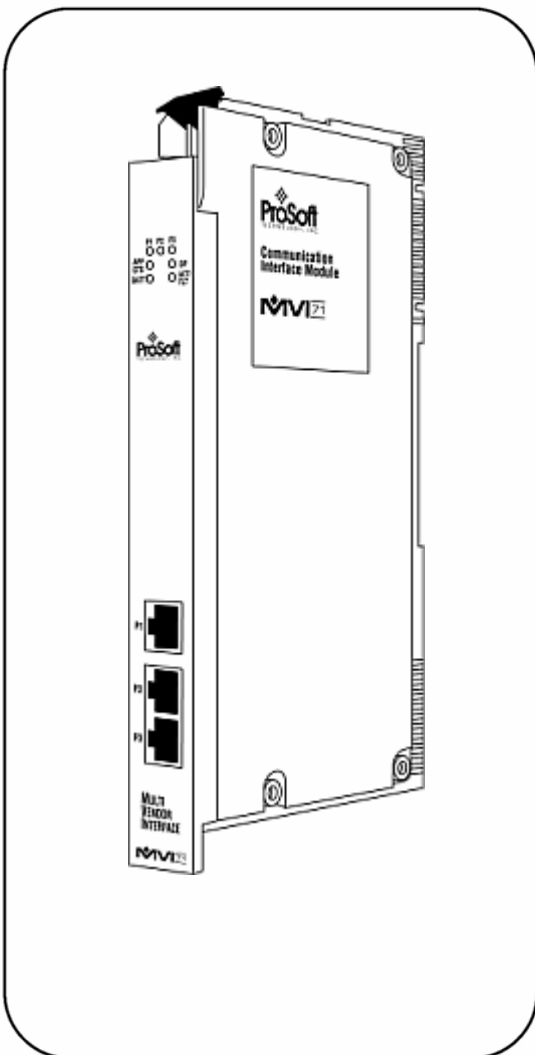


# inRAx<sup>®</sup>



## MVI71-103M

PLC Platform

IEC 60870-5-103 Master Communication  
Module

## User Manual

May 09, 2007

  
**ProSoft**<sup>®</sup>  
TECHNOLOGY

## Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation PLC hardware, the MVI71-103M 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.

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

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

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

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

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

## Your Feedback Please

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

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MVI71-103M User Manual

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## Guide to the MVI71-103M User Manual

Function		Section to Read	Details
Introduction (Must Do)	→	<b>Start Here</b> (page 17, page 9)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Verify Communication, Diagnostic and Troubleshooting	→	<b>Verifying Communication</b> (page 31) <b>Diagnostics and Troubleshooting</b> (page 31)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	<b>Reference</b> (page 57) <b>Functional Overview</b> (page 59) <b>Product Specifications</b> (page 57)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	<b>Support, Service and Warranty</b> (page 104)	This section contains Support, Service and Warranty information. Index of chapters.





# 1 Start Here

## *In This Chapter*

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- Install the Module in the Rack ..... 11
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Installing the MVI71-103M module requires a reasonable working knowledge of the Rockwell Automation hardware, the MVI71-103M Module and the application in which they will be used.



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

## 1.1 System Requirements

The MVI71-103M module requires the following minimum hardware and software components:

- Rockwell Automation PLC processor, with compatible power supply and one free slot in the rack, for the MVI71-103M module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 5 programming software.
- Rockwell Automation RSLinx communication software
- Pentium® 100 MHz minimum. Pentium III 700 MHz (or better) recommended
- Supported operating systems:
  - Microsoft Windows XP
  - Microsoft Windows 2000
  - Microsoft Windows NT v4.0 with Service Pack 3 or greater
  - Microsoft Windows ME
  - Microsoft Windows 98
- 64 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)

- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- CD-ROM drive
- 3.5 inch floppy disk drive
- HyperTerminal or other terminal emulator program capable of file transfers using 103M protocol.

## 1.2 Package Contents

The following components are included with your MVI71-103M module, and are all required for installation and configuration.

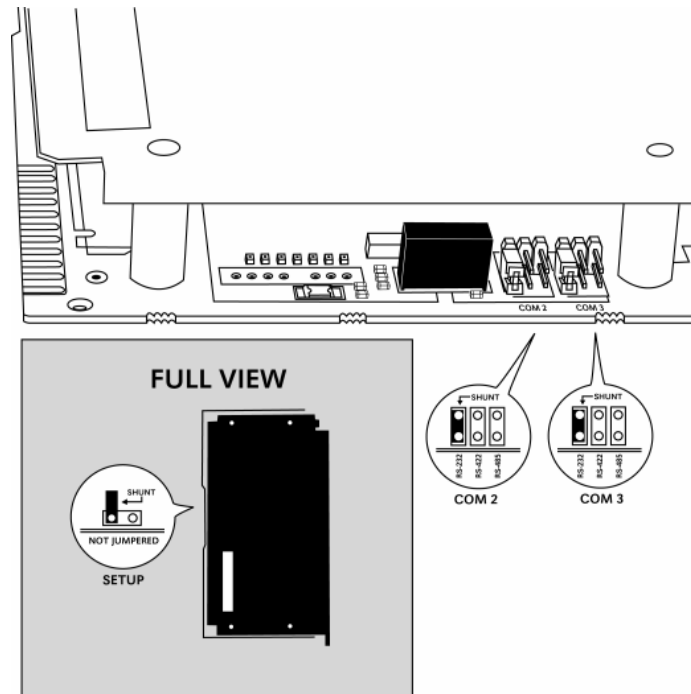
**Important:** Before beginning the installation, please verify that all of the following items are present.

Qty.	Part Name	Part Number	Part Description
1	MVI71-103M Module	MVI71-103M	IEC 60870-5-103 Master 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
1	ProSoft Solutions CD		Contains sample programs, utilities and documentation for the MVI71-103M module.

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

### 1.3 Setting Jumpers

The following illustration shows the jumper configurations for the various RS interfaces. If you are using an interface other than RS-232 (default), you must change the jumpers as shown:



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

### 1.4 Install the Module in the Rack

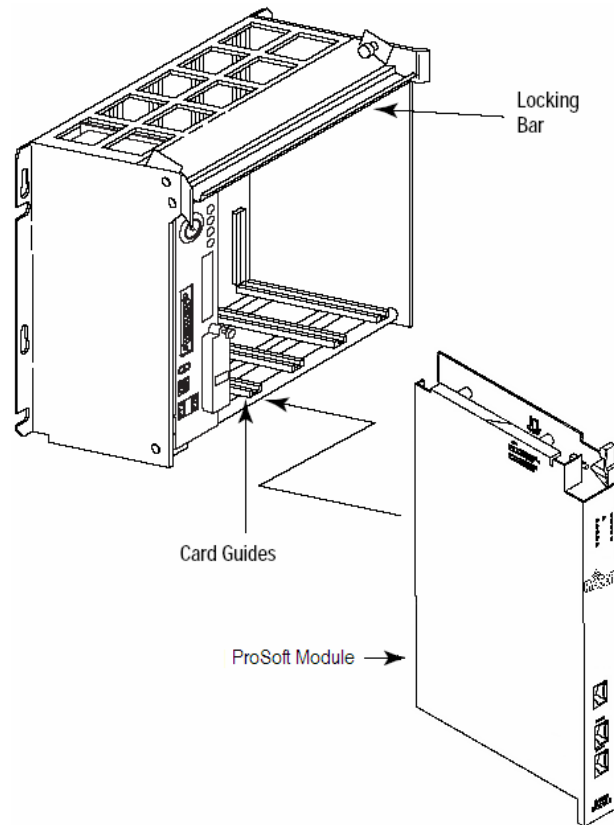
If you have not already installed and configured your PLC processor and power supply, please do so before installing the MVI71-103M module. Refer to your Rockwell Automation product documentation for installation instructions.

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

After you have checked the placement of the jumpers, insert MVI71-103M into the PLC™ chassis. Use the same technique recommended by Rockwell Automation to remove and install PLC modules.

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

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

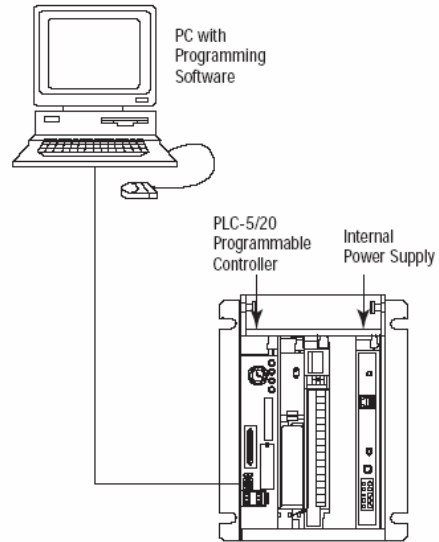


- 3 With a firm but steady push, snap the module into place.
- 4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
- 5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample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

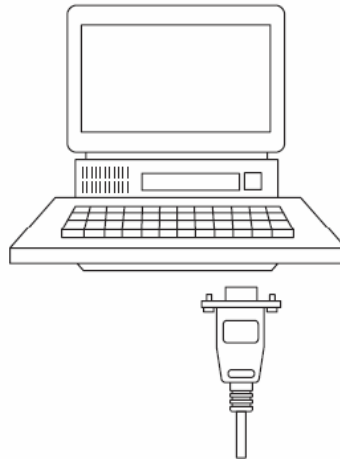
**Note:** If you insert the module improperly, the system may stop working, or may behave unpredictably.

## 1.5 Connect your PC to the Processor

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



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

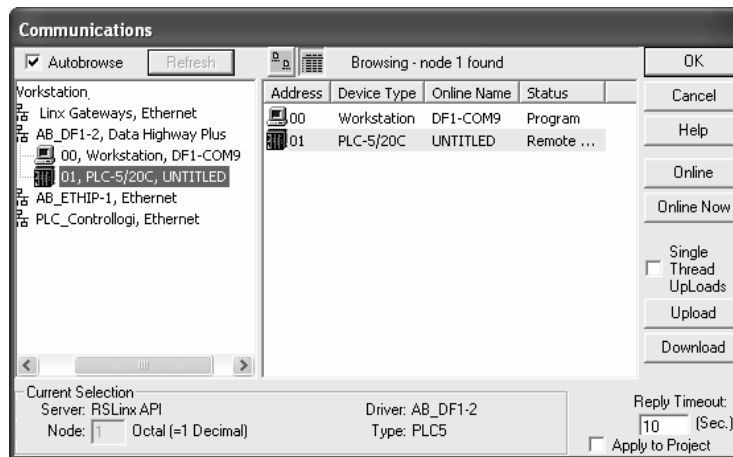


## 1.6 Download the Sample Program to the Processor

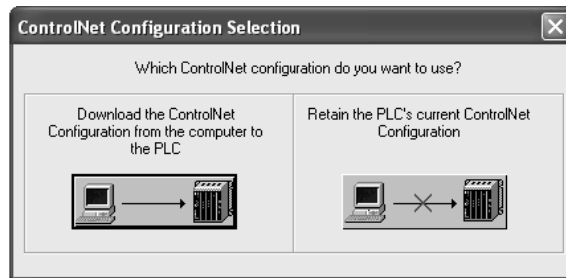
- **To download the sample program from RSLogix 5 to the PLC processor:**

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

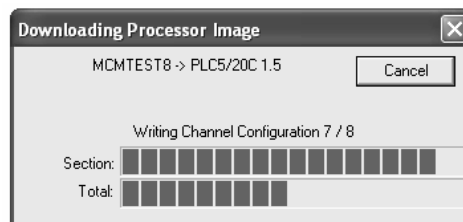
- 1 If you are not already online to the processor, open the Communications menu, and then choose Download. RSLogix will establish communication with the processor.



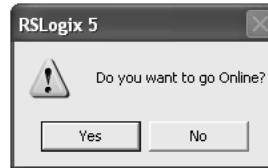
- 2 Click the Download button to transfer the sample program to the processor.
- 3 When prompted, choose Computer to PLC



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



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

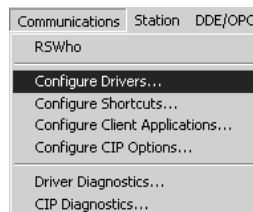


**Note:** If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

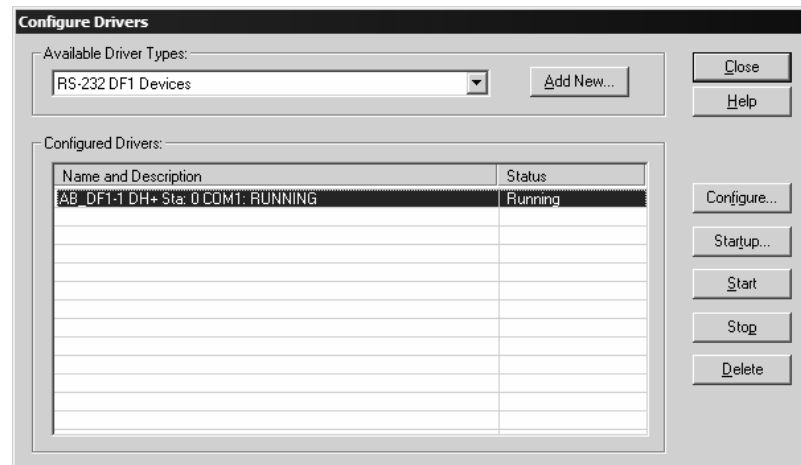
### 1.6.1 Configuring RSLinx

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

- 1 Open RSLinx.
- 2 Open the Communications menu, and choose Configure Drivers.



This action opens the Configure Drivers dialog box.



**Note:** If the list of configured drivers is blank, you must first choose and configure a driver from the Available Driver Types list. The recommended

driver type to choose for serial communication with the processor is "RS-232 DF1 Devices".

- 3 Click to select the driver, and then click Configure. This action opens the Configure Allen-Bradley DF1 Communications Device dialog box.



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

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



## 2 Installing and Configuring the Module

### *In This Chapter*

- Module Configuration ..... 18
- Example of 240 words of read and write data (cfg file=10) .... 26
- Example of 2300 read and 3500 write data registers (cfg file=10)  
..... 26

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

- 1 Use RSLogix 5 to identify the module to the processor and add the module to a project.

**NOTE:** The RSLogix 5 software must be in "offline" mode to add the module to a project.

- 2 Modify the example ladder logic to meet the needs of your application, and copy the ladder logic to the processor. Example ladder logic files are provided on the CD-ROM.

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

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

The next step in installing and configuring the module is to define whether the block-transfer or side-connect interface will be utilized. If the block transfer interface is to be used you should be ready to connect the module to the IEC 60870-5-103 network if the ladder logic is defined correctly.

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

```
SETDNPSC 10
```

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

The next step in module setup is to define the data files to be used with the application. If the block transfer interface is used, define the data files to hold the

user data (read and write data). Enter the ladder logic to handle the blocks transferred between the module and the PLC. Download the program to the PLC and test the program with the module.

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

File Number	Example	Size	Description
Cfg File	N10	200	Control/Status File
Cfg File+1	N11	to 1000	Data transferred from the module to the processor Other files for read data
Cfg File+1+n	N12	to 1000	Data transferred from the processor to the module
Cfg File+1+n+m			Other files for write data
Cfg File+9	N19	1000	File used to pass event messages to processor

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

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

The number of read and write files are dependent on the modules configuration. The following tables provide two examples:

## 2.1 Module Configuration

This section contains the setup procedure, data, and ladder logic for successful application of the MVI71-103M module. Each step in the setup procedure is defined in order to simplify the use of the module.

### 2.1.1 Configuration File

In order for the module to operate, a configuration file (IEC103M.CFG) is required. This configuration file contains all the information required to configure the module's master drivers, set up the databases for the controlled devices and established a command list. Each parameter in the file must be set carefully in order for the application to be implemented successfully.

The configuration file is separated into at least seven sections with topic header names enclosed in the [ ] characters. The following sections are present in the file:

[Section]	Description
[Backplane Configuration]	Backplane transfer parameter section
[IEC-870-5-103 Master]	General Configuration for driver
[IEC-870-5-103 Master Port 0]	Configuration for first application port
[IEC-870-5-103 Master Port 1]	Configuration for second application port
[IEC-103 Master Session x]	Definition for each control unit

[Section]	Description
[IEC-103 Master Session x Sector y]	Definition for each sector in each controlled unit
[IEC-103 Master Commands]	Command list to control slave 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, check 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 provides an example of a parameter entry:

```
Baud Rate : 19200 #Baud rate for master port
```

The parameter label is "Baud Rate" and the parameter value is 19200. 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.

Use any text editor to alter the supplied IEC103M.CFG file for the specific application. Be certain to enter each parameter correctly for successful application of the module. Appendix B contains a complete listing of all parameters utilized by the module with a definition of each parameter.

The session sections of the configuration file are determined by the number of sessions set in the configuration file. The sessions are referenced by a zero based index value. For example, if the module is configured for four sessions, the configuration file should contain sections for sessions 0 to 3 (i.e., [IEC-103 Master Session 0] to [IEC-103 Master Session 3]). Each of these sections will define the characteristics of the specific controlled device to be interfaced. Within each session definition, is a parameter that specifies the number of sectors for the session. For each sector defined for a session, there must exist a [IEC-103 Master Session x Sector y] section. Where the x value represents the session index and the y value represents sector index. For example if session 0 contains 1 sector, there must be a section with the following name in the configuration file: [IEC-103 Master Session 0 Sector 0]. The specific sector parameter set and database is defined in this section.

