



# Software Manual

## Getting Started with VisiLogic

V230-21-G23 Rev: 12/04



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# Welcome to VisiLogic

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VisiLogic is the software tool you use to create control projects for Vision controllers. After you plan the control task, use VisiLogic to write, debug, and download the PLC control and HMI applications into the controller.

The PLC application is your control, or automation application. You write the PLC application using the Ladder Editor.

The HMI application configures the operating panel's function. You use the HMI Editor to create the Displays that are shown on the controller's screen.

Displays tell your operators what to do. You can have your operators log in with a password, enter setpoints and other data, and instruct the operator what to do in case of a system problem or alarm. A Display can contain both text and images. Text and images can be both fixed and/or variable.

Variables are inserted into a Display to:

- Show run-time values as integers
- Represent run-time values with either text, images, or bar graphs
- Show text messages that vary according to runtime conditions.
- Enable an operator to enter data using the Vision's alphanumeric keypad.

Here are some of VisiLogic's major features.

## **Program Editors**

You use 3 editors to create your application:

- Ladder
- HMI Display
- Variable

Each editor is operated through a different window. You switch between the editors via the Toolbar buttons or by clicking elements in the Project Tree.

## **Ladder Modules and Subroutines**

VisiLogic is a modular program you build using Modules and Subroutines.

## **Hardware Configuration**

VisiLogic offers easy Hardware Configuration. The foundation of a Vision control system is the controller. The Snap-in I/O Module provides an on-board I/O configuration. You add I/Os by integrating I/O Expansion Modules.

After you select the Snap-in or Expansion I/O modules connected to the controller, you can configure inputs: analog, digital, and high-speed counter/shaft-encoder/frequency measurers and PT100; and outputs: analog, digital, and PWM high-speed outputs.

## **Project Explorer**

The Project Explorer tree allows you to navigate easily between program components.

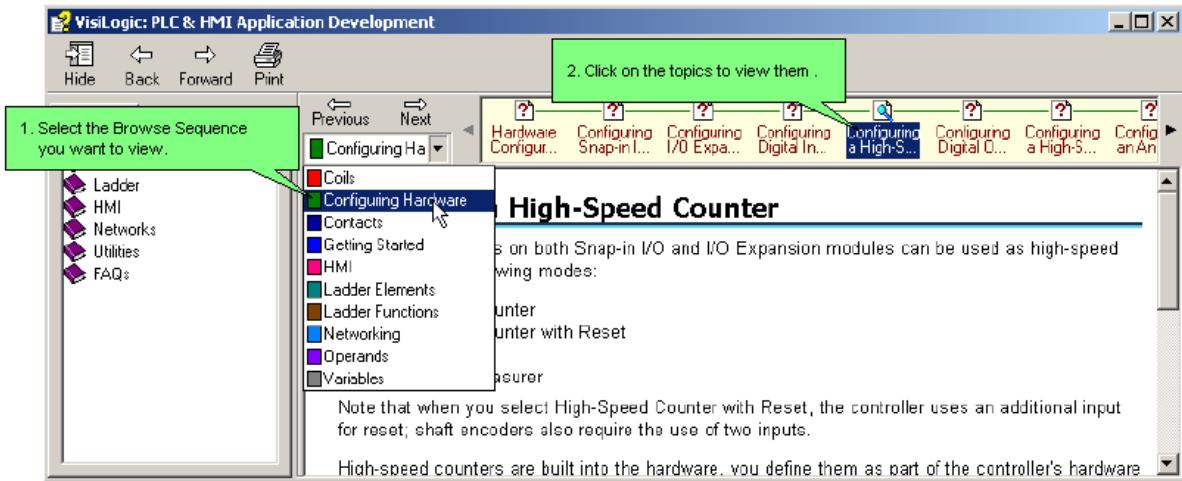
## **Operand View and Watch Folders**

VisiLogic allows you to view operands and their contents according to type and whether or not they are in use. You can also group related operands according to functions in Watch Folders.

## **Help**

Use the VisiLogic Help System to learn how to use the software and answer your questions. Browse sequences present help topics in an order to aid you in learning. The browse sequence shown below is Configuring Hardware.

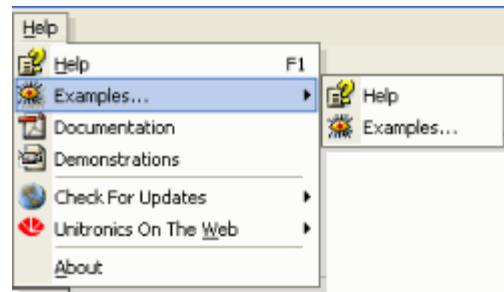
## Getting Started



## VisiLogic Examples

When you install VisiLogic, an Examples folder is created on your hard disk, containing field-tested VisiLogic (.vlp) sample applications. You can copy these sample applications and adapt them for your own use--if, for example, an application is written for the V120, you can select the V230 via Hardware Configuration.

VisiLogic's Help Menu now includes a Help file containing a list of applications as well as their location path.



# Getting Started

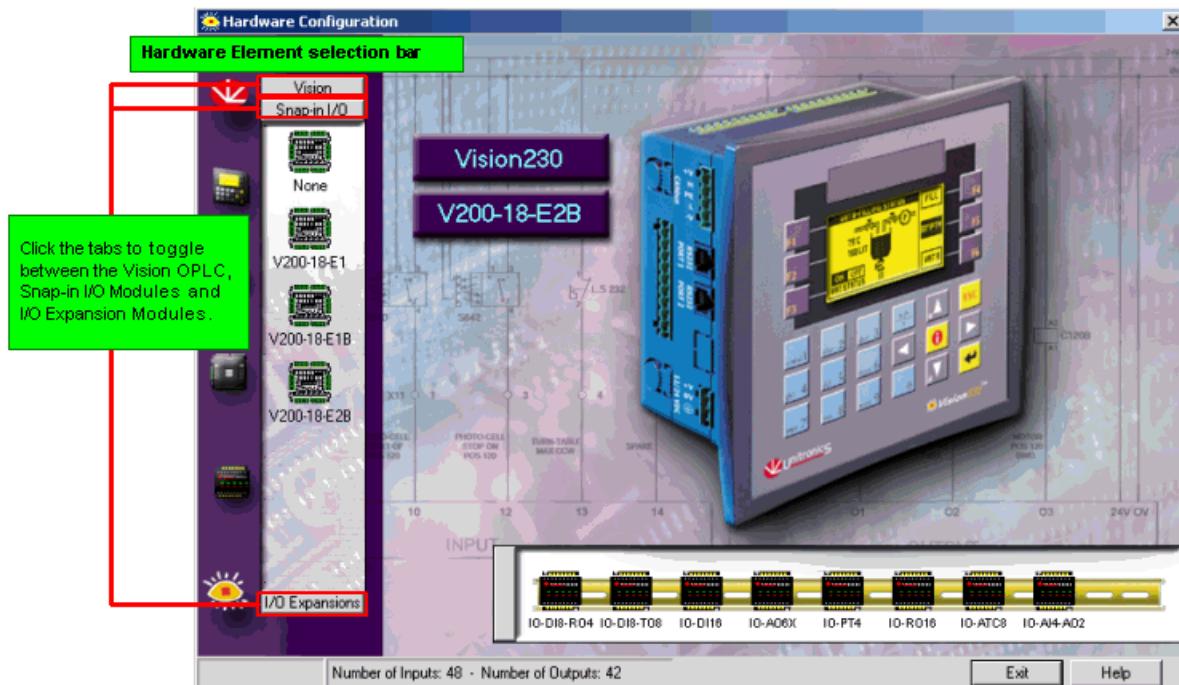
## Hardware Configuration

Hardware Configuration opens automatically when you first create a new project. In order to open Hardware Configuration in an existing project, either select Hardware Configuration from the View menu or click the  button on the toolbar.

Click on the appropriate icon to select the model Vision, the Snap-in I/O module, and any I/O Expansion modules required by your application.

After you select the Snap-in or Expansion I/O modules connected to the controller, you can configure inputs: analog, digital, and high-speed counter/shaft-encoder/frequency measurers and PT100; and outputs: analog, digital, and PWM high-speed outputs.

- Note •** You must select the correct Vision model and Snap-in I/O modules before downloading your project.



## Ladder Editor

Use the Ladder Editor to create the Ladder diagram that comprises your control application. Ladder diagrams are composed of contacts, coils, and function block elements arranged in nets.

In a Ladder diagram, the contacts represent input conditions. They lead power from the left Ladder rail to the right rail. This is why the first element in a net must always touch the left rail. Coils represent output instructions. In order for output coils to be activated, the logical state of the contacts must allow the power to flow through the net to the coil. This is why the elements in a net must be connected. Each net must contain only one rung.

Use the Ladder Editor to:

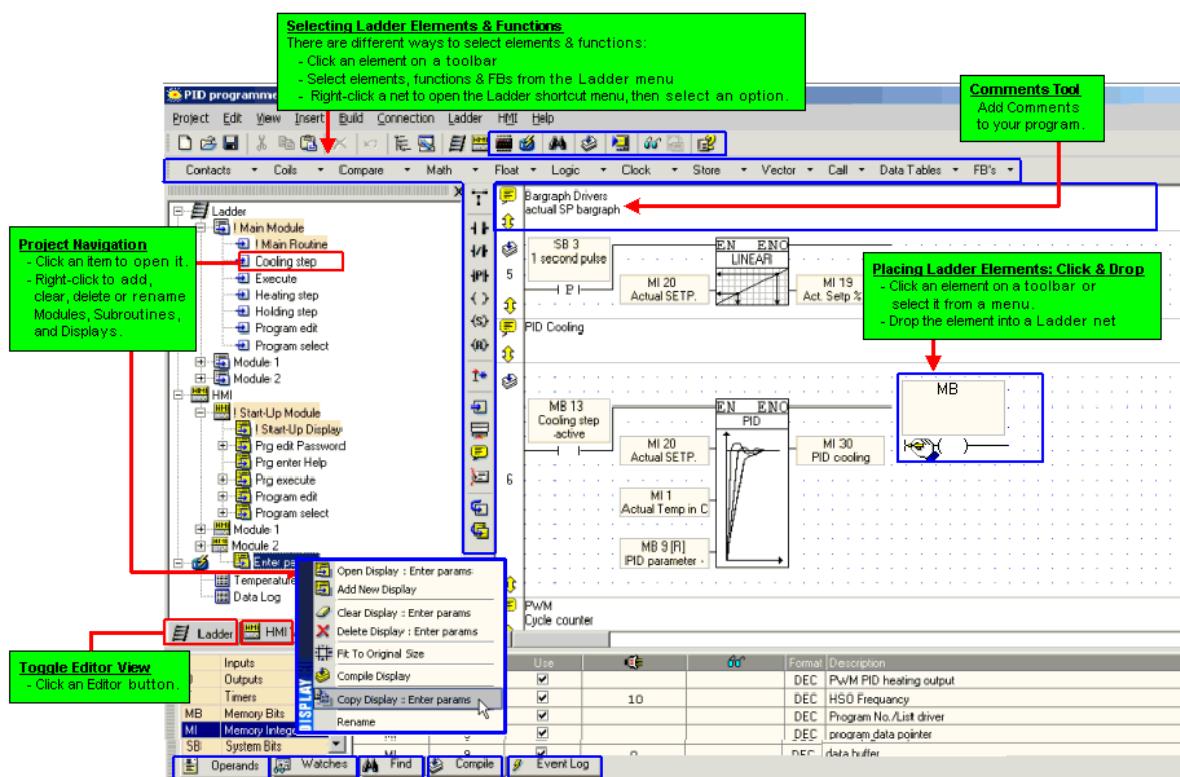
## Getting Started

- Place and connect Ladder Elements.
- Apply Compare, Math, Logic, Clock, Store, and Vector functions.
- Insert Function Blocks (FBs) into your program.
- Build program Modules and Subroutines, and use internal Subroutine Jumps and Labels.
- Place Comments on Ladder nets.

Ladder elements and functions may be dragged and dropped between nets. Hotkeys are also available for easy programming.

To start the Ladder Editor

- Click the Ladder button  on the toolbar.



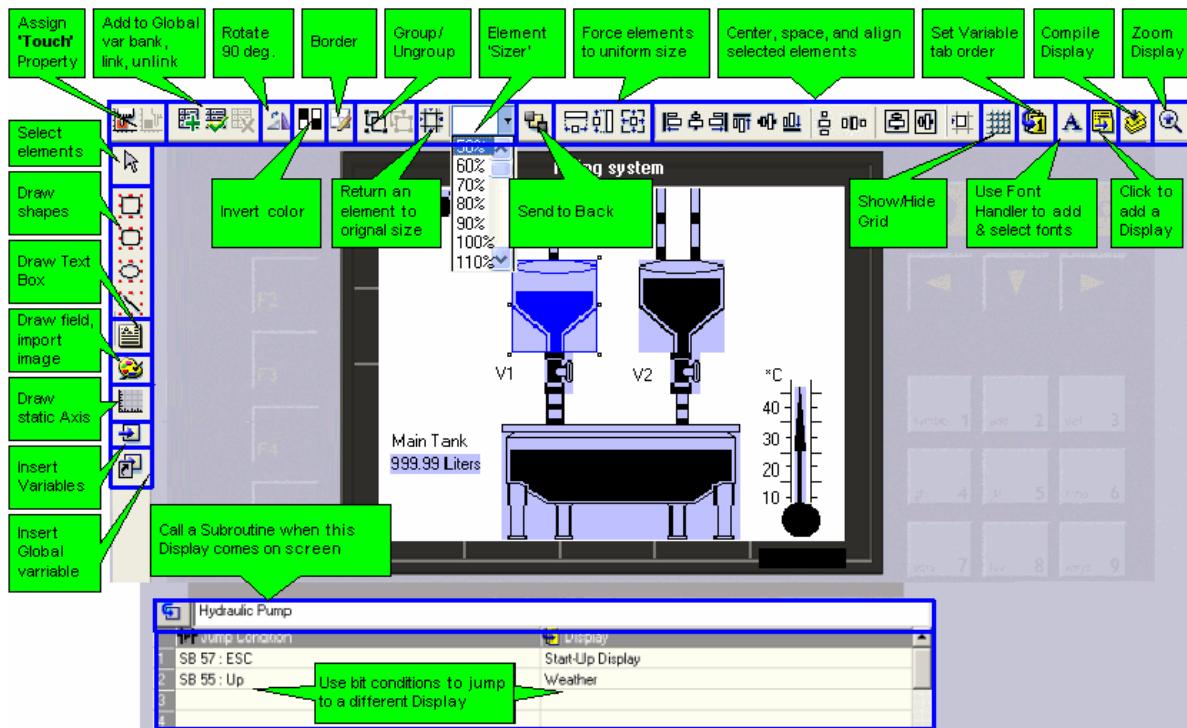
## HMI Display Editor

Use the HMI Display Editor to create the Displays that are shown on the controller screen after the program is downloaded. When you select HMI from the Project Explorer tree, a Display replica opens. The size of this replica reflects the type of Vision controller you have selected in your project's Hardware Configuration.

Displays tell your operators what to do. You can have your operators log in with a password, enter setpoints and other data, and instruct the operator what to do in case of a system problem or alarm. A Display can contain both text and images. Text and images can be both fixed and/or variable.

Variables are inserted into a Display to:

- Show run-time values as integers
- Represent run-time values with either text, images, or bar graphs
- Show text messages that vary according to runtime conditions.



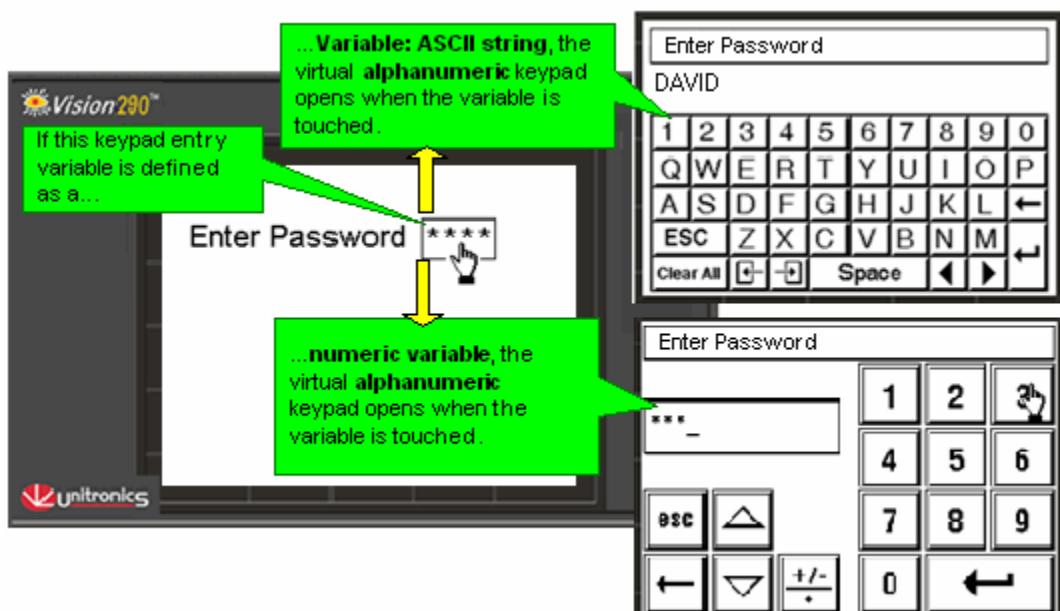
## About the HMI Display and Keypad

All Vision controllers offer an integrated HMI operating panel that includes an LCD screen and a keypad. The screen size, type and keypad vary. Exact specifications regarding Vision operating panels are included in the user's manuals.

## 'Touchscreen' controllers

There are 2 types of Vision touch-screen models:

- Models which comprise only a virtual keypad (V290). In these models, the virtual keypad opens whenever the user touches a keypad entry variable that is currently displayed on the screen.

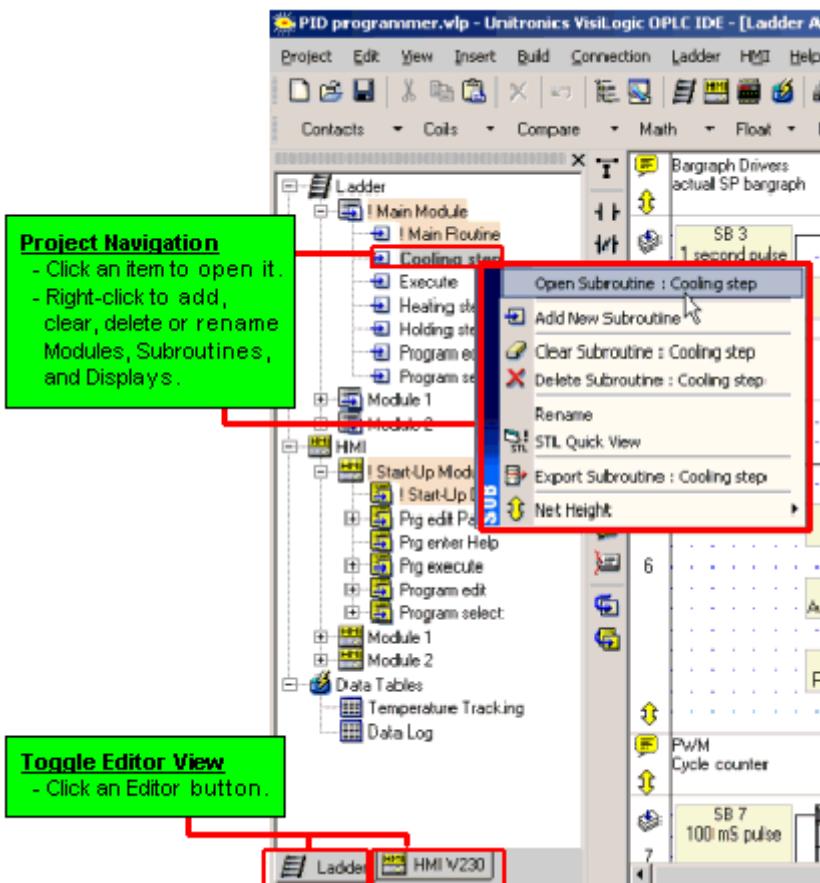


- Models which comprise both an HMI function keypad and a virtual keypad (V280). However, in these models, the virtual keypad must be activated by turning SB 22 Enable Virtual Keypad ON. This must be done at power-up, or before the Display containing the keypad variable is entered. In addition, the Keypad entry variable must be assigned a Touch Property.

### Quick Navigation

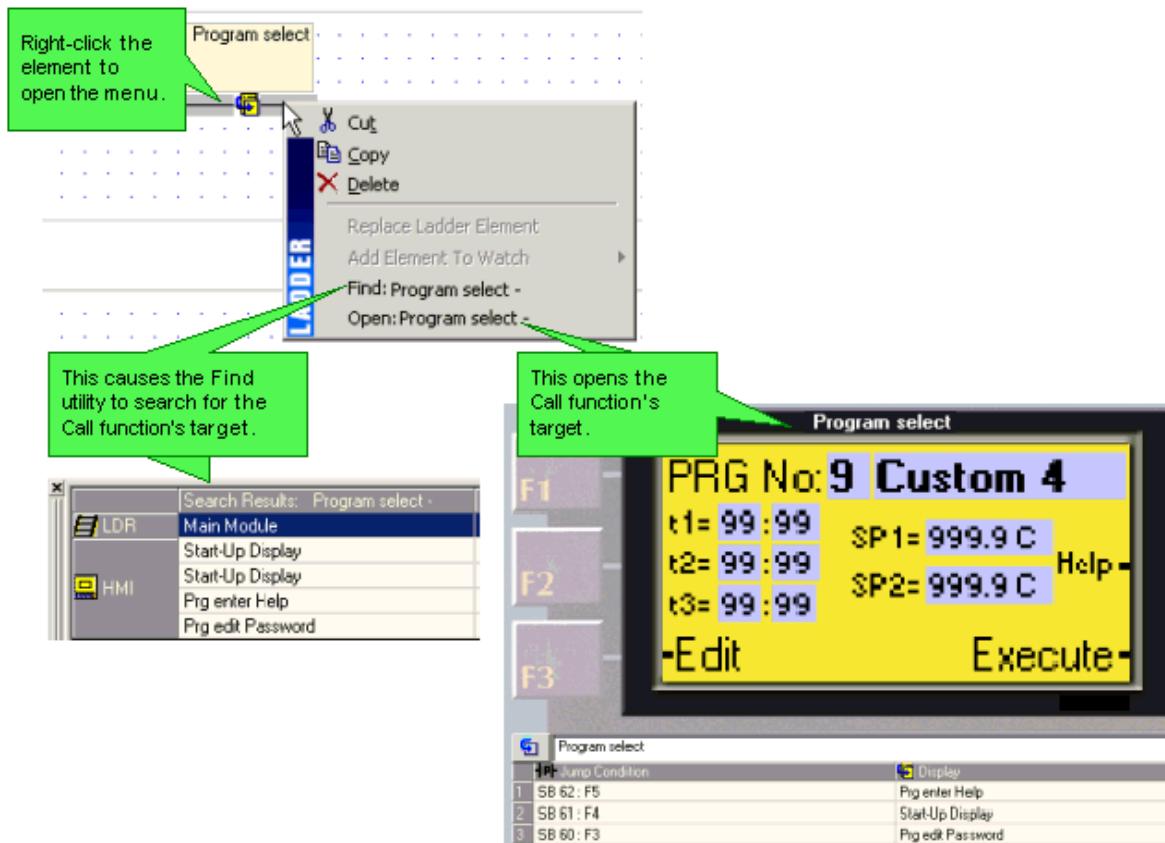
VisiLogic offers different tools for program navigation.

#### Program Tree

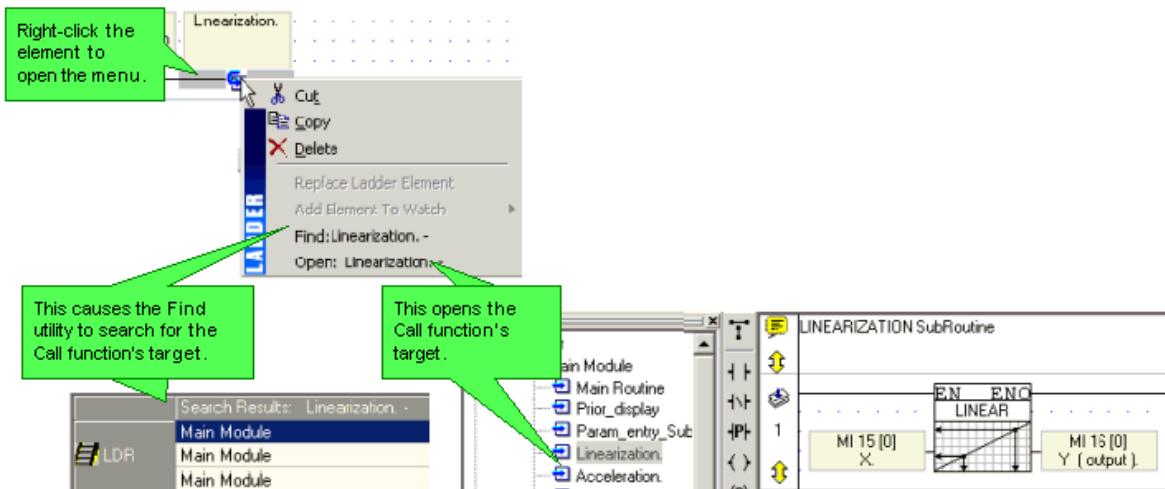


<b>Note •</b>	Within the program tree, elements are presented alphabetically. This does not affect the order in which the program runs.
•	Ladder Modules and subroutines can be moved via drag-and-drop, as can HMI Modules and Displays. Again, moving elements does not affect the order in which they run. The Main Ladder Module, Main Subroutine, Start-up HMI Module and the Start-up HMI Display cannot be moved via drag-and-drop or erased. For easy identification, they are always marked in orange.

### Accessing a Load Display Target

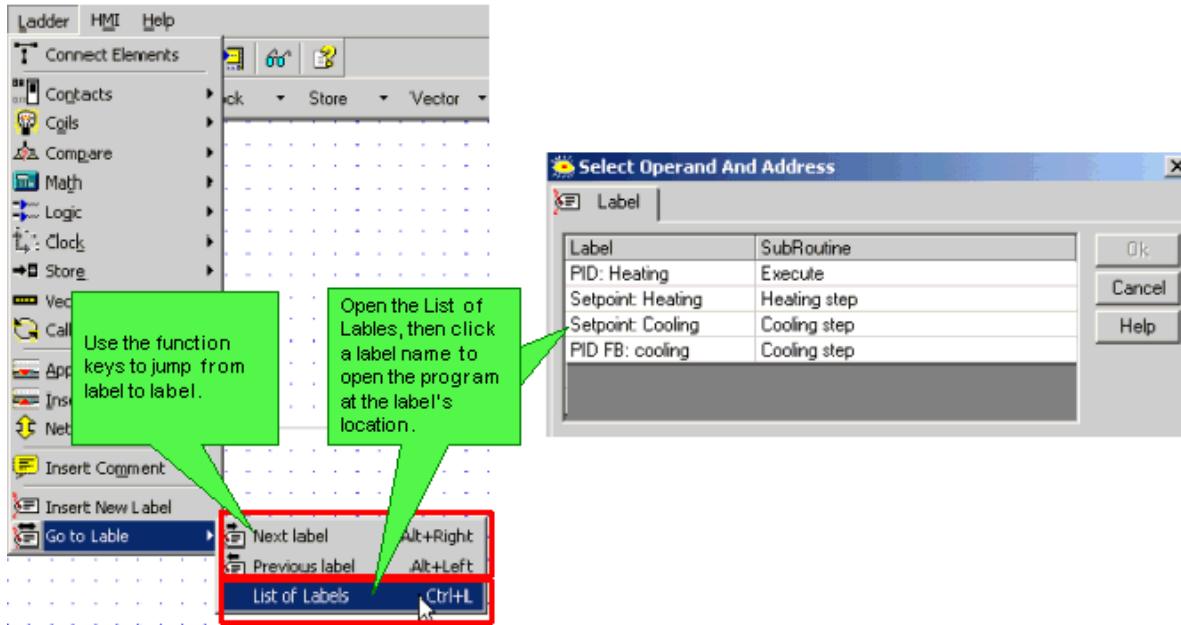


### Accessing a Call Subroutine Target



### Go To Label

Use labels as bookmarks to mark program sections, and then locate them using the Go To Label + <Right/Left arrow> and List of Labels  + <L> utility.



The Find utility also enables you to easily locate, directly open, and edit most program elements.

In addition, shortcut menus that are relevant can be opened.

## Variables

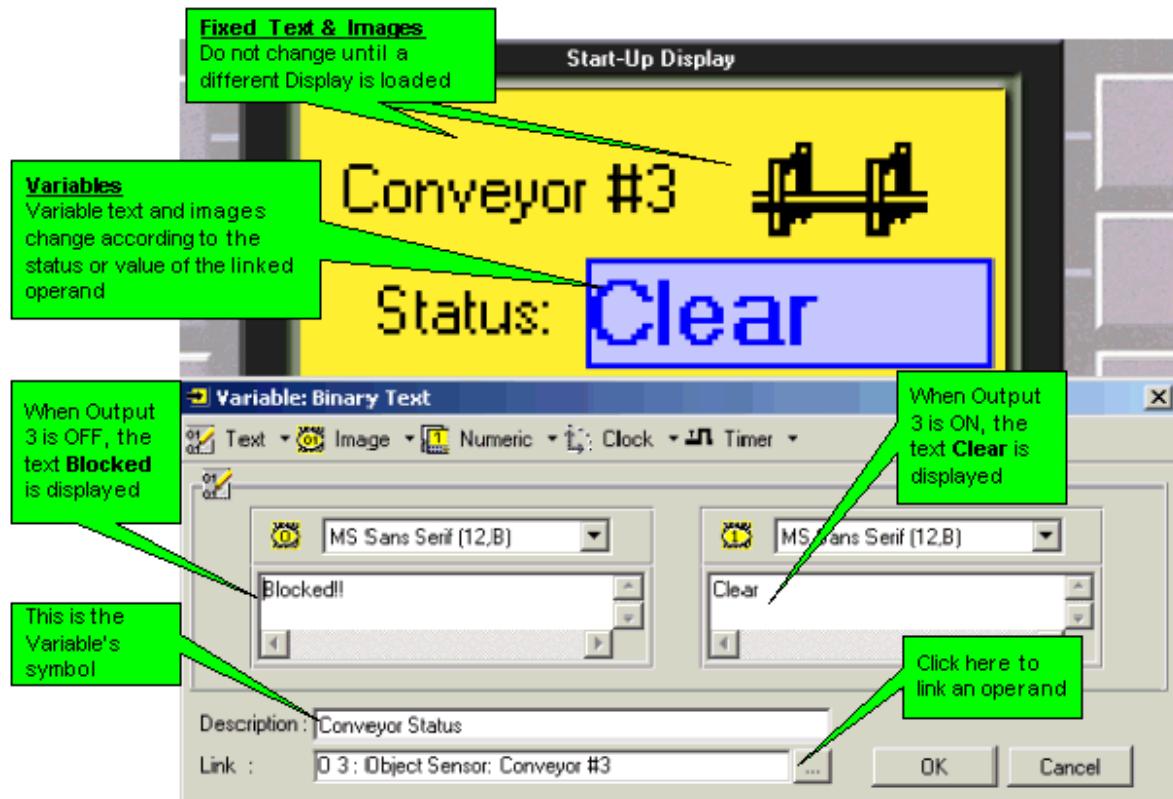
Variables enable you to show run-time values, text, images, and bar graphs on the controller's screen in response to run-time conditions. Bit, or binary text variables, for example, display text messages on the controller's LCD screen according to the status of a bit operand.

A Display may contain up to 24 variables.

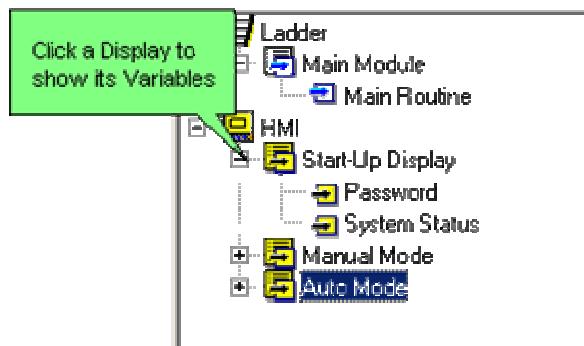
You can also use Keypad Entry Variables to enable an operator to enter a password, or data such as setpoints from the controller's keyboard.

### Variable Editor

When you insert a variable into a display, the Variable Editor opens, showing you the options that are relevant for that type of Variable.



After you have inserted Variables into a display, they are shown with that display in the Project tree.

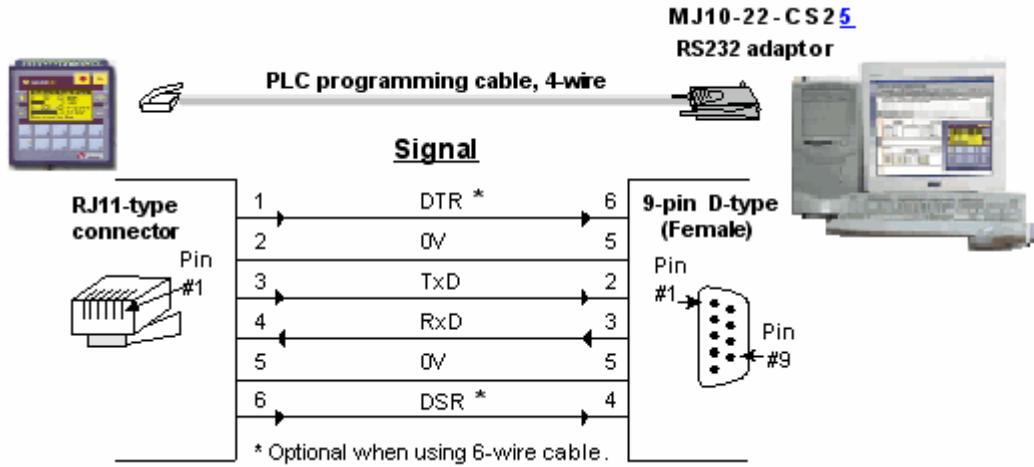


## Downloading/Uploading a Project

The Download process transfers your project from the PC to the controller.

To download a project to a controller:

1. Connect the controller to the PC with the programming cable.



2. Click the Download icon on the Standard toolbar.
3. The downloading process begins.

To upload a project from a controller:

1. Connect the controller to the PC with the programming cable.
2. Select Upload icon from the Connection menu; the Vision Communication PC Settings window opens.
3. Select the connection type and click Exit; the uploading process begins.

Upload copies the complete project from the controller into the PC.

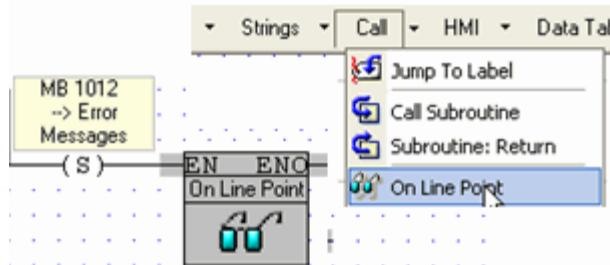
Via Project Properties, you can apply upload and download options:

- Assign a project password. Password protection requires users to enter a password before uploading a project to a PC.
- Prevent project upload.

## On-Line Test Mode (Debug)

To test a project, first connect the controller to your PC using the program download cable provided with the software package, then download the project and click the On-Line Test button. The Online Test toolbar opens, enabling you to:

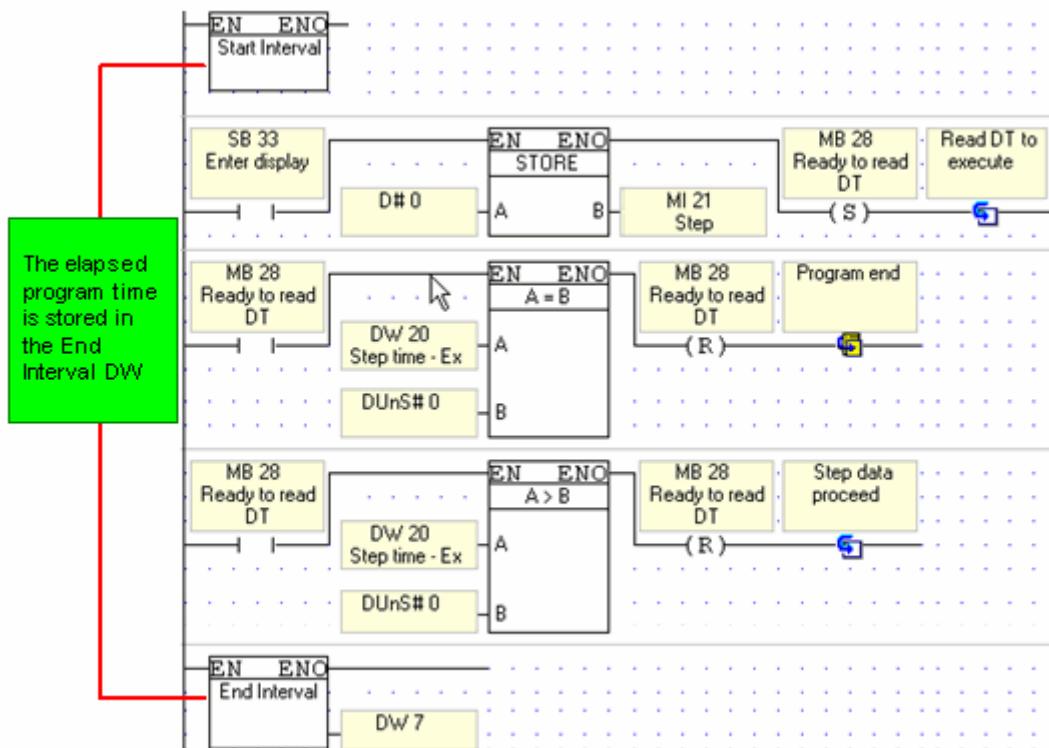
- Switch between Run and Stop modes.
- Use Single Scan to run a single cycle of the ladder program for debugging purposes.  
You can stop the scan cycle at any point by placing OnLine Test Points, located on the More menu, in the Ladder.



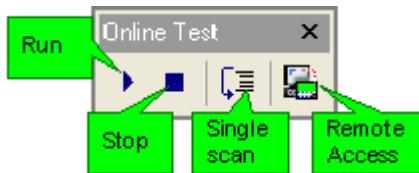
When the scan reaches an OnLine test point that is active (receives RLO), Online Test freezes, enabling you to check element status and values, including Timer values, at that point during Ladder execution. Note that if more than one OnLine test point is activated, SB 35 turns ON.

- Measure the time interval between 2 points in the Ladder application, by placing Start and End Interval elements, located on the More menu, anywhere in the application. The time interval, in

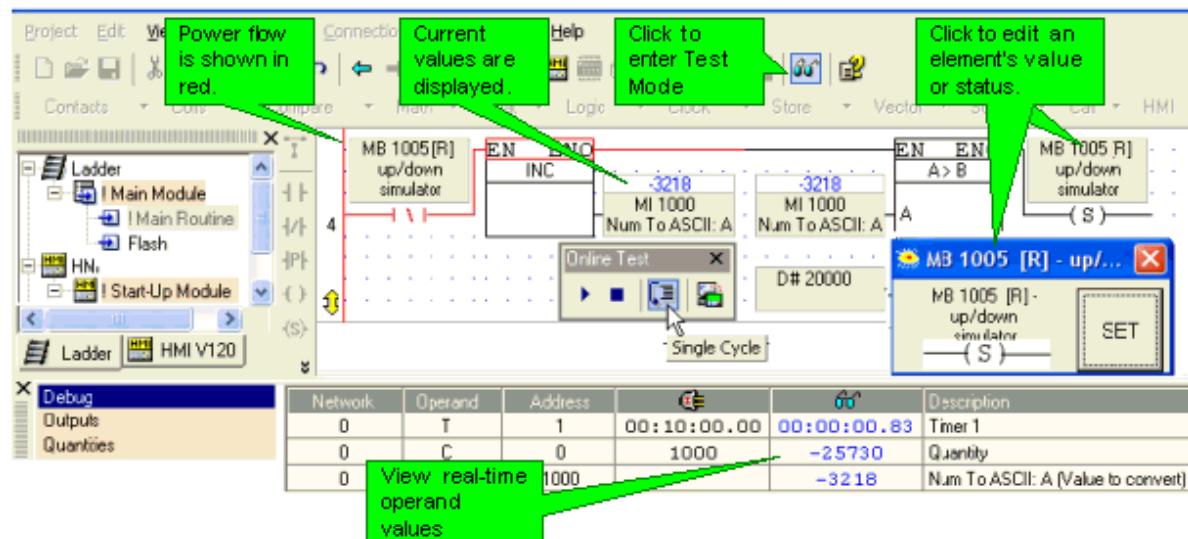
micro-seconds, is stored in the DW linked to the End Interval element.



- Open Remote Access to debug remote controllers via network or modem connections.



In Online Test mode, you can view the power flow, and view and force operand values and element status.



**Note •** The controller can send and receive SMS messages when the controller is in Test mode.

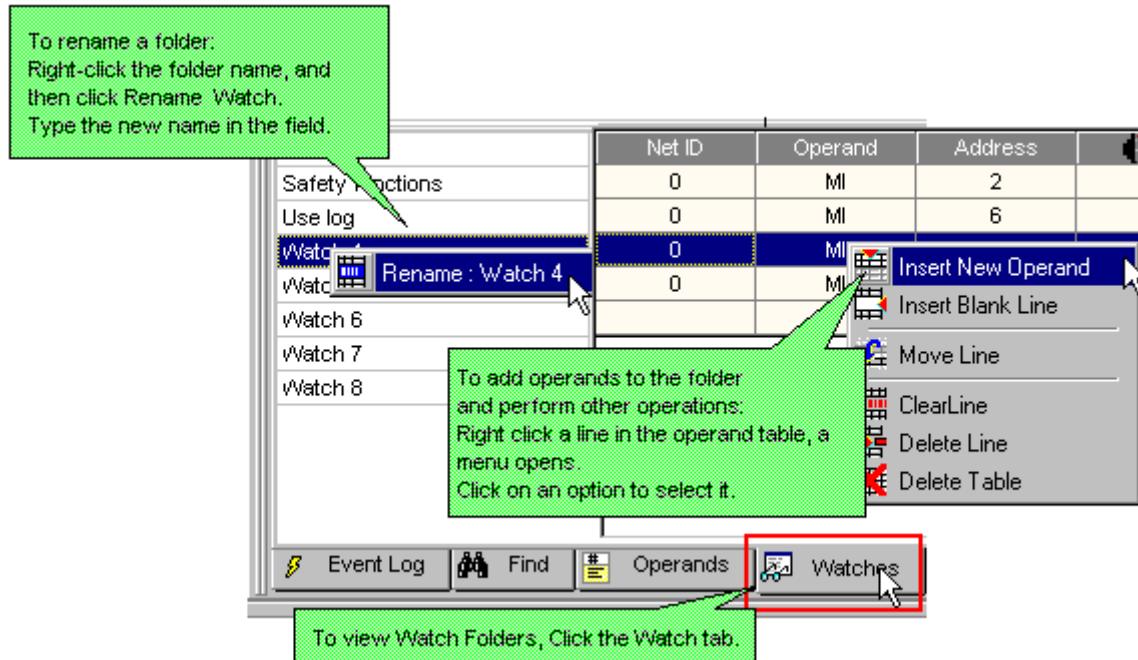
## Watch Folders

Watch Folders enable you to:

## Getting Started

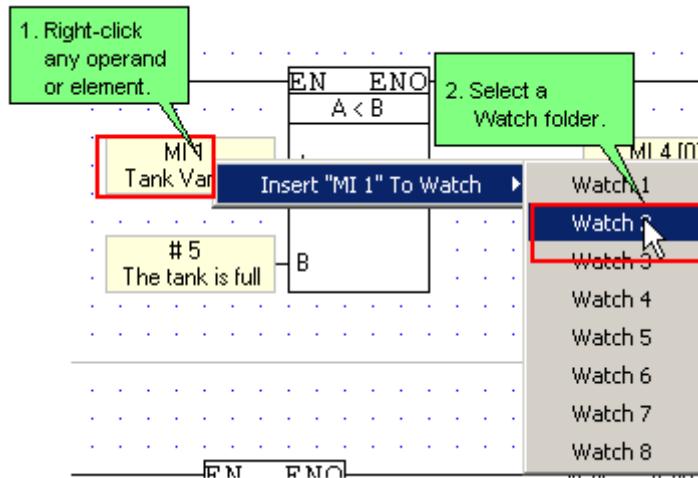
- Arrange related groups of operands in folders.
- Name the folders.
- View these operands in the tabbed Output Window at the bottom of the screen.

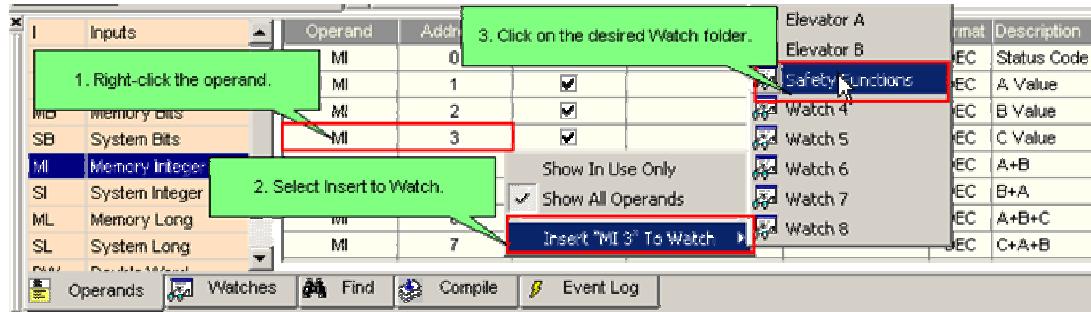
To view a Watch folder, click the Watches tab at the bottom of the screen, then select the desired folder. Edit the folder by right-clicking a line, then selecting the appropriate function.



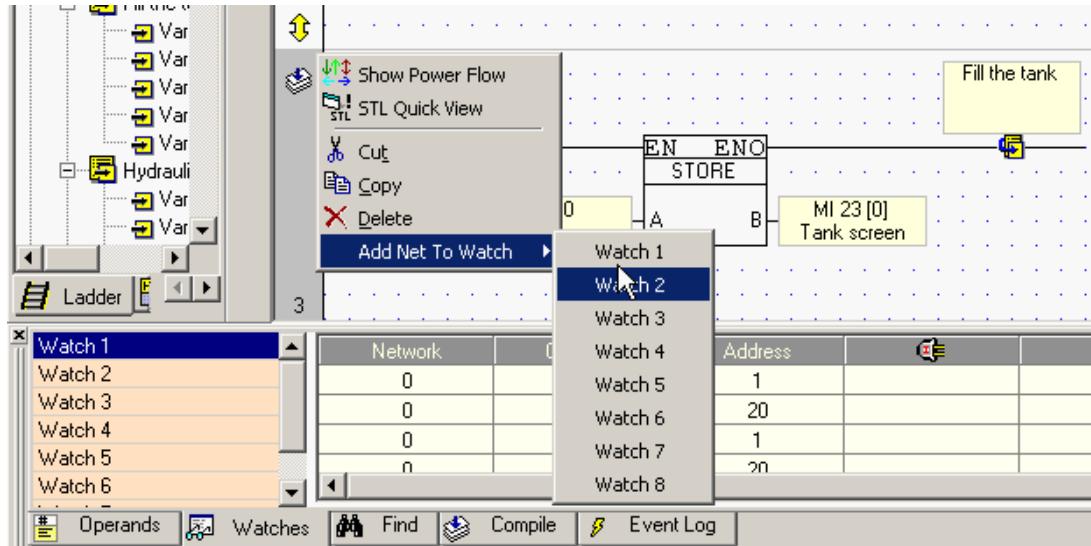
Adding Operands to a Watch Folder from a net

- To add a single operand to a Watch folder, right-click it in the Ladder or in the Operand Output Window.





- To add all of the operands within a net to a Watch folder, right-click the right-hand rail of the desired net.



## Information Mode

Information Mode is a utility that is embedded in the operating system of the controller. Via Information Mode, you can view data on the LCD screen, use the controller's keyboard to directly edit data, and perform certain actions such as resetting the controller. You can enter Information Mode at any time without regard to what is currently displayed on the LCD screen.

Enter Information Mode by pressing the <i> key for a few seconds. The default password is 1111.



Viewing data does not affect the controller's program. Performing actions, such as initializing the controller, can influence the program.

Note that when you use Information Mode, the keyboard is dedicated to that purpose. The keys return to normal application functions when you exit Information Mode.

## Using Information Mode

1. To enter Information mode, press the <i> key on the Vision's keyboard.
2. Enter your password. The default password is 1111. This password remains in effect until you change it via the Information Mode screen described in the table below.
3. The controller enters Information Mode, showing the first category, Data Types. Use the <Enter> key to enter a category.
4. Press the <ESC> key to exit a category, and to exit Information mode.



The controller will block entry into Information mode until the correct password has been entered. This is why you must record any password you set for your controller.

The data in Information Mode is arranged in Categories. Each Category contains several Subjects. You navigate Information Mode by using the keyboard buttons.

To exit Information mode, press the <ESC> button on the Vision's keyboard. Each press returns one level up. Press the number of times necessary to exit.

**Note •** When you reenter Information Mode, the controller will return to the last Category viewed.

- V290 only

Note that in order to enter Information Mode, you touch the V290's touchscreen in an area that is not occupied by a Keypad Entry variable or other screen object that has been assigned a Touch Property. Maintain contact for several seconds, until the controller enters Information Mode. The V290 displays Information Mode options on the touchscreen exactly as other Vision controllers display these options on their LCD screens.

To navigate through Information Mode, use touchscreen keys just as the keypad keys are used in other Vision controllers.

The table below shows the categories of information that can be accessed in this mode.

### **Info System Operands**

INFO mode, SB 36

#	Description	Turned ON	Turned Off	Comments
SB 36	INFO mode	By OS, Remote Access, or program	Turns OFF when user exits Info Mode	Delay time to enter Info Mode is 4 seconds, may be modified via SI 50

INFO Delay time, SI 50

#	Description	Value	Comments
SI 50	INFO delay time	Default by O/S (every power up) = 4 seconds	<ul style="list-style-type: none"> <li>▪ Units: seconds.</li> <li>▪ Legal values: 0, 3 to 20.</li> <li>▪ If you force or store '0' into equal Zero – INFO is disabled.</li> <li>▪ For V290 – Touching the &lt;i&gt; key on the touch screen starts Info Mode – Touching a legal Ladder application variable clears the INFO time.</li> </ul>

Category	Subject	Possible Actions
Data Types	Memory Bits	<ul style="list-style-type: none"> <li>• View bit status</li> </ul>
	System Bits	<ul style="list-style-type: none"> <li>• Change bit status (Set/Reset)</li> </ul>
	Memory Integers	<ul style="list-style-type: none"> <li>• View integer/long integer/double word value.</li> </ul>
	System Integers	<ul style="list-style-type: none"> <li>• Change values</li> </ul>
	Memory Longs	<ul style="list-style-type: none"> <li>• Toggle Base: view the value in decimal or hexadecimal form.</li> </ul>
	System Longs	
	Memory Double Words	
	System Double Words	
	Inputs	<ul style="list-style-type: none"> <li>• View input status.</li> <li>• Force input status to 1 (FR1) or 0 (FR0). Forced values stay in effect until Normal mode (NRM) is selected, or until the controller is initialized or reset. Note • Forced values do influence your program. This can be useful in testing the effect of an input condition on an output status.</li> </ul>
	Outputs	<ul style="list-style-type: none"> <li>• View output status.</li> </ul>

		<ul style="list-style-type: none"> <li>Force output status to 1 (FR1) or 0 (FR0). Note that forced output values do not affect your program.</li> <li>Set/Reset output status.</li> </ul>
	Timers	<ul style="list-style-type: none"> <li>Enter a Preset Timer value.</li> <li>View the current timer value and status by selecting the R.T. option.</li> </ul>
System	Model & O/S Ver	<ul style="list-style-type: none"> <li>Check the controller's model number and operating system version.</li> <li>Check whether the controller is in Run or Stop mode.</li> </ul>
	Working Mode	<ul style="list-style-type: none"> <li>Check whether the controller is in Run or Stop mode.</li> <li>Reset the controller. This restarts your program; restoring power-up values to all data types except for those protected by the battery backup. The battery protects Real Time Clock (RTC), all operand, and Data Table values.</li> <li>Initialize the controller. This restarts your program and initializes all values, restoring 0 values to all data types.</li> </ul>
	Time & Date	<ul style="list-style-type: none"> <li>View the Real Time Clock (RTC) settings. Note that the RTC settings control all time-based functions.</li> <li>Change the RTC settings via the controller's keyboard.</li> </ul>
	Unit ID	<p>The Unit ID number identifies a networked controller. You can:</p> <ul style="list-style-type: none"> <li>Change the ID number. The new ID number will remain in effect until the controller is reset.</li> <li>Burn the ID number into the controller's FLASH memory. This is a permanent change.</li> </ul>
	Serial Port 1 Serial Port 2	<ul style="list-style-type: none"> <li>View and edit communication settings.</li> <li>Select to Change or Burn the new settings.</li> </ul>
	CANbus Baud Rate	<ul style="list-style-type: none"> <li>Change the CANbus baud rate.</li> </ul>
Function Block	Reserved for future use	
Password	New	Set a New Password
Hardware Configuration		<ul style="list-style-type: none"> <li>Check if I/O Expansion Modules are installed. Note that I/O Expansion Modules are represented by letters. Identical module types are represented by identical letters as shown below.</li> <li>Shows if an I/O module is short-circuited.</li> </ul>



## COM Ports and Data Communications

Information regarding the communications features of specific Vision models is available from your local Unitronics distributor, or [export@unitronics.com](mailto:export@unitronics.com).

### Com Ports

Serial	All Vision controllers comprise RS232 serial communication ports. RS232/RS485 adaptors are available by separate order. Certain models, such as the Vision120, support both RS232 and RS485. For details on communications hardware settings, refer to the User Guides and documentation supplied with relevant models.
CANbus	Separate CANbus ports are built into specific controller models.
Ethernet	Ethernet ports are available by separate order.

**Note •** All ports can be used simultaneously. For example, a single controller may use one serial port to send messages to a modem via RS232, another port to communicate with a frequency converter, while the controller engages in communications via its CANbus port.

- Standard programming cables do not provide connection points for pins 1 and 6.

### Initializing COM ports

- Serial and CANbus communication ports must be initialized in your control program using the COM Init FB, located on the FB's menu.
- The Ethernet port must be initialized using the Ethernet Card Init FB, located under Ethernet on the FB's menu.

### Data Communications Options

Data Communications include all of the options shown below:

- CANbus Networking
- Modems, Landline, GSM, and CDMA
- GPRS
- Ethernet

### Communication FBs

- SMS messaging
- GPRS
- MODBUS (serial)
- MODBUS IP (Ethernet)
- Communications Protocol FB

### PC-Vision communications

- PC-Modem Configuration
- Remote Access: Accessing a PLC via PC
- Accessing a Networked PLC via PC

## About Modems

Unitronics' controllers can be hooked up to PSTN (landline), GSM, or CDMA modems via the RS232 COM port.

### PC-side Modems

You can use a PC modem to access a remote, modem-linked controller and perform any task, just as you would if the PLC were directly connected to your PC. For example, you can

- Download, upload, and edit the controller program via the modem connection.
- Run Online test mode.
- Download an OS to the controller via modem.
- Use OnLine test and Information Mode to troubleshoot problems in remote controllers and applications.
- Read and write data to/from controllers via Remote Access or Unitronics' communication .dll utilities.

### PLC-side modems

Via modem, a Vision controller can communicate data using:

- MODBUS (serial) commands.
- VisiLogic's Communication Protocol FB, which enables Vision controllers to communicate data with most external serial devices, such as bar-code readers and frequency converters, via their proprietary protocols.
- SMS messages. The SMS FB enables text messages, including variable data, to be sent and received via GSM and CDMA modems.

### Modem services

Located on the Connections menu, Modem Services enables you to use your PC to:

- Prepare/initialize PC & PLC side modems.
- Dial a PLC modem and receive calls from a PLC.
- Send SMS messages to a PLC.

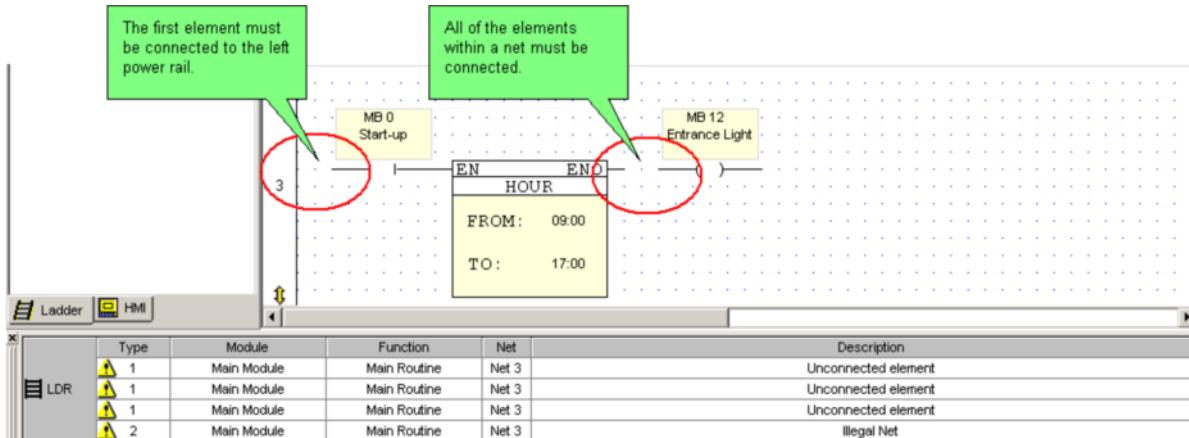
## Getting Started with Ladder

### Ladder Net

The Ladder diagram contains a left and right rail. Between these rails, the control application is arranged in nets. A net contains a row of Ladder elements that drive a coil. Power flows through the ladder elements in a net from left to right. Each net must contain only one rung.

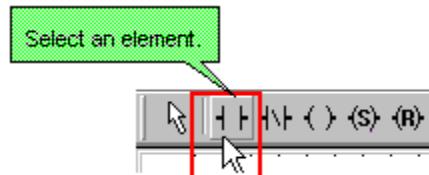
This is why the first ladder element in the net must touch the left Ladder rail. All of the elements in a net must be connected to allow power flow. You do not need to connect the last element on the right to the right side of the ladder in each net.

If the elements in a net are not connected, the software will display an error message when you compile your project.



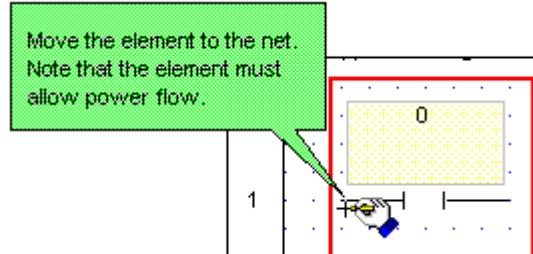
## Placing a Ladder Element in a Net

1. Select any type of Ladder element by:
  - Clicking its icon on the Ladder toolbar, -or-

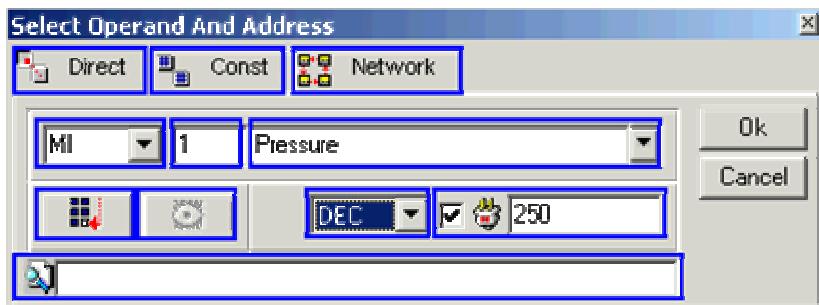


- Selecting it from the Ladder menu, -or-
- Right-clicking on the Ladder to display the Ladder menu and then selecting the element.

2. Move the element to the desired net location, then click.



3. Link operands using the Select Operand and Address dialog box shown below.



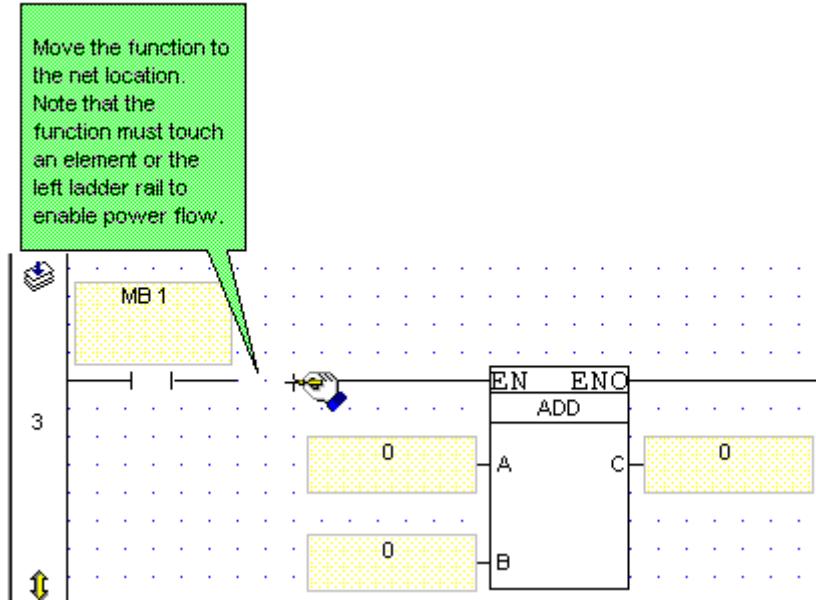
## Placing a Function in a Net

1. Select any type of Ladder function by:

## Getting Started

---

- Selecting it from the Ladder toolbar, -or-
  - Selecting it from the Ladder menu, -or-
  - Right-clicking on the Ladder to display the Ladder menu and then selecting the function.
2. Move the function to the desired net location, then click.

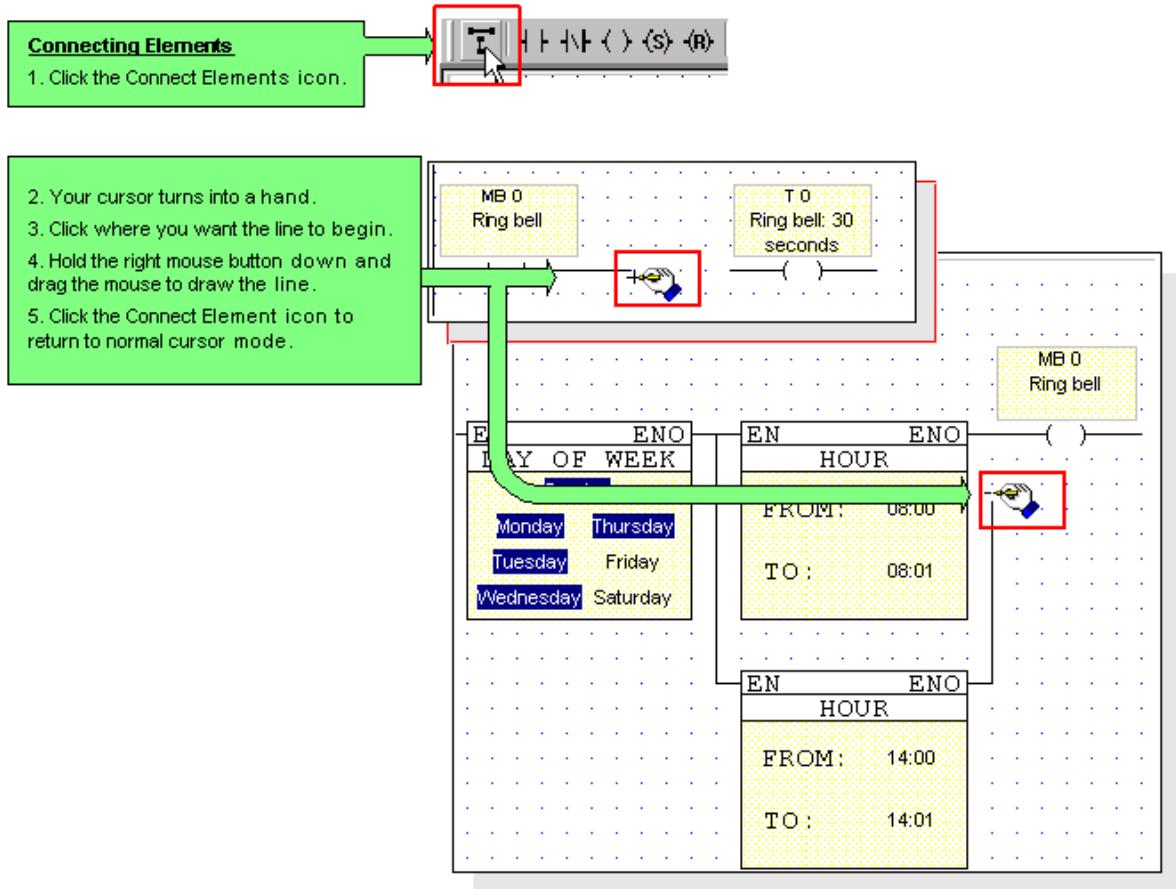


3. Link operands using the Select Operand and Address dialog box.

## Connecting Ladder Elements and Functions

Use the Connect Elements tool to connect two or more elements or functions in a net. All net elements must be connected in order to allow power to flow through the net. If they are not connected you will not be able to compile your application.

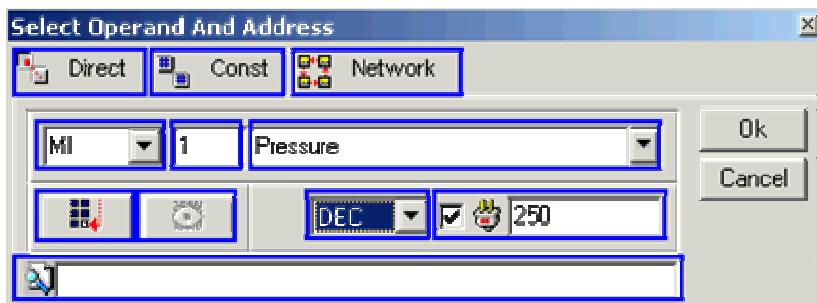
## Connecting Elements



## Linking Operands to Elements

When you place a Ladder element or function on a net, the Select Operand and Address dialog box opens. All of the operands and operand types that are displayed in the Select Operand and Address dialog box are applicable to the element or function that you have selected. To edit an operand attached to an element, you can also double-click on the yellow Description field of an element after it has been placed in the Ladder.

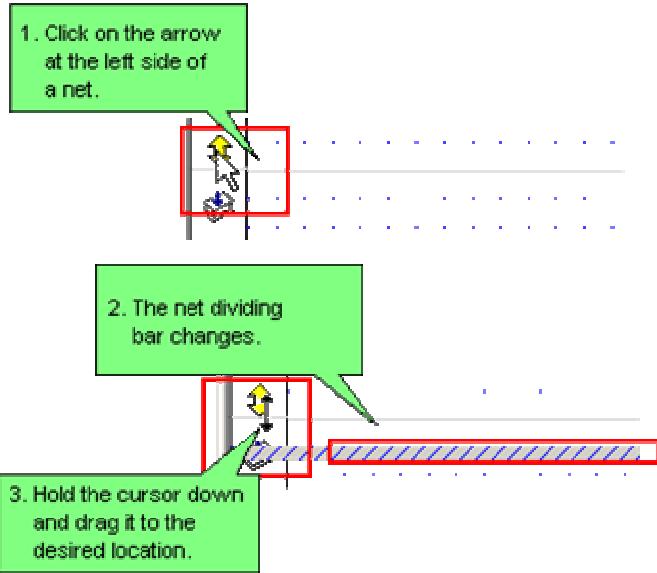
You can search for a particular operand by using the Search: Symbolic Name function at the bottom of the dialog box.



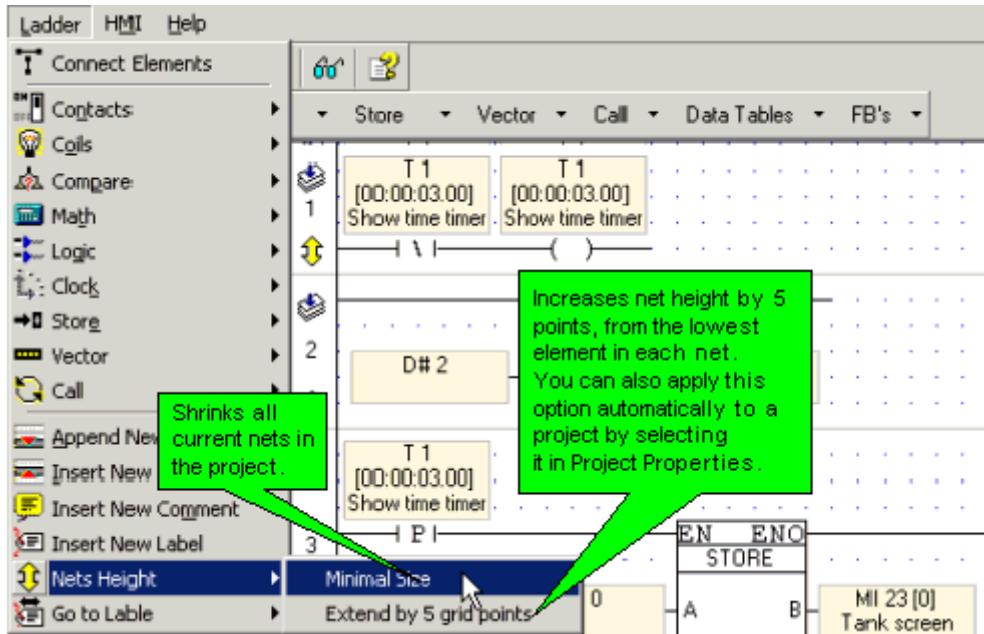
## Nets: Sizing and Resizing

To shrink a net to its minimum height, double-click the net's left-hand rail.

Nets can be also manually resized.



The Ladder menu contains two options that enable you to resize nets throughout a project.



### Adding and Inserting Nets

To add a net to the bottom of your Ladder:

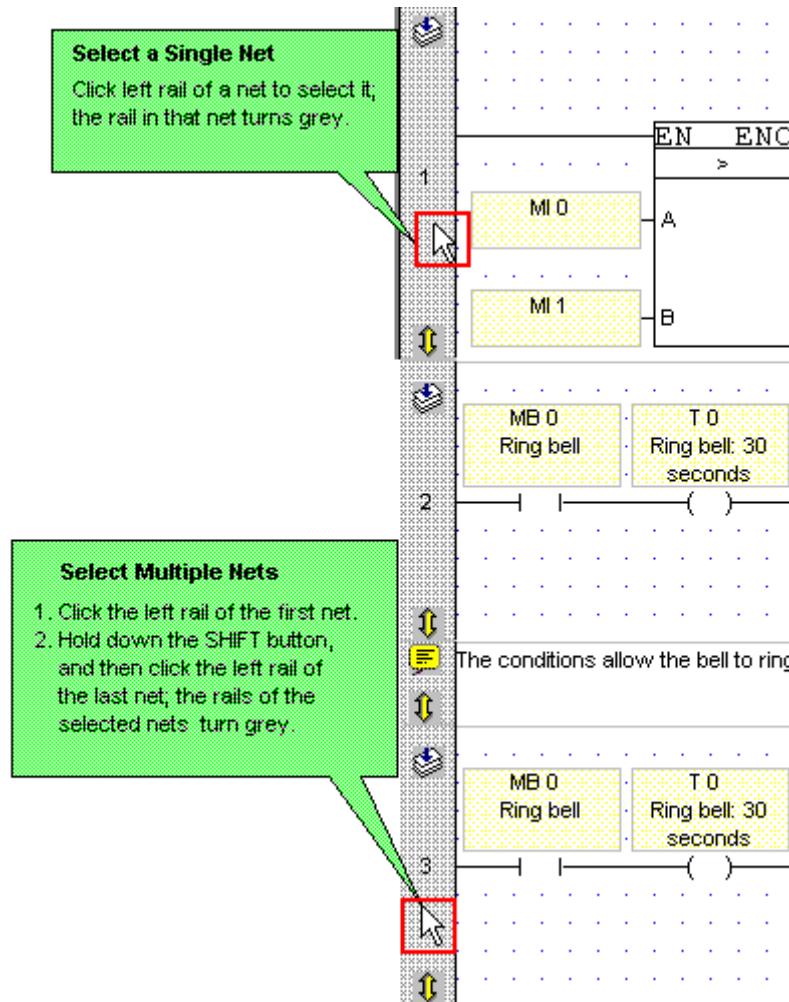
- Select the Append Ladder icon from the Insert menu; a net is added to the bottom of the Ladder application..

To insert a Ladder net:

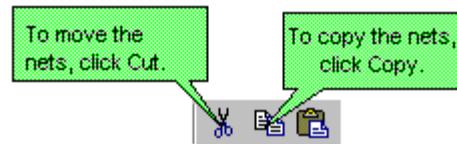
- On the Ladder toolbar, click on the Insert Net icon ; your cursor changes into a cross-hairs.
- Click on a net; the new net is inserted above the net you clicked on.

### Move, Copy, & Paste Nets

- Select the desired net(s).



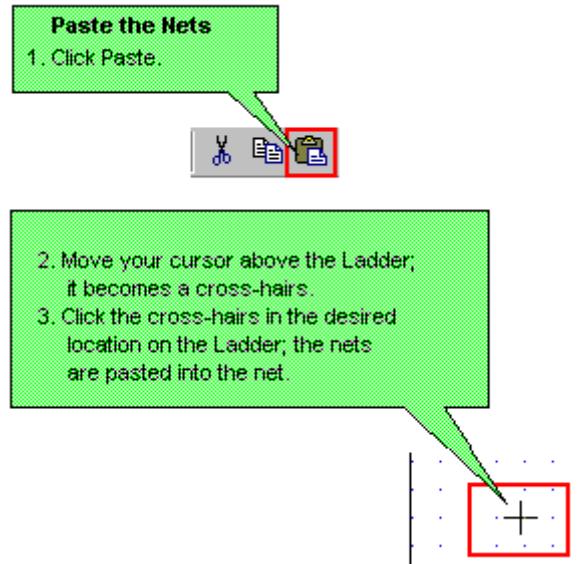
2. Select the desired operation.



-or-

Select Cut or Copy from the Edit menu.

3. Place the elements in the net.

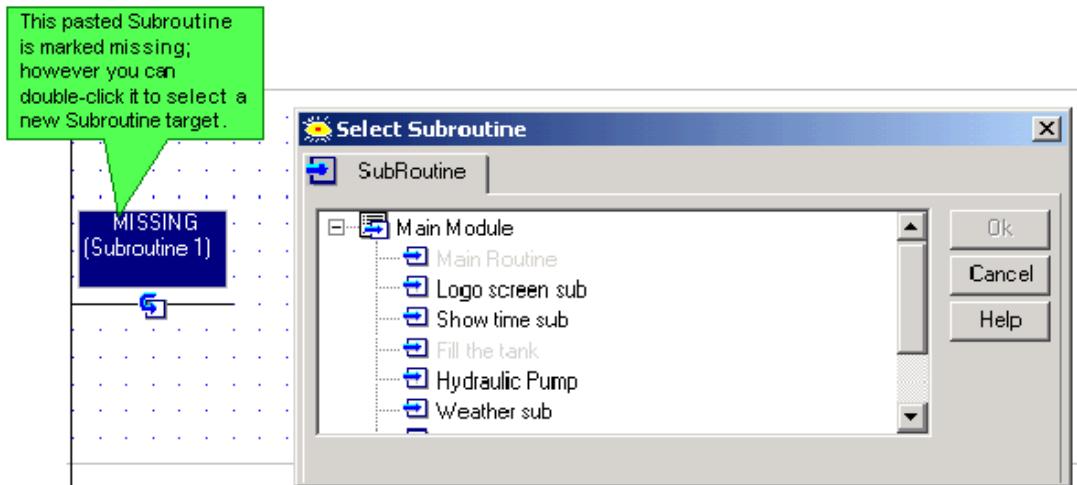


-or-

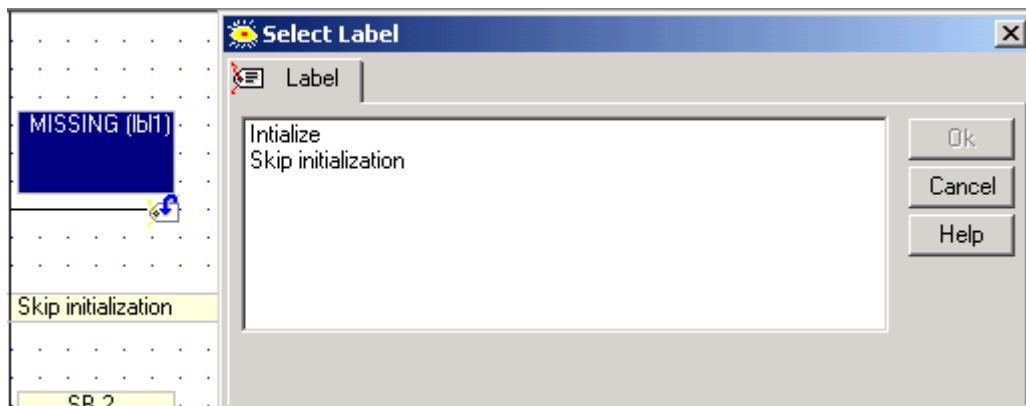
Select Paste from the Edit menu.

You can also cut, copy and paste nets between projects, subject to the information listed below:

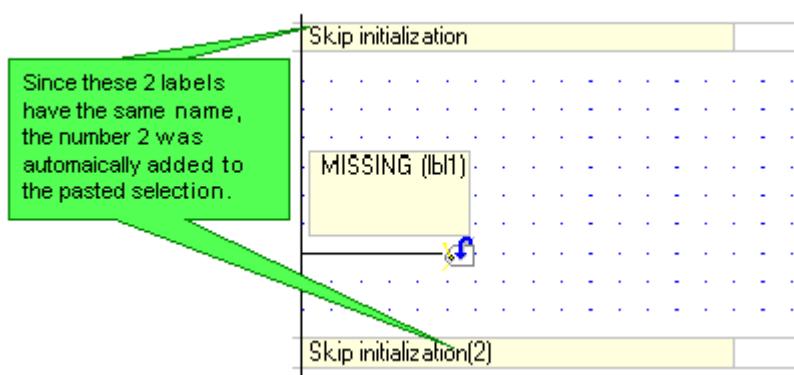
- Once you have cut or copied your selection from the source project, open a target project without closing VisiLogic, either by using the New Project or Open project buttons or via these options on the Project menu. If you close VisiLogic, the selection will be lost.
- If the source project contains Call Subroutine or Load HMI operations, note that the referenced elements will be marked as missing, even if the target project contains elements of the same name. Note that you can reassign the references.



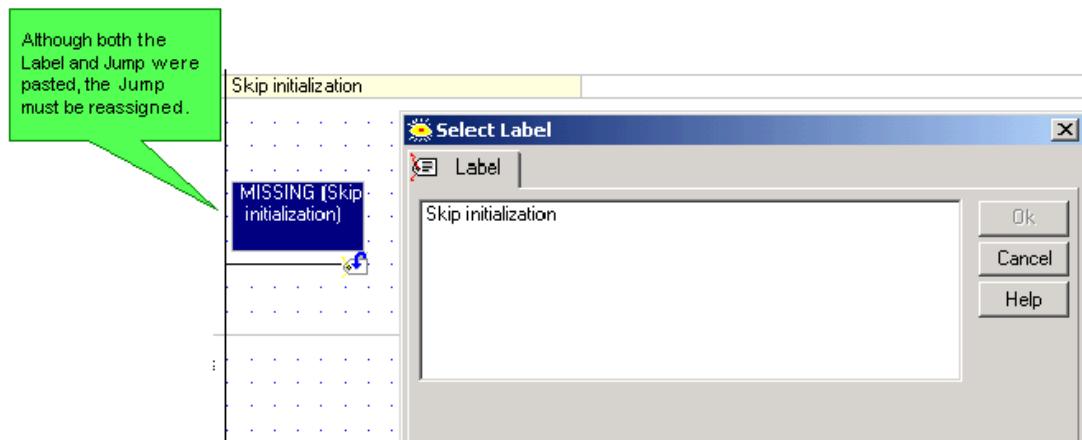
- If the selection contains FBs, and no FBs of that type currently exist in the target project, the pasted FBs will be the version currently in VisiLogic FB library--in other words, if the source selection contains older FB versions, they are automatically updated during the Paste operation.
- If the selection contains FBs, and FBs of that type currently exist in the target project in a different version, Paste cannot be completed.
- If your selection contains only Labels, without the attendant Jump to Label, they will be marked as missing, even if the target project contains Jumps of the same name. Note that you can reassign the references.



- If the selection contains Labels or Jumps with the same name as those in the target project, these will be automatically renamed by the program when they are pasted.



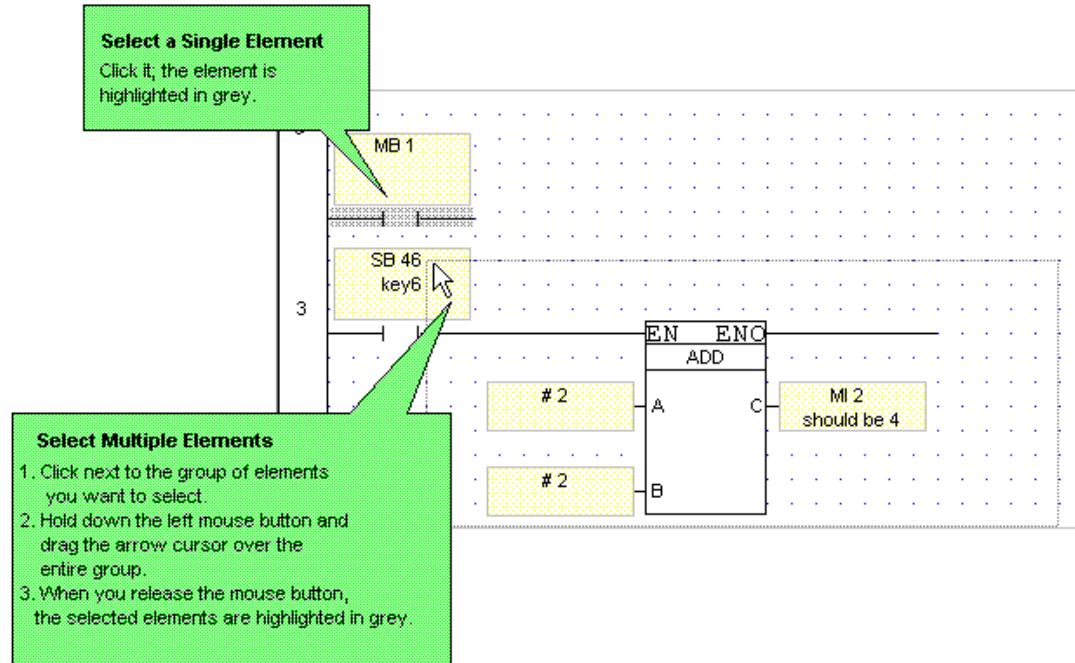
- If you copy both Labels and Jump to Label, the Jumps will be marked as missing. Note that you can reassign the references.



