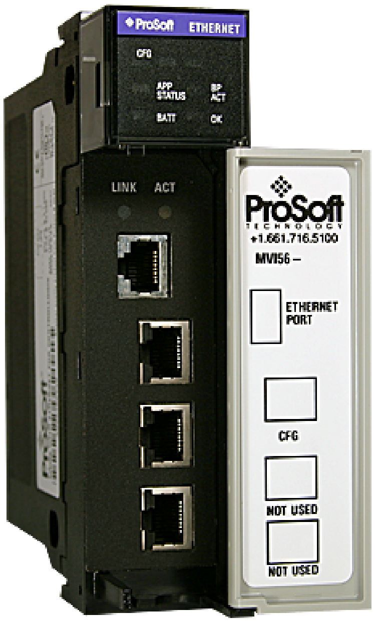
Where Automation Connects.



inRAx®

MVI56-104S

ControlLogix Platform

IEC 60870-5-104 Server
Communication Module

November 18, 2009

USER MANUAL

Important Installation Instructions

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

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

MVI (Multi Vendor Interface) Modules

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

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

CL I Div 2 GPs A, B, C, D

Temp Code T5

II 3 G

Ex nA IIC T5 X

0° C <= Ta <= 60° C

II - Equipment intended for above ground use (not for use in mines).

3 - Category 3 equipment, investigated for normal operation only.

G - Equipment protected against explosive gasses.

Warnings

North America Warnings

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

ATEX Warnings and Conditions of Safe Usage:

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

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

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:

CSA/cUL	C22.2 No. 213-1987
CSA CB Certified	IEC61010
ATEX	EN60079-0 Category 3, Zone 2 EN60079-15

243333

Battery Life Advisory

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

Note: The battery is not user replaceable.

Your Feedback Please

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

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MVI56-104S User Manual
November 18, 2009

ProSoft Technology® Product Documentation

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

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

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Europe, Middle East, Africa: +33 (0) 5.3436.87.20

Latin America: +1.281.298.9109

Contents

Guide to the MVI56-104S User Manual

Function		Section to Read	Details
Introduction (Must Do)	→	Start Here (page 9)	This Section introduces the customer to the module. Included are: package contents, system requirements, hardware installation, and basic configuration.
Diagnostic and Troubleshooting	→	Diagnostics and Troubleshooting (page 77)	This section describes Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview	→	Reference (page 95) Functional Overview (page 145) Product Specifications (page 145)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 177)	This section contains Support, Service and Warranty information. Index of chapters.

1 Start Here

In This Chapter

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

- **Rockwell Automation® RSLogix™ software**: launch the program, configure ladder logic, and transfer the ladder logic to the processor
- **Microsoft Windows:** install and launch programs, execute menu commands, navigate dialog boxes, and enter data.
- **Hardware installation and wiring**: install the module, and safely connect 104 and ControlLogix devices to a power source and to the MVI56-104S module's application port(s).

⚠ Caution: You must be able to complete the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

1.1 System Requirements

The MVI56-104S 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 MVI56-104S module. The module requires 800mA of available power.
- Rockwell Automation RSLogix 5000 programming software version 2.51 or higher.
- Rockwell Automation RSLinx communication software

- Pentium® II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
  - Microsoft Windows XP Professional with Service Pack 1 or 2
  - Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
  - Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- CD-ROM drive
- ProSoft Configuration Builder, 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 MVI56-104S 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	MVI56-104S Module	MVI56-104S	IEC 60870-5-104 Server Communication Module
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection to the CFG Port
1	Cable	RJ45 to DB9 Male Adapter	For DB9 Connection to Module's Port
1	inRAx Solutions CD		Contains sample programs, utilities and documentation for the MVI56-104S 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 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.
4 Save the file to your Windows Desktop, so that you can find it easily when you have finished downloading.
5 When the download is complete, locate and open the file, and then follow the instructions on your screen to install the program.

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

To install ProSoft Configuration Builder from the Product CD-ROM

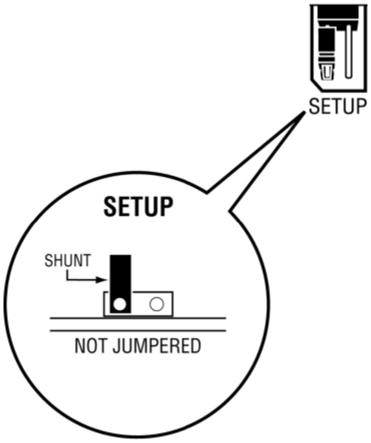
1 Insert the ProSoft Solutions Product CD-ROM into the CD-ROM drive of your PC. Wait for the startup screen to appear.
2 On the startup screen, click **PRODUCT DOCUMENTATION**. This action opens a Windows Explorer file tree window.
3 Click to open the **UTILITIES** folder. This folder contains all of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

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

1.4 Setting Jumpers

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.

The following illustration shows the MVI56-104S jumper configuration.



Note: If you are installing the module in a remote rack, you may prefer to leave the Setup pins jumpered. That way, you can update the module’s firmware without requiring physical access to the module.

1.5 Install the Module in the Rack

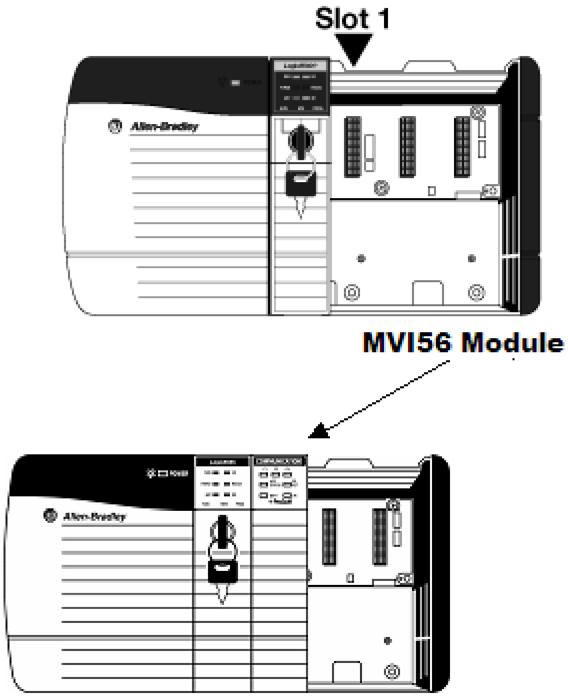
If you have not already installed and configured your ControlLogix processor and power supply, please do so before installing the MVI56-104S module. Refer to your Rockwell Automation product documentation for installation instructions.

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 MVI56-104S 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 must 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.

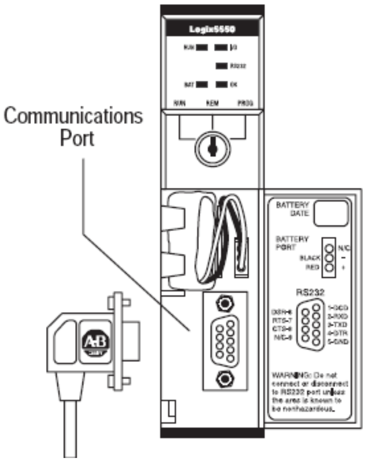
6 Turn power ON.

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

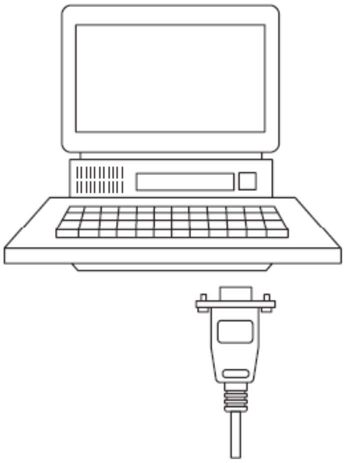
1.6 Connect your PC to the ControlLogix Processor

There are several ways to establish communication between your PC and the ControlLogix processor. The following steps show how to establish communication through the serial interface. It is not mandatory that you use the processor's serial interface. You may access the processor through whatever network interface is available on your system. Refer to your Rockwell Automation documentation for information on other connection methods.

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 MVI56-104S 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.

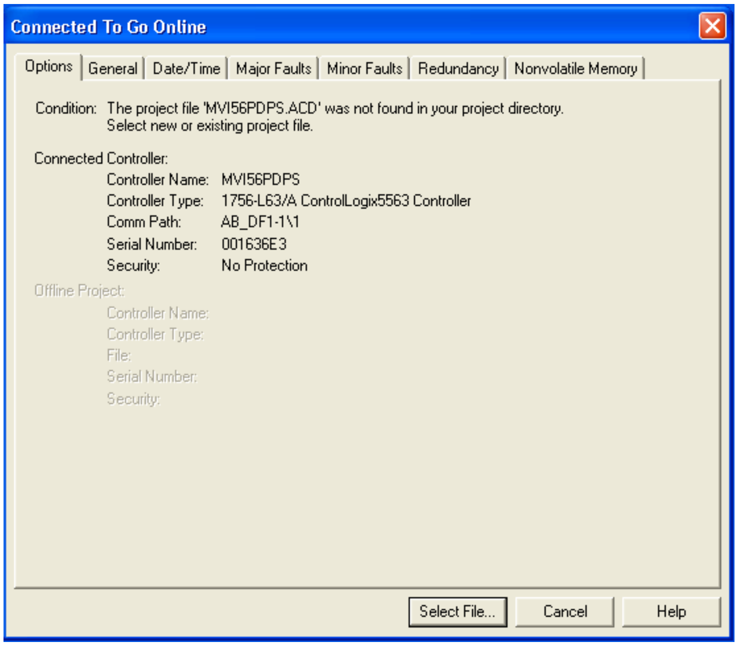
The inRAx Solutions CD provides one or more versions of the sample ladder logic. The version number appended to the file name corresponds with the firmware version number of your ControlLogix processor. The firmware version and sample program version must match.

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.



Connected To Go Online

Options | General | Date/Time | Major Faults | Minor Faults | Redundancy | Nonvolatile Memory

Condition: The project file 'MVI56PDPS.ACD' was not found in your project directory. Select new or existing project file.

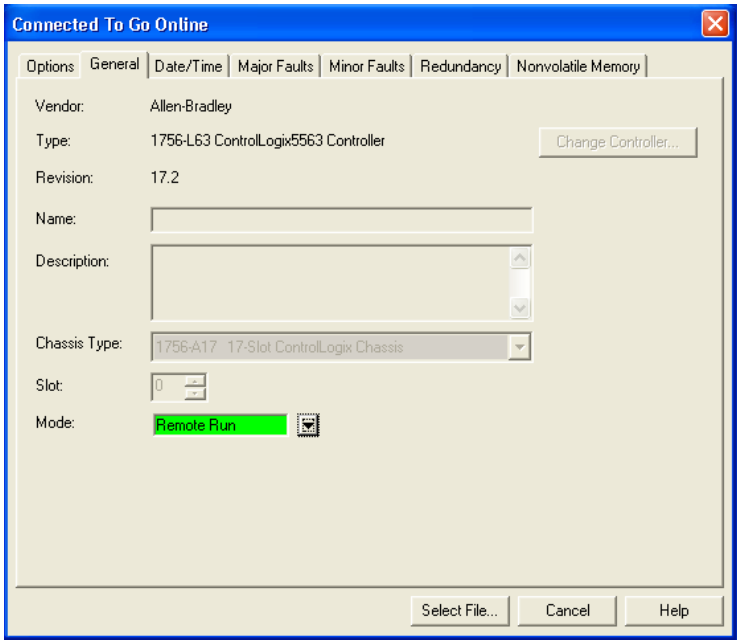
Connected Controller:

Controller Name: MVI56PDPS
Controller Type: 1756-L63/A ControlLogix5563 Controller
Comm Path: AB_DF1-1\1
Serial Number: 001636E3
Security: No Protection

Offline Project:

Controller Name:
Controller Type:
File:
Serial Number:
Security:

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 17.2.



Connected To Go Online

Options | General | Date/Time | Major Faults | Minor Faults | Redundancy | Nonvolatile Memory

Vendor: Allen-Bradley
Type: 1756-L63 ControlLogix5563 Controller
Revision: 17.2
Name:
Description:
Chassis Type: 1756-A17 17-Slot ControlLogix Chassis
Slot: 0
Mode: Remote Run

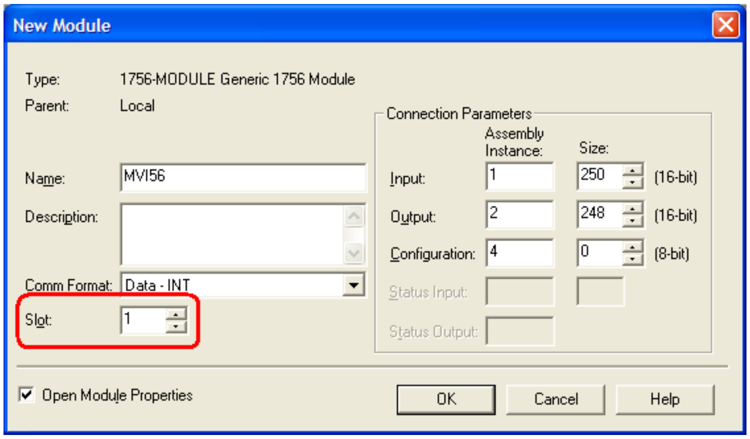
1.7.2 Select the Slot Number for the Module

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.



New Module

Type: 1756-MODULE Generic 1756 Module
Parent: Local
Name: MVI56
Description:
Comm Format: Data - INT
Slot: 1

Connection Parameters

	Assembly Instance:	Size:	
Input:	1	250	(16-bit)
Output:	2	248	(16-bit)
Configuration:	4	0	(8-bit)
Status Input:			
Status Output:			

☑ Open Module Properties

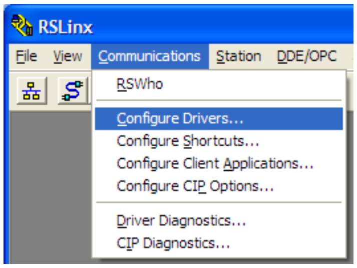
3 In the **Slot:** field, use the spinners on the right side of the field to select the slot number where the module will reside in the rack, and then click OK.

RSLogix will automatically apply the slot number change to all tags, variables and ladder logic rungs that use the MVI56-104S slot number for computation.

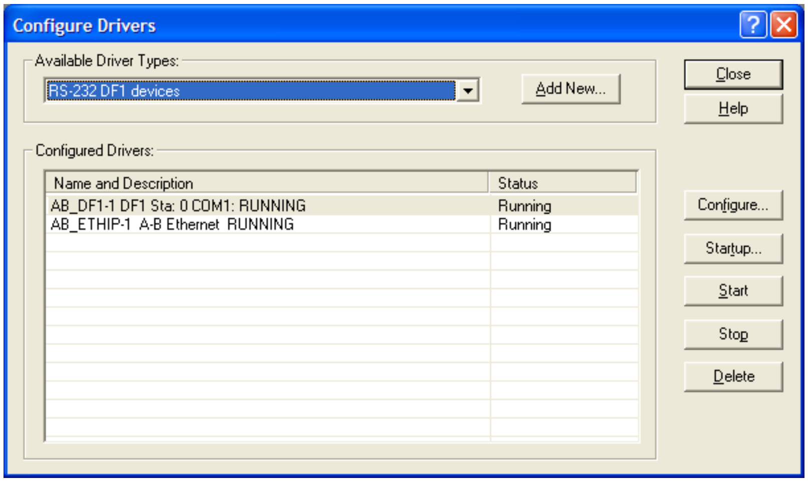
1.7.3 Configuring the RSLinx Driver for the PC COM Port

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

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



This action opens the **CONFIGURE DRIVERS** dialog box.



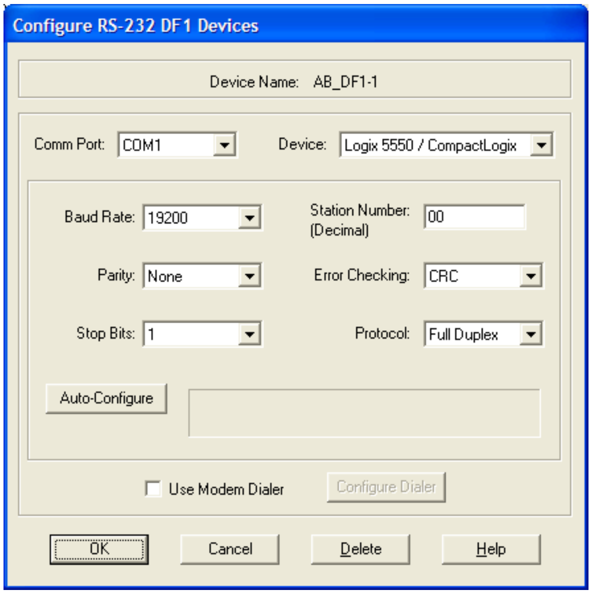
Available Driver Types: RS-232 DF1 devices

Configured Drivers:

Name and Description	Status
AB_DF1-1 DF1 Sta: 0 COM1: RUNNING	Running
AB_ETHIP-1 A-B Ethernet RUNNING	Running

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

3 Click to select the driver, and then click **CONFIGURE.** This action opens the **CONFIGURE RS-232 DF1 DEVICE** dialog box.



Configure RS-232 DF1 Devices

Device Name: AB_DF1-1

Comm Port: COM1

Device: Logix 5550 / CompactLogix

Baud Rate: 19200

Station Number: (Decimal) 00

Parity: None

Error Checking: CRC

Stop Bits: 1

Protocol: Full Duplex

□ Use Modem Dialer

4 Click the **AUTO-CONFIGURE** button. RSLinx will attempt to configure your serial port to work with the selected driver.

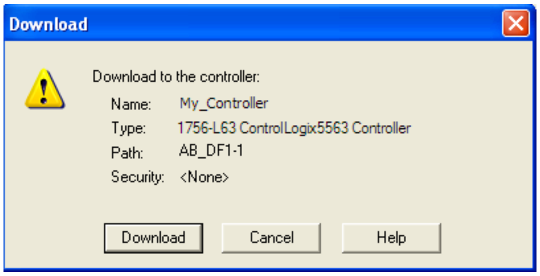
5 When you see the message **AUTO CONFIGURATION SUCCESSFUL**, click the **OK** button to dismiss the dialog box.

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 processor must be in the REM or PROG position.

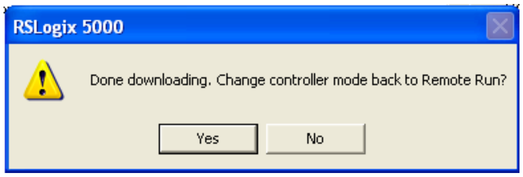
1. If you are not already online with the processor, open the **COMMUNICATIONS** menu, and then choose **DOWNLOAD.** RSLogix will establish communication with the processor. You do not have to download through the processor's serial port, as shown here. You may download through any available network connection.
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 to the controller:

Name: My_Controller
Type: 1756-L63 ControlLogix5563 Controller
Path: AB_DF1-1
Security: <None>

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. If the key switch is in the **REM** position, click **OK** to switch the processor from **PROGRAM** mode to **RUN** mode.



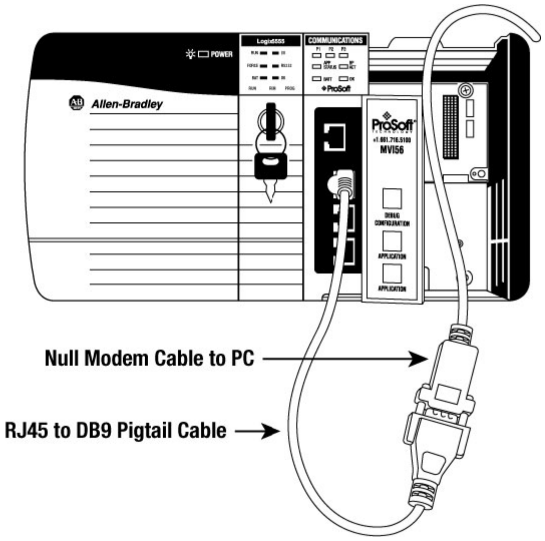
Done downloading. Change controller mode back to Remote Run?

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.



2 Configuring the MVI56-104S Module

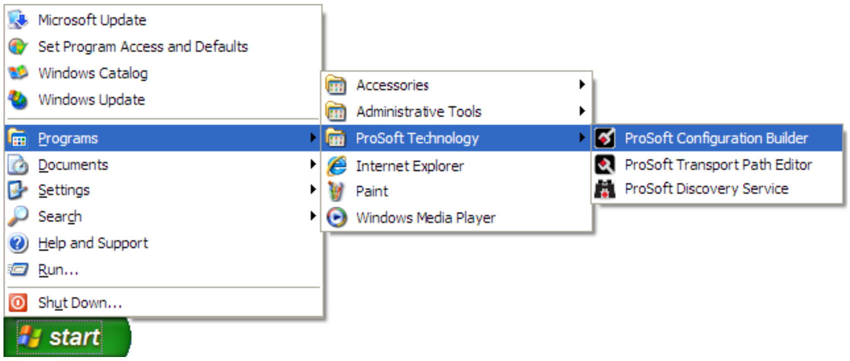
In This Chapter

2.1 Using ProSoft Configuration Builder

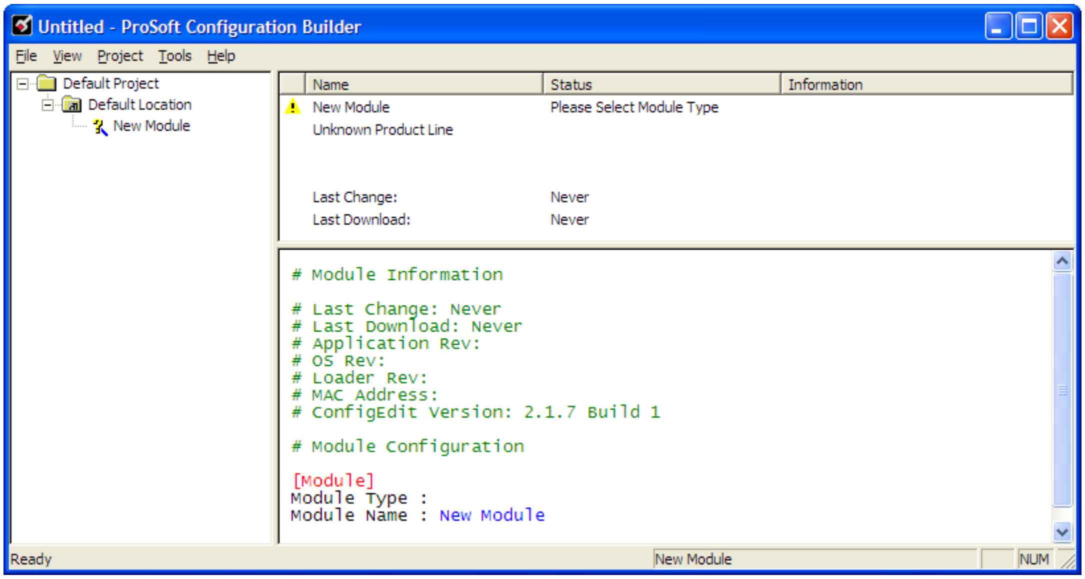
ProSoft Configuration Builder (PCB) provides a quick and easy way to manage module configuration files customized to meet your application needs. *PCB* is not only a powerful solution for new configuration files, but also allows you to import information from previously installed (known working) configurations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

2.1.1 Set Up the Project

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



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



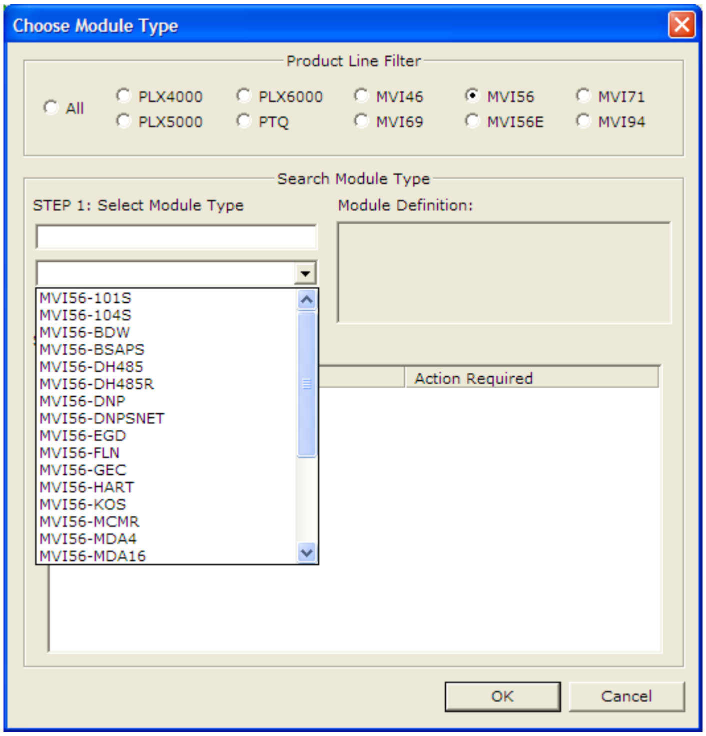
Name	Status	Information
⚠ New Module	Please Select Module Type	
Unknown Product Line		
Last Change:	Never	
Last Download:	Never	

```
# Module Information

# Last Change: Never
# Last Download: Never
# Application Rev:
# OS Rev:
# Loader Rev:
# MAC Address:
# ConfigEdit Version: 2.1.7 Build 1

# Module Configuration

[Module]
Module Type :
Module Name : New Module
```

To add the MVI56-104S 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.



Choose Module Type

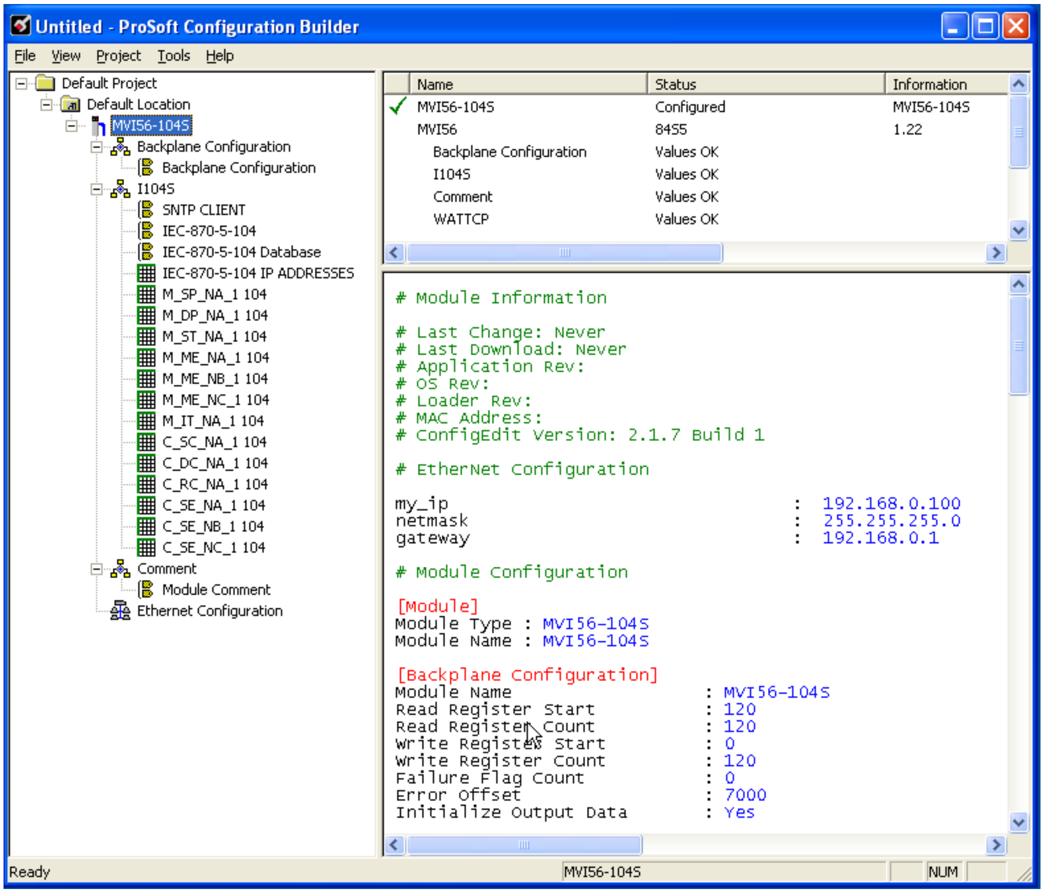
Product Line Filter

○ All ○ PLX4000 ○ PLX5000 ○ PLX6000 ○ PTQ ○ MVI46 ○ MVI69 ● MVI56 ○ MVI56E ○ MVI71 ○ MVI94

3 In the **PRODUCT LINE FILTER** area of the dialog box, select MVI56. In the **SELECT MODULE TYPE** dropdown list, select MVI56-104S, and then click **OK** to save your settings and return to the ProSoft Configuration Builder window.

2.1.2 Set Module Parameters

The next task is to configure module parameters. Notice that the contents of the information pane and the configuration pane changed when you added the MVI56-104S module to the project.



Name	Status	Information
✓ MVI56-104S	Configured	MVI56-104S
MVI56	8455	1.22
Backplane Configuration	Values OK	
I104S	Values OK	
Comment	Values OK	
WATTCP	Values OK	

```
# Module Information

# Last Change: Never
# Last Download: Never
# Application Rev:
# OS Rev:
# Loader Rev:
# MAC Address:
# ConfigEdit Version: 2.1.7 Build 1

# EtherNet Configuration

my_ip                                  :  192.168.0.100
netmask                                :  255.255.255.0
gateway                                :  192.168.0.1

# Module Configuration

[Module]
Module Type : MVI56-104S
Module Name : MVI56-104S

[Backplane Configuration]
Module Name                    : MVI56-104S
Read Register Start            : 120
Read Register Count            : 120
Write Register Start           : 0
Write Register Count           : 120
Failure Flag Count             : 0
Error Offset                   : 7000
Initialize Output Data         : Yes
```

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

To rename an object:

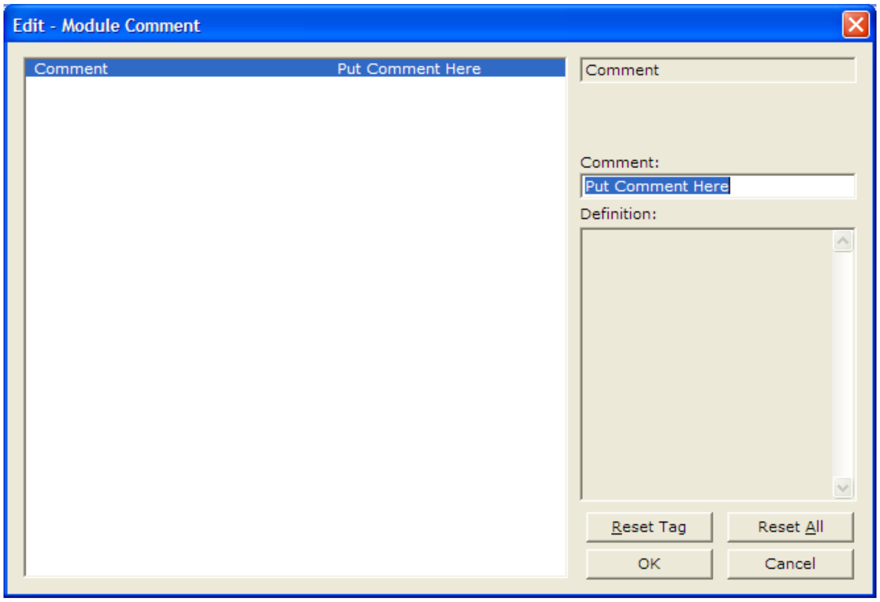
1 Select the object, and then click the right mouse button to open a shortcut menu. From the shortcut menu, choose **RENAME.**
2 Type the name to assign to the object.
3 Click away from the object to save the new name.

To Configure Module Parameters

1 Click on the plus sign next to the icon to expand module information.
2 Double-click the 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.

To Create Optional Comment Entries

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.


Edit - Module Comment

Comment	Put Comment Here

Comment

Comment: Put Comment Here

Definition:

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

Printing a Configuration File

1 Select the **MODULE** icon, and then click the right mouse button to open a shortcut menu.
2 On the shortcut menu, choose **VIEW CONFIGURATION.** This action opens the **VIEW CONFIGURATION** window.
3 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.**

2.2 [Backplane Configuration]

This section provides the module with a unique name, identifies the method of failure for the communications for the module if the processor is not in run, and describes how to initialize the module upon startup.

2.2.1 Module Name

0 to 80 characters

This parameter assigns a name to the module that can be viewed using the configuration/debug port. Use this parameter to identify the module and the configuration file.

2.2.2 Read Register Start

Range 0 to 3999

This parameter specifies the starting register in the module where data will be transferred from the module to the processor. Valid range for this parameter is 0 to 3999.

2.2.3 Read Register Count

0 to 4000

The Read Register Count parameter defines the size of the module's input database, up to a maximum value of 4000 words.

2.2.4 Write Register Start

0 to 3999

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

2.2.5 Read Register Count

0 to 4000

The Read Register Count parameter defines the size of the module's input database, up to a maximum value of 4000 words.

2.2.6 Failure Flag Count

0 through 65535

This parameter specifies the number of successive transfer errors that must occur before halting communication on the application port(s). If the parameter is set to 0, the application port(s) will continue to operate under all conditions. If the value is set larger than 0 (1 to 65535), communications will cease if the specified number of failures occur.

2.2.7 Error Offset

0 to 3980, or -1 to disable

This parameter specifies the database location where to write status data.

2.2.8 Initialize Output Data

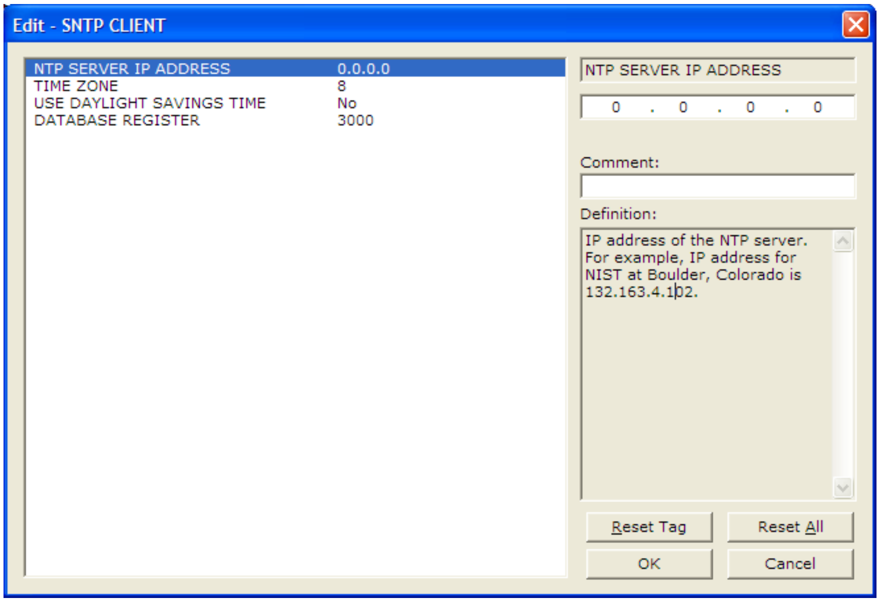
Yes or No

This parameter determines if the output data for the module should be initialized with values from the processor. If the value is set to No (0), the output data will be initialized to 0. If the value is set to Yes (1), the data will be initialized with data from the processor. Use of this option requires associated ladder logic to pass the data from the processor to the module.

2.3 [SNTP CLIENT]

The [SNTP CLIENT] section of the **CFG** file is used to specify the parameters for the Simple Network Time Protocol (SNTP) client provided with the protocol driver. This client is required in order to keep the driver's internal clock set correctly. This version of the driver supports SNTP Revision 3 and stratum between 1 and 14.

SNTP is used for time synchronization of produced and consumed commands. When an exchange occurs the driver compares time stamps from the previous exchange. When the new exchange time is less than the previous exchange, the exchange is ignored. This can occur when the Ethernet packets are routed and delayed. Time synchronization provides for data integrity.



Edit - SNTP CLIENT

NTP SERVER IP ADDRESS	0.0.0.0
TIME ZONE	8
USE DAYLIGHT SAVINGS TIME	No
DATABASE REGISTER	3000

NTP SERVER IP ADDRESS

0 . 0 . 0 . 0

Comment:

Definition:

IP address of the NTP server. For example, IP address for NIST at Boulder, Colorado is 132.163.4.102.

The SNTP driver will compute a new clock value every 5 minutes using the average value of 10 samples each collected over an approximate 6-second period. This new value will be used to adjust the clock maintained by the SNTP driver and used by the application. If a valid database register is specified, the driver will place the time value into the module's database. The first two registers will contain the number of seconds and the next two registers will contain the number of microseconds since January 1, 1970.

A list of some of the common NTP servers can be obtained at http://www.ntp.org/, http://www.eecis.udel.edu/~mills/ntp/servers.html, along with the appropriate IP address. Other server lists can be found by searching the World Wide Web for "NTP Servers".

2.3.1 NTP Server IP Address

Enter in dotted notation

This parameter sets the IP address of the NTP server to utilize for time acquisition. Select an NTP server with the greatest accuracy that can be accessed all the time from your network. Setting this IP address to 0.0.0.0 disables SNTP server requests.

2.3.2 Time Zone

-11 to 11

This parameter specifies the time zone offset to be used from the UTC time zone. A value of zero uses UTC time. If the value entered is positive, the time zone is west of the UTC time zone (that is, Eastern Standard Time is 5). If the value entered is negative, the time zone is east of the UTC time zone (that is, Continental Europe is -1).

2.3.3 Use Daylight Savings Time

Yes or No

This parameter specifies if daylight savings time will be used in the time computation.

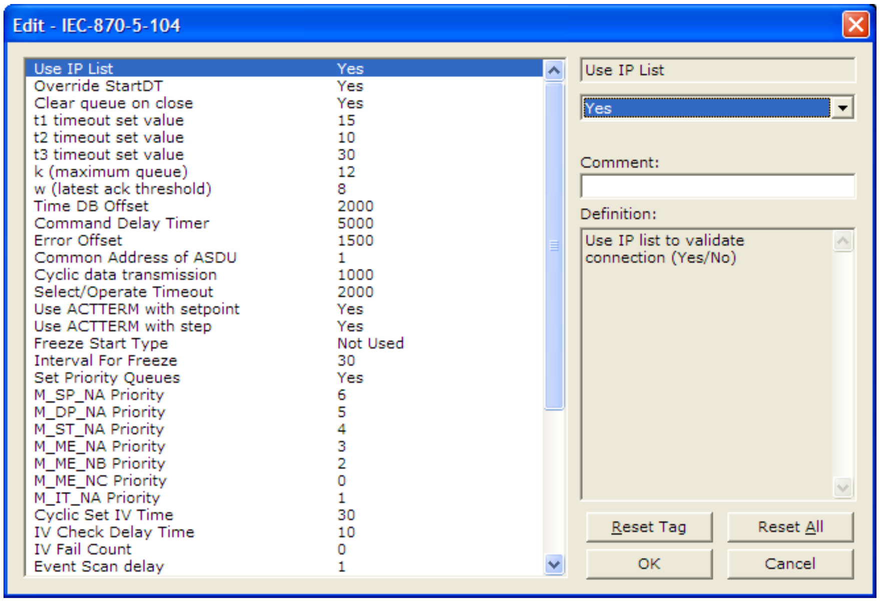
2.3.4 Database Register

-1 or 0 to 3992 as an even value

This parameter specifies if the NTP time computed by the driver is to be placed into the module’s database. If a value of -1 is specified, the time will not be placed into the database. If the value is between 0 and 3992, the time will be placed in the database. The first 4 bytes will represent the seconds since 1/1/1970, and the second 4 bytes will represent the number of microseconds. An even value should be used for the register value in order for the data to be stored correctly.

