inRAx

MVI56-N2

ControlLogix Platform

N2 Slave Interface Module

User Manual

April 21, 2008

ProSoft
T E C H N O L O G Y

Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation ControlLogix hardware, the MVI56-N2 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.

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Warnings

UL Warnings

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

ATEX Warnings and Conditions of Safe Usage:

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

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

Electrical Ratings

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

Markings:

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

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 (15 for the PC56). When the battery is fully discharged, the module will revert to the default BIOS settings.

Note: The battery is not user replaceable.

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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MVI56-N2 User Manual
April 21, 2008
PSFT.N2.MVI56.UM.08.04.21

Contents

Guide to the MVI56-N2 User Manual

Function		**Section to Read**	**Details**
Introduction (Must Do)	→	Start Here (page 11)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Verify Communication, Diagnostic and Troubleshooting	→	Verifying Communication (page 50) Diagnostics and Troubleshooting (page 41)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	Reference (page 53) Functional Overview (page 55) Product Specifications (page 53)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 73)	This section contains Support, Service and Warranty information. Index of chapters.

1   Start Here

In This Chapter

Installing the MVI56-N2 module requires a reasonable working knowledge of the Rockwell Automation hardware, the MVI56-N2 Module and the application in which they will be used.

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

1.1   System Requirements

The MVI56-N2 module requires the following minimum hardware and software components:

- Rockwell Automation ControlLogix™ processor, with compatible power supply and one free slot in the rack, for the MVI56-N2 module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 5000 programming software version 2.51 or higher.
- Rockwell Automation RSLinx communication software
- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  o   Microsoft Windows XP Professional with Service Pack 1 or 2
  o   Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
  o   Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended

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

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

1.2   Package Contents

The following components are included with your MVI56-N2 module, and are all required for installation and configuration.

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

Qty.	Part Name	Part Number	Part Description
1	MVI56-N2 Module	MVI56-N2	N2 Slave Interface 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 MVI56-N2 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 MVI56-N2 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.
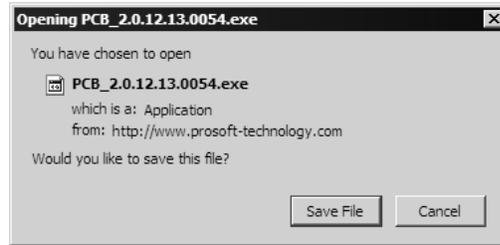
4 Make a note of the location where you saved the file, for example "Desktop", or "My Documents", so you can start the installation program.
5 When the download is complete, locate and open the file, and then follow the instructions on your screen to install the program.

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 MVI56-N2 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. There are three jumpers located at the bottom of the module.

The following illustration shows the MVI56-N2 jumper configuration:
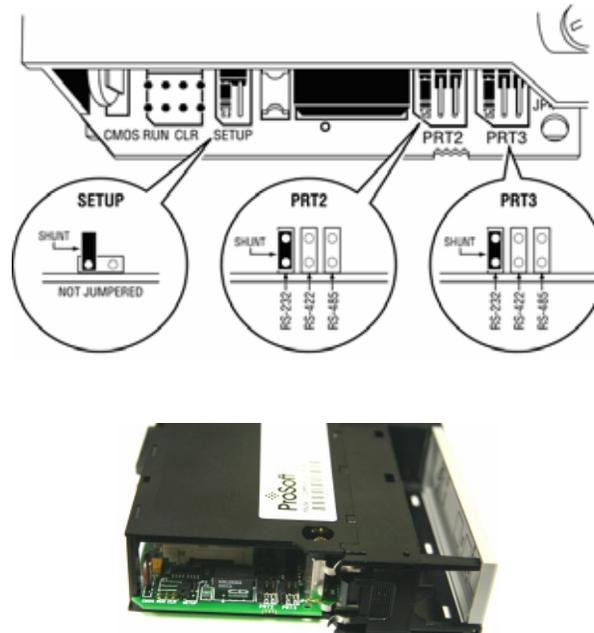
1   Set the PRT 2 (for application port 1) and PRT 3 (for application port 2) jumpers for RS232, RS422 or RS485 to match the wiring needed for your application. The default jumper setting for both application ports is RS-232.
2   The Setup Jumper acts as "write protection" for the module's flash memory. In "write protected" mode, the Setup pins are not connected, and the module's firmware cannot be overwritten. Do not jumper the Setup pins together unless you are directed to do so by ProSoft Technical Support.

1.5   Install the Module in the Rack

If you have not already installed and configured your ControlLogix processor and power supply, please do so before installing the MVI56-N2 module. Refer to your Rockwell Automation product documentation for installation instructions.

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

After you have checked the placement of the jumpers, insert MVI56-N2 into the ControlLogix chassis. Use the same technique recommended by Rockwell Automation to remove and install ControlLogix modules.

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

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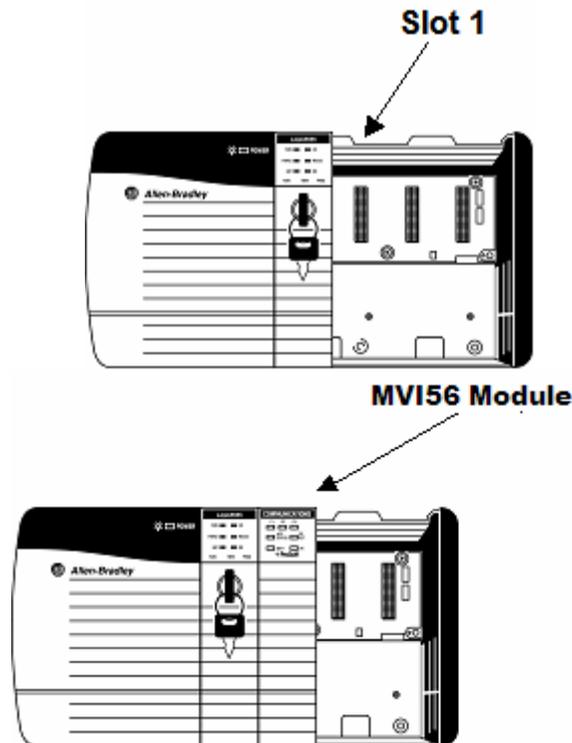
3 With a firm but steady push, snap the module into place.
4 Check that the holding clips on the top and bottom of the module are securely in the locking holes of the rack.
5 Make a note of the slot location. You will need to identify the slot in which the module is installed in order for the sample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

> Note: If you insert the module improperly, the system may stop working, or may behave unpredictably.
> Note: If you are installing MVI56-N2 with other modules connected to the PCI bus, the peripheral modules will not have holding clips. Make sure all of the modules are aligned with their respective slots before you snap them into place.

1.6   Connect your PC to the Processor

1   Connect the right-angle connector end of the cable to your controller at the communications port.
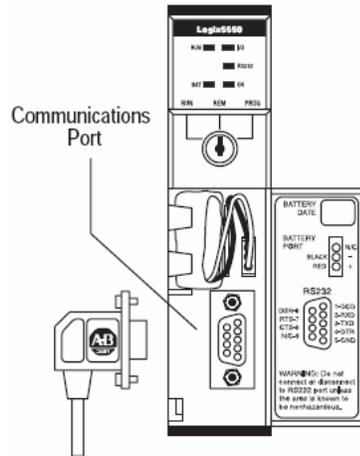
2   Connect the straight connector end of the cable to the serial port on your computer.
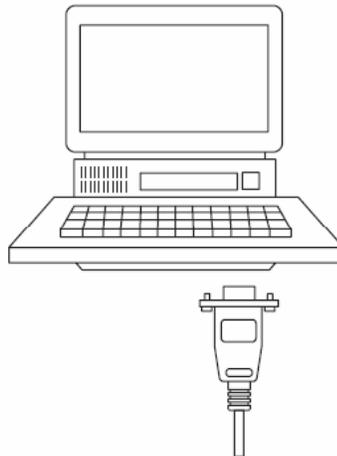
1.7   Open the Sample Ladder Logic

The sample program for your MVI56-N2 module includes custom tags, data types and ladder logic for data I/O and status monitoring. For most applications, you can run the sample ladder program without modification, or, for advanced applications, you can incorporate the sample program into your existing application.

The inRAx Solutions CD provides one or more versions of the sample ladder logic. The version number appended to the file name corresponds with the firmware version number of your ControlLogix processor. The firmware version and sample program version must match.

1.7.1   To Determine the Firmware Version of your Processor

Important: The RSLinx service must be installed and running on your computer in order for RSLogix to communicate with the processor. Refer to your RSLinx and RSLogix documentation for help configuring and troubleshooting these applications.

1 Connect an RS-232 serial cable from the COM (serial) port on your PC to the communication port on the front of the processor.
2 Start RSLogix 5000 and close any existing project that may be loaded.
3 Open the Communications menu and choose **Go Online**. RSLogix will establish communication with the processor. This may take a few moments.
4 When RSLogix has established communication with the processor, the Connected To Go Online dialog box will open.
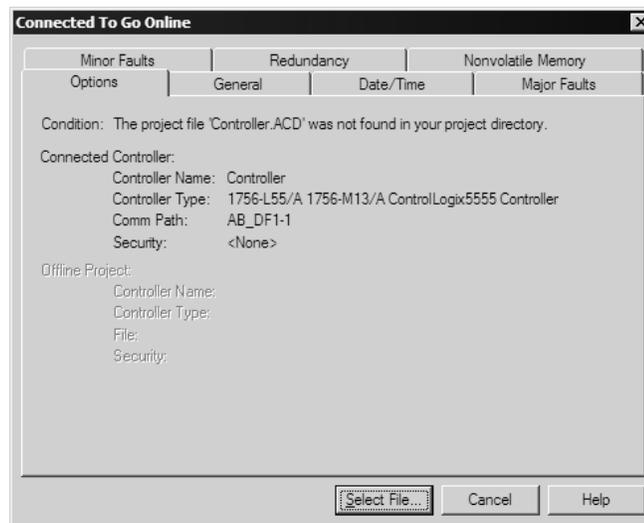
5 On the Connected To Go Online dialog box, click the General tab. This tab shows information about the processor, including the Revision (firmware) version. In the following illustration, the firmware version is 11.32
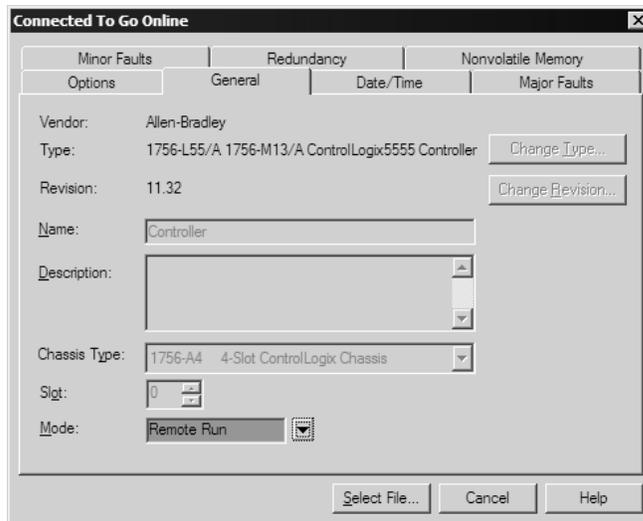
1.7.2 Select the Slot Number for the Module

The sample application is for a module installed in Slot 1 in a ControlLogix rack. The ladder logic uses the slot number to identify the module. If you are installing the module in a different slot, you must update the ladder logic so that program tags and variables are correct, and do not conflict with other modules in the rack.

