ProSoft® TECHNOLOGY

Where Automation Connects.

inRAx®

MVI71-MNET

PLC Platform

Modbus TCP/IP Interface Module

June 23, 2009

USER MANUAL

MVI (Multi Vendor Interface) Modules

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'EQUIPMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DÉSIGNÉ NON DANGEREUX.

CL I Div 2 GPs A, B, C, D
Temp Code T5
II 3 G
Ex nA IIC T5 X
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.

Important Installation Instructions

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, DIV. 2;
B WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES, and
C WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.
D "THIS DEVICE SHALL BE POWERED BY CLASS 2 OUTPUTS ONLY.

Warnings

North America Warnings

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.
Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be nonhazardous.
C 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.

Electrical Ratings

- Backplane Current Load: 800 mA @ 5 V DC; 3mA @ 24V DC
- Operating Temperature: 0 to 60°C (32 to 140°F)
- Storage Temperature: -40 to 85°C (-40 to 185°F)
- Shock: 30g Operational; 50g non-operational; Vibration: 5 g from 10 to 150 Hz
- Relative Humidity 5% to 95% (non-condensing)
- All phase conductor sizes must be at least 1.3 mm(squared) and all earth ground conductors must be at least 4mm(squared).

Markings

ANSI / ISA	ISA 12.12.01 Class I Division 2, GPs A, B, C, D
CSA/cUL	C22.2 No. 213-1987
CSA CB Certified	IEC61010
ATEX	EN60079-0 Category 3, Zone 2 EN60079-15

243333

Warning: This module is not hot-swappable! Always remove power from the rack before inserting or removing this module, or damage may result to the module, the processor, or other connected devices.

Battery Life Advisory

All modules in the MVI series use a rechargeable Lithium Vanadium Pentoxide battery to backup the 512K SRAM memory, 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 it becomes fully charged. After it is fully charged, the battery provides backup power for the CMOS setup and configuration data, the real-time clock, and the 512K SRAM memory for approximately 21 days.
Before you remove a module from its power source, ensure that the battery within the module is fully charged. A fully charged battery will hold the BIOS settings (after being removed from its power source) for a limited number of days. When the battery is fully discharged, the module will revert to the default BIOS settings.

Note: The battery is not user replaceable.

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 the product, documentation or support, please write or call us.

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MVI71-MNET User Manual
June 23, 2009

ProSoft Technology® 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, and are available at no charge from our web site: www.prosoft-technology.com

Printed documentation is available for purchase. Contact ProSoft Technology for pricing and availability.

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Contents

Guide to the MVI71-MNET User Manual

Function		**Section to Read**	**Details**
Introduction (Must Do)	→	Start Here (page 9)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Verify Communication, Diagnostic and Troubleshooting	→	Verifying Communication (page 53) Diagnostics and Troubleshooting (page 43)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview	→	Reference (page 57) Functional Overview (page 59) Product Specifications (page 57)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 99)	This section contains Support, Service and Warranty information. Index of chapters.

1 Start Here

In This Chapter

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 PLC devices to a power source and to the MVI71-MNET module's application ports.

Caution: You must be able to complete the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

1.1 System Requirements

The MVI71-MNET module requires the following minimum hardware and software components:

- Rockwell Automation PLC processor, with compatible power supply and one free slot in the rack, for the MVI71-MNET module. The module requires 800mA of available power.
- The PLC Processor must provide for at least 64 words of BTR/BTW area, otherwise the module may not function correctly.
- Rockwell Automation RSLogix 5 programming software.
- Rockwell Automation RSLinx communication software
- Pentium® 100 MHz minimum. Pentium III 700 MHz (or better) recommended

- Supported operating systems:
  - Microsoft Windows XP
  - Microsoft Windows 2000
  - Microsoft Windows NT v4.0 with Service Pack 3 or greater
  - Microsoft Windows ME
  - Microsoft Windows 98
- 64 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
- HyperTerminal or other terminal emulator program capable of file transfers using Zmodem protocol.

1.2 Package Contents

The following components are included with your MVI71-MNET 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	MVI71-MNET Module	MVI71-MNET	Modbus TCP/IP Interface Module
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection to the CFG Port
1	Cable	RJ45 to DB9 Male Adapter	For DB9 Connection to Module's Port
1	inRAx Solutions CD		Contains sample programs, utilities and documentation for the MVI71-MNET module.

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

1.3 Install ProSoft Configuration Builder Software

You must install the ProSoft Configuration Builder (PCB) software in order to configure the module. You can always get the newest version of ProSoft Configuration Builder from the ProSoft Technology web site.

To install ProSoft Configuration Builder from the ProSoft Web Site

1 Open your web browser and navigate to *http://www.prosoft-technology.com/pcb*
2 Click the **DOWNLOAD HERE** link to download the latest version of ProSoft Configuration Builder.
3 Choose **"SAVE"** or **"SAVE FILE"** when prompted.
4 Save the file to your 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 CD-ROM, included in the package with your module.

To install ProSoft Configuration Builder from the Product CD

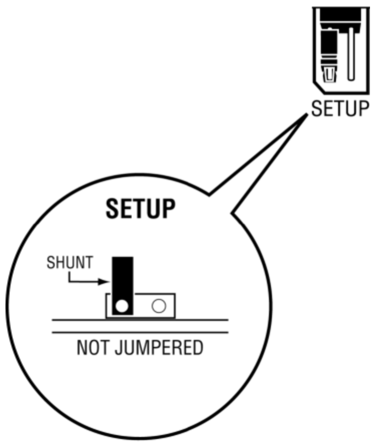
1 Insert the ProSoft Solutions Product CD into the CD drive of your PC. Wait for the startup screen to appear.
2 On the startup screen, click **PRODUCT DOCUMENTATION**. This action opens an explorer window.
3 Click to open the **UTILITIES** folder. This folder contains all of the applications and files you will need to set up and configure your module.
4 Double-click the **SETUPCONFIGURATIONTOOL** 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 MVI71-MNET 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 Install the Module in the Rack

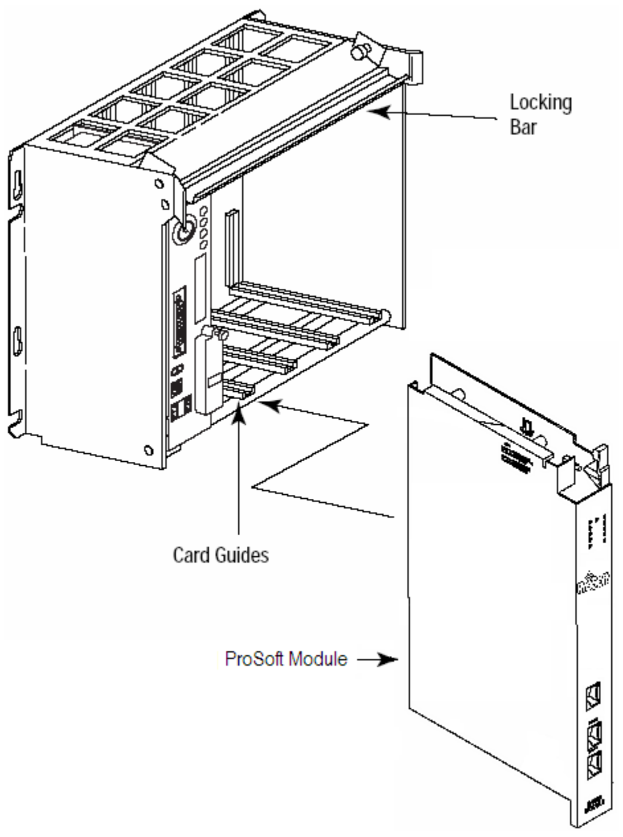
If you have not already installed and configured your PLC processor and power supply, please do so before installing the MVI71-MNET module. Refer to your Rockwell Automation product documentation for installation instructions.

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 MVI71-MNET into the PLC™ chassis. Use the same technique recommended by Rockwell Automation to remove and install PLC modules.

Warning: This module is not hot-swappable! Always remove power from the rack before inserting or removing this module, or damage may result to the module, the processor, or other connected devices.

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.

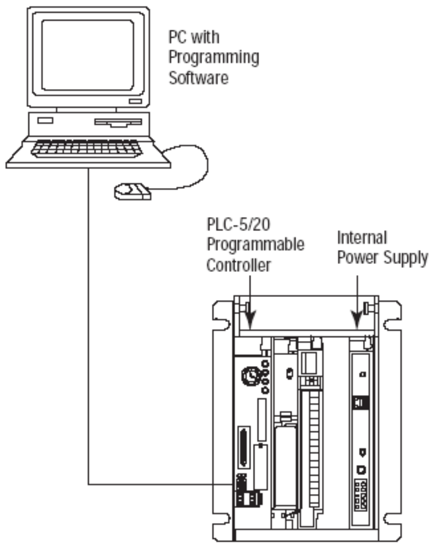


3 With a firm but steady push, snap the module into place.
4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample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

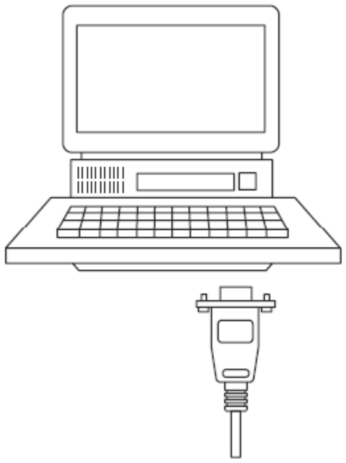
Note: If you insert the module improperly, the system may stop working, or may behave unpredictably.

1.6 Connect your PC to the Processor

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.

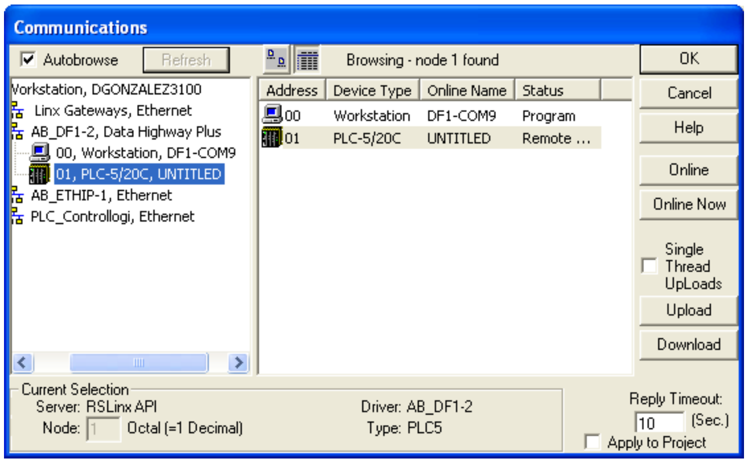


1.7 Download the Sample Program to the Processor

To download the sample program from RSLogix 5 to the PLC processor:

Note: The key switch on the front of the PLC processor 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.

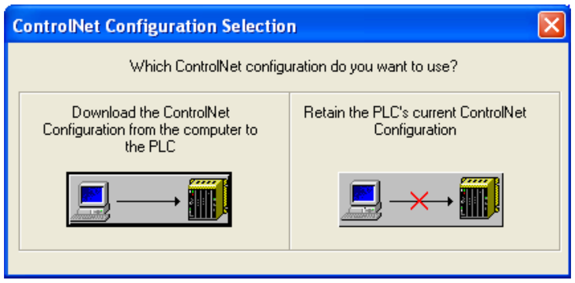


Vorkstation, DGONZALEZ3100
Linx Gateways, Ethernet
AB_DF1-2, Data Highway Plus
00, Workstation, DF1-COM9
01, PLC-5/20C, UNTITLED
AB_ETHIP-1, Ethernet
PLC_Controllogi, Ethernet

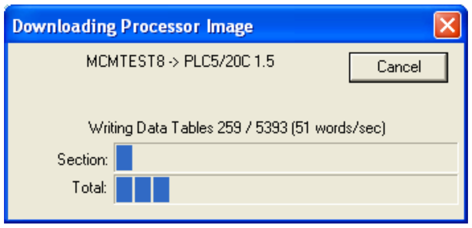
Address	Device Type	Online Name	Status
00	Workstation	DF1-COM9	Program
01	PLC-5/20C	UNTITLED	Remote ...

Current Selection
Server: RSLinx API
Node: 1 Octal (=1 Decimal)
Driver: AB_DF1-2
Type: PLC5
Reply Timeout: 10 (Sec.)

2 Click the Download button to transfer the sample program to the processor.
3 When prompted, choose Computer to PLC


ControlNet Configuration Selection
Which ControlNet configuration do you want to use?
Download the ControlNet Configuration from the computer to the PLC
Retain the PLC's current ControlNet Configuration

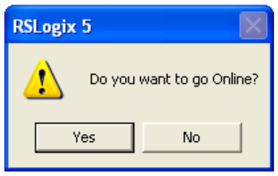
4 RSLogix will compile the program and transfer it to the processor. This process may take a few minutes.



MCMTEST8 -> PLC5/20C 1.5

Writing Data Tables 259 / 5393 (51 words/sec)

5 When the download is complete, RSLogix will open another confirmation dialog box. Click OK to switch the processor from Program mode to Run mode.

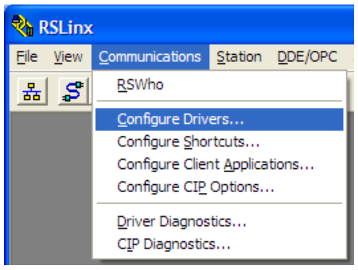


Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

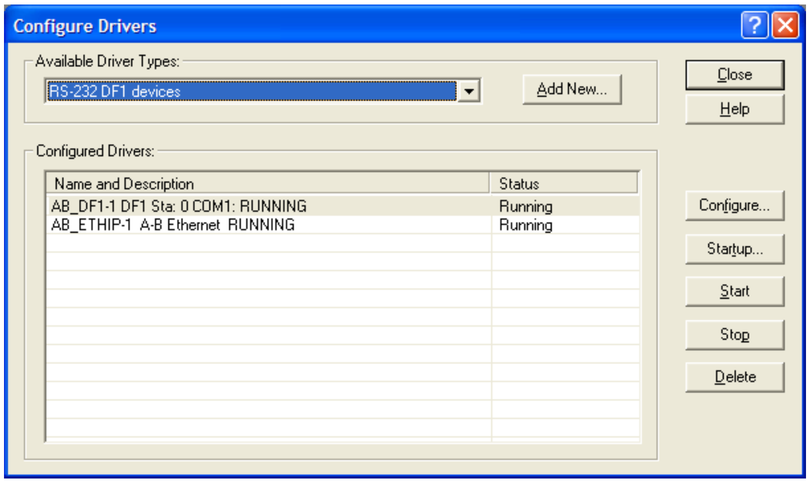
1.7.1 Configuring the RSLinx Driver for the PC COM Port

If RSLogix is unable to establish communication with the processor, follow these steps

1 Open **RSLINX.**
2 Open the **COMMUNICATIONS** menu, and choose **CONFIGURE DRIVERS**.



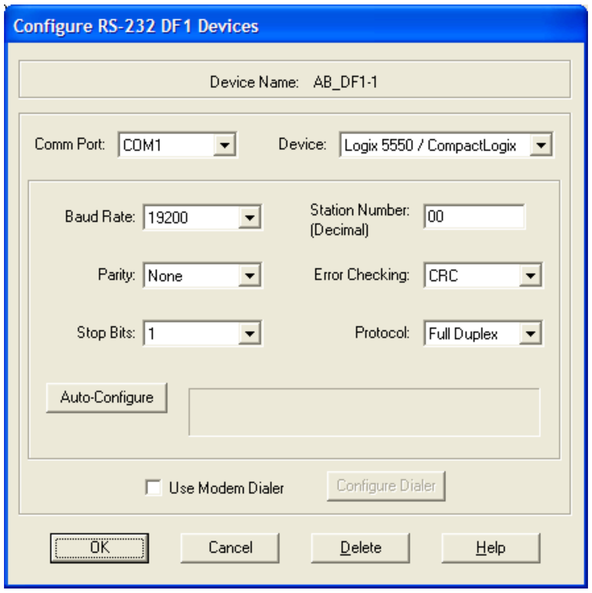
This action opens the **CONFIGURE DRIVERS** dialog box.



Name and Description	Status
AB_DF1-1 DF1 Sta: 0 COM1: RUNNING	Running
AB_ETHIP-1 A-B Ethernet RUNNING	Running

Note: If the list of configured drivers is blank, you must first choose and configure a driver from the Available Driver Types list. The recommended driver type to choose for serial communication with the processor is RS-232 DF1 DEVICES.