2.4 [IEC-870-5-104]

This section provides information required to configure a server application with the module. Most entries contained within this section are self explanatory An item of concern is the maximum size of the total database, although it is possible to configure a database of considerable size, this would not work, as the maximum Class 0 request may not exceed 2048 bytes in size.



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	1000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	30
IV Check Delay Time	10
IV Fail Count	0
Event Scan delay	1

Use IP List
Yes
Comment:
Definition:
Use IP list to validate connection (Yes/No)

2.4.1 Use IP List

0 or 1

This parameter specifies if the IP address of the host connected to the system will be validated. If the parameter is set to 0, any host may connect to the unit. If the parameter is set to 1, only hosts in the IP list will be permitted to connect to the unit.

2.4.2 Override StartDT

0 or 1

This parameter is used when testing the unit with a simulator or with a client unit that does not meet the IEC 60870-5-104 specification. After the host connects to the system, it will send a STARTDT.ACT U-format message to the unit to permit the unit to start sending data. If the client does not support this requirement, set the parameter to a value of 1. Set the parameter to 0 if the unit sends the STARTDT.ACT message.

2.4.3 Clear Queue on Close

0 or 1

Use this command to define whether the module will store the unacknowledged buffers in the unit after the connection is closed. If the specification is to be followed, set this parameter to 0 and the packets will be resent after a connection is made. If you want to flush the packets after the connection is closed, set this parameter to 1 (this is not according to the IEC 60870-5-104 specification).

2.4.4 t1 Timeout Set Value

1 to 255

This is the timeout of send or test ASDUs and is in units of seconds. After a packet is sent from the unit, the client must acknowledge the packet within this time interval or else the unit will close the connection.

2.4.5 t2 Timeout Set Value

1 to 255

This is a timeout of when to send an S-format message to the host to acknowledge outstanding messages received. This parameter is in units of seconds and must be less than the value set for t1.

2.4.6 t3 Timeout Set Value

1 to 255

This is the timeout to wait on an idle line before the unit will send a TestFr.Act message. This value is in units of seconds.

2.4.7 k (maximum queue)

1 to 20

This parameter specifies the number of unacknowledged messages the unit will buffer. This parameter must match that in the host. If the set number of buffers are filled in the unit, no other messages will be sent until the host unit acknowledges some or all the messages.

2.4.8 w (latest ack threshold)

1 to 20

This parameter must match that of the host unit and specifies the number of messages the module will receive before sending an S-format sequence acknowledge message when no I-format data is ready to send. It is recommended to set this value to 2/3 the value of k.

2.4.9 Time DB Offset

-1 or 0 to 3994

This parameter sets the location in the database where the module's current date and time will be copied to.

Note: The following tables lists the 12 byte, data area placed in the database if the Time DB Offset parameter is set to a value other than -1:

Byte	Length	Range	Description
0 to 1	2	0 to 59,999	Seconds and milliseconds
2	1	0 to 59	Minutes
3	1	0 to 23	Hour
4	1		Reserved
5	1	1 to 31	Day of the Month
6	1	1 to 12	Month
7 to 8	2	0 to 65,535	Year (four digit format, for example 2005)
9	1		Reserved
10	1	0 or 1	Invalid Flag (0 = Valid, 1 = Invalid
11	1		Reserved

2.4.10 Error Offset

0 to 3980

-1 to disable

This parameter sets the location in the module's internal database when the status and error information for the server will be stored. Enter a valid database address of 0 to 3980 to store the information, or enter -1 to disable.

2.4.11 Common Address of ASDU

0 to 65535

This parameter specifies the common address of the ASDU (section address) for access to data in the module. There is only one value entered for access to all data in the module.

2.4.12 Cyclic Data Transmission

0 to 2^32

This parameter defines the number of milliseconds between cyclic updates. The range of values for this parameter permit update times of 1 millisecond to 5 minutes. If the parameter is set to 0, cyclic data reporting will be disabled.

2.4.13 Select/Operate Timeout

0 to 2^32

This parameter sets the number of milliseconds after a select command is received in which to wait for a valid execute command. The range of values for this parameter permit times of 1 millisecond to 30 seconds. If the parameter is set to 0, the feature will be disabled.

2.4.14 Use ACTTERM with Setpoint

1 or 0

This parameter determines if an ACTTERM will be sent. If the parameter is set to 1, then setpoint commands will issue an ACTTERM when the command is complete. If the parameter is set to 0, ACTCON is the last response to a setpoint command.

2.4.15 Use ACTTERM with Step

1 or 0

This parameter determines if an ACTTERM will be sent. If the parameter is set to 1, then step commands will issue an ACTTERM when the command is complete. If the parameter is set to 0, ACTCON is the last response to a step command.

2.4.16 Freeze Start Type

D=Day, H=Hour, M=Minute, N=Not used

The Freeze Start Type parameter defines when the module starts sending the M_IT messages.

2.4.17 Interval for Freeze

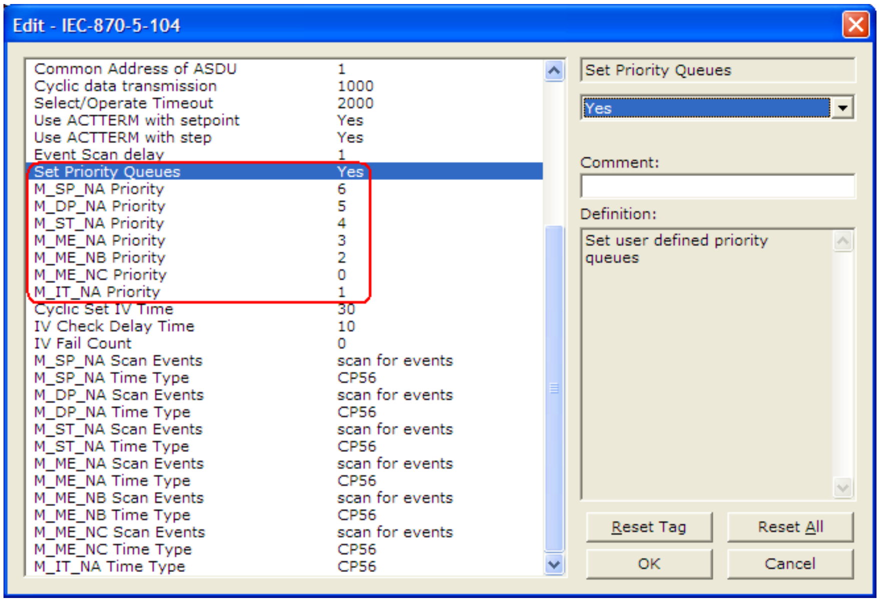
0 to 65535

Freeze Start Type and Interval for Freeze are used if Mode A operation is to be used for the counter freeze operation. If they are not used, the module will operate in Mode D.

2.4.18 Set Priority Queues

Yes or No

This section defines priority queues for the module. You can assign priorities to data types that can return events so that events of data types will be returned before other data types. This may cause events to be lost as the event buffers for low priority queues may overflow. If this feature is utilized, each data type must be assigned a unique index from 0 to 6. The lower the index, the higher the priority (0=highest priority).



Edit - IEC-870-5-104

Common Address of ASDU	1
Cyclic data transmission	1000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Event Scan delay	1
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	30
IV Check Delay Time	10
IV Fail Count	0
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	scan for events
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	scan for events
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	scan for events
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	scan for events
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	scan for events
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

Set Priority Queues

Yes

Comment:

Definition:

Set user defined priority queues

Each of the ASDUs affected by this feature must be assigned a unique priority index from 0 to 6. Events of the ASDU with a priority of 0 will always be reported before any others when they are present.

For more information, refer to Event Priority.

2.4.19 Cyclic Set IV Time

Minimum 3 times larger than IV Check Delay Time parameter

0 to disable

The Cyclic Set IV Time parameter determines how frequently the IV Checks will be performed. If the IV bit is ON for a number of times given by the IV Fail Count parameter (page 37), the module will consider the point as invalid.

If the IV Fail Count parameter is zero, the feature will be disabled.

For more information on using this feature, refer to Invalid Bit Monitoring (page 139).

2.4.20 IV Check Delay Time

Value in Seconds

This feature allows the application to set the invalid (IV) quality bit of the protocol for all the monitored ASDU types supported. The Cyclic Set IV Time parameter must be at least 3 times larger than the IV Check Delay Time.

2.4.21 IV Fail Count

0 to disable

This feature allows the application to set the invalid (IV) quality bit of the protocol for all the monitored ASDU types supported. If you enable this feature, the processor can determine the individual IV quality bit status of each point you configured.

To disable this feature, set the IV Fail Count parameter to 0. If used, the Cyclic Set IV Time parameter must be at least 3 times larger than the IV Check Delay Time.

2.4.22 Event Scan Delay

1 to 65535

0 to disable

If set to 0, the feature will be disabled and the module will not generate any events. If set from 1 to 65535, the parameter represents the number of milliseconds between event scanning. This parameter defines how often the program will scan for new events in the databases.

2.4.23 Scan Events

Scan for Events

No Scanning

Defines whether events of this point type will be generated by the module. If "No Scanning", then events will not be generated. If "Scan for events", events will be scanned and generated on change.

2.4.24 Time Type

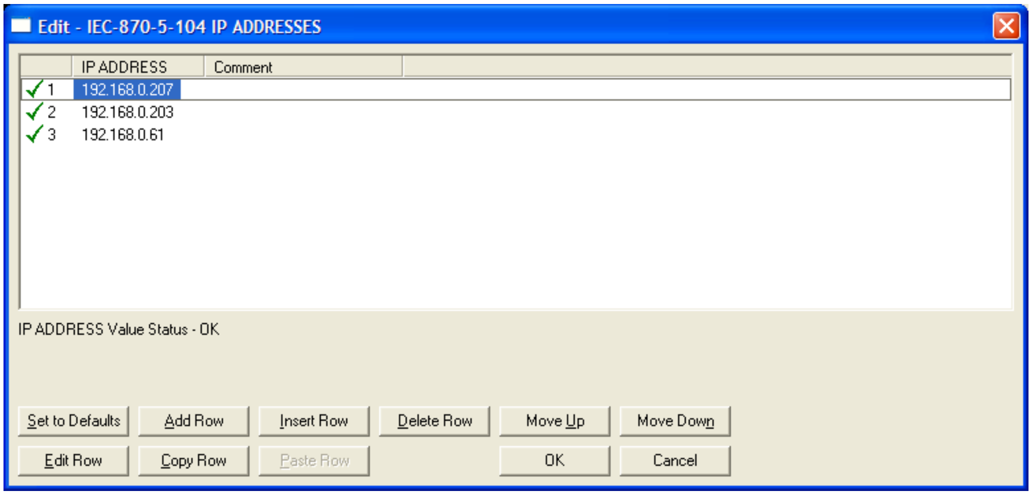
None, CP24 or CP56

This parameter defines the time format used with data events. 0=None, 1=CP24 and 2=CP56 time formats.

2.5 [IEC-870-5-104 IP Addresses]

This section enters the IP addresses for the hosts to connect to this unit. The unit will only accept connections from hosts listed here. This list may contain up to 10 entries between the START and END labels. The address must start in column 1, and must be entered in standard dot notation.

The following is an example of the [IEC-870-5-104 IP Addresses] section:

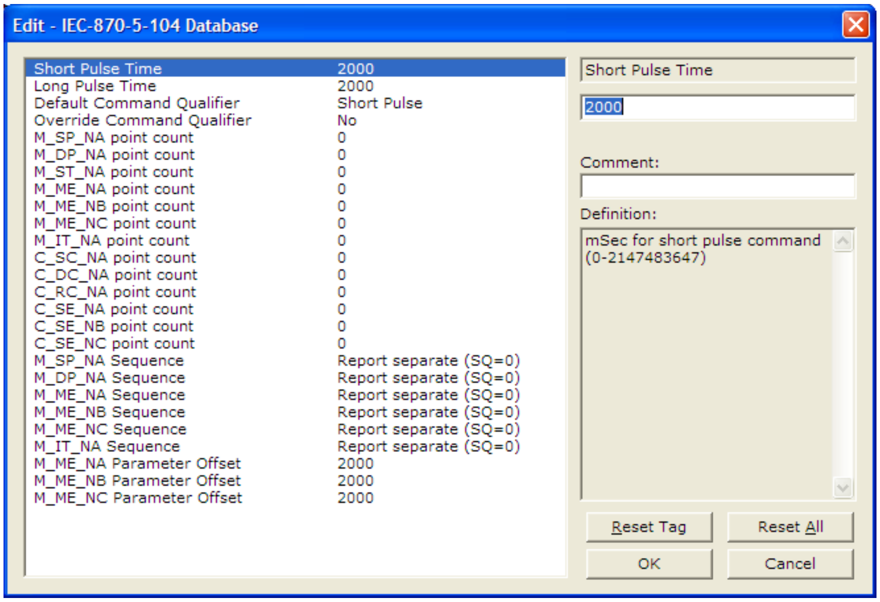


	IP ADDRESS	Comment
✓ 1	192.168.0.207	
✓ 2	192.168.0.203	
✓ 3	192.168.0.61	

IP ADDRESS Value Status - OK

2.6 [IEC-870-5-104 Database]

This section describes the [IEC-870-5-104 Database] section.



Edit - IEC-870-5-104 Database

Short Pulse Time	2000
Long Pulse Time	2000
Default Command Qualifier	Short Pulse
Override Command Qualifier	No
M_SP_NA point count	0
M_DP_NA point count	0
M_ST_NA point count	0
M_ME_NA point count	0
M_ME_NB point count	0
M_ME_NC point count	0
M_IT_NA point count	0
C_SC_NA point count	0
C_DC_NA point count	0
C_RC_NA point count	0
C_SE_NA point count	0
C_SE_NB point count	0
C_SE_NC point count	0
M_SP_NA Sequence	Report separate (SQ=0)
M_DP_NA Sequence	Report separate (SQ=0)
M_ME_NA Sequence	Report separate (SQ=0)
M_ME_NB Sequence	Report separate (SQ=0)
M_ME_NC Sequence	Report separate (SQ=0)
M_IT_NA Sequence	Report separate (SQ=0)
M_ME_NA Parameter Offset	2000
M_ME_NB Parameter Offset	2000
M_ME_NC Parameter Offset	2000

Short Pulse Time

2000

Comment:

Definition:

mSec for short pulse command (0-2147483647)

2.6.1 *Short Pulse Time*

0 to 2,147,483,647 milliseconds

This parameter defines the number of milliseconds to be associated with a short pulse command.

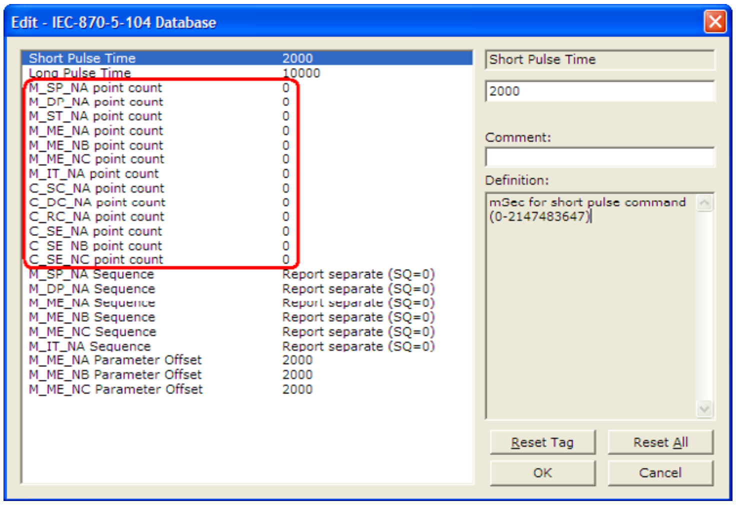
2.6.2 *Long Pulse Time*

0 to 2,147,483,647

This parameter defines the number of milliseconds to be associated with a long pulse command.

2.6.3 Point Count

Point Count configuration ranges in the following configuration items are based on the assumption that you will be using only one of the available data types for your application. The number of point counts you configure will have an effect on module performance, in particular the accuracy of the module’s internal clock.



Short Pulse Time	2000
Long Pulse Time	10000
M_SP_NA point count	0
M_DP_NA point count	0
M_ST_NA point count	0
M_ME_NA point count	0
M_ME_NB point count	0
M_ME_NC point count	0
M_IT_NA point count	0
C_SC_NA point count	0
C_DC_NA point count	0
C_RC_NA point count	0
C_SE_NA point count	0
C_SE_NB point count	0
C_SE_NC point count	0
M_SP_NA Sequence	Report separate (SQ=0)
M_DP_NA Sequence	Report separate (SQ=0)
M_ME_NA Sequence	Report separate (SQ=0)
M_ME_NB Sequence	Report separate (SQ=0)
M_ME_NC Sequence	Report separate (SQ=0)
M_IT_NA Sequence	Report separate (SQ=0)
M_ME_NA Parameter Offset	2000
M_ME_NB Parameter Offset	2000
M_ME_NC Parameter Offset	2000

Short Pulse Time

2000

Comment:

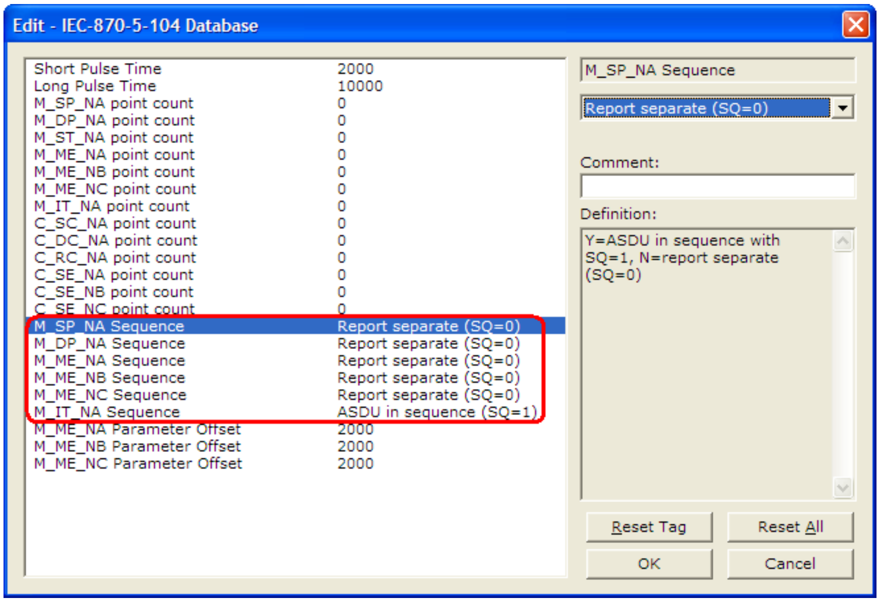
Definition:

mSec for short pulse command (0-2147483647)

- **M_SP_NA point count:** This parameter specifies the number of point values assigned in monitored single-point database. Range is 0 to 1000.
- **M_DP_NA point count:** This parameter specifies the number of point values assigned in monitored dual-point database. Range is 0 to 1000.
- **M_ST_NA point count:** This parameter specifies the number of point values assigned in monitored step-point database. Range is 0 to 1000.
- **M_ME_NA point count:** This parameter specifies the number of point values assigned in monitored normalized-point database. Range is 0 to 1000.
- **M_ME_NB point count:** This parameter specifies the number of point values assigned in monitored scaled-point database. Range is 0 to 1000.
- **M_ME_NC point count:** This parameter specifies the number of point values assigned in monitored scaled short-float point database. Range is 0 to 50.
- **M_IT_NA point count:** This parameter specifies the number of point values assigned in monitored counter-point database. Range is 0 to 99.
- **C_SC_NA point count:** This parameter specifies the number of point values assigned in command single-point database. Range is 0 to 1000.
- **C_DC_NA point count:** This parameter specifies the number of point values assigned in command dual-point database. Range is 0 to 1000.
- **C_RC_NA point count:** This parameter specifies the number of point values assigned in command step-point database. Range is 0 to 1000.
- **C_SE_NA point count:** This parameter specifies the number of point values assigned in command normalized-point database. Range is 0 to 1000.
- **C_SE_NB point count:** This parameter specifies the number of point values assigned in command scaled-point database. Range is 0 to 1000.
- **C_SE_NC point count:** This parameter specifies the number of point values assigned in command short-float point database. Range is 0 to 50.

2.6.4 Sequence Flag

In order to save bandwidth, you can configure the module to use the Sequence Flag feature. If this feature is not selected, the module will send the object address and its value at every monitored response to the master.



Edit - IEC-870-5-104 Database

Short Pulse Time	2000
Long Pulse Time	10000
M_SP_NA point count	0
M_DP_NA point count	0
M_ST_NA point count	0
M_ME_NA point count	0
M_ME_NB point count	0
M_ME_NC point count	0
M_IT_NA point count	0
C_SC_NA point count	0
C_DC_NA point count	0
C_RC_NA point count	0
C_SE_NA point count	0
C_SE_NB point count	0
C_SE_NC point count	0
M_SP_NA Sequence	Report separate (SQ=0)
M_DP_NA Sequence	Report separate (SQ=0)
M_ME_NA Sequence	Report separate (SQ=0)
M_ME_NB Sequence	Report separate (SQ=0)
M_ME_NC Sequence	Report separate (SQ=0)
M_IT_NA Sequence	ASDU in sequence (SQ=1)
M_ME_NA Parameter Offset	2000
M_ME_NB Parameter Offset	2000
M_ME_NC Parameter Offset	2000

M_SP_NA Sequence

Report separate (SQ=0)

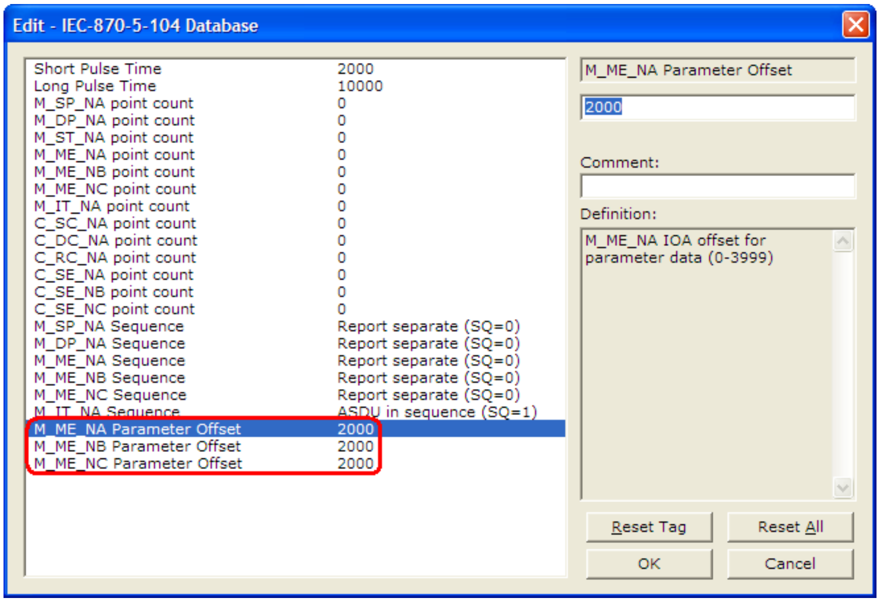
Comment:

Definition:

Y=ASDU in sequence with SQ=1, N=report separate (SQ=0)

If this parameter is selected, the module will turn the Sequence Flag on every monitored response sending the address for the first point along with all point values. The master assumes that all other points use information object addresses in a contiguous order (using the first point as the reference).

2.6.5 Parameter Offset



Short Pulse Time	2000
Long Pulse Time	10000
M_SP_NA point count	0
M_DP_NA point count	0
M_ST_NA point count	0
M_ME_NA point count	0
M_ME_NB point count	0
M_ME_NC point count	0
M_IT_NA point count	0
C_SC_NA point count	0
C_DC_NA point count	0
C_RC_NA point count	0
C_SE_NA point count	0
C_SE_NB point count	0
C_SE_NC point count	0
M_SP_NA Sequence	Report separate (SQ=0)
M_DP_NA Sequence	Report separate (SQ=0)
M_ME_NA Sequence	Report separate (SQ=0)
M_ME_NB Sequence	Report separate (SQ=0)
M_ME_NC Sequence	Report separate (SQ=0)
M_IT_NA Sequence	ASDU in sequence (SQ=1)
M_ME_NA Parameter Offset	2000
M_ME_NB Parameter Offset	2000
M_ME_NC Parameter Offset	2000

M_ME_NA Parameter Offset

2000

M_ME_NA IOA offset for parameter data (0-3999)

This parameter specifies the IOA (Information Object Address) offset to the parameter data for the normalized parameter data. The value entered is added to the Information Object address for the associated point to compute the parameter IOA address.

The Master may send a "Parameter of Measured Normalized" or "Parameter of Measured Scaled" command using the parameter IOA in order to change the deadband values for specific points.

Note: The Low Limit and High Limit values are always calculated based on the deadband value as described in the following table.

Point	Value
Threshold	Determined by the deadband set in the configuration file or altered by the write command.
Low	Last reported event value - threshold.
High	Last reported event value + threshold.

For example, if the MVI56-104S configuration sets two M_ME_NA points with IOA (Point #) of 600 and 601 and a M_ME_NA Parameter Offset value of 3000, it would result in the parameter points shown in the table.

2.7 [M_SP_NA_1 104]

This section defines the monitored single-point database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point in the database occupies 1 bit (1 = On, 0 = Off state).

This section takes the following parameters:

- Point #
- DB Address
- Group(s)
- IV DB Bit

Each point is one bit and the DB address value corresponds to the bit offset in the database.

2.8 [M_DP_NA_1 104]

This section defines the monitored dual-point database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point in the database occupies two bits (00 = intermediate, 01 = off, 10 = on and 11 = intermediate).

This section takes the following parameters:

- Point #:
- DB Address:
- Group(s):
- IV DB Bit

Each point is two bits and the DB address value corresponds to the bit offset in the database.

2.9 [M_ST_NA_1 104]

This section defines the monitored step database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point in the database occupies one byte.

This section takes the following parameters:

- Point #:
- DB Address:
- Group(s):
- IV DB Bit

Each point is one byte and the DB Address value corresponds to the byte offset in the database.

2.10 [M_ME_NA_1 104]

This section defines the monitored measured value, normalized database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point occupies a word position in the database. To determine the IOA (Information Object Address) for each object, add the Point # in the following section to the value of the M_ME_NA parameter offset parameter set in the previous section.

This section takes the following parameters:

- Point #:
- DB Address:
- Group(s):
- Default Deadband:
- IV DB Bit

Each point is one word and the DB Address value corresponds to the word offset in the database.

2.11 [M_ME_NB_1 104]

This section defines the monitored measured value, scaled database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point occupies a word position in the database. To determine the IOA (Information Object Address) for each object, add the Point # in the following section to the value of the M_ME_NB parameter offset parameter set in the previous section.

This section takes the following parameters:

- Point #:
- DB Address:
- Group(s):
- Default Deadband:
- IV DB Bit

Each point is one word and the DB Address value corresponds to the word offset in the database.

2.12 [M_ME_NC_1 104]

This section defines the monitored short-float point database for the slave device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point occupies 4-byte positions in the database. To determine the IOA (Information Object Address) for each object, add the Point # in the following section to the value of the M_ME_NC Parameter Offset parameter set in the previous section.

This section takes the following parameters:

- Point #
- DB Address
- Groups
- Default Deadband
- IV DB Bit

Each point is one word and the DB Address value corresponds to the word offset in the database.

Refer to the Group Codes (page 49) section for a listing of Group Codes.

2.13 [M_IT_NA_1 104]

This section defines the monitored integrated totals (counter) database for the server emulated. This information is sourced from the database and is transferred to the remote client unit. Each point occupies two words in the database (4 bytes).

This section takes the following parameters:

- Point #:
- DB Address:
- Group(s):
- IV DB Bit

Each point is two words and the DB Address value corresponds to the double-word offset in the database.

2.14 [C_SC_NA_1 104]

This section defines the single point command database for the server emulated. This information is sourced from the remote client and is transferred to the database. Each point occupies a single bit position in the database. You can associate a command with a monitored single-point database value to coordinate the command/monitor operation. You must enter the correct Monitor Point # and Monitor DB Address values in the table. If the Require Select parameter is not set to zero, a select command must be received before an execute command will be processed.

This section takes the following parameters:

- Point #:
- DB Address:
- Monitor Point #:
- Monitor DB Addr:
- Require Select:

Each point is one bit and the DB Address value corresponds to the bit offset in the database.

2.15 [C_DC_NA_1 104]

This section defines the double point command database for the server emulated. This information is sourced from the remote client and is transferred to the database. Each point occupies two bits in the database. You can associate a command with a monitored double point database value to coordinate the command/monitor operation. You must enter the correct Monitor Point # and Monitor DB Addr values in the table. If the Require Select parameter is not set to zero, a select command must be received before an execute command will be processed.

This section takes the following parameters:

- Point #:
- DB Address:
- Monitor Point #:
- Monitor DB Addr:
- Require Select:

Each point is two bits and the DB Address value corresponds to the bit offset in the database.

2.16 [C_RC_NA_1 104]

This section defines the step command database for the server emulated. This information is sourced from the remote client and is transferred to the database. Each point occupies a byte in the database. The control value can be associated with a monitored point as described in the previous example.

This section takes the following parameters:

- Point #:
- DB Address:
- Monitor Point #:
- Monitor DB Addr:

Each point is one byte and the DB Address value corresponds to the byte offset in the database.

2.17 [C_SE_NA_1 104]

This section defines the normalized setpoint database for the server emulated. This information is sourced from the remote client and is transferred to the database. Each point occupies a word position in the database. You can associate a command with a monitored normalized database value to coordinate the command/monitor operation. You must enter the correct Monitor Point # and Monitor DB Addr values in the table. If the Require Select parameter is not set to zero, a select command must be received before an execute command will be processed.

This section takes the following parameters:

- Point #
- DB Address
- Monitor Point #
- Monitor DB Addr
- Require Select

Each point is one word and the DB Address value corresponds to the word offset in the database.

2.18 [C_SE_NB_1 104]

This section defines the scaled setpoint database for the server emulated. This information is sourced from the remote client and is transferred to the database. You can associate a command with a monitored scaled database value to coordinate the command/monitor operation. You must enter the correct Monitor Point # and Monitor DB Addr values in the table. If the Require Select parameter is not set to zero, a select command must be received before an execute command will be processed.

This section takes the following parameters:

- Point #:
- DB Address:
- Monitor Point #:
- Monitor DB Addr:
- Require Select:

Each point is one word and the DB Address value corresponds to the word offset in the database.

2.19 [C_SE_NC_1 104]

This section defines the short-float setpoint database for the server emulated. This information is sourced from the remote client and is transferred to the database. Each point occupies a double-word position in the database. If the Require Select parameter is not set to zero, a select command must be received before an execute command will be processed.

This section takes the following parameters:

- Point #:
- DB Address:
- Monitor Point #:
- Monitor DB Addr:
- Require Select:

Each point is two words and the DB Address value corresponds to the double-word offset in the database.

2.20 Group Codes

One aspect of the point configuration database that leads to confusion is the group definition field. This assignment for each point assigns a point to one or more interrogation groups. Use of interrogation groups permits the controlling unit to interface with a specific set of data. Refer to the IEC 60870-5-104 standard for a full discussion of interrogation groups. A specific group, Periodic data group, reports data points on a set frequency. The frequency is set in the **Cyclic Data Transmission** parameter in the configuration file. Remember that a point can be assigned to more than one group.

Group Code	Description
0x00000001	Interrogated by general interrogation (station or global)
0x00000002	Interrogated by group 1 interrogation
0x00000004	Interrogated by group 2 interrogation
0x00000008	Interrogated by group 3 interrogation
0x00000010	Interrogated by group 4 interrogation
0x00000020	Interrogated by group 5 interrogation
0x00000040	Interrogated by group 6 interrogation
0x00000080	Interrogated by group 7 interrogation
0x00000100	Interrogated by group 8 interrogation
0x00000200	Interrogated by group 9 interrogation
0x00000400	Interrogated by group 10 interrogation
0x00000800	Interrogated by group 11 interrogation
0x00001000	Interrogated by group 12 interrogation
0x00002000	Interrogated by group 13 interrogation
0x00004000	Interrogated by group 14 interrogation
0x00008000	Interrogated by group 15 interrogation
0x00010000	Interrogated by group 16 interrogation
0x00020000	Interrogated by general counter request
0x00040000	Interrogated by group 1 counter request
0x00080000	Interrogated by group 2 counter request
0x00100000	Interrogated by group 3 counter request
0x00200000	Interrogated by group 4 counter request
0x40000000	Disable event scanning of this point
0x80000000	Periodic/cyclic data returned from unit

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

2.21 Ethernet Configuration

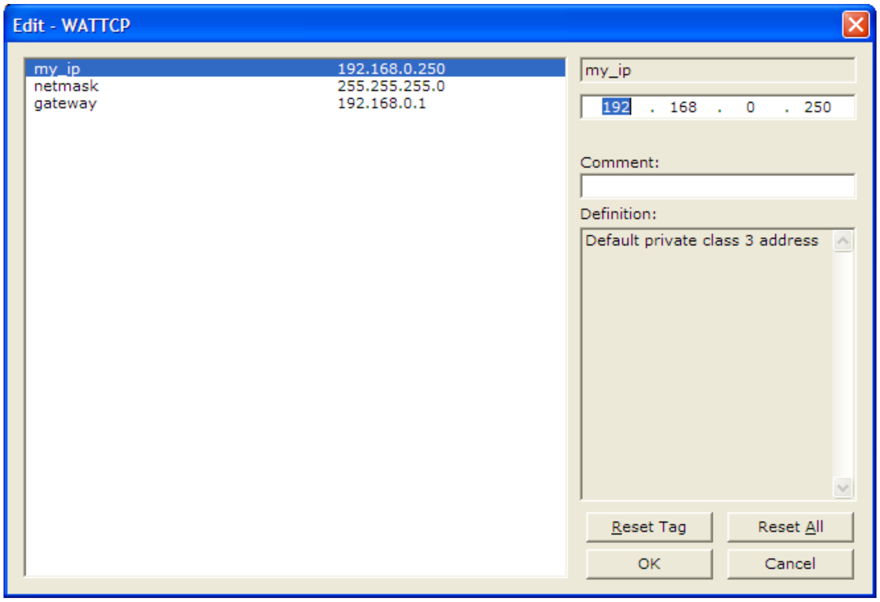
Use this procedure to configure the Ethernet settings for your module. You must assign an IP address, subnet mask and gateway address. After you complete this step, you can connect to the module with an Ethernet cable.

1 Determine the network settings for your module, with the help of your network administrator if necessary. You will need the following information:

- o IP address (fixed IP required) _____ . _____ . _____ . _____
- o Subnet mask _____ . _____ . _____ . _____
- o Gateway address _____ . _____ . _____ . _____

Note: The Gateway Address is optional, and is not required for networks that do not use a default gateway.

2 Double-click the **ETHERNET CONFIGURATION** icon. This action opens the **EDIT** dialog box.



my_ip	192.168.0.250
netmask	255.255.255.0
gateway	192.168.0.1

my_ip

192 . 168 . 0 . 250

Comment:

Definition:

Default private class 3 address

3 Edit the values for my_ip, netmask (subnet mask) and gateway (default gateway).

4 When you are finished editing, click **OK** to save your changes and return to the ProSoft Configuration Builder window.

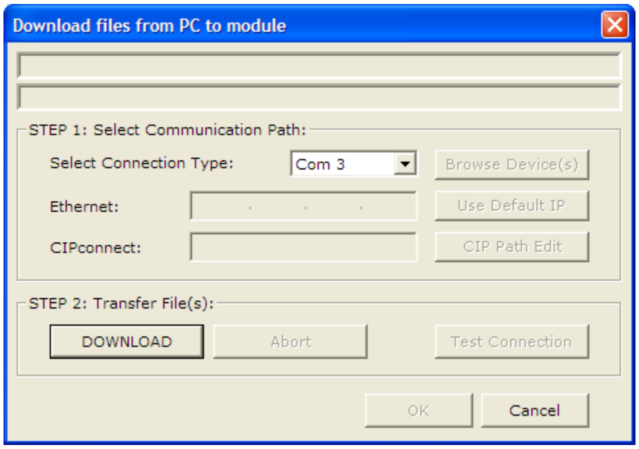
2.22 Download the Project to the Module

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 MVI56-104S module.

2 Open the **PROJECT** menu, and then choose **MODULE / DOWNLOAD.** The program will scan your PC for a valid com port (this may take a few seconds). When PCB has found a valid com port, the **DOWNLOAD** dialog box will open.



Download files from PC to module

STEP 1: Select Communication Path:

Select Connection Type: Com 3

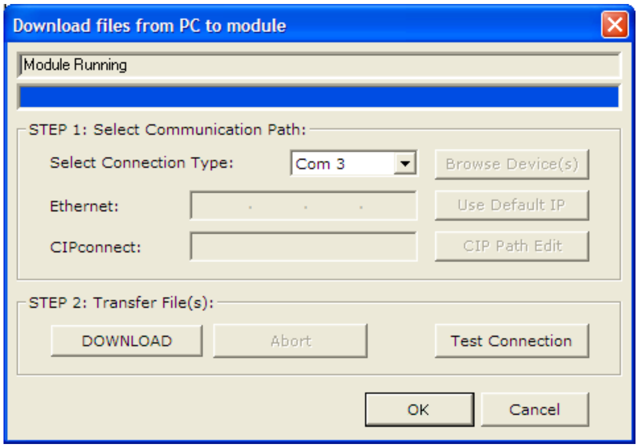
Ethernet:

CIPconnect:

STEP 2: Transfer File(s):

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

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



Download files from PC to module

Module Running

STEP 1: Select Communication Path:

Select Connection Type: Com 3

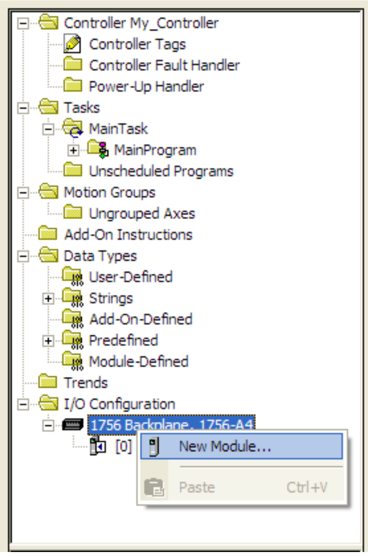
Ethernet:

CIPconnect:

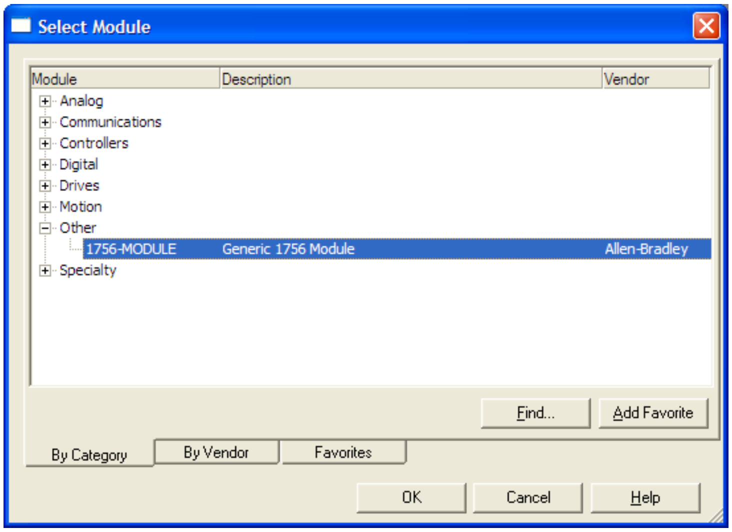
STEP 2: Transfer File(s):

2.23 Adding the Module to an Existing Project

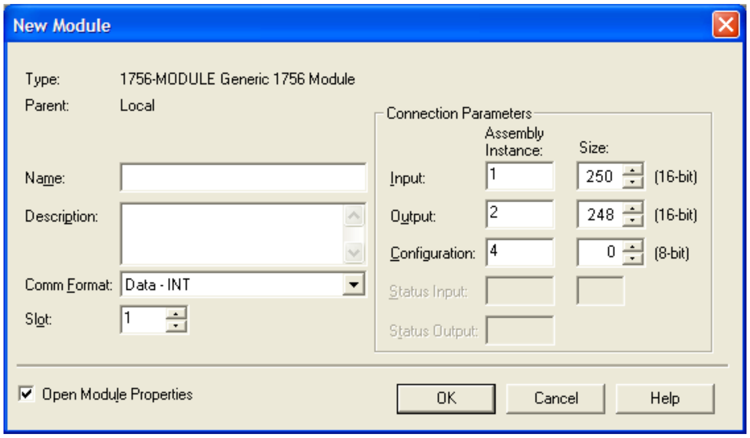
1 **Add the MVI56-104S module to the project.** Select the **I/O CONFIGURATION** folder in the **CONTROLLER ORGANIZATION** window, and then click the right mouse button to open a shortcut menu. On the shortcut menu, choose **NEW MODULE.**



This action opens the **SELECT MODULE** dialog box:



Select the **1756-MODULE** (Generic 1756 Module) from the list and click **OK.** This action opens the **NEW MODULE** dialog box.



