

inRAx



MVI56-103MR

ControlLogix Platform

IEC-870-5-103 Master with Reduced Data
Block

User Manual

January 04, 2008



Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation ControlLogix hardware, the MVI56-103MR Module and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

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

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Warnings

UL Warnings

- A** Warning - Explosion Hazard - Substitution of components may impair suitability for Class I, Division 2.
- B** Warning - Explosion Hazard - When in Hazardous Locations, turn off power before replacing or rewiring modules.
Warning - Explosion Hazard - Do not disconnect equipment unless power has been switched off or the area is known to be nonhazardous.
- C** Suitable for use in Class I, division 2 Groups A, B, C and D Hazardous Locations or Non-Hazardous Locations.

ATEX Warnings and Conditions of Safe Usage:

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

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

Electrical Ratings

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

Markings:



II 3 G 0C <=Ta<= 60C EEx nA IIC T4 DEMKO 07ATEX0710717X

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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.

ProSoft Technology

1675 Chester Avenue, Fourth Floor

Bakersfield, CA 93301

+1 (661) 716-5100

+1 (661) 716-5101 (Fax)

<http://www.prosoft-technology.com>

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MVI56-103MR User Manual

January 04, 2008

PSFT.103MR.MVI56.UM.08.01.04

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Guide to the MVI56-103MR User Manual

Function		Section to Read	Details
Introduction (Must Do)	→	Start Here (page 11)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Verify Communication, Diagnostic and Troubleshooting	→	Verifying Communication (page 37) Diagnostics and Troubleshooting (page 37)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	Reference (page 57) Functional Overview Product Specifications (page 57)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 111)	This section contains Support, Service and Warranty information. Index of chapters.

1 Start Here

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Installing the MVI56-103MR module requires a reasonable working knowledge of the Rockwell Automation hardware, the MVI56-103MR 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 MVI56-103MR module requires the following minimum hardware and software components:

- Rockwell Automation ControlLogix™ processor, with compatible power supply and one free slot in the rack, for the MVI56-103MR module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 5000 programming software version 2.51 or higher.
- Rockwell Automation RSLinx communication software
- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
 - Microsoft Windows XP Professional with Service Pack 1 or 2
 - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
 - Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended

- 100 Mbytes of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- CD-ROM drive
- HyperTerminal or other terminal emulator program.

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

1.2 Package Contents

The following components are included with your MVI56-103MR module, and are all required for installation and configuration.

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

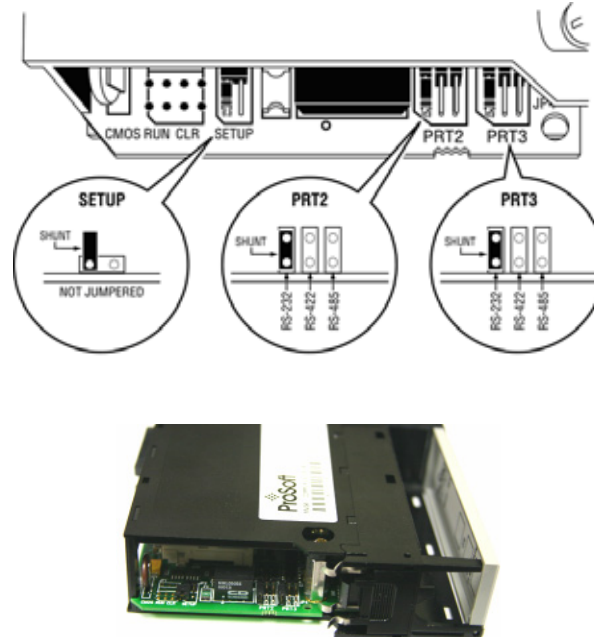
Qty.	Part Name	Part Number	Part Description
1	MVI56-103MR Module	MVI56-103MR	IEC-870-5-103 Master with Reduced Data Block
1	Cable	RS232 Null Modem	For RS232 Connection to the CFG Port
3	Cable	Cable #14, RJ45 to DB9 Male Adapter	For DB9 Connection to Module's Port
2	Adapter	1454-9F	Two Adapters, DB9 Female to Screw Terminal. For RS422 or RS485 Connections to Port 1 and 2 of the Module
1	ProSoft Solutions CD		Contains sample programs, utilities and documentation for the MVI56-103MR module.

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

1.3 Setting Jumpers

If you use an interface other than RS-232 (default), you must change the jumper configuration to match the interface. There are three jumpers located at the bottom of the module.

The following illustration shows the MVI56-103MR jumper configuration:



- 1 Set the PRT 2 (for application port 1) and PRT 3 (for application port 2) jumpers for RS232, RS422 or RS485 to match the wiring needed for your application. The default jumper setting for both application ports is RS-232.
- 2 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

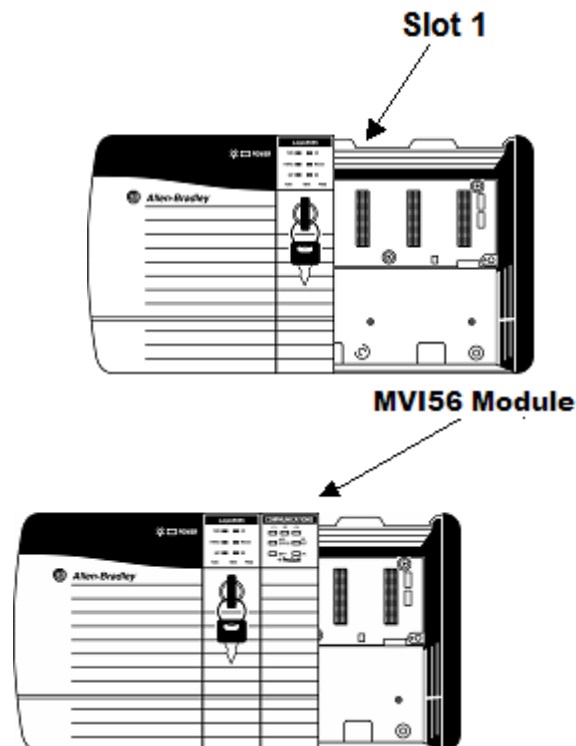
If you have not already installed and configured your ControlLogix processor and power supply, please do so before installing the MVI56-103MR module. Refer to your Rockwell Automation product documentation for installation instructions.

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

After you have checked the placement of the jumpers, insert MVI56-103MR into the ControlLogix chassis. Use the same technique recommended by Rockwell Automation to remove and install ControlLogix modules.

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

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



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

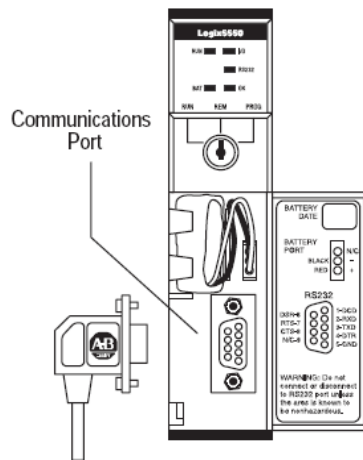
- 4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
- 5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample program to work correctly. Slot numbers are identified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

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

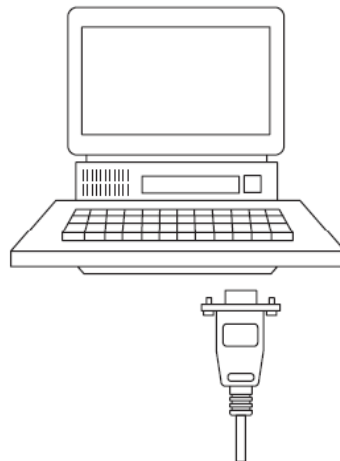
Note: If you are installing MVI56-103MR with other modules connected to the PCI bus, the peripheral modules will not have holding clips. Make sure all of the modules are aligned with their respective slots before you snap them into place.

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.

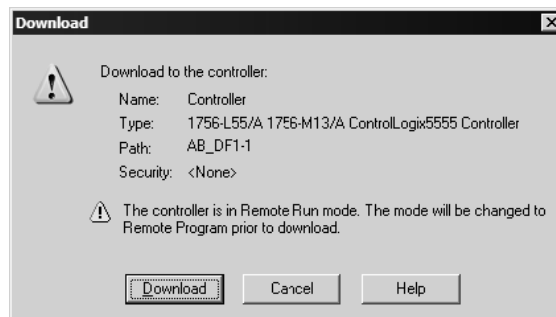


1.6 Download the Sample Program to the Processor

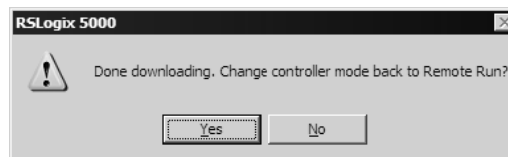
- **To download the sample program from RSLogix 5000 to the ControlLogix processor:**

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

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



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

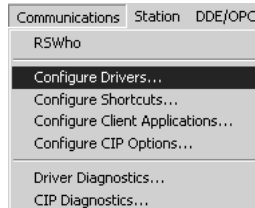


Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

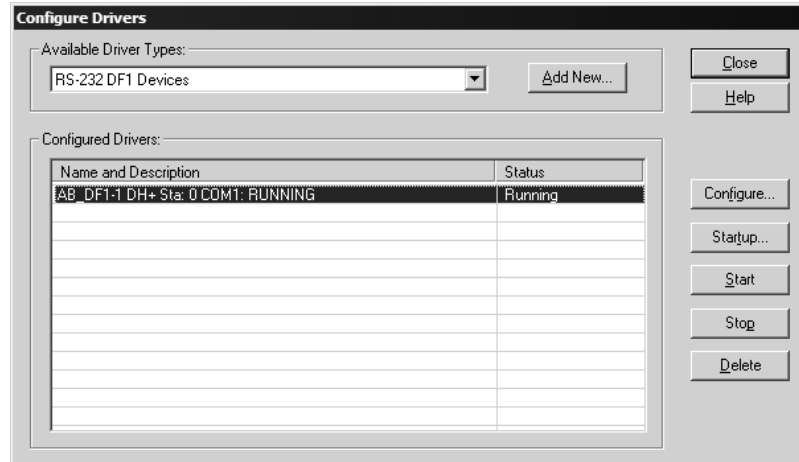
1.6.1 Configuring RSLinx

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

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



This action opens the Configure Drivers dialog box.



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

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



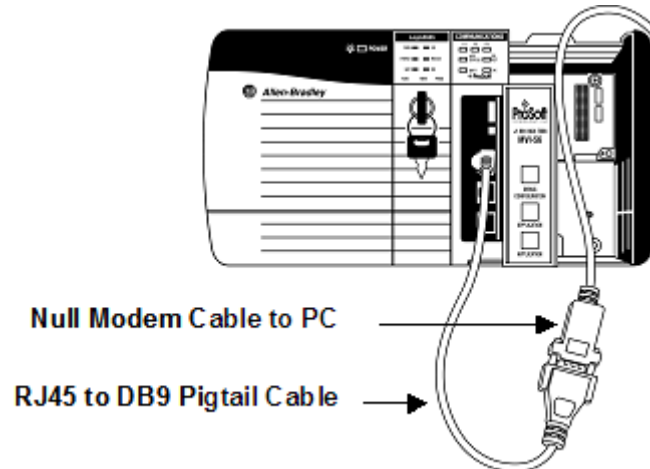
- 4 Click the Auto-Configure button. RSLinx will attempt to configure your serial port to work with the selected driver.
- 5 When you see the message "Auto Configuration Successful", click the OK button to dismiss the dialog box.

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

1.7 Connect your PC to the Module

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

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



2 Module Configuration

In This Chapter

- Installing and Configuring the Module 21
- Module Data 26
- Configuration File 31

This section contains the setup procedure, data, and ladder logic for successful application of the MVI56-103MR module. Each step in the setup procedure is defined in order to simplify the use of the module.

2.1 Installing and Configuring the Module

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

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

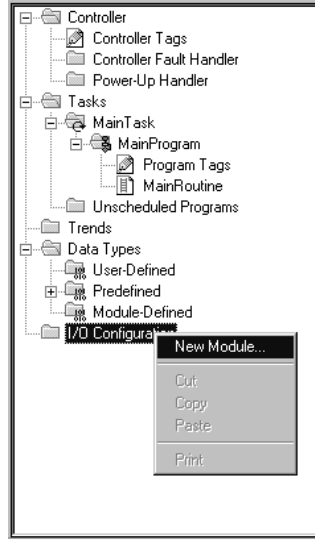
Note: The RSLogix software must be in "offline" mode to add the module to a project.

- 2 Modify the module's configuration files to meet the needs of your application, and copy the updated configuration to the module. Example configuration files are provided on the CD-ROM. Refer to the Modifying the Example Configuration File section, later in this chapter, for more information on the configuration files.
- 3 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.