The last section of the configuration file is the command list definition ([IEC-103 Master Commands]). This section can contain up to 1000 user defined commands to be executed by the module and sent to the controlled devices. There is no need to place Class 1 or Class 2 polls in the this list for the controlled devices as the master driver for each port will execute these automatically when

the port is idle. In order for the port to be idle, make sure that there is idle time available and that the commands do not constantly utilize the ports. The command list section starts with a reserved label **START** and ends with the label **END**. Each row in the file corresponds to an individual command with the first character position in each row left blank (white space). The contents of each command record is outlined in the following table:

Command List Structure

Col	Field	Description															
1	Enable Code	<p>This field determines when the command will be executed according to the following codes:</p> <p>0=Command is disabled and will only execute if enabled from PLC processor</p> <p>1=Command will execute no more frequently than the time set in the Poll interval</p> <p>2=Command will execute when the last value read in the database differs from the current value</p>															
2	Database Index	<p>This field specifies the location in the module's internal database to associate with the command. The data type used in the command determines addressing of the index as follows:</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Description</th> <th>DB Index type</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Special command</td> <td>*Word address</td> </tr> <tr> <td>6</td> <td>Time synchronization</td> <td>*Word address</td> </tr> <tr> <td>7</td> <td>General interrogation</td> <td>*Word address</td> </tr> <tr> <td>20</td> <td>General command (2 bit control)</td> <td>Bit address</td> </tr> </tbody> </table> <p>*Word address = Value only used to signal when to send event (Enable Code = 2)</p>	Type	Description	DB Index type	0	Special command	*Word address	6	Time synchronization	*Word address	7	General interrogation	*Word address	20	General command (2 bit control)	Bit address
Type	Description	DB Index type															
0	Special command	*Word address															
6	Time synchronization	*Word address															
7	General interrogation	*Word address															
20	General command (2 bit control)	Bit address															
3	Poll Interval	This parameter is used if the Enable Code field is set to a value of 1. It sets the minimum number of seconds to delay between successive execution of the command.															
4	Session	This parameter is utilized to associate the command with one of the sessions defined for the module.															
5	Sector	This parameter is used to associate the command with the proper sector of the selected session.															
6	Data Type	<p>This parameter is used to set the ASDU data type to be used with the message. The codes specified are those defined for the IEC-870-5-103 protocol. The following is a listing of command control data types supported in this module:</p> <table border="1"> <thead> <tr> <th>Type</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>Special command</td> </tr> <tr> <td>6</td> <td>Time synchronization</td> </tr> <tr> <td>7</td> <td>General interrogation</td> </tr> <tr> <td>20</td> <td>General command (2 bit control)</td> </tr> </tbody> </table> <p>The type 0 is not defined in the protocol specification but is added to the module application to perform special commands. The command to be issued is determined by the value of the function field. If the function is set to 1, the module will issue a reset process command to the session specified. If the function is set to 2, the module will issue a class 2 poll to the selected session.</p>	Type	Description	0	Special command	6	Time synchronization	7	General interrogation	20	General command (2 bit control)					
Type	Description																
0	Special command																
6	Time synchronization																
7	General interrogation																
20	General command (2 bit control)																

Col	Field	Description
7	Function Code	This parameter specifies the function code as specified in the protocol specification except when Data Type code 0 is used. For the general commands, this field is used in conjunction with the Point Index to determine the point to control in the remote slave device. For the special commands, a value of 1 is used to perform a reset process and 2 to issue a class 2 poll.
8	Point Index	This parameter along with the Function Code determines the point to control in the remote device when the general command is utilized. For all other commands this field is ignored.
9	Override Flag	This field is used to with general commands to determine if the override or database value should be used with the command. If the flag is set to 0, the value in the module's database will be sent when the command is issued. If the flag is set to 1 (or non-zero value), the value set in the Override Value will be sent with the command. When the override flag and value are utilized, the Enable Code 2 and Database Index can be used to trigger the execution of the command.
10	Override Value	This parameter specifies the override value to use with the command if the Override Flag is set. This value should have one of the following values: 1=Off and 2=On. Other values may be valid for certain controlled devices.

\* The Point Index refers to the Data Information Number.

As an alternative to using a command list, blocks with an identification code of 9901 can be used to issue commands from the ladder logic.

#### MVI71 IEC870-5-103 Master Communication Module Configuration

[Section]/Item	Value	Range	Description
[Backplane Configuration]			Backplane transfer parameters
Module Name:		0 to 80 characters	This parameter is used to assign a name to the module that can be viewed using the configuration/debug port. It can be used to identify the module and the configuration file.
Write Register Start:		0 to 3999	This parameter specifies the starting register in the module where the data transferred from the processor will be placed. Valid range for this parameter is 0 to 3999.
Write Register Count:		0 to 4000	This parameter specifies the number of registers to transfer from the processor to the module. Valid entry for this parameter is 0 to 4000.
Read Register Start:		0 to 3999	This parameter specifies the starting register in the module where data will be transferred from the module to the processor. Valid range for this parameter is 0 to 3999.
Read Register Count:		0 to 4000	This parameter specifies the number of registers to be transferred from the module to the processor. Valid entry for this parameter is 0 to 4000.

[Section]/Item	Value	Range	Description
Failure Flag Count:		0 to 65535	This parameter specifies the number of successive transfer errors that must occur before the communication ports are shut down. If the parameter is set to 0, the communication ports will continue to operate under all conditions. If the value is set larger than 0 (1-65535), communications will cease if the specified number of failures occur.
Pass-Through Events:		Y or N	This parameter specifies if event messages received on the master ports will be passed to the processor. If the parameter is set to N, event messages will not be passed to the processor. If the parameter is set to Y, the module will pass all events received to the processor using block identifier 9903.

[Section]/Item	Value	Range	Description
[IEC-870-5-103 MASTER]			Module level parameters
Session Count:		1 to 32	This parameter specifies the maximum number of session to establish on the module. This corresponds to the number of slaves to be interfaced with the module. This value represents the total number of slaves on both ports combined.

[Section]/Item	Value	Range	Description
[IEC-870-5-103 MASTER PORT x]			Settings for each communication port on module
Baud Rate:		Value for baud rate	This parameter specifies the baud rate to be used on the communication channel (port). Values from 110 to 115K are permitted. For baud rates > 38400, use the following values, 576 for 57,600 and 115 for 115,200 baud. NOTE: The specification only utilizes 9600 and 19200 baud.
Parity:		N, O, E, M, or S	This parameter sets the parity to be used on the port. The values correspond to the following settings: N=None, O=Odd, E=Even, M=Mark and S=Space. NOTE: the specification only utilizes Even Parity.
RTS On:		0 to 65535	The parameter sets the RTS present delay. The value entered represents the number of milliseconds the module will wait after setting the RTS modem line before sending the data.

[Section]/Item	Value	Range	Description
RTS Off:		1 to 65535	This parameter sets the RTS off delay. The value entered represents the number of milliseconds the module will wait after the data packet is sent before dropping the RTS modem line.
Minimum Delay:		1 to 65535	This parameter specifies the minimum number of milliseconds to delay before sending the message (setting RTS high). This can be used when the serial network requires time for units to turn off their transmitters.
Receive Timeout:		1 to 65535	This value represents the number of milliseconds to wait on a port from the time the first character is received until the last character in the longest message received on the port. This parameter should be set dependent on the baud rate. A value of 2000 should work with most applications.
Single char ACK F0,1 or 3:		Y or N	This parameter specifies if the single E5 character will be used for ACK messages.

[Section]/Item	Value	Range	Description
[IEC-103 MASTER SESSION x]			Settings for each session utilized
Communication Port:		0 or 1	This parameter sets the port to which the controlled device is connected. On this module, values of 0 and 1 are permitted.
Sector Count:		1 to 5	This parameter sets the number of sectors contained in this controlled device. This version of the application from 1 to 5 sectors (separate databases) for each session.
Data Link Address:		0 to 254	This parameter uniquely defines the data link address for this unit on the communication channel. The ranges of values are from 0 to 254. Address 255 is the broadcast address.
Failure Delay:		0 to 2000	This parameter sets the minimum number of seconds to delay before polling this session when it is not online. This parameter is only used in unbalanced mode.
Confirm Timeout:		0 to 2 <sup>32</sup> -1	This parameter sets the number of milliseconds to wait for a confirm response from the controlled device.
Retry Count:		0 to 255	This parameter sets the number of retries to be performed on the controlled device when a communication error occurs.

[Section]/Item	Value	Range	Description
C1/C2 Poll Count Pend:		0 to 65535	This parameter sets the maximum number of class 1 and class 2 polls performed on this session before trying the next session. This parameter prevents a session from monopolizing the communication port.
Class 1 Polls:		0 to 65535	This parameter sets the maximum number of class one polls performed on this session before switching to another session. This parameter prevents a session from monopolizing the communication port.
Class 1 Pend Delay:		0 to 2 <sup>32</sup> -1	This parameter sets the minimum number of milliseconds to delay between class 1 polls for pending data.
Class 2 Pend Delay:		0 to 2 <sup>32</sup> -1	This parameter sets the minimum number of milliseconds to delay between class 2 polls for pending data.
Class 1 Poll Delay:		0 to 2 <sup>32</sup> -1	This parameter sets the minimum number of milliseconds to delay between each class 1 poll.
Class 2 Poll Delay:		0 to 2 <sup>32</sup> -1	This parameter sets the minimum number of milliseconds to delay between each class 2 poll.

[Section]/Item	Value	Range	Description
[IEC-103 MASTER SESSION x SECTOR y]			This section sets the parameters for a specific sector of a session.
Common ASDU Address:		0 to 255	This parameter sets the common ASDU address to association with this sector of the specified session. This parameter is usually set the same as the data link address when only one sector is utilized.
Online Time Sync:		Y or N	This parameter specifies if the sector in the controlled device will be sent a time synchronization command when the unit is first recognized as being online. This should only be utilized for devices that do not send an EOI message after initializing.
Online General Int:		Y or N	This parameter specifies if the sector in the controlled device will be sent a general interrogation command when the unit is first recognized as being online. This should only be utilized for devices that do not send an EOI message after initializing.
EOI Time Sync:		Y or N	This parameter specifies if the sector in the controlled device will be sent a time synchronization command after this module received an EOI message from the controlled unit.



[Section]/Item	Value	Range	Description						
EOI General Int:		Y or N	This parameter specifies if the sector in the controlled device will be sent a general interrogation command after this module received an EOI message from the controlled unit.						
# ASDU	Point	Function	Database						
# Type	Index	Code	Point						
START									
END									
[Section]/Item						Description			
[IEC-103 MASTER COMMANDS]						This section contains the commands for the module			
# Enable	DB	Poll	Session	Sector	Data	Func	Point	Ovrd	Ovrd
# Code	Index	Interval	Index	Index	Type	Code	Index	Flag	Val
START									
END									

### 2.1.2 Module Data

All data related to the MVI71-103M module is stored in a user defined data files. It is the responsibility of the ladder logic programmer to construct all the data files required by the program and to write the ladder logic required to interface to these files.

#### Status Data

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

When the block transfer interface is used, the status data is transferred to the module in blocks with identification codes of 0 and -1. Data in these blocks should be moved to a user data file. The format of the data passed to the PLC is shown in the Reference chapter with the data starting at word 2 in the BTR block.

#### User Data

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

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

The read data area should be set to match the value entered in the **Read Register Count** parameter of the IEC103M.CFG file. For ease of use, this array should be dimensioned as an even increment of 60 words. This data is paged up to 60 words at a time from the module to the processor. The Read Data task is responsible for placing the data received into the proper position in the read data array. Use this data for status and control in the ladder logic of the processor.

The write data area should be set to match the value entered in the **Write Register Count** parameter of the IEC103M.CFG file. For ease of use, this array should be dimensioned as even increments of 60 words. This data is paged up to 60 words at a time from the processor to the module. The Write Data task is responsible for placing the write data into the output image for transfer to the module. This data is passed from the processor to the module for status and control information for use in other nodes on the network.

Event Message Data

A user file to hold event messages passed to the processor from the master driver must be constructed if the message pass-through feature is enabled. These data blocks are passed to the processor with a block identification code of 9903. It is the responsibility of the ladder logic to read the data and place the data into the user data file. When the side-connect interface is utilized, the ladder logic should set the first word of the event file to 0 after processing the data.

Command Control Data

This data area passes control information from the processor to the module. Refer to the command control section in this document for a complete description of the format used for these data blocks.

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

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

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

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

Even if the files are not required for an application, they are still reserved and should only be used for that purpose. The read and write data contained in the

last set of files possess the data transferred between the module and the processor. The read data file (Cfg File + 1) will contain data transferred from the module to the processor and should be associated with control data types. The write data file (Cfg File + 1 + n) will contain data passed to the module from the processor and should be associated with monitor data types.

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

The module is now ready to be used with your application. Insert the module in the rack (with the power turned off) and attach the serial communication cables. Download the new application to the controller and place the processor in run mode. Download the new IEC101M.CFG file to the module using a terminal emulation program. If all the configuration parameters are set correctly and the module is attached to a network, the module's Application LED (APP LED) should remain off and the backplane activity LED (BP ACT) should blink very rapidly. Refer to the **Trouble Shooting** section if you encounter errors. Attach a computer or terminal to Port 0 on the module and look at the status of the module using the Configuration/Debug Menu in the module.



### 3 Ladder Logic

Ladder logic is required for application of the MVI71-103M 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*

- Reading Status Data From the Module ..... 31
- LED Status Indicators ..... 55

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

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

### 4.1 Reading Status Data From the Module

The MVI71-103M module returns a status data set to the PLC processor in each read block. This data is transferred to the PLC processor continuously with each read block.

The Configuration/Debug port provides the following functionality:

- Full view of the module's configuration data
- View of the module's status data
- Version Information
- Control over the module (warm boot and cold boot)
- Facility to upload and download the module's configuration file

#### **4.1.1            *The Configuration/Debug Menu***

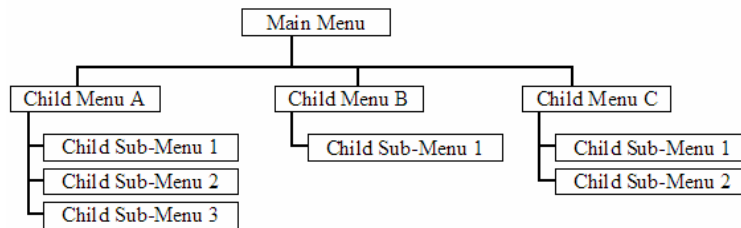
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

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

### Navigation

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

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



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

### Keystrokes

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

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

Also, take care to distinguish capital letter **[I]** from lower case letter **[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 serial communications port available
- 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 Ymodem 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 Ymodem 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 75).
- 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.

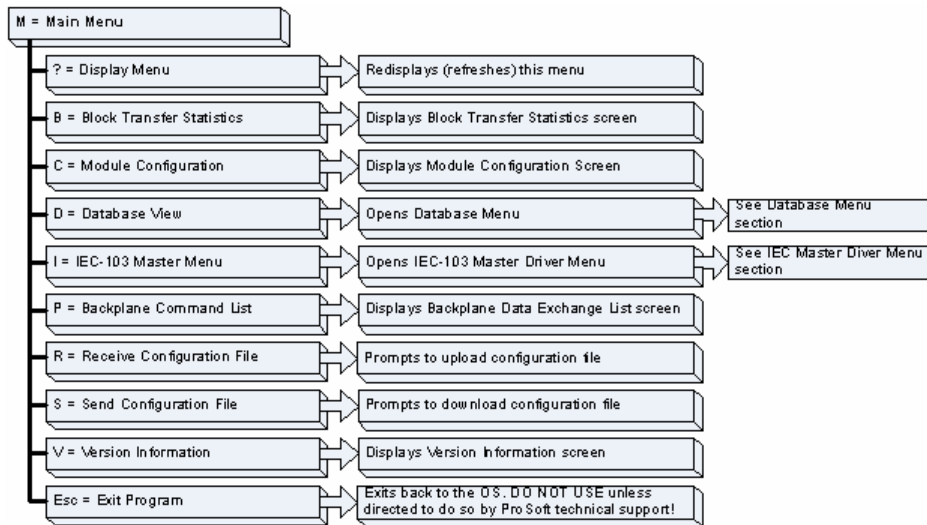
If you are still not able to establish a connection, you can contact ProSoft Technology Technical Support for further assistance.

### 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:

```

IEC-870-5-103 MASTER COMMUNICATION MODULE
?=Display Menu
B=Block Transfer Statistics
C=Module Configuration
D=Database View
I=IEC-103 Master Menu
P=Backplane Command List
R=Receive Configuration File
S=Send Configuration File
V=Version Information
Esc=Exit Program
    
```



**Caution:** Some of the commands available to you from this menu are designed for advanced debugging and system testing only, and can cause the module to stop communicating with the processor or with other devices, resulting in potential data loss or other failures. Only use these commands if you are specifically directed to do so by ProSoft Technology Technical Support staff. Some of these command keys are not listed on the menu, but are active nevertheless. Please be careful when pressing keys so that you do not accidentally execute an unwanted command.

#### Viewing Block Transfer Statistics

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

Use this command to display the configuration and statistics of the backplane data transfer operations between the module and the processor. The information

on this screen can help determine if there are communication problems between the processor and the module.

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

#### Viewing Module Configuration

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

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

#### Opening the Database Menu

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

#### Opening the IEC-103 Master Menu

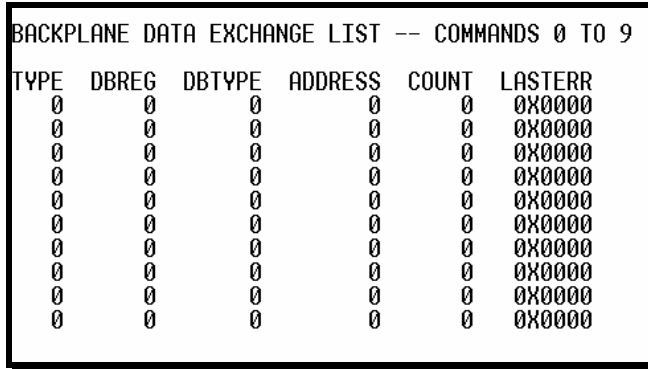
Press **[I]** from the Main Menu to open the IEC-870-5-103 Master Driver Menu. Use this menu command to view detailed configuration information for the module.

```
IEC-103 MASTER Menu Selected
IEC-870-5-103 MASTER DRIVER MENU
?=Display Menu
A=Data Analyzer
C=General Configuration
I=Command List Menu
P=Port Configuration Menu
Q=Port Status Menu
S=Session Menu
V=Version
Z=Previous Menu
```

For more information about the commands on this menu, refer to ***IEC-103 Master Driver Menu*** (page 39).

