



 ProLinX<sup>®</sup>  
**104S v2**

ProLinX Gateway  
IEC 60870-5-104 Server  
(Firmware v2.xx)

March 19, 2010

## Important Installation Instructions

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

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

## All ProLinx® Products

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

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

### Markings

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UL/cUL	ISA 12.12.01 Class I, Div 2 Groups A, B, C, D
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cUL	C22.2 No. 213-M1987
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243333

183151

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

Temp Code T5

II 3 G

Ex nA nL IIC T5 X

0° C ≤ Ta ≤ 60° C

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

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

G – Equipment protected against explosive gasses.

## ProLinx Gateways with Ethernet Ports

Series C ProLinx™ Gateways with Ethernet ports do **NOT** include the HTML Web Server. The HTML Web Server must be ordered as an option. This option requires a factory-installed hardware addition. The HTML Web Server now supports:

- 8 MB file storage for HTML files and associated graphics files (previously limited to 384K)
- 32K maximum HTML page size (previously limited to 16K)

### ***To upgrade a previously purchased Series C model:***

Contact your ProSoft Technology distributor to order the upgrade and obtain a Returned Merchandise Authorization (RMA) to return the unit to ProSoft Technology.

### ***To Order a ProLinX Plus gateway with the -WEB option:***

Add **-WEB** to the standard ProLinX part number. For example, **5201-MNET-MCM-WEB**.

### **Your Feedback Please**

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

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104S v2 Protocol Manual

3/19/2010

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

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

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

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## Guide to the 104S v2 Protocol Manual

Function		Section to Read	Details
Introduction (Must Do)	→	Start Here (page 9)	This Section introduces the customer to the gateway. Included are: package contents, system requirements, hardware installation, and basic configuration.
Diagnostic and Troubleshooting	→	Diagnostics and Troubleshooting (page 91)	This section describes Diagnostic and Troubleshooting procedures.
Reference Product Specifications Functional Overview	→	Reference (page 105) Functional Overview Product Specifications (page 105)	These sections contain general references associated with this product, Specifications, and the Functional Overview.
Support, Service, and Warranty Index	→	Support, Service and Warranty (page 147)	This section contains Support, Service and Warranty information. Index of chapters.





# 1 Start Here

## *In This Chapter*

- ❖ ProLinx Reference Guide .....9
- ❖ Install ProSoft Configuration Builder Software.....9

For most applications, the installation and configuration steps described in this section will work without additional programming. ProSoft Technology strongly recommends that you complete the steps in this chapter before developing a custom application.

## 1.1 ProLinx Reference Guide

The *ProLinx Reference Guide* on the ProSoft Solutions CD-ROM provides detailed information on the entire range of ProLinx gateways. If you have any questions that are not answered in the 104S v2 Protocol Manual, please refer to the *ProLinx Reference Guide*.

## 1.2 Install ProSoft Configuration Builder Software

You must install the ProSoft Configuration Builder (PCB) software to configure the gateway. You can always get the newest version of ProSoft Configuration Builder from the ProSoft Technology web site.

### To install ProSoft Configuration Builder from the ProSoft Web Site

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

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

To install ProSoft Configuration Builder from the Product CD-ROM

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



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

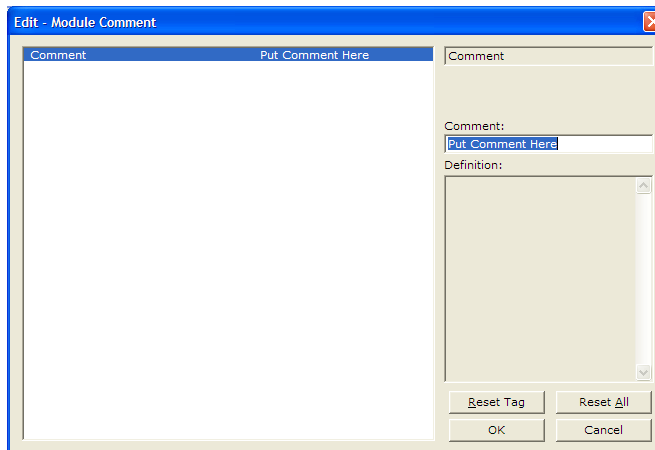
### 1.2.1 Using the Online Help

Most of the information needed to help you use ProSoft Configuration Builder is provided in a Help System that is always available whenever you are running ProSoft Configuration Builder. The Help System does not require an Internet connection.

To view the help pages, start ProSoft Configuration Builder, open the **HELP** menu, and then choose **CONTENTS**.

### 1.2.2 To Create Optional Comment Entries

- 1 Click the plus sign to the left of the  Comment icon to expand the gateway Comments.
- 2 Double-click the  Module Comment icon. The **EDIT - MODULE COMMENT** dialog appears.



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

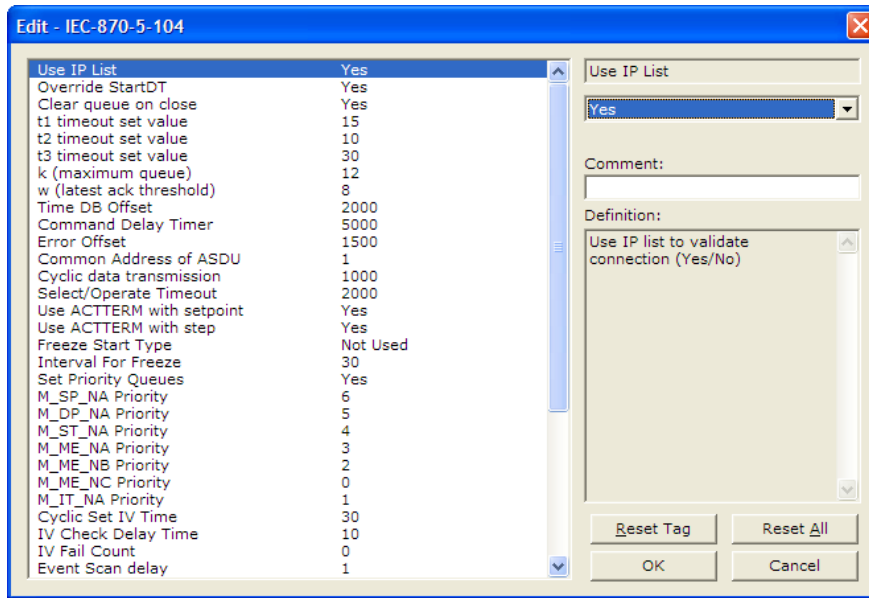
### **1.2.3 Printing a Configuration File**

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



## 2 Configure the Gateway

### 2.1 IEC 60870-5-104 Server section



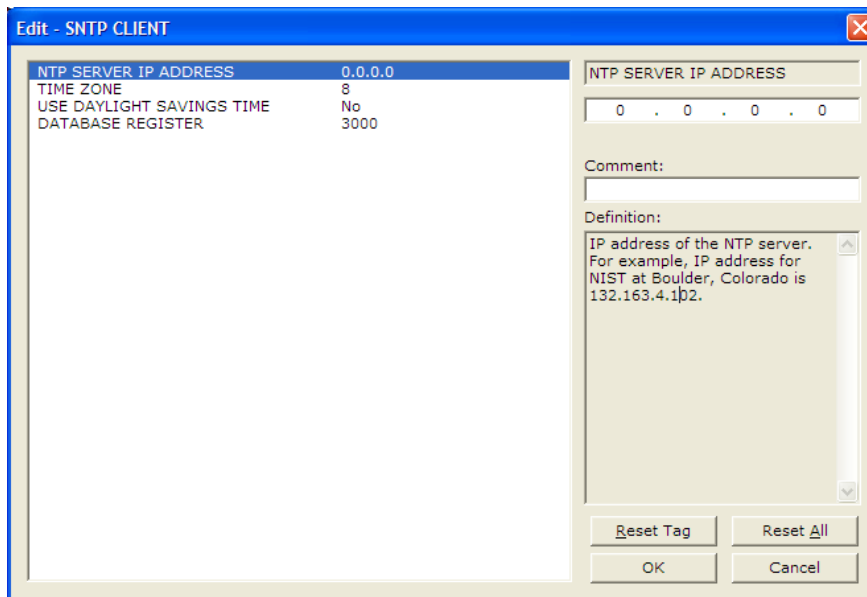
### 2.1.1 [SNTP CLIENT]

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

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

```
# This section used to define the parameters required for the Simple Network
Time
# Protocol (SNTP) client.
[SNTP CLIENT]
#NTP SERVER IP ADDRESS      : 132.163.4.102  #IP address for NIST, Boulder,
Colorado
NTP SERVER IP ADDRESS      : 0.0.0.0        #IP Address for NTP Server
TIME_ZONE                   : 8              #Number of hours from GMT (-11 to
+11)
USE DAYLIGHT SAVINGS TIME  : No             #Yes or No
DATABASE REGISTER           : 3000          #database word location to store
time

#(-1=ignore). This register value should
#be an even number.
```



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

A list of some of the common NTP servers can be obtained at <http://www.ntp.org/> or, <http://support.ntp.org/bin/view/Servers/WebHome>

Other server lists can be found by searching the World Wide Web for "NTP Servers".

#### NTP Server IP Address

Enter in dotted notation

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

#### Time Zone

-11 to 11

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

#### Use Daylight Savings Time

Yes or No

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

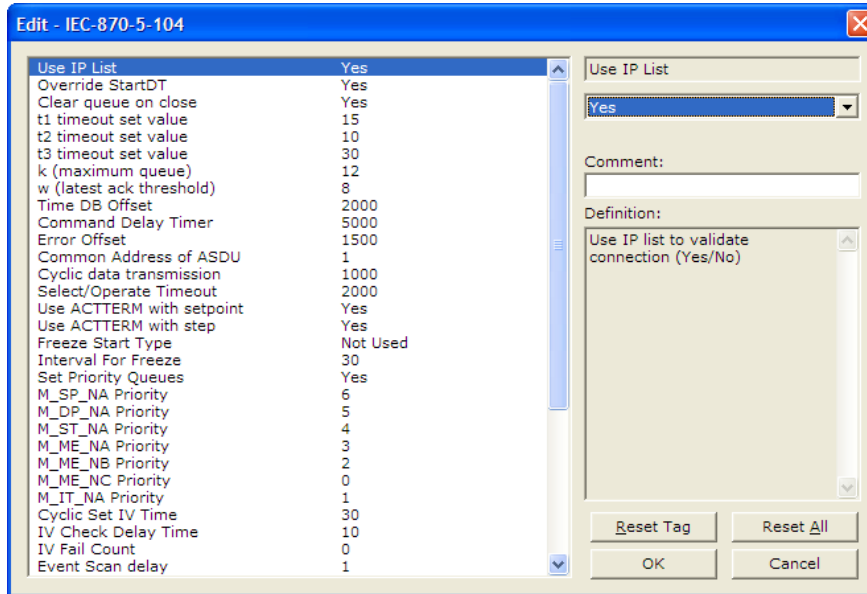
#### Database Register

-1 or 0 to 3992 as an even value

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

### 2.1.2 [IEC-870-5-104]

This section provides information required to configure a server application with the gateway. Most entries contained within this section are self explanatory.



#### Use IP List

**No (0) or YES (1)**

This parameter specifies if the IP address of the host connected to the system will be validated. If the parameter is set to **No (0)**, any host may connect to the unit. If the parameter is set to **YES (1)**, only hosts in the IP list will be permitted to connect to the unit.

#### Override StartDT

**No (0) or YES (1)**

This parameter is used when testing the gateway with a simulator or with a Client unit that does not meet the IEC 60870-5-104 specification. After the Client connects to the gateway, it will send a STARTDT.ACT U-format message to the gateway to permit the gateway to start sending data. If the Client does not support this requirement, set the parameter to **YES (1)**. Set the parameter to **No (0)** if the Client sends the STARTDT.ACT message.

Note: This parameter must be set to No (0) if you wish to use the redundant Clients feature.



Clear Queue on Close

**No (0) or YES (1)**

Use this command to define whether the gateway will store the unacknowledged buffers in the unit after the connection is closed. If the specification is to be followed, set this parameter to **No (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 **YES (1)** (this is not according to the IEC 60870-5-104 specification).

t1 Timeout Set Value

**1 to 255**

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

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 gateway 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.

Common Address of ASDU

**0 to 65535**

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

Cyclic Data Transmission

**0 to 4,294,967,296** (2 raised to the power of 32)

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

Select/Operate Timeout

**0 to 4,294,967,296** (2 raised to the power of 32)

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

Use ACTTERM with Setpoint

**1 or 0**

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

Use ACTTERM with Step

**1 or 0**

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

Time DB Offset

**-1 or 0 to 3994**

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

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

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

Command Delay Timer

**1000 to 60000** milliseconds

This value is used for time-tag validity verification for the ASDUs listed below. The received commands will only be accepted if [timestamp + Command Delay Timer] is greater than the gateway's own time.

- 58: Single command with time tag CP56Time 2a
- 59: Double command with time tag CP56Time 2a
- 60: Regulating step command with time tag CP56Time 2a
- 61: SetPoint command, normalized value with time tag CP56Time 2a
- 62: SetPoint command, scaled value with time tag CP56Time 2a
- 63: SetPoint command, short floating point with time tag CP56Time 2a
- 107: Test command with time tag CP56Time2a

If the value is less than **1000** milliseconds, the gateway will default to **5000** milliseconds

Maximum ASDU Resp Len

**25 to 246**

This parameter limits the maximum size of the ASDU portion of a response message. Most applications will use a value of **246**.

Freeze Start Type

**D = DAY, H = HOUR, M = MINUTE, N = NOT USED**

The Freeze Start Type parameter defines when the gateway starts sending the M\_IT messages.

Interval for Freeze

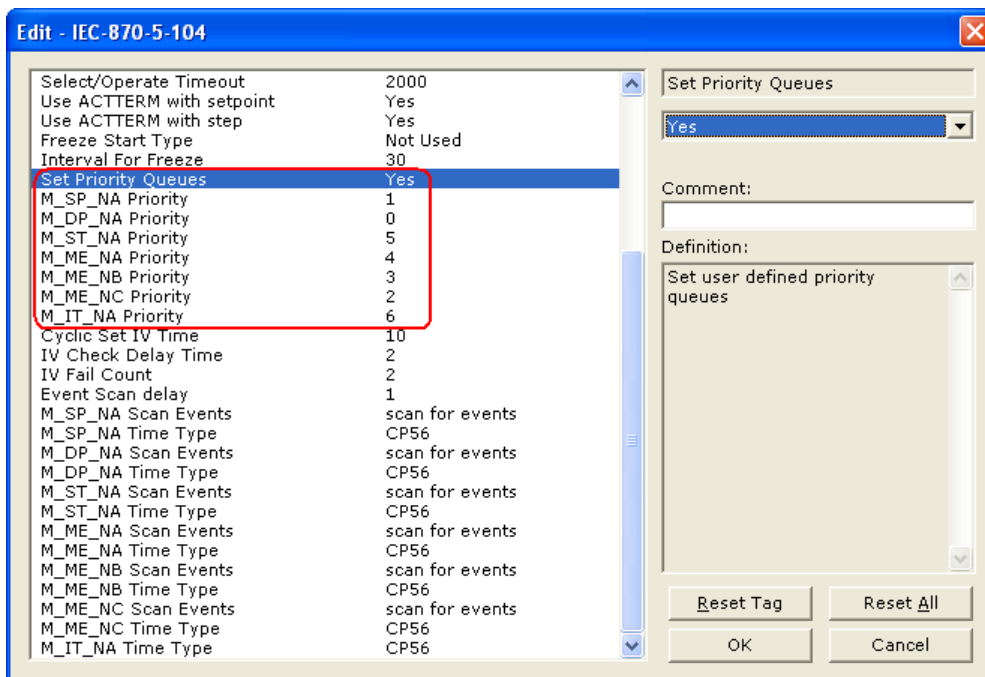
**0 to 65535**

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

Set Priority Queues

**YES or NO**

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



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

For more information, refer to Event Priority (page 87).

### Cyclic Set IV Time

**1** to **65535** seconds, or **0** to disable Invalid Bit Monitoring

The parameter should be set to a value significantly greater than the value of the *IV Check Delay Time* parameter, multiplied by the value of the *IV Fail Count* parameter. Example:

If, *IV Check Delay* = **3**

And, *IV Fail Count* = **5**;

Then set *Cyclic Set IV Time* significantly greater than 15; preferably some multiple of this value, like **30**, **45**, **60**, or more.

The *Cyclic Set IV Time* parameter is one of three parameters needed to establish a fail-safe data validation system for this protocol implementation. This parameter is used with the *IV Check Delay Time* and the *IV Fail Count* parameters to create a way to alert the remote IEC-104 Client to situations where data being sent by the gateway might be invalid.

Use the *Cyclic Set IV Time* parameter to set how frequently the Invalid (IV) Bits assigned to IEC database monitor points (M\_xx\_xx points) will be set ON. This means that all the IEC database monitor points configured with IV Bit addresses greater than zero (0) will have their IV Bit addresses in the gateway database set to a value of one (1) in a timed, periodic cycle, based on the number of seconds entered in *Cyclic Set IV Time*.

The IV Bits are checked at the interval specified by the *IV Check Delay Time* parameter. At the end of each check delay interval, if an IV Bit for any IEC database point is ON, an IV Bit Check Fail accumulator for that point will be incremented. If the value in any IV Bit Check Fail accumulator becomes equal to the value of the *IV Fail Count* parameter, the gateway will consider the data value of that point invalid and will report the invalid status of that point to the Client along with the data value.

If the IV Bit is cleared (reset, set OFF, set to zero) before the IV Bit Check Fail accumulator value becomes equal to the value of the *IV Fail Count* parameter, the IV Bit Check Fail accumulator will be reset to 0. The gateway will consider the data value of that point valid and will report the data value to the Client as valid.

To properly use data validity checking with a ProLinx Gateway, the application that communicates to the gateway through the other gateway protocol (Modbus, EtherNet/IP, etc.) must be programmed to provide data validity information, as well as the actual data to be transferred. This other application must write bit values of zero (0) or one (1) to the proper gateway database addresses along with the data for each IEC database point.

To properly use data validity checking with an inRAX rack-mounted module for Rockwell Automation processor systems or with a ProTalkQ rack-mounted module for Modicon Quantum processor systems, the logic application running in the processor that communicates to the module through a backplane input/output driver must be programmed to provide data validity information, as well as the actual data to be transferred. This logic application must write bit values of zero (0) or one (1) to the proper module database addresses along with the data for each IEC database point.

This means the other protocol application or the logic application will be responsible for clearing the IV Bits for data points which contain valid data at a time interval less than the amount of time required to accumulate the required number of IV Bit Check failures. In cases where inRAx or ProTalkQ modules are used, backplane communication happens so quickly that cyclic setting of the IV Bits will be quickly undone by data transfers from processor memory. However, if the process logic or other protocol application does not clear the IV Bits set by firmware, then all IEC database monitor point values will be reported to the Client as invalid.

**NOTE:** If one or more of the *Cyclic Set IV Time*, the *IV Check Delay Time*, or the *IV Fail Count* parameters are set to zero, the data validity checking feature will be disabled for all points in the IEC database and data reported to the remote Client will always be reported as valid data. If you wish to have actual data validity information relayed to the Client, be sure the *Cyclic Set IV Time*, the *IV Check Delay Time*, and the *IV Fail Count* parameters are set to non-zero values and be sure the application has been programmed to properly manipulate the IV Bit addresses in the gateway database. Once data validity checking has been enabled, you can still turn off validity checking on a point-by-point basis by setting the IV Bit Address to zero (0) for any point you wish to exclude from data validity checking and reporting.

For more information on the data validity features of this protocol implementation, refer to Invalid Bit Monitoring (page 84).

#### IV Check Delay Time

**1** to **65535** seconds, or **0** to disable Invalid Bit Monitoring

This parameter sets the number of seconds between IV Bit value checks. Every IEC database monitor point which has an IV Bit address set greater than 0 will have that bit address checked at the interval specified by this parameter.

Setting this parameter to zero (0) will disable data validity checking.

#### IV Fail Count

**1** to **65535** seconds, or **0** to disable Invalid Bit Monitoring

This parameter sets the number of successive IV Bit check failures which must occur before the data from a IEC database monitor point will be reported to the remote Client as invalid data.

An IV Bit Check Failure occurs when the IV Bit value in the gateway database is set ON, when it contains a value of one (1), at the time an IV Bit Check is performed. IV Bit Check failures are counted and held in separate IV Bit Check Failure accumulators for each IEC monitor point configured for validity checking. If the value in any point's failure accumulator becomes equal to the value set in this parameter, the gateway will flag the data from this point as invalid and report to the Client this invalid status, along with the point's data value.

Setting this parameter to zero (0) will disable data validity checking.

Event Scan Delay

**1** to **65535**, or **0** to disable

If set to 0, the feature will be disabled and the gateway 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.