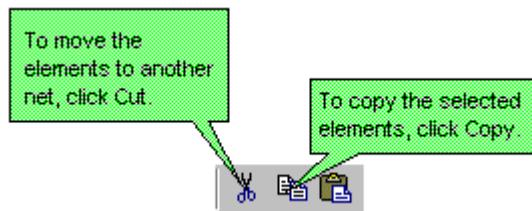
## Move, Copy & Paste Elements

Ladder elements and functions may also be dragged and dropped between nets.

- Select the desired element(s).



2. Select the desired function.



-or-

Select Cut or Copy from the Edit menu.

3. Place the elements in the net.

-or-

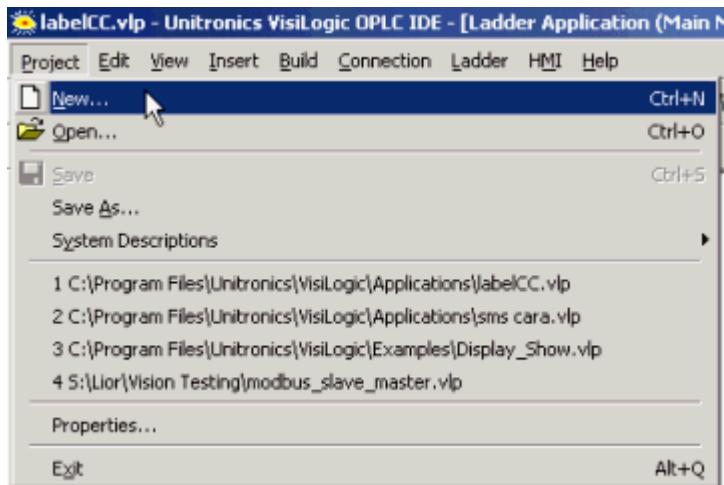
Select Paste from the Edit menu.

Note that when you paste elements into a net, the elements paste into the same relative location in the new net. The elements 'remember' their original net location. Therefore, before you paste elements into a net that already contains elements, move any elements that occupy the same position as the paste selection.

### Move, Copy, & Paste between Projects

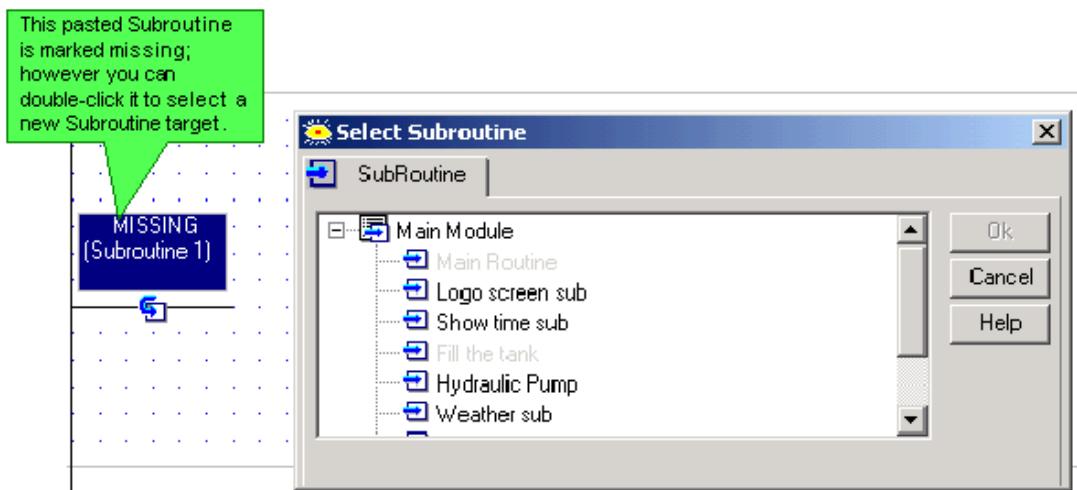
You can cut, copy and paste both HMI Displays and Ladder nets between projects, subject to the information listed below.

Once you have cut or copied your selection from the source project, open a target project without closing VisiLogic, either by using the New Project or Open project buttons or via these options on the Project menu. If you close VisiLogic, the selection will be lost.

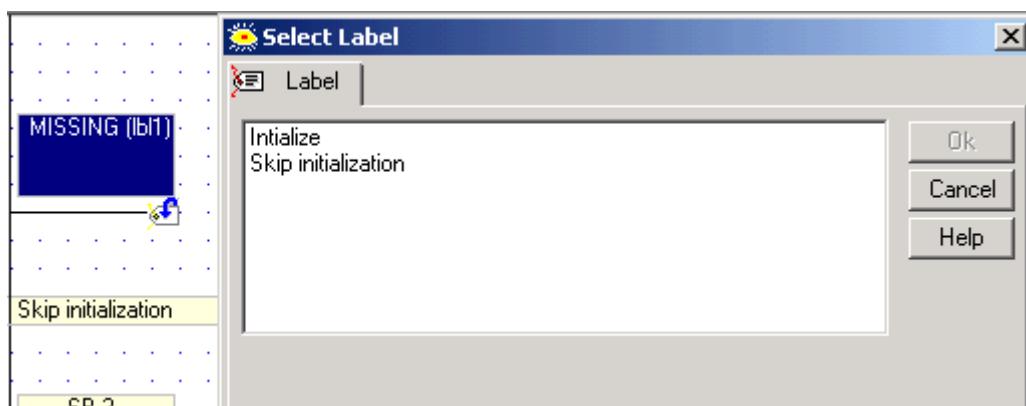


### Ladder

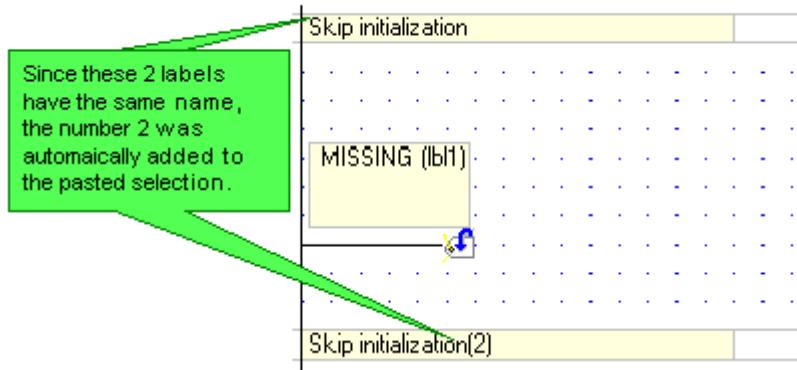
- If the source project contains Call Subroutine or Load HMI operations, note that the referenced elements will be marked as missing, even if the target project contains elements of the same name. Note that you can reassign the references.



- If the selection contains FBs, and no FBs of that type currently exist in the target project, the pasted FBs will be the version currently in VisiLogic FB library--in other words, if the source selection contains older FB versions, they are automatically updated during the Paste operation.
- If the selection contains FBs, and FBs of that type currently exist in the target project in a different version, Paste cannot be completed.
- If your selection contains only Jumps, without the attendant Labels, they will be marked as missing, even if the target project contains Labels of the same name. Note that you can reassign the references.



- If the selection contains Jumps and Labels with the same name as those in the target project, the Jump, Label and link between them will be automatically recreated by VisiLogic when they are pasted.



In this way, VisiLogic maintains the integrity of the links between Jumps and their corresponding Labels.

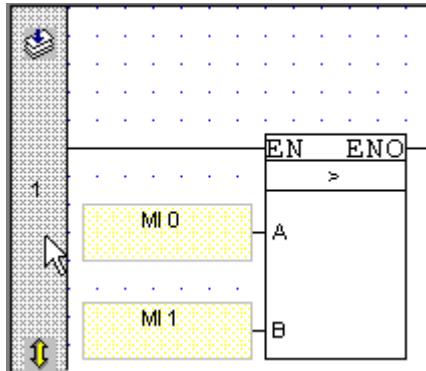
### Display elements

- When you paste elements into a Display, the elements paste into the same relative area in the new net. The elements 'remember' their original location. Therefore, before you paste elements into a Display that already contains elements, move any elements that occupy the same position as the Paste selection.
- If you paste variables that are linked to named constant values, note that the constant's description is lost during the paste operation.
- Variables do not retain their descriptions; they are renamed as Variable 1, Variable 2, etc..

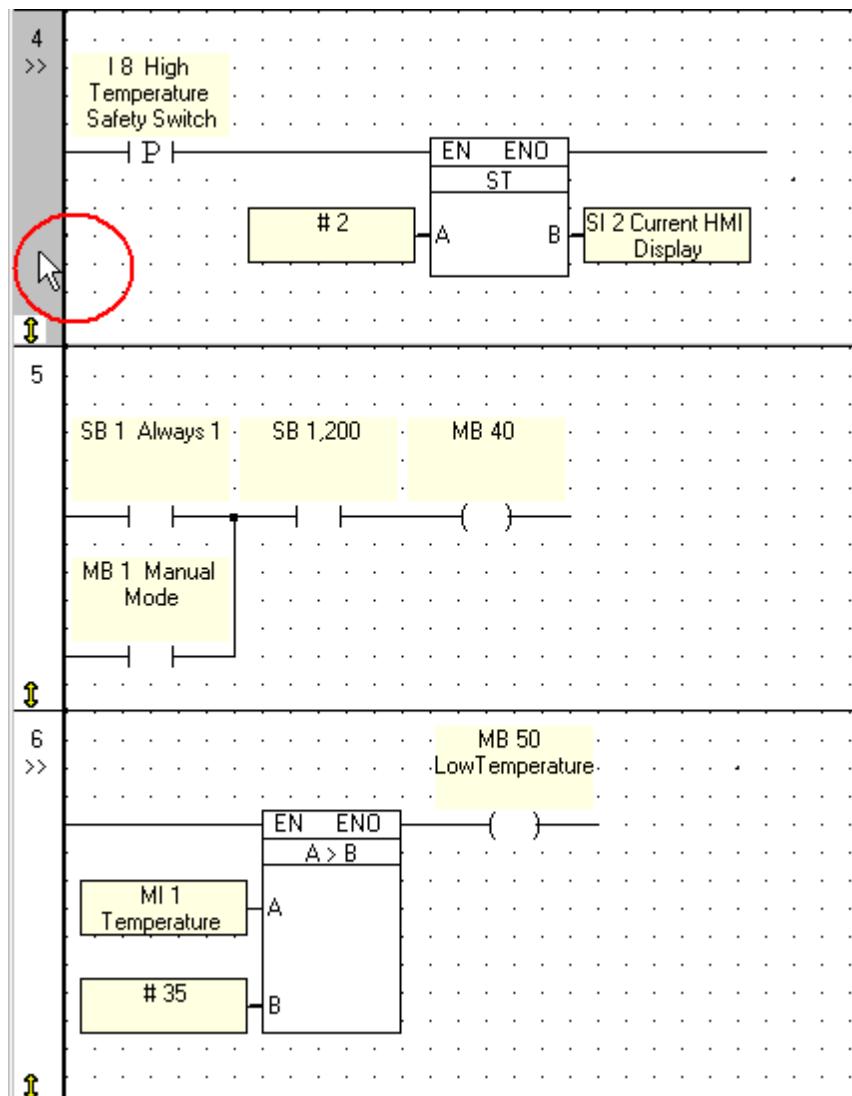
## Deleting Nets

First, select the desired nets.

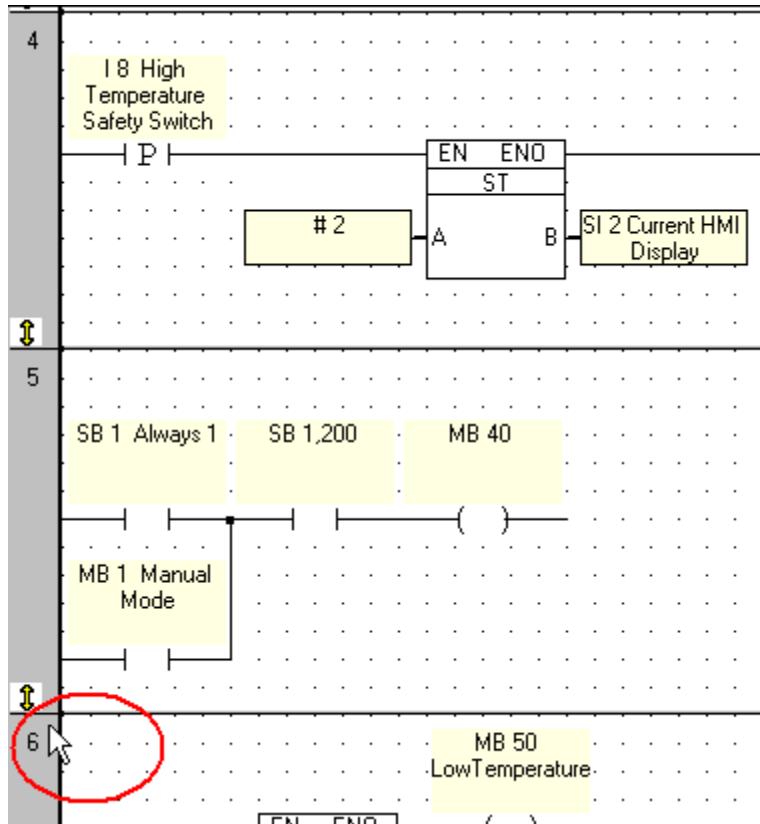
- To select one net
- Click on the left rail of a net to select it; the rail in that net turns grey.



- To select more than one net:
  - Select the first net by clicking on the left net bar.



2. Hold the Shift button and click on the last net in the range that you want to copy.



To move the selected nets,

- Press the Delete button on your computer keyboard; the net is deleted and all of the nets in your project move up.

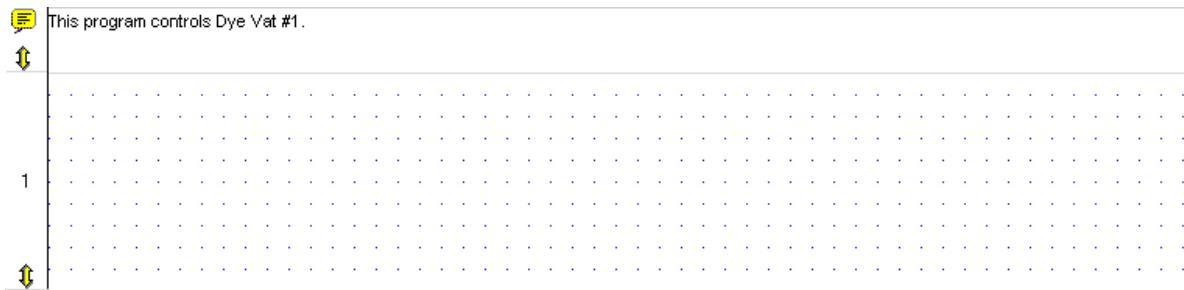
### Comments Tool

Ladder Editor Comments enable you to place remarks program nets. Comments can be written directly into the Comment pane, or written in Notepad and pasted.

Comments are not downloaded to the controller. To toggle Comments in and out of view, press **<Alt> + <C>**, or select the option from the View menu.

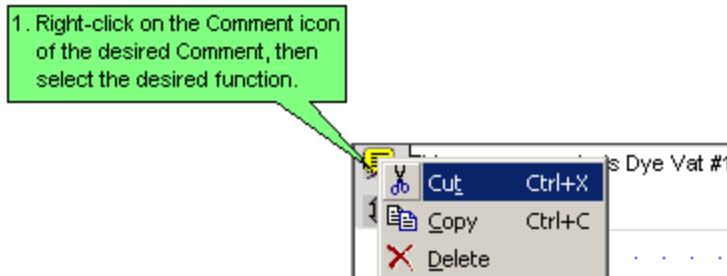
#### Insert a comment:

- Click on the Comment icon ; your cursor changes into a cross-hairs .  
-or-  
Select Insert Comment from either the Insert or Ladder menu.  
-or-  
Right-click on the Ladder, and then select Insert Comment.
- Click on a net; a Comment field opens in the net you clicked.
- Type text in the field.

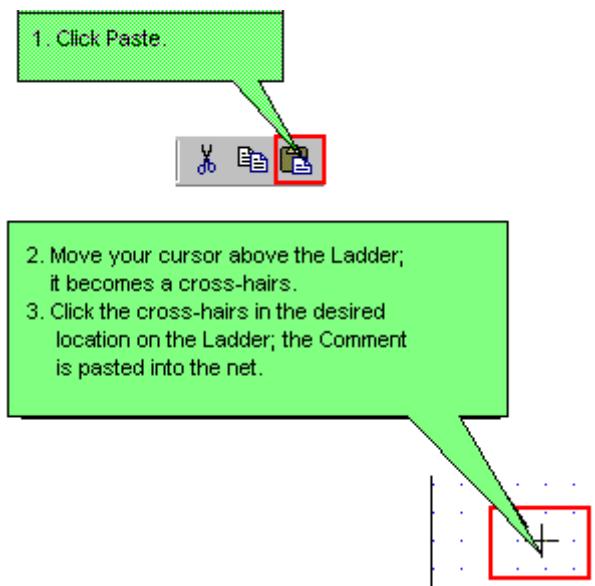


### **Move, Copy, and Paste Comments:**

1. Select the Comment.



2. Place the Comment in the net.

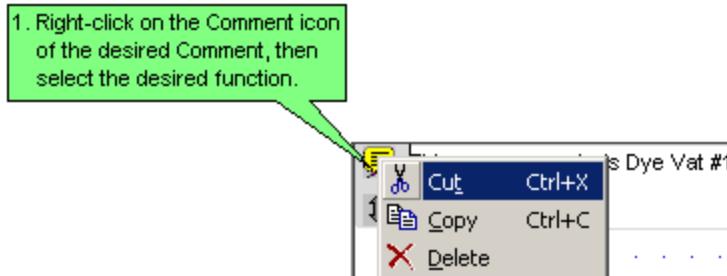


-or-

Select Paste from the Edit menu.

### **Delete a Comment**

1. Select the Comment.

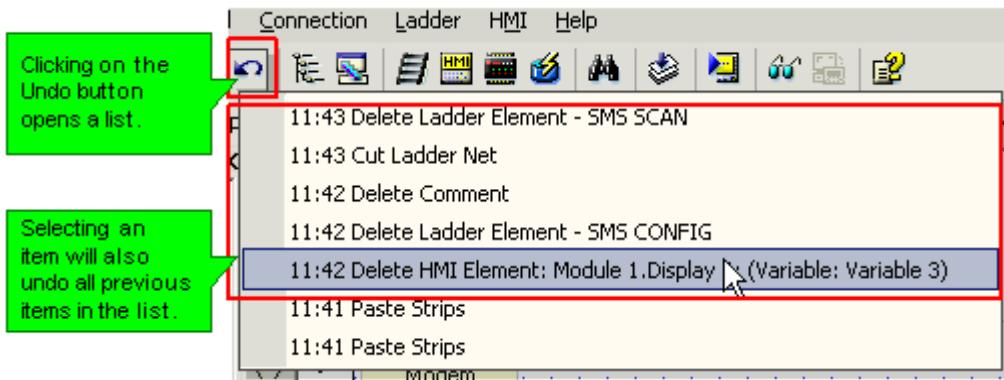


## Getting Started

2. Select Delete.  
-or-  
Press the Delete button on your PC's keyboard.

## Undo

VisiLogic supports up to 10 Undo/Redo actions.

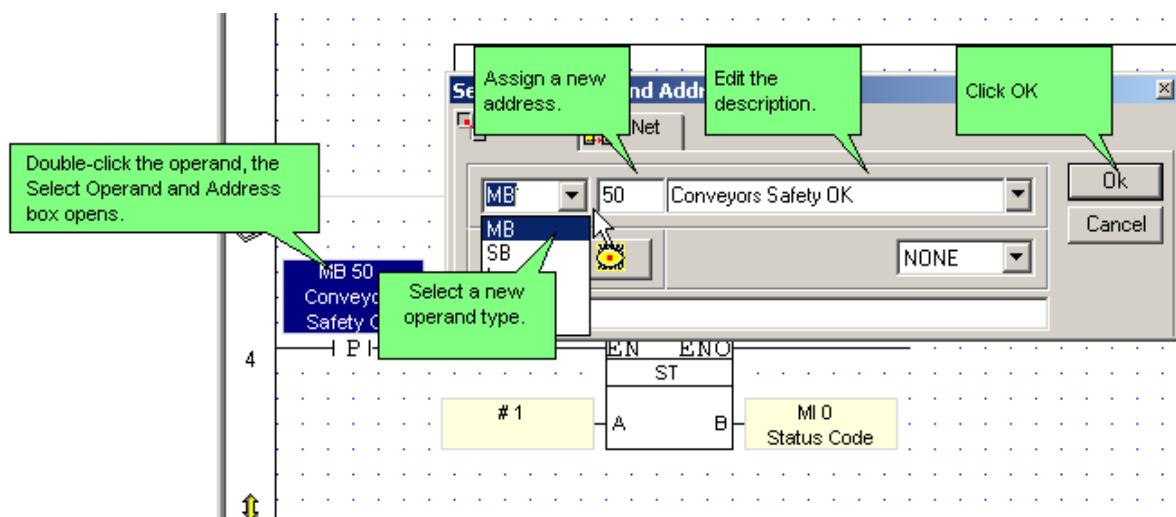


The list of supported actions is shown below.

Ladder	HMI	Project
Delete ladder element	Delete HMI Display	Compile
Delete ladder net	Delete HMI Elements	Build All
Delete Comments	Clear HMI Display	
Cut Ladder Elements	Cut HMI Element	
Cut Ladder Net	Paste HMI Elements	
Paste Ladder Element		
Paste Ladder Net		
Clear Sub		
Import Sub		

## Changing an Element's Operand

To edit an element's operand:



The element appears on the net with the new Operand, Address and symbol.

## Power-up Values

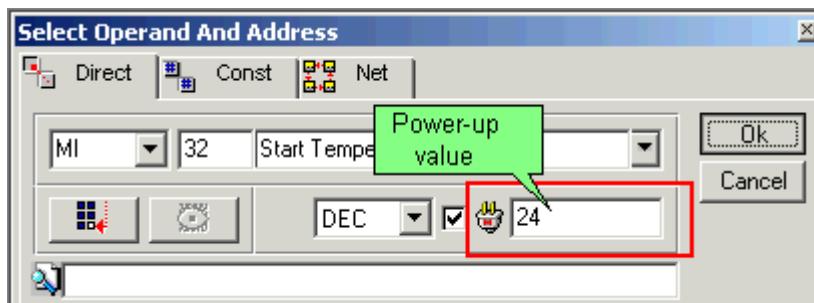
Power-up values can be assigned to most operands. These values are written into the operands when the controller is turned on.

Bit operands can be SET or RESET. Integers, Long Integers, and Double Words can be assigned values that are written into the operand at power-up.

You can assign Power-up Values in the:

- Select Operand and Address Dialog Box

Check the box next to the plug-shaped icon. This enables you to enter a value in the Power-up value fill-in field.



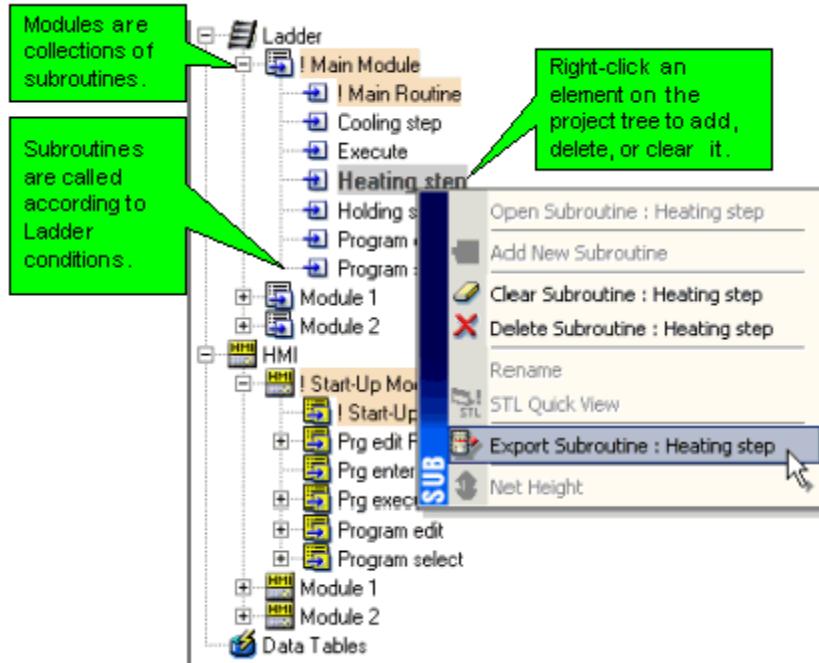
- Operand View Window

1. Select the Operand tab at the bottom of the screen.
2. Click on the Operand type to display the list of operands.
3. Enter Power-up values in the column headed by the Power-up icon.

		Operand	Address	In Use	Power-up value
	MI	Memory Integer	0	<input checked="" type="checkbox"/>	24
	SI	System Integer		<input checked="" type="checkbox"/>	
	ML	Memory Long	1	<input checked="" type="checkbox"/>	1024

## Program Sequencing: Modules, Subroutines, Labels & Jumps

A module is a container of subroutines. Use modules and subroutines to divide your application into program blocks. You can then run these program blocks conditionally, from any point in your control application.



**Note •** Within the program tree, elements are presented alphabetically. This does not affect the order in which the program runs.

- Ladder Modules and subroutines can be moved via drag-and-drop, as can HMI Modules and Displays. Again, moving elements does not affect the order in which they run. The Main Ladder Module, Main Subroutine, Start-up HMI Module and the Start-up HMI Display cannot be moved via drag-and-drop or erased. For easy identification, they are always marked in orange.

To control the Ladder program flow sequence and avoid loops, use the Call Subroutine function to conditionally call subroutines. Within a subroutine, you control the sequence by conditionally skipping over nets using Labels and Jump to Label functions. This enables you to shorten the program scan time.

A new VisiLogic project contains the main module and subroutine for the program. Each new subroutine contains a default number of nets and a Subroutine Return function.

Subroutines do not run if they are not called by Call Subroutine. If no Call Subroutine commands are included in the first subroutine of the main module, the program runs until it reaches the Subroutine Return function, and then jumps back to the beginning of the first subroutine.

**Note •** If a subroutine does not run, the coils in that subroutine will not be updated. For example, Subroutine 4 contains . If MB0 is turned ON in Subroutine 1, but Subroutine 4 is not called, O0 is not updated. The order in which I/Os are updated depend on the PLC program scan.

- Some FBs require Configuration, such as SMS. The FB Configuration should be placed in the first subroutine of the main program module. If a Configuration is in a subroutine that is not called into the program, linked FBs will not be processed even if the activating condition for that FB has been turned ON.

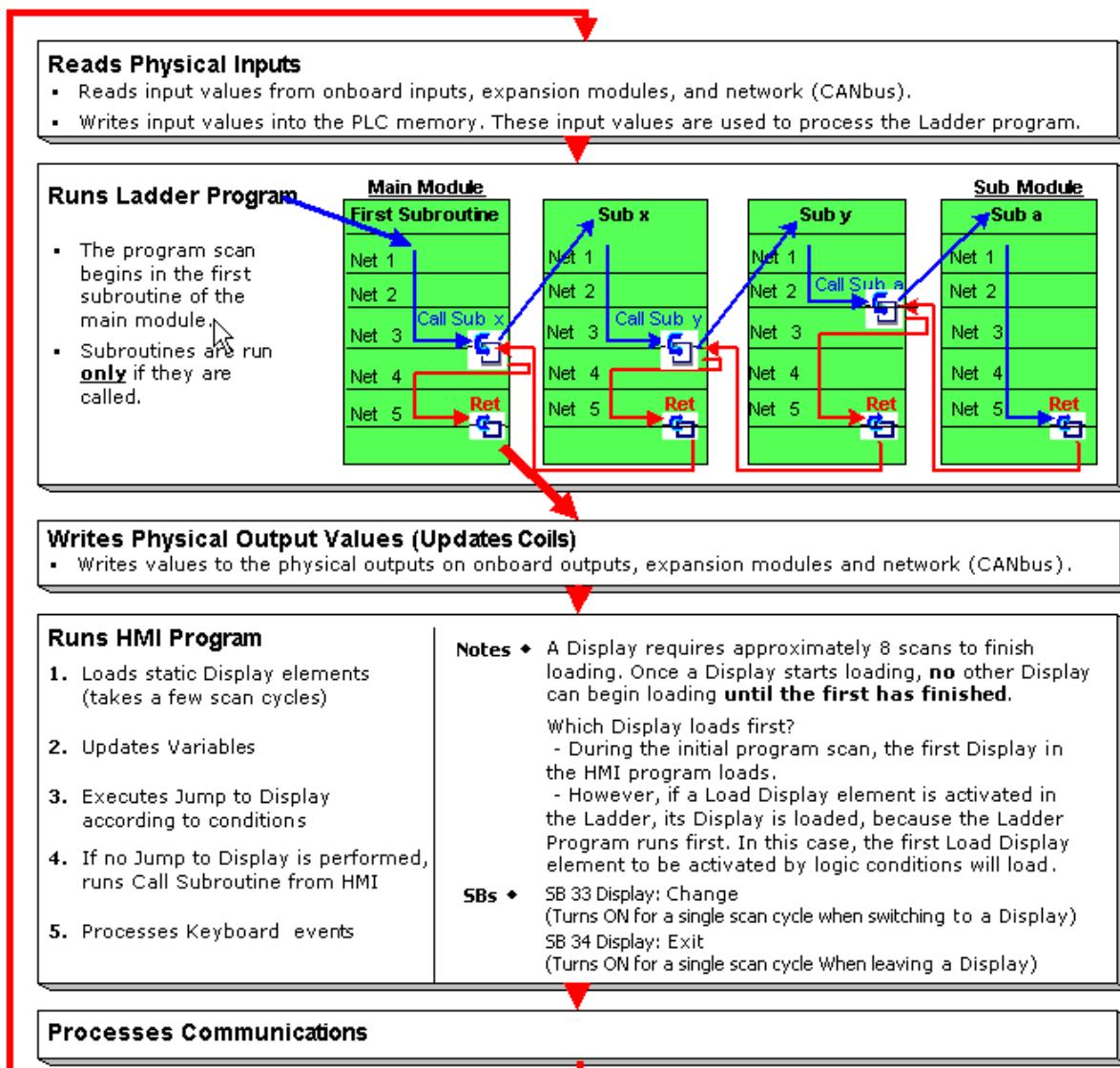
Subroutines can be reused as many times as required. Subroutines can also be exported and imported between projects.

### PLC Program Scan

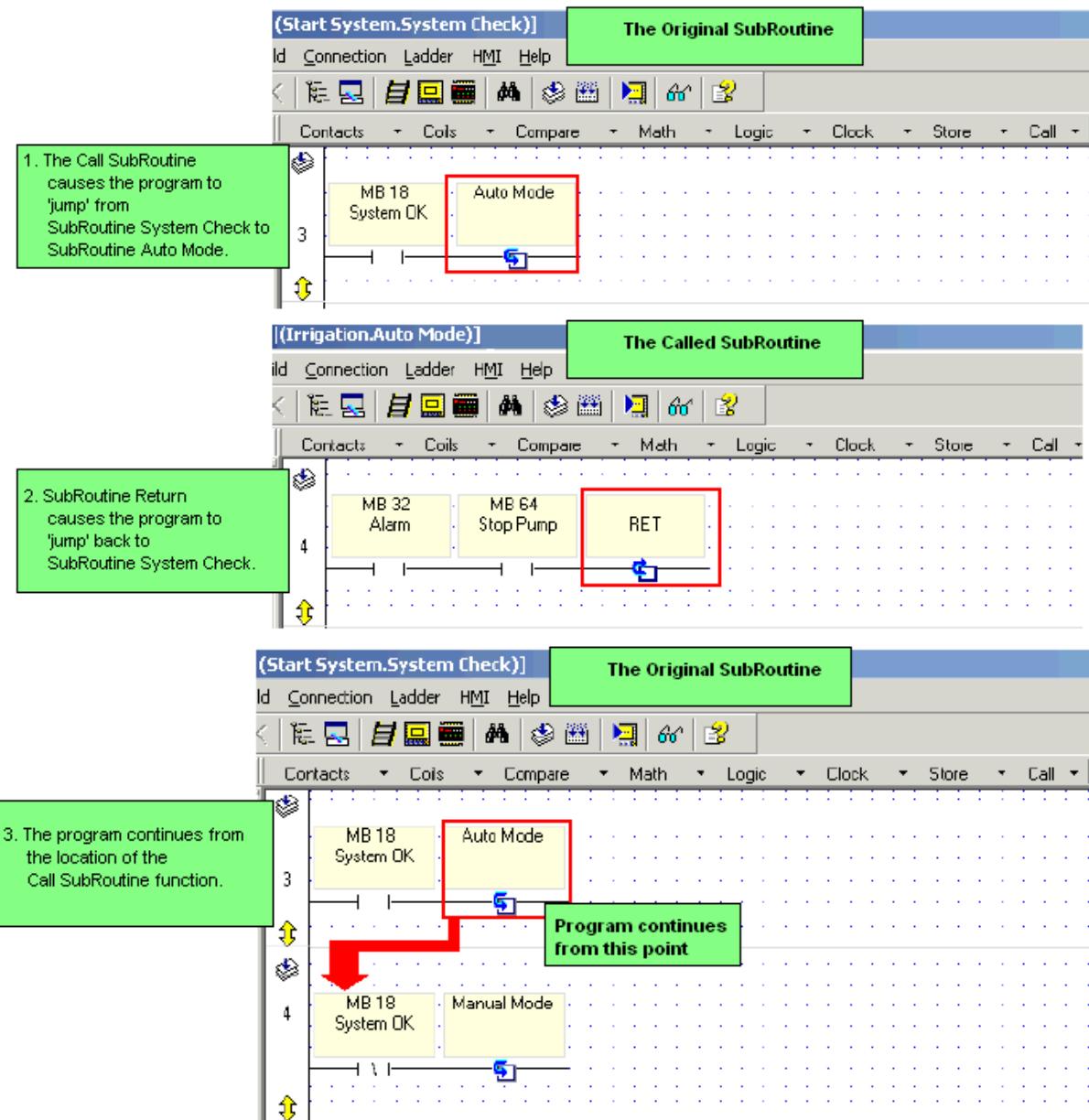
A scan is a complete execution of the controller's entire program. The scan cycle is performed continuously.

**Note •** Power-up tasks, relating to the status of SB2 Power-up bit, are performed when the controller is

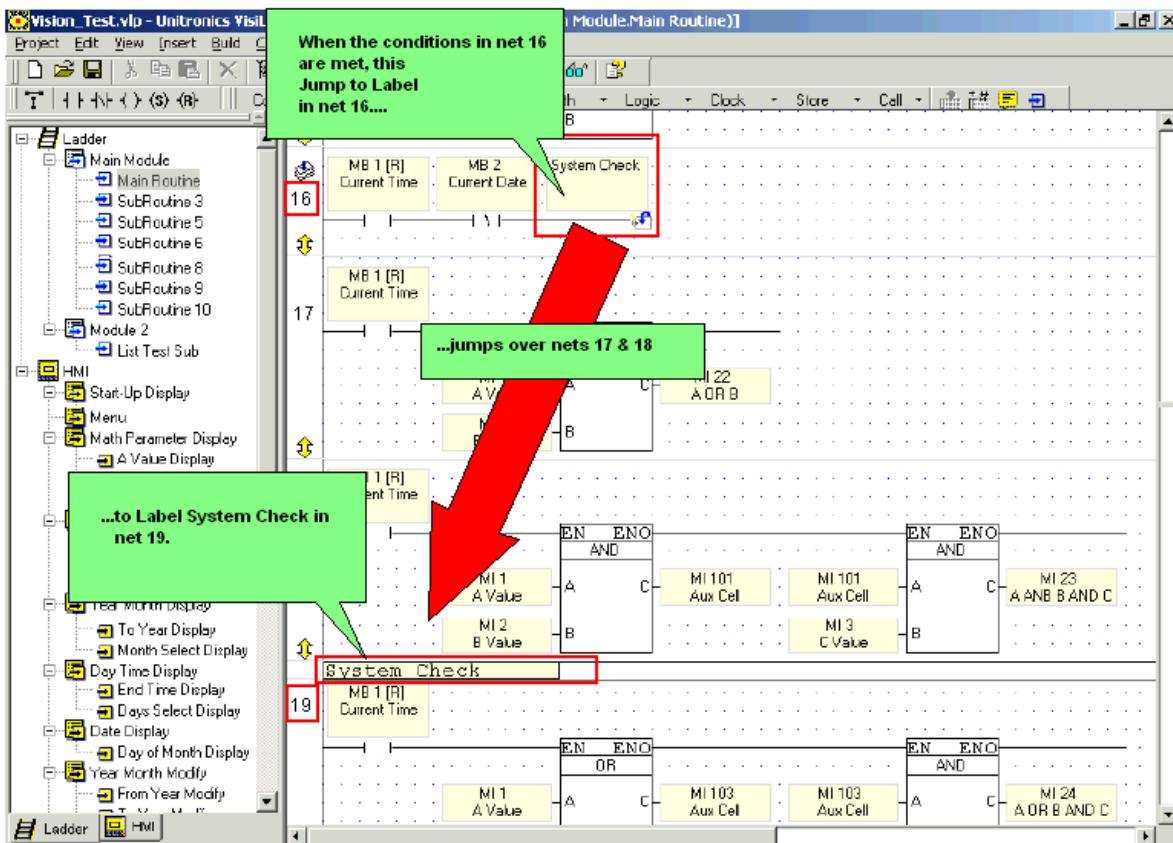
- turned on. These tasks are performed before the program scan.
- The scan time is stored in SI 0 Scan Time, Resolution: Units of 10 mSec.



### Call Subroutine & Subroutine: Return



## Within Subroutines: Labels & Jumps



## Protecting Subroutines

You can create a Ladder Password, then apply it to protect multiple subroutines. When a subroutine is protected, a user cannot export/import it. In addition, the user cannot open, copy, or print it without supplying the password.

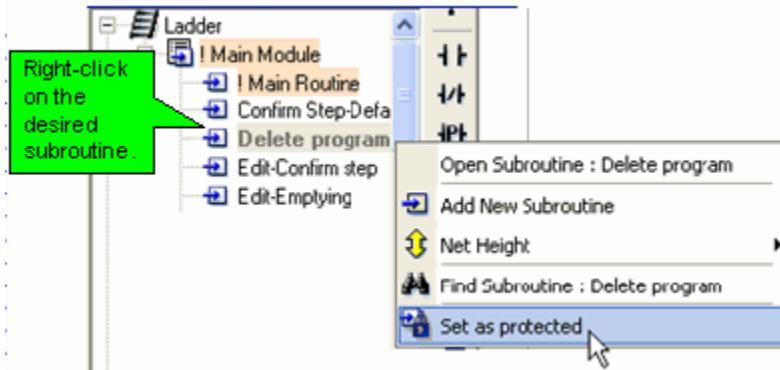
### Creating and Using a Password

- To create a password, select File>Set Ladder Password; then fill in the password field.



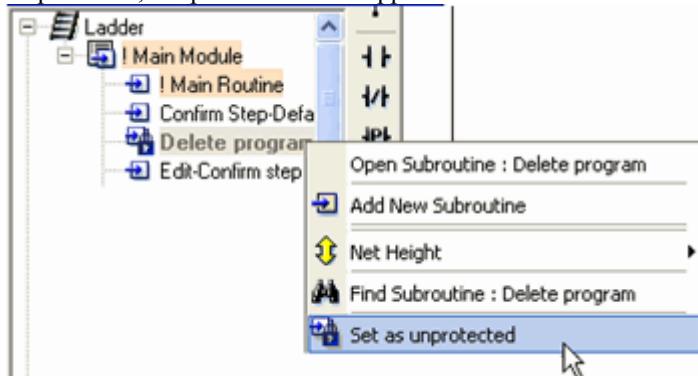
- To apply the password to a subroutine, right-click the subroutine's name in the Project Navigation window, then select Set as Protected; a small padlock icon is displayed next to the subroutine's name.

You can also right-click a module's name and select Protect All Subroutines in Module.

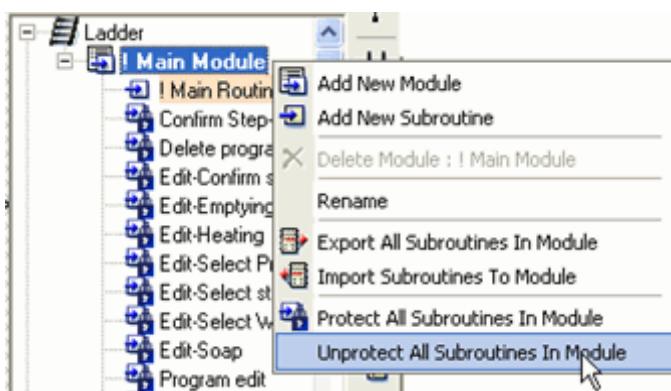


**Note •** Protection is applied after VisiLogic (not just the project) is closed and reopened.

3. To remove protection from a subroutine, right-click the protected subroutine's name, then select Set AS Unprotected; the padlock icon disappears.



You can remove protection from a module in the same way.



**Note •** The same password may be used for different projects.

### Deleting a Ladder Password

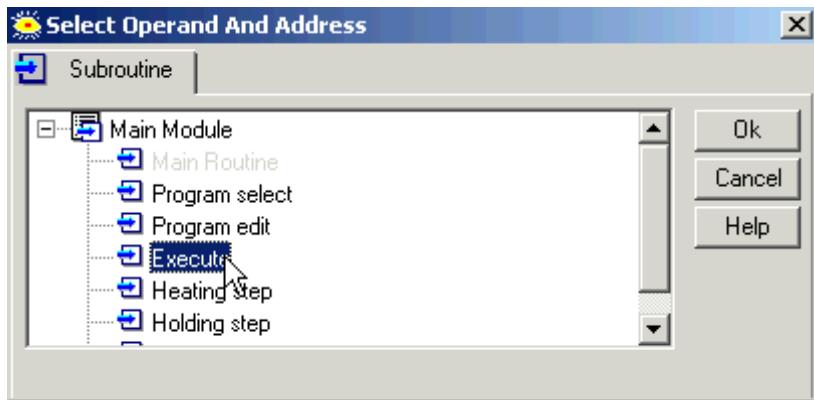
1. To delete a Ladder password from a project, select File>Unset Ladder Password.

### **Import/Export Subroutines**

You can export Subroutines and save them as .vlx files, then import them into other projects. You can import/export single Subroutines, or all of the subroutines in a Module. Note that you cannot export Subroutines from the Main Module.

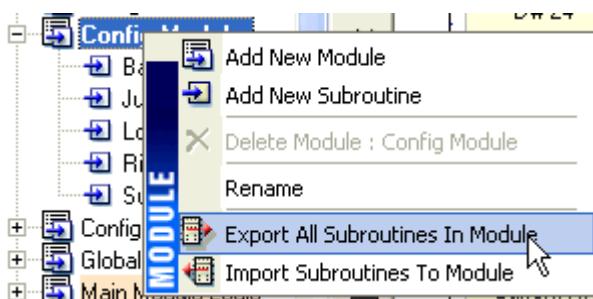
#### Exporting a single Subroutine

1. Right-click the desired Subroutine and select Export Subroutine,  
-or-  
select Export Subroutine from the Project menu; the Select Subroutine box opens.
2. Select the desired subroutine, then save it to the desired folder.



Exporting all of the Subroutines in a Module

1. Right-click the desired module and select Export All Subroutines.

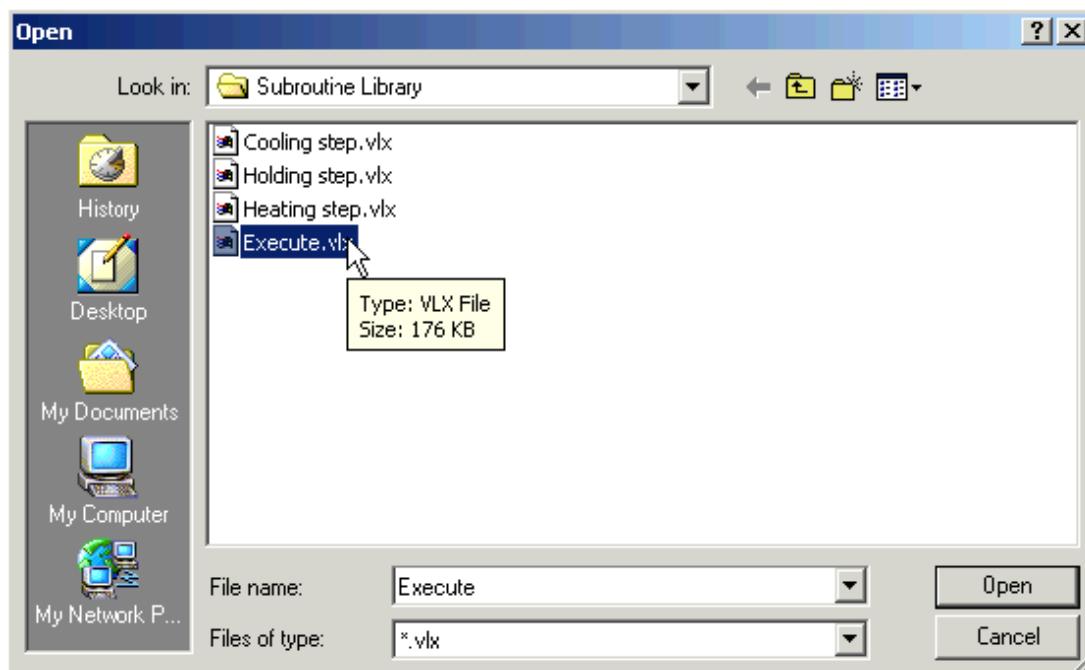


2. Save the .vlx file to the desired folder.

Note that when you import this .vlx file, all of the Subroutines it contains will be imported.

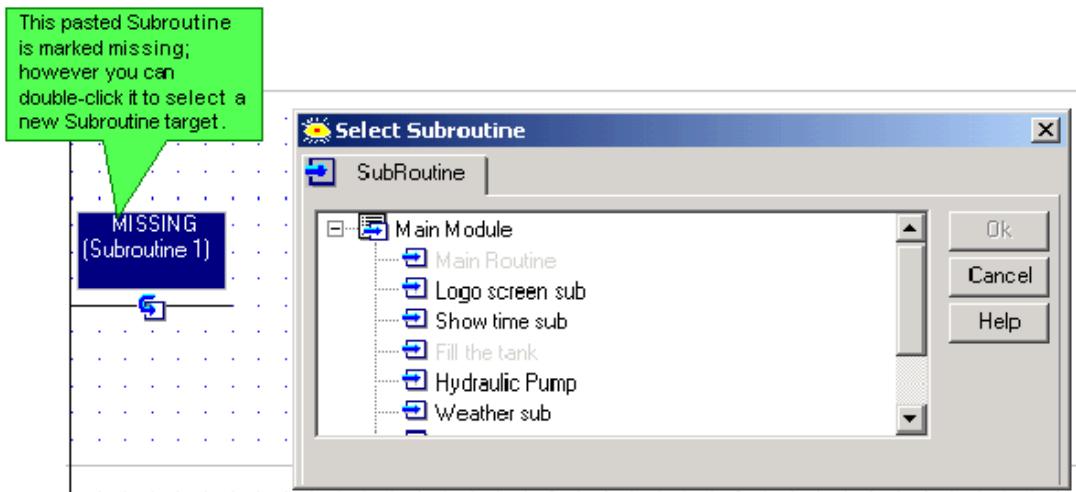
#### Import

1. Right-click a module name and select Import Subroutine,  
-or-  
Select Import Subroutine from the Project menu; the Open box appears.
2. Select the desired subroutine, then save it to the desired folder.

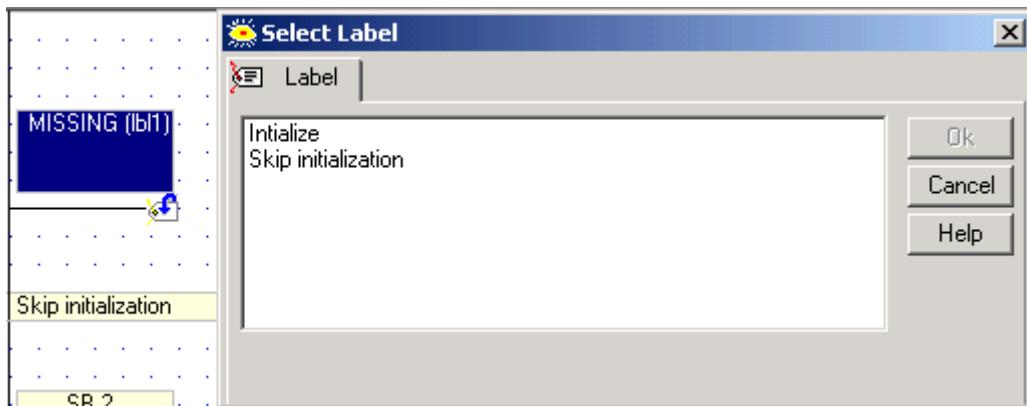


Import/Export is subject to the limitations below.

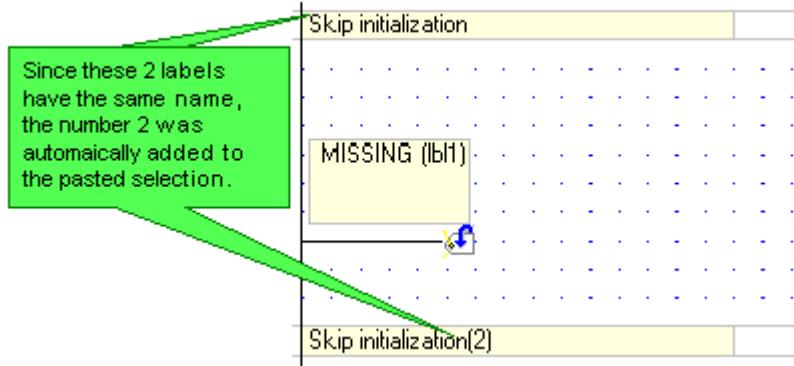
- If the source project contains Call Subroutine or Load HMI operations, note that the referenced elements will be marked as missing, even if the target project contains elements of the same name. Note that you can reassign the references.



- If the selection contains an FB operation related to an FB Configuration, and is imported into an application containing an FB Configuration of the same name, the links will be retained. If, for example, you export a subroutine containing an SMS Send FB linked to SMS Configuration 'Denmark' and then import this subroutine into another application containing an SMS Configuration 'Denmark', the SMS Send FB will automatically link to 'Denmark'.
- If the selection contains FBs, and no FBs of that type currently exist in the target project, the pasted FBs will be the version currently in VisiLogic FB library--in other words, if the source selection contains older FB versions, they are automatically updated during the Paste operation.
- If the selection contains FBs, and FBs of that type currently exist in the target project in a different version, Paste cannot be completed.
- If your selection contains only Jumps, without the attendant Labels, they will be marked as missing, even if the target project contains Labels of the same name. Note that you can reassign the references.



- If the selection contains Jumps and Labels with the same name as those in the target project, the Jump, Label and link between them will be automatically recreated by VisiLogic when they are pasted.
- In this way, VisiLogic maintains the integrity of the links between Jumps and their corresponding Labels.



- Note that the following symbols cannot be used in subroutine names:  
/\|\*!<>. When importing/exporting from older VisiLogic programs containing such symbols, they will be automatically replaced by underscore characters.

## Ladder Logic

You use Ladder Logic to write your project application. Ladder is based on Boolean principals and follows IEC 1131-3 conventions.

Ladder Diagrams are composed of different types of contact, coil and function block elements. These elements are placed in nets.

In any Ladder Diagram, the contacts represent input conditions. They lead power from the left rail to the right rail. Coils represent output instructions. In order for output coils to be activated, the logical state of the contacts must allow the power to flow through the net to the coil.

## Toggling between PLC and HMI Editors

Click the buttons at the bottom of the Program Tree to move between the Ladder Editor and HMI Editor.



## Getting Started with Displays

### Text in HMI Displays

Displays can contain both fixed and Variable text. Fixed (constant) text does not change according to run-time conditions. Variable text can show run-time values, such as timer values, or display operating instructions according to system status.

### Graphic Images in Displays

Simple geometric shapes can be drawn on a Display.

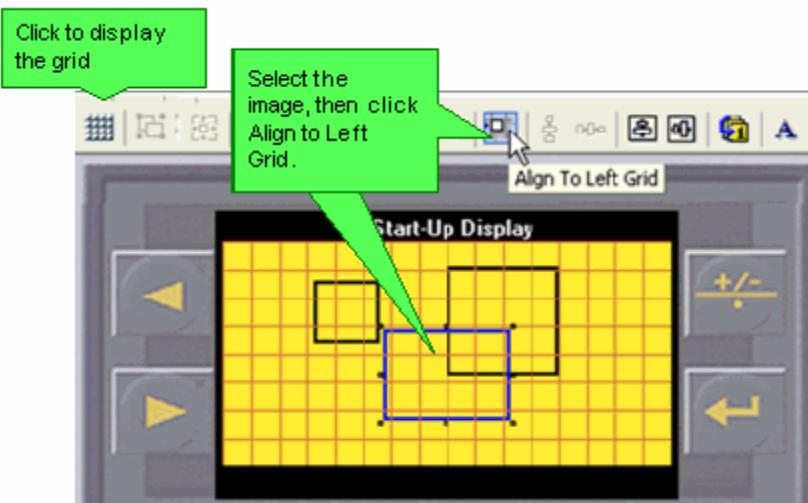
Graphic images can be imported from the Image Library, or created with a program such as Microsoft Paint and then imported.

- Fixed graphic images  
This type of image stays on the screen and does not change until a different Display is loaded by the program.
- Variable graphic images  
Variable images change according to the value of a linked operand. Binary Image Variables are linked to bit operand status (MB, SB, I, T, O). List Image Variables are linked to integers (MI, SI, ML, SL)

You can draw graphic images directly on a Display, or import images.

**Note •** Although an imported image can be resized, resizing may result in some degree of distortion. To avoid this, use images that are created to match the required size.

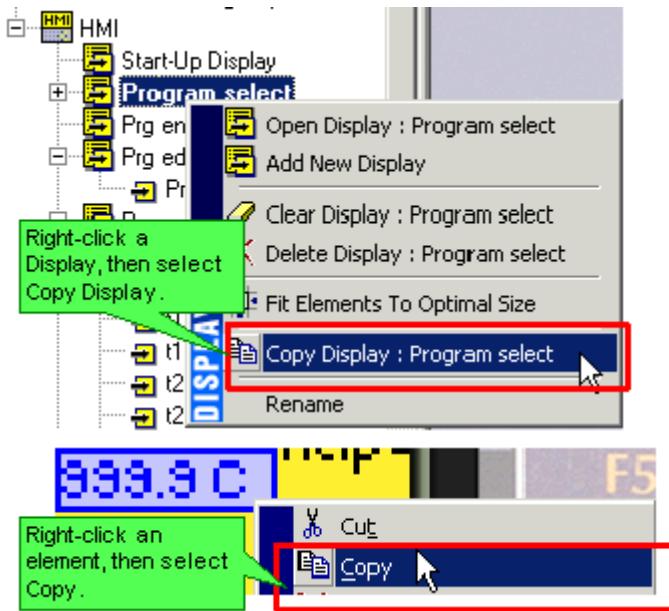
- The HMI display uses a grid which spaces the lines 8 pixels apart. To optimize Displays and shorten the PLC cycle time, images and variables should be aligned to grid.



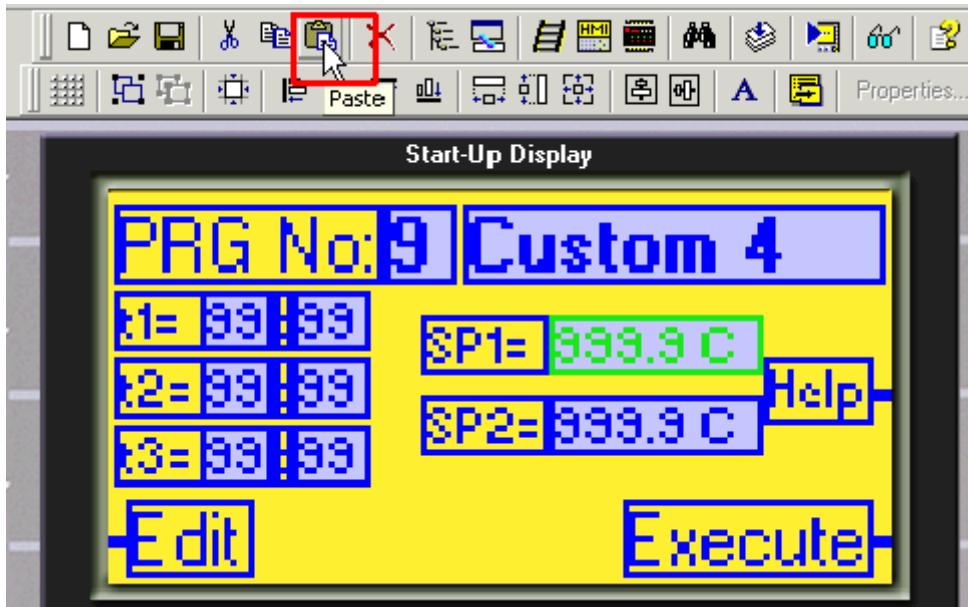
### Copy & Paste Displays

You can copy and paste Display elements.

1. Copy the Display element(s) or select all of the elements in a Display.



- Paste the elements into the Display.



**Note •**

- When you paste elements into a Display, the elements paste into the same relative area in the new net. The elements 'remember' their original location. Therefore, before you paste elements into a Display that already contains elements, move any elements that occupy the same position as the paste selection.
- If you paste variables that are linked to named constant values, note that the constant's description is lost during the paste operation.
- Variables do not retain their descriptions; they are renamed as Variable 1, Variable 2, etc..
- To copy elements between projects, copy your selection from the source project, then open a target project without closing VisiLogic, either by using the New Project or Open project buttons or via these options on the Project menu. If you close VisiLogic, the selection will be lost.

## Getting Started with Variables

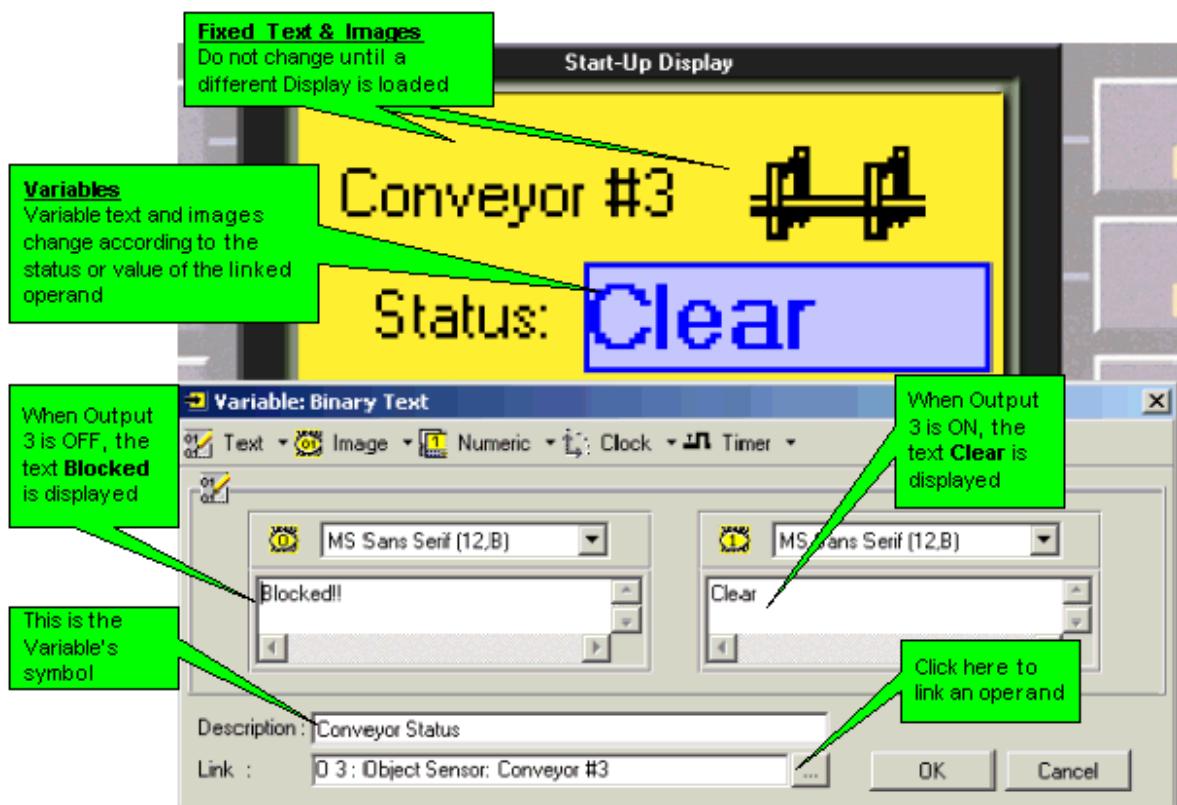
Variables enable you to show run-time values, text, images, and bar graphs on the controller's screen in response to run-time conditions. Bit, or binary text variables, for example, display text messages on the controller's LCD screen according to the status of a bit operand.

A Display may contain up to 24 variables.

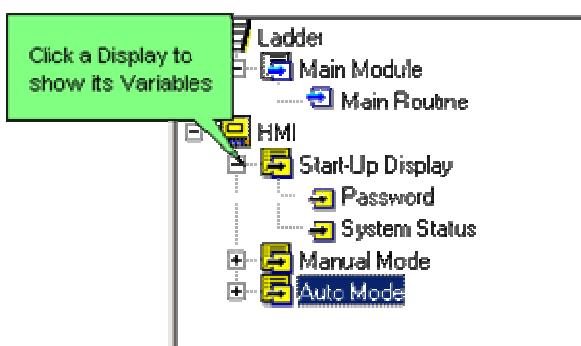
You can also use Keypad Entry Variables to enable an operator to enter a password, or data such as setpoints from the controller's keyboard.

### Variable Editor

When you insert a variable into a display, the Variable Editor opens, showing you the options that are relevant for that type of Variable.

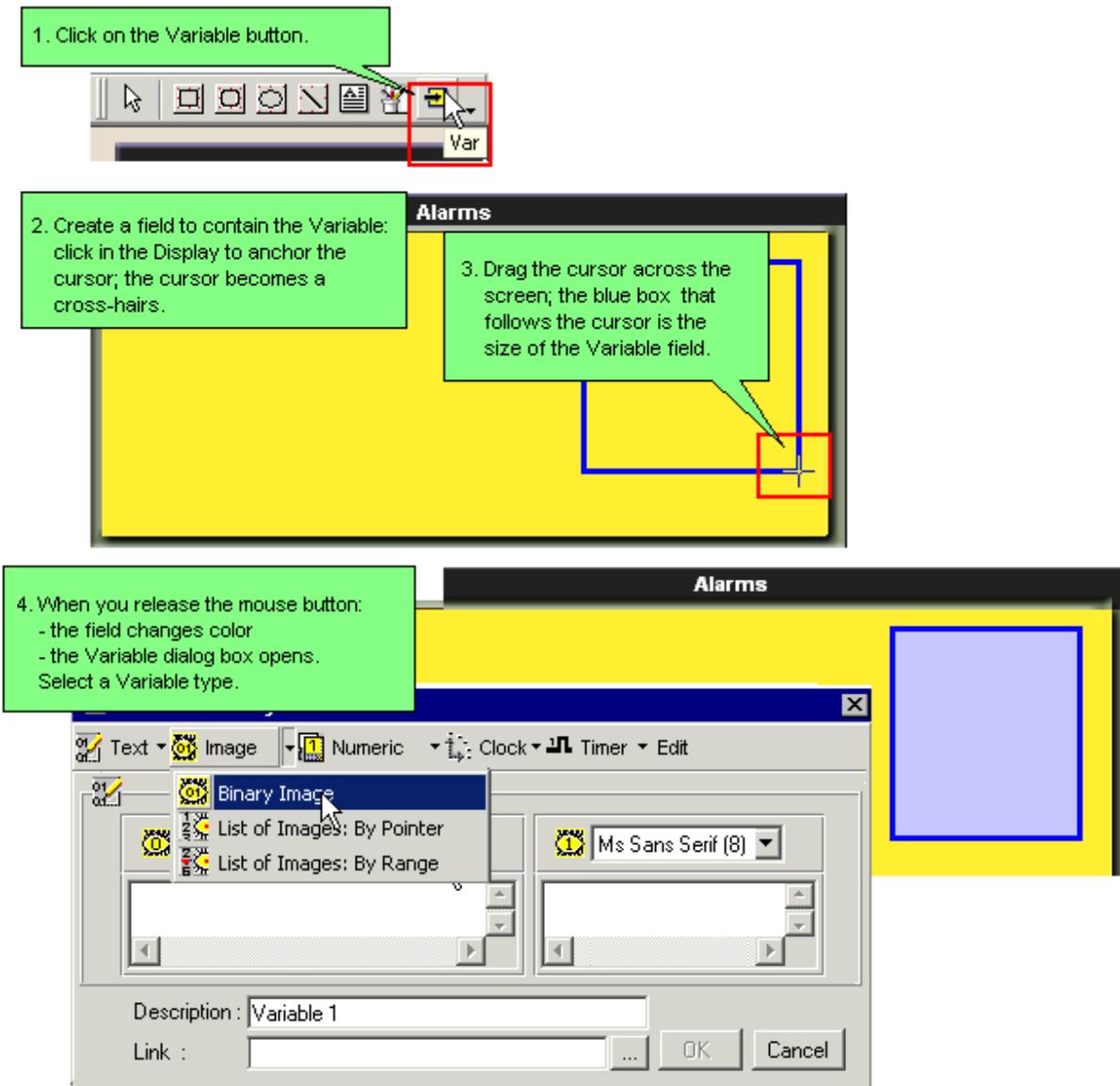


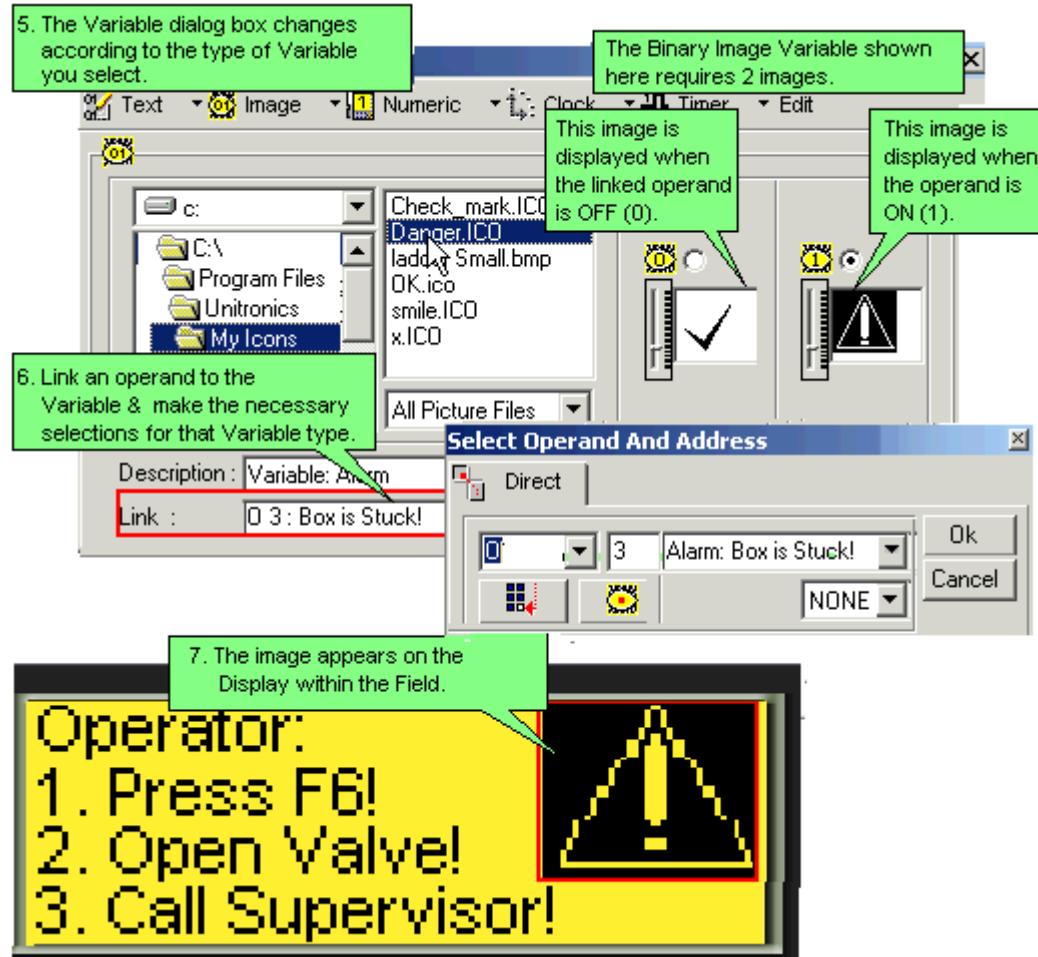
After you have inserted Variables into a display, they are shown with that display in the Project tree.



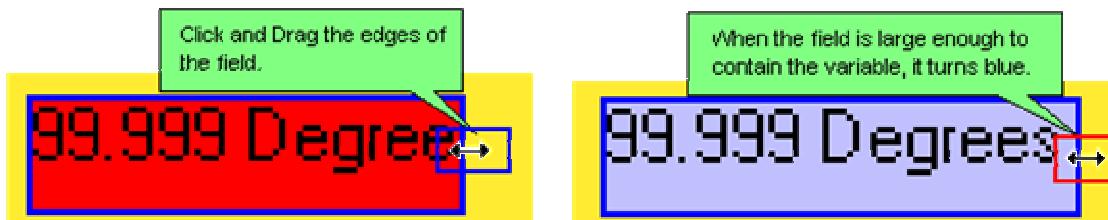
## Inserting a Variable into a Display

To show variable data, you first create a field in the Display. The field is a container that holds the data.





A field that is not big enough to contain its data is red. To resize a field, click it and drag the edges.



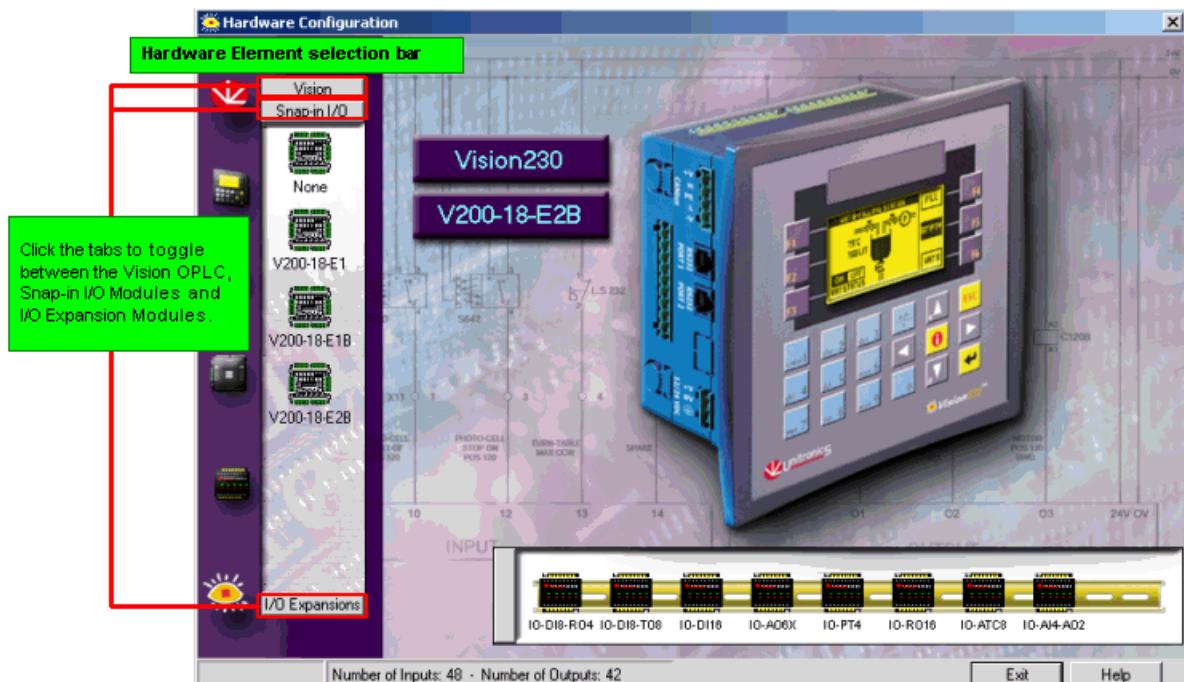
# Hardware Configuration

Hardware Configuration opens automatically when you first create a new project. In order to open Hardware Configuration in an existing project, either select Hardware Configuration from the View menu or click the  button on the toolbar.

Click on the appropriate icon to select the model Vision, the Snap-in I/O module, and any I/O Expansion modules required by your application.

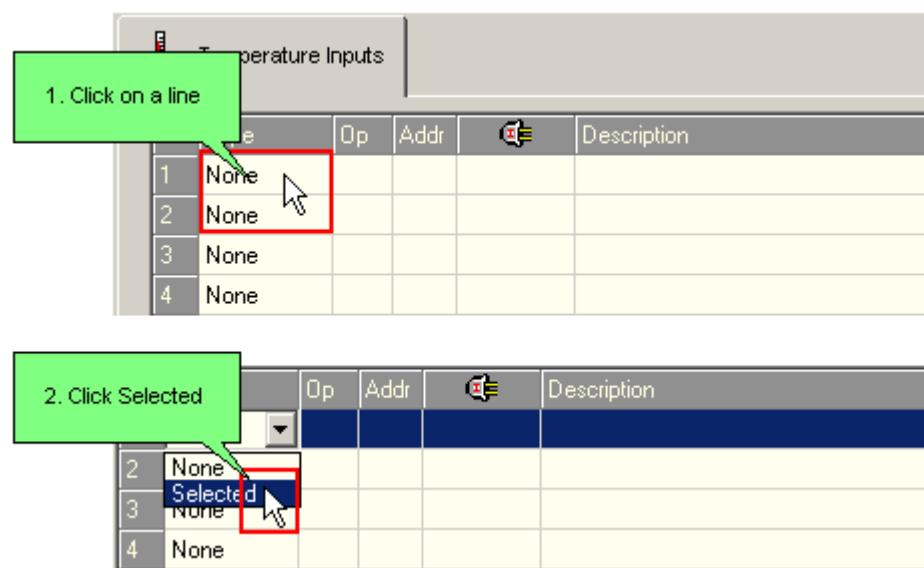
After you select the Snap-in or Expansion I/O modules connected to the controller, you can configure inputs: analog, digital, and high-speed counter/shaft-encoder/frequency measurers and PT100; and outputs: analog, digital, and PWM high-speed outputs.

- Note •** You must select the correct Vision model and Snap-in I/O modules before downloading your project.



## I/O Expansion Modules

### Configuring a PT100 Input

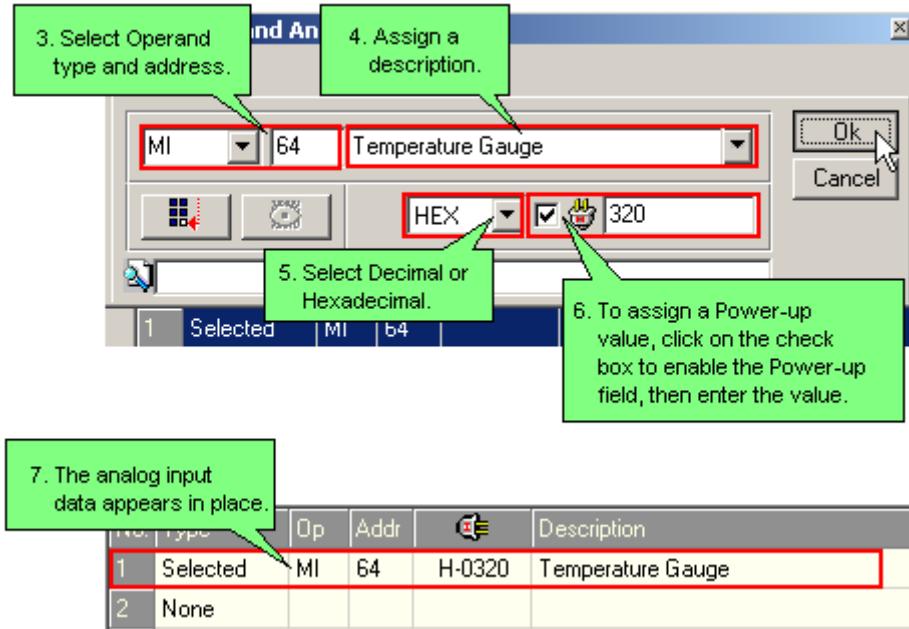


The screenshot shows the configuration of a PT100 input. The top part of the interface has a green callout box with the text '1. Click on a line' pointing to a row in a table. The table has columns for Line, Op, Addr, and Description. The first four rows are empty, each with 'None' in the 'Op' column. The second row is highlighted with a red border. The bottom part of the interface has another green callout box with the text '2. Click Selected' pointing to the same row in the table. The 'Op' column for the second row now contains the text 'Selected'.