Viewing the Backplane Command List

Press **[P]** from the Main Menu to view the Backplane Data Exchange List. Use this command to display the configuration and statistics of the backplane data transfer operations.



```
BACKPLANE DATA EXCHANGE LIST -- COMMANDS 0 TO 9
TYPE  DBREG  DBTYPE  ADDRESS  COUNT  LASTERR
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
 0      0      0        0        0      0X0000
```

**Tip:** Repeat this command at one-second intervals to determine the number of blocks transferred each second.

Receiving the Configuration File

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

Sending the Configuration File

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

Viewing Version Information

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

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

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

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

### Exiting the Program

**Caution:** Some of the commands available to you from this menu are designed for advanced debugging and system testing only, and can cause the module to stop communicating with the processor or with other devices, resulting in potential data loss or other failures. Only use these commands if you are specifically directed to do so by ProSoft Technology Technical Support staff. Some of these command keys are not listed on the menu, but are active nevertheless. Please be careful when pressing keys so that you do not accidentally execute an unwanted command.

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

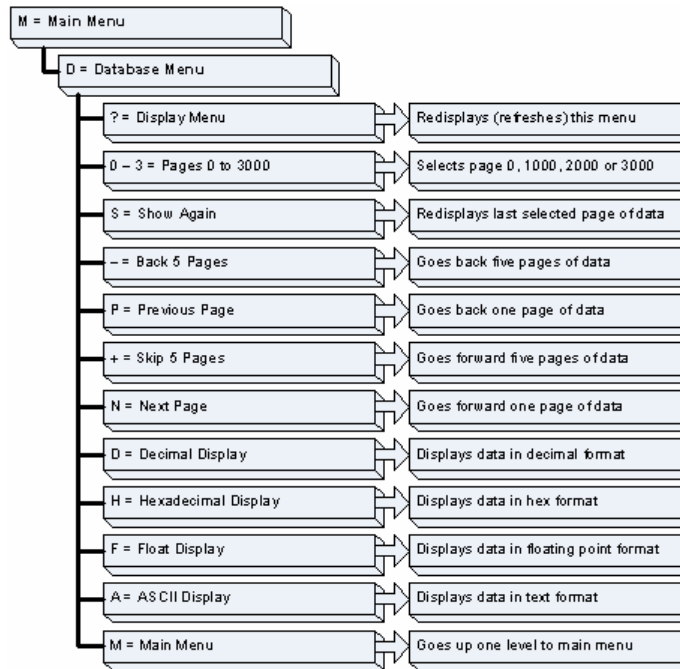
### Warm Booting the Module

**Caution:** Some of the commands available to you from this menu are designed for advanced debugging and system testing only, and can cause the module to stop communicating with the processor or with other devices, resulting in potential data loss or other failures. Only use these commands if you are specifically directed to do so by ProSoft Technology Technical Support staff. Some of these command keys are not listed on the menu, but are active nevertheless. Please be careful when pressing keys so that you do not accidentally execute an unwanted command.

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

### 4.1.6 Database View Menu

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



#### Viewing Database Pages 0 to 3000

The database is divided into pages that correspond with a specific number of registers. The total number of database pages and registers depends on the memory capacity and configuration of the module.

Use the keyboard commands **[0]** through **[3]** to display database contents starting from 0 (zero), 1000, 2000 and 3000 respectively.

#### Moving Back Through 5 Pages of Registers

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

#### Viewing the Previous 100 Registers of Data

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

#### Skipping 500 Registers of Data

Hold down **[Shift]** and press **[=]** to skip forward to the next 500 registers of data.

Viewing the Next 100 Registers of Data

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

Viewing Data in Decimal Format

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

Viewing Data in Hexadecimal Format

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

Viewing Data in Floating Point Format

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

Viewing Data in ASCII (Text) Format

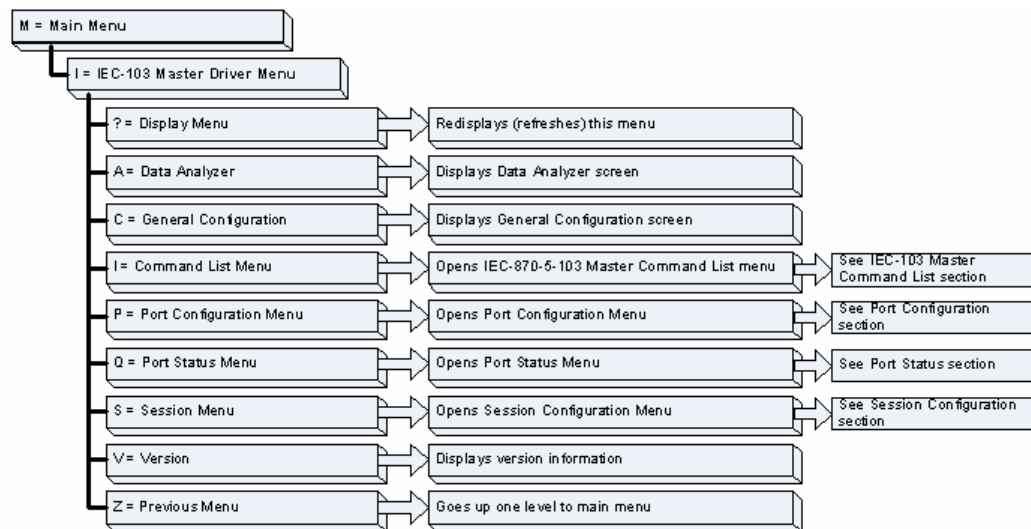
Press **[A]** to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

Returning to the Main Menu

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

**4.1.7 IEC-103 Master Driver Menu**

Press **[I]** from the Main Menu to open the IEC-870-5-103 Master Driver Menu. Use this menu command to view detailed configuration information for the module.



Opening the Data Analyzer Menu

Press **[A]** to open the Data Analyzer Menu. Use this command to view all bytes of data transferred on each port. Both the transmitted and received data bytes are displayed. Refer to Data Analyzer for more information about this menu.

**Important:** When in analyzer mode, program execution will slow down. Only use this tool during a troubleshooting session. Before disconnecting from the Config/Debug port, please be sure to press **[M]** to return to the main menu and disable the data analyzer. This action will allow the module to resume its normal operating mode.

Viewing General Configuration

Press **[C]** from the IEC-103 Master Driver Menu to display the general configuration for the protocol. The following illustration shows an example of the Module Configuration screen:

```
MODULE CONFIGURATION
Max Sessions      = 0 (of maximum 32)
Online States    = 0x00000000 (bit mapped in hex format)
Command Count    = 0 (of maximum 1000)
Current Command  = 0 (IDLE)
MEMORY COUNTERS:
applRec          = 0
applTrans        = 0
anything         = 0
```

The Busy/Idle message indicates the current activity state of the module. "Idle" means it is waiting to execute a command. "Busy" means it is executing a command and is waiting for the response to the request. This does not include the normal class 1 and 2 polls as these are automatically generated.

The counter data displays the number of memory areas allocated for the application layer. When no packets are pending, the counts should all be 0. If messages are waiting to be sent, the applRec count will indicate the number waiting to be sent. If many messages are received at the same time, the applRec count will indicate the number of packets that must be processed. The "anything" count indicates any other buffer area that is allocated and must be processed by the application.



Opening the IEC-870-Master Command List Menu

Press **[I]** from the IEC-103 Master Driver Menu to open the ICE-870 Master Command List menu. Use this command to view the configured command list for the module.

```
IEC 870 5 103 MASTER COMMAND LIST, COMMANDS 0 TO 9
END DDIDX POLLI SEC SEC ASDU FUNC POINT LAST POLL LENERR OUR VALUE
1      0      10      0      0      20  120  16      14932      0      1      3
0      0      11      0      0      20  120  16      14932      0      1      1
0 1600  41      0      0      20  120  17      14932      0      0      0
0 1602  41      0      0      20  120  18      14932      0      0      0
1      0      5       0      0      7  255  14      4         0      0      0
**** END OF COMMAND LIST REACHED ****
```

For more information about the commands on this menu, refer to ***IEC-870-Master Command List Menu*** (page 43).

Opening the Port Configuration Menu

Press **[P]** from the IEC-103 Master Driver Menu to open the Port Configuration menu. Use this command to view the port configuration information for each of the application ports.

```
Port Configuration Menu Selected
IEC-870-5-103 MASTER CHANNEL 0 CONFIGURATION
Baudrate      = 19200
Parity        = EVEN
RTS On        = 1
RTS Off       = 0
Minimum Delay = 30
Receive Timeout = 2000
Single ACK    = YES
Data Link Length = 1
Use Balanced Mode = NO
```

The *Port Configuration Menu* section has more information about the commands on this menu.

Opening the Port Status Menu

Press **[Q]** from the IEC-103 Master Driver Menu to open the Port Status menu. Use this command to verify the status of the master commands sent through the port. If the display indicates a communication error, you should compare the generated error code with the command error codes listed in the Appendices of this manual.

```
Port Status Menu Selected
IEC-870-5-103 MASTER PORT 0 STATUS
Commands Executed = 0
Command Responses = 0
Command Err Count = 0
Request Count = 0
Response Count = 0
Error Sent Count = 0
Error Rec Count = 0
Cfg Error Word = 0x0000
Current Error Code = 0
Last Error Code = 0
```

The *Port Status Menu* section has more information about the commands on this menu.

Opening the Session Configuration Menu

Press **[S]** to open the Session Configuration menu. Use this command to view the session configuration data.

Refer to *Session Configuration Menu* (page 51) for more information about the commands on this menu.

Opening the Sector Menu

Press **[1]** from the IEC-103 Master Driver Menu to open the Sector Configuration menu. Use this command to view the Sector Configuration data.

```
SECTOR CONFIGURATION MENU
?=Display Menu
D=Sector Database Menu
S=Show Again
P=Previous Page
N=Next Page
M=Return to Session Menu
```

The *Sector Configuration Menu* section has more information about the commands on this menu.

Viewing Master Driver Version Information

Press **[V]** from the IEC-103 Master Driver Menu to view the master driver version information.

```

DRIVER VERSION INFORMATION:

(c) 1999-2003, ProLinx Communication Gateways, Inc.

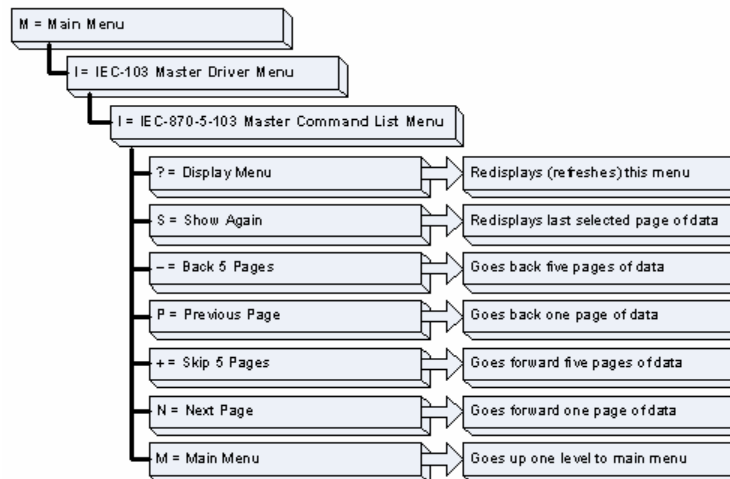
PRODUCT NAME CODE       : IEC-870-5-103 Master Driver
SOFTWARE REVISION LEVEL : 2.14
SOFTWARE REVISION DATE  : 04/17/2003
FAR CORE LEFT           : 322368
  
```

Returning to the Main Menu

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

**4.1.8 IEC-870-Master Command List Menu**

Press **[I]** from the IEC-103 Master Driver Menu to open the ICE-870 Master Command List menu. Use this command to view the configured command list for the module.

Redisplaying the Menu

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

Redisplaying the Current Page

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

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

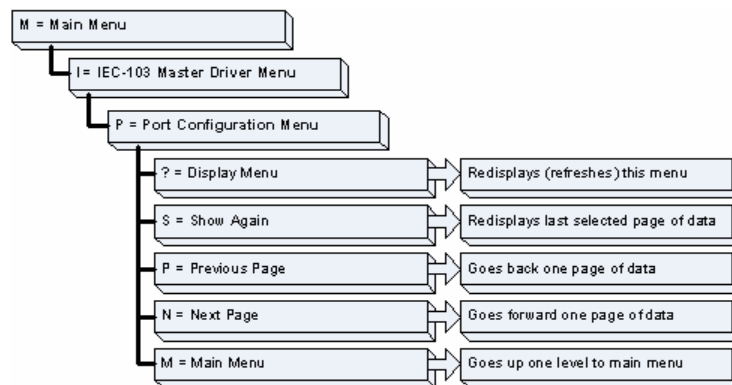
Press **[N]** from the Database View menu to select and display the next 100 registers of data.

Returning to the Main Menu

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

### 4.1.9 Port Configuration Menu

Press **[P]** from the IEC-103 Master Driver Menu to open the Port Configuration menu. Use this command to view the port configuration information for each of the application ports.



Redisplaying the Menu

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

Redisplaying the Current Page

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

Displaying the Next Page

Press **[N]** to display the next 100 registers. Use this command to step forward through the data a page at a time.

Displaying the Previous Page

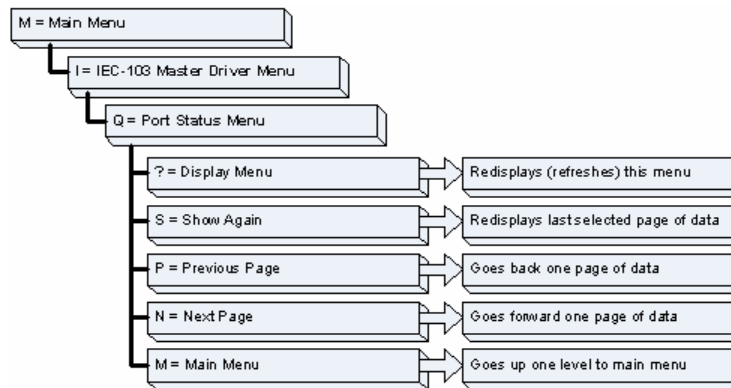
Press **[P]** to display the previous 100 registers. Use this command to step backward through the data a page at a time.

Returning to the Main Menu

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

**4.1.10 Port Status Menu**

Press **[Q]** from the IEC-103 Master Driver Menu to open the Port Status menu. Use this command to view the communication status information for each application port.

Redisplaying the Menu

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

Redisplaying the Current Page

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

Displaying the Previous Page

Press **[P]** to display the previous 100 registers. Use this command to step backward through the data a page at a time.

Displaying the Next Page

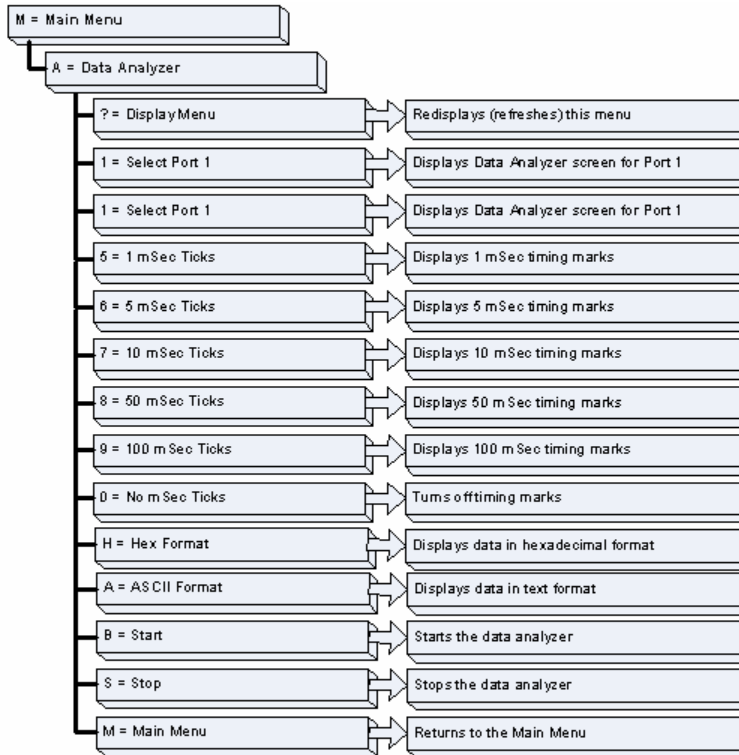
Press **[N]** to display the next 100 registers. Use this command to step forward through the data a page at a time.

Returning to the Main Menu

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

**4.1.11 Data Analyzer**

The data analyzer mode allows you to view all bytes of data transferred on each port. Both the transmitted and received data bytes are displayed. Use of this feature is limited without a thorough understanding of the protocol.



```

Data Analyzer Mode Selected
DATA ANALYZER VIEW MENU
?=Display Menu
1=Select Port 1
2=Select Port 2
5=1 mSec Ticks
6=5 mSec Ticks
7=10 mSec Ticks
8=50 mSec Ticks
9=100 mSec Ticks
0=No mSec Ticks
H=Hex Format
A=ASCII Format
B=Start
S=Stop
M=Main Menu

Port = 1, Format=HEX, Tick=10
    
```

**Important:** When in analyzer mode, program execution will slow down. Only use this tool during a trouble-shooting session. Before disconnecting from the Config/Debug port, please be sure to press **[M]** to return to the main menu and

disable the data analyzer. This action will allow the module to resume its normal operating mode.

### Analyzing Data for Port 1

Press **[1]** to display I/O data for Port 1 in the Data Analyzer. The following illustration shows an example of the Data Analyzer output.

### Analyzing Data for Port 2

Press **[2]** to display I/O data for Port 2 in the Data Analyzer.

### Displaying Timing Marks in the Data Analyzer

You can display timing marks for a variety of intervals in the data analyzer screen. These timing marks can help you determine communication-timing characteristics.

<b>Key</b>	<b>Interval</b>
[5]	1 mSec ticks
[6]	5 mSec ticks
[7]	10 mSec ticks
[8]	50 mSec ticks
[9]	100 mSec ticks

### Removing Timing Marks in the Data Analyzer

Press **[0]** to turn off timing marks in the Data Analyzer screen.

