

Where Automation Connects.



**inRAX<sup>®</sup>**  
**MVI56-MNETC**

ControlLogix Platform  
Modbus TCP/IP Multi Client  
Communication Module

October 26, 2011

## **Your Feedback Please**

We always want you to feel that you made the right decision to use our products. If you have suggestions, comments, compliments or complaints about our products, documentation, or support, please write or call us.

## **How to Contact Us**

### **ProSoft Technology**

5201 Truxtun Ave., 3rd Floor

Bakersfield, CA 93309

+1 (661) 716-5100

+1 (661) 716-5101 (Fax)

[www.prosoft-technology.com](http://www.prosoft-technology.com)

[support@prosoft-technology.com](mailto:support@prosoft-technology.com)

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MVI56-MNETC User Manual

October 26, 2011

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## **ProSoft Technology<sup>®</sup> Product Documentation**

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided on the enclosed CD-ROM in Adobe<sup>®</sup> Acrobat Reader file format (.PDFs). These product documentation files may also be freely downloaded from our web site: [www.prosoft-technology.com](http://www.prosoft-technology.com)

## Warnings

### North America Warnings

Power, Input, and Output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods, Article 501-4 (b) of the National Electrical Code, NFPA 70 for installation in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations in Canada, and in accordance with the authority having jurisdiction. The following warnings must be heeded:

- A** Warning - Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2.
- B** Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or rewiring modules.
- C** Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

*Avertissement - Risque d'explosion - Avant de déconnecter l'équipement, couper le courant ou s'assurer que l'emplacement est désigné non dangereux.*

- D** Suitable for use in Class I, Division 2 Groups A, B, C and D Hazardous Locations or Non-Hazardous Locations.

### ATEX Warnings and Conditions of Safe Usage

Power, Input, and Output (I/O) wiring must be in accordance with the authority having jurisdiction.

- A** Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or wiring modules.
- B** Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.
- C** These products are intended to be mounted in an IP54 enclosure. The devices shall provide external means to prevent the rated voltage being exceeded by transient disturbances of more than 40%. This device must be used only with ATEX certified backplanes.
- D** DO NOT OPEN WHEN ENERGIZED.

### Battery Life Advisory

The MVI46, MVI56, MVI56E, MVI69, and MVI71 modules use a rechargeable Lithium Vanadium Pentoxide battery to backup the real-time clock and CMOS. The battery should last for the life of the module. The module must be powered for approximately twenty hours before the battery becomes fully charged. After it is fully charged, the battery provides backup power for the CMOS setup and the real-time clock for approximately 21 days. When the battery is fully discharged, the module will revert to the default BIOS and clock settings.

**Note:** The battery is not user replaceable.

## Markings

### Hardware Ratings

- Backplane Current Load: 800 mA @ 5 Vdc; 3 mA @ 24 Vdc
- Operating Temperature: 0 °C to 60 °C (32 °F to 140 °F)
- Storage Temperature: -40 °C to 85 °C (-40 °F to 185 °F)
- Shock: 30 g operational; 50 g non-operational; Vibration: 5 g from 10 Hz to 150 Hz
- Relative Humidity: 5% to 95% (without condensation)
- All phase conductor sizes must be at least 1.3 mm (squared) and all earth ground conductors must be at least 4mm (squared).

## Label Markings

<cULus>

E183151

CL I Div 2 GP A, B, C, D

Temp Code T6

-30°C ≤ Ta ≤ 60°C

<Ex>

II 3 G

EEx nA IIC T6

0°C ≤ Ta ≤ 60°C

II – Equipment intended for above ground use (not for use in mines).

3 – Category 3 equipment, investigated for normal operation only.

G – Equipment protected against explosive gasses.

## Agency Approvals and Certifications

Agency	Applicable Standards
RoHS	
ATEX	EN60079-15:2003
CSA	IEC61010
CE	EMC-EN61326-1:2006 EN61000-6-4:2007
CSA CB Safety	CA/10533/CSA IEC 61010-1 Ed. 2 CB 243333-2056722 (2090408)
cULus	UL508, UL1604, CSA 22.2 No. 142 & 213
GOST-R	EN61010

RoHS



243333

E183151

ME06

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## Guide to the MVI56-MNETC User Manual

Function		Section to Read	Details
Introduction (Must Do)	□	Start Here (page 10)	This section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Diagnostic and Troubleshooting	□	Diagnostics and Troubleshooting (page 67)	This section describes Diagnostic and Troubleshooting procedures.
Reference Product Specifications	□	Reference (page 87) Product Specifications (page 88)	These sections contain general references associated with this product and its Specifications..
Support, Service, and Warranty Index	□	Support, Service and Warranty (page 143) Index	This section contains Support, Service and Warranty information. Index of chapters.



# 1 Start Here

## *In This Chapter*

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To get the most benefit from this User Manual, you should have the following skills:

- **Rockwell Automation® RSLogix™ software:** launch the program, configure ladder logic, and transfer the ladder logic to the processor
- **Microsoft Windows:** install and launch programs, execute menu commands, navigate dialog boxes, and enter data
- **Hardware installation and wiring:** install the module, and safely connect Modbus TCP/IP and ControlLogix devices to a power source and to the MVI56-MNETC module's application port(s)

## 1.1 System Requirements

The MVI56-MNETC module requires the following minimum hardware and software components:

- Rockwell Automation ControlLogix™ processor, with compatible power supply and one free slot in the rack, for the MVI56-MNETC module. The module requires 800 mA of available power.
- Rockwell Automation RSLogix 5000 programming software version 2.51 or higher
- Rockwell Automation RSLinx communication software
- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft Windows XP Professional with Service Pack 1 or 2
  - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
  - Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- CD-ROM drive
- ProSoft Configuration Builder, HyperTerminal or other terminal emulator program.

**Note:** You can install the module in a local or remote rack. For remote rack installation, the module requires EtherNet/IP or ControlNet communication with the processor.

## 1.2 Package Contents

The following components are included with your MVI56-MNETC module, and are all required for installation and configuration.

**Important:** Before beginning the installation, please verify that all of the following items are present.

Qty.	Part Name	Part Number	Part Description
1	MVI56-MNETC Module	MVI56-MNETC	Modbus TCP/IP Multi Client Communication Module
1	Cable	Cable #15 - RS232 Null Modem	For RS232 between a Personal Computer (PC) and the CFG port of the module
1	Cable	Cable #14 - RJ45 to DB9 Male Adapter	For connecting the module's port to Cable #15 for RS-232 connections
1	inRAX Solutions CD		Contains sample programs, utilities and documentation for the MVI56-MNETC module.

If any of these components are missing, please contact ProSoft Technology Support for replacement parts.

### 1.3 Installing ProSoft Configuration Builder Software

You must install the *ProSoft Configuration Builder (PCB)* software to configure the module. You can always get the newest version of *ProSoft Configuration Builder* from the ProSoft Technology website.

#### **To install ProSoft Configuration Builder from the ProSoft Technology website**

- 1 Open your web browser and navigate to <http://www.prosoft-technology.com/pcb>
- 2 Click the link at the *Current Release Version* section to download the latest version of *ProSoft Configuration Builder*.
- 3 Choose **SAVE** or **SAVE FILE** when prompted.
- 4 Save the file to your *Windows Desktop*, so that you can find it easily when you have finished downloading.
- 5 When the download is complete, locate and open the file, and then follow the instructions on your screen to install the program.

If you do not have access to the Internet, you can install *ProSoft Configuration Builder* from the *ProSoft Solutions Product CD-ROM*, included in the package with your module.

#### **To install ProSoft Configuration Builder from the Product CD-ROM**

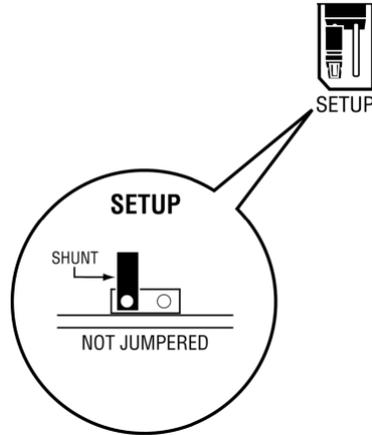
- 1 Insert the *ProSoft Solutions Product CD-ROM* into the CD-ROM drive of your PC. Wait for the startup screen to appear.
- 2 On the startup screen, click **PRODUCT DOCUMENTATION**. This action opens a *Windows Explorer* file tree window.
- 3 Click to open the **UTILITIES** folder. This folder contains all of the applications and files you will need to set up and configure your module.
- 4 Double-click the **SETUP CONFIGURATION TOOL** folder, double-click the **PCB\_\*.EXE** file and follow the instructions on your screen to install the software on your PC. The information represented by the "\*" character in the file name is the *PCB* version number and, therefore, subject to change as new versions of *PCB* are released.

**Note:** Many of the configuration and maintenance procedures use files and other utilities on the CD-ROM. You may wish to copy the files from the *Utilities* folder on the CD-ROM to a convenient location on your hard drive.

## 1.4 Setting Jumpers

The Setup Jumper acts as "write protection" for the module's flash memory. In "write protected" mode, the Setup pins are not connected, and the module's firmware cannot be overwritten. Do not jumper the Setup pins together unless you are directed to do so by ProSoft Technical Support.

The following illustration shows the MVI56-MNETC jumper configuration.



**Note:** If you are installing the module in a remote rack, you may prefer to leave the Setup pins jumpered. That way, you can update the module's firmware without requiring physical access to the module.

## 1.5 Installing the Module in the Rack

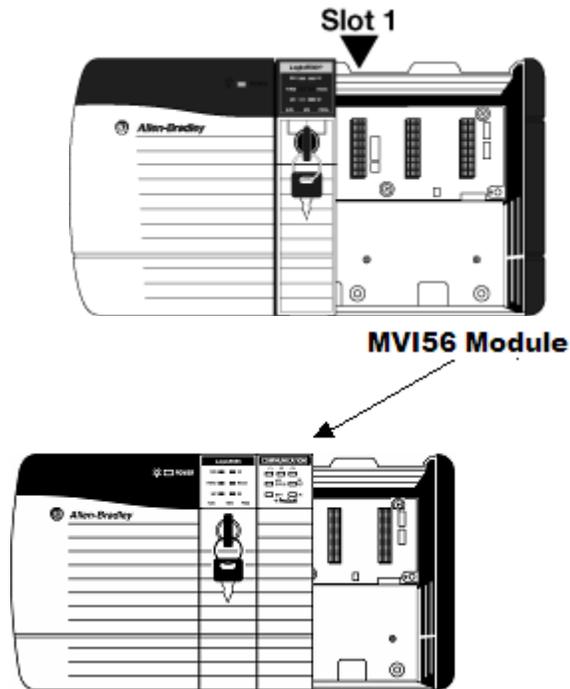
If you have not already installed and configured your ControlLogix processor and power supply, please do so before installing the MVI56-MNETC module. Refer to your Rockwell Automation product documentation for installation instructions.

**Warning:** You must follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device you plan to connect to verify that suitable safety procedures are in place before installing or servicing the device.

After you have checked the placement of the jumpers, insert MVI56-MNETC into the ControlLogix chassis. Use the same technique recommended by Rockwell Automation to remove and install ControlLogix modules.

**Warning:** When you insert or remove the module while backplane power is on, an electrical arc can occur. This could cause an explosion in hazardous location installations. Verify that power is removed or the area is non-hazardous before proceeding. Repeated electrical arcing causes excessive wear to contacts on both the module and its mating connector. Worn contacts may create electrical resistance that can affect module operation.

- 1 Turn power OFF.
- 2 Align the module with the top and bottom guides, and slide it into the rack until the module is firmly against the backplane connector.



- 3 With a firm but steady push, snap the module into place.
- 4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
- 5 Make a note of the slot location. You must identify the slot in which the module is installed in order for the sample program to work correctly. Slot numbers are identified on the green circuit board (backplane) of the ControlLogix rack.
- 6 Turn power ON.

**Note:** If you insert the module improperly, the system may stop working, or may behave unpredictably.



## 2 Configuring the MVI56-MNETC Module

### *In This Chapter*

- ❖ Importing the Sample Add-On Instruction.....20
- ❖ Connecting Your PC to the ControlLogix Processor..... 33
- ❖ Downloading the Sample Program to the Processor ..... 34
- ❖ Using ProSoft Configuration Builder ..... 35
- ❖ Connecting your PC to the Module..... 53
- ❖ Downloading the Project to the Module Using a Serial COM Port..... 54

## 2.1 Importing the Sample Add-On Instruction

**Note:** This section only applies if your processor is using RSLogix 5000 version 16 or higher. If you have an earlier version, please see Using the Sample Program (page 135).

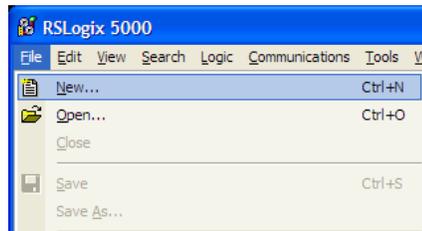
### Before You Begin

The following file is required before you start this procedure. Copy the file from the *ProSoft Solutions CD-ROM*, or download it from [www.prosoft-technology.com](http://www.prosoft-technology.com).

File Name	Description
MVI56MNETC_AddOn_Rung_v1_5.L5X	L5X file containing Add-On instruction, user defined data types, data objects and ladder logic required to set up the MVI56-MNETC module

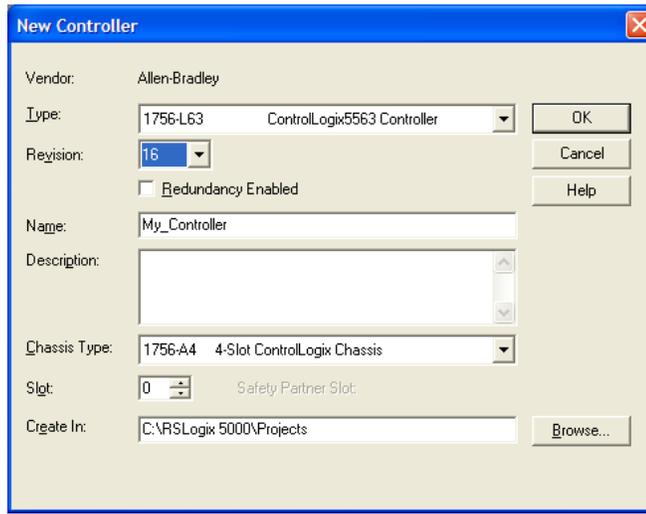
### 2.1.1 Creating a New RSLogix 5000 Project

- 1 Open the **FILE** menu, and then choose **NEW**.



- 2 Select your ControlLogix controller model.
- 3 Select **REVISION 16**.
- 4 Enter a name for your controller, such as *My\_Controller*.
- 5 Select your ControlLogix chassis type.

- 6 Select **SLOT 0** for the controller.



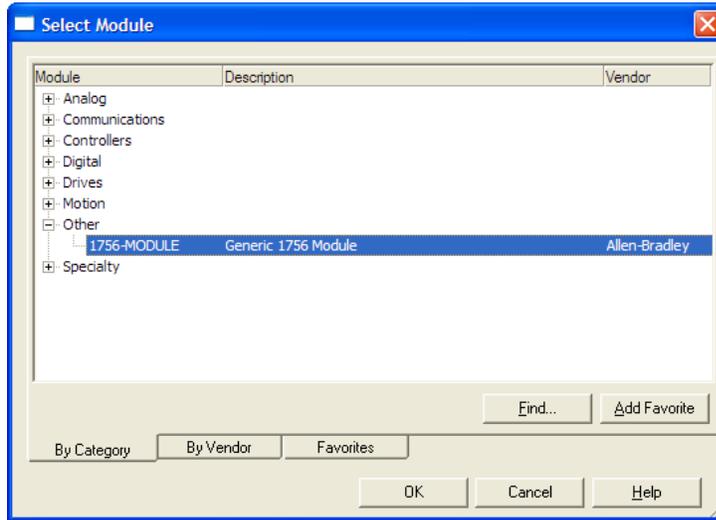
### 2.1.2 Creating the Module

- 1 Add the **MVI56-MNETC** module to the project.

In the *Controller Organization* window, select **I/O CONFIGURATION** and click the right mouse button to open a shortcut menu. On the shortcut menu, choose **NEW MODULE**.



This action opens the *Select Module* dialog box.



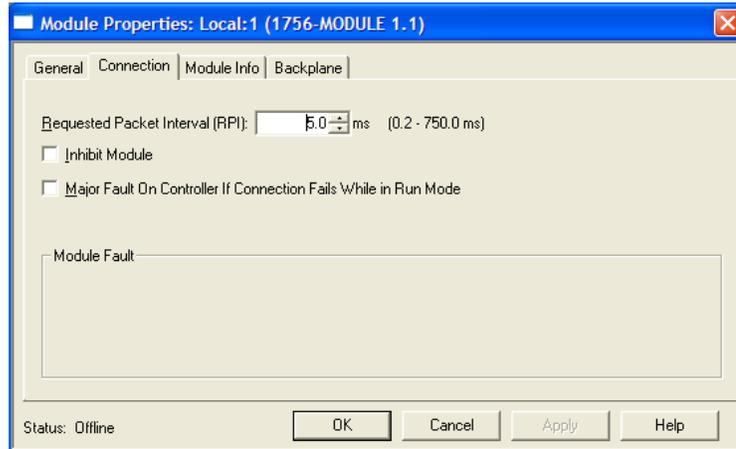
- 2 Select the **1756-MODULE (GENERIC 1756 MODULE)** from the list and click **OK**. This action opens the *New Module* dialog box.
- 3 In the *New Module* dialog box, enter the following values.

Parameter	Value
Name	Enter a module identification string. Example: <b>MNETC</b>
Description	Enter a description for the module. Example: <b>MODBUS TCP/IP MULTI CLIENT COMMUNICATION MODULE</b>
Comm Format	Select <b>DATA-INT</b> .
Slot	Enter the slot number in the rack where the MVI56-MNETC module is located.
Input Assembly Instance	<b>1</b>
Input Size	<b>250</b>
Output Assembly Instance	<b>2</b>
Output Size	<b>248</b>
Configuration Assembly Instance	<b>4</b>
Configuration Size	<b>0</b>

**Important:** You must select the *Comm Format* as **DATA - INT** in the dialog box, otherwise the module will not communicate over the backplane of the ControlLogix rack.

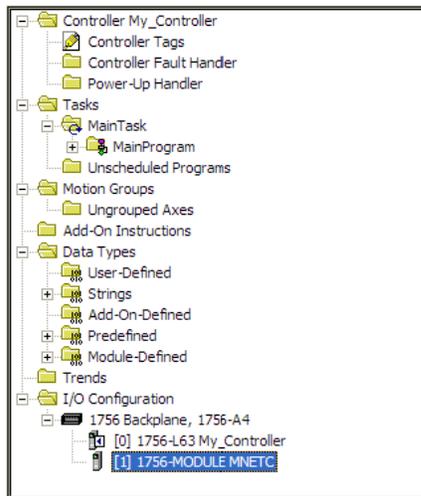
- 4 Click **OK** to continue.

- 5 Edit the Module Properties. Select the *Requested Packet Interval* value for scanning the I/O on the module. This value represents the minimum frequency at which the module will handle scheduled events. This value should not be set to less than 1 millisecond. The default value is 5 milliseconds. Values between 1 and 10 milliseconds should work with most applications.



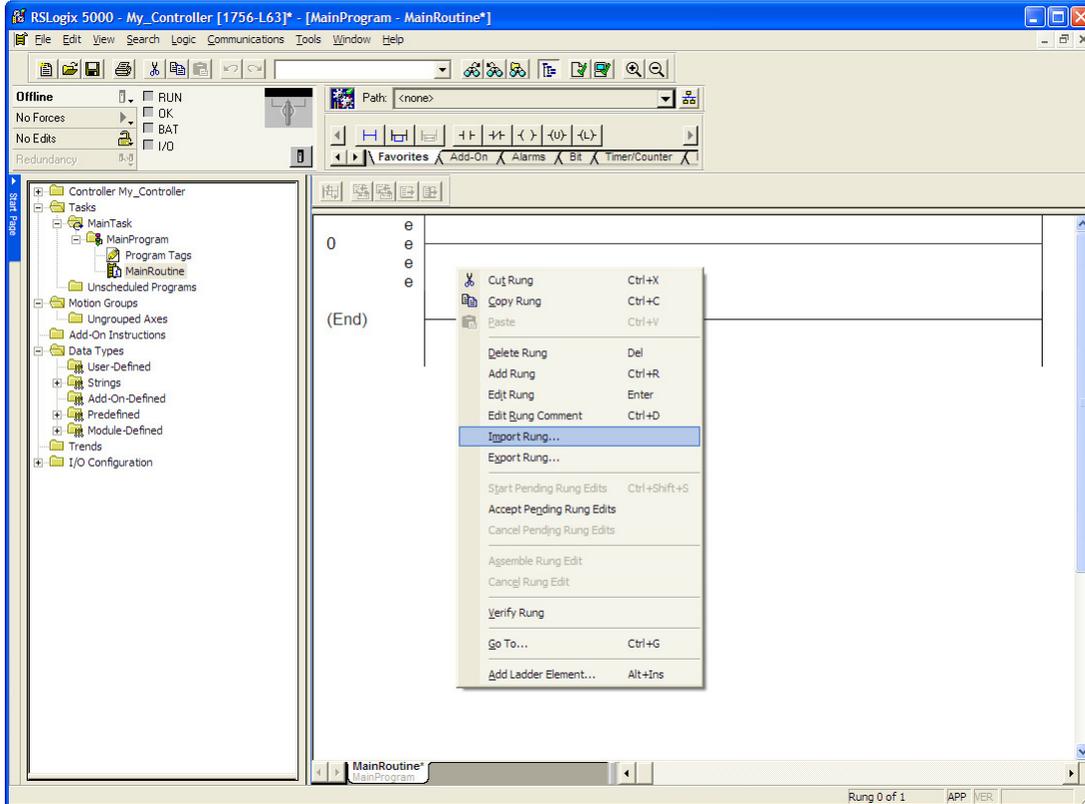
- 6 **Save the module.**

Click **OK** to close the dialog box. Notice that the module now appears in the *Controller Organization* window.

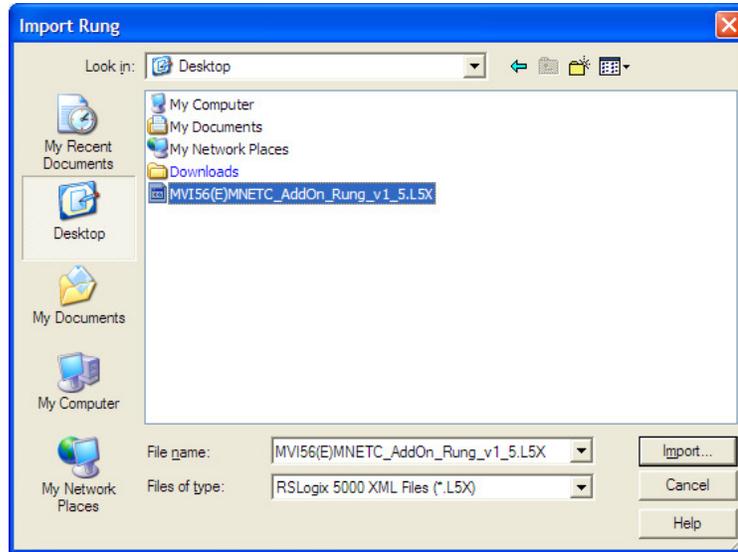


### 2.1.3 Importing the Add-On Instruction

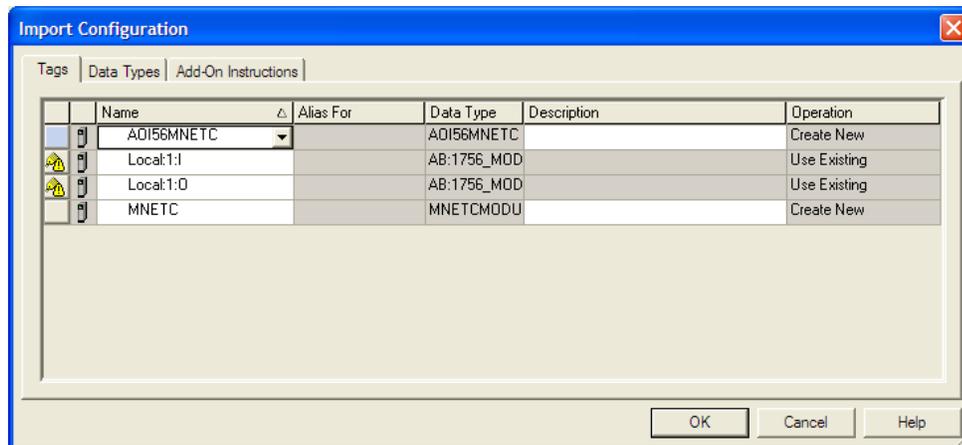
- 1 In the *Controller Organization* window, expand the **TASKS** folder and subfolder until you reach the **MAINPROGRAM** folder.
- 2 In the **MAINPROGRAM** folder, double-click to open the **MAINROUTINE** ladder.
- 3 Select an empty rung in the new routine, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **IMPORT RUNG**.



- 4 Navigate to the location on your PC where you saved the Add-On Instruction (for example, *My Documents* or *Desktop*). Select the **MVI56MNETC\_ADDON\_RUNG\_v1\_5.L5X** file.

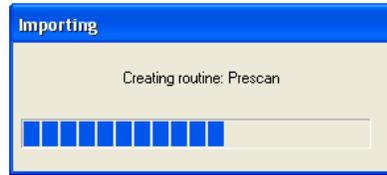


This action opens the *Import Configuration* dialog box, showing the controller tags that will be created.

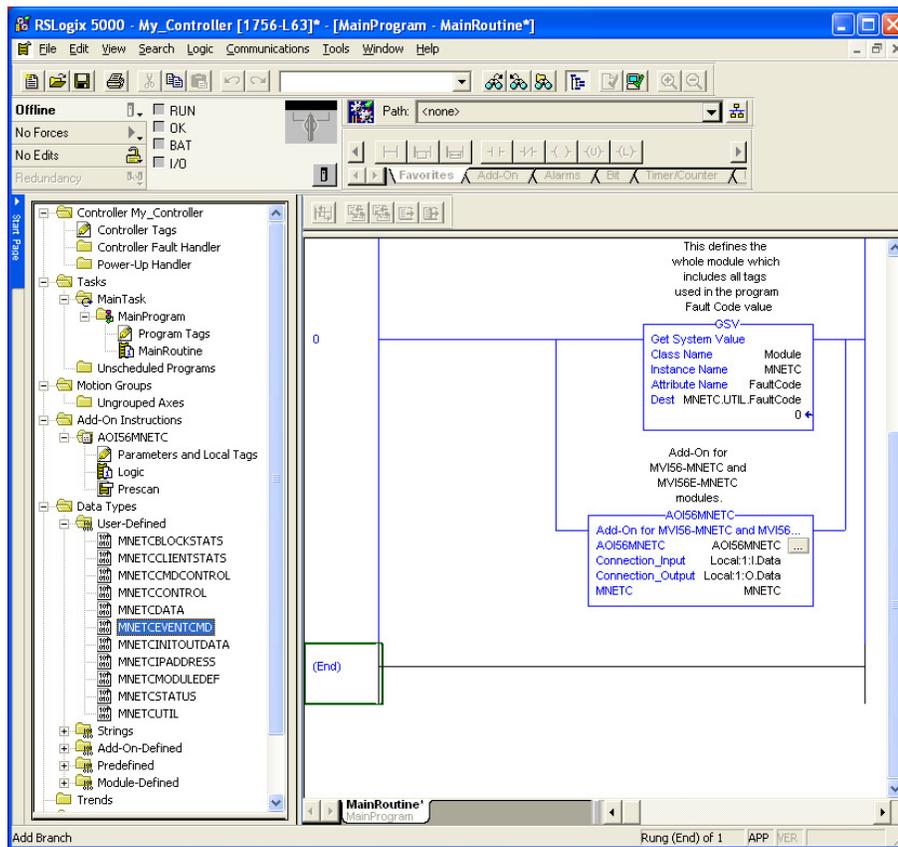


- 5 If you are using the module in a different slot (or remote rack), select the correct connection input and output variables that define the path to the module. If your module is located in Slot 1 of the local rack, this step is not required.