Scan Events

**0 = NO SCANNING** or **1 = SCAN FOR EVENTS**

Separate parameters exist for multiple point types. Defines whether events of this point type will be generated by the gateway. If "No Scanning", then events will not be generated. If "Scan for events", events will be scanned and generated on change.

```

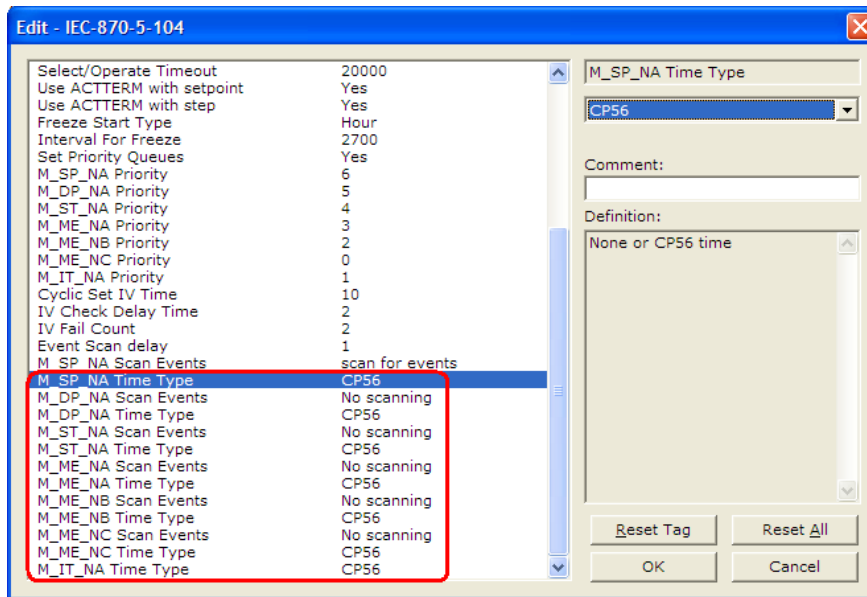
→ M_SP_NA Scan Events           : scan for events
   M_SP_NA Time Type           : CP56
   M_SP_NA Use Recent          : report multiple
→ M_DP_NA Scan Events           : scan for events
   M_DP_NA Time Type           : CP56
   M_DP_NA Use Recent          : report multiple
→ M_ST_NA Scan Events           : scan for events
   M_ST_NA Time Type           : CP56
   M_ST_NA Use Recent          : report multiple
→ M_BO_NA Scan Events           : scan for events
   M_BO_NA Time Type           : CP56
   M_BO_NA Use Recent          : report multiple
→ M_ME_NA Scan Events           : scan for events
   M_ME_NA Time Type           : CP56
   M_ME_NA Use Recent          : report multiple
→ M_ME_NB Scan Events           : scan for events
   M_ME_NB Time Type           : CP56
   M_ME_NB Use Recent          : report multiple
→ M_ME_NC Scan Events           : scan for events
   M_ME_NC Time Type           : CP56
   M_ME_NC Use Recent          : report multiple
   M_IT_NA Time Type           : CP56

```

Time Type

**0 = NONE**, **1 = CP24**, or **2 = CP56**

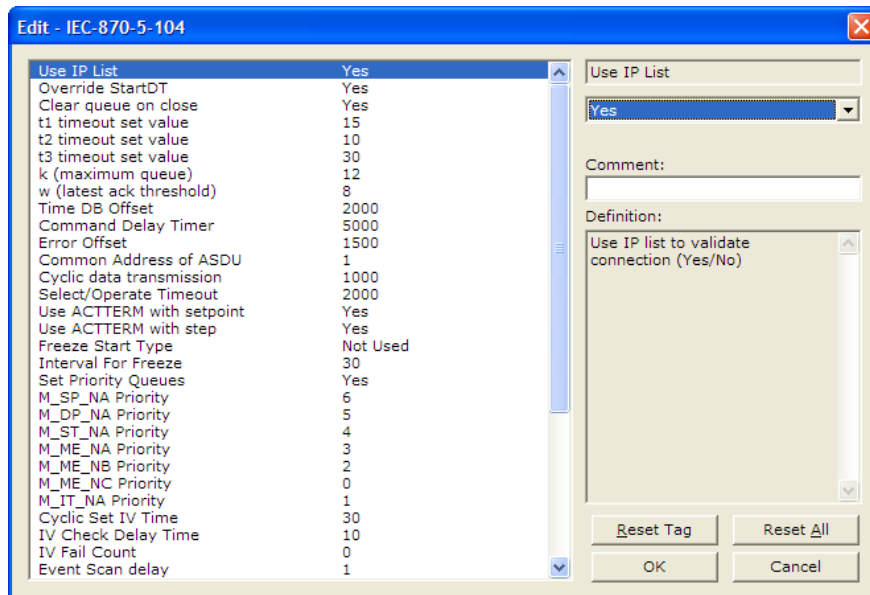
Separate parameters exist for multiple point types. This parameter defines the time format used with data events.





### 2.1.3 [IEC-870-5-104 Database]

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



#### Short Pulse Time

**0 to 2,147,483,647** (2 raised to the power of 31) milliseconds

This parameter defines the number of milliseconds to keep an IEC Command Point set ON, HIGH, equal to one (1), before returning the point to OFF, LOW, equal to zero (0), whenever a pulse point command is sent by the Client and the default value of the *Default Command Qualifier* parameter is set to **SHORT**.

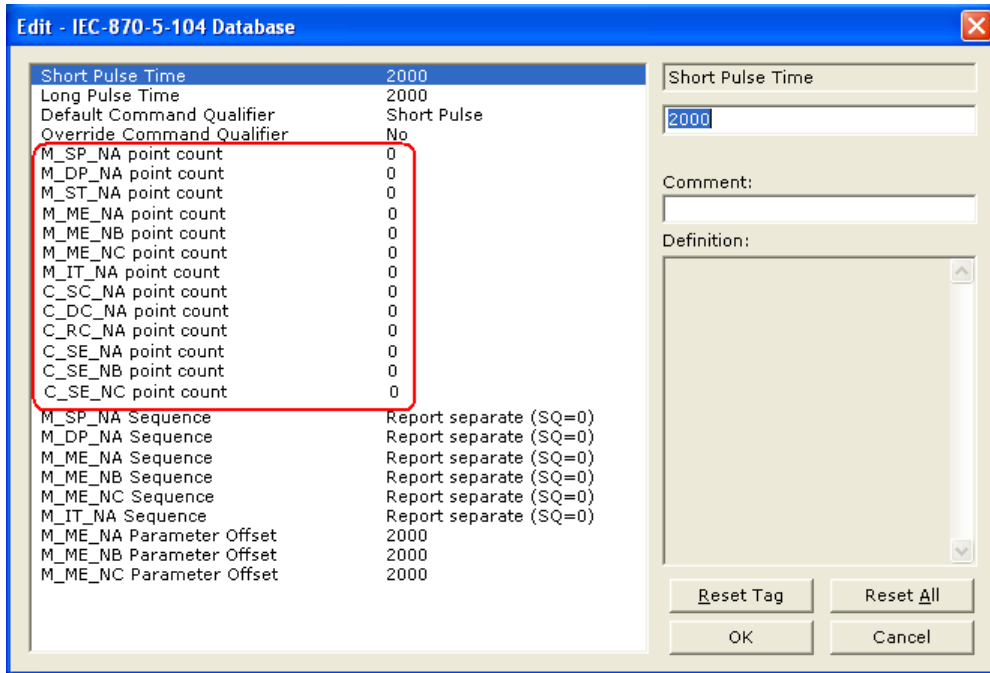
#### Long Pulse Time

**0 to 2,147,483,647** (2 raised to the power of 31) milliseconds

This parameter defines the number of milliseconds to keep an IEC Command Point set ON, HIGH, equal to one (1), before returning the point to OFF, LOW, equal to zero (0), whenever a pulse point command is sent by the Client and the default value of the *Default Command Qualifier* parameter is set to **LONG**.

Point Count

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



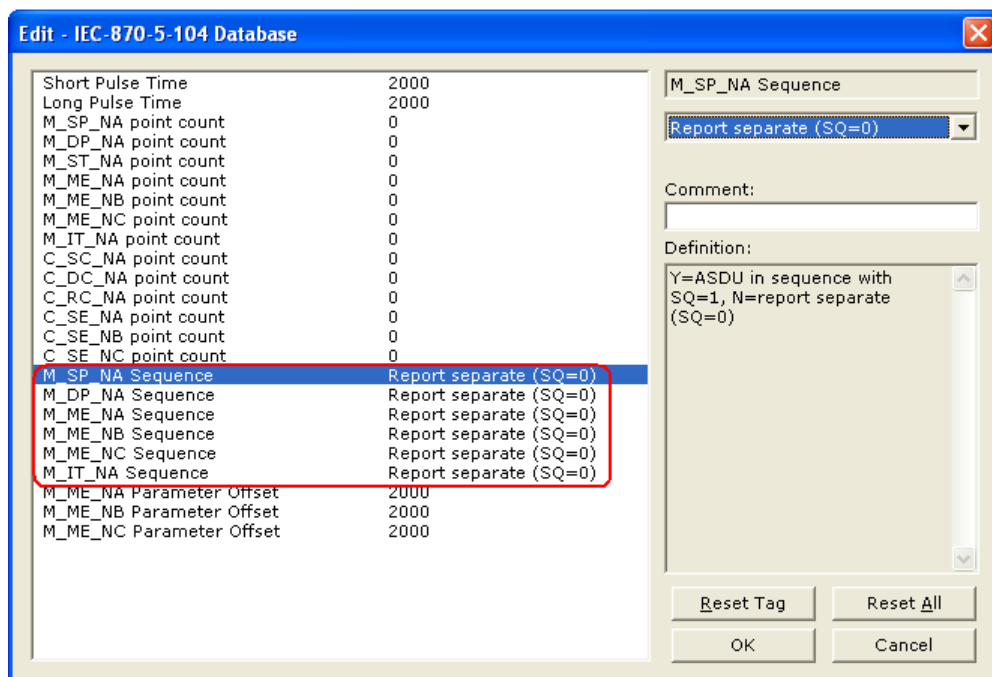
- **M\_SP\_NA point count:** This parameter specifies the number of point values assigned for the monitored single-point database. Range is 0 to 1000.
- **M\_DP\_NA point count:** This parameter specifies the number of point values assigned for the monitored dual-point database. Range is 0 to 1000.
- **M\_ST\_NA point count:** This parameter specifies the number of point values assigned for the monitored step-point database. Range is 0 to 1000.
- **M\_ME\_NA point count:** This parameter specifies the number of point values assigned for the monitored normalized-point database. Range is 0 to 1000.
- **M\_ME\_NB point count:** This parameter specifies the number of point values assigned for the monitored scaled-point database. Range is 0 to 1000.
- **M\_ME\_NC point count:** This parameter specifies the number of point values assigned for the monitored scaled short-float point database. Range is 0 to 50.
- **M\_IT\_NA point count:** This parameter specifies the number of point values assigned for the monitored counter-point database. Range is 0 to 99.
- **C\_SC\_NA point count:** This parameter specifies the number of point values assigned for the command single-point database. Range is 0 to 1000.
- **C\_DC\_NA point count:** This parameter specifies the number of point values assigned for the command dual-point database. Range is 0 to 1000.
- **C\_RC\_NA point count:** This parameter specifies the number of point values assigned for the command step-point database. Range is 0 to 1000.

- **C\_SE\_NA point count:** This parameter specifies the number of point values assigned for the command normalized-point database. Range is 0 to 1000.
- **C\_SE\_NB point count:** This parameter specifies the number of point values assigned for the command scaled-point database. Range is 0 to 1000.
- **C\_SE\_NC point count:** This parameter specifies the number of point values assigned for the command short-float point database. Range is 0 to 50.

### Sequence Flag

#### **YES or No**

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

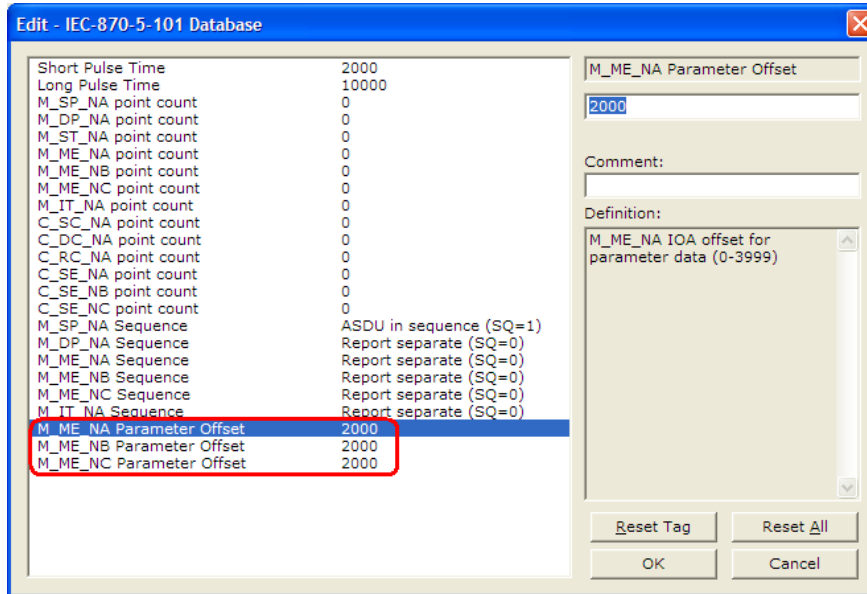


If this parameter is set to **No**, this feature is not selected, the gateway will send the object address and value for every monitored point sent to the Client, and the Sequence Flag (SQ) will be set to zero (0).

If this parameter is set to **YES**, this feature is selected, the gateway will send the object point address and value for only the first point of a sequence of points, send only the data value without point address for any remaining points in the sequence, and the Sequence Flag (SQ) will be set to one (1). When SQ = 1, the Client assumes that all points after the first point use information object addresses in a contiguous order (using the first point as the reference starting address).

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

Parameter Offset



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

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

For example, if the 104S v2 configuration sets two M\_ME\_NA points with IOA (Point #) of 600 and 601 and a M\_ME\_NA Parameter Offset value of 2000, the threshold deadband parameters for those points would be written to IOA addresses 2600 and 2601.

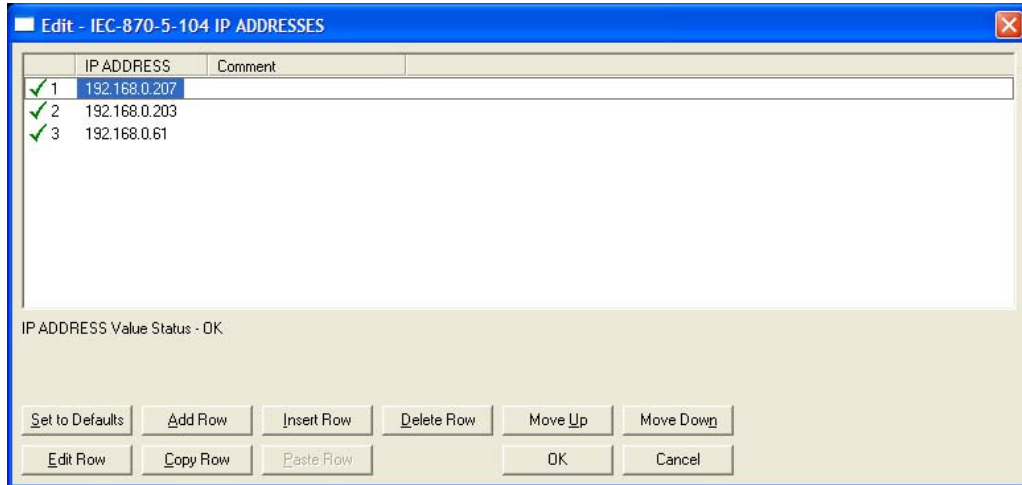
Note: The Low Limit and High Limit threshold values are always calculated based on the threshold deadband value as described in the following table.

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

### 2.1.4 [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:



### 2.1.5 [M\_SP\_NA\_1 104]

This section defines the monitored single-point database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point indicates one of two states, 1 = Bit On, 0 = Bit Off.

This section takes the following parameters:

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

Each point is one bit and the DB address value corresponds to the bit offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.6 [M\_DP\_NA\_1 104]**

This section defines the monitored dual-point database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. Each point in the database can have one of four possible states, 00 = intermediate, 01 = Point Off, 10 = Point On, and 11 = intermediate).

This section takes the following parameters:

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

Each point is two bits and the DB address value corresponds to the bit offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.7 [M\_ST\_NA\_1 104]**

This section defines the monitored step database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit.

This section takes the following parameters:

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

Each point is one, 8-bit byte and the DB Address value corresponds to the byte offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.8 [M\_ME\_NA\_1 104]**

This section defines the monitored measured value, normalized database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. To determine the IOA (Information Object Address) for each object, add the Point # (IOA) in the following section to the value of the *M\_ME\_NA Parameter Offset* as entered in the *[IEC-870-5-104 Database]* section.

This section takes the following parameters:

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

Each point is one, 16-bit word and the DB Address value corresponds to the word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.9 [M\_ME\_NB\_1 104]**

This section defines the monitored measured value, scaled database for the server device emulated. This information is sourced from the database and is transferred to the remote client unit. To determine the IOA (Information Object Address) for each object, add the Point # (IOA) to the *M\_ME\_NB Parameter Offset* parameter value as entered in the *[IEC-870-5-104 Database]* section.

This section takes the following parameters:

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

Each point is one, 16-bit word and the DB Address value corresponds to the word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.10 [M\_ME\_NC\_1 104]**

This section defines the monitored short-float point database for the slave device emulated. This information is sourced from the database and is transferred to the remote client unit. To determine the IOA (Information Object Address) for each object, add the Point # (IOA) to the *M\_ME\_NC Parameter Offset* parameter value as entered in the *[IEC-870-5-104 Database]* section.

This section takes the following parameters:

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

Each point is two, 16-bit words and the DB Address value corresponds to the double-word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

For a list of Group Codes, refer to the section on Group Codes (page 36).

### **2.1.11 [M\_IT\_NA\_1 104]**

This section defines the monitored integrated totals (counter) database for the server emulated. This information is sourced from the database and is transferred to the remote client unit.

This section takes the following parameters:

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

Each point is two, 16-bit words and the DB Address value corresponds to the double-word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.12 [C\_SC\_NA\_1 104]**

This section defines the single point command database for the server emulated. This information is sourced from the remote client and is transferred to the database. 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 gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.



### **2.1.13 [C\_DC\_NA\_1 104]**

This section defines the double point command database for the server emulated. This information is sourced from the remote client and is transferred to the database. 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 gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.14 [C\_RC\_NA\_1 104]**

This section defines the step command database for the server emulated. This information is sourced from the remote client and is transferred to the database. 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, 8-bit byte and the DB Address value corresponds to the byte offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.15 [C\_SE\_NA\_1 104]**

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

This section takes the following parameters:

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

Each point is one, 16-bit word and the DB Address value corresponds to the word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.16 [C\_SE\_NB\_1 104]**

This section defines the scaled setpoint database for the server emulated. This information is sourced from the remote client and is transferred to the database. You can associate a command with a monitored scaled database value to coordinate the command/monitor operation. You must enter the correct Monitor Point # and Monitor DB Addr values in the table. If the *Require Select* parameter is set to one (1) or **YES**, a Select command must be received from the Client before an execute command from the Client will be processed.

This section takes the following parameters:

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

Each point is one, 16-bit word and the DB Address value corresponds to the word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### **2.1.17 [C\_SE\_NC\_1 104]**

This section defines the short-float setpoint database for the server emulated. This information is sourced from the remote client and is transferred to the database. If the *Require Select* parameter is set to one (**1**) or **YES**, a *Select* command must be received from the Client before an *Execute* command from the Client will be processed.

This section takes the following parameters:

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

Each point is two, 16-bit words and the DB Address value corresponds to the double-word offset in the gateway memory database. For additional information on how to set these parameters, see the 104S Tutorial and Reference chapters of this manual.

### 2.1.18 Group Codes

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

Group Code	Description
0x00000001	Interrogated by general interrogation (station or global)
0x00000002	Interrogated by group 1 interrogation
0x00000004	Interrogated by group 2 interrogation
0x00000008	Interrogated by group 3 interrogation (See <b>Note 1</b> , below)
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

**Note 1:** Group 3 interrogation also returns the parameter data (ASDU 110 – threshold, low limit and high limit) for all monitored measured points.

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.