3 Click to select the driver, and then click **CONFIGURE.** This action opens the **CONFIGURE ALLEN-BRADLEY DF1 COMMUNICATIONS DEVICE** dialog box.



Configure RS-232 DF1 Devices

Device Name: AB_DF1-1

Comm Port: COM1
Device: Logix 5550 / CompactLogix
Baud Rate: 19200
Station Number: (Decimal) 00
Parity: None
Error Checking: CRC
Stop Bits: 1
Protocol: Full Duplex

4 Click the **AUTO-CONFIGURE** button. RSLinx will attempt to configure your serial port to work with the selected driver.

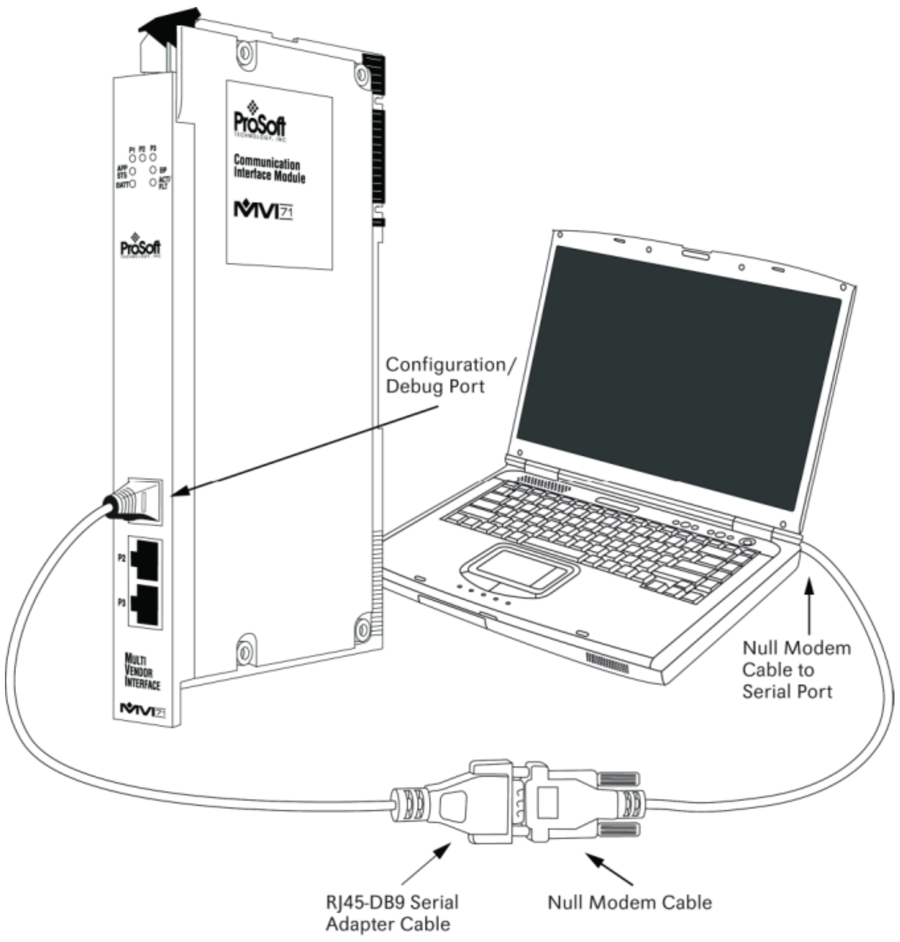
5 When you see the message **AUTO CONFIGURATION SUCCESSFUL**, click the **OK** button to dismiss the dialog box.

Note: If the auto-configuration procedure fails, verify that the cables are connected correctly between the processor and the serial port on your computer, and then try again. If you are still unable to auto-configure the port, refer to your RSLinx documentation for further troubleshooting steps.

1.8 Connect 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 Module Configuration

In This Chapter

This section contains the setup procedure, data, and ladder logic for successful application of the MVI71-MNET module. Each step in the setup procedure is defined in order to simplify the use of the module. Set up for the module for both the BTR/BTW and side-connect interfaces is covered.

2.1 Installing and Configuring the Module

This chapter describes how to install and configure the module to work with your application. The configuration process consists of the following steps.

1. Modify the module's configuration files to meet the needs of your application, and copy the updated configuration to the module. Example configuration files are provided on the CD-ROM. Refer to the Modifying the Example Configuration File section, later in this chapter, for more information on the configuration files.
2. Modify the example ladder logic to meet the needs of your application, and copy the ladder logic to the processor. Example ladder logic files are provided on the CD-ROM.

Note: If you are installing this module in an existing application, you can copy the necessary elements from the example ladder logic into your application.

The rest of this chapter describes these steps in more detail.

It is now time to edit the MNET.CFG file to set up the module for the specific application. Refer to the **Configuration File** section of this document. Download this configuration to the module along with the associated ladder logic.

The next step in installing and configuring the module is to define whether the block transfer or side-connect interface will be utilized. If the block transfer interface is to be used you should be ready to connect the module to the Modbus TCP/IP network if the ladder logic is defined correctly.

If the side-connect interface is utilized, make sure the file SC_DATA.TXT on the Compact Flash Disk contains the correct first file number. You can run the setdnpsc.exe program to set the file number to be used with your application. Install the module in the rack and turn on the power. Connect the serial cable to the module's debug/configuration port and exit the program by pressing **[Esc][X]**. This will cause the program to exit and remain at the operating system prompt. Run the setdnpsc.exe program with a command line argument of the file number to use for the first file. For example, to select N10: as the first file, enter the following:

```
SETDNPSC 10
```

The program will build the SC_DATA.TXT on the Compact Flash Disk (C: drive in the root directory).

Next, define the data files to be used with the application. If the block transfer interface is used, define the data files to hold the user data (read and write data). Enter the ladder logic to handle the blocks transferred between the module and the PLC. Download the program to the PLC and test the program with the module.

If the side-connect interface is used, no ladder logic is required for data transfer. The user data files to interface with the module must reside in contiguous order in the processor. The first file to be used by the interface is the status/control file. This is file number set in the SC_DATA.TXT file using the SETDNPSC.EXE program. The following table lists the files used by the side-connect interface:

File Number	Example	Size	Description
Cfg File	N10	200	Control/Status File
Cfg File+1	N11	to 1000	Data transferred from the module to the processor
			Other files for read data
Cfg File+1+n	N12	to 1000	Data transferred from the processor to the module
Cfg File+1+n+m			Other files for write data

n is the number of read data files minus one. Each file contains up to 1000 words.

m is the number of write data files minus one. Each file contains up to 1000 words.

More than one read and/or write file may exist in an application. This is required when more than 1000 words of data are required. Two examples are given below for the files used with different data set sizes:

2.1.1 Example of 240 words of read and write data (cfg file=10)

Data Files	Description
N11:0 to 239	Read data
N12:0 to 239	Write data

2.1.2 Example of 2300 read and 3500 write data registers (cfg file=10)

Data Files	Description
N11:0 to 999	Read data words 0 to 999
N12:0 to 999	Read data words 1000 to 1999
N13:0 to 299	Read data words 2000 to 2299
N14:0 to 999	Write data words 0 to 999
N15:0 to 999	Write data words 1000 to 1999
N16:0 to 999	Write data words 2000 to 2999
N17:0 to 499	Write data words 3000 to 3499

Even if the files are not required for an application, they still are reserved and should only be used for that purpose. The read and write data contained in the last set of files possess the data transferred between the module and the processor. The read data file (Cfg File + 1) will contain data transferred from the module to the processor and should be associated with control data types. The write data file (Cfg File + 1 + n) will contain data passed to the module from the processor and should be associated with monitor data types.

Special care must be taken when defining the files for the side-connect interface. Because the module directly interacts with the PLC processor and its memory, any errors in the configuration may cause the processor to fault and it may even lose its configuration and program. After defining the files and populating them with the correct data, download the program to the processor, and place the processor in run mode. If everything is configured correctly, the module should start its normal operation.

The module is now set up and ready to be used with your application. Insert the module in the rack (with the power turned off) and attach the serial communication cables. Download the new application to the controller and place the processor in run mode. Download the new MNET.CFG file to the module using a terminal emulation program. If all the configuration parameters are set correctly and the module is attached to a network, the module’s Application LED (APP LED) should remain off and the backplane activity LED (BP ACT) should blink very rapidly.

2.2 Module Data

All data related to the MVI71-MNET module is stored in a user defined data files. It is the responsibility of the ladder logic programmer to construct all the data files required by the program and to write the ladder logic required to interface to these files.

2.3 Status Data

When the side-connect interface is employed in the application, the status data is automatically transferred from the module to the first file used by the interface. The data is placed at an offset of 0 in the file and has the format shown in the Reference chapter.

When the block transfer interface is used, the status data is placed in the module's internal database at the location specified by the Error/Status Offset parameter in the configuration file. If this data area is transferred to the processor in the read data area, it will be passed from the module to the processor in a normal BTR block. This will be placed in the normal read data area. The format of the data is exactly the same as shown above, but the user determines its position. Refer to the Reference chapter for a complete listing of the data stored in this object.

2.4 User Data

When the side-connect interface is utilized, the read and write data is moved between the module and the processor without any ladder logic. The size of the data area and position of the data areas in the module's database is determined by the parameters set in the configuration file.

When the block transfer interface is used, ladder logic is required to page the data between the module and the processor. The size of the data area and position of the data areas in the module's database is determined by the parameters set in the configuration file.

The read data area should be set to match the value entered in the **Read Register Count** parameter of the MNET.CFG file. For ease of use, this array should be dimensioned as an even increment of 60 words. This data is paged up to 60 words at a time from the module to the processor. The Read Data task is responsible for placing the data received into the proper position in the read data array. Use this data for status and control in the ladder logic of the processor.

The write data area should be set to match the value entered in the **Write Register Count** parameter of the MNET.CFG file. For ease of use, this array should be dimensioned as even increments of 60 words. This data is paged up to 60 words at a time from the processor to the module. The Write Data task is responsible for placing 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.

2.5 Event Command Data

A user file containing Event Command Data is only required when event commands are utilized in the application. This file holds the information required for an event command. An array of these objects should be defined and hold the event command set to be employed in the application.

2.6 Modbus Message Data

This new version of the module's program includes the pass-through mode. In this mode, write messages sent to a slave port are passed directly through to the processor. It is the responsibility of the ladder logic to process the message received using this feature. If the side-connect interface is used, this data set will be placed in the file selected in the SC_DATA.TXT file starting at register offset 50. Ladder logic is required to parse the message or data set received and to place the data in the correct user data file.

If the block transfer interface is utilized, the pass-through messages will be passed from the module to the processor in special control blocks. Ladder logic is required to handle each block received and to place the data in the correct user data file.

This information is passed from the module to the processor using a block identification code of 9996 if the unformatted pass-through mode (code 1) is selected. Word two of this block contains the length of the message and the message starts at word 3. Other controller tags are required to store the controlled values contained in these messages. The Modbus protocol supports control of binary output (coils - functions 5 and 15) and registers (functions 6 and 16).

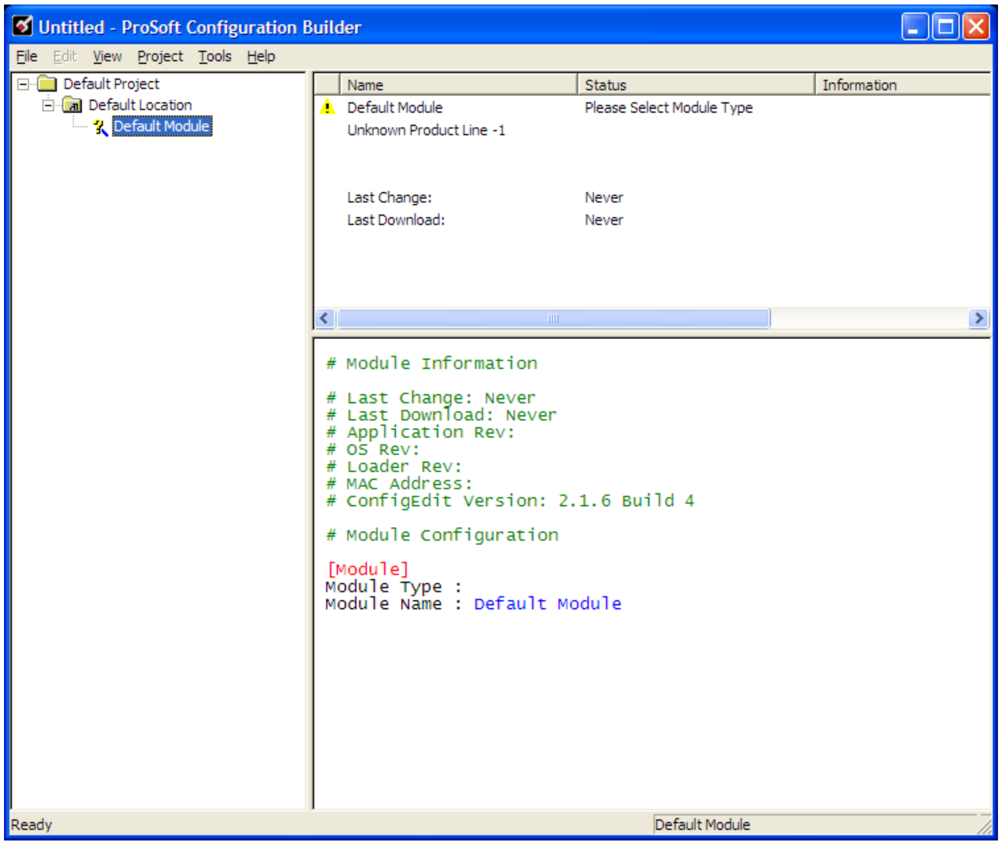
Additionally, formatted message blocks can be sent from the module to the processor when the pass-through option is selected using the format selection (codes 2 or 3 in the MNET.CFG file). These blocks require less decoding than the unformatted blocks. Refer to the user manual for a full discussion on utilizing the pass-through option in an application.

2.7 ProSoft Configuration Builder

ProSoft Configuration Builder (PCB) provides a quick and easy 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.

2.7.1 Set Up the Project

To begin, start ProSoft Configuration Builder. If you have used other Windows configuration tools before, you will find the screen layout familiar. ProSoft Configuration Builder's window consists of a tree view on the left, an information pane and a configuration pane on the right side of the window. When you first start ProSoft Configuration Builder, 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 ProSoft Configuration Builder window with a new project.



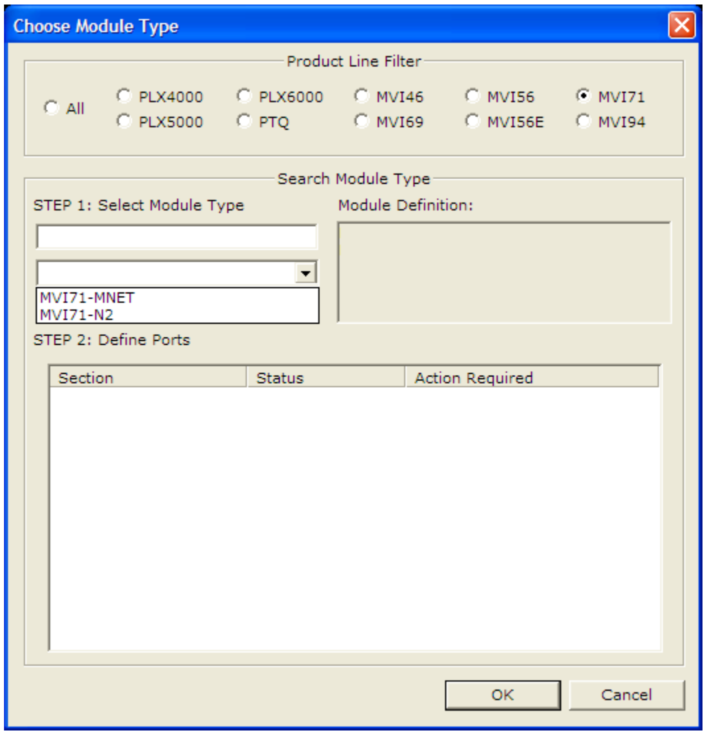
Name	Status	Information
Default Module	Please Select Module Type	
Unknown Product Line -1		
Last Change:	Never	
Last Download:	Never	

```
# Module Information

# Last Change: Never
# Last Download: Never
# Application Rev:
# OS Rev:
# Loader Rev:
# MAC Address:
# ConfigEdit Version: 2.1.6 Build 4

# Module Configuration

[Module]
Module Type :
Module Name : Default Module
```

Your first task is to add the MVI71-MNET 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.