### Viewing Data in Hexadecimal Format

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

### 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.

Starting the Data Analyzer

Press **[B]** to start the data analyzer. After the key is pressed, all data transmitted and received on the currently selected port will be displayed. An example display is shown below:

```

<R+><01><03><00><00><00><0A><C5><CD><R->_TT_[01][03][14][00][00][00][00][00][00]
_TT_[00][00][00][00][00][00][00][00][00][00][00][00][A3][67]_TT_<R+><01>
<03><00><00><00><0A><C5><CD><R->_TT_[01][03][14][00][00][00][00][00][00][00][00][00]
[00][00][00][00][00][00][00][00][00][00][A3][67]_TT_<R+><01><03><00><00><00><00>
<00><00><0A><C5><CD><R->_TT_[01][03][14][00][00][00][00][00][00][00][00][00][00]
[00][00][00][00][00][00][00][00][00][00][A3][67]_TT_<R+><01><03><00><00><00><00>
<0A><C5><CD><R->_TT_[01][03][14][00][00][00][00][00][00][00][00][00][00][00]
[00][00][00][00][00][00][00][00][00][00][A3][67]_TT_<R+><01><03><00><00><00><0A><C5>
<CD><R->_TT_[01][03][14][00][00][00][00][00][00][00][00][00][00][00][00]
[00][00][00][00][00][00][00][00][00][00][A3][67]_TT_<R+><01><03><00><00><00><00><0A><C5><CD><R->
_TT_[01][03][14][00][00][00][00][00][00][00][00][00][00][00][00][00]
[00][00][00][00][00][00][00][00][00][00][A3][67]_TT_<R+><01><03><00><00><00><0A><C5><CD><R->_TT_[01]
[03][14][00][00][00][00][00][00][00][00][00][00][00][00][00][00]_TT_[00][00]
[00][00][00][A3][67]_TT_<R+><01><03><00><00><00><0A><C5><CD><R->_TT_[01][03][14]
[00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00]_TT_[00][00][00][00]
[00][A3][67]_TT_<R+><01><03><00><00><00><0A><C5><CD><R->_TT_[01][03][14][00][00]
[00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][A3]
[67]_TT_<R+><01><03><00><00><00><0A><C5><CD><R->_TT_[01][03][14][00][00][00][00]
[00][00]_TT_[00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][00][A3][67]_TT_

```

The Data Analyzer displays the following special characters:

Character	Definition
[ ]	Data enclosed in these characters represent data received on the port.
< >	Data enclosed in these characters represent data transmitted on the port.
<R+>	These characters are inserted when the RTS line is driven high on the port.
<R->	These characters are inserted when the RTS line is dropped low on the port.
<CS>	These characters are displayed when the CTS line is recognized high.
_TT_	These characters are displayed when the timing mark interval has been reached. This parameter is user defined.

Stopping the Data Analyzer

Press **[S]** to stop the data analyzer. Use this option to freeze the display so the data can be analyzed. To restart the analyzer, press **[B]**.

**Important:** When in analyzer mode, program execution will slow down. Only use this tool during a trouble-shooting session. Before disconnecting from the Config/Debug port, please be sure to press **[S]** to stop the Data Analyzer before returning to the main menu or disconnecting from the port. This action will allow the module to resume its normal operating mode.

Returning to the Main Menu

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



### 4.1.12 Data Analyzer Tips

From the main menu, press **[A]** for the "Data Analyzer". You should see the following text appear on the screen:

```
Data Analyzer Mode Selected
```

After the "Data Analyzer" mode has been selected, press **[?]** to view the Data Analyzer menu. You will see the following menu:

```
DATA ANALYZER VIEW MENU
?=Display Menu
1=Select Port 1
2=Select Port 2
5=1 mSec Ticks
6=5 mSec Ticks
7=10 mSec Ticks
8=50 mSec Ticks
9=100 mSec Ticks
0=No mSec Ticks
H=Hex Format
A=ASCII Format
B=Start
S=Stop
M=Main Menu

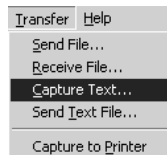
Port = 1, Format=HEX, Tick=10
```

From this menu, you can select the "Port", the "format", and the "ticks" that you can display the data in.

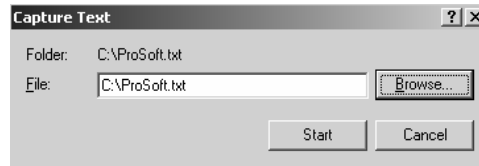
For most applications, HEX is the best format to view the data, and this does include ASCII based messages (because some characters will not display on HyperTerminal and by capturing the data in HEX, we can figure out what the corresponding ASCII characters are supposed to be).

The Tick value is a timing mark. The module will print a `_TT` for every xx mSec of no data on the line. Usually 10msec is the best value to start with.

After you have selected the Port, Format, and Tick, we are now ready to start a capture of this data. The easiest way to do so is to go up to the top of your HyperTerminal window, and do a Transfer -> Capture Text as shown below:



After selecting the above option, the following window will appear:



Next name the file, and select a directory to store the file in. In this example, we are creating a file ProSoft.txt and storing this file on our root C: drive. After you have done this, press the **Start** button.

Now you have everything that shows up on the HyperTerminal screen being logged to a file called ProSoft.txt. This is the file that you will then be able to email to ProSoft Technical Support to assist with issues on the communications network.

To begin the display of the communications data, you will then want to press 'B' to tell the module to start printing the communications traffic out on the debug port of the module. After you have pressed 'B', you should see something like the following:

```
[03][00][04][00][05][00][06][00][07][00][08][00][09][FB][B7] TT TT <R+><01><02>
<00><00><00><0A><F8><0D><R-> TT TT TT [01][02][02][00][00][B9][B8] TT TT <R+>
<01><03><00><00><00><0A><C5><CD><R-> TT TT [01][03][14][00][00][00][01][00] TT
[02][00][03][00][04][00][05][00][06][00][07][00][08][00][09][CD][51] TT TT <R+>
<01><01><00><00><00><A0><3C><72><R-> TT TT [01][01][14][00][00][01][00][02] TT
[00][03][00][04][00][05][00][06][00][07][00][08][00][09][00][B7][52] TT TT <R+>
<01><04><00><00><00><0A><70><0D><R-> TT TT [01][04][14][00][00][00][01][00] TT
[02][00][03][00][04][00][05][00][06][00][07][00][08][00][09][FB][B7] TT TT <R+>
<01><02><00><00><00><0A><F8><0D><R-> TT TT TT [01][02][02][00][00][B9][B8] TT
TT <R+><01><03><00><00><00><0A><C5><CD><R-> TT TT [01][03][14][00][00][00][01]
[00] TT [02][00][03][00][04][00][05][00][06][00][07][00][08][00][09][CD][51] TT
TT <R+><01><01><00><00><00><A0><3C><72><R-> TT TT TT [01][01][14][00][00][01]
[00][02] TT [00][03][00][04][00][05][00][06][00][07][00][08][00][09][00][B7][52]
TT TT <R+><01><04><00><00><00><0A><70><0D><R-> TT TT [01][04][14][00][00][00]
[01][00] TT [02][00][03][00][04][00][05][00][06][00][07][00][08][00][09][FB][B7]
TT TT <R+><01><02><00><00><00><0A><F8><0D><R-> TT TT [01][02][02][00][00][B9]
[B8] TT TT <R+><01><03><00><00><00><0A><C5><CD><R-> TT TT [01][03][14][00][00]
[00][01][00] TT [02][00][03][00][04][00][05][00][06][00][07][00][08][00][09][CD]
[51] TT TT <R+><01><01><00><00><00><A0><3C><72><R-> TT TT TT [01][01][14][00]
[00][01][00][02] TT [00][03][00][04][00][05][00][06][00][07][00][08][00][09][00]
[B7][52] TT TT <R+><01><04><00><00><00><0A><70><0D><R-> TT TT [01][04][14][00]
[00][00][01][00] TT [02][00][03][00][04][00][05][00][06][00][07][00][08][00][09]
[FB][B7] TT TT <R+><01><02><00><00><00><0A><F8><0D><R-> TT TT TT [01][02][02]
[00][00][B9][B8] TT TT <R+><01><03><00><00><00><0A><C5><CD><R-> TT TT TT
```

The <R+> means that the module is transitioning the communications line to a transmit state.

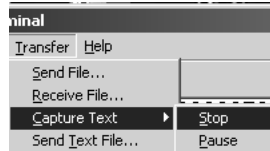
All characters shown in <> brackets are characters being sent out by the module.

The <R-> shows when the module is done transmitting data, and is now ready to receive information back.

And finally, all characters shown in the [ ] brackets is information being received from another device by the module.

After taking a minute or two of traffic capture, you will now want to stop the "Data Analyzer". To do so, press the 'S' key, and you will then see the scrolling of the data stop.

When you have captured the data you want to save, open the Transfer menu and choose Capture Text. On the secondary menu, choose Stop.



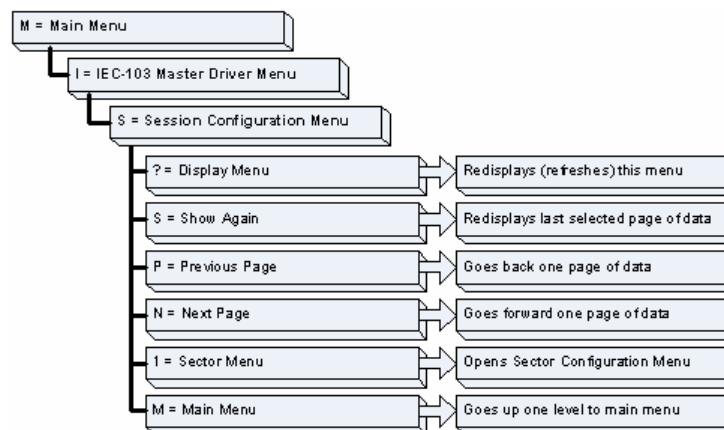
You have now captured, and saved the file to your PC. This file can now be used in analyzing the communications traffic on the line, and assist in determining communication errors.

#### 4.1.13 Session Configuration Menu

Press [**S**] from the IEC-103 Master Driver Menu to open the Session Configuration menu. Use this command to view the session configuration for each controlled device.

```

IEC-870-5-103 MASTER SESSION 0 CONFIGURATION
Online State           = 0
Session State         = 2 (0)
Communication Port     = 0
Sector Count          = 3
Data Link Address     = 0
Failure Delay         = 10
Confirm Timeout       = 1000
Retry Count           = 0
C1/C2 Poll Count Pend = 5
Class 1 Polls         = 0
Class 1 Pend Delay    = 0
Class 2 Pend Delay    = 0
Class 1 Poll Delay    = 0
Class 2 Poll Delay    = 0
Response Timeout      = 20000
  
```



Online State

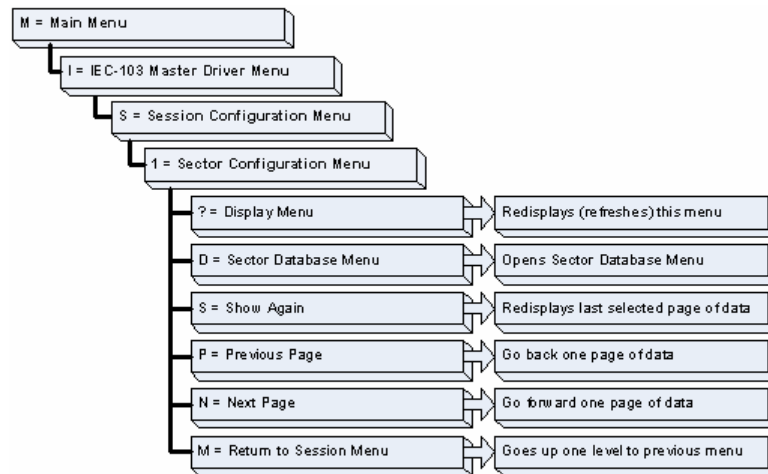
The Online State indicator displays 0 if the module is not online, 1 if the module is online.

Session State

The Session State indicator displays 1 if there is a configuration error, or 2 if the module is ready for communication. If the session is not in use, the Session State indicator displays 0.

**4.1.14 Sector Configuration Menu**

Press **[1]** from the IEC-103 Master Driver Menu to open the Sector Configuration menu. Use this command to view the contents of the Sector Configuration Databases for each session (controlled device). The module supports up to three sectors (databases) per session.



Redisplaying the Menu

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

Opening the Sector Database Menu

Press **[D]** from the Sector Configuration menu to open the Sector Database menu. Use this command to look at the configuration and current value for each point.

```
SECTOR CONFIGURATION MENU
?=Display Menu
$=Show again
0=ASDU 1 and 2 data
1=ASDU 3 data
2=ASDU 4 data
3=ASDU 5 data
4=ASDU 9 data
5=List ASDU point counts
M=Return to Sector
```

The *IEC-870-Master Command List Menu* section has more information about the commands on this menu.

Redisplaying the Current Page

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

Displaying the Next Page

Press **[N]** to display the next 100 registers. Use this command to step forward through the data a page at a time.

Displaying the Previous Page

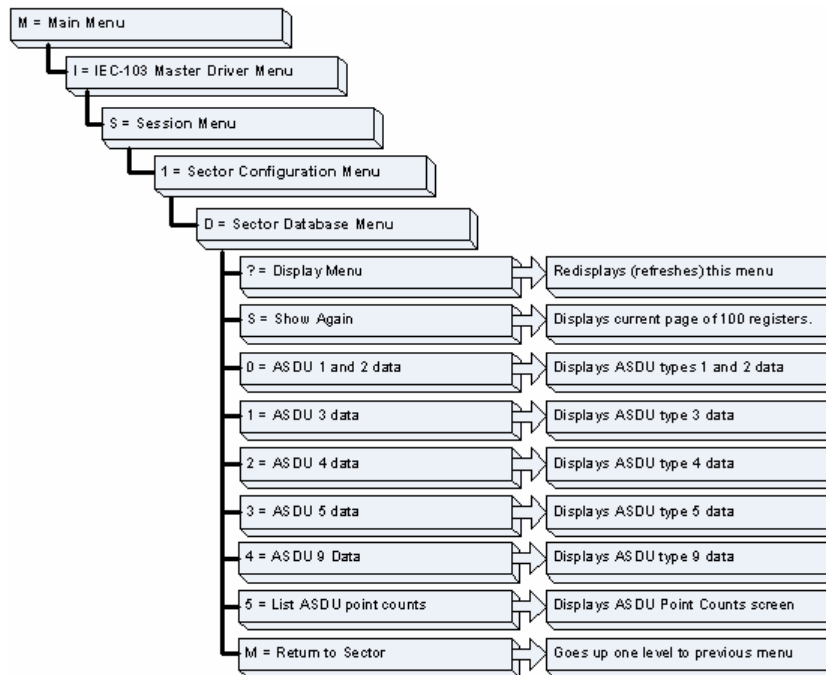
Press **[P]** to display the previous 100 registers. Use this command to step backward through the data a page at a time.

Returning to the Main Menu

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

### 4.1.15 Sector Database Menu

Press **[D]** from the Sector Configuration menu to open the Sector Database menu. Use this command to display the sector database values. Each session (controlled device) contains one or more data sets (sectors) that are defined by the vendor of the device.



#### Redisplaying the Menu

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

#### Redisplaying the Current Page

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

#### Viewing ASDU n Data

Press keys **[0]** (zero) through **[4]** to display ASDU (Application Data Service Unit) data for each of the supported data types. Refer to *[IEC-103 Master Session x Sector x]* for a list of ASDU types.

Listing ASDU point counts

Press **[5]** to display the ASDU point counts for each ASDU type.

SESSION 0 ASDU	SECTOR 0 COUNT	DATABASE SIZES:
1&2	10	
3	0	
4	0	
5	0	
9	0	

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 being transferred on the first application port
		Off	No data being transferred on port
P2	Green	On	Data being transferred on the second application port
		Off	No data being transferred on port
APP Status	Amber	Off	The MVI71-103M is working normally.
		On	The MVI71-103M module program has recognized a communication error.
BP ACT	Amber	On	The LED is on when the module is performing a write operation on the backplane.
		Off	The LED is off when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly on and off.
OK	Red/ Green	Off	The card is not receiving any power and is not securely plugged into the rack.
		Green	The module is operating normally.
		Red	The program has detected an error or is being configured. If the LED remains red for over 10 seconds, the program has probably halted. Remove the card from the rack and re-insert the card to restart the module's program.
BAT	Red	Off	The battery voltage is OK and functioning.
		On	The battery voltage is low or battery is not present. Allow battery to charge by keeping module plugged into rack for 24 hours. If BAT LED still does not go off, contact the factory, as this is not a user serviceable item.

### 4.2.1 **Clearing a Fault Condition**

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

To clear the condition, follow these steps:

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

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

### 4.2.2 **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**

<b>Problem Description</b>	<b>Steps to take</b>
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**

<b>Problem Description</b>	<b>Steps to take</b>
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 MVI71 IEC 60870-5-103 Master Communication Module allows Rockwell Automation PLC backplane I/O compatible processors to interface easily with IEC 60870-5-103 compatible devices. Devices commonly supporting the protocol include relays, breakers, sub-station Communication Modules and other serial communication devices used in power monitoring.

#### **5.1.1 Features and Benefits**

The MVI71-103M supports up to 32 total field devices between the module's two IEC 60870-5-103 Master ports. The module's communication ports can each be independently configured, allowing two separate field networks to be implemented. The field device data is exchanged between the MVI module and the PLC processor over the backplane.

The MVI71-103M module is a powerful communication interface for Rockwell Automation PLC platform processors. Developed under license from Rockwell Automation, the module incorporates proprietary backplane technology that enables powerful data access to the PLC processor.

