PiCPro™

Software Manual

Version 16.1

G & L Motion Control Inc.

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Should information not covered in this document be required, contact the Customer Service Department, G & L Motion Control Inc., 672 South Military Road, P.O. Box 1960, Fond du Lac, WI 54936-1960. G & L Motion Control Inc. can be reached by telephone at (920) 921-7100 or (800) 558- 4808 in the United States or by e-mail at glmotion.support@danahermotion.com.

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Chapter 1 - Getting Started with PiCPro V16.0

Introduction to PiCPro

Introduction to PiCPro

PiC (Programmable industrial Computer) or the MMC (Machine and Motion Control) systems provide an integrated solution to the logic, motion, process, operator interface and communications requirements found in today's industrial automation applications. PiCPro Professional Edition and PiCPro MMC-Limited Edition are the software packages that allow you to program the PiC or the MMC to run your application(s). They include the following programs:

Program	Function
Ladder Diagram	Allows you to program control logic in both ladder and structured text and save it as an .LDO file
Servo Setup	Allows you to program setup information for your servo application and save it as a .SRV file
SERCOS Setup	Allows you to program setup information for your SERCOS application and save it as a .SRC file
Project	Allows you to manage an application through development and production phases and then maintain the application.
Analog Interfaced Drive System	Allows you to identify, setup and monitor the analog interfaced digital drives used in your application.
Digital Interfaced Drive System	Allows you to identify, setup and monitor the digital interfaced digital drives used in your application.
Custom Motor	Allows you to control and define third-party motors.

If PiCPro is new to you, you will soon discover how easy it is to write your application program using the interactive tools available in PiCPro. There are tutorials on the CD you receive that may be helpful. If you have used PiCPro in the past, you will see how the new tools and enhanced features in this Windows version enable you to work more effectively and efficiently in designing your application program(s).

Structured text as used in PiCPro provides powerful data handling such as arrays and structures that contain different data types. It provides control structures for the following statements: IF-THEN-ELSE, CASE, FOR, REPEAT and WHILE loops.

The PiCPro CD also includes .pdf files of manuals commonly referenced when using PiCPro.

PiCPro Professional Edition

PiCPro Professional Edition is the full-featured member of the PiCPro product line. It allows you to program PiC controls, MMC controls and/or MMC Smart Drives to run your application(s). The title bar of the application indicates its edition.

PiCPro MMC Limited Edition

PiCPro MMC-Limited Edition allows you to program the standalone MMC control and/or MMC Smart Drives to run your application(s). The title bar of the application indicates its edition.

Note:

You cannot program an MMC for PC with this edition of software. You must use the Professional Edition.

PiCPro Monitor Edition

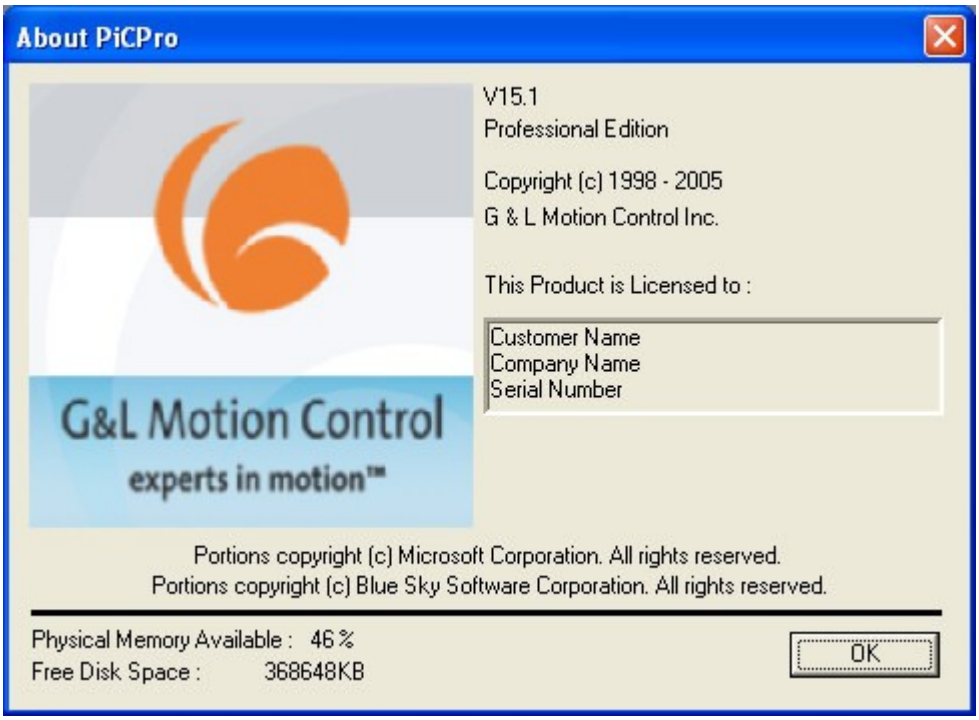
PiCPro Monitor Edition is a subset of the PiCPro Professional Edition software. The Monitor Edition allows you to view, print and monitor the execution of an application program for the PiC/MMC family of controls. It can also perform a PiC Restore. Generally speaking, you cannot create new files, edit existing files or compile and download. However, project files and analog interfaced drive system files can be created and edited with the Monitor Edition.

The Monitor Edition also provides full functionality for the MMC Smart Drive systems. You can identify, configure, setup, monitor and analyze the analog interfaced digital drives used in your application. You can create, edit and maintain the drive files used to save the drive parameters.

The Monitor Edition is packaged with each MMC Smart Drive shipped from Danaher Motion. The title bar of the application indicates its edition.

About Box

The about box contains PiCPro version information, information on who PiCPro is licensed to and the serial number used to install PICPro.



Customer Services

Customer Services

Danaher Motion is committed to providing customers with high-quality technical support. The following sections describe the support services available.

Before Calling Technical Support

Before calling Danaher Motion Technical Support, please have the following information available. This will assist the Technical Support representative in helping you more quickly and efficiently:

- A brief description of the problem, including the text and number of any error messages received, and the steps to recreate the problem.
- The type of control you are using.
- The type of computer and monitor you are using.
- The version of Microsoft Windows and PiCPro in use. Choose the ***About Windows*** command from the **Help** menu in Explorer to find which version of Windows you are running.

Technical Support Services

North American customers may reach an experienced Danaher Motion engineer weekdays from 7am to 5pm (CST). Danaher Motion Technical Support can be reached by telephone or fax as follows:

In the United States – (800) 558-4808

In Europe – (+44)151-546-2010, Fax (+44)151-547-2801

Other areas outside of the United States – (920) 921-7100

The Danaher Motion Technical Support email address is: **glmotion.support@danahermotion.com**.

Hands-On Training Schools

Danaher Motion offers training schools that provide training with PiC products. Classes are conducted at Danaher Motion or at your location. Students will receive thorough orientation and hands-on experience from our qualified instructors.

World Wide Web Site

The World Wide Web address for Danaher Motion on the internet is **www.danahermotion.com.** At this location you can search, read, print, or download information and service packs.

The Computer Workstation

The Computer Workstation

The recommended requirements for a workstation are:

For a PiC or Standalone MMC Controller:

Computer	Pentium or AMD equivalent processor with Windows 2000, Windows XP or Windows Vista.
Memory	Consult operating system requirements for recommended memory
Video	1024x768 or higher resolution, 16 bit or greater color
Disk Drives	Typically, 100 MB of hard disk space required for PiCPro installation
Communications port to controller	RS232 Port (COMx), Optional Ethernet TCP/IP

For an MMC for PC Controller:

Computer	Minimally, 133 MHz Pentium processor or AMD equivalent with Windows 2000, Windows XP, Windows Vista and a PCI or integrated network card. An empty PCI slot is required for the MMC for PC controller.
Memory	Consult operating system requirements for recommended memory
Video	1024x768 or higher resolution, 16 bit or greater color
Disk Drives	Typically, 100 MB of hard disk space required for PiCPro installation

Note:

Power saver option in BIOS should not be set when using an MMC for PC. Setting this option will cause a communications error when the computer is put into a sleep state.

Hardware Connections

Hardware Connections

Two cables are supplied with the PiCPro package. One cable has a mini DIN connector to connect to a MMC Digital Control. The other cable has a standard 9 pin connector to connect to the PiC and Standalone MMC controls. One end of each cable is labeled "Computer". Connect the "Computer" end to the PC serial port you specify in the **Online | Comm Settings** dialog and connect the other end into the PiCPro Port on the control or the MMC Smart Drive. The pin-out for the controller port is given in the appropriate Hardware Manual. The pin-out for the computer port will be in the computer's manual.

Infrared Communications Drivers

If your system has Infrared Communications Drivers, you need to be aware that under the Windows default settings, COM1 and COM3 use the same interrupts and COM2 and COM4 use the same interrupts. The communications settings option in PiCPro, when checking for valid communications ports, may initiate execution of some Infrared Drivers. Communications problems will occur if the Infrared Driver is using one member of the above pairs and PiCPro is using the other. To avoid communications problems, do one of the following:

- Disable the Infrared Driver in the control panel
- Change the communications port used by the Infrared Driver so that it does not conflict with the communications port used by PiCPro.

Installing PiCPro

Installing PiCPro

PiCPro is available on CD. To install from the CD, follow the instructions on the inside jewel case cover of the CD.

Starting PiCPro

Starting PiCPro

To begin working in PiCPro, start the PiCPro Application.

To start PiCPro:

1. Click the **Start** button on the Windows taskbar.
2. Click the PiCPro entry in **Programs**.
3. Click the desired version and edition of PiCPro.
4. Double-click the PiCPro desktop icon provided during the installation.

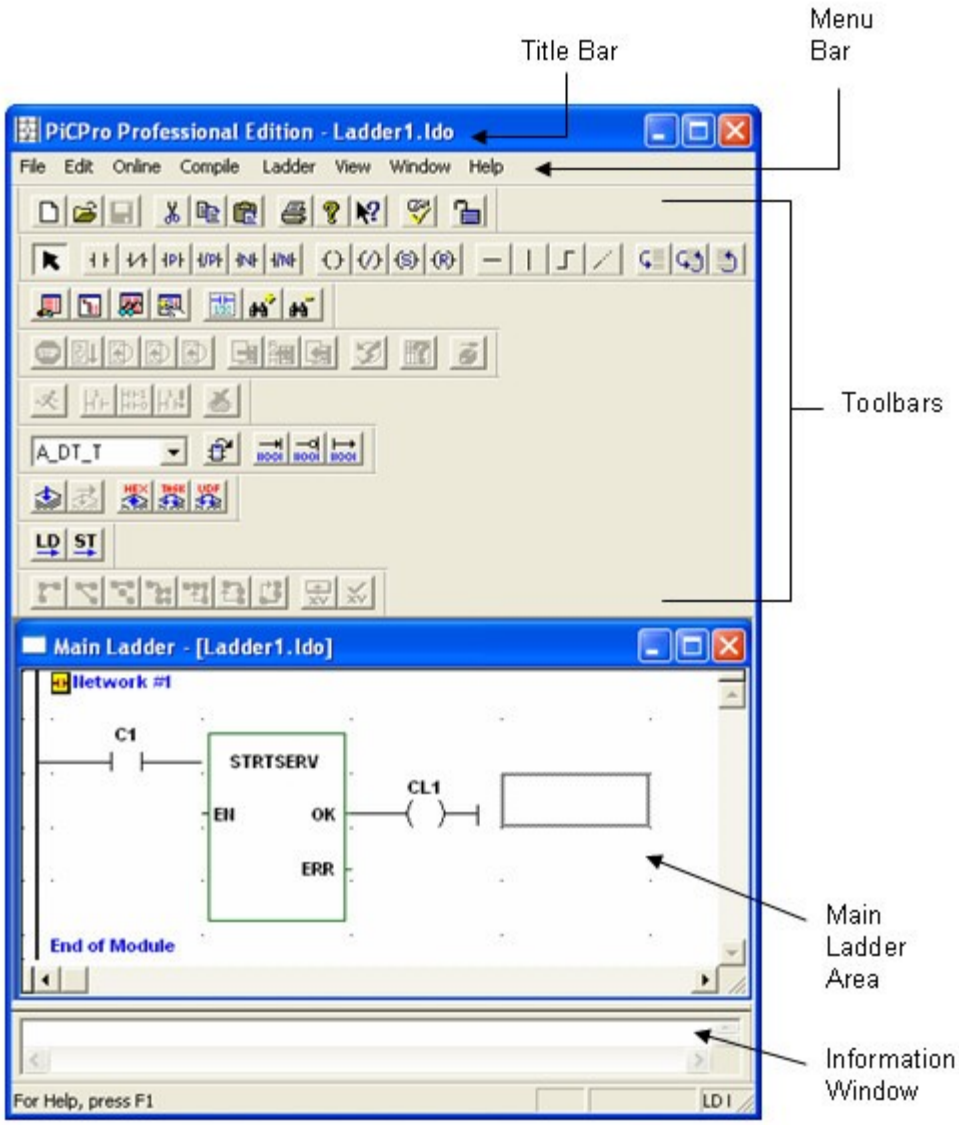
Once you start PiCPro, you will be able to create and develop your various application files.

With PiCPro running, you can easily switch between PiCPro programs (Ladder Diagram, Servo Setup, SERCOS Setup, Analog Interfaced Drive System and Digital Interfaced Drive System). You can go back and forth between programs without exiting one and launching the other.

The Work Area in PiCPro

The Work Area in PiCPro

When you open a file, its window appears in the work area. This is where you work on developing a new file or editing an existing file. An information window appears at the bottom of the work area. You can open multiple files and easily move between them on the work area.



The Main Ladder Area

The main ladder area is where you create or edit your LDO file. Usually, only part of your file can be displayed on your screen and you have to scroll up and down or left and right to bring portions into view.

The Information Window

The information window provides a read-only area that PiCPro uses to display data pertinent to your application. It is displayed when you open a file and anytime data has been placed in it by a process within PiCPro. The information remains in the window until it is replaced by data from another process, the file it pertains to is closed or PiCPro is closed. With certain data (i.e. ladder compiler error messages) you can go to the location of the error in your file by double clicking on the message in the information window.

Other features of the information window include:

- You can undock the information window by dragging it away from the PiCPro edge it is docked to.
- Yow can dock the information window by dragging it to any edge within PiCPro.

- You can resize it vertically or horizontally, but not diagonally.
- You can copy the contents of the information window to the clipboard by selecting some or all of the text, right clicking and then selecting **Copy**.
- You can print the contents of the information window by putting focus in the window and doing a **File | Print** from the menu.

You can hide the information window from view in various ways:

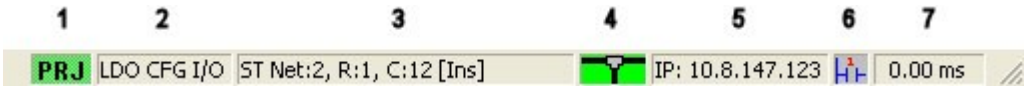
- Select **View | Information** Window from the menu
- Press Esc key.
  Right-click and select Hide

To view a hidden information window, choose **View | Information Window** from the menu.

Status Bar

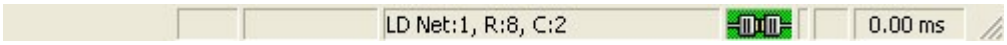
Status Bar

The status bar appears at the bottom of the PiCPro screen and provides the following information.



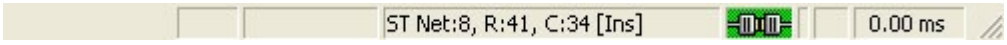
1. Displays the status of an opened project:
   - PRJ A project is open and the PiCPro version/edition matches the project.
   - PRJ A project is open and the PiCPro version/edition doesn't match the project.
2. LDO CFG I/O indicates Ladder Configurable I/O option is enabled.
3. LD Net:1, R:1, C:1 or ST Net:2, R:1, C:16 Lists the location of the focus in your ladder – either in a Ladder network or a Structured Text network..
4. Indicates of communications connection to control or drive:
   - indicates Ethernet TCP/IP is connected
   - indicates Ethernet TCP/IP is not connected
   - indicates serial communications is connected to control or Digital Drive
   - indicates connection to an Analog MMC Smart Drive
   - indicates disconnected
5. IP: 10.8.147.123 or IP:r 10.8.147.123 indicates the Ethernet TCP/IP address of the control or if the communications mode is ‘relay’ mode.
6. (Not shown above, a blank space) until forcing is turned on. The symbol will appear in this location when forcing is on.
7. 1.42 ms Dynamically updates with the scan time when connected to a control and the scan is running.

Example 1:



In Example 1, the workstation is connected to the control, but is configured to connect serially. The scan is not running (scan time is 0.00ms) and the focus in the ladder is in **LD Net**work #1, **R**ow 8, **C**ol 2.

Example 2:



In Example 2, the workstation is connected to a control, but is configured to connect serially. The scan is not running (scan time is 0.00mn) and the focus in the ladder is in **ST Net**work #8, **R**ow 41, **C**ol 34, and is in **Ins**ert mode.

Note:

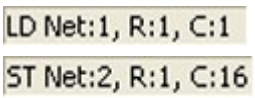
The element can be in either Insert (Ins) or Overstrike (OVR) mode. In Insert mode, characters are inserted at the cursor position and existing characters past the inserted character are pushed to the right. In Overstrike mode, inserted characters will overwrite any characters already at that position.

Example 3:

In Example 3, the workstation is connected to a control (configured for Ethernet-TCP/IP communication), the scan is not running (scan time is 0.00ms) and the focus in the ladder is in **ST Net**work #2, **R**ow 482, **C**ol 1 and is in **Ins**ert mode. The color of this field has changed to yellow to indicate that the number of lines in the ST element is close to the limit of 500.

Status Bar Details

The status bar is displayed at the bottom of the PiCPro screen and provides the following information:

Indicator	Description
<Text at far left>	Concise help information relevant to the selected window component. Also displays information about the toolbar button that the mouse is currently placed over.
	Indicates a project is open and the PiCPro Version/Edition configured for the project matches the one currently running. This icon has a green background.
	Indicates a project is open and the PiCPro Version/Edition configured for the project does NOT match the one currently running. This icon has red background.
	Indicates the Ladder Configurable I/O status: LDO CFG I/O is displayed, when this option is enabled.
	Identifies the Ladder (LD) network or Structured Text (ST) network, row and column in the ladder that the cursor is in.
	Indicates the workstation is connected to a control configured for Ethernet -TCP/IP communication. This icon has a green background

	Indicates the workstation is NOT connected to a control configured for Ethernet-TCP/IP communication. This icon has a red background.
	Indicates the workstation is connected to a control configured for serial communication. This icon has a green background.
	Indicates the workstation is NOT connected to a control configured for serial communication or a drive. This icon has a red background.
	Indicates the workstation is connected to an analog interfaced digital drive configured for serial communication. This icon has a green background.
IP: 10.8.147.123	For Ethernet-TCP/IP communication, the IP address of the control.
IP:r 10.8.147.123	Same as the IP: indicator except that the "r" indicates relay mode
	This symbol appears only when forcing is on in the connected control.
1.42 ms	Dynamically updates with the scan time when connected to a control and the scan is running.

Displaying/Hiding the Status Bar

You can choose to display or hide the status bar.

- Choose **View | Status Bar** from the menu. A check mark indicates that the status bar will be displayed.
- Click on **Status Bar** again to remove the check mark and hide the status bar.

Window Elements

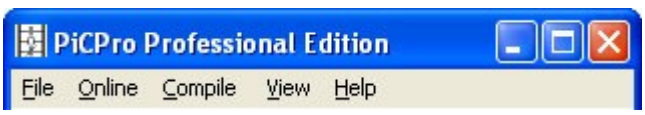
Window Elements

If you are familiar with Windows, you will recognize basic screen elements common to most Windows applications. If you are new to Windows, these help screens will inform you about some of these elements.

The Title Bar

When you start PiCPro, a Title Bar extends across the top of the window. It displays the edition of PiCPro you are using and the name of the file you are working in and indicates whether it is the active window or not. The Title Bar of the active window is highlighted. The Title Bar of the inactive windows is dimmed.

PiCPro Title Bar



The possible versions are Professional, Monitor, and MMC-Limited.

- You can drag the Title Bar to reposition the window within the work area.
- Clicking on the icon on the left end of the Title Bar drops down a menu that allows you to **Restore**, **Move**, **Size**, **Minimize**, **Maximize**, or **Close** PiCPro.
- There are three buttons on the right end of the Title Bar.

Use the first to minimize the window, use the second to maximize the window to fill the entire screen, and use the third to close PiCPro.

The Menu Bar

Directly below the Title Bar is the Menu Bar. It contains the names of the menus that group together similar commands. Clicking a menu name displays a list of commands that can be used to access PiCPro functions.

When PiCPro is started and has no windows open, the Menu Bar contains the names shown below.

Once you open a ladder file, the Menu Bar is expanded to include more items needed to program your ladder.

Overview: Dialog Boxes

Dialogs can appear when you choose a menu item or a command. A dialog presents the list of options available for the selected command and requires you to type in information or select options that PiCPro requires to proceed.

Typically, you will see the following in a dialog.

- OK button
- Cancel button
- Option button
- Check boxes
- Display boxes
- List boxes
- Spin boxes
- Tabs
- Edit fields
- Browse button

When using a dialog, you can use the question mark button in the top right corner, to display **What's This?** help on a specific dialog component by doing the following:

1. Click on the button. The cursor changes to a question mark:
2. Click on the component for which you want help.

Help Files

You can access Help files by using **Help** menu. There you will have two types of Help available.

Help Topics offer information on how PiCPro works, error messages and general help topics.

Function/Function Block Help offers specific help on Functions/Function Blocks, ASFBs and you can even add your own for UDFBs.

Customizing PiCPro

Customizing PiCPro

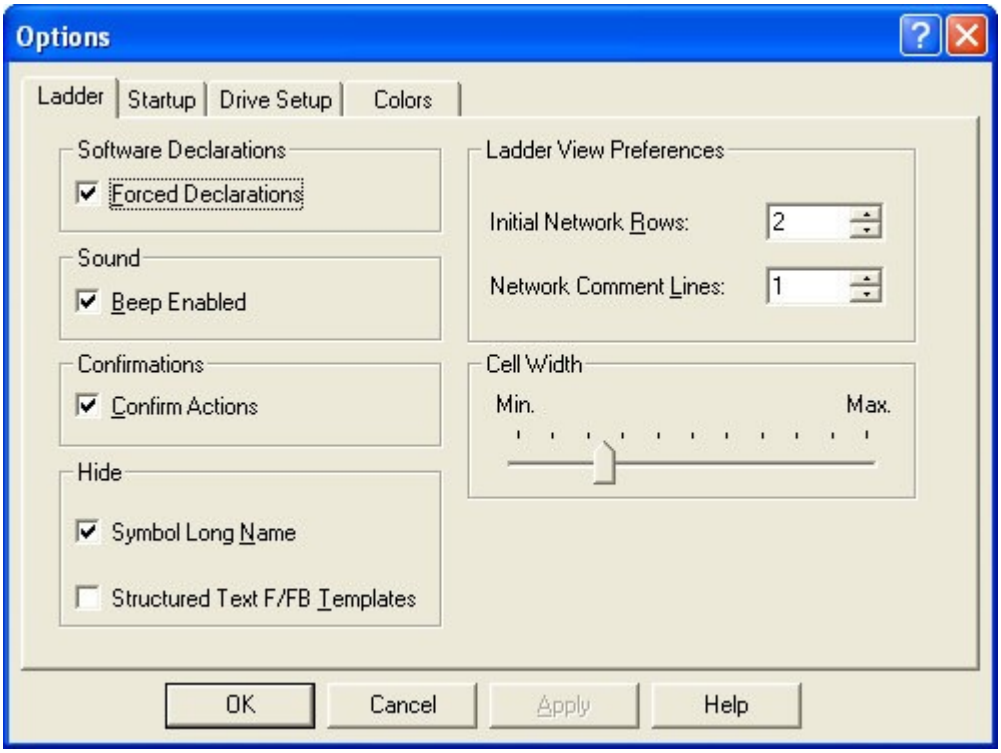
PiCPro has several features that let you set up your PiCPro workspace for the way you want to work.

You can:

- Set Ladder Preferences
- Set Startup Preferences
- Set Drive Setup Preferences
- Choose Animation Color
- Customize the Toolbars
- Displaying/Hiding the Status Bar
- Choose Colors for Structured Text Keywords, Comment Numbers and Templates

Options for user preferences and for choosing animation color can be set under **View | Options** from the menu or by pressing the button from the standard toolbar.

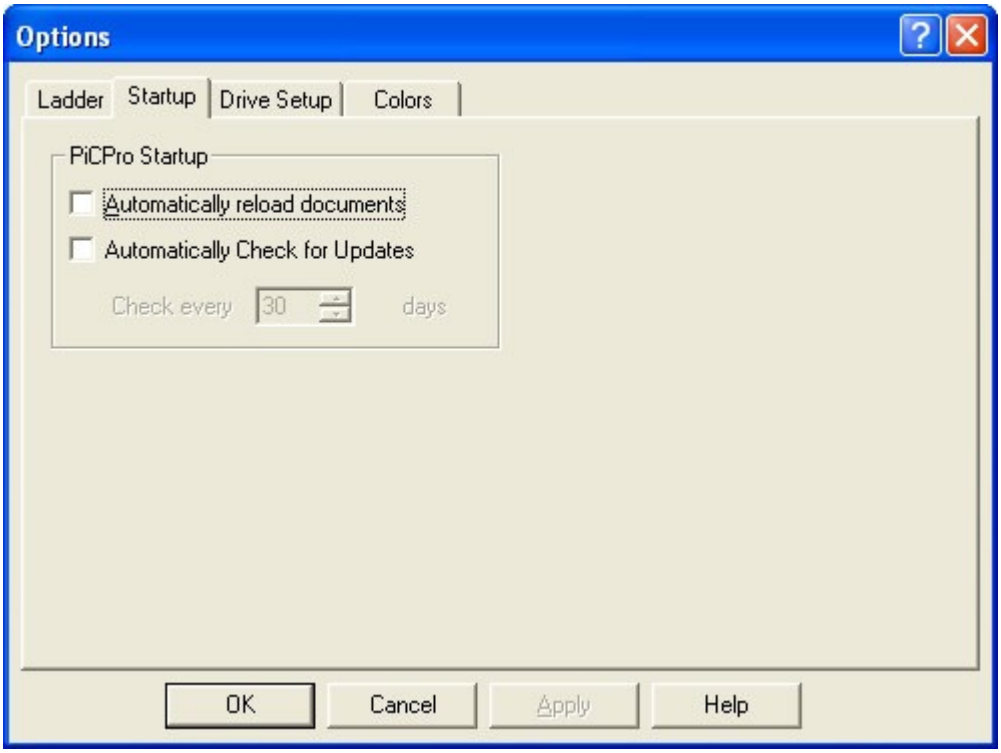
Ladder Tab



Under the Ladder tab, you can set the following:

- **Software Declarations - Forced Declarations**: Whether you want a message to appear that tells you to enter a software declaration for the ladder element you have just added to your ladder.
- **Sound - Beep Enabled**: Whether you want a beep to sound after certain actions.
- **Confirmations - Confirm Actions**: Whether you want a confirmation message to appear after certain actions.
- **Hide:**
    - **Symbol Long Name**: Whether want to view long names you have entered in your program. (When you choose to view the long names all the cells in your ladder are enlarged.)
    - **Structured Text F/FB Templates**: Whether you want Function/Function block templates shown when you drop a Function/Function Block into a Structured Text element.
- **Ladder View Preferences** - Initial Network Rows and Network Comment Lines: The number of network rows and the number of comment lines you want to view in your ladder.
- **Cell Width**: How wide the cells in the networks appear on your screen.

Startup Tab



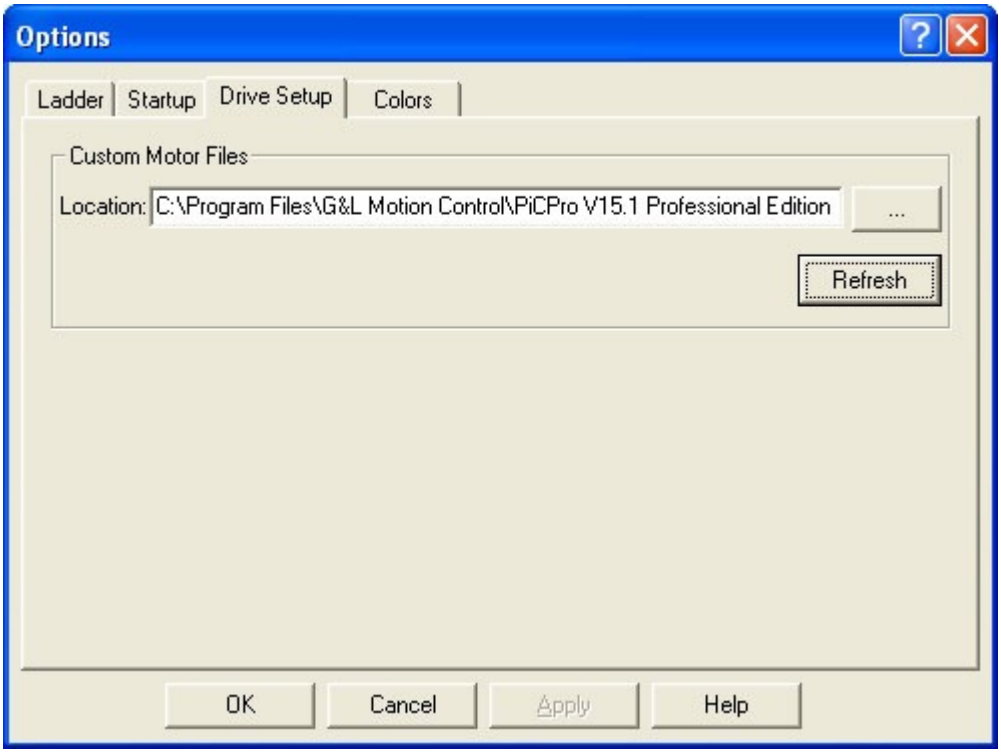
Automatically reload documents: When you restart PiCPro, whether you want to reopen any documents (.ldo, .srv, .src, .ddv, .adv, .prj) opened using **File | Open** or **File | New** that were still open when you exited PiCPro.

Note:

Files that were opened using **View | UDFB/Task**…, **View | Sercos Function** or **View | Servo Function** will not be reopened.

Automatically Check for Updates: PiCPro can check for updates, service packs...prior to startup. When selecting this option, the check for updates frequency can be configured. See **APPENDIX K** for the various methods of Service Pack installations.

Drive Setup Tab



Location: This is the location where custom motor files will be read from when PiCPro is started. To change this location, enter a new folder or select "**...**" to display the browse dialog. After entering the new location, select **Apply** or **OK**. The custom motor files found in that folder will be read and Motor Data Status will be reevaluated for any open drive files.

Refresh: If custom motor files have been added to the custom motor folder outside of PiCPro while PiCPro is running, select the Refresh button to force PiCPro to read all files in the custom motor folder. Motor Data Status will be reevaluated for all open drive files.

Colors Tab

The Animation section shows the colors that will outline power flow when animation is on. The **Running** color is used when the control is scanning. The **Stopped** color is used when the scan is stopped.

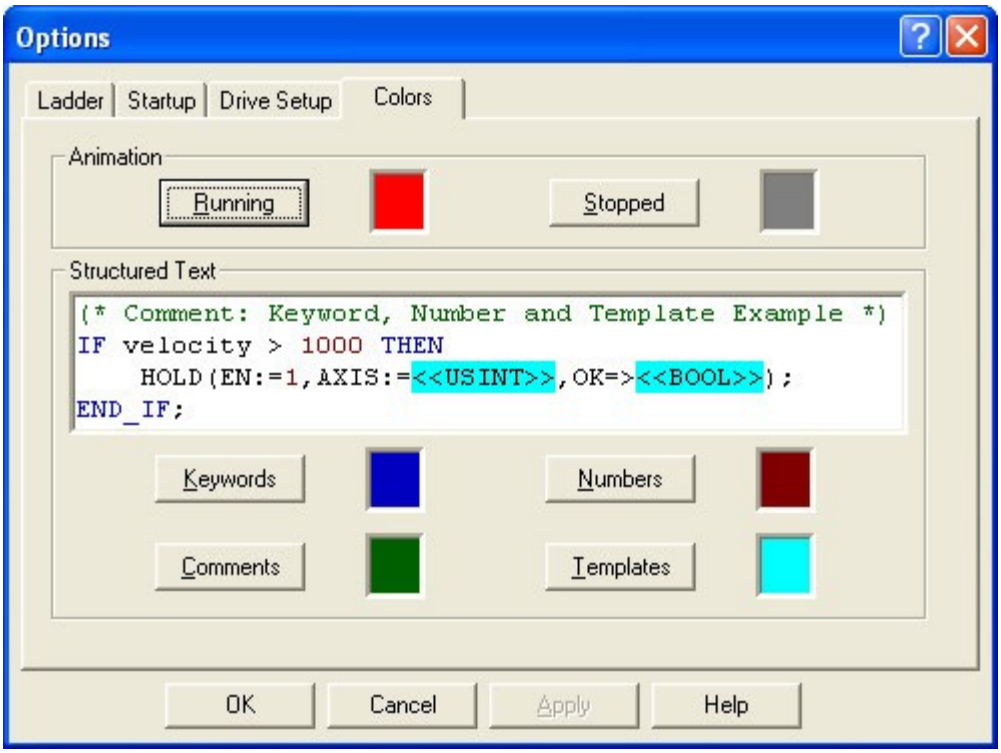
In the **Structured Text** section, the colors used to display Keywords, Comments, Numbers and Templates are shown.

As changes are made to each of the ST element types, a sample of Structured Text code is displayed to preview how the changes will look. The default colors for **Keywords** is blue, for **Comments** green, for **Numbers** red, and for **Templates** cyan.

To Change a Color

Choose the Colors tab of the **View | Options** box.

1. Click on the associated button.
2. Choose a solid color from the Color box that appears.
3. Click **OK** to save your choices.



Customizing Toolbars

Customizing Toolbars

The toolbars give you quick access to some of the frequently used tools. You can enable or disable toolbars from **View | Toolbars** under the menu bar.

The type of toolbars available on-screen depends on the type of file opened on-screen. For example, if an LDO (Ladder) file is open and viewable on-screen, and **View | Toolbars** is selected from the menu, as many as nine different toolbars are available. If there is no file open on-screen, only the Standard and Basic Online Operations toolbars are available. The tools available under each of the toolbars are listed under each toolbar title in APPENDIX I.

There is a lot of flexibility in displaying and arranging toolbars to fit your needs. Toolbars can be:

- Arranged within a toolbar region
- Docked horizontally or vertically on any or all four sides of the PiCPro screen
- Docked inside or outside the PiCPro screen
- Resized

When working with your PiCPro application you will discover which toolbar arrangement works best for you. Your final toolbar arrangement will become the default until you change it.

Moving Toolbars

When you install PiCPro or when you choose to display a toolbar from the menu, the toolbars appear at the top of your PiCPro screen under the menu bar in a toolbar region. Within this region you can move the toolbars by the drag and drop method. The toolbars are dockable and can be positioned in a variety of ways.

Note:

The toolbar region that holds the toolbars that are displayed along any of the four sides of your PiCPro screen disappears when all the toolbars have been docked somewhere else.

Examples of Positioning the Compile Toolbar

Docked Horizontally

Along the top or bottom of your PiCPro screen

Docked Vertically

Along the left or right edge of the PiCPro screen

Undocked (Labeled)

Anywhere within the PiCPro screen or on the desktop

Note: When the toolbar has a label, it is possible to resize it and close it.

Docking Tips:

- Always click in the dead space around a button to move the toolbar.
- When you want to dock the toolbar vertically, be sure that the edge of the PiCPro screen is in view. The orientation switches as you cross the edge of the PiCPro Screen.

Displaying/Hiding Toolbars

You can choose to display or hide any of the toolbars available in PiCPro.

- Choose **View | Toolbars** from the menu. The **Select Toolbars** dialog appears. Click the box in front of the toolbar name to display it. A check mark appears in the box.
- Click the box again to remove the check mark and hide the toolbar.
- Click **OK** to apply the changes and close the **Select Toolbars** dialog. **Apply** will apply the changes but not close the dialog, and **Cancel** will close the dialog without making changes.

Organizing Your PiCPro Files

Organizing your PiCPro Files

Where PiCPro gets installed:

When you install PiCPro, the default directory structure is:

C:\Program Files\G&L Motion Control\PiCPro *VXX.X editionname* Edition

Where *VXX.X* is the version (e.g. V14.0) and *editionname* is the name of the Edition (e.g. Professional). Hereafter, this directory is referred to as the program directory.

Data Subdirectories

In PiCPro V16.1 and later, a new directory structure was created to support Windows Vista. Data files are stored under:

C:\G&L Motion Control Data\PiCPro VXX.X *editionname* Edition\Libraries - contains the standard function and function block library files.

C:\G&L Motion Control Data\PiCPro VXX.X *editionname* Edition\Firmware - contains the hex files.

C:\G&L Motion Control Data\PiCPro VXX.X *editionname* Edition\Personalities – contains personality files.

Organizing your directories:

One method of organizing your files when working with PiCPro is to create a directory structure similar to the following:

C:\PiCApplications\project1	to hold a project, keeping it separated from other projects
C:\PiCApplications\project1\myUDFBs	to hold any User Defined Function Blocks you may create.
C:\PiCApplications\project1\ASFBs	to hold any Application Specific Function Blocks you may be using.

Directory Restrictions

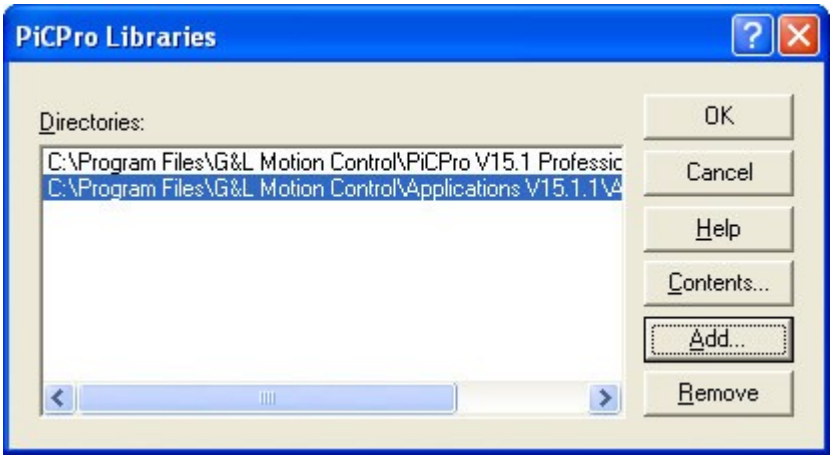
To support Windows Vista, PiCPro will not allow the saving of files under C:\Program Files. If you try to save a file there, PiCPro will display a warning message and then allows you to choose another destination.

PiCPro Libraries

All PiCPro functions and function blocks are stored in libraries. There is a standard set of libraries that is installed with the PiCPro software. There are also libraries that can be created by the user to hold user-defined function blocks, set up functions, etc. You can add and remove the paths to these libraries using the dialog found under **File | PiCPro Libraries…**

Note:

To be able to compile with a function/function block, whether it's a standard one or a user-written one, the path to its library must be configured in the PiCPro Libraries list of directories. You can access this list directly by selecting File | PiCPro Libraries from the menu or, if you are using a project, by adding directories from there (see Library Paths in Projects).

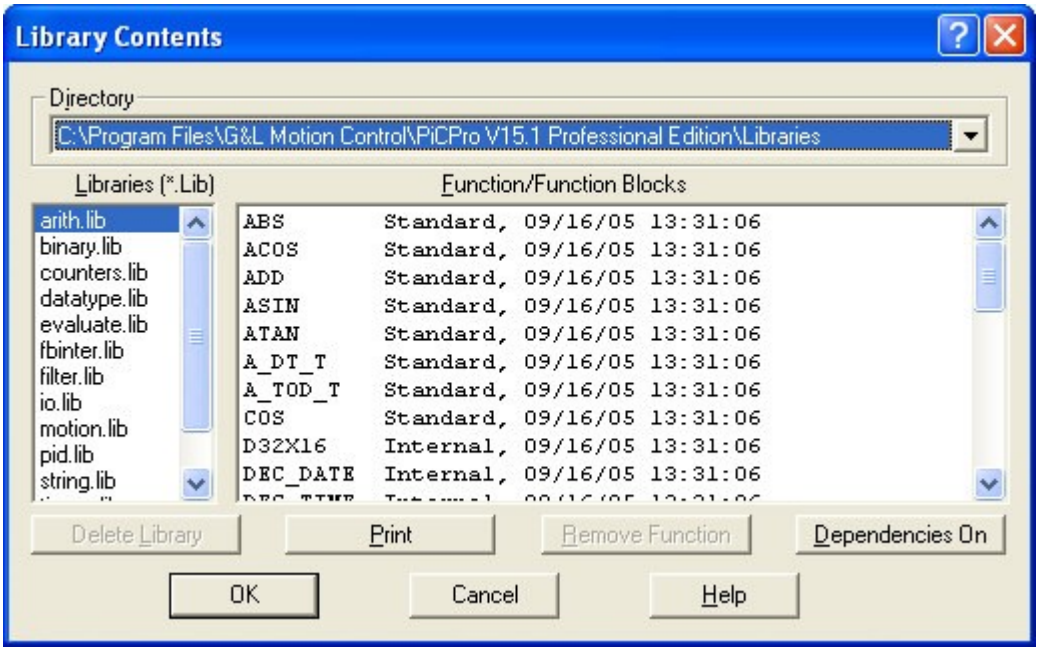


Library Contents

You may want to view a library's contents or delete libraries. You may also remove individual functions from within a library. Deleted libraries and removed functions are removed from the Function list in PiCPro (**Ladder | Functions**).

Note: You cannot delete any of the standard PiCPro libraries or functions.

1. Select **File | PiCPro Libraries….**
2. Click **Contents…**
3. The **Library Contents** dialog appears.



4. In the **Directory** section, select the desired library path from the drop down list.
5. The list of libraries in that path will appear on the left in the **Libraries (*.Lib)** section. Selecting a library causes the functions included in that library to appear on the right in the **Function/Function Blocks** section.
6. To delete the entire library, select the library and choose the **Delete Library** button. **Note:** The library is not deleted until the **OK** button is clicked.
7. To delete one or more functions from a library, select the function and choose the **Remove Function** button. The function is not deleted until the **OK** button is clicked.

   Note: In the Function/Function Block section, the name of the function/function block is listed followed by the type (standard, UDFB, SERCOS, servo, or internal) and the timestamp. The Delete Library and Remove Function buttons will be grayed if you select a function that is either a standard or internal (hidden) type or select a library that contains a standard or internal function.

8. If you want to print a list of all the libraries in the directory along with a list of the functions in each, choose the **Print** button. You can also choose to **Print to a File** from within the print dialog.
9. If you want to display the dependencies, if any, for each function/function block, choose the **Dependencies On** button. The dependencies will be displayed right below the function name entry. With this button on, the dependencies will be included in the print out or print file if you choose to print.

Using On-line Help

Using On-line Help

The Help documentation includes an on-line Help system, a context-sensitive (What's This? system) and Function/Function Help system. Some of ways you can access the Help system are by choosing it from the **Help** menu, by pressing **F1** key or by clicking on the question mark.

Using 'What's This?' Help

The 'What's This?' system displays context-sensitive information that is relevant to the component that you click on. The 'What's This?' help appears in a popup box. To use 'What's This?' Help:

1. Click on the button in the top right corner of the dialog.
2. The cursor changes to
3. Click on the component that you want information on.
4. 'What's This?' Help is displayed. It automatically disappears as soon as you click somewhere else.

Retrieving On-line Help

The on-line Help system enables you to retrieve information you need quickly and return to your work within PiCPro. The Help appears in a separate window on your screen. You can keep the Help window displayed on top of your PiCPro application for quick access. You can also print Help topics.

Printing Online Help

When running the on-line Help system, you can print specific topics or print entire sections from the **Contents** page.

To print a specific Help topic

- Click the Print button that appears along the bottom right side of the Help window.

  OR

- While displaying the topic, right-click and select Print Topic

To print an entire section of Help

1. Display the **Contents** page of the Help system and select the section you want to print.
2. Click the **Print** button that appears along the bottom right side of the window.

Overview: Function/Function Block Help

Function/Function Block (FFB) Help provides online information describing each standard function, standard function block, and ASFB installed on your system. It also provides a mechanism for you to document the UDFB, tasks, Servo Setup, and SERCOS functions that you create.

Note:

For brevity's sake, explanations of Function/Function Block Help will refer to all functions, function blocks, and tasks (whether user-written or not) as "function blocks". In any situation where a distinction is important, it will be noted there. See ***Understanding Files for Function/Function Block Help*** for an explanation of the differences between help files you create and those for standard libraries and ASFB libraries.

Accessing Function/Function Block Help

To access Function/Function Block Help from PiCPro, use any of the following methods:

- Select **Help | Function/Function Block Help** from the menu
- Right click on a function, function block, Servo Setup function, SERCOS Setup function, or task in a ladder and then select **Help** from the popup menu.
- Click the "**?**" button and then click on a function, function block, Servo Setup function, SERCOS Setup function, or task in a ladder.

Navigating in Help

There are several methods of navigating around once you are viewing Function/Function Block Help:

- Double click on a function/function block name in the Contents or Index to view it's description.
- Use the **Back** button or **Go | Go Back** menu item.
- Use the **Forward** button or **Go | Go Forward** menu item.
- Use the **Home** button or **Go | Go Home** menu item to go to the default Function/Function Block Help Overview page.

Managing the viewing in Help

- Use the **Stop** button or **View | Stop** menu item to stop the loading of a Help file for viewing.
- Use the **Refresh** button or **View | Refresh** menu item to refresh the currently HTML page or file.

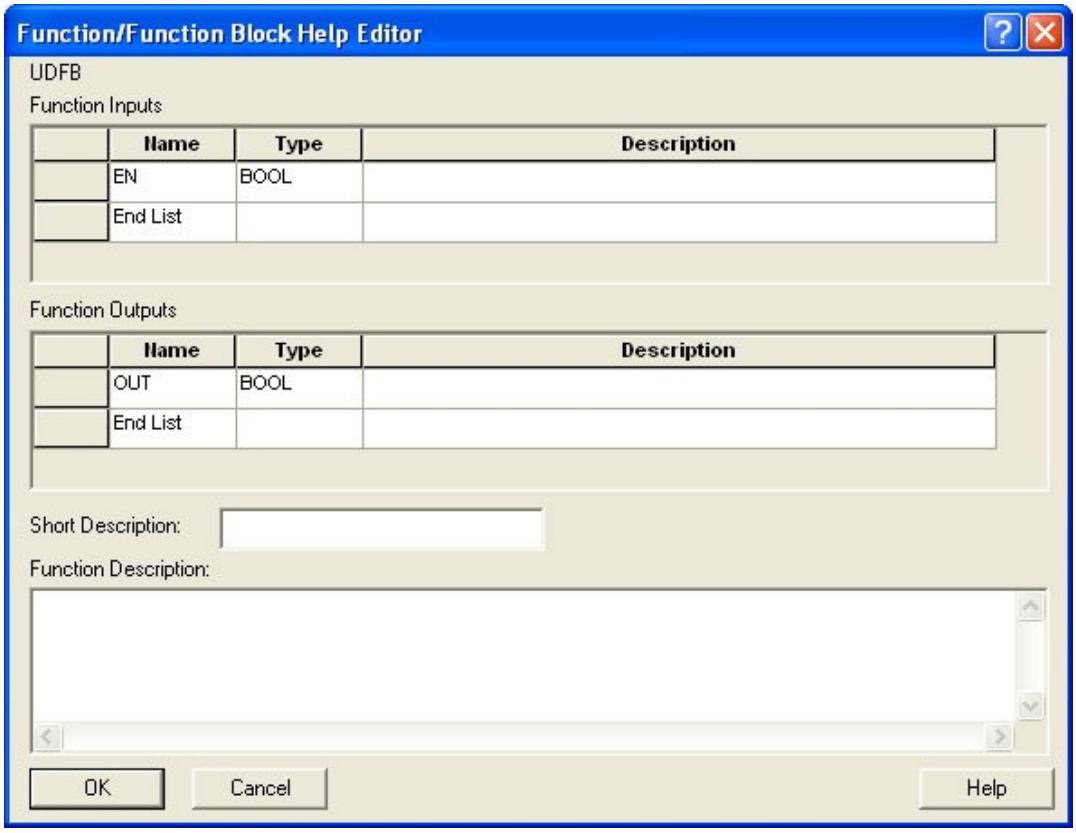
Note:

If you want to include Help for any library in a Project (see ***Project Tree Category: OTHER FILES***), you must manually add the appropriate Help files to the 'Other Files' folder of your Project.

Creating Function/Function Block Help

The Function/Function Block Help system also enables you to write help for your own UDFBs. Just do the following:

1. Make sure your UDFB's library is in your library path. (File | PiCPro Libraries)
2. Open Function/Function Block Help System.
3. Right-click on your UDFB in either the Contents list or Index list on the left side of the help window.
4. Select Edit. At the prompt, choose Yes to create a new file.
5. Proceed with adding any plain text descriptions for your UDFB. The diagram of inputs and outputs is automatically generated for you based upon the inputs and outputs you enter in the corresponding tables that are provided. The initial information provided is based on the information in the library for this UDFB.



6. Choose OK or Cancel. In either case, if you have changed anything, your are asked whether to save. This is to provide you one last chance at not losing any edits.
7. When you're finished, the help system takes your information and generates an html file named <your library name>.htm and deposits it in the same directory as your library. Note: If you ever move or copy your library to a new location, you also need to move or copy its corresponding .htm file. All of the UDFBs for a specific library are documented in that library's .htm file. The more UDFBs you have in a library, the bigger the .htm file and the longer it takes to load when you want to view or edit it.
8. Once you've created help for your UDFBs, you can access it exactly the same way that you access the standard Function/Function Block Help.

Note:

The help files for the standard libraries and the ASFB libraries are not .htm files, but rather .chm files. These are compiled html files. The same rule applies regarding their location and naming. They are named to match their corresponding library: <library name>.chm. Example: arith.chm goes with arith.lib. Both files must exist in the same directory, so if you're moving your libraries around, move their help files with them.

Printing Function/Function Block Help

You may use any of the following to print the HTML file or page that is currently being viewed:

- Select the **File | Print** menu item
- Click the Print button on the toolbar

Understanding Files for Function/Function Block Help

CHM files

The file extension .chm is used exclusively for standard libraries and ASFB libraries. For example, the help file for Arith.lib (a standard library) is Arith.chm.

Library Type	Corresponding Help File	Example
Standard library	*Libraryname*.chm	For Arith.lib: Arith.chm
ASFB library	*Libraryname*.chm	For m_common.lib: m_common.chm

Printing a Function/Function Block from a .CHM file

When you print a Function/Function Block description from a .CHM file, only that description is printed. All of the descriptions for that library are NOT printed.

HTM files

The file extension .htm is used for help that you create for UDFBs, tasks, Servo Setup functions, and SERCOS functions. For example, the help file for MYUDFBS.LIB (UDFB library) is MYUDFBS.HTM.

Library Type	Corresponding Help File	Example
UDFB library	*Libraryname*.htm	For myudfbs.lib: myudfbs.htm
Servo Setup library	*Libraryname*.htm	For myservo.lib: myservo.htm
SERCOS library		For mysercos.lib: mysercos.htm

Printing a Function/Function Block from an .HTM file

When you print a Function/Function Block description from an .HTM file, the entire .HTM file is printed. Because the .HTM file contains descriptions for all of the function blocks in that library, they are all printed.

Note:

If you move a library file (.LIB) to a new directory, you must also move its associated Help file. This file is either *libraryname.chm* or *libraryname.htm*.

FMS-RAMDISK

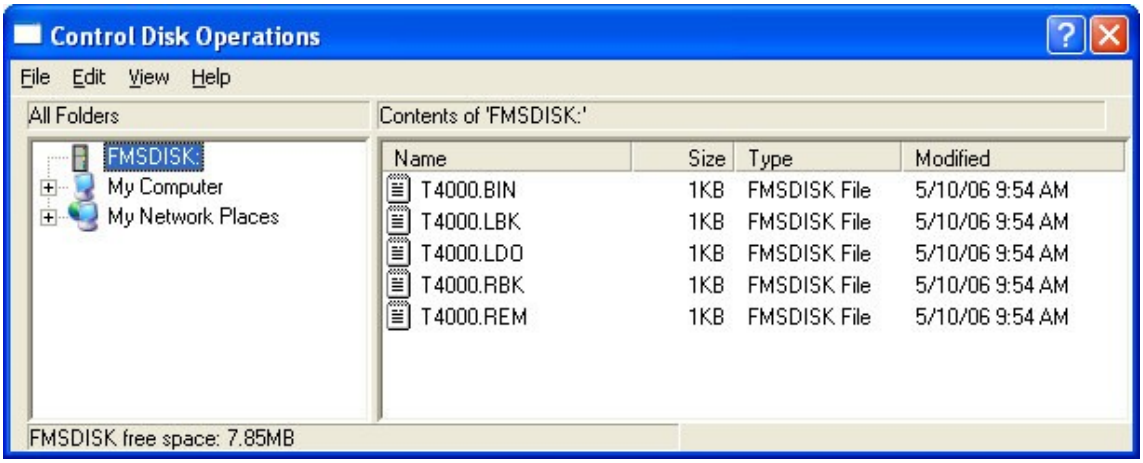
Disk Operations (FMS/RAMDISK)

RAM and FMS disk are hardware options that make extra memory available to the control for use as a file system. These files are then accessible to the control whether the workstation is connected or not. Refer to the COMM group of function blocks in the Reference Guide for more information.

You can access the files on the FMSDISK: or the RAMDISK: by selecting the following from the menu:

- Select **Online | Control Operations | Disk Operations | RAM** from the menu to access RAMDISK
- Select **Online | Control Operations | Disk Operations | Flash** from the menu to access Flash

A Windows Explorer type window is displayed and operates similar in function.



This dialog allows you to navigate to different folders and list files on either the RAMDISK: or the FMSDISK: (Flash) and also on your workstation. You can:

- Create new folders (**File | New Folder**)
- Copy selected file(s) and/or folders to the clipboard (**Edit | Copy** or right-click on the desired file and select **Copy**). If no file is selected, then the RAMDISK: or FMSDISK: is copied.
- Cut selected file(s) and/or folders to the clipboard (**Edit | Cut** or right-click on the desired file and select **Cut**).
- Paste contents of clipboard into selected location (**Edit | Paste** or right-click on the desired location and select **Paste**)
- Paste List will paste contents of several files at one time (**Edit | Paste List**). This function opens a file that contains a list of files to be copied to FMSDisk. Normally these file names reside in a dependency list (.dpl) file. To use Paste List, select a dependency list file and choose copy. Then click on the FMSDISK: icon and choose Paste List. All the files listed in the dependency list file will be copied to the FMSDISK:.
- Delete selected file(s) and/or folders (**File | Delete** or press the **Delete** key on the keyboard)

Note: Pasting any file(s) to the FMSDISK completely overwrites everything that was previously there.

Chapter 2 - Working with Projects

Overview: Using Projects

Overview: Using Projects

A project is a tool to help you manage your applications. A project consists of a project file (.prj) and, optionally, a compressed project file. A project file contains descriptions of all the files (and their paths) that you have determined encompass your project. A compressed project file actually contains, in compressed format, a copy of all of the files described by name in the project file. PiCPro enables you to create, edit, compress, or print the project file as required. There is only one project described in a project file.

Once the files in the project have been defined in the project file, you can work on the development of your application using the tools found in PiCPro. A compressed file containing all the files identified in the project file can be created. This file can be stored on the workstation or on the FMS disk on the control.

Note:

Use the ***DOS 8.3 naming convention*** format naming convention (8 characters, period, 3 characters) for compressed project files if you will be saving those on FMS disk.

A project can play a role in simplifying your control maintenance. You can maintain the control by using a workstation with only the PiC programming tools installed. All the files required for your application can be stored in the PiC on the FMS disk. When you open a project from the FMS disk, the compressed file is loaded onto the workstation. The compressed file is expanded onto your workstation according to the options you select. You can then use the software tools to maintain the project and then compress back to the FMS disk (or even the workstation).

A summary of the capabilities of project maintenance using PiCPro is listed below:

- Allows you to control the development of a project in a development, production, and archive version.
- Allows you to work with multiple versions of PiCPro.
- Simplifies creating a single disk containing all the files required for an application.
- Provides the tools needed to store a single compressed file containing all the files required for an application on the FMS disk in the control.
- Allows you to update the FMS disk on the control without stopping the scan.

Menu Commands that Manage Projects

The following is a list of commands from the menu bar that enable you to manage your projects.

File | New – creates a new project tree. This project tree consists of various categories. To develop your project, you must add file definitions or other information to the applicable categories.

Note:

A project tree and a project file represent the same data; a project tree is the graphical representation of the project characteristics and file definitions in the opened project file.

File | Open – Opens an existing project. You can open a project file (.prj) or a compressed project file. Opening a compressed project file uncompresses its contents to locations your workstation according to the options you select. Once open, you can edit, print, and compress a project file. The content of an open project file is presented to you graphically as a project tree.

File | Open From Control - Opens a compressed project file on the control's FMS disk.

File | Print – Prints the contents of an open project file.

File | Save As – Copies existing files defined in your project file to different directories according to your specifications and creates a new project file containing those new file definitions. After a Save As, the new saved-as project is the one that is left open.

File | Compress – Compresses the files defined by name in your project file into a single compressed project file and stores it on the control's FMS disk, on the workstation's hard disk or mapped network drive according to your specifications. **NOTE:** Use the DOS 8.3 format naming convention for compressed project files if you will be saving those on FMS disk.

File | Launch Project - Launches the version and edition of PiCPro as defined in the PiCPro VERSION category in the project tree.

File | Update Project Tree - Updates the project tree file definitions based upon the file dependencies found in the main LDO in the project. Update removes all items in the UDFBs/TASKs, SERVO SETUP FILES, SERCOS SETUP FILES, and PROFILE SETUP FILES categories and adds file definitions based upon the determined dependencies AND the project's properties. If you manually add file definitions to any of these 4 categories, they could be lost on an update.

File | Validate Project Tree - Validates the project tree by verifying that all files and paths defined in the tree exist. If not found, the icon next to the file or path definition is altered to have a red circle with a diagonal slash through it.

Edit | Add - Enables you to add an item to a selected category such as Library Paths or UDFBs/Tasks. Refer to the specific category or item description for information on the results because they depend upon which category or which item is selected.

Edit | Delete - Enables you to delete all items of a selected category or if an actual item is selected, enables you to delete that item from its category. Refer to the specific category or item description for information on the results because they depend upon which category or which item is selected.

Edit | Cut - Cuts the selected item from its category and places it on the clipboard. Refer to the specific category or item description for information on the results because they depend upon which category or which item is selected.

Edit | Copy - Copies the selected item or category of items to the clipboard. Refer to the specific category or item description for information on the results because they depend upon which category or which item is selected.

Edit | Paste - Pastes the contents of the clipboard into the selected category. Refer to the specific category or item description for information on the results because they depend upon which category or which item is selected.

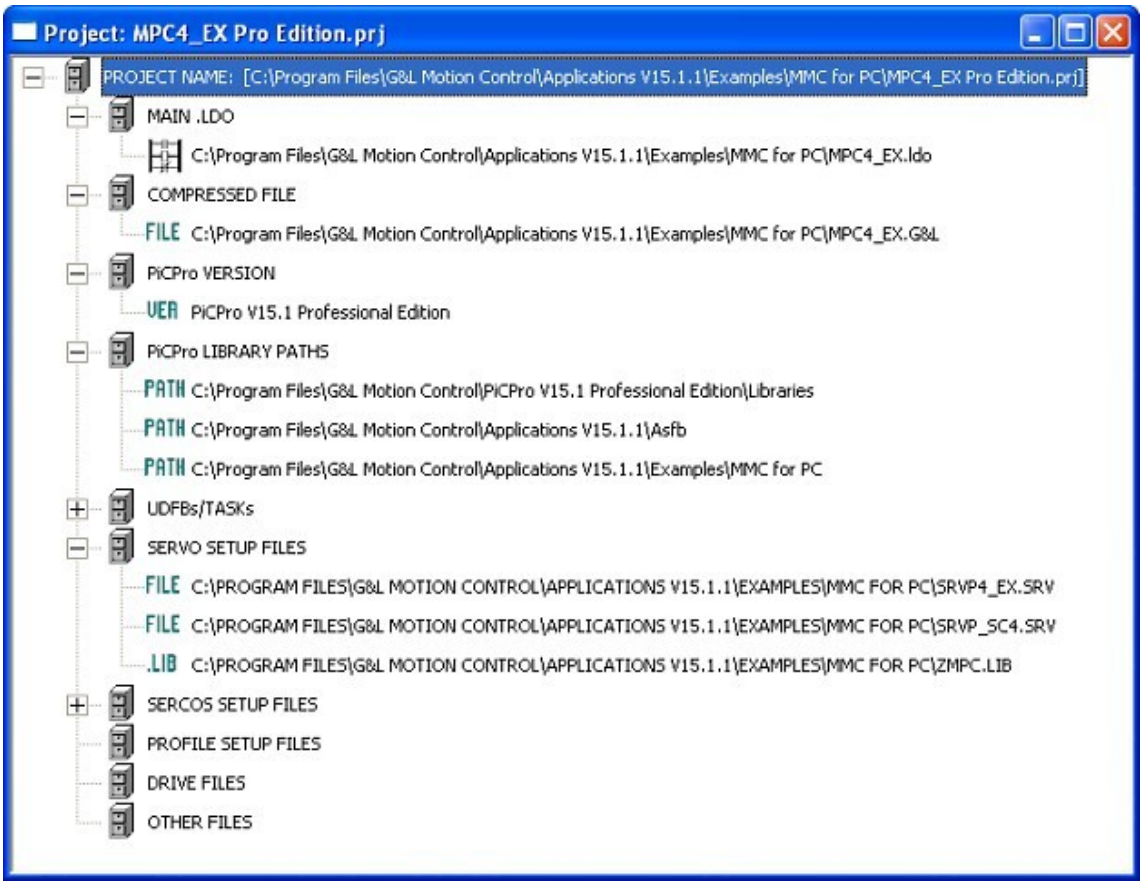
The Project Tree and its Components

A project tree is the graphical representation of the information configured in the project file. The project tree is displayed when you open a project file. It consists of several categories that are made up of items that describe different characteristics of the project or describe files and file locations that belong to the project.

You can see the items in a category by expanding the category. Do this by clicking on the ⊞ symbol to the left of the category name. If the symbol is a ⊟, click on it to collapse the category. You can also double click on the category name itself to toggle between expanded and collapsed. If neither symbol is displayed, no items are currently configured in that category.

Select a category or item in a category by single clicking on it. When selected, the category name or item is highlighted. Once highlighted, you can use menu commands to manipulate an item or category or right-click and use those menu items.

Example Project Tree:



Project Tree Categories

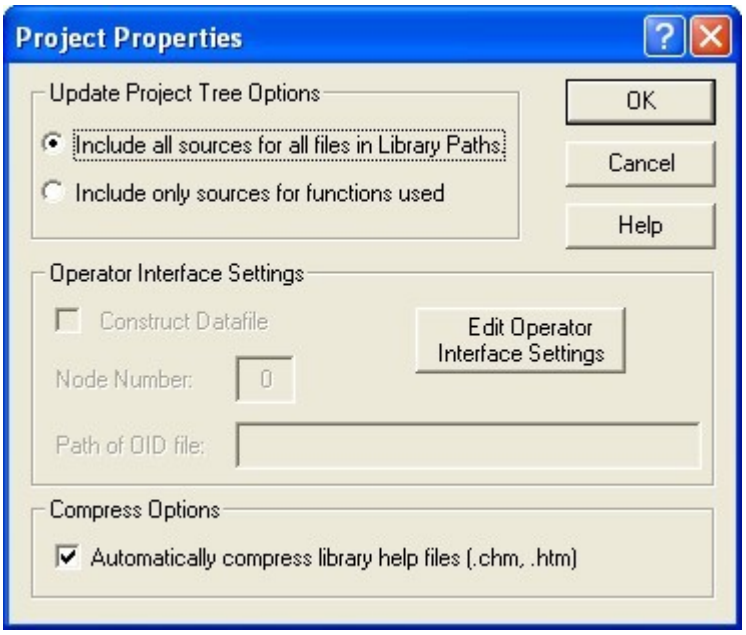
Category: PROJECT NAME

The PROJECT NAME category defines the name of the project file. Its format is <*projectname*>.PRJ where <*projectname*> is whatever name you choose for this particular project. The path (or location) for the project file is also displayed with the name.

If you right-click on the PROJECT NAME category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Compress	Allows you to compress the project file. This is the same as the command selected from **File** on the menu.
Print	Allows you to print the information in the project tree. This is the same as the command selected from **File** on the menu.
Launch Project	Allows you to start up the edition/version of PiCPro configured in the project if it is installed on your workstation. This is the same as the command selected from **File** on the menu.
Update Project Tree	Allows you to automatically update the entire project tree based upon dependency information. This is the same as the command selected from **File** on the menu.
Validate Project Tree	Allows you to validate the contents of the tree categories. This is the same as the command selected from **File** on the menu.
Properties	Enables you to change the properties for this project. See the dialog below.

Project Properties



Update Project Tree Options:

If you want to include all of the sources (all .LIB, .LDO, .SRV, .SRC, .PRO files) for all of the files found in the paths configured in the PiCPro LIBRARY PATHS category, then check the top option. This is the default option.

Otherwise choose Include only sources for functions used. This means that when you select Update Project Tree, only those sources for the actual functions used will be configured in the project file. This will result in a smaller compressed project file (should you choose to compress your project). Be aware, however, that this could limit future development or alteration of the project if working from the compressed project file. For example, let's say that you only have the compressed project file available and a problem occurs. And you want to include a new-to-this-project ASFB in your ladder to help diagnose the problem. The source for that ASFB won't be in the compressed project file and you may or may not be able to find it elsewhere.

Operator Interface Settings:

Your project automatically inherits the current Operator Interface Settings. You can change these settings by pressing the **Edit Operator Interface Settings** button or by using the **Compile | Settings** dialog. Both methods display the same dialog.

- The **Construct Datafile** checkbox is used to create an Operator Interface Datafile (OID) when you compile the BIN file. This file contains necessary information for the operator interface software.
- The **Operator Interface Node Number** is usually set to 0. But, it can be used to create multiple displays for a single machine. Available numbers are 0 – 255.

Compress Options:

When checked, help files associated with a project's libraries will automatically be included when the project is compressed. Help files include files with .chm and .htm extensions.

Note:

Projects created prior to version 13.0 and opened in V13.0 will have this option de-selected by default. Projects created in V13.0 and later will have this option selected by default. Projects created in V13.0 and opened in V11.0 will have the checkbox marked, but it will have no effect on projects compressed in V11.0. Help files will not be included.

Category: MAIN .LDO

The MAIN .LDO category can contain one item. This is the main .LDO file (ladder file) for this project. If you right-click on the MAIN .LDO category, a popup menu displays with the following menu selections:

Popup Menu Item	Description
Add	Enables you to add a main ladder file to your project. This option is only enabled if a main .ldo file is NOT already specified.
Delete All	Enables you to delete all of the items belonging to this category. In this case, that is only one: the main ladder file. **Note:** The actual file is not deleted; just the entry in the project tree is deleted. You are prompted for a confirmation first.
Cut	Cuts (removes) the main ladder file item from this category and places it on the clipboard.
Copy	Copies the main ladder file item from this category to the clipboard.
Paste	Pastes the contents of the clipboard into the MAIN .LDO category. This command is only available if there is not already a main ladder file item entered for this category and if the clipboard contains a main .ldo file item.

Item: MAIN .LDO

If you right-click on an item (the main ldo file) in the MAIN .LDO category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Open	Opens the main ladder file. If this ladder is already open, it makes it the active window. You can also open this file by double clicking on it.
Delete	Removes this item, the main ladder file, from this category. You are prompted for a confirmation first.
Edit	Allows you to manually edit this item's name and path by typing in the new information.
Cut	Removes this item, the main ladder file, from this category.
Copy	Copies this item to the clipboard.
Paste	Pastes a main ladder file into this category. This is only available if a main .ldo file item is on the clipboard. This overwrites the selected main ladder file item.

Category: COMPRESSED FILE

The COMPRESSED FILE category contains a file description for this project's compressed project file, if it has one. (**Note:** Use the DOS 8.3 format naming convention for compressed project files if you will be saving those on FMS disk.) The compressed file contains the project's characteristics like version and properties. It also physically contains, in a compressed format, a copy of all of the files described by name in the project along with their supporting files if any exist:

- .REM - comment file for an .LDO file (main ladder, UDFB, etc.)
- .FRC - force list file for an .LDO file (main ladder, UDFB, etc.)
- .RTD - view list file for an .LDO file (main ladder, UDFB, etc.)
- .SVT - force/view (tuning) information for an .SRV file (servo setup file)
- .SCT - force/view (tuning) information for an .SRC file (SERCOS setup file)

These support files do not show up in the tree, but are the "behind-the-scenes" files that are necessary to support the usage and customization of the .LDO, .SRV, and .SRC files that are named in your tree.

If no file is configured in the COMPRESSED FILE category, you will not be prompted to do a compress when you do things like edit and then save and close a project file. But if there is a compressed file specified, you will be prompted to update the compressed file with the changes you've made (i.e. compress the project again.). During your project's development process, it may be useful for you to postpone specifying a compressed file until closer to completion in order to avoid all of the prompts to compress.

If you right-click on the COMPRESSED FILE category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Add	Enables you to add a compressed project file item to your project. This option is only enabled if a compressed project file is NOT already specified.
Delete All	Enables you to delete all of the items belonging to this category. In this case, that is only one: the compressed project file item. **Note:** The actual file is not deleted; just the entry in the project tree is deleted. You are prompted for a confirmation first.
Cut	Cuts (removes) the compressed project file item from this category and places it on the clipboard.
Copy	Copies the compressed project file item from this category to the clipboard.
Paste	Pastes the contents of the clipboard into the COMPRESSED FILE category. This command is only available if there is not already a compressed project file item entered for this category and if the clipboard contains a compressed project file item.

Item: COMPRESSED FILE

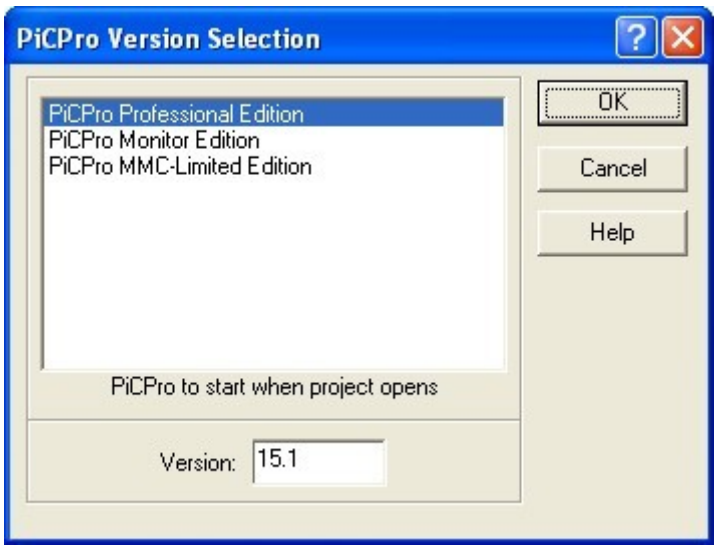
If you right-click on an item (the compressed project file) in the COMPRESSED FILE category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Open	Not enabled for this category. Instead, to open a compressed file, use **File | Open** and select a compressed project. This will close the currently open project and uncompress the selected compressed project according to your specifications.
Delete	Removes this item, the compressed project file, from this category. You are prompted for a confirmation first.
Edit	Enables you to edit the compressed project file item, not the compressed project file itself. You may type in a new path and/or compressed project file name.
Cut	Removes this item, the compressed project file, from this category.
Copy	Copies this item to the clipboard.
Paste	Pastes a compressed project file into this category. This is only available if a compressed project file item is on the clipboard. This overwrites the selected compressed project file item.

Category: PiCPro VERSION

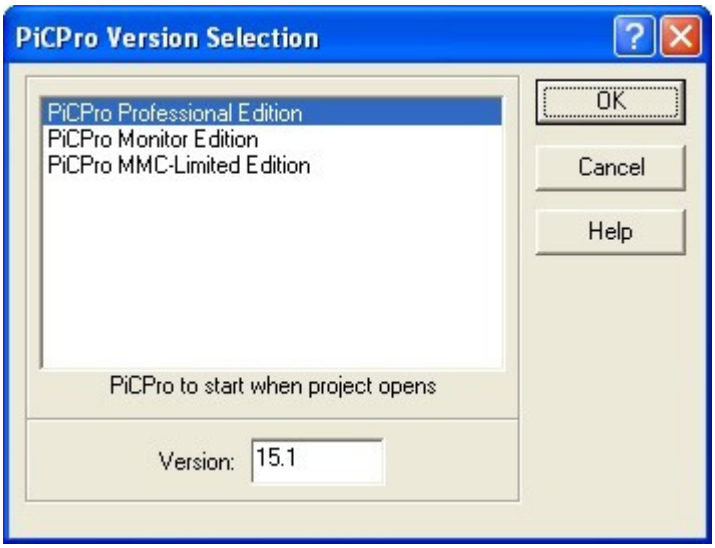
The PiCPro VERSION contains an item that specifies which version and edition this project is built for. If you open a project in a version or edition other than what is specified in its VERSION category, then you will not be able to compile and download the main ladder or any other ladder. In addition, you will not be able to compile servo or SERCOS functions. You must **Launch** the correct version to do so (**File | Launch Project**). Of course, you can only launch a particular version/edition of PiCPro if it is actually installed on your workstation.

If you right-click on the PiCPro VERSION category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Add	Enables you to add a PiCPro version/edition item to your project by displaying the **PiCPro Version Selection** dialog. This dialog allows you choose both the edition and version of PiCPro that you want associated with this project. This option is only enabled if a PiCPro version/edition is NOT already specified.  In this example, the edition that is chosen is the Professional Edition and the version is 15.1.
Delete All	Enables you to delete all of the items belonging to this category. In this case, that is only one: the PiCPro version/ edition item. You are prompted for a confirmation first.
Cut	Cuts (removes) the PiCPro version/edition item from this category and places it on the clipboard.
Copy	Copies the PiCPro version/edition item from this category to the clipboard.
Paste	Pastes the contents of the clipboard into the PiCPro VERSION category. This command is only available if there is not already a version item entered for this category and if the clipboard contains a PiCPro version item.

Item: PiCPro VERSION

If you right-click on an item (PiCPro version/edition) in the PiCPro VERSION category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Open	Not enabled for this category.
Delete	Removes this item, the PiCPro version/edition, from this category. You are prompted for a confirmation first.
Edit	Enables you to edit the PiCPro version/edition by displaying the **PiCPro Version Selection** dialog. You can choose the edition and the version of PiCPro that you want associated with this project.  In this example, the edition that is chosen is the Professional Edition and the version is 15.1.
Cut	Cuts (removes) this item, the PiCPro version/edition, from this category.
Copy	Copies this item to the clipboard.
Paste	Pastes a PiCPro version item into this category. This is only available if a PiCPro version item is on the clipboard. This overwrites the selected PiCPro version item.

Category: PiCPro LIBRARY PATHS

This category contains all of the paths for all of the libraries that your project uses. You can edit this list by right clicking on the category or an actual item in the category and selecting **Modify**. The **PiCPro Libraries** dialog is displayed. Alternatively, you can select **File | PiCPro Libraries** while a project is open. Any changes made to the library path list there, will be reflected in the PiCPro LIBRARIES PATHS category of the open project.

If you right-click on the PiCPro LIBRARY PATHS category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Modify	Allows you to add or remove library paths in this category. Displays the same dialog that you get when you select **File | PiCPro Libraries**.
Delete All	Deletes all of the libraries paths under this category. You are prompted for a confirmation first.
Cut	Cuts (removes) all of the library paths from this category and places them on the clipboard. A library path on the clipboard can be pasted into the PiCPro LIBRARY PATHS category if it does not already exist there. **Note:** If you do a cut on this category, you'll get a warning message stating that PiCPro couldn't find any library paths. Just click **OK**. Remember, you will need to add some library paths back in sometime.
Copy	Copies all of the library paths in this category and places them on the clipboard. A library path on the clipboard can be pasted into the PiCPro LIBRARY PATHS category if it does not already exist there.
Paste	If the clipboard contains library paths, this pastes the contents of the clipboard into this category. If a matching path already exists there, a duplicate one is not added. This menu selection is only available if the clipboard contains library paths.

Item: PiCPro LIBRARY PATHS

If you right-click on an item (a library path) in the PiCPro LIBRARY PATHS category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Edit	Allows you to manually edit the library path by typing in the new information.
Modify	Allows you to add or remove libraries paths in this category. Displays the same dialog that you get when you select **File | PiCPro Libraries**.
Delete	Deletes the selected library path from the list. You are prompted for a confirmation first.

Cut	Cuts (removes) the selected library path from the list and places it on the clipboard.
Copy	Copies the selected library path from the list and places it on the clipboard.
Paste	Pastes the contents of the clipboard into this category, replacing the selected item. This menu selection is only available if the clipboard contains library path items.

Source and Library File Categories

These categories list the source files and the libraries for your projects. These categories are updated by **Update Project Tree** and **Update Items in this Category**. If you manually change the contents of these categories, performing an update will potentially lose those changes. Update first removes all items from a category and then based on dependencies and the Properties settings for the project, adds items back in.

The following are Source and Library File Categories for your project:

Source and Library File Category	Source File Extension	Category Description
UDFBs/TASKs	.ldo	Typically contains entries for the library files (.lib) for the tasks and function blocks for this project. Also contains entries for their corresponding source files (.ldo).
SERVO SETUP FILES	.srv	Typically contains entries for the library files (.lib) for the Servo Setup functions for this project. Also contains entries for their corresponding source files (.srv).
SERCOS SETUP FILES	.src	Typically contains entries for the library files (.lib) for the SERCOS Setup functions for this project. Also contains entries for their corresponding source files (.src).
PROFILE SETUP FILES	.pro	Typically contains entries for the library files (.lib) for the Profile Setup functions for this project. Also contains entries for their corresponding source files (.pro).

Category: Source and Library Files

Covers UDFBs, Tasks, SERCOS, Servo and Profile files. Refer to: Source and Library File Catagories.

If you right click on one of these categories, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Add	Allows you to manually add libraries files (.lib) and source files to the selected category. **WARNING:** any manual changes to this category could be lost if you perform an **Update Project Tree** or **Update Project Items under this Category**. To add files where they won't automatically be removed on an update, add them to the OTHER FILES category.

Delete All	Deletes all of the items in the selected category. You are prompted to confirm this first.
Cut	Cuts (removes) all of the items from this category and places them on the clipboard.
Copy	Copies all of the items in this category and places them on the clipboard.
Paste	Pastes all of the items in the clipboard into the selected category. This menu selection is only available if the sources and/or library items on the clipboard are compatible with the selected category.
Update Project Items under this Category	Performs the **Update Project Tree** operation on just this category of the tree, leaving all of the other categories untouched. All items in the category are removed and new entries are added based on the configured properties for this project. The properties determines whether all sources and libraries in your configured paths are added or only those that are used.

Item: Source and Library Files

Covers UDFBs, Tasks, SERCOS, Servo and Profile files. Refer to: Source and Library File Catagories.

If you right-click on an item in one of these categories, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Open	Opens the selected source file in the appropriate PiCPro editor. This menu selection is not available if a library is selected **Note:** This command is equivalent to **File | Open**. It is not the same as **View | UDFB/Task**, **View | Servo Function** or **View | SERCOS Function**. You will not be able to animate the file if it is a UDFB/Task, Servo function, or SERCOS function.
Delete	Deletes the selected item from its category. The entry for this file is removed from the project; the file itself is not removed from disk. You are prompted for a confirmation first.
Edit	Allows you to manually edit this item's name and path by typing in the new information.
Cut	Cuts (removes) the selected item from its category and places it on the clipboard.
Copy	Copies the selected item and places it on the clipboard.
Paste	Pastes the contents of the clipboard into the selected item's category, overwriting the selected item. The types of items on the clipboard must be compatible with this category, otherwise this menu selection is disabled.

Category: DRIVE FILES

The DRIVE FILES category provides you with the opportunity to include any analog interfaced drive system files (*.adv) or digital interfaced drive system files (*.ddv) that you want in your project. The **Update Project Tree** command will leave these files alone.

If you right-click on the OTHER FILES category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Add	Enables you to add any type of file to this category.
Delete All	Enables you to delete all of the items belonging to this category. You are prompted for a confirmation first.
Cut	Cuts (removes) all of the items belonging to this category and places them on the clipboard.
Copy	Copies all of the items in this category to the clipboard.
Paste	Pastes the contents of the clipboard into this category. This command is enabled only if the clipboard contains DRIVE FILE items.

Item: DRIVE FILES

If you right-click on an item in the DRIVE FILES category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Open	If the selected file is a PiCPro source file, that file is opened in the appropriate PiCPro editor. Otherwise, this menu selection is not enabled.
Delete	Deletes the selected item from this category. You are prompted for a confirmation first.
Edit	Enables you to manually edit the name and location of the selected item.
Cut	Cuts (removes) the selected item from this category and places it on the clipboard.
Copy	Copies the selected item in this category to the clipboard.
Paste	Pastes the contents of the clipboard into this category, overwriting the selected item. This command is enabled only if the clipboard contains DRIVE FILE items.

Category: OTHER FILES

The OTHER FILES category provides you with the opportunity to include any type of files that you want to in your project. Perhaps you have a text file or spreadsheet with relevant notes or data. Or maybe you have some alternative UDFBs you want included but you're not yet using. Or maybe it's important for you to have the online help files for the UDFBs or ASFBs available. Or maybe you would like to include the Drive IDN files associated with your SERCOS functions. You can include them all here and, unlike files entered in the UDFBs/TASKs, SERVO, SERCOS and PROFILE categories, the **Update Project Tree** command will leave them alone.

If you right-click on the OTHER FILES category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Add	Enables you to add any type of file to this category.
Delete All	Enables you to delete all of the items belonging to this category. You are prompted for a confirmation first.
Cut	Cuts (removes) all of the items belonging to this category and places them on the clipboard.
Copy	Copies all of the items in this category to the clipboard.
Paste	Pastes the contents of the clipboard into this category. This command is enabled only if the clipboard contains OTHER FILES items.

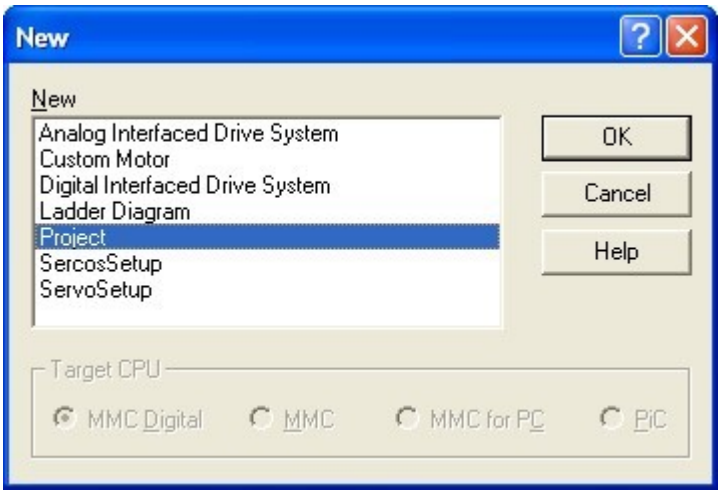
Item: OTHER FILES

If you right-click on an item in the OTHER FILES category, a popup menu is displayed with the following menu selections:

Popup Menu Item	Description
Open	If the selected file is a PiCPro source file, that file is opened in the appropriate PiCPro editor. Otherwise, this menu selection is not enabled.
Delete	Deletes the selected item from this category. You are prompted for a confirmation first.
Edit	Enables you to manually edit the name and location of the selected item.
Cut	Cuts (removes) the selected item from this category and places it on the clipboard.
Copy	Copies the selected item in this category to the clipboard.
Paste	Pastes the contents of the clipboard into this category, overwriting the selected item. This command is enabled only if the clipboard contains OTHER FILE items.

Creating a New Project

Creating a New Project



To create a new project:

1. Select File | New from the menu. The New dialog is displayed.

   Notes:

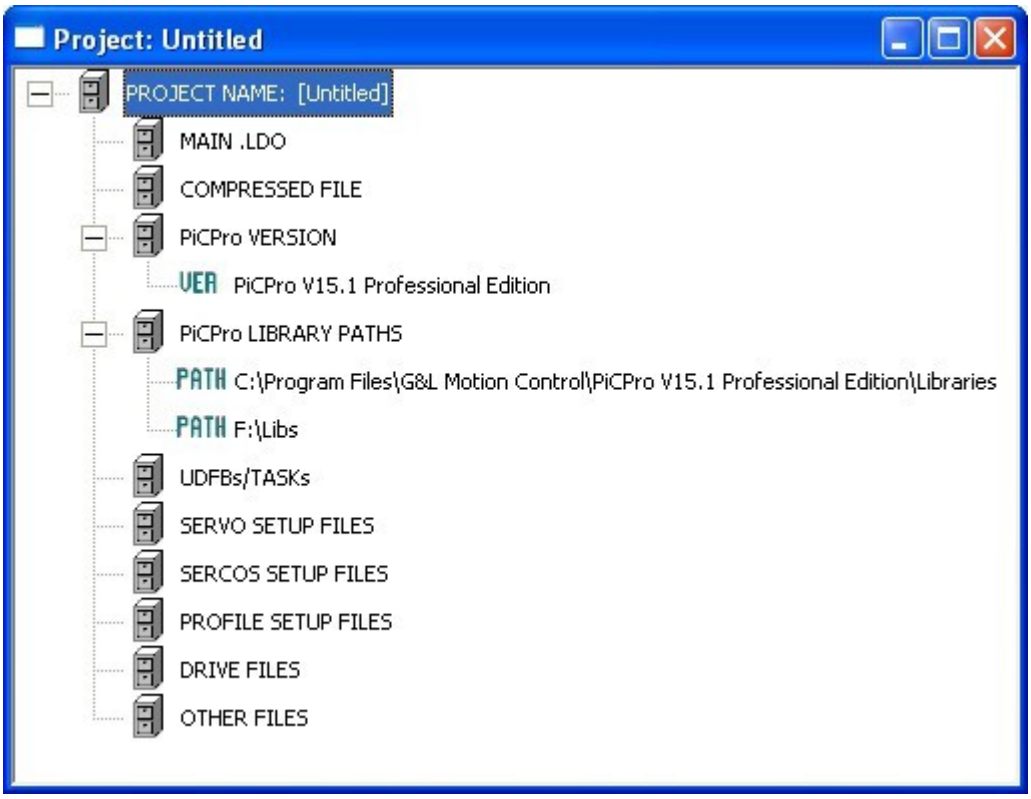
   - If you are running PiCPro Monitor Edition, you will not be prompted with the New dialog. Instead, if another project is open, you are prompted to close it, and then a new project tree is immediately created and displayed for you.
   - In any of the PiCPro editions, if you already have a project open, you are prompted to close it. You can only have one project open at a time.

2. Choose Project from the list by clicking on it. The Target CPU choice is immaterial here and all choices are disabled. CPU type is not a characteristic of the project file itself; it is a characteristic of the source files configured in the project.

3. Click on **OK**.
4. A project tree is created and displayed for you.
5. Modify the project as desired.
6. Select **File | Save** to save the project file. The file name you enter becomes the name of the project. When a new project tree is displayed, all of the categories exist in the tree, but not all have default values.
   - PROJECT NAME - No default. Specified when you **Save** the project (**File | Save**).
   - MAIN .LDO - If you have a ladder open and the ladder has focus when you create this new project, this category defaults to the name and location of the open ladder.
   - COMPRESSED FILE - If you have a ladder open when you create this new project, the file item in this category defaults to <open ladder name and location>.
   - PiCPro VERSION - Defaults to the edition and version of PiCPro that you are currently running.
   - PiCPro LIBRARY PATHS - defaults to the library path list that is configured for the edition/version of PiCPro that you are running.
   - UDFBs/TASKs - If you have a ladder open and the ladder has focus when you create this new project, this category defaults to include all of the dependencies for that ladder based on the project's properties, which default to ALL files in Library Paths, even if not used.

- SERVO SETUP FILES - If you have a ladder open when you create this new project, this category defaults to include all of the dependencies for that ladder based on the project's properties, which default to ALL files in Library Paths, even if not used.
- SERCOS SETUP FILES - If you have a ladder open when you create this new project, this category defaults to include all of the dependencies for that ladder based on the project's properties, which default to ALL files in Library Paths, even if not used.
- PROFILE SETUP FILES - No defaults.
- DRIVE FILES – No defaults.
- OTHER FILES - No defaults.

If an .LDO file is not opened and/or .LDO does not have focus, the **New Project** dialog will open with two defaults entered, the PiCPro VERSION and the PiCPro LIBRARY PATHs. All other entry fields will be blank.



You can modify or add to these defaults as applicable. Remember that any modifications made to the UDFBs/TASKs, SERVO SETUP FILES or SERCOS SETUP categories will be lost if you do an **Update Project Tree**. The OTHER FILES category allows you to enter additional files you want to include in the project and is not altered by an update.

Opening an Existing Project

Opening an Existing Project

A project is opened by using the **File | Open** from the menu. There are two types of project files that can be opened:

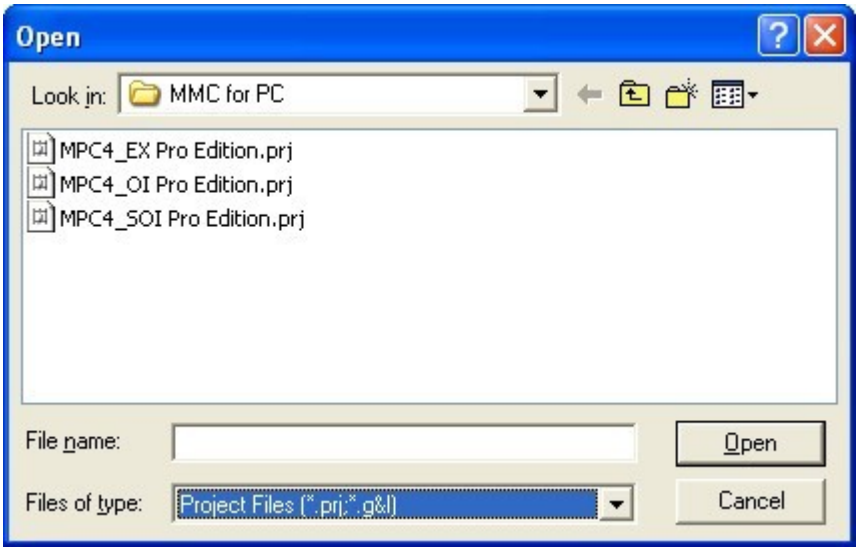
1. PiCPro project file (.PRJ or .prj, same thing).
2. PiCPro compressed project file.

You can also open any of these from the FMS disk, if you have one, on the control

Opening a Project File (.PRJ)

If you want to open an existing PiCPro project file:

1. Selecting **File | Open** from the menu. Then the **Open** dialog displays.



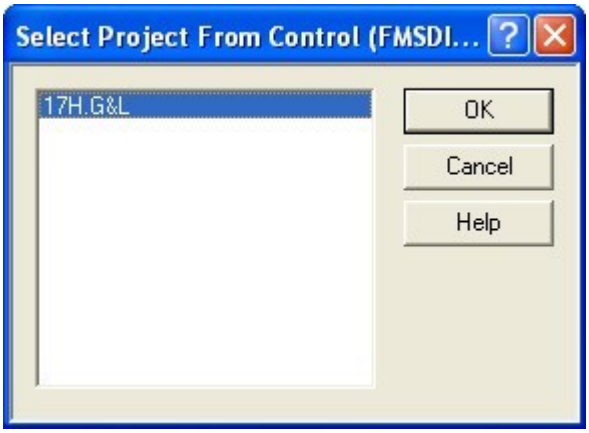
2. In the **Files of type** edit field, select Project Files.
3. Browse to the desired project file.
4. Select the project file that you want to open
5. Click the **Open** button.
6. If any other project is open, you are prompted to close it because only one project can be open at a time.

   Note: If the version and edition of PiCPro that is configured in the project is different than the version and edition you are currently running, you will be warned of this and can either continue opening the project or not. On the status bar, an icon with a red background indicates that the editions/versions do not match: PRJ. This indicates that to have full functionality, you should "launch" the correct edition/version of PiCPro (File | Launch). An icon with a green background indicates that a project is open and that the editions/versions match: PRJ
7. The project is now open for editing and if found, the main ladder file of the project is opened, also. Alternatively, if the desired project has been recently open, you might find it in the "most recently used list" located near the bottom section of the **File** menu. Just select the entry that you want.

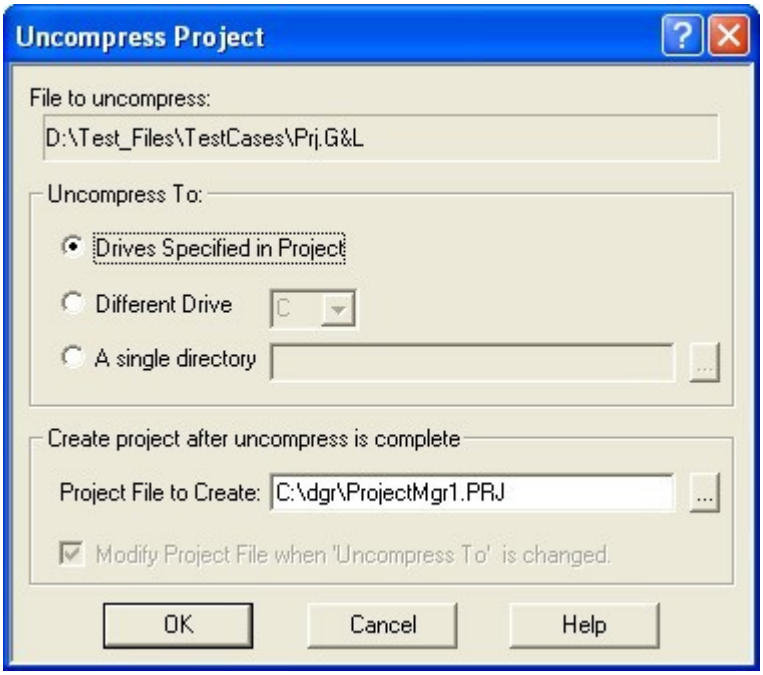
Opening a Compressed Project File

A PiCPro compressed project file that is stored on your workstation or on the FMS disk on your control can be uncompressed by opening it:

1. Select **File | Open** from the menu. Make sure the file type at the bottom of the dialog is set to "Project files". Browse to the compressed project file that you want to open and select it and click on **Open**.
2. Alternatively, if the compressed project file is on the FMS disk on your control, select **File | Open From Control** instead. A list of compressed files on the control's FMS disk is displayed to you. Realistically, there should only be one there. Select the file by clicking on it and then click **OK**. The file is then copied to a temporary directory on your workstation before the Uncompress dialog is displayed to you.



3. If any other project is open, you are prompted to close it because only one project can be open at a time.
4. The **Uncompress Project** dialog is displayed.



5. Choose the locations you want to uncompress to:

- **Drives Specified in Project** - this option uncompresses all of the files in the compressed project file into the exact locations (drive and directory paths) that were specified in the project when the compressed file was made.
- **Different Drive** - this option uncompresses all of the files in the compressed project file into the directory location specified in the original project file, BUT substitutes the drive with the one you select here.
- **A single directory** - this option uncompresses all of the files in the compressed project file into a single drive and directory location. Use the button to the right to browse to the desired location or manually type in the desired location.

6. The Project Name will default to the uncompressed project file name with a .PRJ extension instead. You can modify the name and path.
7. If you have chosen an **Uncompress To:** option other than **Drives Specified in Project**, selecting the **Modify project when 'Uncompress to' is changed** will generate the new project file with file entries whose locations match your **Uncompress To:** choice. Exception: The drive and location of standard libraries in the LIBRARY PATHS is not altered.
8. Click **OK**.

   Note: If the version and edition of PiCPro that is configured in the project is different than the version and edition you are currently running, you will be warned of this and can either continue opening the project or not. On the status bar, an icon with a red background indicates that the editions/versions don't match:

. This indicates that to have full functionality, you should launch the correct edition/version of PiCPro (File | Launch). An icon with a green background indicates that a project is open and that the editions/versions match:

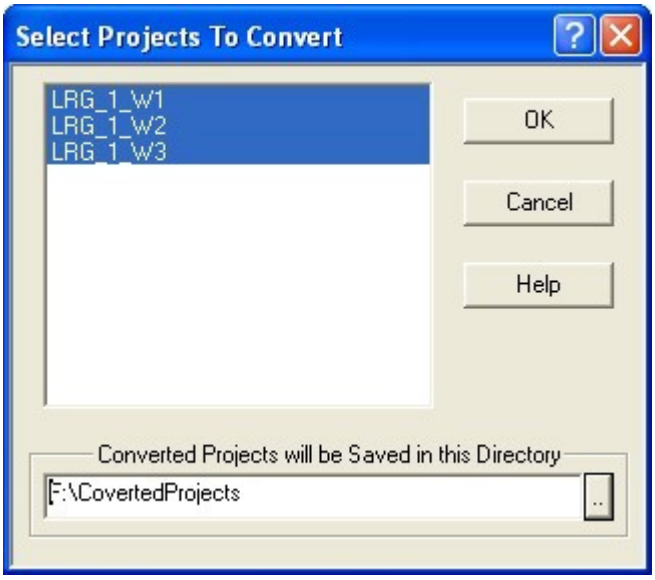
9. When done, a message saying "Uncompress project is complete" appears. All files have then been uncompressed to the location(s) you specified and the specified project file has been created according to your specifications and is opened for editing.

Opening DOS based Projects

Opening a DOS Project File (.PRJ)

If you want to open an existing DOS project file:

1. Select **File | Open** from the menu. In the **Files of type** edit field, select Project Files.
2. Browse to the desired DOS project file.
3. Select the project file (.PRJ) that you want to open.
4. Click the **Open** button.
5. If any other project is open, you are prompted to close it because only one project can be open at a time.
6. Since you chose a DOS project file (.PRJ), you will be prompted whether you want to convert to the PiCPro project file format. Select **Yes** to continue opening. **Note:** PiCPro cannot save a project to the DOS format.
7. Now the **Select Project to Convert** dialog is displayed.



8. Select one or more of the DOS project files listed. Remember that DOS project files can hold more than one project, whereas Windows project files can only hold one. To select a file, click on it. Alternatively, click on a selected file to deselect it. Click and drag to select multiple, continuous files from the list. Or use Shift-click to select multiple, contiguous files from the list. Initially, the dialog has all of the files selected by default.
9. Click **OK**.
10. The DOS project(s) you chose are converted to PiCPro project file format. No projects are left open after the conversion is done.
11. To edit or look at one of these new projects, select **File | Open** from the menu.

Note:

If a DOS project uses the "@" feature to specify a list of files, those files are automatically deposited into the OTHER FILES category when the PiCPro for DOS project is converted to a PiCPro project. Any other use of the "@" feature to list files in a project is not supported in PiCPro.

Opening a DOS Compressed Project File

If you want to open an existing DOS compressed project file:

1. Select **File | Open** from the menu.
2. In the **Files of type** edit field, select Project Files.
3. Browse to the desired DOS compressed project file.
4. Select the compressed project file that you want to open.
5. Click the **Open** button.
6. If any other project is open, you are prompted to close it because only one project can be open at a time. Then the **Open** dialog is displayed.
7. Since you chose a DOS compressed project file, you are prompted whether you want to convert to the PiCPro project file format. Select **Yes** to continue opening.
8. Now the **Uncompress Project** dialog is displayed. **Note:** Just like PiCPro, a PiCPro for DOS compressed project file only contains one project.
9. Just like when you uncompress a PiCPro compressed project file, you are prompted for information on where to expand the contents.
10. The project is now open for editing and is now in PiCPro project format. It cannot be saved in PiCPro for DOS project format.

Note:

If a DOS project uses the "@" feature to specify a list of files, those files are automatically deposited into the OTHER FILES category when the PiCPro for DOS project is converted to a PiCPro project. Any other use of the "@" feature to list files in a project is not supported in PiCPro.

Compressing a Project

Compressing a Project

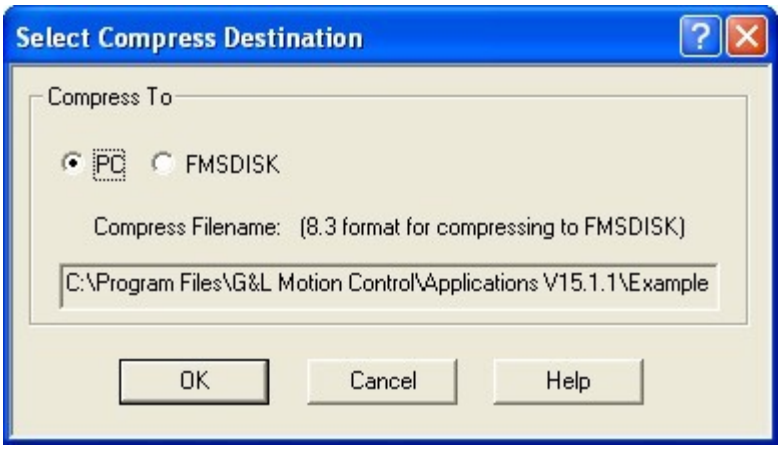
When you create a project using PiCPro, you create a project file. This file has entries that describe the name and location of the various source files and library files and others that constitute your project. The actual files are not a part of the project file. However, if you compress your project, a compressed project file is created. This file physically contains, in compressed format, a copy of all of the files described by name (plus their supporting files) in the project file. You can now easily distribute your project as a single file or deposit it on an appropriate control's FMS disk.

Note:

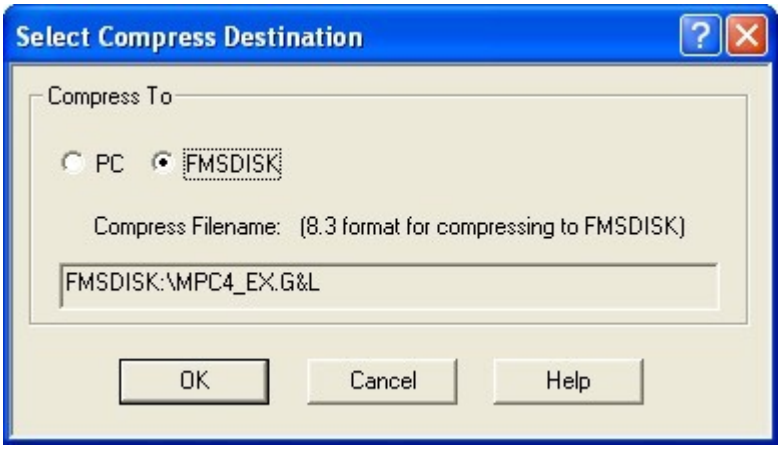
Compressed project files do not include the standard libraries.

To compress a project file:

1. Open or create a project.
2. Make sure a compressed project file name is configured in the COMPRESSED FILE category of the project.
3. Select **File | Compress** or right-click on PROJECT NAME category and select **Compress**
4. The project is automatically **Validated**. This checks that the files that are referenced in the project tree actually exist in the configured location. It does not validate the compressed project file or verify the PiCPro edition/version.
5. You are also prompted to save your project if it has changed. You must save it to continue with the compress.
6. You are asked whether or not to **Update** your project. Updating checks the dependencies for the files in your project and automatically includes source and library files according to the properties selected for this project. Remember that entries for files that were manually added to the UDFBs/TASKs, SERVO SETUP FILES and SERCOS SETUP FILES could be lost if other files are not dependent on them.
7. The **Select Compress Destination** dialog is displayed. Your choices for destination are the workstation or the FMS disk, if you have one. If you select the workstation, the location for the compressed project file is exactly what you had configured in the project file. However, if you select FMS disk, the location for the compressed project file is FMSDISK:\.
   (**Note:** you cannot edit the destination from here, only from the COMPRESSED FILE category in the project tree.)
8. Click **OK**.



Destination if FMS disk is selected



Note:

Even if you compress to your workstation, you can copy the compressed project file to the FMS disk on your control by using **Online | Control Operations | Disk Operations | Flash**. Remember that depositing any file(s) to FMS disk completely removes anything that was already there. You do get a prompt warning you of this, allowing you to **Cancel**, if desired.

Launching a Project

Launching a Project

At times, you may open a project that is configured with a version and edition of PiCPro that is different than the version and edition you are currently running. In these cases, you are warned of this and can either continue opening the project or not. If you choose to continue the open, the status bar will display an icon with a red background that indicates the edition/version mismatch: PRJ. If no mismatch, this icon is displayed in green: PRJ.

If you have a red (version mismatch) icon displayed, PiCPro provides a mechanism for you to automatically reopen your project in the correct edition/version of PiCPro (provided it is installed on your workstation).

- Select **File | Launch Project**

  OR

- Right-click on the PROJECT NAME category of the project tree and select **Launch Project**.

The **Launch Project** feature first checks to see if the configured edition/version of PiCPro is installed on you workstation. If it isn't, a message is displayed and the launch is canceled. Otherwise, the currently running PiCPro is closed, the configured one is opened and the project is also automatically opened.

Note:

It is important to be running the same edition/version of PiCPro as is configured in the project if you need to edit and download any changes to the control. To avoid unexpected results, a particular edition/version of PiCPro should only be used with the libraries distributed with it. For example, if a project called for PiCPro 10.2 Standalone MMC Edition and you are currently running PiCPro 11.0 Professional Edition a version mismatch occurs. In fact, if your editions/versions mismatch, the Compile and Download feature will report the mismatch to you and will then cancel.

Printing a Project

Printing a Project

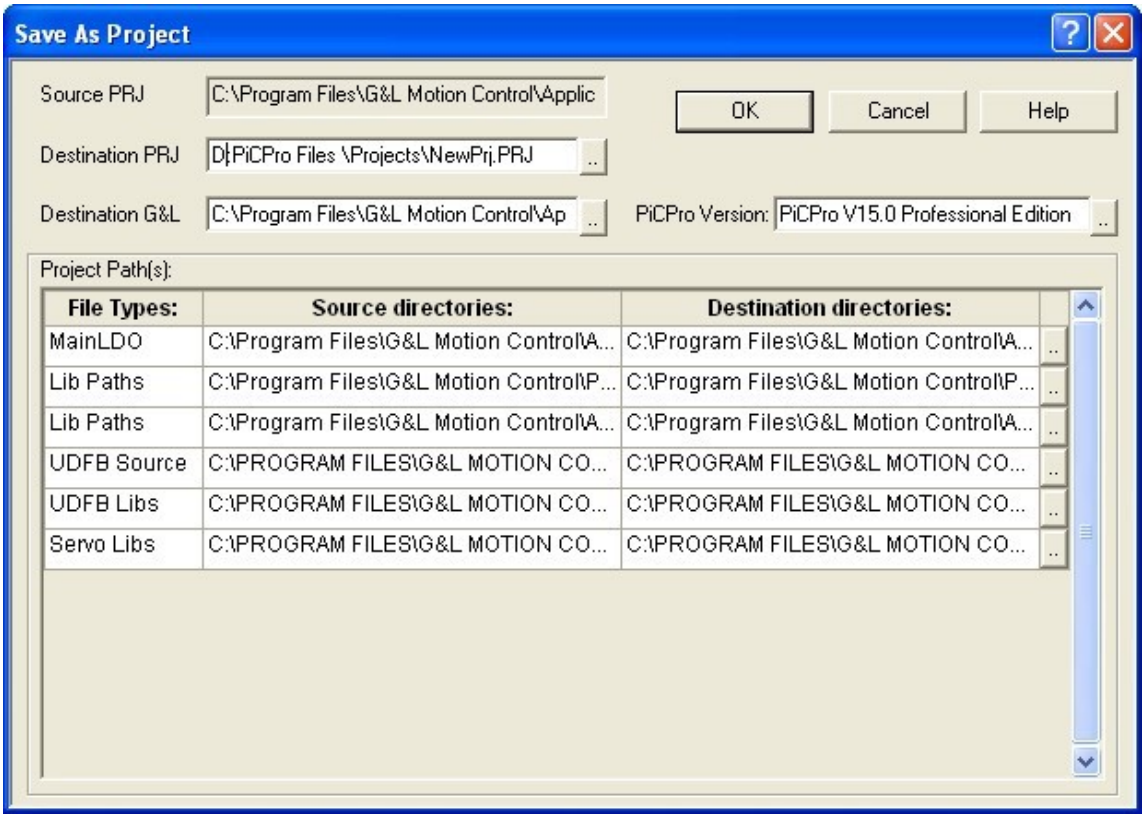
To print the contents of a project file:

1. Open the desired project file.
2. Once the project is open, select **File | Print** from the menu or click the button.
3. The standard **Print** dialog displays.
4. Make appropriate changes for printer properties, etc. if needed.
5. Click **OK**.

Copying a Project (Save As)

Copying a Project (Save As)

The **Save As** command allows you to copy all of the files that make up an entire project to new locations. Here you have total control over where each different file type and directory combination will be copied to for the new project.



The **Save As Project** feature can be useful as a tool to help you move your project from development directories to production directories.

Source PRJ

This is the name and location of the project you are making a copy of. You cannot alter this field.

Destination PRJ

Fill in the name and location for the new project file. The name and/or location are usually different than the Source PRJ name. You can use the button to the right of this field to browse to the location you want and then type in the new name. In the new project, this will be entered into the PROJECT NAME category.

Destination G & L

Fill in the name and location for the new compressed project file. The name can be different than what is configured in the Source PRJ project file, although that is what it defaults to. In the new project, this will be entered into the COMPRESSED FILE category.

PiCPro Version

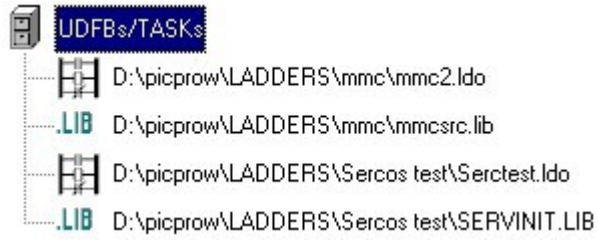
Enter the edition/version for the new project. Pressing the button to the right of this field brings up the **PiCPro Version Selection** dialog. Choose the desired edition and version from this field and click **OK**. In the new project, this will be entered into the PiCPro VERSION category.

Project Paths

This section is made up of file types and paths that are used to build the following categories in the new project:

- UDFBs/TASKs
- SERVO SETUP FILES
- SERCOS SETUP FILES
- PROFILE SETUP FILES
- DRIVE FILES
- OTHER FILES

For every different type of file (Servo Setup source, UDFB library, etc.) and path combination that exists in the Source PRJ project file, a corresponding entry exists in the **Project Path(s):** in the dialog. For the example below, if for some reason this is how you've arranged your UDFB files in the Source PRJ project file...



...then this will be the information the **File Types** and **Source directories** columns of the **Save As Project** dialog:

UDFB Source	D:\picprow\LADDERS\mmc
UDFB Source	D:\picprow\LADDERS\Sercos test
UDFB Libs	D:\picprow\LADDERS\mmc
UDFB Libs	D:\picprow\LADDERS\Sercos test

Note:

If a category in the Source PRJ is empty, then the corresponding File Types will not be listed in this dialog's Project Paths. For example, if the Source PRJ has no items in the OTHER FILES category, then Other Files will not be listed in the File Types: of this dialog. If the Source PRJ has source files in the PROFILE SETUP FILES categories, but no library files, then the File Types: in this dialog will have Profile Setup Source listed but not Profile Setup Libs.

The **File Types:** and **Source directories:** columns cannot be edited from this dialog, but the entries in the **Destination directories:** column can be. Edit this field for every file type's destination that you want changed in the new project. By default, the **Destination directories:** column is initialized with the same information as in the **Source directories:** column.

To begin editing a **Destination directories:** field, single click at the point in the text where you want to start typing. A blinking cursor should appear. Any characters typed will be inserted before the cursor. If any portion of a field is selected, any character you type will replace that selected portion. If you click in the field where there isn't any text, the entire field will be selected.

Note:

- <**Ctrl + X**> cuts any selected portion to the clipboard.
- <**Ctrl + C**> copies any selected portion to the clipboard.
- <**Ctrl + V**> pastes clipboard contents over any selected portion otherwise pastes before the blinking cursor in the field.

You can also use the browse button to the right of each **Destination directories:** field to browse to the desired location.

When done click the **OK** button. The source PRJ file is automatically closed, the files are copies to their new locations, and the new project file is opened in the PiCPro that is currently running.

Chapter 3 - Working with Ladders

A PiCPro Session

A PiCPro Session

This section covers information about basic operation you need to be familiar with to use PiCPro. A PiCPro session begins when you launch the application. Next you choose what you want to do in the session:

- Creating a New Ladder File (.ldo) *(Chapter 3)*
- Opening an Existing Ladder File (.ldo) *(Chapter 3)*
- Create a New Servo Setup File (.srv) *(Chapter 7)*
- Open an Existing Servo Setup File (*.srv) *(Chapter 7)*
- Create a New SERCOS Setup File (.src) *(Chapter 8)*
- Open an Existing SERCOS setup file (*.src) *(Chapter 8)*
- Create a New Analog Interfaced Drive System File (*.adv) *(Chapter 4)*
- Open an Existing Analog Interfaced Drive System File (*.adv) *(Chapter 4)*
- Create a New Digital Interfaced Drive System File (*.ddv) *(Chapter 5)*
- Open an Existing Digital Interfaced Drive System File (*.ddv) *(Chapter 5)*
- Creating a New Project (*.prj) *(Chapter 2)*
- Opening an Existing Project (*.prj) *(Chapter 2)*

Once the file you've chosen is open, you can begin to add/change the file using the editing tools. Then you save the file to a location specified by you. Finally, you can exit PiCPro or, if completed, compile and download your file to the control.

For more information about basic operations you will need to be familiar with to use PiCPro, See:

- Starting PiCPro
- Creating new files
- Printing
- Opening an existing ladder or file
- Using PiCPro tools and toolbars

Once the cable has been connected between your workstation and your controller and your ladder program has been downloaded to the CPU, there are several things you can do that are described on the following Help screens:

- Controlling the scan
- Restarting the ladder
- On-line editing
- Animating the ladder
- Forcing variables
- Viewing variables
- Building a dependency list
- Backup the application program and/or the RAM disk
- Restore the application program and/or the RAM disk

Creating New Ladder Files

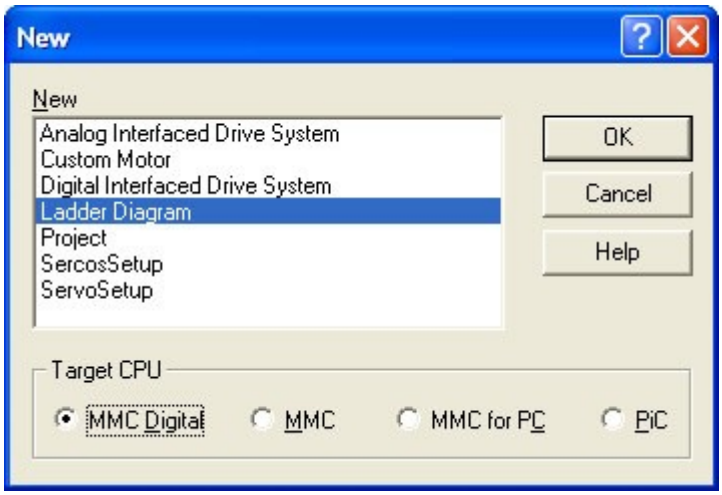
Once PiCPro is started, you can create a new ladder file.

1. To start a file, do one of the following:

   - Click the button in the standard toolbar.
   - Choose **File | New** from the menu.

2. The **New** dialog appears. Choose **Ladder Diagram**.

   When creating new files in PiCPro Professional Edition, you can also select the CPU type (**MMC Digital, MMC, MMC for PC, or PiC**). The default selection is the last selection made.



Note:

When using the PiCPro MMC-Limited Edition, the CPU type is always MMC, and therefore is not an option on this dialog.

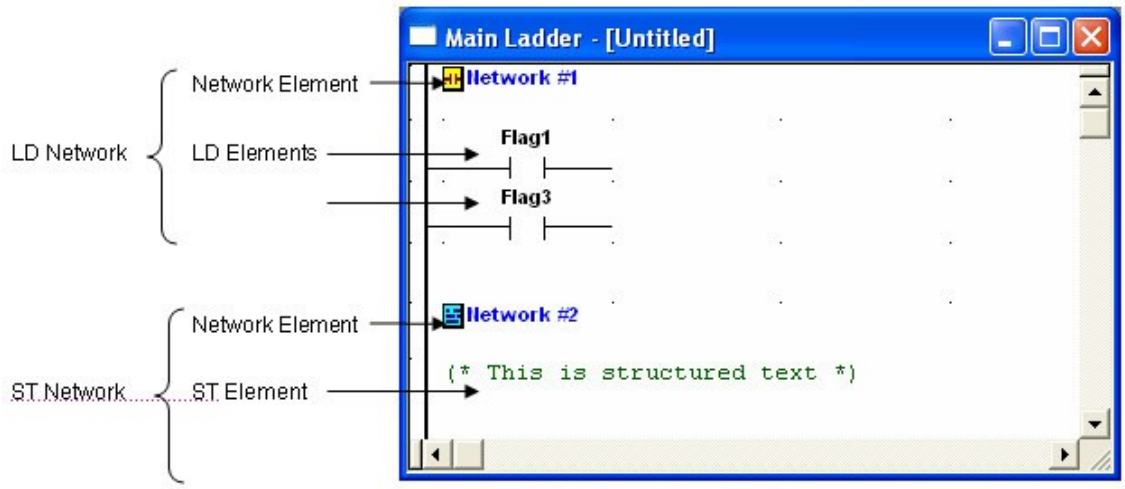
3. Click on **OK** to start a new ladder file. Select **Cancel** or to close the dialog without starting a new ladder file. Select **Help** to display information related to starting a new ladder file.

PiCPro then displays a new ladder diagram. You can now create your ladder program with the tools and features available in PiCPro and then save your ladder file.

Opening a New Ladder File

When you open a new ladder file, Network #1 appears and you can begin entering your program. Additional networks can be added as you develop your program.

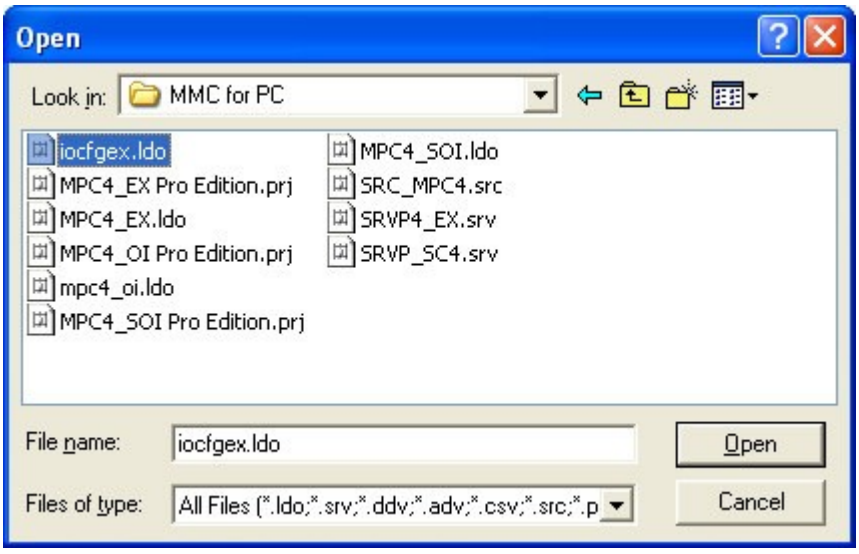
The location of elements for both a LD Network and a ST Network are illustrated below.



Opening an Existing Ladder File

The Open command opens files that have already been saved.

1. To open an existing file, do one of the following:
   - Click the button in the standard toolbar.
   - Choose **File | Open** from the menu.
2. From the Look In: list, choose the drive where the file is located.
3. Double-click the folder where the file is located.
4. Double-click the filename of the file you want to open.



Note:

The toolbar area can be optimized by moving toolbars.

Opening a Recently Opened File

To open a recently opened file, do the following:

- Select **File** from the menu.
  A list of the most recently opened files appears at the bottom of the menu.
- Click on the file you want to open.

Note:

Opening a ladder file (*.ldo) with a PiC or MMC for PC CPU in the MMC-Limited Edition will result in a confirmation prompt. If you choose not to convert the CPU type, the file will be opened, but cannot be downloaded, compiled, etc.

Opening a Recently Opened File

PiCPro supports ladder versions 6.0 and greater. You can determine the version of your ladder by opening a DOS window, changing the directory to where your ladder is and typing: **TYPE <ladder filename>** where <ladder filename> is the name of your ladder file (e.g. angle.ldo)

You should see something similar to this: **G & L PiCPro V06.00**. If your ladder is version 6 or greater, then you can use it in PiCPro. If your ladder is less than version 6, then you must convert it using DOS PiCPro v8 or later. If you get the following error while using PiCPro: "**The version of this file <ladder filename> is not supported by PiCPro**" then PiCPro does not support the version of the ladder you are trying to open for Windows.

Tip:

To convert old ladders, install the DOS version of PiCPro v8 or later. Use this DOS PiCPro to open and then save your old ladders. This will save your ladders as a valid version for PiCPro.

PiCPro Tools

PiCPro Toolbars

The toolbars give you quick access to some of the frequently used tools. These are the toolbars available in PiCPro (refer to APPENDIX I – Toolbar Buttons).

- Servo - Standard and SERCOS -Standard
- Drive List - Standard Tools
- Custom Motor
- Standard
- Basic Online Operations
- Advanced Operations
- Ladder
- View Navigator
- Function/Function Blocks
- Compiler
- Structured Text Tools
- Insert New Network
- Digital Drive List Standard Tools

Using the Pointer Tool

The Pointer tool button is found on the Ladder Toolbar. It is the default selection. It can be used to:

- Point and click to select locations in the ladder (pointer mode).
- Select ladder components (e.g. function, wire, coil, etc.) from the ladder toolbar and drop them into a ladder (drop mode).
- Exit the drop mode and restore the cursor to pointer mode.

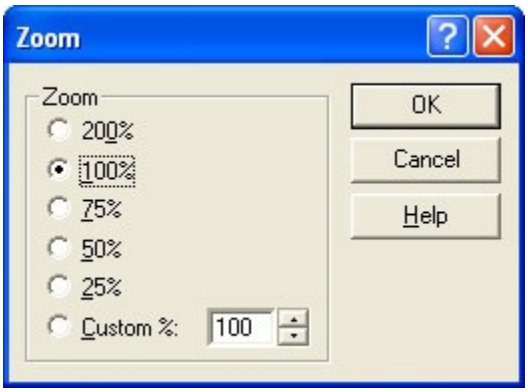
Zooming In and Out

Zooming In and Out

Zooming in and out allows you to view and work on your program from 5% to 400% magnification.

Using Zoom Command from View Menu

1. Select **View | Zoom** from the menu. The **Zoom** dialog appears.



2. Choose zoom rate using one of the following methods:
   - Click a button.
   - Press a hot key (i.e. 7 for 75%).
   - Enter a custom rate by incrementing or decrementing the scroll box in increments of 1%.
   - Choosing 200% will double the size. Choosing 50% will decrease the size by one half. The default is 100%.

3. Click **OK** to accept the zoom rate or Cancel to ignore it.

Using Zoom Command from Navigator Toolbar

- To decrease the size of the display, click on the repeatedly until you reach the desired magnification.
- To increase the size of the display, click on the repeatedly until you reach the desired magnification.

Tip:

When you zoom in or out, the cell in the top left-hand corner remains in that location after zooming.

Selecting and Deselecting Items

Focus

A cell or group of cells in your ladder will always have focus. Focus is indicated by a dashed rectangular border around the area. A cell that has focus can be copied, cut, pasted, and deleted. You can also select a cell or group of cells.

The quickest way to set focus is by using the Pointer tool to single click on a cell. If you place focus on the power rail in your ladder, the whole row will have focus. If you place focus on a Function/Block, the whole Function/Block will have focus. However, if you placed focus on the power rail and there is a Function/Block in the row, the entire Function/Block is not selected. You can also move the cell focus in both LD (ladder) and ST (structured text) network from the keyboard as follows:

Keys	Focus Moves:
<**Arrow Keys**>	From current position to new position in the direction of the arrow
<**Home**>	To first column of current row (not on the power rail)
<**End**>	To the last filled cell of the current row
<**Ctrl + Home**>	To Network #1 in your ladder if focus is already in first row, first column of current network or else to first row, first column of current network
<**Ctrl + End**>	To the End of Module marker if focus is already on the last occupied cell in the last row of the network or else to the last occupied cell of the current network
<**Page Down/Up**>	One vertical viewable page down/up
<**Ctrl + Page Down/Up**>	One horizontal viewable page left/right
LD (ladder) networks only	
<**Tab**>	One element to the right of the current element
<**Shift + Tab**>	One element to the left of the current element

Selection

- Selection is indicated by highlighting the area. Selected cells can be copied, cut, pasted, deleted, dragged and dropped.
- Selection is set by first placing focus on the cell and then clicking within the cell. The cell is highlighted.
- A row is selected by placing focus on the power rail and then clicking on the power rail within the focus row.
- Multiple cells are selected by clicking on the first cell and then dragging the mouse over the area you want to highlight.
- If the power rail is not included in the selection, the selection must be contained within a network.
- If the power rail is included in the selection, the selection can contain sequential rows from more than one network.

Note: A ST element takes up only 1 row but can contain up to 500 lines of text.

You can also select cells using the keyboard:

Keys	Selects
<**Shift + Arrow**>	All cells within the rectangular area defined by the arrow keys (Within a network if focus is not on the power rail and over multiple networks if focus is on the power rail.)
<**Shift + Home**>	The focus cell and cells to the left of it
<**Shift + End**>	The focus cell and cells to the right of it until the last filled cell
<**Shift + Ctrl + Home**>	The focus cell and all cells to the upper left-hand cell in the network if focus cell is not on the power rail.
	The focus cell and all cells to the first row in the module if the focus cell is on the power rail of the first row of the current network or else selects the focus cells and all cells through the first row of the current network
<**Shift + Ctrl + End**>	The focus cell and all cells to the last row in the network if focus cell is not on the power rail.
	The focus cell and all cells to the last row in the module if the focus cell is on the power rail of the last row of the current network or else selects the focus cell and all cells through the last row of the current network
<**Ctrl + A**>	All cells in the ladder if all cells in the current network are selected. If all cells in the current network are not selected, all cells in the current network will be selected.

Deselecting Cells

If you click on any cell, all selected cells will be de-selected. If you move focus with an arrow key, all selected cells will be de-selected.

Password Protecting LDO Files

Overview: Password Protecting LDO Files

Each LDO file can be assigned a password (Main LDO and UDFB files). By assigning a password to an LDO file, a file can be locked to prevent opening or editing. A password can be set, modified, or removed using the **File | Properties** dialog.

Note:

PiCPro Professional and MMC-Limited Editions prior to version V14.1 and all versions of Monitor Edition do not allow assignment of passwords to an LDO file. Also, all versions prior to V14.1 are not compatible with a password protected LDO file (an error will display when an attempt is made to open the file).

Two levels of password protection are available:

- **Password Required to Open File** - The LDO file cannot be opened without entering a password. Once the password is entered, the LDO file is opened and full editing of the LDO file is possible.
- **Password Required to Edit File** - The LDO file is opened without entering a password, but the LDO file cannot be edited until the file is unlocked by entering a password through the menu item **File | Properties** or by selecting the unlock toolbar button.

Note: (for Monitor Edition Only)

If the file is opened in Monitor Edition, a password prompt will be displayed before the file is opened. Once the file is open, the file cannot be edited.

If the same password is used for all files of a ladder program (Main LDO and UDFB's), then all files in that ladder program can be unlocked by entering the password just once. The newly opened files will open in an edit lock state until unlocked by clicking on the unlock toolbar button; but this time, no password is required. This helps prevent accidental changes to a file that was not specifically unlocked.

Note:

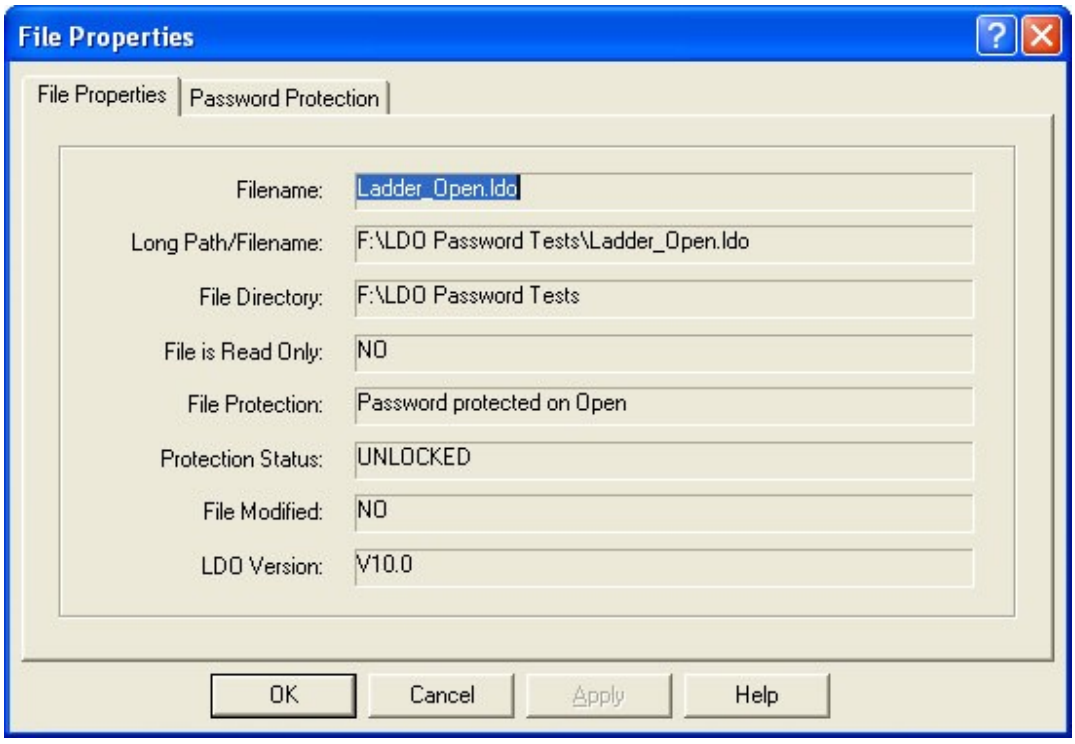
The main LDO is always the main level of password protection. In other words, a UDFB nested inside another UDFB always compares its password against that of the main LDO and not its parent UDFB.

When passwords are different between the main LDO and a UDFB, each file adheres to its own password protection scheme with one exception: the main LDO must always be unlocked before a UDFB can be unlocked. If the main LDO has not been unlocked yet (or has been re-locked), a double password prompt will be displayed; one for the main LDO password and one for the UDFB password.

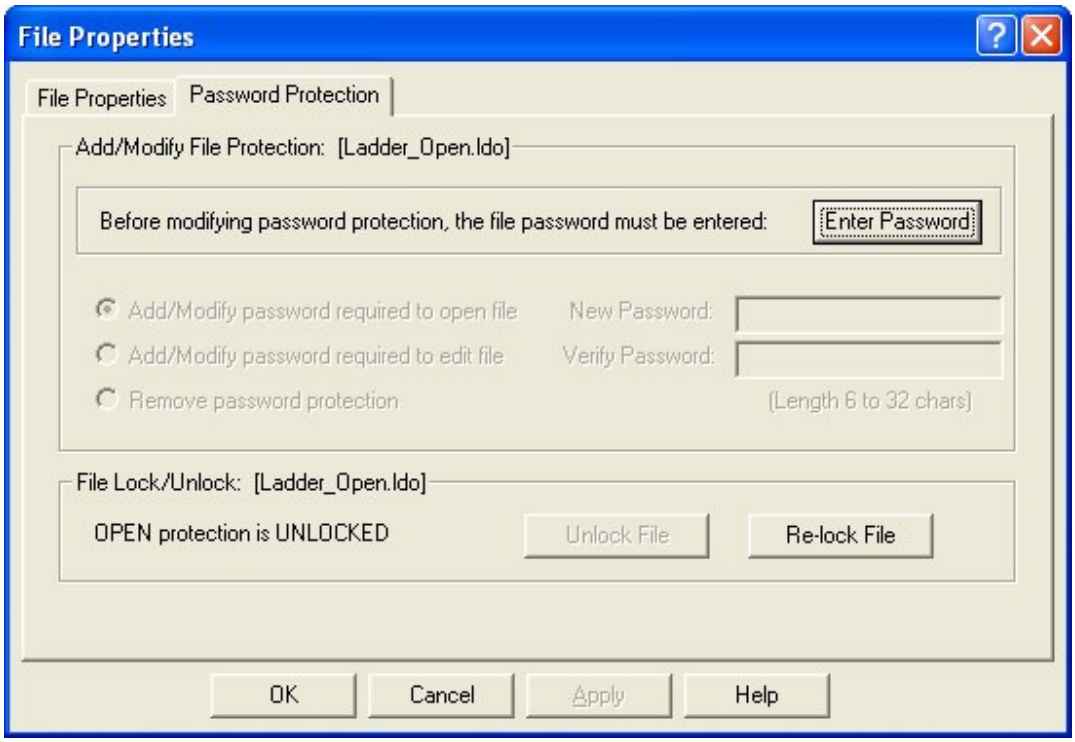
Files that are not password protected can still be locked temporarily during any edit session. This protects a file against accidental changes. A click of the unlock toolbar button is all that is required to unlock the file; no password is needed.

File Properties Dialog for Password Protection

1. From an open LDO file, select **File | Properties**. The file properties will be displayed in the non-editable **File Properties** dialog as follows:



2. Click the **Password Protection** tab and the following will be displayed:



Descriptions of dialog components and related actions are as follows:

Enter Password

In order to modify password protection, the file's password must be entered. Password length is between 6 and 32 characters. The entries can consist of alphanumeric, spaces and punctuation characters.

Add/Modify password required to OPEN file

Click this button to activate password protection required to open this LDO file. This button will be disabled if the current password has not been entered using the Enter Password button.

Add/Modify password required to EDIT file

Click this button to activate password protection required when editing this LDO file. This button will be disabled if the current password has not been entered using the **Enter Password** button.

Remove Password Protection

Click this button to remove password protection for this LDO file. This button is disabled if password protection does not already exist or if the current password has not been entered using the **Enter Password** button.

New Password

Enter the password into this field that will be used to unlock this file.

The entry has to be between 6 and 32 characters. The entry can consist of alphanumeric, spaces and punctuation characters.