## 2.2 CommonNet Data Map

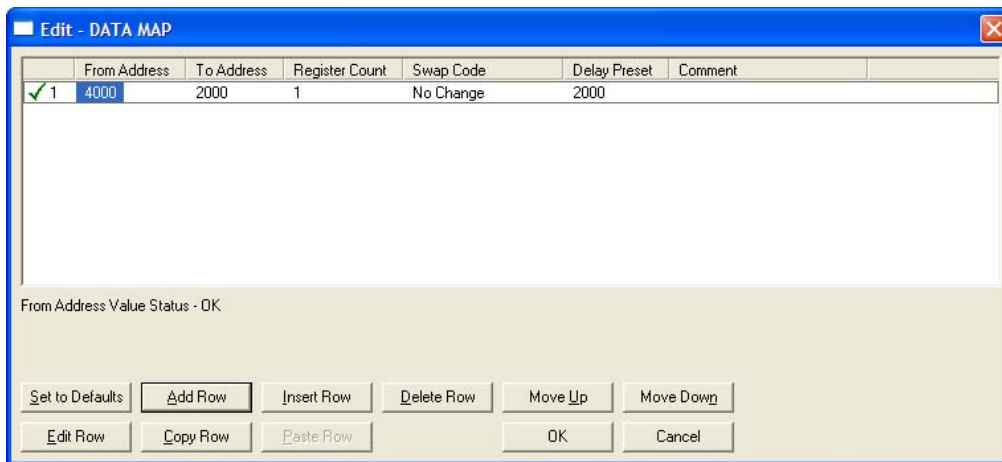
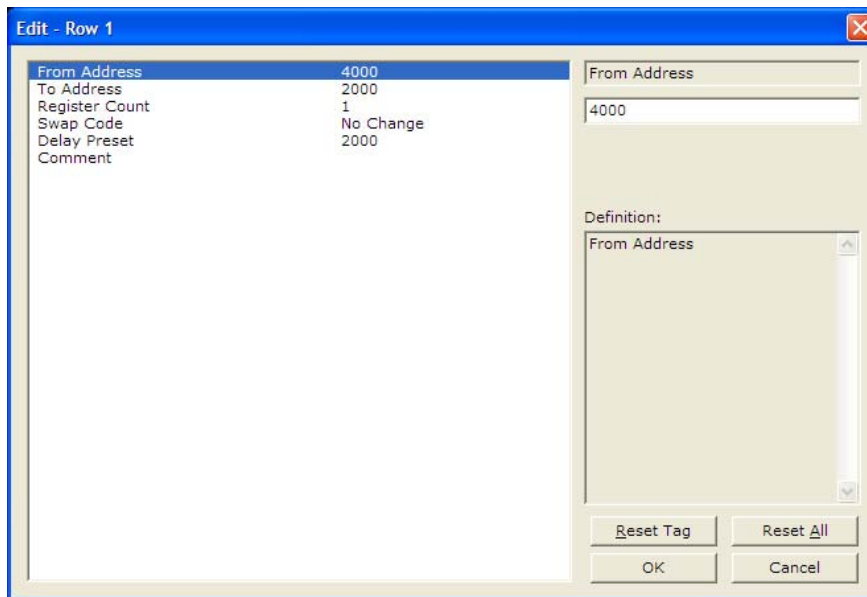
The **[DATA MAP]** section allows you to copy data between areas in the gateway's internal database.

You can copy a maximum of 100 registers per *Data Map* command, and you can configure a maximum of 200 separate copy commands.

For example, you can copy data from the error or status tables in upper memory to internal database registers in the User Data memory area.

You can also rearrange the byte and/or word order during the copy process, for example, to convert floating-point values to the correct format for a different protocol.

You can also use the *Data Map* to condense widely dispersed data into one contiguous data block, making it easier to access.



### 2.2.1 From Address

0 to highest Status Data address

This field specifies the internal database register to copy from. This address can range from the Data area as well as the Status Data Area of the product

### 2.2.2 To Address

0 to 3999

The destination for the copy is always within the User Data registers area. Take care to specify a destination address that will not overwrite data that may be required for other purposes.

### 2.2.3 Register Count

1 to 100

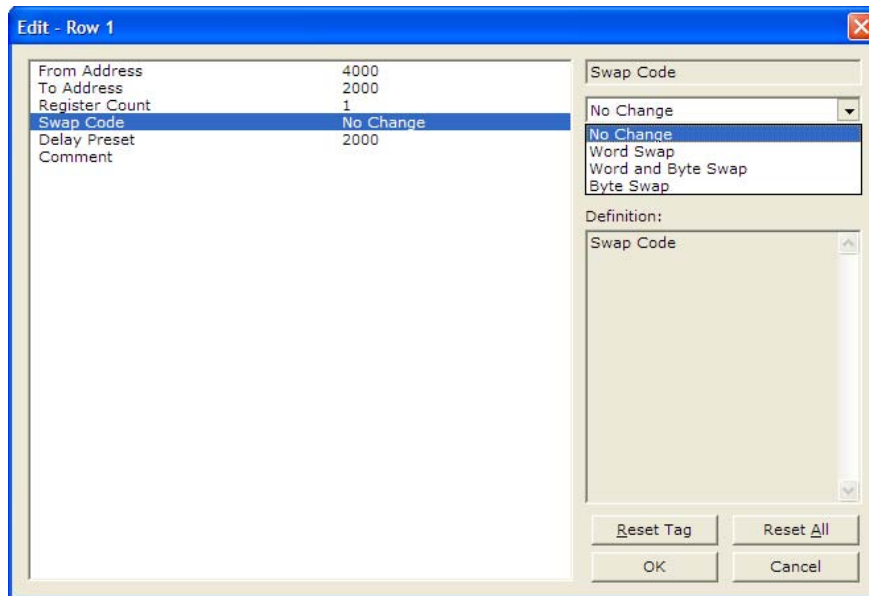
This parameter specifies the number of registers to copy.

### 2.2.4 Swap Code

No Change, Word Swap, Word and Byte Swap, Byte Swap

You may need to swap the order of the bytes in the registers during the copy process in order to change the alignment of bytes between dissimilar protocols. This parameter is helpful when dealing with floating-point or other multi-register values, as there is no standard method of storage of these data types in slave devices.

The following table defines the values and their associated operations:



---

Swap Code	Description
No Swap	No Change is made in the byte ordering (1234 = 1234)
Word Swap	The words are swapped (1234=3412)
Word and Byte Swap	The words are swapped then the bytes in each word are swapped (1234=4321)
Bytes	The bytes in each word are swapped (1234=2143)

---

### 2.2.5 Delay Preset

This parameter sets an interval for each *Data Map* copy operation. The value you put for the **DELAY PRESET** is not a fixed amount of time. It is the number of firmware scans that must transpire between copy operations.

The firmware scan cycle can take a variable amount of time, depending on the level of activity of the protocol drivers running on the ProLinx gateway and the level of activity on the gateway's communication ports. Each firmware scan can take from 1 to several milliseconds to complete. Therefore, *Data Map* copy operations cannot be expected to happen at regular intervals.

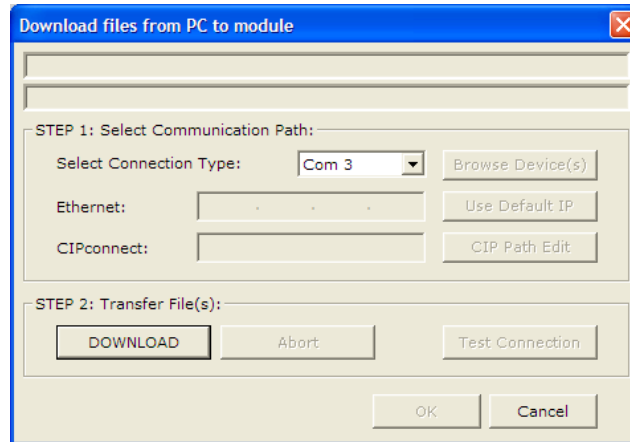
If multiple copy operations (several rows in the *Data map* section) happen too frequently or all happen in the same update interval, they could delay the process scan of the gateway protocols, which could result in slow data updates or missed data on communication ports. To avoid these potential problems, you should set the **DELAY PRESET** to different values for each row in the *Data Map* section and set them to higher, rather than lower, numbers.

For example, **DELAY PRESET** values below 1000 could begin to cause a noticeable delay in data updates through the communication ports. And you should not set all **DELAY PRESETS** to the same value. Instead, use different values for each row in the Data Map such as 1000, 1001, and 1002 or any other different **DELAY PRESET** values you like. This will prevent the copies from happening concurrently and prevent possible process scan delays.



### 2.3 Downloading a File from PC to the gateway

- 1 Verify that your PC is connected to the gateway with a null-modem serial cable connected to the serial port on your PC and the serial port on the gateway
- 2 Open the **PROJECT** menu, and then choose **MODULE**.
- 3 On the **MODULE** menu, choose **DOWNLOAD**. Wait while ProSoft Configuration scans for communication ports on your PC. When the scan is complete, the **DOWNLOAD** dialog box opens.



- 4 Select the port to use for the download.
- 5 Click the **DOWNLOAD** button.



### 3 IEC-60870-5-104 (104S) Protocol Implementation

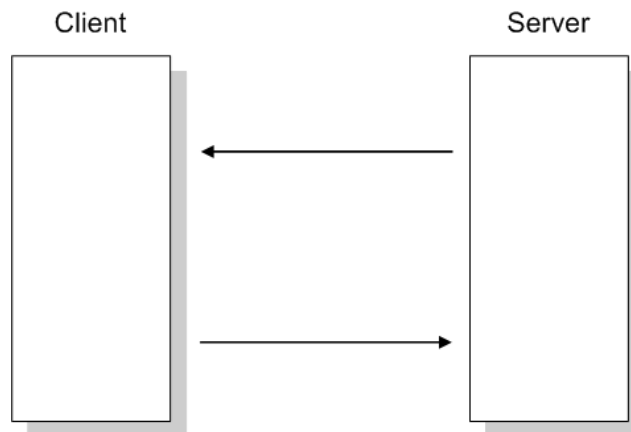
*In This Chapter*

- ❖ Module Address ..... 44
- ❖ Monitor Direction and Control Direction: Point Definition..... 47
- ❖ Using Monitor Points ..... 49
- ❖ Using Control (Command) Points ..... 62
- ❖ Data Communication ..... 70
- ❖ Events ..... 75
- ❖ Sequence Flag ..... 89

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

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

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



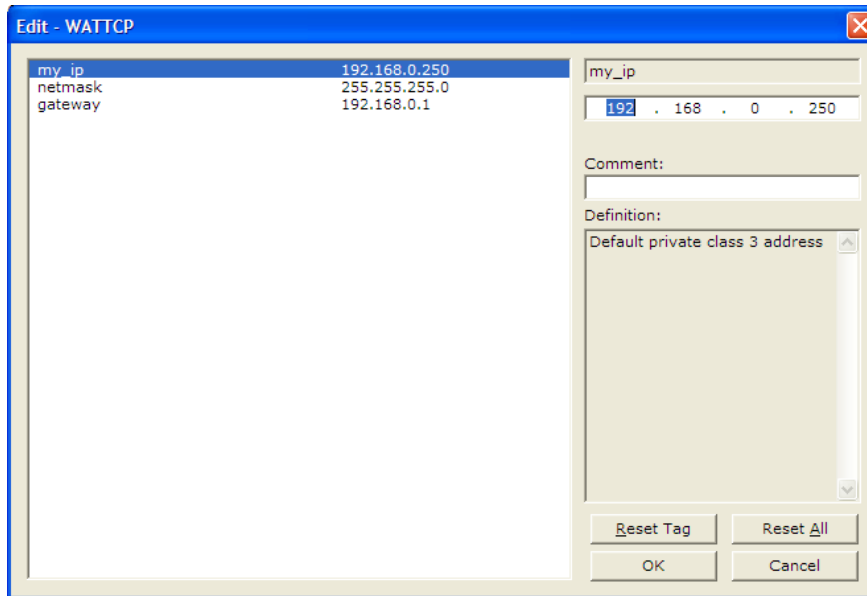
The 104S v2 works as an IEC-60870-5-104 server; it can send monitor data, receive commands, or generate events to the client unit.

### 3.1 Module Address

The 104S v2 gateway is identified at transport level (using the IP Address) and at application level (using the Common ASDU Address).

#### 3.1.1 IP Address

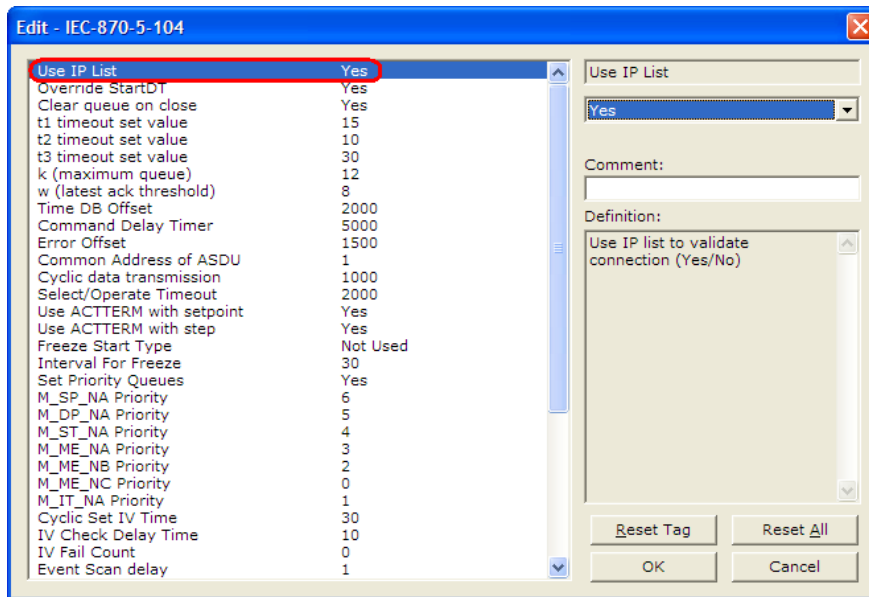
The 104S v2 gateway is identified by a unique IP address on the TCP/IP network. You must edit the WATTCP.CFG configuration file (or use the configuration tool) to enter a valid IP address. The following example lists the default contents of the WATTCP.CFG file:



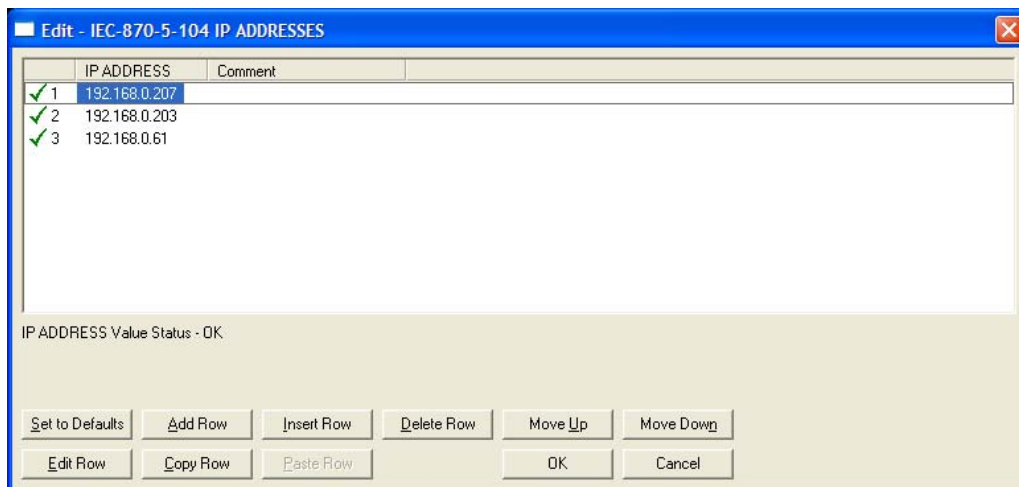
In this example, the 104S v2 gateway is identified by IP address 192.168.0.250 in the IEC-60870-5-104 network, with a netmask (subnet mask) of 255.255.255.0 and a default gateway address of 192.168.0.1.

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

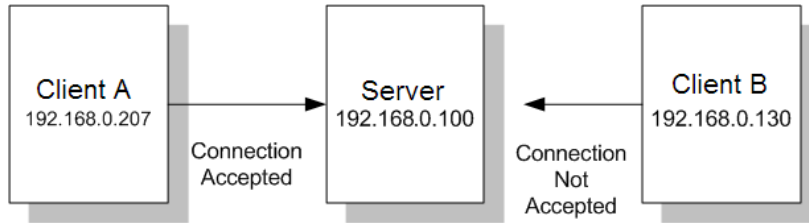
To restrict the units (IP addresses) from which the 104S v2 gateway will accept connections, use the following parameter:



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



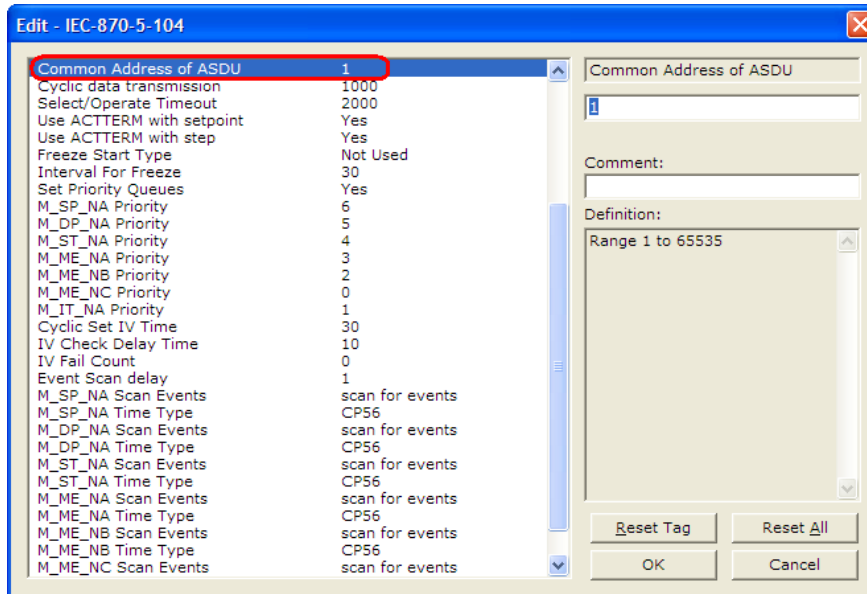
If the *Use IP List* parameter is set to Yes, the gateway will only accept a connection from one of the three IP addresses listed in the example above. The following illustration shows that the Server will accept a connection from Client A, whose address is on the list, but will reject a connection from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



### 3.1.2 Common ASDU Address

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

If the Client sends a message to a different Common ASDU, the gateway ignores the command. To configure the Common ASDU Address for the 104S v2, use the following parameter in the configuration file:

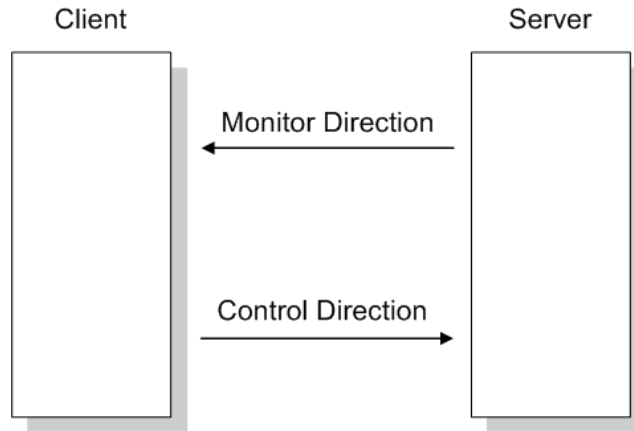


### 3.2 Monitor Direction and Control Direction: Point Definition

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

**Monitor Direction:** The direction of transmission from a server to a Client

**Control Direction:** The direction of transmission from a Client to a server

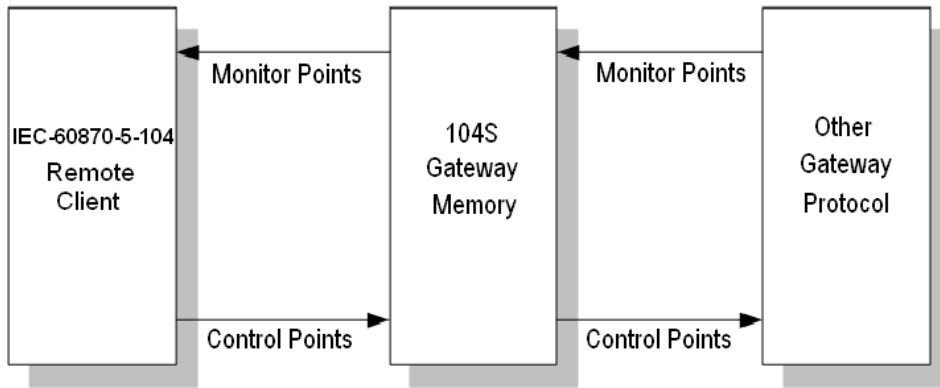


The points that are typically transferred from a server to a Client are also known as **Monitor Points** (or Monitor Information Objects). The points that are typically transferred from a Client to a server are also known as **Control Points** (or Command Information Objects).