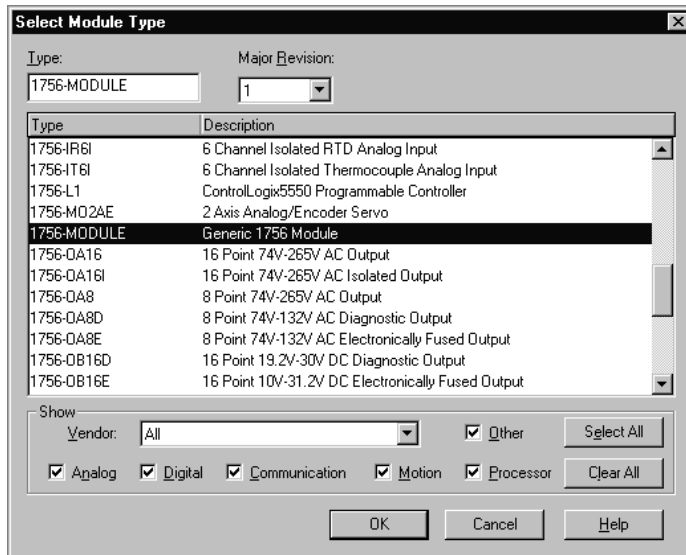
Note: If you are installing this module in an existing application, you can copy the necessary elements from the example ladder logic into your application.

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

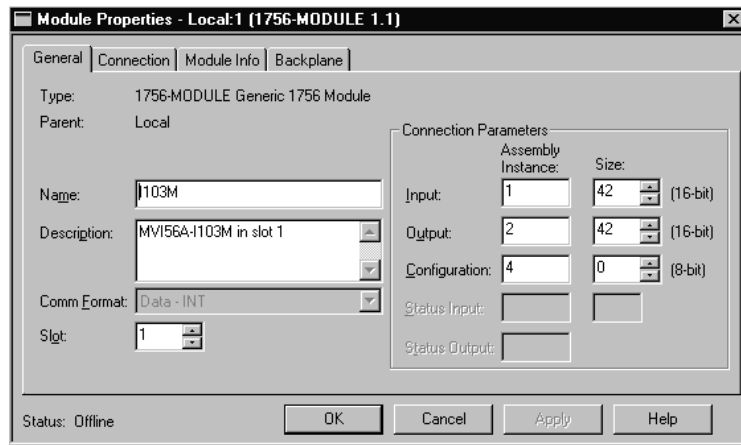
The first step in installing and configuring the module is to define the module to the system. Right-click the mouse button on the I/O Configuration option in the Controller Organization window to display a pop-up menu. Select the **New Module** option from the I/O Configuration menu.



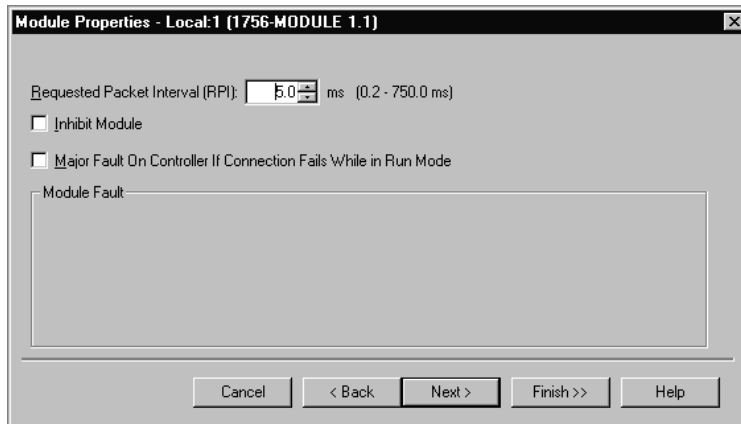
This action opens the following dialog box.



Select the **1756-Module (Generic 1756 Module)** from the list and click the **OK** button. The following dialog box appears:



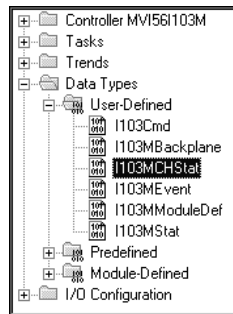
Fill in the dialog box as shown adjusting the Name, Description and Slot options for your application. You must select the **Comm Format** as **Data - INT** in the dialog box. Failure to set the **Assembly Instance** and **Size** values correctly will result in a module that will not communicate over the backplane of the ControlLogix rack. Click the **OK** button to display the next dialog box.



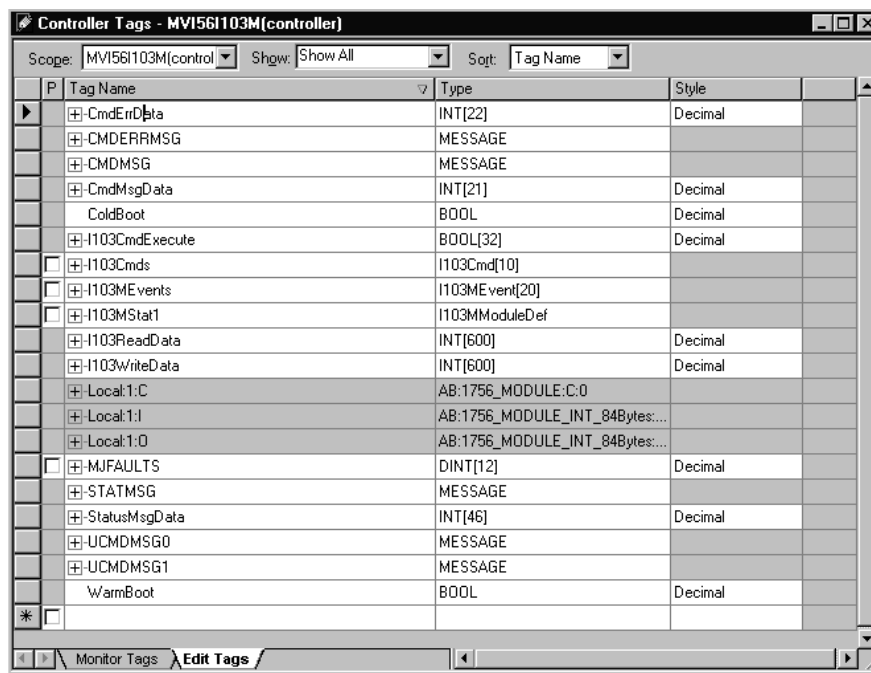
Select the Request Packet Interval value for scanning the I/O on the module. This value represents the minimum frequency that the module will handle scheduled events. This value should not be set to less than 1 millisecond. Values between 1 and 10 milliseconds should work with most applications.

After completing the module setup, the Controller Organization window displays the module's presence. The data required for the module will be defined to the application, and objects will be allocated in the Controller Tags data area.

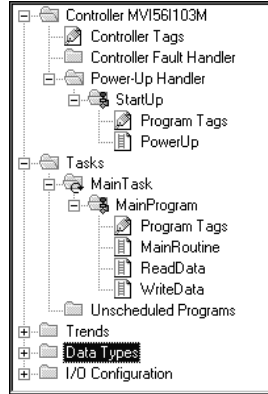
The next step in the module's setup is to define the User Defined Data Types to be used with the module. Copy these data types from the example ladder logic if you are not using the example. They will be defined if you are starting from the example ladder logic. The Controller Organization window should display the User Defined Data Types shown in the following example:



The next step in module setup is to define the data tag to be used to interface with the module and the ladder logic. Open the Controller Tags Edit Tags dialog box and enter the values shown in the following example. The MVI56-103MR module is defined in the example as I103ReadData and I103WriteData to hold all data related to the database and I103MStat1 to hold all status data related to the module (type I103MmoduleDef). The tag name can be set to any valid tag name desired. When using the example ladder logic, this step has already been performed. You must define all controller tags and data areas to be used with the MSG instructions to pass data between the module and the ControlLogix processor. An example of the controller tag window is shown in the following figure:



The last step in the module setup is to add the ladder logic. If the example ladder logic is used, adjust the ladder to fit the application. When the ladder example is not used, copy the ladder logic shown in the Controller Organization window below to the application.



It is now time to edit the IEC103M.CFG file to set up the module for the specific application. Refer to the **Configuration File** section of this document. The module is now set up and ready to be used with your application. Insert the module in the rack and attach the serial communication cable to the debug/configuration port and the application ports.

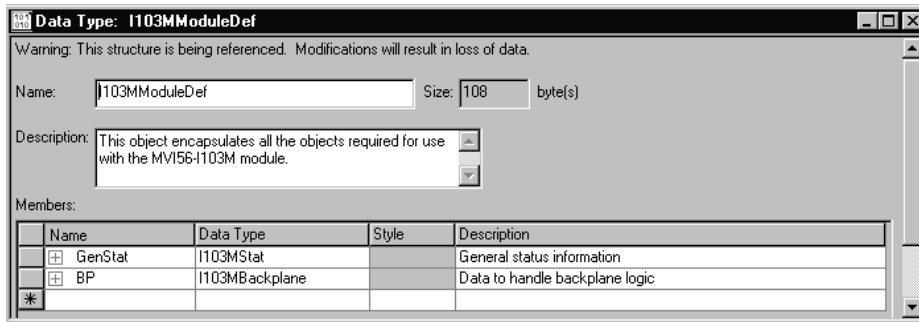
Download the new application to the controller and place the processor in run mode. Download the new IEC103M.CFG file to the processor using the debug/configuration port. If all the configuration parameters are set correctly and the module is attached to a network, the module's Application LED (APP LED) should remain off and the backplane activity LED (BP ACT) should blink rapidly. Refer to the **Diagnostics and Troubleshooting** section if you encounter errors. Attach a computer or terminal to Port 1 on the module and look at the status of the module using the Configuration/Debug Menu in the module.

2.2 Module Data

This section describes the controller tags that are defined in the example logic to interface with the module. The user can extend these tags to meet the specifications required for their application. Additional data is required if the MSG instructions pass data between the module and the processor.

2.2.1 Module Status Data and Variables (I103MModuleDef)

All status and variable data related to the MVI56-103MR is stored in a user defined data type. An instance of the data type is required before the module can be used. This is done by declaring a variable of the data type in the Controller Tags Edit Tags dialog box. The structure of the object is displayed in the following figure:



This object contains objects that define variables to be used with the module and status data related to the module. Each of these object types is discussed in the following topics of the document.

Status Object (I103MStat)

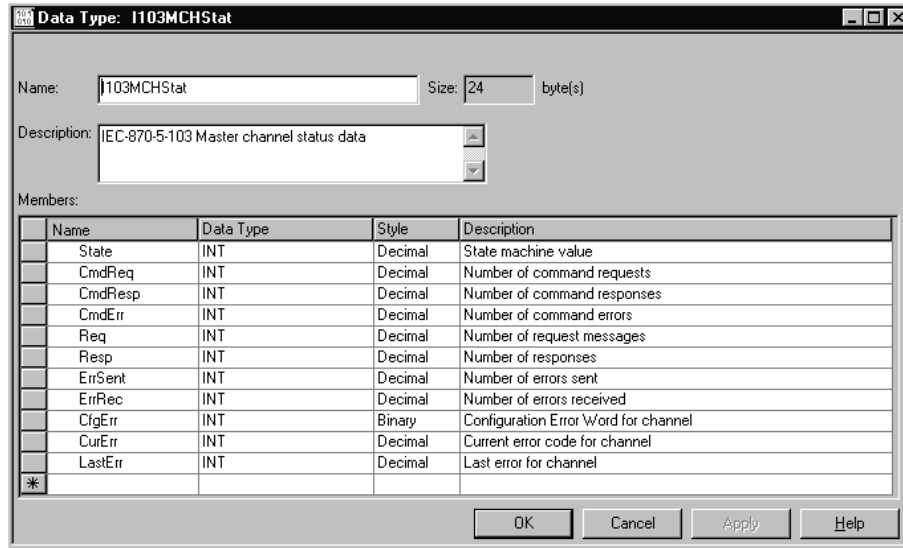
This object stores the status data of the module. The I103MStat object shown below is updated each time a read block is received by the processor. Use this data to monitor the state of the module at a "real-time rate".