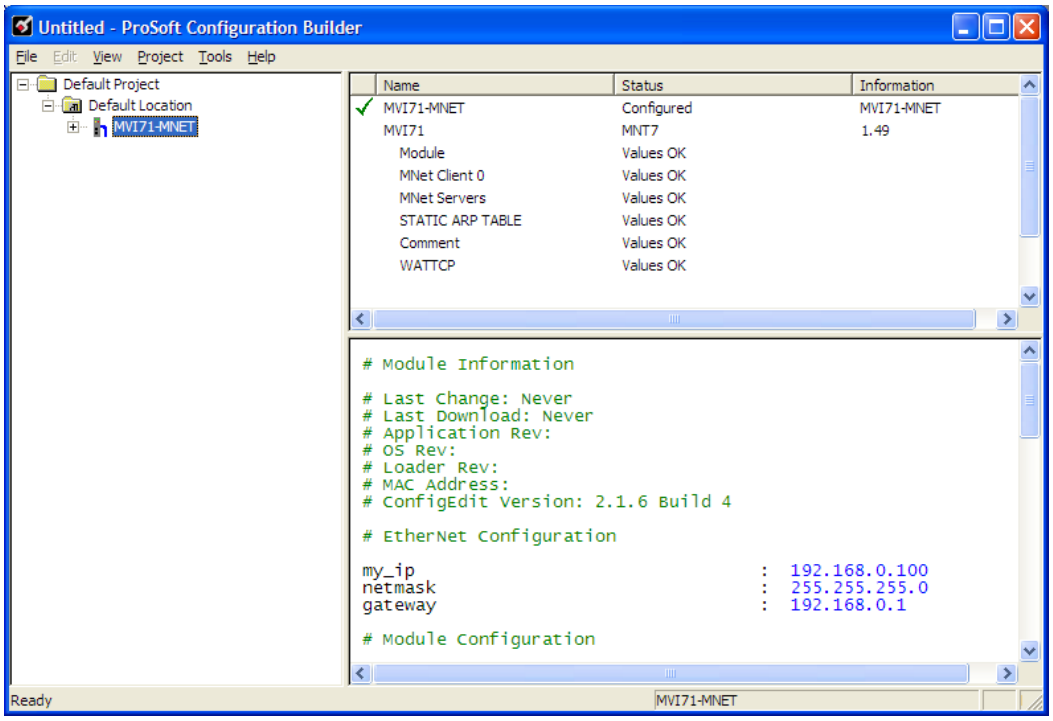


3 In the Product Line Filter area of the dialog box, select MVI71. In the Select Module Type dropdown list, select MVI71-MNET, and then click OK to save your settings and return to the ProSoft Configuration Builder window.

The next task is to set the module parameters.

2.7.2 Set Module Parameters

Notice that the contents of the information pane and the configuration pane changed when you added the MVI71-MNET module to the project.


Untitled - ProSoft Configuration Builder
File Edit View Project Tools Help
Default Project
Default Location
MVI71-MNET
Ready
MVI71-MNET

Name	Status	Information
✓ MVI71-MNET	Configured	MVI71-MNET
MVI71	MNT7	1.49
Module	Values OK	
MNet Client 0	Values OK	
MNet Servers	Values OK	
STATIC ARP TABLE	Values OK	
Comment	Values OK	
WATTCP	Values OK	

```
# Module Information

# Last Change: Never
# Last Download: Never
# Application Rev:
# OS Rev:
# Loader Rev:
# MAC Address:
# ConfigEdit Version: 2.1.6 Build 4

# EtherNet Configuration

my_ip                                    :  192.168.0.100
netmask                                  :  255.255.255.0
gateway                                  :  192.168.0.1

# Module Configuration
```

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

To rename 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.

Module Entries

To configure module parameters

1. Click on the plus sign next to the icon to expand module information.
2. Double-click the icon to open the **EDIT** dialog box.
3. To edit a parameter, select the parameter in the left pane and make your changes in the right pane.
4. Click **OK** to save your changes.

Printing a Configuration File

To print 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 On the **VIEW CONFIGURATION** window, open the **FILE** menu, and choose **PRINT.** This action opens the **PRINT** dialog box.
4 On the **PRINT** dialog box, choose the printer to use from the dropdown list, select printing options, and then click **OK.**

2.7.3 [Module]

This section of the configuration describes the database setup and module level parameters. This section provides the module with a unique name, identifies the method of failure for the communications for the module if the processor is not in run, and describes how to initialize the module upon startup.

Module Name

0 to 80 characters

This parameter assigns a name to the module that can be viewed using the configuration/debug port. Use this parameter to identify the module and the configuration file.

Error/Status Pointer

-1 to 4955

Starting register location in virtual Modbus database for the error/status table. If a value of -1 is entered, the error/status data will not be placed in the database. All other valid values determine the starting location of the data. This data area includes the module version information and all server error/status data.

Read Register Start

0 to 4999

This parameter specifies the starting register in the module where data will be transferred from the module to the processor. Valid range for this parameter is 0 to 4999.

Read Register Count

0 to 5000

This parameter specifies the number of registers to be transferred from the module to the processor. Valid entry for this parameter is 0 to 5000.

Write Register Start

0 to 4999

This parameter specifies the starting register in the module where the data will be transferred from the processor to the module. Valid range for this parameter is 0 to 4999.

Write Register Count

0 to 5000

This parameter specifies the number of registers to transfer from the processor to the module. Valid entry for this parameter is 0 to 5000 words.

Failure Flag Count

0 through 65535

This parameter specifies the number of successive transfer errors that must occur before the communication ports are shut down. If the parameter is set to 0, the communication ports will continue to operate under all conditions. If the value is set larger than 0 (1 to 65535), communications will cease if the specified number of failures occur.

Initialize Output Data

Yes or No

The Initialize Output Data parameter determines if the output data for the module should be initialized with values from the processor. If the value is set to N, the output data will be initialized to 0. If the value is set to Y during initialization, the module will invert (for this scan only) all backplane commands (Type 2).

Pass-Through Mode

0, 1, 2 or 3

This parameter specifies the pass-through mode for write messages received by the MNET and MBAP server ports.

- If the parameter is set to 0, all write messages will be placed in the module's virtual database.
- If a value of 1 is entered, write messages received will be sent to the processor as unformatted messages.
- If a value of 2 is entered, write messages received will be sent to the processor as formatted messages.
- If a value of 3 is entered, write messages received will be sent to the processor with the bytes swapped in a formatted message.

Duplex/Speed Code

0, 1, 2, 3 or 4

This parameter allows you to force 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.

2.7.4 [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 MVI71-MNET 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.

2.7.5 [MNET Client x]

This section defines the configuration for the master device(s) simulated on MNET port.

Error/Status Pointer

-1 to 4990

Starting register location in virtual database for the error/status table for this client. If a value of -1 is entered, the error/status data will not be placed in the database. All other valid values determine the starting location of the data.

Minimum Command Delay

0 to 65535

This parameter specifies the number of milliseconds to wait between the initial issuance of a command. This parameter can be used to delay all commands sent to slaves 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.

Command Error Pointer

-1 to 4999

This parameter sets the address in the internal database where the command error data will be placed. If the value is set to -1, the data will not be transferred to the database.

Response Timeout

0 to 65535 milliseconds

This parameter represents the message response timeout period in 1 millisecond increments. This is the time that a client will wait before re-transmitting a command if no response is received from the addressed server. The value is set depending upon the 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 if the floating-point data access functionality is to be implemented. If the float flag is set to Yes, Modbus functions 3, 6 and 16 will interpret floating point values for registers as specified by the two following parameters.

Float Start

0 to 65535

This parameter defines the first register of floating-point data. All requests with register values greater-than or equal to this value will be considered floating-point data requests. This parameter is only used if the Float Flag is enabled. For example, if a value of 7000 is entered, all requests for registers 7000 and above will be considered as floating-point data.

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.

2.7.6 [MNET Client x Commands]

The [MNET Client x Commands] section of the configuration sets the Modbus master port command list. This command list polls Modbus slave devices attached to the Modbus master port. The module supports numerous commands. This permits the module to interface with a wide variety of Modbus protocol devices.

The function codes used for each command are those specified in the Modbus protocol (page 88). Each command list record has the same format. The first part of the record contains the information relating to the MVI71-MNET communication module and the second part contains information required to interface to the Modbus slave device.

Command List Overview

In order to interface the MVI71-MNET 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 100 commands.

The command list is processed from top (command #0) to bottom. A poll interval parameter is associated with each command to specify a minimum delay time in tenths of a second between the issuance 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.

Write commands have a special feature, as they can be set to execute only if the data in the write command changes. If the register data values in the command have not changed since the command was last issued, the command will not be executed.

If the data in the command has changed since the command was last issued, the command will be executed. Use of this feature can lighten the load on the network. In order to implement this feature; set the enable code for the command to a value of 2.

Commands Supported by the Module

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

The following table lists the functions supported by the module.

Function Code	Definition	Supported in Client	Supported in Server
1	Read Coil Status	X	X
2	Read Input Status	X	X
3	Read Holding Registers	X	X
4	Read Input Registers	X	X
5	Set Single Coil	X	X
6	Single Register Write	X	X
7	Read Exception Status		X
8	Diagnostics	X	
15	Multiple Coil Write	X	X
16	Multiple Register Write	X	X
22	Mask Write 4X		X
23	Read/Write		X

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

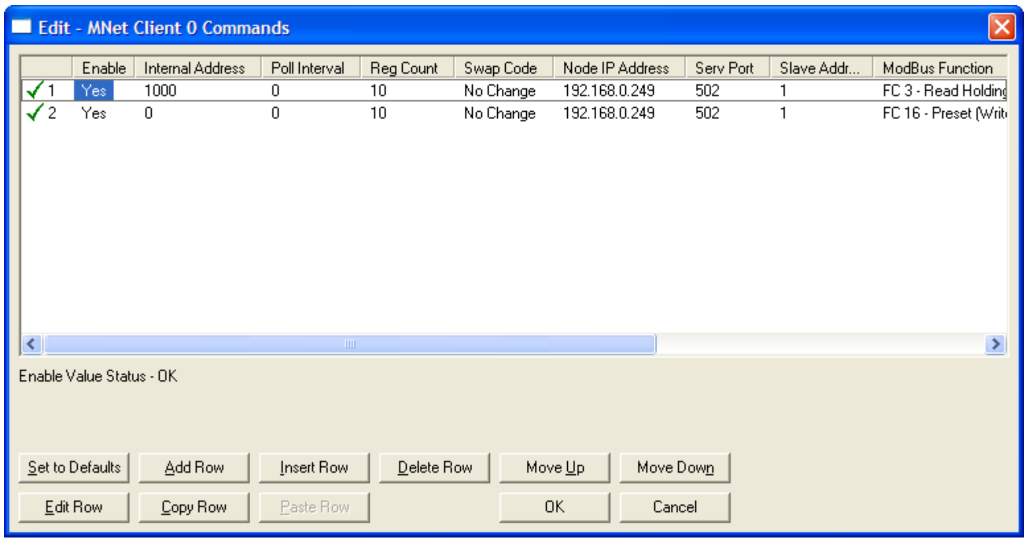
The following table shows the structure of the configuration data necessary for each of the supported commands.

MNET MODBUS Command Structure

Column #	1	2	3	4	5	6	7	8	9	10
Function Code	Enable Code	Internal Address	Poll Interval Time	Count	Swap Code	IP Address	Serv Port	Slave Node	Function Code	Device Modbus Address
fc1	Code	Register	1/10th Seconds	Count	0	IP Address	Port #	Address	1	Register
fc2	Code	Register	1/10th Seconds	Count	0	IP Address	Port #	Address	2	Register
fc3	Code	Register	1/10th Seconds	Count	Code	IP Address	Port #	Address	3	Register
fc4	Code	Register	1/10th Seconds	Count	Code	IP Address	Port #	Address	4	Register
fc5	Code	Register	1/10th Seconds	Count	0	IP Address	Port #	Address	5	Register
fc6	Code	Register	1/10th Seconds	Count	0	IP Address	Port #	Address	6	Register
fc15	Code	Register	1/10th Seconds	Count	0	IP Address	Port #	Address	15	Register
fc16	Code	Register	1/10th Seconds	Count	Code	IP Address	Port #	Address	16	Register

The first part of the record is the Module Information, which relates to the ProLinx module and the second part contains information required to interface to the Server device.

Command list example:


Edit - MNet Client 0 Commands

	Enable	Internal Address	Poll Interval	Reg Count	Swap Code	Node IP Address	Serv Port	Slave Addr...	ModBus Function
✓ 1	Yes	1000	0	10	No Change	192.168.0.249	502	1	FC 3 - Read Holding
✓ 2	Yes	0	0	10	No Change	192.168.0.249	502	1	FC 16 - Preset (Writ

Enable Value Status - OK

Enable

0, 1, 2

This field defines whether or not the command is to be executed and under what conditions.

Value	Description
0	The command is disabled and will not be executed in the normal polling sequence.
1	The command is executed each scan of the command list if the Poll Interval Time is set to zero. If the Poll Interval time is set, the command will be executed, when the interval timer expires.
2	The command will execute only if the internal data associated with the command changes. This value is valid only for write commands.

Internal Address

0 to 4999
or
0 to 9999

This field specifies the database address in the module's internal database to associate with the command. The database address is interpreted as bit-addressing or word-addressing, depending on the Modbus function.

- For Modbus functions 1, 2, 5, and 15, this parameter is interpreted as bit-addressing.
- For Modbus functions 3, 4, 6, and 16, this parameter is interpreted as word-addressing.

If the command is a read function, the data received in the response message is placed at the specified location.

If the command is write function, data used in the command is sourced from the specified data area.

Poll Interval

0 to 65535

This parameter specifies the minimum interval to execute continuous commands (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.

Reg Count

Regs: 1 to 125
Coils: 1 to 800

This parameter specifies the number of registers or digital points to be associated with the command.

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

Swap Code

0, 1, 2, 3

This parameter defines if the data received from the Server is to be ordered differently than received from the Server device. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in Server devices. This parameter can be set to order the register data received in an order useful by other applications. The following table defines the values and their associated operations:

Swap Code	Description
0	None - No Change is made in the byte ordering (1234 = 1234)
1	Words - The words are swapped (1234=3412)
2	Words & Bytes - The words are swapped then the bytes in each word are swapped (1234=4321)
3	Bytes - The bytes in each word are swapped (1234=2143)

The words should be swapped only when using an even number of words.

Node IP Address

xxx.xxx.xxx.xxx

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

Service Port

502 or other supported ports on 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

1 to 255 (0 is a broadcast)

This parameter specifies the Modbus slave node address on the network to be considered. Values of 1 to 255 are permitted.

Note: Most Modbus devices only accept an address in the range of 1 to 247, so be careful. 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 this node address for read operations.

Modbus Function

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

This parameter specifies the Modbus function to be executed by the command. These function codes are defined in the Modbus protocol. The following table defines the purpose of each function supported by the module. More information on the protocol is available from the Schneider Electric web site (www.modicon.com).

Modbus Function Code	Description
1	Read Coil Status
2	Read Input Status
3	Read Holding Registers
4	Read Input Registers
5	Single Coil Write
6	Single Register Write
15	Multiple Coil Write
16	Multiple Register Write

MB Address in Device

This parameter specifies the starting Modbus register or digital point address to be considered by the command in the Modbus slave device. Refer to the documentation of each Modbus slave device on the network for their register and digital point address assignments.

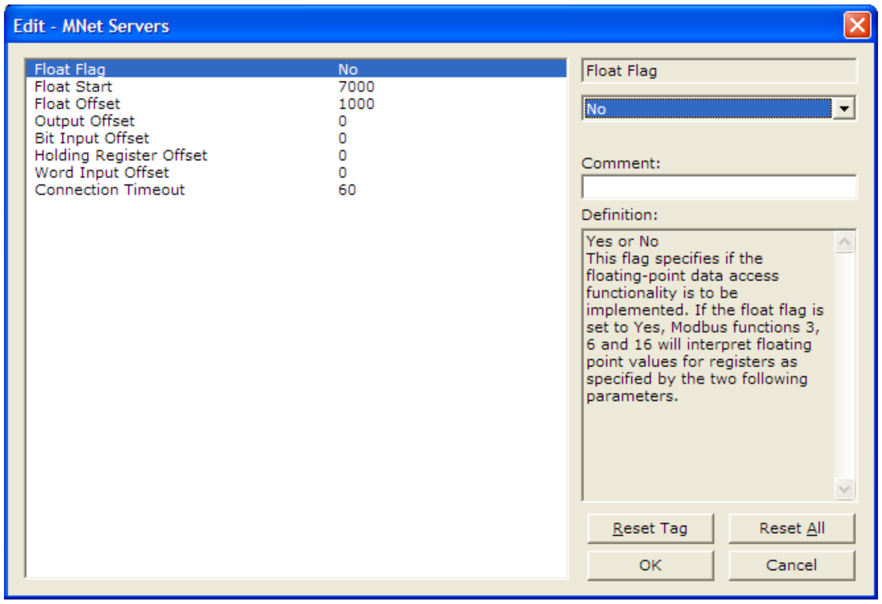
The FC determines the addresses range and that this value will be the register or bit OFFSET into a given data range. For instance, if the command is to be a bit command (FC 1, 2, 5, or 15) to Read/Write a Coil 0X address 00001, then the value to enter here would be 0. For Coil address 00110, the value here would be 109. For register Read/Write commands (FC 3, 4, 6, or 16) in the 3X (FC4) or 4X (FC3), say 30001 or 40001, the value here would, again be 0. For 31101 or 41101, the value to enter for this parameter would be 1100.