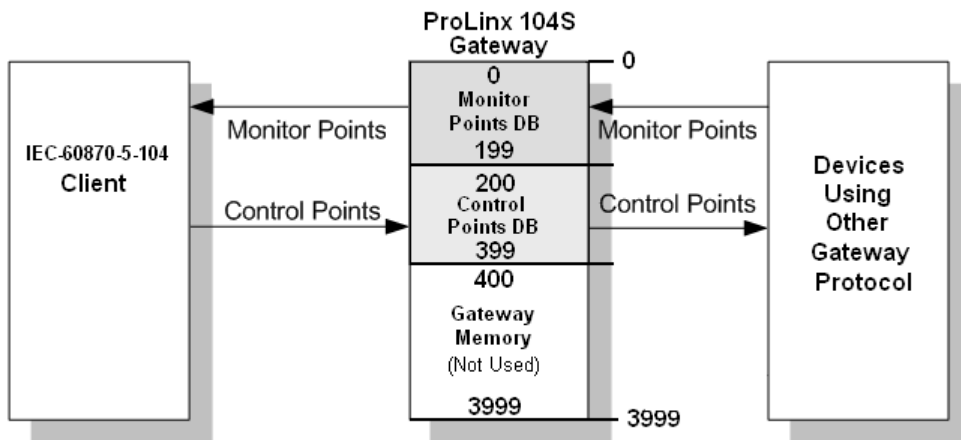
The 104S v2 contains an internal database of 4000, 16-bit words. You must associate the monitor and control points to database addresses in the 104S v2. To configure the points for the 104S v2, follow these steps:

- 1 Calculate the number of monitor and control points for the application.
- 2 Calculate the 104S v2 database regions that are required for the application, based on the number of monitor and control points. Define two separate regions. Remember that each data type stores a different quantity of data (for example, M\_SP\_NA uses one bit, M\_ST\_NA uses one byte, and so on).
- 3 Configure each point within its 104S v2 database region.

- Make sure that the other parts of your application correctly update gateway memory database regions through the other gateway communication protocol, as shown in the following illustration.



All points must be configured in the correct location in the 104S v2 database in order to be properly updated by the other gateway protocol by configuring the control points and monitor points in separate areas of the 104S v2 database. The following illustration shows an example configuration:



In this example, all monitor points are located between database addresses 0 and 199, and all control points are located between address 200 and 399.



### 3.3 Using Monitor Points

The following monitor points are supported by the 104S v2 gateway:

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

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

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

**DB Address** - The database location in the 104S v2 gateway associated with the point. You must associate each point to a database address in the 104S v2 gateway. The interpretation of this parameter depends on the point type configured. For example, for an M\_SP\_NA point, this value represents the bit address. For a M\_ME\_NA point, this value represents the Word address.

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

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

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

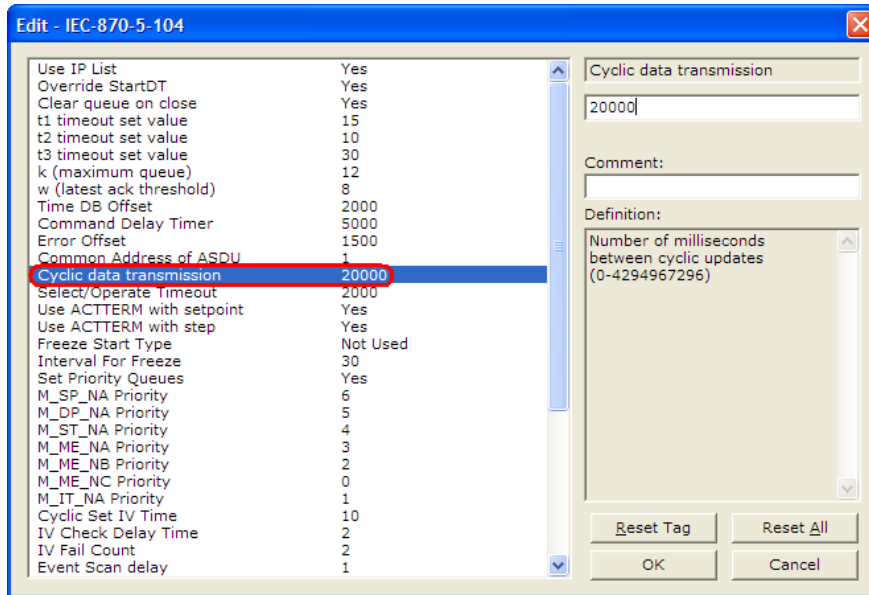
### 3.3.1 Monitor Data Transfer

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

The Group parameter is defined as follows:

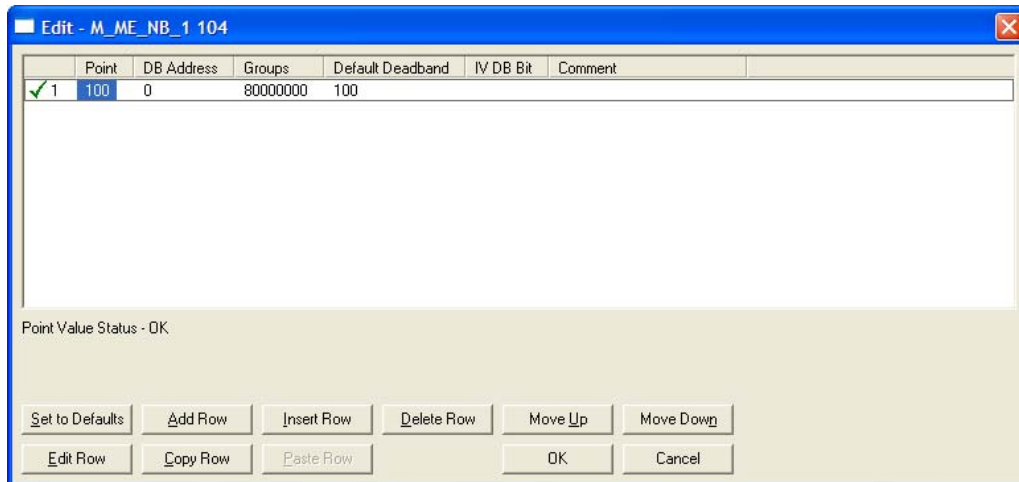
Group Code	Description
0x00000001	Interrogated by general interrogation (station or global)
0x00000002	Interrogated by group 1 interrogation
0x00000004	Interrogated by group 2 interrogation
0x00000008	Interrogated by group 3 interrogation
0x00000010	Interrogated by group 4 interrogation
0x00000020	Interrogated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

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

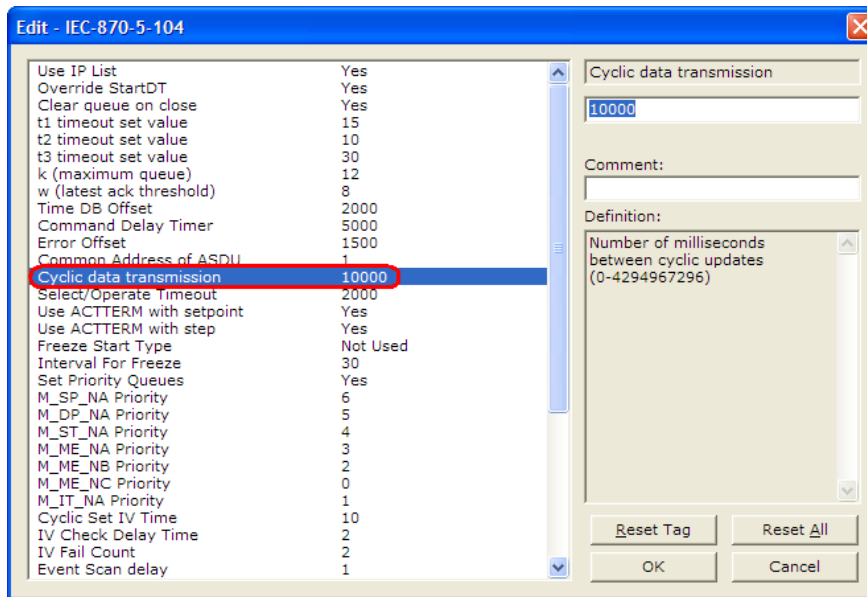


***Example - Periodic Monitor Polling:***

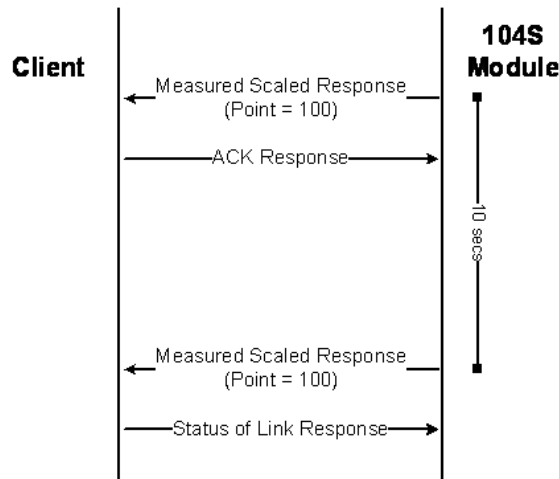
If the following point is configured for monitor polling:



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



The following illustration shows the communication procedure:



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

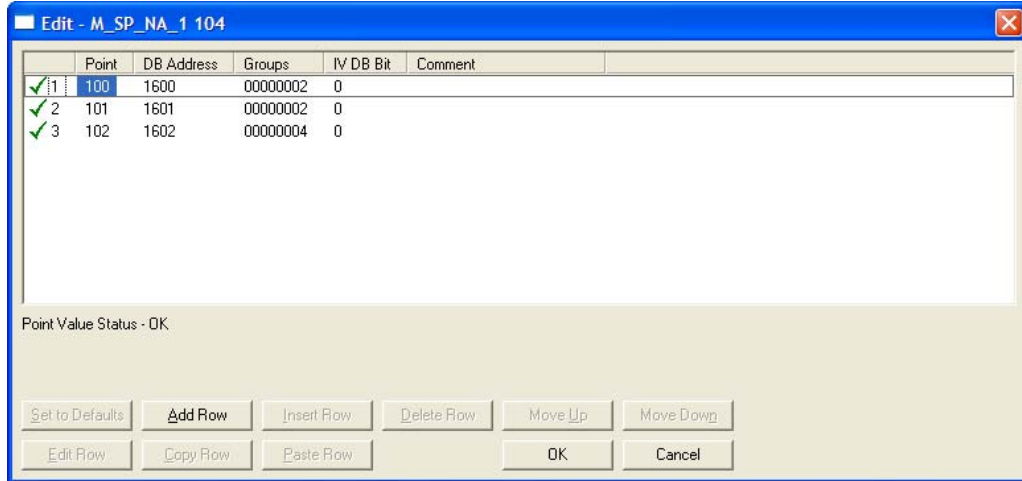
You may also create groups of points allowing the master to poll certain points more frequently than other points. The master may send requests for different groups as follows:

- General Interrogation (station)
- General Interrogation for Group 1
- General Interrogation for Group 2
- (and so...)
- General Interrogation for Group 16

Example - General Interrogation

If the following points are configured for General Interrogation:

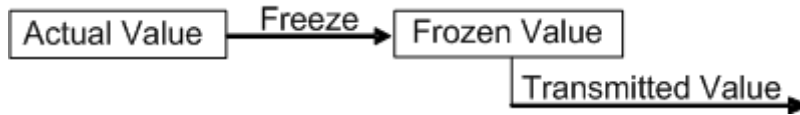
If you configure the following data points:



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

### Counter Points

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



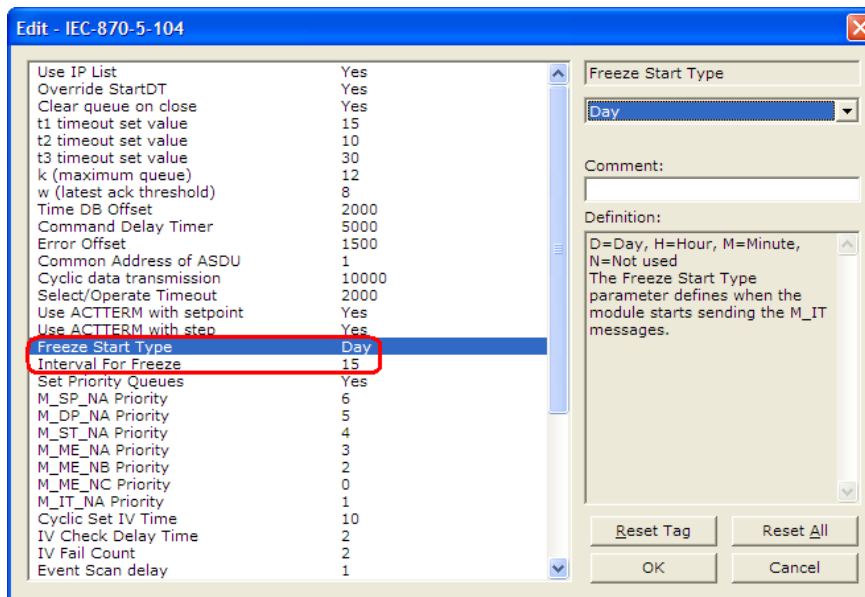
The gateway supports the following modes:

Mode A - Local freeze with spontaneous transmission

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

#### Example - Mode A

To use Mode A, configure the following parameters:



### Freeze Start Type

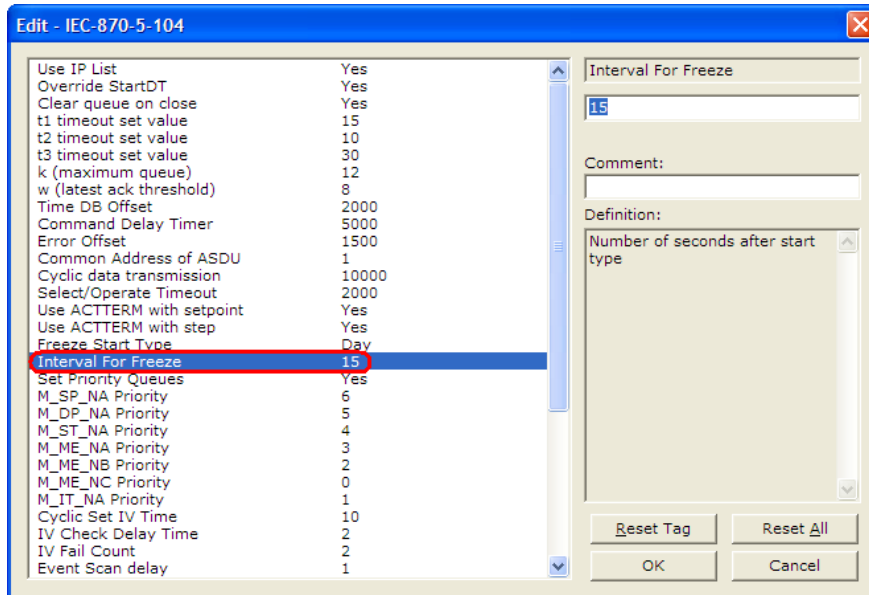
The Freeze Start Type parameter will define when the gateway starts sending the M\_IT messages.

#### Example I - Freeze Start Type

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

03/25/2004 18:07:42

If you configure the Interval For Freeze parameter as follows:

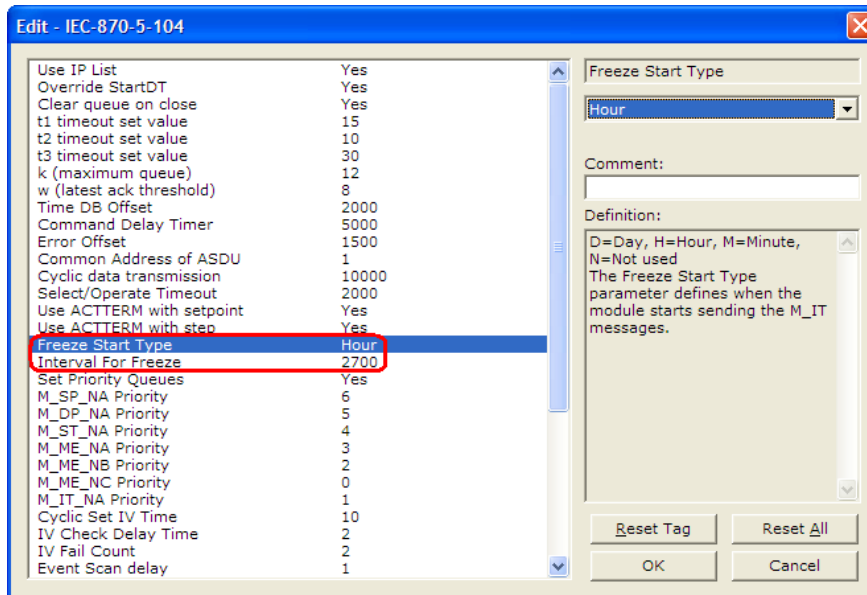


The gateway would send the counter messages every 15 seconds. The gateway would start sending the messages depending on the Freeze Start Type parameter as follows:

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

Example II - Freeze Start Type

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



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

- 17:00:00
- 17:45:00
- 18:00:00
- 18:45:00
- 19:00:00
- 19:45:00

**Mode D**

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



### 3.3.2 Monitor Points Addressing

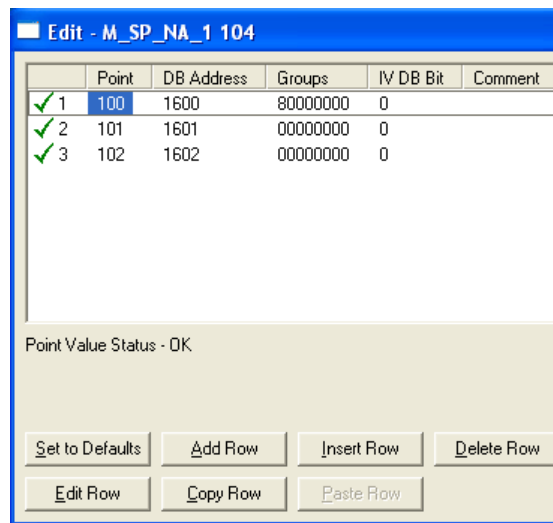
As discussed before, the monitor points must be configured in a database area in the 104S v2 gateway.

The monitor data types are described in the following table.

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

#### M SP NA

A Monitored Single-Point occupies one binary bit and uses bit-addressing. For example, if you configured the following points as shown:

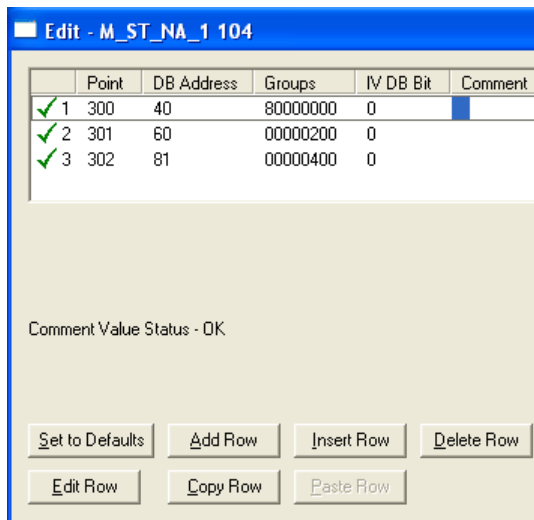


The following table describes how these points would be stored in the gateway memory database.

Inf. Object Address	Gateway Database Address
100	Bit 0 of word 100 (Bit address 1600)
101	Bit 1 of word 100 (Bit address 1601)
102	Bit 2 of word 100 (Bit address 1602)

M ST NA

A Monitored Step-Point occupies one byte and uses byte-addressing.  
For example, if you configured the following points:



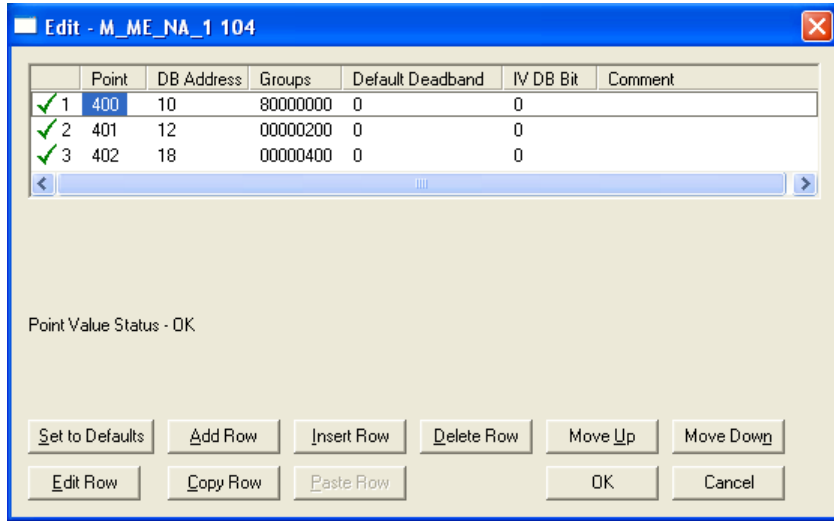
The following table describes how these points would be stored in the gateway memory database.