Name	Data Type	Style	Description
Scan_Cnt	INT	Decimal	Program Scan Counter
Product_Name	SINT[4]	Decimal	Product Code
Rev_Level	SINT[4]	Decimal	Revision
Op_Sys	SINT[4]	Decimal	Operating system revision
Run_Number	SINT[4]	Decimal	Run number
Blk_Rd_Count	INT	Decimal	Number of block read transfers
Blk_Wr_Count	INT	Decimal	Number of block write transfers
Blk_Parse_Cnt	INT	Decimal	Number of blocks parsed by module
Blk_Err	INT	Decimal	Number of block errors
Evt_Cnt	INT	Decimal	Number of event messages in buffer
Evt_Overflow	INT	Decimal	Flag to indicate event message buffer overflow (1=overflow)
SesCnt	INT	Decimal	Number of sessions configured
CurCmd	INT	Decimal	Index of command executing
CmdBusy	INT	Decimal	Command busy flag
CmdMax	INT	Decimal	Maximum number of commands configured
CmdDelay	INT	Decimal	Command delay counter
CmdQueue	INT	Decimal	Command Queue Flag
CmdQCnt	INT	Decimal	Number of commands in command queue
Online	DINT	Decimal	Online status bits for each session
ChStat	I103MCHStat[2]		Channel Status Data
*			

Within the I103MStat objects are objects containing the status information for each application port (I103MCHStat). Refer to [MVI56-103MR Status Data Area](#) (page 81) for a complete listing of the data stored in this object. This data is acquired from the module using and MSG instruction.

Channel Status Object (I103MCHStat)

The I103MCHStat object holds the status data related to a single IEC-870-5-103 Master port. The structure of this object is shown in the following window:



This information is passed to the controller from the module with each normal read block image.

Configuration/Error Status Flags (CfgErr)

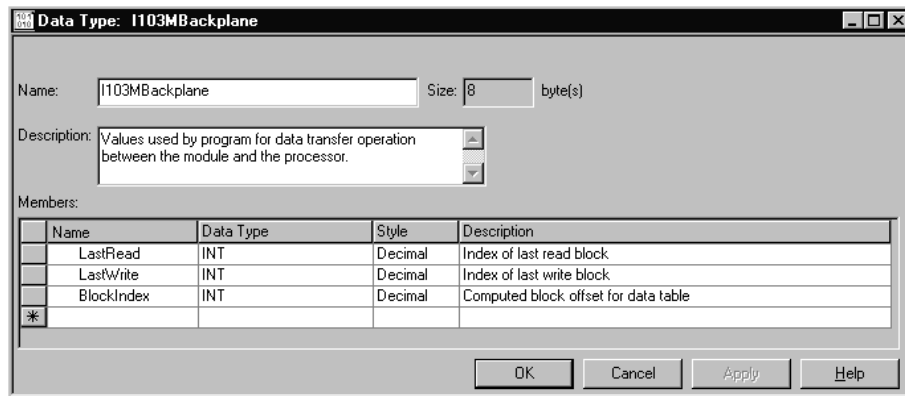
The CfgErr word member of the I103MCHStat reports configuration errors for the respective server. If the module is not functioning as expected, inspect the value presented in this object. If a configuration error exists, the associated bit will be set. A value of zero for the bit indicates the configuration value is valid. This does not guarantee that the module is configured correctly for your application. The bits used by this member are shown in the following table:

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	

Bit	Code	Description
13	0x2000	
14	0x4000	
15	0x8000	

Backplane Object (I103MBackplane)

The I103MBackplane object stores all the variables required for the data transfer operation between the module and the controller. The LastRead data member is used as the handshaking byte to indicate the arrival of new data from the module. The structure of this object is shown in the following illustration:



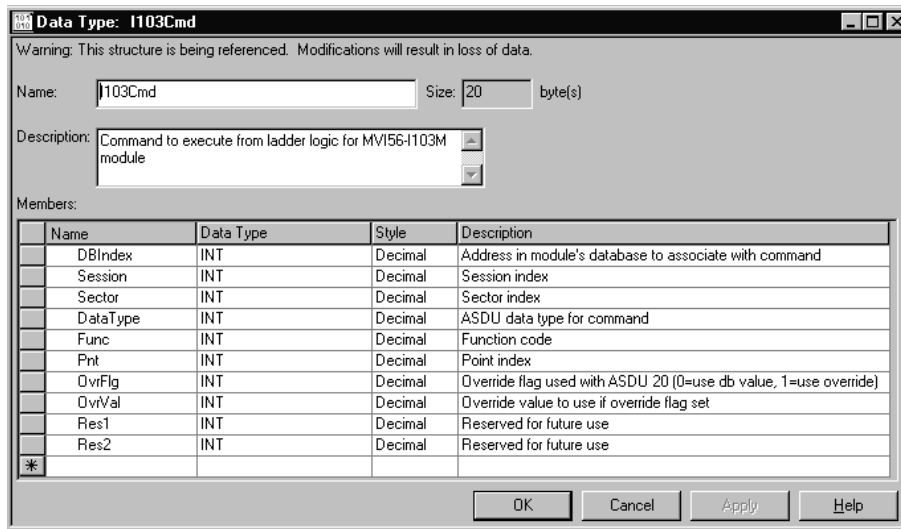
The other members of the object are be utilized in the ladder logic to assist in the data transfer operation.

2.2.2 Data Object

Data for the module is stored in two controller tags for the example ladder logic. The read data (data transferred from the module to the processor) is stored in the controller tag I103ReadData[]. The write data (data transferred from the processor to the module) is stored in the controller tag I103WriteData[]. Separate tags can be constructed for each data type used by the controlled devices and for each device.

2.2.3 Command Control Data Object

In order to support the command control option of the module, two controller tags are constructed, I103Cmds[] and I103CmdExecute[]. The bits in the I103CmdExecute array trigger the execution in the ladder logic. The I103Cmds[] are of type I103Cmd that contain the data necessary to build a user command. The structure of this object is shown in the following figure:



Refer to the **Command List** section of this document for the definition of each of the parameters. This option permits execution of user-generated commands from the ladder logic directly to controlled devices. This feature is especially important in generating general commands (ASDU 20 object) request.

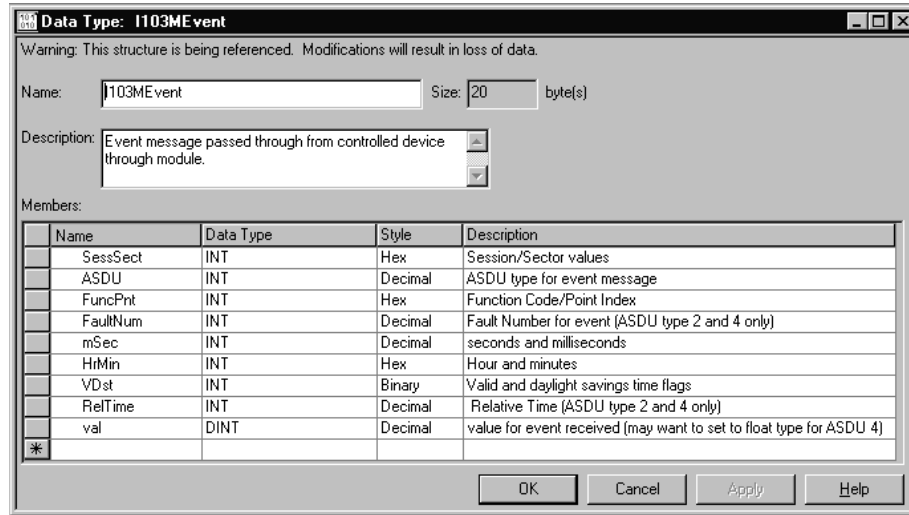
When the command bit (I103CmdExecute[0]) is set in the example ladder logic, the module will build a block 9901 with the command contained in the first command of the I103Cmds[]. The module will receive this block and build and send the command to the specified control device using a MSG block. The data for the command element in the I103Cmds array is shown in the following figure:

I103Cmds[0]	{...}	I103Cmd
I103Cmds[0].DBIndex	0 Decimal	INT
I103Cmds[0].Session	0 Decimal	INT
I103Cmds[0].Sector	0 Decimal	INT
I103Cmds[0].DataType	20 Decimal	INT
I103Cmds[0].Func	128 Decimal	INT
I103Cmds[0].Pnt	18 Decimal	INT
I103Cmds[0].OvrFlg	1 Decimal	INT
I103Cmds[0].OvrVal	2 Decimal	INT
I103Cmds[0].Res1	0 Decimal	INT
I103Cmds[0].Res2	0 Decimal	INT

When the command bit (I103CmdExecute[2]) is set in the example ladder logic, the module builds the block 9902 and sends the block using a MSG instruction to the module. The module receives the new block and places the commands into the command queue for execution.

2.2.4 Event Message Data Object

The module can be configured to pass event messages received from the controlled devices to the processor. The module sends this information to the processor in read blocks with identification codes of 9903 in the input image. The example ladder logic has a data structure that conforms to the data structure sent for each element by the module. The following figure displays the object:



Ladder logic is required to process the block 9903 in the input image and place the event data into the correct controller tags. Each block is capable of passing from 1 to 3 events.

2.3 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 ProSoft Solutions CD contains an example listing of an IEC103M.CFG file.

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

[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
[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, look at the label for the data item. Each parameter's value is separated from the label with the ':' character. This character is used by the program to delimit the position in the data record where to start reading data. All data for a parameter must be placed after the ':' character. For numeric parameter values any text located after the value will not be used. There must be at least one space character between the end of the parameter value and the following text. An example of a parameter entry is given below:

```
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. You must enter each parameter correctly for successful application of the module. MVI56-103MR Configuration Data Definition (page 85) 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 (that is, [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:

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 associates the command with the proper sector of the selected session.															
6	Data Type	<p>This parameter sets 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 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 performs 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 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 maybe valid for certain controlled

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.

3 Ladder Logic

Ladder logic is required for application of the MVI56-103MR 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 37
- 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 MVI56-103MR module returns a status data set to the ControlLogix processor in each read block. This data is transferred to the ControlLogix 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

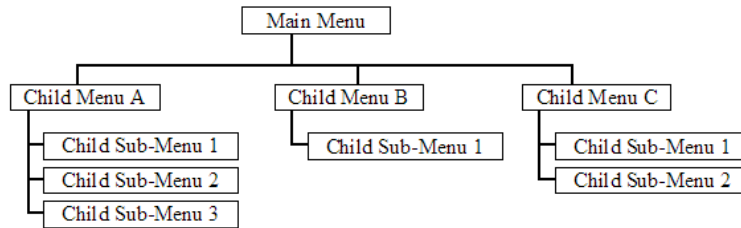
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

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 UART hardware-based serial communications port available. USB-based virtual UART systems (USB to serial port adapters) often do not function reliably, especially during binary file transfers, such as when uploading/downloading configuration files or module firmware upgrades.
- A null modem serial cable.

4.1.3 Required Software

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

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

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

The module uses the 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	None

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

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

- 1 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.
- 2 Verify that RSLinx is not controlling the COM port. Refer to [Disabling the RSLinx Driver for the Com Port on the PC](#) (page 76).
- 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 44).

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.

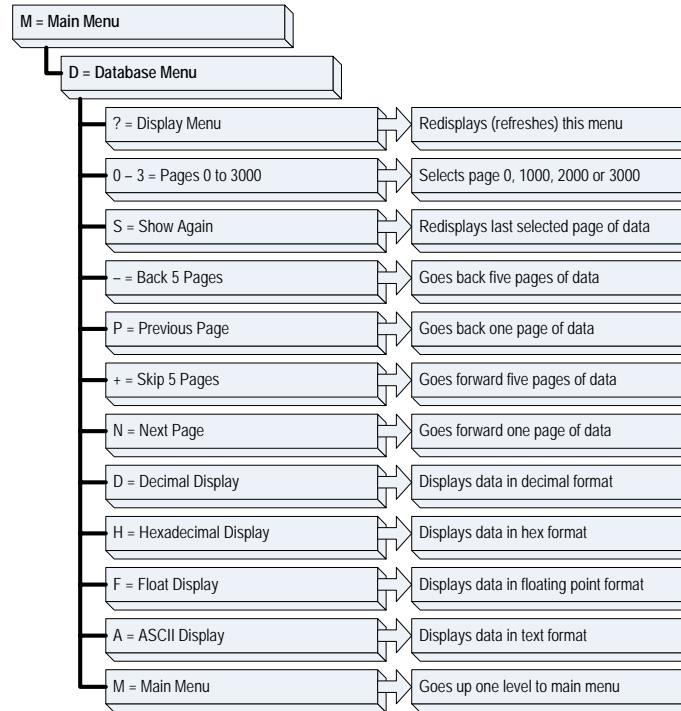
Warm Booting the Module

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

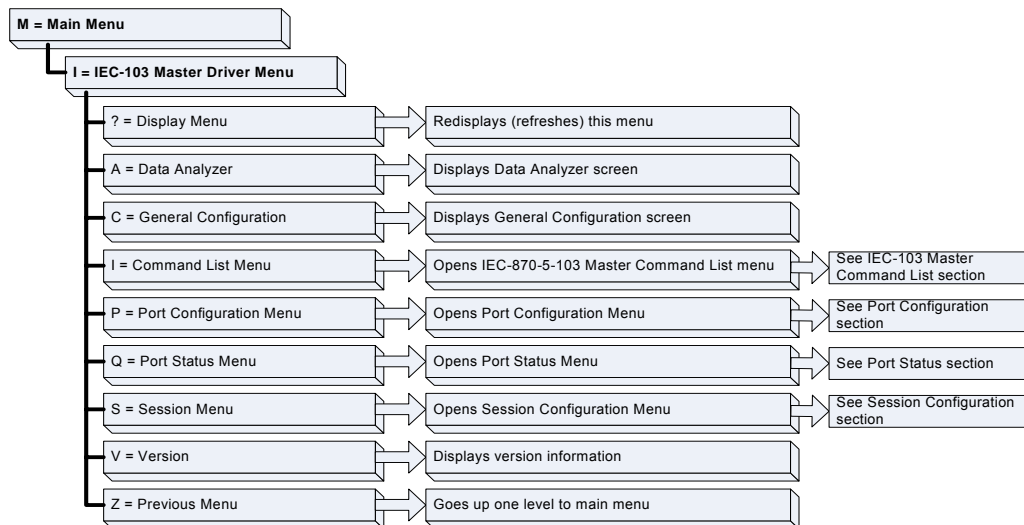
Press **[A]** to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

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 press **[S]** to stop the data analyzer, and then press **[M]** to return to the main menu. This action will allow the module to resume its normal high speed 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
ENB DBIDX POLLI SES SEC ASDU FUNC POINT LAST_POLL LERROR OUR VALUE
1 0 10 0 0 20 128 16 7 0 1 2
0 0 11 0 0 20 128 16 14932 0 1 1
0 1600 41 0 0 20 128 17 14932 0 0 0
0 1602 41 0 0 20 128 18 14932 0 0 0
1 0 5 0 0 7 255 0 4 0
**** END OF COMMAND LIST REACHED ****

