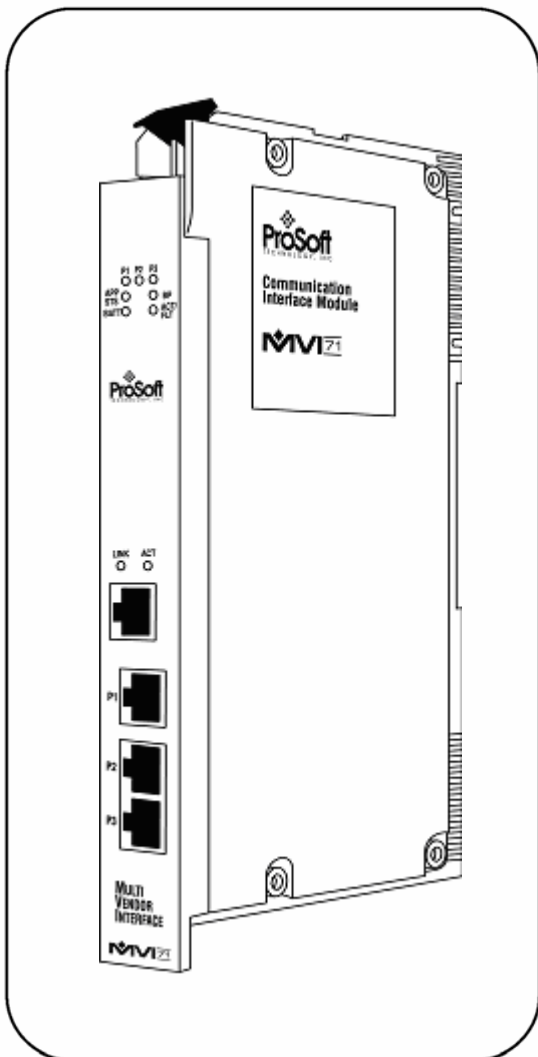


inRAx



MVI71-104S

PLC Platform

IEC 60870-5-104 Server Communication
Module

User Manual

March 27, 2007



Please Read This Notice

Successful application of this module requires a reasonable working knowledge of the Rockwell Automation PLC hardware, the MVI71-104S Module and the application in which the combination is to be used. For this reason, it is important that those responsible for implementation satisfy themselves that the combination will meet the needs of the application without exposing personnel or equipment to unsafe or inappropriate working conditions.

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

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

Power, Input, and Output (I/O) wiring must be in accordance with Class 1, 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.

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MVI71-104S User Manual

March 27, 2007

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Guide to the MVI71-104S 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.
Verify Communication, Diagnostic and Troubleshooting	→	Verifying Communication (page 33) Diagnostics and Troubleshooting (page 33)	This section describes how to verify communications with the network. Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview Glossary	→	Reference (page 45) Functional Overview (page 48) Product Specifications (page 45)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 83)	This section contains Support, Service and Warranty information. Index of chapters.

1 Module Configuration

In This Chapter

- Installing and Configuring the Module 9
- Module Data..... 12
- Modifying the Example Configuration File..... 14

This section contains the setup procedure, data and ladder logic requirements for successful application of the MVI71-104S module. Each step in the setup procedure is defined in order to simplify the use of the module. Go to the **Installing and Configuring the Module** section to begin installing and configuring the module. Additionally, this document contains a discussion on configuring the module using the IEC8704S.CFG file. All configuration information used by the module is stored in this file. Go to the **Configuration File** section to begin setting up this file.

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

The ladder logic requirement section defines the minimum ladder logic required to apply the module in a user application. The logic is simple to understand and implement. Go to the **Ladder Logic** section for a complete discussion of the ladder logic requirements.

1.1 Installing and Configuring the Module

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

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

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

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

Before installing and configuring the module, design the application. Determine the number points for each data type and complete the forms found in the Reference chapter. Make certain that the point index assigned to each point is unique. This is a requirement of the IEC-60870-5-101 specification.

It is now time to edit the IEC8704S.CFG file to set up the module for the specific application. Refer to the **Configuration File** section of this document. Download this configuration to the module along with the associated ladder logic.

The next step in installing and configuring the module is to define whether the block transfer or side-connect interface will be utilized. If the block transfer interface is to be used you should be ready to connect the module to the IEC-60870-5-104 network if the ladder logic is defined correctly.

If the side-connect interface is utilized, make sure the file SC_DATA.TXT on the Compact Flash Disk contains the correct first file number. You can run the setdnpssc.exe program to set the file number to be used with your application. Install the module in the rack and turn on the power. Connect the terminal server to the module's debug/configuration port and exit the program by pressing the Esc key followed by the 'X' key. This will cause the program to exit and remain at the operating system prompt. Run the setdnpssc.exe program with a command line argument of the file number to use for the first file. For example, to select N10: as the first file, enter the following:

```
SETDNPSC 10
```

The program will build the SC_DATA.TXT on the Compact Flash Disk (C: drive in the root directory).

The next step in module setup is to define the data files to be used with the application. If the block transfer interface is used, define the data files to hold the user data (read and write data). Enter the ladder logic to handle the blocks transferred between the module and the PLC. Download the program to the PLC and test the program with the module.

If the side-connect interface is used, no ladder logic is required for data transfer. The user data files to interface with the module must reside in contiguous order in the processor. The first file to be used by the interface is the status/control file. This is file number set in the SC_DATA.TXT file using the SETDNPSC.EXE program. The following table lists the files used by the side-connect interface:

File Number	Example	Size	Description
Cfg File	N10	100	Control/Status File
Cfg File+1	N11	to 1000	Data transferred from the module to the processor Other files for read data
Cfg File+1+n	N12	to 1000	Data transferred from the processor to the module Other files for write data

n is the number of read data files minus one. Each file contains up to 1000 words.
 m is the number of write data files minus one. Each file contains up to 1000 words.

More than one read and/or write file may exist in an application. This is required when more than 1000 words of data are required. The following tables show two examples for the files used with different data set sizes.

1.1.1 Example of 240 words of read and write data (cfg file=10)

Data Files	Description
N11:0 to 239	Read data
N12:0 to 239	Write data

1.1.2 Example of 2300 read and 3500 write data registers (cfg file=10)

Data Files	Description
N11:0 to 999	Read data words 0 to 999
N12:0 to 999	Read data words 1000 to 1999
N13:0 to 299	Read data words 2000 to 2299
N14:0 to 999	Write data words 0 to 999
N15:0 to 999	Write data words 1000 to 1999
N16:0 to 999	Write data words 2000 to 2999
N17:0 to 499	Write data words 3000 to 3499

Even if the files are not required for an application, they still are reserved and should only be used for that purpose. The read and write data contained in the last set of files possess the data transferred between the module and the processor. The read data file (Cfg File + 1) will contain data transferred from the module to the processor and should be associated with control data types. The write data file (Cfg File + 1 + n) will contain data passed to the module from the processor and should be associated with monitor data types.

Special care must be taken when defining the files for the side-connect interface. Because the module directly interacts with the PLC processor and its memory, any errors in the configuration may cause the processor to fault and it may even lose its configuration and program. After defining the files and populating them with the correct data, download the program to the processor, and place the processor in run mode. If everything is configured correctly, the module should start its normal operation.

The module is now and ready to use with your application. Insert the module in the rack (with the power turned off) and attach the serial communication cables. Download the new application to the controller and place the processor in run mode. Download the new IEC8704S.CFG file to the module using a terminal emulation program. If all the configuration parameters are set correctly and the module is attached to a network, the module's Application LED (APP LED) should remain off and the backplane activity LED (BP ACT) should blink very rapidly. Refer to the **Diagnostics and Trouble Shooting** section of this manual if you encounter errors. Attach a computer or terminal to Port 0 on the module and look at the status of the module using the Configuration/Debug Menu in the module. Refer to the **Diagnostics and Troubleshooting** section for a complete discussion of the use of this feature.

1.2 Module Data

All data related to the MVI71-104S module is stored in a user defined data files. It is the responsibility of the ladder logic program to construct all the data files required by the program and to write the ladder logic required to interface to these files.

1.2.1 Status Data

When the side-connect interface is employed in the application, the status data is automatically transferred from the module to the first file used by the interface. The data is placed at an offset of 0 in the file and has the following format:

Block Transfer Status Error Block

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

Immediately following this set of module status data is a data set of protocol status data. The structure of the protocol status data area is shown in the following table:

IEC-870-5-104 Status Error Block

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.

When the block transfer interface is used, the status data is placed in the module's internal database at the location specified by the Error Offset parameter in the configuration file. If this data area is transferred to the processor in the read data area, it will be passed from the module to the processor in a normal BTR block. This will be placed in the normal read data area. The format of the data is exactly the same as shown above, but the user determines its position. Refer to the Reference chapter for a complete listing of the data stored in this object.

1.2.2 User Data

When the side-connect interface is utilized, the read and write data is moved between the module and the processor without any ladder logic. The size of the data area and position of the data areas in the module's database is determined by the parameters set in the configuration file.

When the block transfer interface is used, ladder logic is required to page the data between the module and the processor. The size of the data area and position of the data areas in the module's database is determined by the parameters set in the configuration file.

The read data area 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 60 words. This data is paged up to 60 words at a time from the module to the processor. The Read Data task places the data received into the proper position in the read data array. Use this data for status and control in the ladder logic of the processor.

The write data area 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 60 words. This data is paged up to 60 words at a time from the processor to the module. The Write Data task places the write data into the output image for transfer to the module. This data is passed from the processor to the module for status and control information for use in other nodes on the network.