Inf. Object Address	Gateway Database Address
300	Low Byte of word 20 (Byte address 40)
301	Low Byte of word 30 (Byte address 60)
302	High Byte of word 40 (Byte address 81)

***M ME NA and M ME NB***

A Monitored Measured Normalized point or Monitored Measured Scaled point occupies one word and uses word-addressing.

For example, if you configured the following points:



The following table describes how these points would be stored in the gateway memory database.

Inf. Object Address	Gateway Database Address
400	Word 10 (Word address 10)
401	Word 12 (Word address 12)
402	Word 18 (Word address 18)

Monitored Measured Normalized points use a data representation defined by the protocol specification to represent fractional decimal values. The following table describes the value for each bit as a reciprocal power of two (2), that is two (2) raised to the power of a negative exponent (-1 through -15). Bit 15 is the Sign Bit.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value	S	$2^{-1}$	$2^{-2}$	$2^{-3}$	$2^{-4}$	$2^{-5}$	$2^{-6}$	$2^{-7}$	$2^{-8}$	$2^{-9}$	$2^{-10}$	$2^{-11}$	$2^{-12}$	$2^{-13}$	$2^{-14}$	$2^{-15}$
Hex																
Decimal																
4000h 0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000h 0.25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1000h 0.125	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6000h 0.75	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3210h 0.3957 519531 25	0	0	1	1	0	0	1	0	1	0	1	0	1	0	0	0

**Examples:**

A value of 4000hex (only Bit 14 set, all others clear) is interpreted as 0.5 decimal

A value of 2000hex (only Bit 13 set, all others clear) is interpreted as 0.25 decimal

A value of 1000hex (only Bit 12 set, all others clear) is interpreted as 0.125 decimal

... and so on until...

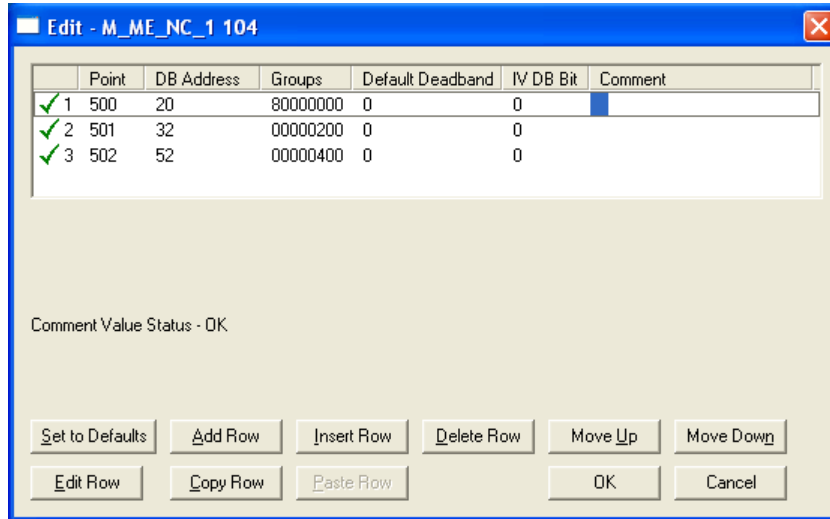
A value of 0001hex (Only Bit 0 set, all others clear) is interpreted as 0.000030517578125

Therefore, the actual data values transmitted may be any combination of the decimal values for any given bit pattern.

M ME NC and M IT NA

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

For example, if you configured the following points:



The following table describes how these points would be stored in the gateway memory database.

Inf. Object Address	Gateway Database Address
500	Words 40 and 41 (Double-word address 20)
501	Words 64 and 65 (Double-word address 32)
502	Word 104 and 105 (Double-word address 52)

### 3.4 Using Control (Command) Points

The following control points are supported by the 104S v2 gateway:

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

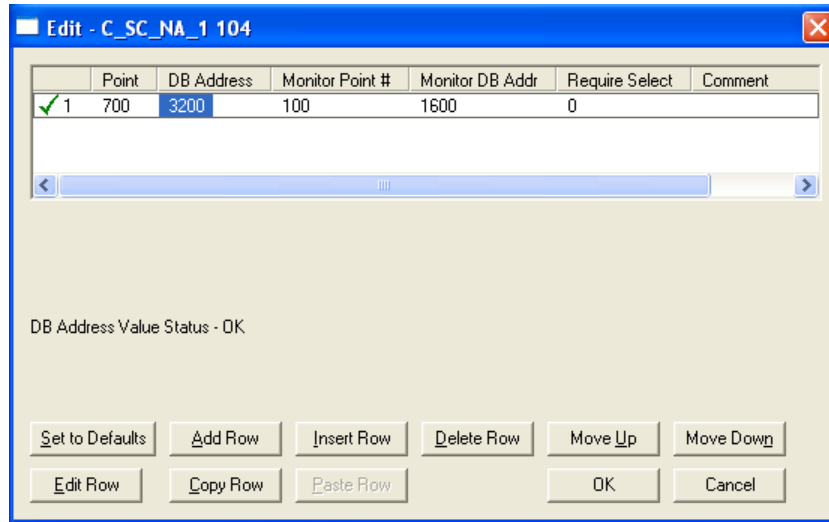
Each control point is identified by its Information Object Address. For each control point, configure the following parameters:

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

**DB Address:** This is the database location in the 104S v2 gateway associated with the point.

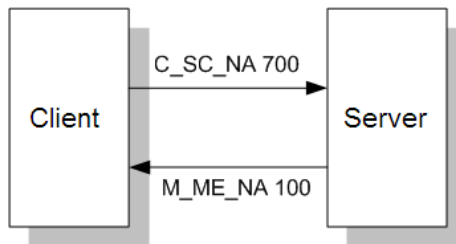
**Monitor Point #-Monitor DB Address-** The user might (optionally) configure a monitor point to be sent by the 104S v2 module gateway receives the command for that specific point.

Example (C\_SC\_NA)



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

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

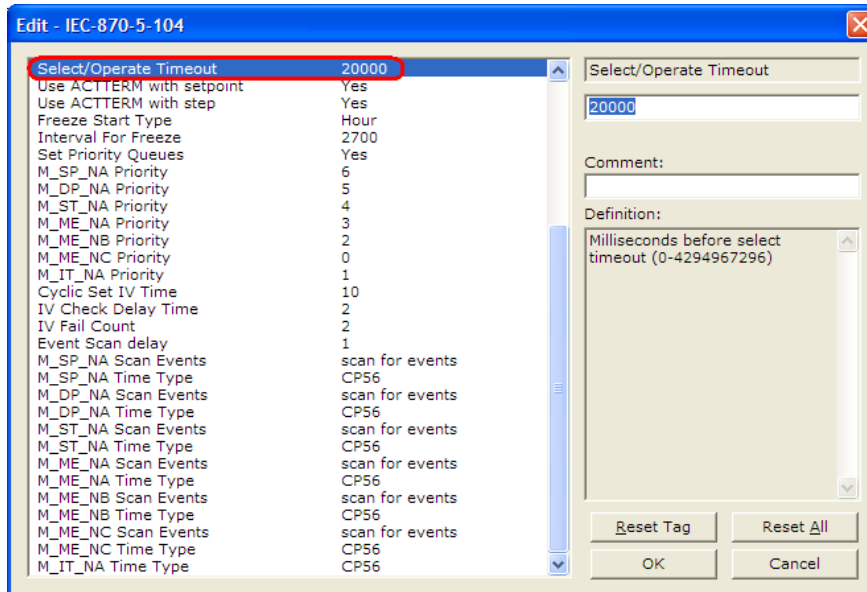


### 3.4.1 Control Data Transfer

The control communication typically occurs when the client sends a command request to update the gateway's command points. The data types addressing are described in the following table.

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

Some of the command points may be configured to be selected before executed. Refer to the following parameter to configure the select/operate timeout period. After the gateway receives the SELECT operation it will wait for this period of time for the EXECUTE operation. If the gateway does not receive an EXECUTE operation within this period of time it will require another SELECT operation before the EXECUTE operation.





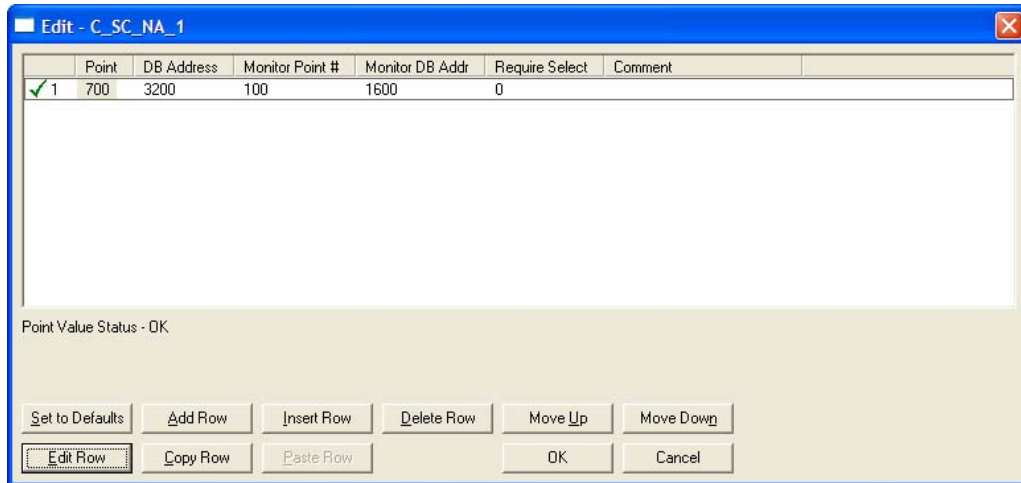
### 3.4.2 Command Points Addressing

Command points must be configured in a database area that is updated in the gateway memory database. You must associate each point to a database address in the 104S v2 gateway. The interpretation of the *DB address* parameter in the configuration tables depends on the point type configured and the type of addressing associated with that point type.

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

#### C SC NA and C DC NA

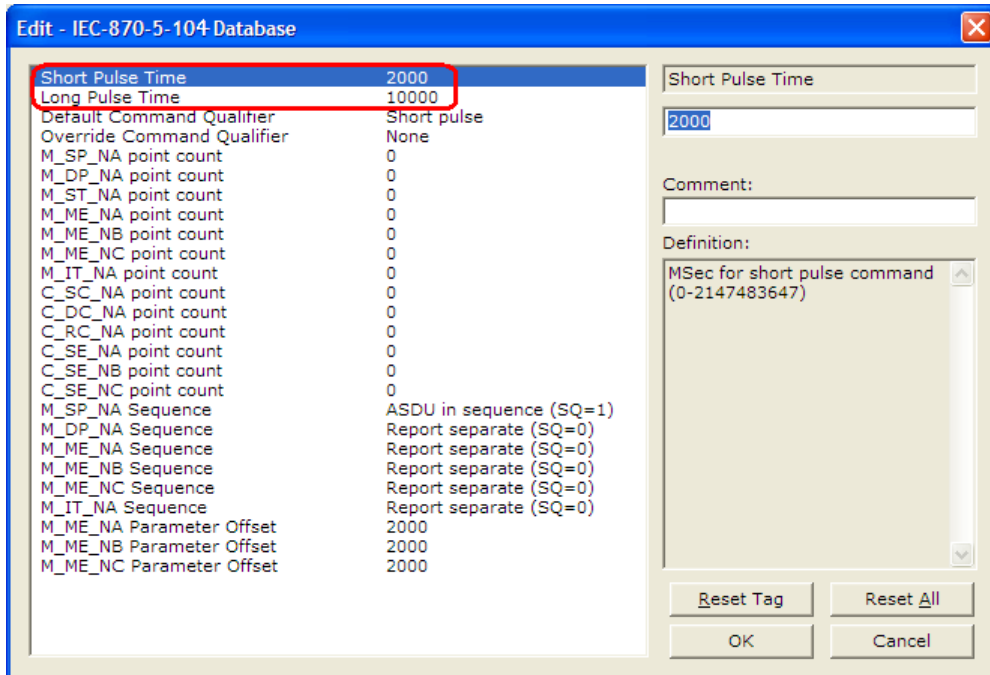
The single-point command and dual-point command points use one bit with bit-addressing. For example, if you configure the following points:



These points would be used as follows:

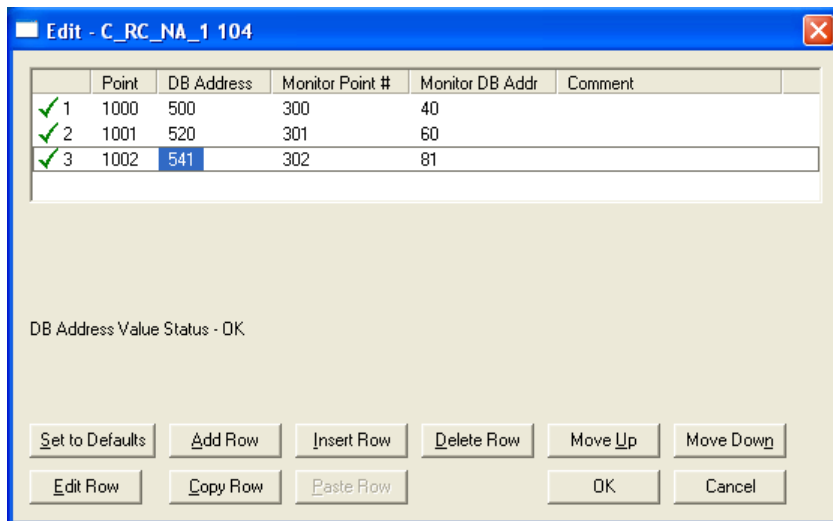
Inf. Object Address	Module Database Address
100	Bit 0 of word 100
101	Bit 1 of word 100
102	Bit 2 of word 100

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



### C RC NA

A Step-Point Command point occupies one byte and uses byte-addressing. For example, if you configured the following points:

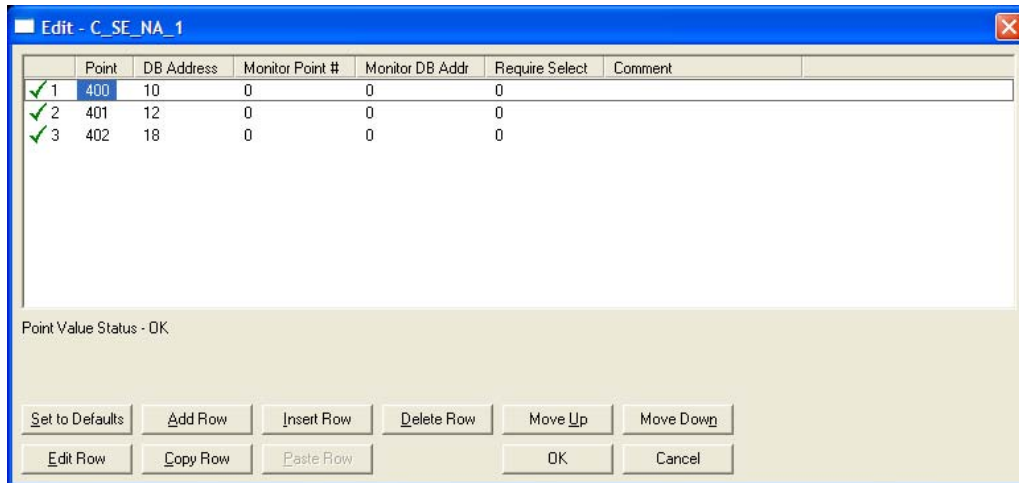


The following table describes how these points would be used.

Inf. Object Address	Gateway Database Address
1000	Low Byte of word 250 (Byte address 500)
300	Low Byte of word 20 (Byte address 40. Must match configuration of point 300 in M_ST_NA.)
1001	Low Byte of word 260 (Byte address 520)
301	Low Byte of word 30 (Byte address 60. Must match configuration of point 301 in M_ST_NA.)
1002	High Byte of word 270 (Byte address 541)
302	High Byte of word 40 (Byte address 81. Must match configuration of point 302 in M_ST_NA.)

**C SE NA and C SE NB**

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



The following table describes how these points would be used.

Inf. Object Address	104S v2 gateway Database Address
1100	Word 2000 (Word address 2000)
400	Word 10 (Word address 10. Must match the configuration of point 400 in M_ME_NA.)
1101	Word 2001 (Word address 2001)
401	Word 12 (Word address 12. Must match the configuration of point 401 in M_ME_NA.)
1102	Word 2001 (Word address 2001)
402	Word 18 (Word address 18. Must match the configuration of point 402 in M_ME_NA.)

The measured normalized points use a data representation defined by the protocol specification to represent fractional decimal values. The following table describes the value for each bit as a reciprocal power of two (2), that is two (2) raised to the power of a negative exponent (-1 through -15). Bit 15 is the Sign Bit.

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Value																
Hex	S	2 <sup>-1</sup>	2 <sup>-2</sup>	2 <sup>-3</sup>	2 <sup>-4</sup>	2 <sup>-5</sup>	2 <sup>-6</sup>	2 <sup>-7</sup>	2 <sup>-8</sup>	2 <sup>-9</sup>	2 <sup>-10</sup>	2 <sup>-11</sup>	2 <sup>-12</sup>	2 <sup>-13</sup>	2 <sup>-14</sup>	2 <sup>-15</sup>
Decimal																
4000h 0.5	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2000h 0.25	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1000h 0.125	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6000h 0.75	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
3210h 0.3957 519531 25	0	0	1	1	0	0	1	0	1	0	1	0	1	0	0	0

**Examples:**

A value of 4000hex (only Bit 14 set, all others clear) is interpreted as 0.5 decimal

A value of 2000hex (only Bit 13 set, all others clear) is interpreted as 0.25 decimal

A value of 1000hex (only Bit 12 set, all others clear) is interpreted as 0.125 decimal

... and so on until...

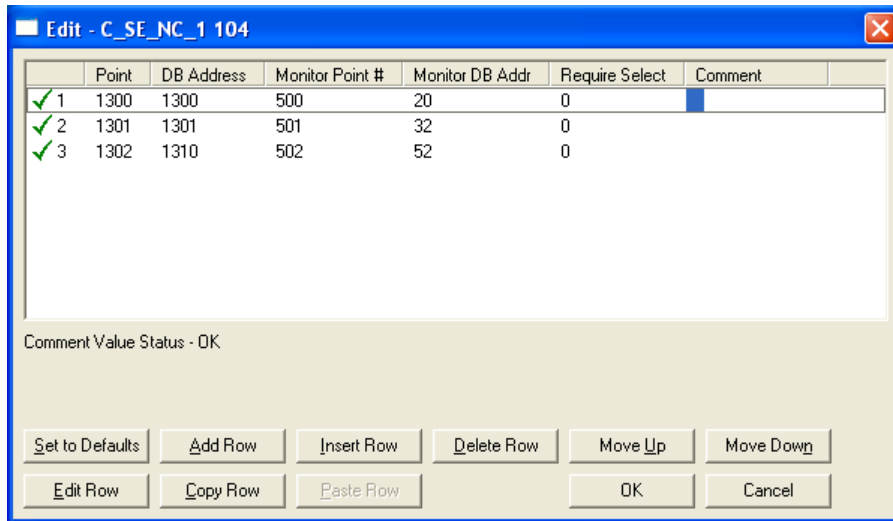
A value of 0001hex (Only Bit 0 set, all others clear) is interpreted as 0.000030517578125

Therefore, the actual data values transmitted may be any combination of the decimal values for any given bit pattern.

C SE NC

A Measured Short Floating- point Command point occupies two words and uses double word addressing.

For example, if you configured the following points:



The following table describes how these points would be stored in the gateway memory database.

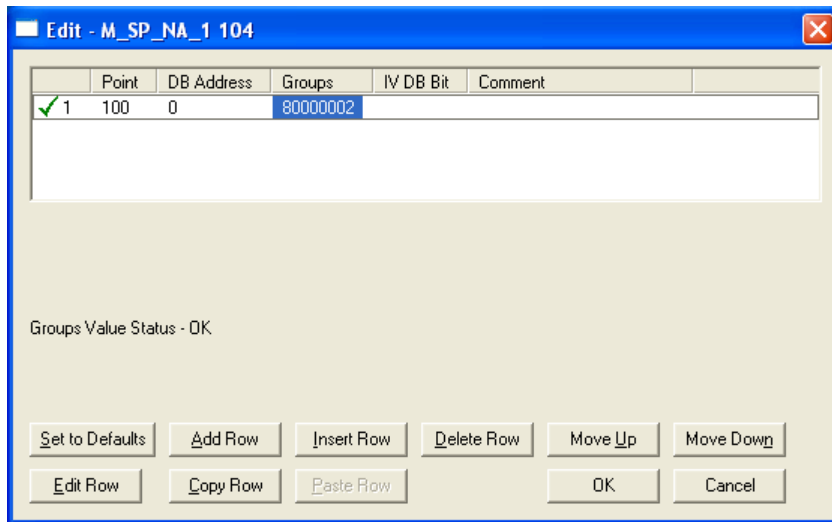
Inf. Object Address	Gateway Database Address
1300	Words 2600 and 2601 (Double-word address 1300)
500	Words 40 and 41 (Double-word address 20. Must match the configuration of point 500 in M_ME_NC.)
1301	Words 2602 and 2603 (Double-word address 1301)
501	Words 64 and 65 (Double-word address 32. Must match the configuration of point 501 in M_ME_NC.)
1302	Words 2620 and 2621 (Double-word address 1310)
502	Word 104 and 105 (Double-word address 52. Must match the configuration of point 502 in M_ME_NC.)