Line	Op	Addr	Description
1	None		
2	None		
3	None		
4	None		

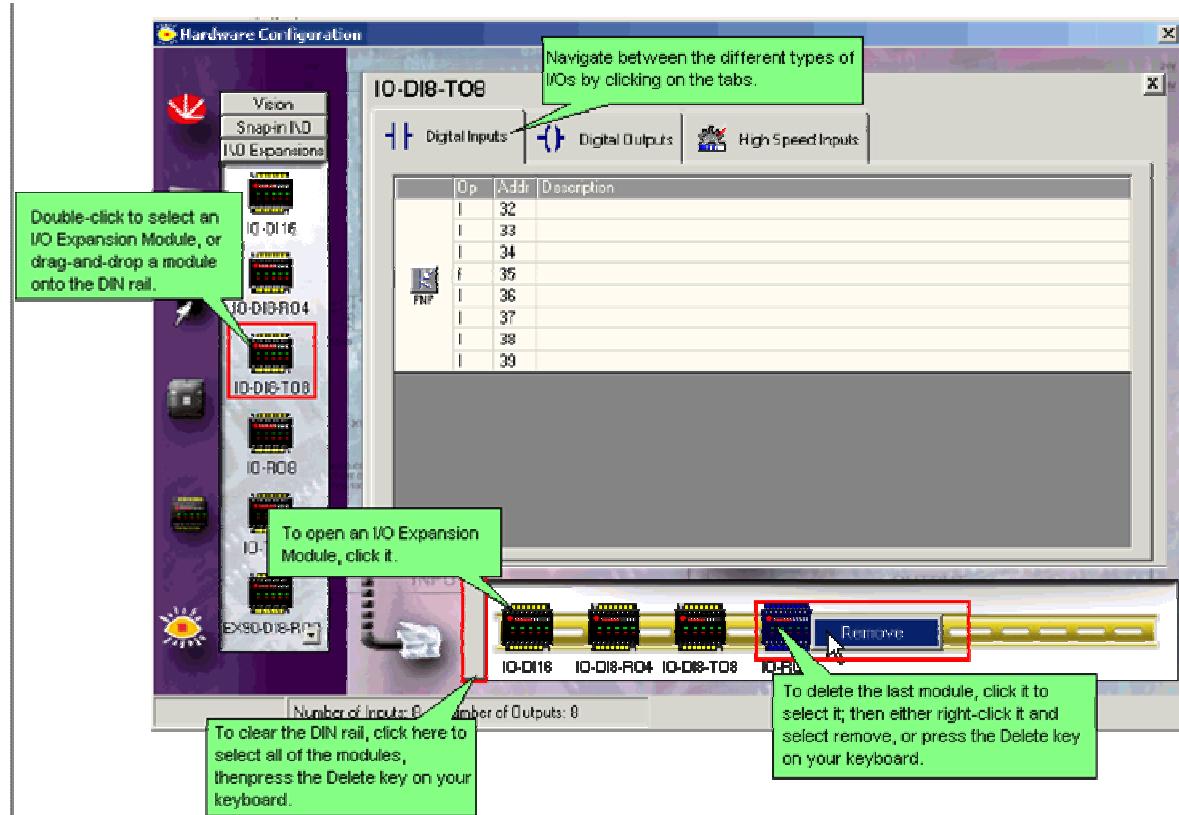
  

Line	Op	Addr	Description
2	Selected		
3	None		
4	None		



## Configuring I/O Expansion Modules

**Note •** I/O Expansion Modules may require an adapter. Check with your distributor for additional details.

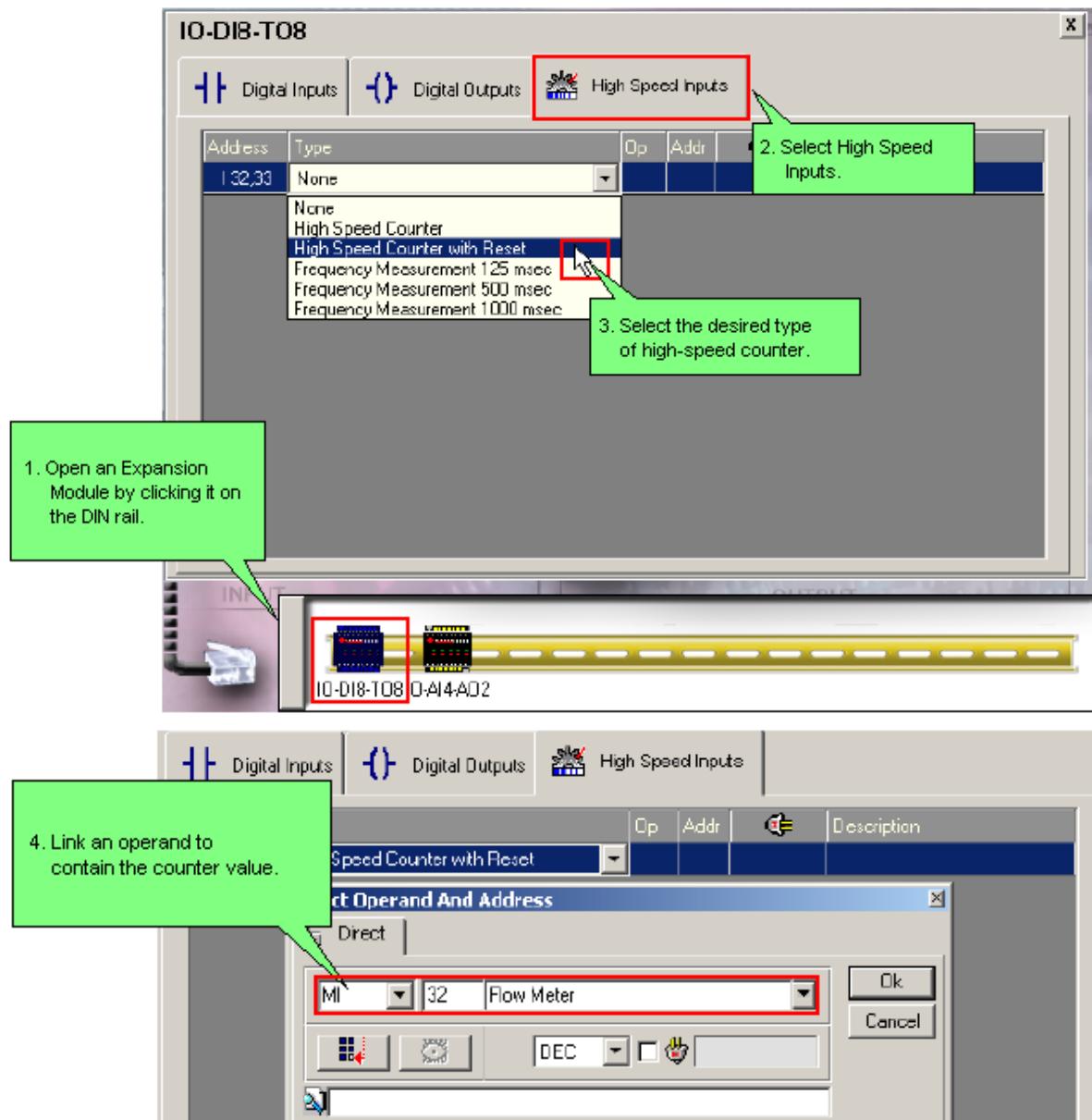


## High-Speed Counters: I/O Expansion Modules

Certain digital inputs on certain I/O Expansion Modules are high-speed inputs that can be used as a 16-bit high-speed counter of the following types:

- High-Speed Counter
- High-Speed Counter with Reset
- Frequency Measurer

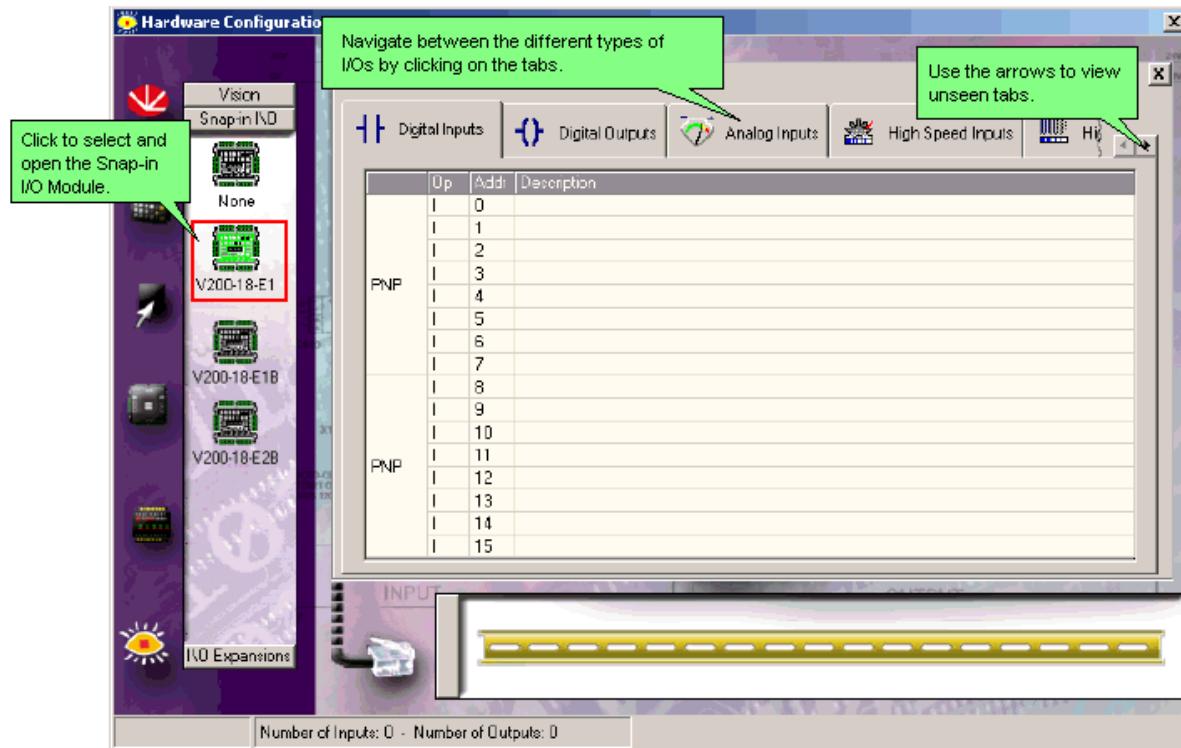
### Configuring a High-Speed Counter



The linked operand contains the counter value which is current at the last program scan. Use this operand in your program like any other.

## Snap-in I/O Expansion Modules

### Configuring Snap-in I/O Modules

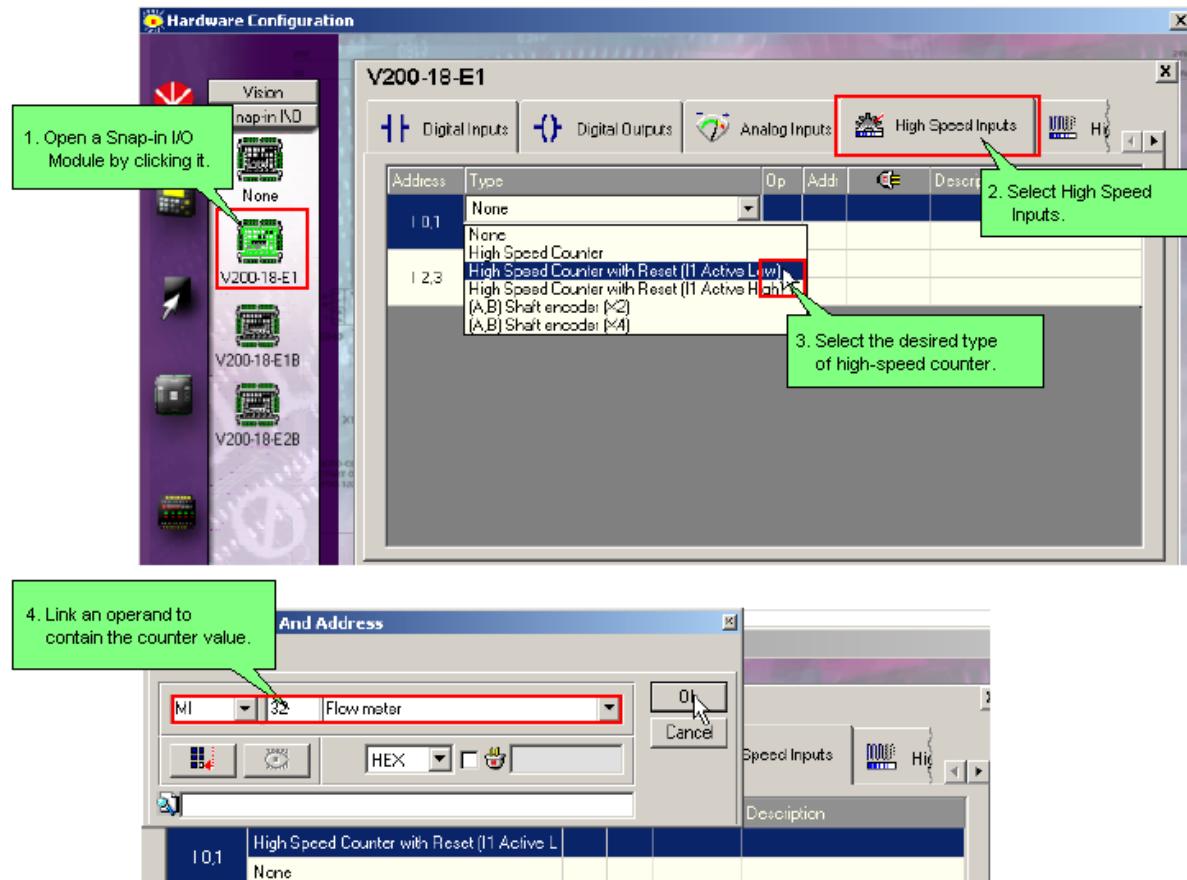


### High-Speed Counters: Snap-in I/O Modules

Certain digital inputs on Snap-in I/O Modules are high-speed inputs that can be used as a 32-bit high-speed counter of the following types:

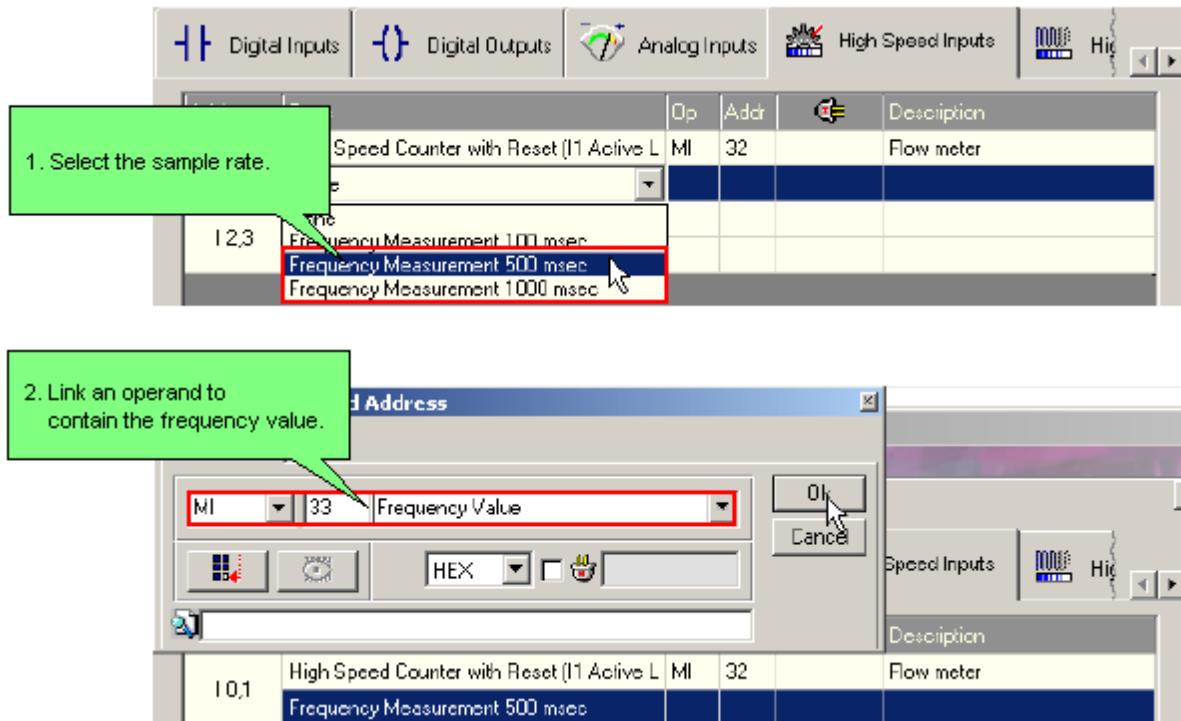
- High-Speed Counter
- High-Speed Counter with Reset
- Frequency Measurer
- Shaft Encoder

### Configuring a High-Speed Counter



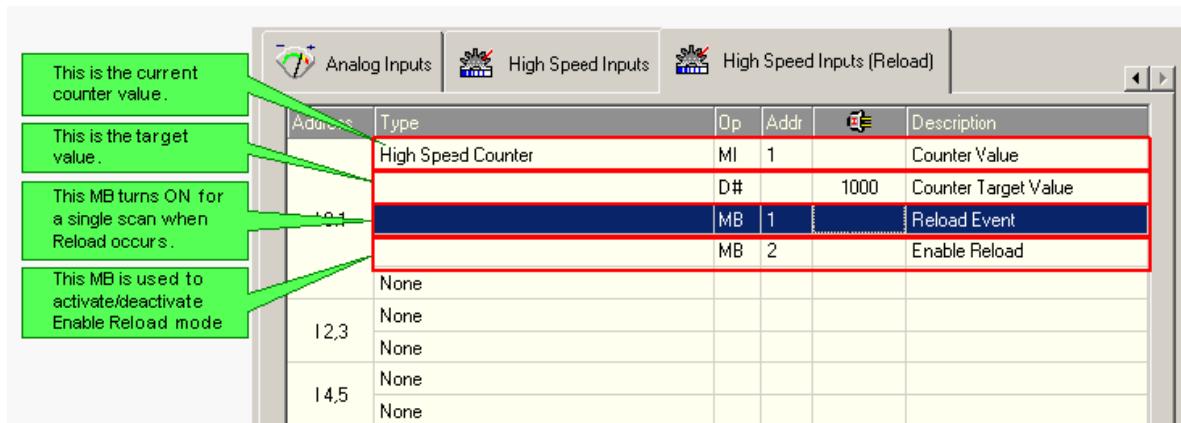
The linked operand contains the counter value which is current at the last program scan.

To measure frequency, click the second input field and select the sample rate.



### High-Speed Counter: Reload

Reload enables you to immediately load 0 into a high-speed counter when the counter value reaches a target value.



## Configuring a High-Speed Counter

Certain digital inputs on both Snap-in I/O and I/O Expansion modules can be used as high-speed counters in the following modes:

- High-Speed counter
- High-Speed counter with Reset
- Shaft encoder
- Frequency Measurer

**Note •** When you select High-Speed Counter with Reset, the controller uses an additional input for reset; shaft encoders also require the use of two inputs.

High-speed counters are built into the hardware, you define them as part of the controller's hardware configuration by first selecting the counter type and then linking it to an operand that contains the counter value.

Compare Functions and Counter Values

The high-speed counter value is read once during every program scan. For this reason, do not use the Equal (=) function together with high-speed counter values. If the counter does not reach the value required by the Equal function during the actual program scan, the function cannot register that the value has been reached. Use functions Greater Than Or Equal To ( $\geq$ ) and Lesser Than Or Equal To ( $\leq$ ).

## Configuring a High-speed Output (PWM)

You can use certain outputs as High-speed Outputs (HSO) via PWM (Pulse Width Modulation). When you select a High Speed Output in the Hardware, the Select Operand and Address dialog box appears three successive times, allowing you to link operands for the following values:

- Duty Cycle

The ratio of the "on" period of a cycle to the total cycle period. This value may be from 0-1000, and is expressed as a percentage.

If, for example, the constant 750 is stored into the Duty Cycle operand, the duty cycle is equal to 75.0%. This means that the pulse will hold a positive state during 75.0% of the total cycle.

- Frequency (F)

Note that  $F=1/T$ , where T is the duration time of a complete cycle. Frequency settings differ from npn to pnp output type.

- npn: You can use a value of 0, or a value from 8-50000Hz ( 50kHz).

- pnp: You can use a value of 0, or a value from 8-1500HZ.

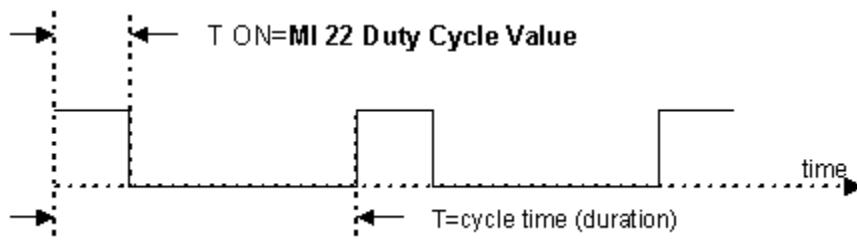
Other frequency values are not supported.

- Run

Changes the operating mode of the output from normal output mode to HSO mode:

0 (SET)=Normal Mode, 1 (RESET): HSO Mode.

In the figure below, MI 22 Duty Cycle Value is equal to 250. This results in the duty cycle being 25% of the total cycle time.



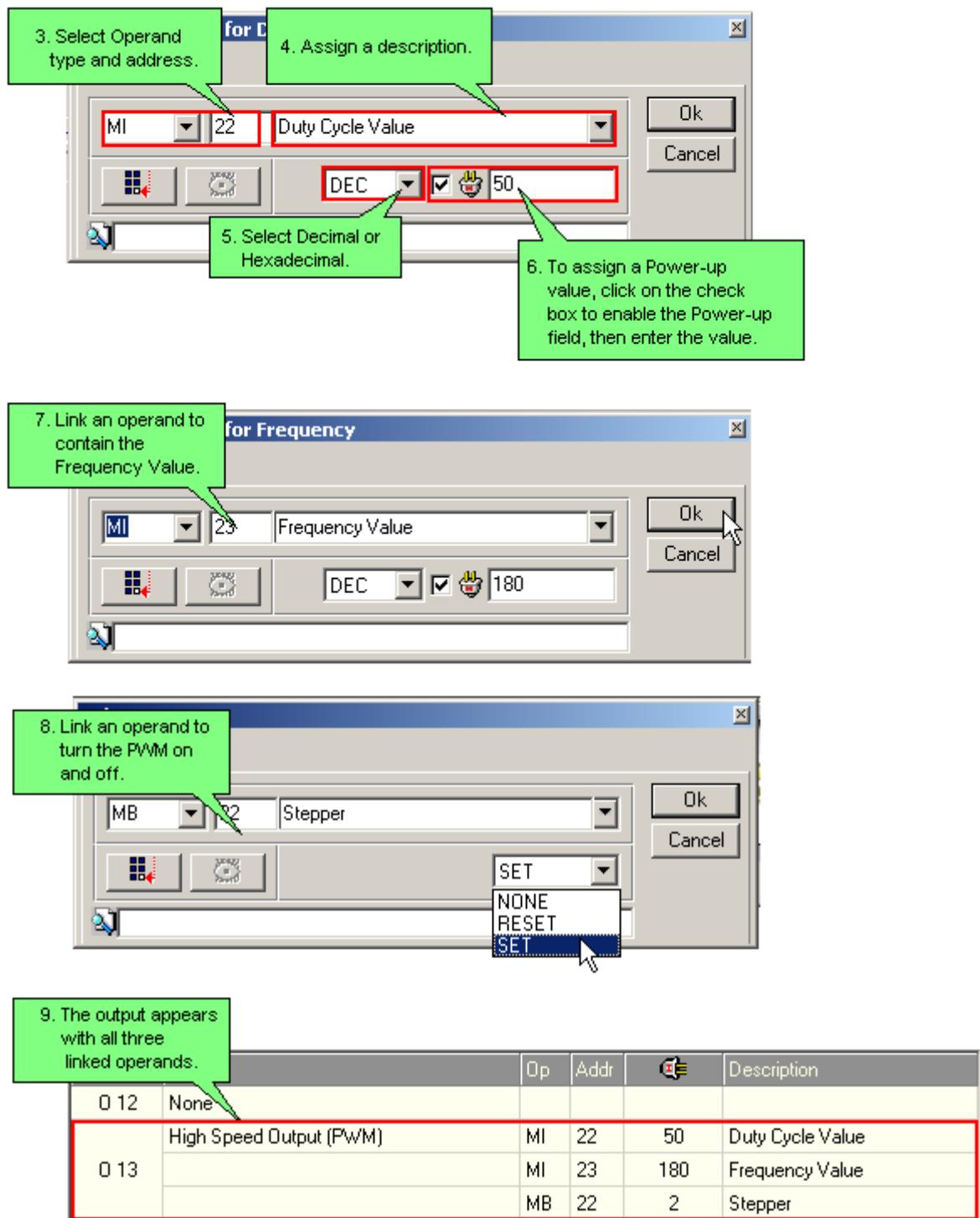
**Note •** If values out of range enter the Duty Cycle and Frequency operands, their values remain unchanged—the operands retain the last legal values stored.

## Configuring the HSO

High Speed Outputs (PWM)					
Address	Type	Op	Addr		Description
0 12	None				
0 13	None				

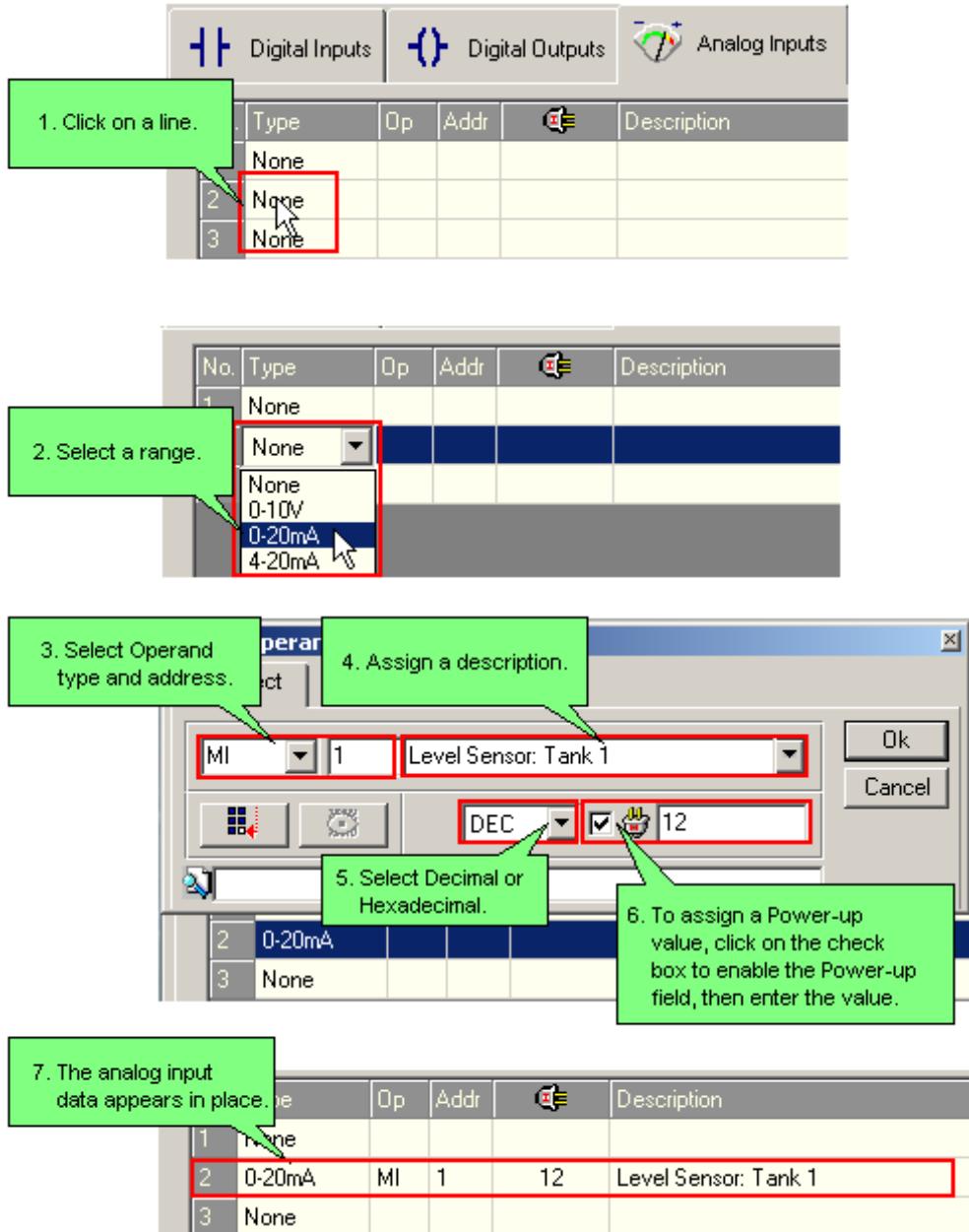
1. Click on a line.

2. Select PWM mode.



## Configuring an Analog Input

Before you can use an analog input in your program, you must link it to an operand. An analog input value can be contained in an MI, ML, or DW.

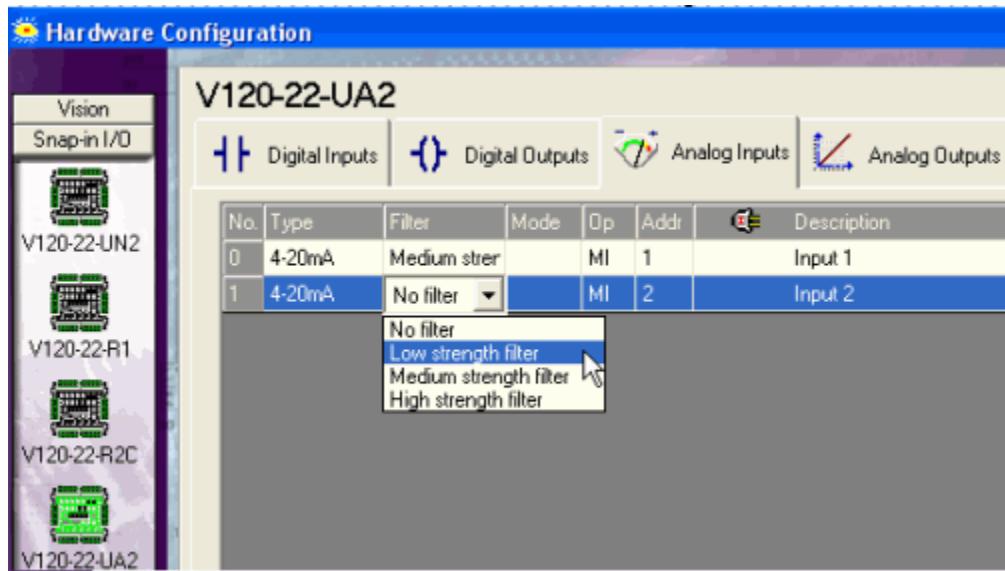


## Analog Filters, PLC

Analog filter options, defined in Hardware Configuration, are available in Vision120, V200-18-E3B, and certain I/O expansion models that offer analog inputs, such as the IO-ATC8. Note that 10-bit inputs do not offer filters.

Using a filter can help protect your system from fluctuating input readings. The filter processes values on a FIFO (First In First Out) basis. The filtering process is run after each new analog reading. Values can be processed further via the Filter FB.

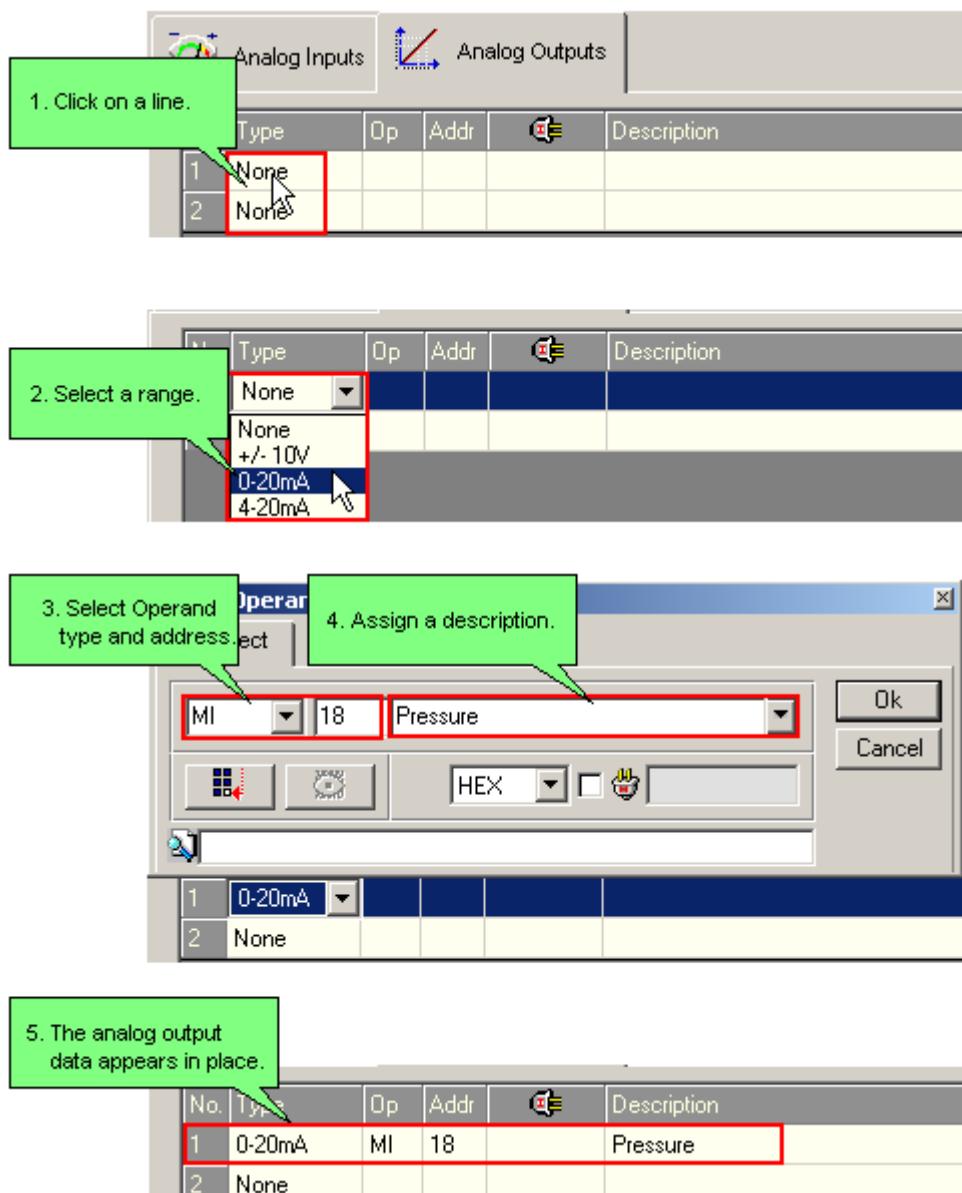
The Filter field, shown below, is activated after you define the analog input.



- Note •** Details regarding an I/O's specific resolution, conversion methods, and rates are given in the technical specifications supplied with Unitronics' controllers and I/O modules.
- When you configure an analog input for use with the PID function, ensure best results by using the highest strength filter.

Filter Types	
Low	Calculates the average of the last two readings
Medium	Takes the last 4 readings, eliminates the lowest and highest values, then calculates the average of the 2 remaining values.
High	Takes the last 8 readings, eliminates the two lowest and the tow highest values, then calculates the average of the 4 remaining values.

## Configuring an Analog Output



## Analog I/O Ranges

Note that devices used in conjunction with the controller must be calibrated according to the available range. Below, Range refers to the value contained by the register that is linked to the I/O in Hardware Configuration.

Model number	Resolution	Range
V200-18-E1 (Snap-in I/O module) V120-12-R1, V120-12-R2C M90 controllers (analog input) M91-19-R1, M91-19-R2, R2C	10 bit (0-10V, 0-20mA, 4-20mA)	0-1023, 1024 units (except at 4-20mA) 204 to 1024, 820 units (at 4-20mA)
V120-12-UN2 M90-19-UN2 M91-19-TC2	14 bit (0-10V, 4-20mA)  Temperature ranges appear in the	0-16383, 16384 units (except at 4-20mA) 3277-16383, 13107 units (at 4-20mA)

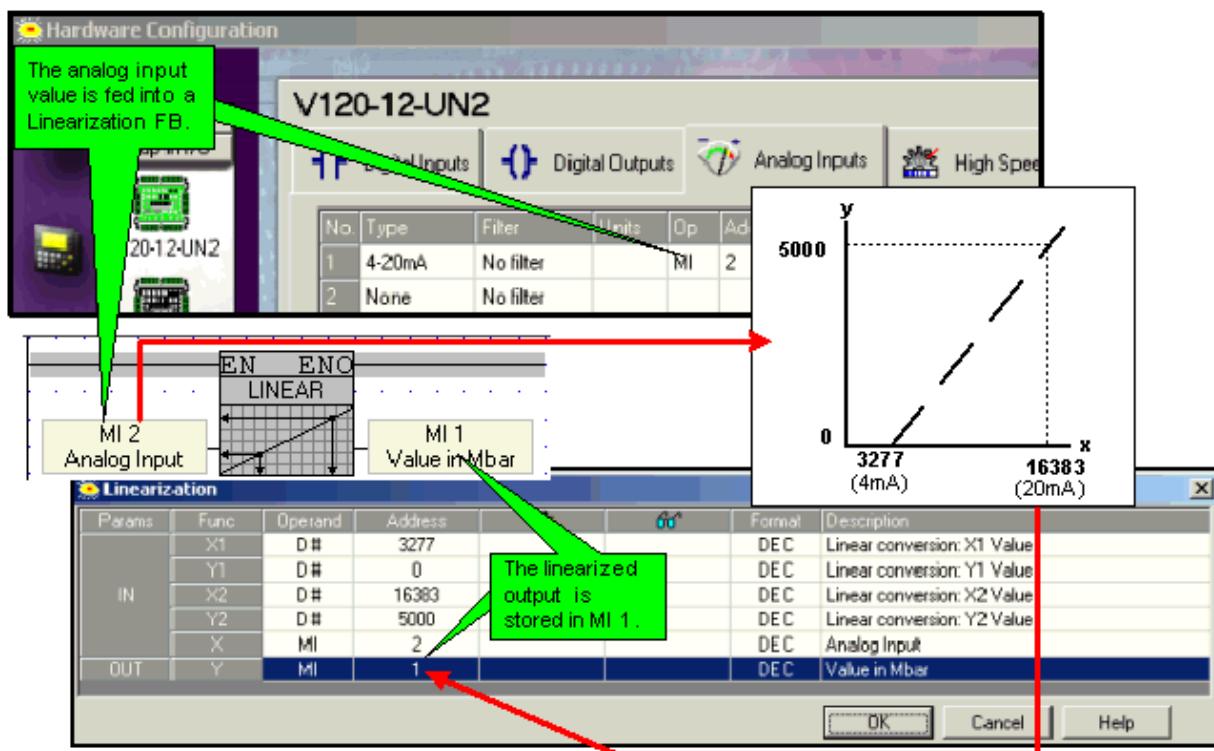
		following table	
IO-AI4-AO2	Input	12 bit (0-10V, 0-20mA, 4-20mA)	0-4095, 4096 units (except at 4-20mA) 819 to 4095, 3277 units (at 4-20mA)
	Output	12 bit +sign ( $\pm$ 10V, 0-20mA, 4-20mA)	0-+4095(except at 4-20mA) 819 to 4095, 3277 units (at 4-20mA)
Model number	Type	Input ranges	Analog Value
V120-12-UN2	mV	-5 to 56mV	-500 to 5600
M90-19-UN2	Thermocouple type		
M91-19-TC2	B	200 to 1820°C (300 to 3276°F)	2000 to 18200 (3000 to 32760)
	E	-200 to 750°C (-328 to 1382°F)	-2000 to 7500 (-3280 to 13820)
	J	-200 to 760°C (-328 to 1400°F)	-2000 to 7600 (-3280 to 14000)
	K	-200 to 1250°C (-328 to 2282°F)	-2000 to 12500 (-3280 to 22820)
	N	-200 to 1300°C (-328 to 2372°F)	-2000 to 13000 (-3280 to 23720)
	R	-0 to 1768°C (-32 to 3214°F)	-0 to 17680 (-32 to 32140)
	S	-0 to 1768°C (-32 to 3214°F)	-0 to 17680 (-32 to 32140)
	T	-200 to 400°C (-328 to 752°F)	-200 to 4000 (-3280 to 7520)
IO-PT4		-50° to 460°C	-500° to 4600°C

## Working with Analog I/O Values

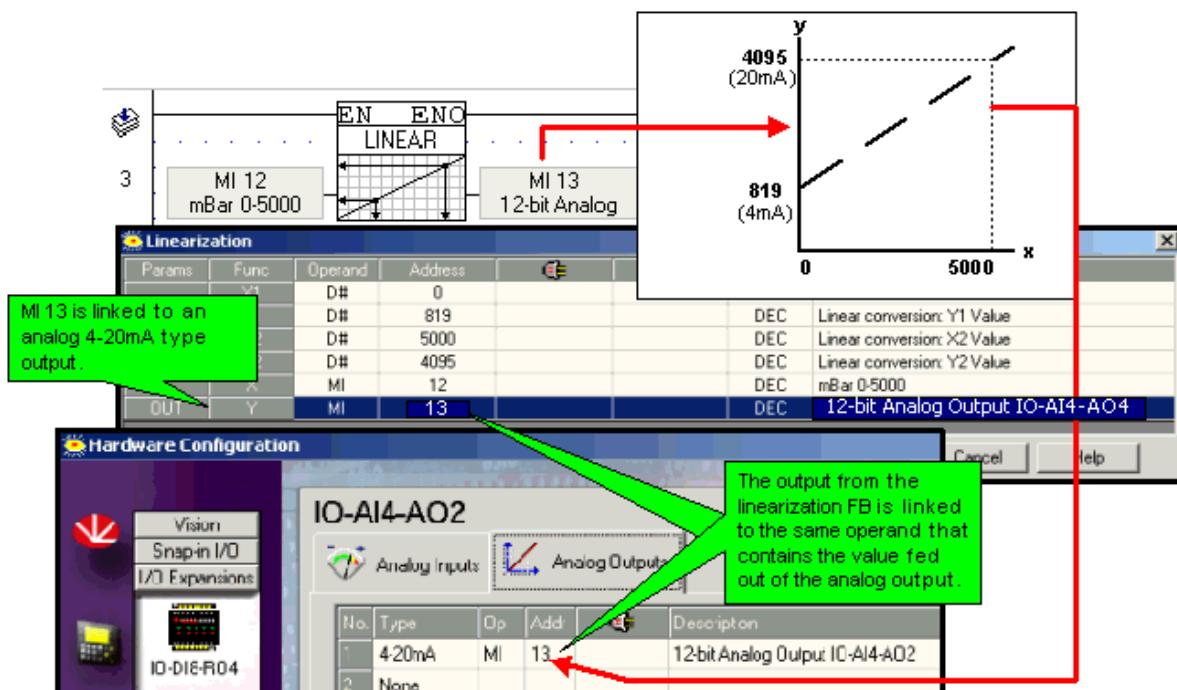
Analog values can be converted to physical values, for example Engineering Units (EU) such as degrees Celsius, by using the Linearization FB.

**Note •** Analog I/O values are contained in the register that you link to the I/O in Hardware Configuration.

Linearizing an Analog Input Value



Linearizing an Analog Output Value



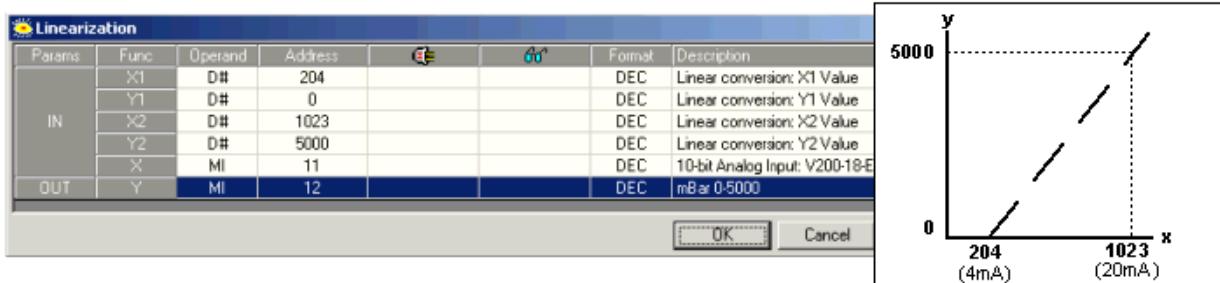
Working within the 4-20mA range

Available ranges, according to controller and I/O module, are shown in the topic Analog I/O ranges. Note that devices used in conjunction with the controller must be calibrated accordingly. In the examples below, the analog device is a pressure transducer; values are therefore translated to millibars.

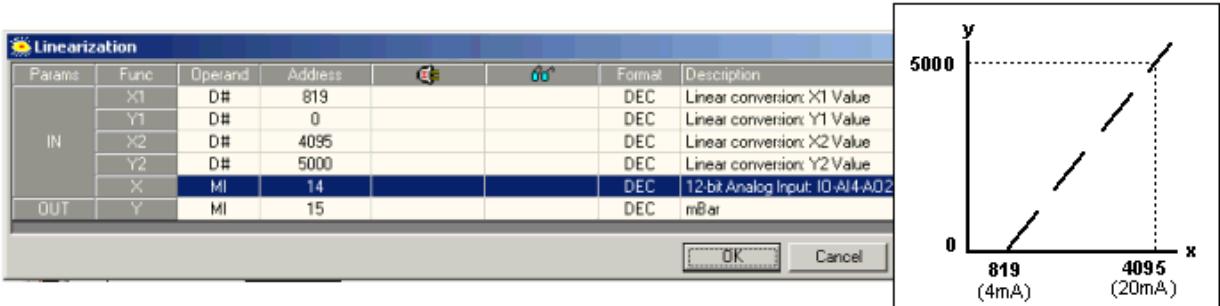
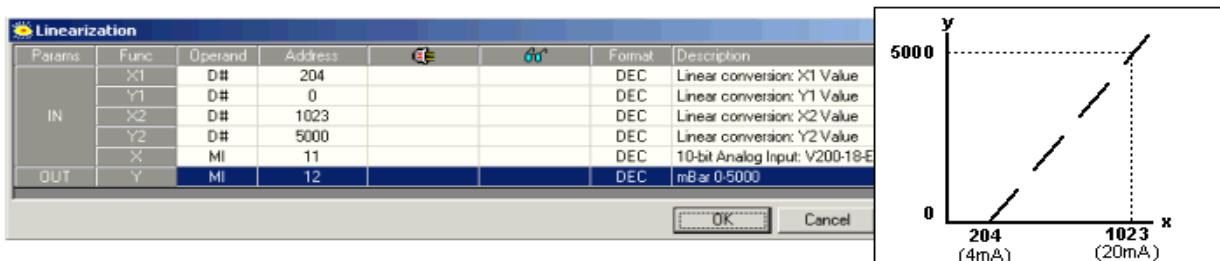
## Getting Started

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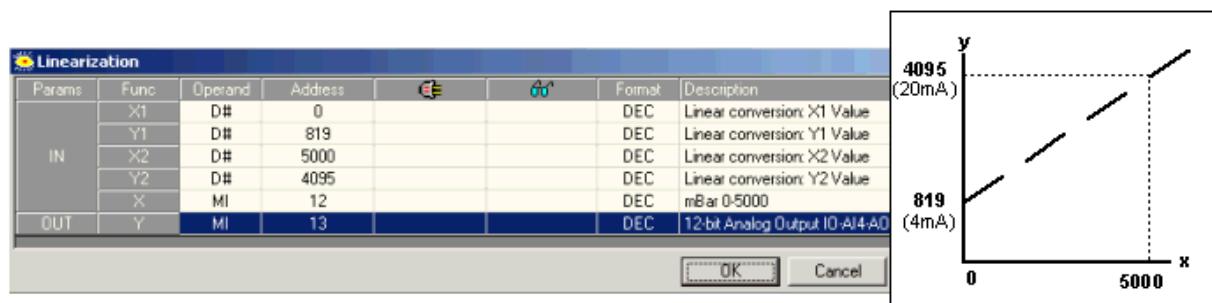
10-bit Analog Input, V200-18-E1



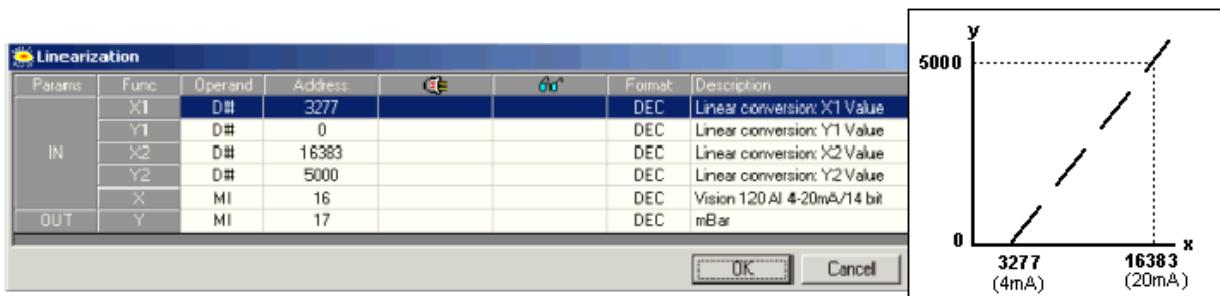
12-bit Analog Input, IO-A14-AO2



12-bit Analog Output, IO-A14-AO2

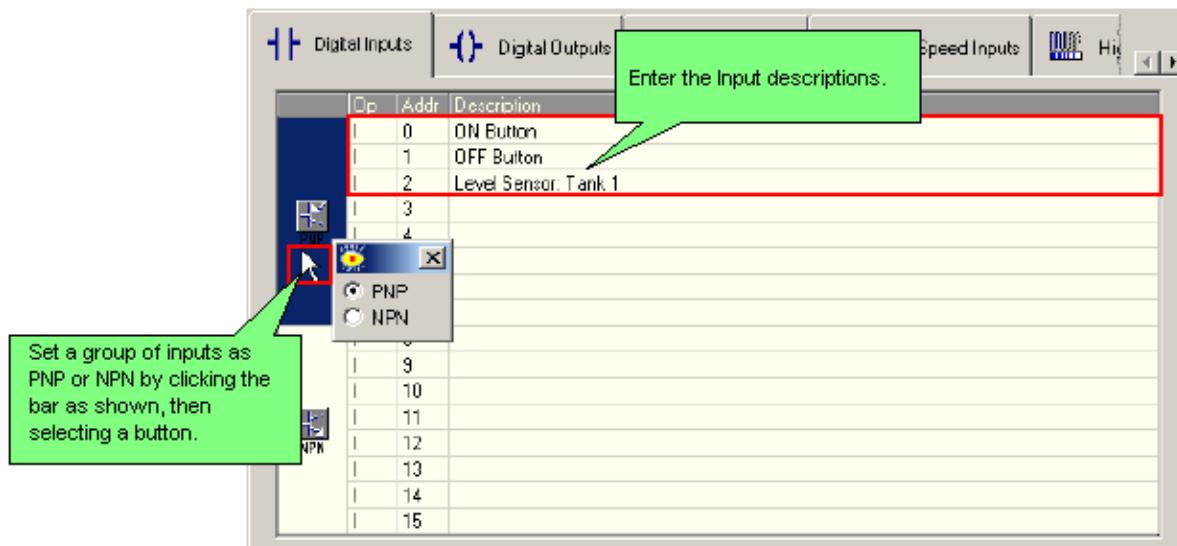


14-bit Analog Input, V120-12-UN2

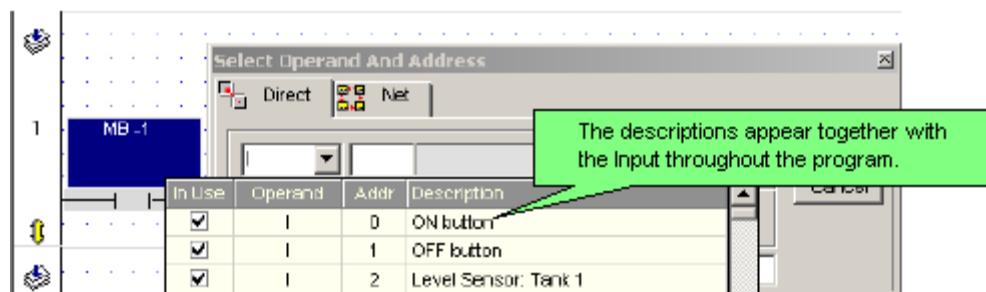


## Configuring Digital Inputs

**Note •** PNP/NPN must be set within the hardware, as explained in the technical specifications supplied with the I/O module. The program settings do not influence the actual hardware input setting.



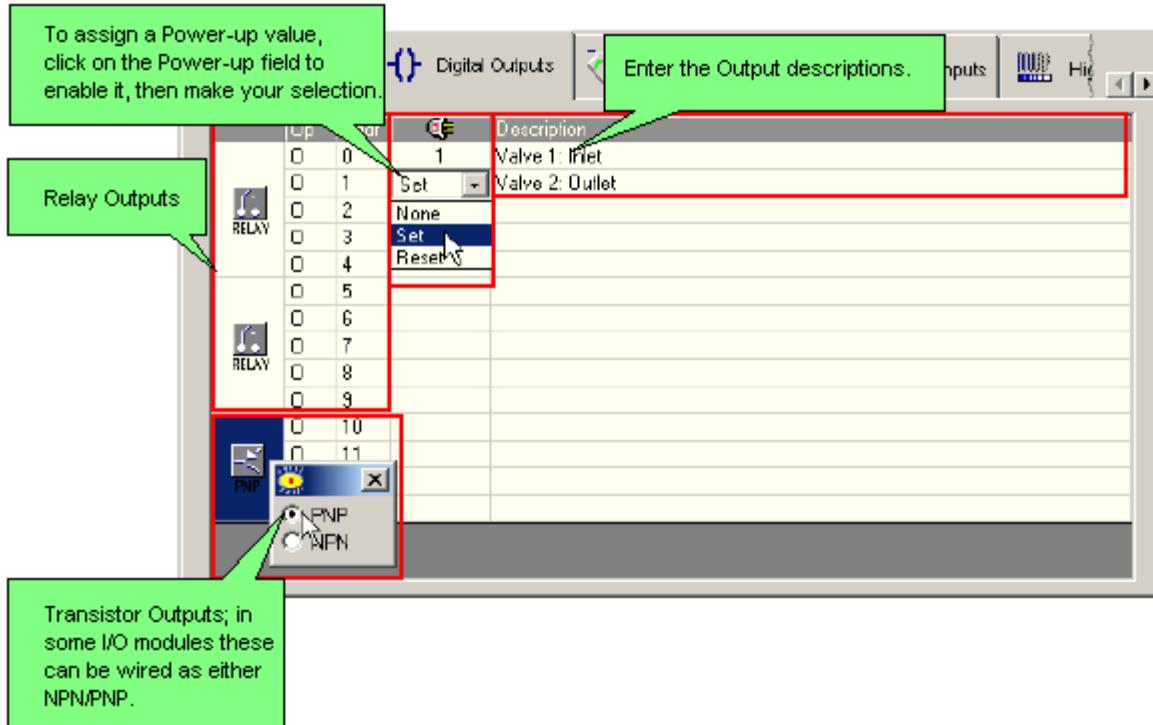
You can also assign a single description to a several lines.



## Configuring Digital Outputs

Digital Outputs may be Relay or Transistor type.

**Note •** PNP/NPN must be set within the hardware, as explained in the technical specifications supplied with the I/O module. The program settings do not influence the actual hardware input setting.

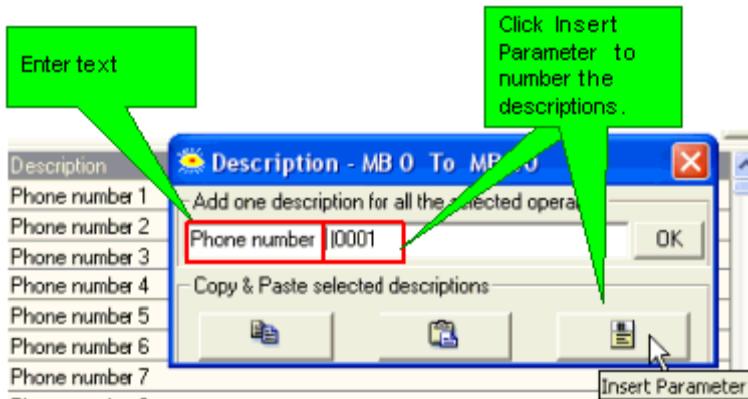


You can also assign a single description to a several lines.

## Assign a Description to Multiple Operands

To assign a Description to multiple operands, select a range of operands by dragging your cursor across them, then type a description and click OK.

You can also copy and paste text to and from other Windows applications.



# Controller Settings

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## Communication and OS-Controller Menu

Via this menu, you can

- Set PC communication parameters (non-modem) to enable PC-PLC communication.
- Reset and initialize a PLC, enter Stop and Run modes, get RTC values as well as reset the RTC.
- Get COM Parameters and PLC status.
- Install an Operating System (O/S) in a PLC
- Check Network Status

## Vision Communication PC Settings

This defines the connection VisiLogic will use when downloading a program or carrying out other communication tasks. To display the current communication settings, select Communication & OS from the Connection menu.

Note that you can cause the Unit ID# to be permanently assigned to the project via Project Properties.

The default settings are shown below.

Select Communication Type	If your Vision contains an Ethernet port, you can select the Ethernet option. Serial is the default communication mode; note that if you select Ethernet and close the project, the setting reverts to Serial.
PC COM Parameters	Port, Retries and Time-Out are the communication settings between VisiLogic and the controller. Note that if you are working with a network, the TimeOut should be greater than 1 second.
Communicate with OPLC	Use these options to communicate with networked controllers. Direct Connection: select this to communicate with any controller that is connected to your PC via the download cable, including a network bridge. Within Network: select this to communicate with a controller that is integrated into a network, then select the controller's ID number Note • ID numbers 1-63 are reserved for controllers linked via CANbus; ID numbers 64-127 are reserved for controllers networked via RS485. Using this range of ID numbers prevents a polled controller from attempting to act as a CANbus bridge, preventing it from attempting to locate the requested controller.
Vision OPLC Information	Click Get OPLC Information to display information about the controller you have selected in Communicate with OPLC.

## Run, Reset, Initialize

When you click one of the buttons shown in the figure below, your PC will access the controller selected in Communicate with OPLC.

<b>Set RTC</b>	These are the values of your PC's clock. Click Set RTC to import these values into the RTC of the controller.
<b>Get Vision RTC Current Values</b>	Click to view the current PLC settings
<b>Run</b>	Click to run the current program in the PLC.
<b>Stop</b>	Click to stop the current PLC program.
<b>Reset</b>	Click to reset the PLC, and reinstall any values preset in the program, such as Timers.
<b>Reset &amp; Initialize</b>	Click to reset, reinstall any preset values, and initialize all memory operands

## Get COM Parameters and PLC status

Select Get to view communication parameters and PLC status in the controller you are currently communicating with. This is the controller selected in Communicate with OPLC.

## Downloading an OS

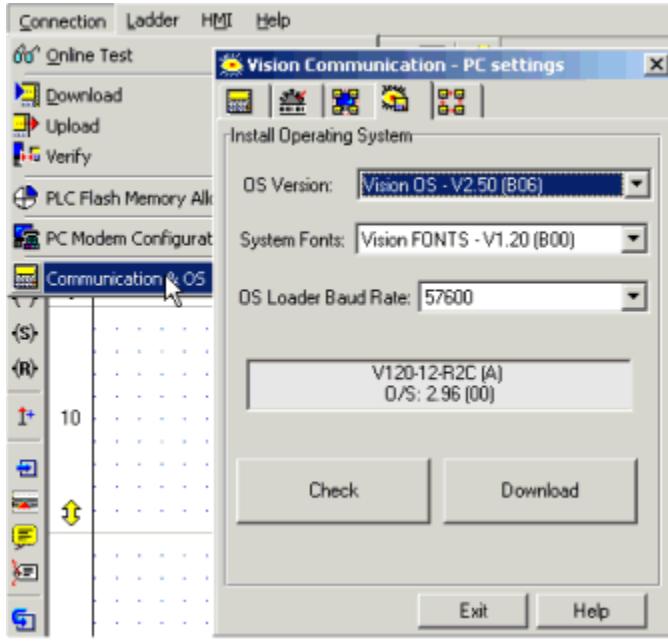
Selecting an OS version via the drop-down arrow and clicking Download installs a new Operating System (OS, OS) into the controller.

Note that System Fonts are used by the controller to show system messages that are not part of your program, such as a message that the controller is in Stop Mode. These fonts are part of the OS, and do not need to be downloaded separately.

The OS cannot be downloaded via a network connection. The controller's COM Port 1 must be directly connected to the PC via the programming cable, and Direct Connection must be selected in Communicate with OPLC. Only COM Port 1 can be used to download an OS.

When the controller is connected to the PC, clicking Check displays the currently installed OS.

To obtain the most recently released OS versions, run Live Update. Note that Live update does not install the new operating system, which must be installed as described above.

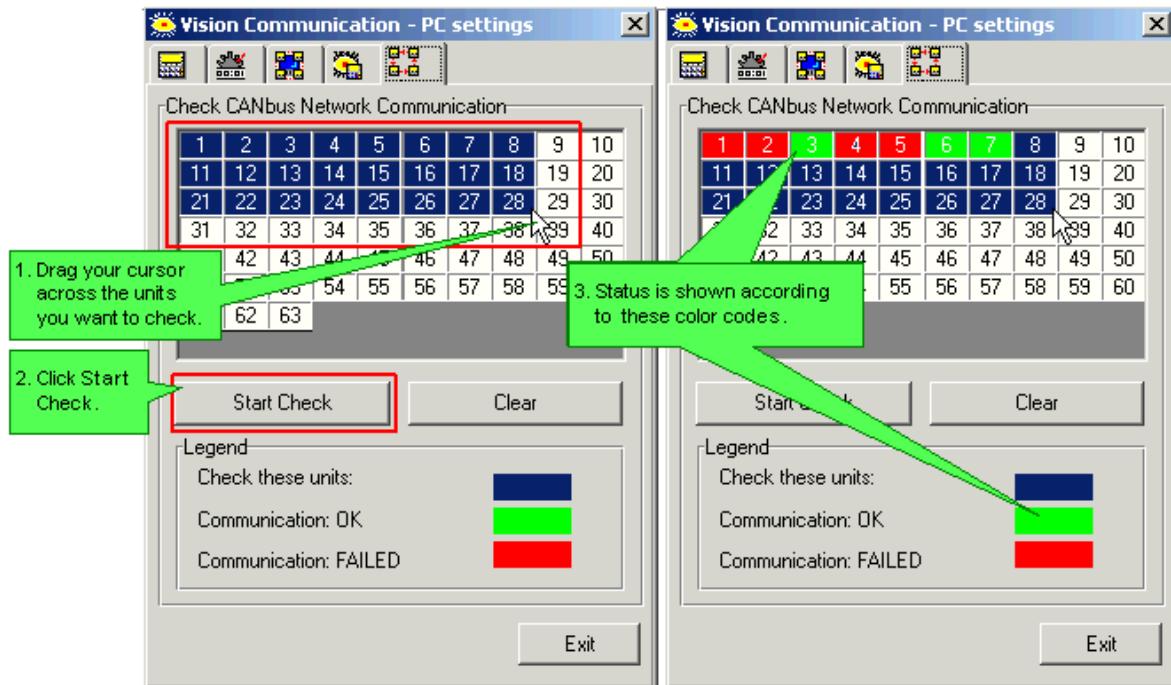


#### Known Issue, Vision 120

Known issue: A power failure during OS download causes V120 models, installed with bootstrap (firmware)1.30 and lower, to enter bootstrap mode. The V120 will not be able to exit Bootstrap mode until it is physically turned off, and then powered on.

## Check Network Status

The network status is checked via the bridge. Access Check Network Status by opening the Connection menu, selecting Communication & OS, then clicking the network tab.





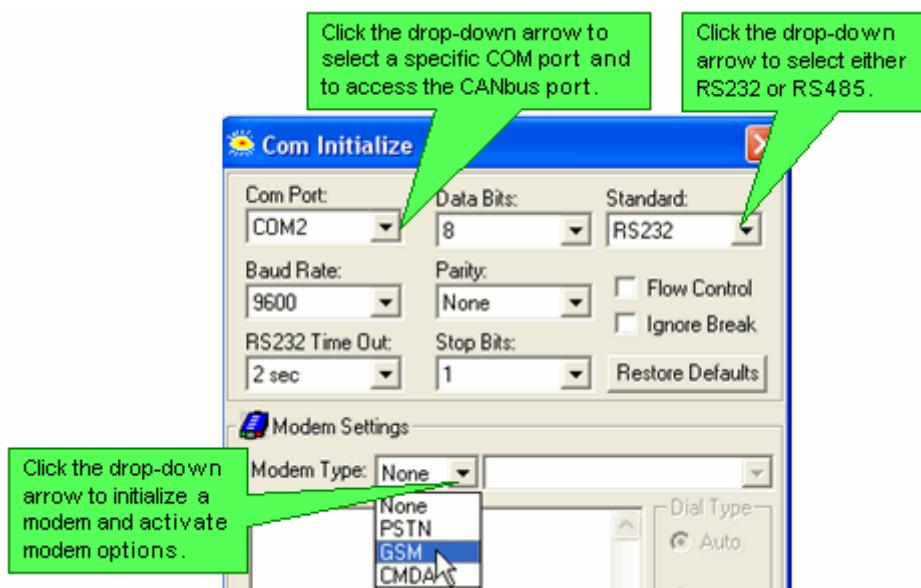
# Communications

## COM Port: Init

COM Init is located on the Com menu. Use this function block:

- To initialize serial communication port settings and enable the controller to communicate with networked controllers, using protocols such as MODBUS; or to communicate with external devices such as modems.
- To initialize the CANbus port.
- To synchronize port settings, enabling the controller to engage in inter-device communications via protocols such as MODBUS.

<b>Note •</b>	COM Init is generally performed once in a program. It is usually a power-up task, however a one-shot transitional contact may also be used.
•	All Vision controllers comprise RS232 serial ports, RS485 ports are not. To learn how to implement RS485 with different Unitronics' controllers, refer to RS485 Options.
•	Note that an Ethernet port is initialized via the Ethernet Card Init FB located on the FBs menu under Ethernet.
•	Where appropriate, use the system operands that are connected to the COM ports and that service communications.



Specific uses of the COM Init FB are detailed in the topics listed below.

- Modems
- CANbus Networking

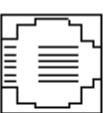
### Examples

The applications below use the COM Init function. To locate application examples, select Examples from the Help menu.

- SMS messaging.vlp
- GPRS.vlp
- MODBUS Slave.vlp
- MODBUS Master.vlp

## RS232

All Vision controllers comprise RS232 serial communication ports. RS232/RS485 adaptors are available by separate order. Certain models, such as the Vision120, support both RS232 and RS485. For details on communications hardware settings, refer to the User Guides and documentation supplied with relevant models.

RS232: Pinout		
Diagram	Pin Number	RS232: Function
	1	DTR signal
	2	0V reference
	3	TxD signal
	4	RxD signal
	5	0V reference
	6	DSR signal

## RS485 Options

The information in this topic is common to all Unitronics' controllers networked via RS485. Note that before you carry out any tasks associated with wiring, you must read and fully understand the safety guidelines.

### About RS485

RS485 is a balanced serial interface for the transmission of digital data, which enables you to create a multi-drop network containing up to 32 devices, or nodes

RS485 gives you 2 main advantages over RS232: longer cable lengths and greater immunity to noise. In comparison to RS232, RS485 uses lower voltage and differential signals. RS485 uses a differential voltage loop interface (balanced differential signal); differential data transmission reduces the effects of ground shifts and induced noise signals, even in an electrically noisy environment. The system is based on balanced circuits that rely on twisted-pair wires (A & B). Thus, the data conversion of logical 0 and 1 is made by converting the polarity of the two wires by reference to each other, instead of changing polarity of a single wire by reference to the "SG" (Signal Ground).

The noise immunity results from the fact that, when electromagnetic noise is induced over the differential signals, the same noise is induced on both signals. When the receiver subtracts the differential signals, the result is noise compensation.

The same 2 wires are used for transmitting and receiving; therefore, within RS485 networks, only one device can transmit while all of the other devices 'listen' (receive).

Unitronics' controllers offer different options for networking via RS485, according to the network series.

### Network Topology & Wiring

The network topology is multi-drop bus. Every RS485 network includes 2 types of nodes; node refers to every device that is physically connected to the network.

- End Nodes: The devices attached at both physical ends of the network, containing a network terminator.
- In-line Node: All devices connected to the network that are not end nodes.

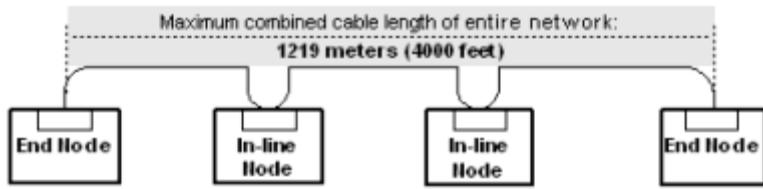
To enable a rapid rate of communication over relatively long distances, the wires function as transmission lines. For this reason, the end nodes of the network must contain network terminators for the purpose of impedance matching. The method for setting network terminators is described individually for each device.

### RS485 Network Wiring

Use shielded twisted pair (STP) cables to network devices. Recommended cables types are:

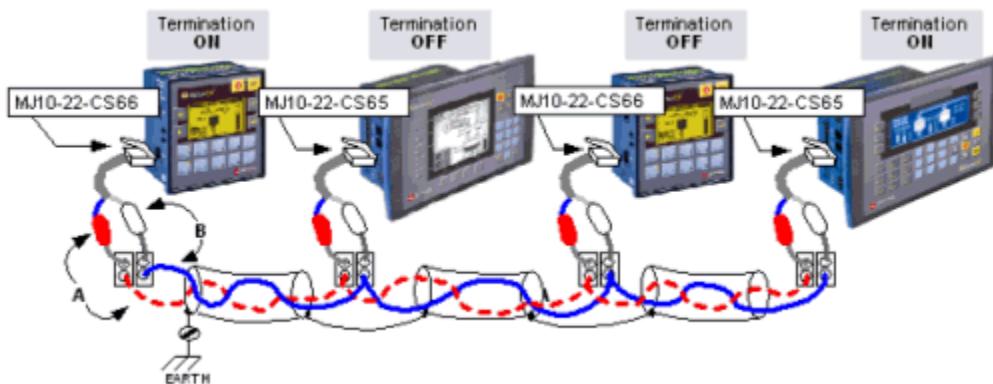
- Twinax cable, type H8106 • Control cable, type due 4001 (0.5mm<sup>2</sup>, twisted pair)
- Twinax cable, type H3094 • Control cable, type V45551-F21-B5 (1.5mm<sup>2</sup>, twisted pair)

The combined total length of all network cables cannot exceed 1219 meters, as shown below.



### **RS485 wiring considerations**

- With the exception of the M90-19-R4, the RS485 signals are NOT isolated. If the controller is used with a non-isolated external device, avoid potential voltage that exceeds  $\pm 10V$ . To avoid severely damaging the system, all non-isolated device ports should relate to the same 0V signal.
- Minimize the stub (drop) length leading from each device to the bus. The stub should not exceed 5 centimeters. Ideally, the main cable must be run in and out of the networked device as shown below. The connectors MJ10-22-CS66 (V120 and M91 series) and MJ10-22-CS65 (V2xxx series), shown below, enable this to be easily accomplished.



- Do not cross positive (A) and negative (B) signals. Positive terminals must be wired to positive, and negative terminals to negative.
- You must create network termination points by using the two end point devices integrated into your network. The method of creating termination points varies according to the controller series.

### **RS485, by controller type**

RS485 is implemented differently in Unitronics' controllers, according to model type. These options are summarized below.

Vision controllers are programmed using VisiLogic software. When Vision controllers are networked via RS485, the COM ports must be initialized to the RS485 standard as explained in COM Port: Init.

In addition, you must assign a unique Unit ID number to each controller, as explained in the Help topic: Assigning a Unit ID number. Note that there is a range of ID numbers reserved for RS485, numbers 64-127.

### **Vision 230/260/280**

May be ordered with or without RS485 ports. A V2xx controller that is ordered containing an RS485 port has a part number that ends in the number '1', for example: V2xx-1x-B21x1. If your V2xxx controller does not have an RS485 port, you can order a port module, V200-19-R4, and install it.

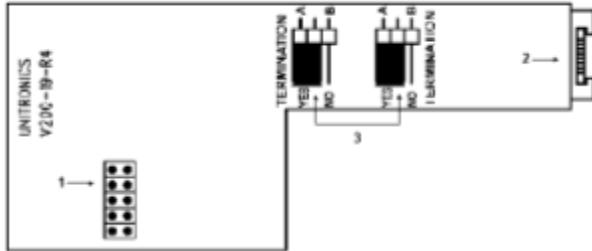
Note that the ports are not isolated. The connector type is RJ-45. RS485 termination settings are determined via jumper.

If your V2xxx controller does not have an RS485 port, you can order a port module, V200-19-R4, and install it.

Installation instructions are provided together with the module when it is ordered separately. The information below applies whether or not the RS485 port was supplied with the V2xxx controller, or whether it is ordered and installed separately.

### RS485 Module (V200-19-R4)

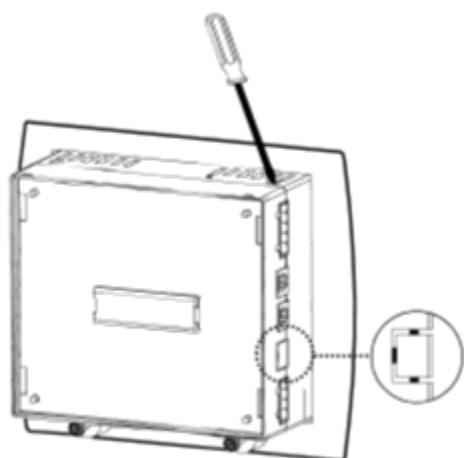
- |   |                                       |
|---|---------------------------------------|
| 1 | J1 connector,<br>plugs into PLC board |
| 2 | RS485 port                            |
| 3 | Termination jumpers                   |



### Network Termination Settings

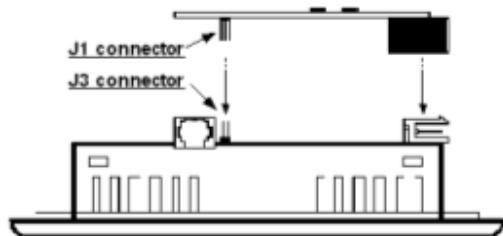
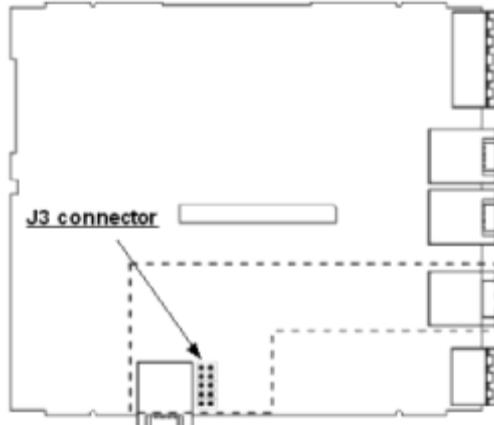
The jumper settings shown above determine whether the controller can function as an end device in a RS485 network. Note that the factory default setting is YES, whether or not the RS485 port was supplied already installed in the controller. If the OPLC is not a network end device, set both jumpers to NO.

To open the controller in order to access the module and change the jumper settings, follow the relevant instructions listed below.



4. Locate the J3 connector.

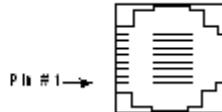
1. Turn power off before opening the controller.
2. Open the OPLC by inserting a screwdriver into the slots located on the sides of the controller as shown, then carefully prying the cover off.
3. The RS485 port's location is covered by plastic. Remove the plastic covering by using a razor cutter to cut through the tabs.



5. Install the module by placing the J1 connector (female) of the module onto the J3 connector (male) in the controller.
6. Make sure that the connection is secure.
7. Close the controller by snapping the plastic cover back in its place. If the module is correctly placed, the cover will snap on easily.

**RJ45 Connector Pin-out**

Pin Number	Function
8	A signal (+)
1	B signal (-)

**Vision 120/ M91****Vision 120 series**

Offers 2 serial communication ports. Each port can be adapted to either the RS232 or RS485 standard, via jumpers located within the controller and VisiLogic software settings. Note that the ports are not isolated. The connector type is RJ-11. RS485 termination settings are determined via jumper.

**M91 series**

An M91 that contains an RS485/RS232 port has a part number that includes the number '4', for example: M91-19-4UN2.

RS485 is via an RJ-11-type serial communication port. Each port can be adapted to either the RS232 or RS485 standard, via jumpers located within the controller. The M91 is programmed using U90 Ladder software. The port mode is determined by SI 64, Set COM Port Mode, as described in the U90 Ladder help topic: COM Port Mode: RS232/RS485 (M91 only).

Note that the port is not isolated. RS485 termination settings are determined via jumper.

**Vision 120/ M91 RS232/RS485 COM ports**

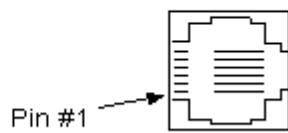
The information below applies to both Vision 120 and M91 series controllers. The controllers in these series offer RJ-11-type serial communication ports. Each port can be adapted to either the RS232 or RS485 standard, via jumpers located within the controller. In the case of the Vision 120, appropriate VisiLogic program settings are also required.

RJ-11 type port

The pinout below is of the RJ-11 type port, when the port is used for RS485.

**RJ11 Connector Pin-out**

Pin Number	Function
1	A signal (+)
2	(RS232 signal)
3	(RS232 signal)
4	(RS232 signal)
5	(RS232 signal)
6	B signal (-)

**Note •**

When a port is set to RS485, both RS232 and RS485 can be used simultaneously if flow control signals DTR and DSR are not used.



The ports are not isolated. If the controller is used with a non-isolated external device, avoid potential voltage that exceeds  $\pm 10V$ .

To avoid damaging the system, all non-isolated device ports should relate to the same ground signal.

**RS232/RS485 Jumper Settings**

Use the jumper settings shown below to change the functionality of the controller's COM port.

COM 1		
To use as:	JP1	JP2
RS232*	A	A
RS485	B	B

COM 2		
To use as:	JP5	JP6
RS232*	A	A
RS485	B	B

To open the controller and access the jumpers, refer to the instructions below.

### **RS485 Network Termination Settings**

The jumper settings shown below determine whether the controller can function as an end device in a RS485 network. Note that the factory default setting is ON. If the OPLC is not a network end device, set both jumpers to OFF.

COM 1		
Termination	JP3	JP4
ON*	A	A
OFF	B	B

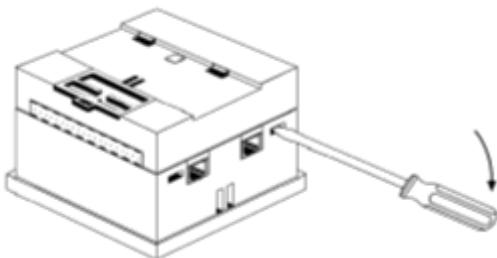
COM2		
Termination	JP7	JP8
ON*	A	A
OFF	B	B

\* Default factory setting.

### **Opening the Controller**

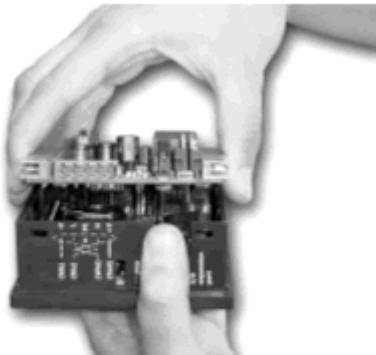


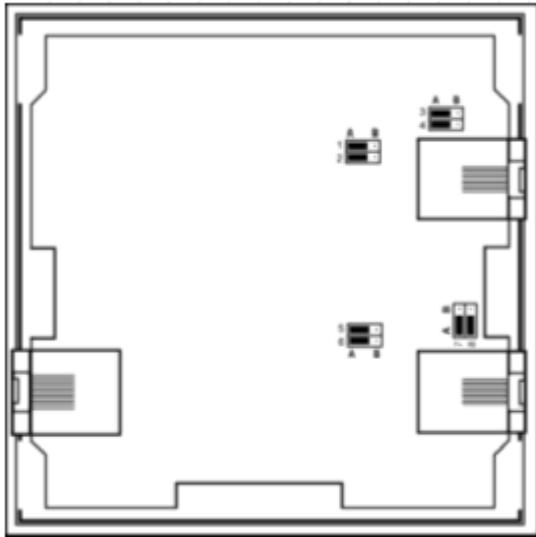
- Before opening the controller, touch a grounded object to discharge any electrostatic charge.
- Avoid touching the PCB board directly by holding the PCB board by its connectors.



1. Turn power off before opening the controller.
2. Locate the 4 slots on the sides of the controller.
3. Using the blade of a flat-bladed screwdriver, gently pry off the back of the controller as shown.

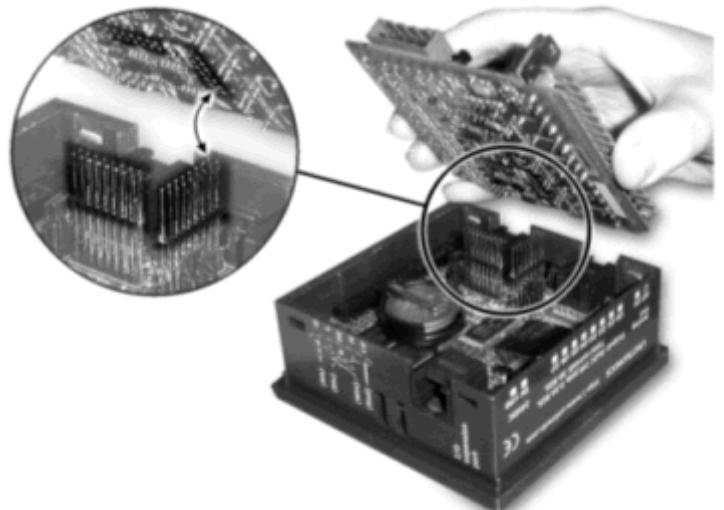
4. Gently remove the top PCB board:
  - Use one hand to hold the top-most PCB board by its top and bottom connectors as shown.
  - With the other hand, grasp the controller, while keeping hold of the serial ports; this will keep the bottom board from being removed together with the top board.
  - Steadily pull the top board off.





5. Locate the jumpers shown in Figure 9, then change the jumper settings as required.

6. Gently replace the PCB board as shown. Make certain that the pins fit correctly into their matching receptacle.
- Do not force the board into place; doing so may damage the controller.
7. Close the controller by snapping the plastic cover back in its place. If the card is placed correctly, the cover will snap on easily.



## M90

These controllers are programmed via U90 Ladder.

RS485 communications are enabled via an external RS232/RS485 converter, such as Unitronics' M90-19-R4, which can be connected to the controller's RS232 port. No U90 Ladder software settings are required.

The M90-19-R4 RS485 port is isolated.

Note that since the M90-19-R4 is an external converter, it is also compatible with other devices, such as PCs.

### Vision / M91 RS485 Port Specifications

The specifications below apply to RS485 ports for all Vision and M91 controllers.

Input Voltage -7 to +12V differential max.

Cable type Shielded twisted pair, in compliance with EIA RS485

Cable length 1200m maximum (4000 feet)

Galvanic Isolation No

Baud rate 110 - 57600 bps

Complete specification for the M90-19-R4, which converts serial data from the RS232 standard to either RS422 or RS485, is located on the Setup CD. It is also available from your local Unitronics distributor. This module is recommended for use with M90 controllers and other devices.

### User safety and equipment protection guidelines

This information is intended to aid trained and competent personnel in the installation of this equipment as defined by the European directives for machinery, low voltage, and EMC. Only a technician or engineer trained in the local and national electrical standards should perform tasks associated with the device's electrical wiring.

Before using a Unitronics' product, it is the responsibility of the user to read and understand this document and any accompanying documentation.

Symbols are used to highlight information relating to the user's personal safety and equipment protection throughout this document. When these symbols appear, the associated information must be read carefully and understood fully.

Symbol	Meaning	Description
	Danger	The identified danger causes physical and property damage.
	Warning	The identified danger can cause physical and property damage.
	Caution	Use caution.

- Under no circumstances will Unitronics be liable or responsible for any consequential damage that may arise as a result of installation or use of equipment, and is not responsible for problems resulting from improper or irresponsible use of Unitronics devices.
- All examples and diagrams shown are intended to aid understanding. They do not guarantee operation.
- Unitronics accepts no responsibility for actual use of a product based on these examples.
- Only qualified service personnel should open a device or carry out repairs.
- Please dispose of this product in accordance with local and national standards and regulations.