To change the slot number

1 In the Controller Organization list, select the module [1] 1756-MODULE MVI56, and then click the right mouse button to open a shortcut menu.
2 On the shortcut menu, choose **Properties**. This action opens the Module Properties dialog box.
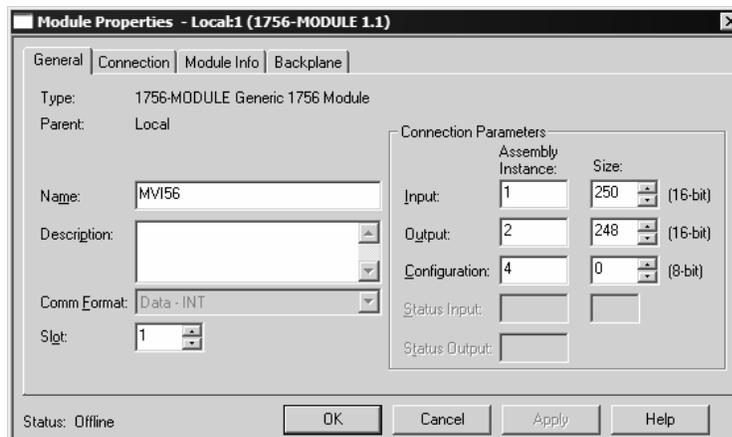
3 In the **Slot:** field, use the spinners on the right side of the field to select the slot number where the module will reside in the rack, and then click OK.

RSLogix will automatically apply the slot number change to all tags, variables and ladder logic rungs that use the MVI56-N2 slot number for computation.

1.7.3 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.

```
Communications  Station  DDE/OPC
  RSWho

  Configure Drivers...
  Configure Shortcuts...
  Configure Client Applications...
  Configure CIP Options...

  Driver Diagnostics...
  CIP Diagnostics...
```
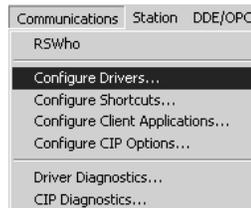
This action opens the Configure Drivers dialog box.

```
Configure Drivers

Available Driver Types:
[RS-232 DF1 Devices                    ▼]    [Add New...]     [Close]
                                                              [Help]

Configured Drivers:

Name and Description                      Status
AB_DF1-1 DH+ Sta: 0 COM1: RUNNING         Running           [Configure...]
                                                            [Startup...]
                                                            [Start]
                                                            [Stop]
                                                            [Delete]
```
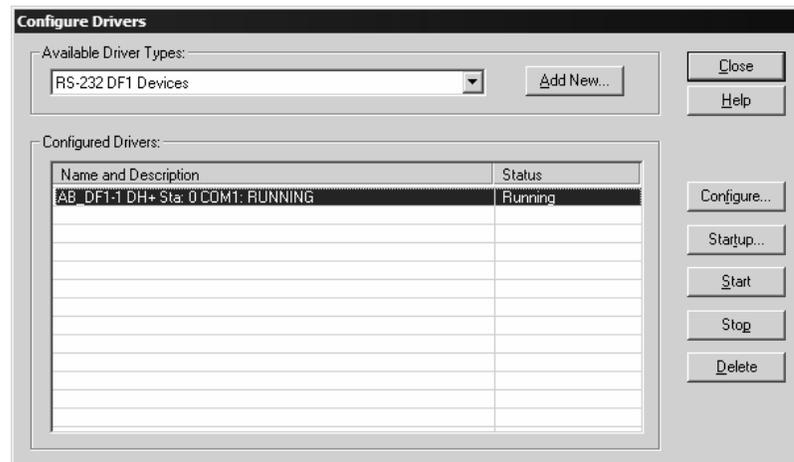
Note: If the list of configured drivers is blank, you must first choose and configure a driver from the Available Driver Types list. The recommended driver type to choose for serial communication with the processor is "RS-232 DF1 Devices".

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   Download the Sample Program to the Processor

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

To download the sample program from RSLogix 5000 to the ControlLogix processor

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

2 When communication is established, RSLogix will open a confirmation dialog box. Click the Download button to transfer the sample program to the processor.

Download

Download to the controller:
Name: Controller
Type: 1756-L55/A 1756-M13/A ControlLogix5555 Controller
Path: AB_DF1-1
Security: <None>

The controller is in Remote Run mode. The mode will be changed to Remote Program prior to download.

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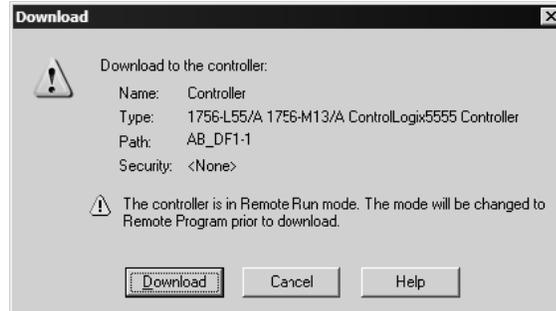
3 RSLogix will compile the program and transfer it to the processor. This process may take a few minutes.
4 When the download is complete, RSLogix will open another confirmation dialog box. Click OK to switch the processor from Program mode to Run mode.

RSLogix 5000

Done downloading. Change controller mode back to Remote Run?

[Yes]   [No]
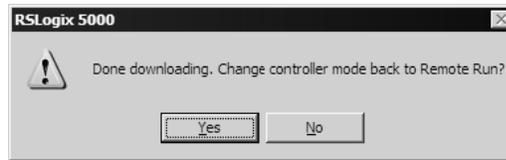
Note: If you receive an error message during these steps, refer to your RSLogix documentation to interpret and correct the error.

1.9 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.
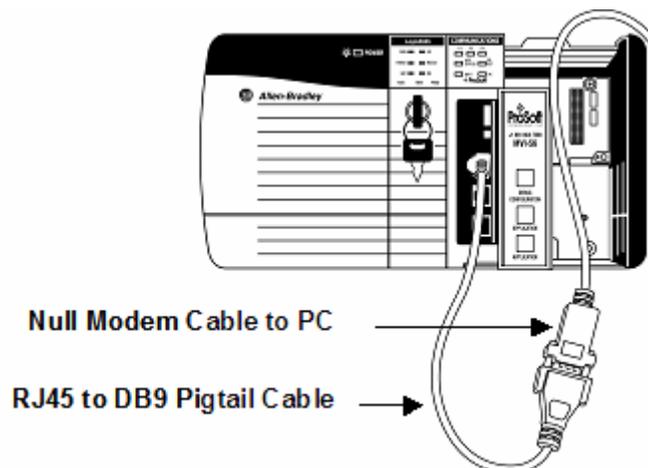
Null Modem Cable to PC

RJ45 to DB9 Pigtail Cable

2   Module Configuration

2.1   Installing and Configuring the Module

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

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

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

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

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

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

The first step in installing and configuring the module is to define the module to the system. Click the right mouse button on the I/O Configuration option in the Controller Organization list to open a shortcut menu. Select the New Module… option from the I/O Configuration menu.
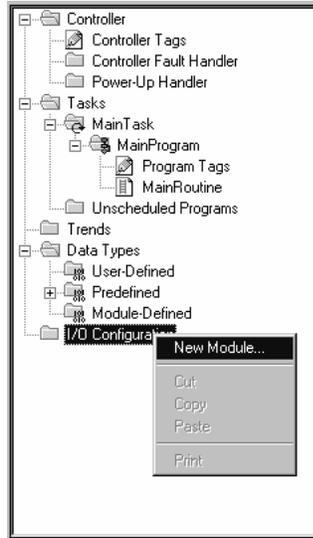
This action opens the following dialog box.
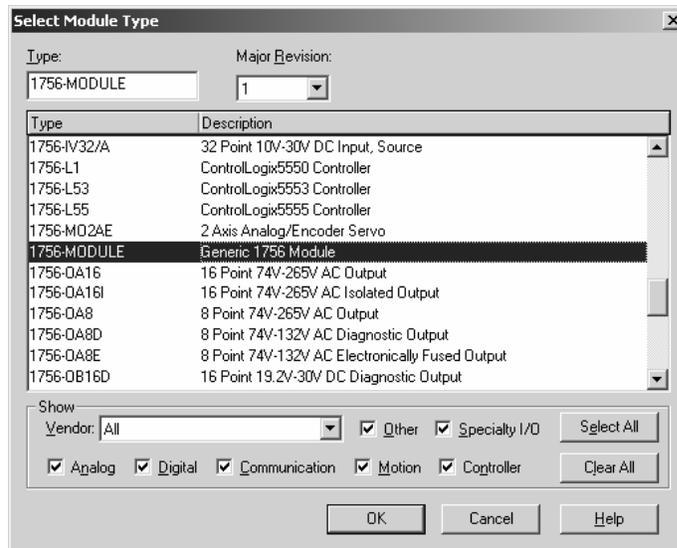
Select the 1756-Module (Generic 1756 Module) from the list and click OK. The following dialog box is displayed.
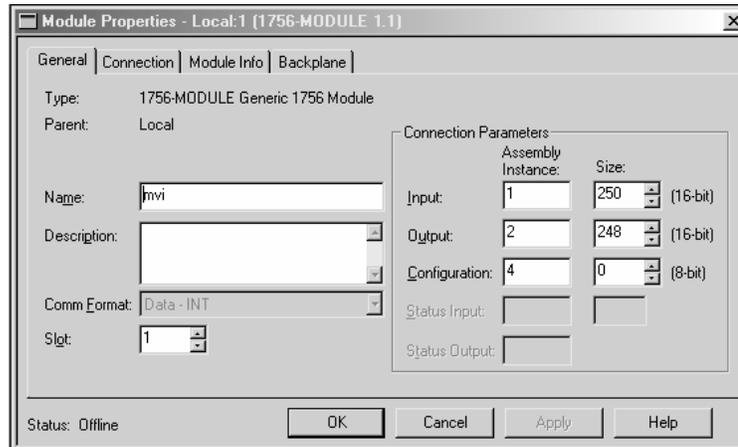
Fill in the dialog boxes as shown adjusting the Name, Description and Slot options for your application. You must select the **Comm Format** as **Data - INT** in the dialog box. Failure to set the **Assembly Instance** and **Size** values correctly will result in a module that will not communicate over the backplane of the ControlLogix rack. Click Next to display the next dialog box.
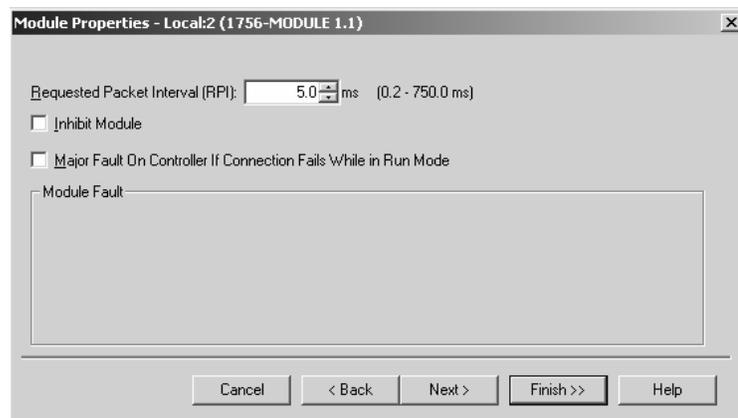
Select the Request Packet Interval value for scanning the I/O on the module. This value represents the minimum frequency the module will handle scheduled events. This value should not be set to less than 1 millisecond. Values between 1 and 10 milliseconds should work with most applications.