Comment

0 to 35 alphanumeric characters

2.7.7 [MNET Servers]

This section contains database offset information used by the servers when accessed by external clients. These offsets can be utilized to segment the database by data type.



Float Flag	No
Float Start	7000
Float Offset	1000
Output Offset	0
Bit Input Offset	0
Holding Register Offset	0
Word Input Offset	0
Connection Timeout	60

Yes or No
This flag specifies if the floating-point data access functionality is to be implemented. If the float flag is set to Yes, Modbus functions 3, 6 and 16 will interpret floating point values for registers as specified by the two following parameters.

Float Flag

Yes or No

This flag specifies if the floating-point data access functionality is to be implemented. If the float flag is set to Yes, Modbus functions 3, 6 and 16 will interpret floating point values for registers as specified by the two following parameters.

Float Start

0 to 65535

This parameter defines the first register of floating-point data. All requests with register values greater-than or equal to this value will be considered floating-point data requests. This parameter is only used if the Float Flag is enabled. For example, if a value of 7000 is entered, all requests for registers 7000 and above will be considered as floating-point data.

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.

Output Offset

This parameter defines the start register for the Modbus command data in the internal database. This parameter is enabled when a value greater than 0 is set. For example, if the Output Offset value is set to 3000, data requests for Modbus Coil Register address 00001, will use the internal database register 3000, bit 0. If the Output Offset value is set to 3000, data requires for Modbus Coil register address 00016 will use the internal database register 3000, bit 15. Function codes affected are 1, 5, and 15.

Bit Input Offset

0 to 3999

This parameter defines the start register for Modbus command data in the internal database. This parameter is enabled when a value greater than 0 is set. For example, if the Bit Input Offset value is set to 3000, data requests for Modbus Input Register address 10001 will use the internal database register 3000, bit 0. If the Bit Input Offset is set to 3000, data requests for Modbus Coil register address 10016 will use the internal database register 3000, bit 15. Function code 2 is affected.

Holding Register Offset

0 to 4999

This parameter defines the start register for the Modbus Command data in the internal database. This parameter is enabled when a value greater than 0 is set. For example, if the Holding Register Offset value is set to 4000, data requests for Modbus Word register 40001 will use the internal database register 4000. Function codes affected are 3, 6, 16, & 23.

Word Input Offset

0 to 4999

This parameter defines the start register for Modbus Command data in the internal database. This parameter is enabled when a value greater than 0 is set. For example, if the Word Input Offset value is set to 4000, data requests for Modbus Word register address 30001 will use the internal database register 4000. Function code 4 is affected.

2.7.8 *Ethernet Configuration*

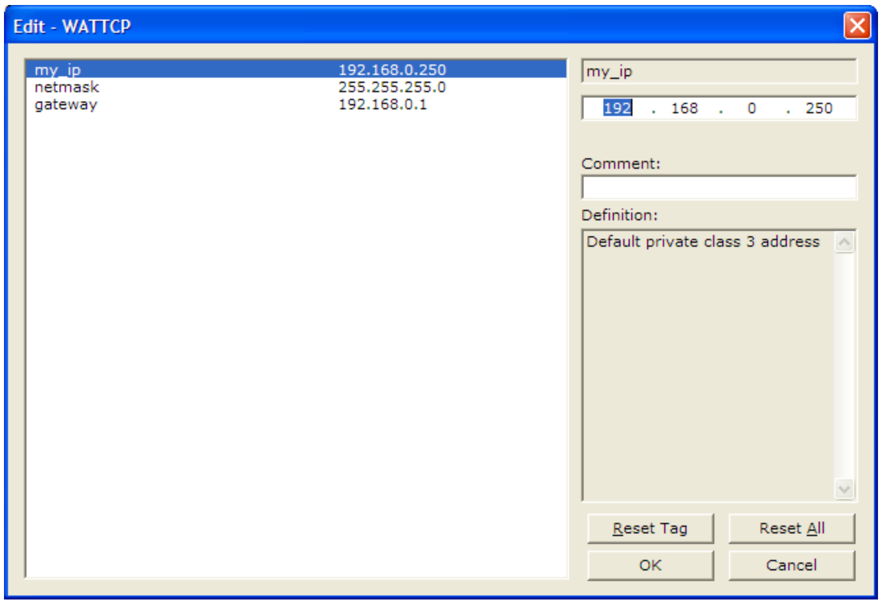
Use this procedure to configure the Ethernet settings for your module. You must assign an IP address, subnet mask and gateway address. After you complete this step, you can connect to the module with an Ethernet cable.

1 Determine the network settings for your module, with the help of your network administrator if necessary. You will need the following information:

- o IP address (fixed IP required) _____ . _____ . _____ . _____
- o Subnet mask _____ . _____ . _____ . _____

2 Gateway address _____ . _____ . _____ . _____

3 Double-click the **ETHERNET CONFIGURATION** icon. This action opens the **EDIT** dialog box.



my_ip	192.168.0.250
netmask	255.255.255.0
gateway	192.168.0.1

my_ip

192 . 168 . 0 . 250

Comment:

Definition:
Default private class 3 address

4 Edit the values for my_ip, netmask (subnet mask) and gateway (default gateway).

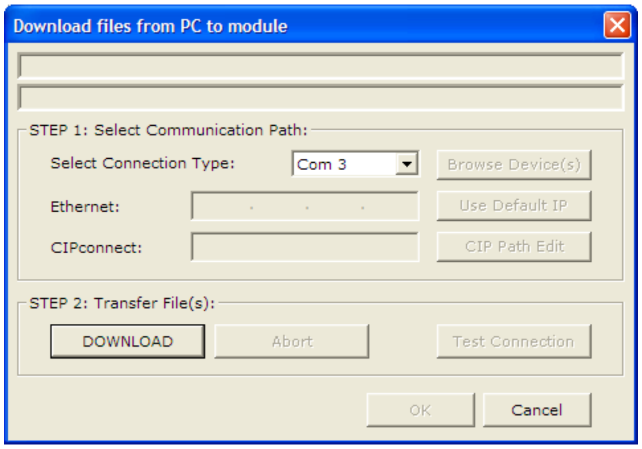
5 When you are finished editing, click **OK** to save your changes and return to the ProSoft Configuration Builder window.

2.8 Download the Project to the Module

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

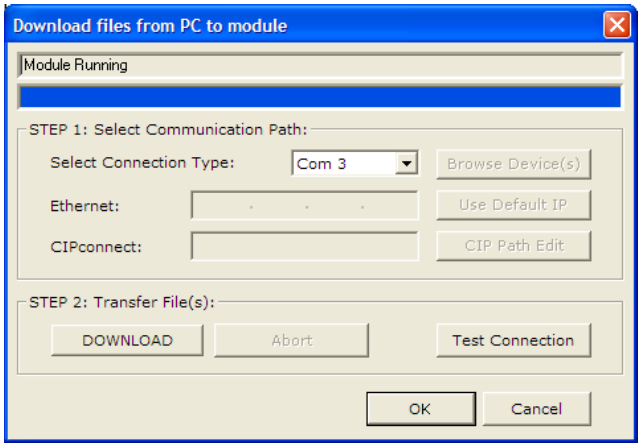
To Download the Project File

1 In the tree view in ProSoft Configuration Builder, click once to select the MVI71-MNET module.
2 Open the **PROJECT** menu, and then choose **MODULE / DOWNLOAD.** 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 with the message *"Module Running*".



3 Ladder Logic

Ladder logic is required for application of the MVI71-MNET module. Tasks that must be handled by the ladder logic are module data transfer, special block handling, and status data receipt. Additionally, a power-up handler may be needed to handle the initialization of the module's data and to clear any processor fault conditions.

The sample ladder logic, on the ProSoft Solutions CD-ROM, is extensively commented, to provide information on the purpose and function of each rung. For most applications, the sample ladder will work without modification.

4 Diagnostics and Troubleshooting

In This Chapter

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

- Status data values are transferred from the module to the processor
- Data contained in the module can be viewed through the Configuration/Debug port attached to a terminal emulator
- LED status indicators on the front of the module provide information on the module's status

4.1 Reading Status Data from the Module

The MVI71-MNET module returns a 47-word Status Data block that can be used to determine the module's operating status. This data is located in the module's database at a user set location. This data is transferred to the PLC processor continuously when the side-connect interface is utilized. For a complete listing of the status data object, refer to the Reference chapter. 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 3999)
- Version Information
- Control over the module (warm boot, cold boot, transfer configuration)
- Facility to upload and download the module's configuration file

4.1.1 Required Hardware

You can connect directly from your computer's serial port to the serial port on the module to view configuration information, perform maintenance, and send (upload) or receive (download) configuration files.

ProSoft Technology recommends the following minimum hardware to connect your computer to the module:

- 80486 based processor (Pentium preferred)
- 1 megabyte of memory
- At least one UART hardware-based serial communications port available. USB-based virtual UART systems (USB to serial port adapters) often do not function reliably, especially during binary file transfers, such as when uploading/downloading configuration files or module firmware upgrades.
- A null modem serial cable.

4.1.2 The Configuration/Debug Menu

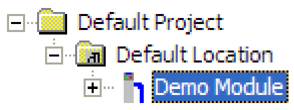
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

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.

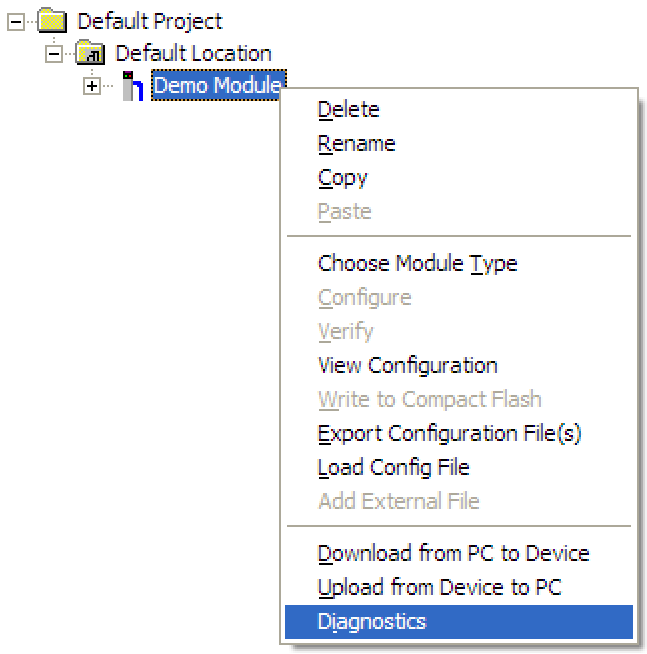
Using the Diagnostic Window in ProSoft Configuration Builder

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

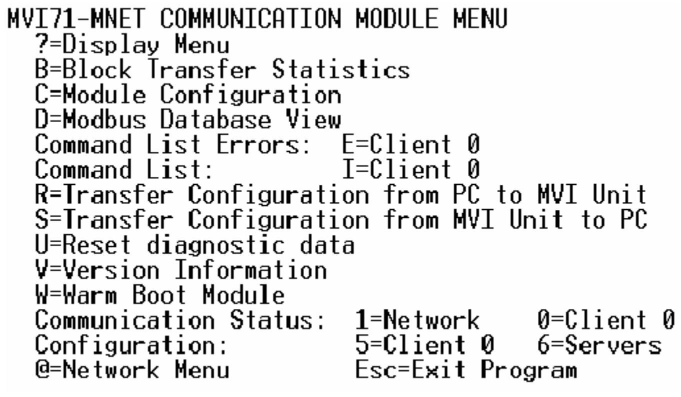
1 Start PCB, and then select the module to test. Click the right mouse button to open a shortcut menu.



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



3 This action opens the **DIAGNOSTICS** dialog box. Press **[?]** to open the Main Menu.



```
MVI71-MNET COMMUNICATION MODULE MENU
  ?=Display Menu
  B=Block Transfer Statistics
  C=Module Configuration
  D=Modbus Database View
  Command List Errors:  E=Client 0
  Command List:         I=Client 0
  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:  1=Network    0=Client 0
  Configuration:         5=Client 0   6=Servers
  @=Network Menu         Esc=Exit Program
```

Important: The illustrations of configuration/debug menus in this section are intended as a general guide, and may not exactly match the configuration/debug menus in your own module.

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

1 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.

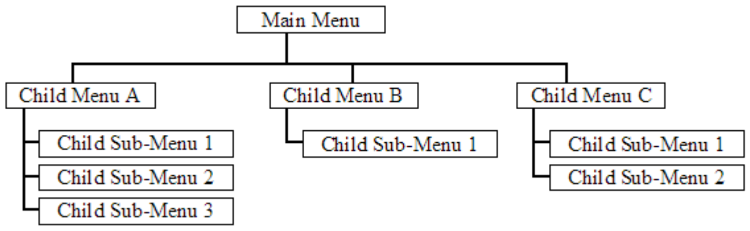
2 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.

If you are still not able to establish a connection, contact ProSoft Technology for assistance.

Navigation

All of the sub-menus for this module contain commands to redisplay the menu or return to the previous menu. You can always return from a sub-menu 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 you the menus available for this module, and briefly discusses the commands available to you.

Keystrokes

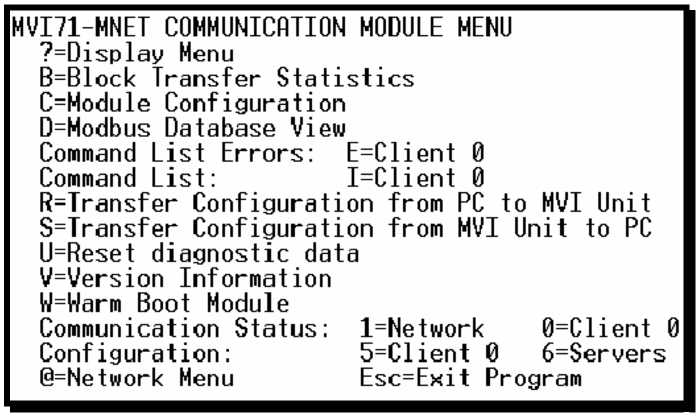
The keyboard commands on these menus are almost always non-case sensitive. You can enter most commands in lower case or capital letters.

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][/].**

Also, take care to distinguish capital letter **[I]** from lower case letter **[L]** (L) and number **[1];** likewise for capital letter **[O]** and number **[0].** Although these characters look nearly the same on the screen, they perform different actions on the module.

4.1.3 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 on your terminal screen:



```
MVI71-MNET COMMUNICATION MODULE MENU
  ?=Display Menu
  B=Block Transfer Statistics
  C=Module Configuration
  D=Modbus Database View
  Command List Errors:  E=Client 0
  Command List:         I=Client 0
  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:  1=Network    0=Client 0
  Configuration:         5=Client 0   6=Servers
  @=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 failures. Only use these commands if you are specifically directed to do so by ProSoft Technology Technical Support staff. Some of these command keys are not listed on the menu, but are active nevertheless. 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 Menu

Press **[D]** to open the Database View menu. Use this menu command to view the current contents of the module's database.

Opening the Command List Menu

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

Opening the Command Error List Menu

Press **[I]** 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.

Receiving the Configuration File

Press **[R]** to download (receive) the current configuration file from the module. For more information on receiving and sending configuration files, please see Uploading and Downloading the Configuration File.

Sending the Configuration File

Press **[S]** to upload (send) an updated configuration file to the module. For more information on receiving and sending configuration files, please see Uploading and Downloading the Configuration File.

Resetting diagnostic data

Press **[U]** to reset the status counters for the client and/or servers 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.

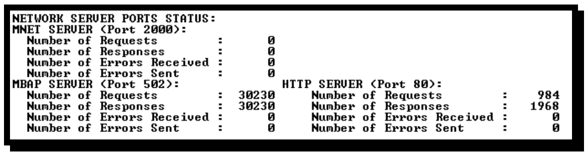
Warm Booting the Module

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 failures. Only use these commands if you are specifically directed to do so by ProSoft Technology Technical Support staff. Some of these command keys are not listed on the menu, but are active nevertheless. Please be careful when pressing keys so that you do not accidentally execute an unwanted command.

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 re-boot.

Viewing Network Status

Press **[1]** to view statistics for the network server ports. The Network Server Ports Status screen shows the number of requests, responses, and errors for each network server.