1.3 Modifying the Example Configuration File

In order for the module to operate, a configuration file (IEC8704S.CFG) is required. This configuration file contains information to set the data transfer characteristics between the module and the processor, to configure the communication ports, to establish the IEC 60870-5-104 protocol parameters and to define the databases required to hold the protocol data sets. Each parameter in the file must be set carefully in order for the application to be implemented successfully.

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

[Section]	Description
[Backplane Configuration]	Backplane transfer parameters
[IEC-870-5-104]	Server and protocol parameters
[IEC-870-5-104 IP Addresses]	List of valid IP addresses accepted by module
[IEC-870-5-104 Database]	Size definitions for each point database
[M_SP_NA_1 104]	Definition of monitored single-point database
[M_DP_NA_1 104]	Definition of monitored dual-point database
[M_ST_NA_1 104]	Definition of monitored step-point database
[M_ME_NA_1 104]	Definition of monitored normalized-point database
[M_ME_NB_1 104]	Definition of monitored scaled-point database
[M_ME_NC_1 104]	Definition of monitored short-float point database
[M_IT_NA_1 104]	Definition of monitored integrated total database
[C_SC_NA_1 104]	Definition of command single-point database
[C_DC_NA_1 104]	Definition of command dual-point database
[C_RC_NA_1 104]	Definition of command step-point database
[C_SE_NA_1 104]	Definition of command normalized-point database
[C_SE_NB_1 104]	Definition of command scaled-point database
[C_SE_NC_1 104]	Definition of command short-float setpoint database

After each section header, the file contains a set of parameters. Unique labels are used under each section to specify a parameter. Each label in the file must be entered exactly as shown in the file for the parameter to be identified by the program. If the module is not considering a parameter, look at the label for the data item. Each parameter's value is separated from the label with the ':' character. This character is used by the program to delimit the position in the data record where to start reading data. All data for a parameter must be placed after the ':' character. For numeric parameter values any text located after the value will not be used. There must be at least one space character between the end of the parameter value and the following text. The following is an example of a parameter entry:

```
Read Register Start : 100 #Starting DB address where read data stored
```

The parameter label is "Read Register Start" and the parameter value is 100. The characters after the parameter value are ignored and are used for internal documentation of the configuration file.

Any record that begins with the '#' character is considered to be a comment record. These records can be placed anywhere in the file as long as the '#' character is found in the first column of the line. These lines are ignored in the file and can be used to provide documentation within the configuration file. Liberal use of comments within the file can ease the use and interpretation of the data in the file.

The database definition sections in the database are formatted differently than the other sections. These sections contain lists of parameters to be used with each point in the database. Each list of points in begins with the label **START** and ends when the number of points specified for the data type is reached or when the **END** label is reached. When entering the point list data, make certain that the first character in each line is left blank. The point number should never be present as the first character in the line it should be a space or tab character.

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

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

Group Code	Description
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.

1.3.1 Obtain the Sample Configuration Files

The MVI71 CD is organized in folders by module name. In the folder for the module you are using, you will find sample configuration files and other information.

- 1 Use Windows Explorer to locate the sample configuration files for your MVI71 module on the MVI71 CD.
- 2 When you have located the correct configuration files, use the Copy and Paste commands to move the files to a location on your PC's hard drive. We recommend C:\temp.
- 3 Files copied from a CD-ROM are read-only. The next step is to make the files writable. Navigate to the directory where you copied the files, then select the files and click the right mouse button to open a shortcut menu. On the shortcut menu, select Properties, and clear (uncheck) the Read Only check box.
- 4 The next step is to open the configuration files in a text editor such as Notepad, which comes with Windows. To start Notepad, click the Start button, and then choose **Programs** → **Accessories** → **Notepad**.
- 5 When Notepad starts, open the File menu, and then choose **Open**. Navigate to the folder where you copied the configuration file on your PC and select the file. Click **Open**. The configuration file will open in Notepad, ready for editing.

Note: We do not recommend opening the configuration file in a word processor such as Microsoft Word, because the file may be saved in a format that cannot be read by the module.

1.3.2 **[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.

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.

Read Register Start

0 to 3999

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

Read Register Count

Range 0 to 4000

This parameter specifies the number of registers to transfer from the processor to the module. Valid entry for this parameter is 0 to 4000.

Write 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.

Write Register Count

Range 0 to 4000

This parameter specifies the number of registers to be transferred from the module to the processor. Valid entry for this parameter is 0 to 4000.

Failure Flag Count

0 through 65535

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

Error Offset

Error Offset : 1000 #Location of where to write status data
#(-1=disable)

This parameter specifies the database location where to write status data (-1=disable).

Initialize Output Data

Initialize Output Data : 0 #0=No, 1=Yes read output values from
#controller

Determines whether the module should read output values from the controller. 0 = No, 1 = Yes.

1.3.3 [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

The following example shows a sample [IEC-870-5-104] section:

Modify each parameter based on the needs of your application.

Use IP List

Use IP List : 0 #Use IP list to validate connection
#(0=No, 1=Yes)

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.

Override StartDT

Override StartDT : 1 #Used to ignore STARTDT/STOPDT state
#(0=No, 1=Yes)

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.

Clear Queue on Close

Clear queue on close : 0 #Clear the queue when connection
#closed (0=No, 1=Yes)

Use this command to define if 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 specification).

t1 Timeout Set Value

t1 timeout set value : 60 #timeout of send or test ASDU

This is the timeout of send or test ASDU's 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.

t2 Timeout Set Value

t2 timeout set value : 10 #timeout of ack when no data (t2<t1)

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.

t3 Timeout Set Value

t3 timeout set value : 30 #timeout for test frame on idle state

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.

k (maximum queue)

k (maximum queue) : 12 #maximum number of message to hold in
#queue (1-20)

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.

w (latest ack threshold)

w (latest ack threshold) : 8 #threshold value when to send ack (1-20)

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.

Time DB Offset

Time DB Offset : 3000 #DB location of IEC time

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

Byte	Length	Range	Description
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

Error Offset

Error Offset : 1000 #Location of where to write status data
#(-1=disable)

This parameter specifies the database location where to write status data (-1=disable).

Common Address of ASDU

Common Address of ASDU : 1 #Range 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.

Cyclic Data Transmission

Cyclic data transmission : 20000 #Numb of milliseconds between cyclic
#updates

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.

Select/Operate Timeout

Select/Operate Timeout : 10000 #Milliseconds before select timeout

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.

Use ACTTERM with Setpoint

Use ACTTERM with setpoint : 0 #1=Yes, 0=No ACTCON is last response
#to cmd

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

Use ACTTERM with Step

Use ACTTERM with step : 1 #1=Yes, 0=No ACTCON is last response
#to cmd

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

Event Scan Delay

Event Scan delay : 1 #MSec between event scanning (0-65535)
#0=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.

M_SP_NA Scan Events

M_SP_NA Scan Events : 1 #0=No scanning, 1=scan for events

Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.

M_SP_NA Time Type

M_SP_NA Time Type : 2 #0=None, 2=CP56 time

This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.

M_DP_NA Scan Events

M_DP_NA Scan Events : 1 #0=No scanning, 1=scan for events

Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.

M_DP_NA Time Type

M_DP_NA Time Type : 2 #0=None, 2=CP56 time

This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.

M_ST_NA Scan Events

M_ST_NA Scan Events : 1 #0=No scanning, 1=scan for events

Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.

M_ST_NA Time Type

M_ST_NA Time Type : 2 #0=None, 2=CP56 time

This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.

M_ME_NA Scan Events

M_ME_NA Scan Events : 1 #0=No scanning, 1=scan for events

Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.

M ME NA Time Type

M_ME_NA Time Type : 2 #0=None, 2=CP56 time

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

M ME NB Scan Events

M_ME_NB Scan Events : 1 #0=No scanning, 1=scan for events

Determines if events of this point type will be generated by the module. If 0, then events will not be generated. If 1, events will be scanned and generated on change.

M ME NB Time Type

M_ME_NB Time Type : 2 #0=None, 2=CP56 time

This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.

M IT NA Time Type

M_IT_NA Time Type : 2 #0=None, 2=CP56 time

This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.

1.3.4 [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:

```
[IEC-870-5-104 IP ADDRESSES]
START
192.168.0.207
192.168.0.203
192.168.0.61
END
```

1.3.5 [IEC-870-5-104 Database]

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

Each parameter is described below. Edit the configuration file according to the needs of your application.

Short Pulse Time

Short Pulse Time : 2000 #MSec for short pulse command

This parameter defines the number of milliseconds to be associated with a short pulse command. The valid range of numbers for this parameter are 0 to 2,147,483,647. Range is 0 to 2³¹-1.

Long Pulse Time

Long Pulse Time : 10000 #MSec for long pulse command

This parameter defines the number of milliseconds to be associated with a long pulse command. The valid range of numbers for this parameter are 0 to 2,147,483,647. Range is 0 to $2^{31}-1$

M_SP_NA Point Count

M_SP_NA point count : 10 #Number of monitored single-points

This parameter specifies the number of point values assigned in monitored single-point database. Range is 0 to 1000.

M_DP_NA Point Count

M_DP_NA point count : 10 #Number of monitored dual-points

This parameter specifies the number of point values assigned in monitored dual-point database. Range is 0 to 1000.

M_ST_NA Point Count

M_ST_NA point count : 10 #Number of monitored step-points

This parameter specifies the number of point values assigned in monitored step-point database. Range is 0 to 1000.