- 6 Click **OK** to confirm the import. RSLogix will indicate that the import is in progress:



When the import is completed, the new rung with the Add-On Instruction will be visible as shown in the following illustration.



The procedure has also imported new user-defined data types, data objects and the Add-On Instruction for your project.

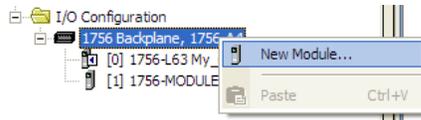


- 7 Save the application and then download the sample ladder logic to the processor.

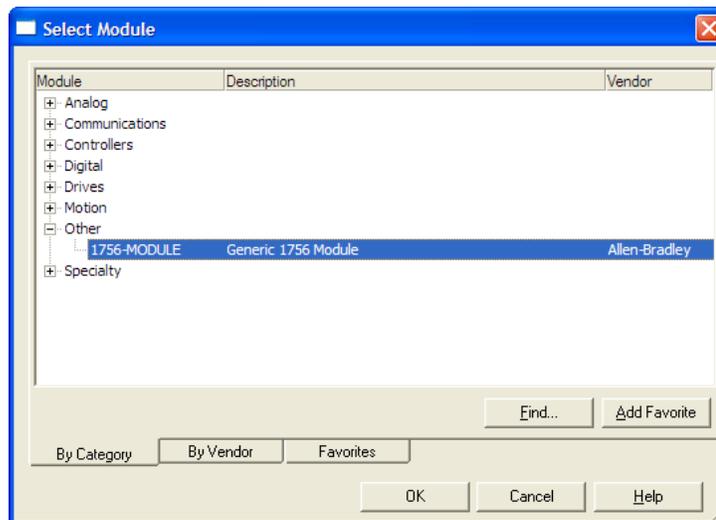
*Adding Multiple Modules (Optional)*

**Important:** If your application requires more than one MVI56-MNETC module in the same project, follow the steps below.

- 1 In the **I/O CONFIGURATION** folder, click the right mouse button to open a shortcut menu, and then choose **NEW MODULE**.



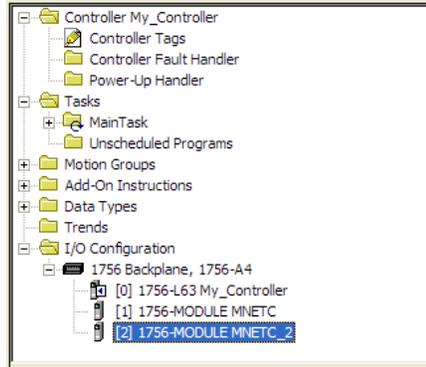
- 2 Select **1756-MODULE**.



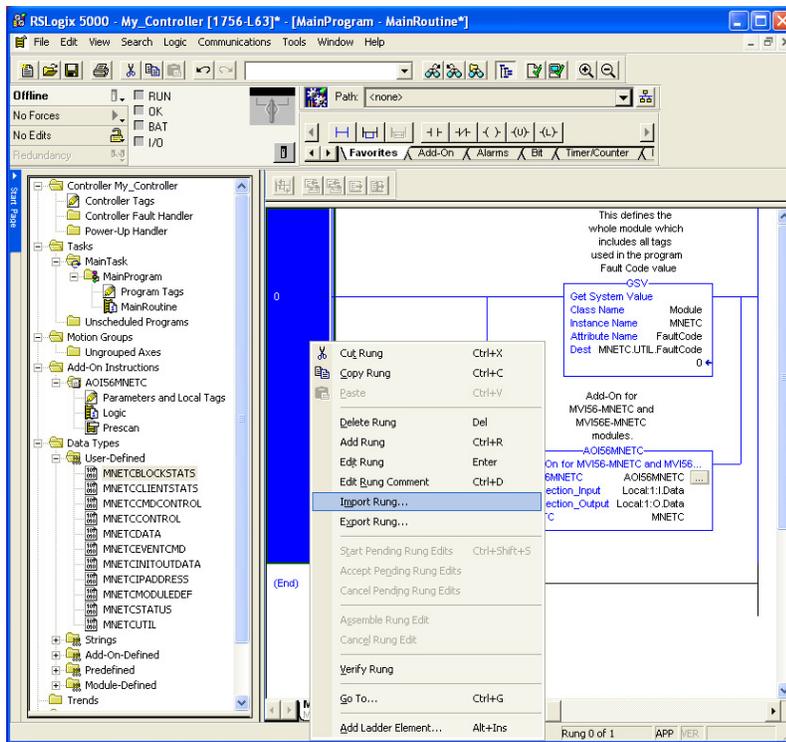
- 3 Fill the module properties as follows:

Parameter	Value
Name	Enter a module identification string. Example: <b>MNETC_2</b> .
Description	Enter a description for the module. Example: <b>MODBUS TCP/IP MULTI CLIENT COMMUNICATION MODULE</b>
Comm Format	Select <b>DATA-INT</b> .
Slot	Enter the slot number in the rack where the MVI56-MNETC module is located.
Input Assembly Instance	<b>1</b>
Input Size	<b>250</b>
Output Assembly Instance	<b>2</b>
Output Size	<b>248</b>
Configuration Assembly Instance	<b>4</b>
Configuration Size	<b>0</b>

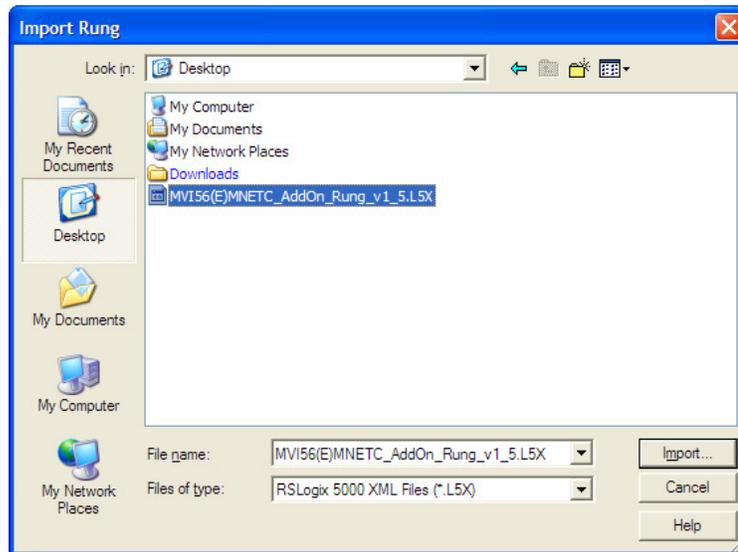
- 4 Click **OK** to confirm. The new module is now visible:



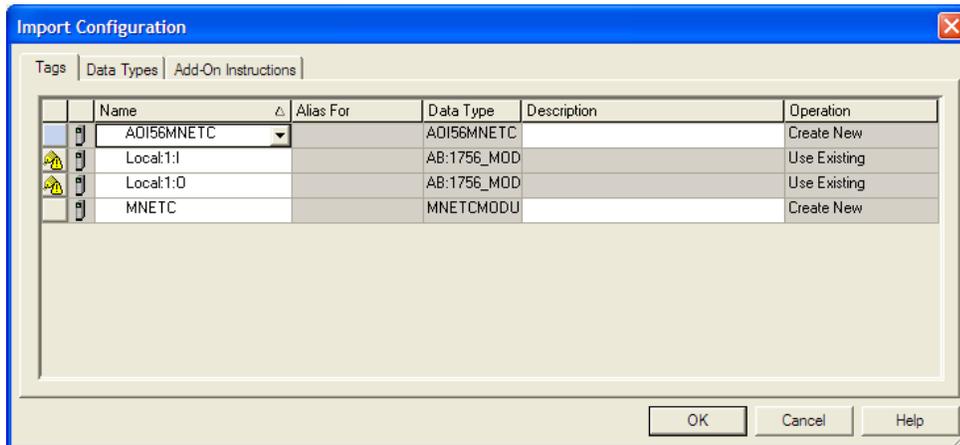
- 5 Expand the **TASKS** folder, and then expand the **MAINTASK** folder.
- 6 In the **MAINPROGRAM** folder, double-click to open the **MAINROUTINE** ladder.
- 7 Select an empty rung in the routine, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **IMPORT RUNG**.



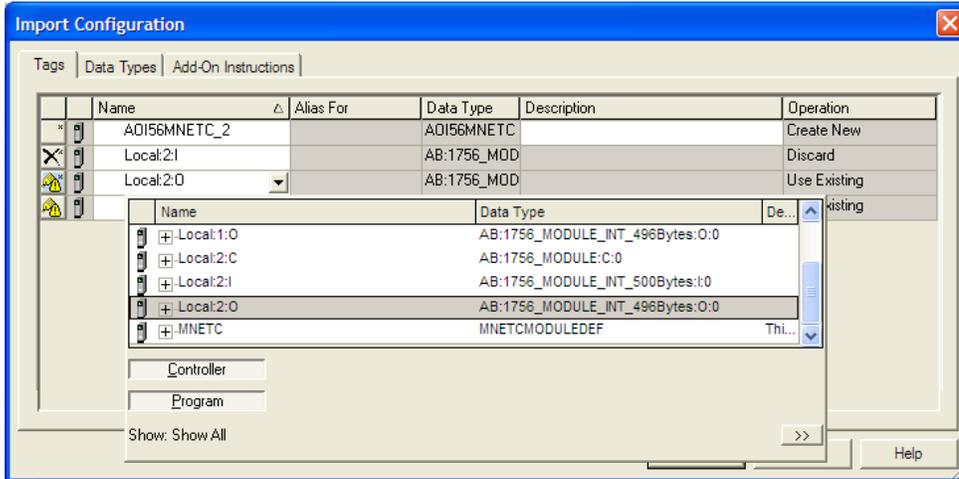
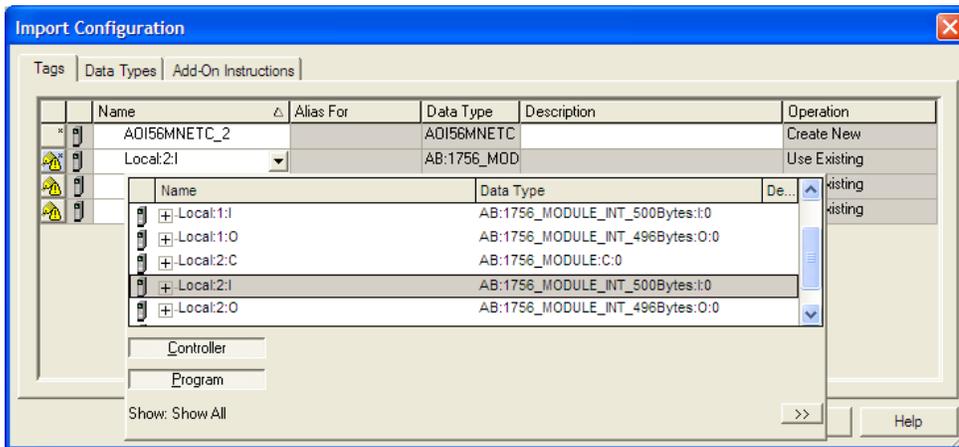
- 8 Select the **MVI56MNETC\_ADDON\_RUNG\_v1\_5.L5X** file, and then click **IMPORT**.



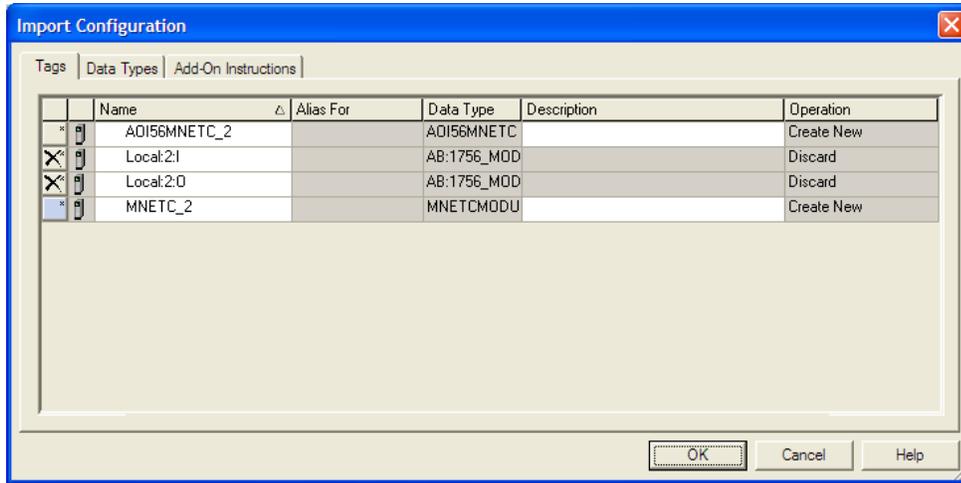
- 9 This action opens the *Import Configuration* window, which shows the tags that will be imported.



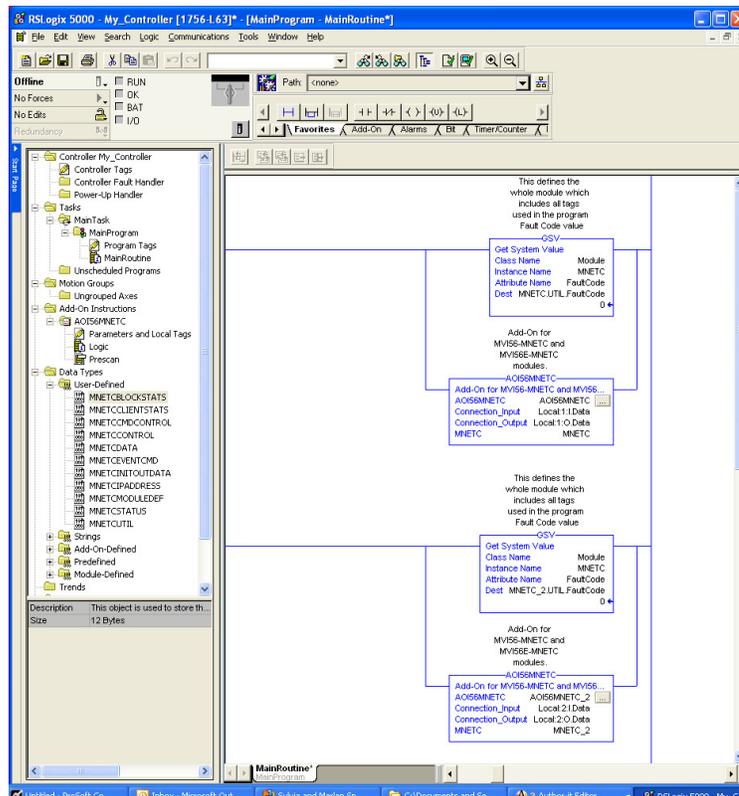
- Associate the I/O connection variables to the correct module. The default values are Local:1:I and Local:1:O so these require change.



- Change the default tags *MNETC* and *AOI56MNETC* to avoid conflict with existing tags. In this step, you should append a string to the default tag names, such as "\_2", as shown in the following illustration.



- Click **OK** to confirm.



The setup procedure is now complete. Save the project and download the application to your ControlLogix processor.

### Adjusting the Input and Output Array Sizes

**Note:** It is unnecessary to manually edit the *ReadData* and *WriteData* user-defined data types in the ladder logic, as these are automatically updated to match the changed array sizes from *ProSoft Configuration Builder*.

The module internal database is divided into two user-configurable areas:

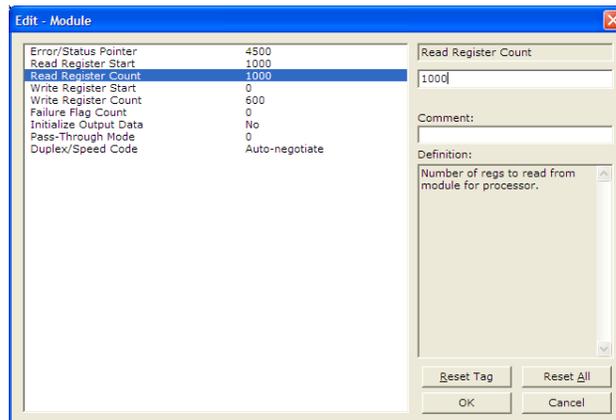
- Read Data
- Write Data

The Read Data area is moved from the module to the processor, while the Write Data area is moved from the processor to the module.

The MVI56-MNETC Add-On Instruction rung is configured for 600 registers of Read Data and 600 registers of Write Data, which is sufficient for most applications. However, you can configure the sizes of these data areas to meet the needs of your application.

- 1 In *ProSoft Configuration Builder*, expand the *Module* icon in the tree view and double-click **MODULE** to open an *Edit* window. Change the **READ REGISTER COUNT** to contain the number of words for your Read Data area.

**Important:** Because the module pages data in blocks of 200 registers at a time, you should configure your user data areas in multiples of 200 registers.

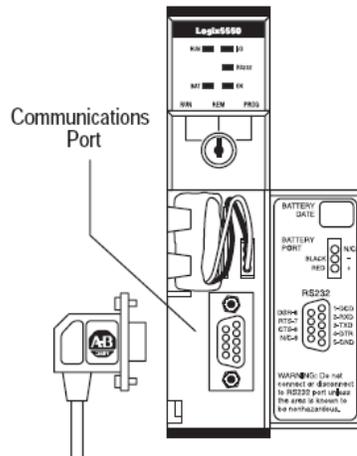


- 2 To modify the *WriteData* array, follow the above steps, substituting *WriteData* for *ReadData*.
- 3 Save and download the configuration to the module (page 54) and reboot. Make sure that the *ReadData* and *WriteData* arrays do not overlap in the module memory. For example, if your application requires 2000 words of *WriteData* starting at register 0, then your *Read Register Start* parameter must be set to a value of 2000 or greater.

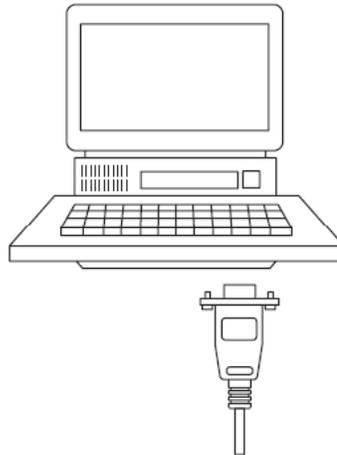
## 2.2 Connecting Your PC to the ControlLogix Processor

There are several ways to establish communication between your PC and the ControlLogix processor. The following steps show how to establish communication through the serial interface. It is not mandatory that you use the processor's serial interface. You may access the processor through whatever network interface is available on your system. Refer to your Rockwell Automation documentation for information on other connection methods.

- 1 Connect the right-angle connector end of the cable to your controller at the communications port.



- 2 Connect the straight connector end of the cable to the serial port on your computer.



### 2.3 Downloading the Sample Program to the Processor

**Note:** The key switch on the front of the ControlLogix processor must be in the REM or PROG position.

- 1 If you are not already online with the processor, open the *Communications* menu, and then choose **DOWNLOAD**. RSLogix 5000 will establish communication with the processor. You do not have to download through the processor's serial port, as shown here. You may download through any available network connection.
- 2 When communication is established, RSLogix 5000 will open a confirmation dialog box. Click the **DOWNLOAD** button to transfer the sample program to the processor.



- 3 RSLogix 5000 will compile the program and transfer it to the processor. This process may take a few minutes.
- 4 When the download is complete, RSLogix 5000 will open another confirmation dialog box. If the key switch is in the REM position, click **OK** to switch the processor from PROGRAM mode to RUN mode.



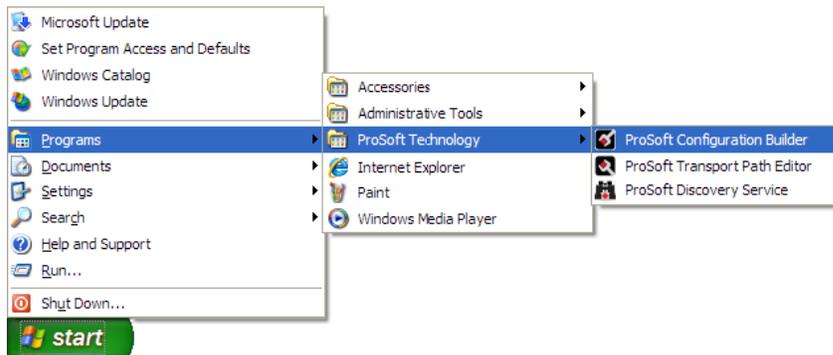
**Note:** If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

## 2.4 Using ProSoft Configuration Builder

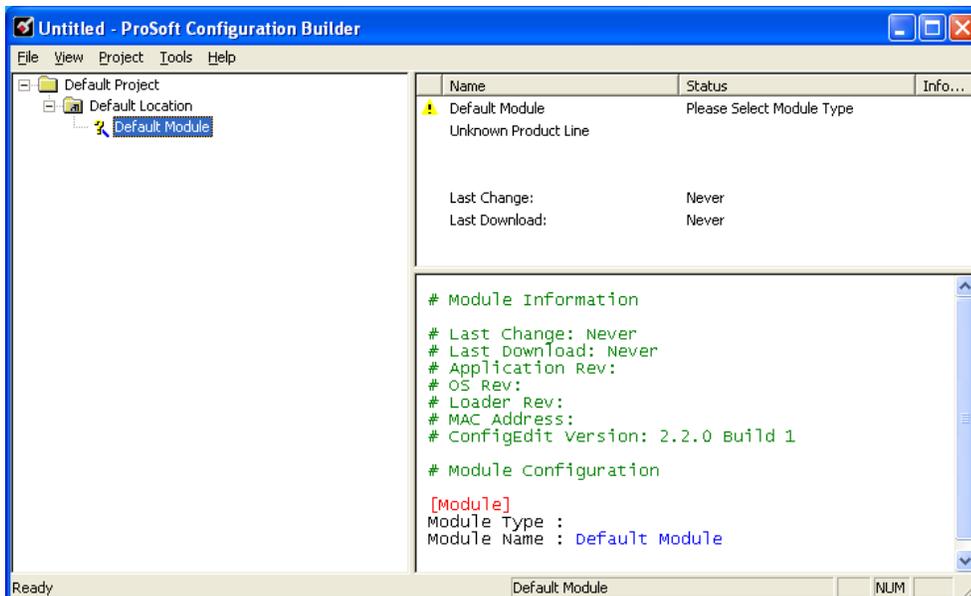
*ProSoft Configuration Builder (PCB)* provides a convenient way to manage module configuration files customized to meet your application needs. *PCB* is not only a powerful solution for new configuration files, but also allows you to import information from previously installed (known working) configurations to new projects.

### 2.4.1 Setting Up the Project

To begin, start **PROSOFT CONFIGURATION BUILDER (PCB)**.

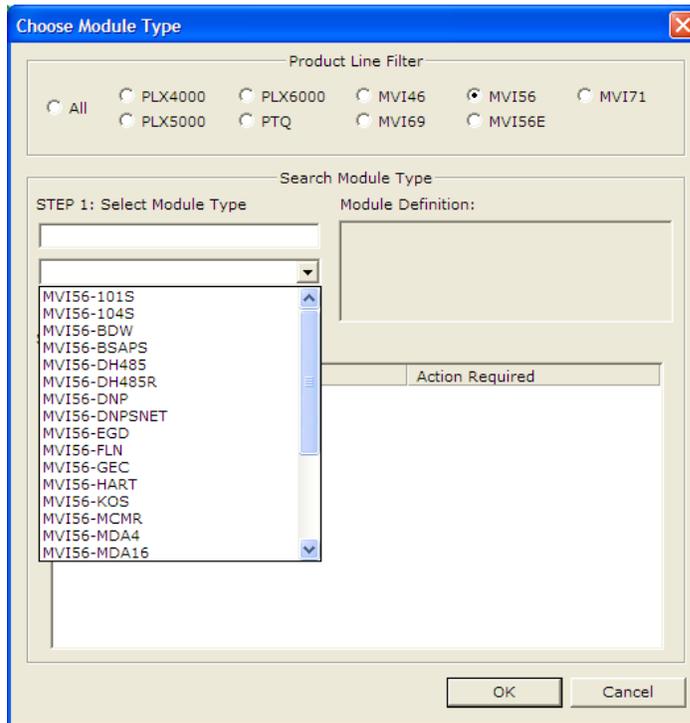


If you have used other Windows configuration tools before, you will find the screen layout familiar. *PCB*'s window consists of a tree view on the left, and an information pane and a configuration pane on the right side of the window. When you first start *PCB*, the tree view consists of folders for *Default Project* and *Default Location*, with a *Default Module* in the *Default Location* folder. The following illustration shows the *PCB* window with a new project.



### Adding the MVI56-MNETC module to the project

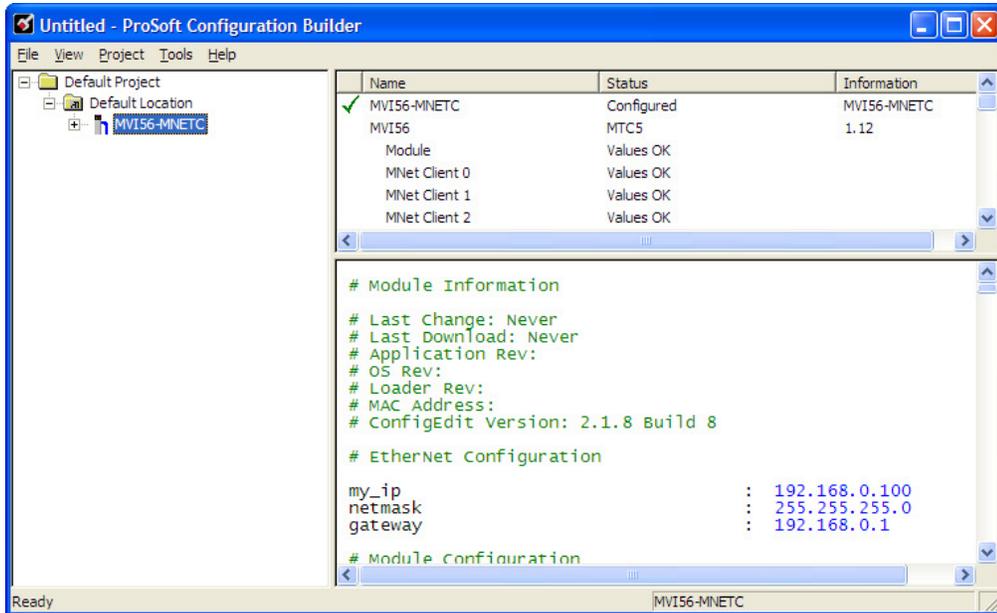
- 1 Use the mouse to select **DEFAULT MODULE** in the tree view, and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose **CHOOSE MODULE TYPE**. This action opens the *Choose Module Type* dialog box.



- 3 In the *Product Line Filter* area of the dialog box, select **MVI56**. In the *Select Module Type* dropdown list, select **MVI56-MNETC**, and then click **OK** to save your settings and return to the *ProSoft Configuration Builder* window.

## 2.4.2 Setting Module Parameters

Notice that the contents of the information pane and the configuration pane changed when you added the MVI56-MNETC module to the project.



At this time, you may wish to rename the *Default Project* and *Default Location* folders in the tree view.

### Renaming an Object

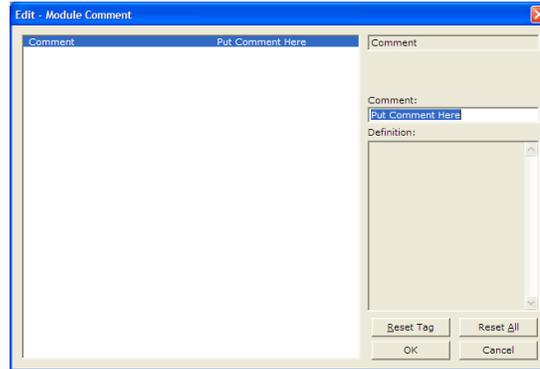
- 1 Select the object, and then click the right mouse button to open a shortcut menu. From the shortcut menu, choose **RENAME**.
- 2 Type the name to assign to the object.
- 3 Click away from the object to save the new name.