After completing the module setup, the Controller Organization list will display the module's presence. The data required for the module will be defined to the application, and objects will be allocated in the Controller Tags data area. The following example shows the Controller Organization list.

The next step is to define the User Defined Data Types to be used with the module. Copy these data types from the example ladder logic if you are not using the example. They will be defined if you are starting from the example ladder logic. The Controller Organization list should display the User Defined Data Types shown in the following example:
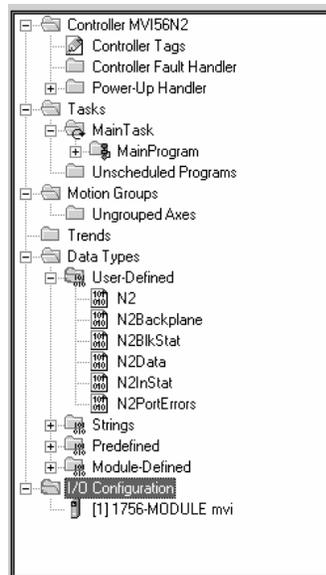
The next step in module setup is to define the data to be used to interface with the module and the ladder logic. Open the Controller Tags Edit Tags dialog box and enter the values required for the application. You can set the tag name to any valid tag name you desire. If you are using the example ladder logic, this step has already been performed.

The last step is to add the ladder logic. If you are using the example ladder logic, adjust the ladder to fit your application. If you are not using the ladder example, copy the ladder logic shown in the Controller Organization list below to your application.

2.2 Module Data Object (N2)

All data related to the MVI56-N2 is stored in a user defined data type. An instance of the data type is required before the module can be used. This is done by declaring a variable of the data type in the Controller Tags Edit Tags dialog box. The following table shows the structure of the object.

Name	Data Type	Description
Backplane	N2Backplane	Values used by program for data transfer operation between the module and the processor.
Statistics	N2InStat	This status data is returned on each read block and can be used to detect proper module operation.
Data	N2Data	This object is used to define the attributes related to the data structures.
BlockRequest	N2_BlockRequest	Coldboot and Warmboot block requests
Auxiliary	N2_Auxiliary	

This object contains objects that define the configuration, user data, status, and command control data related to the module. Each of these object types is discussed in the following topics of the document.

2.2.1 Backplane Control Object

This data object stores the variables required for the data transfer between the processor and the MVI56-N2 module. The structure of the object is shown in the following table.

Name	Data Type	Description
LastRead	INT	Index of last read block
LastWrite	INT	Index of last write block
BlockIndex	INT	Computed block offset for data table

2.2.2 User Data Objects

These objects hold data to be transferred between the processor and the MVI56-N2 module. The user data is the read and write data transferred between the processor and the module as "pages" of data up to 200 words long.

The write data (**N2Data**) is an array containing values that are written into the module database. For ease of use, this array should be dimensioned as even increments of 200 words. This data is paged up to 200 words at a time from the processor to the module. The WriteData task places the write data into the output image for transfer to the module. This data is passed from the processor to the module for status and control information for use in other nodes on the network.

2.2.3 Module Data

This object contains the N2 data points to be used for convenience. These points are constantly moved to the Write Data array or from the Read Data array.

Name	Data Type	Description
AnalogIn	REAL[300]	Analog Inputs

Name	Data Type	Description
BinaryIn	INT[60]	Binary Inputs
AnalogOut	REAL[300]	Analog Outputs
BinaryOut	BOOL[960]	Binary Outputs
BinaryDBOut	INT[60]	Binary Database Output
AnalogDBOut	REAL[300]	Analog Database Outputs

2.2.4 Status Data

This object views the status of the module. The **N2InStat** object shown is updated each time a read block is received by the processor. Use this data to monitor the state of the module at a "real-time rate".

Name	Data Type	Description
PassCnt	INT	Program cycle counter
Product	INT[4]	Product Name
Code	INT[2]	
Rev	INT[2]	Revision Level Number
OP	INT[2]	Operating Level Number
Run	INT[2]	Run Number
PrtErrs	N2PortErrors[2]	Port error statistics
BlkErrs	N2BlkStat	Block transfer statistics
Port1CurErr	INT	Current error/index for Port 1
Port1LErr	INT	Last error/index for Port 1
Port2CurErr	INT	Current error/index for Port 2
Port2LErr	INT	Last error/index for Port 2

This object contains a structure that includes the status information for the data transfer operations between the processor and the module. The structure of this object is shown in the following example:

Name	Data Type	Description
Writes	INT	Total number of read block transfers
Reads	INT	Total number of write block transfers
Parse	INT	Total number of blocks parsed
Err	INT	Total number of block transfer errors

Additionally, the status object contains a structure for each of the servers in the module. The structure used for each server is shown in the following example:

Name	Data Type	Description
Requests	INT	Total number of requests for port
Responses	INT	Total number of responses for port
ErrSent	INT	Total number of errors sent
ErrRec	INT	Total number of errors received

Refer to the Reference chapter for a complete listing of the data stored in status object.

2.3 N2 Message Data

This module's program also includes the pass-through mode. The module supports two types of pass-through operation. Block 9001 is for binary output writes from an N2 master. Block 9002 is for analog output writes from an N2 Master.

In this mode, write messages sent to a slave port are passed directly through to the processor. It is the responsibility of the ladder logic to process the message received using this feature. This information is passed from the module to the processor using block identification codes of 9001 and 9002. The following topics explain the data objects involved.

2.3.1 N2 Data Object (N2Data)

These objects hold data transferred from the MVI56-N2 module. The **N2Data** object shown in the example is updated each time a read block number of 9001 or 9002 is received by the processor.

Name	Data Type	Description
AnalogIn	REAL[300]	Analog Inputs
BinaryIn	INT[60]	Binary Inputs
AnalogOut	REAL[300]	Analog Outputs
BinaryOut	BOOL[960]	Binary Outputs
BinaryDBOut	INT[60]	Binary Database Output
AnalogDBOut	REAL[300]	Analog Database Outputs

2.4 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.

2.4.1 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.
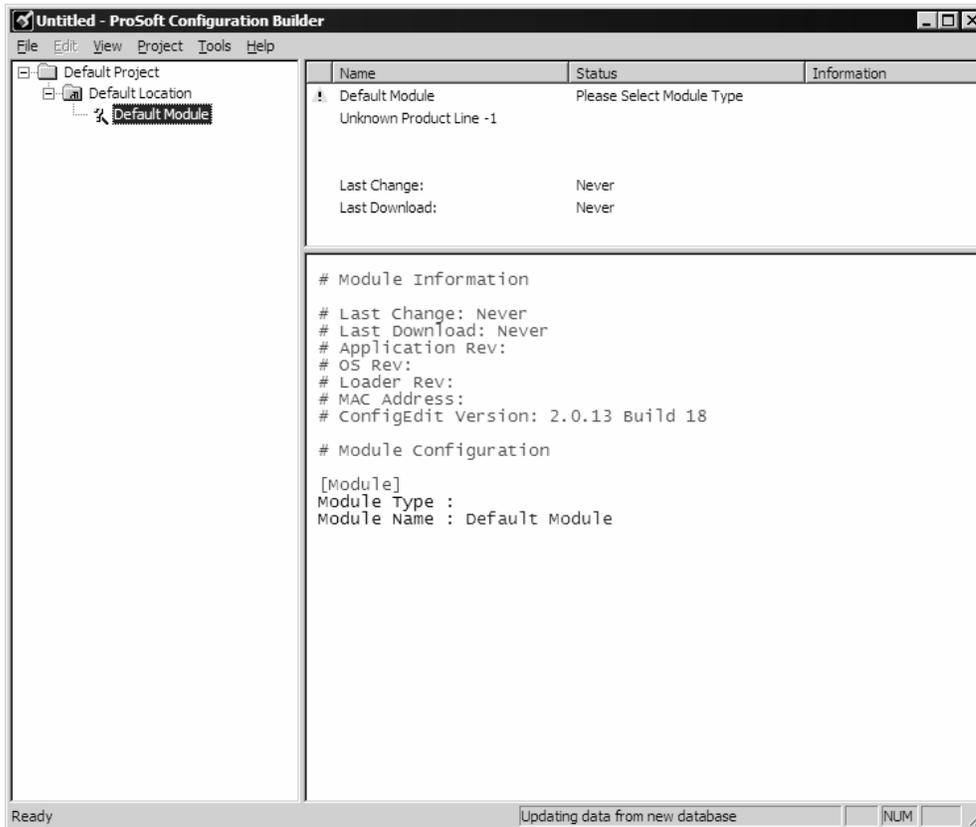
Your first task is to add the MVI56-N2 module to the project.

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.
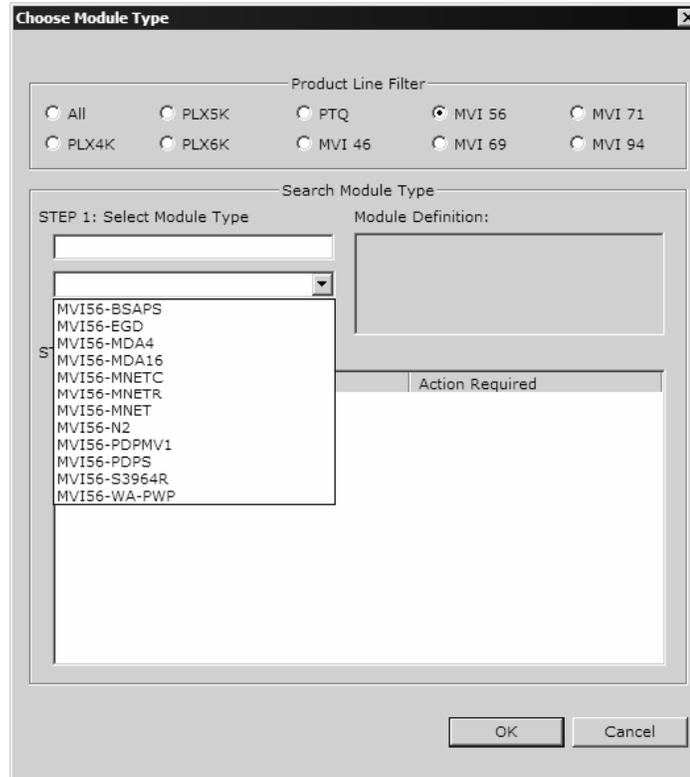
3 In the Product Line Filter area of the dialog box, select MVI56. In the Select Module Type dropdown list, select MVI56-N2, and then click OK to save your settings and return to the ProSoft Configuration Builder window.