M_ME_NA Point Count

M_ME_NA point count : 10 #Number of monitored normalized-points

This parameter specifies the number of point values assigned in monitored normalized-point database. Range is 0 to 1000.

M_ME_NB Point Count

M_ME_NB point count : 10 #Number of monitored scaled-points

This parameter specifies the number of point values assigned in monitored scaled-point database. Range is 0 to 1000.

M_IT_NA Point Count

M_IT_NA point count : 10 #Number of monitored counter-points

This parameter specifies the number of point values assigned in monitored counter-point database. Range is 0 to 1000.

C_SC_NA Point Count

C_SC_NA point count : 10 #Number of command single-points

This parameter specifies the number of point values assigned in command single-point database. Range is 0 to 1000.

C_DC_NA Point Count

C_DC_NA point count : 10 #Number of command dual-points

This parameter specifies the number of point values assigned in command dual-point database. Range is 0 to 1000.

C RC NA Point Count

C_RC_NA point count : 10 #Number of command step-points

This parameter specifies the number of point values assigned in command step-point database. Range is 0 to 1000.

C SE NA Point Count

C_SE_NA point count : 10 #Number of command normalized-points

This parameter specifies the number of point values assigned in command normalized-point database. Range is 0 to 1000.

C SE NB Point Count

C_SE_NB point count : 10 #Number of command scaled-points

This parameter specifies the number of point values assigned in command scaled-point database. Range is 0 to 1000.

M ME NA Parameter Offset

M_ME_NA Parameter Offset : 2000 #M_ME_NA IOA offset for parameter data

This parameter specifies the IOA offset to the parameter data for the normalized parameter data. The value entered is added to the Information Object Address for the associated point to compute the parameter IOA address. When the M_ME_NA or M_ME_NB points are polled (e.g, with a group interrogation request), the module will also include parameter points in the response.

For each monitored point, there will be three parameter points:

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.

M ME NB Parameter Offset

M_ME_NB Parameter Offset : 2000 #M_ME_NB IOA offset for parameter data

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

For each monitored point, there will be three parameter points:

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, for a M_ME_NA point with an Information Object Address of 503, the associated parameter point would have an IOA of 2503 (for a configured parameter offset of 2000).

1.3.6 *[M_SP_NA_1 104] Section*

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)

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

1.3.7 *[M_DP_NA_1 104] Section*

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):

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

1.3.8 *[M_ST_NA_1 104] Section*

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):

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

1.3.9 *[M_ME_NA_1 104] Section*

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. The IOA for the parameters are for each object and are determined by adding the Point # below 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:

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

1.3.10 [M_ME_NB_1 104] Section

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. The IOA for the parameters for each object are determined by adding the Point # below 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:

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

1.3.11 [M_IT_NA_1 104] Section

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):

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

1.3.12 [C_SC_NA_1 104] Section

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.

1.3.13 [C_DC_NA_1 104] Section

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.

1.3.14 [C_RC_NA_1 104] Section

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.

1.3.15 [C_SE_NA_1 104] Section

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.

The following shows an example of a [C_SE_NA_1 104] section:

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.

1.3.16 [C_SE_NB_1 104] Section

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.

1.3.17 Group Definition

One aspect of the point configuration database that leads to confusion is the group definition field. This assignment for each point assigns a point to one or more interrogation groups. Use of interrogation groups permits the controlling unit to interface with a specific set of data. Refer to the IEC 60870-5-104 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 Ladder Logic

Ladder logic is required for application of the MVI71-104S 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.

3 Diagnostics and Troubleshooting

In This Chapter

- Reading Status Data From the Module 33
- LED Status Indicators 43

The module provides diagnostic information in three forms to the user. 1) Status Data values are transferred from the module to the M1 file. 2) All data contained in the module can be viewed through the configuration/debug port to an attached terminal emulator. 3) LED status indicators on the front of the module yield information on the modules status.

The following topics explain how to obtain the Status Data from the module and the meaning of the individual LEDs on the module.

3.1 Reading Status Data From the Module

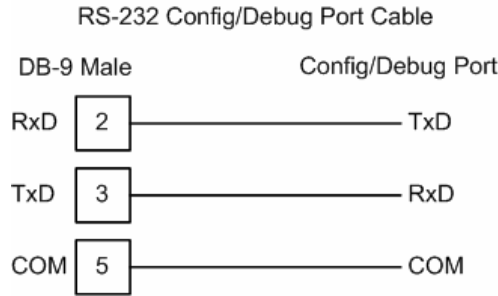
The MVI71-104S module returns a 26-word Status Data block that can be used to determine the module's operating status. This data can be located in the module's database at registers at the location specified in the configuration. This data is transferred to the PLC processor continuously when the side-connect interface is used. For a complete listing of the status data object, refer to the **Module Set Up** section.

3.1.1 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 serial communications port available
- A null modem serial cable. The module's port has a DB-9 male connector at the end of an RJ45 to DB-9 pigtail. The RJ45 end of the cable is to be placed in the MVI71-104S port 1 connector (top port). The cable required is displayed below:



3.1.2 Required Software

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

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

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

The module uses the Ymodem file transfer protocol to send (download) and receive (upload) configuration files from your computer. If you use a communication program that is not on the list above, please be sure that it supports Ymodem file transfers.

3.1.3 Using the Configuration/Debug Port

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

- 1 Connect your computer to the module's port using a null modem cable.
- 2 Start the communication program on your computer and configure the communication parameters with the following settings:

Baud Rate	57,600
Parity	None
Data Bits	8
Stop Bits	1
Software Handshaking	XON/XOFF

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

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

- 1 Verify that the null modem cable is connected properly between your computer's serial port and the module. A regular serial cable will not work.
 - 2 Verify that RSLinx is not controlling the COM port. Refer to ***Disabling the RSLinx Driver for the Com Port on the PC*** (page 58).
 - 3 Verify that your communication software is using the correct settings for baud rate, parity and handshaking.
 - 4 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the module.
- If you are still not able to establish a connection, you can contact ProSoft Technology Technical Support for further assistance.

3.1.4 Main Menu

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

```
IEC-870-5-104 SERVER COMMUNICATION MODULE <MVI71-104S> MENU
?=Display Menu
B=Block Transfer Statistics
C=Module Configuration
D=Database View
I=IEC-870-5-104 Menu
R=Receive Configuration File
S=Send Configuration File
T=Display e-mail setup
U=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 60870-5-104 server driver.

Viewing the Backplane Command List

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

BACKPLANE DATA EXCHANGE LIST -- COMMANDS 0 TO 9					
TYPE	DBREG	DBTYPE	ADDRESS	COUNT	LASTERR
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000
0	0	0	0	0	0X0000

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

Receiving the Configuration File

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

Sending the Configuration File

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

Viewing Version Information

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

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

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

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

Warm Booting the Module

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

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

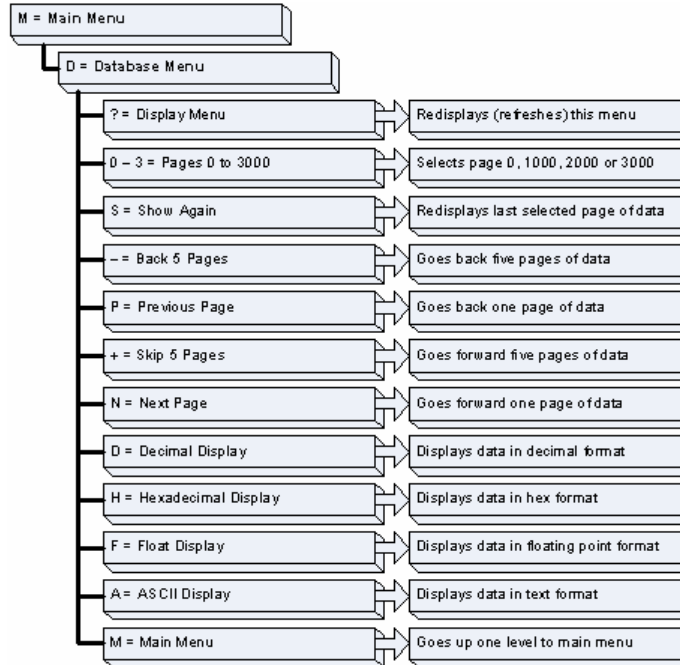
Exiting the Program

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

Press **[Esc]** to exit the program and display the operating system prompt. This command will cause the module to cease operation and stop transferring data between the ports and the module, and between the processor and the module. This could interrupt a currently running process. Only use this command if instructed to do so by the ProSoft Technical Support Group.

3.1.5 Database View Menu

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



Viewing Register Pages

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

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

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

Displaying the Current Page of Registers Again

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

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

Moving Back Through 5 Pages of Registers

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

Viewing the Previous 100 Registers of Data

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

Skipping 500 Registers of Data

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

Viewing the Next 100 Registers of Data

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

Viewing Data in Decimal Format

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

Viewing Data in Hexadecimal Format

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

Viewing Data in Floating Point Format

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

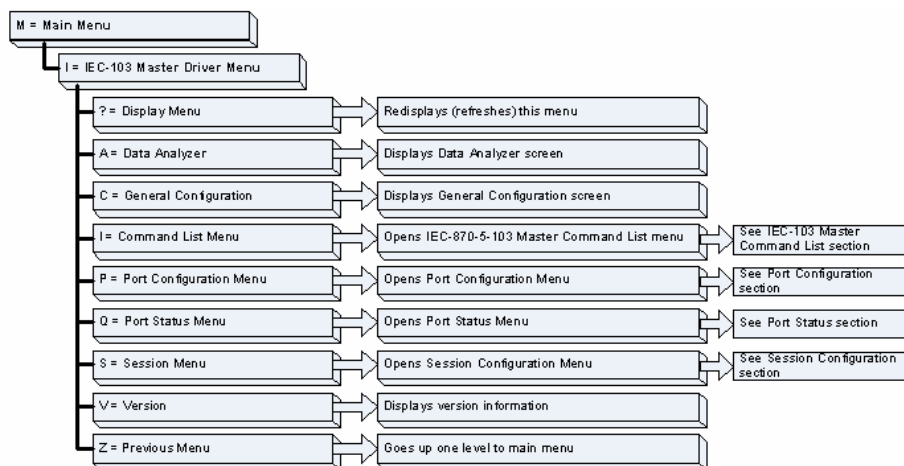
Viewing Data in ASCII (Text) Format

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

Returning to the Main Menu

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

3.1.6 IEC-870-5-104 Server Menu



Press **[I]** from the main menu to display 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 display the IEC-870-5-104 Configuration Menu. This menu shows the module parameters configured by the user through 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=
    
```


