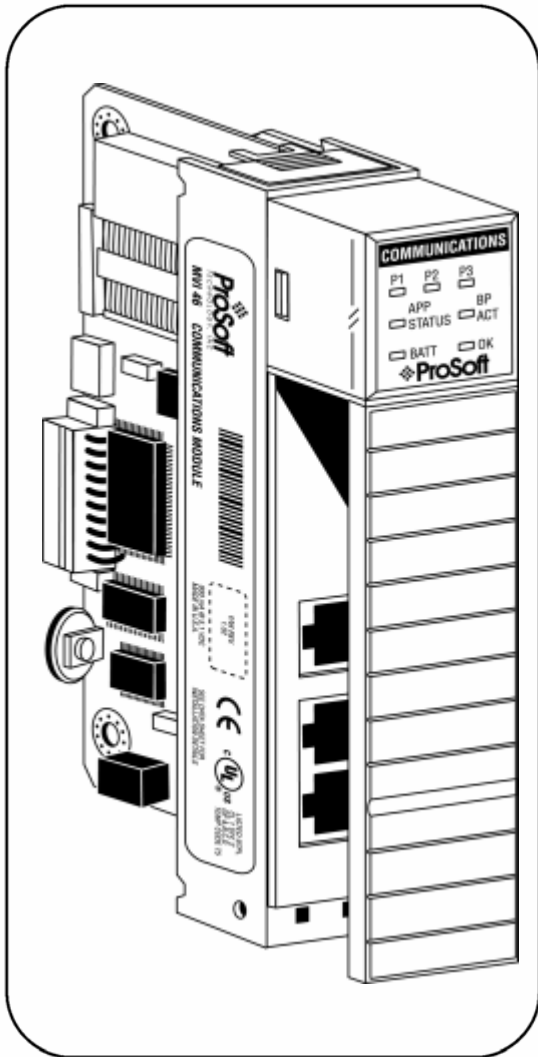


# inRAx



## MVI46-DNP

SLC Platform

Master/Slave Communication Module

## User Manual

August 23, 2007

  
**ProSoft**  
TECHNOLOGY

# Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation SLC hardware, the MVI46-DNP 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 assure that the information provided is accurate and a true reflection of the product's installation requirements. In order to assure 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.

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MVI46-DNP User Manual

August 23, 2007

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## Guide to the MVI46-DNP User Manual

Function		Section to Read	Details
Introduction (Must Do)	→	<a href="#">Start Here</a> (page 7)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Verify Communication, Diagnostic and Troubleshooting	→	<a href="#">Verifying Communication</a> (page 93) <a href="#">Diagnostics and Troubleshooting</a> (page 39)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	<a href="#">Reference</a> (page 55) Functional Overview Product Specifications	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	<a href="#">Support, Service and Warranty</a> (page 131)	This section contains Support, Service and Warranty information. Index of chapters.



# 1 Start Here

## *In This Chapter*

- System Requirements ..... 7
- Package Contents ..... 8
- Setting Jumpers ..... 9
- Install the Module in the Rack ..... 9
- Connect your PC to the Processor ..... 11
- Download the Sample Program to the Processor ..... 12
- Connect your PC to the Module ..... 15

Installing the MVI46-DNP module requires a reasonable working knowledge of the Rockwell Automation hardware, the MVI46-DNP 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 MVI46-DNP module requires the following minimum hardware and software components:

- Rockwell Automation SLC 5/02 M0/M1 capable processors (or newer), with compatible power supply and one free slot in the rack, for the MVI46-DNP module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 500 programming software.
- Rockwell Automation RSLinx communication software
- Pentium® II 500 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft® Windows 98
  - Windows NT® (version 4 with SP4 or higher)
  - Windows 2000
  - Windows XP
- 32 Mbytes of RAM minimum, 64 Mbytes of RAM recommended

- 50 Mbytes of free hard disk space (or more based on application requirements)
- 16-color VGA graphics adapter, 640 x 480 minimum resolution (256 Color 800 × 600 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 MVI46-DNP module, and are all required for installation and configuration.

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

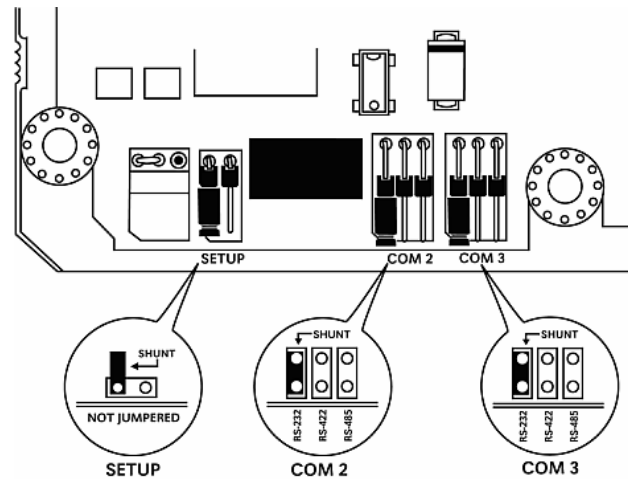
Qty.	Part Name	Part Number	Part Description
1	MVI46-DNP Module	MVI46-DNP	Master/Slave Communication Module
1	Cable	RS232 Null Modem	For RS232 Connection to the CFG Port
3	Cable	Cable #14, RJ45 to DB9 Male Adapter	For DB9 Connection to Module's Port
2	Adapter	1454-9F	Two Adapters, DB9 Female to Screw 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 MVI46-DNP module.

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



### 1.3 Setting Jumpers

If you use an interface other than RS-232 (default), you must change the jumper configuration to match the interface. The following illustration shows the MVI46-DNP jumper configuration:



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 SLC processor and power supply, please do so before installing the MVI46-DNP module. Refer to your Rockwell Automation product documentation for installation instructions.

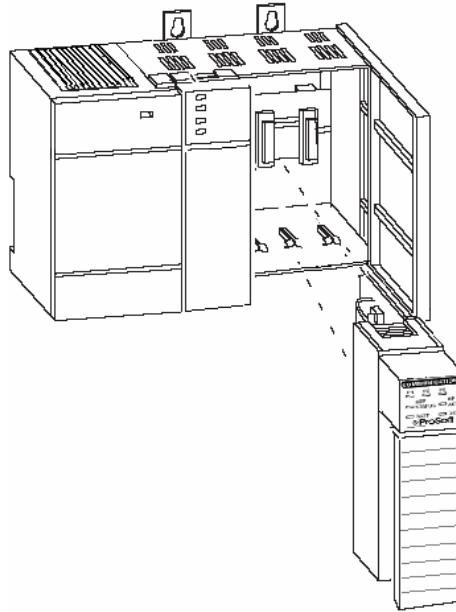
**Warning:** You must follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device you plan to connect to verify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

After you have checked the placement of the jumpers, insert MVI46-DNP into the SLC™ chassis. Use the same technique recommended by Rockwell Automation to remove and install SLC™ 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.

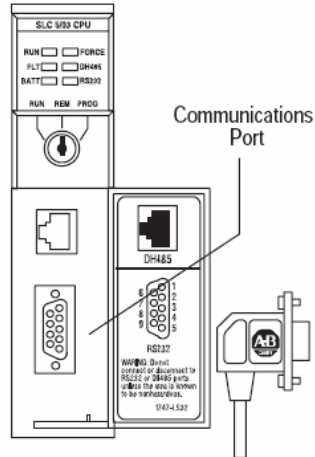


- 3 With a firm but steady push, snap the module into place.
- 4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
- 5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample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

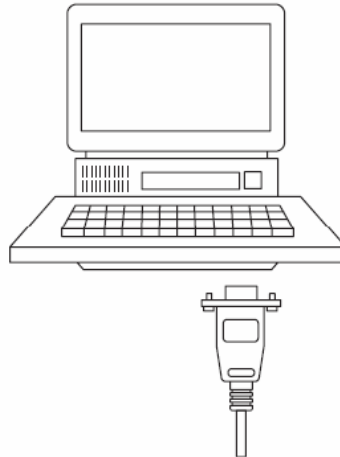
**Note:** If you insert the module improperly, the system may stop working, or may behave unpredictably.

## 1.5 Connect your PC to the Processor

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



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

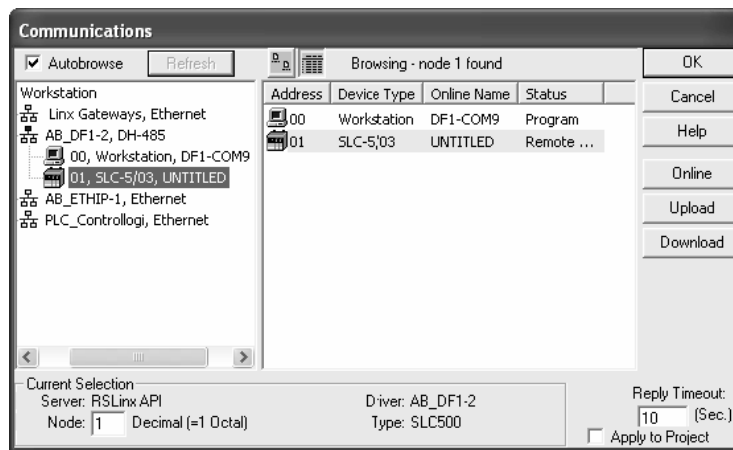


## 1.6 Download the Sample Program to the Processor

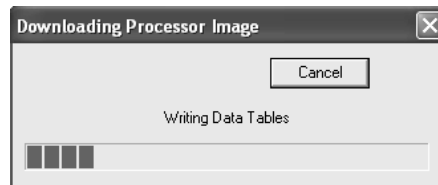
- **To download the sample program from RSLogix 500 to the SLC processor:**

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

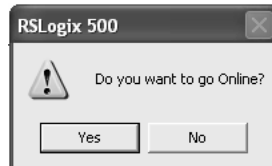
- 1 If you are not already online to the processor, open the Communications menu, and then choose Download. RSLogix will establish communication with the processor.



- 2 Click the Download button to transfer the sample program to the processor.
- 3 RSLogix will compile the program and transfer it to the processor. This process may take a few minutes.



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

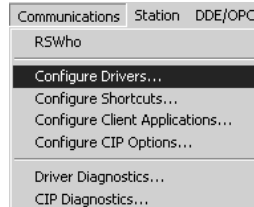


**Note:** If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

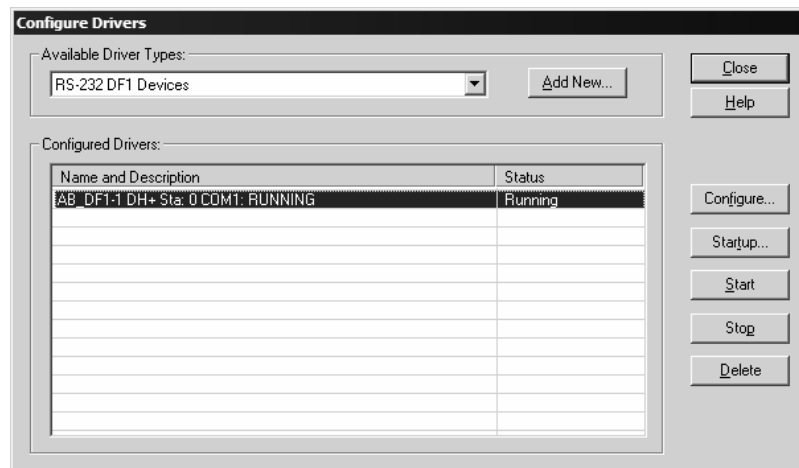
### 1.6.1 Configuring RSLinx

➤ **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.



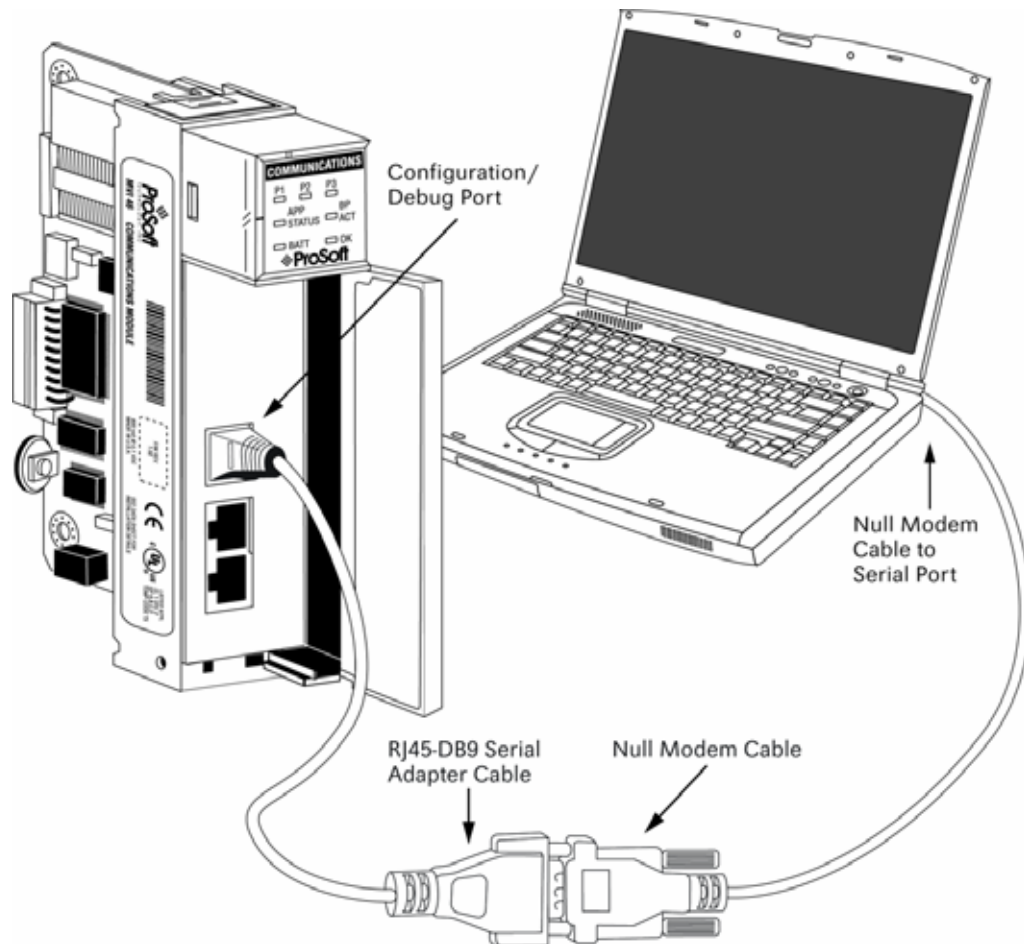
- 4 Click the Auto-Configure button. RSLinx will attempt to configure your serial port to work with the selected driver.
- 5 When you see the message "Auto Configuration Successful", click the OK button to dismiss the dialog box.

**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 Configuring the Module

### *In This Chapter*

- Quick Start Guide ..... 17
- DNP Master Port Command List ..... 18
- Configuration File ..... 25
- Uploading and Downloading the Configuration File ..... 30

Module configuration is accomplished through a text configuration file loaded from the module's Compact Flash disk.

Port 1 on the module connects to a DNP master unit. Port 2 can be attached to a DNP master or slave unit. These ports can be configured for an RS-232, RS-422 or RS-485 interface by setting the jumper on the port to the appropriate position. This defines the physical connection. Port 2 can be configured to utilize a dial-up modem if the port is configured as a slave.

You must also define the communication parameters and the DNP parameters. This includes parameters such as Baud Rate, RTS delays, timeouts, retry counts and modes of protocol operation.

### 2.1 Quick Start Guide

This section describes the installation of the MVI46-DNP module in an SLC rack and also provides information on installing and configuring the module.

- 1 Set the jumpers (page 9) on Port 1 and Port 2 for the correct communication interface (RS-232, RS-422 or RS-485). Each port is configured separately.
- 2 Turn off power to the SLC rack and install the module.
- 3 Turn on the power to the rack.

**CAUTION:** Installing the module into a SLC may cause the processor to fault and may cause incorrect operation of the current program loaded in the SLC. This operation must be performed by a qualified person familiar with the SLC program and module. The fault condition can be cleared after the correct program and the data tables have been configured in the SLC.

- 4 Configure the SLC for the module. Starting with the sample ladder logic provided with the module, complete the following steps.

**5** Configure the slot where the module is installed using the following parameters:

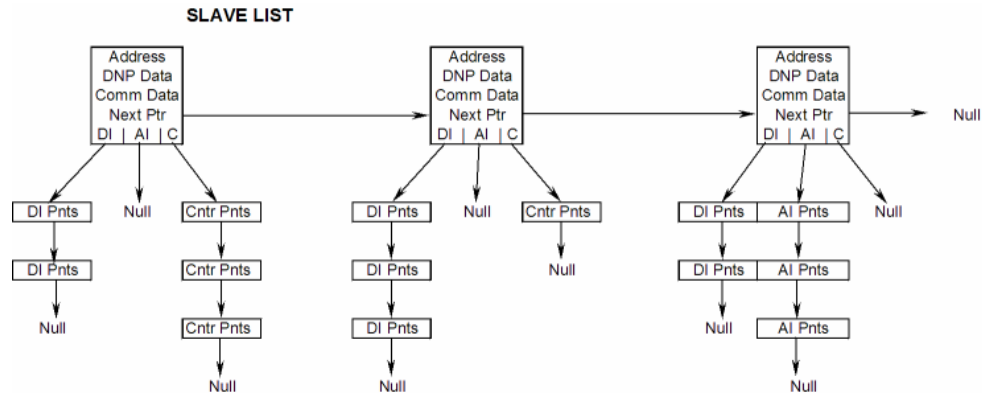
Type:	12835 - Other
Maximum Input Words:	2
Maximum Output Words:	2
Scanned Input Words:	2
Scanned Output Words:	2
Interrupt Service Routine (ISR)#	0
M0 Length:	3800
M1 Length:	2208
G File Length:	0

- 6** Download the example program to the SLC and edit the logic to verify the slot location of the module in the rack (all M0: and M1: related commands).
- 7** If all is configured properly, place the SLC in run mode and communication should start on the slave and master ports.
- 8** Use a text editor such as Notepad.exe to view and edit the example configuration file that ships with the module. Refer to [Configuration File](#) (page 25) for more information on modifying the configuration file.
- 9** Add ladder logic for your specific application.
- 10** Connect the remote DNP master device to Port 1 on the module.
- 11** Connect your PC to the configuration/debug port on the module using the supplied cable. Start a terminal emulation program such as HyperTerminal, and open a connection to the module. Refer to [The Configuration/Debug Menu](#) (page 39) for more information on viewing module status and configuration.
- 12** Connect a DNP master to Port 2 if configured as a DNP slave or connect DNP slave device(s) to Port 2 if configured as a DNP master.

**2.2 DNP Master Port Command List**

The DNP master port supports the use of a command list. This list issues DNP data requests and commands to DNP slave devices. Commands define the data types and points to be used in the command and the database locations in the module. The DNP and/or IED databases can be used with the commands. For example, the master port could request binary input data from a slave device and place the response data in the DNP or IED database. Another request could place the response binary data of another slave in both the DNP and IED databases. Use the configuration file (DNP.CFG) to configure the command list.

The commands are also used to define the point mapping of IED response data to the DNP database. These mappings are used for IED generated event messages. When an IED unit generates an event message, the module must be informed what point in the database to associate with the event. When the command list is read during initialization, the data point mapping is determined for each slave. Mappings are generated for binary input, analog input and counter points. A separate set of lists is maintained for each slave defined for the master port. The following illustration shows the storage of the data in the module.



DI Pnts are generated for each command with an object type of 1. AI Pnts are generated for each command with an object type of 30. Cntr Pnts are generated for each command with an object type of 20 or 21.

When a master port receives a poll response or an unsolicited response message, the points in the message are mapped to the IED and/or DNP databases using the point lists. For example, when a master port receives a value for binary input point 10 from slave unit 14, the module performs the following steps:

- 1 The module searches the slave list to make sure slave 14 is valid for the module. If the slave is not found, the message is ignored. If the slave is found, the module saves the pointer to the binary input point list.
- 2 Point number 10 is searched for in the binary input point list. If the point is found in the DNP point list, the new value is stored at the correct offset in the DNP database. If the point is found in the IED point list, the new value is stored at the correct offset in the IED database. If the point is not found in either point list, it is ignored.

**Note:** Data can be placed in both the DNP and IED databases if the point number is found in both searches. This would cause the value to be stored for use by the remote DNP master unit and the SLC ladder logic.

Each node in the point lists contains the start-stop IED point ranges and the IED and DNP database offset values. These values are read by the module from the command list each time the module performs the restart operation. If the IED or DNP database value is set to -1 or 65535, the database is not used for the specified point range.

Each entry in the command list requires a 10-word storage area. The following table describes the fields within this area:

Word Offset	Definitions
0	Port/Flags
1	Slave Address
2	Object
3	Variation
4	Function
5	Address in Slave
6	Point Count
7	DNP DB Address
8	IED DB Address
9	Poll Interval

Bits in the Port/Flags parameter are dependent on the data type. The following table describes the Port/Flags bits for binary input, analog input and counter data points.

Port/Flags Bits	Description	Decimal Equivalent
0 to 1	Communication port (0=Internal, 2=Port 2)	0 or 2
2	Enable/Disable Command (1=Enable, 0=Disable)	4
3	RBE Flag (0=Events from IED, 1=Events by module)	8
4 to 7	Not Used	

For these data types the qualifier used in the data request is dependent on the Point Count and Address in Slave fields in the command as follows:

- If Point Count < 0, then use Qualifier 06h (All points, packed & -Point Count = # of points to consider)
- If Address in Slave = 0 & Point Count > 0, then use Qualifier 00h or 01h (points 0 to Point Count -1)
- If Address in Slave > 0 & Point Count > 0, then use Qualifier 00h or 01h (Address in Slave to Address in Slave + Point Count -1)

The following table describes the Port/Flags bits for binary output and analog output points.

Port/Flags Bits	Description	Decimal Equivalent
0 to 1	Communication port (0=Internal, 2=Port 2)	0 or 2
2	Enable/Disable Command (1=Enable, 0=Disable)	4
3	Poll Type (0=Poll, 1=Exception)	8
4	Data Source (0=DNP Database, 1=IED Database)	16
5 to 7	Not Used	

For these data types the qualifier used in the data request is dependent on the Point Count and Address in Slave fields in the command as follows:

- If Address in Slave = 0 & Point Count > 0, then use Qualifier 17h or 28h (Point Count specified starting at point 0)
- If Address in Slave > 0 & Point Count > 0, then use Qualifier 17h or 28h (points from Address in Slave to Address in Slave + Point Count -1)
- If Point Count <= 0, then ignore because this is illegal for outputs.

**Slave Address:** This parameter specifies the IED unit address on the DNP network to be considered with the command. The parameter has a range of 0 to 65535. The value of 65535 is reserved for broadcast messages. You must set up the slave configuration information in the module for each slave defined in the command list.

**Object:** This parameter specifies the DNP object type in the command. Valid objects for the module are 1, 2, 12, 20, 21, 30, 32, 41, 50, 60 and 80. A value of 0 is permitted in this field for a set of special commands.

**Variation:** This parameter is specific to the object type selected.

**Function:** This parameter specifies the DNP function for the command list object. The object type determines the value of the functions permitted. For example, the only function permitted for binary input data points is the read function (Function Code 1). For counter and output objects, more functions are available.

**Address in Slave:** This value must be greater-than or equal to zero. If it is set to a value less-than zero, the command is ignored. This parameter specifies the starting point address to consider in the IED unit.

**Point Count:** This parameter defines the number of points in the IED unit. Refer to the discussion above for the interpretation of this parameter's values for the different object types.

**DNP DB Address:** This parameter defines the starting location in the DNP database to be used with the command. If the parameter has a value of -1, the DNP database is not used with the point.

**IED DB Address:** This parameter defines the starting location in the IED database to be used with the command. If the parameter has a value of -1, the IED database is not used with the point.

**Poll Interval:** This parameter specifies the minimum frequency at which the module should execute the command. The value is entered in units of seconds. For example, to execute a command every 10 seconds, enter a value of 10 in the field. A value of 0 for the parameter implies that the command should be executed every scan of the list.

