



**inRAX**<sup>®</sup>  
**MVI46-101M**

**SLC Platform**

IEC 60870-5-101 Master  
Communication Module

November 23, 2010

## **Your Feedback Please**

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

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MVI46-101M User Manual

November 23, 2010

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## **ProSoft Technology<sup>®</sup> Product Documentation**

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided on the enclosed CD-ROM, and are available at no charge from our web site: [www.prosoft-technology.com](http://www.prosoft-technology.com)

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

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## Important Installation Instructions

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

- A** WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;
- B** WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES
- C** WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- D** THIS DEVICE SHALL BE POWERED BY CLASS 2 OUTPUTS ONLY.

## MVI (Multi Vendor Interface) Modules

WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT - RISQUE D'EXPLOSION - AVANT DE DÉCONNECTER L'ÉQUIPEMENT, COUPER LE COURANT OU S'ASSURER QUE L'EMPLACEMENT EST DÉSIGNÉ NON DANGEREUX.

## Warnings

### North America Warnings

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

### ATEX Warnings and Conditions of Safe Usage:

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

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

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

## Battery Life Advisory

The MVI46, MVI56, MVI56E, MVI69, and MVI71 modules use a rechargeable Lithium Vanadium Pentoxide battery to backup the real-time clock and CMOS. The battery should last for the life of the module. The module must be powered for approximately twenty hours before the battery becomes fully charged. After it is fully charged, the battery provides backup power for the CMOS setup and the real-time clock for approximately 21 days. When the battery is fully discharged, the module will revert to the default BIOS and clock settings.

**Note:** The battery is not user replaceable.

## Markings

### Electrical Ratings

- Backplane Current Load: 800 mA @ 5 Vdc
- Operating Temperature: 0°C to 60°C (32°F to 140°F)
- Storage Temperature: -40°C to 85°C (-40°F to 185°F)
- Shock: 30g Operational; 50g non-operational; Vibration: 5 g from 10 Hz to 150 Hz
- Relative Humidity 5% to 95% (without condensation)
- All phase conductor sizes must be at least 1.3 mm(squared) and all earth ground conductors must be at least 4mm(squared).

### Agency Approvals and Certifications

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



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## Guide to the MVI46-101M 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.
Diagnostic and Troubleshooting	→	Diagnostics and Troubleshooting (page 55)	This section describes Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview	→	Reference (page 77) Product Specifications (page 78) Functional Overview	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 115) Index	This section contains Support, Service and Warranty information. Index of chapters.



# 1 Start Here

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To get the most benefit from this User Manual, you should have the following skills:

- **Rockwell Automation® RSLogix™ software:** launch the program, configure ladder logic, and transfer the ladder logic to the processor
- **Microsoft Windows:** install and launch programs, execute menu commands, navigate dialog boxes, and enter data
- **Hardware installation and wiring:** install the module, and safely connect 101 and SLC devices to a power source and to the MVI46-101M module's application port(s)

## 1.1 System Requirements

The MVI46-101M module requires the following minimum hardware and software components:

- Rockwell Automation SLC 5/02 M0/M1 capable processors (or newer), with compatible power supply and one free slot in the rack, for the MVI46-101M module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 500 programming software.
- Rockwell Automation RSLinx communication software
- Pentium® II 500 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft® Windows 98
  - Windows NT® (version 4 with SP4 or higher)
  - Windows 2000
  - Windows XP
- 32 Mbytes of RAM minimum, 64 Mbytes of RAM recommended
- 50 Mbytes of free hard disk space (or more based on application requirements)
- 16-color VGA graphics adapter, 640 x 480 minimum resolution (256 Color 800 × 600 recommended)
- CD-ROM drive

## 1.2 Package Contents

The following components are included with your MVI46-101M module, and are all required for installation and configuration.

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

Qty.	Part Name	Part Number	Part Description
1	MVI46-101M Module	MVI46-101M	IEC 60870-5-101 Master Communication Module
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection to the CFG Port
3	Cable	Cable #14, RJ45 to DB9 Male Adapter cable	For DB9 Connection to Module's Port
2	Adapter	1454-9F	Two Adapters, DB9 Female to Screw Terminal. For RS422 or RS485 Connections to Port 1 and 2 of the Module
1	ProSoft Solutions CD		Contains sample programs, utilities and documentation for the MVI46-101M module.

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

### 1.3 Installing ProSoft Configuration Builder Software

You must install the *ProSoft Configuration Builder (PCB)* software to configure the module. You can always get the newest version of *ProSoft Configuration Builder* from the ProSoft Technology website.

#### **Installing ProSoft Configuration Builder from the ProSoft website**

- 1 Open your web browser and navigate to <http://www.prosoft-technology.com/pcb>
- 2 Click the **DOWNLOAD HERE** link to download the latest version of *ProSoft Configuration Builder*.
- 3 Choose **SAVE** or **SAVE FILE** when prompted.
- 4 Save the file to your *Windows Desktop*, so that you can find it easily when you have finished downloading.
- 5 When the download is complete, locate and open the file, and then follow the instructions on your screen to install the program.

If you do not have access to the Internet, you can install *ProSoft Configuration Builder* from the *ProSoft Solutions Product CD-ROM*, included in the package with your module.

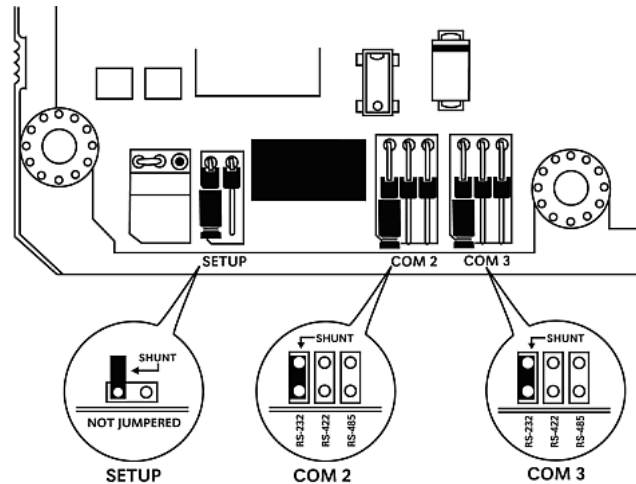
#### **Installing ProSoft Configuration Builder from the Product CD-ROM**

- 1 Insert the *ProSoft Solutions Product CD-ROM* into the CD-ROM drive of your PC. Wait for the startup screen to appear.
- 2 On the startup screen, click **PRODUCT DOCUMENTATION**. This action opens a *Windows Explorer* file tree window.
- 3 Click to open the **UTILITIES** folder. This folder contains all of the applications and files you will need to set up and configure your module.
- 4 Double-click the **SETUP CONFIGURATION TOOL** folder, double-click the **PCB\_\*.EXE** file and follow the instructions on your screen to install the software on your PC. The information represented by the "\*" character in the file name is the *PCB* version number and, therefore, subject to change as new versions of *PCB* are released.

**Note:** Many of the configuration and maintenance procedures use files and other utilities on the CD-ROM. You may wish to copy the files from the *Utilities* folder on the CD-ROM to a convenient location on your hard drive.

## 1.4 Setting Jumpers

If you use an interface other than RS-232 (default), you must change the jumper configuration to match the interface. The following illustration shows the MVI46-101M jumper configuration:



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

## 1.5 Installing the Module in the Rack

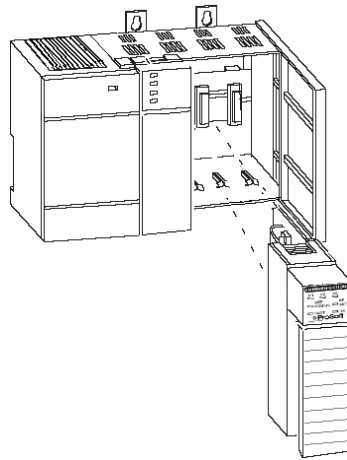
If you have not already installed and configured your SLC processor and power supply, please do so before installing the MVI46-101M module. Refer to your Rockwell Automation product documentation for installation instructions.

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

After you have checked the placement of the jumpers, insert MVI46-101M into the SLC™ chassis. Use the same technique recommended by Rockwell Automation to remove and install SLC™ modules.

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

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



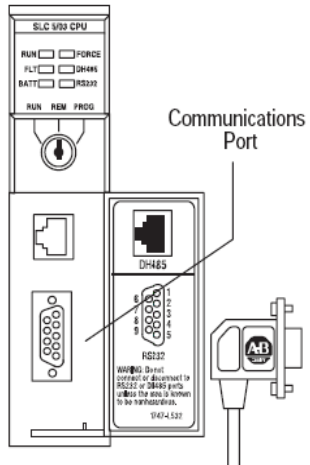
- 3 With a firm but steady push, snap the module into place.
- 4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
- 5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample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

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

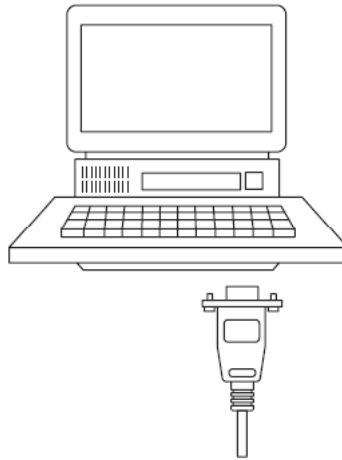


## 1.6 Connecting your PC to the Processor

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



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

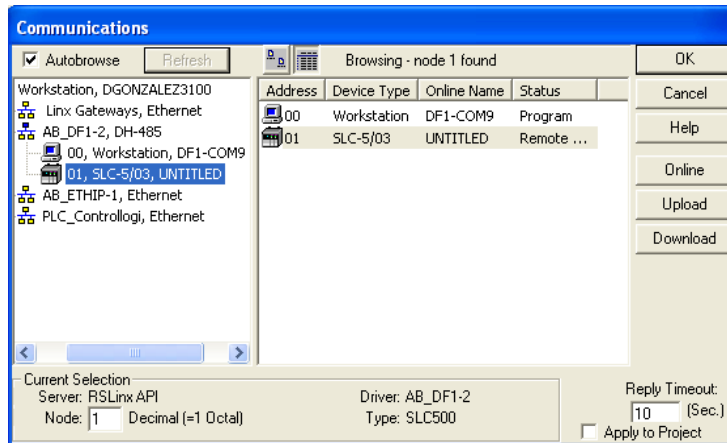


## 1.7 Downloading the Sample Program to the Processor

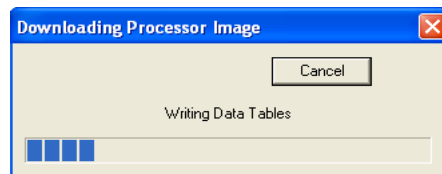
***To download the sample program from RSLogix 500 to the SLC processor:***

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

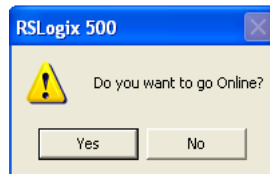
- 1 If you are not already online to the processor, open the Communications menu, and then choose Download. RSLogix will establish communication with the processor.



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



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

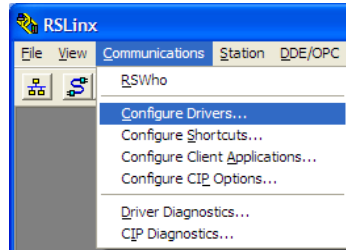


**Note:** If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

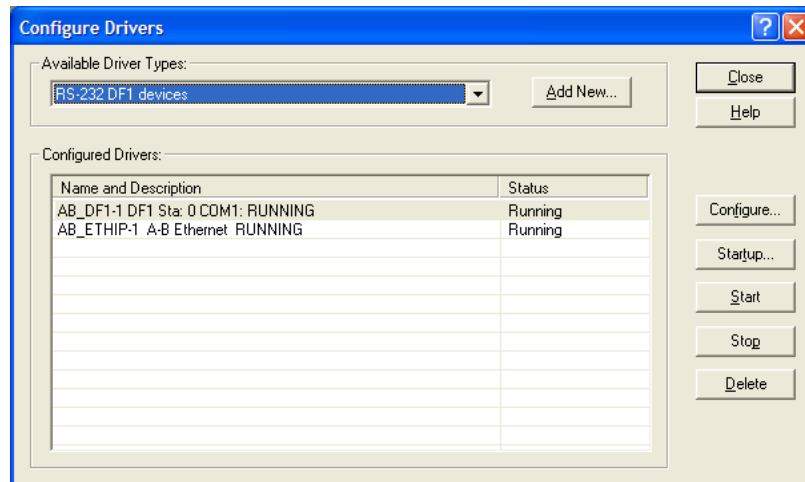
### 1.7.1 Configuring the RSLinx Driver for the PC COM Port

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

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

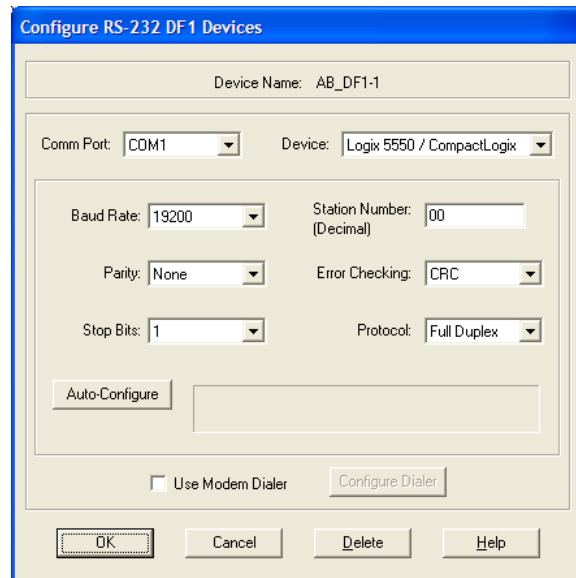


This action opens the *Configure Drivers* dialog box.



**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 RS-232 DF1 Devices* dialog box.



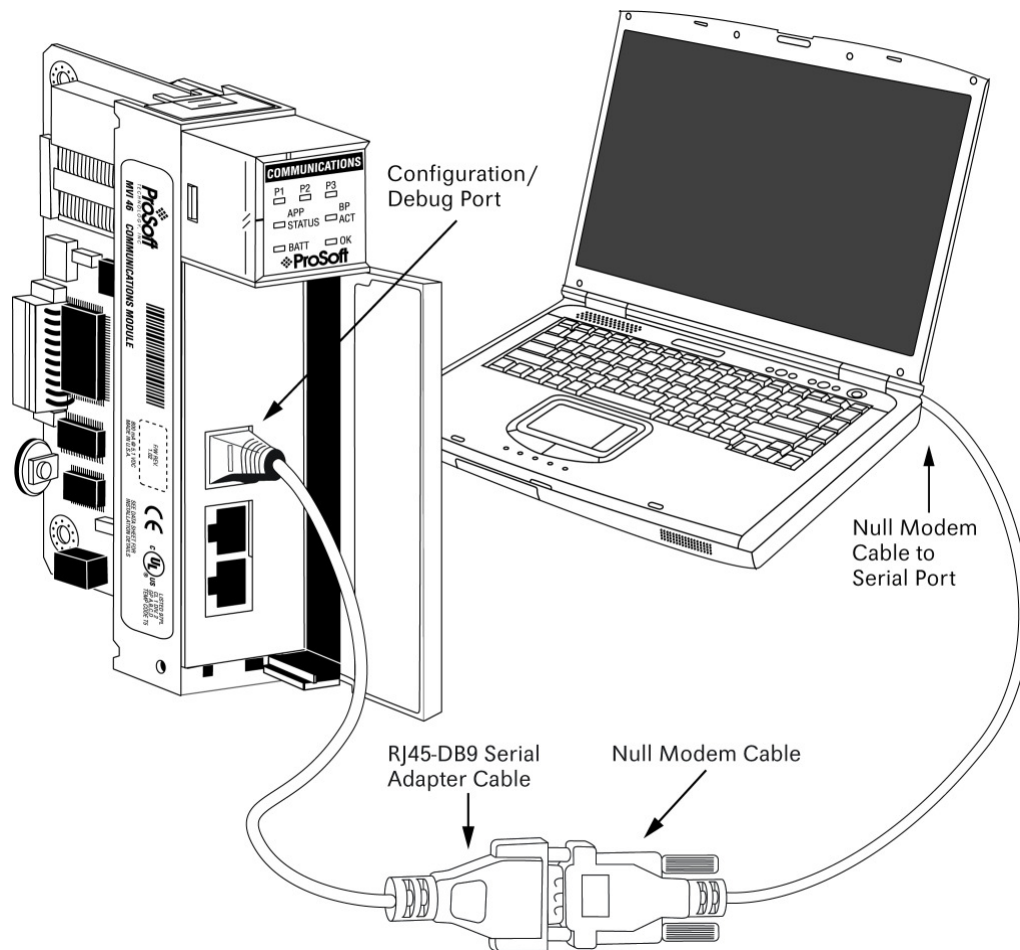
- 4 Click the **AUTO-CONFIGURE** button. RSLinx will attempt to configure your serial port to work with the selected driver.
- 5 When you see the message *Auto Configuration Successful*, click the **OK** button to dismiss the dialog box.

