ProSoft TECHNOLOGY

Where Automation Connects.

inRAx®

MVI71-DNPSNET

PLC Platform

Distributed Network Protocol Interface Module

September 22, 2008

USER MANUAL

Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation PLC hardware, the MVI71-DNPSNET Module and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

This manual is provided to assist the user. Every attempt has been made to ensure that the information provided is accurate and a true reflection of the product's installation requirements. In order to ensure a complete understanding of the operation of the product, the user should read all applicable Rockwell Automation documentation on the operation of the Rockwell Automation hardware.

Under no conditions will ProSoft Technology be responsible or liable for indirect or consequential damages resulting from the use or application of the product.

Information in this manual is subject to change without notice and does not represent a commitment on the part of ProSoft Technology Improvements and/or changes in this manual or the product may be made at any time. These changes will be made periodically to correct technical inaccuracies or typographical errors.

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.

Power, Input, and Output (I/O) wiring must be in accordance with Class 1, 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.

A Warning - Explosion Hazard - Substitution of components may impair suitability for Class 1, Division 2.
B Warning - Explosion Hazard - When in hazardous locations, turn off power before replacing or wiring modules.
C Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

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.

ProSoft® 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: http://www.prosoft-technology.com
Printed documentation is available for purchase. Contact ProSoft Technology for pricing and availability.
Asia Pacific: +603.7724.2080
Europe, Middle East, Africa: +33.5.34.36.87.20
Latin America: +1.281.298.9109
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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-DNPSNET User Manual
September 22, 2008

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Guide to the MVI71-DNPSNET 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 43) Diagnostics and Troubleshooting (page 33)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	Reference (page 47) Functional Overview (page 49) Product Specifications (page 47)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 91)	This section contains Support, Service and Warranty information. Index of chapters.

1 Start Here

In This Chapter

Installing the MVI71-DNPSNET module requires a reasonable working knowledge of the Rockwell Automation hardware, the MVI71-DNPSNET Module and the application in which they will be used.

Caution: It is important that those responsible for implementation can complete the application without exposing personnel, or equipment, to unsafe or inappropriate working conditions. Safety, quality and experience are key factors in a successful installation.

1.1 System Requirements

The MVI71-DNPSNET 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-DNPSNET 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
- 3.5 inch floppy disk 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-DNPSNET module, and are all required for installation and configuration.

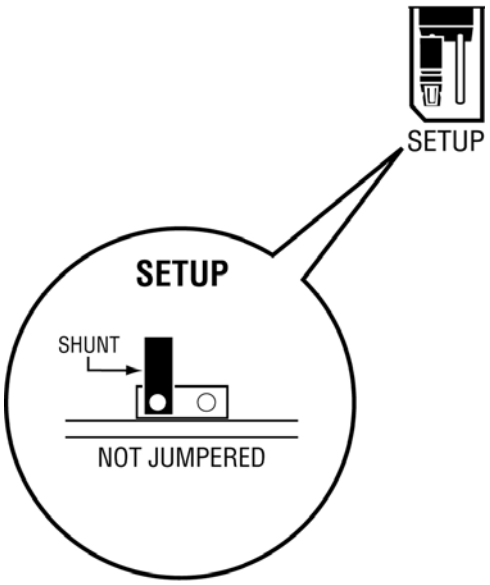
Important: Before beginning the installation, please verify that all of the following items are present.

Qty.	Part Name	Part Number	Part Description
1	MVI71-DNPSNET Module	MVI71-DNPSNET	Distributed Network Protocol Interface Module
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection to the CFG Port
3	Cable	Cable #14, RJ45 to DB9 Male Adapter cable	For DB9 Connection to Module's Port
2	Adapter	1454-9F	Two Adapters, DB9 Female to Screw Terminal. For RS422 or RS485 Connections to Port 1 and 2 of the Module
1	ProSoft Solutions CD		Contains sample programs, utilities and documentation for the MVI71-DNPSNET module.

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

1.3 Setting Jumpers

Note: 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.



1.4 Install the Module in the Rack

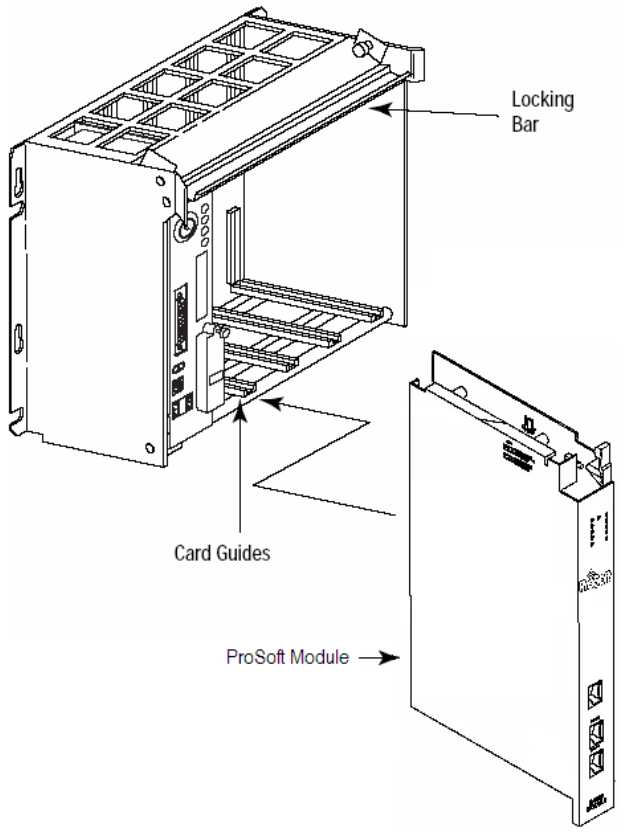
If you have not already installed and configured your PLC processor and power supply, please do so before installing the MVI71-DNPSNET module. Refer to your Rockwell Automation product documentation for installation instructions.

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-DNPSNET 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.



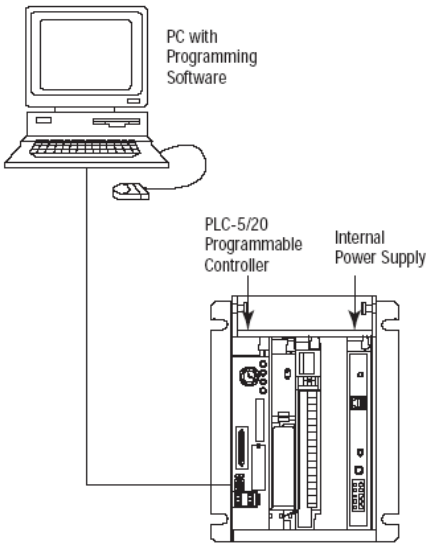
3. With a firm but steady push, snap the module into place.

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.

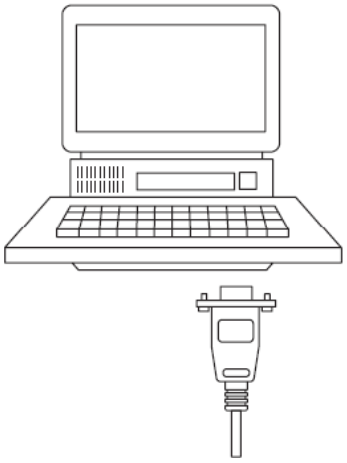
Note: If you insert the module improperly, the system may stop working, or may behave unpredictably.

1.5 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.

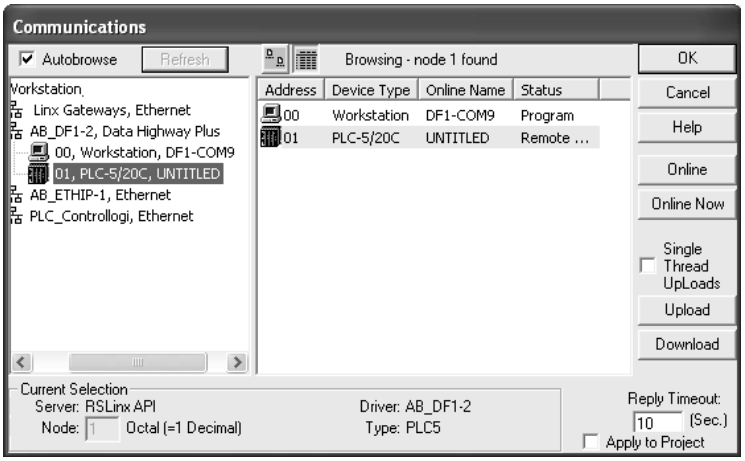


1.6 Download the Sample Program to the Processor

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

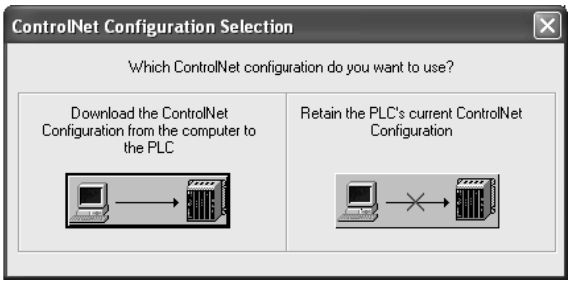
Note: The key switch on the front of the PLC processor must be in the REM position.

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.

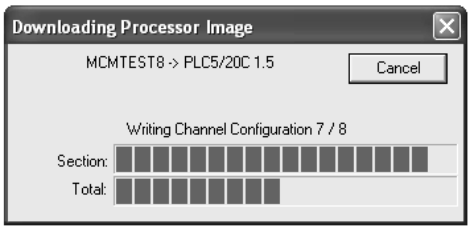


2 Click the Download button to transfer the sample program to the processor.

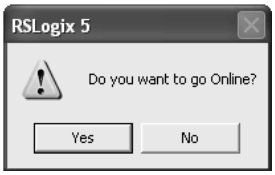
3 When prompted, choose Computer to PLC



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



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.

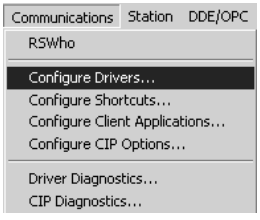


Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

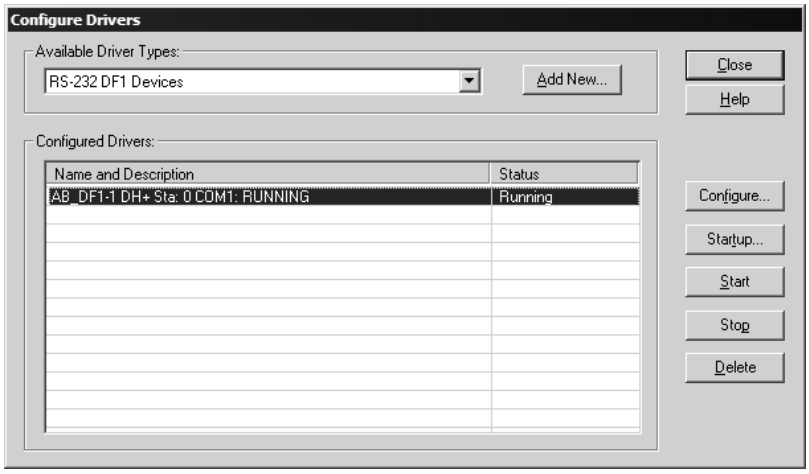
1.6.1 Configuring RSLinx

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.



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.

4 Click the Auto-Configure button. RSLinx will attempt to configure your serial port to work with the selected driver.

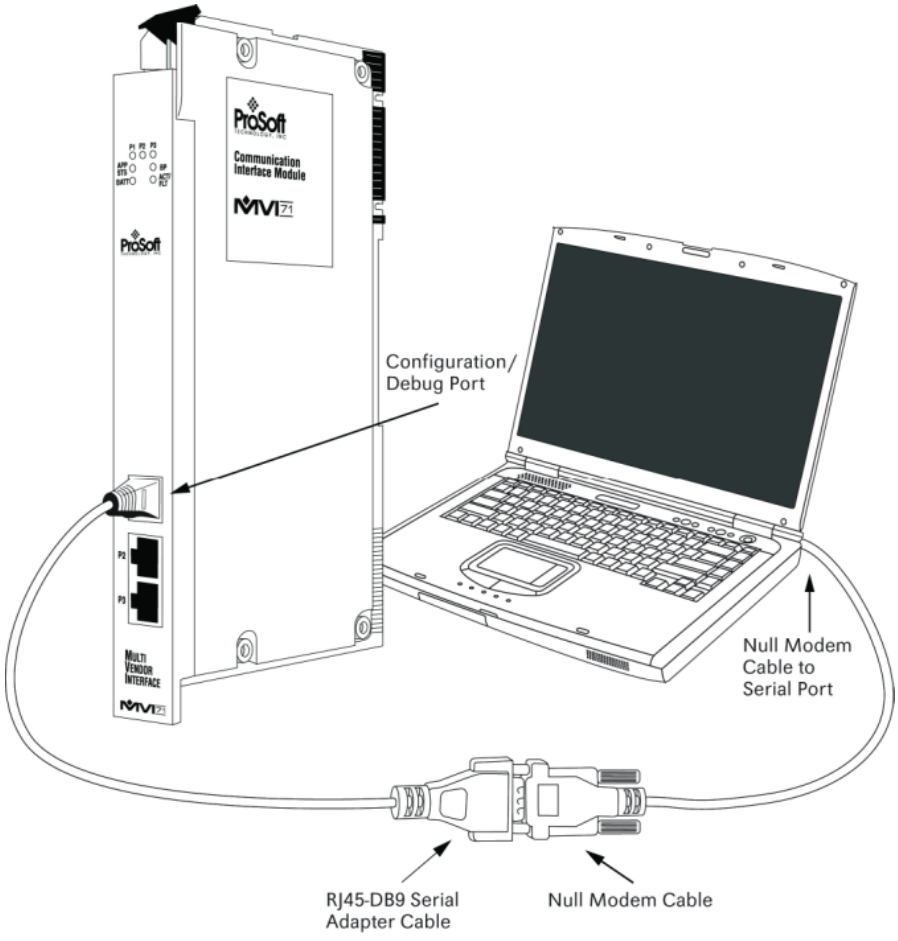
5 When you see the message "Auto Configuration Successful", click the OK button to dismiss the dialog box.

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.

1.7 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 or laptop.



2 Module Configuration

In This Chapter

In order for the MVI71-DNPSNET module to function, a minimum amount of configuration data must be transferred to the module. A text file named DNPSNET.CFG is shipped with the module. This file can serve as a starting point to develop a user application. Edit the file to configure the module for the application.

A terminal server program is used to upload and download the configuration file to the module. An additional file, WATTCP.CFG, must be configured for the specific network on which the module resides.

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.

Before installing and configuring the module, design the application. Determine the number points for each data type. Review the **Application Design** section to aid in application design.

It is now time to edit the DNPSNET.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 DNP Ethernet network if the ladder logic is defined correctly. If the side-connect interface is to be used, you must obtain the side-connect kit, which is sold separately.

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 terminal server to the module's debug/configuration port and exit the program by pressing the Esc key followed by the 'X' key. 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	100	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 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

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 and ready to be used with your application. Insert the module in the rack (with the power turned off) and attach the serial communication cable. Download the new application to the controller and place the processor in run mode. Download the new DNPSNET.CFGfile 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. Refer to the **Diagnostics and Trouble Shooting** section if you encounter errors. Attach a computer or terminal to Port 0 on the module and look at the status of the module using the Configuration/Debug Menu in the module.

2.2 IP Address

In addition to the DNPSNET.CFG, the MVI71-DNPSNET module requires a second configuration file that identifies its Ethernet configuration. Without this configuration file, the module will not communicate properly on the network.

This file contains the Ethernet address information to be used by the module and may be transferred to and from the module from the **Network** command available on the debug port of the module. Please consult your network administrator for the correct settings for your network before placing this or any other Ethernet TCP/IP device upon your network.

Important: If the field "my_ip" does not exist, or if the wattcp.cfg file is corrupted or does not exist, the module will not function.

To set the Module's IP Address

1. Locate the sample configuration files for your module on the ProSoft Solutions CD.
2. Copy the configuration files and ladder to a location on your PC's hard drive. We recommend C:\temp.
3. After you move the files, right-click on each of the files, choose Properties, and clear the READ ONLY check box.
4. Start Notepad.exe, or any other editor that can save plain text files.
5. Open the file WATTCP.CFG. The following example shows the contents of a typical WATTCP.CFG file.

```
# ProSoft Technology
# Default private class 3 address
my_ip=192.168.0.100

# Default class 3 network mask
netmask=255.255.255.0

# The gateway I wish to use
gateway=192.168.0.1,192.168.0.0,255.255.255.0
```

6. Edit the file, using the IP addresses supplied by your network administrator.

Important: The module does not support DHCP (Dynamic Host Configuration Protocol) for obtaining an IP address from a server. This module must have its own static IP address that does not duplicate the IP address of any other device on the Ethernet network.