The module provides for the objects and variations of Level 2 support of the DNP Version 3.0 protocol. The object selected for each command determines several of the fields of the command, as described in the following tables:

	Digital input	Digital input Events	Digital Output	Counter
0	Port/Flags	Port/Flags	Port/Flags	Port/Flags
1	Slave Address	Slave Address	Slave Address	Slave Address
2	1	2	12	20
3	0, 1 or 2	0, 1, 2 or 3	1*	0, 5 or 6
4	1*	1*	3, [4], 5 or 6	1, 7, 8, 9 or 10
5	Address in Slave	Address in Slave	Address in Slave	Address in Slave
6	# of Points	# of Points	# of Points	# of Points

	<b>Digital input</b>	<b>Digital input Events</b>	<b>Digital Output</b>	<b>Counter</b>
7	DNP DB Address		DNP DB Address	DNP DB Address
8	IED DB Address		IED DB Address	IED DB Address
9	Poll Interval	Poll Interval	Poll Interval	Poll Interval
	<b>Frozen Counter</b>	<b>Analog Input</b>	<b>Analog Input Events</b>	<b>Analog Output</b>
0	Ports/Flags	Ports/Flags	Ports/Flags	Ports/Flags
1	Slave Address	Slave Address	Slave Address	Slave Address
2	21	30	32	41
3	0, 9 or 10	0, 1, 2, 3 or 4	0, 1, 2, 3 or 4	2*
4	1*	1*	1*	3, [4], 5 or 6
5	Address in Slave	Address in Slave	Address in Slave	Address in Slave
6	# of Points	# of Points	# of Points	# of Points
7	DNP DB Address	DNP DB Address		DNP DB Address
8	IED DB Address	IED DB Address		IED DB Address
9	Poll Interval	Poll Interval	Poll Interval	Poll Interval
	<b>Time and Date</b>	<b>Class 0</b>	<b>Class 1</b>	<b>Class 2</b>
0	Ports/Flags	Ports/Flags	Ports/Flags	Ports/Flags
1	Slave Address	Slave Address	Slave Address	Slave Address
2	50	60	60	60
3	1*	1	2	3
4	2*			
5				
6	1	1	1	1
7				
8				
9	Poll Interval	Poll Interval	Poll Interval	Poll Interval
	<b>Cold Restart</b>	<b>Warm Restart</b>	<b>Enable Unsol. Msg</b>	<b>Disable Unsol. Msg</b>
0	Ports/Flags	Ports/Flags	Ports/Flags	Ports/Flags
1	Slave Address	Slave Address	Slave Address	Slave Address
2	0	0	0	0
3				
4	13	14	20	21
5				
6	1	1	1	1
7				
8				
9				

Commands are issued by the DNP master port based on the following criteria:

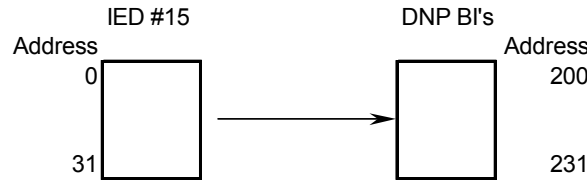
- Commands issued each scan  
Enabled, Poll Interval = 0 and binary and analog outputs have exception bit = 0
- Commands issued at poll time  
Enabled, Poll Interval > 0 and binary and analog outputs have exception bit = 0
- Commands issued on data change (BO and AO)  
Enabled and binary and analog outputs have exception bit = 1

The master port task cycles through the command list sequentially, searching for commands to execute. Commands that meet one of the criteria above are executed.

The following illustrations describe examples of binary input and binary output commands.

**BINARY INPUT COMMAND EXAMPLES:**

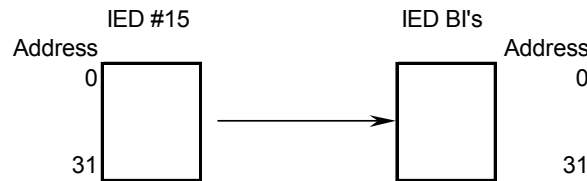
	Port/Flg	Slave	Object	Var	Func	Addr	Pnt Cnt	DNP DB	IED DB	Poll Int
WORD	0	1	2	3	4	5	6	7	8	9
VALUE	6	15	1	0	1	0	-32	200	-1	2



NOTE: Data directly accessible by remote DNP master. Data not accessible by PLC. Events generated by IED unit not by module.

Command for Port 2, Enabled, RBE flag not set. IED Unit 15 is to be polled. Object type is 1 (Binary Input). Variation of 0 (default variation). Function 1 is for a read. Slave address ignored (Qual 6, all points). Point count of -32 indicates only first 32 points are to be used. DNP DB address of 200 is where first data point will be placed. IED DB is not used (-1). Poll command every 2-seconds.

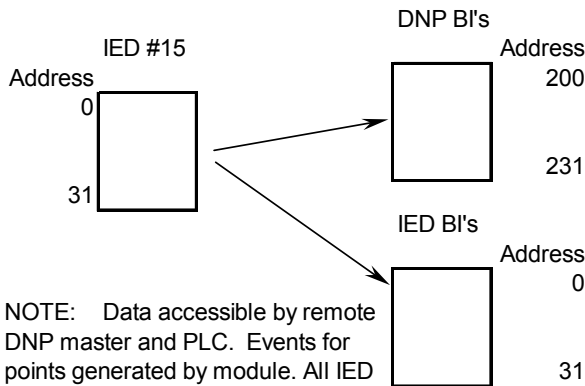
	Port/Flg	Slave	Object	Var	Func	Addr	Pnt Cnt	DNP DB	IED DB	Poll Int
WORD	0	1	2	3	4	5	6	7	8	9
VALUE	6	15	1	0	1	0	-32	-1	0	2



NOTE: Data not accessible by remote DNP master. Data accessible by PLC. No DNP data so RBE flag ignored.

Command for Port 2, Enabled. IED Unit 15 is to be polled. Object type is 1 (Binary Input). Variation of 0 (default variation). Function 1 is for a read. Slave address ignored (Qual 6, all points). Point count of -32 indicates only first 32 points are to be used. DNP DB is not used (-1). IED DB address of 0 is where first data point is placed. Poll command every 2-seconds.

	Port/Flg	Slave	Object	Var	Func	Addr	Pnt Cnt	DNP DB	IED DB	Poll Int
WORD	0	1	2	3	4	5	6	7	8	9
VALUE	14	15	1	0	1	0	-32	200	0	2

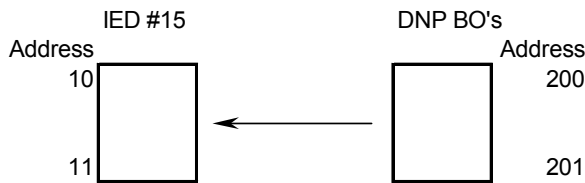


NOTE: Data accessible by remote DNP master and PLC. Events for points generated by module. All IED generated events are ignored.

Command for Port 2, Enabled, RBE Flag Set. IED Unit 15 is to be polled. Object type is 1 (Binary Input). Variation of 0 (default variation). Function 1 is for a read. Slave address ignored (Qual 6, all points). Point count of -32 indicates only first 32 points are to be used. DNP DB address of 200 is where first data point is placed. IED DB address of 0 is where first data point is placed. Poll command every 2-seconds.

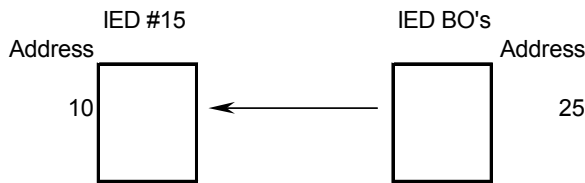
**BINARY OUTPUT COMMAND EXAMPLES:**

	Port/Flg	Slave	Object	Var	Func	Addr	Pnt Cnt	DNP DB	IED DB	Poll Int
WORD	0	1	2	3	4	5	6	7	8	9
VALUE	14	15	12	1	5	10	2	200	0	0



Command for Port 2, Enabled, only operate on point change & use DNP Database. IED Unit 15 is to be polled. Object type is 12 (Binary Output Control). Variation of 1 (Control Relay Output Block). Function 5 is for direct operate. Slave address of 10 is starting point in IED. Two points are to be transferred. DNP DB address of 200 is first source point. IED DB is not used. Command not a polled command.

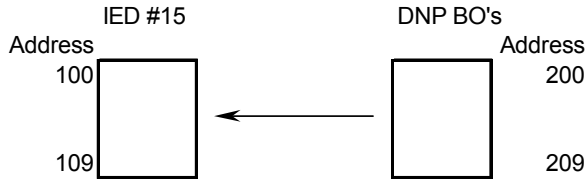
	Port/Flg	Slave	Object	Var	Func	Addr	Pnt Cnt	DNP DB	IED DB	Poll Int
WORD	0	1	2	3	4	5	6	7	8	9
VALUE	30	15	12	1	5	10	1	0	25	0



Command for Port 2, Enabled, only operate on point change & use IED Database. IED Unit 15 is to be polled. Object type is 12 (Binary Output Control). Variation of 1 (Control Relay Output Block). Function 5 is for direct operate. Slave address of 10 is starting point in IED. One point is transferred. DNP DB is not used. IED DB address of 25 is first source point. Command not a polled command.



	Port/Flg	Slave	Object	Var	Func	Addr	Pnt Cnt	DNP DB	IED DB	Poll Int
WORD	0	1	2	3	4	5	6	7	8	9
VALUE	6	15	12	1	5	100	10	200	0	120



Command for Port 2, Enabled, poll command & use DNP Database.  
 IED Unit 15 is to be polled.  
 Object type is 12 (Binary Output Control).  
 Variation of 1 (Control Relay Output Block).  
 Function 5 is for direct operate.  
 Slave address of 100 is starting point in IED.  
 Ten points are to be transferred.  
 DNP DB address of 200 is first source point.  
 IED DB is not used.  
 Poll command every 120-seconds.

### 2.3 Configuration File

In order for the module to operate, a configuration file (DNP.CFG) is required. This configuration file contains information to set the data transfer characteristics between the module and the processor, to configure the communication information, to establish the DNP protocol parameters and to define the databases required to hold the protocol data sets. Each parameter in the file must be set carefully in order for the application to be implemented successfully. Before editing the file, design your system using the forms located in the Reference chapter of this document.

The configuration file is separated into sections with topic header names enclosed in the [ ] characters. The configuration file consists of the following topics:

[Section]	Description
[Module]	General Module configuration section
[DNP Slave]	DNP slave protocol definitions
[DNP Slave Database]	Database definition for the DNP slave driver
[DNP Slave Binary Inputs]	Class assignments for each binary input point in the DNP database. These assignments will override the default setting.
[DNP Slave Analog Inputs]	Class and deadband assignments for each analog input point in the DNP database. These assignments will override the default settings.
[DNP Slave Float Inputs]	Class and deadband assignments for each analog floating-point input point in the DNP database. These assignments will override the default settings.
[Secondary Port]	Communication settings for the secondary port on the module (secondary slave or master port)
[DNP Master]	Definitions of the DNP Master port on the module if utilized
[IED Database]	Database definition for the DNP Master port to hold data to interface with the IEDs.

[Section]	Description
[DNP Master Slave List]	Slave set up information for the DNP Master port. This list contains the settings required for each IED unit the master will interface with.
[DNP Master Commands]	This list contains the command list to be utilized by the DNP Master port. These commands will be issued to configured IED units.

After each section header, the file contains a set of parameters. Unique labels are used under each section to specify a parameter. Each label in the file must be entered exactly as shown in the file for the parameter to be identified by the program. If the module is not considering a parameter, look at the label for the data item. Each parameter's value is separated from the label with the ':' character. This character is used by the program to delimit the position in the data record where to start reading data. All data for a parameter must be placed after the ':' character. For numeric parameter values any text located after the value will not be used. There must be at least one space character between the end of the parameter value and the following text. The following example shows a parameter entry:

```
RTS On : 6          #Set RTS On delay value from 0 to 65535 milliseconds
```

The parameter label is "RTS On" and the parameter value is 6. The characters after the parameter value are ignored and are used for internal documentation of the configuration file.

Any record that begins with the '#' character is considered to be a comment record. These records can be placed anywhere in the file as long as the '#' character is found in the first column of the line. These lines are ignored in the file and can be used to provide documentation within the configuration file. Liberal use of comments within the file can ease the use and interpretation of the data in the file.

Sections of the configuration file that contain lists of data are formatted differently. Each list begins with the label **START** and ends when the **END** label is reached. When entering the list data, make certain that the first character in each line is left blank.

### 2.3.1 Slave List

The slave list defines the IED units and their specific communication parameters for a DNP master port. Up to 40 IED units can be defined in the module to be associated with the master port. The structure of each row in the list is defined in the following table:

Column	Variable Name	Data Range	Description	IF Error
1	DNP Slave Address	0 to 65534	This is the slave address for the unit to override the default values.	Ignore
2	Data Link Confirm Mode	Coded Value (0=Never, 1=Sometimes, 2=Always)	This value specifies if data link frames sent to the remote device require a data link confirm. This value should always be set to zero for almost all applications.	0

Column	Variable Name	Data Range	Description	IF Error
3	Data Link Confirm Time-out	1 to 65535 milliseconds	This parameter specifies the time to wait for a data link confirm from the remote device before a retry is attempted.	300
4	Maximum Retries for Data Link Confirm	0 to 255 retries	Maximum number of retries at the Data Link level to obtain a confirmation. If this value is set to 0, retries are disabled at the data link level of the protocol. This parameter is only used if the frame is sent with confirmation requested.	3
5	Application Layer Response Time-out	1 to 65535 milliseconds	Time-out period the master will wait for each response message fragment. If data link confirms are enabled, make sure the time-out period is set long enough to permit all data confirm retries.	5000
6	Slave Mode	Coded Value (Bit 0=Enable, Bit 1=Unsol Msg, Bit 2=Use DM, Bit 3=Auto Time Sync)	This word contains bits that define the slave mode. The slave mode defines the functionality of the slave device and can be combined in any combination. The fields have the following definition: Enable: determines if this slave will be used. Unsol Msg: causes an enabled unsolicited response message to be sent to the slave when its RESTART IIN bit is set. This parameter is also required for unsolicited message reporting by the IED unit. Use DM: uses delay measurement. Auto Time Sync: time synchronization used when NEED TIME IIN bit set.	5

### 2.3.2 Command List

The command list stores the command list used by the DNP master port. This list only must be defined if the DNP master port is used. Up to 300 commands can be defined for the master port. The structure of each row in the list is shown in the following table:

Word Offset	Definitions
0	Port/Flags
1	Slave Address
2	Object
3	Variation
4	Function
5	Address in Slave

Word Offset	Definitions
6	Point Count
7	DNP DB Address
8	IED DB Address
9	Poll Interval

The definition of each parameter required for each command is provided in the following table.

Bits in the Port/Flags parameter are dependent on the data type. The following table defines the Port/Flags bits for binary input, analog input and counter data points.

Port/Flags Bits	Description	Decimal Equivalent
0 to 1	Communication port (0=Internal, 2=Port 2)	0 or 2
2	Enable/Disable Command (1=Enable, 0=Disable)	4
3	RBE Flag(0=Events from IED, 1=Events by module)	8
4 to 7	Not Used	

For these data types the qualifier used in the data request is dependent on the Point Count and Address in Slave fields in the command as follows:

If Point Count < 0, then use Qualifier 06h (All points, packed & -Point Count = # of points to consider)

If Address in Slave = 0 & Point Count > 0, then use Qualifier 00h or 01h (points 0 to Point Count -1)

If Address in Slave > 0 & Point Count > 0, then use Qualifier 00h or 01h (Address in Slave to Address in Slave + Point Count -1)

The following table defines the Port/Flags bits for binary output and analog output points.

Port/Flags Bits	Description	Decimal Equivalent
0 to 1	Communication port (0=Internal, 2=Port 2)	0 or 2
2	Enable/Disable Command (1=Enable, 0=Disable)	4
3	Poll Type (0=Poll, 1=Exception)	8
4	Data Source(0=DNP Database, 1=IED Database)	16
5 to 7	Not Used	

For these data types the qualifier used in the data request is dependent on the Point Count and Address in Slave fields in the command as follows:

If Address in Slave = 0 & Point Count > 0, then use Qualifier 17h or 28h (Point Count specified starting at point 0)

If Address in Slave > 0 & Point Count > 0, then use Qualifier 17h or 28h (points from Address in Slave to Address in Slave + Point Count -1)

If Point Count <= 0, then ignore because this is illegal for outputs.

### Slave Address

This parameter specifies the IED unit address on the DNP network to consider with the command. The parameter has a range of 0 to 65535. The value of 65535 is reserved for broadcast messages. Be certain the slave configuration information is set up in the module for each slave defined in the command list.

### Object

This parameter specifies the DNP object type in the command. Valid objects for the module are 1, 2, 12, 20, 21, 30, 32, 41, 50, 60 and 80. A value of 0 is permitted in this field for a set of special commands.

### Variation

This parameter is specific to the object type selected.

### Function

This parameter specifies the DNP function for the command list object. The object type determines the value of the functions permitted. For example, the only function permitted for binary input data points is the read function (Function Code 1). For counter and output objects, more functions are available.

### Address In Slave

This value must be greater-than or equal to zero. If it is set to a value less-than zero, the command will be ignored. This parameter specifies the starting point address to consider in the IED unit.

### Point Count

This parameter defines the number of points in the IED unit. Refer to the discussion above for the interpretation of this parameter's values for the different object types.

### DNP DB Address

This parameter defines the starting location in the DNP database to be used with the command. If the parameter has a value of -1, the DNP database is not used with the point.

### IED DB Address

This parameter defines the starting location in the IED database to be used with the command. If the parameter has a value of -1, the IED database is not used with the point.

Poll Interval

This parameter specifies the minimum frequency at which the module should execute the command. The value is entered in units of seconds. For example, to execute a command every 10 seconds, enter a value of 10 in the field. A value of 0 for the parameter implies that the command should be executed every scan of the list.

## 2.4 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 39).

### 2.4.1 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.

```
***** DNP DEBUG PORT HELP *****
KEY      FUNCTION                      | KEY FUNCTION
-----|-----
0-9,A-F  Sets debug level                 | Y   Class/Deadband Assignments
L        Display error list             | U   Show DNP Databases
P        Display setup & pointers       | <   Receive Configuration
O        Operating parameters           | >   Send Configuration
R        Reboot module                  |
S        Display Comm Stats             |
W        Clear error list                | N   Display Blk X-fer Stats
V        List COM States                 | X   Master Port Commands
T        Master Port Slave Setup         | Z   Master Port Slave Errs
G        Version Information             | ?   Display this screen

PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
```

- Press [**>**] key (Send Module Configuration). The message "Press Y to confirm configuration send!" is displayed at the bottom of the screen.

```

***** DNP DEBUG PORT HELP *****
KEY      FUNCTION                | KEY FUNCTION
-----|-----
0-9,A-F  Sets debug level          | Y   Class/Deadband Assignments
L        Display error list       | U   Show DNP Databases
P        Display setup & pointers | <   Receive Configuration
O        Operating parameters     | >   Send Configuration
R        Reboot module
S        Display Comm Stats
W        Clear error list         | N   Display Blk X-fer Stats
V        List COM States          | X   Master Port Commands
T        Master Port Slave Setup  | Z   Master Port Slave Errs
G        Version Information      | ?   Display this screen

PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
Confirm Receive Configuration File from Remote PC by pressing 'Y' key....

```

- Press [**Y**]. The module will automatically start a Zmodem file transfer. The configuration file will be stored in the default file transfer folder on your PC.

- Note:** ProSoft Technology suggests that you download the configuration file pre-loaded on your module. However, configuration files are also available on the ProSoft CD as well as the ProSoft Technology web site at <http://www.prosoft-technology.com>.

When the configuration file has been transferred to your PC, the dialog box will indicate that the transfer is complete.

```

0-9,A-F  Sets debug level          | Y   Class/Deadband Assignments
L        Display error list       | U   Show DNP Databases
P        Display setup & pointers | <   Receive Configuration
O        Operating parameters     | >   Send Configuration
R        Reboot module
S        Display Comm Stats
W        Clear error list         | N   Display Blk X-fer Stats
V        List COM States          | X   Master Port Commands
T        Master Port Slave Setup  | Z   Master Port Slave Errs
G        Version Information      | ?   Display this screen

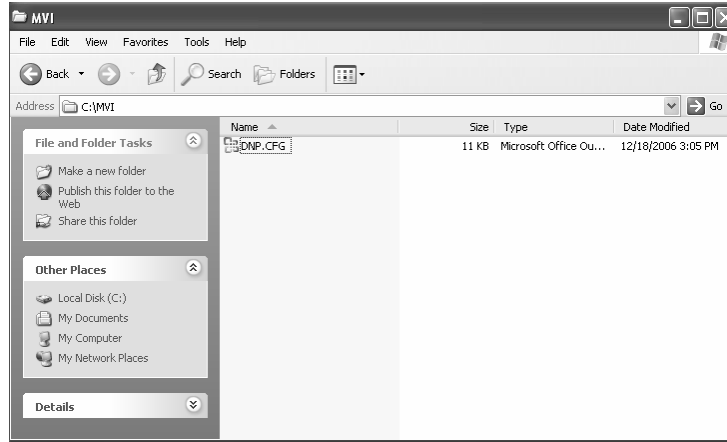
PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
Confirm Send Configuration File to Remote PC by pressing 'Y' key....
Sending configuration file:

TRANSFERRING CONFIGURATION FILES FROM MVI MODULE TO PC:

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

```

The configuration file is now in a folder on your PC. To view the location of this folder, open the Transfer menu in Hyperterminal and choose Receive File.



- 4 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.

**Important:** You must name this file DNP.CFG before you transfer it to the module. The module will not recognize configuration files with any other name or extension.

### 2.4.2 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.

```

***** DNP DEBUG PORT HELP *****
KEY      FUNCTION                               | KEY FUNCTION
-----|-----
0-9,A-F  Sets debug level                            | Y   Class/Deadband Assignments
L        Display error list                    | U   Show DNP Databases
P        Display setup & pointers              | <   Receive Configuration
O        Operating parameters                  | >   Send Configuration
R        Reboot module                         |
S        Display Comm Stats                    |
W        Clear error list                      | N   Display Blk X-fer Stats
V        List COM States                       | X   Master Port Commands
T        Master Port Slave Setup               | Z   Master Port Slave Errs
G        Version Information                   | ?   Display this screen

PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
    
```



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

```

***** DNP DEBUG PORT HELP *****
KEY      FUNCTION                | KEY FUNCTION
-----|-----
0-9,A-F Sets debug level         | Y   Class/Deadband Assignments
L        Display error list       | U   Show DNP Databases
P        Display setup & pointers | <   Receive Configuration
O        Operating parameters     | >   Send Configuration
R        Reboot module
S        Display Comm Stats
W        Clear error list         | N   Display Blk X-fer Stats
V        List COM States          | X   Master Port Commands
T        Master Port Slave Setup  | Z   Master Port Slave Errs
G        Version Information      | ?   Display this screen

PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
Confirm Receive Configuration File from Remote PC by pressing 'Y' key....