**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.

## 1.8 Connecting Your PC to the Module

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

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





## 2 Configuring the MVI46-101M Module

### *In This Chapter*

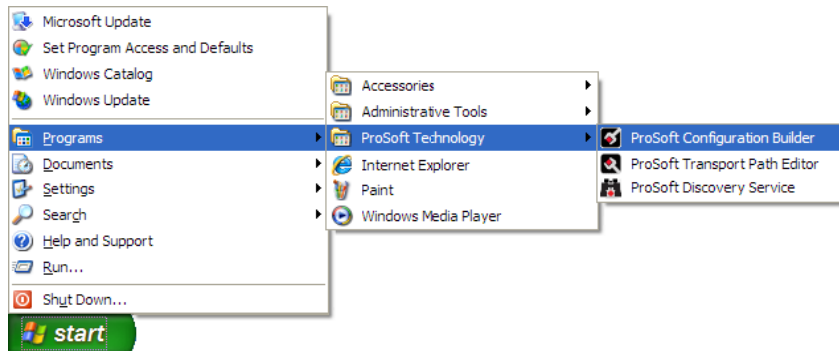
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## 2.1 Using ProSoft Configuration Builder

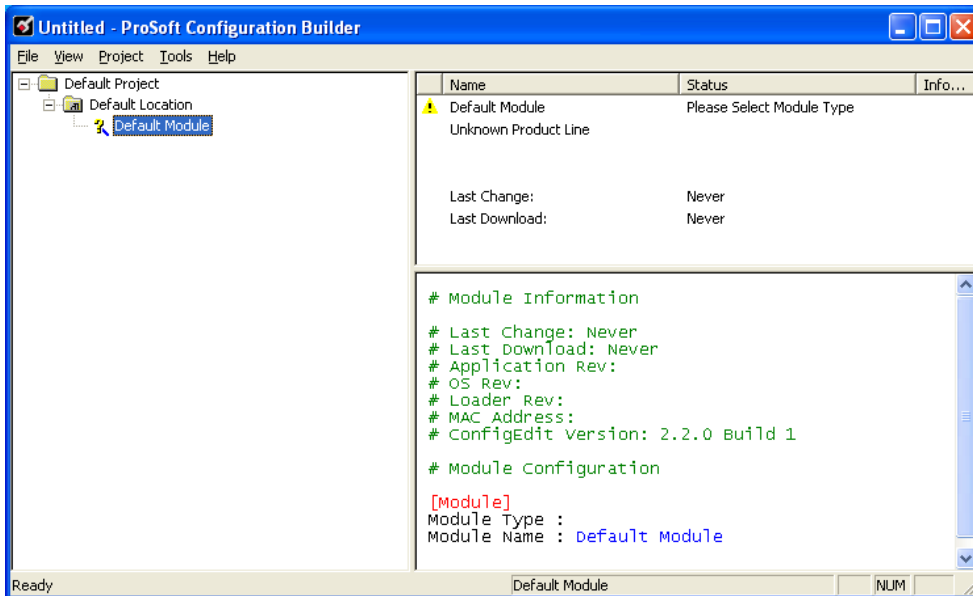
*ProSoft Configuration Builder (PCB)* provides a quick and easy way to manage module configuration files customized to meet your application needs. *PCB* is not only a powerful solution for new configuration files, but also allows you to import information from previously installed (known working) configurations to new projects.

### 2.1.1 Setting Up the Project

To begin, start **PROSOFT CONFIGURATION BUILDER (PCB)**.



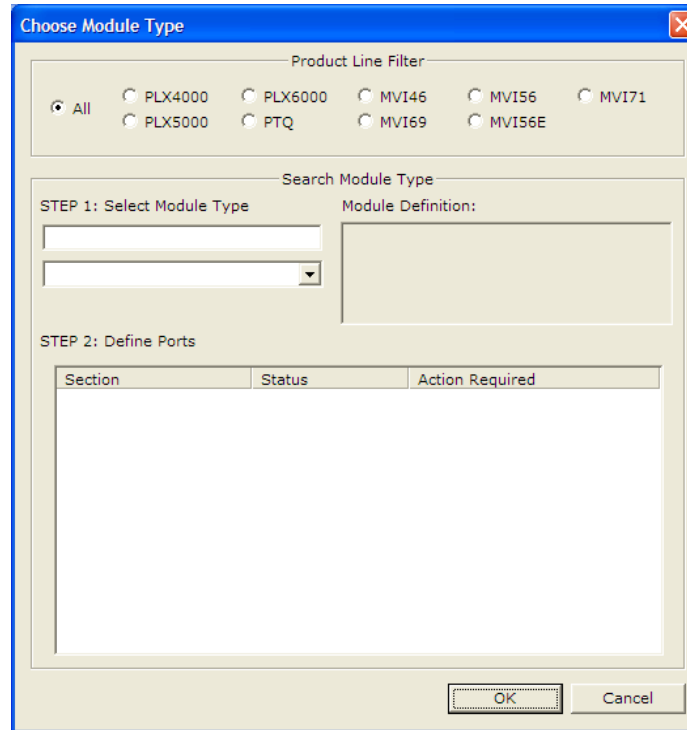
If you have used other Windows configuration tools before, you will find the screen layout familiar. *PCB*'s window consists of a tree view on the left, and an information pane and a configuration pane on the right side of the window. When you first start *PCB*, the tree view consists of folders for **DEFAULT PROJECT** and **DEFAULT LOCATION**, with a **DEFAULT MODULE** in the Default Location folder. The following illustration shows the *PCB* window with a new project.





Your first task is to add the MVI46-101M module to the project.

- 1 Use the mouse to select "Default Module" in the tree view, and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose "Choose Module Type". This action opens the Choose Module Type dialog box.

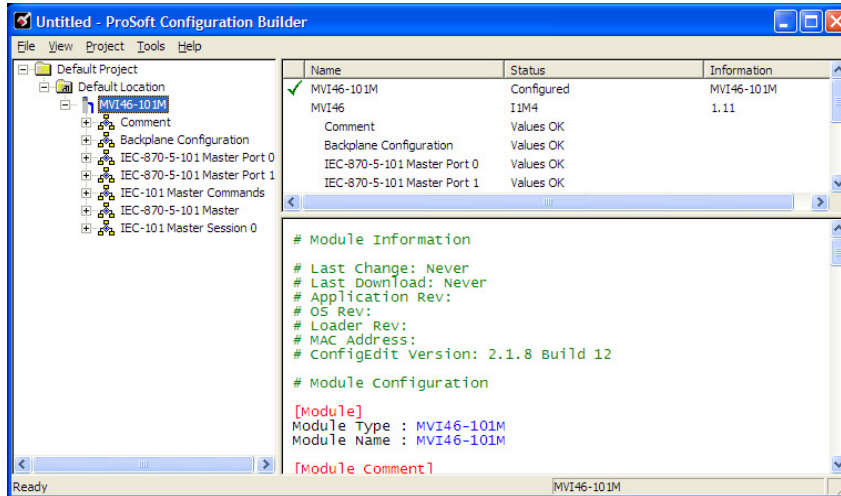


- 3 In the **PRODUCT LINE FILTER** area of the dialog box, select MVI46.
- 4 In the **SELECT MODULE TYPE** dropdown list, select MVI46-101M, and then click **OK** to save your settings and return to the ProSoft Configuration Builder window.

The next task is to set the module parameters.

### 2.1.2 Renaming PCB Objects



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



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

- 1 Select the object, and then click the right mouse button to open a shortcut menu. From the shortcut menu, choose **RENAME**.
- 2 Type the name to assign to the object.
- 3 Click away from the object to save the new name.

#### Configuring Module Parameters

- 1 Click on the **[+]** sign next to the module icon to expand module information.
- 2 Click on the **[+]** sign next to any  icon to view module information and configuration options.
- 3 Double-click any  icon to open an *Edit* dialog box.
- 4 To edit a parameter, select the parameter in the left pane and make your changes in the right pane.
- 5 Click **OK** to save your changes.

#### Printing a Configuration File

- 1 Select the module icon, and then click the right mouse button to open a shortcut menu.
- 2 On the shortcut menu, choose **VIEW CONFIGURATION**. This action opens the *View Configuration* window.
- 3 In the *View Configuration* window, open the **FILE** menu, and choose **PRINT**. This action opens the *Print* dialog box.
- 4 In the *Print* dialog box, choose the printer to use from the drop-down list, select printing options, and then click **OK**.

## 2.2 [Backplane Configuration]

This section contains the backplane configuration information. It is used to determine the number of registers moved between the module and the PLC processor. Additionally, the backplane failure condition is defined as to whether to continue using the protocol.

### 2.2.1 *Failure Flag Count*

**0** through **65535**

This parameter specifies the number of successive transfer errors that must occur before halting communication on the application port(s). If the parameter is set to **0**, the application port(s) 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.

### 2.2.2 *Pass-Through Events*

Y or N (N = Default)

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.

## 2.3 [IEC-870-5-101 Master Port x]

### 2.3.1 Baud Rate

This parameter specifies the baud rate to be used on the communication channel (port). Values from 110 to 38.4K are permitted.

Refer to Communication Parameters for more information on configuring serial communications for the 101M port.

### 2.3.2 Parity

*None, Odd, Even*

Parity is a simple error checking algorithm used in serial communication. This parameter specifies the type of parity checking to use.

All devices communicating through this port must use the same parity setting.

### 2.3.3 RTS On

0 to 65535 milliseconds

This parameter sets the number of milliseconds to delay after *Ready To Send* (RTS) is asserted before data will be transmitted.

### 2.3.4 RTS Off

0 to 65535 milliseconds

This parameter sets the number of milliseconds to delay after the last byte of data is sent before the RTS modem signal will be set low.

### 2.3.5 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.

### 2.3.6 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.

### 2.3.7 DL Address Length

0, 1 or 2

This parameter sets the number of octets used to define the data link address for the session. A value of 0 is only permitted when balanced mode is used.

### **2.3.8 Single char ACK F0, 1 or 3**

#### **Y - YES or N - NO**

If set to Yes, a single character ACK (0xE5) will be sent instead of a fixed length ACK (secondary function code 0) in response to a primary link function code 0, 1 or 3 if there is no access demand for class 1 data (ACD=1). If set to No, the fixed length ACK will be sent.

### **2.3.9 Use Balanced Mode**

#### **Y - YES or N - NO**

This parameter specifies if the port will use balanced mode. If balanced mode is used, only one controlled station will be permitted on the port. If unbalanced mode is used, multiple controlled stations can be used on a port.

Refer to module Initialization for more information on these modes.

## 2.4 [IEC-101 Master Commands]

This section contains the commands for the module. 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 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).

### 2.4.1 Enable Code

0 = Disabled

1 = Enabled, will execute using Poll Interval parameter (page 30) (seconds)

2 = Conditional (executed when point in database changes)

This field defines whether the command is to be executed, and under what conditions. To disable the command, set this parameter to 0 (Disabled). You can still execute commands through the processor, using a *Special Function* block.

To enable the command, set this parameter to 1.

- Set the Poll Interval Time to 0 to execute the command during each scan of the command list.
- Set the Poll Interval Time to a value in seconds, to execute the command at the specified interval (page 30).

To execute the command only if the internal data associated with the command changes, set this parameter to 2. This value is valid only for write commands.

### 2.4.2 Database Index

Database Index is the location in the module's database to use as the source for the data in the command. The data type (page 31) field determines the meaning of the index.

### 2.4.3 Poll Interval

This parameter specifies the minimum frequency at which the module should execute the command when the Enable Code is set to one **1**. The value is entered in units of seconds. For example, to execute a command every 10 seconds, enter a value of **10** in the field. A value of **0** for the parameter implies that the command should be executed every scan of the list, as quickly as possible.

### 2.4.4 Session Index

0 to 31

Session Index represents the session index in the module to associate with the command. This index is set when the session is read in from this file. The range of values for this field is 0 to 31.

### 2.4.5 Sector Index

Sector Index represents the sector index for the specific session. The range of values for this field is 0 to 4.

### 2.4.6 Data Type

Data type file represents the ASDU type as follows:

Type	Description	DB Index type
45	Single point command	Bit address
46	Double point command	Bit address
47	Regulating Step point command	Byte address
48	Setpoint, normalized point command	Word address
49	Setpoint, scaled point command	Word address
50	Setpoint, short float point command	Double-word address
51	Bitstring (32-bits) point command	Double-word address
100	Group interrogation command	NA
101	Counter interrogation command	NA
102	Read command	NA
103	Clock Synchronization	NA
104	Test command (101 standard)	NA
105	Reset process command	NA
107	Test command (104 standard)	NA
110	Parameter, normalized measured value	Word address
111	Parameter, scaled measured value	Word address
112	Parameter, short float value	Double-word address
113	Parameter activation command	NA
242	BCD integrated setpoint command	3 word address
255	Send a class 2 poll	NA

**Note:** The last item in the *Data type* dropdown list is user-defined. If you select **USER DEFINED** from the dropdown list, a text box will appear below the list. You may enter any data type code in this text box that will be accepted by the destination slave.

### 2.4.7 Point Index

The Point Index specifies the point address to be accessed in the remote slave device.

Index Value	Description
1	Bit address with each point occupying 2 bits
2	Bit address with each point occupying 2 bits
3	Word address with each point occupying 4 words
4	Double-word address for the single float value
5	Byte address with each point occupying 12 bytes
9	Word address with each point occupying 9 words

### 2.4.8 Qualifier Parameter

The Qualifier Parameter field defined for a command depends on the data type used in the command. In order to compute the qualifier for a command, add all the values for the features to use with a command together to form a single number. This number should be entered in the command record. Each data set is discussed below:

#### Single Point, Double Point, and Regulating Setup

The format of the field for **Single Point (45)**, **Double Point (46)**, and **Regulating Step (47)** commands is as follows:

#### Single Point, Double Point and Regulating Step Point Commands

Bit	Single	Double	Step
0	Value	Control	Control
1	0	Value	Value
2	Qualifier Code		
3			
4			
5			
6			
7	Select/Execute Code		
8	Deselect Code		
9	Use Override Value		
10	Not Utilized		
11			
12			
13			
14			
15			

The value field for the different data types can be derived from the module's database or that set in the command. The User Override bit is utilized to select the source of the data value. The values for each data type are defined below:



Single Point Value:

- 0=Off
- 1=On

Double Point Value:

- 0=Not permitted
- 1=Off
- 2=On
- 3=Not Permitted

**Regulating Point Value** (Set by module using database value -1=next lower, 1=next higher unless override enabled):

- 0=Not permitted
- 1=Next step lower if database point is set to -1
- 2=Next step high if database point set to +1
- 3=Not Permitted

The Qualifier Code area defines the operation to perform as defined below:

Qualifier Code (Select one of the following):

- 0=No additional definition (slave dependent)
- 4=Short pulse duration
- 8=Long pulse duration
- 12=Persistent output

The Select/Execute area defines if the command should perform a direct execute or select before execute command sequence. The values for this field are as follows (Select one of the values for the following list):

- 0=Direct execution without select
- 128=Select executed followed by execute
- 256=Deselect command

The value field for the qualifier can be derived from the module's database or be that defined in the qualifier. If the override flag is used, the module will issue the command using the values contained in the qualifier defined for the command. If the override flag is not set, the module will use the value in the database to send to the controlled device. The values to use for the override flag are as follows:

- 0=Use value in database (value field should be set to zero for qualifier parameter)
- 512=Use override value for state (preferred when using block 9902 with value field set for command to execute)

Normalized, Scaled, and Short Float

The format of the field for *Normalized (48)*, *Scaled (49)*, and *Short Float (50)* setpoint command is as follows:

**Normalized, Scaled and Short Float Setpoint Commands**

Bit	Description
0	Select/Execute Code
1	Deselect Code
2 to 15	Not Utilized

The value read from database for point specified is used with this qualifier to build a command.

The Qualifier Parameter uses one of the following codes:

- 0=Direct execution without select
- 1=Select executed followed by execute
- 2=Deselect command

Bitstring for 32 Bits

The format of the field for *32-Bitstring (51)* setpoint command is as follows:

**Bitstring of 32 Bit Command**

Bit	Description
0 to 15	Not Utilized

The value read from database for point specified is used with this qualifier to build a command.