7. Save the file as WATTCP.CFG. You must now transfer the file to the module. Refer to Transferring WATTCP.CFG to the module (page 26, page 42) for the correct procedure.

2.3 Uploading and Downloading the Configuration File

ProSoft modules are shipped with a pre-loaded configuration file. In order to edit this file, you must transfer the file from the module to your PC. After editing, you must transfer the file back to the module.

This section describes these procedures.

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. For specific information about the configuration/debug menus in your module, refer to The Configuration/Debug Menu (page 33).

2.3.1 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.

2.3.2 Required Software

In order to send and receive data over the serial port (COM port) on your computer to the module, you must use a communication program (terminal emulator).

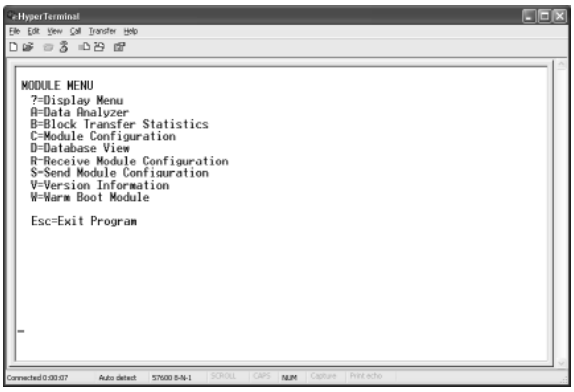
A simple communication program called HyperTerminal is pre-installed with recent versions of Microsoft Windows operating systems. If you are connecting from a machine running DOS, you must obtain and install a compatible communication program. The following table lists communication programs that have been tested by ProSoft Technology.

DOS	ProComm, as well as several other terminal emulation programs
Windows 3.1	Terminal
Windows 95/98	HyperTerminal
Windows NT/2000/XP	HyperTerminal

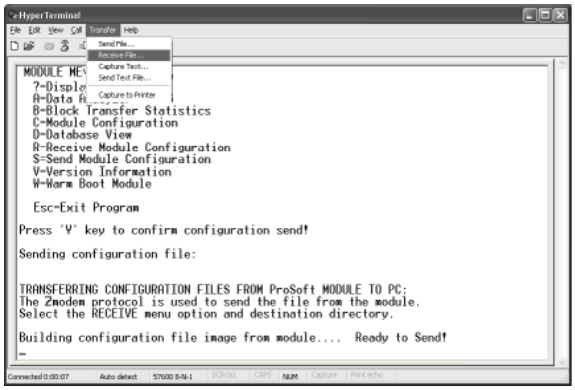
The module uses the Zmodem file transfer protocol to send (upload) and receive (download) configuration files from your module. If you use a communication program that is not on the list above, please be sure that it supports Zmodem file transfers.

2.3.3 Transferring the Configuration File to Your PC

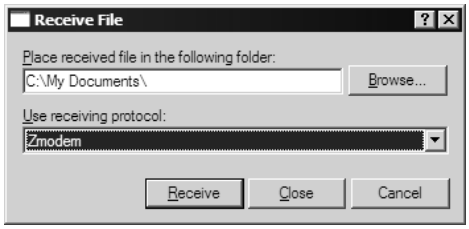
1 Connect your PC to the Configuration/Debug port of the module using a terminal program such as HyperTerminal. Press **[?]** to display the main menu.



2 From the **Transfer** menu in HyperTerminal, select **Receive File**.

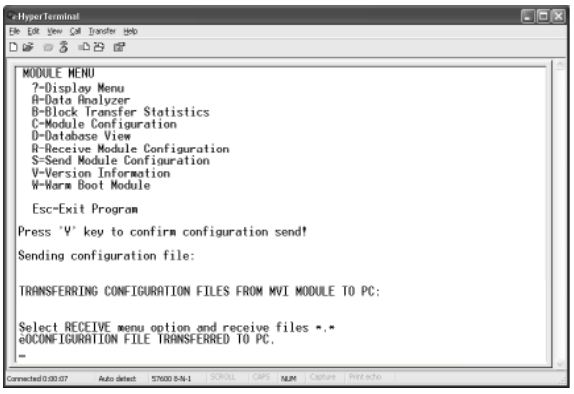


3 In the Receive File dialog box, browse to the location on your PC where the configuration file should be stored, and select Zmodem (or Zmodem with Crash Recovery) as the receiving protocol.



When you have completed your selections, click Close.

4 Press **[S]** (Send Module Configuration), and then press **[Y]** to confirm the transfer.



The file transfer will then begin automatically, using the protocol and location you specified in Step 3.
When the configuration file has been transferred to your PC, the dialog box will indicate that the transfer is complete.

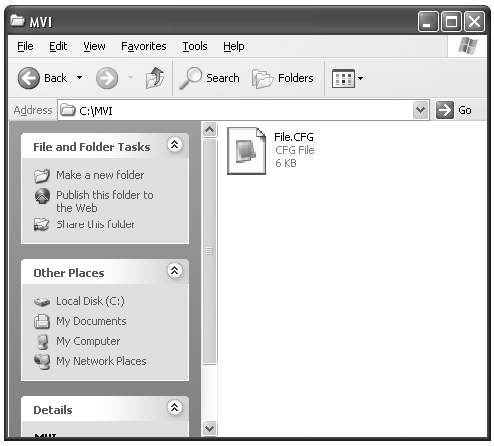
```
Confirm Send Configuration File to Remote PC by pressing 'Y' key....

Sending configuration file:


TRANSFERRING CONFIGURATION FILES FROM MVI MODULE TO PC:


Select RECEIVE menu option and receive files *.*
èOCONFIGURATION FILE TRANSFERRED TO PC.
```

The configuration file is now on your PC at the location you specified.

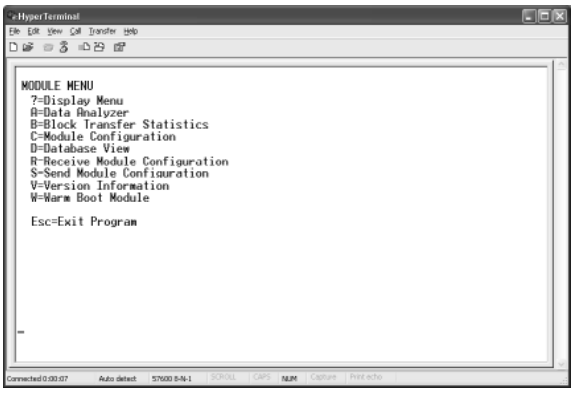


5 You can now open and edit the file in a text editor such as Notepad. When you have finished editing the file, save it and close Notepad.

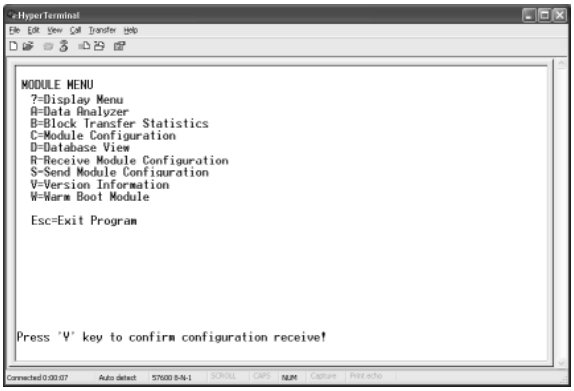
2.3.4 Transferring the Configuration File to the Module

Perform the following steps to transfer a configuration file from your PC to the module.

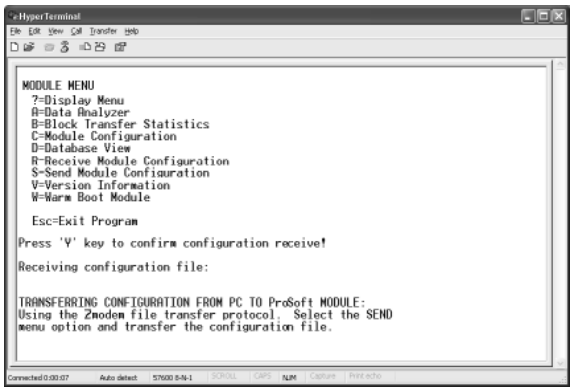
1 Connect your PC to the Configuration/Debug port of the module using a terminal program such as HyperTerminal. Press **[?]** to display the main menu.



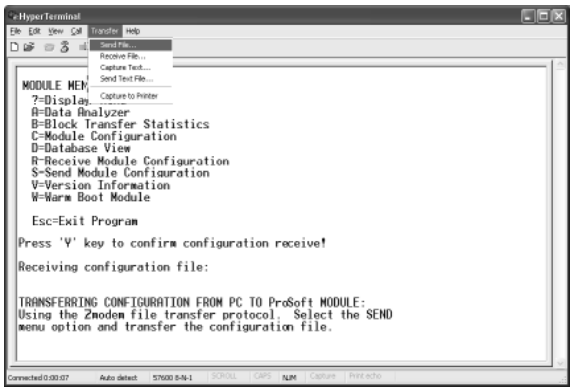
2 Press **[R]** (Receive Module Configuration). The message "Press Y key to confirm configuration receive!" is displayed at the bottom of the screen.



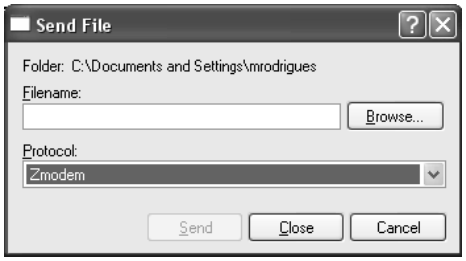
3 Press **[Y]**. The screen now indicates that the PC is ready to send.



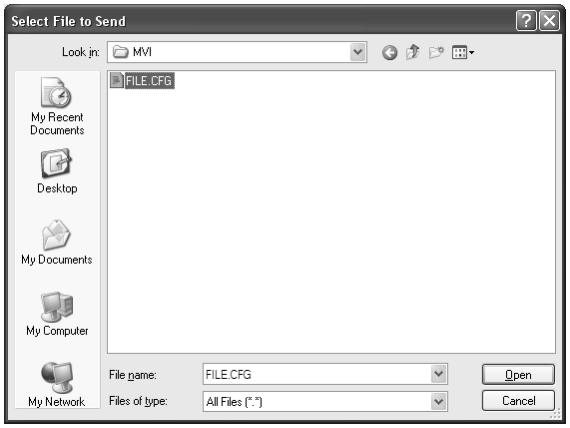
4 From the **Transfer** menu in HyperTerminal, select **Send File**.



The Send File dialog appears.



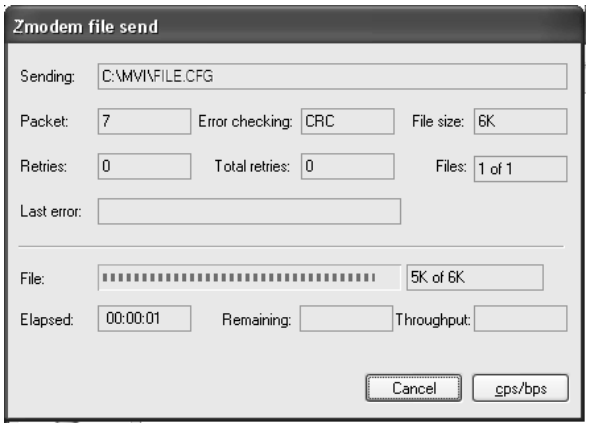
5 Use the Browse button to locate the configuration file your computer.



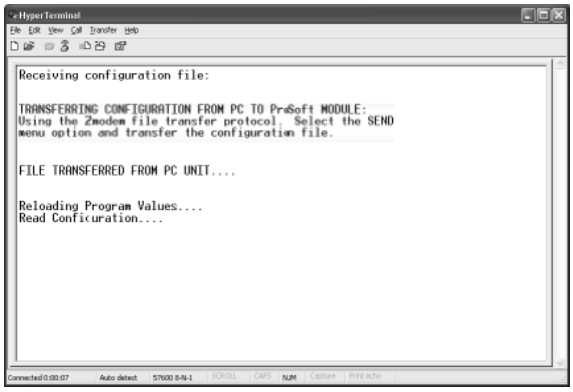
Note: This procedure assumes that you are uploading a newly edited configuration file from your PC to the module. However, configuration files are also available on the ProSoft CD as well as the ProSoft Technology web site.

6 Select Zmodem as the protocol.

7 Click the Send button. This action opens the Zmodem File Send dialog box.



When the upload is complete, the screen indicates that the module has reloaded program values and displays information about the module.



8 Your module now contains the new configuration.

3 Ladder Logic

In This Chapter

Ladder logic is required for application of the MVI71-DNPSNET 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.

3.1 Module Data

All data related to the MVI71-DNPSNET module is stored in a user defined data file. 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.

3.1.1 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 following format:

Word	Variable Name	Description
0	Scan Counter	Program scan counter incremented each time the program loop is executed.
1 to 2	Product Name (ASCII)	These two words contain the product name of the module in ASCII format.
3 to 4	Revision (ASCII)	These two words contain the product revision level of the firmware in ASCII format.
5 to 6	Operating System Revision (ASCII)	These two words contain the module's internal operating system revision level in ASCII format.
7 to 8	Production Run Number (ASCII)	These two words contain the production 'batch' number for the particular chip in the module in ASCII format.
9	Read Block Count	Total number of blocks transferred from the module to the processor.
10	Write Block Count	Total number of blocks transferred from the processor to the module.
11	Parse Block Count	Total number of blocks parsed by the module that were received from the processor.

Word	Variable Name	Description
12	Block number error	Number of BTW requests that resulted in an incorrect BTW identification code.
13	DNP Slave Port total number of message frames received by slave	This value represents the total number of message frames that have matched this slaves address on this port. This count includes message frames which the slave may or may not be able to parse and respond.
14	DNP Slave Port total number of response message frames sent from slave	This value represents the number of good (non-error) responses that the slave has sent to the master on this port. The presumption is that if the slave is responding, the message was good. Note: This is a frame count.
15	DNP Slave Port total number of message frames seen by slave	This value represents the total number of message frames received by the slave, regardless of the slave address.
16	DNP Slave synchronization error count (Physical Layer Error)	This value counts the number of times a sync error occurs. The error occurs when extra bytes are received before the start bytes (0x05 and 0x64) are received.
17	DNP Slave overrun error count (Physical Layer Error)	This value counts the number of times the overrun error occurs. This error occurs when the mainline Data Link Layer routine cannot read the data received on the communication port before it is overwritten.
18	DNP Slave length error count (Physical Layer Error)	This value counts the number of times an invalid length byte is received. If the length of the message does not match the length value in the message, this error occurs.
19	DNP Slave bad CRC error (Data Link Layer Error)	This value counts the number of times a bad CRC value is received in a message.
20	DNP Slave user data overflow error (Transport Layer Error)	This value counts the number of times the application layer receives a message fragment buffer which is too small.
21	DNP Slave sequence error (Transport Layer Error)	This value counts the number of times the sequence numbers of multi-frame request fragments do not increment correctly.
22	DNP Slave address error (Transport Layer Error)	This value counts the number of times the source addresses contained in a multi-frame request fragments do not match.
23	DNP Slave Binary Input Event count	This value contains the total number of binary input events which have occurred.
24	DNP Slave Binary Input Event count in buffer	This value represents the number of binary input events which are waiting to be sent to the master.
25	DNP Slave Analog Input Event count	This value contains the total number of analog input events which have occurred.
26	DNP Slave Analog Input Event count in buffer	This value represents the number of analog input events which are waiting to be sent to the master.
27	DNP Slave bad function code error (Application Layer Error)	This value counts the number of times a bad function code for a selected object/variation is received by the slave device.
28	DNP Slave object unknown error (Application Layer Error)	This value counts the number of times a request for an unsupported object is received by the slave device.

Word	Variable Name	Description
29	DNP Slave out of range error (Application Layer Error)	This value counts the number of times a parameter in the qualifier, range or data field is not valid or out of range.
30	DNP Slave message overflow error (Application Layer Error)	This value counts the number of times an application response message from the slave is too long to transmit.
31	DNP Slave multi-frame message from DNP Master error (Application Layer Error)	This value counts the number of times the slave receives a multi-frame message from the master. The application does not support multi-frame master messages.
32	Free MemoryLSB	Free memory in module
33	Free MemoryMSB	

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 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.

3.1.2 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 DNPSNET.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 DNPSNET.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.

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-DNPSNET module returns a 34-word Status Data block that can be used to determine the module's operating status. This data can be located in the module's database at registers at the location specified in the configuration. This data is transferred to the PLC processor continuously when the side-connect interface is used.