Lists of Valid Hosts

From the IEC-870-5-104 Server Menu press [I] to display the List of Valid Hosts screen. These values are configured by the user and the IP addresses will be displayed only if the "Use IP List" parameter is set to YES.

```
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)
```

Point Setup

From the IEC-870-5-104 Server Menu press keys 1 to 9, 0 or ! to display the point configuration for each data type. The information includes point address, group and its current value.

```
M_SP_NA Setup Menu Selected

M_SP_NA Setup (0 to 3)
Index  Point#  DB Addr  Group(s)  Value
  0     100    1600    00000001    0
  1     101    1602    00000002    0
  2     102    1604    00000004    0
```

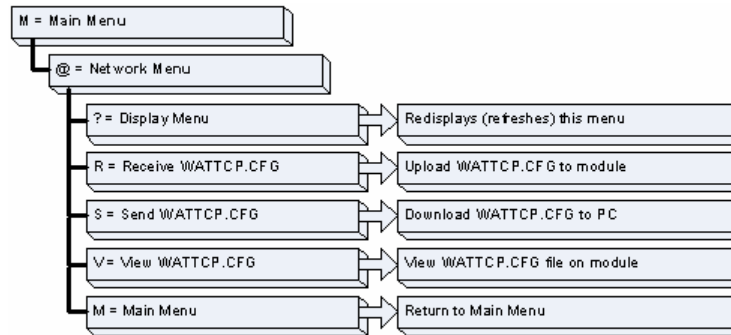
Database Configuration

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
```

3.1.7 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 specification 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.