#### **5.1.2 General Specifications**

- Single Slot – 1771 backplane compatible
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module
- Ladder Logic is used for data transfer between module and processor.
- Configuration data obtained through user-defined ladder. Sample ladder file included

### 5.1.3 Hardware Specifications

Specification	Description
Form Factor	Single Slot 1771 chassis compatible BTR/BTW data transfer Local or remote rack
Backplane current load	800 mA @ 5 V
Operating temperature	0 to 60°C (32 to 140°F)
Storage temperature	-40 to 85°C (-40 to 185°F)
Shock	30g operational 50g non-operational
Vibration	5 g from 10150 Hz
Relative humidity	5 to 95% (non-condensing)
LED Indicators	Module status Backplane transfer status Application status Serial activity and error LED status
<b>Debug/Configuration port (CFG)</b>	
CFG Port (P1)	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 (P2, P3) (Serial Modules)	(2) RJ45 RS-232/422/485 Application ports

### 5.1.4 Functional Specifications

The MV71-103M module supports the IEC 60870-5-103 protocol to the following specifications:

- The IEC 60870-5-103 communication driver is built in accordance to the approved IEC specification
- Module memory usage that is completely user definable
- The module has two independent master ports, each configurable via a simple configuration file
- Supports up to 32 sessions (controlled devices) between the two ports
- Supports up to five sectors (separate databases) for each session, with individual database definition for each sector
- Total of 1000 user configurable commands to control data transfer to/from devices (controlled devices)
- Supports clock synchronization from/to the processor
- Event data received from the Control Devices updates the module database (Date and Time stamping is not stored or used by module)
- Class 1 and Class 2 delay parameter are configurable for each session
- An IEC Interoperability Document for the module is available from the web site, which fully documents data types supported by the module

## 5.2 Functional Overview

The standards used to build the module are listed in the following table:

PUBLICATION	TITLE
IEC 60870-5-103	Companion Standard for the informative interface of protection equipment.
IEC 60870-5-103 Annex A	Generic functions -- Examples of constructing a directory
IEC 60870-5-1	Transmission Frame Formats
IEC 60870-5-2	Link Transmission Procedures
IEC 60870-5-3	General Structure of Application Data
IEC 60870-5-4	Definition and Coding of Application Information Elements
IEC 60870-5-5	Basic Application Functions

These documents should be obtained, reviewed, and understood in order to fully appreciate the protocol implementation. Most of the complexity of the protocol is hidden from the user and simplified in the application of the module. Detailed questions of about the protocol can be answered by reading these documents. In addition to calling our technical support group, there is also help available for the protocol using the following mail list Web Site:

[www.TriangleMicroWorks.com/iec870-5](http://www.TriangleMicroWorks.com/iec870-5). Go to this site to join the mail list and to review questions and answers from mail list users.

### 5.2.1 General Concepts

The following discussion explains several concepts that are important for understanding the operation of the MVI71-103M module.

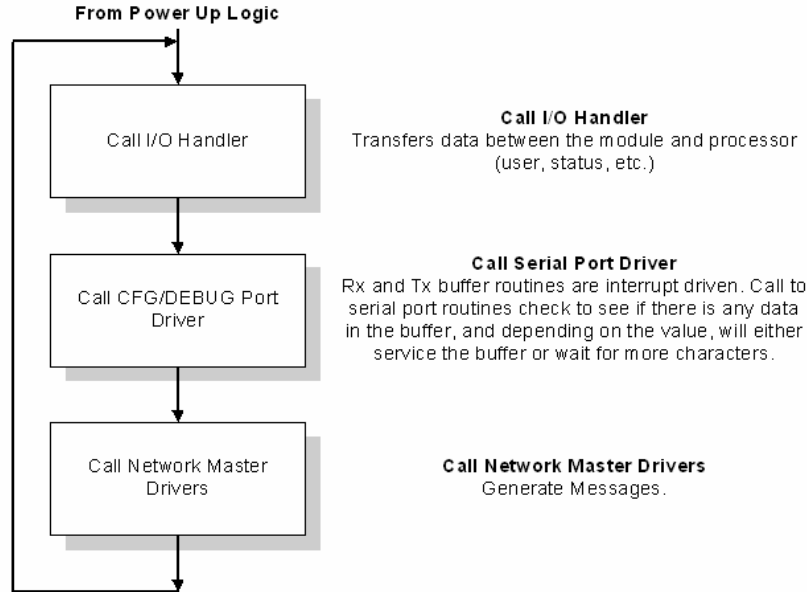
#### Module Power Up

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

- 1 Initialize hardware components
    1. Initialize PLC backplane driver
    2. Test and clear all RAM
    3. Initialize the serial communication ports
  - 2 Read configuration for module from IEC103M.CFG file on Compact Flash Disk
  - 3 Initialize the databases and ports
  - 4 Set up the serial communication interface for the debug/configuration port
- After the module has received the configuration, the module will begin receiving and transmitting messages with devices on the serial networks.

Main Logic Loop

Upon completing the power up configuration process, the module enters an infinite loop that performs the following functions:



IEC 60870-5-103 Data Types

When interfacing data in the processor to that of the IEC 60870-5-103 protocol, it is important that the user understand the mapping of the data types to their corresponding representation in the modules database. The table that follows lists the data types supported by the module and their associated storage representation:

Type ID	Description	Data Representation
1	Time-tagged messages with each data point represented by two bits.	Dual-bit status (7.2.6.5 with 00b (0 decimal) = not used 01b (1 decimal) = Off, 10b (2 decimal) = On and 11b (3 decimal) = not used
2	Time-tagged messages with relative time with each point represented by two bits.	Dual-bit status (7.2.6.5 with 00b (0 decimal) = not used 01b (1 decimal) = Off, 10b (2 decimal) = On and 11b (3 decimal) = not used
3	Measurands with quality descriptor. The lower 3 bits of the values represented in this data type contain status information. The upper 13 bits of the value contained a signed, 12-bit number. This data type will return from 1 to 4 values. The number of words received is dependant on the information object number and the slave device.	Measurand with quality descriptor (7.2.6.8) Bit 0: 0 = No overflow, 1 = Overflow Bit 1: 0 = Valid, 1 = Invalid Bit 2: Reserved Bits 3 to 25: Value from $-1..+1 \cdot 2^{12}$

Type ID	Description	Data Representation
4	Time-tagged measurands with relative time with the value in the packet represented by a single floating point number.*	Short floating-point number stored in IEEE STD 754 format (Fraction, Exponent, Sign) (7.2.6.20)
5	Identification data composed of 12 characters of data. Each point in defined of this data type should reserve 12 bytes (6-word addresses) in the database for the data received.	Byte data as defined in 7.2.6.2. First 8 bytes are characters 1 to 8 and last 4 bytes are manufacture bytes either decimal (0 to 255) or as ASCII characters.
9	Measurands with quality descriptor. The lower 3 bits of the values represented in this data type contain status information. The upper 13 bits of the value contained a signed, 12-bit number. This data type will return from 1 to 9 values (some slaves may return up to 16 values). The number of words received is dependant on the information object number and the slave device.	Measurand with quality descriptor (7.2.6.8) Bit 0: 0 = No overflow, 1 = Overflow Bit 1: 0 = Valid, 1 = Invalid Bit 2: Reserved Bits 3 to 25: Value from $-1..+1-2^{12}$
20	General command to control a dual-point object. Each command issued by the module uses the values of two adjacent bits in the database or an override value specified by the user command.	Dual-bit status (7.2.6.4 with 00b (0 decimal) = not used 01b (1 decimal) = Off, 10b (2 decimal) = On and 11b (3 decimal) = not used

\*The words should be swapped in the ladder logic.

As shown in the previous table, all bit types are addressed as bits in the module's database.

### Addressing the Data Types

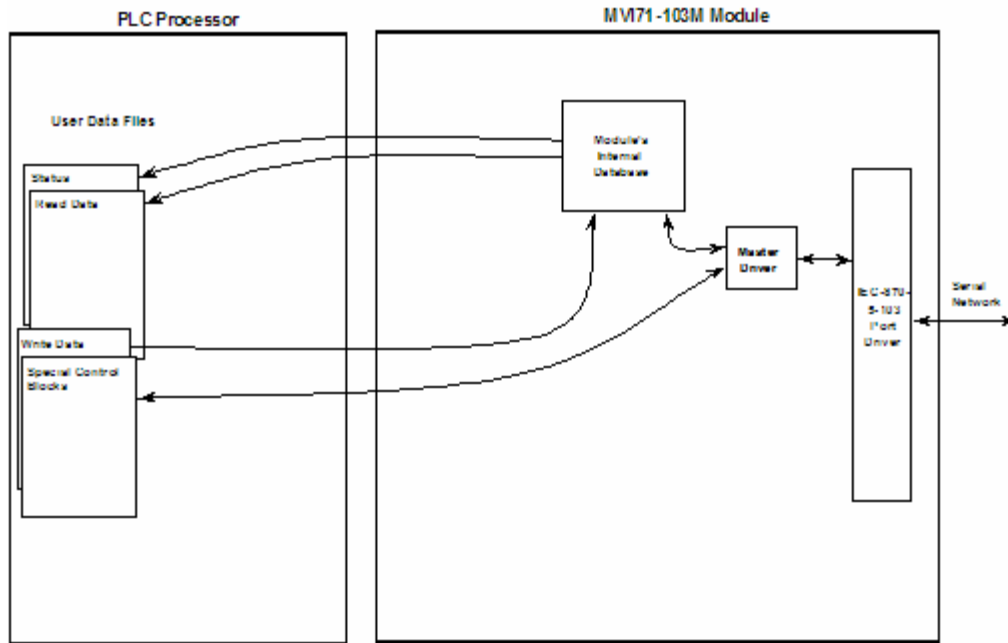
The following table shows an example of how to address the data types in the MVI56-103M:

Data Type	Address Type	Length	Example
1	Bit	2 bits	Address 160 refers to first and second bits from word 10.
2	Bit	2 bits	Address 160 refers to first and second bits from word 10.
3	Word	4 words	Address 50 refers to word 50, 51, 52, and 53.
4	Double-word	2 words	Address 40 refers to two consecutive words starting at word 80.
5	Bit	12 bits	Address 180 refers to 12 consecutive bits starting at the LSB of word 90.
9	Word	5 words	Address 100 refers to 9 consecutive words starting at word 100.
20	Bit	2 bits	Address 160 refers to the first and second bits from word 10.

Therefore, address 16000 represents bit zero in word 1000 of the module's database. Short floating-point, 32-bit strings and integrated total values each occupy a double-word space in the database. Therefore, short float database address of 100 represents the two words, 200 and 201, in the module's database.

Side-Connect Backplane Data Transfer

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



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

File Number	Example	Size	Description
Cfg File	N10	200	Control/Status File
Cfg File+1	N11	to 1000	Data transferred from the module to the processor Other files for read data
Cfg File+1+n	N12	to 1000	Data transferred from the processor to the module
Cfg File+1+n+m			Other files for write data
Cfg File+9	N19	1000	File used to pass event messages to processor

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

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

The number of read and write files are dependent on the module's configuration. The following tables show two examples:

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

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

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

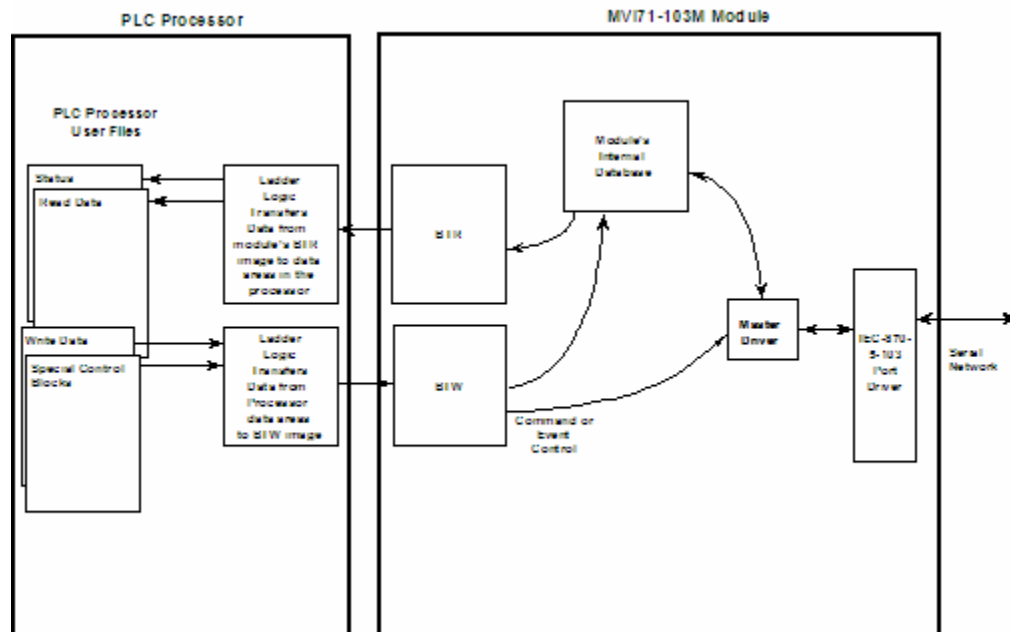
Data Files	Description
N11:0 to 999	Read data words 0 to 999
N12:0 to 999	Read data words 1000 to 1999
N13:0 to 299	Read data words 2000 to 2299
N14:0 to 999	Write data words 0 to 999
N15:0 to 999	Write data words 1000 to 1999
N16:0 to 999	Write data words 2000 to 2999
N17:0 to 499	Write data words 3000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

When the side-connect interface is utilized, registers in the first user data file for the module are used for command control (offset 50 to 113). The format of these control commands is similar to that described in the command control section. The first words of this file store the error/status information for the module. The Reference chapter contains a listing of the data contained in the error/status data table.

*Block Transfer Backplane Data Transfer*

The MVI71-103M module is unique in the way that the PLC backplane is utilized for the block transfer interface. Data is paged between the module and the PLC processor across the backplane using BTR and BTW operations. Data is transferred from the module to the processor using the BTR blocks, and data is transferred from the processor to the module using the BTW blocks.

The following illustration shows the data transfer method used to move data between the PLC processor, the MVI71-103M module and the serial network.



As shown in the diagram above, all data transferred between the module and the processor over the backplane is through the BTR and BTW blocks. Ladder logic must be written in the PLC processor to interface the block data with user data files. All data used by the module is stored in its internal database.

Data contained in this database is paged through the block transfer interface by coordination of the PLC ladder logic and the MVI71-103M module's program. Up to 64 words of data can be transferred from the module to the processor at one time. Up to 64 words of data can be transferred from the processor to the module. The read and write block identification codes in each data block determine the function to be performed or the content of the data block. The following table lists the block identification codes used by the module:

Block Range	Descriptions
-1	Null block
0	Null block
1 to 67	Read or write data
9901	User Constructed Command
9902	Command Control Block (Add command to Command List Queue)
9903	Event Messages from Master port
9950	Command List Error data
9970	Set PLC time using module's time
9971	Set module's time using PLC time
9998	Warm Boot Request from PLC (Block contains no data)
9999	Cold Boot Request from PLC (Block contains no data)

These block identification codes can be broken down into two groups: Normal data transfer blocks (-1 to 67) and Command control blocks (9901 to 9999). Each of these groups of blocks are discussed in the following topics.

Blocks -1 and 0 transfer status data from the module to the processor and they contain no data when transferred from the processor to the module. Blocks 1 to 67 are utilized to transfer data stored or to be stored in the module's database. These data blocks send data from module to the processor (monitored data received from the devices on the serial network) and to send data from the processor to the module (control data to send to the end devices). Block identification codes 9901 to 9999 are used for special control blocks to control the module. Each of these blocks are discussed in the following topics.

### Normal Data Transfer

Normal data transfer includes the transferring of data received by or to be transmitted to the master drivers and the status data. These data are transferred through read and write blocks when the block transfer interface is used. This data is automatically placed in the user data files when the side-connect interface is used. The following topics discuss the structure and function of each block.



**Read Block**

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

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

The Block Identification Code (word 0) is used to signal to the PLC processor that a new block is ready for processing and informs the processor of the contents of the block. If the value of the code is set to 1, the block contains the first 60 words of data contained in the database of the module.

If the block identification code in word zero is -1 or 0, the block contains the module's status data and should be copied to the status user data file in the PLC. This information can be used to determine the "health" and activity of the module. Refer to the Reference chapter for a detailed listing of the area and its contents.

The block also contains the block identification code the module expects to receive from the processor (word 1 in the block). Under normal data transfer conditions, the ladder logic should use the code to build the appropriate block for the module in the output image.

**Write Block**

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

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

The Block Identification code defines the content of the data contained in the block. If the code is set to -1 or 0, the data area contains no valid data. If the word contains a value from 1 to 67, the data contained in the block should be placed in the appropriate position of the module's database. Under normal conditions, the value used for the write block identification code should be that received in the read block from the module.

**Command Control Blocks**

Block identification codes greater than 9900 are utilized to perform special functions in the module. When the side-connect interface is utilized, the file number selected for the configuration/status file is used for this feature. The data blocks shown below are placed in this file starting at word 50. Each control block recognized and used by the module is defined in the following topics.

**User Constructed Command Block (9901)**

Block identification code 9901 issues one or more user constructed commands. When the module receives a block 9901 identification code, it will place the included commands into the command queue.

Word Offset in Block	Data Field(s)	Description
0	Block ID (9901)	This field contains the block identification code of 9901 for the block.
1	Command Count	This field defines the number of user commands contained in the block. The valid range for the field is 1 to 6.
2 to 11	Command #1	Data required to build the user-defined command in the command queue.
12 to 21	Command #2	Data required to build the user-defined command in the command queue.
22 to 31	Command #3	Data required to build the user-defined command in the command queue.
32 to 41	Command #4	Data required to build the user-defined command in the command queue.
42 to 51	Command #5	Data required to build the user-defined command in the command queue.
52 to 61	Command #6	Data required to build the user-defined command in the command queue.
62 to 63	Spare	Not Used

The following fields are used for each 10-word record in the command list:

Word Offset	Definitions	Description
0	Database Index	Address in module to associate with the command.
1	Session Index	Session index defined in the module to associate with the command.
2	Sector Index	Sector index for session as defined in the module.
3	Data Type	ASDU data type associated with the command.
4	Function Code	Function code for the command.
5	Point Index*	Information object address for the point on which command operates.
6	Override Flag	Override flag for general command
7	Override Value	Override value for general command
8	Reserved	Reserved for future use
9	Reserved	Reserved for future use

\*Point Index refers to Data Information Number

Refer to the command list section of this documentation for a detailed definition of the fields contained in this block. They are the same as those used to construct the commands in the command list.