The Qualifier Parameter is not currently used to construct commands.

The format of the field for **Interrogation Command (100)** is as follows:

**Interrogation Command**

Bit	Description
0 to 7	Interrogation Group
8 to 15	Not Utilized

No database value is associated with the construction of this command.

The Qualifier Parameter used with this command defines the interrogation group to request. Only a single group can be requested in a single command. The codes to use for this field are as follows:

- 0=Not used
- 1 to 19 = Reserved by standard
- 20=Station interrogation (global)
- 21=Interrogation group 1
- 22=Interrogation group 2
- 23=Interrogation group 3
- 24=Interrogation group 4
- 25=Interrogation group 5
- 26=Interrogation group 6
- 27=Interrogation group 7
- 28=Interrogation group 8
- 29=Interrogation group 9
- 30=Interrogation group 10
- 31=Interrogation group 11
- 32=Interrogation group 12
- 33=Interrogation group 13
- 34=Interrogation group 14
- 35=Interrogation group 15
- 36=Interrogation group 16
- 37 to 63 = Reserved by standard
- 64 to 255 = Reserved for special use (private range)

Counter Interrogation

The format of the field for *Counter Interrogation Command (101)* is as follows:

**Counter Interrogation Command**

Bit	Description
0 to 5	Counter Interrogation Group
6 to 7	Freeze/Reset Qualifier
8 to 15	Not Utilized

No database value is associated with the construction of this command.

The Qualifier Parameter used with this command defines the counter interrogation group to request. Only a single group can be requested in a single command. The qualifier also contains the freeze/reset operation to be utilized with the command. The codes to use for this field are as follows:

Counter Interrogation Group:

- 0=No counter requested
- 1=Request counter group 1
- 2=Request counter group 2
- 3=Request counter group 3
- 4=Request counter group 4
- 5=Request general counter group
- 6 to 31 = Reserved by standard
- 32 to 63 = Reserved for special use (private range)

Freeze/Reset Qualifier:

- 0=No freeze or reset
- 64=Counter freeze without reset
- 128=Counter freeze with reset
- 192=No freeze with counter reset

### Read Command

The format of this field for the *Read (102)* command is as follows:

#### **Read Command**

<b>Bit</b>	<b>Description</b>
0 to 15	Not Utilized

No database value is associated with the construction of this command and no qualifier value is used in this release of the software.

Clock Synchronization

The format of this field for the *Clock Synchronization (103)* command is as follows:

**Clock Synchronization Command**

Bit	Description
0	Synchronization Mode
1	Qualifier
0 to 15	Not Utilized

No database value is associated with the construction of this command.

The Qualifier Parameter for this command has one of the following values:

- 0=Clock synchronization with out delay utilized
- 1=Synchronize clock with delay set
- 2=Measure delay, load delay then synchronize clock

Test Command

The format of this field for the *test command (104 and 107)* is as follows:

**Test Command (both 101 and 104 versions)**

Bit	Description
0 to 15	Not Utilized

No database value is associated with the construction of this command and no qualifier value is used in this release of the software.

Reset Process

The format of this field for the *Reset Process (105)* command is as follows:

**Reset Process Command**

<b>Bit</b>	<b>Description</b>
0 to 7	Reset Qualifier
8 to 15	Not Utilized

No database value is associated with the construction of this command.

The Qualifier Parameter has one of the following values as define in the protocol specification:

- 0=Not used
- 1=General reset of process
- 2=Reset pending information with time tag of the event buffer
- 3 to 127 = Reserved by standard
- 128 to 255 = Reserved for special use (private range)

Parameter Setting

The format of this field for the *Parameter Setting* (110=Normalized, 111=Scaled, 112=Short float) is as follows:

**Parameter Setting (Normalized, Scaled, Short Float) Command**

Bit	Description
0 to 5	Kind of Parameter
6	Local change
7	Operation
8 to 15	Not Utilized

The value from module's database utilized to build the command.

The Qualifier Parameter used with this command is determined by summing the options from lists that follow:

Kind of parameter:

- 0=Not used
- 1=Threshold value
- 2=Smoothing factor (filter time constant)
- 3=Low limit for transmission of measured values
- 3=High limit for transmission of measured values
- 5 to 31 = Reserved by standard
- 32 to 63 = Reserved for special use (private range)

Local parameter change:

- 0=No change
- 64=Change

Parameter in operation:

- 0=Operation
- 128=Not in operation

Parameter Activation

The format of this field for the *Parameter Activation (113)* is as follows:

**Parameter Activation Command**

Bit	Description
0 to 7	Parameter Qualifier
8 9	Activation Qualifier
to 15	Not Utilized

No database value used with the construction of this command.

The Qualifier Parameter used with the command is determined by summing the options from the lists that follow:

Parameter Qualifier:

- 0=Not used
- 1=Act/Deact of previously loaded parameters (point index = 0)
- 2=Act/Deact of the parameter of the point index specified
- 3=Act/Deact of persistent cyclic or periodic transmission of the addressed object
- 4 to 127 = Reserved by standard
- 128 to 255 = Reserved for special use (private range)

Activation Qualifier:

- 0=Deactivate
- 256=Activate



*BCD Integrated Setpoint*

The format of this field for *BCD Integrated Setpoint (242)* command is as follows:

**BCD Integrated total Setpoint Command**

<b>Bit</b>	<b>Description</b>
0	Select/Execute Code
1	Deselect Code
2 to 15	Not Utilized

The value in database is utilized for this command . The data resides in a 6-byte data area in the module.

The Qualifier Parameter used with this command is selected from the following list:

- 0=Direct execution without select
- 1=Select executed followed by execute
- 2=Deselect command

The format of this field for the Class 2 poll (255) command is as follows:

**Class 2 Poll**

<b>Bit</b>	<b>Description</b>
0 to 15	Not Utilized

No database or qualifier is used with this command.

## **2.5 [IEC-870-5-101 Master]**

This is the configuration for the IEC-870-5-101 master port emulated on the module.

### **2.5.1 *Session Count***

1 to 32

This parameter specifies the maximum number of sessions 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 all ports.

## 2.6 [IEC-101 Master Session x]

This section defines Session *y*, which runs on Port *x*. The *Session Count* parameter in the [IEC-870-5-101 Master] section of the configuration (page 42) determines the number of sessions (controlled devices) for this port.

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-101 Master Session 0] to [IEC-101 Master Session 3]).

The parameters in [IEC-101 Master Session *y*] define the characteristics of the specific controlled device to interface.

### 2.6.1 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.

### 2.6.2 Sector Count

1 to 5

This parameter sets the number of sectors contained in this controlled device. The range of values is from 1 to 5. A sector section is required for each sector in a session to define its database and settings.

### 2.6.3 Data Link Address

0 to 254 or 0 to 65534

This parameter uniquely defines the data link address for this unit on the communication channel. The ranges of values depends on the value set in the DL Address Length parameter.

### 2.6.4 Common address of ASDU Len

1 or 2

This parameter specifies the number of octets used for the common address of ASDU. This parameter must be set the same for all devices on the network.

### 2.6.5 Inform. Object address Len

1, 2 or 3

This parameter sets the number of octets used to specify the address for an information object in each sector for this session.

### **2.6.6 COT octet count**

1 or 2

This parameter sets the number of octets used for the COT field in each message. If a value of 2 is selected, the value entered for the Originator Address For COT will accompany each message from the controlling unit.

### **2.6.7 Originator address for COT**

0 to 255

This parameter sets the address to be passed with each message when the COT Octet Count parameter is set to 2.

### **2.6.8 Failure Delay**

0 to 2000 seconds

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.

### **2.6.9 Confirm Timeout**

0 to 4,294,967,295 (two raised to the power of 32, minus one) milliseconds

This parameter sets the number of milliseconds to wait for a confirm response from the controlled device.

### **2.6.10 Retry Count**

0 to 255

In balanced mode, this parameter specifies the number of retries (0 to 255) if a response is not received. In unbalanced mode, this parameter is ignored.

### **2.6.11 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.

### **2.6.12 Class 1 Polls**

0 to 65535

This parameter sets the maximum number of class 1 polls performed on this session before switching to another session. This parameter prevents a session from monopolizing the communication port.

### **2.6.13 Class 1 Pend Delay**

0 to 4,294,967,295 (two raised to the power of 32, minus one) milliseconds

This parameter sets the minimum number of milliseconds to delay between Class 1 polls for pending data.

### **2.6.14 Class 2 Pend Delay**

0 to 4,294,967,295 (two raised to the power of 32, minus one) milliseconds

This parameter sets the minimum number of milliseconds to delay between Class 2 polls for pending data.

### **2.6.15 Class 1 Poll Delay**

0 to 4,294,967,295 (two raised to the power of 32, minus one) milliseconds

This parameter sets the minimum number of milliseconds to delay between each Class 1 poll.

### **2.6.16 Class 2 Poll Delay**

0 to 4,294,967,295 (two raised to the power of 32, minus one) milliseconds

This parameter sets the minimum number of milliseconds to delay between each Class 2 poll.

### **2.6.17 Auto Clock Req Mode**

0=Sync Only, 1=Load delay/sync, 2=Acquire delay/load delay/sync

This parameter specifies the method used to perform automatic clock synchronization. 0 performs a synchronization without delay, 1 performs synchronization using the fixed Propagation Delay and 2 computes the delay and use this value when synchronization takes place.

### **2.6.18 Propagation Delay**

0 to 65535

This parameter sets the fixed propagation delay to be utilized if the Auto Clock Req Mode parameter is set to a value of 1.

### **2.6.19 Response Timeout**

0 to 4,294,967,295 milliseconds

This parameter sets the maximum number of milliseconds to wait for a confirmation from the controlled station to a request from this module.

### **2.6.20 *ACTTERM* with *setpoint***

Yes or No

This parameter determines if an *ACTTERM* will be sent. If the parameter is set to Yes, then *setpoint* commands will issue an *ACTTERM* when the command is complete. If the parameter is set to No, *ACTCON* is the last response to a *setpoint* command.

## 2.7 [IEC-101 Master Session x Sector y]

This section defines Sector *z*, which belongs to Session *y*. The *Sector Count* parameter within each session definition specifies the number of sectors for the session.

Each sector has a corresponding [*IEC-101 Master Session y Sector z*] section, where *y* represents the session index and *z* represents the sector index.

The sectors are referenced by a zero-based index value. For example, if Session 0 is configured for four sectors, the configuration file should contain sections for Sectors 0 to 3 (that is, [*IEC-101 Master Session 0 Sector 0*] to [*IEC-101 Master Session 0 Sector 3*]).

The parameter set and database for Sector *z* is defined in this section.

### 2.7.1 Common ASDU Address

0 to 255 (1 oct) or 0 to 65535 (2 oct)

This parameter sets the common ASDU address to association with this sector of the specified session. The range of address for this parameter are dependent on the length value set in the session section.

### 2.7.2 Use Time tag commands

Yes or No

This parameter specifies if a time tag field is to be included with commands. This is as specified in the IEC-870-5-104 specification and should only be utilized if the controlled device supports these new data types. If the parameter is set to Yes, a time tag will be added to all commands. If the parameter is set to No, the normal IEC 60870-5-101 data type messages will be utilized.

### 2.7.3 Online Time Sync

Yes or No

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 used for devices that do not send an *EOI* message after initializing.

### 2.7.4 Online General Int

Yes or No

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 used for devices that do not send an *EOI* message after initializing.

### 2.7.5 *EOI Time Sync*

Yes or No

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.

### 2.7.6 *EOI General Int*

Yes or No

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.

### 2.7.7 *Database Definition*

Database definition for this session/sector.

Data Types are as follows:

Monitored Data

- 1 = Single point
- 3 = Double point
- 5 = Step point
- 7 = Bitstring of 32-bits
- 9 = Measured normalized points
- 11 = Measured scaled points
- 13 = Measured short float points
- 15 = Integrated totals
- 110 = Measured normalized parameter (word-addressing/1 point = 1 data word)
- 111 = Measured scaled parameter (word-addressing/1 point = 1 data word)
- 112 = Measured short float parameters (double-word-addressing/1 point = 2 data words)
- 240 = Integrated totals BCD format (3 word-addressing/1 point = 3 data words)

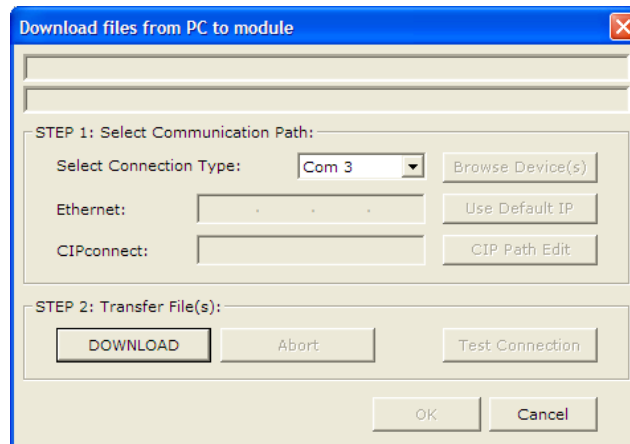
**Note:** The last item in the *Data type* dropdown list is user-defined. If you select **USER DEFINED** from the dropdown list, a text box will appear below the list. You may enter any data type code in this text box that will be accepted by the destination slave.



## 2.8 Downloading the Project to the Module Using a Serial COM port

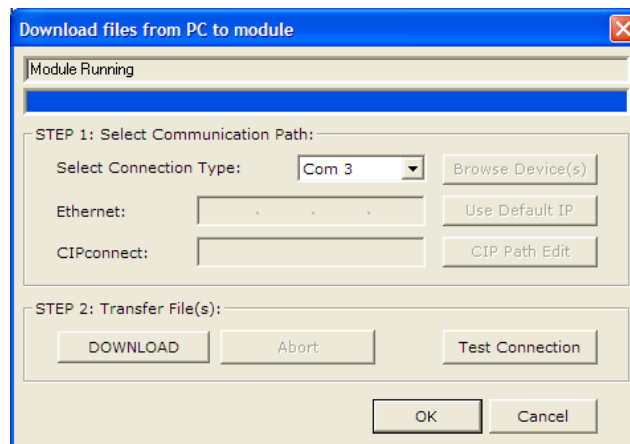
For the module to use the settings you configured, you must download (copy) the updated *Project* file from your PC to the module.

- 1 In the tree view in *ProSoft Configuration Builder*, click once to select the module.
- 2 Open the *Project* menu, and then choose **MODULE/DOWNLOAD**. The program will scan your PC for a valid com port (this may take a few seconds). When *PCB* has found a valid COM port, the *Download* dialog box will open.



- 3 Choose the COM port to use from the dropdown list, and then click the **DOWNLOAD** button.

The module will perform a platform check to read and load its new settings. When the platform check is complete, the status bar in the *Download* dialog box will display the message *Module Running*.





## 3 Ladder Logic

### In This Chapter

- ❖ Module Data ..... 52
- ❖ Adding the Module to an Existing Project ..... 53

Ladder logic is required for application of the MVI46-101M module. Tasks that must be handled by the ladder logic are module data transfer, special block handling, and status data receipt. Additionally, a power-up handler may be needed to handle the initialization of the module's data and to clear any processor fault conditions.

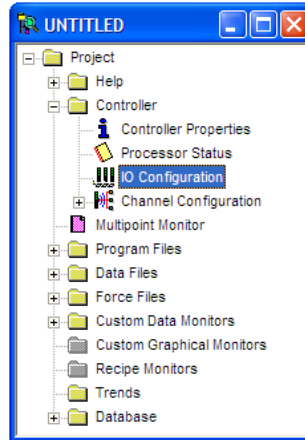
The sample ladder logic, on the *ProSoft Solutions CD-ROM*, is extensively commented, to provide information on the purpose and function of each rung. For most applications, the sample ladder will work without modification.