```

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

```

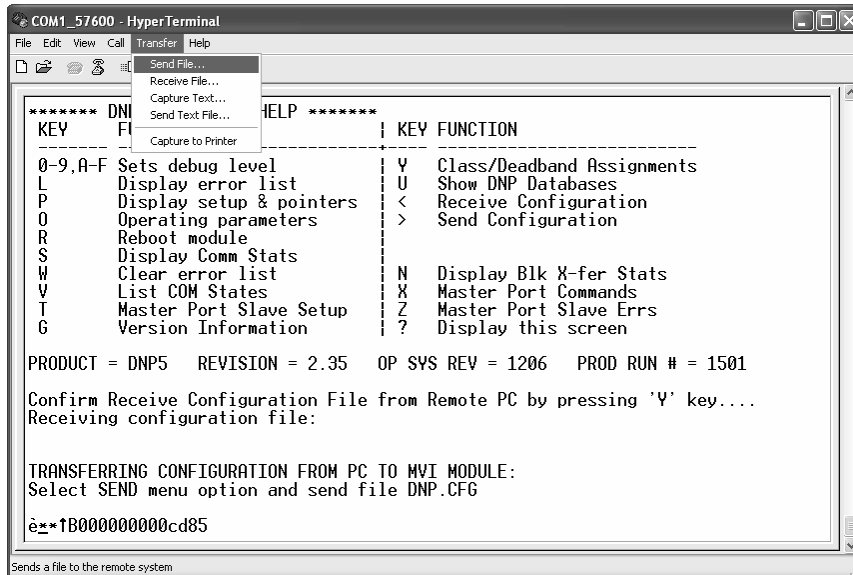
***** DNP DEBUG PORT HELP *****
KEY      FUNCTION                | KEY FUNCTION
-----|-----
0-9,A-F Sets debug level         | Y   Class/Deadband Assignments
L        Display error list       | U   Show DNP Databases
P        Display setup & pointers | <   Receive Configuration
O        Operating parameters     | >   Send Configuration
R        Reboot module
S        Display Comm Stats
W        Clear error list         | N   Display Blk X-fer Stats
V        List COM States          | X   Master Port Commands
T        Master Port Slave Setup  | Z   Master Port Slave Errs
G        Version Information      | ?   Display this screen

PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
Confirm Receive Configuration File from Remote PC by pressing 'Y' key....
Receiving configuration file:

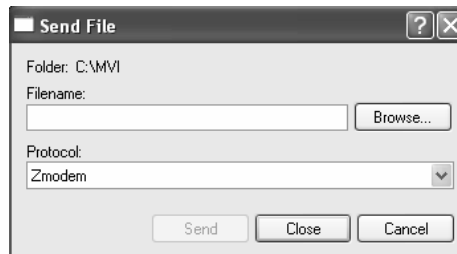
TRANSFERRING CONFIGURATION FROM PC TO MVI MODULE:
Select SEND menu option and send file DNP.CFG
è*†B000000027fed4

```

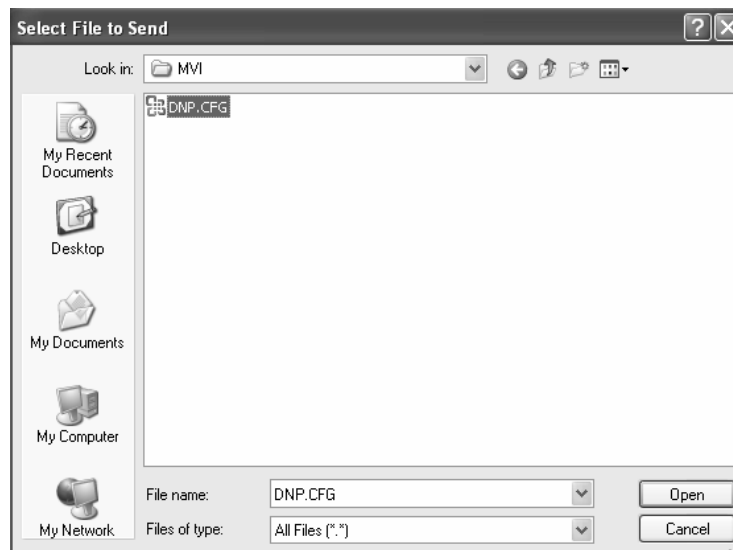
4 From the **Transfer** menu in HyperTerminal, select **Send File**.



The Send File dialog appears.

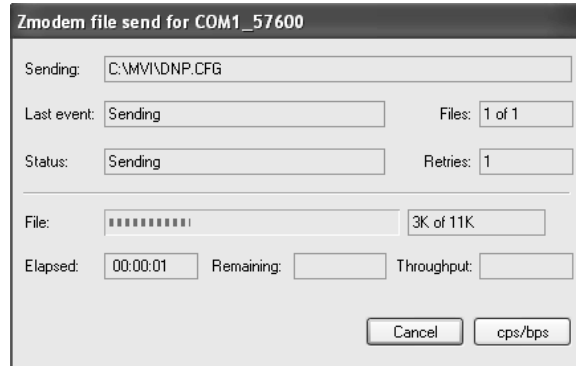


5 Use the Browse button to locate the configuration file your computer.

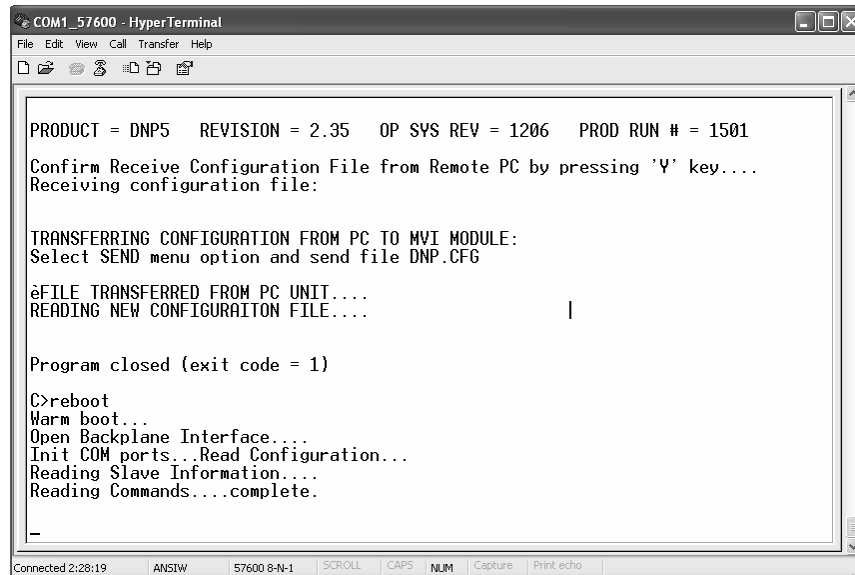


**Note:** This procedure assumes that you are uploading a newly edited configuration file from your PC to the module. However, configuration files are also available on the ProSoft CD as well as the ProSoft Technology web site.

- 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. Press [?] to see the module's main menu.



### 3 Ladder Logic

Ladder logic is required for application of the MVI46-DNP module. Tasks that must be handled by the ladder logic are module data transfer, special block handling and status data receipt. Additionally, a power-up handler may be needed to handle the initialization of the module's data and to clear any processor fault conditions.

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



## 4 Diagnostics and Troubleshooting

### *In This Chapter*

➤ The Configuration/Debug Menu .....	39
➤ LED Status Indicators .....	52
➤ Clearing a Fault Condition.....	53
➤ Troubleshooting .....	53

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 The Configuration/Debug Menu

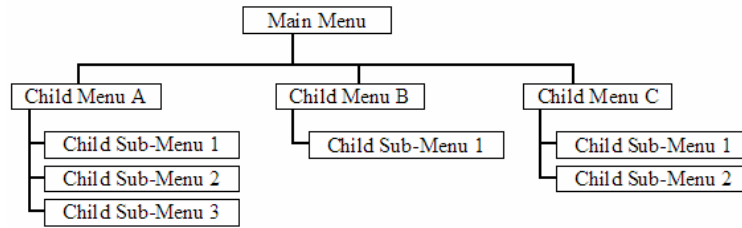
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

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.

#### **4.1.1 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 [**i**] (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	XON/XOFF

- 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 86).
- 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 DEBUG PORT HELP *****
KEY      FUNCTION                | KEY FUNCTION
-----|-----
0-9,A-F Sets debug level         | Y   Class/Deadband Assignments
L        Display error list       | U   Show DNP Databases
P        Display setup & pointers | <   Receive Configuration
O        Operating parameters     | >   Send Configuration
R        Reboot module            |
S        Display Comm Stats       |
W        Clear error list         | N   Display Blk X-fer Stats
V        List COM States          | X   Master Port Commands
T        Master Port Slave Setup  | Z   Master Port Slave Errs
G        Version Information       | ?   Display this screen

PRODUCT = DNP5   REVISION = 2.35   OP SYS REV = 1206   PROD RUN # = 1501
    
```

**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.

#### Setting the Debug Level

You can increase or decrease the level of debug messages sent from the module to the Debug Menu. The following table shows the type of debugging information for each key [0] to [9], [A] to [F]

Key	None	DNP Statistics	Data Link Layer Messages	DPA Level Messages
0	X			
1		X		
2			X	
3		X	X	
4				
5		X		
6			X	
7		X	X	
8				X

Key	None	DNP Statistics	Data Link Layer Messages	DPA Level Messages
9		X		X
A			X	X
B		X	X	X
C				X
D		X		X
E			X	X
F		X	X	X

### Viewing the Error List

Press **[L]** to display the last 60 errors for the DNP slave port. Refer to the error list section of the user manual to interpret each error recorded by the module.

If there are no errors present for the module, the message "NO ERRORS FOR SYSTEM!" is displayed.

### Viewing DNP Set Up & Pointers

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

### Viewing Operating Parameters

Press **[O]** to view the DNP Protocol setup information (Operating Parameters) for the module.

### 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 **[R]** from the Main Menu to warm boot (restart) the module. This command will cause the program to exit and reload, refreshing configuration parameters that must be set on program initialization. Only use this command if you must force the module to re-boot.

### Viewing Comm Stats

Press **[S]** to view the communication status for the DNP port.

### Clearing the Error List

Press **[W]** to clear the error list. Use this command after viewing the error list (page 43) to delete the current list of errors and start a new list.

### Viewing COM States

Press **[V]** to view the current state of the DNP application port and the port configuration information.

### Viewing Master Port Slave Setup

Press **[T]** to view configuration information for the Master Port Slave.

### Viewing Version Information

Press **[G]** 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.

### Opening the Class Assignment Menu

Press **[Y]** to view the class and deadband override values for the binary, analog, float and double input DNP database.

### Opening the DNP Database View Menu

Press **[U]** to open the DNP Database View 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 Database View Menu (page 47).

### Receiving the Configuration File

Press **[<] (Shift Comma)** 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 30).

### Sending the Configuration File

Press **[>] (Shift Period)** 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 30).

### Viewing Block Transfer Statistics

Press **[N]** 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:** Repeat this command at one-second intervals to determine the number of blocks transferred each second.

#### Opening the Command List Menu

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

```

***** DNP MASTER PORT COMMAND SELECTION MENU *****
PRODUCT = DNP      REVISION = 1.00  OP SYS REV = 0900  PROD RUN # = 1501
SELECT RANGE OF COMMANDS TO VIEW USING ONE OF THE KEYS INDICATED.
KEY-COMMANDS      KEY-COMMANDS      KEY-COMMANDS      KEY-COMMANDS      KEY-COMMANDS
0 - 0-19          1 - 20-39          2 - 40-59          3 - 60-79          4 - 80-99
5 - 100-119      6 - 120-139       7 - 140-159       8 - 160-179       9 - 180-199
A - 200-219      B - 220-239       C - 240-259       D - 260-279       E - 280-299
  
```

#### Opening the Command Error List Menu

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

```

***** DNP MASTER PORT SLAVE SELECTION MENU *****
PRODUCT = DNP      REVISION = 1.00  OF SYS REV = 0900  PROD RUN # = 1501
SELECT RANGE OF SLAVES TO VIEW USING ONE OF THE KEYS INDICATED.
KEY-SLAVES        KEY-SLAVES        KEY-SLAVES        KEY-SLAVES
0 - 0-9           1 - 10-19         2 - 20-29         3 - 30-39
  
```

### 4.1.6 The Class Assignment Menu

This menu allows you to view the class and deadband override values for the binary, analog, float and double input DNP database. Press **[?]** to display the commands available on this menu.

```

CLASS ASSIGNMENT MENU
?=Display Menu
0=Binary Inputs
1=Analog Inputs
2=Float Inputs
3=Double Inputs
S=Show Again
P=Previous Page
N=Next Page
M=Main Menu
  
```

The following illustration shows the output for the Analog data set (menu key [1])

POINT#	CLASS	DEADBAND
0	1	1000
1	1	1000
2	1	1000
3	1	1000
4	1	1000
5	1	1000
6	1	2000
7	1	2000
8	2	1000
9	3	2000
10	2	1000
11	2	1000
12	1	1000
13	1	1000
14	1	1000
15	1	1000
16	1	1000
17	1	1000
18	1	1000
19	1	1000

Viewing Binary Inputs

Press [0] to view the override values for Binary Input Data.

Viewing Analog Inputs

Press [1] to view the override values for Analog Input Data.

Viewing Float Inputs

Press [2] to view the override values for Float Input Data.

Viewing Double Inputs

Press [3] to view the override values for Double Input Data.

Redisplaying the Current Page

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

Viewing the Previous Page of Data

Press [P] to display the previous page of data.

Viewing the Next Page of Data

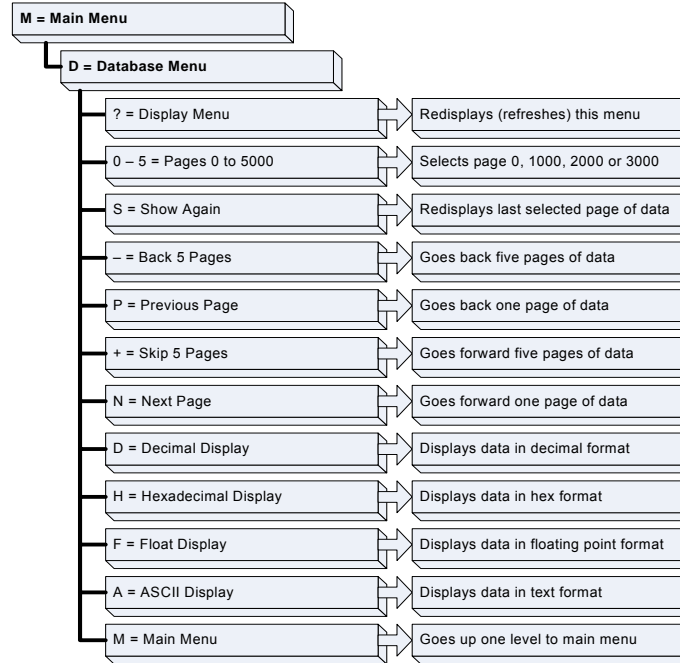
Press [N] to display the next page of data.

Returning to the Main Menu

Press [M] to return to the Main Menu.

### 4.1.7 DNP Database View Menu

Use this menu command to view the current contents of the selected database.  
Press [?] to view a list of commands available on this menu.



```

? = Display Menu
S = Show Again
- = Back 5 Pages
P = Previous Page
+ = Skip 5 Pages
N = Next Page
D = Word Decimal Display
H = Word Hexadecimal Display
L = Double Word Decimal Display
X = Double Word Hexadecimal Display
F = Float Display
E = Double Float Display (only for double databases)
A = ASCII Display
1 = DNP Binary Inputs      2 = DNP Binary Outputs
3 = DNP Counters          4 = DNP Analog Inputs
5 = DNP Analog Outputs    6 = DNP Frozen Counters
7 = DNP Float Inputs      8 = DNP Double Inputs
9 = DNP Float Outputs     0 = DNP Double Outputs
B = IED Binary Inputs     C = IED Binary Outputs
G = IED Counters         I = IED Analog Inputs
J = IED Analog Outputs
M = Main Menu
  
```

Viewing Data Type Databases

Press **[D]** from the DNP menu, then hold down the **[Shift]** key and press the / key.

```

DNP DATABASE VIEW MENU
?=Display Menu
S=Show Again
-=Back 5 Pages
P=Previous Page
+=Skip 5 Pages
N=Next Page
D=Word Decimal Display
H=Word Hexadecimal Display
L=Double Word Decimal Display
X=Double Word Hexadecimal Display
F=Float Display
A=ASCII Display

1=Binary Inputs
2=Binary Outputs
3=Counters
4=Analog Inputs
5=Analog Outputs
6=Frozen Counters

M=Main Menu
    
```

Use the number keys 1 to 6 to select the display of the data type you wish to view. For example, if the '1' key is pressed, the following is displayed:

```

DNP BINARY INPUT DATABASE DISPLAY 0 TO 1 <DECIMAL>
  0  0
    
```

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

```

DATABASE DISPLAY 0 TO 99 <DECIMAL>
100 101 102  4  5  6  7  8  9 10
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
  0  0  0  0  0  0  0  0  0  0
    