There is no response block built by the module to send back to the processor after the block is processed. The commands are placed in the command queue and issued at a high priority.

This block and block 9902 should be used when controlling double-point data points in remote units using general commands. This provides complete control of the slave devices under ladder logic control. Alternatively, the slaves can be controlled by changing data in the database and having the data be transferred using pre-constructed commands in the user's command list. Some points only accept value of on for control (that is, LED reset or activate characteristic). For these points, block 9901 and 9902 should only be utilized.

#### Command Control Block (9902)

The block 9902 identification code is used by the processor to send a list of commands to be placed in the command queue from the user configured command list. Commands placed in the queue with this method need not have their enable bit set in the command list.

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the value of 9902 identifying the enable command to the module.
1	Command count	This field contains the number of commands to enable in the command list. Valid values for this field are 1 to 60.
2 to 61	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.
62 to 63	Spare	Not Used

There is no response to this block by the module. The module places the selected commands into the command queue. If the command references a unit that is not defined, the command will not be placed in the command queue. Normal processing of the command list will continue after the commands specified in this block are processed.

For digital output control, the use of block 9901 and 9902 is preferred to the use of the command list. The exact state of the output can be specified in the command list and then the command can be enabled through the use of block 9902. Therefore, the command list can contain a short pulse on command. When the user wishes to execute this command (knowing the state of the command), he or she can enable the command with the block 9902 request.

#### Event Message Block (9903)

Block identification code 9903 sends event messages received on the master port to the processor. It is not necessary to request a 9903 block. When the message pass-through feature is enabled in the module's configuration file, the module automatically generates the 9903 blocks when one or more messages are present. The BTR logic must be set up to receive these blocks and place the received data into a user-configured file. The following illustration shows the format of the block when the block transfer interface is used:

Note: Events are recognized when using a COT=SPONTANEOUS.

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the block identification code of 9903 for the block.
1	Block ID	This is the next block requested by the module.
2	Event Count	This field contains the number of events present in the block. Values of 1 to 6 are valid.
3 to 12	Event 1	Event message
13 to 22	Event 2	Event message
23 to 32	Event 3	Event message
33 to 42	Event 4	Event message
43 to 52	Event 5	Event message
53 to 62	Event 6	Event message
63	Spare	Not Used

When the side-connect interface is used, the event data is placed in a user data file. The number of this file is nine plus the value set for the configuration/status file. For example, if the configuration/status file is set to 10, event messages are placed in file 19. The module passes the processor up to 50 messages in each block. The format for the message is shown in the following diagram:

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the block identification code of 9903 for the block.
1	Event Count	This field contains the number of events present in the block. Values of 1 to 50 are valid.
2 to 11	Event 1	Event message
12 to 21	Event 2	Event message
22 to 31	Event 3	Event message
...	...	...
482 to 491	Event 49	Event message
492 to 501	Event 50	Event message

The format of each 10-word data region in these blocks is as follows:

Word Offset	Definitions	Description
0	Session Index/Sector Index	This field contains the session and sector indices used to define the controlled unit in the module from which the event was generated. The MSB contains the session index and the LSB contains the sector index.
1	ASDU Type	This field contains the ASDU type code for the data contained in the message.
2	Function Code/Point Index*	This field contains the function code and the point index associated with the event message. The MSB contains the function code and the LSB contains the point index.
3	Fault Number	This is the fault number for the event if applicable. Only valid for ASDU types 2 and 4.

Word Offset	Definitions	Description
4	Sec/mSec	This word contains the seconds and millisecond values with a range of 0 to 59999 time at which the message was generated by the slave device.
5	Hr/Min.	This word contains the hour and minutes the message was generated by the slave. The MSB contains the hour and the LSB contains the minute value.
6	Invalid/DST	This word contains two bits that relate to the time value recorded in the slave device for the message. Bit 0 corresponds to the validity of the time (0=valid, 1=invalid) and Bit 1 defines if daylight savings time is used in the time (0=no, 1=yes).
7	Relative Time	This field contains the relative time value if applicable to the object. Only valid for ASDU types 2 and 4.
8 to 9	Value	This double-word value contains the value for the point index/function code in the event message. For ASDU types 1 and 2, this value is only 2 bits wide. For ASDU type 4, this double-word value contains the floating-point number (short circuit location).

\*Point Index refers to the Data Information Number

In order for this feature to be activated, the event pass-through parameter must be set. When a master driver receives an event message from a controlled station, it builds an event message corresponding to the event in the event buffer of the module. This buffer is then sent to the processor when any messages are present. Therefore, these blocks are sent to the processor on a high priority. After the block is sent, the event message is removed from the module's event buffer.

If too many events are present in the buffer (>200), the module sets the event message overflow flag in the error/status data area of the normal read data block. There is no response block to be received by the module from the processor.

#### Command List Error Data Block (9950)

Block 9950 identification code requests the Command List Error Table from the module for the 1000 user-configurable commands. The format for the block is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the value of 9950 identifying the block type to the module.
1	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.
2	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.
3 to 63	Spare	Not Used

The module responds to a valid request with a block containing the requested error information. The format for the block when the block transfer interface is used is displayed in the following table:

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the value of 9950 identifying the block type to the PLC.
1	Block ID	This is the next block requested by the module.
2	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.
3	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.
4 to 63	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 4) is specified in word 3 of the block. The number of valid command errors in the block is set in word 2 of the block. Refer to the command error list to interpret the error codes reported.

The following illustration shows the response block format when the side-connect interface is used:

Word Offset in Block	Data Field(s)	Description
0	Done Flag	This word contains a value of 0 to indicate the operation is complete.
1	Block ID	This field contains the value of 9950 identifying the block type to the PLC.
2	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.
3	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.
4 to 63	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 4) is specified in word 3 of the block. The number of valid command errors in the block is set in word 2 of the block. Refer to the command error list to interpret the error codes reported.

### Set PLC Time Block (9970)

Block 9970 identification code requests the module's date and time. Use this data to set the PLC clock.

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

The module responds to a valid block 9970 request with a block containing the requested date and time. The format for the block for the block transfer interface is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	Block Read ID	This field contains the block identification code of 9970 for the block.
1	Block Write ID	This is the next block requested by the module.
2	Year	This field contains the four-digit year to be used with the new time value.
3	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
4	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
5	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
6	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.
7	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
8	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.
9 to 63	Not Used	Not Used

The response block for the side-connect interface is shown in the following table:

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

Word Offset in Block	Data Field(s)	Description
7	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
8	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.
9 to 63	Not Used	Not Used

**Set Module Time Block (9971)**

Block identification code 9971 passes the clock time in the PLC to the module. The date and time provided sets the module's clock.

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

The module does not send a response block to the processor after receiving this block.

**Warm Boot Block (9998)**

Block 9998 performs a warm-boot operation on the module. The format of the block constructed by the processor is as follows:

Offset	Description	Length
0	9998	1
1 to 63	Spare	63



In this version of the module, the warm and cold boot processes perform the same operation as many of the variables that must be initialized are fixed when the module first boots and cannot be changed after the application starts.

### Cold Boot Block (9999)

Block 9999 performs a cold-boot operation on the module. The format of the block constructed by the processor is as follows:

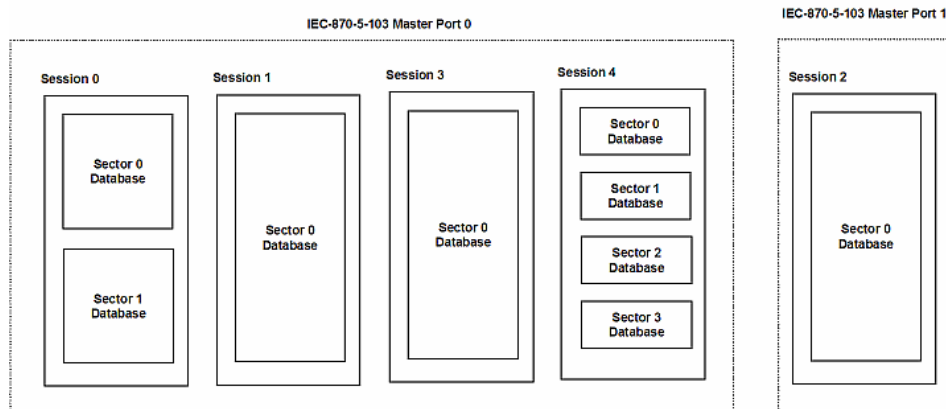
Offset	Description	Length
0	9999	1
1 to 63	Spare	63

In this version of the module, the warm and cold boot processes perform the same operation as many of the variables that must be initialized are fixed when the module first boots and cannot be changed after the application starts.

## 5.2.2 Master Driver

The master driver supported on each application port of the module emulates an IEC 60870-5-103 Master device. Configuration of each port is independent and should be connected to different serial networks.

Each port on the module communicates with one or more controlled stations on what are referred to as sessions. A session represents a controlled device with a unique data link layer address. Each session (controlled device) contains one or more data sets (sectors) that are defined by the vendor of the device. The following illustration shows these relationships.



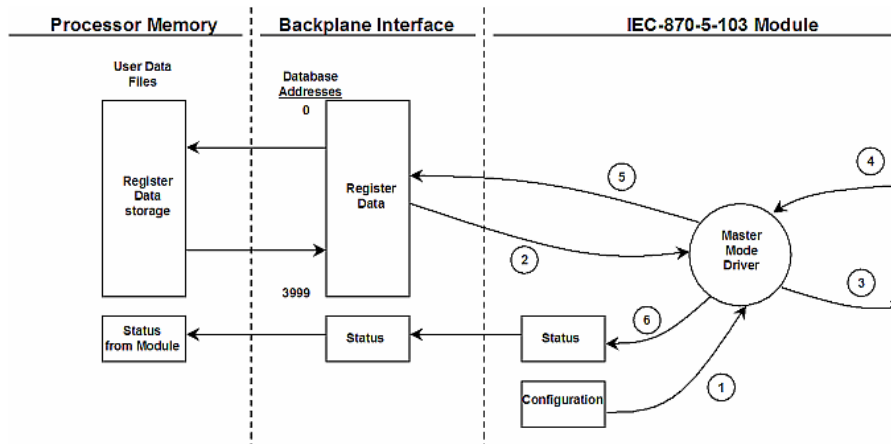
Port 0 on the module communicates with 4 sessions (0, 1, 3 and 4) each of which has their own data set(s). Session 1 only has one sector (all data for device contained in a single database). This sector is addressed by the master using the Common address of ASDU value set for the sector in the configuration file. Session 0 contains two sectors each with their own unique Common address of ASDU value to identify the sector.

Port 1 is connected to one device on the network. This device is defined in the Session 2 section of the configuration file. In this example, all data of the device is stored in a single sector.

**Note:** The IEC 60870-5-103 specification only supports the unbalanced mode. No support is given in the protocol for the balanced mode and the module does not support this mode.

The module supports two application ports. Thirty-two sessions can be defined on the module with each session being assigned to an application port. Within each session, up to five sectors can be defined. This system permits a very flexible assignment of resources in the module. The definition of the data associated with each sector in the system is defined in the configuration file by the user.

The following diagram shows the functionality of the master driver:



- 1 The master driver is configured as specified by the IEC103M.CFG file
- 2 The master will construct control commands using the data in the database
- 3 The master will send these commands and class polls out on the serial network
- 4 Response messages or spontaneous messages generated by controlled devices on the serial network are received by the master driver
- 5 Monitor data received by the master is passed to the module's database and passed to the processor
- 6 Additionally, status data for the module is passed to the processor

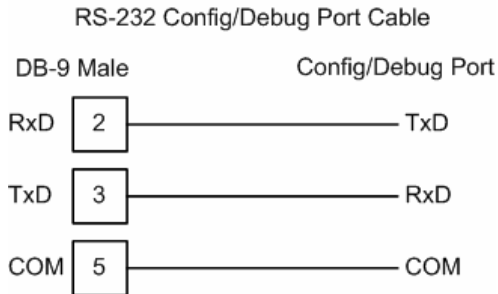
### 5.3 Cable Connections

The application ports on the MVI71-103M 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:

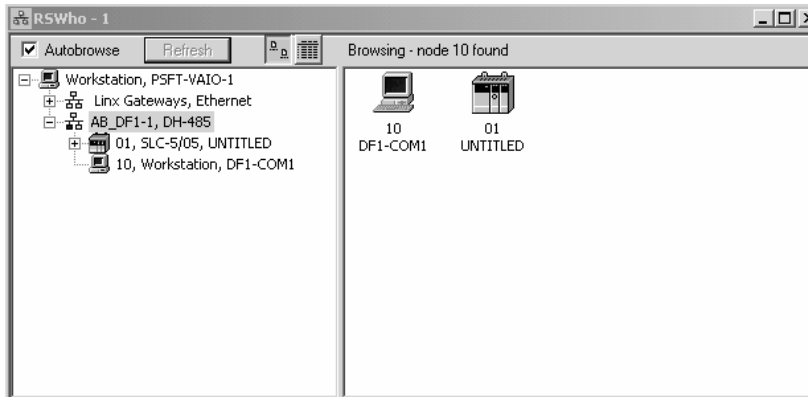


#### Disabling the RSLinx Driver for the Com Port on the PC

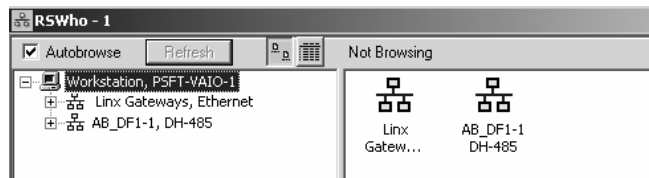
The communication port driver in RSLinx can occasionally prevent other applications from using the PC's COM port. If you are not able to connect to the module's configuration/debug port using HyperTerminal or a similar terminal emulator, follow these steps to disable the RSLinx Driver.

- 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:



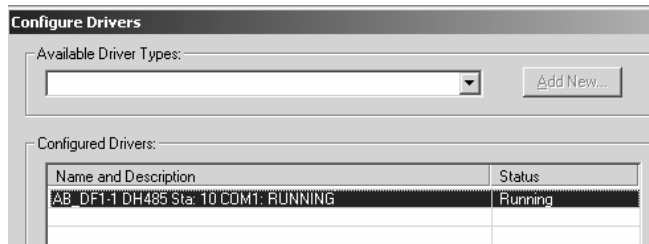
- 3 Notice how the DF1 driver is opened, and the driver is looking for node 1 (an SLC processor). If the network is being browsed, then you will not be able to stop this driver. To stop the driver your RSWho screen should look like this:



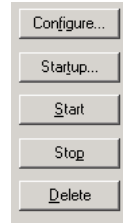
Branches are displayed or hidden by clicking on the  or the  icons.



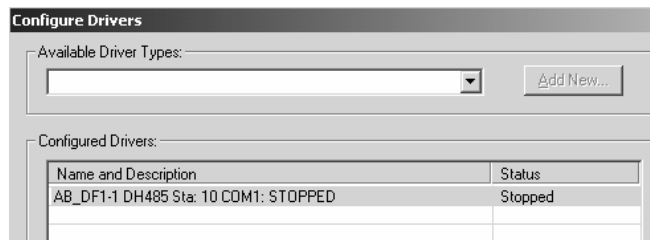
- 4 When you have verified that the driver is not being browsed, go to **Communications>Configure Drivers**  
You may see something like this:



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:

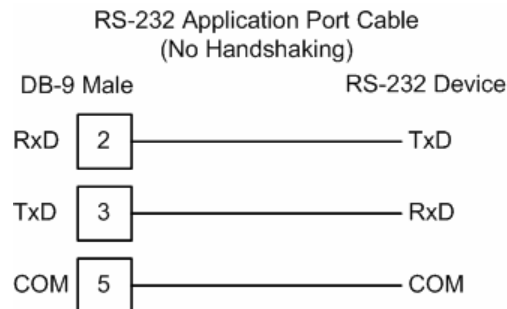


- 6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

**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.

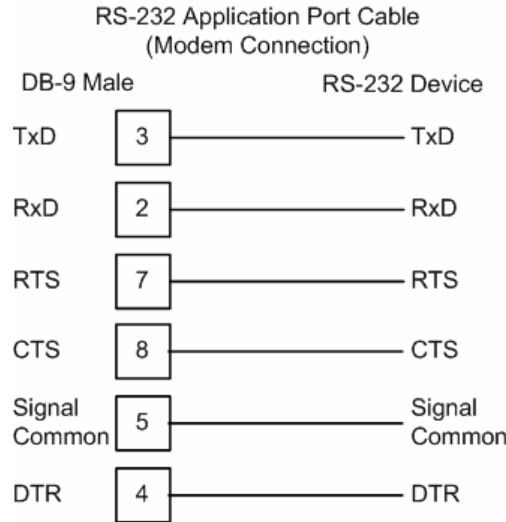
### 5.3.2 RS-232

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

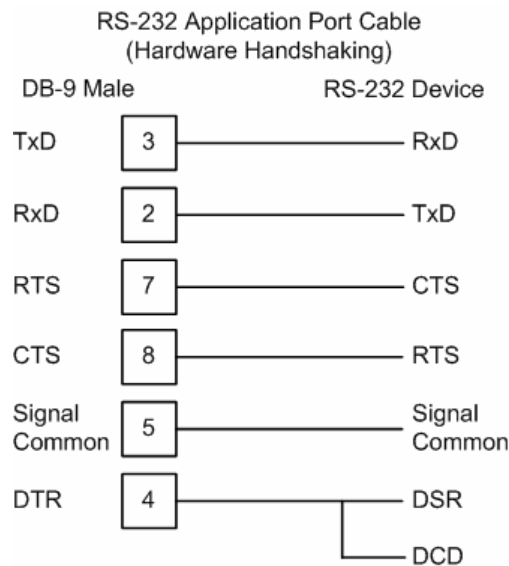
This type of connection is required between the module and a modem or other communication device.