### Configuring Module Parameters

- 1 Click the **[+]** sign next to the module icon to expand module information.
- 2 Click the **[+]** sign next to any  icon to view module information and configuration options.
- 3 Double-click any  icon to open an *Edit* dialog box.
- 4 To edit a parameter, select the parameter in the left pane and make your changes in the right pane.
- 5 Click **OK** to save your changes.

### Creating Optional Comment Entries

- 1 Click the **[+]** to the left of the  **Comment** icon to expand the module comments.
- 2 Double-click the  **Module Comment** icon. The *Edit - Module Comment* dialog box appears.



- 3 Enter your comment and click **OK** to save your changes.

### Printing a Configuration File

- 1 Select the module icon, and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose **VIEW CONFIGURATION**. This action opens the *View Configuration* window.
- 3 In the *View Configuration* window, open the **FILE** menu, and choose **PRINT**. This action opens the *Print* dialog box.
- 4 In the *Print* dialog box, choose the printer to use from the drop-down list, select printing options, and then click **OK**.

## **2.4.3 Module**

This section of the configuration describes the database setup and module-level parameters.

### Backplane Error/Status Pointer

#### **1 to 4955**

This parameter sets the address in the internal database where the backplane error/status data will be placed. If you want the error/status data to be moved to the processor and placed into the *ReadData* array, the value entered should be a module memory address in the Read Data area. If the value is set to **-1**, the error/status data will not be stored in the module's internal database and will not be transferred to the processor's *ReadData* array.

Enabling the *Error/Status Pointer* is optional. The error/status data is routinely returned as part of the input image, which is continually being transferred from the module to the processor. For more information, see Normal Data Transfer Blocks (page 93).

### Read Register Start

**0 to 4999**

The *Read Register Start* parameter specifies the start of the Read Data area in module memory. Data in this area will be transferred from the module to the processor.

**Note:** Total user database memory space is limited to the first 5000 registers of module memory, addresses 0 through 4999. Therefore, the practical limit for this parameter is 4999 minus the value entered for *Read Register Count*, so that the Read Data Area does not try to extend above address 4999. Read Data and Write Data Areas must be configured to occupy separate address ranges in module memory and should not be allowed to overlap.

### Read Register Count

**0 to 5000**

The *Read Register Count* parameter specifies the size of the Read Data area of module memory and the number of registers to transfer from this area to the processor, up to a maximum of 5000 words.

**Note:** Total *Read Register Count* and *Write Register Count* cannot exceed 5000 total registers. Read Data and Write Data Areas must be configured to occupy separate address ranges in module memory and should not be allowed to overlap.

### Write Register Start

**0 to 4999**

The *Write Register Start* parameter specifies the start of the Write Data area in module memory. Data in this area will be transferred in from the processor.

**Note:** Total user database memory space is limited to the first 5000 registers of module memory, addresses 0 through 4999. Therefore, the practical limit for this parameter is 4999 minus the value entered for *Write Register Count*, so that the Write Data Area does not try to extend above address 4999. Read Data and Write Data Areas must be configured to occupy separate address ranges in module memory and should not be allowed to overlap.

### Write Register Count

**0 to 5000**

The *Write Register Count* parameter specifies the size of the Write Data area of module memory and the number of registers to transfer from the processor to this memory area, up to a maximum value of 5000 words.

**Note:** Total *Read Register Count* and *Write Register Count* cannot exceed 5000 total registers. Read Data and Write Data Areas must be configured to occupy separate address ranges in module memory and should not be allowed to overlap.

### Failure Flag Count

If this value is greater than zero the protocol communication will be interrupted once a backplane failure is detected, or communication with the processor fails. A value of zero will disable this feature.

### Initialize Output Data

**0 = No, 1 = Yes**

This parameter is used to determine if the output data for the module should be initialized with values from the processor. If the value is set to **0**, the output data will be initialized to 0. If the value is set to **1**, the data will be initialized with data from the processor. Use of this option requires associated ladder logic to pass the data from the processor to the module.

### Duplex/Speed Code

**0, 1, 2, 3 or 4**

This parameter allows you to cause the module to use a specific duplex and speed setting.

- Value = **1**: Half duplex, 10 MB speed
- Value = **2**: Full duplex, 10 MB speed
- Value = **3**: Half duplex, 100 MB speed
- Value = **4**: Full duplex, 100 MB speed
- Value = **0**: Auto-negotiate

Auto-negotiate is the default value for backward compatibility. This feature is not implemented in older software revisions.

#### **2.4.4 MNET Client x**

This section defines general configuration for the MNET Client (Master).

##### Client Error/Status Pointer

**-1 to 4990**

This parameter sets the address in the internal database where the Client error/status data will be placed. If you want the error/status data to be moved to the processor and placed into the *ReadData* array, the value entered should be a module memory address in the Read Data area. If the value is set to **-1**, the error/status data will not be stored in the module's internal database and will not be transferred to the processor's *ReadData* array.

Enabling the *Error/Status Pointer* is optional. Alternatively, the error/status data for a specific Client can be requested by the processor and returned in a special Client Status block. For more information, see Client Status Blocks (page 104).

##### Command Error Pointer

**-1 to 4999**

This parameter sets the address in the internal database where the Command Error List data will be placed. If you want the Command Error List data to be moved to the processor and placed into the *ReadData* array, the value entered should be a module memory address in the Read Data area. If the value is set to **-1**, the Command Error List data will not be stored in the module's internal database and will not be transferred to the processor's *ReadData* array.

Enabling the *Command Error Pointer* is optional. Alternatively, the Command Error List data for a specific Client can be requested by the processor and returned in a special Client Status block. For more information, see Client Status Blocks (page 104).

##### Minimum Command Delay

**0 to 65535** milliseconds

This parameter specifies the number of milliseconds to wait between the initial issuances of a command. This parameter can be used to delay all commands sent to servers to avoid "flooding" commands on the network. This parameter does not affect retries of a command as they will be issued when failure is recognized.

##### Response Timeout

**0 to 65535** milliseconds

This is the time in milliseconds that a Client will wait before re-transmitting a command if no response is received from the addressed server. The value to use depends on the type of communication network used, and the expected response time of the slowest device on the network.

### Retry Count

**0 to 10**

This parameter specifies the number of times a command will be retried if it fails.

### Float Flag

**YES or NO**

This flag specifies how the Client driver will issue Function Code 3, 6, and 16 commands (read and write Holding Registers) to a remote server when it is moving 32-bit floating-point data.

If the remote server expects to receive or will send one complete 32-bit floating-point value for each count of one (1), then set this parameter to **YES**. When set to **YES**, the Client driver will send values from two consecutive 16-bit internal memory registers (32 total bits) for each count in a write command, or receive 32 bits per count from the server for read commands. Example: Count = **10**, Client driver will send 20 16-bit registers for 10 total 32-bit floating-point values.

If, however, the remote server expects to use a count of two (2) for each 32-bit floating-point value it sends or receives, or if you do not plan to use floating-point data in your application, then set this parameter to **NO**, which is the default setting.

You will also need to set the *Float Start* and *Float Offset* parameters to appropriate values whenever the *Float Flag* parameter is set to **YES**.

### Float Start

**0 to 65535**

Whenever the *Float Flag* parameter is set to **YES**, this parameter determines the lowest Modbus Address, used in commands to a remote server, to consider as commands to read or write floating-point data. All commands with address values greater than or equal to this value will be considered floating-point data commands. All commands with address values less than this value will be considered normal 16-bit register data commands.

This parameter is used only if the *Float Flag* is set to **YES**. For example, if a value of 7000 is entered, all commands sent with addresses of 47001 (or 407001) and above will be considered as floating-point data commands and 32 bits of data will be sent or received for each count of one in the command.

You will also need to set the *Float Offset* parameter to an appropriate value whenever the *Float Flag* parameter is set to **YES**.

### Float Offset

**0 to 9999**

This parameter defines the start register for floating-point data in the internal database. This parameter is used only if the *Float Flag* is enabled. For example, if the *Float Offset* value is set to **3000** and the *Float Start* parameter is set to **7000**, data requests for register 7000 will use the internal Modbus register 3000.

### ARP Timeout

**1 to 60**

This parameter specifies the number of seconds to wait for an ARP reply after a request is issued.

### Command Error Delay

**0 to 300**

This parameter specifies the number of 100 millisecond intervals to turn off a command in the error list after an error is recognized for the command. If this parameter is set to **0**, there will be no delay.

### MBAP Port Override

**YES or NO**

If this parameter is set to **YES**, all messages generated by the Client driver will be MBAP format messages to all Service Port values.

If this parameter is set to **NO** (default value), or is omitted from the configuration file, all messages sent to Service Port 502 will be MBAP format messages, and all other Service Ports values will use the encapsulated Modbus message format (MNET).

Each Client is configured independently in the configuration file.

This parameter applies to firmware version 1.05 and above. For downward compatibility, you may omit this parameter from the Client's configuration.

## **2.4.5 MNET Client x Commands**

The *MNET Client x Commands* section of the configuration sets the Modbus TCP/IP Client command list. This command list polls Modbus TCP/IP server devices attached to the Modbus TCP/IP Client port. The module supports numerous commands. This permits the module to interface with a wide variety of Modbus TCP/IP protocol devices.

The function codes used for each command are those specified in the Modbus protocol. Each command list record has the same format. The first part of the record contains the information relating to the MVI56-MNETC communication module, and the second part contains information required to interface to the Modbus TCP/IP server device.

### Command List Overview

In order to interface the module with Modbus TCP/IP server devices, you must construct a command list. The commands in the list specify the server device to be addressed, the function to be performed (read or write), the data area in the device to interface with, and the registers in the internal database to be associated with the device data. The Client command list supports up to 16 commands.

The command list is processed from top (command #1) to bottom. A poll interval parameter is associated with each command to specify a minimum delay time in tenths of a second between the issuances of a command. If the user specifies a value of **10** for the parameter, the command will be executed no more frequently than every 1 second.

### **Commands Supported by the Module**

The format of each command in the list depends on the Modbus Function Code being executed.

The following table lists the functions supported by the module.

<b>Function Code</b>	<b>Definition</b>
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Force (Write) Single Coil
6	Preset (Write) Single Register
15	Force (Write) Multiple Coils
16	Preset (Write) Multiple Registers

Each command list record has the same general format. The first part of the record contains the information relating to the communication module and the second part contains information required to interface to the Modbus TCP/IP server device.

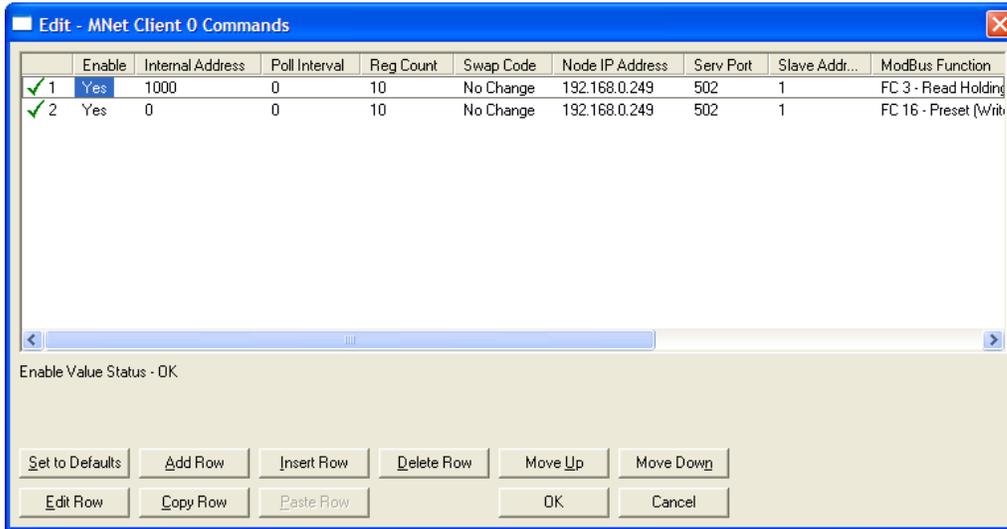
### Command Entry Formats

The following table shows the structure of the configuration data necessary for each of the supported commands.

1	2	3	4	5	6	7	8	9	10
Enable Code	Internal Address	Poll Interval Time	Count	Swap Code	IP Address	Serv Port	Slave Node	Function Code	Device Modbus Address
Code	Register (bit)	1/10th Seconds	Bit Count	0	IP Address	Port #	Address	Read Coil (0x)	Register
Code	Register (bit)	1/10th Seconds	Bit Count	0	IP Address	Port #	Address	Read Input (1x)	Register
Code	Register	1/10th Seconds	Word Count	Code	IP Address	Port #	Address	Read Holding Registers (4x)	Register
Code	Register	1/10th Seconds	Word Count	0	IP Address	Port #	Address	Read Input Registers (3x)	Register
Code	1 bit	1/10th Seconds	Bit Count	0	IP Address	Port #	Address	Force (Write) Single Coil (0x)	Register
Code	1 bit	1/10th Seconds	Word Count	0	IP Address	Port #	Address	Preset (Write) Single Register (4x)	Register
Code	Register (bit)	1/10th Seconds	Bit Count	0	IP Address	Port #	Address	Force (Write) Multiple Coil (0x)	Register
Code	Register	1/10th Seconds	Word Count	0	IP Address	Port #	Address	Preset (Write) Multiple Register (4x)	Register

The first part of the record is the module information, which relates to the MVI56 module, and the second part contains information required to interface to the server device.

**Command list example:**



Enable

**NO (0) or YES (1)**

This field defines whether or not the command is to be executed.

Value	Description
No (0)	The command is disabled and will not be executed in the normal polling sequence.
YES (1)	The command is executed each scan of the command list if the Poll Interval Time is set to zero (0). If the Poll Interval time is set, the command will be executed when the interval timer expires.

**Important:** The commands must also be enabled in the ladder logic in order for them to be executed. The *MNETC.CONTROL.CmdControl.WriteCmdBits[x]* controller tag array holds 16-command bit arrays for each Client. If a bit for a specific command is set to zero (0) in the *WriteCmdBits[x]* controller tag, the command will not be executed, regardless of its enabled or disabled state in the configuration. For more information, see Command Control Blocks (page 105).

### Internal Address

**0** to **65535** (for bit-level addressing)

or

**0** to **4999** (for word-level addressing)

This field specifies the database address in the module's internal database to use as the destination for data brought in by a read command or as the source for data to be sent out by a write command. The database address is interpreted as a bit address or a 16-bit word (register) address, depending on the Modbus Function Code used in the command.

- For Modbus functions 1, 2, 5, and 15, this parameter is interpreted as a bit-level address.
- For Modbus functions 3, 4, 6, and 16, this parameter is interpreted as a word-level or register-level address.

### Poll Interval

**0** to **65535**

This parameter specifies the minimum interval between issuances of a command during continuous command execution (*Enable* code of **1**). The parameter is entered in tenths of a second. Therefore, if a value of **100** is entered for a command, the command executes no more frequently than every 10 seconds.

### Req Count

Regs: **1** to **125**

Coils: **1** to **800**

This parameter specifies the number of 16-bit registers or binary bits to be transferred by the command.

- Functions 5 and 6 ignore this field as they apply only to a single data point.
- For functions 1, 2, and 15, this parameter sets the number of bits (inputs or coils) to be transferred by the command.
- For functions 3, 4, and 16, this parameter sets the number of registers to be transferred by the command.

Swap Code

**NONE**

**SWAP WORDS**

**SWAP WORDS & BYTES**

**SWAP BYTES**

This parameter defines if and how the order of bytes in data received or sent is to be rearranged. This option exists to allow for the fact that different manufacturers store and transmit multi-byte data in different combinations. This parameter is helpful when dealing with floating-point or other multi-byte values, as there is no one standard method of storing these data types. The parameter can be set to rearrange the byte order of data received or sent into an order more useful or convenient for other applications. The following table defines the valid *Swap Code* values and the effect they have on the byte-order of the data.

Swap Code	Description
<b>NONE</b>	No change is made in the byte ordering (1234 = 1234)
<b>SWAP WORDS</b>	The words are swapped (1234=3412)
<b>SWAP WORDS &amp; BYTES</b>	The words are swapped, then the bytes in each word are swapped (1234=4321)
<b>SWAP BYTES</b>	The bytes in each word are swapped (1234=2143)

These swap operations affect 4-byte (or 2-word) groups of data. Therefore, data swapping using these *Swap Codes* should be done only when using an even number of words, such as when 32-bit integer or floating-point data is involved.

Node IP Address

xxx.xxx.xxx.xxx

The IP address of the device being addressed by the command.

Service Port

**502** or other port numbers supported on a server

Use a value of **502** when addressing Modbus TCP/IP servers that are compatible with the Schneider Electric MBAP specifications (this will be most devices). If a server implementation supports another service port, enter the value here.

### Slave Address

**0** - Broadcast to all nodes

**1 to 255**

Use this parameter to specify the slave address of a remote Modbus Serial device through a Modbus Ethernet to Serial converter.

**Note:** Use the *Node IP Address* parameter (page 48) to address commands to a remote Modbus TCP/IP device.

**Note:** Most Modbus devices accept an address in the range of only 1 to 247, so check with the slave device manufacturer to see if a particular slave can use addresses 248 to 255.

If the value is set to zero, the command will be a broadcast message on the network. The Modbus protocol permits broadcast commands for **write** operations. **Do not** use node address 0 for **read** operations.

### Modbus Function

**1, 2, 3, 4, 5, 6, 15, or 16**

This parameter specifies the Modbus Function Code to be executed by the command. These function codes are defined in the Modbus protocol. The following table lists the purpose of each function supported by the module. More information on the protocol is available from [www.modbus.org](http://www.modbus.org).

<b>Modbus Function Code</b>	<b>Description</b>
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Force (Write) Single Coil
6	Preset (Write) Single Register
15	Force Multiple Coils
16	Preset Multiple Registers

### MB Address in Device

This parameter specifies the starting Modbus register or bit address in the server to be used by the command. Refer to the documentation of each Modbus server device for the register and bit address assignments valid for that device.

The Modbus Function Code determines whether the address will be a register-level or bit-level OFFSET address into a given data type range. The offset will be the target data address in the server minus the base address for that data type. Base addresses for the different data types are:

- 00001 or 000001 (0x0001) for bit-level Coil data (Function Codes 1, 5, and 15).
- 10001 or 100001 (1x0001) for bit-level Input Status data (Function Code 2)
- 30001 or 300001 (3x0001) for Input Register data (Function Code 4)
- 40001 or 400001 (4x0001) for Holding Register data (Function Codes 3, 6, and 16).

Address calculation examples:

- For bit-level Coil commands (FC 1, 5, or 15) to read or write a Coil 0X address 00001, specify a value of 0 (00001 - 00001 = 0).
- For Coil address 00115, specify 114  
(00115 - 00001 = 114)
- For register read or write commands (FC 3, 6, or 16) 4X range, for 40001, specify a value of 0  
(40001 - 40001 = 0).
- For 01101, 11101, 31101 or 41101, specify a value of 1100.  
(01101 - 00001 = 1100)  
(11101 - 10001 = 1100)  
(31101 - 30001 = 1100)  
(41101 - 40001 = 1100)

**Note:** If the documentation for a particular Modbus server device lists data addresses in hexadecimal (base16) notation, you will need to convert the hexadecimal value to a decimal value to enter in this parameter. In such cases, it is not usually necessary to subtract 1 from the converted decimal number, as this addressing scheme typically uses the exact offset address expressed as a hexadecimal number.

### Comment

0 to 35 alphanumeric characters

### **2.4.6 Static ARP Table**

The Static ARP Table defines a list of static IP addresses that the module will use when an ARP (Address Resolution Protocol) is required. The module will accept up to 40 static IP/MAC address data sets.

Use the Static ARP table to reduce the amount of network traffic by specifying IP addresses and their associated MAC (hardware) addresses that the MVI56-MNETC module will be communicating with regularly.

**Important:** If the device in the field is changed, this table must be updated to contain the new MAC address for the device and downloaded to the module. If the MAC is not changed, no communications with the module will be provided.

#### IP Address

Dotted notation

This table contains a list of static IP addresses that the module will use when an ARP is required. The module will accept up to 40 static IP/MAC address data sets.

**Important:** If the device in the field is changed, this table must be updated to contain the new MAC address for the device and downloaded to the module. If the MAC is not changed, no communications with the module will occur.

#### Hardware MAC Address

Hex value

This table contains a list of static MAC addresses that the module will use when an ARP is required. The module will accept up to 40 static IP/MAC address data sets.

**Important:** If the device in the field is changed, this table must be updated to contain the new MAC address for the device and downloaded to the module. If the MAC is not changed, no communications with the module will occur.

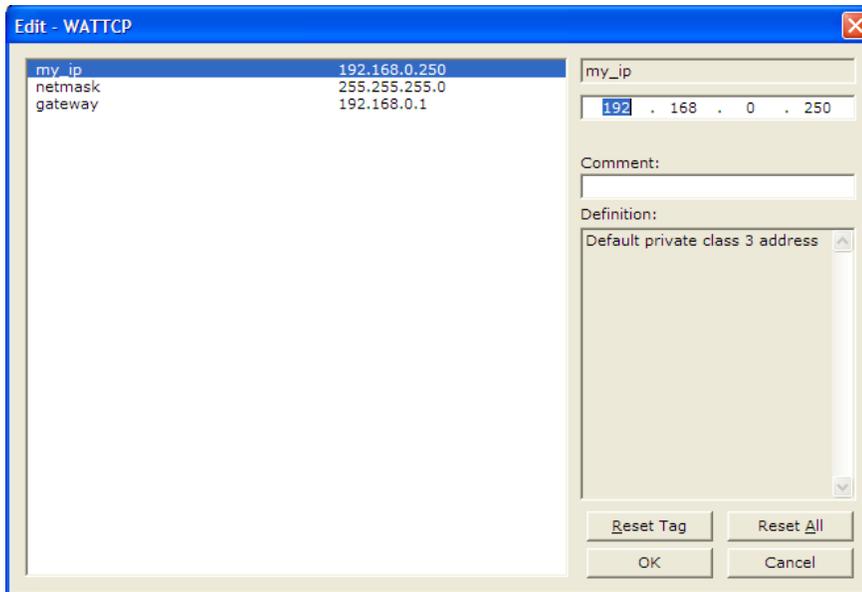
### 2.4.7 Ethernet Configuration

Use this procedure to configure the Ethernet settings for your module. You must assign an IP address, subnet mask and gateway address. After you complete this step, you can connect to the module with an Ethernet cable.

- 1 Determine the network settings for your module, with the help of your network administrator if necessary. You will need the following information:
  - IP address (fixed IP required) \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_
  - Subnet mask \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_
  - Gateway address \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_ . \_\_\_\_\_

**Note:** The gateway address is optional, and is not required for networks that do not use a default gateway.

- 2 Double-click the **ETHERNET CONFIGURATION** icon. This action opens the *Edit* dialog box.

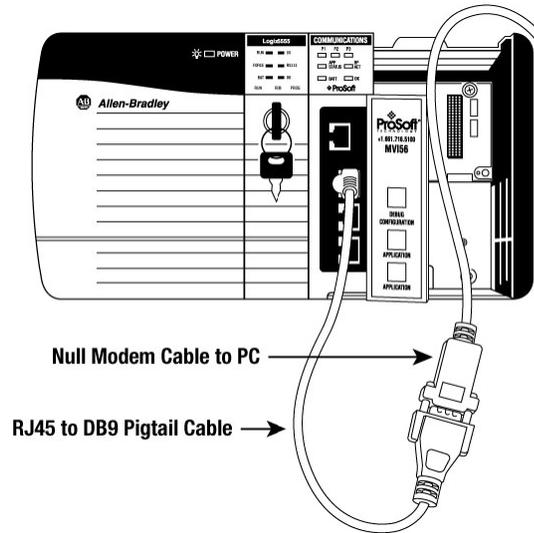


- 3 Edit the values for *my\_ip*, *netmask* (subnet mask) and *gateway* (default gateway).
- 4 When you are finished editing, click **OK** to save your changes and return to the *ProSoft Configuration Builder* window.

## 2.5 Connecting your PC to the Module

With the module securely mounted, connect your PC to the *Configuration/Debug* port using an RJ45-DB-9 Serial Adapter Cable and a Null Modem Cable.

- 1 Attach both cables as shown.
- 2 Insert the RJ45 cable connector into the Configuration/Debug port of the module.
- 3 Attach the other end to the serial port on your PC.

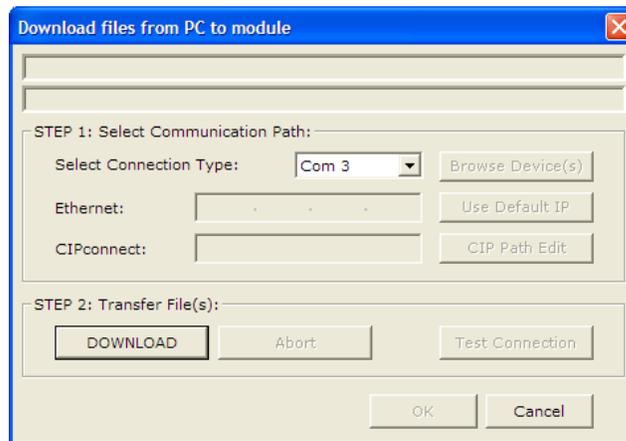


## 2.6 Downloading the Project to the Module Using a Serial COM Port

For the module to use the settings you configured, you must download (copy) the updated *Project* file from your PC to the module.

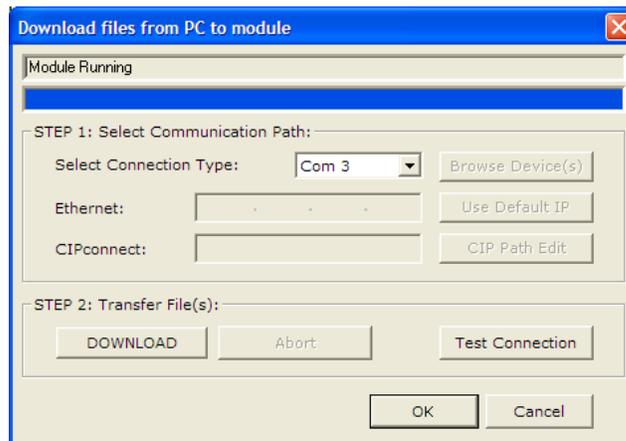
### To download the project file

- 1 In the tree view in *ProSoft Configuration Builder*, click once to select the module.
- 2 Right-click the module icon to open a shortcut menu. From the shortcut menu, choose **DOWNLOAD FROM PC TO DEVICE**. The program will scan your PC for a valid com port (this may take a few seconds). When *PCB* has found a valid COM port, the *Download* dialog box will open.



- 3 Choose the COM port to use from the dropdown list, and then click the **DOWNLOAD** button.

The module will perform a platform check to read and load its new settings. When the platform check is complete, the status bar in the *Download* dialog box will display the message *Module Running*.



## 3 Ladder Logic

### In This Chapter

❖ Controller Tags.....	56
❖ User-Defined Data Types (UDTs) .....	58
❖ Using Controller Tags.....	60
❖ Controller Tag Overview.....	61

Ladder logic is required for managing communication between the MVI56-MNETC module and the processor. The ladder logic handles tasks such as:

- Module backplane data transfer
- Special block handling
- Status data receipt

Additionally, a power-up handler may be needed to initialize the module's database and may clear some processor fault conditions.

The sample Import Rung with Add-On Instruction is extensively commented to provide information on the purpose and function of each user-defined data type and controller tag. For most applications, the Import Rung with Add-On Instruction will work without modification.

### 3.1 Controller Tags

Data related to the MVI56-MNETC is stored in the ladder logic in variables called controller tags. Individual controller tags can be grouped into collections of controller tags called controller tag structures. A controller tag structure can contain any combination of:

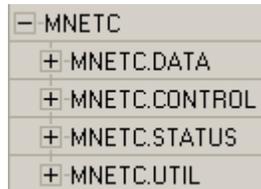
- Individual controller tags
- Controller tag arrays
- Lower-level controller tag structures

The controller tags for the module are pre-programmed into the Add-On Instruction Import Rung ladder logic. You can find them in the *Controller Tags* subfolder, located in the *Controller* folder in the *Controller Organizer* pane of the main RSLogix 5000 window.