```
NETWORK SERVER PORTS STATUS:
MNET SERVER (Port 2000):
  Number of Requests        :      0
  Number of Responses       :      0
  Number of Errors Received :      0
  Number of Errors Sent     :      0
MBAP SERVER (Port 502):                HTTP SERVER (Port 80):
  Number of Requests        :  30230     Number of Requests        :   984
  Number of Responses       :  30230     Number of Responses       :  1968
  Number of Errors Received :      0     Number of Errors Received :     0
  Number of Errors Sent     :      0     Number of Errors Sent     :     0
```

Viewing Client Status

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

Viewing Client Configuration

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

Viewing Server Configuration

Press **[6]** to view configuration information for the MNET Servers.

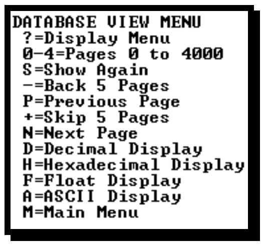
Exiting the Program

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 failures. Only use these commands if you are specifically directed to do so by ProSoft Technology Technical Support staff. Some of these command keys are not listed on the menu, but are active nevertheless. Please be careful when pressing keys so that you do not accidentally execute an unwanted command.

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.

4.1.4 Modbus Database View

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 Modbus Protocol Specification (page 88) 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
[0]	Display registers 0 to 99
[1]	Display registers 1000 to 1099
[2]	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 previous 100 registers of data.

Viewing the Previous 100 Registers of Data

Press **[P]** from the Database View menu to display the previous 100 registers 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 the next 100 registers of data.

Viewing the Next 100 Registers of Data

Press **[N]** from the Database View menu to select and display the next 100 registers of data.

Viewing Data in Decimal Format

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

Viewing Data in Hexadecimal Format

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

Viewing Data in Floating Point Format

Press **[F]** from the Database View menu. Use this command 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

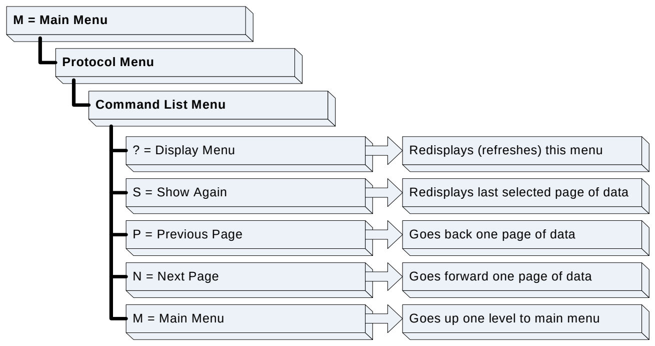
Press **[A]** to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

Returning to the Main Menu

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

4.1.5 Command List Menu

Use this menu to view the configured command list for the module. Press **[?]** to view a list of commands available on this menu.


M = Main Menu
Protocol Menu
Command List Menu
? = Display Menu
Redisplays (refreshes) this menu
S = Show Again
Redisplays last selected page of data
P = Previous Page
Goes back one page of data
N = Next Page
Goes forward one page of data
M = Main Menu
Goes up one level to main menu

Redisplaying the Menu

Press **[?]** to display the current menu. Use this command when you are looking at a screen of data, and want to view the menu choices available to you.

Redisplaying the Current Page

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

Use this command to display the current page of commands. Ten commands are displayed on each page.

If an enabled command has an error, the EN field will contain a value of -1. This indicates that the command will be re-issued every 30 seconds.

Viewing the Previous Page of Commands

Press **[P]** to display the previous page of commands.

Viewing the Next Page of Commands

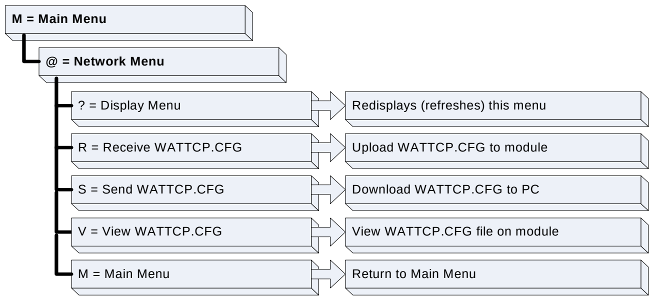
Press **[N]** to display the next page of commands.

Returning to the Main Menu

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

4.1.6 Network Menu

The network menu allows you to send, receive, and view the WATTCP.CFG file that contains the IP and gateway addresses, and other network information.



<u>Transferring WATTCP.CFG to the module</u>

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.

<u>Transferring WATTCP.CFG to the PC</u>

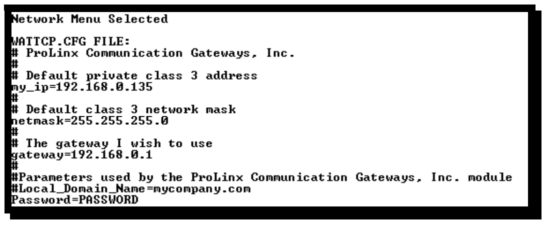
Press **[S]** to transfer the WATTCP.CFG file from the module to your PC.

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.

<u>Viewing the WATTCP.CFG file on the module</u>

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