### **3.1 Module Data**

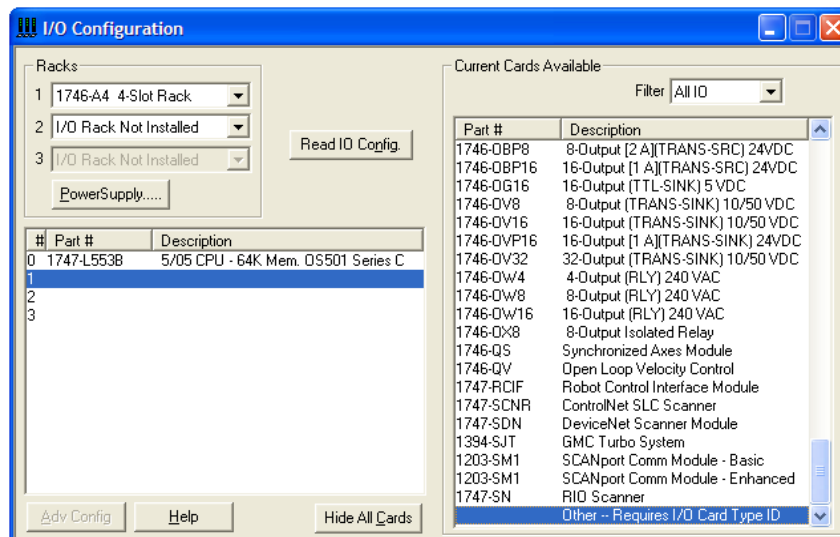
All data related to the MVI46-101M module is stored in user defined data files and the module's M1 file. Files should be defined for each data type for the module. Additionally, a file should be defined to hold the module status data. The status data should be copied from the M1 file and placed in the assigned status file. Input (monitor) data should be copied from the user file to the M1 file and output (command) data should be copied from the user files to the M1 file.

### 3.2 Adding the Module to an Existing Project

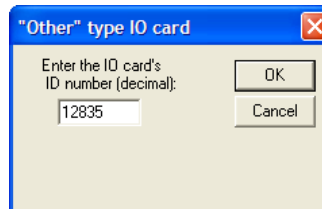
- 1 **Add the MVI46-101M module to the project.** Double-click on the I/O Configuration option in the Controller Organization window.



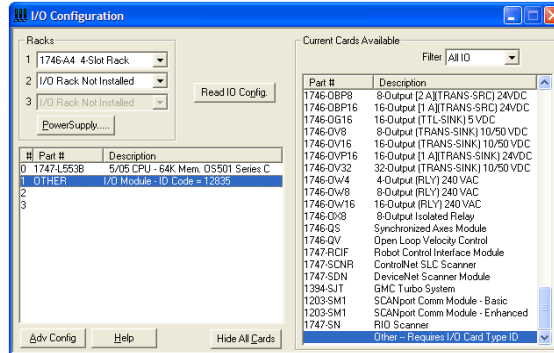
- 2 This action opens the I/O Configuration dialog box. Select an empty slot in the left pane, and then scroll to the bottom of the right pane.



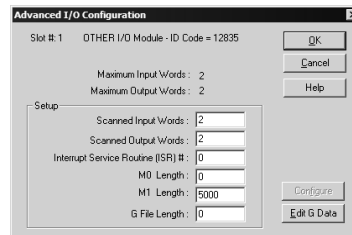
- 3 In the right pane, double-click **Other -- Requires I/O Card Type ID**. This action opens the "Other" type IO card dialog box.



- 4 The module's I/O card ID number is 12835. Enter that value in the ID number field, and then click OK to dismiss the dialog box.
- 5 Observe that the module you selected is now in the list in the left pane of the I/O Configuration dialog box.



- 6 Select and double-click the new module in the left pane. This action opens the Advanced I/O Configuration dialog box. Fill in the dialog box with the values shown in the following illustration.



Field	Value
Scanned Input Words	2
Scanned Output Words	2
Interrupt Service Routine (ISR)#	0
M0 Length	0
M1 Length	5000
G File Length	0

- 7 Click OK to save your configuration.
- 8 Copy the Ladder Logic and data files from the sample program and paste them into your existing program.

**Important:** Take care not to overwrite existing data files in your application with data files in the sample application. Rename either the source or the destination data files, and then search and replace references in the ladder for instances of any renamed files.

- 9 Save and Download (page 18) the new application to the controller and place the processor in run mode.

## 4 Diagnostics and Troubleshooting

### In This Chapter

❖ Reading Status Data from the Module .....	56
❖ LED Status Indicators.....	74

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

- LED status indicators on the front of the module provide general information on the module's status.
- Status data contained in the module can be viewed through the Configuration/Debug port, using the troubleshooting and diagnostic capabilities of *ProSoft Configuration Builder (PCB)*.
- Status data values can be transferred from the module to processor memory and can be monitored there manually or by customer-created logic.

## 4.1 Reading Status Data from the Module

The MVI46-101M module returns a status data set to the SLC processor in each read block. This data is transferred to the SLC 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
- Facility to upload and download the module's configuration file

### 4.1.1 Using ProSoft Configuration Builder (PCB) for Diagnostics

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 submenus for each menu command. The first menu you see when you connect to the module is the *Main* menu.

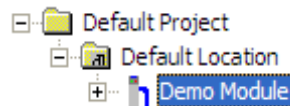
Because this is a text-based menu system, you enter commands by typing the [command letter] from your computer keyboard in the *Diagnostic* window in *ProSoft Configuration Builder (PCB)*. The module does not respond to mouse movements or clicks. The command executes as soon as you press the **[COMMAND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

#### Using the Diagnostic Window in ProSoft Configuration Builder

**Tip:** You can have a ProSoft Configuration Builder Diagnostics window open for more than one module at a time.

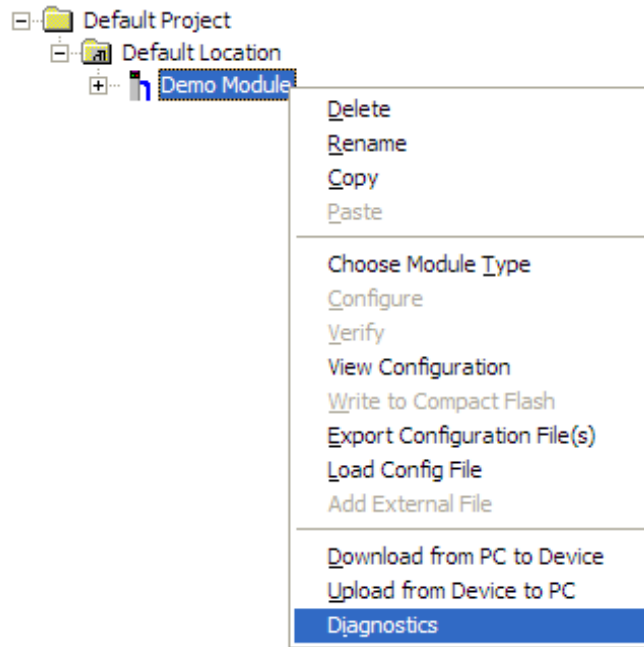
To connect to the module's Configuration/Debug serial port

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



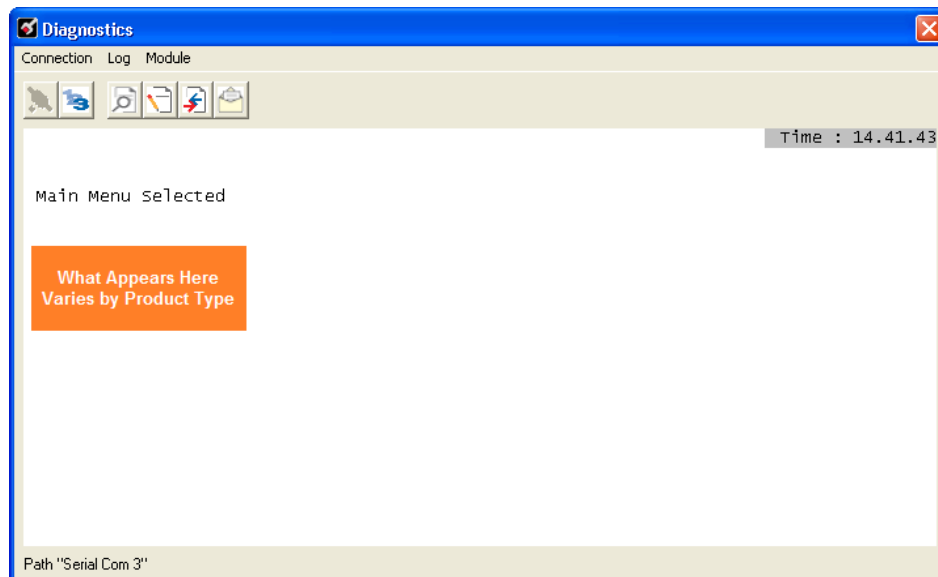


- 2 On the shortcut menu, choose **DIAGNOSTICS**.



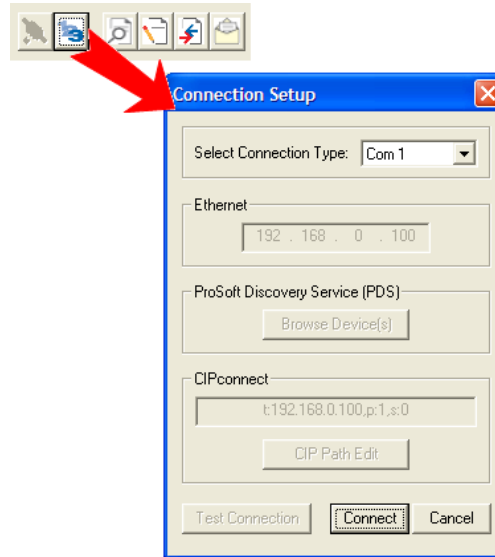
This action opens the *Diagnostics* dialog box.

- 3 Press [?] to open the *Main* menu.



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

- 1 Click to configure the connection. On the *Connection Setup* dialog box, select a valid com port or other connection type supported by the module.



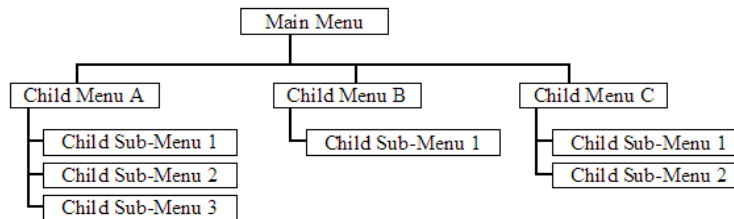
- 2 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.
- 3 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.

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

### Navigation

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

## Keystrokes

The keyboard commands on these menus are usually not case sensitive. You can enter most commands in lowercase or uppercase 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** and **/**.

Also, take care to distinguish the different uses for uppercase letter "eye" (**I**), lowercase letter "el" (**L**), and the number one (**1**). Likewise, uppercase letter "oh" (**O**) and the number zero (**0**) are not interchangeable. Although these characters look alike on the screen, they perform different actions on the module and may not be used interchangeably.

### 4.1.2 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.

```
IEC-870-5-101 MASTER COMMUNICATION MODULE
?=Display Menu
B=Block Transfer Statistics
C=Module Configuration
D=Database View
I=IEC-101 Master Menu
R=Receive Configuration File
S=Send Configuration File
U=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.

#### 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.

### 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 View Menu

Press **[D]** to open the *Database View* menu.

Use this menu command to view the current contents of the module's database. For more information about this submenu, see Database View Menu (page 62).

### Opening the IEC-101 Master Menu

Press **[I]** from the Main Menu to open the IEC-870-5-101 Master Driver Menu.

Use this menu command to view detailed configuration information for the module.

### Transferring the Configuration File from the PC to the Module

On the Diagnostics Menu this is referred to as *Receive Module Configuration*.

Press **[R]** to receive (download) the configuration file from your PC to the module and store the file on the module's Compact Flash Card (Personality Module) or Flash RAM.

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

After the file has been successfully downloaded, the module will restart the program and load the new configuration information. Review the new configuration using menu commands **[6]** and **[0]** to verify that the module is configured correctly.

### Transferring the Configuration File from The Module to the PC

On the Diagnostics Menu this is referred to as *Send Module Configuration*. Press **[S]** to send (upload) the configuration file from the module to your PC.

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

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

### 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

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

### 4.1.3 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 database. Press **[?]** to view a list of commands available on this menu.

```
DB Menu Selected

DATABASE VIEW MENU
?=Display Menu
0-9=Display 0-9000
S=Show Again
-=Back 5 Pages
P=Previous Page
+=Skip 5 Pages
N=Next Page
D=Decimal Display
H=Hexadecimal Display
F=Float Display
A=ASCII Display
M=Main Menu
```

#### Viewing Register Pages

To view sets of register pages, use the keys described below:

Command	Description
<b>[0]</b>	Display registers 0 to 99
<b>[1]</b>	Display registers 1000 to 1099
<b>[2]</b>	Display registers 2000 to 2099

And so on. The total number of register pages available to view depends on your module's configuration.

#### Displaying the Current Page of Registers Again

Press **[S]** from the *Database View* menu to show the current page of registers again.

DATABASE	DISPLAY	0 TO 99	<DECIMAL>							
100	101	102	4	5	6	7	8	9	10	
11	12	13	14	15	16	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	

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

*Moving Back Through 5 Pages of Registers*

Press **[-]** from the *Database View* menu to skip five pages back in the database to see the 100 registers of data starting 500 registers before the currently displayed page.

*Moving Forward (Skipping) Through 5 Pages of Registers*

Press **[+]** from the *Database View* menu to skip five pages ahead in the database to see the 100 registers of data starting 500 registers after the currently displayed page.

*Viewing the Previous Page of Registers*

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

*Viewing the Next Page of Registers*

Press **[N]** from the *Database View* menu to display the next page of data.

*Viewing Data in Decimal Format*

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

*Viewing Data in Hexadecimal Format*

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

*Viewing Data in Floating-Point Format*

Press **[F]** from the *Database View* menu 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*

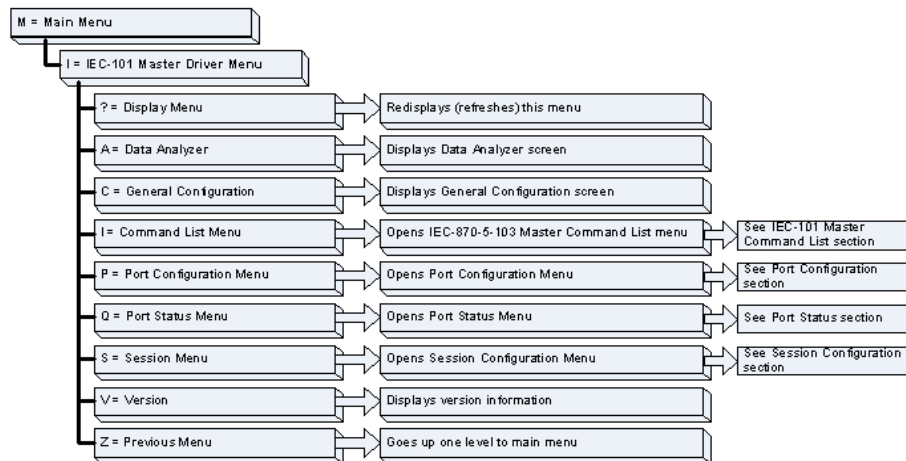
Press **[A]** from the *Database View* menu to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

*Returning to the Main Menu*

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

### 4.1.4 IEC-101M Master Menu

Press **[I]** from the Main Menu to open the ICE-870-5-101 Master Driver Menu. Use this menu command to view detailed configuration information 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.

#### 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 (page 65) 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 Protocol Configuration

Press **[C]** to view configuration information for the 101M protocol.

#### Opening the Client Command List Menu

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

#### Viewing Port Configuration

Press **[P]** to view configuration information for the application port.

Use this command to display detailed configuration information for the port.





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] from the Database View menu to display the data on the current page in hexadecimal format.

Viewing Data in ASCII (Text) Format

Press [A] from the Database View menu 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. The following illustration shows an example.



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.

Data Analyzer Tips

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

**Data Analyzer Mode Selected**

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

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

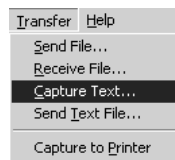
Port = 1, Format=HEX, Tick=10
```

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

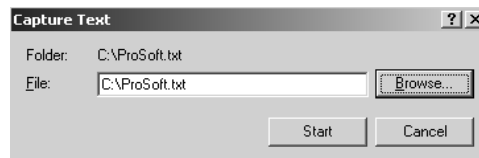
For most applications, HEX is the best format to view the data, and this does include ASCII based messages (because some characters will not display on HyperTerminal and by capturing the data in HEX, we can figure out what the corresponding ASCII characters are supposed to be).

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

After you have selected the Port, Format, and Tick, we are now ready to start a capture of this data. The easiest way to do so is to go up to the top of you HyperTerminal window, and do a **TRANSFER / CAPTURE TEXT** as shown below:



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



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

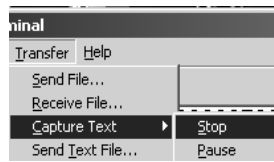
Now you have everything that shows up on the HyperTerminal screen being logged to a file called ProSoft.txt. This is the file that you will then be able to email to ProSoft Technical Support to assist with issues on the communications network.