This controller tag structure is arranged as a tree structure. Individual controller tags are found at the lowest level of the tree structure. Each individual controller tag is defined to hold data of a specific type, such as integer or floating-point data. Controller tag structures are declared with user-defined data types, which are collections of data types.

#### 3.1.1 MVI56(E)-MNETC Controller Tags

The main controller tag structure, *MNETC*, is broken down into four lower-level controller tag structures.



The four lower-level controller tag structures contain other controller tags and controller tag structures. Click the **[+]** sign next to any controller tag structure to expand it and view the next level in the structure.

For example, if you expand the *MNETC.DATA* controller tag structure, you will see that it contains two controller tag arrays, *MNETC.DATA.ReadData* and *MNETC.DATA.WriteData*, which are 600-element integer arrays by default.

Scope: My_Controller		Shgw...	Show All
Name	Value	Data Type	Description
+ ADI56MNETC	{ ... }	ADI56MNETC	Add-On for MVI56-MNE
+ Local:1:C	{ ... }	AB:1756_MODULE:C:0	
+ Local:1:I	{ ... }	AB:1756_MODULE_IN...	
+ Local:1:O	{ ... }	AB:1756_MODULE_IN...	
- MNETC	{ ... }	MNETCMODULEDEF	This defines the whole r
- MNETC.DATA	{ ... }	MNETCDATA	This defines the whole r
+ MNETC.DATA.ReadData	{ ... }	INT[600]	This defines the whole r
+ MNETC.DATA.WriteData	{ ... }	INT[600]	This defines the whole r
+ MNETC.CONTROL	{ ... }	MNETCCONTROL	This defines the whole r
+ MNETC.STATUS	{ ... }	MNETCSTATUS	This defines the whole r
+ MNETC.UTIL	{ ... }	MNETCUTIL	This defines the whole r

Each controller tag in the Add-On Instruction is commented in the *Description* column.

Notice that the *Data Type* column displays the data types used to declare each controller tag, controller tag array or controller tag structure. Individual controller tags are declared with basic data types, such as INT and BOOL. Controller tag arrays are declared with arrays of basic data types. Controller tag structures are declared with user-defined data types (UDTs).

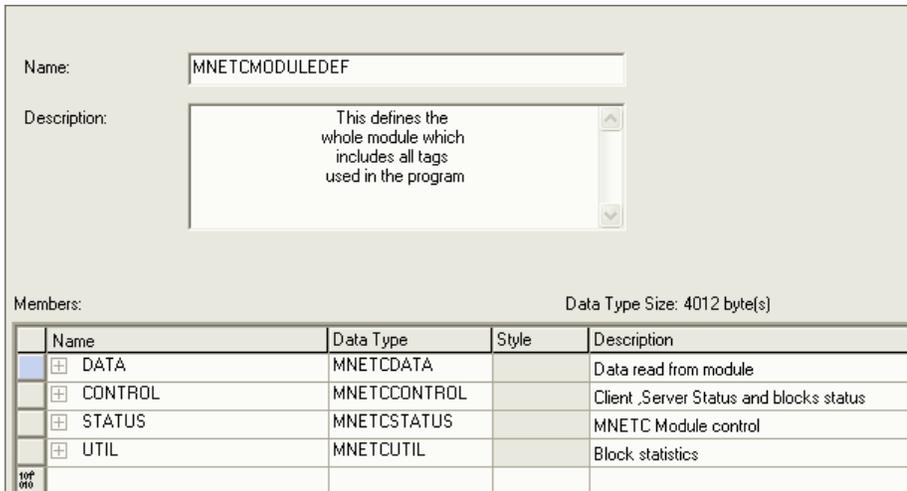
### 3.2 User-Defined Data Types (UDTs)

User-defined data types (UDTs) allow users to organize collections of data types into groupings. These groupings, or data type structures, can then be used to declare the data types for controller tag structures. Another advantage of defining a UDT is that it may be re-used in other controller tag structures that use the same data types.

The Add-On Instruction Import Rung ladder logic for the module has pre-defined UDTs. You can find them in the *User-Defined* subfolder, located in the *Data Types* folder in the *Controller Organizer* pane of the main RSLogix window. Like the controller tags, the UDTs are organized in a multiple-level tree structure.

#### 3.2.1 MVI56(E)-MNETC User-Defined Data Types

Eleven different UDTs are defined for the MVI56(E)-MNETC Add-On Instruction. The main UDT, *MNETCMODULEDEF*, contains all the data types for the module and was used to create the main controller tag structure, *MNETC*. There are four UDTs one level below *MNETCMODULEDEF*. These lower-level UDTs were used to create the *MNETC.DATA*, *MNETC.CONTROL*, *MNETC.STATUS*, and *MNETC.UTIL* controller tag structures.



Click the **[+]** signs to expand the UDT structures and view lower-level UDTs.

For example, if you expand *MNETC.DATA*, you will see that it contains two UDTs, *ReadData* and *WriteData*. Both of these are 600-element integer arrays by default.

Name: MNETCMODULEDEF

Description: This defines the whole module which includes all tags used in the program

Members: Data Type Size: 4012 byte(s)

	Name	Data Type	Style	Description
	DATA	MNETCDATA		Data read from module
	ReadData	INT[600]	Decimal	Data read from module. Set array equal to the size
	WriteData	INT[600]	Decimal	Data to write to module. Set array equal to the size
	CONTROL	MNETCCONTROL		Client ,Server Status and blocks status
	STATUS	MNETCSTATUS		MNETC Module control
	UTIL	MNETCUTIL		Block statistics

Notice that these UDTs are the data types used to declare the *MNETC.DATA.ReadData* and *MNETC.DATA.WriteData* controller tag arrays. Each UDT is commented in the *Description* column.

### 3.3 Using Controller Tags

You can use controller tags to:

- View read and write data that is being transferred between the module and the processor.
- View status data for the module.
- Set up and trigger special functions.
- Initiate module restarts (Warm Boot or Cold Boot).

### 3.4 Controller Tag Overview

Controller Tag	Description
MNETC.DATA	MNET input and output data transferred between the processor and the module
MNETC.CONTROL	Governs the data movement between the PLC rack and the module
MNETC.STATUS	Status information
MNETC.UTIL	Block statistics and generic tags used for internal ladder processing (DO NOT MODIFY)

The following sections describe each of these controller tag structures in more detail.

#### 3.4.1 MNETC.DATA

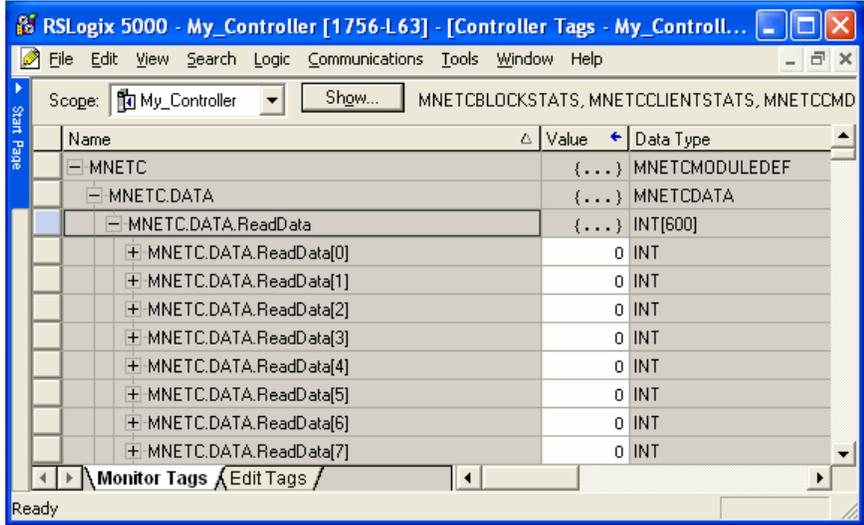
The controller tags in *MNETC.DATA* hold data to be transferred between the processor and the MVI56-MNETC module. This read and write data is transferred between the processor and module as "pages," or blocks, of data up to 200 words long.

The data types for the *MNETC.DATA.ReadData* and *MNETC.DATA.WriteData* controller tag arrays are integer arrays containing variable numbers of elements.

Controller Tag	Data Type	Description
ReadData	INT[x]	Data read from module. Array size is equal to the size set in the configuration.
WriteData	INT[x]	Data to write to module. Array size is equal to the size set in the configuration.

*MNETC.DATA.ReadData*

*ReadData* is a controller tag array that automatically adjusts to match the value entered in the *Read Register Count* (page 39) parameter of the configuration. For ease of use, this array should be dimensioned as a multiple of 200 words. This data is paged up to 200 words at a time from the module to the processor. The ladder logic places the data received into the proper position in the *ReadData* array. This data is used for status and control in the processor ladder logic.



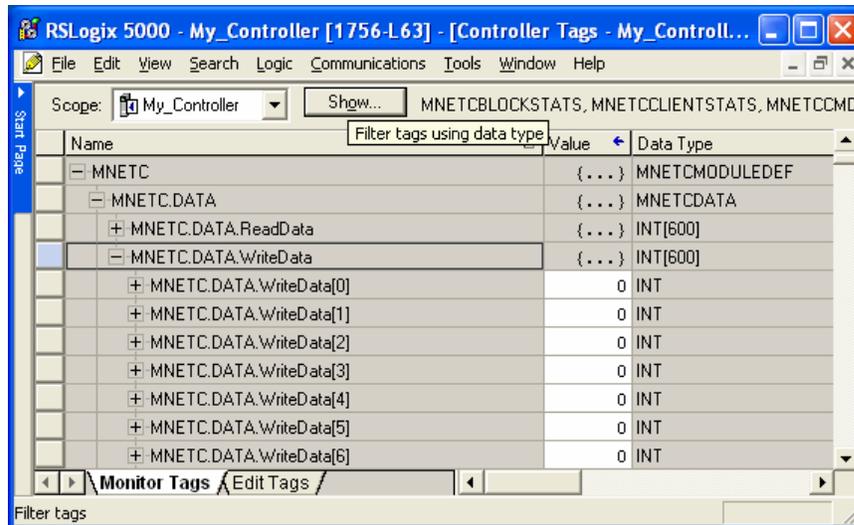
The *ReadData* array is related to the contents of the Read Data area of the module's internal database. To view the actual registers in the module's internal database, access the database display from *ProSoft Configuration Builder's Diagnostics* menu. For more information, see the section on *PCB Diagnostics* (page 71).

DATABASE DISPLAY 0 TO 99 (DECIMAL)

6666	7777	8888	9999	1010	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

*MNETC.DATA.WriteData*

*WriteData* is a controller tag array that automatically adjusts to match the value entered in the *Write Register Count* (page 40) parameter of the configuration. For ease of use, this array should be dimensioned as a multiple of 200 words. This data is paged up to 200 words at a time from the processor to the module. The ladder logic places the write data into the output image for transfer to the module. This data is passed from the processor to the module for status and control information for use in other nodes on the network.



The *WriteData* array is related to the contents of the Write Data area of the module's internal database. To view the actual registers in the module's internal database, access the database display from *ProSoft Configuration Builder's Diagnostics* menu. For more information, see the section on *PCB Diagnostics* (page 71).

DATABASE DISPLAY 1000 TO 1099 (DECIMAL)

1111	2222	3333	4444	5555	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0

### 3.4.2 MNETC.CONTROL

This controller tag structure is used to request special tasks from the module. For more information, see Special Function Blocks (page 97).

Controller Tag	Data Type	Description
BootTimer	TIMER	Timer used to clear both cold and warm boot requests
ColdBoot	BOOL	Hardware reset of the module
WarmBoot	BOOL	Configuration data reset in the module
EventCmdTrigger	BOOL	Event Command trigger
ClientID	INT	Client ID to poll status on remote server
EventCmd	MNETCEVENTCMD[30]	Holds Event Command configuration
CmdID	INT	Command ID from 1 to 16
CmdControl	MNETCCMDCONTROL	Holds Command Control statistics
CmdControlPending	BOOL	Halts rung until module is ready
CmdControlTrigger	BOOL	Command Control Trigger
IPAddress	MNETCIPADDRESS	Getting and setting IP address to and from module

### 3.4.3 MNETC.STATUS

This controller tag structure contains module and Client status data. For a more complete description of the *MNETC.STATUS* controller tag structure, refer to the Status Data Definition (page 81).

Name	Data Type	Description
PassCnt	INT	Program cycle counter
ProductVersion	INT	This is used to pass the product version to the processor
ProductCode	INT[2]	This is used to pass the product code to the processor
BlockStats	MNETCBLOCKSTATS	Block transfer statistics
CmdBits	INT[30]	Command bits array to be used for 30 Clients
ClientStatsTrigger	BOOL	Get Client status
ClientID	INT	Client ID to get status from
ClientStatus	MNETCCCLIENTSTATS[30]	Client status data
CmdErrorList	INT[16]	Command Error List

### 3.4.4 MNETC.UTIL

This controller tag structure stores the variables required for the data transfer between the processor and the MVI56-MNETC module.

Name	Data Type	Description
LastRead	INT	Index of last read block
LastWrite	INT	Index of last write block
BlockIndex	INT	Computed block offset for data table
StatusIndex	INT	Computed block offset for status data
ReadDataSizeGet	INT	Gets <i>ReadData</i> array length
WriteDataSizeGet	INT	Gets <i>WriteData</i> array length
ReadDataBlkCount	INT	Holds the value of the block counts of the <i>ReadData</i> array
WriteDataBlkCount	INT	Holds the value of the block counts of the <i>WriteData</i> array
RBTSremainder	INT	Holds remainder calculation value from the read array
WBTSremainder	INT	Holds remainder calculation value from the write array
IPsetPending	BOOL	Allows setting module IP address
IPgetPending	BOOL	Allows getting module IP address
InitOutputData	MNETCINITOUTDATA	Used to bring the module into a known state after a restart operation
FaultCode	INT	Fault Code value
CheckInitialization	BOOL	Check initialization trigger

The *LastRead* tag stores the latest Read Block ID received from the module. The *LastWrite* tag stores the latest Write Block ID to be sent to the module. The *BlockIndex* tag is an intermediate variable used during the block calculation.



## 4 Diagnostics and Troubleshooting

### In This Chapter

❖ LED Indicators.....	68
❖ Using ProSoft Configuration Builder (PCB) for Diagnostics.....	71
❖ Reading Status Data from the Module .....	80

The module provides information on diagnostics and troubleshooting in the following forms:

- LED status indicators on the front of the module provide general information on the module's status.
- Status data contained in the module can be viewed through the Configuration/Debug port, using the troubleshooting and diagnostic capabilities of *ProSoft Configuration Builder (PCB)*.
- Status data values can be transferred from the module to processor memory and can be monitored there manually or by customer-created logic.

## 4.1 LED Indicators

The LEDs indicate the module's operating status as follows:

LED	Color	Status	Indication
CFG	Green	ON	Data is being transferred between the module and a remote terminal using the Configuration/Debug port.
		OFF	No data is being transferred on the Configuration/Debug port.
P1	Green	ON	Port not used
		OFF	Port not used
P2	Green	ON	Port not used
		OFF	Port not used
APP	Amber	OFF	The MVI56-MNETC is working normally.
		ON	The MVI56-MNETC module program has recognized a communication error.
BP ACT	Amber	ON	The LED is ON when the module is performing a write operation on the backplane.
		OFF	The LED is OFF when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly ON and OFF.
OK	Red / Green	OFF	The card is not receiving any power and is not securely plugged into the rack.
		GREEN	The module is operating normally.
		RED	The program has detected an error or is being configured. If the LED remains RED for more than 10 seconds, the program has probably halted. Remove the card from the rack and re-insert the card to restart the module's program.
BAT	Red	OFF	The battery voltage is OK and functioning.
		ON	The battery voltage is low or battery is not present. Allow battery to charge by keeping module plugged into rack for 24 hours. If BAT LED still does not go OFF, contact ProSoft Technology, as this is not a user serviceable item.

If the APP, BP ACT and OK LEDs blink at a rate of every one-second, this indicates a serious problem with the module. Call ProSoft Technology support to arrange for repairs.

### 4.1.1 Ethernet LED Indicators

LED	State	Description
Data	OFF	No activity on the Ethernet port.
	GREEN Flash	The Ethernet port is actively transmitting or receiving data.
Link	OFF	No physical network connection is detected. No Ethernet communication is possible. Check wiring and cables.
	GREEN Solid	Physical network connection detected. This LED must be ON solid for Ethernet communication to be possible.

### 4.1.2 Clearing a Fault Condition

Typically, if the OK LED on the front of the module turns RED for more than ten seconds, a hardware problem has been detected in the module or the program has exited.

To clear the condition, follow these steps:

- 1 Turn off power to the rack.
- 2 Remove the card from the rack.
- 3 Verify that all jumpers are set correctly.
- 4 If the module requires a Compact Flash card, verify that the card is installed correctly.
- 5 Re-insert the card in the rack and turn the power back on.
- 6 Verify correct configuration data is being transferred to the module from the ControlLogix controller.

If the module's OK LED does not turn GREEN, verify that the module is inserted completely into the rack. If this does not cure the problem, contact ProSoft Technology Technical Support.

### 4.1.3 Troubleshooting

Use the following troubleshooting steps if you encounter problems when the module is powered up. If these steps do not resolve your problem, please contact ProSoft Technology Technical Support.

#### Processor Errors

Problem description	Steps to take
Processor fault	Verify that the module is plugged into the slot that has been configured for the module in the I/O Configuration of RSLogix. Verify that the slot location in the rack has been configured correctly in the ladder logic.
Processor I/O LED flashes	This indicates a problem with backplane communications. A problem could exist between the processor and any installed I/O module, not just the MVI56-MNETC. Verify that all modules in the rack are correctly configured in the ladder logic.

---

## Module Errors

Problem description	Steps to take
BP ACT LED (not present on MVI56E modules) remains OFF or blinks slowly MVI56E modules with scrolling LED display: <Backplane Status> condition reads ERR	<p>This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this.</p> <p>To establish backplane communications, verify the following items:</p> <ul style="list-style-type: none"><li>▪ The processor is in RUN or REM RUN mode.</li><li>▪ The backplane driver is loaded in the module.</li><li>▪ The module is configured for read and write data block transfer.</li><li>▪ The ladder logic handles all read and write block situations.</li><li>▪ The module is properly configured in the processor I/O configuration and ladder logic.</li></ul>
OK LED remains RED	<p>The program has halted or a critical error has occurred. Connect to the Configuration/Debug port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert it, and then restore power to the rack.</p>

---

## 4.2 Using ProSoft Configuration Builder (PCB) for Diagnostics

The *Configuration and Debug* menu for this module is arranged as a tree structure, with the *Main* menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the *Main* menu.

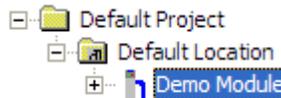
Because this is a text-based menu system, you enter commands by typing the [command letter] from your computer keyboard in the *Diagnostic* window in *ProSoft Configuration Builder (PCB)*. The module does not respond to mouse movements or clicks. The command executes as soon as you press the [COMMAND LETTER] — you do not need to press [ENTER]. When you type a [COMMAND LETTER], a new screen will be displayed in your terminal application.

### 4.2.1 Using the Diagnostic Window in ProSoft Configuration Builder

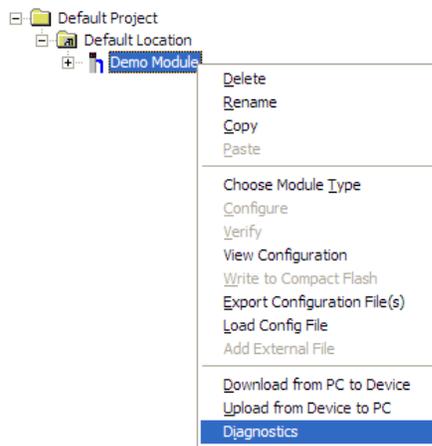
**Tip:** You can have a ProSoft Configuration Builder Diagnostics window open for more than one module at a time.

#### To connect to the module's Configuration/Debug serial port

- 1 Start *PCB*, and then select the module to test. Click the right mouse button to open a shortcut menu.

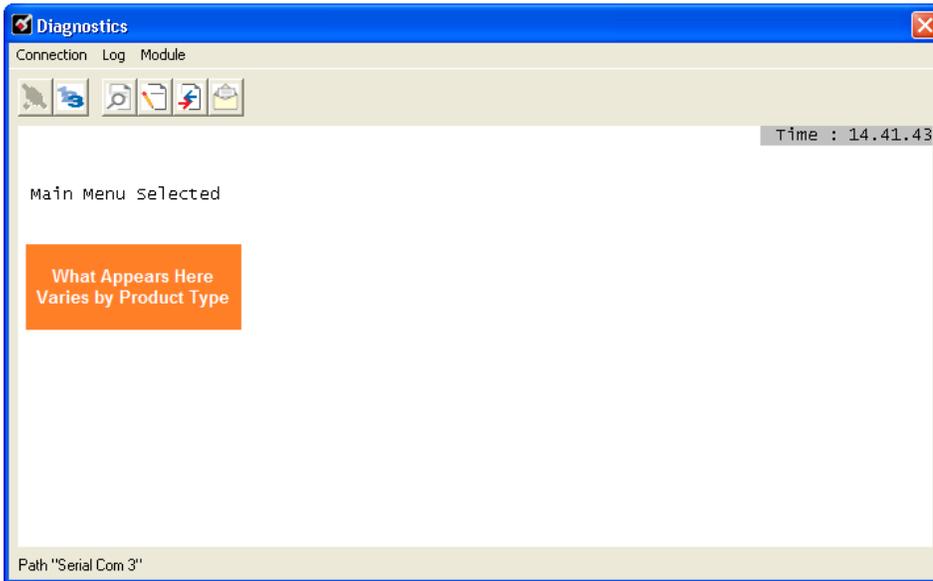


- 2 On the shortcut menu, choose **DIAGNOSTICS**.



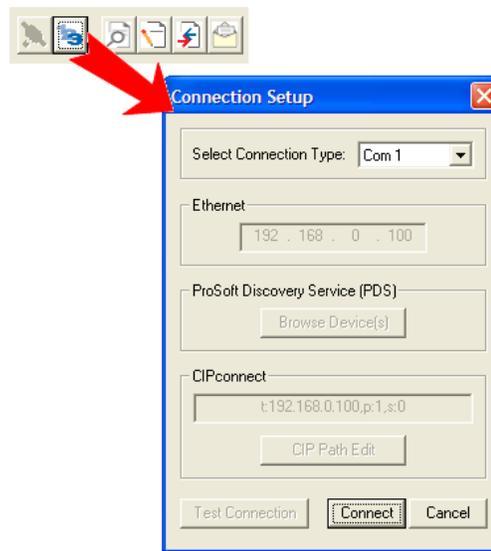
This action opens the *Diagnostics* dialog box.

- 3 Press [?] to open the *Main* menu.



If there is no response from the module, follow these steps:

- 1 Click to configure the connection. On the *Connection Setup* dialog box, select a valid com port or other connection type supported by the module.

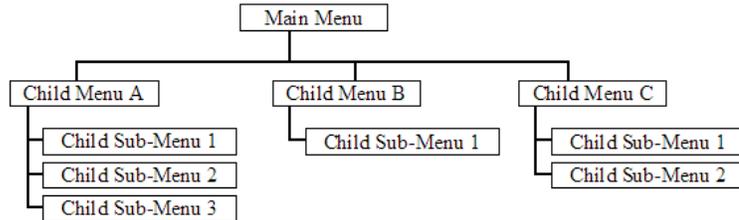


- 2 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.
  - 3 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.
- If you are still not able to establish a connection, contact ProSoft Technology for assistance.

### Navigation

All of the submenus for this module contain commands to redisplay the menu or return to the previous menu. You can always return from a submenu to the next higher menu by pressing **[M]** on your keyboard.

The organization of the menu structure is represented in simplified form in the following illustration:



The remainder of this section shows the menus available for this module, and briefly discusses the commands available to you.

### Keystrokes

The keyboard commands on these menus are usually not case sensitive. You can enter most commands in lowercase or uppercase letters.

The menus use a few special characters (**?**, **-**, **+**, **@**) that must be entered exactly as shown. Some of these characters will require you to use the **SHIFT**, **CTRL**, or **ALT** keys to enter them correctly. For example, on US English keyboards, enter the **?** command as **SHIFT** and **/**.

Also, take care to distinguish the different uses for uppercase letter "eye" (**I**), lowercase letter "el" (**L**), and the number one (**1**). Likewise, uppercase letter "oh" (**O**) and the number zero (**0**) are not interchangeable. Although these characters look alike on the screen, they perform different actions on the module and may not be used interchangeably.

## 4.2.2 Main Menu

When you first connect to the module from your computer, your terminal screen will be blank. To activate the main menu, press the **[?]** key on your computer's keyboard. If the module is connected properly, the following menu will appear.

```
MVI-MNETC COMMUNICATION MODULE MENU
?=Display Menu
B=Block Transfer Statistics
C=Module Configuration
D=Modbus Database View
E=Client Command List Errors
I=Client Command List
R=Transfer Configuration from PC to MVI Unit
S=Transfer Configuration from MVI Unit to PC
U=Reset diagnostic data
V=Version Information
W=Warm Boot Module
Communication Status: 0=Client 4=NIC Status
5=Client Configuration 7=Static ARP Table
@=Network Menu Esc=Exit Program
```

**Caution:** Some of the commands available to you from this menu are designed for advanced debugging and system testing only, and can cause the module to stop communicating with the processor or with other devices, resulting in potential data loss or other communication failures. Use these commands only if you fully understand their potential effects, or if you are specifically directed to do so by ProSoft Technology Technical Support Engineers.

There may be some special command keys that are not listed on the menu but that may activate additional diagnostic or debugging features. If you need these functions, you will be advised how to use them by Technical Support. Please be careful when pressing keys so that you do not accidentally execute an unwanted command.

### Viewing Block Transfer Statistics

Press **[B]** from the *Main* menu to view the *Block Transfer Statistics* screen.

Use this command to display the configuration and statistics of the backplane data transfer operations between the module and the processor. The information on this screen can help determine if there are communication problems between the processor and the module.

**Tip:** To determine the number of blocks transferred each second, mark the numbers displayed at a specific time. Then some seconds later activate the command again. Subtract the previous numbers from the current numbers and divide by the quantity of seconds passed between the two readings.

#### Viewing Module Configuration

Press **[C]** to view the *Module Configuration* screen.

Use this command to display the current configuration and statistics for the module.

#### Opening the Database View Menu

Press **[D]** to open the *Database View* menu.

Use this menu command to view the current contents of the module's database. For more information about this submenu, see *Database View Menu* (page 77).

#### Opening the Command Error List Menu

Press **[E]** to open the Command Error List. This list consists of multiple pages of command list error/status data. Press **[?]** to view a list of commands available on this menu.

#### Opening the Command List Menu

Press **[I]** to open the Command List menu. Use this command to view the configured command list for the module.

#### Receiving the Configuration File

Press **[R]** to download (receive) the current configuration file from the module.

#### Sending the Configuration File

Press **[S]** to upload (send) a configuration file from the module to your PC.

#### Resetting Diagnostic Data

Press **[U]** to reset the status counters for the Client in the module.

#### Viewing Version Information

Press **[V]** to view version information for the module.

Use this command to view the current version of the software for the module, as well as other important values. You may be asked to provide this information when calling for technical support on the product.

Values at the bottom of the display are important in determining module operation. The *Program Scan Counter* value is incremented each time a module's program cycle is complete.

**Tip:** Repeat this command at one-second intervals to determine the frequency of program execution.

### Warm Booting the Module

Press **[W]** from the *Main* menu to warm boot (restart) the module.

This command will cause the program to exit and reload, refreshing configuration parameters that must be set on program initialization. Only use this command if you must force the module to reboot.

### Viewing Client Status

Press **[0]** (zero) to display the statistics of the Client.

### Viewing NIC Status

Press **[4]** to view NIC status. Use this command to view the communication status for the Network Interface Card.

### Viewing Client Configuration

Press **[5]** to display the configuration information for the Client.

### Viewing the Static ARP Table

Press **[7]** to view the Static ARP Table. Use this command to view the list of IP and MAC addresses that are configured not to receive ARP messages from the module.

```
STATIC ARP TABLE DEFINED (Count=4)
105.102.0.15  00:00:8D:B0:0A:16  105.102.0.16  00:00:8D:B0:0A:16
105.102.0.17  00:00:8D:B0:0A:16  105.102.0.18  00:00:8D:B0:0A:16
```

### Opening the Network Menu

Press **[@]** to open the *Network* menu.

