ProSoft TECHNOLOGY

Where Automation Connects.

inRAx®

MVI46-101S

SLC Platform

IEC 60870-5-101 Slave Communication Module

September 03, 2008

USER MANUAL

Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation SLC hardware, the MVI46-101S Module and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

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

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

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

Battery Life Advisory

All modules in the MVI series use a rechargeable Lithium Vanadium Pentoxide battery to backup the 512K SRAM memory, real-time clock, and CMOS. The battery should last for the life of the module.
The module must be powered for approximately twenty hours before it becomes fully charged. After it is fully charged, the battery provides backup power for the CMOS setup and configuration data, the real-time clock, and the 512K SRAM memory for approximately 21 days.
Before you remove a module from its power source, ensure that the battery within the module is fully charged. A fully charged battery will hold the BIOS settings (after being removed from its power source) for a limited number of days. When the battery is fully discharged, the module will revert to the default BIOS settings.

Note: The battery is not user replaceable.

Your Feedback Please

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

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MVI46-101S User Manual
September 03, 2008

ProSoft® Product Documentation

In an effort to conserve paper, ProSoft Technology no longer includes printed manuals with our product shipments. User Manuals, Datasheets, Sample Ladder Files, and Configuration Files are provided on the enclosed CD and are available at no charge from our web site: http://www.prosoft-technology.com
Printed documentation is available for purchase. Contact ProSoft Technology for pricing and availability.
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Contents

Guide to the MVI46-101S User Manual

Function		Section to Read	Details
Introduction (Must Do)	→	Start Here (page 9)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Verify Communication, Diagnostic and Troubleshooting	→	Verifying Communication (page 45) Diagnostics and Troubleshooting (page 31)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	Reference (page 47) Functional Overview (page 49) Product Specifications (page 47)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 87)	This section contains Support, Service and Warranty information. Index of chapters.

1 Start Here

In This Chapter

Installing the MVI46-101S module requires a reasonable working knowledge of the Rockwell Automation hardware, the MVI46-101S Module and the application in which they will be used.

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

1.1 System Requirements

The MVI46-101S 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 MVI46-101S module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 500 programming software.
- Rockwell Automation RSLinx communication software
- Pentium® II 500 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft® Windows 98
  - Windows NT® (version 4 with SP4 or higher)
  - Windows 2000
  - Windows XP
- 32 Mbytes of RAM minimum, 64 Mbytes of RAM recommended
- 50 Mbytes of free hard disk space (or more based on application requirements)

- 16-color VGA graphics adapter, 640 x 480 minimum resolution (256 Color 800 × 600 recommended)
- CD-ROM drive
- 3.5 inch floppy disk drive
- HyperTerminal or other terminal emulator program capable of file transfers using Ymodem protocol.

1.2 Package Contents

The following components are included with your MVI46-101S 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	MVI46-101S Module	MVI46-101S	IEC 60870-5-101 Slave 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 MVI46-101S module.

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

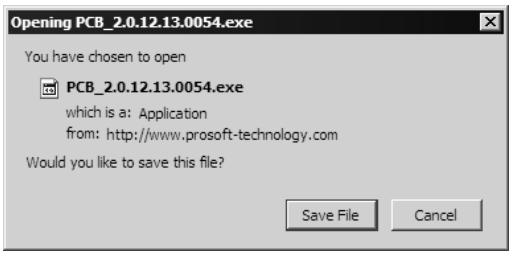
1.3 Install ProSoft Configuration Builder Software

You must install the ProSoft Configuration Builder (PCB) software in order to configure the MVI46-101S module. You can always get the newest version of ProSoft Configuration Builder from the ProSoft Technology web site.

To install ProSoft Configuration Builder from the ProSoft Web Site

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. The following illustrations show the file download prompt for two of the most common web browsers.



4 Make a note of the location where you saved the file, for example "Desktop", or "My Documents", so you can start the installation program.
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 CD-ROM, included in the package with your MVI46-101S module.

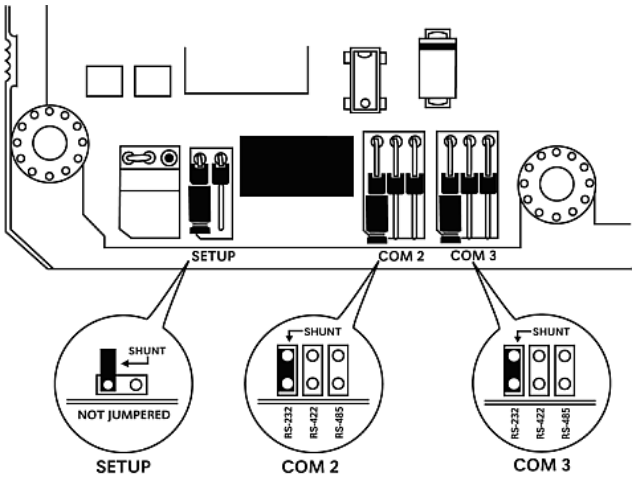
To install ProSoft Configuration Builder from the CD-ROM

1 Insert the ProSoft Solutions CD-ROM into the CD drive of your PC. Wait for the startup screen to appear.
2 On the startup screen, click *Product Documentation*. This action opens an explorer 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 *ProSoft Configuration Builder Setup* program and follow the instructions on your screen to install the software on your PC.

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 MVI46-101S 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 Install the Module in the Rack

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

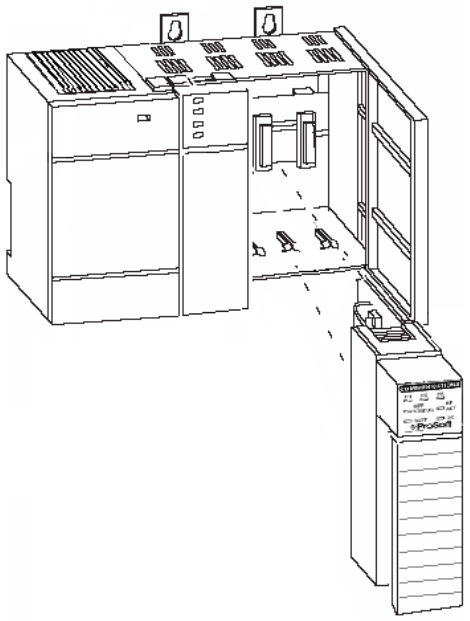
Warning: You must follow all safety instructions when installing this or any other electronic devices. Failure to follow safety procedures could result in damage to hardware or data, or even serious injury or death to personnel. Refer to the documentation for each device you plan to connect to verify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

After you have checked the placement of the jumpers, insert MVI46-101S 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.

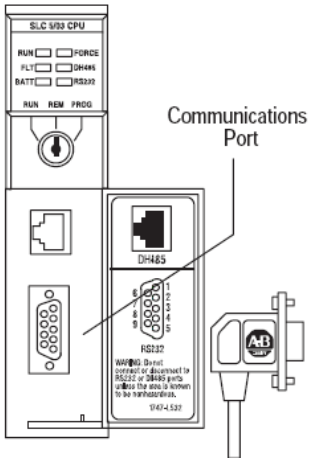


3 With a firm but steady push, snap the module into place.
4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample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

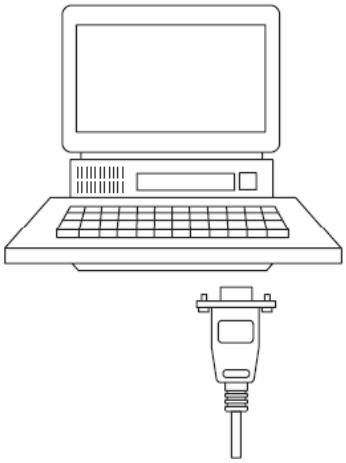
Note: If you insert the module improperly, the system may stop working, or may behave unpredictably.

1.6 Connect your PC to the Processor

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



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

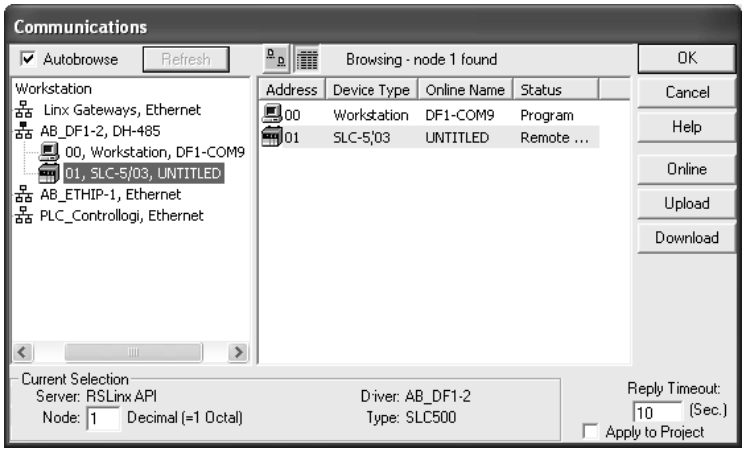


1.7 Download the Sample Program to the Processor

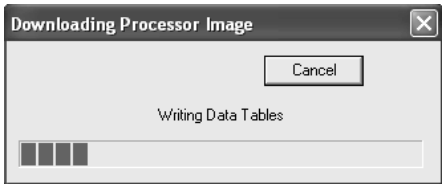
To download the sample program from RSLogix 500 to the SLC processor:

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

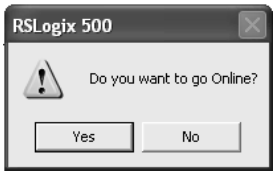
1 If you are not already online to the processor, open the Communications menu, and then choose Download. RSLogix will establish communication with the processor.



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



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

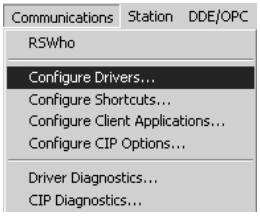


Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

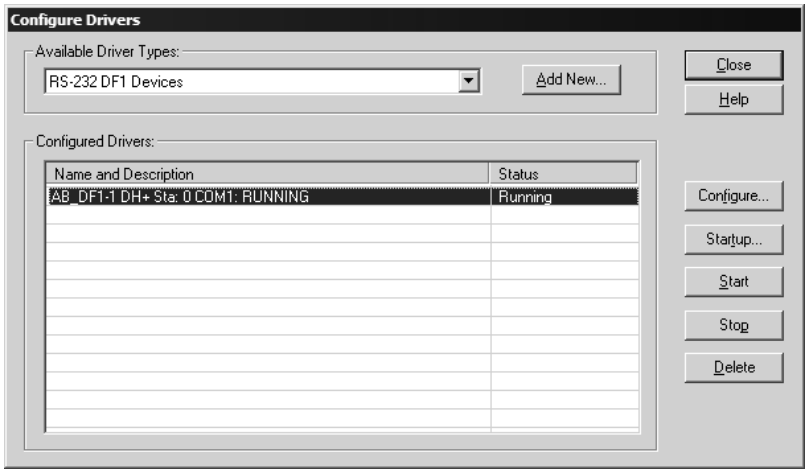
1.7.1 Configuring RSLinx

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

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

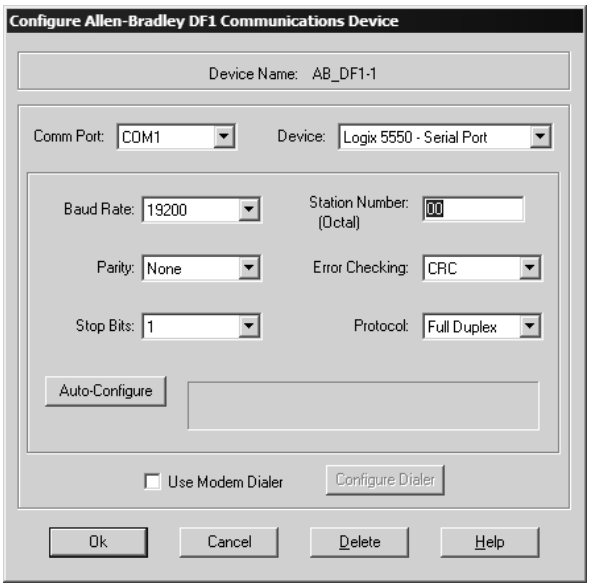


This action opens the Configure Drivers dialog box.