New Module

Type: 1756-MODULE Generic 1756 Module

Parent: Local

Name:

Description:

Comm Format: Data - INT

Slot: 1

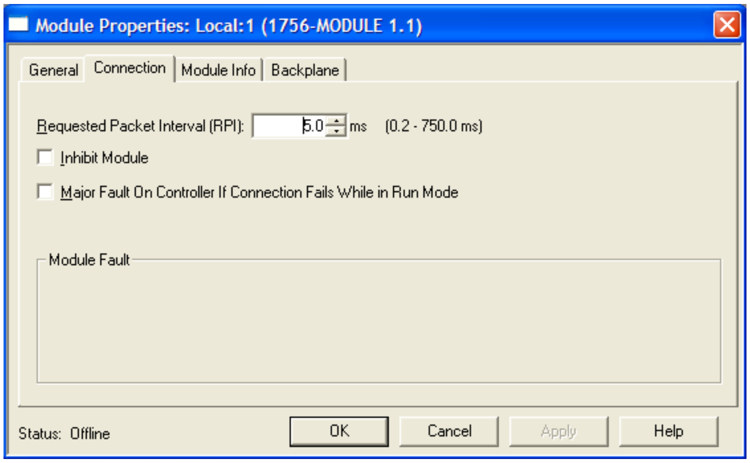
Connection Parameters

	Assembly Instance:	Size:	
Input:	1	250	(16-bit)
Output:	2	248	(16-bit)
Configuration:	4	0	(8-bit)
Status Input:			
Status Output:			

☑ Open Module Properties

Enter the Name, Description and Slot options for your application. You must select the **COMM FORMAT AS DATA - INT** in the dialog box, otherwise the module will not communicate over the backplane of the ControlLogix rack. Click OK to continue.

2 **Edit the Module Properties.** Select the **REQUESTED PACKET INTERVAL** value for scanning the I/O on the module. This value represents the minimum frequency that the module will handle scheduled events. This value should not be set to less than 1 millisecond. The default value is 5 milliseconds. Values between 1 and 10 milliseconds should work with most applications.



Module Properties: Local:1 (1756-MODULE 1.1)

Requested Packet Interval (RPI): 5.0 ms (0.2 - 750.0 ms)

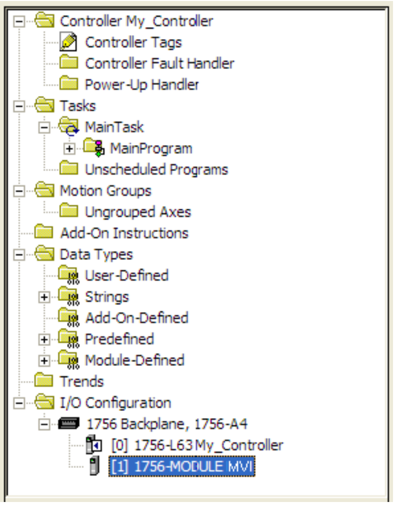
☐ Inhibit Module

☐ Major Fault On Controller If Connection Fails While in Run Mode

Module Fault

Status: Offline

3 Save the module. Click **OK** to dismiss the dialog box. The **CONTROLLER ORGANIZATION** window now displays the module's presence.



- Controller My_Controller
  - Controller Tags
  - Controller Fault Handler
  - Power-Up Handler
- Tasks
  - MainTask
    - MainProgram
  - Unscheduled Programs
- Motion Groups
  - Ungrouped Axes
- Add-On Instructions
- Data Types
  - User-Defined
  - Strings
  - Add-On-Defined
  - Predefined
  - Module-Defined
- Trends
- I/O Configuration
  - 1756 Backplane, 1756-A4
    - [0] 1756-L63 My_Controller
    - [1] 1756-MODULE MVI

4 Copy the Controller Tags from the sample program.

5 Copy the User Defined Data Types from the sample program.

6 Copy the Ladder Rungs from the sample program.

7 Save and Download (page 20) the new application to the controller and place the processor in run mode.

3 Ladder Logic

In This Chapter

Ladder logic is required for application of the MVI56-104S 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.

All data related to the MVI56-104S is stored in a user-defined data type. At least one instance of each data type is required before the module can be used. This is done by declaring a controller tag variable or variable array of the data type in the Controller Tags Edit Tags dialog box (this will be done automatically if you use the Add-On Instruction Rung Import file or use a copy of the provided ladder logic sample).

3.1 User-defined Data Types

3.1.1 Module Data Object (ModuleDef870)

To hold and organize all data related to the MVI56-104S module, data is stored in Controller Tags and Tag Arrays based on standard data types as well as special User-defined Data Types (UDTs).

The *ModuleDef870* data object is the top-level UDT that organizes all data related to the module into one overall data structure.

Tag Name	Data Type	Description
IEC870S.InStat	InStat870	Status information updated and passed in each input image read block
ReadData	INT[600]	Data read from module
IEC870S.WriteData	INT[600]	Data to write to module
IEC870S.Control	Control870	Special function blocks
IEC870S.BP	Backplane870	Data to sequence and control backplane data block transfer logic
IEC870S.Util	Util870	Variables used for convenience purposes

The next few sections will provide a more detailed breakdown of the mid-level and lower-level UDTs used to build the Module Data Object.

User Data Objects

These objects are simple controller tag arrays, composed of 600, 16-bit signed integer (INT) data words (each array element is one 16-bit word). These arrays hold data to be transferred between the processor and the MVI56-104S module. Data is transferred between the processor and the module as "pages" of up to 200 words (array elements) of user data per transfer.

Name	Data Type	Description
ReadData	INT[600]	Data read from module
WriteData	INT[600]	Data to write to module

The **ReadData** array size should be set to match the value entered in the **Read Register Count** parameter of the *IEC8704S.CFG* file. For ease of use, this array should be dimensioned as an even increment of 200 words. This data is paged, 200 words at a time, from the module to the processor. The **ReadData** task places the data received into the proper position in the **ReadData** array. Use this incoming data for status and control in the ladder logic of the processor.

The **WriteData** array size should be set to match the value entered in the **Write Register Count** parameter of the *IEC8704S.CFG* file. For ease of use, this array should be dimensioned as even increments of 200 words. This data is paged, 200 words at a time, from the processor to the module. The **WriteData** task places the values in the **WriteData** array into the output image for transfer to the module. This data is passed from the processor to the module for use as status and control information by other nodes on the network.

3.1.2 Status Data Object (InStat870)

This mid-level data object contains all the available status of the module that can be used by the ladder logic. Values for the *InStat870* object tags and arrays, shown below, are transferred along with the 200 words of application data received in each input image block. Use this data to monitor the state of the module.

Name	Data Type	Description
PassCnt	INT	Program cycle counter
Product	INT[2]	Product Name
Rev	INT[2]	Revision Level Number
OP	INT[2]	Operating Level Number
Run	INT[2]	Run Number
BlkErrs	BlkStat870	Block transfer statistics
Read	INT	Total number of read block transfers
Write	INT	Total number of write block transfers
Parse	INT	Total number of blocks parsed
Err	INT	Total number of block transfer errors
t0_timeouts	INT	Number of t0 timeouts
t1_timeouts	INT	Number to t1 timeouts
t2_timeouts	INT	Number of t2 timeouts
t3_timeouts	INT	Number of t3 timeouts
seq_errors	INT	Number of sequence number errors
bad_addresses	INT	Number of bad command ASDU addresses
len_errors	INT	Number of length field errors
rx_frames	INT	Number of frames received
tx_frames	INT	Number of frames transmitted
socket_state	INT	State of socket
sock_open	INT	Number of socket open function calls
sock_close	INT	Number of active socket close function calls
sock_connect	INT	Number of connections established
EventBuffer_M_SP_NA	INT	Number of events available in the event buffer for M_SP_NA points
EventBuffer_M_DP_NA	INT	Number of events available in the event buffer for M_DP_NA points
EventBuffer_M_ST_NA	INT	Number of events available in the event buffer for M_ST_NA points
EventBuffer_M_ME_NA	INT	Number of events available in the event buffer for M_ME_NA points
EventBuffer_M_ME_NB	INT	Number of events available in the event buffer for M_ME_NB points
EventBuffer_M_ME_NC	INT	Number of events available in the event buffer for M_ME_NC points
EventBuffer_M_IT_NA	INT	Number of events available in the event buffer for M_IT_NA points

The *InStat870* data structure is used to build the top-level data structure, *ModuleDef870. InStat870* contains data from one lower-level data object, *BlkStat870*.

MVI56-104S Status Data Definition

This section contains a description of the members present in the **InStat870** object from the sample ladder logic. This data is transferred from the module to the processor as part of each read block. The data is also available inside the database, configured by two Error Offset parameters in the configuration file.

The following status data is copied to the database through the Error Offset parameter in the [Backplane Configuration] section of the configuration file.

Offset	**Parameter**	**Description**
0	Pass Count	This status value contains a counter incremented on each scan of the module's main loop.
1 to 2	Product Name	This two-word data area contains the text values representing the product name. These words contain the text "87S5" for the MVI56 platform.
3 to 4	Revision Number	This two-word data area contains the text values for the revision number.
5 to 6	Operating System	This two-word data area contains the text values for the operating system number.
7 to 8	Run Number	This two-word data area contains the text values for the run number.
9	Read Block Count	This word contains the total number of block read operations successfully executed.
10	Write Block Count	This word contains the total number of block write operations successfully executed.
11	Parse Block Count	This word contains the total number of write blocks successfully parsed.
12	Error Block Count	This word contains the total number of block transfer errors.

The following status data is copied to the database through the Error Offset parameter in the [IEC-870-5-104] section of the configuration file.

Offset	**Parameter**	**Description**
0	t0 Error Count	This word contains the number of t0 errors recognized by the module.
1	t1 Error Count	This word contains the number of t1 errors recognized by the module.
2	t2 Error Count	This word contains the number of t2 errors recognized by the module.
3	t3 Error Count	This word contains the number of t3 errors recognized by the module.
4	Sequence # Errors	This word contains the number of sequence errors recognized by the module. When the send sequence number received by the module does not match the expected sequence number, the connection is closed and this counter is incremented.

Offset	Parameter	Description
5	Bad Address Errors	This word contains the number of messages received from the remote host that do not contain a valid common ASDU address in the packet.
6	Length Errors	This word contains the number of messages received from the remote host that do not have a valid length field.
7	Receive Frame Count	This word contains the number of message frames (not packets) received from the host. A packet may contain more than one message.
8	Transmit Frame Count	This word contains the number of message frames sent to the host from the unit.
9	Socket State	This word contains the current socket state as follows: -1 = Open socket 0 = Wait for connection 1 = Transmit message if ready 2 = Receive packet and process message 3 = Process multiple messages in packet 50 = Send TestFr Act 51 = Wait for TestFr Con 60 = Send Sequence (S-Format) message 1000 = Close Socket 1001 = Wait for socket to close
10	Socket Open Count	This word contains the number of times the socket listen function executed.
11	Socket Close Count	This word contains the number of times an active close function executed.
12	Socket Connection Count	This word contains the number of times a connection was established with the remote host unit.
13	MSP Event Buffer	This parameter shows the number of events available in the event buffer for M_SP_NA points.
14	MDP Event Buffer	This parameter shows the number of events available in the event buffer for M_DP_NA points
15	MST Event Buffer	This parameter shows the number of events available in the event buffer for M_ST_NA points
16	MMENA Event Buffer	This parameter shows the number of events available in the event buffer for M_ME_NA points
17	MMENB Event Buffer	This parameter shows the number of events available in the event buffer for M_ME_NB points
18	MMENC Event Buffer	This parameter shows the number of events available in the event buffer for M_ME_NC points.
19	MIT Event Buffer	This parameter shows the number of events available in the event buffer for M_IT_NA points

Block Transfer Statistics Data Object (BlkStat870)

This low-level data type creates tags to hold module status values that show input and output image (I/O) block transfer activity. These block transfers occur between the module and the ControlLogix processor. This low-level structure is used to create the higher-level structure, *InStat870***.**

Name	Data Type	Description
Read	INT	Total number of input image blocks transferred
Write	INT	Total number of output image blocks transferred
Parse	INT	Total number of blocks parsed (good blocks received and processed)
Err	INT	Total number of block transfer errors (bad blocks or no blocks received)

These tags hold values of module internal counters that keep a running total of how many input and output image blocks have been transferred between the module and the ControlLogix processor. During normal operation, the values displayed for *Read, Write*, and *Parse* should increment together and be very close to the same values, unless backplane errors are occurring. If backplane errors are occurring, the *Err* value will increment and the *Parse* value will not.

As long as *Read, Write*, and *Parse* continue to increment and *Err* does not change, this indicates normal backplane activity. An occasional backplane error may occur, even in normally functioning systems. So, if the value in the *Err* counter slowly increases over time, this is generally not a cause for concern. However, if normal backplane transfers appear sluggish or non-functional, if input data is being lost or output data is not being sent, especially when the *Err* counter is incrementing frequently, this could indicate a hardware failure, I/O configuration problem, or, for remote rack installations only, a process network problem that may need to be corrected.

3.1.3 Control Data Object (Control870)

The *Control870* data structure is used to build the top-level data structure, *ModuleDef870. Control870* contains data and structure from four (4) lower-level data objects, *EventType870 (for events time-stamped with GMT date/time), EventTypeUTC8970 (for events time-stamped with UTC date/time), ReadTimeType870 (reads time from module into controller tags), and SetTimeType870 (sets module time to match time received from controller tags)*. The data points contained in those data objects will be discussed in their respective sections.

Name	Data Type	Description
EventBlock_GMT	EventType870	Block 9958 GMT data structure
EventBlock_UTC	EventTypeUTC870	Block 9958 UTC data structure
ReadTimeBlock	ReadTimeType870	Block 9970 data structure
SetTimeBlock	SetTimeType870	Block 9971 data structure
ColdBoot	BOOL	Block 9999 for ColdBoot

The ColdBoot boolean tag is provided as a way to re-boot the module from ladder logic. Set this tag to a value of one (1) to request the module reboot, as if from power-up. Once the request is received by the module, it will reboot and reset this tag to a value of zero (0).

Event Block 9958 for GMT Time Data Object (EventType870)

The *EventType870* mid-level data structure is used as part of the higher-level *Control870* data object. *EventType870* uses the lower-level *EventElement870* data object as part of it's structure.

EventType870 is one of two data structures that support moving time-stamped events from the processor to the module so those events can be transmitted on the IEC-60870-5-104S network. The *EventType870* structure is the one to use when events carry a date and time stamp formatted as Greenwich Mean Time (GMT). This structure can hold up to ten (10) separate GMT time-stamped events in an array based on the *EventElement870* data object. Using this structure, up to ten (10) events can be sent to the module in the place of one regular output data image block.

Name	Data Type	Description
EventCommand_GMT	BOOL	Set to 1 to trigger Block 9958 (GMT Event Block) data transfer
EventCount_GMT	INT	Number of events to be sent in current 9958 block
Event_GMT	EventElement870[10]	

See the description of the *EventElement870 (page 62)* data object for details about the data sent as part of a GMT time-stamped event.

GMT Event Element Data Object (EventElement870)

EventElement870 is a low-level data object that holds and organizes all the data required for a single GMT time-stamped event. This low-level structure is used by the mid-level *EventType870* data object to create an array of up to ten (10) events that can be moved to the module in a single output data block transfer.

Name	Data Type	Description
DBIndex	INT	Point index in the module's database - Corresponds to the order of point definition in the Data Type section of the configuration file
ASDU	INT	1=M_SP, 3=M_DP, 5=M_ST, 9=M_ME_NA, 11=M_ME_NB, 15=M_IT
Qualifier	INT	Qualifier code used for ASDU types 5, 9, 11 and 15
Year	INT	Event Year (four digits year ex: 2006)
Month	INT	Event Month (1 to 12)
Day	INT	Event Day (1to 31)
Hour	INT	Event Hour (0 to 23)
Minute	INT	Event Minute (0 to 59)
Seconds_Milliseconds	INT	Event Seconds and Miliseconds in scaled integer format (0 to 59999) Example => 59999 = 59 seconds and 999 milliseconds
Data	INT[6]	Data associated with the event (point value)

Event Block 9958 for UTC Time Data Object (EventTypeUTC870)

The *EventTypeUTC870* mid-level data object is used as part of the higher-level *Control870* data object. *EventTypeUTC870* uses the lower-level *EventElementUTC870* data object as part of it's structure.

EventTypeUTC870 is one of two data structures that support moving time-stamped events from the processor to the module so those events can be transmitted on the IEC-60870-5-104S network. The *EventTypeUTC870* structure is the one to use when events carry a date and time stamp formatted as Coordinated Universal Time (UTC), such as event data received from Rockwell Automation 1756 SOE Sequence of Events modules. This structure can hold up to ten (10) separate UTC time-stamped events in an array based on the *EventElementUTC870* data object. Using this structure, up to ten (10) events can be sent to the module in the place of one regular output data image block.

Name	Data Type	Description
EventCommand_GMT	BOOL	Set to 1 to trigger Block 9958 (GMT Event Block) data transfer
EventCount_GMT	INT	Number of events to be sent in current 9958 block
Event_GMT	EventElement870[10]	

See the description of the *EventElement870 (page 62)* data object for details about the data sent as part of a GMT time-stamped event.

UTC Event Element Data Object (EventElementUTC870)

EventElementUTC870 is a low-level data object that holds and organizes all the data required for a single UTC time-stamped event. This low-level structure is used by the mid-level *EventTypeUTC870* data object to create an array of up to ten (10) events that can be moved to the module in a single output data block transfer.

Name	**Data Type**	**Description**
DBIndex	INT	Point index in the module's database - Corresponds to the order of point definition in the Data Type section of the configuration file
ASDU	INT	1=M_SP, 3=M_DP, 5=M_ST, 9=M_ME_NA, 11=M_ME_NB, 15=M_IT
Qualifier	INT	Qualifier code used for ASDU types 5, 9, 11 and 15
Year	INT	Event Year (This value should be FFFF, hex, or -1, decimal)
UTC_Time	DINT[2]	Event Time in 64-bit UTC format
Reserved	INT	Reserved
Data	INT[6]	Data associated with the event (point value)

Read Time Block 9970 Data Object (ReadTimeType870)

The *ReadTimeType870* mid-level data object is used as part of the higher-level *Control870* data object. *ReadTimeType870* uses the lower-level *TimeType870* data object as part of it's structure. This data structure's purpose is to hold and organize date and time data brought from the module into the ControlLogix processor.

Since the module acts as an IEC-60870-5-104 Server, the module time can be updated across the IEC network by a remote IED Client application. This special 9970 Read Time Block provides a way of synchronizing the date and time on the processor with that of the IEC network.

Name	**Data Type**	**Description**
ReadTimeCommand	BOOL	Set to 1 to trigger block 9970 (Read Module Time)
Time	TimeType870	Time data read from module's clock

Set Time Block 9971 Data Object (SetTimeType870)

The *SetTimeType870* mid-level data object is used as part of the higher-level *Control870* data object. *SetTimeType870* uses the lower-level *TimeType870* data object as part of it's structure. This data structure's purpose is to hold and organize date and time so that it can be sent from the ControlLogix processor to the module to synchronize the module clock with the processor clock. You might want to use this function if the remote IEC 104 Client does not provide time synchronization information to the module through the IEC network.

Name	Data Type	Description
SetTimeCommand	BOOL	Set to 1 to trigger block 9970 (Read Module Time)
Time	TimeType870	Time data read from module's clock

Date and Time Data Object (TimeType870)

The *TimeType870* low-level data object is used as part of the mid-level objects, ReadTimeType870 and SetTimeType870, which are used to create the higher-level *Control870* data object. This data structure's purpose is to provide a single set of controller tags to hold and organize date and time information.

Name	Data Type	Description
Year	INT	
Month	INT	
Day	INT	
Hour	INT	
Minute	INT	
Seconds	INT	
Milliseconds	INT	

3.1.4 Block Transfer Data Object (Backplane870)

The *Backplane870* mid-level data object is used to build the top-level *ModuleDef870* data object. The *Backplane870* mid-level data object holds and organizes the variables required to control input and output image block transfers between the processor and the MVI56-104S module.

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
BootTimer	TIMER	Timer to clear WarmBoot and ColdBoot

3.1.5 Utility Data Object (Util870)

The *Util870* mid-level data object is used to build the top-level *ModuleDef870* data object. The *Util870* mid-level data object holds and organizes the variables required to control special functions within the sample ladder logic application.

Name	Data Type	Description
OneShot_EventCommand	BOOL	Prevents successive repeat executions of 9958 Event Command Block transfers
OneShot_ReadTime	BOOL	Prevents successive repeat executions of 9970 Read Time Command Block transfers
OneShot_SetTime	BOOL	Prevents successive repeat executions of 9971 Set Time Command Block transfers
Date_Time_for_event	LINT[10]	UTC Date and Time in 64-bit format
Enable_UTC_copy_date	BOOL	Timer to clear WarmBoot and ColdBoot

3.2 Normal Data Transfer

Normal data transfer includes the paging of the user data found in the module's internal database in registers 0 to 3999 and the status data. These data are transferred through read (input image) and write (output image) blocks. Refer to the Configuring the MVI56-104S Module (page 23) chapter for a description of the data objects used with the blocks and the ladder logic required. The structure and function of each block is discussed is discussed in the following topics.

3.2.1 Read Block

This block transfers IEC output (control) data sent from the remote IEC 104 Client through the module to the ControlLogix processor. The following table outlines the structure of data contained in the input image of a normal *Read Block*.

Offset	Description	Length
0	Reserved	1
1	Write Block ID	1
2 to 201	Read Data	200
202	Program Scan Counter	1
203 to 204	Product Code	2
205 to 206	Product Version	2
207 to 208	Operating System	2
209 to 210	Run Number	2
211 to 214	Data Transfer Status	4
215	t0 Error Count	1
216	t1 Error Count	1
217	t2 Error Count	1
218	t3 Error Count	1
219	Sequence # Error Count	1
220	Bad Address Error Count	1
221	Length Error Count	1
222	Receive Frame Count	1
223	Transmit Frame Count	1
224	Socket State	1
225	Socket Open Count	1
226	Socket Close Count	1
227	Socket Connection Count	1
228	Free events in event buffer for M_SP_NA points	1
229	Free events in event buffer for M_DP_NA points	1
230	Free events in event buffer for M_ST_NA points	1
231	Free events in event buffer for M_ME_NA points	1
232	Free events in event buffer for M_ME_NB points	1
233	Free events in event buffer for M_ME_NC points	1
234	Free events in event buffer for M_IT_NA points	1
235 to 248	Spare	14
249	Read Block ID	1

The *Read Block ID* is an index value sent by the module and used by the ladder logic to determine where the current 200-word block of input data should be placed in the ControlLogix processor *IEC870S.ReadData* controller tag array. Each input data block transfer can move up to 200 words of user application data (*Read Block* offsets 2 to 201) from the module to the processor. In addition to moving user data, the block also contains module status data. This status data is transferred with each new input image block and can be used for module diagnostics.

3.2.2 Write Block

This block transfers IEC input (monitor) data to be sent to the remote IEC 104 Client through the module from the ControlLogix processor. The following table outlines the structure of data contained in the output image of a normal *Write Block*.

Offset	Description	Length
0	Write Block ID	1
1 to 200	Write Data	200
201 to 247	Spare	47

The *Write Block ID* is sent in the *Read Block* as an index value used by the ladder logic to determine where the current 200-word block of output data should be taken from the ControlLogix processor *IEC870S.WriteData* controller tag array. Each output data block transfer can move up to 200 words of user application data (*Write Block* offsets 1-200) from the processor to the module.

During normal operation, the module sequentially sends *Read Blocks* and requests *Write Blocks*. For example, if the application uses three read and two write blocks, the sequence will be as follows:

R1W1→R2W2→R3W1→R1W2→R2W1→R3W2→R1W1→

This sequence will continue until interrupted by special function write block numbers sent by the controller or operator control through the module's Configuration/Debug port.

3.3 Special Function Blocks

Special Function Blocks are used to provide optional module functions. The current version of the software supports seven special function blocks:

1 Output Data Initialization
2 Event Messages using GMT Time
3 Event Messages using UTC Time
4 Read Module's Time into Processor
5 Write Processor's Time out to Module
6 Warm Boot
7 Cold Boot

3.3.1 Output Data Initialization (1000 to 1019) Blocks

The module can be configured to initialize its internal IEC Input databases, the Monitor Data that will be sent to the remote IEC Client, to the values stored in the ControlLogix processor *IEC870.WriteData* controller tag array at the time the module is started or rebooted before it begins to respond to data requests from the remote Client. This feature requires ladder logic support. If the configuration parameter "Initialize Output Data" in the IEC8704S.CFG configuration file is set to "1" (1 equals "Yes"),then, whenever the module performs a restart or reboot operation, it will send a set of one or more special block ID requests to the processor. These blocks must be handled by the ladder logic and return the requested monitor data. Here is the format of an *Initialize Output Data Read Block*.

Offset	**Description**	**Length**
0	Reserved	1
1	1000 to 1020	1
2 to 248	Spare	247
249	1000 to 1020	1

The value in block offset 249 represents the output data set requested and is an offset used by special function logic to determine where the current 200-word block of initialization data should be taken from the ControlLogix processor *IEC870S.WriteData* controller tag array. The module will request only the amount of data set in the user configuration parameter *Write Register Count* in the *IEC8704S.CFG* configuration file. Special logic must respond to each special input block request by sending a corresponding response output block in the following format.

Offset	**Description**	**Length**
0	1000 to 1020	1
1 to 200	Output Data	200
201 to 247	Spare	47

The IEC monitor data received in the special write block will be put into the proper place in the module's IEC databases according to the setting in the configuration file.

Note: If the "Initialize Output Data" parameter is set to "1" ("Yes") and the special ladder logic required to process Block IDs 1000 through 1019 does not exist in your current program, the module will fail to complete its initialization process and will not begin data transfer operations. The standard ladder logic sample includes an example rung that shows how to process these special Block ID codes.

3.3.2 Event Messages (9958) Blocks

Block ID 9958 is reserved to send Event Messages from the processor to the module. Each block can send up to 10 events to the module in each block transfer.. If a value of *9958* is placed in the *Write Block ID* of the output image, event messages are sent from the processor to the module. For more information about IEC events, refer to Events (page 131).

The module supports a buffer queue of 99 events per data type. When the queue is full for a particular data type is full, the module will delete the oldest event in the queue if a new event is received.

This block should be used only to pass events with a predefined time-stamp (the module will automatically send time-stamped events when monitor database values change). While using block 9958, disable the events for those specific points (refer to Group Codes (page 49)) to avoid multiple event generation (caused by point value update through both the database and *Block ID 9958*).

The original firmware supported only *Greenwich Mean Time (GMT)* format time-stamps. Beginning with firmware version 1.20 and later, a *Coordinated Universal Time (UTC)* time-stamp option was made available. Now there are two versions of *Block ID 9958*, one for *GMT* time-stamps and one for *UTC* time-stamps. Be sure to use the correct one for your application.

If you follow the examples in the sample ladder logic, it is easy to select which 9958 block structure to use. Use the controller tag structures, *IEC870S.Control.EventBlock_GMT*, for GMT time-stamped events. Use the controller tag structures, *IEC870S.Control.EventBlock_UTC* for UTC time-stamped events.

The following topics show the differences in block formats between these two types of *9958* blocks and define the controller tag structures associated with them.

9958 GMT Time Event Write Block Format

Here is the *Write Block* format for *Block ID 9958* that moves *GMT* formatted time-stamped events.

Word Offset in Block	**Data Field(s)**	**Description**
0	Write Block ID	This field contains the value of 9958 identifying the block type to the module.
1	Event Count	Number of events present in the block. Valid Values: 1 to 10.
2	Event #1	Event data to add to event message queue.
17	Event #2	Event data to add to event message queue.
32	Event #3	Event data to add to event message queue.
47	Event #4	Event data to add to event message queue.
63	Event #5	Event data to add to event message queue.
79	Event #6	Event data to add to event message queue.
95	Event #7	Event data to add to event message queue.
111	Event #8	Event data to add to event message queue.
127	Event #9	Event data to add to event message queue.
143	Event #10	Event data to add to event message queue.

Here is the structure of each *GMT* time-stamped event record in the block.

Word Offset in Event Record	**Data Field(s)**	**Description**
0	DB Index	This is the index for the point in the module's database. This corresponds to the order of point definition for the module data types. This is not the point address for the event. For example, to refer to the third configured point, enter a value of 2 (first event is 0).
1	ASDU	This is the ASDU data type for the event message. Valid entries for this field are as follows: 1=single-point 3=double-point 5=step 9=normalized 11=scaled 13 = short floating point 15=integrated total
2	Qualifier	This is the qualifier code for the event message. This parameter is only used for ASDU types 5, 9, 11 and 15. Refer to the IEC Protocol Specification for a full listing of valid qualifier codes for one of these ASDU types.
3	Year	This field contains the four-digit year for this event.
4	Month	This field contains the month value for the event. Valid Values: 1 to 12
5	Day	This field contains the day value for the event. Valid Values: 1 to 31
6	Hour	This field contains the hour value for the event. Valid Values: 0 to 23
7	Minute	This field contains the minute value for the event. Valid Values: 0 to 59
8	Seconds and Milliseconds	This field contains the seconds and milliseconds value for the event. Valid Values: 0 to 59,999 (59 seconds and 999 milliseconds).
9 through 14	Data	These words contain the data for the event. For single- and double-point, step, and measured value events, the first word is used. For integrated total events, the first two words are used.

9958 - UTC Time Event Write Block Format

Word Offset in Block	Data Field(s)	Description
0	Write Block ID	This field contains the value of 9958 identifying the block type to the module.
1	Event Count	Number of events present in the block. Valid Values: 1 to 10.
2	Event #1	Event data to add to event message queue.
17	Event #2	Event data to add to event message queue.
32	Event #3	Event data to add to event message queue.
47	Event #4	Event data to add to event message queue.
63	Event #5	Event data to add to event message queue.
79	Event #6	Event data to add to event message queue.
95	Event #7	Event data to add to event message queue.
111	Event #8	Event data to add to event message queue.
127	Event #9	Event data to add to event message queue.
143	Event #10	Event data to add to event message queue.

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

Word Offset in Event Record	Data Field(s)	Description
0	DB Index	This is the index for the point in the module's database. This corresponds to the order of point definition for the module data types. This is not the point address for the event. For example, to refer to the third configured point, enter a value of 2 (first event is 0).
1	ASDU	This is the ASDU data type for the event message. Valid entries for this field are as follows: 1=single-point 3=double-point 5=step 9=normalized 11=scaled 13 = short floating point 15=integrated total
2	Qualifier	This is the qualifier code for the event message. This parameter is only used for ASDU types 5, 9, 11 and 15. Refer to the IEC Protocol Specification for a full listing of valid qualifier codes for one of these ASDU types.
3	Year	The value in this word should always be set to FFFFhex (-1 decimal) to indicate this block is a UTC time-formatted block.
4 through 7	UTC Time	UTC time is a 64-bit counter in microseconds since January 1, 1972 in little endian byte order, as used in the ControlLogix processor. This time value is converted in the module to produce a valid IEC 60870-5-104 time value, which can be sent to remote Clients.
8	Reserved	Reserved
9 through 14	Data	These words contain the data for the event. For single- and double-point, step, and measured value events, the first word is used. For integrated total events, the first two words are used.

3.3.3 Read Module's Time to Processor (9970) Block

Block 9970 reads the module's current time.

9970 Read Time Write Block Format

The following table shows the block format for write:

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

9970 Read Time Read Block Format

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

Word Offset in Block	Data Field(s)	Description
0	Reserved	Reserved
1	Write Block ID	Block ID of next write block.
2	Year	This field contains the four-digit year for the new time value.
3	Month	This field contains the month value for the new time. Valid Values: 1 to 12.
4	Day	This field contains the day value for the new time. Valid Values: 1 to 31.
5	Hour	This field contains the hour value for the new time. Valid Values: 0 to 23
6	Minute	This field contains the minute value for the new time. Valid Values: 0 to 59.
7	Seconds	This field contains the second value for the new time. Valid Values: 0 to 59.
8	Milliseconds	This field contains the millisecond value for the new time. Valid Values: 0 to 999.
9 to 248	Reserved	Reserved
249	Read Block ID	This field contains a value of 9970

3.3.4 Set Module's Time From Processor (9971) Block

Block 9971 can be used to set the module time using the processor's time. The following table shows the block format for write.

9971 Set Time Write Block Format

Word Offset in Block	Data Field(s)	Description
0	Write Block ID	This word will contain the value of 9971.
1	Year	This field contains the four-digit year for the new time value.
2	Month	This field contains the month value for the new time. Valid Values: 1 to 12.
3	Day	This field contains the day value for the new time. Valid Values: 1 to 31.
4	Hour	This field contains the hour value for the new time. Valid Values: 0 to 23
5	Minute	This field contains the minute value for the new time. Valid Values: 0 to 59.
6	Seconds	This field contains the second value for the new time. Valid Values: 0 to 59.
7	Milliseconds	This field contains the millisecond value for the new time. Valid Values: 0 to 999.

3.3.5 Warm Boot (9998) Block

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. This will force the module to read the new configuration information and to restart. The following table describes the format of the control block.

Offset	Description	Length
0	9998	1
1 to 247	Spare	247

Because many of the parameters set in the configuration file require the program to restart, this function works the same as the cold-boot function. It will cause the module to exit and restart the program.

3.3.6 Cold Boot (9999) Block

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 following table describes the format of the control block.

Offset	Description	Length
0	9999	1
1 to 247	Spare	247

4 Diagnostics and Troubleshooting

In This Chapter

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

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

4.1 Reading Status Data from the Module

The MVI56-104S module returns a 26-word Status Data block that can be used to determine the module's operating status. This data can be located in the module's database at registers at the location specified in the configuration. This data is transferred to the ControlLogix processor continuously with each read block.

The Configuration/Debug port provides the following functionality:

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

4.1.1 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.

4.1.2 The Configuration/Debug Menu

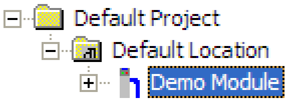
The Configuration and Debug menu for this module is arranged as a tree structure, with the Main Menu at the top of the tree, and one or more sub-menus for each menu command. The first menu you see when you connect to the module is the Main menu.

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.

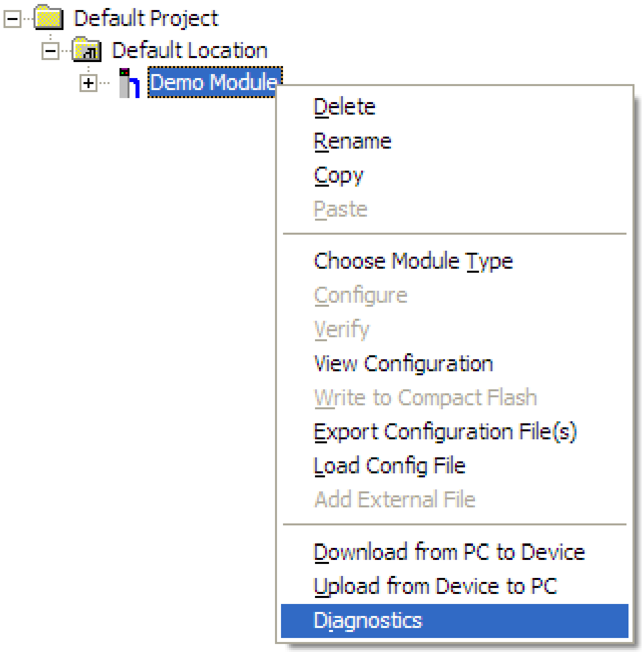
Using the Diagnostic Window in ProSoft Configuration Builder

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

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

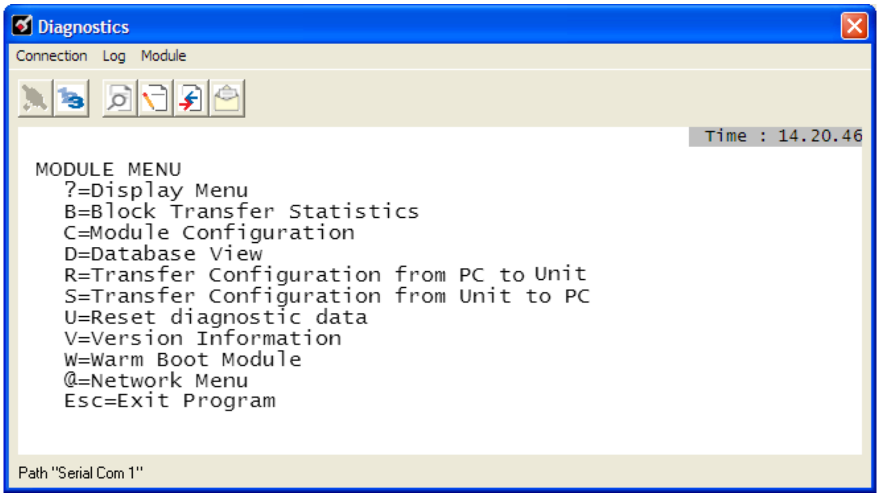


2 On the shortcut menu, choose **DIAGNOSTICS.**



This action opens the **DIAGNOSTICS** dialog box.

3 Press **[?]** to open the Main Menu.



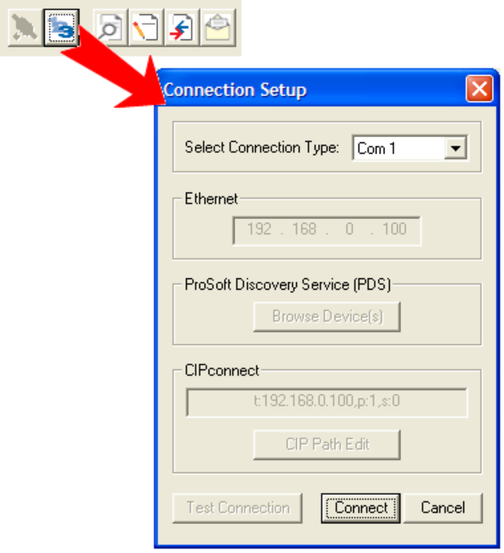
```
                                                  Time : 14.20.46

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
```

Path "Serial Com 1"

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



Connection Setup

Select Connection Type: Com 1

Ethernet: 192 . 168 . 0 . 100

CIPconnect: t:192.168.0.100,p:1,s:0

2 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.

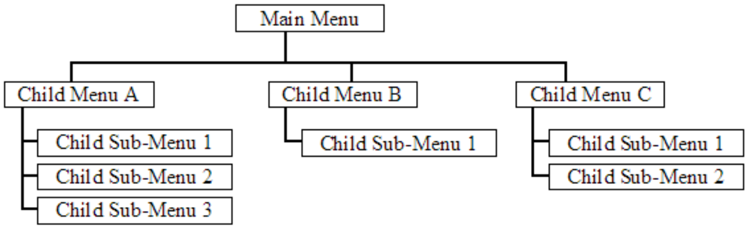
3 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.