```

For more information about the commands on this menu, refer to [IEC-870-Master Command List Menu](#) (page 47).

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 52) 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.

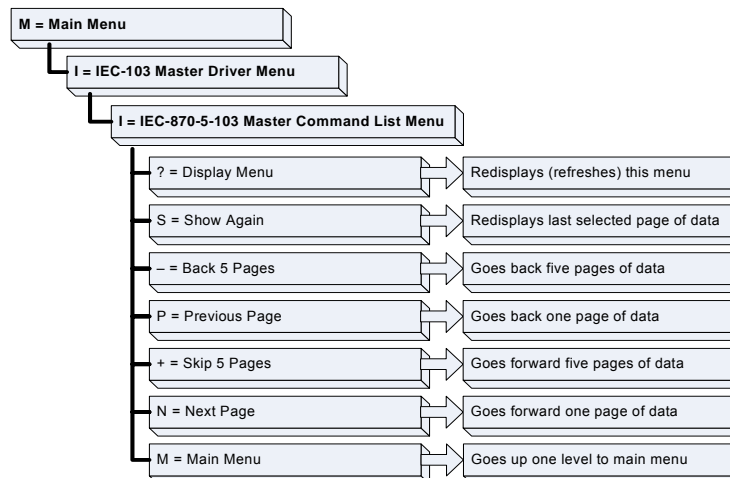
PRODUCT NAME CODE       : IEC-870-5-103 Master Driver
SOFTWARE REVISION LEVEL : 2.14
SOFTWARE REVISION DATE  : 04/17/2003
FAR CORE LEFT           : 322368
  
```

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

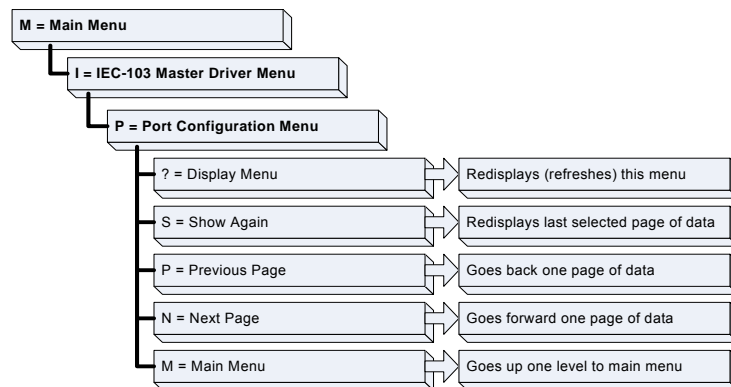
Press **[N]** from the Database View menu to select and display the next 100 registers of data.

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

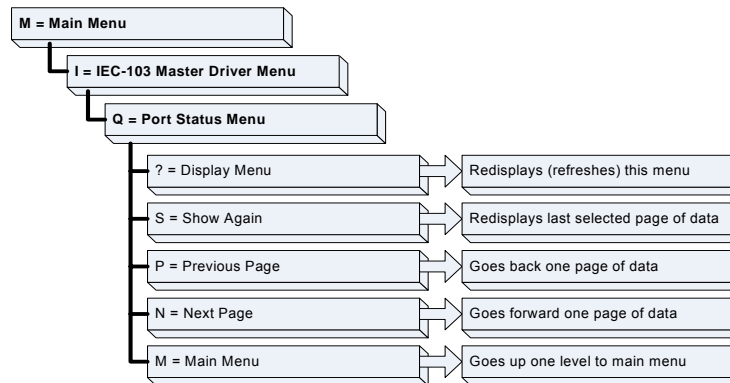
Press **[P]** to display the previous 100 registers. Use this command to step backward through the data a page at a time.

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

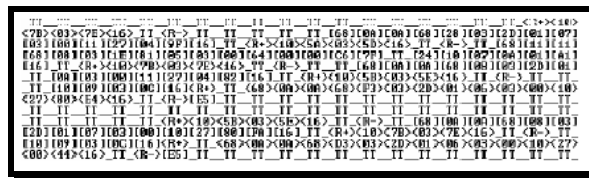
The data analyzer mode allows you to view all bytes of data transferred on each port. Both the transmitted and received data bytes are displayed. Use of this feature is limited without a thorough understanding of the protocol.

Note: The Port selection commands on the Data Analyzer menu differs very slightly in different modules, but the functionality is basically the same. Use the illustration above as a general guide only. Refer to the actual data analyzer menu on your module for the specific port commands to use.

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 press **[S]** to stop the data analyzer, and then press **[M]** to return to the main menu. This action will allow the module to resume its normal high speed operating mode.

Analyzing Data for the first application port

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



Analyzing Data for the second application port

Press **[2]** to display I/O data for the second application port 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.

Key	Interval
[5]	1 milliseconds ticks
[6]	5 milliseconds ticks
[7]	10 milliseconds ticks
[8]	50 milliseconds ticks
[9]	100 milliseconds ticks
[0]	Turn off timing marks

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]_TT_[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][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][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][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_<R+><01><03><00><00><00><0A><C5><CD><R->
_TT_[01][03][14][00][00][00][00][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]_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]_TT_[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 troubleshooting session. Before disconnecting from the Config/Debug port, please press **[S]** to stop the data analyzer, and then press **[M]** to return to the main menu. This action will allow the module to resume its normal high speed operating mode.

Returning to the Main Menu

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

4.1.12 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

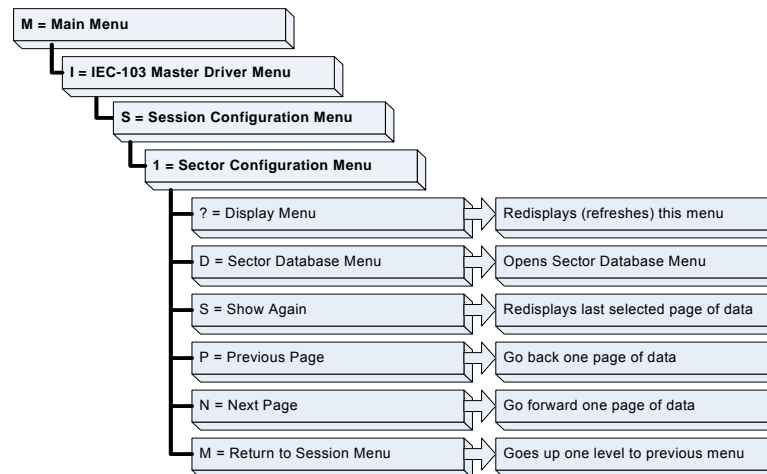
The Online State indicator displays 0 if the module is not online, 1 if the module is online.

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.

4.1.13 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.

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

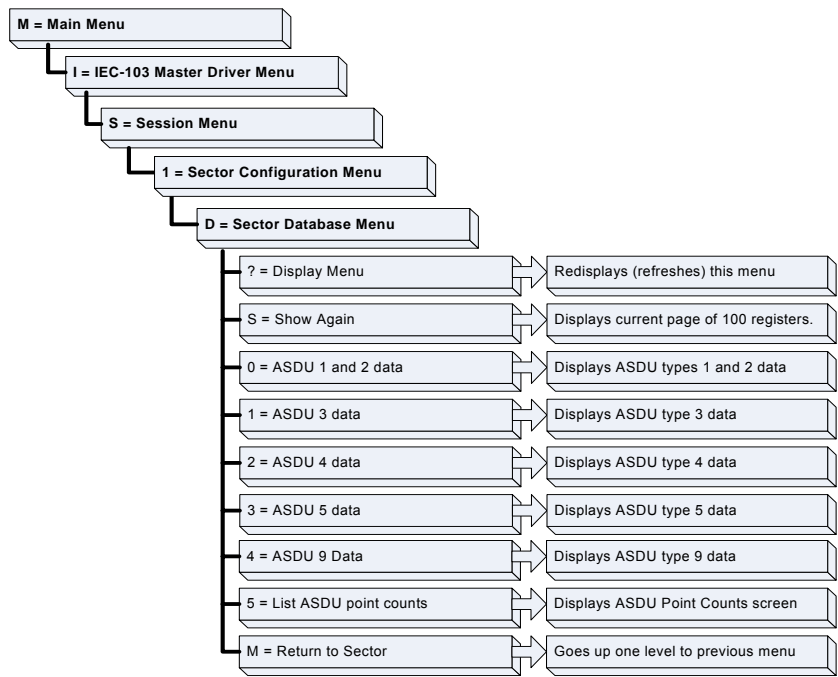
Press **[P]** to display the previous 100 registers. Use this command to step backward through the data a page at a time.

Returning to the Main Menu

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

4.1.14 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 SECTOR 0 DATABASE SIZES:
ASDU      COUNT
 182      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 MVI56-103MR is working normally.
		On	The MVI56-103MR 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 ProSoft Technology, 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 ControlLogix 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

Problem Description	Steps to take
Processor Fault	Verify that the module is plugged into the slot that has been configured for the module. Verify that the slot in the rack configuration has been set up correctly in the ladder logic.
Processor I/O LED flashes	This indicates a problem with backplane communications. Verify that all modules in the rack are configured in the ladder logic.

Module Errors

Problem Description	Steps to take
BP ACT LED remains off or blinks slowly	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: <ul style="list-style-type: none"> ▪ The processor is in Run mode. ▪ The backplane driver is loaded in the module. ▪ The module is configured for read and write block data transfer. ▪ The ladder logic handles all read and write block situations. ▪ The module is configured in the processor.
OK LED remains red	The program has halted or a critical error has occurred. Connect to the Configuration/Debug port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert the card in the rack, and then restore power to the rack.

5 Reference

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5.1 Product Specifications

The MVI56 IEC 60870-5-103 Master Communication Module with Reduced Data Block allows ControlLogix 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.

This module uses a small I/O data area for data transfer between the module and the ControlLogix processor, making it ideal for ControlNet applications.

5.1.1 Features and Benefits

The MVI56-103MR 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 ControlLogix processor over the backplane.

5.1.2 General Specifications

- Single Slot - 1756 backplane compatible
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module
- Ladder Logic is used for data transfer between module and processor. Sample ladder file included.
- Configuration data obtained from configuration text file downloaded to module. Sample configuration file included
- Local or remote rack

5.1.3 Hardware Specifications

Specification	Description
Backplane Current Load	800 mA @ 5 V DC; 3mA @ 24V DC
Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Shock	30g Operational 50g non-operational Vibration: 5 g from 10 to 150 Hz
Relative Humidity	5% to 95% (non-condensing)
LED Indicators	Module Status Backplane Transfer Status Application Status Serial Activity
Debug/Configuration port (CFG)	
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) RS-232 only
Application ports (PRT1 & PRT2)	
Full hardware handshaking control, providing radio, modem and multi-drop support	
Software configurable communication parameters	Baud rate: 110 to 115,200 baud, depending on protocol RS-232 and 422 Parity: none, odd or even Data bits: 5, 6, 7, or 8 Stop bits: 1 or 2 RTS on/off delay: 0 to 65535 milliseconds
App Ports (P1,P2) (Serial modules)	RJ45 (DB-9M with supplied cable) RS-232 handshaking configurable 500V Optical isolation from backplane
Shipped with Unit	RJ45 to DB-9M cables for each port 6-foot RS-232 configuration cable

5.1.4 Functional Specifications

The MV56-103MR 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
- This module uses a small I/O data area for data transfer between the module and the ControlLogix processor
- User-definable module memory usage
- 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 parameters 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

This section provides an overview of how the MVI56-103MR module transfers data using the 103MR protocol. You should understand the important concepts in this chapter before you begin installing and configuring the module.

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

Publication	Title
IEC 60870-5-101	Companion Standard for Basic Telecontrol Tasks
IEC 60870-5-101 Amendment 1	Companion Standard for Basic Telecontrol Tasks
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
IEC 60870-5-104	Network access for IEC 60870-5-101 using standard transport profiles

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. 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 MVI56-103MR module.

Module Power Up

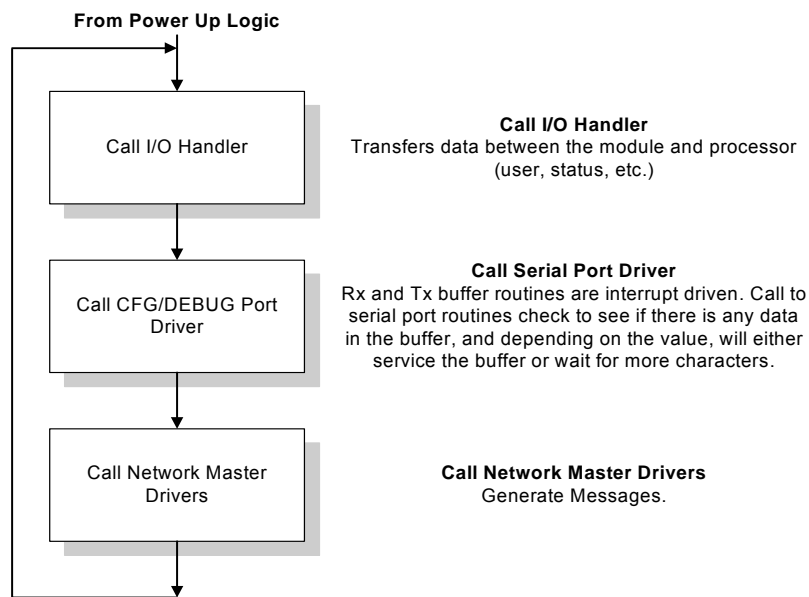
On power up the module begins performing the following logical functions:

- 1 Initialize hardware components
- 2 Initialize ControlLogix backplane driver
- 3 Test and clear all RAM
- 4 Initialize the serial communication ports
- 5 Read configuration for module from IEC103M.CFG file on Compact Flash Disk
- 6 Initialize the databases and ports
- 7 Set up the serial communication interface for the debug/configuration port

After the module has received the configuration, the module begins 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:



Backplane Data Transfer

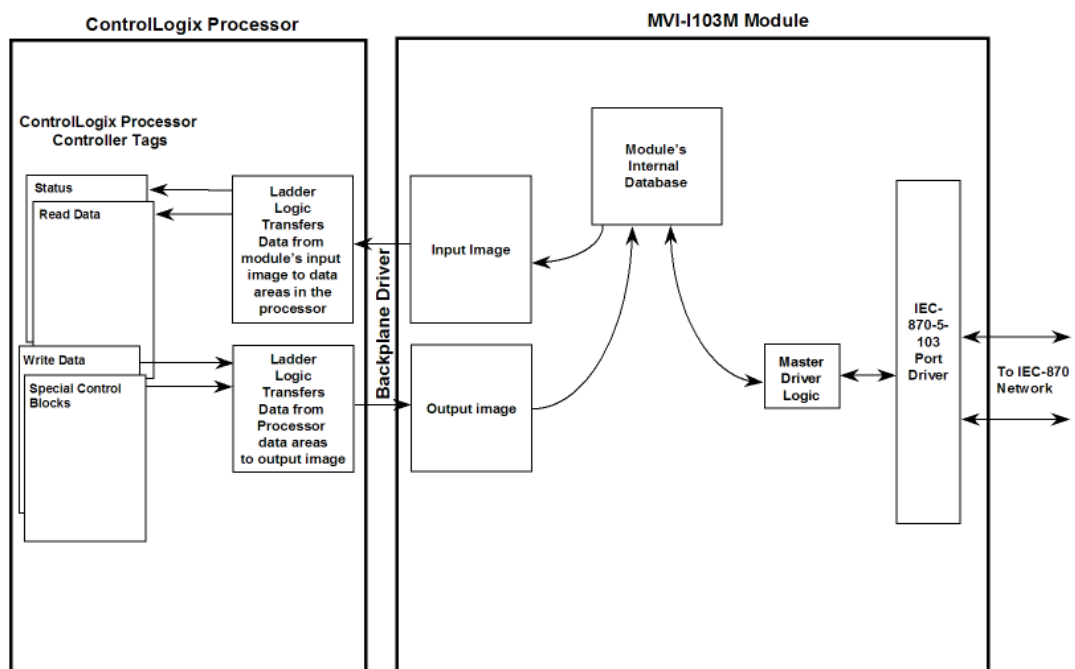
The MVI56-103MR module communicates directly over the ControlLogix backplane. Data travels between the module and the ControlLogix processor across the backplane using the module's input and output images and MSG instructions. The update frequency of the data is determined by the scan rate defined by the user for the module and the communication load on the module for the input and output images. Typical updates are in the range of 1 to 10 milliseconds. Execution time for the MSG instructions for data transfer are dependant on the amount of unscheduled time in the Network Update Time (NUT) and how frequently the instruction is executed.