```

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.

*Viewing Data in Double Word Decimal Format*

Press **[L]** to display the data on the current page in Double Word Decimal format. This is useful for regions of the database that contain Double Word Decimal data.

*Viewing Data in Double Word Hexadecimal Format*

Press **[X]** to display the data on the current page in Double Word Hexadecimal format. This is useful for regions of the database that contain Double Word Hexadecimal data.

*Viewing DNP Binary Inputs*

Press **[1]** to view a list of DNP Binary Inputs.

Viewing DNP Binary Outputs

Press **[2]** to view a list of DNP Binary Outputs.

Viewing DNP Counters

Press **[3]** to view a list of DNP Counters.

Viewing DNP Analog Inputs

Press **[4]** to view a list of DNP Analog Inputs.

Viewing DNP Analog Outputs

Press **[5]** to view a list of DNP Analog Outputs.

Viewing DNP Frozen Counters

Press **[6]** to view a list of DNP Frozen Counters.

Viewing DNP Float Inputs

Press **[7]** to view a list of DNP Float Inputs.

Viewing DNP Float Outputs

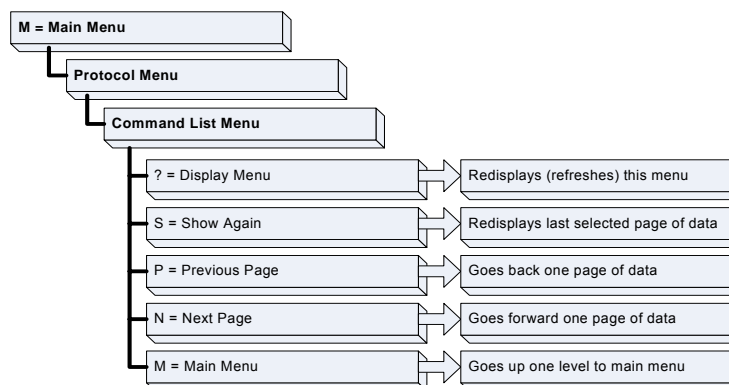
Press **[9]** to view a list of DNP Float Outputs.

Returning to the Main Menu

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

**4.1.8 Master Command List Menu**

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



Redisplaying the Current Page

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

Viewing the Previous 50 Commands

Press **[-]** to view the previous 50 commands.

Viewing the Previous Page of Commands

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

Viewing the Next 50 Commands

Press **[+]** to view the next 50 commands from the master command list.

Viewing the Next Page of Commands

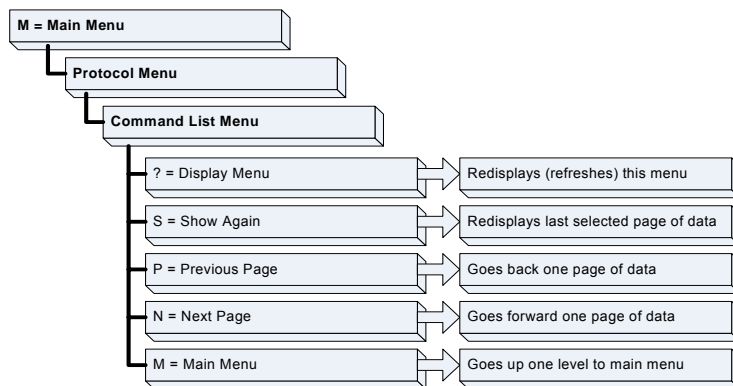
Press **[N]** to display the next page of commands.

Returning to the Main Menu

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

**4.1.9 Master Command Error List Menu**

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

Redisplaying the Current Page

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

Viewing the Previous 20 Commands

Press **[-]** to display data for the previous 20 commands.

Viewing the Previous Page of Commands

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

Viewing the Next 20 Commands

Press **[+]** to display data for the next 20 commands.

Viewing the Next Page of Commands

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

Returning to the Main Menu

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

## 4.2 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	Data is being transferred by the module on Port 1.
		Off	No data is being transferred on the port.
P2	Green	On	Data is being transferred by the module on Port 2
		Off	No data is being transferred on the port.
APP	Amber	On	The MVI module is working normally.
		Off	The MVI module program has recognized a communication error on one of its ports.
BP ACT	Amber	On	The LED is on when the module is performing a write operation on the backplane.
		Off	The LED is off when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly on and off.
OK	Red/ Green	Off	The card is not receiving any power and is not securely plugged into the rack.
		Green	The module is operating normally.
		Red	The program has detected an error or is being configured. If the LED remains red for over 10 seconds, the program has probably halted. Power down and remove the card from the rack and re-insert the card, then power up the rack.
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 the factory, as this is not a user serviceable item.

During module configuration, the OK LED will be red and the APP and BP ACT LEDs will be on. If the LEDs are latched in this mode for a long period of time, look at the configuration error words in the configuration request block.

### 4.3 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 SLC 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.

### 4.4 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: <ul style="list-style-type: none"> <li>▪ The processor is in Run mode.</li> <li>▪ The backplane driver is loaded in the module.</li> <li>▪ The module is configured for read and write block data transfer.</li> <li>▪ The ladder logic handles all read and write block situations.</li> <li>▪ The module is configured in the processor.</li> </ul>
OK LED remains red	The program has halted or a critical error has occurred. Connect to the Configuration/Debug port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert the card in the rack, and then restore power to the rack.



## 5 Reference

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### 5.1 Product Specifications

The MVI46 Distributed Network Protocol Module allows Rockwell Automation SLC I/O compatible processors to interface easily with other DNP protocol compatible devices. The module supports DNP Subset Level 2 features and some of the Level 3 features.

#### **5.1.1 Functional Specifications**

The MVI46-DNP module has three active serial ports

- CFG: Debug/Configuration RS-232
- PRT1: DNP slave RS-232, RS-422 or RS-485
- PRT2: DNP master/slave RS-232, RS-422 or RS-485

---

## DNP 3.0 Product Description

### Features and Benefits

- Time-stamped, report-by-exception data is logged to a sequence of event image in the module for host reading
- Supports report-by-exception and unsolicited responses on a time interval basis or on a user determined event count basis. Analog and binary input points are supported

### Data support maximum point counts (Slave)

- Digital inputs: 2048
- Digital outputs: 2048 (1024 Trip/Close)
- Counters: 64
- Analog inputs: 256
- Float Input: 64
- Float Output: 64
- Analog outputs: 128

### Data support Maximum Point Counts (Master)

- IED Digital Input: 2048
- IED Digital Output: 2048
- IED Counter: 64
- IED Analog Input: 256
- IED Analog Output: 128
- Up to 250 user defined commands can be entered into a command list, each fully configurable for function, slave address, register to/from addressing and word/bit count
- Conditional or continuous polling of command list with configurable poll delay per command
- Special command handling for digital output CROB under PLC control for pulse output control
- Communication error codes returned to ladder logic on a per command basis
- Configuration possible via ladder logic or by simple file text file download to configuration/debug port

### Debug/Configuration port (CFG)

- Communication parameters
  - Baud: 57600 (fixed)
  - Parity: none (fixed)
  - Stop: 1 (fixed)
- Configuration of module
- Communication and backplane transfer stats
- Protocol data monitor
- Internal database viewer

### DNP 3.0 ports (PRT1 & PRT2)

- User-definable module memory usage
- Full radio, modem and multi-drop support



- Support for the storage and transfer of all DNP data types across the backplane
- Communication parameters
  - Address: 0 to 65534 (slave mode)
  - Baud rate: 110 to 115K
  - Parity: none, data bits: 8, Stop bit: 1
  - RTS on delay: 0 to 65535 milliseconds
  - RTS off delay: 0 to 65535 milliseconds
- DNP protocol specifications
  - DNP 3.0 slave level 2 minimum
  - DNP 3.0 master level 2 minimum
- Unsolicited responses supported on slave ports

### 5.1.2 General Specifications

- Single Slot – 1746 backplane compatible (Local or extended I/O rack only. Remote rack not supported)
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module using M0/M1 files
- 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
Backplane Current Load	800 ma @ 5V (from backplane)
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
Relative Humidity	5% to 95% (non-condensing)
Vibration	5 g from 10150 Hz
Processor	Compatible with Rockwell Automation SLC 5/02 M0/M1 capable processors or newer
LED indicators	Module status, Backplane transfer status, Application status, Serial activity and error LED status
<b>Debug/Configuration port (CFG)</b>	
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) RS-232 only
Configuration Connector	RJ45 RS-232 Connector (RJ45 to DB-9 cable shipped with unit)
<b>Application Ports</b>	
Application Serial port (PRT1, PRT2) (Serial Modules)	Two RJ45 RS-232/422/485 Application ports

## 5.2 Functional Overview

In order to implement a solution using the module, the SLC must be set up using both program and data files. The data transfer interface requires ladder logic in order to interface data in the module with that in the SLC. Data is transferred between the module and the SLC through M-files located on the module. These data areas are shared data regions available to both the processor and the module. The ladder logic required is discussed in the ladder logic section. This program interacts with the module by sending and receiving data, issuing commands, and configuring the module.

Data files in the SLC contain the configuration and the data to be used by the module.

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.

### 5.2.1 Module Power Up and Configuration

Configuration information is stored on the module's Compact Flash. Setup of the module requires software configuration using the RSLogix 500 program and the DNP.CFG configuration file on the Compact Flash. The easiest method to implement the module is to start with the example provided with the module (MVI46-DNP.RSS) and the example configuration file (DNP.CFG). [Module Configuration](#) (page 17) describes how to use and/or modify the two files.

If the DNP master port is to be used, the module reads the slave configuration information and builds the slave list during the configuration process. The module also reads the command list from the M0: file. Valid commands will be added to the command list. Binary input, counter and analog input objects will be added to the point lists for each slave based on the commands processed. In addition, the RBE (Report By Exception) flags for the binary and analog input points are set in the RBE flag database.

The module next checks the DNP BO/AO (Binary Output / Analog Output) preset flag to determine if the DNP binary and analog output data must be read from the SLC. The option permits the SLC 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 "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. Ladder logic must transfer the data to the module using the M1-file data area for these data types.

The module now checks the IED (Intelligent Electronic Device) BI/AI/C (Binary Input / Analog Input / Counter) preset flag to determine if the IED binary and analog input and counter data must be read from the SLC. The option permits the SLC 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 "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. Ladder logic must transfer the data to the module using the M1-file data area for these data types.

After the module is completely configured, the module sets the configuration complete bit (I1: /1) in the module's input image. This bit can be used by the SLC ladder logic to indicate that the module is ready for data transfer operations.

### 5.2.2 Data Transfer Operation

After configuration is complete, the module starts data transfer to and from the M1: data area and reads the M0: file for command control operations.

The SLC's ladder logic and the module's program coordinate data transferred between the module and the SLC. The module constantly reads and writes the data in the M1: file of the module. Each scan of the module's program performs a database function on the M-files. The following table describes the scan sequence:

Data Type	Module	SLC
DNP Digital Input Data	Read	Write
DNP Analog Input Data	Read	Write
DNP Counter Data	Read	Write
DNP Digital Output Data	Write	Read
DNP Analog Output Data	Write	Read
IED Digital Input Data	Write	Read
IED Analog Input Data	Write	Read
IED Counter Data	Write	Read
IED Digital Output Data	Read	Write
IED Analog Output Data	Read	Write
DNP Float Input Data	Read	Write
DNP Float Output Data	Write	Read

Each write operation of the SLC must have a corresponding read operation in the module, and each write operation in the module must have a corresponding read operation in the SLC.

The SLC has priority in controlling access to the M1: file. If the ladder logic program accesses the database at a very high frequency, the module will be unable to perform any database operations. This usually occurs in applications that only have the DNP module in the rack without other I/O modules and the only application of the ladder logic is to interface with the M-files. This is a very rare application. Delay processing of the M1: file in the ladder logic so the module can gain access in such applications.

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### **5.2.3 Module DNP Protocol Operation**

#### Unsolicited Messaging

If the module is configured for unsolicited messaging, the module immediately sends an unsolicited response out Port 1 (Primary DNP port) 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 are 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.

#### Solicited Messaging

If the module is not configured for unsolicited messaging, the program listens on Port 1 for DNP messages from a DNP master and sends responses to requests after initialization. The DNP master must clear the restart IIN bit before the module starts logging events. The master must also synchronize the time with the module before events are generated if the module is so configured.

If the DNP master port is used, the port starts processing the command list. It sends commands and requests out the port to slave units. Data acquired is placed in the correct database in the module. Event messages received from the IED units are placed directly in the event buffer or the values are placed in the database. The communication statistics for each slave unit is tracked by the module and is available for the SLC to request.

While the program is running, a status/error table is maintained. This data is automatically passed to the SLC at a frequency set in the configuration. Refer to the following section on the contents of the table.

If an error is encountered in the module's program, it is logged to the error list maintained by the system. The program maintains a list of the last 60 errors. This data is automatically passed to the SLC at a frequency set in the configuration. Refer to the following section on the error codes contained in the list.

If the module is configured to use the secondary slave DNP port (Port 2), the module may automatically switch communications to that port under the following conditions:

- If the module receives a request on the port from the master
- If unsolicited messages are enabled and the module is configured to switch to the port if application confirm messages are not received while using the primary port (user sets the number of retries in the configuration)

Communications will switch back to the primary DNP port when the module receives a message on that port. If the module restarts, communications will always be attempted on the primary DNP port first.

### 5.2.4 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 be certain the functionality and data types required for the whole system are consistent. Review the [DNP Device Profile](#) (page 128) and [DNP Subset](#) (page 113) documentation for a definition of the level of DNP support offered by the module.

The following topics describe each element of system design.

#### DNP Functionality Review

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 be certain the host will support the functionality you select. If a DNP master port is to be used, the parameters required to communicate with the slave devices must be known and considered in installing and configuring the module.

The features that must be defined in this design step are as follows:

Mode	DNP Feature	Discussion
Slave	Is collision avoidance required for the primary DNP port?	Collision avoidance is required when unsolicited messaging is used. Any node on the network (master or slave) can transmit a message when data is ready. Collision avoidance prevents two or more units from transmitting data at the same time. This feature requires special cabling and timing considerations. It will only operate in RS-232 mode, and is not supported in RS-485 or RS-422 modes.
Slave	Will the module use events and the Report by Exception feature?	If the DNP Slave driver will generate event messages, they must be retrieved from the module using class polls or polls for the specific event objects. Refer to <a href="#">Event Size Computation</a> (page 112) for computing event size for digital and analog inputs.
Slave	Will analog events be returned with or without a time value?	The default for analog events is to return them without time. This is as specified in the DNP Subset document. The module supports analog event reporting with time. This is selected setting bit 5 in the configuration word (offset 21) for the module.
Slave	Will events be logged before time synchronization has occurred?	This feature will avoid logging events without the proper date and time stamping. When the DNP slave driver is initialized, it will have the IIN bit set to request time synchronization from the remote master unit. The master must synchronize the time before the module will generate events. This feature is selected using bit 8 in the module's configuration word.
Slave	Will unsolicited messages be used? If so, how may for each class before triggering and what is the delay time?	Unsolicited messaging provides the means for a slave unit to send event data asynchronously to the master unit without a request from the master. This requires the use of collision avoidance to prevent two or more units from transmitting data on the network at one time.
Slave	Will the module use the secondary DNP Slave port?	The secondary DNP slave port on the module is a backup port to the primary slave port. Only one port can be used at any one time. The module supports automatic switching between the two ports based on several factors.

Mode	DNP Feature	Discussion
Master	Will the module use the DNP Master port?	The module can be configured as a DNP master unit to interface with DNP slave (IED) units. This feature requires configuration of the communication characteristics for each slave and the definition of a command list. The command list polls the slave units and to map the data from the IED units to the databases contained in the module.
Master & Slave	What will be the memory mapping for the DNP and IED memory areas?	There are many databases maintained within the module for all the specific DNP data types and for the virtual master and slave unit simulated in the module. For successful application of the module, an understanding of the databases is required to carefully design them.
Slave	Will the secondary DNP port have a dial-up modem attached?	The secondary DNP slave port on the module can be configured to have a dial-up modem attached. Use of this feature requires bit 2 be set in the configuration word. Additionally, many aspects of the modem timing features must also be configured.

Data Requirements

This design phase defines what data elements are to be interfaced in the SLC with the DNP master and slave. The module provides the following data types:

- digital input and output
- counter
- analog input and output
- Floating-Point

All communications between the DNP master and the SLC 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.

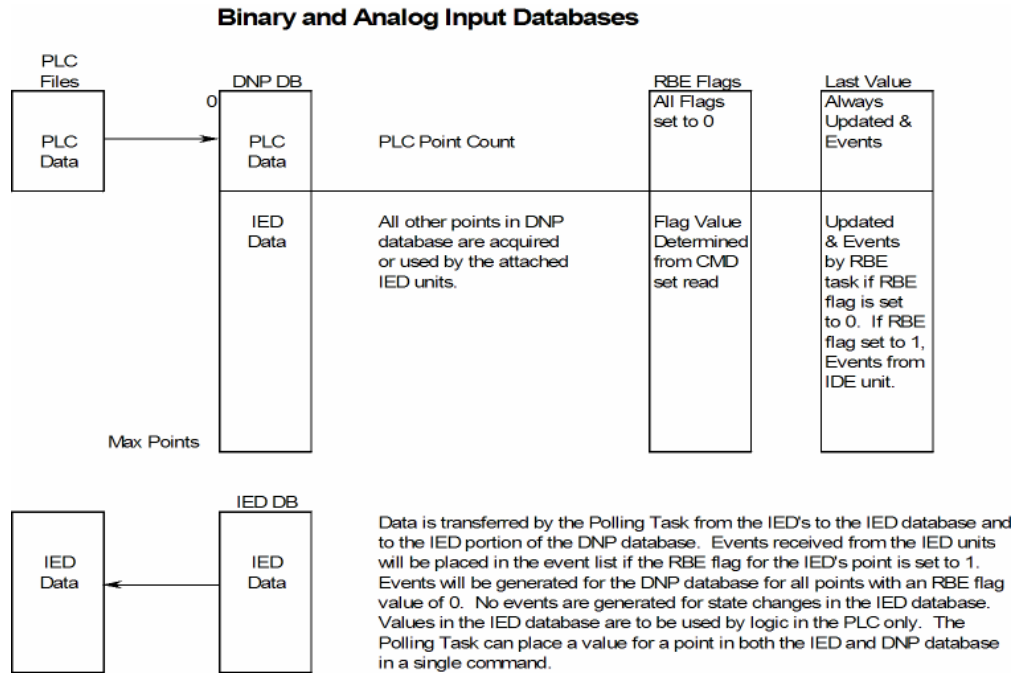
The following illustration shows the databases maintained by the module for the DNP and IED data.

DNP DATA	BINARY INPUTS	PLC DATA
		IED DATA
	BINARY OUTPUTS	PLC DATA
		IED DATA
	COUNTER DATA	PLC DATA
		IED DATA
	ANALOG INPUTS	PLC DATA
		IED DATA
	ANALOG OUTPUTS	PLC DATA
		IED DATA
	FLOAT INPUTS	PLC Data
	FROZEN COUNTER DATA	
	BINARY INPUT EVENTS	
	ANALOG INPUT EVENTS	
	FLOAT INPUT EVENTS	

LAST VALUE DATA	BINARY INPUTS
	ANALOG INPUTS
	FLOAT INPUTS
	DNP BIN OUTPUTS
	DNP ANALOG OUTPUTS
	IED BIN OUTPUTS
	IED ANALOG OUTPUTS
IED DATA	BINARY INPUTS
	BINARY OUTPUTS
	COUNTER DATA
	ANALOG INPUTS
	ANALOG OUTPUTS
RBE FLAGS	BINARY INPUT
	ANALOG INPUT

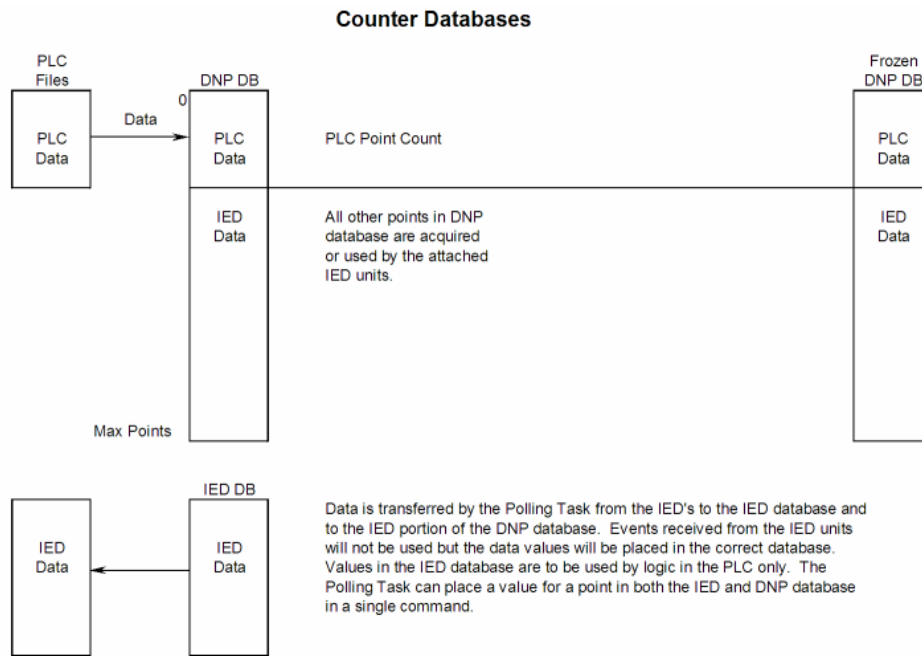
The module is responsible for maintaining the databases using data acquired from the SLC IED units attached to the DNP master port and DNP master attached to the DNP slave port.

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



The DNP database consists of data from the SLC and the IED units. The IED database contains only data acquired from IED units. This data can be used in the SLC's ladder logic, and is the only path to get IED data into the SLC. The RBE flags and last value database are used for event generation. Events received from the IED unit can be placed directly in the event buffer. This requires that the RBE flag for the data points be set to a value of 1. For all points in the RBE flags database with a value of zero, the module will generate the events.

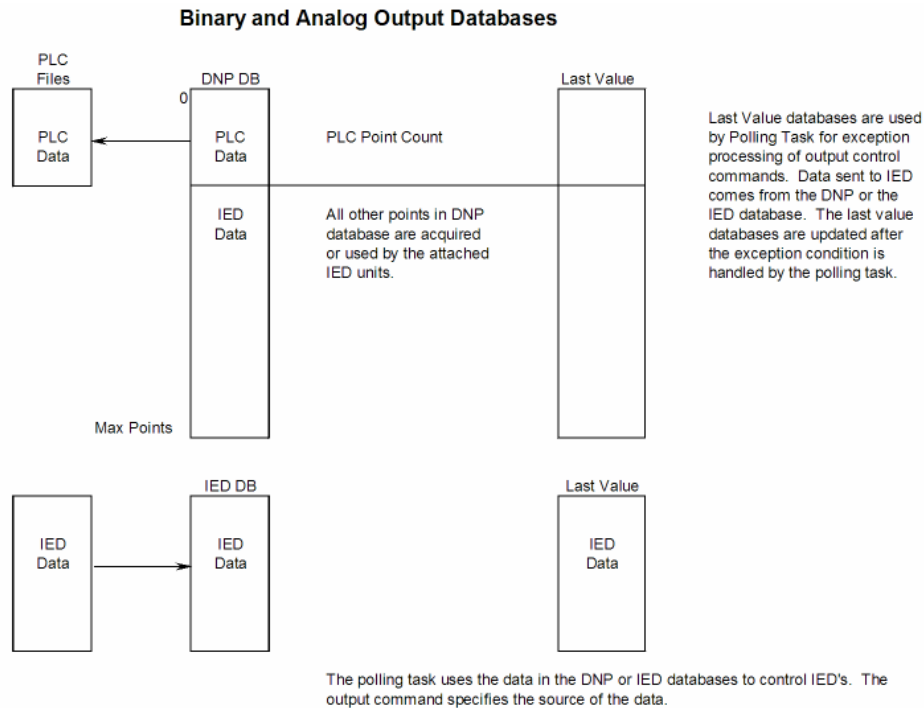
The following illustration shows the interaction of the counter points with the databases.



The DNP database consists of data from the SLC and the IED units. The IED database contains only data acquired from IED units. You can use this data in the SLC's ladder logic. When the DNP slave port receives a counter freeze command, the current counter values are passed to the frozen counter database. If the DNP slave port receives a counter freeze with reset command, the current counter values will be passed to the frozen counter database and only the values in the DNP counter database will be set to 0.



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



The DNP database consists of data from the DNP master on the slave port. This data is passed to the SLC and to the IED units through the command list. The IED database contains control data generated in the SLC. This is the only data path for SLC control of IED units on the DNP master port. A command must be set up to handle the transfer of data from the IED database to the IED unit. The last value databases are used for exception processing of control commands. Commands can be configured to only generate a message if there is a change in the database. The current values are compared against the last value database to recognize the changes. When a change is recognized, the DNP master port executes a command to the specific IED unit containing the new data.

#### Data Transfer Interface

Data is directly transferred between the module and the SLC through M-files (M0: and M1:). The module automatically interfaces the internal DNP and IED databases to the M-files. You must construct ladder logic to read and write the M-file data for use by the SLC. All configuration and command control data is stored in the M0: file.

The following table describes the format of the M0: file used by the module:

**M0: File Configuration**

Offset	Max Elements	Description
0 to 73	74	Reserved
80 to 299	220	Control Block
300 to 420	121	Event Message Data (121 Words of Data)
421 to 3799	3379	Reserved for Future Use

This file contains 3800 elements, and its composition is discussed in the [configuration](#) (page 17) section of this document.

The M1: file stores DNP and IED data. The following table describes the format of this file:

**M1: File Configuration**

Offset	Max Elements	Description	Max Pnts
0 to 127	128	DNP Binary Inputs	2048
128 to 383	256	DNP Analog Inputs	256
384 to 511	128	DNP Counters	64
512 to 639	128	DNP Binary Outputs	2048 (1024 Trip/Close)
640 to 767	128	DNP Analog Outputs	128