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

Navigation

All of the 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

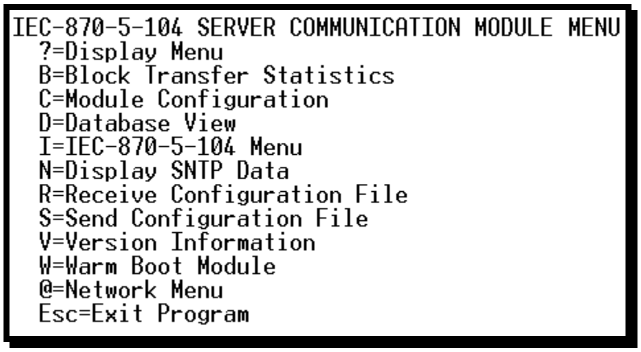
The keyboard commands on these menus are almost always non-case sensitive. You can enter most commands in lower case or capital letters.

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.



```
IEC-870-5-104 SERVER COMMUNICATION MODULE MENU
  ?=Display Menu
  B=Block Transfer Statistics
  C=Module Configuration
  D=Database View
  I=IEC-870-5-104 Menu
  N=Display SNTP Data
  R=Receive Configuration File
  S=Send Configuration File
  V=Version Information
  W=Warm Boot Module
  @=Network Menu
  Esc=Exit Program
```

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

Viewing Block Transfer Statistics

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

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

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

Viewing Module Configuration

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

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

Opening the Database Menu

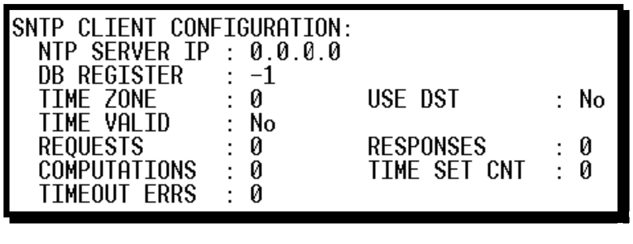
Press **[D]** to open the Database View menu. Use this menu command to view the current contents of the module's database.

Opening the IEC-870-5-104 Server Menu

Press **[I]** to open the IEC-870-5-104 Server Menu. Use this command to view all data associated with the IEC-870-5-104 server driver.

Viewing SNTP Status

Press **[N]** to view configuration information about the SNTP client.



```
SNTP CLIENT CONFIGURATION:
  NTP SERVER IP : 0.0.0.0
  DB REGISTER   : -1
  TIME ZONE     : 0        USE DST       : No
  TIME VALID    : No
  REQUESTS      : 0        RESPONSES     : 0
  COMPUTATIONS  : 0        TIME SET CNT  : 0
  TIMEOUT ERRS  : 0
```

Refer to SNTP Support for more information on configuring and using this function.

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 (page 51).

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 (page 51).

Viewing Version Information

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

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

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

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

Warm Booting the Module

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

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

Opening the Network Menu

Press **[@]** to open the network menu. The network menu allows you to send, receive and view the WATTCP.CFG file that contains the IP, gateway and other network specification information. You can find more information about the commands on this menu in the Network Menu (page 90) section.

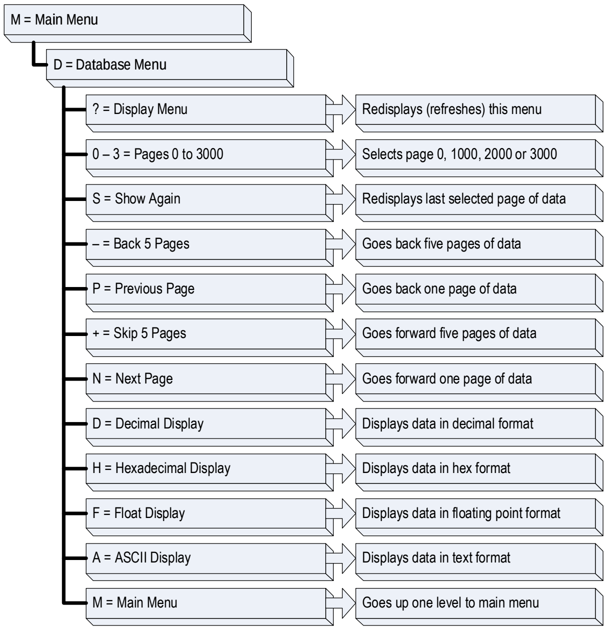
Exiting the Program

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 memory 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

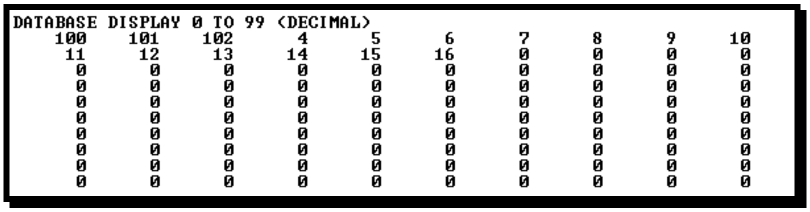
To view sets of register pages, use the keys described below:

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

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



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

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

Moving Back Through 5 Pages of Registers

Press **[-]** from the Database View menu to skip five pages back in the database to see the previous 100 registers of data.

Moving Forward Through 5 Pages of Registers

Press **[+]** from the Database View menu to skip five pages ahead in the database to see the next 100 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.

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

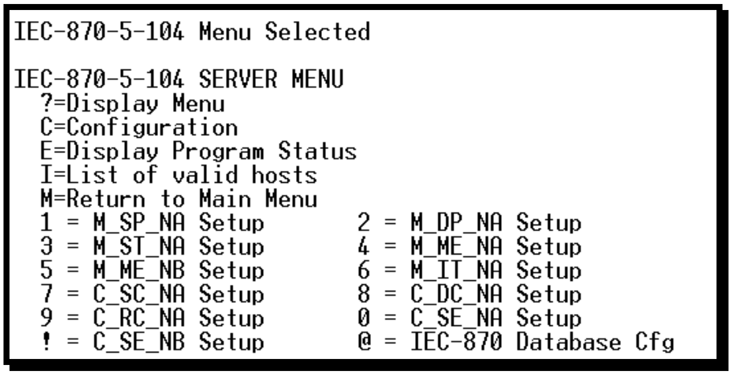
Press **[A]** to display the data on the current page in ASCII format. This is useful for regions of the database that contain ASCII data.

Returning to the Main Menu

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

4.1.5 IEC-870-5-104 Server Menu

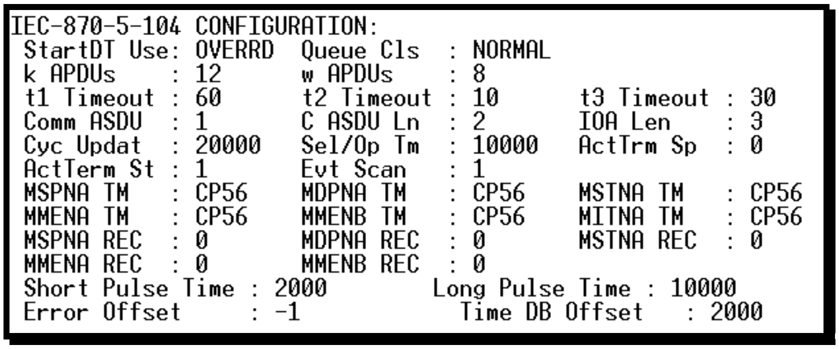
Press **[I]** from the main menu to open the IEC-870-5-104 Server Menu.



```
IEC-870-5-104 Menu Selected

IEC-870-5-104 SERVER MENU
  ?=Display Menu
  C=Configuration
  E=Display Program Status
  I=List of valid hosts
  M=Return to Main Menu
  1 = M_SP_NA Setup       2 = M_DP_NA Setup
  3 = M_ST_NA Setup       4 = M_ME_NA Setup
  5 = M_ME_NB Setup       6 = M_IT_NA Setup
  7 = C_SC_NA Setup       8 = C_DC_NA Setup
  9 = C_RC_NA Setup       0 = C_SE_NA Setup
  ! = C_SE_NB Setup       @ = IEC-870 Database Cfg
```

IEC-870-5-104 Configuration Menu

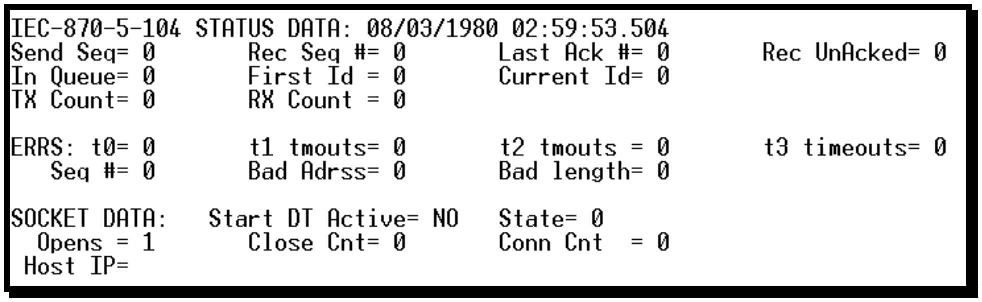
From the IEC-870-5-104 Server Menu, press **[C]** to open the IEC-870-5-104 Configuration Menu. This menu shows the module parameters in the configuration file.



```
IEC-870-5-104 CONFIGURATION:
 StartDT Use: OVERRD  Queue Cls  : NORMAL
 k APDUs    : 12      w APDUs    : 8
 t1 Timeout : 60      t2 Timeout : 10      t3 Timeout : 30
 Comm ASDU  : 1       C ASDU Ln  : 2       IOA Len    : 3
 Cyc Updat  : 20000   Sel/Op Tm  : 10000   ActTrm Sp  : 0
 ActTerm St : 1       Evt Scan   : 1
 MSPNA TM   : CP56    MDPNA TM   : CP56    MSTNA TM   : CP56
 MMENA TM   : CP56    MMENB TM   : CP56    MITNA TM   : CP56
 MSPNA REC  : 0       MDPNA REC  : 0       MSTNA REC  : 0
 MMENA REC  : 0       MMENB REC  : 0
 Short Pulse Time : 2000        Long Pulse Time : 10000
 Error Offset     : -1            Time DB Offset   : 2000
```

IEC-870-5-104 Status Data

From the IEC-870-5-104 Server Menu press **[E]** to display the IEC-870-5-104 Status Data screen. Refer to the Status section for more information about these values.



```
IEC-870-5-104 STATUS DATA: 08/03/1980 02:59:53.504
Send Seq= 0       Rec Seq #= 0       Last Ack #= 0       Rec UnAcked= 0
In Queue= 0       First Id = 0       Current Id= 0
TX Count= 0       RX Count = 0

ERRS: t0= 0       t1 tmouts= 0       t2 tmouts = 0       t3 timeouts= 0
   Seq #= 0       Bad Adrss= 0       Bad length= 0

SOCKET DATA:   Start DT Active= NO   State= 0
  Opens = 1       Close Cnt= 0       Conn Cnt  = 0
 Host IP=
```

Viewing Priority Queues

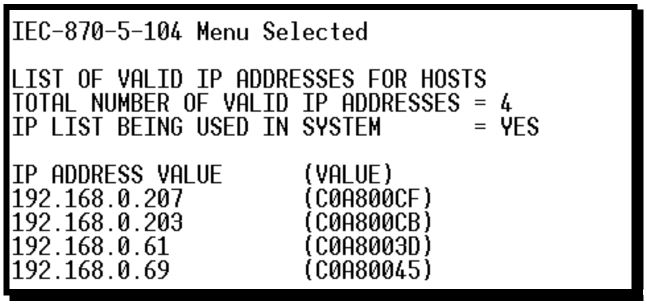
Press **[F]** to view the list of configured priority queues. Use this command to see the relative priority for each database type.

Viewing Invalid State Monitoring

Press **[G]** to view configuration for invalid point monitoring. Use this feature to determine the individual IV quality bit status of each point you configured.

Lists of Valid Hosts

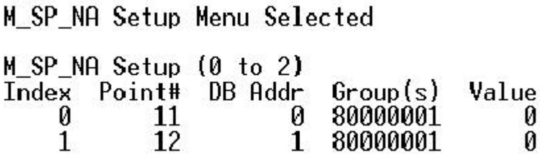
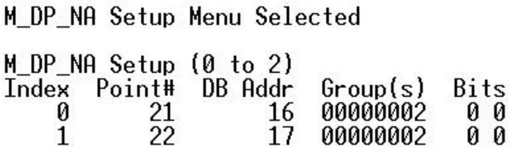
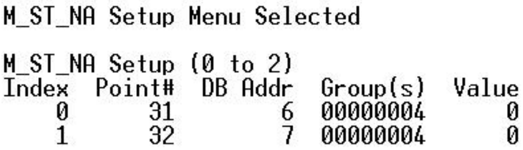
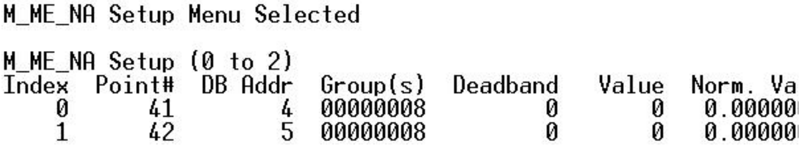
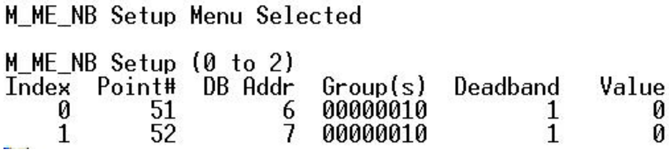
From the IEC-870-5-104 Server Menu, press **[I]** to display the List of Valid Hosts. These values are taken from the configuration file. The IP addresses will be displayed only if the **USE IP LIST** parameter is set to YES. (page 32)

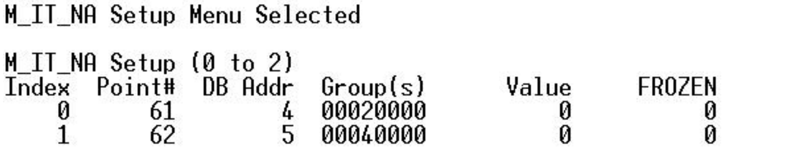


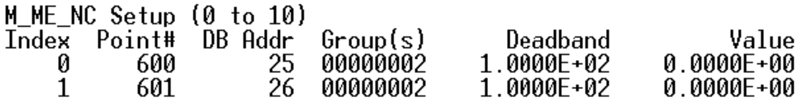
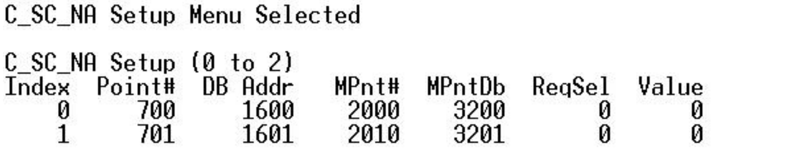
```
IEC-870-5-104 Menu Selected

LIST OF VALID IP ADDRESSES FOR HOSTS
TOTAL NUMBER OF VALID IP ADDRESSES = 4
IP LIST BEING USED IN SYSTEM       = YES

IP ADDRESS VALUE       (VALUE)
192.168.0.207          (C0A800CF)
192.168.0.203          (C0A800CB)
192.168.0.61           (C0A8003D)
192.168.0.69           (C0A80045)
```

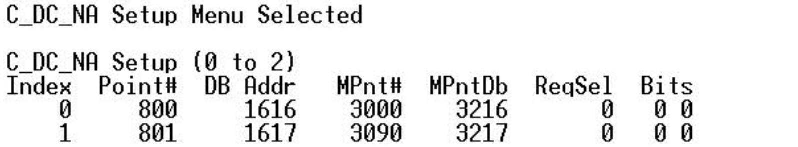
Viewing Data Type Setup

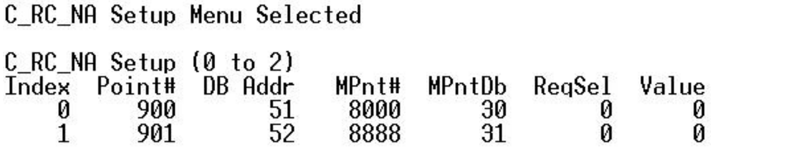
To view setup information for each data type, press the matching key from the Menu.

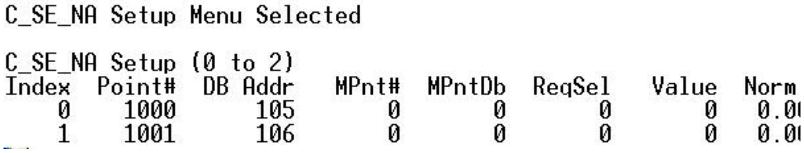
Key	Data Type	Screen Example
1	M_SP_NA	 M_SP_NA Setup Menu Selected M_SP_NA Setup (0 to 2) Index Point# DB Addr Group(s) Value 0 11 0 80000001 0 1 12 1 80000001 0
2	M_DP_NA	 M_DP_NA Setup Menu Selected M_DP_NA Setup (0 to 2) Index Point# DB Addr Group(s) Bits 0 21 16 00000002 0 0 1 22 17 00000002 0 0
3	M_ST_NA	 M_ST_NA Setup Menu Selected M_ST_NA Setup (0 to 2) Index Point# DB Addr Group(s) Value 0 31 6 00000004 0 1 32 7 00000004 0
4	M_ME_NA	 M_ME_NA Setup Menu Selected M_ME_NA Setup (0 to 2) Index Point# DB Addr Group(s) Deadband Value Norm. Va 0 41 4 00000008 0 0 0.00000 1 42 5 00000008 0 0 0.00000
5	M_ME_NB	 M_ME_NB Setup Menu Selected M_ME_NB Setup (0 to 2) Index Point# DB Addr Group(s) Deadband Value 0 51 6 00000010 1 0 1 52 7 00000010 1 0

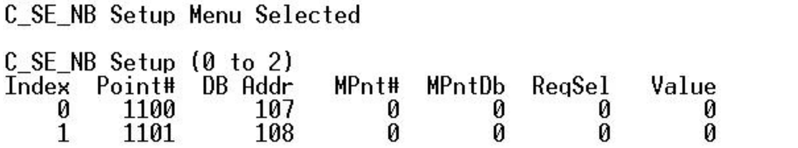
<table>
<tr><th>Key</th><th>Data Type</th><th>Screen Example</th></tr>
<tr><td>6</td><td>M_IT_NA</td><td><pre>
M_IT_NA Setup Menu Selected

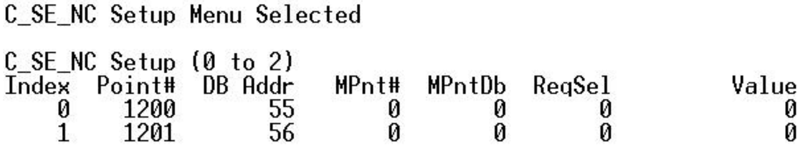
M_IT_NA Setup (0 to 2)
Index Point# DB Addr Group(s)   Value   FROZEN
    0   61   4 00020000   0   0
    1   62   5 00040000   0   0
</pre></td></tr>
<tr><td>Shift 6</td><td>M_ME_NC</td><td><pre>
M_ME_NC Setup (0 to 10)
Index Point# DB Addr Group(s)   Deadband   Value
    0   600   25 00000002   1.0000E+02   0.0000E+00
    1   601   26 00000002   1.0000E+02   0.0000E+00
</pre></td></tr>
<tr><td>7</td><td>C_SC_NA</td><td><pre>
C_SC_NA Setup Menu Selected

C_SC_NA Setup (0 to 2)
Index Point# DB Addr   MPnt# MPntDb ReqSel Value
    0   700   1600   2000   3200   0   0
    1   701   1601   2010   3201   0   0
</pre></td></tr>
<tr><td>8</td><td>C_DC_NA</td><td><pre>
C_DC_NA Setup Menu Selected

C_DC_NA Setup (0 to 2)
Index Point# DB Addr   MPnt# MPntDb ReqSel Bits
    0   800   1616   3000   3216   0   0 0
    1   801   1617   3090   3217   0   0 0
</pre></td></tr>
<tr><td>9</td><td>C_RC_NA</td><td><pre>
C_RC_NA Setup Menu Selected

C_RC_NA Setup (0 to 2)
Index Point# DB Addr   MPnt# MPntDb ReqSel Value
    0   900   51   8000   30   0   0
    1   901   52   8888   31   0   0
</pre></td></tr>
<tr><td>0</td><td>C_SE_NA</td><td><pre>
C_SE_NA Setup Menu Selected

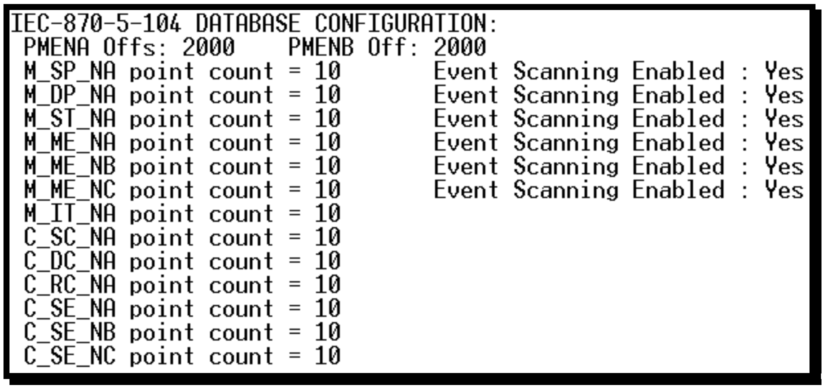
C_SE_NA Setup (0 to 2)
Index Point# DB Addr   MPnt# MPntDb ReqSel   Value Norm
    0   1000   105   0   0   0   0   0.0
    1   1001   106   0   0   0   0   0.0
</pre></td></tr>
<tr><td>Shift 1</td><td>C_SE_NB</td><td><pre>
C_SE_NB Setup Menu Selected

C_SE_NB Setup (0 to 2)
Index Point# DB Addr   MPnt# MPntDb ReqSel   Value
    0   1100   107   0   0   0   0
    1   1101   108   0   0   0   0
</pre></td></tr>
<tr><td>Shift 4</td><td>C_SE_NC</td><td><pre>
C_SE_NC Setup Menu Selected

C_SE_NC Setup (0 to 2)
Index Point# DB Addr   MPnt# MPntDb ReqSel   Value
    0   1200   55   0   0   0   0
    1   1201   56   0   0   0   0
</pre></td></tr>
</table>

Database Configuration

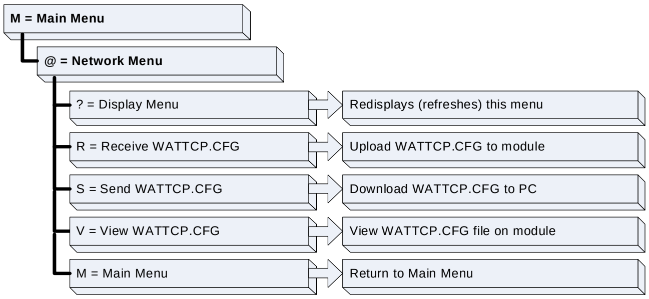
From the IEC-870-5-104 Server Menu press **[@]** to display the Database Configuration screen. It displays the number of configured points and the event configuration for each data type:



```
IEC-870-5-104 DATABASE CONFIGURATION:
 PMENA Offs: 2000    PMENB Off: 2000
 M_SP_NA point count = 10       Event Scanning Enabled : Yes
 M_DP_NA point count = 10       Event Scanning Enabled : Yes
 M_ST_NA point count = 10       Event Scanning Enabled : Yes
 M_ME_NA point count = 10       Event Scanning Enabled : Yes
 M_ME_NB point count = 10       Event Scanning Enabled : Yes
 M_ME_NC point count = 10       Event Scanning Enabled : Yes
 M_IT_NA point count = 10
 C_SC_NA point count = 10
 C_DC_NA point count = 10
 C_RC_NA point count = 10
 C_SE_NA point count = 10
 C_SE_NB point count = 10
 C_SE_NC point count = 10
```

4.1.6 Network Menu

The network menu allows you to send, receive, and view the WATTCP.CFG file that contains the IP and gateway addresses, and other network information.



Transferring WATTCP.CFG to the module

Press **[R]** to transfer a new WATTCP.CFG file from the PC to the module. Use this command to change the network configuration for the module (for example, the module’s IP address).

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

Transferring WATTCP.CFG to the PC

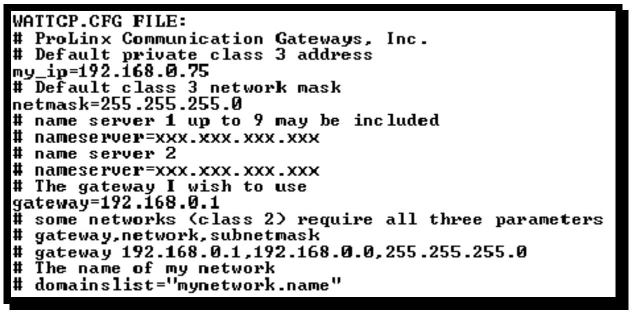
Press **[S]** to transfer the WATTCP.CFG file from the module to your PC.

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

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

Viewing the WATTCP.CFG file on the module

Press **[V]** to view the module's WATTCP.CFG file. Use this command to confirm the module's current network settings.



```
WATTCP.CFG FILE:
# ProLinx Communication Gateways, Inc.
# Default private class 3 address
my_ip=192.168.0.75
# Default class 3 network mask
netmask=255.255.255.0
# name server 1 up to 9 may be included
# nameserver=xxx.xxx.xxx.xxx
# name server 2
# nameserver=xxx.xxx.xxx.xxx
# The gateway I wish to use
gateway=192.168.0.1
# some networks (class 2) require all three parameters
# gateway,network,subnetmask
# gateway 192.168.0.1,192.168.0.0,255.255.255.0
# The name of my network
# domainslist="mynetwork.name"
```

Returning to the Main Menu

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

4.2 Ethernet LED Indicators

LED	State	Description
Data	Off	No activity on the Ethernet port.
	Green Flash	The Ethernet port is actively transmitting or receiving data.
Link	Off	No physical network connection is detected. No Ethernet communication is possible. Check wiring and cables.
	Green Solid	Physical network connection detected. This LED must be on solid for Ethernet communication to be possible.

4.3 LED Status Indicators

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

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	Not used in this application
		Off	Not used in this application
P2	Green	On	Not used in this application
		Off	Not used in this application
APP	Amber	Off	The MVI56-104S is working normally.
		On	The MVI56-104S module program has recognized a communication error on one of its ports.
BP ACT	Amber	On	The LED is on when the module is performing a write operation on the backplane.
		Off	The LED is off when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly on and off.
OK	Red/ Green	Off	The card is not receiving any power and is not securely plugged into the rack.
		Green	The module is operating normally.
		Red	The program has detected an error or is being configured. If the LED remains red for over 10 seconds, the program has probably halted. Remove the card from the rack and re-insert the card to restart the module's program.
BAT	Red	Off	The battery voltage is OK and functioning.
		On	The battery voltage is low or battery is not present. Allow battery to charge by keeping module plugged into rack for 24 hours. If BAT LED still does not go off, contact ProSoft Technology, as this is not a user serviceable item.

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

In addition to these LEDs, the module contains two LEDs under the module's door. The LED on the left (green) displays the link status. If the module is connected properly to a Hub, this LED should be illuminated. The LED on the right (amber) is the data indication LED. Whenever the module is sending or receiving data on the Ethernet interface, this LED will be illuminated.

4.4 Clearing a Fault Condition

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

To clear the condition, follow these steps:

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

4.5 Troubleshooting

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

Processor Errors

Problem Description	**Steps to take**
Processor Fault	Verify that the module is plugged into the slot that has been configured for the module in the I/O Configuration of RSLogix. Verify that the slot location in the rack has been configured correctly in the ladder logic.
Processor I/O LED flashes	This indicates a problem with backplane communications. A problem could exist between the processor and any installed I/O module, not just the <ModuleName>. Verify that all modules in the rack are correctly configured in the ladder logic.

Module Errors

Problem Description	Steps to take
BP ACT LED (not present on MVI56E modules) remains off or blinks slowly MVI56E modules with scrolling LED display: <*Backplane Status*> condition reads ERR	This indicates that backplane transfer operations are failing. Connect to the module's Configuration/Debug port to check this. To establish backplane communications, verify the following items: The processor is in RUN or REM RUN mode. The backplane driver is loaded in the module. The module is configured for read and write data block transfer. The ladder logic handles all read and write block situations. The module is properly configured in the processor I/O configuration and ladder logic.
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 IEC 60870-5-104 Server Communication Module allows ControlLogix compatible processors to interface easily with IEC 60870-5-104 protocol-compatible hosts.

The MVI56-104S module acts as an input/output module between the IEC-60870-5-104 Ethernet network and the ControlLogix processor. Data transfer between the module and the processor is asynchronous from the actions on the network. Databases are defined by the user for the module to hold data as required by the protocol.

The MVI56-104S module is a powerful communication interface for ControlLogix processors. Developed under license from Rockwell Automation, the module incorporates proprietary backplane technology that enables powerful data access to the ControlLogix processor.

5.1.1 Functional Specifications

The MVI56-104S module accepts data read/write commands from a master/client on the network. In addition, the module can be configured to generate unsolicited messages in either a spontaneous or cyclic fashion.

The module has 4000 words of user defined internal register space that are accessible to the protocol driver and to the ControlLogix processor memory. Any of the supported database types can be individually located (within the total database size limit of 4000 words) and each database point is mapped within the module and can be assigned to one or more Groups. The supported database point types are:

Database Type	Description
M_SP_NA	Monitored single-point database
M_DP_NA	Monitored dual-point database
M_ST_NA	Monitored step-point database
M_ME_NA	Monitored normalized-point database
M_ME_NB	Monitored scaled-point database
M_ME_NC	Monitored short-float point database
M_IT_NA	Monitored integrated total database
C_SC_NA	Command single-point database
C_DC_NA	Command dual-point database
C_RC_NA	Command step-point database
C_SE_NA	Command normalized-point database
C_SE_NB	Command scaled-point database
C_SE_NC	Command short-float point database

IEC 60870-5-104 Server Specifications

Operating in the Server mode, the module accepts commands from a Client(s) to read/write data stored in the module's internal registers. This data is easily and continuously transferred between the MVI56-104S module and the ControlLogix processor's data registers.

The IEC 60870-5-104 Server functionality supported by the module includes:

- The IEC 60870-5-104 communication driver is built in accordance to the approved IEC specification
- The module functions as a Server on the network supporting data read/write commands from an IEC 60870-5-104 client on the network
- One TCP server socket
- Supports unsolicited messages, either cyclic or spontaneous (cyclic rate is configurable)
- Supports clock synchronization commands from client or from the ControlLogix processor
- Supports Group interrogation (Global, General 1 to 16, Global Counters, Counters 1 to 4)
- Event timestamping configurable by type (None, 24 bit, 56 bit)
- Event queue supports 99 points for each data type
- Optional user defined list of acceptable client host IP addresses
- Configurable Common ASDU address (sector) and Information Object Address
- An IEC Interoperability Document for the MVI56 is available which fully documents data types supported by the module

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

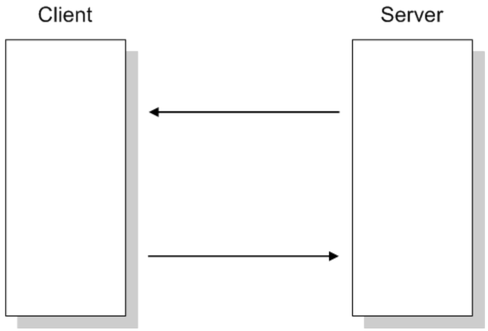
Specification	Description
Backplane Current Load	800 mA @ 5 V DC 800 mA @ 24VDC
Operating Temperature	0 to 60°C (32 to 140°F)
Storage Temperature	-40 to 85°C (-40 to 185°F)
Shock	30g Operational 50g non-operational Vibration: 5 g from 10 to 150 Hz
Relative Humidity	5% to 95% (non-condensing)
LED Indicators	Module Status Backplane Transfer Status Application Status Serial Activity
Application port (Ethernet)	
Ethernet Port (Ethernet modules)	10/100 Base-T RJ45 Connector Link and activity LED indicators Electrical Isolation 1500 V rms at 50 Hz to 60 Hz for 60 s, applied as specified in section 5.3.2 of IEC 60950: 1991 Ethernet Broadcast Storm Resiliency = less than or equal to 5000 [ARP] frames-per-second and less than or equal to 5 minutes duration
Shipped with Unit	RJ45 to DB-9M cables for each port 6-foot RS-232 configuration cable
Debug/Configuration port (CFG)	
CFG Port (CFG)	RJ45 (DB-9M with supplied cable) RS-232 only No hardware handshaking

5.2 IEC-60870-5-104 (104S) Protocol Implementation

The intent of this section is to provide a quick understanding of how the 104S module implements the IEC-60870-5-104 protocol, without going into complex details of the specification.

The IEC-60870-5-104 protocol applies to Telecontrol equipment and systems with data transmission for monitoring and controlling geographically widespread processes. This protocol consists essentially of the IEC-60870-5-101 protocol, with the addition of TCP/IP as the transport mechanism.

Any application with the IEC-60870-5-104 protocol consists of a client (Controlling Station) and one or more servers (Controlled Stations). The client constantly monitors and controls the data from each server in the TCP/IP network.



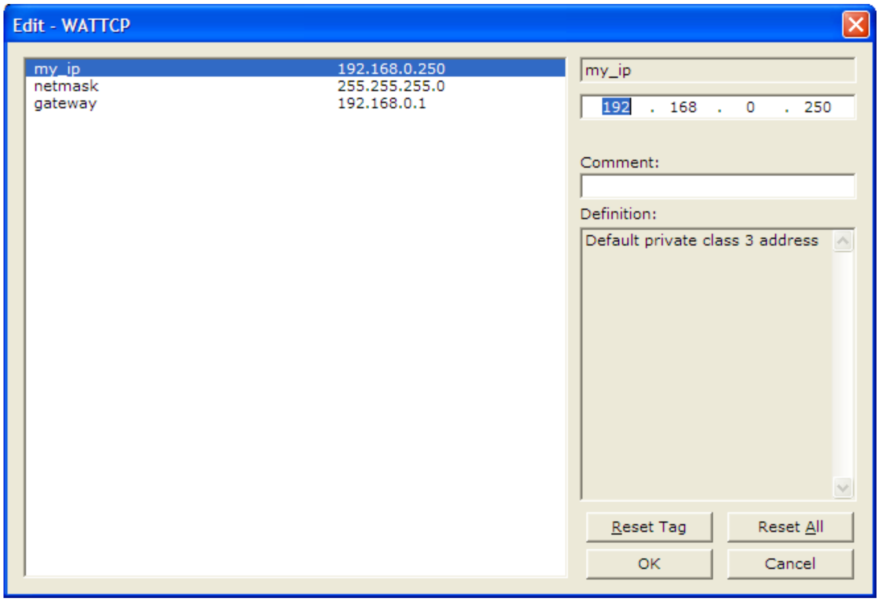
The MVI56-104S works as an IEC-60870-5-104 server; it can send monitor data, receive commands, or generate events to the client unit.

5.2.1 Module Address

The MVI56-104S module is identified at transport level (using the IP Address) and at application level (using the Common ASDU Address).

IP Address

The MVI56-104S module is identified by a unique IP address on the TCP/IP network. You must edit the WATTCP.CFG configuration file (or use the configuration tool) to enter a valid IP address. The following example lists the default contents of the WATTCP.CFG file:



```
my_ip        192.168.0.250
netmask      255.255.255.0
gateway      192.168.0.1
```

my_ip

192 . 168 . 0 . 250

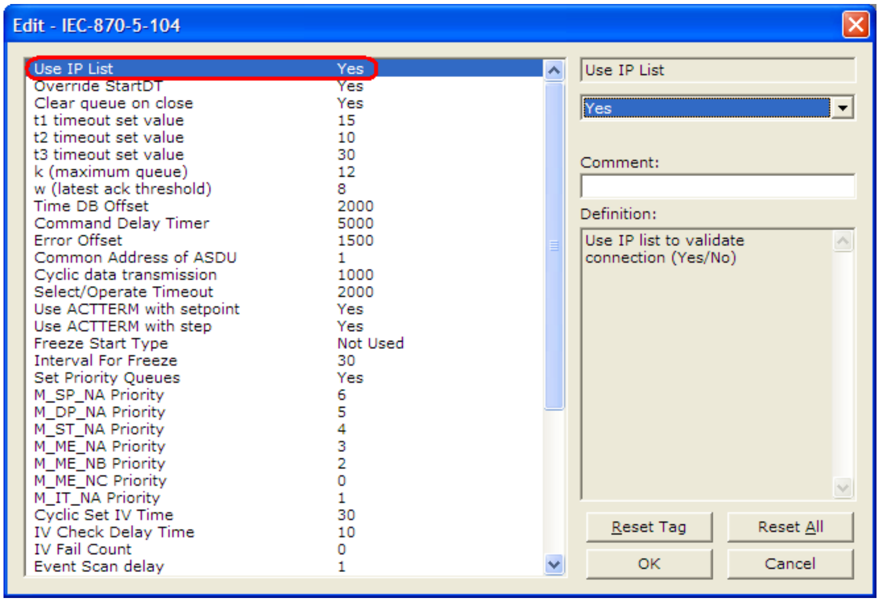
Comment:

Definition:
Default private class 3 address

In this example, the MVI56-104S module is identified by IP address 192.168.0.250 in the IEC-60870-5-104 network, with a netmask (subnet mask) of 255.255.255.0 and a default gateway address of 192.168.0.1.

Because there could be several devices in the same TCP/IP network, some applications may require a connection control (from which IP addresses the module may receive valid messages).

To restrict the units (IP addresses) from which the MVI56-104S module will accept connections, use the following parameter:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	1000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	30
IV Check Delay Time	10
IV Fail Count	0
Event Scan delay	1

Use IP List

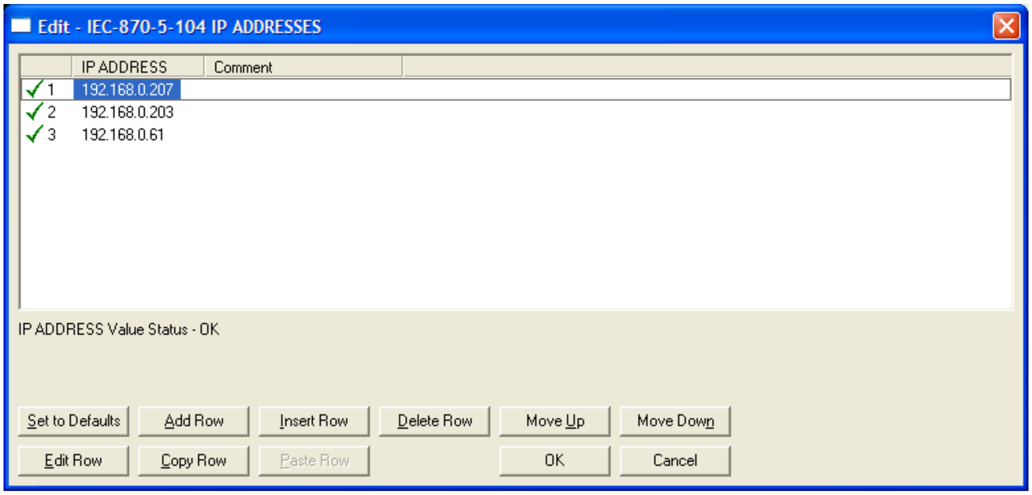
Yes

Comment:

Definition:

Use IP list to validate connection (Yes/No)

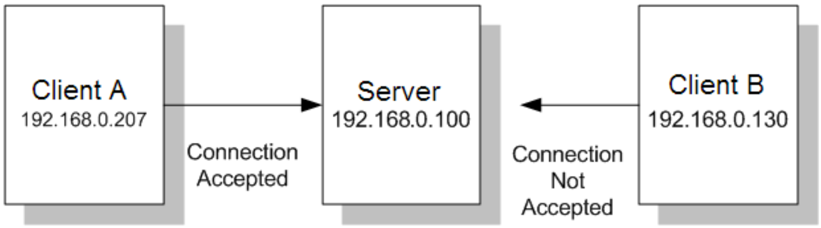
If this parameter is set as 1 (Yes), the module will only accept a connection from a client unit that is listed in the IP address list, in the following format:



	IP ADDRESS	Comment
✓ 1	192.168.0.207	
✓ 2	192.168.0.203	
✓ 3	192.168.0.61	

IP ADDRESS Value Status - OK

If the *Use IP List* parameter is set to Yes, the module will only accept a connection from one of the three IP addresses listed in the example above. The following illustration shows that the Server will accept a connection from Client A, whose address is on the list, but will reject a connection from Client B, whose address is not on the list.