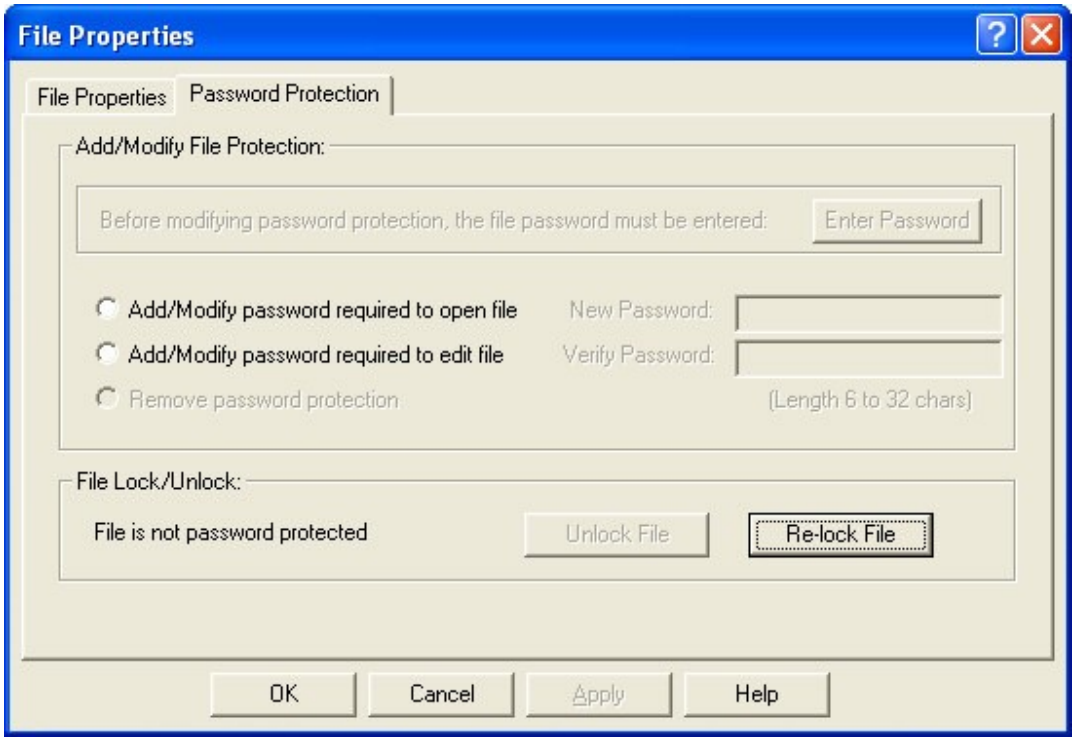
Verify Password

Enter the same password in this field as in the **New Password** field. The **Verify Password** field is used to verify that the two passwords match and prevents a mistyped password from being attached to an LDO file.

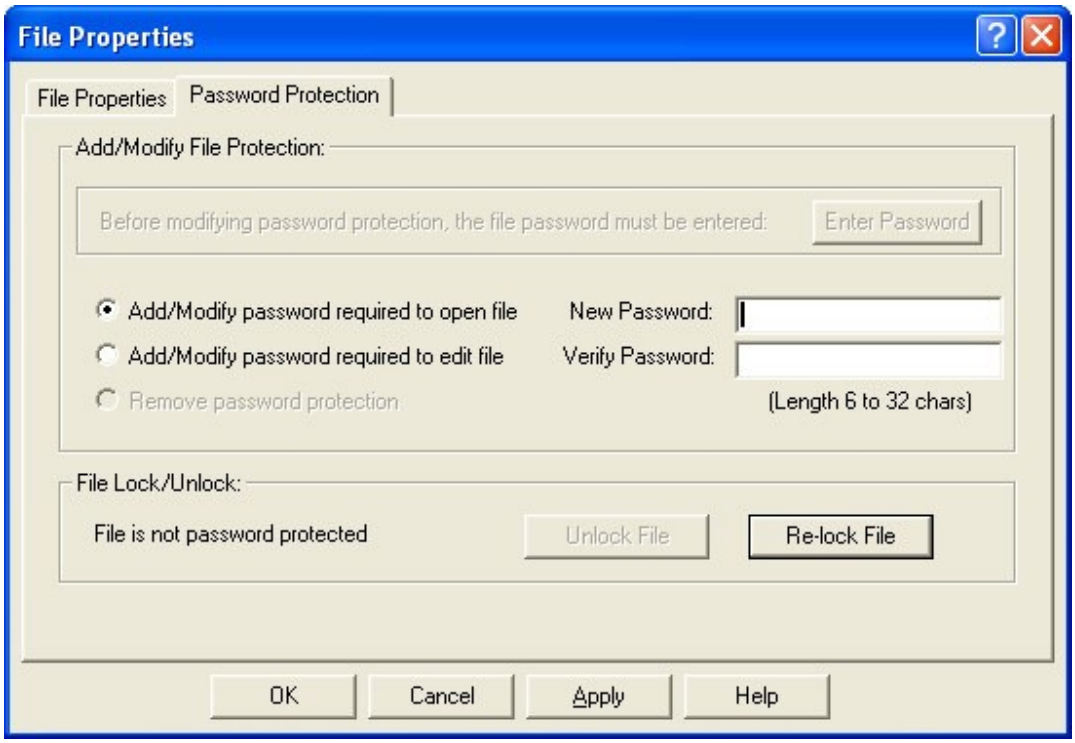
Unlock File	The entry has to be between 6 and 32 characters. The entry can consist of alphanumeric, spaces and punctuation characters.
Re-Lock File	This is used to unlock a password protected LDO file. Click this button to display the **Unlock File** dialog. Enter the file password in this dialog and click **OK**. The entered password will be compared to the file's password. If the passwords match, the file will be unlocked. This button is only enabled if the file is currently locked.
OK	This is used to lock a file and prevent editing. Click this button to re-lock the file.
Cancel	Closes this dialog without saving any changes.
Apply	Click this button to apply the changes made without closing this dialog.
Help	Displays information about this tab.

Password Protecting a File

1. From an open LDO file, select **File | Properties**.
2. Click the **Password Protection** tab and the following will be displayed:



3. Select **Add/Modify password required to open file** to prevent the file from being opened until a password is entered or select **Add/Modify password required to edit file** to prevent editing of the file until a password is entered.
4. At **New Password**, enter the desired password. At **Verify Password**, enter the desired password again.



5. Click **OK**.

Note: The file must be saved to activate the protection.

Opening a Password Protected File

When opening a main LDO file or viewing a UDFB from the main LDO file that is password protected on open, the following prompt will be displayed:

Note: The password entry field will be titled "UDFB Password" if a UDFB is being loaded.

Enter the password. If the password is not correct, the following will be displayed:

Click **OK** and the **Unlock File:** dialog will again be displayed, allowing the correct password to be entered. Enter the correct password.

Once the correct password has been entered, the file will open for viewing.

Unlocking a File that is Edit Protected

If the file is password protected and the option **Add/Modify password required to open file** is selected, the file can be viewed without entering a password. The title block of the file contains [Locked], indicating that the file is password protected and cannot be edited.

To edit this file the file must be unlocked first. To unlock the file:

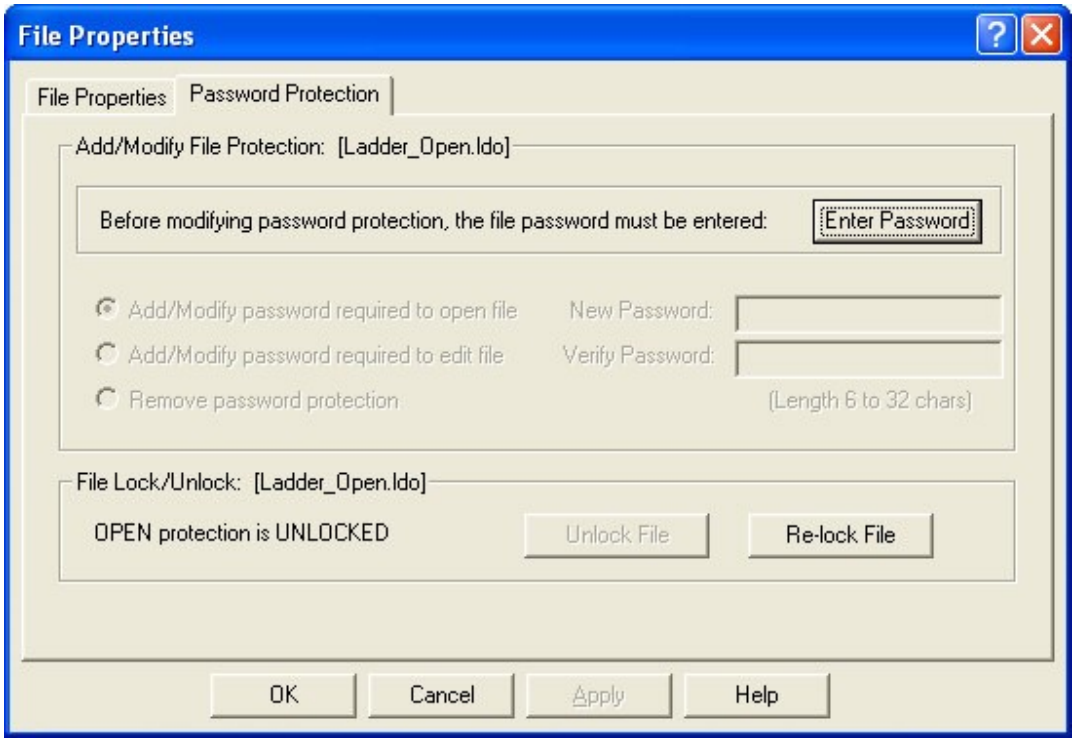
1. Click on the standard toolbar and the **Unlock File:** prompt will be displayed as follows:

2. Enter the correct password. The Lock/Unlock icon will change to indicating that the file is unlocked and can be edited.

Note: There should not be any forcing windows active for the active LDO being re-locked.

Modifying an Existing Password

1. From an open LDO file that is password protected, select **File | Properties**.
2. Click the **Password Protection** tab. The **File Properties** dialog will be displayed as follows:

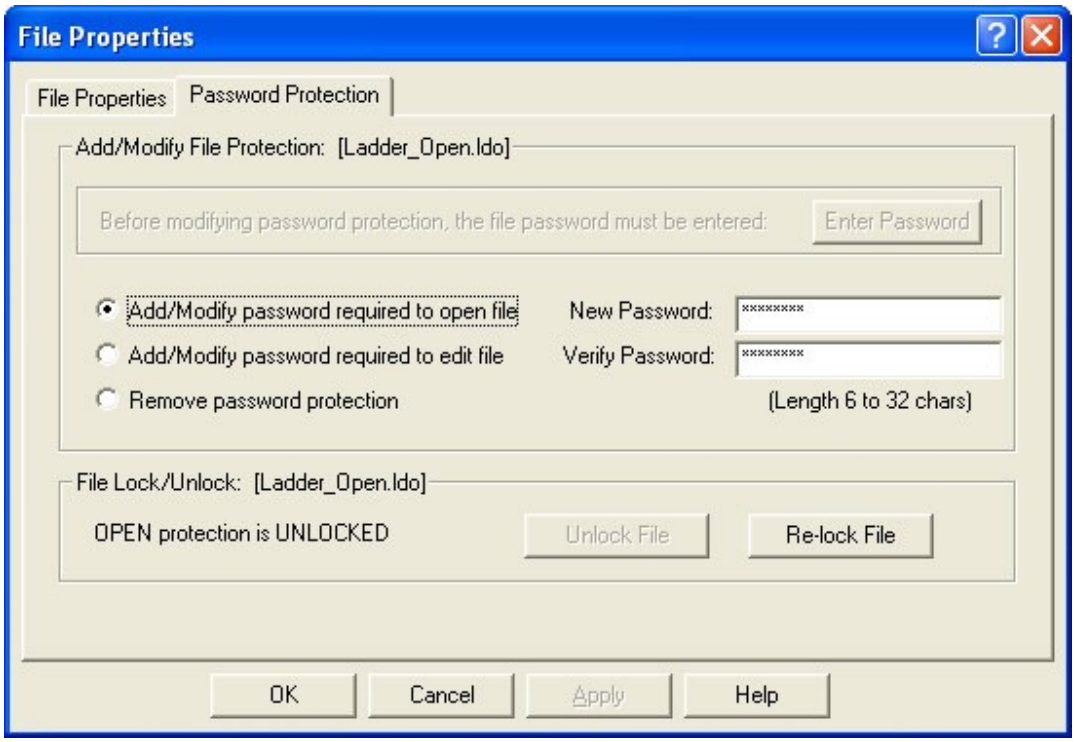


3. Click **Enter Password.** The following will be displayed:

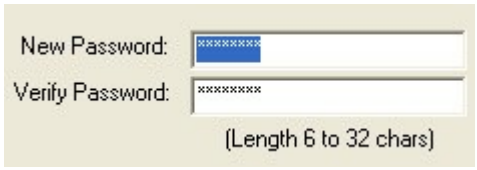
Note:

The password entry field will be titled "UDFB Password" if a UDFB is being edited.

4. Enter the correct password and click **OK**. The File Properties dialog will be displayed as follows:

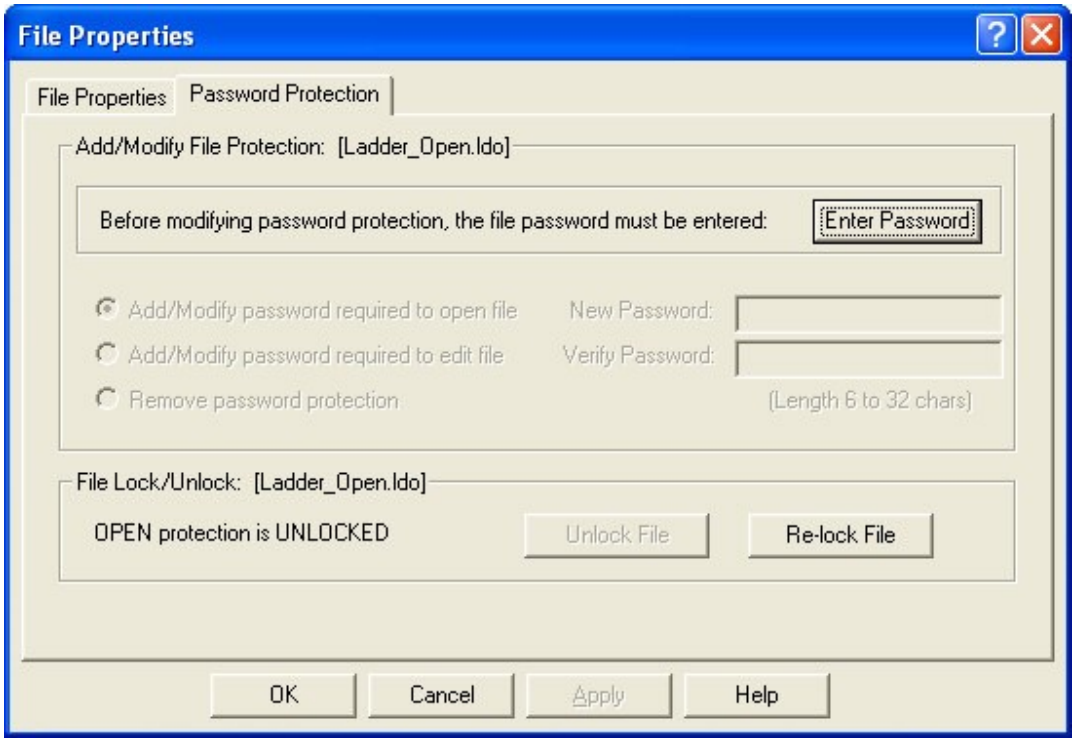


5. You can optionally select one of the bullet items that dictate how the password protection will be used.
   - Select **Add/Modify password required to open file** to apply a password required to open the file.
   - Select **Add/Modify password required to edit file** to apply a password that is required to edit (make changes to) the file.
6. To change the password:
   - At **New Password**, drag and select the asterisks field. Enter the new password.
   - At **Verify Password**, drag and select the asterisks field. Enter the new password again.



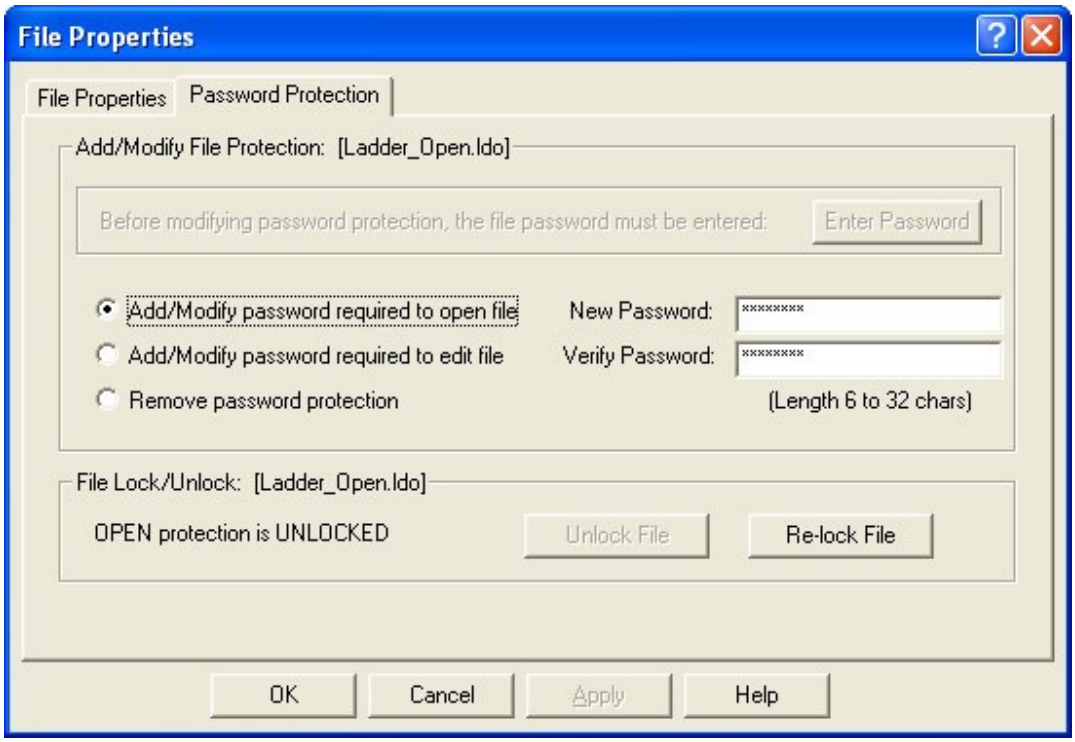
Removing an Existing Password

1. From an open LDO file that is password protected, select **File | Properties**.
2. Click the **Password Protection** tab. The **File Properties** dialog will be displayed as follows:

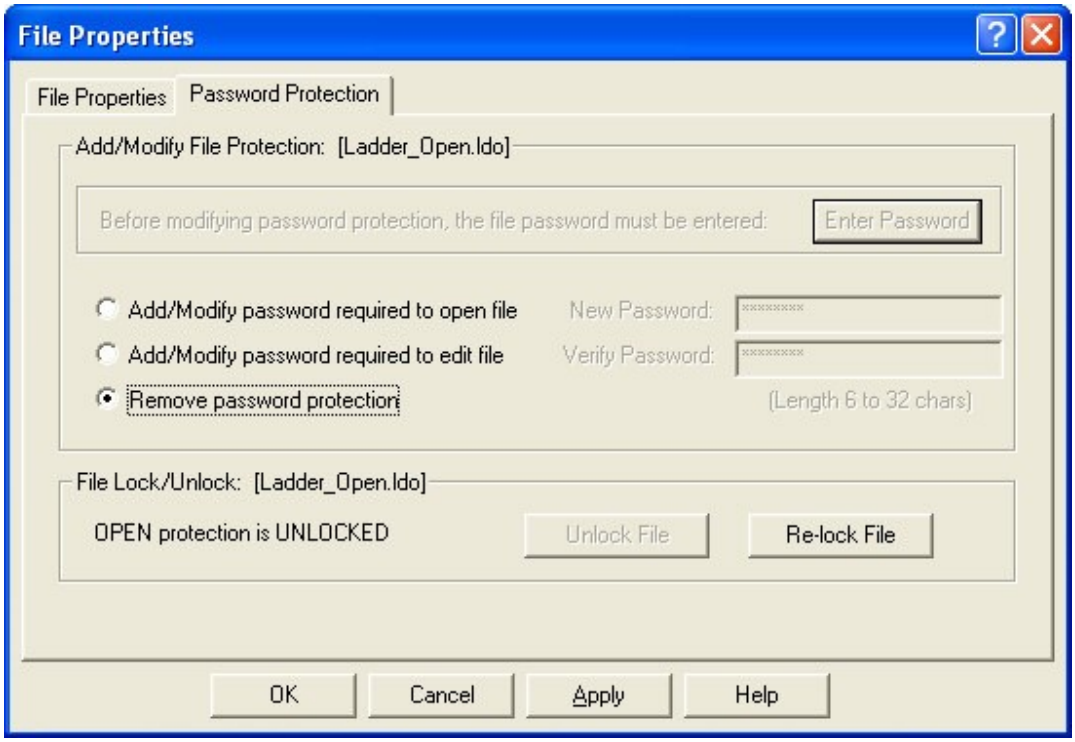


3. Click **Enter Password**. The following will be displayed:

4. Enter the correct password and click **OK**. The File Properties dialog will be displayed as follows:



5. Click Remove password protection as shown in the following display:



6. Click OK or Apply to remove the password. Click Cancel to stop the password removal.

Locking a File

Any LDO file can be locked by clicking on the standard toolbar.

Locking a File with Password Protection

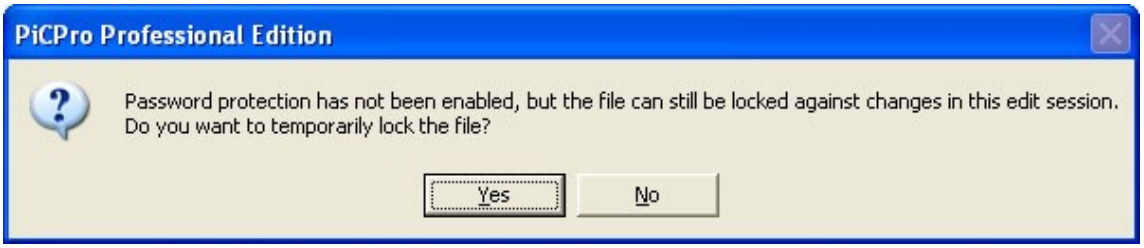
If the file was previously password protection, the file will be locked without further prompting, unless the file has changes that have not been saved or if a force list is opened for that file. If one of these cases exist, a dialog will display describing why the file cannot be locked. Once the file is locked, the file's password will be required to unlock the file again.

Locking a File with no Password Protection

If the file has no password protection a dialog will be displayed asking if you want to add password protection.

If **Yes** is clicked, the **File Properties** password protection dialog will be displayed. From this dialog, password protection can be added.

If **No** is clicked, the following dialog is displayed:



If **Yes** is clicked, the file will be locked against changes. No password is required to unlock the file.

If **No** is clicked, the file will remain unlocked.

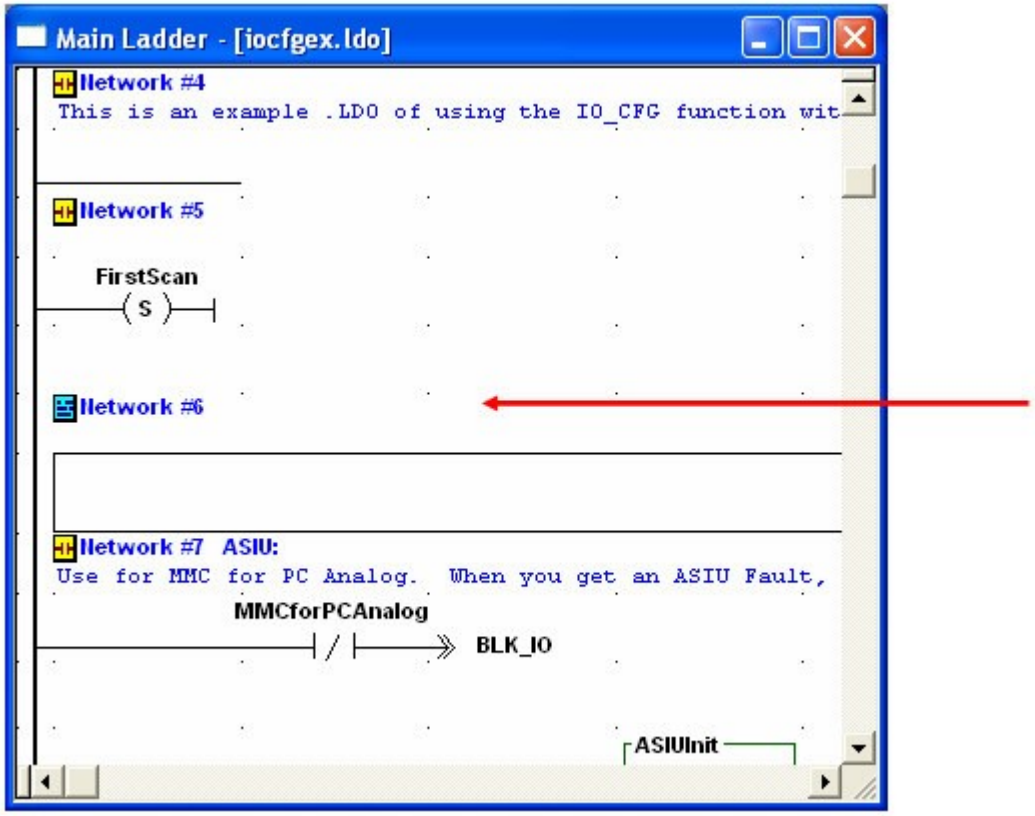
Note:

If password protection is added to a file, the file will not be compatible with versions of PiCPro older than V14.1.

Inserting a Network

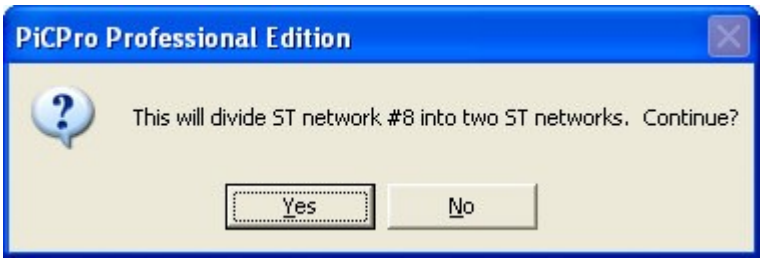
Inserting a Network

When a network is inserted it will be inserted above the focus cell. A new network appears above the focus cell. All the networks below the insertion are renumbered.



Inserting a ST network with focus in a ST element

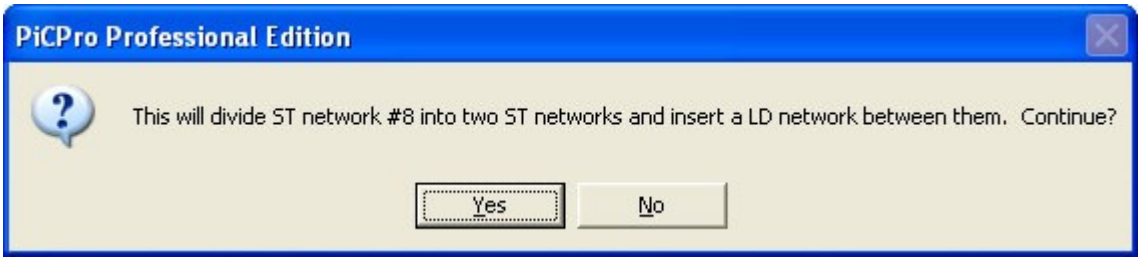
If focus is in a ST element and you insert a ST network, the ST element will be divided at the cursor position. The following type of prompt will appear:



Select **Yes** and the ST network will divide into two ST networks. The line with the cursor will appear in the second ST network. The networks will be renumbered if this is not the last network.

Inserting a LD network with focus in a ST element

If focus is in a ST element and you insert a LD network, the ST element will be divided at the cursor position. The following type of prompt will appear:



Select **Yes** and the ST network will divide into two ST networks at the cursor location and a LD network will be inserted between them. The focused element will be the new LD element. The networks will be renumbered if this is not the last network.

Inserting a ST network with focus in a LD element

If focus is in a LD element and you insert a ST network, the LD network will be divided into two LD networks at the cursor position. A ST network will be inserted between them. The focused element will be the new ST element. The networks will be renumbered if this is not the last network.

Methods for Inserting a Network

Right-Click Method

- Position the focus where you want to insert a network.
- Right-click and select **Insert | LD Network** or **ST Network**.

Menu Pull-Down Method

- Select **Ladder | Network | Insert** from the menu
- Then select either **LD Network** or **ST Network**.

Hotkey Method

Press a hotkey combination:

- <**Shift + Insert**> for a LD Network.
- <**Ctrl + Insert**> for a ST Network.

Toolbar Method

Select a toolbar button from the Insert New Network toolbar. Select **LD** for a Ladder Network or **ST** for a ST Network.

Deleting a Network

Deleting LD or ST Networks

To delete a LD or ST network, do the following:

1. Position the focus anywhere in the network you want to delete.
2. Choose one of the following methods to delete a network:
   - Select **Ladder | Network | Delete** from the menu
   - Press <**Shift + Delete**>
3. A confirmation message will appear. If you select **OK**, the network will be deleted. All the networks after the deleted network are renumbered.
4. You can delete multiple networks by selecting all the rows within the networks. Choose one of the following methods to delete a row:
   - Select **Ladder | Row | Delete** from the menu
   - Press **Delete** key

Deleting LD or ST Network Elements

Deleting a LD or ST network element results in the merging of two networks. However, only like networks can be merged.

To delete a network element, do the following:

1. Position the focus on the network element.
2. Choose one of the following methods to delete a network element:
   - Select **Edit | Delete** from the menu
   - Press <**Ctrl + D**>
   - Press **Delete** key
3. A confirmation message will be displayed.

Deleting LD Elements or Structured Text

The Delete command removes the selected LD Element or Structured Text. It does not place it on the clipboard.

To use the Delete command, do the following:

1. Click on the LD element or select the Structure Text.
2. Choose one of the following methods to issue the Delete command:
   - Select **Edit | Delete** from the menu
   - Press <**Ctrl + D**>
   - Press **Delete** key
3. A confirmation message will be displayed.

Cut, Copy and Paste

Overview: Cut, Copy, Delete and Paste

The Cut, Copy and Paste commands allow you to use the clipboard to make copies of LD or ST Network Elements, LD Elements or Structure Text items from your ladder.

The **Copy** command places a copy of the selected item on the clipboard.

The **Cut** command removes the item from your ladder and places it on the clipboard.

Once an item is on the clipboard, you can use the **Paste** or **Paste Insert** commands to place the item in a ladder. The item remains on the clipboard until you cut or copy another item. Only one item can be placed on the clipboard at a time.

Note:

The **Delete** command removes the selected item from your ladder. It does not place it on the clipboard.

If animation is running when you begin these procedures, it will be halted.

Cutting Network Elements

Cutting a network element results in the merging of two networks. However, only like networks can be merged (i.e. a LD network cannot be merged with a ST network and vice versa).

To cut a network element, do the following:

1. Position the focus in the network element you want to cut.
2. Choose one of the following methods to issue the Cut command:
   - Click the button from the standard toolbar.
   - Select **Edit | Cut** from the menu.
   - Press <**Ctrl + X**>.
   - Right-click and select **Cut**.
3. A confirmation prompt will be displayed if the network element is the same type as the previous network element. An error message will be displayed if the network element is not the same type as the previous network element (a LD network cannot be merged with a ST network).

Cut Rules for LD Network Element

- If you cut a LD network element while focus is in the LD network element and a LD network is located above the LD network element, the row containing the network element will be deleted and the remaining rows in the network will be merged with the LD network above. The networks will be renumbered if this is not the last network.
- If you cut a LD network element while focus is in the LD network element and a ST network is located above the LD network element, the cut is not made because the LD network cannot be merged with a ST network above. An error message will be displayed.
- If you cut the first LD network element in a ladder while focus is in the LD net work element, a prompt will be displayed asking if the entire network should be deleted.

Cut Rules for ST Network Element

- If focus is in a ST network element in a ST network that is located below another ST Network, and you cut the ST network element where the focus is, the row containing the ST network element will be deleted and the two networks will be merged. The networks will be renumbered if this is not the last network.
- If you cut a ST network element while focus is in the ST network element and a LD network is located above the ST network element, the cut is not made because the ST network cannot be merged with a LD network above. An error message will be displayed.
- If you cut the first ST network element in a ladder file while focus is in the ST network element and the network is empty, a prompt will be displayed asking if the entire network should be deleted.

Cutting LD Elements or Structured Text

When you cut a LD Element, a ST element or a portion of a ST element, it is removed from the file and placed on the clipboard.

1. Select what you want to cut.
2. Choose one of the following methods to issue the Cut command:
   - Click the button from the standard toolbar.
   - Select **Edit | Cut** from the menu.
   - Press <**Ctrl + X**>.
   - Right-click and select **Cut**.

Copying LD Elements or Structured Text

Copying LD Elements or Structured Text

When you copy LD Elements or Structured Text Elements, they remain in the file and is placed on the clipboard.

1. Select what you want to copy.
2. Choose one of the following methods to issue the Copy command:
   - Click the button from the standard toolbar.
   - Select **Edit | Copy** from the menu.
   - Press <**Ctrl + C**>.
   - Right-click and select **Copy**.

Copy Rules

- If focus is on a ST element and nothing is selected, nothing will be copied.
- If focus is on a ST network element, only the ST network element will be copied.
- If focus is on a LD element, the LD element will be copied.
- When a portion of a source ladder is copied and pasted into a different target ladder, the software declarations that were used in the copied portion of the source ladder are also placed in the clipboard and pasted to the target ladder. Undeclared variables will remain undeclared. This is true for LD elements and ST elements.

Pasting LD Elements or Structured Text

Pasting LD Elements or Structured Text

To paste LD Elements or Structured Text into a file from the clipboard, you can use either the Paste or the Paste Insert commands.

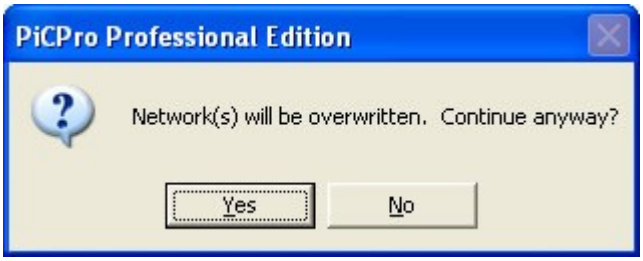
To use the Paste command, do the following:

1. Select a location for the paste.
2. Choose one of the following methods to issue the Paste command:
   - Click the button from the standard toolbar.
   - Select **Edit** | **Paste** from the menu.
   - Press <**Ctrl + V**>.
   - Right-click and select **Paste**.

Paste Rules

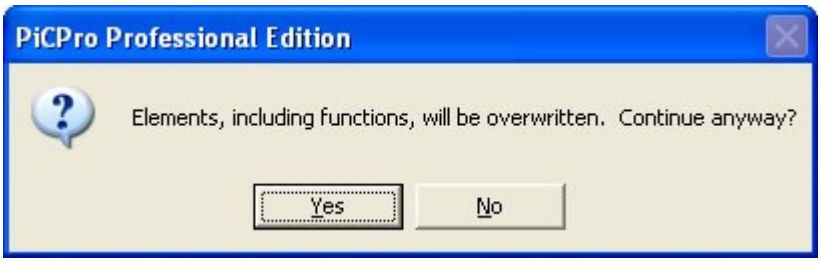
- If the data copied to the clipboard contains a power rail, it must be pasted on a power rail.
- Rows must be pasted on rows. The only exception is if focus is on the End of Module (EOM). If focus is on EOM, rows are inserted.
- Pasting a non-network element on a network element has the effect of merging two like networks.
- A paste operation that does not include the power rail does a replace as follows:

If a paste is attempted while focus is on a LD network element, the following prompt will be displayed:



If you click **Yes** to continue, data in the network will be overwritten with the data from the clipboard.

If focus is on a ladder element and the number of rows affected is less than or equal to the number of rows in the network, the following prompt is displayed:



If you click **Yes** to continue, elements and functions in the network will be overwritten with the data from the clipboard.

If focus is on a ladder element and the number of rows affected is more than the number of rows remaining in the network, rows are added to the network.

If focus is on the EOM, rows are inserted.

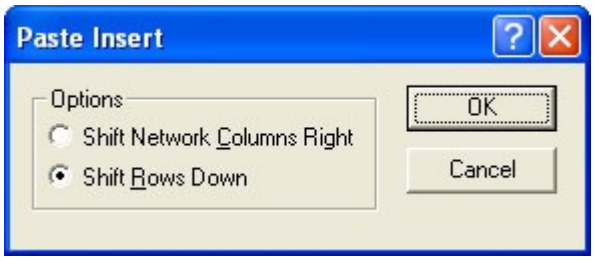
Notes:

- A paste operation that includes the power rail, does an insert above the line with focus.
- The maximum number of cells in a LD network is 255.
- An error message will be displayed if an attempt is made to paste text into a ST network that would cause the number of lines to exceed 500 or the number of characters in a line to exceed 500.
- A ST element (not a ST network) or portion of a ST element that is copied can be pasted as plain text into Microsoft Word™, Notepad™, or Wordpad™. In this case, software declarations are not pasted.
- Text copied from Microsoft Word™, Notepad™, or Wordpad™ can be pasted into a ST element.
- A portion of a ladder can be copied and pasted into the view and force lists.

- Within a LD element, selecting ladder elements makes no difference when pasting. Only ladder elements actually replaced, when the paste takes place, will be deleted.

Paste Insert Rules

- If **Edit | Paste Insert** is selected while focus is on a ladder element, the following prompt is displayed asking if rows should be shifted down or network columns should be shifted right:



- If the clipboard data contains a power rail, it must be pasted on a power rail. The only exception is for End of Module (EOM). If focus is on the EOM, rows can be pasted.
- The maximum number of cells in a LD network is 255.
- Within a ST element, a paste is always a paste insert operation. If text is highlighted when paste is selected, the highlighted text will be deleted when the paste occurs.

Drag and Drop

Drag and Drop

You can drag a highlighted area by left clicking and holding down the button, moving to the desired area, and drop the selection by releasing the button.

If a power rail is not included in the selection, the selection must be contained within a network.

If the power rail is included in the selection, the selection can contain sequential rows from more than one network.

Note: A ST element takes up only 1 row but can contain up to 500 lines of text.

Drag and Drop Copy

Drag and Drop Copy

1. Select an item.
2. Hold down the **Ctrl** key and hold down the left click button at the same time.
3. Drag the selection to a new location. A + character will appear by the mouse pointer.
4. Release the left click button and the item will be copied to the new location.

Drag and Drop Copy Rules

When a portion of a ladder is Drag and Drop copied into a different ladder, the software declarations that were used in the copied portion of the ladder are added to software declarations. Undeclared variables will remain undeclared.

Drag and Drop Move

Drag and Drop Move

1. Select an item.
2. Hold down the left click button.
3. Drag the selection to a new location.
4. Release the left click button and the item will be moved to the new location.

Drag and Drop Move Rules

When a portion of a ladder is Drag and Drop moved into a different ladder, the software declarations that were used in the moved portion of the ladder are added to software declarations. Undeclared variables will remain undeclared.

If a LD network element is dragged and dropped, one of the following will occur based on the location of the element to be moved.

After the move:

- If the network above the element being moved is a LD network, the remaining rows in the network will be merged with the network above.
- If the network above is a ST network, an error message will be displayed.
- If the network is the first network and the network is empty, a prompt will be displayed asking if the entire network should be deleted.
- If the network is the first network and network is not empty, an error message will be displayed along with a prompt asking if the entire network should be deleted.

If a ST network element is dragged and dropped, one of the following will occur based on the location of the element to be moved.

After the move:

- If the network above the element being moved is a ST network, the ST element below the network element being moved will be merged with the ST element above the network element being moved.
- If the network above is a LD network, an error message will be displayed.
- If the network is the first network and the network is empty, a prompt will be displayed asking if the entire network should be deleted.
- If the network is the first network and the network is not empty, an error message will be displayed along with a prompt asking if the entire network should be deleted.

Drop Rules

- The maximum number of lines in a ST network is 500. The maximum number of characters in a line in a ST network is 500.
- The maximum number of cells in a LD network is 255.
- If the data to be dropped contains a power rail, it must be dropped on a power rail (rows must be dropped on rows). The only exception to this rule is the EOM. If focus is on the EOM, rows can be dropped.
- Dropping a non-network element on a network element has the effect of merging two **like** networks.
- A drop operation, which does not include the power rail, does a replace as follows:
- If dropping on a network element, the following prompt is displayed: **Network(s) will be overwritten. Continue anyway?**

- If dropping on a ladder element, and the number of rows affected is less than or equal to the number of rows in the network, the following prompt is displayed. **Element(s) will be overwritten. Continue anyway?**.
- If dropping on a ladder element, and the number of rows affected is more than the number of rows remaining in the network, rows are added to the network.
- If dropping on EOM, rows are inserted.
- A drop operation, which includes the power rail, does an insert above the line with focus.

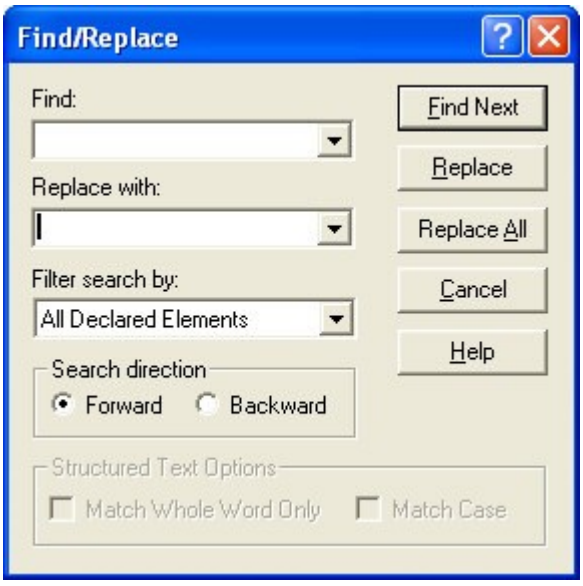
Other Notes - Drag and Drop

- Within a ST element, a drop is always an insert operation.
- Drag and drop can be used to copy/move a ST element (not a ST network) or portion of a ST element into Microsoft Word™. In this case, software declarations are not dropped.
- Text dragged from Microsoft Word™ can be dropped into a ST element.
- Notepad™ and Wordpad™ do not support drag and drop.
- Drag and drop can be used to copy or move a portion of a ladder or structured text into the view and force lists.

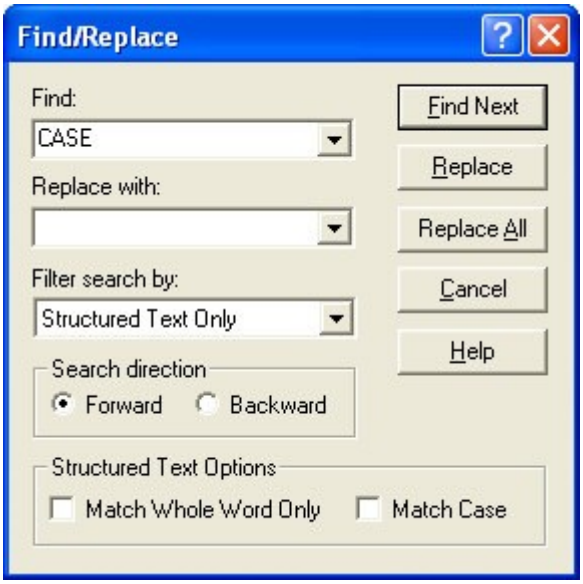
Finding and Replacing

Find and Replace Dialog

In a ladder in PiCPro, you can search for declared contacts, declared coils, declared function blocks, declared elements, function/function block titles, network numbers or structured text.



The search can be refined by applying a filter that limits the search (e.g. Structured Text Only):



Control	Description
Find:	Enter item to search for. An item can be chosen from the list or typed in. Valid entries are filled in when a filter is chosen. The drop down list contains valid entries for the specified filter. If the **Structured Text Only** filter is selected, the **Find:** drop down list contains the most recently searched for "Structured Text Only: strings.
Replace with:	Enter the item you want to replace the **Find:** item with or choose an item from the list. The drop down list will contain items from a previous find/replace.
Filter search by:	An item can be chosen from the list to filter the search with. The filter will describe the type of item being searched for.
Search direction	Check the appropriate box to search either forward or backward from where the focus is in your ladder. The search will proceed in the direction you specify and then auto-wrap when the top/bottom of the ladder is reached.
Structured Text Options	**Match Whole Word Only** – Enabled for Structured Text Only filter. When selected, finds strings that are whole words and not part of a larger word. **Match Case** – Enabled for Structured Text Only filter. When selected, distinguishes between uppercase and lowercase characters and will match only those instances where the capitalization matches the next typed in the **Find:** field.
Find Next	Finds the next occurrence of the entry in **Find:**
Replace	Replaces the entry in **Find:** with the entry in **Replace with:**
Replace All	Replaces all occurrences of the entry in **Find:** with the entry in **Replace with:**
Cancel	Closes this dialog without saving any changes.
Help	Accesses the Help system.

Notes:

- You must enter the complete name of the item you want to search for.
- When searching for declared contacts, coils, Function Blocks or Function Block titles in a ST network, text may not be recognized as a declared element if there are errors while compiling. Replace will be disabled in a ST Network that contains compile errors.
- When searching in a ST network, Function Blocks of a specific type can only be found if the Title is left in the function.
- Choosing the Structured Text Only filter causes a search to be done only inside ST networks. LD networks will not be searched. Any filter selected other than Structured Text Only causes a search to be done in both ST and LD networks.
- You can find and replace items individually or find and replace all occurrences of items by entering a declared variable in the Replace with: field and choosing the Replace or Replace All button.

Finding an Element in the Ladder

1. Choose one of the following methods to see the **Find/Replace** dialog:
   - Select **Edit | Find/Replace** from the menu
   - Press <**Alt + F3**>
2. Enter the name of the ladder or structured text element you want to search for in the **Find:** field or use the dropdown list and select the name of the ladder element you want to search for. If the focus in your ladder is on an element that can be searched for, it will automatically appear in the **Find**: field.
3. Be sure the correct filter is selected in the **Filter search by:** field
4. Choose the **Search direction**.
5. Select the **Find Next** button to move either forward or backward to the next location of the element in the ladder.
6. Continue selecting the **Find Next** button or press the **Enter** key if you want to continue to find occurrences of the element. A message will inform you after the ladder has been completely searched.

Find and Replacing an Element in the Ladder

1. Choose one of the following methods to see the **Find/Replace** dialog:
   - Select **Edit | Find/Replace** from the menu
   - Press <**Alt + F3**>
2. Enter the name of the ladder element you want to search for in the **Find**: field. If the focus in your ladder is on an element that can be searched for, it will automatically appear in the field.
3. Enter the name you want to replace the variable with in the **Replace with:** field or use the dropdown list and select the name you want to replace the variable with. If the replacement name has not been added to the software declarations table, you will be prompted to do so now.
4. Be sure the correct filter is selected in the **Filter search by:** field.
5. Choose the **Search direction**.
6. First choose the **Find Next** button to find the element.
7. Choose either **Replace** to replace an occurrence of the element or **Replace All** to replace all occurrences.

Filtering Find and Replace

You can filter your search by the criteria listed below in the **Filter search by:** field within the **Find/Replace** dialog. Some things to keep in mind include:

- If focus in your ladder is on a contact, coil, data input, data output, function, function block, network label, or a jump label, the name will automatically be entered in the **Find:** field.

- If the focus is on a wire or a return label, things that cannot be searched for, you must enter a name in the **Find:** field and the correct filter in the **Filter search by:** field.
- If you want to find a network, enter the number in the **Find:** field and select Network Numbers for the **Filter search by:** field.

Types of Filter	Ladder Elements to Find
Declared Contacts/Data Ins	Contact or data input
Declared Coils/Data Outs	Coil or data output
Declared Function Blocks	Function block
All Declared Elements	Contact, coil, data input, or data output
Function/Block Titles	Functions
Label Names	Network or jump label
Network Numbers	Numbered network
Structured Text Only	Structured Text

- All the filter selections except **Structured Text Only, Function/Block Titles** and **Network Numbers** require entries into the **Find:** field that are defined in software declarations and that match the current filter. If **Structured Text Only** is selected, any text can be typed into the **Find:** field.
- If the **Declared Contacts/Data Ins** filter is selected, the entire ladder will be searched for the contents of the **Find:** field. A match will be found in a ST network anywhere the contents of the **Find:** field is used and not set. **Note:** When this filter is selected, the **Find:** field must contain a valid variable name.
- If the **Declared Coils/Data Outs** filter is selected, the entire ladder will be searched for the contents of the **Find:** field. A match will be found in a ST network anywhere the contents of the **Find:** edit field is set and not just used. **Note:** When this filter is selected, the **Find:** field must contain a valid variable name.
- If the **Declared Function Blocks** filter is selected, the contents of the **Find:** field represents a function block instance name. In a ST element, a function block is represented in the following format: **Instance:Title(…).** If found in a ST network, only **Instance** will be highlighted.
- If the **All Declared Elements** filter is selected, all declared elements will be searched.
- If the **Function/Block Titles** filter is selected, the contents of the **Find:** field represents a function/block title. In a ST element, a function/block title is represented in the following format: **Instance:Title(…).** If found in a ST network, only **Title** will be highlighted. If '**:Title'** is not typed in (it is optional), the search will not relate the instance name back to the title being searched.
- If the **Label Names** filter or the **Network Numbers** filter is selected, ST elements will not be searched since these items are not relevant to a ST element.
- If the **Structured Text Only** filter is selected, the drop down list for the **Find:** field will contain a list of the last **Structured Text Only** search entries.

Finding Duplicates

Finding Duplicates

When debugging a ladder program, it can be useful to identify all symbols that are modified at multiple locations within a ladder. **Find Duplicates** provides this functionality. When **Find Duplicates** is selected, PiCPro searches for function blocks, data outs, and coils that appear more than once in the ladder. When PiCPro finds duplicated function blocks, data outs, or coils, a message is displayed in the information window.

To search for duplicated elements:

1. Select **Edit | Find Duplicates** from the menu.

2. PiCPro searches the ladder and puts a message in the information window when finished either saying no duplicates were found or listing the ones that were found.

Note: Duplicated Jump labels, contacts, data ins, and functions are not included in this search.

Saving, Closing, and Exiting

Saving, Closing, and Exiting Ladder Files

When you close your ladder, PiCPro asks if you want to keep any changes that have not yet been saved. You have three choices:

- **Yes** to save the latest changes
- **No** to lose the changes and close the ladder
- **Cancel** to allow you to change your mind and continue to work on the ladder.

If you close a ladder that you have not yet assigned a name to, PiCPro asks if you want to save changes to the ladder diagram. If you choose **Yes**, the **Save As** dialog appears and you can type in the name. PiCPro assigns the name to the ladder, saves the ladder, and then closes.

Note:

A ladder saved in V13.0 is saved in a format that cannot be read by previous versions of PiCPro if:

- software declarations contain any mixed case variable names
- variable names longer than 8 characters
- the ladder contains any ST networks
- scan with ASIU error has been enabled in hardware declarations.

Saving Files

It is a good idea to save your file at regular intervals as you work on it. Using the **Save** command, you can save the file under its existing name. Using the **Save As** command, you can specify a new filename and/or a location where you want the file stored.

To save a new file, do the following:

1. Select **File | Save** from the menu or the button from the standard toolbar.
2. In the **Save As** dialog, choose a drive and folder where you want to save your ladder file (*.ldo).
3. Enter a name in the **File name:** field.
4. Click **Save**.

To save an existing file, select **File | Save** from the menu or the button from the standard toolbar. To save all files open within PiCPro, select **File | Save All** from the menu. If any of the open files have not been saved previously, PiCPro prompts you to choose a location to save the file to. Type in a name in the **File name:** field and click **Save**.

Note:

This command updates the Windows time stamp on all of the open files regardless of whether changes were actually made.

Saving Files with a Different Name

You can use the **Save As** command to change the name and/or the location of a file. By giving the file a different name when you save it, you create a copy of the existing file while keeping the original intact.

To save a file under a different name, do the following:

1. Select **File | Save As** from the menu.
2. Select the location you want to save the file to in the **Save in** field.
3. Enter the new file name in the **File name** field.
4. Click **Save**.

Closing Files

If the file has changed but has not yet been saved, PiCPro asks if you want to save the file before closing it. Choose **Yes** to save the file before closing, choose **No** to close the file without saving it.

To close a file, do one of the following:

- Select **File | Close** from the menu
- Click the in the upper right corner of the file window.

Exiting PiCPro

Exiting means shutting down PiCPro. It marks the last step in a PiCPro session.

To exit, do one of the following:

- Select **File | Exit** from the menu.
- Click on the corner symbol on the title bar to drop down a list. Choose **Close**.
- Press <**Alt + F4**>.
- Click the button in the upper right corner.

PiCPro asks if you want to save any unsaved changes in any open files:

- Click **Yes** to save changes before exiting.
- Click **No** to exit without saving changes.
- Click **Cancel** to exit the dialog and continue working on your application.

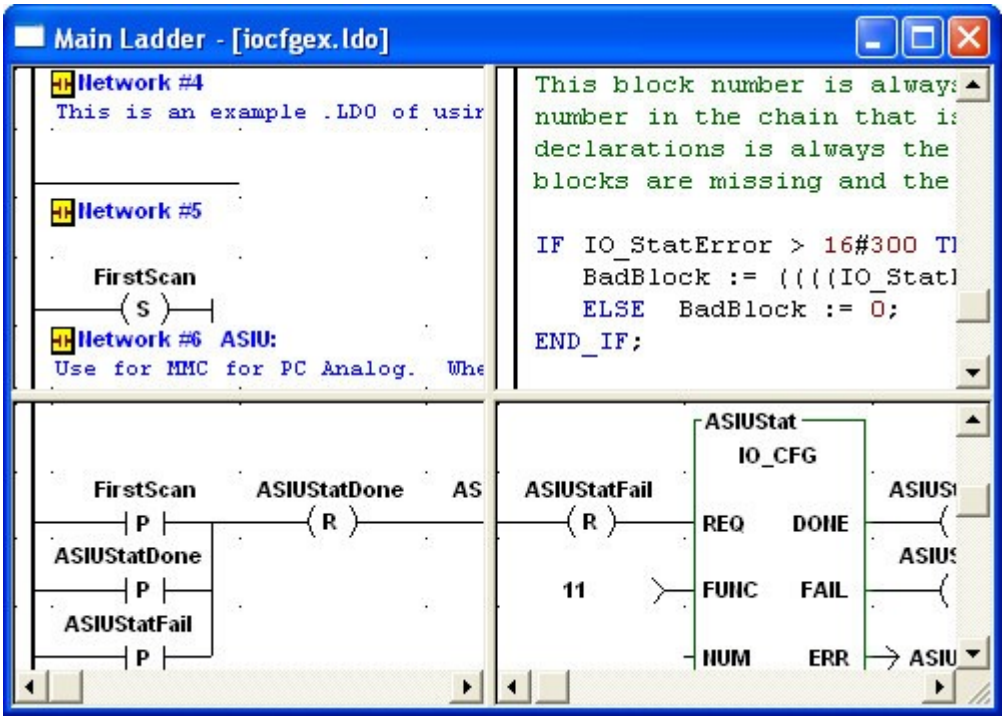
Working with a Split Screen

Working with a Split Screen

You may find it helpful to use the split screen feature when you want to view sections of a ladder at the same time. Each section will have its own scrolling capability so you can move to any ladder location you want.

Note: Click within the quadrant you want to scroll before using the scroll bar.

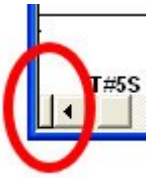
The screen can be split horizontally and/or vertically. Each split screen can be scrolled without affecting the other views. In the example below, a different part of iocfgex.ldo is being displayed in each of the four views.



To split the screen, do the following:

1. To split the screen horizontally, move the arrow to the top section (encircled below) of the vertical scroll bar.

2. When the arrowhead changes to the double line/double arrow, click the button and drag the horizontal line into your ladder and release.
3. To split the screen vertically, move the arrow to the left section (encircled below) of the horizontal scroll bar.



4. When the arrowhead changes to the double line/double arrow, click the button and drag the vertical line into your ladder and release.

To return to a single screen, double click on the vertical or horizontal split line to remove the split screen and return to your normal view.

Hardware Declarations

Hardware Declarations

Hardware declarations will differ based on whether you declare a PiC CPU, MMC Digital CPU, standalone MMC CPU, or MMC for PC CPU. If you declare a CPU that differs from what is actually installed in the control, you may not be able to download your ladder file (*.ldo) to the control.

The hardware configuration in the hardware declarations table is compared to the I/O points defined in the software declarations table when the ladder file (*.ldo) is compiled. PiCPro can detect an error such as an output that is defined at an input location. An error message will be displayed when you issue the **Compile Only** or the **Compile & Download** command.

In the hardware declarations table, you define what type of hardware module occupies each slot in the master rack. Based on the type of CPU selected, you can also define the other types of I/O in your system such as remote I/O expansion racks, block I/O, or ASIU I/O.

If you later change the CPU type from what was originally declared, you will need to review the I/O points defined in software declarations to ensure that your I/O points are correctly assigned.

Hardware Declaration Restrictions

When making hardware declarations, you must first determine that the CPU supports the I/O in your system.

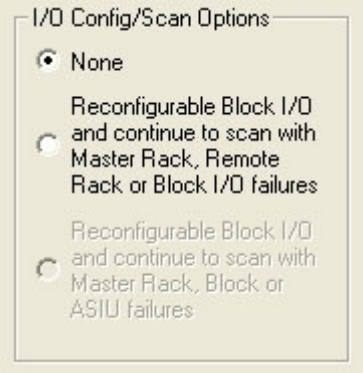
	PiC 90 CPU	PiC 900 CPU	Standalone MMC(3)	Standalone MMC PLUS	MMC Digital	MMC for PC
Remote I/O Expansion Rack	NO	YES	NO	NO	NO	NO
Block I/O Module	YES	YES	YES	YES	YES	YES
ASIU I/O Module	NO	NO	NO	NO	NO	YES
Ethernet	YES	YES	YES	YES	YES	YES
Fieldbus	YES	YES	YES	YES	NO	YES

Notes:

- Not all PiC 900 and PiC 90 CPUs support block I/O modules. Check hardware manuals for these CPUs for complete information.
- MMC for PC does not require a separate Ethernet module. PiC and standalone MMC require separate modules
- Information that applies to standalone MMC also applies to standalone MMC PLUS.
- For CPUs that accept Remote I/O Expansion Racks, up to 7 racks can be added.
- For CPUs that accept Block I/O Modules, up to 77 modules can be added.
- For CPUs that accept ASIU I/O Modules, up to 8 modules can be added.

I/O Config/Scan Options

Checking the enable box allows the ladder to continue scanning even if there has been a failure in the remote or block I/O connected to your system. I/O in the main rack will continue to work unless there has been a failure in the main I/O. If that occurs, all I/O in the system becomes non-operational.



Scanning the ladder even if there is an I/O error allows status information to be passed to the IO_CFG function block so that the I/O can be re-configured or inhibited when you want to add or remove block I/O modules from your system. You must have the enable checked to use all the features of this function block.

Note:

- Ladder configurable I/O applies only to Block I/O (not master rack or ASIU I/O).
- Based on the chosen CPU, options will vary.

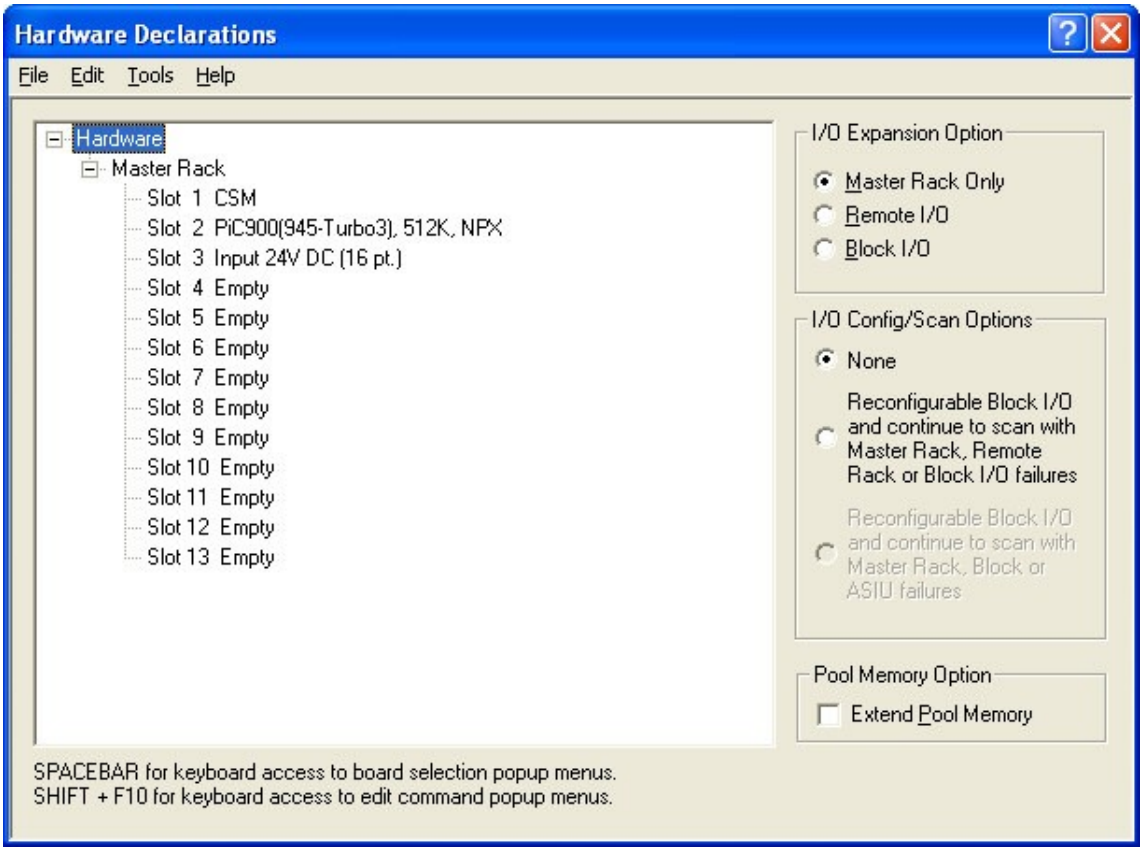
Entering Hardware Declarations

Displaying the Hardware Declarations Table

Use one of the following methods:

- Click the button on the View Navigator toolbar.
- Select **View | Hardware Declarations** from the menu.

The following type of dialog is displayed (PiC Target CPU shown):



The following describes the Hardware Declarations dialog:

Control	Description
I/O Expansion Option	
Master Rack Only	Select this option if your hardware configuration consists of a master rack only
Remote I/O	Select this option if your hardware configuration consists of remote I/O
Block I/O	Select this option if your hardware configuration consists of Block I/O
Note: When an MMC Digital CPU is specified, only Master Rack Only and Block I/O options are available.	
I/O Config/Scan Options	
None	Select this radio button to disable Ladder Configurable I/O and prevent continued scan of a ladder with I/O errors.
Reconfigurable Block I/O and continue to scan with Master rack, Remote Rack or Block I/O failures	Select this radio button to enable Ladder Configurable I/O and allow the ladder to continue scanning with Master Rack, Remote Rack or I/O errors. Note: If an ASIU error is present, the ladder will not continue to scan. The function block IO_CFG must be used to allow the ladder to react to I/O errors.

Reconfigurable Block I/O and continue to scan with Master rack, Block or ASIU failures	Select this radio button to enable Ladder Configurable I/O and allow the ladder to continue scanning with Master Rack, Block or ASIU errors. Note: This option is only available if an MMC for PC Analog Servo CPU is selected.
Pool Memory Option	
Extend Pool Memory	This option is only available with PiC900s. Select this option to replace the standard pool memory with a larger pool, which will be taken from application memory. This decreases the memory available to the application. This option is useful if a large amount of servo data is defined and animation reports an out of memory error.
Note: When an MMC Digital CPU is specified, only None and Reconfigurable Block I/O and continue to scan with Master rack, Remote Rack or Block I/O failures are available. Pool Memory Option is not available.	

Entering Hardware Declarations - Master Rack (all CPU types)

1. Position the cursor on the slot you want to declare a hardware module in and left-click. A fly-out box appears. If an arrow is at the end of the item on the fly-out list, there are more choices.
2. Slide the mouse over each fly-out list, select the description of the module you want to declare.
3. When you are at the final fly-out list, left-click to make your selection. Your choice will be listed in the master rack list. **Note:** if you want a brief description of the module press **F1** key before making your selection.
4. To add remote I/O (PiC CPU only) or block I/O, click the check box. You can then use the fly-out lists to configure the I/O.
5. To enable **I/O Config/Scan Options**, select the appropriate radio button.
6. To save your declarations or changes and return to your ladder, use **File | Save & Close** from the menu or **F10** key or **Enter** key. To exit without saving your changes, use **File | Close** from the menu or **Esc** key.

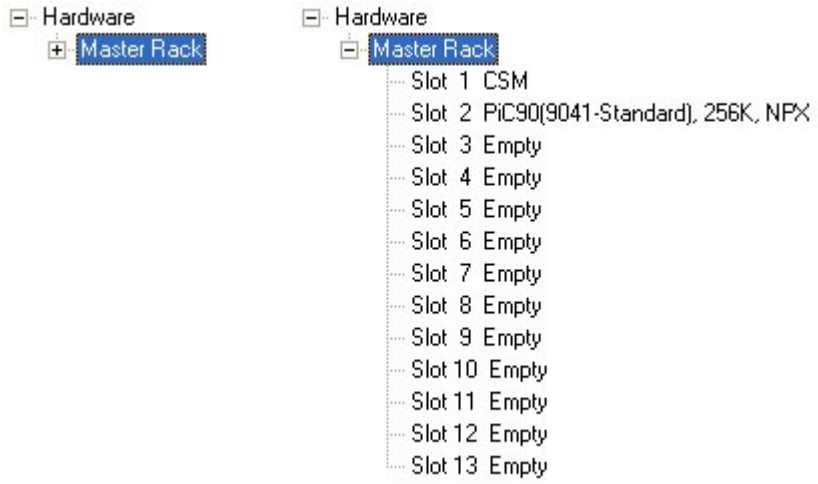
You can access various editing commands (Copy, Paste, Insert, etc.) with a right-click or from the **Edit** menu.

You can also use the keyboard for selecting modules by pressing the spacebar. Then use the up and down arrow keys to scroll, and press **Enter** key to select a module. You can use the keyboard to access the editing commands by pressing **<Shift + F10>.**

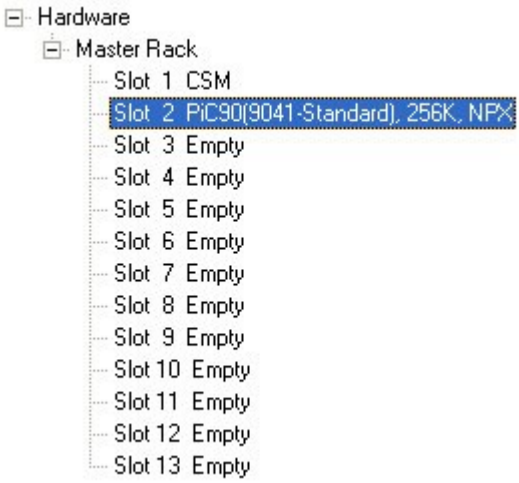
Viewing Hardware Declarations

Viewing Hardware Declarations

You can change the view of the hardware declarations list using the plus (+) and minus (-) symbols to expand and contract the branches.

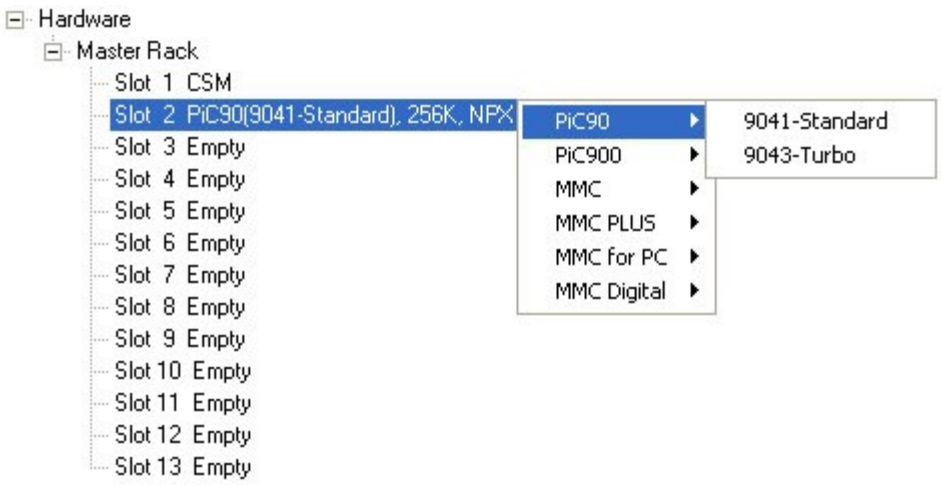


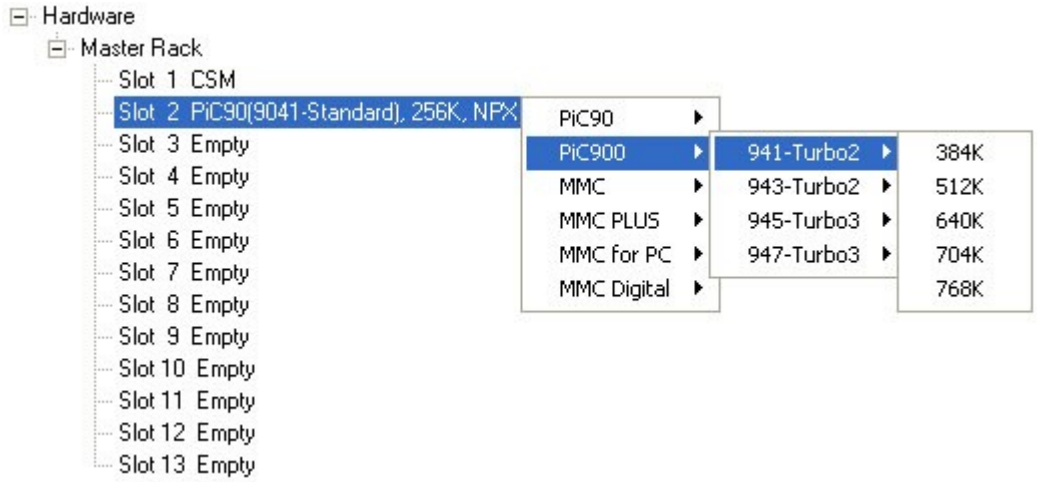
Hardware Declarations Table - PiC CPU



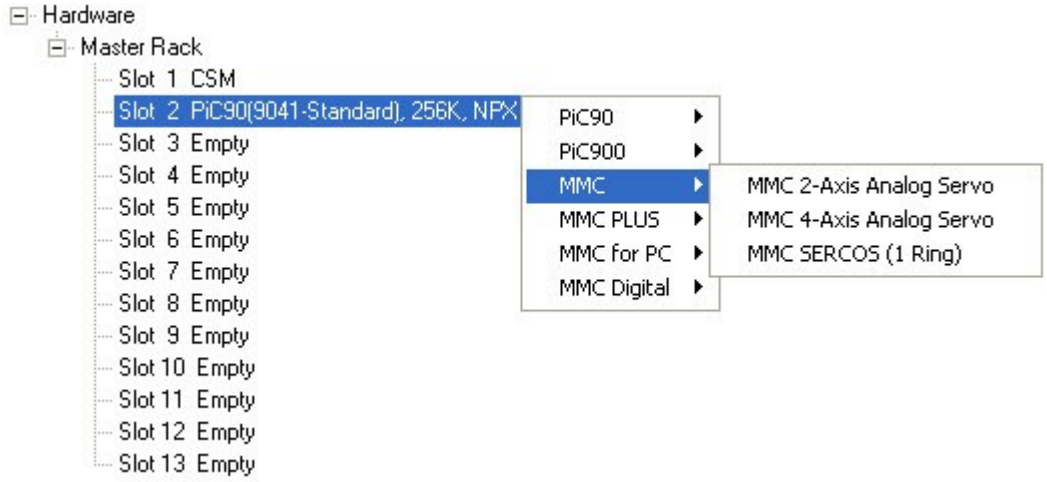
Master Rack

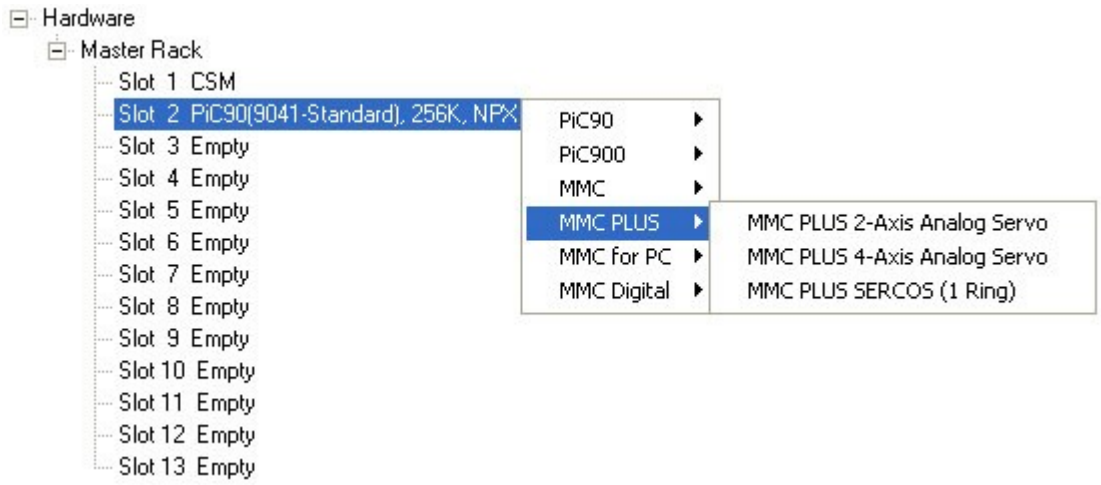
- Slot 1 is reserved for the Central Services Module (CSM)
- Slot 2 is reserved for the CPU module

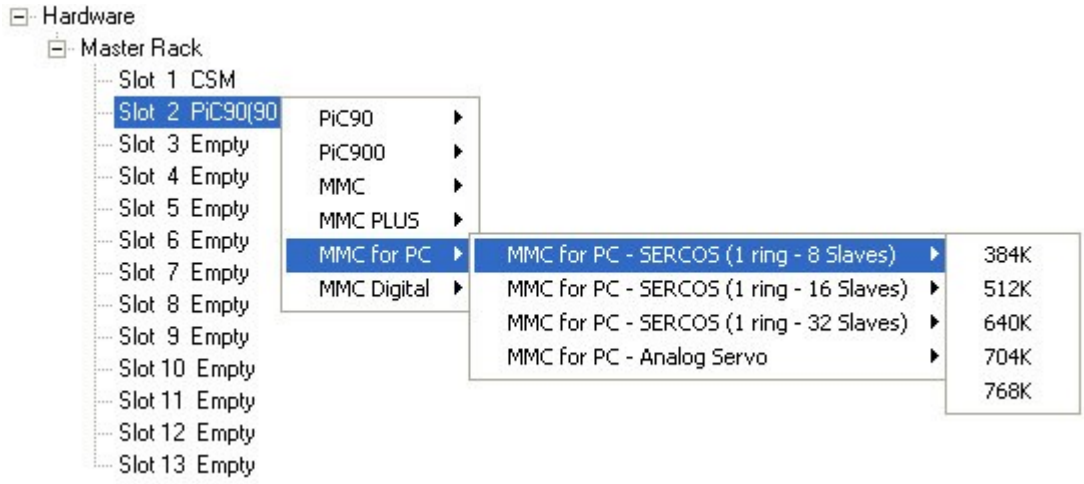




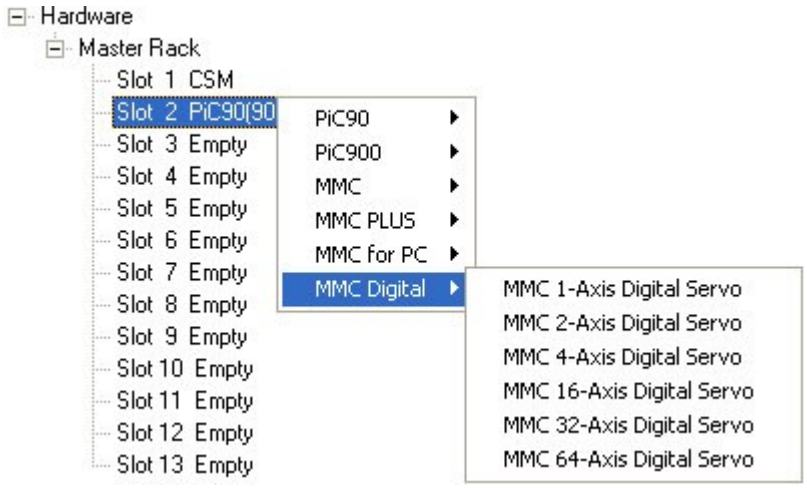
These five memory types are available for all PiC900 models.





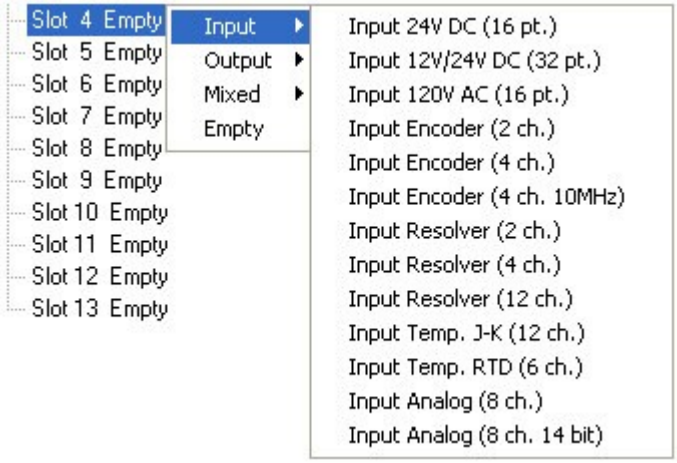


These five memory types are available for all MMC for PC models.

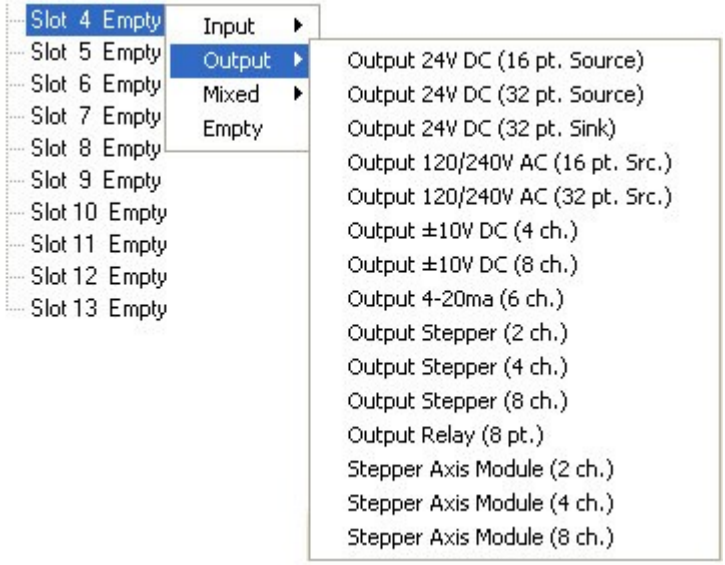


Slots 3 through 13 define the type and location of the I/O modules.

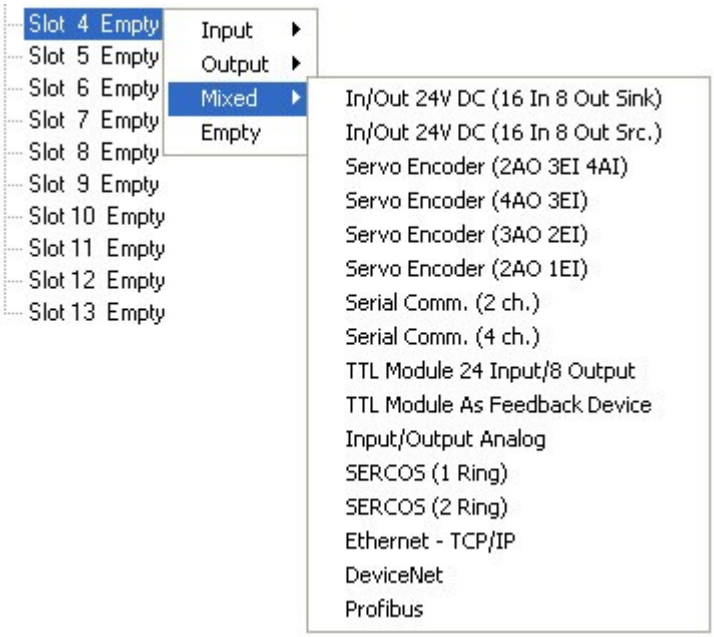
PiC I/O - Inputs



PiC I/O - Outputs



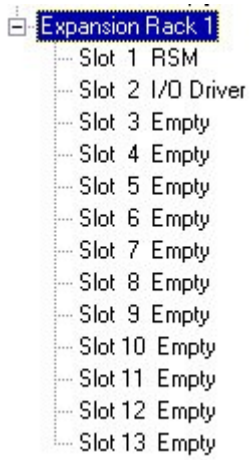
PiC I/O - Mixed I/O



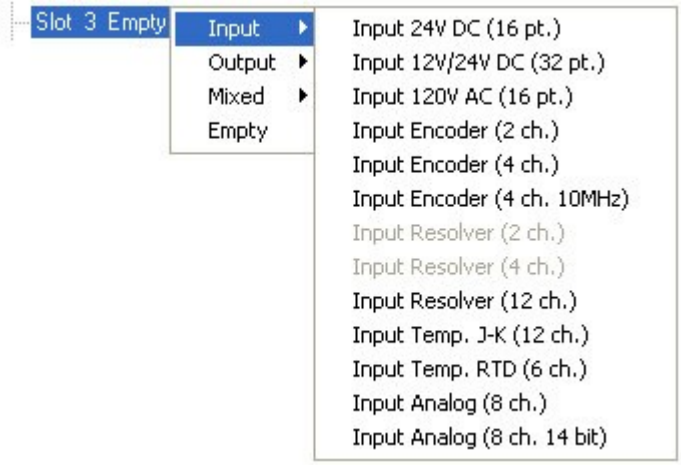
Hardware Declarations Table - Remote I/O Expansion Rack

Expansion Rack

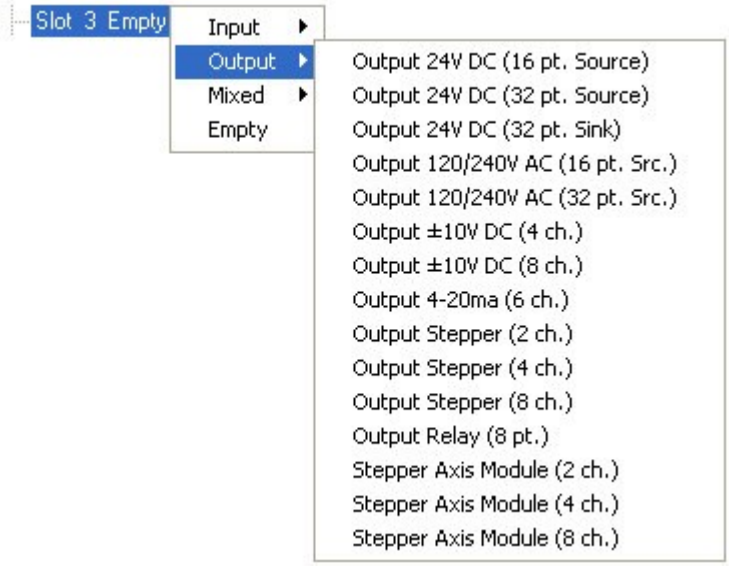
Slot 1:	Reserved for Remote Services Module (RSM)
Slot 2:	Reserved for I/O Drive Module
Slot 3 – 13:	Define the type and location of addition I/O modules.



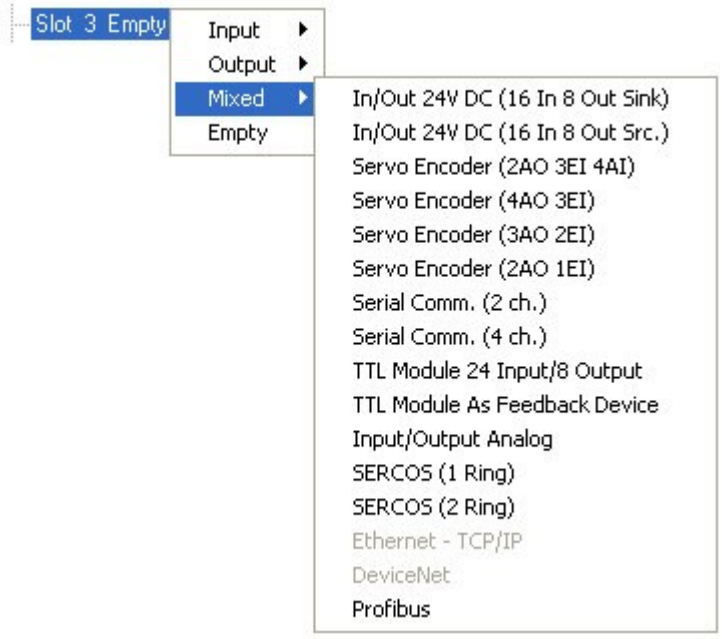
Input



Output



Mixed

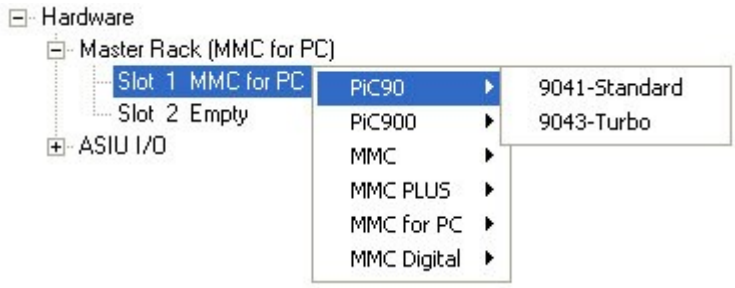


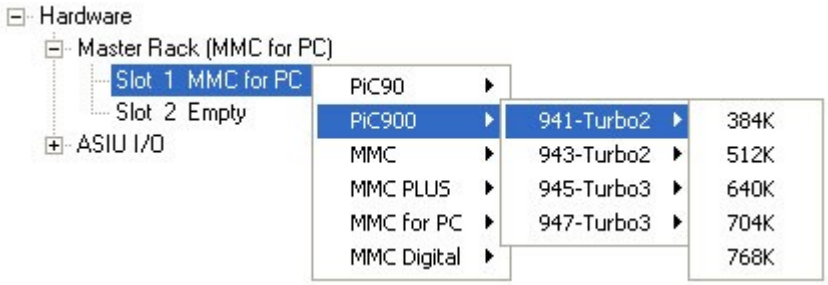
Hardware Declarations Table - MMC for PC CPU

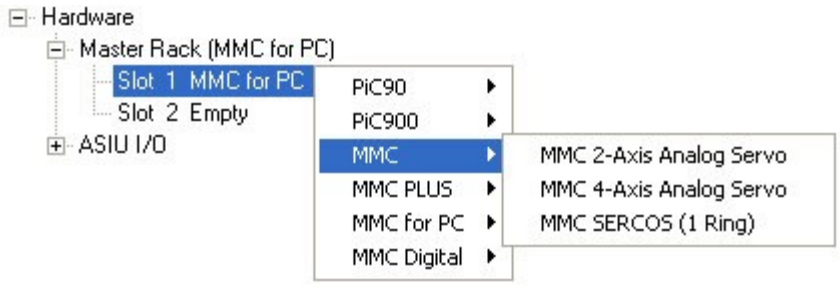
Master Rack (Board mounted in workstation)

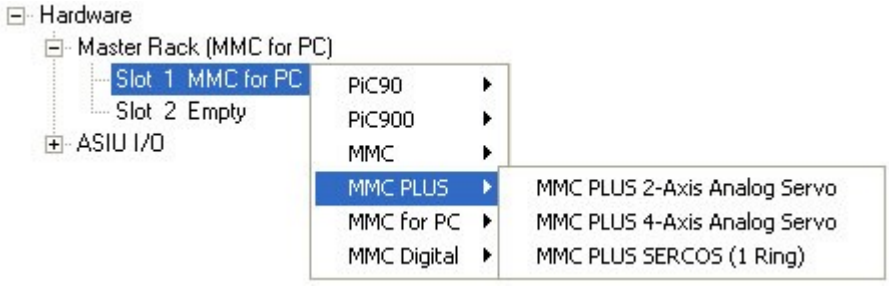
Slot 1: MMC for PC CPU (Analog Servo or SERCOS)

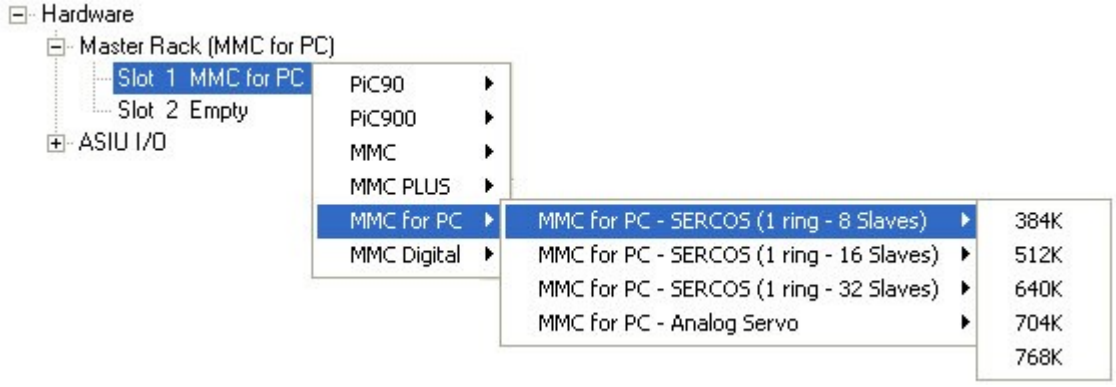
Slot 2: Reserved for DeviceNet, Profibus or Digital Line Shaft (DLS) module.

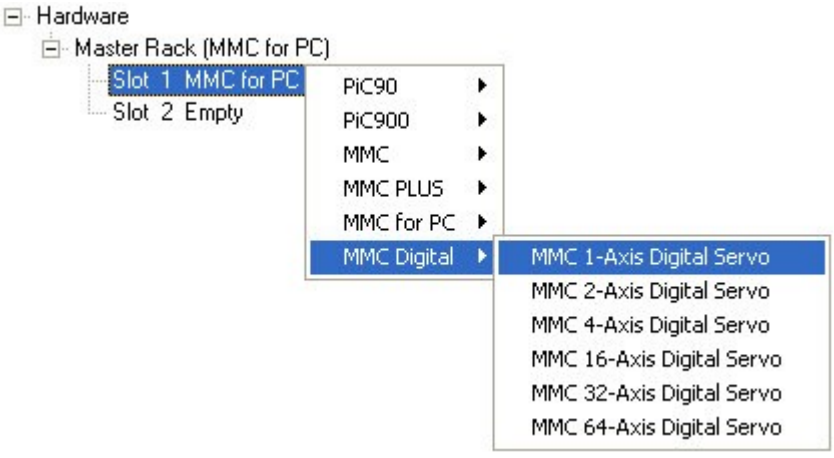


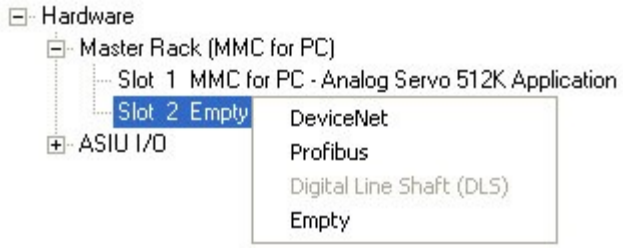



Hardware
Master Rack (MMC for PC)
Slot 1 MMC for PC
Slot 2 Empty
ASIU I/O
PiC90
PiC900
MMC
MMC PLUS
MMC for PC
MMC Digital
MMC 2-Axis Analog Servo
MMC 4-Axis Analog Servo
MMC SERCOS (1 Ring)


Hardware
Master Rack (MMC for PC)
Slot 1 MMC for PC
Slot 2 Empty
ASIU I/O
PiC90
PiC900
MMC
MMC PLUS
MMC for PC
MMC Digital
MMC PLUS 2-Axis Analog Servo
MMC PLUS 4-Axis Analog Servo
MMC PLUS SERCOS (1 Ring)

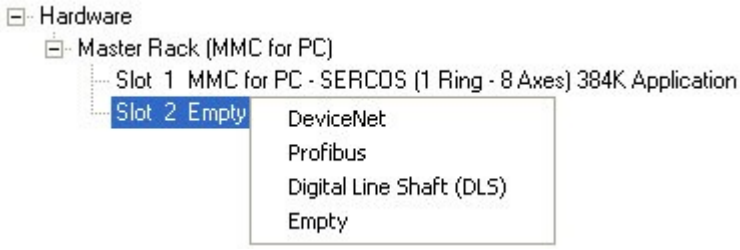

Hardware
Master Rack (MMC for PC)
Slot 1 MMC for PC
Slot 2 Empty
ASIU I/O
PiC90
PiC900
MMC
MMC PLUS
MMC for PC
MMC Digital
MMC for PC - SERCOS (1 ring - 8 Slaves)
MMC for PC - SERCOS (1 ring - 16 Slaves)
MMC for PC - SERCOS (1 ring - 32 Slaves)
MMC for PC - Analog Servo
384K
512K
640K
704K
768K


Hardware
Master Rack (MMC for PC)
Slot 1 MMC for PC
Slot 2 Empty
PiC90
PiC900
MMC
MMC PLUS
MMC for PC
MMC Digital
MMC 1-Axis Digital Servo
MMC 2-Axis Digital Servo
MMC 4-Axis Digital Servo
MMC 16-Axis Digital Servo
MMC 32-Axis Digital Servo
MMC 64-Axis Digital Servo



Note:

If an MMC for PC Digital SERCOS is selected, the Digital Line Shaft (DLS) item will be selectable at Slot 2 as follows:

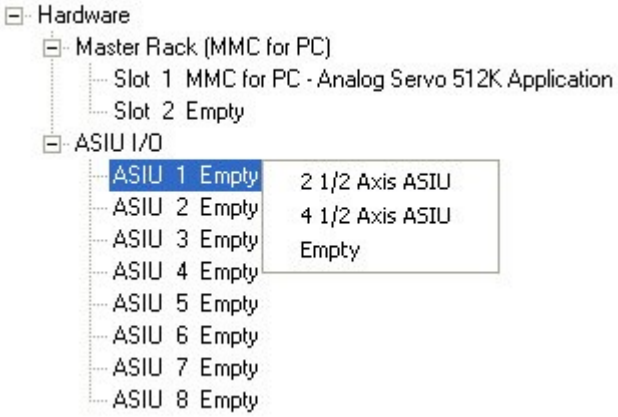


MMC for PC ASIU I/O

Analog Servo Interface Units (ASIU)

Slot 1 – 8 are only available when an Analog Servo CPU is specified.

A left-click on an ASIU "Slot" will display the selection menu shown. The ASIU "slot" number refers to the physical switch setting on the hardware.

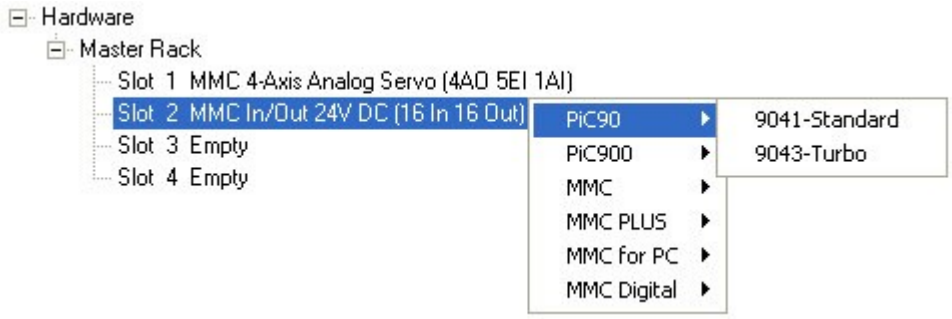


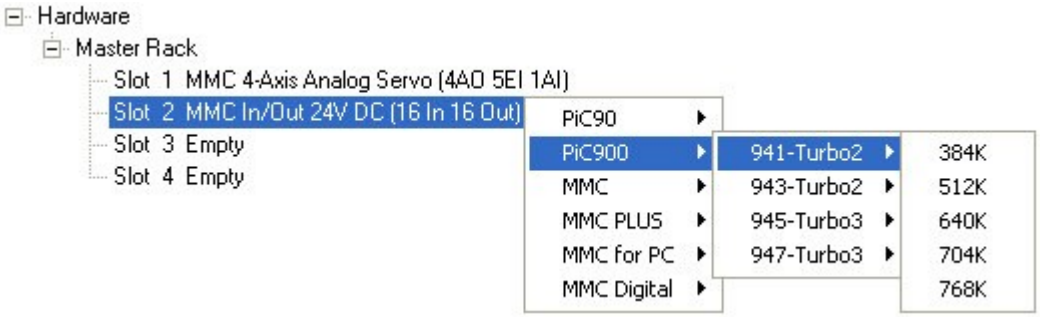
Note: If an MMC for PC SERCOS is selected, the ASIU I/O branch will not be shown on the hardware tree.

Hardware Declarations Table - Standalone MMC CPU

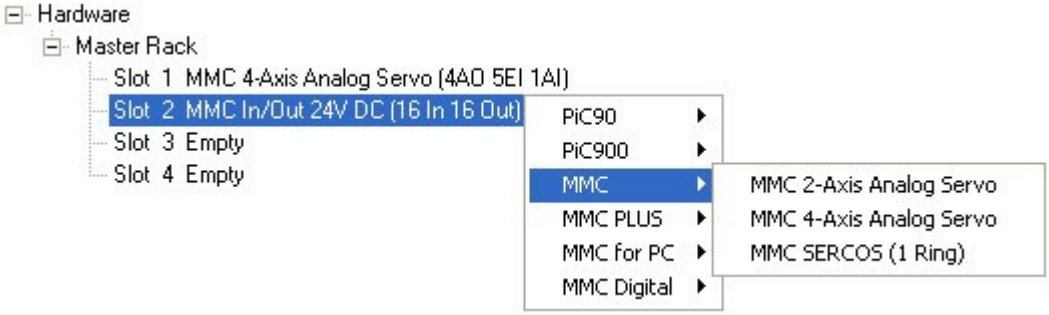
Master Rack

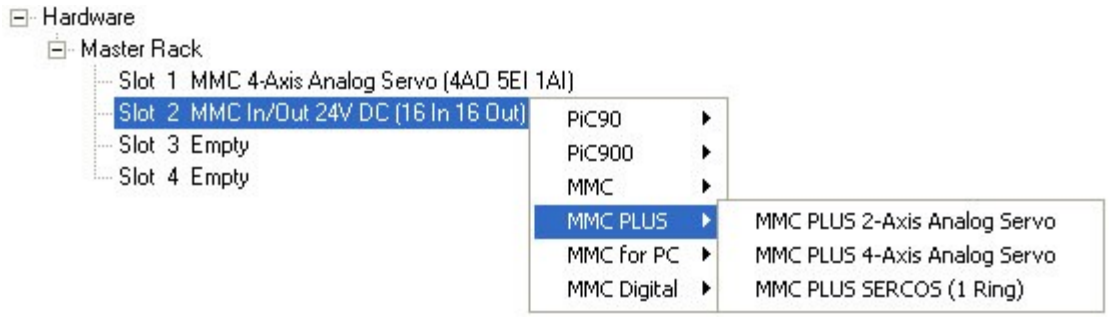
Slot 1:	2 ½ or 4 ½ axes Servo
Slot 2:	MMC and General I/O
Slots 3 – 4:	Reserved for the Ethernet – TCP/IP, DeviceNet, Profibus or 32 In 32 Out modules.

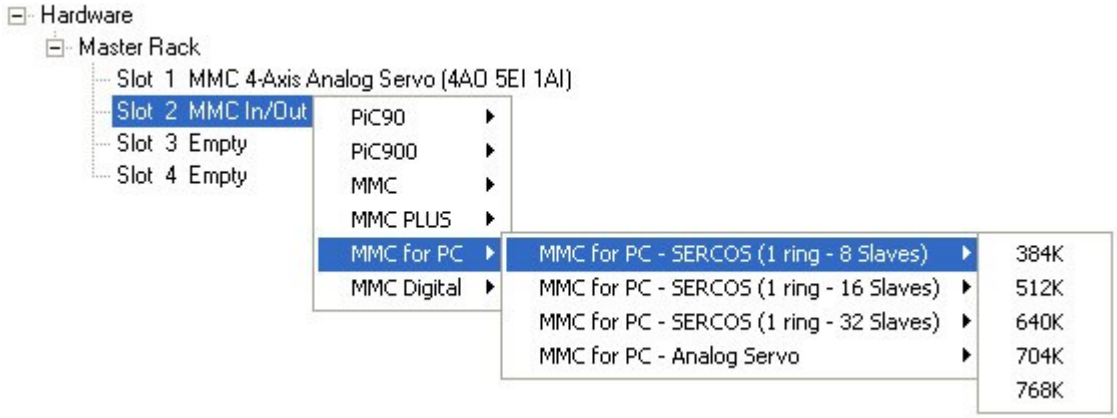




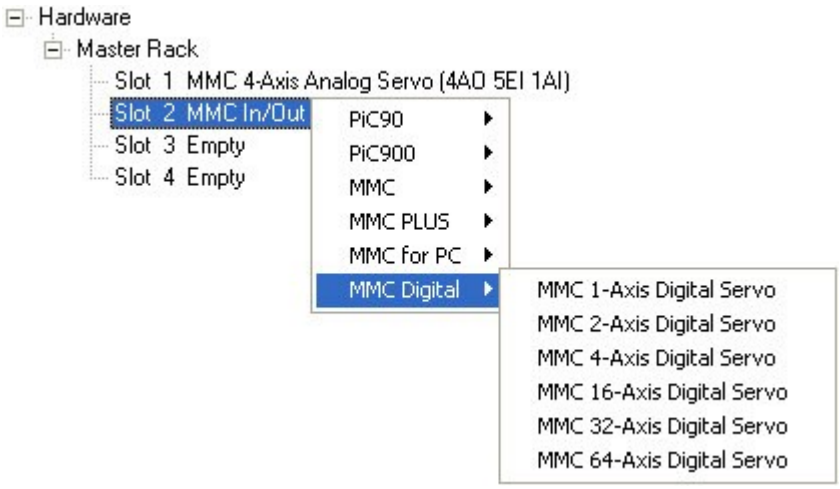
These five memory types are available for all PiC900 models.







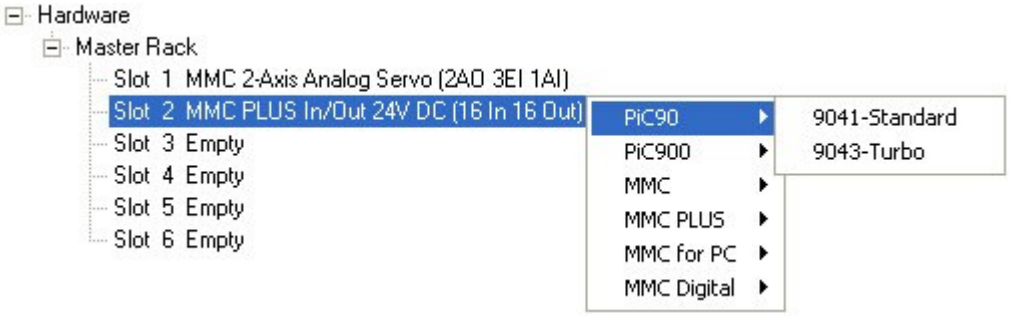
These five memory types are available for all MMC for PC models.

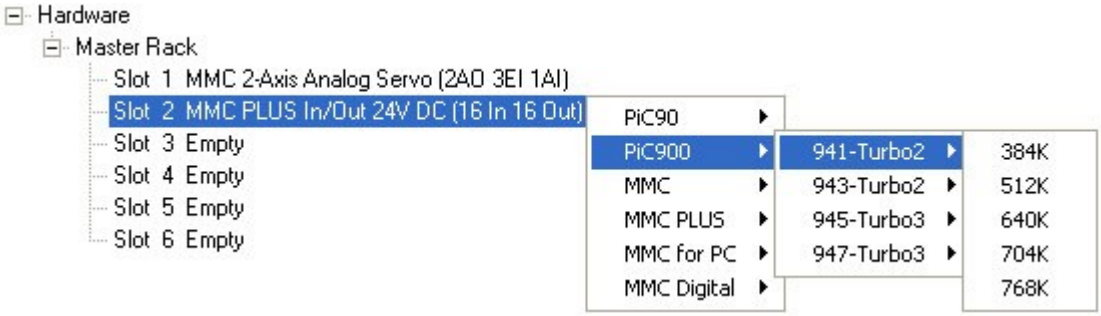


Hardware Declarations Table - MMC PLUS CPU

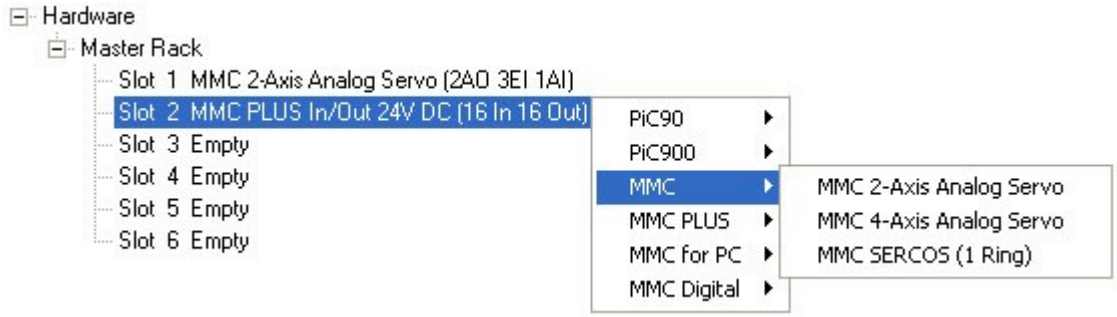
Master Rack

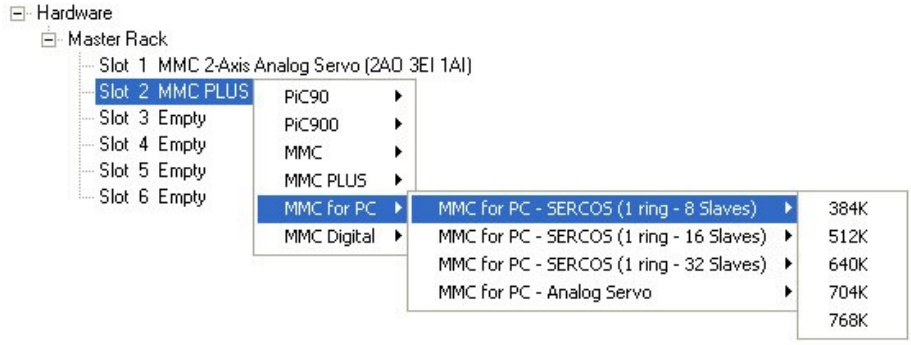
Slot 1:	2 or 4 axes Analog Servo Module or MMC SERCOS
Slot 2:	In/Out 24V DC Module
Slots 3 – 6:	Reserved for DeviceNet, Profibus, Ethernet, MMC 4 axis Analog Servo module or MMC 32 In 32 Out modules.



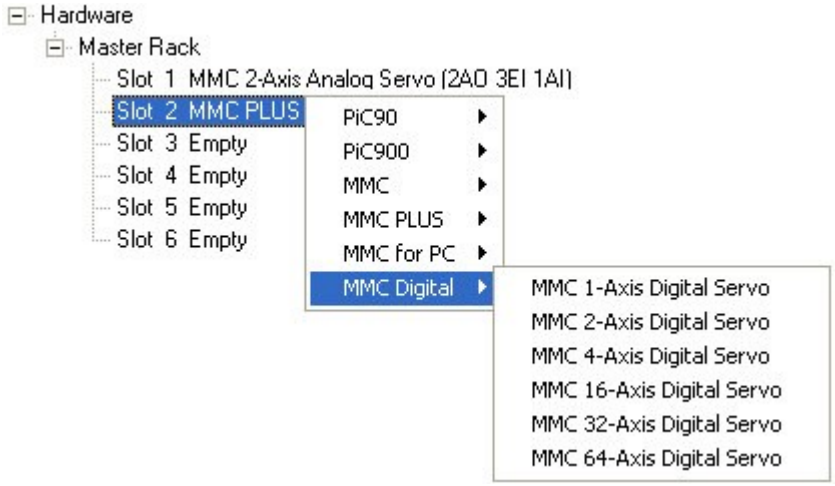


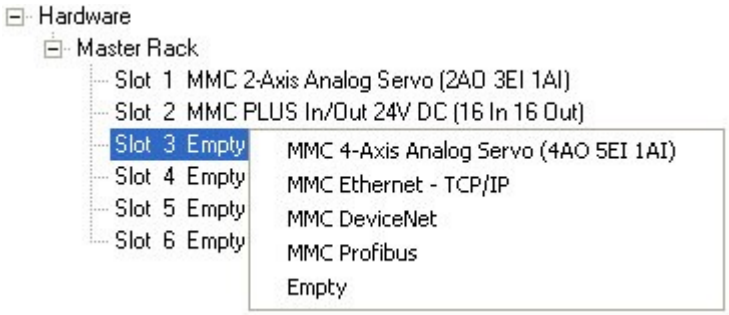
These five memory types are available for all PiC900 models.





These five memory types are available for all MMC for PC models.





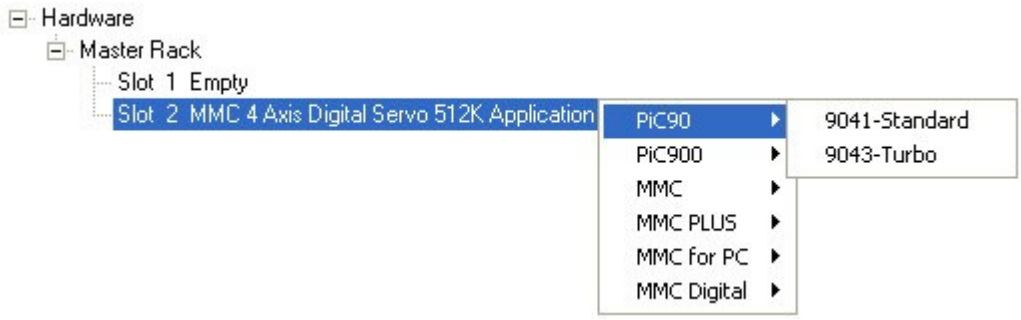
Hardware Declarations Table - MMC Digital

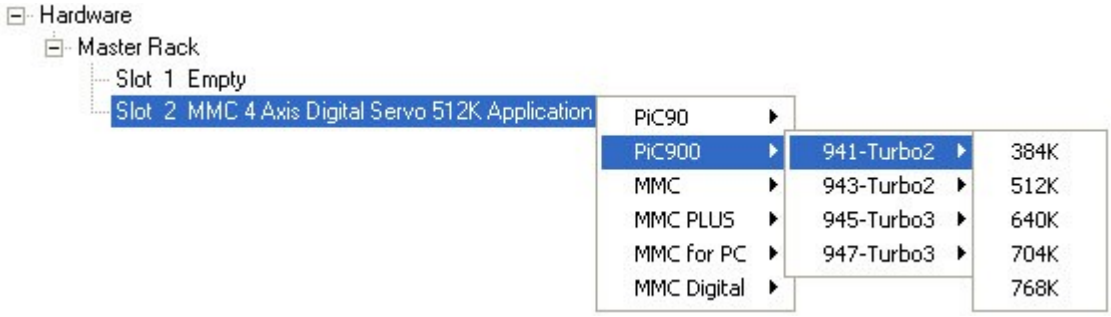
Master Rack

Slot 1: Empty

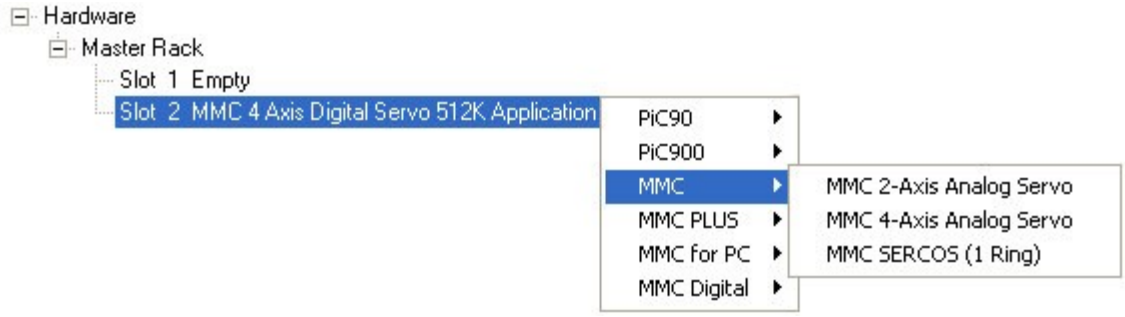
Slot 2: MMC Digital Servo and General I/O (for 1, 2, 4 and 16 Axis)

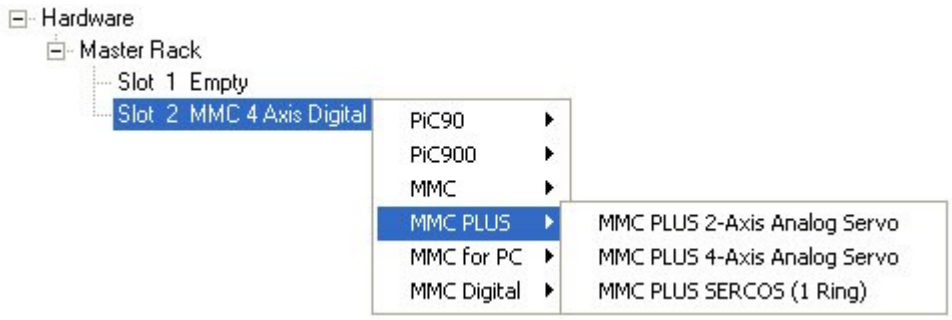
Slot 3-6: Only visible if slot 2 contains 32 or 64 Axis MMC Digital. Reserved for the Device Net, Profibus or 32 In 32 Out modules.

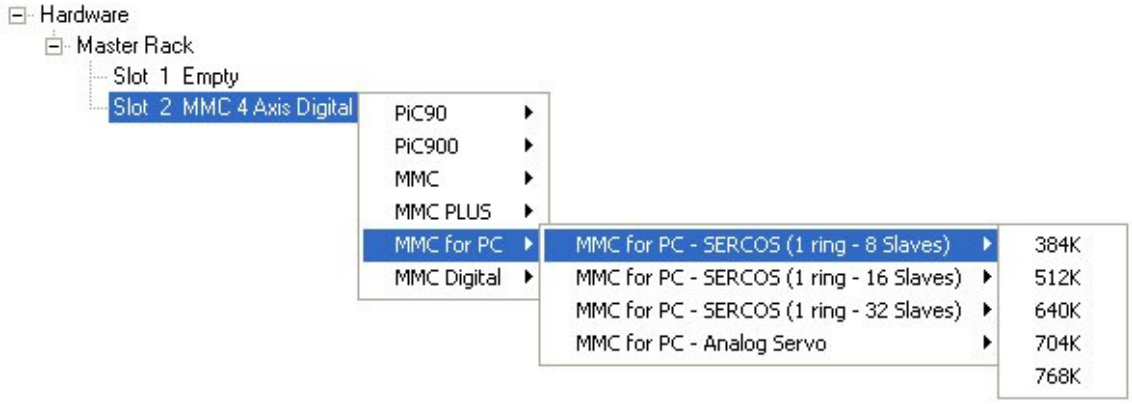




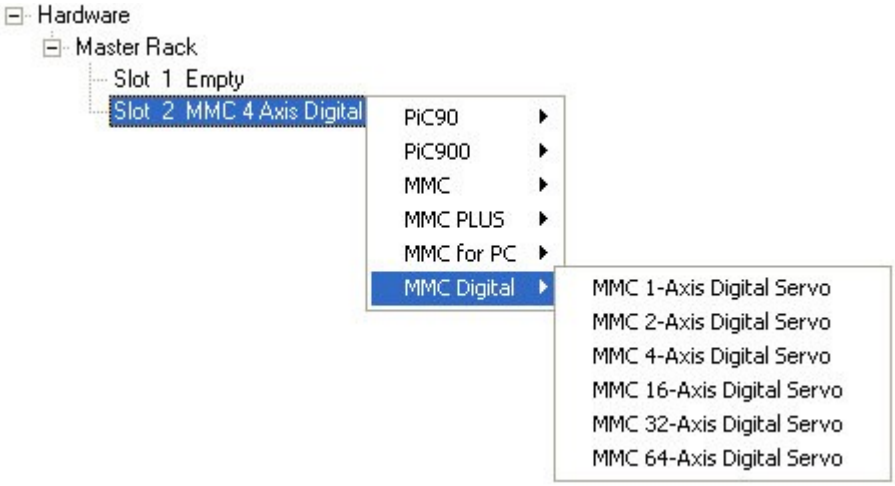
The five memory types shown are available for all PiC900 models.







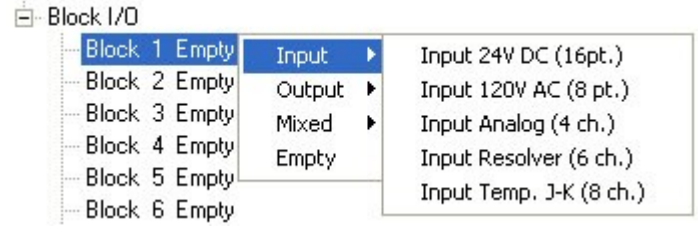
The five memory types shown are available for all MMC for PC models.

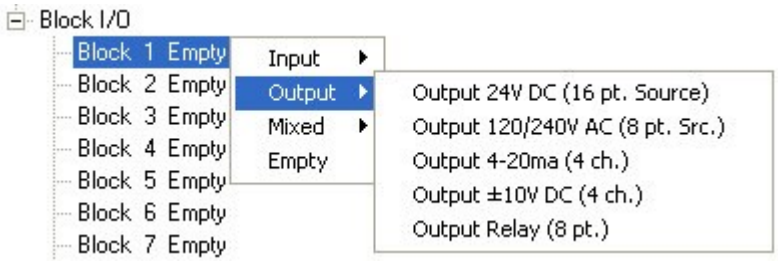


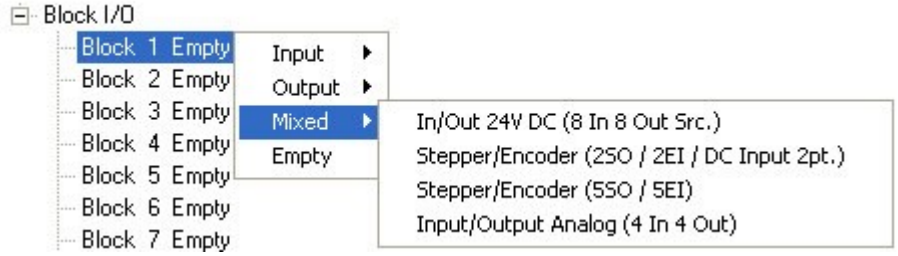
Hardware Declarations Table - Block I/O Module

Block I/O Modules

Blocks 1 – 77: Define the type and location of the I/O modules. Select the module type and then the correct module from the fly-out list provided







Editing Hardware Declarations

Editing Hardware Declarations

The editing commands in the hardware declarations table are insert, delete, cut, copy, and paste.

Inserting and Deleting Hardware Declarations

After entering the first Remote I/O expansion rack, you can add additional expansion racks by using the **Insert After** command.

To insert additional remote I/O expansion racks or block I/O, do the following:

1. Select the device after which you want to insert another device.
2. Choose **Edit | Insert After** from the menu or **Insert** key. The new device will be placed directly after the one you selected. If there are any racks or blocks after it, they will be renumbered.

Note:

Block I/O will only be incremented up to the first empty block. For example, if you have Block I/O modules in blocks 1 through 5, and 6 through 9 are empty, and 10 through 15 contain Block I/O modules, and you **Insert After** at block 2, only 3, 4, and 5 will shift becoming 4, 5, and 6. The block modules in 10 through 15 are unaffected. You will also be prompted to have the corresponding Block I/O points adjusted in Software Declarations. For this example, all I/O points for block 3 would be changed to block 4, etc. You cannot insert Block I/O that would cause a block defined at block 77 to be replaced. You will be prompted to remove that block first.

To delete a remote I/O expansion rack or block I/O, do the following:

1. Select the object you want to delete.
2. Choose **Edit | Delete** from the menu or **Delete** key. A warning message appears. The object will be deleted if you choose **OK**. With a remote I/O expansion rack, if there are any racks after the one you deleted, they will be renumbered.

Note:

When you delete a Block I/O module, remaining modules are moved up in the list to the first empty block. For example, if blocks 1 through 6 are filled with Block I/O modules, 7 through 9 are empty, and 10 through 15 contain Block I/O modules, and you delete block 4, then blocks 5 and 6 become 4 & 5, 6 is empty, and 10 through 15 are unaffected. Any Software Declarations specifying I/O points for block 4 will be modified to remove the I/O points. You are also prompted to have the Software Declarations automatically adjusted. For this example, all I/O points for block 5 will be changed to block 4, etc.

Cutting and Copying Hardware Declarations

The **Copy** and **Cut** commands let you use the clipboard to create copies of some selected objects in the declarations table. The commands are context sensitive and will be grayed if they do not apply to where you are in the table.

The **Copy** command places a copy of the selected object on the clipboard.

The **Cut** command removes the object from the table and places it on the clipboard.

Copy command can be used on these selected objects:

- Entire Hardware Declarations Table
- Master Rack
- Expansion Rack(s)
- Block I/O Branch
- ASIU I/O Branch
- CPU, I/O, Modules

Cut command can be used on these selected objects:

- Expansion Racks
- I/O and Block I/O Modules
- Block I/O Branch
- ASIU I/O Modules

Copy command cannot be used on:

- Modules that cannot be changed

Cut command cannot be used with:

- Entire Hardware Declarations Table
- Master Rack
- CPU and any modules that cannot be changed
- I/O in slot 1

To copy an object in the hardware declarations table:

1. Select the object.
2. Choose **Edit | Copy** from the menu or <**Ctrl + C**> to copy the selected object to the clipboard.

To cut an object in the hardware declarations table:

1. Select the object.
2. Choose **Edit | Cut** from the menu or <**Ctrl +X**> to cut the selected object.

Things to note about cutting objects from the hardware declarations table:

- When you cut a Block I/O module, remaining modules are moved up in the list to the first empty block. For example, if blocks 1 through 6 are filled with Block I/O modules, 7 through 9 are empty, and 10 through 15 contain Block I/O modules, and you cut block 4, then blocks 5 and 6 become 4 & 5, 6 is empty, and 10 through 15 are unaffected. Any Software Declarations specifying I/O points for block 4 will be modified to remove the I/O points. You are also prompted to have the software declarations automatically adjusted. For this example, all I/O points for block 5 will be changed to block 4, etc.
- When you cut an expansion rack or a block branch, the rack or branch is removed. With expansion racks, any remaining racks are renumbered.

Pasting and Inserting Paste in Hardware Declarations

Once an object is on the clipboard, you can use the **Paste** command or the **Paste Insert After** command to place the object back into the table. The object remains on the clipboard until you cut or copy another object onto the clipboard. Only one object can be placed on the clipboard at a time.

Using the Paste command:

1. Select the location where you want the paste to occur.
2. Choose **Edit | Paste** from the menu or <**Ctrl + V**>. The object on the clipboard will replace the selected object.

Using the Paste Insert After command:

1. Select the location where you want the paste insert after to occur.
2. Choose **Edit | Paste Insert After** from the menu or <**Ctrl + A**>. The object on the clipboard will be inserted after the location you selected.

Things to note about pasting objects in the hardware declarations table:

- With the **Paste** command, the object on the clipboard must match the selected object in the table.
- With the **Paste Insert After** command, the object on the clipboard must be an expansion rack or a block module. The selected object can be the master rack, an expansion rack, the block I/O root, or an individual block module.
- With the **Paste Insert After** command, Block I/O will only be incremented up to the first empty block. For example, if you have Block I/O modules in blocks 1 through 5, and 6 through 9 are empty, and 10 through 15 contain Block I/O modules, and you Paste Insert After at block 2, only 3, 4, and 5 will shift becoming 4, 5, and 6. The block modules in 10 through 15 are unaffected. You will also be prompted to have the corresponding Block I/O points adjusted in Software Declarations. For this example, all I/O points for block 3 would be changed to block 4, etc. You cannot insert block I/O that would cause a block defined at block 77 to be replaced. You will be prompted to remove that block first.

Pasting to Software Declarations

Pasting to Software Declarations

You can copy I/O information from a standalone MMC, MMC Plus, MMC for PC Analog Servo, or an MMC Digital Servo to the clipboard and paste it in Software Declarations.

Right-click on the standalone MMC module, the MMC Plus module, the MMC 1, 2, 4, or 16 axis Digital Servo module, an MMC for PC ASIU module or an MMC 32 In 32 Out module, then select **Copy I/O to clipboard**. Declarations for all I/O points on that module will be placed on the clipboard. When hardware declarations is closed and software declarations is opened, these default declarations can be pasted.

Printing Hardware Declarations

Printing Hardware Declarations

The hardware declarations table cannot be printed while the hardware declarations dialog is open. It can be printed using the **Print** command from the **File** menu for the application. The table will be printed in its expanded form regardless of how it was last displayed.

To print your hardware declarations:

1. Put focus on the ladder view.
2. Select **File | Print** from the menu or press <**Ctrl + P**>**.**
3. The **Print** dialog appears. Make sure the **Hardware Declarations Include in Listing** box is checked. Select **OK** to proceed or **Cancel** to exit.

Closing and Saving Hardware Declarations

Closing and Saving Hardware Declarations

You can close the hardware declarations table and save any changes or close without saving changes.

To close and save the hardware declarations table:

1. If you choose **File | Save & Close** from the menu or press the **F10** key, your table will close and any changes will be saved.
2. If you choose **File | Close** from the menu or press the **Esc** key, your table will close and no changes will be saved.

Software Declarations

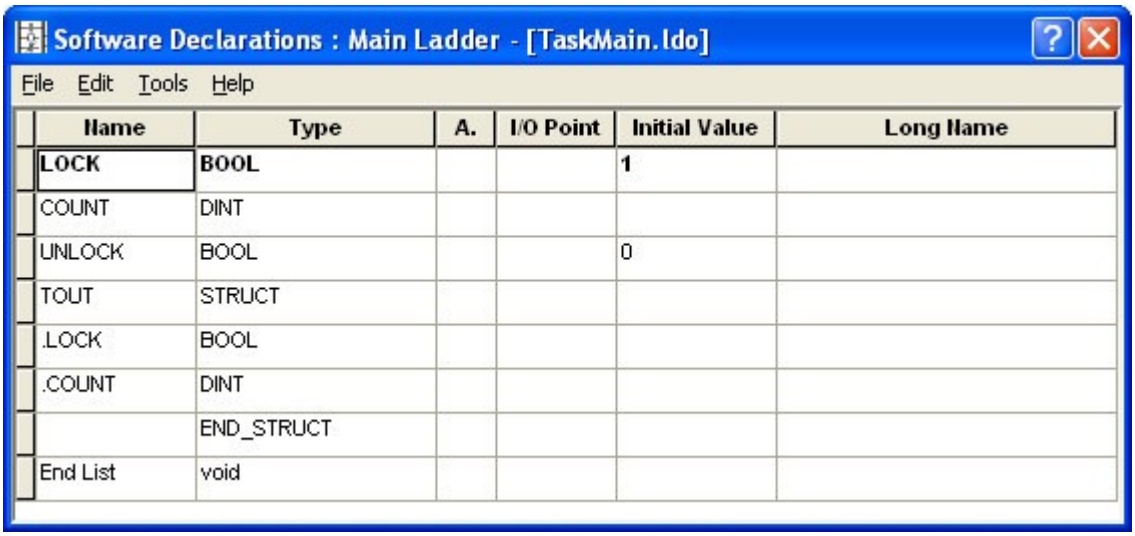
Overview: Software Declarations

In the Software Declarations table, you enter the following information for your ladder:

- The name and data type of every variable, contact, coil, function block, structure and array used.
- The location of every physical input or output used.
- The initial or default value of any entry if required.
- The retentive, global, external, or UDFB in or out attribute of any variable if required.
- A descriptive long name if desired.

You can perform the following editing functions in the Software Declarations table:

- Inserting and deleting entries
- Finding declared entries
- Cutting, copying, and pasting entries
- Purging the table of entries that are not used in your ladder



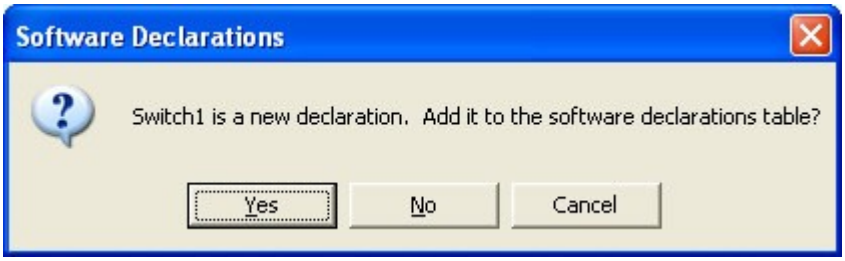
Data Types

Numeric	Bitwise	String	Time	Array/Structure
SINT	BOOL	STRING	TIME	ARRAY
INT	BYTE			STRUCT
DINT	WORD			
LINT	DWORD			
USINT	LWORD			
UINT				
UDINT				
ULINT				
REAL				
LREAL				

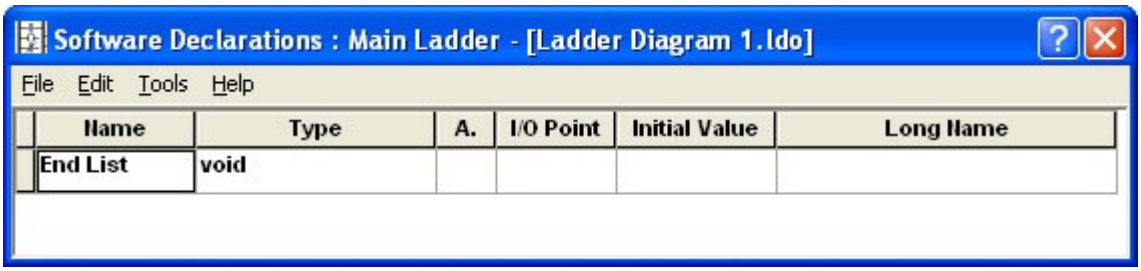
Entering Software Declarations

There are several ways to access the Software Declarations table in order to declare entries.

- Select the button from the view navigator toolbar.
- Select **View | Software Declarations…** from the menu.
- When you enter a new variable in your ladder and it has not been declared yet, answer **Yes** to this dialog and the Software Declarations table will appear.



Press the **Insert** key to add a new variable to the table.



You can add a variable to the declarations. There are six columns in the table in which you enter information.

- The name and data type of every variable, contact, coil, function block, structure and array used must be entered in the Name and Type columns.
- If required, the retentive, global, external, or UDFB in or out attribute of any variable is entered in the A. (or Attribute) column.
- The location of every physical input or output used is entered in the I/O Point column.
- The initial or default value of any entry, if required, is entered in the Initial Value column.
- A descriptive long name, if desired, can be entered in the Long Name column.

Names and Long Names of Variables

Names

In the **Name** column of the Software Declarations table, type in up to 63 alphanumeric/underscore characters.

- The first character must be alpha (A-Z, a-z) or the underscore (_).
- The 2nd through 63rd character can be alpha, numeric (0-9), or underscore.
- Mixed case characters are allowed.

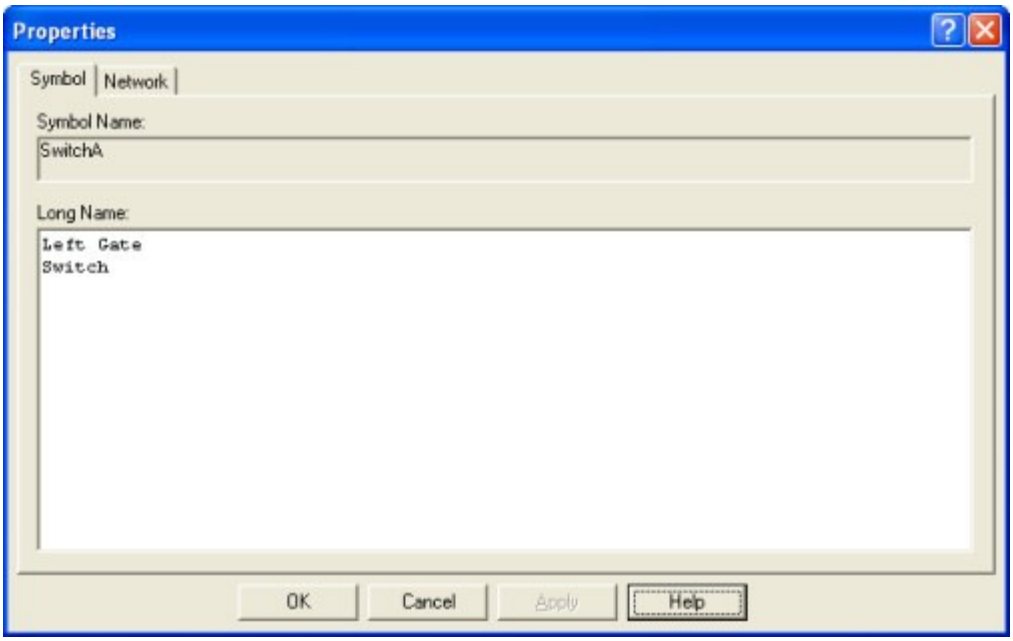
Note:

No distinction is made between names having the same characters with different case (e.g. Switch1 and SWITCH1). If there is an existing variable named SWITCH1 and a new variable named Switch1 is inserted, an error message dialog will be displayed indicating there is already another variable with the same name.

If the name is changed in this column, every occurrence of the variable in your ladder will be changed. The only exception is a ST Network that contains syntax errors. In this case the name may not be changed.

Long Names

Since the release of PiCPro for Windows V13.0, **Long Names** are no longer required. This column is being retained for ladder files created with versions of PiCPro prior to V13.0.



In the **Long Name** column, you can add a long name to any variable used in a network. Long names can have up to 40 ASCII characters on four lines (10 per line). You can view, edit or add a long name to a variable in a LD network or to the Long Name column in the Software Declarations table. When you add or change a long name for a variable in a network, PiCPro automatically updates the Long Name column in the Software Declarations table and vice versa. You can choose to display or hide the long names in your LD Networks.