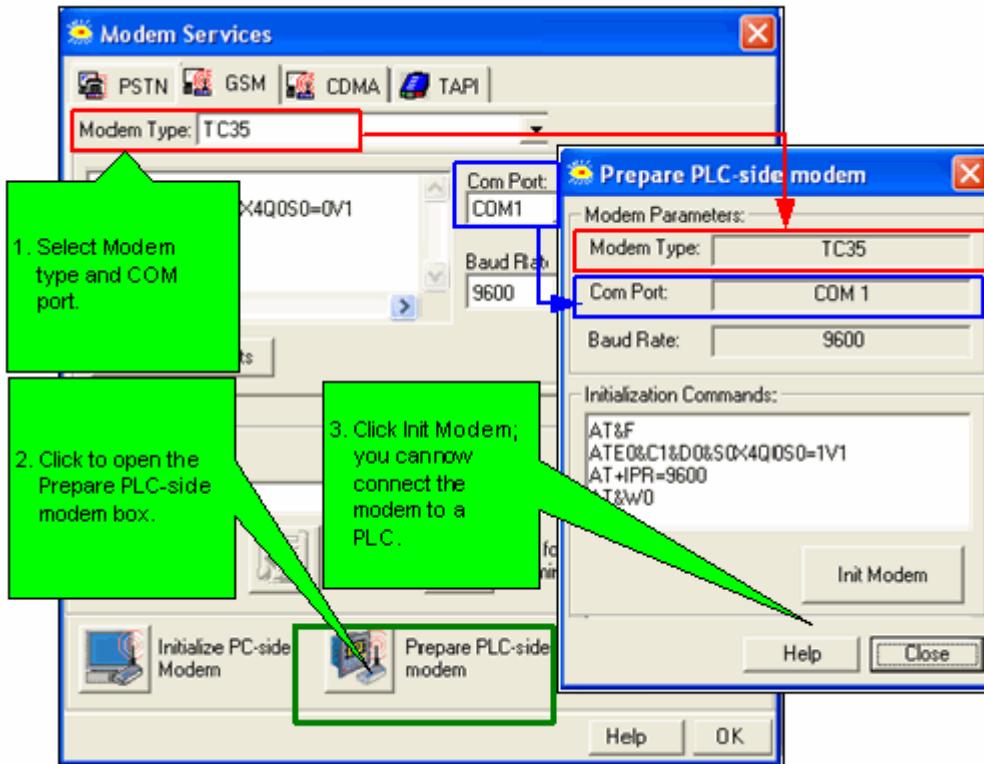
	<ul style="list-style-type: none"><li>▪ Failure to comply with appropriate safety guidelines can result in severe personal injury or property damage. Always exercise proper caution when working with electrical equipment.</li></ul>
Note	<ul style="list-style-type: none"><li>▪ Check the user program before running it.</li><li>▪ Do not attempt to use a device with parameters exceeding permissible levels.</li><li>▪ Install an external circuit breaker and take appropriate safety measures against short-circuiting in external wiring.</li><li>▪ To avoid damaging the system, do not connect or disconnect a device when the power is on.</li><li>▪ Do not touch live wires.</li><li>▪ Double-check all the wiring before turning on the power supply.</li></ul>

## PLC-side Modems

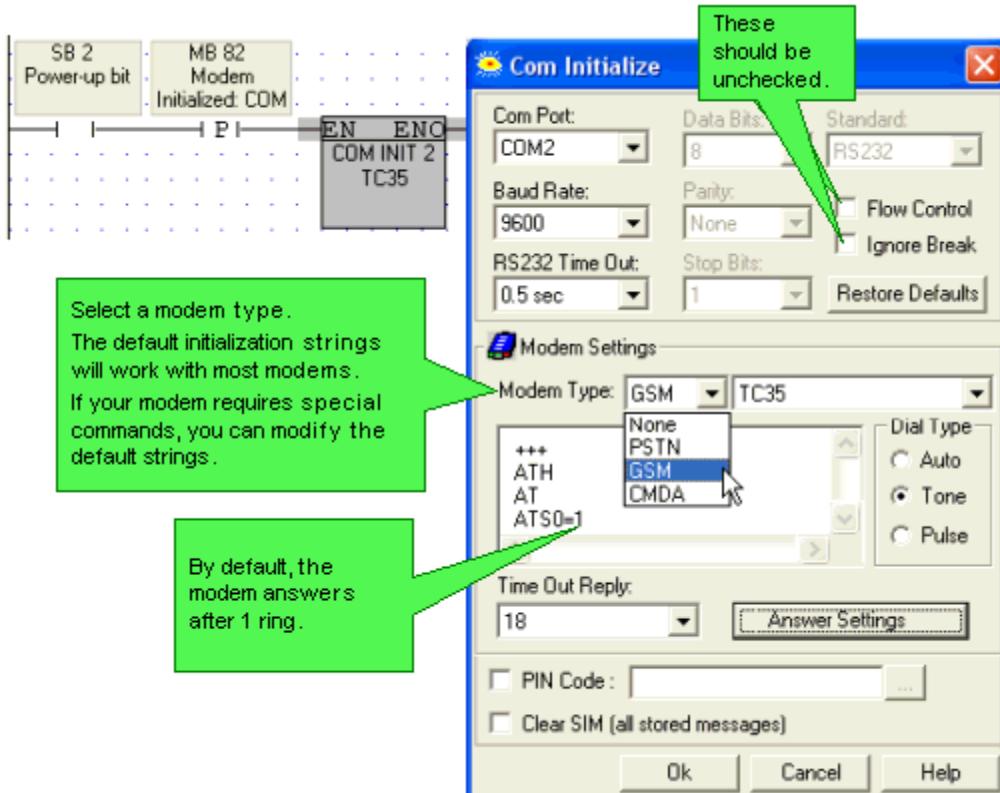
### How to enable a Vision controller to communicate via landline, GSM, or CDMA modem.

1. Connect the modem to a PC, using the cable supplied by the modem manufacturer.
2. Prepare the PLC modem.

- Open Connection>Modem Services, and select the modem type and COM port.
- Click the Prepare PLC-side Modem button; that dialog box opens.
- Click the Init Modem button; the modem is initialized for PLC use.

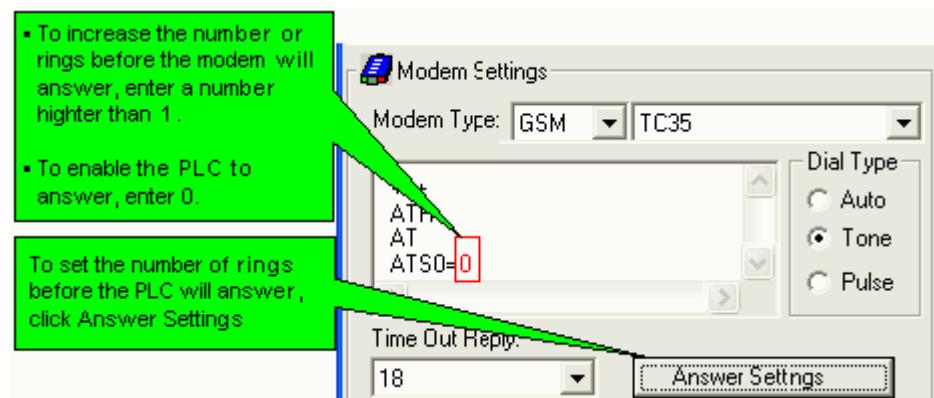


3. Initialize the PLC port using a COM Init FB, located on the FBs menu.

**Note •**

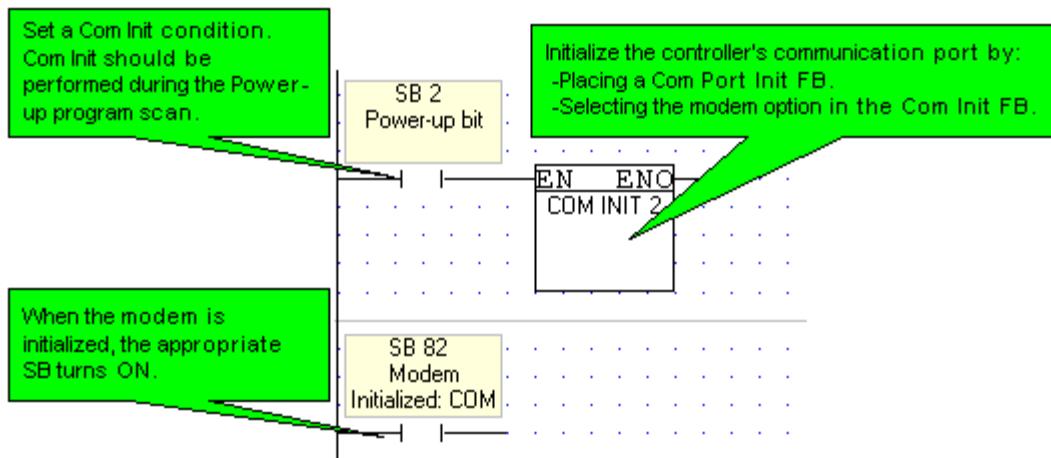
COM Init is generally performed once in a program. It is usually a power-up task, however a one-shot transitional contact may also be used.

- Communications cannot flow through the port during initialization.
- The PLC cannot answer incoming calls when it is in bootstrap mode.
- The Answer Settings parameter, by default, enables the modem to answer incoming calls. This enables you to download an OS to the PLC via modem.  
However, you can enable the PLC to answer instead. To do this, locate the initialization string ATS0=1 and enter 0 (ATS0=0).  
When ATS0=0, an OS cannot be downloaded.



4. Build a Ladder program containing the correct conditions and elements.

**Note •** Communications cannot flow through the port during initialization. To avoid conflicts in your program, use the COM Port initialization SBs 80-85.



5. Download the application to the PLC.

6. Connect the modem to the PLC.

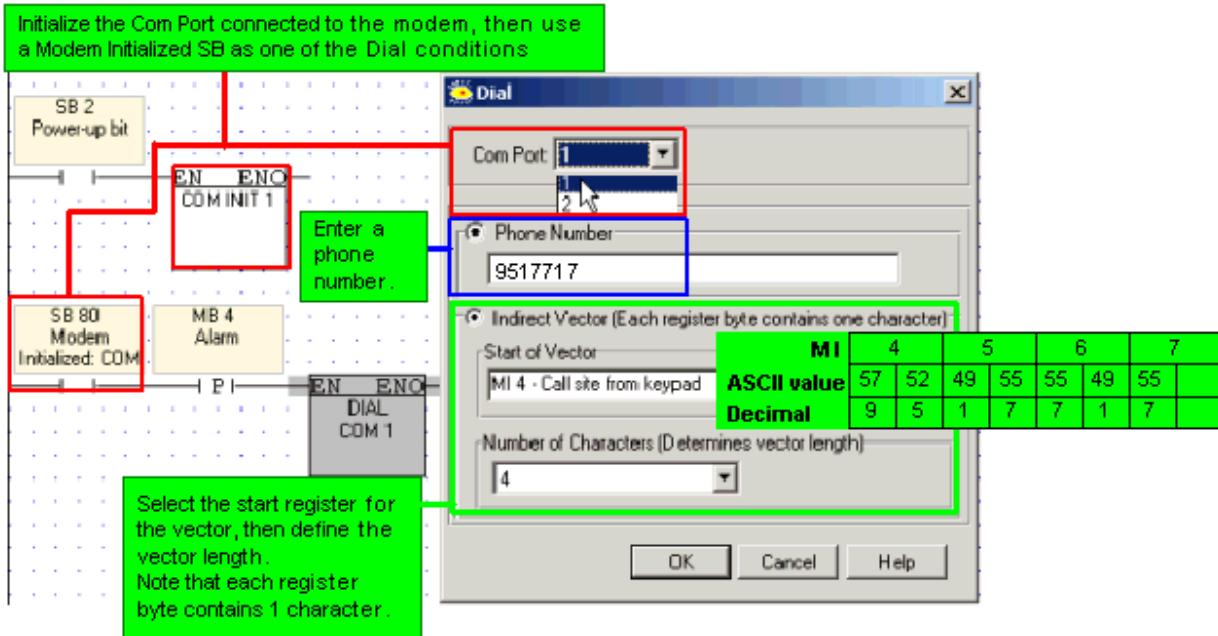
After the modem is enabled and successfully initialized by the PLC (SBs 80, 82, 84 turn ON), the controller can either be accessed via modem or can dial a remote modem to establish a data link.

### How to enable a PLC to dial a remote modem (Ladder)

Landline modems

**Note •** In the conditions used to activate the Dial function, include the appropriate Modem Initialized System Bit: SB 80, SB 82, or SB 84.

For more information regarding Ladder conditions and other details, refer to the topic Dial and Hang-up.



GSM/CDMA modems

- Note •** SMS operations can conflict with applications that use the modem for other data communication processes. To prevent conflicts, use the Modem Busy (GSM) MB, and use an MB to indicate when the modem is in use by another data communications process.

For more information on SMS messaging, refer to the SMS topics.

## How to terminate the link--Hang-up

This enables you to use Ladder conditions to break the connection.

- Note •** Before activating Hang-up, check whether the connection exists, via the appropriate Modem Connection Status System Bit: SB 86, SB 87, or SB 88



- Note •** If calls are routed via a switchboard, note that the switchboard settings may interfere with communications. Consult with your switchboard provider.

- Note •** PC/PLC modem communications: Both PC and controller must use the same type of modem: either landline, GSM, or CDMA. Internal PC modems must be used in conjunction with the driver provided by the modem's manufacturer.



## Modem Tips

To avoid compatibility problems, use modems produced by the same manufacturer and of the same model. This is due to lack of standardization between modem manufacturers, which may result in communication conflicts.

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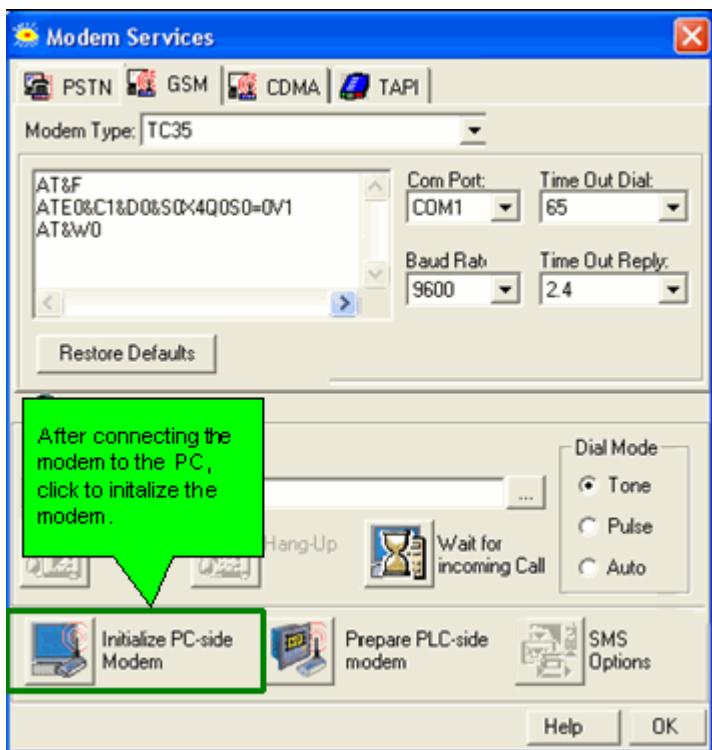
## PC-Side Modems

Once you have configured a PC-side modem, you can use a PC modem to access a remote, modem-linked controller and perform any task, just as you would if the PLC were directly connected to your PC. For example, you can

- Download, upload, and edit the controller program via the modem connection.
- Run Online test mode.
- Download an OS to the controller via modem.
- Use OnLine test and Information Mode to troubleshoot problems in remote controllers and applications.
- Read and write data to/from controllers via Remote Access or Unitronics' communication .dll utilities.

### How to Configure a PC-side Modem

Select and enter the appropriate parameters in Connection>Modem Services



### PC Modem Configuration Parameters

---

#### Initializing a PC Modem

1. Select a tab; the Modem Type selection box shows the options.
  2. Select the PC modem type; the initialization strings change accordingly. To edit strings, click in the field and enter text. Selecting TAPI displays the settings of telephony devices that appear in Windows>Control Panel>Phone and Modem Options.
  3. Edit other options as required. If your GSM modem requires a PIN code, enter the number.
  4. When all parameters are set, initialize the PC modem by clicking Init Modem.
- Note•** Default strings and baud rate enable OS download via modem.

Phone Book	<ul style="list-style-type: none"> <li>Click a line to enter a number and description.</li> <li>To access outside lines, enter the access number required, a comma, then the phone number.</li> </ul>
Dial & Hang-Up	<ul style="list-style-type: none"> <li>To dial, highlight the desired number and click Dial.</li> <li>To break the data link, click Hang-Up.</li> </ul>
Send SMS	<p>This option is available if you have selected GSM or CDMA modem.</p> <ol style="list-style-type: none"> <li>Select the destination number.</li> <li>Enter the SMS text, then click Send SMS.</li> </ol> <p>Note• An SMS can be used to cause the PLC to call the PC.</p>
Wait for Incoming Call	Places the PC modem in auto-answer mode.
Prepare PLC Modem	This is used to initialize a PLC-side modem. Full instructions are in the topic PLC-side Modems.

### How to use the PC modem to access a PLC

1. Prepare and connect the PLC-side modem as described in the topic PLC-side Modems, in the section 'How to enable a Vision controller to communicate via landline, GSM, or CDMA modem's.
2. In Connection PC-Modem Configuration, dial the remote PLC's controller to establish the data link, then enter OnLine mode.

You can now perform any task that can be performed via a direct PC-PLC connection.

<b>Note •</b>	The PC to modem cable is not the same type of cable that connects the controller to the modem. The PC to modem cable must provide connection points for all of the modem's pins.
•	The initialization commands for PC modems, and those found in the COM Init FB used to initialize the PLC's modem are different.
•	If calls are routed via a switchboard, note that the switchboard settings may interfere with communications. Consult with your switchboard provider
•	If the modem initialization string parameter S7, TimeOut, is too short to permit the PLC's modem to answer, an error will result. For example, if this parameter is S7=30, the PC modem waits 3 seconds to receive an answer from the PLC's modem. If, however, the PLC program's COM Init FB Answer Settings are set to 'Answer after 6 rings,' the PLC modem will not be able to answer before the 3 seconds have elapsed. In this case, the TimeOut parameter is exceeded, and the PC modem will return the No Carrier error.
•	PC/PLC modem communications: Both PC and PLC must use the same type of modem: landline or GSM\CDMA. Internal PC modems must use the driver provided by the modem's manufacturer.

### Dial & Hang-up

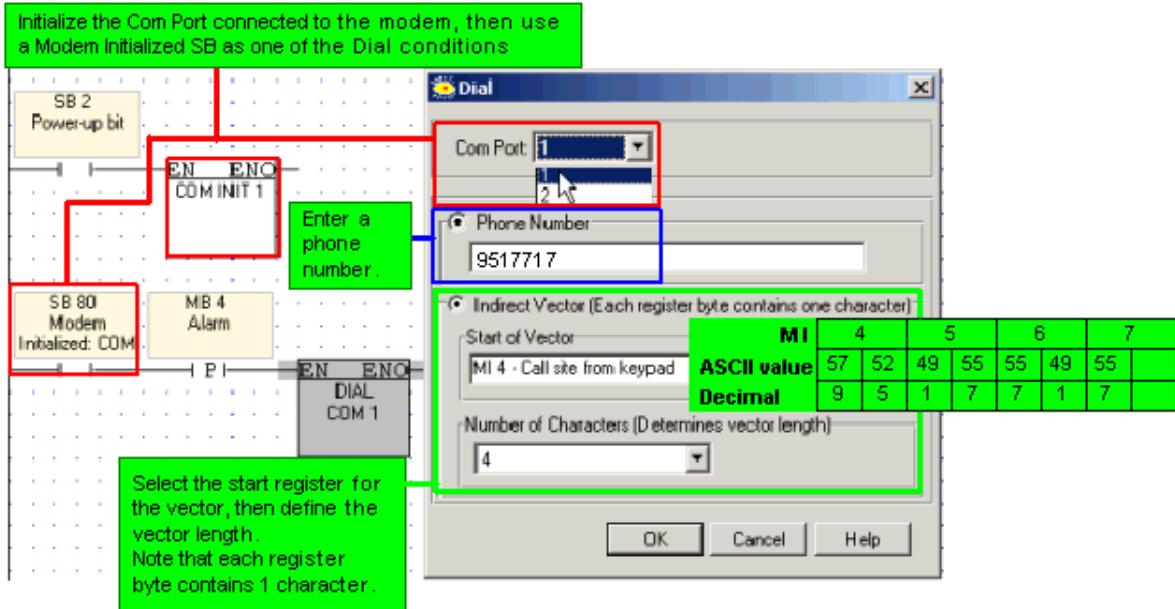
These functions are located on the Com menu. Via the Ladder application, they enable a PLC connected to a modem to establish or terminate a data link to another remote modem.

Before you dial, you must enable the Vision controller to communicate via modem.

#### Dial

This enables you to use Ladder conditions to dial a modem.

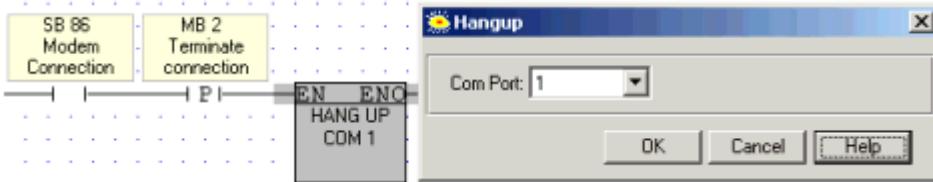
<b>Note •</b>	In the conditions used to activate Dial, include the appropriate Modem Initialized SB: 80, 82, or 84
•	SMS operations can conflict with applications that use the modem for other data communication processes. To prevent conflicts, use the Modem Busy (GSM) MB, and use an MB to indicate when the modem is in use by another data communications process.



### Hang-up

This enables you to use Ladder conditions to break the connection.

**Note •** Before activating Hang-up, check connection status via a Modem Connection SB: 86, 87, or 88.



## Downloading an OS via Modem

By following the recommendations given below, you can successfully download an OS to a Vision controller via modem. Download via modem is supported by OS V3.70, B50 and higher.

---

In order to download an OS via modem:

1. Prepare and connect the PLC-side modem as described in the topic PLC-side Modems, in the section 'How to enable a Vision controller to communicate via landline, GSM, or CDMA modems'. These procedures initialize the modem with the parameters required to download an OS.
2. Connect the modem to COM port 1 on the PLC.

---

If power failures occur, or if the modem communication link is broken, the OS download stops. Controllers V230, 260, and 280 can recover without any intervention; as can V120 controllers installed with bootstrap Version 1.30 or higher.

However, a V120 controller installed with bootstrap versions lower than 1.30 may require physical power-up (must be turned off, and then powered on.)

In all cases, it is recommended that someone be next to the PLC during the OS download in order to attend to any potential problems.

---

The PC-side and PLC-side modems must use the initialization defaults: baud rates must be set to 9600; and COM Init set to ATS0=1.

Once the PC-PLC modem connection has been established, proceed according to the instructions in Downloading an OS.

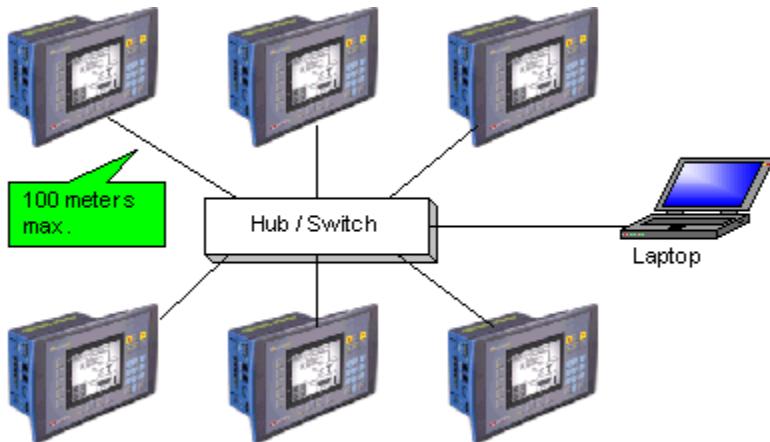
### Modem Tips

To avoid compatibility problems, use modems produced by the same manufacturer and of the same model. This is due to lack of standardization between modem manufacturers, which may result in communication conflicts.

## Using Ethernet

Unitronics currently supports both TCP and UDP protocols, as explained in the topic About Ethernet. This topic also contains general information about Ethernet, IP addressing, sockets, and ports.

Ethernet uses star topology.



In order to use Ethernet, your controller must comprise an Ethernet port.

V2xx Vision OPLCs can be ordered with or without an Ethernet port. The Ethernet port enables you to implement communications via TCP/IP, such as MODBUS over TCP. To check if your Vision controller was supplied with an installed Ethernet port, first check the device's model number. In addition, note that the Ethernet port is an RJ-45-type port that is lined with metal.

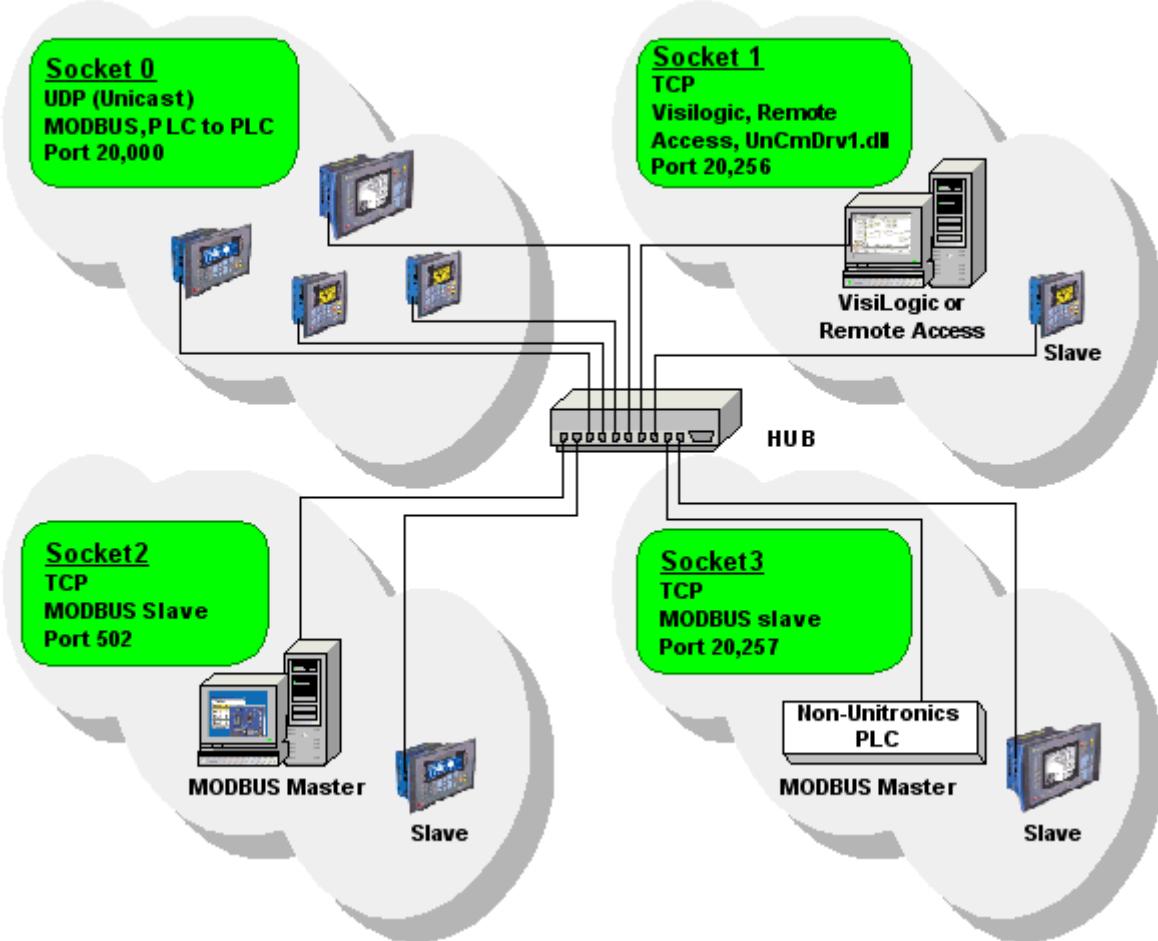
Model Number	<b>V 2 x x - 1 x - B 2 x B</b>	<b>V 2 x x - 1 x - B 2 x E B</b>
	Supplied <b>without</b> an Ethernet port.	Supplied <b>with</b> _____ an Ethernet port

Via Ethernet, you can use the MODBUS IP FB to:

- Communicate data within a PLC network.
- Use a PC to access a PLC via MODBUS over TCP.
- Use MODBUS over TCP to enable non-Unitronics PLCs to access Unitronics PLCs, via MODBUS.

You can also use Ethernet to enable a PC running VisiLogic, Remote Access, or other communication .dll to access a networked PLC.

The default socket configuration enables you to implement these communication options as shown below:



## Default Socket Configuration

Vision controllers currently offer 4 sockets. The default socket configuration includes:

Socket	Protocol	Port Number	Function
0	UDP	20,000	<p>Enables data to be both transmitted and received within a PLC network, via MODBUS.</p> <p>Note• If you are using the default settings for Socket 0, note that data is sent via Unicast to IP: 255.255.255.255, port: 20,000 plus the last byte of the IP address originally assigned to the device.</p> <p>This is why Port numbers 20,000-20,255 are reserved for Socket 0.</p>
1	TCP	20,256	Enables PC to PLC communication via UnCmDrv1.dll, including VisiLogic, Remote Access, and other Unitronics communication applications.
2	TCP	502	Set to 'listen' as slave (server), enables MODBUS applications such as OPC servers and SCADA systems which use MODBUS TCP over IP.
3	TCP	20,257	Set to 'listen' as slave (server), enables non-Unitronics PLCs to access Unitronics PLCs, via MODBUS.

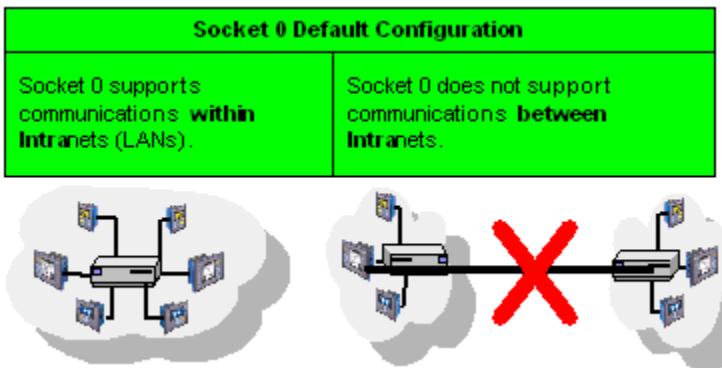
**Note•**

The default configuration means that, for most applications, you do not need to include a Socket Init FB in the ladder application. However, if, for example, your application requires 4 sockets for TCP, change the default configuration of Socket 0 from UDP to TCP via the Socket Init FBs.

•

When using the default socket configuration, Socket 0 cannot be used to communicate data between routers, and therefore cannot transfer data between Intranets as shown in the figure

below. This is because the default configuration for Socket 0 uses Unicast.



- Note that when TCP is used, the formal 'handshake' required by the protocol means that, during each session occurring via a defined socket, other communications cannot flow through that socket until the current session has been terminated.  
Such is not the case with UDP. Since there is no formal handshake, communications can continue to flow through a socket even when there are multiple requests.

## General

When using Ethernet, use the MODBUS IP FBs. For detailed information regarding MODBUS IP commands, refer to the MODBUS IP help topics.

<b>Note •</b>	In order to implement Ethernet, a controller must be assigned an IP address. This is done via the Ethernet Card Init FB, which must be included in the Ladder applications of both master and slave controllers. Class C-type addresses are recommended, as explained in the topic About Ethernet.
•	When the Ethernet card finishes initialization, SB 142 rises. Use this as a condition before activating any Ethernet element, such as Socket Connect.
•	An activating condition must be placed before the Ethernet Card Init FB. This may be assigned as a power-up task; however a one-shot transitional contact may also be used.
•	Unitronics' proprietary COM Protocol FB, located on the FBs menu, which may ordinarily be used to access external slave devices, is not currently compatible with Ethernet.

## Examples

### PLC networks, PLC to PLC

Any controller within the network can be both master and slave. In order to be read by the master, a slave's application must contain the MODBUS IP Scan FB.

### Using UDP to implement controller-to-controller communication

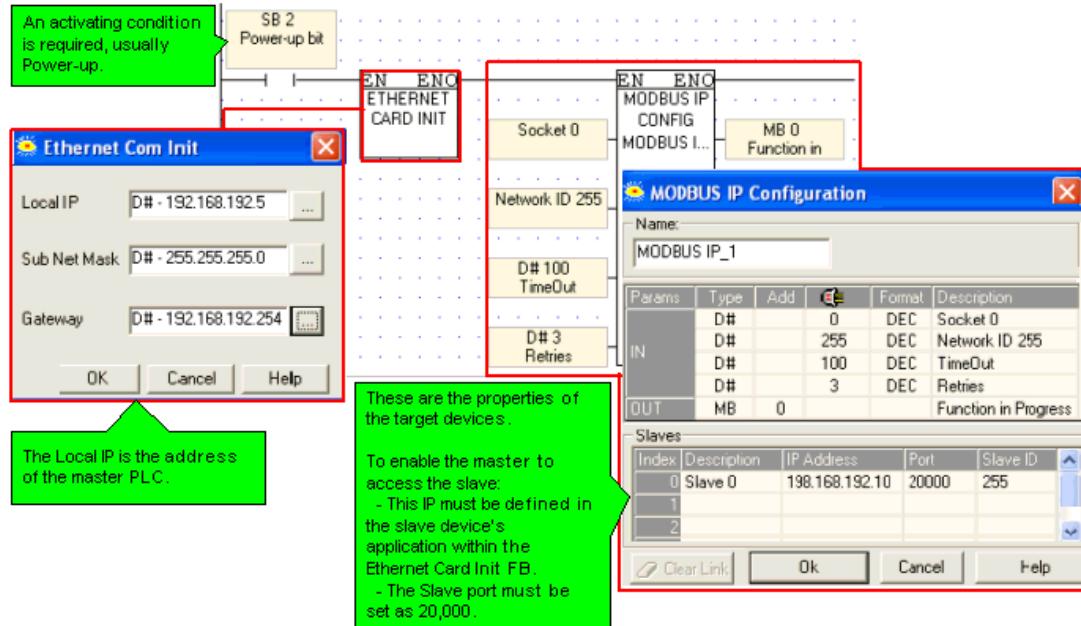
In order to communicate via Ethernet throughout your controller network, you must include an Ethernet Card Init FB in the ladder application of each networked controller. Remember that, when using UDP, do not use the Socket: Connect or Socket: Close elements; these are only required by TCP applications.

- Master

The master PLC Ladder application must include the elements shown below.

Step 1: Initializing the Ethernet card and configuring MODBUS

The MODBUS Configuration is linked to Socket 0, which is by default set to UDP.

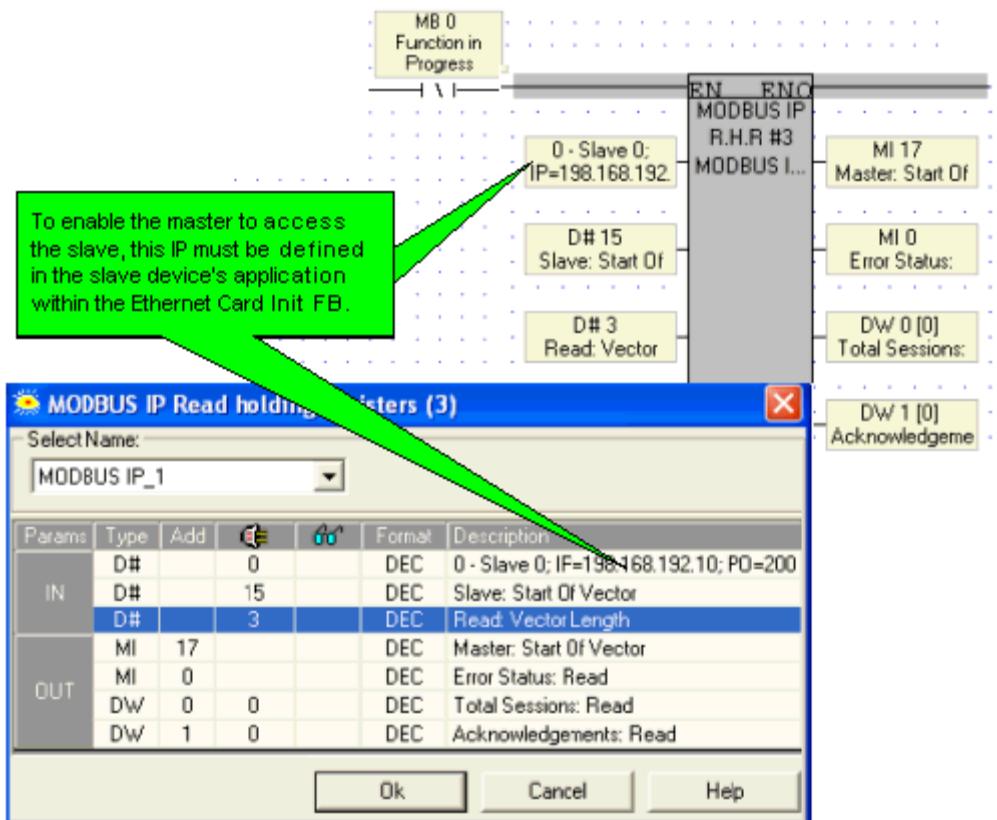


**Note •** A PLC defined as a UDP master can communicate with a number of slave devices.

### Step 2: Using MODBUS Commands

**Note •** Note that the operand addresses in slave PLCs are indirect addresses (pointers). In the figure below, the Slave: Start of Vector parameter is 15. This means that the master will begin reading from MI 15 in the slave PLC. Since the Read: Vector Length parameter is 3, the function takes the values in MI 15, 16 and 17.

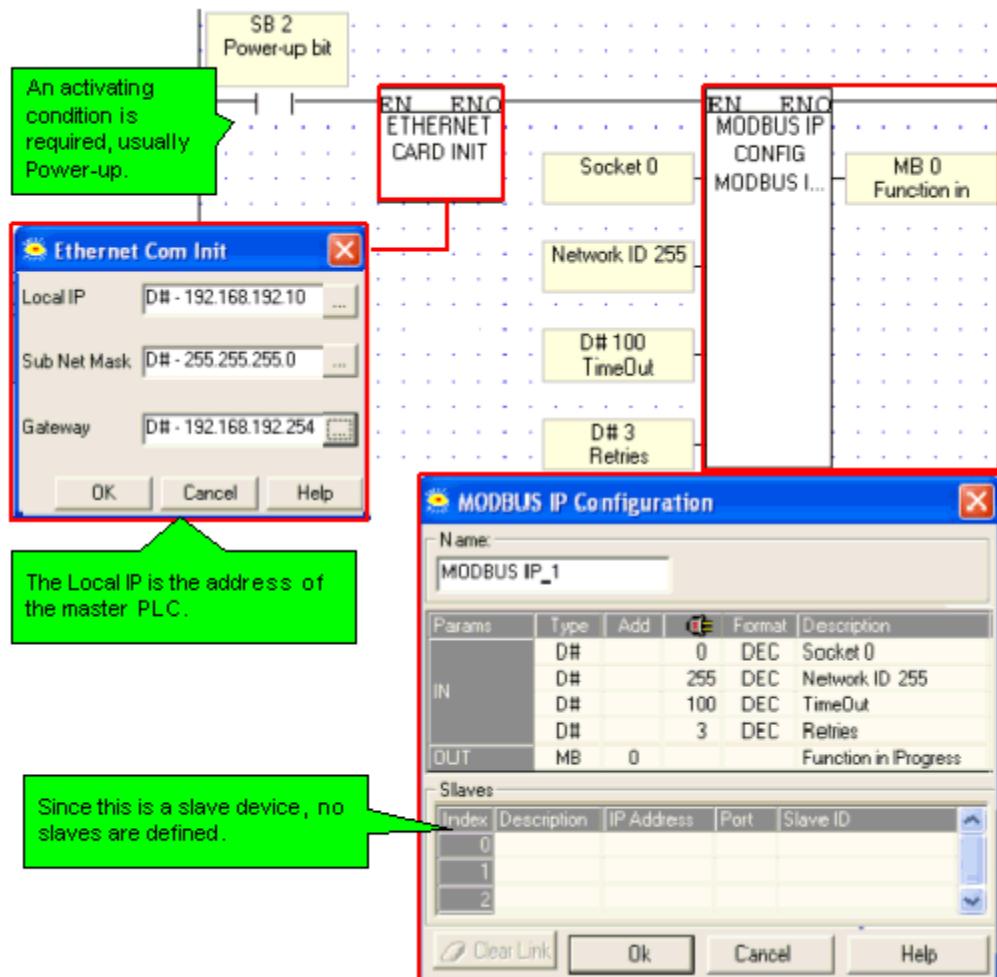
The Master: Start of Vector parameter is 17; therefore the values will be written into MI 17, 18, and 19 in the master device.



- Slave

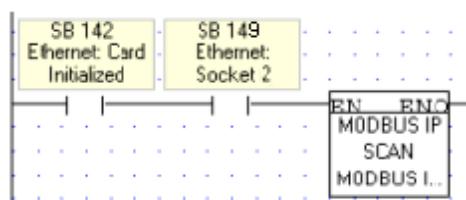
The slave PLC Ladder application must include the elements shown below.

Step 1: Initializing the Ethernet card and configuring MODBUS



Step 2: Scan

To enable the master PLC to access the slave, include a MODBUS Scan FB in the slave's application.



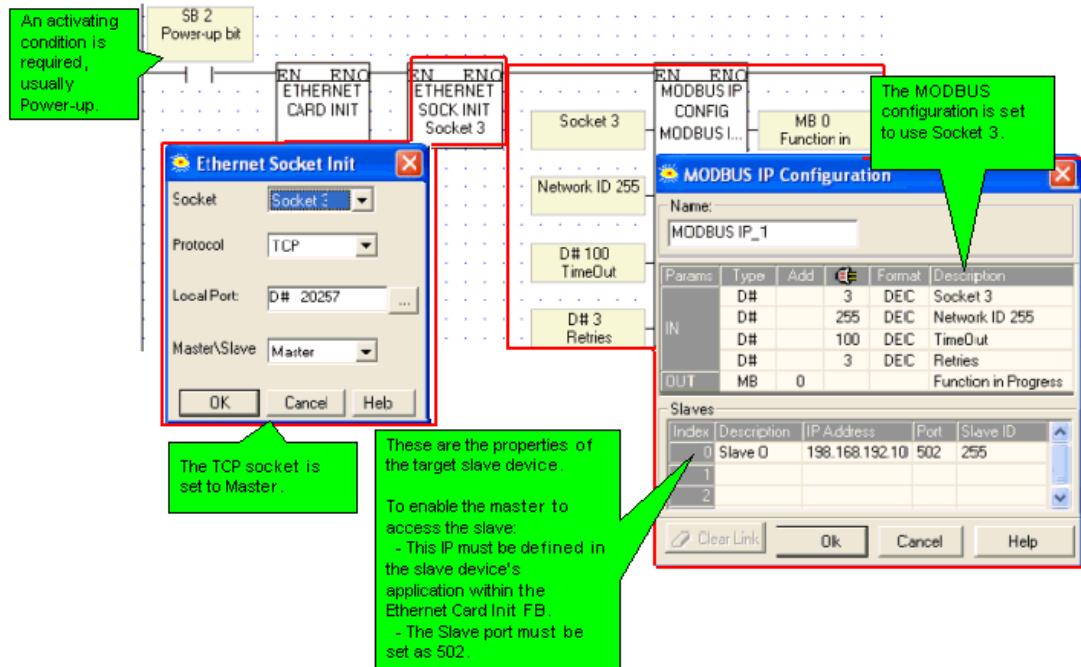
### Using TCP to implement controller-to-controller communication

- Master

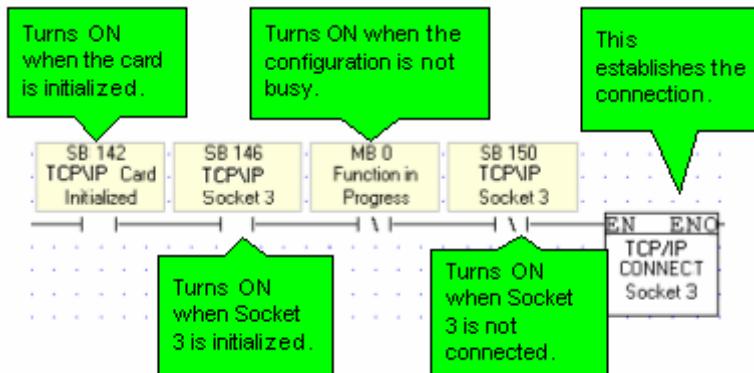
The master PLC Ladder application must include the elements shown below.

Step 1: Initializing the Ethernet card, Socket, and Configuring MODBUS

In the figure below, the socket is configured to use TCP.



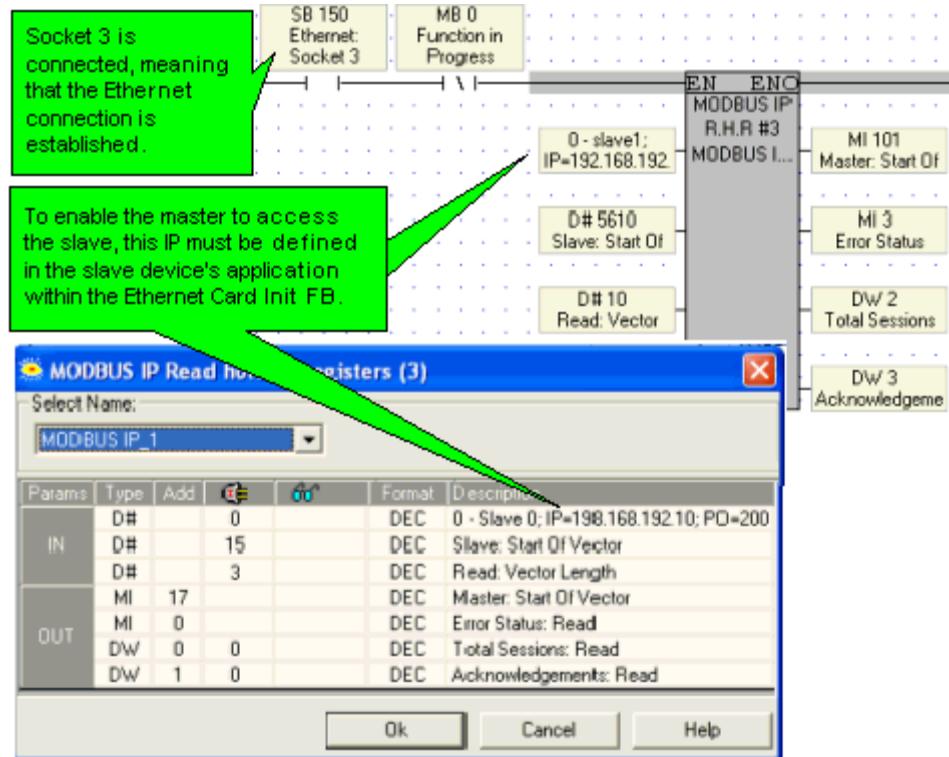
### Step 2: Establishing the Ethernet Connection: Connect Socket



**Note •** It is recommended that there be a time elapse of a few seconds after the Ethernet Card Initialization and before activating Socket Connect. A timer may be used for this purpose.

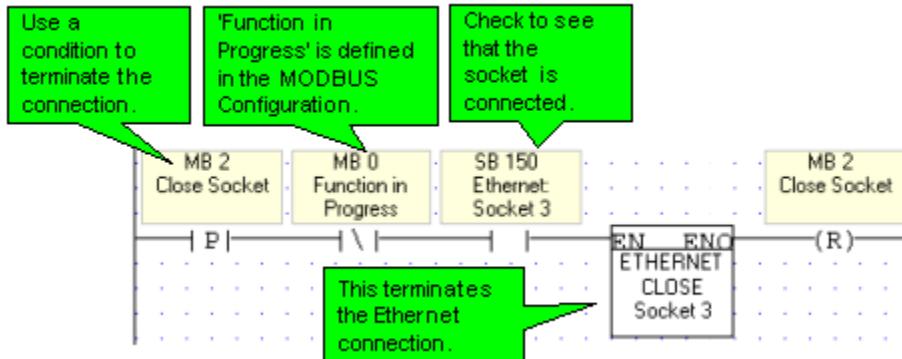
### Step 3: Using MODBUS Commands

**Note •** Note that the operand addresses in slave PLCs are indirect addresses (pointers). In the figure below, Below, the Slave: Start of Vector parameter is 15. This means that the master will begin reading from MI 15 in the slave PLC. Since the Read: Vector Length parameter is 3, the function takes the values in MI 15, 16 and 17. The Master: Start of Vector parameter is 17; therefore the values will be written into MI 17, 18, and 19 in the master device.



#### Step 4: Terminating the Ethernet connection: Close Socket

When you terminate the connection, use the 'Function in Progress' MB to ensure that you do not terminate the connection while data is being communicated.

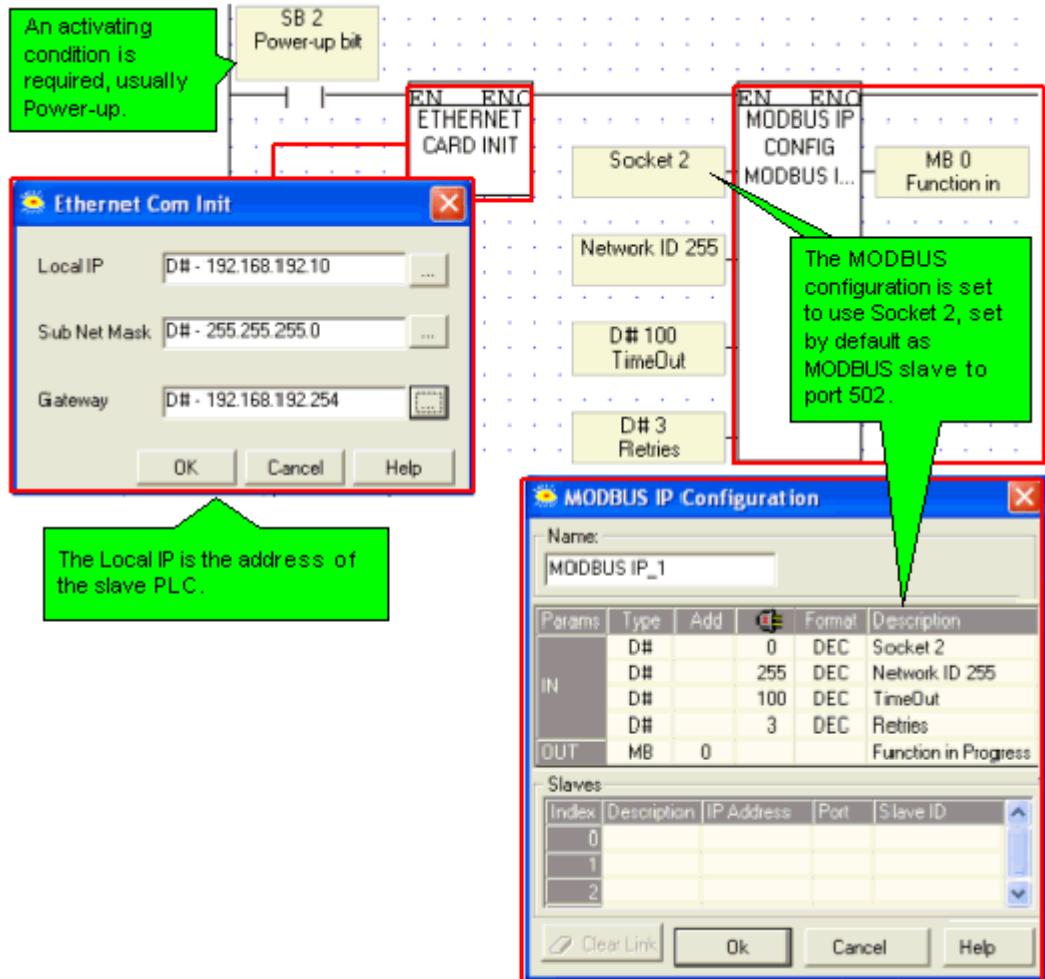


#### ■ Slave

The slave PLC Ladder application must include the elements shown below.

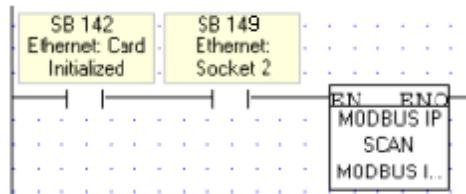
#### Step 1: Initializing the Ethernet card, Socket, and Configuring MODBUS

In the figure below, the socket is configured to use TCP.



### Step 2: Scan

To enable the master PLC to access the slave, include a MODBUS Scan FB in the slave's application.

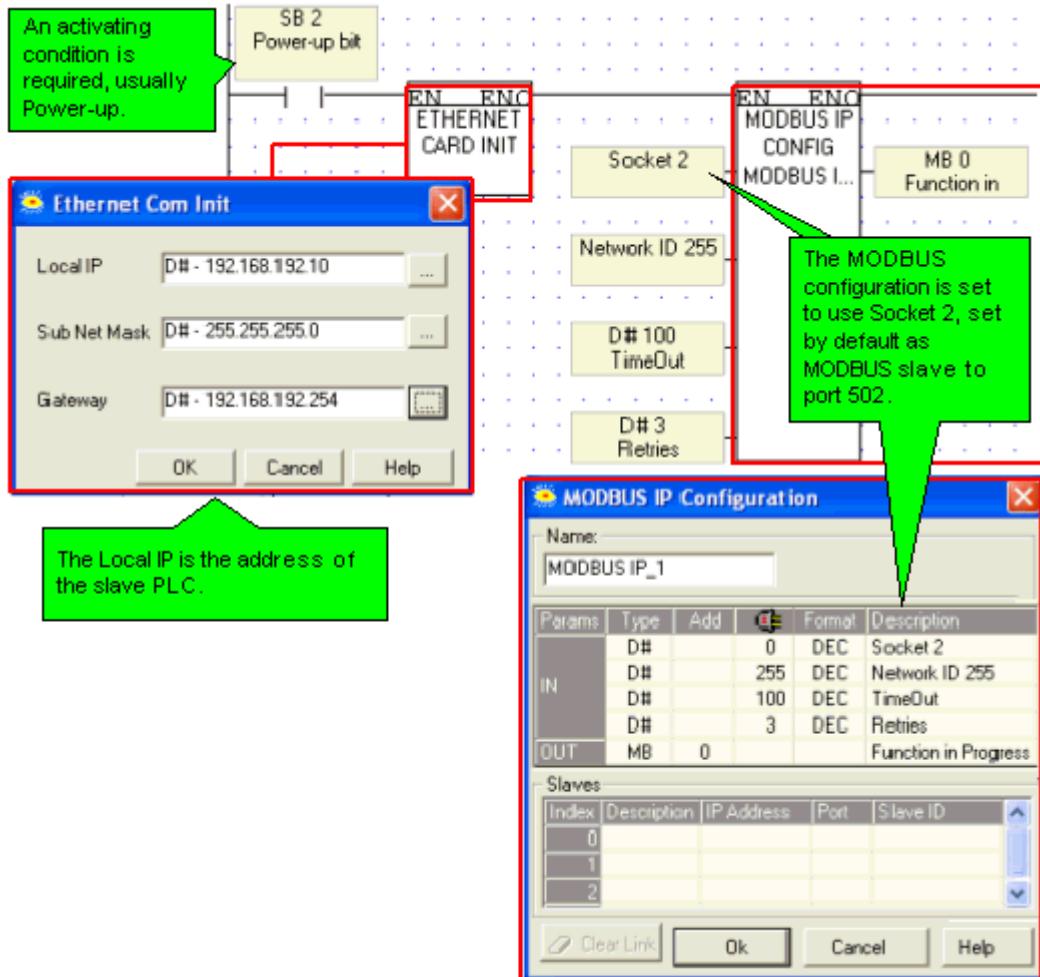


### PC to PLC: Accessing PLC via SCADA

To enable the SCADA application to access the PLC, the PLC is defined as a slave device. The slave PLC Ladder application must include the elements shown below.

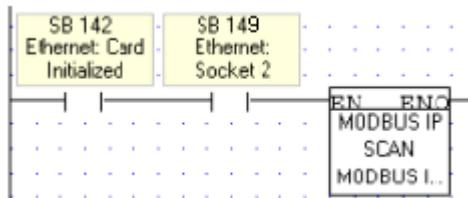
#### Step 1: Initializing the Ethernet card and configuring MODBUS

Port 502 is the well-known port for MODBUS applications.



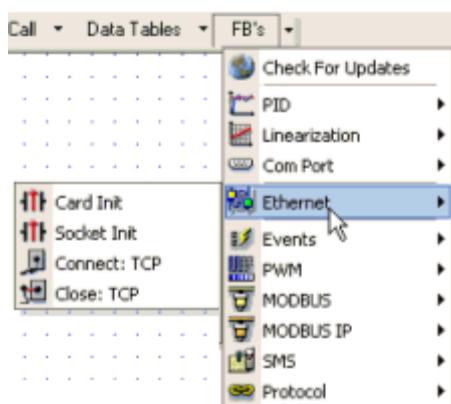
## Step 2: Scan

To enable the SCADA application to access the slave, include a MODBUS Scan FB in the slave's application.



## Ethernet Operations

The Ethernet FBs are grouped under Ethernet on the FB's menu.



[Ethernet: Card Init](#)

[Ethernet: Socket Init](#)

[Ethernet: TCP Connect \ TCP Close](#)

## PC-PLC Communications

### Remote Access: Accessing a PLC via PC

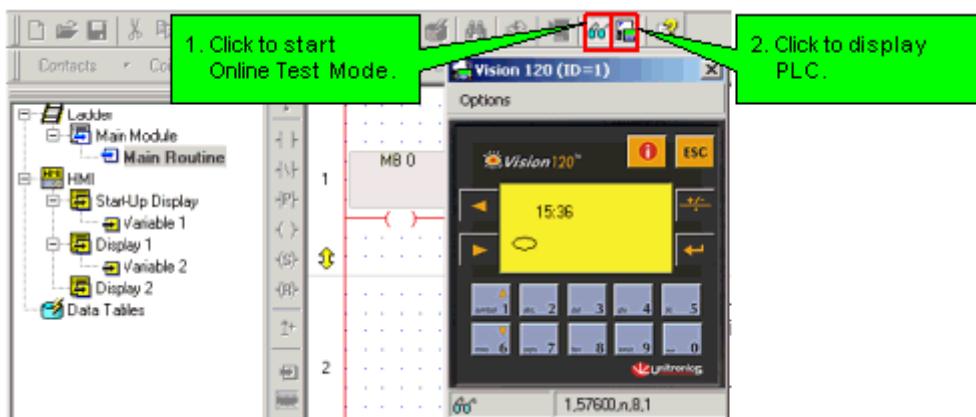
You can use a PC to access a remote Vision and download, upload, and edit programs. You can access:

- Stand-alone controllers that are directly connected to the PC via a cable.
- Controllers within a network
- Either stand-alone or networked controllers via GSM/CDMA or landline modem.



When you run On-line Test mode, you can use the Remote Access utility to display the remote controller on your PC screen. During a Remote Access session, you can:

- 'Press' keypad keys and touch-screen objects (relevant models) by using your cursor, to click the controller keypad touch-screen objects on-screen, or via your PC keyboard, by pressing numeric keys and function keys <F1> to <F8>. Note that the Vision <ESC> key is <E> on the PC keyboard, and that <F9> is reserved for activating Online mode.
- Enter Information Mode by pressing the <i> key on your PC keyboard, or by clicking it on-screen with your cursor.

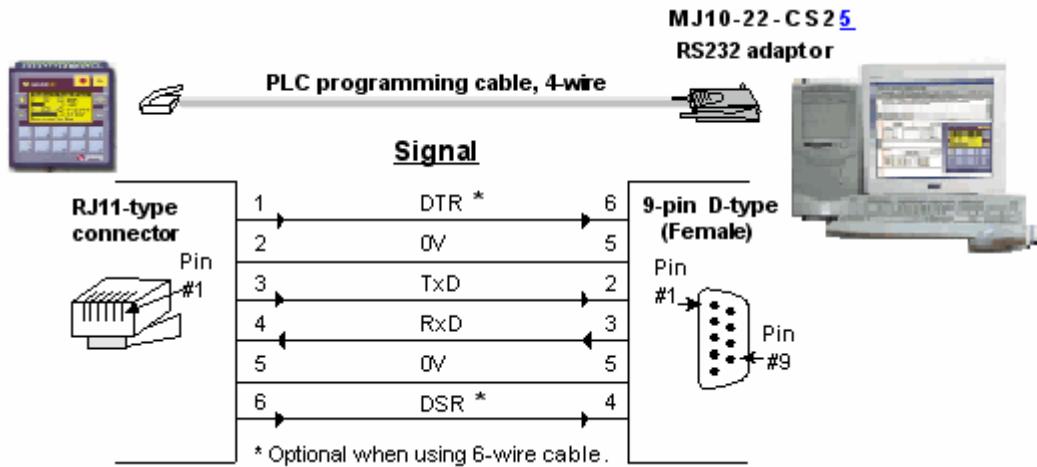


When you are in Online mode, you can toggle Remote Access on and off via <Shift>+<F9>.

### Accessing a Controller

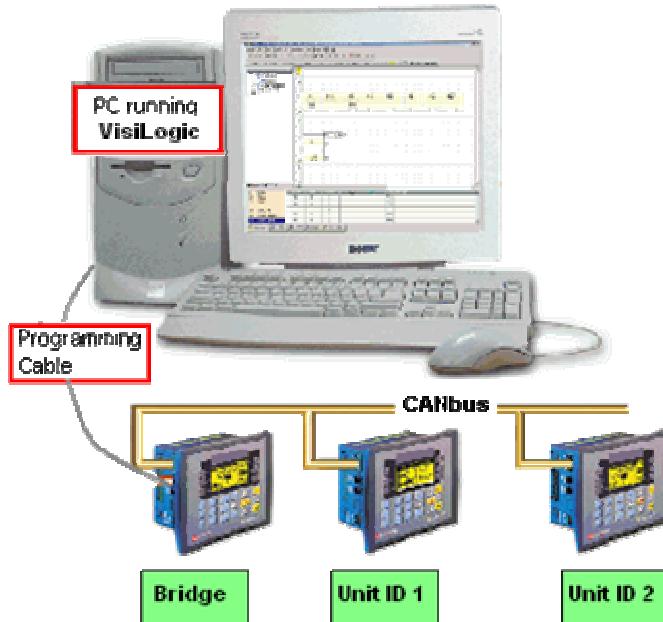
#### Direct Connection: PC-Controller

Connect your PC to any controller using the programming cable supplied with the controller kit.



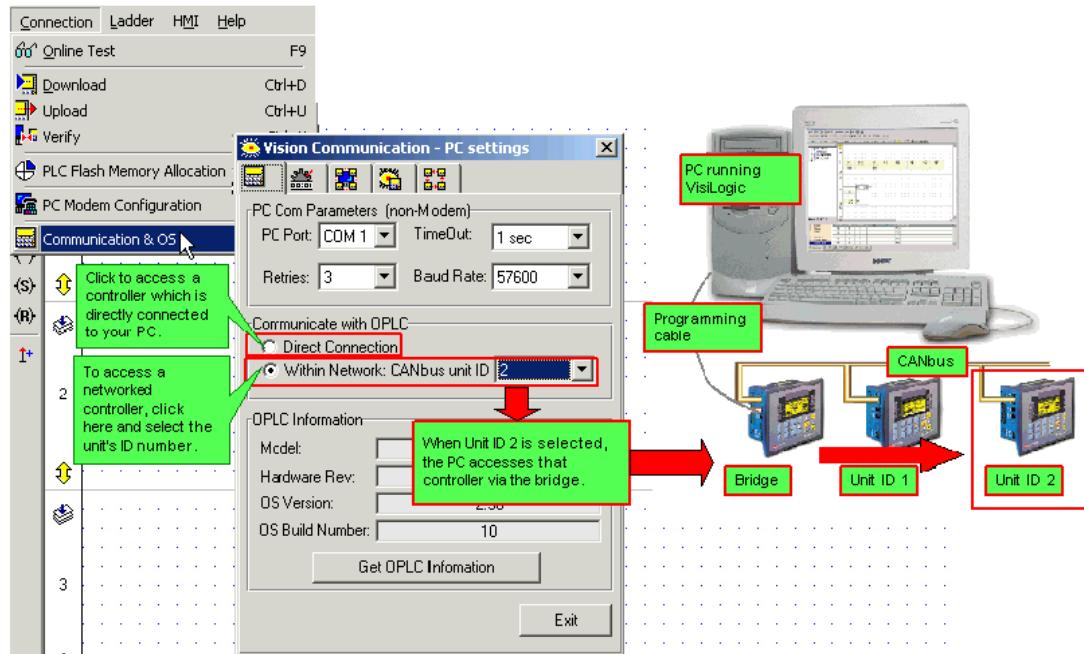
### Accessing a Networked Controller

1. Connect your PC to any controller in the network using the programming cable supplied with the controller kit.

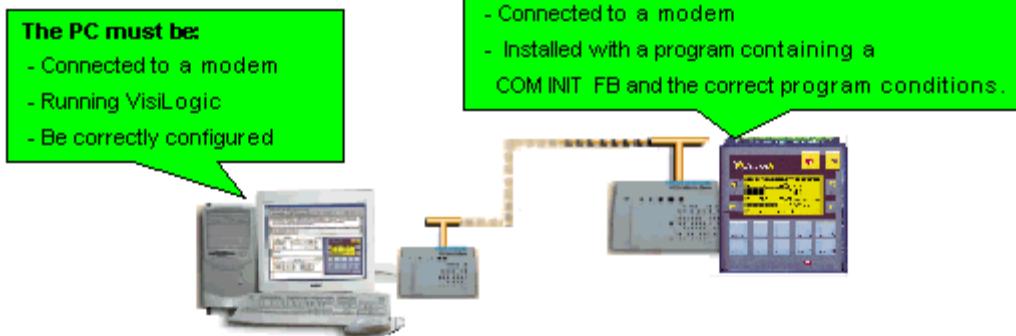


**Note •** Different PCs can access a network at the same time, using different controller units as bridges. However, 2 different PCs cannot simultaneously access the same controller unit.

2. Select a networked controller by opening Communication & OS from the Connection menu, and then entering the Unit ID number.

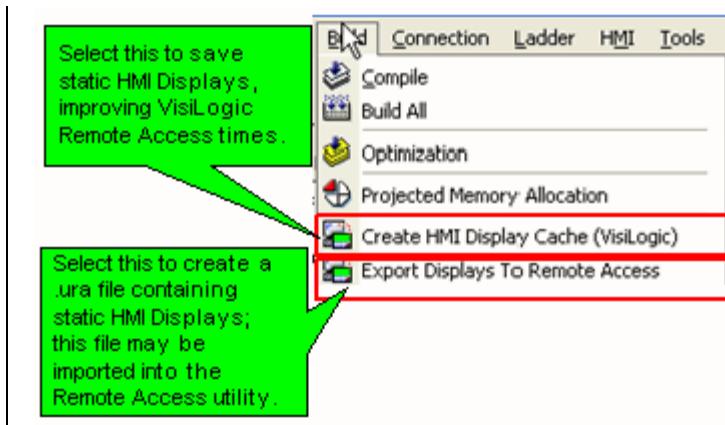


### Accessing a Controller via Modem



1. Prepare and connect your PLC-side modem as described in the topic PLC-side Modems, in the section 'How to enable a Vision controller to communicate via landline, GSM, or CDMA modem'.
2. Prepare the PC-side modem as described in the topic PC-Modem Configuration, in the section 'How to Configure a PC-side Modem'.
3. In Connection PC-Modem Configuration, dial the remote PLC's controller to establish the data link, then enter OnLine mode.

<b>Note •</b>	The Zoom option on the Remote Access Options menu can be activated only if you select Hide Keys. Zoom cannot be used with M90/91 or V280 controllers.
•	<p>Improving Remote Access run times:</p> <ul style="list-style-type: none"> <li>▪ To improve VisiLogic's Remote Access run times, select Create HMI Display Cache from the Build menu.</li> <li>▪ To create a .ura file containing static displays, select Export Displays to Remote Access, a stand-alone utility provided by Unitronics.</li> </ul>



## Vision Communication PC Settings

This defines the connection VisiLogic will use when downloading a program or carrying out other communication tasks. To display the current communication settings, select Communication & OS from the Connection menu.

Note that you can cause the Unit ID# to be permanently assigned to the project via Project Properties.

The default settings are shown below.

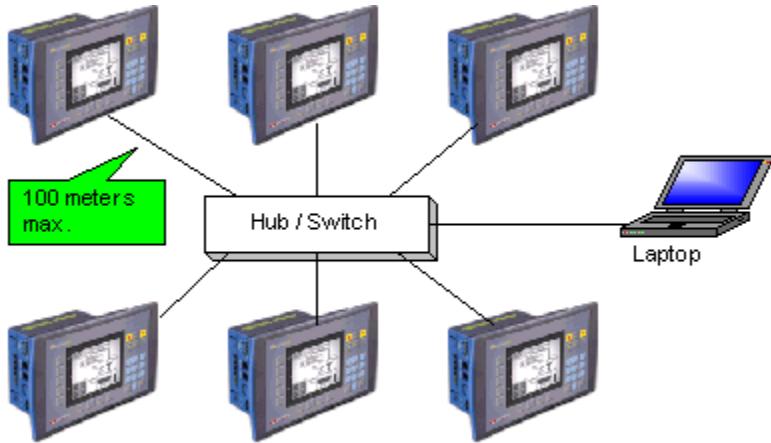
Select Communication Type	If your Vision contains an Ethernet port, you can select the Ethernet option. Serial is the default communication mode; note that if you select Ethernet and close the project, the setting reverts to Serial.
PC COM Parameters	Port, Retries and Time-Out are the communication settings between VisiLogic and the controller. Note that if you are working with a network, the TimeOut should be greater than 1 second.
Communicate with OPLC	Use these options to communicate with networked controllers. Direct Connection: select this to communicate with any controller that is connected to your PC via the download cable, including a network bridge. Within Network: select this to communicate with a controller that is integrated into a network, then select the controller's ID number Note • ID numbers 1-63 are reserved for controllers linked via CANbus; ID numbers 64-127 are reserved for controllers networked via RS485. Using this range of ID numbers prevents a polled controller from attempting to act as a CANbus bridge, preventing it from attempting to locate the requested controller.
Vision OPLC Information	Click Get OPLC Information to display information about the controller you have selected in Communicate with OPLC.

## Ethernet

### About Ethernet

General information regarding the parameters required to implement Ethernet is given below. A glossary of Ethernet terms is included at the bottom of this topic. To learn how to specifically define parameters within the VisiLogic Ethernet FBs, refer to Using Ethernet.

Unitronics' Ethernet uses star topology.



### **About Networks**

Generally, controllers are part of a closed, internal control network. A closed network may be referred to as a LAN (Local Area Network) or an Intranet. When Intranets are connected via gateway devices, they form a WAN (Wide Area Network). The Internet, which is made up of connected Intranets or LANs, is a form of WAN. Internet communications are via the TCP/IP protocol.

Large manufacturing companies, for example, may be made up of a number of factories, each of which contains its own LAN, closed control network. Within the company, all of these LANs may be connected by gateway devices, forming a proprietary WAN--a company Internet, which in turn may be connected to the Internet--the World Wide Web.

Within closed controller networks, Ethernet is becoming a common protocol. Ethernet communications are also via the TCP/IP protocol.

### **What is an IP address?**

In order to enable a controller to communicate over Ethernet, you must assign it an IP address.

An IP address is a unique number which identifies a computer or controller on a TCP/IP network. These networks use the IP address to route messages to their destination. An IP address is a 32-bit numeric address which is divided into four numbers (octets). Each octet is separated by a period formatted as follows:

1.160.10.240. The decimal value in each octet can range from zero to 255, or 00000000 - 11111111 in binary notation.

Note • The values '0' and '255' are restricted and should not normally be used.

Internally, within an Intranet, you can assign IP addresses at random as long as each one is unique within the Intranet. The common IP may be: 192.●.192.xx, where the last octet is the identifies the device on the network.

Note • In the majority of cases, controllers are part of a closed control network (Intranet). The controllers' IP addresses are unique only within the Intranet, and cannot be accessed via the Internet--unless a valid Internet IP address is purchased from a ISP and assigned to the controller.

### **IP Addresses and Networks**

In binary form, the IP address 68.212.226.204 is 10101000.11010100.11100010.11001100.

The 4 octets of the address are used to create classes of IP addresses. Networks are divided into 5 classes, according to size, as explained below. The octets are split into two sections: Net and Host. The Net section is represented by the first octet. It is used to identify the network that a device belongs to. The Host (sometimes called Node) section identifies the actual device on the network. The Host section is always contains by the final octets; how many octets is determined by the network class. There are five IP classes plus certain special addresses.

Although decimals are generally used to represent IP addresses, it is the binary value which determines which class of network the IP address belongs to. All nodes on a given network share the same network prefix but must have a unique host number.



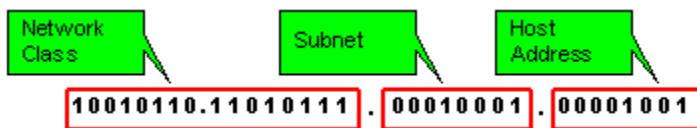
Default Network	The IP address of 0.0.0.0 is used for the default network.
Class A Network	<p>This class is for very large networks.          Binary address start with '0', meaning that the decimal value can be anywhere from 1 to 126.          The first octet bits identify the network as Class A ; Octets 2, 3, and 4 (the next 24 bits) indicate the host within the network.          An example of a Class A IP address is 102.*.212.226, where "102" identifies the network and "*.*.212.226" identifies the host on that network.          Note • The IP address 127.0.0.1 is used as the loopback address. This means that it is used by the host computer to send a message back to itself. It is commonly used for troubleshooting and network testing.</p>
Class B Network	<p>This class is used for medium-sized networks.          The first two octets identify the network as Class B; Octets 3 and 4 (the remaining 16 bits) indicate the host within the network. Binary addresses start with '10', meaning that the decimal value can be anywhere from 128 to 191.          An example of a Class B IP address is *.*.212.226.204 where "*.*.212" identifies the network and "226.204" identifies the host on that network.</p>
Class C Network	<p>This class is used for small to medium-sized networks. This is the most common type of network.          The first three octets identify the network as Class C; Octet 4 (8 bits) indicate the host within the network.          Binary addresses start with '110', meaning that the decimal number can be anywhere from 192 to 223.          An example of a Class C IP address is 200.*.*.226 where "200.*.*.226" identifies the network and "226" identifies the host on that network.</p>
Class D Network	<p>This class is used for multicasting, where a node sends a packet addressed to a special group address.          Binary addresses start with '1110', therefore the decimal number can be anywhere from 224 to 239.</p>
Class E Network	<p>This class is used for experimental purposes only.          Binary addresses start with '1111', therefore the decimal number can be anywhere from 240 to 255. Class E networks are used for experimentation. They have never been documented or utilized in a standard way.</p>
Broadcast	Messages that are intended for all computers on a network are sent as broadcasts. These messages always use the IP address 255.255.255.255.

## Subnet

A subnet is a part of a network.

All of the devices within a subnet share a common address component. On TCP/IP networks, subnets are defined as all devices whose IP addresses have the same prefix. Devices within a particular subnet might, for example, have IP addresses that start with 100.100.100.

Subnetting enables the network administrator to further divide the host part of the address into two or more subnets. In this case, a part of the host address is reserved to identify the particular subnet.



## Subnet Mask

One of the crucial tasks for any router is knowing when a packet of information stays on its local network. For this, it uses a 'subnet mask'.

## Getting Started

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A network mask indicates which portion of the address identifies the network and which portion of the address identifies the node. Class A, B, and C networks have default masks, also known as natural masks, as shown below.

Class A: 255.0.0.0 - binary - 11111111.00000000.00000000.00000000

Class B: 255.255.0.0 - binary - 11111111.11111111.00000000.00000000

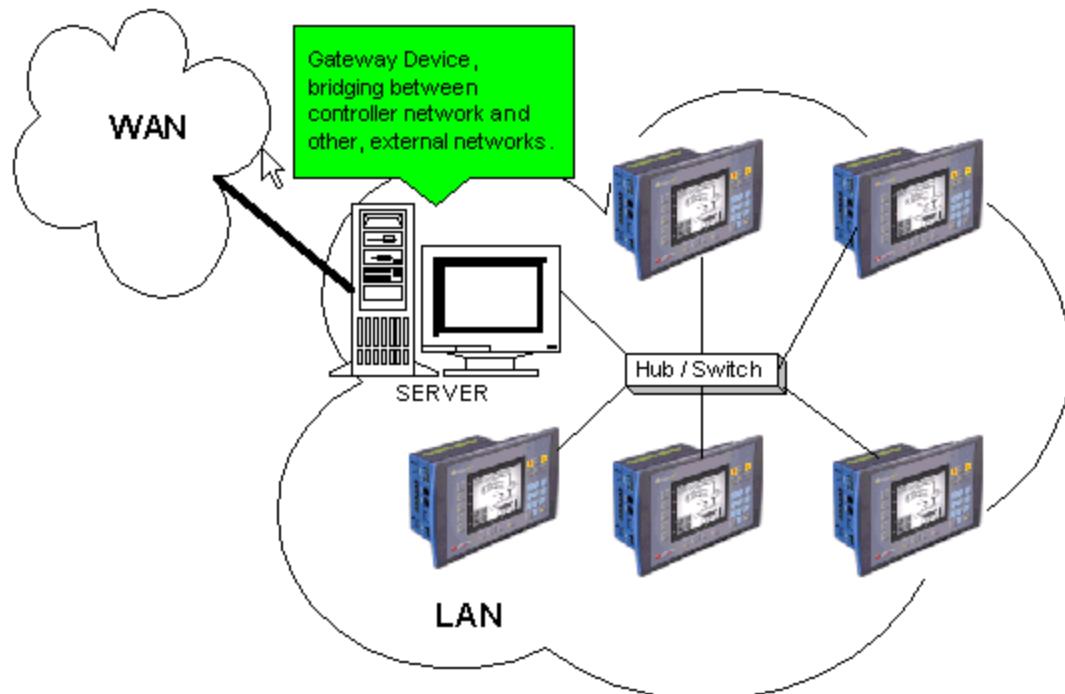
Class C: 255.255.255.0 - binary - 11111111.11111111.11111111.00000000

Since class C networks are the most common type, the most commonly used subnet mask usually reads "255.255.255.xx.". This tells the router that all messages with the sender and receiver having an address sharing the first three groups of numbers are on the same network, and shouldn't be sent out to another network. For example: The computer at address 192.168.1.254 sends a request to the computer at 192.168.1.252. The router, which sees all the packets, matches the first three groups in the address of both sender and receiver (192.168.1.), and keeps the packet on the local network.

## Gateway

A gateway is special software, or a device running special software, that routes data between different networks.

In the case of control networks, the gateway is generally a PC. The gateway PC has its own IP address.



For example, a proxy server provides a gateway between a private network to the Internet. The proxy server is configured to enable a workstation to communicate with remote services on the Internet. In this case, the gateway acts as a barrier that allows a device to request information from the Internet and to receive information, but does not allow access to the host network by unauthorized users.

Note • The IP address assigned to the gateway device is generally the last available address.

## Socket

A software mechanism that connects an application to a network protocol. A program can, for example, send and receive TCP/IP messages by opening a socket and reading and writing data to and from the socket. Note that a socket is a software object, not a physical component.

Note that when TCP is used, the formal 'handshake' required by the protocol means that during each session occurring via a defined socket, other communications cannot flow through any of the other sockets until the current session has been terminated.

Such is not the case with UDP. Since there is no formal handshake, communications can continue to flow through a socket even when there are multiple requests.

### **Protocols: UDP and TCP**

UDP stands for User Datagram Protocol. It is a connectionless protocol that, like TCP, runs on top of IP networks. Unlike TCP/IP, UDP/IP provides very few error recovery services, offering instead a direct way to send and receive datagrams over an IP network. It's used primarily for broadcasting messages over a network.

Note • In Unitronics' implementation of Ethernet, UDP is a secure protocol. Here, UDP runs under MODBUS as well as under Unitronics' proprietary protocols; these additional layers provide the level of data security required by control applications.

TCP stands for Transmission Control Protocol. TCP is one of the main protocols in TCP/IP networks. Whereas the IP protocol deals only with packets, TCP enables two hosts to establish a connection and exchange streams of data. TCP guarantees delivery of data and also guarantees that packets will be delivered in the same order in which they were sent.

UDP takes messages from application process, attaches source and destination port number fields for the multiplexing/demultiplexing service, adds two other fields of minor importance, and passes the resulting "segment" to the network layer. The network layer encapsulates the segment into an IP datagram and then makes a best-effort attempt to deliver the segment to the receiving host. If the segment arrives at the receiving host, UDP uses the port numbers and the IP source and destination addresses to deliver the data in the segment to the correct application process. Note that with UDP there is no handshaking between sending and receiving transport-layer entities before sending a segment. For this reason, UDP is said to be connectionless.

TCP uses a three-way handshake before it starts to transfer data. UDP just blasts away without any formal preliminaries. Thus UDP does not introduce any delay to establish a connection. This is probably the principle reason why DNS runs over UDP rather than TCP -- DNS would be much slower if it ran over TCP. HTTP uses TCP rather than UDP, since reliability is critical for Web pages with text. But the TCP connection establishment delay in HTTP is an important contributor to the "world wide wait".

TCP maintains connection state in the end systems. This connection state includes receive and send buffers, congestion control parameters, and sequence and acknowledgment number parameters. UDP, on the other hand, does not maintain connection state and does not track any of these parameters. For this reason, a server devoted to a particular application can typically support many more active clients when the application runs over UDP rather than TCP.

The TCP segment has 20 bytes of header overhead in every segment, whereas UDP only has 8 bytes of overhead.

TCP has a congestion control mechanism that throttles the sender when one or more links between sender and receiver becomes excessively congested. This throttling can have a severe impact on real-time applications, which can tolerate some packet loss but require a minimum send rate. On the other hand, the speed at which UDP sends data is only constrained by the rate at which the application generates data, the capabilities of the source (CPU, clock rate, etc.) and the access bandwidth to the Internet. We should keep in mind, however, that the receiving host does not necessarily receive all the data - when the network is congested, a significant fraction of the UDP-transmitted data could be lost due to router buffer overflow. Thus, the receive rate is limited by network congestion even if the sending rate is not constrained.

### **Local Port**

In TCP/IP and UDP networks, a port is an endpoint to a logical connection and the way a client program specifies a specific server program on a computer in a network.

The port numbers are divided into three ranges: the Well Known Ports, the Registered Ports, and the Dynamic and/or Private Ports.

- The Well Known Ports, sometimes called the contact port, are those from 0 through 1023. The Well Known Ports numbers are assigned by the IANA and on most systems can only be used by

system (or root) processes or by programs executed by privileged users.

Note • Port 502 is reserved for SCADA.

- The Registered Ports are those from 1024 through 4915. The Registered Ports are listed by the IANA and on most systems can be used by ordinary user processes or programs executed by ordinary users.
- The Dynamic and/or Private Ports are those from 49152 through 65535

To the extent possible, these same port assignments are used with the UDP [RFC768].