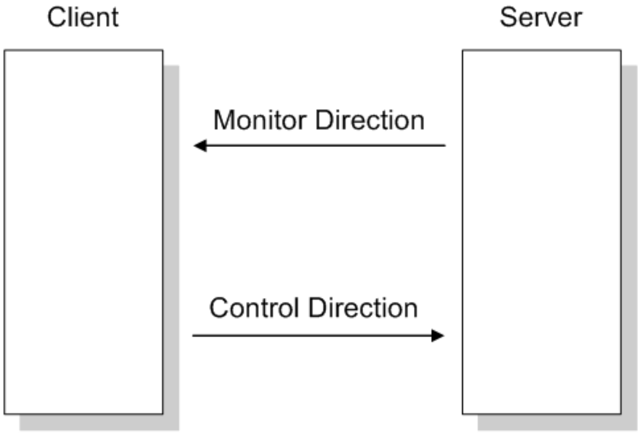


Monitor Direction and Control Direction: Point Definition

The protocol specification defines two directions of data: monitor direction and control direction.

Monitor Direction: The direction of transmission from the server to the client

Control Direction: The direction of transmission from the client to the server

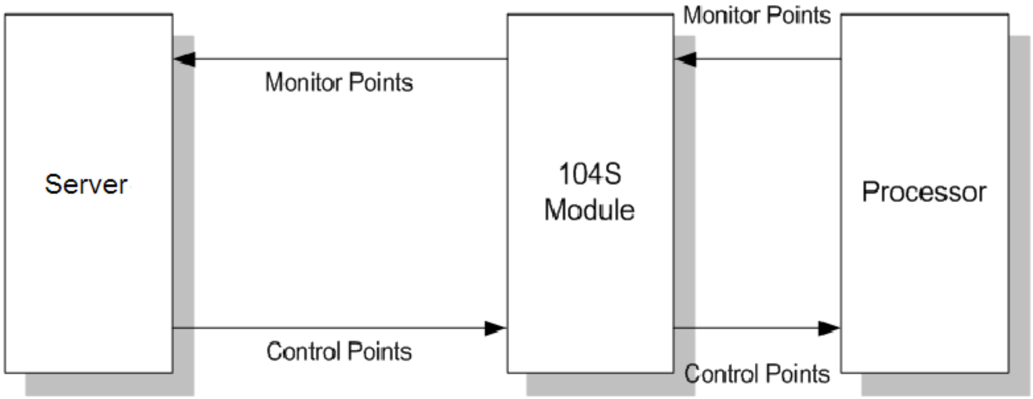


The points that are typically transferred from the server to the client are also known as **Monitor Points** (or Monitor Information Objects). The points that are typically transferred from the client to the server are also known as **Control Points** (or Command Information Objects).

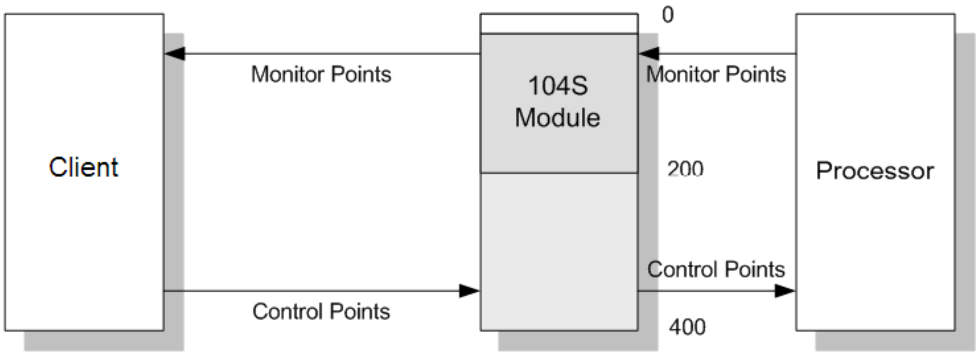
The MVI56-104S contains an internal database of 4000 words. You must associate the monitor and control points to database addresses in the MVI56-104S. To configure the points for the MVI56-104S, follow these steps:

1. Calculate the number of monitor and control points for the application.
2. Calculate the MVI56-104S database regions that are required for the application, based on the number of monitor and control points. Define two separate regions. Remember that each data type stores a different quantity of data (for example, M_SP_NA uses one bit, M_ST_NA uses one byte, and so on).
3. Configure each point within its MVI56-104S database region.
4. Configure the backplane communication between the module and the processor in order to correctly update both database regions as shown in the following illustration.

For the MVI56-104S, the control and monitor points are transferred as follows:



All points must be configured in the correct location in the MVI56-104S database in order to be properly updated from/to the processor, by configuring the control points and monitor points in separate areas of the MVI56-104S database. The following illustration shows an example configuration:

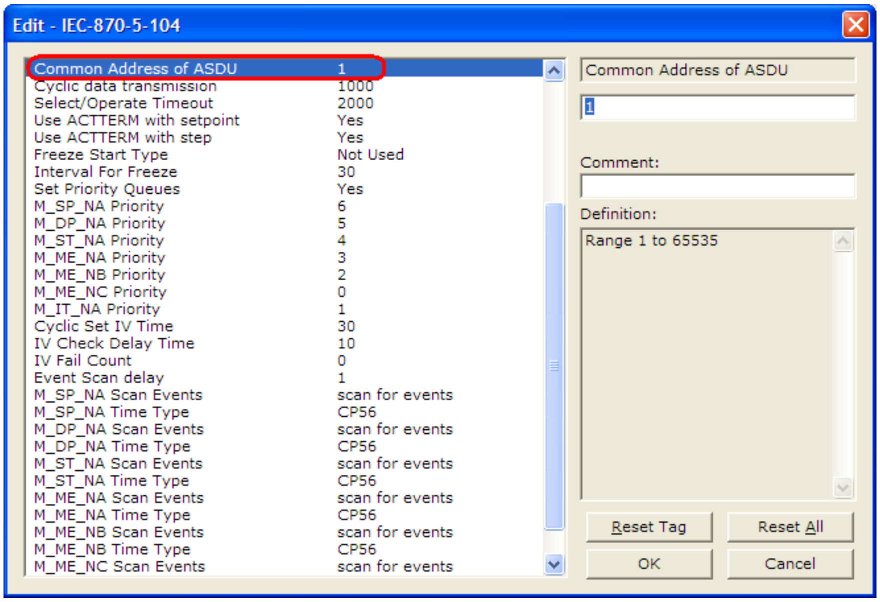


In this example, all monitor points are located between database addresses 0 and 199, and all control points are located between address 200 and 399. The backplane settings must also be configured to correctly update these database ranges. For more information on configuration, refer to [Backplane Configuration] (page 28)

Common ASDU Address

At the application level, the module is identified by the Common ASDU (Application Service Data Unit) Address. This address must match the CASDU sent by the client unit. An ASDU is a data unit that transfers information objects between the client and the server.

If the client sends a message to a different Common ASDU, the module ignores the command. To configure the Common ASDU Address for the MVI56-104S module, use the following parameter in the configuration file:



Common Address of ASDU	1
Cyclic data transmission	1000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	30
IV Check Delay Time	10
IV Fail Count	0
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	scan for events
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	scan for events
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	scan for events
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	scan for events
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	scan for events

Common Address of ASDU

1

Comment:

Definition:

Range 1 to 65535

5.2.2 Using Monitor Points

The following monitor points are supported by the MVI56-104S module:

Symbol	Description	Data Size in Database	Addressing Type
M-SP-NA	Monitored Single-Points	1 bit	Bit
M-DP-NA	Monitored Dual-Points	2 bits	Bit
M-ST-NA	Monitored Step-Points	1 byte	Byte
M-ME-NA	Monitored Measured Normalized-Points	1 word	Word
M-ME-NB	Monitored Measured Scaled-Points	1 word	Word
M-ME-NC	Monitored Measured Short Floating Points	2 words	Double-Word
M-IT-NA	Monitored Counter-Points	2 words	Double-Word

Each monitor point is identified by its Information Object Address (it should be unique for each Common ASDU Address in the network). For each monitor point, configure the following parameters:

Point # - The information object address of the point. It identifies the point in the network.

DB Address - The database location in the MVI56-104S module associated with the point. You must associate each point to a database address in the MVI56-104S module. The interpretation of this parameter depends on the point type configured. For example, for an M_SP_NA point, this value represents the bit address. For a M_ME_NA point, this value represents the Word address.

Group(s) - This is the group definition for the point. It sets how the point will be polled by the master (cyclic or group interrogation). It can also be used to enable or disable the event generation for one specific point. The group parameter is discussed in the Data Communication section.

Deadband - Sets the deadband for each Measured point. If the value changes from more than the configured deadband , the module will generate an event for this point.

IV DB Bit - This feature allows the application to set the invalid (IV) quality bit of the protocol for all the monitored ASDU types supported. If you enable this feature, the processor can determine the individual IV quality bit status of each point you configured.

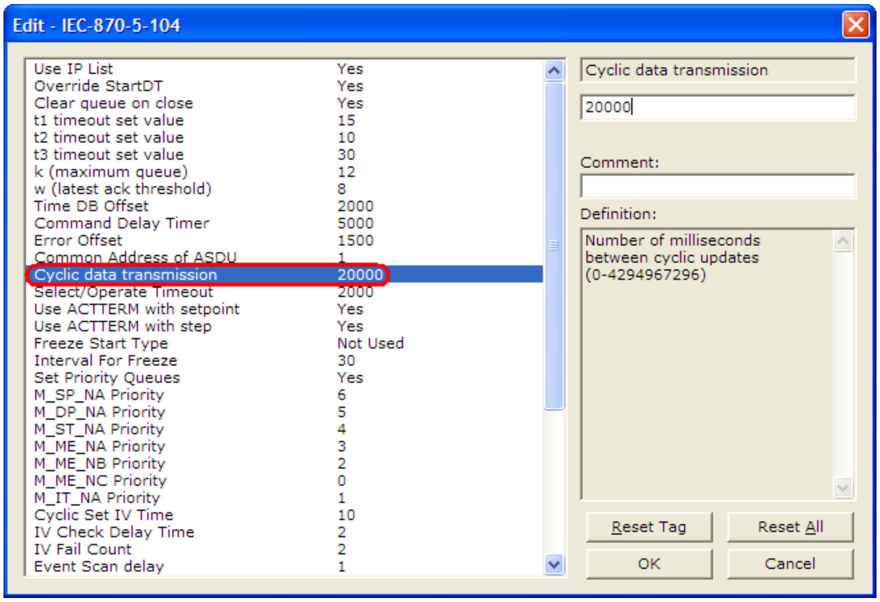
Monitor Data Transfer

Typically, you should properly configure the group code for each monitor point to define how the master will poll for the point. The group codes are defined as follows:

The Group parameter is defined as follows:

Group Code	Description
0x00000001	Interrogated by general interrogation (station or global)
0x00000002	Interrogated by group 1 interrogation
0x00000004	Interrogated by group 2 interrogation
0x00000008	Interrogated by group 3 interrogation
0x00000010	Interrogated by group 4 interrogation
0x00000020	Interrogated by group 5 interrogation
0x00000040	Interrogated by group 6 interrogation
0x00000080	Interrogated by group 7 interrogation
0x00000100	Interrogated by group 8 interrogation
0x00000200	Interrogated by group 9 interrogation
0x00000400	Interrogated by group 10 interrogation
0x00000800	Interrogated by group 11 interrogation
0x00001000	Interrogated by group 12 interrogation
0x00002000	Interrogated by group 13 interrogation
0x00004000	Interrogated by group 14 interrogation
0x00008000	Interrogated by group 15 interrogation
0x00010000	Interrogated by group 16 interrogation
0x00020000	Interrogated by general counter request
0x00040000	Interrogated by group 1 counter request
0x00080000	Interrogated by group 2 counter request
0x00100000	Interrogated by group 3 counter request
0x00200000	Interrogated by group 4 counter request
0x40000000	Disable event scanning of this point
0x80000000	Periodic/cyclic data returned from unit

The module will periodically send all points configured for periodic/cyclic poll (0x80000000) at every x milliseconds, where x is configured with the following parameter:



Edit - IEC-870-5-104

Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Cyclic data transmission

20000

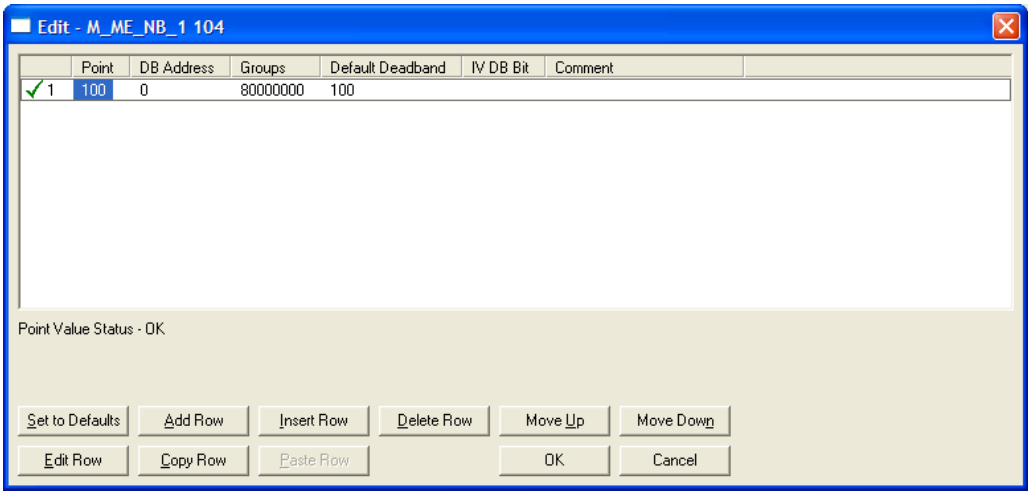
Comment:

Definition:

Number of milliseconds between cyclic updates (0-4294967296)

__Example - Periodic Monitor Polling:__

If the following point is configured for monitor polling:

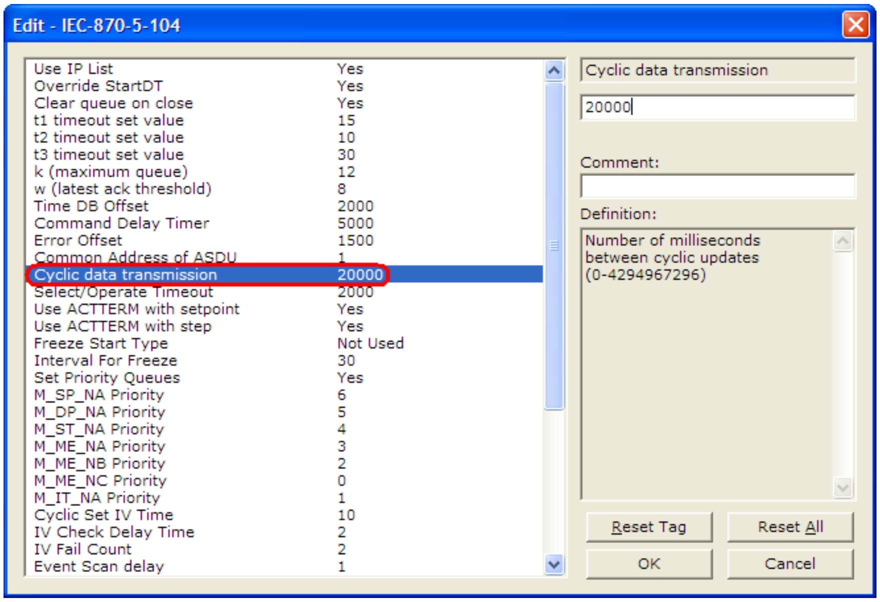


Edit - M_ME_NB_1 104

	Point	DB Address	Groups	Default Deadband	IV DB Bit	Comment
✓ 1	100	0	80000000	100		

Point Value Status - OK

If you configure the periodic polling for 10 seconds (10000 milliseconds) as follows:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Cyclic data transmission

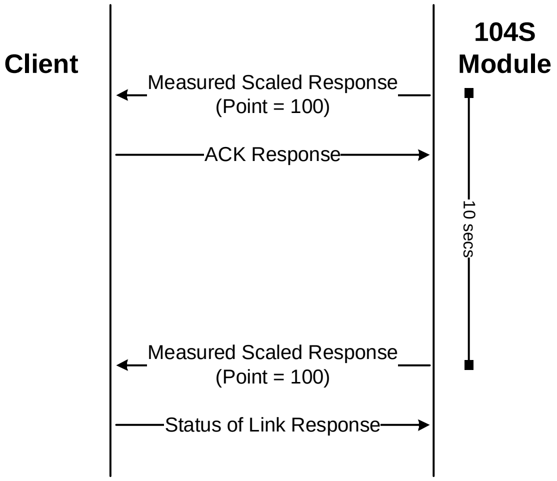
20000

Comment:

Definition:

Number of milliseconds between cyclic updates (0-4294967296)

The following illustration shows the communication procedure:


Client
104S Module
Measured Scaled Response (Point = 100)
ACK Response
10 secs
Measured Scaled Response (Point = 100)
Status of Link Response

Therefore, the point configured for a cyclic poll is periodically reported to the master.

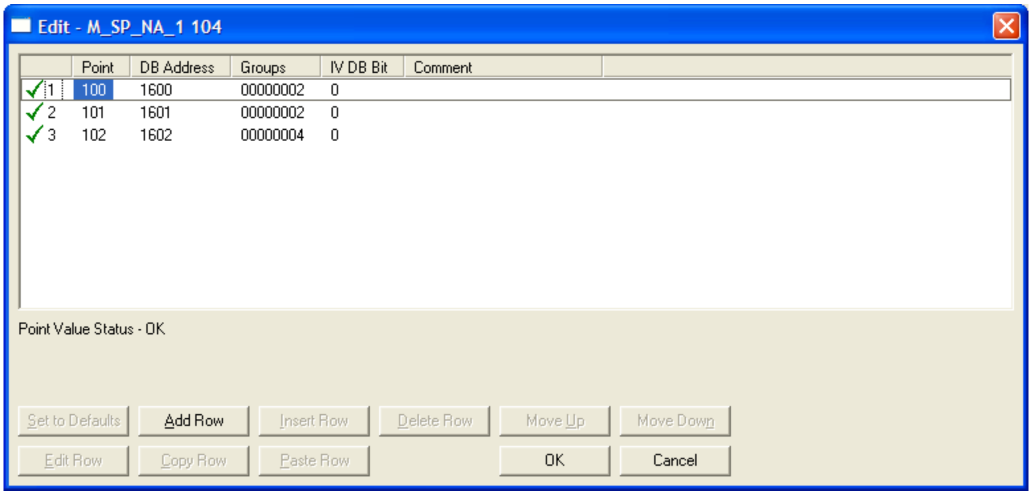
You may also create groups of points allowing the master to poll certain points more frequently than other points. The master may send requests for different groups as follows:

- General Interrogation (station)
- General Interrogation for Group 1
- General Interrogation for Group 2
- …
- General Interrogation for Group 16

Example - General Interrogation

If the following points are configured for General Interrogation:

If you configure the following data points:



Edit - M_SP_NA_1 104

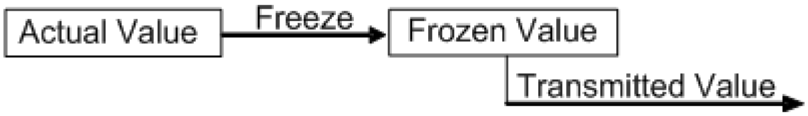
	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	100	1600	00000002	0	
✓ 2	101	1601	00000002	0	
✓ 3	102	1602	00000004	0	

Point Value Status - OK

This feature allows you to separate the points into different groups according to the priority level that these should be reported to the master. In the example above, points 100 and 101 would be returned with a General Interrogation for Group 1 and point 102 would be returned with a General Interrogation for Group 2.

Counter Points

There are four modes of acquisition of integrated totals (M_IT_NA points) defined by the protocol specification. The actual values may be memorized (copied) periodically to frozen values by a freeze command received from the master or initiated locally within the module.



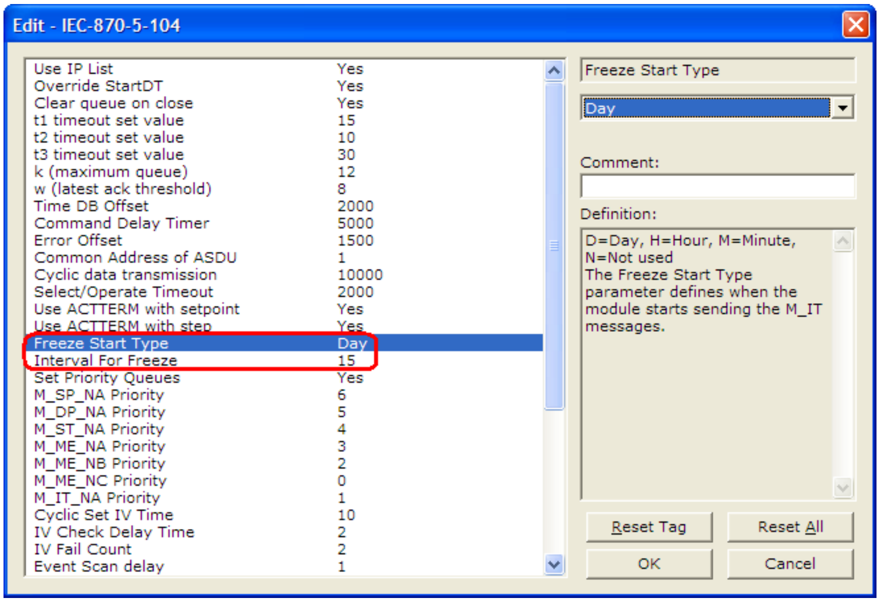
The module supports the following modes:

Mode A - Local freeze with spontaneous transmission

Mode D - Counter interrogation commands from the master initiate the freeze operation and the frozen values are reported spontaneously.

Example - Mode A

To use Mode A, configure the following parameters:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	10000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Day
Interval For Freeze	15
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Freeze Start Type

Day

Comment:

Definition:

D=Day, H=Hour, M=Minute, N=Not used
The Freeze Start Type parameter defines when the module starts sending the M_IT messages.

Freeze Start Type

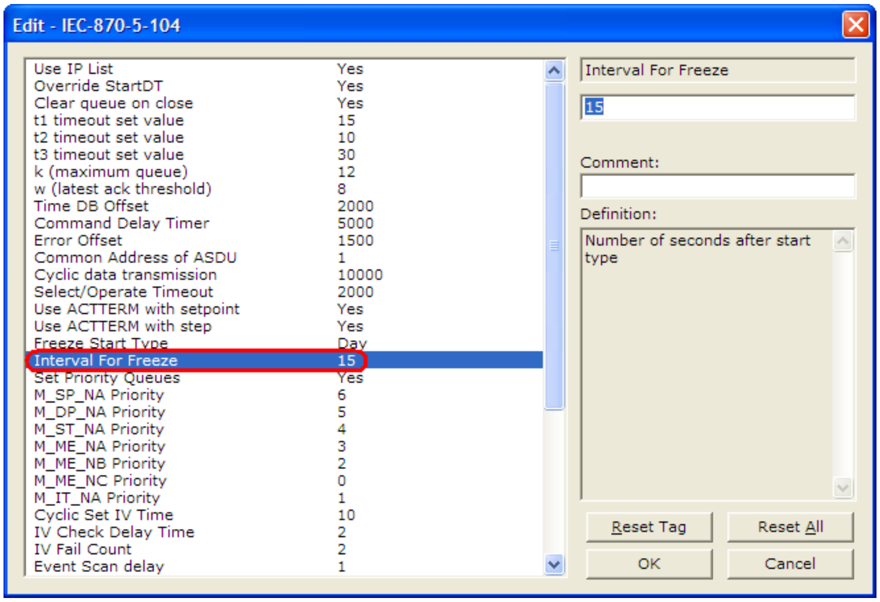
The Freeze Start Type parameter will define when the module starts sending the M_IT messages.

Example I - Freeze Start Type

If the module powers up with the following date and time clock:

03/25/2004 18:07:42

If you configure the Interval For Freeze parameter as follows:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	10000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Day
Interval For Freeze	15
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Interval For Freeze

15

Comment:

Definition:

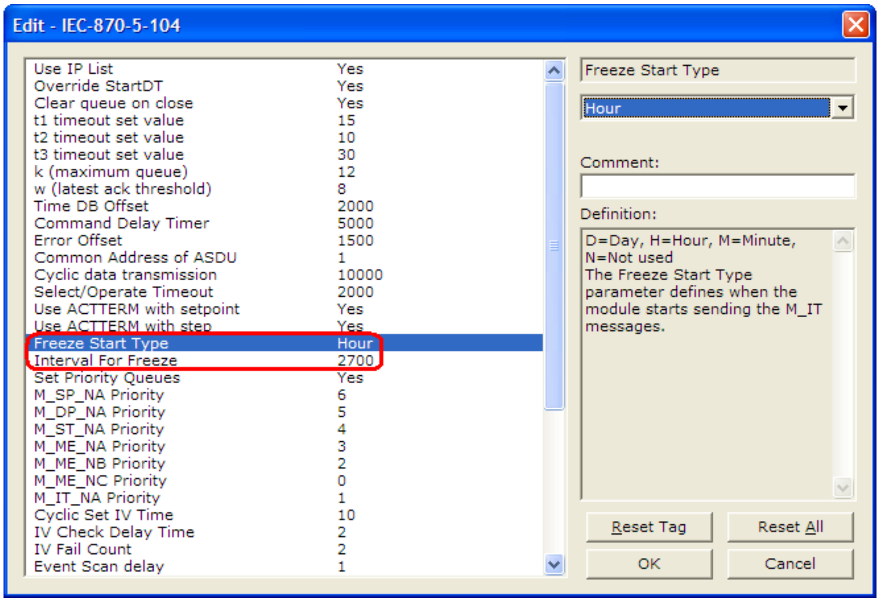
Number of seconds after start type

The module would send the counter messages every 15 seconds. The module would start sending the messages depending on the Freeze Start Type parameter as follows:

Freeze Start Type	Time to Start Sending Messages
D	03/26/2004 00:00:00
H	03/25/2004 19:00:00
M	03/25/2004 18:08:00

Example II - Freeze Start Type

If the module should send the counter points on the hourly turn around time and also 45 minutes later, the Mode A parameters should be configured as follows:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	10000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Freeze Start Type

Hour

Comment:

Definition:

D=Day, H=Hour, M=Minute, N=Not used
The Freeze Start Type parameter defines when the module starts sending the M_IT messages.

So the module would send events as follows (Hours:Minutes:Seconds):

```
17:00:00
17:45:00
18:00:00
18:45:00
19:00:00
19:45:00
```

…

Mode D

To select the Mode D. configure the Freeze Start Type parameter as "N". For this mode the master would periodically send Counter Interrogation Commands to perform the freeze operation. After the values are frozen the module will return the counter points as events. The counter points must be properly configured for counter interrogation groups for Mode D operation.

Monitor Points Addressing

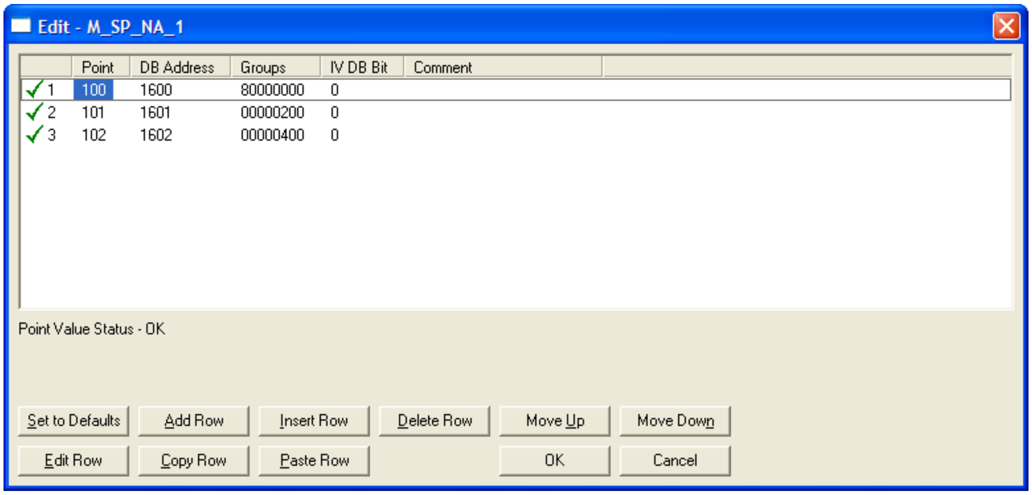
As discussed before, the monitor points must be configured in a database area in the MVI56-104S module.

The monitor data types are described in the following table.

Data Type	Data Size	Addressing Type
M_SP_NA	1 bit	Bit
M_DP_NA	2 bits	Bit
M_ST_NA	1 byte	Byte
M_ME_NA	1 word	Word
M_ME_NB	1 word	Word
M_ME_NC	2 word	Double-Word
M_IT_NA	2 word	Double-Word

M_SP_NA and M_DP_NA

The monitored single-point (1 bit) and monitored double-point (2 bits) types both occupy bit-addressing. For example, if you configured the following points:



	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	100	1600	80000000	0	
✓ 2	101	1601	00000200	0	
✓ 3	102	1602	00000400	0	

Point Value Status - OK

The following table describes how these points would be used.

Inf. Object Address	Module Database Address
100	Bit 0 of word 100
101	Bit 1 of word 100
102	Bit 2 of word 100

The monitored double-point uses two bits with bit-addressing. It typically represents the ON/OFF states where:

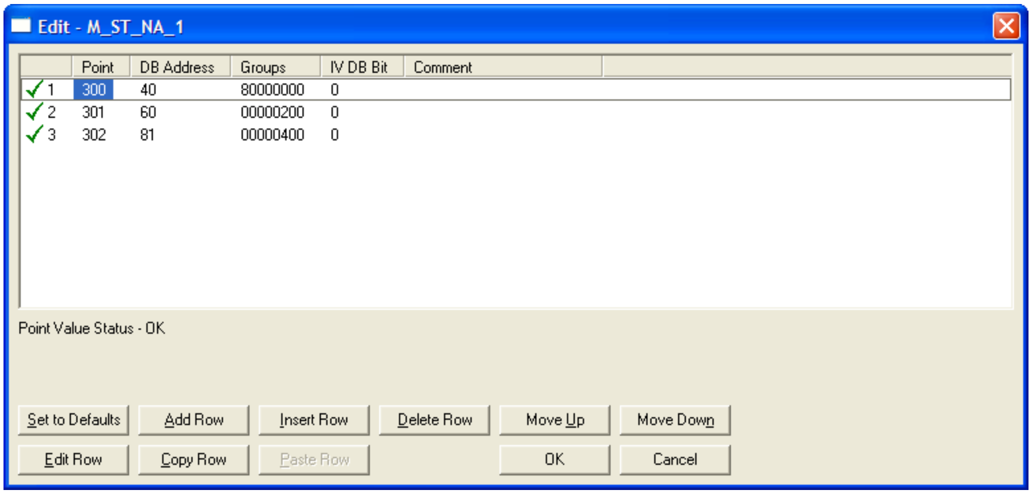
01 = OFF

10 = ON

M_ST_NA

The monitored step-point uses one byte with byte-addressing.

For example, if you configured the following points:



Edit - M_ST_NA_1

	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	300	40	80000000	0	
✓ 2	301	60	00000200	0	
✓ 3	302	81	00000400	0	

Point Value Status - OK

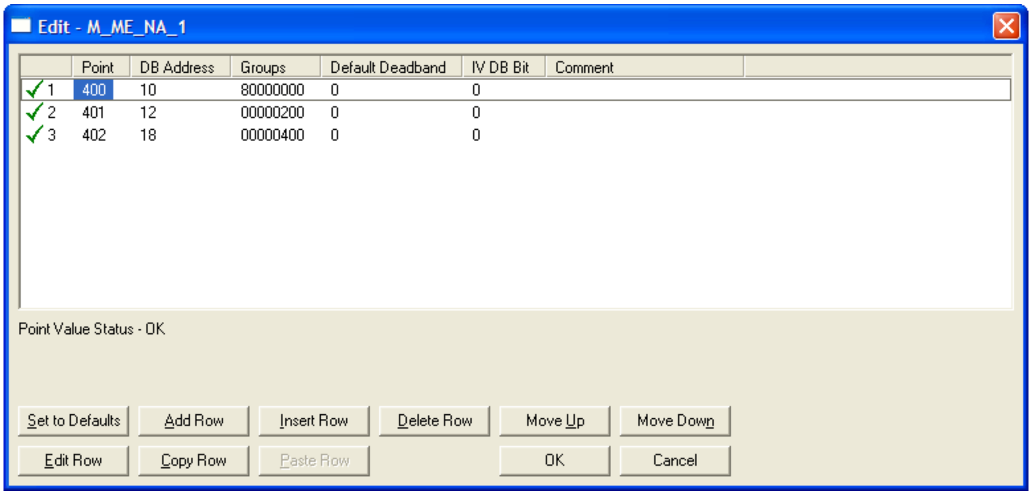
The following table describes how these points would be used.

Inf. Object Address	Module Database Address
300	Low Byte of word 20
301	Low Byte of word 30
302	High Byte of word 40

M_ME_NA and M_ME_NB

The monitored measured normalized and measured scaled points occupy one word with word-addressing.

For example, if you configured the following points:



Edit - M_ME_NA_1

	Point	DB Address	Groups	Default Deadband	IV DB Bit	Comment
✓ 1	400	10	80000000	0	0	
✓ 2	401	12	00000200	0	0	
✓ 3	402	18	00000400	0	0	

Point Value Status - OK

The following table describes how these points would be used.

Inf. Object Address	MVI56-104S Module Database Address
400	Word 10
401	Word 12
402	Word 18

The monitored measured normalized points use a data representation defined by the protocol specification. The following table describes the value for each bit.

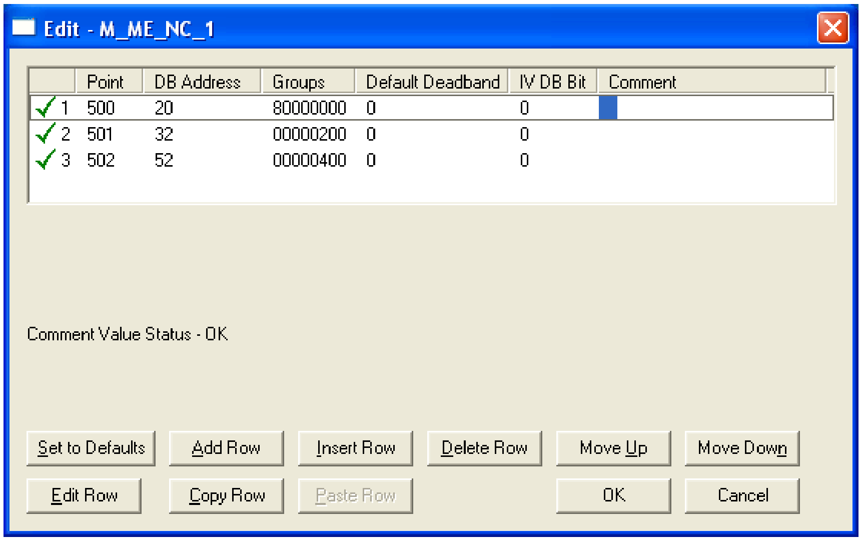
Bit	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Value	S	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}

Example: a value of 4000hex is interpreted as 0.5

M_ME_NC and M_IT_NA

The monitored measured short floating point and monitored integrated total points occupy two words with double-word addressing.

For example, if you configured the following points:



Edit - M_ME_NC_1

	Point	DB Address	Groups	Default Deadband	IV DB Bit	Comment
✓ 1	500	20	80000000	0	0	
✓ 2	501	32	00000200	0	0	
✓ 3	502	52	00000400	0	0	

Comment Value Status - OK

The following table describes how these points would be used.

Inf. Object Address	Module Database Address
500	Words 40 and 41
501	Words 64 and 65
502	Word 104 and 105

5.2.3 Using Control (Command) Points

The following control points are supported by the MVI56-104S module:

Symbol	Description
C_SC_NA	Single-Point Command
C_DC_NA	Dual-Point Command
C_RC_NA	Step-Point Command
C_SE_NA	Measured Normalized Point Command
C_SE_NB	Measured Scaled-Point Command
C_SE_NC	Measured Short Floating-Point Command

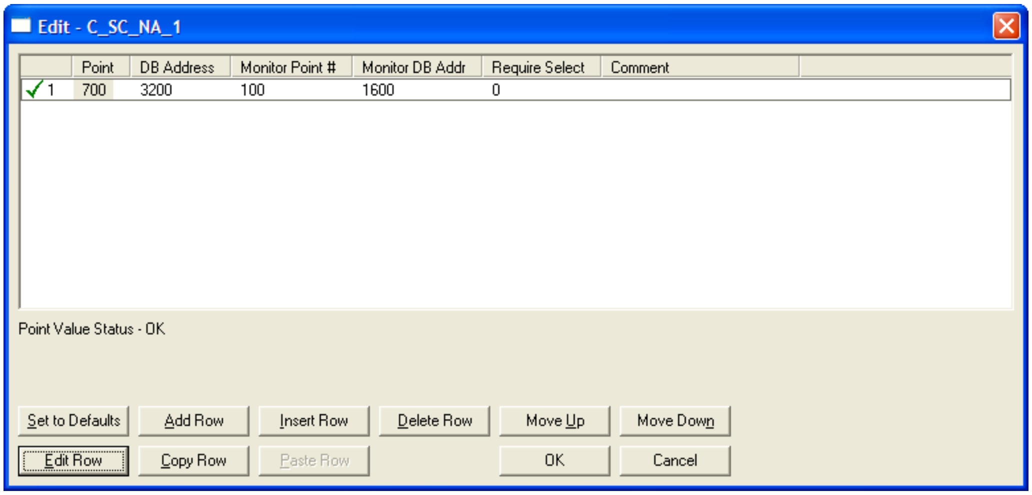
Each control point is identified by its Information Object Address. For each control point, configure the following parameters:

Point #: This is the information object address of the point. It identifies the point in the network. This address must be unique for each Common ASDU Address in the network.

DB Address: This is the database location in the MVI56-104S module associated with the point.

Monitor Point #-**Monitor DB Address-** The user might (optionally) configure a monitor point to be sent by the MVI56-104S module when it receives the command for that specific point.

Example (C_SC_NA)



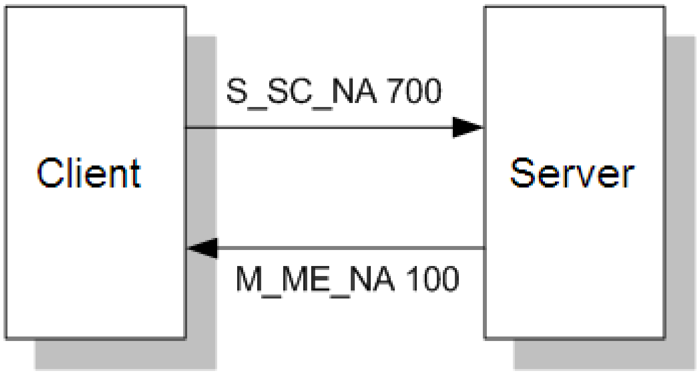
Edit - C_SC_NA_1

	Point	DB Address	Monitor Point #	Monitor DB Addr	Require Select	Comment
✓ 1	700	3200	100	1600	0	

Point Value Status - OK

In the example above, each time the module receives a command for single-command point 700, it sends a response containing a monitored single-point (information object address 100 with the value at database bit-address 1600).