Reserved Keywords

The following are reserved Keywords that are not allowed as variable names:

ACTION	ADD	AND	ANDN
ARRAY	AT	BOOL	BY
BYTE	CAL	CALC	CALCN
CASE	CONFIGURATION	CONSTANT	D
DATE	DATE_AND_TIME	DINT	DIV
DO	DS	DWORD	ELSE
ELSIF	END_ACTION	END_CASE	END_CONFIGURATION
END_FOR	END_IF	END_FUNCTION	END_FUNCTION_BLOCK
END_PROGRAM	END_REPEAT	END_RESOURCE	END_STEP
END_STRUCT	END_TRANSITION	END_TYPE	END_VAR
END_WHILE	ENO	EQ	EXIT
FOR	FROM	FUNCTION	FUNCTION_BLOCK
F_EDGE	GE	GT	IF
INITIAL_STEP	INT	JMP	JMPC
JMPCN	L	LD	LDN
LE	LINT	LREAL	LWORD
LT	MOD	MUL	N

NE	NOT	OF	ON
OR	ORN	P	PROGRAM
R	READ_ONLY	READ_WRITE	READ
REPEAT	RESOURCE	RET	RETURN
R_EDGE	S	SD	SINT
SL	ST	STEP	STN
STRING	STRUCT	SUB	TASK
THEN	TIME	TIME_OF_DAT	TO
TRANSITION	TYPE	UDINT	UINT
ULINT	UNTIL	USINT	VAR
VAR_ACCESS	VAR_EXTERNAL	VAR_GLOBAL	VAR_INPUT
VAR_IN_OUT	VAR_OUTPUT	WITH	WHILE
WORD	XOR	XORN	

If you attempt to enter a variable name that is a reserved keyword (e.g. ACTION), the following message will appear:

Choose **OK** and enter a variable name that is not a reserved keyword.

IO Points

I/O Points

In the **I/O Point** column, enter the location of physical inputs and outputs only.

- For hardware modules located in the master or expansion rack, the rack and slot location of the module and the channel location of the input or output are defined. The hardware module must be declared in the Hardware Declarations table.
- For block I/O modules, the block number and the point number are defined.
- For ASIU I/O modules, the ASIU number and the point number are defined.
- The data type in the **Type** column must be boolean to enter information in the **I/O Point** column.
- The format of I/O points defined in software declarations is different based on the CPU type declared in hardware declarations. The definition of Block I/O points is unaffected by CPU choice.

Note:

I/O point information that applies to the standalone MMC CPU also applies to the standalone MMC PLUS CPU.

Standalone MMC I/O Points

Both PiCPro Professional and the MMC-Limited Edition allow you to copy and paste the I/O information to the Software Declarations table from the Hardware Declarations table. This can be done for the I/O on the MMC CPU module and MMC analog servo module.

The information can be copied by doing the following:

- Select the CPU (Slot 2) or Analog Servo Module (any slot) section in the Hardware Declarations table.
- Right-click and choose **Copy I/O to Clipboard**.
- Close the Hardware Declarations table and view the Software Declarations table.
- Paste the information into the Software Declarations table.

All necessary information will be entered automatically in the Software Declarations table.

Below is a list of the I/O Point labels for the general connector on the MMC CPU module and for the axis and auxiliary connectors on the analog module. The information in column 2 will be pasted in the **Name** column and the information in column 3 will be pasted in the **I/O Point** column of the Software Declarations table. In the following table, '#' represents the slot number.

This table is for the general connector:

Discrete point	Declared Name	Software Declaration I/O assignment (MMC I/O Point)	PiC I/O Point
16 General DC Inputs	GENI1 – GENI16	IGEN#.1 – IGEN#.16	I3.1–I3.16
16 General DC Outputs	GENO1 – GENO16	OGEN#.1 – OGEN#.16	O3.1–O3.16
2 Short Circuit Inputs	SHORT1 - SHORT2	ISGEN#.1 – ISGEN#.2	I3.17–I3.18

This table is for the axis and auxiliary connectors on the analog servo module:

Discrete point	Declared Name	Software Declaration I/O assignment (MMC I/O Point)	PiC I/O Point
6/12 Auxiliary DC Inputs	AUXI#_1 - AUXI#_12	IAUX#.1 – IAUX#.12	Is.1–Is.12
Axis 1 DC Input	AX1RDY#	I#A1.1 *(Slot #, Axis 1, Input 1)*	Is.13
Axis 2 DC Input	AX2RDY#	I#A2.1	Is.14
Axis 3 DC Input	AX3RDY#	I#A3.1	Is.15
Axis 4 DC Input	AX4RDY#	I#A4.1	Is.16
Axis 1 DC Output	AX1EN#	O#A1.1 *(Slot #, Axis 1, Output 1)*	Os.1
Axis 2 DC Output	AX2EN#	O#A2.1	Os.3
Axis 3 DC Output	AX3EN#	O#A3.1	Os.5
Axis 4 DC Output	AX4EN#	O#A4.1	Os.7
Axis 1 DC Output	AX1RES#	O#A1.2	Os.2

		(Slot #, Axis 1, Output 2)	
Axis 2 DC Output	AX2RES#	0#A2.2	0s.4
Axis 3 DC Output	AX3RES#	0#A3.2	0s.6
Axis 4 DC Output	AX4RES#	0#A4.2	0s.8

In the **PiC I/O Point** column, **s** represents the slot number. Where the slot number is 4 if the Analog Servo module was in slot 1, or slot number of the Analog Servo module + 2 if the Analog Servo module was in slots 3 through 6.

Below is a list of the I/O Point labels for the MMC In/Out 24V DC (32 In 32 Out) module. The information in column 2 will be pasted in the Name column and the information in column 3 will be pasted in the I/O Point column of the Software Declarations table.

Discrete point	**Declared Name**	**Software Declaration I/O assignment (MMC I/O Point)**	**PiC I/O Point**
32 general DC inputs	GENAI#_1 - GENAI#_16 GENBI#_1 – GENBI#_16	IGENA#.1 - IGENA#.16 IGENB#.1 - IGENB#.16	Is.1-Is.32
32 general DC outputs	GENAO#_1 - GENAO#_16 GENBO#_1 – GENBO#_16	OGENA#.1 - OGENA#.16 OGENB#.1 - OGENB#.16	Os.1-Os.32
4 short circuit inputs	SHORTA#_1 – SHORTA#_2 SHORTB#_1 – SHORTB#_2	ISGENA#.1 - ISGENA#.2 ISGENB#.1 - ISGENB#.2	Is.33-Is.36

In the Software Declaration I/O assignment column, '#' represents the slot number. In the PiC I/O Point column, 's' represents MMC , MMC Plus, or MMC D64 slot number + 2.

Notes:

- The PiC I/O Point column is what will appear in the software declarations if you later change your CPU from a standalone MMC, MMC Plus or MMC Digital CPU to a different CPU type. Always check the I/O points after changing CPU types to be sure the I/O mappings match your system.
- If you later change the CPU type in hardware declarations, the I/O points will automatically change in software declarations.

Fast Inputs

The following I/O points can be **manually entered** in software declarations. Where # represents the slot number.

Discrete Point	**Declared Name**	**Software Declaration I/O assignment (MMC I/O Point)**
Axis 1 fast input	AX1FIN#	IFAUX#.1 (aux port, Axis 1, Fast Input)
Axis 2 fast input	AX2FIN#	IFAUX#.2
Axis 3 fast input	AX3FIN#	IFAUX#.3
Axis 4 fast input	AX4FIN#	IFAUX#.4
Axis 49 fast input	DIGFIN#	IFAUX#.49 (aux port, Digitize 49, Fast Input)
Expansion input (future)		I3.1 – I3.x

MMC for PC I/O Points

PiCPro Professional Edition is used to program the I/O points for MMC for PC CPU types. If an MMC for PC CPU is specified in the hardware declarations, all I/O points in the software declarations must be MMC for PC I/O points. I/O points can be manually entered or copied from one ladder to another. The ASIU I/O can be copied to the clipboard from Hardware Declarations table and pasted into Software Declarations table.

Note: Declarations for the Fast Inputs available for each axis must be manually entered into Software Declarations table. They cannot be copied to the clipboard from Hardware Declarations table.

ASIU I/O Points

The following table describes the MMC for PC, Analog Servo Interface Unit (ASIU) I/O points. The information in column 2 is the default declared name which will be pasted into the **Name** column if the ASIU I/O is copied to the clipboard from Hardware Declarations table. The information in column 3 will be pasted in the **I/O point** column. The ASIU number is included in both the declared name and the I/O assignment. In the following table, "#" represents the ASIU number.

Discrete point	Declared Name	Software Declaration I/O assignment	PiC I/O Point
16 General DC Inputs	GENI#_1 – GENI#_16	IGEN#.1 – IGEN#.16	Is.1–Is.16
16 General DC Outputs	GENO#_1 – GENO#_16	OGEN#.1 – OGEN#.16	Os.1–Os.16
2 Short Circuit Inputs	SHORT#_1 - SHORT#_2	ISGEN#.1 – ISGEN#.2	Is.17–Is.18
6/12 Auxiliary DC Inputs	AUXI#_1 - AUXI#_12	IAUX#.1 – IAUX#.12	Is.19–Is.30
Axis 1 DC Input	AX1RDY#	I#A1.1 *(ASIU #, Axis 1, Input 1)*	Is.31
Axis 2 DC Input	AX2RDY#	I#A2.1	Is.32
Axis 3 DC Input	AX3RDY#	I#A3.1	Is.33
Axis 4 DC Input	AX4RDY#	I#A4.1	Is.34
Axis 1 DC Output	AX1EN#	O#A1.1 *(ASIU #, Axis 1, Output 1)*	Os.17
Axis 2 DC Output	AX2EN#	O#A2.1	Os.19
Axis 3 DC Output	AX3EN#	O#A3.1	Os.21
Axis 4 DC Output	AX4EN#	O#A4.1	Os.23
Axis 1 DC Output	AX1RES#	O#A1.2 *(ASIU #, Axis 1, Output 2)*	Os.18
Axis 2 DC Output	AX2RES#	O#A2.2	Os.20
Axis 3 DC Output	AX3RES#	O#A3.2	Os.22
Axis 4 DC Output	AX4RES#	O#A4.2	Os.24

In the **PiC I/O Point** column, **s** represents the slot number where slot number is the sum of the ASIU # and 5.

Notes:

- The PiC I/O Point column contains the I/O that would be displayed if the CPU in hardware declarations were changed from an MMC for PC CPU to a PiC CPU or standalone MMC.
- If you later change the CPU type in hardware declarations, the I/O points might be automatically changed in software declarations.

MMC for PC Fast Inputs

The following I/O points can be **manually entered** in software declarations. '#' represents the slot number.

Discrete point	Declared Name	Software Declaration I/O assignment
Axis 1 fast input	AX1FIN#	IFAUX#.1 (aux port, Axis 1, Fast Input)
Axis 2 fast input	AX2FIN#	IFAUX#.2
Axis 3 fast input	AX3FIN#	IFAUX#.3
Axis 4 fast input	AX4FIN#	IFAUX#.4
Axis 49 fast input	DIGFIN#	IFAUX#.49 (aux port, Digitize 49, Fast Input)

MMC Digital 1, 2, 4, or 16 Axis I/O Points

Both PiCPro Professional and the MMC-Limited Edition allow you to copy and paste the I/O information to the Software Declarations table from the Hardware Declarations table. This can be done for the I/O on the MMC CPU module, and MMC 32 In / 32 Out module.

The information can be copied by doing the following:

- Select the CPU (Slot 2) or MMC 32 In / 32 Out Module (any slot) section in the Hardware Declarations table.
- Right-click and choose Copy I/O to Clipboard.
- Close the Hardware Declarations table and view the Software Declarations table.
- Paste the information into the Software Declarations table.

All necessary information will be entered automatically in the Software Declarations table.

The following table describes the MMC Digital I/O points labels that will be pasted into the Software Declarations table for the general connector on the MMC Digital 1, 2, 4 or 16-AxisCPU module. The information in column 2 will be pasted into the **Name** column. The information in column 3 will be pasted in the **I/O point** column.

Discrete point	Declared Name	Software Declaration I/O assignment	PiC I/O Point
8 general DC Inputs	GENI1 - GENI8	IGEN.1 - IGEN.8	13.1-13.8
8 general DC Outputs	GENO1 - GENO8	OGEN.1 - OGEN.8	O3.1-O3.8
1 short circuit Inputs	SHORT1	ISGEN.1	I3.9

Below is a list of the I/O Point labels for the MMC In/Out 24V DC (32 In 32 Out) module. The information in column 2 will be pasted in the Name column and the information in column 3 will be pasted in the I/O Point column of the Software Declarations table.

Discrete point	Declared Name	Software Declaration I/O assignment (MMC I/O Point)	PiC I/O Point
32 general DC inputs	GENAI#_1 - GENAI#_16 GENBI#_1 – GENBI#_16	IGENA#.1 - IGENA#.16 IGENB#.1 - IGENB#.16	Is.1-Is.32
32 general DC outputs	GENAO#_1 - GENAO#_16 GENBO#_1 – GENBO#_16	OGENA#.1 - OGENA#.16 OGENB#.1 - OGENB#.16	Os.1-Os.32
4 short circuit inputs	SHORTA#_1 – SHORTA#_2 SHORTB#_1 – SHORTB#_2	ISGENA#.1 - ISGENA#.2 ISGENB#.1 - ISGENB#.2	Is.33-Is.36

In the Software Declaration I/O assignment column, '#' represents the slot number. In the PiC I/O Point column, 's' represents MMC , MMC Plus, or MMC D64 slot number + 2.

Notes:

- The PiC I/O Point column is what will appear in the software declarations if you later change your CPU from a standalone MMC, MMC Plus or MMC Digital CPU to a different CPU type. Always check the I/O points after changing CPU types to be sure the I/O mappings match your system.
- If you later change the CPU type in hardware declarations, the I/O points will automatically change in software declarations.

MMC Digital 32 or 64 Axis I/O Points

Both PiCPro Professional and the MMC-Limited Edition allow you to copy and paste the I/O information to the Software Declarations table from the Hardware Declarations table. This can be done for the I/O on the MMC analog servo module, and MMC 32 In / 32 Out module.

The information can be copied by doing the following:

- Select the slot in the Hardware Declarations table.
- Right-click and choose Copy I/O to Clipboard.
- Close the Hardware Declarations table and view the Software Declarations table.
- Paste the information into the Software Declarations table.

All necessary information will be entered automatically in the Software Declarations table.

Below is a list of the I/O Point labels for the MMC In/Out 24V DC (32 In 32 Out) module. The information in column 2 will be pasted in the Name column and the information in column 3 will be pasted in the I/O Point column of the Software Declarations table.

Discrete point	Declared Name	Software Declaration I/O assignment (MMC I/O Point)	PiC I/O Point
32 general DC inputs	GENAI#_1 - GENAI#_16 GENBI#_1 – GENBI#_16	IGENA#.1 - IGENA#.16 IGENB#.1 - IGENB#.16	Is.1-Is.32
32 general DC outputs	GENAO#_1 - GENAO#_16 GENBO#_1 – GENBO#_16	OGENA#.1 - OGENA#.16 OGENB#.1 - OGENB#.16	Os.1-Os.32
4 short circuit inputs	SHORTA#_1 – SHORTA#_2 SHORTB#_1 – SHORTB#_2	ISGENA#.1 - ISGENA#.2 ISGENB#.1 - ISGENB#.2	Is.33-Is.36

In the Software Declaration I/O assignment column, '#' represents the slot number. In the PiC I/O Point column, 's' represents MMC , MMC Plus, or MMC D64 slot number + 2.

This table is for the axis and auxiliary connectors on the analog servo module:

Discrete point	Declared Name	Software Declaration I/O assignment (MMC I/O Point)	PiC I/O Point
6/12 Auxiliary DC Inputs	AUXI#_1 - AUXI#_12	IAUX#.1 – IAUX#.12	Is.1–Is.12
Axis 1 DC Input	AX1RDY#	I#A1.1 *(Slot #, Axis 1, Input 1)*	Is.13
Axis 2 DC Input	AX2RDY#	I#A2.1	Is.14
Axis 3 DC Input	AX3RDY#	I#A3.1	Is.15
Axis 4 DC Input	AX4RDY#	I#A4.1	Is.16
Axis 1 DC Output	AX1EN#	O#A1.1 *(Slot #, Axis 1, Output 1)*	Os.1
Axis 2 DC Output	AX2EN#	O#A2.1	Os.3
Axis 3 DC Output	AX3EN#	O#A3.1	Os.5
Axis 4 DC Output	AX4EN#	O#A4.1	Os.7
Axis 1 DC Output	AX1RES#	O#A1.2 *(Slot #, Axis 1, Output 2)*	Os.2
Axis 2 DC Output	AX2RES#	O#A2.2	Os.4
Axis 3 DC Output	AX3RES#	O#A3.2	Os.6
Axis 4 DC Output	AX4RES#	O#A4.2	Os.8

In the **PiC I/O Point** column, **s** represents the slot number. Where the slot number is the slot number of the Analog Servo module + 2.

Notes:

- The PiC I/O Point column is what will appear in the software declarations if you later change your CPU from a standalone MMC, MMC Plus or MMC Digital CPU to a different CPU type. Always check the I/O points after changing CPU types to be sure the I/O mappings match your system.
- If you later change the CPU type in hardware declarations, the I/O points will automatically change in software declarations.

IO Point Numbering

I/O Point Numbering

The manner in which I/O points are displayed changes based on the type CPU selected in Hardware Declarations (PiC, Standalone MMC, MMC Digital, or MMC for PC).

General PiC CPU

The master or CPU rack is #0. Expansion racks are numbered 1 - 7, where #1 is the rack connected to the master, #2 is the rack connected to #1, etc. Slots are numbered left to right when facing the PiC rack. Slot 1 and slot 2 are reserved for the CSM/CPU module. On an expansion rack, slot 2 is reserved for the I/O driver module.

Master Rack, MMC Digital 1, 2, 4 or 16 Axis I/O Point Numbering

(Two options)

1st	I, O or IS	Input, Output or Short Circuit Input
2nd	GEN	Connector/Type
3rd	2	Slot Number
4th	. (point)	Used as a separator
5th	1 - 8	Channel

OR

1st	I, O or IS	Input, Output or Short Circuit Input
2nd	GENA or GENB	Connector/Type
3rd	3 - 6	Slot Number
4th	. (point)	Used as a separator
5th	0 - 1	First digit of channel number (may omit if 0)
6th	0 - 9	Second digit channel number (valid channel numbers are 1 - 16)

Master Rack, MMC Digital 32 or 64 Axis I/O Point Numbering

(Three Options)

1st	I or O	Input or Output
2nd	AUX, FAUX	Connector/Type
3rd	3 - 6	Slot Number
4th	. (point)	Used as a separator
5th	0 - 4	First digit of channel number (may omit if 0)
6th	0 - 9	Second digit of channel number (valid AUX channels are 1 - 12) (valid FAUX channels are 1 - 4 and 49)

OR

1st	I or O	Input or Output
2nd	3 - 6	Slot Number
3rd	A1, A2, A3, A4	Connector/Type
4th	. (point)	Used as a separator
5th	1 - 2	Channel number

OR

1st	I, O, IS	Input, Output or Short Circuit Input
2nd	GENA or GENB	Connector/Type
3rd	3 - 6	Slot Number
4th	. (point)	Used as a separator
5th	0 - 1	First digit of channel number (may omit if 0)
6th	0 - 9	Second digit of channel number (valid AUX channels are 1 - 16)

Master Rack, PiC CPU

Enter four to six characters.

1st	I or O	Input or Output
2nd	0 - 1	First digit of module slot number* (can omit if 0)
3rd	0 - 9	Second digit of the module slot number*
4th	. (point)	Used as a separator
5th	0 - 3	First digit of channel number** (can omit if 0)
6th	0 - 9	Second digit of channel number**

* Valid slot numbers are 3 - 13.
**Valid channel numbers are 1 - 64.

Example:

If the input is in the master rack at slot 4, channel 3, enter: **I4.3**

Master Rack, Standalone MMC CPU

(Four Options)

1st	I or O	Input or Output
2nd	AUX, FAUX	Connector/Type
3rd	1 - 6	Slot Number
4th	. (point)	Used as a separator
5th	0 - 4	First digit of channel number (may omit if 0)
6th	0 - 9	Second digit of channel number (valid AUX channels are 1 - 12) (valid FAUX channels are 1 - 4 and 49)

OR

1st	I or O	Input or Output
2nd	GEN	Connector/Type
3rd	. (point)	Used as a separator
4th	0 - 1	First digit of channel number (may omit if 0)
5th	0 - 9	Second digit channel number (valid channels are 1 - 16)

OR

1st	I or O	Input or Output
2nd	1 - 6	Slot Number
3rd	A1, A2, A3, A4	Connector/Type
4th	. (point)	Used as a separator
5th	1 - 2	Channel number

OR

1st	I or O	Input or Output
2nd	GENA or GENB	Connector/Type
3rd	3 - 6	Slot Number
4th	. (point)	Used as a separator
5th	0 - 1	First digit of channel number (may omit if 0)
6th	0 - 9	Second digit of channel number (valid channel numbers are 1 - 16)

Master Rack, ASIU I/O for MMC for PC CPU

(Two Options)

1st	I or O	Input or Output
2nd	GEN, AUX, FAUX	Connector/Type
3rd	1 - 8	ASIU Number
4th	. (point)	Used as a separator
5th	0 - 4	First digit of channel number
6th	0 - 6	Second digit channel number

OR

1st	I or O	Input or Output
2nd	1 - 8	ASIU Number
3rd	A1, A2, A3, A4	Connector/Type
4th	. (point)	Used as a separator
5th	1 - 2	First digit of channel number

Expansion Rack, I/O for PiC CPU

Note:

Expansion Rack I/O is only available if PiC CPU is chosen. Expansion Rack I/O is not available for a standalone MMC or MMC for PC CPU.

Enter six to eight characters.

1st	I or O	Input or Output
2nd	1 - 7	Expansion rack number
3rd	. (point)	Used as a separator
4th	0 - 1	First digit of module slot number* (can omit if 0)
5th	0 - 9	Second digit of module slot number*
6th	. (point)	Used as a separator
7th	0 - 3	First digit of channel number** (can omit if 0*)
8th	0 - 9	Second digit channel number**

*Valid slot numbers are 3 - 13.
**Valid channel numbers are 1 - 64.

Example

If the output is from expansion rack #7 at slot 12, channel 10, enter: **O7.12.10**

Block Expansion Rack, I/O

Note: Block Expansion Rack I/O is only available for certain CPUs.

Enter five to seven characters.

1st	B	Block
2nd	I or O	Input or Output
3rd	0 - 7	First digit of module number* (can omit if 0)
4th	0 - 9	Second digit of module number*
5th	. (point)	Used as a separator
6th	0 - 6	First digit of point number** (can omit if 0)
7th	0 - 9	Second digit point number**

*Valid block module numbers = 1 - 77.

**Valid point numbers = 1 - 64.

Example

If the input is in block I/O module 33, point 5, enter: **BI33.5**

Blown Fuse Status

The status of up to four fuses on an AC Output, DC Output, or a combination I/O module can be made available to your ladder program. You declare the fuses as inputs in the Software Declarations table.

On modules having both inputs and outputs, the points are numbered sequentially (starting at 1 for inputs and starting at 1 for outputs) in the Software Declarations table as shown in the two examples below.

THE 24V DC OUTPUT 16 POINT MODULE WITH FOUR FUSES

Name	Type	I/O Point
OUT1	BOOL	O4.1
OUT2	BOOL	O4.2
.	.	.
.	.	.
.	.	.
OUT16	BOOL	O4.16
FB1	BOOL	I4.1
FB2	BOOL	I4.2
FB3	BOOL	i4.3
FB4	BOOL	I4.4

THE 24V I/O 16/8 SOURCE MODULE WITH TWO FUSES

Name	Type	I/O Point
IN1	BOOL	I5.1
IN2	BOOL	I5.2
.	.	.
.	.	.
.	.	.
IN16	BOOL	I5.16
OUT1	BOOL	O5.1
OUT2	BOOL	O5.2
.	.	.
OUT8	BOOL	O5.8
FB1	BOOL	I5.17
FB2	BOOL	I5.18

Short Circuit Detection

The status of the short circuit detection feature of the general DC outputs for the MMC Digital, standalone MMC, the MMC for PC ASIU, the MMC 32 In 32 Out and the block I/O output modules can be made available to the ladder diagram. There is one circuit for each group of outputs. The module's hardware description defines how many output points are in a common electrical group. You declare the circuit as an input in Software Declarations table.

	16 point DC out	Mixed (8 in / 8 DC out)	MMC 32 In 32 Out
Block I/O	BI#.1 or .2	BI#.9	(not applicable)
Standalone MMC	ISGEN#.1 or .2	(not applicable)	ISGENA#.1 or .2 ISGENB#.1 or .2
MMC for PC	ISGEN#.1 or .2	(not applicable)	(not applicable)
MMC Digital	ISGEN#.1	(not applicable)	ISGENA#.1 or .2 ISGENB#.1 or .2

Examples:

- If the short circuit input is from a 24VDC input and output block I/O, module number 33, there is only one group of outputs, the detection input would be 9, enter **BI33.9**
- If the short circuit input is from the GEN outputs for a standalone MMC or MMC Digital, there are two groups of outputs (1-8 and 9-16), the detection inputs would be: **ISGEN#.1** and **ISGEN#.2**.
- If the short circuit input is from the GENA or GENB outputs for an MMC 32 In 32 Out module, there are two groups of outputs (1-8 and 9-16). The detection inputs would be: **ISGENA#.1**, **ISGENA#.2**, **ISGENB#.1** and **ISGENB#.2**.
- The detection input from an ASIU would also include the ASIU number.

Fast Inputs

Fast Input I/O Numbering - PiC CPU

The fast inputs available on the encoder, resolver, and servo encoder hardware modules can be declared as inputs in the Software Declarations table. The inputs are:

For Channel 1	For Channel 2	For Channel 4	For Channel 3
X.1	X.3	X.5	X.7

Standalone MMC CPU

The fast inputs available on the standalone MMC can be declared as inputs in the Software Declarations table. The inputs are (where # is the slot number):

IFAUX#.1	Channel 1	(Axis 1)
IFAUX#.2	Channel 2	(Axis 2)
IFAUX#.3	Channel 3	(Axis 3)
IFAUX#.4	Channel 4	(Axis 4)
IFAUX#.49	Channel 5	(Axis 49)

MMC for PC CPU

The fast inputs available on the MMC for PC can be declared as inputs in the Software Declarations table. The inputs are: (where # is the ASIU number)

IFAUX#.1	Channel 1	(Axis 1)
IFAUX#.2	Channel 2	(Axis 2)
IFAUX#.3	Channel 3	(Axis 3)
IFAUX#.4	Channel 4	(Axis 4)
IFAUX#.49	Channel 5	(Axis 49)

Initial Values

Initial Values

All variables have a default value of zero, unless they are initial values for an array. Initial values for an array will default to the value of the first element (index 0). By entering a value in the **Initial Value** column, you can change the default value. Default values go into effect:

- For all variables when a cold restart is performed
- For variables that are not retentive, when a warm restart is performed

Note: An initial value cannot be set if the variable has an I/O point assigned to it.

Prefixes for initial values

The following prefixes are required for values in the formats listed.

Prefix	Value Format
2#	Binary
8#	Octal
None	Decimal
16#	Hexadecimal
D#	Date
TOD#	TIME_OF_DAY
DT#	DATE_AND_TIME
T#	TIME

Working with Data Types in Software Declarations

Working with Data Types in Software Declarations

When a variable is declared in the Software Declarations table, you assign a data type to it in the **Type** column by entering in the type or selecting it from the dropdown list. The data type categories and associated data types are listed below:

Bitwise	Numeric	String	Time of day	Time duration
BOOL	SINT	STRING	DATE	TIME
BYTE	INT		TIME_OF_DAY	
WORD	DINT		DATE_AND_TIME	
DWORD	LINT			
LWORD	USINT			
	UINT			
	UDINT			
	ULINT			
	REAL			
	LREAL			

Function/Function block	Structures/arrays
(Any Data Type)	(Any Data Type)

Bitwise

Bitwise variables/constants are used to represent binary values. When manipulated, these data types are treated as a series of binary digits.

Description	Data Type	Bits	Range
A boolean value is a bit. Contacts and coils are always represented by boolean variables. 0 = off / no 1 = on / yes	**BOOL** Boolean	1	0 or 1
Byte, word, double word, and long word values are groups of bits that are used when logical and bit manipulation operations are performed.	**BYTE**	8	Eight 0s - 1s
	WORD	16	Sixteen 0s - 1s
	DWORD double word	32	Thirty-two 0s - 1s
	LWORD long word	64	Sixty-four 0s - 1s

Bitwise values can be entered in binary, octal, decimal, or hexadecimal. The format for entering these values is shown below for the number 23. (2#, 8#, and 16# are required.)

Binary	Octal	Decimal	Hexadecimal
2#10111	8#27	23	16#17

Note:

Bitwise constants are limited to 32 bit values. A constant can be entered for any bitwise data type. For data types 32 bits or less, the constant value must be within the range of the data type. For data types greater than 32 bits, the 32 bit constant value will be extended. Zeros will be placed in the 32 most significant bits. The constant value will be held in the least significant 32 bits.

When booleans are entered as constants, enter the following:

For:	Enter:
On	(hex) 16#80 or (decimal) 128
Off	0

For boolean initial values, enter a 0 or 1.

Numeric

Numeric variables/constants are used to represent integers and real or floating point numbers. When manipulated, these types of data are treated as numbers.

Description	Data Type	Bits	Range
Integers are whole numbers or zero.	**SINT** short integer	8	-128 to +127
	INT integer	16	-32,768 to +32.767
	DINT double integer	32	-2,147,483,648 to +2,147,483,647
	LINT long integer	64	-9,223,372,036,854,775,808 to +9,223,372,036,854,775,807
Unsigned integers are greater than or equal to zero. PiCPro will prevent you from entering a negative number for an unsigned integer.	**USINT** unsigned short integer	8	0 to 255
	UINT unsigned integer	16	0 to 65,535
	UDINT unsigned double integer	32	0 to 4,294,967,295
	ULINT unsigned long integer	64	0 to 9,223,372,036,854,775,807
Real numbers are floating point numbers. They contain a decimal point and an exponent indicating the power of ten the number is to be multiplied by to obtain the value represented.	**REAL**	32	significant digits 6-7
	LREAL long real	64	significant digits 15-16

String

String variables are used to represent a sequence of zero or more characters. The characters are ASCII and /or extended ASCII.

Description	Data Type	Length in **bytes** (internal)	Range
String type variables are used to read or write messages. Every string has two extra bytes that hold information about the string. The second byte tells the actual length of the string. **Note:** STRINGs cannot be entered as constants.	**STRING**	Two plus number of declared characters	1 to 255 ASCII characters

String values are keyed in exactly as they are to be interpreted. A three character combination of the dollar sign ($) followed by two hexadecimal digits is interpreted as the hex representation of an eight-bit ASCII character code. A two-character combination of the dollar sign followed by a character is the ASCII interpretation given below.

Character String	Interpretation
$$	dollar sign
$’	single quote
$L	line feed
$N	new line
$P	form feed (page)
$R	carriage return
$T	tab

Time of Day

Time of day values represent the time of day, the date, or both.

Description	Data Type	Bits	Range	Examples
Date and time values are used when the date or time is to be printed, or when an event is to be triggered at a given moment in time. Values can be assigned manually or extracted from the PiC clock (with functions).	**DATE**	16	Jan.1, 1988 to Dec. 31, 2051	Year-month-day `D#1997-10-23`
	TIME_OF_DAY	32	00:00:00 to 23:59:59	Hours:minutes:seconds `TOD#23:59:59`
	DATE_AND_TIME	32	Same as the two above, combined	Year-month-day-hours:minutes:seconds `DT#2007-10-23-23:59:59`

Time Duration

A time (duration) value represents an amount of time. Time duration values serve as inputs to timer functions for counting up/down for a specified amount of time. They also serve as outputs into which elapsed time values are entered.

Data Type	Bits	Range	Examples

TIME	32	`0 - 49d17h2m47s295ms`
		`0 - 1193h2m47s295ms`
		`0 - 71582m47s295ms`
		`0 - 4294967s295ms`
		`0 - 4294967295ms`
			Days/hours/minutes/
			seconds/milliseconds
			
			`T#1d2h3m4s5ms`

Values are entered as shown in the examples below where d = day, h = hour, m = minute, s = second, ms = millisecond. T# is required and d, h, m, s, and ms are required if the value for that increment is not zero.

```
T#1d3h7m16s45ms      T#14d     T#459871ms
```

Groups of data - Structures and Arrays

Groups of data - Structures and Arrays

Variables can be grouped to create entities called arrays and structures. This ability to group data enables you to keep various types of data together that have a common link. Values can be read into or written from these groups with I/O functions. Also, individual variables in structures and arrays can serve as inputs to and outputs from Functions/Function Blocks.

Groups of variables can be handled by arrays, structures, structures with arrays, an array of structures, and an array of structures with arrays.

Arrays

An array is a group of variables. Each variable in an array must be of the same data type. Any data type is acceptable. An array can have from 2 to 999 variables. These variables are called elements. Arrays are useful for handling large groups of like data items.

- Only single dimensioned arrays are supported in PiCPro
- Array variables are identified with square brackets.
- Array subscripts follow the same rules in ST and LD. An array subscript can be any variable or constant that evaluates to USINT or UINT. Array subscripts can be nested if the variable name used in the subscript is another array.

As an example, assume that you have a list of 200 rod part numbers. An array could be used to store the list. Each part number is an element in the array. See the table below:

An array of part numbers:

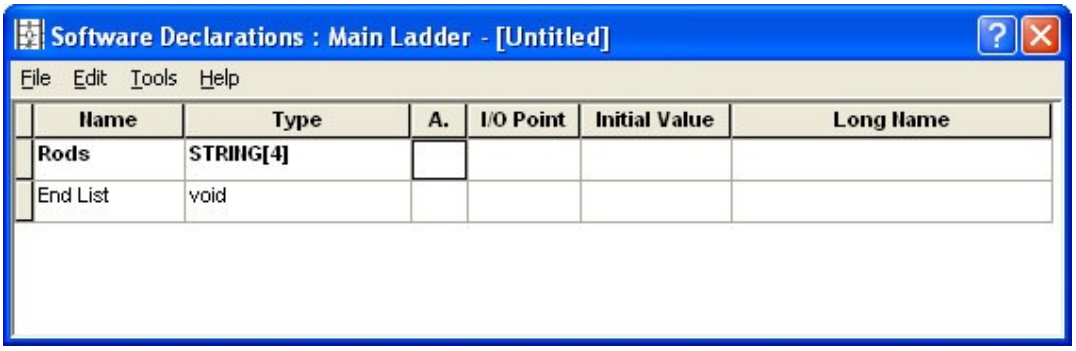
Part Number	Data Type
R101	STRING
R102	STRING
.	.
.	.
R199	STRING
R200	STRING

Declare an Array

To declare an array, follow these steps:

1. Choose one of the following methods to display the **Software Declarations** dialog:
   - Select the button from the view navigator toolbar.
   - Select **View | Software Declarations…** from the menu
   - Right-click and select **Software Declarations…**

2. Enter the name and data type for the array you want to create. In the example, RODS is the name and a STRING with 4 characters is the data type.

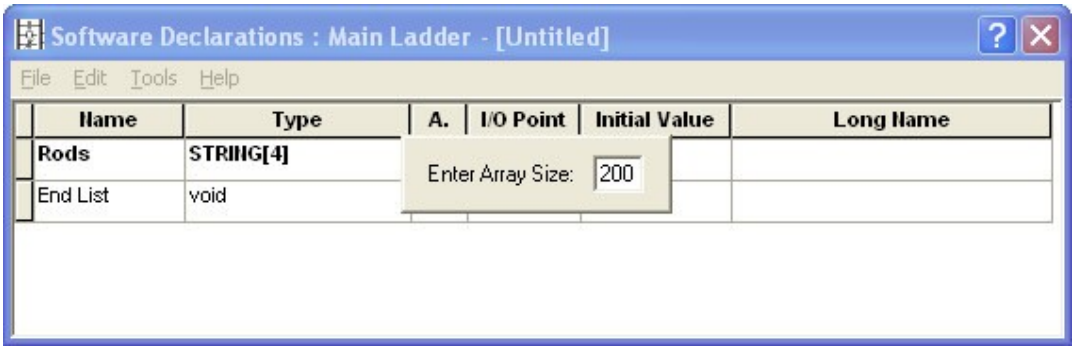


Note:

If all the elements in the array are to have the same value, enter the value in Initial Value column now, before you create the array. That value will then appear with each element in the array when it is declared. This will not be done for the example, since each rod part number is different and will have to be entered individually.

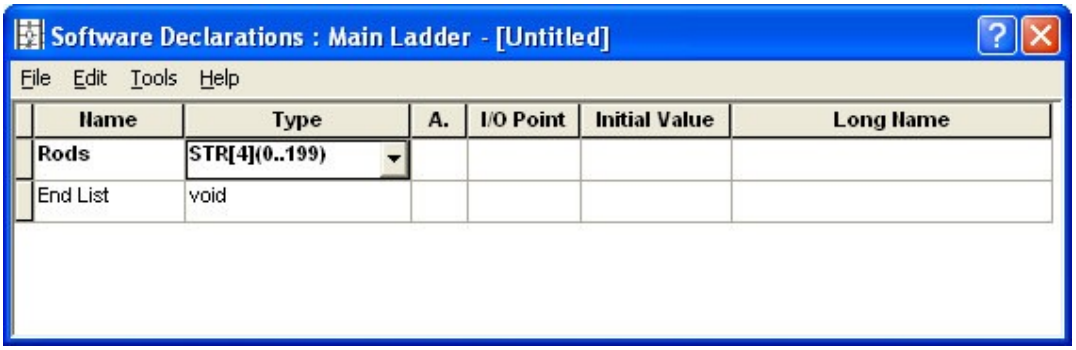
3. Choose one of the following methods to size your array:
   - Select **Tools | Make Array** from the menu
   - Press <**Alt + A**>
   - Right-click and select **Make Array**

4. The **Array Length** dialog appears:

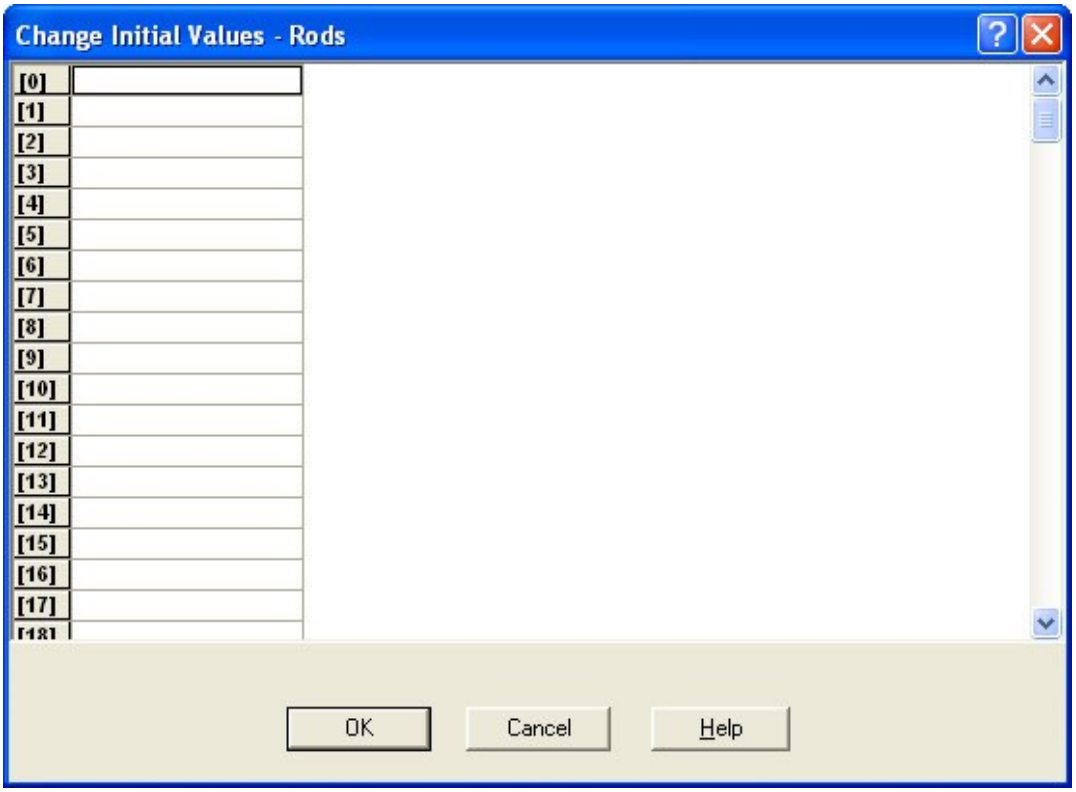


Enter the array length (a number between 2 and 999) in the dialog. Press the **Enter** key to accept the value. For this example, 200 was entered.

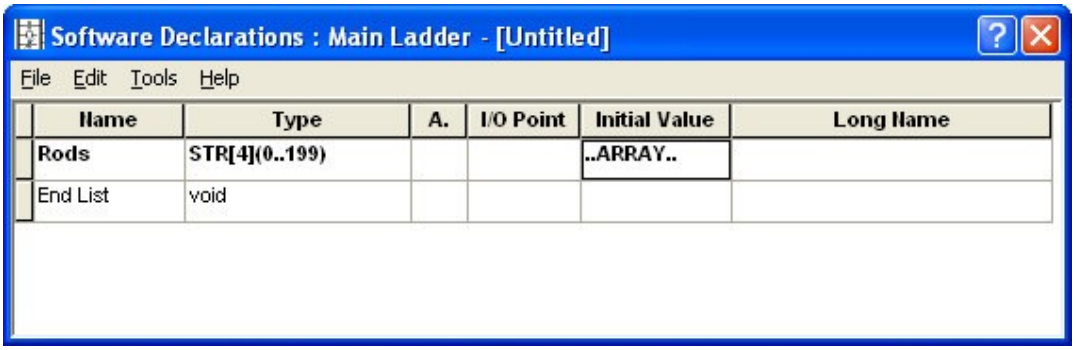
5. The index numbers (0…x-1) will appear behind the data type of the variable where x is the length specified. In the example, x = 200 and the index numbers will be 0 through 199 as shown below:



6. To initialize or change the initial values of the elements in the array, move the cursor to the **Initial Value** field and press the **Enter** key. If no initial value was entered before the array was declared, then there will be no value for any elements. If an initial value was entered before the array was declared, that initial value will be duplicated for all elements in the array.



7. To enter values, either click on a field or use the up and down **arrow** keys to move to the desired location and type in the value you want. In the example, you would type in R101 at **[0]**, R102 at **[1]**, R103 at **[2]** through R200 at **[199]**.
8. When the values have been loaded, select **OK** to accept the values, select **Cancel** or click on button to exit the dialog without saving the values or select **Help** to display information related to initial values.
9. The word **..ARRAY..** will display in the **Initial Value** column for any element that has been entered or changed.



Resize an Array

To resize an array, follow these steps:

1. Choose one of the following methods to display the **Software Declarations** dialog:
   - Select the button from the view navigator toolbar.
   - Select **View | Software Declarations…** from the menu
   - Right-click and select **Software Declarations…**
2. Click anywhere on line of the variable declaration.
3. Choose one of the following methods to resize your array:
   - Select **Tools | Make Array** from the menu
   - Press <**Alt + A**>
   - Right-click and select **Make Array**
4. Enter a new array length. Press the **Enter** key to accept the new value.
5. The index numbers displayed behind the variable in the **Type** column will be updated.
6. To initialize or change the initial values of the added elements in the array, move the cursor to the **Initial Value** field and press the **Enter** key.

Note:

If the array length is increased, the added elements will have the same value as the first element (index 0). In the example, each added element beyond [199] would have the value of R101.

Remove an Array

To remove an array, follow these steps:

1. Choose one of the following methods to display the **Software Declarations** dialog:
   - Select the button from the view navigator toolbar.
   - Select **View | Software Declarations…** from the menu
   - Right-click and select **Software Declarations…**
2. Click anywhere on line of the variable declaration.
3. Choose one of the following methods to remove your array:
   - Select **Tools | Make Array** from the menu
   - Press <**Alt + A**>

- Right-click and select **Make Array**

4. Enter an array length of 1. Press the Enter key to accept the new value. The index numbers previously displayed behind the data type of the variable will be removed. The initial value, if any, will be displayed in the Initial Value column instead of the word ..ARRAY...

Referencing and Accessing Elements of Arrays in the Module

Array elements are referenced according to the position of the element within the array. The positions are numbered 0 through x-1, where x is the number of elements. The position numbers are called **index** numbers and they act as pointers to the elements. To access an element, you enter the name of the array and the index number of the element.

One of the powerful features of arrays is that the index number can be a variable (USINT or UINT). By using a variable and changing its value, you are able to access every element in the array with a minimal number of commands.

I M P O R T A N T

Be careful to enter the correct index number for the element you want. PiCPro does not prevent you from entering an invalid number. If an index number is greater than "x-1", a memory location after the array will be accessed. The results are unpredictable.

The index number is entered in brackets after the array name. For the example array, the name RODS followed by constants or a variable called RODNUM can be used to index the array as shown below:

Name with constant or variable	Contents of each element	Data Type
RODS[0] or RODS[RODNUM]	R101	string
RODS[1] or RODS[RODNUM]	R102	string
.	.	.
RODS[198] or RODS[RODNUM]	R199	string
RODS[199] or RODS[RODNUM]	R200	string

Structures

A structure is a group of variables where the variables can be of any data type except another structure. Each variable that comprises a structure is called a member. A structure can have an unlimited number of members.

Note:

When booleans are used as data types in structures, each boolean occupies a byte of memory and more scan time is required. It is the most significant bit of the byte that indicates the state of the boolean.

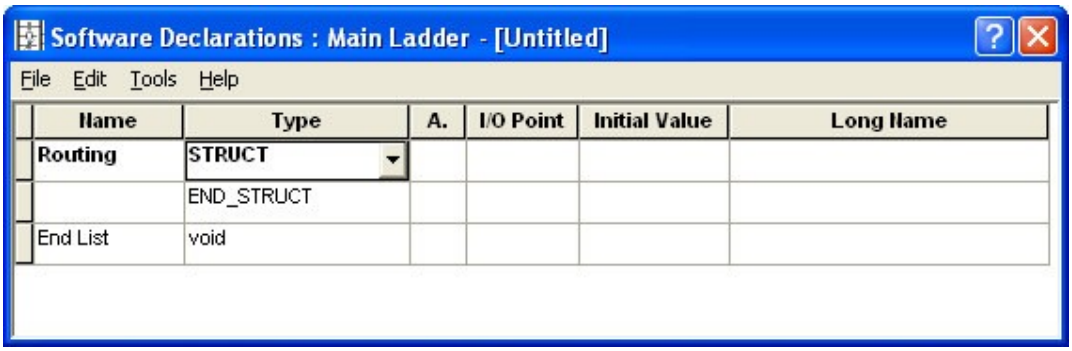
When you declare a structure you are creating a template or framework for a group of data items. As an example, assume that you have some information about a rod part that you want grouped together. The data consists of a part number (PART), a description of the part (DESC), its diameter (DIAM), the first operation on the part (OPER) and the time it takes to perform the operation (TIM1). You could create a structure with five members, depicted below:

Member name	Data Type	Member Data
PART	String	R101
DESC	String	Class A rod
DIAM	USINT	126
OPER	String	deburr
TIM1	Time	15m

Declare a Structure

To declare a structure, follow these steps:

1. Choose one of the following methods to display the **Software Declarations** dialog:
   - Select the button from the view navigator toolbar.
   - Select **View | Software Declarations…** from the menu
   - Right-click and select **Software Declarations…**
2. Enter its name. For the example, the name will be ROUTING.
3. Move to the **Type** column.
4. Use the dropdown list and select **STRUCT**.
5. The screen will display the following:

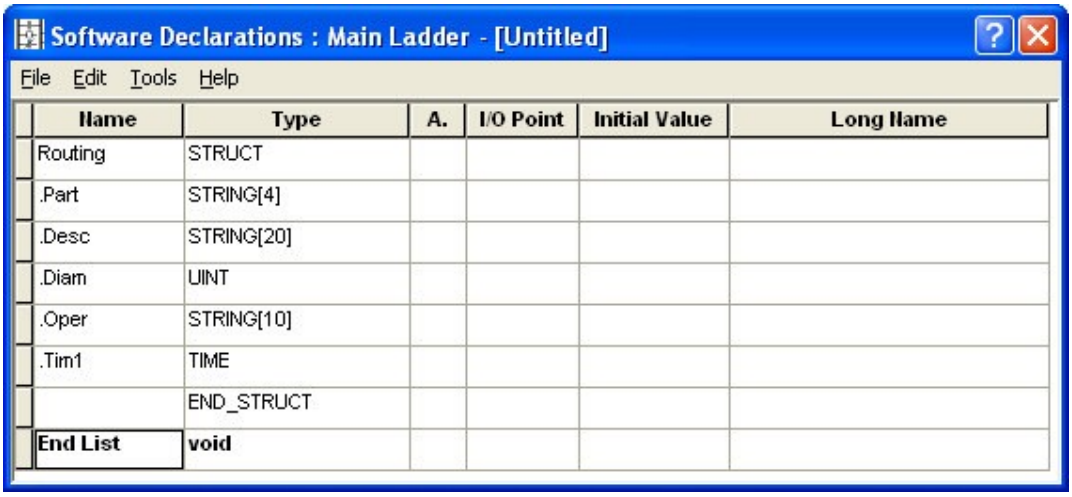


The END_STRUCT type is entered automatically by PiCPro.

6. Enter the members for the structure.

For the example, there will be five members entered.

1. Click in the **Name** field on the END_STRUCT line.
2. Choose one of the following methods to activate Insert mode:
   - Select **Edit | Insert** from the menu
   - Press the **Insert** key
   - Right-click and select **Insert**.
3. Enter the member name, type, etc. as you would for any variable.



Name	Type	A.	I/O Point	Initial Value	Long Name
Routing	STRUCT				
.Part	STRING[4]				
.Desc	STRING[20]				
.Diam	UINT				
.Oper	STRING[10]				
.Tim1	TIME				
	END_STRUCT				
End List	**void**				

Note:

A period will be automatically inserted before the member name by PiCPro. All member names (and only member names) start with a period. Members can be any data type except another structure.

Referencing and Accessing a Member of a Structure

To reference a member or access the data, enter the structure and member names, separated by a dot or period.

For the ROUTING structure with the members PART, DESC, DIAM, OPER and TIM1, the names on the left are used in the module:

Name used to reference member	Contents of the member	Data type assigned
ROUTING.PART	R101	string
ROUTING.DESC	class A rod	string
ROUTING.DIAM	126	usint
ROUTING.OPER	deburr	string
ROUTING.TIM1	15	time

Structures with Arrays

A structure with arrays is a structure where one or more members are arrays of data. Given the definitions and requirements of arrays and structures, it follows that for a structure with arrays:

- Each element in an array must be the same data type.
- Each array can be a different data type.
- The arrays can have different numbers of elements.

As an example, assume that for the structure shown earlier the information for that part is expanded to include data about four diameters, operations and times. This is depicted in the following table of a structure that has three members which are arrays: DIAM, OPER and TIME.

PART	DESC	DIAM	OPER	TIME
R101	class A rod	126	deburr	15m
		122	polish	30m
		124	plate	90m
		123	polish	30m

Declare Structures with Arrays

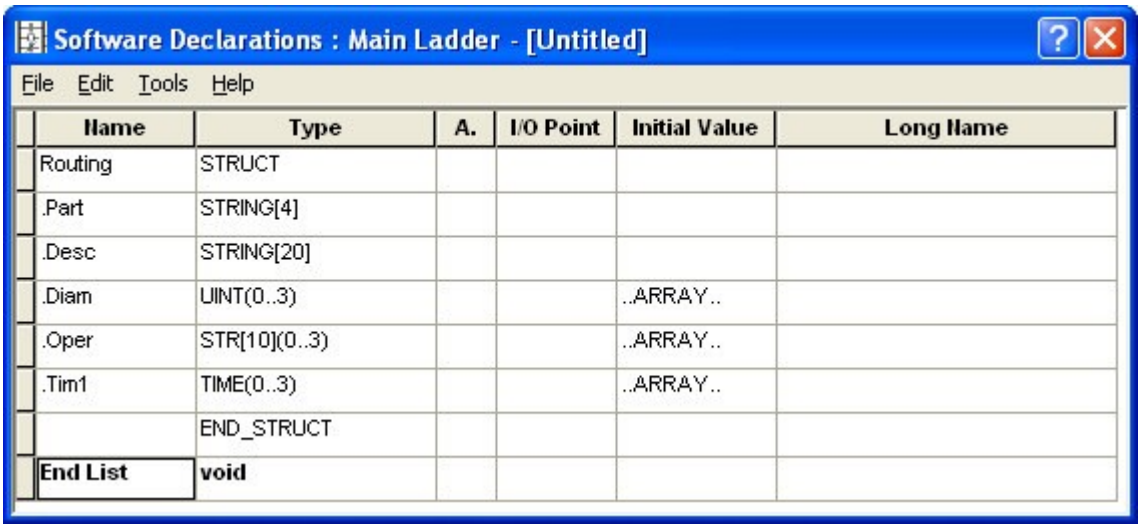
A member of a structure is made into an array the same way that any variable is made into an array. With the cursor in any field on the member line, choose one of the following methods to display the array length dialog:

- Select **Tools | Make Array** from the menu
- Press <**Alt + A**>
- Right-click and select **Make Array**

Enter the array length. Press the **Enter** key to accept the value. Also, initial values are assigned the same way that they are for arrays. Click in the **Initial Value** field of the member and press the **Enter** key.

DIAM, OPER and TIM1 in the example are new arrays with four elements each.

Note: The initial value of one or more of their elements has been changed.



Referencing and Accessing Data in a Structure with Arrays

Since an array in a structure is a member, the entire array is accessed as any member of a structure is accessed. Enter the structure name and member name, separated by a dot or period.

The lowest level of data in a structure with arrays is an element in an array. To access or reference an element you use a combination of the methods used to access elements of arrays and members of structures. Input the name of the structure, the name of the member and an index number for the array element.

For the structure with arrays discussed in this topic, where the structure is named ROUTING, array element data is accessed as follows:

DIAM elements	Contents
ROUTING.DIAM[0]	126
ROUTING.DIAM[1]	122
ROUTING.DIAM[2]	124
ROUTING.DIAM[3]	123

OPER elements	Contents
ROUTING.OPER[0]	deburr
ROUTING.OPER[1]	polish
ROUTING.OPER[2]	plate
ROUTING.OPER[3]	polish

TIME elements	Contents
ROUTING.TIM1[0]	15
ROUTING.TIM1[0]	30
ROUTING.TIM1[0]	90
ROUTING.TIM1[0]	30

Note:

A variable instead of a constant can be used for the index number.

Array of Structures

An array of structures is an array whose elements are structures. By definition of an array (that each element has the same data type) each structure in the array has the same format, i.e., if the first member of a structure is a string, then the first member of all the structures in the array is a string, etc.

As an example, assume that for the array and structure described previously, you want to have the structured data for all 200 parts. This is depicted in the following table. Data for only 2 of the 200 parts is shown.

R101	class A rod	126	deburr	15m
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
.	.	.	.	.
R200	class B rod	113	deburr	20m

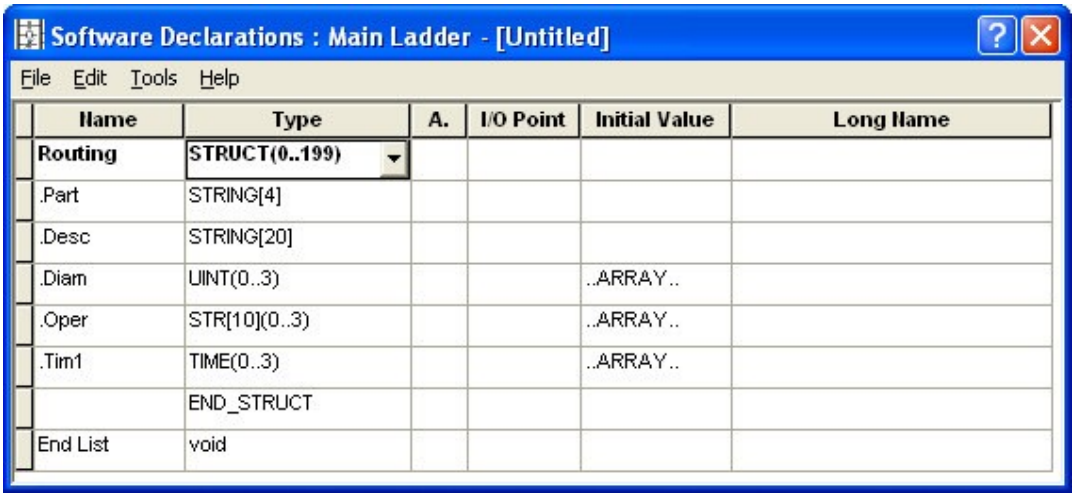
Declare an Array of Structures

To declare an array of structures, follow these steps:

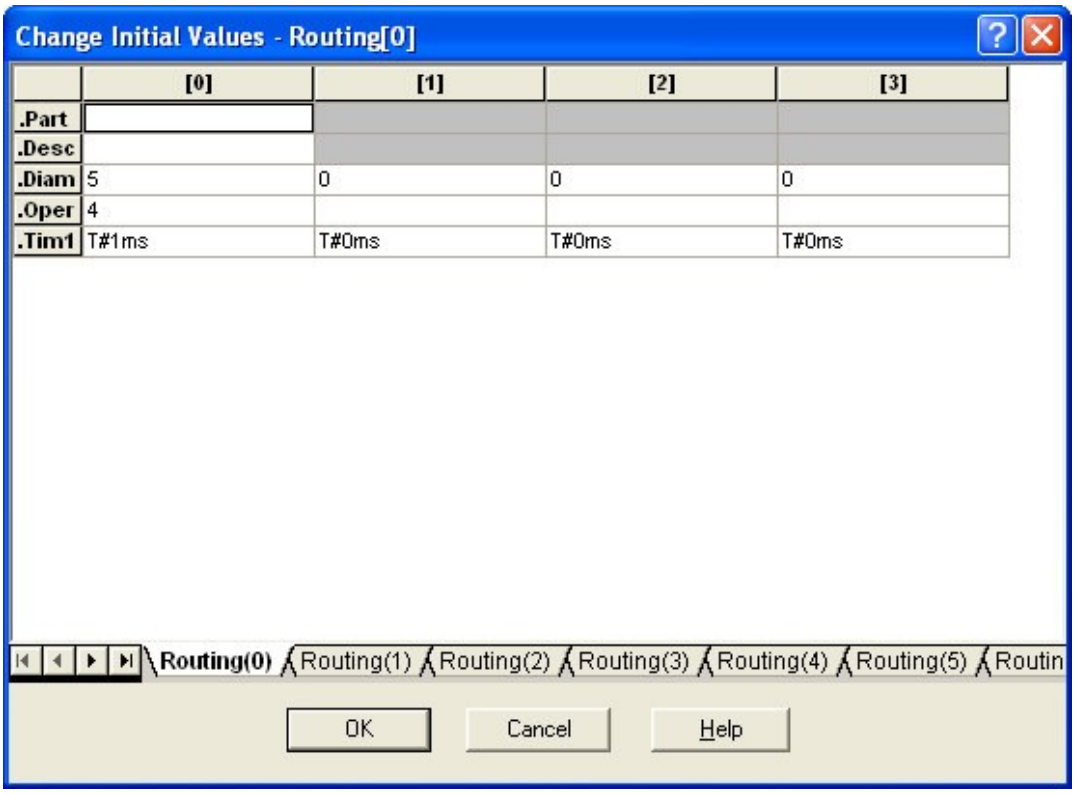
1. Declare a Structure as previously described. Add member information (Names, Types, etc.)

2. Click any field in the line with the structure Name (ROUTING for the example).
3. Choose one of the following methods to size your array:
   - Select Tools | Make Array from the menu
   - Press <**Alt + A**>
   - Right-click and select Make Array

The length of the array appears by STRUCT.



4. To initialize members, click the Initial Value field of the desired member and press the Enter key. The Change Initial Values dialog appears:



A single element appears with its members. You can use the directional buttons or the element tabs near the bottom of the dialog to move to the next element.

5. Click in the value field of the member. Type the value.
6. Use one of the following methods to move to the next member value field:
   - Click in the value field of the next member.
   - Use the up/down **arrow** keys.
   - Press the **Enter** key.
7. When the values have been loaded, select **OK** to accept the values, select **Cancel** or click on button to exit the dialog without saving the values or select **Help** to display information related to initial values.

Referencing and Accessing Data in an Array of Structures

Since a structure in an array is simply an element in the array, the entire structure is accessed as any element in an array is accessed. Enter the name of the array and the element's index number.

The lowest level of data in an array of structures is a member in one of the structures. To access a member, use a combination of the methods used to access members of structures and elements of arrays. Input the name of the structure, (all structures in an array have the same name), its index number, a dot or period and the name of the member.

For the array of structures previously discussed, where the structures are named ROUTING, data can be accessed as follows:

First structure	Second structure	Last structure
ROUTING[0].PART	ROUTING[1].PART	ROUTING[199].PART
ROUTING[0].DESC	ROUTING[1].DESC	ROUTING[199].DESC
ROUTING[0].DIAM	ROUTING[1].DIAM	ROUTING[199].DIAM
ROUTING[0].OPER	ROUTING[1].OPER	ROUTING[199].OPER
ROUTING[0].TIM1	ROUTING[1].TIM1	ROUTING[199].TIM1

Array of Structures with Arrays

An array of structures with arrays is an array of structures each of which has one or more members, which are arrays of data. This is the most complex representation of data that can be created for the control. It combines the four types of groups of data – structures, arrays, arrays of structures and structures with arrays.

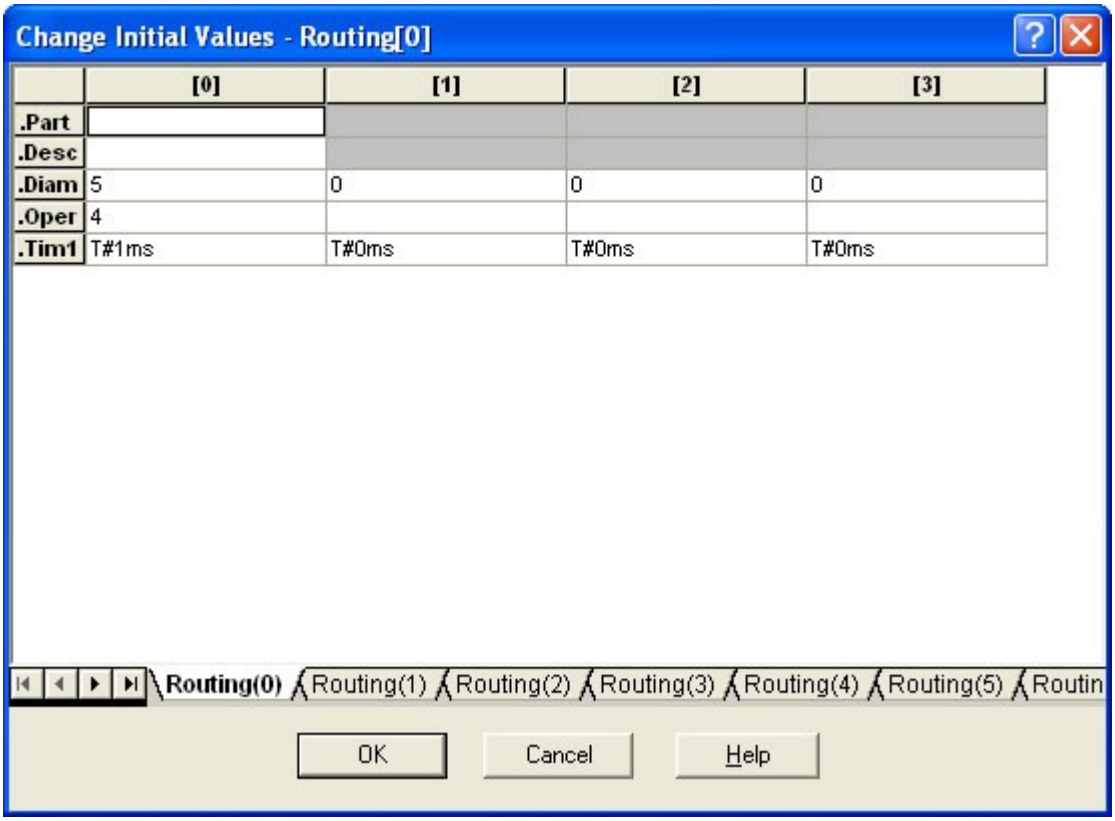
Building upon the previous examples, assume that structured data is to be created for the 200 parts, and that each structure should contain the arrayed data for four operations. The following table depicts the array of structures with arrays. Only 2 of the 200 elements are shown.

R101	class A rod	126	deburr	15m
.		122	polish	30m
.		124	plate	90m
.		123	polish	30m
.				
R200	class A rod	113	deburr	20m
		110	polish	45m
		112	plate	120m
		111	polish	30m

Declare an Array of Structures with Arrays

Declaring an array of structures with arrays is explained in ***declare a structure***, ***declare an array*** and ***declare structures with arrays***. The initialization of arrays of structures with arrays is the same as described for ***arrays of structures*** with an additional step for a member, which is an array. That array is initialized like other arrays are initialized.

In the following example, the DIAM member has been declared an array. To initialize the elements in the array, click the **Initial Value** field on the DIAM line and press the **Enter** key. The **Change Initial Values** dialog appears:



Referencing and Accessing the Data in an Array of Structures with Arrays

An array of structures with arrays is accessed in the same way that a member in an array of structures is accessed.

The lowest level of data in an array of structures with arrays is an element in an array. To access an element, you use a combination of the methods used to access members and arrays. Input the name of the structure, its index number, a dot or period, the name of the member and the index number of the element.

For the array of structures with arrays discussed here, where the name of each structure is ROUTING, the diameter data is accessed as follows for part #s R101 and R200.

Part # R101, enter this:	Contents	Part # R200, enter this:	Contents
ROUTING[0].DIAM[0]	126	ROUTING[199].OPER[0]	deburr
ROUTING[0].DIAM[1]	122	ROUTING[199].OPER[1]	polish
ROUTING[0].DIAM[2]	124	ROUTING[199].OPER[2]	plate
ROUTING[0].DIAM[3]	123	ROUTING[199].OPER[3]	polish

Attributes

Attributes

You can assign a retentive, global, global and retentive, external, variable in or variable out attribute to a selected variable in the Software Declarations table. The global, global and retentive, and external attributes are used when the DOS LDO Merge feature is used to merge multiple LDOs. The external attribute is used for TASKS. Variable in and variable out attributes are used with UDFBs.

You access attributes for a selected variable with one of the following methods:

- Tab to the **A** (Attributes) column and click.
- Select **Tools | Modify Attributes** from the menu.
- Right-click and select **Modify Attributes**.

Clear will remove an attribute from a selected variable as will **Delete**. Also, if the selected field is in the **A** (Attributes) column, you can enter **E** for **External**, **I** for **Variable In**, **O** for **Variable Out**, **G** for **Global**, **R** for **Retentive** or **B** or **Both Global and Retentive**.

Retentive Attribute

The retentive attribute makes the selected variable retain its value upon a warm restart or power cycle, but not on a cold restart. Physical I/O points and individual structure members cannot be made retentive. All other elements, including entire structures, can be made retentive. **Note:** Retentive memory is limited to 24k.

Global Attribute

The global attribute is used when an operator interface device or DOS LDO merge is being used.

When an operator interface device is used, the global attribute identifies the variable as one to be used by the operator interface device.

When DOS LDO merge is used, it identifies the selected variable as the master or global variable. Any variable with the same name in other LDOs will inherit this variable's definition (data type, I/O point, initial value) when the LDOs are merged.

Both Global and Retentive Attribute

The both global and retentive attribute is used when DOS LDO merge is being used. It identifies the selected variable as the master or global variable and as retentive.

External Attribute

The external attribute is used when DOS LDO merge is being used or when the TASK feature is used. It signals PiCPro that this variable is used in more than one LDO, and that the variable's global definition is in another LDO. If the properties of this variable (data type, I/O point, initial value) differ from the properties of its global counterpart, the variable will acquire the properties of the global variable when LDOs are merged.

The external attribute is also applied to a TASK variable that is to be shared with other tasks. Only mark the variable as External in the TASK.LDO, never in the main LDO in which the TASK is called.

In and Out Variable Attributes for UDFBs

Variable In designates the variable as an input to a UDFB. When the LDO you are creating will be converted to a UDFB, every variable you want to use as an input to the UDFB must have this attribute.

Note:

The first variable with the "I" attribute in the Software Declarations table will become the EN input of the UDFB. Its data type must be BOOL. Additional UDFB inputs should be entered in the order you want them to appear on the left side of the function block.

Variable Out designates the variable as an output to a UDFB. When the LDO module you are creating will be converted to a UDFB, every variable you want to use as an output from the UDFB must have this attribute.

Note:

The first variable with the "O" attribute in the declarations table will become the OK output for the UDFB. Its data type must be BOOL. Additional UDFB outputs should be entered in the order you want them to appear on the right side of the function block.

Editing Software Declarations

Inserting and Deleting Software Declarations

You can insert and/or delete entries to the Software Declarations table when it is active.

To insert software declarations, follow these steps:

1. Click in the table and press the Insert key or select Tools | Insert Symbol from the menu. A new row will appear above the row the focus was in. If focus is on the end list, you can either press the Insert key or simply begin typing. A new row will be inserted.
2. Enter the name of the new entry in the Name column and press the Enter key. This accepts the name and moves the focus to the Type column.
3. Typically, the Type column will automatically have the same data type as the previous entry or, if there is no entry, the type defaults to BOOL. If the previous entry is a BOOL type with an I/O point assigned, the new entry will have an incremented I/O point assigned to it. If the new entry has a different data type you must enter the new data type.
4. Enter information in the remaining columns if required.
5. To accept changes to the Software Declarations table, select File | Save and Close from the menu or press the F10 key. To exit without saving any changes, choose File | Close from the menu or press the Esc key.

To delete software declarations, follow these steps:

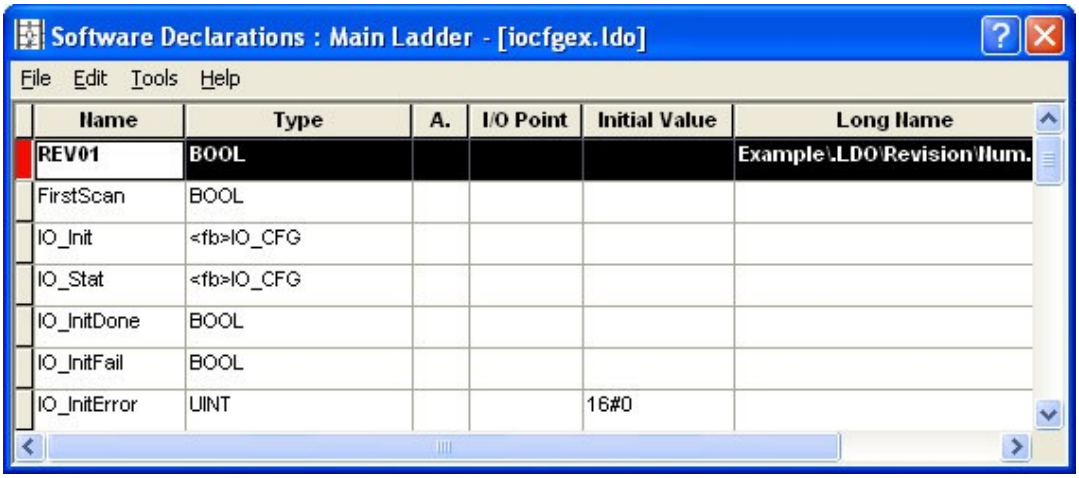
1. Click in the **Name** column of the table (or highlight the entire row) of the entry you want to delete.
2. Select **Edit | Delete** from the menu or press the **Delete** key. A confirmation dialog will appear. You can choose **Yes**, **No**, or **Cancel**. If you choose **Yes**, the entry will be deleted if it is not used in the ladder file.

Cutting, Copying, and Pasting Software Declarations

You can cut or copy and paste items within the Software Declarations table or from the Software Declarations table of one ladder file into the Software Declarations table of another ladder file.

To cut software declarations

1. Make the Software Declarations table active.
2. Highlight the entry you want to cut. You can highlight a row in the table by placing the arrow in the small rectangle region (marked in red below) until the pointer arrow becomes a horizontal black arrow pointing to the row. Then click to select the row. See ***How to Select Multiple Entries*** below for more than one entry.



3. To put the selected information on the clipboard, use one of the following methods:
   - Select **Edit | Cut** from the menu
   - Press <**Ctrl + X**>

If the entry is not referenced in the ladder file, the entry is removed from the table. If the entry is referenced in the ladder file, the entry is grayed and is not removed from the table

If the entry is a structure and the structure or any of its members are referenced in the ladder file, the entire structure will be grayed. The entry will remain grouped until it is pasted into a new location in the same declarations table, or until Software Declarations table is closed.

To copy software declarations

1. Make the Software Declarations table active.
2. Highlight the entry you want to copy. (See above for instructions on how to select an entry.)
3. To put the selected information on the clipboard, use one of the following methods:
   - Select **Edit | Copy** from the menu
   - Press <**Ctrl + C**>

How to Select Multiple Entries

Multiple entries can be selected at the same time if they are part of the same Software Declarations table.

- To select entries next to each other, select an entry, hold down the **Shift** key while pressing the up/down arrow or hold down the **Shift** key and select another value. The entire block of entries will be displayed as selected.
- To select entries not next to each other, select an entry then hold down the **Ctrl** key while left-clicking the other desired entries.

To paste software declarations in another table, follow these steps:

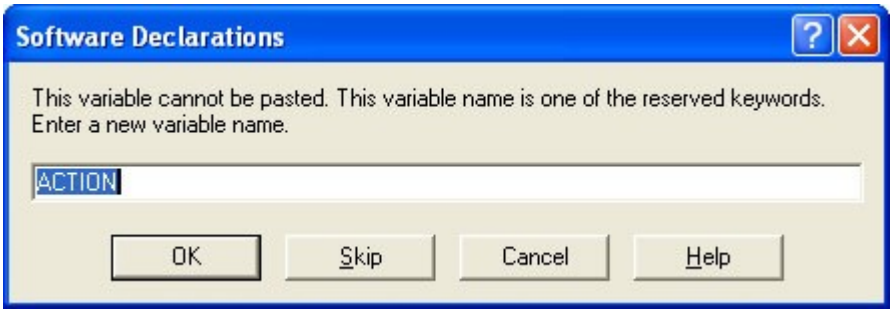
1. Make the Software Declarations table that you want to paste in active.
2. Click anywhere in the table. When you issue the paste command, the paste will be inserted in the row above where you click. If you want to replace a row, highlight the row and then paste.
3. To put the clipboard into the table, use one of the following methods:
   - Select Edit | Paste from the menu
   - Press <**Ctrl + V**>

Note:

If a ladder has a different CPU declared than the one into which you are pasting the software declaration, the I/O points will be changed.

Reserved Keywords when pasting

If you attempt to paste a variable name that is a reserved keyword, the following error message will appear:

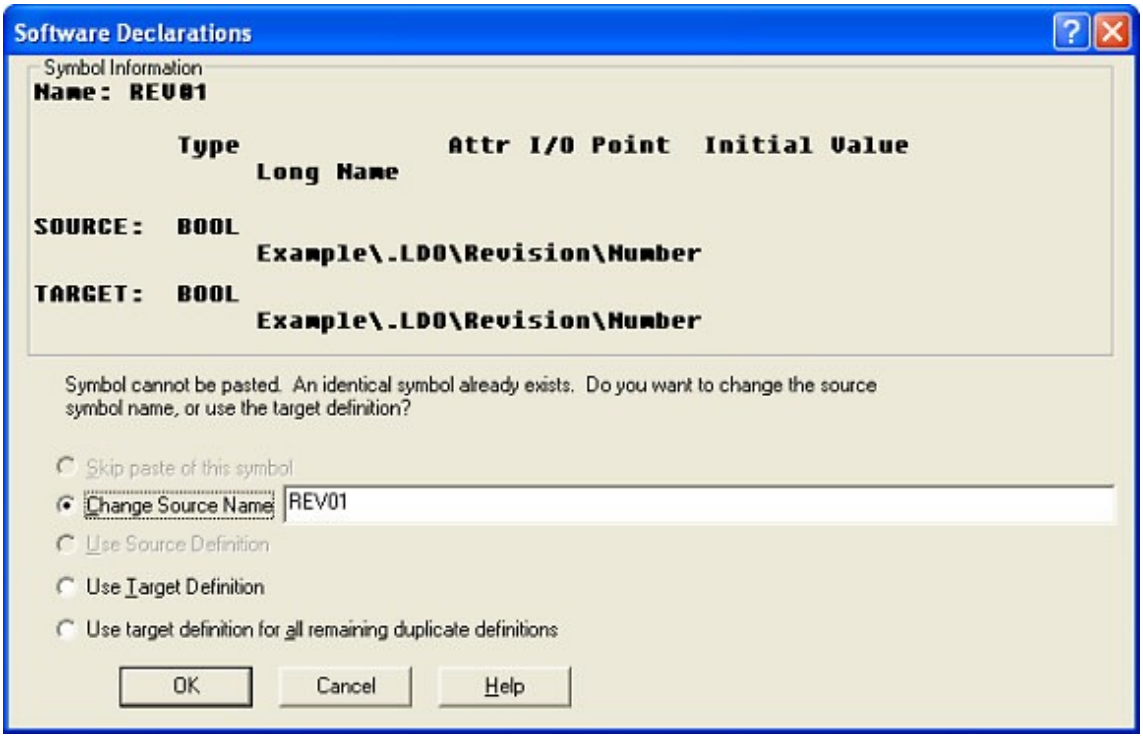


This message displays the variable that cannot be pasted. You must enter a variable name that is not a reserved keyword.

Control Button	Description
OK	Click this button and the dialog closes. The variable name entered is validated.
Skip	Click this button and the dialog closes. The variable is removed from the paste list and is not pasted. All other variables will be pasted.
Cancel	Click this button and the dialog closes. Nothing will be pasted.
Help	Click this button and Help information is displayed.

Duplicate Symbols when Pasting

If you attempt to paste software declarations or networks into another ladder and the symbols have the same name, type, and array status, the following dialog appears with the first symbol in the paste listed in the Symbol Information area. You can choose to skip the paste of this symbol, use the source (where you are copying from) definition, the target definition (where you are pasting to), or change the source name.



If the symbols have the same name, type, and array status and you choose to use the target definition, the resulting array size could be smaller. Initial values could change. No attempt is made to make sure one of the array elements being removed is not referenced in the ladder.

Symbol Information:

This area displays information about a duplicate symbol that was encountered while pasting. It shows the name, type, Attributes, I/O point, initial value, and long name of the duplicate symbol from the source and from the target. The source is the ladder you are cutting or copying from. The target is the ladder you are pasting into.

Change Source Name:

Select this option to alter the name of the duplicate symbol in the source ladder. Enter the new name in the field provided. Select Change Source Name and enter the new name here.

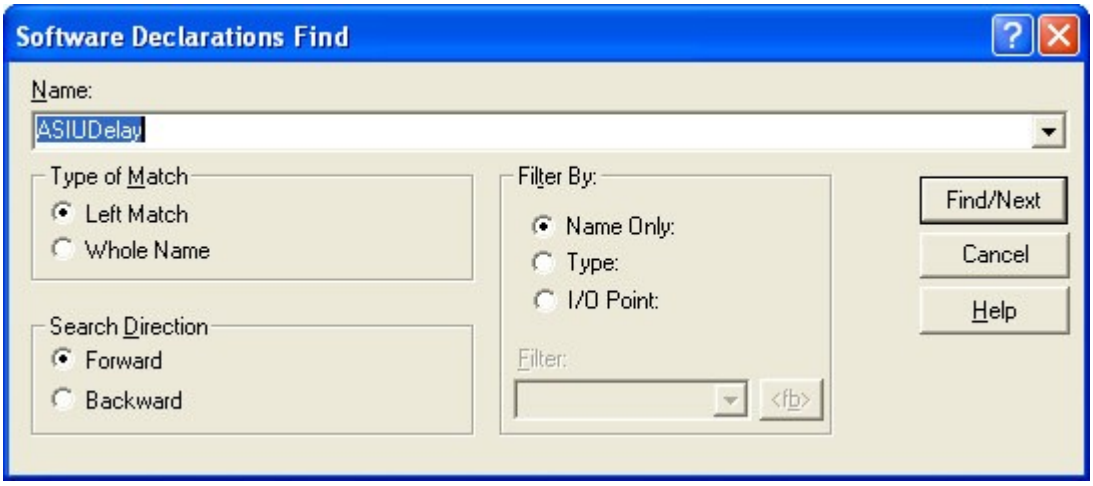
Searching in the Software Declarations Table

You can search for entries in the Software Declarations table using the Find command. The search will begin at the row that has focus and proceed in the specified direction.

Choose one of the following methods to initiate a search:

- Select **Edit | Find** from the menu
- Press <**Alt + F3**>

The dialog below appears and you enter the criteria you want to base your search on.



Find by Name Only

The default is to search by name only.

1. In the **Filter By:** area, select the **Name Only:** button if it is not already selected.
2. Enter the name or portion of a name with Left Match selected (Left Match is not case sensitive) in the Name: field. The list accessed through the down arrow will hold all the declared variable names. You may choose from this list if applicable.

Find by Type

To search by data type:

1. In the **Filter By:** area, select the **Type:** button. This will enable the **Filter:** field.
2. Choose a data type from the drop down list in the Filter field. If you are searching for a function block, click on the fb button and select a function block from the displayed menu.

Find by I/O Point

To search by I/O point:

1. In the **Filter By:** area, select the **I/O Point:** button. This will enable the **Filter:** field.
2. Enter an I/O point in the Filter field. The list accessed through the drop down arrow will hold the most recently searched for points. You may choose from this list if applicable.

Once you have entered the criteria by which you want to search, click on the **Find/Next** button to begin. The focus will move to the row with the first occurrence of the declaration.

Using the Find Next Command

You can find the next occurrence of the declaration by clicking the **Find/Next** button again or by pressing the **F3** key, if you have closed the **Find** dialog.

Purging Unused Variables from the Software Declarations Table

You can remove any variables from your Software Declarations table that are not being used in the ladder with the **Purge Unused** command.

To purge unused variables, choose any of the following:

- Select **Tools | Purge Unused** from the menu

- Press <**Alt + P**>
- Right-click and select **Purge Unused**

Working with Networks and Network Elements

Working with Networks and Network Elements

Your ladder file consists of executable networks entered by you. They hold the ladder logic commands and/or structured text that run your application. They are numbered sequentially by PiCPro as you enter them. The networks are executed in this numerical order unless a jump command forces execution to be out of sequence.

PiCPro supports two types of networks: LD (Ladder Diagram) and ST (Structured Text). A network can be either LD or ST but not both.

Execution of the ladder logic and commands occurs left to right and then top to bottom within the network. When entering network elements, you must enter them in the order you want them to carry out their function starting from the left and proceeding to the right. The split screen feature can be used to view large networks.

A label can be added to a network element to facilitate jumps. Comments can be added to networks to allow for easier identification, or convey other information about the network both on screen and when the ladder is printed.

Network Labels in Networks

You can label a network with the Label command found in the Ladder Menu, submenu Network. You must assign a label to any network you want to jump to. If a Jump command is in a network and there is no network with the designated label, an error message will appear when you attempt to download the module.

A label is one to eight characters long. The characters must be alphanumeric or underscores. **Note:** The first character cannot be numeric.

To assign or edit a label on a network, follow these steps:

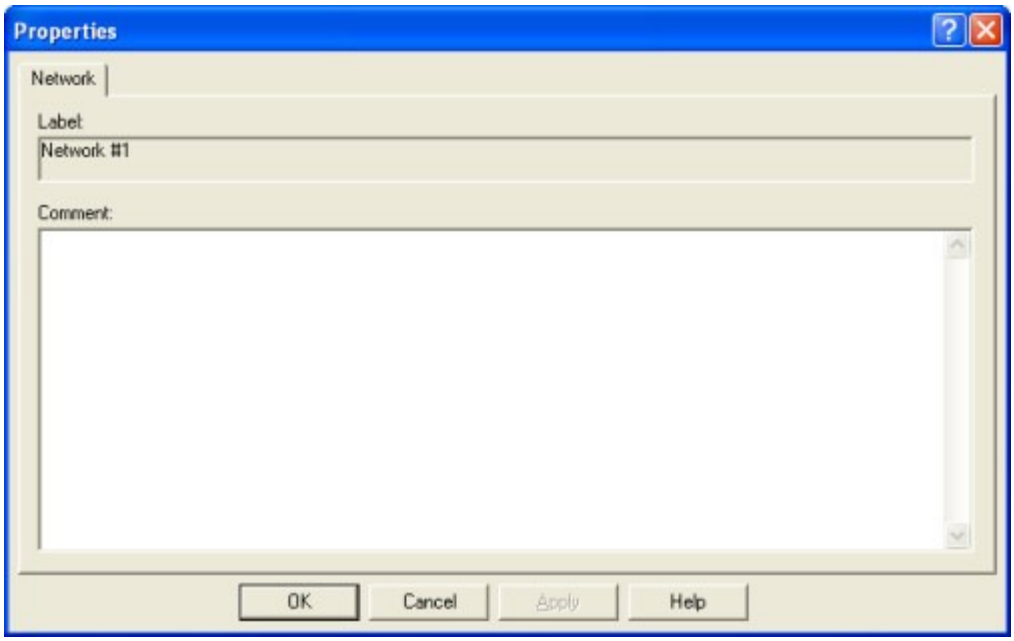
1. Place the cursor in the network you want to label.
2. Select Ladder | Network | Label from the menu.
3. A text box appears next to the network number. Type in the label you want or edit an existing one.

Comments in Network Elements

Up to 100 lines (80 characters long) of comments (documentation) can be added to a network element. The comments appear directly under the network number line. You can choose to display one or more comment lines as you work in your ladder.

To add comments to your ladder, follow these steps:

1. Select **Edit | Properties** from the menu.
2. Select the **Network** tab. Type in the comments you want for the network you are working in.



To choose the number of comment lines to display, follow these steps:

1. Select View | Options from the menu.
2. Select the User Preferences tab. In the Ladder View Preferences field, enter the number of comment lines you want displayed at each network.

Note:

Although you can choose to display up to 100 comment lines, they will not all display at the same time. To see all the lines you must double-click in the comment display. This takes you to the comment editor where you can see all the comments. To exit the comment editor, choose **Cancel**.

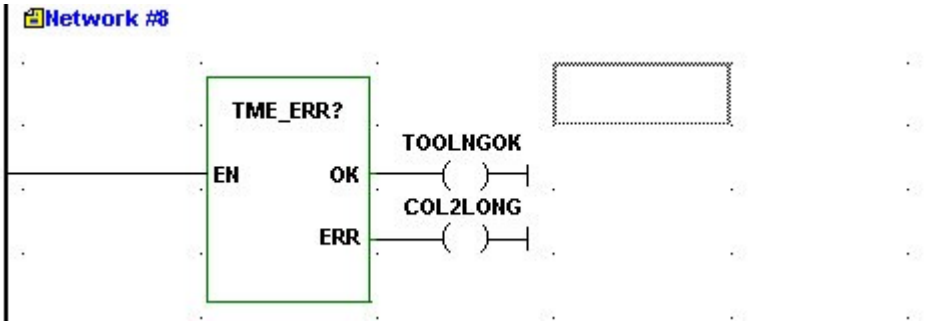
Network Size

LD Network Size

A LD network is comprised of a matrix of rectangles (outlined by dots) called cells. Each cell is approximately the size of the cursor. Each element in the network occupies at least one cell. Elements like functions can occupy several cells.

A PiCPro LD network accepts a network with an area of 1 to 255 cells. The area of a network is the sum of the product of its width (number of columns in widest row, excluding last row) and its length (number of rows – 1) plus the width of the last row.

A portion of a LD network is shown below. The cursor on the right occupies one cell in the network. Note the dots that mark each cell. The function on the left occupies four vertical cells.



ST Network Size

The ST element is dynamically resized to fit the viewable grid.

- If the **Enter** key is pressed to move the caret to a new line, the Structured Text element will expand its vertical size to accommodate one additional line of text.
- Entering and deleting rows of characters along with cut and paste and menu selections that insert text (e.g. constructs) will cause resizing of the ST element.

The maximum number of lines in a ST network is 500. Each line is limited to 500 characters. If a line exceeds the 500 character limit, a message will be displayed indicating the character limit. Furthermore, a ST network is limited by the code it generates.

At this time the network will have to be split and a new ST network started. If you want to continue writing the current structured text network, it must be continued in a new network. Any loop or IF/THEN constructs must be closed in the first ST network; they can not be continued in the next network.

Constants and Variables in Network Elements

Constants and Variables in Network Elements

All data elements in your ladder that can be read from or written to are in the form of variables or constants. A read element can be a variable or a constant. A write element must be a variable.

Constants

- Constants can be used as input values to function/function blocks. In a LD network, constants cannot be entered anywhere else in a network.
- Constant values must be entered in the same form and within the same range a variable value would be entered in the Software Declarations table.
- Strings cannot be represented as constants. String constants are defined in the Software Declarations via a variable and then referenced within the ladder file.

Variables

- Variables are used in four ways:
- As input values to function/function blocks
- As output values from function/function blocks
- As values that represent the states of contacts and coils in a LD network.
- In expressions in a ST network.

Variables must be declared in the Software Declarations table. There you define the following:

- A name for the variable
- The data type of the variable
- The initial value for the variable if it is different than the default 0
- The hardware module location if the variable is a physical input or output
- Any attributes that apply to the variable

Variable Names in Networks

Names

See "Names and Long Names of Variables" in the Software Declaration section of this chapter for an explanation of variable names.

In a LD network, if a variable name does not fit within its cell and there are empty cells or cells containing only horizontal wires to the left, the variable name will extend into the cells to the left (this is not true for Function Blocks and Task names). The cells to the left will not be included when the variable name is selected. If a single cell is selected and it contains a variable name, the variable name will be displayed in the status line.

Long Names

See "Names and Long Names of Variables" in the Software Declaration section of this chapter for an explanation of long variable names.

When editing a long name, <**Ctrl + Tab**> can be used to move focus from the long name edit control to the OK button.

To add/edit long names in a LD network, follow these steps:

1. Place the cursor on the variable you want to add/edit a long name.
2. Select **Edit | Properties** from the menu.
3. Select the **Symbol** tab.
4. Enter/edit the long name and click **OK**.

To view long names in a LD network, choose one of the following methods:

1. Click button on the View Navigator toolbar. Note: All cells in your ladder file increase in size when you display Long Names.
2. Select **View | Options** from the menu.
3. Select the **User Preference** tab.
4. In the Hide box, be sure the **Symbol Long Name** is not checked.
5. Click **OK**.

LD Elements

LD Elements

The elements that go into creating a LD network include contacts, coils, wires, functions/function blocks, data, jumps, variables and constants.

Contacts

Contacts are boolean elements that represent hard wired circuitry or internal logic in the ladder. Each boolean element must be assigned a boolean variable declared in the software declarations table. The variable holds the value of the state of the input. If the input is OFF or de-energized, the value is 0. If the input is ON or energized, the value is 1. If the element is a physical input, its location must also be declared.

Buttons	Contact Types
	Normally Open
	Normally Closed
	Positive transition, normally open
	Positive transition, normally closed
	Negative transition, normally open
	Negative transition, normally closed

Note:

Transition contacts pass power until the next update of the coil. Depending on the logic in your ladder, this may not equal one scan.

Normally Open Contact

Variable = 1 : The power flow/logic continuity is provided.

Variable = 0 : The power flow/logic continuity is not provided.

Normally Closed Contact

Variable = 1 : The power flow/logic continuity is not provided.

Variable = 0 : The power flow/logic continuity is provided.

Normally Open Positive Transition Contact

If the last write to the variable caused it to go from 0 to 1, power flow/logic continuity is provided.

If the last write to the variable did not cause it to go from 0 to 1, continuity is not provided or is dropped.

Normally Closed Positive Transition Contact

If the last write to the variable caused it to go from 0 to 1, power flow/logic continuity is not provided or is dropped.

If the last write did not cause the variable to go from 0 to 1, continuity is provided.

Normally Open Negative Transition Contact

If the last write to the variable caused it to go from 1 to 0, power flow/logic continuity is provided.

If the last write did not cause the variable to go from 1 to 0, continuity is not provided or is dropped.

Normally Closed Negative Transition Contact

If the last write to the variable caused it to go from 1 to 0, power flow/logic continuity is not provided or is dropped.

If the last write did not cause the variable to go from 1 to 0, continuity is provided.

Coils

Coils or control relays are boolean elements that represent hard wired circuitry or internal logic in the ladder. Each boolean element must be assigned a boolean variable declared in the software declarations table. The variable holds the value of the state of the output. If the output is OFF or de-energized, the value is 0. If the output is ON or energized, the value is 1. If the element is a physical output, its location must also be declared.

Buttons	Coil Types
	Energize
	De-energize
	Set (latch)
	Reset (unlatch)

Energize Coil

If power flow/logic continuity to this coil occurs, it is turned on.

If power flow/logic continuity to this coil drops, it is turned off.

De-energize Coil

If power flow/logic continuity to this coil occurs, it is turned off.

If power flow/logic continuity to this coil is dropped, it is turned on.

Set (latch) Coil

If power flow/logic continuity to this coil occurs, it is turned on.

If this coil is on and power flow/logic continuity is dropped, it stays on.

If power flow/logic continuity to this coil does not occur, it does not turn on.

Reset (unlatch) Coil

If power flow/logic to this coil occurs, it is turned off.

If this coil is off and power flow/logic continuity drops, it stays off.

If power flow/logic continuity to this coil does not occur, it does not turn off.

Wires

Wires are used in your network to connect other elements. They create data paths along which data is transferred from one element to another. They can also be used to broaden or lengthen the spacing of elements on your screen.

There are three types of wires available.

Buttons	Wire Types
	Horizontal
	Vertical
	Both (combination)

There are several ways to add wires to your network.

1. Click the toolbar button of the type of wire you want to use and drop it in the appropriate cell. Note that the cursor changes into the shape of the selected wire. You are now in the wire drop mode and can continue to place the chosen wire in your network until you cancel the wire drop mode by clicking another item or pressing the Esc key.
2. Click the point to point wire button . Position the cursor on the wire starting point and drag the cursor to the wire terminal point. Release the button. Note: You must be in the same row (horizontal wires) or column (vertical wires) for this to work.
3. Select **Ladder | Wires** from the menu. A fly-out appears from which you can select Vertical, Horizontal, or Both.

Use the following hot keys for the following wires:

Wire	Hot Key	Position of Focus After Wire is Placed
Vertical	<**Ctrl + Shift + V**>	Remains over vertical wire
	<**Ctrl + I**>	Moves to the cell above vertical wire
	<**Ctrl + M**>	Moves to cell below vertical wire
Horizontal	<**Ctrl + Shift + H**>	Remains over horizontal wire
	<**Ctrl + J**>	Moves to cell to left of horizontal wire
	<**Ctrl + K**>	Moves to cell to right of horizontal wire
Combination	<**Ctrl + Shift + B**>	Remains over the combination wire

Horizontal Wire

The horizontal wire provides a left-to-right horizontal connection between elements in the network.

Vertical Wire

The vertical wire provides a top-to-bottom vertical connection between elements in the network.

Combination Wire

The combination wire provides a branch connection between elements in the network. The branch must follow this same left-to-right, top-to-bottom scanning.

Functions and Function Blocks in LD Network

Functions/Function Blocks in LD Network

Functions are network elements that allow you to perform operations such as arithmetic or motion control.

Function blocks are network elements that allow you to perform operations that must retain data for a period of time, such as timing or counting operations. Function blocks must be declared in the software declarations table.

Function Block

Constants can be inputs to any Function/Function Blocks except functions that operate on STRINGs (string values must be put into variables). A constant value must be in the range and format it would be in if it was a variable value.

Generally, all input variables and the output variable must have the same data type. However, this is not true for a function whose purpose is to change a data type i.e., converting numeric type data into bitwise type data. It is also not true for inputs that are providing extraneous data for the operation, and outputs that are providing information about extraneous data for the operation. In all other cases though the output data type must match the input data type.

Although input and output data must be of the same type, input and output variables usually do not have to be unique variables. For instance, you could add the constant 1 to a variable called VAR1, and place the result in VAR1.

IMPORTANT

If an output variable is unique from an input variable, the input variable is unaltered by execution of the function/block. Only the output variable is changed.

Functions that return a string type variable as an output, have a unique characteristic. The output variable must be assigned on the input (left) side of the function. This is necessary because STRINGs require memory allocations before the operation is performed.

For detailed information on functions/function blocks, please refer to the PiCPro Function/Function Block Reference Guide.

Entering Functions and Function Blocks

To enter functions or function blocks

There are two ways to enter functions/blocks into your ladder.

1. Select a function/block from the drop down list on the Functions toolbar.

2. The name of your choice appears in the box and the cursor changes to an arrow pointer with the name below it.

3. Choose the place function button. You can now drop the selected function in any cell in your ladder with the exception of the left most column.

OR

1. Place the focus on the cell in your ladder that you wish to place the function in.
2. Choose **Ladder | Functions** from the menu. The library categories appear and from the flyouts you can choose the function you want.
3. Clicking on the function places it in the selected cell.

Making Function/Function Block Connections

Each function or function block accepts only certain data types as inputs or outputs. PiCPro will flag you during the programming process if you attempt to assign input/output data that is not acceptable for the function/block.

PiCPro will also flag you if a required input is missing. Connections to outputs are optional. Output variables do not need to be connected to functions/blocks if you do not want to receive that output data.

Boolean Inputs/Outputs

Boolean inputs and outputs are wires, contacts, or coils. Every function/block has a Boolean input on the upper left side and a Boolean output on the upper right side. The input (EN, REQ, CD, CU) is used to start execution of the function/block. The output (OK, DONE, Q) serves as a signal that the function/block has finished executing and that the execution was successful.

To connect a Boolean element to a function/block, select the desired element from the Ladder toolbar or menu and place it at the correct point.

Non-Boolean Inputs/Outputs

The non-boolean inputs are constants or variables. They are either the data that is to be operated on or they provide data required to perform the operation, such as a number of counts.

The non-boolean outputs are variables. They either hold the result of the operation or hold other pertinent information about the operation.

To connect a non-boolean element, select from the Function toolbar.

Data Fly-outs	Descriptions
In	Selected to enable the connection and entering of inputs to functions/function blocks.
In Inverted	Selected to enable the connection and entering of inverted inputs to functions/function blocks.
Out	Selected to enable the connection and entering of outputs to functions/function blocks.

To enable Function/Function Block connections, follow these steps:

1. After inserting the function/function block into the network, place the cursor at the first connection you want to make.
2. Select **Ladder | Data** from the menu and open the flyout. Make your choice. Or choose the correct button from the Function toolbar.
3. In the variable scroll box that appears, enter a new or select an existing variable. If the variable is new and has not been declared in the software declarations table, you will need to do that.
4. Move onto the next input or output you want to connect and follow steps 2 and 3.

Jump in LD Network

The jump command causes the execution of the ladder to jump or move to the beginning of a specified network. The specified network must have a label assigned by you in order for the jump command to find it.

You can jump to a label (with no return) or jump to a subroutine (with return).

Jump Fly-outs	Descriptions
To Label	Places the symbol for the jump to label command into the network and prompts you to enter the label of the network to which execution should jump.
To Subroutine	Places the symbol for the jump to subroutine command into the network and prompts you to enter the label of the network to which execution should jump.
Return	Places the symbol for the return command (<return>) into the network. Can be placed: In a subroutine where it returns you to the network from which the jump originated In the main module (typically at the end of the program before any subroutines) where it takes you to the <End Of Module> in the ladder In a UDFB source ladder (typically at the beginning) where it takes you to the <End Of the Module> if the EN (enable) is not set.

Notes:

It is recommended that subroutines be placed at the end of your main module program. A return command should be placed not only at the end of the subroutine, but also at the end of the main module directly before the subroutine network. The return at the end of the subroutine takes you back to the original jump to subroutine command network. The return at the end of the module takes you to the end of the module. If it were not included, the program would execute the subroutine again.

To insert a jump in your ladder, follow these steps:

- Place the cursor within the network you want to insert the jump into.
- Select **Ladder | Jumps** from the menu. From the fly-out select either **To Label** or **To Subroutine**. Or click the button from the Ladder toolbar.

ST Elements and Structured Text

ST networks are composed of ST statements and comments. The structured text statements that are supported in PiCPro are assignment, conditional, iteration and Function/Function Blocks. Many of the ST statements are created using expressions.

Structured Text is a higher level programming language whose syntax is similar to other higher level programming languages such as C, C++, Java, Pascal, Basic, etc…

Expressions

Expressions are used in many of the ST statements and are one of the fundamental building blocks for many of the ST statements. They are used for calculations and they resemble mathematical formulas. An expression is a combination of operands and operators that are used to form an algebraic expression that evaluates to a single value and data type. An operand can be a variable, constant, or function call. Valid expression operators are listed in the table **ST Operators-Evaluation Precedence** located in **Expressions - Operators and Precedence Order**. Examples of very simple to more complex expressions are shown in following table:

Examples	Explanation/Description
`SPEED`	Expressions can be as simple as a constant or a variable.
`MAX (IN0:=A, IN1:=B)`	Expressions can also be a function call. The result from this expression is either A or B depending on which is larger.
`A * B + MIN(IN0:=C, IN1:=D)`	Expressions can be as complex as needed. Result: A is multiplied by B and then that result is added to the minimum value of C or D.

Notes:

- All operands in an expression must be of the same data type. A compile error will result when an operand does not match the data type of the expression.
- If it is necessary to change the data type on an operand use the data type conversion functions found in the Function/Function Block Reference Guide.
- To detect run time errors such as overflow and divide by zero, in expressions, call the OK_ERROR function. Refer to the Function/Function Block Reference Guide for a description of this function.

Expressions - Operators and Precedence Order

Expressions are evaluated based on a given precedence order. Valid operators and their evaluation precedence order are given in the table below. The precedence order is from highest to lowest. If operators have the same precedence, they are evaluated from left to right.

ST Operators – Evaluation Precedence		
Operator	**Description**	**Precedence**
(…)	Parenthesized expression	Highest
Function (…)	Parameter list of a function, function evaluation	
NOT, -	Boolean Complement, Arithmetic Negation	
*, /, MOD	Multiplication, Division, Modulus operation	
+, -	Addition, Subtraction	
<, >, <=, >=	Less Than, Greater Than, Less Than or Equal To, Greater Than or Equal To	
=, <>	Equal To, Not Equal	
AND, &	Boolean AND, Both operators are used interchangeably	
XOR	Boolean exclusive OR	
OR	Boolean OR	Lowest

Example	**Explanation/Description**
`P * R / Q + W / X – Y`	**A:** 10 * 5 = 50
	B: 50 / 2 = 25
A B D C E	**C:** 15 / 3 = 5
	D: 25 + 5 = 30
The variables are equal to these values before the equation is solved:	**E:** 30 – 12 = 18 (final result)
P:=10, R:=5, Q:=2,	
W:=15, X:=3, Y:=12	

Notes:

Many of the ST operators have an equivalent function that can be called. Each of these functions provides the same functionality/behavior as their ST operator equivalent with the following exceptions:

- Functions are evaluated before their ST operator equivalent.
- Functions provide status via OK. This can be used to check for overflow, divide by zero, etc.

Comments in ST Elements

In addition to the network comments that can be entered there are two types of ST comments that can also be entered.

The first type, also known as line comments, begins with a // and end with the enter key. A line comment can be written on a line by itself or at the end of a line containing an ST statement.

The other comment style begins with (* and ends with *) and can be placed wherever it is acceptable to insert one or more spaces within the text itself. These comments can span multiple lines.

Example of (* and end with *)

(* Title: Determines if limit switch set.
Date: 4/17/02 *)

Example of Line Comment

Area := 3.1416 * Radius * Radius; //Computes the area of a circle

Notes:

- (* *) comments can not be nested (e.g., (* (* comment *) *)).
- Neither type of ST comment can be exported or imported.

Assignment Statements

Overview: Assignment Statements

Assignment statements are used to change the value stored within a variable.

Generic Format	
`<<Variable>> := <<expression>>;`	
Rules	
Expression is evaluated and results are assigned or stored in variable.	
Example	**Explanation/Description**
`A := B + C * (10 / D);`	When • `A is 1090` • `B is 10` • `C is 5` • `D is 2` The expression evaluates to 35. A is then set to 35.

Notes:

- The data type of the <<expression>> must match the data type of the <<variable>>.
- In its simplest form, an assignment statement is equivalent to the MOVE function, the assignment statement can be used to copy an entire structure but cannot be used to copy an entire array. For example, if A and B are of type struct, then A := B; will move the entire contents of struct B into A.
- If a underflow/overflow or divide by 0 occurs when evaluating <<expression>>, then the value stored in <<variable>> will be unpredictable. To determine if this occurred, call the OK_ERROR function. Refer to the Function/Function Block Reference Guide for a description of this function.

Conditional Statements

Conditional Statements

A conditional statement selects and executes one or a group of statements based on a specified condition. A conditional statement can be typed into a ST Element directly or can be selected from **Ladder | Structured Text** or by clicking the appropriate icon button on the Structured Text Toolbar.

Structured Text in PiCPro allows four conditional statements:

- IF-THEN
- IF-THEN-ELSE
- ELSIF-THEN-ELSE
- CASE

IF-THEN

Generic Format	
IF <<boolean-expression>> **THEN** *Section1* **END_IF**;	
Rules	
• Section1 will execute if <<boolean-expression>> is true. • Section1 will not execute if <<boolean-expression>> is false.	
Example	**Explanation/Description**
IF A > 10 THEN C := 20; END_IF;	When A is less than or equal to 10, then the value of C will not be changed. When A is greater than 10, then C will be set to 20.

Note: Section1 must contain at least one ST statement.

IF-THEN-ELSE

Generic Format

IF <<boolean-expression>> **THEN**
Section1
ELSE
Section2
END_IF;

Rules
• Section1 will execute if <<boolean-expression>> is true. • Section2 will execute if <<boolean-expression>> is false.

Example	Explanation/Description

IF A >10 THEN
C := 20;
ELSE
C := 100;
END_IF;
	When A is greater than 10, then C will be set to 20.
	When A is less than or equal to 10, then C will be set to 100.

Notes: Section1 and Section2 must each contain at least one ST statement.

ELSIF-THEN-ELSE

Generic Format

```
IF <<boolean-expression#1>> THEN
Section1
ELSIF <<boolean-expression#2>> THEN
Section2
ELSE
Section3
END_IF;
```

Rules

- Section1 will execute if <<boolean-expression#1>> is true.
- Section2 will execute if <<boolean-expression#1>> is false AND <<boolean-expression#2>> is true.
- Section3 will execute if <<boolean-expression#1>> is false AND <<boolean-expression#2>> is false.

Example	Explanation/Description

IF A > 11 THEN
C := 20;
ELSIF A = 5 THEN
C := B + X;
ELSIF A = 6 THEN
C := B + 1;
ELSE
C := 100;
END_IF;
	When A is greater than 11, then C is set to 20.
	When A is equal to 5, then C is set to B+X.
	When A is equal to 6, then C is set to B+1.
	When A is equal to 2, then C is set to 100.

Notes:

- Each section must contain at least one ST statement.
- Additional ELSIF sections can be added if needed.
- The ELSE and Section 3 are optional.

CASE

Generic Format
CASE <<integer-expression>> **OF** <<int-constant #m>>: *Section1* <<int-constant #n>>: *Section2* **ELSE** *Section3* **END_CASE**;

Rules

- Section1 is executed if <<integer-expression>> matches the value of <<int-constant #m>>.
- Section2 is executed if <<integer-expression>> matches the value of <<int-constant #n>>.
- Section3 will execute if no matches to <<integer-expression>> are found.

Example	Explanation/Description
CASE SPEED_SETTING OF 1: SPEED :=10; 2: SPEED := 20; 3: SPEED := 30; 4,5: SPEED := 50; 6..10: SPEED := 60; 11, 14, 16..18: SPEED := 70; ELSE SPEED := 0; END_CASE;	When SPEED_SETTING is equal to 1, then SPEED will be set to 10. When SPEED_SETTING is equal to 2, then SPEED will be set to 20. When SPEED_SETTING is equal to 3, then SPEED will be set to 30. When SPEED_SETTING is equal to 4 or 5, then SPEED will be set to 50. When SPEED_SETTING is equal to 6, 7, 8, 9, or 10, then SPEED will be set to 60. When SPEED_SETTING is equal to 11, 14, 16, 17, or 18, then SPEED will be set to 70. When SPEED_SETTING is not equal to one of the previous values, then SPEED will be set to 0.

Notes:

- The data type of the <<integer-expression>> must be SINT, INT, DINT, or LINT.
- The ELSE and Section 2 are optional.
- The form of <<int-constant #n>> can be defined as a single, several or a range of values. A single value is simply an integer constant. A range of values is defined by separating 2 integer constants by "..". Several values are defined by putting together any combination of single or range of values and separating them with commas (i.e. 1..5, 10, 13:). The <<int-constant #n>> is terminated by a ":".

- When specifying a range of values, the first number must be less than the last number. A compile error will result if the last number is less than the first number.
- The <<int-constant #n>> cannot overlap. Overlapping <<int-constant #n>> will result in a compile error.
- All sections must each contain at least one ST statement.

Iteration Statements

Iteration statements are provided for situations where it is necessary to repeat one or more statements a number of times depending on the state of a particular variable or condition.

Note:

An iteration statement does have a finite limit. It is the user/programmer's responsibility to insure that the iteration statement does not take too long to execute which may cause a scan loss.

An iteration statement can be typed directly into a ST element or can be selected from **Ladder | Structured Text** or by clicking the appropriate icon on the Structured Text Toolbar.

Structured Text in PiCPro allows three iteration statements:

- WHILE-DO
- FOR-DO
- REPEAT-UNTIL

WHILE-DO

Generic Format
WHILE <<boolean expression>> **DO** *Section1* **END_WHILE**;

Rules
• If <<boolean-expression>> evaluates to true, Section1 will execute. • This process repeats until <<boolean-expression>> evaluates to false.

Example	Explanation/Description

`ArrayIndex := 0;`
`WHILE ArrayIndex < 10 DO`
`  PartReject[ArrayIndex] := 0;`
`  ArrayIndex := ArrayIndex + 1;`
`END_WHILE;`
	The first time through the loop, `ArrayIndex` is 0 and `PartReject[0]` is set to 0.
	The second time through the loop, `ArrayIndex` is 1 and `PartReject[1]` is set to 0.
	This process repeats and the loop terminates when `ArrayIndex` is 10.
	At the end of this loop `PartReject[0]` through `PartReject[9]` will be set to 0.

Notes:

- If <<boolean-expression>> initially evaluates to false, Section 1 will not be executed.
- To prevent an endless loop, ensure that Section 1 includes a ST statement that will cause <<boolean-expression>> to evaluate to false. In the example above, the ST statement ArrayIndex := ArrayIndex + 1; causes the <<boolean-expression>> ArrayIndex < 10 to evaluate to false when ArrayIndex is greater than or equal to 10 and causes the loop to terminate.
- Section 1 must contain at least one ST statement.

FOR-DO

A FOR-DO statement is used to execute a set of ST statements a fixed number of times. It is generally used for counting up or counting down. A FOR-DO statement consists of:

- a starting condition that sets the initial value for the counter of the FOR-DO statement
- a limit expression that defines the termination value of the FOR-DO statement
- set of ST statements that are to be executed in the FOR-DO statement
- a step expression is the value that the counter will be incremented each time through the FOR-DO statement

Note:

The FOR-DO statement does not provide the same functionality as the CTD, CTU, or CTUD function blocks and should not be used in place of these function blocks.

Generic Format

```
FOR <<count-variable>> := <<initialization-expression>> TO
<<limit-expression>> BY <<step-expression>> DO
     Section1
END_FOR;
```

Rules

1. The `<<initialization-expression>>` is evaluated and the results stored in `<<count-variable>>`. This sets the starting value of the loop.
2. The `<<limit-expression>>` and the `<<step-expression>>` are evaluated.
3. The `<<limit-expression>>` is then compared to the `<<count-variable>>`. If the `<<count-variable>>` is less than or equal to (greater than or equal to, if counting down) then `<<limit-expression>>`, continue to Step 4, otherwise the loop terminates.
4. The ST statements in Section1 are executed.
5. The `<<step-expression>>` is then added to the `<<count-variable>>` and the results are stored in `<<count-variable>>`.
6. Go to Step 3.

Example 1

```
Production_Total := 0;
FOR Index := 0 to 9 BY 1 DO
   Production_Total := Production_Total + Lane[Index].Production;
END_FOR;
```

Explanation/Description 1

The first time through the `FOR-DO` statement, `Index` is 0 and `Lane[0].Production` will be added to `Production_Total`.

The second time through the `FOR-DO` statement `Index` is 1 and `Lane[1].Production` will be added to `Production_Total`. This process repeats and the `FOR-DO` statement terminates when `Index` is 10.

At the end of this `FOR-DO` statement, `Index` will be 10 and `Production_Total` will be the sum of `Lane[0].Production` through `Lane[9].Production`.

Example 2

```
FOR Station_Number := 9 TO 0 BY -1 DO
   Station_Pointer := INT2UINT(IN := Station_Number);
IF Station_Available[Station_Pointer] THEN
   EXIT;
END_IF;
END_FOR;
```

Explanation/Description 2

Starting with `Station_Number` 9 we are looking backwards for the first station that is available. When an available station is found, the `FOR-DO` statement terminates and `Station_Number` will contain the available station. If no stations are found, then `Station_Number` will be -1. Each time through the `FOR-DO` statement `Station_Number` is decremented by 1.

Notes:

- The data type for the <<count-variable>>, <<limit-expression>>, and <<step-expression>> must all be the same and must be of the data type SINT, INT, DINT, LINT, USINT, UINT, UDINT, or ULINT.
- BY and <<step-expression>> are optional. If omitted, 1 is assumed to be the step value.
- Specifying a <<step-expression>> that is negative causes the FOR-DO statement to count down. The only data types that are valid with count down FOR-DO statements are SINT, INT, DINT, or LINT. Using USINT, UINT, UDINT, or ULINT with a count down FOR-DO statement will result in a logic error in your program.
- Modifying the <<count-variable>> within Section 1 is not recommended and may produce unpredictable results.
- After the FOR-DO statement is terminated the <<count-variable>> will contain the value that caused the FOR-DO statement to exit.
- Section 1 must contain at least one ST statement.

REPEAT- UNTIL

Generic Format

```
REPEAT
Section1
UNTIL <<boolean-expresssion>> END_REPEAT;
```

Rules

- If <<boolean-expression>> evaluates to false, the ST statements in Section1 are re-executed.
- When <<boolean-expression>> evaluates to True, the loop terminates.

Example 1

```
ArrayIndex := 0;
REPEAT
   PartReject[ArrayIndex] := 0;
   ArrayIndex := ArrayIndex + 1;
UNTIL ArrayIndex > 9 END_REPEAT;
```

Explanation/Description 1

The first time through the loop, `ArrayIndex` is 0 and `PartReject[0]` is set to 0.

The second time through the loop `ArrayIndex` is 1 and `PartReject[1]` is set to 0.

This process repeats and the loop terminates when `ArrayIndex` is 10.

At the end of this loop `PartReject[0]` through `PartReject[9]` will be set to 0

Example 2

```
REPEAT
   FIND (IN1 := Vision_X_String, IN2 := Space_Char,
   OUT =>Loc_of_Space);
   IF Loc_of_Space > 0 THEN
      DELETE (OUT := Vision_X_String, IN := Vision_X_String,
      L := 1, P := Loc_of_Space);
   END_IF;
UNTIL Loc_of_Space = 0 END_REPEAT;
```

Explanation/Description 2

The first time through this loop, find the first space in the string `Vision_X_String`.

If a space is found, delete it from `Vision_X_String`.

The second time through this loop find the next space in the string `Vision_X_String`. If a space is found, delete it from `Vision_X_String`. This process repeats until all spaces are removed from `Vision_X_String`.

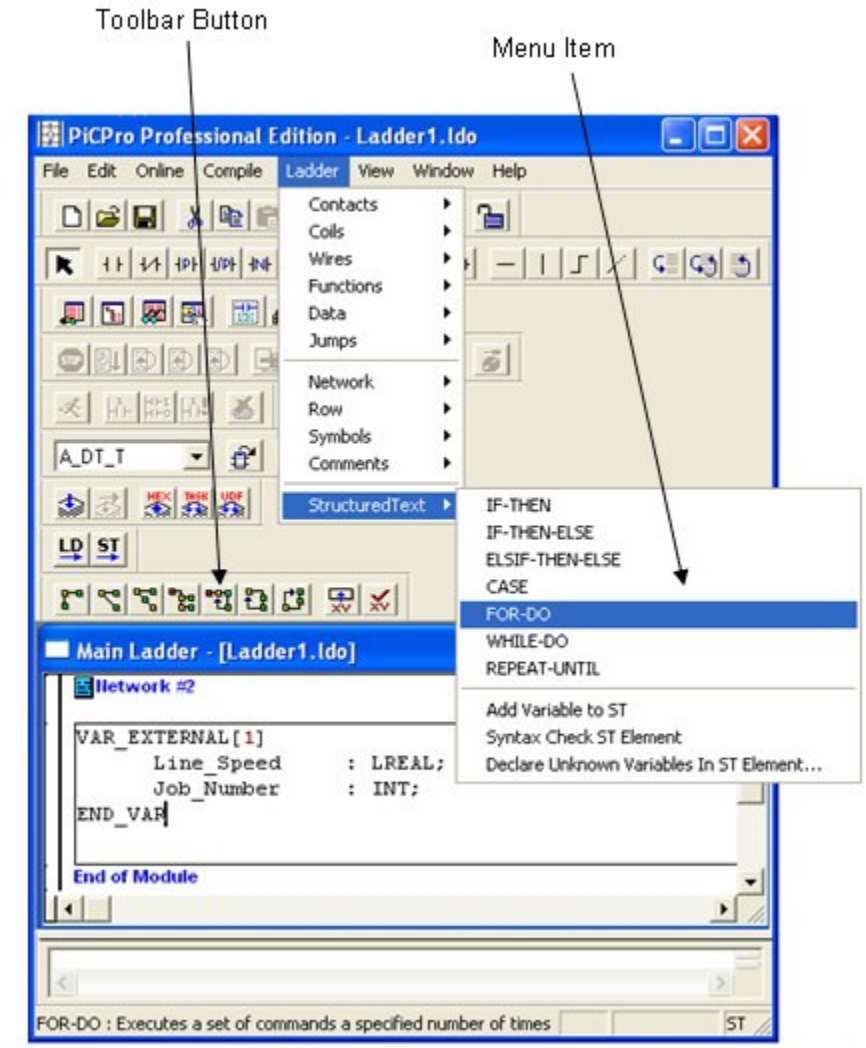
At the end of the loop all spaces `from Vision_X_String` will be deleted.

Notes:

- The ST statements in Section 1 always execute at least one time.
- To prevent an endless loop, ensure that Section 1 includes an ST statement that will cause <<boolean-expression>> to evaluate to true. In Example 1 above, the ST statement ArrayIndex := ArrayIndex + 1; causes the <<boolean-expression>> ArrayIndex > 9 to evaluate to true when ArrayIndex is greater than 9 and causes the loop to terminate.
- Section 1 must contain at least one ST statement.

Inserting Conditional and Iteration Statements in ST

When focus is in a ST network, you can use a toolbar or pull-down menu to enter conditional or iteration statement (e.g. IF-THEN) templates. Replace the template fields with the desired text.



The cursor will be placed on the first template field. The text is located inside << >> and will be highlighted. The first character entered replaces the template field.

Other Statements in ST

EXIT

This statement can only be used within iteration statements and allows iteration loops to be ended prematurely.

Generic Format
EXIT;
Rules
When this statement is executed, the iteration statement is immediately terminated.
Example 1

`FOR Station_Number := 10 TO 0 BY -1 DO`
`  Station_Pointer := INT2UINT(IN := Station_Number);`
`  IF Station_Available[Station_Pointer] THEN`
`  EXIT;`
`  END_IF;`
`END_FOR;`

Explanation/Description 1
When `Station_Available[Station_Pointer]` is true, the `EXIT` statement is executed and the `FOR-DO` statement is terminated.

Notes:

When the EXIT statement is located within nested iteration statements, exit shall be from the innermost iteration statement in which the EXIT is located, that is, control shall pass to the next statement after the innermost iteration statement that is terminated.

RETURN

Generic Format
`RETURN;`
Rules
This statement, when executed will cause the subroutine or UDFB to return to the calling module.
Example 1

`IF NOT EN THEN`
`  RETURN;`
`END_IF;`

Explanation/Description 1
Assuming this example is in a UDFB and `EN` is false, the `RETURN` statement causes a return to the calling module.

Notes:

- This statement has the same functionality in ST as it does in LD.
- For more information about this statement, refer to the section Jump in LD NetworkJumps.

Rules for a Structured Text Template

A Structured Text Template (e.g. <<bool-expression>>) will act as a single character.

- If the cursor is located inside a template field, a character entry will overwrite the template field with that character (even though the template field is not highlighted).
- When dragging a selection, if the beginning or end of the selection ends in the middle of the template field, the entire template field will be selected.
- When deleting or backspacing over a template field, the entire template field will be deleted.
- When typing a character and 'insert mode' is off, if the character overwrites the start of a template field, the entire template field will be replaced with the character.
- You cannot create a template field from the keyboard.

Functions and Function Blocks in ST

ST Templates for Functions and Function Blocks

Function Block titles are limited to 8 characters. Refer to the PiCPro Function/Function Block Reference Guide for proper structure of specific Functions and Function Blocks in Structured Text. Examples of inserted Structured Text code and parameter templates for a Function and a Function Block are as follows:

Function named FNAME is:

```
FNAME(EN:=1, <<datatype>>, IN2 := <<datatype>>, OUT1=> <<datatype>>)
```

Function Block named FBNAME is:

```
<<INSTANCE NAME>> :FBNAME(EN:=1, <<datatype>>, IN2 := <<datatype>>,
OUT1=> <<datatype>>);
```

Functions in ST

Functions allow you to perform operations such as arithmetic or motion control and can be called from a ST statement or from within an expression. See the Generic Format and Examples below.

For detailed information on Functions, please refer to the PiCPro Function/Function Block Reference Guide.

A function block can be typed into a ST element directly or can be selected from the **Ladder | Functions** menu.

Generic Format – ST Statement

```
<<FunctionName>> (<<InputParameter1>> := <<Expression1>>,
<<InputParameter2>> := <<Expression2>>,
<<OutputParameter1>> => <<VariableName1>>,
<<OutputParameter2>> => <<VariableName2>>, ...);
```

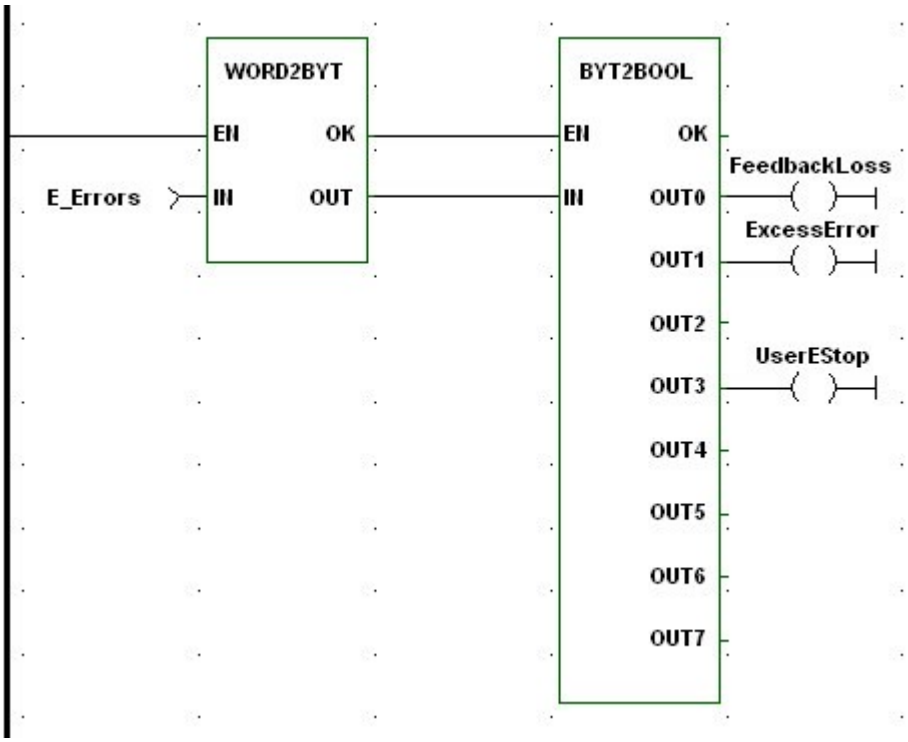
Rules

- `<<Expression1>>` and `<<Expression2>>` are evaluated.
- The function is then called `with <<InputParameter1>>, <<InputParameter2>>, <<VariableName1>>, <<VariableName2>>, ....`
- The results from the function call are returned in output parameters `<<VariableName1>>, <<VariableName2>> , ...`

ST Example

```
BYT2BOOL (IN := WORD2BYT, IN := E_ERRORS, OUT0 => FeedbackLoss,
OUT1 => ExcessError, OUT3 => UserEstop);
```

LD Equivalent



Generic Format – ST Expression Operand

```
<<FunctionName>> (<<InputParameter1>> := <<Expression1>>,
<<InputParameter2>> := <<Expression2>> ,...) ;
```

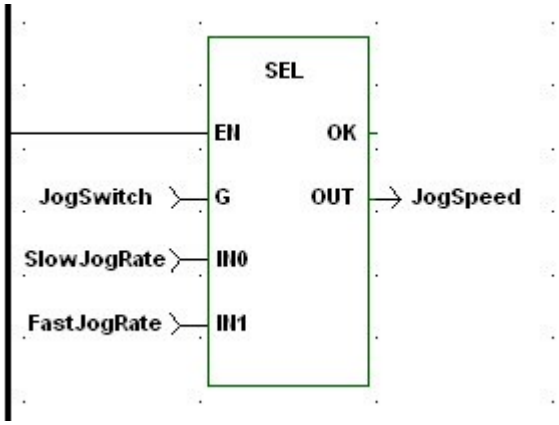
Rules

- `<<Expression1>>, <<Expression2>> ,...` are evaluated.
- The function is then called with `<<InputParameter1>>, <<InputParameter2>>, ....`
- The results from the function are used in the ST expression

ST Example 1

```
JogSpeed:= SEL(G :=JogSwitch, IN0 :=SlowJogRate, IN1 :=FastJogRate);
```

LD Equivalent



Explanation/Description 1

When `JogSwitch` is not set, then `JogSpeed` is set to `SlowJogRate`.

When `JogSwitch` is set, then `JogSpeed` is set to `FastJogRate`.

Notes:

- Selecting **Ladder | Function** will insert a Function template that includes the input and output parameters into your ST Element. Input parameters are identified using := and output parameters are identified using =>. If more than one parameter is used, they are separated by commas. Parameters can be specified in any order.
- Output parameters can not be specified in a function call used in a ST expression. Output parameters are optional in a function call used in a ST statement. However, if no output parameters are specified, no results will be returned from the function.
- Functions that do not return a value cannot be used in a ST expression. They must be called from a ST statement (e.g. CLOSLOOP).
- Functions that return multiple values cannot be used in a ST expression. They must be called from a ST statement (e.g. MOVE, and BYT2BOOL).

- Although EN is always specified as the first input parameter to a Function to a LD network, EN cannot be specified as an input parameter to an ST function.
- The data type for each function input and output parameter must match the data type of the function definition for that parameter.

Function Blocks in ST

Function Blocks allow you to perform operations that must retain data for a period of time, such as timing or counting operations. Function Blocks must be declared in the software declarations table.

For detailed information on Function Blocks, please refer to the PiCPro Function/Function Block Reference Guide.

A Function Block can be typed into an ST element directly or can be selected from the **Ladder | Functions** menu.

Generic Format – ST Expression Operand

```
<<FunctionBlockInstance>> : <<FunctionBlockTitle>>
(<<InputParameter1>> := <<Expression1>>,
<<InputParameter2>> := <<Expression2>>,
<<OutputParameter1>> => <<VariableName1>>,
<<OutputParameter2>> => <<VariableName2>>, ...);
```

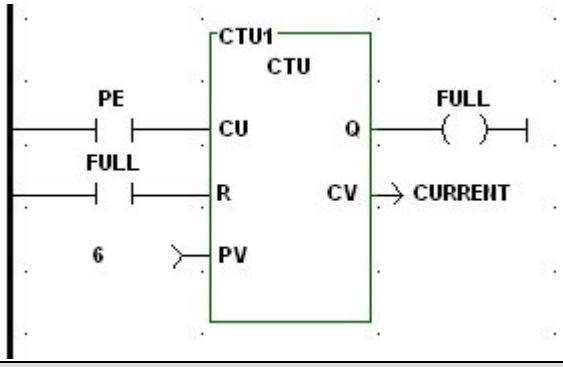
Rules

- `<<Expression1>>, <<Expression2>> ,...` are evaluated.
- The function block is then called with `<<InputParameter1>>, <<InputParameter2>>, ....`
- The results from the function block call are returned in output parameters `<<VariableName1>>, <<VariableName2>>, ...`

ST Example 1

```
CTU1:CTU(CU := PE, R := FULL, PV := 6, Q => FULL, CV => CURRENT);
```

LD Equivalent



Explanation/Description 1

The PE input detects a product on the line. When six products have been completed, the FULL output at Q will energize. CURRENT will represent the number of products in the package. FULL would be used to move the finished package out and reset the counter to zero.

Notes:

- Function Block titles are limited to 8 characters.
- Function Blocks/tasks can not be used in expressions.
- The ":FunctionBlockTitle" is optional and is not part of the standard IEC1131-3. The ":FunctionBlockTitle" has been included so modules are easier to read and understand.
- There is a very significant difference between when Function Blocks are called in ST verses LD. In LD, every Function Block is invoked with each and every scan. It does not matter what ladder logic surrounds the Function Block. In ST, if a Function Block is in a condition or iteration statement, the Function Block will not be invoked if the logic that surrounds it has not been satisfied.
- Selecting Ladder | Function will insert a Function Block template that includes the input and output parameters into your ST Element. Input parameters are identified using := and output parameters are identified using =>. If more than one parameter is used, they are separated by commas. Parameters can be specified in any order.
- Input and output parameters are optional and only need to be specified if needed.
- The data type for each Function Block input and output parameter must match the data type of the Function Block definition for that parameter.

Entering Functions and Function Blocks

There are two ways to enter functions/blocks into your ladder.

1. Select a function/block from the drop down list on the Functions toolbar.

2. The name of your choice appears in the box and the cursor changes to an arrow pointer with the name below it.
3. Choose the place function button. You can now drop the selected function in any cell in your ladder with the exception of the left most column.

OR

1. Place the focus on the cell in your ladder that you wish to place the function in.
2. Choose **Ladder | Functions** from the menu. The library categories appear and from the flyouts you can choose the function you want.
3. Clicking on the function places it in the selected cell.

ST Network Considerations

- In a LD network, Function Blocks are called each and every scan. In a ST network, the Function block will not be called every scan but will be called only when the logic surrounding the Function Block supports it.
- There are no equivalent ST statements for transitional contacts (i.e., Normally Open Positive Transition Contact, Normally Closed Positive Transition Contact, Normally Open Negative Transition Contact, and Normally Closed Negative Transition Contact).
- ST networks, as do LD networks, execute every scan. Therefore, it is important to take this into consideration when creating a ST network.
- Conditional and iteration ST statements can be nested within other conditional and iteration ST statements to create more complex ST networks.
- An iteration statement does have a finite limit. It is the user/programmer's responsibility to insure that the iteration statement does not take too long to execute because this may cause a scan loss.

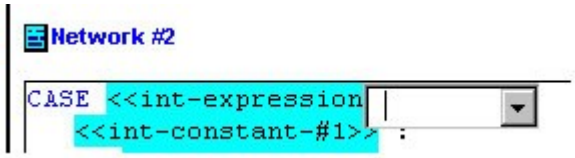
Variables in ST Network

Adding Variables to a ST Network

With focus in a St Element, do one of the following:

- Click the button from the Structured Text toolbar.
- Select **Ladder | Structured Text | Add Variables to ST** from the menu.
- Press <**Ctrl + Enter**>.

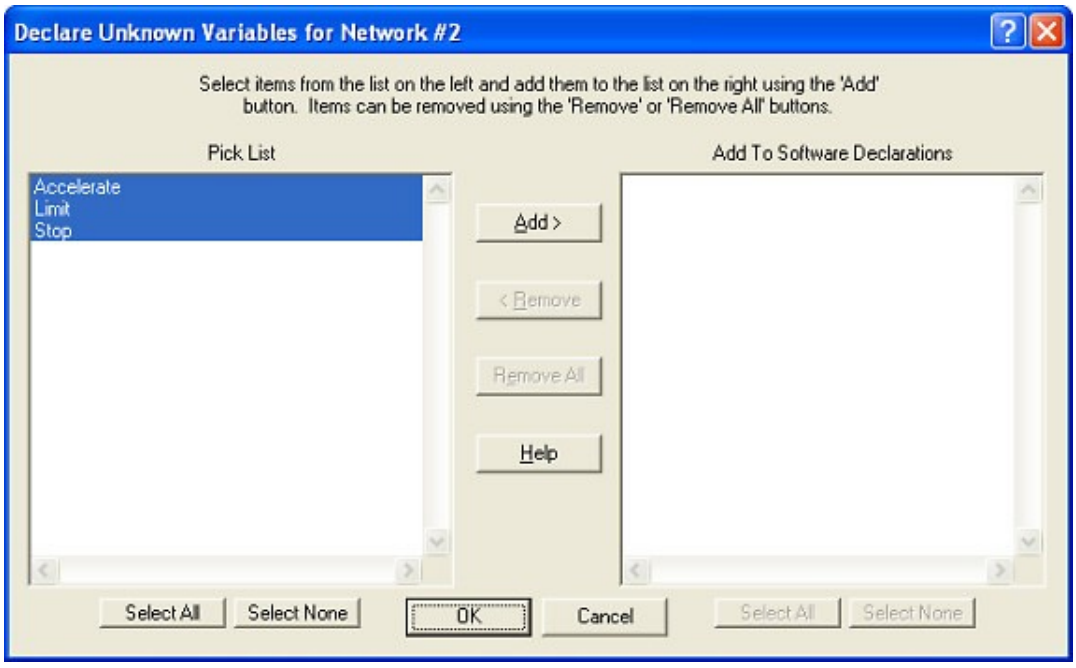
A combo box will appear in the ST network.