### 3.5 Data Communication

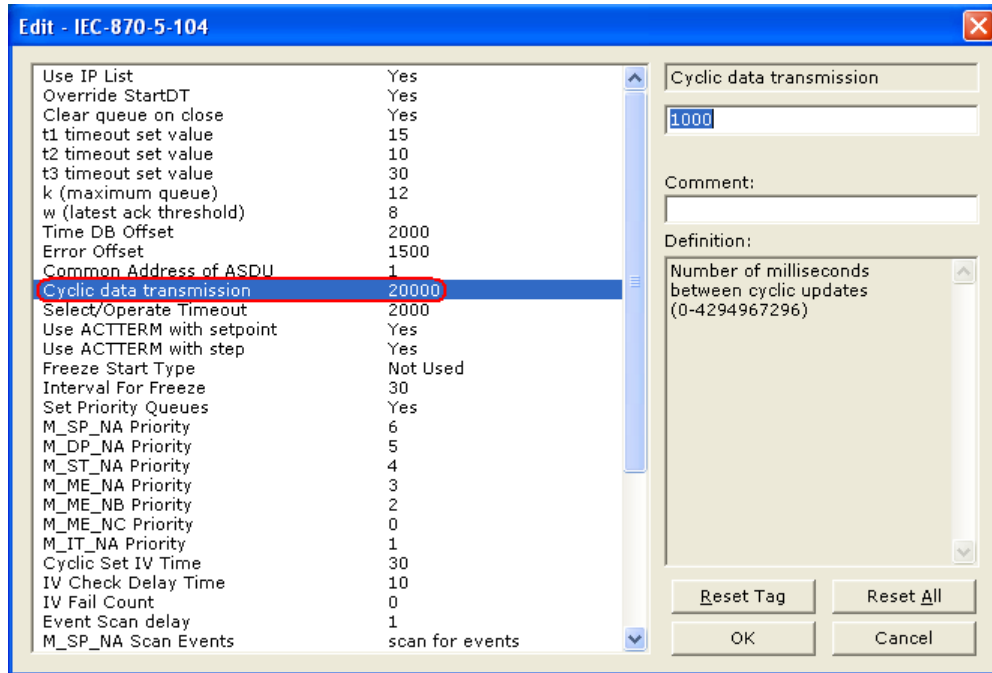
#### 3.5.1 Group Communication

As previously discussed, the Group parameter in the gateway configuration file controls how each monitored point is transferred between the 104S v2 gateway and the client unit. The Group parameter is described in detail in Group Codes (page 36)

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



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



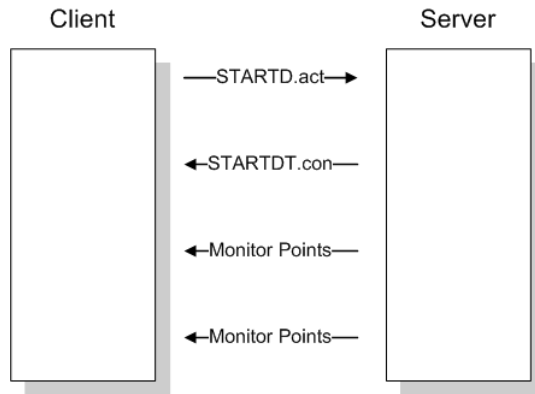
You can also divide the monitored points into different groups, allowing the client to periodically poll only certain points. This also allows some points to be polled more frequently than others.

**Note:** You should configure the counter points (M\_IT\_NA) for general counter interrogation or group counter interrogations.

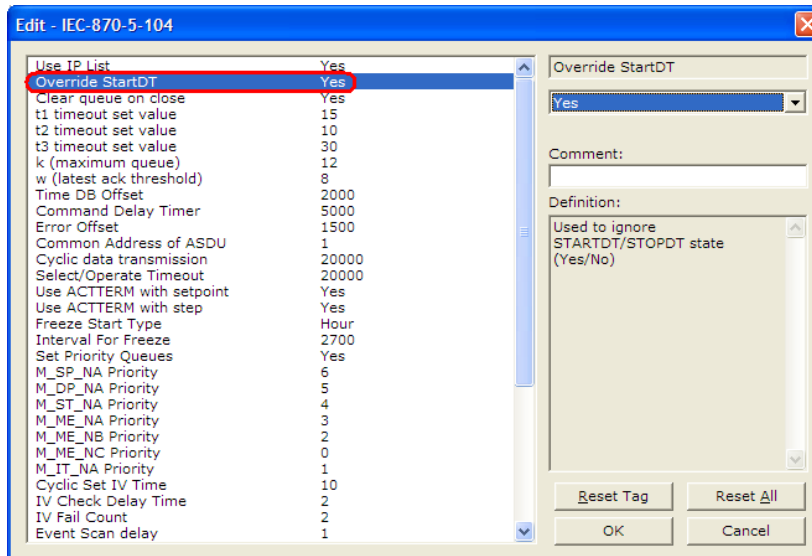
### 3.5.2 STARTDT & STOPDT

STARTDT (Start Data Transfer) and STOPDT (Stop Data Transfer) are used by the client to control the data transfer from the 104S v2 gateway. When the connection is established, user data is not automatically enabled in the server until it receives a STARTDT act request from the client. The server should respond with a STARTDT con response to acknowledge the client request. Once this procedure is concluded, the server can send monitor data to the client.

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



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

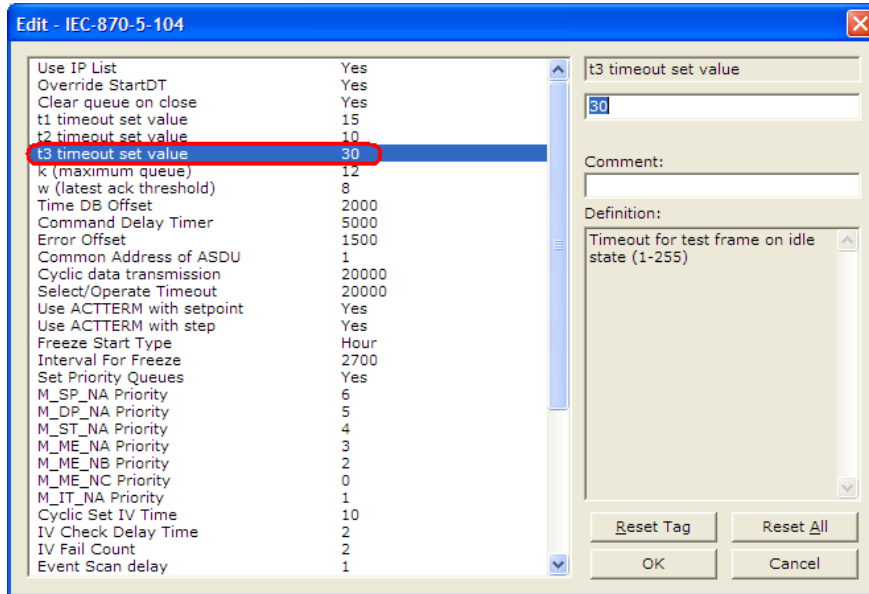


If this parameter is set to 1, the gateway will ignore the STARTDT and STOPDT requests by the client unit.

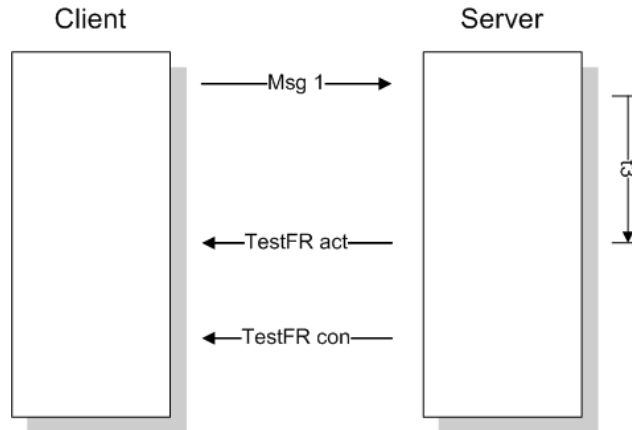


### 3.5.3 TESTFR Requests

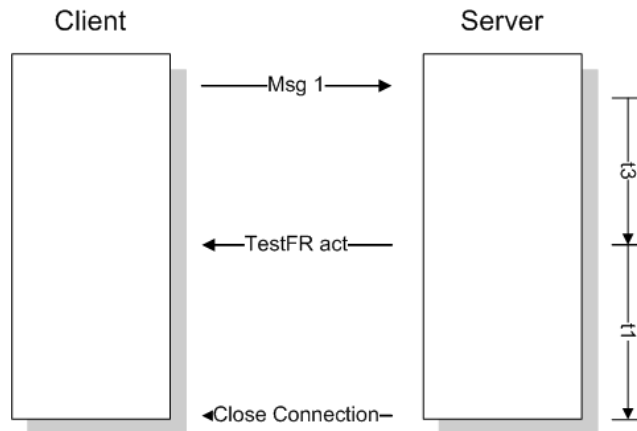
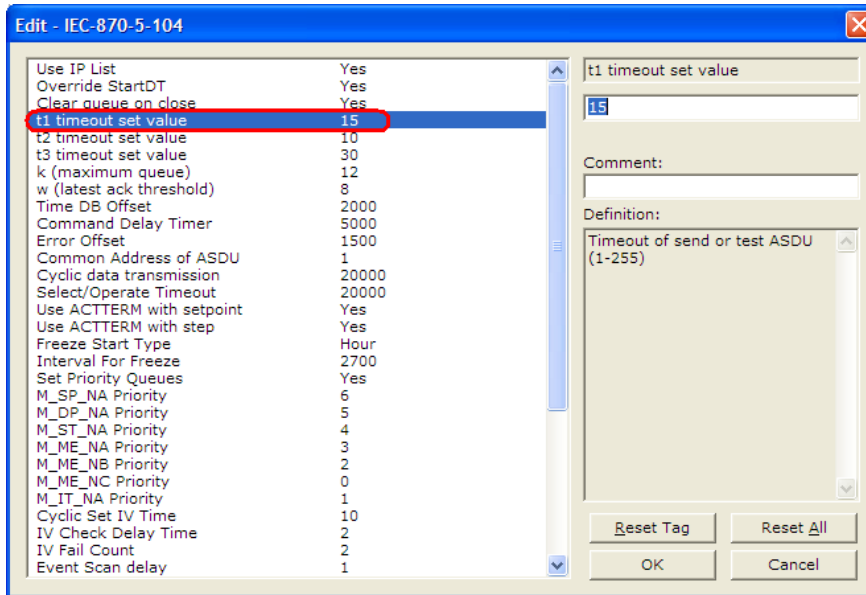
Connections that are unused (but opened) may be periodically tested in both directions by sending test messages (TESTFR=act) which are confirmed by the receiving station sending TESTFR=con messages. The 104S v2 gateway can be configured to periodically send this message using the following parameter:



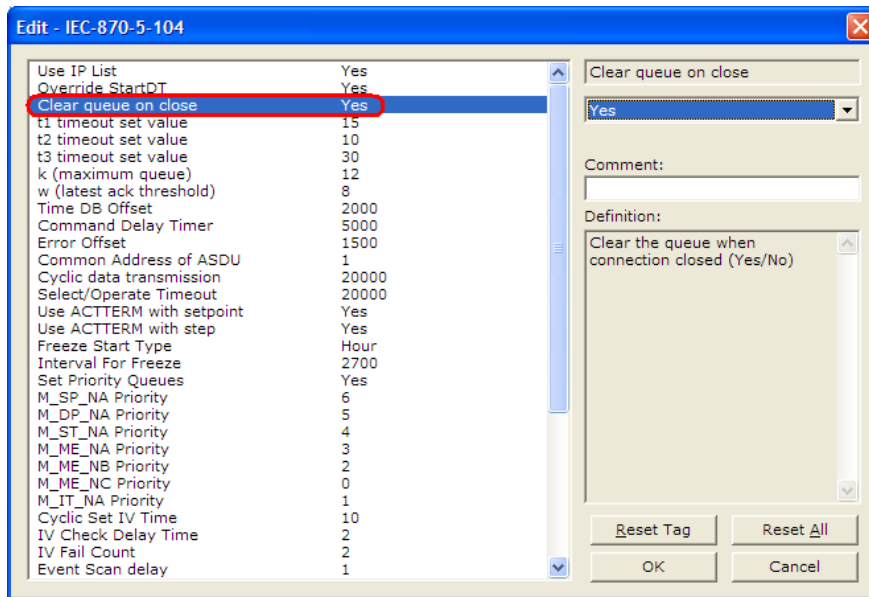
In the example above, the gateway would send a TESTFR.ACT message 30 seconds after receiving the last message:



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



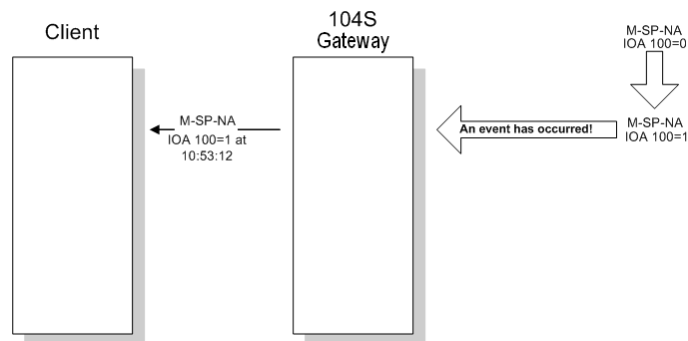
When closing the connection, the gateway can be configured to clear all the messages in its queue. The following parameter is used to implement this task:



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

### 3.6 Events

In order to improve communication efficiency, most applications will require the client to periodically poll for data changes with a higher priority than polling for other monitored data. Every time a data point changes, the server can send this information as an *event*, typically with date and time information indicating when the change occurred.

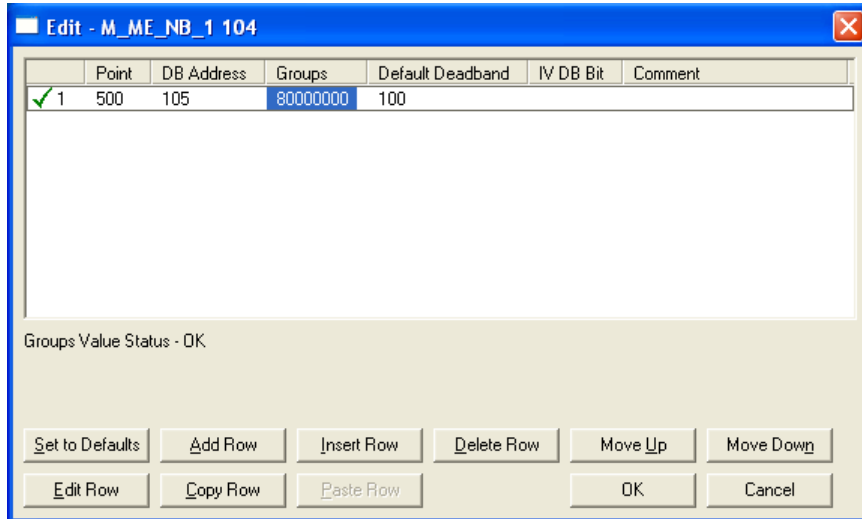


The gateway supports a buffer queue of 99 events per data type. When the queue is full, the gateway will delete the oldest event in the queue, replacing it with the newest event received for that data type.

### 3.6.1 Deadbands

The Monitored Measured points (M\_ME\_NA and M\_ME\_NB) will generate events only if the data value changes an amount greater than or equal to the configured deadband value.

For example, with the following point configured:



If the current value for this point is 130, it would only generate an event, only if:  
NEW VALUE is less than or equal to 30

OR

NEW VALUE is greater than or equal to 230.

You can set the deadband for each Monitored Measured point through the configuration file.

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

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

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

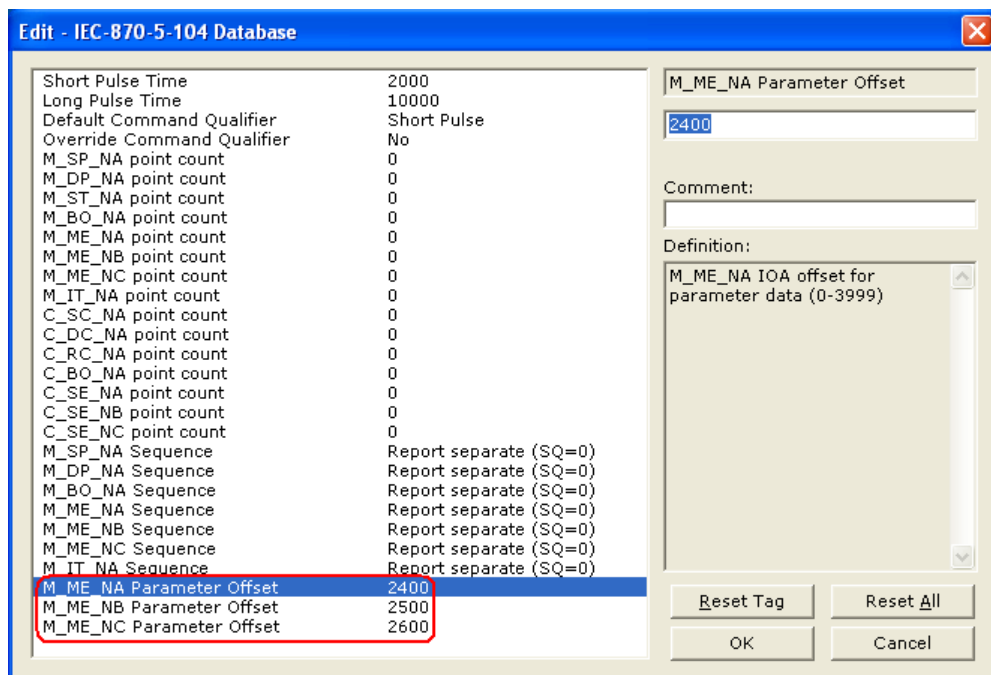
Bits	Value	Description
1 to 6	0	Not Used
	<b>1</b>	<b>Threshold Value (Deadband)</b>
	2	Smoothing Factor (filter time constant) - Not Supported
	3	Low Limit Transmission of Measured Value
	4	High Limit Transmission of Measured Value
	5..31	Reserved
7	0	No Change
	1	Change
8	0	Operation
	1	Not in Operation

For the 104S v2 gateway, the Low Limit and High Limit parameters cannot be changed by command, because these values are calculated as follows:

Low Limit = (LAST REPORTED VALUE) - Deadband

High Limit = (LAST REPORTED VALUE) + Deadband

These commands must be sent to a specific Information Object Address. The 104S v2 gateway associates each Monitor Measured point with a Parameter point using *Parameter Offset* entries:



Example:

Assume the following Monitored Measured points are configured as shown:

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

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

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

And assume the Parameter Offets are configured as shown:

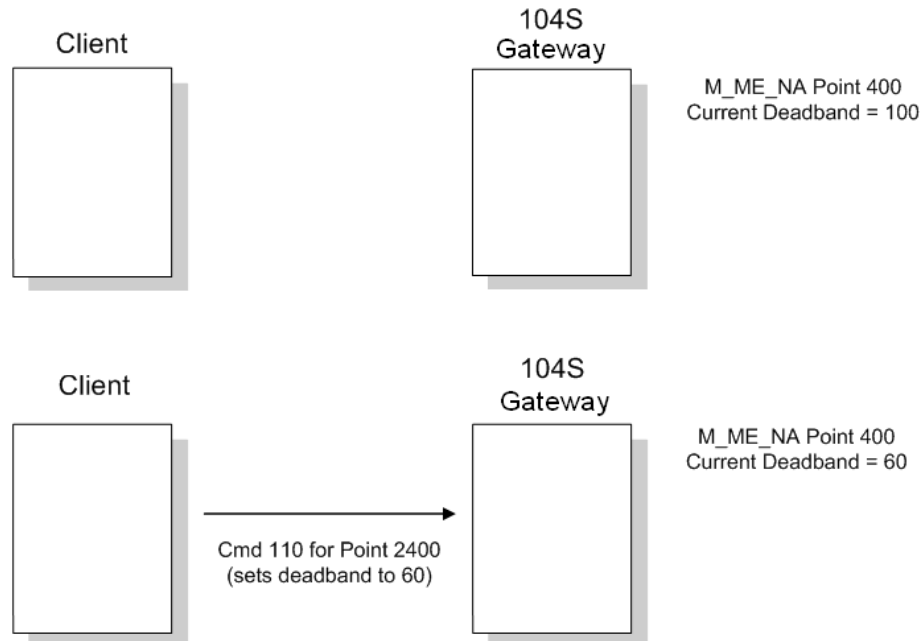
```
M_ME_NA Parameter Offset : 2400 #M_ME_NA IOA offset for parameter data
M_ME_NB Parameter Offset : 2500 #M_ME_NB IOA offset for parameter data
M_ME_NC Parameter Offset : 2600 #M_ME_NC IOA offset for parameter data
```

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

M ME NA

Monitored Measured Normalized Point	Associated Parameter Point
400	2400
401	2401
402	2402
403	2403
...	...
409	2409

In order to send a change of deadband for M\_ME\_NA Point 400, the client would send a command type 110 to point 2400.