Require Select: This parameter configures the point to require a *Select* request before the *Operate* command.



Control Data Transfer

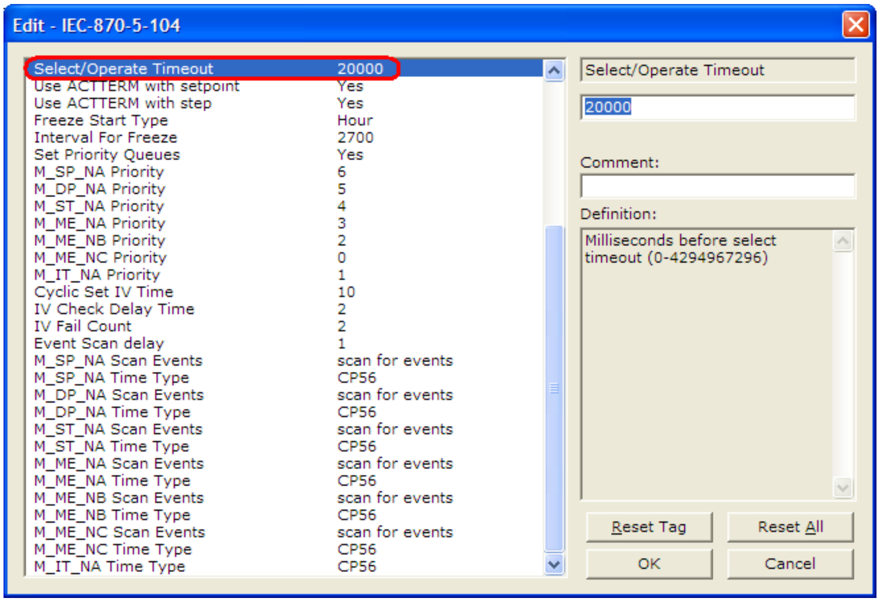
The control communication typically occurs when the client sends a command request to update the module's command points.

The data types addressing are described in the following table.

Data Type	Data Size	Addressing Type
C_SC_NA	1 bit	Bit
C_DC_NA	2 bits	Bit
C_RC_NA	1 byte	Byte
C_SE_NA	1 word	Word
C_SE_NB	1 word	Word
C_SE_NC	2 words	Word

Some of the command points may be configured to be selected before executed.

Refer to the following parameter to configure the select/operate timeout period. After the module receives the SELECT operation it will wait for this period of time for the EXECUTE operation. If the module does not receive an EXECUTE operation within this period of time it will require another SELECT operation before the EXECUTE operation.



Edit - IEC-870-5-104

Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	scan for events
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	scan for events
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	scan for events
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	scan for events
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	scan for events
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

Select/Operate Timeout

20000

Comment:

Definition:

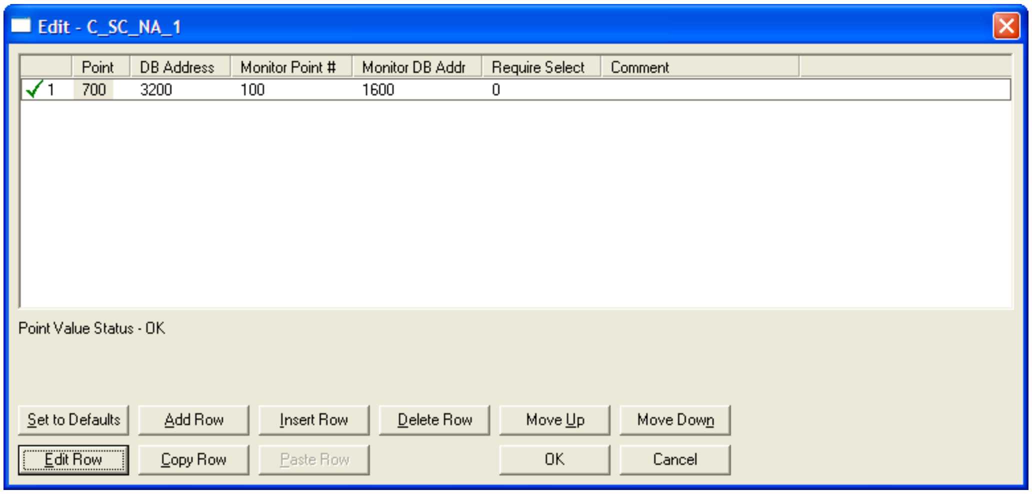
Milliseconds before select timeout (0-4294967296)

Command Points Addressing

As discussed before, the command points must be configured in a database area that is updated at the module. You must associate each point to a database address in the MVI56-104S module. The interpretation of this parameter depends on the point type configured.

C_SC_NA and C_DC_NA

The single-point command and dual-point command points use one bit with bit-addressing. For example, if you configure the following points:



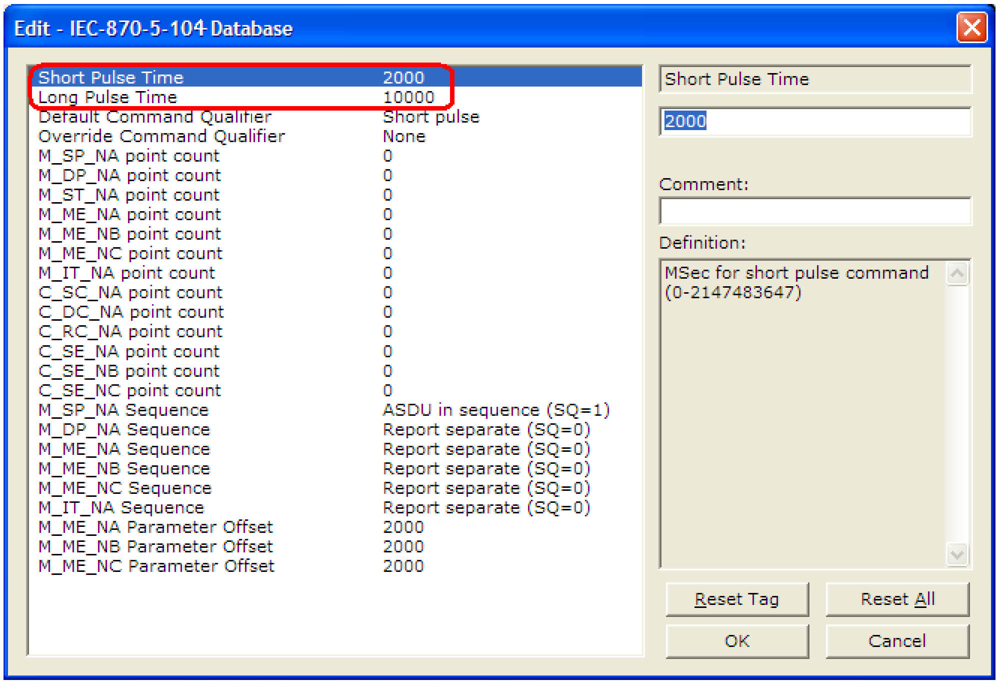
	Point	DB Address	Monitor Point #	Monitor DB Addr	Require Select	Comment
✓ 1	700	3200	100	1600	0	

Point Value Status - OK

These points would be used as follows:

Inf. Object Address	Module Database Address
100	Bit 0 of word 100
101	Bit 1 of word 100
102	Bit 2 of word 100

The protocol specification defines a qualifier value that is set by the master to determine the duration of the pulse (short, long or persistent). Configure the parameters below to set the duration of the short and long pulses:



Edit - IEC-870-5-104 Database

Short Pulse Time	2000
Long Pulse Time	10000
Default Command Qualifier	Short pulse
Override Command Qualifier	None
M_SP_NA point count	0
M_DP_NA point count	0
M_ST_NA point count	0
M_ME_NA point count	0
M_ME_NB point count	0
M_ME_NC point count	0
M_IT_NA point count	0
C_SC_NA point count	0
C_DC_NA point count	0
C_RC_NA point count	0
C_SE_NA point count	0
C_SE_NB point count	0
C_SE_NC point count	0
M_SP_NA Sequence	ASDU in sequence (SQ=1)
M_DP_NA Sequence	Report separate (SQ=0)
M_ME_NA Sequence	Report separate (SQ=0)
M_ME_NB Sequence	Report separate (SQ=0)
M_ME_NC Sequence	Report separate (SQ=0)
M_IT_NA Sequence	Report separate (SQ=0)
M_ME_NA Parameter Offset	2000
M_ME_NB Parameter Offset	2000
M_ME_NC Parameter Offset	2000

Short Pulse Time

2000

Comment:

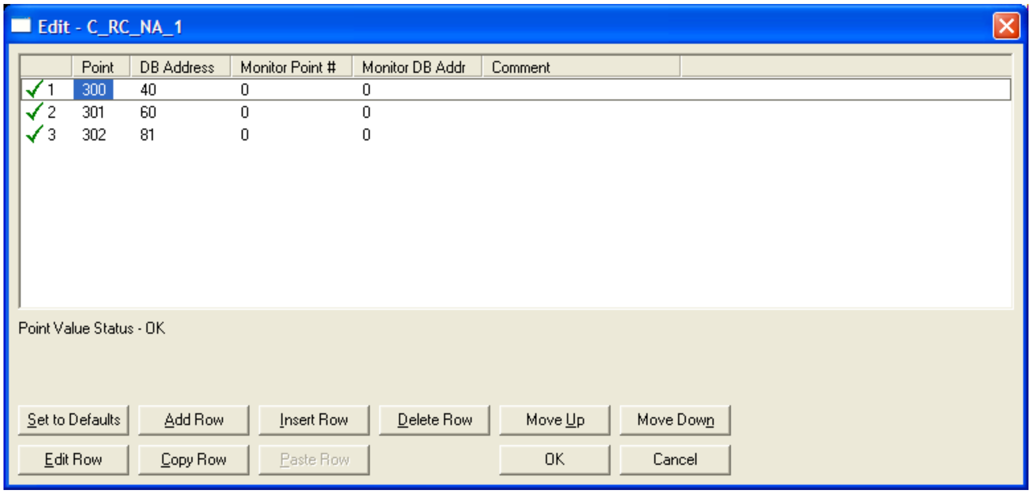
Definition:

MSec for short pulse command (0-2147483647)

C_RC_NA

The step-point command uses one byte with byte-addressing.

For example, if you configured the following points:



Edit - C_RC_NA_1

	Point	DB Address	Monitor Point #	Monitor DB Addr	Comment
✓ 1	300	40	0	0	
✓ 2	301	60	0	0	
✓ 3	302	81	0	0	

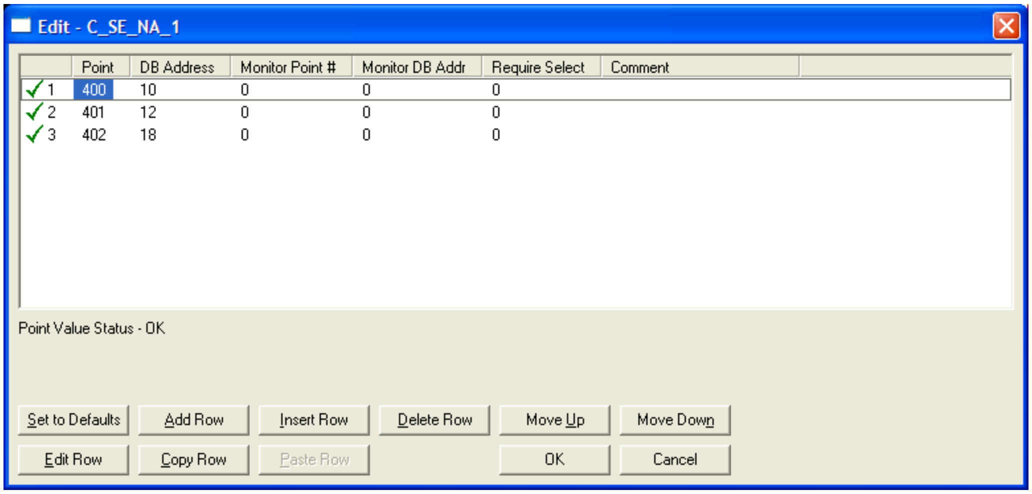
Point Value Status - OK

The following table describes how these points would be used.

Inf. Object Address	Module Database Address
300	Low Byte of word 20
301	Low Byte of word 30
302	High Byte of word 40

C_SE_NA and C_SE_NB

The measured normalized point command uses one word with word-addressing. For example, if you configured the following points:



Edit - C_SE_NA_1

	Point	DB Address	Monitor Point #	Monitor DB Addr	Require Select	Comment
✓ 1	400	10	0	0	0	
✓ 2	401	12	0	0	0	
✓ 3	402	18	0	0	0	

Point Value Status - OK

The following table describes how these points would be used.

Inf. Object Address	MVI56-104S Module Database Address
400	Word 10
401	Word 12
402	Word 18

The measured normalized points use a data representation defined by the protocol specification, where each bit represents a value as follows:

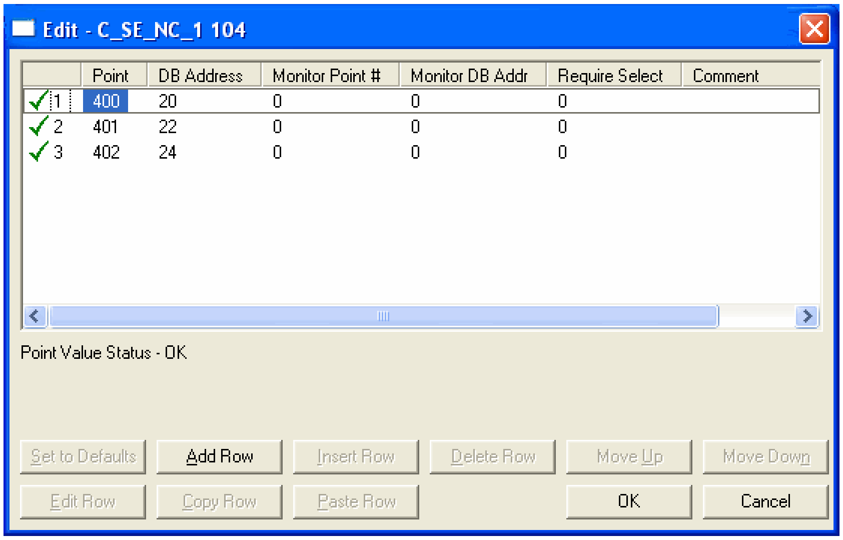
Bit	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Value	S	2^{-1}	2^{-2}	2^{-3}	2^{-4}	2^{-5}	2^{-6}	2^{-7}	2^{-8}	2^{-9}	2^{-10}	2^{-11}	2^{-12}	2^{-13}	2^{-14}	2^{-15}

Example: a value of 4000hex is interpreted as 0.5

C_SE_NC

The measured short floating point command uses two words with double word addressing.

For example, if you configured the following points:



	Point	DB Address	Monitor Point #	Monitor DB Addr	Require Select	Comment
✓ 1	400	20	0	0	0	
✓ 2	401	22	0	0	0	
✓ 3	402	24	0	0	0	

Point Value Status - OK

These points would be used as follows:

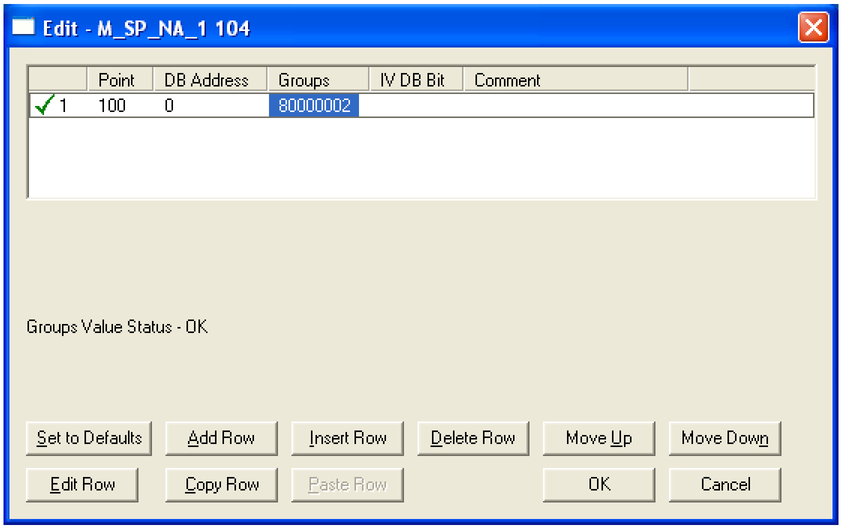
Inf. Object Address	Module Database Address
400	Words 40 and 41
401	Words 44 and 45
402	Words 48 and 49

5.2.4 Data Communication

Group Communication

As previously discussed, the Group parameter in the module configuration file controls how each monitored point is transferred between the MVI56-104S module and the client unit. The Group parameter is described in detail in Group Codes (page 49)

The following example configures this point to be repeated either during cyclic polls, or when a General Interrogation request for Group 1 occurs.

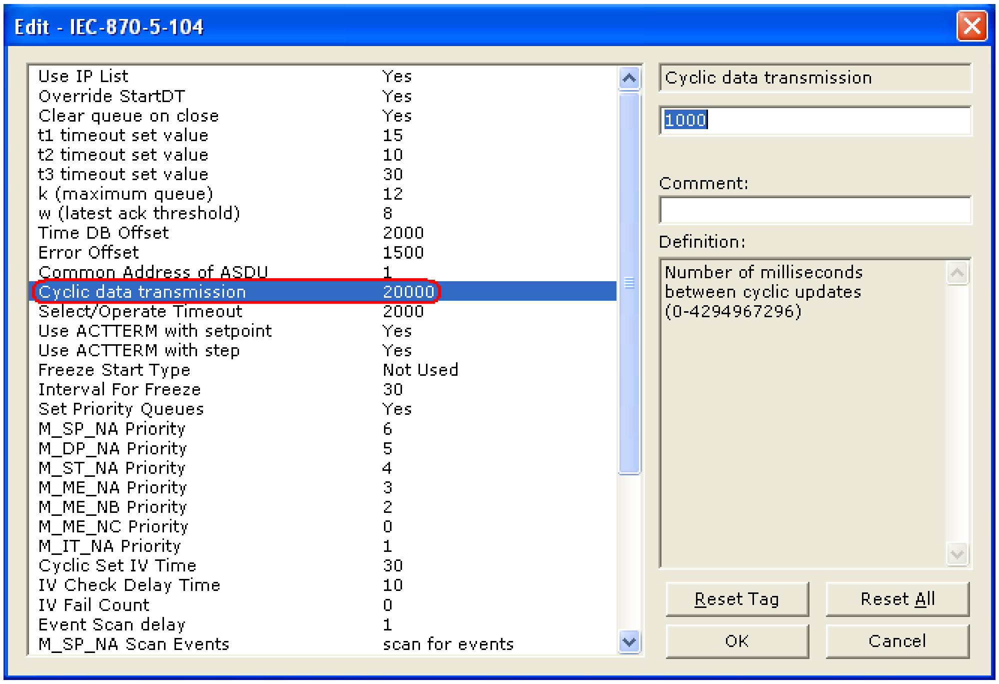


Edit - M_SP_NA_1 104

	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	100	0	80000002		

Groups Value Status - OK

The module periodically sends all points configured for periodic/cyclic poll (0x80000000) at the interval in milliseconds configured with the Cyclic Data Transmission parameter:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	30
IV Check Delay Time	10
IV Fail Count	0
Event Scan delay	1
M_SP_NA Scan Events	scan for events

Cyclic data transmission

1000

Comment:

Definition:

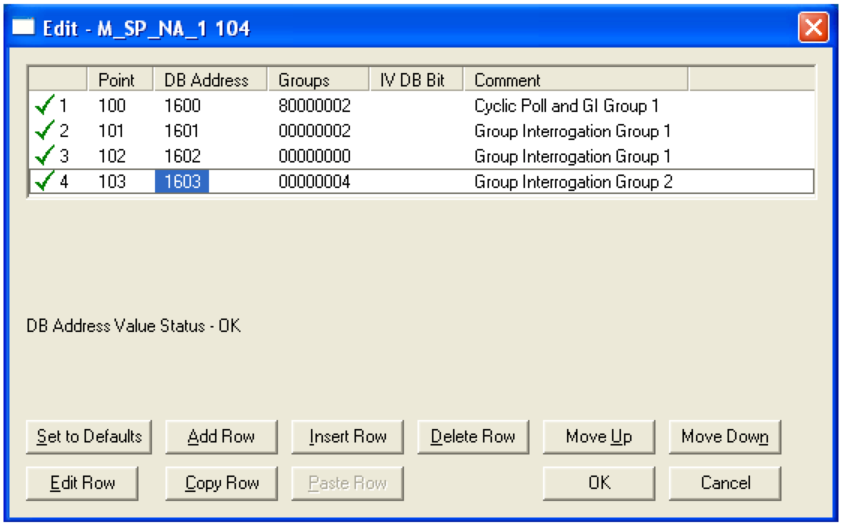
Number of milliseconds between cyclic updates (0-4294967296)

You can also divide the monitored points into different groups, allowing the client to periodically poll only certain points. This also allows some points to be polled more frequently than others.

Note: You should configure the counter points (M_IT_NA) for general counter interrogation or group counter interrogations.

Example:

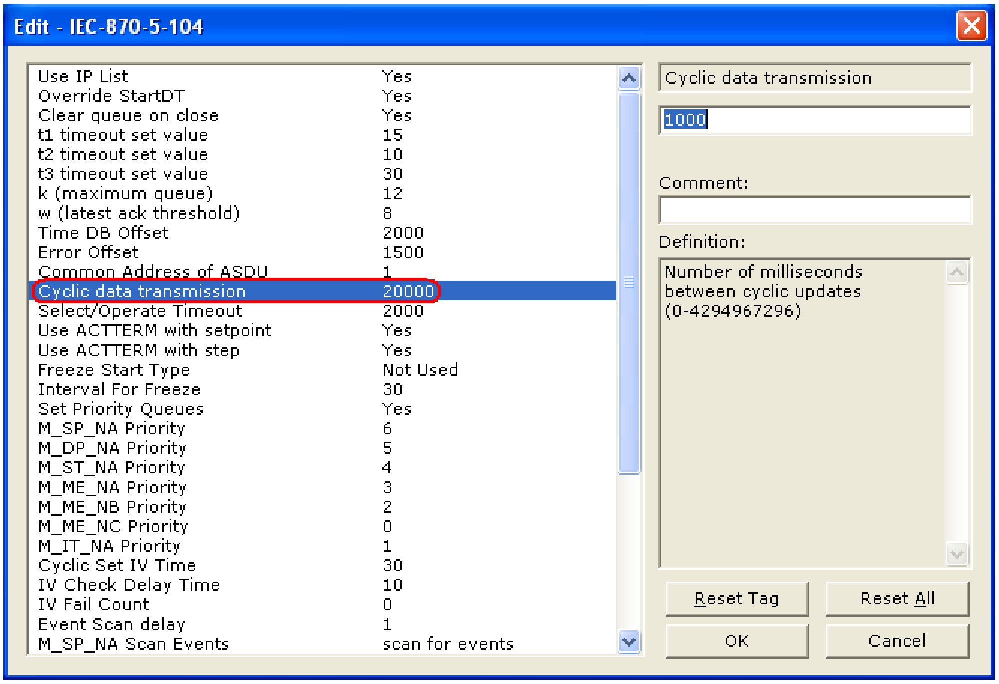
In the following example, with the following data points for data type M_SP_NA configured:



	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	100	1600	80000002		Cyclic Poll and GI Group 1
✓ 2	101	1601	00000002		Group Interrogation Group 1
✓ 3	102	1602	00000000		Group Interrogation Group 1
✓ 4	103	1603	00000004		Group Interrogation Group 2

DB Address Value Status - OK

And the Cyclic data transmission parameter configured as follows:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	30
IV Check Delay Time	10
IV Fail Count	0
Event Scan delay	1
M_SP_NA Scan Events	scan for events

Cyclic data transmission

1000

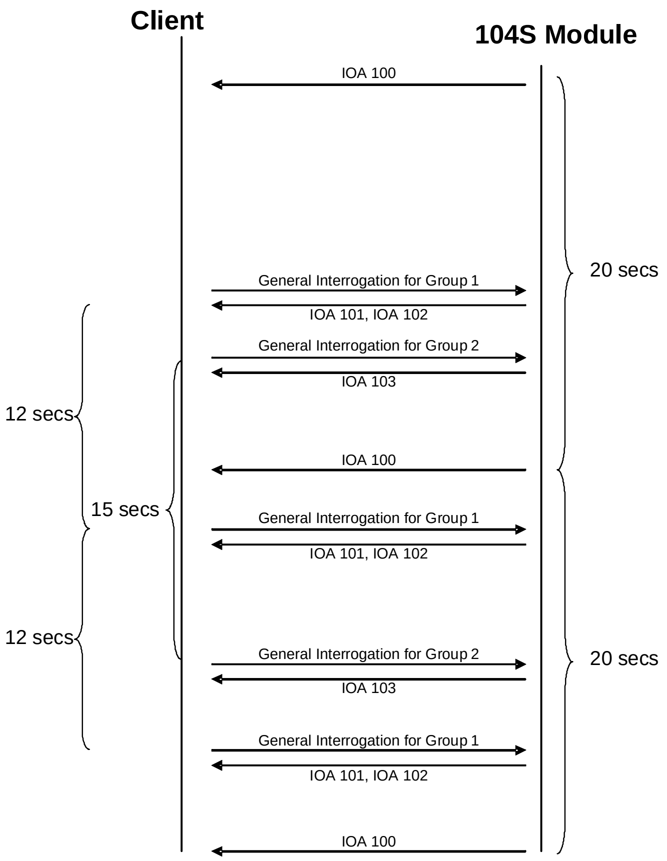
Comment:

Definition:
Number of milliseconds between cyclic updates (0-4294967296)

The client unit sends the following requests:

- General Interrogation for Group 1 every 12 seconds
- General Interrogation for Group 2 every 15 seconds

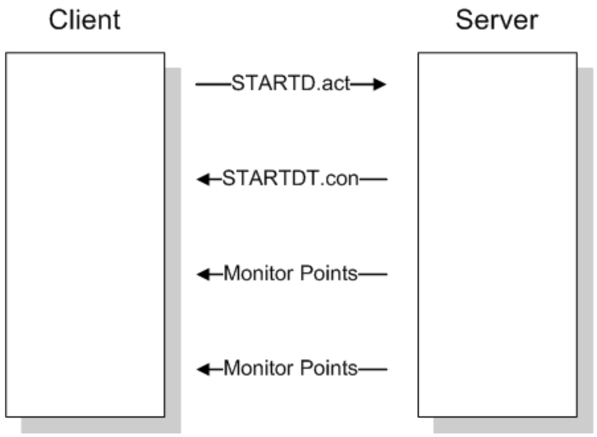
The following illustration shows how the communication would be performed between the client and the 104S module.


Client
104S Module
IOA 100
General Interrogation for Group 1
IOA 101, IOA 102
General Interrogation for Group 2
IOA 103
IOA 100
General Interrogation for Group 1
IOA 101, IOA 102
General Interrogation for Group 2
IOA 103
General Interrogation for Group 1
IOA 101, IOA 102
IOA 100
20 secs
20 secs
12 secs
15 secs
12 secs

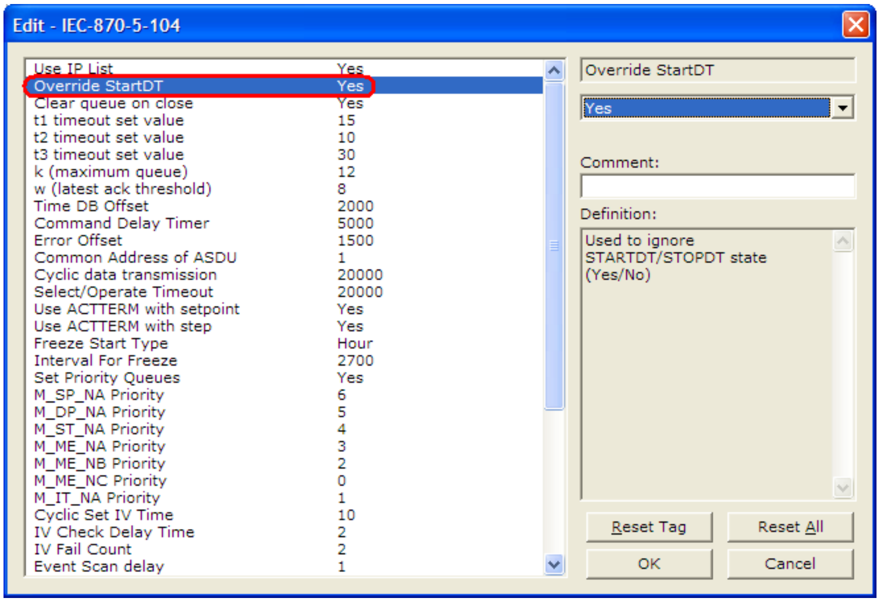
STARTDT & STOPDT

STARTDT (Start Data Transfer) and STOPDT (Stop Data Transfer) are used by the client to control the data transfer from the MVI56-104S module. When the connection is established, user data is not automatically enabled in the server until it receives a STARTDT act request from the client. The server should respond with a STARTDT con response to acknowledge the client request. Once this procedure is concluded, the server can send monitor data to the client.

The client can interrupt the monitor data flow at any time sending a STOPDT act command to the server.



In some circumstances the client unit may not support STARTDT and STOPDT messages. The module may also be tested with simulator software that does not support these features. During these situations, you may want to disable the parameter:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Override StartDT

Yes

Comment:

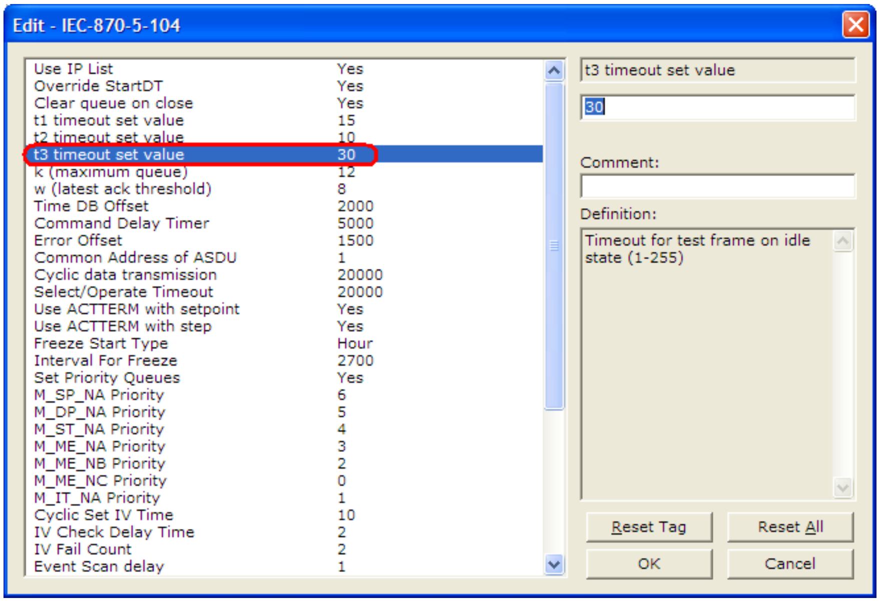
Definition:

Used to ignore STARTDT/STOPDT state (Yes/No)

If this parameter is set to 1, the module will ignore the STARTDT and STOPDT requests by the client unit.

TESTFR Requests

Connections that are unused (but opened) may be periodically tested in both directions by sending test messages (TESTFR=act) which are confirmed by the receiving station sending TESTFR=con messages. The MVI56-104S module can be configured to periodically send this message using the following parameter:



Edit - IEC-870-5-104

Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

t3 timeout set value

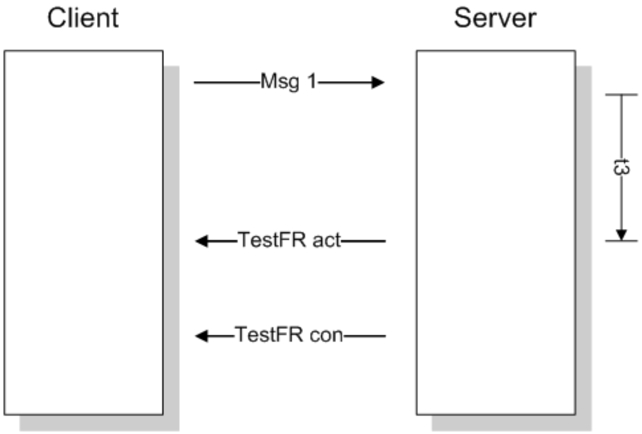
30

Comment:

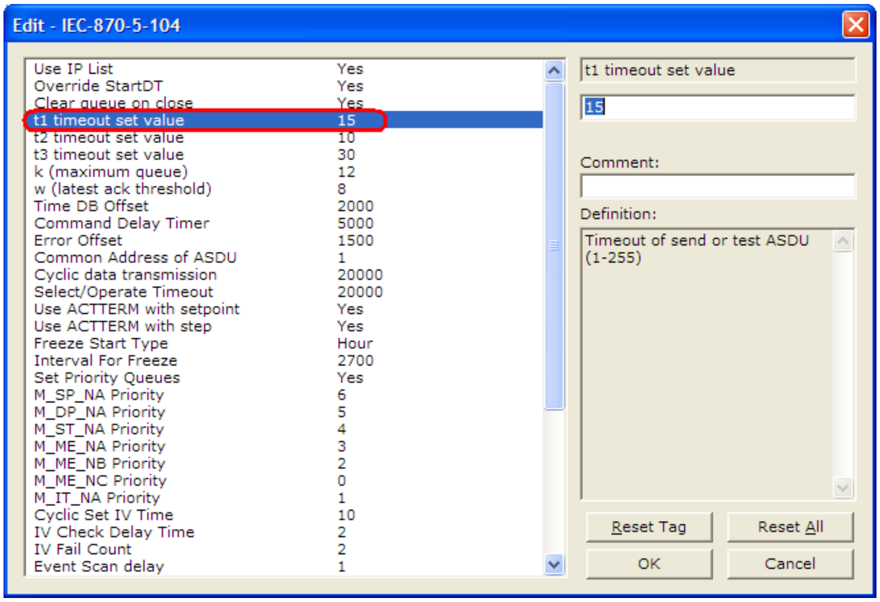
Definition:

Timeout for test frame on idle state (1-255)

In the example above, the module would send a TESTFR.ACT message 30 seconds after receiving the last message:



If the module does not receive the TESTFR.con message within a certain amount of time, it will timeout and close the connection. You can configure the timeout period using the following parameter:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

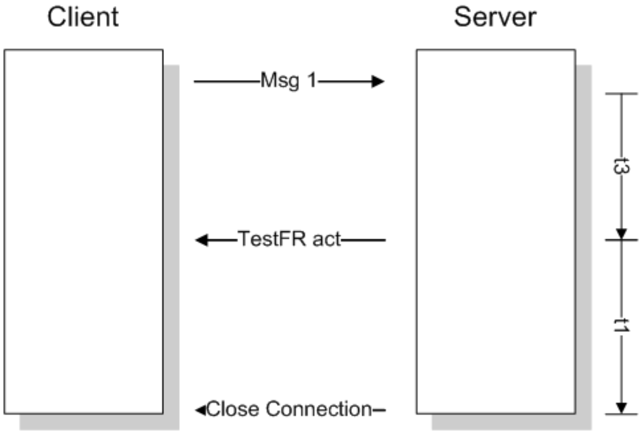
t1 timeout set value

15

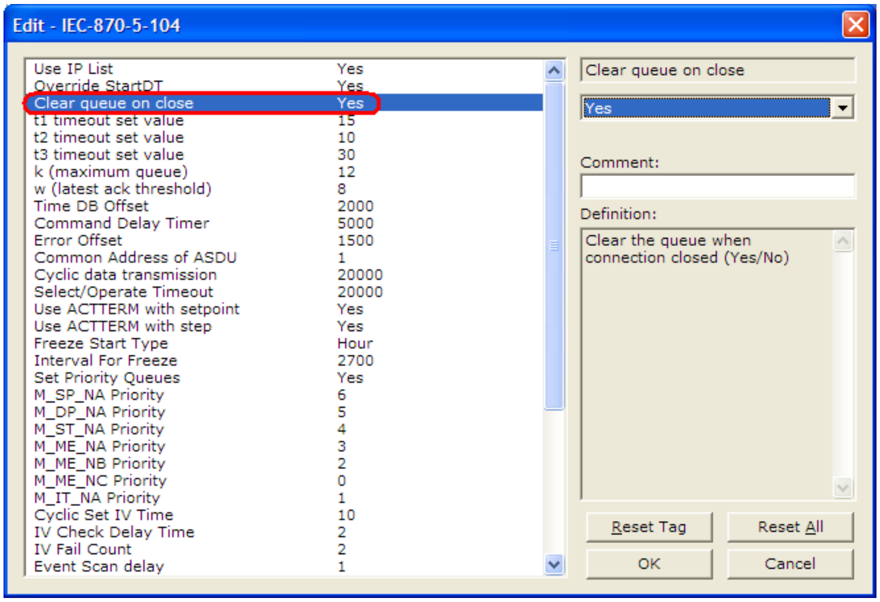
Comment:

Definition:

Timeout of send or test ASDU (1-255)



When closing the connection, the module can be configured to clear all the messages in its queue. The following parameter is used to implement this task:



Use IP List	Yes
Override StartDT	Yes
Clear queue on close	Yes
t1 timeout set value	15
t2 timeout set value	10
t3 timeout set value	30
k (maximum queue)	12
w (latest ack threshold)	8
Time DB Offset	2000
Command Delay Timer	5000
Error Offset	1500
Common Address of ASDU	1
Cyclic data transmission	20000
Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1

Clear queue on close

Yes

Comment:

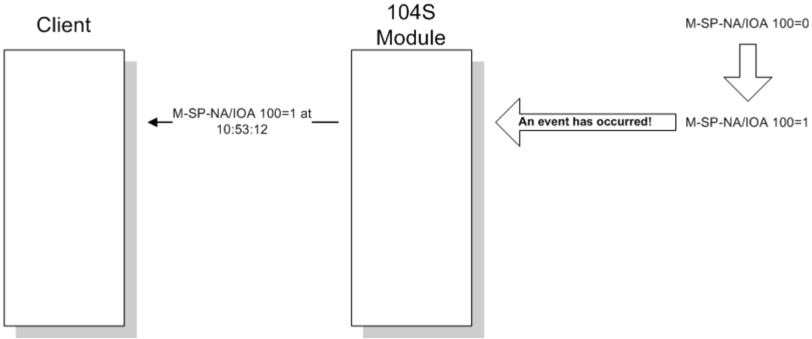
Definition:

Clear the queue when connection closed (Yes/No)

The configuration above would cause to module to delete all pending messages/events while closing the connection to the client.

5.2.5 Events

In order to improve communication efficiency, most applications will require the client to periodically poll for data changes with a higher priority than polling for monitor data. Every time a data changes, the server sends this information, typically with the date and time information on when it has occurred.

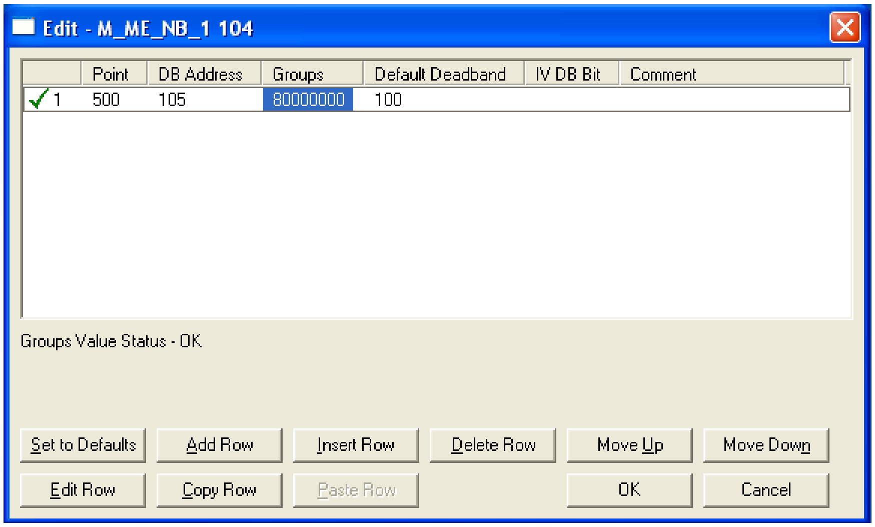


The module supports a buffer queue of 99 events per data type. When the queue is full, the module will delete the older event in the queue if a new event is received.