If the cursor is on a ST template that specifies a certain type of variable (e.g. integer), only that type of variable is available in the combo box.

Adding Undefined Variables to Software Declarations - ST Network

1. Enter a new variable in a ST network and either click outside of the network or use the arrow keys to move out of the ST network. A list of undefined variables will be displayed under **Pick List**:

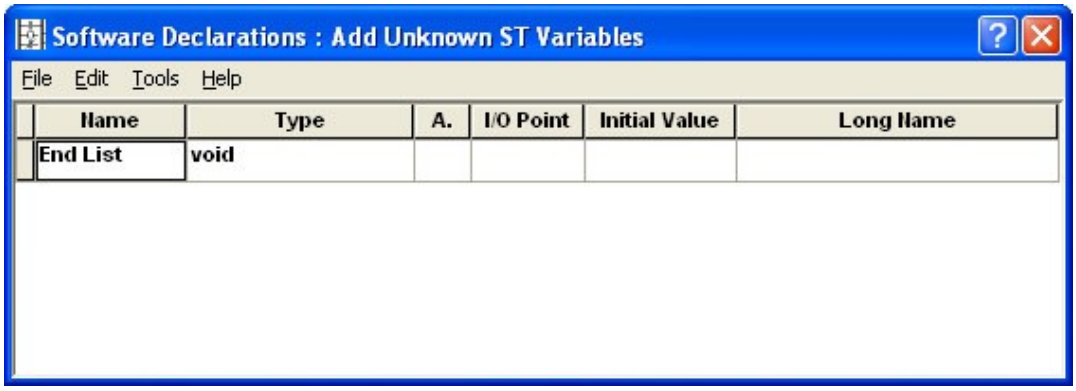


Note:

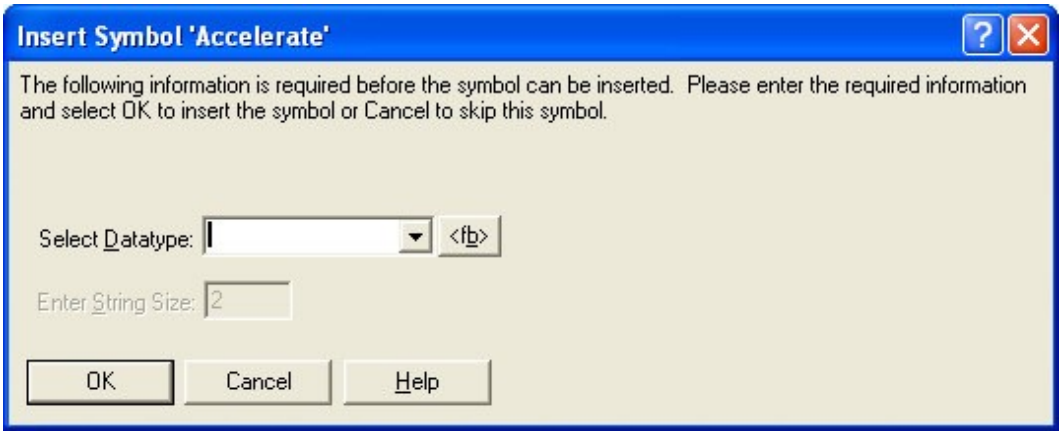
If an * is displayed before the variable name, the variable has been used more than once in the ST network and the compiler detects a conflict with the variable type.

2. Click **Add>** to move the variable(s) to the **Add to Software Declarations** list.

3. Click **OK** and the Software Declarations dialog will be displayed:

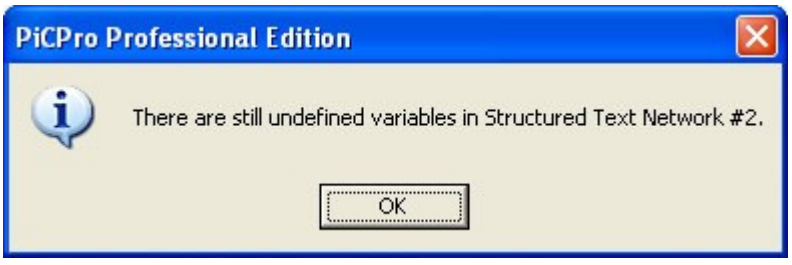


4. Put the focus on the line in the **Software Declarations: Add Unknown ST Variables** dialog.
5. To display the **Insert Symbol** dialog, choose one of the following:
   - Select **Tools | Insert Symbol** from the menu.
   - Press the **Insert** key.



6. Enter the data type in the **Select Datatype:** field.

After variables have been added to software declarations, the ST network will be recompiled. If the **Forced Declarations** field is checked in the **User Preferences** tab of the **Options** dialog, and if any unknown variables still exist, you are prompted to add the variables to software declarations.



Note:

If the Forced Declarations field is checked you will be forced to enter software declarations for unknown variables when:

- Ladder focus has changed from a ST element to another grid or row.
- Save, Save All or Save As is chosen and a change has been made to the ladder program.
- Closing the current ladder program or closing PiCPro causes a Save to occur.

The following is a description of all control buttons for the **Declare Unknown Variables** dialog:

Control Button	Description
Add >	Click this button to move undefined variables selected in **Pick List** to **Add to Software Declarations** List.
< Remove	Click this button to move undefined variables selected in **Add to Software Declarations** List to **Pick List**.
Remove All	Click this button to move everything in **Add to Software Declarations** List to **Pick List**.
Select All	Click this button to select all undefined variables in the list above.
Select None	Click this button to deselect selected undefined variables in the list above.
OK	Click this button after selecting undefined variables to be added to software declarations. The Software Declarations dialog will be displayed. Press the **Insert** key to insert undefined variables.
Cancel	Click to close the dialog without adding any undefined variables to software declarations.
Help	Click to display information related to this subject.

ST Constructs – Arrays

The following rules apply:

- Only single dimensioned arrays are supported in PiCPro
- Array variables are identified with square brackets.
- Array subscripts follow the same rules in ST and LD. An array subscript can be any variable or constant that evaluates to USINT or UINT. Array subscripts can be nested if the variable name used in the subscript is another array. Array subscripts can be nested no more than 16 levels.

ST Constructs - Data I/O Points

Data I/O points cannot be entered into a ST network directly. They must be defined in Software Declarations via a variable and then referenced within the ladder.

Checking Syntax in a ST Element

With the focus in a ST Element, do one of the following:

- Click the button from the Structured Text toolbar.
- Select **Ladder | Structured Text | Syntax Check ST Element** from the menu.
- Press <**Ctrl + Alt + S**>.

A compile and syntax check will occur. Upper and lower case spelling errors of variables will be corrected automatically. Compiler errors will be displayed in the Information Window.

Note: This menu item is enabled anytime a ST element is edited.

Using the Right-Click Menu in a ST Element

Various tasks can be performed using the right-click menu while focus is on a ST Element. The availability of the menu items used to perform these tasks depends on the location of the cursor. A description of these menu items follows:

Menu Item	Description
Help	Select to view the on-line Help topics.
Cut	Select to cut a highlighted selection.
Copy	Select to copy a highlighted selection.
Paste	Select to paste, what was cut or copied, where the cursor is located.
Insert	Provides a choice of inserting a LD or ST network where the cursor is located. Networks are renumbered if the cursor is not at the end of the module.
Delete Network	Select to delete the network on which the cursor is located.
Find/Replace…	Select to specify a search or a search with a replacement and activate it.
Find Next	Select to execute another search on data from the previous search.
Info: *xxxxxxxxxxxxx*	The information displayed will vary based on the location of the cursor
Add '*variable-name'* to Software Declarations	Select to add unknown variables to the Software Declarations table.
Software Declarations…	Select to open the Software Declarations table.
Declare All Unknown Variables in Network…	Select to add unknown variables to the Software Declarations table.
Add '*variable-name'* to View List	If the cursor is on a know variable, select to add the variable to the view list. If multiple variables are highlighted, this item becomes **Add Selected Var(s) to View List** and all variables selected and declared will be added to the View List.
Add '*variable-name'* to Force List	If the cursor is on a know variable, select to add the variable to the force list. If multiple variables are highlighted, this item becomes **Add Selected Var(s) to Force List** and all variables selected and declared will be added to the Force List.
View UDFB/Task	If the cursor is on a UDFB or task, select to open the UDFB or task.
View Servo Function	If the cursor is on a servo function, select to open the servo function.
View SERCOS Function	If the cursor is on a SERCOS function, select to open the SERCOS function.

Compiling and Downloading

Compiling and Downloading

Compiling

When the development is complete, the ladder file can be compiled into one of the following:

- A BIN file which can either be downloaded directly to a control or stored in a directory or on a disk and later loaded into a control with the Restore command
- A HEX file which allows your ladder file to be copied to an EPROM
- A TASK creating a UDFB for use in a main ladder file
- A UDFB creating a customized UDFB for use in other ladder files

Downloading

Downloading sends the active ladder file on your workstation to the control memory after it has been compiled into an executable program.

The source form of your ladder file remains on the workstation. You can edit the source form, run animation, etc. Any off-line changes you make to the source file must be downloaded to the control before they take effect. Always backup this source ladder file to ensure that you will have a copy of your ladder file in its source form. Include in the backup the filenames for the ladder files with any of the following extensions:

LDO, REM, SRV, LIB, SRC, FRC, RTD, SVT, SCT, ADV, DDV

You can backup this executable form from the control to the workstation by using the **Online | Control Operations | User Program | Backup | Application Program** command or the button on the Basic Online Operations toolbar. You can restore any BIN file to the control memory with the **Online | Control Operations | User Program | Restore** command or the button on the Basic Online Operations toolbar.

Compiling a Bin File

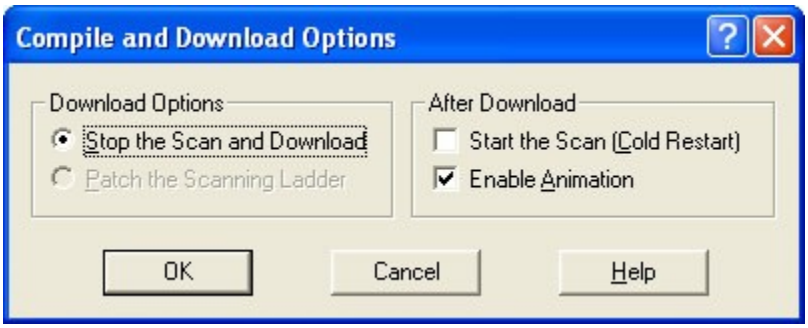
There are two options under **the Compile | Bin File** command**: Compile and Download**… or **Compile Only**.

These commands can be accessed from the button or the button on the Compiler toolbar.

Compile and Download

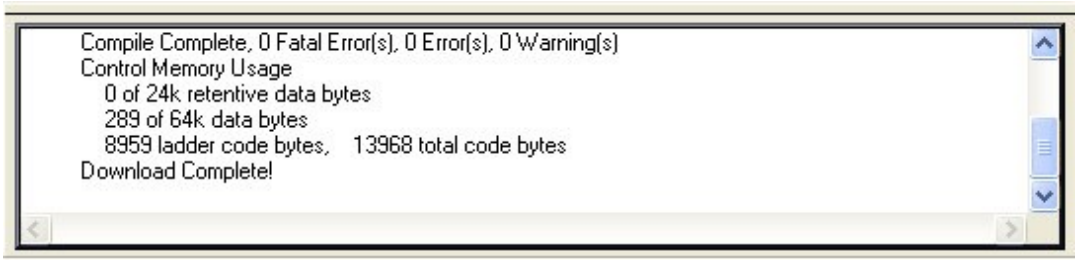
The **Compile and Download** command allows you to create a binary file out of the active ladder file on your workstation and download it to the control.

1. Ensure that your workstation is connected to the control.
2. To display the **Compile and Download Options** dialog, do one of the following:
   - Click the button on the Compiler toolbar.
   - Select **Compile | Bin File | Compile & Download…** from the menu.



You have two download options. You can choose to stop the scan and download the ladder file or, if you were able to make on-line changes to the ladder file, you can choose to patch the scanning ladder. You can also choose to restart the scan if it was stopped and have animation enabled after the download is complete.

3. The binary file is compiled and downloaded and the status is reported in the information window. If the download is successful without any errors, the memory usage information is shown in the info window.



This displays:

- The amount of retentive memory used in data bytes. (24K limit)
- The amount of memory used for data bytes. (64K limit)
- The amount of memory used for the ladder code bytes.
- The total code bytes for your application ladder plus libraries (The total code bytes must not exceed the application memory available on your CPU module).

Compile Only

The **Compile Only** command allows you to create a binary file without downloading it to the control. This provides an opportunity to check the ladder file for errors and make any corrections or to build a binary file that can be stored on disk or in a directory and later restored to a control.

1. Choose the **Compile | Bin File | Compile Only** command or the button on the Compiler toolbar. The binary file is compiled and the status is reported in the information window. If the compile is successful without any errors, the memory usage information is shown in the window.

Just like when you perform a compile and download, this displays:

- The amount of memory used for data bytes. (64K limit)
- The amount of memory used for the ladder code bytes.

- The total code bytes for your application ladder plus libraries (The total code bytes must not exceed the application memory available on your CPU module).

Compiling a Hex File

A ladder file that has been opened on your workstation can be saved in Intel 8086 Hex format. The name of the ladder file becomes the name of the hex file with a .HEX extension. This file may then be copied to an EPROM programmer to program your EPROMs or loaded to FLASH memory on processors that support this option.

To Compile a Hex File

1. Open the ladder file you want to compile as a hex file.
2. Choose **Compile | Hex** from the menu or choose the

button from the compiler toolbar.
3. If there are no errors, the hex file details are listed in the Information Window and the compile is complete.
4. The hex file is saved in the directory of the current ladder file with the ladder filename and the HEX extension.
5. If any errors occur during the compile process, they will be reported to the Information Window. The compile process will stop and you must edit the ladder to resolve the errors and compile again.

The **Download Hex** command from the **Online** menu is used to load the file to flash memory.

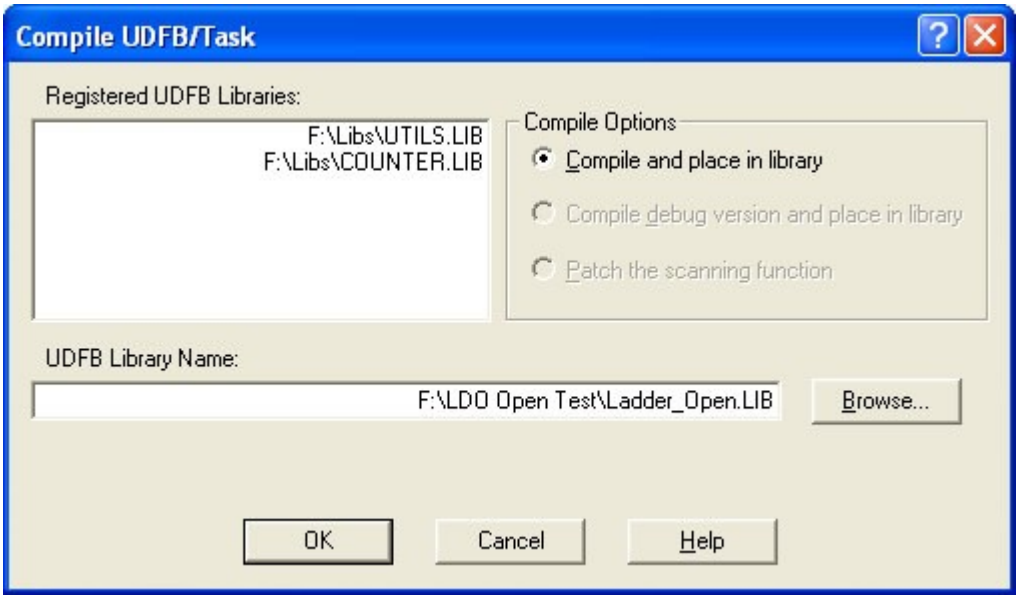
Compiling a Task

The logic you enter in a task ladder file is converted into a TASK function block by compiling it.

To Compile a Task

1. Open or create the ladder file you want to compile as a TASK.
2. To display the **Compile UDFB/Task** dialog, do one of the following:
   - Click the

button from the Compiler toolbar.
   - Select **Compile | Task** from the menu.



3. Under **Compile Options**, **Compile and place in library** is selected by default. The other options are grayed and not available for TASKs.
4. You must select the library file in which to insert the TASK. You can enter the name of a new library file in the **UDFB Library Name:** field. A confirmation message will appear. If there are existing libraries listed in the **Registered UDFB Libraries:** field, you may select one of them. If the task already exists in one of the registered UDFB libraries, this library will be selected by default and cannot be changed.

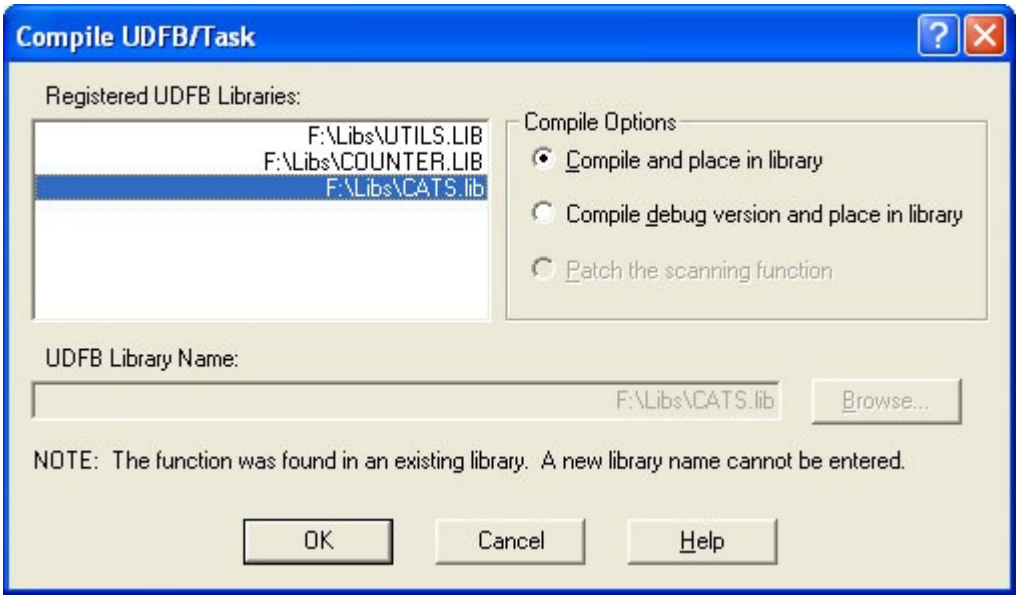
Note: You cannot place a TASK in any of the standard library files.

Compiling a UDFB

The logic you enter in a UDFB ladder file is converted into a function block by compiling it.

To Compile a UDFB

1. Open or create the ladder file you want to compile as a UDFB
2. To display the Compile UDFB/Task dialog, do one of the following:
   - Click the button from the compiler toolbar.
   - Select Compile | UDFB from the menu.



3. You may choose from the Compile Options to Compile and place in library or Compile debug version and place in library. The debug version reserves some space for patching. (Adds additional data bits (40), data bytes (80), and function/jump links (20) to each instance of the UDFB to allow you to perform more extensive on-line changes.)

Notes:

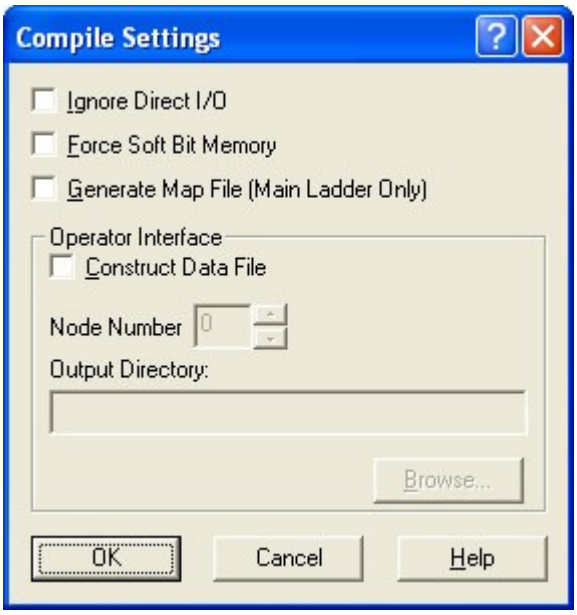
- Minor changes that do not add things like new functions, declarations, or jump labels can be made on-line without creating a debug version.
- You also must select the library file in which to insert the UDFB
- You can enter the name of a new library file in the UDFB Library Name: field. A confirmation message will appear. If there are existing libraries listed in the Registered UDFB Libraries: field, you may select on e of them.

- You are not allowed to place a UDFB in a standard library file.
- If the UDFB already exists in one of the registered UDFB libraries, this library will be selected by default and cannot be changed.

Compile Settings

The Compile Settings command under the **Compile** menu allows you to choose settings in four areas:

1. Ignore Direct I/O
2. Force Soft Bit Memory
3. Generate Map File (Main Ladder Only)
4. Use an Operator Interface



Ignore Direct I/O

If this setting is selected, the compiling of the binary file will occur with all the direct I/O disabled. Typically, this is used for testing where the current I/O does not match the specified I/O.

Force Soft Bit Memory

If this setting is selected, soft bit memory is enabled in all Turbo CPUs that do not have standard soft bit memory. Typically, this is used when data memory is low.

Generate Map File (Main Ladder Only)

If this setting is selected, a symbol map file will be generated for the main ladder whenever you do a compile. The map file is saved in the directory of the current ladder file with the ladder filename and the MAP extension. Subsequent compiles of the main ladder will automatically delete and regenerate the map file. Typically, the MAP File is used for debug purposes and to try to optimize data memory when data memory exceeds 64K.

Operator Interface

Within the operator interface box, there are several settings.

When the **Construct Data File** checkbox is checked, an operator interface data file (OID) is created when you compile the BIN file. This file contains the necessary information for the operator interface software.

The Operator Interface **Node Number** is usually set to 0. But it can be used to create multiple displays for a single machine. Available numbers are 0 to 255.

The Operator Interface **Output Directory** allows you to put the OID file in the directory of your choice. If you leave this box empty, the OID file will be placed in the same directory as the ladder file.

Extended Data Memory Feature

Extended Data Memory Feature

If you have a PiC control with a 486 processor running firmware dated August 1, 1999 or later and at least 512K of application memory, data memory can be extended beyond the standard 64K. Two additional data memory areas have been added bringing the total to three, each containing 64K providing a total of 192K of data memory for your control.

To take advantage of this feature, you do not have to do anything. But you should be aware of how the processor handles this extended memory feature. When you select the **Compile Only** or **Compile & Download** command, the first data memory area of 64K is allocated. When it is filled and more data area is needed, a second data memory area is automatically allocated. This data memory is taken from the application memory. When the second area is filled, a third data memory area is allocated. When that is used and filled, an error message will warn you that the PiC is out of data memory.

After a Compile command, the information window reflects how much data memory is being used and how much is allocated for each data memory area.

Note: The allocated memory may not match 64K exactly. If all three data memory segments are filled, you may want to optimize your memory usage by getting all three segments as close to 64K as possible. Call our technical support department for help with this.

You can produce a readable symbol map file using the **Compile | Compile Settings** dialog. Check the **Generate Symbol Map** check box so that a text file is generated when you compile. This can only be done from the main ladder file.

IMPORTANT
You must rebuild all UDFBs and TASKs if this is the first time you are using a version of PiCPro and firmware that have the Extended Data Memory feature.

Refer to: ***Compile Settings***

Tips on Working with Extended Data Memory

- The extended data memory feature requires a version of firmware dated August 1, 1999 or later and the CPU has at least 512K of application memory. The firmware version can be checked using **Online | Control Operations | Status**.
- Retained variables and discrete I/O are restricted to the first data segment. This means you cannot have a combined total of more than 64K of them. You will get an "out of data memory" error message if this is exceeded.
- UDFBs are restricted to 64K of data memory.
- No structure or array may be larger than 64K. An error message will be issued if one is found.
- Patching of data is allowed up until the last data memory area is filled. At that point, a full compile and download is required.

IMPORTANT
UNPREDICTABLE RESULTS MAY OCCUR if you group arrays in software declarations so that they are treated as one large array using an index value that exceeds the first array's limit! It is NOT recommended that you do this.

It is possible to change the memory configuration in PiC controls with 486DX processors and the MMC for PC. The default configuration is 256K of RAMDISK and 512K of Application memory. If you find it necessary to change the default configuration, use the **Download Hex** command from the **Online** menu available before any files are open.

Animating the Ladder

Animating the Ladder

Animation allows you to monitor the power flow in the LD networks of a ladder diagram that has been compiled and downloaded to the control and in one or multiple UDFB and/or TASK ladder files that are displayed. Variables used in ST networks must be animated in the View List.

To Turn Animation On, follow these steps:

1. Compile and download the ladder.
2. Display any UDFB or Task LDOs you want to animate using the **View | UDFB/Task** command.
3. To turn on animation, choose one of the following:
   - Click the button on the Advanced Operations toolbar
   - Select **Online | Control Operations | Animate** from the menu

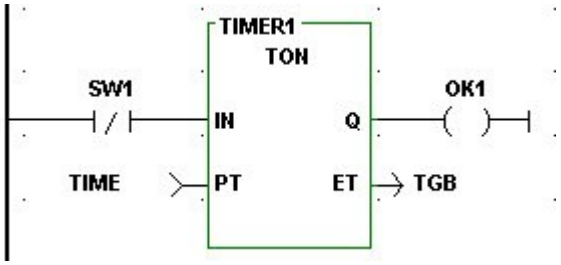
Power flow is indicated by heavy wire in customized color. The default is red. Use the button to change the color. Any energized element (contact, coil, etc.) in the ladder will be highlighted in the color chosen.

Numeric variables are displayed above the variable name. These variables are updated dynamically as the contents change. You can view things like timers or counters changing. If the results of working with floating point numbers yield an infinite, indefinite, or not-a-number result, the OK on the function will not be set and animation will display the following labels:

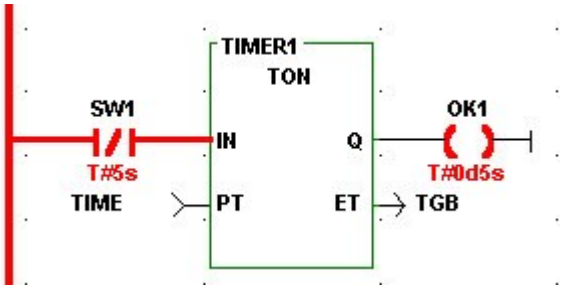
Value	Output
+Infinity	1.#INF
-Infinity	-1.#INF
Indefinite	*digit*.#IND
Not-a-number	*digit*.#NAN

All variable lengths are dependent on cell size for display. If a string is too long for the cell, you can view it in the view list.

Ladder with Animation Off

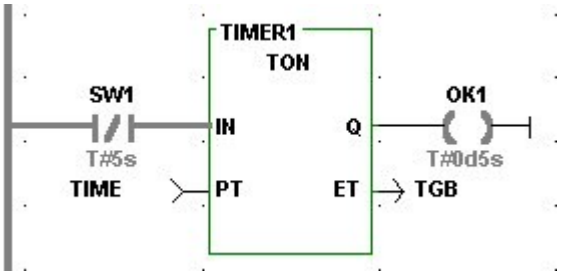


Ladder with Animation On, Scan Running



If the scan is stopped while animation is on, the color of the power flow is grayed to indicate that the control is no longer scanning. When the scan is started again, animation will resume.

Ladder with Animation On, Scan Off



To Turn Animation Off, do any of the following:

- De-select Online | Control Operations | Animate | LDO from the menu.
- Toggle the button on the Advanced Operations toolbar when the window which should no longer be animated has focus.
- Enter the edit mode for the ladder file. A message will tell you that the workstation version is no longer identical to the control version. The ladder file must be compiled and downloaded after an edit.
- Access any dialog other than View List or Forcing List.

When animation is turned off, any numeric values shown above the variables are no longer displayed.

Forcing and Viewing Variables

Forcing & Viewing Variables

Forcing is a way to alter the contents of up to 61 variables while the program is running. It is a powerful tool in isolating a problem. Variables can be forced individually or as a group. Grouping is an extension of the forcing feature. One example of how it could be used is to allow you to toggle the state or value of a variable by entering one value or state in grouping and the other in forcing and then switching between them.

When testing or debugging a software module, you can Force a value into the following:

- An input element to simulate the data input from an application device, which has not been connected
- An element that enables a function or function block you want to check
- A preset timer variable to check what happens when it times out

When troubleshooting an application, you can Force a value into the following:

- An output element to locate a problem when troubleshooting an application
- Selected elements between an input that works and an output that does not to isolate an internal problem

W A R N I N G

Do not force any variable in a program that is running an application until you are sure you understand all the effects the changes may cause. A malfunctioning program may cause injury or damage the machinery.

Note: Forcing is turned off automatically when power is cycled. If you use the power reset button in PiCPro, a warning message will inform you of this.

If you have a forcing list open but inactive when you attempt to turn forcing on, you will get a message that asks if you want to activate forcing. When you switch from the main ladder force list to a UDFB force list, you turn off the main force list and vice versa.

Briefly, to force a variable, you will do the following:

1. Enter the variable name and value in the Force List.
2. Mark the variable in the Force List to enable it.
3. Turn Force on.
4. If needed, edit the Force List and update the forcing information to the control.

I M P O R T A N T

Animation may not reflect forced conditions. Physical inputs are forced at the beginning of the scan. All other variables are forced at the end of the scan. The writing of variable values by the ladder is not inhibited by forcing. Therefore, it is possible to change the state of a coil during the scan but not see the change in animation.

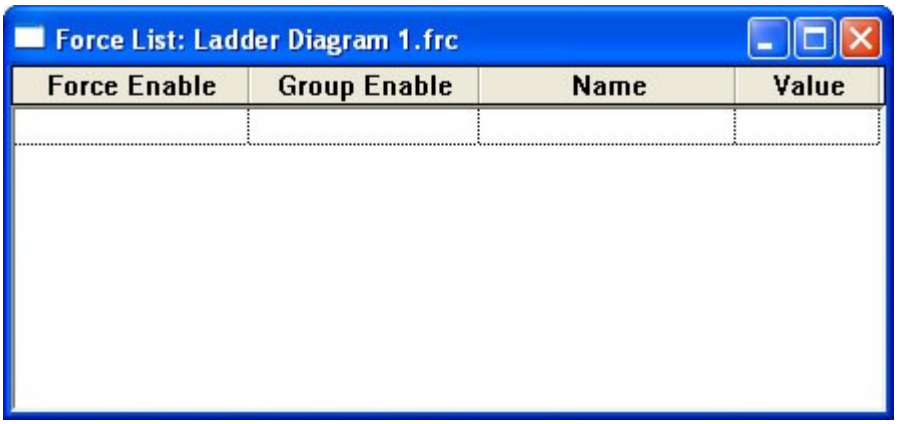
Entering Variables in the Force List

With control running and your ladder file open, you are ready to enter variables into a Force list. Only one Force List is created for each ladder file. It is given the FRC extension and the same filename as the ladder file.

To bring up the Force list, choose one of the following:

- Click the button from the View Navigator toolbar
- Select **View | Forcing List** from the menu

The **Force List Window** appears with focus on the **Name** column. The Window and columns are sizable.



You have four ways to enter a variable into the Force List Window:

Copy/Paste

1. Copy the element in the ladder file that you want to place in the Force List.
2. Open or activate the **Force List Window**.
3. Position the focus in the Force List Window grid and paste the selection.
   If you are in a blank row, the variable you are entering will fill that row.
   If you are in a row that already contains a variable, the new variable will appear in a row above the existing one.
   If you are in a row that is highlighted, the new variable will replace that row.
4. Enter a value in the **Value** column. An error message will appear if the value you enter is out of range, incompatible, etc.
5. Check the **Force Enable** and/or **Group Enable** column.

Drag-n-Drop

1. Open or activate the **Force List Window**.
2. Select the variable in the ladder to add to the Force List.
3. Drag the selection from the ladder to the Force List row you want to insert the variable in and release the button.
4. Enter a value in the **Value** column. An error message will appear if the value you enter is out of range, incompatible, etc.
5. Check the **Force Enable** and/or **Group Enable** column.

Right-Click Menu in Ladder

1. Select the variable in the ladder to add to the Force List.
2. Right-click and select **Add Symbols to Force List**. The variable will be added to the end of the Force List.
3. Enter a value in the **Value** column. An error message will appear if the value you enter is out of range, incompatible, etc.
4. Check the **Force Enable** and/or **Group Enable** column.

Manual Entry

1. Open or activate the Force List Window.
2. Place the focus in the **Name** column of the Force List.
3. Type in the name of the variable you want to add or click on the down arrow to bring up a list of all variables in the software declarations table except function blocks. If the symbol is an array, it will be entered into the list as an ARRAY( ). You must enter the index number in the parenthesis.

4. Enter a value in the **Value** column. An error message will appear if the value you enter is out of range, incompatible, etc.
5. Check the **Force Enable** and/or **Group Enable** column.

Turn Forcing/Grouping On/Off

Turn Forcing/Grouping On

In order to activate variable forcing/grouping, the following conditions must be met:

- The LDO file is open.
- The LDO file has been compiled and downloaded to the control.
- If you make any changes after the download, be sure to compile and download again or the time stamps will be different. If the time stamps are different, an error message will appear and you will not be able to activate forcing.
- The Force List Window is open (the window does not have to be active)

.

If the above conditions are met, you have two ways to turn forcing on.

Turning On Forcing/Grouping from the Online Menu

1. Check all variables that you want to force and/or group in the **Force Enabled** column or in the **Group Enabled** column respectively of the Force List.
2. Choose **Online | Control Operations | Force | Forcing** from the menu to activate forcing. Select **OK** from the OK/Cancel confirmation that appears.
3. Choose **Online | Control Operations | Force | Grouping** from the menu to activate grouping. Select **OK** from the OK/Cancel confirmation that appears. Turning off forcing turns off grouping. The symbols for forcing and grouping will appear on the status bar when they are on.

Turning On Forcing/Grouping from the Toolbar Buttons

1. Check all variables that you want to force and/or group in the **Force Enable** column or in the **Group Enable** column respectively of the Force List.
2. Toggle forcing on by choosing the button from the Advanced Operations toolbar.
3. Toggle grouping on by choosing the button from the Advanced Operations toolbar.

The symbols for forcing and grouping will appear on the status bar when they are on.

Turning Off Forcing/Grouping from the Online Menu

1. Choose **Online | Control Operations | Force | Forcing** from the menu to deactivate forcing. If grouping is on, it will be turned off when forcing is deselected.
2. Choose **Online | Control Operations | Force | Grouping** from the menu to deactivate grouping.

Turning Off Forcing/Grouping from the Toolbar Buttons

1. Toggle forcing off by choosing the button from the Advanced Operations toolbar. **Note:** If grouping is on, it will also be toggled off.
2. Toggle grouping off by choosing the button from the Advanced Operations toolbar.

Updating the control after Force List is edited

While forcing, you can change any entries in the Force List. These changes can then be updated in the control.

1. Edit the Force List.
2. Choose one of the following methods:
   - Click the button from the On-line menu.
   - Select **Online | Control Operations | Force | Update Forcing List** from the menu

Note:

If you delete any or all entries from your force list without updating the control, the entries remain active.

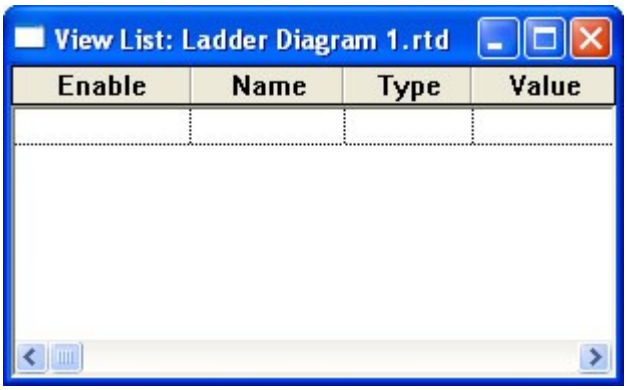
Viewing Enabled Variables

With control running and your ladder file open, you are ready to enter variables into a View List. Only one View List is created for each ladder file. It is given the RTD extension and the same filename as the ladder file.

To bring up the View List, choose one of the following:

- Click the button from the View Navigator toolbar
- Select **View | View List** from the menu

The **View List Window** appears with focus on the **Name** column. The Window and columns are sizable.



You have four ways to enter a variable into the **View List Window**.

Copy/Paste

1. Copy the element in the ladder file that you want to place in the View List.
2. Open or activate the **View List Window**.
3. Position the focus in the View List grid and paste the selection.
   If you are in a blank row, the variable you are entering will fill that row.
   If you are in a row that already contains a variable, the new variable will appear in a row above the existing one.
   If you are in a row that is highlighted, the new variable will replace that row.
4. Check Enable.

Drag-n-Drop

1. Open or activate the **View List Window**.
2. Select the variable in the ladder to add to the View List.

3. Drag the selection from the ladder to the View List row you want to insert the variable in and release the button.
4. Check **Enable**.

Right-Click Menu in Ladder

1. Select the variable in the ladder to add to the View List.
2. Right click and select **Add Symbols to View List**. The variable will be added to the end of the View List.
3. Check **Enable**.

Manual Entry

1. Open or activate the **View List Window**.
2. Place the focus in the **Name** column of the View List.
3. Type in the name of the variable you want to add or click on the down arrow to bring up a list of all variables in the software declarations table except function blocks. If the symbol is an array, it will be entered into the list as an ARRAY( ). You must enter the index number in the parenthesis.
4. Check **Enable**.

Turning Animation On in the View List

In order to view the variable values, which are updated dynamically in the View List, you must turn animation on in the View List.

1. Ensure that the View List has focus.
2. To turn on animation in the View List, choose one of the following:
   - Click the button on the Advanced Operations toolbar
   - Select **Online | Control Operations | Animate** from the menu

Controlling the Scan

Controlling the Scan

When the control is running, the CPU repeatedly scans the application program in its memory. A scan is the cyclical process of:

1. Reading data from the hardware input modules
2. Using the forcing list to modify input data
3. Executing ladder logic and using the data to update program variables*
4. Using the forcing list to modify output data
5. Sending commands to the hardware output modules
6. Sending data to the workstation to be displayed in animation and/or view modes

Note:

When you created your ladder program, the PiC hardware modules were declared under Hardware Declarations. Each input/output point was assigned to a specific logic element through the Software Declarations.

* Step 3 above is referred to as the ladder scan and the remaining steps are referred to as the system overhead. How long a scan takes depends on the length and complexity of the program.

IMPORTANT

The PiC or MMC systems shut down as a safety measure if either the ladder scan or the overhead takes more than 200 ms.

Note:

To display the Scan Control menu, select Online | Control Operations |Scan Control from the menu.

WARNING

Do not use any commands in the **Scan Control** menu until you understand how the control system runs and exactly how the command will affect the application. Starting or stopping the scan at random may cause injury or damage to machinery.

Stopping the Scan

When you stop the scan, the current scan is completed, but the logic commands sent to the output modules are all zero. Power is still on to the system so all elements in the program - timers, counters, input contacts, output coils, etc. keep their values until the scan starts again.

To Stop the Scan, choose one of the following:

- Click the button from the Basic Online Operations toolbar.
- Select Online | Control Operations | Scan Control | Stop from the menu.

Running One Scan

The CPU will run through one complete scan and then send zeros to all the outputs when this command is issued.

To Run One Scan, choose one of the following:

- Click the button with the BLUE arrow from the Basic Online Operations toolbar.
- Select Online | Control Operations | Scan Control | Run One from the menu.

Restart Scan

Restart Scan

There are three ways you can restart the scan from the **Scan Control** menu.

However, do not use any commands in the menu until you understand how the control system runs and exactly how the command will affect the application.

Doing a Hot Restart

If you restart the scan with a hot restart, all the element values are kept as they were when the scan stopped. The application continues as if the Stop scan command had not been sent.

To do a Hot Restart, choose one of the following:

- Click the button with the circular RED arrow from the Basic Online Operations toolbar.
- Select Online | Control Operations | Scan Control | Hot Restart from the menu.

Doing a Warm Restart

If you restart the scan with a warm restart, all elements that were declared with the retentive attribute will keep the values they had when the scan stopped. All other elements return to the initial values they had when the module was first downloaded. Scanning resumes and the application continues normally.

To do a Warm Restart, choose one of the following:

- Click the button with the circular YELLOW arrow from the Basic Online Operations toolbar.
- Select Online | Control Operations | Scan Control | Warm Restart from the menu.

Doing a Cold Restart

If you restart the scan with a cold restart, all elements are returned to their initial values declared by you as if the module had just been downloaded.

To do a Cold Restart, choose one of the following:

- Click the button with the circular BLUE arrow from the Basic Online Operations toolbar.
- Select Online | Control Operations | Scan Control | Cold Restart from the menu.

Online Editing

In normal program development, you edit your ladder and then download the entire module to the control to incorporate the changes. The scan is stopped during this download and you must restart the scan when the download is complete.

There may be times when you need to edit or patch the ladder on-line without stopping the scan. If you make changes to the ladder that is currently being scanned in the control and choose compile and download, you are given two choices.

- Stop the Scan and Download (off-line edit)

  OR

- Patch the Scanning Ladder (on-line edit)

If you choose **Patch the Scanning Ladder**, only the changes you have just made will be downloaded and the scan is not stopped. The changes will take effect at the beginning of the next scan. These changes become a permanent part of the program in your control. They are included in any backup from the control. When you are working with UDFBs, you can patch the main module and the source ladders of any UDFB. Animation is turned off when patching but forcing remains on.

When the patch download is complete, the information window will summarize the resources listed below that you still have available.

- Data Bits (in hard bit systems only)
- Data Bytes
- Code Bytes
- Number of Patches (out of 100)

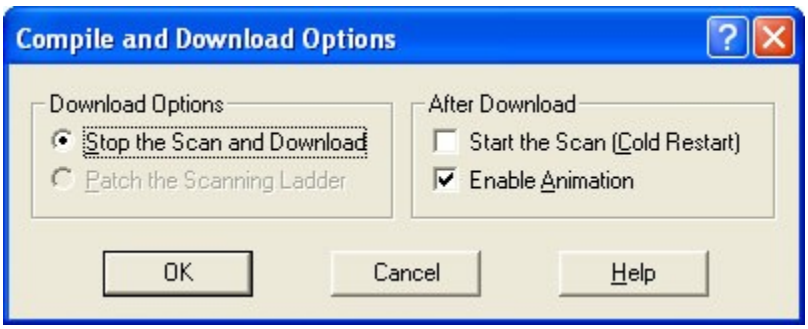
- Number of Label/Function Links (out of 27)

Patch the Scanning Ladder is not available in the following situations.

- If any changes have been made to the hardware declarations, you must do a full download stopping the scan to incorporate them into your ladder.
- If more than 40 internal tasks have been added/modified in the current ladder
- If more than 100 patches have been added to the current ladder
  Every time a network is modified, it is considered one patch but could include several internal tasks.
- If more than 27 label or function links have been established in the current ladder
- If the network to be patched contains a TASK
- If the application program is in EPROM memory
- If you have ignored a previous Save request from PiCPro
- If you change or add initial values to existing variables, you must do a full download stopping the scan to incorporate these into your ladder. You can add new variables with initial values with on-line edit.

To perform an on-line edit or patch

1. Enter your changes into the ladder. Save the file.
2. To display the Compile and Download Options dialog, choose one of the following:
   - Click the button on the Compile toolbar.
   - Select **Compile | Bin File | Compile & Download** from the menu
   - The **Compile and Download Options** dialog appears with the defaults shown.



3. Select Patch the Scanning Ladder and click OK.

To abort a patch

You can undo the last patch downloaded to the control with the Abort Last Patch command. This will remove the patch from the control but does not remove it from your ladder. You can redo the patch in your ladder and do another patch download. The Abort Last Patch command remains enabled after patching a ladder until one of the following occurs:

- The next full download is performed.
- The ladder doc is closed.
- PiCPro is closed.

1. After a patch has been downloaded to the control, choose one of the following:
   - Click the button on the Online toolbar
   - Select **Online | Control Operations | Abort Last Patch** from the menu
2. The last patch is removed from the control. Edit your ladder to remove it from your ladder program.
3. To download the edited ladder to the control, choose one of the following:
   - Click the button from the Compile toolbar
   - Select **Compile | Bin File | Compile & Download** from the menu

IMPORTANT
Aborting the last patch removes the operation but not necessarily the effect of that operation from the control. For example, if you add a new network that turns on a new coil and do a patch download followed by an Abort Last Patch command, the network is removed from the control but the coil will remain on.

Printing

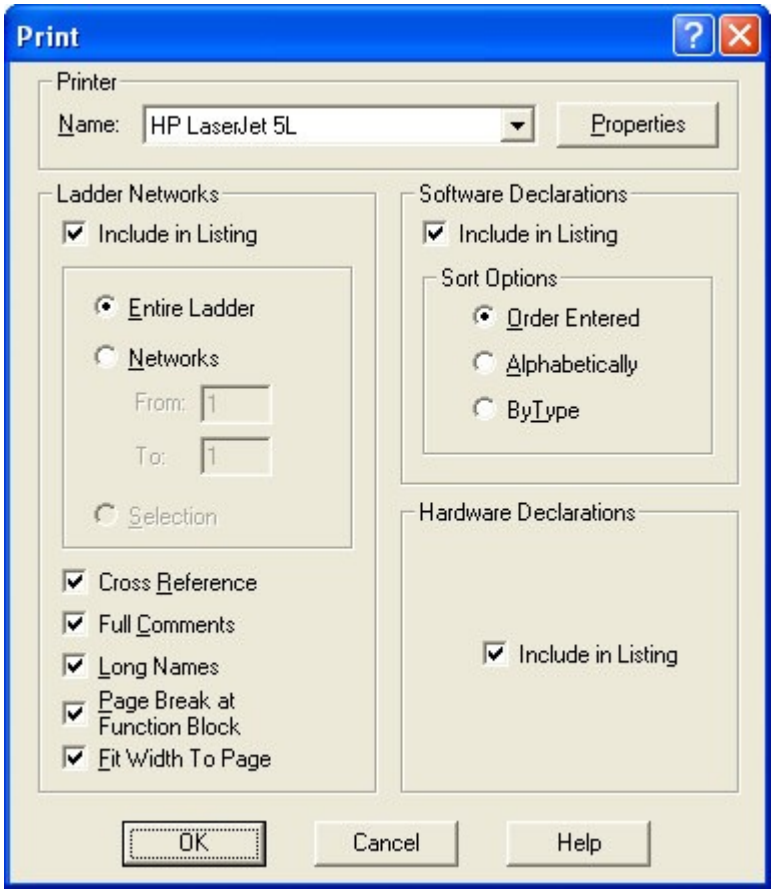
You can print your ladder file, the View list, Forcing list, or the Information Window. Put focus, by clicking, on the window you want printed, and choose **File | Print.**

Printing the Ladder

Once your ladder program is developed, you can print it out using the print command.

To print the ladder file, follow these steps:

1. Make the window that contains the ladder active.
2. Choose any of the following to bring up the print dialog:
   - Click the button on the standard toolbar
   - Select **File | Print** from the menu
   - Press <**Ctrl + P**>
   - Right-click and select **Print**
3. Make your selections or accept the defaults and click **OK** in the print dialog.



Selections in the Ladder Network Section of the Print Dialog

Include in Listing

The **Include in Listing** box is checked (default) and the **Entire Ladder** selected (default). If you do not want to print the entire ladder you have two choices.

- You can print a range of networks by selecting **Networks** and entering a range in the **From:** and **To:** fields. The From/To fields initially contain the range of networks for the entire ladder.
- You can print a previously highlighted ladder selection by choosing **Selection**.

Cross Reference

When the **Cross Reference** box is checked (default), all cross-reference information on all elements in the ladder is printed. The listing includes:

- Name
- Type
- Source (Where written)
- Used (Where)

The listing is sorted alphabetically by the variable name. At the end of each network, a Network Coil Usage list will be printed listing all the outputs along with any other networks which reference the same output. Each contact/coil element will also display cross-reference information. Variable names longer than 22 characters are displayed on a separate line followed by the 'used in' information.

- Beneath contacts/coils representing direct inputs/outputs, the I/O point is displayed.
- Beneath all other contacts, the source network(s) is displayed.

Full Comments

When the **Full Comments** box is checked (default), the entire comment for each network is printed. If unchecked, the first line of each comment is printed.

Long Names

When the **Long Names** box is checked (default), the long name is printed below each element in a ladder network for which you have entered a long name for in software declarations. This has no impact on ST networks.

Page Break at Function Block

When the **Page Break at Function Block** box is checked (default), a page break is inserted to prevent a function block from being printed on two pages if possible.

Fit Width to Page

When the **Fit Width to Page** box is checked (default), the widest network determines the font, etc. so that the network will print on the page. If this is not checked, printing can span multiple pages, both vertically and horizontally. Print size is affected by current zoom settings and cell width options.

Selections in the Software Declarations Section of the Print Dialog

Include in Listing

When the **Include in Listing** box is checked (default), the software declarations table is printed with the ladder. You can choose to sort the software declarations by one of the following:

- Order Entered (default)
- Alphabetically
- By Type

Note:

When you choose to print a portion of your ladder, only the software declarations connected to the printed portion will be included.

If a variable name is longer than 8 characters, the name is displayed on a separate line. The line(s) following the name display the type, attribute, I/O point, initial value and long name.

Selections in the Hardware Declarations Section of the Print Dialog

Include in Listing

When the **Include in Listing** box is selected (default), the hardware declarations are printed with the ladder.

Printing View List, Force List, or Information Window

You can also open a file and print the View List, Force List, or the Information Window from the standard Windows print dialog. Choose one of the following to print:

- **View | View List** and then select **File | Print** from the menu.
- **View | Forcing List** and then select **File | Print** from the menu.
- **View | Information Window** and then select **File | Print** from the menu.

To print the view list, force list, or information window, follow these steps:

1. Ensure that the list or window you want to print is active by clicking it. If you want to print part of the list or window, highlight that portion before choosing the print command.
2. Choose any of the following to bring up the print dialog:
   - Click the button on the standard toolbar
   - Select **File | Print** from the menu
   - Press <**Ctrl + P**>
3. Make your selections or accept the defaults and click **OK** in the print dialog.

Printout Symbols

When you print out a copy of your ladder, these symbols may appear.

Symbol	Description
&	Appears in the cross reference section of the printout and in the Network Coil Usage section at the end of each network telling you that the output/coil is sourced in more than one place.
/	Appears in the cross-reference section of the printout and also in the Network Coil Usage section at the end of each network telling you that the contact is normally closed.
@	If a network contains a complex variable name, an alias will be substituted in the printout. The alias format is @1 for the first substitution, @2 for the second substitution…up to @255. Numbering is restarted within each network.
I04.01 or I2.04.01	Appears under a direct input to indicate the following: • Input in master rack (I), slot 4 (04), channel 1 (01) **OR** • Input in expansion rack 2 (I2), slot 4 (04), channel 1 (01) **OR** • A standalone MMC or MMC for PC specific Input point
O03.01 or O2.03.01	Appears under a direct output to indicate the following: • Output in master rack (O), slot 3 (03), channel 1 (01) **OR** • Output in expansion rack 2 (O2), slot 3 (03), channel 1 (01) **OR** • A standalone MMC or MMC for PC specific Output point

Troubleshooting the Print Option

If your file does not print, check the following:

1. Printer is on-line and supplied with paper.
2. The computer end of the cable is plugged into the correct port. Make sure the connections are secure on both ends.
3. Run the printer's diagnostic tests, then try to print the file again.
4. If the printer still does not print, check these possibilities:
   - An incorrect or damaged cable
   - A malfunctioning port on the workstation
   - A malfunctioning port on the printer

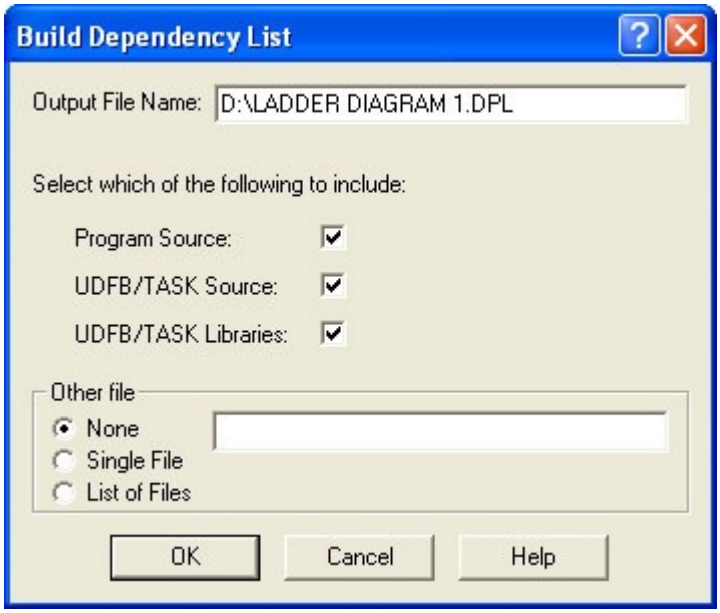
Building a Dependency List

Building a Dependency List

When you build a dependency list, you create a complete list of all the files that are related to the module you are currently running in PiCPro. The list can include all the LDO source, REM source, UDFB/TASK sources, and UDFB/TASK libraries required to run the program. If you have FLASH memory installed on your control, the dependency list can be used to send all the listed files to the FMSDISK using the Flash Disk Operations under the online menu.

To build a dependency list

1. Select **View | Build Dependency List**… from the menu.
2. The **Build Dependency List** dialog appears. It defaults to include the program source, the UDFB/TASK source, and the UDFB/TASK libraries.
   The **Other file** section allows you to include additional files in your dependency list.



3. When you click **OK**, the list is generated and saved to the current folder of the active ladder. The filename is that of your ladder with a DPL extension.
4. To view your dependency list, open the .dpl file in a text editor program.

Comment Import and Export

Importing Comments

You can import a text file of exported comments (or a text file of comments you have created) into your ladder file.

1. Select **Ladder | Comments | Import** from the menu.
2. Browse to the location on your workstation of the text file you want to import and select it so that it appears in the entry field.
3. Select either the option to update the comments or the options to replace all comments with the text file.
   - **Update comments with text file** option: This is the default. Only the comments whose index or network number is in the text file will be modified in the ladder.
   - **Replace ALL comments with text file** … option: ALL comments in the ladder file will be removed and replaced with the comments defined in the text file. In other words, any comment in the ladder file that has no counter part in the text file is removed.
4. Click the **Start** button. The Action display shows the progress.

Note: After importing comments, the ladder file must be saved to keep these changes.

Exporting Comments

You can export the ladder comments to a text file. You can then open and edit the text file using a text editor. This text file can then be imported back into the same ladder or into a different one.

1. Select **Ladder | Comments | Export** from the menu.
2. Enter the path and filename for the text file that will hold the comments. The default will be the path and filename of the ladder file with a .txt extension.
3. Select the option to use index numbers (#n) used by the software to keep track of each network comment or to use the actual network numbers (@n). The symbol and number appear above your comment in the text file.
4. Select the **Start** button. A bar shows the progress.

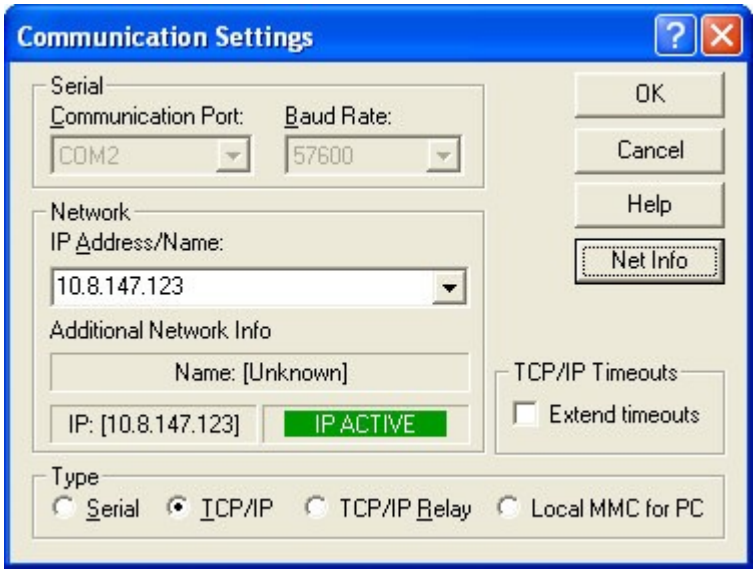
Note:

- Comments in a ST network that being with (* and end with *) are not exported.
- Never change the number or use the # (or @) symbol in the first column of any comment you edit in the text file.

Communications

Communication Settings

Your workstation and control must be set up to communicate with each other. The **Comm Settings** command found under the **Online** menu item allows you to set the serial communications port, the baud rate, the IP address if communicating via Ethernet, and the type of communications you are doing: serial or Ethernet-TCP/IP.



- The Type section specifies the type of communicating you are doing:

  Serial, **TCP/IP** (if you have an Ethernet card in your workstation),

  TCP/IP Relay (if you do not have an Ethernet card in your workstation)

  Local MMC for PC (if you have an MMC for PC in your workstation).
- With TCP/IP Relay, you select a RS232 connection to a control and then an Ethernet connection to another control that has an Ethernet-TCP/IP module installed. Use the ***Danaher Motion Ethernet-TCP/IP configuration tool*** to set up the module.
- The Serial section is active if you choose **Serial** or **TCP/IP Relay** as a communication type. You select a RS232 communication port that the control is connected to and a baud rate to communicate at.
- If you choose **TCP/IP** or **TCP/IP Relay**, the Network section is active. You enter the **IP Address** in dotted decimal format, name, or internet format. This is the address of the control you are communicating with over Ethernet.
- If you click the **Net Info** button, additional information associated with the IP Address/Name is displayed. An indication is also provided if the destination IP Address/Name is on the network and this computer can communicate with it. If the IP Address/Name field is empty, clicking Net info will display information about the IP address of the computer that PiCPro is running on.
- The TCP/IP Timeouts section is available if you choose either **TCP/IP** or **TCP/IP Relay**. Selecting **Extend timeouts** increases the timeout value for TCP/IP network and internet connections between PiCPro and the control. This means that PiCPro will wait longer for a response from the control before issuing a communications timeout message.

Note:

If you are experiencing timeouts with your control that is connected via your TCP/IP network or the internet, try running with this option selected. Be aware, however, that because PiCPro will now wait longer for messages from the control, you will probably experience a slowdown in the responsiveness of PiCPro (especially animation, which relies on the receipt of messages from the control to supply the animation.)

Communications Status

The current status of communications with the control, as well as additional information about the control can be displayed.

To access this information, choose one of the following:

- Click button from the basic online operations toolbar
- Select Online | Control Operations | Status from the menu

From the dialog, click the question mark in the top right corner and then click on any of the statuses displayed to get more information. You cannot change any of the information from this dialog.

Time Read/Set

The control has its own battery-powered clock located in the CSM. This dialog allows you to edit the current time and date inside the control.

Get System Time fills the edit fields with the data from the workstation settings.

Note:

To ensure that the time for PiCPro in Windows and PiCPro for DOS match, on your DOS computer, you must add a line in your CONFIG. SYS file. The following example applies to a time zone setting of Central Standard Time with a six hour difference between UTC and local time and Central Daylight Savings time.

```
Set TZ=CST6CDT
```

Refer to the DOS documentation regarding the environment variable TZ and how to set it for your time zone.

Downloading a Hex File

Overview: Downloading a Hex File

The Download Hex File command allows you to do any of the following:

- Configure application/RAMDISK size.
- Update control firmware.
- Update drive firmware (for drives only).
- Update TCP/IP firmware.
- Update the SERCOS module firmware.
- Load the ladder flash memory on the CPU.
- Clear the ladder flash memory.
- Clear the ladder application memory.

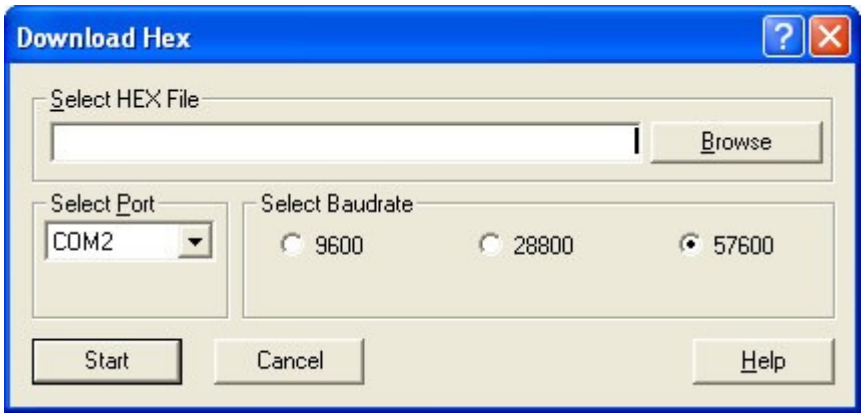
Note: Back up your RAMDISK and ladder before downloading new firmware.

Downloading a Hex File for a PiC or Standalone MMC

To use the Download Hex command, PiCPro must be running on your workstation and communicating with a PiC, Standalone MMC or Digital MMC control. No files can be open. If a file is open, this command will be grayed and inaccessible.

Follow this procedure to download a hex file:

1. Select **Online | Download Hex** from the menu.
2. The **Download Hex** dialog appears. Use **Browse** button to select the Hex file you want to download. The default location for these files is the firmware folder for PiCPro.



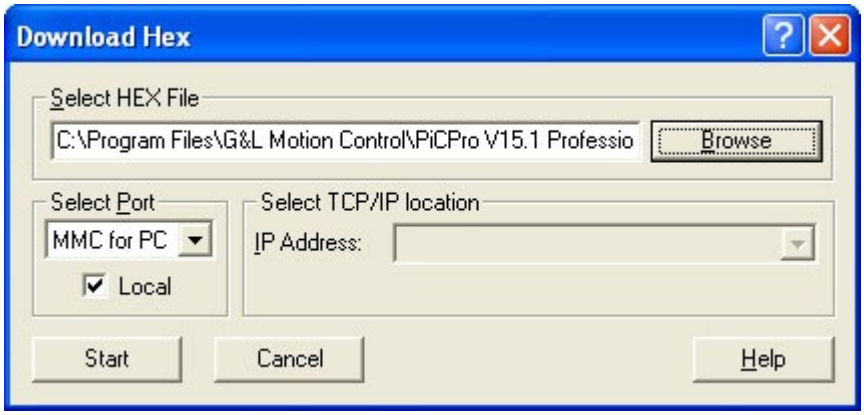
3. Select the appropriate **Baudrate** if different from the default of 57600.
4. Select the **Port** if different from the default (PiCPro port).
5. Click **Start** to begin downloading the hex file. Read and follow each prompt carefully. They will tell you to turn the control off and then back on again.
6. A status bar will show you the progress of the download.
7. If any errors occur, they will be reported in the Information Window.

Downloading a Hex File to a MMC for PC

To use the Download Hex command, PiCPro must be running on your workstation and communicating with a MMC for PC control. No files can be open. If a file is open, this command will be grayed and inaccessible.

Follow this procedure to download a hex file:

1. Select **Online | Download Hex** from the menu.
2. The **Download Hex** dialog appears. Use **Browse** button to select the Hex file you want to download. The default location for these files is the firmware folder for PiCPro.



3. Use **Select Port** drop down list to select the com ports available on the computer. Select the MMC for PC port.
4. Use the **Local** checkbox to indicate that the MMC for PC is in the local machine. If the MMC for PC is not in the computer you are currently using, uncheck the box.
5. Use the **Select TCP/IP location** drop down lists to enter the **IP Address**.
6. Click **Start** to begin the download process.
7. A status bar will show you the progress of the download.
8. If any errors occur, they will be reported in the Information Window.

Configure Application/RAMDISK Size

It is possible to change the memory configuration in the PiC and MMC for PC. The default configuration is 256K of RAMDISK and 512K of Application memory. If you find it necessary to change the default configuration, use the **Download Hex** command from the **Online** menu available before any files are open.

The five memory configuration hex files are found in the Firmware folder in your PiCPro folder. (Application Memory sizes are approximate). They are:

- *512K Application Memory Configuration.hex*
  *(*256K of RAMDISK and 512K of application memory) default
- *384K Application Memory Configuration.hex*
  (384K of RAMDISK and 384K of application memory) optional
  Cannot be used with extended memory feature.
- *640K Application Memory Configuration.hex*
  (128K of RAMDISK and 640K of application memory) optional
- *704K Application Memory Configuration.hex*
  (64K of RAMDISK and 704K of application memory) optional
- *768K Application Memory Configuration.hex*
  (0K of RAMDISK and 768K of application memory) optional

W A R N I N G

The contents of the RAMDISK and APPLICATION memory areas will be erased when you change the memory configuration. You will have to reload the contents of these memory areas after changing the configuration.

Refer to:

- ***Downloading a Hex File***
- ***Disk Operations (FMS/RAMDISK)***

Update CPU's Firmware

To update the CPU firmware, connect the workstation to the control.

Using the Online | Download Hex command, select the appropriate .hex file from the Firmware folder. Click Start once you have set the proper port and baud rate (if different from the default settings).

Update TCP/IP Module Firmware

To update the Ethernet TCP/IP module firmware, connect the workstation to the RS232 Com 2 Port on the module.

Using the **Online | Download Hex** command, select the Ethernet TCPIP R####.hex file (where #### is a version number) from the Firmware folder. Click **Start** once you have set the proper port and baud rate (if different from the default settings).

Update SERCOS Module Firmware

To update the SERCOS module firmware, connect the workstation to the RS232 Port on the SERCOS module.

Using the **Online | Download Hex** command, select the SERCO##.hex file (where #### is a version number) from the Firmware folder. Click **Start** once you have set the proper port and baud rate (if different from the default settings).

Update Drive Firmware

To update the drive firmware, connect the workstation to the drive.

Using the **Online | Download Hex** command, select the .hex file from the Firmware folder. Click **Start** once you have set the proper port and baud rate (if different from the default settings).

Downloading Ladder Hex File

A ladder can be downloaded to the CPU flash memory using the Online | Download Hex after you have created the .hex file using Compile | Hex File.

If the battery in the control were to become low on power (or runs out), when the CPU was next powered up, the ladder would be taken from the flash memory and loaded to the application memory.

Clear Flash Memory

To clear the flash memory in the control, from the **Online** menu, select **Download Hex**. Select the clrflash.hex file from the Firmware folder. Click **Start** once you have set the proper port and baud rate (if different from the default settings).

This procedure should be done before using the Clear Application procedure.

Clear Application Memory

If you are using a standalone MMC, MMC for PC or MMC Digital control, the Clear Application Memory command provides a software solution to clearing out a ladder application that may not be scanning correctly. When you choose the command from the Online menu, the Download Hex dialog appears. The entry field for a hex file is grayed because PiCPro automatically enters the correct .hex file for the control that is connected to PiCPro. This file is downloaded to the control when you choose Start. If connected to an MMC or a Digital MMC-D control, you will be prompted to turn the control off and on again.

Some examples of common programming errors that require you to do this include:

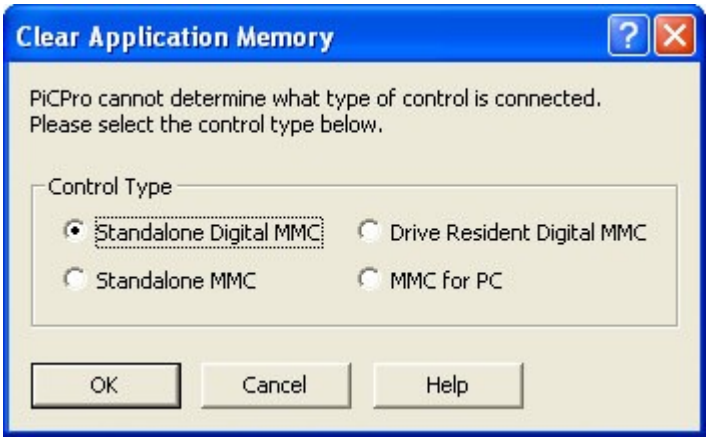
- Programming a backwards jump and losing the scan
- Declaring the wrong Block I/O and getting a Block I/O error

When these programming errors occur, communication to the control is lost. By using the **Clear Application Memory** command to clear the ladder currently in the MMC or a MMC Digital control, communications is re-established and you can proceed to download a ladder file.

To clear application memory with any MMC type of CPU:

- Select **Online | Control Operations | Clear Application Memory** from the menu.

If PiCPro cannot detect the type of control it is connected to, the following prompt will be displayed:



1. Select the appropriate control.

   Select Standalone Digital MMC if PiCPro is connected to one of the following controls.

   - MMC 32-Axis Digital Servo
   - MMC 64-Axis Digital Servo

   Select Drive Resident Digital MMC if PiCPro is connected to one of the following controls.

- MMC 1-Axis Digital Servo
- MMC 2-Axis Digital Servo
- MMC 4-Axis Digital Servo
- MMC 16-Axis Digital Servo

Select Standalone MMC if PiCPro is connected to one of the following controls.

- MMC or MMC PLUS 2-Axis Analog Servo
- MMC or MMC PLUS 4-Axis Analog Servo
- MMC or MMC PLUS SERCOS (1 ring)

Select MMC for PC if PiCPro is connected to an MMC for PC control.

2. Select **OK** to continue.

IMPORTANT

An action that affects the contents of the application memory, does not affect the contents of the flash memory, and vice versa.

If a ladder is downloaded to flash memory, and no ladder is loaded in application memory, the ladder in flash memory is scanned. If subsequently, a ladder (the same or another) is downloaded to application memory, the ladder in application memory is scanned.

The .hex file used to clear application memory does not clear the ladder in flash memory, and the .hex file used to clear flash memory does not clear the ladder in application memory.

Note:

- Do not use the standalone MMC control clear application memory file (.hex) for a Digital MMC control.
- Do not use the MMC Digital control clear application memory file (.hex) for any other control.
- Use the most current .hex file specified in Appendix M - Firmware to clear application memory.

Troubleshooting Download Hex

- No files can be open while downloading a hex file. Close all ladders, SRV and SRC files.
- PiCPro communications is turned off during the download. No other functions can be performed.
- Aborting once the download has begun can leave the control in an unstable condition. Don't stop the download before it is complete.
- PiCPro Version 12 and up requires Winsock.dll version 2.2. See ***Installing PiCPro*** to check the version on your computer.
- If the download process hangs, you might want to re-start PiCPro before trying again.
- For more information on messages and error messages that may appear in the information window when working with the download hex command, see ***DOWNLOAD HEX HELP***.

Backing Up and Restoring User Programs

Backup User Programs

Your program in the control memory may be backed up as a binary file directly to a computer disk. With your workstation connected to the control and communications established, follow these steps.

1. Select **Online | Control Operations | User Program | Backup | Application Program** from the menu. Backup will be bold and selectable if there is an existing communication link to your workstation.
2. The **Backup File to PC** dialog appears. The filename of the ladder file currently in the control memory with a .bin extension will appear in the entry field.
3. Choose the location you want to save the binary file to and choose **Save**. A progress display will tell you the file is being saved to the workstation.

The file can later be restored to the control using the **Restore** command.

Restore User Programs

A program file saved in binary format with a .bin extension can be restored to the control memory by doing the following:

1. Select Online | Control Operations | User Program | Restore from the menu.
2. The **Restore File to Control** dialog appears. Restore will be bold and selectable if there is an existing communication link to your workstation.
3. On your workstation, find the location the binary file you want to restore and click on it so that it appears in the entry field. When the correct bin file is in the entry field, choose **Restore**. A progress display will tell you the file is being downloaded to the control.

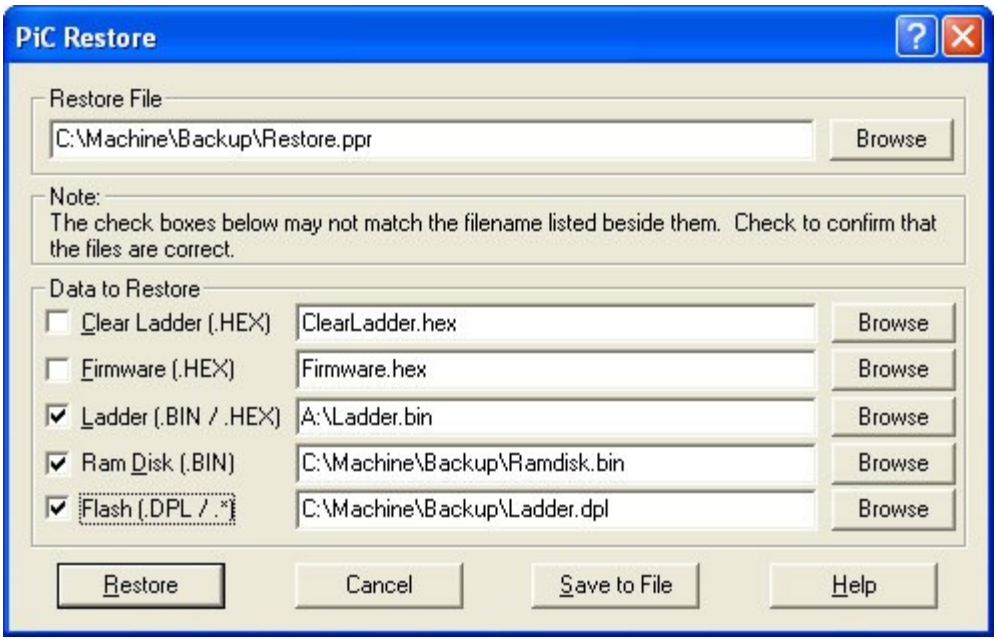
PiC Restore

PiC Restore

You can restore your PiC or MMC controls with the firmware, ladder (hex or binary), RAM disk data (binary), and flash memory if you ever lose the data in your control. You will need the required files either saved previously by you or supplied by your OEM.

PiC Restore is available only if an application ladder is not open. Select **Online | Control Operations | PiC Restore** from the menu.

The following dialog appears.

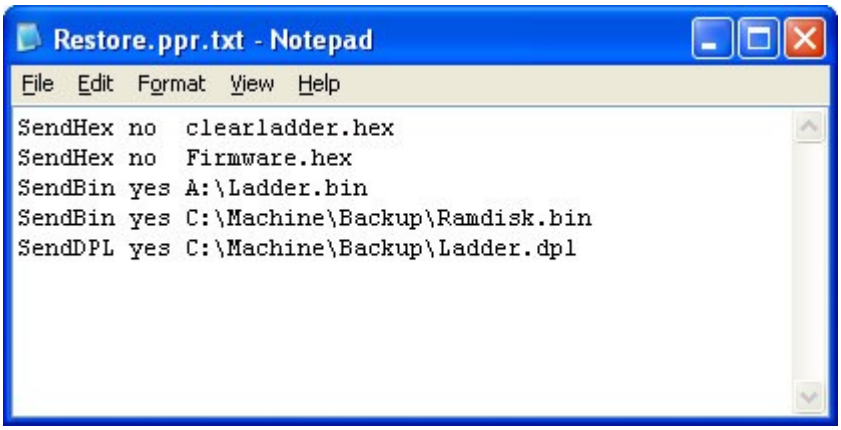


To restore or save files, enter the name of the restore file (.ppr). The five check boxes allow you to check the files you want sent to the control. (The check boxes will default to any settings currently in an existing restore file.) Selecting **Restore** starts execution of the restore file. When the download is complete without any errors, the information window will indicate the results by listing the files sent to the control. The **Save to File** button allows you to save the path and filenames of the hex, bin, or dpl files and the check box settings to the restore file.

Note:

Generic filenames are shown above. Your filenames and locations will be different.

In addition to using PiC Restore, a standard text editor can be used to create a restore file. The format for the restore file is shown below. The filenames are listed in the order they are to be sent to the control and shown in the PiC Restore dialog. **Note:** Generic filenames are shown below.



(SendDPL can also be entered as: SendFlash yes C:\filelocation\Ladder.ldo, and any extension can be used.)

The first field is the type of send: either SendHex, SendBin, SendDPL, SendFlash, or Empty. The second field contains either a "yes" or a "no" and defines the default value used for the checkbox. The third field is the name and path of the file. Make sure the type of file corresponds with the type of send. For example, use SendHex for sending a hex file. If there is a file type you aren’t using, type in "Empty No Null" (without the quotes) to so indicate.

Chapter 4 - Setting Up an MMC Analog Smart Drive

Overview: MMC Smart Drive Setup

Analog Interfaced Drive Terminology

To better understand the remainder of this chapter, you should be familiar with the following terms:

Drive file/list Access Status – **ONLINE** or **OFFLINE** See ***ONLINE vs. OFFLINE Drive List/Drive Data Views*** for operational details.

The first drive list accessed becomes the **ONLINE** drive list. Any other drive lists subsequently accessed are **OFFLINE**. To change an **OFFLINE** drive list to **ONLINE**, the current **ONLINE** drive list must be closed. The actual data is uploaded and monitored for the connected drive if it is in the **ONLINE** drive list. Both file data and actual data can be modified for the connected drive if it is in the **ONLINE** drive list. Only file data can be modified in **OFFLINE** drive lists, actual data is not available.

Data – Parameter information is provided in two forms – File and Actual.

File data is the information read from a drive file (.adv) or available to be written to a drive file (.adv). File data can be downloaded to a drive on command, if the drive list is ONLINE. File data contains two elements for each parameter, 1) **File values** and 2) **File units**. These elements appear as columns in the Drive Data view.

Actual data is the information uploaded from the connected drive in an ONLINE drive list. Actual data is dynamic. Changes are downloaded immediately to the connected drive. Actual data can be copied to file data for storage in a drive file (.adv), but cannot be saved directly into a drive file (.adv). Actual data contains two elements for each parameter, 1) **Actual values** and 2) **Actual units**. These elements appear as columns in the Drive Data view or Control Panel / Oscilloscope view.

Overview: MMC Smart Drive Setup - Analog Drive

The Drive Setup program in PiCPro allows you to identify all analog interfaced digital drives used in your application. As each drive is identified, it is put into a Drive List. Within Drive List view, you can add, remove, rename, cut, copy and paste drives. You can then save information to a drive file.

The Drive Setup program also allows you to monitor and/or configure characteristics of the analog interfaced digital drives in the form of parameters. Drive Data view is activated from the Drive List view. Within Drive Data, the parameters for each drive can be monitored and/or configured.

Drive Control Panel/Oscilloscope View, subsequently referred to as **Control Panel / Oscilloscope view**, allows you to view the drive in action. You can capture data throughout the setup process of the drive to compare the effect of changes to the parameters.

To use Drive Setup:

1. Start your drive list by creating a new analog interfaced drive system file or opening an existing analog interfaced drive system file.
2. Build your drive list - add, remove, rename, cut, copy and paste drives.
3. Save the analog interfaced drive system file (*name*.ADV), subsequently referred to as **drive file**.
4. Further refine or monitor parameters from the Drive Data view.
5. Analyze drive operation from the Control Panel / Oscilloscope View using the Oscilloscope tool.

Maintenance Mode - Analog Drive

Maintenance mode allows quick identification of an analog interfaced drive.

1. Connect the drive to the workstation and open PiCPro.
2. Choose one of the following methods to start Maintenance Mode:

- Click the button on the drive list standard toolbar
- Select **Online | Drive Operations | Maintenance** from the menu.

Note: If a drive list is already open, a prompt stating the following will be displayed:

All analog drive lists must be closed before drive maintenance can be selected. Only one analog drive list can be online at a time. Since there is already an online analog drive list, drive maintenance cannot create one.

Choose **OK** and close all drive lists, then retry step 2.

- If the drive has not been initialized, you will be prompted to name the drive and select the motor. If the drive has already been initialized the Drive List view will be displayed with a line for the new drive. The Drive Data view will also be displayed.

3. Modify, download or monitor configuration parameters.
4. Save the current configuration to a drive file (.adv).

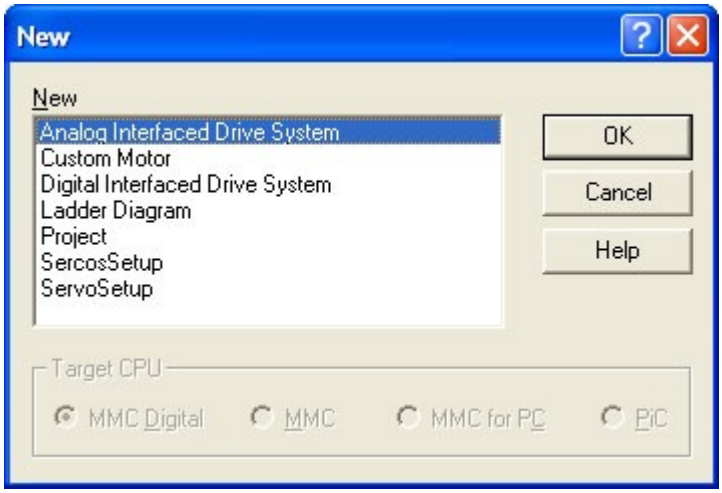
Accessing Drive System Setup

Accessing Drive System Setup

To access Analog Interfaced Drive System setup information, open or create an Analog Interfaced Drive System file.

Creating a New Analog Interfaced Drive System File

1. Choose one of the following methods to create a drive file.
   - Click the button on the standard toolbar
   - Select **File | New** from the menu
   - Press <**Ctrl + N**>
2. Select **Analog Interfaced Drive System** from the dialog that appears.
3. Choose **OK** to create a drive file. Select **Cancel** or click to close the dialog without creating a drive file. Select **Help** to display information related to creating a new PiCPro application file.

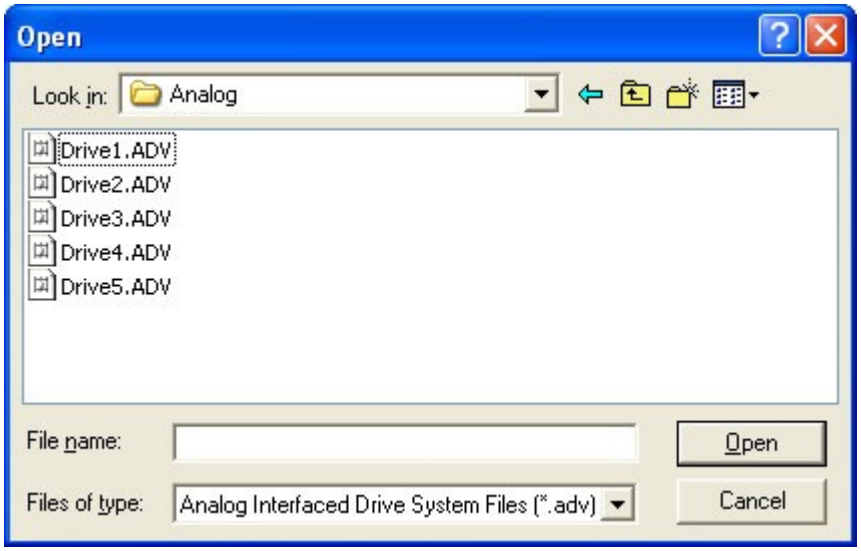


Opening an Existing Analog Interfaced Drive System File

1. Choose one of the following methods to open a drive file:

   - Click the button on the standard toolbar
   - Select **File | Open** from the menu
   - Press <**Ctrl + O**>

2. The **Open** dialog appears. At the bottom, choose Analog Interfaced Drive System Files (*.adv) from the drop down list in the **Files of type:** field. A list of drive files displays.
3. Select the file you want to open.



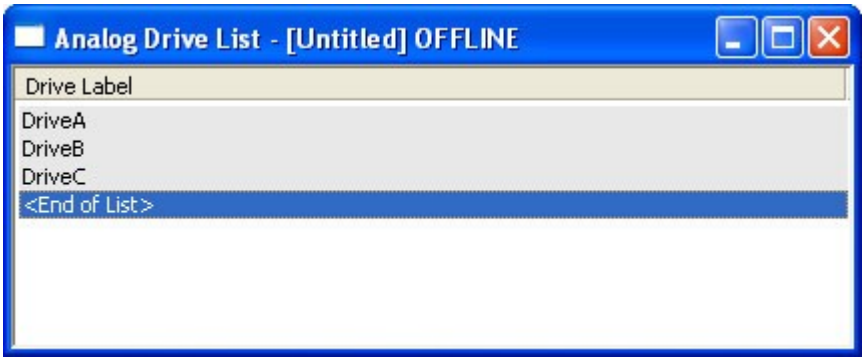
   - Select **Open**
   - Double-click the filename
   - Press **Enter** key

   Note: Select Cancel or to exit the dialog without opening a drive file.

4. A drive list will either display as an OFFLINE Drive List view or an ONLINE Drive List view.

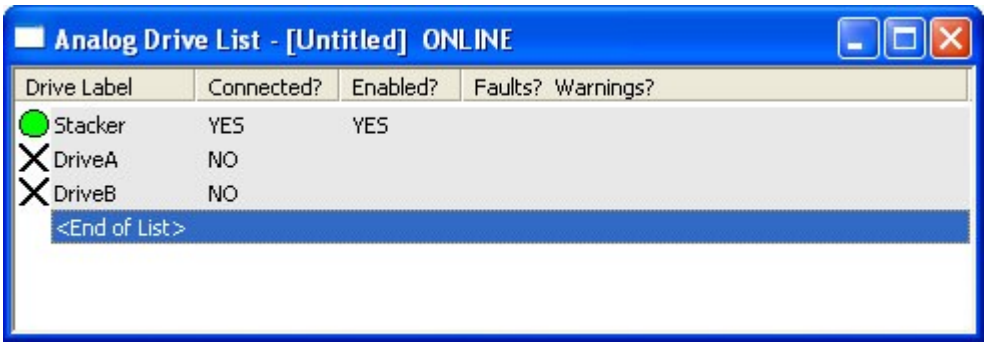
OFFLINE Drive List View - Analog

An OFFLINE Drive List view will appear when there is another Drive List open. This is indicated by the word OFFLINE appearing to the right of the filename.



ONLINE Drive List View - Analog

An ONLINE Drive List view will appear when it is the only Drive List being displayed. An ONLINE Drive List view is indicated by the word ONLINE to the right of the filename.



In the ONLINE Drive List view, only one analog interfaced digital drive can be connected at a time.

ONLINE Drive List View Details

ONLINE Drive List View Details - Analog

This chart shows the possible states of a connected drive appearing in the ONLINE Drive List view. Each column of information will be explained.

Drive Label	Connected?	Enabled?	Faults?
✕ Drive1	No		
✕ Drive2	No	Yes/No	Fault/Warning description when last connected
● Drive3	Yes	Yes	

Drive4	Yes	No	
Drive5	Yes	Yes	Warning(s) description
Drive6	Yes	No	Warning(s) description
Drive7	Yes	No	Fault(s) description

Data – File vs. Actual

Text color indicates whether there are differences between file data and actual data. If there are differences, the text color is blue. If there are no differences, the text color is black.

Drive Label

The drive label consists of 2 elements:

- A drive status icon (shown in the table below)
- An alphanumeric string that represents the drive name.

The drive name must adhere to the following criteria:

- Drive name is limited to 31 characters
- First character must be an alpha or underscore
- The remaining characters can be alphanumeric or underscores
- The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
- Drive names must be unique.

Icon	Indication
Black X	• Drive is not connected.
Green Circle	• Drive connected to PiCPro • Drive Enabled • No Faults
Write Circle	• Drive connected to PiCPro • Drive not Enabled • No Faults
Green Circle w/Yellow Triangle	• Drive connected to PiCPro • Drive Enabled • Warning(s) present
White Circle w/Yellow Triangle	• Drive connected to PiCPro • Drive not Enabled • Warning(s) present

Red Octagon	• Drive connected to PiCPro • Drive Enabled • Fault(s) present

Connected?

A **Yes** in this column indicates the drive data is being monitored for changes. Only one drive can be connected at a time. A **No** in this column indicates the drive data is not being monitored for changes.

Enabled?

A **Yes** in this column indicates the connected drive is enabled or previously connected drives were enabled when disconnected from the workstation. A **No** in this column indicates the connected drive is not enabled or previously connected drives were not enabled when disconnected from the workstation. If this column is blank, the drive has not been connected to the workstation since the file was opened.

Faults? Warnings?

If this column is blank, there are no faults or warnings registered for the connected drive or the previously connected drives. If a single fault or warning exists for the connected drive or existed for the previously connected drives, the fault or warning description will be displayed. If multiple faults or warnings are detected for the connected drive or the previously connected drives, the fault and/or warning numbers will be listed. More details on the faults and warnings can be obtained in the Drive Data view.

ONLINE Drive List and Drive Data View Scenarios

Connecting to an Analog Drive in Drive List

- Physically connect the drive to the workstation using the PiCPro cable.
- The Status bar connection icon will change to .
- Configuration parameters will automatically be uploaded into actual data for the newly connected drive.
- Differences between file data and actual data will be identified for the newly connected drive.

Drive List view

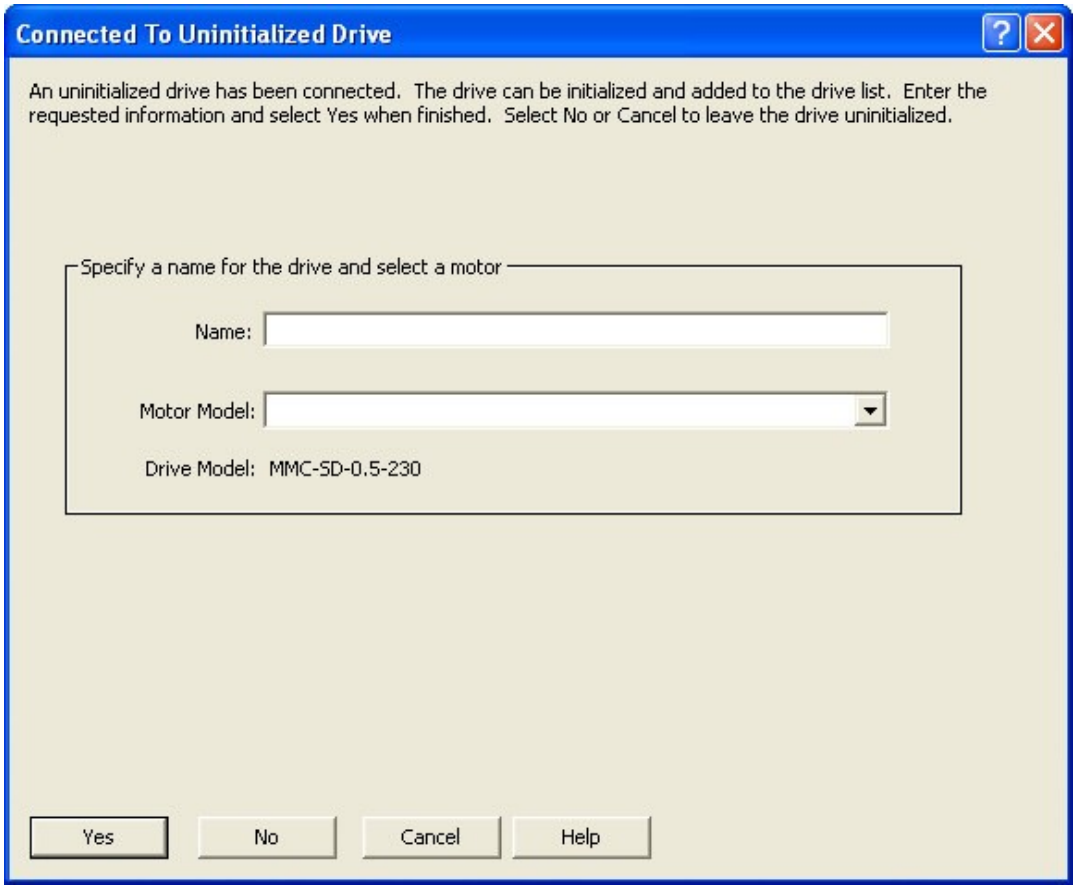
The drive label icon and drive information will change to reflect the current status of the newly connected drive.

Drive Data view

The drive label icon and drive information will change to reflect the current status of the newly connected drive.

Connecting to an Uninitialized Analog Drive not in the Drive List

1. Physically connect the drive to the workstation using the PiCPro cable. The Status bar connection icon is changed to .
2. A dialog window will appear asking for information about the uninitialized drive:



3. Supply the information required inside the box titled **Specify a name for the drive and select a motor**.
   - At **Name:** enter a name for the drive. The drive name must adhere to the following criteria:
     - Drive name is limited to 31 characters
     - First character must be an alpha or underscore
     - The remaining characters can be alphanumeric or underscores
     - The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
     - Drive names must be unique.
   - At **Motor Model:** select a motor from the dropdown list.
4. Select **Yes** to initialize the drive and add it to the drive list. Select **No** or **Cancel** or to close the dialog without initializing the drive to the drive list. Select **Help** to display information related to initializing drives to drive list.

Drive name, motor model and default values for the remaining drive configuration parameters will be downloaded to the drive automatically.

Drive List view

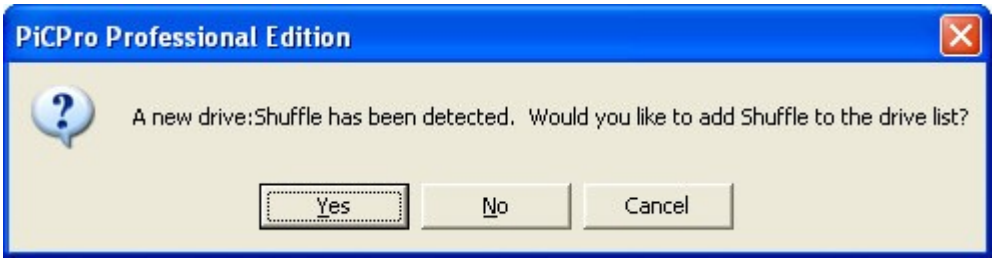
1. The newly connected drive will be initialized and added to the drive list.
2. The drive label icon and drive information will reflect the current status of the drive.

Drive Data view

1. Actual and File columns will be added to the Drive Data view for the drive.
2. The drive label icon and drive information will reflect the current status of the drive.

Initialized Drive not in the Drive List - Analog Drive

If an initialized drive is found with a name that does not match any names in the drive list, a prompt will be displayed asking if you want to add the drive to the drive list (e.g. Shuffle):



- Choose **Yes** to add the drive to the drive list. Select **No** or **Cancel** or click to exit the dialog without adding a drive to the drive list.
- Configuration parameters will automatically be uploaded into actual data for the newly connected drive.
- Actual data is copied to file data for the newly connected drive. There will be no differences identified between file data and actual data.

Drive List view

1. A line will be added to the drive list for the new drive.
2. The drive label icon and drive information will reflect the current status of the drive.

Drive Data view

1. Actual and File columns will be added to the Drive Data view for the newly connected drive.
2. The drive label icon and drive information will reflect the current status of the newly connected drive.

Disconnecting from the Current Drive and Connecting to a Different Drive Already in the Drive List

- Physically disconnect the PiCPro cable from the current drive and connect it to the desired drive.
- The Status bar connection icon will change to and then change back to .
- Configuration parameters will automatically be uploaded into actual data for the newly connected drive.
- Differences between file data and actual data will be identified for the newly connected drive.

Drive List view

1. The drive label icon will change to for the previously connected drive.
2. The drive label icon and drive information will change to reflect the current status of the newly connected drive.

Drive Data view

1. The drive label icon will change to for the previously connected drive.
2. Actual data can no longer be changed for the previously connected drive. It will remain unchanged until the drive is reconnected.

3. The drive label icon and drive information will change to reflect the current status of the newly connected drive.

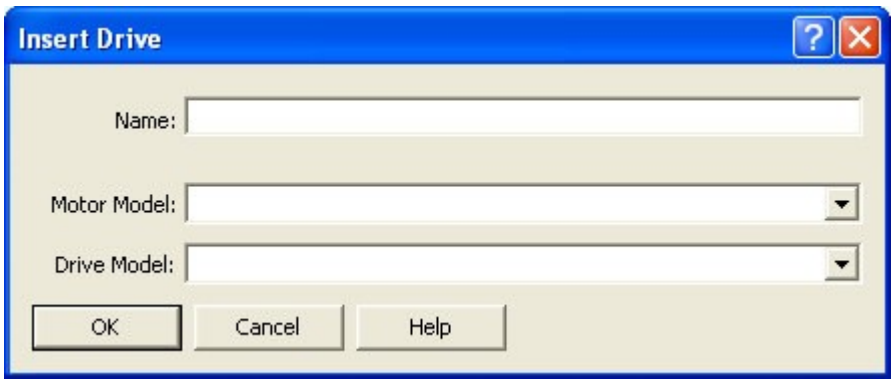
Drive Information Operations

Insert/Add a New Analog Drive to a Drive List

Up to 32 analog interfaced digital drives are allowed in a drive list.

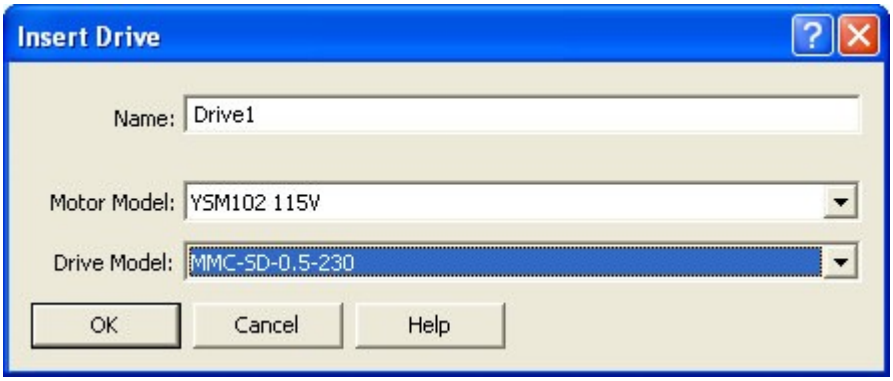
1. Choose one of the following methods to insert/add a drive to a drive list:
   - Select **Edit | Insert Drive…** from the menu
   - Press the **Insert** key
   - Right-click and select **Insert Drive…**

2. The **Insert Drive** window will appear.



3. At **Name:** enter a name for the drive. The drive name must adhere to the following criteria:
   - Drive name is limited to 31 characters
   - First character must be an alpha or underscore
   - The remaining characters can be alphanumeric or underscores
   - The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
   - Drive names must be unique.

4. At **Motor Model:** select a motor from the drop down list.
5. At **Drive Model:** select a drive model from the drop down list.
6. Choose **OK** to insert/add a drive to a drive list. Select **Cancel** or to close the dialog without inserting/adding a drive to the drive list. Select **Help** to display information related to inserting/adding a drive to a drive list.



File data will be loaded with selected motor model, drive model and default values for the remaining configuration parameters.

If the name of the drive matches the name of the currently connected drive, the following events will take place:

Configuration parameters will automatically be uploaded into actual data for the connected drive.

Drive List view

1. A line will be added to the drive list for the connected drive.
2. The drive label icon and drive information will reflect the current status of the connected drive.

Drive Data view

1. Actual and File columns will be added to the Drive Data view for the connected drive.
2. The drive label icon and drive information will reflect the current status of the connected drive.

If the name of the drive does not match the name of the currently connected drive, the following events will take place:

Drive List view

1. A line will be added to the drive list.
2. The drive label icon ✕ will reflect that drive is not connected.

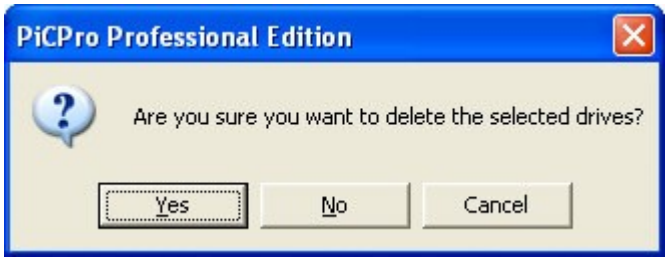
Drive Data view

1. Actual and File columns will be added for the drive. The Actual columns will be empty because the drive is not connected.
2. The drive label icon ✕ will reflect that drive is not connected.

Deleting an Analog Drive from the Drive List

1. Select the desired drive(s) in the Drive List.
2. Choose one of the following methods to delete a drive from a drive list:
   - Select **Edit | Delete Drive(s)…** from the menu
   - Press the **Delete** key
   - Right-click and select **Delete Drive(s)…**

3. The following window will appear:

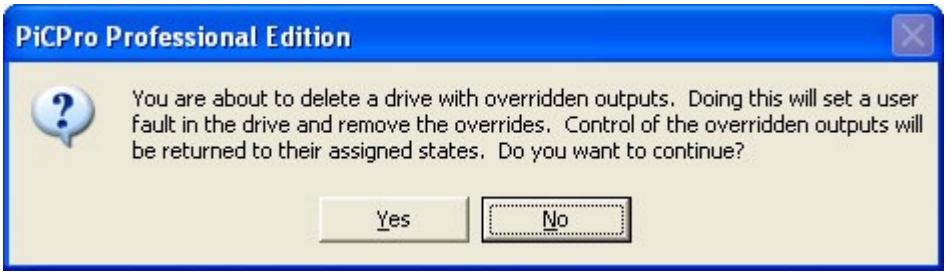


4. Choose **Yes** if you want to delete the selected drive(s). Select **No**, **Cancel** or if you do not want to delete the drive(s) from the Drive List.

   If **Yes** is selected, the drive(s) will be deleted from the Drive List:

Note:

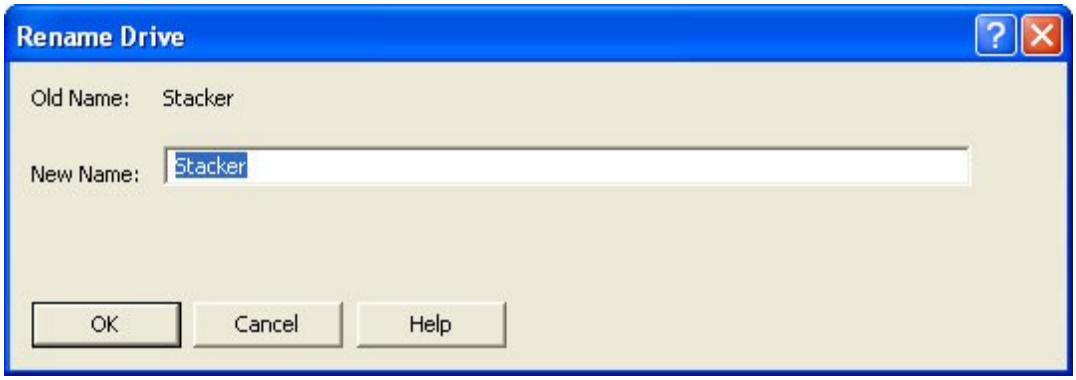
If the selected drive(s) have outputs overridden, an additional message will be displayed:



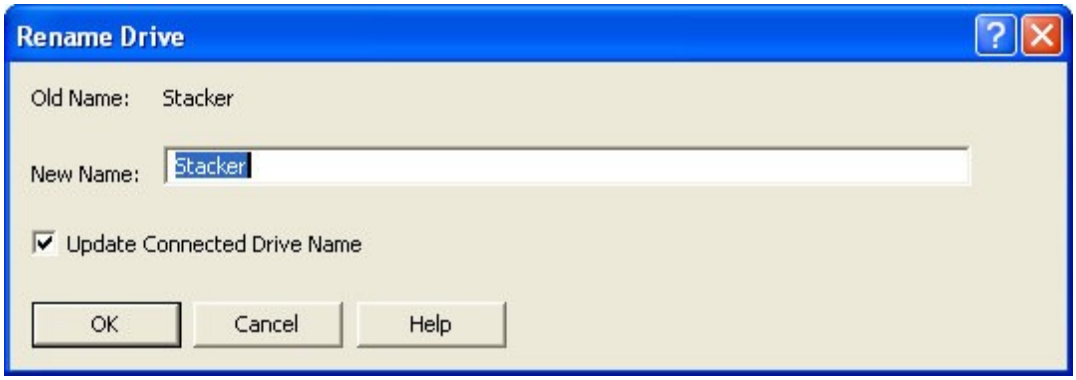
Renaming a Drive in a Drive List

1. Choose a single line in the Drive List and do one of the following.
   - Click the button from the drive list standard toolbar.
   - Select **Edit | Edit Drive Name** from the menu
   - Press <**Ctrl + Shift + N**>
   - Right-click and select **Edit Drive Name**

2. The following dialog will be displayed when the drive being renamed is not the connected drive:



The following dialog will be displayed when the drive being renamed is the connected drive:



Update Connected Drive Name will be checked by default. If you do not want to update the connected drive's name, click the box to uncheck it.

Note:

Removing this check allows the name of the drive in the drive list to be changed but does not change the name of the connected drive. When OK is selected, the drive's icon changes to 'X' to indicate the drive name no longer matches the name of the connected drive.

3. At **New Name:** enter a name for the drive. The drive name must adhere to the following criteria:
   - Drive name is limited to 31 characters
   - First character must be an alpha or underscore
   - The remaining characters can be alphanumeric or underscores
   - The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
   - Drive names must be unique.

4. Choose **OK**. The drive will be renamed if a valid name has been entered.

Note:

Click Cancel or to close the dialog without renaming the drive. Click Help to display information related to renaming a drive.

Editing Drive Data

1. From the Drive List view, select the drive you want to edit.
2. Choose one of the following methods to edit parameters:
   - Click the button from the drive list standard toolbar.
   - Double-click on the drive.
   - Select **Edit | Edit Drive(s) Data** from the menu.
   - Right-click and select **Edit Drive(s) Data**.

The first time Drive Data is displayed after installing PiCPro, the Basic View will be displayed. Only parameter values with white backgrounds can be edited. Parameter values with grayed backgrounds are read-only and can not be edited. Monitored parameter values with red text will have gray backgrounds. Some actual values will have gray backgrounds while the drive is enabled. Disable the drive or stop the scan to make these parameter values available for editing.

Changes to parameter values in the actual data column are sent to the drive immediately.

Changes to parameter values in the file data column will need to be downloaded to the drive if the change is required in the drive. See ***Downloading File Data***

Selecting Parameters - Analog Data View

How to Select Parameters

Single value is selected by left-clicking the value.

Multiple values can be selected at the same time if they are part of the same drive and in the same column.

- To select values next to each other in the column, select a value, hold down the **Shift** key while pressing the up/down arrow or hold down the **Shift** key and select another value. The entire block of values will be displayed as selected.
- To select values not next to each other in the column, select a value then hold down the **Ctrl** key while left-clicking the other desired values within the same column.

Entire file column can be selected by one of the following methods:

- Left-click on any of the values in the File column and select **Edit | Select All In Col** in the menu.
- Right-click on any of the values in the File column and choose **Select All In Col**.
- Left-click on the **File** column header.

Cut/Copy/Paste from the Drive List View

Cut/Copy/Paste from the Drive List view

The Cut, Copy and Paste Drive(s) commands allow you to cut or copy drives from one drive list and paste them to another drive list. The **Copy Drive(s)** command places a copy of the selected item(s) on the clipboard. The **Cut Drive(s)** command removes the selected item(s) from the drive list and places it on the clipboard.

Once the selected item(s) is/are on the clipboard, you can use the **Paste Drive(s)** command to place the selected item(s) into the drive list.

Selecting Drives - Analog Drive List

Single drive is selected by left-clicking the drive name.

Multiple drives can be selected at the same time if they are part of the same drive list.

- To select drives next to each other in the drive list, select a drive, hold down the **Shift** key while pressing the up/down arrow or hold down the **Shift** key and select another drive. The entire block of drives will be displayed as selected.
- To select drives not next to each other in the drive list, select a drive then hold down the **Ctrl** key while left-clicking the other desired drives within the same drive list.

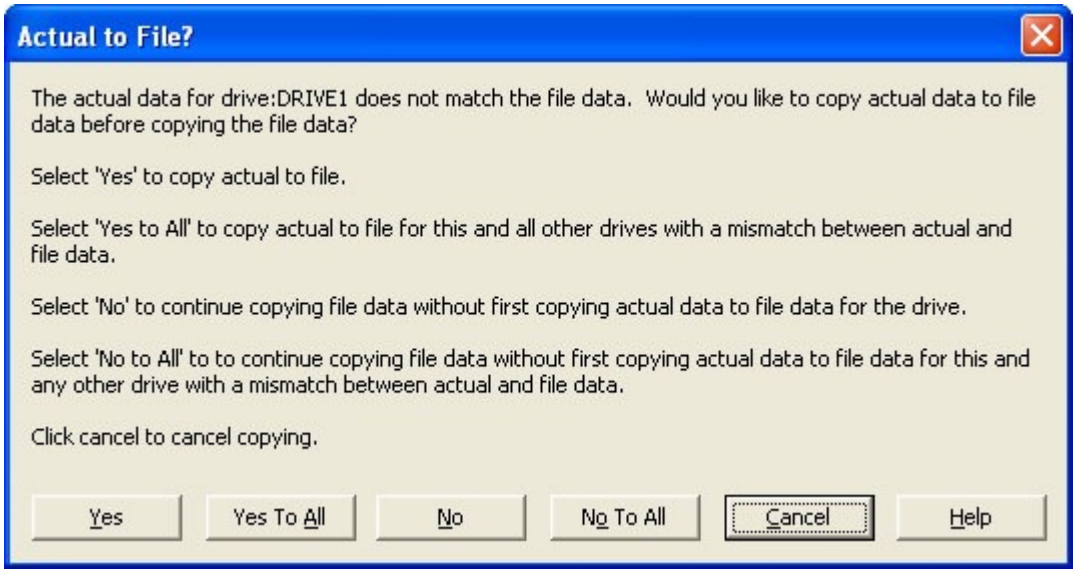
Cutting a Drive - Analog Drive List

1. Select the drive(s) you want to cut.
2. Choose one of the following methods to issue the Cut command:

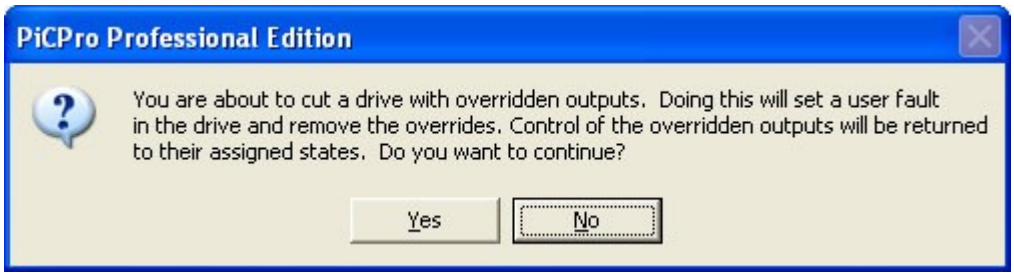
- Click the button on the standard toolbar.
- Select **Edit | Cut Drive(s)** from the menu.
- Press <**Ctrl + X**>.
- Right-click and select **Cut Drive(s)**.

Note:

- Cutting a drive in Drive List view cuts the file data for the drive. If the actual data is different than the file data when a cut command is selected, you will be prompted to decide if actual data should replace the file data before the cut takes place. The following dialog will be displayed:



- If the selected drive(s) have outputs overridden, an additional message will be displayed:



Copying a Drive - Analog Drive List

1. Select the drive(s) you want to copy.
2. Choose one of the following methods to issue the Copy command:

   - Click the button on the standard toolbar.
   - Select **Edit | Copy Drive(s)** from the menu.
   - Press <**Ctrl + C**>.
   - Right-click and select **Copy Drive(s)**.

Note:

Copying a drive in Drive List view copies the file data for the drive. If the actual data is different than the file data when a copy command is selected, you will be prompted to decide if actual data should replace the file data before the copy takes place.

Pasting a Drive - Analog Drive List

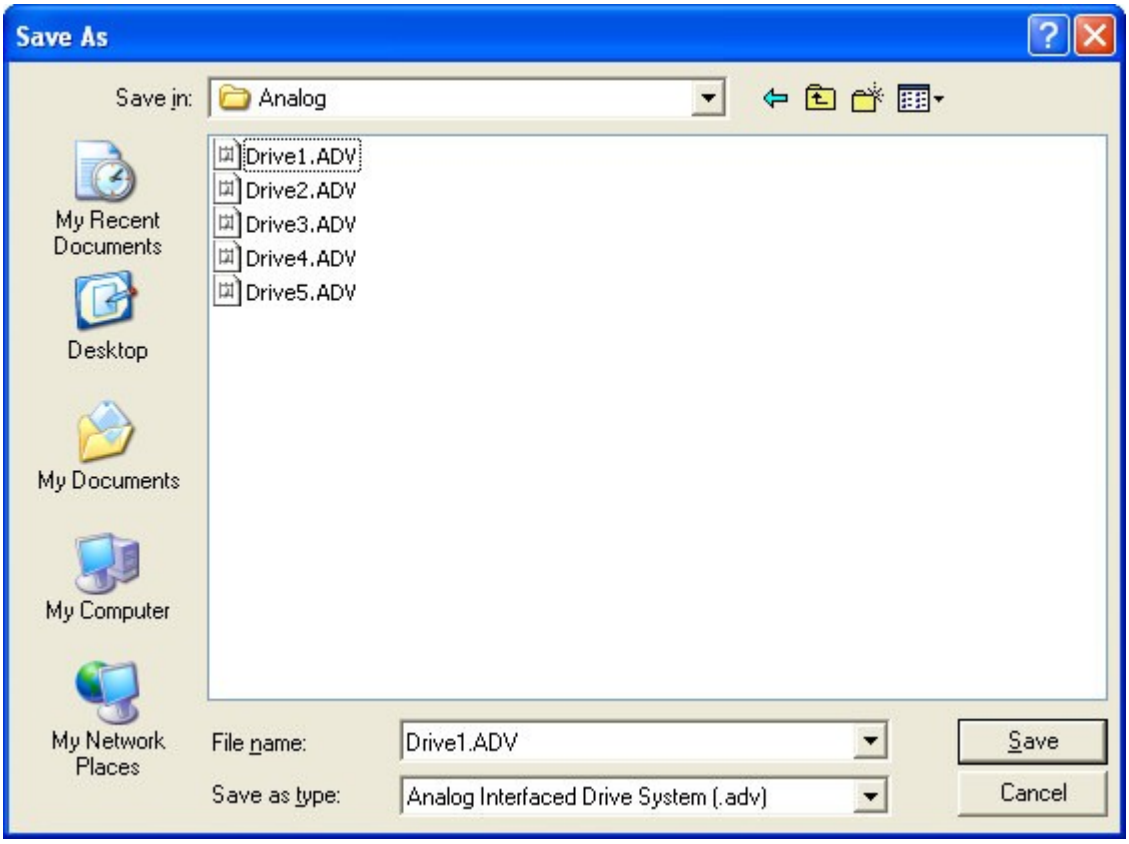
1. Select a location for the paste.
2. Choose one of the following methods to issue the Paste command:
   - Click the button on the standard toolbar.
   - Select **Edit | Paste Drive(s)** from the menu.
   - Press <**Ctrl + V**>.
   - Right-click and select **Paste Drive(s)**.

Save and Save as

Save and Save As - Analog Drive

1. Select the drive list or Drive Data view you want to save.
2. Choose one of the following methods to issue the Save command:
   - Click the button on the drive list standard toolbar.
   - Select **File | Save** from the menu.
   - Press <**Ctrl + S**>.
   - Choose **Yes** when prompted by a dialog whether you wish to save the file.

The first time the drive file is saved, you will be prompted to provide a filename and location. The prompt displays your default directory. Enter a filename and location desired. Choose **Save** to execute the save command. If **Cancel** or is chosen, the dialog disappears and the drive file is not saved.



If you wish to give the drive file a different name, choose **File | Save as…** You will be prompted to provide a filename and location. The prompt displays your default directory. Enter a filename and location desired. Choose **Save** to complete the save command. If **Cancel** or is chosen, the dialog disappears and the drive system file is not saved.

Note:

File data is saved with a Save or Save as command. You will be prompted to check for differences between file and actual before saving the file. If you select Yes, actual data will be refreshed for all drives. If differences exist between file data and actual data, you will be prompted to update the file data with the actual data for each drive in the drive file that has differences before the Save or Save as is executed. Choose Yes to update the file data with the actual data for the specified drive. Choose No to keep only the file data, ignoring the actual data.

Choose Cancel or to exit the dialog without saving the drive file. Once each drive with a difference has been addressed, the Save or Save as command will execute.

Close

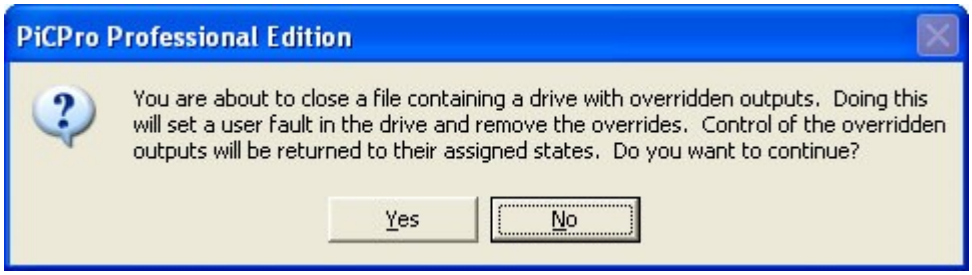
Closing an Analog Drive

When closing a Drive List view, the associated Drive Data view will also close. If drives have been modified without being saved, you will be prompted to save the drive files.

When closing PiCPro, you will be prompted to save any modified drive files that have not been saved.

Note:

- If no changes have been made to file data, but differences exist between file data and actual data, you will be prompted to save the drive file.
- If the drive file has drive(s) that have outputs overridden, an additional message will be displayed:



ONLINE vs OFFLINE Drive List/Drive Data Views

The following operations/commands can be executed from each view:

Operations/Commands	ONLINE Drive List	ONLINE Drive Data	OFFLINE Drive List	OFFLINE Drive Data
Insert/Delete Drives	X		X	
Cut/Copy/Paste Drives	X		X	
Edit Drive Data		X		X
Save Drive System File	X	X	X	X
Save Drive System File to Different File	X	X	X	X
Print Information for All or Selection of Drives	X	X	X	X
Rename a Drive	X		X	
Online | Drive Operations	X	X		
View Control Panel / Oscilloscope	X	X		

Only one drive list can be ONLINE at a time. All other drive lists opened will be OFFLINE. To change an OFFLINE drive list to ONLINE, the current ONLINE drive list must be closed.

The OFFLINE Drive List view only maintains file data, whereas the ONLINE List View maintains file data for all the drives in the drive list and actual data for all the drives connected since the drive list was opened.

ONLINE Operation

1. If the workstation is connected to a MMC Digital Control and if the connected drive is in the drive list (ONLINE drive list view), the parameters of the connected drive are uploaded from the drive to the actual data. The actual data and file data are compared. The Drive List view and its Drive Data view are updated to reflect differences between the file data and the actual data. If the connected drive is not in the Drive List view, you will be prompted to insert/add the drive. If you choose **Yes** to the prompt, the drive data will be uploaded and stored in both the file data and the actual data. The drive will be added to the Drive List and no differences will be indicated. **Note:** When drive maintenance is selected, no differences will be shown, actual data will be loaded into file data.
2. In the Drive List view, blue text color indicates that differences exist between file data and actual data of a connected drive or any drive, connected since the drive file has been opened. To see the detail of the differences, double-click on the connected drive in the Drive List view. This activates the Drive Data view. The various parameters are displayed in columns under Actual data (information uploaded from the drive) and File data (information read from a saved drive file). Those parameters where the actual data differs from the file data are displayed in a blue color.
3. When the cable is moved from one drive to another, the actual data for the previously connected drive is grayed out and can no longer be modified until the drive is reconnected. If differences existed between file and actual data, differences will still be indicated by blue text. If the newly connected drive is already in the Drive List view, drive data automatically uploads and stores as the actual data. If differences exist, the Drive List view and its Drive Data view will update to reflect differences between the file data and the actual data. If, however, the newly connected drive is not in the Drive List, you will be prompted to insert/add the drive. If you choose **Yes** to the prompt, the drive data will be uploaded and stored in both the file data and the actual data. The drive will be added to the Drive List and no differences will be indicated.
4. When saving the drive file, only the file data is saved to the .adv file. If differences exist between file data and actual data, you are prompted to copy the actual data to the file data before the save is executed.
5. When copying a drive from the Drive List view, only the file data is copied. If differences exist between file data and actual data, you are prompted to copy the actual data to the file data before the copy is executed.

OFFLINE Operation

While in the OFFLINE Drive List/Drive Data View, actual drive data will not be uploaded. Only file data is kept for each drive.

Other Operations in the ONLINE Drive List View

Reset Drive Faults - Analog

Reset Faults command resets all faults in the selected drive. This command is available in the ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To reset faults, follow these steps:

1. Select the drive.
2. Choose one of the following methods to issue the Reset Faults command:
   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Reset Faults** from the menu in Drive List and Drive Data view or **Online | Reset Faults** from the menu in Control Panel/Oscilloscope view.
   - Press <**Ctrl + Shift + F**>.
   - Right-click and select **Reset Faults**.

Reset Drive Peaks - Analog

Reset Peaks command sets maximum latched values to zero in the selected drive. This applies to Current – Peak Plus and Current – Peak Minus. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To reset peaks, follow these steps:

1. Select the connected drive.
2. Choose one of the following methods to issue the Reset Peaks command:
   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Reset Peaks** from the menu in Drive List view or **Online | Reset Peaks** from the menu in Control Panel/Oscilloscope view.
   - Press <**Ctrl + Shift + P**>.
   - Right-click and select **Reset Peaks**.

Cold Restart - Analog Drive

Cold Restart completely resets the drive. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To cold restart, follow these steps:

1. Select the drive.
2. Choose one of the following methods to issue the Cold Restart command:
   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Cold Restart** from the menu in Drive List view or **Online | Cold Restart** from the menu in Control Panel/Oscilloscope view.
   - Right-click and select **Cold Restart**.

Remove Input Offset

Remove Input Offset removes the analog input offset. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected, enabled and not under software control. To remove input offset, follow these steps:

1. Select the connected drive.
2. Choose one of the following methods to issue the Remove Input Offset command:
   - Select **Online | Drive Operations | Remove Input Offset** from the menu.
   - Right-click and select **Remove Input Offset**.

Set User Fault - Analog

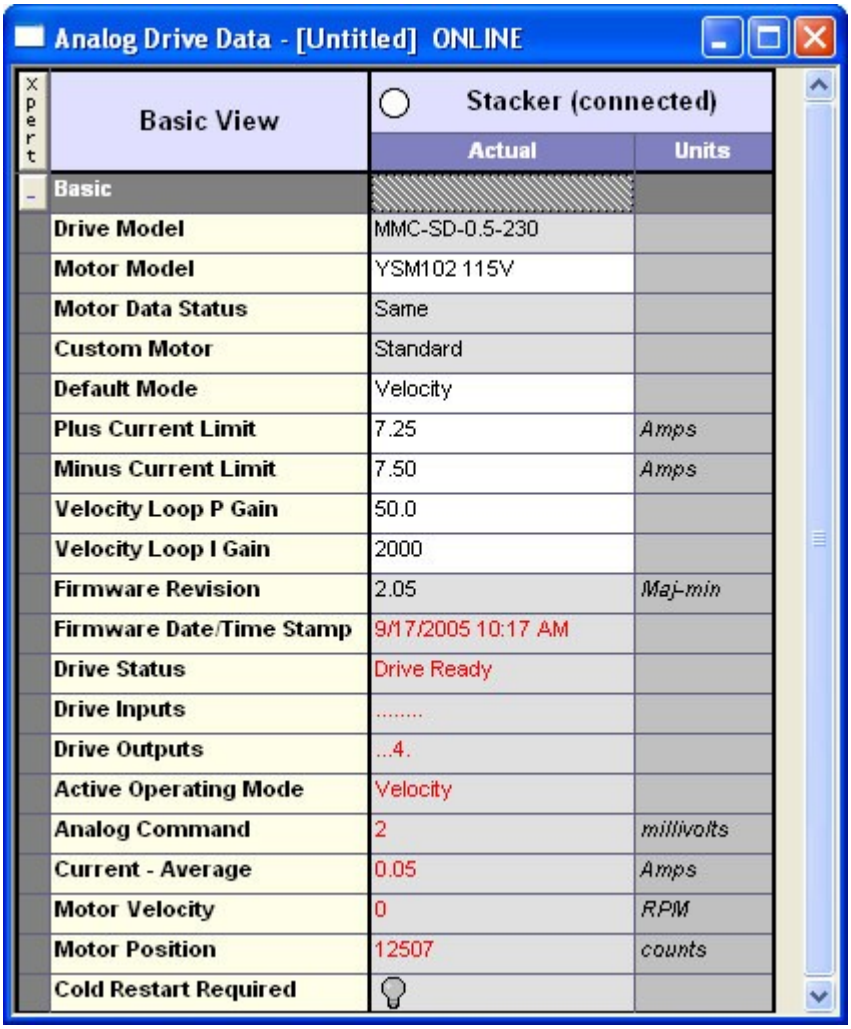
Set User Fault creates a disabling fault in the drive. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To set the user fault, follow these steps:

1. Select the connected drive.
2. Choose one of the following methods to issue the Set User Fault command:
   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Set User Fault** from the menu.
   - Right-click and select **Set User Fault**.

Configuring, Editing and Monitoring a Drive

Configuring/Editing/Monitoring a Drive

Drive Data view is the location to configure/monitor drive characteristics in the form of parameters. The Drive Data view can be active in the ONLINE and OFFLINE modes. The Drive Data view, however, must have a Drive List view open first. When a Drive List view is ONLINE, its Drive Data view is ONLINE also. Closing a Drive List view will also close its Drive Data view.



Some operations that can be performed on the values in this view are as follows:

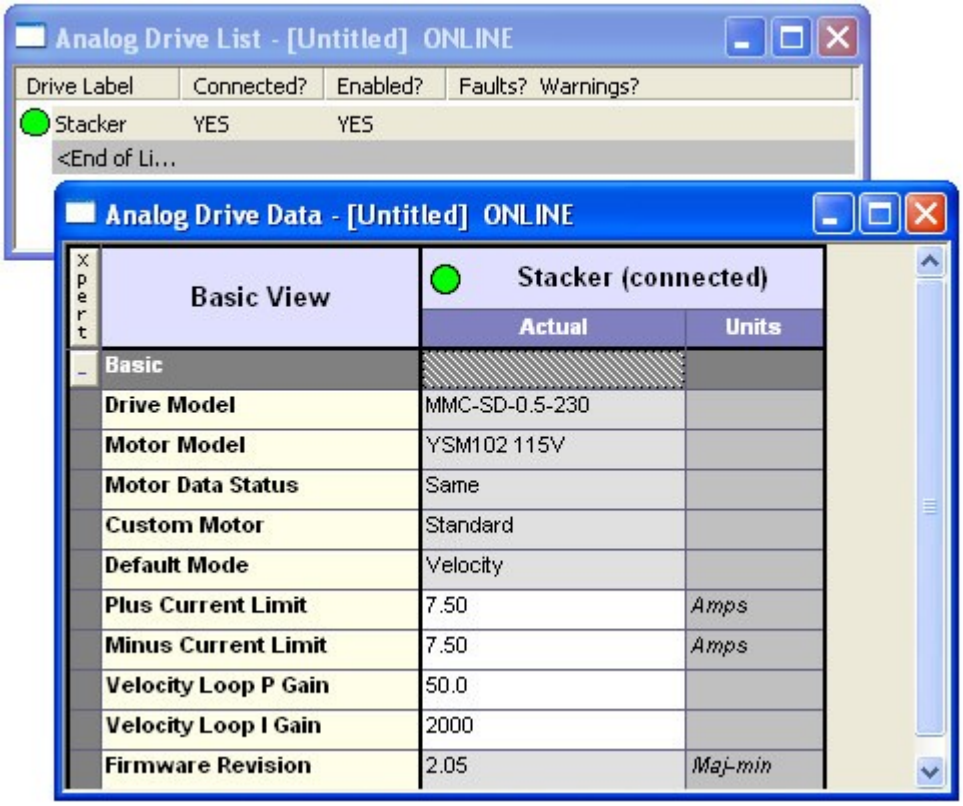
- Copy/Paste Parameters
- Edit
- Undo
- Redo
- Download

Accessing Drive Data View from Analog Drive List View

From the Drive List view, select a drive in the drive list and use one of the following methods:

- Click the button on the drive list standard toolbar.
- Double-click.
- Select **Edit | Edit Drive(s) Data** from the menu.
- Right-click and select **Edit Drive(s) Data**.

Drive Data view will be displayed in front of the Drive List view.



Content of Drive Data View

Only one Drive Data view per Drive List view is permitted. Attempts to open a secondary Drive Data view will result in the open Drive Data view updating with whatever information is available for the selected drive(s).

The following information is supported:

ONLINE Drive Data View	OFFLINE Drive Data View
File Values	File Values
File Units	File Units
Actual Values	
Actual Units	

Parameters

Parameters have been grouped into categories. Categories can be collapsed by selecting the (-) button to the left of the category name. Categories can be expanded by selecting the (+) button to the left of the category name. The following chart specifies the categories and the views in which they are available:

Category	Basic View	Expert View (ONLINE Drive Data view)	Expert View (OFFLINE Drive Data view)
Basic	X		
System		X	X
Command		X	X
Tuning		X	X
I/O		X	X
Limits and Indicators		X	X
Faults and Warnings		X	
Fault History		X	
Motor		X	X

Changing Analog Drive Data Views

There are three kinds of Drive Data views available.

1. Basic View contains the parameters most often configured and monitored. Basic View contains only one category – Basic.
2. Expert View (ONLINE Drive Data view) contains all parameters – configuration and monitored. This view contains all categories except Basic.
3. Expert View (OFFLINE Drive Data view) contains configuration parameters. This view contains a subset of the categories available in the ONLINE Drive Data Expert View.

To move between the above views, choose one of the following methods:

1. Click

or

button along the upper left side of the Drive Data View. The view name on the button is the view that will be displayed when the button is clicked.
2. Select **View | Basic View** or **View | Expert View** from the menu.

Navigating in the Analog Drive Data View

The Drive Data view contains the same number of drives in the same order as its Drive List view. You may need to change the view to see the information you are looking for. There are four columns of information for each drive in the drive list. The columns are Actual values, Actual Units, File values and File Units. The bolded words are the column headers in the Drive Data view.

Note:

Actual values and actual units are only available in the ONLINE Drive Data view.

Here are some ways to change the look of the Drive Data view:

1. Pressing the arrow keys moves the cursor to an adjacent cell in the data view. A dark colored cell indicates a category. A category contains additional parameters related to the category name. A category can be collapsed (parameters are hidden) or expanded (parameters are visible).

2. Use any of the following methods to collapse categories:
   - Select the (-) button to the left of the category name to collapse single categories.
   - Double click on the category line located under the Actual or File data columns.
   - Press the **Enter** key while on a category line.
   - Select **View | Categories | Collapse All** from the menu to collapse all categories.
   - Right-click anywhere in the Actual values or File values column and select **Categories | Collapse All** to collapse all categories.
   - Click the far-left dark gray cell of any parameter row, all categories will collapse.
3. Use any of the following methods to expand categories:
   - Select the (+) button to the left of the category name to expand single categories.
   - Double click on the category line located under the Actual or File data columns.
   - Press the **Enter** key while on a category line.
   - Select **View | Categories | Expand All** from the menu to expand all categories.
   - Right-click anywhere in the Actual values or File values column and select **Categories | Expand All** to expand all categories.
   - Double-click in the area below the data view (below the grid), all categories will expand.
4. Column width can be adjusted by using the mouse.
   - Move the mouse pointer over the line separating two columns. The mouse pointer will change to a vertical list with horizontal arrows in either side .
   - Hold the left mouse button down and move the mouse left or right to contract, expand or hide the column.
5. Columns can selectively be hidden and shown for all drives in a drive list. To hide or show the **same** column for **all** drives in a drive list:
   - Select **View | Columns | Show All Actual Values** from the menu.
   - Select **View | Columns | Show All File Values** from the menu.
   - Select **View | Columns | Hide All Actual Values** from the menu.
   - Select **View | Columns | Hide All File Values** from the menu.

   When hiding Actual value or File value columns, their respective Units columns are also hidden.

   The Units columns can be additionally controlled by the following menu items. Add a check (click on a menu item without a check) to show the columns or remove a check (click on a menu item with a check) to hide the columns.
   - Select **View | Columns | Display Actual Units** from the menu.
   - Select **View | Columns | Display File Units** from the menu.

   Double-click in the area to the right of the data view (right of the grid) to show all columns.

6. Columns can selectively be hidden and shown for a single drive in a drive list. To hide or show a column for a single drive, use one of the follow methods:
   - Right-click on either the Actual values or File values column. Add a check to hide or remove a check to show one of the following from the **Columns** menu:
     - Display Actual Values for This Drive
     - Display Actual Units for This Drive
     - Display File Values for This Drive
     - Display File Units for This Drive

- Double-click on the column header to hide individual columns.
- Move the cursor over the line separating columns until the mouse cursor changes to . Double-click on the line to show individual columns

7. Drives can be selectively hidden/shown.

To hide all drives:

- Select **View | Hide All Drives** from the menu.

To hide a drive, use one of the following:

- Select **View | Visible Drives** and remove the check for the drive to hide.
- Right-click on the drive header bar, Actual values column or File values column and select **Hide This Drive**.
- Double-click on the drive header bar.

To show all drives:

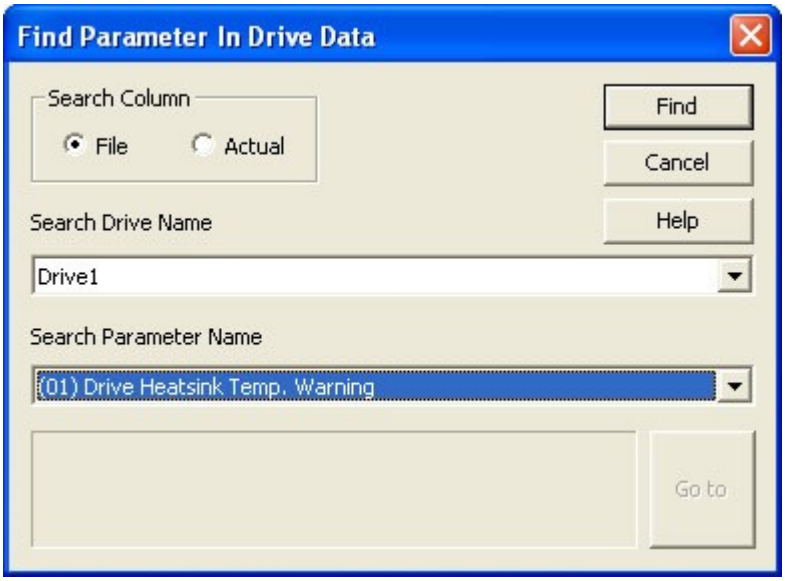
- Select **View | Show All Drives** from the menu.

To show a drive, use one of the following:

- Select **View | Visible Drives** and add the check for the drive to show.
- Double-click on the vertical line separating drives.

Finding Parameters In Drive Data

This search function is activated from the Drive Data view and locates parameters for any of the displayed drives. Select **Edit | Find…** from the menu to bring up the Find dialog.



Search Column

The radio buttons select where the cursor will end up when the search is complete either in the **File** values column or in the **Actual** values column.

Search Drive Name

All drives in the drive list will be available for selection from the drop down list. Data entry is not allowed. The drop down list is sorted alphabetically.