```
Network Menu Selected
WATTCP.CFG FILE:
# ProLink Communication Gateways, Inc.
# Default private class 3 address:
# ip=192.168.0.135
# Default class 3 network mask:
# netmask=255.255.255.0
# The gateway I wish to use:
# gateway=192.168.0.1
# Parameters used by the ProLink Communication Gateways, Inc. module
# Host1_Domain_Name=prolink.com
# Password=PASSWORD
```

Returning to the Main Menu

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

3.2 LED Status Indicators

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

ProSoft Module	Color	Status	Indication
CFG	Green	On	Data is being transferred between the module and a remote terminal using the Configuration/Debug port.
		Off	No data is being transferred on the Configuration/Debug port.
P1	Green	On	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 MVI71-104S is working normally.
		On	The MVI71-104S module program has recognized a communication error.
BP ACT	Amber	On	The LED is on when the module is performing a write operation on the backplane.
		Off	The LED is off when the module is performing a read operation on the backplane. Under normal operation, the LED should blink rapidly on and off.
OK	Red/ Green	Off	The card is not receiving any power and is not securely plugged into the rack.
		Green	The module is operating normally.
		Red	The program has detected an error or is being configured. If the LED remains red for over 10 seconds, the program has probably halted. Remove the card from the rack and re-insert the card to restart the module's program.
BAT	Red	Off	The battery voltage is OK and functioning.
		On	The battery voltage is low or the battery is not present. Replace the battery on the module.

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.

3.2.1 Clearing a Fault Condition

Typically, if the ACT/FAULT LED on the front of the module becomes illuminated red for over ten seconds, a hardware problem has been detected in the module or the program has exited. To attempt to clear the condition:

- 1 Turn the power to the rack off
- 2 Remove the card from the rack
- 3 Re-insert the card in the rack and turn the power back on

- 4 Verify the configuration data being transferred to the module from the PLC processor

If the module's ACT/FAULT LED does not turn green, make sure the module is inserted completely into the rack. If this does not cure the problem, contact the factory.

3.2.2 *Troubleshooting*

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

Problem Description	Steps to take
Processor Fault	<p>Confirm that the module is plugged into the slot that has been configured for the MVI71-104S module.</p> <p>Confirm that the slot in the rack configuration has been set up correctly.</p>
Processor I/O LED flashes	<p>This indicates there is a problem with backplane communications. Be certain this and all modules in the rack are configured in the processor.</p> <p>Module has a power supply distance rating of 2 on Compact Logix. Make sure that the module is within 2 slots of the power supply on Compact Logix or on MicroLogix that the backplane can supply the 800ma for the module.</p>
BP ACT LED remains off or blinks slowly	<p>This indicates that backplane transfer operations are failing. Use the Configuration/Debug port facility to check this. To establish backplane communications, verify the following items:</p> <ul style="list-style-type: none"> ▪ The backplane driver is loaded in the module. ▪ The module is configured for read and write block data transfer. ▪ The ladder logic handles all read and write block situations. ▪ The module is configured in the processor.
OK LED remains red	<p>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.</p>

4 Reference

In This Chapter

- Product Specifications..... 45
- Functional Overview..... 48
- Cable Connections..... 57
- MVI71-104S Configuration Form..... 61
- MVI71-104S Status Data Definition..... 68
- MVI71-104S Database Design Forms..... 68
- IEC 60870-5-104 Server Interoperability Document..... 73

4.1 Product Specifications

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

PUBLICATION	TITLE
IEC 60870-5-101	Companion Standard for Basic Telecontrol Tasks
IEC 60870-5-101 Amendment 1	Companion Standard for Basic Telecontrol Tasks
IEC 60870-5-1	Transmission Frame Formats
IEC 60870-5-2	Link Transmission Procedures
IEC 60870-5-3	General Structure of Application Data
IEC 60870-5-4	Definition and Coding of Application Information Elements
IEC 60870-5-5	Basic Application Functions
IEC 60870-5-104	Network access for IEC 60870-5-101 using standard transport profiles
ITU-T Recommendation X.25	Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit
IEEE 802.3	Information technology - Telecommunications and information exchange between systems - Local and metropolitan area networks
RFC 791	Internet Protocol
RFC 793	Transmission Control Protocol
RFC 894	Internet Protocol on Ethernet Networks
RFC 1700	Assigned Numbers
RFC 2200	Internet Official Protocol Standards

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

The MVI71 IEC 60870-5-104 Server Communication Module allows PLC backplane I/O compatible processors to interface easily with IEC 60870-5-104 protocol-compatible hosts.

4.1.1 Features and Benefits

The MVI71-104S module acts as an input/output module between the IEC 60870-5-104 Ethernet network and the Rockwell Automation backplane. The data transfer from the PLC processor is asynchronous from the actions on the network. A 4000-word register space in the module exchanges data between the processor and the Ethernet network.

4.1.2 General Specifications

- Single Slot – 1771 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.

4.1.3 Hardware Specifications

Specification	Description
Form Factor	Single Slot 1771 chassis compatible BTR/BTW data transfer Local or remote rack
Backplane current load	800 mA @ 5 V
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 10150 Hz
Relative humidity	5 to 95% (non-condensing)
LED Indicators	Module status Backplane transfer status Application status Serial activity and error LED status
Configuration Serial port (CFG)	DB-9M PC compatible RS-232 Hardware handshaking
Ethernet Port (Ethernet modules)	RJ45 Connector Link and activity LED indicators

4.1.4 **Functional Specifications**

The MVI71-104S 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 PLC 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_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 MVI module and the PLC 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 PLC
- 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 MVI71 is available which fully documents data types supported by the module.

4.2 Functional Overview

This section provides an overview of how the MVI71-104S module transfers data using the 104S protocol. You should understand the important concepts in this chapter before you begin installing and configuring the module.

4.2.1 General Concepts

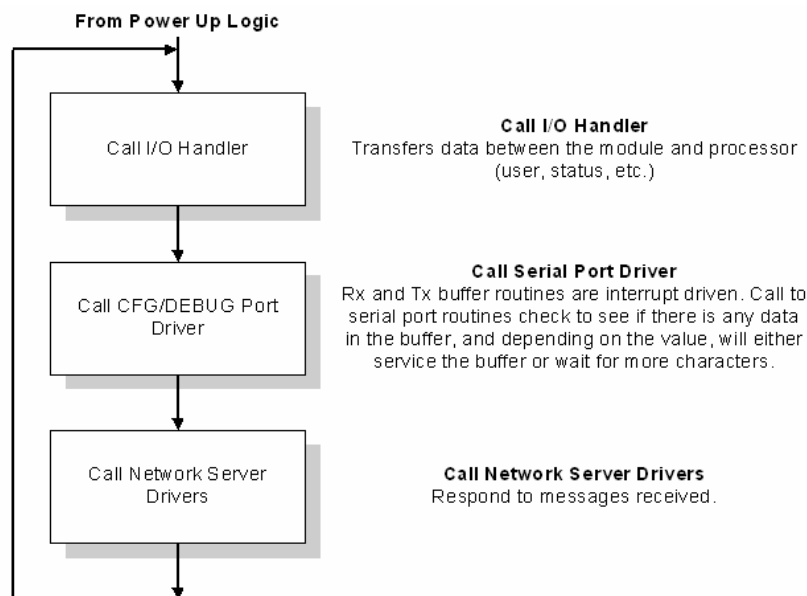
The following topics describe several concepts that are important for understanding the operation of the MVI71-104S module.

- 1 Initialize hardware components
 - Initialize PLC backplane driver
 - Test and Clear all RAM
 - Initialize the serial communication port
 - Initialize the Ethernet driver and TCP/IP stack
- 2 Reads configuration from Compact Flash Disk
- 3 Initialize Module Register space
- 4 Enable Server Driver for TCP/IP stack

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

Main Logic Loop

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



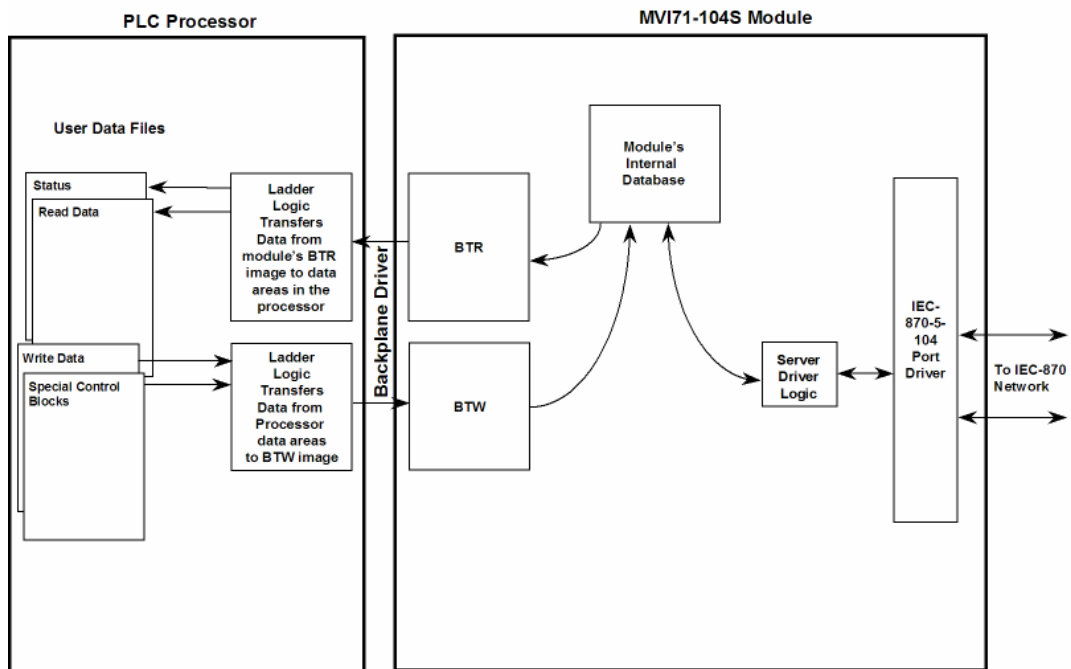
PLC Processor Not in Run

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

Backplane Data Transfer

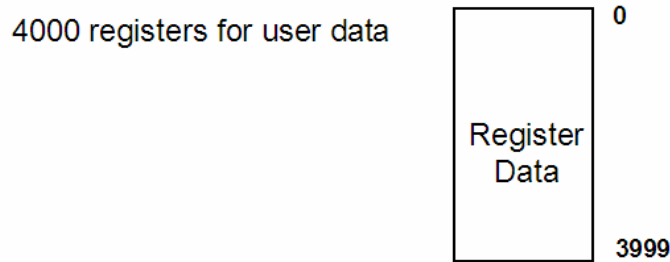
The MVI71-104S module is unique in the way that the PLC backplane is utilized for the block transfer interface. Data is paged between the module and the PLC processor across the backplane using BTR and BTW operations. Data is transferred from the module to the processor using the BTR blocks, and data is transferred from the processor to the module using the BTW blocks.

The following illustration shows the data transfer method used to move data between the PLC processor, the MVI71-104S module and the IEC 60870-5-104 network.



As shown in the diagram above, all data transferred between the module and the processor over the backplane is through the BTR and BTW blocks. Ladder logic must be written in the PLC processor to interface the block data with user data files. 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



Data contained in this database is paged through the block transfer interface by coordination of the PLC ladder logic and the MVI71-104S module's program. Up to 64 words of data can be transferred from the module to the processor at a time. Up to 64 words of data can be transferred from the processor to the module. 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 block identification codes used by the module are listed in the following table:

Block Range	Descriptions
-1	Null block
0	Null block
1 to 67	Read or write data
1000 to 1066	Request Output Data from Processor
9998	Warm-boot control block
9999	Cold-boot control block

Each image has a defined structure depending on the data content and the function of the data transfer as defined in the sections that follow.

4.2.2 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 (BTR) and write (BTW) blocks. Refer to the **Module Set Up** section 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 in the following topics.