768 to 895	128	IED Binary Inputs	2048
896 to 1151	256	IED Analog Inputs	256
1152 to 1279	128	IED Counters	64
1280 to 1407	128	IED Binary Outputs	2048
1408 to 1535	128	IED Analog Outputs	128
1536 to 1595	60	Error/Status Data	N/A
1596 to 1695	100	Error List and Status Data	N/A
1696 to 1823	128	DNP Float Input	64
1824 to 1951	128	Reserved	32
1952 to 2079	128	DNP Float Output	64
2080 to 2207	128	Reserved	32

This file contains 2207 elements with a fixed memory location for each data type.

The following table describes the relationship between the SLC data files and the DNP and IED memory areas in the module's M1: file.

SLC Files		M1: File Data DNP Memory		DNP Master Device
Digital Input File	→		→	Digital Input Data
Analog Input File	→		→	Analog Input Data
Counter Data File	→		→	Counter Data
Digital Output File	←		←	Digital Output Data
Analog Output File	←		←	Analog Output Data

SLC Files		M1: File Data DNP Memory		DNP Master Device
		IED Memory		DNP Slave Device
Digital Input File	←		←	Digital Input Data
Analog Input File	←		←	Analog Input Data
Counter Data File	←		←	Counter Data
Digital Output File	→		→	Digital Output Data
Analog Output File	→		→	Analog Output Data
		Floating-Point Data		DNP Master Device
Float Input	→		→	Floating-Point Input Data
Float Output	←		←	Floating-Point Output Data

It is recommended to associate each individual data type with a separate file in the SLC. This permits easier management of the ladder logic and expansion of the system.

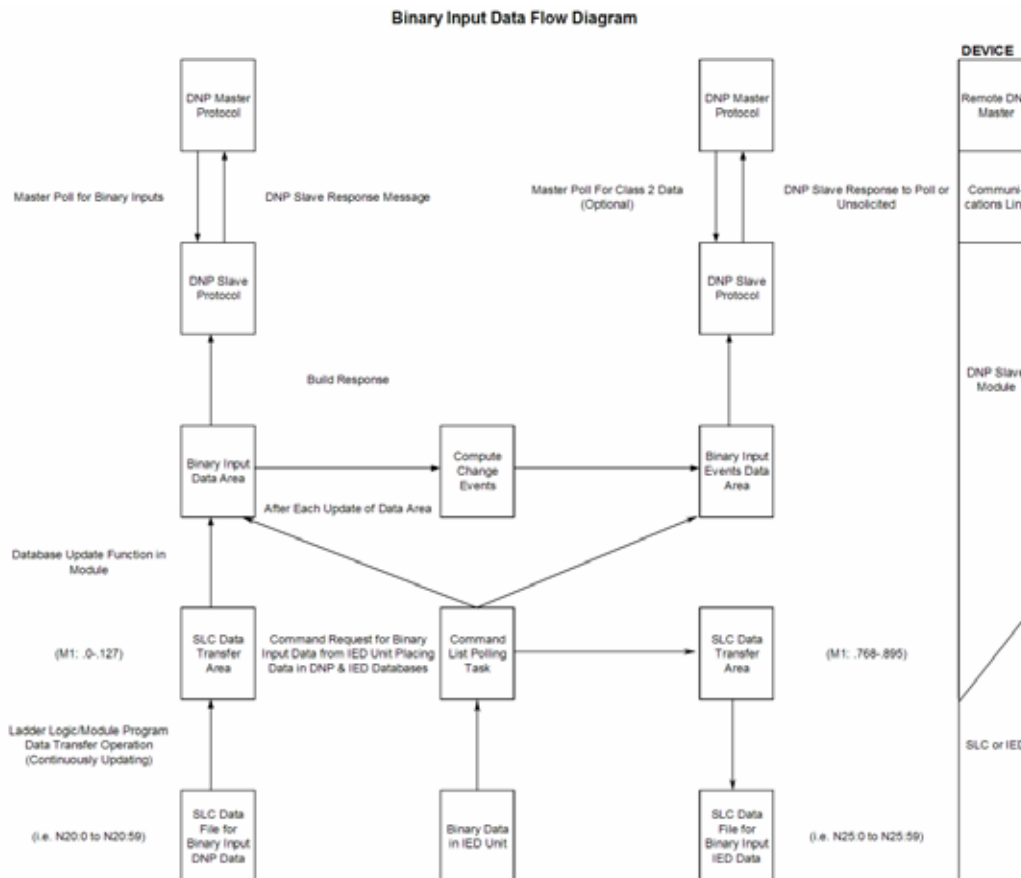
#### DNP Digital Input Data

This data type stores the binary value of 1 or 0. The size of this data area is determined from the configuration parameter Number of Binary Input Points. The data area is partitioned into two separate areas. The first is the DNP binary input data acquired from the SLC, and the second is the binary input data from IED units on the DNP master port. The configuration parameter, Number of Binary Input Points for SLC, determines the size of the SLC's data area. The remaining portion is defined as the IED binary input data area.

SLC data are transferred to the module from the SLC using the COP command in the ladder logic. 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 SLC, it compares the new values to those currently in the database. If there is a change in any of the data, the module generates an event message for the points that change.

Data from IED units can also be placed in the DNP binary input data area. Commands in the command list must specify the DNP database address (point number) where the data will be placed.

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 module automatically sends the events 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. The following shows a data flow diagram for the digital input data:

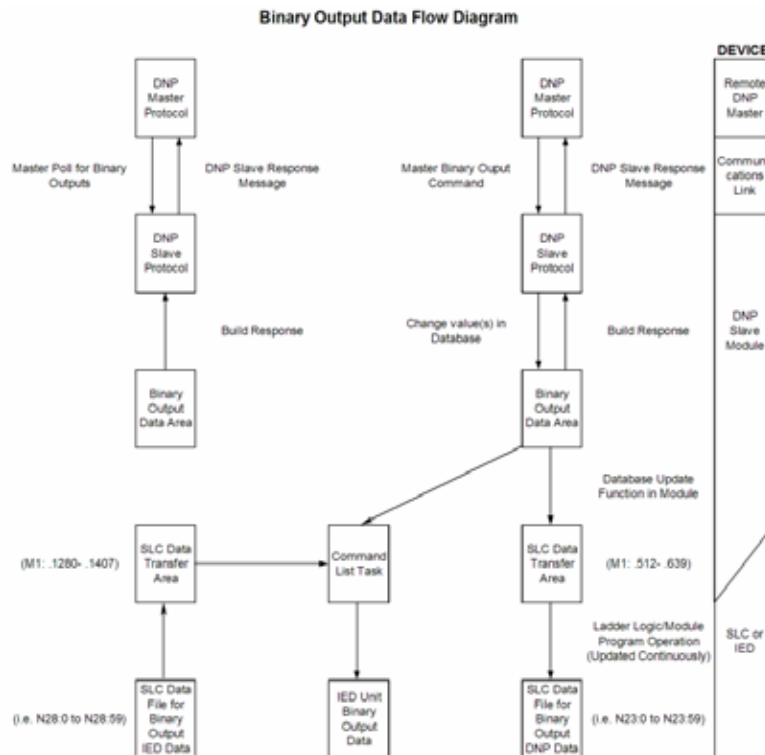


All data associated with the digital inputs is transferred from the SLC to the module in M1: file data area 0 to 127. This provides for a maximum number of 2048 points.

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 Number of Binary Output Points. The area is partitioned into two separate areas. The first area is the DNP binary output data for the SLC, and the second is the DNP binary output data for the IED units. The configuration parameter, Number of Binary Output Points for SLC, determines the size of the SLC's data area. The remaining portion is defined as the IED binary output data area. IED units can use any portion of the DNP binary output data area. The command list instructions are not limited to the IED data area.

SLC data are transferred from the module to the SLC using the COP command from the M1: file. Therefore, these data are read-only for the SLC, as the SLC 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 sets a digital point to the ON state, it remains ON until the master resets the point. The following shows a data flow diagram for the digital output data:



All data associated with the digital outputs is transferred from the module to the SLC in the module's M1: file data area 512 to 639. This provides for a maximum number of 2048 points.

Trip/Close

The MVI46-DNP module supports Trip/Close functionality for Binary Output points.

This allows Trip/Close commands to be sent to the MVI46-DNP module, for dual point control. Each DNP Trip/Close command will occupy 2 bits within the module memory.

This does overlap the regular pulse on/off and latch on/off Binary Output database, therefore special consideration must be used to make sure that points are not used twice.

The following table describes the address mapping for the module using Latch and Pulse commands, and Trip/Close functionality.

DNP BO Database Point	BO Latch/Pulse Point	BO Trip/Close Point
0	BO 0	Close BO 0
1	BO 1	Trip BO 0
2	BO 2	Close BO 1
3	BO 3	Trip BO 1
4	BO 4	Close BO 2
5	BO 5	Trip BO 2
100	BO 100	Close BO 50
101	BO 101	Trip BO 50
1000	BO 1000	Close BO 500
1001	BO 1001	Trip BO 500
2046	BO 2046	Close BO 1023
2047	BO 2047	Trip BO 1023

As you can see from the above chart, trip/close requires 2 points within the module's DNP database. A trip is represented by the value of 2#10 for those 2 points, and a close is represented by the value of 2#01 for those same 2 points.

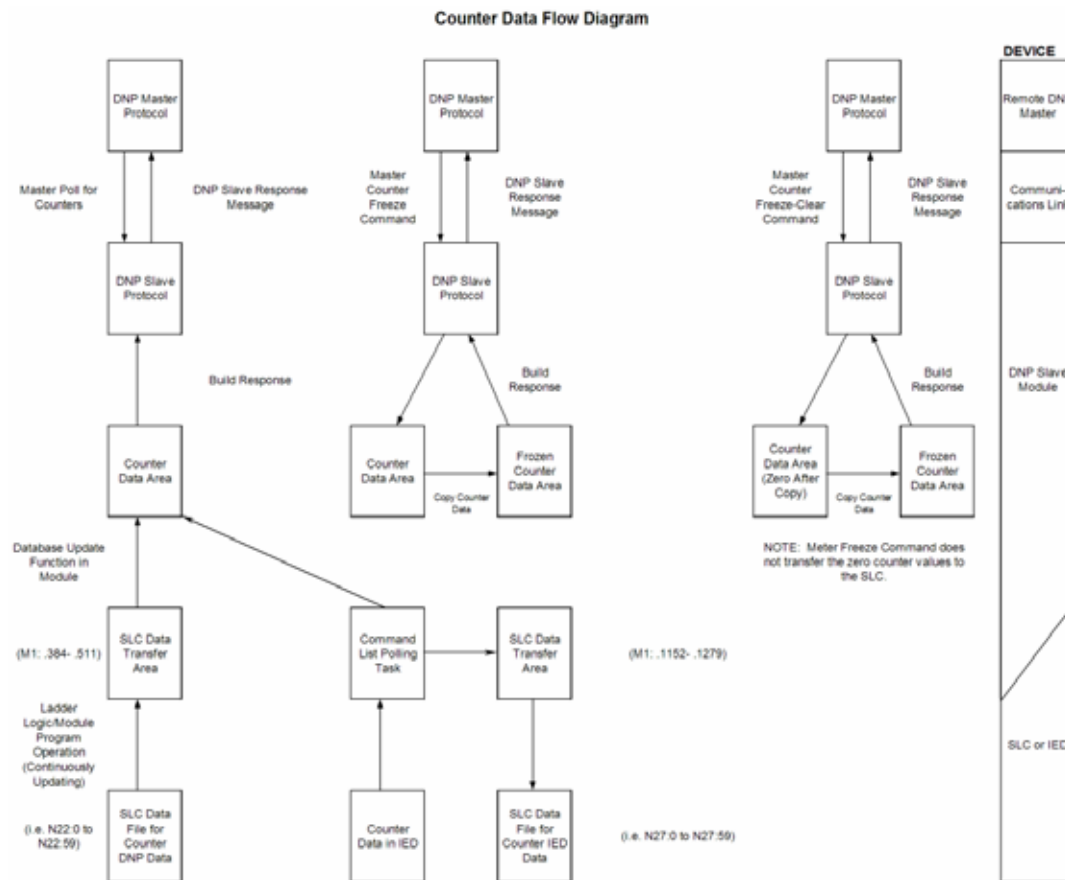
The module can only process 1024 trip/close points, as the database for the DNP BO is limited to 2048 bits total.

**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 Number of Counter Points. The data area is partitioned into two separate areas. The first is the DNP counter data acquired from the SLC, and the second is the counter data from the IED units. The configuration parameter, Number of Counter Points for SLC, determines the size of the SLC's data area. The remaining portion is defined as the IED counter data area.

The SLC transfers data of this type to the module using COP command. 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. Additionally, the DNP master can send a freeze/clear command to the module. This causes the frozen counter area to be updated with the current running values, and then the current running values are reset to zero. **The values will only be zeroed in the module's M1: file and not in the SLC.** Data from IED units can also be placed in the DNP counter data area. Commands in the command list must specify the DNP database address (point number) where the data will be placed. Both frozen counter and counter data values obtained from the IED units are placed in the counter data. The frozen counter data is only updated on a request from the remote DNP master. The counter data from the IED units can be read by the remote DNP master unit connected to the DNP slave port.

The following shows a data flow diagram for the counter data:



All the current running counter data is transferred from the SLC to the module using M1: file elements 384 to 511. This provides for a maximum number of 64 counter values.

### DNP Analog Input Data

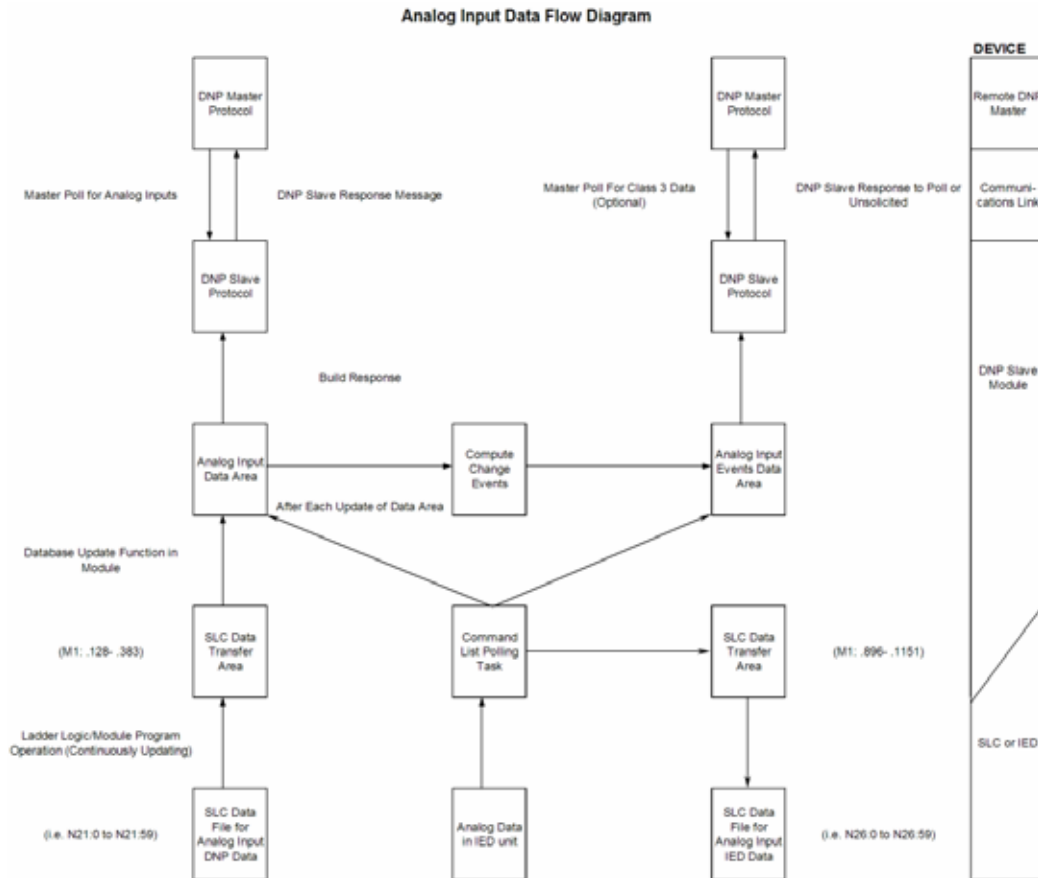
This data type stores analog data with a data range of 0 to 65535 or –32768 to 32767. The size of this data area is determined from the configuration parameter Number of Analog Input Points. The data area is partitioned into two separate areas. The first is the DNP analog input data acquired from the SLC and the second is the analog input data from IED units. The configuration parameter, Number of Analog Input Points for SLC, determines the size of the SLC's data area. The remaining portion is defined as the IED analog input data area.

SLC data are transferred to the module from the SLC using the COP command. Therefore, these data are read-only for the module and the DNP master unit. When the module receives new data from the SLC, it compares the new values to those currently in the database. If there is a change in any of the data, the module generates an event message for the points that change. The dead-band parameter configured for the module determines the variance required for the event message.

Data from IED units can also be placed in the DNP analog input data area. Commands in the command list must specify the DNP database address (point number) where the data will be placed.



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 are automatically 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. The following shows a data flow diagram for the analog input data:

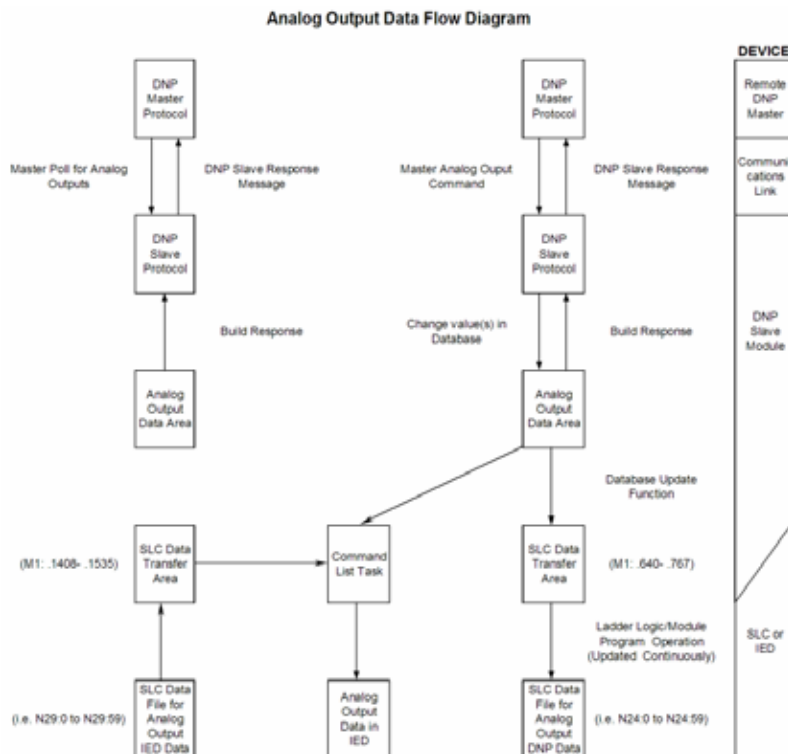


All data associated with the analog inputs is transferred from the SLC to the module in M1: file elements 128 to 383. This provides for a maximum number of 256 points.

### DNP Analog Output Data

This data type stores analog values sent from the DNP master unit to the module and SLC with a data range of 0 to 65535 or -32768 to 32767. The size of this data area is determined from the configuration parameter Number of Analog Output Points. The area is partitioned into two separate areas. The first area is the DNP analog output data for the SLC and the second is the DNP analog output data for the IED units. The configuration parameter, Number of Analog Output Points for SLC, determines the size of the SLC's data area. The remaining portion is defined as the IED analog output data area. IED units can use any portion of the DNP analog output data area. The command list instructions are not limited to the IED data area.

SLC data are transferred from the module to the SLC using the COP command operation. Therefore, these data are read-only for the SLC, as the SLC 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. The following shows a data flow diagram for the analog output data:



All data associated with the analog outputs is transferred from the module to the SLC in M1: file elements 640 to 767. This provides for a maximum number of 128 points.

### IED Binary Input Data

This data area stores binary input data retrieved from IED units attached to the DNP master port. The size of the data area is determined by the configuration parameter Number of Binary Input Points for IED. The command list polls IED units for their binary input data and to place the data in the database. The SLC program uses this input data for monitoring and control in the ladder logic program. The module transfers these data to the M1: file elements 768 to 895. This provides for 2048 binary input points.

### IED Binary Output Data

This data area controls IED units attached to the DNP master port. The size of the data area is determined by the configuration parameter Number of Binary Output Points for IED. The command list sends the control values in this database to the IED units. The SLC ladder logic program is responsible for setting the values in this database. This provides direct control of IED units by the SLC program. These data are stored in the module M1: file elements 1280 to 1407. This provides for 2000 binary output points.

### IED Counter Data

This data area stores counter and frozen counter data retrieved from IED units attached to the DNP master port. The size of the data area is determined by the configuration parameter Number of Counter Points for IED. The command list polls the IED units for their counter or frozen counter data. The SLC program uses this data for monitoring or control in the ladder logic program. The module transfers these data to the M1: file elements 1152 to 1279. This provides for 64 counter points.

### IED Analog Input Data

This data area stores the analog input data retrieved from IED units attached to the DNP master port. The size of the data area is determined by the configuration parameter Number of Analog Input Points for IED. The command list polls the IED units for their analog input data. The SLC program uses this input data for monitoring and control in the ladder logic program. The module transfers these data to the M1: file elements 896 to 1151. This provides for 256 analog input points.

### IED Analog Output Data

This data area controls IED units attached to the DNP master port. The size of the data area is determined by the configuration parameter Number of Analog Output Points for IED. The command list sends the control values in this database to the IED units. The SLC ladder logic program is responsible for setting the values in this database. This provides direct control of IED units by the SLC program. These data are transferred to the module M1: file elements 1408 to 1535. This provides for 128 analog output points.

### 5.2.5 Warm and Cold Boot

The DNP slave module supports both warm and cold boots. There are several sources for the reboot process.

#### Cold Boot

A cold boot will request the configuration information from the SLC and reset all program variables in the module. When the configuration is received, all program variables will be initialized and the program will execute.

Source of the Cold Boot:

- Power up of module
- Cold restart command from DNP master (function 0x0D)
- Receipt of 253 Command Control code from SLC when running
- Cold boot request from DNP Module Configuration Program (Must have appropriate ladder logic in place)

#### Warm Boot

A warm boot will use the information in a newly acquired configuration data block to initialize data related to the communication ports, file and errors. It will not initialize the database and the pointers. These values are only initialized in a cold boot.

Source of the Warm Boot:

- Warm restart command from DNP master (function 0x0E)
- Receipt of 255 Command Control code from SLC when running
- Warm boot request from DNP Module Configuration Program (Must have appropriate ladder logic in place)

### 5.2.6 Command Control

In addition to interfacing to the M1: file, the module constantly scans the module's output file for a command control event. If the SLC ladder logic sets the command control ready bit (O0: /1), the module reads the command control area of the M0: file. The format of the data to be read is dependent on the command to be processed. Note the ladder logic program initiates all command control. The general format of the data area is shown in the following diagram:

Word Offset in Block	Data Field(s)	Description
M0: .80	Command Code	This field contains the command control function code to perform.
M0: .81	Parameter 1	This field contains the first parameter to be passed to the function.
M0: .82	Parameter 2	This field contains the second parameter to be passed to the function.
M0: .143	Parameter 63	This field contains the last parameter to be passed to the function.

If the command control code (M0: .80) passed in the block is valid, the module performs the requested operation. In processing the requested function, the module first sets the command control processing bit (I1: /2) to inform the ladder logic that the event is being processed. When the function is completed by the module, the return data to the function will be placed in the M0: file, the command complete bit will be set (I1: /3) and the command control processing bit (I1: /2) will be cleared. The ladder logic should be programmed to handle the response message.

The command control functions processed by the module are described in the following topics:

#### 249 or 9949 – Read Slave Communication Error Table (Master Port)

If the SLC sends a command control code of 249 or 9949, the module responds with a slave communication error listing. The module can be set up for 100 slaves on its DNP master port. A 10-word data area is established in the module for each slave. This requires 1000 words of data storage. The following table defines the data stored for each slave.

Index	Parameter	Description
0	Index	This value corresponds to the index in the device array for the slave.
1	Slave Addr	This value corresponds to the DNP slave address for the device.
2	Bad CRC	This value represents the number of bad CRC values received from the slave device.
3	Buff Ovrflw	This value represents the number of buffer overflow messages received from the slave device.
4	Tran Seq#	This value represents the number of incorrect transport layer sequence number errors.
5	Conf Retry	This value represents the number of data link layer confirm request retries.
6	Conf Fail	This value represents the number of data link layer confirm request failures.
7	No App Rsp	This value represents the number of application layer no responses to requests.
8	Spare	Reserved for future use.
9	Spare	Reserved for future use.

These data values are updated after each command processed by the module. The command control function 249 (or 9949) is structured to retrieve data for up to six slave units. The format of the command control block sent from the SLC is shown in the following table.

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains the value of 249 identifying the slave communication error table request.
M0: .81	Number of slaves	This field contains the number of slaves to report in the response message. The value has a range of 1 to 6.
M0: .82	Start Slave Index	This parameter sets the index in the slave array where to start. The first slave in the array has a value of 0 and is the broadcast slave. The first user defined slave has an index of one. The last index in the array has a value of MaxSlaves.

Using the data in this block, the module responds with data in the M0: with the following format.

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero the command is complete. indicating
M0: .81	Acknowledge Value	This field contains a value of 249 to indicate that the module processed the command. This value is written over the number of slaves sent in the request message.
M0: .82	Slave Count	This field contains the number of slave records contained in the block that must be processed by the PLC. This field will have a value of 1 to 6.
M0: .83	Slave Start Index	This field contains the index in the slave array for the first record in the file. This field will have a value of 0 to MaxSlaves.
M0: .84 to M0: .93	Slave Data #1	This is the slave data for the first slave in the block. The slave index for the data is the Slave Start Index given in word 83.
94 to 103	Slave Data #2	This is the slave data for the second slave in the block.
104 to 113	Slave Data #3	This is the slave data for the third slave in the block.
114 to 123	Slave Data #4	This is the slave data for the fourth slave in the block.
124 to 133	Slave Data #5	This is the slave data for the fifth slave in the block.
134 to 143	Slave Data #6	This is the slave data for the sixth slave in the block.

The 10-word data area for each slave is that shown in the previous table. You can sequentially read through the list of all IED units up to six at a time to retrieve all the error information. If all 100-slave units are to be retrieved, it requires 17 transfers.

250 or 9950 – Read Command Error List (Master Port)

If the SLC sends a command control code of 250 or 9950, the application responds with a command error list. Each command in the system has a data word set aside for its last error code. This value is set by the DNP master port command list task and the values correspond to the errors listed in the error section of this documentation. This 250-word data area can be accessed 60 commands at a time. The format of the command control block sent from the SLC is described in the following table.

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains the value of 250 identifying the command list error table request.
M0: .81	Number of Commands to report	This field contains the number of commands to report in the response message. The value has a range of 1 to 60.
M0: .82	Start Index of First Command	This parameter sets the index in the command list where to start. The first command in the list has a value of 0. The last index in the list has a value of MaxCommands -1.

The module responds to the request with data in the M0: file with the following format:

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero indicating the command is complete.
M0: .81	Acknowledge Value	This field contains a value of 250 to indicate that the module processed the command. This value is written over the number of commands sent in the request message.
M0: .82	Number of Commands reported	This field contains the number of commands contained in the block that must be processed by the PLC. This field will have a value of 1 to 60.
M0: .83	Start Index of First Command	This field contains the index in the command list for the first value in the file. This field will have a value of 0 to MaxCommands -1.
M0: .84 to M0: .143	Command List Errors	Each word of this area contains the last error value recorded for the command. The command index of the first value (offset 83) is specified in the block. The number of valid command errors in the block is set in word 82 of the block. Refer to the command error list to interpret the error codes reported.

The SLC program can sequentially step through the list of commands to retrieve the value of the last error. To retrieve all 250 commands, requires 5 transfers.

#### 253 or 9999 – Cold Boot Module (General Module)

If the SLC sends a command control code of 253 or 9999, the application performs the cold-boot operation. The module's program requests the configuration information from the SLC by setting the configuration request bit (I1: /0) and clearing the configuration complete bit (I1: /1). After the module has completed the cold-boot process, it will return the following data in the M0: file:

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero indicating the command is complete.
M0: .81	Acknowledge Value	This field contains a value of 253 to indicate that the module processed the command.

#### 255 or 9998 – Warm Boot Module (General Module)

If the SLC sends a command control code of 255 or 9998, the module performs a warm-boot operation. The module's program requests the configuration information from the SLC by setting the configuration request bit (I1: /0) and clearing the configuration complete bit (I1: /1). After the module has completed the warm-boot process, it returns the following data in the M0: file:

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero indicating the command is complete.
M0: .81	Acknowledge Value	This field contains a value of 255 to indicate that the module processed the command.

***258 or 9958 – SLC Binary Input Event (Slave Port)***

If the SLC sends a command control code of 258 or 9958, the module places the binary input event data in the block into the event buffer and alters 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 Fields	Description
M0: .80	Command Code	This field contains the value of 258 identifying the event block to the module.
M0: .81	Event Count	This field contains the number of events contained in the block. Valid values for this field are 1 to 12.
M0: .82	Sequence Counter	This field holds the sequence counter for each 258 block transfer. This synchronizes and confirms receipt of the block by the module.
M0: .83	DNP Binary Input Data point	This is the data point in the DNP binary input database represented by the event.
M0: .84	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.
M0: .85	Hour/Minute	Formatted: bits 0 to 5 = Minutes, bits 8 to 12 = Hour. All other bits are ignored.
M0: .86	Sec/Millisecond	Formatted: bits 0 to 9 = Milliseconds, bits 10 to 15 = Seconds.
M0: .87	Year	This is the four-digit year for the event.
88 to 92		Five words of data for Event #2.
93 to 98		Five words of data for Event #3.
98 to 102		Five words of data for Event #4.
103 to 107		Five words of data for Event #5.
108 to 112		Five words of data for Event #6.