Search Parameter Name

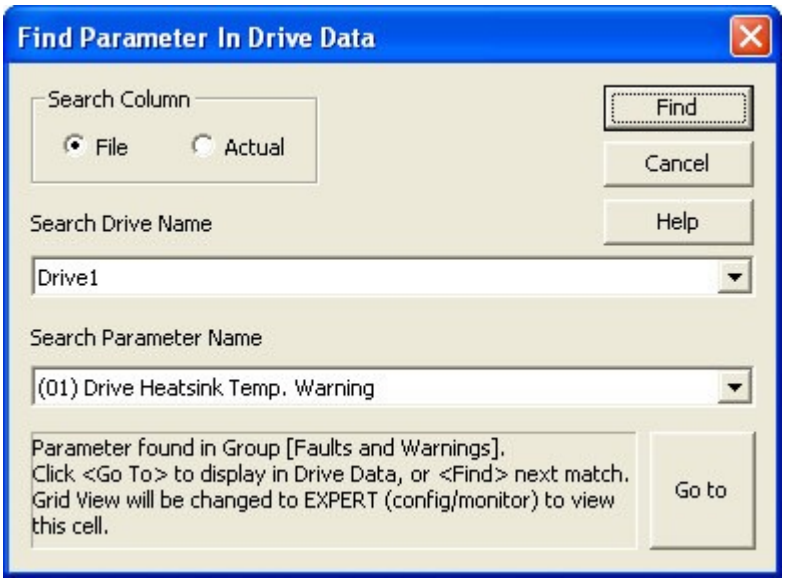
All parameters will be available for selection from the drop down list. Data entry is not allowed. The drop down list is sorted alphabetically.

Select the **Find** button to execute the search.

Select the **Cancel** button to exit the dialog without performing the search.

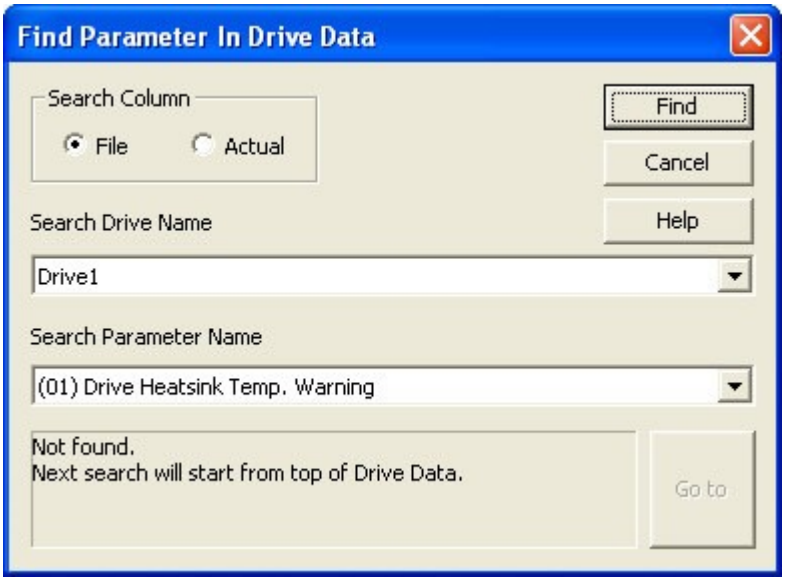
Select the **Help** button to display help on this command.

When a match is found



The matching category will be displayed in the text to the left of the Go To button. You can either find the next match by pressing the Find button again or display this match by pressing the Go To button. By displaying a match, any collapsed category will be expanded and any hidden drives or hidden columns will be shown so that the matching parameter can be displayed.

When a match is not found



When a match is not found, the dialog will display "Not Found". The first match will always be found, subsequent searches of the same information may not have a match. The next search will start from the top of the Drive Data.

Copy/Paste Parameters - Analog Data View

Copy

Single value, multiple values and entire value columns can be copied. See the section on How To Select Parameters.

Once values are selected, use one of the following methods to Copy:

- Click the button from the standard toolbar
- Choose **Edit | Copy** from the menu.
- Press <**Ctrl + C**>.
- Right-click and select **Copy**.

Paste

A single value can be pasted anywhere there is a currently configurable value. Select the value and use one of the following methods to Paste:

- Click the button from the standard toolbar
- Choose **Edit | Paste** from the menu.
- Press <**Ctrl + V**>.
- Right-click and select **Paste**.

Multiple values will be pasted onto matching parameters.

Note:

When multiple values are to be pasted, all receiving values must be configurable. If any are not, an error message will display and the paste command will not execute.

Undo

Undo reverses the last edit action. Undo/Redo maintains 10 levels each. Undo command can be activated by one of the following methods:

- Click the button on the drive list standard toolbar.
- Choose **Edit | Undo** from the menu.
- Press <**Ctrl + Z**>.

When an Undo operation involves changes to values which are now read-only, the Undo operation will fail and an error message will be displayed. When the read-only status of the values changes, Undo can be selected and the operation that previously failed will be performed.

A single Undo operation may contain several commands. For example, when Factory Defaults are restored for an entire column; all value changes will be stored as a single Undo command.

Note: Undo command cannot be used to undo output override or toggle an overridden output.

Redo

Redo reverses the action of the last Undo command. Undo/Redo maintains 10 levels each. Redo command can be activated by one of the following methods:

- Click the button on the drive list standard toolbar.
- Choose **Edit | Redo** from the menu.
- Press <**Ctrl + R**>.

When a Redo operation involves changes to values which are now read-only, the Redo operation will fail and an error message will be displayed. When the read-only status of the values changes, Redo can be selected and the operation that previously failed will be performed.

A single Redo operation may contain several commands. For example, when Factory Defaults are restored for an entire column; all value changes will be stored as a single Redo command.

Note: Redo command cannot be used to redo output override or toggle an overridden output.

Monitoring ONLINE Drive Data

Monitored parameters are parameters that cannot be changed. They are available for observation and comparison.

Monitored parameters read from the drive will be displayed in the current animation color (default is red) when the drive is connected. When the drive is disconnected, the color of the read-only data will change to black to indicate the drive is no longer connected.

Download File Data - Analog Drive

Changes in the file values are **not** automatically downloaded to the drive. Single file value, multiple file values or entire file value columns can be downloaded.

Additionally, the file data from another drive in the ONLINE drive list can be downloaded to the connected drive. This is only available for all the file data from another drive, not selected values.

Note:

If the selected drive is not the connected drive, the connected drive will be renamed to the selected drive's name.

Once values are selected, use one of the following methods to Download File Data:

- Click the button on the drive list standard toolbar.
- Select **Online | Drive Operations | Download File Data** from the menu.
- Right-click and select **Download File Data**.

When changes in the File column are downloaded, the Actual column will be updated to reflect the downloaded values.

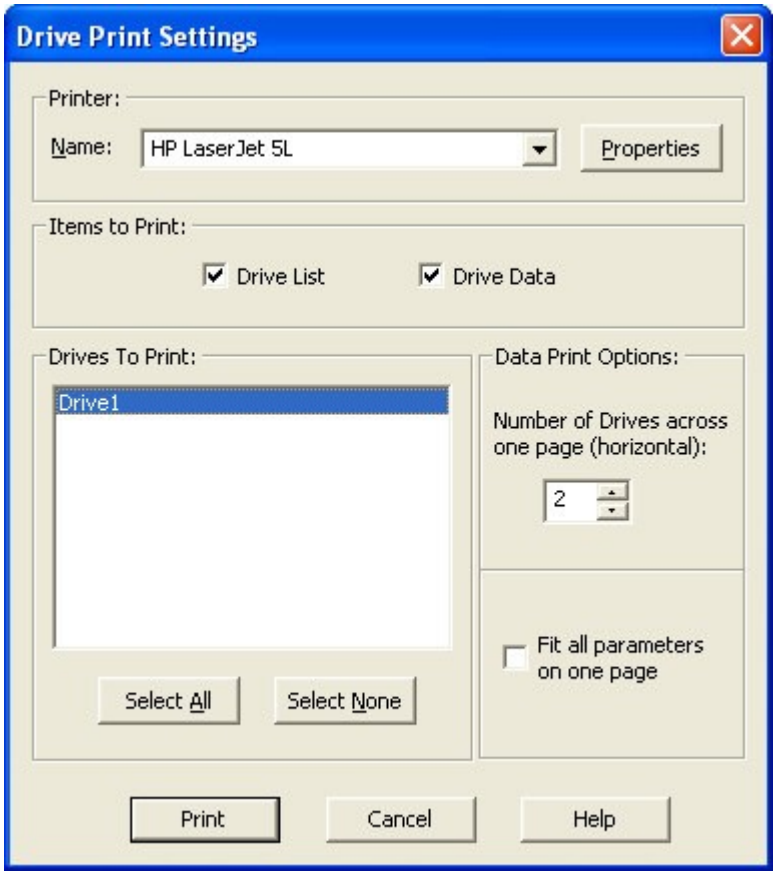
Some configuration parameters can only be downloaded while the drive is disabled. If an attempt is made to download any of these parameters while the drive is enabled, an error message will be displayed and the download will be aborted.

File data can only be downloaded if the File firmware version matches that of the Actual firmware version.

Printing Drive Information

With either a drive list open and having focus, or drive data view open and having focus, the **Drive Print Settings** dialog can be displayed by choosing one of the following:

- Click the button from the drive list standard toolbar
- Select **File | Print…** from the menu



The following settings can be adjusted to get a printed document:

1. Under the **Printer:** box, there are two items to configure:
   - The drop-down list in the **Name:** field allows you to choose known printers. The printers can reside locally or on a network.
   - The **Properties** button opens up a dialog to further configure the chosen printer. Select **OK** to accept the printer properties. Select **Cancel** or click the to exit the properties dialog without changing the settings.
2. Under the **Items to Print:** box, there are two selections:
   - Drive List
   - Drive Data

3. Under the **Drives to Print:** box, there are three options:
   - Drives To Print
   - Select All
   - Select None
4. Under the **Data Print Options:** box, there are two ways to configure the output:
   - Number of Drives across one page (horizontal):
   - Fit all parameters on one page

When the settings are satisfactory, select **Print** to queue the output to a printer. Select **Cancel** or click the to exit the dialog without printing. Select **Help** to display information related to this subject.

Restore Factory Defaults

Factory defaults can be restored for selected values or entire columns of Actual data or File data. If Actual data is restored to factory defaults, the changes will download to the drive immediately. If File data is restored to factory defaults, the changes will need to be downloaded to the drive, if required.

To restore factory defaults, choose one of the following methods:

- Click the button on the drive list standard toolbar.
- Select **Edit | Restore Factory Defaults** from the menu.
- Right-click on selected values and choose **Restore Factory Defaults**.

Output Override

Output Override - Analog Drive

You may want to force a situation to observe the results. One way is to override outputs. The control of the overridden output is exclusively with the PiCPro user. The PiCPro user can toggle the overridden output and can also remove the override.

Outputs can be overridden only if the following criteria are met:

- The drive must be connected and in the ONLINE drive list.
- Drive Data view and/or Control Panel/Oscilloscope view must be active for the ONLINE drive list.
- 220V Shunt on 440V Drive is not assigned to the output.

Note: If communications with the connected drive are lost while the drive has overridden outputs, the following actions will be taken in the drive:

- (34) Drive Communication Fault will be set.
- The control of the overridden output will be taken from PiCPro and returned to the states currently assigned to the output.

Override Output

To override an output, do one of the following:

- Put focus on an output and select **Online | Drive Operations | Override Output** from the menu.
- Right-click on an output and select **Override Output**.

A check mark will appear in front of the menu item to indicate **Override Output** is selected. The word **OVERRIDDEN** will appear in the current animation color next to the light bulb of the output to indicate **Override Output** is active. The status of the output will not change. The output can only be changed by the PiCPro user with a request for the output to be toggled.

Toggle Overridden Output

To toggle an overridden output, do one of the following:

- Put focus on an overridden output and select **Online | Drive Operations | Toggle Output** from the menu.
- Right-click on an overridden output and select **Toggle Output**.

Remove an Override

To remove an override, do one of the following:

- Put focus on an overridden output and select **Online | Drive Operations | √ Override Output** from the menu.
- Right-click on an overridden output and select √ **Override Output**.

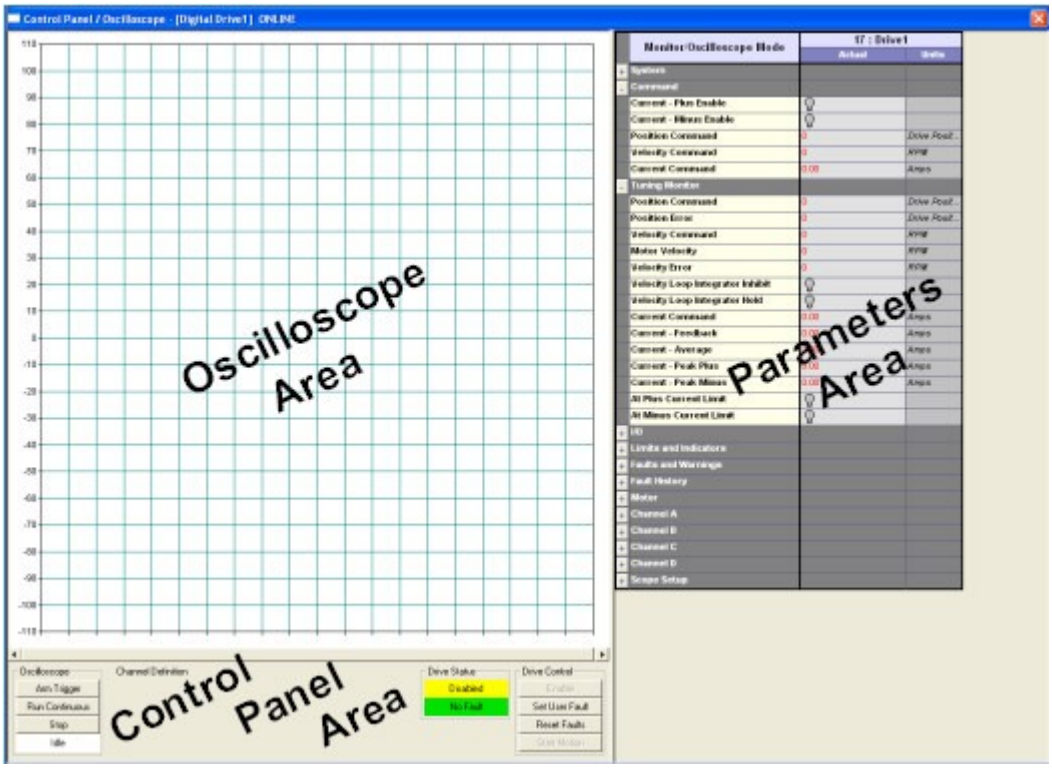
The check mark will disappear from in front of the menu item to indicate **Override Output** is no longer selected. A confirmation message will be displayed.

Control Panel, Oscilloscope View

Control Panel/Oscilloscope View - Analog Drive

Control Panel/Oscilloscope view can be used to setup and tune the drives. The Control Panel/Oscilloscope view, however, must have a Drive List view open first. Closing a Drive List view will also close its Control Panel/ Oscilloscope view.

The Control Panel/Oscilloscope view can be used to display a saved trace.



Note:

It is recommended to maximize the PiCPro display before activating the Control Panel/Oscilloscope view. There is a massive amount of information in this view. It is more easily accessed and analyzed from a full screen view.

Accessing Control Panel/Oscilloscope view

With an ONLINE drive list, one of the following methods will open the Control Panel/Oscilloscope view:

- Click the button on the drive list standard toolbar.
- Select **View | Control Panel/Oscilloscope…** from the menu.
- Right-click and select **Control Panel/Oscilloscope…**

Content of Control Panel/Oscilloscope View - Analog Drive

There are three main areas in this view.

- Oscilloscope
- Control Panel
- Parameters

The Oscilloscope area is located in the upper left corner. It is the only area that cannot be hidden. The Oscilloscope area will expand and contract accordingly as the Control Panel area and Parameters area are hidden and shown.

The Control Panel area is located in the lower left corner. It can be hidden and shown. The Control Panel area will not expand or contract due to the Parameters area being hidden or shown.

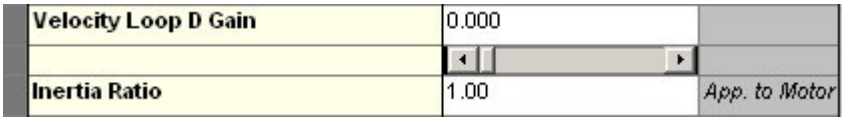
The Parameters area is located in the right side. It can be hidden and shown. The Parameters area will not expand or contract due to the Control Panel area being hidden or displayed. The Parameters area is using the same format and much of the same information as the Drive Data view.

The Parameters area has the following modes available:

- Monitor/Oscilloscope Mode
- Tuning mode
- Velocity Control Mode
- Current Control Mode
- Auto Tuning Control Mode
- Alignment Control

The Parameters area displays only actual data. File data cannot be modified from the Control Panel/Oscilloscope view.

Several parameters use a scrollbar to determine a value. The scrollbar applies to the parameter directly preceding it and functions in the following manner. The value can be entered into the parameter actual value field or selected with a scrollbar control. Movement of the scrollbar button produces a coarse change in value. The value can be fine-tuned by clicking on the arrows of the scrollbar to increment/decrement by 1 or clicking between the scroll box and the arrows to increment/decrement by 10.



Note: This applies to any parameter that uses a scrollbar for value adjustment.

Parameters have been grouped into categories. Categories can be collapsed by selecting the (-) button to the left of the category name. Categories can be expanded by selecting the (+) button to the left of the category name. The following chart specifies the categories and the modes in which they are available:

Category	Monitor / Oscilloscope Mode	Tuning Mode	Velocity Control Mode	Current Control Mode	Auto Tuning Control Mode	Alignment Control Mode
System	X	X	X	X	X	X
Command	X	X	X	X	X	X
Tuning Monitor	X	X	X	X	X	X
I/O	X	X	X	X	X	X
Limits & Indicators	X	X	X	X	X	X
Faults & Warnings	X	X	X	X	X	X
Fault History	X	X	X	X	X	X
Motor	X	X	X	X	X	X
Channel A	X	X	X	X	X	X
Channel B	X	X	X	X	X	X
Channel C	X	X	X	X	X	X
Channel D	X	X	X	X	X	X
Scope Setup	X	X	X	X	X	X
Tuning Control		X	X	X	X	
Manual Velocity Tuning Settings			X			
Manual Current Tuning Settings				X		
Auto Tuning Settings					X	
Alignment Settings						X

Changing Control Panel/Oscilloscope modes

The following modes are available in the Parameters area:

1. **Monitor Mode** contains the parameters most often monitored. In this view, the Oscilloscope is usable to monitor any parameter. There are no provisions to change anything in the drive or to control the drive.
2. **Tuning Mode** contains the parameters and settings required to tune a drive. The capability is provided to adjust the drive velocity tuning parameters. The velocity P, I, and D gains and Inertia Ratio may be adjusted along with controlling the low pass filter. These parameters have no effect when running the drive in current control mode.

Tuning Mode	Stacker	
	Actual	Units
Tuning Control		
Velocity Loop P Gain	50.0	
Velocity Loop I Gain	2000	
Velocity Loop D Gain	0.000	
Inertia Ratio	1.00	App. to Motor
Low Pass Filter Enable	Active	
Low Pass Filter Bandwidth	800	Hz

3. **Velocity Control Mode** contains the parameters and settings required to run a drive in velocity mode. A category is added that allows for software control of the drive by specifying velocity. Four commands can be issued to the drive: forward, reverse, sine wave and square wave. These are selected from a drop down list. The velocity is specified in RPM. Forward causes the drive to run with a constant positive command. Reverse causes the drive to run with a constant negative command. For the sine and square wave modes a period is selected from a dropdown list. Although the drive must be stopped to change the command mode, the velocity and period can be adjusted while the drive is running.

Velocity Control Mode	Stacker	
	Actual	Units
Manual Velocity Tuning Settings		
Motor Direction/Mode	Forward	
Velocity	0	RPM
Period	0.25	Seconds

While parameters are used to control the drive, they cannot initiate or terminate motion. Motion is started/stopped by the start/stop motion pushbuttons in the Control Panel area.

When entering or leaving Velocity Control View, the drive must be disabled to prevent unexpected motion. A dialog will appear accordingly.

4. **Current Control Mode** contains the parameters and settings required to run a drive in current mode. A category is added that allows for software control of the drive by specifying current. Current Control mode operates exactly the same as the Velocity Control mode, except that the current controls are in Amps. The tuning parameters have no affect while running in current control mode.

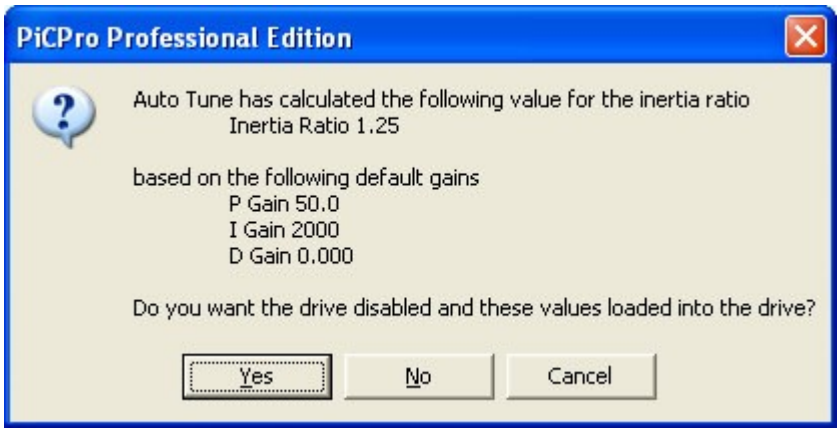
Current Control Mode	Stacker	
	Actual	Units
Manual Current Tuning Settings		
Motor Direction/Mode	Forward	
Current	0.00	*Amps*
Period	0.25	*Seconds*

5. **Auto Tuning Control Mode** allows the interface to setup and execute an auto tune cycle. While executing the auto tune cycle, the drive is under software control and being operated in current mode. The Current Limit parameter is a percentage of the motor continuous current and the Distance Limit parameter limits the number of revolutions of the motor for the forward and reverse stroke of the auto tune cycle.

Auto Tuning Control Mode	Stacker	
	Actual	Units
Auto Tuning Settings		
Current Limit	10	*% continuo...*
Distance Limit	0.1	*Revs +/-*

Motion is initiated by the Start/Stop Motion button in the Drive Control group of the Control Panel. The drive will oscillate for a few seconds and then stop. The auto tune cycle can be stopped at any time by clicking the Stop Motion button.

When the drive has completed the auto tune cycle, the following dialog will be displayed. Select **Yes** to disable the drive and change the parameters in the drive. Select **No**, **Cancel** or to close the dialog without updating the parameters in the drive.



Note: To move between the above modes, select

- **Mode | Monitor**
- **Mode | Tuning**
- **Mode | Control Panel | Velocity Control**
- **Mode | Control Panel | Current Control**
- **Mode | Control Panel | Auto Tuning Control**

Navigating in the Control Panel, Oscilloscope View

Navigating in the Control Panel/Oscilloscope View

The Control Panel/Oscilloscope view contains the connected drive from the ONLINE drive list.

Note: The Control Panel/Oscilloscope view only interfaces with the connected drive.

Display Control Panel

This command shows the pushbuttons and indicators below the oscilloscope. Otherwise the oscilloscope trace covers the full height of the screen.

Select **View | Show Control Panel** from the menu to display the command area. A √ will appear in front of the menu item to indicate the feature is activated.

Select **View |** √ **Show Control Panel** from the menu to hide the command area. The √ will disappear from in front of the menu item to indicate the feature is deactivated.

Display Parameters

This command shows the parameters to the right of the oscilloscope. Otherwise the oscilloscope trace covers the full width of the screen.

Select **View | Show Parameters** from the menu to display the parameter area. A √ will appear in front of the menu item to indicate the feature is activated.

Select **View |** √ **Show Parameters** from the menu to hide the parameter area. The √ will disappear from in front of the menu item to indicate the feature is deactivated.

Changing the Parameters Area

There are two columns of information for the connected drive from ONLINE drive list. The columns are **Actual** values and Actual **Units**. The bold words are the column headers in the Parameters area of the Control Panel/Oscilloscope view.

Here are some ways to change the look of the Parameters area of the Control Panel/Oscilloscope view:

1. Pressing the up or down arrow on the keyboard moves the cursor to the next category in the column.
2. Use any of the following methods to collapse categories:
   - Select the (-) button to the left of the category name to collapse single categories.
   - Select **View | Categories | Collapse All** from the menu to collapse all categories.
   - Right-click anywhere in the Actual values column and select **Categories | Collapse All** to collapse all categories.
   - Click the far-left dark gray cell of any parameter row, all categories will collapse.
3. Use any of the following methods to expand categories:
   - Select the (+) button to the left of the category name to expand single categories.

- Select **View | Categories | Expand All** from the menu to expand all categories.
- Right-click anywhere in the Actual values column and select **Categories | Expand All** to expand all categories.
- Double-click in the area below the categories and parameters, all categories will expand.

4. To toggle between collapsing and expanding single categories, use any of the following methods:
   - Double-click on a dark gray category row of either the Actual or File data columns.
   - Set the cursor to a dark gray category row of either the Actual or File data columns and press the **Enter** key.

File Menu

File Menu Features

The features made available by the File menu are performed on files used by the Control Panel/Oscilloscope view. These operations do not address the drive files.

While some drive parameter values can be modified from the Control Panel/Oscilloscope view, the changes cannot be saved from this view. You must move to the Drive List view (Digital Drive List view for a digital drive system) or the Drive Data view (Digital Drive Data view for a digital drive system) to save the drive parameter value changes to the drive file.

Save Trace

This feature saves the entire current trace data to a tab-delimited text file (*.txt).

1. Select **File | Save Trace …** from the menu.
2. The **Save As** dialog appears for filename and location. The current drive name will be the default filename with a .txt extension.
3. Enter the filename.
4. Select **Save** to save the file and close the dialog. Click or select **Cancel** to close the dialog without saving the file.

Even though the saved trace is a text file, it is not intended that the file be modified. **MMC Smart Drive.xls** has been developed to generate a plot similar to what is seen in the Oscilloscope area of the Control Panel/Oscilloscope view.

MMC Smart Drive.xls is part of the Applications software installation. It can be found in the tools directory **C:\Program Files\G&L Motion Control\Applications Vx.y.z\Tools**.

Restore Trace

This feature reads in a trace from a previously saved tab-delimited text file (*.txt).

1. Select **File | Restore Trace …** from the menu.
2. The **Open** dialog appears for filename and location. The current drive name will be the default filename with a .txt extension.
3. Enter the filename.
4. Select **Open** to open the file and close the dialog. Click or select **Cancel** to close the dialog without opening the file. An additional selection is available. You can check the **Open as read-only** box for read-only access to the trace file.

Note: A dialog will appear if discrepancies are detected in the format of the restored trace file.

Save Scope Template

This feature saves the oscilloscope settings and the velocity, current, auto tuning and alignment control settings in a *.scp file for use on other drives. Typically, this feature would be used to establish a favorite group of settings that can be called into any drive. None of the drive parameters are saved in this file, only the control panel and oscilloscope settings.

1. Select **File | Save Scope Template…** from the menu.
2. The **Save As** dialog appears for filename and location.
3. Enter the filename.
4. Select **Save** to save the file and close the dialog. Click or select **Cancel** to close the dialog without saving the file.

Note:

For a specific drive, all the above mentioned settings along with all the drive data is saved in the *.adv file for an analog drive system or the *.ddv file for a digital drive system.

Recall Scope Template…

This feature reads a previously saved control panel and oscilloscope settings (*.scp).

1. Select **File | Recall Scope Template…** from the menu.
2. The **Open** dialog appears for filename and location.
3. Enter the filename.
4. Select **Open** to open the file and close the dialog. Click or select **Cancel** to close the dialog without opening the file. An additional selection is available. You can check **Open as read-only** box for read-only access to the scope template.

Note:

Template files (*.scp) have a signature that is checked on recall. A dialog will appear if there is a problem.

Restore Parameters

This feature restores the drive to the condition it was in before entering the Control Panel/Oscilloscope view.

1. Select **File | Restore Parameters** from the menu.
2. A dialog will appear to confirm this action.

Print Trace

This feature prints the current trace screen on the selected printer.

1. Select **File | Print Trace…** from the menu. The **Print** dialog appears.
2. Set the print characteristics.
3. Select **OK** to print the trace and close the dialog. Click or select **Cancel** to close the dialog without printing the trace.

Note:

Although there typically is more data, only what is currently visible on the screen is printed.

Close Oscilloscope

This feature closes the Control Panel/Oscilloscope view.

Select **File | Close Oscilloscope** from the menu.

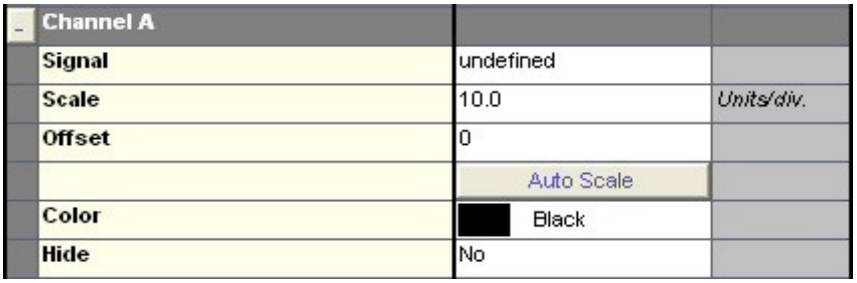
Note:

If attempting to exit while under software control of the drive, a dialog appears to confirm this action.

Oscilloscope Settings

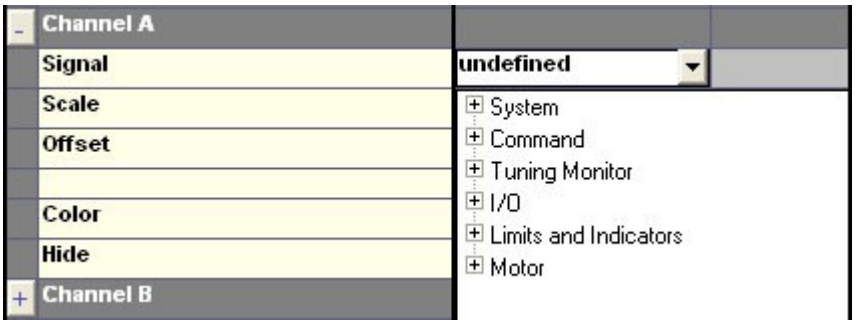
Oscilloscope Channel Configuration

The Oscilloscope can display up to four channels of information. Each channel has a group of settings that describe how the information will appear on the screen. With the exception of the Signal setting, all the settings can be changed whether the Oscilloscope is running or stopped. The settings are found in the Parameters area under categories **Channel A**, **Channel B**, **Channel C** or **Channel D**.



Oscilloscope Channel Signal - Analog

The channel signal setting is the drive variable you wish to monitor with the oscilloscope. The channel signal is selected from a tree control type list of signals in any of the Parameters area views. Any signal can be used in any channel. To return the field to **undefined**, move to the field and press the **Delete** key.



Note: Data entry is not allowed in this field.

Oscilloscope Channel Scale and Auto Scale

The channel scale setting establishes the number of vertical units per division on the oscilloscope display for this channel. The oscilloscope vertical display defaults to 10 units/division. This field's drop down list provides the available choices.

Channel scale can be configured automatically by clicking the button

'. This feature will automatically configure the offset and scale values based on the data collected for that channel. The trace will then be centered and scaled to fit the oscilloscope window.

Oscilloscope Channel Offset and Auto Scale

The channel offset setting establishes the value that appears at the vertical center of the oscilloscope trace. A value can be entered directly into this field.

Channel offset can be configured automatically by clicking the button

. This feature will automatically configure the offset and scale values based on the data collected for that channel. The trace will then be centered and scaled to fit the oscilloscope window.

Oscilloscope Channel Color

The channel color setting allows you to select a different color for each of the channels. The channels are defaulted to different colors. This field's drop down list provides alternate choices.

Oscilloscope Channel Hide

The channel hide setting allows you to remove a channel from the display. Even though the hidden channel will not be displayed, data is still being recorded so that the channel can be displayed at any time and the data will be correct. This field's drop down list provides a Yes/No choice. The default value is No.

Oscilloscope Setup

Oscilloscope Setup

The settings described in this section define the characteristics for the trigger and sampling of the trace.

Scope Setup		
Trigger Signal	undefined	
Trigger Level	0.000	
Trigger Edge	Rising	
Trigger Mode	Single	
Buffer Trigger Position	0	*% before*
Sample Rate	2.000	*mSeconds*
Samples per division	1	
Secondary Scale	Channel B	
Line Weight	Thin	

Trigger Signal

Trigger signal is the drive variable the drive monitors to create a trigger event. The trigger signal is selected from a tree control type list of signals in any of the Parameters area views. Any signal can be used. To return the field to **undefined**, move to the field and press the **Delete** key.

Note:

Data entry is not allowed in this field.

Trigger Level

Trigger level is the value of the trigger signal at which the trigger should occur. The acceptable range is –2,147,483,648 to 2,147,483,647.

Trigger Edge

Trigger edge setting is a three-selection choice from a drop down list.

1. **Immediate** triggers once the buffer position criteria are met.
2. **Rising** triggers when the present value is greater than the last value and the present value is greater than or equal to the trigger level.

3. **Falling** triggers when the present value is less than the last value and the present value is less than or equal to the trigger level.

Trigger Mode

Trigger mode setting is a two-selection choice from a drop down list.

1. **Continuous** captures data, displays it and then re-arms the trigger so that another data capture occurs automatically. This process will continue until it is manually stopped.
2. **Single** allows the trigger event to occur once and then ends the process. The trigger must be armed again for another data capture to occur.

Buffer Trigger Position

To view an event, buffer trigger position setting allows you to adjust where in buffered data the trigger occurs. If this value is 0, then all the data will be buffered after the trigger occurred. If this value is 50, then half the data will be buffered before and half will be buffered after the trigger occurred. If this value is 100, then all the data will be buffered before the trigger occurred.

Buffer trigger position field is a percentage ranging from 0 to 100. A value can be entered directly into the field. It also has a slider control selection. There are 600 words of trigger capture buffer. For one channel of a word variable, there are 600 entries. For two channels of a word variable, there are 300 entries for each channel. For one channel of a double word variable, there are 300 entries…

Sample Rate

Sample rate setting specifies the rate at which data is captured. The acceptable range is 0.125 to 8191 milliseconds. Values can be entered directly into this field.

Note: Sample rate applies only to the trigger mode, which runs in foreground.

Samples per Division

Samples per division setting is a four-selection choice from a drop down list. This setting specifies the number of samples to display per each major division along the horizontal axis.

Secondary Scale

Secondary scale setting is a four-selection choice from a drop down list. This setting specifies which channel's scale to display on the right side of the oscilloscope when more than one channel is being displayed. By default, the first channel's scale is displayed on the left and the second channel's scale is displayed on the right, in the appropriate color.

Note: If an invalid channel is selected, a dialog will indicate the problem.

Line Weight

The thickness or width of the lines used in the Oscilloscope traces can be adjusted by the drop down list. There are 3 selections; thin, medium and thick.

Control Panel Features

Control Panel Features

Pushbuttons and indicators are located in the Control Panel area of the Control Panel/Oscilloscope view. They are arranged in the following four columns:

1. Oscilloscope
2. Channel Definition
3. Drive Status
4. Drive Control

Oscilloscope

Oscilloscope Pushbutton Group

This group of pushbuttons controls the trace.

Arm Trigger

Click this button to initiate data capture with the oscilloscope setup information. The drive will begin capturing data, waiting for the trigger event to occur. Data is captured in foreground at the sample rate specified.

Run Continuous

Click this button to run the oscilloscope continuously, where there is no trigger and the capture rate is determined by how fast the workstation is capable of processing the data. Data is captured in background whenever requested by the workstation.

Notes:

- Foreground capture occurs in the control on a very specific time basis. Background capture occurs in the workstation as time permits.
- For best oscilloscope performance, it is recommended that Ladder Animation and View List animation be disabled.

Stop

Click this button to stop the oscilloscope, whether running in trigger mode or continuous.

Trigger State Indicator

The trigger state indicator reflects the current state of the drive trigger mechanism.

- Solid **Idle** – When not using the oscilloscope
- Solid **Running** - When running the oscilloscope in continuous mode
- Blinking **Waiting for Trigger** – When the capture mechanism is armed and looking for a trigger
- Blinking **Triggered** – When a trigger has been encountered, but the capture buffer is not yet full
- Solid **Triggered** – When the capture is complete and being displayed

Channel Definition

To the right of the column heading is the source for the current trace. Normally this is the same as the heading of the drive parameters view. However, if the trace was restored from a file, it will be the source of the information for that file.

The information in this column is a summary of the channels being displayed. The information included is the color of the trace, the signal description and the scaling. When running in continuous mode, the latest actual value is displayed. When a channel is hidden, the text for that channel is grayed out.

Drive Status

This group of indicators reflects the current status of the connected drive.

Enabled/Disabled

This status indicates whether the drive is enabled or disabled. **Enabled** with a green background indicates the drive is enabled. **Disabled** with a yellow background indicates the drive is either physically not enabled or the drive has not been enabled by software control.

Warning/Fault

This status indicates the fault condition of the drive. **No Fault** with a green background indicates the drive has no active faults or warnings. **Warning Fault** with a yellow background indicates that at least one warning is active. **Disabling Fault** with a red background indicates that at least one fault is active.

Drive Control

This group of pushbuttons is used to run the drive while in software control. Software control of the drive is allowed while in the Velocity Control mode, Current Control mode, Auto Tuning Control mode or Alignment Control mode in the Control Panel area of the Control Panel/Oscilloscope view. Pushbuttons unavailable for use will be grayed out.

Enable/Disable

The text on the pushbutton (**Enable** or **Disable**) is the action that will be taken when the pushbutton is clicked and proper conditions exist in the drive for the action to take place. If the software control of the drive cannot be enabled due to the drive not physically being enabled or a disabling fault being active, messages will be generated identifying the problem.

Set User Fault

Click this button to set user fault. The user fault is a disabling fault, which will immediately disable the drive. This button is operational while on the Control Panel/Oscilloscope view.

Reset Faults

Click this button to clear existing faults. If conditions have not been changed to eliminate the fault, the fault indication will come back. This button is operational while on the Control Panel/Oscilloscope view.

Start/Stop Motion

The text on the pushbutton (**Start Motion** or **Stop Motion**) is the action that will be taken when the pushbutton is clicked and proper conditions exist in the drive for the action to take place. If the software control of the drive cannot be enabled due to the drive not physically being enabled or a disabling fault being active, messages will be generated identifying the problem. The type of motion will be determined by the Parameters area mode selected; Velocity Control mode, Current Control mode, Auto Tuning Control mode or Alignment Control mode.

Alignment Mode

Overview: Alignment Mode

Alignment mode is used to establish an operational relationship between a feedback device and a motor magnetic position. After the motor and feedback devices are aligned, the feedback device provides the precise location of the motor magnetic position.

For the purposes of alignment, PiCPro recognizes the following types of feedback devices:

- Incremental Encoders
- Resolvers

PiCPro cannot perform alignment if it is connected to a drive with a motor having a Stegmann encoder. PiCPro will only support Stegmann encoders that have been pre-programmed by Danaher Motion.

The Alignment Tool is only available with MMC Smart Drive firmware versions 2.2 or greater. If alignment is attempted with an earlier version of drive firmware the following message will appear:

Accessing Alignment Mode

1. From the ONLINE drive list view, use one of the following methods to open the Control Panel / Oscilloscope view:
   - Click on the drive list standard toolbar.
   - Select **View | Control Panel / Oscilloscope…** from the menu.
   - Right-click and select **Control Panel / Oscilloscope…**
2. Select **Mode | Control Panel | Alignment Control**. A dialog message will be displayed.
3. Click **Yes** to continue. Click **No** or **Cance**l to exit the dialog.
4. If **Yes** is selected, the drive will be disabled and set to alignment mode. The Control Panel / Oscilloscope grid view will appear.

Parameters in Alignment Mode

- The Parameters area displays only actual data. File data cannot be modified from the Control Panel / Oscilloscope view.
- While parameters are used to control the drive, they cannot initiate or terminate motion. Motion is started/stopped by the start/stop motion pushbuttons in the Control Panel area.
- The Parameters area displays only actual data. File data cannot be modified from the Control Panel / Oscilloscope view.

Overview: Alignment Mode for a Motor with an Incremental Encoder

Current Limit (percentage of continuous current that will align the motor) can be entered. The default value is 25%.

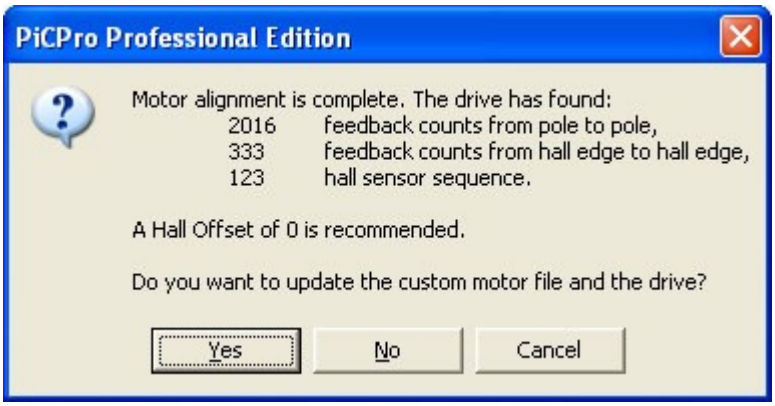
The current will be applied when **Start Motion** is clicked at the Drive Control Panel and remain until the automatic alignment cycle is complete or **Stop Motion** is clicked. While the current is applied, the Current Limit can be changed. The motor will be commanded to magnetic zero, and then incrementally commanded to the next magnetic zero over several sequential moves. When the cycle is complete or **Stop Motion** is selected, the process will discontinue.

Alignment Successful for Motor with an Incremental Encoder

Alignment complete is continuously monitored. When alignment is successful and complete, and the recommended offset is different from the old offset by +/- 15 degrees, PiCPro will indicate that no change is required. A message will be displayed as shown in the following example:

Click **OK** to continue.

If the recommended offset is different from the old by >15 degrees, a prompt will appear asking if the Hall Offset in the .csv file and the motor's Hall Offset should be updated. The following is an example prompt:



Click **Yes** to update the custom motor file and drive.

Click **No** or **Cancel** to discontinue alignment.

Notes:

- When a successful alignment has been indicated, the value can be manually entered into the motor table.
- The Danaher Motion standard motor personality file cannot be modified.

Upon completion of motor alignment a message is displayed recommending a Hall Offset. However, the Hall Offset for a standard motor cannot be changed. The following prompt will be displayed if alignment is performed on a standard motor:

Click **OK** to continue.

A new custom motor must be created to use the recommended Hall Offset.

Alignment Unsuccessful for Motor with an Incremental Encoder

If alignment is complete, and the alignment is unsuccessful, an alignment error message will be displayed.

Incremental Encoder Pole to Pole Count Invalid

Click **OK** to continue. Make sure the counts per rev and number of poles are correct in the motor data file.

Incremental Encoder No Hall Transition Detected

Click **OK** to continue. Make sure the hall sensors are connected correctly to the drive.

Incremental Encoder Too Many Hall Transitions Detected

Click **OK** to continue. Try again. If the problem persists, there may be a problem with the hall sensors in the motor.

Incremental Encoder Hall to Hall Count Invalid

Click **OK** to continue. Make sure the counts per rev and number of poles are correct in the motor data file.

Incremental Encoder Hall Sequence Invalid

Click **OK** to continue. Make sure the hall sensors are connected correctly to the drive.

Overview: Alignment Mode for a Motor with a Resolver

A resolver uses an Index Offset instead of a Hall Offset and therefore does not have Hall sensors. Functionality includes Current Limit adjustment, drive enable, and starting motion.

Alignment Successful for a Motor with a Resolver

Alignment complete is continuously monitored. When alignment is successful and complete, and the recommended offset is different from the old by +/- 15 degrees, PiCPro will indicate no change is required. A message will be displayed as shown in the following example:

Click **OK** to continue.

If the recommended offset is different from the old by >15 degrees, a prompt will appear asking if the Index Offset in the .csv file and the motor's Index Offset should be updated. The following is an example prompt:

Click **Yes** to update the custom motor file and drive.

Click **No** or **Cancel** to discontinue alignment.

Notes:

- When a successful alignment has been indicated, the value can be manually entered into the motor table.
- The Danaher Motion standard motor personality file cannot be modified.

Upon completion of motor alignment, a message is displayed recommending an Index Offset. However, the Index Offset for a standard motor cannot be changed. The following prompt will be displayed if alignment is performed on a standard motor:

Click **OK** to continue.

A new custom motor must be created to use the recommended Index Offset.

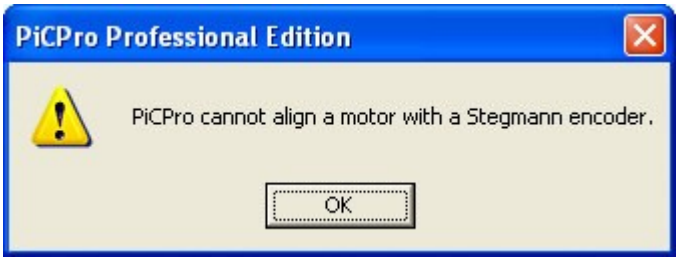
Alignment Unsuccessful for Motor with Resolver

If alignment is complete, and the alignment is unsuccessful, a pole-to-pole alignment error message will be displayed. The following is an example of this type of message:

Click **OK** to continue. Make sure the counts per rev and number of poles are correct in the motor data file.

PiCPro Cannot Perform Alignment with Stegmann Encoder

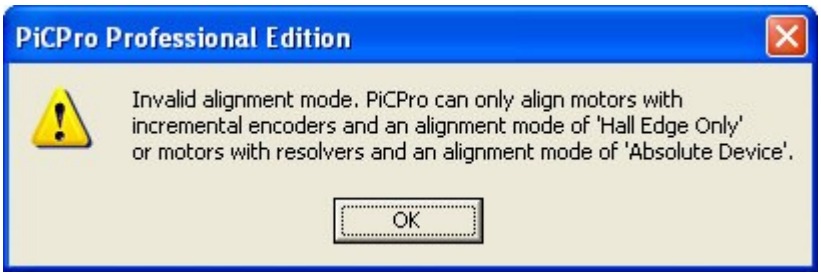
PiCPro cannot perform alignment if it is connected to a drive with a motor having a Stegmann encoder. PiCPro will only support Stegmann encoders that have been pre-programmed by Danaher Motion. If the attempt is made to do so, the following error message will be displayed:



Click **OK** to continue.

PiCPro Cannot Perform Alignment mode of Move, Minimum or Hall then Index

PiCPro cannot perform alignment when connected to a drive with a motor having an alignment mode of ‘Move’, ‘Move Minimum’, or ‘Hall then Index’. If the attempt is made to do so, an error message will be displayed.



Click **OK** to continue.

Chapter 5 - Setting Up an MMC Digital Smart Drive

Overview: MMC Digital Smart Drive Setup

Overview: MMC Smart Drive Setup - Digital Drive

The Drive Setup program in PiCPro allows you to identify all digital interfaced digital drives used in your application. As each drive is identified, it is put into a Drive List. Within Drive List view, you can add, remove, rename, cut, copy and paste drives. You can then save information to a drive file.

The Drive Setup program also allows you to monitor and/or configure characteristics of the digital interfaced drives in the form of parameters. Drive Data view is activated from the Drive List view. Within Drive Data, the parameters for each drive can be monitored and/or configured.

You can view the drive in action using the **Control Panel / Oscilloscope view**. You can also capture data throughout the setup process of the drive to compare the effect of changes to the parameters.

To use Drive Setup:

1. Start your drive list by creating a new digital interfaced drive system file, opening an existing digital interfaced drive system file,
2. Build your drive list - add, remove, rename, cut, copy and paste drives.
3. Save the digital interfaced drive system file (*name*.ddv), subsequently referred to as **drive file**.
4. Further refine or monitor parameters from the Drive Data View as described in Configuring/Editing/Monitoring a Digital Drive.
5. Analyze the drive operation from the Control Panel/Oscilloscope View using the Oscilloscope tool.

Maintenance Mode - Digital Drive

Maintenance mode allows quick identification of all digital interfaced drives.

1. Connect the MMC Digital control to the workstation and open PiCPro.
2. Choose one of the following methods to start Maintenance Mode:
   - Click the button on the Basic Online Operation toolbar.
   - Select **Online | Drive Operations | Maintenance** from the menu.

     Note: If a drive list is already open, a prompt stating the following will be displayed:

     All digital drive lists must be closed before drive maintenance can be selected. Only one digital drive list can be online at a time. Since there is already an online digital drive list, drive maintenance cannot create one.

     Choose **OK** and close all drive lists, then retry step 2.
   - If a drive has not been initialized, you will be prompted to name the drive and select the motor. See the section: ***Connecting to an Uninitialized Digital Drive not in the Drive List***
   - If a drive has already been initialized the Drive List view will be displayed with a line for the new drive.
3. Modify, download or monitor configuration parameters.
4. Save the current configuration to a drive file (.ddv).

Digital Interfaced Drive Terminology

To better understand the remainder of this chapter, you should be familiar with the following terms:

Drive file/list Access Status – **ONLINE** or **OFFLINE** See ***ONLINE vs. OFFLINE Drive List/Drive Data Views*** for operational details.

The first drive list accessed becomes the **ONLINE** drive list. Any other drive lists subsequently accessed are **OFFLINE**. To change an **OFFLINE** drive list to **ONLINE**, the current **ONLINE** drive list must be closed. The actual data is uploaded and monitored for the connected drive. Both file data and actual data can be modified for the connected drive. Only file data can be modified in **OFFLINE** drive lists, actual data is not available.

Data – Parameter information is provided in two forms – File and Actual.

File data is the information read from a drive file (.ddv) or available to be written to a drive file (.ddv). File data can be downloaded to a drive on command, if the drive list is ONLINE. File data contains two elements for each parameter, 1) **File values** and 2) **File units**. These elements appear as columns in the Drive Data view.

Actual data is the information uploaded from the connected drive in an ONLINE drive list. Actual data is dynamic. Changes are downloaded immediately to the connected drive. Actual data can be copied to file data for storage in a drive file (.ddv), but cannot be saved directly into a drive file. Actual data contains two elements for each parameter, 1) **Actual values** and 2) **Actual units**. These elements appear as columns in the Drive Data view or Control Panel / Oscilloscope view.

Accessing Drive System Setup

Accessing Digital Drive System Setup

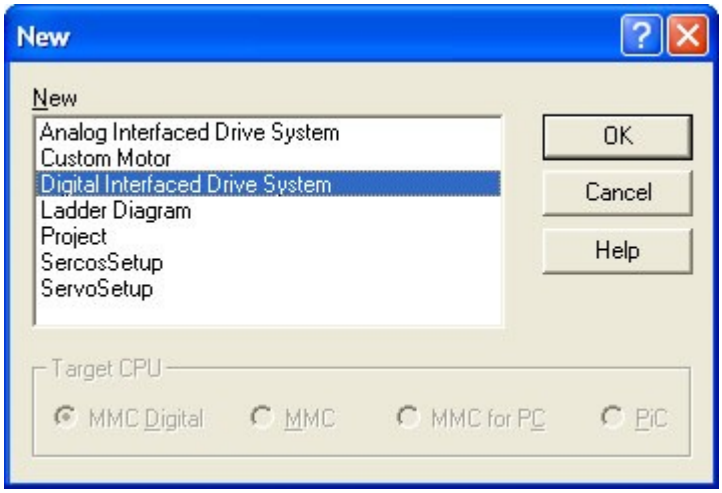
To access Digital Interfaced Drive System setup information, open or create a Digital Interfaced Drive System file.

Creating a New Digital Interfaced Drive System File

1. Choose one of the following methods to create a drive file.
   - Click the button on the standard toolbar
   - Select **File | New** from the menu
   - Press <**Ctrl + N**>

2. Select **Digital Interfaced Drive System** from the dialog that appears.

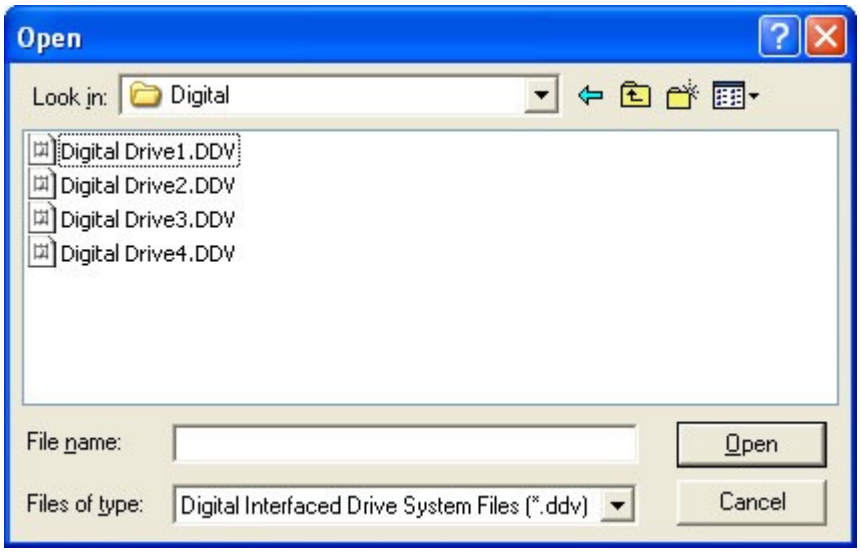
3. Choose **OK** to create a drive file. Select **Cancel** or click to close the dialog without creating a drive file. Select **Help** to display information related to creating a new PiCPro application file.



Opening an Existing Digital Interfaced Drive System File

1. Choose one of the following methods to open a drive file:
   - Click the button on the standard toolbar
   - Select **File | Open** from the menu
   - Press <**Ctrl + O**>

2. The **Open** dialog appears. At the bottom, choose Digital Interfaced Drive System Files (*.ddv) from the drop down list in the **Files of type:** field. A list of drive files displays.
3. Select the file you want to open.



   - Select **Open**
   - Double-click the filename
   - Press **Enter** key

   Note: Select **Cancel** or to exit the dialog without opening a drive file.
4. A drive list will either display as an OFFLINE Drive List View or an ONLINE Drive List View.

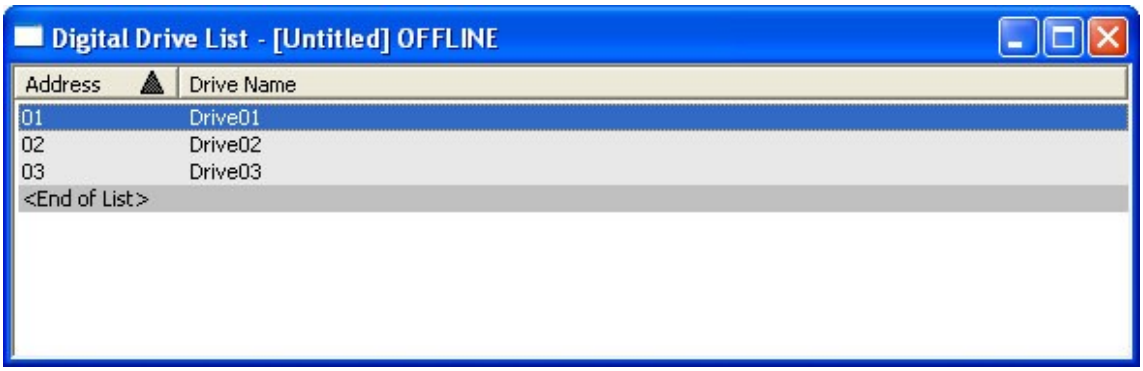
Digital Drive Data List View

The Drive List View is used to view a list of the drives in a system and perform operations such as:

- Insert or Add a Drive
- Edit a Drive Name and Address
- Delete a Drive from the List
- Cut a Drive

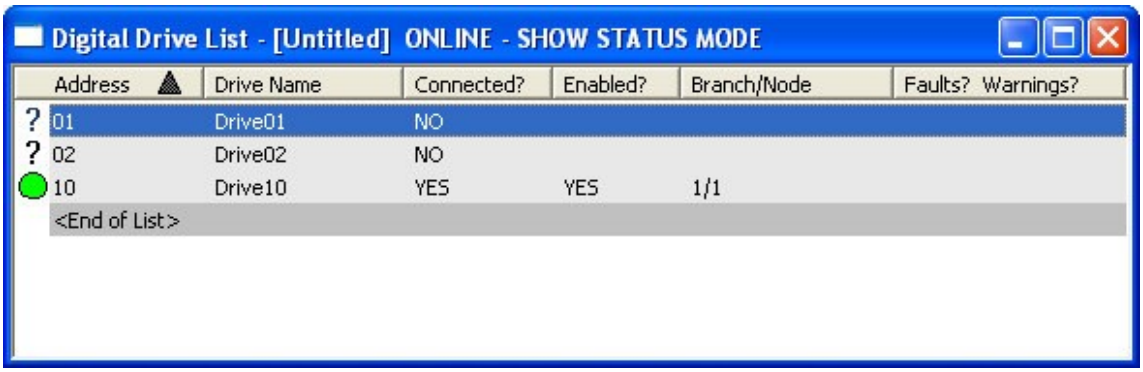
OFFLINE Drive List View - Digital

An OFFLINE Drive List view will appear when there is another Drive List open. This is indicated by the word OFFLINE appearing to the right of the filename.



ONLINE Drive List View - Digital

An ONLINE Drive List view will appear when it is the only Drive List being displayed. An ONLINE Drive List view is indicated by the word ONLINE to the right of the filename.



In the ONLINE Drive List view, only one analog interfaced digital drive can be connected at a time.

ONLINE Drive List view Details

ONLINE Drive List View Details - Digital

This chart shows the possible states of a connected drive appearing in the ONLINE Drive List view.

Drive Name	Connected?	Enabled?	Faults?
✕ Drive1	No		
✕ Drive2	No		Fault/Warning description when last connected
Drive3	Yes	Yes	
Drive4	Yes	No	
Drive5	Yes	Yes	Warning(s) description

Drive6	Yes	No	Warning(s) description
Drive7	Yes	No	Fault(s) description
Drive8	No		
Drive9	No	No	Duplicate Address information

Data – File vs. Actual

Text color indicates whether there are differences between file data and actual data. If there are differences, the text color is blue. If there are no differences, the text color is black.

Drive Address - Digital Drive

The drive address column consists of a status icon and an address number. The address number is a unique number from 1 to 64. The following table describes the status icons when the list view appears in Show Status Mode.

Icon	Indication
Black X	• Drive is not connected.
Green Circle	• PiCPro connected to MMC Digital Control • Drive connected to MMC Control • Drive Enabled • No Faults
Write Circle	• PiCPro connected to MMC Digital Control • Drive connected to MMC Control • Drive not Enabled • No Faults
Green Circle w/Yellow Triangle	• PiCPro connected to MMC Digital Control • Drive connected to MMC control • Drive Enabled • Warning(s) present
White Circle w/Yellow Triangle	• PiCPro connected to MMC Digital Control • Drive connected to MMC Control • Drive not Enabled • Warning(s) present
Red Octagon	• PiCPro connected to MMC Digital Control • Drive connected to MMC Control

	• Drive Enabled • Fault(s) present
? Black Question Mark	• PiCPro connected to MMC Digital Control • Drive with this address is not connected to the MMC Digital control
! Black Exclamation Point	• PiCPro connected to MMC Digital Control • More than one drive with this address is connected.

Drive Name - Digital Drive

The drive name consists of an alphanumeric string that represents the drive name. The drive name must adhere to the following criteria:

- Drive name is limited to 31 characters
- First character must be an alpha or underscore
- The remaining characters can be alphanumeric or underscores
- The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
- Drive names must be unique.

Connected?

A **Yes** in this column indicates the drive data is being monitored for changes. Only one drive can be connected at a time. A **No** in this column indicates the drive data is not being monitored for changes.

Enabled? - Digital Drive

A **Yes** in this column indicates the drive was enabled when the drive status was last read. A **No** in this column indicates the drive was not enabled when the drive status was last read. If this column is blank, the control does not recognize this drive.

If the drive being viewed is the connected drive (as indicated by a **Yes** in the connected column) the drive status will be read continuously. If the drive list view is in "Show Status Mode" (indicated in the Windows title bar), the drive status of all drives connected to the MMC Digital control will be read frequently.

Faults? Warnings?

If this column is blank, there are no faults or warnings registered for the connected drive or the previously connected drives. If a single fault or warning exists for the connected drive or existed for the previously connected drives, the fault or warning description will be displayed. If multiple faults or warnings are detected for the connected drive or the previously connected drives, the fault and/or warning numbers will be listed. More details on the faults and warnings can be obtained in the Drive Data view.

Branch/Node - Digital Drive

A ‘Branch/Node’ column is optional and can be toggled by selecting **View | Column | Branch/Node**. The branch and node column help illustrate how the drives are wired together. There can be 4 branches and up to 16 nodes per branch. The first drive wired off of a branch becomes node 1 for that branch - the next drive, node 2, and so on.

ONLINE Drive List and Drive Data View Scenarios

Connecting to a MMC Digital Control

- Physically connect the MMC Digital Control to the workstation using the PiCPro cable.
- The Status bar connection icon will change to .
- Configuration parameters will automatically be uploaded into actual data for the drives in the drive list.
- Differences between file data and actual data will be identified.

Drive List view

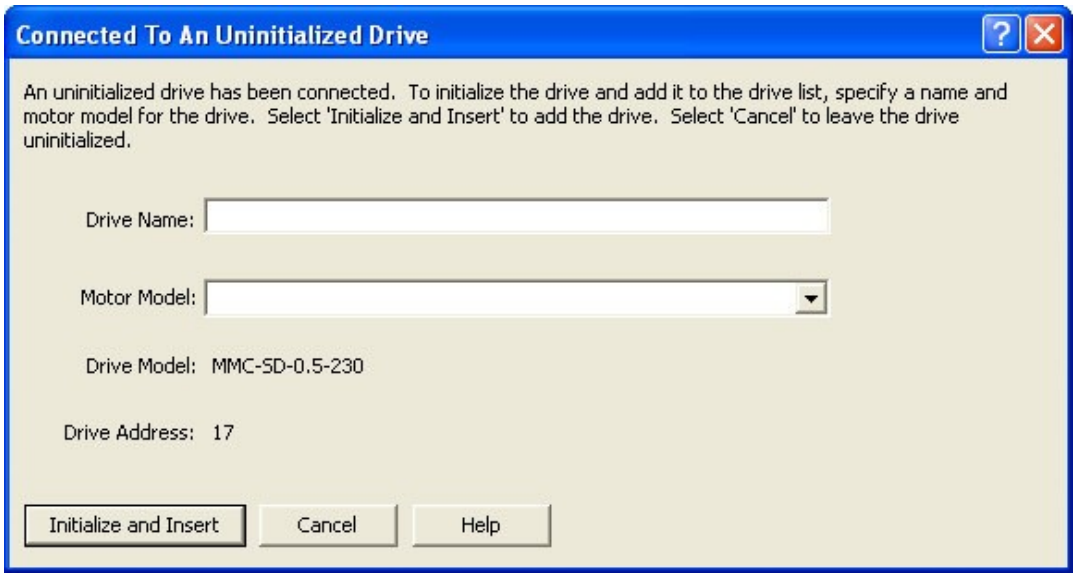
The drive icon and drive information will change to reflect the current status.

Drive Data view

The drive icon and drive information will change to reflect the current status.

Connecting to an Uninitialized Digital Drive not in the Drive List

1. Physically connect the MMC Digital Control to the workstation using the PiCPro cable. The Status bar connection icon is changed to .
2. A dialog window will appear asking for information about the uninitialized drive:



3. If you wish to identify this drive as a new drive, specify a name for the drive and select a motor.
   - At **Drive Name:** enter a name for the drive. The drive name must adhere to the following criteria:
     - Drive name is limited to 31 characters
     - First character must be an alpha or underscore
     - The remaining characters can be alphanumeric or underscores
     - The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
     - Drive names must be unique.
   - At **Motor Model:** select a motor from the dropdown list.

4. Select **Initialize and Insert** to initialize the drive and add it to the drive list. Select **Cancel** or to close the dialog without initializing the drive. Select **Help** to display information related to initializing drives.

If **Initialize and Insert** is selected, drive name, motor model and default values for the remaining drive configuration parameters will be downloaded to the drive automatically.

Drive List view

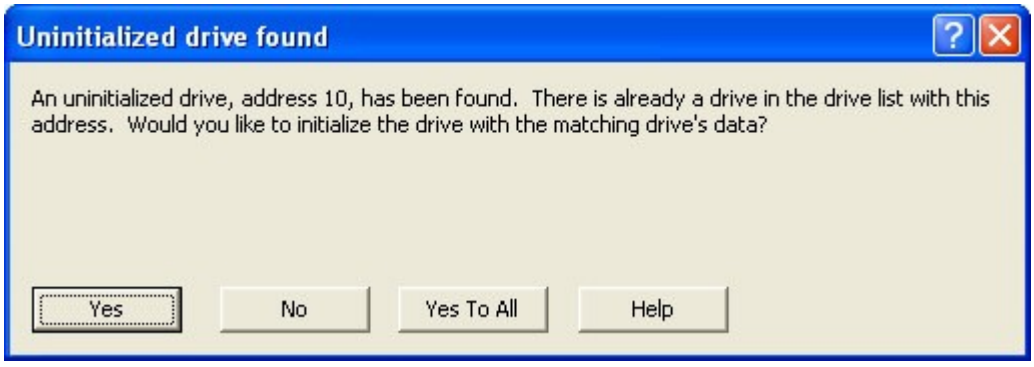
1. The new drive will be added to the drive list.
2. The drive label icon and drive information will reflect the current status of the drive.

Drive Data view

1. Actual and File columns will be added to the Drive Data view for the drive.
2. The drive label icon and drive information will reflect the current status of the drive.

Connecting to an Uninitialized Digital Drive whose Address is in the Drive List

1. Physically connect the MMC Digital Control to the workstation using the PiCPro cable. The Status bar connection icon is changed to .
2. If the uninitialized drives address matches one already in the Drive List, a dialog window will appear asking to initialize the drive with the data already in the Drive List:



3. Choose **Yes** to download the data stored for the drive in the Drive List to the uninitialized drive. This procedure will initialize the drive, enter Show Status Mode and the drives label icon will reflect the current status of the drive.

   If more than one uninitialized drive address is found that matches one already in the drive list, choose **Yes To All** to initialize those drives with the data for the matching drive address stored in the Drive List.
4. Choose **No** to leave the drive uninitialized.

Connecting to an Initialized Digital Drive not in the Drive List

- Physically connect the drive to the workstation using the PiCPro cable.
- The Status bar connection icon will change to .
- If an initialized drive is found with an address that is not in the drive list, and it's name does not match any names in the drive list, a prompt will be displayed asking if you want to add the drive to the drive list (e.g. Drive1 at Address 1):

- Choose **Yes** to add the drive to the drive list. Select **No** or **Cancel** or click to exit the dialog without adding a drive to the drive list.
- Configuration parameters will automatically be uploaded into actual data for the newly connected drive.
- Actual data is copied to file data for the newly connected drive. There will be no differences identified between file data and actual data.

Drive List view

1. A line will be added to the drive list for the newly connected drive.
2. The drive label icon and drive information will reflect the current status of the newly connected drive.

Drive Data view

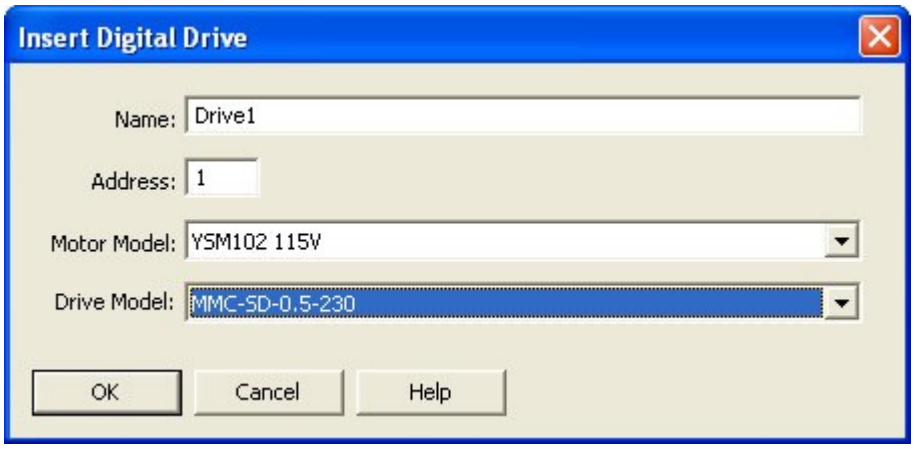
1. Actual and File columns will be added to the Drive Data view for the newly connected drive.
2. The drive label icon and drive information will reflect the current status of the newly connected drive.

Drive Information Operations

Insert/Add a New Digital Drive to a Drive List

Up to 16 digital drives are allowed in a drive list.

1. Choose one of the following methods to insert/add a drive to a drive list:
   - Select **Edit | Insert Drive…** from the menu
   - Press the **Insert** key
   - Right-click and select **Insert Drive…**
2. The **Insert Drive** window will appear. **Address:** defaults to the next available drive address.
3. At **Name:** enter a name for the drive. The drive name must adhere to the following criteria:
   - Drive name is limited to 31 characters
   - First character must be an alpha or underscore
   - The remaining characters can be alphanumeric or underscores
   - The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
   - Drive names must be unique.
4. At **Address:** enter the address desired (allowable address range is 1 to 64).
5. At **Motor Model:** select a motor from the drop down list.
6. At **Drive Model:** select a drive model from the drop down list.
7. Choose **OK** to insert/add a drive to a drive list. Select **Cancel** or to close the dialog without inserting/adding a drive to the drive list. Select **Help** to display information related to inserting/adding a drive to a drive list.



File data will be loaded with selected motor model, drive model and default values for the remaining configuration parameters.

If the address and name of the drive matches the address of a drive connected to the MMC Digital Control that is connected to the workstation, the following events will take place:

Configuration parameters will automatically be uploaded into actual data.

Drive List view

1. A line will be added to the drive list view.
2. The drive label icon and drive information will reflect the current status of the connected drive.

Drive Data view

1. Actual and File columns will be added to the Drive Data view for the drive.
2. The drive label icon and drive information will reflect the current status of the drive.

If the name of the drive does not match the name of the drive that is connected to the MMC Digital Control with the same address, the following events will take place:

Drive List view

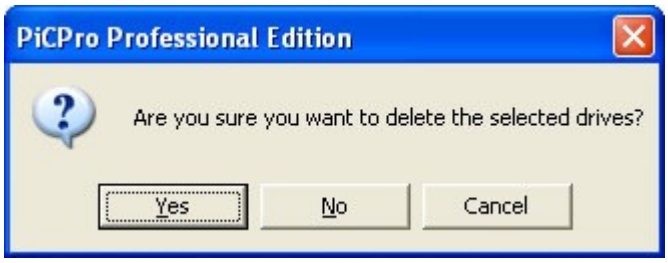
1. A line will be added to the drive list.
2. The drive label icon and drive information will reflect the current status of the connected drive.
3. The drive name shown in the **Label** column will be the one entered in the **Insert Digital Drive** dialog.

Drive Data view

1. Actual and File columns will be added to the Drive Data view for the drive.
2. The drive label icon and drive information will reflect the current status of the drive.
3. The column heading that displays the drive address and the drive label will have a yellow background to indicate that the **File** column drive label is not the same as the **Actual** column drive label.
4. The actual drive name is displayed in the **Drive Label** field in the **Basic** and **System** categories.

Deleting a Digital Drive from the Drive List

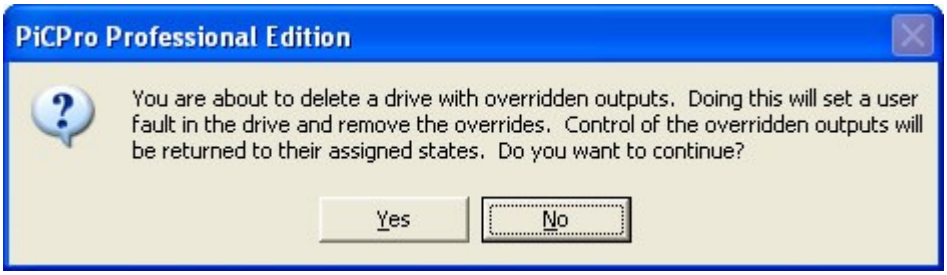
1. Select the desired drive(s) in the Drive List.
2. Choose one of the following methods to delete a drive from a drive list:
   - Select **Edit | Delete Drive(s)…** from the menu
   - Press the **Delete** key
   - Right-click and select **Delete Drive(s)…**
3. The following window will appear:



4. Choose **Yes** if you want to delete the selected drive(s). Select **No**, **Cancel** or if you do not want to delete the drive(s) from the Drive List.

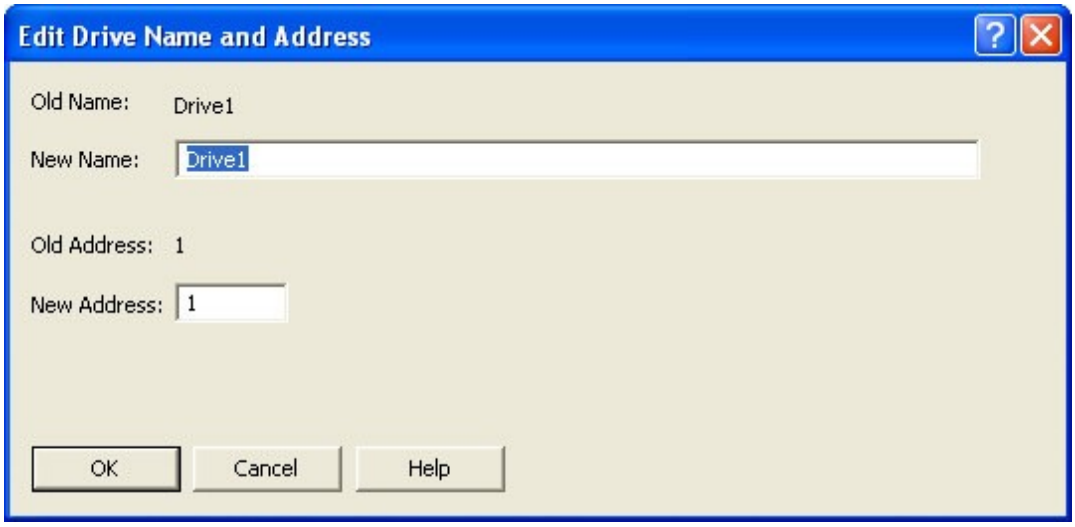
   If **Yes** is selected, the drive(s) will be deleted from the Drive List.

Note: If the selected drive(s) have outputs overridden, an additional message will be displayed:

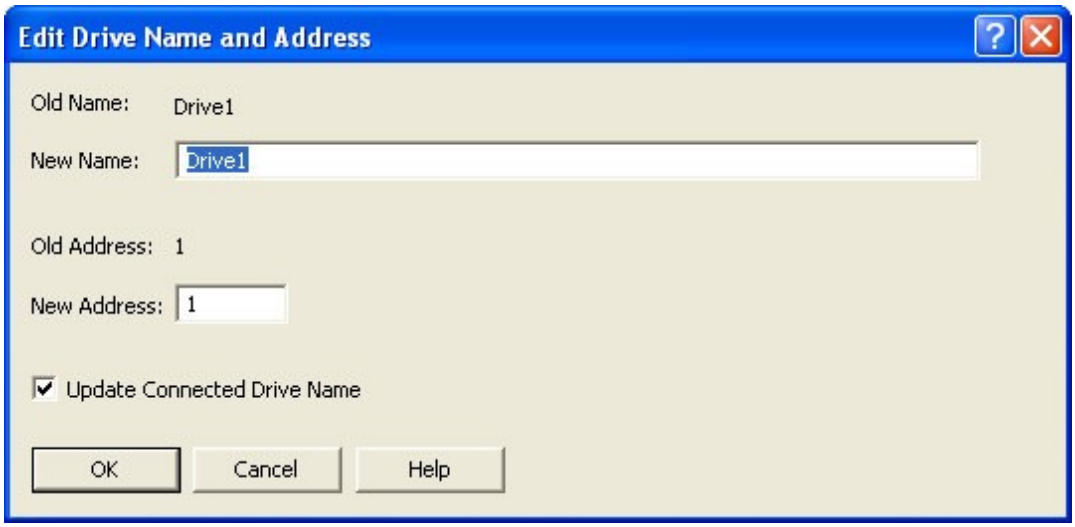


Editing Drive Name and Address

1. Choose a single line in the Drive List and do one of the following.
   - Click the button from the drive list standard toolbar.
   - **Select Edit | Edit Drive Name and Address** from the menu.
   - Press <**Ctrl + Shift + N**>.
   - Right-click and select **Edit Drive Name**.
2. The following dialog will be displayed when the drive being renamed is part of an OFFLINE drive list or if the drive icon is a ? or ✕ indicating a drive with the same address is not connected to the MMC Digital control.



3. The following dialog will be displayed when the drive being renamed is part of an ONLINE drive list, an MMC Digital control is connected to the workstation and there is an initialized drive with the same address connected to the MMC Digital control.



Update Connected Drive Name will be checked by default. If you do not want to update the connected drive's name, click the box to uncheck it.

Note:

Removing this check allows the name of the drive in the drive list to be changed but does not change the name of the connected drive. When OK is selected, the drive header background in the drive data view will be changed to yellow indicating that the drive name no longer matches the name of the connected drive.

4. At **New Name:** enter a name for the drive. The drive name must adhere to the following criteria:
   - Drive name is limited to 31 characters
   - First character must be an alpha or underscore
   - The remaining characters can be alphanumeric or underscores

- The strings are not case sensitive, therefore drive1 is the same as Drive1 or DRIVE1
- Drive names must be unique.

5. At **New Address:** enter the address for the drive. If this is a connected drive, the actual drive address will not be changed. The drive will be shown as disconnected.
6. Choose **OK**. The drive will be renamed if a valid name has been entered.

Note:

Select Cancel or to close the dialog without renaming the drive. Select Help to display information related to renaming a drive.

Editing Drive Data - Digital

1. From the Drive List view, select the drive you want to edit.
2. Choose one of the following methods to edit parameters:
   - Click the button from the drive list standard toolbar.
   - Double-click on the drive.
   - Select **Edit | Edit Drive(s) Data** from the menu.
   - Right-click and select **Edit Drive(s) Data.**

The first time Drive Data is displayed after installing PiCPro, the Basic View will be displayed. Only parameter values with white backgrounds can be edited. Parameter values with grayed backgrounds are read-only and can not be edited. Monitored parameter values with red text will have gray backgrounds. Some actual values will have gray backgrounds while the drive is enabled or while cyclic is running. Disable the drive or stop the scan to make these parameter values available for editing.

Note:

If Drive Enable is not assigned to a drive input, the Drive Enable is on all the time if cyclic is running and CLOSLOOP has been called in the ladder. To disable the drive to make parameter changes, stop the scan. To change parameter values while in Drive Data view, do one of the following methods:

- Double-click on the value.
- Select the value and press Enter key.
- Select the value and start typing.

Changes to parameter values in the actual data column are sent to the drive immediately. Changes to parameter values in the file data column will need to be downloaded to the drive if the change is required in the drive. See ***Downloading File Data for a Digital Drive.***

Selecting Parameters - Digital Data View

How to Select

Single value is selected by left-clicking the value.

Multiple values can be selected at the same time if they are part of the same drive and in the same column.

- To select values next to each other in the column, select a value, hold down the **Shift** key while pressing the up/down arrow or hold down the **Shift** key and select another value. The entire block of values will be displayed as selected.

- To select values not next to each other in the column, select a value then hold down the **Ctrl** key while left-clicking the other desired values within the same column.

Entire file column can be selected by one of the following methods:

- Left-click on any of the values in the File column and select **Edit | Select All In Col** in the menu.
- Right-click on any of the values in the File column and choose **Select All In Col**.
- Left-click on the **File** column header.

Cut/Copy/Paste from the Drive List View

Cut/Copy/Paste from the Drive List view

The Cut, Copy and Paste Drive(s) commands allow you to cut or copy drives from one drive list and paste them to another drive list. The **Copy Drive(s)** command places a copy of the selected item(s) on the clipboard. The **Cut Drive(s)** command removes the selected item(s) from the drive list and places it on the clipboard.

Once the selected item(s) is/are on the clipboard, you can use the **Paste Drive(s)** command to place the selected item(s) into the drive list.

Selecting Drives - Digital Drive List

Single drive is selected by left-clicking the drive name.

Multiple drives can be selected at the same time if they are part of the same drive list.

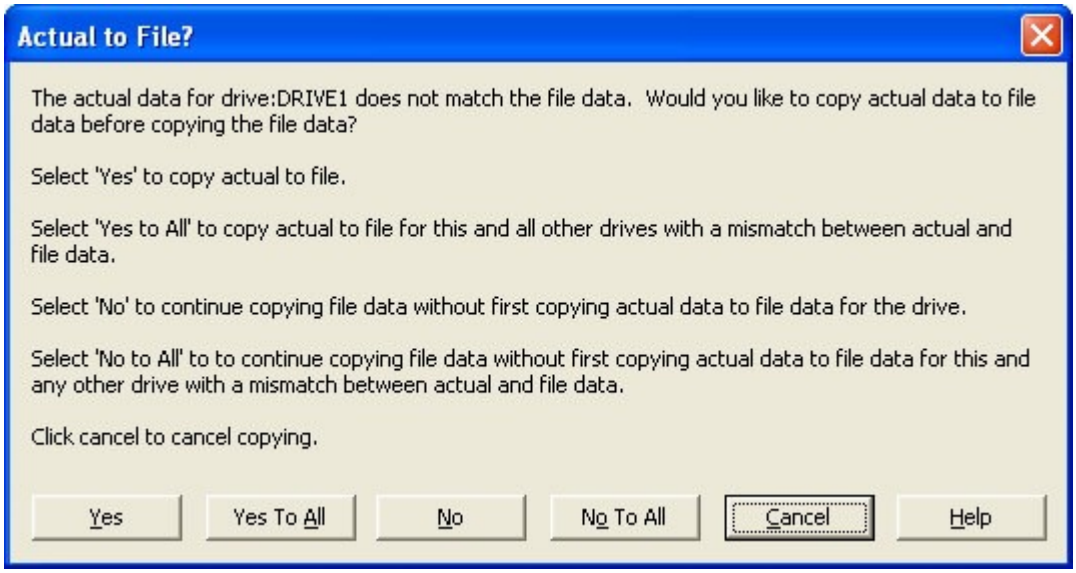
- To select drives next to each other in the drive list, select a drive, hold down the **Shift** key while pressing the up/down arrow or hold down the **Shift** key and select another drive. The entire block of drives will be displayed as selected.
- To select drives not next to each other in the drive list, select a drive then hold down the **Ctrl** key while left-clicking the other desired drives within the same drive list.

Cutting a Drive - Digital Drive List

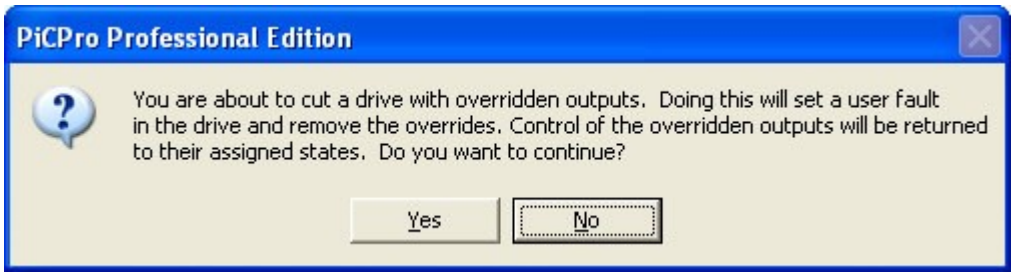
1. Select the drive(s) you want to cut.
2. Choose one of the following methods to issue the Cut command:
   - Click the button on the standard toolbar.
   - Select **Edit | Cut Drive(s)** from the menu.
   - Press <**Ctrl + X**>.
   - Right-click and select **Cut Drive(s)**.

Note:

- Cutting a drive in Drive List view cuts the file data for the drive. If the actual data is different than the file data when a cut command is selected, you will be prompted to decide if actual data should replace the file data before the cut takes place. The following dialog will be displayed:



- If the selected drive(s) have outputs overridden, an additional message will be displayed:



Copying a Drive - Digital Drive List

1. Select the drive(s) you want to copy.
2. Choose one of the following methods to issue the Copy command:
   - Click the button on the standard toolbar.
   - Select **Edit | Copy Drive(s)** from the menu.
   - Press <**Ctrl + C**>.
   - Right-click and select **Copy Drive(s)**.

Note:

Copying a drive in Drive List view copies the file data for the drive. If the actual data is different than the file data when a copy command is selected, you will be prompted to decide if actual data should replace the file data before the copy takes place.

Pasting a Drive - Digital Drive List

1. Select a location for the paste.
2. Choose one of the following methods to issue the Paste command:
   - Click the button on the standard toolbar.

- Select **Edit | Paste Drive(s)** from the menu.
- Press <**Ctrl + V**>.
- Right-click and select **Paste Drive(s)**.

Note:

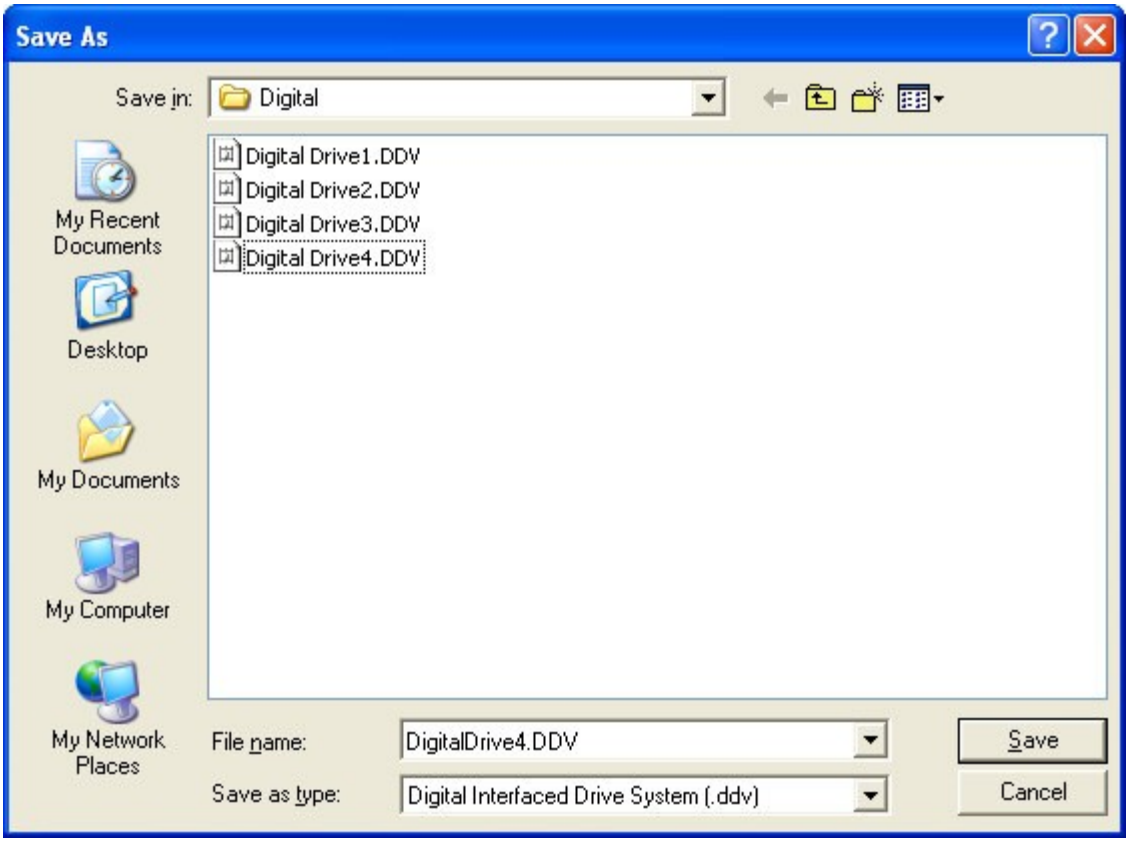
If there is already a drive in the drive list with the same name or address as the drive to be pasted, a prompt will be displayed, asking for a new name or address for the drive to be pasted.

Save and Save as

Save and Save as - Digital Drive

1. Select the drive list or Drive Data view you want to save.
2. Choose one of the following methods to issue the Save command:
   - Click the button on the drive list standard toolbar.
   - Select **File | Save** from the menu.
   - Press <**Ctrl + S**>.
   - Choose **Yes** when prompted by a dialog whether you wish to save the file.

The first time the drive file is saved, you will be prompted to provide a filename and location. The prompt displays your default directory. Enter a filename and location desired. Choose **Save** to execute the save command. If **Cancel** or is chosen, the dialog disappears and the drive file is not saved.



If you wish to give the drive file a different name, choose **File | Save as…** You will be prompted to provide a filename and location. The prompt displays your default directory. Enter a filename and location desired. Choose **Save** to complete the save command. If **Cancel** or is chosen, the dialog disappears and the drive system file is not saved.

Note:

File data is saved with a Save or Save as command. You will be prompted to check for differences between file actual before saving the file. If you select Yes, actual data will be refreshed for all drives. If differences exist between file data and actual data, you will be prompted to update the file data with the actual data for each drive in the drive file that has differences before the Save or Save as is executed. Choose Yes to update the file data with the actual data for the specified drive. Choose Yes to All to update the file data with the actual data for all drives. Choose No to keep only the file data, ignoring the actual data. Choose No to All to keep only the file data, ignoring the actual data for all drives. Choose Cancel or to exit the dialog without saving the drive file. Once each drive with a difference has been addressed, the Save or Save as command will execute.

Close

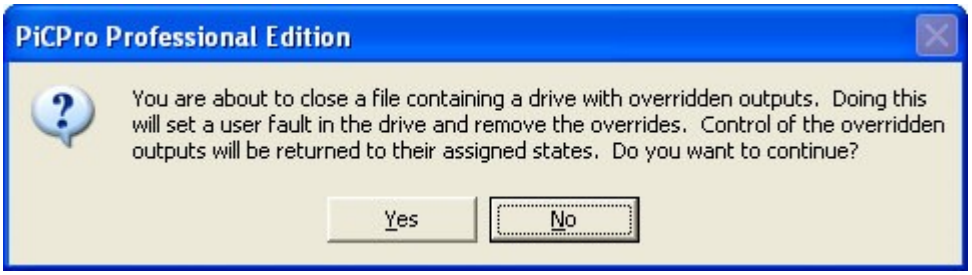
Closing a Digital Drive

When closing a Drive List view, the associated Drive Data view will also close. If drives have been modified without being saved, you will be prompted to save the drive files.

When closing PiCPro, you will be prompted to save any modified drive files that have not been saved.

Note:

- If no changes have been made to file data, you will be prompted to check for differences between file and actual data before closing the drive file.
- If the drive file has drive(s) that have outputs overridden, an additional message will be displayed:



ONLINE vs. OFFLINE Drive List/Drive Data Views

ONLINE vs. OFFLINE Drive List/Drive Data Views - Digital Drive

The following operations/commands can be executed from each view:

Operations/Commands	ONLINE Drive List	ONLINE Drive Data	OFFLINE Drive List	OFFLINE Drive Data
Insert/Delete Drives	X		X	
Cut/Copy/Paste Drives	X		X	
Edit Drive Data		X		X
Save Drive System File	X	X	X	X
Save Drive System File to Different File	X	X	X	X
Print Information for All or Selection of Drives	X	X	X	X
Edit Drive Name and Address	X		X	
Online | Drive Operations	X	X		
View Control Panel / Oscilloscope	X	X		
Download File Data	X	X		
Download File Data to All Drives	X			
Connect To	X	X		
Refresh All	X	X		
Reset Drive Communications	X			

Only one drive list can be ONLINE at a time. All other drive lists opened will be OFFLINE. To change an OFFLINE drive list to ONLINE, the current ONLINE drive list must be closed.

The OFFLINE Drive List view only maintains file data, whereas the ONLINE List View maintains file data for all the drives in the drive list and actual data for all the drives in the drive list connected to the MMC Digital control.

ONLINE Operation

1. If the workstation is connected to a MMC Digital control, actual drive data will be uploaded for any initialized drive that is connected to the MMC Digital control and has an address matching a drive already in the drive list (ONLINE Drive List view). The actual data and file data are compared. The Drive List view and its Drive Data view are updated to reflect differences between file data and actual data. If drives are connected to the MMC Digital control that are not in the drive list, you will be prompted to insert/add the drives. If you choose **Yes** to the prompt, the drive data will be uploaded and stored in both the file data and the actual data. The drive will be added to the Drive List and no differences will be indicated.

   Note: When drive maintenance is selected, initialized drives connected to the MMC Digital control will be automatically added to the drive list. No differences will be shown; actual data will be loaded into file data.
2. In the Drive List view, blue text color indicates that differences exist between file data and actual data. To see the detail of the differences, double-click on the connected drive in the Drive List view. This activates the Drive Data view. The various parameters are displayed in columns under Actual data (information uploaded from the drive) and File data (information read from a saved drive file). Those parameters where the actual data differs from the file data are displayed in a blue color.
3. When saving the drive file, only the file data is saved to the .ddv file. You will be prompted to check for differences between file and actual data before saving the file. If you select **Yes**, actual data will be refreshed for all drives. If differences exist between file data and actual data, you are prompted to copy the actual data to the file data before the save is executed.

4. When cutting or copying a drive from the Drive List view, only the file data is cut or copied. If differences exist between file data and actual data, you are prompted to copy the actual data to the file data before the cut or copy is executed.

OFFLINE Operation

While in the OFFLINE Drive List/Drive Data View, actual drive data will not be uploaded. Only file data is kept for each drive.

Other Operations in the ONLINE Drive List View

Reset Drive Faults - Digital

Reset Faults command resets all faults in the selected drive. This command is available in the ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To reset faults, follow these steps:

1. Select the drive.
2. Choose one of the following methods to issue the Reset Faults command:
   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Reset Faults** from the menu in Drive List and Drive Data view or **Online | Reset Faults** from the menu in Control Panel/Oscilloscope view.
   - Press <**Ctrl + Shift + F**>.
   - Right-click and select **Reset Faults**.

Note:

If the Drive List is in Show Status mode, this command is available in the Drive List for any drive in the list that is connected to the MMC Digital control.

Reset Drive Peaks - Digital

Reset Peaks command sets maximum latched values to zero in the selected drive. This applies to Current – Peak Plus and Current – Peak Minus. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To reset peaks, follow these steps:

1. Select the connected drive.
2. Choose one of the following methods to issue the Reset Peaks command:
   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Reset Peaks** from the menu in Drive List view or **Online | Reset Peaks** from the menu in Control Panel/Oscilloscope view.
   - Press <**Ctrl + Shift + P**>.
   - Right-click and select **Reset Peaks**.

Note:

If the Drive List is in Show Status mode, this command is available in the Drive List for any drive in the list that is connected to the MMC Digital control.

Cold Restart - Digital

Cold Restart completely resets the drive. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected and cyclic is not running. To cold restart, follow these steps:

1. Select the drive.

2. Choose one of the following methods to issue the Cold Restart command:

   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Cold Restart** from the menu in Drive List view or **Online | Cold Restart** from the menu in Control Panel/Oscilloscope view.
   - Right-click and select **Cold Restart**.

Note:

- If the Drive List is in Show Status mode, this command is available in the Drive List for any drive in the list that is connected to the MMC Digital control.
- To stop cyclic, stop the scan.

Set User Fault - Digital

Set User Fault creates a disabling fault in the drive. This command is available in the ONLINE Drive List view, ONLINE Drive Data view or the Control Panel / Oscilloscope view when the connected drive is selected. To set the user fault, follow these steps:

1. Select the connected drive.
2. Choose one of the following methods to issue the Set User Fault command:

   - Click the button on the drive list standard toolbar.
   - Select **Online | Drive Operations | Set User Fault** from the menu.
   - Right-click and select **Set User Fault**.

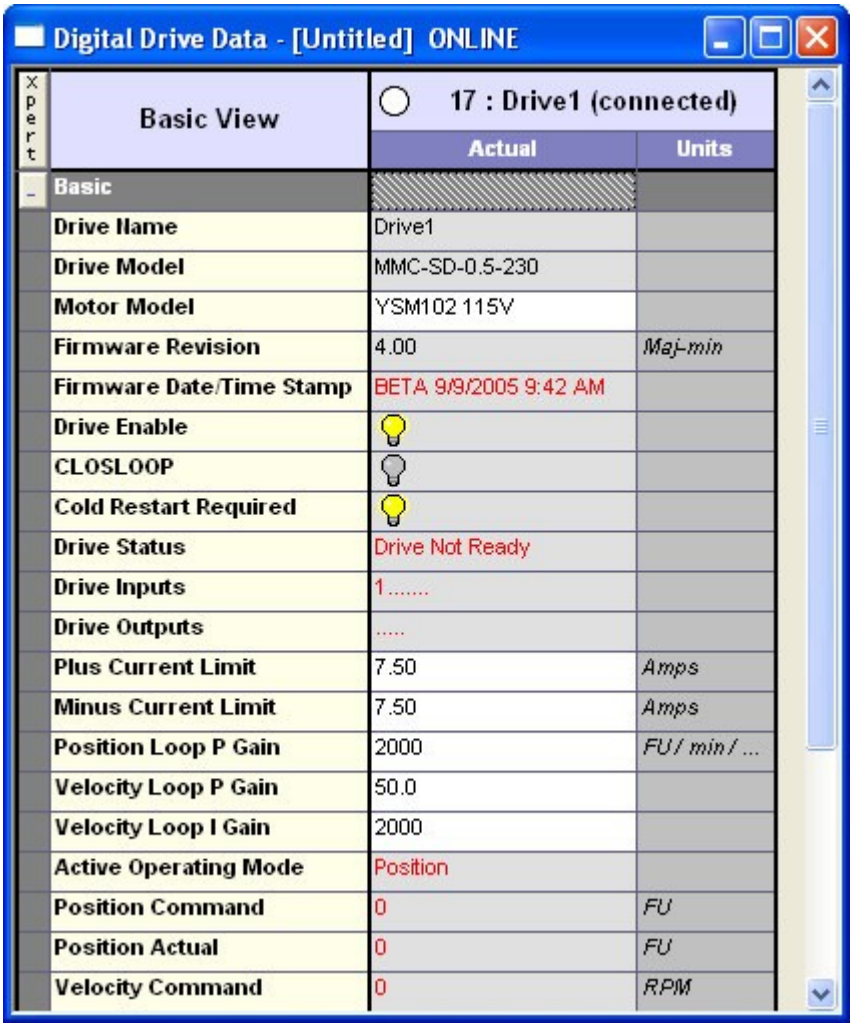
Note:

If the Drive List is in Show Status mode, this command is available in the Drive List for any drive in the list that is connected to the MMC Digital control.

Configuring, Editing and Monitoring a Drive

Configuring/Editing/Monitoring a Digital Drive

Drive Data view is the location to configure/monitor drive characteristics in the form of parameters. The Drive Data view can be active in the ONLINE and OFFLINE modes. The Drive Data view, however, must have a Drive List view open first. When a Drive List view is ONLINE, its Drive Data view is ONLINE also. Closing a Drive List view will also close its Drive Data view.



Some operations that can be performed on the values in this view are as follows:

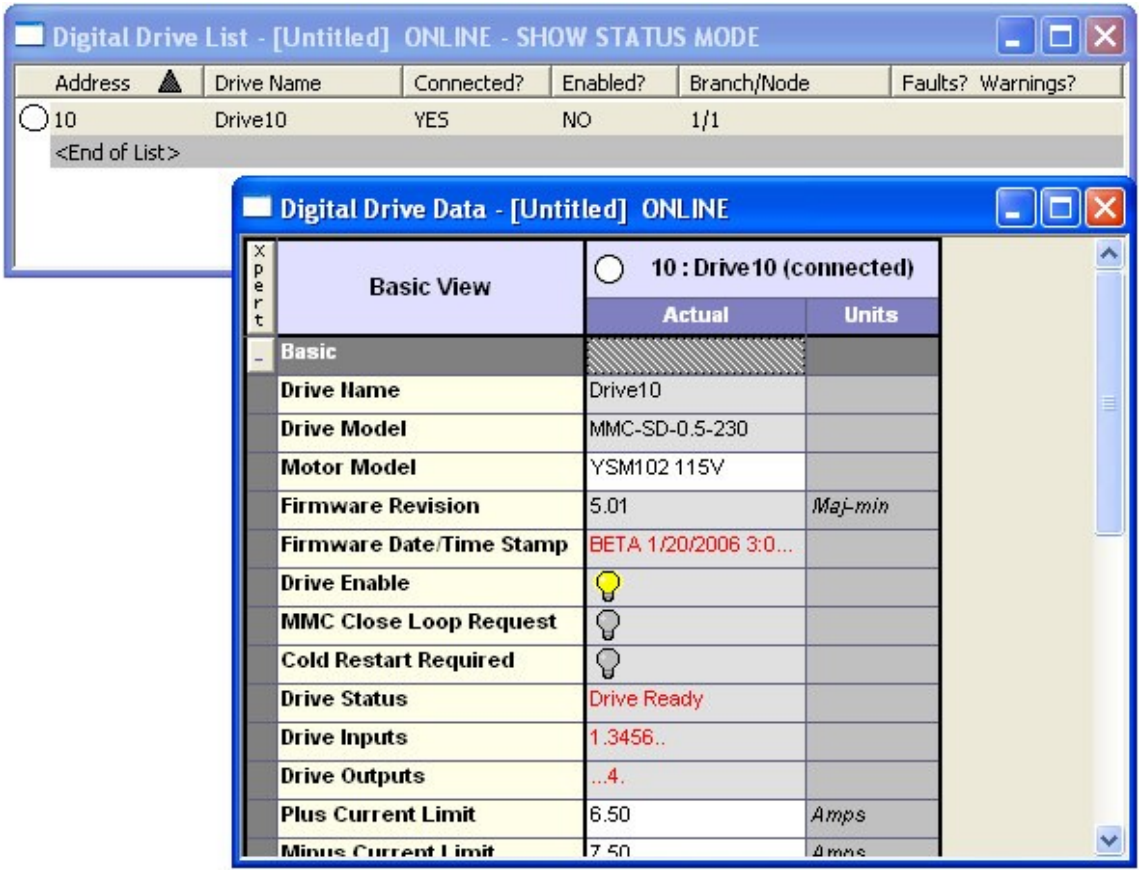
- Copy/Paste Parameters
- Edit
- Undo
- Redo
- Download

Accessing Drive Data View from Digital Drive List View

From the Drive List view, select a drive in the drive list and use one of the following methods:

- Click the button on the drive list standard toolbar.
- Double-click.
- Select **Edit | Edit Drive(s) Data** from the menu.
- Right-click and select **Edit Drive(s) Data**.

Drive Data view will be displayed in front of the Drive List view.



Content of Digital Drive Data View

Only one Digital Drive Data view per Digital Drive List view is permitted. Attempts to open a secondary Digital Drive Data view will result in the open Digital Drive Data view updating with whatever information is available for the selected drive(s).

The following information is supported:

ONLINE Digital Drive Data View	OFFLINE Digital Drive Data View
File Values	File Values
File Units	File Units
Actual Values	
Actual Units	

Parameters

Parameters have been grouped into categories. Categories can be collapsed by selecting the (-) button to the left of the category name. Categories can be expanded by selecting the (+) button to the left of the category name. The following chart specifies the categories and the views in which they are available:

Category	Basic View	Expert View (ONLINE Digital Drive Data view)	Expert View (OFFLINE Digital Drive Data view)
Basic	X		
System		X	X
Tuning		X	X
I/O		X	X
Limits and Indicators		X	X
Faults and Warnings		X	
Fault History		X	
Feedback and Scaling		X	X
Motor		X	X

Changing Digital Drive Data Views

There are three kinds of Digital Drive Data views available.

1. Basic View contains the parameters most often configured and monitored. Basic View contains only one category – Basic.
2. Expert View (ONLINE Digital Drive Data view) contains all parameters – configuration and monitored. This view contains all categories except Basic.
3. Expert View (OFFLINE Digital Drive Data view) contains all configuration parameters. This view contains a subset of the categories available in the ONLINE Digital Drive Data Expert View.

To move between the above views, choose one of the following methods:

1. Click

or

button along the upper left side of the Digital Drive Data View. The view name on the button is the view that will be displayed when the button is clicked.
2. Select **View | Basic View** or **View | Expert View** from the menu.

Navigating in the Digital Drive Data View

The Digital Drive Data view contains 0 up to the number of drives in the Digital Drive List view. You may need to change the view to see the information you are looking for. There are four columns of information for each drive in the drive list. The columns are Actual values, Actual Units, File values and File Units.

Note:

Actual values and actual units are only available in the ONLINE Digital Drive Data view.

The appearance of the Digital Drive Data view can be adjusted as follows:

1. Press the arrow keys move the cursor to an adjacent cell in the data view. A dark colored cell indicates a category. A category contains additional parameters related to the category name. A category can be collapsed (parameters are hidden) or expanded (parameters are visible).
2. Use any of the following methods to collapse categories:
   - Select the (-) button to the left of the category name to collapse single categories.
   - Double click on the category line located under the Actual or File data columns.

- Press the **Enter** key while on a category line.
- Select **View | Categories | Collapse All** from the menu to collapse all categories.
- Right-click anywhere in the Actual values or File values column and select **Categories | Collapse All** to collapse all categories.
- Click the far-left dark gray cell of any parameter row, all categories will collapse.

3. Use any of the following methods to expand categories:
   - Select the (+) button to the left of the category name to expand single categories.
   - Double click on the category line under the Actual or File data columns.
   - Press the **Enter** key while on a category line.
   - Select **View | Categories | Expand All** from the menu to expand all categories.
   - Right-click anywhere in the Actual values or File values column and select **Categories | Expand All** to expand all categories.
   - Double-click in the area below the data view (below the grid), all categories will expand.
4. Column width can be adjusted by using the mouse.
   - Move the mouse pointer over the line separating two columns. The mouse pointer will change to a vertical list with horizontal arrows in either side .
   - Hold the left mouse button down and move the mouse left or right to contract, expand or hide the column.
5. Columns can selectively be hidden and shown for all drives in a drive list. To hide or show the **same** column for **all** drives in a drive list:
   - Select **View | Columns | Show All Actual Values** from the menu.
   - Select **View | Columns | Show All File Values** from the menu.
   - Select **View | Columns | Hide All Actual Values** from the menu.
   - Select **View | Columns | Hide All File Values** from the menu.

   When hiding Actual value or File value columns, their respective Units columns are also hidden.

   The Units columns can be additionally controlled by the following menu items. Add a check (click on a menu item without a check) to show the columns or remove a check (click on a menu item with a check) to hide the columns.
   - Select **View | Columns | Display Actual Units** from the menu.
   - Select **View | Columns | Display File Units** from the menu.

   Double-click in the area to the right of the data view (right of the grid) to show all columns of the currently displayed drives or to display all drives in the Drive List and expand their columns.
6. Columns can selectively be hidden and shown for a single drive in a drive list. To hide or show a column for a single drive, use one of the following methods:
   - Right-click on either the Actual values or File values column. Add a check to hide or remove a check to show one of the following from the **Columns** menu:
     - Display Actual Values for This Drive
     - Display Actual Units for This Drive
     - Display File Values for This Drive
     - Display File Units for This Drive
   - Double-click on the column header to hide individual columns.

- Once all columns for a drive are hidden, the drive is removed from the data view. This happens only in the Digital Drive data view (not Analog data view) to assure that cells can be updated at maximum speed. To re-display a hidden drive, select **View | Visible Drives** and select the drive you want to add to the data view. A check marked drive is visible in the data view.

7. Drives can be selectively hidden/shown.

   To hide all drives:

   - Select **View | Hide All Drives** from the menu.

   To hide a drive, use one of the following:

   - Select **View | Visible Drives** and remove the check for the drive to hide.
   - Right-click on the drive header bar, Actual values column or File values column and select **Hide This Drive**.
   - Double-click on the drive header bar.

   To show all drives:

   - Select **View | Show All Drives** from the menu.

   To show a drive, use one of the following:

   - Select **View | Visible Drives** and add the check for the drive to show.

   To show a single drive and remove all the others:

   - Select from the pop-up menu, **Only Show This Drive.**

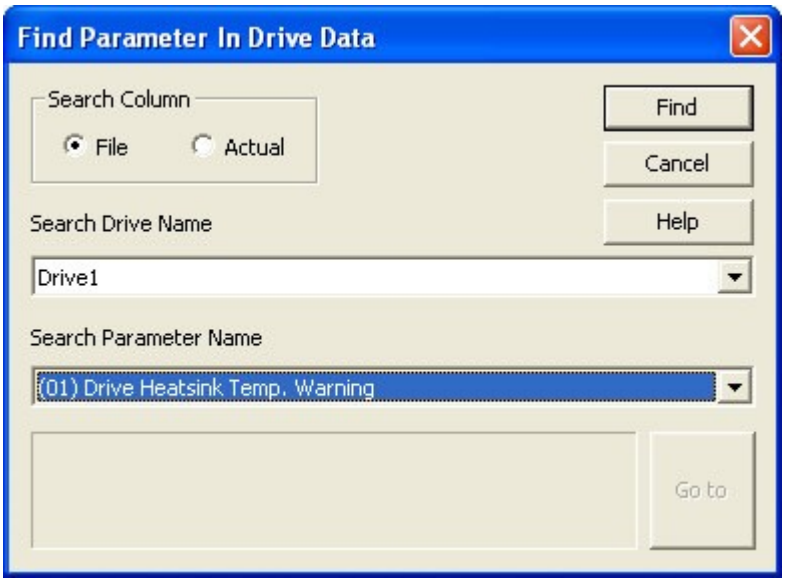
8. The Drives in the Data View can be sorted by address or drive name. To sort the drive list, use one of the following methods:

   - Select **View | Sort by | Address** or **Drive Name**
   - Select from the pop-up menu, **Sort by | Address** or **Drive Name**

Finding Parameters In Drive Data

This search function is activated from the Drive Data view and locates parameters for any of the displayed drives.

Select **Edit | Find…** from the menu to bring up the Find dialog.



Search Column

The radio buttons select where the cursor will end up when the search is complete either in the **File** values column or in the **Actual** values column.

Search Drive Name

All drives in the drive list will be available for selection from the drop down list. Data entry is not allowed. The drop down list is sorted alphabetically.

Search Parameter Name

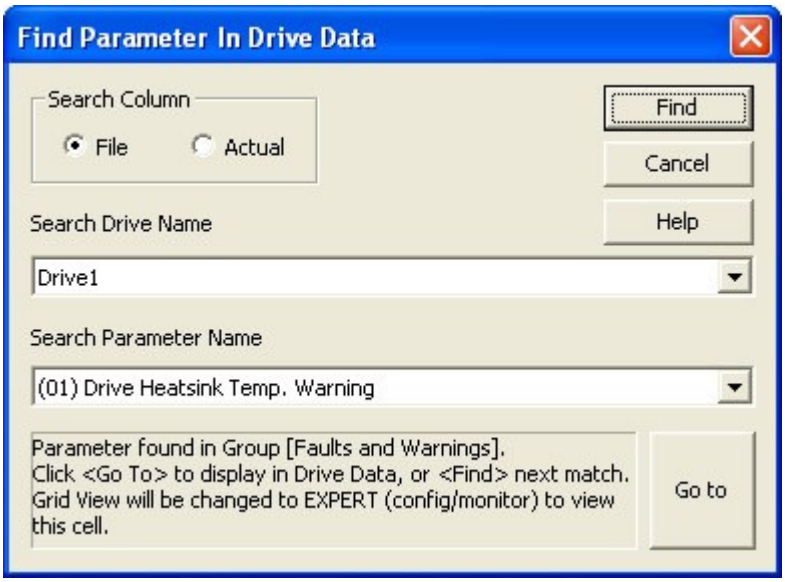
All parameters will be available for selection from the drop down list. Data entry is not allowed. The drop down list is sorted alphabetically.

Select the **Find** button to execute the search.

Select the **Cancel** button to exit the dialog without performing the search.

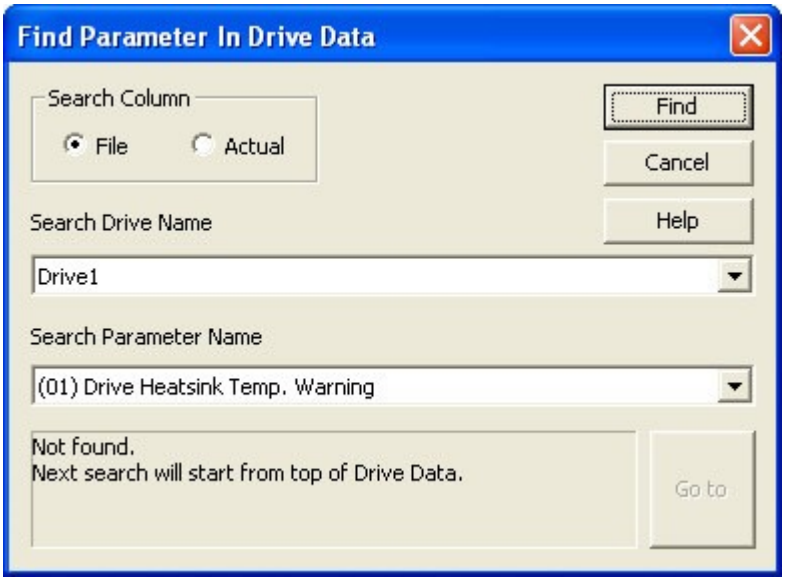
Select the **Help** button to display help on this command.

When a match is found



The matching category will be displayed in the text to the left of the Go To button. You can either find the next match by pressing the Find button again or display this match by pressing the Go To button. By displaying a match, any collapsed category will be expanded and any hidden drives or hidden columns will be shown so that the matching parameter can be displayed.

When a match is not found



When a match is not found, the dialog will display "Not Found". The first match will always be found, subsequent searches of the same information may not have a match. The next search will start from the top of the Drive Data.

Copy/Paste Parameters - Digital Data View

Copy

Single value, multiple values and entire value columns can be copied.

Once values are selected, use one of the following methods to Copy:

- Click the button from the standard toolbar
- Choose **Edit | Copy** from the menu.
- Press <**Ctrl + C**>.
- Right-click and select **Copy**.

Paste

Single value can be pasted anywhere there is a currently configurable value. Select the value and use one of the following methods to Paste:

- Click the button from the standard toolbar
- Choose **Edit | Paste** from the menu.
- Press <**Ctrl + V**>.
- Right-click and select **Paste**.

Multiple values will be pasted onto matching parameters.

Note:

When multiple values are to be pasted, all receiving values must be configurable. If any are not, an error message will display and the paste command will not execute.

Editing User Defined Position Loop Scaling

General

In order to provide the ability to scale the number of feedback units, the drive needs to know the ratio of motor feedback units to user feedback units. Special calculations are required to provide this information based on user-entered values and the selected motor.

Scaling information is found in the **User Defined Position Loop Scaling** category found below the **Feedback and Scaling** category in the drive data view.

User Defined Position Loop Scaling	**Off**
Position Loop FU/Load Rev	8000
Position Loop Load Rev	1
Position Loop Motor Rev	1

User defined position loop scaling can be turned on or off using the dropdown list. The default is **OFF**.

- **Turning User Defined Position Loop Scaling on**

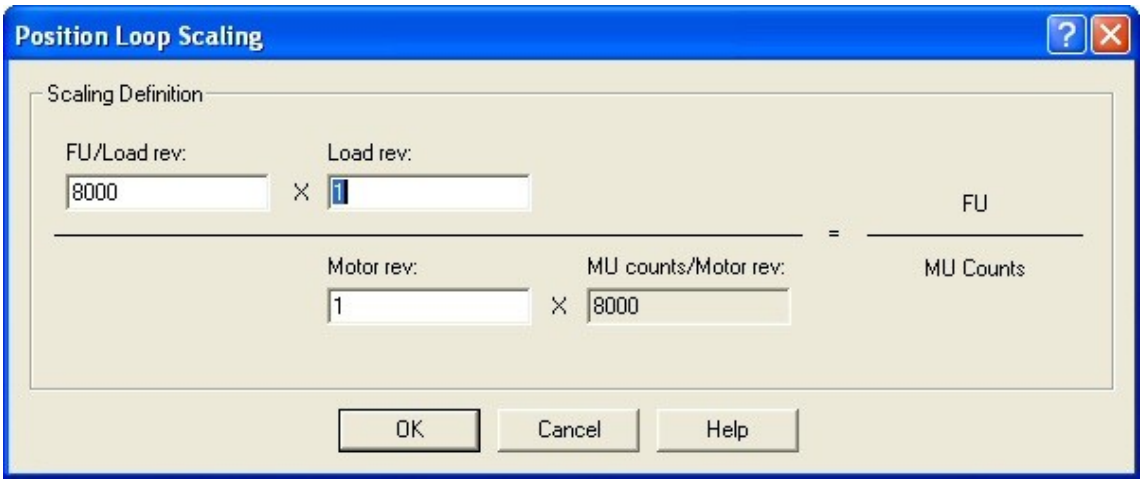
  Before user defined position loop scaling can be turned on, position loop scaling info will be validated. If it is invalid, user defined position loop scaling cannot be turned on. A prompt will be displayed indicating the error and prompting the modification of one or more position loop scaling numbers before turning this feature on again.

- **Turning User Defined Position Loop Scaling off**

  Turning user defined position loop scaling off will reset position loop scaling to the default of 1 FU/MU Counts. Position Loop FU/Load Rev, Load Rev and Motor Rev in the grid will retain their current values, but are not used in any calculations.

To display the **Position Loop Scaling** dialog, do one of the following:

- Double click on any of the data fields relating to user defined position loop scaling (ON/OFF field is not included).
- Select the field and select main menu item **Edit | Edit Position Loop Scaling Data**.
- Select the field, right click and select popup menu item **Edit Position Loop Scaling Data**.
- Paste a single text item into a user defined position loop scaling data row.



Editing Values

Enter the desired values and click **OK**. The position-scaling values will be validated.

If the value is valid:

- The numeric values are saved to the drive data view.
- If position loop scaling is currently off, the user will be notified and have the option to turn position loop scaling on.
- The dialog will be closed.

If value is not valid:

- A confirmation prompt will be displayed identifying the error.
- The dialog can be kept open and values can be re-edited.
- The prompt can be cancelled and the previous settings can be kept. None of the current data will be saved.
- The dialog's numeric values can be saved to the data view grid. Position scaling will be turned off automatically.

Other Notes

- **Validation Calculation** - The value for MU Counts / motor rev: is calculated from the currently selected motor by using data for **LINES PER REV** and **FEEDBACK TYPE**.
- **Motor Change** - Any time a motor change is about to occur when user defined position loop scaling is active, position loop scaling information will be validated.
- **Copy/Paste** - Individual pieces of position loop scaling data can be copied and pasted. A new motor model can also be pasted. However, if User Defined Position Loop Scaling is active, the paste will be prevented if it will result in invalid user defined position loop scaling. If invalid position loop scaling will result from the paste, a confirmation prompt will be displayed. The prompt will indicate the error and ask if User Defined Position Loop Scaling should be turned off. If **Yes** is selected, User Defined Position Loop Scaling will be turned off and the paste will occur. If **No** is selected, the paste will not occur. Undo operations caused by paste will be grouped with any forced position loop scaling changes so both can be undone with one undo command.
- **Downloading File Data** - Individual pieces of position loop scaling data can be downloaded. However, if user defined position loop scaling is active, the download will be prevented if it will result in invalid user defined position loop scaling. If invalid position loop scaling will result from the download, a confirmation prompt will be displayed. The prompt will indicate the error and ask if user defined position loop scaling should be turned off. If **Yes** is selected, User Defined Position Loop Scaling will be turned off and the download will occur. If **No** is selected, the download will not occur.
- **Factory Defaults** - Individual pieces of position loop scaling data can be set to factory defaults. However, if User Defined Position Loop Scaling is active, the change to factory defaults will be prevented if it will result in invalid user defined position loop scaling. If invalid position loop scaling will result from by resetting data to factory defaults, a confirmation prompt will be displayed. The prompt will indicate the error and ask if user defined position loop scaling should be turned off. If **Yes** is selected, user defined position loop scaling will be turned off and the change to factory defaults will occur. If **No** is selected, the change to factory defaults will not occur. Undo operations caused by changing data to factory defaults will be grouped with any forced position loop scaling changes so both can be undone with one undo command.

Editing User Defined Digitizing Scaling

General

Scaling information is found in the **User Defined Digitizing Scaling** category found below the **Feedback and Scaling** category in the drive data view.

User Defined Digitizing Scaling	Off
Digitized FU/Load Rev	1
Digitized Load Rev	1
Digitized Motor Rev	1

User defined digitizing scaling can be turned on or off using the dropdown list. The default is **OFF**.

- **Turning User Defined Digitizing Scaling on**

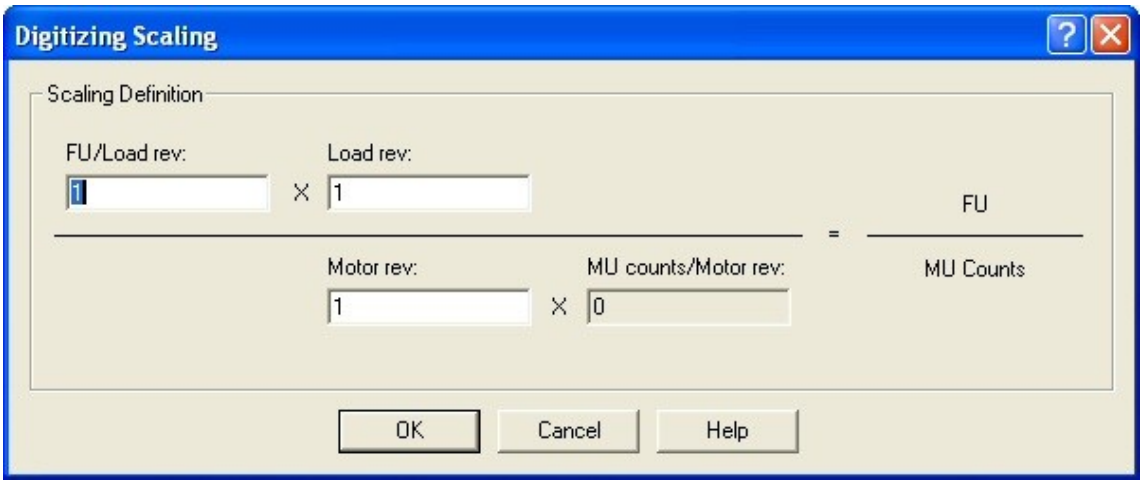
  Before user defined digitizing scaling can be turned on, digitizing scaling info will be validated. If it is invalid, user defined digitizing scaling cannot be turned on. A prompt will be displayed indicating the error and prompting the modification of one or more digitizing scaling numbers before turning this feature on again.

- **Turning User Defined Digitizing Sscaling off**

  Turning user defined digitizing scaling off will reset digitizing scaling to the default of 1 FU/MU Counts. Digitizing FU/Load Rev, Load Rev and Motor Rev in the grid will retain their current values, but are not used in any calculations.

To display the **Digitizing Scaling** dialog, do one of the following:

- Double click on any of the data fields relating to user defined digitizing scaling (ON/OFF field is not included).
- Select the field and select main menu item **Edit | Edit Digitizing Scaling Data**.
- Select the field, right click and select popup menu item **Edit Digitizing Scaling Data**.
- Paste a single text item into a user defined digitizing scaling data row.



Editing Values

Enter the desired values and click **OK**. The digitizing scaling values will be validated.

If the value is valid:

- The numeric values are saved to the drive data view.
- If digitizing scaling is currently off, the user will be notified and have the option to turn digitizing scaling on.
- The dialog will be closed.

If value is not valid:

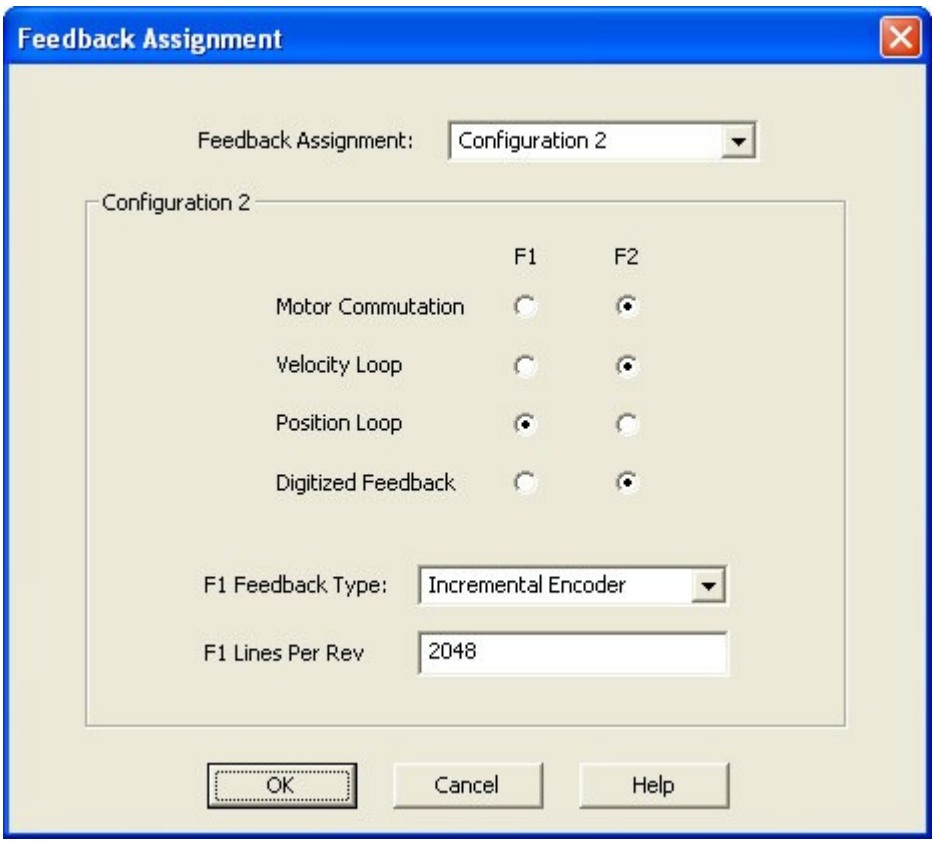
- A confirmation prompt will be displayed identifying the error.
- The dialog can be kept open and values can be re-edited.
- The prompt can be cancelled and the previous settings can be kept. None of the current data will be saved.
- The dialog's numeric values can be saved to the data view grid. Digitizing scaling will be turned off automatically.

Other Notes

- **Validation Calculation** - The value for MU Counts / motor rev: is calculated from the currently selected motor by using data for **LINES PER REV** and **FEEDBACK TYPE**.
- **Motor Change** - Any time a motor change is about to occur when user digitizing scaling is active, digitizing scaling information will be validated.
- **Copy/Paste** - Individual pieces of digitizing scaling data can be copied and pasted. A new motor model can also be pasted. However, if User Defined Digitizing Scaling is active, the paste will be prevented if it will result in invalid user defined digitizing scaling. If invalid digitizing scaling will result from the paste, a confirmation prompt will be displayed. The prompt will indicate the error and ask if User Defined Digitizing Scaling should be turned off. If **Yes** is selected, User Defined Digitizing Scaling will be turned off and the paste will occur. If **No** is selected, the paste will not occur. Undo operations caused by paste will be grouped with any forced digitizing scaling changes so both can be undone with one undo command.
- **Downloading File Data** - Individual pieces of digitizing scaling data can be downloaded. However, if digitizing scaling is active, the download will be prevented if it will result in invalid user defined digitizing scaling. If invalid digitizing scaling will result from the download, a confirmation prompt will be displayed. The prompt will indicate the error and ask if user defined digitizing scaling should be turned off. If **Yes** is selected, User Defined Digitizing Scaling will be turned off and the download will occur. If **No** is selected, the download will not occur.
- **Factory Defaults** - Individual pieces of digitizing scaling data can be set to factory defaults. However, if User Defined Digitizing Scaling is active, the change to factory defaults will be prevented if it will result in invalid user defined digitizing scaling. If invalid digitizing scaling will result from by resetting data to factory defaults, a confirmation prompt will be displayed. The prompt will indicate the error and ask if user defined digitizing scaling should be turned off. If **Yes** is selected, user defined digitizing scaling will be turned off and the change to factory defaults will occur. If **No** is selected, the change to factory defaults will not occur. Undo operations caused by changing data to factory defaults will be grouped with any forced digitizing scaling changes so both can be undone with one undo command.

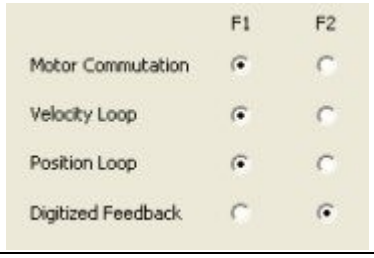
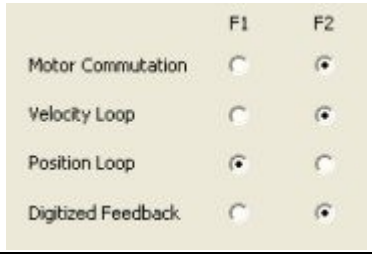
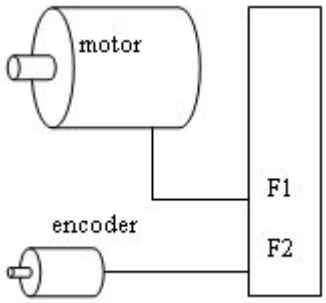
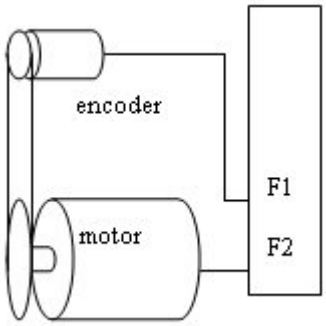
Feedback Assignment Dialog

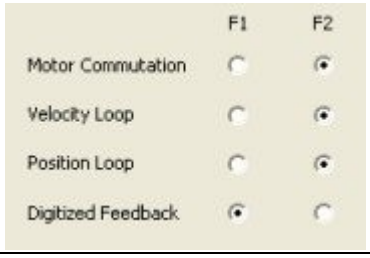
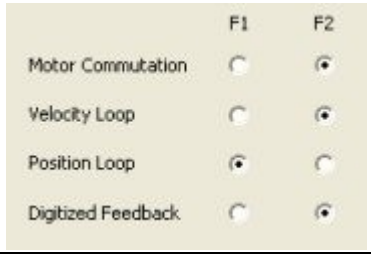
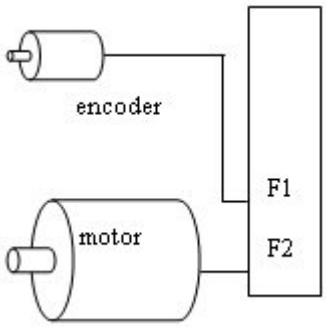
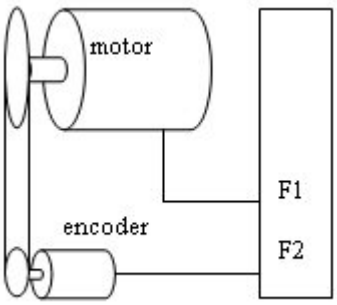
The **Feedback Assignment** dialog is used to setup feedback assignment for Motor Commutation, Motor Velocity, Motor Position and Digitized Feedback. This dialog is only displayed if the drive is disabled and cyclic data is not running. Changing these values requires a cold restart.



Feedback Assignment:	Select the configuration to be used for feedback assignment. See below for an explanation of each configuration.
F1/F2 columns:	F1 and F2 columns are filled in automatically based on the selected configuration.
F1 Feedback Type	Available in configurations 2 and 3. Allows the choice of F1 feedback type.
F1 Lines Per Rev	Available in configurations 2 and 3. Allows the choice of F1 lines per rev.
OK	Click this button to accept the entered values.
Cancel	No changes are made to feedback assignment.. The dialog is closed.
Help	Displays this help window.

The following tables summarize the four feedback configurations that are offered:

Configuration 1	Configuration 2
	
	
F1 feedback type: motor **F2** feedback type: Inc Enc.	**F1** feedback type: user set **F2** feedback type: motor, (must be Incremental Enc.)
MMC axis position: F1 **MMC digitize position** : F2	**MMC axis position**: F1 **MMC digitize position** : F2
Axis Scaling: Applied to axis position on F1	**Axis Scaling:** Applied to axis position on F1
Digitize Scaling: Applied to digitize position on F2	**Digitize Scaling**: Applied to digitize position on F2
Absolute Reference Rollover: Applied to axis position on F1	**Absolute Reference Rollover**: Applied to axis position on F1

Configuration 3	Configuration 4
	
	
F1 feedback type: user set **F2** feedback type: motor, (must be Incremental Enc.)	**F1** feedback type: motor **F2** feedback type: Inc Enc.
MMC axis position: F2 **MMC digitize position** : F1	**MMC axis position**: F2 **MMC digitize position** : F1
Axis Scaling: Applied to axis position on F2	**Axis Scaling:** Applied to axis position on F2
Digitize Scaling: Applied to digitize position on F1	**Scaling**: Applied to digitize position on F1
Absolute Reference Rollover: Applied to digitize position on F1	**Absolute Reference Rollover**: Applied to digitize position on F1

NOTE:

The feedback configuration dialog will only offer feedback configuration 4 if the firmware version is 8.00 or higher. Changing the firmware version from 8.00 or later to a version prior to 8.00 will set feedback configuration back to 1 if feedback configuration is set to 4.

The hall sensors inputs on the two feedback connections are connected together, allowing either input to accept the hall sensor signal, but NOT both. Only one feedback may be connected to a motor. The second feedback must be connected to a feedback device only.

There are three ways to display the feedback assignment dialog:

- Choose the menu item ‘Edit Feedback Assignment Data…’ under main menu ‘Edit’. This menu is only enabled if the cursor is on a feedback assignment field (see below for a list of fields).
- Choose the popup menu item ‘Edit Feedback Assignment Data…’ when right clicking on a feedback assignment field (see below for a list of fields).

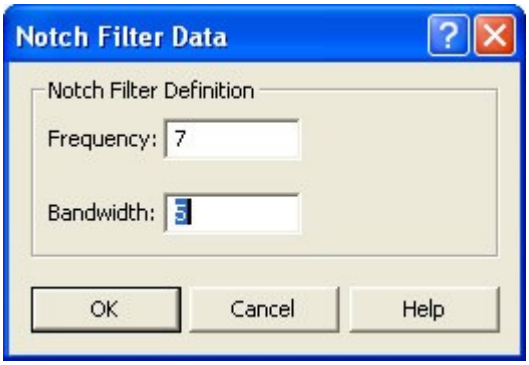
- Double click on one of the following fields related to Feedback Assignment:

Feedback and Scaling		
Motor Commutation Feed...	F2	
Motor Velocity Feedback ...	F2	
Motor Position Feedback ...	F1	
Digitized Feedback Assign...	F2	
F1 Feedback Type	Stegmann Singleturn Encoder	
F1 Lines Per Rev	2048	*Lines*

Notch Filter Data Dialog

Notch Filter data can be changed at any time in the File column if the data is valid. In the Actual column it can only be changed if this is the connected drive, the drive is disabled, cyclic is not running and the data is valid. For the data to be valid, the frequency minus ½ the bandwidth may not be below 6hz.