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

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

The <R+> means that the module is transitioning the communications line to a transmit state.  
All characters shown in <> brackets are characters being sent out by the module.  
The <R-> shows when the module is done transmitting data, and is now ready to receive information back.  
And finally, all characters shown in the [ ] brackets is information being received from another device by the module.  
After taking a minute or two of traffic capture, you will now want to stop the "Data Analyzer". To do so, press the [S] key, and you will then see the scrolling of the data stop.

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



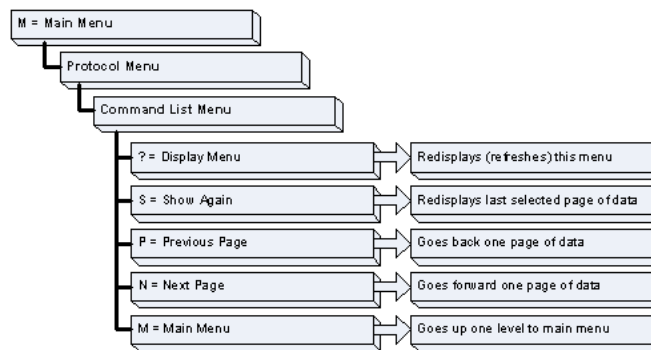
You have now captured, and saved the file to your PC. This file can now be used in analyzing the communications traffic on the line, and assist in determining communication errors.

Returning to the Main Menu

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

**4.1.6 Master Command List Menu**

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



Redisplaying the Current Page

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

Viewing the Previous 50 Commands

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

Viewing the Previous Page of Commands

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

Viewing the Next 50 Commands

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

Viewing the Next Page of Commands

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

Returning to the Main Menu

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

**4.1.7 Session Configuration Menu**

Press **[S]** from the IEC-101 Master Driver Menu to open the Session Configuration menu. Use this command to view the session configuration for each controlled device.

```
IEC-870-5-101 MASTER SESSION 0 CONFIGURATION
Online State           = 1
Communication Port     = 0
Sector Count          = 1
Data Link Address     = 3
Common ASDU Length    = 2
IOA Length            = 2
COT Octet Count       = 1
COT Originator Address = 1
Failure Delay         = 120
Confirm Timeout       = 1000
Retry Count           = 2
C1/C2 Poll Count Pend = 100
Class 1 Polls         = 20
Class 1 Pend Delay    = 10
Class 2 Pend Delay    = 10
Class 1 Poll Delay    = 10
Class 2 Poll Delay    = 10
Auto Clk Sync Mode    = 0
Propagation Delay     = 0
Response Timeout      = 2000
ACTTERM with setpoint = 1
```

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.

### 4.1.8 Sector Configuration Menu

Press **[1]** from the IEC-101 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.

```
SECTOR CONFIGURATION MENU
?=Display Menu
S=Show again
0=Single-point data
1=Double-point data
2=Step point data
3=Bitstring point data
4=Normalized measured point data
5=Scaled measured point data
6=Short float measured point data
7=Integrated total point data
8=Parameter, normalized data
9=Parameter, scaled data
A=Parameter, short float data
B=BCD integrated total data
M=Return to Sector
```

#### 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.

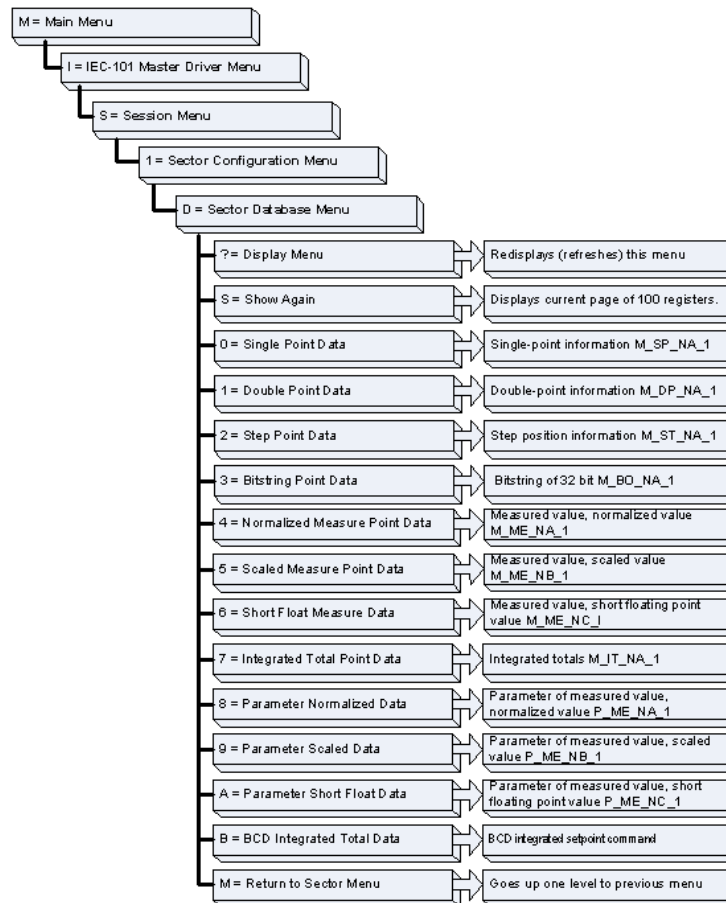
#### Returning to the Main Menu

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



### 4.1.9 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.

#### 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:

LED	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 MVI46-101M is working normally.
		On	The MVI46-101M 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 correct configuration data is being transferred to the module from the SLC controller.

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 Technical 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 in the I/O Configuration of RSLogix. Verify that the slot location in the rack has been configured correctly in the ladder logic.
Processor I/O LED flashes	This indicates a problem with backplane communications. A problem could exist between the processor and any installed I/O module, not just the MVI46-101M. Verify that all modules in the rack are correctly configured in the ladder logic.

### Module Errors

Problem description	Steps to take
BP ACT LED (not present on MVI56E modules) remains OFF or blinks slowly MVI56E modules with scrolling LED display: <Backplane Status> condition reads ERR	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: <ul style="list-style-type: none"> <li>▪ The processor is in RUN or REM RUN mode.</li> <li>▪ The backplane driver is loaded in the module.</li> <li>▪ The module is configured for read and write data block transfer.</li> <li>▪ The ladder logic handles all read and write block situations.</li> <li>▪ The module is properly configured in the processor I/O configuration and ladder logic.</li> </ul>
OK LED remains RED	The program has halted or a critical error has occurred. Connect to the Configuration/Debug port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert it, and then restore power to the rack.



## 5 Reference

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## 5.1 Product Specifications

The MVI46 IEC 60870-5-101 Master Communication Module allows SLC to interface easily with IEC 60870-5-101 Master (controlling unit) devices.

The MVI46-101M module interfaces up to 32 serial communication devices with the <Processor Model>. Two communication ports on the module act as controlling devices (masters) to interface with controlled devices on their own networks. Each port is individually configurable and can be set for balanced or unbalanced mode. Data is exchanged between the serial network and the <Processor Model> through the database contained in the module and direct control by the processor's ladder logic.

### 5.1.1 Hardware Specifications

Specification	Description
Backplane Current Load	800 ma @ 5V (from backplane)
Operating Temperature	0 to 60 °C (32 to 140 °F)
Storage Temperature	-40 to 85 °C (-40 to 185 °F)
Shock	30g operational, 50g non-operational
Relative Humidity	5% to 95% (non-condensing)
Vibration	5 g from 10150 Hz
Processor	Compatible with Rockwell Automation SLC 5/02 M0/M1 capable processors or newer
LED indicators	Module status, Backplane transfer status, Application status, Serial activity and error LED status
<b>Debug/Configuration port (CFG)</b>	
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) RS-232 only
Configuration Connector	RJ45 RS-232 Connector (RJ45 to DB-9 cable shipped with unit)
<b>Application Ports</b>	
Application Serial port (PRT1, PRT2) (Serial Modules)	Two RJ45 RS-232/422/485 Application ports

### 5.1.2 General Specifications

- Single Slot - 1746 backplane compatible (Local or extended I/O rack only. Remote rack not supported)
- The module is recognized as an Input/Output module and has access to processor memory for data transfer between processor and module using M0/M1 files
- Ladder Logic is used for data transfer between module and processor. Sample ladder file included
- Configuration data obtained from configuration text file downloaded to module. Sample configuration file included

### **5.1.3 Functional Specifications - 101M**

- Built in accordance to the approved international specification
- Two independent master ports completely user configurable
- Support for balanced and unbalanced mode
- Up to 32 sessions
- Up to five sectors (separate databases) for each session
- Individual database definition for each sector
- 1000 commands to control stations
- SLC processor can issue control commands directly to the module or a controlled device (10 at each scan)
- Pass-through of event messages from controlled device to processor for logging of time-tagged events
- Operation via simple ladder logic
- Supports clock synchronization from/to the SLC
- Receives events from the slave and sends them to the SLC processor
- Supports monitored data
  - Single-point
  - Double-point
  - Step-point
  - Measured-point
  - Bitstring 32-bit
  - Integrated total point
- Class 1 and Class 2 delay parameter in the configuration file
- Complete set up and monitoring of module through RSLogix 500 software and user constructed configuration file (IEC101M.CFG)
- SLC backplane interface via M-File access
- All data related to the module is contained in user data files to simplify monitoring and interfacing with the module

## 5.2 Functional Overview

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

Detailed questions about the protocol can be answered by reading these documents. 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.

The following discussion explains several concepts that are important for understanding module operation.

### 5.2.1 General Concepts

The following discussion explains several concepts that are important for understanding module operation.

#### Module Power Up

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

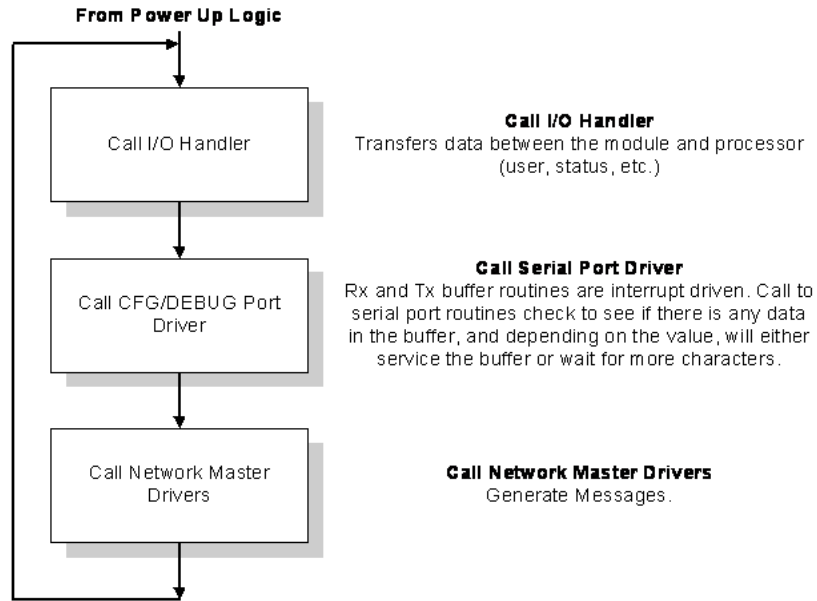
- 1 Initialize hardware components
  - Initialize SLC backplane driver
  - Test and clear all RAM
  - Initialize the serial communication ports
- 2 Read configuration for module from IEC101M.CFG file on Compact Flash Disk
- 3 Initialize the databases and ports
- 4 Set up the serial communication interface for the debug/configuration port

After the module has received the configuration, the module will begin receiving and transmitting messages with devices on the serial networks.



### Main Logic Loop

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



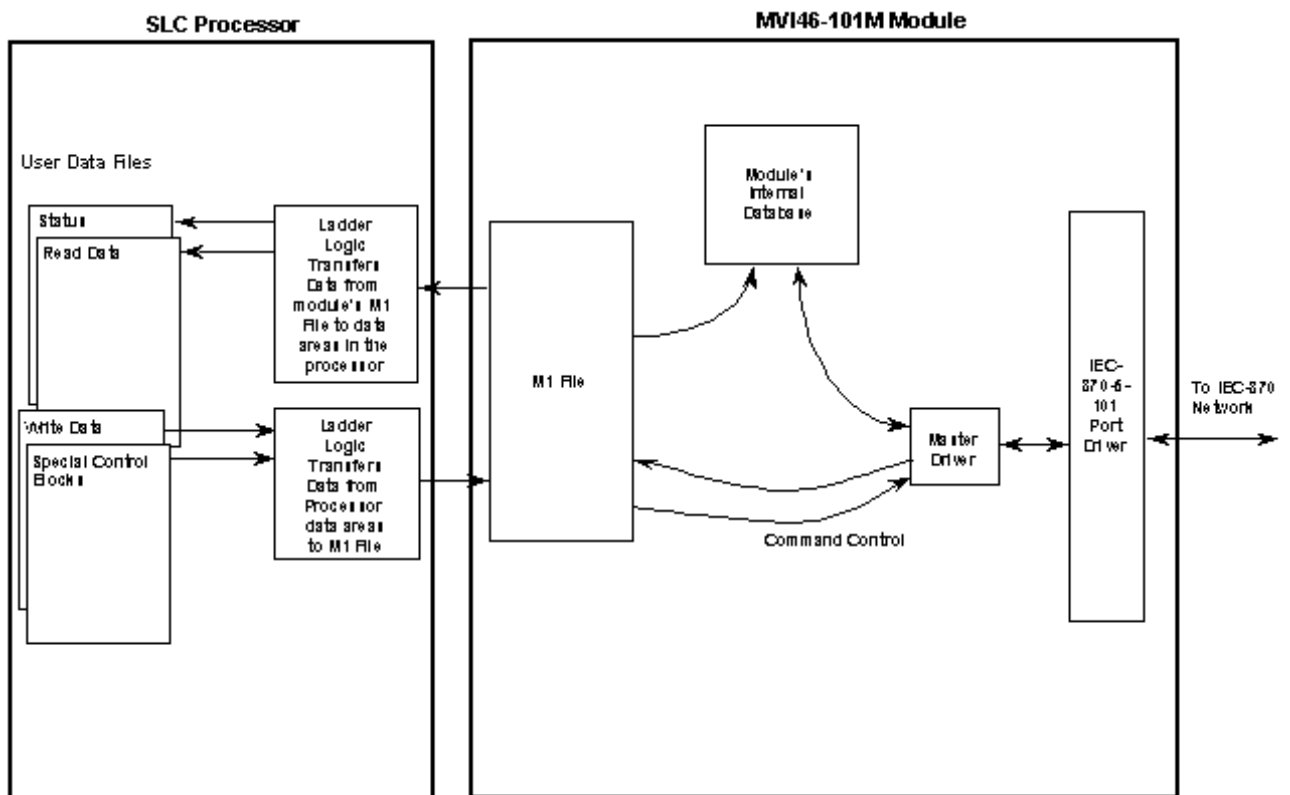
### SLC Processor Not in Run

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

Backplane Data Transfer

The MVI46-101M module communicates directly over the SLC backplane. All data for the module is contained in the module's M1 file. Data is moved between the module and the SLC processor across the backplane using the module's M1 file. The SLC scan rate and the communication load on the module determine the update frequency of the M1 file. The COP instruction can be used to move data between user data files and the module's M1 file.

The following illustration shows the data transfer method used to move data between the SLC processor, the MVI46-101M module and the IEC 60870-5-101 network.



All data transferred between the module and the processor over the backplane is through the M1 file. Ladder logic must be written in the SLC processor to interface the M-file data with data defined in the user-defined data files in the SLC. All data used by the module is stored in its internal database. Data contained in this database is constantly updated with the M1 file data by the module and requires no SLC ladder logic to implement. The user database resides in the M1 file at addresses 0 to 3999. Addresses above 3999 are used for special block control of the module.

### Data Type Mapping and Addressing

When interfacing data in the processor to that of the IEC 60870-5-101 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.