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

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



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

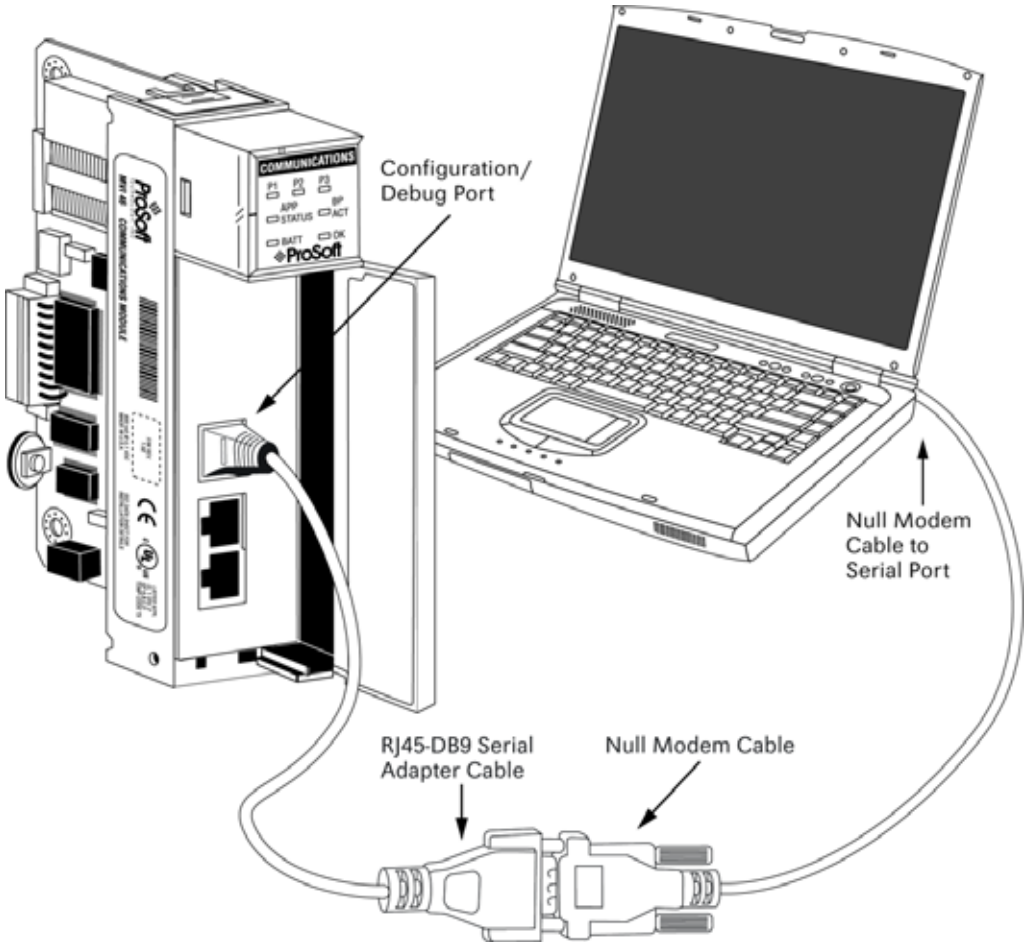
5 When you see the message "Auto Configuration Successful", click the OK button to dismiss the dialog box.

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

1.8 Connect your PC to the Module

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

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



2 Module Configuration

In This Chapter

This section contains the setup procedure, data and ladder logic requirements for successful application of the MVI46-101S module. Each step in the setup procedure is defined in order to simplify the use of the module. Refer to **Installing and Configuring the Module** (page 19) to begin installing and configuring the module. Additionally, this document contains a discussion on configuring the module using the IEC8701S.CFG file. All configuration information used by the module is stored in this file. Refer to **Configuration File** (page 26) to begin setting up this file.

The document also contains a discussion of the data areas defined for the module. These areas contain the read and write data from the module and status related to the module. It is important to understand each element of the data areas for proper application of the module. Refer to **Module Data (page 21)** for the presentation of the data areas.

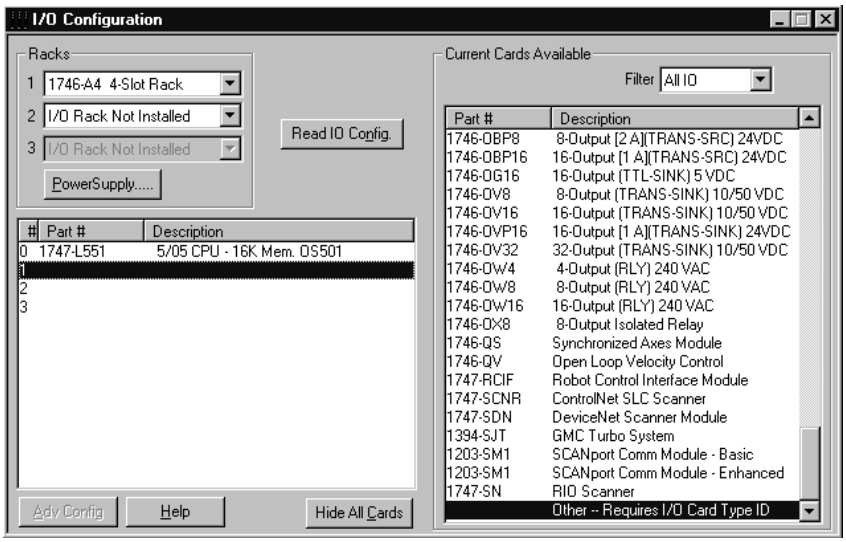
2.1 Installing and Configuring the Module

The configuration process consists of the following steps.

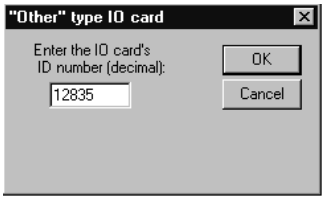
1 Download the sample program to the processor.

Note: For most applications, the sample program will work without modification. We strongly recommend setting up the module first with the sample program, before attempting to add the module to an existing application or create a custom application.
Modify the module's configuration files to meet the needs of your application, and copy the updated configuration to the module. Example configuration files are provided on the CD-ROM. Refer to Modifying the Configuration File (page 24) for more information on the configuration files.

First, define the module to the system. Select the I/O Configuration option from the program screen. This displays the following dialog box:



Select the "Other" module from the list. This action opens the following dialog box



Enter the module I/O card ID number as 12835, and then click OK. Double-click the mouse on the module just added to the rack. The fields should be filled in as follows:

Field	Value
Scanned Input Words	2
Scanned Output Words	2
Interrupt Service Routine (ISR)#	0
M0 Length	0
M1 Length	6000
G File Length	0

If the fields match the table, or once you make the appropriate changes, click OK to apply these settings to the module. Then, close the I/O Configuration dialog box.

Next, define the user defined data areas to hold the status and read and write database areas. Edit the IEC8701S.CFG file now for the application to implement. Use any text editor to set the values in the file. You must retain the file name, IEC8701S.CFG.

The last step in the module setup is to add the ladder logic. If the example ladder logic is used, adjust the ladder to fit the application. When the ladder example is not used, copy the example ladder logic to your application and alter as necessary.

The module is now set up and ready to be used with your application. Insert the module in the rack and attach the serial communication cables. Download the IEC8701S.CFG file to the module. Download the new application to the controller and place the processor in run mode. If all the configuration parameters are set correctly and the module is attached to a network, the module's Application LED (APP LED) should remain off and the backplane activity LED (BP ACT) should blink very rapidly. Refer to the **Diagnostics and Troubleshooting** section of this manual if you encounter errors. Attach a computer or terminal to Debug/Configuration port on the module and look at the status of the module using the Configuration/Debug Menu in the module. Refer to the **Diagnostics and Troubleshooting** section for a complete discussion of the use of this feature.

2.2 Module Data

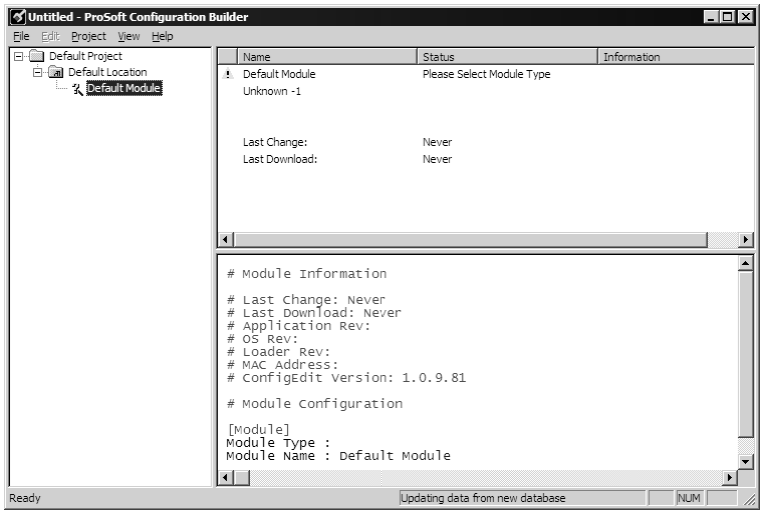
All data related to the MVI46-101S module is stored in a user defined data files and the module's M1 file. Files should be defined for each data type to be used with the module. Additionally, a file should be defined to hold the module status data. The status data should be copied from the M1 file and 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.

2.3 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.

2.3.1 Set Up the Project

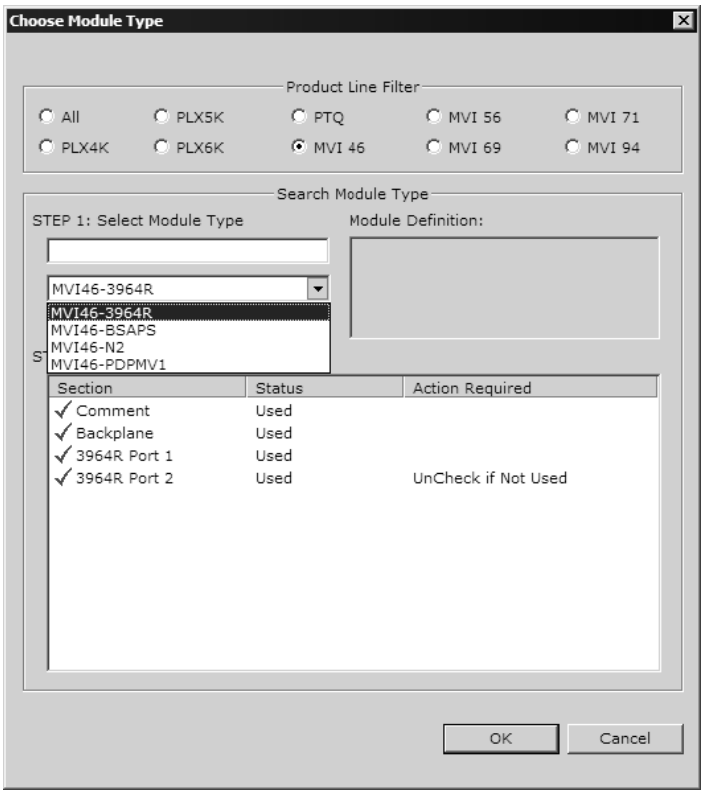
To begin, start ProSoft Configuration Builder. If you have used other Windows configuration tools before, you will find the screen layout familiar. ProSoft Configuration Builder's window consists of a tree view on the left, an information pane and a configuration pane on the right side of the window. When you first start ProSoft Configuration Builder, 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 ProSoft Configuration Builder window with a new project.



Your first task is to add the MVI46-101S 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. In the Select Module Type dropdown list, select MVI46-101S, 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.

Adding a Module

To add a module to your project:

1 Double-click the Default Module icon to open the Choose Module Type dialog box.
2 On the Choose Module Type dialog box, select the module type.

Or

1 Open the Project menu and choose Location.
2 On the Location menu, choose Add Module.

To add a module to a different location:

1 Right-click the Location folder and choose Add Module. A new module icon appears.

Or

1 Select the Location icon.
2 From the Project menu, select Location, then select Add Module.

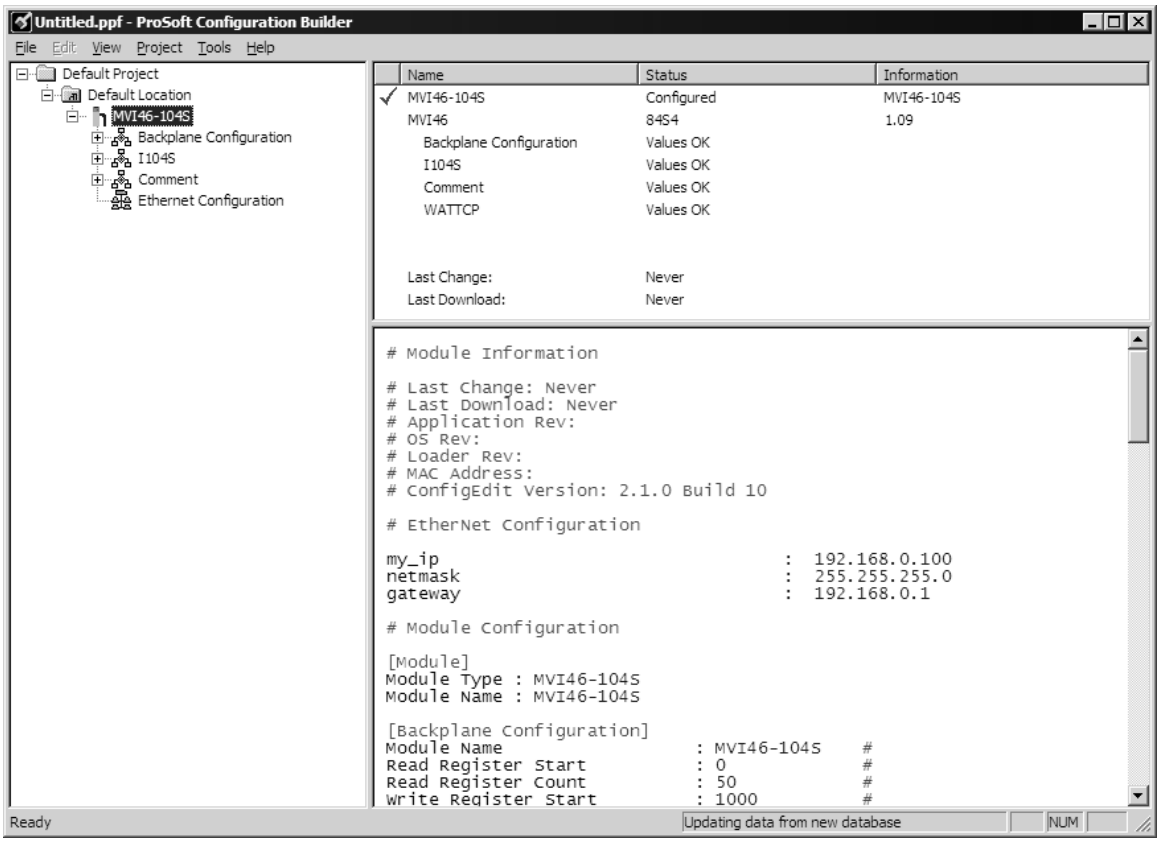
Adding a Project

To add a project to an existing project file:

1 Select the Default Project icon.
2 Choose Project from the Project menu, then choose Add Project. A new project folder appears.