Deadbands

The monitored measured points (M_ME_NA and M_ME_NB) will generate events only if the data value changes an amount greater than or equal to the configured deadband value.

For example, with the following point configured:



Edit - M_ME_NB_1 104

	Point	DB Address	Groups	Default Deadband	IV DB Bit	Comment
✓ 1	500	105	80000000	100		

Groups Value Status - OK

If the current value for this point is 130, it would only generate events if:

NEW VALUE is less than or equal to 30

OR

NEW VALUE is greater than or equal to 230.

You can set the deadband for each monitored measured point through the configuration file.

The client may also dynamically change the deadband for each monitored point. The client may send one of the following commands:

Type	Command
110	Parameter of Measured Normalized Data (M_ME_NA)
111	Parameter of Measured Scaled Data (M_ME_NB)
112	Parameter of Measured Short Floating Point (M_ME_NC)

The protocol specification explains that the qualifier value for these commands should be configured as:

Bits	Value	Description
1 to 6	0	Not Used
	1	**Threshold Value (Deadband)**
	2	Smoothing Factor (filter time constant) - Not Supported
	3	Low Limit Transmission of Measured Value
	4	High Limit Transmission of Measured Value
	5..31	Reserved
7	0	No Change
	1	Change
8	0	Operation
	1	Not in Operation

For the MVI56-104S module, the Low Limit and High Limit parameters cannot be changed by command, because these values are calculated as follows:

Low Limit = (LAST REPORTED VALUE) - Deadband

High Limit = (LAST REPORTED VALUE) + Deadband

These commands must be sent to a specific Information Object Address. The MVI56-104S module associates each monitor measured point with a parameter point through the following configuration parameters:

```
M_ME_NA Parameter Offset : 2000 #M_ME_NA IOA offset for parameter data
M_ME_NB Parameter Offset : 2000 #M_ME_NB IOA offset for parameter data
M_ME_NC Parameter Offset : 2000 #M_ME_NC IOA offset for parameter data
```

Example:

If the following monitored measured points are configured:

```
[M_ME_NA_1 104]
#
#                                  Default
# Point #   DB Address   Group(s)  Deadband  IV DB Bit
# -------   ----------   --------  --------  ---------
START
      400           10   00000002       100        # P1 suction pressure
      401           11   00000002       100        # P1 discharge pressure
      402           12   00000002       100        # P2 suction pressure
      403           13   00000002       100        # P2 discharge pressure
      404           14   00000002       100        # Station discharge pressure
      405           15   00000002       100        # VSD speed
      406           16   00000002       100        #
      407           17   00000002       100         #
      408           18   00000002       100         #
      409           19   00000002       100         #
END

[M_ME_NB_1 104]
#
#                                   Default
# Point #   DB Address   Group(s)  Deadband  IV DB Bit
# -------   ----------   --------  --------  ---------
START
      500           20   00000002       100        # P1 inboard bearing temp
      501           21   00000002       100        # P1 outboard bearing temp
      502           22   00000002       100        # P1 winding Temp
      503           23   00000002       100        # P1 current
      504           24   00000002       100        # P2 inboard bearing temp
      505           25   00000002       100        # P2 outboard bearing temp
      506           26   00000002       100        # P2 winding Temp
      507           27   00000002       100        # P2 current
      508           28   00000002       100        #
      509           29   00000002       100        #
END

[M_ME_NC_1 104]
#
#                                   Default
# Point #   DB Address   Group(s)  Deadband  IV DB Bit
# -------   ----------   --------  --------  ---------
START
      600           30   00000002       100              #
      601           32   00000002       100              #
      602           34   00000002       100              #
      603           36   00000002       100              #
      604           38   00000002       100              #
      605           40   00000002       100              #
      606           42   00000002       100              #
      607           44   00000002       100              #
      608           46   00000002       100              #
      609           48   00000002       100              #
END
```

And the parameter points are configured as follows:

```
M_ME_NA Parameter Offset : 2000 #M_ME_NA IOA offset for parameter data
M_ME_NB Parameter Offset : 2000 #M_ME_NB IOA offset for parameter data
M_ME_NC Parameter Offset : 2000 #M_ME_NC IOA offset for parameter data
```

It would imply that the parameter points would be configured as follows:

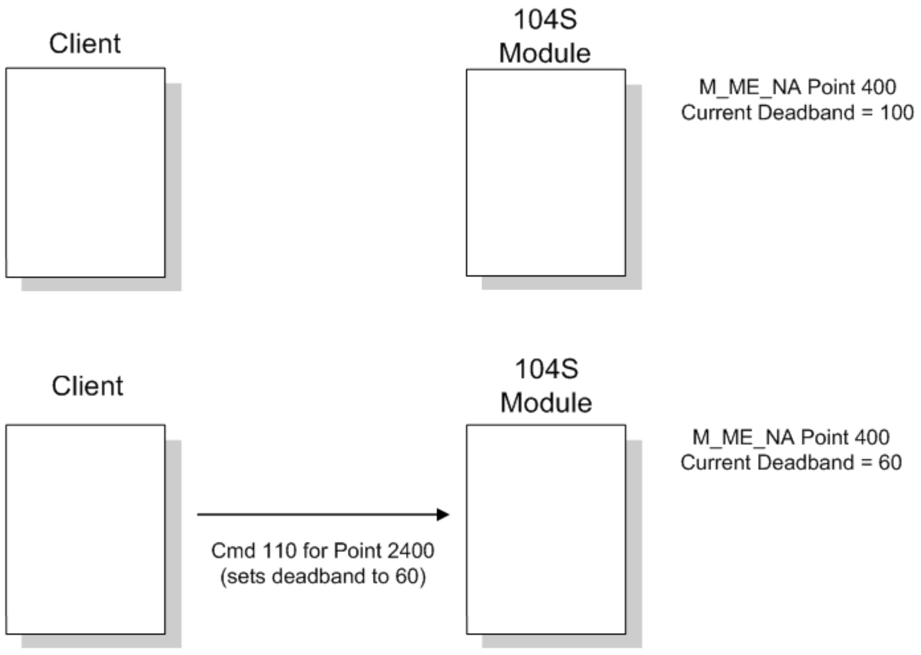
M_ME_NA

Monitored Measured Normalized Point	Associated Parameter Point
400	2400
401	2401
402	2402
403	2403
404	2404

M_ME_NB

Monitored Measured Normalized Point	Associated Parameter Point
500	2500
501	2501
502	2502
503	2503
504	2504

In order to send change the deadband for the M_ME_NA point 400, the client would send a command type 110 to point 2400:



M_ME_NC

Monitored Measured Normalized Point	Associated Parameter Point
600	2600
601	2601
602	2602
603	2603
604	2604

Controlling the Generation of Events

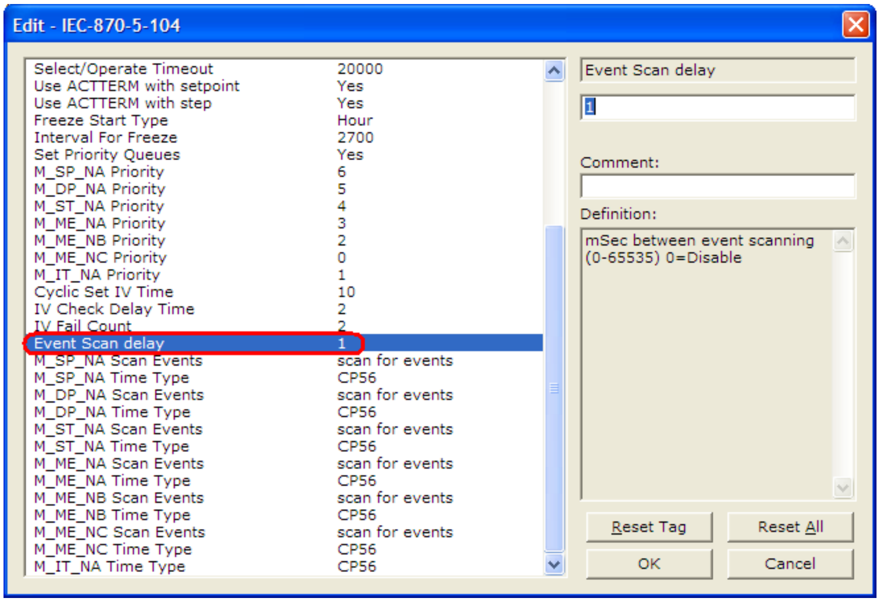
Some applications may require that only some points should generate events. The application would only poll the current value for these points, although changes in these values would have no significance. Other applications may require that all configured points should generate events.

The MVI56-104S module offers a lot of flexibility for event control. The user may control if events will be generated at 3 different levels:

1. General (All Points)
2. Data Type Level
3. Point Level

General (All Points)

The user may control how frequently the module will scan the database for events using the following configuration parameter:



Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	scan for events
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	scan for events
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	scan for events
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	scan for events
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	scan for events
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

Event Scan delay

1

Comment:

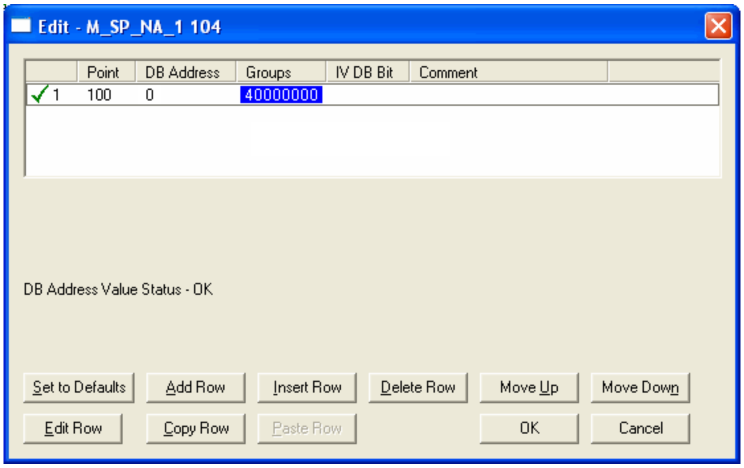
Definition:

mSec between event scanning
(0-65535) 0=Disable

If this parameter is set to 0, the module will not generate events for any points. A non-zero value will configure how frequently the module will scan for events in the database.

Point Level

You can configure if each point should generate events or not using the Group field for each point configuration. The user should set the value as 40000000 in order to disable the generation of events for that specific point.



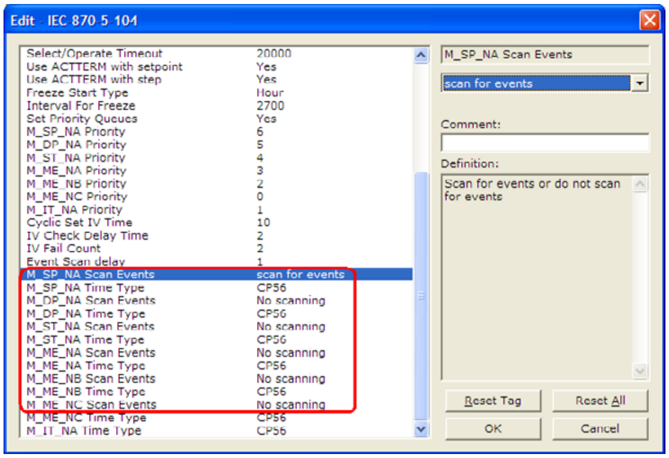
Edit - M_SP_NA_1 104

	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	100	0	40000000		

DB Address Value Status - OK

Data Type Level

The user may configure if a data type should generate events or not. Each data type has a configuration parameter to control the generation of events:



Edit - IEC 870 5 104

Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	No scanning
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	No scanning
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	No scanning
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	No scanning
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	No scanning
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

M_SP_NA Scan Events

scan for events

Comment:

Definition:

Scan for events or do not scan for events

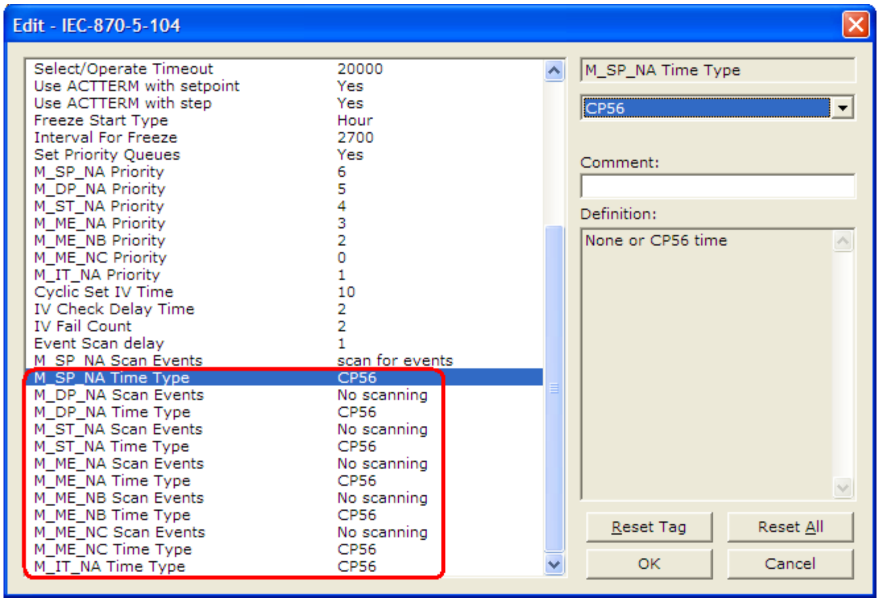
In the example above, only the M_SP_NA points would generate events.

Time Information

Each event may also send the date and time when it has occurred. The MVI56-104S module supports the CP56 time format (as defined in the protocol specification). This format contains the milliseconds, seconds, minute, hour, day, month and year when the event has occurred.

The MVI56-104S module may also be configured not to send any time information with each event for certain data types.

The following "Time Type" parameters may be used to control the time information for each data type:



Select/Operate Timeout	20000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Hour
Interval For Freeze	2700
Set Priority Queues	Yes
M_SP_NA Priority	6
M_DP_NA Priority	5
M_ST_NA Priority	4
M_ME_NA Priority	3
M_ME_NB Priority	2
M_ME_NC Priority	0
M_IT_NA Priority	1
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	No scanning
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	No scanning
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	No scanning
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	No scanning
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	No scanning
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

M_SP_NA Time Type

CP56

Comment:

Definition:

None or CP56 time

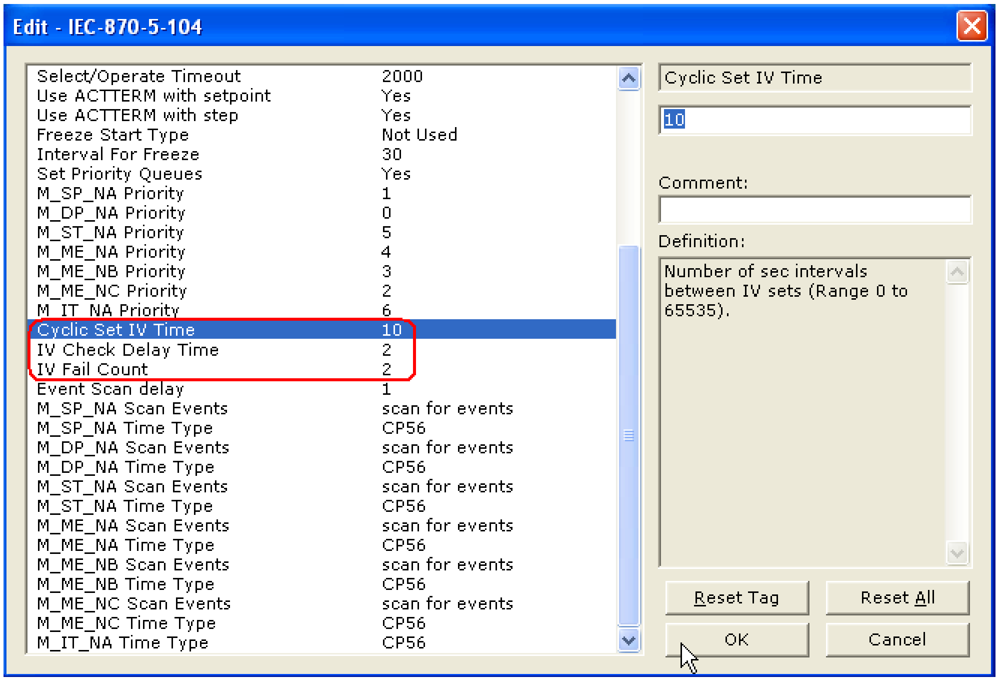
Note: The client should send a Time Synchronization command to the module in order to synchronize its date and time information, according to the protocol specifications. Depending on certain parameters, as well as hardware limitations, the module may present some time delay over time. The client should periodically send time synchronization requests to the 104S module.

Invalid Bit Monitoring

This feature allows the application to set the invalid (IV) quality bit of the protocol for all the monitored ASDU types supported. If the feature is enabled, the status of each point configured by the user can have the individual IV quality bit determined by the processor.

The parameters required to support this feature are:

- Cyclic Set IV Time
- IV Check Delay Time
- IV Fail Count



Edit - IEC-870-5-104

Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	1
M_DP_NA Priority	0
M_ST_NA Priority	5
M_ME_NA Priority	4
M_ME_NB Priority	3
M_ME_NC Priority	2
M_IT_NA Priority	6
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	scan for events
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	scan for events
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	scan for events
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	scan for events
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	scan for events
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

Cyclic Set IV Time

10

Comment:

Definition:

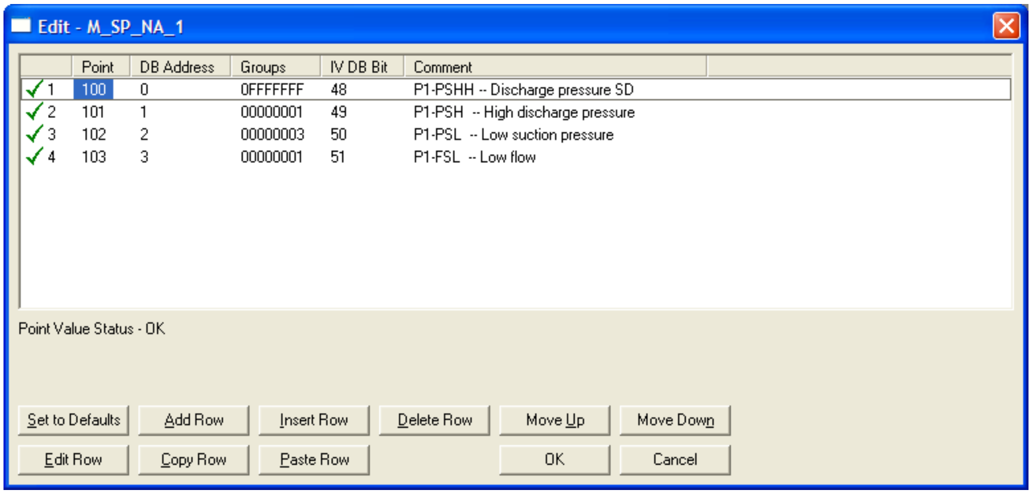
Number of sec intervals between IV sets (Range 0 to 65535).

To disable this feature, set the IV Fail Count parameter to 0. If the IV bit field is absent or set to 0, the invalid quality state for the point will always be reported as valid. If used, the Cyclic Set IV Time parameter must be at least 3 times larger than the IV Check Delay Time.

The **CYCLIC SET IV TIME** parameter determines the interval at which the driver will set all the IV bits for the points being monitored in the module. If the IV bit is ON for the number of times specified by the **IV FAIL COUNT** parameter , the point is in an invalid state. The driver will check the state of each bit at the frequency determined by the **IV CHECK DELAY TIME**.

The values for the parameters must permit the driver to properly execute the logic. For example, the value for **CYCLIC SET IV TIME** should be twice the **IV CHECK DELAY TIME,** multiplied by the **IV FAIL COUNT**. If the cyclic timer is set to a smaller value, the logic may not execute correctly.

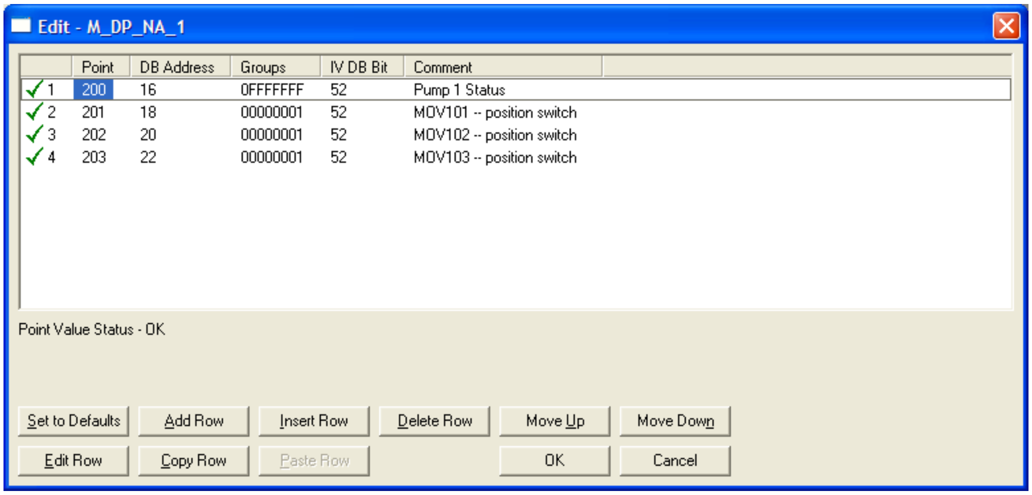
In order to configure points for this feature, the **IV DB BIT** field for each data type must be set to the database configuration records in the configuration file. For example;



Edit - M_SP_NA_1

	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	100	0	0FFFFFFF	48	P1-PSHH -- Discharge pressure SD
✓ 2	101	1	00000001	49	P1-PSH -- High discharge pressure
✓ 3	102	2	00000003	50	P1-PSL -- Low suction pressure
✓ 4	103	3	00000001	51	P1-FSL -- Low flow

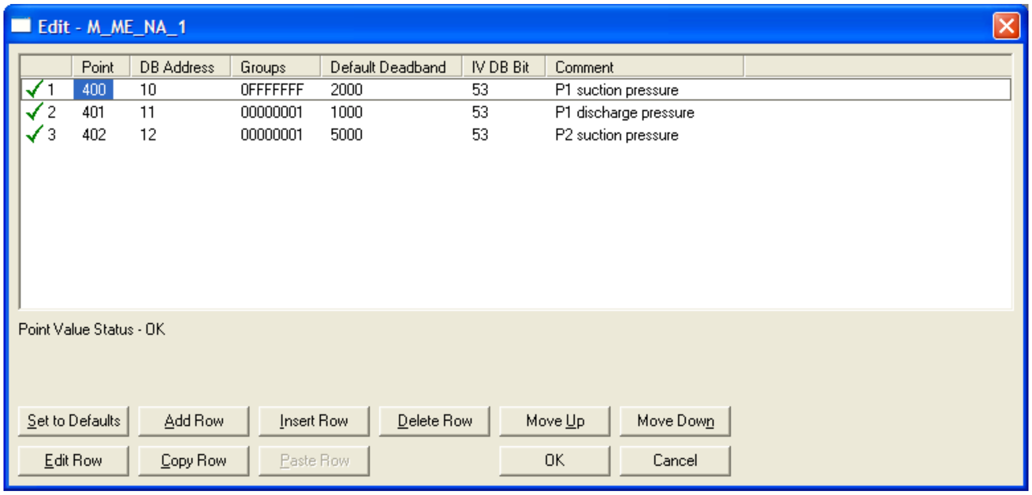
Point Value Status - OK



Edit - M_DP_NA_1

	Point	DB Address	Groups	IV DB Bit	Comment
✓ 1	200	16	0FFFFFFF	52	Pump 1 Status
✓ 2	201	18	00000001	52	MOV101 -- position switch
✓ 3	202	20	00000001	52	MOV102 -- position switch
✓ 4	203	22	00000001	52	MOV103 -- position switch

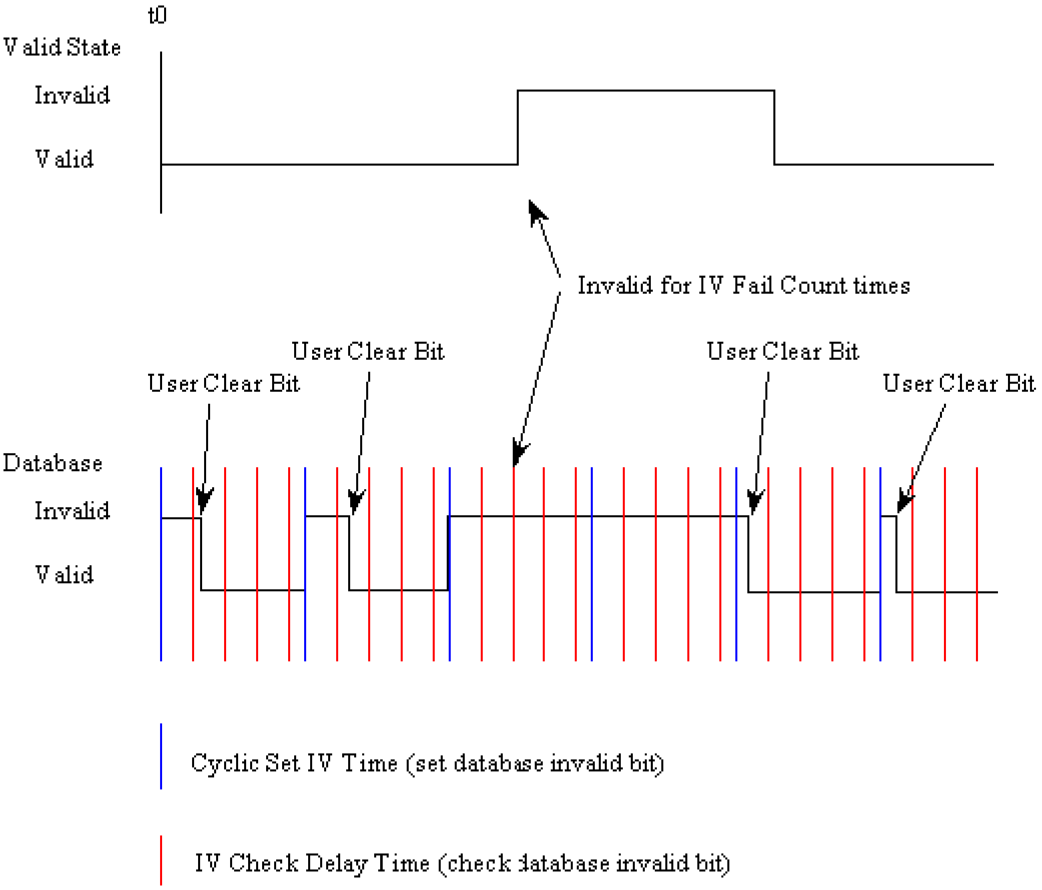
Point Value Status - OK



	Point	DB Address	Groups	Default Deadband	IV DB Bit	Comment
✓ 1	400	10	0FFFFFFF	2000	53	P1 suction pressure
✓ 2	401	11	00000001	1000	53	P1 discharge pressure
✓ 3	402	12	00000001	5000	53	P2 suction pressure

Point Value Status - OK

The following illustration shows how these parameters are implemented:

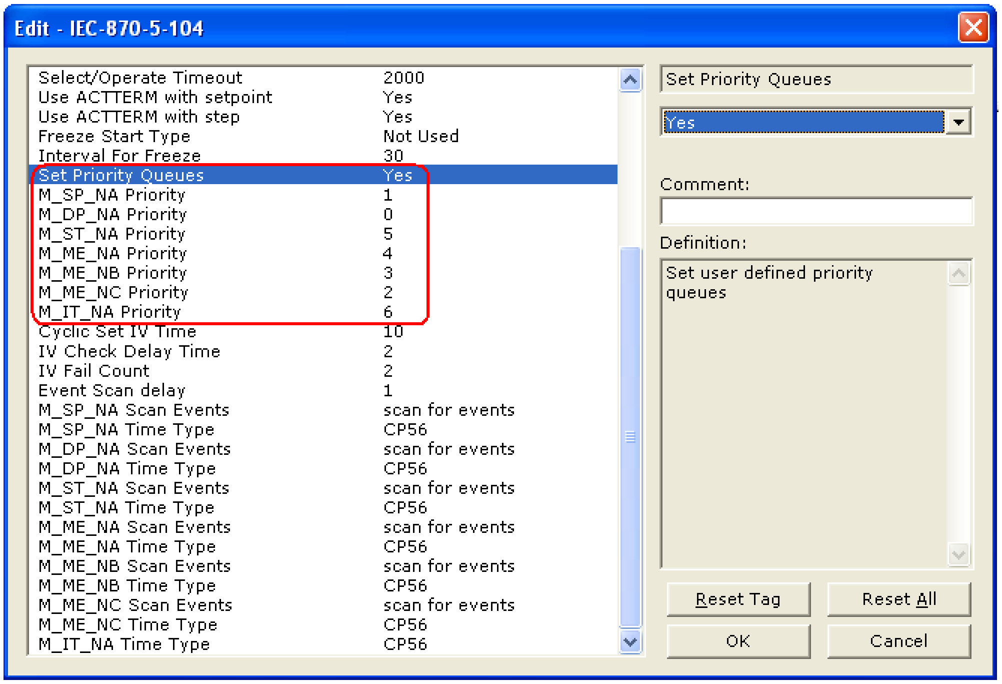

t0
Valid State
Invalid
Valid
Invalid for IV Fail Count times
User Clear Bit
User Clear Bit
User Clear Bit
User Clear Bit
Database
Invalid
Valid
Cyclic Set IV Time (set database invalid bit)
IV Check Delay Time (check database invalid bit)

If a database bit address (1 to 64000) is present, the application may consider the point with an invalid flag if the previous logic checks the IV bit as 1 during consecutive IV Check Delay scans. The IV bits would have to be reset to 0 to set the point to valid state.

The IV DB bit defined for each point can be unique, or many points may share the same bit. The last case could be used when the points on an I/O module are to be considered as one set. In this case only a single bit is required. For a point that is the result of a computation, the valid quality state could be set for each point individually.

Event Priority

Event Priority permits ASDUs that generate events to be placed in priority queues that are set by the user. The configuration file contains the following parameters to support this feature:



Edit - IEC-870-5-104

Select/Operate Timeout	2000
Use ACTTERM with setpoint	Yes
Use ACTTERM with step	Yes
Freeze Start Type	Not Used
Interval For Freeze	30
Set Priority Queues	Yes
M_SP_NA Priority	1
M_DP_NA Priority	0
M_ST_NA Priority	5
M_ME_NA Priority	4
M_ME_NB Priority	3
M_ME_NC Priority	2
M_IT_NA Priority	6
Cyclic Set IV Time	10
IV Check Delay Time	2
IV Fail Count	2
Event Scan delay	1
M_SP_NA Scan Events	scan for events
M_SP_NA Time Type	CP56
M_DP_NA Scan Events	scan for events
M_DP_NA Time Type	CP56
M_ST_NA Scan Events	scan for events
M_ST_NA Time Type	CP56
M_ME_NA Scan Events	scan for events
M_ME_NA Time Type	CP56
M_ME_NB Scan Events	scan for events
M_ME_NB Time Type	CP56
M_ME_NC Scan Events	scan for events
M_ME_NC Time Type	CP56
M_IT_NA Time Type	CP56

Set Priority Queues

Yes

Comment:

Definition:

Set user defined priority queues

The Set Priority Queues parameter must be enabled for this feature to be used. Each of the ASDUs affected by this feature must be assigned a unique priority index from 0 to 6. Events of the ASDU with a priority of 0 will always be reported before any others when they are present.

Example - Event Priority

If the module is configured with the example values above, and the event queue contains the events generated in the following order:

Event Order	ASDU
1	M_SP_NA
2	M_SP_NA
3	M_DP_NA
4	M_ST_NA
5	M_DP_NA
6	M_SP_NA

The module will respond to a class one data request from the controlling station by returning the data in the event queue in the order shown in the following table.

Packet Order	Content
1	M_DP_NA events 3 and 5
2	M_SP_NA events 1, 2 and 6
3	M_ST_NA event 4

Note that the events are packed into messages in order to maximize the efficiency of the network. The following warning must be considered when deciding to use this feature: Because events from the highest priority queues are always reported when present before lower priority queues, events in the lower queues may be lost due to buffer overflow.

If this feature is not utilized, each ASDU's events are stored in their own queue. The module will report each queue containing events in a round-robin fashion with all the data for each ASDU being packed. This methodology limits the possibility of a buffer overflowing and still maximizes the use of bandwidth on the communication channel.

5.2.6 SNTP Support

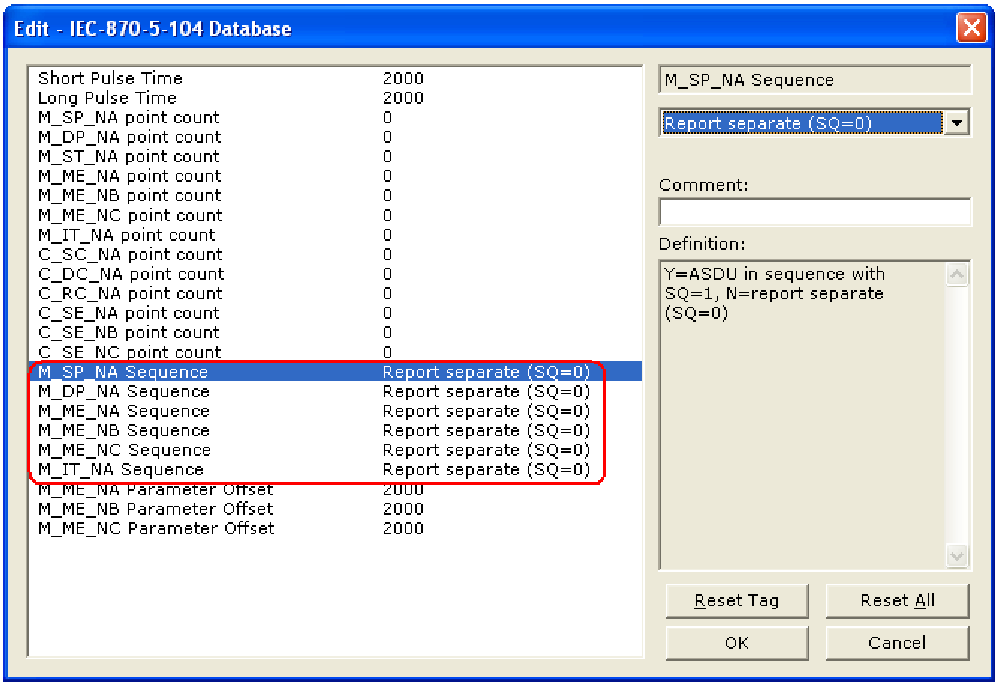
SNTP is used for time synchronization of produced and consumed commands. When an exchange occurs the driver compares time stamps from the previous exchange. When the new exchange time is less than the previous exchange, the exchange is ignored. This can occur when the Ethernet packets are routed and delayed. Time synchronization provides for data integrity. The following table lists the parameters defined in this section:

The SNTP driver will compute a new clock value every 5 minutes using the average value of 10 samples each collected over an approximate 6-second period. This new value will be used to adjust the clock maintained by the SNTP driver and used by the application. If a valid database register is specified, the driver will place the time value into the module’s database. The first two registers will contain the number of seconds and the next two registers will contain the number of microseconds since January 1, 1970.

A list of some of the common NTP servers can be obtained at http://www.ntp.org/, http://www.eecis.udel.edu/~mills/ntp/servers.html, along with the appropriate IP address. Other server lists can be found on the Internet by searching on "NTP Servers" with your browser.

5.2.7 Sequence Flag

In order to save bandwidth, you can configure the module to use the Sequence Flag feature using the following parameters:



Short Pulse Time	2000
Long Pulse Time	2000
M_SP_NA point count	0
M_DP_NA point count	0
M_ST_NA point count	0
M_ME_NA point count	0
M_ME_NB point count	0
M_ME_NC point count	0
M_IT_NA point count	0
C_SC_NA point count	0
C_DC_NA point count	0
C_RC_NA point count	0
C_SE_NA point count	0
C_SE_NB point count	0
C_SE_NC point count	0
M_SP_NA Sequence	Report separate (SQ=0)
M_DP_NA Sequence	Report separate (SQ=0)
M_ME_NA Sequence	Report separate (SQ=0)
M_ME_NB Sequence	Report separate (SQ=0)
M_ME_NC Sequence	Report separate (SQ=0)
M_IT_NA Sequence	Report separate (SQ=0)
M_ME_NA Parameter Offset	2000
M_ME_NB Parameter Offset	2000
M_ME_NC Parameter Offset	2000

M_SP_NA Sequence

Report separate (SQ=0)

Comment:

Definition:

Y=ASDU in sequence with SQ=1, N=report separate (SQ=0)

If this feature is not selected, the module will send the object address and its value at every monitored response to the master.

If this parameter is selected, the module will turn the Sequence Flag on every monitored response sending the address for the first point along with all point values. The MVI56-104S module assumes that all other points use information object addresses in a contiguous order (using the first point as the reference). So since the module does not send the address for each point it end up saving bandwidth communication, increasing the network performance.

Note: Refer to the client device specification to verify if this feature is supported before you consider using it.

5.3 General Concepts

The following discussion explains several concepts that are important for understanding MVI56-104S module operation.

5.3.1 Module Power Up

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

1 Initialize hardware components
- Initialize ControlLogix backplane driver
- Test and clear all RAM
- Initialize the serial communication ports

2 Read configuration on Compact Flash Disk
3 Initialize module register space
4 Enable Server Driver for TCP/IP stack.

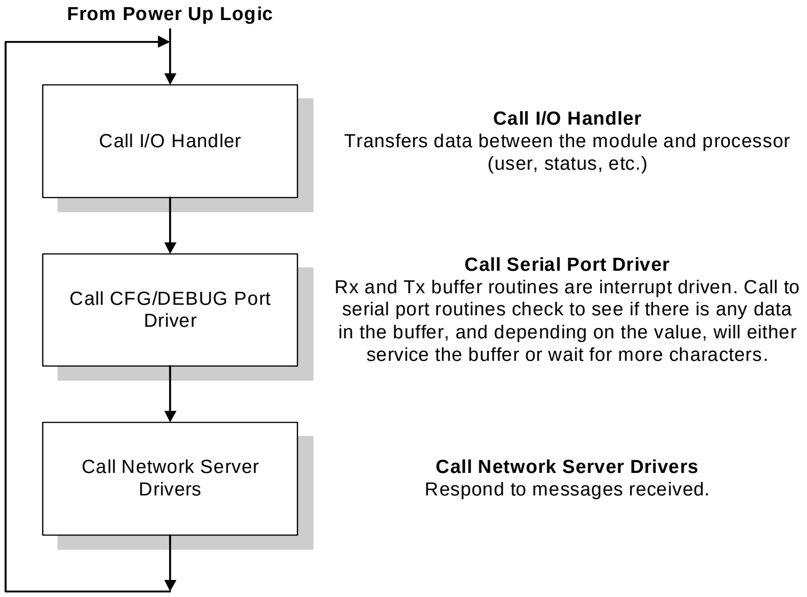
After the module has received the configuration, the module will begin receiving and transmitting messages with devices on the serial networks.