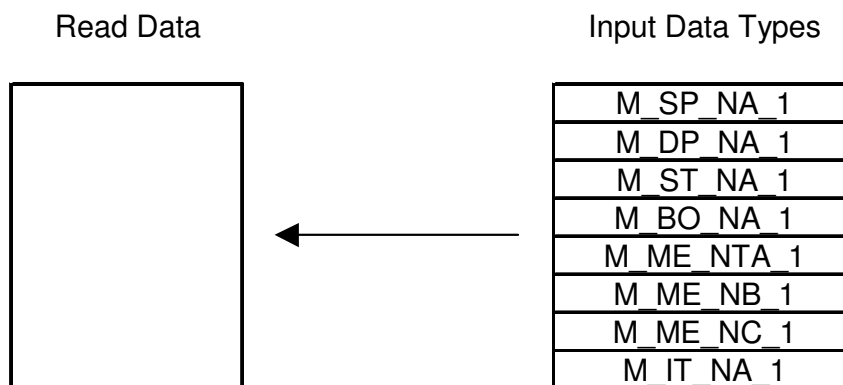
Type ID	Type	Description	Data Representation
1	M_SP_NA_1 (7.3.1.1)	Monitored Single-point Information: This data type stores a single binary input point. Associated time-tagged event information for this type are M_SP_TA_1 (2) and M_SP_TB_1 (30).	Single bit value (7.2.6.1) with 0=Off and 1=On.
3	M_DP_NA_1 (7.3.1.3)	Monitored Dual-point Information: This data type stores a dual-point binary input value (that is, valve status). Associated time-tagged event information for this type are M_DP_TA_1 (4) and M_DP_TB_1 (31).	Dual-bit status (7.2.6.2) with 00b (0 decimal) = indeterminate or intermediate, 01b (1 decimal) = Off, 10b (2 decimal) = On and 11b (3 decimal) = indeterminate.
5	M_ST_NA_1 (7.3.1.5)	Monitored Step-point Information: This data type is used for step position of transformers or other step position information. The value for the position ranges from -64 to 63. Associated time-tagged event information for this type are M_ST_TA_1 (6) and M_ST_TB_1 (32).	Step data (7.2.6.5) is stored in a single character value with bits 0 to 6 (-64 to +63) representing the step position and bit 7 representing the following states: 0 = Equipment is not in transient state 1 = Equipment in transient state
7	M_BO_NA_1 (7.3.1.7)	Monitored Bitstring of 32-bit data: This data type stores 32-bit data in binary form. Each bit in the string has a value of 0 or 1. Associated time-tagged event information for this type are M_BO_TA_1 (8) and M_BO_TB_1 (33).	Each of the 32 bits in the bitstring has a value of 0 or 1 (7.2.6.13).
9	M_ME_NA_1 (7.3.1.9)	Monitored Normalized Measured Value: This data type is used for analog input data. Associated time-tagged event information for this type are M_ME_TA_1 (10) and M_ME_TD_1 (34).	Normalized values (7.2.6.6) are stored in a (16-bit) word data area with a range of $-1..+1 - 2^{15}$
11	M_ME_NB_1 (7.3.1.11)	Monitored Scaled Measured Value: This data type is used for analog input data. Associated time-tagged event information for this type are M_ME_TB_1 (12) and M_ME_TE_1 (35).	Scaled values (7.2.6.7) are stored in a (16-bit) word data area with a range of $-2^{15}..+2^{15}-1$

Type ID	Type	Description	Data Representation
13	M_ME_NC_1 (7.3.1.13)	Monitored Measured Value, Short Floating-Point Number: This data type is used for analog input data stored in floating point format according to the IEEE STD 754, QDS format. Associated time-tagged event information for this type are M_ME_TC_1 (14) and M_ME_TE_1 (36).	Short floating-point number stored in IEEE STD 754 format (Fraction, Exponent, Sign) (7.2.6.8)
15	M_IT_NA_1 (7.3.1.15)	Monitored Integrated Total-point Information: This data type stores meter or other count data. Associated time-tagged event information for this type are M_IT_TA_1 (15) and M_IT_TB_1 (37).	Binary counter data (7.2.6.9) is stored in a double-word (32-bit) value with a range of $-2^{31} \dots +2^{31}-1$ .
45	C_SC_NA_1 (7.3.2.1)	Single-point Command: This command controls a single binary point such as a relay.	Single bit value (7.2.6.15) with 0 = Off and 1 = On
46	C_DC_NA_1 (7.3.2.2)	Double-point Command: This command controls a dual-point binary control device such as a trip/close relay.	Double Command (7.2.6.16) with 0 = Not permitted 1 = Off 2 = On 3 = Not permitted
47	C_RC_NA_1 (7.3.2.3)	Regulating Step Command: This command controls a stepping device such as a transformer.	Regulating Step Command (7.2.6.17) with 0 = Not permitted 1 = Next step lower 2 = Next step higher 3 = Not permitted
48	C_SE_NA_1 (7.3.2.4)	Setpoint Command, Normalized Value: This command controls an analog device.	Normalized values (7.2.6.6) are stored in a (16-bit) word data area with a range of $-1 \dots +1$ to $2^{15}$
49	C_SE_NB_1 (7.3.2.5)	Setpoint Command, Scaled Value: This command controls an analog device.	Scaled values (7.2.6.7) are stored in a (16-bit) word data area with a range of $-2^{15} \dots +2^{15}-1$
50	C_SE_NC_1 (7.3.2.6)	Setpoint Command, Short Floating-Point Format: This command controls an analog device accepting an IEEE STD 754 floating-point format value.	Short floating-point number stored in IEEE STD 754 format (Fraction, Exponent, Sign) (7.2.6.8)
51	C_BO_NA_1 (7.3.2.7)	Setpoint Command, 32-bit Bitstring: This command controls a bitstring in a device.	Each of the 32 bits in the bitstring has a value of 0 or 1 (7.2.6.13).

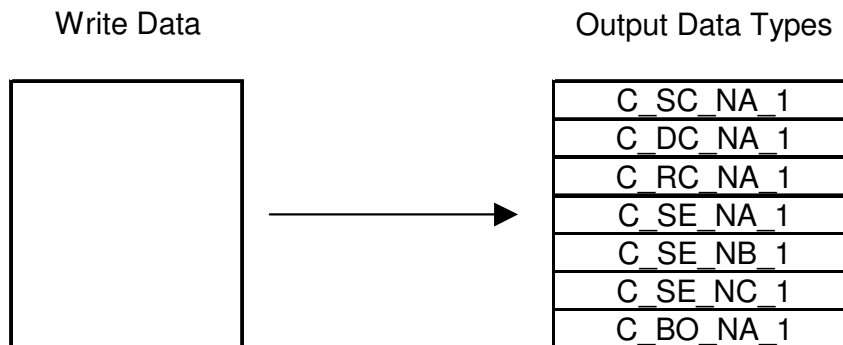
The data addressing is resumed in the following table.

Data	Size	Example
Single Point	1 bit	Address 1600 refers to word 100, bit 1 in database
Dual Point	2 bits	Address 1600 refers to word 100, bits 1 and 2 in database
Step Point	1 byte	Address 200 refers to word 100, lower byte in database
Bitstring 32 bit	2 words	Address 50 refers to word 100 and 101 in database
Normalized Measured Value	1 word	Address 100 refers to word 100 in database
Scaled Measured Value	1 word	Address 100 refers to word 100 in database
Short Float Point Measured Value	2 words	Address 50 refers to words 100 and 101 in database
Integrated Total Point	2 words	Address 50 refers to words 100 and 101 in database

Another important concept to understand is the direction of data transfer for the different data types with reference to the controller. The following illustration shows the data types (monitored data) that are transferred from the module to the processor.



The next diagram shows the movement of control data from the processor to the module. This data is then sent to the controlled devices on the serial networks.



Ladder logic in the SLC can control the module or devices on the serial network using special control blocks. The following table lists the special control codes (block numbers) used by the module:

<b>Block Code</b>	<b>Descriptions</b>
9901	User Constructed Command
9902	Command Control Block (Add command to Command List Queue)
9903	Event Messages from Master port
9950	Command List Error data
9970	Set PLC time using module's time
9971	Set module's time using PLC time
9998	Warm Boot Request from PLC (Block contains no data)
9999	Cold Boot Request from PLC (Block contains no data)

Registers 4000 to 4099 report module status data. This data area should be copied to a user file for use in the SLC. The Reference chapter of this document contains a listing of the contents of this data area.

Registers 4200 to 4299 are utilized for the transfer of event messages from the master driver to the SLC. These data are passed to the module when a value of 9903 is placed in register 4200. The ladder logic should copy the information contained in the block of data and then set register 4200 to 0 to inform the module that the messages have been accepted.

Registers 4100 to 4199 are used to control the module with ladder logic. For example, if the processor places a value of 9998 in register 4100, the module will perform a warm-boot operation. If the processor places a value of 9999 in this register, the module will perform a cold-boot operation. In this application module, both of these operations perform the same function. They exit the program and then restart the program. Many of the program parameters set in the user configuration must be set at program initialization and cannot be set while the program is running. Therefore, both functions operate the same.

The command functions supported by the module and there data formats are discussed in the following section.

Special Function Blocks

Block identification codes greater than 9900 are utilized to perform special functions in the module. Each Special Function block recognized and used by the module is defined in the following topics.

**User Constructed Command Block (9901)**

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

Word Offset in Block	Data Field(s)	Description
4100	Block ID	This field contains the block identification code of 9901 for the block.
4101	Command Count	This field defines the number of user commands contained in the block. The valid range for the field is 1 to 10.
4102 to 4107	Command #1	Data required to build the user defined command in the command queue.
4108 to 4113	Command #2	Data required to build the user defined command in the command queue.
4114 to 4119	Command #3	Data required to build the user defined command in the command queue.
4120 to 4125	Command #4	Data required to build the user defined command in the command queue.
4126 to 4131	Command #5	Data required to build the user defined command in the command queue.
4132 to 4137	Command #6	Data required to build the user defined command in the command queue.
4138 to 4143	Command #7	Data required to build the user defined command in the command queue.
4144 to 4149	Command #8	Data required to build the user defined command in the command queue.
4150 to 4155	Command #9	Data required to build the user defined command in the command queue.
4156 to 4161	Command #10	Data required to build the user defined command in the command queue.

The following fields are used for each 6-word record in the command list:

Word Offset	Definitions	Description
0	Database Index	Address in module to associate with the command
1	Session Index	Session index defined in the module to associate with the command.
2	Sector Index	Sector index for session as defined in the module.
3	Data Type	ASDU data type associated with the command.
4	Point Index	Information object address for the point on which command operates.
5	Qualifier	Qualifier as defined for the command parameter is data type dependent. list. This

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

There is no response block built by the module to send back to the processor after the block is processed. The module will set register 4100 to a value of zero after the commands have been processed. The commands are placed in the command queue and issued at a high priority.

This block and block 9902 should be used when controlling single-point, double-point and regulating step data points in remote units. If the persistent output qualifier is used in a command list, the command list can be utilized. For points that are controlled using the short or long pulse or no definition given qualifier, block 9901 should be used to control the output. For example, if the command list controls a short pulse output for a single point using the enable code of 2, any time the point's value in the database changes the command will be executed. When the point changes to a value of 0, the short pulse off command will be executed. When the point changes to a value of 1, the short pulse on command will be executed. This may not be what is desired for the application. If block 9901 is utilized instead, the ladder logic can execute a short pulse on command using a database point it that is set to 1.

For step control, if the database value is set to -1, the regulating step command of next lower will be executed. If the value in the database is 1, the regulating step command of next higher will be executed. Using block 9901 control of end device may be more reliable.

**Command Control Block (9902)**

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

Word Offset in Block	Data Field(s)	Description
4100	Block ID	This field contains the value of 9902 identifying the enable command to the module.
4101	Command count	This field contains the number of commands to enable in the command list. Valid values for this field are 1 to 60.
4102 to 4161	Command Numbers to enable	These 60 words of data contain the command numbers in the command list to enable. The commands in the list will be placed in the command queue for immediate processing by the module. The first command in the list has an index of 0.

There is no response to this block by the module. The module will place the selected commands into the command queue and set register 4100 to a value of 0. If the command references a unit that is not defined, the command will not be placed in the queue. Normal processing of the command list will continue after the commands specified in this block are processed.



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

Word Offset in Block	Data Field(s)	Description
4200	Reserved	This field contains the block identification code of 9903 for the block.
4201	Event Count	This field contains the number of events present in the block. Values of 1 to 7 are valid.
4202 to 4215	Event 1	Event message
4216 to 4229	Event 2	Event message
4230 to 4243	Event 3	Event message
4244 to 4257	Event 4	Event message
4258 to 4271	Event 5	Event message
4272 to 4285	Event 6	Event message
4286 to 4299	Event 7	Event message

The format of each 12-word data region in the block is as follows:

Word Offset	Definitions	Description
0	Session Index	This field contains the session index used to define the controlled unit in the module from which the event was generated.
1	Sector Index	This field contains the sector index used to define the database within the controlled unit from which the event was generated.
2	COT	This field contains the COT for the event message received from the IED. If the size of the COT is a single byte, the originator address will always be zero. The COT is in the LSB and the originator address is in the MSB.
3	Reserved	This field is reserved for future use and is added here to keep the structure double-word aligned for all platforms.
4 to 5	Point Index	This field contains the point index in the remote device that generated the event.
6	ASDU Type	This field contains the ASDU type code for the data contained in the message.
7	Milliseconds and Seconds	This word contains the seconds and milliseconds when the event occurred.
8	Minutes and Hours	This field contains the minutes and hours the event occurred.
9	Month and Day	This field contains the month and day of the month the event occurred.
10	Year	This field contains the year the event occurred.
11	Qualifier	This field contains the point qualifier, quality or sequence value as described in the protocol specification.
12 to 13	Value	This field contains the a double word value for the point associated with the event message.

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 will build 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. The ladder logic should set register 4200 to a value of zero after processing the event message data.

If too many events are present in the buffer (>200), the module will set 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.

### Read Command Error List Block (9950)

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

Word Offset in Block	Data Field(s)	Description
4100	Block ID	This field contains the value of 9950 identifying the block type to the module.
4101	Number of Commands to report	This field contains the number of commands to report in the response message. The value has a range of 1 to 60.
4102	Start Index of First Command	This parameter sets the index in the command list where to start. The first command in the list has a value of 0. The last index in the list has a value of MaxCommands - 1.

The module will respond to a valid request with a block containing the requested error information. The format for the block is shown the following diagram:

Word Offset in Block	Data Field(s)	Description
4100	Done Flag	This word will be set to 0 when the command block is complete.
4101	Block ID	This field will contain the value of 9950.
4102	Number of Commands reported	This field contains the number of commands contained in the block that must be processed by the PLC. This field will have a value of 1 to 60.
4103	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.
4104 to 4163	Command List Errors	Each word of this area contains the last error value recorded for the command. The command index of the first value (offset 4) is specified in word 3 of the block. The number of valid command errors in the block is set in word 2 of the block. Refer to the command error list to interpret the error codes reported.

### Set Processor Time Block (9970)

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

Word Offset in Block	Data Field(s)	Description
4100	Block ID	This field contains the value of 9970 identifying the block type to the module.

The module will respond to a valid block 9970 request with a block containing the requested date and time. The format for the block is shown the following diagram:

Word Offset in Block	Data Field(s)	Description
4100	Done Flag	This word will be set to 0 when the command is complete.
4101	Block ID	This word will contain the value of 9970
4102	Year	This field contains the four-digit year for the new time value.
4103	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
4104	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
4105	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
4106	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.
4107	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
4108	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.

### Set Module Time Block (9971)

Block identification code 9971 passes the clock time to the module. The date and time provided will be used to set the module's clock.

Word Offset in Block	Data Field(s)	Description
4100	Block ID	This field contains the block identification code of 9971 for the block.
4101	Year	This field contains the four-digit year for the new time value.
4102	Month	This field contains the month value for the new time. Valid entry for this field is in the range of 1 to 12.
4103	Day	This field contains the day value for the new time. Valid entry for this field is in the range of 1 to 31.
4104	Hour	This field contains the hour value for the new time. Valid entry for this field is in the range of 0 to 23.
4105	Minute	This field contains the minute value for the new time. Valid entry for this field is in the range of 0 to 59.
4106	Seconds	This field contains the second value for the new time. Valid entry for this field is in the range of 0 to 59.
4107	Milliseconds	This field contains the millisecond value for the new time. Valid entry for this field is in the range of 0 to 999.

The module does not send a response block to the processor after receiving this block. The module will set register 4100 to zero after processing the data.

### Warm Boot Block (9998)

Block 9998 performs a warm-boot operation on the module. The following table describes the format of the block constructed by the processor.

Offset	Description	Length
4100	9998	1

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 following table describes the format of the block constructed by the processor.