113 to 117		Five words of data for Event #7.
118 to 122		Five words of data for Event #8.
123 to 127		Five words of data for Event #9.
128 to 132		Five words of data for Event #10.
133 to 137		Five words of data for Event #11.
138 to 142		Five words of data for Event #12.

Up to 12 events can be passed from the SLC to the module in each block. To ensure that the block reached the module and was processed, the module sends response data in the M0: file to the SLC. The format of the block is shown in the following table.

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero to indicate that the module processed the command.
M0: .81	Acknowledge Value	This field contains a value of 258 to indicate that the module processed the command. This value is written over the event count sent in the request message.
M0: .82	Event Count	This field contains the number of events processed by the module.
M0: .83	Sequence Counter	This field contains the sequence number corresponding to the last event set processed.



The sequence counter field in the returned message is set to the last successfully processed 258 command from the SLC. Compare this value to that sent by the SLC. If the values match, the events can be removed from the SLC. If the values do not match, or the SLC does not receive a 258 response, the SLC must re-send the block.

**259 or 9959 – SLC Analog Input Event (Slave Port)**

If the SLC sends a command control code of 259 or 9959, the module places the analog input event data in the block into the event buffer and alters 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 Fields	Description
M0: .80	Command Code	This field contains the value of 259 identifying the event block to the module.
M0: .81	Event Count	This field contains the number of events contained in the block. Valid values for this field are 1 to 10.
M0: .82	Sequence Counter	This field holds the sequence counter for each 259 block transfer. This synchronizes and confirms receipt of the block by the module.
M0: .83	DNP Analog Input Data point	This is the data point in the DNP analog input database represented by the event.
M0: .84	Analog Input Value	This is the new analog input value represented in the event.
M0: .85	Month/Day	Formatted: bits 0 to 4 = Day, bits 8 to 11 = Month. All other bits are ignored.
M0: .86	Hour/Minute	Formatted: bits 0 to 5 = Minutes, bits 8 to 12 = Hour. All other bits are ignored.
M0: .87	Sec/Millisecond	Formatted: bits 0 to 9 = Milliseconds, bits 10 to 15 = Seconds.
M0: .88	Year	Four-digit year value for event.
89 to 94		Six words of data for Event #2.
95 to 100		Six words of data for Event #3.
101 to 106		Six words of data for Event #4.
107 to 112		Six words of data for Event #5.
113 to 118		Six words of data for Event #6.
119 to 124		Six words of data for Event #7.
125 to 130		Six words of data for Event #8.
131 to 136		Six words of data for Event #9.
137 to 142		Six words of data for Event #10.

Up to 10 events can be passed from the SLC to the module in each block. To insure that the block reached the module and was processed, the module will send a response to the M0: file.

The format of the block is shown in the following table:

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero to indicate that the module processed the command.
M0: .81	Acknowledge Value	This field contains a value of 259 to indicate that the module processed the command. This value is written over the event count sent in the request message.
M0: .82	Event Count	This field contains the number of events processed by the module.
M0: .83	Sequence Counter	This field contains the sequence number corresponding to the last event set processed.

The sequence counter field in the returned block is set to the last successfully processed 259 (or 9959) command from the SLC. Compare this value to that sent by the SLC. If the values match, the events can be removed from the SLC. If the values do not match, or the SLC does not receive a 259 (or 9959) response, the SLC must re-send the block.

***270 or 9970 – Set SLC Time Using Module Time (Slave Mode)***

This block transfers the module's DNP clock time to the SLC processor. The module responds to the command with the time in the response message. The structure of the command and response is shown below:

**Command Request Format**

Word Offset in Block	Data Field(s)	Description
M0: .80	BTR ID Code	This field contains the value of 270 identifying the set time request to the module.

**Command Response Format**

Word Offset in Block	Data Field(s)	Description
M0: .80	Command Code	This field contains a value of zero to indicate that the module processed the command.
M0: .81	Acknowledge Value	This field contains a value of 270 to indicate that the module processed the command.
M0: .82	Year	This field contains the four-digit year to be used with the new time value.
M0: .83	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
M0: .84	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
M0: .85	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
M0: .86	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.
M0: .87	Seconds	This field contains the second 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
M0: .88	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.
M0: .89	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.

### **271 or 9971 – Set Module Time using SLC Time (Slave and Master Mode)**

If the SLC sends a command control code of 271 or 9971 with the correct Command Request Format, the module places the SLC's real time clock value into the module's DNP clock. The module responds to the command with an acknowledgement response. The structure of the command and response is shown in the following table:

#### **Command Request Format**

Word Offset in Block	Data Field(s)	Description
M0: .80	BTW ID Code	This field contains the value of 271 identifying the set time request for the module.
M0: .81	Year	This field contains the four-digit year to be used with the new time value.
M0: .82	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
M0: .83	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
M0: .84	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
M0: .85	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.
M0: .86	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
M0: .87	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.

#### **Command Response Format**

Word Offset in Block	Data Field(s)	Description
M0: .80	Command Code	This field contains a value of zero to indicate that the module processed the command.
M0: .81	Acknowledge Value	This field contains a value of 271 to indicate that the module processed the command.

297 or 9901 – CROB Digital Output Control (Master Mode)

The CROB (Control Relay Output Block) Digital Output Control is used for direct control of single and trip/close relay operation. If the SLC sends a command control code of 297 or 9901 with the correct Command Request Format, the module will place one or more commands into the command queue to be sent to the slave device. The structure of the command and response are shown in the following table:

**Command Request Format**

Word Offset in Block	Data Field(s)	Description
M0: .80	BTW ID Code	This field contains the block identification code of 297 for the block.
M0: .81	Command Count	This field defines the number of CROB blocks to generate. The valid range for the field is 1 to 6.
M0: .82 to .91	Command #1	Data for the command relay block (CROB) to be generated.
M0: .92 to .101	Command #2	Data for the command relay block (CROB) to be generated.
M0: .102 to .111	Command #3	Data for the command relay block (CROB) to be generated.
M0: .112 to .121	Command #4	Data for the command relay block (CROB) to be generated.
M0: .122 to .131	Command #5	Data for the command relay block (CROB) to be generated.
M0: .132 to .141	Command #6	Data for the command relay block (CROB) to be generated.

**Command Response Format**

Word Offset in Block	Data Field(s)	Description
M0: .80	Command Code	This field contains a value of zero to indicate that the module processed the command.
M0: .81	Acknowledge Value	This field contains a value of 297 to indicate that the module processed the command.

**Command Structure (Command #1 to #6)**

Word Offset	Definitions	Description
0	Port/Flags	This field is currently ignored as all 297 blocks are sent immediately out port 2.
1	Slave Address	This is the IED node address for the slave to consider on the network.
2	Object	Object type always 12
3	Variation	Variation always 1
4	Function	Function codes 3, 5 and 6 supported. Function code 4 is automatically sent after a successful function 3.
5	Address in Slave	Point in IED to consider with the CROB.
6	Control Code	This is a standard DNP protocol control code byte (see description below).
7	Pulse Count	This parameter specifies the number of pulses to generate for pulse output control. This parameter has a range of 0 to 255 as the value is a byte parameter in the CROB. If a value of zero is entered, the operation will not execute.
8	Pulse On Time	This parameter specifies the on-time interval for pulse control.
9	Pulse Off Time	This parameter specifies the off-time interval for pulse control.

**Control Code Bit Definitions**

Bits	Definitions	Description
0 to 3	Code	The value of these bits determines the control operation to be performed by the command: 0=No operation, 1=Pulse on, 2=Pulse off, 3=Latch on and 4=Latch off All other values are undefined
4	Queue (Check operation)	0=Normal (execute once), 1=Requeue (place at end of queue after operation).
5	Clear (Check operation)	This parameter clears the queue. If the value is set to zero, the queue is not affected. If the value is set to 1, the queue will be cleared.
6 to 7	Trip/Close	These two bits select the trip or close relay. For close relay control, set the bits to 01. For trip relay control, set the bits to 10. A value of 00 for the bits is used for single point control of normal digital output points.

**299 or 9902 – Command Queue Control (Master Port)**

If the SLC sends a command control code of 299 or 9902, the module places the commands referenced in the block in the command queue. Commands placed in the queue with this method need not have their enable bit set. Only valid commands will be placed in the queue. The format for the block is as follows:

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains the value of 299 identifying the enable command to the module.
M0: .81	Command count	This field contains the number of commands to enable in the command list. Valid values for this field are 1 to 60.
M0: .82 to M0: .141	Command Numbers to enable	These 60 words of data contain the command numbers in the command list to enable. The commands in the list will be placed in the command queue for immediate processing by the module. The first command in the list has an index of 0.

Up to 60 commands can be enabled and placed in the command queue with one command request from the SLC. The module will generate the following response to a 299-command request:

Word Offset in Block	Data Fields	Description
M0: .80	Command Code	This field contains a value of zero to indicate that the module processed the command.
M0: .81	Acknowledge Value	This field contains a value of 299 to indicate that the module processed the command. This value is written over the command count sent in the request message.

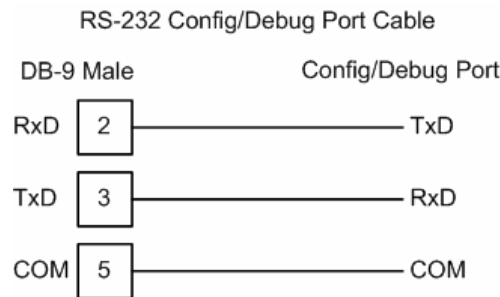
### 5.3 Cable Connections

The application ports on the MVI46-DNP module support RS-232, RS-422, and RS-485 interfaces. Please look at the module to ensure that the jumpers are set correctly to correspond with the type of interface you are using.

**Note:** When using RS-232 with radio modem applications, some radios or modems require hardware handshaking (control and monitoring of modem signal lines). Enable this in the configuration of the module by setting the UseCTS parameter to 1.

#### 5.3.1 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:

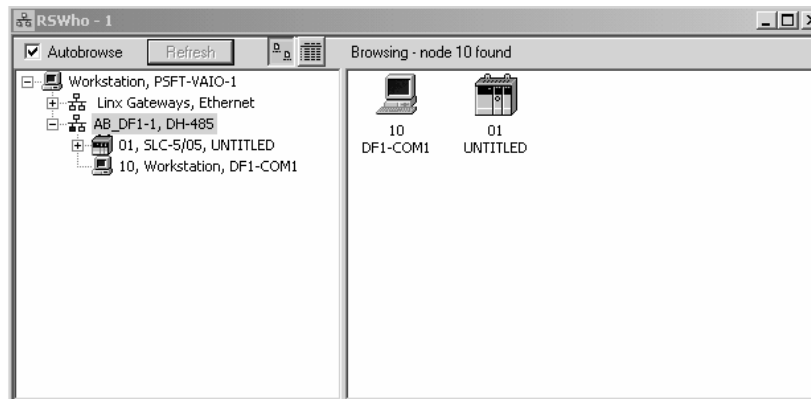


#### Disabling the RSLinx Driver for the Com Port on the PC

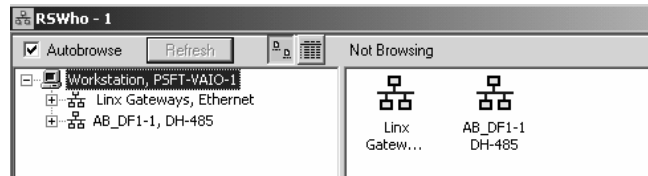
The communication port driver in RSLinx can occasionally prevent other applications from using the PC's COM port. If you are not able to connect to the module's configuration/debug port using HyperTerminal or a similar terminal emulator, follow these steps to disable the RSLinx Driver.



- 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:

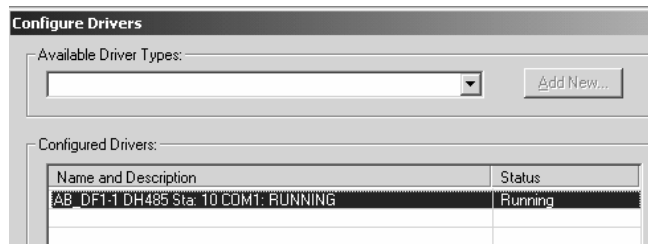


Branches are displayed or hidden by clicking on the  or the  icons.

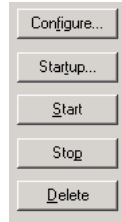


- 4 When you have verified that the driver is not being browsed, go to **Communications>Configure Drivers**

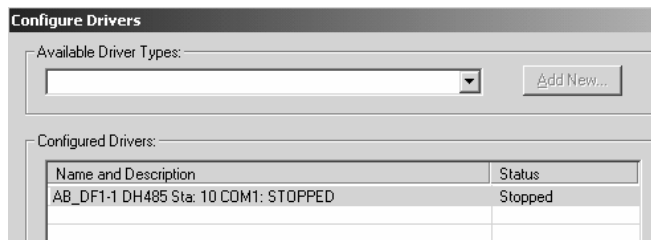
You may see something like this:



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:

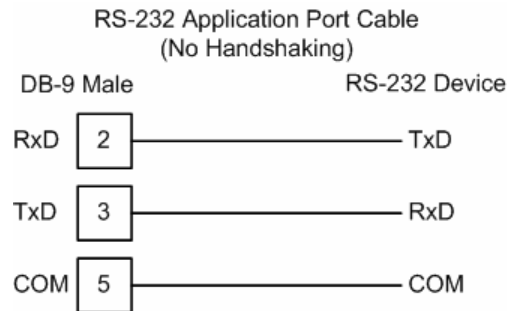


6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

**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.

### 5.3.2 RS-232

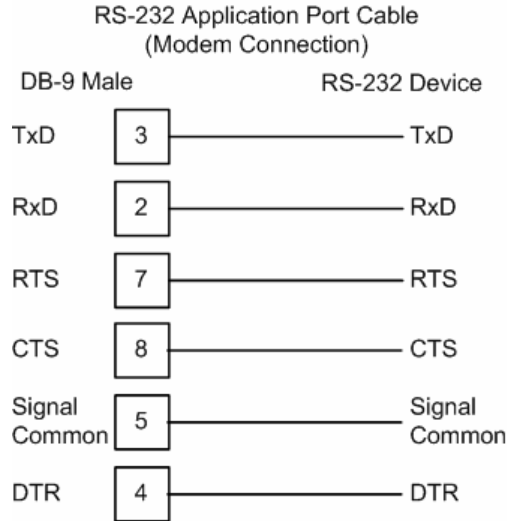
When the RS-232 interface is selected, the use of hardware handshaking (control and monitoring of modem signal lines) is user definable. If no hardware handshaking will be used, the cable to connect to the port is as shown below:





RS-232: Modem Connection

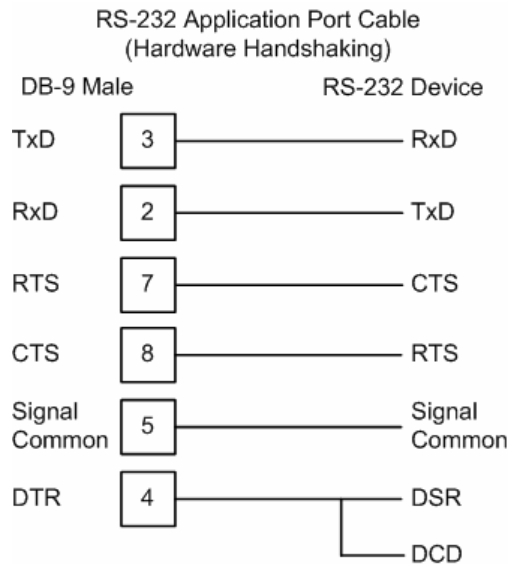
This type of connection is required between the module and a modem or other communication device.



The "Use CTS Line" parameter for the port configuration should be set to 'Y' for most modem applications.

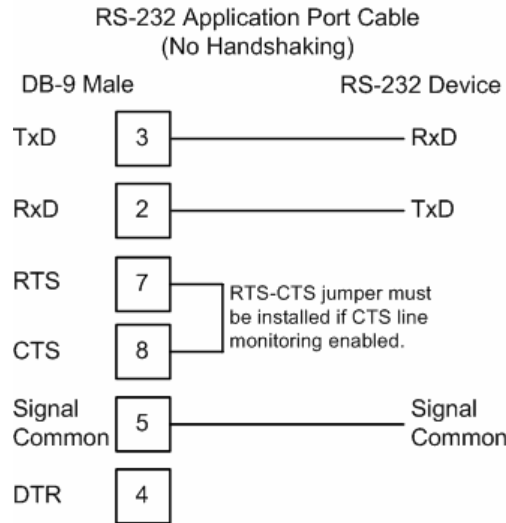
RS-232: Null Modem Connection (Hardware Handshaking)

This type of connection is used when the device connected to the module requires hardware handshaking (control and monitoring of modem signal lines).



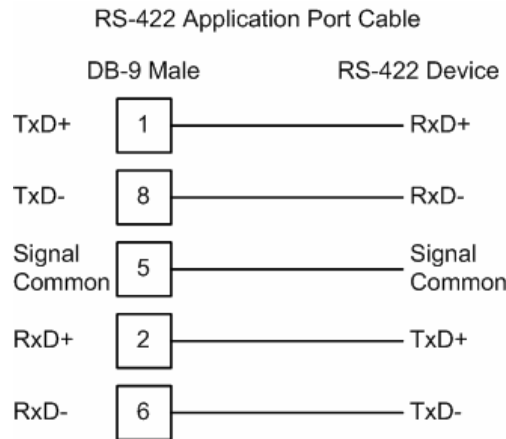
RS-232: Null Modem Connection (No Hardware Handshaking)

This type of connection can be used to connect the module to a computer or field device communication port.



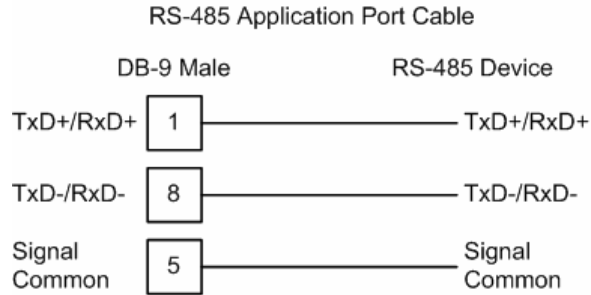
**Note:** If the port is configured with the "Use CTS Line" set to 'Y', then a jumper is required between the RTS and the CTS line on the module connection.

**5.3.3 RS-422**



### 5.3.4 RS-485

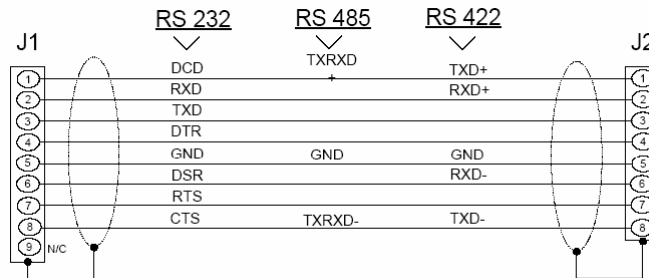
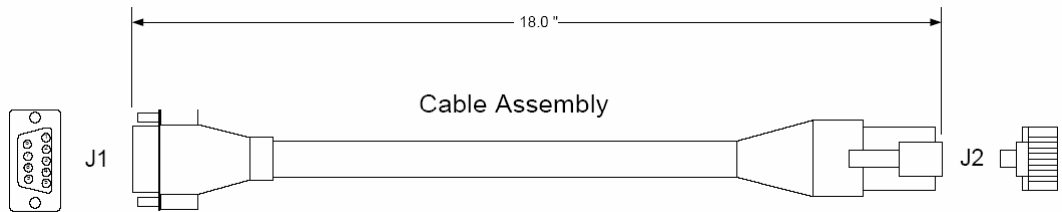
The RS-485 interface requires a single two or three wire cable. The Common connection is optional and dependent on the RS-485 network. The cable required for this interface is shown below:



#### RS-485 and RS-422 Tip

If communication in the RS-422/RS-485 mode does not work at first, despite all attempts, try switching termination polarities. Some manufacturers interpret +/- and A/B polarities differently.

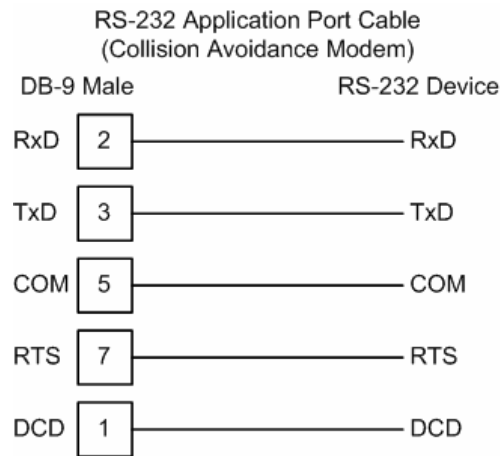
### 5.3.5 DB9 to RJ45 Adaptor (Cable 14)



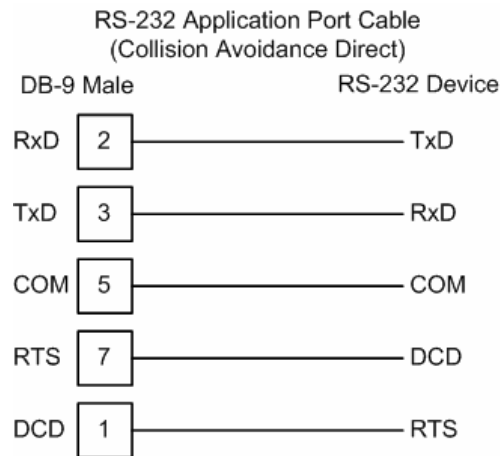
Wiring Diagram

### 5.4 Collision Avoidance (DNP modules only)

The RTS line is controlled by the RTS on and off parameters set for the port. If the CTS line is used (usually only required for half-duplex modems and not defined for use in the DNPS specification), the RTS and CTS lines must either be connected together or connected to the modem. The following illustration shows the cable required when connecting the port to a modem.

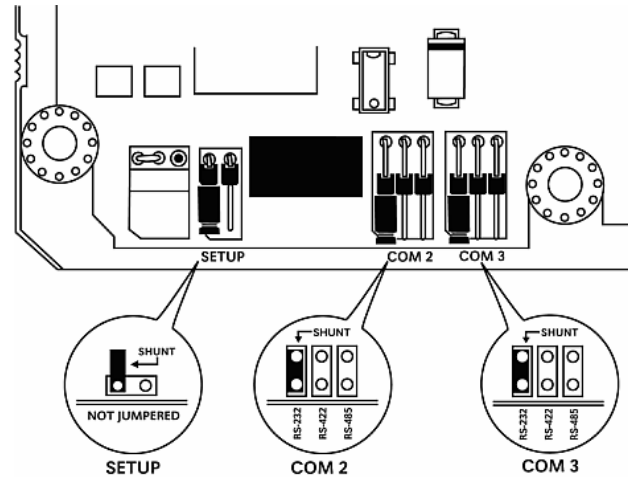


If collision avoidance is used in a point-to-point connection on the RS-232 interface, the following cable should be used.



## 5.5 Setting Jumpers

If you use an interface other than RS-232 (default), you must change the jumper configuration to match the interface. The following illustration shows the MVI46-DNP jumper configuration:



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.

## 5.6 Module Error/Status Data

The module maintains an Error/Status table. This table of data is available to the SLC in the M1: file of the module in elements 1536 to 1595. The ladder logic should be programmed to read this block of data and place the data in a file. This data can be viewed via the Configuration / Debug Port. You can use the Error/Status data to determine the "health" of the module. The module automatically transfers this data to the M1: file at a frequency determined by the Error Block Delay parameter in the module's configuration.

### 5.6.1 Error/Status Table

The data in the SLC file is structured as shown in the following table:

Example Address	Word	Data Address	Variable Name	Description
N11:0	0	M1: .1536	PLC State	This value represents the current state of the SLC. The codes returned are as follows: 0=Unknown/Error, 1=Run, 2=Program and 3=Test.
N11:1	1	M1: .1537	DNP Slave Port last transmitted error code	This value represents the last error code transmitted to the master by this slave port.

Example Address	Word	Data Address	Variable Name	Description
N11:2	2	M1: .1538	DNP Slave Port total number of message frames received by slave	This value represents the total number of message frames that have matched this slave's address on this port. This count includes message frames which the slave may or may not be able to parse and respond.
N11:3	3	M1: .1539	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.
N11:4	4	M1: .1540	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.
N11:5	5	M1: .1541	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.
N11:6	6	M1: .1542	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.
N11:7	7	M1: .1543	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.
N11:8	8	M1: .1544	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.
N11:9	9	M1: .1545	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.
N11:10	10	M1: .1546	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.
N11:11	11	M1: .1547	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.
N11:12	12	M1: .1548	DNP Slave Binary Input Event count	This value contains the total number of binary input events which have occurred.
N11:13	13	M1: .1549	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.
N11:14	14	M1: .1550	DNP Slave Analog Input Event count	This value contains the total number of analog input events which have occurred.
N11:15	15	M1: .1551	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.
N11:16	16	M1: .1552	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.

Example Address	Word	Data Address	Variable Name	Description
N11:17	17	M1: .1553	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.
N11:18	18	M1: .1554	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.
N11:19	19	M1: .1555	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.
N11:20	20	M1: .1556	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.
N11:21	21	M1: .1557	Total blocks transferred	Total module/SLC data transfers attempted by the module.
N11:22	22	M1: .1558	Successful blocks transferred	This value represents the total number of transfer operations between the PLC and module that are successful.
N11:23	23	M1: .1559	Total errors in block transfer	Total number of transfers that resulted in an error condition.
N11:24	24	M1: .1560	Total write errors	Total number of write transfers that resulted in an error.
N11:25	25	M1: .1561	Total read errors	Total number of read transfers that resulted in an error.
N11:26	26	M1: .1562	Reserved	Future Use
N11:27	27	M1: .1563	Continuous block error counter	Count of sequential data transfer errors. When this value exceeds that specified for the data transfer operation, the error flag below will be set.
N11:28	28	M1: .1564	Reserved	Future Use
N11:29	29	M1: .1565	Configuration Type	This is a coded field that defines the configuration of the module. The codes are as follows: 0=Single Slave Configuration, 1=Dual Slave Configuration, 2=Slave/Master Configuration
N11:30 N11:31	30 to 31	M1: .1566 M1: .1567	Product Name (ASCII)	These two words contain the product name of the module in ASCII format.
N11:32 N11:33	32 to 33	M1: .1568 M1: .1569	Revision (ASCII)	These two words contain the product revision level of the firmware in ASCII format.
N11:34 N11:35	34 to 35	M1: .1570 M1: .1571	Operating System Revision (ASCII)	These two words contain the module's internal operating system revision level in ASCII format.
N11:36 N11:37	36 to 37	M1: .1572 M1: .1573	Production Run Number (ASCII)	These two words contain the production 'batch' number for the particular chip in the module in ASCII format.
N11:38	38	M1: .1574	DNP Master Port Slave Count	This is the total number of slaves configured for the DNP Master port. This may not represent the number of active slaves as it includes slaves that are not enabled.

Example Address	Word	Data Address	Variable Name	Description
N11:39	39	M1: .1575	DNP Master Port Command Count	This is the total number of commands configured for the DNP Master port. This may not represent the number of active commands as it includes commands that are disabled.
N11:40	40	M1: .1576	DNP Master Port Device Memory Block Count	This value represents the number of memory allocation blocks for slave devices. This number should be one greater than the number of slave devices. The extra device is held for the broadcast device.
N11:41	41	M1: .1577	DNP Master Port Frame Block Count	This value represents the number of physical layer frame memory allocation blocks used by the program.
N11:42	42	M1: .1578	DNP Master Port Data Link Receive Block Count	This value represents the number of receive data link layer memory blocks allocated.
N11:43	43	M1: .1579	DNP Master Port Data Link Transmit Block Count	This value represents the number of transmit data link layer memory blocks allocated.
N11:44	44	M1: .1580	DNP Master Port Application Layer Receive Block Count	This value represents the number of application layer receive memory blocks allocated.
N11:45	45	M1: .1581	DNP Master Port Application Layer Transmit Block Count	This value represents the number of application layer transmit memory blocks allocated.
N11:46	46	M1: .1582	DNP Master Port Device Memory Allocation Error Count	This value represents the number of memory allocation errors for device blocks.
N11:47	47	M1: .1583	DNP Master Port Physical Layer Memory Allocation Error Count	This value represents the number of memory allocation errors for physical layer frame blocks.
N11:48	48	M1: .1584	DNP Master Port Data Link Layer Receive Memory Allocation Error Count	This value represents the number of memory allocation errors for data link layer receive blocks.
N11:49	49	M1: .1585	DNP Master Port Data Link Layer Transmit Memory Allocation Error Count	This value represents the number of memory allocation errors for data link layer transmit blocks.
N11:50	50	M1: .1586	DNP Master Port Application Layer Receive Memory Allocation Error Count	This value represents the number of memory allocation errors for application layer receive blocks.
N11:51	51	M1: .1587	DNP Master Port Application Layer Transmit Memory Allocation Error Count	This value represents the number of memory allocation errors for application layer transmit blocks.
N11:52	52	M1: .1588	DNP Master 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.



Example Address	Word	Data Address	Variable Name	Description
N11:53	53	M1: .1589	DNP Master 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.
N11:54	54	M1: .1590	DNP Master Bad CRC Error Count (Physical Layer Error)	This value counts the number of times a bad CRC value is received in a message.
N11:55 N11:56	55 to 56	M1: .1591 M1: .1592	Program Scan Counter	This value is incremented each time a program scan occurs in the module. The double-word value can be used to determine if the module is functioning and at what rate.