The *Network* menu allows you to send, receive and view the WATTCP.CFG file that contains the IP, gateway and other network specification information. For more information about this submenu, see Network Menu (page 78).

### Exiting the Program

Press **[ESC]** to restart the module and force all drivers to be loaded. The module will use the configuration stored in the module's flash memory to configure the module.

### 4.2.3 Modbus Database View Menu

Press **[D]** to open the *Modbus Database View* menu. Use this command to view the module's internal database values. Press **[?]** to view a list of commands on this menu.

```
DATABASE VIEW MENU
?=Display Menu
0-4=Pages 0 to 4000
S=Show Again
-=Back 5 Pages
P=Previous Page
+=Skip 5 Pages
N=Next Page
D=Decimal Display
H=Hexadecimal Display
F=Float Display
A=ASCII Display
M=Main Menu
```

All data contained in the module's database is available for viewing using the commands. Refer to the Modbus Protocol Specification (page 119) for information on the structure of Modbus messages. Each option available on the menu is discussed in the following topics.

#### Viewing Register Pages

To view sets of register pages, use the keys described below:

Command	Description
<b>[0]</b>	Display registers 0 to 99
<b>[1]</b>	Display registers 1000 to 1099
<b>[2]</b>	Display registers 2000 to 2099

And so on. The total number of register pages available to view depends on your module's configuration.

#### Redisplaying the Current Page

Press **[S]** to display the current page of data.

#### Moving Back Through 5 Pages of Registers

Press **[-]** from the *Database View* menu to skip five pages back in the database to see the 100 registers of data starting 500 registers before the currently displayed page.

#### Viewing the Previous Page of Registers

Press **[P]** from the *Database View* menu to display the previous page of data.

#### Moving Forward Through 5 Pages of Registers

Press **[+]** from the *Database View* menu to skip five pages ahead in the database to see 100 registers of data 500 registers ahead of the currently displayed page.

#### Viewing the Next Page of Registers

Press **[N]** from the *Database View* menu to display the next page of data.

#### Viewing Data in Decimal Format

Press **[D]** from the *Database View* menu to display the data on the current page in decimal format.

#### Viewing Data in Hexadecimal Format

Press **[H]** from the *Database View* menu to display the data on the current page in hexadecimal format.

#### Viewing Data in Floating-Point Format

Press **[F]** from the *Database View* menu to display the data on the current page in floating-point format. The program assumes that the values are aligned on even register boundaries. If floating-point values are not aligned as such, they are not displayed properly.

#### Viewing Data in ASCII (Text) Format

Press **[A]** from the *Database View* menu to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

#### Returning to the Main Menu

Press **[M]** to return to the *Main* menu.

### **4.2.4 Network Menu**

From the *Main* menu press **[@]** to display the *Network* menu. The *Network* menu allows you to send, receive, and view the WATTCP.CFG file that contains the IP and module addresses, and other network information.

#### Transferring WATTCP.CFG to the Module

Press **[R]** to transfer a new WATTCP.CFG file from the PC to the module. Use this command to change the network configuration for the module (for example, the module's IP address).

Press **[Y]** to confirm the file transfer, and then follow the instructions on the terminal screen to complete the file transfer process.

### Transferring WATTCP.CFG to the PC

Press **[S]** to transfer the WATTCP.CFG file from the module to your PC.

Press **[Y]** to confirm the file transfer, and then follow the instructions on the terminal screen to complete the file transfer process.

After the file has been successfully transferred, you can open and edit the file to change the module's network configuration.

### Viewing the WATTCP.CFG File on the module

Press **[V]** to view the module's WATTCP.CFG file. Use this command to confirm the module's current network settings.

```
WATTCP.CFG FILE:
# ProLinx Communication Gateways, Inc.
# Default private class 3 address
my_ip=192.168.0.75
# Default class 3 network mask
netmask=255.255.255.0
# name server 1 up to 9 may be included
# nameserver=xxx.xxx.xxx.xxx
# name server 2
# nameserver=xxx.xxx.xxx.xxx
# The gateway I wish to use
gateway=192.168.0.1
# some networks <class 2> require all three parameters
# gateway,network,subnetmask
# gateway 192.168.0.1,192.168.0.0,255.255.255.0
# The name of my network
# domainlist="mynetwork.name"
```

### Returning to the Main Menu

Press **[M]** to return to the *Main* menu.

### 4.3 Reading Status Data from the Module

Module status information is useful for troubleshooting and can be accessed in several different ways.

#### **In the ladder logic's *MNETC.STATUS* controller tag structure.**

The MVI56-MNETC module returns status data in the input image that can be used to determine the module's operating status. This data is transferred from the module to the processor continuously as part of the normal data transfer block sequence (page 93). You can view this data in the *MNETC.STATUS* controller tag structure in the ladder logic.

Client status data can also be requested and returned in a special Client Status block (page 104), outside of the normal data transfer block sequence. The status data contained in the Client Status block is different from the status data in the normal data transfer blocks. It can also be viewed in the *MNETC.STATUS* controller tag structure.

For more information about status data contained in *MNETC.STATUS*, see the Status Data Definition (page 81).

#### **In ProSoft Configuration Builder's Diagnostics screens.**

For more information, see the section on PCB Diagnostics (page 71).

#### **In database locations specified by *Error/Status Pointers* (optional).**

If optional *Error/Status Pointers* are enabled, the status data can also be found in the Read Data area of the module's database at the locations specified by the pointer configuration parameters. For more information, see Backplane Error/Status Pointer (page 38), Client Error/Status Pointer (page 41) and Command Error Pointer (page 41).

#### **Via the Configuration/Debug port.**

Use a terminal program such as HyperTerminal. The Configuration/Debug port provides the following functionality:

- Full view of the module's configuration data
- View of the module's status data
- Complete display of the module's internal database (registers 0 to 4999)
- Version information
- Control over the module (warm boot, cold boot, transfer configuration)
- Facility to upload and download the module's configuration file

### **4.3.1 Status Data Definition**

This section contains a description of the controller tags in the *MNETC.STATUS* controller tag structure, which contains module and Client status data.

- The first ten controller tags contain status data routinely transferred from the module to the processor in the normal data transfer block sequence (page 93).
- The remaining controller tags are used to request and receive Client status data via the Client Status block functionality (page 104).

**Note:** In order to access up-to-date status data from these remaining controller tags, you must ensure that a Client Status block was recently received from the module. Client Status blocks are not routinely sent from the module; they are returned on a once-per-request basis as a response to a Client Status block request from the processor.

<b>Controller Tag</b>	<b>Data Type</b>	<b>Description</b>
PassCnt	INT	This value is incremented each time a complete program cycle occurs in the module.
ProductVersion	INT	Product version
ProductCode	INT[2]	Product code
BlockStats.Read	INT	Total number of read blocks transferred from the module to the processor
BlockStats.Write	INT	Total number of write blocks transferred from the processor to the module
BlockStats.Parse	INT	Total number of blocks successfully parsed that were received from the processor
BlockStats.Event	INT	Total number of Event Command blocks received from the processor
BlockStats.Cmd	INT	Total number of Command Control blocks received from the processor
BlockStats.Err	INT	Total number of block errors recognized by the module
CmdBits[x]	INT	Displays enabled or disabled status of all 16 commands in the <i>Client x Command List</i> for each Client
ClientStatsTrigger	BOOL	Initiates request for Client Status block from module when set to <b>1</b>
ClientID	INT	Specifies Client ( <b>0-29</b> ) to request status data from
ClientStatus[x].CmdReq	INT	Total number of command list requests sent from Client
ClientStatus[x].CmdResp	INT	Total number of command list responses received by Client
ClientStatus[x].CmdErr	INT	This value is incremented each time an error message is received from a remote unit or a local error is generated for a command.
ClientStatus[x].Requests	INT	Not used
ClientStatus[x].Responses	INT	Not used
ClientStatus[x].ErrSent	INT	Not used
ClientStatus[x].ErrRec	INT	Not used
ClientStatus[x].CfgErrWord	INT	Configuration Error Word - This word contains a bitmap that indicates general module configuration errors.
ClientStatus[x].CurErr	INT	Most recent error code recorded for the Client
ClientStatus[x].LastErr	INT	Previous most recent error code recorded for the Client
CmdErrorList[x]	INT	Command error code for each command (0-15) on the specified Client's command list

### 4.3.2 Configuration Error Word

The *Configuration Error Word* contains Client configuration error indications, in a bit-mapped format. Specific bits in the module's *Configuration Error Word* are turned on (set to 1) to indicate various configuration errors. The *Configuration Error Word* appears in the *MNETC.STATUS.ClientStatus[x]* controller tag array. Bits set to 1 in the *Configuration Error Word* indicate the following errors.

Bit	Description	Hex Value
0	Reserved - not currently used	0001h
1	Reserved - not currently used	0002h
2	Reserved - not currently used	0004h
3	Reserved - not currently used	0008h
4	Invalid retry count parameter	0010h
5	The float flag parameter is not valid.	0020h
6	The float start parameter is not valid.	0040h
7	The float offset parameter is not valid.	0080h
8	The ARP Timeout is not in range (ARP Timeout parameter 0 or greater than 60000 milliseconds) and will default to 5000 milliseconds.	0100h
9	The Command Error Delay is > 300 and will default to 300.	0200h
10	Reserved - not currently used	0400h
11	Reserved - not currently used	0800h
12	Reserved - not currently used	1000h
13	Reserved - not currently used	2000h
14	Reserved - not currently used	4000h
15	Reserved - not currently used	8000h

Combinations of errors will result in more than one bit being set in the error word. Correct any invalid data in the configuration for proper module operation. A value of zero (0) in this word indicates all bits are clear, which means that all module configuration parameters contain valid values. However, this does not mean that the configuration is valid for the user application. Make sure each parameter is set correctly for the intended application.

### 4.3.3 Client Command Errors

There are several different ways to view Client Command Errors.

- In the *MNETC.STATUS.CmdErrorList* controller tag array
- On the Client status data screens in the *ProSoft Configuration Builder Diagnostics*
- At a module database location specified by the configuration's *MNET Client x Command Error Pointer*, if the *Command Error Pointer* is enabled. This means that the first register refers to command 1 and so on.

Word Offset	Description
0	Command 0 Error
1	Command 1 Error
2	Command 2 Error
3	Command 3 Error
...	....
...	...
15	Command 15 Error
16	Command 16 Error

For every command that has an error, the module automatically sets the poll delay parameter to 30 seconds. This instructs the module to wait 30 seconds until it attempts to issue the command again.

As the commands in the Client Command Last are polled and executed, an error value is maintained in the module for each command. This error list can be transferred to the processor.

#### Standard Modbus Exception Code Errors

Code	Description
1	Illegal function
2	Illegal data address
3	Illegal data value
4	Failure in associated device
5	Acknowledge
6	Busy; message was rejected

Module Communication Error Codes

Code	Description
-2	Timeout while transmitting message
-11	Timeout waiting for response after request (same as -36)
253	Incorrect slave/server address in response
254	Incorrect function code in response
255	Invalid CRC/LRC value in response

MNET Client Specific Errors

Code	Description
-33	Failed to connect to server specified in command
-35	Invalid length of response message
-36	MNET command response timeout (same as -11)
-37	TCP/IP connection ended before session finished

Command List Entry Errors

Code	Description
-40	Too few parameters
-41	Invalid enable code
-42	Internal address > maximum address
-43	Invalid node address (<0 or >255)
-44	Count parameter set to 0
-45	Invalid function code
-46	Invalid swap code
-47	ARP could not resolve MAC from IP (bad IP address, not part of a network, invalid parameter to ARP routine).
-48	Error during ARP operation: the response to the ARP request did not arrive to the module after a user-adjustable ARP Timeout.

**Note:** When the Client gets error -47 or -48, it uses the adjustable ARP Timeout parameter in the configuration file to set an amount of time to wait before trying again to connect to this non-existent server. This feature allows the Client to continue sending commands and polling other existing servers, while waiting for the non-existent server to appear on the network.



## 5 Reference

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## 5.1 Product Specifications

The MVI56 Modbus TCP/IP Client Communication Module allows Rockwell Automation® ControlLogix® processors to interface easily with other Modbus compatible devices.

Compatible devices include Modicon PACs, as well as a wide variety of instruments and devices. The module acts as an input/output module between the Modbus network and the Rockwell Automation backplane. The data transfer from the processor is asynchronous from the actions on the Modbus Client-controlled network. A 5000-word register space in the module exchanges data between the processor and the Modbus network.

### 5.1.1 General Specifications

- Single Slot - 1756 backplane compatible
- 10/100 MB Ethernet port
- Module I/O data memory mapping supports up to 5000 registers and is user definable
- ProSoft Configuration Builder (PCB) software supported, a Windows-based graphical user interface providing simple product and network configuration
- Sample Ladder Logic and Add-On Instructions (AOI) are used for data transfer between module and processor and module configuration
- Personality Module (non-volatile CF card) used to store configuration allowing for quick in-the-field product replacement.
- Remote or local rack

### 5.1.2 Modbus TCP/IP

- 10/100 MB Ethernet port
- Module I/O data memory mapping supports up to 5000 registers and is user definable
- ProSoft Configuration Builder (PCB) software supported, a Windows-based graphical user interface providing simple product and network configuration
- Sample Ladder Logic and Add-On Instructions (AOI) are used for data transfer between module and processor and module configuration
- Personality Module (non-volatile CF card) used to store configuration allowing for quick in-the-field product replacement.

### **5.1.3 Functional Specifications**

The MVI56-MNETC will operate on a local or remote rack. This module was created to improve the performance when servers are not needed on a Modbus TCP/IP network. The module supports up to 30 Clients with up to 16 commands for each Client, making it easy to enable/disable the commands from the ladder logic. The Client command control word contains one bit for each command. This module does not support the conditional write command.

- 10/100 MB Ethernet Application port
- Supports Enron version of Modbus protocol for floating-point data transactions
- PCB includes a powerful Modbus network analyzer
- Special functions (Event Commands, Command Control, status, etc.) are supported by message transfer (unscheduled) using the MSG instruction
- Configurable parameters for the Client including a minimum response delay of 0 to 65535 ms and floating-point support
- Supports up to 30 Clients with up to 16 commands for each Client
- All data mapping begins at Modbus register 40001.
- Error codes, network error counters, and port status data available in user data memory

#### **Client Specifications**

A port configured as a virtual Modbus Client device on the MVI56-MNETC module actively issues Modbus commands to other nodes on the Modbus network. Additionally, the Client ports have an optimized polling characteristic that polls servers with communication problems less frequently. The ControlLogix processor can be programmed to control the activity on the port by actively selecting commands from the command list to execute or issuing commands directly from the ladder logic.

### 5.1.4 Hardware Specifications

Specification	Description
Backplane Current Load	800 mA @ 5 Vdc 3 mA @ 24 Vdc
Operating Temperature	32°F to 140°F (0°C to 60°C)
Storage Temperature	-40°F to 185°F (-40°C to 85°C)
Shock	30 g operational 50 g non-operational Vibration: 5 g from 10 Hz to 150 Hz
Relative Humidity	5% to 95% (with no condensation)
LED Indicators	Module Status Backplane Transfer Status Application Status Serial Activity
<b>Application port (Ethernet)</b>	
Ethernet Port (Ethernet modules)	10/100 Base-T RJ45 Connector Link and activity LED indicators Electrical Isolation 1500 V rms at 50 Hz to 60 Hz for 60 s, applied as specified in section 5.3.2 of IEC 60950: 1991 Ethernet Broadcast Storm Resiliency = less than or equal to 5000 [ARP] frames-per-second and less than or equal to 5 minutes duration
Shipped with Unit	RJ45 to DB-9M cables for each port 6-foot RS-232 configuration cable
<b>Debug/Configuration port (CFG)</b>	
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) No hardware handshaking

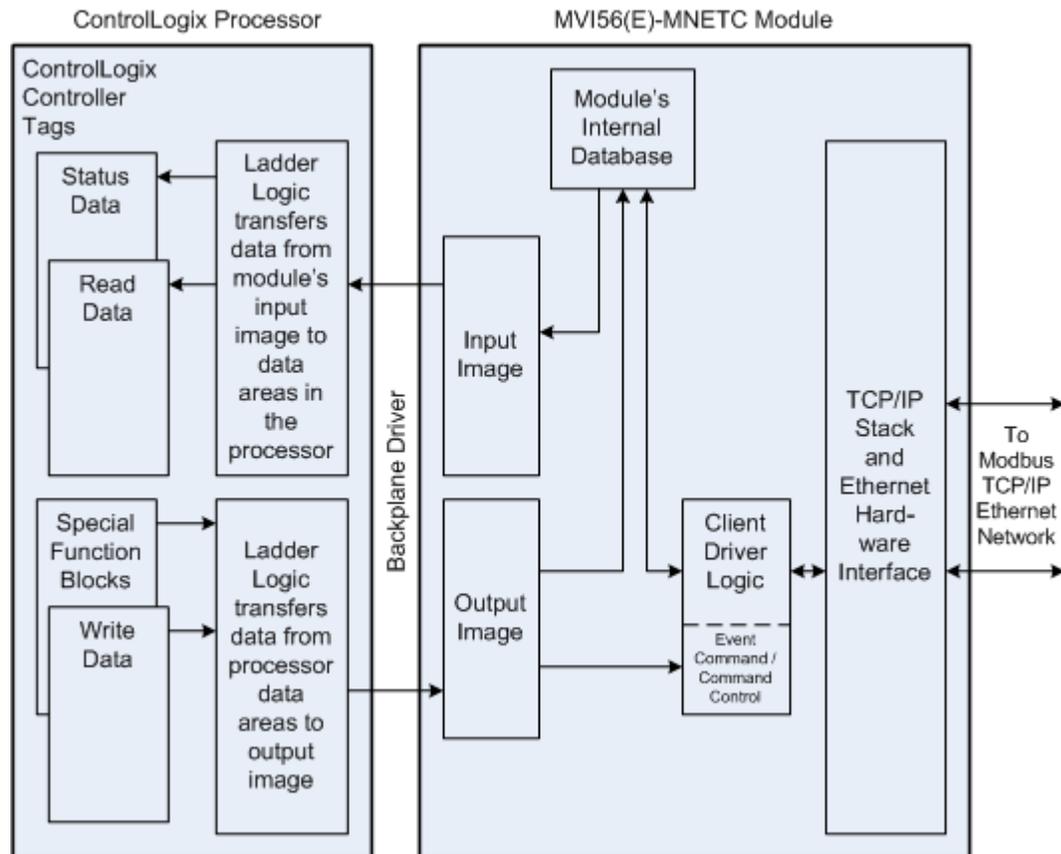
## 5.2 Backplane Data Transfer

The MVI56-MNETC module communicates directly over the ControlLogix backplane. Data is paged between the module and the ControlLogix processor across the backplane using the module's input and output images. The update frequency of the images is determined by the scheduled scan rate defined by the user for the module and the communication load on the module. Typical update times range from 1 to 10 milliseconds.

This bi-directional transfer of data is accomplished by the module putting data in the input image to send to the processor. Data in the input image is placed in the processor's controller tags by ladder logic. The input image is set to 250 words.

Processor logic inserts data to the output image to be transferred to the module. The module's firmware program extracts the data and places it in the module's internal database. The output image is set to 248 words.

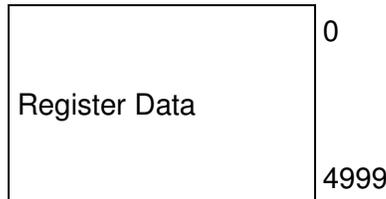
The following illustration shows the data transfer method used to move data between the ControlLogix processor, the MVI56-MNETC module and the Modbus TCP/IP Network.



All data transferred between the module and the processor over the backplane is through the input and output images. Ladder logic must be written in the ControlLogix processor to interface the input and output image data with data defined in the controller tags. All data used by the module is stored in its internal database. This database is defined as a virtual Modbus data table with addresses from 0 (40001 Modbus) to 4999 (45000 Modbus).

**Module’s Internal Database Structure**

5000 registers for user data



Data contained in this database is transferred in blocks, or pages, using the input and output images. ControlLogix ladder logic and the MVI56-MNETC module's program work together to coordinate these block transfers. Up to 200 words of data can be transferred from the module to the processor (read block - input image) or from the processor to the module (write block - output image) in each block transfer. The block structure of each block type depends on the data content and function of the block. The module uses the following block identification numbers:

Block ID Range	Descriptions
-1	Null block
0	For firmware versions earlier than 2.05, this is a null block. For firmware versions 2.05 and newer, block 0 contains the same data as block 1. This feature enhances performance, especially when using less than 200 words of read/write data: <ul style="list-style-type: none"> <li>▪ If Read Register Count in the module configuration file is set &gt; 200 words, Block ID 0 is not used.</li> <li>▪ If Read Register Count in the module configuration file is set &gt;0 and &lt;= 200 words, Block ID contains the same data as block 1 (both read data and status data).</li> </ul>
1 to 25	Read or Write blocks
1000 to 1024	Initialize Output Data blocks
2000 to 2029	Event Command blocks
3000 to 3029	Client Status blocks
5001 to 5016	Command Control blocks
9990	Set Module IP Address block
9991	Get Module IP Address block
9998	Warm-boot block
9999	Cold-boot block

These block identification codes can be broken down into two groups:

Normal data transfer blocks

- Read and Write blocks (-1 to 25)

Special function blocks

- Initialize Output Data blocks (1000 to 1024)
- Event Command blocks (2000 to 2029)
- Client Status blocks (3000 to 3029)
- Command Control blocks (5001 to 5016)
- Module IP Address blocks (9990 and 9991)
- Warm-boot and Cold-boot blocks (9998 and 9999)

### 5.2.1 Normal Data Transfer Blocks

Normal data transfer includes the paging of user data from the module's internal database (registers 0 to 4999), as well as paging of status data. These data are transferred through read (input image) and write (output image) blocks.

The following topics describe the function and structure of each block.

#### Read Block

These blocks of data transfer information from the module to the ControlLogix processor.

The following table describes the structure of the input image.

#### Read Block from Module to Processor

Word Offset	Description	Length
0	Reserved	1
1	Write Block ID	1
2 to 201	Read Data	200
202	Program Scan Counter	1
203 to 208	Block Transfer Status	6
209 to 238	Command bit data for Clients	30
239 to 240	Product Code	2
241	Product Version	1
242 to 248	Reserved	7
249	Read Block ID	1

The Read Block ID is an index value used to determine where the 200 words of data from module memory will be placed in the *ReadData[x]* controller tag array of the ControlLogix processor. Each transfer can move up to 200 words (block offsets 2 to 201) of data. In addition to moving user data, the block also contains status data for the module. The Write Block ID associated with the block requests data from the ControlLogix processor.

During normal program operation, the module sequentially sends read blocks and requests write blocks.

For example, if the application uses three read and two write blocks, the sequence will be as follows:

R1W1 □ R2W2 □ R3W1 □ R1W2 □ R2W1 □ R3W2 □ R1W1 □

This sequence will continue until interrupted by other write block numbers sent by the controller or by a command request from a node on the Modbus network or operator control through the module's Configuration/Debug port.

### Status Data in Read Block

The following table describes in more detail the status information found in the Read Block.

Word Offset	Content	Description
202	Program Scan Count	This value is incremented each time a complete program cycle occurs in the module.
203	Read Block Count	This field contains the total number of read blocks transferred from the module to the processor.
204	Write Block Count	This field contains the total number of write blocks transferred from the processor to the module.
205	Parse Block Count	This field contains the total number of blocks successfully parsed that were received from the processor.
206	Command Event Block Count	This field contains the total number of command event blocks received from the processor.
207	Command Block Count	This field contains the total number of command blocks received from the processor.
208	Error Block Count	This field contains the total number of block errors recognized by the module.
209	Client 0 command execution word	Each bit in this word enables/disables the commands for Client 0. If the bit is set, the command will execute. If the bit is clear, the command will be disabled. This data is set in the output image (WriteBlock) from the ladder logic.
210 to 238	Client 1 to Client 29 command execution words	These 29 words are used for each of the other 29 Clients in the module. This data is set in the output image (WriteBlock) from the ladder logic.
239 to 240	Product Code	The product ID code for the module
241	Product Version	The firmware version number for the module

Status information transferred in the Read block can be viewed in the *MNETC.STATUS* controller tag in the ladder logic. For more information, see the Status Data Definition (page 81).

### Write Block

These blocks of data transfer information from the ControlLogix processor to the module.

The following table describes the structure of the output image.

#### **Write Block from Processor to Module**

<b>Word Offset</b>	<b>Description</b>	<b>Length</b>
0	Write Block ID	1
1 to 200	Write Data	200
201 to 230	Command bit data for Clients (set)	30
231 to 246	Spare	16
247	Select Priority Read Block	1

The Write Block ID is an index value used to determine the location in the module's database where the data will be placed. Each transfer can move up to 200 words (block offsets 1 to 200) of data.

### Select Priority Read Block (Write Block Offset 247)

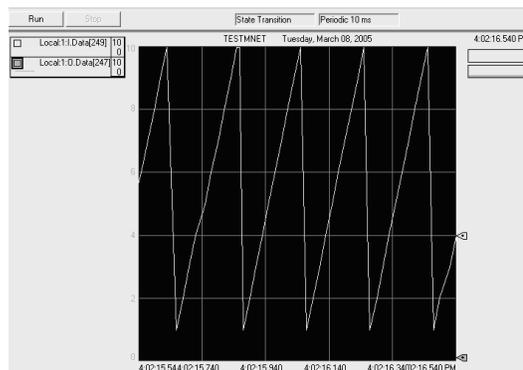
**Note:** The Select Priority Read Block feature is only available for firmware versions 1.36.000 and newer.

This register allows the processor to select which read blocks will be returned from the module. If this register equals zero, the module will return all read blocks in sequential order.

If this register has a non-zero value, the module will return the read block selected, and the following one.

This feature can be used for applications that require some read blocks to be updated more frequently than other blocks.

The following illustrations show the effect of changing the value of the Select Priority Read Block register (Write Block offset 247). In the following histogram curve, the Select Priority Read Block is equal to 0.



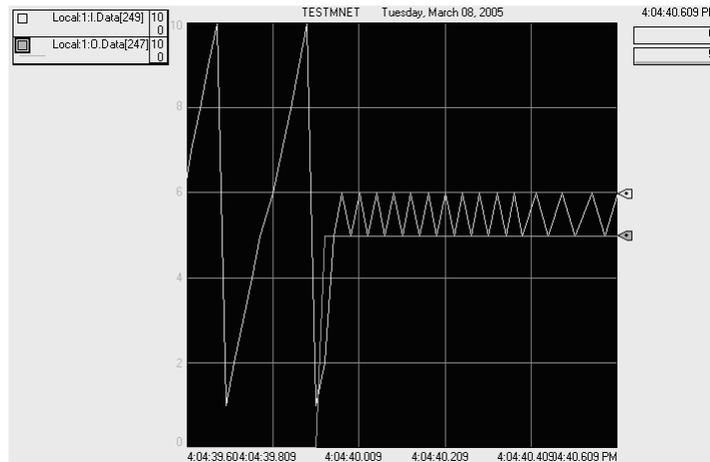
- Local:1.O.Data[247] = Select Priority Read Block.
- Local:1.I.Data[249] = Read Block ID.

In the example above, all read blocks (1 to 10) are returned in sequential order.

### Select Priority Read Block = 5

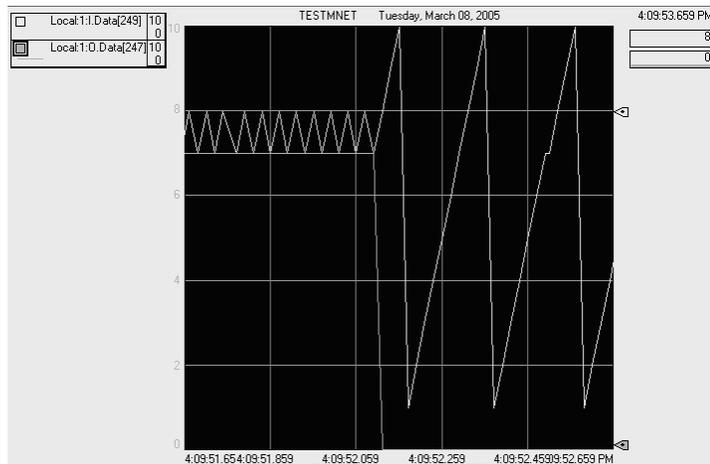
If the ladder logic changes the value of Local:1:O.Data[247] from 0 to 5, note that the Local:1:I.Data[249] value begins to alternate between Block IDs 5 and 6 as long as Local:1:I.Data[247] stays set to 5.