Notch Filter Enable can be edited in the drive data view. If the user attempts to edit the value of Notch Filter Frequency or Notch Filter Bandwidth, the Notch Filter Data dialog will be displayed.



Frequency — Enter the Center Frequency of the Notch Filter. The center frequency of the Notch Filter is the frequency in hertz that the 3db bandwidth is centered about. This is used in conjunction with the Notch Filter Bandwidth to eliminate mechanical resonance. Note, the center frequency minus ½ the bandwidth may not be below 6hz

Bandwidth — Enter the bandwidth of the Notch Filter. The bandwidth of the Notch Filter is the approximate 3db width of the Notch filter in hertz. This is used in conjunction with the Notch Filter Center Frequency to eliminate mechanical resonance. Note, the center frequency minus ½ the bandwidth may not be below 6hz.

OK — Click this button to accept the entered values. Calculations will then be performed to determine if the result is valid. A message will be displayed if the result is not valid. The dialog will not be closed until the result is valid or the dialog is canceled.

Cancel — Click this button to close the dialog without changing the values of Notch Filter Frequency or Notch Filter Bandwidth.

Help	Displays this help window.

Undo

Undo reverses the last edit action. Undo/Redo maintains 10 levels each. Undo command can be activated by one of the following methods:

- Click the button on the drive list standard toolbar.
- Choose **Edit | Undo** from the menu.
- Press <**Ctrl + Z**>.

When an Undo operation involves changes to values which are now read-only, the Undo operation will fail and an error message will be displayed. When the read-only status of the values changes, Undo can be selected and the operation that previously failed will be performed.

A single Undo operation may contain several commands. For example, when Factory Defaults are restored for an entire column; all value changes will be stored as a single Undo command.

Note: Undo command cannot be used to undo output override or toggle an overridden output.

Redo

Redo reverses the action of the last Undo command. Undo/Redo maintains 10 levels each. Redo command can be activated by one of the following methods:

- Click the button on the drive list standard toolbar.
- Choose **Edit | Redo** from the menu.
- Press <**Ctrl + R**>.

When a Redo operation involves changes to values which are now read-only, the Redo operation will fail and an error message will be displayed. When the read-only status of the values changes, Redo can be selected and the operation that previously failed will be performed.

A single Redo operation may contain several commands. For example, when Factory Defaults are restored for an entire column; all value changes will be stored as a single Redo command.

Note: Redo command cannot be used to redo output override or toggle an overridden output.

Monitoring ONLINE Drive Data

Monitored parameters are parameters that cannot be changed. They are available for observation and comparison.

Monitored parameters read from the drive will be displayed in the current animation color (default is red) when the drive is connected. When the drive is disconnected, the color of the read-only data will change to black to indicate the drive is no longer connected.

Refer to: ***Connect to***

Download File Data - Digital Drive

Changes in the file values are **not** automatically downloaded to the drive. Single file value, multiple file values or entire file value columns can be downloaded. Once values are selected, use one of the following methods to Download File Data:

- Click the button on the drive list standard toolbar.
- Select **Online | Drive Operations | Download File Data** from the menu.
- Right-click and select **Download File Data**.

When changes in the File column are downloaded, the Actual column will be updated to reflect the downloaded values.

Some configuration parameters can only be downloaded while the drive is disabled. If an attempt is made to download any of these parameters while the drive is enabled, an error message will be displayed and the download will be aborted.

File data can only be downloaded if the File firmware version matches that of the Actual firmware version.

Refer to: ***Firmware for the Digital MMC Smart Drive***

If the connected drive at this node is uninitialized, Download File Data can be used to initialize the drive.

Note:

If the entire File column is selected for download and the file and actual drive names don't match for the connected node, a confirmation prompt will be displayed indicating that the connected drive name can be changed.

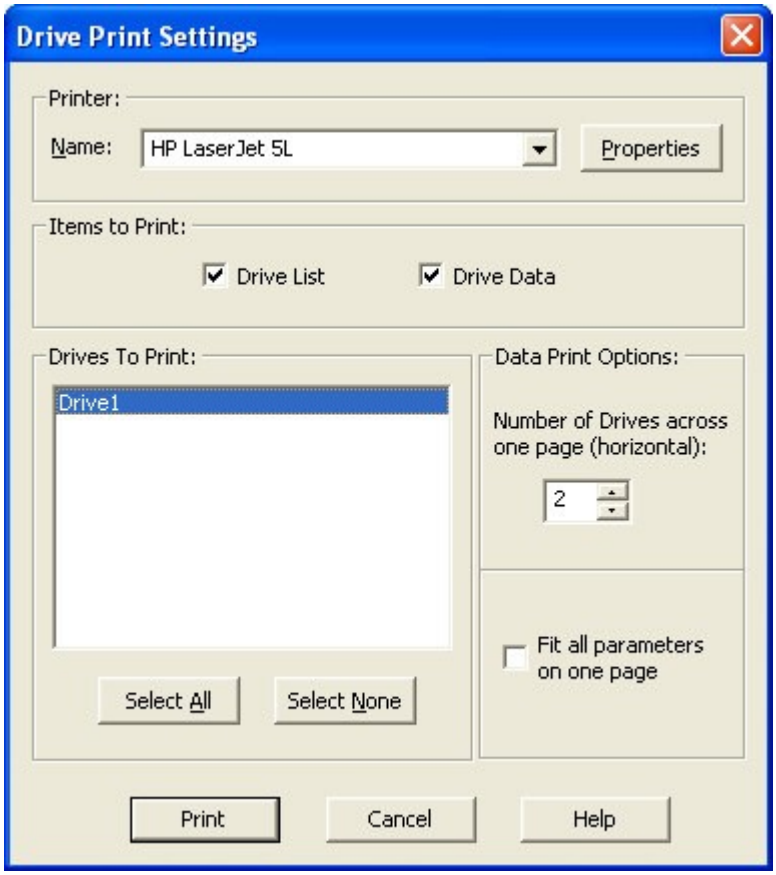
The following procedures for downloading data to all drives is only available from the Drive List view.

- Downloading file data to all drives (**Online | Drive Operations | Download File Data to All Drives**) can be executed when cyclic data is not running and the drive is not enabled.
- Uninitialized drives will be initialized if there's a drive in the drive list with the same address. A confirmation prompt will be displayed. Before any of the drives are configured power sections will be checked to make sure they match. If any drive fails the power section match, none of the drives will be configured and an error message will be displayed.

Printing Drive Information

With either a drive list open and having focus, or drive data view open and having focus, the **Drive Print Settings** dialog can be displayed by choosing one of the following:

- Click the button from the drive list standard toolbar
- Select **File | Print…** from the menu



The following settings can be adjusted to get a printed document:

1. Under the **Printer:** box, there are two items to configure:
   - The drop-down list in the **Name:** field allows you to choose known printers. The printers can reside locally or on a network.
   - The **Properties** button opens up a dialog to further configure the chosen printer. Select **OK** to accept the printer properties. Select **Cancel** or click the to exit the properties dialog without changing the settings.
2. Under the **Items to Print:** box, there are two selections:
   - Drive List
   - Drive Data
3. Under the **Drives to Print:** box, there are three options:
   - Drives To Print
   - Select All
   - Select None
4. Under the **Data Print Options:** box, there are two ways to configure the output:
   - Number of Drives across one page (horizontal):
   - Fit all parameters on one page

When the settings are satisfactory, select **Print** to queue the output to a printer. Select **Cancel** or click the to exit the dialog without printing. Select **Help** to display information related to this subject.

Restore Factory Defaults

Factory defaults can be restored for selected values or entire columns of Actual data or File data. If Actual data is restored to factory defaults, the changes will download to the drive immediately. If File data is restored to factory defaults, the changes will need to be downloaded to the drive, if required.

To restore factory defaults, choose one of the following methods:

- Click the button on the drive list standard toolbar.
- Select **Edit | Restore Factory Defaults** from the menu.
- Right-click on selected values and choose **Restore Factory Defaults**.

Output Override

Output Override - Digital Drive

You may want to force a situation to observe the results. One way is to override outputs. The control of the overridden output is exclusively with the PiCPro user. The PiCPro user can toggle the overridden output and can also remove the override.

Outputs can be overridden only if the following criteria are met:

- The drive must be connected and in the ONLINE drive list.
- Drive Data view and/or Control Panel/Oscilloscope view must be active for the ONLINE drive list.
- 220V Shunt on 440V Drive is not assigned to the output.

Note:

If communications with the connected drive are lost while the drive has overridden outputs, the following actions will be taken in the drive:

- (34) Control Panel Disconnect Fault will be set.
- The control of the overridden output will be taken from PiCPro and returned to the states currently assigned to the output.

Override Output

To override an output, do one of the following:

- Put focus on an output and select **Online | Drive Operations | Override Output** from the menu.
- Right-click on an output and select **Override Output**.

A check mark will appear in front of the menu item to indicate **Override Output** is selected. The word **OVERRIDDEN** will appear in the current animation color next to the light bulb of the output to indicate **Override Output** is active. The status of the output will not change. The output can only be changed by the PiCPro user with a request for the output to be toggled.

Toggle Overridden Output

To toggle an overridden output, do one of the following:

- Put focus on an overridden output and select **Online | Drive Operations | Toggle Output** from the menu.
- Right-click on an overridden output and select **Toggle Output**.

Remove an Override

To remove an override, do one of the following:

- Put focus on an overridden output and select **Online | Drive Operations |** √ **Override Output** from the menu.
- Right-click on an overridden output and select √ **Override Output**.

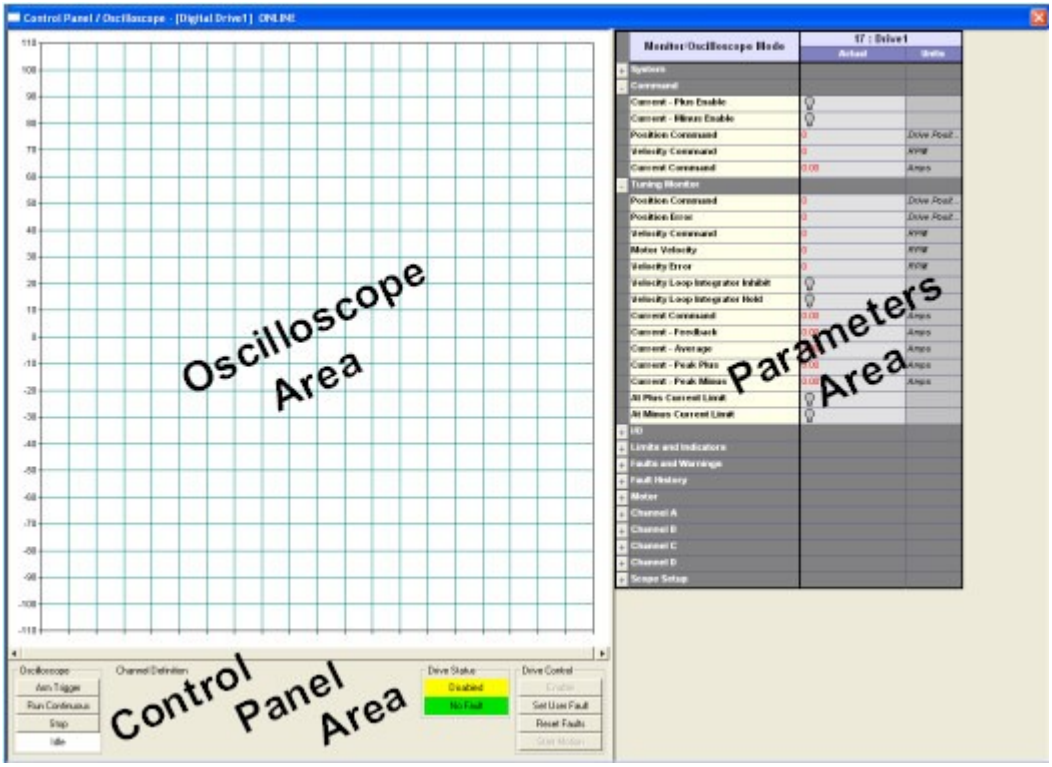
The check mark will disappear from in front of the menu item to indicate **Override Output** is no longer selected. A confirmation message will be displayed.

Control Panel, Oscilloscope View

Control Panel/Oscilloscope View - Digital Drive

Control Panel/Oscilloscope view can be used to setup and tune the drives. The Control Panel/Oscilloscope view, however, must have a Drive List view open first. Closing a Drive List view will also close its Control Panel/Oscilloscope view.

The Control Panel/Oscilloscope view can be used to display a saved trace.



Note:

- It is recommended that the PiCPro display be maximized before activating the Control Panel/Oscilloscope view. There is a massive amount of information in this view. It is more easily accessed and analyzed from a full screen view.
- The Control Panel cannot be used if cyclic data is running but the Oscilloscope can still be used.

Accessing Control Panel/Oscilloscope view

With an ONLINE drive list, one of the following methods will open the Control Panel/Oscilloscope view:

- Click the button on the drive list standard toolbar.
- Select **View | Control Panel/Oscilloscope…** from the menu.
- Right-click and select **Control Panel/Oscilloscope…**

Content of Control Panel/Oscilloscope View - Digital Drive

There are three main areas in this view:

- Oscilloscope
- Control Panel
- Parameters

The Oscilloscope area is located in the upper left corner. It is the only area that cannot be hidden. The Oscilloscope area will expand and contract accordingly as the Control Panel area and Parameters area are hidden and shown.

The Control Panel area is located in the lower left corner. It can be hidden and shown. The Control Panel area will not expand or contract onto the Parameters area being hidden or shown.

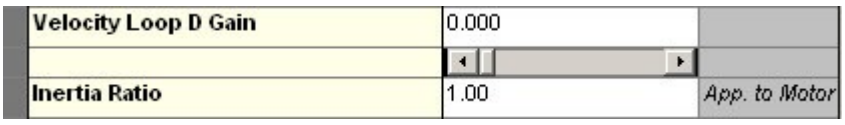
The Parameters area is located in the right side. It can be hidden and shown. The Parameters area will not expand or contract due to the Control Panel area being hidden or displayed. The Parameters area is using the same format and much of the same information as the Drive Data view.

The Parameters area has the following modes available:

- Monitor/Oscilloscope Mode (**Mode | Monitor**)
- Tuning Mode (**Mode | Tuning**)
- Velocity Control Mode (**Mode | Control Panel | Velocity Control**)
- Current Control Mode (**Mode | Control Panel | Current Control**)
- Auto Tuning Control Mode (**Mode | Control Panel | Auto Tuning Control**)
- Alignment Mode Control (**Mode | Control Panel | Alignment Control**)

The Parameters area displays only actual data. File data cannot be modified from the Control Panel/Oscilloscope view.

Several parameters use a scrollbar to determine a value. The scrollbar applies to the parameter directly preceding it and functions in the following manner. The value can be entered into the parameter actual value field or selected with a scrollbar control. Movement of the scrollbar button produces a coarse change in value. The value can be fine-tuned by clicking on the arrows of the scrollbar to increment/decrement by 1 or clicking between the scroll box and the arrows to increment/decrement by 10.



Note:

This applies to any parameter that uses a scrollbar for value adjustment.

Parameters have been grouped into categories. Categories can be collapsed by selecting the (-) button to the left of the category name. Categories can be expanded by selecting the (+) button to the left of the category name. The following chart specifies the categories and the modes in which they are available:

Category	Monitor / Oscilloscope Mode	Tuning Mode	Velocity Control Mode	Current Control Mode	Auto Tuning Control Mode	Alignment Control Mode
System	X	X	X	X	X	X
Tuning Monitor	X	X	X	X	X	X
I/O	X	X	X	X	X	X
Limits & Indicators	X	X	X	X	X	X
Faults & Warnings	X	X	X	X	X	X
Fault History	X	X	X	X	X	X
Feedback and Scaling		X	X	X	X	X
Motor	X	X	X	X	X	X
Channel A	X	X	X	X	X	X
Channel B	X	X	X	X	X	X
Channel C	X	X	X	X	X	X
Channel D	X	X	X	X	X	X
Scope Setup	X	X	X	X	X	X
Tuning Control		X	X	X	X	
Manual Velocity Tuning Settings			X			
Manual Current Tuning Settings				X		
Auto Tuning Settings					X	
Alignment Settings						X

Changing Control Panel/Oscilloscope modes - Digital

There following modes are available in the Parameters area:

1. **Monitor Mode** contains the parameters most often monitored. In this view, the Oscilloscope is useable to monitor any parameter. There are no provisions to change anything in the drive or to control the drive.
2. **Tuning Mode** contains the parameters and settings required to tune a drive. The capability is provided to adjust the drive position loop and velocity tuning parameters. The position loop I and D gains, position loop I limits, and position feedforward percent may be adjusted. The velocity P, I, and D gains and Inertia Ratio may be adjusted along with controlling the low pass filter. These parameters have no effect when running the drive in current control mode.

Tuning Mode	17 : Drive1	
	Actual	Units
Tuning Control		
Position Loop P Gain	2000	FU / min / ...
Position Loop I Gain	0	((FU / min) ...
Position Loop I Plus Limit	10000	FUFE * 1mS
Position Loop I Minus Limit	-10000	FUFE * 1mS
Position Loop D Gain	0	(FU / min) /...
Position Feedforward Percent	100	%
Velocity Loop P Gain	50.0	
Velocity Loop I Gain	2000	
Velocity Loop D Gain	0.000	
Inertia Ratio	0.00	App. to Motor
Low Pass Filter Enable	Active	
Low Pass Filter Bandwidth	800	Hz

3. **Velocity Control Mode** contains the parameters and settings required to run a drive in velocity mode. A category is added that allows for software control of the drive by specifying velocity. Four commands can be issued to the drive: forward, reverse, sine wave and square wave. These are selected from a drop down list. The velocity is specified in RPM. Forward causes the drive to run with a constant positive command. Reverse causes the drive to run with a constant negative command. For the sine and square wave modes a period is selected from a dropdown list. Although the drive must be stopped to change the command mode, the velocity and period can be adjusted while the drive is running.

Velocity Control Mode	17 : Drive1	
	Actual	Units
Manual Velocity Tuning Settings		
Motor Direction/Mode	Forward	
Velocity	0	RPM
Period	0.25	Seconds

While parameters are used to control the drive, they cannot initiate or terminate motion. Motion is started/stopped by the start/stop motion pushbuttons in the Control Panel area.
When entering or leaving Velocity Control View, the drive must be disabled to prevent unexpected motion. A dialog will appear accordingly.

4. **Current Control Mode** contains the parameters and settings required to run a drive in current mode. A category is added that allows for software control of the drive by specifying current. Current Control mode operates exactly the same as the Velocity Control mode, except that the current controls are in Amps. The tuning parameters have no affect while running in current control mode.

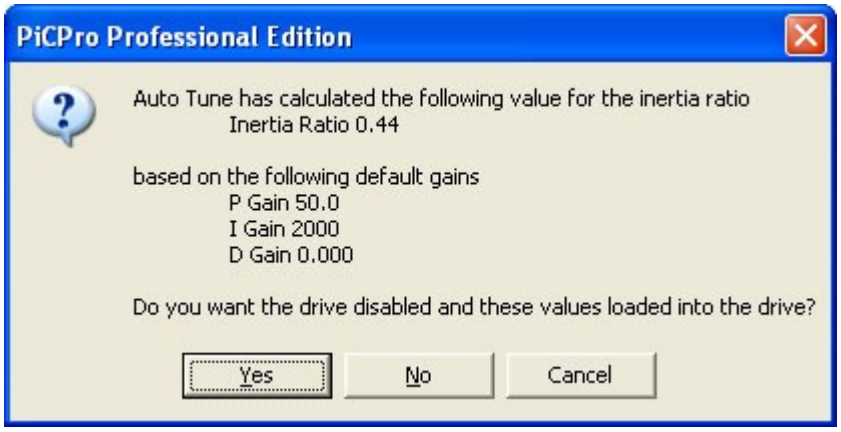
Current Control Mode	17 : Drive1	
	Actual	Units
Manual Current Tuning Settings		
Motor Direction/Mode	Forward	
Current	0.00	Amps
Period	0.25	Seconds

5. **Auto Tuning Control Mode** allows the interface to setup and execute an auto tune cycle. While executing the auto tune cycle, the drive is under software control and being operated in current mode. The Current Limit parameter is a percentage of the motor continuous current and the Distance Limit parameter limits the number of revolutions of the motor for the forward and reverse stroke of the auto tune cycle.

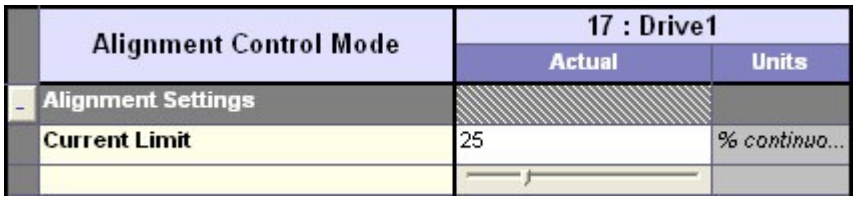
Auto Tuning Control Mode	17 : Drive1	
	Actual	Units
Auto Tuning Settings		
Current Limit	10	% continuo...
Distance Limit	0.1	Revs +/-

Motion is initiated by the Start/Stop Motion button in the Drive Control group of the Control Panel. The drive will oscillate for a few seconds and then stop. The auto tune cycle can be stopped at any time by clicking the Stop Motion button.

When the drive has completed the auto tune cycle, the following dialog will be displayed. Select **Yes** to disable the drive and change the parameters in the drive. Select **No**, **Cancel** or to close the dialog without updating the parameters in the drive.



6. **Alignment Control Mode** provides the capability to adjust the drive current limit.



Note:

To move between the above modes, select

- **Mode | Monitor**
- **Mode | Tuning**
- **Mode | Control Panel | Velocity Control**
- **Mode | Control Panel | Current Control**
- **Mode | Control Panel | Auto Tuning Control**
- **Mode | Control Panel | Alignment Control**

Navigating in the Control Panel, Oscilloscope View

Navigating in the Control Panel/Oscilloscope View

The Control Panel/Oscilloscope view contains the connected drive from the ONLINE drive list.

Note:

The Control Panel/Oscilloscope view only interfaces with the connected drive.

Display Control Panel

This command shows the pushbuttons and indicators below the oscilloscope. Otherwise the oscilloscope trace covers the full height of the screen.

Select **View | Show Control Panel** from the menu to display the command area. A √ will appear in front of the menu item to indicate the feature is activated.

Select **View |** √ **Show Control Panel** from the menu to hide the command area. The √ will disappear from in front of the menu item to indicate the feature is deactivated.

Display Parameters

This command shows the parameters to the right of the oscilloscope. Otherwise the oscilloscope trace covers the full width of the screen.

Select **View | Show Parameters** from the menu to display the parameter area. A √ will appear in front of the menu item to indicate the feature is activated.

Select **View |** √ **Show Parameters** from the menu to hide the parameter area. The √ will disappear from in front of the menu item to indicate the feature is deactivated.

Changing the Parameters Area

There are two columns of information for the connected drive from ONLINE drive list. The columns are **Actual** values and Actual **Units**. The bold words are the column headers in the Parameters area of the Control Panel/Oscilloscope view.

Here are some ways to change the look of the Parameters area of the Control Panel/Oscilloscope view:

1. Pressing the up or down arrow on the keyboard moves the cursor to the next category in the column.

2. Use any of the following methods to collapse categories:
   - Select the (-) button to the left of the category name to collapse single categories.
   - Select **View | Categories | Collapse All** from the menu to collapse all categories.
   - Right-click anywhere in the Actual values column and select **Categories | Collapse All** to collapse all categories.
   - Click the far-left dark gray cell of any parameter row, all categories will collapse.
3. Use any of the following methods to expand categories:
   - Select the (+) button to the left of the category name to expand single categories.
   - Select **View | Categories | Expand All** from the menu to expand all categories.
   - Right-click anywhere in the Actual values column and select **Categories | Expand All** to expand all categories.
   - Double-click in the area below the categories and parameters, all categories will expand.
4. To toggle between collapsing and expanding single categories, use any of the following methods:
   - Double-click on a dark gray category row of either the Actual or File data columns.
   - Set the cursor to a dark gray category row of either the Actual or File data columns and press the **Enter** key.

File Menu

File Menu Features

The features made available by the File menu are performed on files used by the Control Panel/Oscilloscope view. These operations do not address the drive files.

While some drive parameter values can be modified from the Control Panel/Oscilloscope view, the changes cannot be saved from this view. You must move to the Drive List view (Digital Drive List view for a digital drive system) or the Drive Data view (Digital Drive Data view for a digital drive system) to save the drive parameter value changes to the drive file.

Save Trace

This feature saves the entire current trace data to a tab-delimited text file (*.txt).

1. Select **File | Save Trace …** from the menu.
2. The **Save As** dialog appears for filename and location. The current drive name will be the default filename with a .txt extension.
3. Enter the filename.
4. Select **Save** to save the file and close the dialog. Click or select **Cancel** to close the dialog without saving the file.

Even though the saved trace is a text file, it is not intended that the file be modified. **MMC Smart Drive.xls** has been developed to generate a plot similar to what is seen in the Oscilloscope area of the Control Panel/Oscilloscope view.

MMC Smart Drive.xls is part of the Applications software installation. It can be found in the tools directory **C:\Program Files\G&L Motion Control\Applications Vx.y.z\Tools**.

Restore Trace

This feature reads in a trace from a previously saved tab-delimited text file (*.txt).

1. Select **File | Restore Trace …** from the menu.

2. The **Open** dialog appears for filename and location. The current drive name will be the default filename with a .txt extension.
3. Enter the filename.
4. Select **Open** to open the file and close the dialog. Click or select **Cancel** to close the dialog without opening the file. An additional selection is available. You can check the **Open as read-only** box for read-only access to the trace file.

Note: A dialog will appear if discrepancies are detected in the format of the restored trace file.

Save Scope Template

This feature saves the oscilloscope settings and the velocity, current, auto tuning and alignment control settings in a *.scp file for use on other drives. Typically, this feature would be used to establish a favorite group of settings that can be called into any drive. None of the drive parameters are saved in this file, only the control panel and oscilloscope settings.

1. Select **File | Save Scope Template…** from the menu.
2. The **Save As** dialog appears for filename and location.
3. Enter the filename.
4. Select **Save** to save the file and close the dialog. Click or select **Cancel** to close the dialog without saving the file.

Note:

For a specific drive, all the above mentioned settings along with all the drive data is saved in the *.adv file for an analog drive system or the *.ddv file for a digital drive system.

Recall Scope Template…

This feature reads a previously saved control panel and oscilloscope settings (*.scp).

1. Select **File | Recall Scope Template…** from the menu.
2. The **Open** dialog appears for filename and location.
3. Enter the filename.
4. Select **Open** to open the file and close the dialog. Click or select **Cancel** to close the dialog without opening the file. An additional selection is available. You can check **Open as read-only** box for read-only access to the scope template.

Note: Template files (*.scp) have a signature that is checked on recall. A dialog will appear if there is a problem.

Restore Parameters

This feature restores the drive to the condition it was in before entering the Control Panel/Oscilloscope view.

1. Select **File | Restore Parameters** from the menu.
2. A dialog will appear to confirm this action.

Print Trace

This feature prints the current trace screen on the selected printer.

1. Select **File | Print Trace…** from the menu. The **Print** dialog appears.
2. Set the print characteristics.
3. Select **OK** to print the trace and close the dialog. Click or select **Cancel** to close the dialog without printing the trace.

Note: Although there typically is more data, only what is currently visible on the screen is printed.

Close Oscilloscope

This feature closes the Control Panel/Oscilloscope view. Select **File | Close Oscilloscope** from the menu.

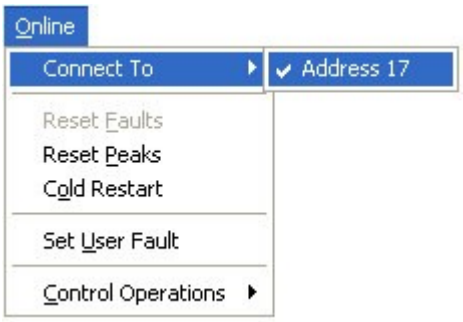
Note: If attempting to exit while under software control of the drive, a dialog appears to confirm this action.

Online Menu

ONLINE Menu Features - Digital

The features made available by the Online menu are performed on files used by the Control Panel/Oscilloscope view.

Connect To – Click to see a choice of drives to connect to. Click the desired drive.



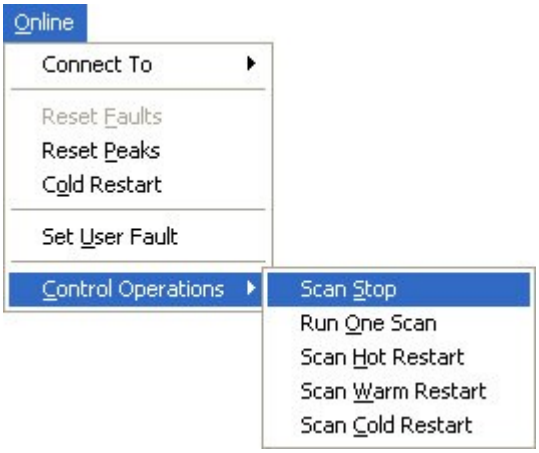
Reset Faults – Click to reset faults in the connected drive.

Reset Peaks – Click to set maximum latched values to zero in the connected drive.

Cold Restart – Click to initiate a Cold Restart in the connected drive.

Set User Faults – Click to set a user fault.

Control Operations – Click to select Scan Control functionality.



Scan Stop - Select to stop a ladder scan.

Run One Scan – Click to command the CPU to run through one complete scan and then send zeros to all the outputs when this command is issued.

Scan Warm Restart – Click to restart the scan with a warm restart. All elements that were declared with the retentive attribute will keep the values they had when the scan stopped. All other elements return to the initial values they had when the module was first downloaded. Scanning resumes and the application continues normally.

Scan Hot Restart – Click to restart the scan with a hot restart. All the element values remain as they were when the scan stopped. The application continues as if the Stop scan command had not been sent.

Scan Cold Restart – Click to restart the scan with a cold restart. All elements are returned to their initial values and declared as if the module had just been downloaded.

Oscilloscope Settings

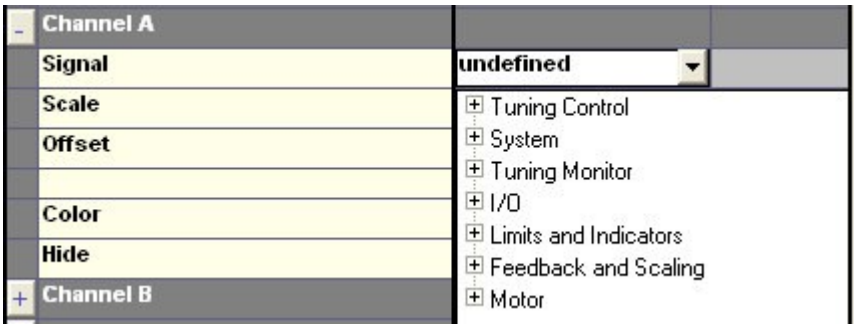
Oscilloscope Channel Configuration

The Oscilloscope can display up to four channels of information. Each channel has a group of settings that describe how the information will appear on the screen. With the exception of the Signal setting, all the settings can be changed whether the Oscilloscope is running or stopped. The settings are found in the Parameters area under categories **Channel A**, **Channel B**, **Channel C** or **Channel D**.

Channel A		
Signal	undefined	
Scale	10.0	*Units/div.*
Offset	0	
	Auto Scale	
Color	Black	
Hide	No	

Oscilloscope Channel Signal - Digital

The channel signal setting is the drive variable you wish to monitor with the oscilloscope. The channel signal is selected from a tree control type list of signals in any of the Parameters area views. Any signal can be used in any channel. To return the field to **undefined**, move to the field and press the **Delete** key.



Note: Data entry is not allowed in this field.

Oscilloscope Channel Scale and Auto Scale

The channel scale setting establishes the number of vertical units per division on the oscilloscope display for this channel. The oscilloscope vertical display defaults to 10 units/division. This field's drop down list provides the available choices.

Channel scale can be configured automatically by clicking the button Auto Scale. This feature will automatically configure the offset and scale values based on the data collected for that channel. The trace will then be centered and scaled to fit the oscilloscope window.

Oscilloscope Channel Offset and Auto Scale

The channel offset setting establishes the value that appears at the vertical center of the oscilloscope trace. A value can be entered directly into this field.

Channel offset can be configured automatically by clicking the button Auto Scale. This feature will automatically configure the offset and scale values based on the data collected for that channel. The trace will then be centered and scaled to fit the oscilloscope window.

Oscilloscope Channel Color

The channel color setting allows you to select a different color for each of the channels. The channels are defaulted to different colors. This field's drop down list provides alternate choices.

Oscilloscope Channel Hide

The channel hide setting allows you to remove a channel from the display. Even though the hidden channel will not be displayed, data is still being recorded so that the channel can be displayed at any time and the data will be correct. This field's drop down list provides a Yes/No choice. The default value is No.

Oscilloscope Setup

Oscilloscope Setup

The settings described in this section define the characteristics for the trigger and sampling of the trace.

Scope Setup		
Trigger Signal	undefined	
Trigger Level	0.000	
Trigger Edge	Rising	
Trigger Mode	Single	
Buffer Trigger Position	0	*% before*
Sample Rate	2.000	*mSeconds*
Samples per division	1	
Secondary Scale	Channel B	
Line Weight	Thin	

Trigger Signal

Trigger signal is the drive variable the drive monitors to create a trigger event. The trigger signal is selected from a tree control type list of signals in any of the Parameters area views. Any signal can be used. To return the field to **undefined**, move to the field and press the **Delete** key.

Note: Data entry is not allowed in this field.

Trigger Level

Trigger level is the value of the trigger signal at which the trigger should occur. The acceptable range is –2,147,483,648 to 2,147,483,647.

Trigger Edge

Trigger edge setting is a three-selection choice from a drop down list.

1. **Immediate** triggers once the buffer position criteria are met.
2. **Rising** triggers when the present value is greater than the last value and the present value is greater than or equal to the trigger level.
3. **Falling** triggers when the present value is less than the last value and the present value is less than or equal to the trigger level.

Trigger Mode

Trigger mode setting is a two-selection choice from a drop down list.

1. **Continuous** captures data, displays it and then re-arms the trigger so that another data capture occurs automatically. This process will continue until it is manually stopped.
2. **Single** allows the trigger event to occur once and then ends the process. The trigger must be armed again for another data capture to occur.

Buffer Trigger Position

To view an event, buffer trigger position setting allows you to adjust where in buffered data the trigger occurs. If this value is 0, then all the data will be buffered after the trigger occurred. If this value is 50, then half the data will be buffered before and half will be buffered after the trigger occurred. If this value is 100, then all the data will be buffered before the trigger occurred.

Buffer trigger position field is a percentage ranging from 0 to 100. A value can be entered directly into the field. It also has a slider control selection. There are 600 words of trigger capture buffer. For one channel of a word variable, there are 600 entries. For two channels of a word variable, there are 300 entries for each channel. For one channel of a double word variable, there are 300 entries…

Sample Rate

Sample rate setting specifies the rate at which data is captured. The acceptable range is 0.125 to 8191 milliseconds. Values can be entered directly into this field.

Note: Sample rate applies only to the trigger mode, which runs in foreground.

Samples per Division

Samples per division setting is a four-selection choice from a drop down list. This setting specifies the number of samples to display per each major division along the horizontal axis.

Secondary Scale

Secondary scale setting is a four-selection choice from a drop down list. This setting specifies which channel's scale to display on the right side of the oscilloscope when more than one channel is being displayed. By default, the first channel's scale is displayed on the left and the second channel's scale is displayed on the right, in the appropriate color.

Note: If an invalid channel is selected, a dialog will indicate the problem.

Line Weight

The thickness or width of the lines used in the Oscilloscope traces can be adjusted by the drop down list. There are 3 selections; thin, medium and thick.

Control Panel Features

Control Panel Features

Pushbuttons and indicators are located in the Control Panel area of the Control Panel/Oscilloscope view. They are arranged in the following four columns:

1. Oscilloscope
2. Channel Definition
3. Drive Status
4. Drive Control

Oscilloscope

Oscilloscope Pushbutton Group

This group of pushbuttons controls the trace.

Arm Trigger

Click this button to initiate data capture with the oscilloscope setup information. The drive will begin capturing data, waiting for the trigger event to occur. Data is captured in foreground at the sample rate specified.

Run Continuous

Click this button to run the oscilloscope continuously, where there is no trigger and the capture rate is determined by how fast the workstation is capable of processing the data. Data is captured in background whenever requested by the workstation.

Notes:

- Foreground capture occurs in the control on a very specific time basis. Background capture occurs in the workstation as time permits.
- For best oscilloscope performance, it is recommended that Ladder Animation and View List animation be disabled.

Stop

Click this button to stop the oscilloscope, whether running in trigger mode or continuous.

Trigger State Indicator

The trigger state indicator reflects the current state of the drive trigger mechanism.

- Solid **Idle** – When not using the oscilloscope
- Solid **Running** - When running the oscilloscope in continuous mode
- Blinking **Waiting for Trigger** – When the capture mechanism is armed and looking for a trigger
- Blinking **Triggered** – When a trigger has been encountered, but the capture buffer is not yet full
- Solid **Triggered** – When the capture is complete and being displayed

Channel Definition

To the right of the column heading is the source for the current trace. Normally this is the same as the heading of the drive parameters view. However, if the trace was restored from a file, it will be the source of the information for that file.

The information in this column is a summary of the channels being displayed. The information included is the color of the trace, the signal description and the scaling. When running in continuous mode, the latest actual value is displayed. When a channel is hidden, the text for that channel is grayed out.

Drive Status

This group of indicators reflects the current status of the connected drive.

Enabled/Disabled

This status indicates whether the drive is enabled or disabled. **Enabled** with a green background indicates the drive is enabled. **Disabled** with a yellow background indicates the drive is either physically not enabled or the drive has not been enabled by software control.

Warning/Fault

This status indicates the fault condition of the drive. **No Fault** with a green background indicates the drive has no active faults or warnings. **Warning Fault** with a yellow background indicates that at least one warning is active. **Disabling Fault** with a red background indicates that at least one fault is active.

Drive Control

This group of pushbuttons is used to run the drive while in software control. Software control of the drive is allowed while in the Velocity Control mode, Current Control mode, Auto Tuning Control mode or Alignment Control mode in the Control Panel area of the Control Panel/Oscilloscope view. Pushbuttons unavailable for use will be grayed out.

Enable/Disable

The text on the pushbutton (**Enable** or **Disable**) is the action that will be taken when the pushbutton is clicked and proper conditions exist in the drive for the action to take place. If the software control of the drive cannot be enabled due to the drive not physically being enabled or a disabling fault being active, messages will be generated identifying the problem.

Set User Fault

Click this button to set user fault. The user fault is a disabling fault, which will immediately disable the drive. This button is operational while on the Control Panel/Oscilloscope view.

Reset Faults

Click this button to clear existing faults. If conditions have not been changed to eliminate the fault, the fault indication will come back. This button is operational while on the Control Panel/Oscilloscope view.

Start/Stop Motion

The text on the pushbutton (**Start Motion** or **Stop Motion**) is the action that will be taken when the pushbutton is clicked and proper conditions exist in the drive for the action to take place. If the software control of the drive cannot be enabled due to the drive not physically being enabled or a disabling fault being active, messages will be generated identifying the problem. The type of motion will be determined by the Parameters area mode selected; Velocity Control mode, Current Control mode, Auto Tuning Control mode or Alignment Control mode.

Digital Link

Overview: Digital Link Communications

The two major states involved in starting Digital Link communications are Digital Link Initialization and Cyclic Communications. It is also important to understand the relationship between PiCPro and Motion Library when Digital Link is used.

Digital Link Initialization

- At power on, the MMC Digital Control will initiate a Digital Link Initialization and communicate to all connected drives. The number of Digital control drives found and their corresponding switch addresses are made available to **DSTRTSRV** in the Motion Library (motion.lib) and PiCPro.
- The MMC Smart Drive firmware will read the hardware setting of the address switch when the MMC initializes Digital Link. This means that the switch setting that is reported is the state of the switch of the most recent Digital Link Initialization. See the description for fault (52) Invalid Switch Setting for more information.
- A call to **DSTRTSRV** will initiate a Digital Link Initialization and test whether the quantity of drives expected and their switch settings (defined in servo setup in PiCPro) match the drives found. The result is reported on the **DSTRTSRV** outputs in the PiCPro ladder. The ladder can be programmed so it continually checks to see if all drives have been connected or powered on. See the ladder example in the description of DSTRTSRV in the Function-Function Block Reference Manual.
- PiCPro can communicate with any drive found as a result of Digital Link Initialization. The list of drives can be shown by selecting **Online | Drive Operations | Maintenance**. If Cyclic Communications is not running, PiCPro will start a Digital Link Initialization. PiCPro will also start a Digital Link Initialization when **Online | Drive Operations | Reset Drive Communications** is selected.

- Drives may be powered on at different times, and Digital Link connections may be made after power is applied. The MMC searches for additional drives on the Digital Link only during Digital Link Initialization, which occurs at:
  - power on of the MMC
  - when the function block **DSTRTSRV** is called
  - when a **Reset Drive Communications** request is made from PiCPro.

Cyclic Communications

Cyclic Communication is the repetitive data transfer between the drive and the Motion Library. Cyclic Communication starts after Digital Link Initialization when the REQ input of the function block **DSTRTSRV** (see the Function-Function Block Reference Manual) transitions from 0 to 1. Cyclic Communications is required for the Motion Library to enable drives and send position commands. PiCPro does not use Cyclic Communications to communicate with drives.

How PiCPro and Motion Library Work Over Digital Link

PiCPro and the Motion Library can independently transfer data to and from drives but there are some limitations as to when each can control drive functions. An interlock mechanism provides a means by which drives will be exclusively controlled by either PiCPro or the Motion Library. The following conditions are the result of the interlock mechanism.

- If the function block **DSTRTSRV** (see the Function-Function Block Reference Manual) is called while PiCPro is in Control Panel mode, **DSTRTSRV** will not perform Digital Link Initialization. **DSTRTSRV** will wait until the PiCPro connection is released before setting the **FAIL** or **DONE** outputs or reporting any data on the **ERR** or **ERAX** outputs.
- PiCPro will not request a drive Cold Reset while Cyclic Communications is running (see ***Cold Restart***).
- PiCPro will not enter Control Panel mode (although the oscilloscope may still be used) while Cyclic Communications is running.
- PiCPro will not perform Digital Link Initialization if Cyclic Communications is running.
- PiCPro and the Motion Library may not control different drives on the same Digital Link at the same time.

Recovering From Drive Communication Faults

The Digital Link communication integrity is observed both in the drive and in the control. In the event of unrecoverable communication errors, both the Smart Drive and the MMC Digital Control will report the condition and disable the drive. The reporting and recovery is dependent on whether the control or drive discovered the communication error.

Detecting and reporting errors

If the MMC Digital Control detects a communication error, the *E_RROR 8100 Digital Drive Communication Error* will be set. The MMC will disable the drive, but unless the drive also discovered a communication error, it will not report an error. This E_ERROR cannot be reset in the ladder until after a call to DSTRTSRV is made to initiate a Digital Link Initialization. E_RESET will not reset this error.

If the drive detects a communication error, Fault 51 will be set in the drive. The drive will be disabled and the fault will be reported to the MMC through the fault reporting variable in cyclic data. In the MMC, this drive fault will cause an *E_ERROR 8080 Digital Drive Fault***.** This can also be read from **READ_SV variable 68**. This drive fault is reset in a similar manner as all other drive faults in that, first the condition that caused the error must be corrected, and second the fault must be cleared. Applying power to the MMC or a call to DSTRTSRV will initiate a Digital Link Initialization and will correct the condition. Second, the fault must be reset, either from PiCPro or by calling the function E_RESET in the ladder.

Fault 51 is not reset when a Digital Link Initialization occurs. Should an intermittent condition exist that causes the drive to set fault 51, allowing that fault to remain after initializing communications allows the historical condition to be seen by the ladder or by PiCPro. If the fault were always cleared when initializing communications, the condition could never be seen.

Power cycle scenarios

If during operation of the MMC and drive, the power is removed and restored to only drives, the MMC will detect a communication error. A call to DSTRTSRV must be made to correct the problem. This will also reset the E_ERRORS when servos are re-initialized.

If during operation of the MMC and drive, the power is removed and restored to only the MMC, all connected drives will detect the communication error and set fault 51. When DSTRTSRV is called when the ladder begins to run in the MMC, a Digital Link Initialization occurs, but all drives will still have fault 51. This fault must be cleared by calling E_RESET or selecting "Reset Faults" from the PiCPro menu.

Alignment Mode

Overview: Alignment Mode

Alignment mode is used to establish an operational relationship between a feedback device and a motor magnetic position. After the motor and feedback devices are aligned, the feedback device provides the precise location of the motor magnetic position.

For the purposes of alignment, PiCPro recognizes the following types of feedback devices:

- Incremental Encoders
- Resolvers

PiCPro cannot perform alignment if it is connected to a drive with a motor having a Stegmann encoder. PiCPro will only support Stegmann encoders that have been pre-programmed by Danaher Motion.

The Alignment Tool is only available with MMC Smart Drive firmware versions 2.2 or greater. If alignment is attempted with an earlier version of drive firmware the following message will appear:

Accessing Alignment Mode

1. From the ONLINE drive list view, use one of the following methods to open the Control Panel / Oscilloscope view:
   - Click on the drive list standard toolbar.
   - Select **View | Control Panel / Oscilloscope…** from the menu.
   - Right-click and select **Control Panel / Oscilloscope…**
2. Select **Mode | Control Panel | Alignment Control**. A dialog message will be displayed.
3. Click **Yes** to continue. Click **No** or **Cancel** to exit the dialog.

4. If **Yes** is selected, the drive will be disabled and set to alignment mode. The Control Panel / Oscilloscope grid view will appear.

Parameters in Alignment Mode

- The Parameters area displays only actual data. File data cannot be modified from the Control Panel / Oscilloscope view.
- While parameters are used to control the drive, they cannot initiate or terminate motion. Motion is started/stopped by the start/stop motion pushbuttons in the Control Panel area.
- The Parameters area displays only actual data. File data cannot be modified from the Control Panel / Oscilloscope view.

Overview: Alignment Mode for a Motor with an Incremental Encoder

Current Limit (percentage of continuous current that will align the motor) can be entered. The default value is 25%.

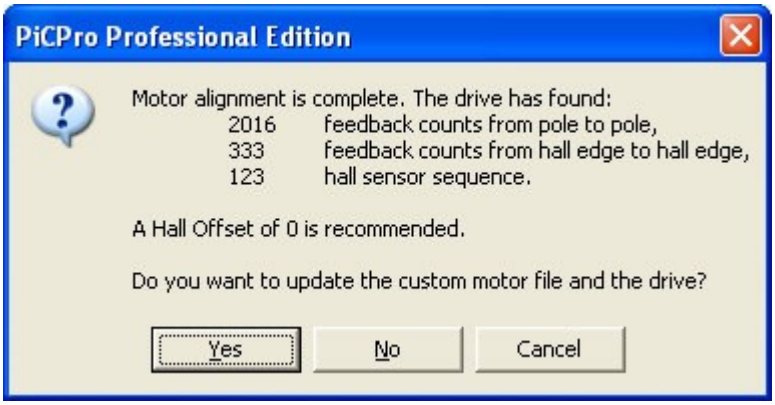
The current will be applied when **Start Motion** is clicked at the Drive Control Panel and remain until the automatic alignment cycle is complete or **Stop Motion** is clicked. While the current is applied, the Current Limit can be changed. The motor will be commanded to magnetic zero, and then incrementally commanded to the next magnetic zero over several sequential moves. When the cycle is complete or **Stop Motion** is selected, the process will discontinue.

Alignment Successful for Motor with an Incremental Encoder

Alignment complete is continuously monitored. When alignment is successful and complete, and the recommended offset is different from the old offset by +/- 15 degrees, PiCPro will indicate that no change is required. A message will be displayed as shown in the following example:

Click **OK** to continue.

If the recommended offset is different from the old by >15 degrees, a prompt will appear asking if the Hall Offset in the .csv file and the motor's Hall Offset should be updated. The following is an example prompt:



Click **Yes** to update the custom motor file and drive.

Click **No** or **Cancel** to discontinue alignment.

Notes:

- When a successful alignment has been indicated, the value can be manually entered into the motor table.
- The Danaher Motion standard motor personality file cannot be modified.

Upon completion of motor alignment a message is displayed recommending a Hall Offset. However, the Hall Offset for a standard motor cannot be changed. The following prompt will be displayed if alignment is performed on a standard motor:

Click **OK** to continue.

A new custom motor must be created to use the recommended Hall Offset.

Alignment Unsuccessful for Motor with an Incremental Encoder

If alignment is complete, and the alignment is unsuccessful, an alignment error message will be displayed.

Incremental Encoder Pole to Pole Count Invalid

Click **OK** to continue. Make sure the counts per rev and number of poles are correct in the motor data file.

Incremental Encoder No Hall Transition Detected

Click **OK** to continue. Make sure the hall sensors are connected correctly to the drive.

Incremental Encoder Too Many Hall Transitions Detected

Click **OK** to continue. Try again. If the problem persists, there may be a problem with the hall sensors in the motor.

Incremental Encoder Hall to Hall Count Invalid

Click **OK** to continue. Make sure the counts per rev and number of poles are correct in the motor data file.

Incremental Encoder Hall Sequence Invalid

Click **OK** to continue. Make sure the hall sensors are connected correctly to the drive.

Overview: Alignment Mode for a Motor with a Resolver

A resolver uses an Index Offset instead of a Hall Offset and therefore does not have Hall sensors. Functionality includes Current Limit adjustment, drive enable, and starting motion.

Alignment Successful for a Motor with a Resolver

Alignment complete is continuously monitored. When alignment is successful and complete, and the recommended offset is different from the old by +/- 15 degrees, PiCPro will indicate no change is required. A message will be displayed as shown in the following example:

Click **OK** to continue.

If the recommended offset is different from the old by >15 degrees, a prompt will appear asking if the Index Offset in the .csv file and the motor's Index Offset should be updated. The following is an example prompt:

Click **Yes** to update the custom motor file and drive.

Click **No** or **Cancel** to discontinue alignment.

Notes:

- When a successful alignment has been indicated, the value can be manually entered into the motor table.
- The Danaher Motion standard motor personality file cannot be modified.

Upon completion of motor alignment, a message is displayed recommending an Index Offset. However, the Index Offset for a standard motor cannot be changed. The following prompt will be displayed if alignment is performed on a standard motor:

Click **OK** to continue.

A new custom motor must be created to use the recommended Index Offset.

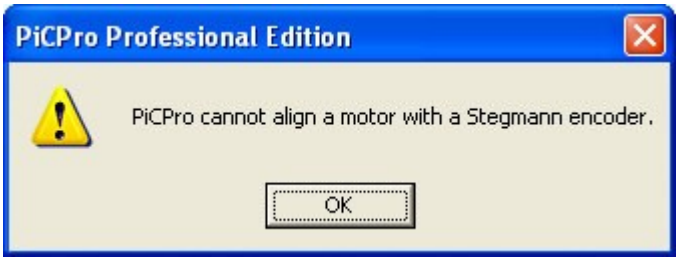
Alignment Unsuccessful for Motor with Resolver

If alignment is complete, and the alignment is unsuccessful, a pole-to-pole alignment error message will be displayed. The following is an example of this type of message:

Click **OK** to continue. Make sure the counts per rev and number of poles are correct in the motor data file.

PiCPro Cannot Perform Alignment with Stegmann Encoder

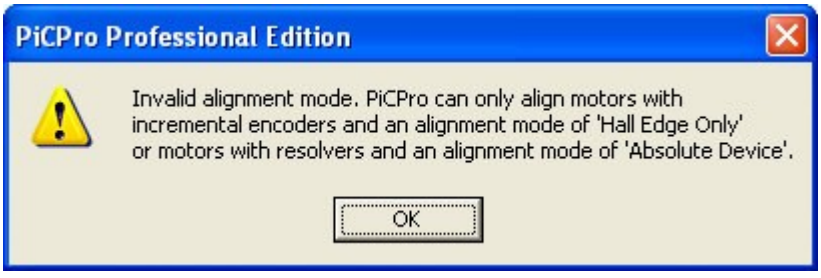
PiCPro cannot perform alignment if it is connected to a drive with a motor having a Stegmann encoder. PiCPro will only support Stegmann encoders that have been pre-programmed by Danaher Motion. If the attempt is made to do so, the following error message will be displayed:



Click **OK** to continue.

PiCPro Cannot Perform Alignment mode of Move, Minimum or Hall then Index

PiCPro cannot perform alignment when connected to a drive with a motor having an alignment mode of ‘Move’, ‘Move Minimum’, or ‘Hall then Index’. If the attempt is made to do so, an error message will be displayed.



Click **OK** to continue.

Chapter 6 - Custom Motors

Overview: Custom Motor Files

When PiCPro is installed, a list of standard motors is also installed. This is the list of motors that is available when specifying motor model for a drive. If the motor model being used is not found in the list, a custom motor must be created.

If non-standard motors are being used, there are two choices available for creating custom motor files:

1. Custom motor files can be created in PiCPro using the procedures included in this manual.
2. Danaher Motion will create the custom motor files.

The motor(s) are first sent to Danaher Motion for testing by Danaher Motion Engineers who specialize in the creation of custom motor files. The engineers create a custom motor file and a speed torque curve for each motor. Email **glmotion.info@danahermotion.com** for further information.

A custom motor file (.csv) contains motor data for a single motor. The Custom Motor View allows configuration of Custom Motor parameters.

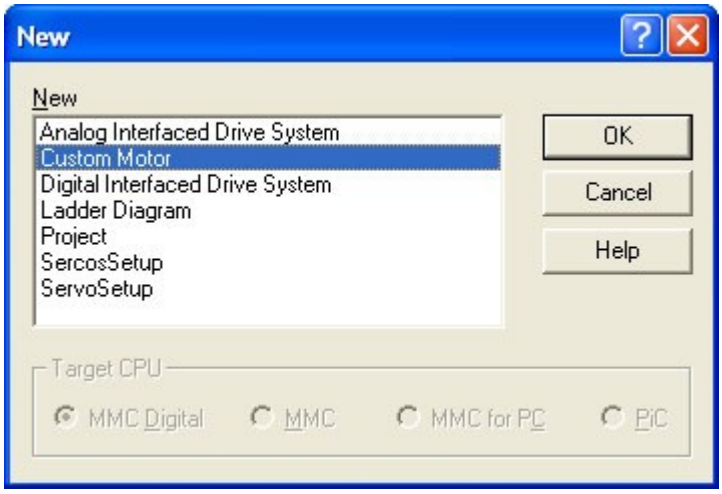
Custom motor files are read:

1. At the startup of PicPro.
2. If the location of the custom motor files is changed.

Creating a New Custom Motor File

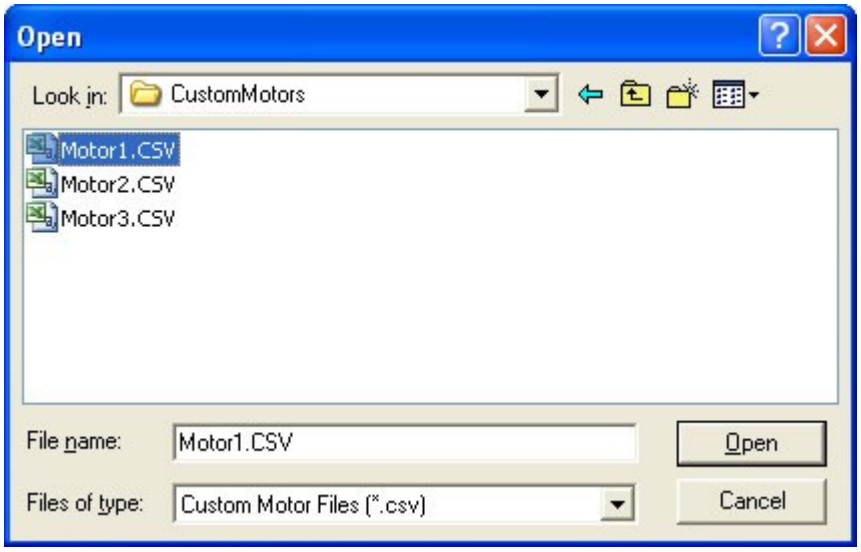
Choose one of the following methods to display the **New** dialog and create a new custom motor file:

1. Click on the standard toolbar
   - Select **File | New** from the menu
   - Press <**Ctrl + N**>
   - Select Custom Motor from the dialog that appears.
2. Click **OK** to create a Custom Motor File. Select **Cancel** or click to close the dialog without creating a Custom Motor file. Select **Help** to display information related to creating new Custom Motor files.



Opening an Existing Custom Motor File

1. To display the **Open** dialog, choose one of the following methods:
   - Click on the standard toolbar and browse to the folder containing the existing Custom Motor files.
   - Select **File | Open** from the menu.
   - Press <**Ctrl + O**>
2. The **Open** dialog box appears. At the bottom, choose Custom Motor Files (*.csv) from the drop down list in the **Files of type:** box. A list of all existing custom motor files is displayed.
3. Select the desired file to be opened.



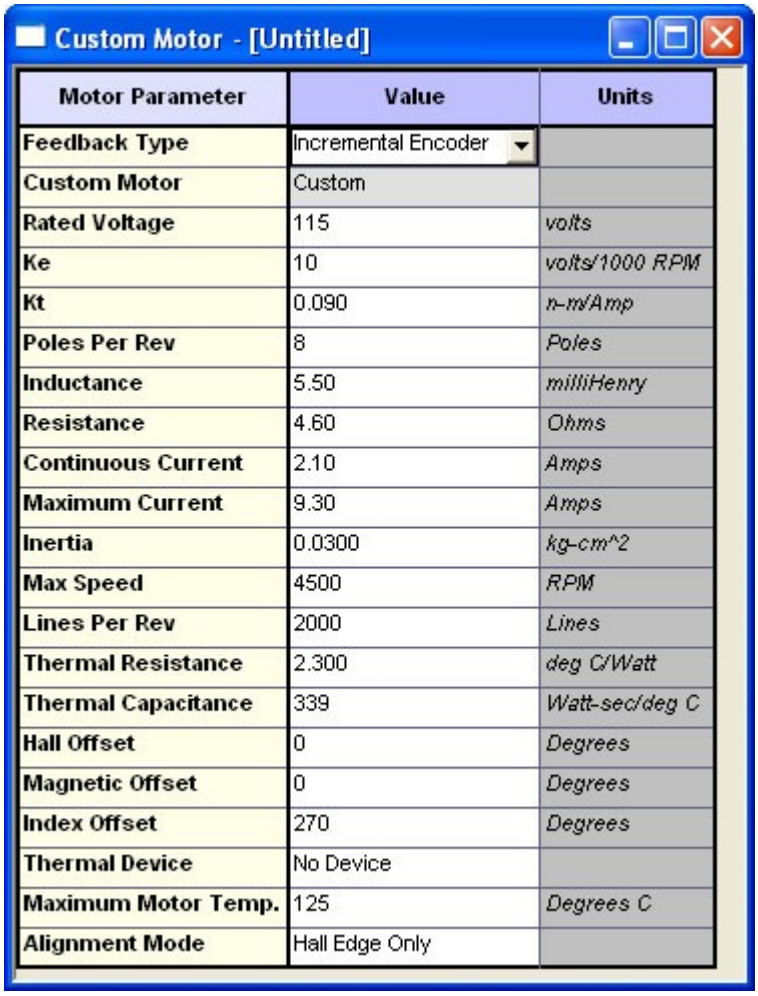
4. Use one of the following methods to open the file:
   - Click **Open**.
   - Double-click the file name.
   - Press the **Enter** key.

Note: Select Cancel or click to close the dialog without creating a Custom Motor file.

Configuring and Editing a Custom Motor File

The Custom Motor grid view is the location in which custom motor parameters are configured. The grid view provides the ability to:

1. Edit, copy and paste motor data within the grid.
2. Restore default data and load default values from another motor.



Motor Parameter	Value	Units
Feedback Type	Incremental Encoder	
Custom Motor	Custom	
Rated Voltage	115	volts
Ke	10	volts/1000 RPM
Kt	0.090	n-m/Amp
Poles Per Rev	8	Poles
Inductance	5.50	milliHenry
Resistance	4.60	Ohms
Continuous Current	2.10	Amps
Maximum Current	9.30	Amps
Inertia	0.0300	kg-cm^2
Max Speed	4500	RPM
Lines Per Rev	2000	Lines
Thermal Resistance	2.300	deg C/Watt
Thermal Capacitance	339	Watt-sec/deg C
Hall Offset	0	Degrees
Magnetic Offset	0	Degrees
Index Offset	270	Degrees
Thermal Device	No Device	
Maximum Motor Temp.	125	Degrees C
Alignment Mode	Hall Edge Only	

Navigating in the Custom Motor Data View

There are two columns of information for each parameter, **Values** and **Units**. The column width can be adjusted by using the mouse.

Move the mouse pointer over the line separating two columns. The pointer will change to a vertical list with horizontal arrows on either side .

Hold the left mouse button down and move the mouse left or right to contract, expand or hide the column.

Selecting Parameter Values

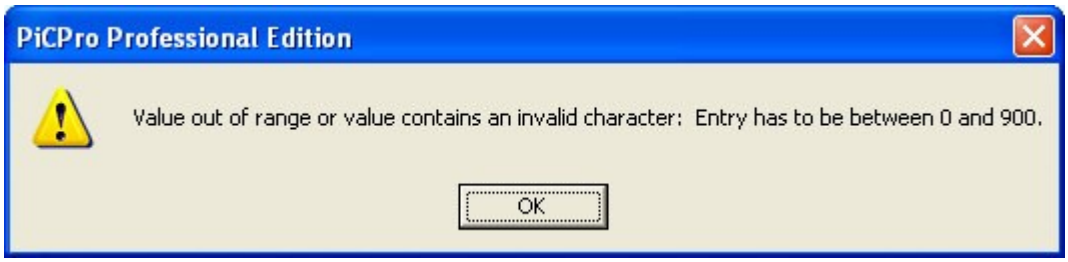
- A single value is selected by clicking on the value.
- The entire file column can be selected by one of the following methods:
- Left-click on any of the values in the File column and select **Edit | Select All in Col** in the menu.
- Right-click on any of the values in the File column and choose **Select All in Col**.
- Left-click on the **Value** column header.
- Left-click in the first or the last Value cell. Hold down the mouse button and drag up or down to select the entire column.

- To select multiple value cells, left-click in the first or the last value cell of the desired selection of value cells. Hold down the mouse button and drag up or down to select the cells.

Editing Custom Motor Values

To change parameter values while in Custom Motor Data view do the following:

1. Select the value.
2. Enter the changes.
3. Press the **Enter** key. If the value entered is out of the acceptable range, a prompt will appear. The requested entry range depends on the value type.



If the above prompt is displayed, click the OK button and enter the proper value.

Copying Parameter Values

A single value, multiple values, or the entire values column can be copied. Once values are selected, use one of the following methods to Copy:

- Click the button from the standard toolbar.
- Choose **Edit | Copy** from the menu.
- Press <**Ctrl + C**>.
- Right-click and select **Copy**.

Pasting Parameter Values

A Single value can be pasted anywhere there is a configurable value. Select the value and use one of the following methods to Paste:

- Click the button from the standard toolbar.
- Choose **Edit | Paste** from the menu.
- Press <**Ctrl + C**>.
- Right-click and select **Copy**.

Multiple values will be pasted onto matching parameters.

Undo Edit Action

Undo reverses the last edit action. Undo maintains 10 levels. An undo command can be activated by one of the following methods:

- Click the button on the drive list standard toolbar.
- Choose **Edit | Undo** from the menu.
- Press **<Ctrl + Z>**.

A single Undo operation may contain several commands. For example, when Factory Defaults are restored for an entire column; all value changes will be stored as a single Undo command.

Redo Edit Action

Redo reverses the last Undo command. Redo maintains 10 levels. A redo command can be activated by one of the following methods:

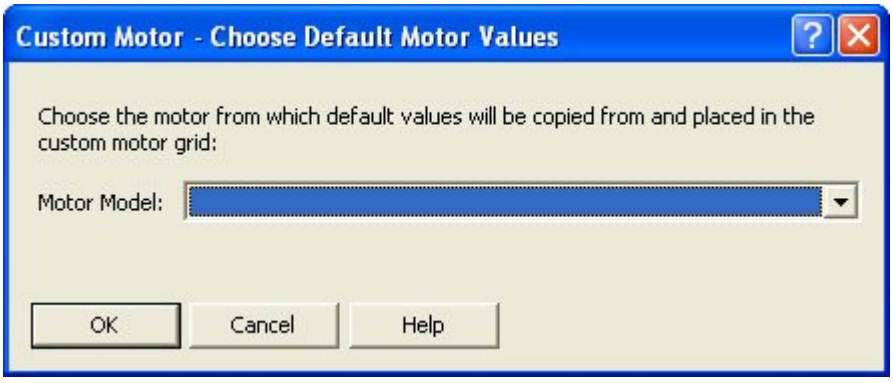
- Click the button on the drive list standard toolbar.
- Choose **Edit | Redo** from the menu.
- Press **<Ctrl + R>**.

A single Redo operation may contain several commands. For example, when Factory Defaults are restored for an entire column; all value changes will be stored as a single Redo command.

Loading Default Data from Another Motor

Load Default Data From Another Motor provides the ability to choose a known motor from a list. The selected motor's default values will replace all entries for the custom motor currently displayed.

1. Use one of the following methods to load the data from another motor:
   - Click the button on the custom motor standard tools toolbar.
   - Select **Edit | Load Default Data From Another Motor...** from the menu.
   - Right-click on selected values and choose **Load Default Data From Another Motor...** .
   - The following prompt will be displayed:



2. Select the motor from which the default values will be copied.
3. Click **OK** or press **Enter**.

Restoring Factory Defaults

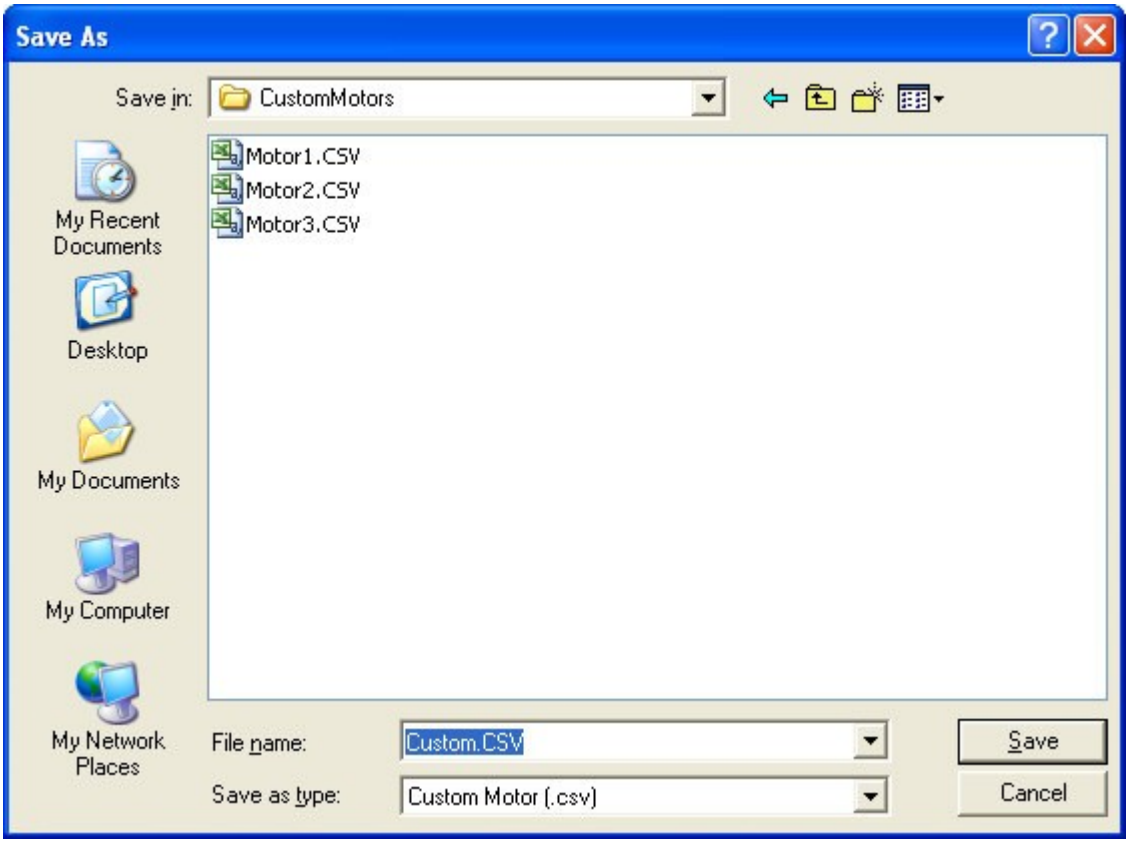
Factory defaults can be restored for selected values. To restore factory defaults, choose one of the following methods:

- Click the button on the drive list standard toolbar.
- Select **Edit | Restore Factory Defaults** from the menu.
- Right-click on selected values and choose **Restore Factory Defaults**.

Saving to a New Custom Motor File

A custom motor is added to the list of available motors in PiCPro when it's custom motor file is saved. If a custom motor existing in PiCPro is modified using PiCPro, the custom motor data will be updated when the file is saved.

Choose **File | Save as...** The following prompt will be displayed:



Enter a file name and the desired location. Click **Save** to save the new file. Click **Cancel** or to cancel the new file save process.

The default file save location will be the custom motor directory. If the file is saved to the custom motor directory, the new motor name will be added to all motor dropdown lists. If the file is saved to a different location, a message will be displayed indicating that the custom motor data will not be used because the file was not saved to the custom motor directory.

Note:

If files are added to the custom motor directory outside of PiCPro while PiCPro is running, one of the following procedures must be performed before the motors found in those files will appear in any of the motor drop down lists:

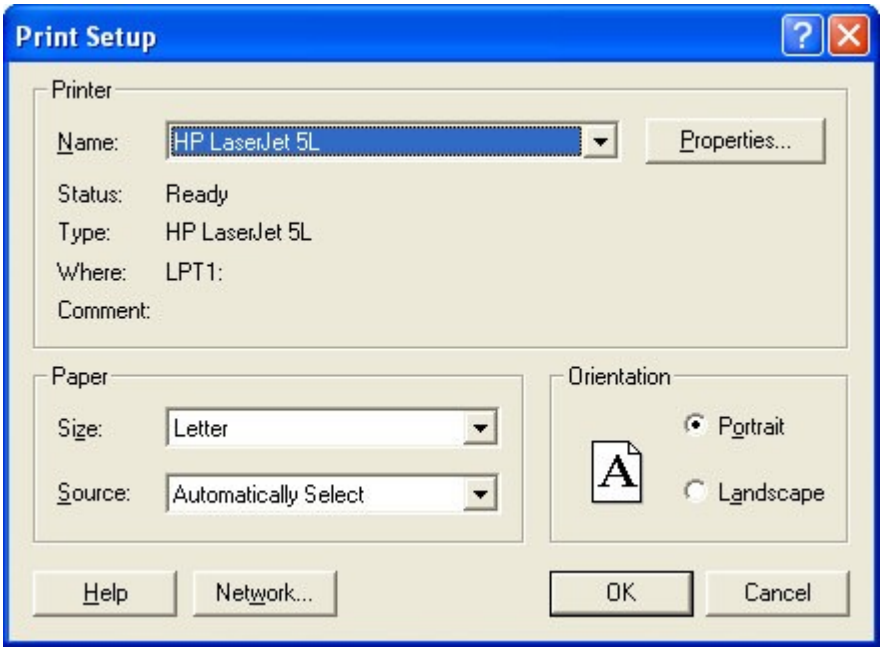
1. PiCPro must be stopped and restarted.
2. The Refresh button on the Drive Setup tab in the Options dialog must be pressed.

Printing Custom Motor Information

To print custom motor information choose one of the following:

Click from the drive list standard toolbar.

Select **File | Print . . .** from the menu.



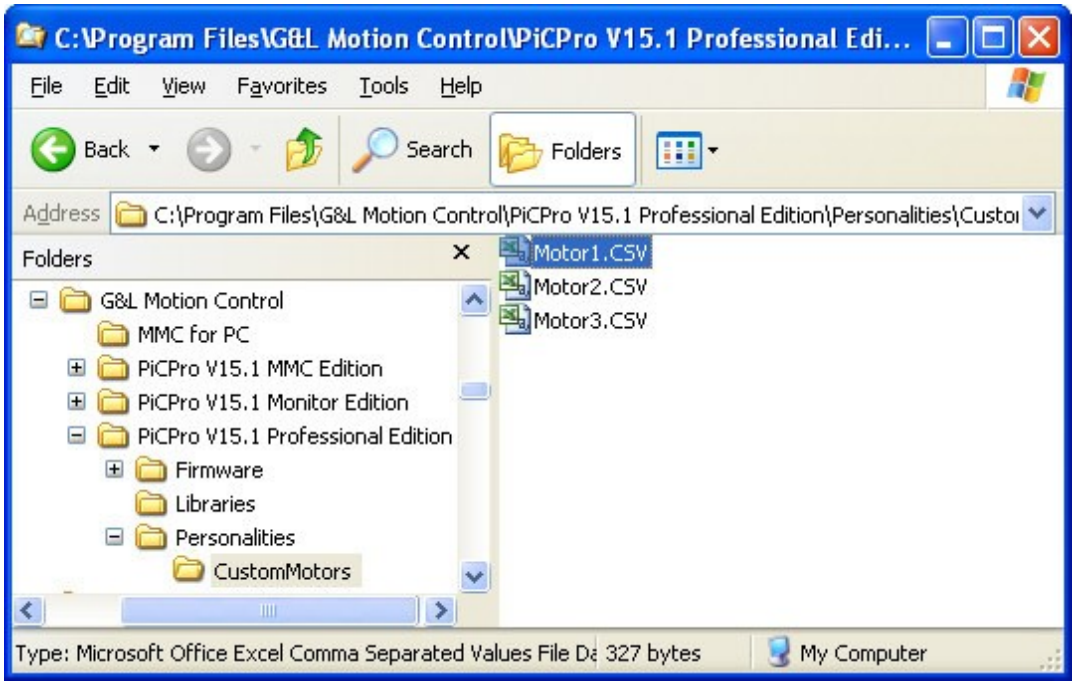
When the settings are satisfactory, select **Print** to queue the output to a printer. Select **Cancel** or click to exit the dialog without printing. Select **Help** to display information related to this subject.

Deleting a Custom Motor File

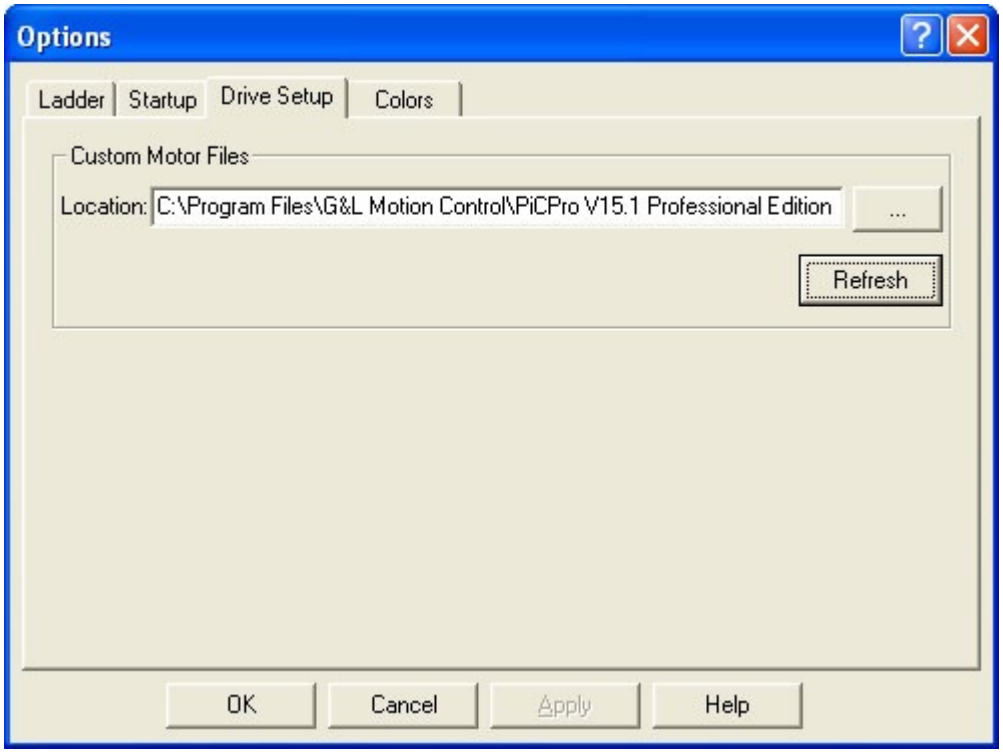
PiCPro does not provide functionality to delete a custom motor. To delete a custom motor do the following:

1. Right click **Start** and click **Explore** to display the Windows Explorer view.
2. Navigate to the folder that contains the custom motor files.

Note: The default location for custom motors is a subdirectory (subfolder) of the installed personalities directory (folder) titled CustomMotors.



3. Select the custom motor (.csv) file and delete it from the Custom Motor folder.
4. From within PiCPro, select **View | Options**. Select the **Drive Setup** tab and click the **Refresh** button.



5. Close and restart PiCPro.

Information Window Messages

When custom motor files are read, messages will be displayed in the information window if one of the following conditions exists:

1. A custom motor file is found whose name matches that of a motor already in the installed motor file.
2. A custom motor file with an invalid checksum is found.
3. A custom motor file is found that includes parameters not supported by the current personality files.

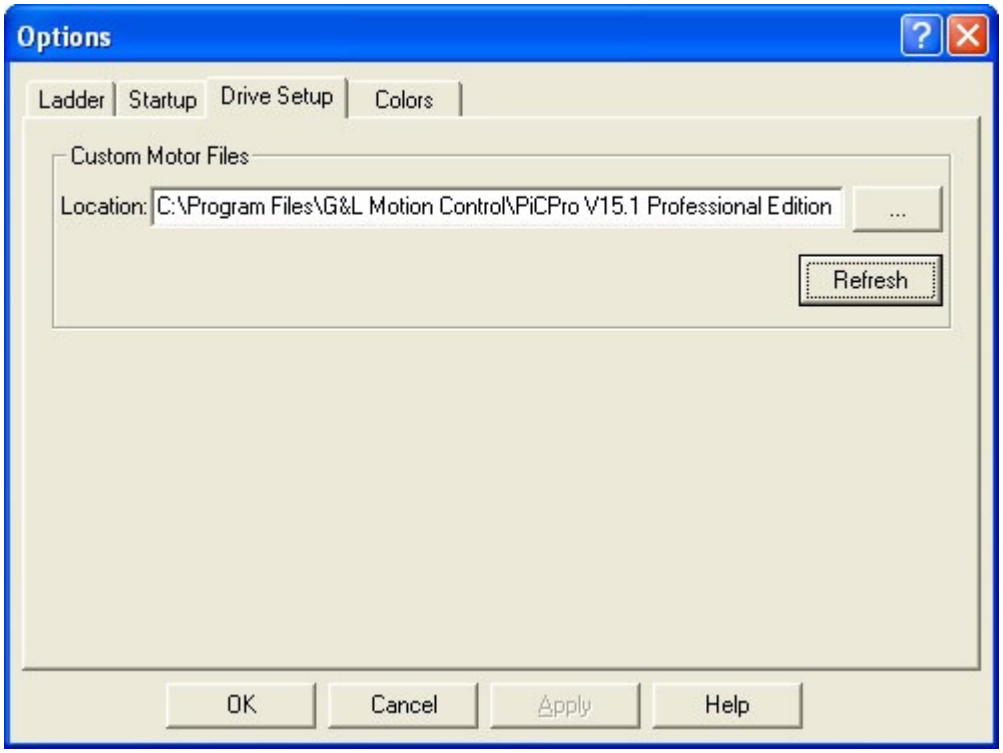
   Note: If the motor file is saved in the current version of PiCPro, any unused information will be lost.
4. A custom motor file is found that was created with an earlier version of PiCPro that did not support all of the motor parameters supported in the current version PiCPro. If motor parameters are missing, default values will be given to the missing motor parameters.

Changing Location of Custom Motor Files

When PiCPro is installed, a CustomMotors directory is created as a subdirectory of the Personalities directory *(installed location\ Personalities \CustomMotors).* All custom motor files found in the CustomMotor directory are read when PiCPro starts.

To change the location of the custom motor files, do the following:

1. Select **View** | **Options** and click the **Drive Setup** tab. The following will be displayed:



Location	Contains the directory path of custom motor files.
…	Displays a dialog for browsing to the custom motor directory.
Refresh	Forces PiCPro to reread all custom motor files in the custom motor directory.

2. Click the '**…**' button to browse to the desired folder.
3. Click **OK** or **Apply** to save the change. The custom motor files (.csv) are read and data status is reevaluated for open .csv files.

Note:

The custom motor files can also be read and motor data status reevaluated by selecting **View | Options** and clicking on the Cancel button.

To Cancel the Location Change of Custom Motor File, click the Cancel button, , or press Esc on the keyboard.

Chapter 7 - Servo Setup and Tuning

Overview: Servo Setup

The Servo Setup program in PiCPro is used to enter setup data for all digitizing and servo axes used in your application. Each axis you insert appears in a list sorted by the axis type. It also allows you to read servo setup parameters in the servo view list and write selected parameters to an axis in the servo force list.

A general overview of the procedure to incorporate servo setup into your application program follows:

1. Use servo setup to enter setup data for your application. Refer to: ***Create a New Servo Setup File.***
2. Save the setup file (name.SRV). Refer to: ***Saving a Servo Setup File.***
3. With the compile command, make a function containing all the setup data. Assign an appropriate name to the function. This function is placed in a library file you create (name.LIB) which PiCPro can find. This library file will hold all servo functions defined by you for your application. Refer to: ***Compile a Servo Setup Function***
4. Use PiCPro to create an application program (name.LDO).
5. Include the setup function you made, along with the STRTSERV standard motion function, in a network of your ladder program.

   Note: When the setup data is called in the ladder, it is copied into the RAM memory of the CPU.
6. Download the application to the control. The setup data for your application is sent to the CPU in the form of the function.
7. Read and write setup parameters to fine-tune each axis in your application.

Note: This creates a .SVT file for the Servo View List and the Servo Force List. Refer to: *Axis Tuning*

Accessing Servo Setup

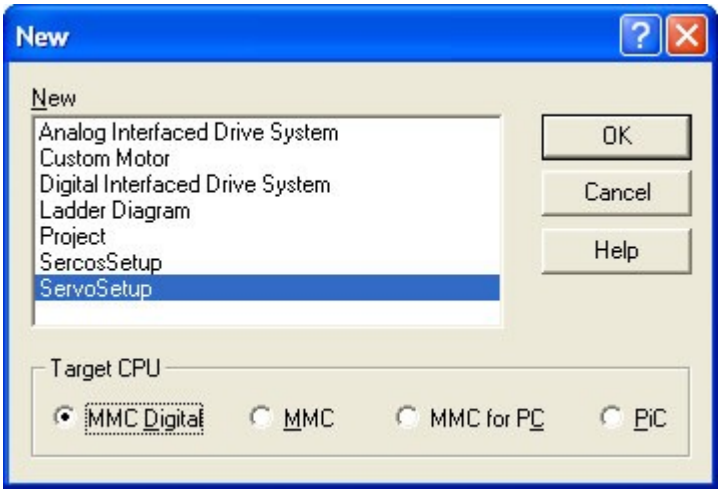
Accessing Servo Setup

There are several ways to access the Servo Setup program.

- Create a New Servo Setup File
- Open an Existing Servo Setup File
- Open from the Setup function in your ladder
- Open from Windows explorer

Creating a New Servo Setup File

1. To display the New dialog, choose one of the following:
   - Click the button on the standard toolbar.
   - Select **File | New** from the menu.
2. Select **Servo Setup** from the dialog that appears.
3. Select the CPU Type (**MMC Digital, MMC, MMC for PC or PiC**). The default selection is the last selection made.
4. Choose **OK**.



Note:

In the PiCPro MMC-Limited Edition, the CPU type is limited to MMC and MMC Digital.

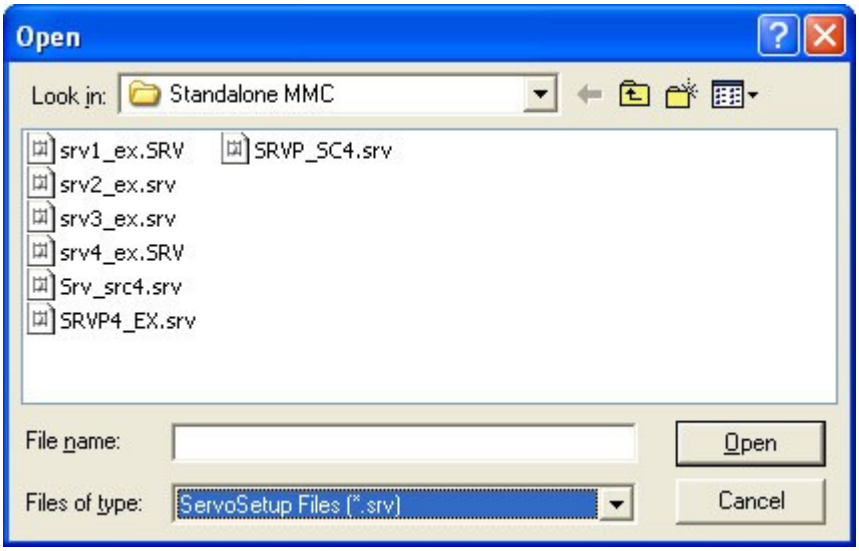
Opening an Existing Servo Setup File

To display the Open dialog, choose one of the following:

- Click the button on the standard toolbar.
- Select **File | Open** from the menu.

The Open dialog appears. At the bottom, choose **ServoSetup Files (*.srv)** from the drop down list in the Files of type: field. This brings up a list of all existing servo setup files.

Highlight the file you want to open.

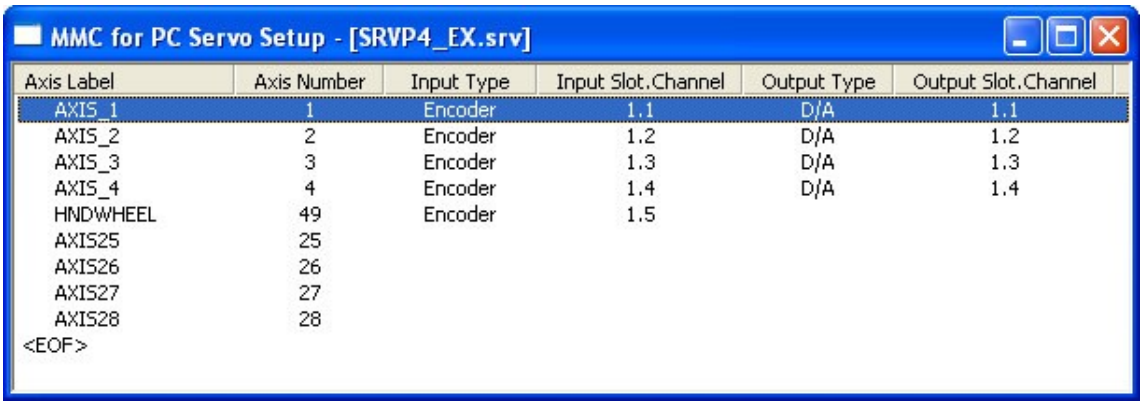


To open the file, choose one of the following:

- Click **Open**.
- Press **Enter** key.

- Double-click on the file.

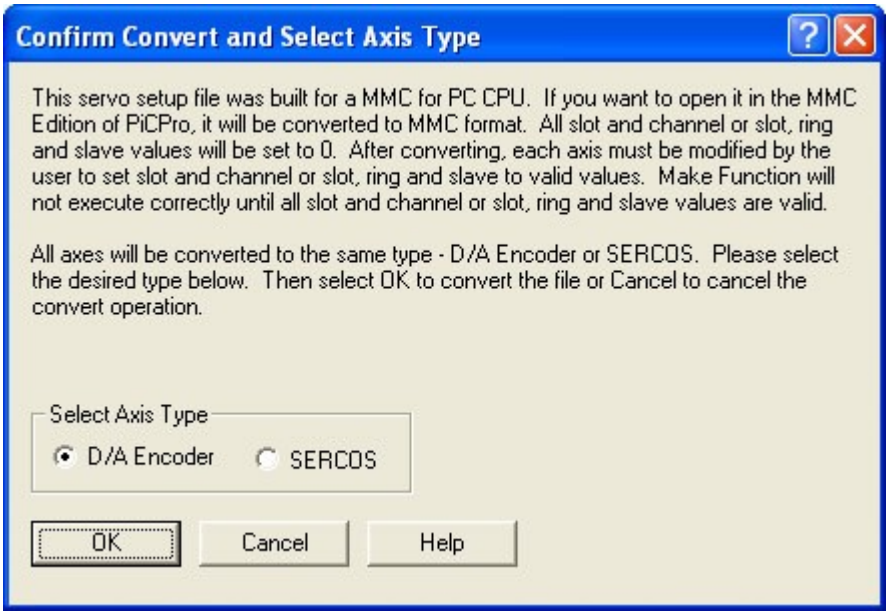
The servo setup list view will appear (MMC for PC CPU selected in example below):



Note:

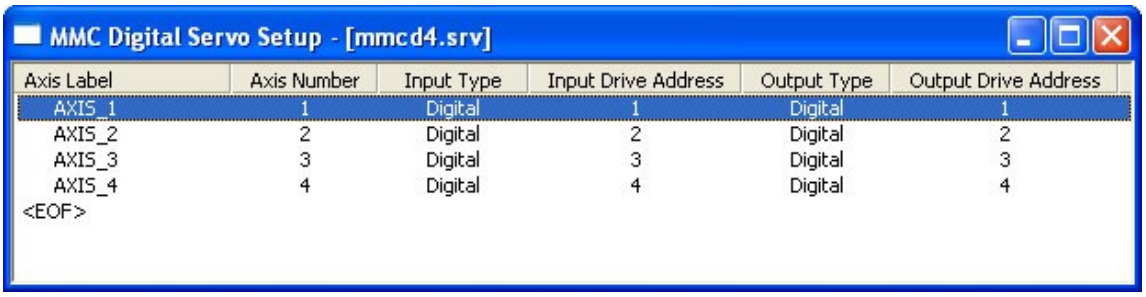
- If Time axes are included, they will be displayed after digitizing axes in the Servo Setup list view (e.g Axis Label 26 above). Input and Output data are not included for Time axes. Refer to***: Inserting a Time Axis***.
- If an axis is specified as a DLS Communication Master axis, a (M) will appear before the axis name in the first column of the servo setup list.

If you attempt to open an existing .SRV file in PiCPro MMC-Limited Edition, and the SRV file was previously saved for a PiC or MMC for PC CPU, a confirmation prompt similar to the following will be displayed that indicates the types of changes that will be made to the servo setup information.



The column headers are the same for a PiC, MMC and MMC for PC Servo Setup file.

If an MMC Digital Servo Setup file is opened, a servo setup view list similar to the following will appear:



Note:

If Time axes are included, they will be displayed after digitizing axes in the Servo Setup list view (e.g. Axis Label TA above). Input and Output data are not included for Time axes. Refer to***: Inserting a Time Axis***.

Opening a Servo File from the Setup Function in your Ladder

If you have already created a servo setup function with your setup data and have included it in your ladder, you can access the servo setup file from there.

1. Place focus on the setup function in your ladder.
2. Choose one of the following methods to view a servo function:
   - Select **View | Servo Function** from the menu. Then select the desired setup function from the fly-out list.
   - Right-click and select **View Servo Function**.

Note:

In order to open a servo setup file from within your ladder, the servo file and the servo function must have the same name. Any servo setup file created with PiCPro Version 10.0 or later automatically has the same name as the servo setup function. However, any DOS servo setup file may not have the same name as the servo setup function. Change the name of the .srv file to match the name of the servo setup function if you want to be able to open the file from within the ladder and/or be able to force axis values using the Servo Force List.

Opening a Servo File from Windows Explorer

1. Open Windows Explorer and find the .srv file you want to open.
2. Select the .srv file that you want to open and double-click on it. The Servo Setup window is displayed.

Inserting an Axis in Servo Setup

Inserting an Axis in Servo Setup

An axis is added to Servo Setup by using the Insert command from the menu, pressing the Insert key, or right clicking and selecting one of the insert menu items. You can insert a servo, digitizing (read-only) or time axis. Digitizing axes have no output type. Time axes have no input or output type.

Servo setup will number the axes sequentially as they are inserted. Axis numbers are unique. No two axes can have the same axis number.

Each time you insert an axis you must enter the axis properties for that axis.

Servo Axis Limitations - PiCPro Professional Edition:

If an MMC, MMC for PC or PiC CPU type is selected, the limitations are:

- Valid axis numbers are 1 to 132.
- The maximum number of servo axes is 32.

- The maximum number of digitizing axes is 32.
- The maximum number of time axes is 4.

If an MMC Digital CPU type is selected, the limitations are:

- Valid axis numbers are 1 to 132.
- The maximum number of servo axes is 64. The drive address is numbered 1 to 64.
- The maximum number of digitizing axes is 64. The drive address is numbered 1 to 64.
- The maximum number of time axes is 4.

Servo Axis Limitations - PiCPro MMC-Limited Edition:

If a standalone MMC CPU type is selected, the limitations are:

- The maximum number of servo axes is 4 if axes are D/A Encoder. The servo axes are numbered from 1 to 4.
- The maximum number of servo axes is 8 if axes are SERCOS. The axes are numbered from 1 to 8.
- The maximum number of digitizing axes is 1 if axis is Encoder. The digitizing axis is numbered 49.
- The maximum number of digitizing axes is 8 if axes are SERCOS. The axes are numbered 49 to 56.
- The maximum number of time axes is 4. The time axes are numbered from 25-28.
- The input and output channel numbers of a servo D/A Encoder axis must be the same as the axis number.
- The input channel number of a digitizing Encoder axis must be 5

If an MMC Digital CPU type is selected, the limitations are:

- Valid axis numbers are 1 to 143
- Valid drive address is 1 to 64
- The maximum number of servo axes is 16.
- The maximum number of digitizing axes is 16.
- The maximum number of time axes is 4.

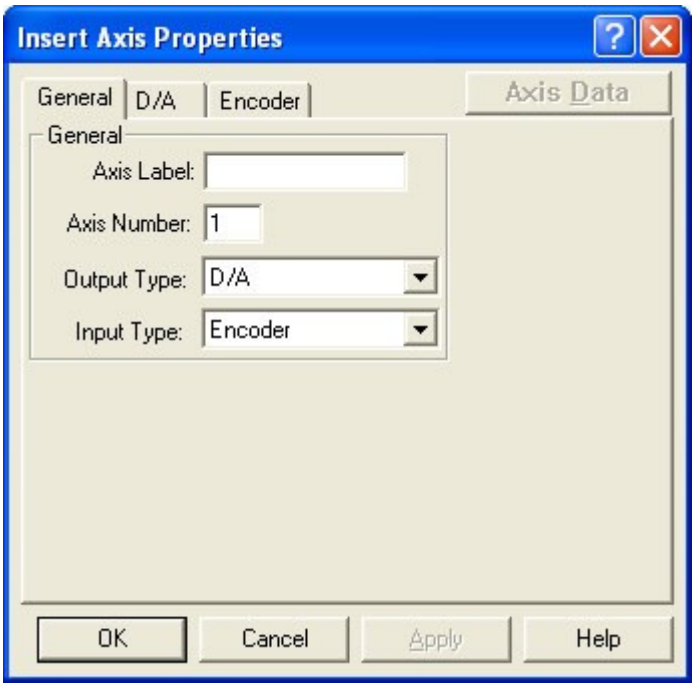
Note:

All axes must be the same type in a standalone MMC or MMC for PC servo setup function regardless of which PiCPro Edition it is created in.

Inserting a Servo Axis

Insert a Servo Axis for an MMC, MMC for PC, or PiC CPU

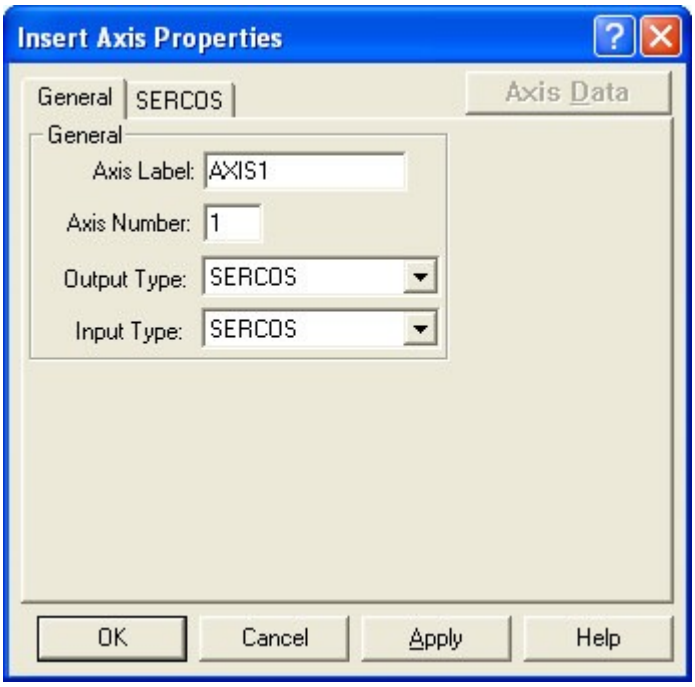
1. Select **Insert | Servo Axis** from the menu. If the CPU type selected is PiC, MMC, or MMC for PC the **Insert Axis Properties** dialog appears as follows:



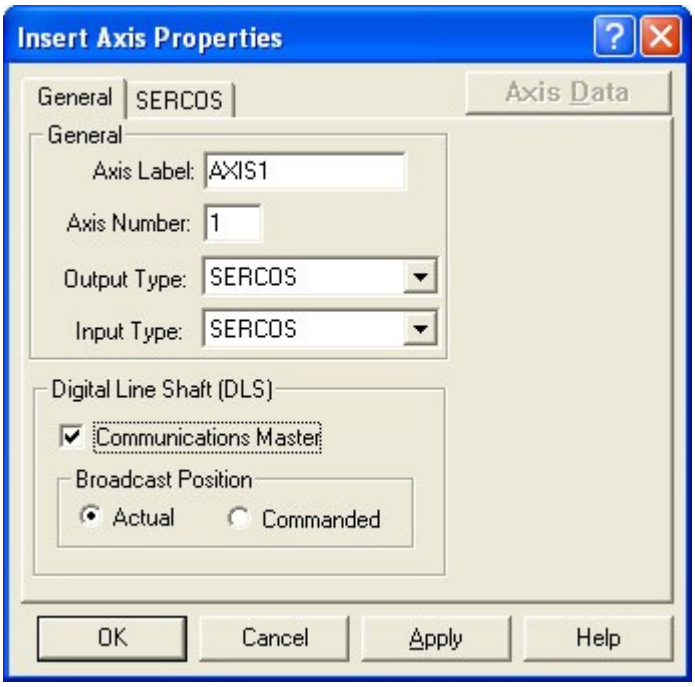
2. Enter a name for the axis in the **Axis Label:** field.
3. The **Axis Number:** is entered by PiCPro in sequential order. These can, however, be changed.
4. Enter the **Output Type:** and **Input Type:** in those fields if they are different from the defaults you see above. Typically, a servo axis has a D/A output and an Encoder input.

Note: If you need to change the defaults, change the Output Type first since the Input Type choices vary based on your output selection.

If the **Output Type:** selected is SERCOS, the **Insert Axis Properties** dialog appears as follows:

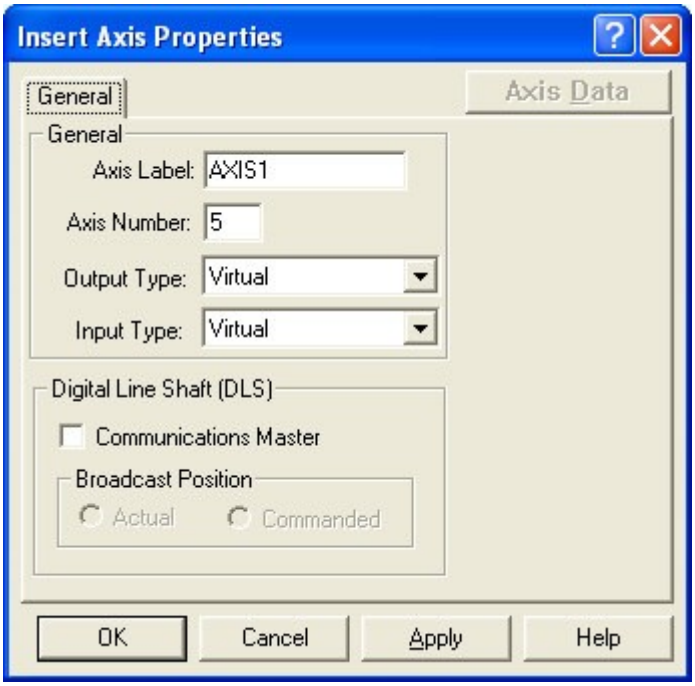


When the CPU type is MMC for PC, the SERCOS axis can be designated as the DLS Communications Master Axis by clicking on **Communications Master**. As the **Insert Axis Properties** dialog shows:



Select **Actual** or **Commanded** to specify the Position to be broadcast. The default is **Actual**. **Actual** must be selected if the Communications Master axis is a Time or a digitizing SERCOS axis. **Commanded** is only available for a normal SERCOS axis.

Regardless of the CPU type, if the **Output Type:** selected is Virtual, the additional tabs disappear. Input and output device configuration is not required. In the case of MMC for PC CPU type, DLS designation is also available with the Virtual axis as the **Insert Axis Properties** dialog shows:

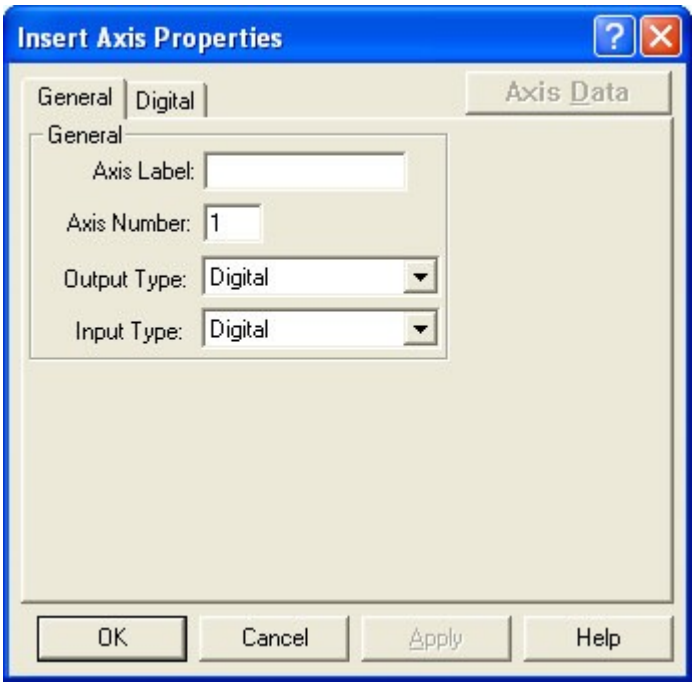


5. Click on the tabs that appear to configure the output and input devices for your application. Typically, you will need to specify at least the input and output slot and channel for each device.
6. When you are done configuring your input and output properties, click on **Apply** to activate the **Axis Data** button for this axis OR click **OK** to continue inserting axes.

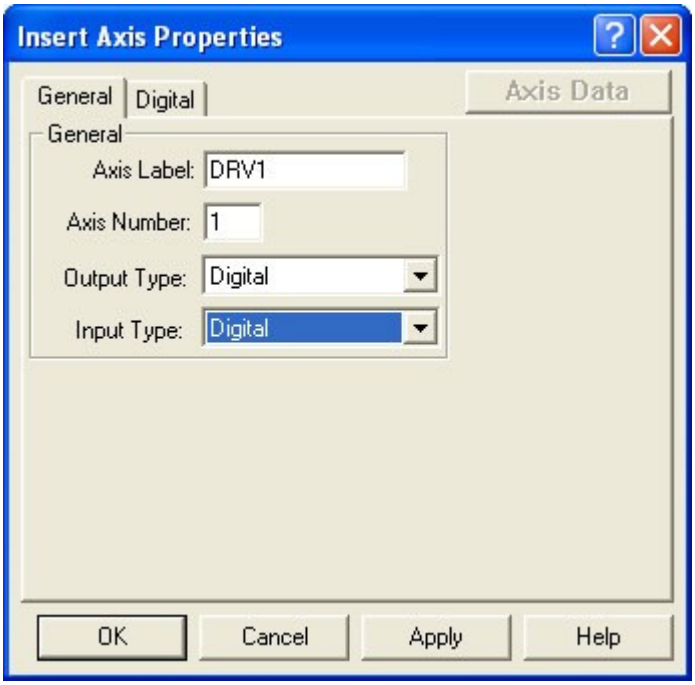
Note: A MMC for PC *.srv file can only contain 1 axis specified as a digitizing DLS axis a Communications Master.

Insert a Servo Axis for MMC Digital CPU

1. Select **Insert | Servo Axis** from the menu. the **Insert Axis Properties** dialog appears as follows:

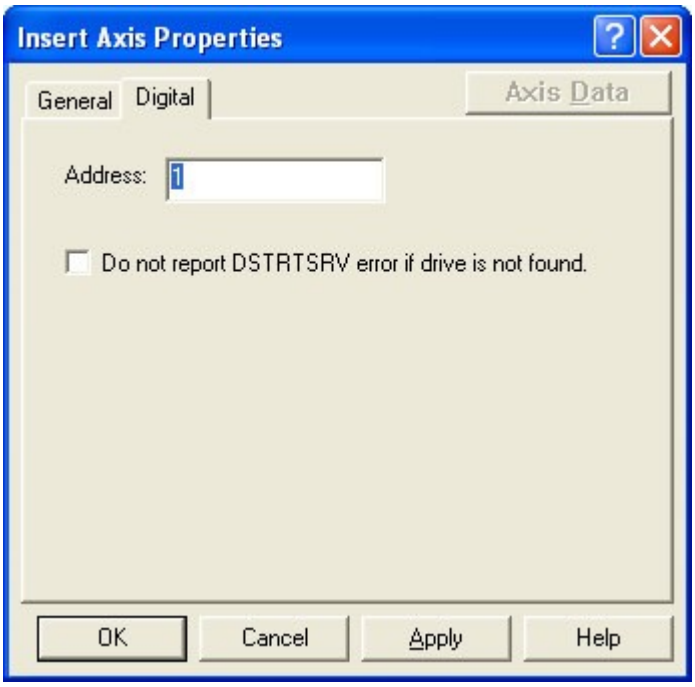


2. Enter a name for the axis in the **Axis Label:** field.
3. The **Axis Number:** is entered by PiCPro in sequential order. These can, however, be changed.
4. Choices for **Output Type:** and **Input Type:** for a MMC Digital CPU default to **Digital** output and **Digital** input.



Virtual output is also selectable for **Output Type:**. When **Virtual** is selected for **Output Type**:, Input Type: changes to **Virtual**.

5. If **Input/Output Type** is set to Digital, click the **Digital** tab. Enter the desired address number.



Servo Input/Output Types

The various combinations of Input and Output types are listed below.

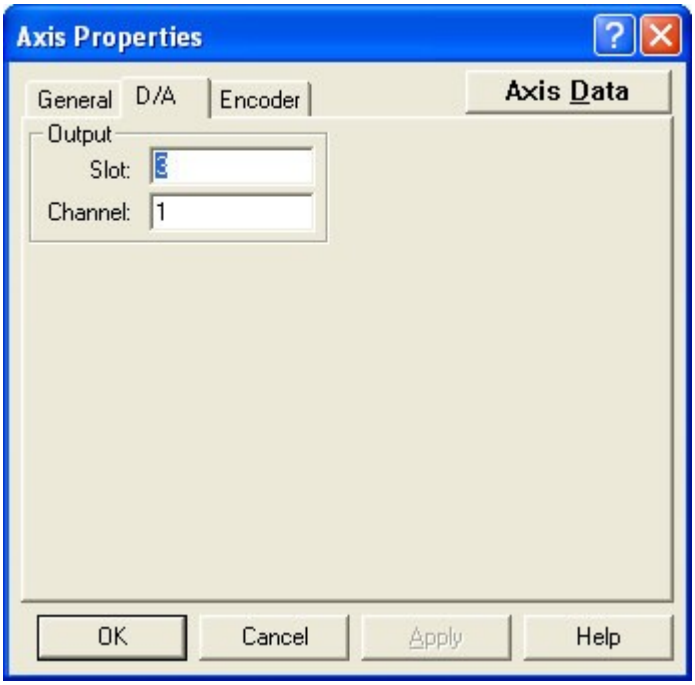
CPU Type	For a Servo Axis		For a Digitizing Axis	
	Output	**Inputs**	**Output**	**Inputs**
PiC	Encoder Resolver Analog TTL SERCOS No Input Virtual	D/A (+/- 11V) D/A D/A D/A SERCOS Stepper Virtual	Encoder Resolver Analog TTL	No Output
Standalone MMC	Encoder SERCOS Virtual	D/A (+/- 10V) SERCOS Virtual	Encoder SERCOS	No Output
MMC for PC	Encoder SERCOS Virtual	D/A (+/- 10V) SERCOS Virtual	Encoder SERCOS DLS	No Output
MMC Digital	Digital Virtual	Digital Virtual	Digital	No Output

D/A Output Setup

To configure the D/A Output

1. Enter the **Slot:** and **Channel:** location of the D/A module.
   - For a PiC CPU: Slot is between 3 – 13, Channel is 1 – 8
   - For an MMC for PC: Slot is 1 – 8, where it represents the ASIU number, Channel is 1 - 4
   - For a standalone MMC: Slot is limited to 1, Channel is 1 – 4

     Note: In PiCPro MMC-Limited Edition, Channel is limited to axis number. If the axis number is later changed, you must modify the channel number.
2. Click **OK**.

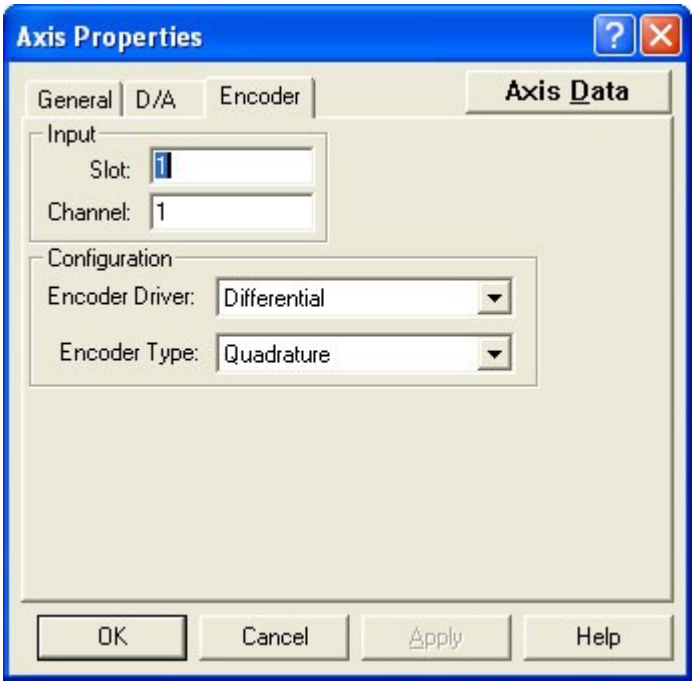


Encoder Input Setup

To configure the encoder input

1. Enter the **Slot:** and **Channel:** location of the encoder module.
2. Select the correct **Encoder Driver:**
3. Select the correct **Encoder Type:**

   Note: Quadrature type assumes that there are four counts for each quadrature cycle. The rising and falling edges of both channel A and channel B are counted. Pulse type counts either channel A or channel B so that one count is recorded per cycle.
4. Click **OK**.



The options available on the Encoder tab will vary depending on CPU type.

CPU Type	Slot	Channel	Driver	Type
PiC	3 – 13	1 – 4	Differential Single-ended	Quadrature Pulse
Standalone MMC	1	1 – 4 Servo 1 – 5 Digitizing	Differential	Quadrature
Standalone MMC PLUS	1 or 3 - 6	1 – 4 Servo 1 – 5 Digitizing	Differential	Quadrature
MMC for PC	1 – 8 (ASIU)	1 – 4 Servo 1 – 5 Digitizing	Differential	Quadrature

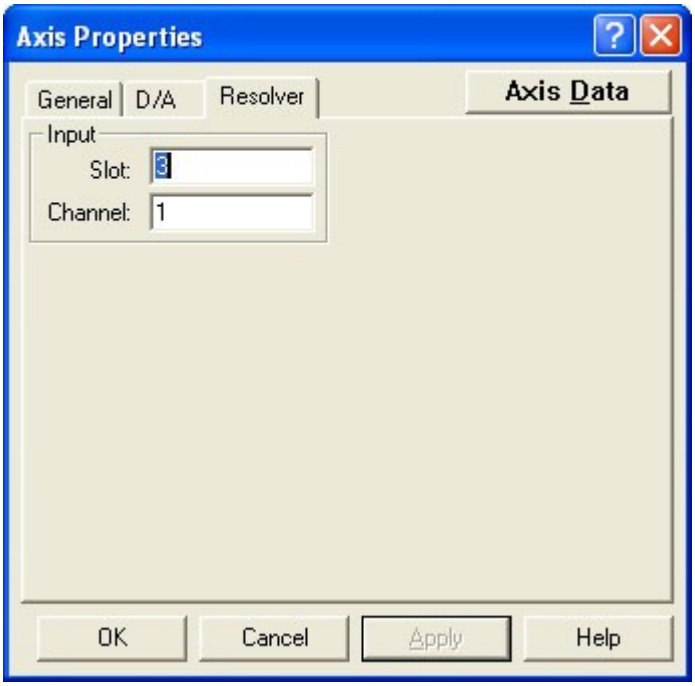
Note:

In PiCPro MMC-Limited Edition, channel is limited to axis number for servo axes. When a new axis is inserted, channel will be set to axis number. If axis number is later changed, you must modify the channel number too. Channel is limited to 5 for a digitizing axis.

Resolver Input Setup (Only for PiC CPU)

To configure the resolver input

1. Enter the **Slot:** and **Channel:** location of the resolver module.
2. Click **OK**.



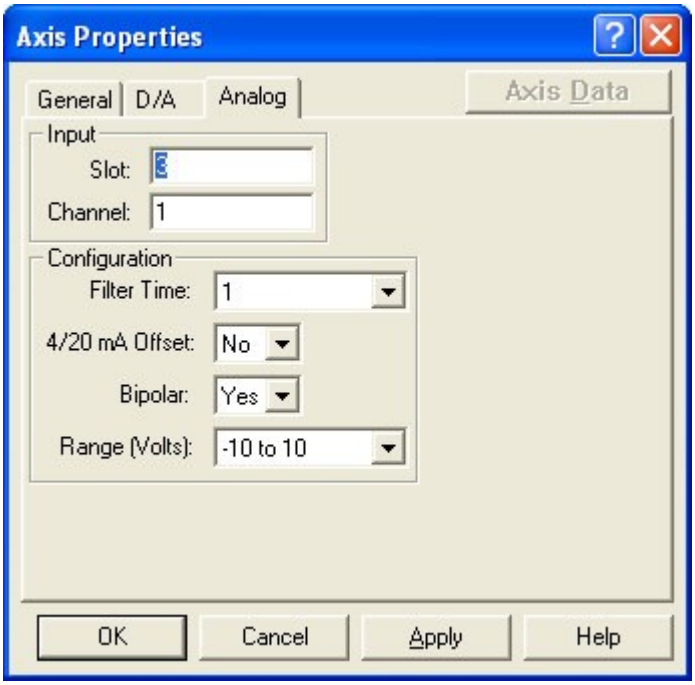
Note: An inductosyn device may also be used. Choose resolver if you will be using an inductosyn.

Servo Analog Input Setup (Only for PiC CPU)

To configure the analog input

1. Enter the **Slot:** and **Channel:** location of the analog input module.
2. Select the **Filter Time:** from the drop down list.
3. If you are using the module in the **4/20 mA Offset:** mode, select **Yes** from the drop down list.

   Note: The Bipolar: box will be changed to No and the unipolar input Range (Volts): will be changed to 0 to 5. These defaults cannot be changed when in the 4/20 mA mode.
4. If you are not using the module in the **4/20 mA Offset:** mode, select the Bipolar or Unipolar voltage range from the drop down list.
5. Click **OK**.



TTL Input Setup (Only for PiC CPU)

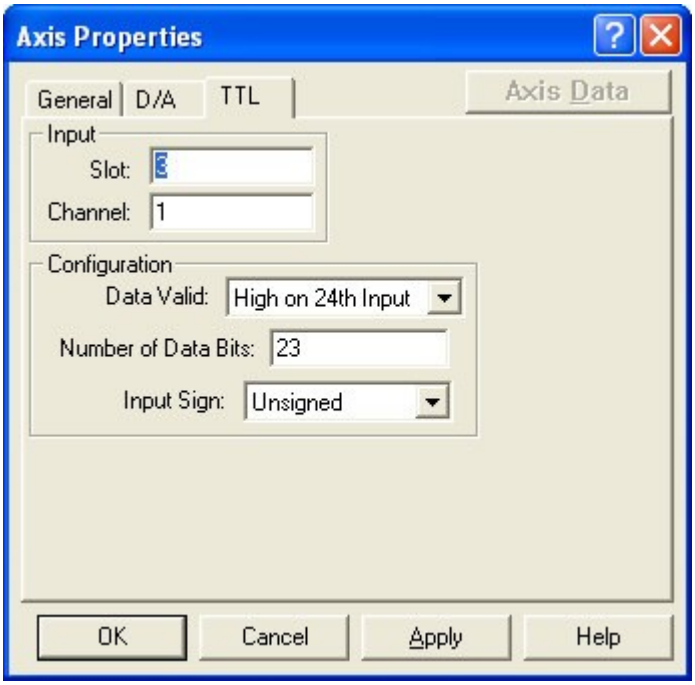
To configure the TTL input

Selections for the TTL configuration are based on the type of feedback device.

1. Enter the **Slot:** and **Channel:** location of the TTL input module.
2. Select the **Data Valid:** from the drop down list.

Binary	High	Whenever input 24 is high, the inputs are not allowed to change.
	Low	Whenever input 24 is low, the inputs are not allowed to change.
	Same	Whenever two consecutive reads of the inputs are the same The 24th input is not used.
Gray Code	This is an alternative to binary encoding. Only one bit of a gray code number changes at a time. The 24th input is not used.	

3. Enter the **Number of Data Bits:** your device requires.
   - A minimum of eight bits is required.
   - A maximum of 16 and a minimum of eight bits can be used if Same or Gray code is selected. The 24th input is not used.
   - A maximum of 23 bits can be used if High or Low is selected with the 24th bit used as an indicator of valid data.
4. The **Input Sign:** field defaults to unsigned. Most TTL devices return an unsigned pattern with one end of travel all 1's and the other end all 0's. If the device returns a signed pattern with all 0's in the center of travel, change the default to signed.
5. Click **OK**.



SERCOS Setup

When a SERCOS slave is connected to a servo axis, SERCOS is chosen as the feedback module.

To configure a SERCOS axis

1. Enter the **Slot:** and **Ring:** numbers for the SERCOS axis. The slot number identifies the slot location of the SERCOS module in the control. The ring number identifies whether this slave axis is on the first or second ring on a SERCOS module.
2. Enter the **Slave Number:** for the SERCOS axis. The number entered here must match the address of the slave.

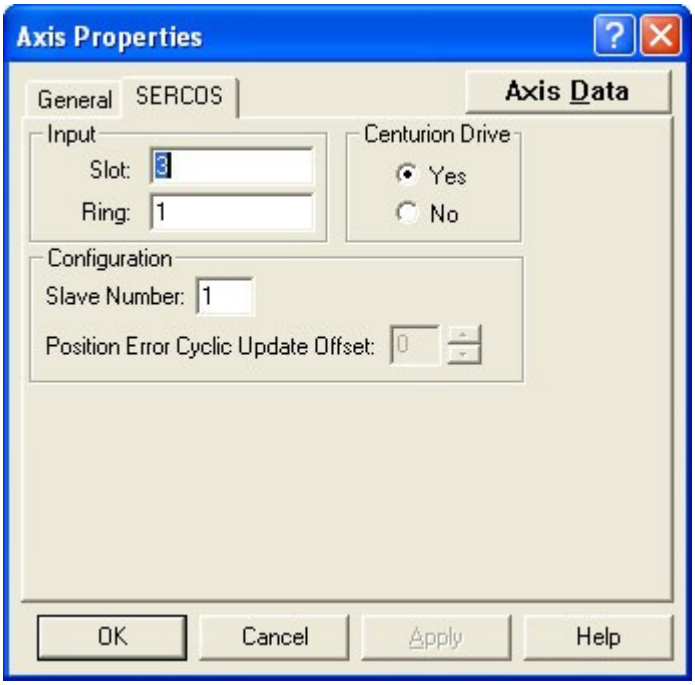
   Note: The slot number, ring number, and slave number correspond to the SRS input on the SERCOS functions which identify this slave axis.
3. Indicate whether or not the drive is a **Centurion Drive**.

   Different SERCOS drives use a different number of update cycles to accept a command position and return an actual position. This number of update cycles affects the accuracy of the approximate position error in the control.

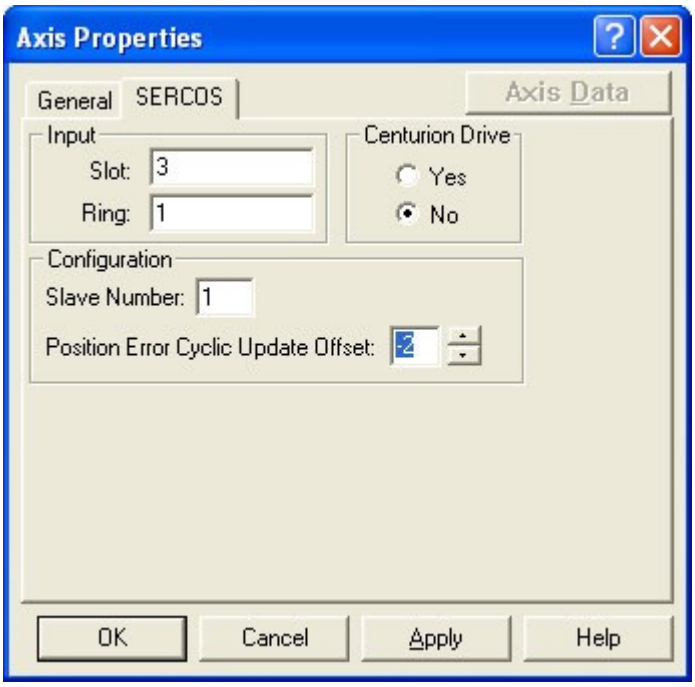
   The **Position Error Cyclic Update Offset:** allows the position error approximation to be optimized for the SERCOS drive being used. A default value of zero provides the optimum approximation for a Centurion drive. When the drive type is Centurion (**Yes** is checked), **Position Error Cyclic Update Offset:** is set to 0 and cannot be changed.

   If a different drive is used (**Centurion Drive** is set to **No**), this number may be changed (within the range [-5,2]) to achieve a more accurate position error approximation in the control. Reducing the number will increase the approximate position error value. Increasing the number will reduce the approximate position error value. The control's approximate position error is only used for display (READ_SV and Servo View List), In Position calculations, and Excess Following Error calculations. Changing this value does not affect the actual position error in the drive used to maintain closed loop control of the axis.

   When the drive type is Centurion (Yes is checked), Position Error Cyclic Update Offset: is set to 0 and cannot be changed:



When the drive type is not Centurion (No is checked), Position Error Cyclic Update Offset: defaults to 0 but can be changed to any value between –5 and 2:



Note:

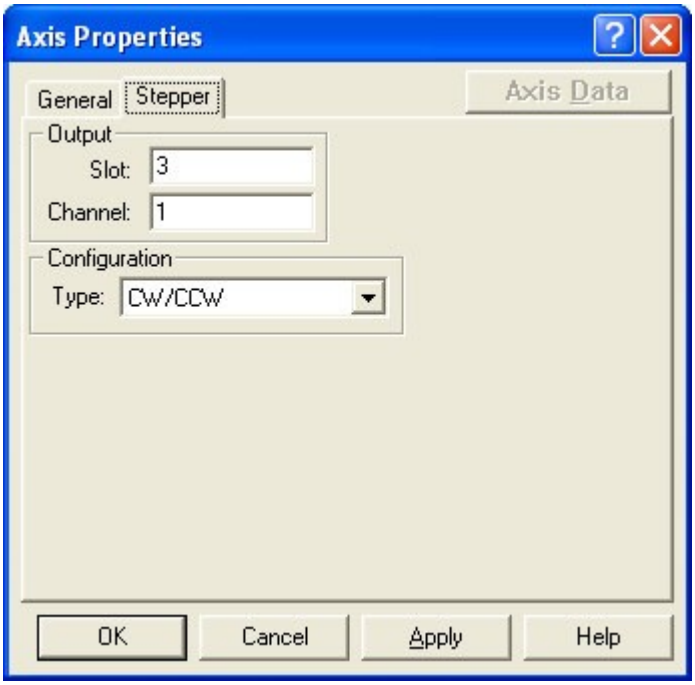
For a SERCOS Digitizing Axis, Position Error Cyclic Update Offset: fields are always hidden because they do not apply to digitizing axes.

SERCOS SETUP					
CPU Type	**Number of Rings**	**Slaves per Ring**	**Slot Number**	**Ring Number**	**Slave Number**
PiC	16	8	3 – 13	1– 2	1– 8
Standalone MMC	1	8	1	1	1– 8
Standalone MMC Plus	2	8	1	1– 2	1– 8
MMC for PC	1	32	1	1	1– 32

Stepper Setup (Only for PiC CPU)

To configure the stepper module

1. Enter the **Slot:** and **Channel:** location of the stepper module.
2. Enter the **Type:** of stepper you are using, CW/CCW or Step/Direction. The default is CW/CCW.



Default Axes Using Auto Fill (Standalone MMC)

Auto Fill is only available in PiCPro when a standalone MMC is the Target CPU.

1. Select **Insert | Auto Fill Default Axes** from the menu.
2. Select **4 1/2 Axes**, **2 1/2 Axes**, or **SERCOS Axes** from the resulting fly-out menu.

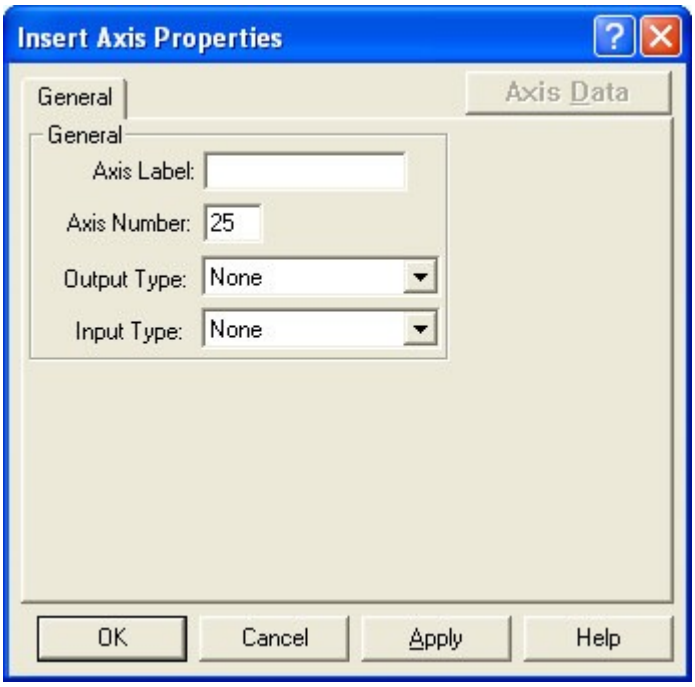
If axes are present when one of these menu items is selected, a message will be displayed to indicate that all axes must be removed before default axes can be inserted. If the axis count is 0 and 4 1/2 Axes or 2 1/2 Axes is selected, 4 or 2 servo axes will be added and 1 digitizing axis will be added. The servo axes will have an input type of Encoder and an output type of D/A. The digitizing axis will have an input of type of encoder. The servo axes will be named AXIS1-4. The digitizing axis will be named AXIS49.

If the axis count is 0, and SERCOS Axes is selected, 8 SERCOS servo axes and 8 SERCOS digitizing axes will be added. Slot and ring will be set to 1. The slave numbers will be 1-8. The servo axes will be named AXIS 1-8. The digitizing axes will be named AXIS 49-56.

Inserting a Time Axis

1. Choose one of the following methods:
   - Select **Insert | Time Axis** from the menu
   - Press the **Insert** key and select **Time Axis**
   - Right-click select **Insert | Time Axis**

   Up to 4 time axes can be inserted. The **Insert Axis Properties** dialog appears.



2. Enter a name for the axis in the **Axis Label:** field.
3. The **Axis Number:** is entered by PiCPro in sequential order. These can, however be changed.

   Note: Output Type: and **Input Type:** are not available for a Time Axis and appear as None.
4. Click on Apply to activate the Axis Data button for this axis OR click on OK to continue inserting axes.

Digital Setup

To configure the Digital Axis

1. Enter the **Address:** of the Digital Drive address switch.
2. Select the **'Do not report DSTRTSRV error if drive is not found'** checkbox if DSTRTSRV should not report an error if the drive with the specified address is not found.
3. Click **OK**.

Editing a Servo Setup File

Editing a Servo Setup File

Your servo setup file contains the data for one or more axes. When you open a servo setup file, the axes are ordered by axis type (Servo, Digitizing, Time). You entered the properties and data for each axis when you inserted them into the file. You can edit that information.

Editing Axis Properties

You can access the axis properties dialog in one of the following ways.

- With the axis selected, choose **Edit | Axis Properties** from the menu.
- With the axis selected, press the **Enter** key.
- With the axis selected, right-click and choose **Axis Properties**.
- Double-click on the axis.

Make the necessary changes and click **OK**.

Editing Axis Data

You can access the axis data dialog in one of the following ways:

- With the axis selected, select **Edit | Axis Data** from the menu.
- With the axis selected, press <**Alt + Enter**>.
- With the axis selected, right-click and select **Axis Data**.

Make the necessary changes to Scaling, Iterator, or Position Data and choose **OK**.

Servo Digitizing Axis Setup Data Categories

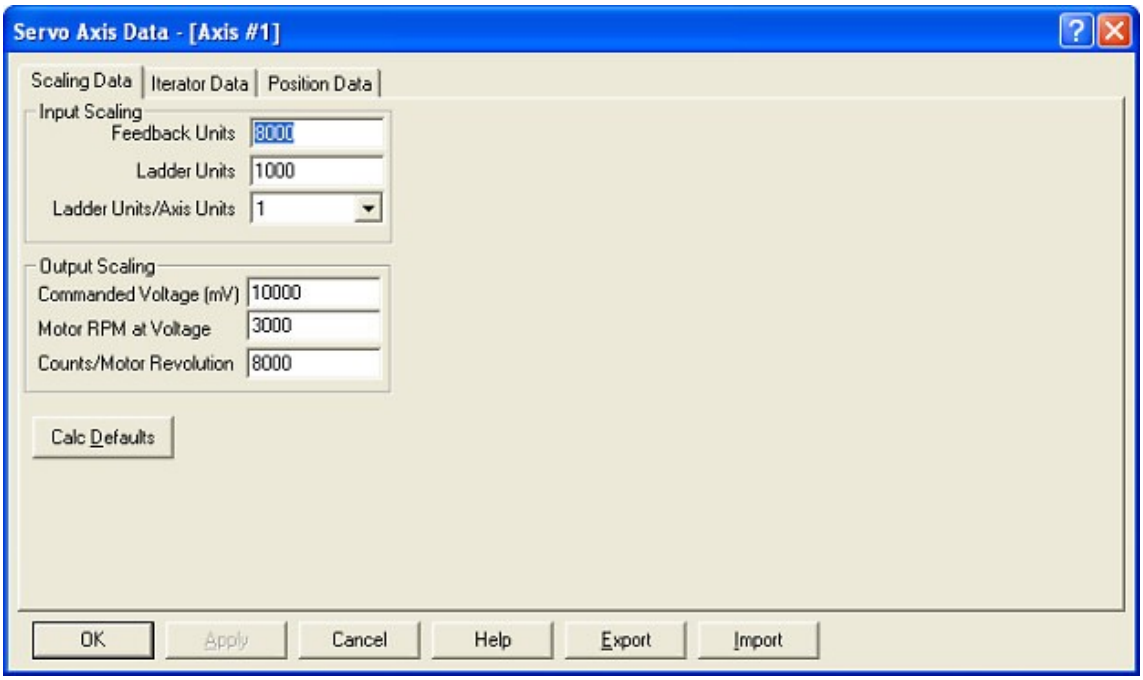
Servo/Digitizing Axis Setup Data Categories

There are three categories of servo axis data in the Servo Setup program:

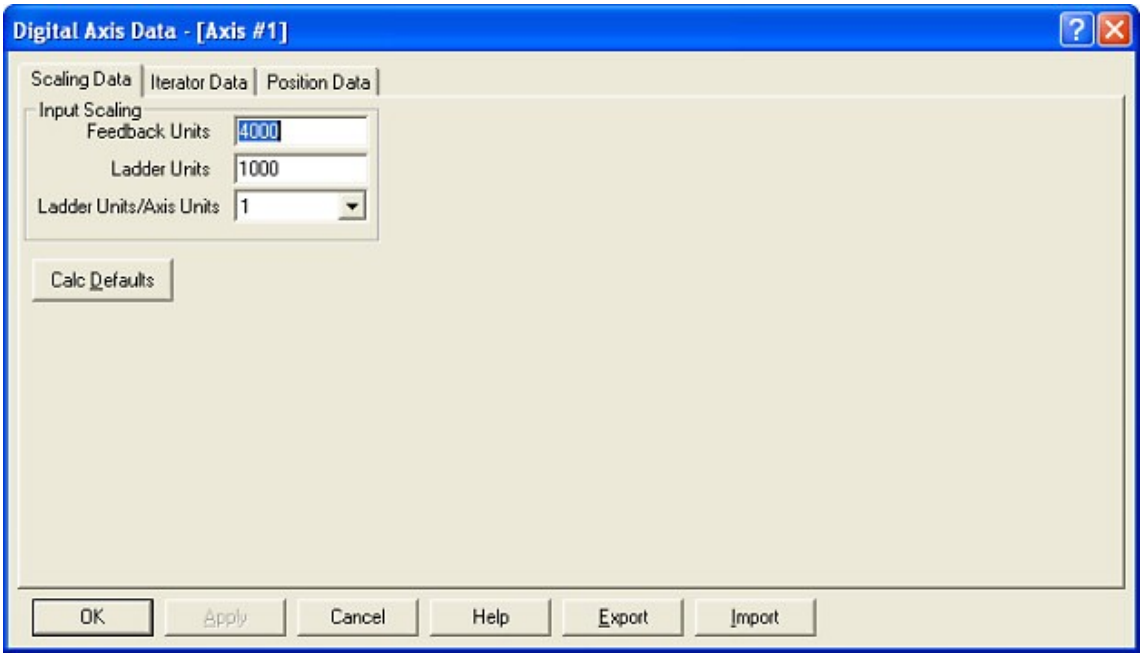
1. **Scaling data** - sets up the ratio between feedback units, ladder units, and axis units. This allows you to enter axis units instead of feedback units in the appropriate places for iterator and position data in setup. The three types of units are defined below:
   - Feedback units - the units the servo software uses to perform its calculations and issue its commands in.
   - Ladder units - the units used in the ladder program. They must be integers.
   - Axis units - the units of measurement (inches, millimeters, degrees) for the system. They may be integers or non-integers (decimals) and are used in the Servo setup program to enter certain types of setup data.
2. **Iterator data** - specifies how data such as limits, ramps, filters, and rollovers will be handled by the move iterator.
3. **Position data** - provides the servo software with information on how the axis is set up for the position loop.