Data received by the master drivers is placed in the module's input image. This data is processed by the ladder logic in the ControlLogix processor. The input image for the module is set to 84 bytes. This data is transferred in the scheduled I/O timeslot.

The processor inserts data in the module's output image to transfer to the module. The module's program extracts the data and transmits the data out to the master driver to the serial network. Additionally, the ControlLogix processor can send special control blocks to the module to instruct it to perform a special task. The output image for the module is set to 84 bytes. This data is transferred in the scheduled I/O timeslot.

Status and control blocks are also passed between the module and the processor using MSG instructions initiated under ladder logic control. These blocks are transferred between the processor and the module in the unscheduled timeslot.

The following illustration shows the data transfer method used to move data between the ControlLogix processor, the MVI56-103MR module, and the serial network for the scheduled I/O data.



As shown in the previous diagram, all data transferred between the module and the processor over the backplane is through the input and output images. Ladder logic must be written in the ControlLogix processor to interface the input and output image data defined in the controller tags. The user is responsible for handling and interpreting all data received on the application ports and transferred to the input image.

When interfacing data in the processor to that of the IEC-870-5-103 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 three 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..+1-2 to 12
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 three 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 to 2 to 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

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

Addressing the Data Types

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

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 modules database. Identification objects are stored as byte values in the modules database. Identification object address 1000 is stored in the module's database in word addresses 500 to 505.

When setting the monitored data and commands, each point is defined by its ASDU type, function code, and information number. Valid function codes are listed in the following table:

Function Code	Symbol	Number
Distance Protection	T(z)	128
Over-current Protection	I>>	160
Transformer Differential Protection	rlt	176
Line Differential Protection	rll	192
Global Function Type	GLB	255

Refer to Protocol Interoperability Documentation for a full listing of the protocol support offered by the module.

Using Data Blocks

As blocks are transferred between the module and the processor, each block contains block identification codes that define the content or function of the block of data transferred. The block identification codes used by the module are displayed in the following table.

Blocks -1 and 0 contain no data when transferred from the processor to the module. Blocks 1 to 100 are utilized to transfer data stored or to be stored in the module's database 40-words of data per block. 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.

Type	Block Range	Descriptions
I/O	-1	Null block
I/O	0	Null block
I/O	1 to 100	Read or write data
MSG	9250	Error/Status Data
MSG	9901	User Constructed Command
MSG	9902	Command Control Block (Add command to Command List Queue)
I/O	9903	Event Messages from Master port
MSG	9950	Command List Error data
I/O	9970	Set PLC time using module's time
I/O	9971	Set module's time using PLC time
I/O	9998	Warm Boot Request from PLC (Block contains no data)
I/O	9999	Cold Boot Request from PLC (Block contains no data)

As can be seen in the table, some data is transferred between the module and the ControlLogix processor using the input and output images (Type=I/O), and some is transferred using MSG blocks (Type=MSG). Data transferred using the input and output images is used for high-speed, deterministic delivery time data. The MSG data is used for lower priority data and must be interfaced using MSG instructions under ladder logic control. This last set of data is handled when there is time available in the unscheduled bandwidth of the Network Update Time (NUT).

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. This data is transferred through read (input image) and write (output image) blocks. Refer to Module Configuration for a description of the data objects used with the blocks and the ladder logic required. The following topics discuss the structure and function of each block.

Read Block

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

Offset	Description	Length
0	Write Block ID (1 to 100)	1
1 to 40	Read Data	40
41	Read Block ID (1 to 100)	1

The Block Identification Code (word 41) is used to signal to the ControlLogix 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 40 words of data contained in the database of the module.

The block also contains the block identification code the module expects to receive from the processor (word 0 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 ControlLogix processor to the module. The structure of the output image used to transfer this data is shown in the following table.

Offset	Description	Length
0	Write Block ID (1 to 100)	1
1 to 40	Write Data	40
41	Spare	1

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 100, 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

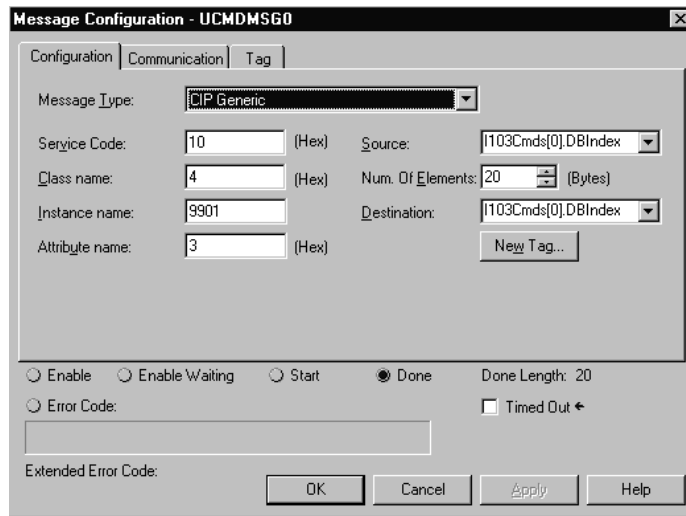
Block identification codes greater than 9900 perform special functions in the module. Some of these blocks are high-priority and are moved between the processor and the module through the input and output images. Others are of low-priority and are moved using MSG instruction blocks. Each control block 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 using MSG blocks. When the module receives a block 9901 identification code, it places the included commands into the command queue. The data required for this block must be placed in a controller tag and passed to the MSG block instruction. The following table lists the parameters required for a user command:

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

This block requires the following parameters in the MSG block:



The data returned to the processor after the message block is processed is that passed to the module.

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

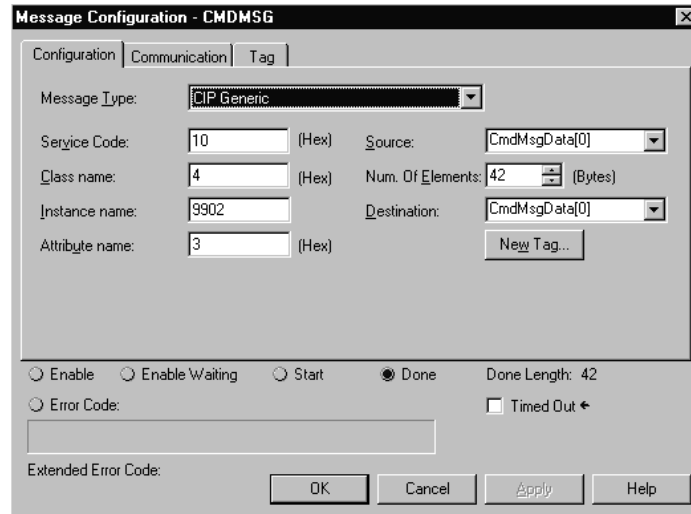
This block and block 9902 should be used when controlling double-point data points in remote units using general commands. The addressing for general commands is done using bit addressing. This provides complete control of the slave devices under ladder logic control. Alternatively, the slaves can be 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. This block is passed to the module using a MSG block. The structure of the MSG block data is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	Command count	This field contains the number of commands to enable in the command list. Valid values for this field are 1 to 20.
1 to 20	Command Numbers to enable	These 20 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.

An example MSG instruction block is shown in the following figure:



If the MSG is executed by the module, the data received in the block is that passed back to the block. If any of the parameters in the block are not correct, the command count filed in the data area will be set to zero. Ladder logic should copy the data received from the block into the appropriate controller data area.

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. 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 and are passed in the input image. The format of the block is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	Block ID	This is the next block requested by the module.
1	Event Count	This field contains the number of events present in the block. Values of 1 to 3 are valid.
2 to 11	Event 1	Event message
12 to 21	Event 2	Event message
22 to 31	Event 3	Event message
32 to 40	Spare	Not Used
41	Block ID	This field contains the block identification code of 9903 for the block.

The format of each 10-word data region in the block 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 point index for the 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.
4	Sec/milliseconds	This word contains the seconds and milliseconds 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).

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.

Ladder logic must copy different events to different data files according to the application criteria (selection by time, section index, function code, etc.).

Command List Error Data Block (9950)

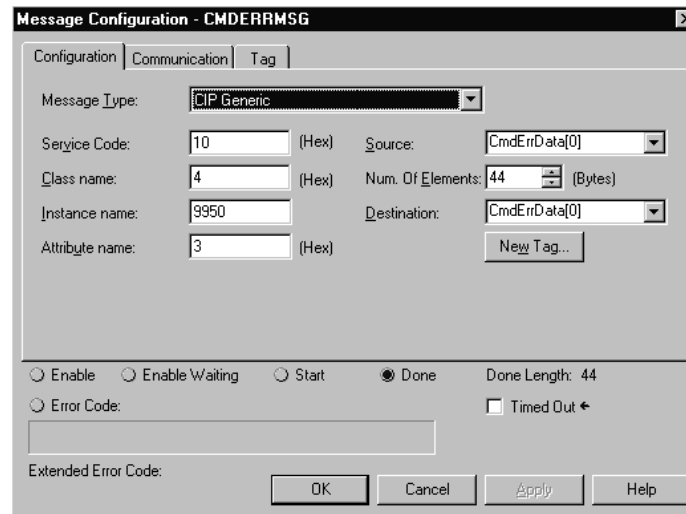
Block 9950 identification code requests the Command List Error Table from the module for the 1000 user-configurable commands. This block of data is requested using the MSG instruction. The format of the data in the MSG block is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	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 20.
1	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.
2 to 21	Spare	Not Used