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 8999)
- Version Information
- Control over the module (warm boot and cold boot)
- Facility to upload and download the module's configuration file

4.1.1 The Configuration/Debug Menu

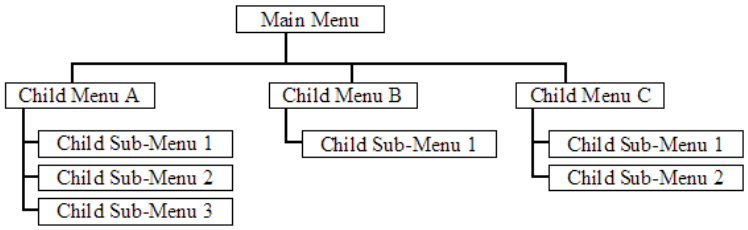
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

Because this is a text-based menu system, you enter commands by typing the command letter from your computer keyboard in the terminal application (for example, HyperTerminal). 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.

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.

4.1.2 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.

4.1.3 Required Software

In order to send and receive data over the serial port (COM port) on your computer to the module, you must use a communication program (terminal emulator).

A simple communication program called HyperTerminal is pre-installed with recent versions of Microsoft Windows operating systems. If you are connecting from a machine running DOS, you must obtain and install a compatible communication program. The following table lists communication programs that have been tested by ProSoft Technology.

DOS	ProComm, as well as several other terminal emulation programs
Windows 3.1	Terminal
Windows 95/98	HyperTerminal
Windows NT/2000/XP	HyperTerminal

The module uses the Zmodem file transfer protocol to send (upload) and receive (download) configuration files from your module. If you use a communication program that is not on the list above, please be sure that it supports Zmodem file transfers.

4.1.4 Using the Configuration/Debug Port

To connect to the module's Configuration/Debug port:

1. Connect your computer to the module's port using a null modem cable.
2. Start the communication program on your computer and configure the communication parameters with the following settings:

Baud Rate	57,600
Parity	None
Data Bits	8
Stop Bits	1
Software Handshaking	None

3. Open the connection. When you are connected, press the **[?]** key on your keyboard. If the system is set up properly, you will see a menu with the module name followed by a list of letters and the commands associated with them.

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. Verify that RSLinx is not controlling the COM port. Refer to Disabling the RSLinx Driver for the Com Port on the PC (page 63).
3. Verify that your communication software is using the correct settings for baud rate, parity and handshaking.
4. 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, you can contact ProSoft Technology Technical Support for further assistance.

4.1.5 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:

```
DNP ETHERNET SERVER COMMUNICATION MODULE
  ?=Display Menu
  B=Block Transfer Statistics
  C=Module Configuration
  D=Database View
  I=DNP Menu
  R=Receive Configuration File
  S=Send Configuration File
  V=Version Information
  W=Warm Boot Module
  @=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 DNP Menu

Press **[I]** from the Main Menu to open the DNP Menu. This menu allows you to view all data associated with the DNP Server driver. For more information about the commands on this menu, refer to DNP Menu (page 38).

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 (page 23).

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 (page 23).

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.

Opening the Network Menu

Press **[@]** to open the network menu. The network menu allows you to send, receive and view the WATTCP.CFG file that contains the IP, gateway and other network specification information. You can find more information about the commands on this menu in the Network Menu (page 42) section.

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 ROM to configure the module.

4.1.6 DNP Menu

This opens the DNP menu. After the option is selected, press the '?' key to display the menu and the following is displayed:

```
DNP ETHERNET PROTOCOL MENU
  ?=Display Menu
  B=DNP Set Up & Pointers
  C=DNP Configuration
  D=DNP Database View
  I=List of valid hosts
  M=Return to Main Menu
  1=DNP Communication Status
  2=TCP Socket Status
  3=UDP Socket Status
```

Each option on the menu is discussed in the following topics.

Viewing DNP Set Up & Pointers

Press **[B]** to display the memory allocation and the database setup parameters.

Viewing DNP Configuration

Press **[C]** to displays the configuration information for the server. Use this command to confirm that the module is configured as desired. If any parameter is not set correctly, adjust the configuration file and download the altered file to the unit.

Opening the DNP Database View Menu

Press **[D]** to open the DNP Database View menu. Use this command to display the database associated with each data type.

Viewing a List of Valid Hosts

Press **[I]** to view the list of IP addresses from which the module will accept connections This list is only used if the module configuration parameter, Use IP List, is set to a value other than 0.

Returning to the Main Menu

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

Viewing DNP Communication Status

Press **[1]** to view DNP Communication Status. Use this command to view the communication status data for the DNP driver.

Viewing TCP Socket Status

Press **[2]** to view the status of the TCP socket in the module. After selecting the option, the following is displayed:

```
TCP SOCKET STATUS
Rx Count       : -20148
Tx Count       : -20146
Tx State       : 0
TCP State      : 1
Busy Flag      : 0
App Frame      : 0
Tx Frame       : 1
Packet Length  : 0
```

The parameters displayed have the following definitions:

Rx Count - Number of messages received on TCP socket

Tx Count - Number of messages transmitted on TCP socket

Tx State - 0=not transmitting, 1=transmitting

TCP State - Value used for TCP/IP socket state machine

Busy Flag - 0=not busy, 1=TCP has control of DNP server, 2=UDP has control of DNP server, 3=Unsolicited message being sent

App Frame - 0=no application data frame data, 1=application data available

Tx Frame - 0=Data link level frame ready to send, 1=Data link level message not ready to send

Packet Length - Length of message left to process

Viewing UDP Socket Status

Press **[3]** to view the status of the UDP socket in the module. After selecting the option, the following is displayed:

```
UDP SOCKET STATUS
Rx Count       : 0
Tx Count       : 0
Tx State       : 0
UDP State      : 0
Busy Flag      : 0
App Frame      : 0
Tx Frame       : 1
Packet Length  : 0
```

The parameters displayed have the following definitions:

Rx Count - Number of messages received on UDP socket

Tx Count - Number of messages transmitted on UDP socket

Tx State - 0=not transmitting, 1=transmitting

TCP State - Value used for UDP/IP socket state machine

Busy Flag - 0=not busy, 1=TCP has control of DNP server, 2=UDP has control of DNP server, 3=Unsolicited message being sent

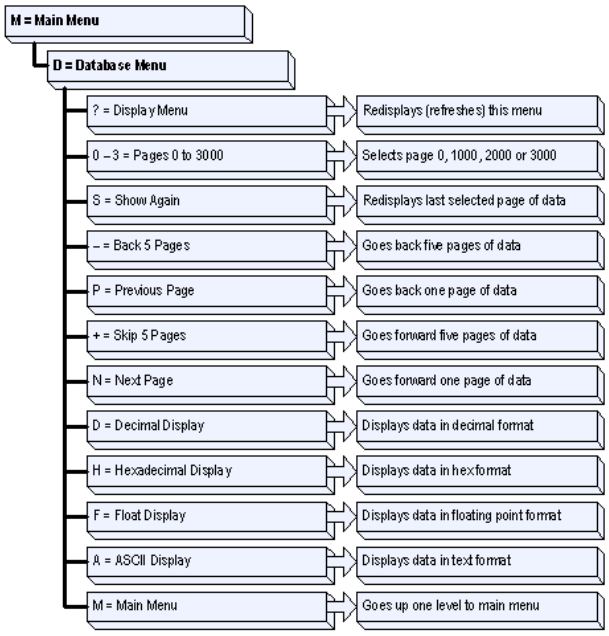
App Frame - 0=no application data frame data, 1=application data available

Tx Frame - 0=Data link level frame ready to send, 1=Data link level message not ready to send

Packet Length - Length of message left to process

4.1.7 Database View Menu

Press **[D]** from the Main Menu to open the Database View menu. Use this menu command to view the current contents of the module's database. Press **[?]** to view a list of commands available on this menu.



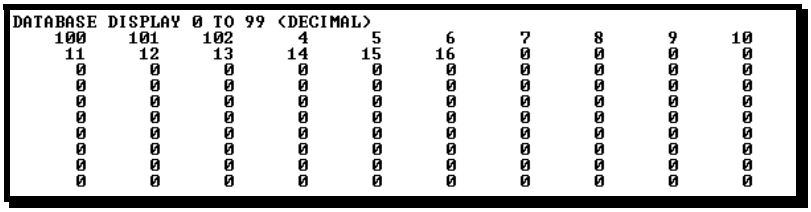
Viewing Register Pages

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.

Displaying the Current Page of Registers Again



This screen displays the current page of 100 registers in the database.

Moving Back Through 5 Pages of Registers

Press **[-]** from the Database View menu to skip back to the previous 500 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.

Skipping 500 Registers of Data

Hold down **[Shift]** and press **[=]** to skip forward to the next 500 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

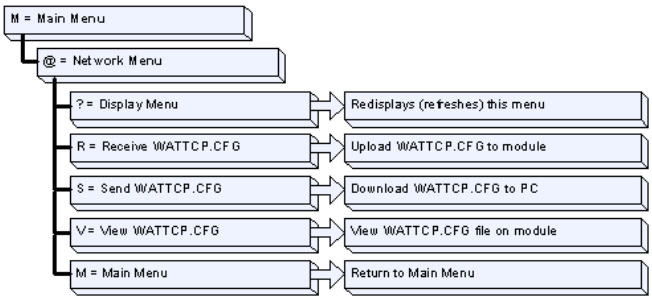
Press **[A]** to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

Returning to the Main Menu

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

4.1.8 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 specification information.



Transferring WATTCP.CFG to the module

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

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

Transferring WATTCP.CFG to the PC

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

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

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

Viewing the WATTCP.CFG file on the module

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