2.3.2 Set Module Parameters

Notice that the contents of the information pane and the configuration pane changed when you added the MVI46-101S module to the project.



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

To rename an object:

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.

Module Entries

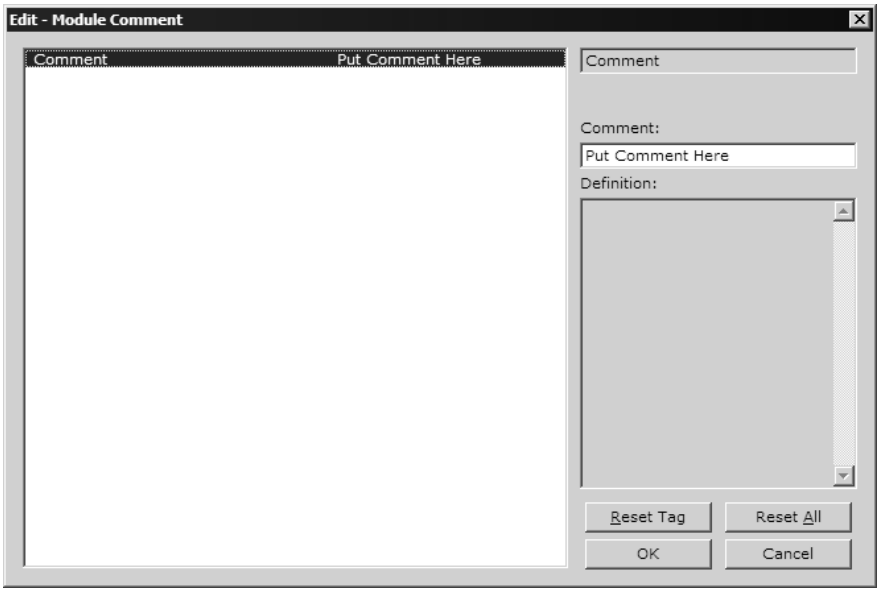
To configure module parameters

1. Click on the plus sign next to the icon Comment to expand module information.
2. Double-click the Module Comment icon to open the Edit dialog box.
3. To edit a parameter, select the parameter in the left pane and make your changes in the right pane.
4. Click OK to save your changes.

Comment Entries

To add comments to your configuration file:

1. Click the plus sign to the left of the Comment icon to expand the Module Comments.
2. Double-click the Module Comment icon. The Edit - Module Comment dialog appears.



3. Enter your comment and click OK to save your changes.

Printing a Configuration File

To print 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. On the View Configuration window, open the File menu, and choose Print. This action opens the Print dialog box.
4. On the Print dialog box, choose the printer to use from the dropdown list, select printing options, and then click OK.

2.4 Group Definition

One aspect of the point configuration database that leads to confusion is the group definition field. This assignment for each point assigns a point to one or more interrogation groups. Use of interrogation groups permits the controlling unit to interface with a specific set of data. Refer to the IEC 60870-5-101 standard for a full discussion of interrogation groups. A specific group, Periodic data group, reports data points on a set frequency. The frequency is set in the **Cyclic Data Transmission** parameter in the configuration file. Remember that a point can be assigned to more than one group:

Definition of Interrogation Groups

Group Code	Description
0x00000001	Interrogated by general interrogation (station or global)
0x00000002	Interrogated by group 1 interrogation
0x00000004	Interrogated by group 2 interrogation
0x00000008	Interrogated by group 3 interrogation
0x00000010	Interrogated by group 4 interrogation
0x00000020	Interrogated by group 5 interrogation
0x00000040	Interrogated by group 6 interrogation
0x00000080	Interrogated by group 7 interrogation
0x00000100	Interrogated by group 8 interrogation
0x00000200	Interrogated by group 9 interrogation
0x00000400	Interrogated by group 10 interrogation
0x00000800	Interrogated by group 11 interrogation
0x00001000	Interrogated by group 12 interrogation
0x00002000	Interrogated by group 13 interrogation
0x00004000	Interrogated by group 14 interrogation
0x00008000	Interrogated by group 15 interrogation
0x00010000	Interrogated by group 16 interrogation
0x00020000	Interrogated by general counter request
0x00040000	Interrogated by group 1 counter request
0x00080000	Interrogated by group 2 counter request
0x00100000	Interrogated by group 3 counter request

Definition of Interrogation Groups	
Group Code	**Description**
0x00200000	Interrogated by group 4 counter request
0x40000000	Disable event scanning of this point
0x80000000	Periodic/cyclic data returned from unit

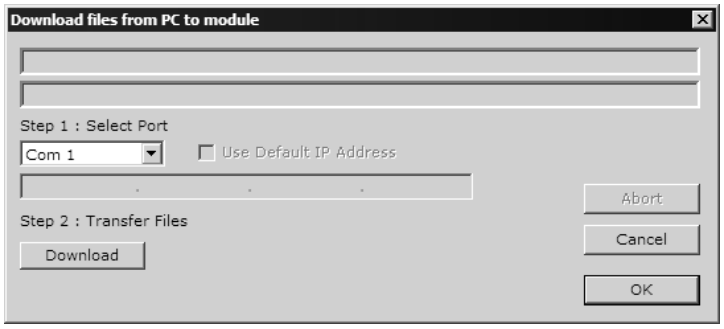
If the highest bit (bit 31) is set, data will be produced by the driver for the specified point at the rate set for periodic data generation. Bit 30 (0x40000000) enables scanning of this point for event generation. If the bit is clear and the data type is set for scanning, events will be generated for the point. If the bit is set, events will not be generated for the point. This feature can be used to select which points will generate events for the controlling station and can get rid of event data that is not important to the application.

2.5 Download the Project to the Module

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

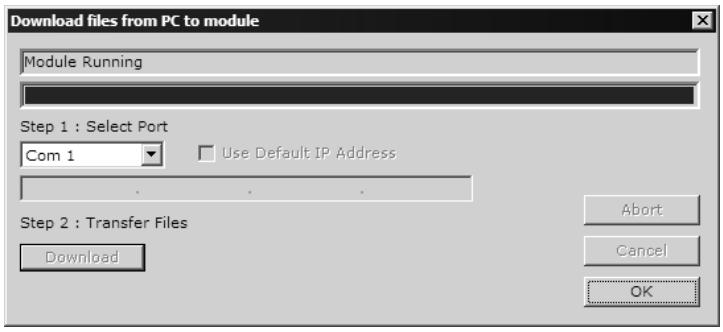
To Download the Project File

1. In the tree view in ProSoft Configuration Builder, click once to select the MVI46-101S 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 following 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 ProSoft Configuration Builder will be updated with the message *"Module Running*".



3 Ladder Logic

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

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

4 Diagnostics and Troubleshooting

In This Chapter

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

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

4.1 Reading Status Data from the Module

The MVI46-101S module returns a 20-word Status Data block that can be used to determine the module's operating status. This data is located in the module's database and M1 file registers at the location specified in the configuration. This data is transferred to the M1 file continuously.

4.1.1 Required Hardware

You can connect directly from your computer's serial port to the serial port on the module to view configuration information, perform maintenance, and send (upload) or receive (download) configuration files.

ProSoft Technology recommends the following minimum hardware to connect your computer to the module:

- 80486 based processor (Pentium preferred)
- 1 megabyte of memory
- At least one UART hardware-based serial communications port available. USB-based virtual UART systems (USB to serial port adapters) often do not function reliably, especially during binary file transfers, such as when uploading/downloading configuration files or module firmware upgrades.
- A null modem serial cable.

4.1.2 The Configuration/Debug Menu

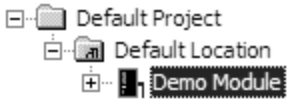
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

Because this is a text-based menu system, you enter commands by typing the command letter from your computer keyboard in the 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.

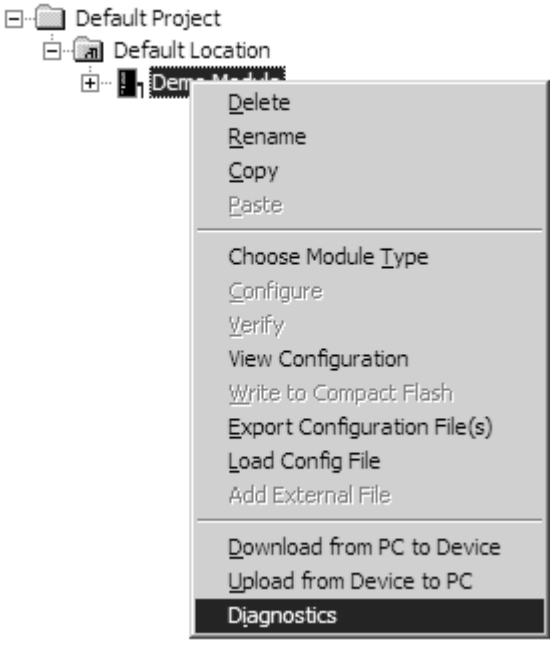
Using the Diagnostic Window in ProSoft Configuration Builder

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

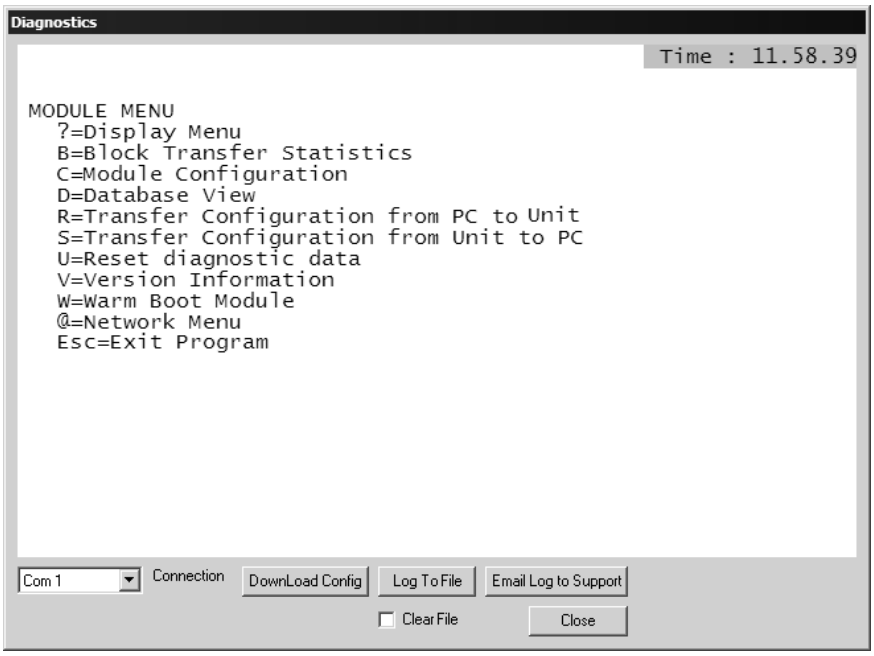
1 Start PCB program with the application file to be tested. Right click over the module icon.



2 On the shortcut menu, choose Diagnostics.



3 This action opens the Diagnostics dialog box. Press "?" to display the Main Menu.



Important: The illustrations of configuration/debug menus in this section are intended as a general guide, and may not exactly match the configuration/debug menus in your own module.

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

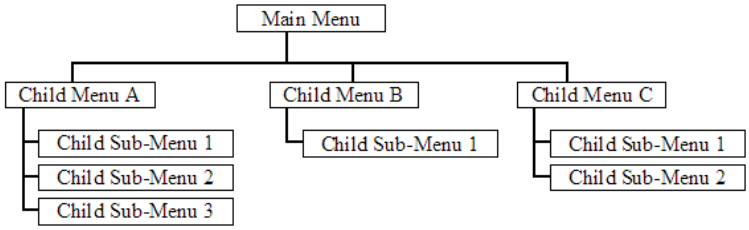
1 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.
2 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.

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

Navigation

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

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



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

Keystrokes

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

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

Also, take care to distinguish capital letter **[I]** from lower case letter **[l]** (L) and number **[1]**; likewise for capital letter **[O]** and number **[0]**. Although these characters look nearly the same on the screen, they perform different actions on the module.