Read Block

These blocks of data transfer information from the module to the PLC processor and transfer output (control) data sent to the module from the remote master

unit. The structure of the image used to transfer this data is shown in the following table:

Offset	Description	Length
0	Read Block ID	1
1	Write Block ID	1
2 to 61	Read Data	60
62 to 63	Spare	2

The Read Block ID is an index value used to determine the location of where the data will be placed in the PLC processor data files. Each transfer can move up to 60 words (block offsets 2 to 61) of data.

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

R1W1→R2W2→R3W1→R1W2→R2W1→R3W2→R1W1→

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

Write Block

These blocks of data transfer information from the PLC processor to the module and source the input (monitored) data to be used by the remote master. The structure of the image used to transfer this data is shown in the following table:

Offset	Description	Length
0	Write Block ID	1
1 to 60	Write Data	60
61 to 63	Spare	3

The Write Block ID is an index value used to determine the location in the module's database where the data will be placed. Each transfer can move up to 60 words (block offsets 1 to 60) of data.

4.2.3 Output Data Initialization

The module can be configured to have the output data in the module set to that stored in the PLC processor. This feature requires ladder logic support. When the module performs a restart operation, it will send a set of one or more special block requests to the processor. These blocks must be handled by the ladder logic and return the requested output data. The format of the blocks used by the module to request this data has the following format:

Offset	Description	Length
0	1000 to 1066	1
1	1000 to 1066	1
2 to 62	Spare	62

The value in the block at offset 0 represents the output data set required. The module will only request the data set in the user configuration. Each block

requested must receive a response block from the processor. The format of the response block is as follows:

Offset	Description	Length
0	1000 to 1066	1
1 to 60	Output Data	60
61 to 63	Spare	3

The module places the received output data in the block into the module's database.

4.2.4 **Command Control Blocks**

Command control blocks are special blocks used to control the module. The current version of the software supports two command control blocks: warm boot and cold boot.

Warm Boot

This block is sent from the PLC processor to the module (BTW block) 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 structure of the control block is shown in the following table:

Offset	Description	Length
0	9998	1
1 to 63	Spare	63

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.

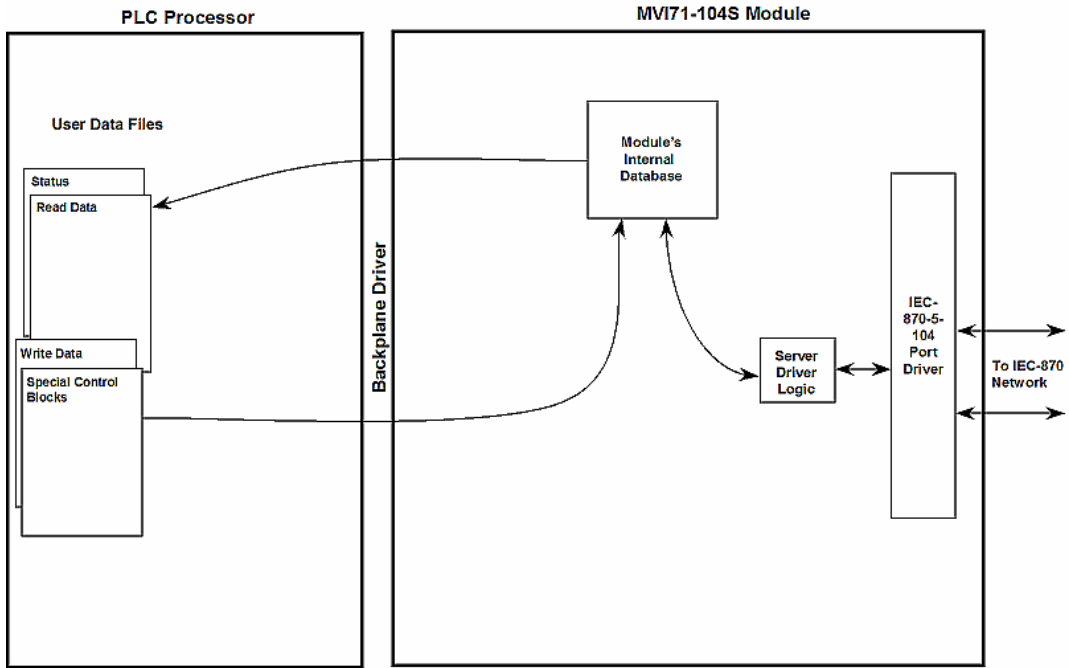
Cold Boot

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

Offset	Description	Length
0	9999	1
1 to 63	Spare	63

4.2.5 Side Connect Backplane Transfer

The side-connect interface is the simplest method to implement the module. No ladder logic is required for the interface because the driver handles data movement between the module and the processor automatically. The data flow diagram associated with this interface is shown in the following figure:



The configuration information for the module determines the size of the read and write data areas and the locations of these data sets in the module's internal database. Therefore, to use this interface, just set up the files required by the module. The following table lists the files required for the side-connect interface.

File Number	Example	Size	Description
Cfg File	N10	100	Control/Status File
Cfg File+1	N11	to 1000	Data transferred from the module to the processor
			Other files for read data
Cfg File+1+n	N12	to 1000	Data transferred from the processor to the module
Cfg File+1+n+m			Other files for write data

n is the number of read data files minus one. Each file contains up to 1000 words.
m is the number of write data files minus one. Each file contains up to 1000 words.

The number of read and write files are dependent on the modules configuration. The following tables provide two examples:

Example of 240 words of read and write data (cfg file=10)

Data Files	Description
N11:0 to 239	Read data
N12:0 to 239	Write data

Example of 2300 read and 3500 write data registers (cfg file=10)

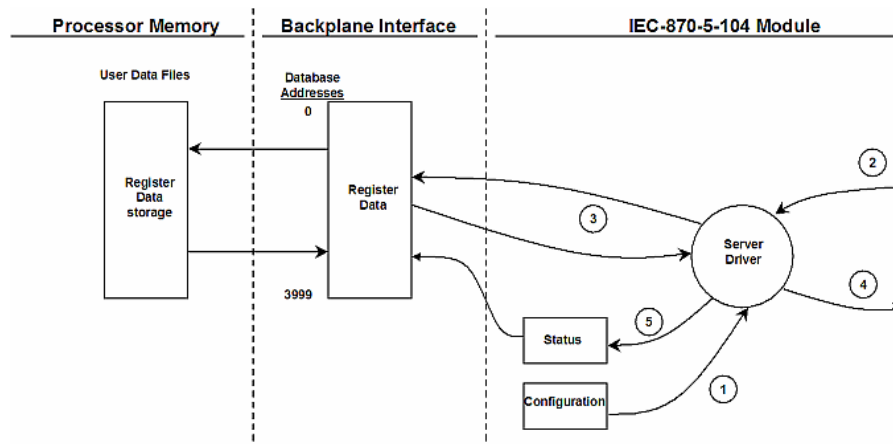
Data Files	Description
N11:0 to 999	Read data words 0 to 999
N12:0 to 999	Read data words 1000 to 1999
N13:0 to 299	Read data words 2000 to 2299
N14:0 to 999	Write data words 0 to 999
N15:0 to 999	Write data words 1000 to 1999
N16:0 to 999	Write data words 2000 to 2999
N17:0 to 499	Write data words 3000 to 3499

4.2.6 Data Flow Between MVI71-104S Module and PLC Processor

The following topics describe the flow of data between the two pieces of hardware (PLC processor and MVI71-104S module) and the IEC 60870-5-104 master unit.

Server Driver

The Server Driver allows the MVI71-104S module to respond to data read and write commands issued by a master 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.

Step	Description
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 master 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 **Module Set Up** section for a complete list of the parameters that must be defined for a server. The IEC 60870-5-104 Interoperability Document for the MVI71-104S Server Module contains a listing of the protocol support supplied in the module.

4.2.7 Databases

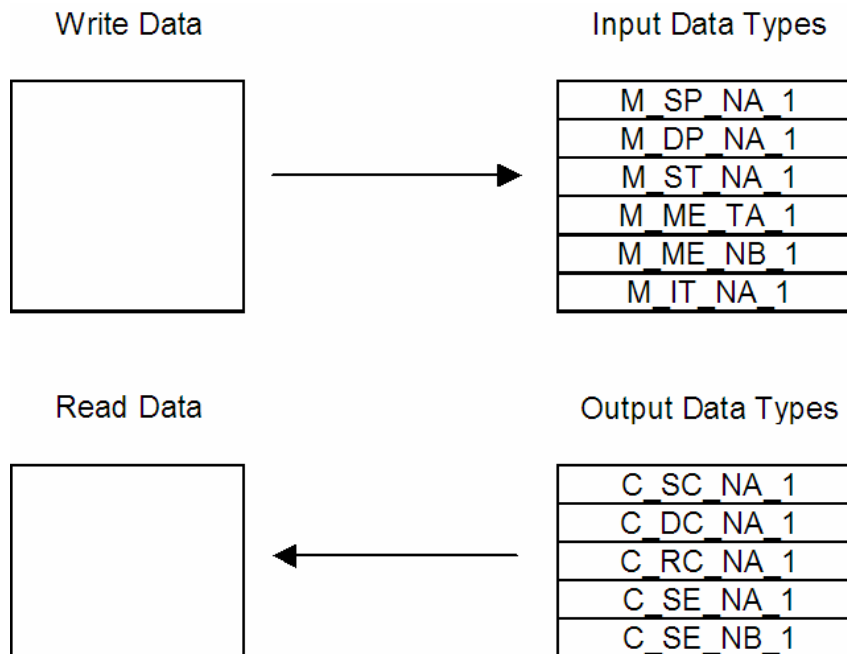
This section discusses the databases utilized by the module to support the IEC 60870-5-104 protocol of the IEC-870-5-101 data types. The user is responsible for defining the databases for their specific application. In the module's configuration file, the size of each database and definition of each 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 with (7.2.6.1)0=Off and 1=On.
3	M_DP_NA_1 (7.3.1.3)	Monitored Dual-point Information -- This data type stores a dual-point binary input value (that is, valve status). Associated time-tagged event information for this type are M_DP_TA_1 (4) and M_DP_TB_1 (31).	Dual-bit status (7.2.6.2) with 00b (0 decimal) = indeterminate or intermediate, 01b (1 decimal) = Off, 10b (2 decimal) = On and 11b (3 decimal) = indeterminate.
5	M_ST_NA_1 (7.3.1.5)	Monitored Step-point Information -- This data type is used for step position of transformers or other step position information. The value for the position ranges from -64 to 63. Associated time-tagged event information for this type are M_ST_TA_1 (6) and M_ST_TB_1 (32).	Step data (7.2.6.5) is stored in a single character value with bits 0 to 6 (-64 to +63) representing the step position and bit 7 representing the following states: 0 = Equipment is not in transient state 1 = Equipment in transient state

Type ID	Type	Description	Data Representation
9	M_ME_TA_1 (7.3.1.9)	Monitored Normalized Measured Value -- This data type is used for analog input data. Associated time-tagged event information for this type are M_ME_TA_1 (10) and M_ME_TD_1 (34).	Normalized values (7.2.6.6) are stored in a (16-bit) word data area with a range of $-1..+1-2^{-15}$
11	M_ME_NB_1 (7.3.1.11)	Monitored Scaled Measured Value --This data type is used for analog input data. Associated time-tagged event information for this type are M_ME_TB_1 (12) and M_ME_TE_1 (35).	Scaled values (7.2.6.7) are stored in a (16-bit) word data area with a range of $-2^{15}..+2^{15}-1$
15	M_IT_NA_1 (7.3.1.15)	Monitored Integrated Total-point Information --This data type stores meter or other count data. Associated time-tagged event information for this type are M_IT_TA_1 (15) and M_IT_TB_1 (37).	Binary counter data (7.2.6.9) is stored in a double-word (32-bit) value with a range of $-2^{31}..+2^{31}-1$.
45	C_SC_NA_1 (7.3.2.1)	Single-point Command -- This command controls a single binary point such as a relay.	Single bit value (7.2.6.15) with 0 = Off and 1 = On
46	C_DC_NA_1 (7.3.2.2)	Double-point Command -- This command controls a dual-point binary control device such as a trip/close relay.	Double (7.2.6.16) with Command 0 = Not permitted 1 = Off 2 = On 3 = Not permitted
47	C_RC_NA_1 (7.3.2.3)	Regulating Step Command - This command controls a stepping device such as a transformer.	Regulating Step Command with (7.2.6.17) 0 = Not permitted 1 = Next step lower 2 = Next step higher 3 = Not permitted
48	C_SE_NA_1 (7.3.2.4)	Setpoint Command, Normalized Value -- This command controls an analog device.	Normalized values (7.2.6.6) are stored in a (16-bit) word data area with a range of $-1..+1-2^{-15}$
49	C_SE_NB_1 (7.3.2.5)	Setpoint Command, Scaled Value -- This command controls an analog device.	Scaled values (7.2.6.7) are stored in a (16-bit) word data area with a range of $-2^{15}..+2^{15}-1$

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

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



The read and write areas can be placed anywhere in the module's 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.

4.3 Cable Connections

The MVI71-104S module has the following communication connections on the module:

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

4.3.1 Ethernet Connection

The MVI71-104S 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 MVI71-104S 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.

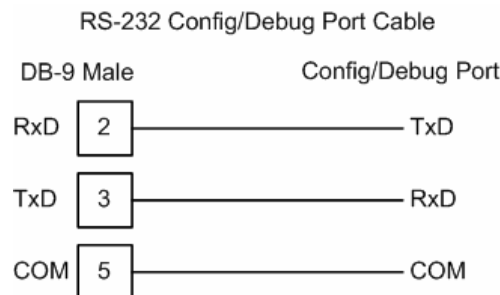
Ethernet Port Configuration: wattcp.cfg

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.