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

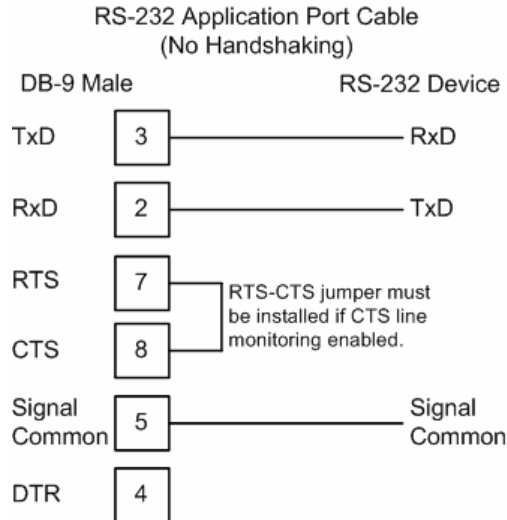
RS-232 -- Null Modem Connection (Hardware Handshaking)

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

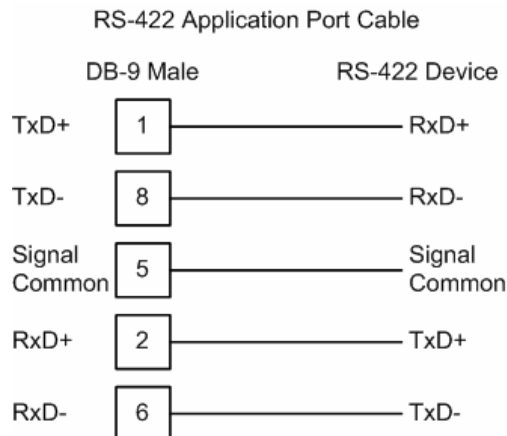


RS-232 -- Null Modem Connection (No Hardware Handshaking)

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

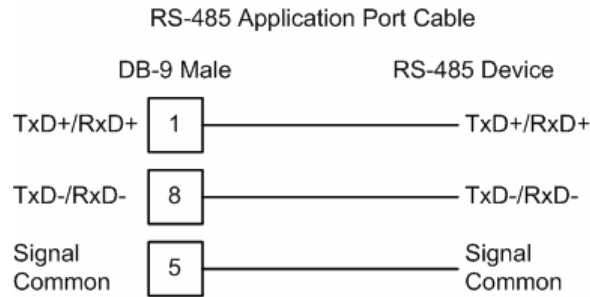


**NOTE:** If the port is configured with the "Use CTS Line" set to 'Y', then a jumper is required between the RTS and the CTS line on the module connection.

**5.3.3 RS-422**

### 5.3.4 RS-485

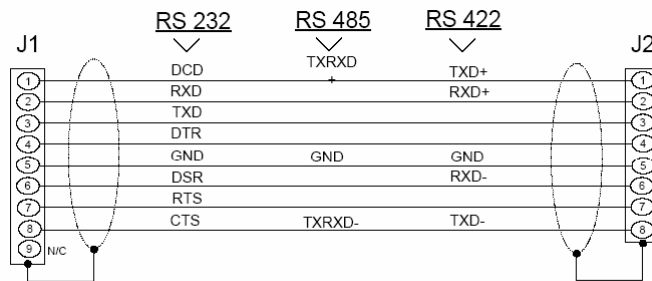
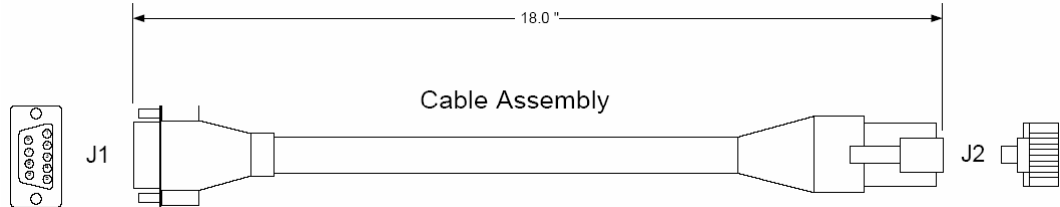
The RS-485 interface requires a single two or three wire cable. The Common connection is optional and dependent on the RS-485 network. The cable required for this interface is shown below:



#### 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 MVI71-103M Status Data Area

This section contains a listing of the data contained in the MVI71-103M status data object, configuration error word and module error codes.

### MVI71-IEC 60870-5-103 Master Communication Module Error/Status Data Format

Offset	Parameter	Description
0	Scan Count	This status value contains a counter incremented on each scan of the module's main loop.
1 to 2	Product Name	This two-word data area contains the text values representing the product name. These words contain the text 'I3M7' for the MVI71 platform.
3 to 4	Revision	This two-word data area contains the text values for the revision number.
5 to 6	Op Sys #	This two-word data area contains the text values for the operating system number.
7 to 8	Run Number	This two-word data area contains the text values for the run number.
9	Read Blk Cnt	This word contains the total number of block read operations successfully executed.
10	Write Blk Cnt	This word contains the total number of block write operations successfully executed.
11	Parse Blk Cnt	This word contains the total number of write blocks successfully parsed.
12	Error Blk Cnt	This word contains the total number of block transfer errors.
13	Event Msg Cnt	This word contains the number of event messages waiting to send to the processor.
14	Event Msg Overflow	This word contains a value of 0 if the event message buffer has not overflowed. If the event buffer overflows, this word will be set to a value of 1.
15	Session Count	This word contains the number of session configured in the module.
16	Current Cmd	This word contains the index of the current command being executed in the command list.
17	Cmd Busy Flag	This word is set to zero if no command is currently being executed and waiting on a response. If the word is set to 1, a command is currently executing.
18	Cmd Count	This word contains the count of the number of commands configured for the module.
19	Cmd Delay	This word contains the command delay counter preset. There is a fixed delay between each command to permit the module to perform class polls on controlled stations.
20	Cmd Queue	This word is set to zero if the command executing is from the command list. If the executing command is from the command queue, the word will be set to 1.
21	Cmd Queue Count	This word contains the number of active commands in the command queue for the module. Up to 100 commands can be buffered in this queue. These commands are transferred from the processor to the module using special command blocks.

Offset	Parameter	Description
22 to 23	Online Status	This double word value contains a bit for each of the 32 potential sessions in the module. If the bit is set for a session in the double word, the station is online. If the bit is clear, the station is offline. Use this value to determine if commands sent from the processor will have a chance of succeeding.
24	CH 0 State	This word contains the state machine value for channel 0.
25	Cmd Req	This word contains the number of commands transferred out channel 0.
26	Cmd Resp	This word contains the number of command response messages received on channel 0.
27	Cmd Err	This word contains the number of command errors recognized on channel 0.
28	Requests	This word contains the total number of messages transmitted on channel 0.
29	Responses	This word contains the total number of messages received on channel 0.
30	Err Sent	This word contains the number of error messages sent on channel 0.
31	Err Received	This word contains the number of error messages received on channel 0.
32	Cfg Err	This bit mapped word recognizes any configuration errors for channel 0. Refer to the configuration error word table for a definition of each bit.
33	Current Error	This word contains the error code for the current command executing on channel 0.
34	Last Error	This word contains the error code for the last error recognized on channel 0.
35	CH 1 State	This word contains the state machine value for channel 1.
36	Cmd Req	This word contains the number of commands transferred out channel 1.
37	Cmd Resp	This word contains the number of command response messages received on channel 1.
38	Cmd Err	This word contains the number of command errors recognized on channel 1.
39	Requests	This word contains the total number of messages transmitted on channel 1.
40	Responses	This word contains the total number of messages received on channel 1.
41	Err Sent	This word contains the number of error messages sent on channel 1.
42	Err Received	This word contains the number of error messages received on channel 1.
43	Cfg Err	This bit mapped word recognizes any configuration errors for channel 1. Refer to the configuration error word table for a definition of each bit.
44	Current Error	This word contains the error code for the current command executing on channel 1.
45	Last Error	This word contains the error code for the last error recognized on channel 1.

The following table defines the contents of the configuration error word. Each bit in the word corresponds to an error condition recognized when the module is configured. There is a separate word for each application port. This data is reported in the status data area previously defined.

Bit	Code	Description
0	0x0001	Invalid baud rate selected
1	0x0002	Invalid parity selected
2	0x0004	Received timeout set to 0
3	0x0008	Invalid Port selected for a session
4	0x0010	Invalid sector count for session
5	0x0020	Could not allocate memory for sector of a session.
6	0x0040	
7	0x0080	Invalid failure delay or confirm timeout for session.
8	0x0100	
9	0x0200	
10	0x0400	
11	0x0800	
12	0x1000	
13	0x2000	
14	0x4000	
15	0x8000	

The following table lists all potential errors that can be generated by the IEC 60870-5-103 Master driver:

**MVI71-IEC 60870-5-103 Master COMMUNICATION MODULE Error Codes**

Error	Description
51	Physical layer error - Error transmitting message
52	Physical layer error - Intercharacter timeout occurred before message fully received.
53	Physical layer error - Frame not entirely received before timeout condition.
54	Physical layer error - Invalid frame length.
101	Link layer error - Invalid checksum received
102	Link layer error - Address unknown to module
103	Link layer error - Link established
104	Link layer error - Link failed
105	Link layer error - Received primary
106	Link layer error - FCB error discard
107	Link layer error - FCB error repeat
108	Link layer error - Invalid start character received
109	Link layer error - Invalid second character received
110	Link layer error - Invalid ending character received
111	Link layer error - Length mismatch error
112	Link layer error - Illegal function
113	Link layer error - No confirmation received
114	Link layer error - No ACK received
115	Link layer error - Sequence unknown
116	Link layer error - Out of sequence
117	Link layer error - Remote close

---

<b>Error</b>	<b>Description</b>
118	Link layer error - Unexpected ACK
119	Link layer error - Request cancelled
201	Application layer error - Length mismatch
202	Application layer error - Address unknown
203	Application layer error - Response late
251	RBE error - Clock event buffer overflow
252	RBE error - Event buffer overflow
271	Data error - Address unknown
281	Control error - Illegal operation
282	Control error - Illegal value
283	Control error - Not selected
301	Initialization error - Database
302	Initialization error - Out of memory
401	Channel open error
501	Session error - Database
502	Session error - Configuration
601	No memory to receive message
602	Session not reserved
603	Illegal session
604	Session is reserved
605	Session is not available
701	No memory to transmit message
702	ASDU not supported
703	Duplicate request
704	Illegal sector
705	Control mode is illegal
801	Partial stop request
802	Stop request failed
901	Response timeout
902	Negative COT in response
903	Session is offline
904	Session is disabled
905	Select confirmation received, waiting to execute
906	Execute confirmation has not be received

---





## 5.7 Protocol Interoperability Documentation

This companion standard presents sets of parameters and alternatives from which subsets have to be selected to implement particular telecontrol systems. Certain parameter values, such as the number of octets in the COMMON ADDRESS of ASDUs represent mutually exclusive alternatives. This means that only one value of the defined parameters is admitted per system. Other parameters, such as the listed set of different process information in command and in monitor direction allow the specification of the complete set or subsets, as appropriate for given applications. This clause summarizes the parameters of the previous clauses to facilitate a suitable selection for a specific application. If a system is composed of equipment stemming from different manufacturers it is necessary that all partners agree on the selected parameters.

**NOTE:** In addition, the full specification of a system may require individual selection of certain parameters for certain parts of the system, such as the individual selection of scaling factors for individually addressable measured values.

The selected parameters should be marked in the white boxes as follows:

- Function or ASDU is not used
- Function or ASDU is used as standardized (default)
- R** Function or ASDU is used in reverse mode
- B** Function or ASDU is used in standard and reverse mode

The possible selection (blank, X, R, B) is specified for each specific clause or parameter.

A black check box indicates that the option cannot be selected in this companion standard.

The pages in this section have been extracted from the 60870-5-103 © IEC:1997, pages 159 to 171.

### INTEROPERABILITY

#### 5.7.1 *Physical Layer*

#### 5.7.2 *Electrical Interface*

- EIA RS-485
- Number of loads 32. For one protection equipment

**NOTE** – EIA RS-485 standard defines unit loads so that 32 of them can be operated on one line. For detailed information refer to clause 3 of EIA RS-485 standard.

#### 5.7.3 *Optical Interface*

- Glass fiber

- Plastic fiber
- F-SMA type connector
- BFOC/2,5 type connector

**5.7.4                    *Transmission speed***

- 9 600 bit/s
- 19 200 bit/s

**5.7.5                    *Link Layer***

There are no choices for the link layer.

**5.7.6                    *Application Layer***

**5.7.7                    *Transmission mode for application data***

Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

**5.7.8                    *Common address of ASDU***

- One Common Address of ASDU (identical with station address)
- More than one Common Address of ASDU

**5.7.9                    *Selection of standard information numbers in monitor direction***

**5.7.10                  *System functions in monitor direction***

- | <b>INF</b>                              | <b>Semantics</b>             |
|-----------------------------------------|------------------------------|
| <input checked="" type="checkbox"/> <0> | End of general interrogation |
| <input checked="" type="checkbox"/> <0> | Time synchronization         |
| <input checked="" type="checkbox"/> <2> | Reset FCB                    |
| <input checked="" type="checkbox"/> <3> | Reset CU                     |
| <input checked="" type="checkbox"/> <4> | Start/restart                |
| <input checked="" type="checkbox"/> <5> | Power on                     |

**5.7.11                  *Status indications in monitor direction***

- | <b>INF</b>                               | <b>Semantics</b>     |
|------------------------------------------|----------------------|
| <input checked="" type="checkbox"/> <16> | Auto-recloser active |



- ☒ <17> Teleprotection active
- ☒ <18> Protection active
- ☒ <19> LED reset
- ☒ <20> Monitor direction blocked
- ☒ <21> Test mode
- ☒ <22> Local parameter setting
- ☒ <23> Characteristic 1
- ☒ <24> Characteristic 2
- ☒ <25> Characteristic 3
- ☒ <26> Characteristic 4
- ☒ <27> Auxiliary input 1
- ☒ <28> Auxiliary input 2
- ☒ <29> Auxiliary input 3
- ☒ <30> Auxiliary input 4

#### **5.7.12**                    ***Supervision indications in monitor direction***

##### **INF    Semantics**

- ☒ <32> Measurand supervision I
- ☒ <33> Measurand supervision V
- ☒ <35> Phase sequence supervision
- ☒ <36> Trip circuit supervision
- ☒ <37> I>> back-up operation
- ☒ <38> VT fuse failure
- ☒ <39> Teleprotection disturbed
- ☒ <46> Group warning
- ☒ <47> Group alarm

#### **5.7.13**                    ***Earth fault indications in monitor direction***

##### **INF    Semantics**

- ☒ <48> Earth fault L<sub>1</sub>
- ☒ <49> Earth fault L<sub>2</sub>
- ☒ <50> Earth fault L<sub>3</sub>
- ☒ <51> Earth fault forward, that is, line
- ☒ <52> Earth fault reverse, that is, busbar

---

**5.7.14**                    ***Fault indications in monitor direction***

	<b>INF</b>	<b>Semantics</b>
<input checked="" type="checkbox"/>	<64>	Start /pick-up L <sub>1</sub>
<input checked="" type="checkbox"/>	<65>	Start /pick-up L <sub>2</sub>
<input checked="" type="checkbox"/>	<66>	Start /pick-up L <sub>3</sub>
<input checked="" type="checkbox"/>	<67>	Start /pick-up N
<input checked="" type="checkbox"/>	<68>	General trip
<input checked="" type="checkbox"/>	<69>	Trip L <sub>1</sub>
<input checked="" type="checkbox"/>	<70>	Trip L <sub>2</sub>
<input checked="" type="checkbox"/>	<71>	Trip L <sub>3</sub>
<input checked="" type="checkbox"/>	<72>	Trip I>> (back-up operation)
<input checked="" type="checkbox"/>	<73>	Fault location X in ohms
<input checked="" type="checkbox"/>	<74>	Fault forward/line
<input checked="" type="checkbox"/>	<75>	Fault reverse/busbar
<input checked="" type="checkbox"/>	<76>	Teleprotection signal transmitted
<input checked="" type="checkbox"/>	<77>	Teleprotection signal received
<input checked="" type="checkbox"/>	<78>	Zone 1
<input checked="" type="checkbox"/>	<79>	Zone 2
<input checked="" type="checkbox"/>	<80>	Zone 3
<input checked="" type="checkbox"/>	<81>	Zone 4
<input checked="" type="checkbox"/>	<82>	Zone 5
<input checked="" type="checkbox"/>	<83>	Zone 6
<input checked="" type="checkbox"/>	<84>	General start/pick-up
<input checked="" type="checkbox"/>	<85>	Breaker failure
<input checked="" type="checkbox"/>	<86>	Trip measuring system L <sub>1</sub>
<input checked="" type="checkbox"/>	<87>	Trip measuring system L <sub>2</sub>
<input checked="" type="checkbox"/>	<88>	Trip measuring system L <sub>3</sub>
<input checked="" type="checkbox"/>	<89>	Trip measuring system E
<input checked="" type="checkbox"/>	<90>	Trip I>
<input checked="" type="checkbox"/>	<91>	Trip I>>
<input checked="" type="checkbox"/>	<92>	Trip IN>
<input checked="" type="checkbox"/>	<93>	Trip IN>>

**5.7.15            *Auto-reclosure indications in monitor direction*****INF    Semantics**

- <128> CB 'on' by AR
- <129> CB 'on' by long-time AR
- <130> AR blocked

**5.7.16            *Measurands in monitor direction*****INF    Semantics**

- <144> Measurand I
- <145> Measurands I, V
- <146> Measurands I, V, P, Q
- <147> Measurands  $I_N$ ,  $V_{EN}$
- <148> Measurands  $I_{L1,2,3}$ ,  $V_{L1,2,3}$ , P, Q, f

**5.7.17            *Generic functions in monitor direction*****INF    Semantics**

- <240> Read headings of all defined groups
- <241> Read values or attributes of all entries of one group
- <243> Read directory of a single entry
- <244> Read value or attribute of a single entry
- <245> End of general interrogation of generic data
- <249> Write entry with confirmation
- <250> Write entry with execution
- <251> Write entry aborted

**5.7.18            *Selection of standard information numbers in control direction*****5.7.19            *System functions in control direction*****INF    Semantics**

- <0>    Initiation of general interrogation
- <0>    Time synchronization

**5.7.20            *General commands in control direction*****INF    Semantics**

- <16> Auto-recloser on/off
- <17> Teleprotection on/off
- <18> Protection on/off
- <19> LED reset
- <23> Activate characteristic 1
- <24> Activate characteristic 2
- <25> Activate characteristic 3
- <26> Activate characteristic 4

### 5.7.21 **Generic functions in control direction**

#### **INF Semantics**

- <240> Read headings of all defined groups
- <241> Read values or attributes of all entries in one group
- <243> Read directory of a single entry
- <244> Read value or attribute of a single entry
- <245> General interrogation of generic data
- <248> Write entry
- <249> Write entry with confirmation
- <250> Write entry with execution
- <251> Write entry abort

### 5.7.22 **Basic application functions**

- Test mode
- Blocking of monitor direction
- Disturbance data
- Generic services
- Private data (*if ASDU type is supported by module*)

### 5.7.23 **Miscellaneous**

Measurands are transmitted with ASDU 3 as well as with ASDU 9. As defined in 7.2.6.8, the maximum MVAL can either be 1,2 or 2,4 times the rated value. No different rating shall be used in ASDU 3 and ASDU 9, that is, for each measurand there is only one choice.