The next task is to set the module parameters.

Adding a 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.

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
Select the Location icon.

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

2.4.2 Set Module Parameters

Notice that the contents of the information pane and the configuration pane
changed when you added the MVI56-N2 module to the project.
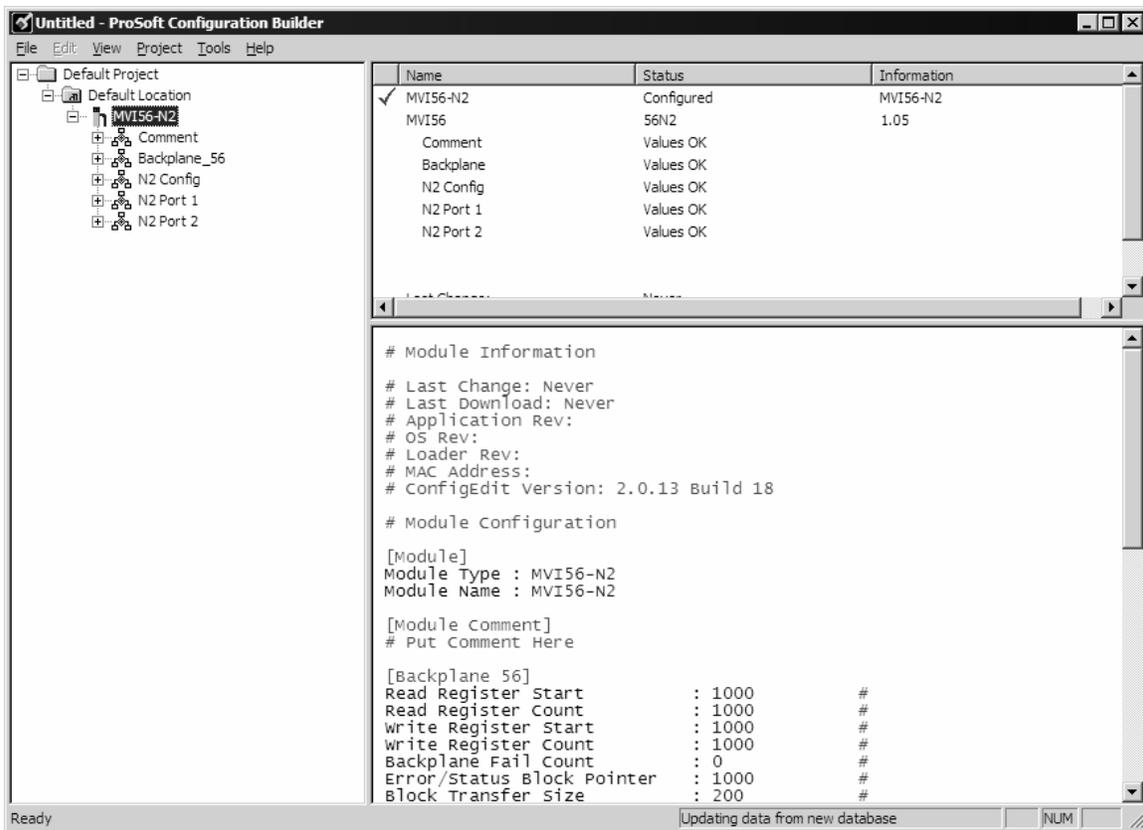
At this time, you may wish to rename the "Default Project" and "Default Location"
folders in the tree view.

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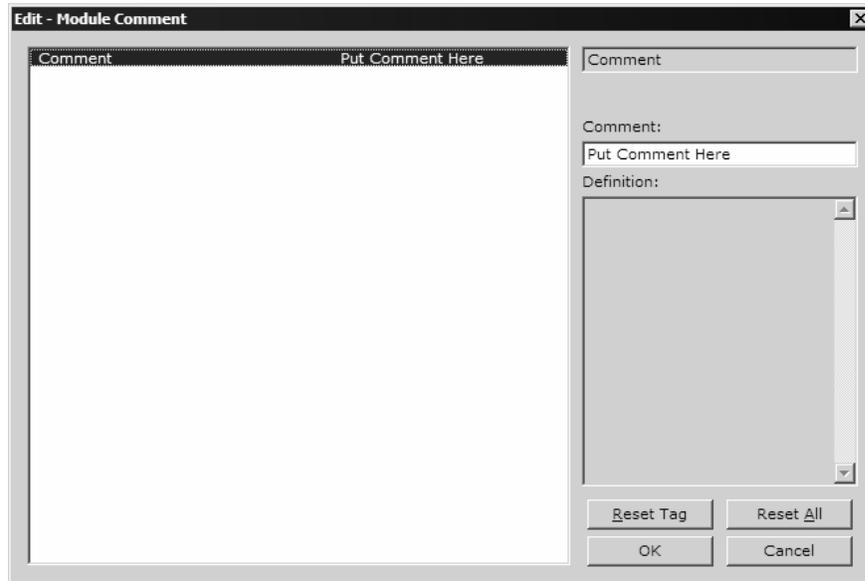
3   Enter your comment and click OK to save your changes.

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.

2.5 [Backplane 56]

2.5.1 Read Register Start

1000 (recommended value)

This parameter specifies the starting register in the module where data will be transferred from the module to the processor.

Note: This value applies only when the configuration item Enable Database Output (page 35) in the [N2 Config] section is set to Yes.

2.5.2 Read Register Count

800 (recommended value)

This parameter specifies the number of registers to be transferred from the module to the processor.

Note: This value applies only when the configuration item Enable Database Output (page 35) in the [N2 Config] section is set to Yes.

2.5.3 Write Register Start

0 (recommended value)

This parameter specifies the starting register in the module where the data transferred from the processor will be placed.

2.5.4 Write Register Count

800 (recommended value)

This parameter specifies the number of registers to transfer from the processor to the module.

2.5.5 Backplane Fail Count

0 to 65535

This parameter specifies the number of consecutive backplane transfer failures that can occur before communications should be halted.

2.5.6 Error/Status Block Pointer

1 to 7000

The Error/Status Block Pointer parameter is used to specify the range of database registers to use for error and status data. The value range should be no lower than 700, to avoid overwriting data, and no higher than 6970, to allow sufficient space for the error/status block.

2.5.7 Block Transfer Size

40 or 200

Specifies the number of words in each block transferred between the module and processor. Valid values for this parameter are 40 (for remote rack installations) and 200 (for local rack installations).

2.6 [N2 Config]

This section is used to define the N2 configuration data.

2.6.1 Enable Database Output

Yes or No

When this parameter is set to No (the default value), the module will immediately pass through response data from the master to the processor without writing to the module database (Legacy mode).

When this parameter is set to Yes, response data is saved to the module database for backplane output transfer. The database location is set in the Read Register Start (page 34) parameter in the [Backplane Configuration] section.

2.6.2 Binary Input Object Count

0 to 960

Determines the number of Binary Input Objects available

2.6.3 Analog Input Object Count

0 to 256

Determines the number of Analog Input Objects available.

2.6.4 Binary Output Object Count

0 to 960

Determines the number of Binary Output Objects available.

2.6.5 Analog Output Object Count

0 to 256

Determines the number of Analog Output Objects available.

2.7 [N2 Port x]

This section is used to define the port configuration for the N2 device

2.7.1 Enable

Yes or No

This parameter specifies whether to enable or disable the port. No = Port Disabled, Yes = Port Enabled.

2.7.2 Slave Address

1 to 255

This parameter defines the Slave Node Address for the internal database. All requests received by the port with this address are processed by the module. Verify that each device has a unique address on a network. Valid range for this parameter is 1 to 255.

2.7.3 Baud Rate

300 to 115200

This parameter specifies the baud rate to be used on the port. Valid values are 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200.

2.7.4 Parity

N, O, E

This parameter specifies the parity setting for this port. Valid values are N = None, O = Odd, E = Even.

2.7.5 Data Bits

7 to 8

This parameter sets the number of data bits for each word used by the protocol.

2.7.6 Stop Bits

1 or 2

This parameter sets the number of stop bits to be used with each data value sent.

2.7.7 RTS On

0 to 65535

This parameter sets the number of milliseconds to delay after RTS is asserted before the data will be transmitted.

2.7.8 RTS Off

0 to 65535

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

2.7.9 Minimum Response Delay

0 to 65535

This parameter sets the number of milliseconds to wait to respond to a request on the port. This is required for slow reacting devices.

2.7.10 Use CTS Line

Yes or No

This parameter specifies if the CTS modem control line is to be used. If the parameter is set to No, the CTS line will not be monitored. If the parameter is set to Yes, the CTS line will be monitored and must be high before the module will send data. Normally, this parameter is required when half-duplex modems are used for communication (2-wire).

2.8   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 MVI56-N2 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.
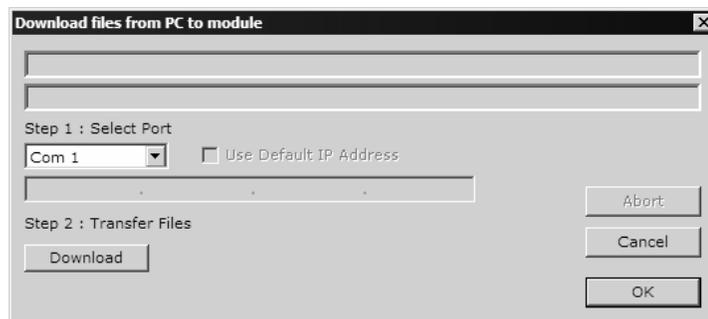
3   Choose the com port to use from the dropdown list, and then click the Download button.

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"*.

Download files from PC to module	✕
Module Running	

Step 1 : Select Port

Com 1 ▾   ☐ Use Default IP Address

| . | . | . |

Step 2 : Transfer Files

Download   Abort

Cancel

OK
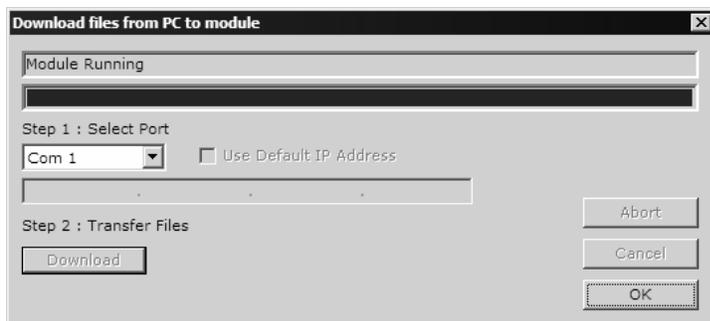
3   Ladder Logic

Ladder logic is required for application of the MVI56-N2 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

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

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

4.1 Reading Status Data from the Module

The MVI56-N2 module returns a 30-word Status Data Block that may be used to determine the module's operating status. This data is located in the module's database in registers 6000 through 6029.