The module responds to a valid request with a block containing the requested error information. The format for the block is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	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 20.
1	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.
2 to 21	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 2) is specified in word 1 of the block. The number of valid command errors in the block is set in word 0 of the block. Refer to the command error list to interpret the error codes reported.

The following figure displays the MSG instruction configuration for a block of this type:



Get Module Time Block (9970)

Block 9970 identification code requests the module's date and time. This data is requested in the output image and returned in the input image. Use this data to set the PLC clock. The format of the output image to request this block is shown in the following table:

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 41	Not Used	Not Used

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

Word Offset in Block	Data Field(s)	Description
0	Block Write ID	This is the next block requested by the module.
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 40	Not Used	Not Used
41	Block Read ID	This field contains the block identification code of 9970 for the block.

Set Module Time Block (9971)

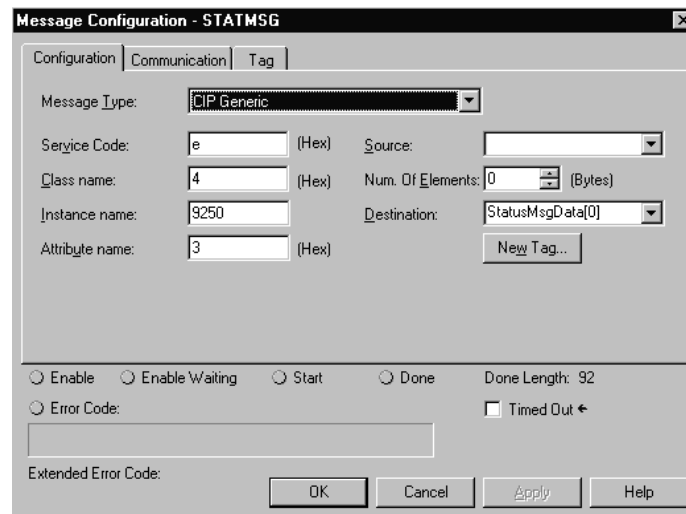
Block identification code 9971 passes the clock time in the PLC to the module. The date and time provided will be used to set the module's clock. The format of the output image used to pass this data from the processor to the module is shown in the following table:

Word Offset in Block	Data Field(s)	Description
0	Block ID	This field contains the block identification code of 9971 for the block.
1	Year	This field contains the four-digit year to be used with the new time value.
2	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.

Word Offset in Block	Data Field(s)	Description
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 41	Not Used	Not Used

Error/Status Block (9250)

The error status data for the module is passed to the processor in a MSG block when requested by the ladder logic. An example MSG instruction set up is shown in the following diagram:



The format of this 46-word block returned to the processor has the following 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 'I3M5' for the MVI56 platform (ASCII format).
3 to 4	Revision	This two-word data area contains the text values for the revision number (ASCII format).
5 to 6	Op Sys #	This two-word data area contains the text values for the operating system number (ASCII format).

Offset	Parameter	Description
7 to 8	Run Number	This two-word data area contains the text values for the run number (ASCII format).
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.
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 received from the slave 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.

Offset	Parameter	Description
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.

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 41	Spare	41

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:

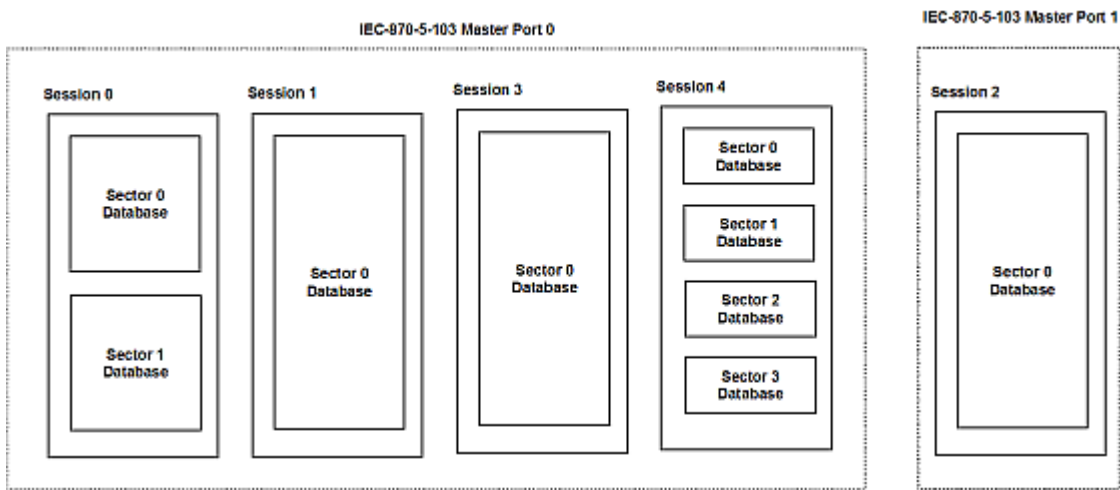
Offset	Description	Length
0	9999	1
1 to 41	Spare	41

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-870-5-103 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.



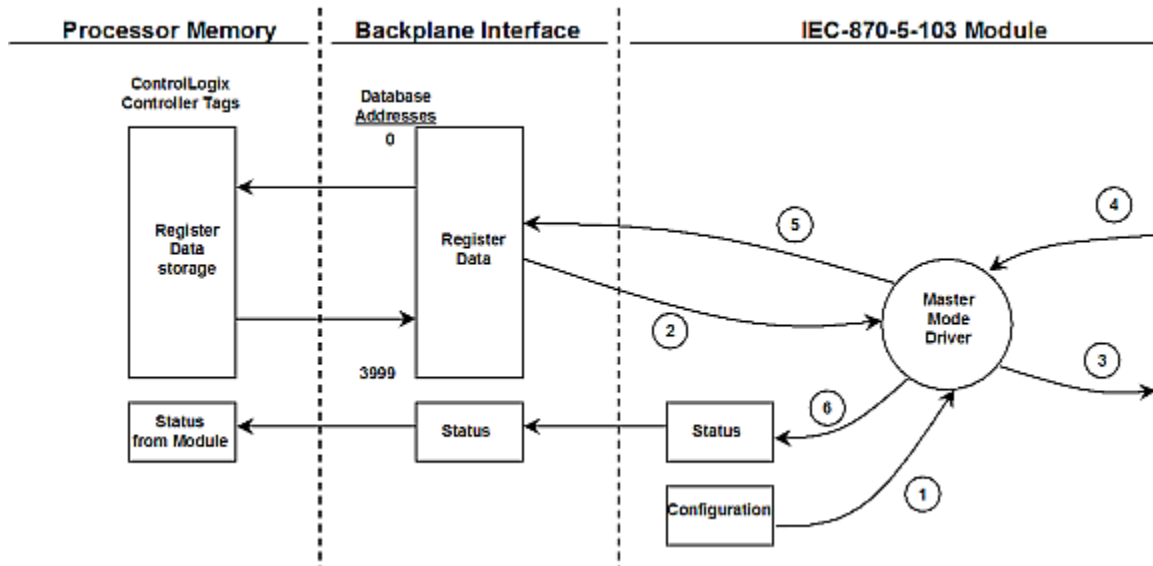
Port 0 on the module communicates with 4 sessions (0, 1, 3 and 4), each of which contain their own data set(s). Session 1 only has one sector (all data for device contained in a single database). This sector is addressed by the master using the Common address of ASDU value set for the sector in the configuration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

The IEC-870-5-103 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. Up to five sectors can be defined within each session. 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 by the user in the configuration file.

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 constructs control commands using the data in the database
- 3 The master sends 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

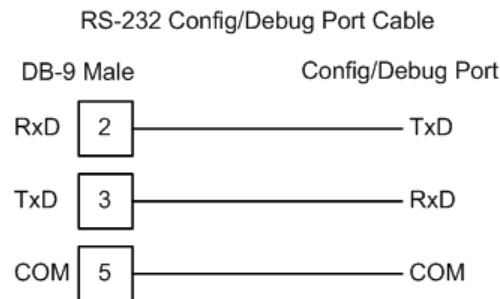
5.3 Cable Connections

The application ports on the MVI56-103MR module support RS-232, RS-422, and RS-485 interfaces. Please inspect 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

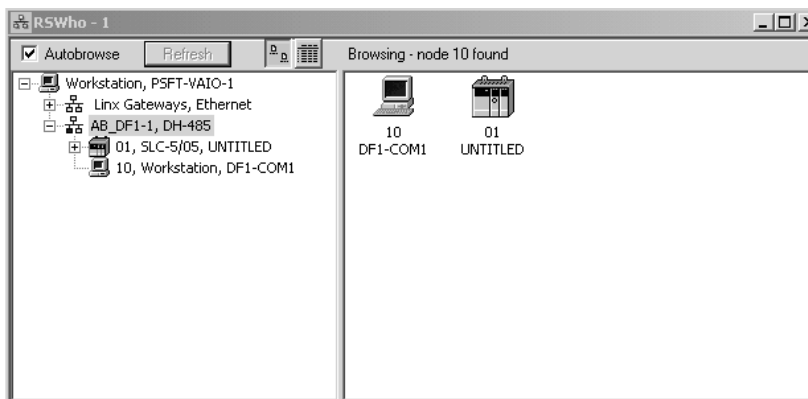
This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC based terminal emulation program to view configuration and status data in the module and to control the module. The cable for communications on this port is shown in the following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



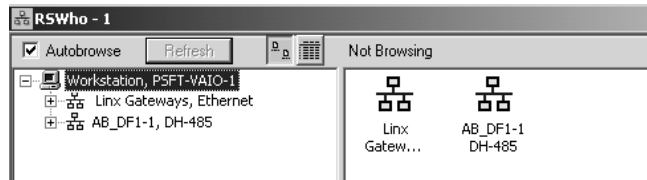
Disabling the RSLinx Driver for the Com Port on the PC



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 ProSoft Configuration Builder (PCB), HyperTerminal or another terminal emulator, follow these steps to disable the RSLinx Driver.

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



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

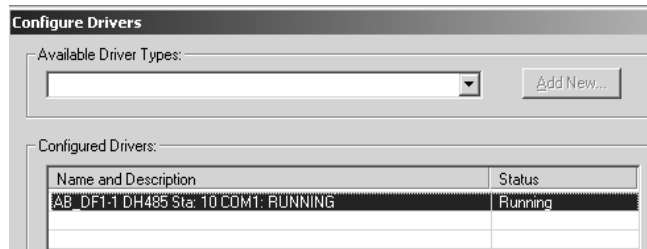


Branches are displayed or hidden by clicking on the  or the  icons.

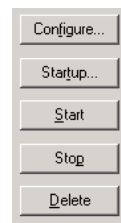


- 4 When you have verified that the driver is not being browsed, go to **Communications>Configure Drivers**

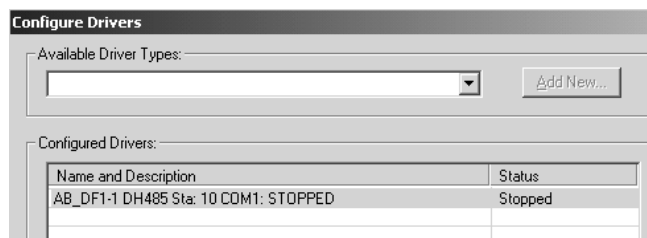
You may see something like this:



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



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

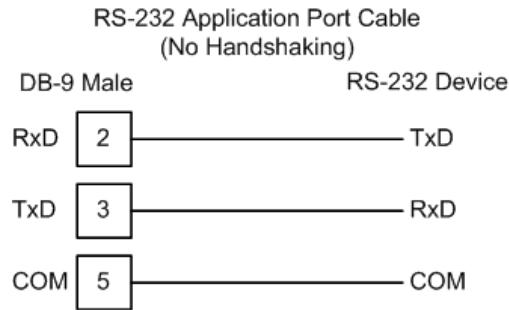


- 6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

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

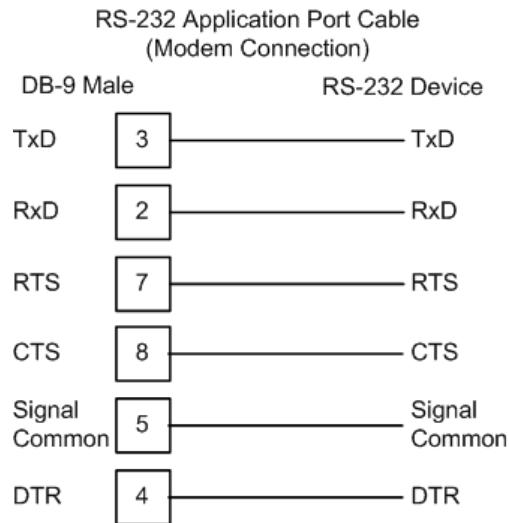
5.3.2 RS-232

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

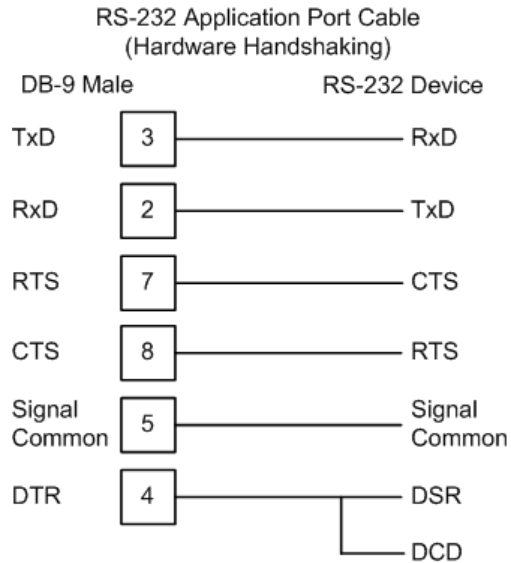
This type of connection is required between the module and a modem or other communication device.



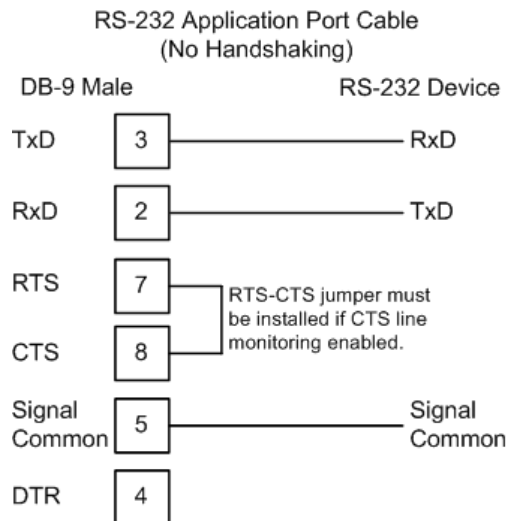
The "Use CTS Line" parameter for the port configuration should be set to 'Y' for most modem applications.

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).

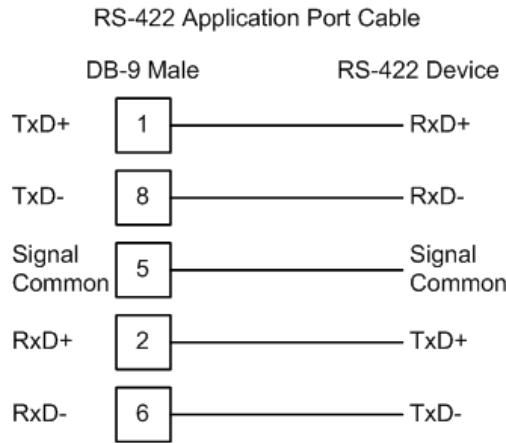
RS-232: Null Modem Connection (No Hardware Handshaking)

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



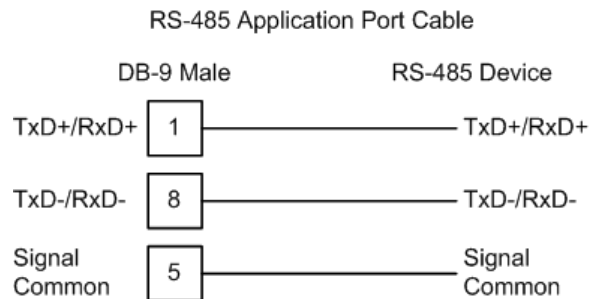
Note: If the port is configured with the "Use CTS Line" set to 'Y', then a jumper is required between the RTS and the CTS line on the module connection.

5.3.3 RS-422



5.3.4 RS-485

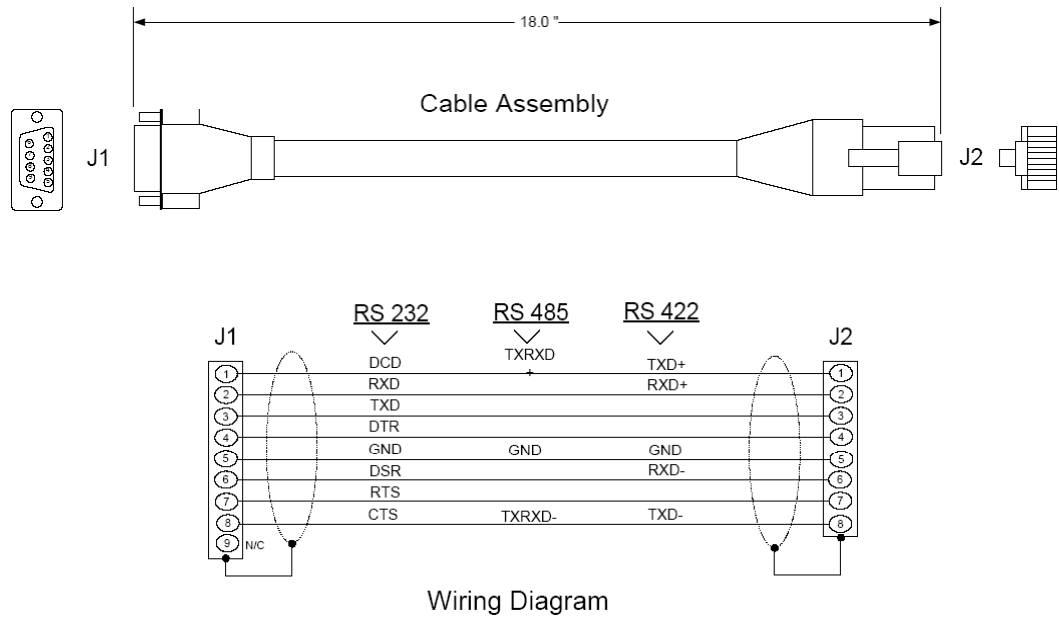
The RS-485 interface requires a single two or three wire cable. The Common connection is optional and dependent on the RS-485 network. The cable required for this interface is shown below:



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)



5.4 MVI56-103MR Status Data Area

This section contains a listing of the data contained in the MVI56-103MR status data object, configuration error word and module error codes return in an MSG block.

5.4.1 MVI56A-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 'I3M5' for the MVI56 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.

Offset	Parameter	Description
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.
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.

Offset	Parameter	Description
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	

5.4.2 MVI56A-IEC 60870-5-103 Master Communication Module Error Codes

The following table lists all potential errors that can be generated by the IEC-870-5-103 Master driver:

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
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

Error	Description
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

5.5 MVI56-103MR Configuration Data Definition

This section contains a listing of the parameters and their definitions for the MVI56-103MR module configuration file definition (IEC103M.CFG).

5.5.1 MVI56 IEC 60870-5-103 Master Communication Module Configuration

[Section]/Item	Value	Range	Description
[Backplane Configuration]			Backplane transfer parameters
Module Name:		0 to 80 characters	This parameter assigns a name to the module that can be viewed using the configuration/debug port. Use this parameter to identify the module and the configuration file.
Write Register Start:		0 to 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.

[Section]/Item	Value	Range	Description
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.
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 to 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	This parameter sets the parity to be used on the port. The values correspond to the following settings: N=None, O=Odd, E=Even. Note: the specification only utilizes Even Parity.
RTS On:		0 to 65535	The parameter sets the RTS presend delay. The value entered represents the number of milliseconds the module will wait after setting the RTS modem line before sending the data.
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.

[Section]/Item	Value	Range	Description
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 supports 1 to 5 sectors 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 ³² -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.