```
# WATTCP.CFG FILE:  
# Prosoft Technology.  
  my_ip=192.168.0.100  
# Default class 3 network mask  
  netmask=255.255.255.0  
# The gateway I wish to use  
  gateway=192.168.0.1
```

4.3.2 RS-232 Configuration/Debug Port

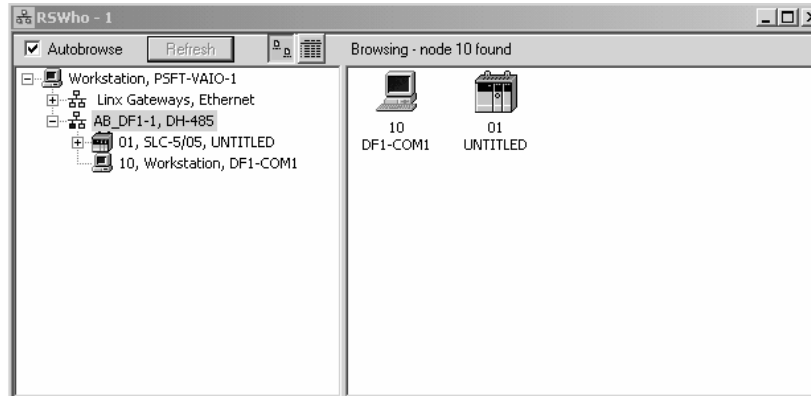
This port is physically an RJ45 connection. An RJ45 to DB-9 adapter cable is included with the module. This port permits a PC based terminal emulation program to view configuration and status data in the module and to control the module. The cable for communications on this port is shown in the following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



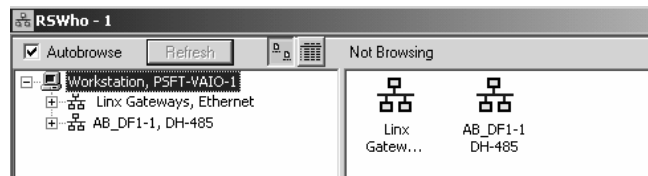
Disabling the RSLinx Driver for the Com Port on the PC

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 HyperTerminal or a similar terminal emulator, follow these steps to disable the RSLinx Driver.

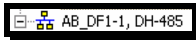
- 1 Open RSLinx and go to Communications>RSWho
- 2 Make sure that you are not actively browsing using the driver that you wish to stop. The following shows an actively browsed network:



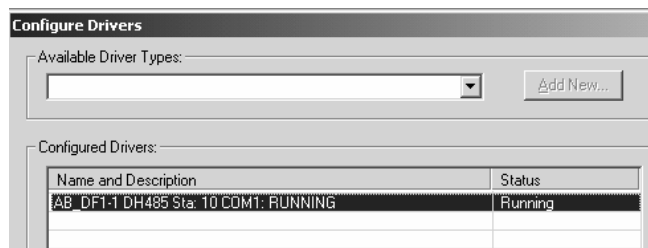
- 3 Notice how the DF1 driver is opened, and the driver is looking for node 1 (an SLC processor). If the network is being browsed, then you will not be able to stop this driver. To stop the driver your RSWHo screen should look like this:



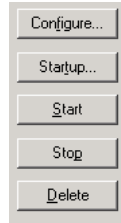
Branches are displayed or hidden by clicking on the  or the  icons.



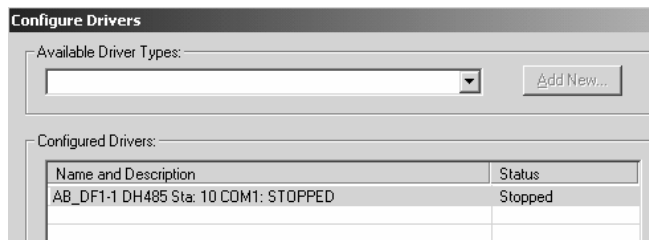
- 4 When you have verified that the driver is not being browsed, go to **Communications>Configure Drivers**
You may see something like this:



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



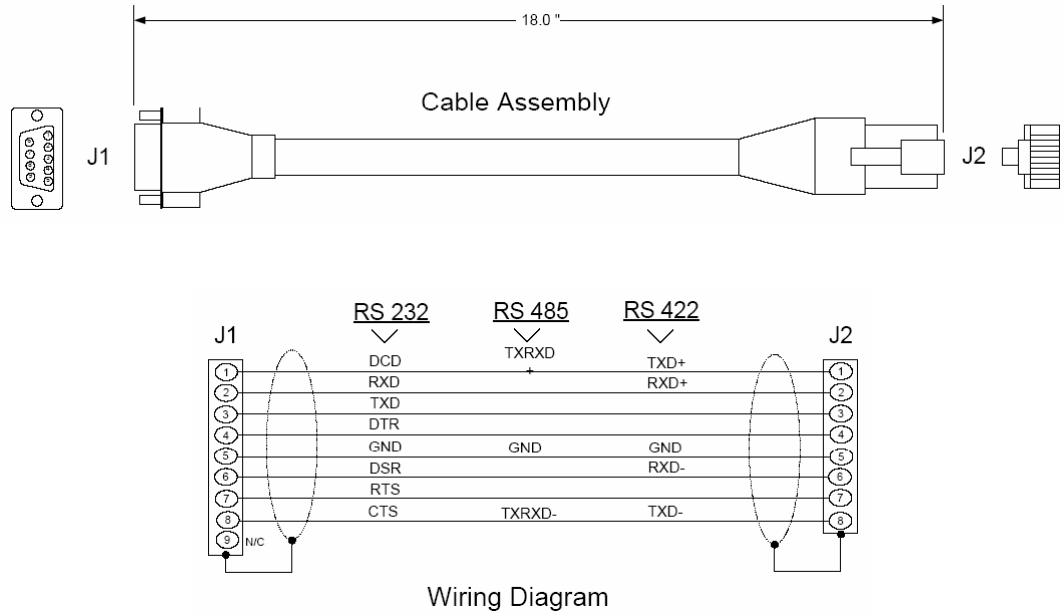
5 After you have stopped the driver you will see the following:



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

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

4.3.3 DB9 to RJ45 Adaptor (Cable 14)



4.4 MVI71-104S Configuration Form

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

MVI71-IEC 60870-5-104 SERVER COMMUNICATION MODULE CONFIGURATION			
[Section]/Item	Value	Range	Description
[Backplane Configuration]			Backplane transfer parameters
Module Name:		0 to 80 characters	This parameter assigns a name to the module that can be viewed using the configuration/debug port. Use this parameter to identify the module and the configuration file.
Read Register Start:		0 to 3999	This parameter specifies the starting register in the module where data will be transferred from the module to the processor. Valid range for this parameter is 0 to 3999.
Read Register Count:		0 to 4000	This parameter specifies the number of registers to be transferred from the module to the processor. Valid entry for this parameter is 0 to 4000.
Write Register Start:		0 to 3999	This parameter specifies the starting register in the module where the data transferred from the processor will be placed. Valid range for this parameter is 0 to 3999.
Write Register Count:		0 to 4000	This parameter specifies the number of registers to transfer from the processor to the module. Valid entry for this parameter is 0 to 4000.

MVI71-IEC 60870-5-104 SERVER COMMUNICATION MODULE CONFIGURATION

[Section]/Item	Value	Range	Description
Failure Flag Count:		0 to 65535	This parameter specifies the number of successive transfer errors that must occur before the communication ports are shut down. If the parameter is set to 0, the communication ports will continue to operate under all conditions. If the value is set larger than 0 (1-65535), communications will cease if the specified number of failures occur.
Error Offset:		-1 to 3980	This parameter specifies the register location in the module's database where module status data will be stored. If a value less than 0 is entered, the data will not be stored in the database. If the value specified is in the range of 0 to 3980, the data will be placed in the user data area. This data area has a length of 20 words.
Initialize Output Data:		0 or 1	This parameter determines if the output data for the module should be initialized with values from the processor. If the value is set to 0, the output data will be initialized to 0. If the value is set to 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.

[Section]/Item	Value	Range	Description
[IEC-870-5-104]			Server and protocol parameters
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.
Override StartDT:		0 or 1	This parameter is used when testing the unit with a simulator or with a master unit that does not meet the 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 master 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.
Clear Queue on Close:		0 or 1	Use this command to define if 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 specification).
t1 Timeout Set value:		1 to 255	This is the timeout of send or test ASDU's and is in units of seconds. After a packet is sent from the unit, the master must acknowledge the packet within this time interval or else the unit will close the connection.

[Section]/Item	Value	Range	Description
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.
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.
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.
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.
Time DB Offset		0 to 3999	This parameter sets the database location of the IEC time.
Error Offset:		-1 to 3980	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. To not store the information in the database, set the parameter to a value of -1.
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.
Cyclic data transmission:		0 to 2 ³²	This parameter defines the number of milliseconds between cyclic updates. The range of values for this parameter permit update times of 1 millisecond to 49.7 days. If the parameter is set to 0, cyclic data reporting will be disabled.
Select/Operate Timeout:		0 to 2 ³²	This parameter sets the number of milliseconds after a select command is received in which to wait for a valid execute command. The range of values for this parameter permit times of 1 millisecond to 49.7 days. If the parameter is set to 0, the feature will be disabled.
Use ACTTERM with setpoint:		0 or 1	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.
Use ACTTERM with step:		0 or 1	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.

[Section]/Item	Value	Range	Description
Event Scan Delay:		0 to 65535	If set to 0, the feature will be disabled. If set from 1 to 65535, the parameter represents the number of milliseconds between event scanning. This parameter defines how often the program will scan for new events in the databases.
M_SP_NA Scan Events		0 or 1	This parameter sets even scanning on or off. 0 = No scanning, 1 = Scan for events
M_SP_NA Time Type:		0 or 2	This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.
M_DP_NA Scan Events		0 or 1	This parameter sets even scanning on or off. 0 = No scanning, 1 = Scan for events
M_DP_NA Time Type:		0 or 2	This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.
M_ST_NA Scan Events		0 or 1	This parameter sets even scanning on or off. 0 = No scanning, 1 = Scan for events
M_ST_NA Time Type :		0 or 2	This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.
M_ME_NA Scan Events		0 or 1	This parameter sets even scanning on or off. 0 = No scanning, 1 = Scan for events.
M_ME_NA Time Type :		0 or 2	This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.
M_ME_NB Scan Events		0 or 1	This parameter sets even scanning on or off. 0 = No scanning, 1 = Scan for events.
M_ME_NB Time Type :		0 or 2	This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.
M_IT_NA Time Type :		0 or 2	This parameters defines the time format used with data events. 0=None and 2=CP56 time formats.

[Section]/Item	Value	Range	Description
[IEC-870-5-104 IP Addresses]			List of valid IP addresses accepted by module
START			
#			Insert the list of IP addresses for the host(s) to connect to this unit. Only used if Use IP List set to 1.
END			

[Section]/Item	Value	Range	Description
[IEC-870-5-104 Database]			Size definitions for each point database
Short Pulse Time:		0 to 2 ³¹ -1	This parameter defines the number of milliseconds to be associated with a short pulse command. The valid range of numbers for this parameter are 0 to 2,147,483,647.
Long Pulse Time:		0 to 2 ³¹ -1	This parameter defines the number of milliseconds to be associated with a long pulse command. The valid range of numbers for this parameter are 0 to 2,147,483,647.

[Section]/Item	Value	Range	Description
M_SP_NA point count:		0 to 64000	This parameter specifies the number of point values assigned in monitored single-point database.