### Port Number Description

1 TCP Port Service Multiplexer (TCPMUX)

5 Remote Job Entry (RJE)

7 ECHO

18 Message Send Protocol (MSP)

20 FTP -- Data

21 FTP -- Control

22 SSH Remote Login Protocol

23 Telnet

25 Simple Mail Transfer Protocol (SMTP)

29 MSG ICP

37 Time

42 Host Name Server (Nameserv)

43 WhoIs

49 Login Host Protocol (Login)

53 Domain Name System (DNS)

69 Trivial File Transfer Protocol (TFTP)

70 Gopher Services

79 Finger

80 HTTP

103 X.400 Standard

108 SNA Gateway Access Server

109 POP2

110 POP3

115 Simple File Transfer Protocol (SFTP)

118 SQL Services

119 Newsgroup (NNTP)

137 NetBIOS Name Service

139 NetBIOS Datagram Service

143 Interim Mail Access Protocol (IMAP)

150 NetBIOS Session Service

156 SQL Server

161 SNMP

179 Border Gateway Protocol (BGP)

190 Gateway Access Control Protocol (GACP)

194 Internet Relay Chat (IRC)

197 Directory Location Service (DLS)

389 Lightweight Directory Access Protocol (LDAP)

396 Novell Netware over IP

443 HTTPS

444 Simple Network Paging Protocol (SNPP)

445 Microsoft-DS  
458 Apple QuickTime  
502 MODBUS  
546 DHCP Client  
547 DHCP Server  
563 SNEWS  
569 MSN  
1080 Socks

## **Glossary**

### **ARP**

Address Resolution Protocol associates an IP address to a hardware address by requesting the sending machine for additional information called a MAC address. This only applies to Ethernet based networks.

### **Client**

The client is generally an application that runs on a personal computer or workstation and relies on a server to perform some operations. For example, an e-mail client is an application that enables you to send and receive e-mail.

### **Client/server architecture**

In this type of network architecture, each computer or process on the network is either a client or a server. Servers are powerful computers or processes dedicated to managing disk drives (file servers), printers (print servers), or network traffic (network servers). Clients are PCs or workstations on which users run applications. Clients rely on servers for resources, such as files, devices, and even processing power.

Another type of network architecture is known as a peer-to-peer architecture because each node has equivalent responsibilities. Both client/server and peer-to-peer architectures are widely used, and each has unique advantages and disadvantages.

### **DHCP**

Dynamic Host Configuration Protocol is a protocol for organizing and simplifying the administration of IP addresses for local machines. In many cases (such as with WinRoute) A DHCP server is built into the gateway for further simplification.

### **DNS**

Domain Name System is a naming scheme for IP addressing. For example www.kerio.com is a domain name and has an associated IP address. A DNS server matches domain names to an IP address. We use the domain name system because it is easier to remember a domain name than a string of numbers.

### **Firewall**

A filtering module located on a gateway machine that examines all incoming and outgoing traffic to determine if it may be routed to its destination. WinRoute Lite is a simple Firewall based on Network Address Translation.

### **Gateway**

The point of entrance from one network to another. A gateway is responsible for the proper distribution of data coming in and going out of a local area network. WinRoute must be installed on the gateway machine, also referred to as the host computer or network router.

### **ICMP**

Internet Control Message Protocol uses datagrams to report errors in transmission between the host and gateway.

### **IP address**

## Getting Started

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An IP address is the unique 32-bit number, which identifies a computer in a network. In order to communicate across wide area networks, each computer must have a unique IP address. Local area networks cannot directly communicate across wide area networks because they are defined by a private class of IP's.

### Local Area Network

A Local Area Network (LAN) is a group of interconnected computers with the ability to share resources without having to access a wide area network.

### MAC Address

A Media Access Control (MAC) address is a hard-coded interface identification used by layer 2 devices (switch or bridge) for proper forwarding of frames between computers on a network.

### NAT

Network Address Translation is an Internet standard that enables a local-area network (LAN) to use one set of IP addresses for internal traffic and a second set of addresses for external traffic. A NAT box located where the LAN meets the Internet makes all necessary IP address translations.

NAT serves three main purposes:

- Provides a type of firewall by hiding internal IP addresses
- Enables a company to use more internal IP addresses. Since they're used internally only, there's no possibility of conflict with IP addresses used by other companies and organizations.
- Allows a company to combine multiple ISDN connections into a single Internet connection.

### Network interface

A network interface may be an Ethernet card, modem, ISDN card, etc. The computer sends and receives packets by means of the network interface.

### Network Mask

A Network mask is used to group IP addresses together. Routers use a subnet mask to define the group (or IP subnet) to which an IP address belongs so that it can identify the correct interface from which it should forward an IP packet.

### Packet

When data is transmitted over the network it is broken up into smaller pieces called packets and individually routed to their destination. This way if one packet is not properly received, the receiving party can request resubmission of the single packet, as opposed to the entire piece of data. Each packet contains headers, which are responsible for the successful transmission of the packet, and a data part, which contains a portion of the original data being transmitted over the network. The term packet is used when referring to layer 3 devices (i.e. a router). A frame is the term used when referring to layer two devices (i.e. a switch).

### Peer-to-peer architecture

A type of network in which each workstation has equivalent capabilities and responsibilities. This differs from client/server architectures, in which some computers are dedicated to serving the others. Peer-to-peer networks are generally simpler, but they usually do not offer the same performance under heavy loads.

### Port

A port, in terms of TCP/IP, is a 16-bit number (the allowed range being 1 through 65535) used by the protocols of the transport layer - the TCP and UDP protocols. Ports are used to address applications. In other words, when a packet is received by the computer, the operating system uses port information to determine which application will receive the data within the packet.

### Port Mapping

Port mapping is an advanced feature of WinRoute that allows servers to be hosted securely behind NAT. When a packet is received by the WinRoute host it can be forwarded (by translating the destination information in the packet header) to another computer in the local network.

## Protocol

Defines rules for the transmission of data.

## RAS

Remote Access Service refers to the ability to dial into another computer or network remotely. In the context of WinRoute, RAS simply refers to a dial-up connection.

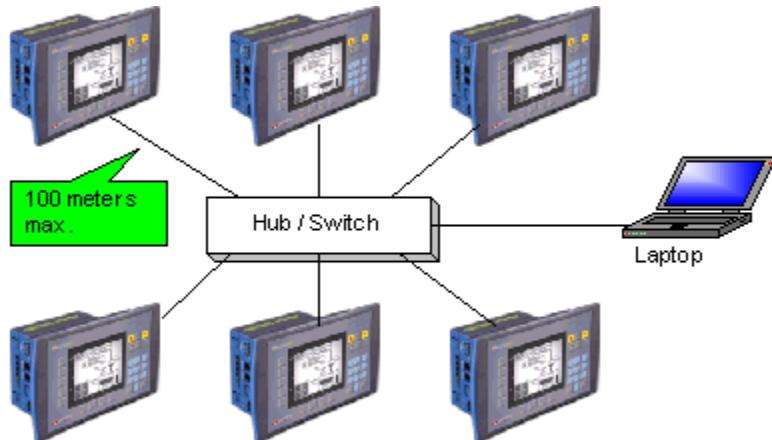
## TCP/IP

TCP/IP is a suite of networking protocols used for communication across networks. It is the standard form of communication over the Internet. The two most significantly used Internet Protocols are TCP and UDP. Transmission Control Protocol (TCP) is a connection oriented protocol intended to provide reliability and to ensure that all data is transferred successfully from one computer to another. User Datagram Protocol (UDP) is a connectionless protocol that does not require any confirmation from the receiving party. UDP is more commonly used for multimedia and streaming applications.

## Using Ethernet

Unitronics currently supports both TCP and UDP protocols, as explained in the topic About Ethernet. This topic also contains general information about Ethernet, IP addressing, sockets, and ports.

Ethernet uses star topology.



In order to use Ethernet, your controller must comprise an Ethernet port.

V2xx Vision OPLCs can be ordered with or without an Ethernet port. The Ethernet port enables you to implement communications via TCP/IP, such as MODBUS over TCP. To check if your Vision controller was supplied with an installed Ethernet port, first check the device's model number. In addition, note that the Ethernet port is an RJ-45-type port that is lined with metal.

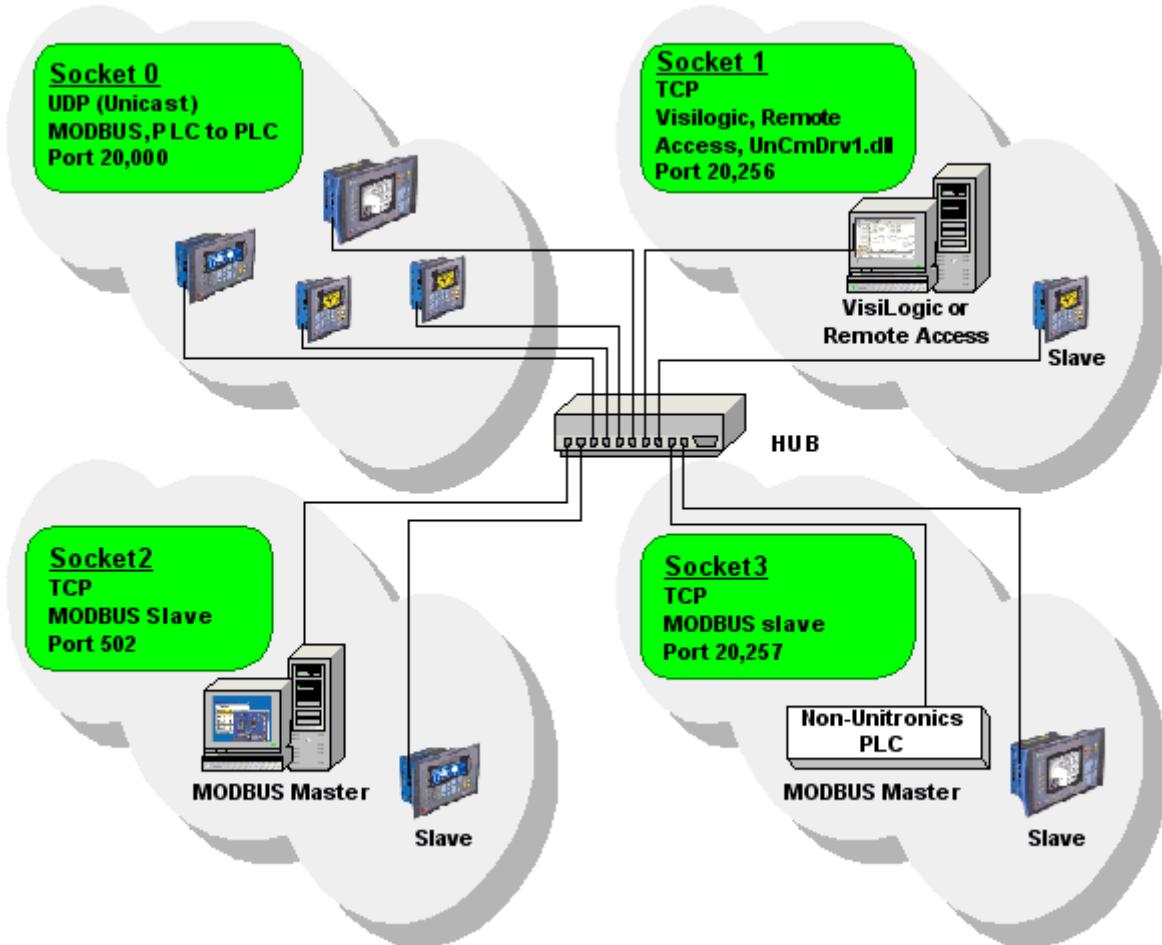
Model Number	<b>V 2 x x - 1 x - B 2 x B</b>	<b>V 2 x x - 1 x - B 2 x E B</b>
	Supplied <b>without</b> an Ethernet port.	Supplied <b>with</b> _____ an Ethernet port

Via Ethernet, you can use the MODBUS IP FB to:

- Communicate data within a PLC network.
- Use a PC to access a PLC via MODBUS over TCP.
- Use MODBUS over TCP to enable non-Unitronics PLCs to access Unitronics PLCs, via MODBUS.

You can also use Ethernet to enable a PC running VisiLogic, Remote Access, or other communication .dll to access a networked PLC.

The default socket configuration enables you to implement these communication options as shown below:



### Default Socket Configuration

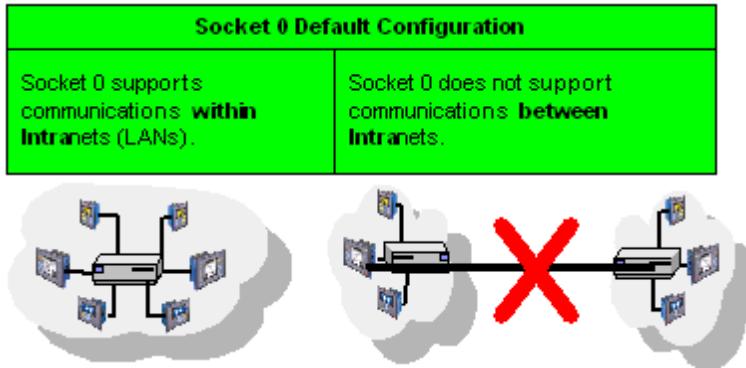
Vision controllers currently offer 4 sockets. The default socket configuration includes:

Socket	Protocol	Port Number	Function
0	UDP	20,000	<p>Enables data to be both transmitted and received within a PLC network, via MODBUS.</p> <p>Note• If you are using the default settings for Socket 0, note that data is sent via Unicast to IP: 255.255.255.255, port: 20,000 plus the last byte of the IP address originally assigned to the device.</p> <p>This is why Port numbers 20,000-20,255 are reserved for Socket 0.</p>
1	TCP	20,256	Enables PC to PLC communication via UnCmDrv1.dll, including Visilogic, Remote Access, and other Unitronics communication applications.
2	TCP	502	Set to 'listen' as slave (server), enables MODBUS applications such as OPC servers and SCADA systems which use MODBUS TCP over IP.
3	TCP	20,257	Set to 'listen' as slave (server), enables non-Unitronics PLCs to access Unitronics PLCs, via MODBUS.

**Note •**

The default configuration means that, for most applications, you do not need to include a Socket Init FB in the ladder application. However, if, for example, your application requires 4 sockets for TCP, change the default configuration of Socket 0 from UDP to TCP via the Socket Init FBs.

- When using the default socket configuration, Socket 0 cannot be used to communicate data between routers, and therefore cannot transfer data between Intranets as shown in the figure below. This is because the default configuration for Socket 0 uses Unicast.



- Note that when TCP is used, the formal 'handshake' required by the protocol means that, during each session occurring via a defined socket, other communications cannot flow through that socket until the current session has been terminated. Such is not the case with UDP. Since there is no formal handshake, communications can continue to flow through a socket even when there are multiple requests.

## General

When using Ethernet, use the MODBUS IP FBs. For detailed information regarding MODBUS IP commands, refer to the MODBUS IP help topics.

- Note •** In order to implement Ethernet, a controller must be assigned an IP address. This is done via the Ethernet Card Init FB, which must be included in the Ladder applications of both master and slave controllers. Class C-type addresses are recommended, as explained in the topic About Ethernet.
- When the Ethernet card finishes initialization, SB 142 rises. Use this as a condition before activating any Ethernet element, such as Socket Connect.
  - An activating condition must be placed before the Ethernet Card Init FB. This may be assigned as a power-up task; however a one-shot transitional contact may also be used.
  - Unitronics' proprietary COM Protocol FB, located on the FBs menu, which may ordinarily be used to access external slave devices, is not currently compatible with Ethernet.

## Examples

### PLC networks, PLC to PLC

Any controller within the network can be both master and slave. In order to be read by the master, a slave's application must contain the MODBUS IP Scan FB.

### Using UDP to implement controller-to-controller communication

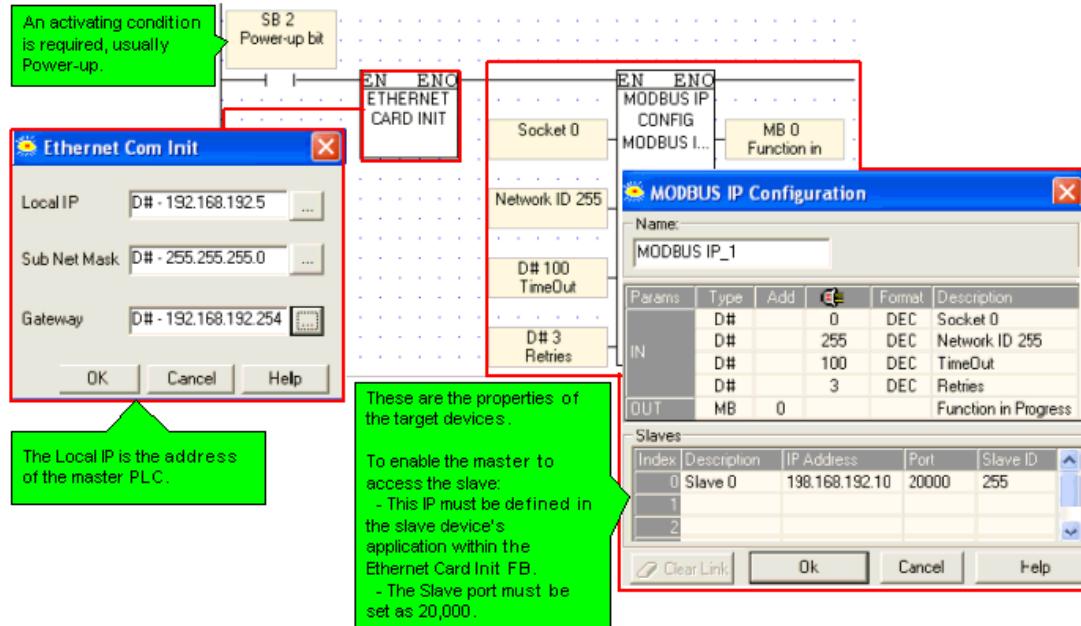
In order to communicate via Ethernet throughout your controller network, you must include an Ethernet Card Init FB in the ladder application of each networked controller. Remember that, when using UDP, do not use the Socket: Connect or Socket: Close elements; these are only required by TCP applications.

- Master

The master PLC Ladder application must include the elements shown below.

Step 1: Initializing the Ethernet card and configuring MODBUS

The MODBUS Configuration is linked to Socket 0, which is by default set to UDP.

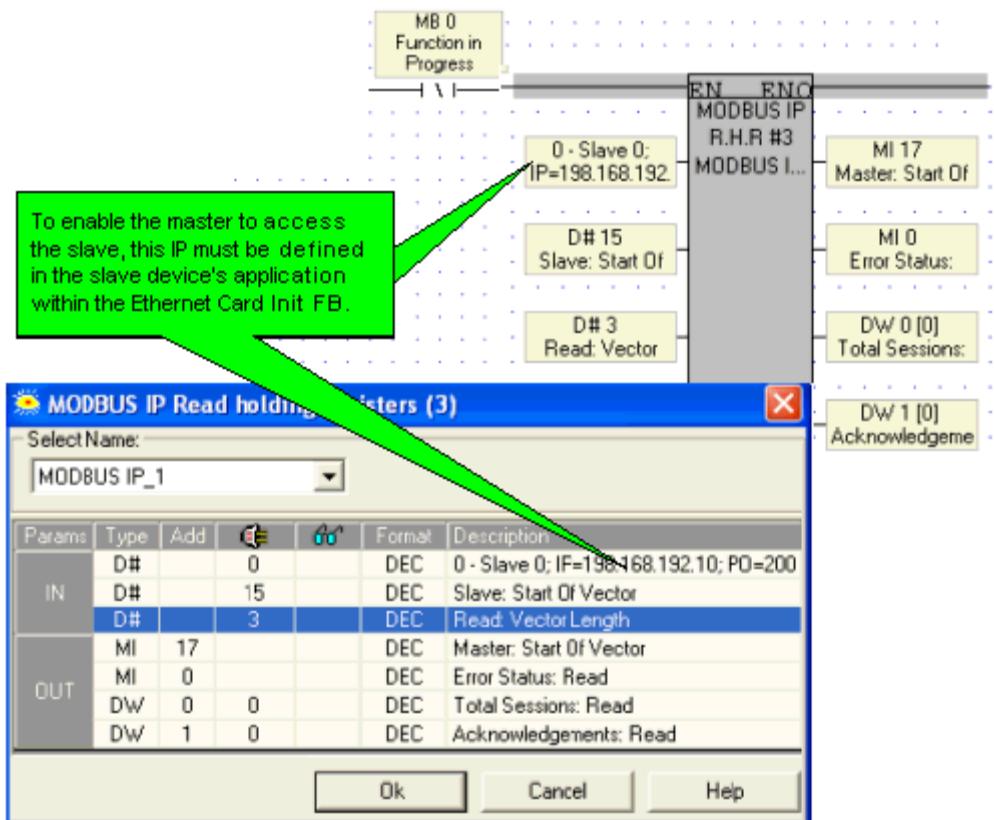


**Note •** A PLC defined as a UDP master can communicate with a number of slave devices.

### Step 2: Using MODBUS Commands

**Note •** Note that the operand addresses in slave PLCs are indirect addresses (pointers). In the figure below, the Slave: Start of Vector parameter is 15. This means that the master will begin reading from MI 15 in the slave PLC. Since the Read: Vector Length parameter is 3, the function takes the values in MI 15, 16 and 17.

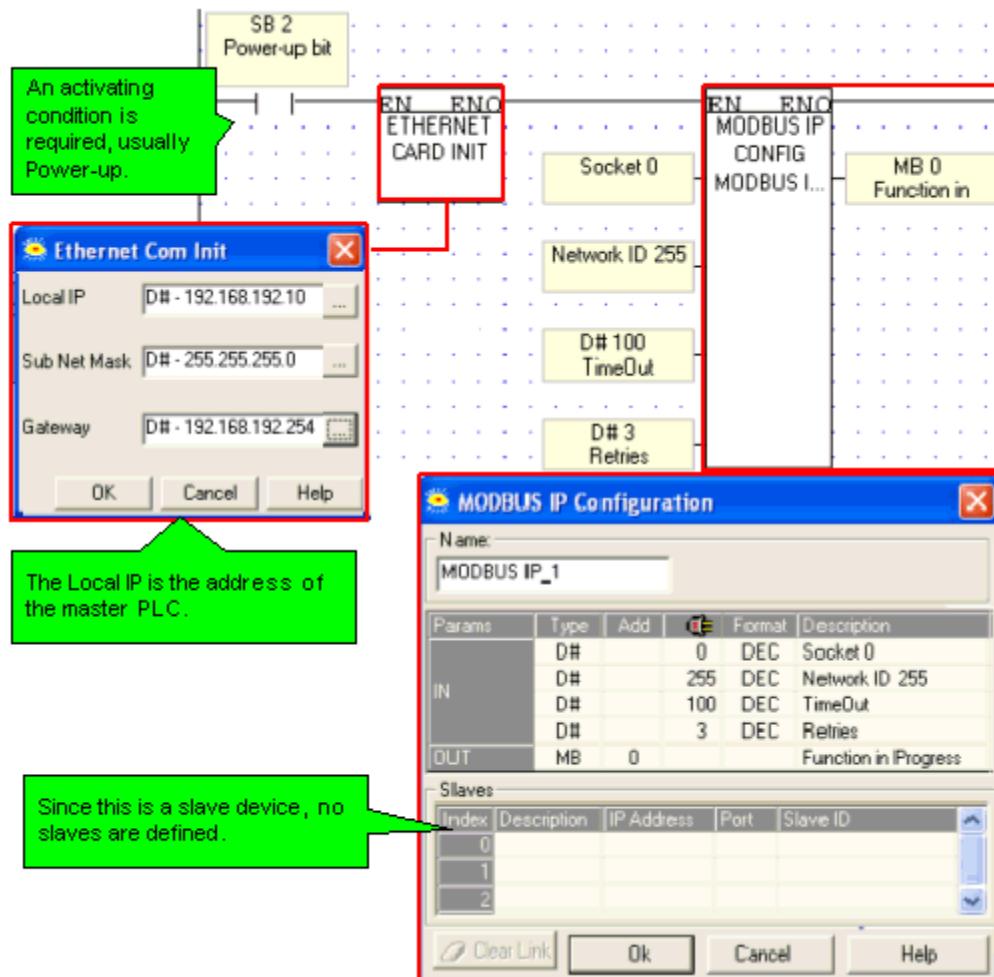
The Master: Start of Vector parameter is 17; therefore the values will be written into MI 17, 18, and 19 in the master device.



- Slave

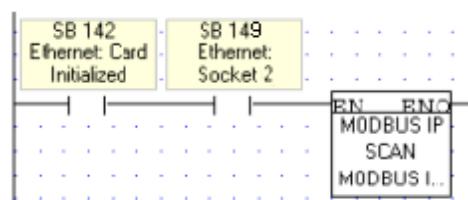
The slave PLC Ladder application must include the elements shown below.

Step 1: Initializing the Ethernet card and configuring MODBUS



Step 2: Scan

To enable the master PLC to access the slave, include a MODBUS Scan FB in the slave's application.



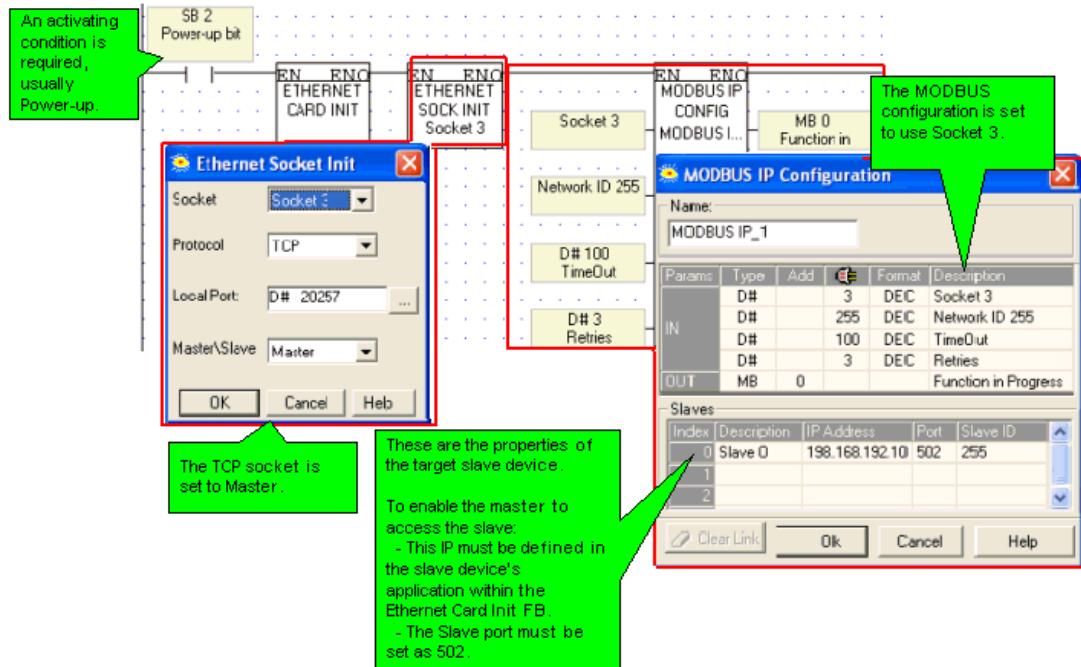
### Using TCP to implement controller-to-controller communication

- Master

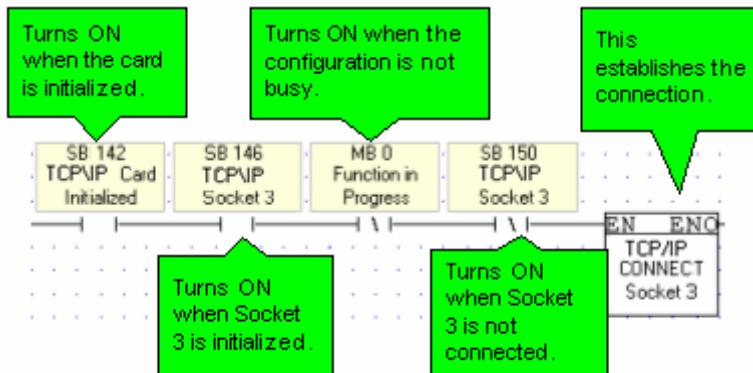
The master PLC Ladder application must include the elements shown below.

Step 1: Initializing the Ethernet card, Socket, and Configuring MODBUS

In the figure below, the socket is configured to use TCP.



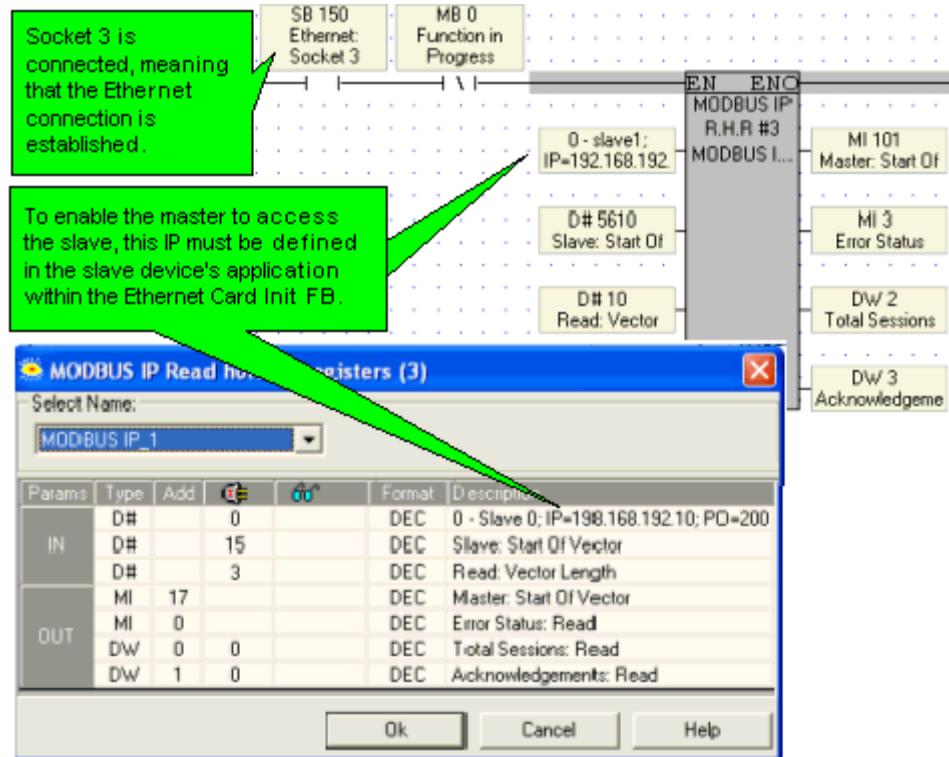
### Step 2: Establishing the Ethernet Connection: Connect Socket



**Note •** It is recommended that there be a time elapse of a few seconds after the Ethernet Card Initialization and before activating Socket Connect. A timer may be used for this purpose.

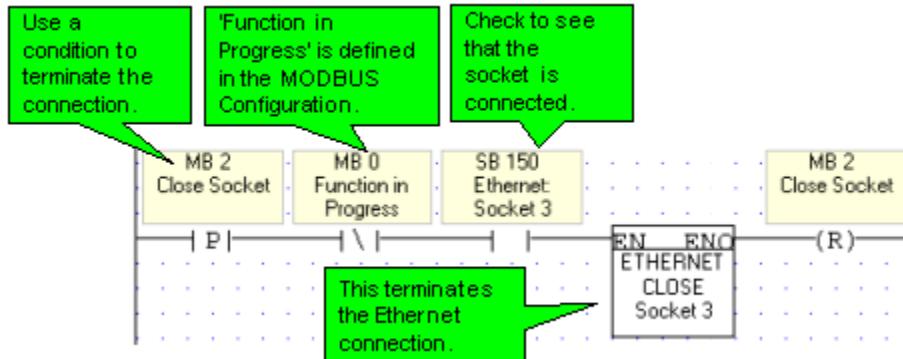
### Step 3: Using MODBUS Commands

**Note •** Note that the operand addresses in slave PLCs are indirect addresses (pointers). In the figure below, Below, the Slave: Start of Vector parameter is 15. This means that the master will begin reading from MI 15 in the slave PLC. Since the Read: Vector Length parameter is 3, the function takes the values in MI 15, 16 and 17. The Master: Start of Vector parameter is 17; therefore the values will be written into MI 17, 18, and 19 in the master device.



#### Step 4: Terminating the Ethernet connection: Close Socket

When you terminate the connection, use the 'Function in Progress' MB to ensure that you do not terminate the connection while data is being communicated.

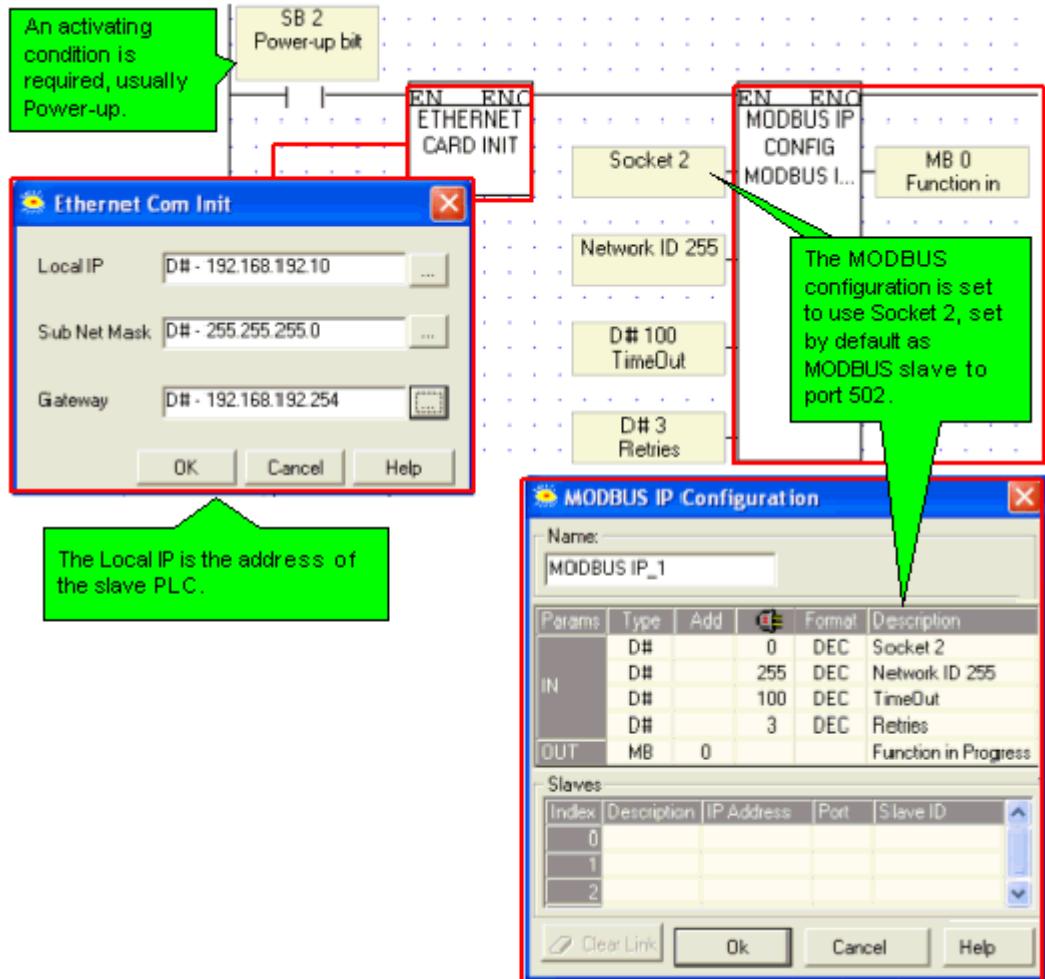


#### ■ Slave

The slave PLC Ladder application must include the elements shown below.

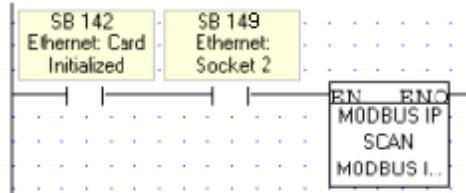
#### Step 1: Initializing the Ethernet card, Socket, and Configuring MODBUS

In the figure below, the socket is configured to use TCP.



### Step 2: Scan

To enable the master PLC to access the slave, include a MODBUS Scan FB in the slave's application.

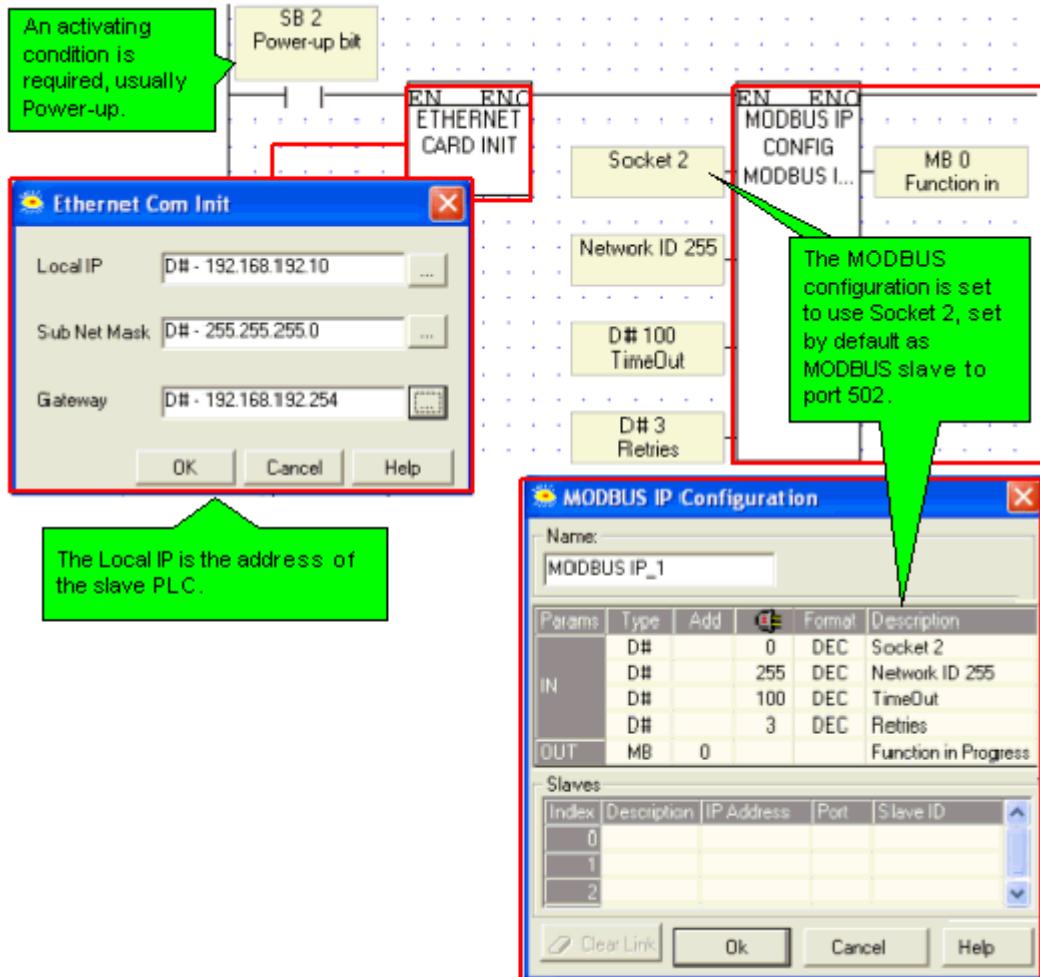


### PC to PLC: Accessing PLC via SCADA

To enable the SCADA application to access the PLC, the PLC is defined as a slave device. The slave PLC Ladder application must include the elements shown below.

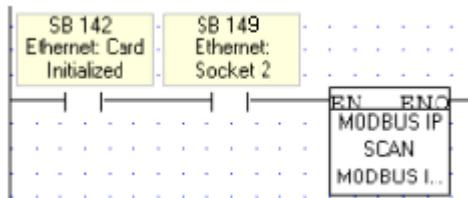
Step 1: Initializing the Ethernet card and configuring MODBUS

Port 502 is the well-known port for MODBUS applications.



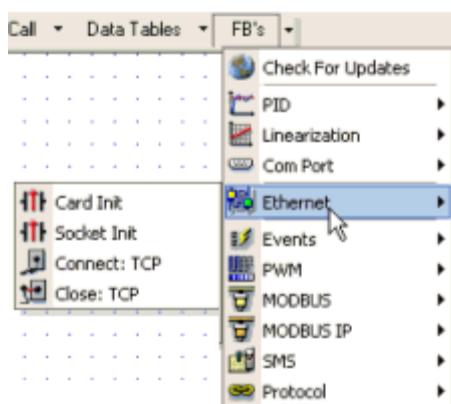
## Step 2: Scan

To enable the SCADA application to access the slave, include a MODBUS Scan FB in the slave's application.



## Ethernet Operations

The Ethernet FBs are grouped under Ethernet on the FB's menu.



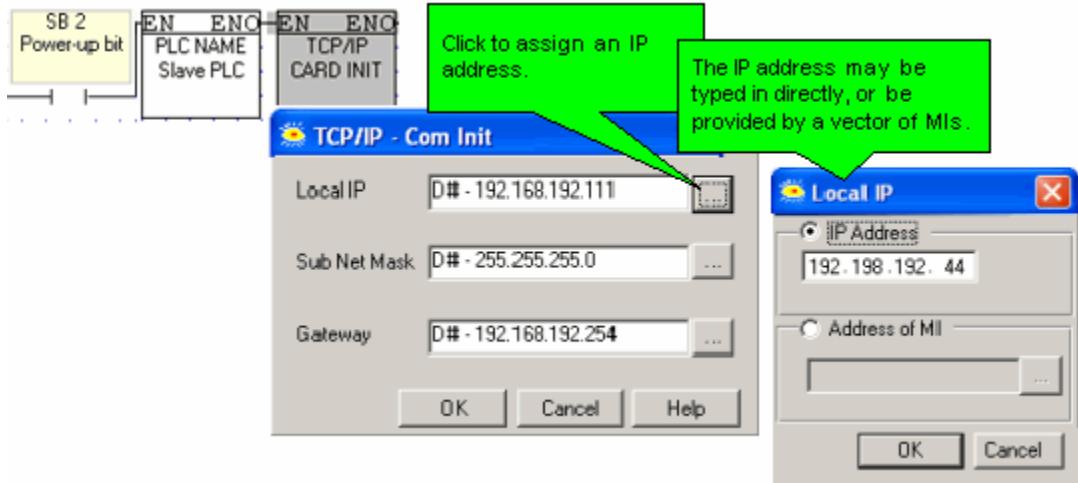
### Ethernet: Card Init

### Ethernet: Socket Init

### Ethernet: TCP Connect \ TCP Close

## TCP\IP: Card Init

This function is located on the Com>TCP/IP menu.



If you assign an IP address indirectly, via an MI vector, note that the vector is 4 MIs long. The low byte of each MI provides the number for an octet within the IP address.

If, for example, the IP address is linked to MI 0, and the low bytes of MI 0 to MI 3 contain the values 192, 198, 192, 45, the IP address will be 192.198.192. 45.

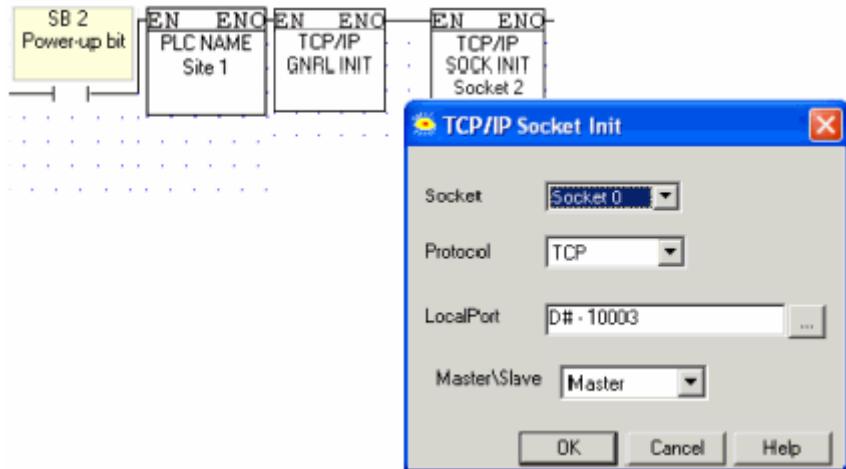
<b>Note •</b>	In order to implement Ethernet, a controller must be assigned an IP address. This is done via the TCP\IP Init FB, which must be included in the Ladder applications of both master and slave controllers. Information on IP addressing is given in the topic About Ethernet
•	When the Ethernet card finishes initialization, SB 142 rises. Use this as a condition before activating any Ethernet element, such as Socket: Connect.
•	An activating condition must be placed before the Ethernet Card Init FB. This may be assigned as a power-up task; however a one-shot transitional contact may also be used.
•	If you have linked the IP address to a vector of MIs, and this condition is not activated, the IP address will not be assigned to the controller. Make sure, for example, that if you have used a power-up condition, that the controller does go through power-up.

## TCP\IP: Socket Init

This function is located on the Com>TCP/IP menu.

Vision controllers currently offer 4 sockets.

The default configuration means that, for most applications, you do not need to include a Socket Init FB in the ladder application. However, if, for example, your application requires 4 sockets for TCP, change the default configuration of Socket 0 from UDP to TCP via the Socket Init FBs.



The default socket configuration includes:

Socket	Protocol	Port Number	Function
0	UDP	20,000	<p>Enables data to be both transmitted and received within a PLC network, via MODBUS.</p> <p>Note • If you are using the default settings for Socket 0, note that data is sent via Unicast to IP: 255.255.255.255, port: 20,000 plus the last byte of the IP address originally assigned to the device.</p> <p>This is why Port numbers 20,000-20,255 are reserved for Socket 0.</p>
1	TCP	20,256	Enables PC to PLC communication via UnCmDrv1.dll, including VisiLogic, Remote Access, and other Unitronics communication applications.
2	TCP	502	Set to 'listen' as slave (server), enables MODBUS applications such as OPC servers and SCADA systems which use MODBUS TCP over IP.
3	TCP	20,257	Set to 'listen' as slave (server), enables non-Unitronics PLCs to access Unitronics PLCs, via MODBUS.

**Note •**

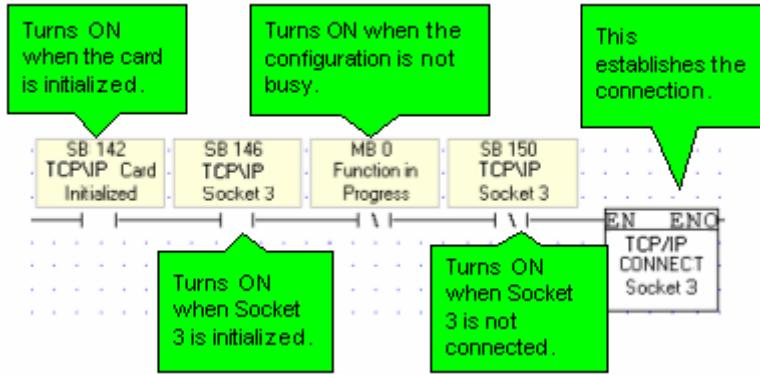
When TCP is used, the formal 'handshake' required by the protocol means that during each session occurring via a defined socket, other communications cannot flow through any of the other sockets until the current session has been terminated.

Such is not the case with UDP. Since there is no formal handshake, communications can continue to flow through a socket even when there are multiple requests.

### TCP\IP: TCP Connect \ TCP Close

TCP applications require you to use a TCP: Connect FB to establish the Ethernet connection after the Ethernet card is initialized and before activating any of the MODBUS IP commands.

To terminate the session, use the TCP: Close FB. Both elements are located on the Com>TCP/IP menu.



### Ethernet TCP\IP: PC to Vision

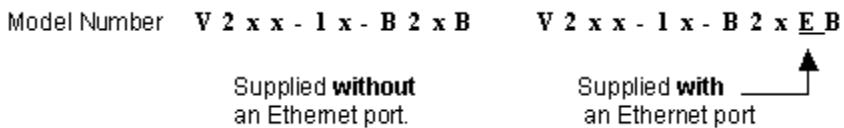
In order to use a PC to access a Vision controller via Ethernet:

1. The Vision PLC must contain an Ethernet port.
2. Both the PC and PLC must be connected to an Ethernet network, and be assigned valid IP addresses; the PLC must be assigned a unique name via the Set PLC Name.
3. The PLC must be defined in either TCP\IP's Ethernet Project Settings or in TCP\IP Favorites .
4. In VisiLogic's Vision Communication - PC Settings:
  - Ethernet must be selected
  - the target PLC must be selected from either Favorites or TCP\IP Project Settings.

These conditions enable VisiLogic to access a PLC via Ethernet in order to download programs and carry out other tasks.

### Vision Ethernet Port

V2xx Vision OPLCs can be ordered with or without an Ethernet port. The Ethernet port enables you to implement communications via TCP/IP, such as MODBUS over TCP. To check if your Vision controller was supplied with an installed Ethernet port, first check the device's model number. In addition, note that the Ethernet port is an RJ-45-type port that is lined with metal.

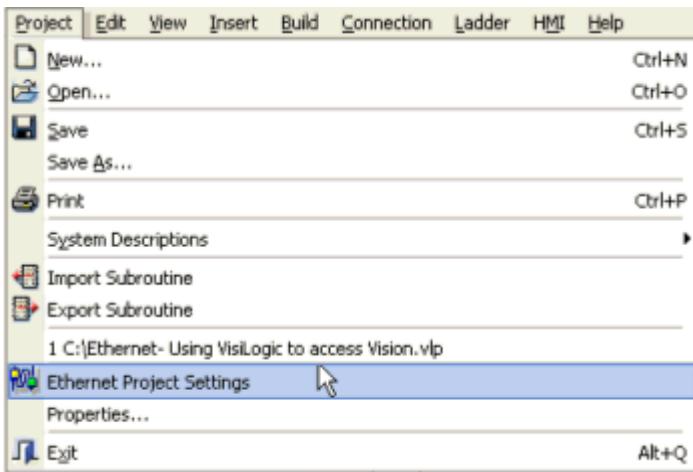


### TCP/IP Project Settings

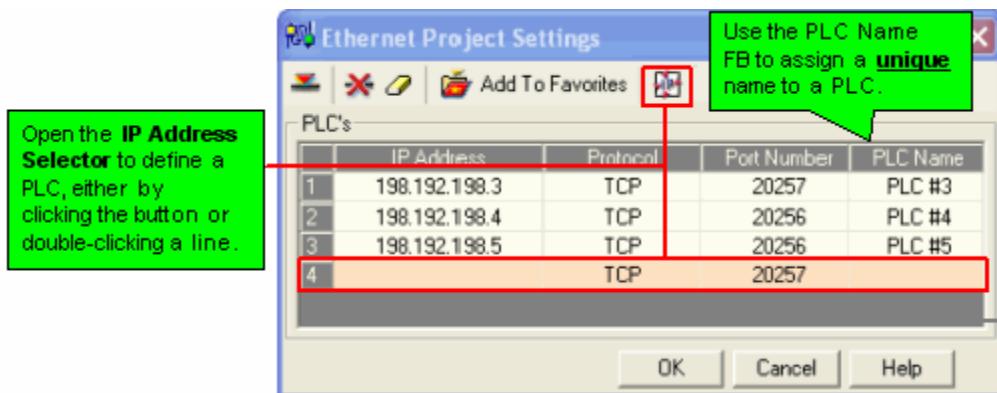
TCP/IP Project Settings enable VisiLogic to access a Vision PLC via an Ethernet connection. Each PLC included in the project will be accessed according via the protocol and port number assigned to it.

TCP/IP Project Settings contain IP addresses and settings that are specific to a particular VisiLogic project. However, you can add any of the IP addresses it contains to the Favorites file, which is a common, global file that can be accessed from any VisiLogic project.

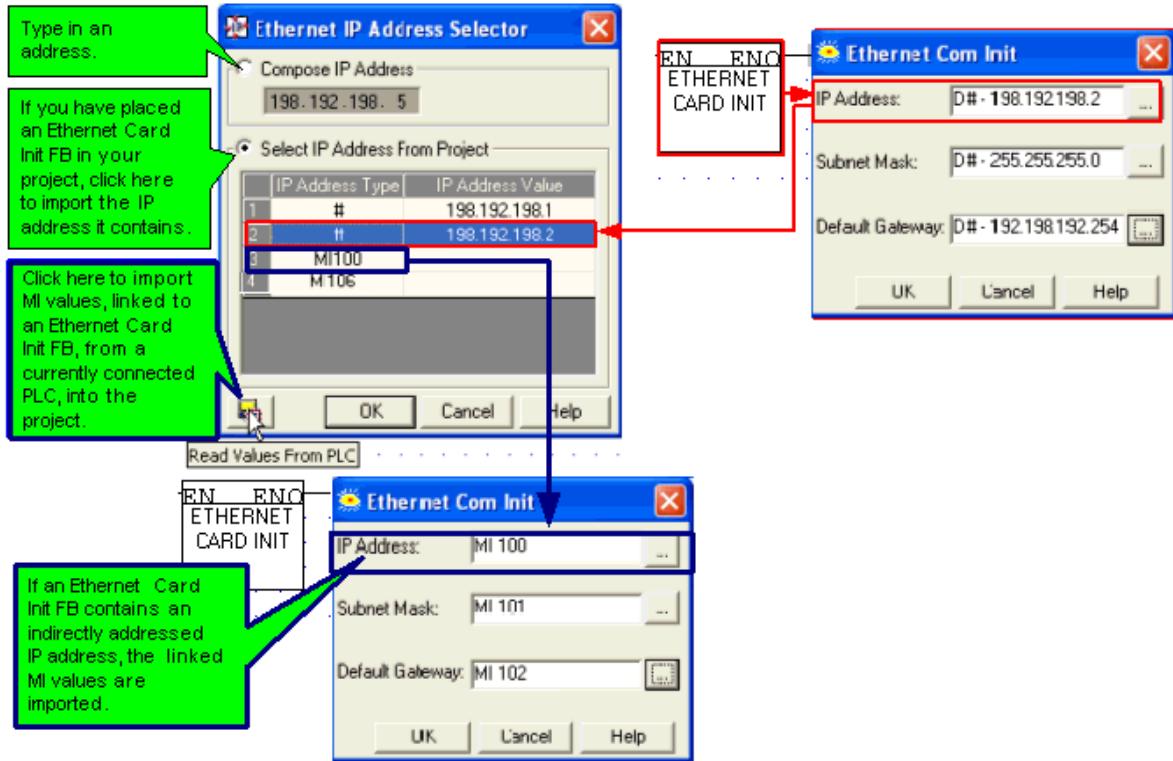
1. Select TCP/IP Settings from the Project menu.



2. Open the IP Address Selector in order to enter the IP of the PLCs in the project.

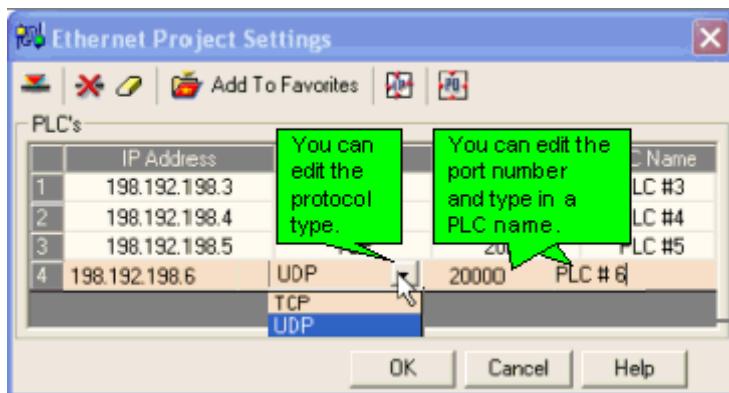


3. Enter an IP address either by:
  - Typing it,
  - Importing any IP addresses you may have defined in your project within TCP/IP Init FBs
  - Importing the IP of a PLC currently linked to your PC via a valid communication connection.

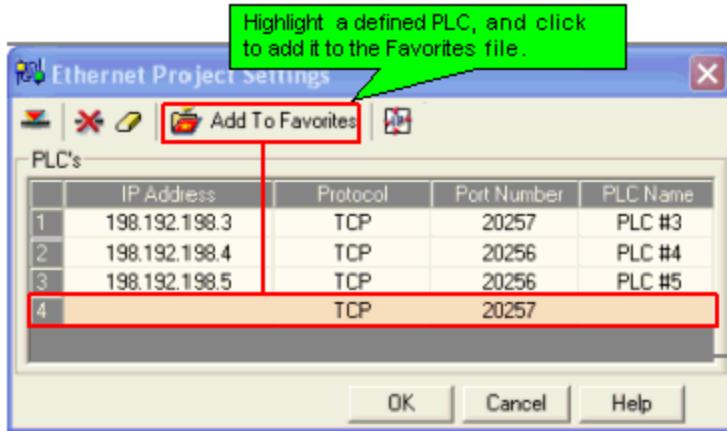


**Note •** If you import a Vision's IP, its protocol type (UDP or TCP) and port number are also imported. If you have typed the IP address, you must also type the port number.

- Before exiting TCP/IP Project Settings, you must set the PLC name. This is a unique name that is assigned to the controller via the Set PLC Name FB.



**Note •** You can add any PLC defined in TCP/IP Project Settings to the Ethernet Favorites file.

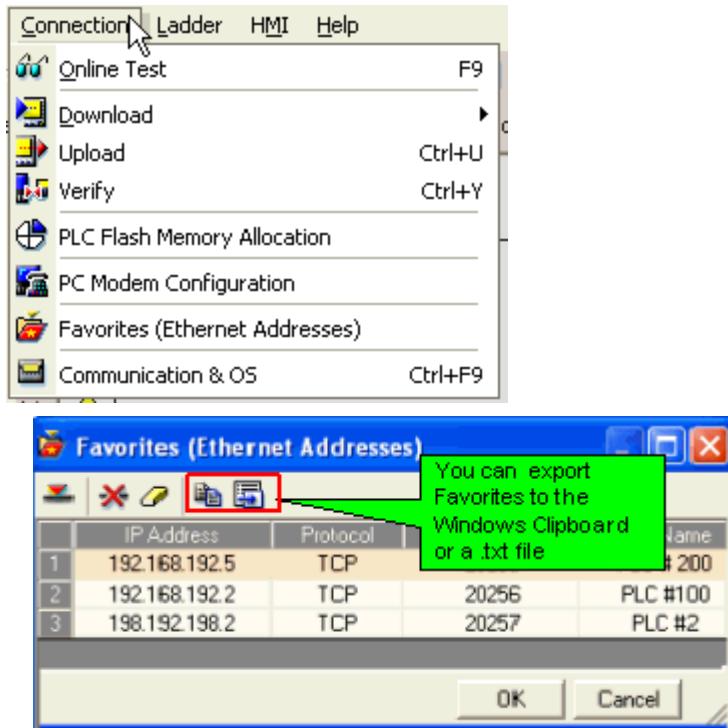


### TCP/IP Favorites

Favorites is a common, global file that can be accessed from any VisiLogic project, as well as by other programs such as Remote Access.

Favorites is a file that is created by VisiLogic after you have added a PLC to the favorites list. It is a global file stored in the Program\Common files\Unitronics folder as Eth\_Favorites.evb.

Ethernet Favorites is located on the Connection menu.



Once Favorites have been created, you can access them in order to:

- Import the definitions into TCP/IP Project Settings.
- Select a PLC listed in Favorites to enable VisiLogic to access a PLC via Vision Communication - PC Settings.

### Vision Communication - PC Settings--Selecting the target PLC

Once the conditions above have been met, VisiLogic can access a selected PLC via Ethernet.

- Select Communication and OS from the Connection menu.

## Getting Started

- Under Connection Type, select Ethernet, and then select the target PLC from either Project Settings or Favorites.



VisiLogic is now ready to communicate via Ethernet.

### Ethernet TCP\IP: SBs & SIs

#	Description	Turns ON when:	Turns OFF when:	Reset by:	Comments
SB 141	Ethernet: Card Exists	Ethernet card is found	No Ethernet card is installed		When the Ethernet: Card Initialization FB runs, the PLC checks whether an Ethernet card is installed.
SB 142	Ethernet: Card Initialized	Ethernet card initialization succeeds	Ethernet card initialization fails		
SB 143	Ethernet: Socket 0 Initialized	Socket 0 initialization succeeds	Socket 0 initialization fails		
SB 144	Ethernet: Socket 1 Initialized	Socket 1 initialization succeeds	Socket 1 initialization fails		
SB 145	Ethernet: Socket 2 Initialized	Socket 2 initialization succeeds	Socket 2 initialization fails		
SB 146	Ethernet: Socket 3 Initialized	Socket 3 initialization succeeds	Socket 3 initialization fails		
SB 147	Ethernet: Socket 0 Connected	Connection established via Socket 0	Socket 0 is free		
SB 148	Ethernet: Socket 1 Connected	Connection established via Socket 1	Socket 1 is free		
SB 149	Ethernet: Socket 2 Connected	Connection established via Socket 2	Socket 2 is free		
SB 150	Ethernet Status: Socket 3 Connected	Connection established via Socket 3	Socket 3 is free		

SB 151	Ethernet Link: Communication established	A link exists	No link exists		
SB 152	Ethernet Link: 10baseT	When a 10baseT link is detected, during data transmit/ receive.	When a 10baseT link is not detected, during data transmit/ receive.		
SB 153	Ethernet Link: 100baseT	When a 100baseT link is detected, during data transmit/ receive.	When a 100baseT link is not detected, during data transmit/ receive.		
SB 154	Ethernet: data collision	More than one device is transmitting data over the Ethernet network	One or no devices are transmitting data over the Ethernet network		
SB 155	Ethernet: Socket 0 Send in Progress	Data is being transmitted via Socket 0	Data is not being transmitted via Socket 0		
SB 156	Ethernet: Socket 1 Send in Progress	Data is being transmitted via Socket 1	Data is not being transmitted via Socket 1		
SB 157	Ethernet: Socket 2 Send in Progress	Data is being transmitted via Socket 2	Data is not being transmitted via Socket 2		
SB 158	Ethernet: Socket 3 Send in Progress	Data is being transmitted via Socket 3	Data is not being transmitted via Socket 3		

Parameter	Description	Value	Comments
SI 141	Ethernet Socket 0: Protocol Type	<ul style="list-style-type: none"> <li>0=PC application (default)</li> <li>1=MODBUS</li> </ul>	(Read-only) Sockets are set to Protocol Type 0 by default. Activating MODBUS Configuration changes the Protocol Type to 1.
SI 142	Ethernet Socket 1: Protocol Type		
SI 143	Ethernet Socket 2: Protocol Type		
SI 144	Ethernet Socket 3: Protocol Type		

Parameter	Function	SI value	Message
		0	Initialized to UDP, status: Closed
S1 145	Socket 0: Status		

## Getting Started

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SI 146	Socket 1: Status	2	Initialized to TCP, status: Listen
SI 147	Socket 2: Status	14	Initialized to UDP, status: Ready
SI 148	Socket 3: Status	15	Initialized to UDP, status: Engaged in Transmit/Receive

Parameter	Description	Value	Comments
SDW 14	Socket 0: Number of sent transmissions	Updated after each data transmission via Socket 0	
SDW 15	Socket 1: Number of sent transmissions	Updated after each data transmission via Socket 1	
SDW 16	Socket 2: Number of sent transmissions	Updated after each data transmission via Socket 2	
SDW 17	Socket 3: Number of sent transmissions	Updated after each data transmission via Socket 3	
SDW 18	Socket 0: Number of received transmissions	Updated after each data packet received via Socket 0	
SDW 19	Socket 1: Number of received transmissions	Updated after each data packet received via Socket 1	
SDW 20	Socket 2: Number of received transmissions	Updated after each data packet received via Socket 2	
SDW 21	Socket 3: Number of received transmissions	Updated after each data packet received via Socket 3	

## Ethernet TCP\IP: PC to Vision

In order to use a PC to access a Vision controller via Ethernet:

1. The Vision PLC must contain an Ethernet port.
2. Both the PC and PLC must be connected to an Ethernet network, and be assigned valid IP addresses; the PLC must be assigned a unique name via the Set PLC Name.
3. The PLC must be defined in either TCP\IP's Ethernet Project Settings or in TCP\IP Favorites .
4. In VisiLogic's Vision Communication - PC Settings:
  - Ethernet must be selected
  - the target PLC must be selected from either Favorites or TCP\IP Project Settings.

These conditions enable VisiLogic to access a PLC via Ethernet in order to download programs and carry out other tasks.

## **Vision Ethernet Port**

V2xx Vision OPLCs can be ordered with or without an Ethernet port. The Ethernet port enables you to implement communications via TCP/IP, such as MODBUS over TCP. To check if your Vision controller was supplied with an installed Ethernet port, first check the device's model number. In addition, note that the Ethernet port is an RJ-45-type port that is lined with metal.

## **TCP/IP Project Settings**

TCP/IP Project Settings enable VisiLogic to access a Vision PLC via an Ethernet connection. Each PLC included in the project will be accessed according via the protocol and port number assigned to it.

TCP/IP Project Settings contain IP addresses and settings that are specific to a particular VisiLogic project. However, you can add any of the IP addresses it contains to the Favorites file, which is a common, global file that can be accessed from any VisiLogic project.

1. Select TCP/IP Settings from the Project menu.
  
2. Open the IP Address Selector in order to enter the IP of the PLCs in the project.
  
3. Enter an IP address either by:
  - Typing it,
  - Importing any IP addresses you may have defined in your project within TCP/IP Init FBs
  - Importing the IP of a PLC currently linked to your PC via a valid communication connection.

**Note •** If you import a Vision's IP, its protocol type (UDP or TCP) and port number are also imported. If you have typed the IP address, you must also type the port number.

4. Before exiting TCP/IP Project Settings, you must set the PLC name. This is a unique name that is assigned to the controller via the Set PLC Name FB.

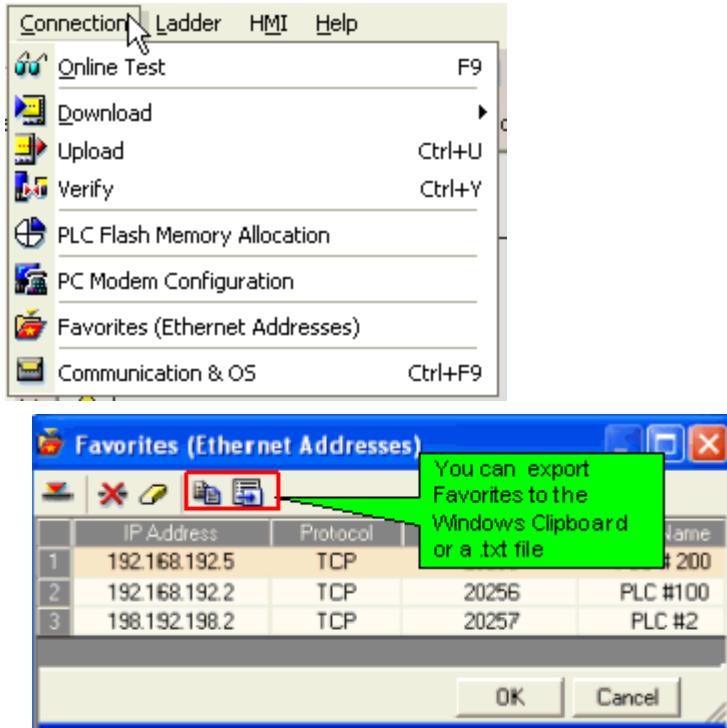
**Note •** You can add any PLC defined in TCP/IP Project Settings to the Ethernet Favorites file.

## **TCP/IP Favorites**

Favorites is a common, global file that can be accessed from any VisiLogic project, as well as by other programs such as Remote Access.

Favorites is a file that is created by VisiLogic after you have added a PLC to the favorites list. It is a global file stored in the Program\Common files\Unitronics folder as Eth\_Favorites.evb.

Ethernet Favorites is located on the Connection menu.



Once Favorites have been created, you can access them in order to:

- Import the definitions into TCP/IP Project Settings.
- Select a PLC listed in Favorites to enable VisiLogic to access a PLC via Vision Communication - PC Settings.

### **Vision Communication - PC Settings--Selecting the target PLC**

Once the conditions above have been met, VisiLogic can access a selected PLC via Ethernet.

1. Select Communication and OS from the Connection menu.
2. Under Connection Type, select Ethernet, and then select the target PLC from either Project Settings or Favorites.



VisiLogic is now ready to communicate via Ethernet.

# Networks

## About Networks

Vision controllers offer different networking options:

### CANbus

You can create a decentralized control network of up to 63 controllers using CANbus. This is sometimes called a multi-master network. In such a network, CANbus enables inter-PLC data exchange. Technical specifications and wiring diagrams are given in the User Guide. Vision controllers also support data exchange via the MODBUS protocol



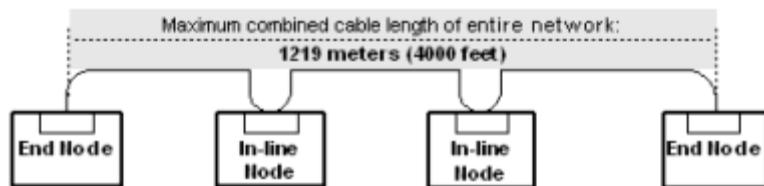
You can network M90 Micro-OPLCs and Vision OPLC controllers.



Via RS232 and RS485, you can implement communication protocols such as MODBUS.

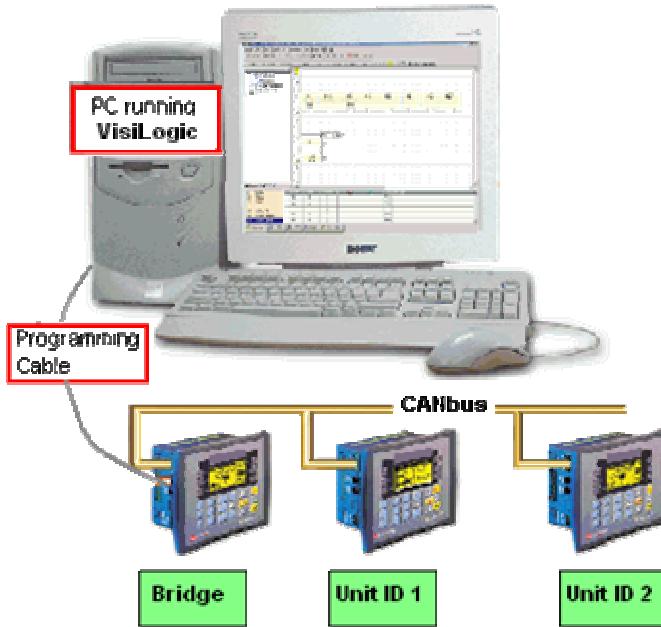
### RS485

RS485 is a balanced serial interface for the transmission of digital data, which enables you to create a multi-drop network containing up to 32 devices, or nodes.



### Network Access via Serial COM Ports

You can access a networked controller unit via its RS232/RS485 port using a PC, whether directly connected or via modem link. Using any networked controller as a bridge, you can view, read, and write data into any unit, as well as upload and download programs.



This feature can also allow you to view your network via a SCADA program.



## CANbus Networking Operands

CANbus enables inter-PLC data exchange. Via the CANbus port, you can:

- Network up to 64 controllers, where each unit can read information from up to 8 other controllers in the network.
- Connect one PC to 63 controllers.

Each networked PLC broadcasts specific data to the network, stamped with the controller's unique ID number. This data is contained in the following system operands: 16 System Bits (SB 200 to SB 215) (16 Inputs (I 0 to I 15), and 2 System Integers (SI 200 and SI 201).

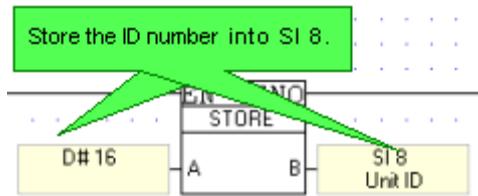
When the data in these operands is constant (unchanging), it is broadcast every 400mS. When the data is dynamic (changing) it is broadcast at a rate not exceeding 20mS. Even when the data changes are rapid, data is not broadcast at a rate exceeding 20mS; this avoids network overload.

### Implementing inter-PLC data exchange

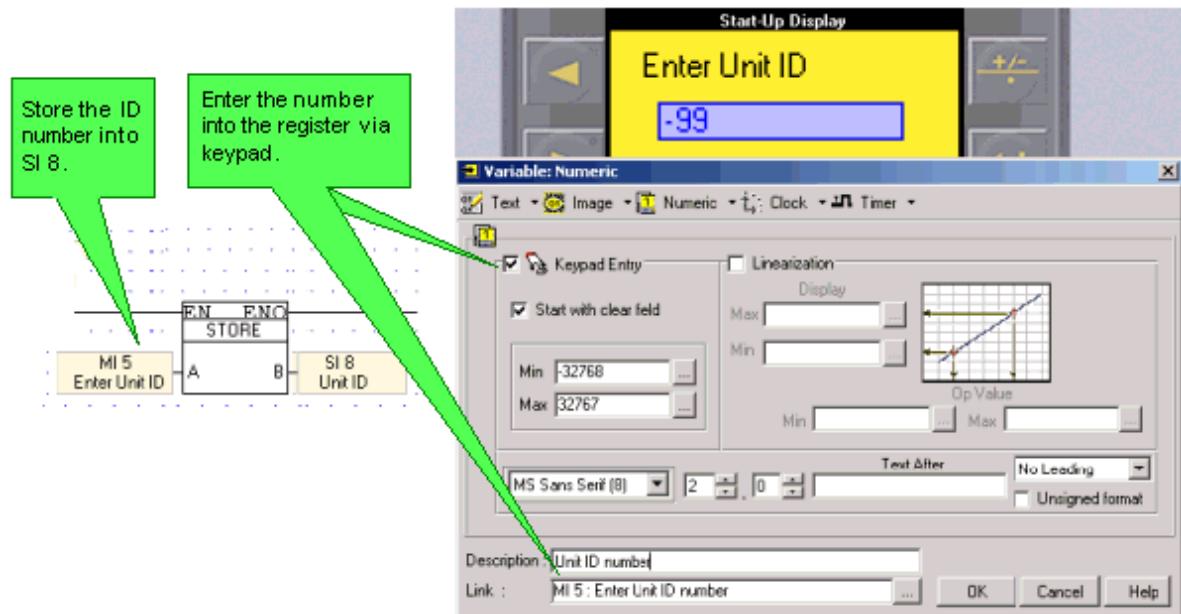
Assigning each networked controller a unique Unit ID number

CANbus ID numbers range from 1 to 63. The ID number is contained in SI 8. You can assign an ID number by:

- Entering a value into SI 8 via Information Mode.
- Storing a value into SI 8 as shown below, either by storing a constant number or by linking a register value.



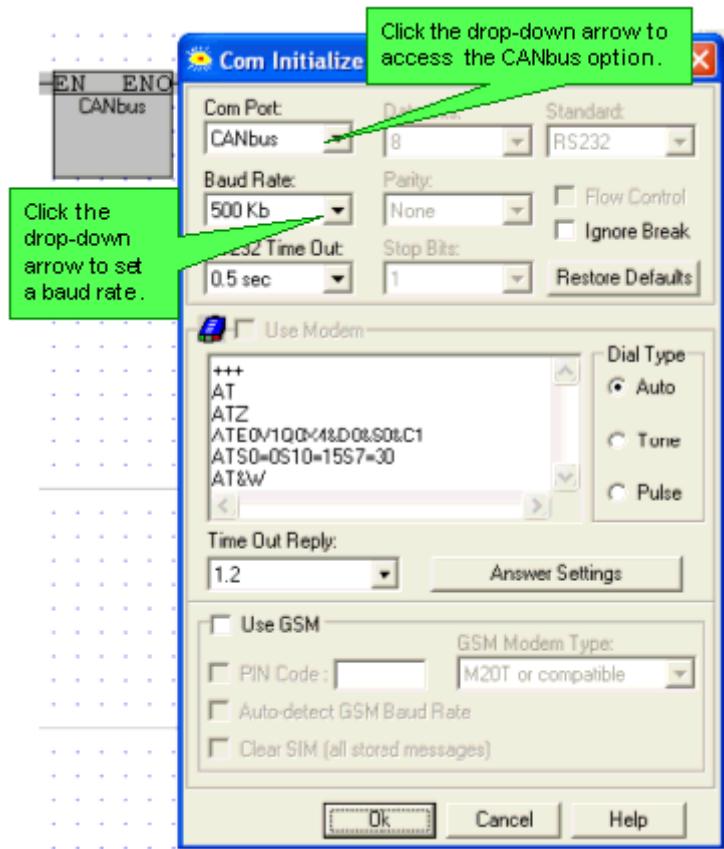
Linking a register value allows you to enable an end-user to enter an Unit ID number via the HMI panel. You can create a Display for this purpose as shown below.



**Note •** The default ID # is 1.

#### Initializing the CANbus port

The CANbus ports of all controllers in the network must be initialized. This is done via a COM Port Init FB as shown below.

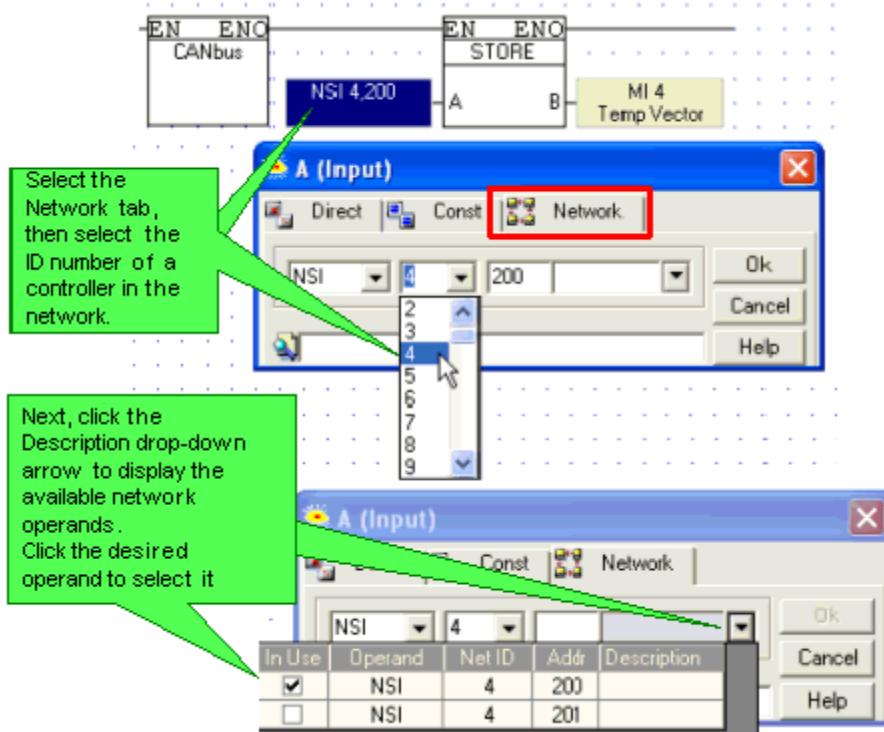


- |               |   |
|---------------|---|
| <b>Note •</b> | The baud rates of all controllers in the network must be set to the same rate. Baud rate is limited by cable length, as described in the CANbus Specifications section below. |
| •             | The COM Init FB used to initialize the CANbus port should be included in the Main Routine of the Ladder application.  |

### Reading Data from a Networked Controller via Network Operands

When a controller is integrated into a CANbus network, the values in these operands are continually broadcast to the network: SB 200 to SB 215, I 0 to I 15, SI 200 and SI 201.

In order to enable a networked controller to read the values from another networked controller, place the desired function in the net. In the Select Operand Address box, click on the Network tab, then select the ID of the target controller and the desired operand.



#### SB 237: Enable/Disable Broadcast

By default, SB 237 is set to ON, enabling the controller to broadcast data. When this SB is OFF, the data is not broadcast. This can be used prevent network overload.

#### CANbus Specifications

Power Requirements: 24VDC ( $\pm 4\%$ ), 40mA max. per unit

Galvanic Isolation between CANbus and controller: Yes

Baud rate	Max. Network Cable Length:
1 Mbit/s	25 m
500 Kbit/s	100 m
250 Kbit/s	250 m
125 Kbit/s	500 m
100 Kbit/s	500 m
50 Kbit/s	1000 m
20 Kbit/s	1000 m
Note • Cable lengths over 500 meters require an additional power supply.	

#### Wiring Considerations

Use twisted-pair cable. DeviceNet® thick shielded twisted pair cable is recommended.

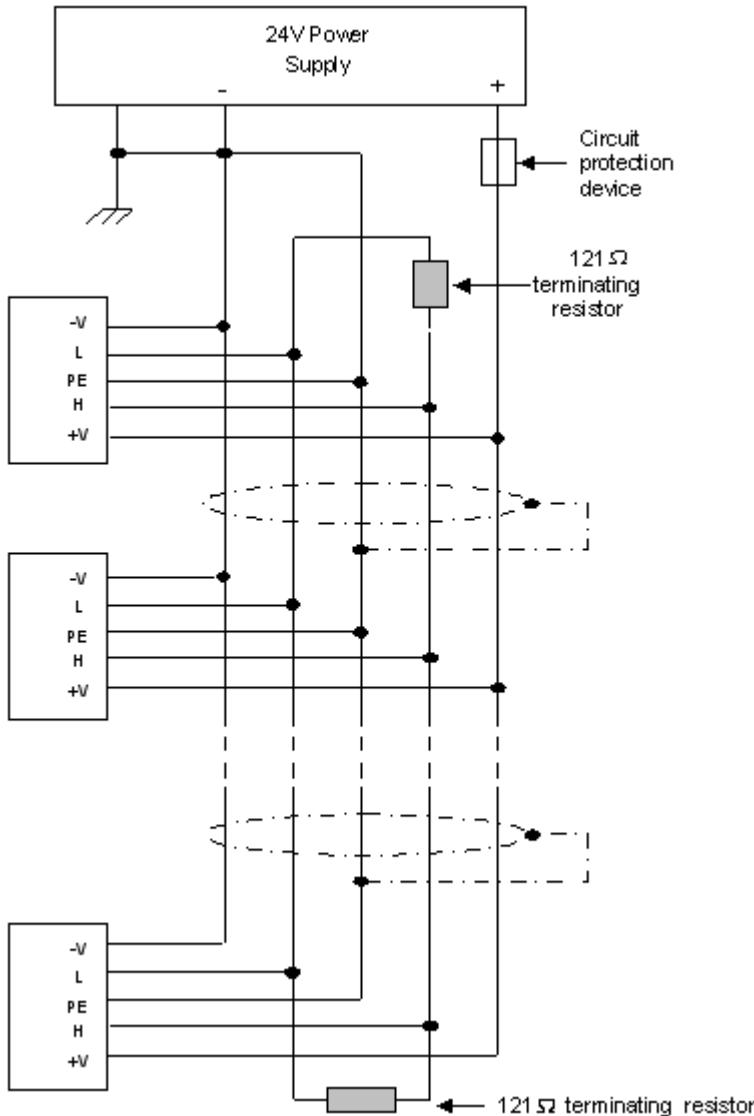
Network terminators: These are supplied with the controller. Place terminators at each end of the CANbus network. Resistance must be set to  $1\%, 121\Omega, 1/4W$ .