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 ³² -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 ³² -1	This parameter sets the minimum number of milliseconds to delay between class 2 polls for pending data.

[Section]/Item	Value	Range	Description
Class 1 Poll Delay:		0 to 2 ³² -1	This parameter sets the minimum number of milliseconds to delay between each class 1 poll.
Class 2 Poll Delay:		0 to 2 ³² -1	This parameter sets the minimum number of milliseconds to delay between each class 2 poll.
Response Timeout:		0 to 2 ³² -1	This parameter sets the maximum number of milliseconds to wait for a confirmation from the controlled station to a request from this module.

[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.
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	Value	Range	Description
[IEC-103 MASTER COMMANDS]			This section contains the commands for the module
# Enable DB Poll Session Sector Data Func Point Ovrdr			
# Code Index Interval Index Index Type Code Index Flag Val			
START			
END			

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
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
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	ΔI_T
192	Line differential protection	ΔI_L
254	Generic function type	GEN
255	Global function type	GLB

5.8.4 Information Numbers Used In Monitor DirectionSystem functions

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	ΔI_T	ΔI_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	160	176	192	254	255
				t(z)	I>>	ΔI_T	ΔI_L	GEN	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		

Inf	Description	GI	Type	Fun						
				128	160	176	192	254	255	
				t(z)	I>>	ΔI_T	ΔI_L	GEN	GLB	
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	160	176	192	254	255	
				t(z)	I>>	ΔI_T	ΔI_L	GEN	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	160	176	192	254	255	
				t(z)	I>>	ΔI_T	ΔI_L	GEN	GLB	
48	earth fault L ₁	X	1	X	X					
49	earth fault L ₂	X	1	X	X					
50	earth fault L ₃	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>>	ΔI_T	ΔI_L	GEN	GLB	
64	start/pick-up L ₁	X	2	X	X		X			
65	start/pick-up L ₂	X	2	X	X		X			
66	start/pick-up L ₃	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 ₁		2	X	X	X	X			

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	ΔI_T	ΔI_L	GEN	GLB
70	trip L ₂		2	X	X	X	X		
71	trip L ₃		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 ₁		2			X			
87	trip measuring system L ₂		2			X			
88	trip measuring system L ₃		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>>	ΔI_T	ΔI_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>>	ΔI_T	ΔI_L	GEN	GLB
144	measurand I		3.1	X	X				
145	measurands I, V		3.2	X	X				

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	ΔI_T	ΔI_L	GEN	GLB
146	measurands I, V, P, Q		3.3	X					
147	measurands I _N , V _{EN}		3.4	X	X				
148	measurands I _{L1,2,3} , V _{L1,2,3} , P, Q, f		9	X					

Generic functions

Inf	Description	GI	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	ΔI_T	ΔI_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	Type	Fun					
			128	160	176	192	254	255
			t(z)	I>>	ΔI_T	ΔI_L	GEN	GLB
0	initiation of general interrogation	7						X
0	time synchronization	6						X

General commands

Inf	Description	Com	Type	Fun					
				128	160	176	192	254	255
				t(z)	I>>	ΔI_T	ΔI_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					

Inf	Description	Com	Type	Fun						
				128	160	176	192	254	255	
				t(z)	l>>	ΔI_T	ΔI_L	GEN	GLB	
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)	l>>	ΔI_T	ΔI_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 DirectionType 1: Time-tagged

Bytes	Description	Spec
1	Value of 1	
1	0x81	
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	

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
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 ₂	7.2.6.8
2	Voltage L ₁ to L ₂	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 _N and val2=V _{EN}		

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	
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 ₁	7.2.6.8
2	Current L ₂	7.2.6.8
2	Current L ₃	7.2.6.8
2	Voltage L _{1 to E}	7.2.6.8
2	Voltage L _{2-E}	7.2.6.8
2	Voltage L _{3-E}	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 L₁ value.

Definition and Presentation Of ASDUs In Control Direction

Type 6: Time synchronization

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

5.9 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

5.9.1 Physical Layer

5.9.2 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.

5.9.3 Optical Interface

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

5.9.4 Transmission speed

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

5.9.5 Link Layer

There are no choices for the link layer.

5.9.6 Application Layer

5.9.7 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.

5.9.8 Common Address of ASDU

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

5.9.9 Selection of standard information numbers in monitor direction

5.9.10 System functions in monitor direction

	INF	Semantics
<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

5.9.11 Status indications in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<16>	Auto-recloser active
<input checked="" type="checkbox"/>	<17>	Teleprotection active
<input checked="" type="checkbox"/>	<18>	Protection active
<input checked="" type="checkbox"/>	<19>	LED reset
<input checked="" type="checkbox"/>	<20>	Monitor direction blocked
<input checked="" type="checkbox"/>	<21>	Test mode
<input checked="" type="checkbox"/>	<22>	Local parameter setting
<input checked="" type="checkbox"/>	<23>	Characteristic 1
<input checked="" type="checkbox"/>	<24>	Characteristic 2
<input checked="" type="checkbox"/>	<25>	Characteristic 3
<input checked="" type="checkbox"/>	<26>	Characteristic 4
<input checked="" type="checkbox"/>	<27>	Auxiliary input 1
<input checked="" type="checkbox"/>	<28>	Auxiliary input 2
<input checked="" type="checkbox"/>	<29>	Auxiliary input 3
<input checked="" type="checkbox"/>	<30>	Auxiliary input 4

5.9.12 Supervision indications in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<32>	Measurand supervision I
<input checked="" type="checkbox"/>	<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

5.9.13 Earth fault indications in monitor direction

INF Semantics

- <48> Earth fault L₁
- <49> Earth fault L₂
- <50> Earth fault L₃
- <51> Earth fault forward, that is, line
- <52> Earth fault reverse, that is, busbar

5.9.14 Fault indications in monitor direction

INF Semantics

- <64> Start /pick-up L₁
- <65> Start /pick-up L₂
- <66> Start /pick-up L₃
- <67> Start /pick-up N
- <68> General trip
- <69> Trip L₁
- <70> Trip L₂
- <71> Trip L₃
- <72> Trip I>> (back-up operation)
- <73> Fault location X in ohms
- <74> Fault forward/line
- <75> Fault reverse/busbar
- <76> Teleprotection signal transmitted
- <77> Teleprotection signal received
- <78> Zone 1
- <79> Zone 2

-
- <80> Zone 3
 - <81> Zone 4
 - <82> Zone 5
 - <83> Zone 6
 - <84> General start/pick-up
 - <85> Breaker failure
 - <86> Trip measuring system L₁
 - <87> Trip measuring system L₂
 - <88> Trip measuring system L₃
 - <89> Trip measuring system E
 - <90> Trip I>
 - <91> Trip I>>
 - <92> Trip IN>
 - <93> Trip IN>>

5.9.15 Auto-reclosure indications in monitor direction

INF Semantics

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

5.9.16 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

5.9.17 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

5.9.18 Selection of standard information numbers in control direction

5.9.19 System functions in control direction

INF Semantics

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

5.9.20 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

5.9.21 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

5.9.22 Basic application functions

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

5.9.23 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 ₁	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Current L ₂	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Current L ₃	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L _{1-E}	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L _{2-E}	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L _{3-E}	<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 ₁ - L ₂	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>

6 Support, Service & Warranty

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- Return Material Authorization (RMA) Policies and Conditions 113
- Procedures for Return of Units Under Warranty..... 113
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Be sure and read the full Warranty that can be found on our web site at www.prosoft-technology.com for details and other terms and conditions. The content in this summary is subject to change without notice. The content is current at date of publication.

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

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

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

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

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

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

For technical support calls within the United States, an after-hours answering system allows pager access to one of our qualified technical and/or application support engineers at any time to answer your questions.

6.1 How to Contact Us: Sales and Support

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