4.1.3 Main Menu

When you first connect to the module from your computer, your terminal screen will be blank. To activate the main menu, press the [?] key on your computer's keyboard. If the module is connected properly, the following menu will appear on your terminal screen:

```
IEC-870-5-101 SLAVE COMMUNICATION MODULE (MVI46-870S) MENU
  ?=Display Menu
  A=Data Analyzer
  B=Block Transfer Statistics
  C=Module Configuration
  D=Database View
  E=Display Program Status
  P=Port Cfg
  R=Receive Configuration File
  S=Send Configuration File
  V=Version Information
  W=Warm Boot Module
  1 = M_SP_NA Setup       2 = M_DP_NA Setup
  3 = M_ST_NA Setup       4 = M_ME_NA Setup
  5 = M_ME_NB Setup       6 = M_IT_NA Setup
  7 = C_SC_NA Setup       8 = C_DC_NA Setup
  9 = C_RC_NA Setup       0 = C_SE_NA Setup
  ! = C_SE_NB Setup       @ = IEC-870 Database Cfg
  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.

Opening the Data Analyzer Menu

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

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

Viewing Block Transfer Statistics

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

Use this command to display the configuration and statistics of the backplane data transfer operations between the module and the processor. The information on this screen can help determine if there are communication problems between the processor and the module.

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

Viewing Module Configuration

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

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

Opening the Database Menu

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

Viewing Program Status

Press **[E]** to view the error/status data 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.

Receiving the Configuration File

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

Sending the Configuration File

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

Viewing Version Information

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

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

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

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

Warm Booting the Module

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

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

Viewing Data Type Setup

To view setup information for each data type, press the matching key from the Menu.

Key	Data Type	Screen Example
1	M_SP_NA	M_SP_NA Setup Menu Selected M_SP_NA Setup (0 to 2) Index Point# DB Addr Group(s) Value 0 11 0 80000001 0 1 12 1 80000001 0
2	M_DP_NA	M_DP_NA Setup Menu Selected M_DP_NA Setup (0 to 2) Index Point# DB Addr Group(s) Bits 0 21 16 00000002 0 0 1 22 17 00000002 0 0

Key	Data Type	Screen Example
3	M_ST_NA	M_ST_NA Setup Menu Selected M_ST_NA Setup (0 to 2) Index Point# DB Addr Group(s) Value 0 31 6 00000004 0 1 32 7 00000004 0
4	M_ME_NA	M_ME_NA Setup Menu Selected M_ME_NA Setup (0 to 2) Index Point# DB Addr Group(s) Deadband Value Norm. Va 0 41 4 00000008 0 0 0.00000 1 42 5 00000008 0 0 0.00000
5	M_ME_NB	M_ME_NB Setup Menu Selected M_ME_NB Setup (0 to 2) Index Point# DB Addr Group(s) Deadband Value 0 51 6 00000010 1 0 1 52 7 00000010 1 0
6	M_IT_NA	M_IT_NA Setup Menu Selected M_IT_NA Setup (0 to 2) Index Point# DB Addr Group(s) Value FROZEN 0 61 4 00020000 0 0 1 62 5 00040000 0 0
7	C_SC_NA	C_SC_NA Setup Menu Selected C_SC_NA Setup (0 to 2) Index Point# DB Addr MPnt# MPntDb ReqSel Value 0 700 1600 2000 3200 0 0 1 701 1601 2010 3201 0 0
8	C_DC_NA	C_DC_NA Setup Menu Selected C_DC_NA Setup (0 to 2) Index Point# DB Addr MPnt# MPntDb ReqSel Bits 0 800 1616 3000 3216 0 0 0 1 801 1617 3090 3217 0 0 0
9	C_RC_NA	C_RC_NA Setup Menu Selected C_RC_NA Setup (0 to 2) Index Point# DB Addr MPnt# MPntDb ReqSel Value 0 900 51 8000 30 0 0 1 901 52 8888 31 0 0
0	C_SE_NA	C_SE_NA Setup Menu Selected C_SE_NA Setup (0 to 2) Index Point# DB Addr MPnt# MPntDb ReqSel Value Norm 0 1000 105 0 0 0 0 0.0 1 1001 106 0 0 0 0 0.0
Shift 1	C_SE_NB	C_SE_NB Setup Menu Selected C_SE_NB Setup (0 to 2) Index Point# DB Addr MPnt# MPntDb ReqSel Value 0 1100 107 0 0 0 0 1 1101 108 0 0 0 0
Shift 4	C_SE_NC	C_SE_NC Setup Menu Selected C_SE_NC Setup (0 to 2) Index Point# DB Addr MPnt# MPntDb ReqSel Value 0 1200 55 0 0 0 0 1 1201 56 0 0 0 0

Viewing IEC 60870 Database Configuration

Press **[@]** to view the database size configuration information.

```
IEC-870-5-101 DATABASE CONFIGURATION:
 PMENA Offs: 2000    PMENB Off: 2000
 M_SP_NA point count = 10       Event Scanning Enabled : Yes
 M_DP_NA point count = 10       Event Scanning Enabled : Yes
 M_ST_NA point count = 10       Event Scanning Enabled : Yes
 M_ME_NA point count = 10       Event Scanning Enabled : Yes
 M_ME_NB point count = 10       Event Scanning Enabled : Yes
 M_IT_NA point count = 4
 C_SC_NA point count = 10
 C_DC_NA point count = 10
 C_RC_NA point count = 10
 C_SE_NA point count = 10
 C_SE_NB point count = 10
```

Exiting the Program

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

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

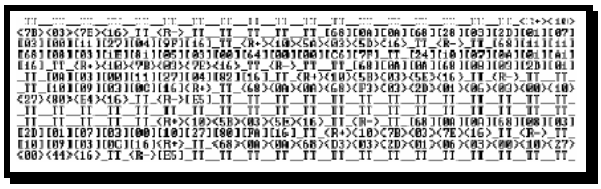
4.1.4 Data Analyzer

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

Note: The Port selection commands on the Data Analyzer menu differs very slightly in different modules, but the functionality is basically the same. Use the illustration above as a general guide only. Refer to the actual data analyzer menu on your module for the specific port commands to use.
Important: When in analyzer mode, program execution will slow down. Only use this tool during a troubleshooting session. Before disconnecting from the Config/Debug port, please press [S] to stop the data analyzer, and then press [M] to return to the main menu. This action will allow the module to resume its normal high speed operating mode.

Analyzing Data for the first application port

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



Analyzing Data for the second application port

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

Displaying Timing Marks in the Data Analyzer

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

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

Removing Timing Marks in the Data Analyzer

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

Viewing Data in Hexadecimal Format

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

Viewing Data in ASCII (Text) Format

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

Starting the Data Analyzer

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

The Data Analyzer displays the following special characters:

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

Stopping the Data Analyzer

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

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

Returning to the Main Menu

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

4.1.5 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:

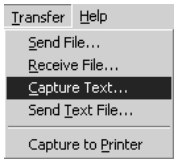
```
DATA ANALYZER VIEW MENU
 ?=Display Menu
 1=Select Port 1
 2=Select Port 2
 5=1 mSec Ticks
 6=5 mSec Ticks
 7=10 mSec Ticks
 8=50 mSec Ticks
 9=100 mSec Ticks
 0=No mSec Ticks
 H=Hex Format
 A=ASCII Format
 B=Start
 S=Stop
 M=Main Menu

 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.

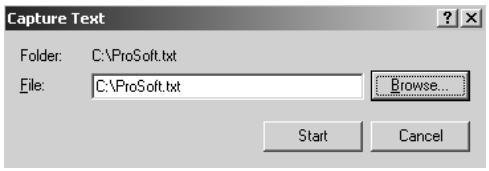
For most applications, HEX is the best format to view the data, and this does include ASCII based messages (because some characters will not display on HyperTerminal and by capturing the data in HEX, we can figure out what the corresponding ASCII characters are supposed to be).

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 Start button.

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

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

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

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

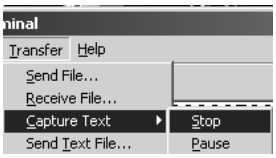
All characters shown in <> brackets are characters being sent out by the module.

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

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

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

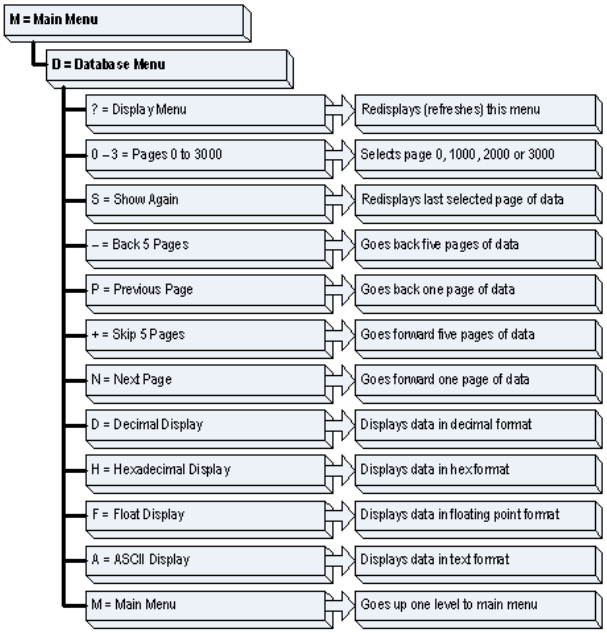
When you have captured the data you want to save, open the Transfer menu and choose Capture Text. On the secondary menu, choose Stop.



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

4.1.6 Database View Menu

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



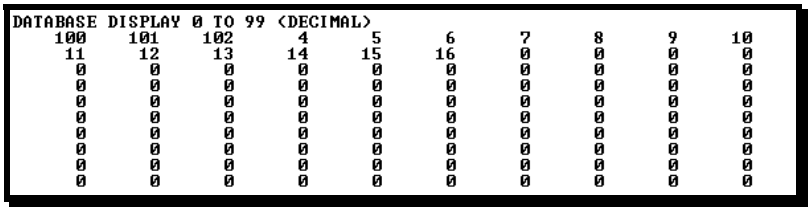
Viewing Register Pages

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

Command	Description
[0]	Display registers 0 to 99
[1]	Display registers 1000 to 1099
[2]	Display registers 2000 to 2099

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

Displaying the Current Page of Registers Again



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

Moving Back Through 5 Pages of Registers

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

Viewing the Previous 100 Registers of Data

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

Skipping 500 Registers of Data

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

Viewing the Next 100 Registers of Data

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

Viewing Data in Decimal Format

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

Viewing Data in Hexadecimal Format

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

Viewing Data in Floating Point Format

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

Viewing Data in ASCII (Text) Format

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

Returning to the Main Menu

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

4.2 LED Status Indicators

The LEDs indicate the module's operating status as follows:

ProSoft Module	Color	Status	Indication
CFG	Green	On	Data is being transferred between the module and a remote terminal using the Configuration/Debug port.
		Off	No data is being transferred on the Configuration/Debug port.
P1	Green	On	Data is being transferred between the module and the IEC 60870-5-101 network on Port 1.
		Off	No data is being transferred on the port.
P2	Green	On	Data is being transferred between the module and the IEC 60870-5-101 network on Port 2.
		Off	No data is being transferred on the port.
APP	Amber	Off	The MVI46-101S is working normally.
		On	The MVI46-101S module program has recognized a communication error on one of its ports.
BP ACT	Amber	On	The LED is on when the module is performing a write operation on the backplane.
		Off	The LED is off when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly on and off.
OK	Red/ Green	Off	The card is not receiving any power and is not securely plugged into the rack.
		Green	The module is operating normally.
		Red	The program has detected an error or is being configured. If the LED remains red for over 10 seconds, the program has probably halted. Remove the card from the rack and re-insert the card to restart the module's program.
BAT	Red	Off	The battery voltage is OK and functioning.
		On	The battery voltage is low or battery is not present. Allow battery to charge by keeping module plugged into rack for 24 hours. If BAT LED still does not go off, contact ProSoft Technology, as this is not a user serviceable item.

If the APP, BP ACT and OK LEDs blink at a rate of every one-second, this indicates a serious problem with the module. Call ProSoft Technology support to arrange for repairs.

4.2.1 Clearing a Fault Condition

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

To clear the condition, follow these steps:

1. Turn off power to the rack
2. Remove the card from the rack
3. Verify that all jumpers are set correctly

4 If the module requires a Compact Flash card, verify that the card is installed correctly
5 Re-insert the card in the rack and turn the power back on
6 Verify the configuration data being transferred to the module from the SLC processor.

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

4.2.2 Troubleshooting

Use the following troubleshooting steps if you encounter problems when the module is powered up. If these steps do not resolve your problem, please contact ProSoft Technology Technical Support.

Processor Errors

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

Module Errors

Problem Description	Steps to take
BP ACT LED remains off or blinks slowly	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: ▪ The processor is in Run mode. ▪ The backplane driver is loaded in the module. ▪ The module is configured for read and write block data transfer. ▪ The ladder logic handles all read and write block situations. ▪ The module is configured in the processor.
OK LED remains red	The program has halted or a critical error has occurred. Connect to the Configuration/Debug port to see if the module is running. If the program has halted, turn off power to the rack, remove the card from the rack and re-insert the card in the rack, and then restore power to the rack.

5 Reference

In This Chapter

5.1 Product Specifications

The MVI46 IEC 60870-5-101 Slave Communication Module allows Rockwell Automation SLC I/O compatible processors to interface easily with IEC 60870-5-101 protocol compatible hosts. The module's two powerful and highly configurable redundant ports allow the many SCADA host systems supporting the IEC protocol to be integrated into the SLC platform.

The standards used in developing the product are listed in the following table:

PUBLICATION	TITLE
IEC 60870-5-101	Companion Standard for Basic Telecontrol Tasks
IEC 60870-5-101	Companion Standard for Basic Telecontrol Tasks
Amendment 1	
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

Refer to these standards for any questions on the protocol and data types supported.

The MVI46 IEC 60870-5-101 Slave Communication Module allows Rockwell Automation SLC I/O compatible processors to interface easily with IEC 60870-5-101 protocol compatible hosts. The module's two powerful and highly configurable redundant ports allow the many SCADA host systems supporting the IEC protocol to be integrated into the SLC platform.

5.1.1 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

5.1.2 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
Debug/Configuration port (CFG)	
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)
Application Ports	
Application Serial port (PRT1, PRT2) (Serial Modules)	Two RJ45 RS-232/422/485 Application ports

5.1.3 Functional Specifications

The MVI46-101S module accepts commands from an attached master unit. A port configured as a virtual slave permits a remote master to interact with all data contained in the module. This data can be derived from the SLC processor. The remote master device uses the fully-configured databases in the module to control outputs and monitor inputs. The module can operate in balanced or unbalanced mode.