5.3.2 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 protocol ports can be shut down as prescribed in the user configuration. When the processor is returned to a running state, the module will resume communications on the network.

5.3.3 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 CFG/DEBUG Port Driver
Call Network Server Drivers
Call I/O Handler
Transfers data between the module and processor (user, status, etc.)
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 Server Drivers
Respond to messages received.

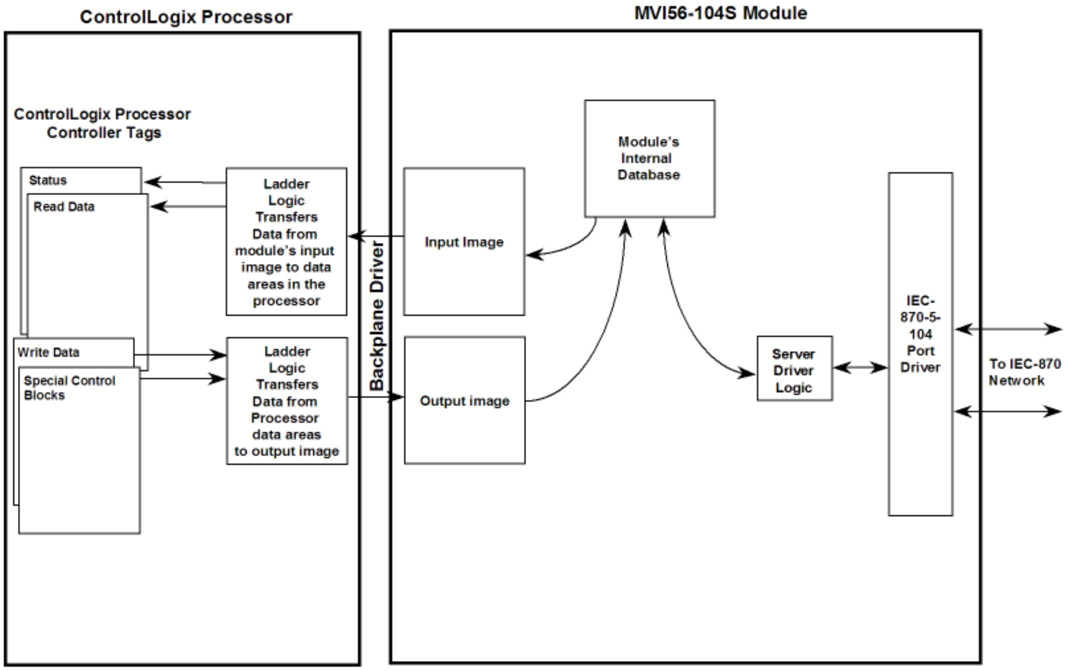
5.3.4 Backplane Data Transfer

The MVI56-104S 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 by the user for the module and the communication load on the module. Typical updates are in the range of 1 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 into 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 MVI56-104S module and the IEC 60870-5-104 network.


ControlLogix Processor
MVI56-104S Module
ControlLogix Processor Controller Tags
Status
Read Data
Write Data
Special Control Blocks
Ladder Logic Transfers Data from module's input image to data areas in the processor
Ladder Logic Transfers Data from Processor data areas to output image
Backplane Driver
Input Image
Output image
Module's Internal Database
Server Driver Logic
IEC-870-5-104 Port Driver
To IEC-870 Network

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:

Module's Internal Database Structure

4000 registers for user data	Register Data	**0** 3999

Data contained in this database is paged through the input and output images by coordination of the ControlLogix ladder logic and the MVI56-104S module's program. Up to 248 total words of data (including up to 200 words of user application-specific data and status data) can be transferred from the module to the processor at a time. Up to 247 words of data (including up to 200 words of user application-specific data) can be transferred from the processor to the modulea. The read and write block identification codes in each data block determine the function to be performed or the content of the data block. The module uses the following block numbers:

Block Range	**Descriptions**
-1	Null block
0	Null block
1 to 20	Read or write data
1000 to 1024	Request Output Data from Processor
9958	Event Messages
9970	Read Module's Time to Processor
9971	Set Module's Time Using Processor Time
9998	Warm-boot control block
9999	Cold-boot control block

5.3.5 Databases

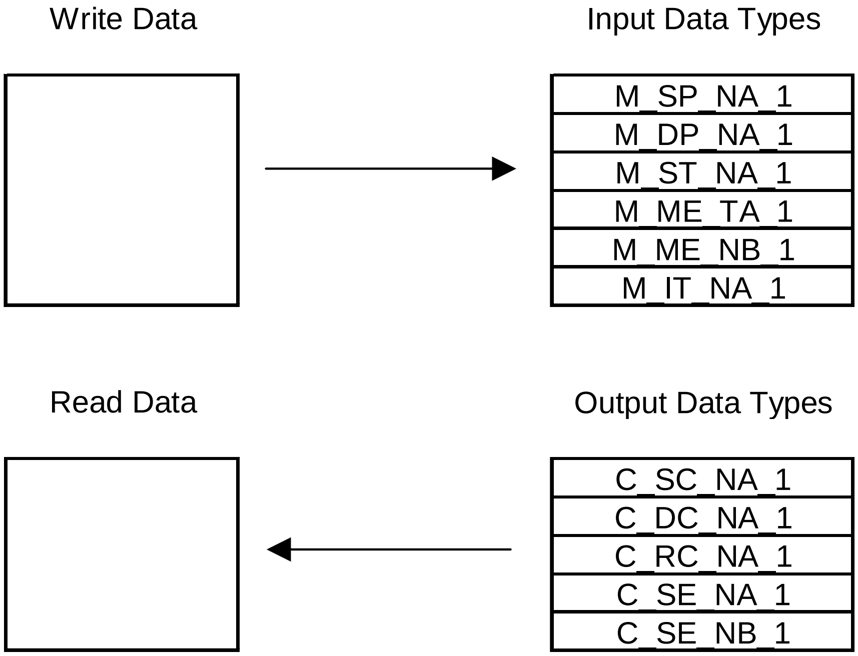
This section discusses the databases utilized by the module to support the IEC 60870-5-104 protocol of the IEC-60870-5-104 data types. The user is responsible for defining the databases for their specific application. In the module’s configuration file, the size of each database and definition of each point is established. Refer to the **Module Set Up** section for a complete discussion of the configuration file. The following table summarizes the data types used in each of the 11 individual databases:

Type ID	Type	Description	Data Representation
1	M_SP_NA_1 (7.3.1.1)	Monitored Single-point Information: This data type stores a single binary input point. Associated time-tagged event information for this type are M_SP_TA_1 (2) and M_SP_TB_1 (30).	Single bit value (7.2.6.1) with 0=Off and 1=On.
3	M_DP_NA_1 (7.3.1.3)	Monitored Dual-point Information: This data type stores a dual-point binary input value (that is, valve status). Associated time-tagged event information for this type are M_DP_TA_1 (4) and M_DP_TB_1 (31).	Dual-bit status (7.2.6.2) with 00b (0 decimal) = indeterminate or intermediate, 01b (1 decimal) = Off, 10b (2 decimal) = On and 11b (3 decimal) = indeterminate.

Type ID	Type	Description	Data Representation
5	M_ST_NA_1 (7.3.1.5)	Monitored Step-point Information: This data type is used for step position of transformers or other step position information. The value for the position ranges from -64 to information for this type are M_ST_TA_1 (6) and 63. Associated time-tagged event M_ST_TB_1 (32).	Step data (7.2.6.5) is stored in a single character value with bits 0 to 6 (-64 to +63) representing the step position and bit 7 representing the following states: 0 = Equipment is not in transient state 1 = Equipment in transient state
9	M_ME_NA_1 (7.3.1.9)	Monitored Normalized Measured Value: This data type is used for analog input data. Associated time-tagged event information for this type are M_ME_NA_1 (10) and M_ME_TD_1 (34).	Normalized values (7.2.6.6) are stored in a (16-bit) word data area with a range of -1..+1-2-15
11	M_ME_NB_1 (7.3.1.11)	Monitored Scaled Measured Value: This data type is used for analog input data. Associated time-tagged event information for this type are M_ME_TB_1 (12) and M_ME_TE_1 (35).	Scaled values (7.2.6.7) are stored in a (16-bit) word data area with a range of -215.. +215-1
13	M_ME_NC_1 (7.3.1.13)	Monitored Measured Value, Short Floating-Point Number: This data type is used for analog input data stored in floating point format according to the IEEE STD 754, QDS format. Associated time-tagged event information for this type are M_ME_TC_1 (14) and M_ME_TE_1 (36).	Short floating-point number stored in IEEE STD 754 format (Fraction, Exponent, Sign) (7.2.6.8)
15	M_IT_NA_1 (7.3.1.15)	Monitored Integrated Total-point Information: This data type stores meter or other count data. Associated time-tagged event information for this type are M_IT_TA_1 (15) and M_IT_TB_1 (37).	Binary counter data (7.2.6.9) is stored in a double-word (32-bit) value with a range of -231..+231-1.
45	C_SC_NA_1 (7.3.2.1)	Single-point Command: This command controls a single binary point such as a relay.	Single bit value (7.2.6.15) with 0 = Off and 1 = On
46	C_DC_NA_1 (7.3.2.2)	Double-point Command: This command controls a dual-point binary control device such as a trip/close relay.	Double Command (7.2.6.16) with 0 = Not permitted 1 = Off 2 = On 3 = Not permitted
47	C_RC_NA_1 (7.3.2.3)	Regulating Step Command: This command controls a stepping device such as a transformer.	Regulating Step Command (7.2.6.17) with 0 = Not permitted 1 = Next step lower 2 = Next step higher 3 = Not permitted
48	C_SE_NA_1 (7.3.2.4)	Setpoint Command, Normalized Value: This command controls an analog device.	Normalized values (7.2.6.6) are stored in a (16-bit) word data area with a range of -1..+1-2-15
49	C_SE_NB_1 (7.3.2.5)	Setpoint Command, Scaled Value: This command controls an analog device.	Scaled values (7.2.6.7) are stored in a (16-bit)word data area with a range of -215 .. +215-1
50	C_SE_NC_1 (7.3.2.6)	Setpoint Command, Short Floating-Point Format: This command controls an analog device accepting an IEEE STD 754 floating-point format value.	Short floating-point number stored in IEEE STD 754 format (Fraction, Exponent, Sign) (7.2.6.8)

A key concept in interfacing the protocol with the ControlLogix processor is the relationship between the databases and the data transfer operation between the module and the processor. The module transfers data to the processor in read blocks using the input image. These blocks should contain the information received from the controlling unit (output data) and includes the following data types: C_SC_NA_1, C_DC_NA_1, C_RC_NA_1, C_SE_NA_1 and C_SE_NB_1. This data is all sourced from the client unit and passed to the processor for control. Databases associated with these data types should place the points in the read data area of the module's database. The Read Register Start and Read Register Count parameters in the configuration file establish the portion of the database to transfer to the processor. Ladder logic extracts the data from the read data area and places it in the proper location for use by the processor.

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



The read and write areas can be placed anywhere in the module's 4000-word database area. Because each point is defined individually to the module, the data for a specific type need not be contiguous in the module's database. This means that the module error/status data area can be passed to the controlling station using the M_ME_NB_1 database. In the database definition for the type, establish a point for each status value to be monitored by the controlling station and set the module's database address for the point in the definition.

5.3.6 SNTP Support

SNTP is used for time synchronization of produced and consumed commands. When an exchange occurs the driver compares time stamps from the previous exchange. When the new exchange time is less than the previous exchange, the exchange is ignored. This can occur when the Ethernet packets are routed and delayed. Time synchronization provides for data integrity. The following table lists the parameters defined in this section:

The SNTP driver will compute a new clock value every 5 minutes using the average value of 10 samples each collected over an approximate 6-second period. This new value will be used to adjust the clock maintained by the SNTP driver and used by the application. If a valid database register is specified, the driver will place the time value into the module’s database. The first two registers will contain the number of seconds and the next two registers will contain the number of microseconds since January 1, 1970.

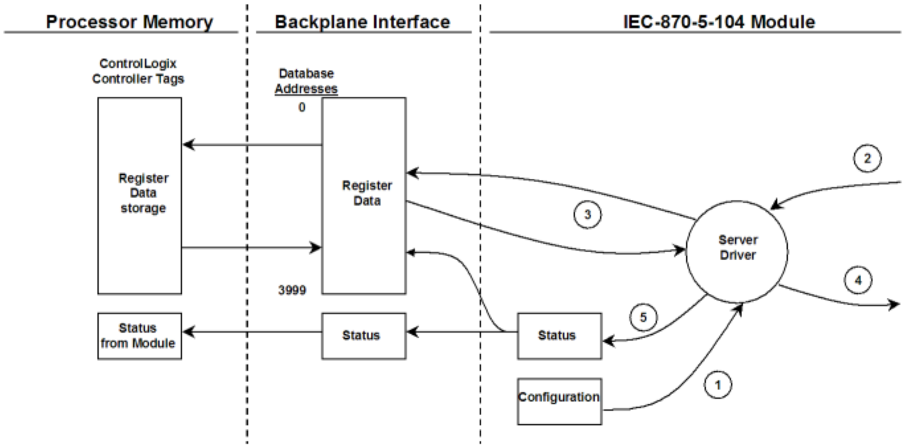
A list of some of the common NTP servers can be obtained at http://www.ntp.org/, http://www.eecis.udel.edu/~mills/ntp/servers.html, along with the appropriate IP address. Other server lists can be found on the Internet by searching on "NTP Servers" with your browser.

5.4 Data Flow Between the MVI56-104S Module and the ControlLogix Processor

The following topics describe the flow of data between the ControlLogix processor, the MVI56-104S module IEC60870-5-104 server, and the remote IEC 60870-5-104 Client unit.

5.4.1 Server Driver

The Server Driver allows the MVI56-104S module to respond to data read and write commands issued by a client unit on the Ethernet network. The following flow chart and associated table describe the flow of data into and out of the module:



Step	Description
1	The server driver receives the configuration information from the Compact Flash Disk in the module. This information configures the driver and define the node characteristics.
2	A Host device issues a read or write command (I-format messages) to the module's node address. The driver qualifies the message before accepting it into the module. Additionally, the host can send S- and U-format messages to the module that will also be handled by the driver.
3	After the module accepts the message, the data is immediately transferred to or from the internal database in the module. If the command is a read command, the data is read out of the database and a response message is built. If the command is a write command, the data is written directly into the database and a response message is built. The module will also generate messages without being queried by the host. These messages include spontaneous and cyclic COT messages. Additionally, the driver may send S- and U-format messages as required by the user set timeout parameters.
4	After the data processing has been completed in Step 3, the response is issued to the originating client node.
5	Counters are available in the Status Block that permit the ladder logic program to determine the level of activity of the Driver.

Review the Configuring the MVI56-104S Module (page 23) chapter for a complete list of the parameters that must be defined for a server. The IEC 60870-5-104 Interoperability Document for the MVI56-104S Server Module contains a listing of the protocol support supplied in the module.

5.5 Cable Connections

The MVI56-104S module has the following functional communication connections installed:

- One Ethernet port (RJ45 connector)
- One RS-232 Configuration/Debug port (RJ45 connector)

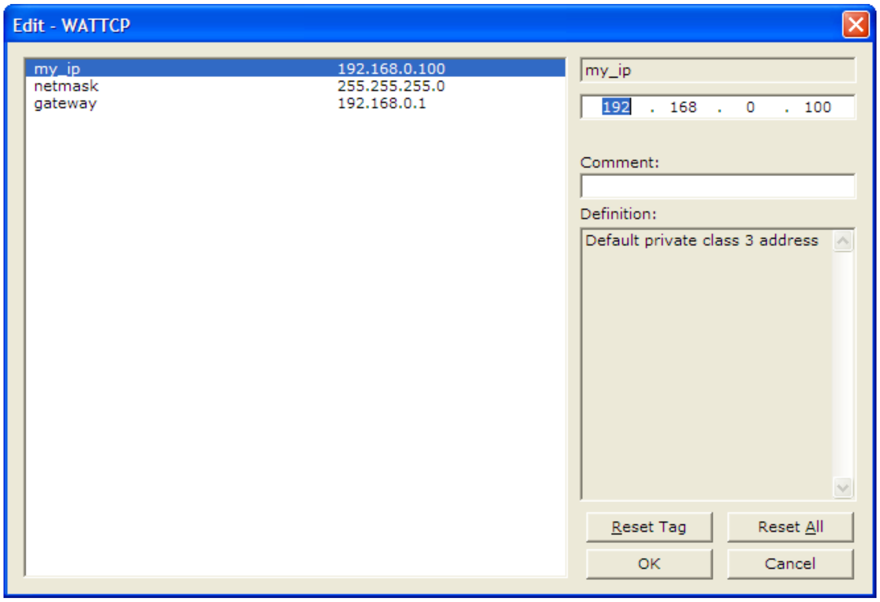
5.5.1 Ethernet Connection

The MVI56-104S module has an RJ45 port located on the front of the module labeled "Ethernet", for use with the TCP/IP network. The module is connected to the Ethernet network using an Ethernet cable between the module's Ethernet port and an Ethernet switch or hub.

Note: Depending on hardware configuration, you may see more than one RJ45 port on the module. The Ethernet port is labeled "Ethernet".
Warning: The MVI56-104S module is NOT compatible with Power Over Ethernet (IEEE802.3af / IEEE802.3at) networks. Do NOT connect the module to Ethernet devices, hubs, switches or networks that supply AC or DC power over the Ethernet cable. Failure to observe this precaution may result in damage to hardware, or injury to personnel.
Important: The module requires a static (fixed) IP address that is not shared with any other device on the Ethernet network. Obtain a list of suitable IP addresses from your network administrator BEFORE configuring the Ethernet port on this module.

Ethernet Port Configuration - wattcp.cfg

The wattcp.cfg file must be set up properly in order to use a TCP/IP network connection. You can view the current network configuration using an ASCII terminal by selecting **[@]** (Network Menu) and **[V]** (View) options when connected to the Debug port.



```
my_ip        192.168.0.100
netmask      255.255.255.0
gateway      192.168.0.1
```

my_ip

192 . 168 . 0 . 100

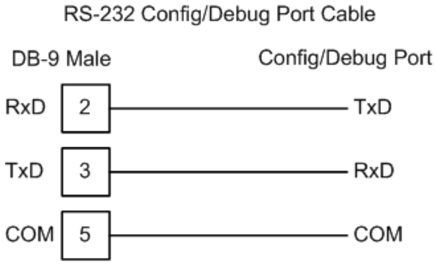
Comment:

Definition:

Default private class 3 address

5.5.2 RS-232 Configuration/Debug Port

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

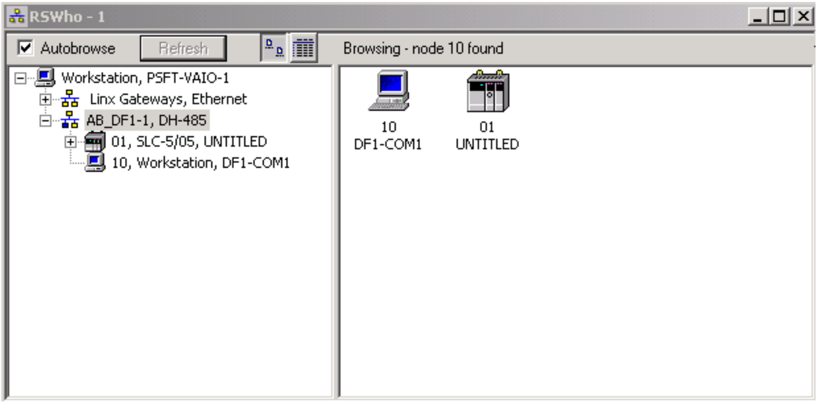


Disabling the RSLinx Driver for the Com Port on the PC

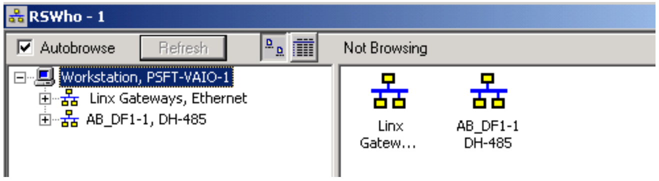
The communication port driver in RSLinx can occasionally prevent other applications from using the PC's COM port. If you are not able to connect to the module's configuration/debug port using ProSoft Configuration Builder (PCB), HyperTerminal or another terminal emulator, follow these steps to disable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

1 Open RSLinx and go to Communications>RSWho

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



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

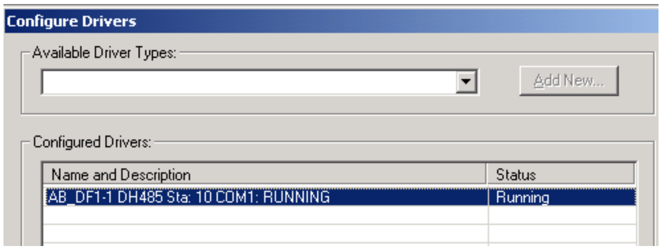


Branches are displayed or hidden by clicking on the ⊞ or the ⊟ icons.

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

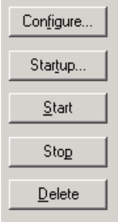
Communications>Configure Drivers

You may see something like this:

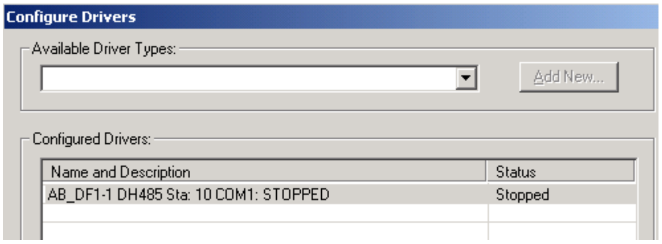


Name and Description	Status
AB_DF1-1 DH485 Sta: 10 COM1: RUNNING	Running

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:

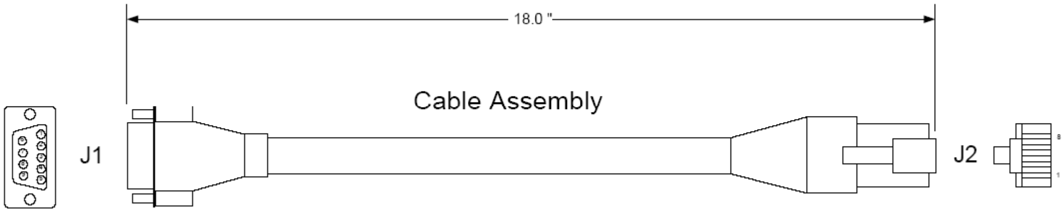


Name and Description	Status
AB_DF1-1 DH485 Sta: 10 COM1: STOPPED	Stopped

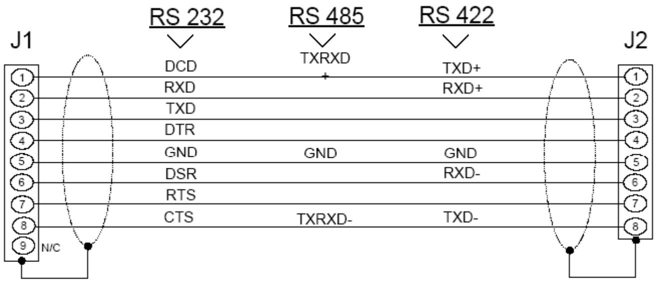
6 Upon seeing this, you may now use that com port to connect to the debug port of the module.

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.

5.5.3 DB9 to RJ45 Adaptor (Cable 14)



Cable Assembly



Wiring Diagram

5.6 IEC 60870-5-104 Server Interoperability Document

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

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

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

□ Function or ASDU is not used

☒ Function or ASDU is used as standardized (default)

R Function or ASDU is used in reverse mode

B Function or ASDU is used in standard and reverse mode

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

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

5.6.1 System or device

□ System definition

□ Controlling station definition (Master)

☒ Controlled station definition (Slave)

5.6.2 Application Layer

Transmission mode for application data

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

Common Address of ASDU

(System-specific parameter)

□ One octet ☒ Two octets

Information object address

(System-specific parameter)

□ One octet □ Structured

□ Two octets □ Unstructured

☒ Three octets

Cause of transmission

(System-specific parameter)

□ One octet ☒ Two octets (with originator address)

Length of APDU

(System-specific parameter, specify the maximum length of the APDU per system)

The Maximum length of the APDU is 253 (default). The maximum length may be reduced by the system.

253 Maximum length of APDU per system

5.6.3 Selection of standard ASDUs

Process information in monitor direction

(Station-specific parameter, mark each Type ID '**X**" if it is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ <1> := Single-point information M_SP_NA_1

☒ <3> := Double-point information M_DP_NA_1

☒ <5> := Step position information M_ST_NA_1

□ <7> := Bitstring of 32 bit M_BO_NA_1

☒ <9> := Measured value, normalized value M_ME_NA_1

☒ <11> := Measured value, scaled value M_ME_NB_1

☒ <13> := Measured value, short floating point value M_ME_NC_I

☒ <15> := Integrated totals M_IT_NA_1

□ <20> := Packed single-point information with status change detection M_PS_NA_1

□ <21> := Measured value, normalized value without quality descriptor M_ME_ND_1

☒ <30> := Single-point information with time tag CP56Time2a M_SP_TB_1

☒ <31> := Double-point information with time tag CP56Time2A M_DP_TB_1

☒ <32> := Step position information with time tag CP56Time2A M_ST_TB_1

□ <33> := Bitstring of 32 bit with time tag CP56Time2A M_BO_TB_1

☒ <34> := Measured value, normalized value with time tag CP56Time2A M_ME_TD_1

☒ <35> := Measured value, scaled value with time tag CP56Time2A M_ME_TE_1

☒ <36> := Measured value, short floating point value with time tag CP56Time2A M_ME_TF_1

☒ <37> := Integrated totals with time tag CP56Time2A M_IT_TB_1

□ <38> := Event of protection equipment with time tag CP56Time2A M_EP_TD_1

□ <39> := Packed start events of protection equipment with time tag CP56time2A M_EP_TE_1

□ <40> := Packed output circuit information of protection equipment with time tag CP56Time2a M_EP_TF_1

Process information in control direction

(Station-specific parameter, mark each Type ID '**X**" if it is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒	<45>	:= Single command	C_SC_NA_1
☒	<46>	:= Double command	C_DC_NA_1
☒	<47>	:= Regulating step command	C_RC_NA_1
☒	<48>	:= Set point command, normalized value	C_SE_NA_1
☒	<49>	:= Set point command, scaled value	C_SE_NB_1
☒	<50>	:= Set point command, short floating point value	C_SE_NC_1
□	<51>	:= Bitstring of 32 bit	C_BO_NA_1
☒	<58>	:= Single command with time tag CP56Time2a	C_SC_TA_1
☒	<59>	:= Double command with time tag CP56Time2A	C_DC_TA_1

☒ <60> := Regulating step command with time tag CP56Time2A C_RC_TA_1

☒ <61> := Set point command, normalized value with time tag CP56Time2A C_SE_TA_1

☒ <62> := Set point command, scaled value with time tag CP56Time2A C_SE_TB_1

☒ <63> := Set point command, short float value with time tag CP56Time2A C_SE_TC_1

□ <64> := Bitstring of 32 bit with time tag CP56Time2A C_BO_TA_1

Either the ASDUs of the set <45>-<51> or of the set <58>-<64> are used.

System information in monitor direction

(Station-specific parameter, mark "**X**" if used)

☒ <70> := End of initialization M_EI_NA_1

System information in control direction

(Station-specific parameter, mark each Type ID '**X**" if it is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒	<100>	:= Interrogation command	C_IC_NA_1
☒	<101>	:= Counter interrogation command	C_CI_NA_1
☒	<102>	:= Read command	C_RD_NA_1
☒	<103>	:= Clock synchronization command	C_CS_NA_1
☒	<105>	:= Reset process command	C_RP_NC_1
☒	<107>	:= Test command with time tag CP56Time2a	C_TS_TA_1

Parameter in control direction

(Station-specific parameter, mark each Type ID '**X**" if it is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒	<110>	:= Parameter of measured value, normalized value	P_ME_NA_1
☒	<111>	:= Parameter of measured value, scaled value	P_ME_NB_1
☒	<112>	:= Parameter of measured value, short floating point value	P_ME_NC_1
□	<113>	:= Parameter activation	P_AC_NA_1

File transfer

(Station-specific parameter, mark each Type ID "**X**" if it is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

□	<120>	:= File ready	F_FR_NA_1
□	<121>	:= Section ready	F_SR_NA_1
□	<122>	:= Call directory, select file, call file, call section	F_SC_NA_1
□	<123>	:= Last section, last segment	F_LS_NA_1
□	<124>	:= Ack file, ack section	F_AF_NA_1
□	<125>	:= Segment	F_SG_NA_1
□	<126>	:= Directory	F_DR_TA_1

5.6.4 Type identifier and cause of transmission assignments

(Station-specific parameters)

Shaded boxes: option not required

Black boxes: option not permitted in this companion standard

Blank boxes: functions or ASDU not used

Mark Type Identification/Cause of Transmission combinations: '**X**" if only used in standard direction, "**R**" if only used in reverse direction, and "**B**" if used in both directions

Type Identification		Cause of transmission																		
		1	2	3	4	5	6	7	8	9	10	11	12	13	20 to 36	37 to 41	44	45	46	47
<1>	M_SP_NA_1	X		X		X						X			X					
<3>	M_DP_NA_1	X		X		X						X			X					
<5>	M_ST_NA_1	X		X		X						X			X					
<7>	M_BO_NA_1																			
<9>	M_ME_NA_1	X		X		X									X					
<11>	M_ME_NB_1	X		X		X									X					
<13>	M_ME_NC_1	X		X		X									X					
<15>	M_IT_NA_1	X		X		X										X				
<20>	M_PS_NA_1																			
<21>	M_ME_ND_1																			
<30>	M_SP_TB_1			X											X					
<31>	M_DP_TB_1			X											X					
<32>	M_ST_TB_1			X											X					
<33>	M_BO_TB_1																			
<34>	M_ME_TD_1			X											X					
<35>	M_ME_TE_1			X											X					
<36>	M_ME_TF_1			X											X					
<37>	M_IT_TB_1			X												X				
<38>	M_EP_TD_1																			
<39>	M_EP_TE_1																			
<40>	M_EP_TF_1																			
<45>	C_SC_NA_1						X	X	X	X	X									
<46>	C_DC_NA_1						X	X	X	X	X									
<47>	C_RC_NA_1						X	X	X	X	X									
<48>	C_SE_NA_1						X	X	X	X	X									
<49>	C_SE_NB_1						X	X	X	X	X									
<50>	C_SE_NC_1						X	X	X	X	X									
<51>	C_BO_NA_1						X	X	X	X	X									
<58>	C_SC_TA_1						X	X	X	X	X									
<59>	C_DC_TA_1						X	X	X	X	X									
<60>	C_RC_TA_1						X	X	X	X	X									
<61>	C_SE_TA_1						X	X	X	X	X									
<62>	C_SE_TB_1						X	X	X	X	X									
<63>	C_SE_TC_1						X	X	X	X	X									
<64>	C_BO_TA_1																			
<70>	M_EI_NA_1				X															
<100>	C_IC_NA_1						X	X	X	X	X									
<101>	C_CI_NA_1						X	X			X									
<102>	C_RD_NA_1					X														
<103>	C_CS_NA_1						X	X												
<105>	C_RP_NA_1						X	X												
<107>	C_TS_TA_1						X	X												
<110>	P_ME_NA_1						X	X												
<111>	P_ME_NB_1						X	X												
<112>	P_ME_NC_1						X	X												
<113>	P_AC_NA_1																			
<120>	F_FR_NA_1																			
<121>	F_SR_NA_1																			
<122>	F_SC_NA_1																			
<123>	F_LS_NA_1																			
<1124>	F_AF_NA_1																			
<125>	F_SG_NA_1																			
<126>	F_DR_TA_1																			

5.6.5 Basic Application Functions

Station initialization

(Station-specific parameter, mark "**X**" if function is used)

☒ Remote initialization

Cyclic data transmission

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Cyclic data transmission

Read procedure

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Read procedure

Spontaneous transmission

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Spontaneous transmission

Double transmission of information objects with cause of transmission spontaneous

(Station-specific parameter, mark each information type "**X**" where both a Type ID without time and corresponding Type ID with time are issued in response to a single spontaneous change of a monitored object)

The following type identifications may be transmitted in succession caused by a single status change of an information object. The particular information object addresses for which double transmission is enabled are defined in a project-specific list.

□ Single-point information M_SP_NA_1, M_SP_TA_1, M_SP_TB_1 and M_PS_NA_1

□ Double-point information M_DP_NA_1, MDP_TA_1 and M_DP_TB_1

□ Step position information M_ST_NA_1, M_ST_TA_1 and M_ST_TB_1

□ Bitstring of 32 bit M_BO_NA_1, M_BO_TA_1 and M_BO_TB_1

□ Measured value, normalized value M_ME_NA_1, M_ME_TA_1, M_ME_ND_1 and M_ME_TD_1

□ Measured value, scaled value M_ME_NB_1, M_ME_TB_1 and M_ME_TE_1

□ Measured value, short floating point number M_ME_NC_1, M_ME_TC_1 and M_ME_TF_1

Station Interrogation

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ global

☒ group 1

☒ group 2

☒ group 3

☒ group 4

☒ group 5

☒ group 6

☒ group 7

☒ group 8

☒ group 9

☒ group 10

☒ group 11

☒ group 12

☒ group 13

☒ group l4

☒ group 15

☒ group 16

Addresses per group have to be defined

Clock synchronization

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Clock synchronization

Optional

Command transmission

(Object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Direct command transmission

☒ Direct set point command transmission

☒ Select and execute command

☒ Select and execute set point command

☒ C_SE_ACTTERM used note 2

☒ No additional definition

☒ Short pulse duration (duration determined by a system parameter in the outstation)

☒ Long pulse duration (duration determined by a system parameter in the outstation)

☒ Persistent output

□ Supervision of maximum delay in command direction of commands and set point commands

Maximum allowable delay of commands and set point commands

Transmission of Integrated totals

(Station- or object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Mode A: Local freeze with spontaneous transmission

□ Mode B: Local freeze with counter interrogation

□ Mode C: Freeze and transmit by counter-interrogation commands

☒ Mode D: Freeze by counter-interrogation command, frozen values reported spontaneously

☒ Counter read

☒ Counter freeze without reset

□ Counter freeze with reset

□ Counter reset

☒ General request counter

☒ Request counter group 1

☒ Request counter group 2

☒ Request counter group 3

☒ Request counter group 4

Parameter loading

(Object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

☒ Threshold value

□ Smoothing factor

☒ Low limit for transmission of measured value

☒ High limit for transmission of measured value

Parameter activation

(Object-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

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

Test procedure

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

□ Test procedure

File transfer

(Station-specific parameter, mark "**X**" if function is used)

File transfer in monitor direction

□ Transparent file

□ Transmission of disturbance data of protection equipment

□ Transmission of sequence of events

□ Transmission of sequence of recorded analogue values

File transfer in control direction

□ Transparent file

Background scan

(Station-specific parameter, mark "**X**" if function is only used in the standard direction, "**R**" if only used in the reverse direction, and "**B**" if used in both directions)

□ Background scan

Definition of time outs

Parameter	Default Value	Remarks	Selected Value
t_0	60 seconds	Time-out of connection establishment	60 seconds
t_1	15 seconds	Time-out of send or test APDUs	
t_2	10 seconds	Time-out for acknowledges in case of no data messages ($t_2 < t_1$)	
t_3	20 seconds	Time-out for sending test frames in case of a long idle time	

Maximum range of values for configurable time-outs: 1 to 255 seconds, accuracy 1 second. (t1,t2,and t3 only)

Maximum number of outstanding I format APDUs k and latest acknowledge APDUs (w)

Parameter	Default Value	Remarks	Selected Value
k	12 APDUs	Maximum difference receive sequence number to send state variable (Maximum value is 19)	
w	8 APDUs	Latest acknowledge after receiving *w* I format APDUs	

Maximum range of values *k*: 1 to 32767 (2^{15}-1) APDUs, accuracy 1 APDU

Maximum range of values *w*: 1 to 32767 (2^{15}-1) APDUs, accuracy 1 APDU

(Recommendation: *w* should not exceed two-thirds of *k*).

Port number

Parameter	Value	Remarks
Port number	2404	In all cases

RFC 2200 suite

RFC 2200 is an official Internet Standard which describes the state of standardization of protocols used in the Internet as determined by the Internet Architecture Board (IAB). It offers a broad spectrum of actual standards used in the Internet. The suitable selection of documents from RFC 2200 defined in this standard for given projects has to be chosen by the user of this standard.

☒ Ethernet 802.3

□ Serial X.21 interface

□ Other selection from RFC 2200

6 MVI56-104S Database Design Forms

In This Chapter

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

6.1 M_SP_NA_1, M_DP_NA_1, M_ST_NA_1 and M_IT_NA_1 Form

Point Number	Database Address	Group Assignment

6.2 M_ME_NA_1 and M_ME_NB_1 Form

Point Number	Database Address	Group Assignment	Default Deadband

6.3 C_RC_NA_1 Form

Point Number	Database Address	Monitor Point #	Monitor Database Address

6.4 Form for all C_ (Command) data types, except C_RC_NA_1

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

7 Support, Service & Warranty

In This Chapter

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

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

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

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

7.1 How to Contact Us: Technical Support

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

Asia Pacific

+603.7724.2080, support.asia@prosoft-technology.com
Languages spoken include: Chinese, English

Europe (location in Toulouse, France)

+33 (0) 5.34.36.87.20, support.EMEA@prosoft-technology.com
Languages spoken include: French, English

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

+1.661.716.5100, support@prosoft-technology.com
Languages spoken include: English, Spanish
For technical support calls within the United States, an after-hours answering system allows pager access to one of our qualified technical and/or application support engineers at any time to answer your questions.

Brasil (location in Sao Paulo)

+55-11-5084-5178, eduardo@prosoft-technology.com
Languages spoken include: Portuguese, English

7.2 Return Material Authorization (RMA) Policies and Conditions

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

7.2.1 All Product Returns:

a) In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Returned Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.
b) In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above (page 177). A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.
c) All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft using a shipment method other than that specified by ProSoft or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
d) A 10% restocking fee applies to all warranty credit returns whereby a Customer has an application change, ordered too many, does not need, and so on.

7.2.2 Procedures for Return of Units Under Warranty:

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

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

7.2.3 *Procedures for Return of Units Out of Warranty:*

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

The following is a list of non-repairable units:

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

7.3 LIMITED WARRANTY

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

7.3.1 What Is Covered By This Warranty

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

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

7.3.2 What Is Not Covered By This Warranty

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

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

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

7.3.3 Disclaimer Regarding High Risk Activities

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

7.3.4 Intellectual Property Indemnity

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

a) Any documentation included with Product purchased from ProSoft is protected by copyright and may not be duplicated or reproduced in any form without prior written consent from ProSoft.
b) ProSoft's technical specifications and documentation that are included with the Product are subject to editing and modification without notice.
c) Transfer of title shall not operate to convey to Customer any right to make, or have made, any Product supplied by ProSoft.
d) Customer is granted no right or license to use any software or other intellectual property in any manner or for any purpose not expressly permitted by any license agreement accompanying such software or other intellectual property.

e) Customer agrees that it shall not, and shall not authorize others to, copy software provided by ProSoft (except as expressly permitted in any license agreement accompanying such software); transfer software to a third party separately from the Product; modify, alter, translate, decode, decompile, disassemble, reverse-engineer or otherwise attempt to derive the source code of the software or create derivative works based on the software; export the software or underlying technology in contravention of applicable US and international export laws and regulations; or use the software other than as authorized in connection with use of Product.

f) **Additional Restrictions Relating To Software And Other Intellectual Property**

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

7.3.5 Disclaimer of all Other Warranties

The Warranty set forth in What Is Covered By This Warranty (page 180) 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.

*7.3.6 Limitation of Remedies ***

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

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

7.3.7 Time Limit for Bringing Suit

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

7.3.8 No Other Warranties

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

7.3.9 Allocation of Risks

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

7.3.10 Controlling Law and Severability

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

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