```
Network Menu Selected

WATTCP.CFG FILE:
# ProLinx Communication Gateways, Inc.
#
# Default private class 3 address
my_ip=192.168.0.135
#
# Default class 3 network mask
netmask=255.255.255.0
#
# The gateway I wish to use
gateway=192.168.0.1
#
#Parameters used by the ProLinx Communication Gateways, Inc. module
#Local_Domain_Name=mycompany.com
Password=PASSWORD
```

<u>Returning to the Main Menu</u>

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

4.2 LED Status Indicators

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

ProSoft Module	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 MVI71-MNET is working normally.
		On	The MVI71-MNET module program has recognized a communication error on one of its Modbus ports.
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 over 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 a configuration error is found for the client, the client configuration error word will have a value other than zero. The configuration error word bits have the following definitions:

Bit	Description	Value
0		0x0001
1		0x0002
2		0x0004
3		0x0008
4	Invalid retry count parameter	0x0010
5	The float flag parameter is not valid.	0x0020
6	The float start parameter is not valid.	0x0040
7	The float offset parameter is not valid.	0x0080
8		0x0100
9		0x0200

Bit	Description	Value
10		0x0400
11		0x0800
12		0x1000
13		0x2000
14		0x4000
15		0x8000

Correct any invalid data in the configuration for proper module operation. When the configuration contains a valid parameter set, all the bits in the configuration word will be clear. This does not indicate that the configuration is valid for the user application. Make sure each parameter is set correctly for the specific application.

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.

4.2.1 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.

4.2.2 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 the configuration data being transferred to the module from the PLC processor.

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 Support.

4.2.3 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. 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. Verify that all modules in the rack are configured in the ladder logic.

Module Errors

Problem Description	**Steps to take**
BP ACT LED remains off or blinks slowly MVI56E modules with scrolling LED display: <*Backplane Status*> condition reads ERR	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: ▪ The processor is in Run mode. ▪ The backplane driver is loaded in the module. ▪ The module is configured for read and write block data transfer. ▪ The ladder logic handles all read and write block situations. ▪ The module is configured in the processor.
OK LED remains red	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 the card in the rack, and then restore power to the rack.

5 Reference

In This Chapter

5.1 Product Specifications

The MVI71 Modbus TCP/IP Client/Server Communication Module allows Rockwell Automation PLC processors to interface easily with other Modbus compatible devices.

Compatible devices include Modicon PAC's as well as a wide variety of instruments and devices. A 5000-word register space in the module exchanges data between the processor and the Modbus network.

5.1.1 General Specifications

- Single Slot - 1771 backplane compatible
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module
- Ladder Logic is used for data transfer between module and processor. Sample ladder file included.
- 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 for data transfer between module and processor and module configuration
- Personality Module (non-volatile CF card) used to store module and network configuration allowing for in the field quick product replacement.

5.1.2 Hardware Specifications

Specification	Description
Form Factor	Single Slot 1771 chassis compatible BTR/BTW data transfer Local or remote rack
Backplane current load	800 mA @ 5 V
Operating temperature	0 to 60°C (32 to 140°F)
Storage temperature	-40 to 85°C (-40 to 185°F)
Shock	30g operational 50g non-operational
Vibration	5 g from 10150 Hz
Relative humidity	5% to 95% (non-condensing)
LED Indicators	Module status Backplane transfer status Application status Serial activity and error LED status
Configuration Serial port (CFG)	DB-9M PC compatible RS-232 Hardware handshaking
Ethernet Port (Ethernet modules)	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

5.1.3 Functional Specifications

- 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 (command control, event commands, 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 five independent server connections for Service Port 502
- Supports five independent server connections for Service Port 2000
- All data mapping begins at Modbus register 40001.
- Error codes, network error counters, and port status data available in user data memory

Server Specifications

The MVI71-MNET module accepts Modbus function code commands of 1, 2, 3, 4, 5, 6, 8, 15, 16, 17, 22 and 23 from an attached Modbus Client unit. A port configured as a Modbus server permits a remote Client to interact with all data contained in the module. This data can be derived from other Modbus server devices on the network, through a Client port, or from the ControlLogix processor.

Client Specifications

A port configured as a virtual Modbus master device on the MVI71-MNET module actively issues Modbus commands to other nodes on the Modbus network. One hundred (100) commands are supported on each port. Additionally, the master ports have an optimized polling characteristic that polls slaves with communication problems less frequently. The PLC 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.

5.2 Functional Overview

This section describes how the MVI71-MNET module transfers data between itself and the processor, and how it implements the Modbus TCP/IP protocol.

5.2.1 General Concepts

The following discussion explains several concepts that are important for understanding the operation of the MVI71-MNET module.

Module Power Up

On power up the module begins performing the following logical functions:

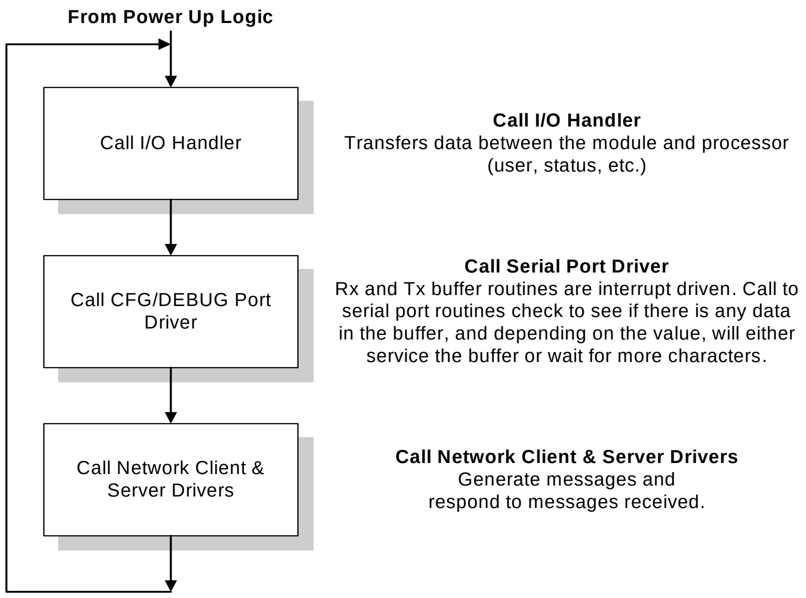
1 Initialize hardware components
- o Initialize PLC backplane driver
- o Test and Clear all RAM
- o Initialize the serial communication ports

2 Initialize the TCP/IP Stack and Ethernet interface module
3 Read configuration for module from MNET.CFG file on Compact Flash Disk
4 Initialize Module Register space
5 Enable Server Drivers
6 Enable Client Driver

After the module has received the configuration, the module will begin communicating with other nodes on the network, depending on the configuration.

Main Logic Loop

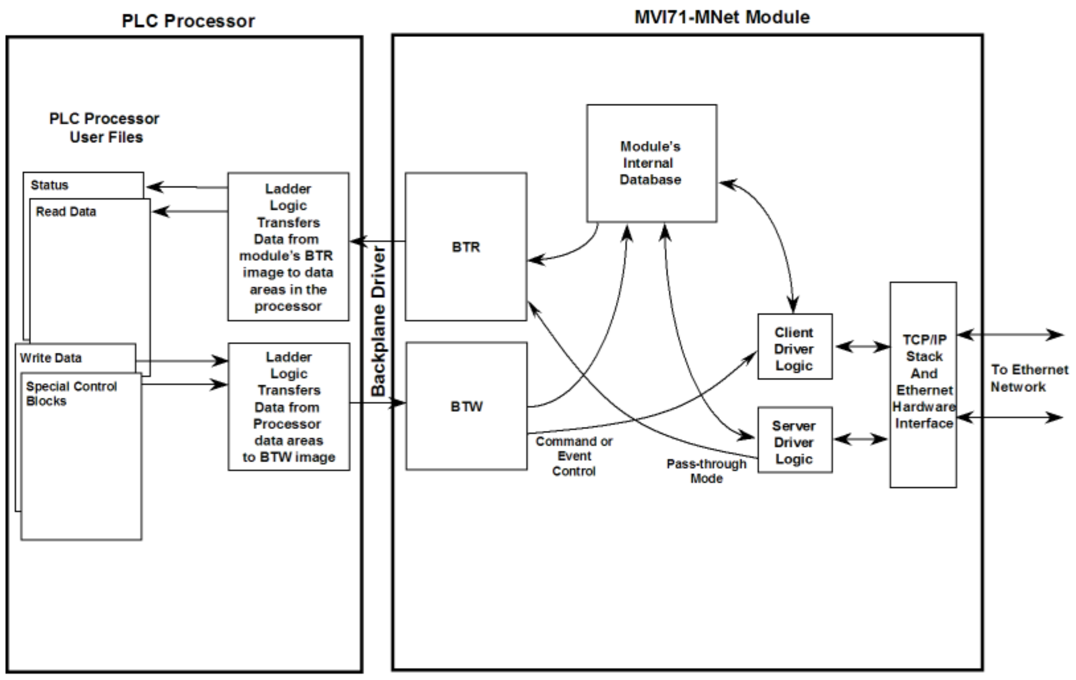
Upon completing the power up configuration process, the module enters an infinite loop that performs the functions shown in the following diagram.


From Power Up Logic
Call I/O Handler
Call CFG/DEBUG Port Driver
Call Network Client & Server Drivers
Call I/O Handler
Transfers data between the module and processor (user, status, etc.)
Call Serial Port Driver
Rx and Tx buffer routines are interrupt driven. Call to serial port routines check to see if there is any data in the buffer, and depending on the value, will either service the buffer or wait for more characters.
Call Network Client & Server Drivers
Generate messages and respond to messages received.

Block Transfer Backplane Data Transfer

The MVI71-MNET module communicates directly over the PLC backplane for the block transfer interface. Data is paged between the module and the PLC processor across the backplane using BTR and BTW operations. Data is transferred from the module to the processor using the BTR blocks, and data is transferred from the processor to the module using the BTW blocks.

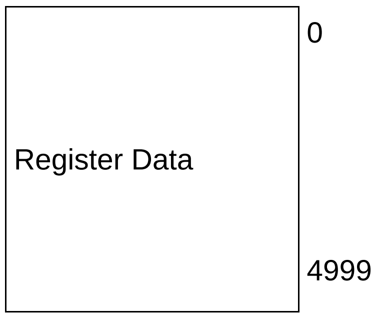
The following illustration shows the data transfer method used to move data between the PLC processor, the MVI71-MNET module and the Modbus TCP/IP Network.



All data transferred between the module and the processor over the backplane is through the BTR and BTW blocks. Ladder logic must be written in the PLC processor to interface the block data with user data files. All data used by the module is stored in its internal database. The following illustration shows the layout of the database:

Module's Internal Database Structure

5000 registers for user data



Data contained in this database is paged through the block transfer interface by coordination of the PLC ladder logic and the MVI71-MNET module's program. Up to 64 words of data can be transferred from the module to the processor at a time. Up to 64 words of data can be transferred from the processor to the module. The read and write block identification codes in each data block determine the function to be performed or the content of the data block.

The module uses the following block numbers:

Block Range	Descriptions
-1	Null block
0	Null block
1 to 84	Read or write data
1000 to 1083	Output Initialization Blocks
2000	Event Command Block
5001 to 5006	Command Control
9956	Formatted pass-through block from function 6 or 16 with word data.
9957	Formatted pass-through block from function 6 or 16 with floating-point data.
9958	Formatted pass-through block from function 5.
9959	Formatted pass-through block from function 15.
9960	Formatted pass-through block from function 22.
9961	Formatted pass-through block from function 23.
9970	Function 99 indication block.
9996	Unformatted Pass-through block with raw Modbus message.
9998	Warm-boot control block
9999	Cold-boot control block

These block identification codes can be broken down into a few groups: Normal data transfer blocks (-1 to 84), Initialization blocks (1000 to 1083), Command control blocks (2000, 5000 to 5006, 9998 and 9999) and pass-through function blocks (9956 to 9961, 9970 and 9996). Each of these groups of blocks are discussed in the following topics:

Normal Data Transfer

Normal data transfer includes the paging of the user data found in the module's internal database in registers 0 to 4999 and the status data. These data are transferred through read (BTR) and write (BTW) 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 PLC processor. The following table describes the structure of the input image.

Offset	Description	Length
0	Read Block ID	1
1	Write Block ID	1
2 to 61	Read Data	60
62 to 63	Spare	2

The Read Block ID is an index value used to determine the location of where the data will be placed in the PLC processor controller tag array of module read data. Each transfer can move up to 60 words (block offsets 2 to 61) of data.

The Write Block ID associated with the block requests data from the PLC processor. Under 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.

Write Block

These blocks of data transfer information from the PLC processor to the module. The following table describes the structure of the output image.

Offset	Description	Length
0	Write Block ID	1
1 to 60	Write Data	60
61 to 63	Spare	3

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 60 words (block offsets 1 to 60) of data.

Initialize Output Data

When the module performs a restart operation, it will request blocks of output data from the processor to initialize the module's output data. Use the **Initialize Output Data** parameter in the configuration file to bring the module to a known state after a restart operation. The following table describes the structure of the request block.

Offset	Description	Length
0	1000 to 1083	1
1	1000 to 1083	1
2 to 63	Spare	62

The block number in word 0 of the block determines the data set of up to 60 output words to transfer from the processor. Ladder logic in the processor must recognize these blocks and place the correct information in the output image to be returned to the module. The format of the returned write block is shown in the following table.

Offset	Description	Length
0	1000 to 1083	1
1 to 60	Output Data	60
61 to 63	Spare	3

Command Control Blocks

Command control blocks are special blocks used to control the module. The current version of the software supports four command control blocks: event command control, command control, warm boot and cold boot.

Event Command

Event command control blocks send Modbus TCP/IP commands directly from the ladder logic to one of the client on the module. The following table describes the format of these blocks.

Offset	Description	Length
0	2000	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 63	Spare	52

The parameters passed with the block 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 message will be generated. All other service port values will generate a Modbus command message encapsulated in a TCP/IP packet.

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 slave device to be associated with the command.

When the module receives the block, it will process it and place it in the command queue. The following table describes the format of this block.

Word	Description
0	This word contains the block 2000 identification code to indicate that this block contains a command to execute by the Client Driver.
1 to 4	These words contain the IP address for the server the message is intended. Each digit (0 to 255) of the IP address is placed in one of the four registers. For example, to reach IP address 192.168.0.100, enter the following values in words 1 to 4 $\rightarrow$ 192, 168, 0 and 100. The module will construct the normal dotted IP address from the values entered. The values entered will be anded with the mask 0x00ff to insure the values are in the range of 0 to 255.

Word	Description
5	This word contains the TCP service port the message will be interfaced. For example, to interface with a MBAP device, the word should contain a value of 502. To interface with a MNET device, a value of 2000 should be utilized. Any value from 0 to 65535 is permitted. A value of 502 will cause a MBAP formatted message to be generated. All other values will generate an encapsulated Modbus message.
6	This word contains the Modbus node address to use with the message. This field should have a value from 0 to 247.
7	This word contains the internal Modbus address in the module to be used with the command. This word can contain a value from 0 to 4999.
8	This word contains the count parameter that determines the number of digital points or registers to associate with the command.
9	The parameter specifies the swap type for the data. This function is only valid for function codes 3 and 4.
10	This word contains the Modbus function code to be used with the command.
11	This word contains the Modbus address in the slave device to be associated with the command.
12 to 63	Spare

The module will respond to each command block with a read block. The following table describes the format of this block.

Word	Description
0	This word contains the block identification code 2000 requested by the processor.
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 queue.
3 to 63	Spare

Word two of the block can be used by the ladder logic to determine if the command was added to the command queue of the module. The command will only fail if the command queue for the port is full (100 commands for each queue).

Command Control

Command control blocks place commands in the command list into the command queue. The client has a command queue of up to 100 commands. The module services commands in the queue before the user defined command list. This gives high priority to commands in the queue. Commands placed in the queue through this mechanism must be defined in the module's command list. Under normal command list execution, the module will only execute commands with the Enable parameter set to one or two. If the value is set to zero, the command is skipped. Commands may be placed in the command queue with an Enable parameter set to zero using this feature. These commands can then be executed using the command control blocks.

One to six commands can be placed in the command queue with a single request. The following table describes the format for this block.

Word	Description
0	Command queue block identification code of 5001 to 5006.
1	This word contains the index in the command list for the first command to be entered into the command queue.

Word	Description
2	This word contains the index in the command list for the second command to be entered into the command queue.
3	This word contains the index in the command list for the third command to be entered into the command queue.
4	This word contains the index in the command list for the fourth command to be entered into the command queue.
5	This word contains the index in the command list for the fifth command to be entered into the command queue.
6	This word contains the index in the command list for the sixth command to be entered into the command queue.
7 to 63	Spare

The last digit in the block code defines the number of commands to process in the block. For example, a block code of 5003 contains 3 command indexes that are to be placed in the command queue. The Command index parameters in the block have a range of 0 to 99 and correspond to the module's command list entries.

The module responds to a command control block with a block containing the number of commands added to the command queue for the port. The following table describes the format for this block.

Word	Description
0	This word contains the block 5001 to 5006 requested by the processor.
1	This word contains the next write block identification code.
2	This word contains the number of commands in the block placed in the command queue.
3 to 63	Spare

Warm Boot

This block is sent from the PLC 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 force the module to read the new configuration information and to restart. The following table describes the format of the control block.

Offset	Description	Length
0	9998	1
1 to 63	Spare	63

Cold Boot

This block is sent from the PLC 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. The following table describes the format of the control block.

Offset	Description	Length
0	9999	1
1 to 63	Spare	63

Pass-Through Control Blocks