Entering Servo Scaling Data

MMC, MMC for PC, PiC CPU



MMC Digital CPU



Input Scaling

Feedback units, ladder units, and ladder units/axis units establish a scaling ratio between the feedback units the servo software uses to perform its calculations and issue its commands, the units used in the ladder, and the units entered in setup.

Note:

When using SERCOS feedback, it is recommended that the units be entered in a 1:1 ratio.

Feedback Units - These are the units the servo software uses to perform its calculations and issue its commands.

Ladder Units - These are the units used in the ladder program. Ladder units must be integers and cannot be fractional values.

The ratio of the feedback device signal to the control feedback units is:

- One revolution of a resolver = x feedback units
- One pulse of an encoder = one feedback unit
- One cycle of a quadrature type encoder equals four pulses.

Ladder Units/Axis Units - Axis units are the units of measurement (inches, millimeters, degrees) used in your system. They are used to enter values for several setup parameters.

Enter the ratio of ladder units to axis units. (1, 10, 100, 1,000, 10,000, or 1,000,000)

IMPORTANT

Keep in mind that certain iterator and position loop data is entered in axis units. The default values are also in axis units and are sometimes at the upper limit of an acceptable value (ramps and software limits). If you choose a ratio for your ladder units/axis units that is greater than 1, then these default values will exceed the limit. Change the default value to a lower value for those parameters.

Output Scaling

(not applicable to MMC Digital CPUs)

These three parameters provide the information the controller needs to be able to calculate how much voltage the analog output will need to operate the axis at a certain speed and how many feedback units will be received for each motor revolution.

Commanded Voltage - Enter a commanded voltage in millivolts.

Motor RPM at Voltage - Enter the motor RPM at the Commanded Voltage entered.

Counts/Motor Revolution - Enter the number of feedback units that occur for each motor revolution.

Note:

The Commanded Voltage, Motor RPM at Voltage, and Counts/Motor Revolution parameters are used for scaling servo calculations by the servo software. They do not represent limits. They do not apply to Stepper, SERCOS, digitizing or time axes.

Calculate Defaults

The Calc Defaults button can be used to calculate new default values of Iterator Data and Position Loop Data as long as the ratio of feedback units to ladder units (FU/LU) is less than 65535. (Not available for Digitizing Axes)

Data Field	Default Calculation
Velocity Limit (AU/min)	Counts/Motor Rev x Motor RPM at Voltage x AU/LU x LU/FU
Acceleration Ramp (AU/min/sec)	Velocity Limit / 2 sec.
Deceleration Ramp (AU/min/sec)	Velocity Limit / 2 sec.
Controlled Stop Ramp (AU/min/sec)	Velocity Limit / .2 sec.
Software Limit (Upper) (AU)	536870911 / (FU/LU x LU/AU)
Software Limit (Lower) (AU)	-536870912 / (FU/LU x LU/AU)
Following Error Limit (AU)	(Counts/Motor Rev / 8) x (AU/LU) x (LU/FU)

In Position Band (AU)	10 LU x AU/LU
(+) Integral Error Limit (AUFE x update)	In Position Band x 10
(-) Integral Error Limit (AUFE x update)	-In Position Band x 10
Max Acceleration (AU/min/sec)	(3/2) x (Velocity Limit) / (3 sec)
Constant Jerk (AU/min/sec/sec)	(3) x (Max Acceleration) / (3 sec)

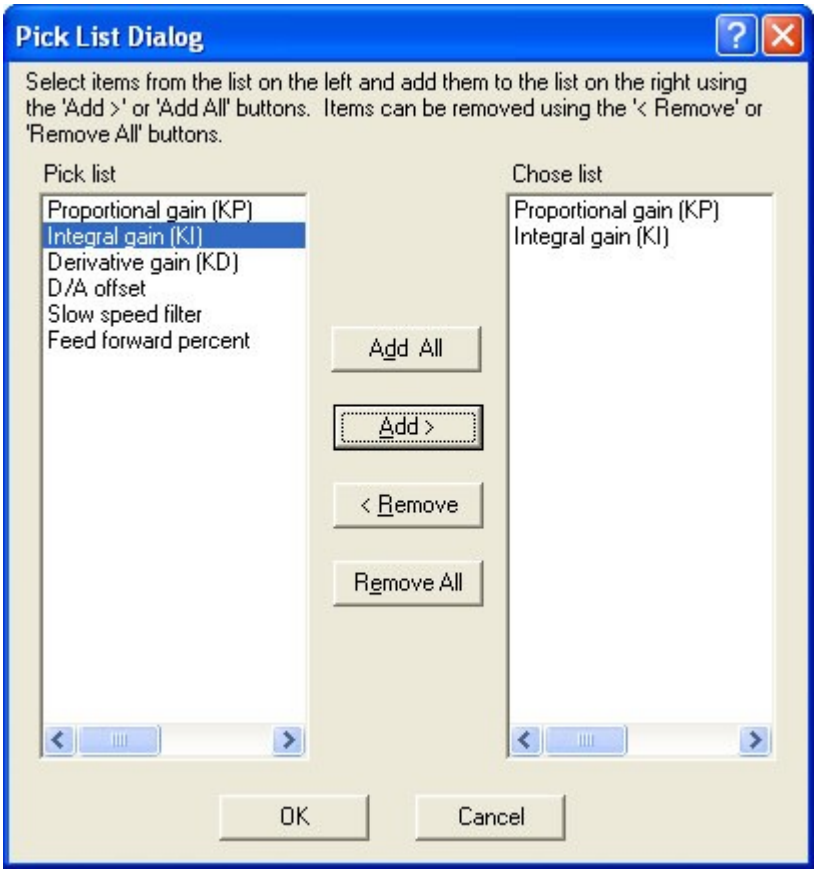
Note:

If the result of a calculation would exceed the upper or fall below the lower limit of a given field, the field will be set to that limit.

Determining Scaling Information

To determine what scaling information to enter for the number of FU/min/volt of the D/A, you can use the Servo Force list (write) and the Servo View List (read).

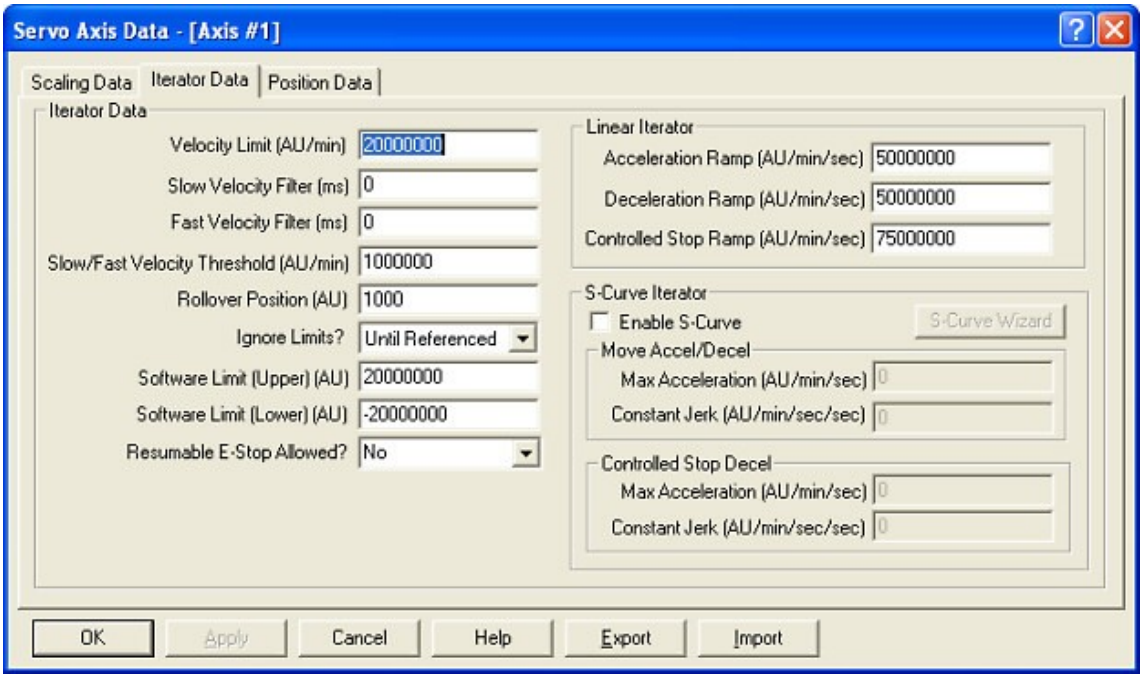
1. Highlight the axis in Servo Setup and open the **View | Servo Force List**.
2. Click the **Add/Remove** to bring up the **Pick List Dialog**.



Pick List Dialog buttons

1. Highlight and then **Add>** the **Feed Forward Percent** parameter to the list
2. Click **OK**.
3. Enter 100% for the value of Feed Forward Percent.
4. Move the axis at a fixed velocity in either always the positive or always the negative direction.
5. Observe the following error in the Servo View List. If the following error is not zero, the velocity scaling is incorrect.
6. Change the Motor RPM at Voltage in the Output Scaling of Axis Data.
   For example, if you are jogging in the positive direction and the error is always negative, increase the RPMs and vice versa.
7. Make the servo setup function and download the ladder to the control.
8. Again, observe the following error in the **Servo View List**.
9. Repeat the above steps until the following error is close to zero.
10. Finally, remake the servo setup function and perform a complete download of the ladder.

Entering Iterator Data for Servo Axis



The following parameters comprise the Iterator Data for Servo, Digital, SERCOS or Stepper axis.

Iterator Data	Description
Velocity Limit (AU/min)	Enter the maximum velocity the motor should ever be commanded to in axis units/min. Limits the maximum motor RPM. Does not apply to a slave axis. **WARNING** The position loop may cause the axis to travel faster than this speed if enough position, integral, and/or derivative error accumulates.

Typical values are 100,000 to 10,000,000 AU/min (where 1 AU = 1 LU), not to exceed 4095 FU/update. Note: If 1 AU does not equal 1 LU, scale these values accordingly.

Slow Velocity Filter (ms)

Enter in milliseconds the filter time constant will take to smooth out a "step" change in velocity while the axis is moving at slow velocities.

Note: Specifically, the value entered represents the milliseconds that the servo software takes to carry out 63.2% of the step change.

Range = 0 - 10,000 ms

Fast Velocity Filter (ms)

Enter the milliseconds the filter time constant will take to smooth out a "step" change in velocity while the axis is moving at fast velocities.

Note: Specifically, the value entered represents the milliseconds that the servo software takes to carry out 63.2% of the step change.

Range = 0 - 10,000 ms

Slow/Fast Velocity Threshold (AU/min)

Enter the velocity in axis units/minute (AU/min) at which the slow or fast velocity filter should be applied.

Typical value is 0, not to exceed 4095 FU/update.

Rollover Position (A/U)

Enter the rollover position in axis units. If non-zero, this is the axis position where commanded position will roll over to zero. If zero, the commanded position will accumulate. Valid range is 0 to 536,870,911 FU. If the value is zero, rollover position is off. If the value is non-zero, rollover position is on.

Ignore Limits?

An **Until Ref**. here allows a machine reference to occur without exceeding the software limits designated earlier. This is useful if you exceed the software limits because of how far you have to travel to your reference switch or where your reference switch is located.

After the machine reference is complete, the software limits are in effect. If **Yes** is selected, software limits cannot be set and .srv file cannot be saved to a format prior to V13.0. If No is selected, software limits are always in effect.

Software Limit (Upper)(AU)

Enter the software-imposed upper travel limit in axis units. Exceeding this limit will generate a C-stop condition.

Typical values are 100 to 1,000,000 AU (where 1 AU = 1 LU), not to exceed 536,870,911 FU. **Note:** If 1 AU does not equal 1 LU, scale these values accordingly.

Software Limit (Lower)(AU)

Enter the software-imposed lower travel limit in axis units. Exceeding this limit will generate a C-stop condition. Typical values are 100 to 1,000,000 AU (where 1 AU = 1 LU), not to exceed 536,870,911 FU. **Note:** If 1 AU does not equal 1 LU, scale these values accordingly.

Resumable E-Stop Allowed?

Options are **Yes** or **No**. Select **Yes** to allow Resumable E-Stop.

Default value is **No**.

If **Yes** is selected, the E_STOP function and the Excess Following Error E-Stop will execute a Resumable E-Stop. When a Resumable E-Stop occurs, the following happens:

1. The servo loop is opened.
2. Zero voltage is sent to the analog outputs.
3. The moves in the active and next queues remain intact.
4. The axis' Normal Interpolator remains running.

The axis goes into Resume Mode. In Resume Mode, the axis will follow the Resume Interpolator. The Resume Interpola tor will output zero velocity until the RESUME function is called. The RESUME function can only be called after the Resumable E-Stop has been reset and the servo loop has been closed. The axis remains in Resume Mode until the RESUME function brings it back on path or until a non-resumable E-Stop occurs and cancels Resume Mode.

If **No** is selected, the E_STOP function and the Excess Following Error E_Stop will execute a normal E_Stop (i.e. open the servo loop, zero voltage to the Analog outputs, and clear the active and next queues)

The E_STOP function and the Excess Following Error E-Stop are the only types of E-Stops that are resumable. All other types of E_Stops will execute normally regardless of this selection.

Linear Iterator

Acceleration Ramp (AU/min/sec)

Enter the rate in axis units/minute/second at which the servo software will iterate the axis to reach a higher velocity command.

Typical values are 10,000 to 10,000,000 AU/min/sec (where 1 AU = 1 LU), not to exceed 1023 FU/update/update. **Note:** If 1 AU does not equal 1 LU, scale these values accordingly.

Deceleration Ramp (A/Umin/sec)

Enter the rate in axis units/minute/second at which the servo software will iterate the axis to reach a lower velocity command.

Typical values are 10,000 to 10,000,000 AU/min/sec (where 1 AU = 1 LU), not to exceed 1023 FU/update/update. **Note:** If 1 AU does not equal 1 LU, scale these values accordingly.

Controlled Stop Ramp (AU/min/sec)

Enter the rate in axis units/minute/second at which the servo software will iterate the axis to reach a controlled stop.

Typical values are 10,000 to 10,000,000 AU/min/sec (where 1 AU = 1 LU), not to exceed 1023 FU/update/update. **Note:** If 1 AU does not equal 1 LU, scale these values accordingly.

S-Curve Iterator

Enable S-Curve

Check this box to enable the S-Curve Iterator. If enabled, S-Curve is the default iterator for this axis. If not enabled, it cannot be enabled from the ladder.

S-Curve Wizard

Select this button to display the S-Curve Wizard dialog that will assist in defining max acceleration and constant jerk for Move Accel/Decel

and Controlled Stop.

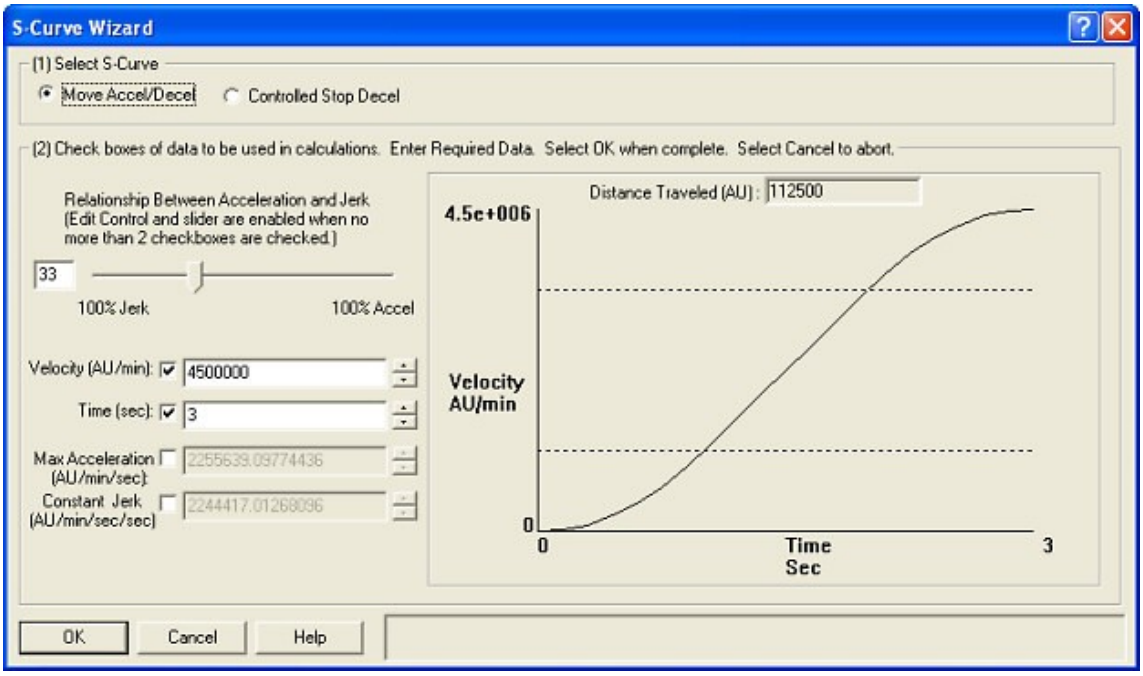
Move Accel/Decel or Normal Move

Max Acceleration (AU/min/sec)	Enter the maximum acceleration for Move Accel/Decel.
Constant Jerk (AU/min/min/ sec)	Enter the constant jerk for Move Accel/Decel.

Controlled Stop Decel

Max Acceleration (AU/min/sec)	Enter the maximum acceleration for Controlled Stop Decel.
Constant Jerk (AU/min/sec/sec)	Enter the constant jerk for Controlled Stop Decel.

Entering S-Curve Data for Servo Axis



Using this dialog, S-Curve information can be specified for both **Move Accel/Decel** and **Controlled Stop Decel**. Selecting **Move Accel/Decel** will display known information for **Move Accel/Decel**. Selecting **Controlled Stop Decel** will display known information for **Controlled Stop Decel**.

When initially displayed:

- **Move Accel/Decel** will be selected.
- If S-Curve information has previously been entered, existing values will be entered, and checkboxes checked accordingly. The slider will indicate the relationship between acceleration and jerk. The resulting S-Curve will be drawn with Distance Traveled displayed at the top.

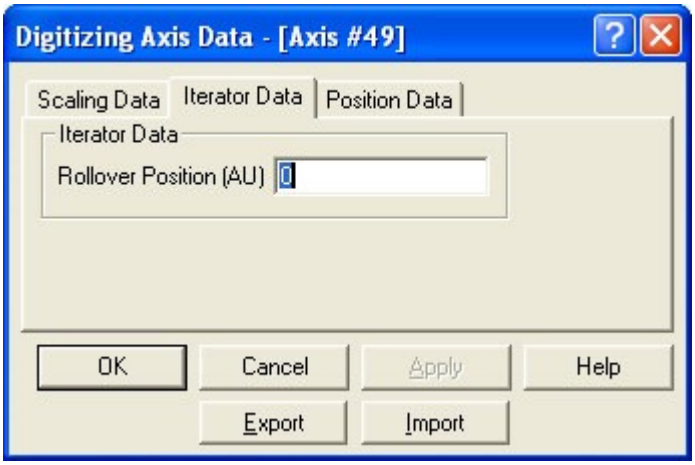
- If S-Curve information has not been entered, Velocity will be checked and set to a value equal to that of Velocity Limit as specified in the iterator data. In addition, Time will be checked and set to a value of 3 seconds. Constant Jerk and Max Acceleration will be calculated based on the initial 1/3 of the time at constant jerk, the next 1/3 of the time at constant maximum acceleration and the final 1/3 of the time at constant jerk. The slider will be set to approximately 1/3 from the left. And the resulting SCURVE will display Distance Traveled.

The checkboxes are used to indicate data that is entered. The values for fields where the checkbox is not checked will be calculated. At least two fields, but no more than three at the most can be checked in order for a calculation to take place and the graph to be updated. The spinner controls increment or decrement the value in the associated field by 1% of the value. They are enabled when the associated checkbox is checked.

S-Curve Data	Description
Move Accel/Decel	Select this button to display the S-Curve information for Move Accel/Decel.
Controlled Stop Decel	Select this button to display the S-Curve information for Controlled Stop Decel. Note: This button will be disabled if S-Curve is being defined for a time axis.
Relationship Between Acceleration and Jerk (Edit Control and slider are enabled when no more than 2 checkboxes are checked.)	Enter % acceleration here or use the slider to express the relationship between acceleration and jerk. When the slider is positioned at the far left, the relationship is 0% acceleration, 100% jerk. If positioned at the far right, the relationship is 100% acceleration, 0% jerk. If positioned in the middle, the relationship is 50% acceleration, 50% jerk.
Velocity (Au/min):	Check this box to use the velocity entered in the calculations. If the Velocity checkbox is checked, a velocity can be entered here and the spinner can be used to increase or decrease the value entered in the edit control. If the Velocity checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated velocity will be displayed here.
Time (sec):	Check this box to use the time entered in the calculations. If the Time checkbox is checked, a time can be entered here and the spinner control can be used to increase or decrease the value entered in the edit control. If the Time checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated time will be displayed here.
Max Acceleration (AU/min/sec):	Check this box to use the acceleration entered in the calculations. If the Max Acceleration checkbox is checked, an acceleration can be entered here and the spinner control can be used to increase or decrease the value entered in the edit control. If the Max Acceleration checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated Max Acceleration will be displayed here.
Constant Jerk (AU/min/sec/sec)	Check this box to use the jerk entered in the calculations. If the Constant Jerk checkbox is checked, Constant Jerk can be entered here and the spinner control can be used to increase or decrease the value entered in the edit control. If the Constant Jerk checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated Constant Jerk will be displayed here.

Distance Traveled (AU):	If an S-Curve is displayed, the distance traveled is displayed here.
OK	Click to save data and return to the Iterator Data tab of the Axis Data dialog.
Cancel	Click to close the dialog without saving data and return to the Iterator Data tab of the Axis Data dialog.
Help	Click to display information related to the S-Curve Wizard Dialog.

Entering Iterator Data for Digitizing Axis



Iterator Data	Description
Rollover Position (AU)	Enter the rollover position in axis units (AU) in this field. Valid range is 0 to 536,870,911 FU. If the value is zero, rollover position is off. If the value is non-zero, rollover position is on.

Entering Position Data

Position data provides the servo software with information on how the axis is set up for the position loop.

Notes:

- The fastest allowed update rate is .25 ms.
- Update rates do not have to be the same on all axes.
- The update rate on a digitizing axis can be different than the update rate of the associated servo axis.

The fields displayed are different for different axis types.

Position Loop Data	Description
Input Polarity	Provides a software method of changing the polarity of the position feedback device. If the input polarity is incorrect, the axis will either "run away" or move in the wrong direction. If this occurs, enter the opposite polarity here. **Note:** This setting will not be displayed for a digitizing DLS axis.
Output Polarity	Provides a software method of changing the polarity of the analog output. If the output polarity is incorrect, the axis will either "run away" or move in the wrong direction. If this occurs, enter the opposite polarity here.
Analog Output Offset (mV)	If it is not possible to get a zero volts reading from a voltmeter placed across the analog output channel for the axis, enter the amount of voltage in millivolts that allows you to reach a zero reading. Range: -10,000 to +10,000 mV
Feed Forward Percent	Enter a percentage (from 0 to 100%) that you want the position loop to compensate for the lag that occurs between the generation of the following error and the correction of that error by the PID calculations. Range: 0 to 100%
Proportional Gain (AU/min/ AUFE)	Proportional gain calibrates corrective action proportional to the amount of following error. The value entered represents the axis unit per minute for each axis unit of following error. Typical values are 1,000 - 5,000 AU/min/AUFE
Integral Gain (AU/min/ AUFE x min)	Integral gain determines corrective action proportional to the amount of following error summed over the time duration of the error at a zero velocity command. The longer the following error exists, the greater the integral error. The value entered represents the number of axis units per minute per axis unit of following error times minutes. Typical value is 0. If required, up to 32,000 AU/min/AUFE x min
(+) Plus Integral Error Limit (AUFE x update)	Tells the position loop to ignore any additional integral error beyond the value entered when the axis is moving in a positive direction. Typical value is 0. If required, from 100,000 to 500,000,000 AUFE x update (where 1 AU = 1 LU). **Note:** If 1 AU is not equal to 1 LU, scale these values accordingly.
(-) Minus Integral Error Limit (AUFE x update)	Tells the position loop to ignore any additional integral error beyond the value entered when the axis is moving in a negative direction. Typical value is 0. If required, from -500,000,000 to -100,000 AUFE x update (where 1 AU = 1 LU). **Note:** If 1 AU is not equal to 1 LU, scale these values accordingly.
Derivative	Derivative gain determines the corrective action proportional to the magnitude of

Gain (AU/min/ AUFE/min)

change of the following error. The value entered represents the number of axis units per min for each axis unit of following error per minute. Typically, this is set to 0.

Typical value is 0. If required, up to 500 AU/min/AUFE/min

Following Error Limit (AU)

Enter the amount of excess error in axis units to allow before an E-stop condition occurs.

Typical values are 10 to 10,000 AU (where 1 AU = 1 LU), not to exceed 536,870,911 FU. Note: If 1 AU is not equal to 1 LU, scale these values accordingly.

Update Rate (ms)

Enter in milliseconds, (1, 2, 4, or 8) how often the servo upgrade occurs. 4ms is adequate for most applications. Lower values consume more CPU processing time. If too many axes have too low an update rate, the CPU may not have enough processing time available to run the application program.

The iteration rate is eight times the servo upgrade rate:

SUG (ms) Iteration Rate (ms)
.25 2
.5 4
1 8
2 16
4 32
8 64

For digitizing axes, the update rates are .25, .5, 1, 2, 4, 8, or 16 ms.

A rate can be selected for each axis.

Note: In master/slave moves, the iteration rate is the same as the servo upgrade rate. The update rate for the master axis and the slave axis must be the same in any master/slave move.

In-Position Band (AU)

Enter the distance in axis units that the axis must be on either side of its endpoint before the in position flag is set. This in-position flag can be used in your program.

Typical values are 10 to 1,000 AU (where 1 AU = 1 LU), not to exceed 536,870,911 FU. Note: If 1 AU is not equal to 1 LU, scale these values accordingly.

Time Axis Setup Data Categories

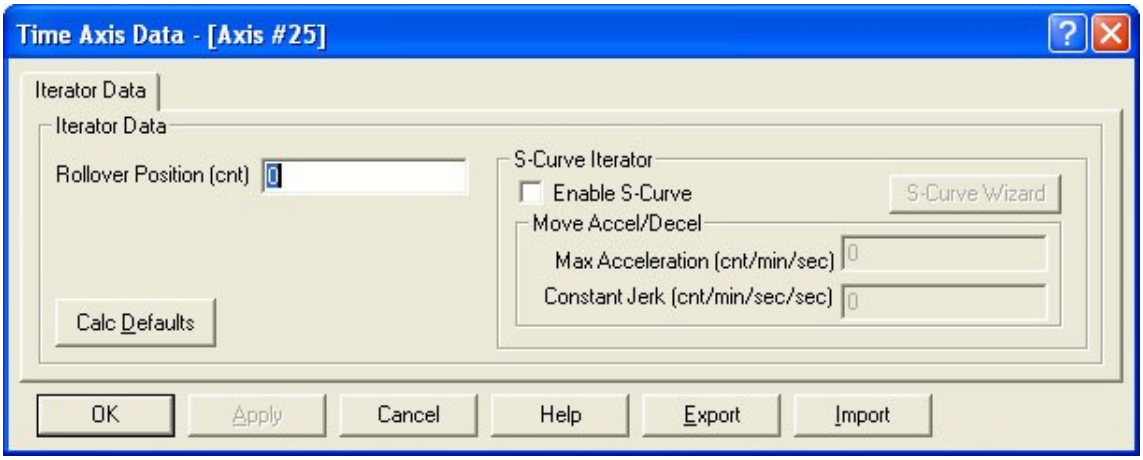
Time Axis Setup Data Categories

There is only a single category of time axis setup data in the Servo Setup program that:

- Specifies how data such rollover, max acceleration and constant jerk will be handled by the move iterator,
- Allows you to calculate default values for max acceleration and constant jerk.

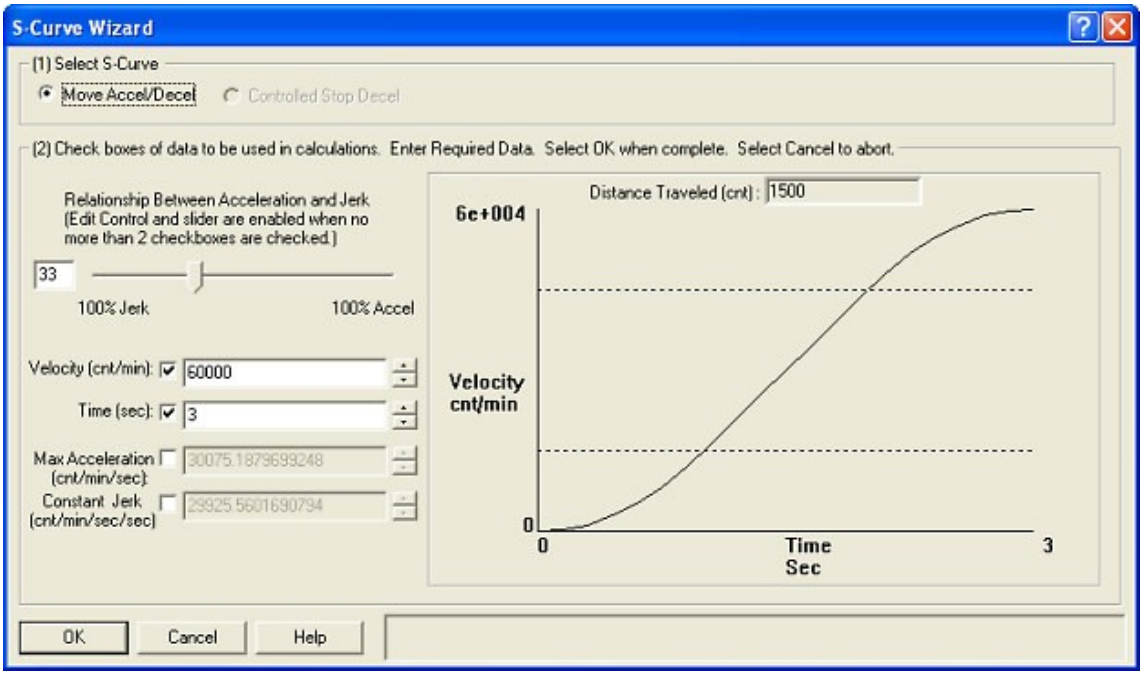
Note: There must be at least one Servo or Digitizing axis defined if a Time Axis is defined.

Entering Iterator Data for Time Axis



Iterator Data	Description
Rollover Position (cnt)	Enter the rollover position in axis units (AU) in this field. Valid range is 0 to 536,870,911 FU. If the value is zero, rollover position is off. If the value is non-zero, rollover is on.
Enable S-Curve	Check this box to enable S-Curve for this axis. If enabled, S-Curve is the default iterator for this axis.
S-Curve Wizard	Selectable if Enable S-Curve box is checked. Select this button to display the S-Curve Wizard dialog that will assist in defining max acceleration and constant jerk for **Move Accel/Decel**.
Max Acceleration (cnt/min/sec)	Enter the maximum acceleration for **Move Accel/Decel**.
Constant Jerk (cnt/min/min/sec)	Enter the constant jerk for **Move Accel/Decel**.
Calc Defaults	Select this button to initialize Max Acceleration to 30,000 cnt/min/sec and Constant Jerk to 30,000 cnt/min/sec/sec.

Entering S-Curve Data for Time Axis



Using this dialog, S-Curve information can be specified for **Move Accel/Decel**. **Controlled Stop Decel** is disabled and grayed because it is not valid for a time axis.

When initially displayed,

- **Move Accel/Decel** will be selected.
- If **Max Acceleration** and **Constant Jerk** are 0 when the S-Curve Wizard button is pressed, Max Acceleration and Constant Jerk will be calculated using a time of 3 seconds, a velocity of 60,000 cnt/min and a value of 33 for the relationship between acceleration and jerk.
- If S-Curve information has previously been entered, existing values will be entered, and checkboxes checked accordingly. The slider will indicate the relationship between acceleration and jerk. The resulting S-Curve will be drawn with Distance Traveled displayed at the top.

The checkboxes are used to indicate data that is entered. The values for fields where the checkbox is not checked will be calculated. At least two fields, but no more than three at the most can be checked in order for a calculation to take place and the graph to be updated. The spinner controls increment or decrement the value in the associated field by 1% of the value. They are enabled when the associated checkbox is checked.

S-Curve Data	Description
Move Accel/Decel:	Select this button to display the S-Curve information for Move Accel/Decel.
Controlled Stop Decel:	This button is disabled. It is not valid for a time axis.
Relationship Between Acceleration and Jerk	Edit Control and slider are enabled when no more than 2 checkboxes are checked**.** Enter % acceleration here or use the slider to express the relationship between acceleration and jerk. When the slider is positioned at the far left, the relationship is 0% acceleration, 100% jerk. If positioned at the far right, the relationship is 100% acceleration, 0% jerk. If positioned in the middle, the relationship is 50% acceleration, 50% jerk.

Velocity (Au/min):	Check this box to use the velocity entered in the calculations. If the Velocity checkbox is checked, a velocity can be entered here and the spinner can be used to increase or decrease the value entered in the edit control. If the Velocity checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated velocity will be displayed here.
Time (sec):	Check this box to use the time entered in the calculations. If the Time checkbox is checked, a time can be entered here and the spinner control can be used to increase or decrease the value entered in the edit control. If the Time checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated time will be displayed here.
Max Acceleration (AU/min/sec):	Check this box to use the acceleration entered in the calculations. If the Max Acceleration checkbox is checked, an acceleration can be entered here and the spinner control can be used to increase or decrease the value entered in the edit control. If the Max Acceleration checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated Max Acceleration will be displayed here.
Constant Jerk (AU/min/sec/sec)	Check this box to use the jerk entered in the calculations. If the Constant Jerk checkbox is checked, Constant Jerk can be entered here and the spinner control can be used to increase or decrease the value entered in the edit control. If the Constant Jerk checkbox is not checked, the adjacent edit control (data entry field) will be grayed and disabled. The calculated Constant Jerk will be displayed here.
Distance Traveled (AU):	If an S-Curve is displayed, the distance traveled is displayed here.
OK	Click to save data and return to the Iterator Data tab of the Axis Data dialog.
Cancel	Click to close the dialog without saving data and return to the Iterator Data tab of the Axis Data dialog.
Help	Click to display information related to the S-Curve Wizard Dialog.

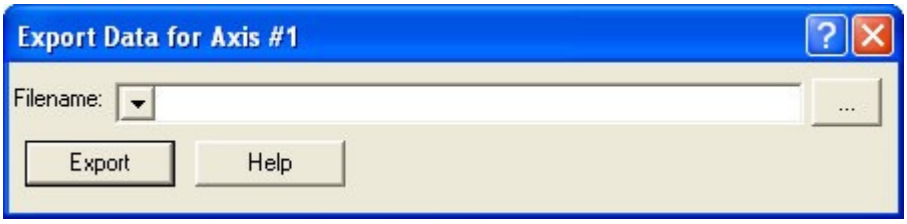
Importing and Exporting Axis Data

Importing/Exporting Servo Axis Data

Axis data can be imported from or exported to a file, which can be read by a spreadsheet or text editor. The data file will be in comma separated values (.csv) format.

Exporting Axis Data

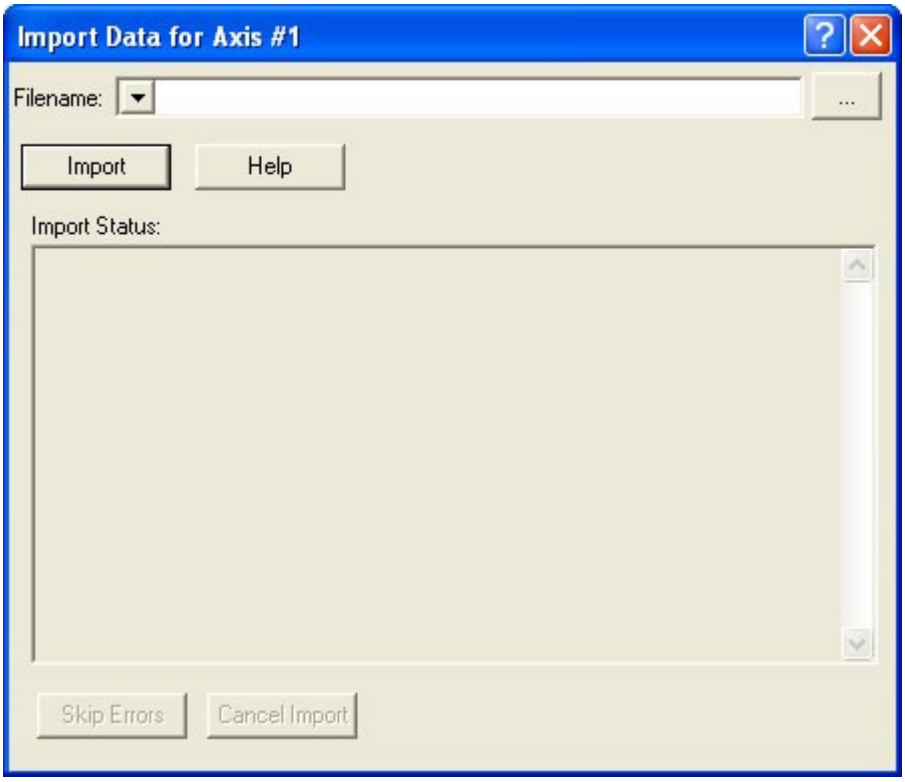
From the Axis Data dialog, click the **Export** button. To replace an existing file, select the filename from the dropdown most recently used list or use the browse (...) button.



To create a new file, that can be opened by Excel®, enter a complete filename (include full path information) with a .csv extension. Then click the **Export** button.

Importing Axis Data

From the Axis Data dialog, click the **Import** button. Select the filename from the dropdown most recently used list, use the browse (...) button, or type in the full path and filename. Then click the **Import** button.



Any error or warning messages will appear in the **Import Status:** field. The line number and type of error or warning will be listed. These errors or warnings could be caused by an invalid data field identifier, invalid value, or a field that is not valid for a particular type of axis. You can select to **Skip Errors**, which will ignore any invalid lines and import only valid data, or **Cancel Import**, which will close the dialog without importing any data. You can also exit this dialog by using the in upper right corner, or the press the **ESC** key.

File Format for Servo Data File

You can create your own data file for importing using Excel or any text editor. However, there are some important rules to follow when developing this .csv file. You might want to consider exporting data first which will give you the full names of the identifiers with all the proper spacing, and the needed id and version information in your file. You can then edit the data elsewhere, and import it.

- The first line of the file must contain the following id and version: PiCPro Servo Data, V2.0 OR you can use PSD, V2.0. PiCPro cannot import the file without this line. When exporting a file, PiCPro will add the version of PiCPro used to export the data to the end of this line.
- Each line is made up of 2 fields separated by a comma: identifier,value. The first specifies the data field, the second the value for that field. Any or all identifiers can be used. If an identifier isn't used, no change will be made to that axis data. If multiple entries for the same identifier are encountered, only the last one read will be used.
- Each line ends in a carriage return, line feed.

- To include a comment in the file, use // as a comment delimiter. Any infor mation following this delimiter will be ignored.
- The data field identifiers can be entered using either the complete or abbreviated form and are not case sensitive.

Servo Data Field Identifiers

Shown in the first column is the complete identifier. The second column shows the abbreviated identifier. The third column shows the valid range of values. The final column lists the axes type for which the data field is NOT valid. Only valid data fields can be imported.

Complete Data Field Identifier	Abbreviated Identifier	Value Range	NOT valid for Axes Type
Feedback Units	FU	1 – 4294967295	
Ladder Units	LU	1 – 4294967295	
Ladder Units/Axis Units	LU2AU	1, 10, 100, 1000, 100000, 1000000	
Commanded Voltage (mV)	CV	1 – 10000	Stepper, SERCOS, Digitizing, Time, Digital
Motor RPM at Voltage	RPM	1 – 10000	Stepper, SERCOS, Digitizing, Time, Digital
Counts/Motor Revolution	CPMR	1 – 50,000,000	Stepper, SERCOS, Digitizing, Time, Digital
Velocity Limit (AU/min)	VL	0.0 – 4294967295.0	Digitizing, Time
Acceleration Ramp (AU/min/sec)	AR	0.0 – 3839941406.0	Digitizing, Time
Deceleration Ramp (AU/min/sec)	DR	0.0 – 3839941406.0	Digitizing, Time
Controlled Stop Ramp (AU/min/sec)	CSR	0.0 – 3839941406.0	Digitizing, Time
Slow Velocity Filter (ms)	SVF	0 – 10000	Digitizing, Time
Fast Velocity Filter (ms)	FVF	0 – 10000	Digitizing, Time
Slow/Fast Velocity Threshold (AU/min)	SFVT	0.0 – 4294967295.0	Digitizing, Time
Rollover Position (AU)	RP	-2147483648.0 – 2147483647.0	
Ignore Limits?	IL	Yes, No, Until Referenced Y, N, U	Digitizing, Time
Software Limit (Upper) (AU)	SLU	-2147483648.0 – 2147483647.0	Digitizing, Time
Software Limit (Lower) (AU)	SLL	-2147483648.0 – 2147483647.0	Digitizing, Time
Input Polarity	IP	Positive, Negative P, N	Stepper, SERCOS, Time, Digital

Output Polarity	OP	Positive, Negative P, N	Stepper, SERCOS, Digitizing, Time, Digital
Analog Output Offset	AOO	-10000 – 10000	Stepper, SERCOS, Digitizing, Time, Digital
Feed Forward Percent	FFP	0 – 100	Stepper, SERCOS, Digitizing, Time, Digital
Proportional Gain (AU/min/AUFE)	PG	0 – 20000	Stepper, SERCOS, Digitizing, Time, Digital
Integral Gain (AU/min/AUFE x min)	IG	0 – 32000	Stepper, SERCOS, Digitizing, Time, Digital
(+) Integral Error Limit (AUFE x update)	PIEL	0.0 – 2147483647.0	Stepper, SERCOS, Digitizing, Time, Digital
(-) Integral Error Limit	NIEL	-2147483648.0 – 0.0	Stepper, SERCOS, Digitizing, Time, Digital
Derivative Gain (AU/min/AUFE/min)	DG	0 – 1000	Stepper, SERCOS, Digitizing, Time, Digital
Following Error Limit (AU)	FEL	0.0 – 4294967295.0	Stepper, Digitizing, Time
Update Rate (ms)	UR	16*, 8, 4, 2, 1, .5, .25	Time
In Position Band (AU)	IPB	0.0 – 4294967295.0	Stepper, Digitizing, Time
Move Accel/Decel Max Acceleration (AU/min/sec)	MACCEL	1 - 67108862.0	Digitizing
Move Accel/Decel Constant Jerk (AU/min/sec/sec)	MJERK	1 - 67108862.0	Digitizing
Controlled Stop Decel Max Acceleration (AU/min/sec)	CACCEL	1 - 67108862.0	Digitizing, Time
Controlled Stop Decel Constant Jerk (AU/min/sec/sec)	CJERK	1 - 67108862.0	Digitizing, Time
S-Curve Enabled?	SCRVEN	No, Yes	Digitizing

***Note:** 16 is only valid for Digitizing Axes

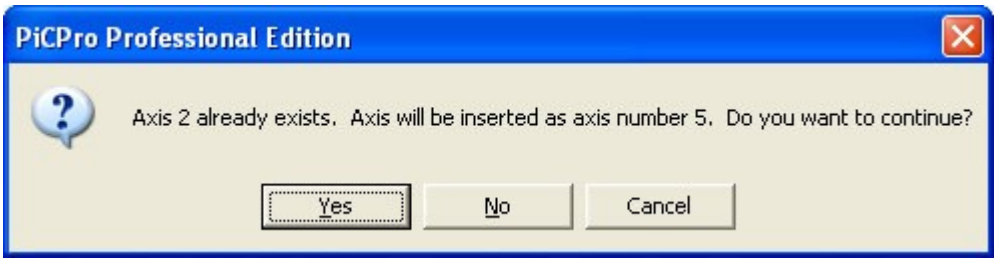
Copying Axis Information

Copying Axis Information

Once you have entered an axis in servo setup and entered all the axis data for that axis, you can use the copy/paste commands to add additional axes with the same information.

How to copy and paste an entire axis

1. Select the axis you want to copy. Select **Edit | Copy** from the menu, press <**Ctrl + C**> or right-click and select Copy.
2. Place the focus on the EOF line and select **Edit | Paste** from the menu, press <**Ctrl + V**> or right-click and select Paste. If there is already an axis with the same number as the one you are pasting, you will be advised that the axis will be pasted with the first available, valid axis number. You can confirm the procedure.



3. The **Axis Properties** dialog will appear, with the cursor in the **Axis Label:** field. You must give the axis a new Axis Label as there cannot be duplicates in the .srv file. Also, for a digital axis, you must give the axis a new Input Drive Address. If there is already a digital axis with the same address as the one you are pasting, you will be advised that only one axis can specify this drive address.

You can also make any other changes to the axis properties or axis data that you wish.

How to copy axis data from one axis to another

From the servo setup screen you can also copy Position, Iterator and Scaling data for one axis into the axis data for another axis. This is a time-saver if the axis data parameters for both axes are similar. If some of the axis parameters for the second axis need to be changed, you can change them after you have copied the axis data to the second axis.

1. Highlight the axis with the data you want to copy, select **Edit | Copy** from the menu, press <**Ctrl + C**> or right-click and select **Copy**.
2. Highlight the axis you want to copy the axis data to and select **Edit | Paste** from the menu, press <**Ctrl + V**> or right-click and select **Paste**.
3. If you need to change some of the parameters for the second axis, select **Edit | Axis Data** from the menu or press <**Alt + Enter**> to bring up the axis data dialog.

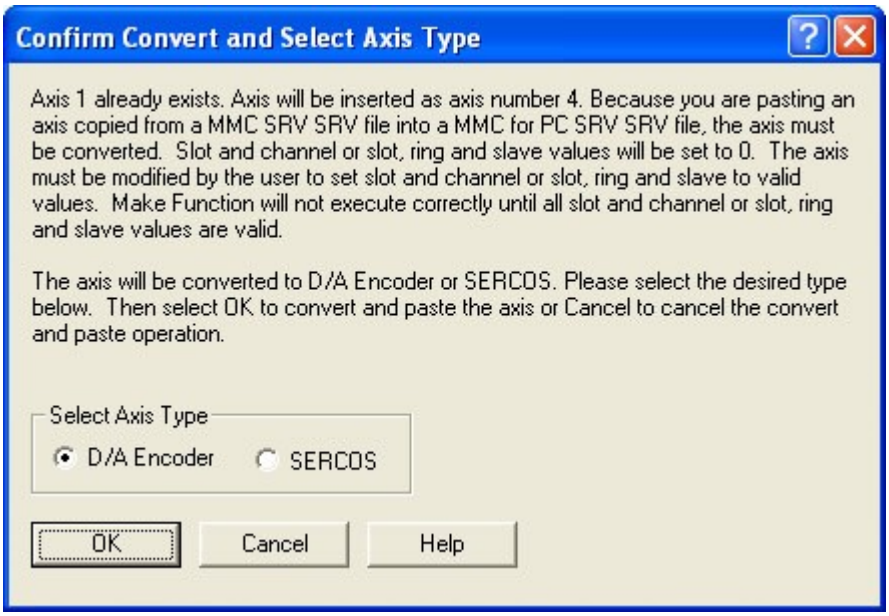
Note:

When pasting axes, the servo view list and servo force list information will not be pasted. That information must be manually entered.

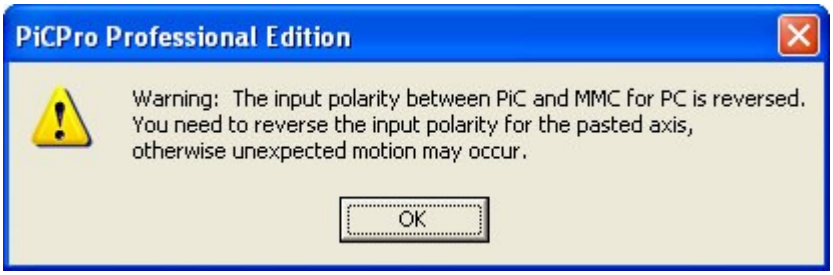
Pasting between .srv files of different CPU types (MMC, MMC for PC, and PiC CPU)

When copying from and pasting to files of different CPU types, you will be prompted that the slot, channel, or slot/ring/slave values will be set to zero. You must edit the axis to enter valid values.

If you are pasting into a standalone MMC or an MMC for PC file, you will also be asked to select the axis type, either D/A Encoder or SERCOS.



When pasting between files with different CPU types, you will receive a warning to check the input polarity. The input polarity of a PiC CPU is reversed from that of the standalone MMC or MMC for PC. You must edit the axis data to avoid unexpected motion when the ladder is run.



- If a digitizing DLS axis is pasted into a MMC for PC or PiC SRV file, an error message will be displayed. A digitizing DLS axis can only be pasted when the target CPU is MMC for PC.
- If an axis, created in a MMC for PC SRV file and specified as a DLS Communications Master, is pasted into a MMC or PiC SRV file, a message will be displayed indicating that DLS Communications Master information will be removed.

Pasting between .srv files of different CPU types (MMC Digital and MMC, MMC for PC, or PiC CPU)

A MMC Digital CPU axis cannot be pasted to an MMC, MMC for PC, or PiC servo setup file. An MMC, MMC for PC, or PiC axis cannot be pasted to an MMC Digital servo setup file.

Saving a Servo Setup File

Saving a Servo Setup File

Save your file at regular intervals as you work on it.

To save a new file

1. Select **File | Save** from the menu.
2. In the **Save As** dialog that appears, choose a drive and folder where you want to save your setup file.
3. Enter a name in the **File name:** field. **Note:** It is strongly recommended that the filename use the DOS 8.3 naming convention of 8 characters, a period, and 3 characters.
4. Click **Save**.

To save an existing file

1. Choose one of the following methods:
   - Select **File | Save** from the menu.
   - Select **File | Save As** from the menu to change the name and/or location of a file. By giving the file a different name when you save it, you create a copy of the existing file while keeping the original intact.
2. Select the location for the file in the **Save in:** field.
3. Enter the new file name in the **File name:** field.
4. Click **Save**.

To save a file in a format readable by a previous version of PiCPro

1. Select **File | Save As** from the menu.
2. In the **Save as type:** list, select the desired type..
3. Click **Save**. Any errors will be displayed in the Information Window.

Note:

- MMC Digital servo setup files cannot be read in any version of PiCPro prior to V15.0.
- To be read in versions of PiCPro prior to V16.0, axis numbers must be in the following ranges:

Servo Axis:	1-16, 101-116
Digitizing Axis:	49-80
Time Axis:	25-28

Printing Axis Information

Printing Servo Axis Information

You can print the axis information (scaling, iterator, and position loop information) for one or all axes in your servo setup program.

To print axis information

1. Open the Servo Setup file (.srv) that you want to print. If you just want to print the axis information for one axis, select that axis.

2. Choose one of the following methods:
   - Select **File | Print** from the menu
   - Press <**Ctrl + P**>

The print dialog appears and you can click **OK**. If you want to print the axis data for all axes in your setup file, choose **All** in the print dialog and click **OK**.

Making a Servo Setup Function

Making a Servo Setup Function

After you have entered all the setup information for all the axes in your application, you will create a servo setup function to store all this information. This function will be stored in the servo library you designate and can then be called in your ladder program to initialize the setup data for your application. The axes setup information will then be sent to the control when you download your application.

The name of the function will be the same as the name of the .srv file name. It will appear in the list of functions in PiCPro.

Note: Function name is limited to eight characters.

To create a servo setup function

1. After all the setup information for all your axes has been entered, select **Compile | Make Function** from the menu.
2. The **Save As** dialog will appear if you have not previously saved your setup file. Choose the location you want to save your .SRV file to. There is a default that is entered in the **File name** field beginning with Servo1.SRV. You can accept this name or enter your own.

   Notes:

   - The second setup file you create will have the default name Servo2.SRV, the third will be Servo3.SRV and so on.
   - It is strongly recommended that the filename use the DOS 8.3 naming convention of 8 characters, a period, and 3 characters.

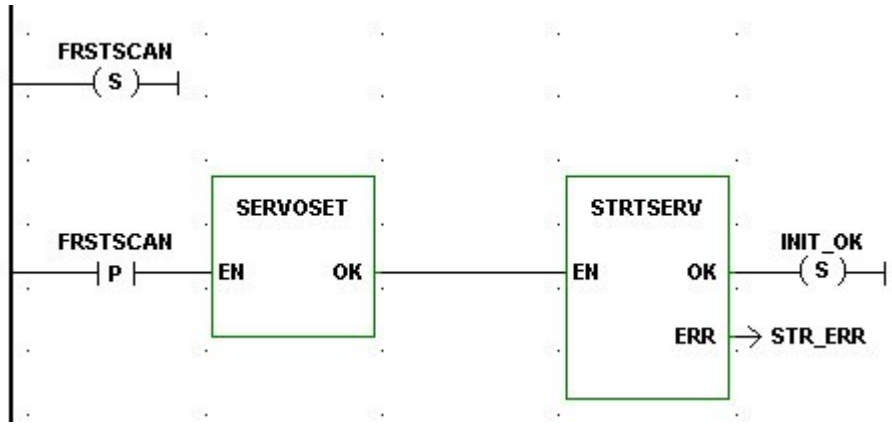
3. The **Compile SRV** dialog appears. The **Registered ServoSetup/SercosSetup Libraries:** section will hold the names of any setup libraries you have created previously. You may choose from this list or create a new Servo Setup Library by entering one in the **Library Name:** field.

   Note: If you are recompiling a function that was created earlier, you must place the function in the same library where it was originally located. You cannot select a new library location. The Library Name: fields are disabled (grayed out).
4. Click **OK** to insert the servo setup function into the chosen library. If you are creating a new library a prompt will appear asking if you want to create a new library. If the directory path specified for the new library is not found in the current library path, a prompt will be displayed asking if this path should be added.

   Choosing **Yes** will define the library path so PiCPro can locate the function. The library and setup function will immediately show up in PiCPro under **Ladder | Functions** and in the Functions list on the toolbar.
5. Do a full compile and download of the ladder using this function.

To initialize setup data in your ladder

The servo setup function you compile with the Servo Setup program must be incorporated into your ladder program. To initialize all the setup data you use the standard motion function STRSERV with your setup function. Below is a network designed to do this. The example setup function is labeled SERVOSET.



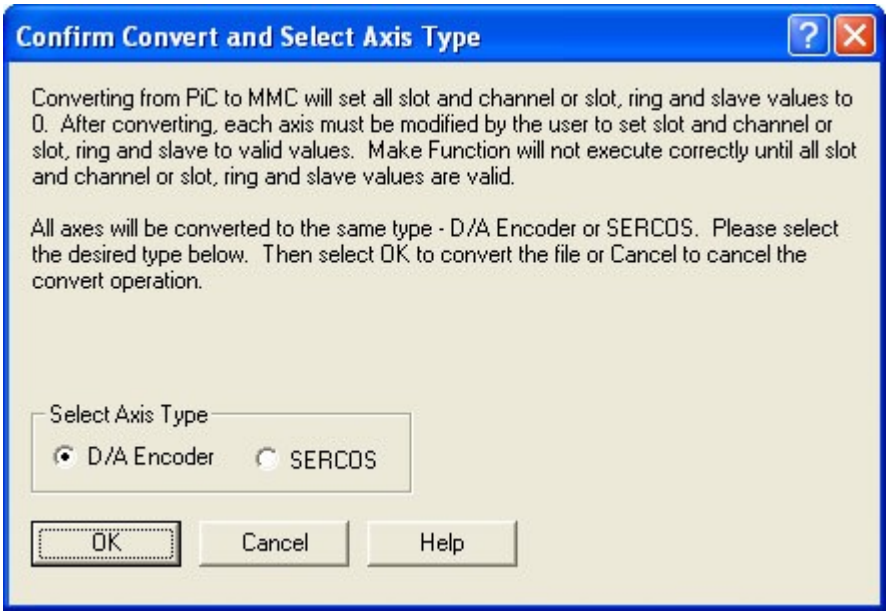
If the target CPU is an MMC Digital CPU, STRTSERV would be replaced with DSTRTSRV.

Converting a Servo Setup File CPU Type

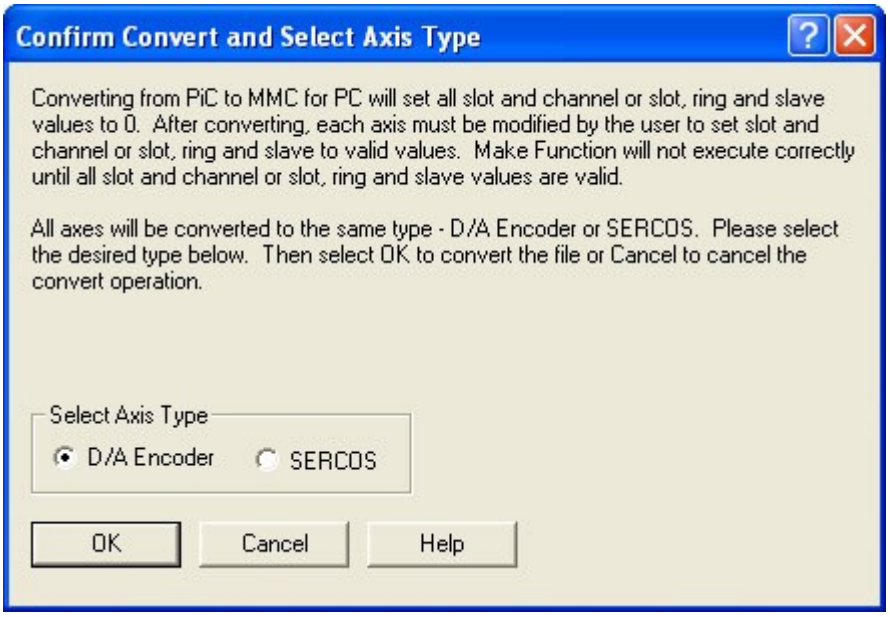
Converting Servo Setup CPU Type (MMC, MMC for PC and PiC CPU)

1. Select **Edit | Convert Target CPU To** from the menu.
2. A confirmation prompt will be displayed as shown below. The prompt indicates the types of changes that will be made to the servo setup information for this file. You will need to manually enter the slot, channel, and slot/ring/slave values.

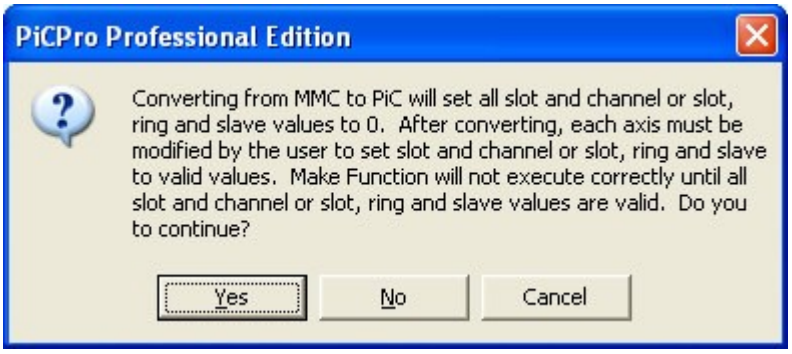
PiC CPU to MMC CPU



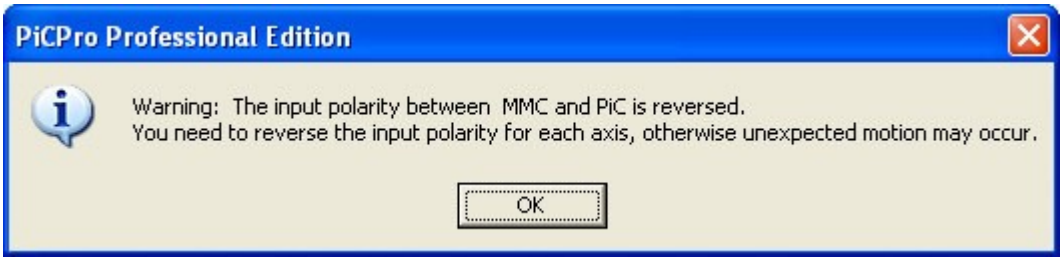
PiC CPU to MMC for PC CPU



MMC CPU to PiC CPU

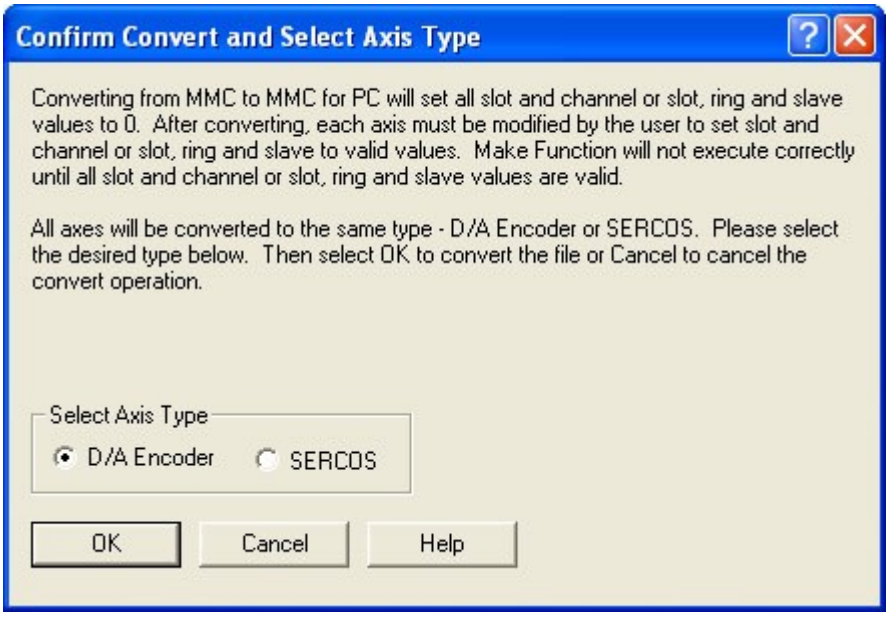


If input polarity between the MMC and the PiC CPUs are reversed the following prompt will be displayed:

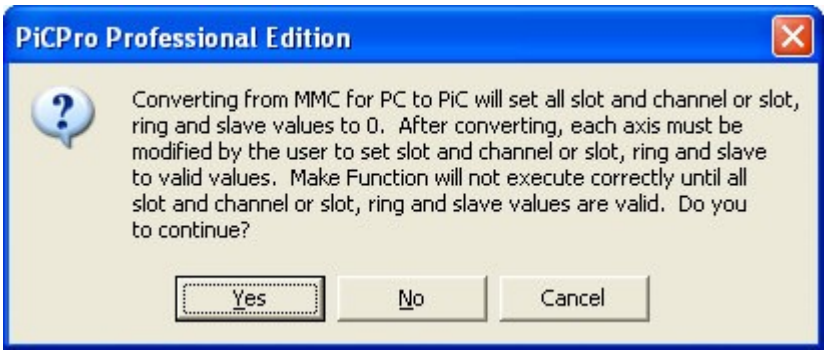


Click OK and perform the required action.

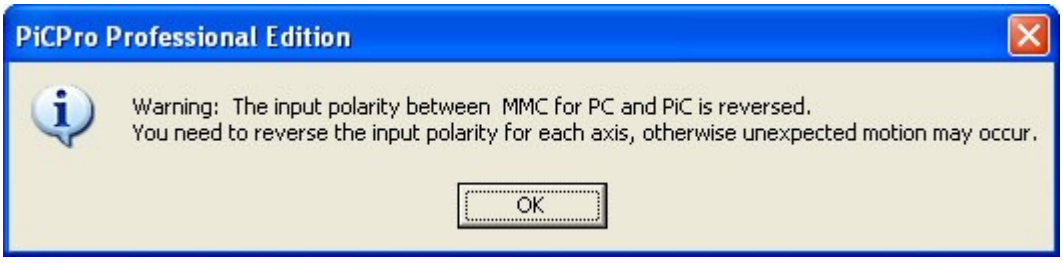
MMC to MMC for PC



MMC for PC to PiC

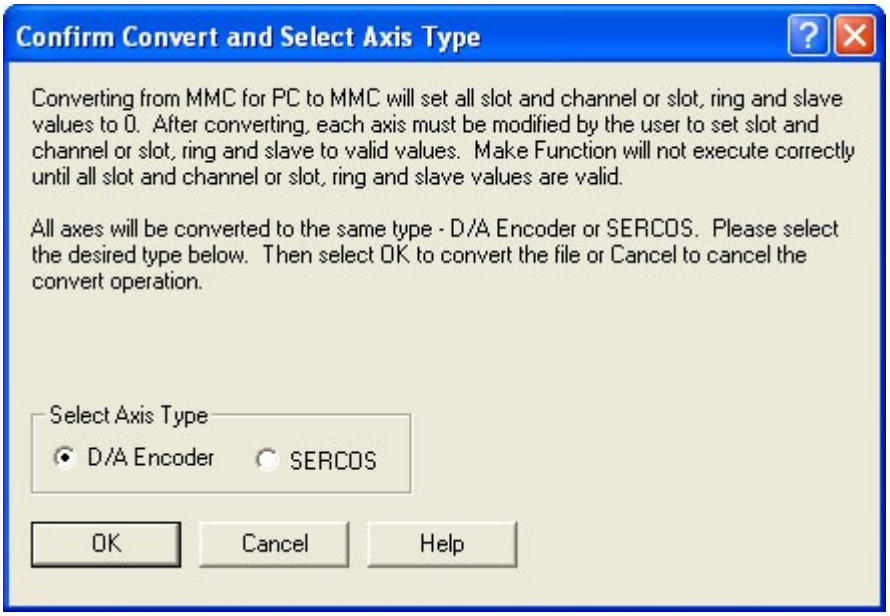


If input polarity between the MMC and the PiC CPUs are reversed the following prompt will be displayed:



Click OK and perform the required action.

MMC for PC to MMC



Note:

This conversion function is not available in PiCPro MMC-Limited Edition

Axis Tuning

Axis Tuning

Axis tuning allows you to make adjustments to offsets and gains for an axis through software rather than hardware. When the ladder containing your servo setup file is downloaded and scanning in the control, any servo axis defined in your servo setup file can be tuned using the Servo Force List (Write) and the Servo View List (Read) in Servo Setup. When you change a value through the Servo Force List, a prompt will appear when you close the force list asking if you want to update the axis data for the selected axis. If you answer **Yes**, the data will become a permanent part of your program.

Note:

In order to use Servo View and Servo Force, the latest version of the motion library must be installed. This occurs automatically if you choose Typical as an installation choice.

Axis Tuning using Forcing

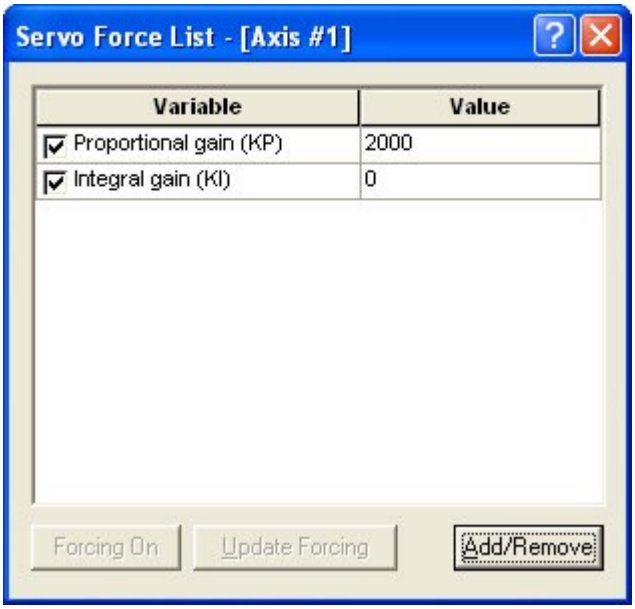
You can write values into certain servo variables for an axis running in the control using the Servo Force List.

To force an axis servo variable in the Servo Force list

1. Open the ladder containing a servo function. Choose one of the following methods:
   - Select **View | Servo Function** from the menu
   - Select the servo setup function, right-click and select **View Servo Function**.
2. Select the axis you want to force variable values on.
3. Choose one of the following methods:
   - Select **View | Servo Force List** from the menu
   - Right-click and select **Servo Force List**.

A Servo Force List can be opened for each axis you have defined in Servo Setup. The Axis number appears in the title bar of each list.

- Use the **Add/Remove** button to edit the forcing list.
- Click in the check box of the variables you want to force.
- Enter a value for the variable in the **Value** column. A message will appear if the value is out of range for the variable.
- Choose **Update Forcing** to send the updated values to the CPU.



Note:

Available choices vary depending on whether the axis is an MMC Digital or an MMC, MMC for PC, or PiC CPU. See ***Axis Tuning Variables.***

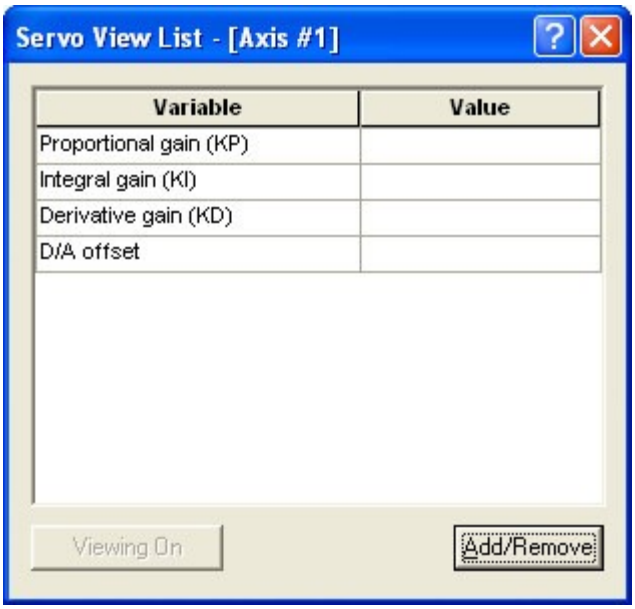
Axis Tuning using Viewing

You can read values from certain servo variables for an axis running in the CPU using the Servo View List.

To view an axis servo variable in the Servo View list

1. Open ladder containing a servo function. Choose one of the following methods:
   - Select View | Servo Function from the menu
   - Select the servo setup function, right-click and choose View Servo Function.
2. Select the axis you want to view variable values on.
3. Choose one of the following methods:
   - Select **View | Servo View List** from the menu
   - Right-click and select **Servo View List**.

A Servo View List can be opened for each axis you have defined in Servo Setup. The Axis number appears in the title bar of each list. Use the **Add/Remove** button to edit your view list.



Note:

Available choices vary depending on whether the axis is an MMC Digital or an MMC, MMC for PC, or PiC CPU. See ***Axis Tuning Variables***.

Axis Tuning Variables

Servo Force List

Notes:

- The Servo Force List variables can also be written to and read from your ladder using the TUNEREAD and TUNEWRIT functions.
- The force list is not available for a digitizing axis or a time axis.

The following servo variables can be added to or removed from the Servo Force List:

Variables
Proportional Gain
Integral Gain
Derivative Gain
D/A Offset
Slow Speed Filter
Feed Forward Percent

Servo View List

The following servo variables can be added to or removed from the Servo View List:

Variables
Slow Speed Filter
Position Error
Command Velocity
Actual Position
Command Position
D/A Output Voltage
Move Type
Next Move
Emergency Errors
Controlled Stop Errors
Programming Errors
Loop State
Resume Distance
Resume Mode
Slow Velocity Filter Error
Proportional Gain (KP)
Integral Gain (KI)
Derivative Gain (KD)
D/A Offset
Feed Forward Percent

Chapter 8 - PiCPro and SERCOS

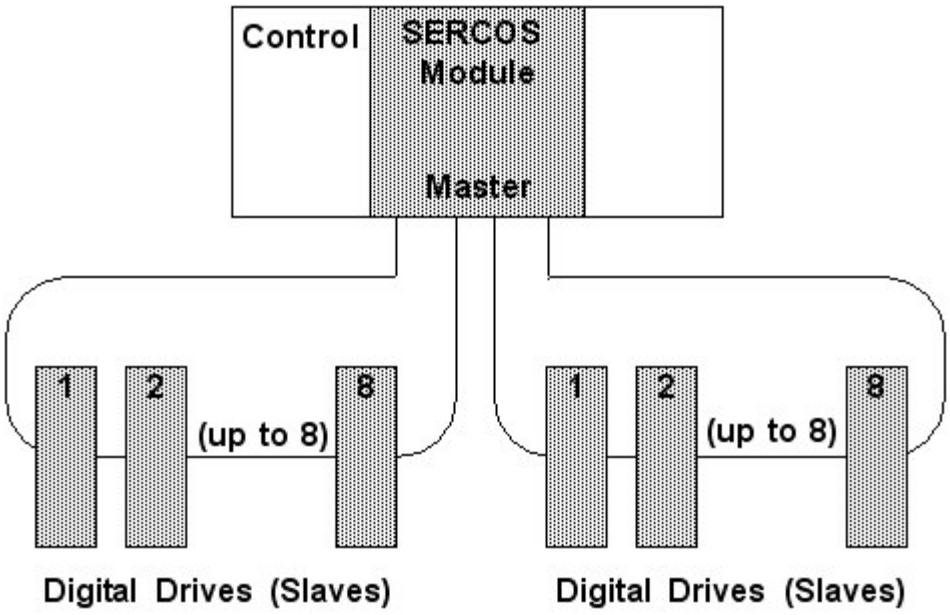
SERCOS Background Information

Overview: SERCOS

SERCOS is a Serial, Realtime, Communication System developed to interface with digital controls and drives. Fiber optic cables are used to transmit data serially with noise immunity and fast update times. SERCOS allows motion control in velocity, torque, or position modes.

Danaher Motion recommends that you acquire a copy of the NEMA SERCOS Specification for reference information, especially if you will be performing advanced control techniques. The SERCOS Specification is available through ANSI. To order, call ANSI at (212) 642-4900 and ask for Manual IEC 61491. The web page for SERCOS North American user's group is ***www.sercos.com***.

SERCOS allows you to create a digital instead of an analog motion control network. A typical Control/SERCOS network is illustrated below. The network consists of up to eight digital drives connected to one master in a ring topology in which messages travel unidirectional. The network can support two fiber optic rings from one SERCOS module.



Typically, the SERCOS drive accepts position commands from the control whereas an analog drive accepts velocity commands. In SERCOS, the position loop that compares the commanded position to the actual position and then applies a PID algorithm to the difference is performed in the drive rather than in the control.

SERCOS and the control work together to provide a mechanism to control the drive through communications. The following are all part of how communications is established between the control master and the drive slaves.

- Each drive identified with a unique number
- Five communication phases (0-4) that must be passed through before operation begins
- The AT and MDT telegrams
- The cyclic data containing IDN numbers

- The service channel containing data

The following are all part of how control is performed once communications is established:

- The value of the IDN in cyclic data
- The value of the data transferred over the service channel
- The mode defined by the status word
- The state of the control and status words

Note:

Currently, PiC/SERCOS and standalone MMC/SERCOS configurations support up to eight slaves on a ring where each slave controls a single drive. MMC for PC/SERCOS supports up to sixteen slaves on a ring. None of the configurations support a slave controlling a group of drives as described in the SERCOS Specification.

You define the SERCOS configuration for all the SERCOS axes using SERCOS setup in PiCPro.

SERCOS Functions

The Motion library contains the following function/function blocks in the groups listed. Refer to the Function/Function Block Reference Guide for a complete description of the function/function blocks.

SCA_...	function blocks have an AXIS input to identify the SERCOS axis that has been initialized in Servo setup.
SCS_...	function/function blocks identify the SERCOS axis by slot, ring, and slave number.
SCR_...	function/function blocks apply to one ring.
SC_...	function applies to all rings.

DATA Group	
SCA_CTRL	Writes control bits to the MDT for a servo axis
SCA_RCYC	Reads cyclic data from the AT for a servo axis
SCA_RECV	Receives data from the service channel of the AT for a servo axis
SCA_SEND	Sends data to the service channel of the MDT for a servo axis
SCA_STAT	Reports the status from the AT for a servo axis
SCA_WCYC	Writes cyclic data to the MDT for a servo axis

ERRORS Group	
SCA_ERST	Resets E-errors and closes the loop on a servo SERCOS axis
INIT Group	
SCA_CLOS	Reads the current position and closes the loop on a servo SERCOS axis

MOVE_SUP Group	
SCA_PBIT	Initializes the SERCOS fast input (probe input)
REF Group	

SCA_ACKR	Acknowledges the reference cycle for a servo axis
SCA_REF	Starts the reference cycle on the servo SERCOS axis
SCA_RFIT	Initializes the reference cycle on the servo SERCOS axis

SERC_SLV Group

SCS_ACKR	Acknowledges the reference cycle for a non-servo axis
SCS_CTRL	Writes the control bits to the MDT
SCS_RECV	Receives data from the service channel of the AT for a non-servo axis
SCS_REF	Starts the reference cycle on the non-servo SERCOS axis
SCS_SEND	Sends data to the service channel of the MDT
SCS_STAT	Reports the status from the AT

SERC_SYS Group

SCR_CONT	Continues communication if it was halted after Phase 2
SCR_ERR	Reports ring errors
SCR_PHAS	Reports the highest phase number completed
SC_INIT	Copies the user data into the SERCOS module

Using Standard Motion Functions and Variables

There are certain things you should be aware of when using SERCOS feedback with the motion library of PiCPro.

READ_SV/WRITE_SV Functions

These READ_SV and WRITE_SV variables cannot be used when using SERCOS feedback on an axis.

Var #	Name
27	Backlash compensation
28	TTL feedback
46	Set user PID command
47	User PID command

All other READ_SV/WRITE_SV variables can be used with an axis using SERCOS feedback.

TUNEREAD/TUNEWRIT Functions

The filter variable is the only one that can be read and written by these functions when using a SERCOS axis. The remaining TUNEREAD/TUNEWRIT variables cannot be used with a SERCOS axis.

CLOSLOOP/OPENLOOP Functions

The CLOSLOOP function is not called on a SERCOS axis. The SCA_CLOS function block is used to close the loop on the SERCOS axis. The top three bits of the SERCOS control word are set on subsequent SERCOS updates. When the OPENLOOP function is called, the top three bits of the SERCOS control word are cleared on subsequent SERCOS updates.

E_RESET Function

The E_RESET function is not called on a SERCOS axis. The SCA_ERST is used to reset E-stop conditions on a SERCOS axis. The SCA_ERST function will read the current position of the drive prior to closing the position loop.

STRTSERV Function

The SERCOS ring must be into Phase 4 of its communication cycle before the servos can be initialized. Call STRTSERV after Phase 4 has started.

An additional error can appear at the ERR output with a SERCOS axis;

Error # 5: The axis update rate in PiCPro is different from the SERCOS ring update rate.

Using SERCOS Functions/Blocks with TASKS

Some of the SERCOS functions/function blocks can be used in TASK LDOs as well as in Main LDOs.

For use in Main LDOs only	For use in TASK or Main LDOs
SC_INIT	SCR_CONT
SCA_RECV	SCR_ERR
SCA_SEND	SCR_PHAS
SCA_CLOS	SCS_CTRL
SCA_ACKR	SCS_STAT
SCA_REF	SCA_CTRL
SCA_ERST	SCA_RCYC
SCS_SEND	SCA_WCYC
SCS_RECV	
SCS_ACKR	
SCS_REF	

SERCOS Telegrams

SERCOS has a master/slave communications structure with the control as the master and the drives as the slaves. All the communication between the two is done with messages referred to as telegrams. A telegram is an ordered bit stream carrying data and timing information.

There are three standard telegrams used in SERCOS communication as described below:

1. **MST - Master Synchronization Telegram** - sent by the control to the drives to set the timing and synchronization for everything that happens on the network.
2. **AT - Amplifier Telegram** - sent by the drives to the control.
3. **MDT - Master Data Telegram** - sent by the control to the drives after it receives the last AT in a cycle.

The type of data transferred by these telegrams is determined by the telegram type you enter in SERCOS setup. IDN 15 contains the telegram types available. They are described below.

IDN 15 (Telgram Type)	Description
0	No data
1	Torque control
2	Velocity control, velocity feedback
3	Velocity control, position feedback
4*	Position control, position feedback
5	Position and velocity control, position and velocity feedback
6	Velocity control
7	User-defined

*If the slave will be controlled by the Motion.Lib, 4 or 7 is the telegram type number that is entered in SERCOS setup and the primary mode (defined by IDN 32) must be set to the position mode. If telegram 7 is selected IDN 47 must be part of the MDT and IDN 51 must be part of the AT.

IDNs

SERCOS has a system of identification numbers (IDNs) used to access specific data. You can find a list of these IDNs in the SERCOS specification. There is a standardized set covering the following categories:

1. General parameters
2. Diagnostics
3. Lists of operation data
4. Internal and external signals
5. Manufacturer's specifications
6. Definitions of telegram contents
7. Drive operation modes
8. Standard operation data
9. Drive parameters

There is also a drive manufacturer-defined set of IDNs available.

Below is a list of IDNs that must be supported by any slave device you are using. They are listed in the order they are worked through as Phase 2 and 3 proceed. For complete descriptions of these IDNs, consult the SERCOS specification.

	IDN READ	Description
Phase 2	00003	Shortest AT Transmission Starting Time (T1min)
	00004	Transmit/Receive Transmission Time (TATMT)
	00005	Minimum Feedback Processing Time (T4TMT)
	00088	Receive to Receive Recovery Time (TMTSY)
	00090	Command Value Proceeding Time (TMTSG)
	00096	Slave Arrangement 0

	WRITE	Description
	00001	Control Unit Cycle Time, Tncyd
	00002	Communication Cycle Time, Tscyc
	00006	AT Transmission Starting Time (T1)
	00007	Feedback Acquisition Capture
	00009	Position of Data Record in MDT
	00010	Length of Master Data Telegram
	00015	Telegram Type Parameter
	00032	Primary Operation Mode
	00089	MDT Transmission Starting Time

	R/W	Description
	00099	Reset Class 1 Diagnostic
	00127	CP3 Transition Check
Phase 3	00128	CP4 Transition Check

Working with Procedure Command Function IDNs

There are two types of IDNs used in SERCOS:

1 **Parameter Data IDNs**

These handle simple commands (i.e., IDN 100 where the value for gain can be read or written). You define the values for these IDNs.

2 **Procedure Command Function (PCF) IDNs**

These are commands that take a longer time to execute (i.e., IDN 262, load parameter data or homing cycle). With PCFs the one word DATA values hold bit patterns that relay the progress of the function. The MDT has two bits and the AT has five bits. All PCFs use these bits the same way. This bit field provides the communication between the master and the slave.

Follow these steps to use a PCF IDN from your ladder:

1. Start the procedure by sending the PCF IDN with the data value of 3 using the SCS_SEND or SCA_SEND functions. This sets (bit 0 = 1) and enables (bit 1 = 1) the PCF. SIZE for PCF IDNs is one word.
2. In the SCS_RECV or SCA_RECV function blocks, enter a 1 as the ELEM member of the DATA structure.
3. Continually read the PCF IDN value using SCS_RECV or SCA_RECV function blocks. If the command was received by the drive, a status of 7 will be read. This means the drive acknowledges the command set (bit 0 = 1) and enabled (bit 1 = 1). If no error occurs and the procedure is complete, a status of 3 is returned. This means the drive acknowledges the command set (bit 0 = 1) enabled (bit 1 = 1), and executed (bit 2 = 0). This may take only a few SERCOS updates or several minutes depending on the PCF. If an error occurred during the procedure, status bit 3 will equal 1.

   Note: There is a change bit (bit 5) in the status word which can be used to avoid continually reading the PCF IDN value as described above. See the SERCOS specification for more information on this change bit.
4. After the read value of the PCF IDN equals status of 3, the command set (bit 0 = 1), the enabled (bit 1 = 1), and executed (bit 2 = 0), or the read value has status bit 3 set (> 8), the PCF must be sent again using the SCS_SEND or SCA_SEND functions with data = 0. This cancels the procedure by sending the PCF IDN with bit 0 = 0.

This procedure and other advanced SERCOS features are described in the SERCOS specification. Refer to section 7.4.4 of the NEMA SERCOS specification for more detailed information on PCFs.

Note: PCFs may not be used in the SERCOS setup list.

You can also work with PCFs using the **Online | Control Operations | Execute Procedure CMD** within SERCOS setup.

SERCOS Phases

During initialization, the SERCOS system moves through five communication phases (0 through 4) before normal communication can begin. These are summarized below.

Phase #	Description
Phase 0	Closes the communication ring and allows initialization to proceed.
Phase 1	Identification phase where the control addresses each drive individually and waits for an acknowledgment.
Phase 2	Sets parameters for cyclic data transmission.
Phase 3	Sets parameters for non-cyclic or service channel data transmission.
Phase 4	The SERCOS ring can begin normal operation as defined by the application.

The movement through these five communication phases occurs in sequential order. In SERCOS setup, it is possible to decide to halt the movement after the completion of Phase 2 allowing you to send additional IDNs specific to your application which you did not enter in SERCOS setup and then resume moving through Phase 4. At the end of Phase 4, you have another opportunity to send IDNs.

Cyclic Operation

After initialization is complete, SERCOS transmits critical data such as command values, feedback values, etc. in synchronized, cyclic form. This data is updated cyclically in real time at the update rate set in the control. You define the cyclic data by choosing the Define Cyclic Data button within the **Insert Slave** dialog.

Service Channel

Non-critical data such as diagnostics, loop gains, etc. are transferred over a service channel. This data is transferred once each cycle and goes both ways. It may take several cycles to transfer data. The transfer is initiated by the control. Both operations within your ladder and within SERCOS setup make use of the service channel.

Comparing Cyclic Data and Service Channel Transfers

Cyclic Data	Service Channel Data
• Words in the telegram (AT/MDT) are devoted to each piece of cyclic data to be transferred.	• One word in the telegram (AT/MDT) is shared by all service channel requests. The content of the word changes with each service channel request.
• Data included in the cyclic data causes the telegram to be larger. Consequently, more communication time is used.	• Service channel requests have no effect on the length of the telegrams. One word in the telegram is devoted to the service channel whether there are any requests or not.
• Cyclic data is sent every time a communication cycle occurs on the ring.	• Only one word of the service channel data is sent each communication update. Several updates are required to send or receive data over the service channel.
• You define cyclic data in SERCOS setup and you cannot change this after the ring has completed phase 4. **Note:** Once communications is established, you can access the cyclic data with the SCA_RCYC and SCA_WCYC functions.	• You make service channel requests from the ladder or from SERCOS setup after communications is established. The requests are queued up on the SERCOS module and are completed in order. **Note:** The ladder has priority over SERCOS setup.
• Cyclic data can only be sent after phase 4 is completed.	• Service channel data can be sent after the completion of phases 2, 3, or 4.
• Only the operation data of an IDN can be sent as cyclic data.	• Any element (name, attribute, units, minimum value, maximum value, and operation data) of an IDN can be sent over the service channel.

Service Channel Application Notes

For a complete description of the activity on the service channel, read the Non-Cyclic Data Exchange section of the SERCOS specification.

There is one word in the AT (from drive to control) and one word in the MDT (from control to drive) that are dedicated to service channel communication. One word of the service channel data is transmitted each way between the control and the drive during each update. Both the ladder and SERCOS setup use the service channel.

From the ladder, the following functions request information over the service channel:

SCA_RECV	SCA_SEND	SCA_REF	SCA_CLOS
SCS_RECV	SCS_SEND	SCS_REF	

From SERCOS setup, the following online commands request information over the service channel:

Execute Procedure CMD	Receive IDN	Receive Continuous	Send IDN	Upload Drive Information

Keep the following in mind:

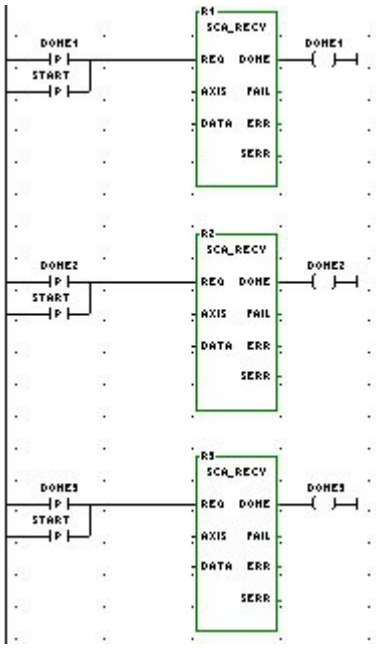
- The ladder requests are used for machine control.
- SERCOS setup requests are used for diagnosis.
- Only one request is processed on the ring at a time. It must be completed before the next one begins.
- The SERCOS module allows the ladder to queue up to 16 requests to the service channel.
- The ladder requests in the queue have priority over any requests coming from SERCOS setup.
- All ladder queue requests (1 to 16) will be processed before any requests from SERCOS setup.
- Resources are consumed in the transfer of information.
- The throughput of the service channel for a slave is also affected by the service channel activity of other slaves on the ring.

Examples of Ladder Design to Access the Service Channel

There are many possible ways to design your ladder to access the service channel and base ladder logic on the results. In the examples presented here, partial logic is used to illustrate three approaches to monitoring the data of three IDNs in the ladder.

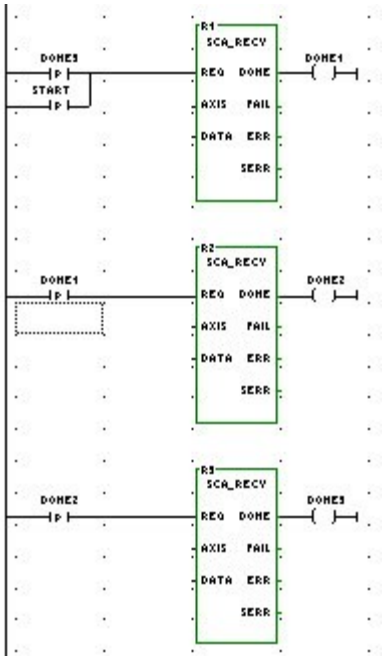
Example 1 Logic that gives priority to the ladder requests

In this example, you want to read IDN 1, read IDN 2, read IDN 3, then read IDN1 when IDN 1 is complete, read IDN 2 when IDN 2 is complete, read IDN 3 when IDN 3 is complete, and repeat. This example uses three queues because all three are queued when START transitions. Any SERCOS setup requests will be processed after the three queues have finished.



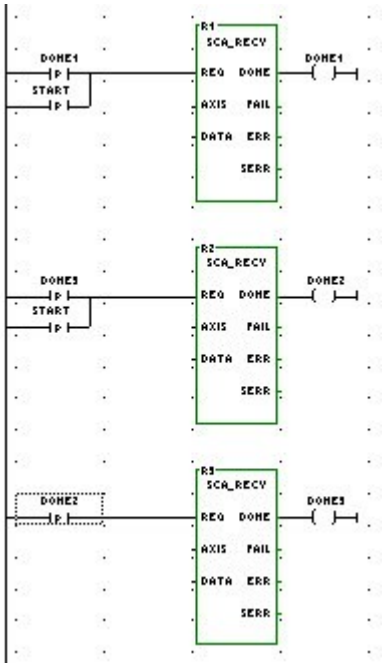
Example 2 Logic that allows SERCOS Setup commands to be read sooner

In this example, you want to read IDN1. Read IDN 2 when IDN 1 is complete. Read IDN 3 when IDN 2 is complete. Read IDN 1 when IDN 3 is complete and repeat. Using the logic shown below, only one queue is used because each request is queued after the previous one is complete. This allows requests from SERCOS setup to be processed after each function block.



Example 3 Logic that allows one IDN to be read more frequently.

In this example, you want to read IDN1 more frequently than IDN 2 or 3. Read IDN1. Read IDN 2 when IDN 1 is complete. Read IDN 1 again. Read IDN 3 when IDN 2 is complete and repeat. This example uses two queues: one for IDN1 and one shared by IDN 2 and IDN 3.



SERCOS Setup Overview

Overview: SERCOS Startup

Two approaches to SERCOS startup are presented next. In the first situation, it is assumed that you are simply replacing your analog drives with SERCOS drives and not attempting to use the advanced features available. In the second situation, you are planning to use advanced features available with SERCOS.

Replacing Your Analog System with SERCOS

When you are replacing your analog system with a SERCOS system, the analog output module and the feedback module are both replaced by the SERCOS communication module in the control. The fiber optic cable will replace the analog voltage wires and the feedback wires. The drive will connect to the feedback device and send that information back to the control over the SERCOS cable.

An overview of the procedure to follow if you simply want to use SERCOS without any advanced features is summarized here. In SERCOS Setup:

1. Enter a ring for each SERCOS ring.
2. For each ring, set the update rate, the baud rate to the rate of the drive, and No pause after phase 2.
3. Enter a slave for each drive on each ring.
4. Leave the setup list empty.
5. Define the cyclic data to telegram 4 for all drives.
6. Define the operation mode for all slaves to operate in position control, with Following Distance, Cyclic and System Interface.
7. Make a SERCOS setup function.

In Servo Setup, define each slave axis for basic control:

1. Select SERCOS as the Input and Output Type for the axis.
2. Make other selections for the servo axes for your application.
3. Make a servo function.

In PiCPro, program a ladder that will initialize the SERCOS slaves, then the servo axes.

1. Call the SERCOS function you've made and then the SC_INIT function.
2. Call SCR_PHAS to read the phase and logic to detect phase 4.
3. When phase 4 is complete, call the servo function you made, then the STRTSERV function.

You can now control the axes using the same functions you used for analog servos (with some exceptions including referencing and tuning).

Using SERCOS Advanced Features

There are features offered by a SERCOS system that go beyond simply replacing the analog signal with a digital interface. In addition to position command and feedback, other information can be exchanged between the drive and the control or the workstation. In order to use these advanced features, it is necessary to upload the IDN list that resides in the drive. This list holds all the information that can be read/written to/from the drive. The list also indicates the units and range for each IDN in the list. With this information, SERCOS setup can read or write this information, define custom cyclic data, or change modes.

The ladder functions can use the advanced features to read and write data as well. It is not required that the IDN list be uploaded from the drive in order to program the ladder. But the content of the drive IDN list provides the feature description for the drive. Knowing the drive features available will aid you in your ladder design.

An overview of the procedure to follow if you want to use SERCOS with advanced features is summarized here. In SERCOS Setup:

1. Enter a ring for each SERCOS ring.
2. For each ring, set the update rate, the baud rate to the rate of the drive, and No pause after phase 2.
3. Enter a slave for each drive on each ring.
4. Leave the setup list empty.
5. Define the cyclic data to telegram 4 for all drives.
6. Define the operation mode for all slaves to operate in position control, with Following Distance, Cyclic and System Interface.
7. Make a SERCOS setup function.

In Servo Setup, define each slave axis:

1. Select SERCOS as the Input and Output Type for the axis.
2. Make other selections for the servo axes for your application.
3. Make a servo function.

In PiCPro, program a ladder that will initialize the SERCOS slaves, then the servo axes.

1. Call the SERCOS function you've made and then the SC_INIT function.
2. Call SCR_PHAS to read the phase and logic to detect phase 4.

When phase 4 is complete, read the IDN list from the drive in SERCOS setup.

1. Select **Online | Control Operations | Upload Drive Information** from the menu.

2. Enter a unique file name and click **Upload now**. The status bar indicates progress. This can take several minutes per drive. Typically, you only need to upload this information once for each drive type.
3. The drive file (.csv) is a comma-separated variable file that can be read by a text editor or spreadsheet.

Once the IDN list is read from the drive and SERCOS is initialized from the ladder, SERCOS setup can be used for the following:

- Run the drive via the battery box feature.
- Read the value of IDNs either once or continuously.
- Write the value of IDNs.
- Execute procedure command functions
- Customize the cyclic data .
- Operate the drive in different modes: position, velocity, or torque.
- Use secondary feedback. Secondary feedback can be read by customizing the telegram and using the SCA_RCYC function in your ladder. Motion.lib does not read secondary feedback.

Axis Positioning and Referencing in SERCOS

You can control axis position using either servo or non-servo SERCOS function/function blocks. In SERCOS setup, the telegram type must be Telegram 4 position mode. As defined by the SERCOS specification, with Telegram 4 IDN 47 is cyclic data sent from the control to the slave. IDN 51 is cyclic data sent from the slave to the control. When using a servo axis, SERCOS is selected as the feedback type in Servo Setup.

With a Servo SERCOS Axis

The servo setup data is made into the User setup function in servo setup. The STRTSERV function installs all the data. Both functions are put in your ladder.

To close a SERCOS axis loop, use the SCA_CLOS function. It will read IDN 47, update the servo data with the new position, send the value as commanded position, read rollover on position information, and set the control bits to cause the drive to close it.

To reference the axis, the SCA_RFIT function block must be called and completed prior to calling FAST_REF or LAD_REF.

Another option is to reference the axis using the SERCOS drive's reference cycle via the SCA_REF function block. This function block reads the value for IDN 47 as the last step in the reference process and returns this value in the RSLT output.

Use the SCA_ACKR function block to acknowledge that the reference cycle is complete. Control will return to the control after this function block is called.

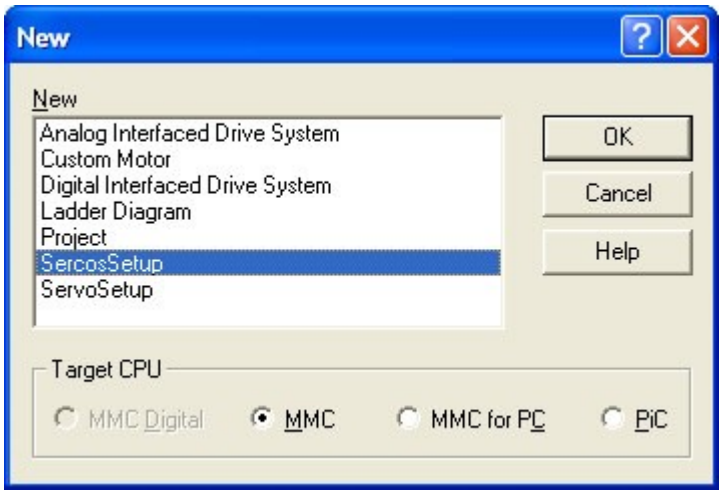
Opening SERCOS Setup

Creating/Opening SERCOS Setup

With the SERCOS Setup program, you will create a *.src file containing data for all the slaves in your SERCOS system. You convert this *.src file to a function in order to send all the data to the control so that the SERCOS slaves can be initialized. There are several ways to access the SERCOS Setup program.

To create a new SERCOS setup file

1. Choose one of the following methods:
   - Click on the button on the standard toolbar
   - Select **File | New** from the menu
2. Select **SERCOS Setup** from the dialog that appears.



3. Select target CPU type (**PiC**, **MMC**, or **MMC for PC**).
4. Choose **OK**.

Note: In the MMC-Limited Edition of PiCPro, target CPU selection is not made. Target CPU is always standalone MMC.

To open an existing SERCOS setup file

1. Choose one of the following methods:
   - Click on the button on the standard toolbar
   - Select **File | Open** from the menu
2. The **Open** dialog appears. At the bottom, choose SERCOS Setup Files (*.src) from the drop down list in the **Files of type:** field. This brings up a list of all existing SERCOS setup files.
3. Highlight the file you want to open and click **Open** or press the **Enter** key.

Note:

If you attempt to open a PiC or MMC for PC SERCOS Setup file in the MMC-Limited Edition, you will be prompted to convert the file to a standalone MMC format. When opening an MMC for PC file in the MMC-Limited Edition, the baud rate of the ring is 8 or 16 and the baud rate will be set to 4.

To open an existing SERCOS setup file from the setup function in your ladder

If you have already created a SERCOS setup function with your setup data and have included it in your ladder, you can access the SERCOS setup file from there.

1. Place focus on the setup function in your ladder
2. Right-click and select **View SERCOS Function**.
3. Select **View | SERCOS Function** from the menu and then select the desired setup function from the fly-out list.

Note:

In order to open a SERCOS setup file from within your ladder, the SERCOS file and the SERCOS function must have the same name. Any SERCOS setup file created with PiCPro automatically has the same name as the SERCOS setup function. However, any DOS SERCOS setup file may not have the same name as the SERCOS setup function. Change the name of the *.src file to match the name of the SERCOS setup function if you want to be able to open the file from within the ladder.

To open an existing SERCOS setup file from Windows explorer

1. Open Windows explorer and find the *.src file you want to open.
2. Double click on the *.src file you want to open and the SERCOS Setup window will appear.

Inserting and Editing SERCOS Rings

Inserting/Editing SERCOS Rings

A ring is added to SERCOS Setup by using the **Insert** menu. Each time you insert a ring you must insert the slave axes you are connecting to that ring and any IDNs required.

Inserting / Editing a SERCOS ring

1. Select **Insert | Ring** from the menu. The **Insert Master Ring** dialog appears.

2. Enter the Slot number (3-13) identifying the slot in which your SERCOS module is installed in the control rack.

3. Enter the Ring number (1-2).

   Note: If a standalone MMC is selected, slot is limited to a value of 1.

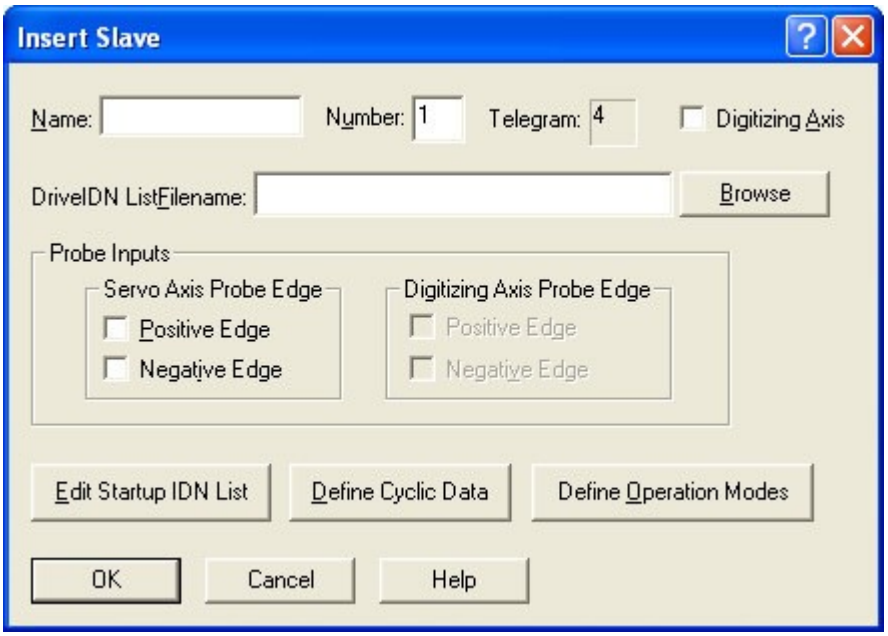
4. The default update rate is 4 ms. Choose an **Update Rate** from the drop down list (1, 2, 4, or 8) if you want to change this. The update rate for any ring cannot exceed the CPU update rate. The CPU update rate is the fastest of all servos initialized. If the SERCOS slave axis is a servo axis, the ring update rate must be the same as the axis update rate.
5. Choose the **Baud Rate** from the drop down list.
6. Choosing **YES** for **Pause after Phase 2** allows you to send/receive additional IDNs via the ladder if required. Use the SCR_CONT function to continue on through phase 4.
7. Choose **OK** to accept your ring configuration.

Once you have entered a ring in SERCOS setup, you can edit it by highlighting the line the ring is on and pressing the **Enter** key or selecting **Edit** | **Ring Data** from the menu. This brings up the **Edit Master Ring Data** dialog. To insert another ring, highlight an existing ring or the end of rings line and press the **Insert** key. The ring will be inserted above the highlighted line.

Inserting and Editing SERCOS Slaves

Inserting/Editing SERCOS Slaves

After the ring has been entered, highlight the **End of Slaves** line in the Setup screen and press the **Insert** key or select **Insert | Slave** from the menu. The **Insert Slave** dialog appears.



1. Enter the name you want to assign to the slave axis.
2. If the CPU is a standalone MMC or PiC, enter the slave number (1-8).
   If the CPU is an MMC for PC, enter the slave number (1-32).

   Note: The number entered here must match the address switch set on the slave.

3. With a PiC or standalone MMC CPU, the slaves on a ring must be numbered to match the quantity of slaves entered and must begin with 1. For example, if you are entering three slave axes on this ring, number them in any order (i.e. 3, 1, 2; or 1, 3, 2 or 1, 2, 3. However, they cannot be numbered as 1, 2, 4). If the CPU is an MMC for PC, enter the slave number (1-32) in any order, that matches the address switch set on the slave. Slaves do not have to be numbered to match the quantity of slaves entered. This is known as "Slave Gapping" and is allowed only with an MMC for PC CPU. If you later change the CPU type, you will need to renumber the slaves accordingly.
4. The **Telegram:** number defaults to 4. If the slave will be controlled by motion.lib, then this is the telegram number you want. If you want to change to one of the numbers listed below, you can do so under **Define Cyclic Data**.

Telegram #	Description
0	No data
1	Torque control
2	Velocity control, velocity feedback
3	Velocity control, position feedback
4	Position control, position feedback
5	Position and velocity control, position and velocity feedback
6	Velocity control
7	User-defined

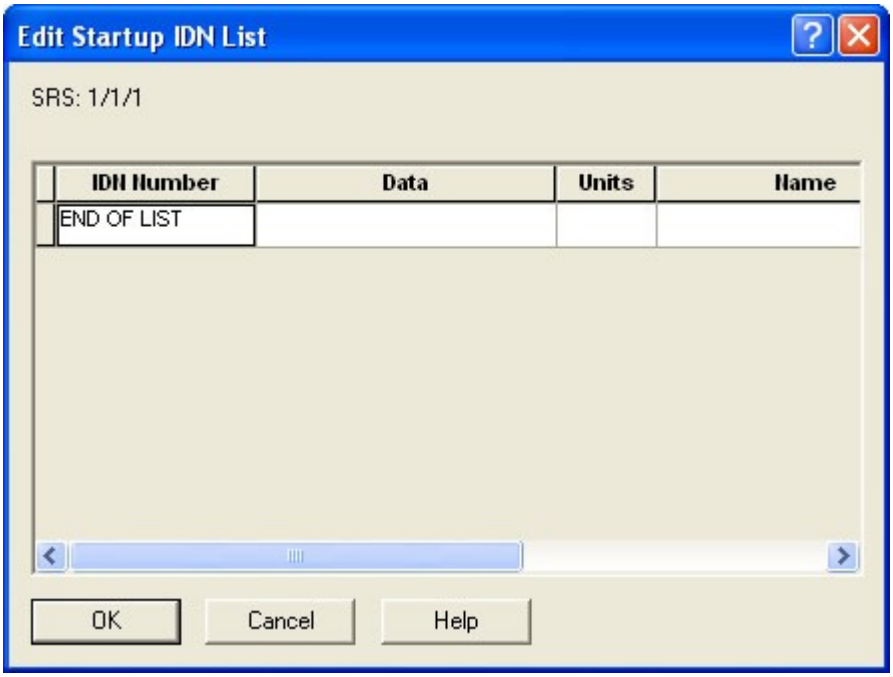
5. Enter the filename and location of the **DriveIDN ListFilename**: for this slave. Use the Browse button to locate the file if necessary.
6. If this axis is a digitizing axis (external feedback will be used), check the **Digitizing Axis** box. The telegram changes to 7, **Digitizing Axis Probe Edge** checkboxes become active, and IDN 53 is added to the AT (if not already present).
   Note: A valid drive filename before you can select the Digitizing Axis box.
7. In the Probe Inputs section, you can select whether the positive or negative edge of the probe input should be used for a servo or digitizing axis. If you use probe edges in your ladder, be sure to check them here in setup. The Telegram defaults to 7 when a probe input box is checked. The following IDNs will be added to the AT if they are not already present:
   - Servo Axis - 130 for positive edge, 131 for negative edge
   - Digitizing Axis - 132 for positive edge, 133 for negative edge
   - For either Servo or Digitizing Axis - 179 if any box is checked.

   Once you have inserted a slave in setup, you can edit it by highlighting the line it is on and pressing the **Enter** key or select **Edit | Slave Data** from the menu. The **Edit Slave Data** dialog appears. The **Edit** dialog looks just like the **Insert** dialog.

Edit Startup IDN List

Edit Startup IDN List

When you click on **Edit Startup IDN List**, the following dialog appears.



If you are entering IDN numbers to be used at startup with this slave axis, double-click on the **END OF LIST** entry in the IDN number column or press the **Insert** key. The Insert IDN dialog appears.

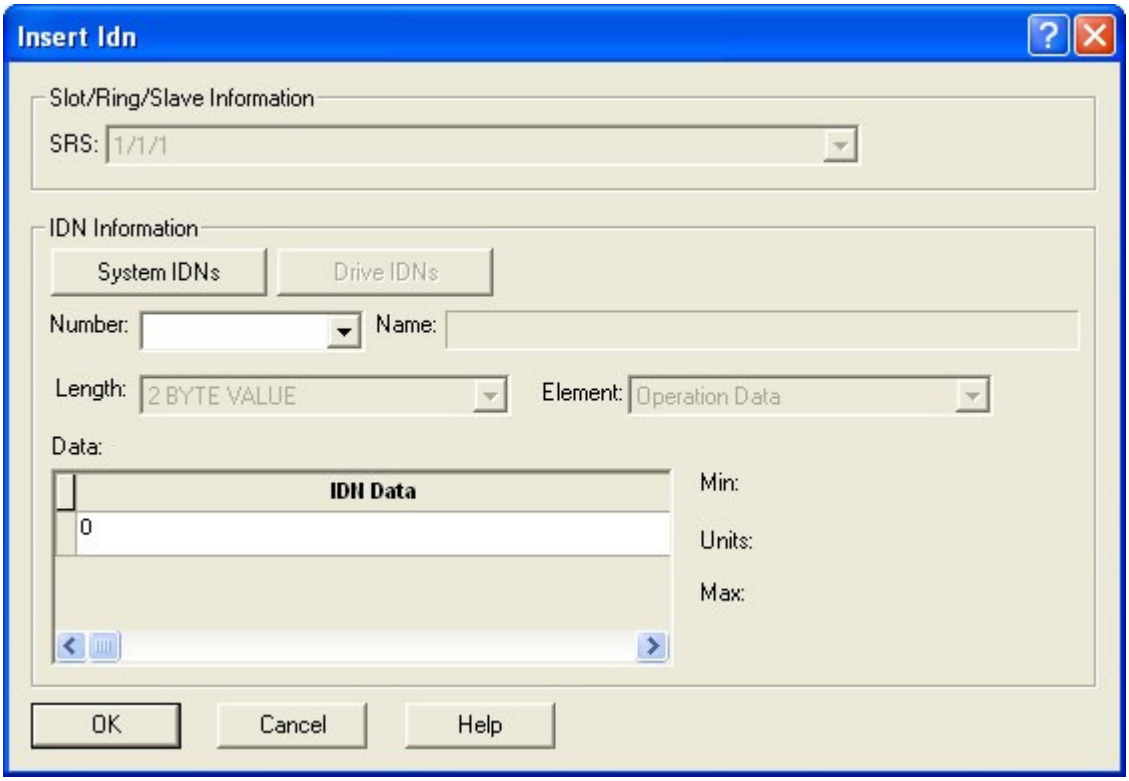
To edit an existing entry, double-click on that entry in the list or press the **Enter** key. The **Insert IDN** dialog appears and you can make the necessary changes to the selected IDN. If you press the **Insert** key on an existing entry, you can add a new IDN. It will be entered directly above the existing one.

You can cut/copy/paste entries within this list using the <**Ctrl + X**, **Ctrl + C**, and **Ctrl +V**> keys.

Inserting and Editing IDNs

Inserting/Editing IDNs

Enter the data for the IDN to be added to the startup list.



- The Slot/Ring/Slave Information identifies the slave you are inserting an IDN for.
- The System IDNs button brings up a list of system IDNs from the SERCOS specification. If you select an IDN from this list, it will appear in Number:.
- The Drive IDNs button brings up a list of drive IDNs from the file you uploaded from the drive. If you select an IDN from this list, it will appear in Number: You can choose an IDN that is not in any list by entering its number from the range of 1 to 65535 (S1 to S32767 or P0 to P32767) in the Number: field.
- The Name: field displays the IDN name for an IDN number that can be found in any list.
- The Length: field indicates the size of the data (two or four byte, variable length one, two, or four byte data strings). This information is usually found in the system or drive IDN file. If not, refer to the SERCOS specification and enter the size listed there.
- The Element: field indicates the SERCOS element to use.
- Min: displays the minimum value allowed for the selected IDN.
- Units: displays the units used with the selected IDN.
- Max: displays the maximum value allowed for the selected IDN.
- The IDN Data field allows you to enter the value within the minimum/maximum range given.
- Clicking OK will place the data entered into the startup list. Cancel allows you to exit without saving any data.

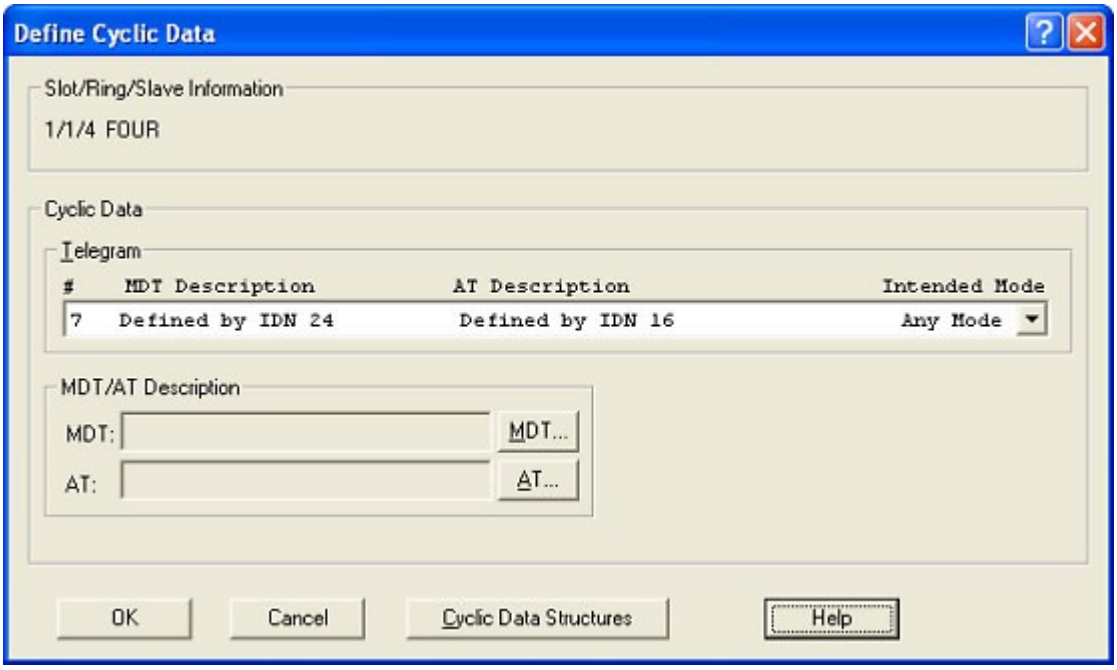
Define Cyclic Data

Define Cyclic Data

From the Edit Slave Data dialog, click on **Define Cyclic Data**.

The Slot/Ring/Slave Information identifies the slave you are defining cyclic data for.

The Telegram area allows you to choose from the list of telegrams shown in a drop down list.

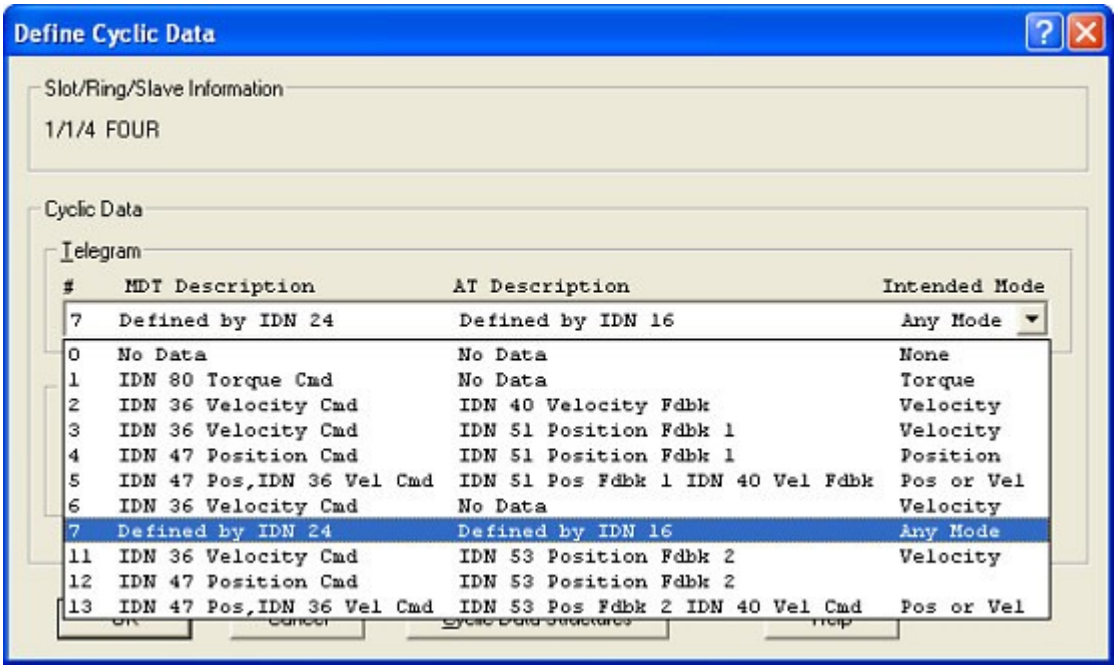


The telegram you choose is held in IDN 15. The **MDT** and **AT** telegram boxes hold the IDNs connected to the telegram you select.

Note:

Once SERCOS is initialized, you cannot change this configuration. The operation mode must support these cyclic data requirements.

If you choose any **Telegram** number from the drop down list excluding number 7, the cyclic data will be defined for you. If you choose number 7, you must be sure that the drive IDN list has been uploaded from your drive and stored in a file. Then you define the cyclic data.



If you choose any telegram other than 7 you do not have to make any other choices.

If you choose telegram 3, 4, or 5, you are using feedback 1 on the drive.

If you choose telegram 11, 12, or 13, you are using feedback 2 on the drive.

If you choose telegram 7, you must also define a list of IDNs for sending and receiving cyclic data.

The **MDT** and **AT** buttons to the right of the **MDT:** and **AT:** description boxes are only active if telegram 7 is chosen. They include lists of IDNs from IDN 187 (AT) and IDN 188 (MDT). These come from the drive list that you uploaded from your drive. You click on an IDN in the list to add it to the description. You can click on a highlighted IDN in the list to remove it from the description.

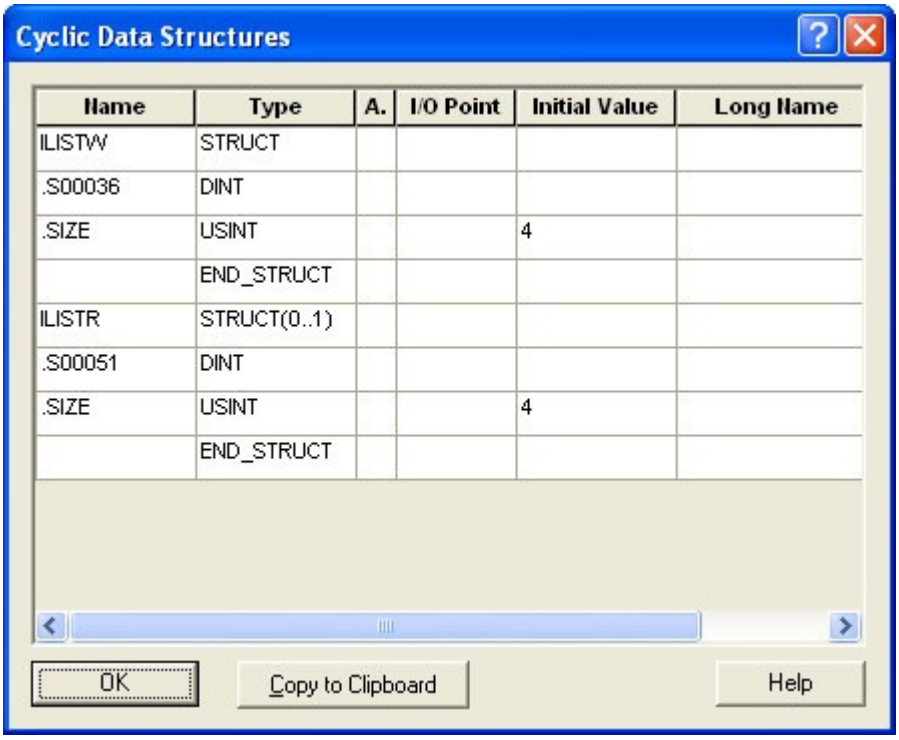
Note:

When you are working with motion.lib, select either telegram 4 or telegram 7. If you choose 4, nothing further needs to be done. If you choose 7, IDN 47 (position read) must appear in the MDT description and IDN 51 for feedback 1 (IDN 53 for feedback 2) (position write) must appear in the AT description. You can then place additional IDNs in the description from the MDT/AT lists. The list of IDNs for MDT becomes IDN 24 and for AT becomes IDN 16.

Cyclic Data Structures

From the Define Cyclic Data dialog, click on **Cyclic Data Structures**.

If you are using the SCA_RCYC and SCA_WCYC functions from motion.lib, you will need to include the structures in the Cyclic Data Structures dialog in your ladder. The Copy to Clipboard button allows you to transfer these structures to your software declarations table with the Paste command. The structure ILISTW is used with the SCA_WCYC function and the structure ILISTR is used with the SCA_RCYC function.

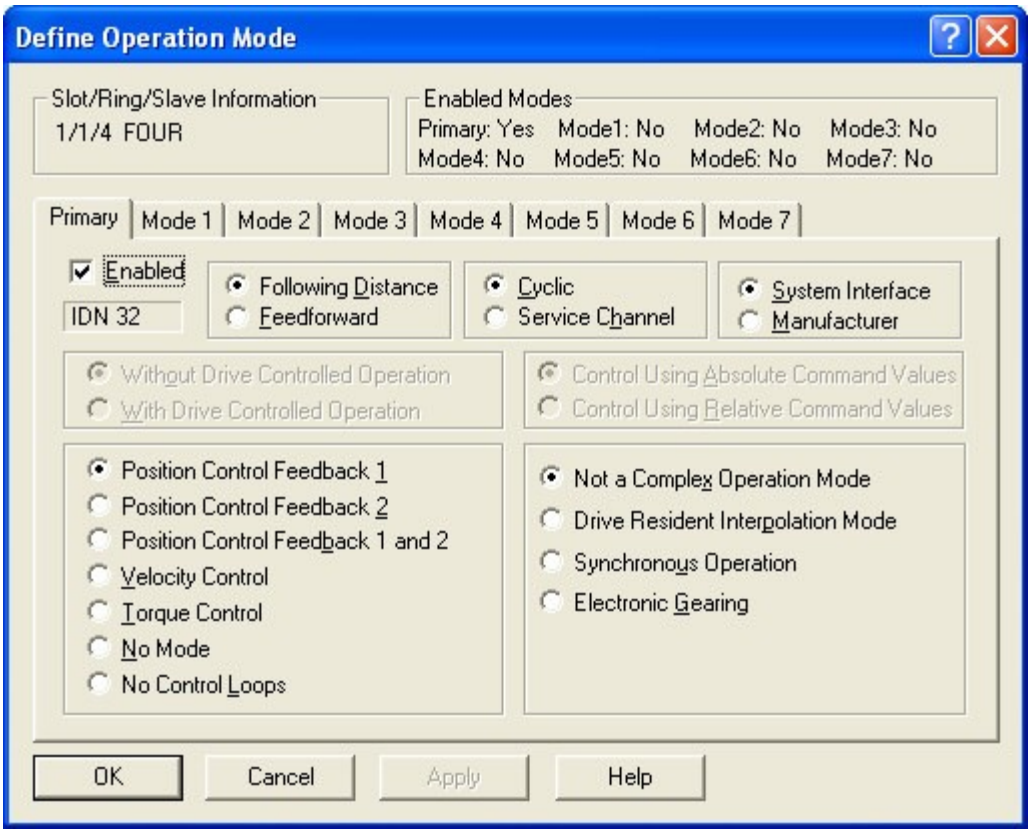


Define Operation Modes

Define Operation Modes

From the **Edit Slave Data** dialog, click the **Define Operation Modes** button.

A SERCOS slave can operate in up to eight modes provided the drive you are using supports them. The modes are defined and enabled in the Define Operation Mode dialog.



The slave is identified in the **Slot/Ring/Slave Information** area.

The enabled modes are shown in the **Enabled Mode** area.

When the **Define Operation Mode** dialog is opened, the **Primary** Mode tab is enabled with the defaults shown. You can change these defaults for the Primary Mode and you can enable any other mode and change the defaults connected to them. Simply click on the tab you want to define and enable.

The modes must support the cyclic data requirements that are configured using the **Define Cyclic Data** dialog.

Operation Mode Application Note

Typically, you will operate in the Primary Mode, which represents position control. If your drive must operate in an additional mode such as torque, one or more of the Secondary modes is defined. The options you choose will depend on the features of the drive. If you choose something that is not supported by your drive, an error will be reported by the SCR_ERR function when the SC_INIT function block is called during the initialization of the drive. After you have made your SERCOS setup function, downloaded it to the control, and started the scan, your selections will be sent to the drive after phase 2. If an error occurs, it will appear in the SCR_ERR function and the initialization will stop. The slave number, the IDN, and the reason for the error are reported on the SLV, IDN, and SERR outputs respectively.

The option of **Cyclic** or **Service Channel** determines whether the command for this mode will be sent to the drive over the cyclic data or the service channel. Since torque control usually requires a fast update time, you would want to use cyclic data. Velocity control, on the other hand, can use the service channel. If cyclic is chosen, a custom telegram must be created. To do this, click on the **Define Cyclic Data** button in the **Edit Slave Data** dialog.

When you are using motion.lib to operate the drive, you use the position or Primary Mode. Position commands are sent to the drive. When operating in a Secondary Mode, the ladder has the responsibility of setting the mode and sending the appropriate commands.

The mode can be set by calling the SCA_CTRL function with the OPTN input set to 1. Prior to calling SCA_CTRL, the default is the primary mode. You can disconnect motion.lib from the drive by writing a 1 to WRITSV variable 48. Then you use the SCS_CTRL function to write the loop state, the cyclic data, and the operation mode to the drive.

The command is sent to the drive by the ladder. It is based on the mode selected and whether the transmission will be cyclic or service channel. If cyclic is chosen, the SCA_WCYC function is used to write the command from the ladder. It is recommended that this function be called from a task that is executed every servo update.

Copying SERCOS Data

Copying SERCOS Data

Once you have entered a SERCOS configuration in setup, you can use the copy/cut/paste commands.

How to use the copy/paste commands

1. Enter the SERCOS configuration.
2. Select the ring(s) or slave(s) you want to copy or cut and choose one of the following methods:
   - Click or buttons on the standard toolbar
   - Select **Edit | Copy** or **Edit | Cut** from the menu
   - Press <**Ctrl + C**> (copy) or <**Ctrl + X**> (cut)
   - Right-click and select **Copy** or **Cut**.

     Note: When you cut/copy a ring its slaves are also cut/copied.
3. Place the focus on the location you want to paste into and choose one of the following methods:
   - Click button on the standard toolbar
   - Select **Edit | Paste** from the menu
   - Press <**Ctrl + V**>
   - Right-click and select **Paste**.

     The configuration will be pasted above the selected location.
     Note: Pasting is limited by the valid number of rings and slaves allowed for the CPU type.
4. Double-click on the slave. Make the necessary changes and choose **OK**.

Cut/Copy/Paste Limitations (between different SRC files)

- When you cut/copy/past between setup files that were created for different CPU types, you will receive confirmation messages about converting the slot, ring and slave values to zero. Each ring and slave will have to be edited to enter valid values.
- If you are trying to paste more rings than allowed by the CPU type, you will receive an error message, and nothing will be pasted.
- In some cases when pasting rings, more slaves will be pasted than allowed for that CPU type. They will have to be manually deleted.
- When pasting a slave, the Receive Continuous and Send IDN entries for the slave will not be pasted. That information must be manually entered.

- When pasting a ring from MMC for PC to PiC or standalone MMC, if the baud rate of the ring is 8 or 16, the baud rate will be set to 4.

<**Ctrl + C**> (copy) or <**Ctrl + X**> (cut), and <**Ctrl + V**> (paste) can also be used when editing the Startup IDN, Receive Continuous, and Send IDN lists.

Saving SERCOS Setup File

Saving a SERCOS Setup File

It is a good idea to save your file at regular intervals as you work on it.
Using the **Save** command, you can save the file under its existing name.
Using the **Save As** command, you can specify a new filename and/or a location where you want to store the file.

To save a new file

1. Select **File | Save** from the menu.
2. In the **Save As** dialog that appears, choose a drive and folder where you want to save your setup file.
3. Enter a name in the **File name:** field. It is strongly recommended that the filename follow the DOS 8.3 naming convention of 8 characters, a period, and 3 characters.
4. Click **Save**.

To save an existing file

1. Select **File | Save** from the menu.

To save a file under a different name or in a different location

You can use the **File | Save As** command to change the name and/or location of a file. By giving the file a different name when you save it, you create a copy of the existing file while keeping the original intact.

1. Select **File | Save As** from the menu.
2. Select the location for the file in the **Save in:** field.
3. Enter the new file name in the **File name:** field.
4. Click **Save**.

To save in a format readable by a previous version of PiCPro

SERCOS Setup files created or modified in V13.0 cannot be read by previous versions of PiCPro.

- To save the file in a format that can be read by older versions of PiCPro, select **File | Save As** from the menu.
- In the **Save as type:** combo box, select the desired PiCPro version.
- If invalid information for the specified format exists in the file, details will be shown in the Information Window to indicate the invalid ring(s) or slave(s).
- If the CPU type is MMC for PC, the file cannot be saved in a format readable by older versions of PiCPro.

Printing SERCOS Setup

Printing SERCOS Setup

You can print the selection you have highlighted or all the information in the SERCOS Setup file.

To print SERCOS data

1. Open the SERCOS Setup file (*.src) that you want to print. If you just want to print the data for one ring, select that ring. If you just want to print the data for one slave, select that slave.
2. Choose one of the following methods to bring up the print dialog:
   - Click button from the standard toolbar.
   - Select **File | Print** from the menu.
   - Press <**Ctrl + P**>.
3. The print dialog appears and you can click **OK**.
4. If you want to print the data for everything in your setup file, choose **All** in the print dialog and click **OK**.

Making a SERCOS Setup Function

Making a SERCOS Setup Function

After you have entered all the SERCOS setup information, you will create a SERCOS setup function to store all this information. This function will be stored in the SERCOS library you designate and can then be called in your ladder program to initialize the SERCOS setup data for your application. The SERCOS setup information will then be sent to the control when you download your application.

The name of the function will be the same as the name of the *.src file name. It will appear in the list of functions in PiCPro.

To create a SERCOS setup function

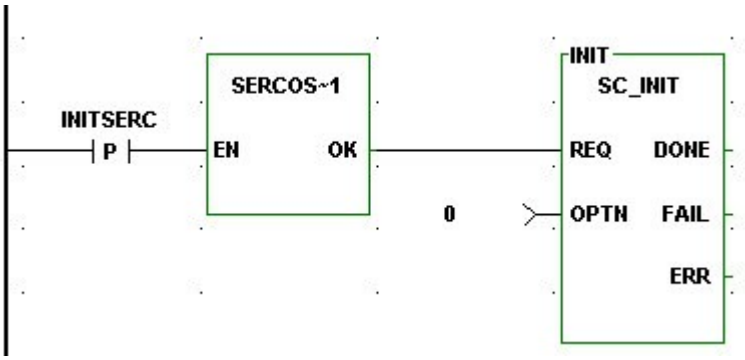
1. After all the setup information has been entered, select **Compile | Make Function** from the menu.
2. The **Save As** dialog will appear if you have not previously saved your setup file. Choose the location you want to save your .SRC file to.
   There is a default that is entered in the **File name:** field beginning with SERCOS1.SRC. You can accept this name or enter your own.

   Note: The second setup file you create will have the default name SERCOS2.SRC, the third will be SERCOS3.SRC and so on.
3. The **Compile SRC** dialog appears. The **Registered ServoSetup /SercosSetup Libraries:** section will hold the names of any setup libraries you have created previously. You may choose from this list or create a new SERCOS Setup Library by entering one in the **Library Name:** field.

   Note: If you are recompiling a function that was created earlier, you must place the function in the same library where it was originally located. You cannot select a new library location. The Library Name: fields are disabled (grayed out).
4. Click **OK** to insert the SERCOS setup function into the chosen library. If you are creating a new library a prompt will appear asking if you want to create a new library. If the location of the new library is not part of the PiCPro Library paths, a prompt will appear asking if the path should be added. Choosing **Yes** will define the library path so PiCPro can locate the function. The library and setup function will immediately show up in PiCPro under **Ladder | Functions** and in the Functions list on the toolbar.

To initialize setup data in your ladder

The SERCOS setup function you compile with the SERCOS Setup program must be incorporated into your ladder program. To initialize all the setup data you use the standard motion SC_INIT function block with your setup function. Below is a network designed to do this. The example setup function is labeled SERCOS~1.