N11:57 N11:58	57 to 58	M1: .1593 M1: .1594	Free Memory	This value indicates the amount of memory available in the unit. This memory is located in the far heap of the module.
N11:59	59	M1: .1595	Reserved	Future Use
N11:60 to N11:119	60 to 119	M1: .1596 to M1: .1655	Error List Data	Error List of log. The following topic contains a complete list of error codes returned here.
N11:120	120	M1: .1656	Floating-point Input Event Count	This value represents the number of event messages generated from the Floating-point input database.
N11:121	121	M1: .1657	Double Floating-point Input Event Count	This value represents the number of event messages generated from the double input database.
N11:122	122	M1: .1658	Number of Event Messages to Send to Processor from Master Driver	This value represents the number of event messages waiting to be processed.
N11:123	123	M1: .1659	Event Message Buffer Overflow	This flag will be set to 1 if the event message buffer overflows. If the value is set to 0, the buffer is not overflowed.
N11:124 to N11:159	124 to 159	M1: .1669 to M1: .1695	Reserved	Reserved for future use.

### 5.6.2 Module Error Codes – 60 Word Error List

If the module's program encounters an error during execution, it will log the error to the error list. This list is transferred to the M1: file in elements 1596 to 1655. The SLC ladder logic should be programmed to transfer this M1: file data to a data table in the SLC. The tables below list the error codes generated by the program with their associated description. Use the errors to help determine where problems exist in the system.

Slave Port Error Codes

Error Code	Name	Description
0	OK	The module is operating correctly and there are no errors.
10	DNP synchronization error (Physical Layer Error)	Extra bytes are received before the start bytes (0x05 and 0x64).
11	DNP overrun error (Physical Layer Error)	Mainline Data Link Layer routine could not read data received on DNP port before it was overwritten.
12	DNP length error (Physical Layer Error)	Length of message does not match length value in message.
13	DNP bad CRC error (Data Link Layer Error)	Computed CRC value for message does not match that received in message.
14	DNP user data overflow error (Transport Layer Error)	Application layer received a message fragment buffer which is too small.
15	DNP sequence error (Transport Layer Error)	Sequence numbers of multi-frame request fragments do not increment correctly.
16	DNP address error (Transport Layer Error)	Source addresses contained in multi-frame request fragments do not match.
17	DNP bad function code error (Application Layer Error)	Function code received from DNP master is not supported for selected object/variation.
18	DNP object unknown error (Application Layer Error)	Slave does not have the specified objects or there are no objects assigned to the requested class.
19	DNP out of range error (Application Layer Error)	Qualifier, range or data fields are not valid or out of range for the selected object/variation.
20	DNP message overflow error (Application Layer Error)	Application response buffer overflow condition. The response message from the slave is too long to transmit.
21	DNP master multi-frame message error (Application Layer Error)	Received a multi-frame message from the DNP master. This application does not support multi-frame messages from the master.

System Configuration Errors

Error Code	Name	Description
100	Too many binary input points	Too many binary input points are configured for the module. Maximum value is 15360.
101	Too many binary output points	Too many binary output points are configured for the module. Maximum value is 15360.
102	Too many counter points	Too many counter points are configured for the module. Maximum value is 480.
103	Too many analog input points	Too many analog input points are configured for the module. Maximum value is 960.
104	Too many analog output points	Too many analog output points are configured for the module. Maximum value is 960.
105	Too many binary input events	Too many binary input events are configured for the module. Maximum value is 400.
106	Too many analog input events	Too many analog input events are configured for the module. Maximum value is 400.

Error Code	Name	Description
107	Invalid analog input deadband	Deadband value for analog input events is out of range. Value must be in the range of 0 to 32767.
108	Not enough memory	There is not enough memory in the module to configure the module as specified.
109	Invalid block transfer delay for blocks 251 and 252 (error/status blocks)	Block transfer delay value specified is too low.
110	File count invalid	The file count must be in the range of 0 to 6.
111	Invalid file record size	The file record size must be in the range of 1 to 120.
112	Invalid block identification code for file	The file block transfer code must be in the range of 100 to 120.

### DNP Port Configuration Error

Error Code	Name	Description
212	Invalid DNP address	The DNP address specified in the configuration is not valid (0 to 65534).
213	Invalid DNP port baud rate	The baud rate code specified in the configuration is not valid.
219	Invalid DNP data link layer confirm mode	The data link confirmation mode code is not valid in the configuration.
220	Invalid DNP data link confirm time-out	The data link time-out period specified in the configuration is 0. It must be an integer in the range of 1 to 65535.
222	Invalid DNP select/operate arm time duration	The select/operate arm timer is set to 0. It must be an integer in the range of 1 to 65535.
223	Invalid DNP application layer confirm time-out	The application layer confirm time-out value is set to 0. It must be an integer in the range of 1 to 65535.
224	Invalid DNP write time interval	The write time interval is not in the data range in the configuration. The value must be in the range of 0 to 1440.
225	Invalid DNP unsolicited response mode	The unsolicited response mode code is not valid in the configuration.
226	Invalid DNP unsolicited response minimum quantity for Class 1	The unsolicited response minimum quantity for Class 1 is not valid in the configuration. Value must be an integer in the range of 1 to 255.
227	Invalid DNP unsolicited response minimum quantity for Class 2	The unsolicited response minimum quantity for Class 2 is not valid in the configuration. Value must be an integer in the range of 1 to 255.
228	Invalid DNP unsolicited response minimum quantity for Class 3	The unsolicited response minimum quantity for Class 3 is not valid in the configuration. Value must be an integer in the range of 1 to 255.
230	Invalid DNP unsolicited response destination address	The unsolicited response destination address is not valid in the configuration. Value must be in the range of 1 to 65534.

### Debug Port Configuration Errors

Error Code	Name	Description
340	Invalid Debug Port baud rate	The baud rate code specified in the configuration is not valid.

**Command Error Codes**

Error Code	Name	Description
-1	Command is currently being issued to slave	
0	Command executed successfully, valid response from slave	
1	Device not defined	The IED slave address referenced in the command is not defined in the module. Check to make sure there is an entry in the slave table for each slave device referenced in the command list.
2	Invalid command	This command is not valid. Check to make sure the slave address parameter is greater than or equal to zero and that the point count is not set to zero.
3	Object not supported	The data object in the command is not supported by the module. Refer to the DNP subset for the Master Port.
4	Command function not supported	The function specified in the command is not supported for the object type selected. Refer to the DNP subset for the Master Port.
10	Invalid binary input poll command	This binary input object command is not valid.
11	Invalid binary input event poll command	This binary input event object poll command is not valid.
20	Invalid binary output command function	This binary output command function is not valid.
30	Invalid counter poll command function	The counter object poll command contains an invalid function code.
31	Invalid counter poll command	This counter object poll command is not valid.
40	Invalid frozen counter poll command	This frozen counter object poll command is not valid.
50	Invalid analog input poll command	This analog input poll command is not valid.
51	Invalid analog input event poll command	This analog input event poll command is not valid.
60	Invalid analog output poll command function	This analog output poll command contains an invalid function code.
61	Invalid analog output poll command	This analog output poll command is not valid.
70	Invalid time/date poll command	This time/date object poll command is not valid.
80	Invalid event poll command	This event poll command is not valid.

**Application Layer Errors**

Error Code	Name	Description
1000	Device index invalid	The device index in the request or response message is not found in the slave list.
1001	Duplicate request in application layer queue	The newly submitted message to the application layer already exists in the queue. The message is ignored.
1002	COM port device removed from system	The communication port for the message has been uninstalled on the system. This error should never occur as the communication ports are only uninstalled when the module's program is terminated.
1003	Sequence number error	The application sequence number in the response message does not match that based on the last request message. This indicates application layer messages are received out of order.

Error Code	Name	Description
1004	Response to select before operate does not match	The select response message received from the slave module is not that expected from the last select request. This indicates a synchronization problem between the master and slave devices.
1005	Response does not contain date/time object	The response message from the slave device does not contain a date/time object. The master expects this object for the response message.
1006	Time-out condition on response	The slave device did not respond to the last request message from the master within the time-out set for the IED device. The application layer time-out value is specified for each IED unit in the slave configuration table in the module. This table is established each time the module performs the restart operation.
1007	Function code in application layer message not supported	The function code returned in the response message is not valid for the application layer or not supported by the module.
1008	Read operation not supported for object/variation	The application layer response message contains an object that does not support the read function.
1009	Operate function not supported for the object/variation	The application layer response message contains an object that does not support the operate function.
1010	Write operation not supported for the object/variation	The application layer response message contains an object that does not support the write function.

## 5.7 DNP Configuration Forms

This section contains a configuration form to be used when designing an application.

### 5.7.1 MVI46-DNP Communication Module Configuration

[Section]/Item	Value	Range	Description
[MODULE]			General module configuration section
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.

[Section]/Item	Value	Range	Description
[DNP Slave]			DNP Slave configuration information
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.
Baud Rate:		Baud rate value	Primary DNP Port Baud Rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 384 (38400) , 576 (57600), 115 (115200)
RTS On:		0 to 65535 milliseconds	This value represents the number of 1 ms increments to be inserted between asserting the RTS modem line and the actual transmission of the data.

[Section]/Item	Value	Range	Description
RTS Off:		0 to 65535 milliseconds	This value represents the number of 1 ms increments to be inserted after the last character of data is transmitted before the RTS modem line is dropped.
Min Response Delay:		0 to 65535 milliseconds	Minimum time between receiving a request and transmitting a response. Allows master time to disable transmitter on an RS-485 network.
Modem:		Yes or No	This parameter defines if a dial-up modem is used on the secondary DNP slave port. A modem cannot be used if the port is configured as a master.
Connect Timeout:		0 to 65535	Defines the number of milliseconds to wait for the CD signal to be set high. The CD signal indicates a connection is made using a dial-up modem.
First Character Delay:		0 to 65535	Defines the number of milliseconds to wait before sending the first message after the connection is first made. This delay only applies to the first packet sent to the modem.
Redial Delay Time:		0 to 32000	Defines the minimum number of milliseconds to wait before a redial attempt is made by the slave.
Redial Random Delay:		0 to 32000	Defines a random millisecond time range to be added to the redial delay time before the modem is accessed.
Idle Timeout:		0 to 65535	Defines the number of milliseconds the modem is inactive before it will disconnect.
Phone Number:		ASCII String Data	This field contain a null-terminated, ASCII character string used by the dial-up modem. The string must contain all characters required by the modem. An example string is ATDT1800222333. Maximum length is 34 bytes including the terminating 0.
Collision Avoidance:		Yes or No	This parameter defines if collision avoidance will be utilized on the primary DNP slave port.
CD Idle Time:		0 to 32000	Defines the minimum number of milliseconds to wait before transmitting a message after the CD signal is recognized as low.
CD Random Time:		0 to 32000	Defines the range of random time to be added to the CD Idle Time before a message will be transmitted from the slave.
CD Time Before Receive:		0 to 65535	Defines the number of milliseconds to wait before receiving characters after the CD signal is recognized as high.
BI Class:		0 to 3	This parameter specifies the default class to be utilized for all the binary input points in the DNP database that are not defined in the override list section.
AI Class:		0 to 3	This parameter specifies the default class to be utilized for all the analog input points in the DNP database that are not defined in the override list section.
Float Class:		0 to 3	This parameter specifies the default class to be utilized for all the floating-point input points in the DNP database that are not defined in the override list section.
AI Deadband:		0 to 32767	This parameter specifies the default deadband value assigned to all points not defined in the override list for the analog input point type in the DNP database.

[Section]/Item	Value	Range	Description
Float Deadband:		0 to maximum float value	This parameter specifies the default deadband value assigned to all points not defined in the override list for the floating-point input point type in the DNP database.
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.
Data Link Confirm Mode:		Coded Value (N=Never, S=Sometimes, A=Always)	IED can request acknowledgement from master station when sending data. The codes are as follows: 0=Never, 1=Sometimes, 2=Always
Data Link Confirm Tout:		1 to 65535 milliseconds	Time period to wait for Master Data Link confirmation of last frame sent. This time is in milliseconds. This parameter is only used if the frame is sent with confirmation requested.
Data Link Max Retry:		0 to 255 retries	Maximum number of retries at the Data Link level to obtain a confirmation. If this value is set to 0, retries are disabled at the data link level of the protocol. This parameter is only used if the frame is sent with confirmation requested.
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:		Yes or No	Set if the slave unit will send unsolicited response messages. If set to No, the slave will not send unsolicited responses. If set to Yes, 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.
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.
Uresp Retry Count:		0 to 255 retries	Determines the number of unsolicited message retries sent on primary DNP port before changing to secondary port. If the value is 0, port switching will be disabled.
AI Events with time:		Yes or No	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 No, the default is set to no time data. If the parameter is set to Yes, the default object will include the time of the event.

[Section]/Item	Value	Range	Description
Time Sync Before Events:		Yes or No	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 No, no events will be generated until the module's time has been synchronized. If the parameter is set to Yes, events will always be generated.
Initialize DNP Database:		Y or N	This parameter determines if the module will request data from the processor to initialize the DNP database output data areas. If this option is utilized, ladder logic is required to send the requested block from the processor to the module.
Use Trip/Close Single Point	Y or N		Used for backwards compatibility with older MVI46-DNP modules, will cause Trip/Close operations to use a single point operation.

[Section]/Item	Value	Range	Description
[DNP Slave Database]			DNP Slave Database definition
Binary Inputs:		0 to 2048 points	Number of digital input points to configure in the DNP slave device. Each point will be stored as a single bit in the module memory.
PLC Binary Inputs:		0 to 2048 points	Number of digital input points configured above that are to be obtained from the SLC processor. All other binary input points must come from the attached IED units.
Analog Inputs:		0 to 256 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.
PLC Analog Inputs:		0 to 256 points	Number of analog input points configured above that are to be obtained from the SLC processor. All other analog input points must come from the attached IED units.
Float Inputs:		0 to 64 points	Number of floating-point input points to configure in the DNP slave device. Each point will occupy a two-word area in the module memory.
PLC Float Inputs:		0 to 64 points	Number of floating-point input points configured above that are to be obtained from the PLC.
Counters:		0 to 64 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.
PLC Counters:		0 to 64 points	Number of counter points configured above that are to be obtained from the SLC processor. All other counter points must come from the attached IED units.
Binary Outputs:		0 to 2000 points	Number of digital output points to configure in the DNP slave device. Each point will be stored as a single bit in the module memory.
PLC Binary Outputs:		0 to 2000 points	Number of digital output points configured above that are to be sent to the SLC processor. All other binary output points will be sent to the attached IED units.



[Section]/Item	Value	Range	Description
Analog Outputs:		0 to 128 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.
PLC Analog Outputs:		0 to 128 points	Number of analog output points configured above that are to be sent to the SLC processor. All other analog output points will be sent to the attached IED units.
Float Outputs:		0 to 64 points	Number of floating-point output points to configure in the DNP slave device. Each point will occupy a two-word area in the module memory.
PLC Float Outputs:		0 to 64 points	Number of floating-point output points configured above that are to be sent to the SLC.

[Section]/Item		Description
[DNP Slave Binary Inputs]		DNP database binary input override values
# This area is to override the class assignment for binary input database points. Enter list of points between the		
# START and END labels.		
#		
# Point# Class		
START		
END		

[Section]/Item		Description
[DNP Slave Analog Inputs]		DNP database analog input override values
START		
# This area is to override the class and deadband assignment for analog input database points. Enter list of points		
# between the START and END labels.		
#		
# Point# Class Deadband		
START		
END		

[Section]/Item		Description
[DNP Slave Float Inputs]		DNP database floating-point input override values
# This area is to override the class and deadband assignment for float input database points. Enter list of points		
# between the START and END labels.		
#		
# Point# Class Deadband		
START		
END		

[Section]/Item	Value	Range	Description
[Secondary Port]			Definitions for secondary port on module
Type:		M or S or blank	This parameter defines the functionality of the secondary port on the module. M = emulate a DNP master port S = back-up DNP slave port to the primary port. Any other value will disable the port.
Baud Rate:		Baud rate value	Secondary DNP Port Baud Rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 384 (38400) , 576 (57600), 115 (115200)
RTS On:		0 to 65535 milliseconds	This value represents the number of 1 ms increments to be inserted between asserting the RTS modem line and the actual transmission of the data.
RTS Off:		0 to 65535 milliseconds	This value represents the number of 1 ms increments to be inserted after the last character of data is transmitted before the RTS modem line is dropped.
Min Response Delay:		0 to 65535 milliseconds	Minimum time between receiving a request and transmitting a response. Allows master time to disable transmitter on an RS-485 network.
Collision Avoidance:		Yes or No	This parameter defines if collision avoidance will be utilized on the primary DNP slave port.
CD Idle Time:		0 to 32000	Defines the minimum number of milliseconds to wait before transmitting a message after the CD signal is recognized as low.
CD Random Time:		0 to 32000	Defines the range of random time to be added to the CD Idle Time before a message will be transmitted from the slave.
CD Time Before Receive:		0 to 65535	Defines the number of milliseconds to wait before receiving characters after the CD signal is recognized as high.
[Section]/Item	Value	Range	Description
[DNP Master]			Definitions for DNP Master port if utilized.
Internal 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.
Initialize IED Database:		Yes or No	This parameter determines if the module will request data from the processor to initialize the IED database input data areas. If this option is utilized, ladder logic is required to send the requested block from the processor to the module.
Event Messages to PLC:		Yes or No	This parameter determines if event messages received on the master port will be sent to the processor. If this option is utilized, ladder logic must handle the 9903 blocks generated by the module.

[Section]/Item	Value	Range	Description
[IED Database]			Database definition for DNP master port if utilized
Binary Inputs:		0 to 2048 points	Number of binary input points contained in the IED database to transfer to the SLC processor and obtained from the attached IED units.
Analog Inputs:		0 to 256 points	Number of analog input points contained in the IED database to transfer to the SLC processor and obtained from the attached IED units.
Counters:		0 to 64 points	Number of counter points contained in the IED database to transfer to the SLC processor and obtained from the attached IED units.
Binary Outputs:		0 to 2048 points	Number of binary output points contained in the IED database which are transferred from the SLC processor and used by the attached IED units.
Analog Outputs:		0 to 128 points	Number of analog output points contained in the IED database which are transferred from the SLC processor and used by the attached IED units.

[Section]/Item	Description
[DNP Master Slave List]	Definition of the IED units to be interfaced with the DNP master port if utilized