```
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
```

Returning to the Main Menu

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 Status	Amber	Off	The MVI71-DNPSNET is working normally.
		On	The MVI71-DNPSNET module program has recognized a communication error on one of its DNP ports.
BP	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 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.

In addition to these LEDs, the module contains two LEDs under the module's door. The LED on the left (green) displays the link status. If the module is connected properly to a hub, this LED should be illuminated. The LED on the right (amber) is the data indication LED. Whenever the module is sending or receiving data on the Ethernet interface, this LED is illuminated.

4.2.1 Ethernet LED Indicators

LED	State	Description
Data	Off	No activity on the port.
	Green Flash	The port is either actively transmitting or receiving data.
Link	Off	No connection to hub or network is detected.
	Green Solid	Connected to hub or network correctly. This is the normal operating state.

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 in the rack configuration has been set up 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	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.

4.2.4 Error Status Table

The program maintains an error/status table that is transferred to the processor in each read block. Ladder logic should be programmed to accept this block of data and place it in the module's controller tag. You can use the error/status data to determine the "health" of the module.

The data in the block is structured as shown in the following table.

Word	Variable Name	Description
0	Scan Counter	Program scan counter incremented each time the program loop is executed.
1 to 2	Product Name (ASCII)	These two words contain the product name of the module in ASCII format.
3 to 4	Revision (ASCII)	These two words contain the product revision level of the firmware in ASCII format.
5 to 6	Operating System Revision (ASCII)	These two words contain the module's internal operating system revision level in ASCII format.
7 to 8	Production Run Number (ASCII)	These two words contain the production 'batch' number for the particular chip in the module in ASCII format.
9	Read Block Count	Total number of blocks transferred from the module to the processor.
10	Write Block Count	Total number of blocks transferred from the processor to the module.
11	Parse Block Count	Total number of blocks parsed by the module that were received from the processor.
12	Block number error	Number of BTW requests that resulted in an incorrect BTW identification code.
13	DNP Slave Port total number of message frames received by slave	This value represents the total number of message frames that have matched this slaves address on this port. This count includes message frames which the slave may or may not be able to parse and respond.
14	DNP Slave Port total number of response message frames sent from slave	This value represents the number of good (non-error) responses that the slave has sent to the master on this port. The presumption is that if the slave is responding, the message was good. Note: This is a frame count.
15	DNP Slave Port total number of message frames seen by slave	This value represents the total number of message frames received by the slave, regardless of the slave address.
16	DNP Slave synchronization error count (Physical Layer Error)	This value counts the number of times a sync error occurs. The error occurs when extra bytes are received before the start bytes (0x05 and 0x64) are received.
17	DNP Slave overrun error count (Physical Layer Error)	This value counts the number of times the overrun error occurs. This error occurs when the mainline Data Link Layer routine cannot read the data received on the communication port before it is overwritten.
18	DNP Slave length error count (Physical Layer Error)	This value counts the number of times an invalid length byte is received. If the length of the message does not match the length value in the message, this error occurs.
19	DNP Slave bad CRC error (Data Link Layer Error)	This value counts the number of times a bad CRC value is received in a message.

Word	Variable Name	Description
20	DNP Slave user data overflow error (Transport Layer Error)	This value counts the number of times the application layer receives a message fragment buffer which is too small.
21	DNP Slave sequence error (Transport Layer Error)	This value counts the number of times the sequence numbers of multi-frame request fragments do not increment correctly.
22	DNP Slave address error (Layer Error) (Transport	This value counts the number of times the source addresses contained in a multi-frame request fragments do not match.
23	DNP Slave Binary Input Event count	This value contains the total number of binary input events which have occurred.
24	DNP Slave Binary Input Event count in buffer	This value represents the number of binary input events which are waiting to be sent to the master.
25	DNP Slave Analog Input Event count	This value contains the total number of analog input events which have occurred.
26	DNP Slave Analog Input Event count in buffer	This value represents the number of analog input events which are waiting to be sent to the master.
27	DNP Slave bad function code error (Application Layer Error)	This value counts the number of times a bad function code for a selected object/variation is received by the slave device.
28	DNP Slave object unknown error (Application Layer Error)	This value counts the number of times a request for an unsupported object is received by the slave device.
29	DNP Slave out of range error (Application Layer Error)	This value counts the number of times a parameter in the qualifier, range or data field is not valid or out of range.
30	DNP Slave message overflow error (Application Layer Error)	This value counts the number of times an application response message from the slave is too long to transmit.
31	DNP Slave multi-frame message from DNP Master error (Application Layer Error)	This value counts the number of times the slave receives a multi-frame message from the master. The application does not support multi-frame master messages.
32	Free Memory LSB	Free memory in module
33	Free Memory MSB	

5 Reference

In This Chapter

5.1 Product Specifications

The MVI71 DNP 3.0 Server over Ethernet Communications Module supports the implementation of the DNP 3.0 (Distributed Network Protocol) over Ethernet, allowing PLC processors to easily communicate with host systems supporting the protocol. The module supports DNP Subset Level 2 features and some Level 3 features.

5.1.1 Features and Benefits

The MVI71-DNPSNET (Distributed Network Protocol Module over Ethernet) allows PLC processors to easily communicate with other DNP protocol-compatible devices.

The module supports DNP subset level 2 features and some Level 3 features. The MVI71-DNPSNET module acts as an input/output module between the DNP Ethernet network and the Rockwell Automation backplane. The data transfer from the PLC processor is asynchronous from the actions on the DNP network. Databases are defined in the module to house the data required by the protocol.

5.1.2 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.
- Configuration data obtained from configuration text file downloaded to module. Sample configuration file included.

5.1.3 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

5.1.4 Functional Specifications

The MVI71-DNPSNET module accepts DNP commands to control and monitor the data stored in the DNP databases. This data is passed between the module and the PLC processor over the backplane for use in user applications.

- DNP databases to house data for the slave port supporting the following maximum input counts
  - Binary input: 8000 points (500 words)
  - Binary output: 8000 points (500 words)
  - Counter: 250 (500 words)
  - Analog input: 500
  - Analog output: 500
- User-definable module memory usage
- Data movement between module using block-transfer or side-connect interface
- Ethernet port supporting both TCP and UDP over Ethernet
- Supports DNP 3.0 in a level 2 implementation
- Supports sending of input event data from the ladder to the module
- Supports time synchronization from/to processor
- Network configurable via text file
- Status and error information

5.2 Functional Overview

This section provides an overview of how the MVI71-DNPSNET module transfers data using the DNPSNET protocol. You should understand the important concepts in this chapter before you begin installing and configuring the module.

The DNPSNET protocol driver exists as a single service port (DNPSNET port 20000) implementation that supports a single TCP port connection and multiple UDP ports on a TCP/IP Ethernet network. The DNPSNET port operates as a server, supporting the DNP 3.0 protocol in a Level 2 implementation using the DNP User Group recommended extension for use on LAN/WAN. This is published in "Transporting DNP V3.00 over Local and Wide Area Networks", December 15, 1998 by the DNP Users Group and is available on the Internet at http://www.dnp.org.

5.2.1 General Concepts

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

Module Power Up

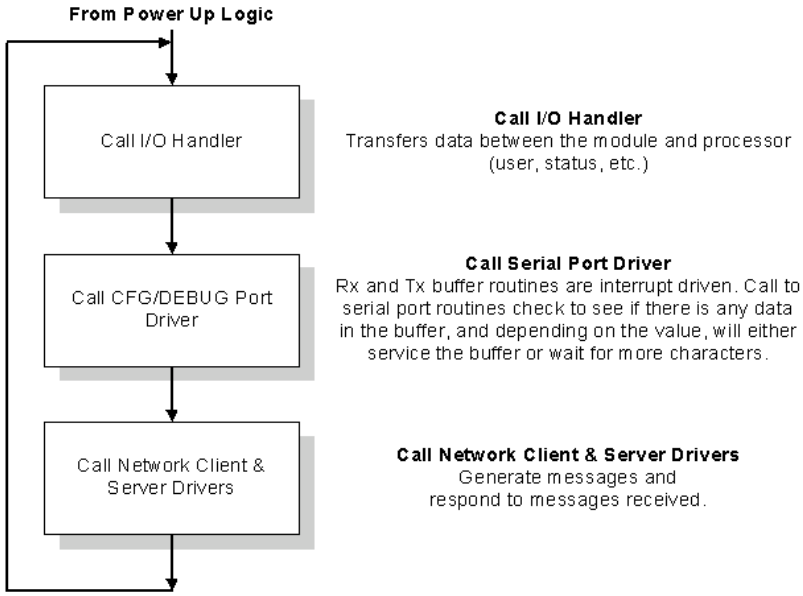
On power up the module begins performing the following logical functions:

1. Initialize hardware components
   - Install packet driver for Ethernet network interface and TCP/IP stack
   - Initialize PLC backplane driver
   - Test and clear all RAM
   - Initialize the serial communication ports
2. Read configuration file from Compact Flash Disk
3. Enable Slave 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.



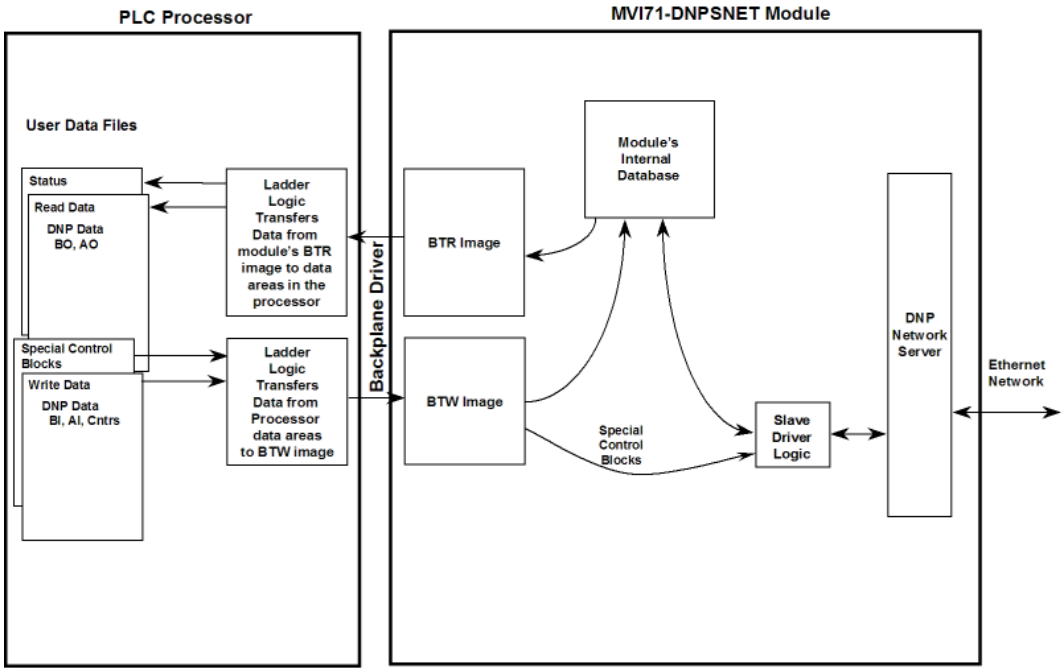
PLC Processor Not in Run

Whenever the module detects that the processor has gone out of the Run Mode (that is, Fault or PGM), the protocol ports can be shut down as prescribed in the user configuration. When the processor is returned to a running state, the module resumes communications on the network.

Backplane Data Transfer

The MVI71-DNPSNET module communicates directly over the PLC backplane. 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 BTW blocks.

The following illustration shows the data transfer method used to move data between the PLC processor, the MVI71-DNPSNET module, and the DNP 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 databases. These databases are defined as virtual DNP data tables with addresses from 0 to the maximum number of points for each data type.

The following illustration shows the layout of the databases:

DATA AREA	
DNP DATA	BINARY INPUTS
	ANALOG INPUTS
	COUNTER DATA
	BINARY OUTPUTS
	ANALOG OUTPUTS
FROZEN DATA	FROZEN COUNTER DATA
LAST VALUE DATA	BINARY INPUTS
	ANALOG INPUTS
EVENT DATA	BINARY INPUT EVENTS
	ANALOG INPUT EVENTS

Data contained in this database is paged through the BTR and BTW images by coordination of the PLC ladder logic and the MVI71-DNPSNET 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.

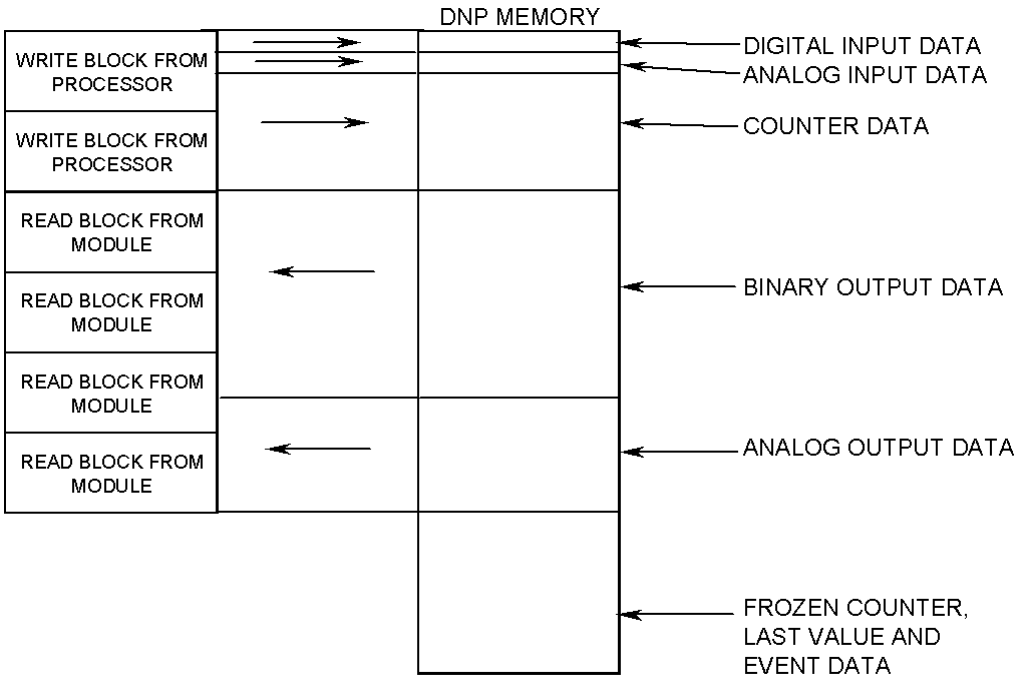
Each block transferred from the module to the processor or from the processor to the module contains a block identification code that describes the content of the block. The following table defines the blocks used by this module:

Block Number	Function/Description
0 or -1	Dummy Blocks: Used by module when no data is to be transferred
1 to 149	DNP Data blocks
1000 to 1148	Output initialization blocks
9958	PLC Binary Input Event data
9959	PLC Analog Input Event Data
9970	Set PLC time using module's DNP time
9971	Set module's time using PLC time
9998	Warm Boot Request from PLC (Block contains no data)
9999	Cold Boot Request from PLC (Block contains no data)

Blocks 1 through 149 transfer data between the module and the processor. Blocks 1000 to 1148 transfer the initial output databases (binary and analog output data) from the processor to the module at startup. Blocks 9958 to 9999 are used for command control of the module. Each group of blocks are described in the following topics.

Normal Data Transfer

Normal data transfer includes the paging of the user data found in the module's internal databases between the module and the controller. These data are transferred through read (BTR) and write (BTW) blocks. Refer to the **Module Configuration** section for a description of the data objects used with the blocks and the ladder logic required. Each data block transferred between the module and the processor has a specific block identification code that defines the data set contained in the block. The following illustration shows the direction of movement of the DNP data types between the module and the processor:



The structure and function of each block is described in the following topics:

Read Block

These blocks of data transfer information from the module to the PLC processor. The structure of the BTR image used to transfer this data is shown in the following table.

Block Offset	Content
0	Read block ID
1	Write block ID
2 to 61	Read data
62 to 63	Spare (Not used)

The Read Block ID is an index value used to determine the location of where the data will be placed in the PLC processor user data file. 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 two blocks of read data and three blocks of write data are to be moved between the module and the processor, the sequence will be as follows:

R1W1→R2W2→R1W3→R2W1→R1W2→R2W3→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 DNP 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 structure of the BTW image used to transfer this data is shown in the following table.

Block Offset	Content
0	Write block ID
1 to 60	Write data
61 to 63	Spare (Not used)

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.

Command Control Blocks

Command control blocks are special blocks used to control the module or request special data from the module. The current version of the software supports several command control blocks each of which is discussed in the following topics.

Block 9958 or 258 - PLC Binary Input Event

If the PLC sends a block 9958, the module will place the binary input event data in the block into the event buffer and alter the data values for the points in the DNP binary input database. The format for the event message is shown in the following table.

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the value of 9958 identifying the event block to the module.
1	Event Count	This field contains the number of events contained in the block. Valid values for this field are 1 to 12.
2	Sequence Counter	This field holds the sequence counter for each 9958 block transfer. This synchronizes and confirms receipt of the block by the module.
3	DNP Binary Input Data point	This is the data point in the DNP binary input database represented by the event.
4	Month/Day/State	Formatted: bits 0 to 4 = Day, bits 8 to 11 = Month, bit 15 = digital state for point. All other bits are ignored.
5	Hour/Minute	Formatted: bits 0 to 5 = Minutes, bits 8 to 12 = Hour. All other bits are ignored.
6	Sec/Millisecond	Formatted: bits 0 to 9 = Milliseconds, bits 10 to 15 = Seconds.
7	Year	This is the four digit year for the event.
8 to 12		Five words of data for Event #2.
13 to 17		Five words of data for Event #3.
18 to 22		Five words of data for Event #4.
23 to 27		Five words of data for Event #5.
28 to 32		Five words of data for Event #6.
33 to 37		Five words of data for Event #7.
38 to 42		Five words of data for Event #8.
43 to 47		Five words of data for Event #9.
48 to 52		Five words of data for Event #10.
53 to 57		Five words of data for Event #11.
58 to 62		Five words of data for Event #12.
63	Spare	Not Used

Up to 12 events can be passed from the PLC to the module in each block. To ensure that the block reached the module and was processed, the module will send a response read block 9958 to the PLC. The format of the block is shown in the following table.

Word Offset in Block	Data Field(s)	Description
0	Block ID	Identification code for block set to 9958.
1	Block ID	Block identification code for request from PLC by the module.
2	Event Count	This field contains the number of events processed by the module.

Word Offset in Block	Data Field(s)	Description
3	Sequence	This field contains the sequence counter of
	Counter	the last successful block 9958 received.
4 to 63	Spare	Not used

The sequence counter field in the returned block is set to the last successfully processed block 9958 from the PLC. Compare this value to that sent by the PLC. If the values match, the events can be removed from the PLC. If the values do not match, or the PLC does not receive a 9958 block, the PLC must re-send the block.

Block 9959 or 259 - PLC Analog Input Event

If the PLC sends a block 9959, the module will place the analog input event data in the block into the event buffer and alter the data values for the points in the DNP analog input database. The format for the event message is shown in the following table.

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the value of 9959 identifying the event block to the module.
1	Event Count	This field contains the number of events contained in the block. Valid values for this field are 1 to 10.
2	Sequence Counter	This field holds the sequence counter for each 9959 block transfer. This synchronizes and confirms receipt of the block by the module.
3	DNP Analog Input Data point	This is the data point in the DNP analog input database represented by the event.
4	Analog Input Value	This is the new analog input value represented in the event.
5	Month/Day	Formatted: bits 0 to 4 = Day, bits 8 to 11 = Month. All other bits are ignored.
6	Hour/Minute	Formatted: bits 0 to 5 = Minutes, bits 8 to 12 = Hour. All other bits are ignored.
7	Sec/Millisecond	Formatted: bits 0 to 9 = Milliseconds, bits 10 to 15 = Seconds.
8	Year	Four digit year value for event.
9 to 14		Six words of data for Event #2.
15 to 20		Six words of data for Event #3.
21 to 26		Six words of data for Event #4.
27 to 32		Six words of data for Event #5.
33 to 38		Six words of data for Event #6.
39 to 44		Six words of data for Event #7.
45 to 50		Six words of data for Event #8.
51 to 56		Six words of data for Event #9.
57 to 62		Six words of data for Event #10.
63	Spare	Not Used