- Supports time stamp events
- Supports time and data synchronization from a master or the processor
- Supports monitored data
- Event queue supports 99 points for each data type
- Reports events by configurable priority order
- Order monitored points by interrogation groups

- Configurable deadband for monitored measured points
- Supports Master Class 1 and Class 2 polls with configurable parameters
- Acknowledgement transmission is handled internally by the module
- Configurable data link address, Common ASDU address and Information Object Address
- Configurable pulse duration

5.2 Functional Overview

This section provides an overview of how the MVI46-101S module transfers data using the 101S protocol. You should understand the important concepts in this chapter before you begin installing and configuring the module.

5.2.1 General Concepts

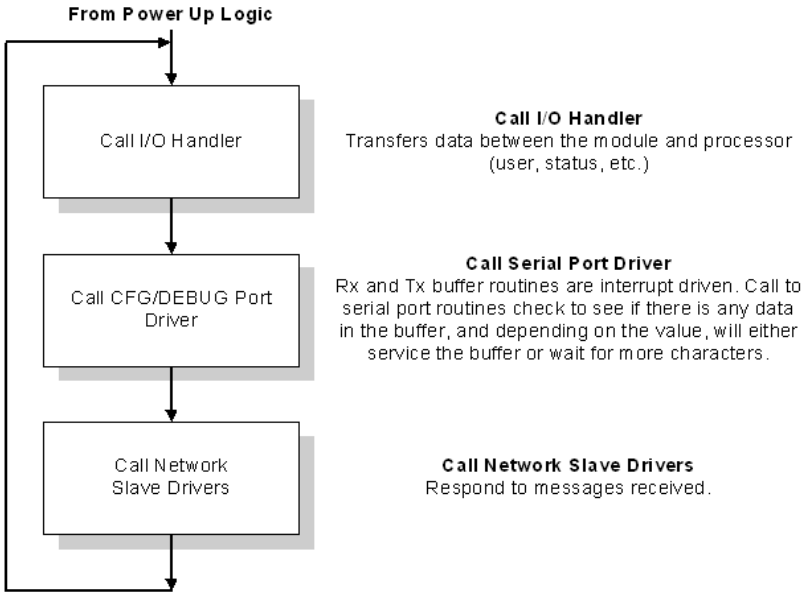
The following topics describe several concepts that are important for understanding the operation of the MVI46-101S module.

1. On power up the module begins performing the following logical functions:
2. Initialize hardware components
   - Initialize SLC backplane driver
   - Test and Clear all RAM
   - Initialize the serial communication ports
3. Reads configuration from Compact Flash Disk
4. Initialize Module Register space
5. Enable Slave Driver on selected ports

After the module has received the Module Configuration, the module will begin communicating with other nodes on the network, depending on the configuration.

Main Logic Loop

Upon completing the power up configuration process, the module enters an infinite loop that performs the functions shown in the following diagram.



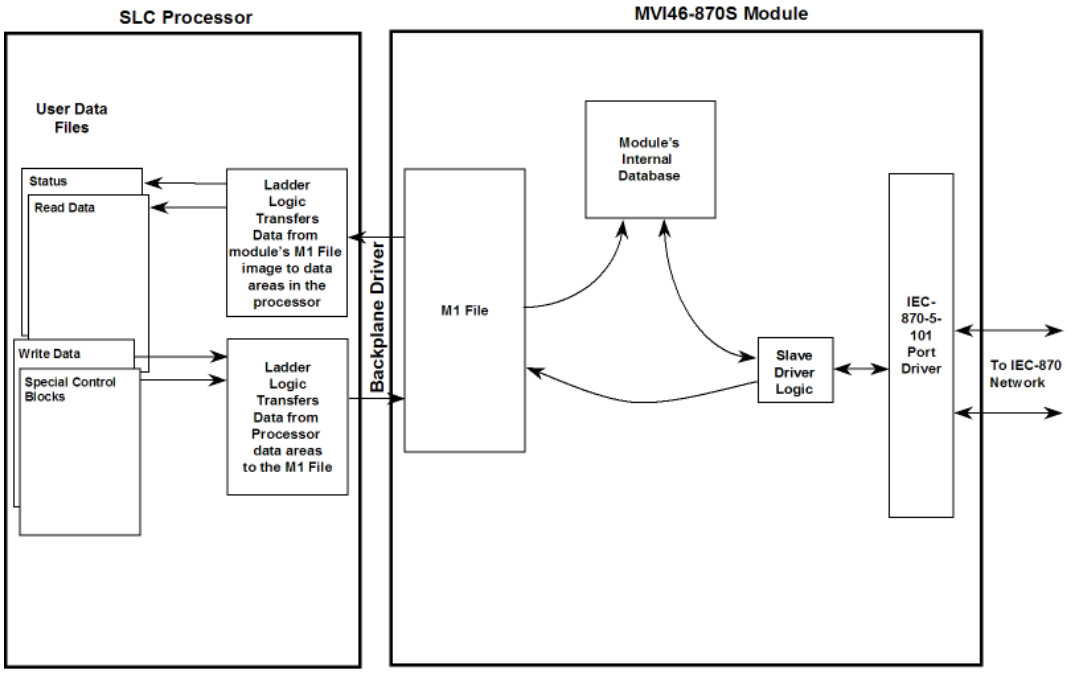
SLC Processor Not in Run

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 MVI46-101S 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.

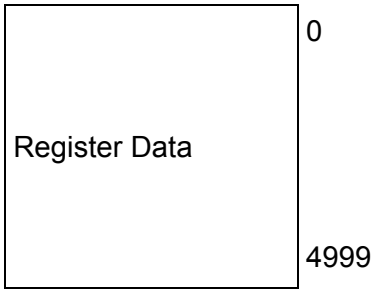
The following illustration shows the data transfer method used to move data between the SLC processor, the MVI46-101S module and the IEC 60870-5-101 network.



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. The following illustration shows the layout of the database:

Module's Internal Database Structure

5000 registers for user data



The blocks in the range of 5000 to 5999 are used for command control functions listed in Command Control (page 52).

Sending Events

The module operates by sending data when the master sends Class 2 polls. When the slave has an event, it sends the event to the module queue. If the communication mode is unbalanced, the slave notifies the master that it has an event to be sent and the master's next poll should be a Class 1 poll. The slave then replies to this poll sending the first event to the queue.

There are two ways of sending timestamp events to the module queue. The first is when a configured point changes its value in the module's database. This is actually the way the module would normally send events.

The second method is by using block 9958 (refer to the next section), in which case ladder logic should be used to send events in this manner. This method is limited by the number of events that can be sent to the master. The important issue about events, is that the slave should have its clock synchronized with the master. The master should send a Sync. Command to the MVI module in order to synchronize both clocks. You can also synchronize the module and the processor clocks using blocks 9970 and 9971 (Refer to the next section).

5.2.2 Command Control

Data contained in this database is constantly updated with the M1 file data by the module and requires no SLC ladder logic to implement. A reserved word in the M1 and database, address 4999, is used as a control register for module, control by the ladder logic, and for control of the ladder logic by the module.

Values placed in this register control what commands are to be performed. Supported commands include:

Command Description	Register Value
Send Event Messages from SLC	9958
Set SLC Time using Module's Time	9970
Set Module's Time using SLC Time	9971
Warm Boot	9998
Cold Boot	9999

Event Messages From SLC (9958)

If a value of 9958 is placed in the control register, event messages are sent from the processor to the module. The following table shows the block format for write.

Word Offset in Block	Data Field(s)	Description
4999	Block ID	This field contains the value of 9958 identifying the block type to the module.
5000	Event Count	Number of events present in the block. Valid Values: 1 to 10.
5001 to 5015	Event #1	Event data to add to event message queue.
5016 to 5030	Event #2	Event data to add to event message queue.
5031 to 5045	Event #3	Event data to add to event message queue.
5046 to 5060	Event #4	Event data to add to event message queue.
5061 to 5075	Event #5	Event data to add to event message queue.

Word Offset in Block	Data Field(s)	Description
5076 to 5090	Event #6	Event data to add to event message queue.
5091 to 5105	Event #7	Event data to add to event message queue.
5106 to 5120	Event #8	Event data to add to event message queue.
5121 to 5135	Event #9	Event data to add to event message queue.
5136 to 5150	Event #10	Event data to add to event message queue.

The structure of each event record in the block is shown in the following table.

Word Offset in Event Record	Data Field(s)	Description
0	DB Index	This is the index for the point in the module's database. This corresponds to the order of point definition for the module data types. This is not the point address for the event.
1	ASDU	This is the ASDU data type for the event message. Valid entries for this field are as follows: 1=single-point 3=double-point 5=step 9=normalized 11=scaled 15=integrated total
2	Qualifier	This is the qualifier code to be used with the event message. Refer to the IEC Protocol Specification for a full listing of valid qualifier codes for each ASDU type.
3	Year	This field contains the four-digit year to be used with this event.
4	Month	This field contains the month value for the event. Valid Values: 1 to 12
5	Day	This field contains the day value for the event. Valid Values: 1 to 31
6	Hour	This field contains the hour value for the event. Valid Values: 0 to 23
7	Minute	This field contains the minute value for the event. Valid Values: 0 to 59
8	Seconds and Milliseconds	This field contains the seconds and milliseconds value for the event. Valid Values: 0 to 59,999
9 to 14	Data	These words contain the data to be used with the event. For single- and double-point, step, and measured value events, the first word is used. For integrated total events, the first two words are used.

Set SLC Time Using Module's Time (9970)

If a value of 9970 is placed in the control register, SLC time is set using the module's time. The following table shows the block format for write:

Word Offset in Block	Data Field(s)	Description
4999	Block ID	This field contains the value of 9970 identifying the block type to the module.

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

Word Offset in Block	Data Field(s)	Description
4999	Done Flag	The word will be set to 0 when the command is complete.
5000	Block ID	This word will contain the value of 9970.
5001	Year	This field contains the four-digit year to be used with the new time value.
5002	Month	This field contains the month value for the new time. Valid Values: 1 to 12.
5003	Day	This field contains the day value for the new time. Valid Values: 1 to 31.
5004	Hour	This field contains the hour value for the new time. Valid Values: 0 to 23
5005	Minute	This field contains the minute value for the new time. Valid Values: 0 to 59.
5006	Seconds	This field contains the second value for the new time. Valid Values: 0 to 59.
5007	Milliseconds	This field contains the millisecond value for the new time. Valid Values: 0 to 999.

Set Module's Time Using SLC Time (9971)

If a value of 9971 is placed in the control register, Module time is set using the SLC's time. The following table shows the block format for write.

Word Offset in Block	Data Field(s)	Description
4999	Block ID	This word will contain the value of 9970.
5000	Year	This field contains the four-digit year to be used with the new time value.
5001	Month	This field contains the month value for the new time. Valid Values: 1 to 12.
5002	Day	This field contains the day value for the new time. Valid Values: 1 to 31.
5003	Hour	This field contains the hour value for the new time. Valid Values: 0 to 23
5004	Minute	This field contains the minute value for the new time. Valid Values: 0 to 59.
5005	Seconds	This field contains the second value for the new time. Valid Values: 0 to 59.
5006	Milliseconds	This field contains the millisecond value for the new time. Valid Values: 0 to 999.

Warm Boot (9998) or Cold Boot (9999)

If the processor places a value of 9998 in this register, 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.

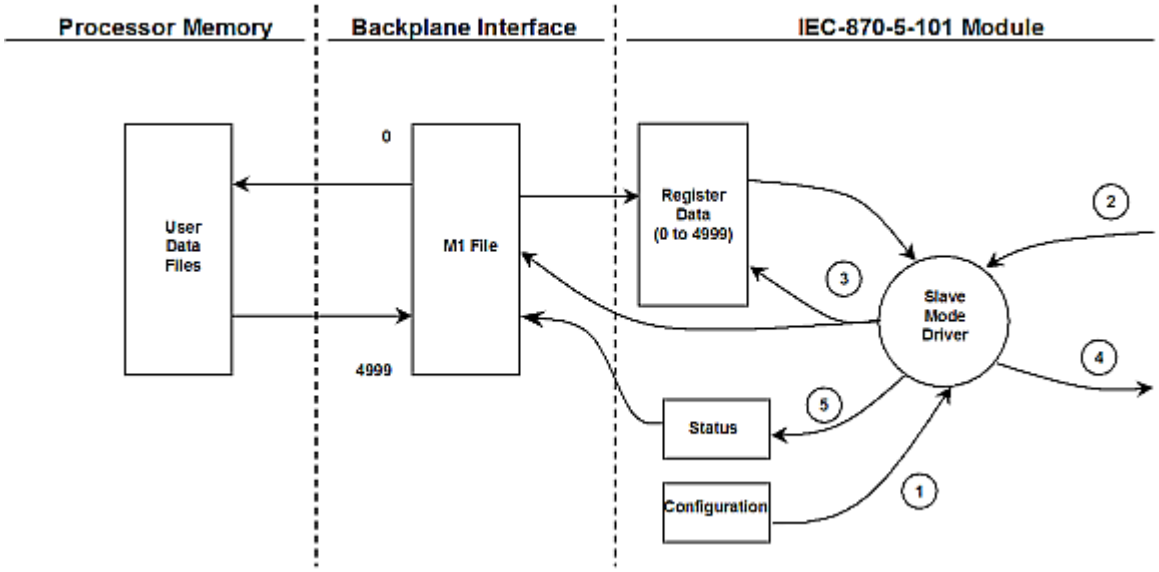
The module can be configured to have the output data in the module set to that stored in the SLC processor during program initialization. This feature requires ladder logic support. When the module performs a restart operation, it will set the output area of the M1 file to the current values stored in the processor. The module requests this action by placing a value of 1000 in the control register. After the ladder logic has completely built the M1 file image, it will set the control register to a value of 1001. This informs the module that the initialization is complete and the program can continue with the startup procedure.