If the module is set for pass-through operation by placing a value of 1 to 3 in the configuration file parameter **Pass-Through** Mode, the module will send special blocks to the module when a write request is received from a client. Any Modbus function 5, 6, 15 or 16 commands will be passed from the server to the processor using this block identification numbers 9956 to 9961, 9970 and 9996. Ladder logic must handle the receipt of these blocks and to place the enclosed data into the proper controller tags in the module.

There are two basic modes of operation when the pass-through feature is utilized: Unformatted (code 1) and Formatted (code 2 or 3). The unformatted mode will pass the message received on the server directly to the processor without any processing. The following table describes the format of the read block.

Offset	Description	Length
0	9996	1
1	9996	1
2	Number of bytes in Modbus msg	1
3	Reserved (always 0)	1
4 to 63	Modbus message received	60

The ladder logic should copy and parse the received message and control the processor as expected by the master device. The processor must respond to the pass-through control block with a write block with the following format.

Offset	Description	Length
0	9996	1
1 to 63	Spare	63

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

In formatted pass-through mode, the module will process the received write request and generate a special block dependent on the function received. There are two modes of operation when the formatted pass-through mode is selected. If code 2 is utilized (no swap), the data received in the message is presented in the order expected by the processor. If code 3 is utilized (swap mode), the bytes in the data area of the message will be swapped. This selection is applied to all received write requests. The block identification code used with the request is dependent on the Modbus function requested. Block 9956 passes word type data for functions 6 and 16. Block 9957 passes a floating-point message for functions 6 and 16. Block 9958 is utilized when Modbus function 5 data is received. Block 9959 is employed when function 15 is recognized. Block 9960 is used for function 22 and Block 9961 is used for function 23 requests. Block 9970 is utilized for function 99.

The following tables describe the format for the read blocks.

Offset	Description	Length
0	9956, 9957, 9958, 9960 or 9961	1
1	9956, 9957, 9958, 9960 or 9961	1
2	Number of word registers in Modbus data set	1

Offset	Description	Length
3	Starting address for Modbus data set	1
4 to 63	Modbus data set	60

Offset	Description	Length
0	9959	1
1	9959	1
2	Number of word registers in Modbus data set	1
3	Starting word address for Modbus data set	1
4 to 33	Modbus data set	30
34 to 63	Bit mask to use with the data set. Each bit to be considered with the data set will have a value of 1 in the mask. Bits to ignore in the data set will have a value of 0 in the mask.	30

Offset	Description	Length
0	9970	1
1	9970	1
2	1	1
3	0	1
4 to 63	Spare data area	60

The ladder logic should copy and parse the received message and control the processor as expected by the master device. The processor must respond to the formatted pass-through control blocks with a write block. The following tables describe the format of the write blocks.

Offset	Description	Length
0	9956, 9957, 9958, 9960 or 9961	1
1 to 63	Spare	63

Offset	Description	Length
0	9959	1
1 to 63	Spare	63

Offset	Description	Length
0	9970	1
1 to 63	Spare	63

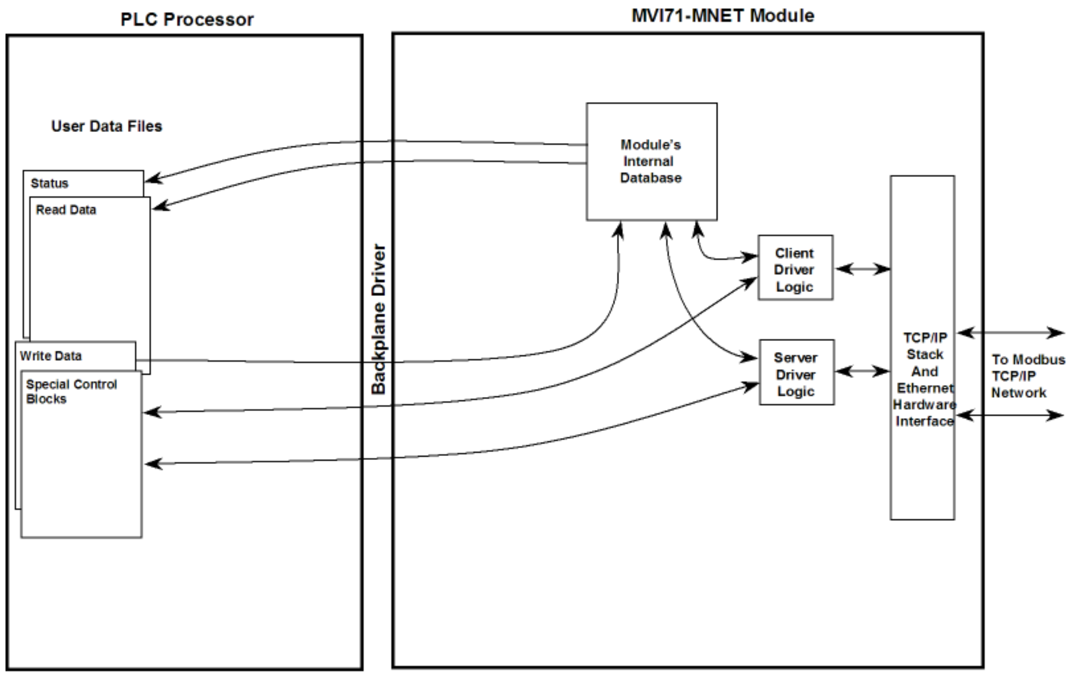
In order to copy status data from module to processor, use the Error/Status Pointer parameter in the [Module] section of the configuration file.

Move Status to desired database registers, then create a rung in the ladder logic to pass them to the processor.

Program Scan Counter	1
Block Transfer Status	6
Not used	10
MNet Server Status	10
MBAP Server Status	10

Side-Connect Backplane Data Transfer

The side-connect interface is the simplest method to implement the module. No ladder logic is required for the interface because the driver handles data movement between the module and the processor automatically. The data flow diagram associated with this interface is shown in the following diagrams:



The configuration information for the module determines the size of the read and write data areas and the locations of these data sets in the module's internal database. Therefore, to use this interface, just set up the files required by the module. The following table lists the files required for the side-connect interface:

File Number	Example	Size	Description
Cfg File	N10	200	Control/Status File
Cfg File+1	N11	to 1000	Data transferred from the module to the processor
			Other files for read data
Cfg File+1+n	N12	to 1000	Data transferred from the processor to the module
Cfg File+1+n+m			Other files for write data

n is the number of read data files minus one. Each file contains up to 1000 words.

m is the number of write data files minus one. Each file contains up to 1000 words.

The number of read and write files are dependent on the modules configuration. Two examples follow:

Example of 240 words of read and write data (cfg file=10)

Data Files	Description
N11:0 to 239	Read data
N12:0 to 239	Write data

Example of 2300 read and 3500 write data registers (cfg file=10)

Data Files	Description
N11:0 to 999	Read data words 0 to 999
N12:0 to 999	Read data words 1000 to 1999
N13:0 to 299	Read data words 2000 to 2299
N14:0 to 999	Write data words 0 to 999
N15:0 to 999	Write data words 1000 to 1999
N16:0 to 999	Write data words 2000 to 2999
N17:0 to 499	Write data words 3000 to 3499

When the side-connect interface is utilized, registers in the first user data file for the module are used for command control (offset 50 to 113). The format of these control commands is similar to that described in the preceding section. The following section describes the use of command control when the side-connect interface is used:

Command Control Blocks

Command control blocks are special blocks used to control the module. These blocks of data are located in the first file of the side-connect interface starting at register offset 50. The current version of the software supports four command control blocks: event command control, command control, warm boot and cold boot.

Event Command

Event command control blocks send Modbus TCP/IP commands directly from the ladder logic to one of the client on the module. The following table describes the format of these blocks.

Offset	Description	Length
50	2000	1
51 to 54	IP Address	4
55	Service Port	1
56	Slave Address	1
57	Internal DB Address	1
58	Point Count	1
59	Swap Code	1
60	Modbus Function Code	1
61	Device Database Address	1

The parameters passed with the block 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 an 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 message will be generated. All other service port values will generate a Modbus command message encapsulated in a TCP/IP packet.

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 slave device to be associated with the command. When the module receives the block, it will process it and place it in the command queue.

The module will respond to each command block with a read block. The following table describes the format of this block.

Offset	Description	Length
50	0	1
51	2000	1
52	Write Block ID	1
53	0=Fail, 1=Success	1

Word two of the block can be used by the ladder logic to determine if the command was added to the command queue of the module. The command will only fail if the command queue for the port is full (100 commands for each queue).

Command Control

Command control blocks place commands in the command list into the command queue. The client has a command queue of up to 100 commands. The module services commands in the queue before the user defined command list. This gives high priority to commands in the queue. Commands placed in the queue through this mechanism must be defined in the module's command list.

Under normal command list execution, the module will only execute commands with the Enable parameter set to one or two. If the value is set to zero, the command is skipped. Commands may be placed in the command queue with an Enable parameter set to zero using this feature.

These commands can then be executed using the command control blocks.

One to six commands can be placed in the command queue with a single request. The following table describes the format for this block.

Offset	Description	Length
50	5001 to 5006	1
51	Command index	1

Offset	Description	Length
52	Command index	1
53	Command index	1
54	Command index	1
55	Command index	1
56	Command index	1

The last digit in the block code defines the number of commands to process in the block. For example, a block code of 5003 contains 3 command indexes that are to be placed in the command queue. The Command index parameters in the block have a range of 0 to 99 and correspond to the module's command list entries.

The module responds to a command control block with a block containing the number of commands added to the command queue for the port. The following table describes the format for this block.

Offset	Description	Length
50	0	1
51	5001 to 5006	1
52	Write Block ID	1
	Number of commands added to	
53	command queue	1

Warm Boot

This block is sent from the PLC 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 force the module to read the new configuration information and to restart. The following table describes the format of the control block.

Offset	Description	Length
50	9998	1

Cold Boot

This block is sent from the PLC 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. The following table describes the format of the control block.

Offset	Description	Length
50	9999	1

Pass-Through Control Blocks

If the module is set for pass-through operation by placing a value of 1 to3 in the configuration file parameter **Pass-Through** Mode, the module will send special blocks to the module when a write request is received from a client. Any Modbus function 5, 6, 15 or 16 commands will be passed from the server to the processor using this block identification numbers 9956 to 9961, 9970 and 9996. Ladder logic must handle the receipt of these blocks and to place the enclosed data into the proper controller tags in the module.

There are two basic modes of operation when the pass-through feature is utilized: Unformatted (code 1) and Formatted (code 2 or 3). The unformatted mode will pass the message received on the server directly to the processor without any processing. The format of the read block transferred in this mode is shown below:

Offset	Description	Length
50	0	1
51	9996	1
52	Number of bytes in Modbus msg	1
53	Reserved (always 0)	1
54 to 113	Modbus message received	60

The ladder logic should copy and parse the received message and control the processor as expected by the master device. The processor must respond to the pass-through control block with a write block with the following format.

Offset	Description	Length
50	9996	1

This will inform the module that the command has been processed and can be cleared from the pass-through queue.

In formatted pass-through mode, the module will process the received write request and generate a special block dependent on the function received. There are two modes of operation when the formatted pass-through mode is selected. If code 2 is utilized (no swap), the data received in the message is presented in the order expected by the processor. If code 3 is utilized (swap mode), the bytes in the data area of the message will be swapped. This selection is applied to all received write requests. The block identification code used with the request is dependent on the Modbus function requested. Block 9956 passes word type data for functions 6 and 16. Block 9957 passes a floating-point message for functions 6 and 16. Block 9958 is utilized when Modbus function 5 data is received. Block 9959 is employed when function 15 is recognized. Block 9960 is used for function 22 and Block 9961 is used for function 23 requests. Block 9970 is utilized for function 99. The format for the read blocks is shown below:

Offset	Description	Length
50	0	1
51	9956, 9957, 9958, 9960 or 9961	1
52	Number of word registers in Modbus data set	1
53	Starting address for Modbus data set	1
54 to 113	Modbus data set	60

Offset	Description	Length
50	0	1
51	9959	1
52	Number of word registers in Modbus data set	1
53	Starting word address for Modbus data set	1
54 to 83	Modbus data set	30
84 to 113	Bit mask to use with the data set. Each bit to be considered with the data set will have a value of 1 in the mask. Bits to ignore in the data set will have a value of 0 in the mask.	30

Offset	Description	Length
50	0	1
51	9970	1
52	1	1
53	0	1

The ladder logic should copy and parse the received message and control the processor as expected by the master device. The processor must respond to the formatted pass-through control blocks with a write block. The following tables describe the format of the write blocks.

Offset	Description	Length
50	9956, 9957, 9958, 9960 or 9961	1

Offset	Description	Length
50	9956, 9957, 9958, 9960 or 9961	1

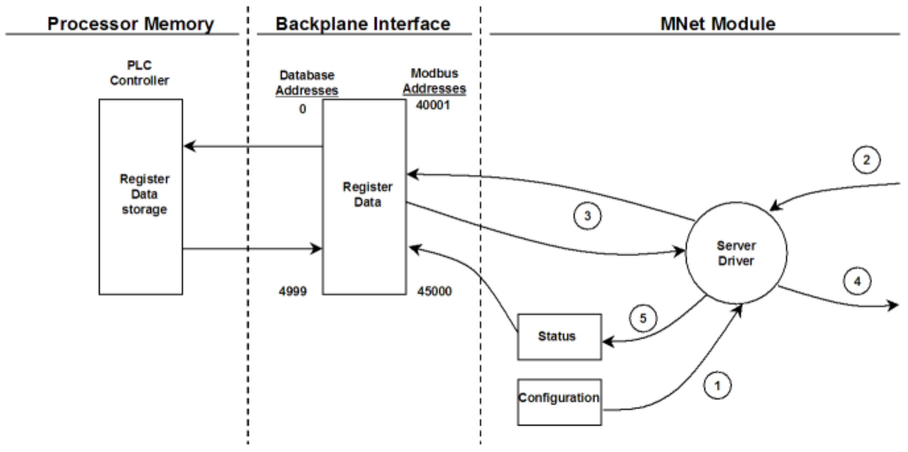
Offset	Description	Length
50	9970	1

5.2.2 Data Flow between MVI71-MNET Module and PLC Processor

The following topics describe the flow of data between the two pieces of hardware (PLC processor and MVI71-MNET module) and other nodes on the Modbus TCP/IP network under the module's different operating modes. The module contains both servers and a client. The servers accept TCP/IP connections on service ports 502 (MBAP) and 2000 (MNET). The client can generate either MBAP or MNET requests dependent on the service port selected in the command.

Server Driver

The Server Driver allows the MVI71-MNET module to respond to data read and write commands issued by clients on the Modbus TCP/IP network. The following flow chart and associated table describe the flow of data into and out of the module.



1 The server driver receives the configuration information from the configuration file on the Compact Flash Disk, and the module initializes the servers.

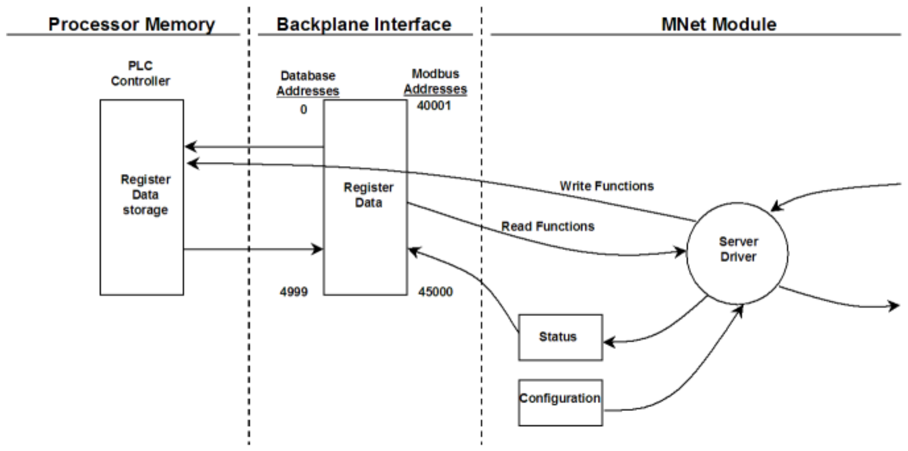
2 A Host device, such as a Modicon PLC or an HMI application issues a read or write command to the module's node address. The server driver qualifies the message before accepting it into the module.

3 After the module accepts the command, the data is immediately transferred to or from the internal database in the module. If the command is a read command, the data is read out of the database and a response message is built. If the command is a write command, the data is written directly into the database and a response message is built. If the pass-through feature is utilized, the write message is transferred directly to the processor and is not written to the module's database.

4 After the data processing has been completed in Step 3, the response is issued to the originating master node.

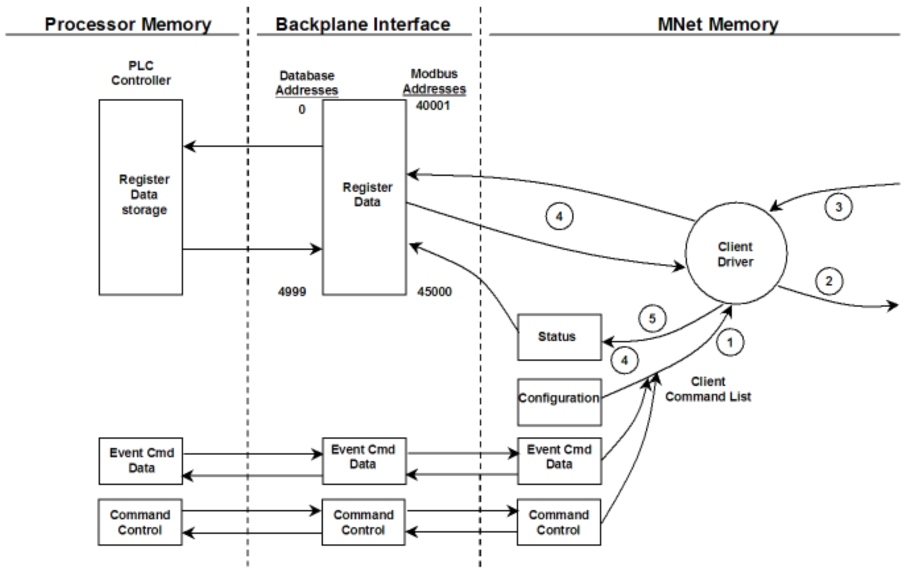
5 Counters are available in the Status Block that permit the ladder logic program to determine the level of activity of the Server Driver.

An exception to this normal mode is when the pass-through mode is implemented. In this mode, all write requests will be passed directly to the processor and will not be placed in the database. This permits direct, remote control of the processor without the intermediate database. This mode is especially useful for Master devices that do not send both states of control. For example, a SCADA system may only send an on command to a digital control point and never send the clear state. The SCADA system expects the local logic to reset the control bit. Pass-through must be used to simulate this mode. The following illustration shows the data flow for a slave port with pass-through enabled:



Client Driver

In the client driver, the MVI71-MNET module is responsible for issuing read or write commands to servers on the Modbus TCP/IP network. These commands are user configured in the module via the Client Command List received from the module's configuration file (MNET.CFG) or issued directly from the PLC processor (event command control). Command status is returned to the processor for each individual command in the command list status block. The location of this status block in the module's internal database is user defined. The following flow chart and associated table describe the flow of data into and out of the module.



1 The client driver obtains configuration data from the MNET.CFG file when the module restarts. The configuration data obtained includes the timeout parameters and the Command List. These values are used by the driver to determine the type of commands to be issued to the other nodes on the Modbus TCP/IP.

2 After configuration, the client driver begins transmitting read and/or write commands to the other nodes on the network. If writing data to another node, the data for the write command is obtained from the module's internal database to build the command.

3 Presuming successful processing by the node specified in the command, a response message is received into the client driver for processing.

4 Data received from the node on the network is passed into the module's internal database, assuming a read command.

5 Status data is returned to the PLC processor for the client and a Command List error table can be established in the module's internal database.

Client Command List

In order for the client to function, the module's Client Command List must be defined. This list contains up to 100 individual entries, with each entry containing the information required to construct a valid command. This includes the following:

- Command enable mode ((0) disabled, (1) continuous or (2) conditional)
- 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 (1/10th second)

5.3 Cable Connections

The MVI71-MNET module has the following communication connections on the module:

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

5.3.1 Ethernet Connection

The MVI71-MNET 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 MVI71-MNET 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.

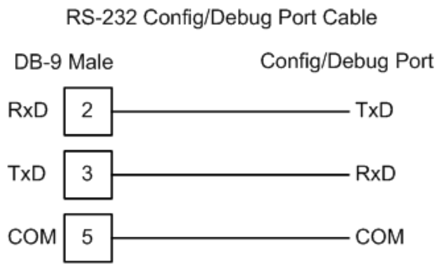
Ethernet Port Configuration - wattcp.cfg

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 using an ASCII terminal by selecting "@" (Network Menu) and "V" (View) options when connected to the Debug port.