Connect the ground signal to the earth at only one point, near the power supply.

The network power supply need not be at the end of the network.

Maximum number of controllers in a network: 63.

### Wiring Diagram



**Note •** Unitronics' CANbus control network is run by a separate isolated power supply that is not part of the network power supply.

## Assigning a Unit ID number

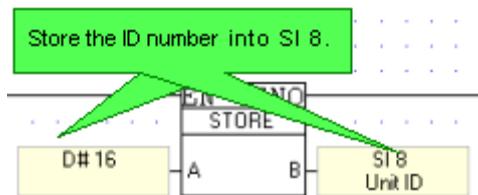
When you create an controller network, you must assign a Unit ID number to each controller. A Unit ID number is unique. The same ID number must not be assigned to more than one device within a network.

You use this number for two purposes:

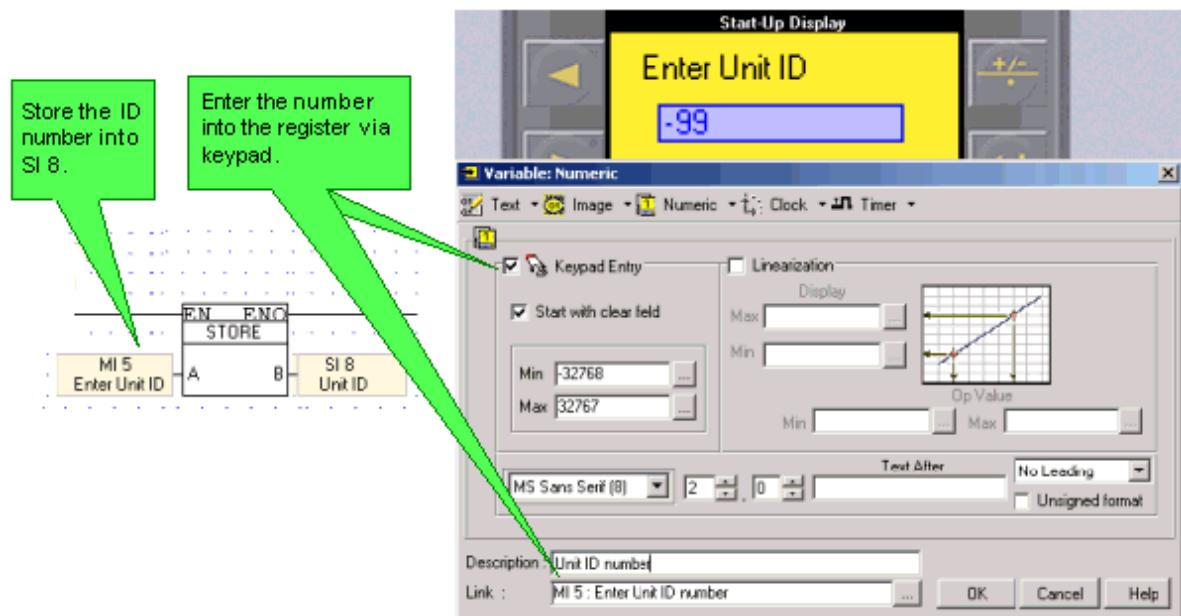
- To enable controllers to exchange data.
- To access a networked controller via your PC.

The ID number is contained in SI 8. You can assign an ID number by:

- Entering a value into SI 8 via Information Mode.
- Storing a value into SI 8 as shown below, either by storing a constant number or by linking a register value.



Linking a register value allows you to enable an end-user to enter an Unit ID number via the HMI panel. You can create a Display for this purpose as shown below.

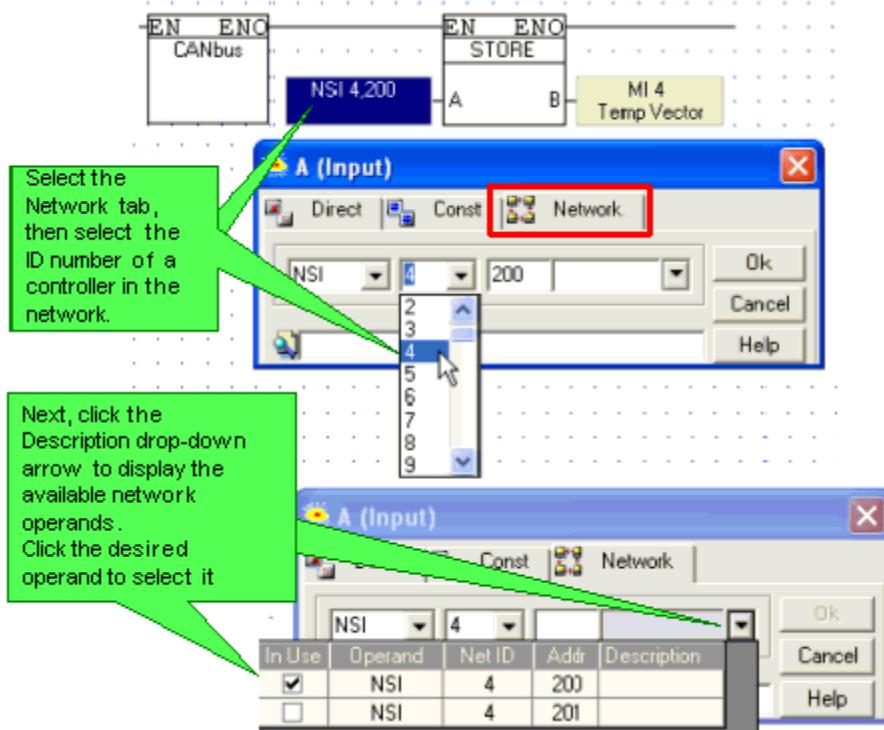


<p><b>Note •</b></p> <p>The default ID # is 1.</p> <ul style="list-style-type: none"> <li>• ID numbers 1-63 are reserved for controllers linked via CANbus; ID numbers 64-127 are reserved for controllers networked via RS485.</li> </ul> <p>Using this range of ID numbers prevents a polled controller from attempting to act as a CANbus bridge, preventing it from attempting to locate the requested controller.</p>	<p>The screenshot shows the 'Vision Communication - PC settings' dialog box. In the 'Communicate with OPLC' section, there is a radio button group for 'Direct Connection' and 'Within Network (Unit ID)'. The 'Within Network (Unit ID)' option is selected, and its dropdown menu is open, displaying a list of unit IDs. The list includes 1 (CANbus), 62 (CANbus), 63 (CANbus), and 64 (RS485), which is highlighted with a blue selection bar. Below the dropdown are fields for 'Vision Model', 'Hardware Rev.', 'OS Version', and 'OS Build Number', each containing a list of values corresponding to the selected unit ID.</p>
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## Network Operands-Communicating Data Via CANbus

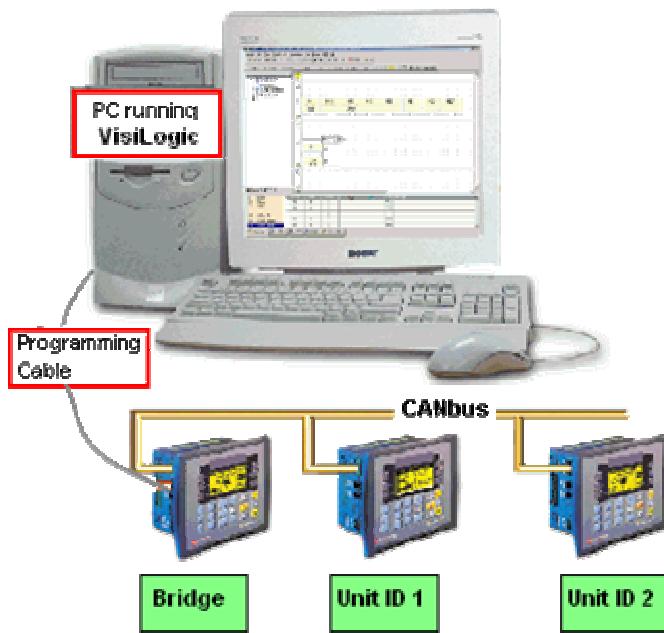
When a controller is integrated into a CANbus network, the data contained in certain system operands is continuously broadcast to the network, together with the controller's unique ID number. The data is contained in 16 System Bits (SB 200 to SB 215( 16 Inputs (I 0 to I 15), and 2 System Integers (SI 200 and SI 201).

In order to enable a networked controller to read the values from another networked controller, place the desired function in the net. In the Select Operand Address box, click on the Network tab, then select the ID of the target controller and the desired operand.



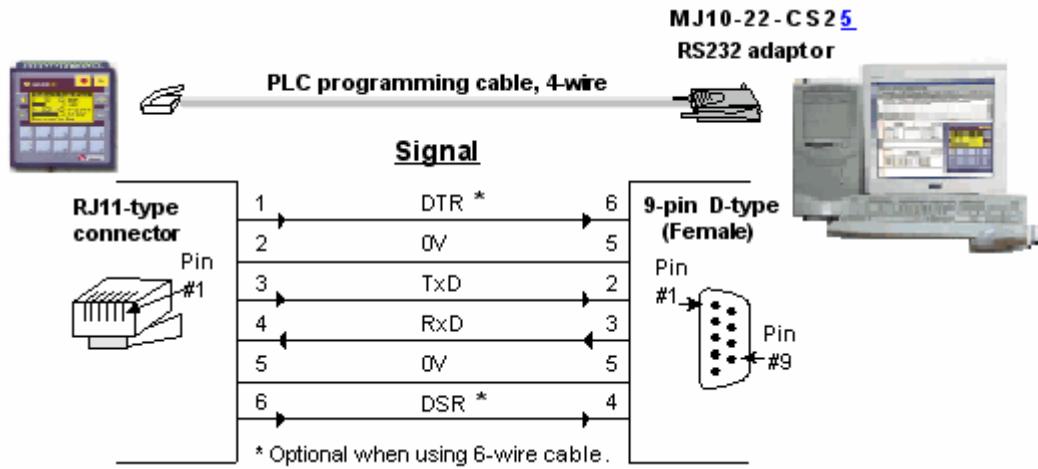
## Accessing a Networked PLC via PC

Use a PC to access controllers within a network either via a direct connection, GSM or landline modem.



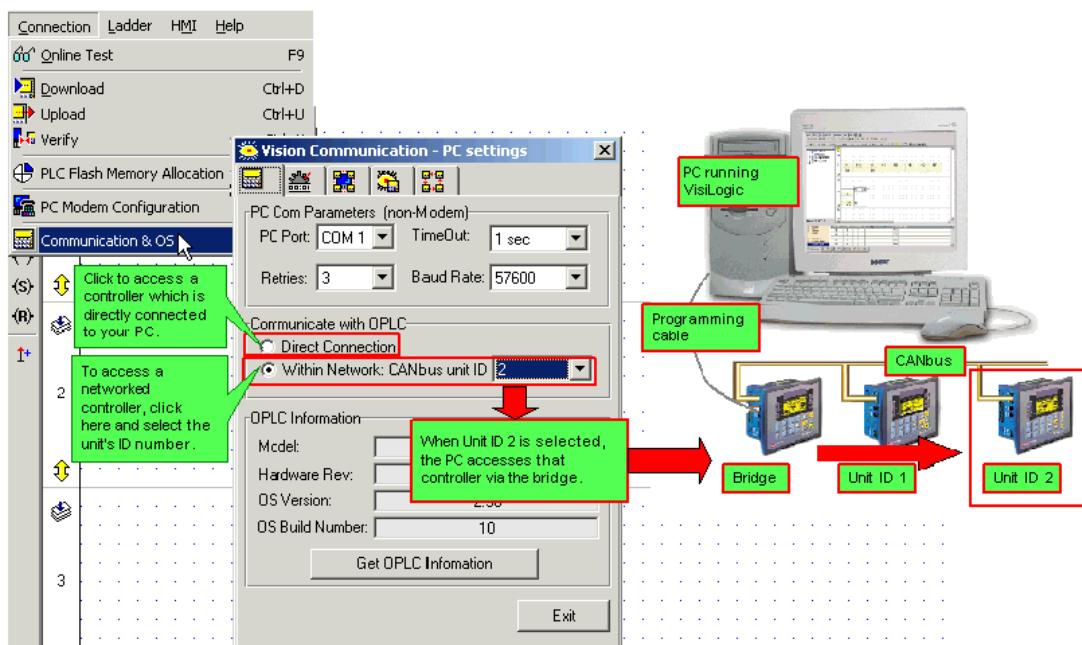
## Accessing a Networked Controller

1. Connect your PC to any controller in the network using the programming cable supplied with the controller kit.



**Note •** Different PCs can access a network at the same time, using different controller units as bridges. However, 2 different PCs cannot simultaneously access the same controller unit.

- Select a networked controller by opening Communication & OS from the Connection menu, and then entering the Unit ID number.



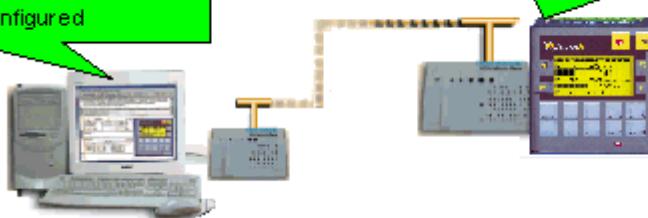
### Accessing a Networked Controller via Modem

**The PC must be:**

- Connected to a modem
- Be installed with VisiLogic
- Be correctly configured

**The controller must be:**

- Connected to a modem
- Installed with a program supporting Remote Access.



**Note •** The PC-modem cable is not the same type of cable used to connect between the controller and the

	modem. Ensure that the cable used to connect the PC to the modem provides connection points for all of the modem's pins.
•	In order to ensure successful operations, it is recommended that you use an external PC modem. Internal modems may not support communications.
•	Both PC and controller must use the same type of modem: either landline or GSM. Internal PC modems must be used in conjunction with the driver provided by the modem's manufacturer.
•	If calls are routed via a switchboard, note that the switchboard settings may interfere with communications. Consult with your switchboard provider.

## Modems: Setting Up

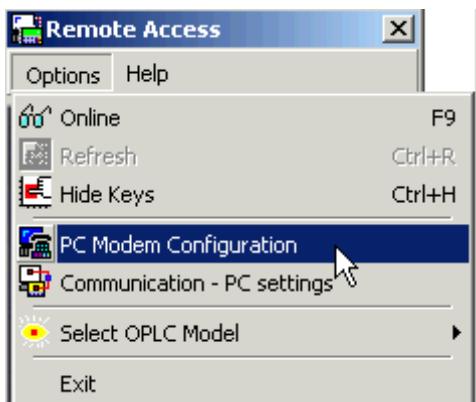
### PLC-Modem Connection

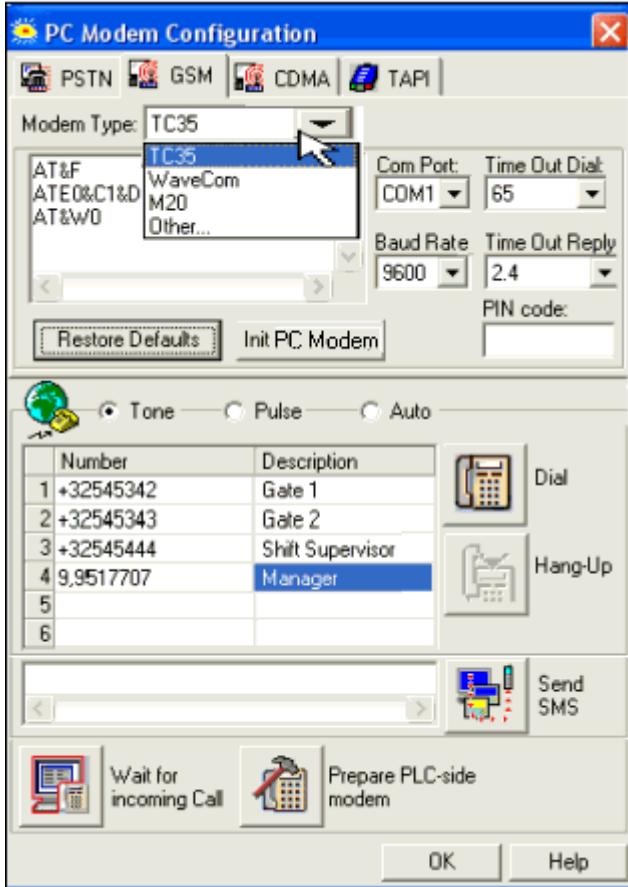
The Unitronics' cable provided with modem kits does not provide a standard connection. This connection is adapted to support the fact that Unitronics controllers do not support the control lines. The cable shorts the DSR and the DTR together, which ensures that the terminal is always ready to receive data.

For more information, refer to the topic Modem Connection and Pinouts.

### PC Modem Configuration

Open PC Modem Configuration from the Options menu.





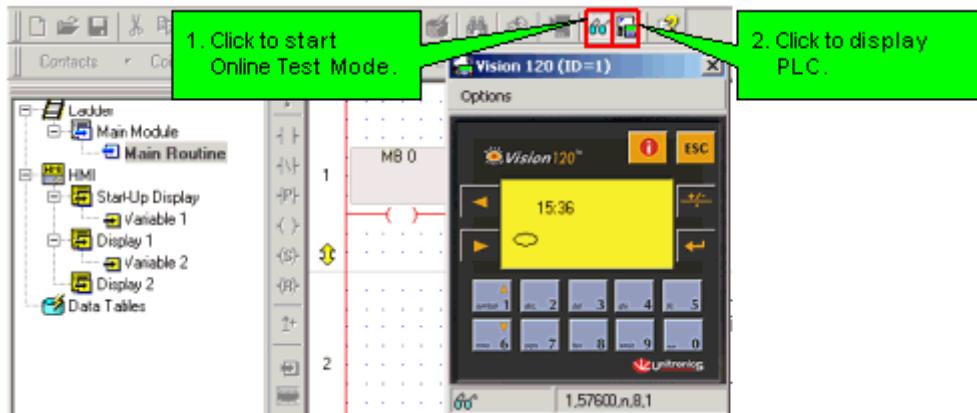
Note • If, within the modem initialization strings, the parameter S7 TimeOut, is too short to permit the PLC's modem to answer, an error will result.

For example, if this parameter is set as S7=30, the PC modem will wait for 3 seconds to receive an answer from the PLC's modem. If, however, the PLC program's COM Init FB Answer Settings are set to 'Answer after 6 rings,' the PLC modem will not be able to answer before the 3 seconds have elapsed. In this case, the TimeOut parameter is exceeded, and the PC modem will return the No Carrier error.

### Online Test Mode & Remote Access

You can run Online Test mode and use Remote Access session to display the networked controller on your PC screen.

To do this, click the Online Test button on the toolbar, then click the Remote Access button.



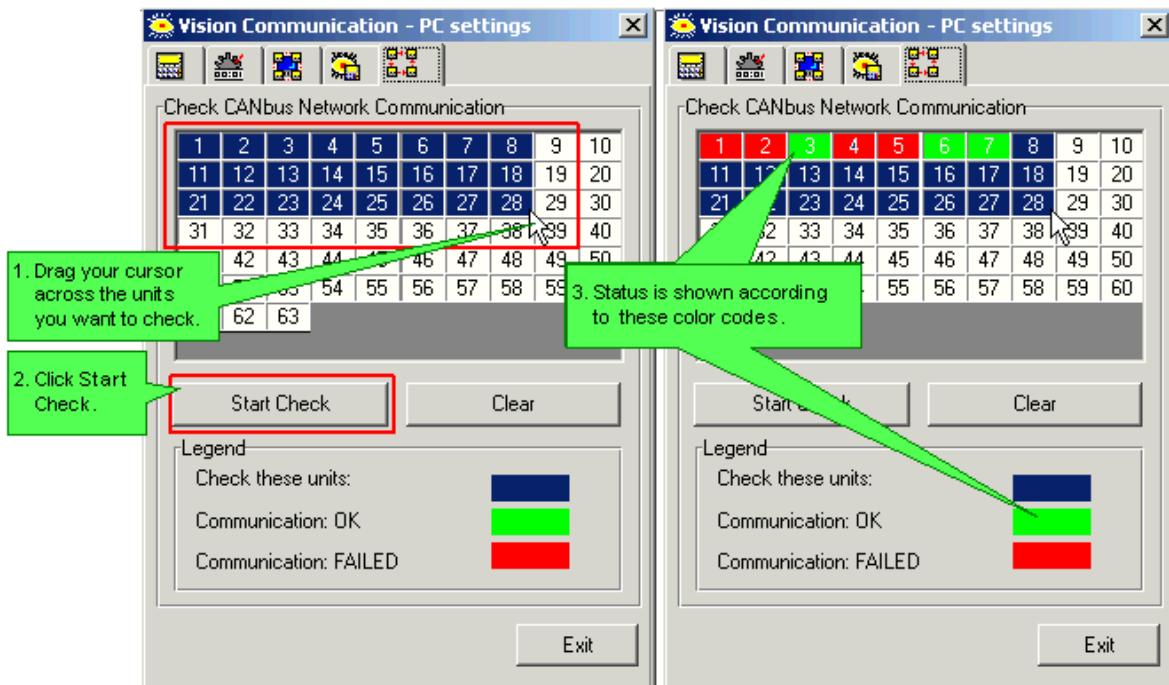
The controller model that is shown on the display is the one selected in Hardware Configuration.

During a Remote Access session, you can:

- Use your cursor to operate the controller keypad and activate touch-screen objects (relevant models).
- Use your PC keyboard to operate the controller keypad (numeric keys, function keys <F1> to <F8>). Note that the Vision <ESC> key is <E> on the PC keyboard, and that <F9> is reserved for activating Online mode.
- Enter Information Mode by pressing the <i> key with your cursor.

## Check Network Status

The network status is checked via the bridge. Access Check Network Status by opening the Connection menu, selecting Communication & OS, then clicking the network tab.



## CANbus Network Problems

SB 236 indicates that there is an error in the CANbus network.

SI 236 CANbus Network: Failed Unit ID. Note that the first 3 bits turn ON only when the controller is unable to broadcast via the CANbus port. The value of SI 236 indicates the following messages:

Value	Message	May result from:
0	No Acknowledgement	CANbus power failure, crossed wires, incorrectly set termination points.
1	CANbus OFF	
2	CANbus Warning error	Poor transmission quality due to faulty wiring, or if the cable length exceeds recommendations.
4	One or more networked units cannot be read. If this bit is ON, check SI 238, SI 240-243.	

SI 237 CANbus Network Communication Error Code is a bitmap that indicates the LAST unit that cannot be read. Note that each controller can receive messages from up to 8 others. Example: Assume that there are 6

## Getting Started

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controllers in the network (3,6,8,13,17,34). Controller 3 is waiting for data from controllers 8 and 13 and 17. If the controller does not receive data from controller 13 (assume a 1 second timeout) then SI 237 will contain a value of 13. Bit 4 in SI 236 will also turn ON. Once controller 3 has received the data, Bit 4 turns OFF.

SI 240, 241, 242, and 243 serve as a bitmap indicating which unit is in error. If, for example, the network includes unit ID numbers 8, 9 and 13, and PLC #9 cannot be accessed, then the ninth bit in SI 240 will turn ON. When the error is fixed, the bit falls to OFF.

### CANbus troubleshooting

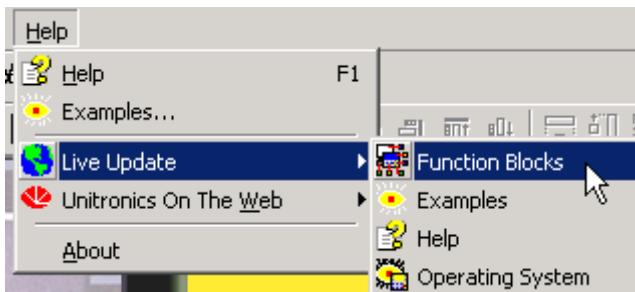
Problem	Possible cause	Recommended Action
Failed communication	Baud rate settings	All controllers in the network must be set to the same CANbus baud rate. Baud rate may be set: <ul style="list-style-type: none"><li>• By initializing a port via the COM Init FB.</li><li>• Temporarily via Info mode; however, note that the baud rate will be reset at the next power-up</li></ul>
	Termination resistors	Termination resistor settings are provided in the chapter Communications in the controller's user guide.
	CANbus power supply	Check that the CANbus power supply is properly connected, and that the voltage is in the permissible range as described in the chapter Communications in the controller's user guide.
	Incorrect ID number	You may not have assigned the correct unit ID number in your operand addresses (between 1-63). Check the OPLC settings tab Communicate with OPLC.
PC cannot communicate with bridge	Incorrect setting	When you communicate with the controller unit that you are using as a bridge to the network, either enter the ID# of the bridge or select Direct Connection in the OPLC settings tab Communicate with OPLC.
PC cannot communicate with network	Communication settings	Make sure the current RS232 parameters in your project are the same as the parameters that are actually in the bridge. Check these topics:Check Network Status,Vision Communication PC Settings
	Incorrect baud rate	The bridge's RS232 port's baud rate cannot be set below 9600.

## Utilities

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### Live Update from the Web

Live Update is available from the Help menu. To start Update, select a subject and follow the on-screen instructions.



- |               |  |
|---------------|--|
| <b>Note •</b> | To enable Live Update, you may need to change the settings in Project Properties, which is located on the Project menu.<br>Via the Project Properties Download tab, you can select to run Live Update via a proxy server, or via your Internet Explorer settings.  |
| •             | After downloading FBs, you must close and then restart VisiLogic. The new FBs will appear on the FBs menu. Check the topic FB Library for more information.  |
| •             | After downloading a new Operating System to your PC, you must install it in the controller. Connect the controller to your PC, then open Communication and OS from the Connection menu. The new Operating system will appear in the Install Operating System tab. Select Download to begin the installation process. |

### Information Mode

Information Mode is a utility that is embedded in the operating system of the controller. Via Information Mode, you can view data on the LCD screen, use the controller's keyboard to directly edit data, and perform certain actions such as resetting the controller. You can enter Information Mode at any time without regard to what is currently displayed on the LCD screen.

Enter Information Mode by pressing the <i> key for a few seconds. The default password is 1111.



Viewing data does not affect the controller's program. Performing actions, such as initializing the controller, can influence the program.

Note that when you use Information Mode, the keyboard is dedicated to that purpose. The keys return to normal application functions when you exit Information Mode.

## Using Information Mode

1. To enter Information mode, press the <i> key on the Vision's keyboard.
2. Enter your password. The default password is 1111. This password remains in effect until you change it via the Information Mode screen described in the table below.
3. The controller enters Information Mode, showing the first category, Data Types. Use the <Enter> key to enter a category.
4. Press the <ESC> key to exit a category, and to exit Information mode.



The controller will block entry into Information mode until the correct password has been entered. This is why you must record any password you set for your controller.

The data in Information Mode is arranged in Categories. Each Category contains several Subjects. You navigate Information Mode by using the keyboard buttons.

To exit Information mode, press the <ESC> button on the Vision's keyboard. Each press returns one level up. Press the number of times necessary to exit.

**Note •** When you reenter Information Mode, the controller will return to the last Category viewed.

- V290 only

Note that in order to enter Information Mode, you touch the V290's touchscreen in an area that is not occupied by a Keypad Entry variable or other screen object that has been assigned a Touch Property. Maintain contact for several seconds, until the controller enters Information Mode. The V290 displays Information Mode options on the touchscreen exactly as other Vision controllers display these options on their LCD screens.

To navigate through Information Mode, use touchscreen keys just as the keypad keys are used in other Vision controllers.

The table below shows the categories of information that can be accessed in this mode.

### **Info System Operands**

INFO mode, SB 36

#	Description	Turned ON	Turned Off	Comments
SB 36	INFO mode	By OS, Remote Access, or program	Turns OFF when user exits Info Mode	Delay time to enter Info Mode is 4 seconds, may be modified via SI 50

INFO Delay time, SI 50

#	Description	Value	Comments
SI 50	INFO delay time	Default by O/S (every power up) = 4 seconds	<ul style="list-style-type: none"> <li>▪ Units: seconds.</li> <li>▪ Legal values: 0, 3 to 20.</li> <li>▪ If you force or store '0' into equal Zero – INFO is disabled.</li> <li>▪ For V290 – Touching the &lt;i&gt; key on the touch screen starts Info Mode – Touching a legal Ladder application variable clears the INFO time.</li> </ul>

Category	Subject	Possible Actions
Data Types	Memory Bits	<ul style="list-style-type: none"> <li>• View bit status</li> </ul>
	System Bits	<ul style="list-style-type: none"> <li>• Change bit status (Set/Reset)</li> </ul>
	Memory Integers	<ul style="list-style-type: none"> <li>• View integer/long integer/double word value.</li> </ul>
	System Integers	<ul style="list-style-type: none"> <li>• Change values</li> </ul>
	Memory Longs	<ul style="list-style-type: none"> <li>• Toggle Base: view the value in decimal or hexadecimal form.</li> </ul>
	System Longs	
	Memory Double Words	
	System Double Words	
	Inputs	<ul style="list-style-type: none"> <li>• View input status.</li> <li>• Force input status to 1 (FR1) or 0 (FR0). Forced values stay in effect until Normal mode (NRM) is selected, or until the controller is initialized or reset. Note • Forced values do influence your program. This can be useful in testing the effect of an input condition on an output status.</li> </ul>
	Outputs	<ul style="list-style-type: none"> <li>• View output status.</li> </ul>

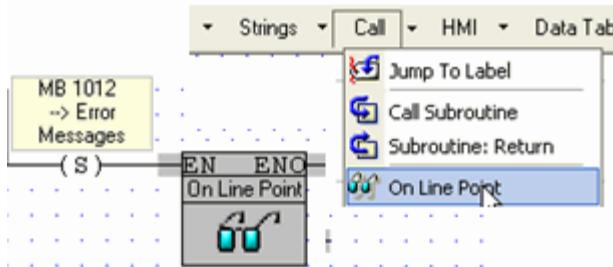
		<ul style="list-style-type: none"> <li>Force output status to 1 (FR1) or 0 (FR0). Note that forced output values do not affect your program.</li> <li>Set/Reset output status.</li> </ul>
	Timers	<ul style="list-style-type: none"> <li>Enter a Preset Timer value.</li> <li>View the current timer value and status by selecting the R.T. option.</li> </ul>
System	Model & O/S Ver	<ul style="list-style-type: none"> <li>Check the controller's model number and operating system version.</li> <li>Check whether the controller is in Run or Stop mode.</li> </ul>
	Working Mode	<ul style="list-style-type: none"> <li>Check whether the controller is in Run or Stop mode.</li> <li>Reset the controller. This restarts your program; restoring power-up values to all data types except for those protected by the battery backup. The battery protects Real Time Clock (RTC), all operand, and Data Table values.</li> <li>Initialize the controller. This restarts your program and initializes all values, restoring 0 values to all data types.</li> </ul>
	Time & Date	<ul style="list-style-type: none"> <li>View the Real Time Clock (RTC) settings. Note that the RTC settings control all time-based functions.</li> <li>Change the RTC settings via the controller's keyboard.</li> </ul>
	Unit ID	<p>The Unit ID number identifies a networked controller. You can:</p> <ul style="list-style-type: none"> <li>Change the ID number. The new ID number will remain in effect until the controller is reset.</li> <li>Burn the ID number into the controller's FLASH memory. This is a permanent change.</li> </ul>
	Serial Port 1 Serial Port 2	<ul style="list-style-type: none"> <li>View and edit communication settings.</li> <li>Select to Change or Burn the new settings.</li> </ul>
	CANbus Baud Rate	<ul style="list-style-type: none"> <li>Change the CANbus baud rate.</li> </ul>
Function Block	Reserved for future use	
Password	New	Set a New Password
Hardware Configuration		<ul style="list-style-type: none"> <li>Check if I/O Expansion Modules are installed. Note that I/O Expansion Modules are represented by letters. Identical module types are represented by identical letters as shown below.</li> <li>Shows if an I/O module is short-circuited.</li> </ul>



## On-Line Test Mode (Debug)

To test a project, first connect the controller to your PC using the program download cable provided with the software package, then download the project and click the On-Line Test button. The Online Test toolbar opens, enabling you to:

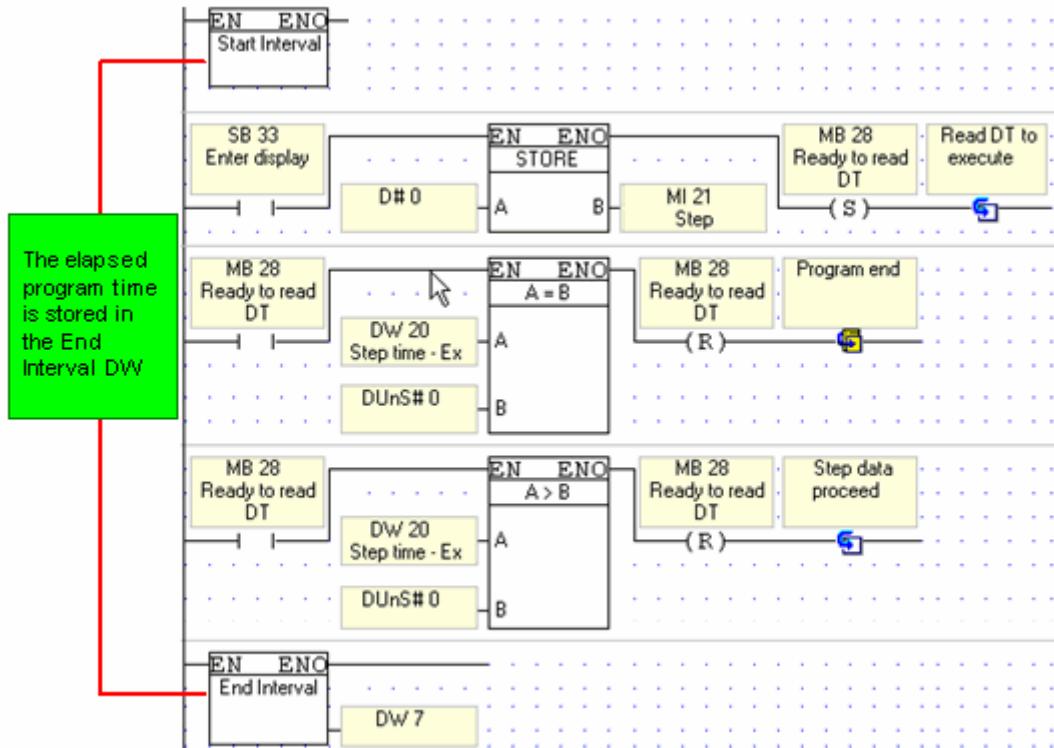
- Switch between Run and Stop modes.
- Use Single Scan to run a single cycle of the ladder program for debugging purposes. You can stop the scan cycle at any point by placing OnLine Test Points, located on the More menu, in the Ladder.



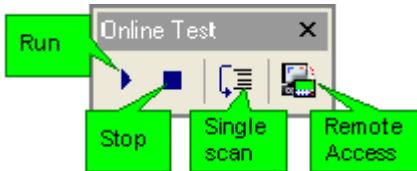
When the scan reaches an OnLine test point that is active (receives RLO), Online Test freezes, enabling you to check element status and values, including Timer values, at that point during Ladder execution. Note that if more than one OnLine test point is activated, SB 35 turns ON.

- Measure the time interval between 2 points in the Ladder application, by placing Start and End Interval elements, located on the More menu, anywhere in the application. The time interval, in

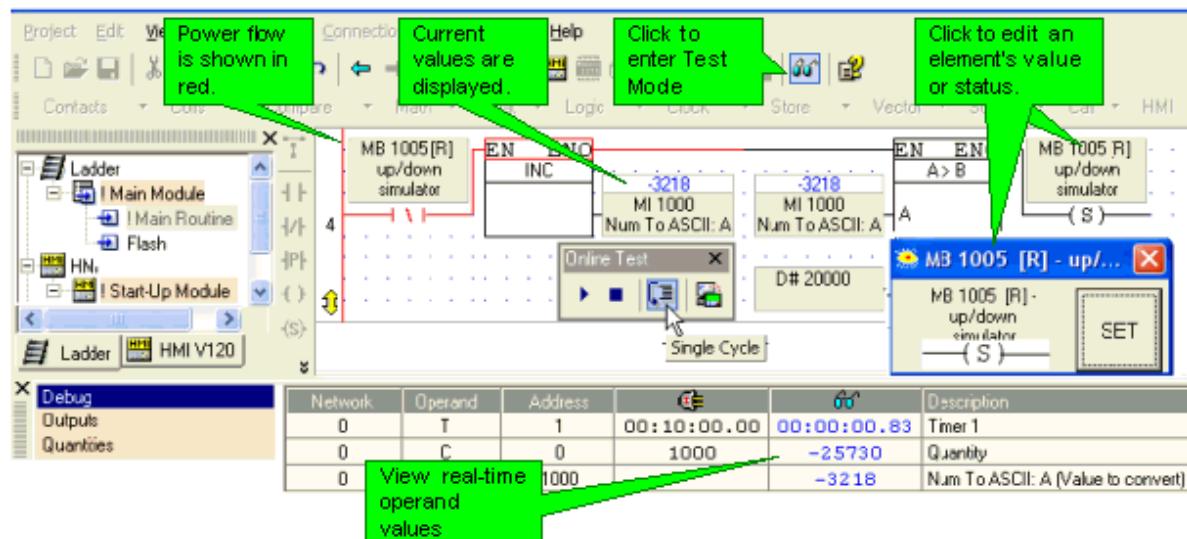
micro-seconds, is stored in the DW linked to the End Interval element.



- Open Remote Access to debug remote controllers via network or modem connections.



In Online Test mode, you can view the power flow, and view and force operand values and element status.



**Note •** The controller can send and receive SMS messages when the controller is in Test mode.

## Remote Access: Accessing a PLC via PC

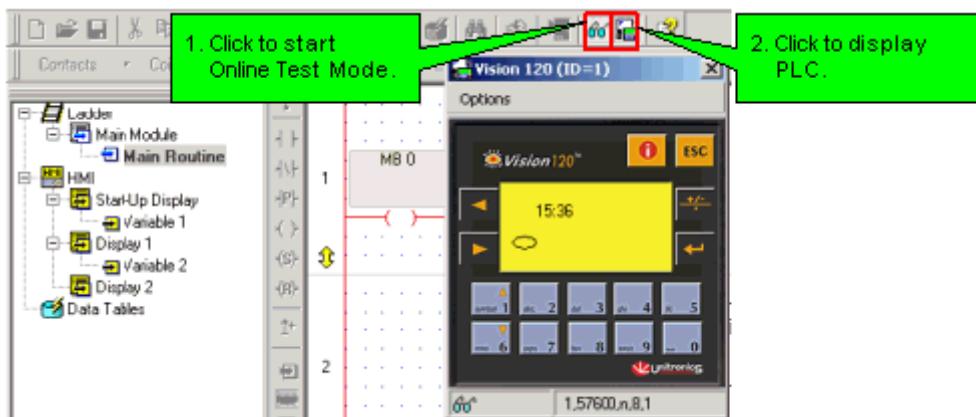
You can use a PC to access a remote Vision and download, upload, and edit programs. You can access:

- Stand-alone controllers that are directly connected to the PC via a cable.
- Controllers within a network
- Either stand-alone or networked controllers via GSM/CDMA or landline modem.



When you run On-line Test mode, you can use the Remote Access utility to display the remote controller on your PC screen. During a Remote Access session, you can:

- 'Press' keypad keys and touch-screen objects (relevant models) by using your cursor, to click the controller keypad touch-screen objects on-screen, or via your PC keyboard, by pressing numeric keys and function keys <F1> to <F8>. Note that the Vision <ESC> key is <E> on the PC keyboard, and that <F9> is reserved for activating Online mode.
- Enter Information Mode by pressing the <i> key on your PC keyboard, or by clicking it on-screen with your cursor.

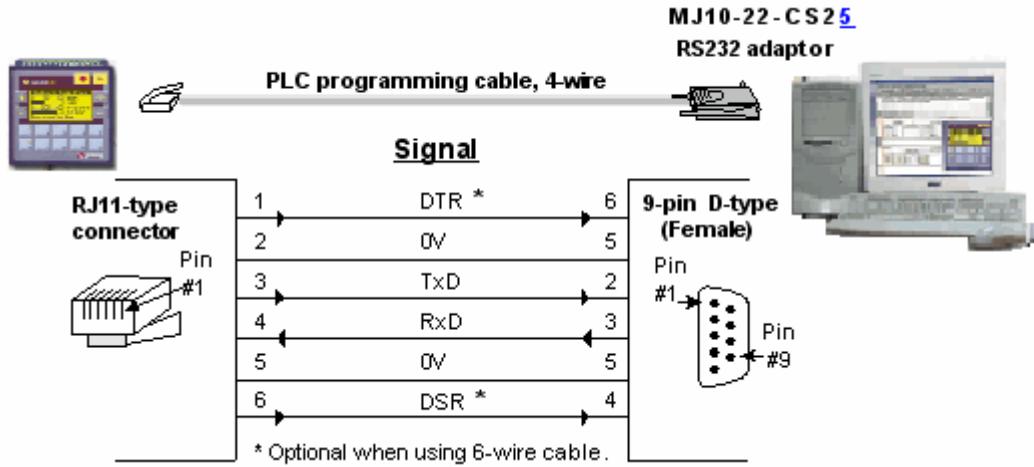


When you are in Online mode, you can toggle Remote Access on and off via <Shift>+<F9>.

### Accessing a Controller

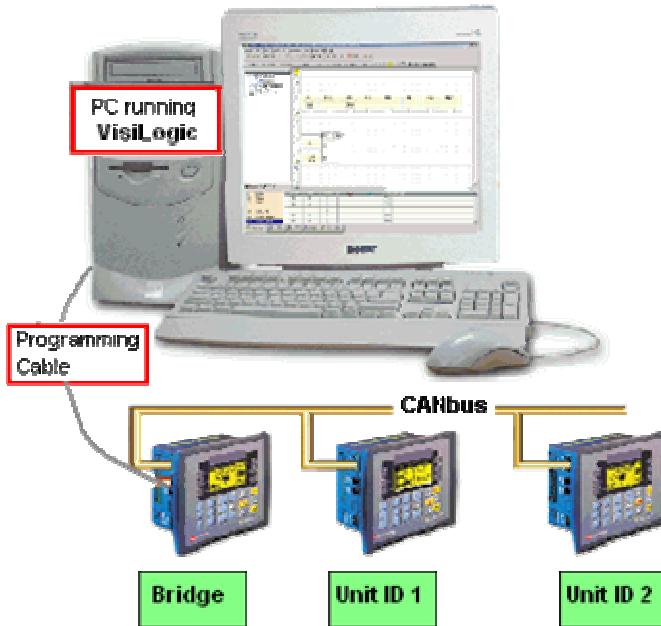
#### Direct Connection: PC-Controller

Connect your PC to any controller using the programming cable supplied with the controller kit.



### Accessing a Networked Controller

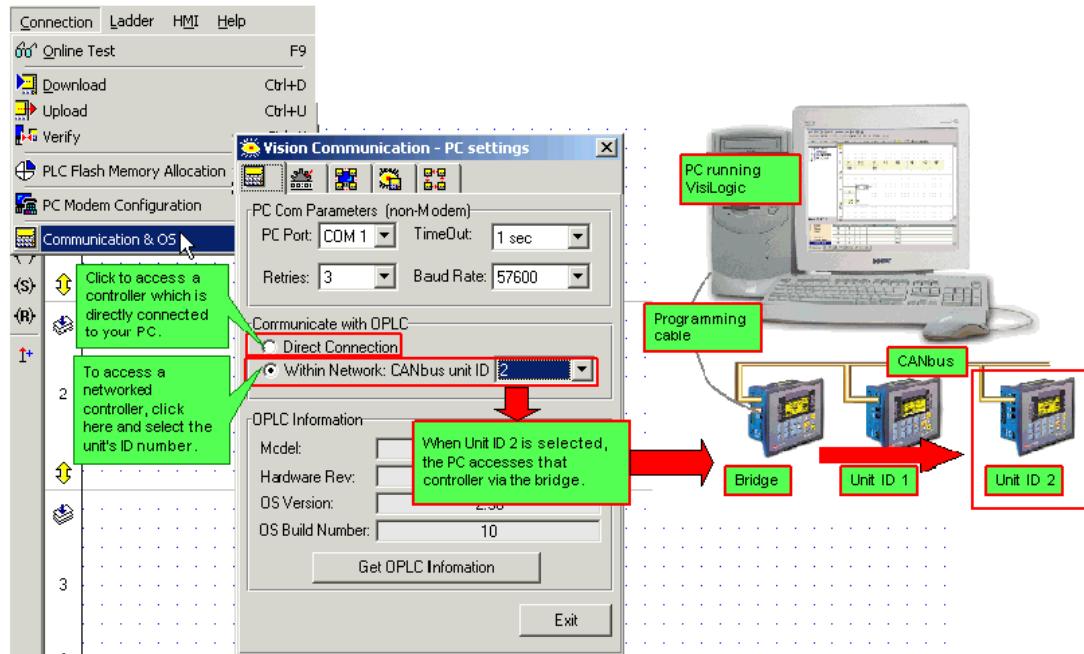
1. Connect your PC to any controller in the network using the programming cable supplied with the controller kit.



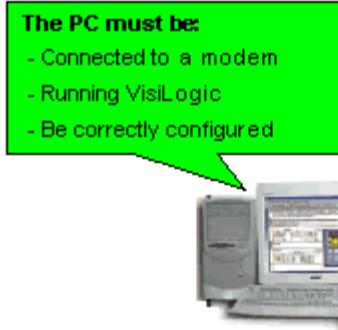
**Note •**

Different PCs can access a network at the same time, using different controller units as bridges. However, 2 different PCs cannot simultaneously access the same controller unit.

2. Select a networked controller by opening Communication & OS from the Connection menu, and then entering the Unit ID number.



### Accessing a Controller via Modem



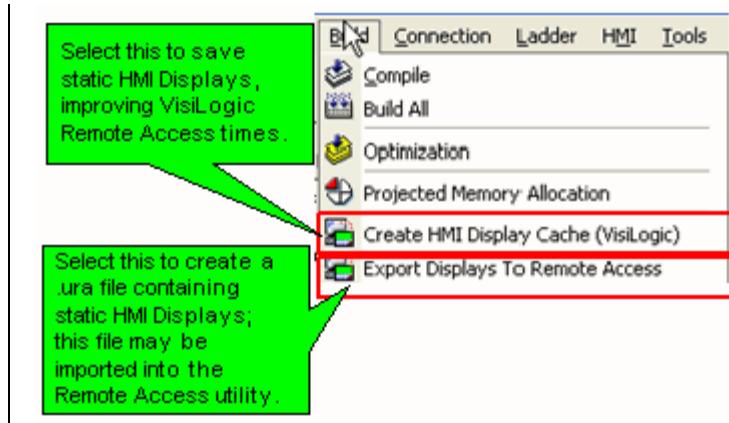
#### **The controller must be:**

- Connected to a modem
- Installed with a program containing a COM INIT FB and the correct program conditions.

1. Prepare and connect your PLC-side modem as described in the topic PLC-side Modems, in the section 'How to enable a Vision controller to communicate via landline, GSM, or CDMA modem'.
2. Prepare the PC-side modem as described in the topic PC-Modem Configuration, in the section 'How to Configure a PC-side Modem'.
3. In Connection PC-Modem Configuration, dial the remote PLC's controller to establish the data link, then enter OnLine mode.

**Note •** The Zoom option on the Remote Access Options menu can be activated only if you select Hide Keys. Zoom cannot be used with M90/91 or V280 controllers.

- Improving Remote Access run times:
  - To improve VisiLogic's Remote Access run times, select Create HMI Display Cache from the Build menu.
  - To create a .ura file containing static displays, select Export Displays to Remote Access, a stand-alone utility provided by Unitronics.



## Project (Vision) Downloader

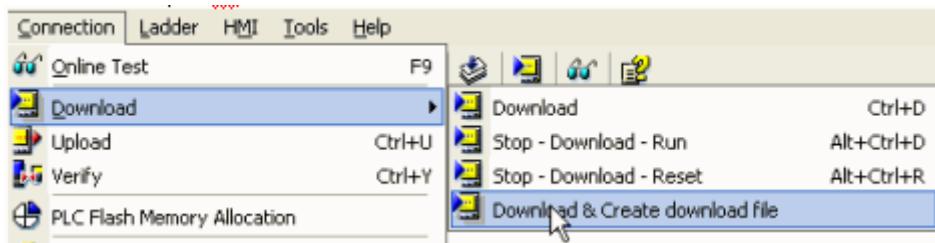
The Project Downloader utility is included in Unitronics Remote Access software, which is installed with VisiLogic. The Project Downloader makes it possible to install .dvi files in local or remote controllers without using VisiLogic.

.dvi files are complete applications in a compressed format. You create them when you download programs to a controller.

### Creating Download files

- |               |   |
|---------------|---|
| <b>Note •</b> | Both the controller used to make the download file (source), and the controller that is installed with the .dvi file (target) should be installed with the same OS Version. |
| •             | To avoid errors in the .dvi file, the Download process must run smoothly, without being aborted or affected by PC faults.   |

1. Click Download, then select Create Download file.

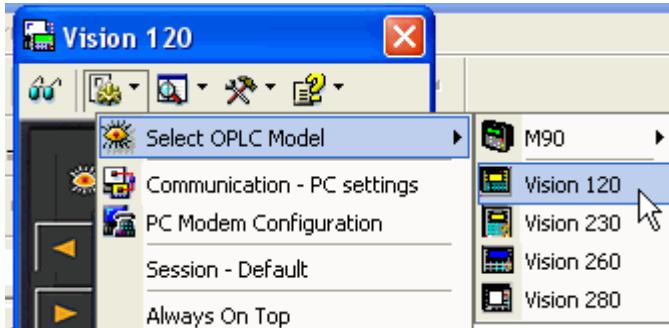


2. A dialog box opens, enabling you to select a Save location. Select a location, then click OK, a .dvi file is created.

### Checking the integrity of the Download file

Although you do not need to have Remote Access installed on your PC in order to create .d90 files, you need to install it in order to check .dvi files.

1. After you have created the .dvi file, save the project from which it was downloaded.
2. Open a new, empty project and download it to the controller.
3. Start Remote Access and select the appropriate Vision model.



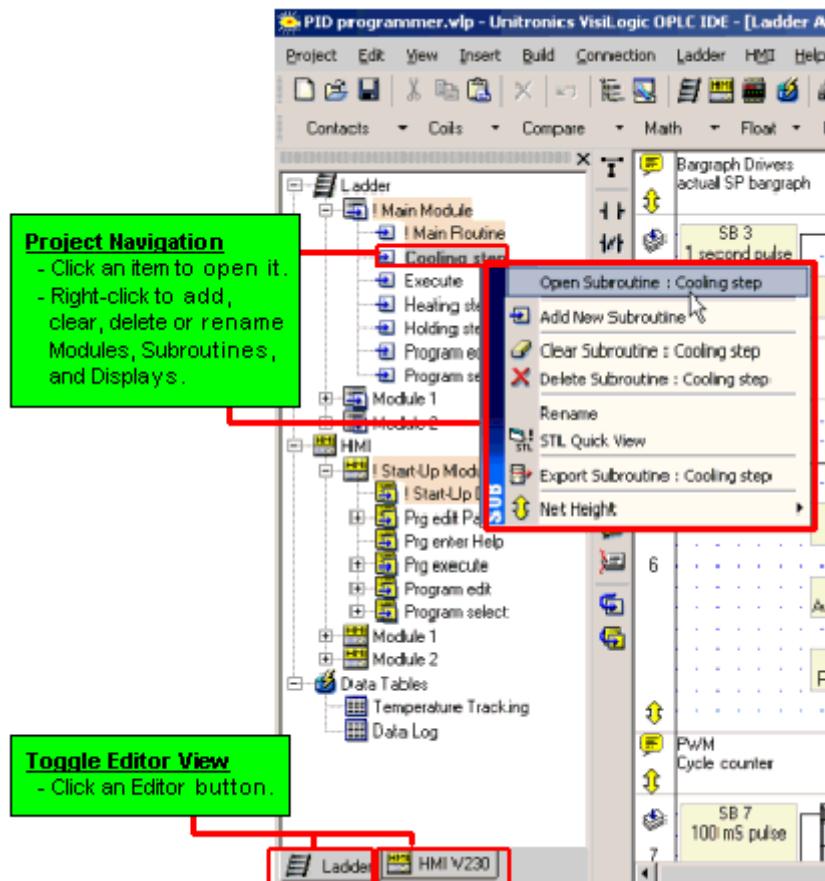
4. Click on the Project Downloader which is located on the Remote Access Tools menu.
5. Navigate to the .dvi file and download it into the controller.
6. Reopen the original Ladder project used to create the .dvi file.
7. Select Verify from the Controller menu; the Verify process will compare the project in your PC with the .dvi application installed in the controller.
8. If the Verify process is successful, the .dvi file is valid.

For more information regarding the Project Downloader, check the Remote Access Help.

## Quick Navigation

VisiLogic offers different tools for program navigation.

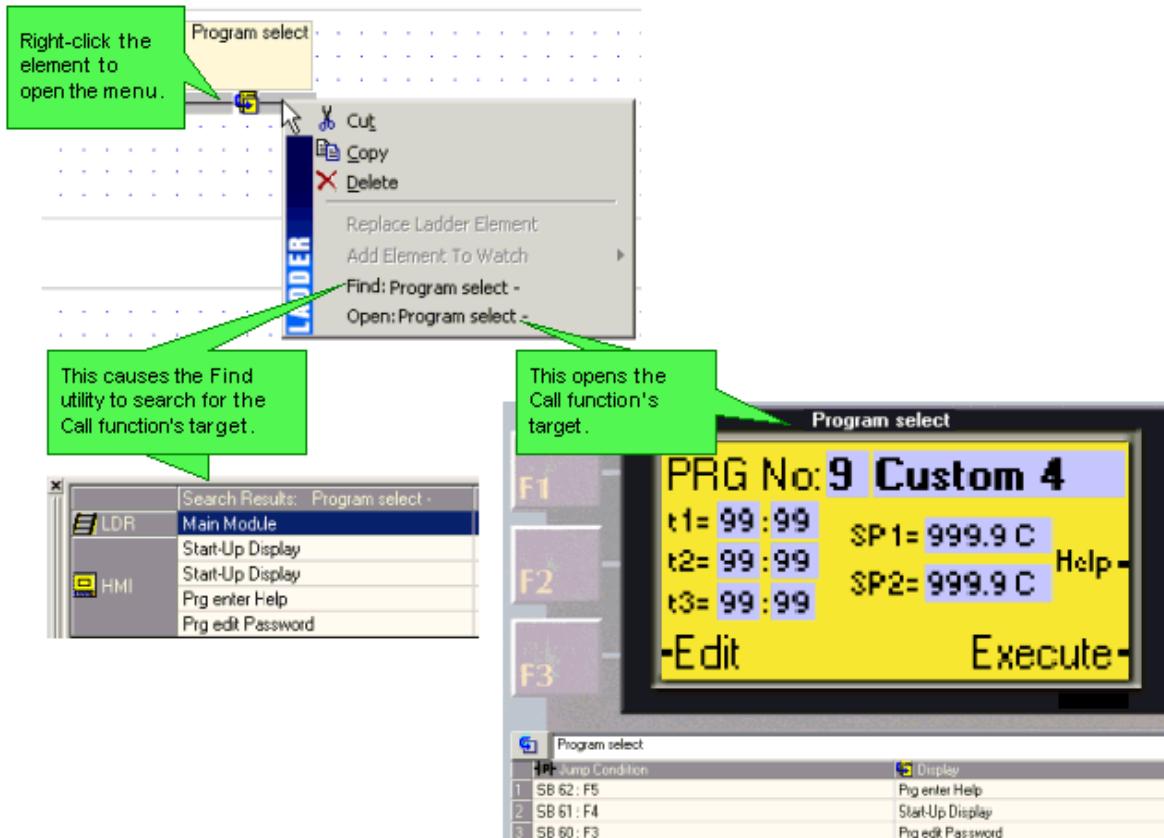
### Program Tree



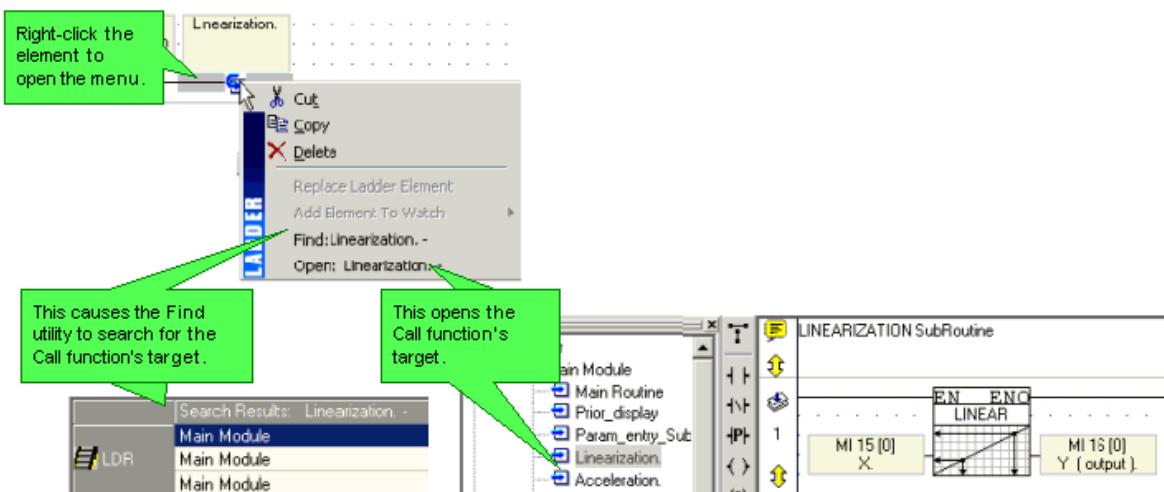
<b>Note •</b>	Within the program tree, elements are presented alphabetically. This does not affect the order in which the program runs.
•	Ladder Modules and subroutines can be moved via drag-and-drop, as can HMI Modules and Displays. Again, moving elements does not affect the order in which they run.

The Main Ladder Module, Main Subroutine, Start-up HMI Module and the Start-up HMI Display cannot be moved via drag-and-drop or erased. For easy identification, they are always marked in orange.

### Accessing a Load Display Target

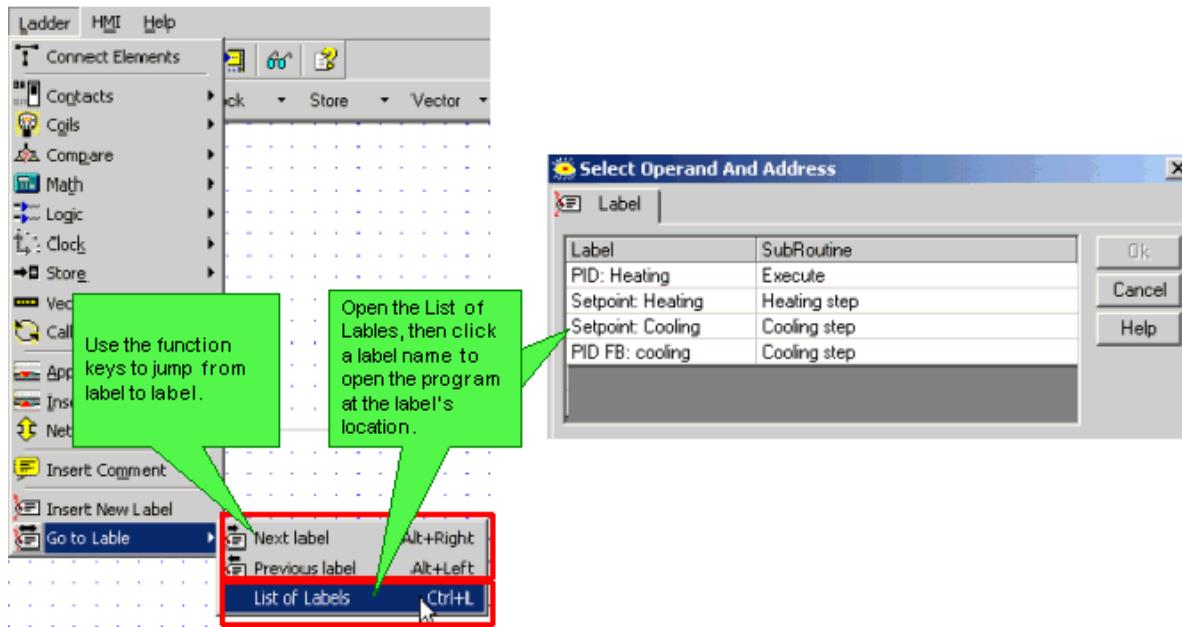


### Accessing a Call Subroutine Target



### Go To Label

Use labels as bookmarks to mark program sections, and then locate them using the Go To Label <Alt> + <Right/Left arrow> and List of Labels <Ctrl> + <L> utility.



The Find utility also enables you to easily locate, directly open, and edit most program elements.

In addition, shortcut menus that are relevant can be opened.

## Operand View

Use the Operands tab in the Output Window to see if operands and I/Os are used in a program, assign power-up and preset values, view current values when you run Test mode, change formats, assign descriptions (symbols), and view and edit Watch Folders.

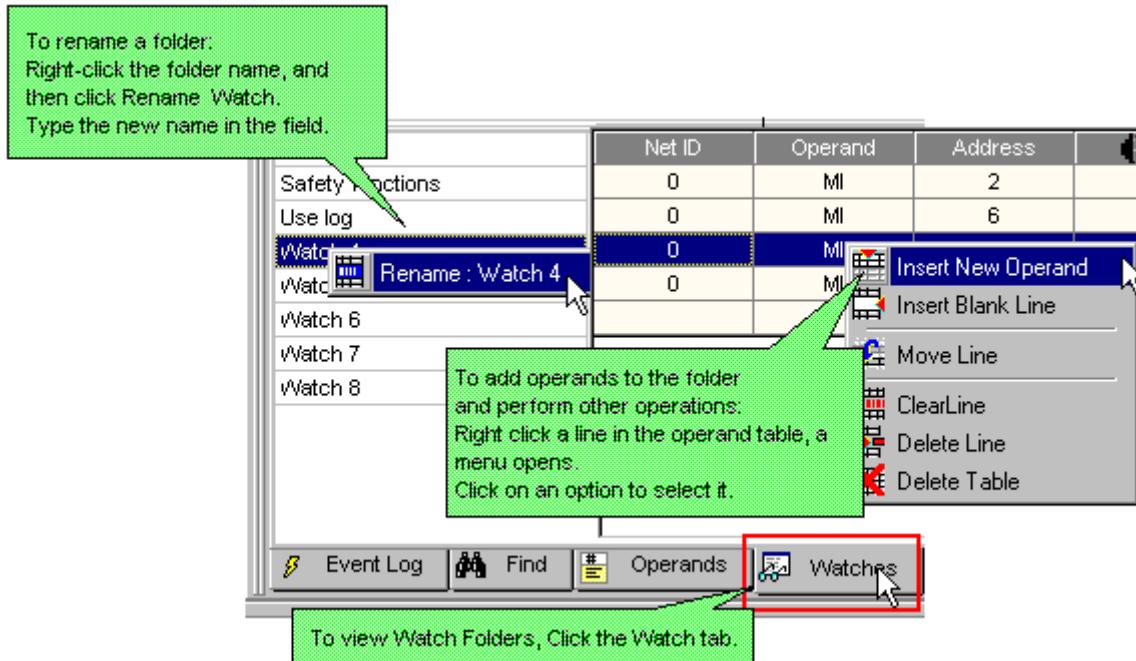
	Inputs	Operand	Address	In Use	Format	Description
0	Outputs	MI	1	<input checked="" type="checkbox"/>	DEC	Actual Temp in C
T	Timers	MI	2	<input checked="" type="checkbox"/>	DEC	Pwm PID heating output
MB	Memory Bits	MI	3	<input checked="" type="checkbox"/>	10	HSD Frequency
SB	System Bits	MI	4	<input checked="" type="checkbox"/>	DEC	Program No./List driver
MI	Memory Integer	MI	5	<input checked="" type="checkbox"/>	DEC	Program data pointer

## Watch Folders

Watch Folders enable you to:

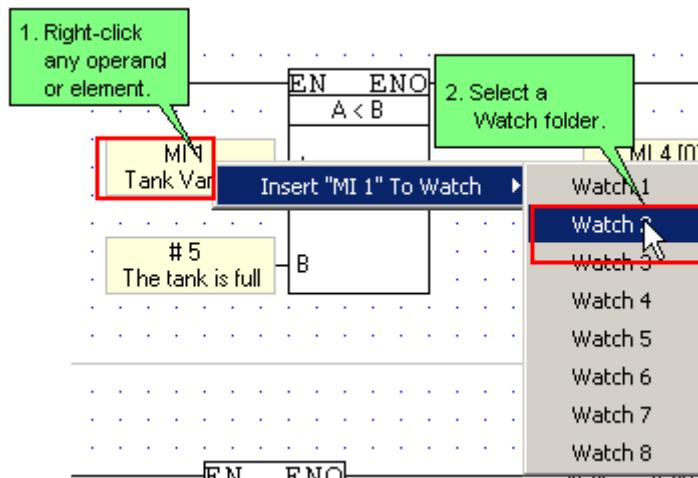
- Arrange related groups of operands in folders.
- Name the folders.
- View these operands in the tabbed Output Window at the bottom of the screen.

To view a Watch folder, click the Watches tab at the bottom of the screen, then select the desired folder. Edit the folder by right-clicking a line, then selecting the appropriate function.

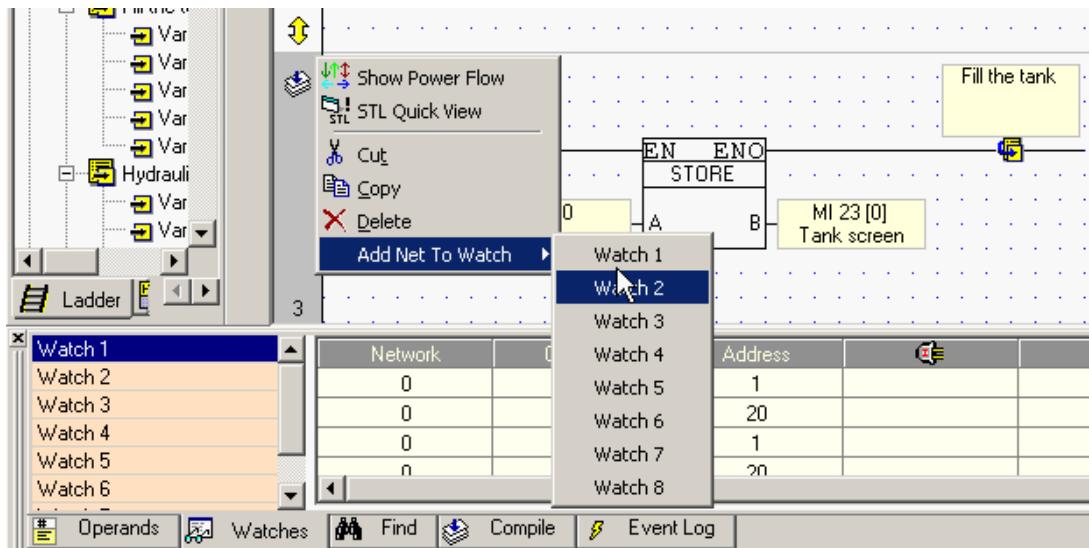


### Adding Operands to a Watch Folder from a net

- To add a single operand to a Watch folder, right-click it in the Ladder or in the Operand Output Window.



- To add all of the operands within a net to a Watch folder, right-click the right-hand rail of the desired net.



## Protecting Subroutines

You can create a Ladder Password, then apply it to protect multiple subroutines. When a subroutine is protected, a user cannot export/import it. In addition, the user cannot open, copy, or print it without supplying the password.

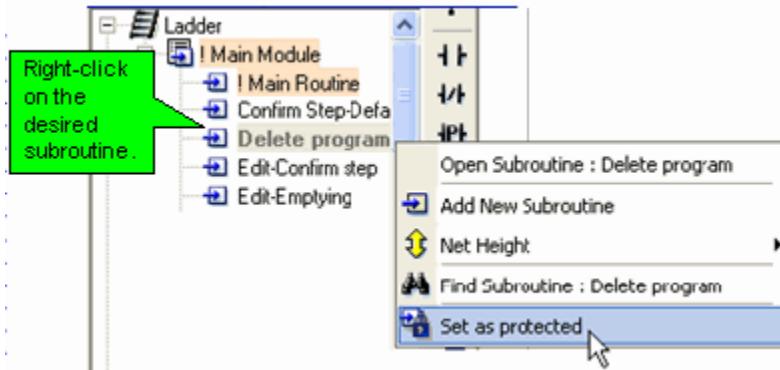
### Creating and Using a Password

- To create a password, select File>Set Ladder Password; then fill in the password field.



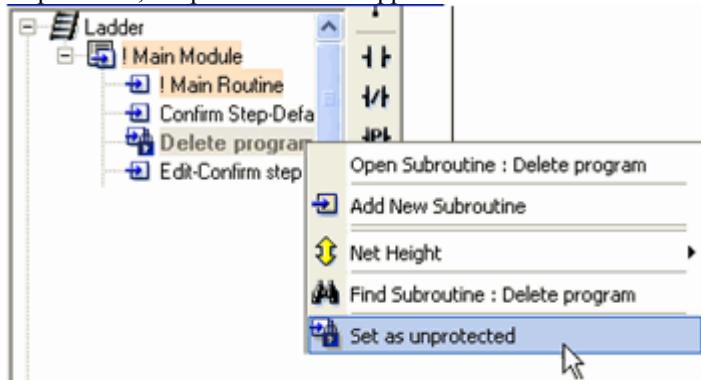
- To apply the password to a subroutine, right-click the subroutine's name in the Project Navigation window, then select Set as Protected; a small padlock icon is displayed next to the subroutine's name.

You can also right-click a module's name and select Protect All Subroutines in Module.



**Note •** Protection is applied after VisiLogic (not just the project) is closed and reopened.

3. To remove protection from a subroutine, right-click the protected subroutine's name, then select Set AS Unprotected; the padlock icon disappears.



You can remove protection from a module in the same way.



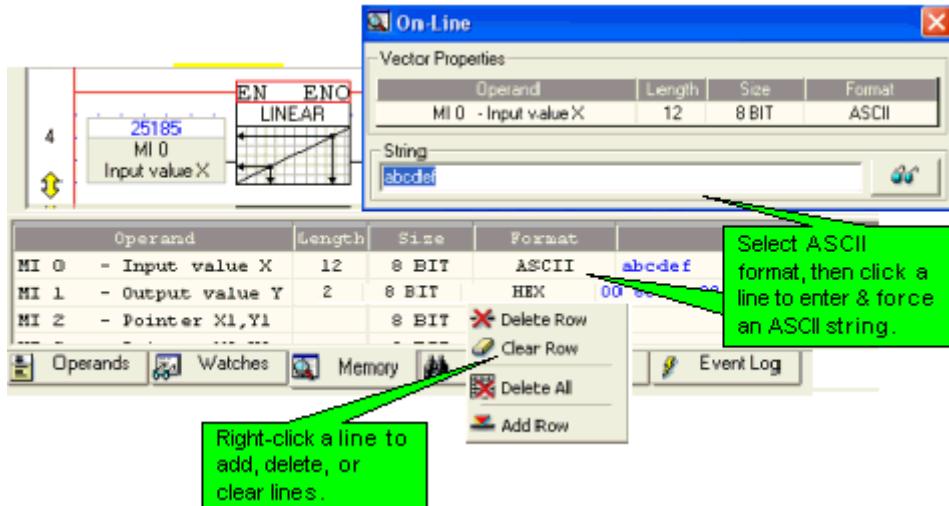
**Note •** The same password may be used for different projects.

### Deleting a Ladder Password

1. To delete a Ladder password from a project, select File>Unset Ladder Password.

### Memory Tab

Memory enables you to view a vector according to the length you set and in the format you desire. When ASCII is the selected format, you can click a line and force a string to the vector.



## Find (& Replace)

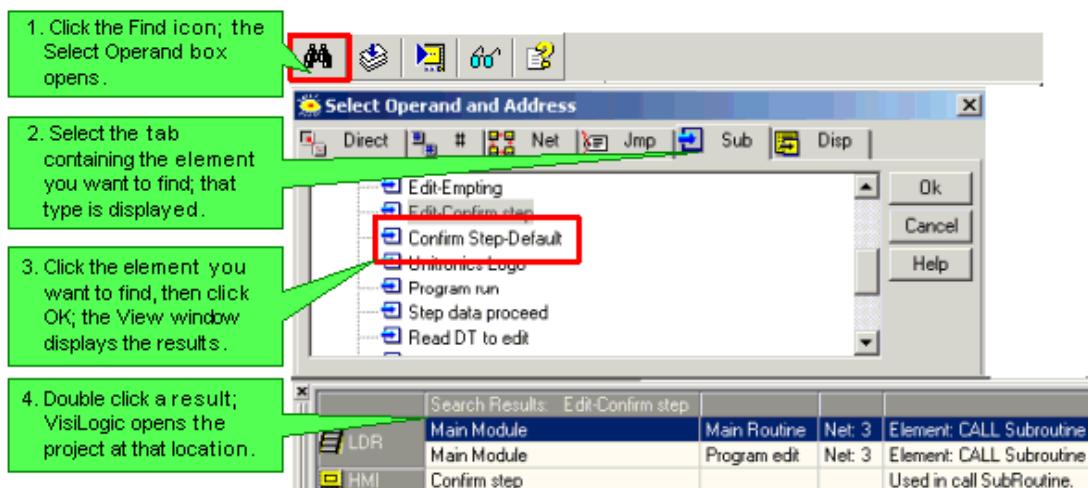
Highlight an operand or Ladder Element and press  $<\text{Ctrl}> + <\text{F}>$ ; the results will be displayed in the Output window at the bottom of the screen. Highlighting a function and pressing  $<\text{Ctrl}> + <\text{F}>$  will open a dialog box, enabling you to select the desired operand.

In addition, right-clicking most program elements will display the Find button.

In addition, VisiLogic offers the following Find functions:

- **Find**

Use Find to locate operands, labels, subroutines and Displays.



You can also right-click an element or subroutine to display the Find icon on the right-click menu.

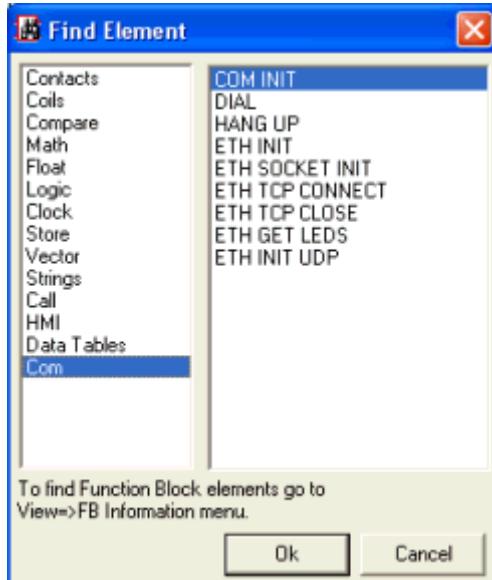
**Note •**

Labels: Clicking on a found 'Label' will list the Jump to Label linked to that label in the Output Window.

- **Find Element**

The Find Element utility enables you quickly locate any element that is used in a project.

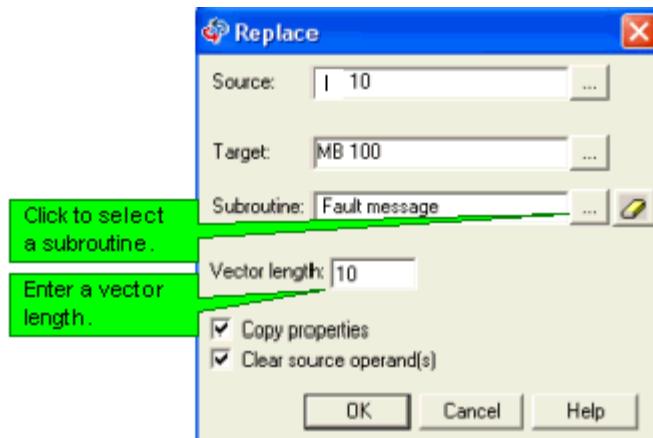
1. Select Find Element from the Edit menu; the utility opens.
2. Click the desired element type in the left pane, then select the element from the right and click OK.



- Find & Replace Operand

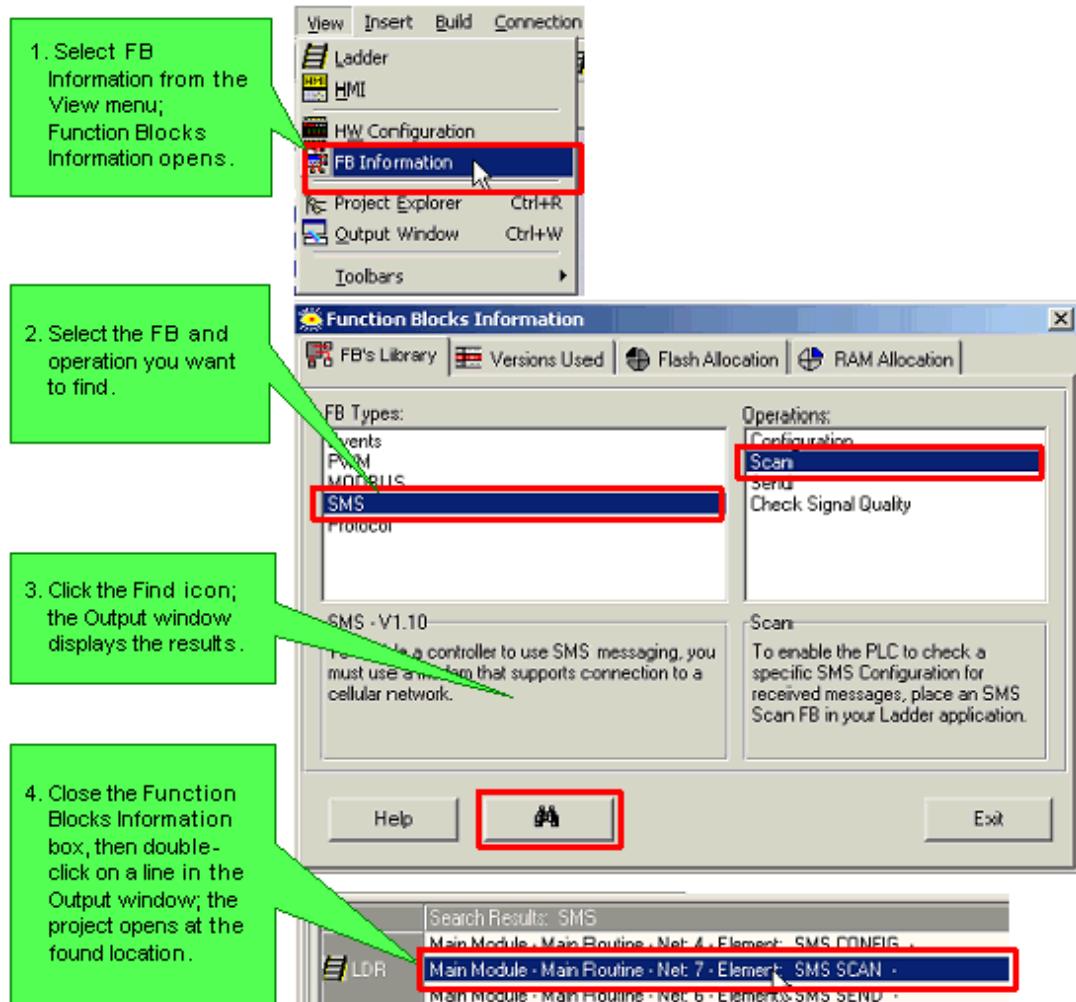
The Find & Replace Operand utility enables you quickly replace any operand or vector of operands that is used in a project.

1. Select Replace Operand from the Edit menu; the Replace utility opens.
2. The Select Operand box opens; select the Source and Target operands.
3. To restrict the Replace operation to a specific subroutine, click the Subroutine field to open the selection box, then click the desired subroutine.
4. To replace a vector, enter its length..
5. To copy the operand descriptions, power-up values, and formats, select Copy Properties; select Clear Source to remove these from the source operands.
6. Click OK; the operands are replaced.



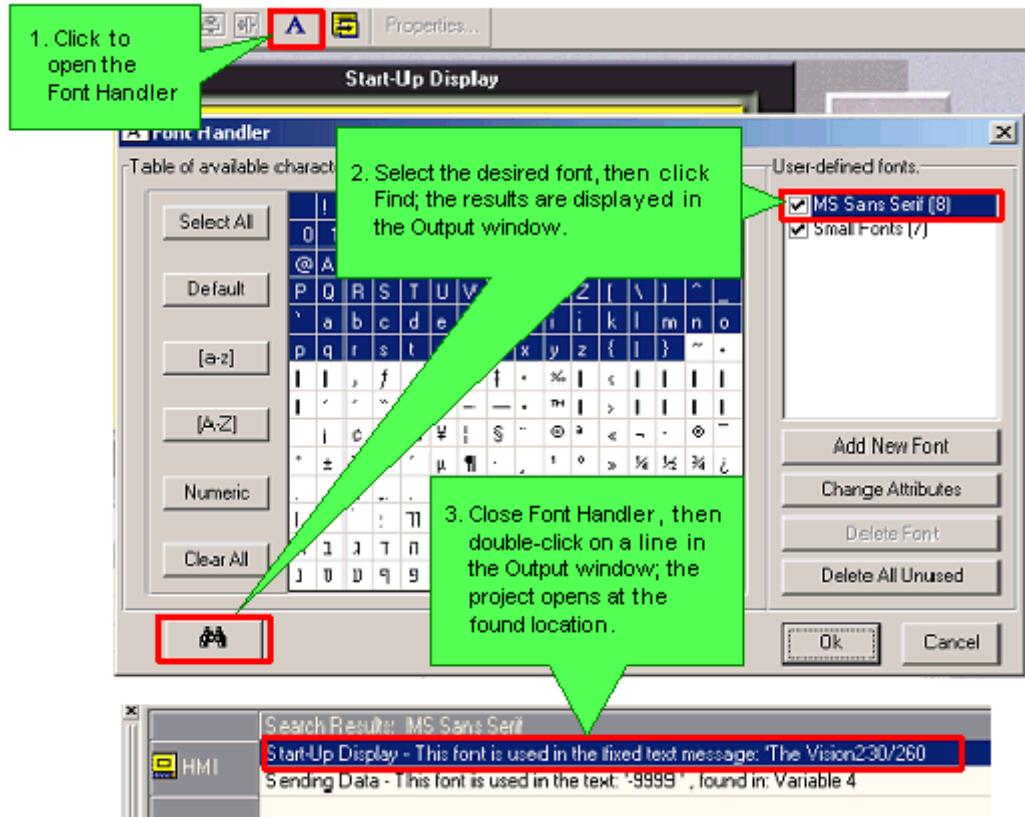
- Find FB

Find FB enables you to locate the FBs in your project.