5.2.3 Data Flow Between MVI46-101S Module and SLC Processor

The following topics describe the flow of data between the two pieces of hardware (SLC processor and MVI46-101S module) and the IEC 60870-5-101 master unit. Each port on the module is configured to emulate a common slave device. The database used in the module is used for both ports and only one port can be utilized at one time.

Slave Driver

The Slave Driver allows the MVI46-101S module to respond to data read and write commands issued by a master unit on the telecontrol network. The following flow chart and associated table describe the flow of data into and out of the module.



Step	Description
1	The slave port driver receives the configuration information from the Compact Flash Disk in the module. This information configures the serial port and define the slave node characteristics.
2	A Host device issues a read or write command to the module's node address. The port driver qualifies the message before accepting it into the module.
3	After the module accepts the message, the data is immediately transferred to or from the internal database in the module. If the command is a read command, the data is read out of the database and a response message is built. If the command is a write command, the data is written directly into the database and the M1 file and a response message is built.
4	After the data processing has been completed in Step 3, the response is issued to the originating master node.
5	Counters are available in the Status Block that permit the ladder logic program to determine the level of activity of the Slave Driver.

Review Module Configuration (page 19) for a complete list of the parameters that must be defined for a slave port. The IEC 60870-5-101 Interoperability Document (page 80) for the MVI46-101S Slave Module contains a listing of the protocol support supplied in the module.

5.2.4 Databases

The read and write areas can be placed anywhere in the module's database area. Because each point is defined individually to the module, the data for a specific type need not be contiguous in the module's database. This means that the module error/status data area can be passed to the controlling station using the M_ME_NB_1 database. In the database definition for the type, establish a point for each status value to be monitored by the controlling station and set the module's database address for the point in the definition.

This section discusses the databases utilized by the module to support the IEC 60870-5-101 protocol. The user is responsible for defining the databases for their specific application. In the module's configuration file, the size of each database and definition of each point is established. Refer to the Module Configuration section for a complete discussion of the configuration file. The following table summarizes the data types used in each of the 11 individual databases.

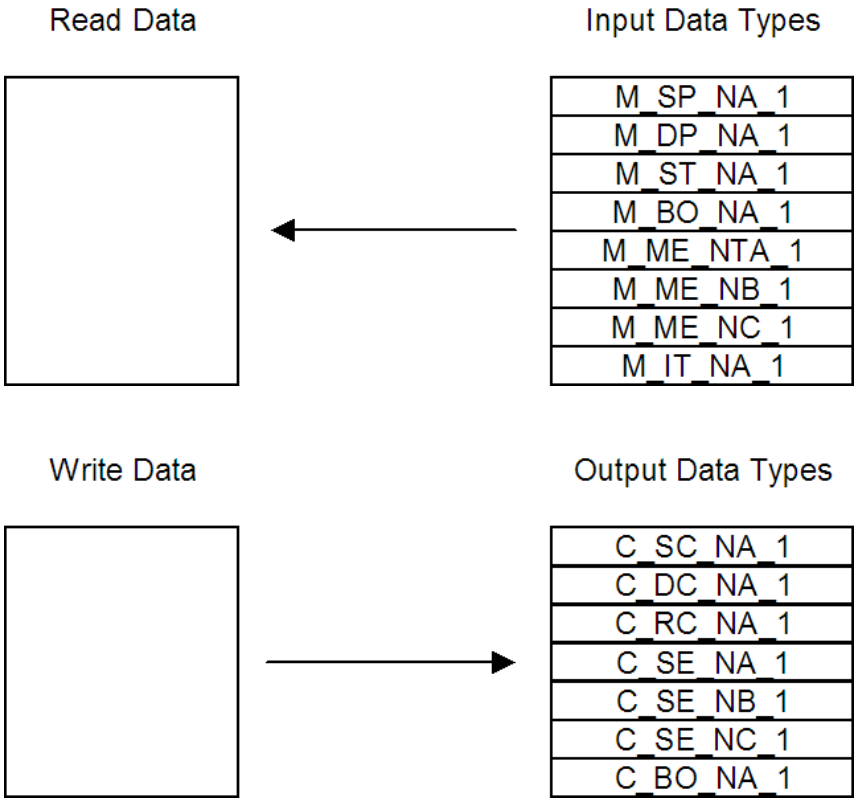
Type ID	Type	Description	Data Representation
1	M_SP_NA_1 (7.3.1.1)	Monitored Single-point Information: This data type stores a single binary input point. Associated time-tagged event information for this type are M_SP_TA_1 (2) and M_SP_TB_1 (30).	Single bit value with (7.2.6.1)0=Off and 1=On.
3	M_DP_NA_1 (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.

Type ID	Type	Description	Data Representation
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
9	M_ME_TA_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}.. $^{+215}$-1
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}..+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 with (7.2.6.17)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..+1-2^{-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}.. $^{+215}$-1

A key concept in interfacing the protocol with the SLC processor is the relationship between the databases and the data transfer operation between the module and the processor. The module transfers data to the processor in read blocks using the input image. These blocks should contain the information received from the controlling unit (output data) and includes the following data types: C_SC_NA_1, C_DC_NA_1, C_RC_NA_1, C_SE_NA_1 and C_SE_NB_1.

This data is all sourced from the master unit and passed to the processor for control. Databases associated with these data types should place the points in the read data area of the module's database. The Read Register Start and Read Register Count parameters in the configuration file establish the portion of the database to transfer to the processor. Ladder logic extracts the data from the read data area and places it in the proper location for use by the processor.

Similarly, data to be monitored (input data) by the master unit (all databases associated with the "M_" data types) must all be placed in the write data area of the module. The Write Register Start and Write Register Count parameters establish the portion of the database to receive data from the processor. This data is sourced from the processor and passed through the module to the remote controlling unit. Ladder logic is required to place the data in the correct position in the write data area. The relationship between the data types and the read and write data areas is displayed in the following diagram:



The read and write areas can be placed anywhere in the module's 5000-word database area. Because each point is defined individually to the module, the data for a specific type need not be contiguous in the module's database. This means that the module error/status data area can be passed to the controlling station using the M_ME_NB_1 database. In the database definition for the type, establish a point for each status value to be monitored by the controlling station and set the module's database address for the point in the definition.

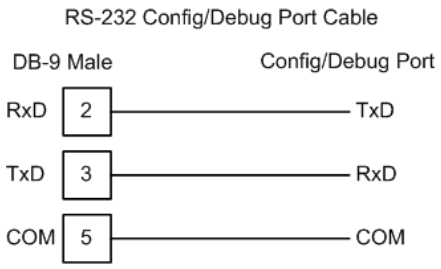
5.3 Cable Connections

The application ports on the MVI46-101S module support RS-232, RS-422, and RS-485 interfaces. Please inspect the module to ensure that the jumpers are set correctly to correspond with the type of interface you are using.

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

5.3.1 RS-232 Configuration/Debug Port

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

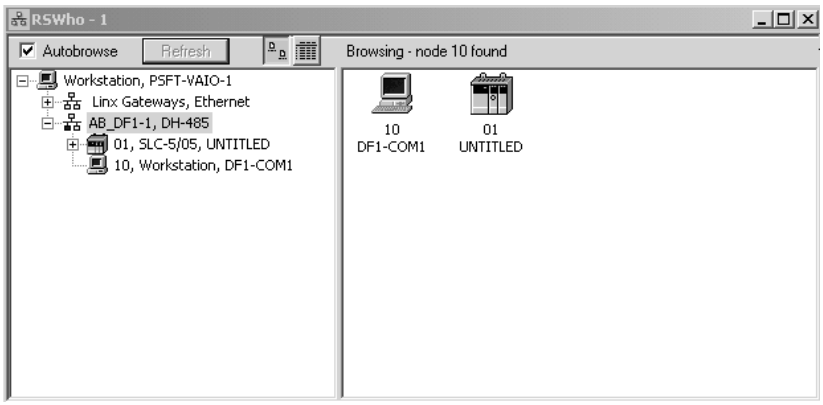


Disabling the RSLinx Driver for the Com Port on the PC

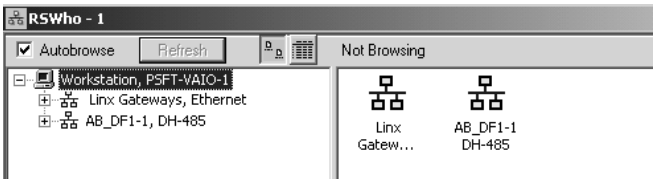
The communication port driver in RSLinx can occasionally prevent other applications from using the PC's COM port. If you are not able to connect to the module's configuration/debug port using ProSoft Configuration Builder (PCB), HyperTerminal or another terminal emulator, follow these steps to disable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

1 Open RSLinx and go to Communications>RSWho

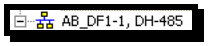
2 Make sure that you are not actively browsing using the driver that you wish to stop. The following shows an actively browsed network:



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

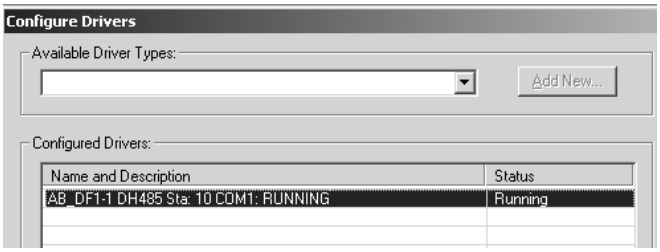


Branches are displayed or hidden by clicking on the ⊞ or the ⊟ icons.



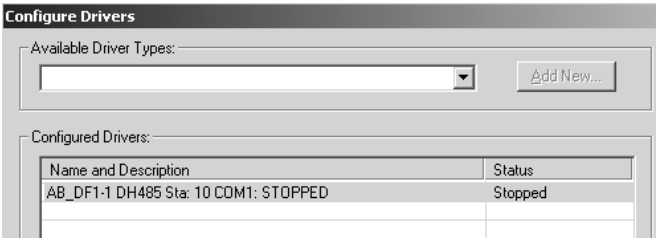
4 When you have verified that the driver is not being browsed, go to

Communications>Configure Drivers
You may see something like this:



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

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

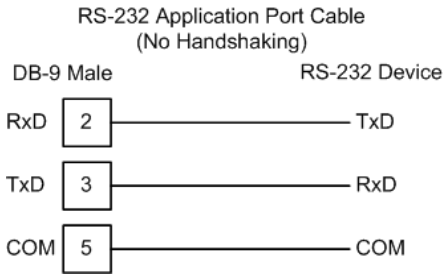


6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

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

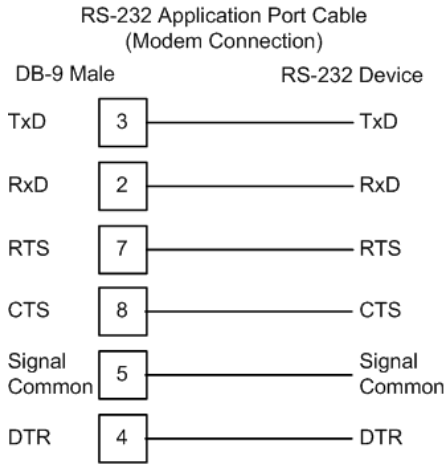
5.3.2 RS-232

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



RS-232: Modem Connection

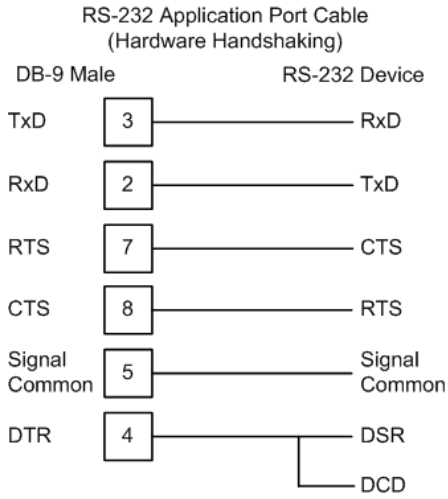
This type of connection is required between the module and a modem or other communication device.



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

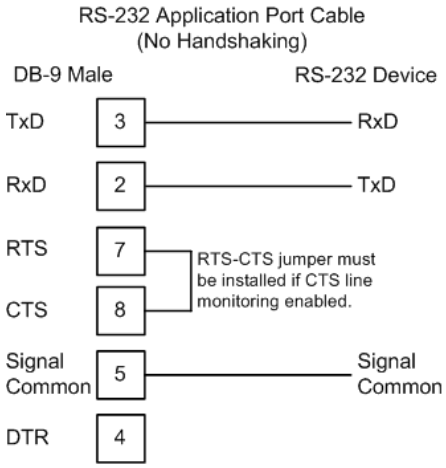
RS-232: Null Modem Connection (Hardware Handshaking)

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



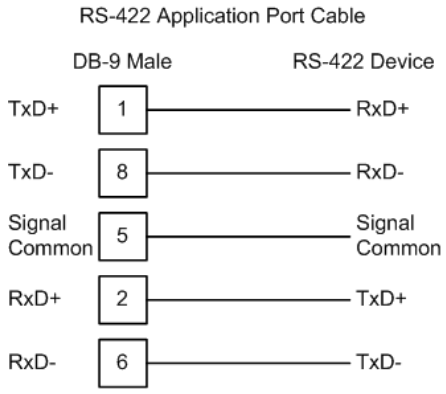
RS-232: Null Modem Connection (No Hardware Handshaking)

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



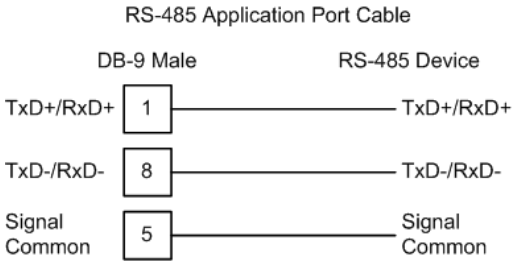
Note: If the port is configured with the "Use CTS Line" set to 'Y', then a jumper is required between the RTS and the CTS line on the module connection.