Measurand	Max. MVAL = rated value times
	1,2 or 2,4

Current L <sub>1</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Current L <sub>2</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Current L <sub>3</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L <sub>1-E</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L <sub>2-E</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L <sub>3-E</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active power P	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reactive power Q	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Frequency f	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L <sub>1</sub> - L <sub>2</sub>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

## 5.8 Protocol Support

This section contains a listing of the IEC 60870-5-103 protocol support provided by the module.

**Note:** Shaded areas are not supported by the module.

### 5.8.1 List of Type Identification Codes

#### In Monitor Direction

Type	Description
1	time-tagged message
2	time-tagged message with relative time
3	measurands I
4	time-tagged measurands with relative time
5	identification
6	time synchronization
8	general interrogation termination
9	measurands II
10	generic data
11	generic identification
23	list of recorded disturbances
26	ready for transmission of disturbance data
27	ready for transmission of channel
28	ready for transmission of tags
29	transmission of tags

Type	Description
30	transmission of disturbance values
31	end of transmission

*In Control Direction*

Type	Description
6	time synchronization
7	general interrogation
10	generic data
20	general command
21	generic command
24	order for disturbance data transmission
25	ack for disturbance data transmission

**5.8.2 List of Cause of Transmission Codes**

*In Monitor Direction*

COT	Description
1	spontaneous
2	cyclic
3	reset frame count bit (FCB)
4	reset communication unit (CU)
5	start/restart
6	power on
7	test mode
8	time synchronization
9	general interrogation
10	termination of general interrogation
11	local operation
12	remote operation
20	positive ack of command
21	negative ack of command
31	transmission of disturbance data
40	positive ack of generic write command
41	negative ack of generic write command
42	valid data response to generic read command

COT	Description
43	invalid data response to generic read command
44	generic write confirmation

### In Control Direction

COT	Description
8	time synchronization
9	initiation of general interrogation
20	general command
31	transmission of disturbance data
40	generic write command
42	generic read command

### 5.8.3 List of Function Types

Fun	Description	SYMBOL
128	Distance protection	t(z)
160	Overcurrent protection	I>>
176	Transformer differential protection	$\Delta I_T$
192	Line differential protection	$\Delta I_L$
254	Generic function type	GEN
255	Global function type	GLB

### 5.8.4 Information Numbers Used In Monitor Direction

#### System functions

Inf	Description	GI	Type	Fun							
				128	160	176	192	254	255		
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB		
0	end of general interrogation		8								X
0	time synchronization		6								X
2	reset FCB		5								*
3	reset CU		5								*
4	start/restart		5								*
5	power on		5								*

\* - According to main function

Status Indications

Inf	Description	GI	Type	Fun					
				128 t(z)	160 I>>	176 $\Delta I_T$	192 $\Delta I_L$	254 GEN	255 GLB
16	auto-recloser active	X	1	X	X		X		
17	teleprotection active	X	1	X	X				
18	protection active	X	1	X	X	X	X		
19	LED reset		1	X	X	X	X		
20	monitor direction blocked	X	1	X	X	X	X		
21	test mode	X	1	X	X	X	X		
22	local parameter setting	X	1	X	X	X	X		
23	characteristic 1	X	1	X					
24	characteristic 2	X	1	X					
25	characteristic 3	X	1	X					
26	characteristic 4	X	1	X					
27	auxiliary input 1	X	1	X	X	X	X		
28	auxiliary input 2	X	1	X	X	X	X		
29	auxiliary input 3	X	1	X	X	X	X		
30	auxiliary input 4	X	1	X	X	X	X		

Supervision indications

Inf	Description	GI	Type	Fun					
				128 t(z)	160 I>>	176 $\Delta I_T$	192 $\Delta I_L$	254 GEN	255 GLB
32	measured supervision I	X	1	X	X				
33	measured supervision V	X	1	X	X				
35	phase sequence supervision	X	1	X	X				
36	trip circuit supervision	X	1	X	X	X	X		
37	I>>back-up operation	X	1	X					
38	VT fuse failure	X	1	X	X				
39	teleprotection disturbed	X	1	X	X		X		
46	group warning	X	1	X	X	X	X		
47	group alarm	X	1	X	X	X	X		

Earth fault indications

Inf	Description	GI	Type	Fun					
				128 t(z)	160 I>>	176 $\Delta I_T$	192 $\Delta I_L$	254 GEN	255 GLB
48	earth fault L <sub>1</sub>	X	1	X	X				
49	earth fault L <sub>2</sub>	X	1	X	X				



Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB
50	earth fault L <sub>3</sub>	X	1	X	X				
51	earth fault forward (that is, line)	X	1	X	X				
52	earth fault reverse (that is, busbar)	X	1	X	X				

Fault indications

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB
64	start/pick-up L <sub>1</sub>	X	2	X	X		X		
65	start/pick-up L <sub>2</sub>	X	2	X	X		X		
66	start/pick-up L <sub>3</sub>	X	2	X	X		X		
67	start/pick-up N	X	2	X	X		X		
68	general trip		2	X	X	X	X		
69	trip L <sub>1</sub>		2	X	X	X	X		
70	trip L <sub>2</sub>		2	X	X	X	X		
71	trip L <sub>3</sub>		2	X	X	X	X		
72	trip I>> (back-up operation)		4	X					
73	fault location X in ohms		2	X	X				
74	fault forward/line		2	X	X				
75	fault reverse/busbar		2	X	X				
76	teleprotection signal transmitted		2	X	X				
77	teleprotection signal received		2	X	X				
78	zone 1		2	X					
79	zone 2		2	X					
80	zone 3		2	X					
81	zone 4		2	X					
82	zone 5		2	X					
83	zone 6		2	X					
84	general start/pick-up	X	2	X	X	X	X		
85	breaker failure		2	X	X				
86	trip measuring system L <sub>1</sub>		2			X			
87	trip measuring system L <sub>2</sub>		2			X			
88	trip measuring system L <sub>3</sub>		2			X			
89	trip measuring system E		2			X			
90	trip I>		2		X				
91	trip I>>		2		X				
92	trip IN>		2		X				
93	trip IN>>		2		X				

Auto-reclosure indications

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB
128	CB 'on' by AR		1	X	X		X		
129	CB 'on' by long-time AR		1	X	X		X		
130	AR blocked	X	1	X	X		X		

Measurands

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB
144	measurand I		3.1	X	X				
145	measurands I, V		3.2	X	X				
146	measurands I, V, P, Q		3.3	X					
147	measurands I <sub>N</sub> , V <sub>EN</sub>		3.4	X	X				
148	measurands I <sub>L1,2,3</sub> , V <sub>L1,2,3</sub> , P, Q, f		9	X					

Generic functions

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB
240	read headings of all defined groups		10					X	
241	read values or attributes of all entries of one group		10					X	
243	read directory of a single entry		11					X	
244	read value or attribute of a single entry	(x)	10					X	
245	end of general interrogation of generic data		10					X	
249	write entry with confirmation		10					X	
250	write entry with execution		10					X	
251	write entry aborted		10					X	

**5.8.5 Information Numbers Used In Control Direction**

System functions

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB
0	initiation of general interrogation		7						X

Inf	Description	Type	Fun							
			128	160	176	192	254	255		
			t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB		
0	time synchronization	6								X

General commands

Inf	Description	Com	Type	Fun						
				128	160	176	192	254	255	
				t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB	
16	auto-recloser on/off	On/Off	20	X	X		X			
17	teleprotection on/off	On/Off	20	X	X					
18	protection on/off	On/Off	20	X	X	X	X			
19	LED reset	On	20	X	X	X	X			
23	activate characteristic 1	On	20	X						
24	activate characteristic 2	On	20	X						
25	activate characteristic 3	On	20	X						
26	activate characteristic 4	On	20	X						

Generic functions

Inf	Description	Type	Fun							
			128	160	176	192	254	255		
			t(z)	I>>	$\Delta I_T$	$\Delta I_L$	GEN	GLB		
240	read headings of all defined groups	21						X		
241	read values or attributes of all entries of one group	21						X		
243	read directory of a single entry	21						X		
244	read value or attribute of a single entry	21						X		
245	general interrogation of generic data	21						X		
248	write entry	10						X		
249	write entry with confirmation	10						X		
250	write entry with execution	10						X		
251	write entry abort	10						X		

**5.8.6 Definition and Presentation of ASDUs In Monitor Direction**Type 1 - Time-tagged

Bytes	Description	Spec
1	Value of 1	
1	0x81	

Bytes	Description	Spec
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
1	DPI (0 to 3)	7.2.6.5
4	4-octet binary time	7.2.6.28
1	SIN	7.2.6.23

*Type 2 - Time-tagged with relative time*

Bytes	Description	Spec
1	Value of 2	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
1	DPI (0 to 3)	7.2.6.5
2	RET (relative time)	7.2.6.15
2	FAN (fault number)	7.2.6.6
4	4-octet binary time	7.2.6.28
1	SIN	7.2.6.23

*Type 3 - Measurands I*

Bytes	Description	Spec
1	Value of 3	
1	i = value of 1, 2 or 4	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
2	Current L <sub>2</sub>	7.2.6.8
2	Voltage L <sub>1</sub> to L <sub>2</sub>	7.2.6.8
2	Active power P	7.2.6.8
2	Reactive power Q	7.2.6.8
	ASD U3.1: i=1	
	ASDU 3.2: i=2	
	ASDU 3.3: i=4	
	ASDU 3.4: i=2 val1=I <sub>N</sub> and val2=V <sub>EN</sub>	

Type 4 - Time-tagged measurands with relative time

Bytes	Description	Spec
1	Value of 4	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
4	SCL (short-circuit location (real))	7.2.6.20
2	RET (relative time)	7.2.6.15
2	FAN (fault number)	7.2.6.6
4	4-octet binary time	7.2.6.28

Type 5 - Identification

Bytes	Description	Spec
1	Value of 5	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
1	COL (compatibility level 2 or 3)	7.2.6.3
1	Char 1	7.2.6.2
1	Char 2	7.2.6.2
1	Char 3	7.2.6.2
1	Char 4	7.2.6.2
1	Char 5	7.2.6.2
1	Char 6	7.2.6.2
1	Char 7	7.2.6.2
1	Char 8	7.2.6.2
1	Manufacture byte	Free assignment
1	Manufacture byte	Free assignment
1	Manufacture byte	Free assignment
1	Manufacture byte	Free assignment

Type 6 - Time synchronization

Bytes	Description	Spec
1	Value of 6	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type	

Bytes	Description	Spec
1	Information number	
7	7-Octet binary time	7.2.6.29

Type 8 - Termination of general interrogation

Bytes	Description	Spec
1	Value of 8	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
1	SCN (scan number 0 to 255)	7.2.6.21

Type 9 - Measurands II

Bytes	Description	Spec
1	Value of 9	
1	I = 1 to 9 for number of values	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
2	Current L <sub>1</sub>	7.2.6.8
2	Current L <sub>2</sub>	7.2.6.8
2	Current L <sub>3</sub>	7.2.6.8
2	Voltage L <sub>1 to E</sub>	7.2.6.8
2	Voltage L <sub>2-E</sub>	7.2.6.8
2	Voltage L <sub>3-E</sub>	7.2.6.8
2	Active power P	7.2.6.8
2	Reactive power Q	7.2.6.8
2	Frequency f	7.2.6.8

Value of I determines number of parameters passed in the message with a range of 1 to 9 but always starts with the L<sub>1</sub> value.

**5.8.7 Definition and Presentation Of ASDUs In Control Direction**

Type 6 - Time synchronization

Bytes	Description	Spec
1	Value of 6	
1	0x81	
1	COT	

Bytes	Description	Spec
1	Common address of ASDU	
1	Function Type = GLB (255)	
1	Information number	
7	7-Octet binary time	7.2.6.29

Type 7 - Initiation of general interrogation

Bytes	Description	Spec
1	Value of 7	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type = GLB (255)	
1	Information number	
1	SCN (scan number 0 to 255)	7.2.6.21

Type 20 - General command

Bytes	Description	Spec
1	Value of 20	
1	0x81	
1	COT	
1	Common address of ASDU	
1	Function Type	
1	Information number	
1	DCO (1=Off, 2=On)	7.2.6.4
1	RII	7.2.6.19

RII is not to be processed within the protection equipment, but to be used as a SIN of the return message.





## Support, Service & Warranty

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

---

<b>Internet</b>	Web Site: <a href="http://www.prosoft-technology.com/support">http://www.prosoft-technology.com/support</a> E-mail address: <a href="mailto:support@prosoft-technology.com">support@prosoft-technology.com</a>
<b>Phone</b>	+1 (661) 716-5100 +1 (661) 716-5101 (Fax)
<b>Postal Mail</b>	ProSoft Technology, Inc. 1675 Chester Avenue, Fourth Floor Bakersfield, CA 93301

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Before calling for support, please prepare yourself for the call. In order to provide the best and quickest support possible, we will most likely ask for the following information:

- 1 Product Version Number
- 2 System architecture
- 3 Module configuration and contents of configuration file
- 4 Module Operation
  - Configuration/Debug status information
  - LED patterns
- 5 Information about the processor and user data files as viewed through the processor configuration software and LED patterns on the processor
- 6 Details about the serial devices interfaced

An after-hours answering system allows pager access to one of our qualified technical and/or application support engineers at any time to answer the questions that are important to you.

### Module Service and Repair

The MVI71-103M device is an electronic product, designed and manufactured to function under somewhat adverse conditions. As with any product, through age, misapplication, or any one of many possible problems the device may require repair.

When purchased from ProSoft Technology, Inc., the device has a 1 year parts and labor warranty (3 years for RadioLinX) according to the limits specified in the warranty. Replacement and/or returns should be directed to the distributor from whom the product was purchased. If you must return the device for repair, obtain an RMA (Returned Material Authorization) number from ProSoft Technology, Inc. Please call the factory for this number, and print the number prominently on the outside of the shipping carton used to return the device.

---

## General Warranty Policy – Terms and Conditions

ProSoft Technology, Inc. (hereinafter referred to as ProSoft) warrants that the Product shall conform to and perform in accordance with published technical specifications and the accompanying written materials, and shall be free of defects in materials and workmanship, for the period of time herein indicated, such warranty period commencing upon receipt of the Product. Limited warranty service may be obtained by delivering the Product to ProSoft in accordance with our product return procedures and providing proof of purchase and receipt date. Customer agrees to insure the Product or assume the risk of loss or damage in transit, to prepay shipping charges to ProSoft, and to use the original shipping container or equivalent. Contact ProSoft Customer Service for more information.

This warranty is limited to the repair and/or replacement, at ProSoft's election, of defective or non-conforming Product, and ProSoft shall not be responsible for the failure of the Product to perform specified functions, or any other non-conformance caused by or attributable to: (a) any misuse, misapplication, accidental damage, abnormal or unusually heavy use, neglect, abuse, alteration (b) failure of Customer to adhere to ProSoft's specifications or instructions, (c) any associated or complementary equipment, software, or user-created programming including, but not limited to, programs developed with any IEC1131-3 programming languages, 'C' for example, and not furnished by ProSoft, (d) improper installation, unauthorized repair or modification (e) improper testing, or causes external to the product such as, but not limited to, excessive heat or humidity, power failure, power surges or natural disaster, compatibility with other hardware and software products introduced after the time of purchase, or products or accessories not manufactured by ProSoft; all of which components, software and products are provided as-is. In no event will ProSoft be held liable for any direct or indirect, incidental consequential damage, loss of data, or other malady arising from the purchase or use of ProSoft products.

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ProSoft warrants its products to be free from defects in material and workmanship and shall conform to and perform in accordance with published technical specifications and the accompanying written materials for up to one year (12 months) from the date of original purchase (3 years for RadioLinx products) from ProSoft. If you need to return the device for repair, obtain an RMA (Returned Material Authorization) number from ProSoft Technology, Inc. in accordance with the RMA instructions below. Please call the factory for this number, and print the number prominently on the outside of the shipping carton used to return the device.

If the product is received within the warranty period ProSoft will repair or replace the defective product at our option and cost.

Warranty Procedure: Upon return of the hardware product ProSoft will, at its option, repair or replace the product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement product will be furnished on an exchange basis and will be either reconditioned or new. All replaced product and parts become the property of ProSoft. If ProSoft determines that the Product is not under warranty, it will, at the Customer's option, repair the Product using then current ProSoft standard rates for parts and labor, and return the product freight collect.

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### **RMA Procedures**

In the event that repairs are required for any reason, contact ProSoft Technical Support at +1 661.716.5100. A Technical Support Engineer will ask you to perform several tests in an attempt to diagnose the problem. Simply calling and asking for a RMA without following our diagnostic instructions or suggestions will lead to the return request being denied. If, after these tests are completed, the module is found to be defective, we will provide the necessary RMA number with instructions on returning the module for repair.



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