Up to 10 events can be passed from the PLC to the module in each block. To ensure that the block reached the module and was processed, the module will send a response read block 9959 to the PLC. The format of the block is shown in the following table.

Word Offset in Block	Data Field(s)	Description
0	Block ID	Identification code for block set to 9959.
1	Block ID	Block identification code for request from PLC by the module.
2	Event Count	This field contains the number of events processed by the module.
3	Sequence Counter	This field contains the sequence counter of the last successful block 9959 received.
4 to 63	Spare	Not used

The sequence counter field in the returned block is set to the last successfully processed block 9959 from the PLC. Compare this value to that sent by the PLC. If the values match, the events can be removed from the PLC. If the values do not match, or the PLC does not receive a 9959 block, the PLC must re-send the block.

Block 9970 or 270 - Set PLC Time Using Module Time

This block transfers the module's time to the PLC processor. Ladder logic must be used to set the processor's clock using the data received. The format of the block sent from the PLC has the following format:

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the value of 9970 identifying the block type to the module.
1 to 63	Not Used	Not Used

The module responds to the request with a read block 9970 with the following format:

Word Offset in Block	Data Field(s)	Description
0	Block Read ID	This field contains the block identification code of 9970 for the block.
1	Block Write ID	This is the next block requested by the module.
2	Year	This field contains the four-digit year to be used with the new time value.
3	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
4	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
5	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
6	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.

Word Offset in Block	Data Field(s)	Description
7	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
8	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.
9	Remote Time Synchronization	This field informs the PLC if the date and time passed has been synchronized with a remote DNP master device on the module's slave port.
10 to 63	Not Used	Not Used

Block 9971 or 271 - Set Module's Time Using PLC Time

This block sets the clock in the module to match the clock in the PLC processor. If the PLC sends a block 9971, the module will set its time using the data contained the block. The format of the block is shown in the following table.

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the block identification code of 9971 for the block.
1	Year	This field contains the four-digit year to be used with the new time value.
2	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
3	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
4	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
5	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.
6	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
7	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.
8 to 63	Not Used	Not Used

The module responds to a valid 9971 block with a read block of the following format:

Word Offset in Block	Data Field(s)	Description
0	Block Read ID	This field contains the block identification code of 9971 for the block.
1	Block Write ID	This is the next block requested by the module.
2 to 63	Not Used	Not Used

Block 9998 or 255 - Warm Boot Module

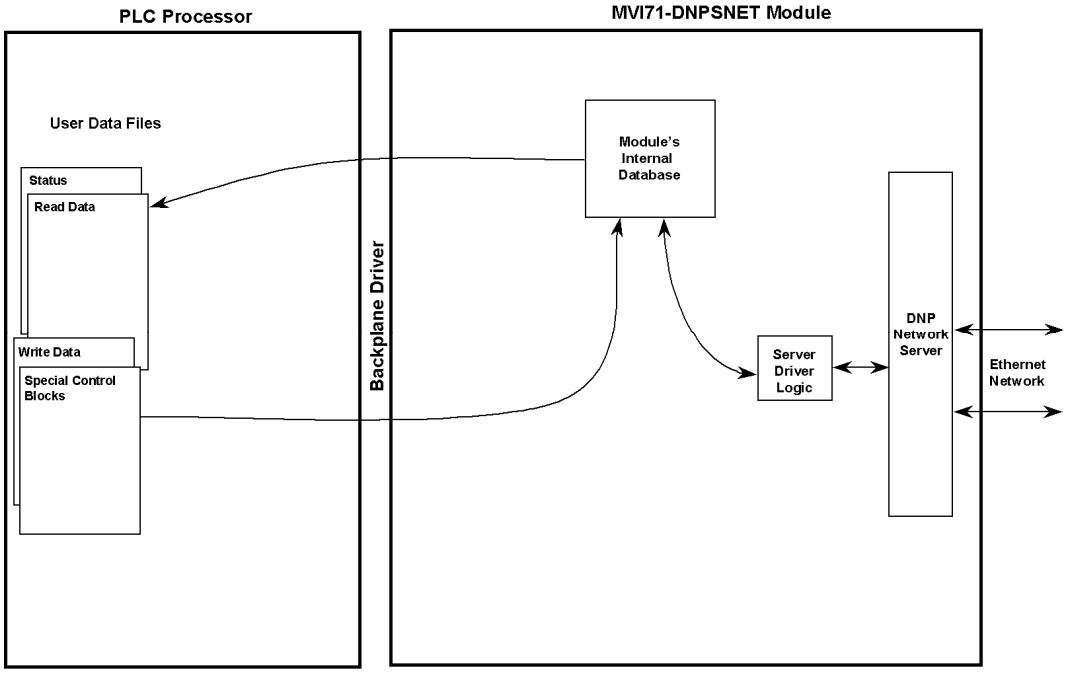
If the PLC sends a block number 9998, the module performs a warm-boot operation.

Block 9999 or 253 - Cold Boot Module

If the PLC sends a block number 9999, the application will perform the cold-boot operation. The module exits the program and performs a soft restart on the module.

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 associated with this interface is shown in the following diagram:



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	100	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

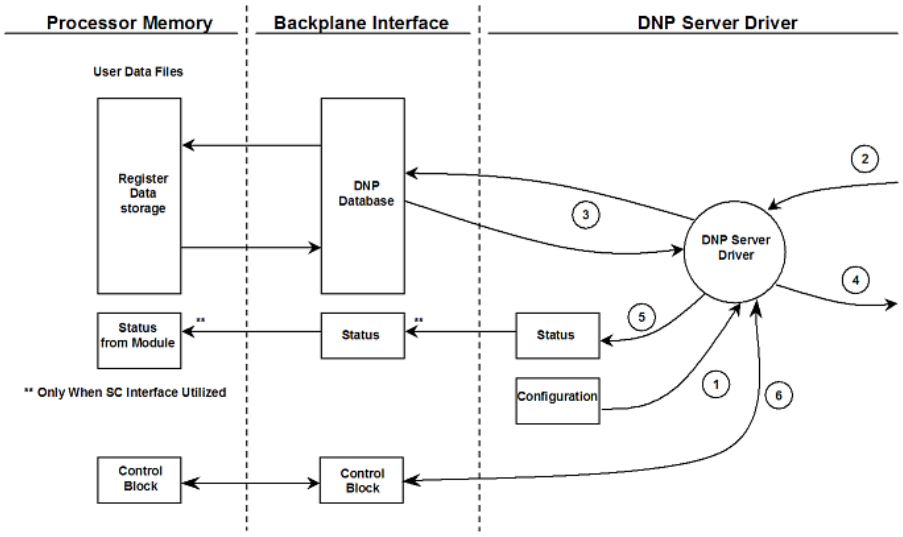
Example of 2300 read and 3500 write data registers (cfg file=10)

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

Command control is also supported on the side-connect interface. A reserved data area in the first user data file for the interface in the PLC is utilized for this function. Starting at register 50 in the file and extending for 64 registers is the location of the data area. The format for the control blocks is identical to that described in the previous sections. The only difference is in the response blocks from the module. Register 50 will be set to zero when the function is complete and register 51 will contain the command control code requested. The BTW block identification code is not included and the data shown starting at word 2 is contained in registers 52 to 113.

Data Flow Between MVI71-DNPSNET Module and the PLC Processor

The following topics describe the flow of data between the two pieces of hardware (PLC processor and MVI71-DNPSNET module) and other nodes on the DNP network for the block-transfer interface. Data is automatically moved between the module and the processor when the side-connect interface is employed. The DNP Server Driver allows the MVI71-DNPSNET module to respond to data read and write commands issued by a master on the DNP network. The following flow chart and associated table describe the flow of data into and out of the module.



Step	Description
1	The configuration information for the module is retrieved from the DNPSNET.CFGfile on the Compact Flash Disk. This information configures the module and define the Ethernet node characteristics.
2	A Host device (DNP Master unit) issues a read or write command to the module's node address. The 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 appropriate 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.
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 Slave Driver.
6	The module constantly monitors for command control blocks from the processor. If a valid block is received, the function is executed. Additionally, data is constantly being exchanged between the module and the processor.

Review the **Module Configuration** section for a complete list of the parameters that must be defined for a slave port.

5.3 Cable Connections

The MVI71-DNPSNET 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-DNPSNET 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-DNPSNET 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.

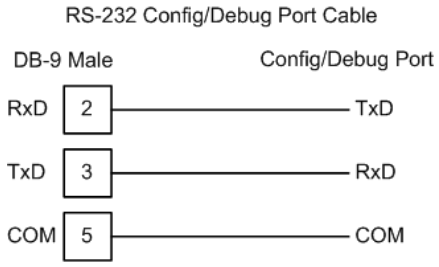
Ethernet Port Configuration - wattcp.cfg

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

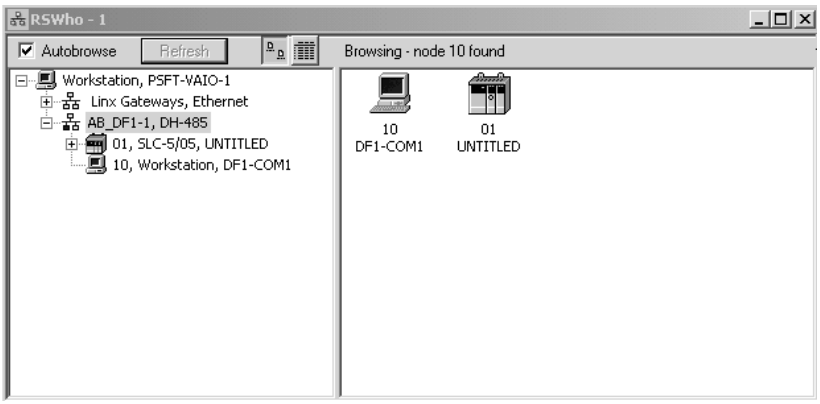
This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC based terminal emulation program to view configuration and status data in the module and to control the module. The cable for communications on this port is shown in the following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



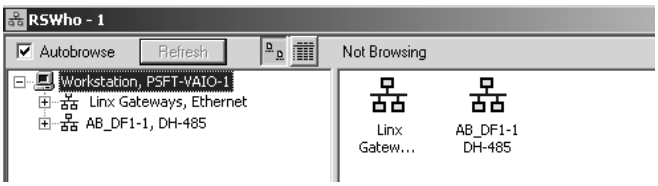
Disabling the RSLinx Driver for the Com Port on the PC

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

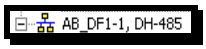
1. Open RSLinx and go to Communications>RSWho
2. Make sure that you are not actively browsing using the driver that you wish to stop. The following shows an actively browsed network:



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

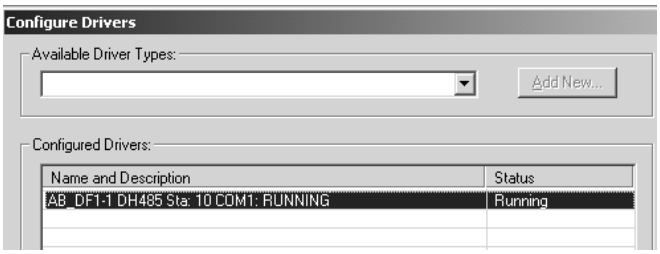


Branches are displayed or hidden by clicking on the ⊞ or the ⊟ icons.

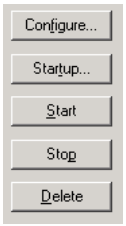


4 When you have verified that the driver is not being browsed, go to

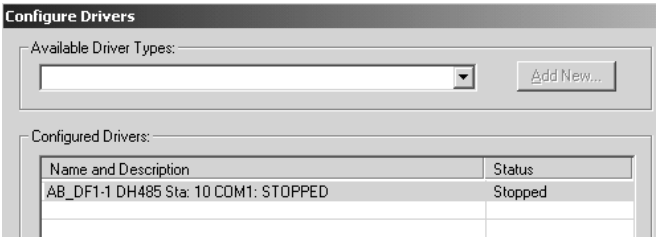
Communications>Configure Drivers
You may see something like this:



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



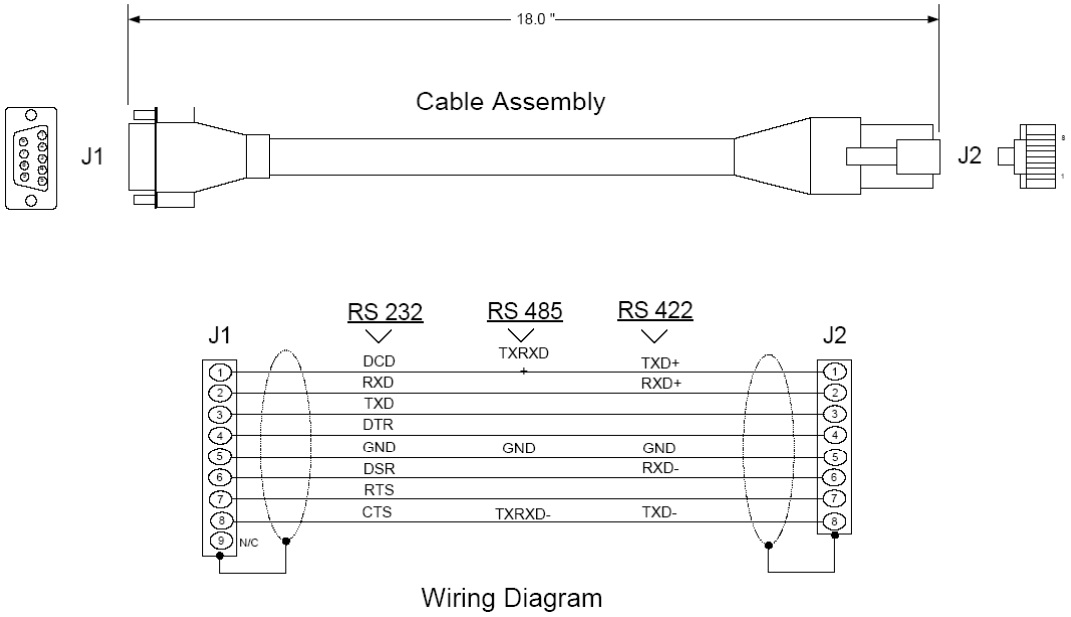
5 After you have stopped the driver you will see the following:



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-DNPSNET Configuration Forms

This section contains listings of the MVI71-DNPSNET module's configuration contained in the DNPSNET.CFG file.

[Section]/Item	Value	Range	Description
[Backplane Configuration]			Backplane transfer parameters
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.
Write Register Start:		0 to 8899	This parameter specifies the starting register in the module where the data transferred from the processor will be placed. Valid range for this parameter is 0 to 8899.

[Section]/Item	Value	Range	Description
Write Register Count:		0 to 8900	This parameter specifies the number of registers to transfer from the processor to the module. Valid entry for this parameter is 0 to 8900.
Read Register Start:		0 to 8899	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 8899.
Read Register Count:		0 to 8900	This parameter specifies the number of registers to be transferred from the module to the processor. Valid entry for this parameter is 0 to 8900.
Failure Flag Count:		0 to 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, the module will stop communications when the preset value is reached based on successive failures.
Error Offset:		0 to 8899	This parameter specifies the register location in the module's database where module status data will be stored. If a value less than 0 is entered, the data will not be stored in the database. If the value specified is in the range of 0 to 8966, the data will be placed in the modules database.
Initialize Output Data:		Y or N	This 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, the data will be initialized with data from the processor.

[Section]/Item	Value	Range	Description
[DNP ENET Slave]			Server and protocol parameters
Internal Slave ID:		0 to 65534	This is the DNP address for the module. All messages with this address from the master will be processed by the module.
Use IP List:		Y or N	This parameter specifies if the IP address of the host connected to the system will be validated. If the parameter is set to N, any host may connect to the unit. If the parameter is set to Y, only hosts in the IP list will be permitted to connect to the module. All other IP addresses will be ignored by the module and the module will issue a RST to the TCP/IP connection.

[Section]/Item	Value	Range	Description
Binary Inputs:		0 to 500 words	Number of digital input points to configure in the DNP slave device based on a word count. Each word stores 16 points. Therefore, if the parameter is set to 2, 32 binary inputs will be defined for the application.
Analog Inputs:		0 to 500 points	Number of analog input points to configure in the DNP slave device. Each point will occupy a one word area in the module memory.
Counters:		0 to 250 points	Number of counter points to configure in the DNP slave device. Each point will occupy a two word area in the module memory. This number corresponds to the number of frozen counters. The application maps the counters to the frozen counters directly.
Binary Outputs:		0 to 500 words	Number of digital output points to configure in the DNP slave device based on a word count. Each word stores 16 points. Therefore, if the parameter is set to 2, 32 binary outputs will be defined for the application.
Analog Outputs:		0 to 500 points	Number of analog output points to configure in the DNP slave device. Each point will occupy a one word area in the module memory.
AI Deadband:		0 to 32767 data units	This value sets the global deadband for all analog input points. When the current value for an analog input point is not within the deadband limit set based on the last event for the point, an event will be generated.
Select/Operate Arm Time:		1 to 65535 milliseconds	Time period after select command received in which operate command will be performed. After the select command is received, the operate command will only be honored if it arrives within this period of time.
Write Time Interval:		0 to 1440 minutes	Time interval to set the need time IIN bit (0=never), which will cause the master to write the time. Stored in milliseconds in the module memory.
App Layer Confirm Tout:		1 to 65535 milliseconds	Event data contained in the last response may be sent again if not confirmed within the millisecond time period set. If application layer confirms are used with data link confirms, ensure that the application layer confirm timeout is set long enough.
Unsolicited Response:		Y or N	Set if the slave unit will send unsolicited response messages. If set to N, the slave will not send unsolicited responses. If set to Y, the slave will send unsolicited responses.
Class 1 Unsol Resp Min:		1 to 255 events	Minimum number of events in Class 1 required before an unsolicited response will be generated.

[Section]/Item	Value	Range	Description
Class 2 Unsol Resp Min:		1 to 255 events	Minimum number of events in Class 2 required before an unsolicited response will be generated.
Class 3 Unsol Resp Min:		1 to 255 events	Minimum number of events in Class 3 required before an unsolicited response will be generated.
Unsol Resp Delay:		0 to 65535 milliseconds	Maximum number of 1 millisecond intervals to wait after an event occurs before sending an unsolicited response message. If set to 0, only use minimum number of events.
Uresp Master Address:		0 to 65534	DNP destination address where unsolicited response messages are sent.
AI Events with time:		Y or N	This parameter sets if the analog input events generated by the module will include the date and time of the event. If the parameter is set to N, the default is set to no time data. If the parameter is set to Y, the default object will include the time of the event.
Time Sync Before Events:		Y or N	This parameter determines if events are to be generated by the module before the time synchronization from the master unit. If the parameter is set to N, events will be generated irrespective of the module's time sync status. If the parameter is set to Y, events will be generated only if the module's time is synchronized.

[Section]/Item	Value	Range	Description
[DNP ENET IP Addresses]			List of valid IP addresses accepted by module
START			
# Insert the list of IP addresses for the host(s) to connect to this unit. Only used if Use IP List set to 1.			
END			

5.5 MVI71-DNPSNET Status Data

This section contains a listing of the MVI71-DNPSNET module's status data area.

Word	Variable Name	Description
0	Scan Counter	Program scan counter incremented each time the program loop is executed.
1 to 2	Product Name (ASCII)	These two words contain the product name of the module in ASCII format.
3 to 4	Revision (ASCII)	These two words contain the product revision level of the firmware in ASCII format.
5 to 6	Operating System Revision (ASCII)	These two words contain the module's internal operating system revision level in ASCII format.
7 to 8	Production Run Number (ASCII)	These two words contain the production 'batch' number for the particular chip in the module in ASCII format.
9	Read Block Count	Total number of blocks transferred from the module to the processor.
10	Write Block Count	Total number of blocks transferred from the processor to the module.
11	Parse Block Count	Total number of blocks parsed by the module that were received from the processor.
12	Block number error	Number of BTW requests that resulted in an incorrect BTW identification code.
13	DNP Slave Port total number of message frames received by slave	This value represents the total number of message frames that have matched this slaves address on this port. This count includes message frames which the slave may or may not be able to parse and respond.
14	DNP Slave Port total number of response message frames sent from slave	This value represents the number of good (non-error) responses that the slave has sent to the master on this port. The presumption is that if the slave is responding, the message was good. Note: This is a frame count.
15	DNP Slave Port total number of message frames seen by slave	This value represents the total number of message frames received by the slave, regardless of the slave address.
16	DNP Slave synchronization error count (Physical Layer Error)	This value counts the number of times a sync error occurs. The error occurs when extra bytes are received before the start bytes (0x05 and 0x64) are received.
17	DNP Slave overrun error count (Physical Layer Error)	This value counts the number of times the overrun error occurs. This error occurs when the mainline Data Link Layer routine cannot read the data received on the communication port before it is overwritten.
18	DNP Slave length error count (Physical Layer Error)	This value counts the number of times an invalid length byte is received. If the length of the message does not match the length value in the message, this error occurs.
19	DNP Slave bad CRC error (Data Link Layer Error)	This value counts the number of times a bad CRC value is received in a message.
20	DNP Slave user data overflow error (Transport Layer Error)	This value counts the number of times the application layer receives a message fragment buffer which is too small.

Word	Variable Name	Description
21	DNP Slave sequence error (Transport Layer Error)	This value counts the number of times the sequence numbers of multi-frame request fragments do not increment correctly.
22	DNP Slave address error (Transport Layer Error)	This value counts the number of times the source addresses contained in a multi-frame request fragments do not match.
23	DNP Slave Binary Input Event count	This value contains the total number of binary input events which have occurred.
24	DNP Slave Binary Input Event count in buffer	This value represents the number of binary input events which are waiting to be sent to the master.
25	DNP Slave Analog Input Event count	This value contains the total number of analog input events which have occurred.
26	DNP Slave Analog Input Event count in buffer	This value represents the number of analog input events which are waiting to be sent to the master.
27	DNP Slave bad function code error (Application Layer Error)	This value counts the number of times a bad function code for a selected object/variation is received by the slave device.
28	DNP Slave object unknown error (Application Layer Error)	This value counts the number of times a request for an unsupported object is received by the slave device.
29	DNP Slave out of range error (Application Layer Error)	This value counts the number of times a parameter in the qualifier, range or data field is not valid or out of range.