5-6-5-6-5-6-5-6-5-6-...



### Select Priority Read Block = 0

After the ladder logic changes the value of Local:1:O.Data[247] from 5 to 0, then the Local:1:I.Data[249] value is updated as before, by returning all blocks 1 through 10 in a repeating sequence.

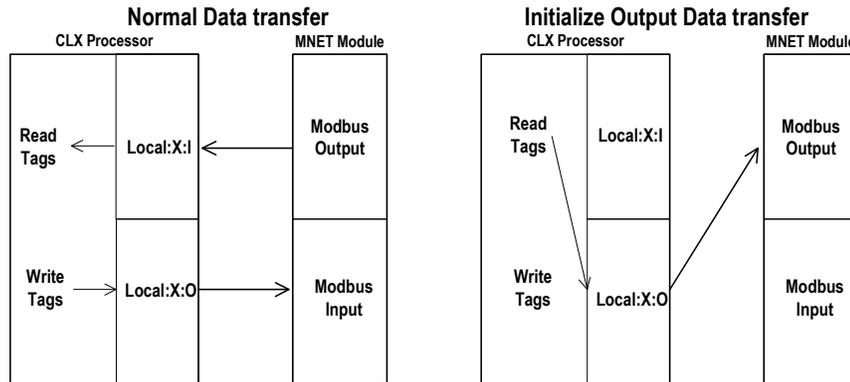


## 5.2.2 Special Function Blocks

Special function blocks are optional blocks used to request special tasks from the module.

Initialize Output Data Blocks (1000 to 1024)

Use the *Initialize Output Data* parameter in the configuration to bring the module to a known state after a restart operation. If the *Initialize Output Data* parameter is enabled, when the module performs a restart operation, it will request blocks of output data from the *ReadData* array in the processor to initialize the Read Data area of the module’s internal database.



**Block Request from Module to Processor**

Word Offset	Description	Length
0	Reserved	1
1	1000 to 1024	1
2 to 248	Spare	247
249	1000 to 1024	1

Ladder logic subtracts 1000 from the value contained in word 249 to determine a block index. This block index determines which 200-word block of data will be taken from the *ReadData* array and placed in the output image to be returned to the module.

**Block Response from Processor to Module**

Word Offset	Description	Length
0	1000 to 1024	1
1 to 200	Output data to preset in module.	200
201 to 247	Spare	47

Event Command Blocks (2000 to 2029)

**Note:** When using the Event Command Block (2000 & 4000) for polling operations, at least one command needs to be configured in client even if the command is disabled.

During routine operation, the module continuously cycles through the user-defined *MNET Client x Command List* (page 43) for each Client, examining commands in the order they are listed, and sending enabled commands on the network. However, the module also has a special command priority queue, which is an internal buffer that holds commands from special function blocks until they can be sent on the network.

When one or more commands appear in the command priority queue:

- 1 The routine polling process is temporarily interrupted.
- 2 The commands in the command priority queue are executed until the queue is empty.
- 3 Then the module goes back to where it left off on the *MNET Client x Command List* and continues routine polling.

Event Command blocks send Modbus TCP/IP commands directly from controller tags by ladder logic to the Client command priority queue on the module. Event Commands are not placed in the module's internal database and are not part of the *MNET Client x Command List*.

**Block Request from Processor to Module**

Word Offset	Description	Length
0	2000 to 2029 (last digits indicate which Client to utilize)	1
1 to 4	IP Address	4
5	Service Port	1
6	Slave Address	1
7	Internal DB Address	1
8	Point Count	1
9	Swap Code	1
10	Modbus Function Code	1
11	Device Database Address	1
12 to 247	Spare	236

The module will use the parameters passed in this block to construct the command.

- The *IP Address* for the node to reach on the network is entered in four registers (1 to 4). Each digit of the IP address is entered in the appropriate register. For example, to interface with node 192.168.0.100, enter the values 192, 168, 0 and 100 in registers 1 to 4.

- The *Service Port* field selects the TCP service port on the server to connect. If the parameter is set to 502, a standard MBAP (Modbus API for network communications) message will be generated. All other service port values will generate a Modbus command message encapsulated in a TCP/IP packet.
- The *Slave Address* is the Modbus node address for the message.
- The *Internal DB Address* parameter specifies the module's database location to associate with the command.
- The *Point Count* parameter defines the number of points or registers for the command.
- The *Swap Code* is used with Modbus functions 3 and 4 requests to change the word or byte order.
- The *Modbus Function Code* has one of the following values 1, 2, 3, 4, 5, 6, 15 or 16.
- The *Device Database Address* is the Modbus register or point in the remote server device to be associated with the command.

The module then places the command in the command priority queue (if the queue is not already full; maximum capacity is 16 commands), and returns a response block to tell the ladder logic whether or not the command has been successfully added to the queue.

### Block Response from Module to Processor

Word Offset	Description
0	Reserved
1	This word contains the next read request block identification code.
2	This word contains the result of the event request. If a value of one is present, the command was issued. If a value of zero is present, no room was found in the command priority queue.
3 to 248	Spare
249	This word contains the block identification code 2000 to 2029 requested by the processor.

Word 2 of the block can be used by the ladder logic to determine if the command was successfully added to the command priority queue. The command will fail if the queue for the Client is already full at the time when the Event Command block is received by the module.

### Controller Tags

The elements of the *MNETC.CONTROL.EventCmd[x]* controller tag array contain all the values needed to build one Modbus TCP/IP command, have it sent to a specific Client on the module, and control the processing of the returned response block.

Controller Tag	Description
IP0	Enter the first octet of the IP address of the target Modbus server.
IP1	Enter the second octet of the IP address of the target Modbus server.
IP2	Enter the third octet of the IP address of the target Modbus server.
IP3	Enter the fourth octet of the IP address of the target Modbus server.
ServPort	Enter <b>502</b> for a MBAP message or <b>2000</b> for a MNET message.
Node	Enter the Modbus slave node address. Enter <b>1</b> to <b>247</b> . Enter <b>0</b> if not needed.
DBAddress	Enter the module internal database address to associate with the command.
Count	Enter the number of words or bits to be transferred by the Client.
Swap	Enter the swap code for the data. This function is only valid for function codes 3 and 4.
Function	Enter the Modbus function code for the command.
Address	Enter the database address for the server.

When these values have been entered, set the bit in *MNETC.CONTROL.EventCmdTrigger* to one (**1**) to trigger the execution of the Event Command.

### Block 4000

Functionality of block 4000 is identical to block 2000 with the exception that an extra parameter is added (Sequence) number

Tag Name	Value
MNETC.CONTROL.EventSeqCmd	{...}
MNETC.CONTROL.EventSeqCmd.Trigger	0
MNETC.CONTROL.EventSeqCmd.ClientID	1
MNETC.CONTROL.EventSeqCmd.IP0	105
MNETC.CONTROL.EventSeqCmd.IP1	102
MNETC.CONTROL.EventSeqCmd.IP2	0
MNETC.CONTROL.EventSeqCmd.IP3	67
MNETC.CONTROL.EventSeqCmd.ServPort	502
MNETC.CONTROL.EventSeqCmd.Node	1
MNETC.CONTROL.EventSeqCmd.DBAddress	3000
MNETC.CONTROL.EventSeqCmd.Count	10
MNETC.CONTROL.EventSeqCmd.Swap	0
MNETC.CONTROL.EventSeqCmd.Function	3
MNETC.CONTROL.EventSeqCmd.Address	0
MNETC.CONTROL.EventSeqCmd.Sequence	2001

When the event is sent it will also trigger the event sequence ready bit shown below.

+ MNETC.STATUS.CmdErrorList	{...}
+ MNETC.STATUS.EventSeqCmdPending	{...}
+ MNETC.STATUS.EventSeqCmd	{...}
+ MNETC.STATUS.EventSeqReady	2#0000_0000_0000_0000_0000_0000_0000_0010

**When a bit is on this parameter it tells the customer that there are events waiting on that specific client. In this case it would be events on client 1 ( 0-29)**

**Block 4100**

Sending this block will display the result of each command sent, customer needs to input what client he wants to poll from and trigger the block as shown. The response will be the event count and error code for each event. A value of 0 in the error code means there was no error detected.

- MNETC.STATUS.EventSeqCmd	{...}
- MNETC.STATUS.EventSeqCmd.Trigger	0
+ MNETC.STATUS.EventSeqCmd.ClientID	1
- MNETC.STATUS.EventSeqCmd.Client	{...}
+ MNETC.STATUS.EventSeqCmd.Client[0]	{...}
- MNETC.STATUS.EventSeqCmd.Client[1]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Count	15
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd	{...}
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[0]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[0].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[0].Error	-48
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[1]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[1].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[1].Error	-48
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[2]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[2].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[2].Error	-48
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[3]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[3].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[3].Error	-48
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[4]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[4].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[4].Error	-48
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[5]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[5].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[5].Error	-48
- MNETC.STATUS.EventSeqCmd.Client[1].Cmd[6]	{...}
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[6].Sequence	2001
+ MNETC.STATUS.EventSeqCmd.Client[1].Cmd[6].Error	-48

### Other changes

The MNETC Control tags were changed from:

- MNETC.CONTROL		{...}	
+ MNETC.CONTROL.BootTimer		{...}	
- MNETC.CONTROL.ColdBoot		0	
- MNETC.CONTROL.WarmBoot		0	
- MNETC.CONTROL.ResetStatus		0	
- MNETC.CONTROL.EventCmdTrigger		0	
+ MNETC.CONTROL.ClientID		10	
+ MNETC.CONTROL.EventCmd		{...}	Before
+ MNETC.CONTROL.CmdID		1	
+ MNETC.CONTROL.CmdControl		{...}	
- MNETC.CONTROL.CmdControlPending		0	
- MNETC.CONTROL.CmdControlTrigger		0	
+ MNETC.CONTROL.IPAddress		{...}	
- MNETC.CONTROL.EventSeqCmdTrigger		0	
+ MNETC.CONTROL.ClientSeqID		29	
+ MNETC.CONTROL.EventSEQCmd		{...}	

The eventcmd trigger and client ID were moved inside the EventCmd section, in turn moving down the entire section to be next to new eventSeqCmd

- MNETC.CONTROL		{...}	
+ MNETC.CONTROL.BootTimer		{...}	
- MNETC.CONTROL.ColdBoot		0	
- MNETC.CONTROL.WarmBoot		0	
- MNETC.CONTROL.ResetStatus		0	
+ MNETC.CONTROL.CmdID		1	
+ MNETC.CONTROL.CmdControl		{...}	
- MNETC.CONTROL.CmdControlPending		0	
- MNETC.CONTROL.CmdControlTrigger		0	
+ MNETC.CONTROL.IPAddress		{...}	
+ MNETC.CONTROL.EventCmd		{...}	After
+ MNETC.CONTROL.EventSeqCmd		{...}	

### Block 4200

When the client sends this block, the module will display the Queue count which is the command queue count and the waiting msgs which correspond to the event sequence messages waiting packed.

- MNETC.STATUS.EventSeqCmdPending		{...}
MNETC.STATUS.EventSeqCmdPending.Trigger		0
+ MNETC.STATUS.EventSeqCmdPending.Client0_QueueCount		0
+ MNETC.STATUS.EventSeqCmdPending.Client0_WaitingMsgs		0
+ MNETC.STATUS.EventSeqCmdPending.Client1_QueueCount		15
+ MNETC.STATUS.EventSeqCmdPending.Client1_WaitingMsgs		3
+ MNETC.STATUS.EventSeqCmdPending.Client2_QueueCount		0
+ MNETC.STATUS.EventSeqCmdPending.Client2_WaitingMsgs		0

Client Status Blocks (3000 to 3029)

Client status data for a specific Client can be requested and returned in a special Client Status block. The status data contained in the Client Status block is different from the status data contained in the normal data transfer blocks.

**Block Request from Processor to Module**

Word Offset	Description	Length
0	3000 to 3029 (last digits indicate which Client to consider)	1
1 to 247	Spare	247

**Block Response from Module to Processor**

Word Offset	Description	Length
0	0	1
1	Write Block ID	1
2	3000 to 3029 number requested	1
3 to 12	Client status data	10
13 to 28	Command error list data for Client	16
29 to 248	Reserved	220
249	3000 to 3029	1

**Client Status Data**

Word Offset	Client Status
3	Total number of command list requests
4	Total number of command list responses
5	Total number of command list errors
6	Not used
7	Not used
8	Not used
9	Not used
10	Configuration Error Word
11	Current Error
12	Last Error

Status information transferred in the Client Status block can be viewed in the *MNETC.STATUS* controller tag in the ladder logic. For more information, see Status Data Definition (page 81).

## Controller Tags

To issue a Client Status block request, enter the appropriate values in the following members of the *MNETC.STATUS* controller tag in the ladder logic.

Controller Tag	Data Type	Description
ClientID	INT	Enter the Client ( <b>0-29</b> ) to request status data for.
ClientStatsTrigger	BOOL	Set the value of this tag to <b>1</b> to trigger the Client Status block request.

### Command Control Blocks (5001-5016)

**Note:** Command Control is not needed for normal Modbus command list polling operations and is needed only occasionally for special circumstances.

During routine operation, the module continuously cycles through the user-defined *MNET Client x Command List* (page 43) for each Client, examining commands in the order they are listed, and sending enabled commands on the network. However, the module also has a special command priority queue, which is an internal buffer that holds commands from special function blocks until they can be sent on the network.

When one or more commands appear in the command priority queue:

- 1 The routine polling process is temporarily interrupted.
- 2 The commands in the command priority queue are executed until the queue is empty.
- 3 Then the module goes back to where it left off on the *MNET Client x Command List* and continues routine polling.

Like Event Command blocks, Command Control blocks place commands into the module's command priority queue. Unlike Event Command blocks, which contain all the values needed for one command, Command Control is used with commands already defined in the *MNET Client x Command List*.

Commands in the *MNET Client x Command List* may be either enabled for routine polling or disabled and excluded from routine polling. A disabled command has its bit in the *MNETC.CONTROL.CmdControl.WriteCmdBits* controller tag set to zero (**0**) and is skipped during routine polling. An enabled command has its bit in the *WriteCmdBits* controller tag set to one (**1**) and is sent during routine polling. However, Command Control allows any command in the predefined *MNET Client x Command List* to be added to the command priority queue, whether it is enabled for routine polling or not.

Command Control also gives you the option to use ladder logic to have commands from the *MNET Client x Command List* executed at a higher priority and out of routine order, if such an option might be required in special circumstances.

A single Command Control block request can place up to 16 commands from the *MNET Client x Command List* into the command priority queue.

**Block Request from Processor to Module**

Word Offset	Description	Length
0	Command Control block identification code of <b>5001</b> to <b>5016</b> . The rightmost digit indicates the number of commands ( <b>1</b> to <b>16</b> ) to add to the command priority queue.	1
1	Client index	1
2	This word contains the Command Index for the first command to be entered into the queue.	1
3	Command Index 2	1
4	Command Index 3	1
5	Command Index 4	1
6	Command Index 5	1
7	Command Index 6	1
8	Command Index 7	1
9	Command Index 8	1
10	Command Index 9	1
11	Command Index 10	1
12	Command Index 11	1
13	Command Index 12	1
14	Command Index 13	1
15	Command Index 14	1
16	Command Index 15	1
17	Command Index 16	1
18 to 247	Spare	230

The last digit in the block identification code indicates the number of commands to process. For example, a block identification code of **5003** indicates that three commands are to be placed in the queue. In this case, the first three of the 16 available Command Indexes will be used to determine exactly which three commands will be added to the queue, and to set their order of execution.

Values to enter for the 16 Command Indexes range from **0** to **15** and correspond to the *MNET Client x Command List* entries, which are numbered from 1 to 16. To determine the Command Index value, subtract one (**1**) from the row number of the command in the *MNET Client x Command List*, as seen in the *Command Editor* window of *ProSoft Configuration Builder (PCB)*.

The module responds to a Command Control block request with a response block, indicating the number of commands added to the command priority queue.

### Block Response from Module to Processor

Offset	Description	Length
0	Reserved	1
1	Write Block ID	1
2	Number of commands added to command queue	1
3 to 248	Spare	246
249	5001 to 5016	1

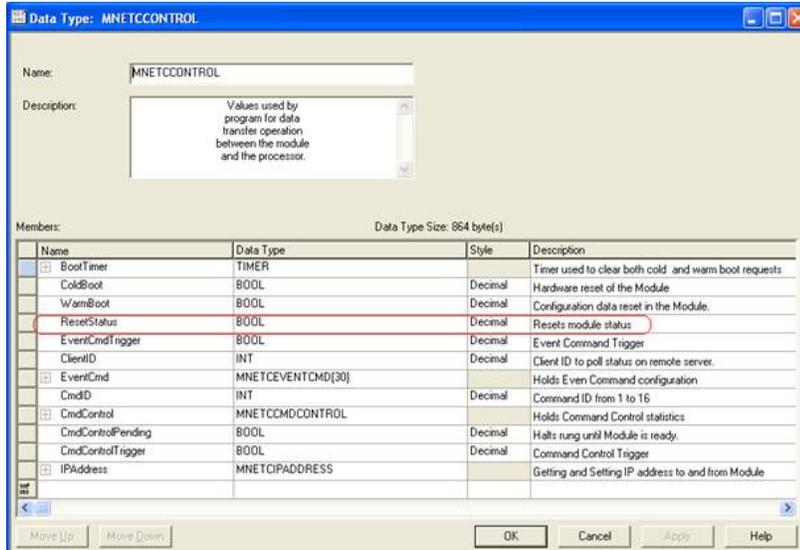
### Controller Tags

The *MNETC.CONTROL* controller tag array holds all the values needed to create one Command Control block, have it sent to the module, and control the processing of the returned response block.

Controller Tag	Description
CmdID	Enter a decimal value representing the quantity of commands to be requested in the Command Control block ( <b>1 to 16</b> ). This value is used by the ladder logic to generate the Command Control Block ID. The rightmost digits of the Command Control Block ID are the number of commands requested by the block.
CmdControl.ClientID	Enter the Client to issue the commands to ( <b>0 to 29</b> )
CmdControl.CMDqty	Not used
CmdControl.CmdIndex	Enter the <b>ROW NUMBER</b> of the command in the <i>MNET Client x Command List</i> in <i>Prosoft Configuration Builder</i> minus <b>1</b> . This is a 16-element array. Each element holds one Command Index.
CmdControl.WriteCmdBits	Enter a <b>1</b> (enable) or a <b>0</b> (disable) to select which commands on the configuration's <i>Client x Command List</i> will be executed during routine polling. There is one 16-bit word for each of the 30 Clients. Each of the 16 bits corresponds to one of the 16 commands available to each Client. The state of these <i>WriteCmdBits</i> overrides whatever value may be assigned to the <i>Enable</i> parameter in the configuration.  <div style="background-color: #e0e0e0; padding: 5px;"><b>Note:</b> This parameter only affects routine polling. It has no effect on Command Control blocks.</div>
CmdControlPending	Not used
CmdControlTrigger	Set this tag to <b>1</b> to trigger the execution of a Command Control block after all the other parameters have been entered.

**Reset Module Status Block (9971) MNETC**

This block allows the processor to reset all status values available from the module to the processor or through the PCB diagnostics menu. This block is triggered through the following data type and controller tag elements:



-	MNETC	{ ... }	MNETCMO
+	MNETC.DATA	{ ... }	MNETCDA
-	MNETC.CONTROL	{ ... }	MNETCCO
+	MNETC.CONTROL.BootTimer	{ ... }	TIMER
	MNETC.CONTROL.ColdBoot	0 Decimal	BOOL
	MNETC.CONTROL.WarmBoot	0 Decimal	BOOL
	MNETC.CONTROL.ResetStatus	0 Decimal	BOOL
	MNETC.CONTROL.EventCmdTrigger	0 Decimal	BOOL
+	MNETC.CONTROL.ClientID	10 Decimal	INT

**Set Module IP Address Block (9990)**

**Block Request from Processor to Module**

Word Offset	Description	Length
0	9990	1
1	First digit of dotted IP address	1
2	Second digit of dotted IP address	1
3	Third digit of dotted IP address	1
4	Last digit of dotted IP address	1
5 to 247	Reserved	243

**Block Response from Module to Processor**

Word Offset	Description	Length
0	0	1
1	Write Block ID	1
2	First digit of dotted IP address	1
3	Second digit of dotted IP address	1
4	Third digit of dotted IP address	1
5	Last digit of dotted IP address	1
6 to 248	Spare data area	243
249	9990	1

Get Module IP Address Block (9991)

**Block Request from Processor to Module**

Word Offset	Description	Length
0	9991	1
1 to 247	Spare data area	247

**Block Response from Module to Processor**

Word Offset	Description	Length
0	0	1
1	Write Block ID	1
2	First digit of dotted IP address	1
3	Second digit of dotted IP address	1
4	Third digit of dotted IP address	1
5	Last digit of dotted IP address	1
6 to 248	Spare data area	243
249	9991	1

Warm Boot Block (9998)

This block is sent from the ControlLogix processor to the module (output image) when the module is required to perform a warm-boot (software reset) operation. This block is commonly sent to the module any time configuration data modifications are made in the controller tags data area. This will cause the module to read the new configuration information and to restart.

**Block Request from Processor to Module**

Offset	Description	Length
0	9998	1
1 to 247	Spare	247

Cold Boot Block (9999)

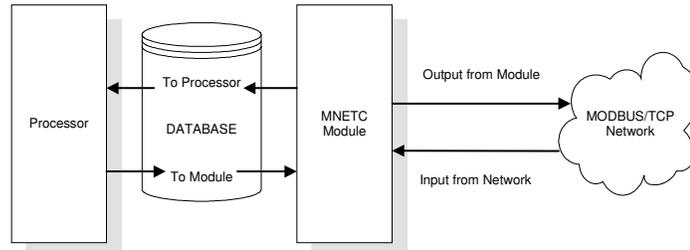
This block is sent from the ControlLogix processor to the module (output image) when the module is required to perform the cold boot (hardware reset) operation. This block is sent to the module when a hardware problem is detected by the ladder logic that requires a hardware reset.

**Block Request from Processor to Module**

Word Offset	Description	Length
0	9999	1
1 to 247	Spare	247

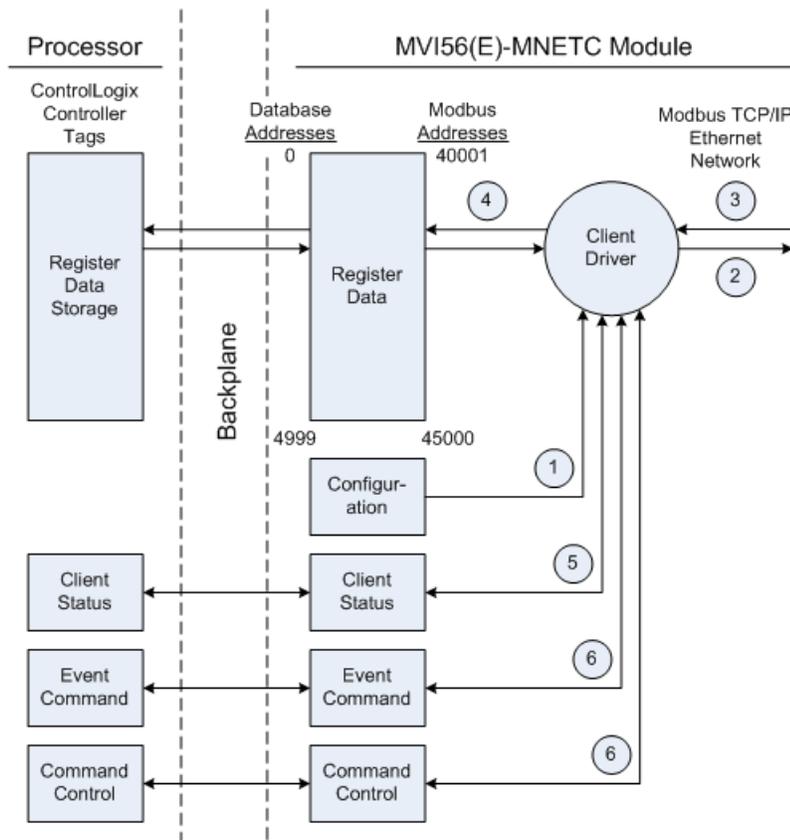
### 5.3 Data Flow between MVI56-MNETC Module and Processor

The following topics describe the flow of data between the two pieces of hardware (processor and MVI56-MNETC module) and other nodes on the Modbus TCP/IP network. The module contains up to 30 Clients, which can generate either MBAP (Modbus API for network communications) or MNET requests dependent on the service port selected in the command.



### 5.3.1 Client Driver

In the Client driver, the MVI56-MNETC module issues read or write commands to servers on the Modbus TCP/IP network using up to 30 simulated Clients. The commands originate either from the module's user-configured *Client x Command List* for each Client, or directly from the processor as Event Commands. The commands from the *Client x Command List* are executed either via routine polling or as a result of special Command Control block requests from the processor. Client status data is returned to the processor in special Client Status blocks. The following flowchart describes the flow of data into and out of the module.



- 1 The Client driver obtains configuration data when the module restarts. This includes the timeout parameters and the Command List. These values are used by the driver to determine the types of commands to be issued to servers on the Modbus TCP/IP network.
- 2 When configured, the Client driver begins transmitting read and/or write commands to servers on the network. The data for write commands is obtained from the module's internal database.
- 3 Assuming successful processing by the server specified in the command, a response message is received into the Client driver for processing.

- 4 Data received from the server is passed into the module's internal database, if the command was a read command. General module status information is routinely returned to the processor in the input images.
- 5 Status data for a specific Client can be requested by the processor and returned in a special Client Status block.
- 6 Special functions, such as Event Commands and Command Control options, can be generated by the processor and sent to the Client driver for action.

### **5.3.2 Client Command List**

In order for the Client to function, the module's Client Command List must be defined in the *MNET Client x Commands* section of the configuration. This list contains up to 16 individual entries, with each entry containing the information required to construct a valid command. This includes the following:

- Command enable mode: **(0)** disabled or **(1)** continuous
- IP address and service port to connect to on the remote server
- Slave Node Address
- Command Type - Read or Write up to 100 words per command
- Database Source and Destination Register Address - Determines where data will be placed and/or obtained
- Count - Select the number of words to be transferred - 1 to 100
- Poll Delay - 1/10<sup>th</sup> seconds

For information on troubleshooting commands, see Client Command Errors (page 84).

## 5.4 Cable Connections

The MVI56-MNETC module has the following functional communication connections installed:

- One Ethernet port (RJ45 connector)
- One RS-232 Configuration/Debug port (RJ45 connector)

### 5.4.1 Ethernet Connection

The MVI56-MNETC module has an RJ45 port located on the front of the module, labeled *Ethernet*, for use with the TCP/IP network. The module is connected to the Ethernet network using an Ethernet cable between the module's Ethernet port and an Ethernet switch or hub.

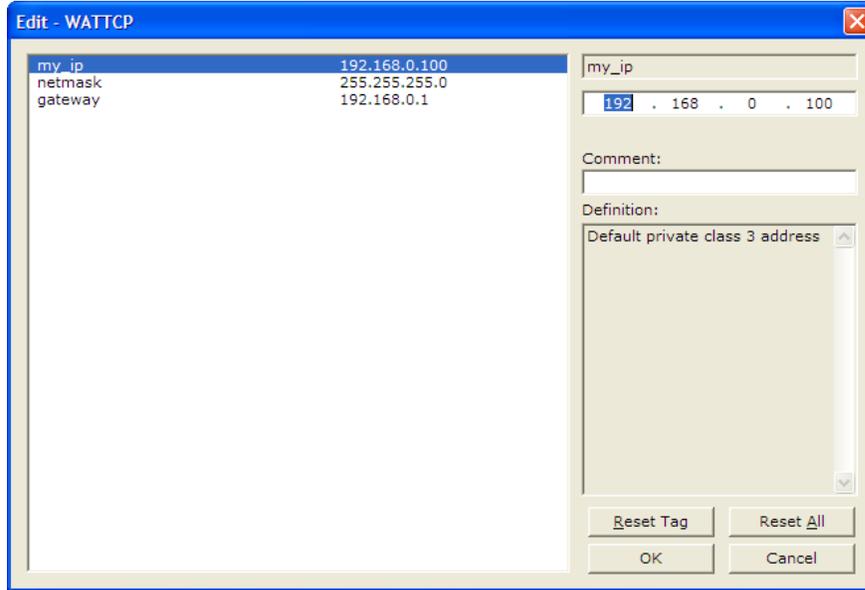
**Note:** Depending on hardware configuration, you may see more than one RJ45 port on the module. The Ethernet port is labeled *Ethernet*.