```
# This section stores information about each slave to be used by the master port. There must be an
# entry in this table for each node to be used in the command list. Two of the parameters in this list are coded
# values:
# Conf Mode ==> 0=Never, 1=Sometimes and 2=Always (select 0).
# Flags is bit coded as follows:
# Bit 0 (decimal 1) ==> Enable the slave
# Bit 1 (decimal 2) ==> Use Unsolicited messaging with this slave
# Bit 2 (decimal 4) ==> Use delay measurement with this slave
# Bit 3 (decimal 8) ==> Auto time synchronization enabled
#
# Node DL Conf Conf Conf App Rsp
# Address Mode Timeout Retry Timeout Flags
START
END
```

[Section]/Item	Description
[DNP Master Commands]	Definition of the commands to be issued to the IED units by the DNP master port.

```
# This section contains the list of commands to process on the master port.
# Node addresses present in the command list must have an entry in the
# [DNP Slave List]. Commands with nodes not present in the list will not be
# executed.
# 1 2 3 4 5 6 7 8 9 10
#Flags/ Node Data Data Cmd Device Point DNP DB IED DB Poll
#Enable Address Object Variation Func Address Count Address Address interval
START
END
```

## 5.8 IIN Response – Slave Port

The module defines the IIN data bits returned with a response message from the module to a DNP master unit. These bits should be interpreted and handled by the master. These bits report status and error information to the master DNP device.

The following is a description of the word:

### 5.8.1 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 master station know broadcast 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.
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 master. The master should write the date and time when this bit is set. After receiving the write command, the bit will be cleared. Events may not be generated until this bit is cleared after a restart if configured by the user.
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. Events will not be generated until this bit is cleared.

### 5.8.2 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 requested operation is already executing. The slave will never set this bit.
5	Bad configuration. The slave configuration is invalid and should be re-configured. If the configuration is invalid, the slave will set the invalid parameters to default values and continue to run. Check error log using debug port.
6	Reserved, always 0.
7	Reserved, always 0.

## 5.9 DNP Collision Avoidance

### WHEN REQUIRED:

Collision avoidance should be enabled whenever the following conditions are all true:

- A multi-point network is used (that is, master unit is communicating with several slave units on same physical link). This excludes a dial-up modem network where the master only communicates with one slave at a time in a point-to-point physical link. Will only operate on two-wire, half-duplex communication networks.
- The user layer supports unsolicited messages. Unsolicited messaging is used where asynchronous, spontaneous messages may be generated by any node on the network.
- Any network where the physical layer does not implement a collision avoidance scheme and permits several nodes to communicate at one time (that is, some radio networks).

**IMPORTANT NOTE:** A system should either be configured to operate in a polled-only mode, or in a report-by-exception mode. The Data Link was never designed to handle the traffic load of frequent scheduled polls by the master interspersed with unsolicited messages from slave devices.

The collision avoidance scheme in DNP was designed for half-duplex communications only. It requires the use of DCD and RTS control lines by every device on the link. A device will assert RTS before transmitting data on the circuit. The RTS signal is an indication that the line is busy.

Any device that wishes to transmit a frame does so according to the following rules.

### RULES:

- RTS controls DCD line on all other units.
- No stations transmit while DCD line is high except the one that has the RTS line high.
- After DCD line drops low, slaves wait variable time before attempting to transmit.
- Master has smallest delay (can be set to 0)
- Slaves have higher delays (fixed delay (that is, slave#\*20 milliseconds) + random delay (20 to 50 milliseconds))
- Only supported in 2-wire half-duplex mode. Not supported in 4-wire half-duplex mode.
- This option is set in the configuration of the module with the port type.

### CABLE:

This is the cable required for direct connection of the module to a remote unit:

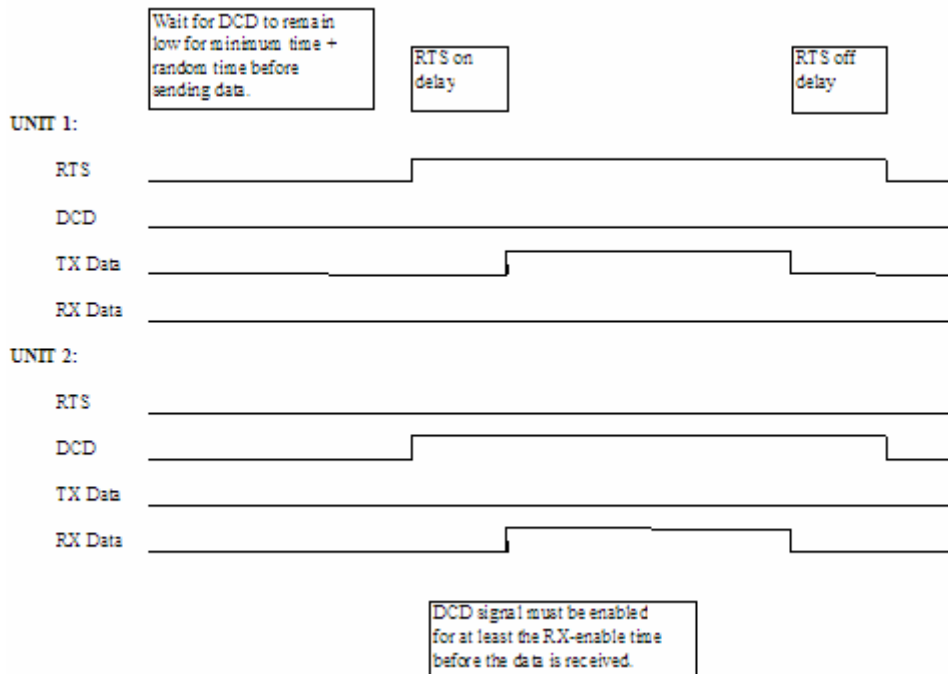
DCD	RTS	DB-9	DB-25
RX	TX	7	4
TX	RX	3	2
GND	GND	2	3
RTS	DCD	5	7
		1	8

**TIMING CHART:**

Several timing parameters are required for each unit in order to implement the collision avoidance feature. The parameters are as follows:

Parameter	Description
Fixed DCD Idle Delay Time Before Transmit	This parameter specifies the minimum number of milliseconds to delay before transmitting a message after recognizing that the DCD line is low.
Random DCD Idle Delay Time Before Transmit	This parameter determines the random time to be added to the above fixed delay value above before attempting to transmit a message. The value specified for the parameter determines the range of random values (milliseconds) to be used. For example, if a value of 20 is specified, the random delay time will be from 0 to 20 each time the value is requested.
DCD Time Before Receive	This parameter specifies the number of milliseconds to delay after recognizing that DCD has been asserted before accepting data. The RTS on time of the sending unit must be set greater that the time specified here or else the first part of the data message will be ignored.
RTS On Time	This parameter specifies the number of milliseconds to delay after asserting the RTS modem control line before sending the data.
RTS Off Time	This parameter specifies the number of milliseconds to delay after the data has been transmitted before dropping the RTS modem control line.

The timing parameters defined above must be set correctly for successful use of the collision avoidance feature. A timing diagram displaying the data and modem control lines used with the collision avoidance scheme is shown below. This example displays the state of the signal lines in transmitting a message from Unit 1 to Unit 2.



## 5.10 SLC File Usage

SLC File	# of Elements	Max. Elements	M1: Elements	M1: Range	DNP Data
N:		128	0-	0 to 127	DNP Binary Inputs
N:		256	128-	128 to 383	DNP Analog Inputs
N:		128	384-	384 to 511	DNP Counters
N:		128	512-	512 to 639	DNP Binary Outputs
N:		128	640-	640 to 767	DNP Analog Outputs
N:		128	768-	768 to 895	IED Binary Inputs
N:		256	896-	896 to 1151	IED Analog Inputs
N:		128	1152-	1152 to 1279	IED Counters
N:		128	1280-	1280 to 1407	IED Binary Outputs
N:		128	1408-	1408 to 1535	IED Analog Outputs
N:	60	60	1536 to 1595	1536 to 1595	Error/Status Data
N:	60	60	1596 to 1655	1596 to 1655	Error List Data
N:	40	40	1656 to 1695	1656 to 1695	Additional Status
N:		128	1696-	1696 to 1823	DNP Float Inputs
N:		128	1824-	1824 to 1951	Reserved
N:		128	1952-	1952 to 2079	DNP Float Outputs
N:		128	2080-	2080 to 2207	Reserved

Use this form to define the files set up in the SLC for data transfer to and from the M1: file from the module. This form will aid in the construction of the ladder logic required to transfer the data.

Each data type should be placed in a separate data file. This will make debugging and expansion of the ladder logic easier. The values placed in the table can be used to define the variables required in the COP command in the ladder logic. For example, if the DNP Binary Input data has the following values: N:20:0, 10 (0 to 9), the COP command would have the following parameters:

Source#N20:0

Dest #M1:1.0

Length 10

This assumes the module is placed in slot one of the rack. This will copy the first 10 elements of N20 starting at offset 0 to the M1: file elements 0 to 9 representing binary input data.

## 5.11 Event Size Computation

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

$$\frac{((\text{number of static points}) * (\text{rate per second scan of change function}))}{(\text{rate per second of master event data poll})}$$

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

$$(51 * 2) / .02 = 510 \text{ events}$$

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:

$$(\text{number of points that change per change function} * \text{rate per second of scan of change function}) * (\text{number of seconds between master event data poll})$$

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

$$(5 * 2) * 5 = 50 \text{ events required}$$

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 the BI Class, AI Class, and Float Class parameters within the DNP.CFG files. This will cause the slave to never generate event data for classes 1, 2, or 3.



## 5.12 Slave Unit Device Profile Object Subset

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
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

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	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
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

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	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

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	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
	5	Short Floating Point Analog Input	1	06	129, 130	00, 01	40	Slave will return Unknown Object to this request
31	0	Frozen Analog Input - All Variations						Slave will return Unknown Object to this request

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	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
	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

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
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
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
60	0	Not Defined						Not Defined in DNP
	1	Class 0 Data	1	06				Slave will respond to this variation will all static data
	2	Class 1 Data	1	06, 07, 08				Slave will respond to this variation (No class 1 data defined in application)

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	3	Class 2 Data	1	06, 07, 08				Slave will respond to this variation will all class 2 data (binary input events)
	4	Class 3 Data	1	06, 07, 08				Slave will respond to this variation will all class 3 data (analog input events)
70	0	Not Defined						
	1	File Identifier						
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						
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	

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	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

### 5.13 Master Unit Device Profile Object Subset

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
1	0	Binary Input - All Variations	1	06			1	Master will generate this variation.
	1	Binary Input	1	06	129, 130	00, 01	1	Master will generate and process this variation.
	2	Binary Input with Status	1	06	129, 130	00, 01	8	Master will generate and process this variation.
2	0	Binary Input Change - All Variations	1	06, 07, 08			56	Master will generate this variation.



Object		Request			Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	1	Binary Input Change Without Time	1	06, 07, 08	129, 130	17, 28	8	Master will generate and process this variation.
	2	Binary Input Change With Time	1	06, 07, 08	129, 130	17, 28	56	Master will generate and process this variation.
	3	Binary Input Change With Relative Time	1	06, 07, 08	129, 130	17, 28	24	Master will generate and process this variation.
10	0	Binary Output - All Variations	1	06			8	Master does not use this object type and will not generate a message or process this type.
	1	Binary Output					1	
	2	Binary Output Status			129, 130	00, 01	8	
12	0	Control Block - All Variations					88	
	1	Control Relay Output Block	3, 4, 5, 6	17, 28	129	Echo of request	88	Master will generate this variation and parse the response.
	2	Pattern Control Block					88	
	3	Pattern Mask					16	
20	0	Binary Counter - All Variations	1, 7, 8, 9, 10	06			32	Master will generate this variation.
	1	32-Bit Binary Counter			129, 130	00, 01	40	Master will process this variation.
	2	16-Bit Binary Counter			129, 130	00, 01	24	Master will process this variation.
	3	32-Bit Delta Counter			129, 130	00, 01	40	Master will process this variation.
	4	16-Bit Delta Counter			129, 130	00, 01	24	Master will process this variation.
	5	32-Bit Binary Counter Without Flag	1, 7, 8, 9, 10	06	129, 130	00, 01	32	Master will generate and process this variation.

Object		Description	Request		Response			Notes
Obj	Var		Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	6	16-Bit Binary Counter Without Flag	1, 7, 8, 9, 10	06	129, 130	00, 01	16	Master will generate and process this variation.
	7	32-Bit Delta Counter Without Flag			129, 130	00, 01	32	Master will process this variation.
	8	16-Bit Delta Counter Without Flag			129, 130	00, 01	16	Master will process this variation.
21	0	Frozen Counter - All Variations	1	06			32	Master will generate this variation.
	1	32-Bit Frozen Counter			129, 130	00, 01	40	Master will process this variation.
	2	16-Bit Frozen Counter			129, 130	00, 01	24	Master will process this variation.
	3	32-Bit Frozen Delta Counter					40	
	4	16-Bit Frozen Delta Counter					24	
	5	32-Bit Frozen Counter With Time Of Freeze					88	
	6	16-Bit Frozen Counter With Time Of Freeze					72	
	7	32-Bit Frozen Delta Counter With Time Of Freeze					88	
	8	16-Bit Frozen Delta Counter With Time Of Freeze					72	
	9	32-Bit Frozen Counter Without Flag	1	06	129, 130	00, 01	32	Master will generate and process this variation.
	10	16-Bit Frozen Counter Without Flag	1	06	129, 130	00, 01	16	Master will generate and process this variation.
	11	32-Bit Frozen Delta Counter Without Flag					32	
	12	16-Bit Frozen Delta Counter Without Flag					16	

Object		Description	Request		Response			Notes
Obj	Var		Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
22	0	Counter Change Event - All Variations	1	06, 07, 08				Master will not generate a request for this variation.
	1	32-Bit Counter Change Event Without Time			129, 130	17, 28	40	Master will process this variation.
	2	16-Bit Counter Change Event Without Time			129, 130	17, 28	24	Master will process this variation.
	3	32-Bit Delta Counter Change Event Without Time					40	
	4	16-Bit Delta Counter Change Event Without Time					24	
	5	32-Bit Counter Change Event With Time					88	
	6	16-Bit Counter Change Event With Time					72	
	7	32-Bit Delta Counter Change Event With Time					88	
	8	16-Bit Delta Counter Change Event With Time					72	
23	0	Frozen Counter Event - All Variations						
	1	32-Bit Frozen Counter Event Without Time					40	
	2	16-Bit Frozen Counter Event Without Time					24	
	3	32-Bit Frozen Delta Counter Event Without Time					40	
	4	16-Bit Frozen Delta Counter Event Without Time					24	
	5	32-Bit Frozen Counter Event With Time					88	
	6	16-Bit Frozen Counter Event With Time					72	

Object			Request		Response			
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	Notes
	7	32-Bit Frozen Delta Counter Event With Time					88	
	8	16-Bit Frozen Delta Counter Event With Time					72	
30	0	Analog Input - All Variations	1	06			16	Master will generate this variation.
	1	32-Bit Analog Input	1	06	129, 130	00, 01	40	Master will generate this variation. Note: Data returned will only be Least Significant 16 bits from Slave
	2	16-Bit Analog Input	1	06	129, 130	00, 01	24	Master will generate and process this variation.
	3	32-Bit Analog Input Without Flag	1	06	129, 130	00, 01	32	Master will generate this variation. Note: Data returned will only be Least Significant 16 bits from Slave
	4	16-Bit Analog Input Without Flag	1	06	129, 130	00, 01	16	Master will generate and process this variation.
31	0	Frozen Analog Input - All Variations						
	1	32-Bit Frozen Analog Input					40	
	2	16-Bit Frozen Analog Input					24	
	3	32-Bit Frozen Analog Input With Time To Freeze					88	
	4	16-Bit Frozen Analog Input With Time To Freeze					72	
	5	32-Bit Frozen Analog Input Without Flag					32	

Object			Request		Response			Notes
Obj	Var	Description	Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	6	16-Bit Frozen Analog Input Without Flag					16	
32	0	Analog Change Event - All Variations	1	06, 07, 08			24	Master will generate this variation
	1	32-Bit Analog Change Event Without Time	1	06, 07, 08	129, 130	17, 28	40	Master will generate and process this variation.
	2	16-Bit Analog Change Event Without Time	1	06, 07, 08	129, 130	17, 28	24	Master will generate and process this variation.
	3	32-Bit Analog Change Event With Time	1	06, 07, 08	129, 130	17, 28	88	Master will generate and process this variation.
	4	16-Bit Analog Change Event With Time	1	06, 07, 08	129, 130	17, 28	72	Master will generate and process this variation.
33	0	Frozen Analog Event - All Variations						
	1	32-Bit Frozen Analog Event Without Time					40	
	2	16-Bit Frozen Analog Event Without Time					24	
	3	32-Bit Frozen Analog Event With Time					88	
	4	16-Bit Frozen Analog Event With Time					72	
40	0	Analog Output Status - All Variations	1	06			24	Master does not use this object type and will not generate a message or process this type.
	1	32-Bit Analog Output Status					40	
	2	16-Bit Analog Output Status			129, 130	00, 01	24	
41	0	Analog Output Block - All Variations					24	
	1	32-Bit Analog Output Block					40	

Object		Description	Request		Response			Notes
Obj	Var		Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	2	16-Bit Analog Output Block	3, 4, 5, 6	17, 28	129	Echo of Request	24	Master will generate this variation and parse the response.
50	0	Time and Date - All Variations					48	
	1	Time and Date	2	07, With Quant=1			48	Master will generate this variation.
	2	Time and Date With Interval					80	
51	0	Time and Date CTO - All Variations						
	1	Time and Date CTO			129, 130	07, With Quant=1	48	Master will process this variation.
	2	Unsynchronized Time and Date CTO			129, 130	07, With Quant=1	48	Master will process this variation.
52	0	Time Delay - All Variations						
	1	Time Delay Coarse			129	07, With Quant=1	16	Master will not process this variation.
	2	Time Delay Fine			129	07, With Quant=1	16	Master will not process this variation.
60	0	Not Defined						Not Defined in DNP
	1	Class 0 Data	1	06				Master will generate this variation.
	2	Class 1 Data	1	06, 07, 08				Master will generate this variation.
	3	Class 2 Data	1	06, 07, 08				Master will generate this variation.
	4	Class 3 Data	1	06, 07, 08				Master will generate this variation.
70	0	Not Defined						
	1	File Identifier						
80	0	Not Defined						

Object		Description	Request		Response			Notes
Obj	Var		Func Codes	Qual Codes (hex)	Func Codes	Qual Codes (hex)	Data Size (bits)	
	1	Internal Indications	2	00, Index=7			24	The Master will generate this variation.
81	0	Not Defined						
	1	Storage Object						
82	0	Not Defined						
	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					Master supports the Cold Restart Function
			14					Master supports the Warm Restart Function
			20					Master supports the Enable Unsolicited Function
			21					Master supports the Disable Unsolicited Function

### 5.14 DNP Device Profile

<b>DNP V3.00 DEVICE PROFILE DOCUMENT</b>	
Vendor Name: ProSoft Technology, Inc.	
Device Name: MVI46-DNP (Revision 1.00)	
Highest DNP Level Supported : For Request: L2 For Responses: L2	Device Function: Slave & Master
<p>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:                  Configuration Error - User specified point or event count is too high for application (can only correct by changing configuration in PLC).</p> <p>Support for a redundant slave port on the module which may be attached to a dial-up modem is provided. Auto switching is provided by the module to switch between the primary and secondary ports.</p> <p>The following features are configurable on the module: Collision avoidance, time sync before events are generated and default analog input events, Obj32V4 or O32V2, select option.</p> <p>Events generated by IED units attached to a master port may pass their events directly to the slave port. These events may not occur in the correct time sequence. They are placed in the event buffer as the module receives them. This provides the greatest time resolution for remote events.</p> <p>Module will not generate events until Restart IIN bit is cleared by DNP master except for events passed through module from attached IED units.</p>	
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 from 0 - 255	Maximum Application Layer Re-tries: None
Requires Data Link Layer Confirmation: Configurable at module start-up (never, sometimes, & always)	
Requires Application Layer Confirmation: When reporting Event Data as a slave unit	



Time-outs while waiting for: Data Link Confirm : Configurable at module start-up (1 to 65535 mSec) 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	



## 6 ProSoft Technology, Inc., Support, Service & Warranty

### *In This Chapter*

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*Be sure and read the full Warranty that can be found on our web site at [www.prosoft-technology.com](http://www.prosoft-technology.com) for details and other terms and conditions. The content in this summary is subject to change without notice. The content is current at date of publication.*

ProSoft Technology, Inc. strives to provide meaningful support to its customers. Should any questions or problems arise, please feel free to contact us at:

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**Internet**Web Site: <http://www.prosoft-technology.com/support>E-mail address: [support@prosoft-technology.com](mailto:support@prosoft-technology.com)

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Those of us at ProSoft Technology, Inc. want to provide the best and quickest support possible, so before calling please have the following information available. You may wish to fax this information to us prior to calling.

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

In the case of hardware, we will also need the following information:

- 1 Module configuration and contents of file
- 2 Module Operation
- 3 Configuration/Debug status information
- 4 LED patterns
- 5 Information about the processor and user data files as viewed through the development software and LED patterns on the processor
- 6 Details about the networked devices interfaced, if any

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.

## 6.1 How to Contact Us: Sales and Support

All ProSoft Technology Products are backed with full technical support. Contact our worldwide Technical Support team and Customer Service representatives directly by phone or email:

### **USA / Latin America (excluding Brasil) (Office in California)**

+1(661) 716-5100  
+1(661) 716-5101 (Fax)  
1675 Chester Avenue, 4th Floor  
Bakersfield, California 93301  
U.S.A.  
+1.661.716.5100, [support@prosoft-technology.com](mailto:support@prosoft-technology.com)  
Languages spoken include: English, Spanish

### **Asia Pacific (office in Malaysia)**

+603.7724.2080  
+603.7724.2090 (Fax)  
C210, Damansara Intan,  
1 Jalan SS20/27, 47400 Petaling Jaya  
Selangor, Malaysia  
+603.7724.2080, [asiapc@prosoft-technology.com](mailto:asiapc@prosoft-technology.com)  
Languages spoken include: Chinese, Japanese, English

### **China Pacific (office in China)**

+86.21.64518356 x 8011  
+86.21.64756957 (Fax)  
4/F, No. 16 Hongcao Road  
Shanghai, China 200233  
China  
+86.21.64518356 x 8011, [zhang@prosoft-technology.com](mailto:zhang@prosoft-technology.com)  
Languages spoken include: Chinese, English

### **Europe / Middle East / Africa (office in Toulouse, France)**

+33 (0) 5.34.36.87.20  
+33 (0) 5.61.78.40.52 (Fax)  
Zone d'activité de Font Grasse  
17, rue des Briquetiers  
F-31700 Blagnac  
France  
+33 (0) 5.34.36.87.20. support. [EMEA@prosoft-technology.com](mailto:EMEA@prosoft-technology.com)  
Languages spoken include: French, English

### **Brasil (office in Sao Paulo)**

+55-11-5084-5178  
+55-11-5083-3776 (Fax)  
Rua Vergueiro, 2949 - sala 182 - Edifício Vergueiro Work Center  
Vila Mariana - São Paulo  
Cep: 04101-300 – Brasil  
+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 apply to any returned product. These RMA Policies are subject to change by ProSoft without notice. For warranty information, see Section C below entitled "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

- 1 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.
- 2 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 in Section A. A Technical Support Engineer will request several tests in an attempt to isolate the problem. If after these tests are completed, the Product is found to be the source of the problem, ProSoft will issue an RMA.
- 3 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. 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 without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
- 4 Out of warranty returns are not allowed on RadioLinx accessories such as antennas, cables, and brackets.

The following policy applies for Non-Warranty Credit Returns:

- A 10% Restocking Fee if Factory Seal is *not* broken
- B 20% Restocking Fee if Factory Seal is broken

ProSoft retains the right, in its absolute and sole discretion, to reject any non-warranty returns for credit if the return is not requested within three (3) months after shipment of the Product to Customer, if the Customer fails to comply with ProSoft's shipping instructions, or if the Customer fails to return the Product to ProSoft within six (6) months after Product was originally shipped.

## 6.3 Procedures for Return of Units Under Warranty

- 1 A Technical Support Engineer must pre-approve all product returns.
- 2 Module is repaired or replaced after a Return Material Authorization Number is entered and a replacement order is generated.
- 3 Credit for the warranted item is issued within 10 business days after receipt of product and evaluation of the defect has been performed by ProSoft. The credit will only be issued provided the product is returned with a valid Return Material Authorization Number and in accordance with ProSoft's shipping instructions.
  - a) If no defect is found, a credit is issued.

- b) If a defect is found and is determined to be customer generated or if the defect is otherwise not covered by ProSoft's Warranty, or if the module is not repairable, a credit is not issued and payment of the replacement module is due.

## 6.4 Procedures for Return of Units Out of Warranty

- 1 Customer sends unit in for evaluation.
- 2 If no defect is found, Customer will be charged the equivalent of US \$100 plus shipping, duties and taxes that may apply. A new Purchase Order will be required for this evaluation fee.  
If the unit is repaired the charge to the Customer will be 30%\* of the list price plus any shipping, duties and taxes that may apply. A new Purchase Order will be required for a product repair.
- 3 For an immediate exchange, a new module may be purchased and sent to Customer while repair work is being performed. Credit for purchase of the new module will be issued when the new module is returned in accordance with ProSoft's shipping instructions and subject to ProSoft's policy on non-warranty returns. This is in addition to charges for repair of the old module and any associated charges to Customer.
- 4 If, upon contacting ProSoft Customer Service, the Customer is informed that unit is believed to be unrepairable, the Customer may choose to send unit in for evaluation to determine if the repair can be made. Customer will pay shipping, duties and taxes that may apply. If unit cannot be repaired, the Customer may purchase a new unit.

### 6.4.1 Un-repairable Units

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

**\* 30% of list price is an estimated repair cost only. The actual cost of repairs will be determined when the module is received by ProSoft and evaluated for needed repairs.**

### **6.4.2 Purchasing Warranty Extension**

As detailed below in ProSoft's Warranty, the standard Warranty Period is one year (or in the case of RadioLinx modules, three years) from the date of delivery. The Warranty Period may be extended 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

## **6.5 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.

### **6.5.1 What Is Covered By This Warranty**

- A** *Warranty On New Products:* ProSoft warrants, to the original purchaser only, 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 one year (or in the case of RadioLinx modules, 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 15 months (or in the case of RadioLinx modules, 39 months) from the date of delivery. 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. If ProSoft is unable to repair the Product to conform to this Warranty after a reasonable number of attempts, ProSoft will provide, at its option, one of the following: a replacement product, a full refund of the purchase price or a credit in the amount of the purchase price. All replaced product and parts become the property of ProSoft. These remedies are the Customer's only remedies for breach of warranty.

- B** *Warranty On Services:* Material and labor used by ProSoft to repair a verified malfunction or defect are warranted on 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.
- C** The Warranty Period for RadioLinx accessories (such as antennas, cables, brackets, etc.) are the same as for RadioLinx modules, that is, three years from the date of shipment.

### **6.5.2 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** With the exception of RadioLinx accessories referenced in paragraph 1(c) this Warranty does not cover any product, components, or parts not manufactured by ProSoft.
- C** This Warranty also 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 programming languages, or "C") 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 outside of the limits indicated on the product specifications; or (viii) disasters such as fire, flood, earthquake, wind or lightning.
- D** 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 guides included with your original product purchased by you 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.



### **6.5.3 *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, 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.

### **6.5.4 *DISCLAIMER OF ALL OTHER WARRANTIES***

THE WARRANTIES SET FORTH IN PARAGRAPH 1 ABOVE 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.

### **6.5.5 *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 AND ITS DEALER WILL NOT BE RESPONSIBLE FOR INCLUDE, BUT ARE NOT LIMITED TO: LOSS OF PROFITS; LOSS OF SAVINGS OR REVENUE; LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT; LOSS OF DATA; COST OF CAPITAL; COST OF ANY SUBSTITUTE EQUIPMENT, FACILITIES, OR SERVICES; DOWNTIME; THE CLAIMS OF THIRD PARTIES, INCLUDING CUSTOMERS OF THE PURCHASER; AND INJURY TO PROPERTY.

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

### **6.5.6 *Time Limit for Bringing Suit***

Any action for breach of warranty must be commenced within 15 months (or in the case of RadioLinx modules, 39 months) following shipment of the Product.

### **6.5.7 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.

### **6.5.8 Intellectual Property**

- A** Any documentation included with Product purchased from ProSoft is protected by copyright and may not be photocopied 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.
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### **6.5.9 Additional Restrictions Relating To Software And Other Intellectual Property**

In addition to complying 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.

### **6.5.10 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.

**6.5.11 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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