```
# WATTCP.CFG FILE:
# ProSoft Technology.
  my_ip=192.168.0.100
# Default class 3 network mask
  netmask=255.255.255.0
# The gateway I wish to use
  gateway=192.168.0.1
```

5.3.2 RS-232 Configuration/Debug Port

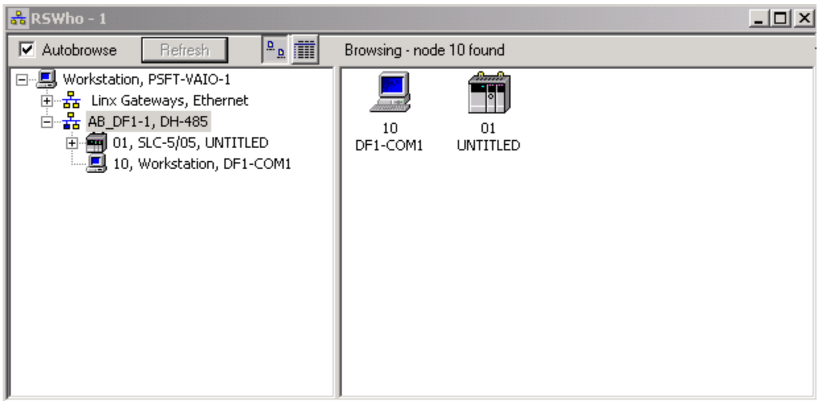
This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC based terminal emulation program to view configuration and status data in the module and to control the module. The cable for communications on this port is shown in the following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



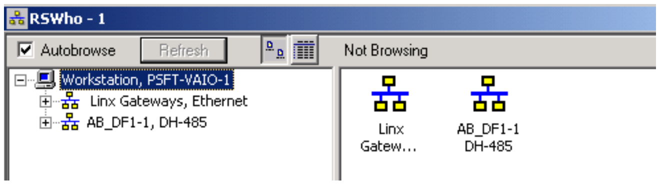
<u>Disabling the RSLinx Driver for the Com Port on the PC</u>

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.

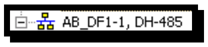
1 Open RSLinx and go to Communications>RSWho
2 Make sure that you are not actively browsing using the driver that you wish to stop. The following shows an actively browsed network:



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:

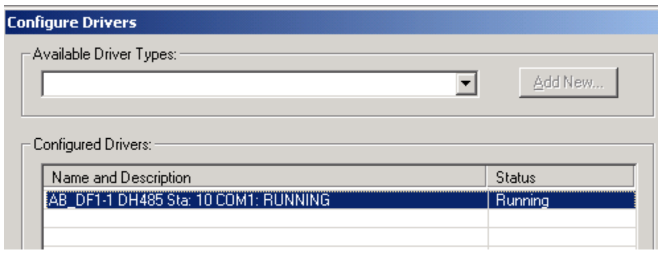


Branches are displayed or hidden by clicking on the ⊞ or the ⊟ icons.



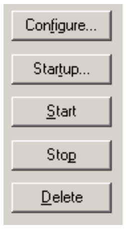
4 When you have verified that the driver is not being browsed, go to

Communications>Configure Drivers
You may see something like this:

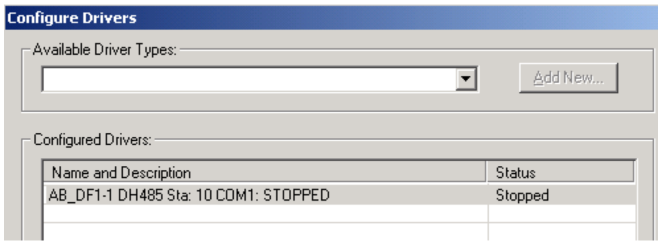


Name and Description	Status
AB_DF1-1 DH485 Sta: 10 COM1: RUNNING	Running

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" on the side of the window:



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

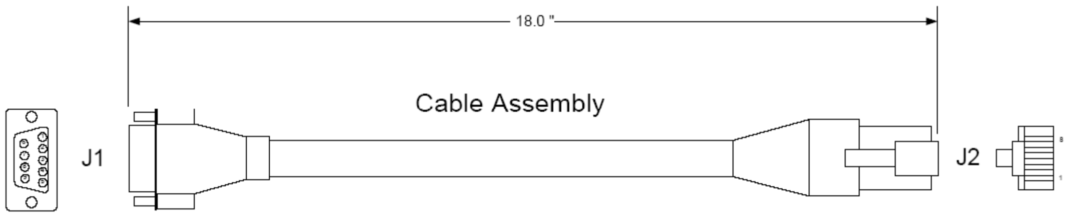


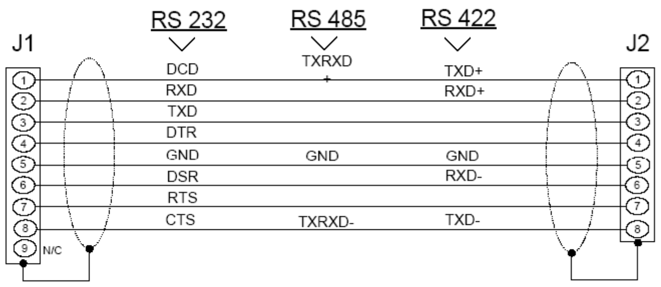
Name and Description	Status
AB_DF1-1 DH485 Sta: 10 COM1: STOPPED	Stopped

6 Upon seeing this, you may now use that 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.

5.3.3 DB9 to RJ45 Adaptor (Cable 14)





Wiring Diagram

5.4 MVI71-MNET Status Data Definition for Side Connect File

This section contains a description of the members present in the status data object. This data is transferred from the module to the processor as part of the read data area when the block transfer interface is used. When the side-connect interface is employed, this data set is automatically transferred to the user file by the module.

Offset	Content	Description
0	Program Scan Count	This value is incremented each time a complete program cycle occurs in the module.
1	Read Block Count	This field contains the total number of read blocks transferred from the module to the processor.
2	Write Block Count	This field contains the total number of write blocks transferred from the processor to the module.
3	Parse Block Count	This field contains the total number of blocks successfully parsed that were received from the processor.
4	Command Event Block Count	This field contains the total number of command event blocks received from the processor.
5	Command Block Count	This field contains the total number of command blocks received from the processor.
6	Error Block Count	This field contains the total number of block errors recognized by the module.
7	Reserved	Not Used
8	Reserved	Not Used
9	Reserved	Not Used
10	Reserved	Not Used
11	Reserved	Not Used
12	Reserved	Not Used
13	Reserved	Not Used
14	Reserved	Not Used
15	Reserved	Not Used
16	Reserved	Not Used
17	Reserved	Not Used
18	Reserved	Not Used
19	Reserved	Not Used
20	MNet Request Count	This counter increments each time a MNet (port 2000) request is received.
21	MNet Response Count	This counter is incremented each time a MNet (port 2000) response message is sent.
22	Reserved	Not Used
23	Reserved	Not Used
24	Reserved	Not Used
25	Reserved	Not Used
26	Reserved	Not Used
27	Reserved	Not Used
28	Reserved	Not Used
29	Reserved	Not Used
30	MBAP Request Count	This counter increments each time a MBAP (port 502) request is received.

Offset	Content	Description
31	MBAP Response Count	This counter is incremented each time a MBAP (port 502) response message is sent.
32	Reserved	Not Used
33	Reserved	Not Used
34	Reserved	Not Used
35	Reserved	Not Used
36	Reserved	Not Used
37	Client Cmd Request	This value is incremented each time a command request is issued.
38	Client Cmd Response	This value is incremented each time a command response is received.
39	Client Cmd Error	This value is incremented each time an error message is received from a remote unit or a local error is generated for a command.
40	Client Request Count	This value is incremented each time a request message is issued.
41	Client Response Count	This value is incremented each time a response message is received.
42	Client Error Sent Count	This value is incremented each time an error is sent from the client.
43	Client Error Received Count	This value is incremented each time an error is received from a remote unit.
44	Client Cfg Error Word	This word contains a bit map that defines configuration errors in the configuration file for the client.
45	Client Current Error Code	This value corresponds to the current error code for the client.
46	Client Last Error Code	This value corresponds to the last error code recorded for the client.

5.5 Status Data Structure for Database Storage

This section contains a description of the members present in the status data object. This data is transferred from the module to the processor as part of the read data area when the block transfer interface is used.

Offset	Content	Description
0	Program Scan Count	This value is incremented each time a complete program cycle occurs in the module.
1 to 2	Product Code	Four bytes of text data containing the string MNT7.
3 to 4	Version	Contains a four byte data area containing the version of the software running in the module.
5 to 6	Operating System Number	Four-byte area containing the operating system number for the module.
7 to 8	Run Number	Four-byte area containing the run number for the module.
9	Read Block Count	This field contains the total number of read blocks transferred from the module to the processor.
10	Write Block Count	This field contains the total number of write blocks transferred from the processor to the module.
11	Parse Block Count	This field contains the total number of blocks successfully parsed that were received from the processor.

Offset	Content	Description
12	Command Event Block Count	This field contains the total number of command event blocks received from the processor.
13	Command Block Count	This field contains the total number of command blocks received from the processor.
14	Error Block Count	This field contains the total number of block errors recognized by the module.
15	Reserved	Not Used
16	Reserved	Not Used
17	Reserved	Not Used
18	Reserved	Not Used
19	Reserved	Not Used
20	Reserved	Not Used
21	Reserved	Not Used
22	Reserved	Not Used
23	Reserved	Not Used
24	Reserved	Not Used
25	Reserved	Not Used
26	Reserved	Not Used
27	Reserved	Not Used
28	MNet Request Count	This counter increments each time a MNet (port 2000) request is received.
29	MNet Response Count	This counter is incremented each time a MNet (port 2000) response message is sent.
30	Reserved	Not Used
31	Reserved	Not Used
32	Reserved	Not Used
33	Reserved	Not Used
34	Reserved	Not Used
35	Reserved	Not Used
36	Reserved	Not Used
37	Reserved	Not Used
38	MBAP Request Count	This counter increments each time a MBAP (port 502) request is received.
39	MBAP Response Count	This counter is incremented each time a MBAP (port 502) response message is sent.
40	Reserved	Not Used
41	Reserved	Not Used
42	Reserved	Not Used
43	Reserved	Not Used
44	Reserved	Not Used

5.6 Client Error/Status Data

The Client connection Error and Status Data areas are discussed in this section. The error/status data table is located at the virtual address assigned by the user. If the address is set to -1, the data will not be placed in the database. It will only be available through the Configuration/Debug Port. If a valid address value is assigned, the module will update the data area.

The data area is initialized with zeros whenever the module is initialized. This occurs during a cold-start (power-on), reset (reset push-button pressed) or a warm-boot operation (commanded or loading of new configuration).

Refer to Error Codes to interpret the status/error codes present in the data area.

5.6.1 MNET Server Port 2000 Status Error Locations

The following table lists the status error locations for MNET Server Port 2000 errors.

Internal Database Address	Offset	Description
6200	0	Number of Command Requests
6201	1	Number of Command Responses
6202	2	Number of Command Errors
6203	3	Number of Requests
6204	4	Number of Responses
6205	5	Number of Errors Sent
6206	6	Number of Errors Received
6207	7	Configuration Error Word
6208	8	Current Error Code
6209	9	Last Error Code

Refer to the Error Codes section in this manual to interpret the status/error codes present in the data area.

5.6.2 MNET Server Port 502 Status Error Locations

The following table lists the status error locations for MNET Server Port 502 errors.

Internal Database Address	Offset	Description
6210	0	Number of Command Requests
6211	1	Number of Command Responses
6212	2	Number of Command Errors
6213	3	Number of Requests
6214	4	Number of Responses
6215	5	Number of Errors Sent
6216	6	Number of Errors Received
6217	7	Configuration Error Word
6218	8	Current Error Code
6219	9	Last Error Code

Refer to the Error Codes section in this manual to interpret the status/error codes present in the data area.

5.6.3 MNET Server Port 2001 Error Locations

The following table lists the status error locations for MNET Server Port 2001 errors.

Internal Database Address	Offset	Description
6220	0	Number of Command Requests
6221	1	Number of Command Responses
6222	2	Number of Command Errors
6223	3	Number of Requests
6224	4	Number of Responses
6225	5	Number of Errors Sent
6226	6	Number of Errors Received
6227	7	Configuration Error Word
6228	8	Current Error Code
6229	9	Last Error Code
6230 to 6299		No Valid Data

Refer to the Error Codes section in this manual to interpret the status/error codes present in the data area.

5.6.4 MNET Client Command List Error Data

Each command in the command list for the MNET client has a reserved word value for a status/error code. This error data list can be read using the Debug/Config Port and can be placed in the module's internal database. Each network client has its own register location parameter.

The first word in the register location defined contains the status/error code for the first command in the client's command list. Each successive word in the command error list is associated with the next command in the list. Therefore, the size of the data area is dependent upon the number of commands defined. The structure of the data area is displayed below:

Internal Database Address (Example)	Offset	Description
6010	0	Command #0 Error Status
6011	1	Command #1 Error Status
6012	2	Command #2 Error Status
6013	3	Command #3 Error Status
6014	4	Command #4 Error Status
	.	.
	.	.
	.	.
6107	97	Command #97 Error Status
6108	98	Command #98 Error Status
6109	99	Command #99 Error Status

Note that the values in the Command List Error Status tables are initialized to zero (0) at power-up, cold boot and during warm boot. Refer to the next section containing Error Codes to interpret the status/error codes present in the data area.

Standard Modbus Protocol Errors

Code	Description
1	Illegal Function
2	Illegal Data Address
3	Illegal Data Value
4	Failure in Associated Device
5	Acknowledge
6	Busy, Rejected Message

Module Communication Error Codes

Code	Description
-1	CTS modem control line not set before transmit
-2	Timeout while transmitting message
-11	Timeout waiting for response after request
253	Incorrect slave 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
-36	MNET command response timeout
-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.

5.7 Modbus Protocol Specification

5.7.1 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 Slave only. Broadcast mode is not supported with this function code. In addition to the Slave 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 Slave 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 Slave 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 Slave 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 Slave interface device is serviced at the end of a controller's scan, data will reflect coil status at the end of the scan. Some Slaves 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.

Adr	Func	Byte Count	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.

5.7.2 *Read Input Status (Function Code 02)*

Query

This function allows the user to obtain the ON/OFF status of discrete inputs in the addressed Slave PC Broadcast mode is not supported with this function code. In addition to the Slave 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 Slave device may have restrictions that lower the maximum quantity. The inputs are numbered form 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 Slave 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 Slave 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 Slave interface device is serviced at the end of a controller's scan, data will reflect input status at the end of the scan. Some Slaves 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 102180) instead of 8 inputs. The two left-most bits are provided as zeros to fill the 8-bit format.

5.7.3 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 Slave. 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 Slave 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 Slave 584 number 11.

Adr	Func	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 Slave 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 Slave 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 Slaves 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

5.7.4 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 Slave 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 Slave number 11.

Adr	Func	Data Start Reg Hi	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 Slave 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 Slave 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 form 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

5.7.5 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 Slave address 00 (Broadcast Mode) will force all attached Slaves 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 Slave 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".

5.7.6 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 Slave address zero (Broadcast mode) all Slave 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

5.7.7 Diagnostics (Function Code 08)

MODBUS function code 08 provides a series of tests for checking the communication system between a client (Master) device and a server (Slave), 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. User logic, like discrete and registers, is not accessed by the diagnostics. Certain functions can optionally reset error counters in the remote device.

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.

The following diagnostic functions are dedicated to serial line devices.

The normal response to the Return Query Data request is to loopback the same data. The function code and sub-function codes are also echoed.

Request

Function code	1 Byte	0x08
Sub-function	2 Bytes	
Data	N x 2 Bytes	

Response

Function code	1 Byte	0x08
Sub-function	2 Bytes	
Data	N x 2 Bytes	

Error

Error code	1 Byte	0x88
Exception code	1 Byte	01 or 03 or 04

Sub-function codes supported by the serial line devices

Only Sub-functions 00 is supported by the MVI71-MNET 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.

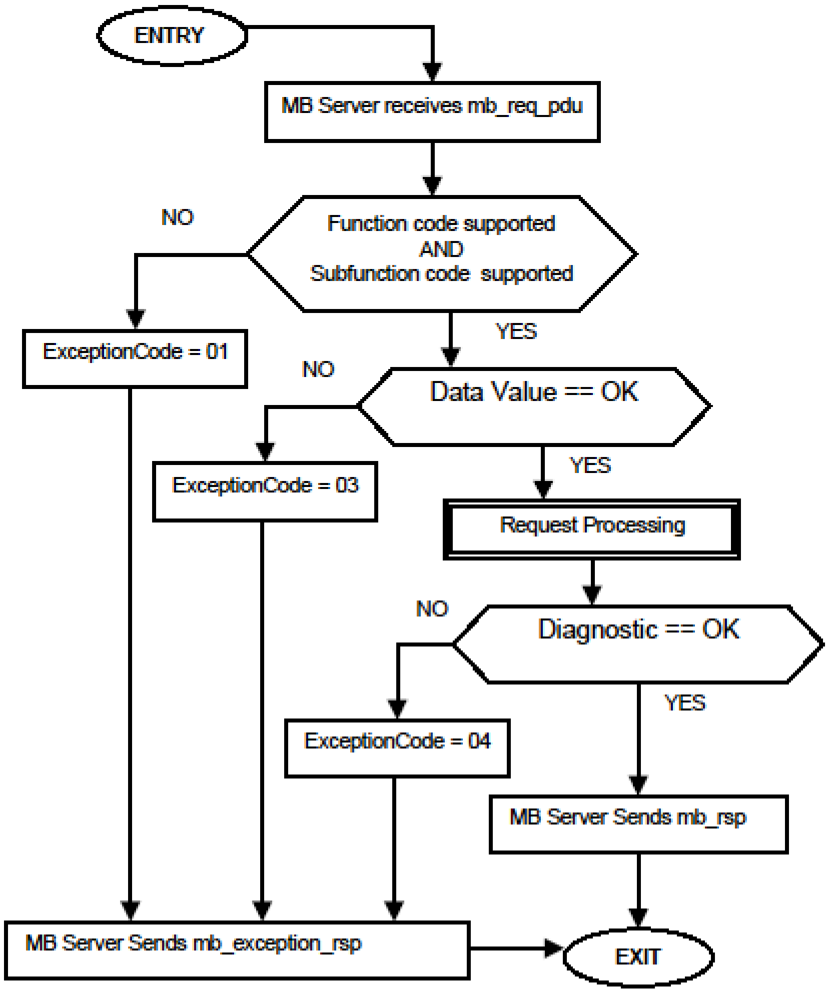
Sub-function	**Data Field (Request)**	**Data Field (Response)**
00 00	Any	Echo Request Data

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.



5.7.8 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 Slave address 0 (Broadcast Mode) will force all attached Slaves 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 Slave 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.

5.7.9 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. When specified registers with contents specified.

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

5.7.10 MODBUS Exception Responses

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

MODBUS Exception Codes

Code	Name	Meaning
01	Illegal Function	The function code received in the query is not an allowable action for the server (or Slave). 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 (or Slave) 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 (or Slave). 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 (or Slave). 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 (or Slave) was attempting to perform the requested action.
05	Acknowledge	Specialized use in conjunction with programming commands. The server (or Slave) 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 (or Master). The client (or Master) 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 (or Slave) is engaged in processing a long-duration program command. The client (or Master) should retransmit the message later when the server (or Slave) 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 (or Slave) attempted to read record file, but detected a parity error in the memory. The client (or Master) can retry the request, but service may be required on the server (or Slave) 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.

6 Support, Service & Warranty

In This Chapter

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 contents of file
   - Module Operation
   - Configuration/Debug status information
   - LED patterns

2 Information about the processor and user data files as viewed through and LED patterns on the processor.
3 Details about the serial devices interfaced, if any.

6.1 How to Contact Us: Technical Support

Internet	Web Site: www.prosoft-technology.com/support
	E-mail address: support@prosoft-technology.com

Asia Pacific

+603.7724.2080, support.asia@prosoft-technology.com
Languages spoken include: Chinese, English

Europe (location in Toulouse, France)

+33 (0) 5.34.36.87.20, support.EMEA@prosoft-technology.com
Languages spoken include: French, English

North America/Latin America (excluding Brasil) (location in California)

+1.661.716.5100, support@prosoft-technology.com
Languages spoken include: English, Spanish
*For technical support calls within the United States, an after-*hours *answering system allows pager access to one of our qualified technical and/or application support engineers at any time to answer your questions.*

Brasil (location in Sao Paulo)

+55-11-5084-5178, eduardo@prosoft-technology.com
Languages spoken include: Portuguese, English

6.2 Return Material Authorization (RMA) Policies and Conditions

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

6.2.1 All Product Returns:

a) In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Returned Material Authorization (RMA) number from ProSoft and comply with ProSoft 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 99). 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, 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 using a shipment method other than that specified by ProSoft 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, and so on.

6.2.2 Procedures for Return of Units Under Warranty:

A Technical Support Engineer must approve the return of Product under ProSoft'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 at designated location referenced on the Return Material Authorization.

6.2.3 Procedures for Return of Units Out of Warranty:

a) Customer sends unit in for evaluation
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:

- 3150 - All
- 3750
- 3600 - All
- 3700
- 3170 - All
- 3250
- 1560 - Can be repaired, only if defect is the power supply
- 1550 - Can be repaired, only if defect is the power supply
- 3350
- 3300
- 1500 - All

6.2.4 *Purchasing Warranty Extension:*

a) ProSoft's standard warranty period is three (3) years from the date of shipment as detailed in "Limited Warranty (page 101)". The Warranty Period may be extended at the time of equipment purchase for an additional charge, as follows:

- Additional 1 year = 10% of list price
- Additional 2 years = 20% of list price
- Additional 3 years = 30% of list price

6.3 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, 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.

6.3.1 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 years from the date of shipment (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. 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 used replacement parts. 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 warranteed 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.

6.3.2 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.

6.3.3 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 of 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.

6.3.4 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.

6.3.5 Disclaimer of all Other Warranties

The Warranty set forth in What Is Covered By This Warranty (page 102) 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.

*6.3.6 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 included, 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.

6.3.7 Time Limit for Bringing Suit

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

6.3.8 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.

6.3.9 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.

6.3.10 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.

Index