M ME NB

<b>Monitored Measured Normalized Point</b>	<b>Associated Parameter Point</b>
500	2500
501	2501
502	2502
503	2503
...	...
509	2509

In order to send a change of deadband for M\_ME\_NB Point 500, the client would send a command type 110 to point 2500.

M ME NC

<b>Monitored Measured Normalized Point</b>	<b>Associated Parameter Point</b>
600	2600
601	2601
602	2602
603	2603
...	...
609	2609

In order to send a change of deadband for M\_ME\_NC Point 600, the client would send a command type 110 to point 2600.



### 3.6.2 Controlling the Generation of Events

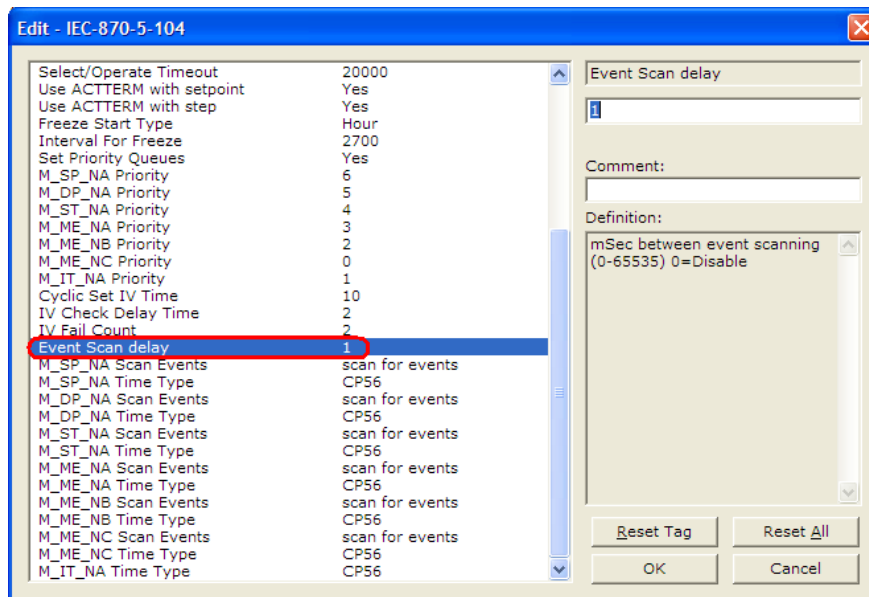
Some applications may require that only some points should generate events. The application will receive current values from points which have not been configured to generate events only by issuing a poll request, or what the protocol specification calls an *interrogation*. Other applications may require that all configured points generate events.

The 104S v2 gateway offers much flexibility for event control. You may control whether or not events will be generated at three (3) different levels:

- 1 At the General Application Level (all configured points of all types)
- 2 At the Data Type Level (all configured point in each data type)
- 3 At the Individual Point Level (any specific point of any data type)

#### General (All Points)

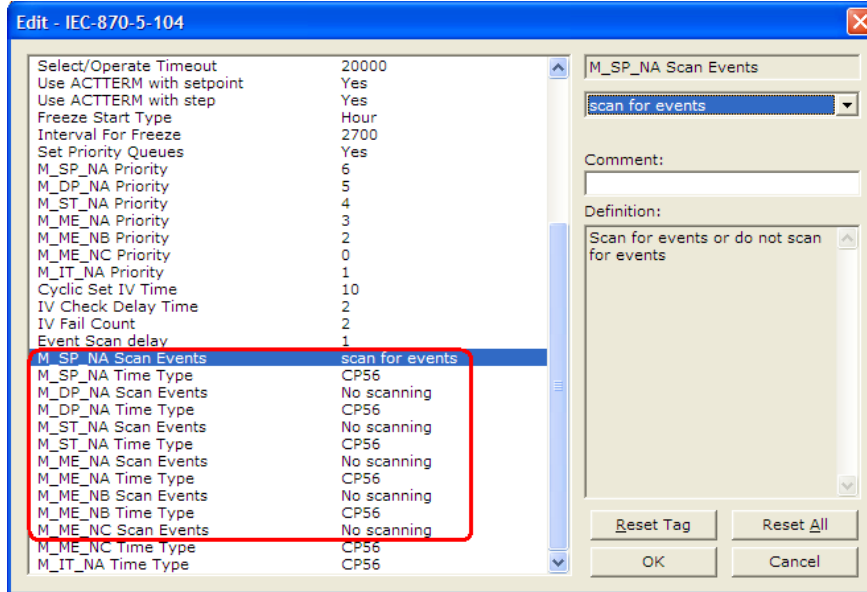
The user may control how frequently the gateway will scan the database for events using the following configuration parameter:



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

Data Type Level

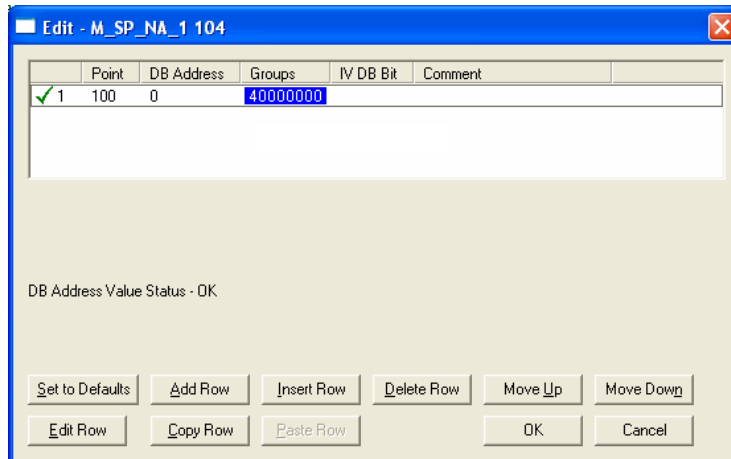
The user may configure if a data type should generate events or not. Each data type has a configuration parameter to control the generation of events:



In the example above, only the M\_SP\_NA points would generate events.

Point Level

You can configure whether or not each point should generate events on a point-by-point basis by using the Group field for each point configuration. Set the value as 40000000 to disable the generation of events for any specific point.

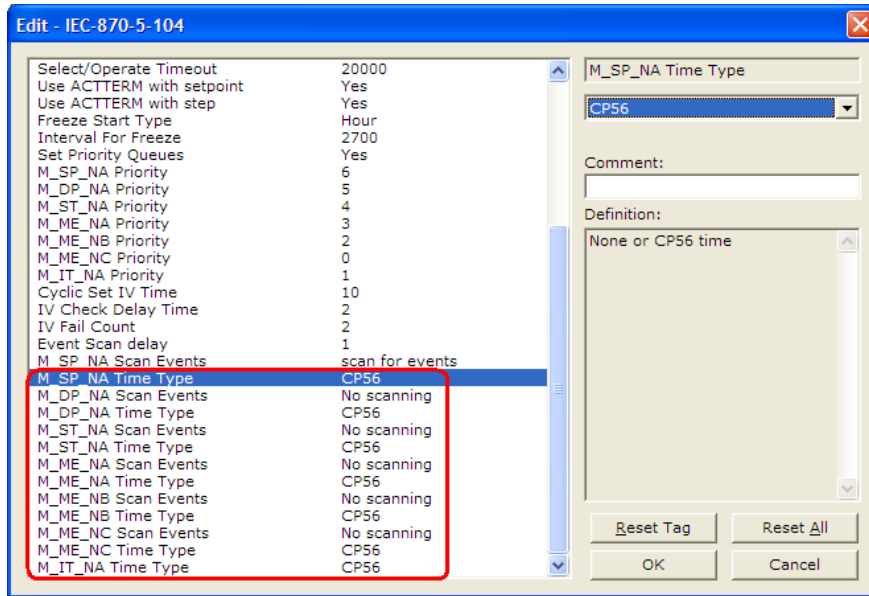


### 3.6.3 Time Information

Each event may also send the date and time when it has occurred. The 104S v2 gateway supports the CP56 time format (as defined in the protocol specification). This format contains the milliseconds, seconds, minute, hour, day, month and year when the event has occurred.

The 104S v2 gateway may also be configured not to send any time information with each event for certain data types.

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



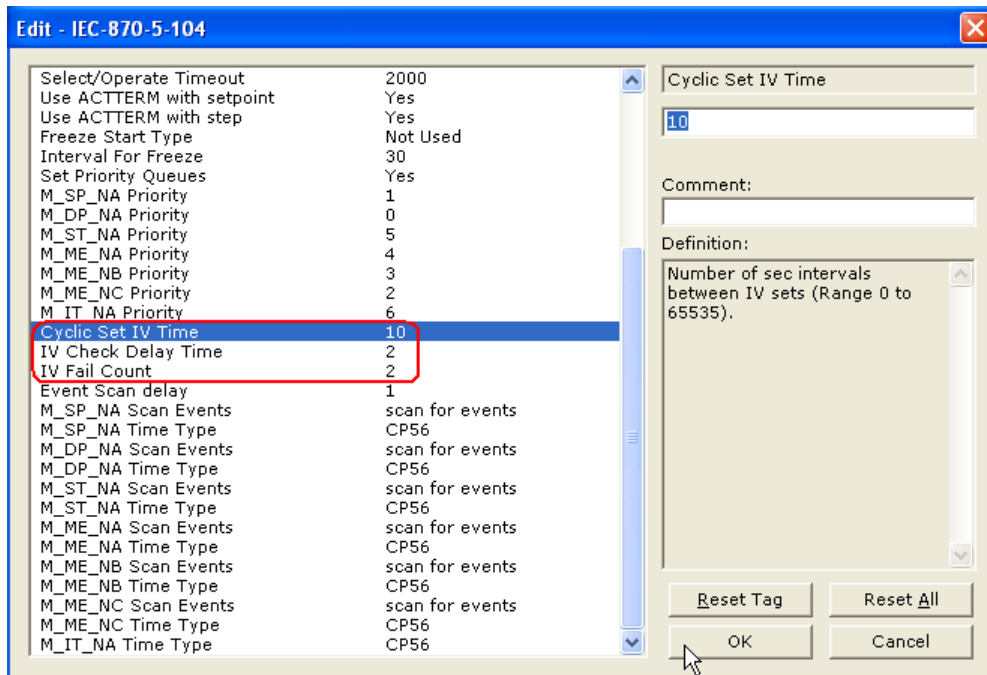
**Note:** The client should send a Time Synchronization command to the gateway in order to synchronize its date and time information, according to the protocol specifications. Depending on certain parameters, as well as hardware limitations, the gateway may present some time delay over time. The client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

### 3.6.4 Invalid Bit Monitoring

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

The parameters required to support this feature are:

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

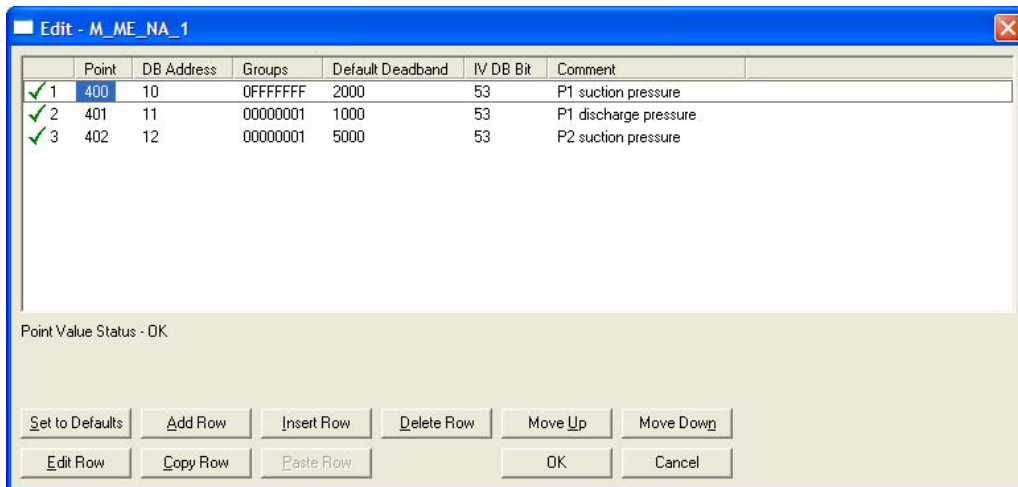
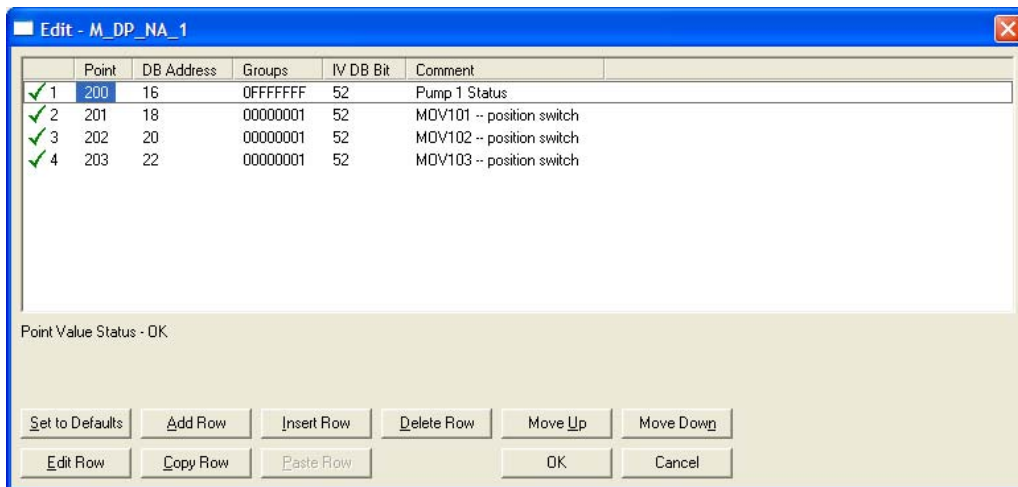
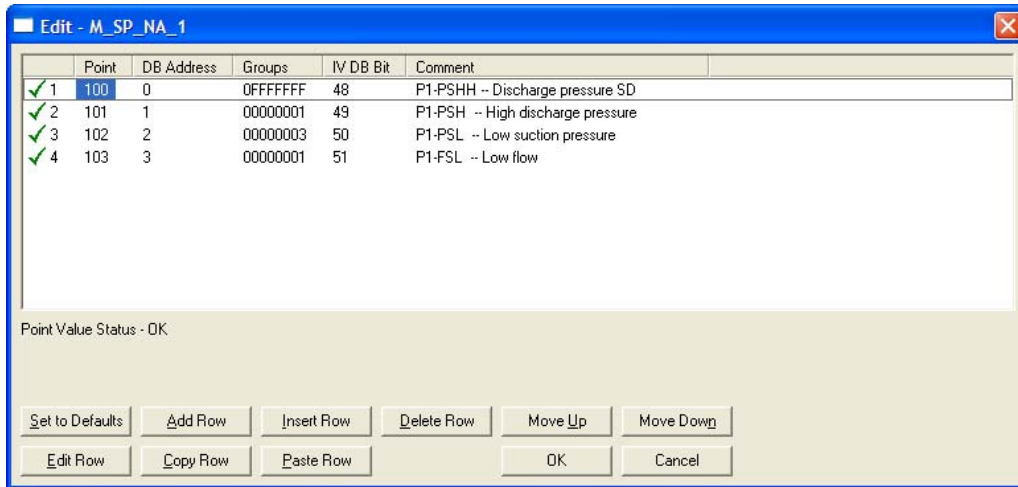


To disable this feature, set the IV Fail Count parameter to 0. If the IV bit field is absent or set to 0, the invalid quality state for the point will always be reported as valid. If used, the Cyclic Set IV Time parameter must be at least 3 times larger than the IV Check Delay Time.

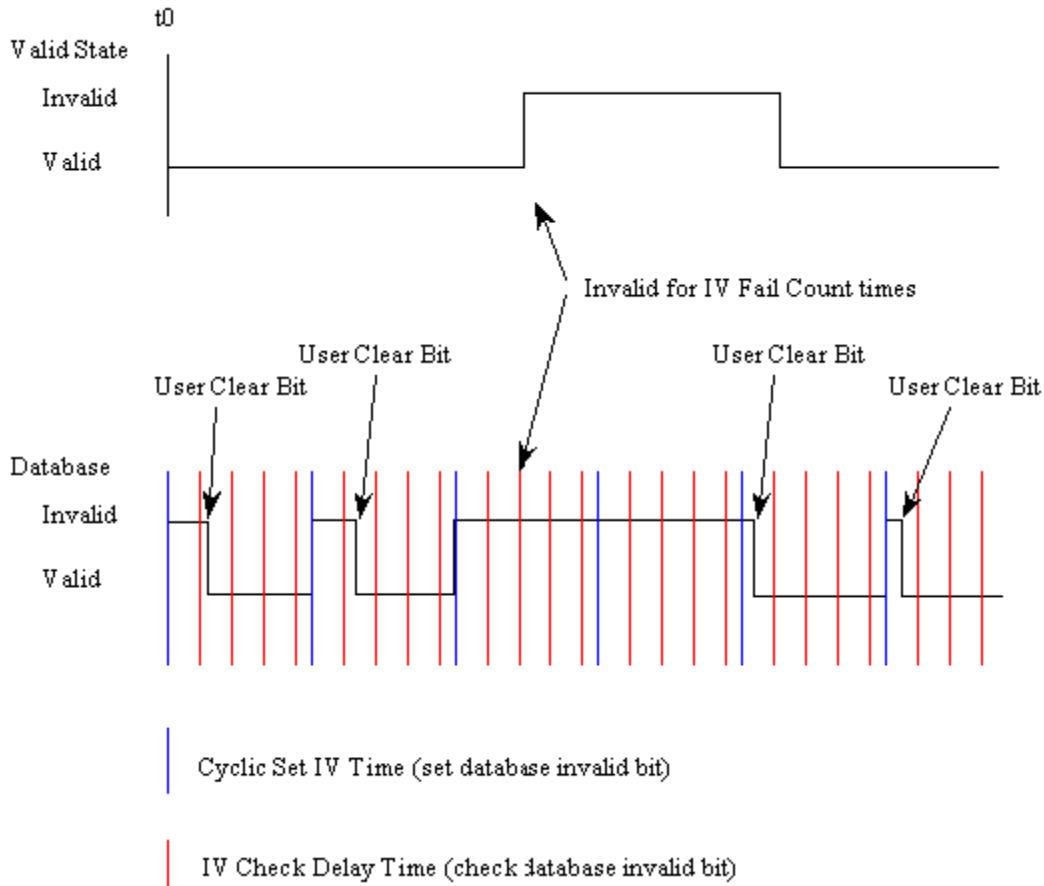
The **CYCLIC SET IV TIME** parameter determines the interval at which the driver will set all the IV bits for the points being monitored in the gateway. If the IV bit is ON for the number of times specified by the **IV FAIL COUNT** parameter, the point is in an invalid state. The driver will check the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

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

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



The following illustration shows how these parameters are implemented:

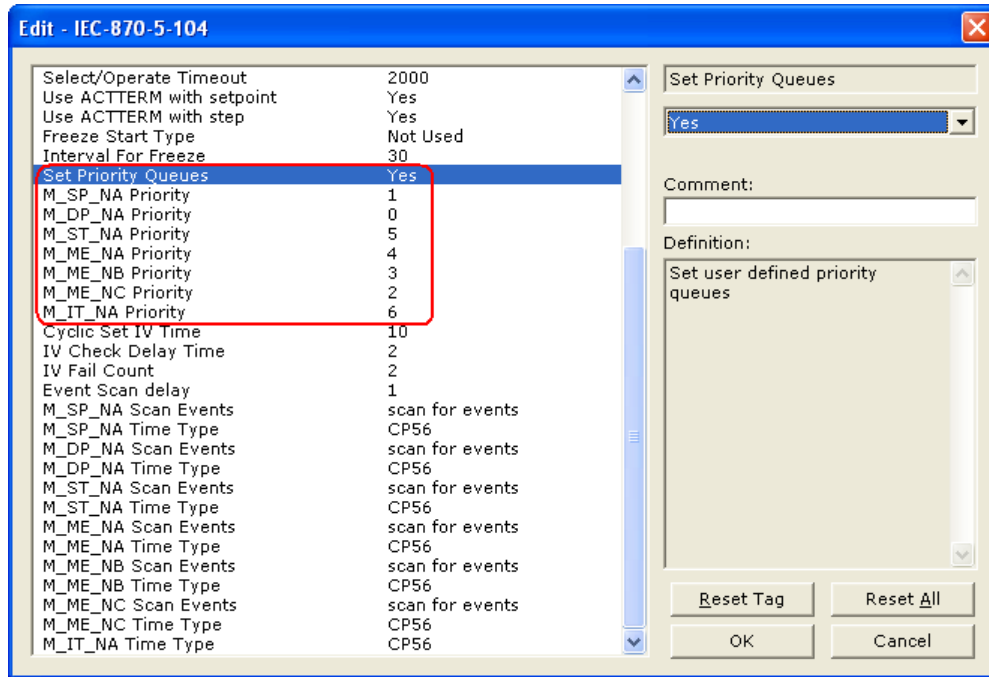


If a database bit address (1 to 64000) is present, the application may consider the point with an invalid flag if the previous logic checks the IV bit as 1 during consecutive IV Check Delay scans. The IV bits would have to be reset to 0 to set the point to valid state.