This data is transferred to the ControlLogix processor every 100 blocks.

The Configuration/Debug port provides the following functionality:

- Full view of the module's configuration data
- View of the module's status data
- Complete display of the module's internal database (registers 0 to 10000)
- Version Information
- Control over the module (warm boot, cold boot, transfer configuration)

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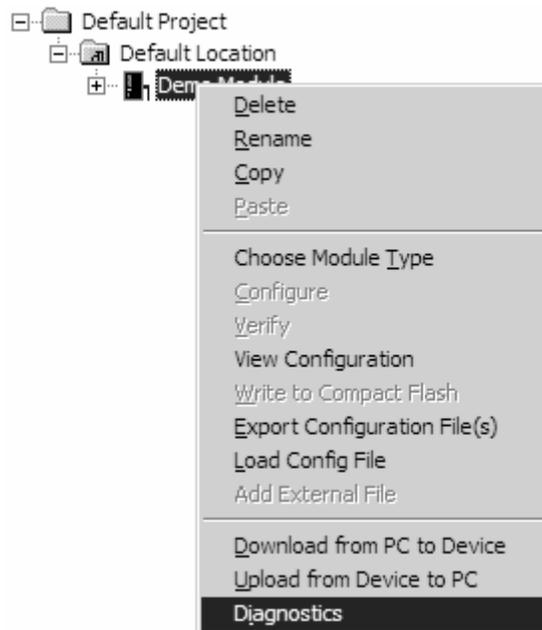
3 This action opens the Diagnostics dialog box. Press "?" to display the Main Menu.

```
Diagnostics
                                          Time : 11.58.39

  MODULE MENU
    ?=Display Menu
    B=Block Transfer Statistics
    C=Module Configuration
    D=Database View
    R=Transfer Configuration from PC to Unit
    S=Transfer Configuration from Unit to PC
    U=Reset diagnostic data
    V=Version Information
    W=Warm Boot Module
    @=Network Menu
    Esc=Exit Program

  Com 1  ▼  Connection   DownLoad Config   Log To File   Email Log to Support
                                       □ Clear File        Close
```

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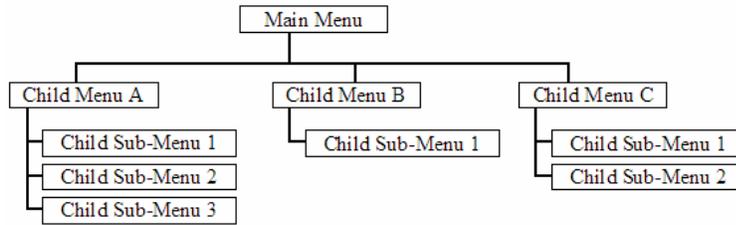
The remainder of this section shows you the menus available for this module, and briefly discusses the commands available to you.

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:

```
?=Display Menu
V=Version Information
D=Database Menu
C=Clear diagnostic data
B=Backplane Menu
0=Protocol_Serial_N2 1
1=Protocol_Serial_N2 2
S=Transfer Configuration from Unit to PC
R=Transfer Configuration from PC to Unit
W=Warm Boot Module
Esc=Exit Program
```

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

Viewing 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.

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.

Resetting diagnostic data

Press **[C]** to reset the status counters for the client and servers in the module.

Opening the Backplane Menu

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

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

Opening the Protocol_Serial_N2 Menu

Press **[0]** or **[1]** from the Main Menu to open the Protocol_Serial_N2 menu for N2 Ports 1 and 2.

Use this command to view communication status and statistics for the selected port. This information can be useful for trouble-shooting communication problems.

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.

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.

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.

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 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.

```
M = Main Menu
   └── D = Database Menu

        ? = Display Menu              ⇨  Redisplays (refreshes) this menu

        0 – 3 = Pages 0 to 3000       ⇨  Selects page 0, 1000, 2000 or 3000

        S = Show Again                ⇨  Redisplays last selected page of data

        – = Back 5 Pages              ⇨  Goes back five pages of data

        P = Previous Page             ⇨  Goes back one page of data

        + = Skip 5 Pages              ⇨  Goes forward five pages of data

        N = Next Page                 ⇨  Goes forward one page of data

        D = Decimal Display           ⇨  Displays data in decimal format

        H = Hexadecimal Display       ⇨  Displays data in hex format

        F = Float Display             ⇨  Displays data in floating point format

        A = ASCII Display             ⇨  Displays data in text format

        M = Main Menu                 ⇨  Goes up one level to main 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

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

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

Moving Back Through 5 Pages of Registers

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

Viewing the Previous 100 Registers of Data

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

Skipping 500 Registers of Data

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

Viewing the Next 100 Registers of Data

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

Viewing Data in Decimal Format

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

Viewing Data in Hexadecimal Format

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

Viewing Data in Floating Point Format

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

### *Viewing Data in ASCII (Text) Format*

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

Returning to the Main Menu

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

4.1.5 Protocol Serial N2 Menu

Press **[0]** or **[1]** to view protocol serial information for ports 1 and 2, respectively. Use this command to view a variety of error and status screens for the port. Press **[?]** to view a list of commands available on this menu.
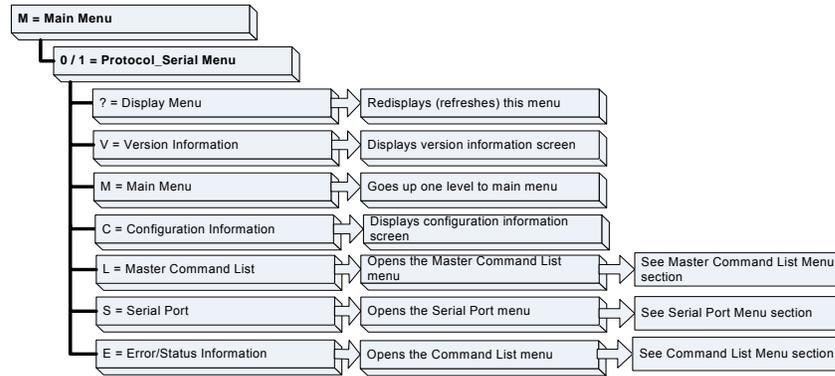
Redisplaying the Menu

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

Viewing 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.

Returning to the Main Menu

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

Viewing Configuration Information

Press **[C]** to view configuration information for the selected port, protocol, driver or device.

Opening the Command List Menu

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

Opening the Serial Port Menu

Press **[S]** to open the Serial Port menu. Use this command to view and change additional serial port driver settings.

Viewing Error and Status Data

Press **[E]** to display the error/status data for the module.

4.2   LED Status Indicators

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

ProSoft Module	Color	Status	Indication
CFG	Green	On	Data is being transferred between the module and a remote terminal using the Configuration/Debug port.
		Off	No data is being transferred on the Configuration/Debug port.
P1	Green	On	Data being transferred between master and port 1.
		Off	No data
P2	Green	On	Data being transferred between master and port 2.
		Off	No data
APP Status	Amber	Off	The MVI56-N2 is working normally.
		On	The MVI56-N2 module program has recognized a communication error.
BP ACT	Amber	On	The LED is on when the module is performing a write operation on the backplane.
		Off	The LED is off when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly on and off.
OK	Red/ Green	Off	The card is not receiving any power and is not securely plugged into the rack.
		Green	The module is operating normally.
		Red	The program has detected an error or is being configured. If the LED remains red for over 10 seconds, the program has probably halted. Remove the card from the rack and re-insert the card to restart the module's program.
BAT	Red	Off	The battery voltage is OK and functioning.
		On	The battery voltage is low or battery is not present. Allow battery to charge by keeping module plugged into rack for 24 hours. If BAT LED still does not go off, contact ProSoft Technology, as this is not a user serviceable item.

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 ControlLogix processor.

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

4.2.2 Troubleshooting

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

Processor Errors

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

Module Errors

Problem Description	Steps to take
BP ACT LED remains off or blinks slowly	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this.
	To establish backplane communications, verify the following items:
	▪ 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 MVI56 Johnson Controls Metasys Slave Communication Module allows
ControlLogix I/O compatible processors to interface easily with other Johnson
Controls N2 master devices.

5.1.1 Features and Benefits

The MVI56-N2 module acts as an input/output module between the Johnson
Controls Metasys network and the ControlLogix processor. The module acts as a
slave receiving commands from a master device. The data transfer from the
ControlLogix processor is asynchronous from the actions on the Johnson
Controls Metasys network. An internal database in the module exchanges data
between the processor and the Johnson Controls Metasys Master (NCM, N-30,
NAE, NIE).

5.1.2 General Specifications

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

5.1.3 Hardware Specifications

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

5.1.4 Functional Specifications

- Support for the storage and transfer of internal database registers to/from the ControlLogix processor's controller tags
- Two ports to emulate a Johnson Controls N2 slave
- Supports the following N2 objects:
  - Binary Input: Up to 960 points
  - Analog Input: Up to 255 points
  - Binary Output: Up to 960 points
  - Analog Output: Up to 255 points
- Supported Commands/Sub-commands
  - 0/4: Poll Message No Acknowledge
  - 0/5: Poll Message with Acknowledge
  - 0/9: Status Update

- o 1/1: Read Analog Input Attributes
- o 1/2: Read Binary Input Attributes
- o 1/3: Read Analog Output Attributes
- o 1/4: Read Binary Output Attributes
- o 2/1: Write Analog Input Attributes
- o 2/2: Write Binary Input Attributes
- o 2/3: Write Analog Output Attributes
- o 2/4: Write Binary Output Attributes
- o 7/2/3: Override Analog Output
- o 7/2/4: Override Binary Output
- o F: Identify Device Type
- ▪ The following commands are recognized, and acknowledged, but are not communicated in any way to the processor, and do not return any data:
  - o 0/0: Time Update
  - o 0/8: Warm Start
  - o All other commands return a Bad Command Error Code
- ▪ Configurable through the configuration file for the following:
  - o Slave Address (assignable individually for Port 1 and 2)
  - o Analog Input Object Count
  - o Binary Input Object Count
  - o Analog Output Object Count
  - o Binary Output Object Count
- ▪ Warning and Alarming functions performed on Analog Input and Binary Input data types
- ▪ Change of State Response buffering
- ▪ Communication status error codes and statistics returned per port
- ▪ Communication parameter: Baud rate 9600 bps
- ▪ Memory mapping is pre-assigned to optimize data access and to ease implementation

A port configured as a Johnson Controls N2 slave permits a remote master to interact with data contained in the module. This data is derived from the ControlLogix processor.

5.2   Functional Overview

This section provides an overview of how the MVI56-N2 module transfers data using the N2 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 discussion explains several concepts that are important for understanding the operation of the MVI56-N2 module.
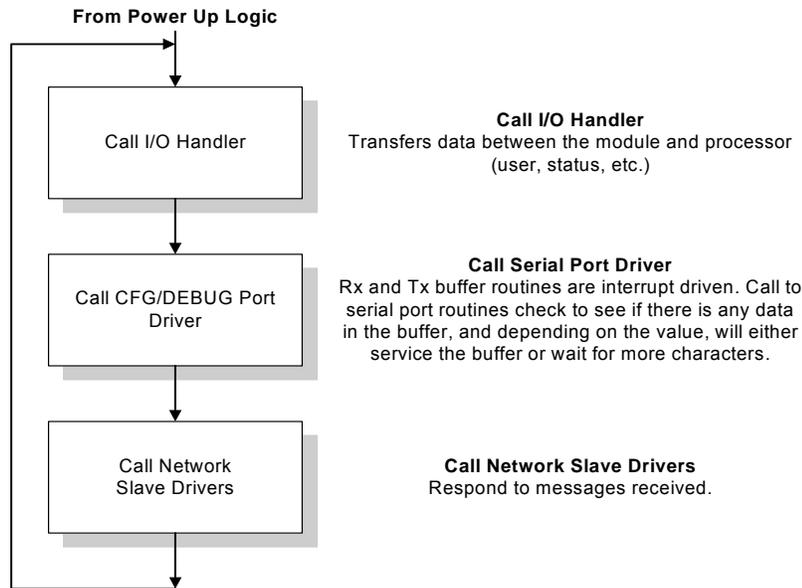
Module Power Up

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

1   Initialize hardware components:

  o   Initialize ControlLogix backplane driver.
  o   Test and clear all RAM.
  o   Initialize the serial communication ports.

2   Initialize module register space.
3   Enable slave driver on selected ports.

After the module is configured, the module begins receiving and transmitting messages with Johnson Controls N2 devices on the network.

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.

From Power Up Logic