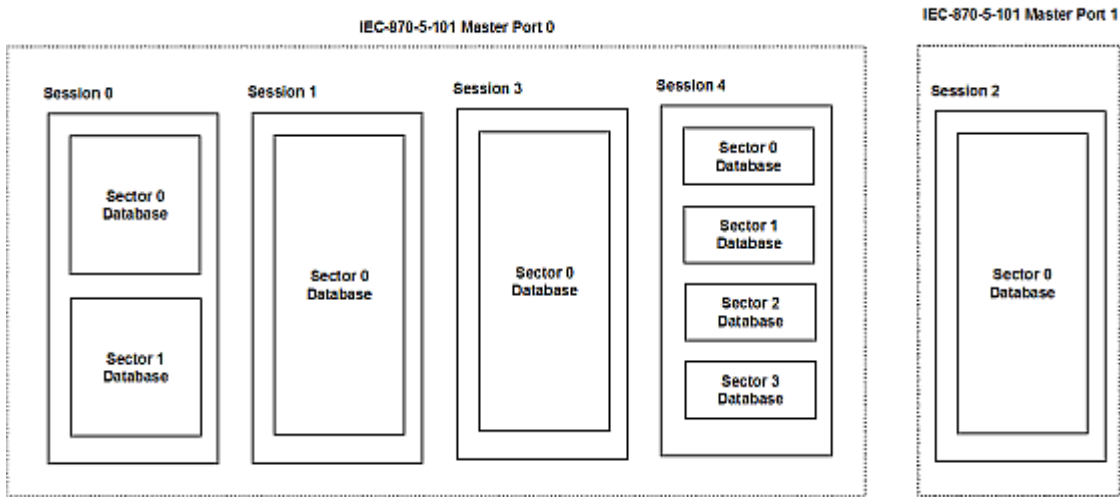
Offset	Description	Length
4100	9999	1

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

### 5.2.2 Master Driver

The master driver supported on each application port of the module emulates an IEC 60870-5-101 master device. Configuration of each port is independent and should be connected to different serial networks.

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

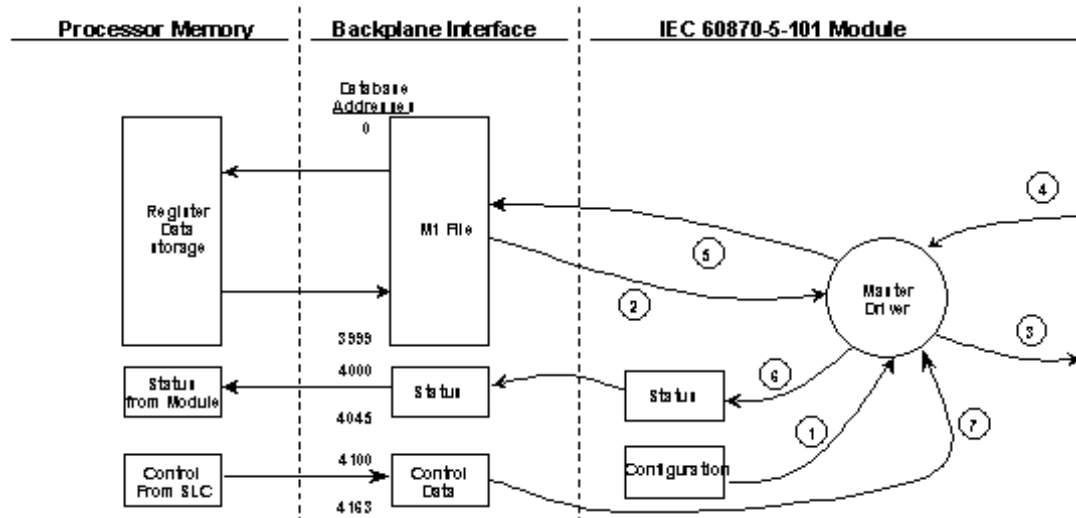


Port 0 on the module communicates with 4 sessions (0, 1, 3 and 4) each of which has their own data set(s). Session 1 only has one sector (all data for device contained in a single database). This sector is addressed by the master using the Common address of ASDU value set for the sector in the configuration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

Port 1 may operate in balanced mode as it only contains one device on the network. This device is defined in the Session 2 section of the configuration file. In this example, all data of the device is stored in a single sector.

The module supports two application ports. Thirty-two session can be defined on the module with each session being assigned to an application port. Within each session, up to five sectors can be defined. This system permits a very flexible assignment of resources in the module. The definition of the data associated with each sector in the system is defined 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 IEC101M.CFG file
- 2 The master will construct control commands using the data in the database
- 3 The master will send these commands and class polls out on the serial network
- 4 Response messages or spontaneous messages generated by controlled devices on the serial network are received by the master driver
- 5 Monitor data (static and event) 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
- 7 If the SLC controls the module, messages are passed from the ladder logic to the module. The master driver uses these commands to control the module or devices on the network.

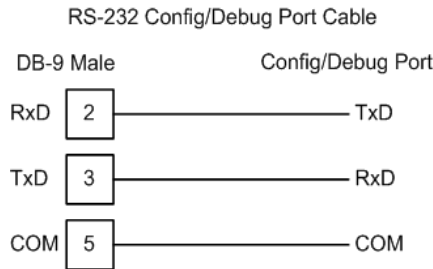
### 5.3 Cable Connections

The application ports on the MVI46-101M 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.

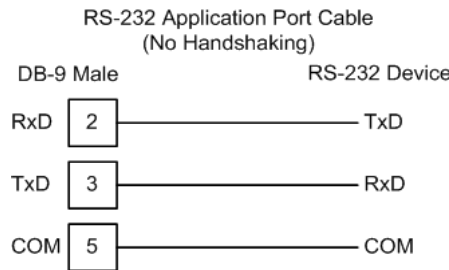
#### 5.3.1 RS-232 Configuration/Debug Port

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:



#### 5.3.2 RS-232 Application Port(s)

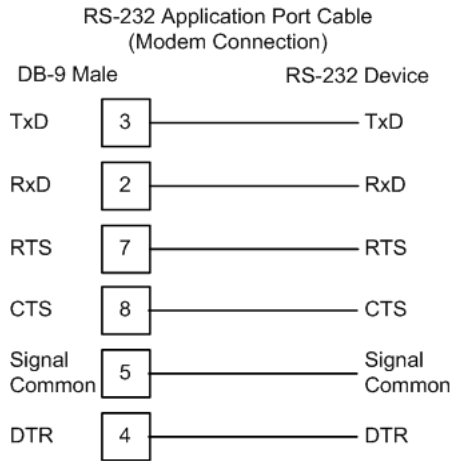
When the RS-232 interface is selected, the use of hardware handshaking (control and monitoring of modem signal lines) is user definable. If no hardware handshaking will be used, here are the cable pinouts to connect to the port.





RS-232: Modem Connection (Hardware Handshaking Required)

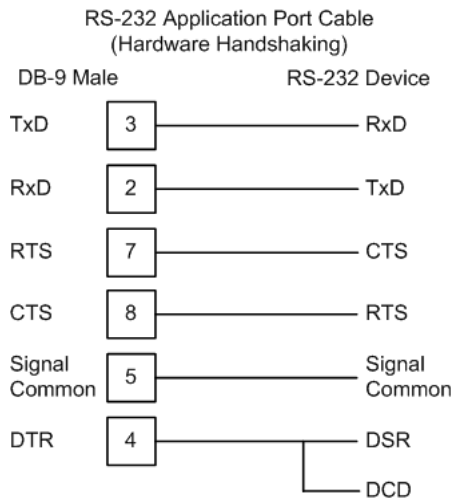
This type of connection is required between the module and a modem or other communication device.



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

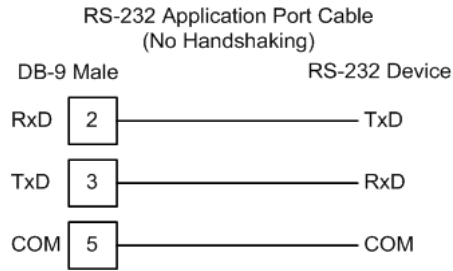
RS-232: Null Modem Connection (Hardware Handshaking)

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

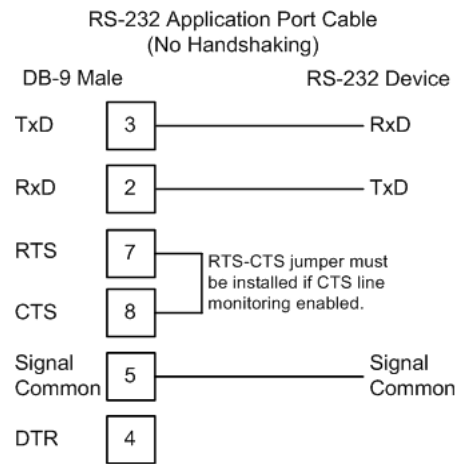


RS-232: Null Modem Connection (No Hardware Handshaking)

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

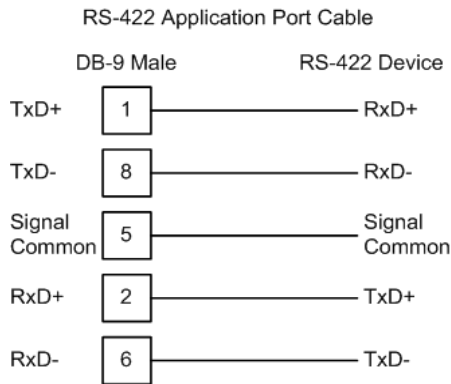


**Note:** For most null modem connections where hardware handshaking is not required, the *Use CTS Line* parameter should be set to **N** and no jumper will be required between Pins 7 (RTS) and 8 (CTS) on the connector. If the port is configured with the *Use CTS Line* set to **Y**, then a jumper is required between the RTS and the CTS lines on the port connection.



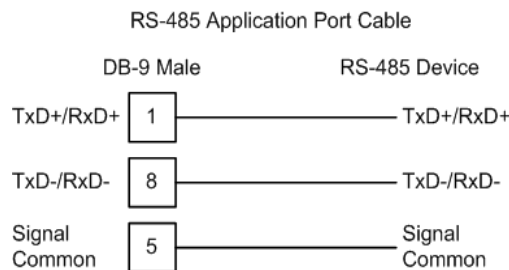
### 5.3.3 RS-422

The RS-422 interface requires a single four or five wire cable. The Common connection is optional, depending on the RS-422 network devices used. The cable required for this interface is shown below:



### 5.3.4 RS-485 Application Port(s)

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

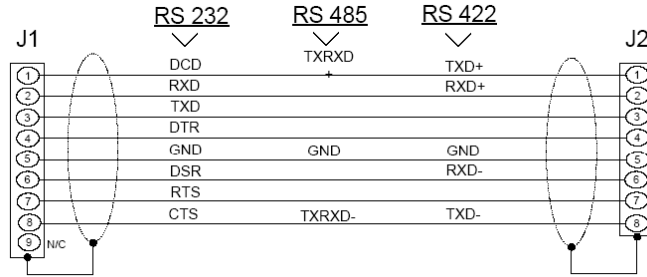
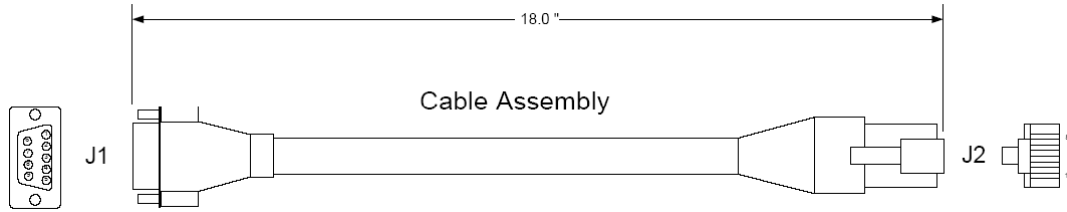


**Note:** Terminating resistors are generally not required on the RS-485 network, unless you are experiencing communication problems that can be attributed to signal echoes or reflections. In these cases, installing a 120-ohm terminating resistor between pins 1 and 8 on the module connector end of the RS-485 line may improve communication quality.

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

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

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



Wiring Diagram

## 5.4 MVI46-101M Status Data Area

This section contains a listing of the data contained in the MVI46-101M status data object, configuration error word and module error codes.

### 5.4.1 MVI46-IEC 60870-5-101 Master Communication Module Error/Status Data Format

Offset	Parameter	Description
4000	Scan Count	This status value contains a counter incremented on each scan of the module's main loop.
4001 to 4002	Product Name	This two-word data area contains the text values representing the product name. These words contain the text '87S5' for the MVI56 platform.
4003 to 4004	Revision	This two-word data area contains the text values for the revision number.
4005 to 4006	Op Sys #	This two-word data area contains the text values for the operating system number.
4007 to 4008	Run Number	This two-word data area contains the text values for the run number.
4009	Read Blk Cnt	This word contains the total number of block read operations successfully executed.
4010	Write Blk Cnt	This word contains the total number of block write operations successfully executed.
4011	Parse Blk Cnt	This word contains the total number of write blocks successfully parsed.
4012	Error Blk Cnt	This word contains the total number of block transfer errors.
4013	Event Msg Cnt	This word contains the number of event messages waiting to send to the processor.
4014	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.
4015	Session Count	This word contains the number of session configured in the module.
4016	Current Cmd	This word contains the index of the current command being executed in the command list.
4017	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.
4018	Cmd Count	This word contains the count of the number of commands configured for the module.
4019	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.
4020	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.

Offset	Parameter	Description
4021	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.
4022 to 4023	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.
4024	CH 0 State	This word contains the state machine value for channel 0.
4025	Cmd Req	This word contains the number of commands transferred out channel 0.
4026	Cmd Resp	This word contains the number of command response messages received on channel 0.
4027	Cmd Err	This word contains the number of command errors recognized on channel 0.
4028	Requests	This word contains the total number of messages transmitted on channel 0.
4029	Responses	This word contains the total number of messages received on channel 0.
4030	Err Sent	This word contains the number of error messages sent on channel 0.
4031	Err Received	This word contains the number of error messages received on channel 0.
4032	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.
4033	Current Error	This word contains the error code for the current command executing on channel 0.
4034	Last Error	This word contains the error code for the last error recognized on channel 0.
4035	CH 1 State	This word contains the state machine value for channel 1.
4036	Cmd Req	This word contains the number of commands transferred out channel 1.
4037	Cmd Resp	This word contains the number of command response messages received on channel 1.
4038	Cmd Err	This word contains the number of command errors recognized on channel 1.
4039	Requests	This word contains the total number of messages transmitted on channel 1.
4040	Responses	This word contains the total number of messages received on channel 1.
4041	Err Sent	This word contains the number of error messages sent on channel 1.
4042	Err Received	This word contains the number of error messages received on channel 1.
4043	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.

Offset	Parameter	Description
4044	Current Error	This word contains the error code for the current command executing on channel 1.
4045	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	Invalid length data for session: Data link length Command address of ASDU length Information object address length COT octet count
7	0x0080	Invalid failure delay or confirm timeout for session.
8	0x0100	
9	0x0200	
10	0x0400	
11	0x0800	
12	0x1000	
13	0x2000	
14	0x4000	
15	0x8000	

The following table lists all potential errors that can be generated by the IEC 60870-5-101 master driver:

### 5.4.2 MVI46-IEC 60870-5-101 Master Communication Module Error Codes

Error	Description
51	Physical layer error: Error transmitting message
52	Physical layer error: Intercharacter timeout occurred before message fully received.
53	Physical layer error: Frame not entirely received before timeout condition.
54	Physical layer error: Invalid frame length.
101	Link layer error: Invalid checksum received
102	Link layer error: Address unknown to module
103	Link layer error: Link established
104	Link layer error: Link failed
105	Link layer error: Received primary
106	Link layer error: FCB error discard
107	Link layer error: FCB error repeat
108	Link layer error: Invalid start character received
109	Link layer error: Invalid second character received
110	Link layer error: Invalid ending character received
111	Link layer error: Length mismatch error
112	Link layer error: Illegal function
113	Link layer error: No confirmation received
114	Link layer error: No ACK received
115	Link layer error: Sequence unknown
116	Link layer error: Out of sequence
117	Link layer error: Remote close
118	Link layer error: Unexpected ACK
119	Link layer error: Request cancelled
201	Application layer error: Length mismatch
202	Application layer error: Address unknown
203	Application layer error: Response late
251	RBE error: Clock event buffer overflow
252	RBE error: Event buffer overflow
271	Data error: Address unknown
281	Control error: Illegal operation
282	Control error: Illegal value
283	Control error: Not selected
301	Initialization error: Database
302	Initialization error: Out of memory
401	Channel open error
501	Session error: Database
502	Session error: Configuration
601	No memory to receive message



---

<b>Error</b>	<b>Description</b>
602	Session not reserved
603	Illegal session
604	Session is reserved
605	Session is not available
701	No memory to transmit message
702	ASDU not supported
703	Duplicate request
704	Illegal sector
705	Control mode is illegal
801	Partial stop request
802	Stop request failed
901	Response timeout
902	Negative COT in response
903	Session is offline
904	Session is disabled
905	Select confirmation received, waiting to execute
906	Execute confirmation has not be received

---





## 5.7 Interoperability

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.