**Warning:** The MVI56-MNETC module is NOT compatible with Power Over Ethernet (IEEE802.3af / IEEE802.3at) networks. Do NOT connect the module to Ethernet devices, hubs, switches or networks that supply AC or DC power over the Ethernet cable. Failure to observe this precaution may result in damage to hardware, or injury to personnel.

**Important:** The module requires a static (fixed) IP address that is not shared with any other device on the Ethernet network. Obtain a list of suitable IP addresses from your network administrator BEFORE configuring the Ethernet port on this module.

### Ethernet Port Configuration - wattcp.cfg

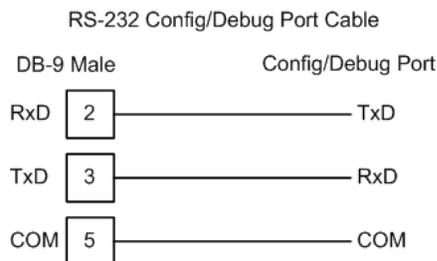
The wattcp.cfg file must be set up properly in order to use a TCP/IP network connection. You can view the current network configuration in *ProSoft Configuration Builder (PCB)*, as shown:



You may also view the network configuration using a PC serial port connection and an ASCII terminal program (like Windows HyperTerminal) by selecting **[@]** (Network Menu) and **[V]** (View) options when connected to the Debug port. For more information on serial port access, see the chapter on Diagnostics and Troubleshooting (page 67).

### **5.4.2 RS-232 Configuration/Debug Port**

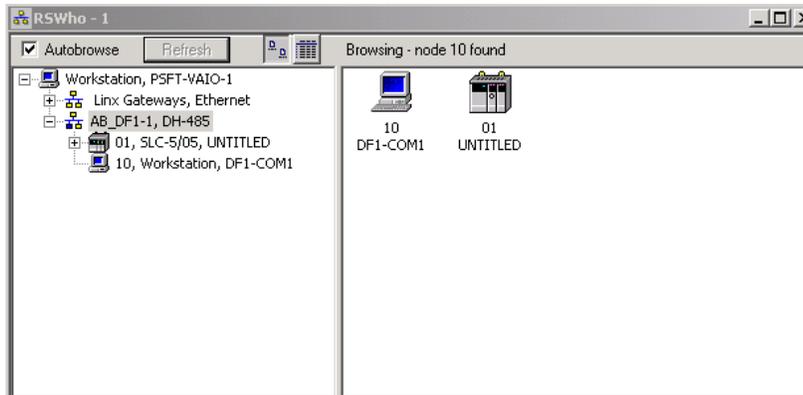
This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC-based terminal emulation program to view configuration and status data in the module and to control the module. The cable pinout for communications on this port is shown in the following diagram.



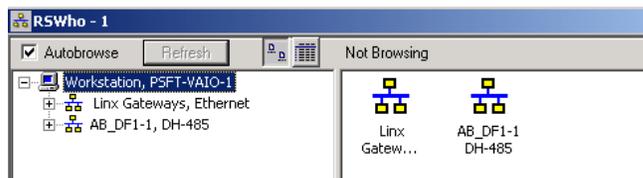
Disabling the RSLinx Driver for the Com Port on the PC

The communication port driver in *RSLinx* can occasionally prevent other applications from using the PC's COM port. If you are not able to connect to the module's configuration/debug port using *ProSoft Configuration Builder (PCB)*, *HyperTerminal* or another terminal emulator, follow these steps to disable the *RSLinx* driver.

- 1 Open *RSLinx* and go to **COMMUNICATIONS > RSWHO**.
- 2 Make sure that you are not actively browsing using the driver that you wish to stop. The following shows an actively browsed network.



- 3 Notice how the DF1 driver is opened, and the driver is looking for a processor on node 1. If the network is being browsed, then you will not be able to stop this driver. To stop the driver your *RSWho* screen should look like this:



Branches are displayed or hidden by clicking on the  or the  icons.



- 4 When you have verified that the driver is not being browsed, go to **COMMUNICATIONS > CONFIGURE DRIVERS**.

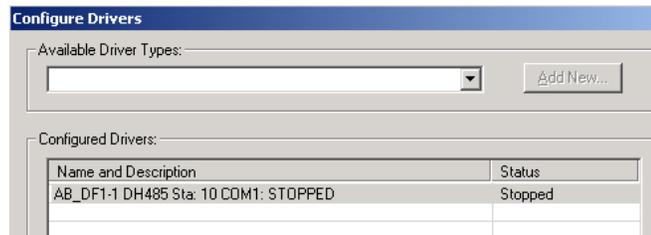
You may see something like this:



If you see the status as running, you will not be able to use this com port for anything other than communication to the processor. To stop the driver press the **STOP** button on the side of the window:



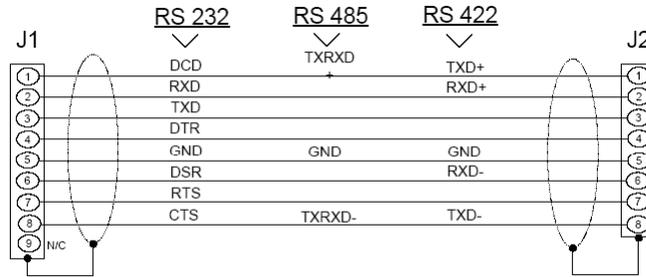
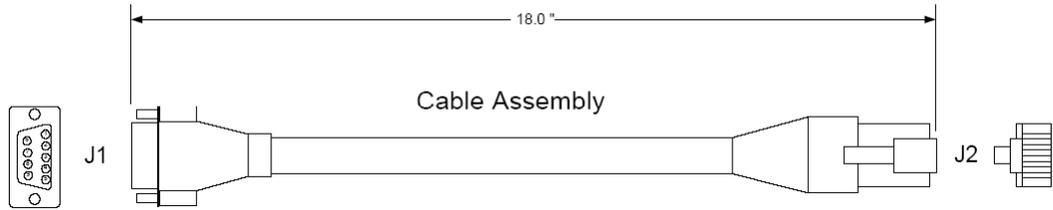
5 After you have stopped the driver you will see the following.



6 You may now use the com port to connect to the debug port of the module.

**Note:** You may need to shut down and restart your PC before it will allow you to stop the driver (usually only on *Windows NT* machines). If you have followed all of the above steps, and it will not stop the driver, then make sure you do not have *RSLogix* open. If *RSLogix* is not open, and you still cannot stop the driver, then reboot your PC.

### 5.4.3 DB9 to RJ45 Adaptor (Cable 14)



Wiring Diagram

## 5.5 Modbus Protocol Specification

The following pages give additional reference information regarding the Modbus protocol commands supported by the MVI56-MNETC.

### ***5.5.1 About the MODBUS/TCP Protocol***

MODBUS is a widely-used protocol originally developed by Modicon in 1978. Since that time, the protocol has been adopted as a standard throughout the automation industry.

The original MODBUS specification uses a serial connection to communicate commands and data between Client and server devices on a network. Later enhancements to the protocol allow communication over Ethernet networks using TCP/IP as a "wrapper" for the MODBUS protocol. This protocol is known as MODBUS/TCP.

MODBUS/TCP is a Client/server protocol. The Client establishes a connection to the remote server. When the connection is established, the Client sends the MODBUS/TCP commands to the server. The MVI56-MNETC module simulates up to 30 Clients.

Aside from the benefits of Ethernet versus serial communications (including performance, distance, and flexibility) for industrial networks, the MODBUS/TCP protocol allows for remote administration and control of devices over an Internet connection. It is important to note that not all Internet protocols are implemented in the module; for example, HTTP and SMTP protocols are not available. Nevertheless, the efficiency, scalability, and low cost of a MODBUS/TCP network make this an ideal solution for industrial applications.

The MVI56-MNETC module acts as an input/output module between devices on a MODBUS/TCP network and the Rockwell Automation backplane. The module uses an internal database to pass data and commands between the processor and the server devices on the MODBUS/TCP network.

### 5.5.2 Read Coil Status (Function Code 01)

#### Query

This function allows the user to obtain the ON/OFF status of logic coils used to control discrete outputs from the addressed server only. Broadcast mode is not supported with this function code. In addition to the server address and function fields, the message requires that the information field contain the initial coil address to be read (Starting Address) and the number of locations that will be interrogated to obtain status data.

The addressing allows up to 2000 coils to be obtained at each request; however, the specific server device may have restrictions that lower the maximum quantity. The coils are numbered from zero; (coil number 1 = zero, coil number 2 = one, coil number 3 = two, and so on).

The following table is a sample read output status request to read coils 0020 to 0056 from server device number 11.

Adr	Func	Data Start Pt Hi	Data Start Pt Lo	Data # Of Pts Ho	Data # Of Pts Lo	Error Check Field
11	01	00	13	00	25	CRC

## Response

An example response to Read Coil Status is as shown in Figure C2. The data is packed one bit for each coil. The response includes the server address, function code, quantity of data characters, the data characters, and error checking. Data will be packed with one bit for each coil (1 = ON, 0 = OFF). The low order bit of the first character contains the addressed coil, and the remainder follow. For coil quantities that are not even multiples of eight, the last characters will be filled in with zeros at high order end. The quantity of data characters is always specified as quantity of RTU characters, that is, the number is the same whether RTU or ASCII is used.

Because the server interface device is serviced at the end of a controller's scan, data will reflect coil status at the end of the scan. Some servers will limit the quantity of coils provided each scan; thus, for large coil quantities, multiple PC transactions must be made using coil status from sequential scans.

Ad r	Func	Byte Coun t	Data Coil Status 20 to 27	Data Coil Status 28 to 35	Data Coil Status 36 to 43	Data Coil Status 44 to 51	Data Coil Status 52 to 56	Error Check Field
11	01	05	CD	6B	B2	OE	1B	CRC

The status of coils 20 to 27 is shown as CD(HEX) = 1100 1101 (Binary). Reading left to right, this shows that coils 27, 26, 23, 22, and 20 are all on. The other coil data bytes are decoded similarly. Due to the quantity of coil statuses requested, the last data field, which is shown 1B (HEX) = 0001 1011 (Binary), contains the status of only 5 coils (52 to 56) instead of 8 coils. The 3 left most bits are provided as zeros to fill the 8-bit format.

### 5.5.3 Read Input Status (Function Code 02)

#### Query

This function allows the user to obtain the ON/OFF status of discrete inputs in the addressed server PC Broadcast mode is not supported with this function code. In addition to the server address and function fields, the message requires that the information field contain the initial input address to be read (Starting Address) and the number of locations that will be interrogated to obtain status data.

The addressing allows up to 2000 inputs to be obtained at each request; however, the specific server device may have restrictions that lower the maximum quantity. The inputs are numbered from zero; (input 10001 = zero, input 10002 = one, input 10003 = two, and so on, for a 584).

The following table is a sample read input status request to read inputs 10197 to 10218 from server number 11.

Adr	Func	Data Start Pt Hi	Data Start Pt Lo	Data #of Pts Hi	Data #of Pts Lo	Error Check Field
11	02	00	C4	00	16	CRC

### Response

An example response to Read Input Status is as shown in Figure C4. The data is packed one bit for each input. The response includes the server address, function code, quantity of data characters, the data characters, and error checking. Data will be packed with one bit for each input (1=ON, 0=OFF). The lower order bit of the first character contains the addressed input, and the remainder follow. For input quantities that are not even multiples of eight, the last characters will be filled in with zeros at high order end. The quantity of data characters is always specified as a quantity of RTU characters, that is, the number is the same whether RTU or ASCII is used.

Because the server interface device is serviced at the end of a controller's scan, data will reflect input status at the end of the scan. Some servers will limit the quantity of inputs provided each scan; thus, for large coil quantities, multiple PC transactions must be made using coil status for sequential scans.

Adr	Func	Byte Count	Data Discrete Input 10197 to 10204	Data Discrete Input 10205 to 10212	Data Discrete Input 10213 to 10218	Error Check Field
11	02	03	AC	DB	35	CRC

The status of inputs 10197 to 10204 is shown as AC (HEX) = 10101 1100 (binary). Reading left to right, this show that inputs 10204, 10202, and 10199 are all on. The other input data bytes are decoded similar.

Due to the quantity of input statuses requested, the last data field which is shown as 35 HEX = 0011 0101 (binary) contains the status of only 6 inputs (10213 to 10218) instead of 8 inputs. The two left-most bits are provided as zeros to fill the 8-bit format.

### 5.5.4 Read Holding Registers (Function Code 03)

#### Query

Read Holding Registers (03) allows the user to obtain the binary contents of holding registers 4xxxx in the addressed server. The registers can store the numerical values of associated timers and counters which can be driven to external devices. The addressing allows up to 125 registers to obtained at each request; however, the specific server device may have restriction that lower this maximum quantity. The registers are numbered form zero (40001 = zero, 40002 = one, and so on). The broadcast mode is not allowed.

The example below reads registers 40108 through 40110 from server 584 number 11.

Ad r	Fun c	Data Start Reg Hi	Data Start Reg Lo	Data #of Regs Hi	Data #of Regs Lo	Error Check Field
11	03	00	6B	00	03	CRC

## Response

The addressed server responds with its address and the function code, followed by the information field. The information field contains 1 byte describing the quantity of data bytes to be returned. The contents of the registers requested (DATA) are two bytes each, with the binary content right justified within each pair of characters. The first byte includes the high order bits and the second, the low order bits.

Because the server interface device is normally serviced at the end of the controller's scan, the data will reflect the register content at the end of the scan. Some servers will limit the quantity of register content provided each scan; thus for large register quantities, multiple transmissions will be made using register content from sequential scans.

In the example below, the registers 40108 to 40110 have the decimal contents 555, 0, and 100 respectively.

Adr	Func	ByteCnt	Hi Data	Lo Data	Hi Data	Lo Data	Hi Data	Lo Data	Error Check Field
11	03	06	02	2B	00	00	00	64	CRC

### 5.5.5 Read Input Registers (Function Code 04)

#### Query

Function code 04 obtains the contents of the controller's input registers at addresses 3xxxx. These locations receive their values from devices connected to the I/O structure and can only be referenced, not altered from within the controller. The addressing allows up to 125 registers to be obtained at each request; however, the specific server device may have restrictions that lower this maximum quantity. The registers are numbered for zero (30001 = zero, 30002 = one, and so on). Broadcast mode is not allowed.

The example below requests the contents of register 3009 in server number 11.

Adr	Func	Data Start Reg	Data Start Reg Lo	Data #of Regs Hi	Data #of Regs Lo	Error Check Field
11	04	00	08	00	01	CRC

## Response

The addressed server responds with its address and the function code followed by the information field. The information field contains 1 byte describing the quantity of data bytes to be returned. The contents of the registers requested (DATA) are 2 bytes each, with the binary content right justified within each pair of characters. The first byte includes the high order bits and the second, the low order bits.

Because the server interface is normally serviced at the end of the controller's scan, the data will reflect the register content at the end of the scan. Each PC will limit the quantity of register contents provided each scan; thus for large register quantities, multiple PC scans will be required, and the data provided will be from sequential scans.

In the example below the register 3009 contains the decimal value 0.

Adr	Func	Byte Count	Data Input Reg Hi	Data Input Reg Lo	Error Check Field
11	04	02	00	00	E9

## 5.5.6 Force Single Coil (Function Code 05)

### Query

This message forces a single coil either ON or OFF. Any coil that exists within the controller can be forced to either state (ON or OFF). However, because the controller is actively scanning, unless the coil is disabled, the controller can also alter the state of the coil. Coils are numbered from zero (coil 0001 = zero, coil 0002 = one, and so on). The data value 65,280 (FF00 HEX) will set the coil ON and the value zero will turn it OFF; all other values are illegal and will not affect that coil.

The use of server address 00 (Broadcast Mode) will force all attached servers to modify the desired coil.

**Note:** Functions 5, 6, 15, and 16 are the only messages that will be recognized as valid for broadcast.

The example below is a request to server number 11 to turn ON coil 0173.

Adr	Func	Data Coil # Hi	Data Coil # Lo	Data On/off Ind	Data	Error Check Field
11	05	00	AC	FF	00	CRC

## Response

The normal response to the Command Request is to re-transmit the message as received after the coil state has been altered.

Adr	Func	Data Coil # Hi	Data Coil # Lo	Data On/ Off	Data	Error Check Field
11	05	00	AC	FF	00	CRC

The forcing of a coil via MODBUS function 5 will be accomplished regardless of whether the addressed coil is disabled or not (*In ProSoft products, the coil is only affected if the necessary ladder logic is implemented*).

**Note:** The Modbus protocol does not include standard functions for testing or changing the DISABLE state of discrete inputs or outputs. Where applicable, this may be accomplished via device specific Program commands (*In ProSoft products, this is only accomplished through ladder logic programming*).

Coils that are reprogrammed in the controller logic program are not automatically cleared upon power up. Thus, if such a coil is set ON by function Code 5 and (even months later), an output is connected to that coil, the output will be "hot".

### 5.5.7 Preset Single Register (Function Code 06)

#### Query

Function (06) allows the user to modify the contents of a holding register. Any holding register that exists within the controller can have its contents changed by this message. However, because the controller is actively scanning, it also can alter the content of any holding register at any time. The values are provided in binary up to the maximum capacity of the controller unused high order bits must be set to zero. When used with server address zero (Broadcast mode) all server controllers will load the specified register with the contents specified.

**Note** Functions 5, 6, 15, and 16 are the only messages that will be recognized as valid for broadcast.

Adr	Func	Data Start Reg Hi	Data Start Reg Lo	Data #of Regs Hi	Data #of Regs Lo	Error Check Field
11	06	00	01	00	03	CRC

**Response**

The response to a preset single register request is to re-transmit the query message after the register has been altered.

Adr	Func	Data Reg Hi	Data Reg Lo	Data Input Reg Hi	Data Input Reg Lo	Error Check Field
11	06	00	01	00	03	CRC

**5.5.8 Diagnostics (Function Code 08)**

MODBUS function code 08 provides a series of tests for checking the communication system between a Client device and a server, or for checking various internal error conditions within a server.

The function uses a two-byte sub-function code field in the query to define the type of test to be performed. The server echoes both the function code and sub-function code in a normal response. Some of the diagnostics cause data to be returned from the remote device in the data field of a normal response.

In general, issuing a diagnostic function to a remote device does not affect the running of the user program in the remote device. Device memory bit and register data addresses are not accessed by the diagnostics. However, certain functions can optionally reset error counters in some remote devices.

A server device can, however, be forced into 'Listen Only Mode' in which it will monitor the messages on the communications system but not respond to them. This can affect the outcome of your application program if it depends upon any further exchange of data with the remote device. Generally, the mode is forced to remove a malfunctioning remote device from the communications system.

Sub-function Codes Supported

Only Sub-function 00 is supported by the MVI56-MNETC module.

**00 Return Query Data**

The data passed in the request data field is to be returned (looped back) in the response. The entire response message should be identical to the request.

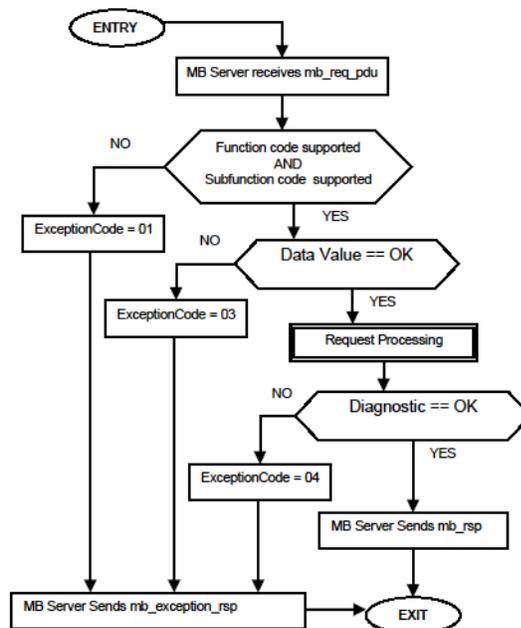
Sub-function	Data Field (Request)	Data Field (Response)
00 00	Any	Echo Request Data

### Example and State Diagram

Here is an example of a request to remote device to Return Query Data. This uses a sub-function code of zero (00 00 hex in the two-byte field). The data to be returned is sent in the two-byte data field (A5 37 hex).

Request		Response	
Field Name	(Hex)	Field Name	(Hex)
Function	08	Function	08
Sub-function Hi	00	Sub-function Hi	00
Sub-function Lo	00	Sub-function Lo	00
Data Hi	A5	Data Hi	A5
Data Lo	37	Data Lo	27

The data fields in responses to other kinds of queries could contain error counts or other data requested by the sub-function code.



### 5.5.9 Force Multiple Coils (Function Code 15)

#### Query

This message forces each coil in a consecutive block of coils to a desired ON or OFF state. Any coil that exists within the controller can be forced to either state (ON or OFF). However, because the controller is actively scanning, unless the coils are disabled, the controller can also alter the state of the coil. Coils are numbered from zero (coil 00001 = zero, coil 00002 = one, and so on). The desired status of each coil is packed in the data field, one bit for each coil (1= ON, 0= OFF). The use of server address 0 (Broadcast Mode) will force all attached servers to modify the desired coils.

**Note:** Functions 5, 6, 15, and 16 are the only messages (other than Loopback Diagnostic Test) that will be recognized as valid for broadcast.

The following example forces 10 coils starting at address 20 (13 HEX). The two data fields, CD =1100 and 00 = 0000 000, indicate that coils 27, 26, 23, 22, and 20 are to be forced on.

Adr	Func	Hi Add	Lo Add	Quantity	Byte Cnt	Data Coil Status 20 to 27	Data Coil Status 28 to 29	Error Check Field
11	0F	00	13	00	0A	02	CD	00 CRC

#### Response

The normal response will be an echo of the server address, function code, starting address, and quantity of coils forced.

Adr	Func	Hi Addr	Lo Addr	Quantity	Error Check Field
11	0F	00	13	00	0A CRC

The writing of coils via Modbus function 15 will be accomplished regardless of whether the addressed coils are disabled or not.

Coils that are unprogrammed in the controller logic program are not automatically cleared upon power up. Thus, if such a coil is set ON by function code 15 and (even months later) an output is connected to that coil, the output will be hot.

### 5.5.10 Preset Multiple Registers (Function Code 16)

#### Query

Holding registers existing within the controller can have their contents changed by this message (a maximum of 60 registers). However, because the controller is actively scanning, it also can alter the content of any holding register at any time. The values are provided in binary up to the maximum capacity of the controller (16-bit for the 184/384 and 584); unused high order bits must be set to zero.

**Note:** Function codes 5, 6, 15, and 16 are the only messages that will be recognized as valid for broadcast.

Adr	Func	Hi Add	Lo Add	Quantity	Byte Cnt	Hi Data	Lo Data	Hi Data	Lo Data	Error Check Field
11	10	00	87	00	02 04	00	0A	01	02	CRC

#### Response

The normal response to a function 16 query is to echo the address, function code, starting address and number of registers to be loaded.

Adr	Func	Hi Addr	Lo Addr	Quantity	Error Check Field
11	10	00	87	00 02	56

### 5.5.11 Modbus Exception Responses

When a Modbus Client sends a request to a server device, it expects a normal response. One of four possible events can occur from the Client's query:

- If the server device receives the request without a communication error, and can handle the query normally, it returns a normal response.
- If the server does not receive the request due to a communication error, no response is returned. The Client program will eventually process a timeout condition for the request.
- If the server receives the request, but detects a communication error (parity, LRC, CRC, ...), no response is returned. The Client program will eventually process a timeout condition for the request.
- If the server receives the request without a communication error, but cannot handle it (for example, if the request is to read a non-existent output or register), the server will return an exception response informing the Client of the nature of the error.

The exception response message has two fields that differentiate it from a normal response:

**Function Code Field:** In a normal response, the server echoes the function code of the original request in the function code field of the response. All function codes have a most-significant bit (MSB) of 0 (their values are all below 80 hexadecimal). In an exception response, the server sets the MSB of the function code to 1. This makes the function code value in an exception response exactly 80 hexadecimal higher than the value would be for a normal response.

With the function code's MSB set, the Client's application program can recognize the exception response and can examine the data field for the exception code.

**Data Field:** In a normal response, the server may return data or statistics in the data field (any information that was requested in the request). In an exception response, the server returns an exception code in the data field. This defines the server condition that caused the exception.

The following table shows an example of a Client request and server exception response.

Request		Response	
Field Name	(Hex)	Field Name	(Hex)
Function	01	Function	81
Starting Address Hi	04	Exception Code	02
Starting Address Lo	A1		
Quantity of Outputs Hi	00		
Quantity of Outputs Lo	01		

In this example, the Client addresses a request to server device. The function code (01) is for a Read Output Status operation. It requests the status of the output at address 1245 (04A1 hex). Note that only that one output is to be read, as specified by the number of outputs field (0001).

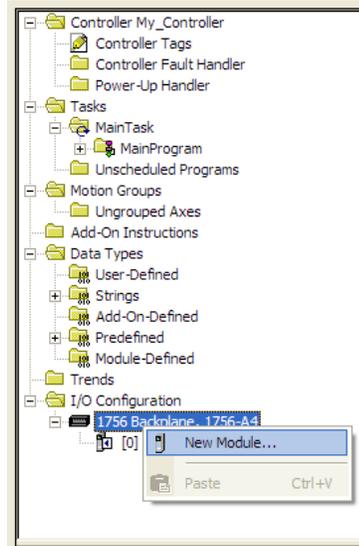
If the output address is non-existent in the server device, the server will return the exception response with the exception code shown (02). This specifies an illegal data address for the server.

Modbus Exception Codes

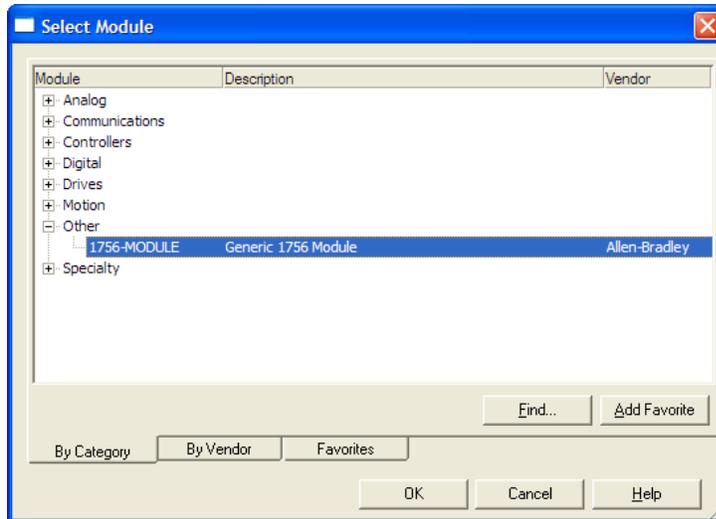
Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the server. This may be because the function code is only applicable to newer devices, and was not implemented in the unit selected. It could also indicate that the server is in the wrong state to process a request of this type, for example because it is unconfigured and is being asked to return register values.
02	Illegal Data Address	The data address received in the query is not an allowable address for the server. More specifically, the combination of reference number and transfer length is invalid. For a controller with 100 registers, a request with offset 96 and length 4 would succeed; a request with offset 96 and length 5 will generate exception 02.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for server. This indicates a fault in the structure of the remainder of a complex request, such as that the implied length is incorrect. It specifically does not mean that a data item submitted for storage in a register has a value outside the expectation of the application program, because the Modbus protocol is unaware of the significance of any particular value of any particular register.
04	Slave Device Failure	An unrecoverable error occurred while the server was attempting to perform the requested action.
05	Acknowledge	Specialized use in conjunction with programming commands. The server has accepted the request and is processing it, but a long duration of time will be required to do so. This response is returned to prevent a timeout error from occurring in the Client. The Client can next issue a poll program complete message to determine if processing is completed.
06	Slave Device Busy	Specialized use in conjunction with programming commands. The server is engaged in processing a long-duration program command. The Client should retransmit the message later when the server is free.
08	Memory Parity Error	Specialized use in conjunction with function codes 20 and 21 and reference type 6, to indicate that the extended file area failed to pass a consistency check. The server attempted to read record file, but detected a parity error in the memory. The Client can retry the request, but service may be required on the server device.
0a	Gateway Path Unavailable	Specialized use in conjunction with gateways, indicates that the gateway was unable to allocate an internal communication path from the input port to the output port for processing the request. Usually means that the gateway is misconfigured or overloaded.
0b	Gateway Target Device Failed To Respond	Specialized use in conjunction with gateways, indicates that no response was obtained from the target device. Usually means that the device is not present on the network.