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

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

Asia Pacific (office in Malaysia)

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

China Pacific (office in China)

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

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

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

Brasil (office in Sao Paulo)

+55-11-5084-5178
+55-11-5083-3776 (Fax)
Rua Vergueiro, 2949 - sala 182 - Edifício Vergueiro Work Center
Vila Mariana - São Paulo
Cep: 04101-300 - Brasil
+55-11-5084-5178, eduardo@prosoft-technology.com
Languages spoken include: Portuguese, English

6.2 Return Material Authorization (RMA) Policies and Conditions

The following RMA Policies and Conditions apply to any returned product. These RMA Policies are subject to change by ProSoft without notice. For warranty information, see Section C below entitled "Limited Warranty". In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

6.2.1 All Product Returns

- 1 In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Returned Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.
- 2 In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above in Section A. A Technical Support Engineer will request several tests in an attempt to isolate the problem. If after these tests are completed, the Product is found to be the source of the problem, ProSoft will issue an RMA.
- 3 All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
- 4 Out of warranty returns are not allowed on RadioLinx accessories such as antennas, cables, and brackets.

The following policy applies for Non-Warranty Credit Returns:

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

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

6.3 Procedures for Return of Units Under Warranty

- 1 A Technical Support Engineer must pre-approve all product returns.
- 2 Module is repaired or replaced after a Return Material Authorization Number is entered and a replacement order is generated.
- 3 Credit for the warranted item is issued within 10 business days after receipt of product and evaluation of the defect has been performed by ProSoft. The credit will only be issued provided the product is returned with a valid Return Material Authorization Number and in accordance with ProSoft's shipping instructions.

- a) If no defect is found, a credit is issued.
- b) If a defect is found and is determined to be customer generated or if the defect is otherwise not covered by ProSoft's Warranty, or if the module is not repairable, a credit is not issued and payment of the replacement module is due.

6.4 Procedures for Return of Units Out of Warranty

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

6.4.1 Un-repairable Units

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

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

6.4.2 Purchasing Warranty Extension

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

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

6.5 LIMITED WARRANTY

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

6.5.1 What Is Covered By This Warranty

- A** *Warranty On New Products:* ProSoft warrants, to the original purchaser only, that the Product that is the subject of the sale will (1) conform to and perform in accordance with published specifications prepared, approved, and issued by ProSoft, and (2) will be free from defects in material or workmanship; provided these warranties only cover Product that is sold as new. This Warranty expires one year (or in the case of RadioLinx modules, three years) from the date of shipment (the "Warranty Period"). If the Customer discovers within the Warranty Period a failure of the Product to conform to specifications, or a defect in material or workmanship of the Product, the Customer must promptly notify ProSoft by fax, email or telephone. In no event may that notification be received by ProSoft later than 15 months (or in the case of RadioLinx modules, 39 months) from the date of delivery. Within a reasonable time after notification, ProSoft will correct any failure of the Product to conform to specifications or any defect in material or workmanship of the Product, with either new or used replacement parts. Such repair, including both parts and labor, will be performed at ProSoft's expense. All warranty service will be performed at service centers designated by ProSoft. If ProSoft is unable to repair the Product to conform to this Warranty after a reasonable number of attempts, ProSoft will provide, at its option, one of the following: a replacement product, a full refund of the purchase price or a credit in the amount of the purchase price. All replaced product and parts become the property of ProSoft. These remedies are the Customer's only remedies for breach of warranty.
- B** *Warranty On Services:* Material and labor used by ProSoft to repair a verified malfunction or defect are warranted on the terms specified above

- for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.
- C** The Warranty Period for RadioLinx accessories (such as antennas, cables, brackets, etc.) are the same as for RadioLinx modules, that is, three years from the date of shipment.

6.5.2 What Is Not Covered By This Warranty

- A** ProSoft makes no representation or warranty, expressed or implied, that the operation of software purchased from ProSoft will be uninterrupted or error free or that the functions contained in the software will meet or satisfy the purchaser's intended use or requirements; the Customer assumes complete responsibility for decisions made or actions taken based on information obtained using ProSoft software.
- B** With the exception of RadioLinx accessories referenced in paragraph 1(c) this Warranty does not cover any product, components, or parts not manufactured by ProSoft.
- C** This Warranty also does not cover the failure of the Product to perform specified functions, or any other non-conformance, defects, losses or damages caused by or attributable to any of the following: (i) shipping; (ii) improper installation or other failure of Customer to adhere to ProSoft's specifications or instructions; (iii) unauthorized repair or maintenance; (iv) attachments, equipment, options, parts, software, or user-created programming (including, but not limited to, programs developed with any IEC 61131-3 programming languages, or "C") not furnished by ProSoft; (v) use of the Product for purposes other than those for which it was designed; (vi) any other abuse, misapplication, neglect or misuse by the Customer; (vii) accident, improper testing or causes external to the Product such as, but not limited to, exposure to extremes of temperature or humidity, power failure or power surges outside of the limits indicated on the product specifications; or (viii) disasters such as fire, flood, earthquake, wind or lightning.
- D** The information in this Agreement is subject to change without notice. ProSoft shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. The user guides included with your original product purchased by you from ProSoft, contains information protected by copyright. No part of the guide may be duplicated or reproduced in any form without prior written consent from ProSoft.

6.5.3 DISCLAIMER REGARDING HIGH RISK ACTIVITIES

PRODUCT MANUFACTURED OR SUPPLIED BY PROSOFT IS NOT FAULT TOLERANT AND IS NOT DESIGNED, MANUFACTURED OR INTENDED FOR USE IN HAZARDOUS ENVIRONMENTS REQUIRING FAIL-SAFE PERFORMANCE (INCLUDING, WITHOUT LIMITATION, THE OPERATION OF NUCLEAR FACILITIES, AIRCRAFT NAVIGATION OF COMMUNICATION SYSTEMS, AIR TRAFFIC CONTROL, DIRECT LIFE SUPPORT MACHINES OR WEAPONS SYSTEMS), IN WHICH THE FAILURE OF THE PRODUCT COULD LEAD DIRECTLY OR INDIRECTLY TO DEATH, PERSONAL INJURY, OR SEVERE PHYSICAL OR ENVIRONMENTAL DAMAGE (COLLECTIVELY, "HIGH RISK ACTIVITIES"). PROSOFT SPECIFICALLY DISCLAIMS ANY EXPRESS OR IMPLIED WARRANTY OF FITNESS FOR HIGH RISK ACTIVITIES.

6.5.4 DISCLAIMER OF ALL OTHER WARRANTIES

THE WARRANTIES SET FORTH IN PARAGRAPH 1 ABOVE ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

6.5.5 LIMITATION OF REMEDIES**

IN NO EVENT WILL PROSOFT (OR ITS DEALER) BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES BASED ON BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT TORT, OR ANY OTHER LEGAL THEORY. DAMAGES THAT PROSOFT AND ITS DEALER WILL NOT BE RESPONSIBLE FOR INCLUDE, BUT ARE NOT LIMITED TO: LOSS OF PROFITS; LOSS OF SAVINGS OR REVENUE; LOSS OF USE OF THE PRODUCT OR ANY ASSOCIATED EQUIPMENT; LOSS OF DATA; COST OF CAPITAL; COST OF ANY SUBSTITUTE EQUIPMENT, FACILITIES, OR SERVICES; DOWNTIME; THE CLAIMS OF THIRD PARTIES, INCLUDING CUSTOMERS OF THE PURCHASER; AND INJURY TO PROPERTY.

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

6.5.6 Time Limit for Bringing Suit

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

6.5.7 No Other Warranties

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

6.5.8 Intellectual Property

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

6.5.9 Additional Restrictions Relating To Software And Other Intellectual Property

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

6.5.10 Allocation of risks

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

6.5.11 Controlling Law and Severability

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

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