```
Call I/O Handler
```

Call I/O Handler
Transfers data between the module and processor
(user, status, etc.)

```
Call CFG/DEBUG Port
Driver
```

Call Serial Port Driver
Rx and Tx buffer routines are interrupt driven. Call to
serial port routines check to see if there is any data
in the buffer, and depending on the value, will either
service the buffer or wait for more characters.

```
Call Network
Slave Drivers
```

Call Network Slave Drivers
Respond to messages received.

ControlLogix Processor Not in Run

Whenever the module detects that the processor has gone out of the Run mode (that is, Fault or PGM), the Johnson Controls N2 ports can be shut down as prescribed in the user configuration. When the processor is returned to a running state, the module resumes communications on the network.

Backplane Data Transfer

The MVI56-N2 module communicates directly over the ControlLogix backplane. Data is paged between the module and the ControlLogix processor across the backplane using the module's input and output images. The update frequency of the images is determined by the scheduled scan rate defined the user for the module and the communication load on the module. Typical updates are in the range of 2 to 10 milliseconds.

This bi-directional transference of data is accomplished by the module filling in data in the module's input image to send to the processor. Data in the input image is placed in the controller tags in the processor by the ladder logic. The input image for the module is set to 250 words. This large data area permits fast throughput of data between the module and the processor.

The processor inserts data to the module's output image to transfer to the module. The module's program extracts the data and places it in the module's internal database. The output image for the module is set to 248 words. This large data area permits fast throughput of data from the processor to the module.

The following illustration shows the data transfer method used to move data between the ControlLogix processor, the MVI56-N2 module, and the Johnson Controls N2 network.
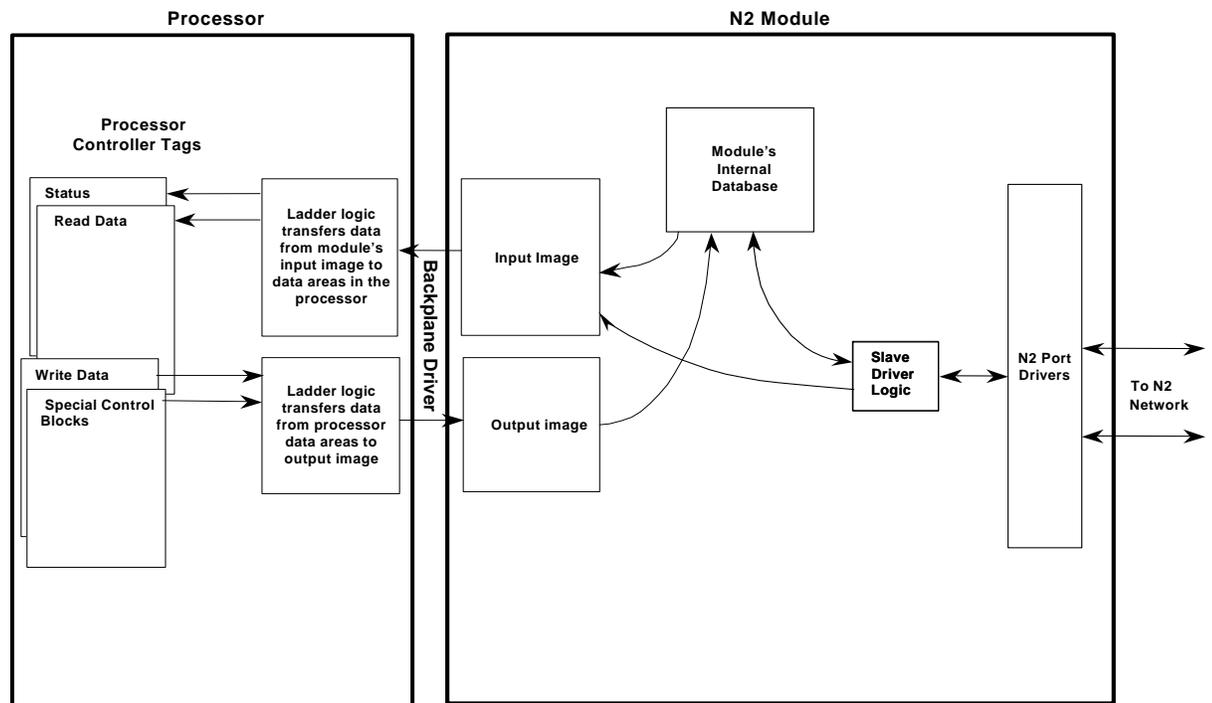
As shown in the diagram, all data transferred between the module and the processor over the backplane is through the input and output images. Ladder logic must be written in the ControlLogix processor to interface the input and output image data with data defined in the controller tags. All data used by the module is stored in its internal database. The following illustration shows the layout of the database:

MVI56-N2 Database Map

Start Address	End Address	Data
0	60	Binary Inputs
200	799	Analog Inputs
1000	1060	Binary Outputs

Start Address	End Address	Data
1200	1799	Analog Outputs
5000	5011	Error / Status Table

Data contained in this database is paged through the input and output images by coordination of the ControlLogix ladder logic and the MVI56-N2 module's program. Up to 248 words of data can be transferred from the module to the processor at a time. Up to 247 words of data can be transferred from the processor to the module. Each image has a defined structure depending on the data content and the function of the data transfer described in the following topics.

Normal Data Transfer

Normal data transfer includes the paging of the user data found in the module's internal database in registers 0 to 6999 and the status data. These data are transferred through read (input image) and write (output image) blocks. The **Module Setup** section provides a description of the data objects used with the blocks and the ladder logic required. The structure and function of each block is described in the following topics.

Read Block

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

Offset	Description	Length
0	Reserved	1
1	Write Block ID	1
2 to 201	Read Data	200
202	Program Scan Counter	1
203 to 206	Product Name	2
207 to 208	Product Code	2
209 to 210	Product Version	2
211 to 212	Operating System	2
213 to 214	Run Number	2
215 to 218	Port 1 Error Status	4
219 to 222	Port 2 Error Status	4
223 to 226	Data Transfer Status	6
227	Port 1 Current Error/Index	1
228	Port 1 Last Error/Index	1
229	Port 2 Current Error/Index	1
230	Port 2 Last Error/Index	1
231 to 248	Spare	20
249	Read Block ID	1

The Read Block ID is an index value used to determine the location of where the data will be placed in the ControlLogix processor controller tag array of module read data. Each transfer can move up to 200 words (block offsets 2 to 201) of data. In addition to moving user data, the block also contains status data for the module. This last set of data is transferred with each new block of data and is used for high-speed data movement.

The Write Block ID associated with the block requests data from the ControlLogix processor. Under normal program operation, the module sequentially sends read blocks and requests write blocks. For example, if three read and two write blocks are used with the application, the sequence is as follows:

R1W1 → R2W2 → R3W1 → R1W2 → R2W1 → R3W2 → R1W1

This sequence will continue until interrupted by other write block numbers sent by the controller or by a command request from a node on the Johnson Controls N2 network or operator control through the module's Configuration/Debug port.

Write Block

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

Offset	Description	Length
0	Write Block ID	1
1 to 200	Write Data	200
201 to 247	Spare	30

The Write Block ID is an index value used to determine the location in the module's database where the data will be placed. Each transfer can move up to 200 words (block offsets 1 to 200) of data.

Warm Boot

This block is sent from the ControlLogix processor to the module (output image) when the module is required to perform a warm-boot (software reset) operation. This block is commonly sent to the module any time configuration data modifications are made in the controller tags data area. This will force the module to read the new configuration information and to restart. The structure of the control block is shown in the following table:

Offset	Description	Length
0	9998	1
1 to 247	Spare	247

Cold Boot

This block is sent from the ControlLogix processor to the module (output image) when the module is required to perform the cold boot (hardware reset) operation. This block is sent to the module when a hardware problem is detected by the ladder logic that requires a hardware reset. The structure of the control block is shown in the following table:

Offset	Description	Length
0	9999	1
1 to 247	Spare	247

Pass-Through Control Blocks

The module will pass blocks with identification codes of 9001 and 9002 to the processor for each received function 7/2/4, and 7/2/3 command respectively.

- In Normal Mode (Enable database output parameter = Yes) blocks 9001 and 9002 are not generated. The module will copy all 800 registers to the processor.
- In Legacy Mode (Enable database output parameter = No), blocks 9001 and 9002 will be generated and passed to the processor one point at a time.

The structure of the pass-through control blocks are shown in the following tables:

Block 9001

Offset	Description	Length
0	0	
1	9001	1
2	Binary Point Offset	1
3	Binary Value	1
4 to 248	Spare	245
249	9001	1

Block 9002

Offset	Description	Length
0	0	1
1	9002	1
2	Analog Point Offset	1
3	Analog Value	2
5 to 248	Spare	244
249	9002	1

The ladder logic should copy the received data and control the processor as expected by the master device. The processor must respond to the pass-through control block with the following format:

Offset	Description	Length
0	9001 and 9002	1
1 to 247	Spare	247

This informs the module that the command has been processed and can be cleared from the pass-through queue.

5.2.2 Data Flow Between the MVI56-N2 Module and the ControlLogix Processor

The following section describes the flow of data between the two pieces of hardware (ControlLogix processor and MVI56-N2 module). Each port on the module is configured to emulate a Johnson Controls N2 slave device. The operation of each port is dependent on this configuration.

Slave Driver

The Slave Driver Mode allows the MVI56-N2 module to respond to data read and write commands issued by a master on the Johnson Controls N2 network. The following flowchart describes the flow of data into and out of the module. The Module Setup section provides a list of the parameters that must be defined for a slave port.

All write requests will be passed directly to the processor. The following illustration shows the data flow for a slave port.
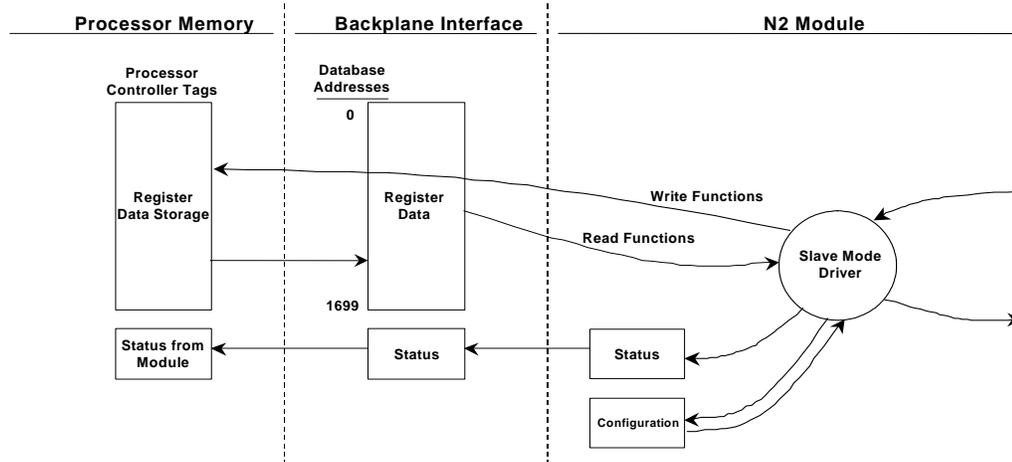
5.3   Cable Connections