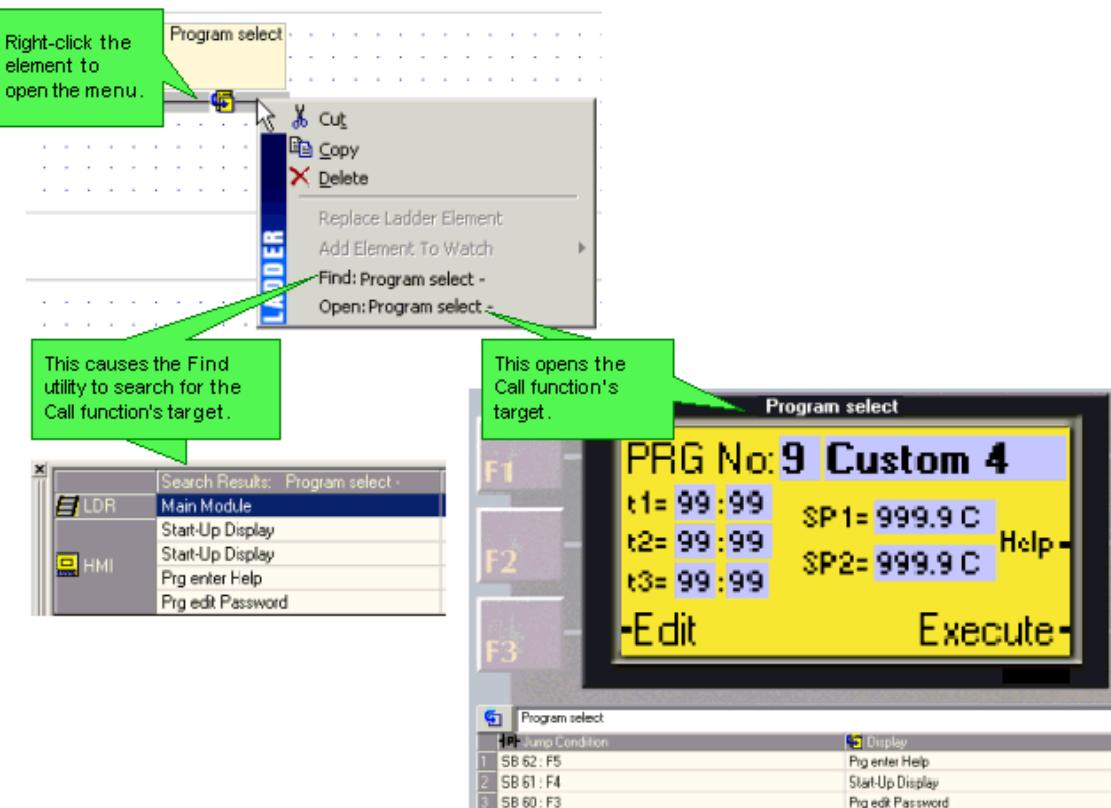


- Find Font

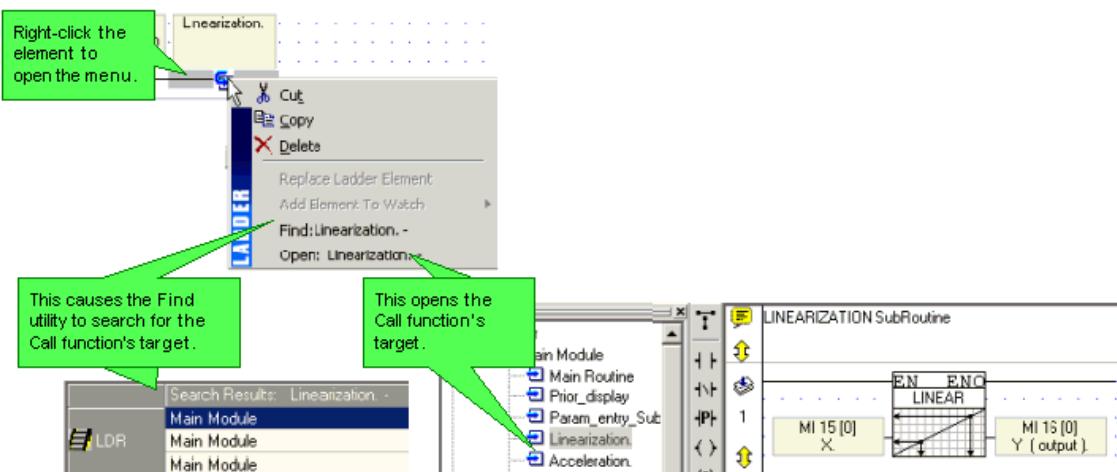
This enables you to find fonts used in HMI Displays.



- Finding a Load Display Target

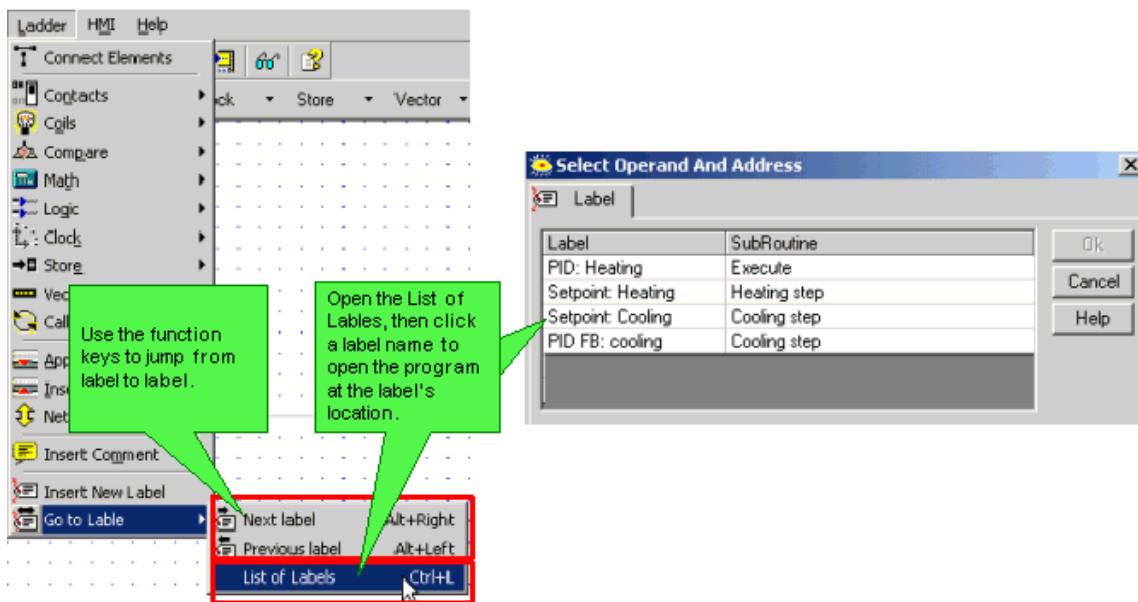


- Finding a Call Subroutine Target



- Go To Label

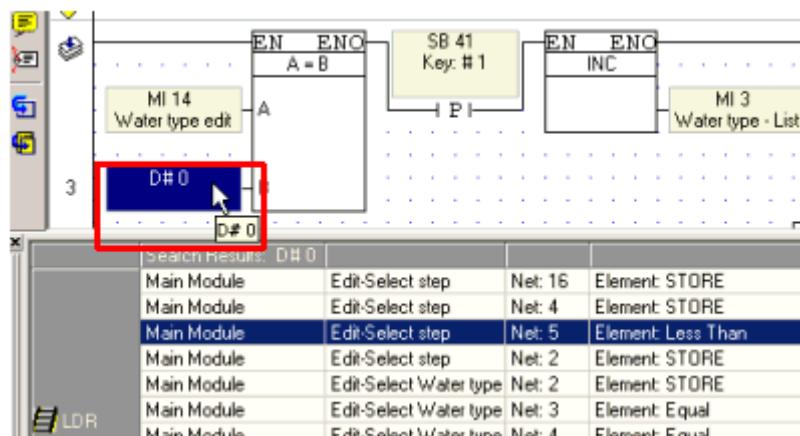
To find Labels, use Go To Label+<Right/Left arrow> and List of Labels <Ctrl> + <L> utility.



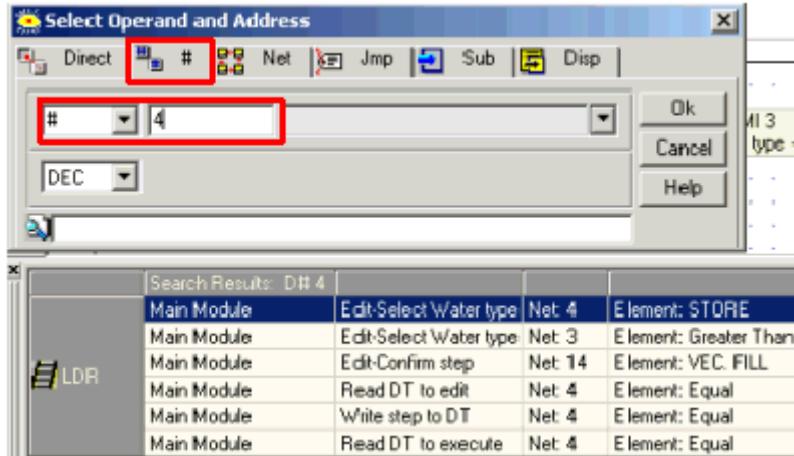
- Find Constant Value

To find Constant values, either:

- Click on the Constant, then press <Ctrl> + <F>; the results appear in the Output window.



- Start Find, select the Constant tab and enter the value, then press OK ; the results appear in the Output window.



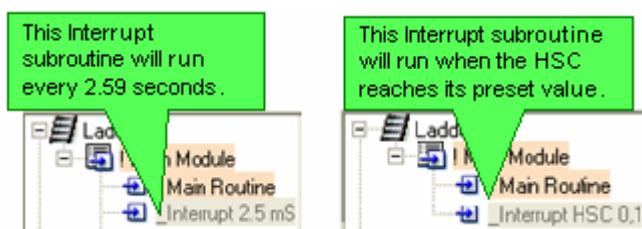
## Interrupt Routines

Interrupt routines cause:

- A program to stop immediately, whenever the interrupt is activated, even if the program is in the middle of scanning a net in another subroutine.
- A jump to the Interrupt subroutine. An Interrupt subroutine must have the exact name shown in the examples below.
- When the interrupt routine is finished, the program returns to where it was interrupted, and continues from that point until the next Interrupt arrives.

Interrupt routines are generally used with Immediate elements, for example to turn an output ON in case of an alarm or emergency. To call an interrupt routine:

- Include an Interrupt subroutine of the correct name in your program; the subroutine is executed automatically when the condition for calling it is filled.

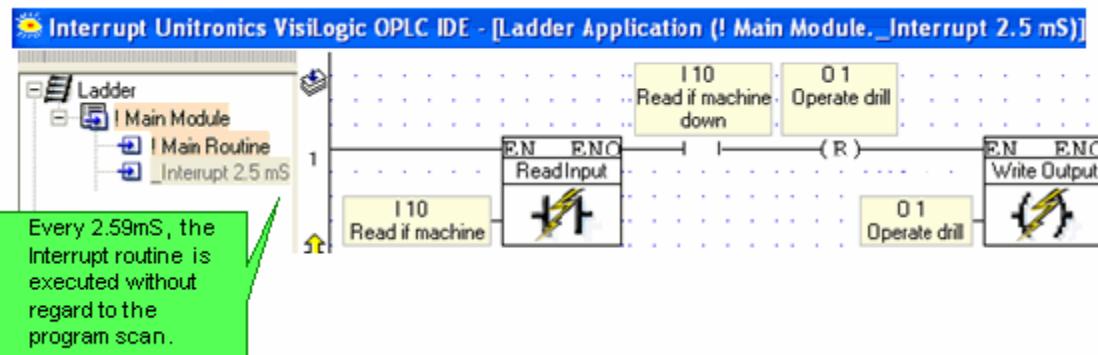


- Note •**
- If the name of the subroutine is incorrect, the subroutine will not function as an Interrupt routine.
  - Interrupt features are not supported by the V120-12 series.

Sample applications showing how to use Interrupt routines in conjunction with Immediate elements may be located in :::\ProgramFiles\Unitronics\VisiLogic\Examples.

### 2.5 mS Interrupt Routine

This function is timed-based. The interrupt function is called by naming a subroutine \_Interrupt 2.5 mS.



Including a \_Interrupt 2.5 mS subroutine in the Ladder application causes:

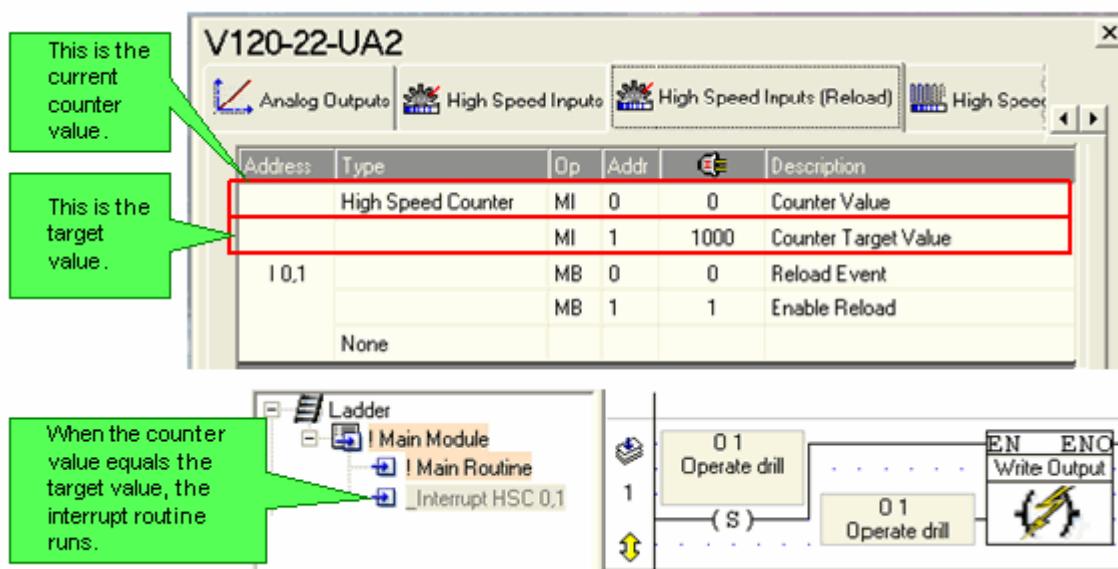
- The program scan to pause every 2.509 msec.
- A jump to the subroutine named \_Interrupt 2.5 mS. Note that the interrupt routine should be as short as possible, and must not exceed approximately 0.5 msec.

When the interrupt routine is finished, the program returns to where it was interrupted, and continues from that point until the next Interrupt arrives.

**Note •** The Subroutine \_Interrupt 2.5 mS will run for the first time after the first Ladder scan is run.

## Interrupt HSC

This function is called according to the current value of a high-speed counter. The program stops immediately and executes the subroutine when the Counter Value reaches the Counter Target Value.



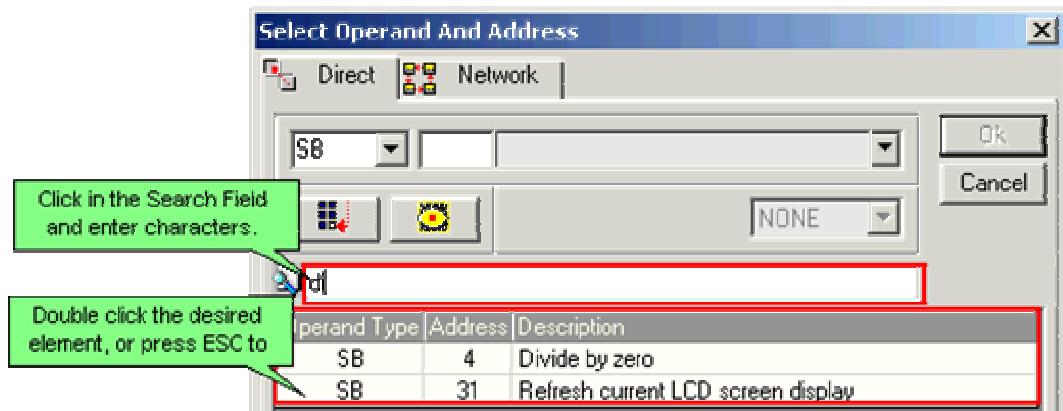
The interrupt function is included in the program by naming a subroutine \_Interrupt x,x where the first x is the high-speed counter, and the second x is the reload. These subroutines must be named in accordance with your Hardware Configuration as:

- \_Interrupt HSC 0,1
- \_Interrupt HSC 2,3
- \_Interrupt HSC 4,5

When the interrupt routine is finished, the program returns to where it was interrupted, and continues from that point until the next Interrupt arrives.

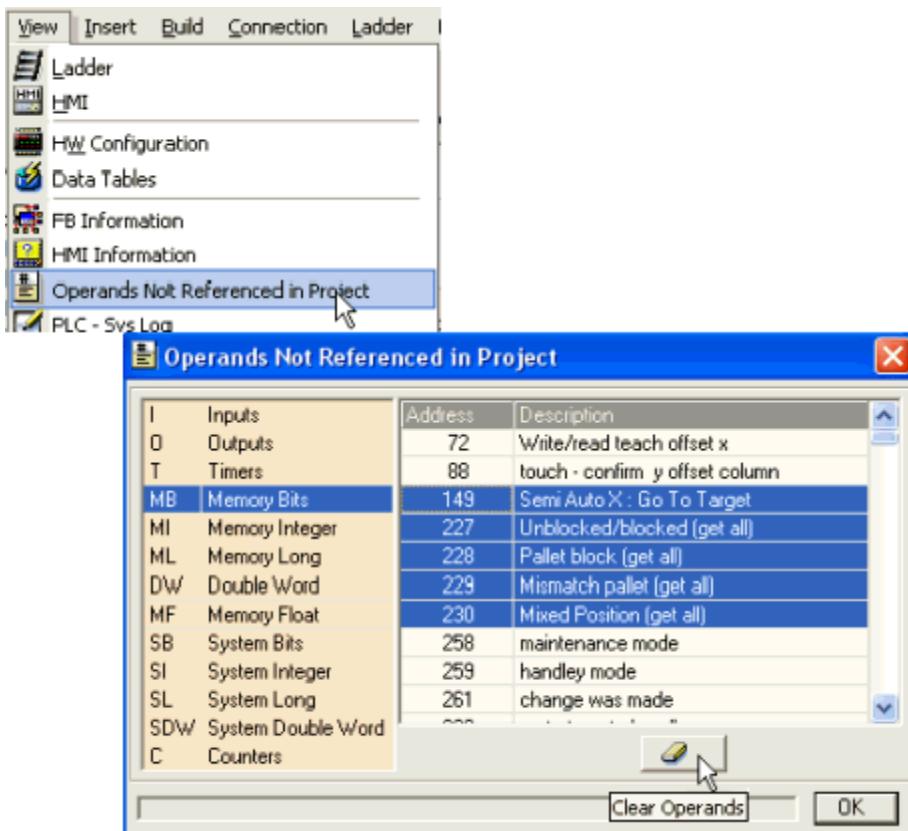
## Search: Symbolic Name

Use Search: Symbolic Name to find operands by description. Within the Select Operand box, this is activated via <Ctrl> + <L> .



## Deleted Unreferenced Operands

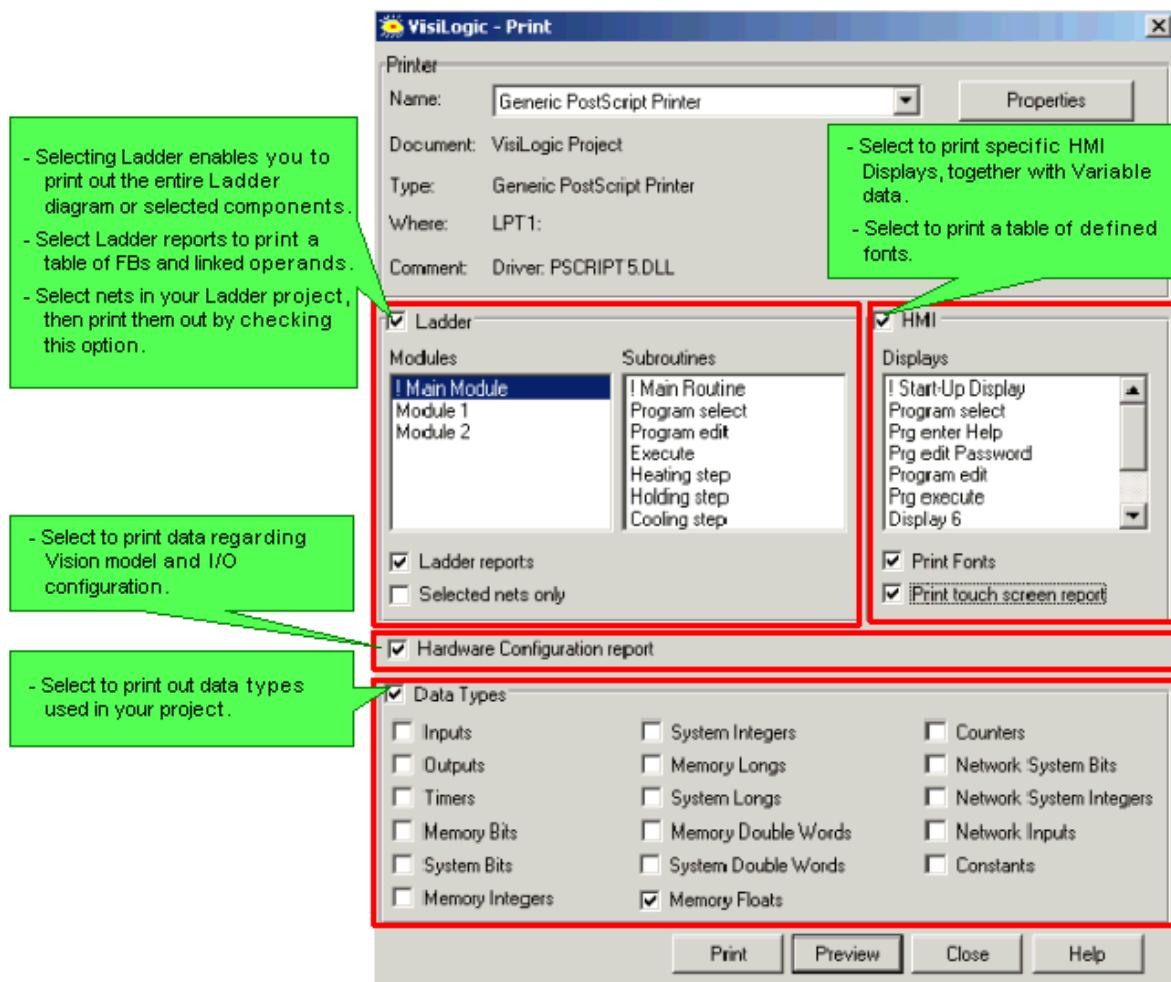
To help manage your project, you can delete unreferenced operands.



## Print Project

Print Project is located on the Project menu.

Via the Print dialog box, you can print various aspects of your project. Print Preview is also offered.



## Project Properties

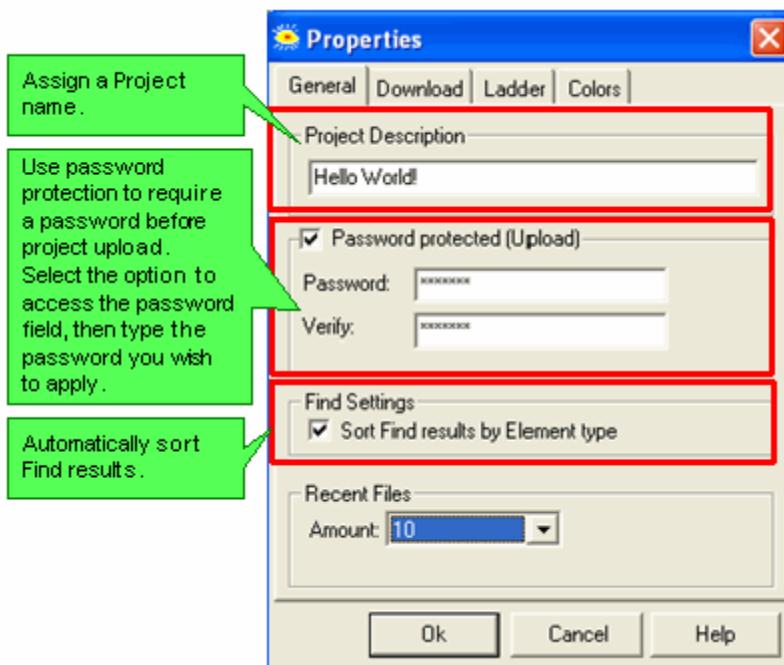
Located on the Project menu, Project Properties enables you to :

- Apply a password to your project.
- Select download options.
- Determine Live Update settings.

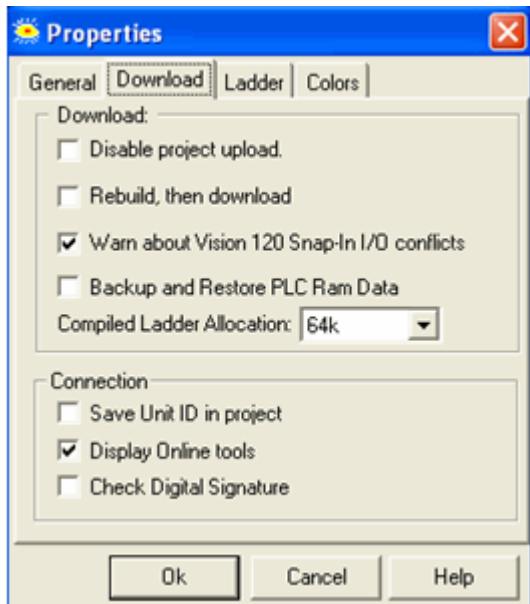
Set net height throughout a project.

1. Select Properties from the Project menu.
2. Click on the tabs to view and edit the various properties.

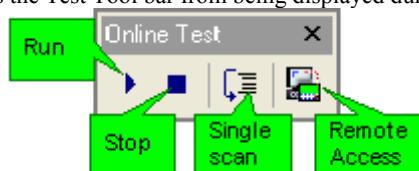
- General



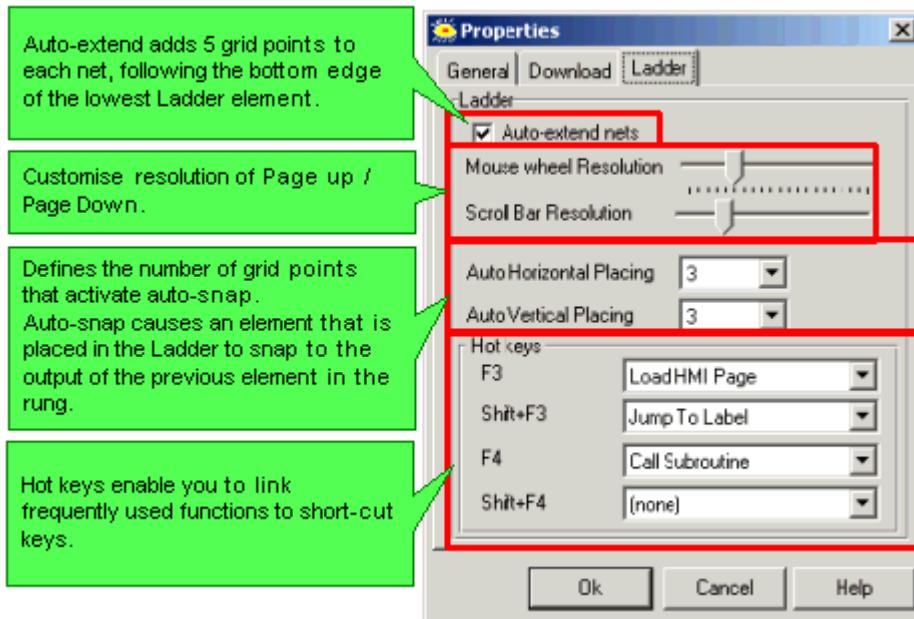
- Download



Parameters	Function
Disable Project upload	If you select this, no user will be able to upload the project from the PLC.
Rebuild, then Download	Select this if the project was originally created in another VisiLogic version.
Warn about Vision 120 Snap-in conflicts	If the Vision120 selected in Hardware Configuration is different from the one to which you are downloading, by default VisiLogic issues a warning. Select this option to disable such warnings.
Compiled Ladder	By default, the amount of memory allocated for the Ladder application in the PLC is 64k. If the

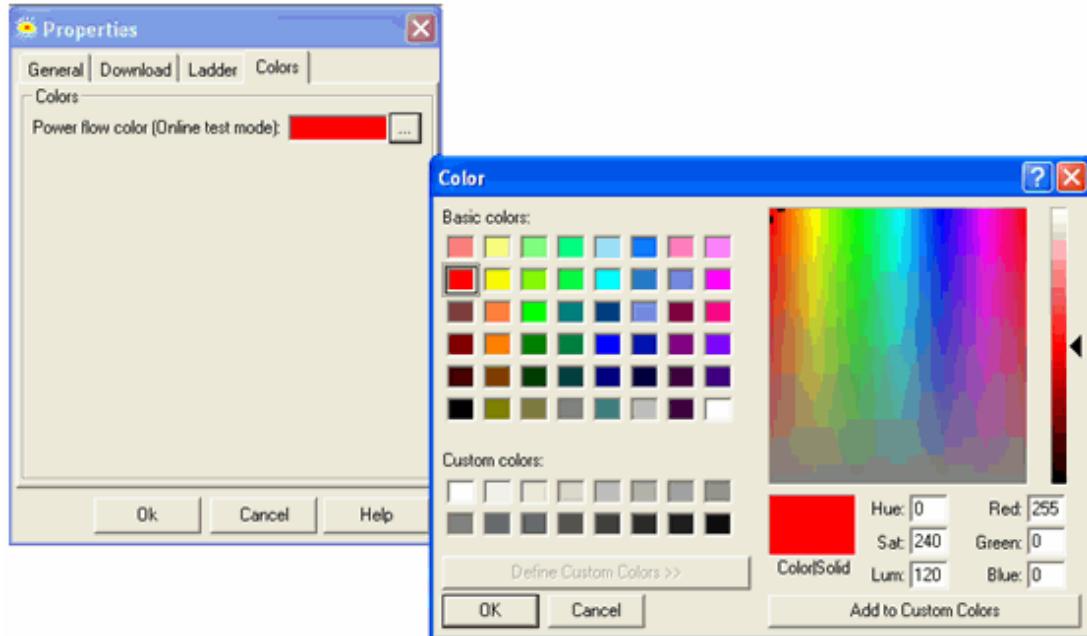
Allocation	application requires, you can select this option and enter a different amount.
Back up and Restore PLC RAM Data	<p>This enables you to backup a project together with all of the current values in Data Tables and all memory operand values.</p> <p>If this option is selected:</p> <ul style="list-style-type: none"> <li>At project upload, the PC will upload all of the current values in Data Tables and all operands--except for system operands. To back up system operand values, store them to memory operands.</li> <li>At project download, the PC will download the complete project, including all of the current values in Data Tables and all memory operands.</li> </ul> <p>Note that this option is not part of the project. Once selected, such files will be created for all of the projects downloaded from the PC--until it is deselected.</p>
Save Unit ID in Project	<p>When you select the Save Unit ID option, the ID number of the controller selected in Connection&gt;Communication &amp; OS&gt;Vision-PC Communication Settings is saved together with the project.</p> <p>You will not be able to download the project to another controller until the number is changed.</p>
Display OnLine Tools	<p>Keeps the Test Tool bar from being displayed during Test Mode.</p> 
Check Digital Signature	Select this to check the digital signature of the project in a PLC every time PC-PLC connection is established.

#### ■ Ladder



#### ■ Color

You can assign any color to show power flow during Test mode.

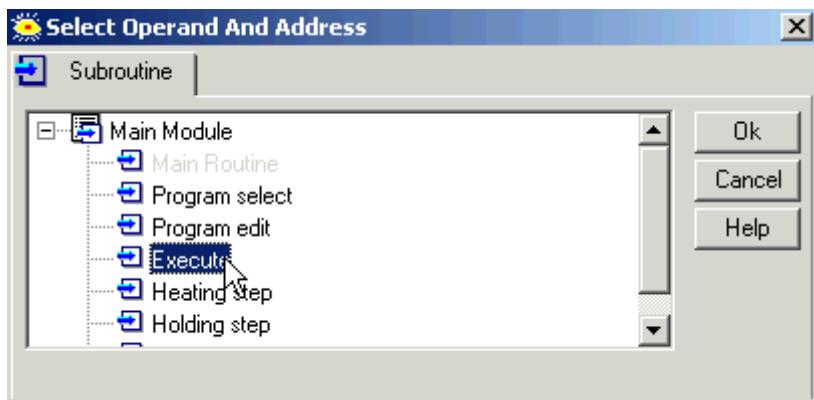


## Import/Export Subroutines

You can export Subroutines and save them as .vlx files, then import them into other projects. You can import/export single Subroutines, or all of the subroutines in a Module. Note that you cannot export Subroutines from the Main Module.

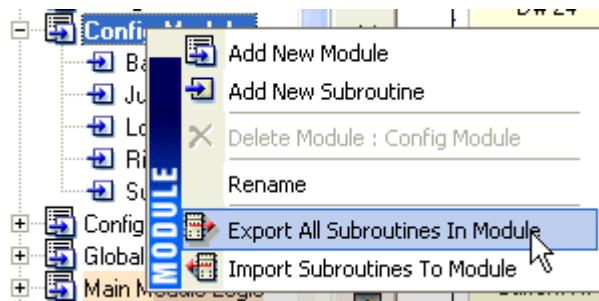
### Exporting a single Subroutine

1. Right-click the desired Subroutine and select Export Subroutine,  
-or-  
select Export Subroutine from the Project menu; the Select Subroutine box opens.
2. Select the desired subroutine, then save it to the desired folder.



### Exporting all of the Subroutines in a Module

1. Right-click the desired module and select Export All Subroutines.

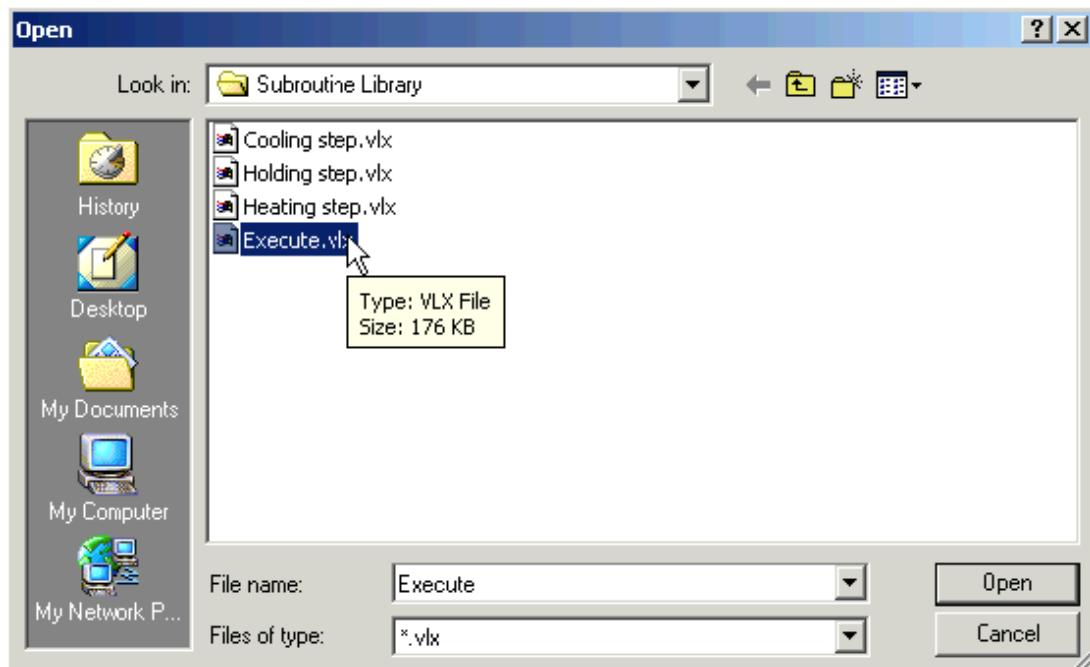


2. Save the .vlx file to the desired folder.

Note that when you import this .vlx file, all of the Subroutines it contains will be imported.

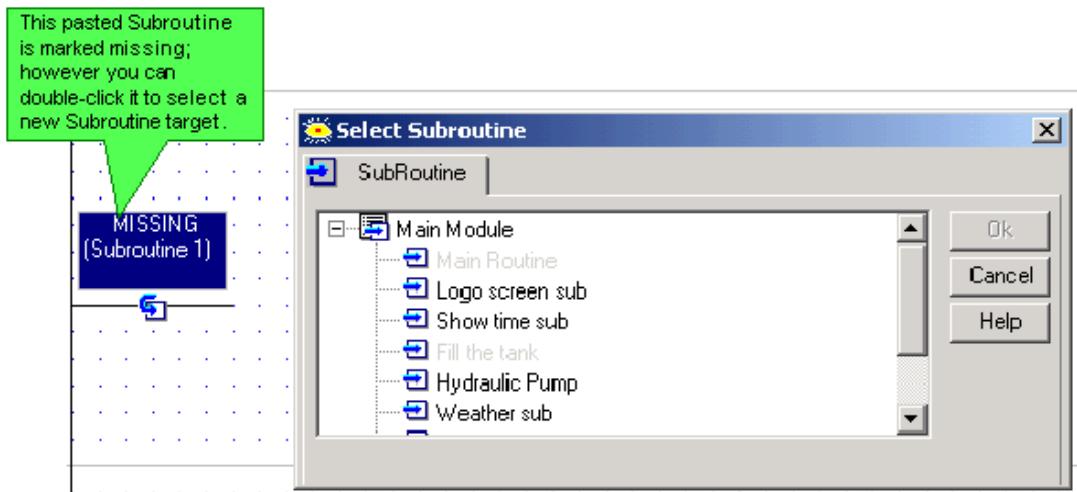
#### Import

1. Right-click a module name and select Import Subroutine,  
-or-
- Select Import Subroutine from the Project menu; the Open box appears.
2. Select the desired subroutine, then save it to the desired folder.

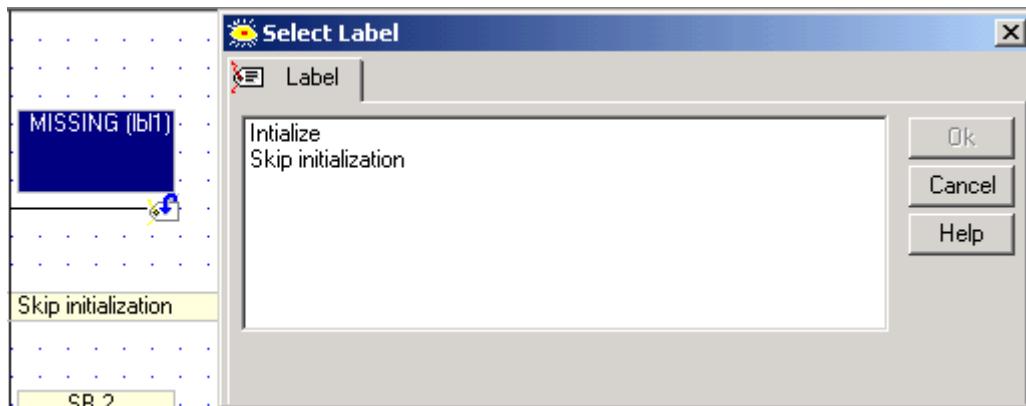


Import/Export is subject to the limitations below.

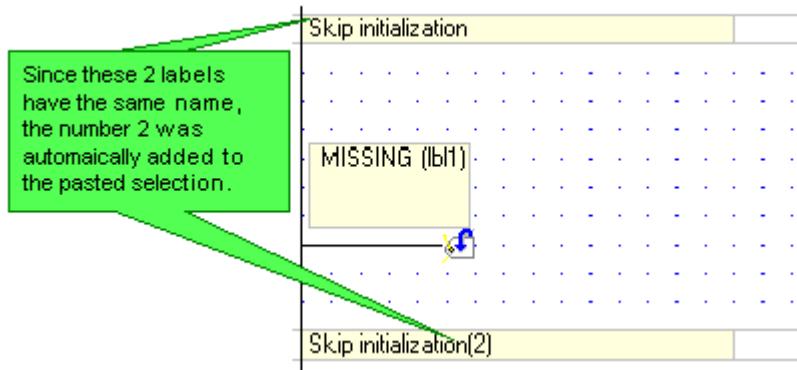
- If the source project contains Call Subroutine or Load HMI operations, note that the referenced elements will be marked as missing, even if the target project contains elements of the same name. Note that you can reassign the references.



- If the selection contains an FB operation related to an FB Configuration, and is imported into an application containing an FB Configuration of the same name, the links will be retained. If, for example, you export a subroutine containing an SMS Send FB linked to SMS Configuration 'Denmark' and then import this subroutine into another application containing an SMS Configuration 'Denmark', the SMS Send FB will automatically link to 'Denmark'.
- If the selection contains FBs, and no FBs of that type currently exist in the target project, the pasted FBs will be the version currently in VisiLogic FB library--in other words, if the source selection contains older FB versions, they are automatically updated during the Paste operation.
- If the selection contains FBs, and FBs of that type currently exist in the target project in a different version, Paste cannot be completed.
- If your selection contains only Jumps, without the attendant Labels, they will be marked as missing, even if the target project contains Labels of the same name. Note that you can reassign the references.



- If the selection contains Jumps and Labels with the same name as those in the target project, the Jump, Label and link between them will be automatically recreated by VisiLogic when they are pasted.
- In this way, VisiLogic maintains the integrity of the links between Jumps and their corresponding Labels.



- Note that the following symbols cannot be used in subroutine names:  
/\ | \* : ! " <>. When importing/exporting from older VisiLogic programs containing such symbols, they will be automatically replaced by underscore characters.

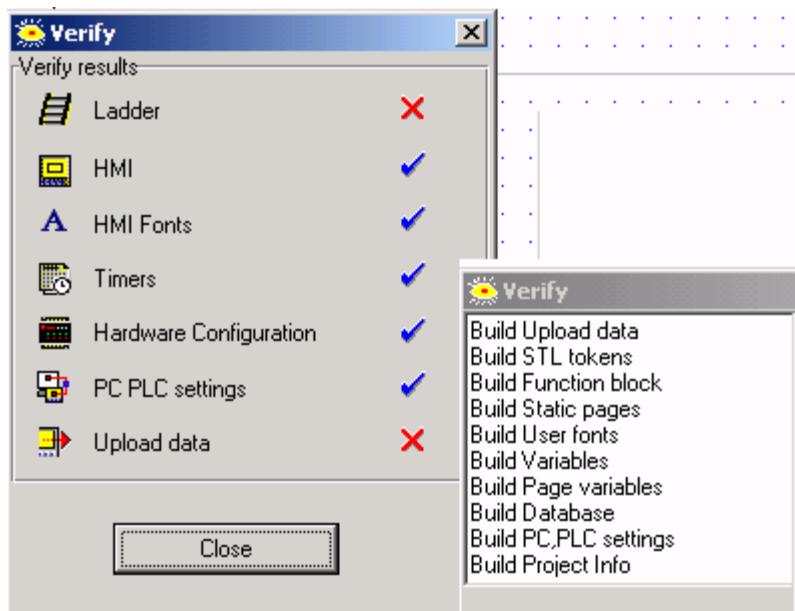
## Verify Project

The Verify utility shows the differences between the project open in your PC and the program currently installed in the controller.

To use Verify:

1. Connect your PC it to the controller using a program download cable
2. Select Verify from the Connection menu.

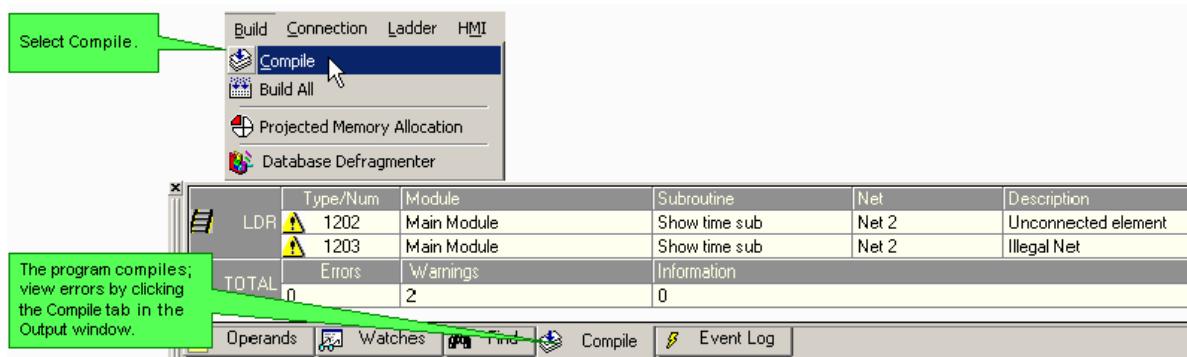
Verify marks different sections with an , as shown below.



## Compile

## Getting Started

When you compile your program, you can see any errors in the Output Window.



Clicking the Compile tab displays the last compiled results.

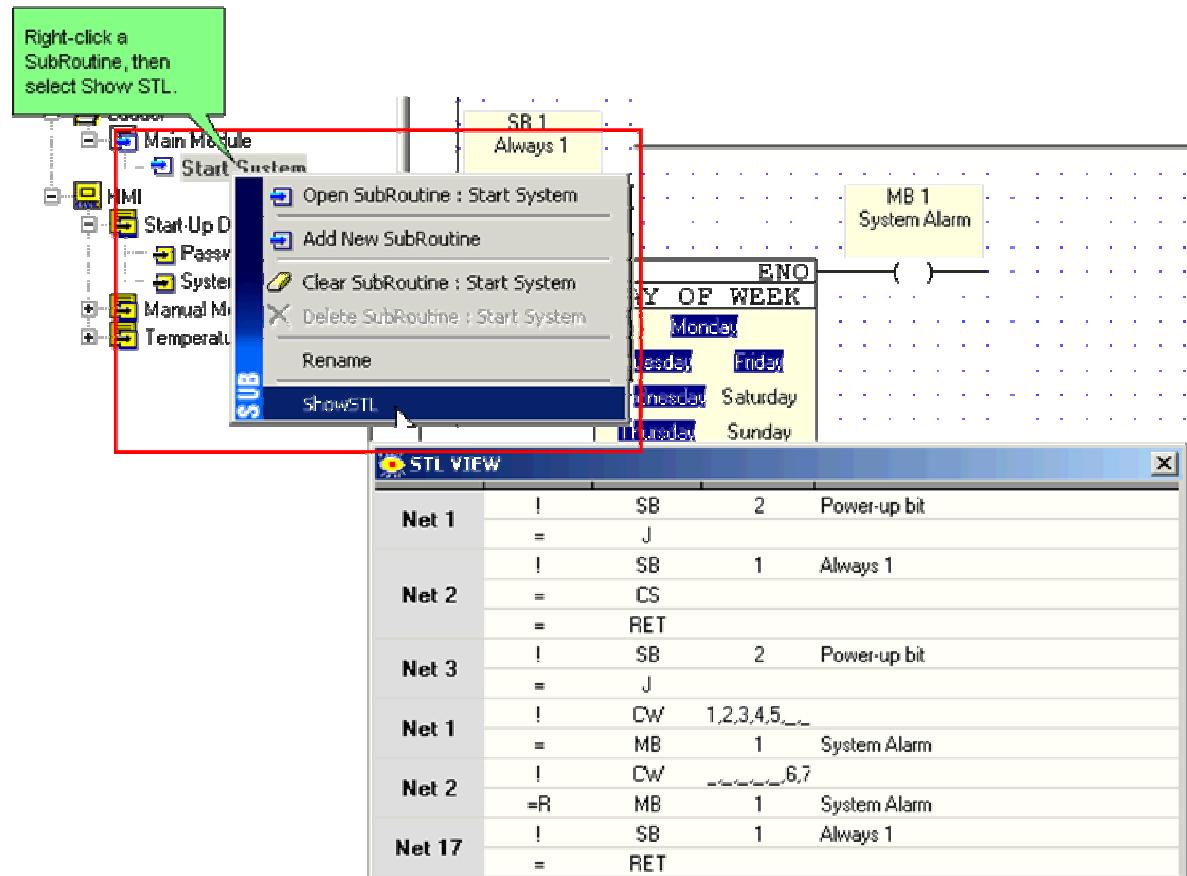
## Log

To view a log of events, click the Log tab at the bottom of the Output Window.

## Show STL

You can view STL code for a particular Subroutine, whether off-line or in Online Test mode.

To view STL online test values after downloading a project to a controller, open STL View, then press F9 to enter online test mode.



## Power-up Modes: Trouble-shooting

You can force the controller to boot up into Bootstrap or Stop mode by turning on the power supply while pressing specific keypad keys.

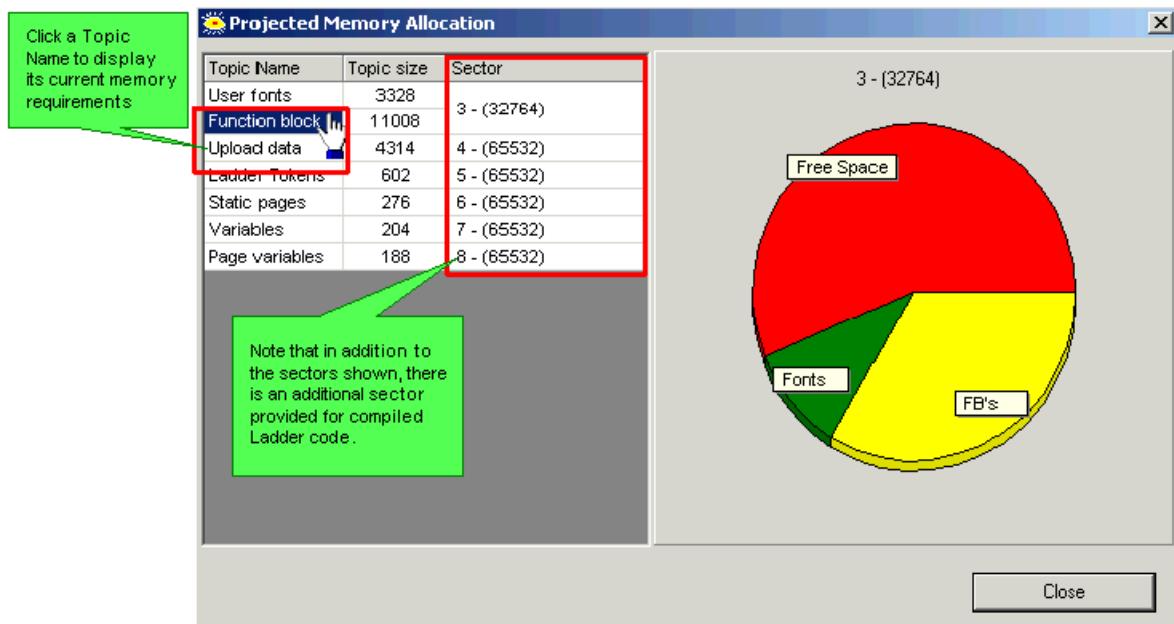
Mode	Features	Possible Actions	V120	V230/260	V280
Bootstrap	<ul style="list-style-type: none"> <li>The controller's LCD is on.</li> <li>PC-PLC communications are enabled, but PC must be connected to COM 1.</li> </ul>	Via Vision Communication PC Settings, you can: <ul style="list-style-type: none"> <li>Check which OS is currently installed in the controller.</li> <li>Download a new OS.</li> </ul>	<I> + <ESC>	<I> + <Right Arrow>	<I> + <Right Arrow>
Stop (O/S)	As in Bootstrap, but Info mode can be entered.	As above, but all Info mode actions are supported. Exit Stop Mode by entering Information Mode, and then selecting System>Working Mode> Reset.	<I>	<I>	<I>
Bootstrap, default LCD contrast		Contrast range is 0-100, this option automatically sets Contrast to 50.	<I> + <ESC> + <+/->		<I> + <Right Arrow> + <+/->
Stop (O/S, default LCD contrast		Contrast range is 0-100, this option sets Contrast to 50.	<I> + <+/->		<I> + <+/->

## Memory Allocation

You can check the flash memory requirements of a project via Projected Memory Allocation, which is located on the Build menu.

You can also view the current allocated flash memory of a controller via PLC Flash Memory Allocation, which is located on the Connection menu.

- Note •** Each topic may not exceed 64K.

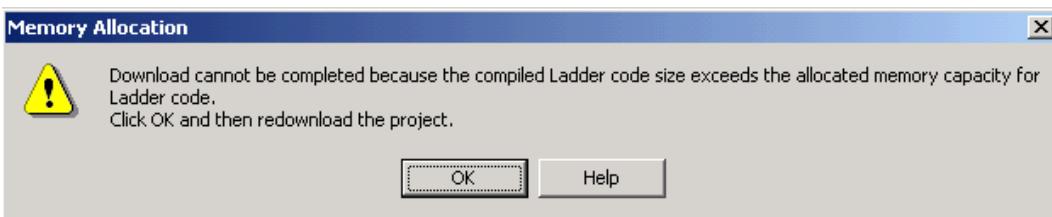


## Ladder Code Capacity

The table below shows how much memory is allocated for the Ladder code; note that an additional sector comprising double that amount is allocated for compiled Ladder code.

Controller Model	Ladder Code	Compiled Ladder Code	Total
V230, V260, V280	64K	128K	320K
V120	32K	64K	192K

During download, Ladder code is compiled into machine code. The compiled code may exceed the memory that is allocated for compiled Ladder code. If the allocated memory is exceeded, the message below will appear at download.



- Note •** If the second download attempt is not successful, the message will be displayed again. If this occurs, contact technical support.

## Hotkeys: Quick Editing

VisiLogic offers keyboard shortcuts for a number of tasks, including Ladder editing. You can also assign certain tasks to keys F3 and F4 via Program Properties.

**Note •** Selected Ladder elements can be moved within a net via the keyboard arrows.

Task		Hotkeys
Ladder  Pressing the appropriate key attaches the element to the cursor; click to drop it into the net.  Once a Ladder element is placed in the net, the user can type the operand name and number, for example SB41, and then press Enter.  Note• Selecting an element and pressing <Fn> attaches the new element to the one selected.	Insert Direct (N.O.) Contact	<F5>
	Insert Indirect N.C.) Contact	<F6>
	Insert Positive Transition Contact	<F7>
	Insert Negative Transition Contact	<F8>
	Insert Direct Coil	<Shift> + <F5>
	Insert Indirect Coil	<Shift> + <F6>
	Insert Set Coil	<Shift> + <F7>
	Insert Reset Coil	<Shift> + <F8>
Within Operand Address Box	Get Next Address	<Ctrl> + <N>
	Symbolic Search	<Ctrl> + <L>
	Toggle to Hex (when entering Constant value)	<Ctrl> + <H>
Go to Label  This enables to you skip from label to label. Note that labels can be used both as bookmarks as well as to cause program jumps.	Next Label	<Alt> + <Right Arrow>
	Previous Label	<Alt> + <Left Arrow>
	Open Label Navigation	<Alt> + <L>
Help	Open Help	<F1>

Project	New Project	<Ctrl> + <N>
	Open Project	<Ctrl> + <O>
	Print Project	<Ctrl> + <P>
	Exit Project	<Alt> + <Q>
Edit	Select All	<Ctrl> + <A>
	Find	<Ctrl> + <F>
View Toggles	Show/Hide Project Explorer	<Ctrl> + <R>
	Show/Hide Ladder	<Ctrl> + <Alt> + <L>
	Show/Hide HMI Display Editor	<Ctrl> + <Alt> + <H>
	Show/Hide Output Window	<Ctrl> + <W>
	Show/Hide Comments	<Alt> + <C>
Connection	Online Test	<F9>
	Download	<Ctrl> + <D>
	Upload	<Ctrl> + <U>
	Verify	<Ctrl> + <Y>
	Remote Access (During Online Test)	<Shift> + <F9>
HMI	Show Grid	<Ctrl> + <G>
	Zoom	<Ctrl> + <I>

# Data Tables

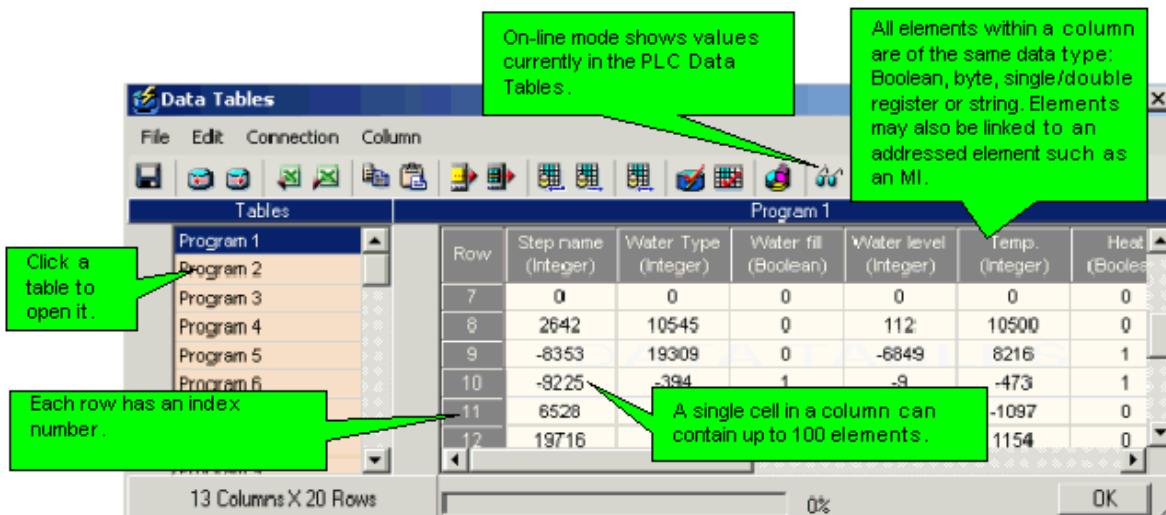
## About Data Tables

You can store data into the Data Table memory section of your controller, then access the data in accordance with program requirements. Vision controllers can contain up to 120K of Data Tables (RAM); Data Tables (that are marked Part of Project) can take up to 250K (Flash).

You create tables in VisiLogic, define their structure, then download them to the controller. Data within the tables can be copied and pasted to and from third-party tools such as Excel.

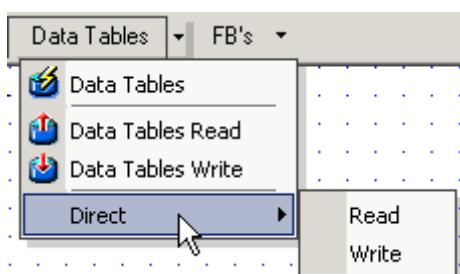
**Note •** Data Tables are based on bytes, not on registers.

Data tables consist of columns and rows.

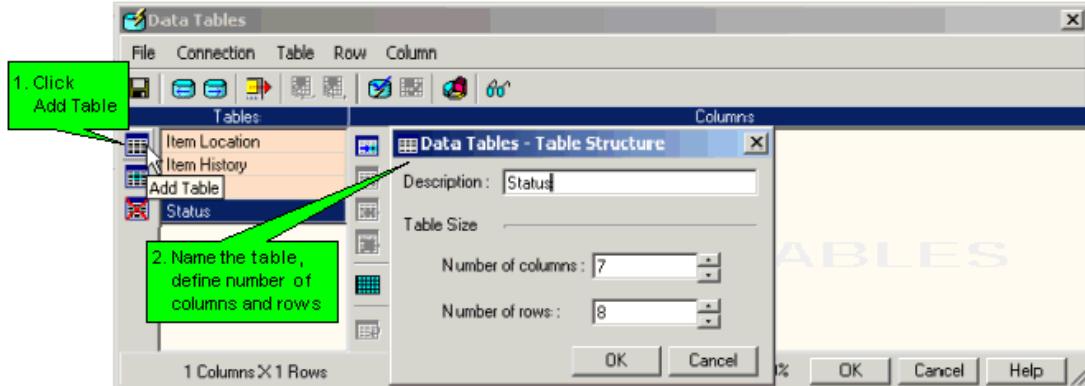


## Creating a Data Table

1. Open the Data Tables editor by clicking the PLC Data Tables icon on the toolbar, or by selecting it from the Data Tables menu.

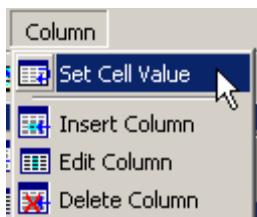


2. Create a table by clicking the Add Table icon, then name the table and define the number of columns and rows.



**Note •** The grid that appears represents only the table's column and row structure. Each column in the table can contain up to 100 elements, such as MIs.

3. Define a table's columns by selecting the column, then clicking the Edit button , or by right-clicking and selecting Edit from the Column menu.



### Data Table Options

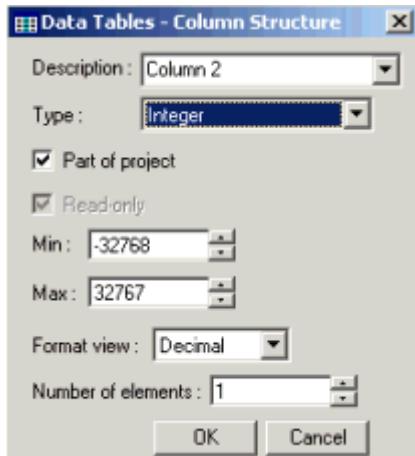
Menu Name	Option
<b>File</b>	<p><b>Import/Export</b> Data Tables can be exported from an application as .upd files, then imported into any VisiLogic program. When you import the file, you can select to:</p> <ul style="list-style-type: none"> <li>• Add individual tables to the structure. If tables of the same name already exist, the tables are automatically renamed.</li> <li>• Delete existing tables and import the new structure.</li> </ul> <p><b>Memory Requirements</b> Displays pie charts that show the amount of memory that will be required by the data tables when the project is downloaded.</p>
<b>Connection</b>	<p>All of the Connection commands require that the PLC be connected to the PC.</p> <p><b>Read Structure from PLC</b> Imports the structure of the data tables within the PLC into the project.</p> <p><b>Verify: Tables Structure</b> Compares the table structure in the project to the structure of tables within the PLC.</p> <p>The commands below also require that the table structure in the PLC be identical with the table structure in the current project.</p> <p><b>Read Range</b> Reads the values of the selected cells from within the PLC data table into the project.</p> <p><b>Write Range</b> Writes the values of the selected cells from the project data table into the PLC.</p> <p><b>Verify Cell Value: by Range</b></p>

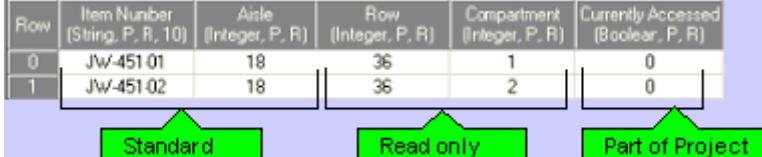
	Compares the values of the cells in the project to the values within the PLC.
<b>Table</b>	<p><b>Table options have short-cut buttons on the left side of the Tables pane. Right-clicking the pane also opens the Table menu.</b></p> <p><b>Add Table</b> Adds a new data table.</p> <p><b>Edit Table</b> Enables you to change the name of the data table and the number of rows and columns.</p> <p><b>Delete Table</b> Deletes the entire table, both values and structure.</p> <p><b>Duplicate Table</b> Creates a new table, including both the values and the structure of the table being duplicated.</p> <p><b>Select All</b> Selects the entire table.</p>
<b>Row</b>	<p><b>Edit Number of Rows</b> Enables you to change the name of the data table and the number of rows and columns.</p> <p><b>Insert Row</b> Enables you to insert a row at any point in the table.</p> <p><b>Delete Row</b> Enables you to delete a row from any point in the table.</p> <p><b>Note •</b> Inserting or deleting a row changes the index number of all successive rows; impacting your data operations.</p>
<b>Column</b>	<p><b>Set Cell Value</b> Enables you to enter values for a cell or range of cells within a column.</p> <p><b>Insert Column</b> Inserts a column.</p> <p><b>Edit Column</b> Enables you to name the column, set a data type for the entire column, define the number of elements held by each cell in the column and make other selections based on the data type that has been assigned to the column.</p> <p><b>Delete Column</b> Deletes a column.</p>

## Column Parameters

The column structure options change according to the data type selected.

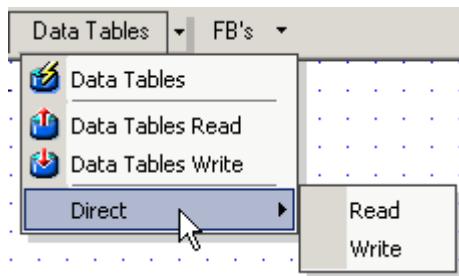
## Getting Started



Parameter	Function
Description	Assign a unique name.
Type	A column is assigned to the data type selected. Data types may be directly assigned, or linked via address.
Part of Project, Read-only	Protects the marked data from being modified by unauthorized third-party tools. Recommended column order 
Min/Max	Enables you to set limits for the value of an element in the column.
Format View	Choose between decimal and hexadecimal.
Number of elements	A column can contain a maximum of 100 elements.

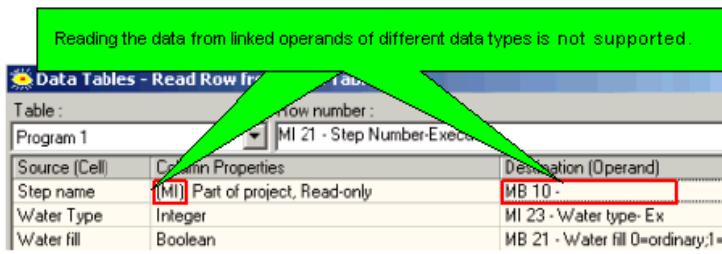
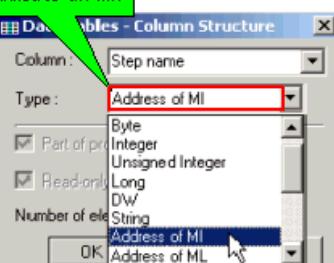
## Database-Read/Write

Read/Write functions enable you to copy a row of values from and to Data Tables. They are located on the Data Tables menu.



- Notes •** Reading/Writing data from linked operands of different data types is not supported.

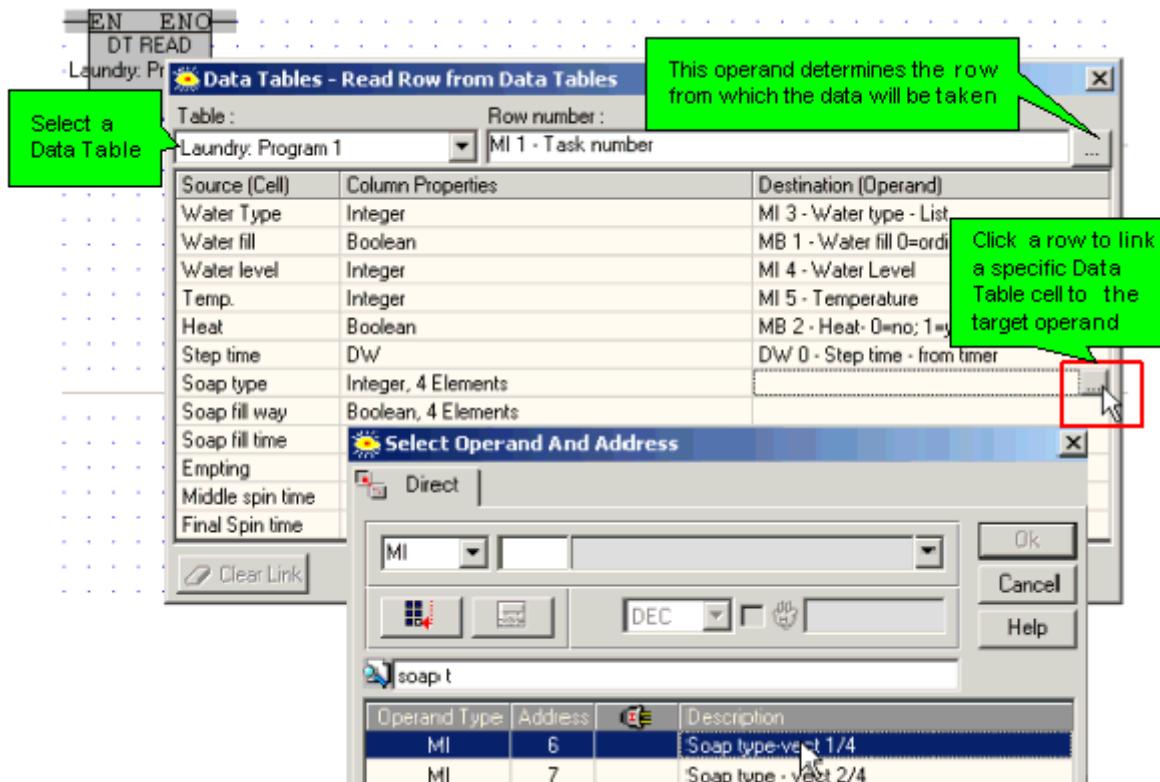
The column is linked to an MI.



- If the source operands are single registers, and the destination registers are double registers, the 2 LSBs of the double registers will contain the value. For example, the values in 10 MIs will occupy the 2 lower bytes of 20 MLs.  
If the source registers are double registers and the destination operands are single registers, the values will be truncated. The 2 MSBs will be discarded, and the 2 LSBs saved.
- The maximum number of operands of any type for a Read/Write operation is 128.

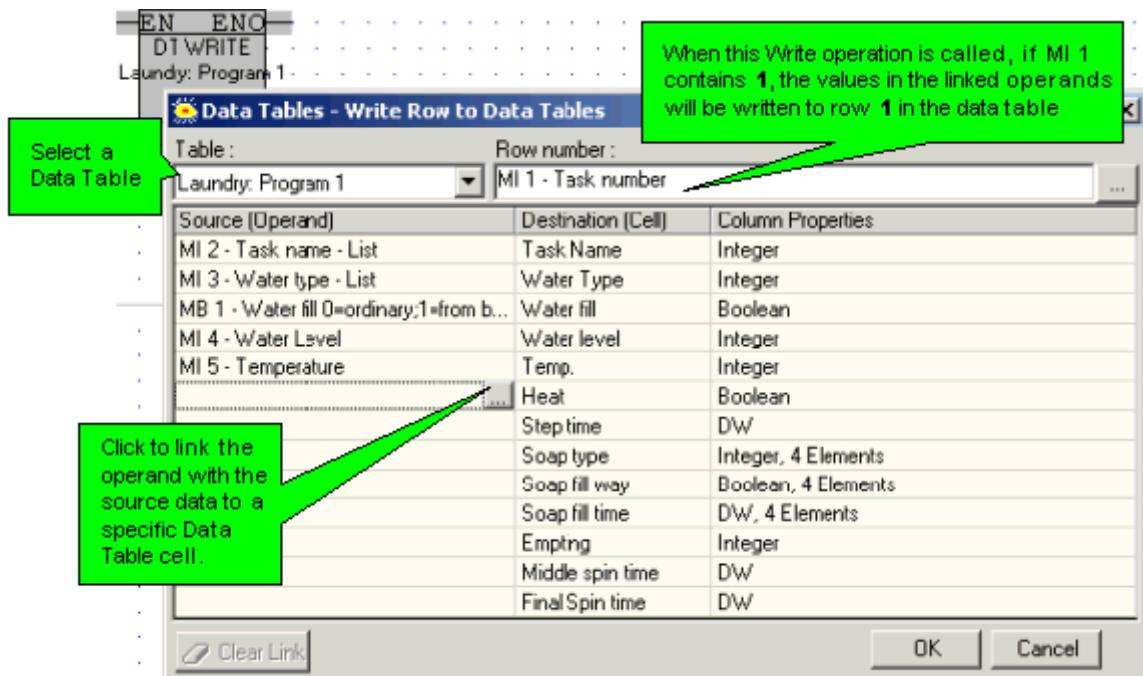
## Read Row

A row in a Data Table is the source for the Read function. Values are read from the Data Table into the operands that are linked to it in the Read function.



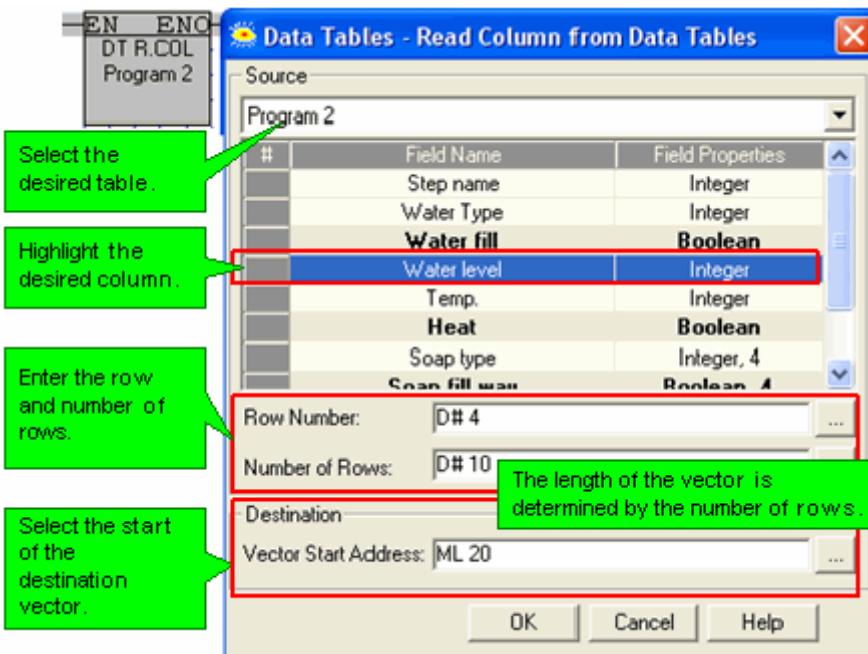
## Write Row

Operands within the PLC memory are the source for the Read function. Values are read from the PLC into the Data Table cells that are linked to it in the Write function.



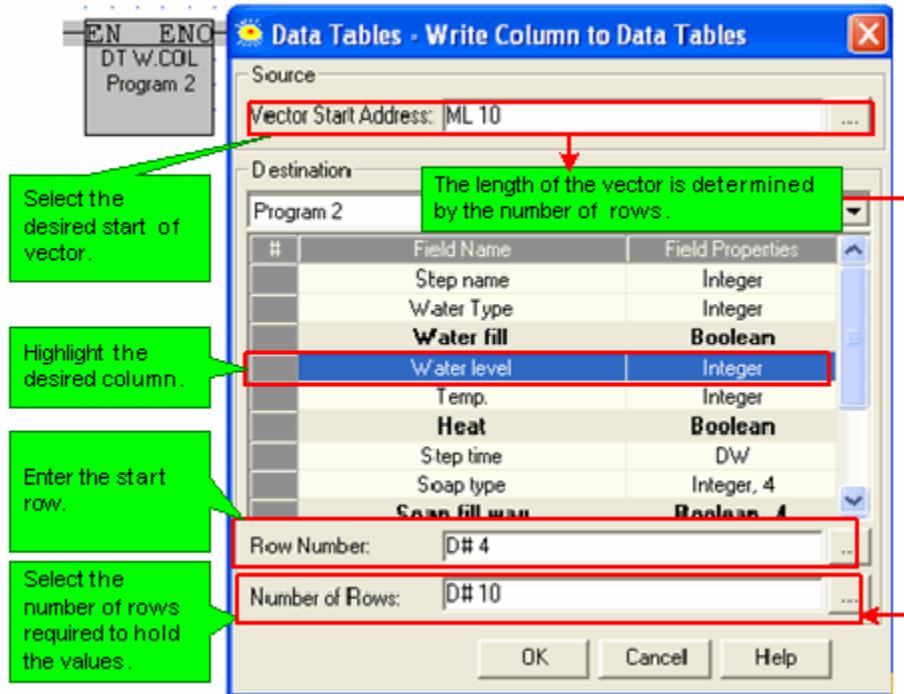
## Read Column

A column in a Data Table is the source for the Read function. Values are read from the Data Table into the operands that are linked to it in the Read function.



## Write Column

PLC operands are the source for the Write function. Values are read into the Data Table cells that are linked to it in the Write function.



## Read/Write Direct

These operations access the values in the database without reference to table structure

### Database: Read Direct

The Read Direct operation copies data from the data tables into a vector of registers within the controller.

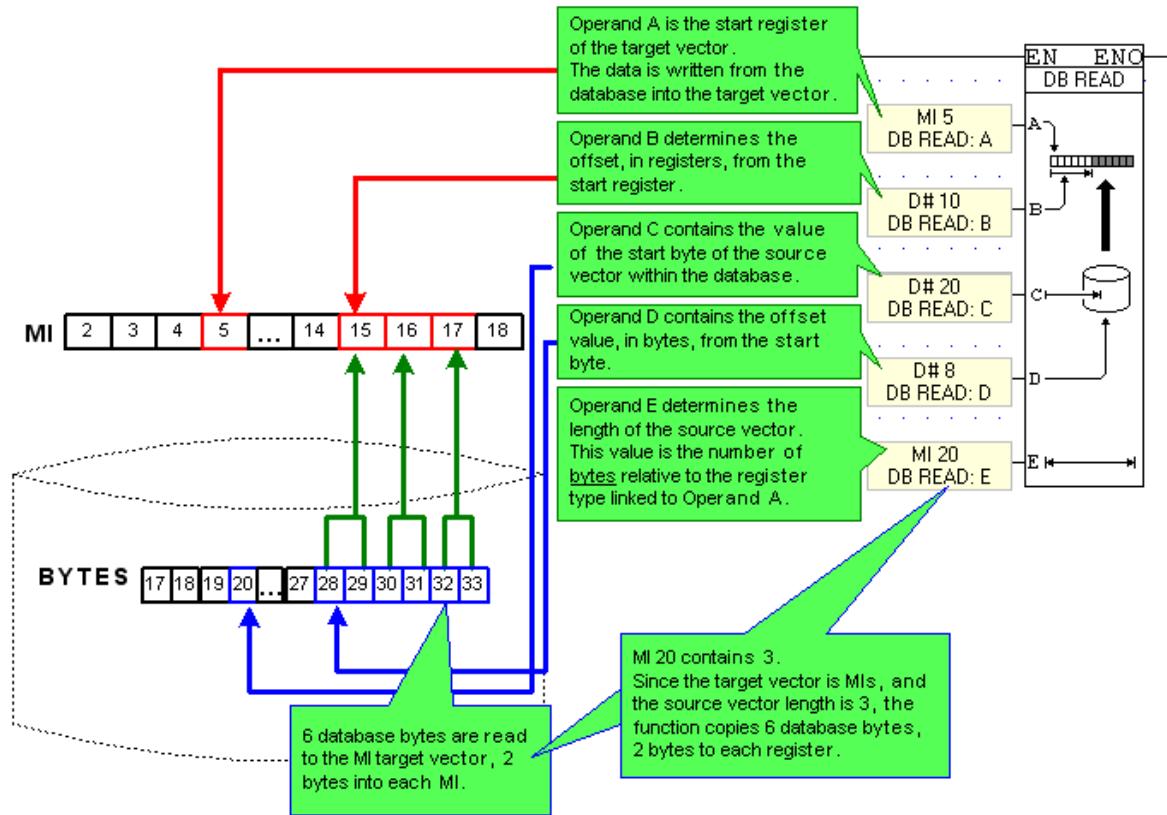
1. Select Direct: Read from the Data Tables menu.
  2. Place the function in the desired net.
  3. Link the desired Operands and Addresses.
- Operands A & B determine the data's destination --to where the data from the data table will be copied.  
Operand A: sets the register type for the target vector and the start register.  
Operand B: determines the offset, in registers, from the start register.
  - Operands C, D, & E determine the data's source --from where in the data table the data will be copied.  
Operand C: contains the start byte of the source vector within the data table.  
Operand D: determines the offset, in bytes, from the start register.  
Operand E: determines the length of the source vector.

Note that the length is relative to the type of register linked to Operand A. For example, if Operand A is linked to an MI and Operand E contains 5, 10 bytes of data will be copied from the data table into 5 MIs, 2 bytes into each MI.

If Operand A is linked to a double register; ML or DW; and Operand E contains 2, 8 bytes of data will be copied into 2 double register.

### Read Example

Below, database bytes 28, 29, 30, 31, 32, and 33 are read and written into MIs 15, 16, and 17.



### Database: Write Direct

The Write operation copies data a vector of registers into the database.

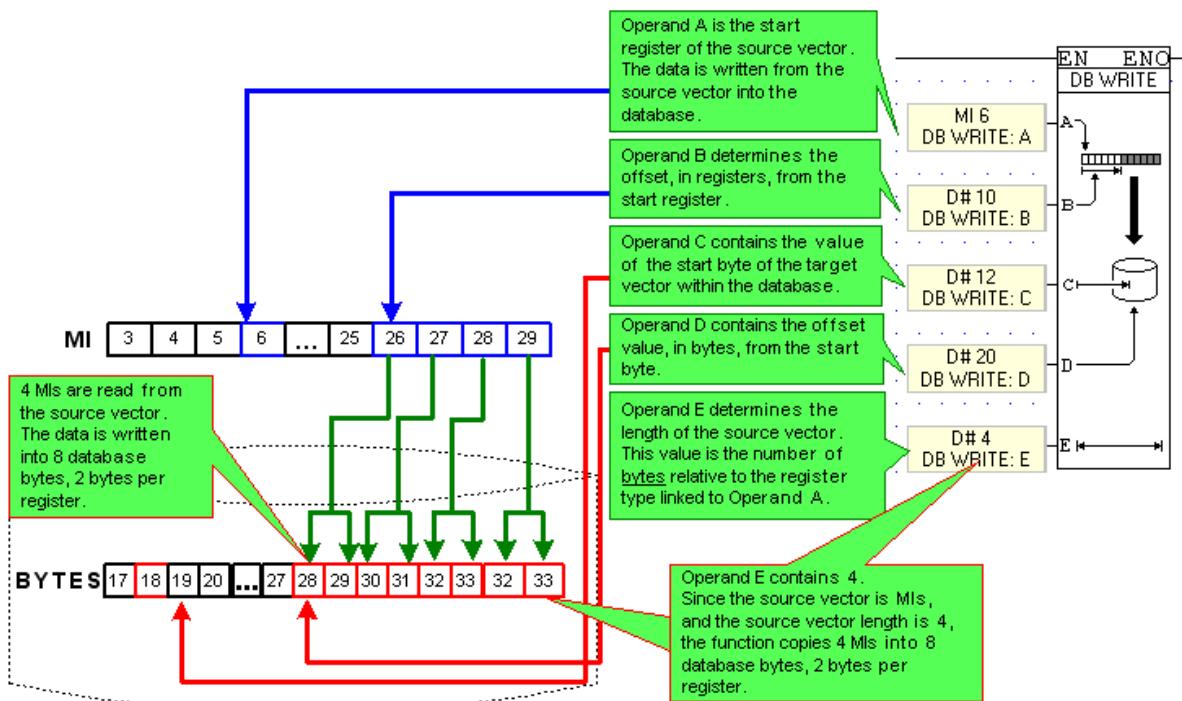
1. Select Data Block Read from the Data Tables menu.
  2. Place the function in the desired net.
  3. Link the desired Operands and Addresses.
- Operands A & B determine the data's source --from which registers the data will be copied.
    - Operand A: sets the register type for the target vector and the start register.
    - Operand B: determines the offset, in registers, from the start register.
  - Operands C, D, & E determine the data's destination--to where in the database the data will be written.
    - Operand C: contains the start byte of the source vector within the database.
    - Operand D: determines the offset, in bytes, from the start register.
    - Operand E: determines the length of the source vector.