## 5.6 Adding the Module to an Existing Project

- 1 Select the *I/O Configuration* folder in the *Controller Organization* window of RSLogix 5000, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **NEW MODULE**.



This action opens the *Select Module* dialog box:

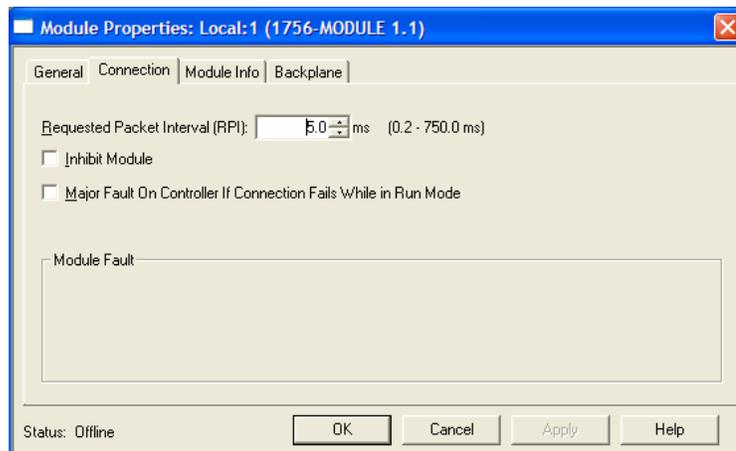


- 2 Select the **1756-MODULE (GENERIC 1756 MODULE)** from the list and click **OK**. This action opens the *New Module* dialog box.

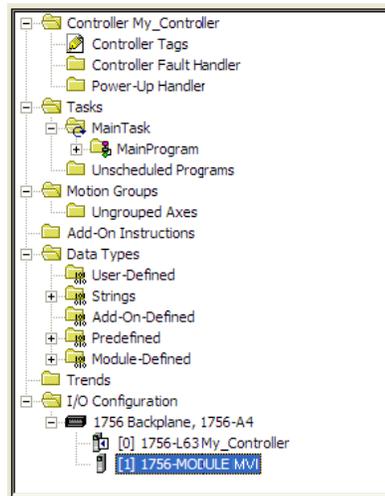
- 3 Enter the *Name*, *Description* and *Slot* options for your application. You must select the *Comm Format* as **DATA - INT** in the dialog box, otherwise the module will not communicate. Click **OK** to continue.

Parameter	Value
Name	Enter a module identification string. Example: <b>MNETC_2</b>
Description	Enter a description for the module. Example: <b>MODBUS TCP/IP MULTI CLIENT COMMUNICATION MODULE</b>
Comm Format	Select <b>DATA-INT</b> .
Slot	Enter the slot number in the rack where the MVI56-MNETC module is located.
Input Assembly Instance	<b>1</b>
Input Size	<b>250</b>
Output Assembly Instance	<b>2</b>
Output Size	<b>248</b>
Configuration Assembly Instance	<b>4</b>
Configuration Size	<b>0</b>

- 4 Select the *Requested Packet Interval* value for scanning the I/O on the module. This value represents the minimum frequency that the module will handle scheduled events. This value should not be set to less than **1** millisecond. The default value is **5** milliseconds. Values between **1** and **10** milliseconds should work with most applications.



- 5 Save the module. Click **OK** to dismiss the dialog box. The *Controller Organization* window now displays the module's presence.



- 6 Copy the *User-Defined Data Types* from the sample program into your existing RSLogix 5000 project.
- 7 Copy the *Controller Tags* from the sample program into your project.
- 8 Copy the *Ladder Rungs* from the sample program into your project.

## 5.7 Using the Sample Program

If your processor uses RSLogix 5000 version 15 or earlier, you will not be able to use the Add-On Instruction for your module. Follow the steps below to obtain and use a sample program for your application.

### ***5.7.1 Opening the Sample Program in RSLogix***

The sample program for your MVI56-MNETC module includes custom tags, data types and ladder logic for data I/O, status and command control. For most applications, you can run the sample program without modification, or, for advanced applications, you can incorporate the sample program into your existing application.

#### ***Download the manuals and sample program from the ProSoft Technology web site***

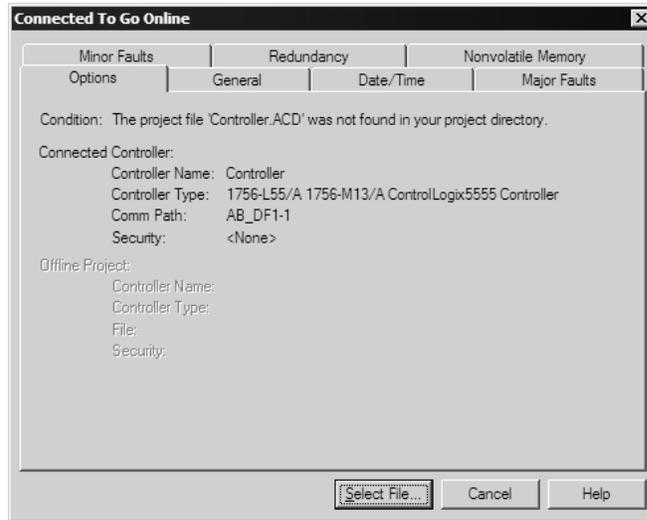
You can always download the latest version of the sample ladder logic and user manuals for the MVI56-MNETC module from the ProSoft Technology website, at [www.prosoft-technology.com/support/downloads](http://www.prosoft-technology.com/support/downloads) (<http://www.prosoft-technology.com/support/downloads>)

From that link, navigate to the download page for your module and choose the sample program to download for your version of RSLogix 5000 and your processor.

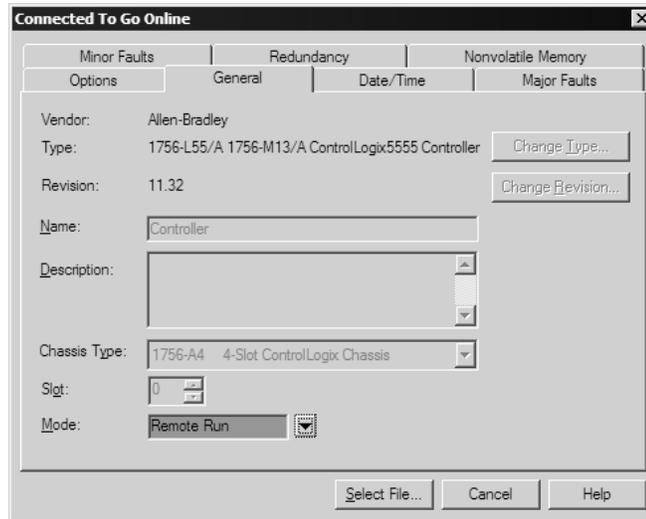
***To determine the firmware version of your processor***

**Important:** The RSLinx service must be installed and running on your computer in order for RSLogix to communicate with the processor. Refer to your RSLinx and RSLogix documentation for help configuring and troubleshooting these applications.

- 1 Connect an RS-232 serial cable from the COM (serial) port on your PC to the communication port on the front of the processor.
- 2 Start RSLogix 5000 and close any existing project that may be loaded.
- 3 Open the **COMMUNICATIONS** menu and choose **GO ONLINE**. RSLogix will establish communication with the processor. This may take a few moments.
- 4 When RSLogix has established communication with the processor, the *Connected To Go Online* dialog box will open.



- 5 In the *Connected To Go Online* dialog box, click the **GENERAL** tab. This tab shows information about the processor, including the Revision (firmware) version. In the following illustration, the firmware version is 11.32



- 6 Select the sample ladder logic file for your firmware version.

**To open the sample program**

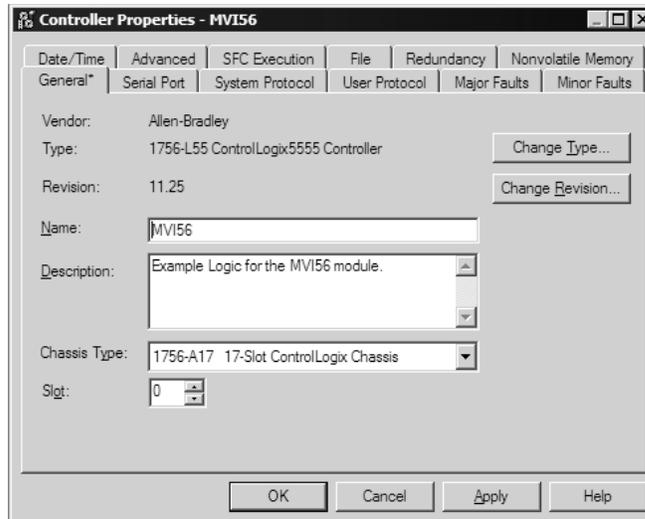
- 1 On the *Connected to Go Online* dialog box, click the **SELECT FILE** button.
- 2 Choose the sample program file that matches your firmware version, and then click the **SELECT** button.
- 3 RSLogix will load the sample program.

The next step is to configure the correct controller type and slot number for your application.

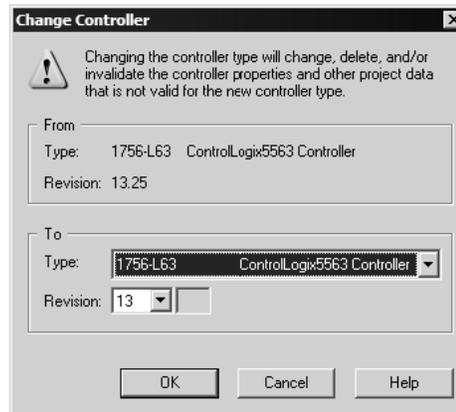
### 5.7.2 Choosing the Controller Type

The sample application is for a 1756-L63 ControlLogix 5563 Controller. If you are using a different model of the ControlLogix processor, you must configure the sample program to use the correct processor model.

- 1 In the *Controller Organization* list, select the folder for the controller and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose **PROPERTIES**. This action opens the *Controller Properties* dialog box.



- 3 Click the **CHANGE TYPE** or **CHANGE CONTROLLER** button. This action opens the *Change Controller* dialog box.



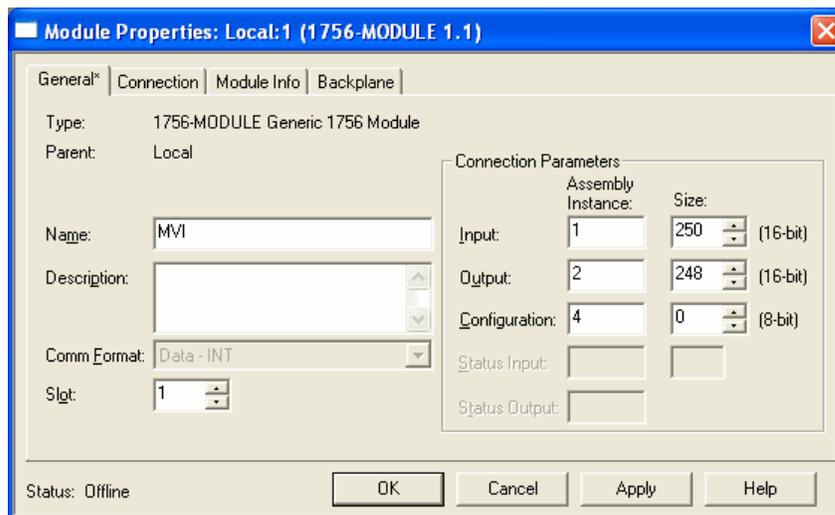
- 4 Open the **TYPE** dropdown list, and then select your ControlLogix controller.
- 5 Select the correct firmware revision for your controller, if necessary.
- 6 Click **OK** to save your changes and return to the previous window.

### 5.7.3 Selecting the Slot Number for the Module

The sample application is for a module installed in Slot 1 in a ControlLogix rack. The ladder logic uses the slot number to identify the module. If you are installing the module in a different slot, you must update the ladder logic so that program tags and variables are correct, and do not conflict with other modules in the rack.

#### To change the slot number

- 1 In the *Controller Organization* list, select the module, and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose **PROPERTIES**. This action opens the *Module Properties* dialog box.



- 3 In the **SLOT** field, use the up and down arrows on the right side of the field to select the slot number where the module will reside in the rack, and then click **OK**.

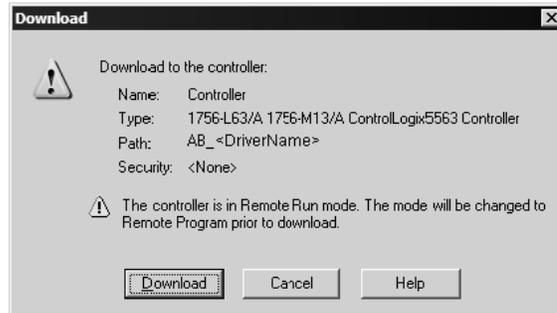
RSLogix will automatically apply the slot number change to all tags, variables and ladder logic rungs that use the MVI56-MNETC slot number for computation.

### 5.7.4 Downloading the Sample Program to the Processor

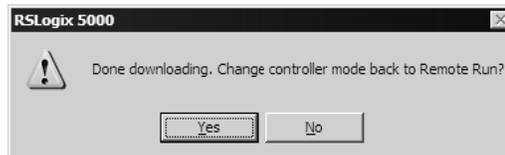
#### To download the sample program from RSLogix 5000 to the ControlLogix processor

**Note:** The key switch on the front of the ControlLogix module must be in the REM position.

- 1 If you are not already online to the processor, open the **COMMUNICATIONS** menu, and then choose **DOWNLOAD**. RSLogix will establish communication with the processor.
- 2 When communication is established, RSLogix will open a confirmation dialog box. Click the **DOWNLOAD** button to transfer the sample program to the processor.



- 3 RSLogix will compile the program and transfer it to the processor. This process may take a few minutes.
- 4 When the download is complete, RSLogix will open another confirmation dialog box. Click **OK** to switch the processor from PROGRAM mode to RUN mode.



**Note:** If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

### ***5.7.5 Adding the Sample Ladder to an Existing Application***

- 1** Copy the Controller Tags (page 56) from the sample program.
- 2** Copy the User-Defined Data Types (page 58) from the sample program.
- 3** Copy the Ladder Rungs from the sample program.
- 4** Save and Download (page 34, page 140) the new application to the controller and place the processor in RUN mode.



## 6 Support, Service & Warranty

### In This Chapter

- ❖ Contacting Technical Support ..... 143
- ❖ Return Material Authorization (RMA) Policies and Conditions..... 145
- ❖ LIMITED WARRANTY..... 147

### **Contacting Technical Support**

ProSoft Technology, Inc. (ProSoft) is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

- 1 Product Version Number
- 2 System architecture
- 3 Network details

If the issue is hardware related, we will also need information regarding:

- 1 Module configuration and associated ladder files, if any
- 2 Module operation and any unusual behavior
- 3 Configuration/Debug status information
- 4 LED patterns
- 5 Details about the serial, Ethernet or fieldbus devices interfaced to the module, if any.

**Note:** *For technical support calls within the United States, an after-hours answering system allows 24-hour/7-days-a-week pager access to one of our qualified Technical and/or Application Support Engineers. Detailed contact information for all our worldwide locations is available on the following page.*

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<b>Internet</b>	Web Site: <a href="http://www.prosoft-technology.com/support">www.prosoft-technology.com/support</a> E-mail address: <a href="mailto:support@prosoft-technology.com">support@prosoft-technology.com</a>
<b>Asia Pacific</b> (location in Malaysia)	Tel: +603.7724.2080, E-mail: <a href="mailto:asiapc@prosoft-technology.com">asiapc@prosoft-technology.com</a> Languages spoken include: Chinese, English
<b>Asia Pacific</b> (location in China)	Tel: +86.21.5187.7337 x888, E-mail: <a href="mailto:asiapc@prosoft-technology.com">asiapc@prosoft-technology.com</a> Languages spoken include: Chinese, English
<b>Europe</b> (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: <a href="mailto:support.EMEA@prosoft-technology.com">support.EMEA@prosoft-technology.com</a> Languages spoken include: French, English
<b>Europe</b> (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: <a href="mailto:mea@prosoft-technology.com">mea@prosoft-technology.com</a> Languages spoken include: English, Hindi
<b>North America</b> (location in California)	Tel: +1.661.716.5100, E-mail: <a href="mailto:support@prosoft-technology.com">support@prosoft-technology.com</a> Languages spoken include: English, Spanish
<b>Latin America</b> (Oficina Regional)	Tel: +1-281-2989109, E-Mail: <a href="mailto:latinam@prosoft-technology.com">latinam@prosoft-technology.com</a> Languages spoken include: Spanish, English
<b>Latin America</b> (location in Puebla, Mexico)	Tel: +52-222-3-99-6565, E-mail: <a href="mailto:soporte@prosoft-technology.com">soporte@prosoft-technology.com</a> Languages spoken include: Spanish
<b>Brasil</b> (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: <a href="mailto:brasil@prosoft-technology.com">brasil@prosoft-technology.com</a> Languages spoken include: Portuguese, English

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## 6.1 Return Material Authorization (RMA) Policies and Conditions

The following Return Material Authorization (RMA) Policies and Conditions (collectively, "RMA Policies") apply to any returned product. These RMA Policies are subject to change by ProSoft Technology, Inc., without notice. For warranty information, see Limited Warranty (page 147). In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

### 6.1.1 Returning Any Product

- a) In order to return a Product for repair, exchange, or otherwise, the Customer must obtain a Return Material Authorization (RMA) number from ProSoft Technology and comply with ProSoft Technology shipping instructions.
- b) In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above (page 143). A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.
- c) All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft Technology, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft Technology using a shipment method other than that specified by ProSoft Technology, or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
- d) A 10% restocking fee applies to all warranty credit returns, whereby a Customer has an application change, ordered too many, does not need, etc. Returns for credit require that all accessory parts included in the original box (i.e.; antennas, cables) be returned. Failure to return these items will result in a deduction from the total credit due for each missing item.

### **6.1.2 Returning Units Under Warranty**

A Technical Support Engineer must approve the return of Product under ProSoft Technology's Warranty:

- a) A replacement module will be shipped and invoiced. A purchase order will be required.
- b) Credit for a product under warranty will be issued upon receipt of authorized product by ProSoft Technology at designated location referenced on the Return Material Authorization
  - i. If a defect is found and is determined to be customer generated, or if the defect is otherwise not covered by ProSoft Technology's warranty, there will be no credit given. Customer will be contacted and can request module be returned at their expense;
  - ii. If defect is customer generated and is repairable, customer can authorize ProSoft Technology to repair the unit by providing a purchase order for 30% of the current list price plus freight charges, duties and taxes as applicable.

### **6.1.3 Returning Units Out of Warranty**

- a) Customer sends unit in for evaluation to location specified by ProSoft Technology, freight prepaid.
- b) If no defect is found, Customer will be charged the equivalent of \$100 USD, plus freight charges, duties and taxes as applicable. A new purchase order will be required.
- c) If unit is repaired, charge to Customer will be 30% of current list price (USD) plus freight charges, duties and taxes as applicable. A new purchase order will be required or authorization to use the purchase order submitted for evaluation fee.

#### **The following is a list of non-repairable units:**

##### ScanPort Adapters

- o 1500 - All
- o 1550 - Can be repaired only if defect is the power supply
- o 1560 - Can be repaired only if defect is the power supply

##### inRAx Modules

- o 3150 - All
- o 3170 - All
- o 3250
- o 3300
- o 3350
- o 3600 - All
- o 3700
- o 3750
- o 3800-MNET

##### ProLinx Standalone Gateways

- o 4xxx - All (No hardware available to do repairs)

## 6.2 LIMITED WARRANTY

This Limited Warranty ("Warranty") governs all sales of hardware, software, and other products (collectively, "Product") manufactured and/or offered for sale by ProSoft Technology, Incorporated (ProSoft), and all related services provided by ProSoft, including maintenance, repair, warranty exchange, and service programs (collectively, "Services"). By purchasing or using the Product or Services, the individual or entity purchasing or using the Product or Services ("Customer") agrees to all of the terms and provisions (collectively, the "Terms") of this Limited Warranty. All sales of software or other intellectual property are, in addition, subject to any license agreement accompanying such software or other intellectual property.

### 6.2.1 What Is Covered By This Warranty

- a) *Warranty On New Products:* ProSoft warrants, to the original purchaser, that the Product that is the subject of the sale will (1) conform to and perform in accordance with published specifications prepared, approved and issued by ProSoft, and (2) will be free from defects in material or workmanship; provided these warranties only cover Product that is sold as new. This Warranty expires three (3) years from the date of shipment for Product purchased **on or after** January 1st, 2008, or one (1) year from the date of shipment for Product purchased **before** January 1st, 2008 (the "Warranty Period"). If the Customer discovers within the Warranty Period a failure of the Product to conform to specifications, or a defect in material or workmanship of the Product, the Customer must promptly notify ProSoft by fax, email or telephone. In no event may that notification be received by ProSoft later than 39 months from date of original shipment. Within a reasonable time after notification, ProSoft will correct any failure of the Product to conform to specifications or any defect in material or workmanship of the Product, with either new or remanufactured replacement parts. ProSoft reserves the right, and at its sole discretion, may replace unrepairable units with new or remanufactured equipment. All replacement units will be covered under warranty for the 3 year period commencing from the date of original equipment purchase, not the date of shipment of the replacement unit. Such repair, including both parts and labor, will be performed at ProSoft's expense. All warranty service will be performed at service centers designated by ProSoft.
- b) *Warranty On Services:* Materials and labor performed by ProSoft to repair a verified malfunction or defect are warranted in the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.

### **6.2.2 What Is Not Covered By This Warranty**

- a) ProSoft makes no representation or warranty, expressed or implied, that the operation of software purchased from ProSoft will be uninterrupted or error free or that the functions contained in the software will meet or satisfy the purchaser's intended use or requirements; the Customer assumes complete responsibility for decisions made or actions taken based on information obtained using ProSoft software.
- b) This Warranty does not cover the failure of the Product to perform specified functions, or any other non-conformance, defects, losses or damages caused by or attributable to any of the following: (i) shipping; (ii) improper installation or other failure of Customer to adhere to ProSoft's specifications or instructions; (iii) unauthorized repair or maintenance; (iv) attachments, equipment, options, parts, software, or user-created programming (including, but not limited to, programs developed with any IEC 61131-3, "C" or any variant of "C" programming languages) not furnished by ProSoft; (v) use of the Product for purposes other than those for which it was designed; (vi) any other abuse, misapplication, neglect or misuse by the Customer; (vii) accident, improper testing or causes external to the Product such as, but not limited to, exposure to extremes of temperature or humidity, power failure or power surges; or (viii) disasters such as fire, flood, earthquake, wind and lightning.
- c) The information in this Agreement is subject to change without notice. ProSoft shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. The user guide included with your original product purchase from ProSoft contains information protected by copyright. No part of the guide may be duplicated or reproduced in any form without prior written consent from ProSoft.

### **6.2.3 Disclaimer Regarding High Risk Activities**

Product manufactured or supplied by ProSoft is not fault tolerant and is not designed, manufactured or intended for use in hazardous environments requiring fail-safe performance including and without limitation: the operation of nuclear facilities, aircraft navigation or communication systems, air traffic control, direct life support machines or weapons systems in which the failure of the product could lead directly or indirectly to death, personal injury or severe physical or environmental damage (collectively, "high risk activities"). ProSoft specifically disclaims any express or implied warranty of fitness for high risk activities.

#### **6.2.4 Intellectual Property Indemnity**

Buyer shall indemnify and hold harmless ProSoft and its employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not ProSoft is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless ProSoft and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party. ProSoft makes no warranty that the product is or will be delivered free of any person's claiming of patent, trademark, or similar infringement. The Buyer assumes all risks (including the risk of suit) that the product or any use of the product will infringe existing or subsequently issued patents, trademarks, or copyrights.

- a) Any documentation included with Product purchased from ProSoft is protected by copyright and may not be duplicated or reproduced in any form without prior written consent from ProSoft.
- b) ProSoft's technical specifications and documentation that are included with the Product are subject to editing and modification without notice.
- c) Transfer of title shall not operate to convey to Customer any right to make, or have made, any Product supplied by ProSoft.
- d) Customer is granted no right or license to use any software or other intellectual property in any manner or for any purpose not expressly permitted by any license agreement accompanying such software or other intellectual property.
- e) Customer agrees that it shall not, and shall not authorize others to, copy software provided by ProSoft (except as expressly permitted in any license agreement accompanying such software); transfer software to a third party separately from the Product; modify, alter, translate, decode, decompile, disassemble, reverse-engineer or otherwise attempt to derive the source code of the software or create derivative works based on the software; export the software or underlying technology in contravention of applicable US and international export laws and regulations; or use the software other than as authorized in connection with use of Product.
- f) **Additional Restrictions Relating To Software And Other Intellectual Property**

In addition to compliance with the Terms of this Warranty, Customers purchasing software or other intellectual property shall comply with any license agreement accompanying such software or other intellectual property. Failure to do so may void this Warranty with respect to such software and/or other intellectual property.

#### **6.2.5 Disclaimer of all Other Warranties**

The Warranty set forth in What Is Covered By This Warranty (page 147) are in lieu of all other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

### **6.2.6 Limitation of Remedies \*\***

In no event will ProSoft or its Dealer be liable for any special, incidental or consequential damages based on breach of warranty, breach of contract, negligence, strict tort or any other legal theory. Damages that ProSoft or its Dealer will not be responsible for include, but are not limited to: Loss of profits; loss of savings or revenue; loss of use of the product or any associated equipment; loss of data; cost of capital; cost of any substitute equipment, facilities, or services; downtime; the claims of third parties including, customers of the Purchaser; and, injury to property.

\*\* Some areas do not allow time limitations on an implied warranty, or allow the exclusion or limitation of incidental or consequential damages. In such areas, the above limitations may not apply. This Warranty gives you specific legal rights, and you may also have other rights which vary from place to place.

### **6.2.7 Time Limit for Bringing Suit**

Any action for breach of warranty must be commenced within 39 months following shipment of the Product.

### **6.2.8 No Other Warranties**

Unless modified in writing and signed by both parties, this Warranty is understood to be the complete and exclusive agreement between the parties, suspending all oral or written prior agreements and all other communications between the parties relating to the subject matter of this Warranty, including statements made by salesperson. No employee of ProSoft or any other party is authorized to make any warranty in addition to those made in this Warranty. The Customer is warned, therefore, to check this Warranty carefully to see that it correctly reflects those terms that are important to the Customer.

### **6.2.9 Allocation of Risks**

This Warranty allocates the risk of product failure between ProSoft and the Customer. This allocation is recognized by both parties and is reflected in the price of the goods. The Customer acknowledges that it has read this Warranty, understands it, and is bound by its Terms.

### **6.2.10 Controlling Law and Severability**

This Warranty shall be governed by and construed in accordance with the laws of the United States and the domestic laws of the State of California, without reference to its conflicts of law provisions. If for any reason a court of competent jurisdiction finds any provisions of this Warranty, or a portion thereof, to be unenforceable, that provision shall be enforced to the maximum extent permissible and the remainder of this Warranty shall remain in full force and effect. Any cause of action with respect to the Product or Services must be instituted in a court of competent jurisdiction in the State of California.

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