The application ports on the MVI56-N2 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:

RS-232 Config/Debug Port Cable

DB-9 Male   Config/Debug Port

RxD   2 ———————————— TxD

TxD   3 ———————————— RxD

COM   5 ———————————— COM
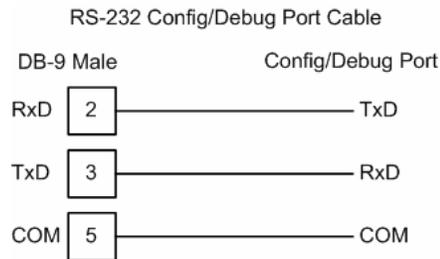
Disabling the RSLinx Driver for the Com Port on the PC

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:
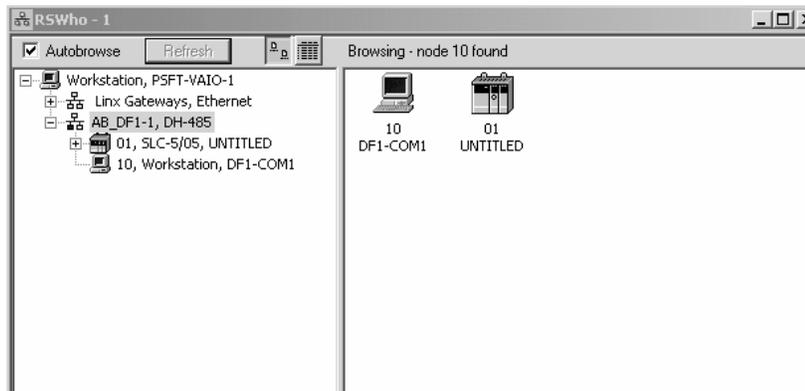
3 Notice how the DF1 driver is opened, and the driver is looking for a processor on node 1. If the network is being browsed, then you will not be able to stop this driver. To stop the driver your RSWho screen should look like this:
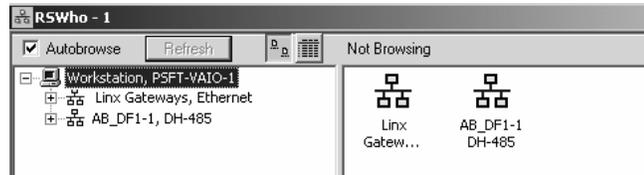
Branches are displayed or hidden by clicking on the ⊞ or the ⊟ icons.
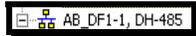
4 When you have verified that the driver is not being browsed, go to

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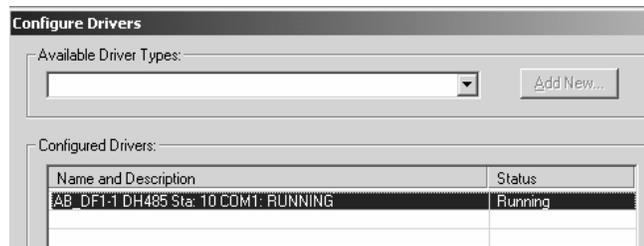
If you see the status as running, you will not be able to use this com port for anything other than communication to the processor. To stop the driver press the "Stop" on the side of the window:

5 After you have stopped the driver you will see the following:
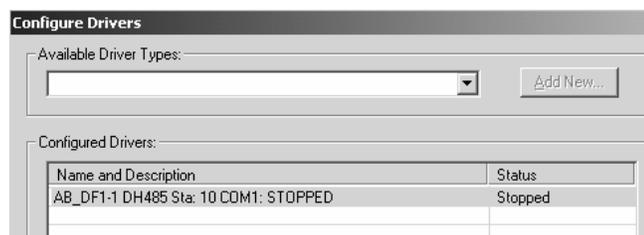
6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

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:
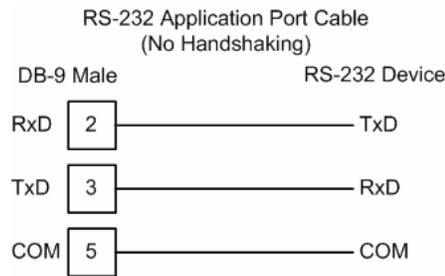
RS-232: Modem Connection

This type of connection is required between the module and a modem or other communication device.
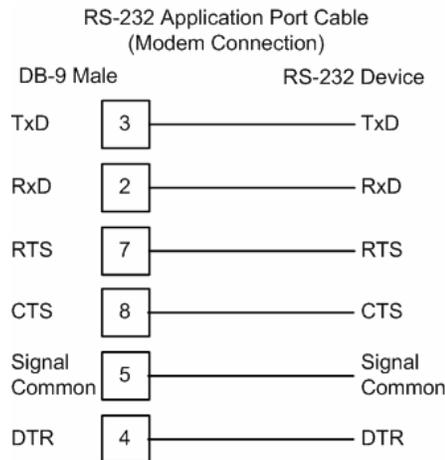
The "Use CTS Line" parameter for the port configuration should be set to 'Y' for most modem applications.

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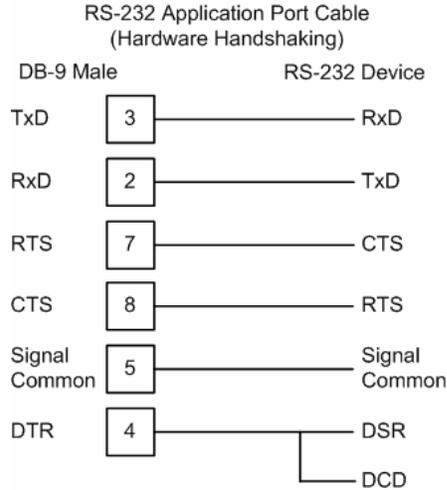
RS-232: Null Modem Connection (No Hardware Handshaking)

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

RS-232 Application Port Cable
(No Handshaking)
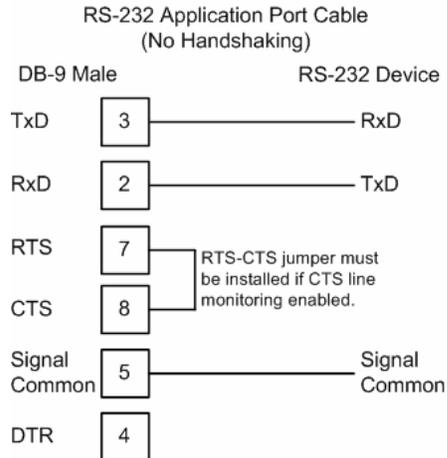
Note: If the port is configured with the "Use CTS Line" set to 'Y', then a jumper is required between the RTS and the CTS line on the module connection.

5.3.3 RS-422

RS-422 Application Port Cable

DB-9 Male			RS-422 Device
TxD+	1	——	RxD+
TxD-	8	——	RxD-
Signal Common	5	——	Signal Common
RxD+	2	——	TxD+
RxD-	6	——	TxD-
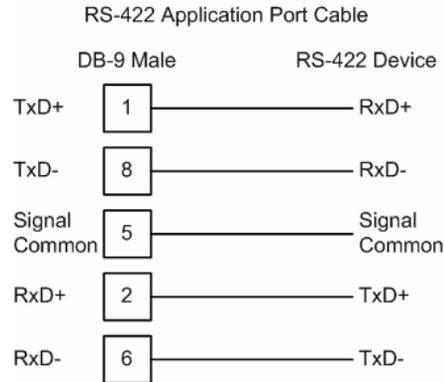
5.3.4 RS-485

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

RS-485 Application Port Cable

DB-9 Male			RS-485 Device
TxD+/RxD+	1	——	TxD+/RxD+
TxD-/RxD-	8	——	TxD-/RxD-
Signal Common	5	——	Signal Common
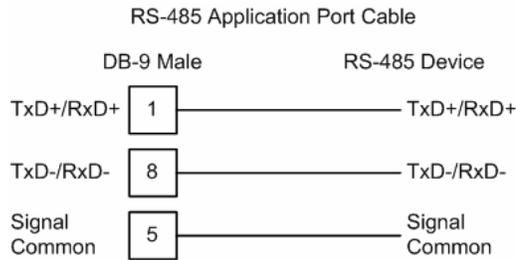
Note: Terminating resistors are generally not required on the RS-485 network, unless you are experiencing communication problems that can be attributed to signal echoes or reflections. In this case, install a 120 ohm terminating resistor on the RS-485 line.

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)

Cable Assembly

Wiring Diagram
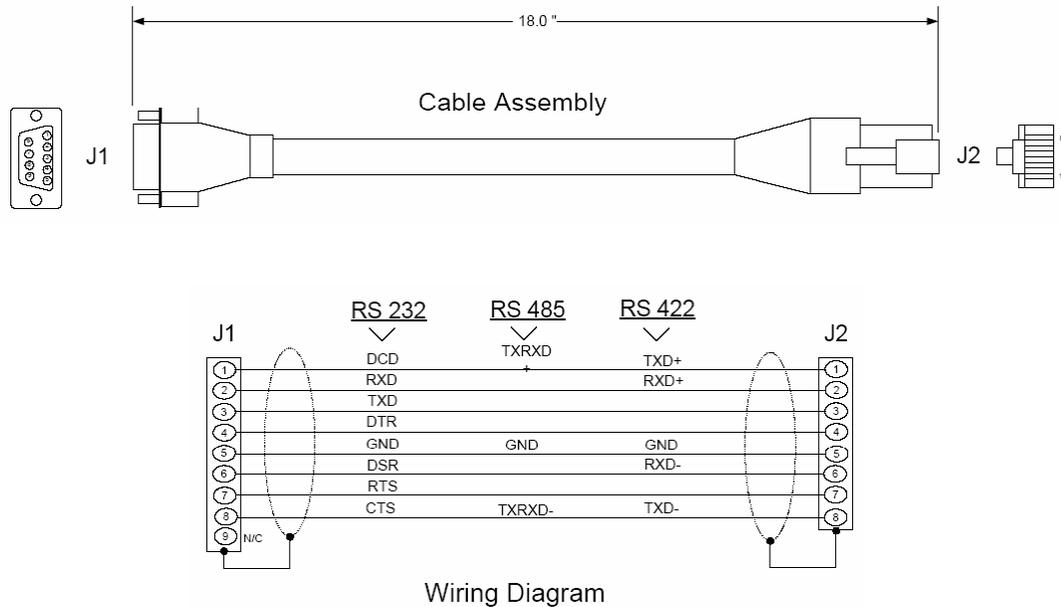
5.4 Status Data Area

This section contains a listing of the data contained in the MVI56-N2 status data object.

Offset	Content	Description
202	Program cycle counter	This value is incremented each time a complete program cycle occurs in the module.
203 to 206	Product Name	
207 to 208	Product Code as ASCII string	This register contains the product code of "N2"
209 to 210	Revision level as ASCII string	This register contains the product version for the current software.
211 to 212	Operating system level as ASCII string	This register contains the month and year values for the program operating system.
213 to 214	Run number as ASCII string	This register contains the run number value for the current software.
215	Number of requests - Port 1	Contains the number of port messages sent out of the port.
216	Number of responses - Port 1	Contains the total number of messages received on the port.
217	Number of errors sent - Port 1	Contains the total number of message errors sent out of the port.
218	Number of errors received - Port 1	Contains the total number of message errors received on the port.
219	Number of requests - Port 2	Contains the total number of messages sent out the port.
220	Number of responses - Port 2	Contains the total number of messages received on the port.

Offset	Content	Description
221	Number of errors sent - Port 2	Contains the total number of message errors sent out the port.
222	Number of errors received - Port 2	Contains the total number of message errors received on the port.
223	Backplane Transfer Writes	Contains the total number of write blocks transferred from the processor to the module.
224	Backplane Transfer Reads	Contains the total number of read blocks transferred from the module to the processor.
225	Backplane Blocks Parsed	
226	Backplane Transfer Errors	Contains the total number of block errors recognized by the module.
227	Current Error - Port 1	For a slave port, this field contains the value of the current error code returned.
228	Last Error - Port 1	For a slave port, this field contains the value of the last error code returned.
229	Current Error - Port 2	For a slave port, this field contains the value of the current error code returned.
230	Last Error - Port 2	For a slave port, this field contains the value of the last error code returned.

A data file should be allocated in the ladder logic to hold this block of data. The size of the block of data is 35 words.

5.5 N2 Data Object

Network Point Type	Network Point Address	Unit	Description	Notes
AI	1	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file, for example Analog Input Object Count: 16
AI	…	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Input Object Count: 16
AI	300	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Input Object Count: 16
BI	1	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Binary Input Object Count: 16
BI	...	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Binary Input Object Count: 16

Network Point Type	Network Point Address	Unit	Description	Notes
BI	960	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Binary Input Object Count: 16
AO	1	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Output Object Count: 16
AO	...	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Output Object Count: 16
AO	256	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Output Object Count: 16
BO	1	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. That is, Binary Output Object Count: 16
BO	...	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Output Object Count: 16
BO	960	User Defined in Ladder Program	User Defined in Ladder Program	Actual number of points supported is defined in configuration file. for example Analog Output Object Count: 16

ADF points are not supported. A write to an ADF point will return A. A read from an ADF point will return a status of unreliable and data of zero.

ADI points are not supported. A write to an ADI point will return A. A read from an ADI point will return a status of unreliable and data of zero.

BD points are not supported. A write to an BD point will return A. A read from an BD point will return a status of unreliable and data of zero.

5.6   N2 Error Codes

The Slave Error Table is a 20 word block. The location of the Error Table is determined by the Slave Error Table Pointer parameter in the Configuration Block. The structure of the data block is as follows:

Word	Description
Port 1	
0	Current port status
1	Last error condition
2	Total Messages to this slave
3	Total Msg responses from this slave
4	Total Msgs seen by this slave
Port 2	
5	Current port status
6	Last error condition
7	Total Messages to this slave
8	Total Msg responses from this slave
9	Total Msgs seen by this slave
System Information	
10-11	Product Name (ASCII)
12-13	Revision (ASCII)
14	Operating System Rev(ASCII)
15	Production Run Number (ASCII)
16-19	Spare

5.6.1 Current Port Error Status

This value represents the current value of the error code for the port. This value will only be valid if the port is configured as a Slave. The possible values are described in the following section.

Code	Description
0	All OK
1	Bad Command
2	Checksum Error
3	Recv buffer overflow
5	Command Data Error
16	Data Register Addr out of range
17	Field Data Error
18	Command Rejected
20	Unit not Warm Started
255	TX Timeout – RTS/CTS jumper missing

5.6.2 Last Error Code

This value is the last error code transmitted to the master by this slave port.

5.6.3 Total Messages to This Slave

This value represents the total number of messages that have matched this slaves address on this port, whether the slave actually determined them to be good (worthy of response) or not.

5.6.4 Total Message Responses From This Slave