The selected parameters should be crossed in the white boxes (replace "□" with "☒").

**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.

### Network configuration

(network-specific parameter)

- ☒ Point-to-point    ☒ Multipoint-party line  
☒ Multiple point-to-point    ☒ Multipoint-star

### Physical Layer

(network-specific parameter)

#### Transmission speed (control direction)

Unbalanced interchange circuit V.24/V.28	Unbalanced interchange circuit V.24/V.28	Balanced interchange circuit X.24/X.27
---	---	---

Standard	Recommended if >1 200 bit/s		
□ 100 bit/s 56000 bit/s	☒ 2400 bit/s	☒ 2400 bit/s	□
□ 200 bit/s 64000 bit/s	☒ 4800 bit/s	☒ 4800 bit/s	□
☒ 300 bit/s	☒ 9600 bit/s	☒ 9600 bit/s	
☒ 600 bit/s		☒ 19200 bit/s	
☒ 1200 bit/s		☒ 38400 bit/s	

#### Transmission speed (monitor direction)

Unbalanced interchange circuit V.24/V.28	Unbalanced interchange circuit V.24/V.28	Balanced interchange circuit X.24/X.27
---	---	---

Standard	Recommended if >1 200 bit/s		
□ 100 bit/s 56000 bit/s	☒ 2400 bit/s	☒ 2400 bit/s	□
□ 200 bit/s 64000 bit/s	☒ 4800 bit/s	☒ 4800 bit/s	□

- |                                     |            |                                     |            |                                     |             |
|-------------------------------------|------------|-------------------------------------|------------|-------------------------------------|-------------|
| <input checked="" type="checkbox"/> | 300 bit/s  | <input checked="" type="checkbox"/> | 9600 bit/s | <input checked="" type="checkbox"/> | 9600 bit/s  |
| <input checked="" type="checkbox"/> | 600 bit/s  |                                     |            | <input checked="" type="checkbox"/> | 19200 bit/s |
| <input checked="" type="checkbox"/> | 1200 bit/s |                                     |            | <input checked="" type="checkbox"/> | 38400 bit/s |

#### Link Layer

(network-specific parameter)

Frame format FT 1.2, single character 1 and the fixed time out interval are used exclusively in this companion standard.

Link transmission procedure Address field of link

- Balanced transmission     Not present (balanced transmission only)
- Unbalanced transmission     One octet
  - Two octets
  - Structured

Frame length  Unstructured

255 Maximum length L (number of octets)

#### Application Layer

Transmission mode for application data

Mode 1 (Least significant octet first), as defined in clause 4.10 of IEC 870-5-4, is used exclusively in this companion standard.

Common address of ASDU

(system-specific parameter)

- One octet     Two octets

Information object address

(system-specific parameter)

- One octet     structured
- Two octets     unstructured
- Three octets

Cause of transmission

(system-specific parameter)

- One octet     Two octets (with originator address)

Selection of standard ASDUs

Process information in monitor direction

(station-specific parameter)

- <1>    := Single-point information M\_SP\_NA\_1
- <2>    := Single-point information with time tag M\_SP\_TA\_1
- <3>    := Double-point information M\_DP\_NA\_1
- <4>    := Double-point information with time tag M\_DP\_TA\_1
- <5>    := Step position information M\_ST\_NA\_1
- <6>    := Step position information with time tag M\_ST\_TA\_1
- <7>    := Bitstring of 32 bit M\_BO\_NA\_1
- <8>    := Bitstring of 32 bit with time tag M\_BO\_TA\_1

- <9> := Measured value, normalized value M\_ME\_NA\_1
  - <10> := Measured value, normalized value with time tag M\_ME\_TA\_1
  - <11> := Measured value, scaled value M\_ME\_NB\_1
  - <12> := Measured value, scaled value with time tag M\_ME\_TB\_1
  - <13> := Measured value, short floating point value M\_ME\_NC\_1
  - <14> := Measured value, short floating point value with time tag  
M\_ME\_TC\_1
  - <15> := Integrated totals M\_IT\_NA\_1
  - <16> := Integrated totals with time tag M\_IT\_TA\_1
  - <17> := Event of protection equipment with time tag M\_EP\_TA\_1
  - <18> := Packed start events of protection equipment with time tag  
M\_EP\_TB\_1
  - <19> := Packed output circuit information of protection equipment with  
time tag M\_EP\_TC\_1
  - <20> := Packed single-point information with status change detection  
M\_PS\_NA\_1
  - <21> := Measured value, normalized value without quality descriptor  
M\_ME\_ND\_1
  - <30> := Single-point information with time tag CP56Time2a  
M\_SP\_TB\_1
  - <31> := Double-point information with time tag CP56Time2A  
M\_DP\_TB\_1
  - <32> := Step position information with time tag CP56Time2A  
M\_ST\_TB\_1
  - <33> := Bitstring of 32 bit with time tag CP56Time2A M\_BO\_TB\_1
  - <34> := Measured value, normalized value with time tag CP56Time2A  
M\_ME\_TD\_1
  - <35> := Measured value, scaled value with time tag CP56Time2A  
M\_ME\_TE\_1
  - <36> := Measured value, short floating point value with time tag  
CP56Time2A M\_ME\_TF\_1
  - <37> := Integrated totals with time tag CP56Time2A M\_IT\_TB\_1
  - <38> := Event of protection equipment with time tag CP56Time2A  
M\_EP\_TD\_1
  - <39> := Packed start events of protection equipment with time tag  
CP56time2A M\_EP\_TE\_1
  - <40> := Packed output circuit information of protection equipment with  
time tag CPT56Time2a M\_EP\_TF\_1
- Process information in control direction  
(station-specific parameter)
- <45> := Single command C\_SC\_NA\_1
  - <46> := Double command C\_DC\_NA\_1

- <47> := Regulating step command C\_RC\_NA\_1
- <48> := Set point command, normalized value C\_SE\_NA\_1
- <49> := Set point command, scaled value C\_SE\_NB\_1
- <50> := Set point command, short floating point value C\_SE\_NC\_1
- <51> := Bitstring of 32 bit C\_BO\_NA\_1

System information in monitor direction

(station-specific parameter)

- <70> := End of initialization M\_EI\_NA\_1

System information in control direction

(station-specific parameter)

- <100> := Interrogation command C\_IC\_NA\_1
- <101> := Counter interrogation command C\_CI\_NA\_1
- <102> := Read command C\_RD\_NA\_1
- <103> := Clock synchronization command C\_CS\_NA\_1
- <104> := Test command C\_TS\_NB\_1
- <105> := Reset process command C\_RP\_NC\_1
- <106> := Delay acquisition command C\_CD\_NA\_1

Parameter in control direction

(station-specific parameter)

- <110> := Parameter of measured value, normalized value P\_ME\_NA\_1
- <111> := Parameter of measured value, scaled value P\_ME\_NB\_1
- &#246;<112> := Parameter of measured value, short floating point value P\_ME\_NC\_1
- <113> := Parameter activation P\_AC\_NA\_1

File transfer

(station-specific parameter)

- <120> := File ready F\_FR\_NA\_1
- <121> := Section ready F\_SR\_NA\_1
- <122> := Call directory, select file, call file, call section F\_SC\_NA\_1
- <123> := Last section, last segment F\_LS\_NA\_1
- <124> := Ack file, ack section F\_AF\_NA\_1
- <125> := Segment F\_SG\_NA\_1
- <126> := Directory F\_DR\_TA\_1

Basic Application Functions

Station initialization

(station-specific parameter)

- Remote initialization

General Interrogation

(system- or station-specific parameter)

- global

- group 1       group 7       group 13
- group 2       group 8       group 14
- group 3       group 9       group 15
- group 4       group 10      group 16
- group 5       group 11
- group 6       group 12

Addresses per group have to be defined

Clock synchronization

(station-specific parameter)

- Clock synchronization

Command transmission

(object-specific parameter)

- Direct command transmission       Select and execute command
- Direct set point command transmission       Select/execute set point cmd

- C\_SE\_ACTTERM used

- No additional definition
- Short pulse duration (duration determined by a system parameter in the outstation)
- Long pulse duration (duration determined by a system parameter in the outstation)
- Persistent output

Transmission of Integrated totals

(station- or object-specific parameter)

- Counter request       General request counter
- Counter freeze without reset       Request counter group 1
- Counter freeze with reset       Request counter group 2
- Counter reset       Request counter group 3
- Request counter group 4

Addresses per group have to be defined

Parameter loading

(object-specific parameter)

- Threshold value
- Smoothing factor
- Low limit for transmission of measured value
- High limit for transmission of measured value

Parameter activation

(object-specific parameter)



Act/deact of persistent cyclic or periodic transmission of the addressed object

File transfer

(station-specific parameter)

File transfer in monitor direction

File transfer in control direction



## 6 Support, Service & Warranty

### In This Chapter

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### **Contacting Technical Support**

ProSoft Technology, Inc. (ProSoft) is committed to providing the most efficient and effective support possible. Before calling, please gather the following information to assist in expediting this process:

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

If the issue is hardware related, we will also need information regarding:

- 1 Module configuration and associated ladder files, if any
- 2 Module operation and any unusual behavior
- 3 Configuration/Debug status information
- 4 LED patterns
- 5 Details about the serial, Ethernet or fieldbus devices interfaced to the module, if any.

**Note:** For technical support calls within the United States, an after-hours answering system allows 24-hour/7-days-a-week pager access to one of our qualified Technical and/or Application Support Engineers. Detailed contact information for all our worldwide locations is available on the following page.

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<b>Internet</b>	Web Site: <a href="http://www.prosoft-technology.com/support">www.prosoft-technology.com/support</a> E-mail address: <a href="mailto:support@prosoft-technology.com">support@prosoft-technology.com</a>
<b>Asia Pacific</b> (location in Malaysia)	Tel: +603.7724.2080, E-mail: <a href="mailto:asiapc@prosoft-technology.com">asiapc@prosoft-technology.com</a> Languages spoken include: Chinese, English
<b>Asia Pacific</b> (location in China)	Tel: +86.21.5187.7337 x888, E-mail: <a href="mailto:asiapc@prosoft-technology.com">asiapc@prosoft-technology.com</a> Languages spoken include: Chinese, English
<b>Europe</b> (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: <a href="mailto:support.EMEA@prosoft-technology.com">support.EMEA@prosoft-technology.com</a> Languages spoken include: French, English
<b>Europe</b> (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: <a href="mailto:mea@prosoft-technology.com">mea@prosoft-technology.com</a> Languages spoken include: English, Hindi
<b>North America</b> (location in California)	Tel: +1.661.716.5100, E-mail: <a href="mailto:support@prosoft-technology.com">support@prosoft-technology.com</a> Languages spoken include: English, Spanish
<b>Latin America</b> (Oficina Regional)	Tel: +1-281-2989109, E-Mail: <a href="mailto:latinam@prosoft-technology.com">latinam@prosoft-technology.com</a> Languages spoken include: Spanish, English
<b>Latin America</b> (location in Puebla, Mexico)	Tel: +52-222-3-99-6565, E-mail: <a href="mailto:soporte@prosoft-technology.com">soporte@prosoft-technology.com</a> Languages spoken include: Spanish
<b>Brasil</b> (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: <a href="mailto:brasil@prosoft-technology.com">brasil@prosoft-technology.com</a> Languages spoken include: Portuguese, English

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## 6.1 Return Material Authorization (RMA) Policies and Conditions

The following Return Material Authorization (RMA) Policies and Conditions (collectively, "RMA Policies") apply to any returned product. These RMA Policies are subject to change by ProSoft Technology, Inc., without notice. For warranty information, see Limited Warranty (page 119). In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

### 6.1.1 Returning Any Product

- a) In order to return a Product for repair, exchange, or otherwise, the Customer must obtain a Return Material Authorization (RMA) number from ProSoft Technology and comply with ProSoft Technology shipping instructions.
- b) In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above (page 115). A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.
- c) All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft Technology, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft Technology using a shipment method other than that specified by ProSoft Technology, or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
- d) A 10% restocking fee applies to all warranty credit returns, whereby a Customer has an application change, ordered too many, does not need, etc. Returns for credit require that all accessory parts included in the original box (i.e.; antennas, cables) be returned. Failure to return these items will result in a deduction from the total credit due for each missing item.

### 6.1.2 Returning Units Under Warranty

A Technical Support Engineer must approve the return of Product under ProSoft Technology's Warranty:

- a) A replacement module will be shipped and invoiced. A purchase order will be required.
- b) Credit for a product under warranty will be issued upon receipt of authorized product by ProSoft Technology at designated location referenced on the Return Material Authorization
  - i. If a defect is found and is determined to be customer generated, or if the defect is otherwise not covered by ProSoft Technology's warranty, there will be no credit given. Customer will be contacted and can request module be returned at their expense;

- ii. If defect is customer generated and is repairable, customer can authorize ProSoft Technology to repair the unit by providing a purchase order for 30% of the current list price plus freight charges, duties and taxes as applicable.

### **6.1.3 Returning Units Out of Warranty**

- a) Customer sends unit in for evaluation to location specified by ProSoft Technology, freight prepaid.
- b) If no defect is found, Customer will be charged the equivalent of \$100 USD, plus freight charges, duties and taxes as applicable. A new purchase order will be required.
- c) If unit is repaired, charge to Customer will be 30% of current list price (USD) plus freight charges, duties and taxes as applicable. A new purchase order will be required or authorization to use the purchase order submitted for evaluation fee.

**The following is a list of non-repairable units:**

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

## 6.2 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 Technology, Incorporated (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.

### 6.2.1 What Is Covered By This Warranty

- a) *Warranty On New Products:* ProSoft warrants, to the original purchaser, that the Product that is the subject of the sale will (1) conform to and perform in accordance with published specifications prepared, approved and issued by ProSoft, and (2) will be free from defects in material or workmanship; provided these warranties only cover Product that is sold as new. This Warranty expires three (3) years from the date of shipment for Product purchased **on or after** January 1st, 2008, or one (1) year from the date of shipment for Product purchased **before** January 1st, 2008 (the "Warranty Period"). If the Customer discovers within the Warranty Period a failure of the Product to conform to specifications, or a defect in material or workmanship of the Product, the Customer must promptly notify ProSoft by fax, email or telephone. In no event may that notification be received by ProSoft later than 39 months from date of original shipment. 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 remanufactured replacement parts. ProSoft reserves the right, and at its sole discretion, may replace unrepairable units with new or remanufactured equipment. All replacement units will be covered under warranty for the 3 year period commencing from the date of original equipment purchase, not the date of shipment of the replacement unit. Such repair, including both parts and labor, will be performed at ProSoft's expense. All warranty service will be performed at service centers designated by ProSoft.
- b) *Warranty On Services:* Materials and labor performed by ProSoft to repair a verified malfunction or defect are warranted in the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.

### **6.2.2 What Is Not Covered By This Warranty**

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

### **6.2.3 Disclaimer Regarding High Risk Activities**

Product manufactured or supplied by ProSoft is not fault tolerant and is not designed, manufactured or intended for use in hazardous environments requiring fail-safe performance including and without limitation: the operation of nuclear facilities, aircraft navigation or 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.



#### **6.2.4 Intellectual Property Indemnity**

Buyer shall indemnify and hold harmless ProSoft and its employees from and against all liabilities, losses, claims, costs and expenses (including attorney's fees and expenses) related to any claim, investigation, litigation or proceeding (whether or not ProSoft is a party) which arises or is alleged to arise from Buyer's acts or omissions under these Terms or in any way with respect to the Products. Without limiting the foregoing, Buyer (at its own expense) shall indemnify and hold harmless ProSoft and defend or settle any action brought against such Companies to the extent based on a claim that any Product made to Buyer specifications infringed intellectual property rights of another party. ProSoft makes no warranty that the product is or will be delivered free of any person's claiming of patent, trademark, or similar infringement. The Buyer assumes all risks (including the risk of suit) that the product or any use of the product will infringe existing or subsequently issued patents, trademarks, or copyrights.

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

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

#### **6.2.5 Disclaimer of all Other Warranties**

The Warranty set forth in What Is Covered By This Warranty (page 119) 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.

### **6.2.6 Limitation of Remedies \*\***

In no event will ProSoft or its Dealer be liable for any special, incidental or consequential damages based on breach of warranty, breach of contract, negligence, strict tort or any other legal theory. Damages that ProSoft or its Dealer will not be responsible for 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.

### **6.2.7 Time Limit for Bringing Suit**

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

### **6.2.8 No Other Warranties**

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

### **6.2.9 Allocation of Risks**

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

### **6.2.10 Controlling Law and Severability**

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

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