30	DNP Slave message overflow error (Application Layer Error)	This value counts the number of times an application response message from the slave is too long to transmit.
31	DNP Slave multi-frame message from DNP Master error (Application Layer Error)	This value counts the number of times the slave receives a multi-frame message from the master. The application does not support multi-frame master messages.
32	Free Memory LSB	Free memory in module
33	Free MemoryMSB	

5.6 MVI71-DNPSNET Module Internal Indication Bits (IIN Bits) for DNP Server

The internal indication bits are stored in a word that follows the function code in all response messages. These bits report status and error information to the master DNP device. The following description describes the word.

5.6.1 First Byte

Bit	Description
0	All stations message received. Set when a request is received with the destination address set to 0xffff. Cleared after next response. Used to let the master station know that the broadcast was received.
1	Class 1 data available. Set when class 1 data is ready to be sent from the slave to the master. Master should request class 1 data when this bit is set.
2	Class 2 data available. Set when class 2 data is ready to be sent from the slave to the master. Master should request class 2 data when this bit is set.

Bit	Description
3	Class 3 data available. Set when class 3 data is ready to be sent from the slave to the master. Master should request class 3 data when this bit is set.
4	Time synchronization required from the master. The master should write the date and time when the bit is set. After receiving the write command, the bit will be cleared.
5	Slave digital outputs are in local control. This bit is not used in this application.
6	Not used
7	Device restart. This bit is set when the slave either warm or cold boots. It is cleared after a master writes a 0 to the bit.

5.6.2 Second Byte

Bit	Description
0	Bad function code. The function code contained in the master request is not supported for the specified object/variation.
1	Requested object(s) unknown. Object requested by master is not supported by the application.
2	Parameters in the qualifier, range, or data fields are not valid or out of range for the slave.
3	Event buffer(s) or other application buffers have overflowed. This bit is also set if the slave receives a multi-frame message from the master.
4	Request understood but the requested operation is already executing. The slave will never set this bit.
5	Not used.
6	Reserved. Always 0.
7	Reserved. Always 0.

5.7 Device Profile

DNP V3.00
DEVICE PROFILE DOCUMENT

Vendor Name:	ProSoft Technology, Inc.
Device Name:	MVI71-DNPSNET (VERSION 1.00)

Highest DNP Level Supported : For Request: L2 For Responses: L2	Device Function: Slave (TCP/IP Server (Data Provider))

Notable objects, functions, and/or qualifiers supported in addition to the highest DNP level stated above (see attached table for complete list):
Definition of selected IIN bits: Device Trouble - PLC data transfer operation is not taking place and

Supports both TCP and UDP protocols as specified in the recommendation document. Supports new function 24 and object 50 variation 3 for time synchronization. Supports list of valid IP addresses for clients to connect (may be disabled by user). Setting of IP list secure. Supports receipt of multiple messages in a single network packet.

The following features are configurable on the module: Time sync before events are generated and default analog input events, Obj32V4 or O32V2, select option.

Counter Freeze with reset will not zero values in the processor. Therefore, this function should not be utilized.

Module will not generate events until Restart IIN bit is cleared by DNP master.

Maximum Data Link Frame Size (octets): Transmitted : 292 Received : 292	Maximum Application Fragment Size (octets): Transmitted : 2048 Received : 2048
Maximum Data Link Re-tries: Configurable	Maximum Application Layer Re-tries: None

Requires Data Link Layer Confirmation:
Always set to Never as defined in recommendation

Requires Application Layer Confirmation:
When reporting Event Data as a slave unit

Time-outs while waiting for:

Data Link Confirm	: NA
Complete Application Fragment	: Configurable at module start-up
Application Confirm	: Configurable at module start-up (1 to 65535 mSec)
Complete Application Response	: None

Sends/Executes Control Operations:

WRITE Binary Outputs	: Never
SELECT/OPERATE	: Always
DIRECT OPERATE	: Always
DIRECT OPERATE-NO ACK	: Always
Count > 1	: Always (1 to 65535)
Pulse On	: Always
Pulse Off	: Always
Latch On	: Always
Latch Off	: Always
Queue	: Never
Clear Queue	: Never

Reports Binary Input Change Events when no specific variation requested: Only time-tagged	Reports time-tagged Binary Input Change Events when no specific variation requested: Binary Input Change with Time
Sends Unsolicited Responses: This is configurable at module start-up. If the number of events for the Binary or Analog Input Events is greater than 0, unsolicited responses are supported. Use the Enable/Disable Unsolicited function code from the DNP master for control.	Sends Static Data in Unsolicited Responses: Never
Default Counter Object/Variation: Object : 20 Variation : 5	Counters Roll Over at: 32 Bits
Sends Multi-Fragment Responses: Yes	

5.8 DNP Subset Definition

OBJECT			REQUEST		RESPONSE			
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	NOTES
1	0	Binary Input - All Variations	1	06			1	Slave will return variation 1 data
	1	Binary Input	1	06	129, 130	00, 01	1	Slave will return this variation
	2	Binary Input with Status			129, 130	00, 01	8	Slave will return Unknown Object to this request
2	0	Binary Input Change - All Variations	1	06, 07, 08			56	Slave will return variation 2 data
	1	Binary Input Change Without Time	1	06, 07, 08	129, 130	17, 28	8	Slave will return this variation
	2	Binary Input Change With Time	1	06, 07, 08	129, 130	17, 28	56	Slave will return this variation
	3	Binary Input Change With Relative Time	1	06, 07, 08	129, 130	17, 28	24	Slave will parse this message and return no data
10	0	Binary Output - All Variations	1	06			8	Slave will return variation 2 data
	1	Binary Output					1	Slave will return Unknown Object to this request
	2	Binary Output Status	1	06	129, 130	00, 01	8	Slave will return this variation
12	0	Control Block - All Variations					88	Slave will use variation 1 control
	1	Control Relay Output Block	3, 4, 5, 6	17, 28	129	Echo of request	88	Slave will respond correctly to this variation
	2	Pattern Control Block					88	Slave will return Unknown Object to this request
	3	Pattern Mask					16	Slave will return Unknown Object to this request
20	0	Binary Counter - All Variations	1, 7, 8, 9, 10	06			32	Slave will return variation 5 data
	1	32-Bit Binary Counter			129, 130	00, 01	40	Slave will return Unknown Object to this request
	2	16-Bit Binary Counter			129, 130	00, 01	24	Slave will return Unknown Object to this request
	3	32-Bit Delta Counter			129, 130	00, 01	40	Slave will return Unknown Object to this request
	4	16-Bit Delta Counter			129, 130	00, 01	24	Slave will return Unknown Object to this request
	5	32-Bit Binary Counter Without Flag	1, 7, 8, 9, 10	06	129, 130	00, 01	32	Slave will return this variation
	6	16-Bit Binary Counter Without Flag	1, 7, 8, 9, 10	06	129, 130	00, 01	16	Slave will return this variation (counter upper 16-bits removed)
	7	32-Bit Delta Counter Without Flag			129, 130	00, 01	32	Slave will return Unknown Object to this request
	8	16-Bit Delta Counter Without Flag			129, 130	00, 01	16	Slave will return Unknown Object to this request

OBJECT			REQUEST		RESPONSE			
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	NOTES
21	0	Frozen Counter - All Variations	1	06			32	Slave will return variation 9 data
	1	32-Bit Frozen Counter			129, 130	00, 01	40	Slave will return Unknown Object to this request
	2	16-Bit Frozen Counter			129, 130	00, 01	24	Slave will return Unknown Object to this request
	3	32-Bit Frozen Delta Counter					40	Slave will return Unknown Object to this request
	4	16-Bit Frozen Delta Counter					24	Slave will return Unknown Object to this request
	5	32-Bit Frozen Counter With Time Of Freeze					88	Slave will return Unknown Object to this request
	6	16-Bit Frozen Counter With Time Of Freeze					72	Slave will return Unknown Object to this request
	7	32-Bit Frozen Delta Counter With Time Of Freeze					88	Slave will return Unknown Object to this request
	8	16-Bit Frozen Delta Counter With Time Of Freeze					72	Slave will return Unknown Object to this request
	9	32-Bit Frozen Counter Without Flag	1	06	129, 130	00, 01	32	Slave will return this variation
	10	16-Bit Frozen Counter Without Flag	1	06	129, 130	00, 01	16	Slave will return this variation (counter upper 16-bits removed)
	11	32-Bit Frozen Delta Counter Without Flag					32	Slave will return Unknown Object to this request
	12	16-Bit Frozen Delta Counter Without Flag					16	Slave will return Unknown Object to this request
22	0	Counter Change Event - All Variations	1	06, 07, 08				Slave will parse this request and return no data
	1	32-Bit Counter Change Event Without Time			129, 130	17, 28	40	Slave will return Unknown Object to this request
	2	16-Bit Counter Change Event Without Time			129, 130	17, 28	24	Slave will return Unknown Object to this request
	3	32-Bit Delta Counter Change Event Without Time					40	Slave will return Unknown Object to this request
	4	16-Bit Delta Counter Change Event Without Time					24	Slave will return Unknown Object to this request
	5	32-Bit Counter Change Event With Time					88	Slave will return Unknown Object to this request
	6	16-Bit Counter Change Event With Time					72	Slave will return Unknown Object to this request
	7	32-Bit Delta Counter Change Event With Time					88	Slave will return Unknown Object to this request
	8	16-Bit Delta Counter Change Event With Time					72	Slave will return Unknown Object to this request
23	0	Frozen Counter Event - All Variations						Slave will return Unknown Object to this request
	1	32-Bit Frozen Counter Event Without Time					40	Slave will return Unknown Object to this request
	2	16-Bit Frozen Counter Event Without Time					24	Slave will return Unknown Object to this request
	3	32-Bit Frozen Delta Counter Event Without Time					40	Slave will return Unknown Object to this request
	4	16-Bit Frozen Delta Counter Event Without Time					24	Slave will return Unknown Object to this request
	5	32-Bit Frozen Counter Event With Time					88	Slave will return Unknown Object to this request
	6	16-Bit Frozen Counter Event With Time					72	Slave will return Unknown Object to this request
	7	32-Bit Frozen Delta Counter Event With Time					88	Slave will return Unknown Object to this request
	8	16-Bit Frozen Delta Counter Event With Time					72	Slave will return Unknown Object to this request
30	0	Analog Input - All Variations	1	06			16	Slave will respond with variation 4 data
	1	32-Bit Analog Input	1	06	129, 130	00, 01	40	Slave will return this variation (NOTE: Data will only be 16-bit)
	2	16-Bit Analog Input	1	06	129, 130	00, 01	24	Slave will return this variation
	3	32-Bit Analog Input Without Flag	1	06	129, 130	00, 01	32	Slave will return this variation (NOTE: Data will only be 16-bit)
	4	16-Bit Analog Input Without Flag	1	06	129, 130	00, 01	16	Slave will return this variation
31	0	Frozen Analog Input - All Variations						Slave will return Unknown Object to this request
	1	32-Bit Frozen Analog Input					40	Slave will return Unknown Object to this request
	2	16-Bit Frozen Analog Input					24	Slave will return Unknown Object to this request

OBJECT			REQUEST		RESPONSE			
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	NOTES
	3	32-Bit Frozen Analog Input With Time To Freeze					88	Slave will return Unknown Object to this request
	4	16-Bit Frozen Analog Input With Time To Freeze					72	Slave will return Unknown Object to this request
	5	32-Bit Frozen Analog Input Without Flag					32	Slave will return Unknown Object to this request
	6	16-Bit Frozen Analog Input Without Flag					16	Slave will return Unknown Object to this request
32	0	Analog Change Event - All Variations	1	06, 07, 08			24	Slave will return variation 2 data
	1	32-Bit Analog Change Event Without Time	1	06, 07, 08	129, 130	17, 28	40	Slave will return this variation (NOTE: Data only 16-bit)
	2	16-Bit Analog Change Event Without Time	1	06, 07, 08	129, 130	17, 28	24	Slave will return this variation
	3	32-Bit Analog Change Event With Time	1	06, 07, 08	129, 130	17, 28	88	Slave will return this variation (NOTE: Data only 16-bit)
	4	16-Bit Analog Change Event With Time	1	06, 07, 08	129, 130	17, 28	72	Slave will return this variation
33	0	Frozen Analog Event - All Variations						Slave will return Unknown Object to this request
	1	32-Bit Frozen Analog Event Without Time					40	Slave will return Unknown Object to this request
	2	16-Bit Frozen Analog Event Without Time					24	Slave will return Unknown Object to this request
	3	32-Bit Frozen Analog Event With Time					88	Slave will return Unknown Object to this request
	4	16-Bit Frozen Analog Event With Time					72	Slave will return Unknown Object to this request
40	0	Analog Output Status - All Variations	1	06			24	Slave will return variation 2 data
	1	32-Bit Analog Output Status	1	06	129,130	00,01	40	Slave will return this variation but data only 16-bit accuracy
	2	16-Bit Analog Output Status	1	06	129, 130	00, 01	24	Slave will return this variation
41	0	Analog Output Block - All Variations					24	Slave will respond to this request using variation 2 data
	1	32-Bit Analog Output Block	3, 4, 5, 6	17, 28	129,130	00,01	40	Slave will respond to this request but data only 16-bit
	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	Echo of Request	24	Slave will respond to this request

OBJECT			REQUEST		RESPONSE			
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	NOTES
50	0	Time and Date - All Variations	2	07, With Quant=1			48	Slave will use variation 1
	1	Time and Date	2	07, With Quant=1			48	Slave will respond to this variation
	2	Time and Date With Interval					80	Slave will return Unknown Object to this request
51	0	Time and Date CTO - All Variations						Slave will return Unknown Object to this request
	1	Time and Date CTO			129, 130	07, With Quant=1	48	Slave will return Unknown Object to this request
	2	Unsynchronized Time and Date CTO			129, 130	07, With Quant=1	48	Slave will return Unknown Object to this request
52	0	Time Delay - All Variations						
	1	Time Delay Coarse			129	07, With Quant=1	16	Slave will never return this variation
	2	Time Delay Fine			129	07, With Quant=1	16	Slave will return this variation to functions 0D, 0E, and 17
	3	Date and Time at Last Recorded Time	2				48	Slave will process the data in this object for time synchronization.
60	0	Not Defined						Not Defined in DNP
	1	Class 0 Data	1	06				Slave will respond to this variation with all static data
	2	Class 1 Data	1	06, 07, 08				Slave will respond to this variation (No class 1 data defined in application)
	3	Class 2 Data	1	06, 07, 08				Slave will respond to this variation with all class 2 data (binary input events)
	4	Class 3 Data	1	06, 07, 08				Slave will respond to this variation with all class 3 data (analog input events)
70	0	Not Defined						Not Defined in DNP
	1	File Identifier						Slave will return Unknown Object to this request
80	0	Not Defined						Not Defined in DNP
	1	Internal Indications	2	00, Index=7			24	Slave will respond to this variation
81	0	Not Defined						Not Defined in DNP
	1	Storage Object						

OBJECT			REQUEST		RESPONSE			
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	NOTES
82	0	Not Defined						Not Defined in DNP
	1	Device Profile						
83	0	Not Defined						Not Defined in DNP
	1	Private Registration Object						
	2	Private Registration Objection Descriptor						
90	0	Not Defined						Not Defined in DNP
	1	Application Identifier						
100	0							
	1	Short Floating Point					48	
	2	Long Floating Point					80	
	3	Extended Floating Point					88	
101	0							
	1	Small Packed Binary-Coded Decimal					16	
	2	Medium Packed Binary-Coded Decimal					32	
	3	Large Packed Binary-Coded Decimal					64	
No Object			13					Slave supports the Cold Restart Function and will return Obj 52, Var 2, Qual 7, Cnt 1
			14					Slave supports the Warm Restart Function and will return Obj 52, Var 2, Qual 7, Cnt 1
			20					Slave supports the Enable Unsolicited Function
			21					Slave supports the Disable Unsolicited Function
			23					Slave supports the Delay Measurement & Time Synchronization Function and will return Obj 52, Var 2, Qual 7, Cnt 1
			24					Slave supports use of this new time synchronization function. Used with Obj 52, Var 3.

5.9 MVI71-DNPSNET Application Design

This section describes the MVI71-DNPSNET module configuration and setup as it applies to application design. Before attempting to implement this module with a DNP network, verify that the whole design of the system is complete. This includes definition of all the data types and point counts required for each type, all communication parameters required for the network including media type and the use of advanced features such as unsolicited messaging. These must be defined for all master and slave devices on the network. Additionally, the DNP Device Profiles and DNP Subset Definition documents for each device must be reviewed to make sure all the devices will interact on the network as expected. Failure to fully understand these important documents for all devices on the network will usually lead to many problems when implementing the design.

It is important to fully understand the DNP specification as outlined in the Basic Four Documents. These are available to users of the DNP users group. It is recommended that all users of the module have access to these important documents as they define the DNP data types, functions and variations. It will be very difficult to implement the module without an understanding of the protocol and the rules that are defined in the specification. Additionally, potential users should review the DNP Subset and Conformance Test documents and the document that discusses DNP protocol support on Ethernet using the UDP and TCP protocols. These documents provide auxiliary information on the protocol. All of these documents are available to members of the DNP User Group at http://www.dnp.org (http://www.dnp.org). Please check this site for other important information regarding the DNP protocol.