This value represents the number of good (non-error) responses that the slave has sent to the master on this port. The presumption is that if the slave is responding, the message was good.

5.6.5 Total Messages Seen By This Slave

This value represents the total number of commands seen by the slave on this port, regardless of the slave address.

Note: All counters in the Slave Error Table will rollover to 0 after reaching 65535

5.6.6 Product Name

These two words represent the product name of the module in an ASCII representation. In the case of the N2 product, the letters "N2" should be displayed when placing the programming software in the ASCII data representation mode.

5.6.7 Revision

These two words represent the product revision level of the firmware in an ASCII representation. An example of the data displayed would be '1.00' when placing the programming software in the ASCII data representation mode.

5.6.8 Operating System Revision

These two words represent the module's internal operating system revision level in an ASCII representation.

5.6.9 Production Run Number

This number represents the 'batch' number that your particular chip belongs to in an ASCII representation.

6   Support, Service & Warranty

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

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

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

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

1   Product Version Number
2   System architecture
3   Network details

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

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

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

6.1   How to Contact Us: Sales and Support

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

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

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

Asia Pacific Sales (office in Malaysia)

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

Asia Pacific Support (office in China)

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

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

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

Brasil (office in Sao Paulo)

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

6.2   Return Material Authorization (RMA) Policies and Conditions

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

6.2.1 All Product Returns

1 In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Returned Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.

2 In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above in Section A. A Technical Support Engineer will request several tests in an attempt to isolate the problem. If after these tests are completed, the Product is found to be the source of the problem, ProSoft will issue an RMA.

3 All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.

4 Out of warranty returns are not allowed on RadioLinx accessories such as antennas, cables, and brackets.

The following policy applies for Non-Warranty Credit Returns:

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

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

6.3   Procedures for Return of Units Under Warranty

1 A Technical Support Engineer must pre-approve all product returns.

2 Module is repaired or replaced after a Return Material Authorization Number is entered and a replacement order is generated.

3 Credit for the warranted item is issued within 10 business days after receipt of product and evaluation of the defect has been performed by ProSoft. The credit will only be issued provided the product is returned with a valid Return Material Authorization Number and in accordance with ProSoft's shipping instructions.

a) If no defect is found, a credit is issued.

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

6.4   Procedures for Return of Units Out of Warranty

1   Customer sends unit in for evaluation.
2   If no defect is found, Customer will be charged the equivalent of US $100 plus shipping, duties and taxes that may apply. A new Purchase Order will be required for this evaluation fee.

If the unit is repaired the charge to the Customer will be 30%* of the list price plus any shipping, duties and taxes that may apply. A new Purchase Order will be required for a product repair.

3   For an immediate exchange, a new module may be purchased and sent to Customer while repair work is being performed. Credit for purchase of the new module will be issued when the new module is returned in accordance with ProSoft's shipping instructions and subject to ProSoft's policy on non-warranty returns. This is in addition to charges for repair of the old module and any associated charges to Customer.
4   If, upon contacting ProSoft Customer Service, the Customer is informed that unit is believed to be unrepairable, the Customer may choose to send unit in for evaluation to determine if the repair can be made. Customer will pay shipping, duties and taxes that may apply. If unit cannot be repaired, the Customer may purchase a new unit.

6.4.1 Un-repairable Units

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

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

6.4.2 Purchasing Warranty Extension

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

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

6.5 LIMITED WARRANTY

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

6.5.1 What Is Covered By This Warranty

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

B *Warranty On Services*: Material and labor used by ProSoft to repair a verified malfunction or defect are warranted on the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.

C The Warranty Period for RadioLinx accessories (such as antennas, cables, brackets, etc.) are the same as for RadioLinx modules, that is, three years from the date of shipment.

6.5.2 What Is Not Covered By This Warranty

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

B With the exception of RadioLinx accessories referenced in paragraph 1(c) this Warranty does not cover any product, components, or parts not manufactured by ProSoft.

C This Warranty also does not cover the failure of the Product to perform specified functions, or any other non-conformance, defects, losses or damages caused by or attributable to any of the following: (i) shipping; (ii) improper installation or other failure of Customer to adhere to ProSoft's specifications or instructions; (iii) unauthorized repair or maintenance; (iv) attachments, equipment, options, parts, software, or user-created programming (including, but not limited to, programs developed with any IEC 61131-3 programming languages, or "C") not furnished by ProSoft; (v) use of the Product for purposes other than those for which it was designed; (vi) any other abuse, misapplication, neglect or misuse by the Customer; (vii) accident, improper testing or causes external to the Product such as, but not limited to, exposure to extremes of temperature or humidity, power failure or power surges outside of the limits indicated on the product specifications; or (viii) disasters such as fire, flood, earthquake, wind or lightning.

D The information in this Agreement is subject to change without notice. ProSoft shall not be liable for technical or editorial errors or omissions made herein; nor for incidental or consequential damages resulting from the furnishing, performance or use of this material. The user guides included with your original product purchased by you from ProSoft, contains information protected by copyright. No part of the guide may be duplicated or reproduced in any form without prior written consent from ProSoft.

6.5.3 DISCLAIMER REGARDING HIGH RISK ACTIVITIES

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

6.5.4 DISCLAIMER OF ALL OTHER WARRANTIES

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

6.5.5 LIMITATION OF REMEDIES**

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

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

6.5.6 Time Limit for Bringing Suit

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

6.5.7 No Other Warranties

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

6.5.8 Intellectual Property

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

6.5.9 Additional Restrictions Relating To Software And Other Intellectual Property

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

6.5.10 Allocation of risks

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

6.5.11 Controlling Law and Severability

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

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