Note that the length is relative to the type of register linked to Operand A. For example, if Operand A is linked to an MI and Operand E contains 5, the data from 5 registers will be copied into 10 database bytes, 2 bytes per MI.

If Operand A is linked to a double register; ML or DW; and Operand E contains 2, the data from 2 double registers will be copied into 8 database bytes, 4 bytes per ML or DW.

#### Write Example

Below, MIs 26, 27, 28, 29 are written into database bytes 28 through 33; each register is copied into 2 bytes within the database.



## Data Tables: Clear Table

This function is located in the Data Tables menu.

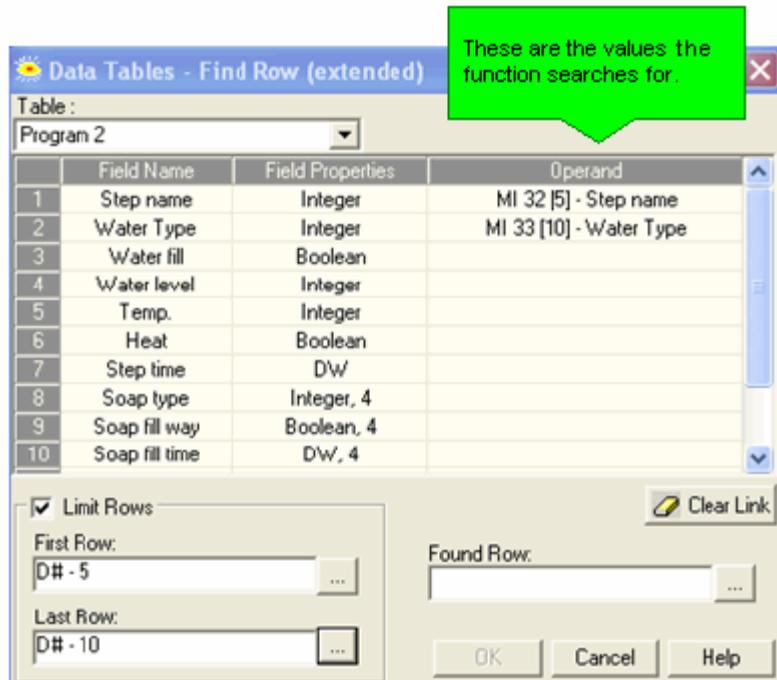
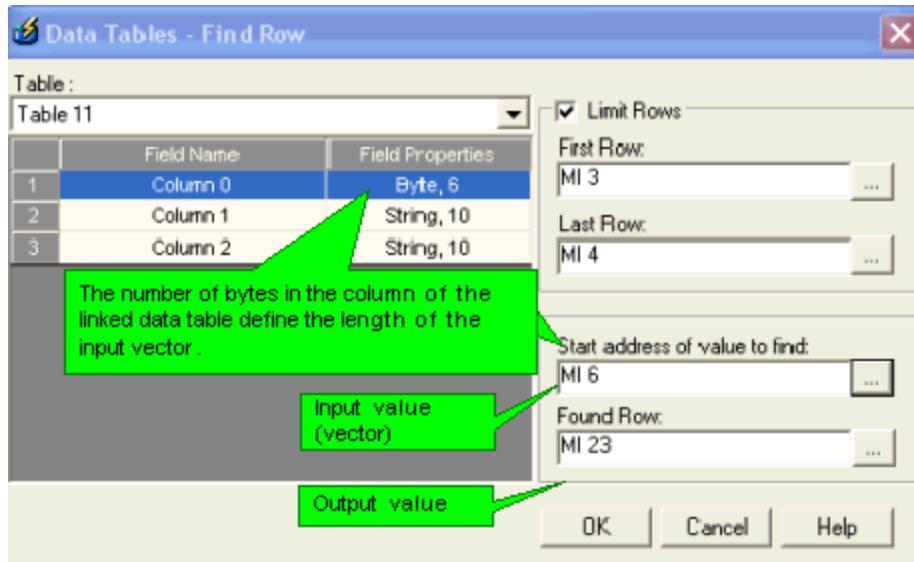
Clear Table enables you to use a Ladder condition to delete values in a particular table.



## Data Tables: Find Row, Find Row Extended

Find Row and Find Row Extended are located on the Data Tables menu. These functions search through a data table, comparing the input value with the values in the data table.

- **Find Row:**  
If a matching value is found, the number of the row is stored in the output value.
- **Find Row Extended:**  
This function enables you to search for more than one value. The number of the row containing all of the values is stored in the output value.



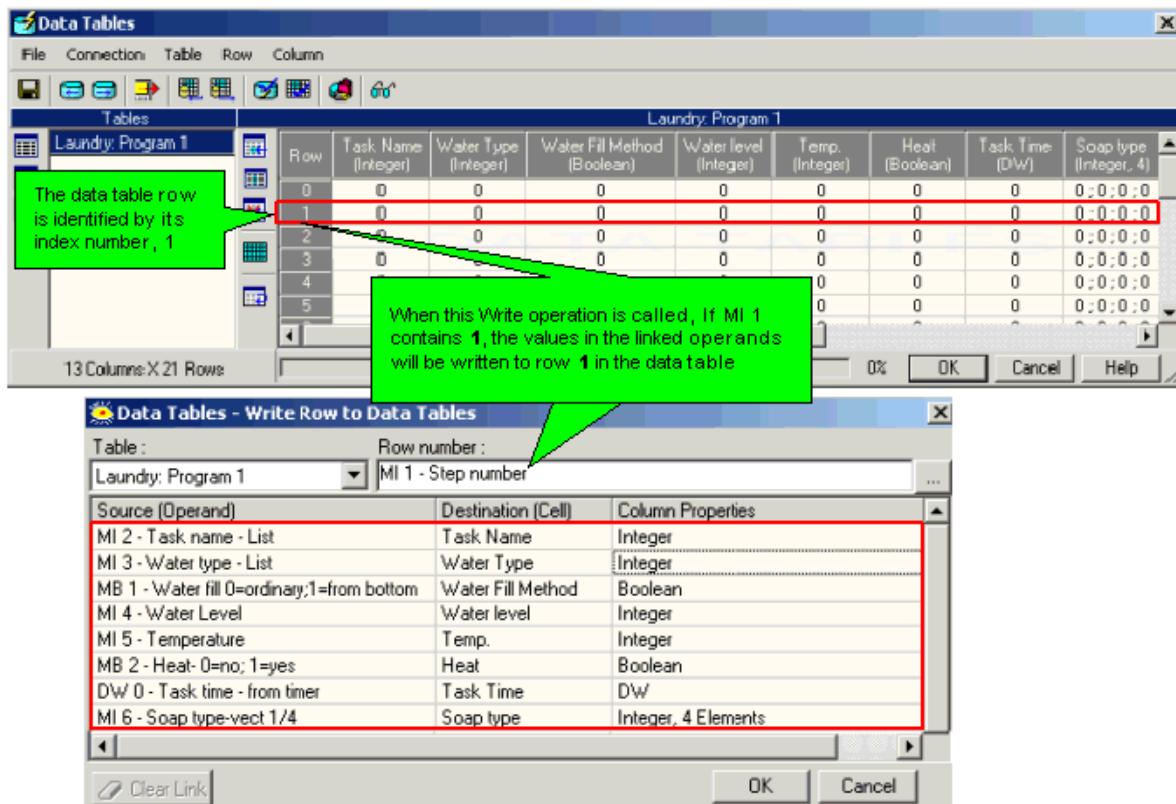
Parameter Name	Purpose
Table	Click on the drop-down arrow to select a table from the project, then click the desired column. The number of bytes in the column of the linked data table define the length of the input vector.
Limit Rows	Check this option to limit the number of rows the function will search.
Start Address	The length of the input vector is determined by the number of bytes in the selected data table column. If, for example, the column contains 6 bytes, the vector will be 3 MIs long. Note that a string must end with a null (0) character.
Found Row	If a matching value is found, the number of the row is stored in the output value.

## Program Recipes

A recipe is a collection of ingredients or values that are used to prepare a batch of product or to perform a specific task.

Data Tables can be used to contain parameters for pre-programmed recipes.

For example, assume that a laundry machine performs different tasks such as 'Fill', 'Wash' and 'Rinse'. A Data Table is created that contains 1 row for each task. Each row contains cells; each cell holds a specific parameter required for the task assigned to that row. The parameter values are transferred into the cells via a Write to Data Tables function. Within the Write function, the operands containing the parameter values are linked directly to the appropriate cells.

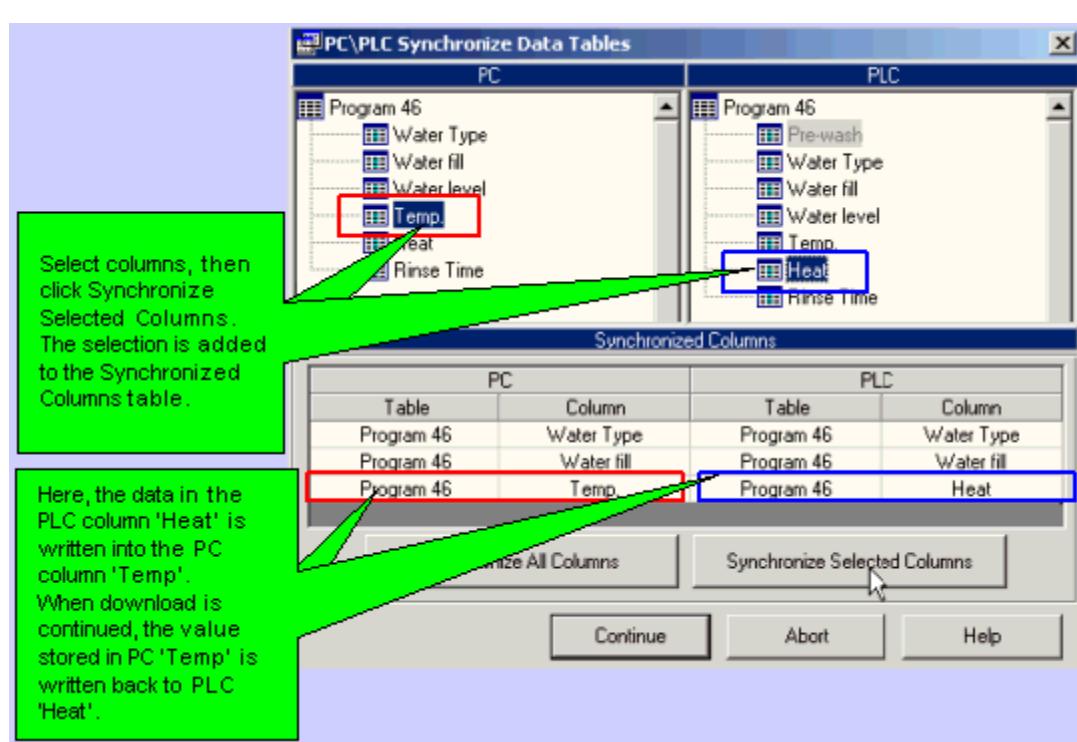


## Data Tables: Synchronizing Data

When you download Data Tables to a controller, VisiLogic checks to see if the controller already contains Data Tables. If the structure of the tables is not identical, VisiLogic opens the Synchronize Data Tables box.

To synchronize data values, VisiLogic uploads the data from the PLC Data Tables into Data Tables within the PC, and then downloads the tables and data values when download is completed. This enables you to preserve values within the controller's Data Tables, even if the data type in that column has been changed. For example, if a Data Table column in the PLC that contains an integer is transferred to a long integer, the two bytes of the integer value will be placed in the 2 least significant bytes of the long integer.

Synchronize all columns	VisiLogic automatically uploads all of the data values in the PLC Data Tables into the PC tables. Data is matched up according to column name. When download is completed, the new Data Table is installed in the PLC with all of its data values intact.
Synchronize selected columns	Selecting this option opens up a window that enables you to manually link the PC Data Table columns with those in your PC. The data values within the columns are then transferred to the new defined location.



Do not synchronize

Downloads the Data Tables as structured in your project, regardless of any PLC data.

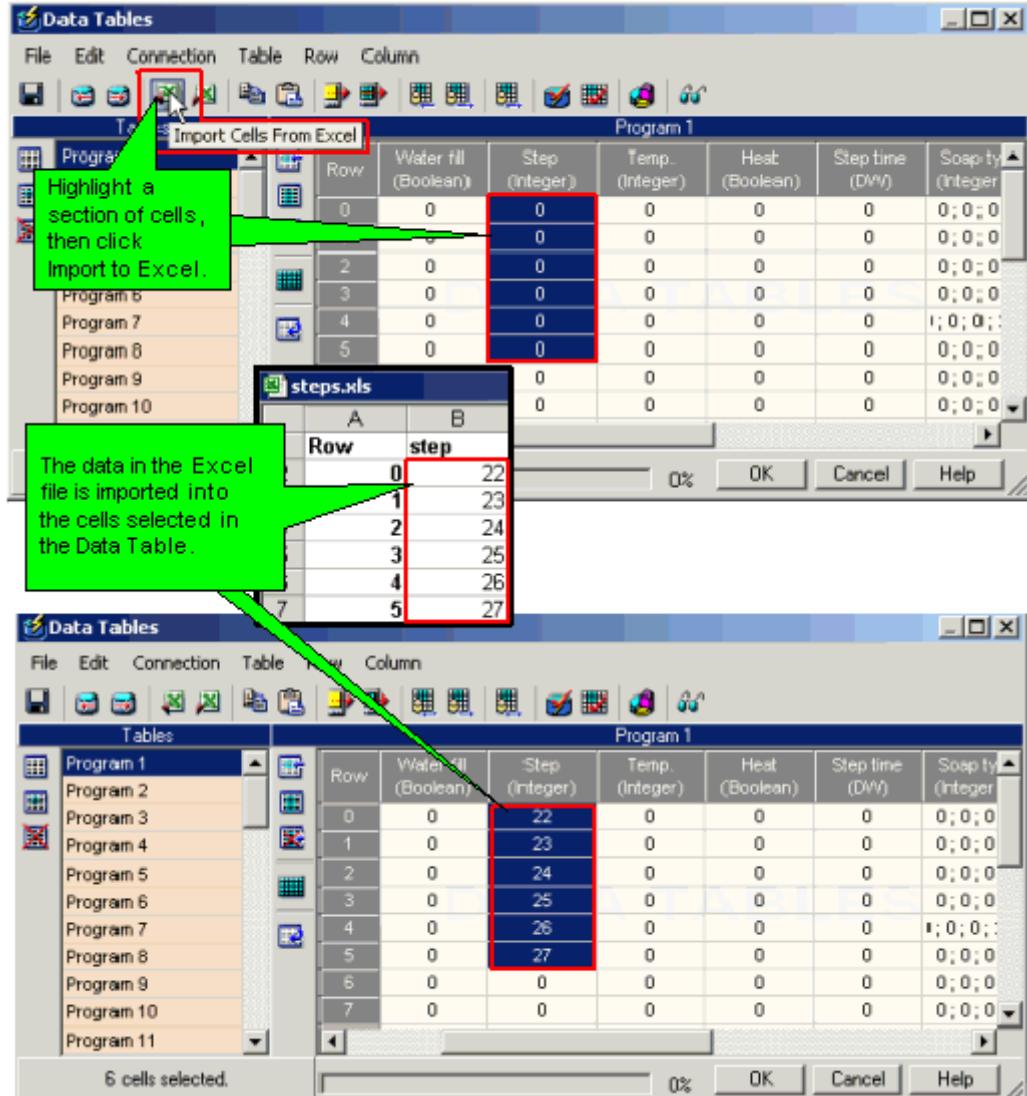
## Data Tables and Excel

Data can be imported to and exported from Excel.

Export: When you click the Export to Excel icon, VisiLogic opens a Save As dialog box, enabling you to create an Excel file to save your data. The data is copied as shown below.

	A	B
1	Row	Temp.
2	0	99
3	1	100
4	2	99
5	3	98
6	4	98
7	5	99

Import: When you click the Import from Excel icon, VisiLogic opens an Open dialog box, enabling you to select an Excel source file. The data is copied as shown below.



Copy & paste data

To copy/paste data to and from Data Tables and Excel.

1. Select data. You can select individual cells, rows, columns, or contiguous groups of cells.
2. Copy the values to the Clipboard either by pressing **<Ctrl>+<C>** or by clicking the Copy button.
3. Click the cursor in the Paste location, then paste the either press **<Ctrl> + <V>** or click the Paste button.

**Note •** The selection is pasted towards the right and down. When you paste from Excel to Data Tables, the Data Table must have enough rows and columns to contain the Paste selection.



# Troubleshooting

## Detecting Short-circuited End Devices

The controller can detect short circuits in end devices (loads) that are connected to transistor outputs located on snap-in or expansion I/O modules. Short circuits can also be detected in end-devices connected to analog outputs.

If a short circuit is detected on either an expansion or snap-in I/O module, SB 5 turns ON.

If the short circuit is located on an:

- I/O expansion module, the location is indicated in SDW 5.
- Snap-in I/O module, the LSB in SDW 6 turns ON.

SDW 5 provides a bitmap. Each I/O expansion module included in your controller's hardware configuration is assigned a number, 0-7, according to its place in that configuration. In the bitmap, bits 0-7 correspond to these place numbers.

V120 only

Bit 8 within SDW 5 is reserved for the controller. A value of '1' indicates that the short-circuit has been detected in an on-board V120 output.

In the bitmap below, short circuits have been detected in devices that are connected to expansion modules 1 and 3, and to the V120 itself.

SDW 5

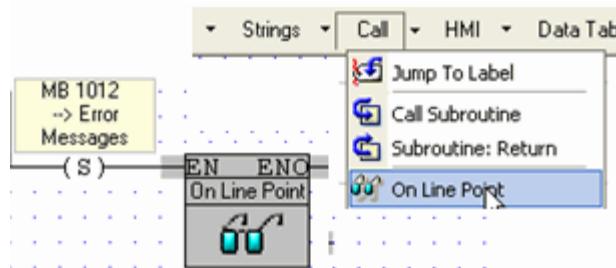
(Please note that although an SDW is 32 bits long, only 16 bits are shown below.)

Bit#	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Output location	0	0	0	0	0	0	1	0	0	0	0	1	0	1	0	0

## On-Line Test Mode (Debug)

To test a project, first connect the controller to your PC using the program download cable provided with the software package, then download the project and click the On-Line Test button. The Online Test toolbar opens, enabling you to:

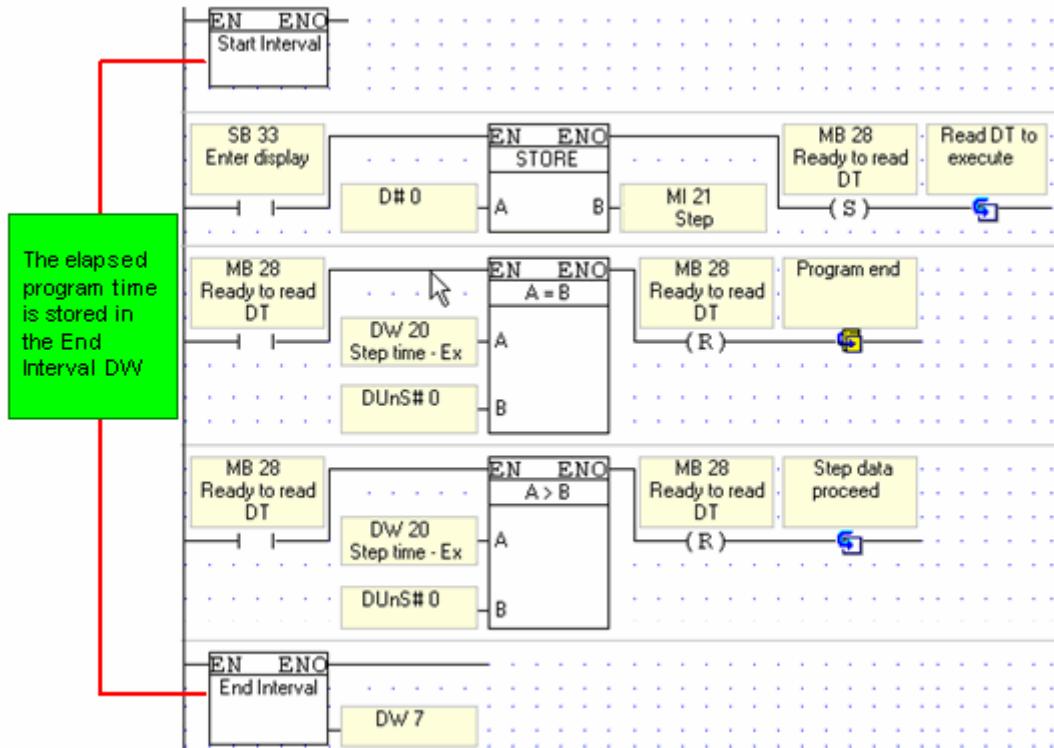
- Switch between Run and Stop modes.
- Use Single Scan to run a single cycle of the ladder program for debugging purposes.  
You can stop the scan cycle at any point by placing OnLine Test Points, located on the More menu, in the Ladder.



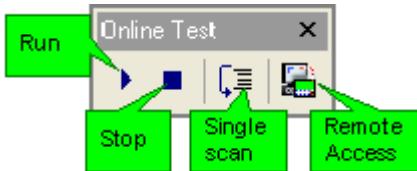
When the scan reaches an OnLine test point that is active (receives RLO), Online Test freezes, enabling you to check element status and values, including Timer values, at that point during Ladder execution. Note that if more than one OnLine test point is activated, SB 35 turns ON.

- Measure the time interval between 2 points in the Ladder application, by placing Start and End Interval elements, located on the More menu, anywhere in the application. The time interval, in

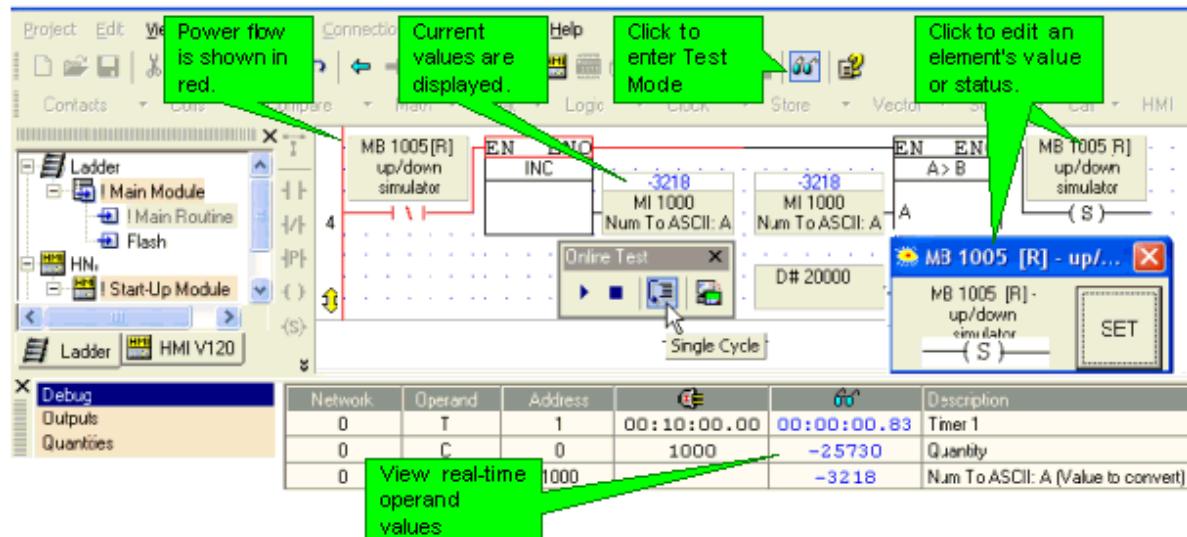
micro-seconds, is stored in the DW linked to the End Interval element.



- Open Remote Access to debug remote controllers via network or modem connections.



In Online Test mode, you can view the power flow, and view and force operand values and element status.



**Note •** The controller can send and receive SMS messages when the controller is in Test mode.

## Power-up Modes: Trouble-shooting

You can force the controller to boot up into Bootstrap or Stop mode by turning on the power supply while pressing specific keypad keys.

Mode	Features	Possible Actions	V120	V230/260	V280
Bootstrap	<ul style="list-style-type: none"> <li>The controller's LCD is on.</li> <li>PC-PLC communications are enabled, but PC must be connected to COM 1.</li> </ul>	Via Vision Communication PC Settings, you can: <ul style="list-style-type: none"> <li>Check which OS is currently installed in the controller.</li> <li>Download a new OS.</li> </ul>	<I> + <ESC>	<I> + <Right Arrow>	<I> + <Right Arrow>
Stop (O/S)	As in Bootstrap, but Info mode can be entered.	As above, but all Info mode actions are supported. Exit Stop Mode by entering Information Mode, and then selecting System>Working Mode> Reset.	<I>	<I>	<I>
Bootstrap, default LCD contrast		Contrast range is 0-100, this option automatically sets Contrast to 50.	<I> + <ESC> + <+/->		<I> + <Right Arrow> + <+/->
Stop (O/S, default LCD contrast		Contrast range is 0-100, this option sets Contrast to 50.	<I> + <+/->		<I> + <+/->

## I/O Expansion Module Errors

An interruption in communication between an I/O expansion module and controller can cause the controller to enter Stop Mode, and an 'Expansion Error' message to be displayed on the controller's LCD.

This error results when:

1. The module was connected at power-up.
2. The communication between module and controller was interrupted for more than 200 milliseconds. Interruptions may occur if the connecting cables are disconnected, or may result from signal interference (noise).

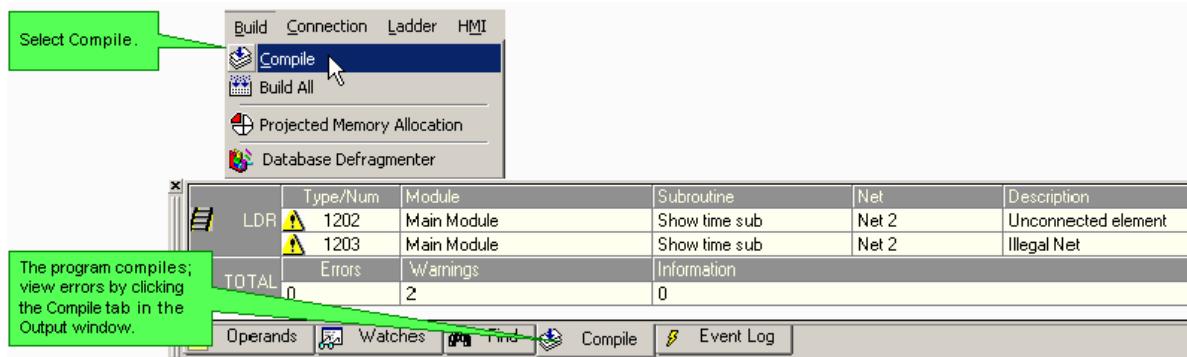
**Note •** When a controller enters stop mode, the program stops running and all outputs within the system are initialized. This includes on-board outputs, outputs located on Snap-in I/O modules, and outputs located I/O expansion modules.

What to do

- Check that the cables are connected and in proper order.
- Remedy signal interference. Such an error may also result from a hardware malfunction.
- If the RUN LED on the expansion module blinks, check the documentation supplied with the expansion module to see if a hardware error is indicated.
- To exit Stop Mode, reset the controller either by turning it off and on, or by entering Information Mode, and then selecting System>Working Mode> Reset.

## Compile

When you compile your program, you can see any errors in the Output Window.



Clicking the Compile tab displays the last compiled results.

## Why does the Controller display the 'Restart' message?

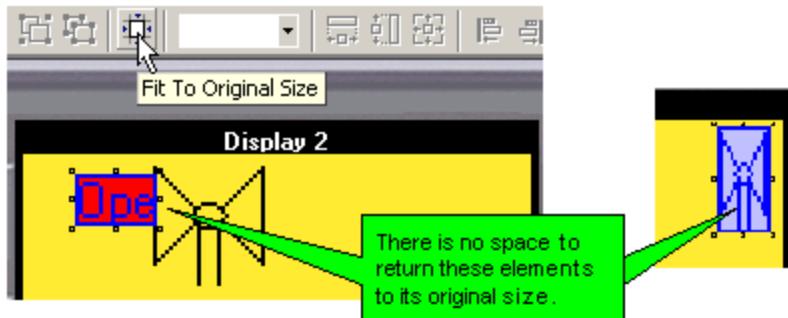
The most common reason for this event is a peak in electromagnetic (EMF) 'noise'. This may result from contactors, power relays, solenoid valves, etc. switching on and off, as well as from power transformers and motor speed drivers. Recommendations:

- Use different power supplies - highly recommended - one for the controller (CPU and inputs), and a different one for other electromagnetic devices;
- Use suppressors - reverse connected diodes for DC loads and RC filters for AC loads;
- Where possible, place the signal cables, including the 24V power supply, far away from power lines, especially from cables, coming in and out of motor drivers;
- If needed, use shielded cables for signals, including for 24 VDC and for power cables between the motor driver and the motor itself.

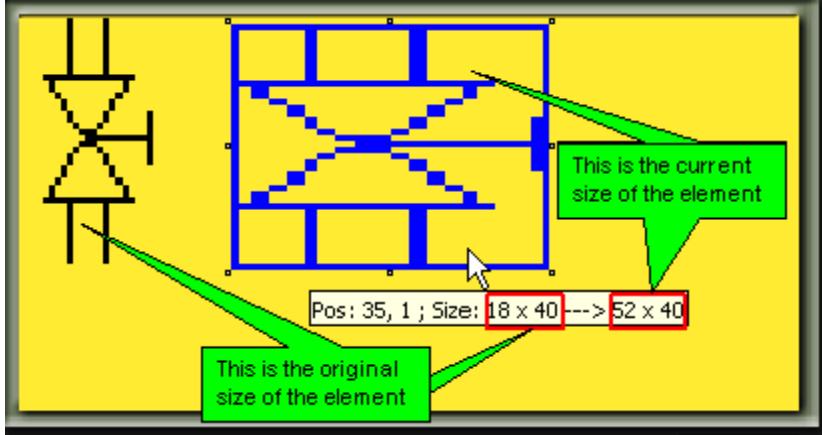
Taking these precautions should help prevent 'Controller Restart'. If the problem persists, contact support@unitronics or your local Unitronics representative.

## HMI Element Resizing/Rotating Limitations

Elements 'grow' down, and to the right. If resizing/rotating will cause Variable elements to collide, or any element to extend beyond the boundaries of the Display, the element cannot be returned to its original size, or resized to a larger size.



<b>Note •</b>	'Original size' is the actual size of the element as it appears in the element's ToolTip.
•	Fit to Original Size does not affect geometric shapes that are drawn on the Display.
•	'Original size' cannot be used to resize Variable elements if the elements have different original sizes.



- Note •** Although an imported image can be resized, resizing may result in some degree of distortion. To avoid this, use images that are created to match the required size.
- Resizing text elements changes the size of the text field, but does not affect font size.
  - Shapes that are imported are resized in proportion to their original size.

## Float Errors

When an Float function error occurs, SB 10 Float Error turns on. This SB is reset by the user.

The error code is stored in SI 500 General Error. The codes are shown below.

Value	Message	Result
3	Integer Overflow	7FFF or 8000 (integer result) FFFF or 0000(unsigned integer result)
4	Floating Overflow	+INF or -INF (float result)
5	Floating Underflow	0.0 (float result)
7	Divide by Zero	+INF or -INF or NaN (float result)
9	Undefined Float	NAN (float result)
10	Conversion Error	0 (integer result)
11	Floating point Stack Overflow	Floating point stack underflow
12	Floating point Stack Underflow	Floating point stack overflow

INF Infinite which is the largest absolute floating point number.

NAN Not a Number, special notation for undefined floating point number.

## Changing Panel Types: Conflicts

If a project contains Displays, selecting a different panel type in your project's Hardware Configuration may cause you to lose some of your Display elements and their properties.

If you select a smaller panel, some of the elements in your Displays may be too large. In this case, any variable, graphic, or text elements that extend beyond the edge of the screen will be deleted from your project, and may not be retrieved.

In addition, note that all calendar variables will be deleted.

Also, note that if you change from a touch panel to a non-touch panel, any 'touch' properties linked to on-screen objects will be deleted.

## Insufficient Flash Memory

This error message is displayed when the PLC does not have sufficient memory to handle the current project. To see the memory requirements of the project, click the Events tab in the Output Window at the bottom of the screen.

Source	Date and Time	Event Description	
Memory Allocation	3/5/2003 11:14:04 AM	Page variables	108
Memory Allocation	3/5/2003 11:14:04 AM	Upload data	32
Memory Allocation	3/5/2003 11:14:04 AM	Function block	34
Memory Allocation	3/5/2003 11:14:04 AM	Ladder Tokens	94
Memory Allocation	3/5/2003 11:14:04 AM	Static pages	66
Memory Allocation	3/5/2003 11:14:04 AM	User fonts	136266
Memory Allocation	3/5/2003 11:14:04 AM	Variables	32

Operands   Watches   Find   Compile   Event Log

## Communications

### CANbus Network Problems

SB 236 indicates that there is an error in the CANbus network.

SI 236 CANbus Network: Failed Unit ID. Note that the first 3 bits turn ON only when the controller is unable to broadcast via the CANbus port. The value of SI 236 indicates the following messages:

Value	Message	May result from:
0	No Acknowledgement	CANbus power failure, crossed wires, incorrectly set termination points.
1	CANbus OFF	
2	CANbus Warning error	Poor transmission quality due to faulty wiring, or if the cable length exceeds recommendations.
4	One or more networked units cannot be read. If this bit is ON, check SI 238, SI 240-243.	

SI 237 CANbus Network Communication Error Code is a bitmap that indicates the LAST unit that cannot be read. Note that each controller can receive messages from up to 8 others. Example: Assume that there are 6 controllers in the network (3,6,8,13,17,34). Controller 3 is waiting for data from controllers 8 and 13 and 17. If the controller does not receive data from controller 13 (assume a 1 second timeout) then SI 237 will contain a value of 13. Bit 4 in SI 236 will also turn ON. Once controller 3 has received the data, Bit 4 turns OFF.

SI 240, 241, 242, and 243 serve as a bitmap indicating which unit is in error. If, for example, the network includes unit ID numbers 8, 9 and 13, and PLC #9 cannot be accessed, then the ninth bit in SI 240 will turn ON. When the error is fixed, the bit falls to OFF.

## CANbus troubleshooting

Problem	Possible cause	Recommended Action
Failed communication	Baud rate settings	All controllers in the network must be set to the same CANbus baud rate. Baud rate may be set: <ul style="list-style-type: none"> <li>• By initializing a port via the COM Init FB.</li> <li>• Temporarily via Info mode; however, note that the baud rate will be reset at the next power-up</li> </ul>
	Termination resistors	Termination resistor settings are provided in the chapter Communications in the controller's user guide.
	CANbus power supply	Check that the CANbus power supply is properly connected, and that the voltage is in the permissible range as described in the chapter Communications in the controller's user guide.
	Incorrect ID number	You may not have assigned the correct unit ID number in your operand addresses (between 1-63). Check the OPLC settings tab Communicate with OPLC.
PC cannot communicate with bridge	Incorrect setting	When you communicate with the controller unit that you are using as a bridge to the network, either enter the ID# of the bridge or select Direct Connection in the OPLC settings tab Communicate with OPLC.
PC cannot communicate with network	Communication settings	Make sure the current RS232 parameters in your project are the same as the parameters that are actually in the bridge. Check these topics: Check Network Status, Vision Communication PC Settings
	Incorrect baud rate	The bridge's RS232 port's baud rate cannot be set below 9600.

**Modem Troubleshooting**

## General Information

<b>Note •</b>	The PC to modem cable is not the same type of cable that connects the controller to the modem. The PC to modem cable must provide connection points for all of the modem's pins.
•	The initialization commands for PC modems, and those found in the COM Init FB used to initialize the PLC's modem are different.
•	If calls are routed via a switchboard, note that the switchboard settings may interfere with communications. Consult with your switchboard provider
•	If the modem initialization string parameter S7, TimeOut, is too short to permit the PLC's modem to answer, an error will result. For example, if this parameter is S7=30, the PC modem waits 3 seconds to receive an answer from the PLC's modem. If, however, the PLC program's COM Init FB Answer Settings are set to 'Answer after 6 rings,' the PLC modem will not be able to answer before the 3 seconds have elapsed. In this case, the TimeOut parameter is exceeded, and the PC modem will return the No Carrier error.
•	PC/PLC modem communications: Both PC and PLC must use the same type of modem: landline or GSM\CDMA. Internal PC modems must use the driver provided by the modem's manufacturer.

## Modem Commands

<b>Note •</b>	The modem must reply with either OK or READY to each command entered. If the modem fails to answer, the command has not been processed.
---------------	---

+++	Escape Sequence. This causes the modem to close connections and go back to command mode
AT	This command means Attention; and is used to begin a session
AT&F	Restores factory default settings
ATZ	Resets the modem. This command may take time to implement, so the response from the modem may be delayed
ATE0	No Echo
V1	Enable Verbose (long) response
Q0	Respond
X4	Detailed answers
&D0	Ignore DTR
&S0	DSR always ON. Since the DSR can be permanently set to ON, connecting it to the RTS causes the terminal always be ready to transmit\receive data
&S1	DSR OFF in command and test modes
&C1	Give the user a signal for the DCD
ATS0=1	Auto-Answer after 1 ring
&W	Burn the configuration into the modem's non-volatile memory

### PC-side modem, error messages

This deals with errors that may result from the PC's modem

Message	Cause
COM Port not open, or modem does not exist	The PC was unable to access the PC port. The port may: -Already be in use. -Be damaged.
Modem not connected	The PC receives no reply from the modem following the 'AT' command. Check that: -The modem is connected to the same PC port you have defined in PC-modem Configuration. -The PC-modem cable is in proper order.
Modem not initialized	The modem was not successfully initialized, or The modem answered, but did not approve all strings. Check the topic: Using Hyperterminal for Modem Troubleshooting

The messages below describe the modem's status if the PC dial attempt (ATD+ number) fails. Any one of these errors aborts the Dial process.

Modem Busy	
Modem Error	
No Dial Tone	
No Carrier	<p>Note • This can occur if, within the modem initialization strings, the parameter S7 TimeOut, is too short to permit the PLC's modem to answer.</p> <p>For example, if this parameter is set as S7=30, the PC modem will wait for 3 seconds to receive an answer from the PLC's modem. If, however, the PLC program's COM Init FB Answer Settings are set to 'Answer after 6 rings,' the PLC modem will not be able to answer before the 3 seconds have elapsed. In this case, the TimeOut parameter is exceeded, and the PC modem will return the</p>

	No Carrier error.
Dial time-out exceeded	No reply was received from the modem within the defined time.
The messages below only relate to unsuccessful GSM modem initialization.	
GSM SIM card blocked	
GSM SIM card does not exist	
Illegal GSM PIN code	
GSM Network not found	
CDMA Network not found	
SMS message too long	A message containing only English characters may contain up to 160 characters. A message containing non-English characters may contain up to 70 characters.
Time-out exceeded	

#### PLC modems

These errors may result from problems in the PLC-side modem

Message	Possible cause	Recommended action
Modem Busy	Modem is engaged, or is being initialized	Check that the line is free. Use the SBs: Modem Initialization Status listed above to check the COM port status; communications cannot flow through the port during initialization. For more information check the topic COM Port Init.
Handshake between modems complete ('CONNECT'), PLC does not reply	Modem adapter cable	Check the PLC-to-modem connection and pin-out, particularly that the DSR is connected to the RTS on the modem side.

Problem	SI Value (80, 82, 84)	Possible Cause & Recommended Action
Modem fails to initialize (SB 81, 83, 85 ON)	3	<ul style="list-style-type: none"> <li>PLC-to-modem cable: Make sure that the cable is securely connected. Check the modem connection and pin-out of the PLC-to-modem adapter cables. Note that if you use cables comprising this pin-out, you must set the parameter Flow Control to N (none) in the COM Port Init FB.</li> <li>Incompatible communication settings. Most modems automatically match the parameters of incoming data: baud rate, data bits, parity &amp; stop bits. You may need to manually change your modem's communication settings.</li> </ul>
	0	You may have selected the wrong type of modem in the COM Port Init FB.

### Modem Connection

#### Cable Pin-out

The Unitronics' cable provided with modem kits does not provide a standard connection. This connection is adapted to support the fact that Unitronics controllers do not support the control lines. The cable shorts the DSR and the DTR together, which ensures that the terminal is always ready to receive data.

For more information, refer to the topic Modem Connection and Pinouts.

#### Data Flow Direction

Generally, when you transmit data, you send it out. Note, however, that transmitted data (TXD) is input to the DCE. A Receive Data signal (RXD) is input to the DTE, but output from the DCE.

Therefore, the RXD and TXD signals are crossed within the majority of modems. This means that a straight through "one to one" cable is generally all that is necessary between a modem and a controller or PC serial port.

#### RS-232 signal information

RXD Receive Data	Input for DTE devices (Receive), output for DCE devices. This is the data channel from the DCE device to the DTE device.
TXD Transmit Data	Output for DTE devices (Send), input for DCE devices. This is the data channel from the DTE device to the DCE device.
GND Signal Ground	Signal return for all signal lines.
RTS Request To Send	Terminal is ready to receive data. When the DTE is ready to receive data, the DTE serial port RTS signal is ON.
CTS Clear To Send	Terminal is ready --not related to data transfer.
DTR Data Terminal Read	It is an output for DTE devices and an input for DCE devices. This signal is typically used to show that the port has been activated or "opened".
DSR Data Set Ready	Detects if the RS232 is actually connected.
DCD Data Carrier Detect	Turns ON when the modems connect.
RING	Turns ON when someone is calling the DTE.

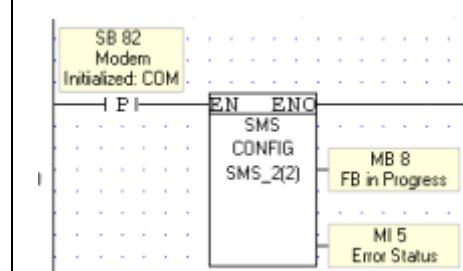
### GSM modems

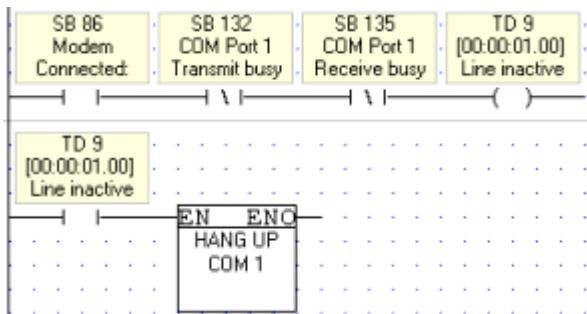
Problem	SI Value (81, 83, 85)	Possible Cause & Recommended Action
Wrong PIN number	3	Check the PIN number in the COM Port Init FB; leave it empty if your SIM card has no PIN number.
Failed Registration	4	GSM modem did not register successfully, for example if no network was found, or if the modem antenna is not functioning.
PUK number needed	5	The SIM card is locked due to too many attempts to enter an incorrect PIN number.

Problem	Possible Cause & Recommended Action
Cell phone does not receive message	Check the cell phone's SIM card; it may be full. You can clear the SIM card using the Clear option in the COM Port Init FB.
PLC modem does not respond to cell phone call	GSM modems generally recognize whether the incoming call is voice or data. If the modem has been set to answer (via the ATS0=x command, where x is set to a value greater than 0), the modem will not answer an incoming cell phone call, since it will be recognized as a voice message.

**Note •**

The appropriate Modem: Initialized SBs [80 (COM 1), SB 82 (COM 2), SB 84 (COM 3)] must turn ON before activating an SMS Config FB using that COM port; ideally the SBs should be used as an activating condition.

**Modem Troubleshooting Table**

Problem	Possible cause	Recommended Action
PLC stays connected when modem connection fails	A modem which is reset, or to which the power supply is interrupted, may lose the connection and may not send a 'No Carrier' string to the PLC.  In this case, the SB remains ON, as though the data link still exists.  (Note that Modem Connected SBs, 86-88, turn ON when the relevant COM port receives the 'Connect' modem string. Receiving a 'No Carrier' string causes the SB to turn OFF.)	Modem Connection and COM Port Transmit/Receive SBs can be used in conjunction with a timer to check if the line is inactive; the timer state is used to trigger Hang-up as shown below.  
VisiLogic is not able to communicate with the PLC:  PLC has initialized a modem. The modem is disconnected, and a PC is plugged into the COM port.	Once the modem is connected to the PLC, and the modem is initialized, the Modem Initialized SB turns ON.  As long as this SB is ON, the COM port stays initialized to the baud rate required in order to work with the modem. If VisiLogic attempts to access the PLC via a different baud rate, the attempt will fail.  The Synchronization process (using break signals) is disabled while the SB is ON.	Either:  Reset the PLC, which will reset the Modem Initialized SB, or Via Vision Communication PC Settings, set VisiLogic's baud rate to match the baud rate to which the COM port was initialized to communication with the modem.

## COM Port/Modem Status, System Operands, & Error Messages

You can check the status of the System Bits and Integers either via ON-line Test Mode or Information Mode.

COM Port/Modem initialization, SBs 80-85

Each port is linked to 2 SBs indicating COM Port/Modem initialization status following COM Init.

Both SBs are initialized to OFF by the OS, at Power-up and at the beginning of COM Init process. When COM Init is complete, one is ON, the other OFF.

#	Description			
SB 80	Modem Initialized: COM Port 1			Example: COM Port 1
SB 81	COM Port/Modem Initialization Failed: COM Port 1	SB 80	SB 81	
SB 82	Modem Initialized: COM Port 2	0	0	After Power-up, before COM Init
SB 83	COM Port/Modem Initialization Failed: COM Port 2	0	1	Modem Initialization attempt failed, Modem is not initialized
SB 84	Modem Initialized: COM Port 3	1	0	Modem Initialization attempt succeeded, Modem is initialized.
SB 85	COM Port/Modem Initialization Failed: COM Port 3	1	1	Not possible

Each port is linked to 2 SBs indicating COM Port/Modem initialization status following COM Init.

Both SBs are initialized to OFF by the OS, at Power-up and at the beginning of COM Init process. When COM Init is complete, one is ON, the other OFF.

#	Description			
SB 80	Modem Initialized: COM Port 1			Example: COM Port 1
SB 81	COM Port/Modem Initialization Failed: COM Port 1	SB 80	SB 81	
SB 82	Modem Initialized: COM Port 2	0	0	After Power-up, before COM Init
SB 83	COM Port/Modem Initialization Failed: COM Port 2	0	1	Modem Initialization attempt failed, Modem is not initialized
SB 84	Modem Initialized: COM Port 3	1	0	Modem Initialization attempt succeeded, Modem is initialized.
SB 85	COM Port/Modem Initialization Failed: COM Port 3	1	1	Not possible

Modem connection status, SB 86-88

Each port is linked to an SB indicating modem connection status. These can be used in conjunction with SBs 132-137, which indicate indicating whether incoming or outgoing data is flowing through the port, to troubleshoot problems as shown in the Help topic Modem Troubleshooting.

#	Description	Turns ON when:	Turns OFF when:	Reset by:

SB 86	Modem Connection Status: COM Port 1	PLC receives 'Connect' string from modem	<ul style="list-style-type: none"> <li>• Hang-up</li> <li>• PLC receives string 'No Carrier'</li> <li>• PLC receives break signal</li> </ul>	OS, at Power-up
SB 87	Modem Connection Status: COM Port 2			
SB 88	Modem Connection Status: COM Port 3			

COM Ports, SBs 132-137

Each port is linked to 2 SBs indicating when incoming or outgoing data is flowing through the port. To troubleshoot problems, use these in conjunction with the Modem Connection Status SBs 86-88, as shown in the topic Modem Troubleshooting.

#	Description	Turns ON when:	Turns OFF when:	Reset by:
SB 132	COM Port 1, Data Transmission	During data send	When data is not being sent	OS
SB 133	COM Port 2, Data Transmission			
SB 134	COM Port 3, Data Transmission			
SB 135	COM Port 1, Data Receive	During data reception	When data is not being received	OS
SB 136	COM Port 2, Data Receive			
SB 137	COM Port 3, Data Receive			

SMS message transmission status, SBs 184-185

Operands that are linked by the user to SMS FBs may be found in the topic SMS Operands.

SB	Description	Turns ON when:	Turns OFF when:
184	SMS: Transmission Succeeded	Transmission succeeds	Transmission begins
185	SMS: Transmission Failed	Transmission fails	Transmission begins

COM Port: Port/Modem Status, Error codes, SIs 80-85

Each COM Port is linked to 2 SIs; their values and messages are indicated below.

SI 80	Modem Status: COM 1	Error (SI 81,83,85)		Status ( SI 80, 82, 84)	
SI 81	Error Code: COM 1	Value	Message	Value	Message

## Getting Started

---

SI 82	Modem Status: COM 2	0	No error	0	Modem Idle
SI 83	Error Code: COM 2	1	TimeOut exceeded: no reply	1	Initialization in Progress
		2	Reply Error	2	Initialization OK
SI 84	Modem Status: COM 3	3	Wrong PIN number	3	Initialization Failed
SI 85	Error Code: COM 3	4	Registration failed	4	Modem Connected
		5	PUK number needed	5	Hang-up in progress
		10	COM Busy	6	Dial in progress
		11	Reply Busy		
		12	Reply No Dial		
		15	Attempted Initialization during active break signal. Note that a port cannot be initialized while the break signal is active		

GSM Cellular Modem, GSM Signal Quality, SI 185

SI	Description	Value
185	GSM Signal Quality	<ul style="list-style-type: none"> <li>The value is written during COM Init of the GSM modem. The value is updated whenever the user uses the GSM Signal Quality FB.</li> <li>A value of -1(FFFF) signifies a modem error. This may be due to a weak signal; try repositioning the antenna. If this has no effect, check the modem.</li> </ul>

SDW: Last Received SMS

SDW	Description
13	Phone number of last received SMS (last 9 digits)

Information on SMS messaging status and messages may be found in the topic SMS Operands.

## Using Hyperterminal for COM Troubleshooting

You can use a standard Windows application called Hyperterminal to perform certain tasks, such as changing a modem's communication rate.

**Note •** The modem driver does not need to be installed in order to access the modem via Hyperterminal.

### Modem Connections

#### Cable Pin-out

The Unitronics' cable provided with modem kits does not provide a standard connection. This connection is adapted to support the fact that Unitronics controllers do not support the control lines. The cable shorts the DSR and the DTR together, which ensures that the terminal is always ready to receive data.

For more information, refer to the topic Modem Connection and Pinouts.

#### Data Flow Direction

Generally, when you transmit data, you send it out. Note, however, that transmitted data (TXD) is input to the DCE. A Receive Data signal (RXD) is input to the DTE, but output from the DCE.

Therefore, the RXD and TXD signals are crossed within the majority of modems. This means that a straight through "one to one" cable is generally all that is necessary between a modem and a controller or PC serial port.

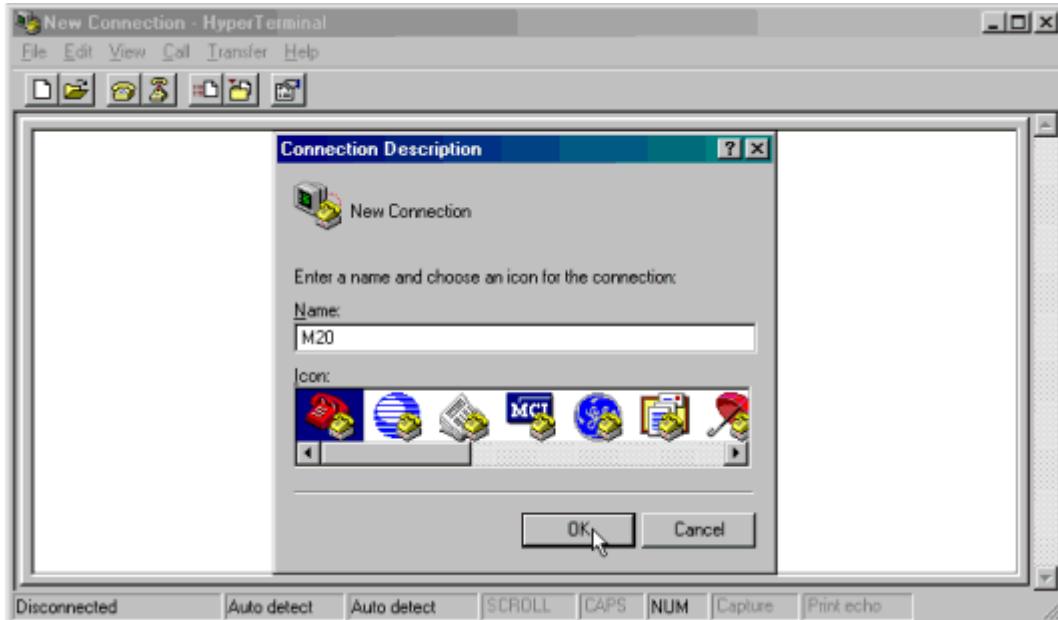
#### RS-232 signal information

RXD Receive Data	Input for DTE devices (Receive), output for DCE devices. This is the data channel from the DCE device to the DTE device.
TXD Transmit Data	Output for DTE devices (Send), input for DCE devices. This is the data channel from the DTE device to the DCE device.
GND Signal Ground	Signal return for all signal lines.
RTS Request To Send	Terminal is ready to receive data. When the DTE is ready to receive data, the DTE serial port RTS signal is ON.
CTS Clear To Send	Terminal is ready --not related to data transfer.
DTR Data Terminal Read	It is an output for DTE devices and an input for DCE devices. This signal is typically used in UNIX to show that the port has been activated or "opened".
DSR Data Set Ready	Detects if the RS232 is actually connected.
DCD Data Carrier Detect	Turns ON when the modems connect.
RING	Turns ON when someone is calling the DTE.

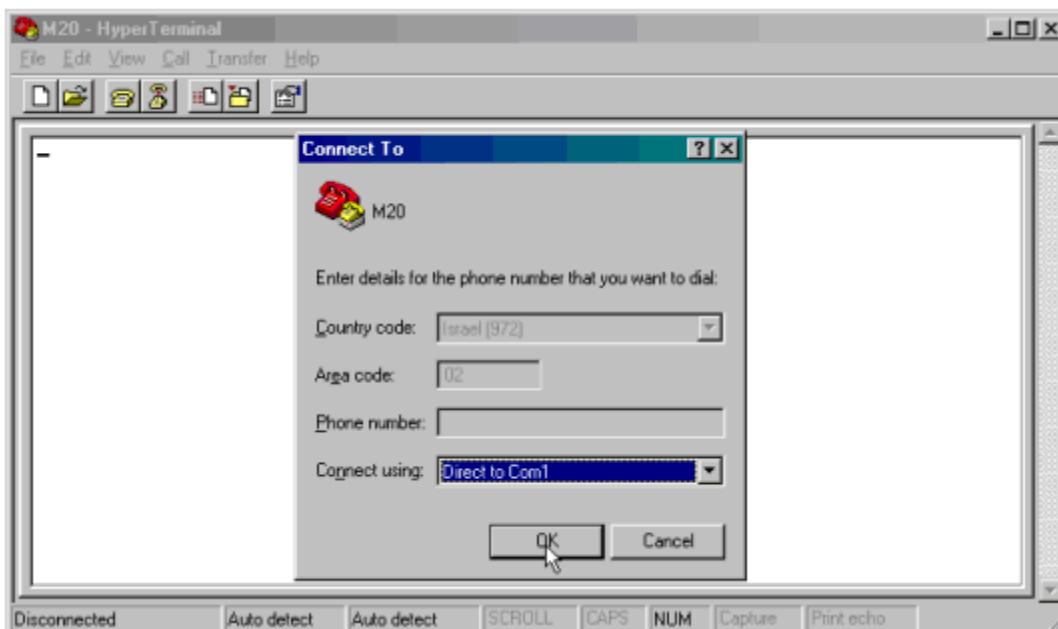
### Using Hyperterminal

1. Open Hyperterminal. The program can generally be located by clicking the Start button in the lower left corner of your screen, then selecting Programs>Accessories>Communications>Hyperterminal. The New Connection window opens as shown below.

**Note •** Hyperterminal generally starts by pointing to the internal modem, if one is installed on the PC.



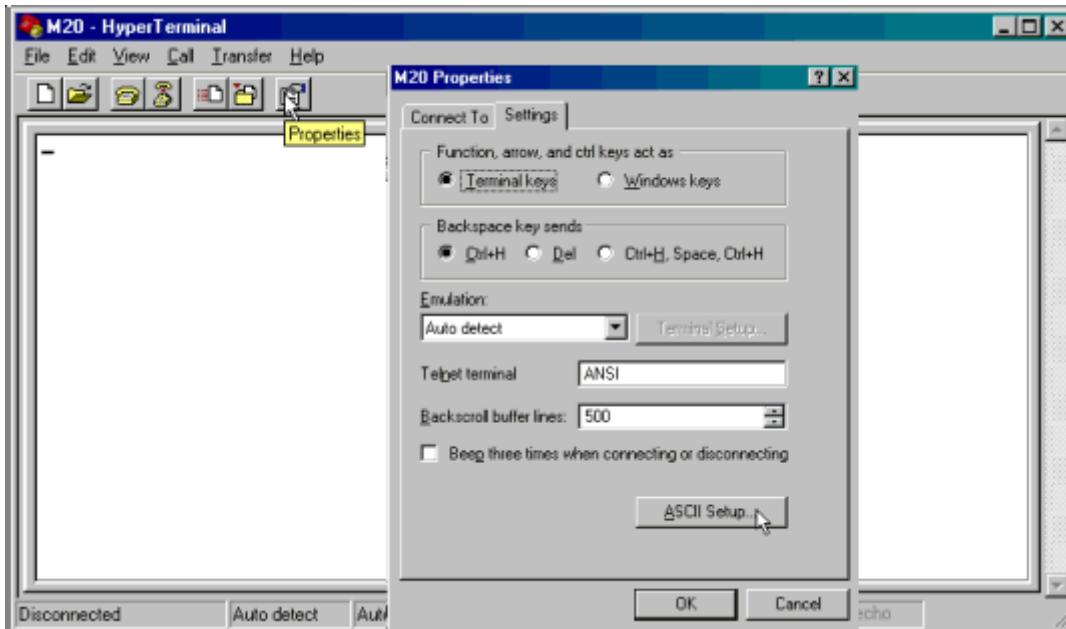
2. Enter a name for the new connection and select an icon, and then click OK. The Connect To box opens .
3. Select a COM port for the modem, and then click OK.



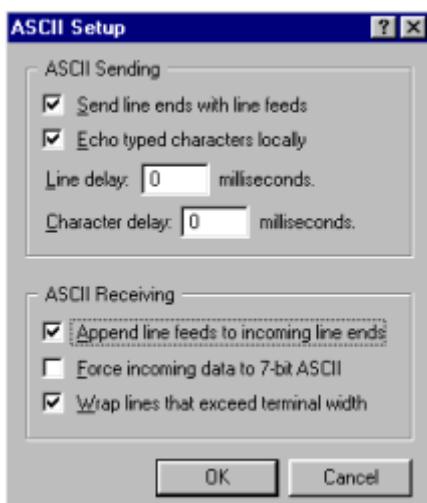
4. The Port Settings box opens as shown below. To enable your PC to communicate with the modem, set the COM port parameters to a BPS of either 9600 or 19200, Data bits=8, Parity=N, Stop bits=1, Flow control=None, and then click OK.



5. Open the modem's Properties box by clicking on the Properties button, then open ASCII Setup.



6. Select the options shown below, and then click OK.



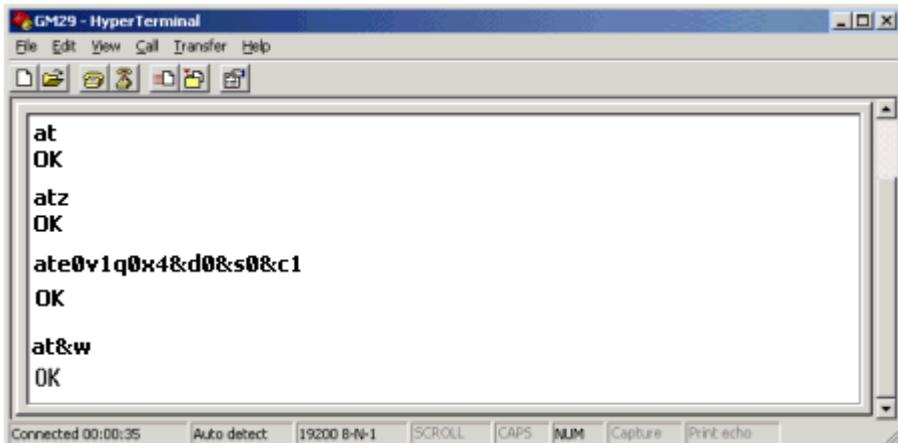
Hyperterminal is now connected to your PC via COM 1; the ASCII settings now enable you to enter commands via the PC keyboard and see the replies from the modem within the Hyperterminal window.

## Getting Started

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To test the connection, type AT; if the connection is valid the modem will respond 'OK'.

Typical initialization strings used with a Siemens M20-type modem are shown below.



The screenshot shows a window titled "GM29 - HyperTerminal". The menu bar includes File, Edit, View, Call, Transfer, Help. The toolbar has icons for Open, Save, Print, Copy, Paste, Find, Replace, and Cut. The main window displays the following text:

```
at
OK
atz
OK
ate0v1q0x4&d0&s0&c1
OK
at&w
OK
```

At the bottom, there are status indicators: Connected 00:00:35, Auto detect, 19200 B-N-1, SCROLL, CAPS, NUM, Capture, Print echo.

### Modem Commands

Note • The modem must reply with either OK or READY to each command entered. If the modem fails to answer, the command has not been processed.

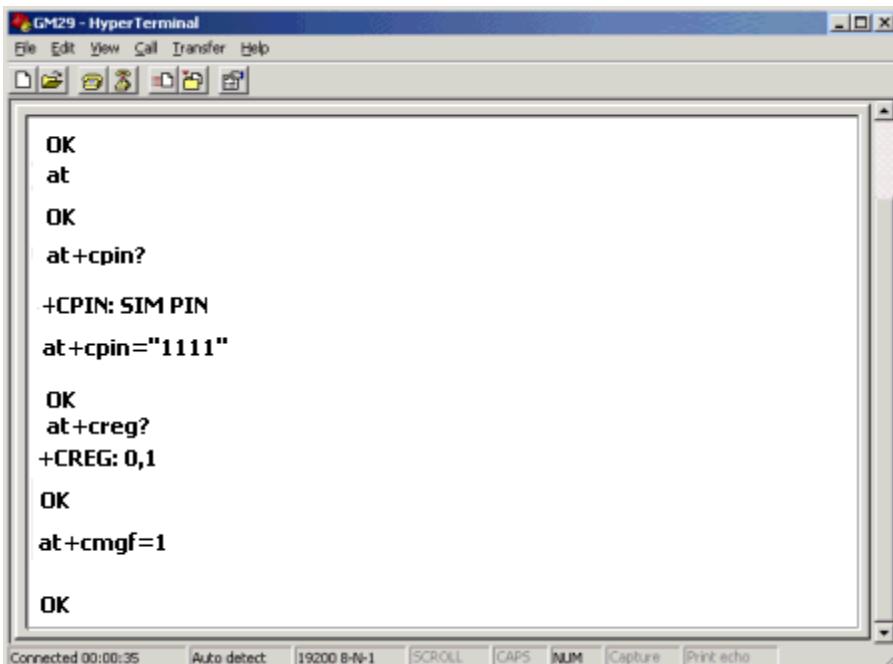
+++	Escape Sequence. This causes the modem to close connections and go back to command mode
AT	This command means Attention; and is used to begin a session
AT&F	Restores factory default settings
ATZ	Resets the modem. This command may take time to implement, so the response from the modem may be delayed
ATE0	No Echo
V1	Enable Verbose (long) response
Q0	Respond
X4	Detailed answers
&D0	Ignore DTR
&S0	DSR always ON. Since the DSR can be permanently set to ON, connecting it to the RTS causes the terminal always be ready to transmit\receive data
&S1	DSR OFF in command and test modes
&C1	Give the user a signal for the DCD
ATS0=1	Auto-Answer after 1 ring
&W	Burn the configuration into the modem's non-volatile memory

### Initializing the modem to SMS mode via Hyperterminal

Once the modem is successfully initialized, you can use Hyperterminal to initialize the modem to SMS mode.

Command	Description	Notes
at+cpin=?	Is a pin number required?	
at+pin="xxxx" xxxx	Is the pin number set in the application?	
at+creg?	Has the SIM card been registered with	Should return one of two answers:

	the local cellular provider?	<ul style="list-style-type: none"> <li>• +CREG: 0,1 The SIM is registered with its local provider.</li> <li>• +CREG: 0,5 The SIM is in roaming mode.</li> </ul>
at+cmgf=1	Go to text mode	



The screenshot shows a HyperTerminal window titled "GM29 - HyperTerminal". The window displays a series of AT commands and their responses:

```

OK
at
OK
at+cpin?
+CPIN: SIM PIN
at+cpin="1111"

OK
at+creg?
+CREG: 0,1

OK
at+cmgf=1

OK

```

The status bar at the bottom of the terminal window shows "Connected 00:00:35", "Auto detect", "19200 B-N-1", and various control buttons like SCROLL, CAPS, NUM, Capture, Print echo.

<b>Note •</b>	Commands including question marks are run for verification twice. If the command is not verified during the second attempt, the attempts stop.
•	If the SIM requests the PUK number, the SIM must be taken out of the modem and installed into a phone to enable the number to be entered.
•	If the SIM is full, the SIM must be taken out of the modem and installed into a phone to enable the SIM to be cleared.
•	The modem must be able to support Text mode. P.D.U. mode is not supported.

### When a controller sends an SMS text message

- It uses the Send command, containing the number to be called: AT+CMGS= "phone number".
- The controller then waits for the reply '>'.
- When the '>' is received, the controller sends the message, ending the line with CTRL\_Z
- If the message is successfully sent, the controller will receive a message of confirmation,+CMGS:xx. When this message is received by the controller, SB 184 turns ON. The confirmation message is acknowledged by OK.
- If :
  - the message of confirmation is not received within 15 seconds, or
  - the '>' is not received within 3 seconds, SB 185 turns ON.

When the controller receives an SMS text message:

- It receives the command: +CMTI: "SM" ,xx. Xx is a number in the controller's memory, 1 to 20.
- When the message is received, the controller asks the modem for the text via the command AT+CMGR=xx
- The modem replies with +CMGR, including the phone number, status, text, and concluding with OK.

**Note •** When a COM port has been successfully initialized, the relevant bit turns ON: SB 80 , 82, 83 or 84.

If initialization fails, SB 81, 83, 85, or 87 will turn ON.

### 'The Sniffer'--Viewing communication strings

The instructions below show you how to construct a communications 'Sniffer'. This device enables you to use Hyperterminal to view communication strings flowing between a PLC and an external, connected device such as a bar code reader.

'Sniffer' is connected to the external device.



'COM' is connected to the PLC.

The completed Sniffer is connected to a PLC communication port, PC and external device.



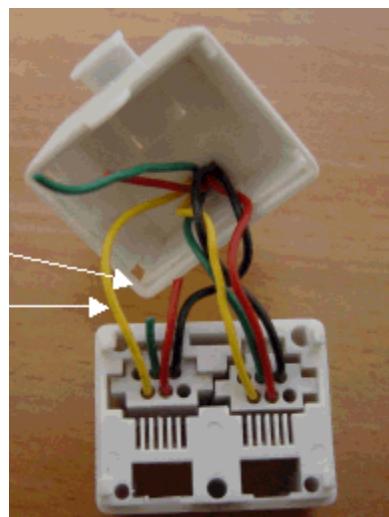
To make a Sniffer, you need:

- An adapter.
- Two 1N4148 or 1N914 diodes.

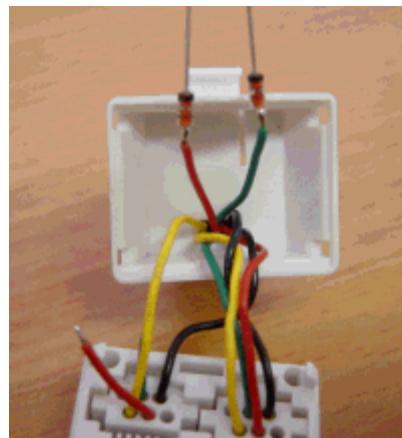
1. Open the adapter carefully via the 4 snaps in its sides.



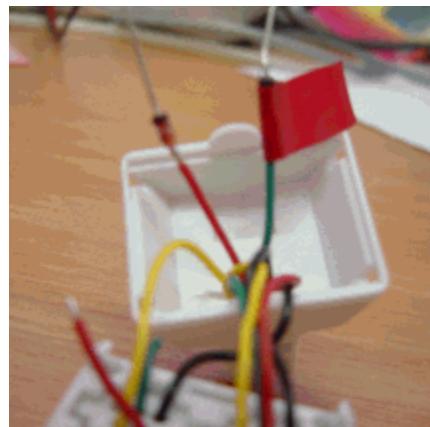
2. Cut the red and green wires as shown below.



3. Solder one diode to the red wire, and one diode to the green wire. The soldered point provides the anode.



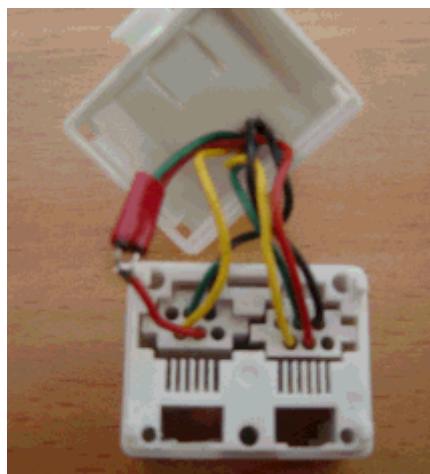
4. Put isolating material on the soldered points.



## Getting Started

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5. Solder both diodes' cathodes to the red wire.



6. Put isolating material on the solder.  
7. Close the Sniffer.  
8. Label the connectors as shown.



**Note •** In order to run view the strings in Hyperterminal, you must set the program to display ASCII strings as described above in Using Hyperterminal.

## Using Hyperterminal to check PC-PLC direct communications

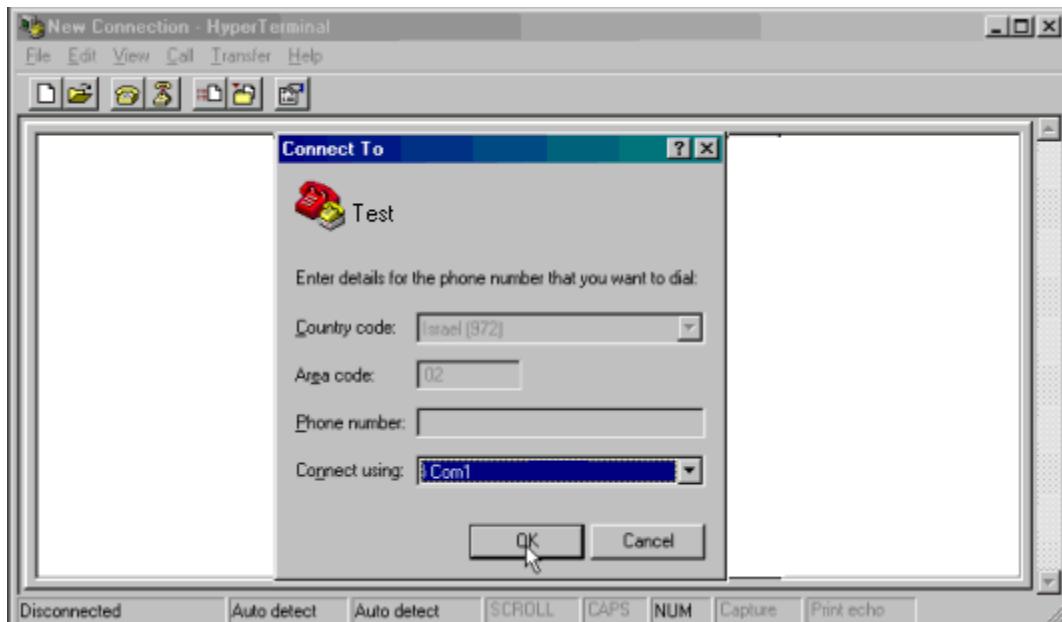
If the PC port is defective or in use by another application, you may be unable to access a directly connected controller with your PC.

Via Hyperterminal, you can check the PLC-PC communication connection by sending a simple text command, Get ID. If the connection is in order, the controller replies with its ID; if the connection is faulty, the controller will not reply.

1. Open Hyperterminal.



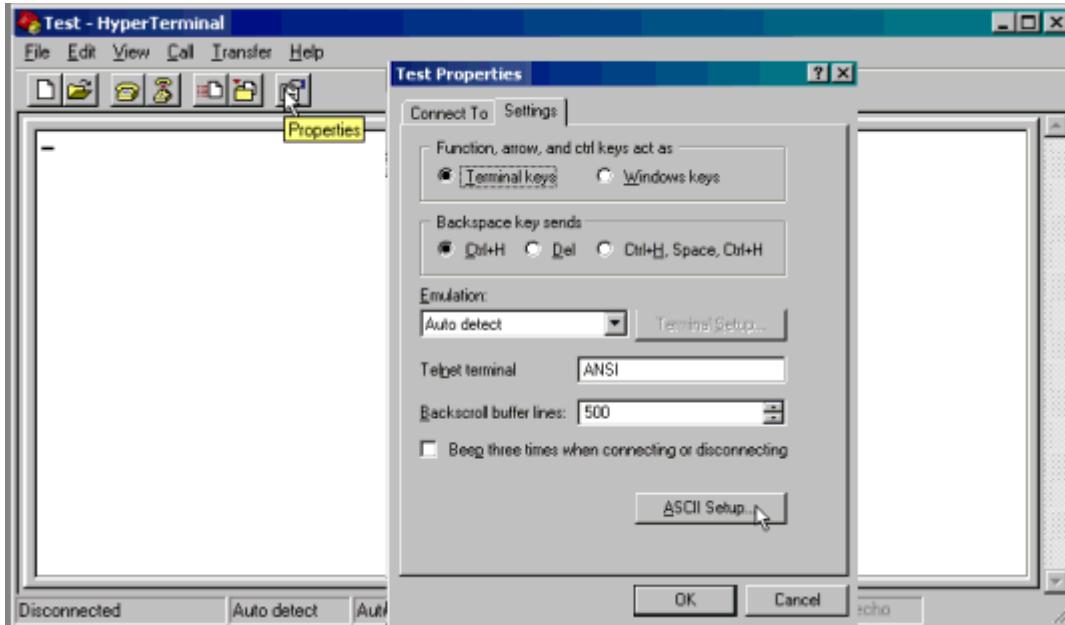
2. Enter a name for the new connection and select an icon, and then click OK. The Connect To box opens.
3. Select the PC COM port that connects the PC to the controller, and then click OK.



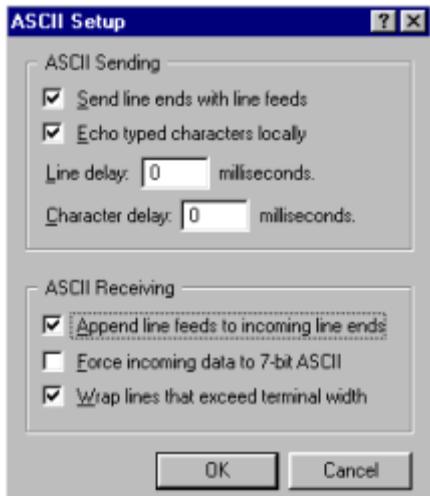
4. The Port Settings box opens as shown below. To enable your PC to communicate with the modem, set the COM port parameters to a BPS of either 9600 or 19200, Data bits=8, Parity=N, Stop bits=1, Flow control=None, and then click OK.



5. Open the Properties box by clicking on the Properties button, then open ASCII Setup.

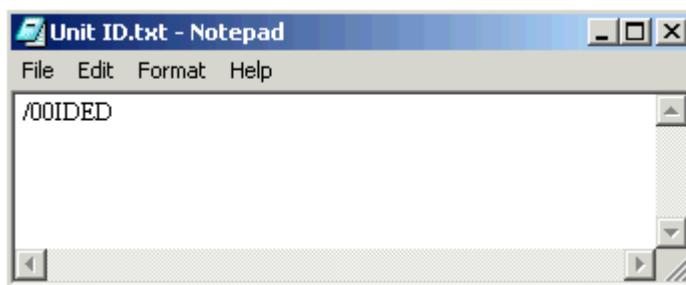


6. Select the options shown below, and then click OK.

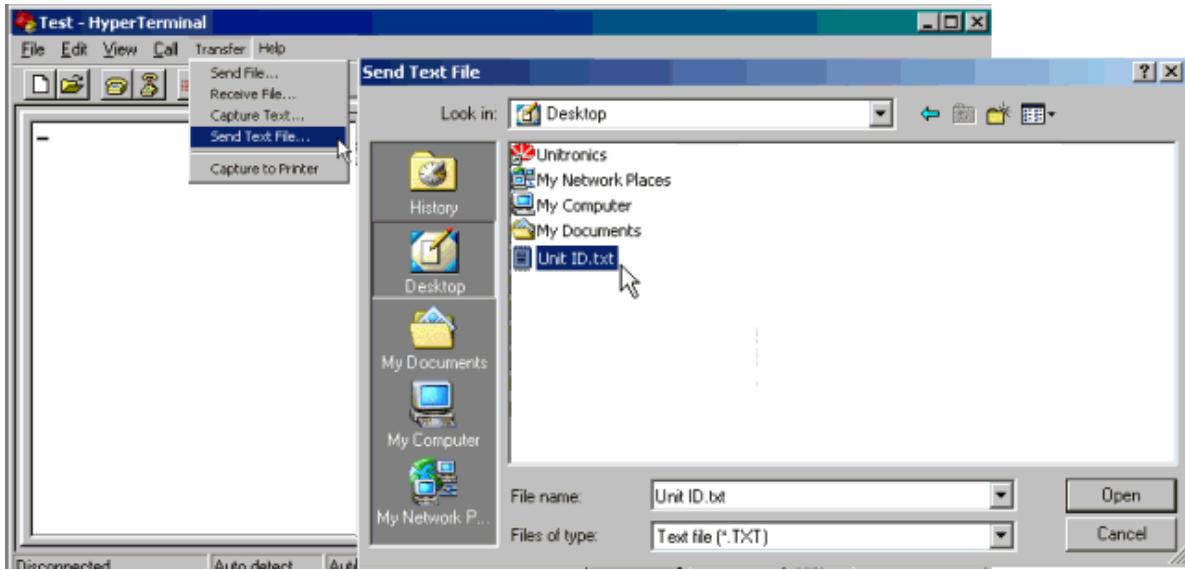


7. To synchronize the controller's communication settings, enter Info mode. Navigate to System>RS232>Restore Defaults, and then press the Enter key.
8. Open Notepad, enter the text /00IDED, press Enter, and save the file. This is the Get ID command, where 00 is the 'placeholder' for the controller's Unit ID number. 00 enables any directly controller to answer, no matter what its actual ID number is. ED is the command's checksum.

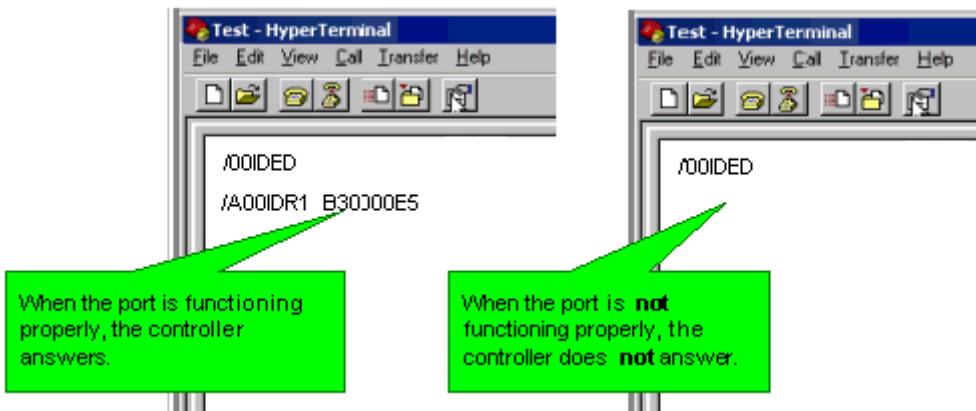
**Note •** Pressing Enter places a Carriage Return command at the end of the text. Although the Carriage Return is not visible, the command will not be processed without it.



9. Select Send Text file from the Transfer menu, and open the text file



10. If you have configured everything according to the instructions above, and the port is functioning properly, the controller with its ID number. If the port is out of order, the controller will not reply.



In the figure above, the characters in the string that is returned by the controller, /A00IDR1 B30000E5 may be interpreted as follows:

A	00	ID (PLC model)	B (Hardware Version)	E5	CR (ETX)
Answer	Requested number	M90-R1	OS V3.00 (00)	Checksum	Not visible



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