5.3.3 RS-422



5.3.4 RS-485

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

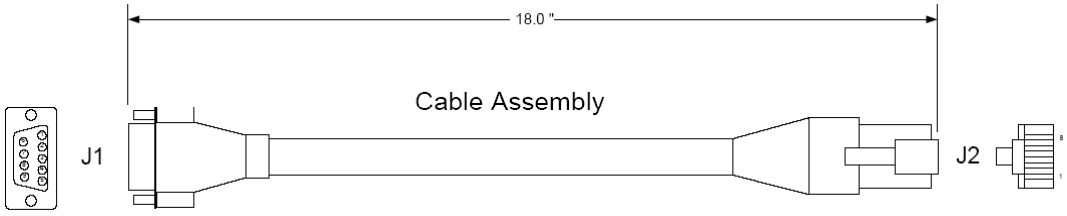


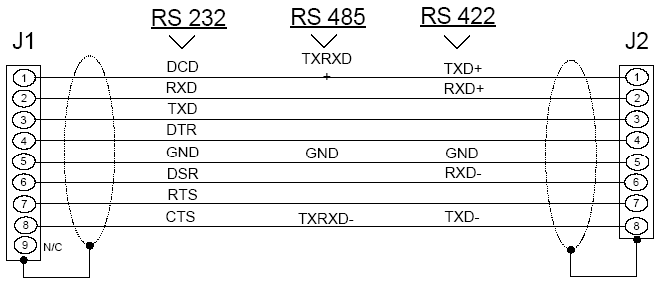
Note: Terminating resistors are generally not required on the RS-485 network, unless you are experiencing communication problems that can be attributed to signal echoes or reflections. In this case, install a 120 ohm terminating resistor on the RS-485 line.

RS-485 and RS-422 Tip

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

5.3.5 DB9 to RJ45 Adaptor (Cable 14)

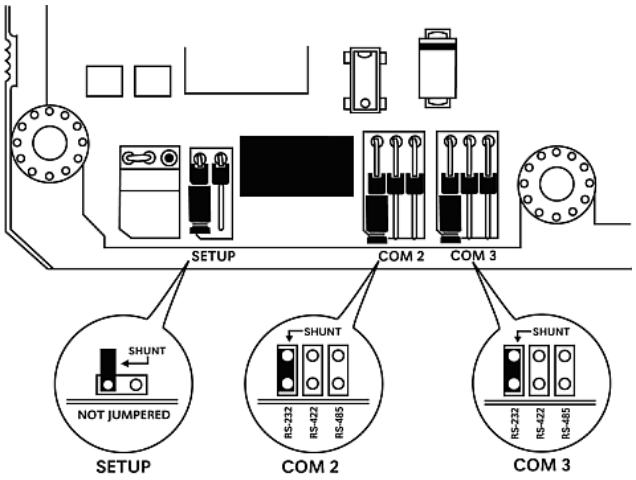




Wiring Diagram

5.4 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 MVI46-101S jumper configuration:



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

5.5 Configuration Data

This section contains a configuration form to be used when designing an application. Use of this form will aid in defining a successful application.

[Section]/Item	Value	Range	Description
[IEC-870-5-101 Port 0]			Slave port communication and protocol parameters
Enabled:		Y or N	This parameter determines if the primary port will be utilized. If the port is not enabled (N), then the module will not use the port. If the port is enabled (Y), the module will emulate a IEC-870-101 slave device on the port.
Time DB Offset:		-1 or 0 to 3994	This parameter defines the location in the database where the time maintained for the IEC protocol is copied. This time is updated whenever a time synchronization command is received from the host and continually as the program runs.
Data link address:		0 to 65535	This parameter defines the data link address for the device emulated on the module. This address identifies the module on the network along with the common address of ASDU.

[Section]/Item	Value	Range	Description
Data link address length:		0, 1 or 2	This parameter specifies the number of octets used for the data link address. This parameter must be set the same for all devices on the network. A value of 0 is only valid when the balanced mode is used. If unbalanced mode is used, a value of 1 or 2 must be used.
Common Address of ASDU:		0 to 65535	This parameter specifies the common address of the ASDU (section address) for access to data in the module. There is only one value entered for access to all data in the module.
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.
Inform. Object Address Len:		1, 2 or 3	This parameter specifies the number of octets used to define the address of an information object (point address).
Cyclic data transmission:		0 to 2^32	This parameter defines the number of milliseconds between cyclic updates. The range of values for this parameter permit update times of 1 millisecond to 49.7 days. If the parameter is set to 0, cyclic data reporting will be disabled.
Maximum ASDU Resp Len		25 to 252	This parameter limits the maximum size of the ASDU portion of a response message. Most applications will use a value of 252.
Cause of Trans Octets		1 or 2	This parameter sets the COT length to 1 or 2. The second octet stores the originator address passed in the register. Spontaneous and cyclic data will always respond with the originator address set to 0.
Select/Operate Timeout:		0 to 2^32	This parameter sets the number of milliseconds after a select command is received in which to wait for a valid execute command. The range of values for this parameter permit times of 1 millisecond to 49.7 days. If the parameter is set to 0, the feature will be disabled.
Use ACTTERM with setpoint:		Y or N	This parameter determines if an ACTTERM will be sent. If the parameter is set to Y, then setpoint commands will issue an ACTTERM when the command is complete. If the parameter is set to N, ACTCON is the last response to a setpoint command.
Use ACTTERM with step:		Y or N	This parameter determines if an ACTTERM will be sent. If the parameter is set to Y, then step commands will issue an ACTTERM when the command is complete. If the parameter is set to N, ACTCON is the last response to a step command.

[Section]/Item	Value	Range	Description
Single char ACT F0,1 or 3:		Y or N	If set to Y, 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 N, the fixed length ACK will be sent.
Single char ACK C1 or C2		Y or N	If set to Y, a single character ACK (0xE5) will be sent instead of a fixed length NACK (secondary function code 9) when no response user data is available. If set to N, the fixed length NACK will be sent.
Event Scan Delay:		0 to 65535	If set to 0, the feature will be disabled and the module will not generate any events. If set from 1 to 65535, the parameter represents the number of milliseconds between event scanning. This parameter defines how often the program will scan for new events in the databases.
M_SP_NA Scan Events:		0 or 1	Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.
M_SP_NA Time Type:		0, 1 or 2	This parameters defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.
M_DP_NA Scan Events:		0 or 1	Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.
M_DP_NA Time Type:		0, 1 or 2	This parameters defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.
M_ST_NA Scan Events:		0 or 1	Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.
M_ST_NA Time Type:		0, 1 or 2	This parameters defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.
M_ME_NA Scan Events:		0 or 1	Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.
M_ME_NA Time Type:		0, 1 or 2	This parameters defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.
M_ME_NB Scan Events:		0 or 1	Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.
M_ME_NB Time Type:		0, 1 or 2	This parameters defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.

[Section]/Item	Value	Range	Description
M_IT_NA Time Type:		0, 1 or 2	This parameters defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.
Use Balanced Mode:		Y or N	This parameter specifies if the port will support balanced mode (requires point-to-point connection). If set to N, the module will only function in unbalanced mode. If set to Y, the module will function in balanced mode.
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.
Response Timeout:		0 to 65535	This parameter specifies the minimum number of milliseconds to wait for a response to a primary message. Do not set this parameter too small or timeout conditions may prevent successful data transmission. If the timeout is recognized, the message will be retransmitted up to the number of times specified in the Retry Count parameter. This parameter is only used in balance mode.
Baud Rate:		300 to 38400	This parameter specifies the baud rate for the primary port on the module. Baud rates from 300 to 38400 are supported on the module.
Parity:		N, O, E, M or S	This parameter specifies the parity for this port using the following code definitions: N=none, O=odd, E=even, M=mark and S=space.
RTS On:		0 to 65535	This parameter specifies the number of milliseconds to delay after asserting the RTS line before data will be sent from the primary port.
RTS Off:		0 to 65535	This parameter specifies the number of milliseconds to delay after sending the data frame before the RTS line is dropped.
Receive Timeout:		0 to 65535	This parameter specifies the minimum number of milliseconds to wait after the first byte of a frame is received before a timeout condition is set. Be careful not to set this parameter too small. If the timeout condition is set, all bytes in the frame received will be discarded.
Hardware Handshaking		0, 1, 2,	This parameter specifies the handshaking control used by the communication port. For modem applications, it should be configured for 1 or 2. 0 = None, 1 = RTS/CTS, 2 = DTR/DSR.
Minimum Delay:		0 to 65535	This parameter defines the minimum number of milliseconds to wait before a response is sent from the unit.
Backup Port Enabled		0 or 1	0 = Disable port, 1 = Enable port for protocol

[Section]/Item	Value	Range	Description
Backup Port Baud Rate:		300 to 38400	This parameter specifies the baud rate for the primary port on the module. Baud rates from 300 to 38400 are supported on the module.
Backup Port Parity:		N, O, E, M or S	This parameter specifies the parity for this port using the following code definitions: N=none, O=odd, E=even, M=mark and S=space.
Backup Port RTS On:		0 to 65535	This parameter specifies the number of milliseconds to delay after asserting the RTS line before data will be sent from the primary port.
Backup Port RTS Off:		0 to 65535	This parameter specifies the number of milliseconds to delay after sending the data frame before the RTS line is dropped.
Receive Timeout:		0 to 65535	This parameter specifies the minimum number of milliseconds to wait after the first byte of a frame is received before a timeout condition is set. Be careful not to set this parameter too small. If the timeout condition is set, all bytes in the frame received will be discarded.
Backup Port Hardware Handshaking		0, 1, 2,	This parameter specifies the handshaking control used by the communication port. For modem applications, it should be configured for 1 or 2. 0 = None, 1 = RTS/CTS, 2 = DTR/DSR.
Backup Port Minimum Delay:		0 to 65535	This parameter defines the minimum number of milliseconds to wait before a response is sent from the unit.
M_ST_NA point count:		0 to 1000	This parameter specifies the number of point values assigned in monitored step-point database.
M_ME_NA point count:		0 to 1000	This parameter specifies the number of point values assigned in monitored normalized-point database.
M_ME_NB point count:		0 to 1000	This parameter specifies the number of point values assigned in monitored scaled-point database.
M_IT_NA point count:		0 to 1000	This parameter specifies the number of point values assigned in monitored counter-point database.
C_SC_NA point count:		0 to 1000	This parameter specifies the number of point values assigned in command single-point database.
C_DC_NA point count:		0 to 1000	This parameter specifies the number of point values assigned in command dual-point database.
C_RC_NA point count:		0 to 1000	This parameter specifies the number of point values assigned in command step-point database.