5.9.1 Design

In order to implement a solution using the module, the PLC processor must be set up using predefined user data structures. The data transfer interface requires ladder logic in order to interface data in the module with that in the processor. The program required for data transfer is developed in ladder and is discussed in the Module Configuration section of this manual. This program will interact with the module by sending and receiving data and issuing special control commands.

Data tags in the PLC processor contain the data to be used by the module and the configuration information is stored in the text file, DNPSNET.CFG, stored on the module's Compact Flash Disk. Before you generate the program or layout the data files, you must first design your system. Time spent doing system design at the outset of the project will greatly enhance the success and ease of development of the project.

Designing the system

System design defines the data requirements of the system, communication parameters, and module functionality. The application developer should refer to the person responsible for the DNP master and slave device configurations to verify that the functionality and data types required for the whole system are consistent. Review the DNP Device Profile and DNP Subset documentation for a definition of the level of DNP support offered by the module.

The following topics describe each element of system design.

Data Requirements

This phase of design defines what data elements are to be interfaced in the PLC processor with the DNP master. The module provides the following data types: digital input, digital output, counter, analog input and analog output. All communications between the DNP master and the PLC is through these data types. Therefore, all data to be used by the system must be contained and configured in one of these data types.

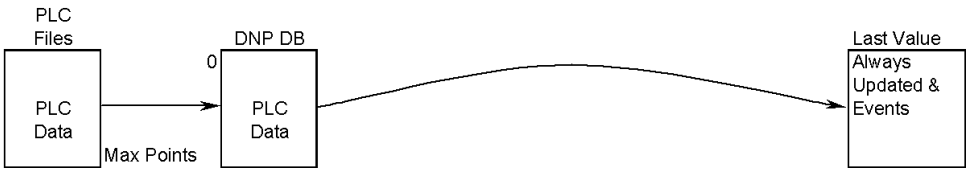
The following illustration shows the databases maintained by the module for the DNP data.

DATA AREA	
DNP DATA	BINARY INPUTS
	ANALOG INPUTS
	COUNTER DATA
	BINARY OUTPUTS
	ANALOG OUTPUTS
FROZEN DATA	FROZEN COUNTER DATA
LAST VALUE DATA	BINARY INPUTS
	ANALOG INPUTS
EVENT DATA	BINARY INPUT EVENTS
	ANALOG INPUT EVENTS

The module is responsible for maintaining the databases using data acquired from the PLC and DNP master attached network port.

The following illustration shows the interaction of the binary and analog input points with the databases.

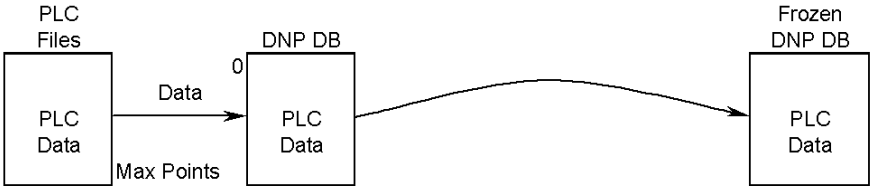
Binary and Analog Input Databases



All data for these data types is derived from the processor and is passed to the module over the backplane. The module will constantly monitor for changes in this data and generate event messages when point values change. For binary input points, events will be generated on any state change. For analog input points, events will be generated for points that have a current value outside of the user-set deadband based on the last value used for an event.

The following illustration shows the interaction of the counter points with the databases.

Counter Databases

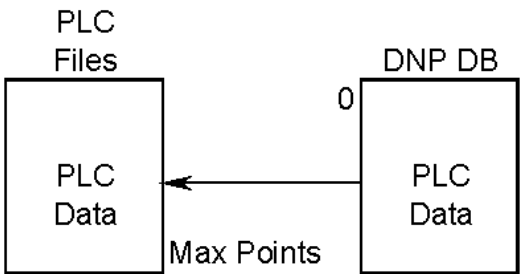


This data is constantly sourced from the processor and placed in the module's internal database. This information is available to the remote master for monitoring. When the module receives a freeze command from the master unit, it will copy the current counter values into the frozen counter database area. The remote master can then monitor this information. If the module receives a counter freeze with reset command, the current counter values will be passed to the frozen counter database and only the module's values will be set to 0.

Note: This data is not sent to the controller, and the zero data be overwritten by the counter data contained in the controller. Therefore, the freeze with reset should not be used with this module. The results will not be as expected. There is no way to guarantee that counts will not be lost during the reset step in the module and controller. As a result, this feature was not implemented in the module.

The following illustration shows the interaction of the binary and analog output points with the databases.

Binary and Analog Output Databases



Output data is sourced from the controlling master station and passed to the processor over backplane from the module. These data are used in the ladder logic to control operations and I/O in the processor.

Data Transfer Interface

Data is transferred between the PLC processor and the module using module's BTR/BTW images when the block-transfer interface is employed or directly from user data files to the module when the side-connect interface is utilized. Each BTR/BTW block transfer operation transfers up to 64 words of information of which 60 holds data. The module defines the blocks to be transferred between the PLC and the module when the system is initialized. For the PLC BTR operations, word 0 of the module's BTR image identifies the data set contained in the image. Word 1 contains the block index the module is requesting the processor to write. The PLC constructs the BTW image to send to the module in the module's output image. The first word of the block identifies the data set contained in the block.

The module determines the block numbers required based on the module read and write register counts defined in the configuration file. The user is responsible for defining these parameters and the starting location of these data areas in the module's database correctly. These data must correspond to the DNP database definitions defined. The module stores the data in fixed order for the data types. The size of each data area for each type is determined by the user configuration. An example is shown in the following table.

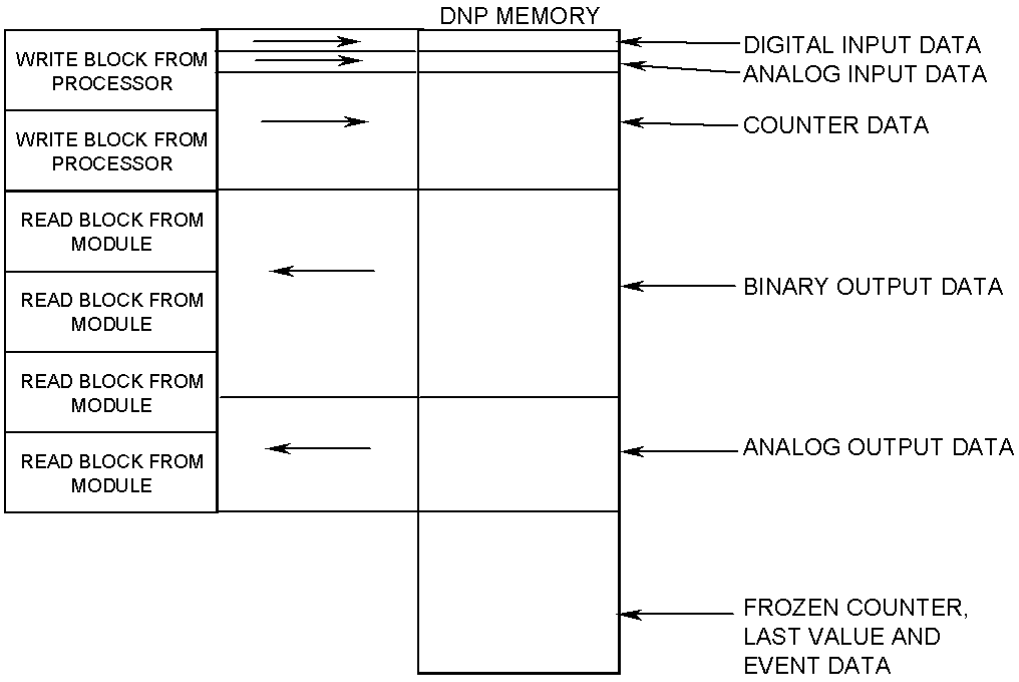
DATA AREA		Cfg	Points	Words	Offset
DNP DATA	BINARY INPUTS	2	32	2	0 to 1
	ANALOG INPUTS	148	148	148	2 to 149
	COUNTER DATA	25	25	50	150 to 199
	BINARY OUTPUTS	4	64	4	200 to 203
	ANALOG OUTPUTS	52	52	52	204 to 255

For the example above, 200 registers will be transferred from the processor (requires 4 BTW blocks) and 56 registers will be transferred to the processor (requires 1 BTR block). The data transfer parameters should be defined as follows:

Parameter	Value
Write Register Start	0
Write Register Count	200
Read Register Start	200
Read Register Count	56

Note that in one block, one or more DNP data types may be transferred. This is especially important when considering the counter data. Counter values require two registers to store their value. The value of a counter should never be passed in two separate blocks. To avoid this potential problem, always configure the module to have the counter data start on an even word number.

The following figure displays the direction of movement of the DNP database data between the module and the processor.



It is important to understand the relationship of the block identifications and the data in the module. Confident data handling in the module is only accomplished if the user defines a consistent set of parameters in the module configuration, handles the read and write operations for the blocks in the module in the PLC ladder logic and understands the requirements of the DNP master unit.

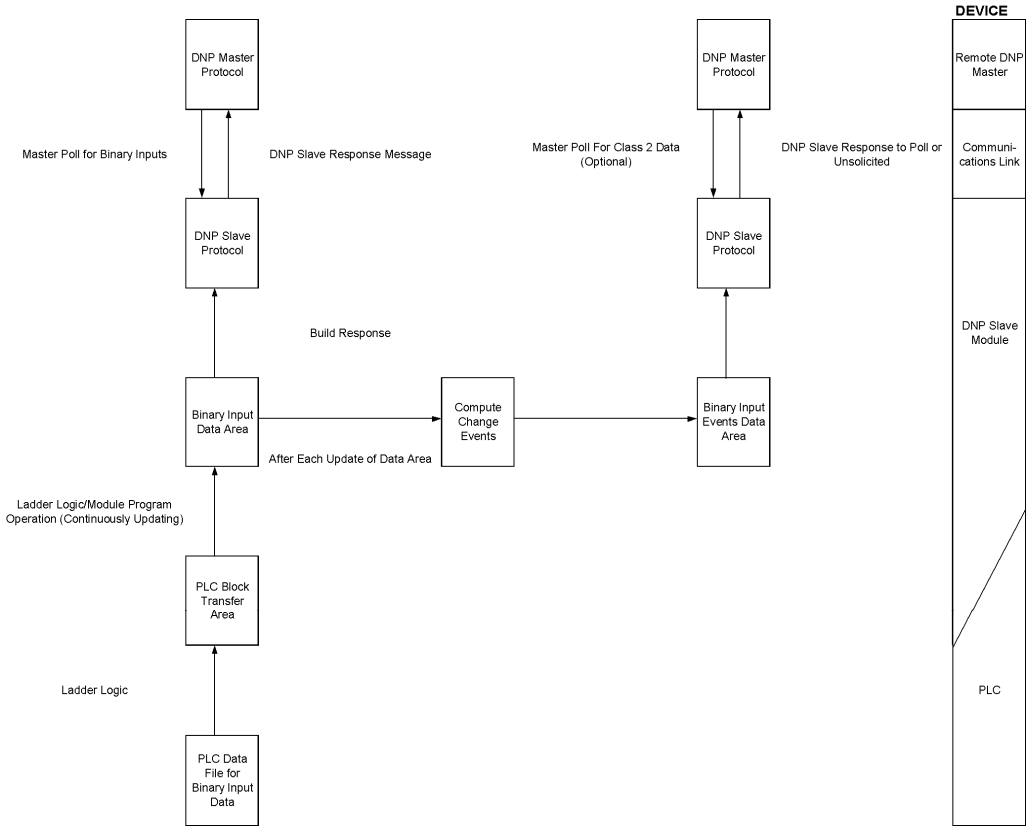
This manual contains forms to aid in designing your system. They can be used to document the relationship between the point assignments, block identification numbers and the PLC file and offset values and to define the program configuration. Use these forms during your design phase.

DNP Digital Input Data

This data type stores the binary value of 1 or 0. The size of this data area is determined from the configuration parameter Binary Inputs (number of words, each containing 16 binary input points). These data are transferred to the module from the PLC using the read operation. Therefore, these data are read-only for the module and the DNP master unit communicating with the module. When the module receives a new block of this data from the PLC, it compares the new values to those currently in the database. If there is a change in any of the data, the module will generate an event message for the points that change.

The remote DNP master unit can read the current status data and the event data from the module. Event messages generated by the module can be retrieved using a poll for Class 2 data, as all digital input events are considered a Class 2 data type. If unsolicited message generation is enabled in the application, the events will automatically be sent by the module to the DNP master unit when the maximum event count for Class 2 data is reached or when the timeout for unsolicited messages is exceeded. A following illustration shows data flow for the digital input data.

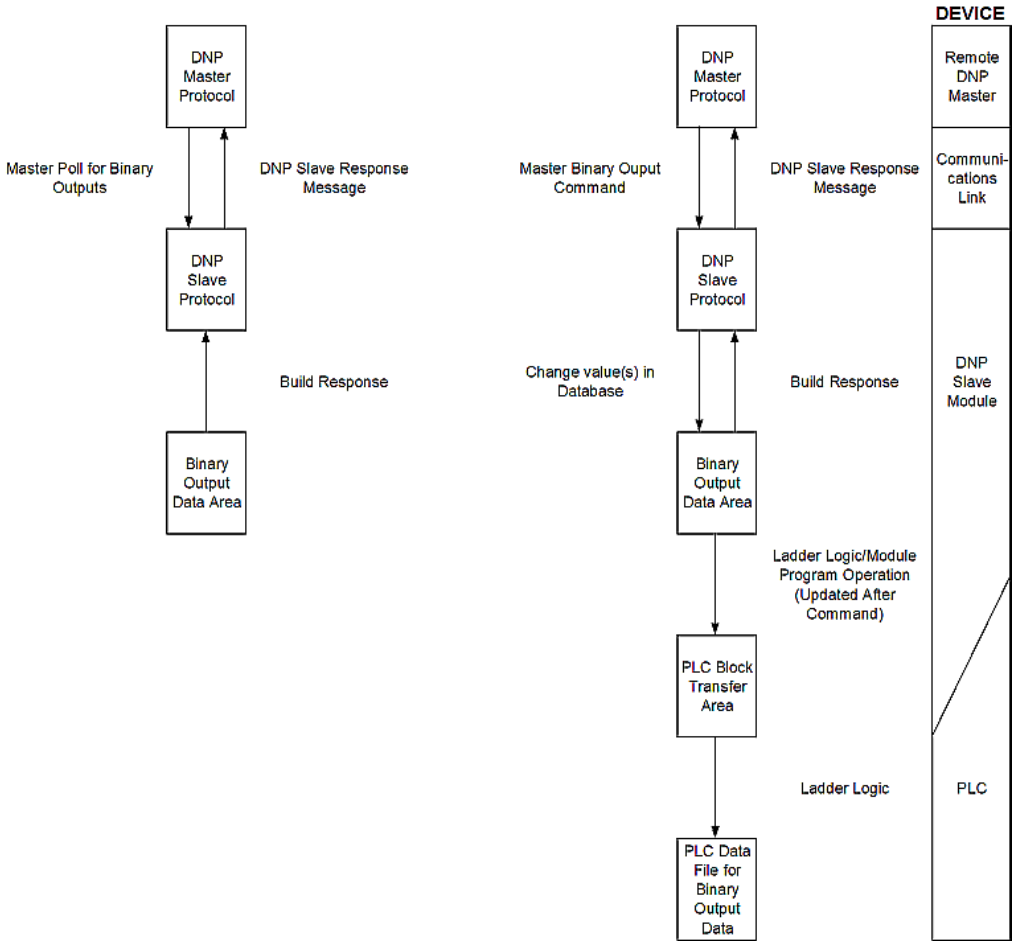
Binary Input Data Flow Diagram



DNP Digital Output Data

This data type stores digital control and command state data received from the DNP master unit with a value of 1 or 0. The size of this data area is determined from the configuration parameter Binary Outputs (defines number of words, each containing 16 binary output points). These data are transferred from the module to the PLC using the write operation. Therefore, these data are read-only for the PLC, as the PLC cannot directly alter these values in module. It is the responsibility of the DNP master unit to maintain this data. For example, if the DNP master sets a digital point on, it will remain on until the master resets the point. The following illustration shows data flow for the digital output data.

Binary Output Data Flow Diagram



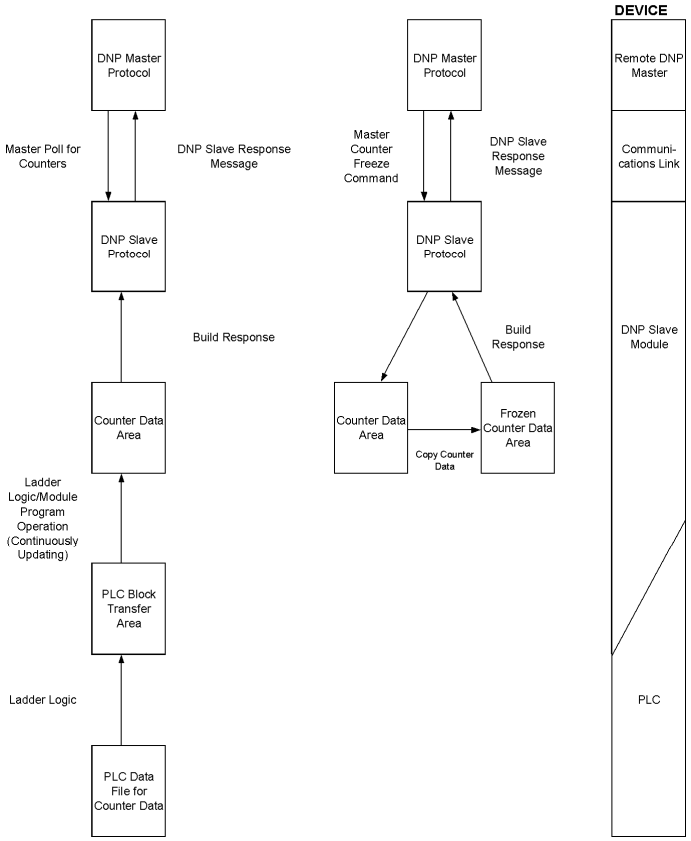
DNP Counter Data

This data type stores accumulated count data. These data are stored in the module in a double word value and have a data range of 0 to 4,294,967,296. The size of this data area is determined from the configuration parameter Counters. The PLC transfers data of this type to the module using the read operation. The module maintains two values for each counter point: a current running value and a frozen value. The DNP master must send the freeze command to the module in order to transfer the current running values to the frozen area.

Note: The freeze-reset command is not supported in the data transfer operation. There is no way to guarantee counts will not be lost using the freeze-reset operation, therefore, this feature is not implemented.

A data flow diagram for the counter follows.

Counter Data Flow Diagram

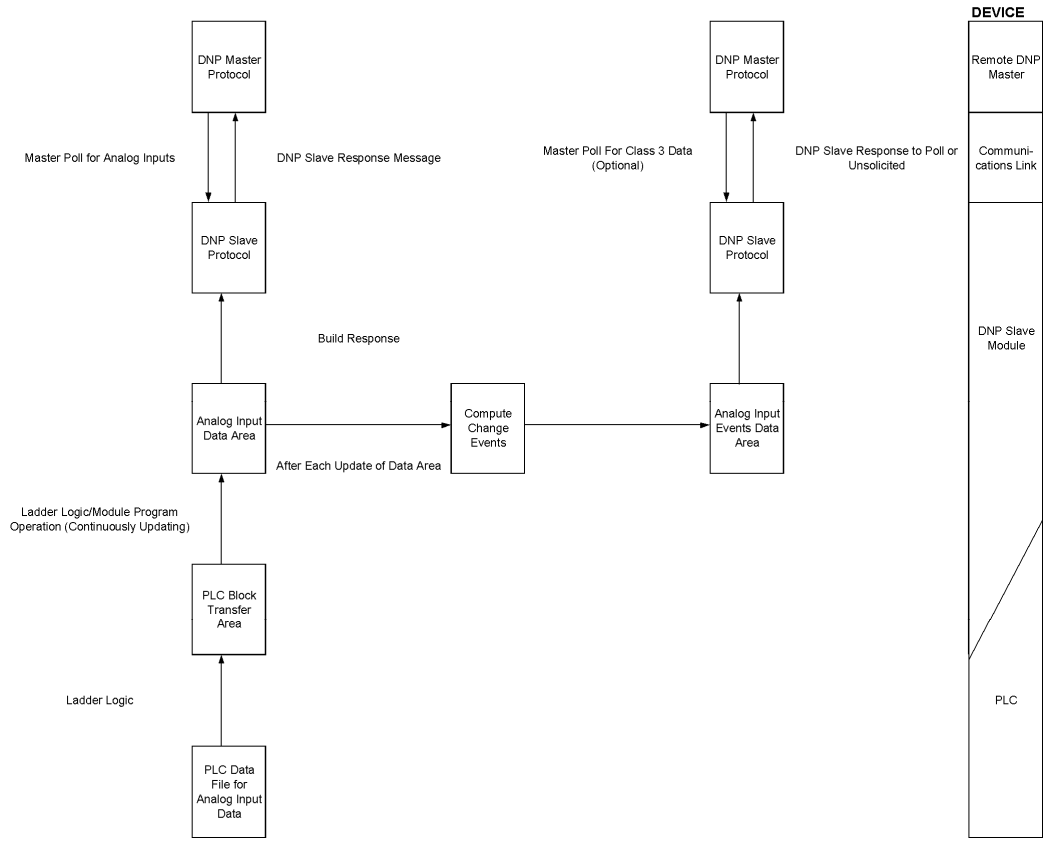


DNP Analog Input Data

This data type stores analog data with a data range of 0 to 65535 or -32768 to 32767. The size of this data area is determined from the configuration parameter Analog Inputs. These data are transferred to the module from the PLC using the read operation. Therefore, these data are read-only for the module and the DNP master unit. When the module receives a new block of this data from the PLC, it compares the new values to those currently in the database. If there is a change in any of the data, the module will generate an event message for the points that change. The dead-band parameter configured for the module determines the variance required for the event message.

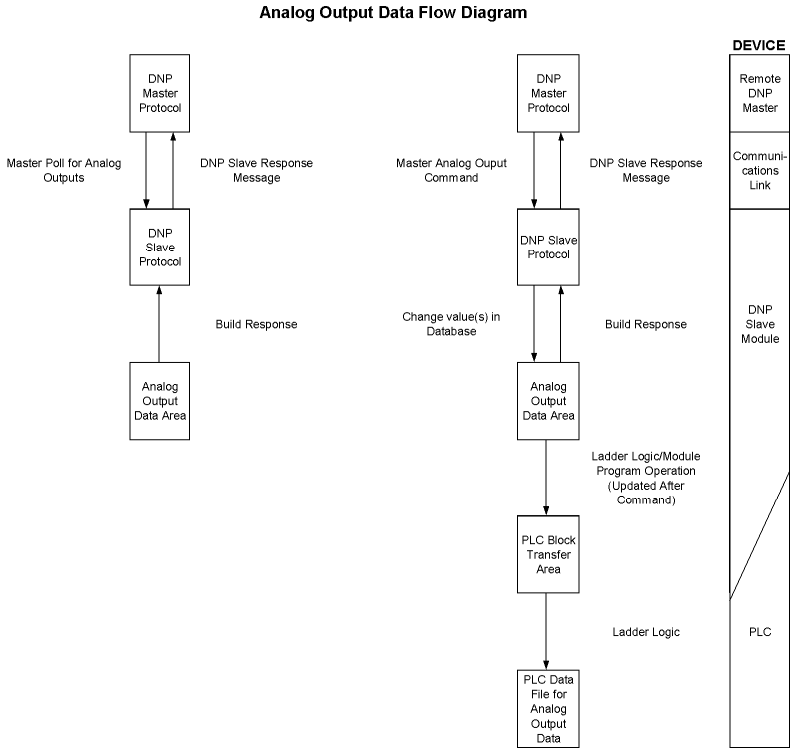
The DNP master unit can read the current value data and the event data from the module. Event messages generated by the module can be retrieved using a poll for Class 3 data, as all analog input events are considered a Class 3 data type. If unsolicited message generation is enabled in the application, the events will automatically be sent by the module to the DNP master unit when the maximum event count for Class 3 data is reached or when the timeout for unsolicited messages is exceeded. A data flow diagram for the analog input data is shown in the following example.

Analog Input Data Flow Diagram



DNP Analog Output Data

This data type stores analog values sent from the DNP master unit to the module and PLC with a data range of 0 to 65535 or -32768 to 32767. The size of this data area is determined from the configuration parameter Analog Outputs. These data are transferred from the module to the PLC using the write operation. Therefore, these data are read-only for the PLC, as the PLC cannot directly alter these values in the module. It is the responsibility of the DNP master unit to maintain this data. For example, if the DNP master sends a value of 3405 to the module for a specific point, the value will be stored in the module until changed by the master. A data flow diagram for the analog output data follows.



Communication Parameters

This phase of design defines the communication parameters required for successful communications between the module and DNP master and slave units over the Ethernet network. Determine the IP address for the module and the list of IP addresses that can connect to the unit if this feature is enabled. Consult with the MIS person in charge of assigning these addresses and setting up the network configuration. The **Module Configuration** section contains a form to aid in setting these parameters. Fill out this form before attempting to configure the module. You must also determine if the UDP or the TCP protocol or both will be used in your application. The module supports a single connection for the TCP protocol. The UDP server supports receipt of messages from multiple clients. Access to both servers can be limited by using the IP address list filtering.

Functionality

This phase of design defines the features of the DNP Level 2 Subset supported by the module and to be utilized in the specific application. For example, will the unit use unsolicited messaging? Coordination with the DNP master developer is required to verify that the host will support the functionality you select. The features that must be defined in this design step are as follows:

- Will analog events be returned with or without a time value?
- Will events be logged before time synchronization has occurred?
- Will the module start with database values initialized by the processor?

For a complete description of the module configuration, refer to the **Module Configuration** section.

Data Transfer at Startup

The module can be configured to have the internal databases initialized with data contained in the processor. This feature requires ladder logic if the block-transfer interface is utilized. Data to be initialized are as follows: Binary and Analog Output data. This feature can be used to bring the module to a known state (last state set in controller) when the module is first initialized. For example, in order to have the module startup using the last set of binary output values and setpoint values (analog outputs), enable this feature.

If this feature is implemented, the module will request the data from the processor. If the side-connect interface is employed, the module will read this data directly from the user data files. If the block transfer interface is used, ladder logic must handle the blocks requested by the module (1000 to 1148) based on the modules configuration values for the write block data. When the block is requested, the module must place the correct data in the block and return the block to the module. The module will receive the data and initialize the output values. Each block required by the module for initialization will be requested.

5.9.2 Module Operation

After the system has been designed and the system is set up, the module will be ready to operate. When the module is first initialized, it will read the configuration file (DNPSNET.CFG on the module's Compact Flash Disk). After the file is processed, the module will use the data to set up the data structures of the application. If any errors are encountered during the initialization process, the default value for the parameter will be assigned and used.

The module will next check if the output initialization feature is utilized. The option permits the PLC to set these read-only data at startup. There is no static memory available on the module to remember the last values for these data types. In order to prevent a "shock" to the system at boot time, this option can be used to set the module's database to the last transferred set of data. If this option is enabled, the module will request the binary and analog output from the PLC.

After the successful initialization of the module, the program will start the normal data transfer between the module and the PLC processor. For the side-connect interface, the module will interact directly with the user data files. For the block-transfer interface, the program will send a BTR block first and then wait for a BTW block to receive data from the PLC. This alternating sequence of read and write will continue as long as the program is running. The program will update the DNP memory areas in the module with the new data in the BTW and generate events for digital and analog input status changes.

If the module is configured for unsolicited messaging, the module will immediately send an unsolicited response once the remote master connects to the module, informing the master of a module restart. The module will not log events or process any data read operations from the master until the master clears the restart IIN data bit. The master must also synchronize the time with the module before events will be generated if the module is so configured. The master is also responsible for enabling the unsolicited message facility in the module by sending the Enable Unsolicited Messaging command to the module.

If the module is not configured for unsolicited messaging, the DNP master must clear the restart IIN bit before the module will start logging events. The master must also synchronize the time with the module before events will be generated if the module is so configured.

Additionally, the program will listen on Port 1 for requests. This is the debug port for the module and transfers module information to an attached terminal. Refer to the **Diagnostics and Troubleshooting** section for a complete discussion on the use of this important feature.

5.10 Event Size Computation

The minimum event buffer size required to avoid overflow can be computed as follows:

```
((number of static points)*(rate per second scan of change function)) /(rate
per second of master event data poll)
```

For example: 51 binary input points are scanned 2 times each second and polled by the master station about every 5 seconds. The minimum number of binary input events is:

```
(51 * 2)/.02 = 510 events
```

This computation assumes the unlikely event that all data points will change in consecutive calls to the scan of change function. If an event buffer overflow condition occurs, the internal indication bit, BUFFER OVERFLOW, will be set. If the system you are working with is fairly stable, the following equation can be used to compute the event buffer size:

```
(number of points that change per change function * rate per second of scan of
change function) * (number of seconds between master event data poll)
```

For example: 1000 binary input points are scanned 2 times each second and polled by the master station about every 5 seconds. Only about 5 points change state every scan of the change function call.

```
(5 * 2) * 5 = 50 events required
```

The number of events that can be defined in the system is limited to 400. The event buffer will overflow in systems which are very dynamic unless one of the following conditions exist:

- The master frequently polls the slave device for events to keep the buffer empty.

OR

- The slave is configured to send unsolicited messages to the master station. This method requires full-duplex operation of the network because the slave may be sending a message during a request from the master station.

In order to disable the report by exception feature in the module, set the number of events to 0 for both the binary and analog input events in the configuration. This will cause the DNP slave port driver to never return any data on object 2 and 32 and class 2 and 3 master station requests.

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: http://www.prosoft-technology.com/support (http://www.prosoft-technology.com/support) E-mail address: support@prosoft-technology.com (mailto:support@prosoft-technology.com)

Asia Pacific

+603.7724.2080, support.asia@prosoft-technology.com (mailto:support.asia@prosoft-technology.com)

Languages spoken include: Chinese, English

Europe (location in Toulouse, France)

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Languages spoken include: French, English

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

+1.661.716.5100, support@prosoft-technology.com (mailto: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 (mailto: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 91). 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, etc.

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 94)". 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 94) 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.

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