M_DP_NA point count:		0 to 32000	This parameter specifies the number of point values assigned in monitored dual-point database.
M_ST_NA point count:			This parameter specifies the number of point values assigned in monitored step-point database.
M_ME_NA point count:			This parameter specifies the number of point values assigned in monitored normalized-point database.
M_ME_NB point count:			This parameter specifies the number of point values assigned in monitored scaled-point database.
M_IT_NA point count:		0 to 2000	This parameter specifies the number of point values assigned in monitored counter-point database.
C_SC_NA point count:		0 to 64000	This parameter specifies the number of point values assigned in command single-point database.
C_DC_NA point count:		0 to 32000	This parameter specifies the number of point values assigned in command dual-point database.
C_RC_NA point count:		0 to 8000	This parameter specifies the number of point values assigned in command step-point database.
C_SE_NA point count:		0 to 4000	This parameter specifies the number of point values assigned in command normalized-point database.
C_SE_NB point count:		0 to 4000	This parameter specifies the number of point values assigned in command scaled-point database.
M_ME_NA Parameter Offset:		Application dependent	This parameter specifies the IOA offset to the parameter data for the normalized parameter data. The value entered is added to the Information Object Address for the associated point to compute the parameter IOA address.
M_ME_NB Parameter Offset:		Application dependent	This parameter specifies the IOA offset to the parameter data for the scaled parameter data. The value entered is added to the Information Object Address for the associated point to compute the parameter IOA address.

[Section]/Item	Description
[M_SP_NA_1 104]	Definition of monitored single-point database
# Point # DB Address Group(s)	
# -----	
START	
END	

[Section]/Item		Description
[M_DP_NA_1 104]		Definition of monitored dual-point database
# Point #	DB Address	Group(s)
# -----	-----	-----
START		
END		

[Section]/Item		Description
[M_ST_NA_1 104]		Definition of monitored step-point database
# Point #	DB Address	Group(s)
# -----	-----	-----
START		
END		

[Section]/Item		Description
[M_ME_NA_1 104]		Definition of monitored normalized-point database
#	Default	
# Point #	DB Address	Group(s) Deadband
# -----	-----	-----
START		
END		

[Section]/Item		Description
[M_ME_NB_1 104]		Definition of monitored scaled-point database
#	Default	
# Point #	DB Address	Group(s) Deadband
# -----	-----	-----
START		
END		

[Section]/Item		Description
[M_IT_NA_1 104]		Definition of monitored integrated total database
# Point #	DB Address	Group(s)
# -----	-----	-----
START		
END		

[Section]/Item	Description
[C_SC_NA_1 104]	Definition of command single-point database
#	Monitor Monitor Require
# Point #	DB Address Point # DB Addr Select
#	-----
START	
END	

[Section]/Item	Description
[C_DC_NA_1 104]	Definition of command dual-point database
#	Monitor Monitor Require
# Point #	DB Address Point # DB Addr Select
#	-----
START	
END	

[Section]/Item	Description
[C_RC_NA_1 104]	Definition of command step-point database
#	Monitor Monitor
# Point #	DB Address Point # DB Addr
#	-----
START	
END	

[Section]/Item	Description
[C_SE_NA_1 104]	Definition of command normalized-point database
#	Monitor Monitor Require
# Point #	DB Address Point # DB Addr Select
#	-----
START	
END	

[Section]/Item	Description
[C_SE_NB_1 104]	Definition of command scaled-point database
#	Monitor Monitor Require
# Point #	DB Address Point # DB Addr Select
#	-----
START	
END	

4.5 MVI71-104S Status Data Definition

This section contains a description of the members present in the status data area. This data is automatically transferred to the PLC when the side-connect interface is used. When the block transfer interface is employed, this data can be mapped into the read data area transferred to the processor. The format of the status data block is shown in the following table.

4.5.1 Block Transfer Status Error Block

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

4.7 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.

4.7.1 *System or device*

- System definition
- Controlling station definition (Master)
- Controlled station definition (Slave)

4.7.2 *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

4.7.3 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

4.7.4 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										X												
<31>	M_DP_TB_1			X	X										X												
<32>	M_ST_TB_1			X	X										X												
<33>	M_BO_TB_1																										
<34>	M_ME_TD_1			X	X										X												
<35>	M_ME_TE_1			X	X										X												
<36>	M_ME_TF_1																										
<37>	M_IT_TB_1			X	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																										
<58>	C_SC_TA_1																										
<59>	C_DC_TA_1																										
<60>	C_RC_TA_1																										
<61>	C_SE_TA_1																										
<62>	C_SE_TB_1																										
<63>	C_SE_TC_1																										
<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																										
<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																										

4.7.5 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)

- | | | | |
|---|--|--|--|
| <input checked="" type="checkbox"/> global | | | |
| <input checked="" type="checkbox"/> group 1 | <input checked="" type="checkbox"/> group 7 | <input checked="" type="checkbox"/> group 13 | |
| <input checked="" type="checkbox"/> group 2 | <input checked="" type="checkbox"/> group 8 | <input checked="" type="checkbox"/> group 14 | |
| <input checked="" type="checkbox"/> group 3 | <input checked="" type="checkbox"/> group 9 | <input checked="" type="checkbox"/> group 15 | |
| <input checked="" type="checkbox"/> group 4 | <input checked="" type="checkbox"/> group 10 | <input checked="" type="checkbox"/> group 16 | |
| <input checked="" type="checkbox"/> group 5 | <input checked="" type="checkbox"/> group 11 | | |
| <input checked="" type="checkbox"/> group 6 | <input checked="" type="checkbox"/> group 12 | | 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 all time-outs: 1 to 255 seconds, accuracy 1 second.

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:

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Internet	Web Site: http://www.prosoft-technology.com/support E-mail address: support@prosoft-technology.com
Phone	+1 (661) 716-5100 +1 (661) 716-5101 (Fax)
Postal Mail	ProSoft Technology, Inc. 1675 Chester Avenue, Fourth Floor Bakersfield, CA 93301

Before calling for support, please prepare yourself for the call. In order to provide the best and quickest support possible, we will most likely ask for the following information:

- 1 Product Version Number
- 2 System architecture
- 3 Module configuration and contents of configuration file
- 4 Module Operation
 - Configuration/Debug status information
 - LED patterns
- 5 Information about the processor and user data files as viewed through the processor configuration software and LED patterns on the processor
- 6 Details about the serial devices interfaced

An after-hours answering system allows pager access to one of our qualified technical and/or application support engineers at any time to answer the questions that are important to you.

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If the product is received within the warranty period ProSoft will repair or replace the defective product at our option and cost.

Warranty Procedure: Upon return of the hardware product ProSoft will, at its option, repair or replace the product at no additional charge, freight prepaid, except as set forth below. Repair parts and replacement product will be furnished on an exchange basis and will be either reconditioned or new. All replaced product and parts become the property of ProSoft. If ProSoft determines that the Product is not under warranty, it will, at the Customer's option, repair the Product using then current ProSoft standard rates for parts and labor, and return the product freight collect.

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RMA Procedures

In the event that repairs are required for any reason, contact ProSoft Technical Support at +1 661.716.5100. A Technical Support Engineer will ask you to perform several tests in an attempt to diagnose the problem. Simply calling and asking for a RMA without following our diagnostic instructions or suggestions will lead to the return request being denied. If, after these tests are completed, the module is found to be defective, we will provide the necessary RMA number with instructions on returning the module for repair.

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