Uploading Drive Information

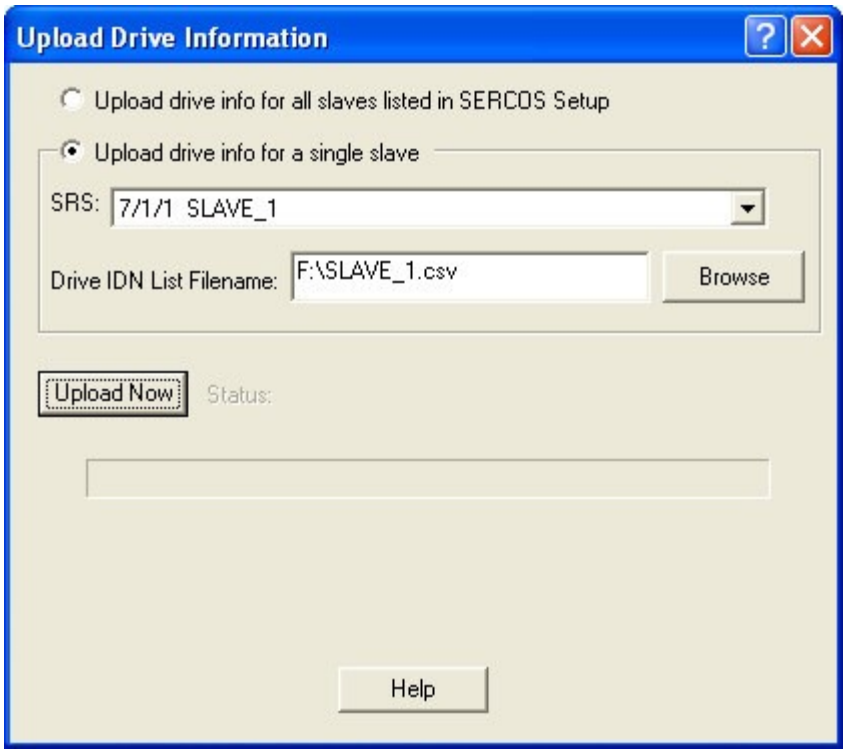
Uploading SERCOS Drive Information

To use additional SERCOS features beyond replacing the analog signal with a dig-ital interface, it is necessary to upload the drive information from the drive. This information is in the form of a list of IDNs. The list will show all the information that can be read or written from the drive. It will indicate the units and the limits for each IDN in the list. Using this information, SERCOS setup can read or write information, define custom cyclic data, or change modes.

To upload this IDN List, select **Online | Upload Drive Information** from the main menu. This dialog provides the capability to upload the IDN List from a single device or for all of the slaves defined in SERCOS Setup.

Uploading Drive Information for a Single Drive

1. Select **Online | Upload Drive Information** from the main menu. This dialog provides the capability to upload the IDN List from a single device or for all of the slaves defined in SERCOS Setup.
2. To upload drive information for a single drive, select Upload drive info for a single slave as shown below:



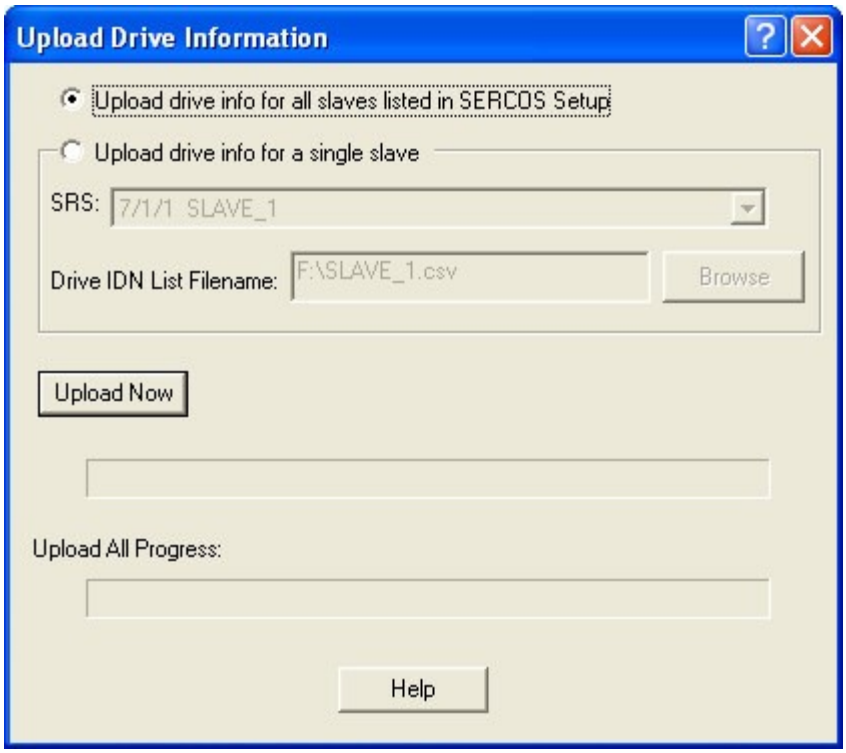
3. Select a slot/ring/slave (SRS) from the drop down list. Available slave axes will be listed in the drop down list for SRS:. Choose the slave to which the drive information is to be uploaded.
4. Select a Drive IDN List Filename. The **Drive IDN List Filename:** box allows entry of a path and filename or the capability of searching for a folder and filename by using the **Browse** button. It is recommended that the .csv extension be used since it allows the file to be opened in Excel. However, any three letter extension can be used.
5. Finally, select Upload Now to begin the upload process. The **Status:** line will indicate that the upload is complete, whether or not the process was halted due to an error, or if your workstation is waiting for a response. The status bar will show the progress of the upload.

Note:

Upload can only be done in phase 2 or 4. The upload time can vary considerably based on the type of drive, the number of IDNs supported and the type of control being used.

Uploading Drive Information for all Slaves in SERCOS Setup

1. Select **Online | Upload Drive Information** from the main menu. This dialog provides the capability to upload the IDN List from a single device or for all of the slaves defined in SERCOS Setup.
2. To upload drive information for all the drives listed in SERCOS setup, select **Upload drive info for all slaves listed in SERCOS Setup** as shown below:



3. Select Upload Now to begin the upload process for all slaves listed in SERCOS Setup. SRS:, Device IDN List Filename, and Status will update to reflect which slave is currently being uploaded, the filename the IDN List is being written to, and the status of the current slave's upload.
4. The **Upload All Progress** bar indicates the progress for the upload of all slaves. It indicates the number of SERCOS slaves that have been updated versus the total number of SERCOS slaves to upload. Errors that occur during the upload as well as the completion status of each upload are provided in the information window.

Note:

Upload can only be done in phase 2 or 4. The upload time can vary considerably based on the type of drive, the number of IDNs supported and the type of control being used.

Changing IDN Data and Uploading IDNs Note

Changing the data value of some IDNs can change related IDNs also. One example is the IDNs that control scaling. For example, IDN 76 position data scaling type determines the units of IDN 47 position command value (inches, millimeters, etc.). The attribute and units elements of IDN 47 change based on the value of IDN 76. If your drive allows you to write the data value of IDN 76, the drive should also make corresponding changes to the attribute and unit elements of IDN 47.

When you upload the IDN list from the drive, the units and attributes of each IDN are read and stored in the drive file. If, for example, changes are made to IDN 76 after the list is uploaded, IDN 47 attribute and unit elements will be different in the drive than in the drive file.

Always upload the drive IDNs after you make changes to IDNs that affect other IDNs. You can read the drive documentation to determine which IDNs affect the attribute and unit elements of other IDNs. Following is a list of common ones:

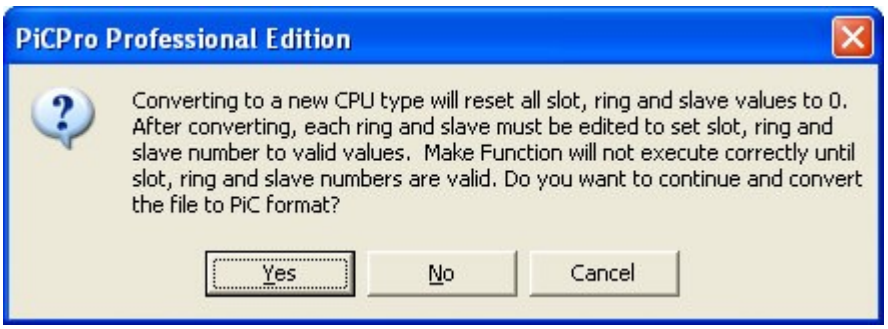
76	Position data scaling type
77	Linear position data scaling factor
78	Linear position data scaling exponent
79	Rotational position resolution
44	Velocity data scaling type
45	Velocity data scaling factor
46	Velocity data scaling exponent
160	Acceleration data scaling type
161	Acceleration data scaling factor
162	Acceleration data scaling exponent
86	Torque/force data scaling type
93	Torque/force data scaling factor
94	Torque/force data scaling exponent

Converting a SERCOS Setup File's CPU Type

Converting a SERCOS Setup File's CPU Type

Select **Edit | Convert Target CPU To | PiC or MMC or MMC for PC** from the menu.

A message dialog similar to the following will appear.



When you convert from one CPU type to another, all slot, ring, and slave values are set to zero. You will need to edit each one to assign the correct slot, ring and slave values. In cases where more rings or slaves are present than allowed for the chosen CPU type, you will need to delete them. The compile function will not allow you to have more rings or slaves than valid for the CPU type, and all must have valid values.

Valid Values are:

CPU Type	Number of Rings	Slaves per Ring	Slot Number	Ring Number	Slave Number
PiC	16	8	3-13	1-2	1-8
Standalone MMC	1	8	1	1	1-8
MMC for PC	1	32	1	1	1-32

Note:

Converting to a new CPU type will remove all entries from the Receive Continuous and Send IDN lists. The information will have to be manually loaded.

When converting from MMC for PC to a PiC or standalone MMC, if the baud rate of the ring is 8 or 16, the baud rate will be set for 4.

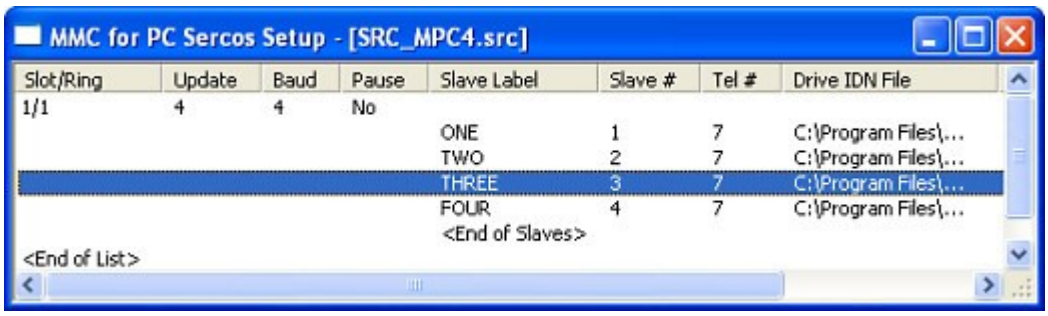
Copying a SRS Structure to the Clipboard

Copying a SRS Structure to the Clipboard

You can copy an SRS structure to the clipboard for the slave that is currently selected. This structure will contain slot, ring, and slave information. The structure can be pasted into software declarations and used as the input to the SERCOS functions that need SRS.

The procedure is as follows:

1. Create or Open the SERCOS Setup file
2. Select the Slave by clicking on the line containing the desired Slave. That line should now be highlighted.



3. Select **Edit | Create SRS Structure…** from the menu.
   The SRS structure has now been copied to the clipboard and is available for pasting to software declarations.

Note:

If any slot, ring, or slave number was set to zero (because of a conversion of CPU type, or because of pasting between files for different CPU types) and was not manually changed to a valid number, an error message will be displayed and the SRS Structure will not be pasted to the clipboard.

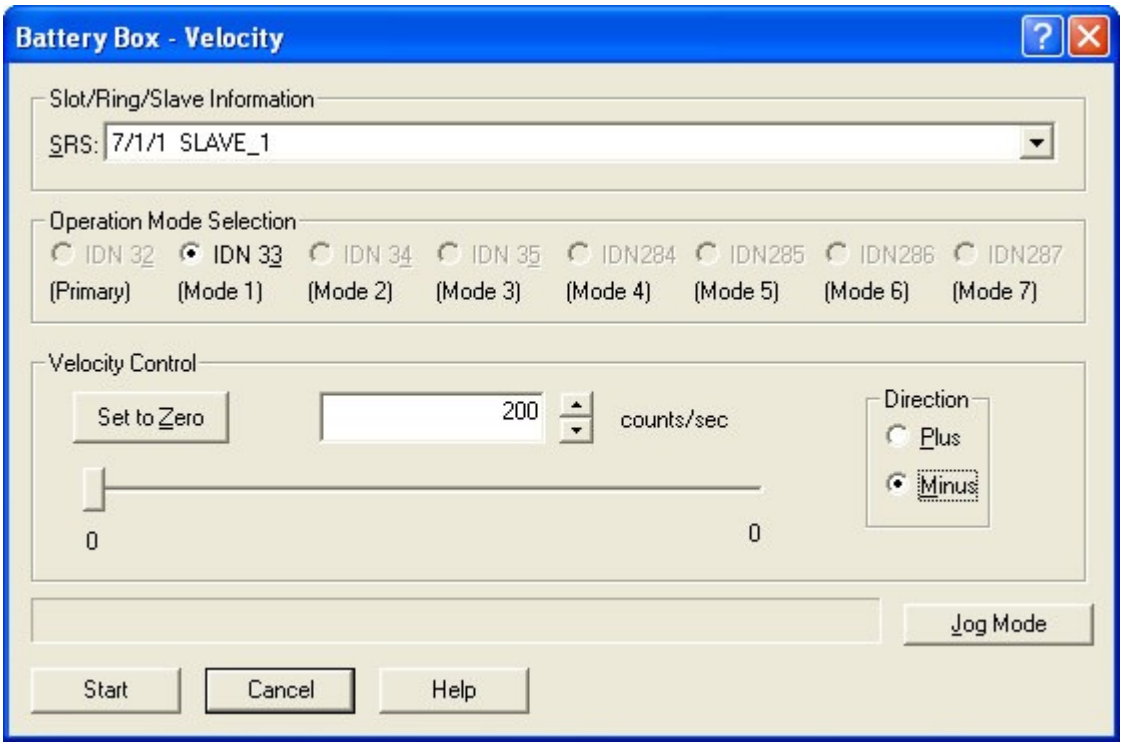
Battery Box

Battery Box

The battery box feature allows you to command velocity motion of a SERCOS slave from PiCPro.

IMPORTANT
It is the operator's responsibility to prevent possible damage to machinery that is connected to the drive due to overspeed or direction errors.

Select **Online | Control Operations | Batterybox** from the menu.



Using the Battery Box

The following procedure describes the steps to take to use the battery box to control the SERCOS drive.

1. In SERCOS setup, define the operation mode for the SERCOS slave as velocity over the service channel. It is recommended that you use one of the secondary modes for this since the primary mode is used by motion.lib. Click the mode tab, and click the **Enabled** box. Select the **Velocity Control** and the **Service Channel** radio buttons. Click **OK** when finished. Compile the function and do a full download to the controller.
2. The Drive IDN S91 is the velocity limit for the battery box. If S91 is changed to enable the battery box (i.e. Send IDN), then the Drive IDN list file must be updated as well. If S91 is left at 0, the battery box velocity will be no greater than 0 preventing axis movement. Reference IEC61491 for additional information on this IDN.
3. Ensure that all motion is stopped.
4. Call the OPENLOOP function to open the servo loop.

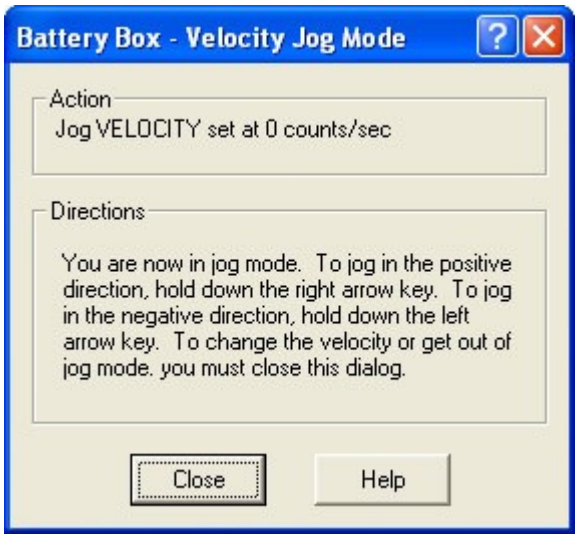
Note: It is important to remember that there is a loop in the control and also a loop in the SERCOS drive that must be opened.

5. Call the CLSLOOP? function to ensure that both loops have been opened.
6. Use the WRITE_SV function to set variable 48 to one. This prevents motion.lib in the control from controlling the drive. You can now use the battery box to move the axis.

   Note: The drive loop is closed while the battery box is active. It does not open when you exit the battery box.
7. The Slot/Ring/Slave Information (**SRS:**) defaults to the selected slave in the SERCOS Setup List. If no slave was selected, all of the other controls in the dialog are disabled until you fill in the SRS.
8. Select the operation mode.
9. Type in the velocity or adjust the slider. You can also use the up and down buttons.
10. Select either **Plus** or **Minus** for the direction.
11. Click **Start**. Once started, the motion continues until you click on the **Stop** button.

OR

12. Click Jog Mode for jogging the SERCOS drive and follow the directions shown in the dialog.



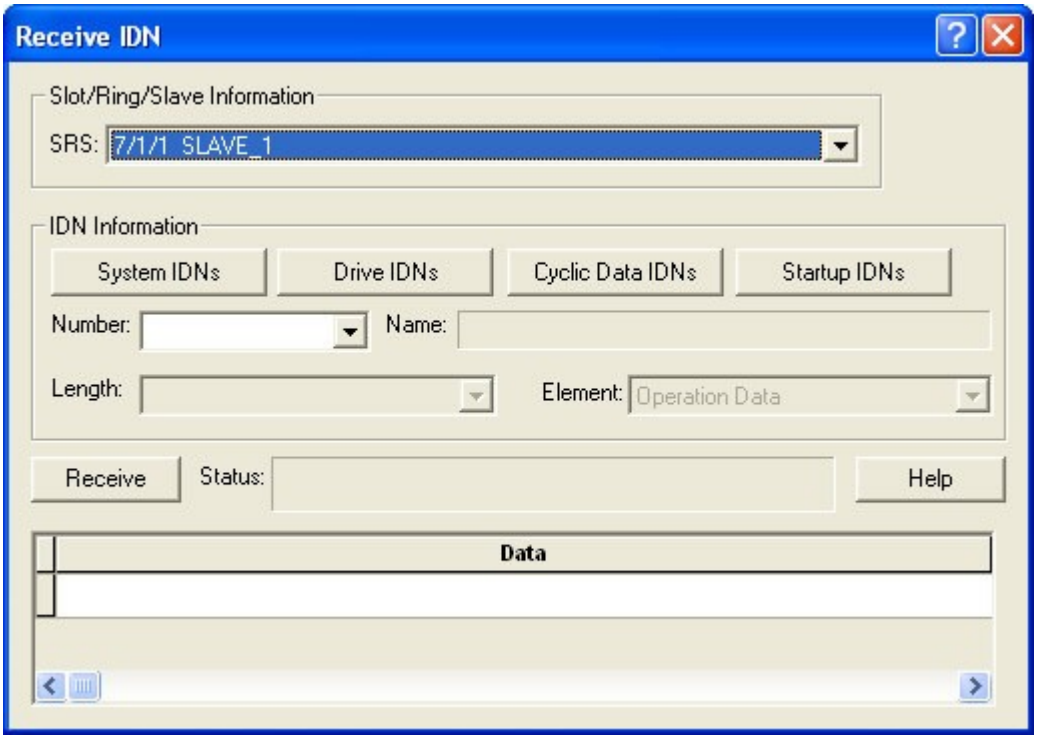
Note: With either method, there may be some delay between selecting an action and the drive motor reacting depending on the speed of the workstation.

13. When you are finished using the battery box, exit it.
14. Use the WRITE_SV function to set variable 48 to zero. This gives control back to motion.lib in the control and both loops will be opened as in step 2.
15. Ensure that all motion is stopped.
16. Call the SCA_CLOS function to close the loop.
17. Call the CLSLOOP? function to confirm that both loops are closed.

You are now ready to resume control using motion.lib in the control.

Receive IDNs

You can receive information on an IDN from the drive with this feature (**Online | Control Operations | Receive Idn…**). If you have a slave selected, the **Slot/Ring/Slave Information** will default to it. If there is no information in the **SRS:** field, you cannot proceed.



You can choose from four categories of IDNs; **System**, **Drive**, **Cyclic Data**, or **Startup IDNs**. The **Number:**, **Name:**, **Length:**, and **Element:** boxes will be filled in when you select an IDN from one of the lists.

Or you can enter an IDN number (Range from 1 to 65535; or S1 - 32767 or P0 - 32767). If the number you entered can be found in one of the IDN lists, the data length will be displayed. If it cannot be found, you must enter the data length. Valid values will be listed in the drop down list.

The **Element:** field allows you to select what element of the IDN you want to receive. The default is the operation data. Other elements include the name, attribute, units, minimum value, and maximum value. Choose them from the drop down list.

After you have entered the IDN number, the **Receive** button is activated. Click it to read the requested IDN from the drive. The **Receive** button changes to **Abort**.

The **Status:** display reports on the progress of the receive command.

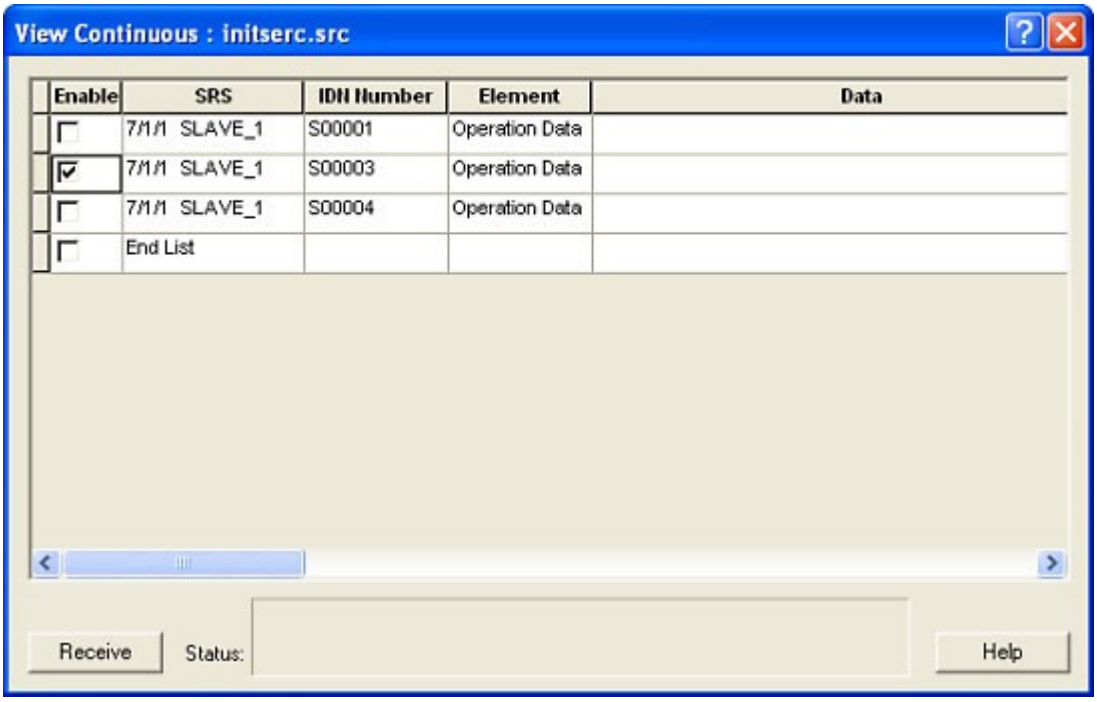
The **Data** field holds the data for the requested IDN. If the IDN is a string and is not completely displayed, double-click on the Data entry to view the entire string. If the IDN requested is a variable length array, a grid will be displayed. Each array element is displayed in a separate row.

Receive Continuous IDN Data

Receive Continuous IDN Data

You can choose to receive IDN data continuously. Select **Online | Control Operations | Receive Continuous…** from the menu. Add new IDNs to the list by double clicking or pressing the **Insert** key on the **End List** line. The Insert IDN dialog appears.

Click in the **Enable** column to choose which IDNs you want to receive continuously.



With **Receive Continuous**, the **Element** column can include operation data, attribute, minimum value, and maximum value.

Note: Variable length data cannot be requested in **Receive Continuous**. Use **Receive IDN**.

To delete an entry from the receive continuous list, click in the first column or select the entire row and press the **Delete** key. A warning message will appear. Click **OK** if you want to proceed with the deletion.

To cut, copy, and paste in the list use the <**Ctrl + X**, **Ctrl + C**, and **Ctrl +V**> keys.

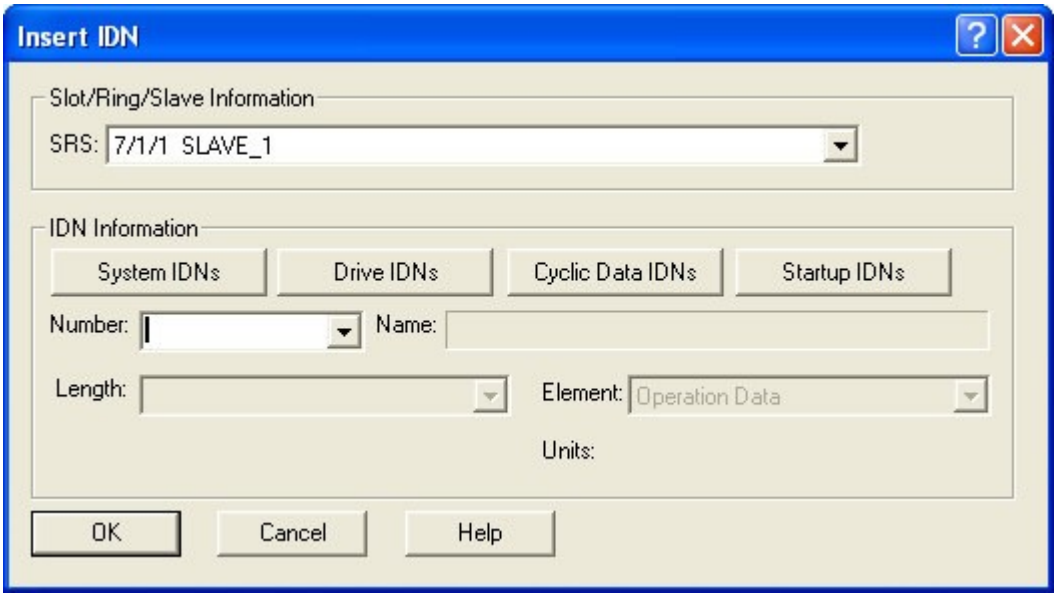
When the **Receive** button is chosen, all the enabled IDNs will be received continuously. The button text changes to **Abort**. You can choose **Abort** to halt the receive continuous command. The **Status:** field reports on the status of the receive continuous command.

Inserting/Editing IDNs for Receive Continuous

To insert a new IDN in the Receive Continuous list, you can double-click on the **End List** line or press the **Insert** key when the focus is on any line. The new IDN will be inserted above the line focus is on.

To edit an existing IDN in the Receive Continuous list, you can double-click on the entry or press the **Enter** key. To enter a new IDN when the focus is on an existing entry, press the **Insert** key. The new IDN appears above the selected line.

The **Insert IDN** dialog shown below appears.



The **SRS:** information must be entered in order to proceed.

- You can choose an IDN from any of the four IDN buttons or enter one from the range 1 to 65535 or S1 to S32767 or P0 to P32767 in the **Number:** field.
- If the number you entered is located in any of the IDN lists, a name will appear in the **Name:** field and a value will appear in the **Length:** field.
- If the number is not found in any of the IDN lists, no name appears in the **Name:** field and you must enter the length in the **Length:** field.
- The **Element:** field defaults to operation data. You can change this to attribute, minimum, maximum, or data from the drop down list.
- **Units:** displays the type of units for the selected IDN.

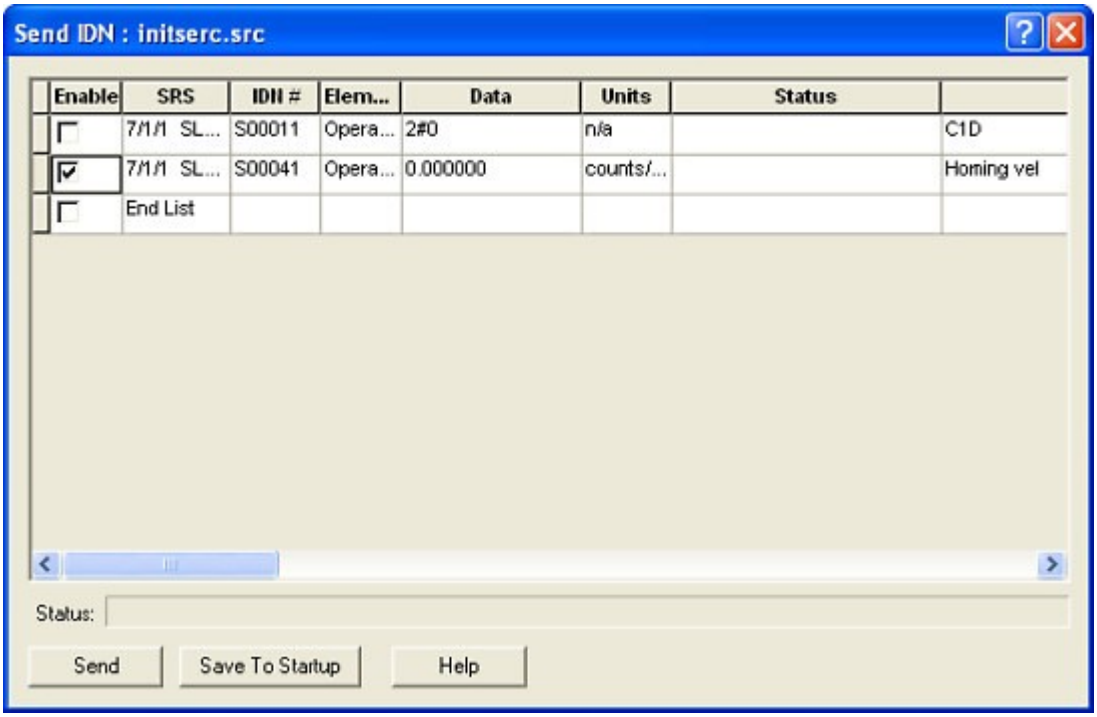
Click **OK** to add the information entered to the Receive Continuous list. Click **Cancel** to ignore any changes and return to the **Receive Continuous** dialog.

Send IDNs

Send IDNs

If you want to send IDNs, select **Online | Control Operations | Send IDN** from the menu or right-click and select **Send IDN**. Add new IDNs to the list by double clicking or pressing the **Insert** key on the **End List** line. The Insert IDN dialog appears and you enter the information for the IDN you want to add to the Send List.

Once your list is complete, you must check the box in the **Enable** column if you want to send that IDN when you select the **Send** button.



You can cut/copy/paste entries within this list using the <**Ctrl + X**, **Ctrl + C**, and **Ctrl +V**> keys.

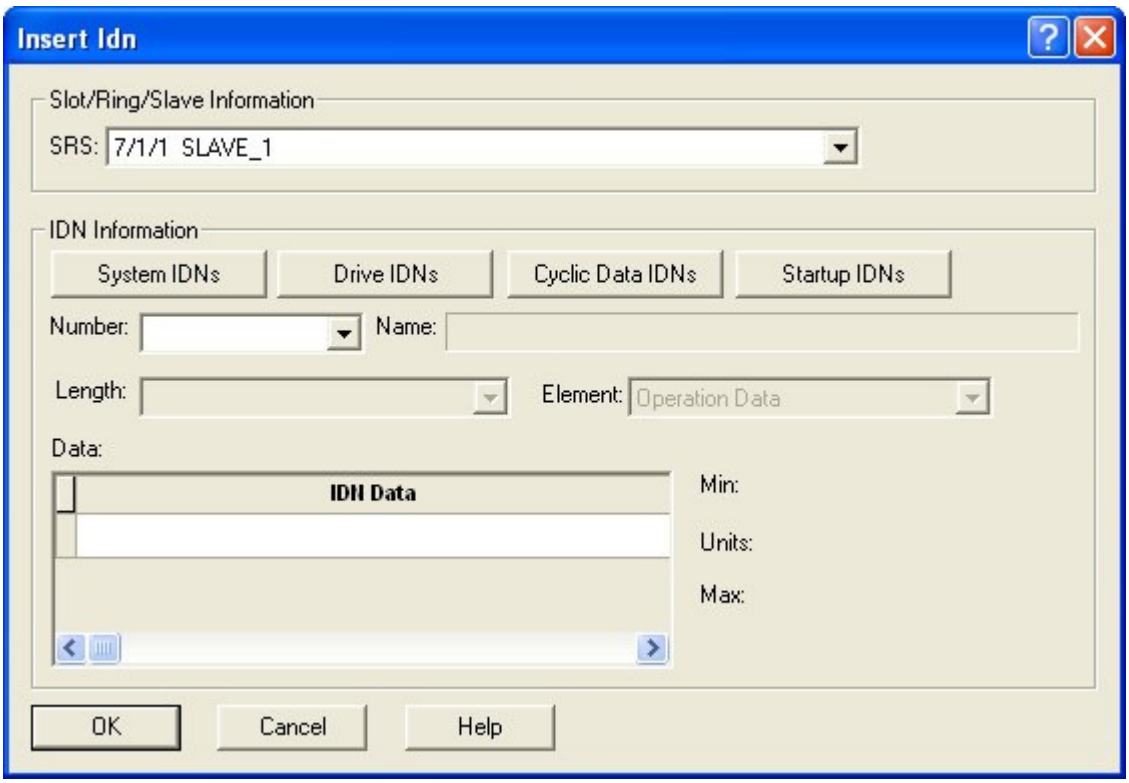
When the **Send** button is selected, the text changes to **Abort** so that you can select it to stop the transfer at any time. The **Status:** bar reports on the progress of the send command. Communication and drive errors that may occur are also reported here. The **Save To Startup** button saves the IDNs you highlight to the appropriate startup list. You may want to do this after you know the data you have entered is working for your application.

Note: Only IDNs with the Operation Data element can be saved to the startup list.

Inserting/Editing IDNs for Send

To insert a new IDN in the Send list, you can double-click on the **End List** line or press the **Insert** key when the focus is on any line. The new IDN will be inserted above the line focus is on.

To edit an existing IDN in the Send list, you can double-click on the entry or press the **Enter** key. The **Insert IDN** dialog shown below appears.



The **SRS:** information must be entered in order to proceed.

- You can choose an IDN from any of the four IDN buttons or enter one from the range 1 to 65535 or S1 to S32767 or P0 to P32767 in the **Number:** field.
- If the number you entered is located in any of the IDN lists, a name will appear in the **Name:** field and a value will appear in the **Length:** field.
- If the number is not found in any of the IDN lists, no name appears in the **Name:** field and you must enter the length in the **Length:** field.
- The **Element:** field defaults to operation data and indicates the SERCOS element to use. You can change this to attribute, minimum, maximum, or data from the drop down list.
- The **Element:** field indicates the SERCOS element to use.
- **Min:** displays the minimum value allowed for the selected IDN.
- **Units:** displays the units used with the selected IDN.
- **Max:** displays the maximum value allowed for the selected IDN.
- The **IDN Data** field allows you to enter the value within the minimum/maximum range given.

Click **OK** to place the data into the Send List. Click **Cancel** to exit without saving any data.

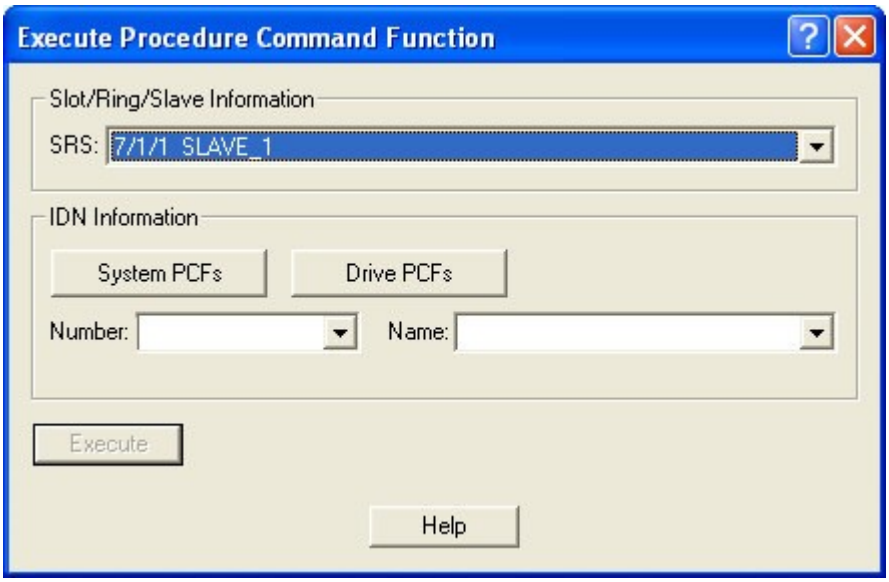
Execute Procedure Command

Execute Procedure Command

The **Online** | **Control Operations | Execute Procedure CMD** Command Function (PCF) allows you to select and execute SERCOS procedure commands.

The **Slot/Ring/Slave Information** must be entered in order to proceed. If you have selected a slave in SERCOS setup, it will appear in the **SRS:** field. You can choose one from the drop down list.

The **System PCFs** and the **Drive PCFs** buttons hold lists of PCFs from the system file or the drive file respectively. Select a PCF (IDN) from a list or enter one. It will be displayed in the **Number:** field. The name appears in the **Name:** field.



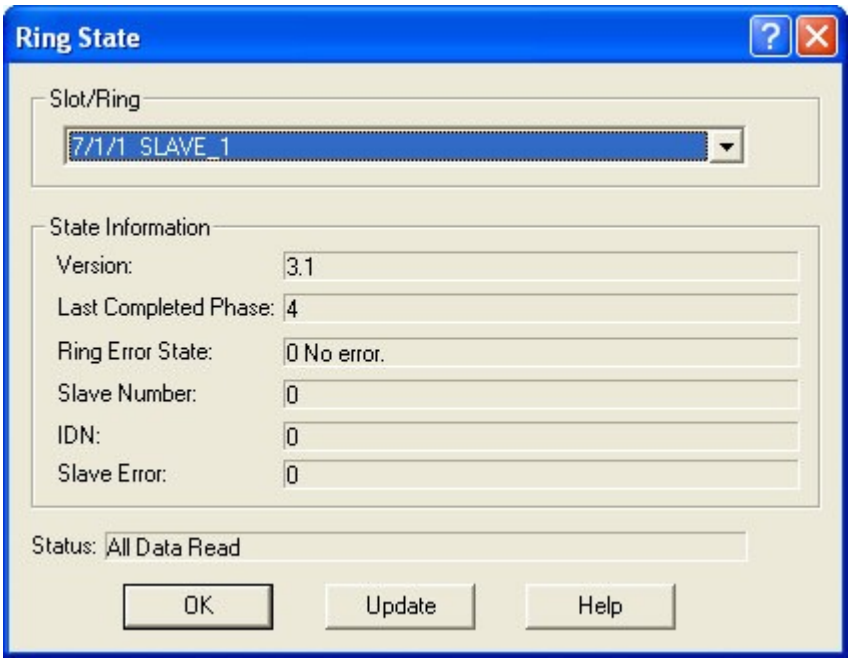
Once the PCF has been entered, the **Execute** button is active. Click it to send the PCF IDN to the drive and begin the procedure. The progress of the procedure will be noted to the right of the **Execute** button.

The **Execute** button converts to a **Cancel** button when progress begins.

Ring State

Ring State

By using **Online | Control Operations | Ring State…** you can read the **State Information** shown below for a ring.



The **Version:** represents the version number of the firmware on the SERCOS module.

The **Last Completed Phase:** gives the phase number including whether the ladder is halted after phase 2.

The **Ring Error State:** displays one of the ring error numbers shown below if one occurs.

ERR#	Description	What to do/check
0	No error	
3	Axis is not initialized, is not a SERCOS axis, or the slot/ring/slave specification is incorrect.	• SERCOS board in correct slot • SR structure members correct
17	The SERCOS module did not receive an expected AT response. Cable could be disconnected.	• Check connection
20	Phase 0 detected that the ring is not complete.	• Check connection • Ensure drive is turned on
65	Error occurred calculating when MDT should occur.	• Too many slaves on one ring • One or more drives cannot accommodate required MDT

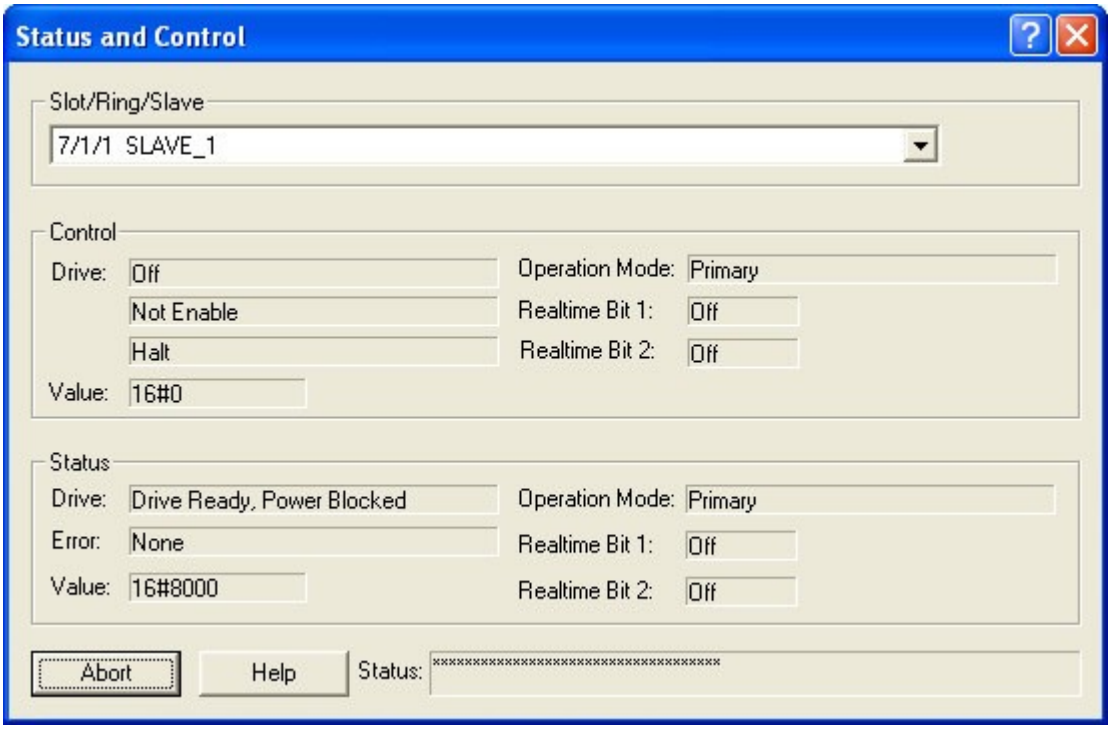
66	Error occurred calculating when drive data valid.	• Too many slaves on one ring • One or more drives cannot accommodate command times
67	Error occurred calculating when feedback data valid.	• Too many slaves on one ring • One or more drives cannot accommodate feedback capture times
68	Error occurred calculating total time required for communication cycle.	• Too many slaves on one ring • Cyclic data on slaves too long • Update rate too fast
69	Error occurred calculating cyclic data memory for SERCON processor.	• Too many slaves on one ring • Cyclic data on slaves too long
70	Error occurred calculating cyclic data memory for internal memory map.	• Too many slaves on one ring • Cyclic data on slaves too long
71	Error occurred calculating service channel memory map.	• Too many slaves on one ring • Cyclic data on slaves too long
74	CPU on SERCOS module has too many tasks during update.	• Too many slaves on one ring • Cyclic data on slaves too long
128	Slave error occurred. Read SERR output to identify error. The SLV output indicates the slave number.	• SLV output contains slave number • IDN output contains the IDN transfer that caused the error • SERR output contains the drive generated error number • Read Drive diagnostic IDN 95
136	Individual slave will not respond. The SLV output indicates the slave number.	• Address switch on drive does not match slave number • Baud rate switch on drive does not match rate in ring definition • SLV output contains slave number that does not respond
144	Individual slave cannot carry out a Procedure Command Function. The SLV output indicates the slave number.	• SLV output contains slave number • IDN output contains the Procedure Command Function that caused the error • For IDN = 127, read IDN 22 to read list of IDNs still required by the drive • For IDN = 128, read IDN 23 to read list of IDNs still required by the drive • Read Drive diagnostic IDN 95

- The **Slave Number:** can be 1 to 8 when using PiC or a standalone MMC or 1-32 when using an MMC for PC.
- The **IDN:** is either a S (system) or P (product) IDN number.
- The **Slave Error:** holds the SERR if one occurs.
- **Status:** provides current information on the status of the ring.
- Selecting the **Update** button updates the ring data in the dialog.

Slave Status Control

Slave Status/Control

In SERCOS, there is a status word from each slave to the control and there is a control word from the control to each slave. You can read the data in each word using the **Online | Control Operations | Slave Status/Control** command that brings up the dialog shown below.



The **Control** section displays the control word data continuously. The three lines for the **Drive:** tell whether it's on or off, enabled or not, halted or restarted. The **Operation Mode:** indicates which mode is in effect. The **Realtime Bit**s indicate whether they are on or off. The word **Value:** is displayed in hex.

The **Status** section displays the status word data continuously. The **Drive:** line tells whether the drive is ready or not, the logic is ready, and the power is active or not. The **Error:** line reports on whether or not an error has occurred. The **Operation Mode:** indicates which mode is in effect. The **Realtime Bit**s indicate whether they are on or off. The word **Value:** is displayed in hex.

IDN Lists

Overview: IDN Lists

There are lists of IDNs for the system, the drive, the cyclic data, the startup, the system PCFs, and the drive PCFs. While working in SERCOS setup, there are several dialogs that allow you to access these lists of IDNs. You can also view the system and drive IDN lists from the **View** menu.

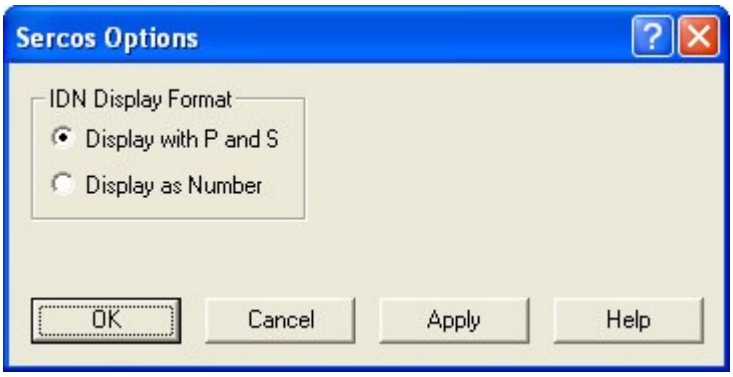
Options for IDN Display

There is an **Options** command found in the **View** menu in SERCOS setup. It allows you to choose how IDN numbers (1 to 65635) will be displayed. There are two groups of IDN numbers:

- The P group is specific to the drive manufacturer's product. They range from 32768 to 65635 or P0 to P32767.
- The S group is defined by the SERCOS specification. They range from 1 to 32767 or S1 to S32767.

You can choose to display IDNs with the P and S format (default) or with numbers only.

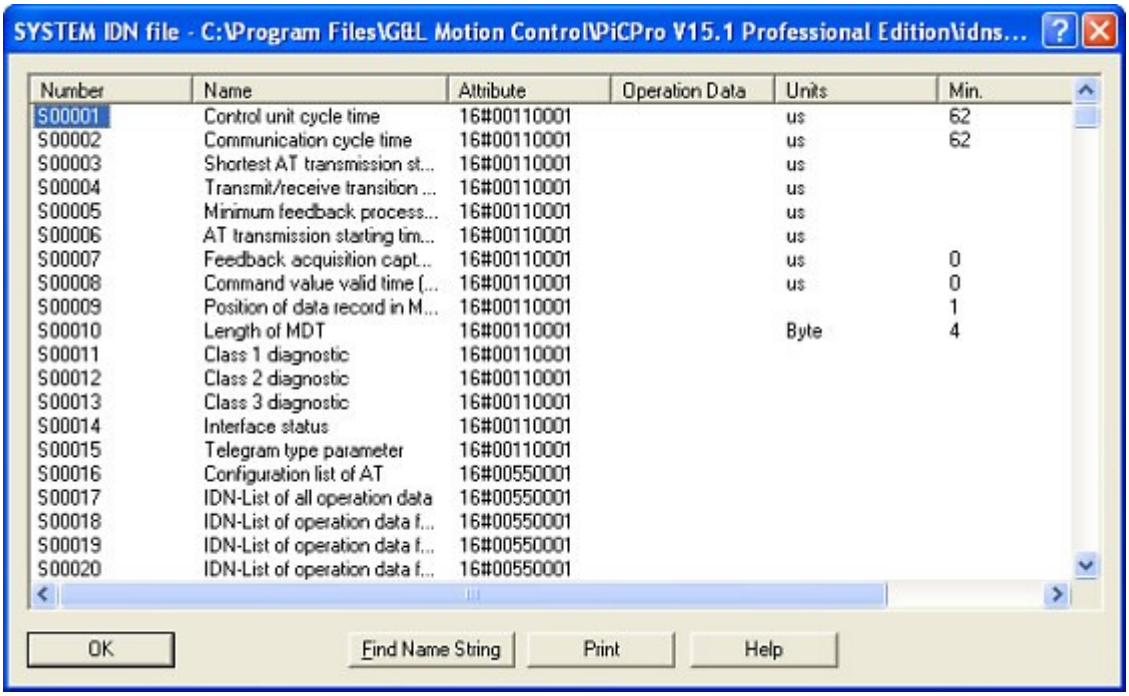
Note: Not all drive manufacturers support the P and S format.



When the **Display with P and S** option is selected, if you enter an IDN number without the letter prefix, it will be added for you when you tab off of the IDN field. When the **Display as Number** option is selected, if you enter an IDN number with the letter prefix, it will be converted to the number only when you tab off the IDN field. After selecting the IDN display format you want, choose **OK** to accept your format and close the dialog. If you choose **Apply**, your format will be applied but the dialog does not close.

IDN Lists

The system IDN list appears when you click on the **System IDNs** button in a dialog or choose **View | View System IDN** from the menu. If under **View | Options** in SERCOS setup, **Display with P and S** is chosen, the System IDNs are identified with an "S" preceding the IDN number. If **Display as Number** is chosen, then the system IDNs are numbered from 1 to 32767. Clicking on the **Number** column sorts the list by number; clicking on the **Name** column sorts the list by name. Also, the columns will toggle between ascending and descending order.

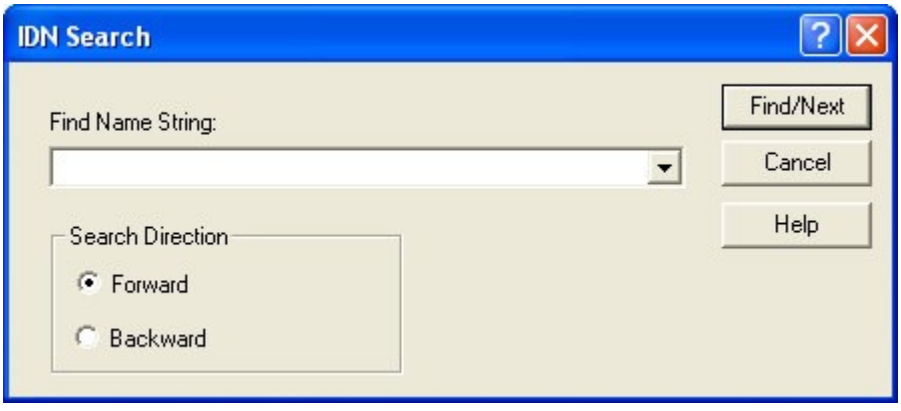


You can use the **Find Name String** button to bring up an **IDN Search** dialog.

- When you click on the **Drive IDNs** button in a dialog, it displays a list of IDNs that you uploaded from the drive. You can sort by number or name, toggle the sort order, search by name, and print this drive IDN list.
- When you click on the **Cyclic Data IDNs** button in a dialog, it displays a list of IDNs that you entered as cyclic data.
- The **Startup IDNs** button in a dialog displays a list of IDNs you entered for startup.

Finding a Specific IDN in an IDN List

When viewing an IDN list, you can use the **Find Name String** dialog to help you locate a specific IDN. If you know the name or part of the name of the IDN you want to search for, the **Find Name String** dialog locates the IDNs that match your search criteria quickly and easily.



To find specific text in an IDN list, follow these steps:

1. Click the **Find Name String** button on the IDN list you are viewing. This will display the dialog above.
2. Type the desired text to search for in the field labeled **Find Name String:**.

3. Select the direction you wish to search, **Forward** or **Backward**, from the currently highlighted IDN.
4. Click the **Find/Next** button to begin the search.
5. If a matching IDN is found, the IDN number is highlighted. To search again for another match, click the **Find/Next** button again.
6. The most recently searched for names will appear in the drop down list.

Printing IDNs from an IDN list

When viewing an IDN List, you can use the IDN printing dialog to print the IDN list.

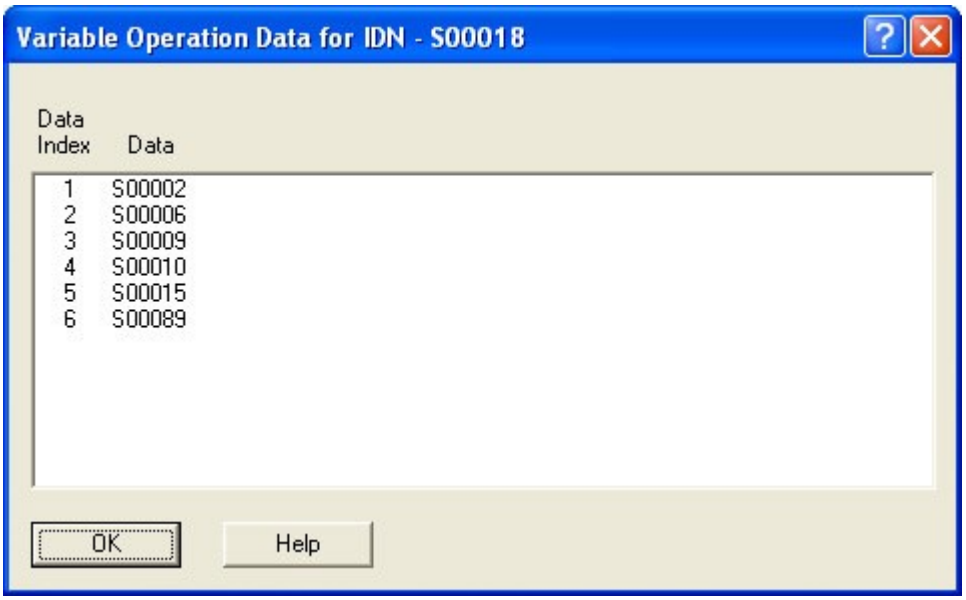
To print an IDN list, follow these steps:

1. Click the **Print** button on the IDN list you are viewing. This displays the IDN printing dialog shown above.
2. Select **Brief Listing** to print the IDN number, name, and data for all of the IDNs in the list.
3. Select **Full Listing** to print all the IDN elements for all the IDNs in the list.
4. Click **OK**. This will display the **Print** dialog for your default printer.

Viewing Variable Length Data from an IDN List

Some IDNs in IDN lists have variable length operation data. This is indicated by the word Variable appearing in the **Operation Data** column of the list. (S00018 is an example.)

To view this data you must use the **Variable Operation Data** dialog shown below .



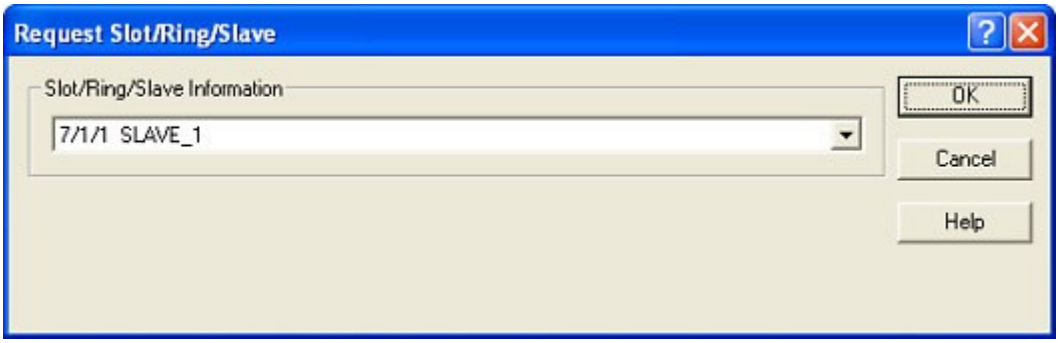
To view variable length operation data, follow these steps:

1. Right-click on the IDN with variable data in the IDN list. This will display a popup menu. Select the **View Variable Data** item from this menu. This brings up the **Variable Operation Data** dialog shown above.
2. The variable length Operation Data is listed in this dialog under the heading **Data**.
3. You will notice a column to the left of the data labeled Data Index. This is just a column that numbers the data items in the displayed list. It is not a part of the Operation Data itself.
4. When finished, click **OK** to close the dialog.

Specifying the SRS for Viewing the Drive IDN List

In order to view the Drive IDN List from the **View** menu on the menu bar, you must indicate which drive you want.

Using the **Request Slot/Ring/Slave** dialog, select the appropriate SRS which uniquely identifies the desired drive.



To specify the SRS, follow these steps:

1. From SERCOS Setup, select **View | View Drive IDN** from the menu.
2. The **Request Slot/Ring/Slave** dialog shown above appears. You specify which drive by selecting the appropriate SRS from the drop down list provided.
3. After choosing the SRS, click the **OK** button. The Drive IDN list for the specified drive will be displayed.

Troubleshooting SERCOS

Troubleshooting SERCOS

Here are a few tips on troubleshooting while working in SERCOS.

Communication Problems

- Communication phase 4 must be completed before you can begin to control.
- The ERR output of the **SC_INIT** function block can provide information on what went wrong during communication.
- If **SC_INIT** executes correctly with no errors, you should check for ring errors next using the **SCR_ERR** function or within SERCOS setup using the **Online | Control Operations | Ring State** command. Information reported here indicates problems with moving through the communication phases.
- Check the phase number completed by using the **SCR_PHAS** function or within SERCOS setup using the **Online | Control Operations | Ring** State command.
- If the drive will not advance into phase 3 or 4, it is possible that there are IDNs that need to be defined. The IDNs that have not yet been defined are contained in IDN 22 and 23. This list can be read from the ladder using the **SCA_RECV** or **SCS_RECV** function or within SERCOS setup using the **Online | Control Operations | Receive** Idn command.

Control Problems

- If the loop will not close, you can read the status of the drive using the **SCA_STAT** or **SCS_STAT** function or the **Online | Control Operations | Slave Status/Control** command. The control word has 16 bits. Bits 1 and 2 indicate the state of power stage the drive is in. Bits 8, 9, and 10 indicate the operation mode. You may also want to read IDNs 11, 12, and 13.
- A loss of feedback error may occur if the ring has not reached phase 4.
- If the drive does not accept IDNs, the drive may not support the feature. Check the **SERR** output of a SERCOS function to learn more.
- Use **SCS_** or **SCA_RECV** functions to read IDN 95. IDN 95 contains a text diagnostic message with basic error conditions reported from the drive.
- IDN 11, 12, and 13 are diagnostic IDNs that report common control problems. Consult your drive documentation for the bit definition of these IDNs.

Chapter 9 - Working With Tasks and UDFBs

UDFBs

Overview: UDFBs

The User Defined Function Block (UDFB) feature allows you to convert the logic in a ladder module (.LDO) into an individual function block. The name you give to the LDO becomes the name of the UDFB. The UDFB is inserted into a library file (.LIB) and appears in the list of available functions. It can then be used in a network of any module you create.

Using the UDFB feature results in an application program that is better organized, more readable, and easier to maintain. Some ways UDFBs can be used include:

- UDFBs can segregate the logic for a section of an application program (i.e. diagnostics, fault logging, etc.).
- Custom functions with a higher level of functionality can be created (i.e. analog output with ramping).
- A single UDFB can replace in-line programming of repetitive machine functions (i.e. axis one fault control, axis two fault control, etc.).

The UDFB follows the same conventions as the standard function blocks found in PiCPro. It must be declared in the software declarations table when it is used in the network of a module. You assign a name to it when it is declared.

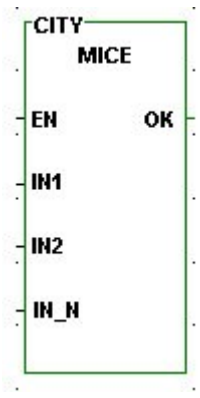
Creating an UDFB

Creating a UDFB

Briefly, you will do the following to create and use a UDFB.

1. Open a new ladder diagram and enter ladder logic that will accomplish what you want the UDFB to do.
2. Mark the variables that you want to appear as labels in the UDFB template as inputs or outputs in the software declarations table.
3. Compile the UDFB.
4. Open another ladder diagram in which you want to use the UDFB and insert the UDFB from the Function list into a network. It will have to be declared in the software declarations table and given a name (CITY in the example below.)

Ladder



Structured Text

```
<<INSTANCE NAME>>:MICE(EN:=<<BOOL>>, IN1:=<<BOOL>>,
IN2:=<<BOOL>>, IN_N:=<<NUMERIC>>,
OK=><<BOOL>>;
```

The EN input and the OK output are required. The remaining inputs and outputs are determined by you when creating the module.

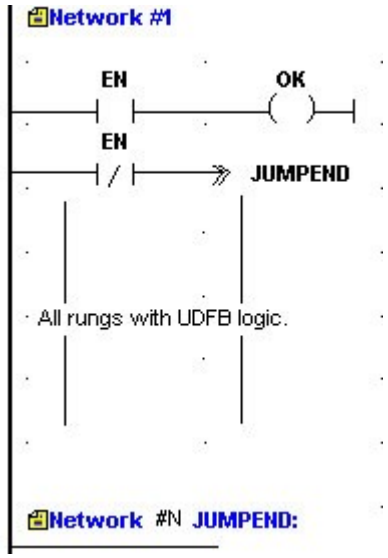
Naming the UDFB

The name of the LDO module will become the name of the UDFB when you compile it. If you have not saved the module previously, you will be prompted to enter the name at compile time. If the name is more than eight characters, it will be truncated. Be sure to choose a name that does not already exist in another module you may want to convert to a UDFB or in a standard function/function block supplied by PiCPro.

Scanning UDFB Logic

The logic contained in the UDFB is scanned regardless of whether or not there is power flow into the EN input. Therefore, in the majority of cases, you will want to include the following lines of logic in your UDFB module.

Ladder



Structured Text

```
IF NOT EN THEN
RETURN;
END IF;

OK :=1;
```

This ensures that you will always have control of the EN and OK in any module you use the function block in. It causes the program to jump to the end of the UDFB logic if the EN is not set. This prevents the logic in the function block from being scanned unless the EN is set.

Note the wire in the empty network #N with the JUMPEND label. PiCPro does not allow empty networks. A horizontal wire was added so that the empty network error is not generated.

The only situation where you would not want to control the EN and OK in this manner is if you create a UDFB that would need to work when the EN is not set. The TOF (timer off) standard function block is an example. The function block continues to execute after the EN is reset.

IMPORTANT

Execution of a UDFB that contains a data input that is a pointer (i.e. string, array, or structure) is prevented until power flow to the EN has occurred at least once. In addition, under this scenario, the power flow at the first output (OK) is forced to off until power flow to the EN has occurred at least once.

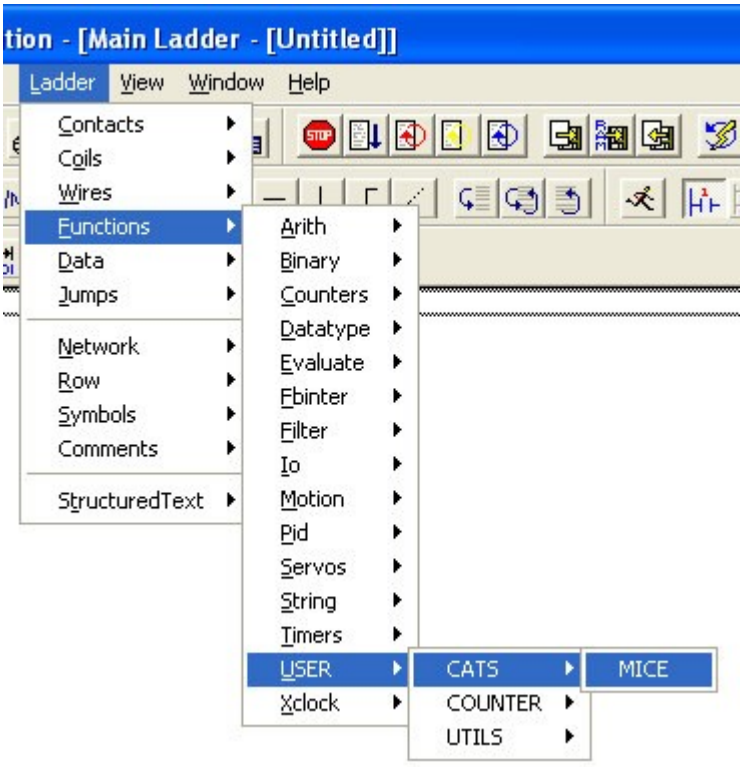
Contents of the UDFB LDO Module

Only the logic you want handled by the UDFB should be included in the module. The size of any UDFB can be up to 64K. The size of your UDFB will be listed in the information window when you compile.

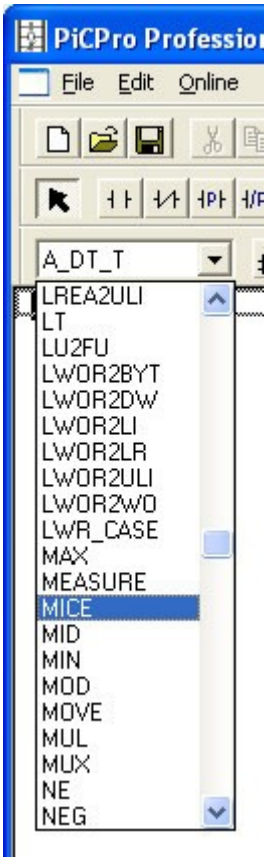
Size of UDFB Libraries

You may have one or multiple UDFB libraries. Because PiCPro copies the entire UDFB library whenever you use the **Compile | UDFB** command during program development, it is recommended that you keep the size of the UDFB library under 100K. This will improve the time it takes to build UDFBs.

The UDFB library will appear under the **Ladder | Functions | USER** menus. The individual UDFBs will appear in a fly-out from the library. In the example below the function block named MICE is located in the library called CATS.



The UDFB will also appear in the list in the Function toolbar.



Data Handling in UDFBs

Data is passed to the UDFB from its inputs in one of two ways depending on its type.

- If the internal input is any variable other than a structure, string, or an array, then the value of the external input is passed to the UDFB. This value is acted upon internally in the UDFB leaving the external variable unchanged.
- If the internal input is a structure, string, or an array, then a pointer is passed to the UDFB. This pointer gives the location of the associated data in the calling program. The data is acted upon outside the UDFB.

IMPORTANT

Data is copied and pointers are passed into a UDFB only when there is power flow to the first input (EN). Execution of a UDFB that contains a data input that is a pointer (i.e. string, array, or structure) is prevented until power flow to the EN has occurred at least once. In addition, under this scenario, the power flow at the first output (OK) is forced to off until power flow to the EN has occurred at least once.

Compiling a UDFB

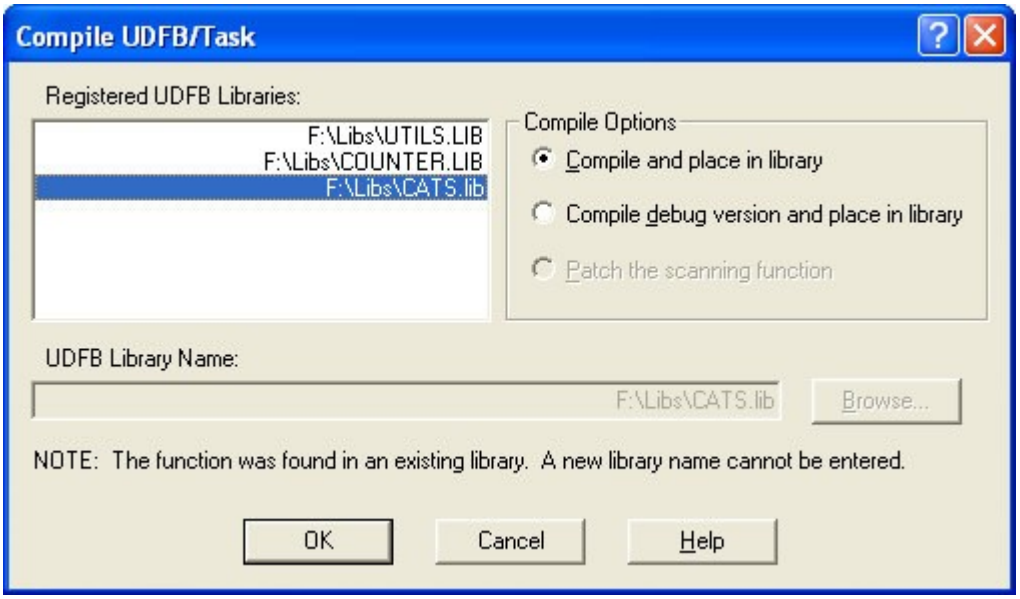
When you have entered all your logic for the UDFB in your ladder, marked all the Inputs and Outputs that you want to appear in the UDFB template, and saved the module, you can compile the UDFB and place it in a library. Select **Compile | UDFB** from the menu.

Note:

If you are recompiling a function that was created earlier, you must place the function in the same library where it was originally located. You cannot select a new library location. The UDFB Library Name: field will be disabled (grayed out).

Editing a UDFB

You can edit the UDFB either on-line or off-line depending on the types of changes you are making. PiCPro will determine this and make the appropriate options available in the **Compile Options** dialog.



Off-Line Editing

When you are doing off-line editing, the first two choices are available.

- The **Compile and place in library** option changes the module in the library and requires a full download. If you add any function/blocks and/or declarations that require initializations, you must compile the UDFB and do a full download. The scan is stopped.
- The **Compile debug version and place in library** option also changes the module in the library and requires a full download with the scan stopped. But it allows you to create a debug version of the UDFB. Creating a debug version adds additional data bits (40), data bytes (80), and function/jump links (20) to each instantiation of the UDFB for more extensive on-line changes.

Note:

Minor changes that do not add things like new functions, declarations, or jump labels can be made on-line without creating a debug version.

On-Line Editing

When you are doing on-line editing, the third choice becomes available.

- The **Patch the scanning function** option allows you to make an on-line edit change to this UDFB. This does not change the version of the module in the library, but does allow you to continue to animate and do on-line editing.

Viewing a UDFB

When you are working in the ladder in which you have entered your UDFB (called the parent ladder), you can view the UDFB ladder by selecting **View | UDFB/Task** from the menu or right clicking on the function in the ladder and then selecting **View**.

Viewing the Parent Ladder

When you are working in the UDFB ladder, you can view the parent ladder by selecting **View | Parent** from the menu or by right clicking anywhere in the ladder and selecting **View | Parent Ladder**.

UDFB Software Declarations

UDFB Software Declarations

Variables of any type with optional initial values may be declared for use in the UDFB module. However, variables cannot be external, retained, global, or discrete I/O.

Note:

If you need to add discrete I/O in order to test the UDFB module, be sure to remove them from the module and the software declarations table before compiling the UDFB.

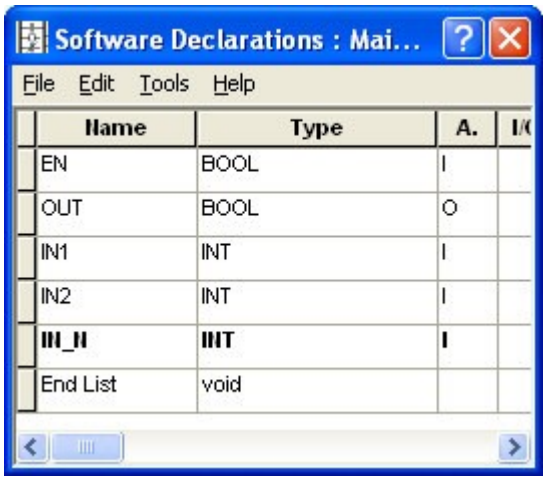
The variables which will become the inputs for the UDFB may be any data type except function blocks. The variables which will become the outputs for the UDFB may be any data type except function blocks, structures, arrays, and strings.

Inputs that are structures, arrays, and strings all pass pointers to the UDFB and, therefore, cannot be used as outputs. It is possible, however, to design a function block in which the result of the function block being executed ends up in a structure, array, or string used as an input.

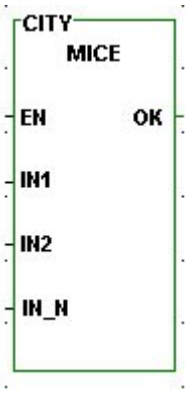
Naming the Variables

Up to the first four characters you assign to the UDFB input and output variables in the software declarations table will become the labels in the UDFB template.

Software Declarations Entries



Example UDFB Template



Order of UDFB Inputs and Outputs

The first input and the first output will always become the EN (enable) and the OK of the function block. Their data type is Boolean. It is recommended that they appear before any other UDFB inputs and outputs in the software declarations table.

Additional UDFB inputs and outputs should be entered in the software declarations table in the order you want them to appear in the function block template. The inputs appear on the left side of the template and the outputs on the right.

Number of UDFB Inputs and Outputs

The maximum number of inputs or outputs for a UDFB is 64. It is recommended that you keep the number to a minimum (under 16). More can be declared if necessary, but transferring all the inputs and outputs to and from a function block does use scan time. There is also the constraint of the 255 element matrix to consider. If you have a large number of inputs, you may want to enter them as a structure using just one input.

Marking UDFB Inputs and Outputs

You must mark all the inputs and outputs for the function block in the software declarations table using the attribute tool. When you compile your UDFB ladder, these inputs and outputs will appear on the UDFB template in the order you have entered them. Remember that the EN input and the OK output must be entered in the software declarations table before any other UDFB inputs or outputs. Their data type is Boolean.

To mark a variable as an input or output in the software declarations table:

1. Place the focus anywhere in the row of the software declarations table that holds the variable you want to mark.
2. Choose one of the following methods:
   - Select Tools | Modify Attributes | Variable In or Variable Out from the menu.
   - Right-click and select Modify Attributes | Variable In or Variable Out
   - With focus on a cell in the attribute column, type I or O.

All of these methods will enter the **I** or **O** symbol in the Attribute column.

Tasks

Tasks

A task is a programming tool that allows you to create a module (.LDO) that will execute at periodic intervals or on the rising or falling edge of a boolean variable from within your main LDO. This provides the ability to schedule events from your main LDO.

W A R N I N G

Use discretion when programming tasks in your LDO. You must have a thorough understanding of how they work and what affect they will have on your program to ensure that your program will execute properly.

Tasks are programmed similar to UDFBs. You convert the task LDO into a function block that is stored in a library. Whenever PiCPro is executed, the task will be available through this library under the Functions menu. It can then be used in a network of your main LDO.

Comparing UDFBs and Tasks

There are some differences between tasks and UDFBs.

- Tasks can access I/O modules located in the main rack of the control. UDFBs cannot.
- A task cannot be programmed within another task or within a UDFB. A UDFB can be nested within another UDFB.
- The on-line edit feature cannot be used in a network containing a task.
- Forcing is not allowed in a task.
- When you insert tasks into your main LDO, the function block template is always the same. You cannot program any inputs or outputs for a TASK. They are predefined.

Types of Tasks

There are three types of tasks available.

1. Servo Interrupt Tasks - triggered on the 250µs, 500µs, 1, 2, 4, 8, or 16 millisecond servo time tick.
2. Hardware Interrupt Tasks - triggered on a hardware event.
3. System Tick Tasks - triggered on a multiple of the 10-millisecond system tick task.

Note:

Variables 44 through 48 are available to be used with servo tasks using the READ_SV and WRITE_SV functions. Refer to the Function/Function Block Reference Guide for information on these variables.

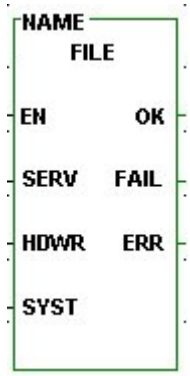
When multiple tasks are declared in the main LDO, the task that is declared first in the software declarations table is executed first.

When a task is triggered in the main LDO, the following hierarchy occurs.

- System tasks will interrupt the main LDO.
- Hardware tasks will interrupt system tasks and the main LDO.
- Servo tasks will interrupt hardware tasks, system tasks, and the main LDO.

Using the Task Template

Every task you create and subsequently use in your main LDO will use the template shown below. FILE will be replaced with the name of your task LDO file when you compile the TASK. You will provide a NAME when you declare the function block in the software declarations table of your main LDO.

TASK Template		Description
	**Inputs:**	**EN** (BOOL) - enables execution **SERV** (TIME) - 250µs, 500µs, 1, 2, 4, 8, or 16ms constant for servo task. To enter 250 or 500 microseconds, use the format T#250us or T#500us. For millisecond times, use the normal T# format. **HDWR** (BOOL) - I/O point used to trigger the hardware interrupt task must be programmed as Data In or Data Inverted which inverts a boolean input. Never program a wire or contact to this BOOL input. **SYST** (TIME) - constant or variable based on 10ms system time tick. If a time is entered that is not a multiple of 10, it will be rounded up to the next 10ms increment. Time must be less than 10.92 minutes. Enter in the T# format.
	Outputs:	**OK** (BOOL) - set if EN is on and the TASK is successfully installed. Does not indicate whether or not the task has run. **FAIL** (BOOL) - set if ERR is not equal to zero. **ERR** (INT) - Zero if no error, non-zero if an error

Structured Text

```
<<INSTANCE NAME>>:FILE(EN:=<<BOOL>>, SERV:=<<TIME>>,
HDWR:=<<BOOL>>, SYST:=<<TIME>>,
OK=><<BOOL>>; FAIL=><<BOOL>>,
ERR=><<INT>>;
```

The EN must be on for a task to run. The SERV, HDWR, and SYST inputs are mutually exclusive. Only one can be connected at a time depending on whether your task is a servo, hardware, or system interrupt task.

Errors at the ERR Output of Task

The errors that can appear at the ERR output are:

ERR #	Description
1	Task installation failure
2	The time tick requested is larger than 10.92 minutes.
3	The servo task is faster than the servo interrupt time.

Using Functions from the I/O and Motion Libraries

There are some rules that apply to functions from the standard I/O and Motion libraries when working with tasks.

I/O Functions

Functions in these groups that access an I/O module must be called in the main LDO or within the same task.

ANLGIN	ANLGOUT	JKTHERM
READFDBK	RTDTEMP	STEPPER

I.O functions in these groups can be called in the main LDO only.

COMM	NETWORK

These I/O functions can be called in both the main LDO and the task LDO.

BAT_OK?	PID	IPACCEPT	IPCLOSE	IPCONN
IPHOSTID	IPIP2NAM	IPLISTEN	IPNAM2IP	IPREAD
IPRECV	IPSEND	IPSOCK		

Motion Functions

These motion functions can only be called in the main LDO.

STRTSERV	CAM_OUT	MEASURE	REGIST	SCURVE
SC_START	SCA_SEND	SCA_RECV	SCA_CLOS	SCA_ACKR
SCA_REF	SCA_ERST	SCS_SEND	SCS_RECV	SCS_ACKR
SCS_REF	SCA_PBIT	SCA_RFIT		

These motion functions may not interrupt each other, i.e. if one function is accessing a queue, a second function is not allowed to interrupt the first function and access the same queue. If this occurs, the function in the interrupting task will not execute and the OK will not be set.

DISTANCE	POSITION	VEL_END	VEL_STRT	GR_END
RATIOCAM	RATIOSLP	RATIOSYN	RATIO_GR	RATIO_RL
REP_END	SYN_END	FAST_REF	LAD_REF	IN_POS?
NEWRATIO	NEW_RATE	ABRTALL	ABRTMOVE	Q_AVAIL?
Q_NUMBER	FAST_QUE	C_RESET	E_RESET	PART_CLR
PART_REF				

These motion functions can be called in both the main LDO and any task LDO.

ACC_DEC	CAPTINIT	CAPTSTAT	CLOSLOOP	CLSLOOP?
COORD2RL	C_ERRORS	C_STOP	E_ERRORS	E_STOP
E_STOP?	HOLD	HOLD_END	OPENLOOP	P_ERRORS
P_RESET	RATIOSCL	READ_SV	READ_SV	REF_DNE?

REF_END	TME_ERR?	TUNEREAD	TUNEWRIT	WRITE_SV
R_PERCEN	SCR_CONT	SCR_ERR	SCR_PHASE	SCS_CTRL
SCS_READ	SCS_STAT	SCA_WCYC	RESUME	RESMODE?

The STATUSSV motion function can only be called once because it does a read and then clear of all but one status flag. After an event occurs, only the first read of the status will recognize the corresponding flag.

Comparing Declaration Rules for Main and Task LDOs

There are rules for making hardware and software declarations in the main and task LDOs.

Hardware Declarations

Description	in Main LDO	in Task LDO
Hardware module used in task LDO	Yes	Yes
Hardware module used in main LDO	Yes	No
Hardware module used in both LDOs	Yes	Yes

Software Declarations

Description	in Main LDO	in Task LDO
Hardware input used in task LDO	No	Yes
Hardware input used in main LDO	Yes	No
Hardware input used in both LDOs	Yes	Yes
Hardware output used in task LDO	No	Yes
Hardware output used in main LDO	Yes	No
Hardware output used in both LDOs	Not allowed	
Variable used in task LDO	No	Yes
Variable used in main LDO	Yes	No
Variable used in both LDOs	Yes	Yes (Mark External*)

*Never mark with the External attribute in software declarations any direct I/O used in the LDO.

Hardware modules and I/O points may be used in multiple task LDOs. They must be declared in all task LDOs they are used in.

Creating a Task

Creating a Task

Briefly, you will do the following to create and use a TASK:

1. Open a new ladder diagram and enter ladder logic that will accomplish what you want the task to do.
2. Mark as External any variable in the software declarations table of the task LDO that will be used in the task LDO and in the main LDO.
3. Compile the task.

4. Open another ladder diagram that will be the main LDO where you want to run the task(s). Insert the task from the Function list into a network. It will have to be declared in the software declarations table and given a name at that time.
5. Set up the type of interrupt (servo, hardware, or system) you want and when it will run.

Before you begin to create a task program or use tasks in your main LDO, keep in mind the following:

- Tasks can access I/O located in the main rack of the control. Declare any hardware module whose I/O you use in a task in both the main LDO and in the task LDO hardware declarations table. (In the main LDO, all hardware modules must be declared whether the main LDO uses them or not. In the task LDO, only the hardware modules used in the task LDO must be declared in the task LDO.)
- Hardware outputs used in a task may not be used in the main LDO. Hardware inputs may be used in a task and in the main LDO. Hardware inputs and outputs used in one task may be used in other task(s). Declare them only in the software declarations table of the LDO(s) they will be used in.
- Inputs are strobed at the beginning of a task. Outputs are strobed at the end of a task.

  Note: When the task is running, only the inputs and outputs in the task, not the inputs and outputs in the main LDO, will be strobed.
- Do not use timer functions in a task.
- Tasks can be animated but cannot be forced or patched.
- Tasks cannot be programmed within another TASK or within a UDFB.
- If software data information in a task needs to be shared with other tasks, declare it as External in the software declarations table of the task LDO. This data must also be declared in the software declarations table of the main LDO whether the main LDO uses it or not. In the main LDO, it is never marked as External or Global.

  Note: Never assign the External attribute to direct I/O used in the LDO.
- To ensure that the data to be transferred between LDOs is from the same scan, interlock multiple externals, arrays, structures, and variables. This can be done with semaphore flags.
- Hardware interrupts can come from the first input in each group of eight on the digital input modules (numbers X.1, X.9, X.17, or X.25) or from the fast input on the encoder/resolver modules. The fast inputs for a PiC CPU must be numbered as X.1 for channel one, X.3 for channel two, X.5 for channel three, and X.7 for channel four. X represents the slot number for the module. The fast inputs for a standalone MMC CPU or MMC for PC CPU must be numbered IFAXU#.1, IFAXU#.2, IFAXU#.3, and IFAXU#.4 where # represents slot number for standalone MMC and ASIU number for MMC for PC.
- Servo interrupt tasks put the heaviest burden on system resources. Always try to conserve system resources by using the appropriate task, i.e., do not use a servo task when a system or hardware task can accomplish the same thing.

Naming the Task

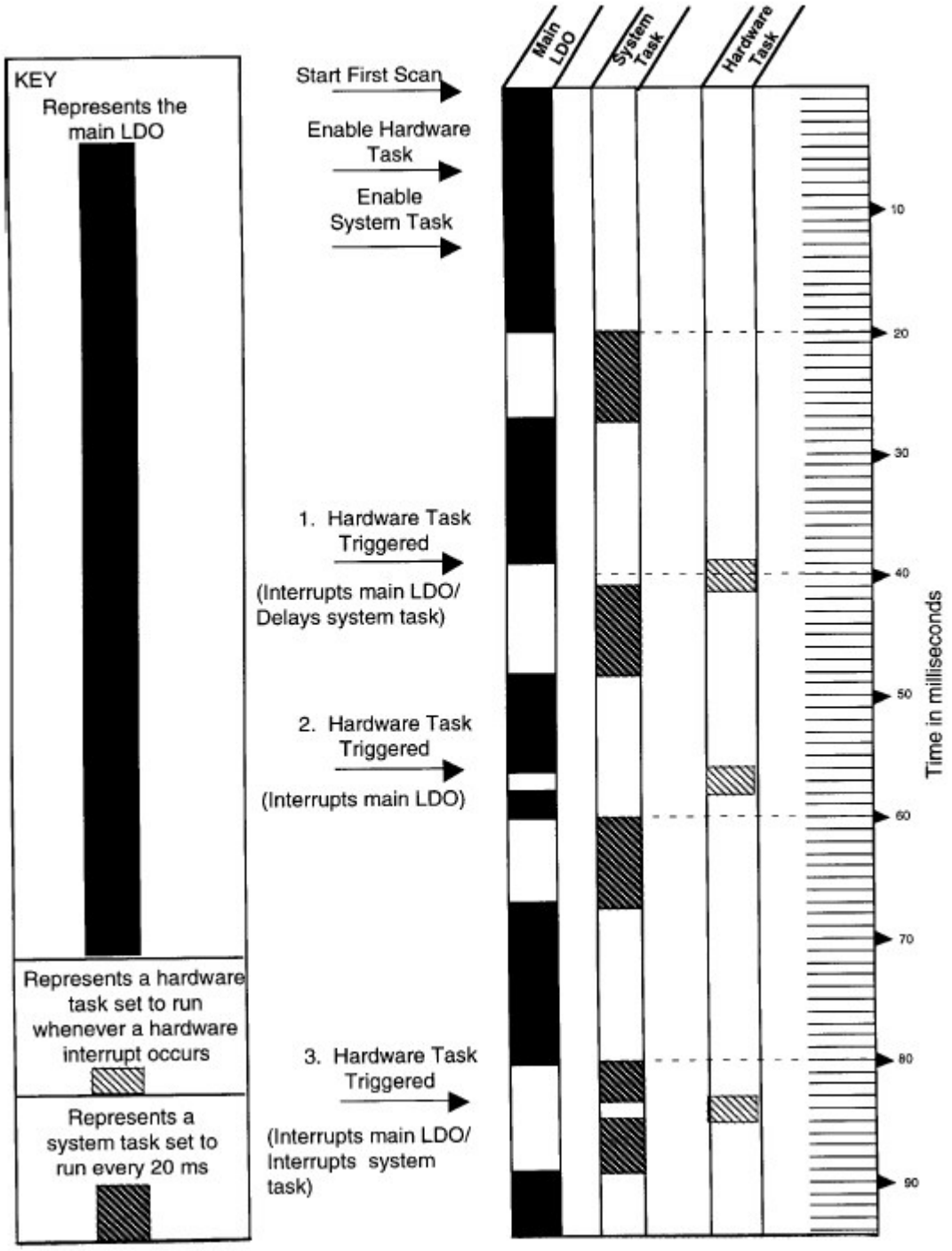
The name of the LDO module will become the name of the task when you compile it. If you have not saved the module previously, you will be prompted to enter the name at compile time. If the name is more than eight characters, it will be truncated. Be sure to choose a name that does not already exist in another module you may want to convert to a task or in a standard function/function block supplied by PiCPro.

Task Hierarchy

When tasks are triggered in the main LDO, system tasks will interrupt the main LDO; hardware tasks will interrupt system tasks and the main LDO; and servo tasks will interrupt hardware tasks, system tasks, and the main LDO.

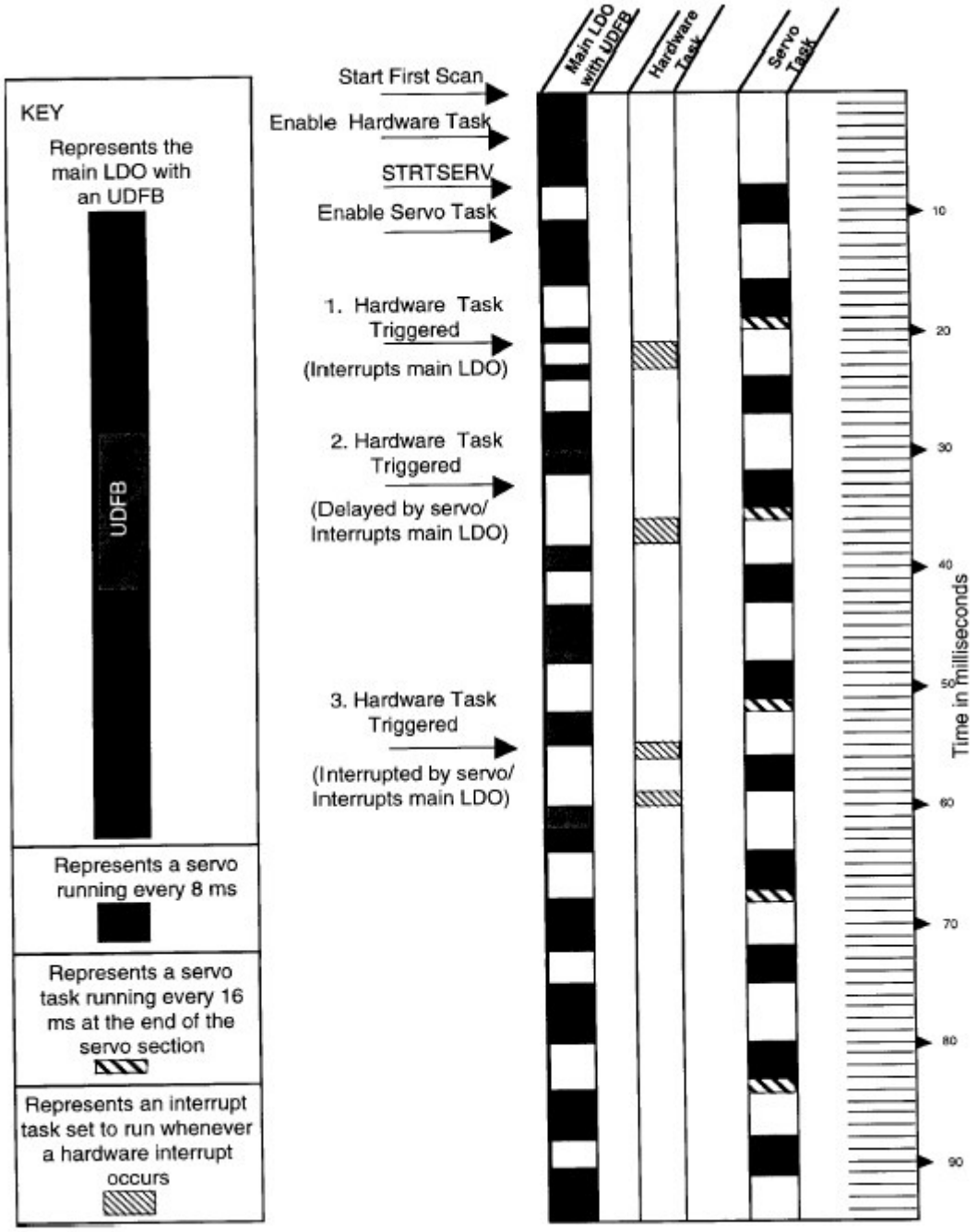
If there are multiple tasks of one type in the main LDO, the task that is declared first in the software declarations table will execute first.

Example 1:



Priority Between the Main LDO, Hardware Tasks, and System Tasks

Example 2:



Priority Between the Main LDO with UDFB, Hardware Tasks, and System Tasks

Interlocking Data in Tasks

Interlocking Data in Tasks

Whenever data is exchanged between the main LDO and a task LDO, there is a possibility of inaccurate data being transferred. This is dependent on when a task interrupts the main LDO or interrupts a lower priority task accessing the same data.

In order to preserve the integrity of the data that is being read/written, you need to program an interlock between the main LDO and the task LDO. One method of interlocking data is to use semaphore flags. A semaphore flag refers to a way of communicating between the main LDO and a task LDO when a significant event has occurred.

Setting up Semaphore Flags

In setting up semaphore flags, the main LDO energizes a LOCK flag, which prevents the task LDO from reading or writing data while data is being transferred to or from the main LDO. After the data transfer is complete, the main LDO de-energizes the LOCK flag and the task LDO is allowed to read or write the data.

There are two examples that follow. The first shows data being transferred from the task LDO to the main LDO. The second shows the data being transferred from the main LDO to the task LDO. In both examples the main LDO has control of the data even though tasks of higher priority are accessing it.

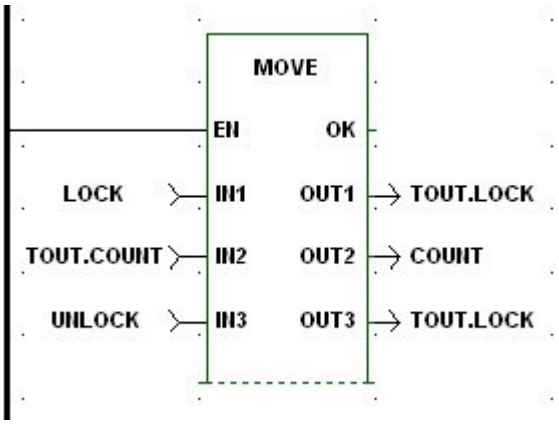
Semaphore Flag Example 1 - Data Transfer from Task LDO to Main LDO

The MOVE function with a task output TOUT data structure is used in both the main and task LDO. The TOUT structure acts as a buffer for the data transfer. The TOUT structure is marked External (only in the task LDO software declarations table, not the main LDO software declarations table) allowing that data to be used by both the main and task LDOs.

In the Main LDO

When the MOVE function in the main LDO is enabled, the following sequence of events occurs.

1. TOUT.LOCK is energized by moving LOCK into TOUT.LOCK.
2. TOUT.COUNT is moved into COUNT.
3. TOUT.LOCK is de-energized by moving UNLOCK into TOUT.LOCK.



The variables in the software declarations table of the main LDO are:

Variable	Definition
TOUT	Task output structure
.LOCK	Semaphore flag
.COUNT	Count variable to be written by the task LDO
COUNT	Main LDO count variable
LOCK	IN1 to MOVE function, set to 1
UNLOCK	IN3 to MOVE function, set to 0

The declarations in the main LDO software declarations table are:

Software Declarations : Main Ladder - [TaskMain.ldo]

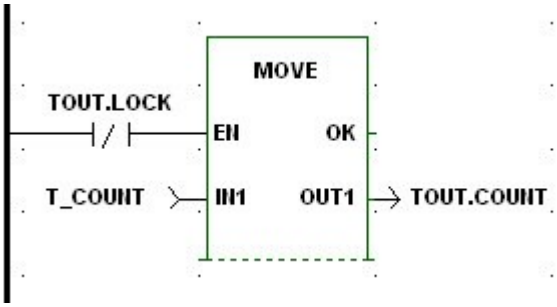
File Edit Tools Help

Name	Type	A.	I/O Point	Initial Value	Long Name
LOCK	BOOL			1	
COUNT	DINT				
UNLOCK	BOOL			0	
TOUT	STRUCT				
.LOCK	BOOL				
.COUNT	DINT				
	END_STRUCT				
End List	void				

In the Task LDO

In the task LDO, the following sequence of events occurs:

1. If TOUT.LOCK is off, then move the data (Step 2). If TOUT.LOCK is on, do not move the data.
2. T_COUNT is moved into TOUT.COUNT.



The variables in the software declarations table of the task LDO are:

Variable	Definition
TOUT	Task output structure
.LOCK	Semaphore flag
.COUNT	Count variable to write to the main LDO
T_COUNT	Task variable to be transferred into COUNT in main LDO

The declarations in the task LDO software declarations table are:

Software Declarations : Main Ladder - [Task..ldo]

File Edit Tools Help

	Name	Type	A.	I/O Point	Initial Value	Long Name
	TOUT	STRUCT	E			
	.LOCK	BOOL				
	.COUNT	DINT				
		END_STRUCT				
	T_COUNT	DINT				
	End List	void				

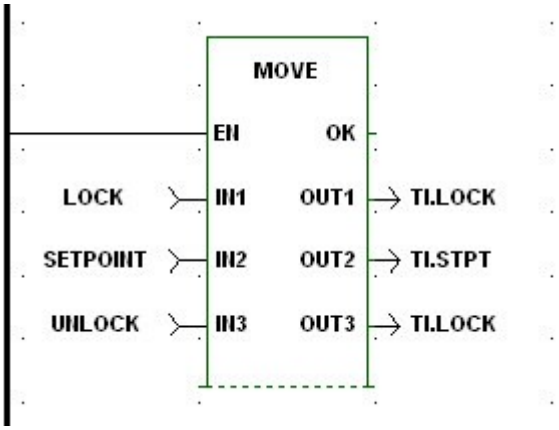
Semaphore Flag Example 2 - Data Transfer from Main LDO to Task LDO

The MOVE function with a task input TI data structure is used in both the main and task LDO. The TI structure acts as a buffer for the data transfer. The TI structure is marked External (only in the task LDO software declarations table, not the main LDO software declarations table) allowing that data to be used by both the main and task LDOs.

In the Main LDO

When the MOVE function in the main LDO is enabled, the following sequence of events occurs:

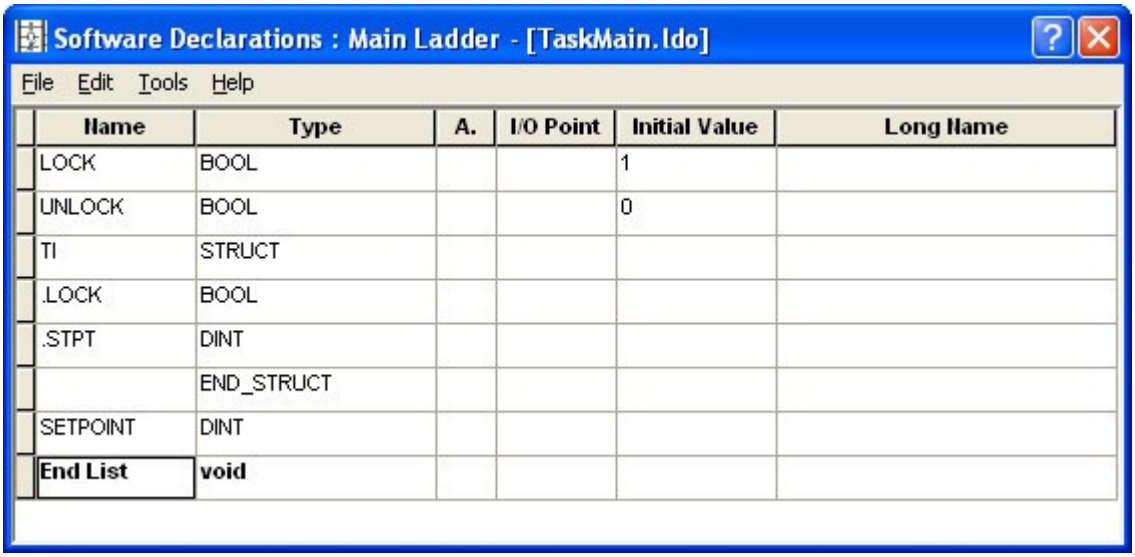
1. TI.LOCK is energized by moving LOCK into TI.LOCK.
2. SETPOINT is moved into TI.STPT.
3. TI.LOCK is de-energized by moving UNLOCK into TI.LOCK.



The variables in the software declarations table of the main LDO are:

Variable	Definition
LOCK	IN1 to MOVE function, set to 1
UNLOCK	IN3 to MOVE function, set to 0
TI	Task input structure
.LOCK	Semaphore flag
.COUNT	Setpoint to be read by the task LDO
SETPOINT	Main LDO setpoint

The declarations in the main LDO software declarations table are:

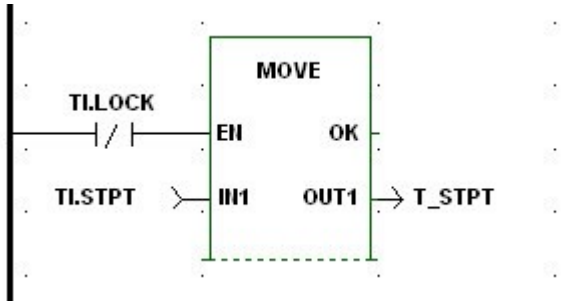


	Name	Type	A.	I/O Point	Initial Value	Long Name
	LOCK	BOOL			1	
	UNLOCK	BOOL			0	
	TI	STRUCT				
	.LOCK	BOOL				
	.STPT	DINT				
		END_STRUCT				
	SETPOINT	DINT				
	End List	**void**				

In the Task LDO

In the task LDO, the following sequence of events occurs:

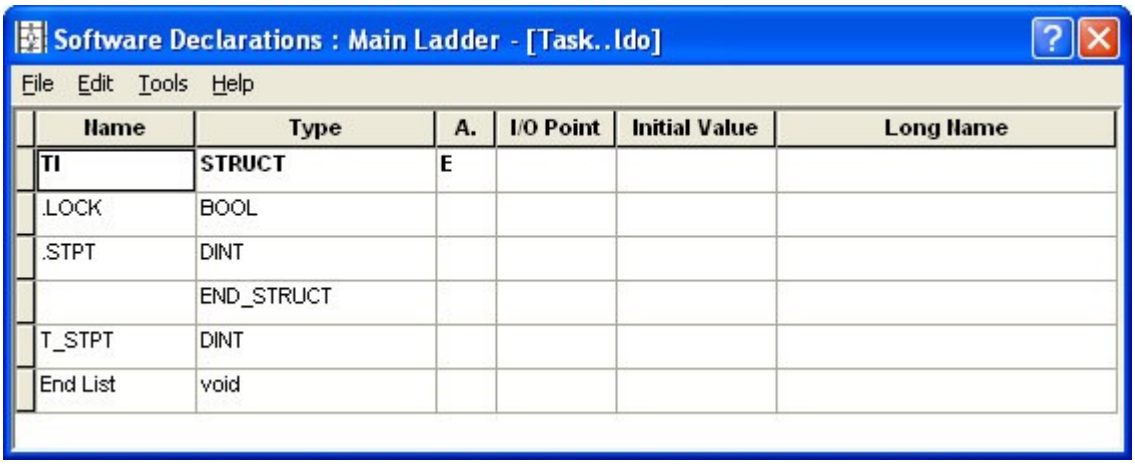
1. If TI.LOCK is off, then move the data (Step 2). If TI.LOCK is on, do not move the data.
2. TI.STPT is moved into T_STPT.



The variables in the software declarations table of the main LDO are:

Variable	Definition
TI	Task input structure
.LOCK	Semaphore flag
.STPT	Setpoint to be read by the task LDO
T_STPT	Main LDO setpoint

The declarations in the main LDO software declarations table are:

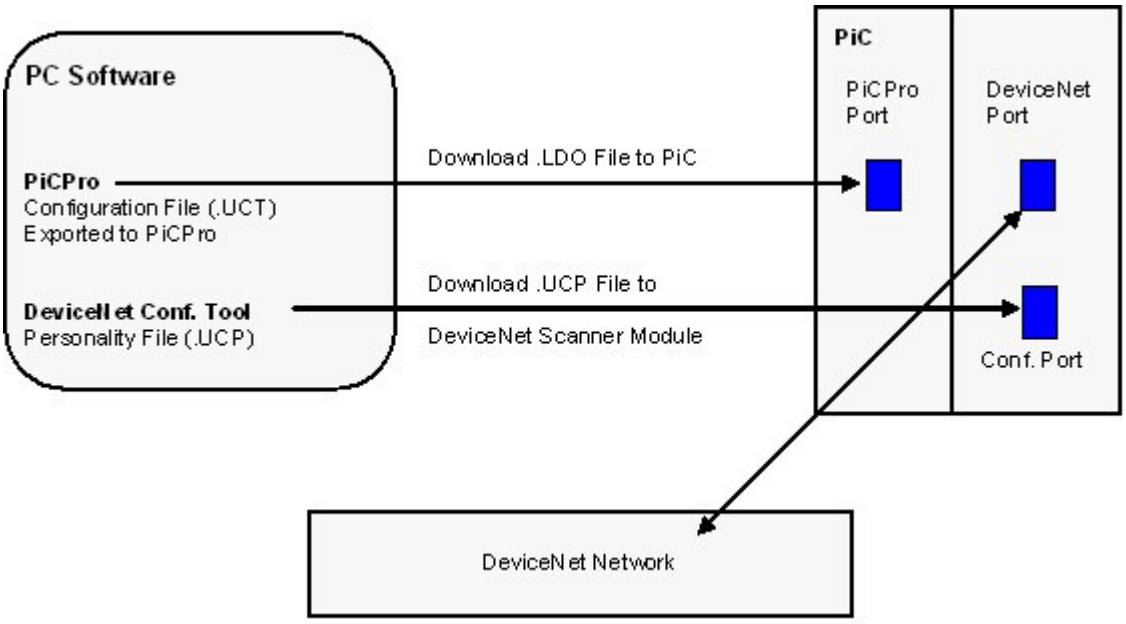


Chapter 10 - DeviceNet - Ethernet - TCPIP

DeviceNet Software

Danaher Motion DeviceNet Configuration Software

Block Diagram of DeviceNet Setup



Overview of setting up a DeviceNet Network

1. Use the Danaher Motion DeviceNet Configuration Tool to provide information about your DeviceNet system. This information includes a description of input and output data associated with each node, tags (variable names) for this data, and the address of each node.
2. Always use the "export" command of the Danaher Motion DeviceNet Configuration Software to generate two files in your workstation:
   - Current configuration file (.UCT) for PiCPro.
   - Current personality file (.UCP) for the DeviceNet scanner module.

For PiC and standalone MMC:

1. Use the Danaher Motion DeviceNet Configuration Software to download the personality file to the DeviceNet scanner module. Be sure the PiCPro cable connected to the Configuration Port.*
2. Design your ladder program using PiCPro (refer to the fieldbus function/function blocks in the Function/Function Bock Reference Guide and the Theory of Operation section for your DeviceNet Scanner Module in the appropriate Hardware Manual).

   Typically DeviceNet communication is opened with a FB_OPN function block. After this is done FB_STA is used to continually monitor for possible error conditions and to update the on-line (ONLI) status flag. Once the network is on-line the FB_SND and FB_RCV functions are used to transfer variables to and from the memory image in the DeviceNet Scanner Module. The DeviceNet Scanner Module in turn transfers this memory image from and to actual I/O hardware associated with the tagged variables.

   Once a DeviceNet network is properly on-line, only severe electrical noise or a hardware error will cause the network to go off-line. Detection of a negative transition of the on-line status flag (from FB_STA) can be used as a warning that data from and to the DeviceNet network may no longer be correct. The value of each device status byte (described at the end of this chapter) can serve as a similar warning. In applications where DeviceNet data affects safety, these warnings should be used by the ladder for taking appropriate action.
3. Use PiCPro to download the ladder file to the control. Be sure the PiCPro cable connected to the PiCPro Port.*
4. Connect the DeviceNet cable to the DeviceNet Port on the DeviceNet scanner module.

For MMC for PC:

Use the PiCPro Download Hex feature to load the personality file via local or remote Ethernet. There are no cables or ports to connect directly. However, the ladder scan in the MMC for PC must be stopped before downloading.

Note:

Before downloading the personality file, make sure the ladder scan in the CPU is stopped. The PiCPro cable from your workstation is first used to download the personality file; this cable must be connected to the Configuration Port on the DeviceNet scanner module. You then need to connect this cable to the PiCPro Port on the CPU module in order to download the ladder.

Procedure for using the Danaher Motion DeviceNet Configuration Software

There are several ways to accomplish the following. Once you become familiar with the operations, you can use whichever method you prefer. **Note:** Additional information can be obtained by selecting **Help** from the menu or by using the **Help** button in a given dialog.

1. Select the Danaher Motion DeviceNet Configuration Software icon to get to the application window.
2. Select **File | New** from the menu to bring up your working screen. A window will appear with the heading GLDNCFG1. This is the default name for your configuration files. It should be renamed when saving the file to match the base name of your ladder file.
3. Select the **Network** (Network Configuration) symbol and right-click to bring up a menu. Select **Properties** to bring up the **Node Properties** menu. This allows you to change the name and description of your DeviceNet system. It is recommended that you use the name of your configuration file.
   Select **OK** to exit this menu.
4. If the symbol for the Danaher Motion DeviceNet scanner module is not already displayed, right-click to bring up another menu and select **New**. This will display the symbol for the scanner module. Right-click on this symbol to bring up a menu and select **Properties**. A menu with five tabs appears (only the first three are presently used). Enter appropriate information.
   - **General TAB**
     Enter a name for the scanner module or leave it as the default name Scanner1. Check "Assign network parameters" in order to program the following:
     - Always leave MAC ID at 0.

- Select appropriate baud rate (125K bps, 250K bps, or 500K bps).
- Leave the Scan Interval at the default setting of 0 for the fastest update rate possible for this scanner.
- Select Apply.

- **I/O TAB**
  (Not used for the Danaher Motion scanner module.)
- **Tag TAB**
  You will come back to this tab after the other DeviceNet nodes are entered. For now, select **OK**.

5. With the Danaher Motion Scanner symbol highlighted, right-click to bring up a menu and select **New**. This brings up a **Select New Node** menu.
   Select **Device** and select **OK** to enter a Device or node symbol.
   Right-click on this to bring up a menu and select **Properties**.
   A menu with three tabs appears.

   - **Identity TAB**
     Assign a "Name" and a "Description".
     Select a MAC ID.
     Other information is optional.
   - **I/O TAB**
     Select either "Polled" or "Strobed".
     If Polled is selected, enter the number of "Input" and/or "Output" bytes associated with the node.
     Leave Update Interval blank.

     If Strobed is selected, enter the number of bytes associated with the node. (Strobed outputs are not supported, COS and Cyclic are not supported yet.)
     Select **Apply**.
   - **Tag TAB**
     Select **New** and then **Edit**. Another menu with two tabs appears.

     - **Names TAB**
       Assign a Tag Name for an object (variable) in the DeviceNet node. Use the same name as used when defining the variable in your ladder with PiCPro.
     - **Tag TAB**
       Select the appropriate I/O Type and select a Data Type to match the data type for the variable in your ladder.

6. Select **OK** to go back one level and select **OK** to get to the node symbol.
7. Repeat Step 5 for each DeviceNet node in your network.
8. After all nodes are entered, select the **Danaher Motion Scanner** symbol to highlight it. Right-click to bring up the **Node Properties** menu again.
   Now select the **Tags** Tab.
   Select **New** and then **Edit**. A **Tag Properties** menu appears allowing you to assign a variable name for the status of each node you defined.
   Under the **Tag** Tab, select **Device x Status** where x is the MAC ID of the desired node. Also, select **WORD** for Data Type. A description of the Device Status Word is shown at the end of this topic. See ***Device Status Word***.
9. After assigning a device status variable for each node, go back two levels. Select the **Danaher Motion Scanner** symbol. Right-click to bring up a menu.
   Select **Export** to bring up the **Save As** menu. Use the same base file name and the same directory as used for your ladder.
   When you Save, several files will be saved with the same base name but with different extensions. One of these files (.uct) will be used by PiCPro when downloading your ladder. Another file (.ucp) will be used by this Danaher Motion DeviceNet Configuration Software when downloading the personality file to the DeviceNet scanner module.

10. For PiC and standalone MMC CPUs, after exiting the **Save As** menu, right-click on the **Danaher Motion Scanner** symbol to bring up a menu. This time select **Download**. You must have the PiCPro cable connected between your workstation and the configuration port on the DeviceNet scanner module. Select the **Download** button and wait for the operation to be completed.

    Note: If the Download dialog indicates the Baud Rate as "Not Connected", first check for proper cabling. And then, be sure the ladder scan in the CPU is stopped.

    For MMC for PC CPUs, use PiCPro Professional Edition, select **Online | Download Hex**. Enter the name of the personality file (.ucp) and select the port as MMC for PC. More information can be found in Chapter 3.
11. Return to the application screen and save your file before exiting.

Note: The on-line configuration option and EDS files are not supported in the Danaher Motion DeviceNet Configuration Software.

Device Status Word

A 16-bit device status word for each slave device can optionally be tagged. (Refer back to set 7 of the procedure for using the Danaher Motion DeviceNet Configuration Software.) The word has the following format:

Bits 15 - 9	8	Bits 7 – 0
(Reserved)	IDLE	STATUS

IDLE	Received idle, the device is configured to send one or more bytes of input data, but is currently sending zero-length (idle) input messages.
STATUS	Device status code (see next table)

Device Status Codes			
Status	**Description**	**Status**	**Description**
00h	(Reserved)	0Dh	Invalid I/O connection 1 input size
01h	Device idle (not being scanned)	0Eh	Error reading I/O connection 1 input size
02h	Device being scanned	0Fh	Invalid I/O connection 1 output size
03h	Device timed-out	10h	Error reading I/O connection 1 output size
04h	UCMM connection error	11h	Invalid I/O connection 2 input size
05h	Master/Slave connection set is busy	12h	Error reading I/O connection 2 input size
06h	Error allocating Master/Slave connection set	13h	Invalid I/O connection 2 output size
07h	Invalid vendor ID	14h	Error reading I/O connection 2 output size
08h	Error reading vendor ID	15h	Error setting I/O connection 1 packet
09h	Invalid device type	16h	Error setting I/O connection 2 packet
0Ah	Error reading device type	17h	Master/Slave connection set sync fault
0Bh	Invalid product code	18h	Error setting Production Inhibit Time
0Ch	Error reading product code	19h-FFh	(Reserved)

Ethernet - TCPIP

Ethernet - TCP/IP Configurator

The section covers the configuration of an Ethernet network for PiC and standalone MMC. This procedure is not needed when using an MMC for PC.

Overview of setting up an Ethernet Network

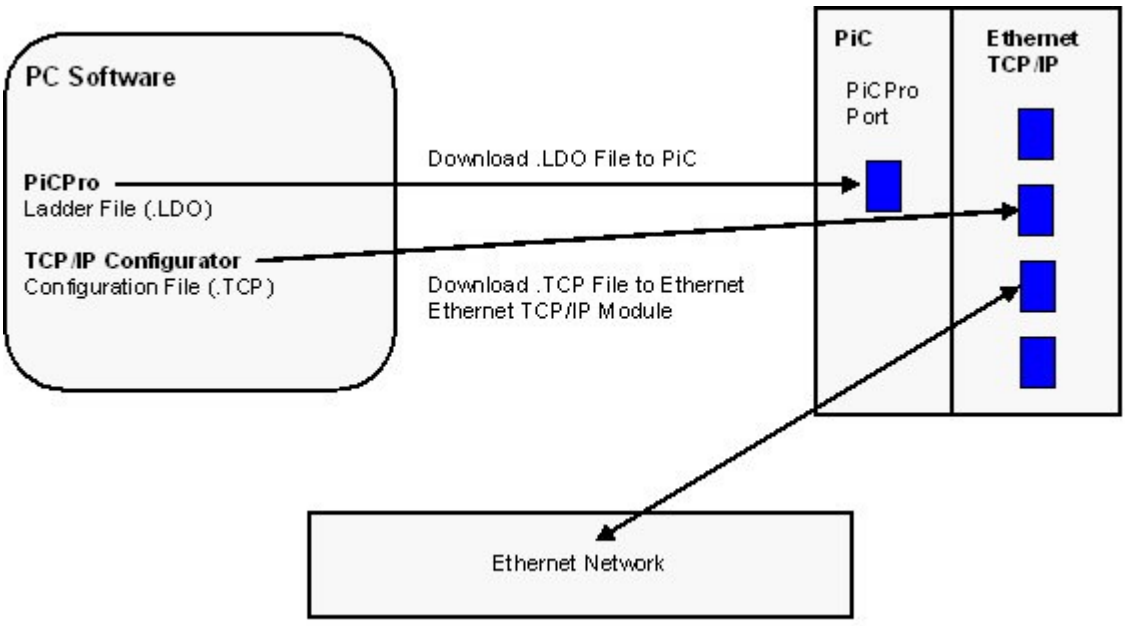
The following steps summarize what you need to do to set up an Ethernet network.

1. Use the Ethernet-TCP/IP Configurator within PiCPro to configure your system. (See procedure at the end of this section.)
2. Send the configuration information to the Ethernet – TCP/IP module using the PiCPro cable connected to the RS232 Com 2 port on the module.
3. Always cycle power after changing Ethernet settings.
4. Design your ladder program using PiCPro.
5. Download the ladder file to the control using the PiCPro cable connected to the PiCPro Port.*
6. Make your connections to your Ethernet – TCP/IP system.

Note:

The PiCPro cable is first used to download the configuration file by connecting it to the RS232 Com 2 port on the Ethernet – TCP/IP module. You then need to connect it to the PiCPro Port on the CPU module in order to download the ladder.

Block Diagram of Ethernet – TCP/IP Setup



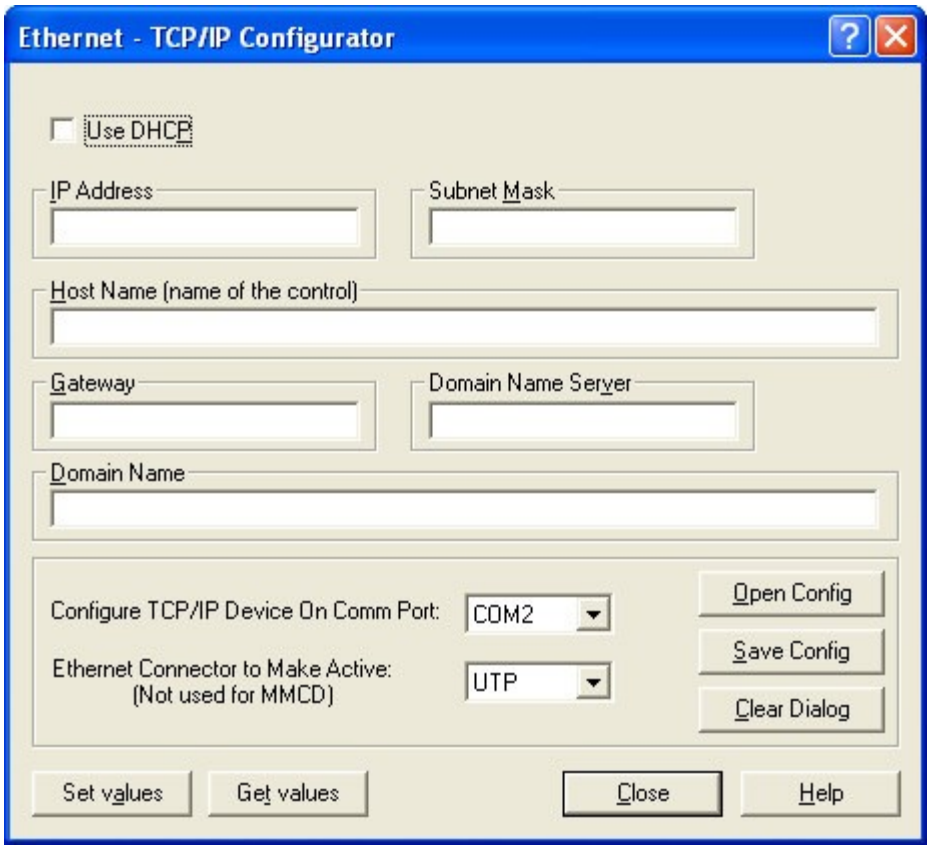
Ethernet-TCP/IP Configuration Procedure

To set up an Ethernet – TCP/IP network, you will need to use the Ethernet – TCP/IP Configurator. All open files have to be closed before TCP/IP configuration can take place. If there are open files, you will be asked to save/close those files.

Most Ethernet devices have a dedicated RS232 port that is used to setup the device. With a MMC Digital control, a special RS232 port does not exist. The same port that PiCPro is connected to is used, so no cable swapping is necessary.

Fields that require an address in dotted decimal notation are in the format: A.B.C.D, where A, B, C and D are values between 0 and 255.

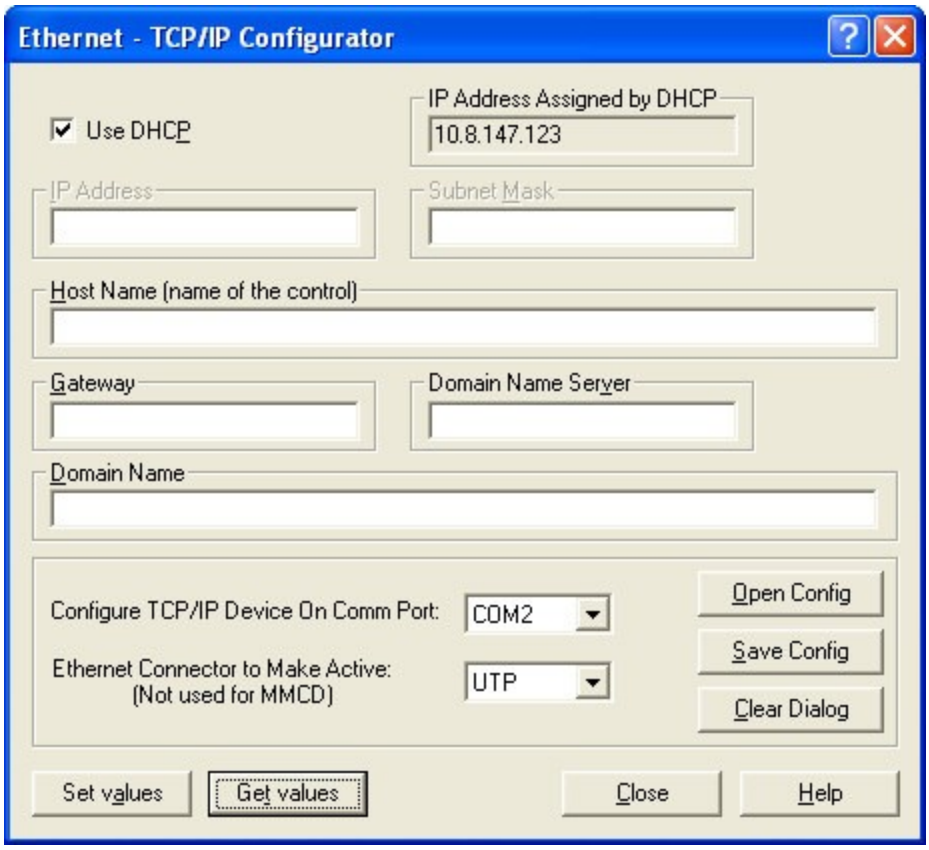
1. With PiCPro running on your workstation, select Online | Control Operations | Configure TCP/IP… from the menu and the following dialog appears. If you do not have all the information needed for this dialog, see your network administrator (at minimum, an IP address and subnet mask is needed).



2. Enter the information in the following entry fields:

   - **Use DHCP**
     By checking the DHCP check box, the device will ask a special server on your network for an IP address, Subnet Mask and other information. At minimum, the IP address and subnet mask will be assigned.
     If the DHCP box is checked, the IP Address and Subnet Mask labels are grayed out to indicate that these fields will be assigned by the DHCP server. You can still enter values in these fields, which will be used if a DHCP server is not available.

- **IP Address**
  Enter the IP address that you want to give to the Ethernet device in dotted decimal notation. Note: If DHCP is checked, you do not have to enter an address here.
- **Subnet mask**
  Enter the Subnet mask that you want to give to the Ethernet device in dotted decimal notation. Note: If DHCP is checked, you do not have to enter an address here.
- **Host Name (name of the control)**
  Enter the network name of the Ethernet device. If your network allows, you can assign a name to your device. This makes the device easier to access than remembering the IP address assigned to the device. If you are going to access the device by IP address only, you do not need a host name.
- **Gateway**
  A gateway is a device on a network which sends local network traffic to other networks. Enter the gateway by name or by address in dotted decimal notation.
- **Domain Name Server (DNS)**
  A DNS is a server on the network that resolves domain names to IP addresses. Enter the address of the domain name server in dotted decimal notation.
- **Domain Name**
  Enter the domain name of this Ethernet device.
- **Configure TCP/IP Device on Comm Port**
  Enter the workstation communications port your Ethernet device is connected to from the drop down list. The list can hold up to nine ports depending on how many are available on your workstation.
- **Ethernet Connector to Make Active**
  There are three choices for the PiC900 Ethernet module: UTP (default), BNC, and AUI. There is one choice for the standalone MMC Ethernet module: UTP. This field is not used for a MMC Digital drive.
- **Open Config**
  Choosing the Open Config button, allows you to open a previously saved .tcp file.
- **Save Config**
  Choosing the Save Config button, saves the TCP/IP configuration data to a .tcp file.
- **Clear Dialog**
  Choosing the Clear Dialog button, blanks out all the fields in the dialog.
- **Set values**
  Choosing the Set values button sends the entered data to the Ethernet-TCP/IP module via the PiCPro cable connected from the workstation to the RS232 COM port on the Ethernet device.
- **Get values**
  Choosing the Get values button retrieves the data from the Ethernet device via the PiCPro Cable connected from the workstation to the RS232 port on the Ethernet device. The values read are displayed in the appropriate fields in the configurator dialog. If the Ethernet values from a MMC Digital device are being read and DHCP was selected, a new field in the dialog will appear showing the IP address assigned by the DHCP server. If the DHCP server has not assigned an address to the control yet, the field will display "Not Assigned Yet".

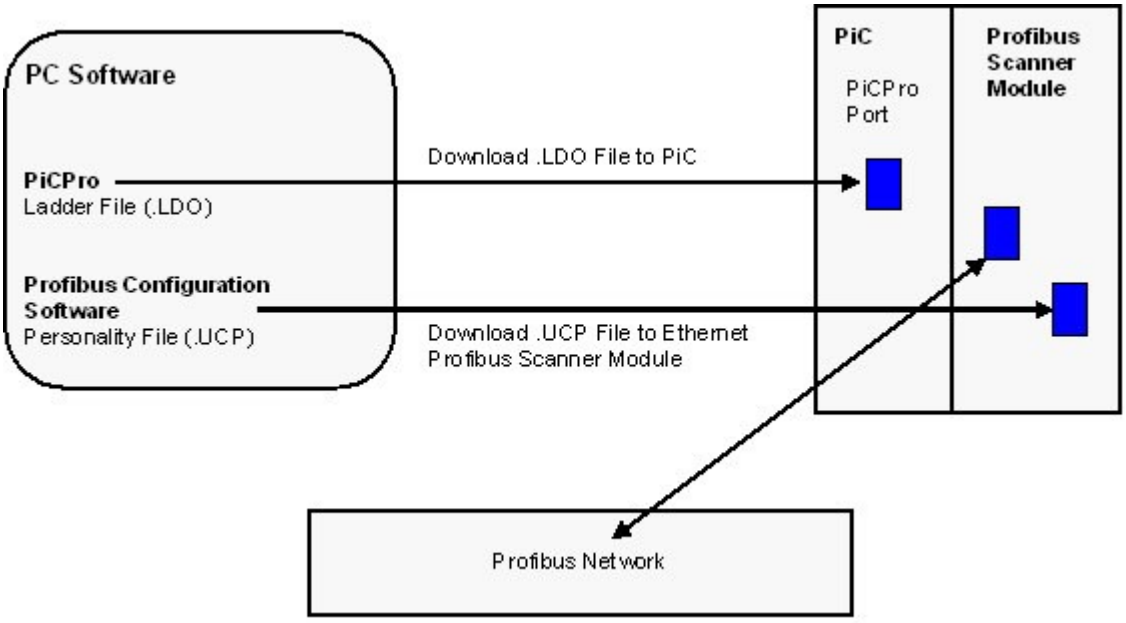


3. After all the information is entered, choose Save button to save your configuration data to a *.tcp file.
4. Connect the PiCPro cable between your workstation and the appropriate COM port on the Ethernet – TCP/IP device.
5. Choose the Set values button to send the entered data to the Ethernet – TCP/IP device.
6. Cycle power

Chapter 11 - Profibus Configuration Software

Danaher Motion Profibus Configuration Software

Block Diagram of Profibus Setup



Overview of setting up a Profibus Network

1. Use the Danaher Motion Profibus Configuration Software to provide information about your Profibus system. This information includes a description of input and output data associated with each node, tags (variable names) for this data, and the address of each node. (See procedure that follows this section.)
2. Always use the **File | Export Tags** and **File | Export Binary** from the menu of the Danaher Motion Profibus Configuration Software to generate two files in your workstation:
   - Current configuration file (.UCT) for PiCPro.
   - Current personality file (.UCP) for the Profibus scanner module.

For PiC and standalone MMC:

3. Use the Danaher Motion Profibus Configuration Software to download the personality file to the Profibus scanner module. Be sure the PiCPro cable is connected to the Configuration Port.*

4. Design your ladder program using PiCPro (refer to the fieldbus function/function blocks in the Function/Function Block Reference Guide and the Theory of Operation section for your Profibus Scanner Module in the appropriate Hardware Manual).

   Typically Profibus communication is opened with a FB_OPN function block. After this is done FB_STA is used to continually monitor for possible error conditions and to update the on-line (ONLI) status flag. Once the network is on-line the FB_SND and FB_RCV functions are used to transfer variables to and from the memory image in the Profibus Scanner Module. The Profibus Scanner Module in turn transfers this memory image from and to actual I/O hardware associated with the tagged variables.

   Once a Profibus network is properly on-line, only severe electrical noise or a hardware error will cause the network to go off-line. Detection of a negative transition of the on-line status flag (from FB_STA) can be used as a warning that data from and to the Profibus network may no longer be correct. The value of each device status byte (described at the end of this chapter) can serve as a similar warning. In applications where Profibus data affects safety, these warnings should be used by the ladder for taking appropriate action.
5. Use PiCPro to download the ladder file to the control. Be sure the PiCPro cable is connected to the PiCPro Port*
6. Connect the Profibus cable to the Profibus Port on the Profibus scanner module.

For MMC for PC:

Use the PiCPro Download Hex feature to load the personality files via local or remote Ethernet. There are no cables or ports to connect directly. However, the ladder scan in the MMC for PC must be stopped before downloading.

Note:

Before downloading the personality file, make sure the ladder scan in the CPU is stopped. The PiCPro cable from your workstation is first used to download the personality file; this cable must be connected to the Configuration Port on the Profibus scanner module. You then need to connect this cable to the PiCPro Port on the CPU module in order to download the ladder.

Procedure for using the Danaher Motion Profibus Configuration Software

There are several ways to accomplish the following. Once you become familiar with the operations, you can use whichever method you prefer. **Note:** Additional information can be obtained by selecting **Help** from the menu or by using the **Help** button in a given dialog.

1. Select the Danaher Motion Profibus Configuration icon to get to the application window.
2. Select **File | New** from the menu to bring up your working screen. A window will appear with the heading New Network Configuration. Select **Scanner** (to the left of Danner Motion Profibus Sca…). The working screen will then appear with the default name GLDPBFG1. Another window will also appear prompting for scanner properties. Enter the appropriate information at the following tabs as follows:

   - **General**
     Enter a name for the scanner module or leave it as the default name Scanner. This scanner is a network master and the station address is typically left at 0.
   - **Parameters**
     Typically, leave Scan Cycle Times in Auto.

3. Select the **Profibus_DP** and double-click to define overall network properties. A window with the heading of **Network** will appear with 3 tabs, as follows:

   - **General**
     Select the desired network baud rate. All nodes have to be capable of supporting the rate selected. The highest station address can be left at 126.

- **Timing**
  The timing parameters are defined in tbit units. Tbit equals 1/baud rate. The default values are typically used.
- **Parameters**
  Again, the default values for the parameters are typically used.

4. Add nodes under scanner by selecting **Slaves** in the left-hand window. By drilling down, an icon and description for the desired node can be found. This feature is based upon information stored in *.gsd files in a subdirectory of your choosing. You have to obtain the *.gsd files from the manufacturer of the parts you wish to use. Most manufacturers have links to their sites from **www.profibus.com**. Once an icon is found and selected, drag and drop it under the scanner symbol. A window will appear with specific information about the node. Enter the appropriate information at the following tabs as follows:
   - **General**
     Assign a specific name if so desired and select a unique station address for this node in the network.
   - **Modules**
     If there are plug in modules associated with the node, add the description(s) for those modules.
   - **Address**
     Do not modify offsets. The default settings are required for the Danaher Motion applications.
   - **Tag**
     Select a tag name for each available variable.
   - **Std. Prms**
     Some parts have additional information and do not require modification.
   - **Ext. Prms**
     Some parts have additional information and do not require modification.
   - **Diagnostics**
     Some parts have additional information and do not require modification.

   Continue to drag and drop icons from the *.gsd files in the slave directory until all nodes have been defined for the network.
5. Select **File | Export Tags** from the menu You will be prompted for a file name with a .uct extension. Then select **File | Export Binary** from the menu. You will be prompted for a file name with a .ucp extension.
6. Use the same base file name and same directory as that used for your ladder. One of these files (.uct) will be used by PiCPro when down loading your ladder. Another file (.ucp) will be used by Danaher Motion Profibus Configuration when down loading the personality file to the Profibus scanner module.
7. For PiC and standalone MMC CPUs, after exiting the **File** menu, right-click on the Motion Control Scanner symbol to bring up a menu. This time select **Download**. You must have the PiCPro cable connected between your workstation and the configuration port on the Profibus scanner module. Select the **Download** button and wait for the operation to be completed.

   Note: If the Download dialog indicates the Com Port as "Not Connected", first check for proper cabling. Then, be sure the ladder scan in the CPU is stopped.
8. For MMC for PC CPUs, use PiCPro Professional Edition, click **Online | Download Hex** from the menu. Enter the name of the personality file (.ucp) and select the port as MMC for PC. Return to the application screen and save your file before exiting.

Device Status

There is a status byte variable associated with each node (slave). It can be tagged with the Danaher Motion Profibus Configuration Software. When this byte is equal to zero, the node has not been detected properly by the Danaher Motion scanner module. When equal to 80h, the node is OK.

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