<table>
<tr><th>[Section]/Item</th><th>Value</th><th>Range</th><th>Description</th></tr>
<tr><td>C_SE_NA point count:</td><td></td><td>0 to 1000</td><td>This parameter specifies the number of point values assigned in command normalized-point database.</td></tr>
<tr><td>C_SE_NB point count:</td><td></td><td>0 to 1000</td><td>This parameter specifies the number of point values assigned in command scaled-point database.</td></tr>
<tr><td>M_ME_NA Parameter Offset:</td><td></td><td>Application dependent</td><td>This parameter specifies the IOA offset to the parameter data for the normalized parameter data. The value entered is added to the Information Object Address for the associated point to compute the parameter IOA address. When the M_ME_NA or M_ME_NB points are polled (e.g, with a group interrogation request), the module will also include parameter points in the response.
For each monitored point, there will be three parameter points:
<table>
<tr><td>Point</td><td>Value</td></tr>
<tr><td>Threshold</td><td>Determined by the deadband set in the configuration file or altered by the write command.</td></tr>
<tr><td>Low</td><td>Last reported event value - threshold.</td></tr>
<tr><td>High</td><td>Last reported event value + threshold.</td></tr>
</table></td></tr>
<tr><td>M_ME_NB Parameter Offset:</td><td></td><td>Application dependent</td><td>This parameter specifies the IOA offset to the parameter data for the scaled parameter data. The value entered is added to the Information Object Address for the associated point to compute the parameter IOA address. When the M_ME_NA or M_ME_NB points are polled (e.g, with a group interrogation request), the module will also include parameter points in the response.
For each monitored point, there will be three parameter points:
<table>
<tr><td>Point</td><td>Value</td></tr>
<tr><td>Threshold</td><td>Determined by the deadband set in the configuration file or altered by the write command.</td></tr>
<tr><td>Low</td><td>Last reported event value - threshold.</td></tr>
<tr><td>High</td><td>Last reported event value + threshold.</td></tr>
</table></td></tr>
</table>

[Section]/Item	[redacted]	Description
[M_SP_NA_1]		Definition of monitored single-point database

```
# Point #   DB Address   Group(s)
# -------   ----------   --------
START
END
```

[Section]/Item	[redacted]	Description
[M_DP_NA_1]		Definition of monitored dual-point database

```
# Point #   DB Address   Group(s)
# -------   ----------   --------
START
END
```

[Section]/Item	[redacted]	Description
[M_ST_NA_1]		Definition of monitored step-point database

```
# Point #   DB Address   Group(s)
# -------   ----------   --------
START
END
```

[Section]/Item	[redacted]	Description
[M_ME_NA_1]		Definition of monitored normalized-point database

```
#                                Default
# Point #   DB Address   Group(s)  Deadband
# -------   ----------   --------  --------
START
END
```

[Section]/Item	[redacted]	Description
[M_ME_NB_1]		Definition of monitored scaled-point database

```
#                                 Default
# Point #   DB Address   Group(s)  Deadband
# -------   ----------   --------  --------
START
END
```

[Section]/Item	[redacted]	Description
[M_IT_NA_1]		Definition of monitored integrated total database

```
# Point #   DB Address   Group(s)
# -------   ----------   --------
START
END
```

[Section]/Item	[redacted]	Description
[C_SC_NA_1] (See Note)		Definition of command single-point database

```
#                       Monitor  Monitor  Require
# Point #   DB Address   Point #  DB Addr   Select
# -------   ----------   -------  -------  -------
START
END
```

[Section]/Item	[redacted]	Description
[C_DC_NA_1] (See Note)		Definition of command dual-point database

```
#                       Monitor  Monitor  Require
# Point #   DB Address   Point #  DB Addr   Select
# -------   ----------   -------  -------  -------
START
END
```

[Section]/Item	[redacted]	Description
[C_RC_NA_1]		Definition of command step-point database

```
#                       Monitor  Monitor
# Point #   DB Address   Point #  DB Addr
# -------   ----------   -------  -------
START
END
```

[Section]/Item	[redacted]	Description
[C_SE_NA_1] (See Note)		Definition of command normalized-point database

```
#                       Monitor  Monitor  Require
# Point #   DB Address   Point #  DB Addr   Select
# -------   ----------   -------  -------  -------
START
END
```

[Section]/Item		Description
[C_SE_NB_1] (See Note)		Definition of command scaled-point database

```
#                        Monitor  Monitor  Require
# Point #   DB Address   Point #  DB Addr   Select
# -------   ----------   -------  -------  -------
START
END
```

[Section]/Item		Description
[C_SE_NC_1] (See Note)		Definition of command short float database

```
#                        Monitor  Monitor  Require
# Point #   DB Address   Point #  DB Addr   Select
# -------   ----------   -------  -------  -------
START
END
```

Note:
Monitor Point # and Monitor DB Addr
You can also associate a monitor point with each command point. Therefore, every time the module responds to a command, it will include the monitor point with the information object address given by the Monitor Point # parameter. Its value will be copied from the database address location given by the Monitor DB Address parameter.
Require Select
This parameter specifies if the point requires a "select" before an "Operation" command.

5.6 MVI46-101S Status Data Definition

This section contains a description of the members present in the status data area stored in the M1 file. This data is continuously transferred from the module to the processor.

Offset	Parameter	Description
0	Scan Count	This status value contains a counter incremented on each scan of the module's main loop.
1 to 2	Product Name	This two-word data area contains the text values representing the product name. These words contain the text '87S5' for the MVI56 platform.
3 to 4	Revision	This two-word data area contains the text values for the revision number.
5 to 6	Op Sys #	This two-word data area contains the text values for the operating system number.
7 to 8	Run Number	This two-word data area contains the text values for the run number.
9	Read Blk Cnt	This word contains the total number of block read operations successfully executed.
10	Write Blk Cnt	This word contains the total number of block write operations successfully executed.

Offset	Parameter	Description
11	Parse Blk Cnt	This word contains the total number of write blocks successfully parsed.
12	Error Blk Cnt	This word contains the total number of block transfer errors.
13	Port Selected	This parameter determines which port on the module is being utilized. If the value is set to 0, the primary port is being used. If the value is set to 1, the backup port is being utilized.
14	Bad CKS	This word contains the total number of frames received by the module that contain a bad check-sum values in the message.
15	Sync Errors	This word contains the total number of frames received by the module that have synchronization errors. Each frame in the protocol has a specific header that must be received in a fixed sequence. If this header is not received correctly, this word will be incremented, and the frame will be discarded.
16	Length Errors	This word contains the total number of frames received by the module that do not have the correct length.
17	Timeout	This word contains the total number of frames received by the module that were not received within the specified receive timeout parameter.
18	RX Frames	This word contains the total number of frames received by the module.
19	TX Frames	This word contains the total number of frames transmitted by the module.

5.7 MVI46-101S Error Status Table

This section contains a listing of the MVI46-101S module's status data area. This file is located at the MVI46-101S database starting at address 4000. You may also configure an additional area using the "Error Offset" parameter.

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.
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	Port Selected	This parameter determines which port on the module is being utilized. If the value is set to 0, the primary port is being used. If the value is set to 1, the backup port is being utilized.

Offset	Parameter	Description
4014	Bad CKS	This word contains the total number of frames received by the module that contain a bad check-sum values in the message.
4015	Sync Errors	This word contains the total number of frames received by the module that have synchronization errors. Each frame in the protocol has a specific header that must be received in a fixed sequence. If this header is not received correctly, this word will be incremented, and the frame will be discarded.
4016	Length Errors	This word contains the total number of frames received by the module that do not have the correct length.
4017	Timeout	This word contains the total number of frames received by the module that were not received within the specified receive timeout parameter.
4018	RX Frames	This word contains the total number of frames received by the module.
4019	TX Frames	This word contains the total number of frames transmitted by the module.
4020	MSP Event Buffer	This parameter shows the number of events available in the event buffer for M_SP_NA points.
4021	MDP Event Buffer	This parameter shows the number of events available in the event buffer for M_DP_NA points
4022	MST Event Buffer	This parameter shows the number of events available in the event buffer for M_ST_NA points
4023	MMENA Event Buffer	This parameter shows the number of events available in the event buffer for M_ME_NA points
4024	MMENB Event Buffer	This parameter shows the number of events available in the event buffer for M_ME_NB points
4025	MMENC Event Buffer	This parameter shows the number of events available in the event buffer for M_ME_NC points.
4026	MIT Event Buffer	This parameter shows the number of events available in the event buffer for M_IT_NA points

5.8 MVI46-101S Database Design Forms

This section contains a set of forms that can be used to design the databases required by the module.

Form for use with the data types M_SP_NA_1, M_DP_NA_1,

M_ST_NA_1 and M_IT_NA_1

Point Number	Database Address	Group Assignment

Form to be used with data types M_ME_NA_1 and M_ME_NB_1

Point Number	Database Address	Group Assignment	Default Deadband

Forms to be used with all command data types except C_RC_NA_1

Point Number	Database Address	Monitor Point #	Monitor Database Address	Require Select

Form to be used with C_RC_NA_1 data type

Point Number	Database Address	Monitor Point #	Monitor Database Address

5.9 IEC 60870-5-101 Slave Interoperability Document

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 originating from different manufacturers it is necessary that all partners agree on the selected parameters.

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

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

☐ Function or ASDU is not used

☒ Function or ASDU is used as standardized (default)

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

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 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if >1 200 bit/s	Balanced interchange circuit X.24/X.27
☐ 100 bit/s	☒ 2400 bit/s	☒ 2400 bit/s ☐ 56000 bit/s
☐ 200 bit/s	☒ 4800 bit/s	☒ 4800 bit/s ☐ 64000 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 Standard	Unbalanced interchange circuit V.24/V.28 Recommended if >1 200 bit/s	Balanced interchange circuit X.24/X.27
☐ 100 bit/s	☒ 2400 bit/s	☒ 2400 bit/s ☐ 56000 bit/s
☐ 200 bit/s	☒ 4800 bit/s	☒ 4800 bit/s ☐ 64000 bit/s
☒ 300 bit/s	☒ 9600 bit/s	☒ 9600 bit/s
☒ 600 bit/s	☒ 19200 bit/s	
☒ 1200 bit/s	☒ 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) See Note 3.

Application Layer

Transmission mode for application data

Mode 1 (Least significant octet first), as defined in clause 4.10 of IEC 60870-5-4, 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 S 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_I
☒	<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 description 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

☒⑨<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 CP56Time2a 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 [Note 1] 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
☐	<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 l4
☒	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 and execute set point command

☒ C_SE_ACTTERM used [Note 2]

☒ No additional definition

☒ Short pulse duration (duration determined by a system parameter in the outstation) [Note 4]

☒ Long pulse duration (duration determined by a system parameter in the outstation) [Note 4]

☒ 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

Note 1: Delay acquisition command supports Load Delay only.

Note 2: C_SE_ACTTERM may be enabled or disabled at time of installation.

Note 3: The ASDU length can be configured by the user (between 25 and 252).

Note 4: Only applies to C_SC_NA_1 and C_DC_NA_1 commands.

Note 5: The low limits and high limit values are calculated based on the Deadband values as follows:

Low Limit: Last reported event value - threshold

High Limit: Last reported event value + threshold

6 Support, Service & Warranty

In This Chapter

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

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

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

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

6.1 How to Contact Us: Technical Support

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

Asia Pacific

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

Languages spoken include: Chinese, English

Europe (location in Toulouse, France)

+33 (0) 5.34.36.87.20, support.EMEA@prosoft-technology.com (mailto:support.emea@prosoft-technology.com)

Languages spoken include: French, English

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

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

Languages spoken include: English, Spanish

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

Brasil (location in Sao Paulo)

+55-11-5084-5178 , eduardo@prosoft-technology.com (mailto:eduardo@prosoft-technology.com)

Languages spoken include: Portuguese, English

6.2 Return Material Authorization (RMA) Policies and Conditions

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

6.2.1 All Product Returns:

a) In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Returned Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.
b) In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above (page 87). A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.
c) All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft using a shipment method other than that specified by ProSoft or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
d) A 10% restocking fee applies to all warranty credit returns whereby a Customer has an application change, ordered too many, does not need, etc.

6.2.2 Procedures for Return of Units Under Warranty:

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

a) A replacement module will be shipped and invoiced. A purchase order will be required.
b) Credit for a product under warranty will be issued upon receipt of authorized product by ProSoft at designated location referenced on the Return Material Authorization.

6.2.3 Procedures for Return of Units Out of Warranty:

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

The following is a list of non-repairable units:

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

6.2.4 Purchasing Warranty Extension:

a) ProSoft's standard warranty period is three (3) years from the date of shipment as detailed in "Limited Warranty (page 90)". The Warranty Period may be extended at the time of equipment purchase for an additional charge, as follows:

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

6.3 LIMITED WARRANTY

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

6.3.1 What Is Covered By This Warranty

a) *Warranty On New Products*: ProSoft warrants, to the original purchaser, that the Product that is the subject of the sale will (1) conform to and perform in accordance with published specifications prepared, approved and issued by ProSoft, and (2) will be free from defects in material or workmanship; provided these warranties only cover Product that is sold as new. This Warranty expires three years from the date of shipment (the "Warranty Period"). If the Customer discovers within the Warranty Period a failure of the Product to conform to specifications, or a defect in material or workmanship of the Product, the Customer must promptly notify ProSoft by fax, email or telephone. In no event may that notification be received by ProSoft later than 39 months. Within a reasonable time after notification, ProSoft will correct any failure of the Product to conform to specifications or any defect in material or workmanship of the Product, with either new or used replacement parts. Such repair, including both parts and labor, will be performed at ProSoft's expense. All warranty service will be performed at service centers designated by ProSoft.
b) *Warranty On Services*: Materials and labor performed by ProSoft to repair a verified malfunction or defect are warranteed in the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.

6.3.2 What Is Not Covered By This Warranty

a) ProSoft makes no representation or warranty, expressed or implied, that the operation of software purchased from ProSoft will be uninterrupted or error free or that the functions contained in the software will meet or satisfy the purchaser's intended use or requirements; the Customer assumes complete responsibility for decisions made or actions taken based on information obtained using ProSoft software.

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

6.3.3 Disclaimer Regarding High Risk Activities

Product manufactured or supplied by ProSoft is not fault tolerant and is not designed, manufactured or intended for use in hazardous environments requiring fail-safe performance including and without limitation: the operation of nuclear facilities, aircraft navigation of communication systems, air traffic control, direct life support machines or weapons systems in which the failure of the product could lead directly or indirectly to death, personal injury or severe physical or environmental damage (collectively, "high risk activities"). ProSoft specifically disclaims any express or implied warranty of fitness for high risk activities.

6.3.4 Intellectual Property Indemnity

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

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

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

6.3.5 Disclaimer of all Other Warranties

The Warranty set forth in What Is Covered By This Warranty (page 90) are in lieu of all other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.

*6.3.6 Limitation of Remedies ***

In no event will ProSoft or its Dealer be liable for any special, incidental or consequential damages based on breach of warranty, breach of contract, negligence, strict tort or any other legal theory. Damages that ProSoft or its Dealer will not be responsible for included, but are not limited to: Loss of profits; loss of savings or revenue; loss of use of the product or any associated equipment; loss of data; cost of capital; cost of any substitute equipment, facilities, or services; downtime; the claims of third parties including, customers of the Purchaser; and, injury to property.

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

6.3.7 Time Limit for Bringing Suit

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

6.3.8 No Other Warranties

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

6.3.9 Allocation of Risks

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

6.3.10 Controlling Law and Severability

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

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