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

### 3.6.5 Event Priority

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



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

#### Example - Event Priority

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

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

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

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

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

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

### 3.6.6 *SNTP Support*

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

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

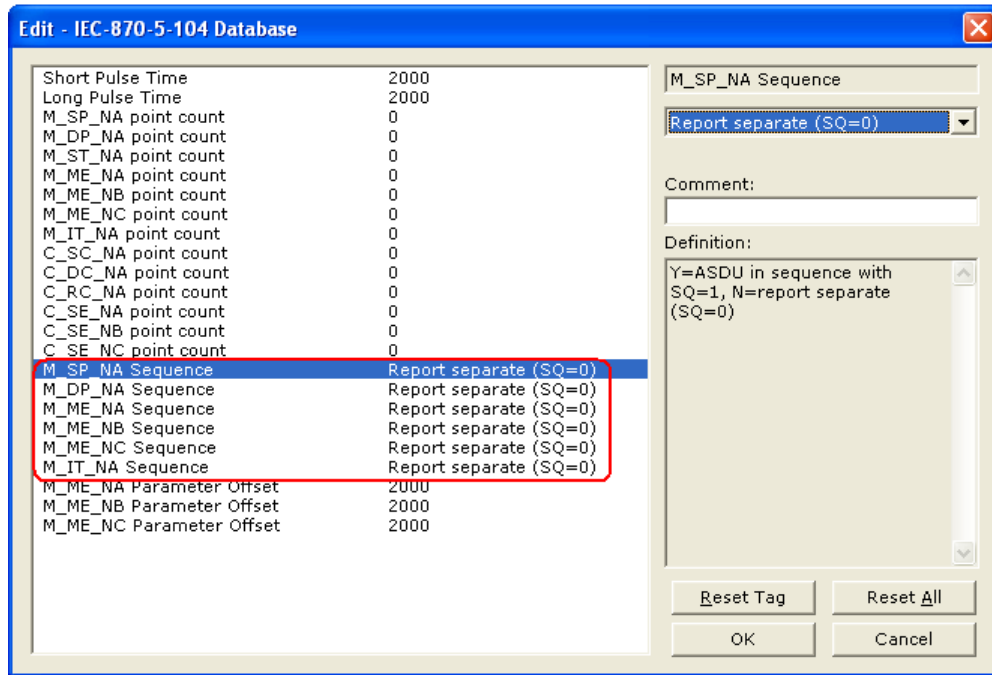
A list of some of the common NTP servers can be obtained at <http://www.ntp.org/>, <http://www.eecis.udel.edu/~mills/ntp/servers.html>, along with the appropriate IP address. Other server lists can be found on the Internet by searching on "NTP Servers" with your browser.



### 3.7 Sequence Flag

**YES** or **No**

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



If this parameter is set to **No**, this feature is not selected, the gateway will send the object address and value for every monitored point sent to the Client, and the Sequence Flag (SQ) will be set to zero (0).

If this parameter is set to **YES**, this feature is selected, the gateway will send the object point address and value for only the first point of a sequence of points, send only the data value without point address for any remaining points in the sequence, and the Sequence Flag (SQ) will be set to one (1). When SQ = 1, the Client assumes that all points after the first point use information object addresses in a contiguous order (using the first point as the reference starting address).

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



## 4 Diagnostics and Troubleshooting

### *In This Chapter*

- ❖ The Configuration/Debug Menu ..... 91
- ❖ LED Indicators ..... 104

There are two ways to troubleshoot ProLinx gateways: LEDs located on the front of the gateway and a Debug port that provides a view into the gateway's internal database.

### 4.1 The Configuration/Debug Menu

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

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

#### 4.1.1 Required Hardware

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

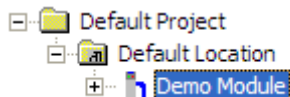
ProSoft Technology recommends the following minimum hardware to connect your computer to the gateway:

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

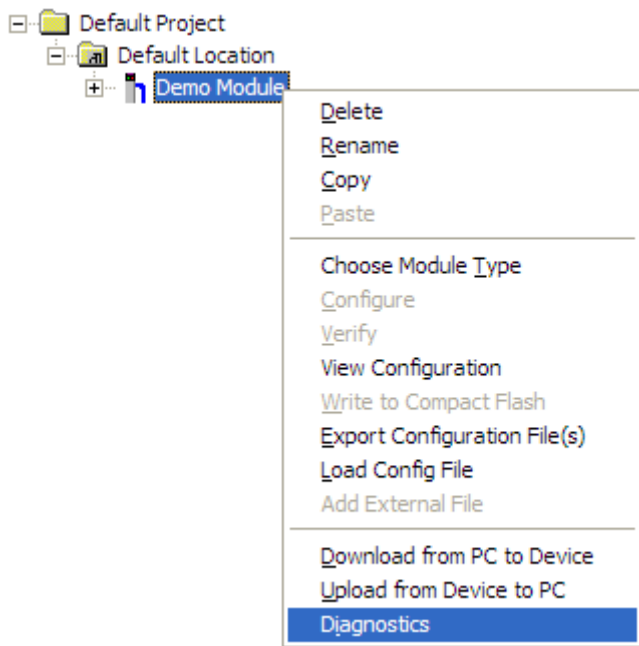
### 4.1.2 Using the Diagnostic Window in ProSoft Configuration Builder

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

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

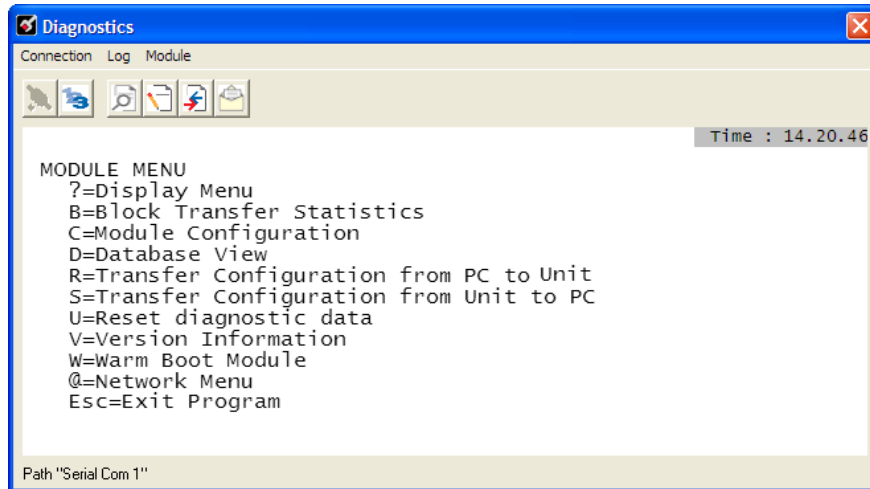


- 2 On the shortcut menu, choose **DIAGNOSTICS**.



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

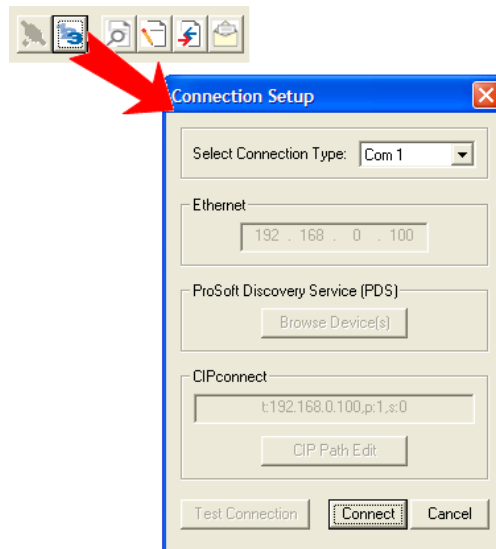
- 3 Press [?] to open the Main Menu.



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

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

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



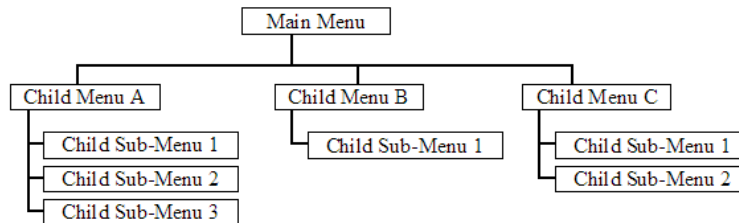
- 2 Verify that the null modem cable is connected properly between your computer's serial port and the gateway. A regular serial cable will not work.
- 3 On computers with more than one serial port, verify that your communication program is connected to the same port that is connected to the gateway.

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

### 4.1.3 Navigation

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

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



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

#### Keystrokes

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

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

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

#### Redisplaying the Menu

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

#### Viewing Module Configuration

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

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

#### Opening the Database Menu

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

### Opening the IEC-870-5-104 Server Menu

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

### Viewing SNTP Status

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

```
Sntp Client Configuration:
NTP Server IP : 0.0.0.0
DB Register   : -1
Time Zone     : 0           USE DST       : No
Time Valid    : No
Requests      : 0           Responses  : 0
Computations  : 0           Time Set Cnt : 0
Timeout Errs  : 0
```

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

### Receiving the Configuration File

Press **[R]** to download (receive) the current configuration file from the gateway. For more information on receiving and sending configuration files, please see [Uploading and Downloading the Configuration File](#) (page 41).

### Sending the Configuration File

Press **[S]** to upload (send) a configuration file from the gateway to your PC. For more information on receiving and sending configuration files, please see [Uploading and Downloading the Configuration File](#) (page 41).

### Viewing Version Information

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

Use this command to view the current version of the software for the gateway, 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 gateway operation. The Program Scan Counter value is incremented each time a gateway's program cycle is complete.

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

### Resetting diagnostic data

Press **[U]** to reset the status counters for the client and/or servers in the gateway.

### 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 gateway. 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 gateway to reboot.

### Exiting the Program

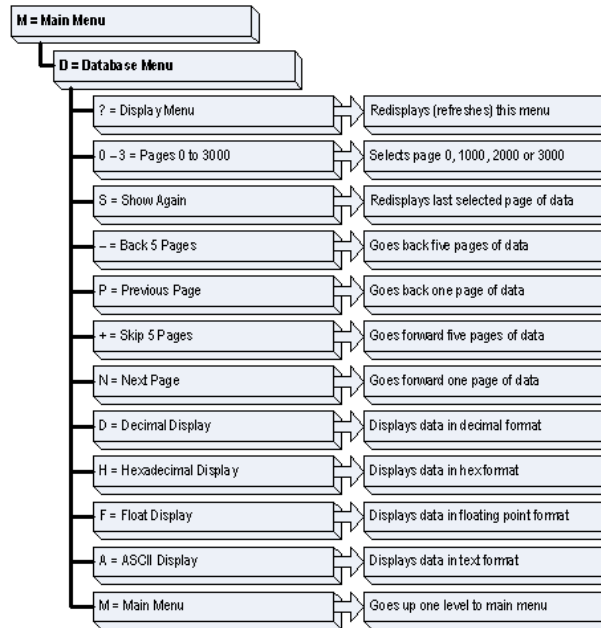
**Caution:** Some of the commands available to you from this menu are designed for advanced debugging and system testing only, and can cause the module to stop communicating with the processor or with other devices, resulting in potential data loss or other failures. Only use these commands if you are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

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



#### 4.1.4 Database View Menu

Press **[D]** from the Main Menu to open the Database View menu. Use this menu command to view the current contents of the gateway 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
<b>[0]</b>	Display registers 0 to 99
<b>[1]</b>	Display registers 1000 to 1099
<b>[2]</b>	Display registers 2000 to 2099

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

Displaying the Current Page of Registers Again

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

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

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

Moving Back Through 5 Pages of Registers

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

Moving Forward Through 5 Pages of Registers

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

Viewing the Previous 100 Registers of Data

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

Viewing the Next 100 Registers of Data

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

Viewing Data in Decimal Format

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

Viewing Data in Hexadecimal Format

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

Viewing Data in Floating Point Format

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

Viewing Data in ASCII (Text) Format

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

Returning to the Main Menu

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

**4.1.5 IEC-870-5-104 Server Menu**

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

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

IEC-870-5-104 Configuration Menu

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

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

IEC-870-5-104 Status Data

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

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

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

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

Lists of Valid Hosts

From the IEC-870-5-104 Server Menu, press **[I]** to display the List of Valid Hosts. These values are taken from the configuration file. The IP addresses will be displayed only if the **USE IP LIST** parameter is set to YES. (page 16)

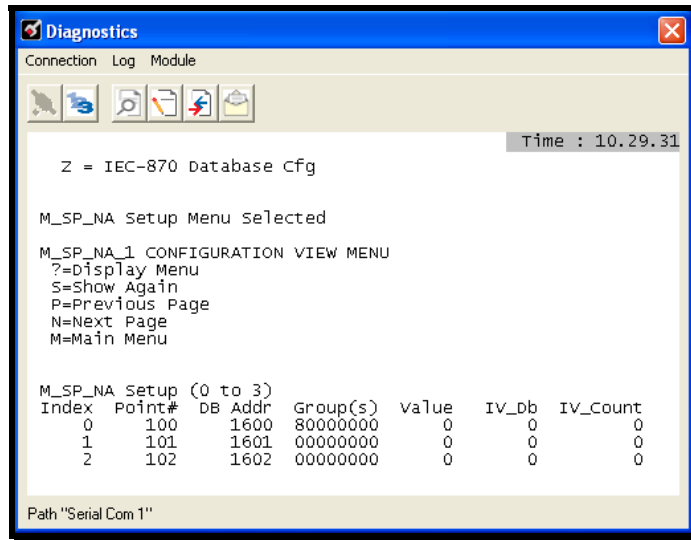
```
IEC-870-5-104 Menu Selected

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.



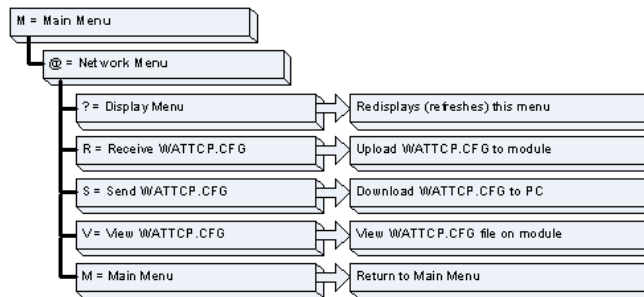
### Database Configuration

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

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

### **4.1.6 Network Menu**

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



### Transferring WATTCP.CFG to the gateway

Press [**R**] to transfer a new WATTCP.CFG file from the PC to the gateway. Use this command to change the network configuration for the gateway (for example, the gateway'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 gateway 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 gateway's network configuration.

### Viewing the WATTCP.CFG file on the gateway

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

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

### Returning to the Main Menu

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

## 4.2 LED Indicators

Troubleshooting the operation of the IEC Slave port can be performed using several methods.

The first and quickest is to scan the LEDs on the gateway to determine the existence and possibly the cause of a problem. This section provides insight into the operation of the Serial Port status LEDs. Information on the gateway's other LEDs can be found in the ProLinx Reference Guide.

### LEDs for Port 0 Serial Port

Some ProLinx gateways will include an extra three serial ports. Each of these serial ports has two LEDs indicating status.

LED	Color	Description
Port 0 - ACT	Off	No activity on the port.
	Green Flash	The port is either actively transmitting or receiving data
Port 0 - ERR	Off	Normal state. When off and Port Active led is indicating activity, there are no communication errors
	Red On or Flashing	Activity on this led indicates some communication error was detected, either during transmit or receive

### 4.2.1 Ethernet LED Indicators

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



## 5 Reference

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### 5.1 Product Specifications

#### **5.1.1 General Specifications**

ProLinx<sup>®</sup> Communication Gateways provide connectivity for two or more dissimilar network types. The gateways, encased in sturdy extruded aluminum, are stand-alone, DIN-rail-mounted solutions that provide data transfer between many of today's most widely used industrial automation protocols.

#### **5.1.2 Internal Database**

The ProLinx gateway contains an internal database that consists of areas for application data, status information, and configuration information.

The internal database is shared between all ports on the gateway and is used as a conduit to pass information from a device on one network to one or more devices on another network.

### Application Data Area

The protocol drivers exchange data by storing and retrieving data from a shared application memory data area. The database is used as a source for data to be sent to remote devices and holds data received from the remote devices. For protocol drivers that act as Masters or Clients, commands defined in the configuration file (stored in the configuration data area) control how the data is to be handled in the database. For protocol drivers that act as Slaves or Servers, the remote Master or Client must be properly programmed to send data to or request data from the correct memory addresses in the gateway application data area.

### Status Data Area

This area stores error codes, counters, and other status information.

### Optional Web Server for Ethernet Solutions

An HTML server is available for Ethernet ProLinx gateways. With this option, HTML text pages can be enabled to:

- Display gateway internal register and status values
- Accept user data input values via POST commands for setpoint, on/off control, and so on.
- Provide limited graphic file support

Type	Specifications
HTML Server (See note below)	Key features of the HTML server include: Max HTML page size: 1MB Max File Storage: 32MB Supported context types: jpeg, bmp, css Supported data types: bit, ASCII, integer, float Sockets: Up to five connections. Note that this limits the number of simultaneous graphic file and frame references per HTML page
FTP Server	Permits remote HTML file transfer between the gateway and remote host. Capabilities of the FTP Server include: Single socket connection Non-passive transfers only WS_FTP or Command Line FTP recommended CuteFTP, Internet Explorer, Netscape, or NCFTP all support multiple socket connections and therefore are not supported by the ProLinx gateway

**Important Note:** The Web Server is not designed to act like, or replace, the powerful web servers available in the marketplace today. Please check application specifics with Technical Support if you are unsure if your application will work with the ProLinx Web Server.

### 5.1.3 Hardware Specifications

Specification	Description
Power Supply	24 VDC nominal 18 to 32 VDC allowed Positive, Negative, GND Terminals 2.5 mm screwdriver blade
Current Load	500 mA max @ 32 VDC max
Operating Temperature	-4° F to 122° F (-20° C to 50° C)
Storage Temperature	-40° F to 185° F (-40° C to 85° C)
Relative Humidity	5 to 95% (without condensation)
Dimensions (Height x Width x Depth)	Standard: 5.20 in x 2.07 in x 4.52 in (13.2 cm x 5.25 cm x 11.48 cm) Extended: 5.20 in x 2.73 in x 4.52 in (13.2 cm x 6.934 cm x 11.48 cm)
LED Indicators (On all gateways)	Power and Hardware Fault Configuration and Application Communication Status Serial Configuration Port Activity and Error
Configuration Serial Port	DB-9M RS-232 only No hardware handshaking
Ethernet Port (Ethernet protocol gateways only)	10Base-T half-duplex RJ45 Connector Link LED and Activity LED indicators Electrical Isolation 1500 V rms at 50 Hz to 60 Hz for 60 s, applied as specified in section 5.3.2 of IEC 60950: 1991 Ethernet Broadcast Storm Resiliency = less than or equal to 5000 [ARP] frames-per-second and less than or equal to 5 minutes duration
Application Serial Port(s) (Serial protocol gateways only)	RS-232/422/485 RS-232 handshaking configurable RS-422/485 DB-9 to Screw Terminal Adaptor <b>Note:</b> The number of serial application ports depends on the gateway type, and the combination of protocols.
Serial Port Isolation	2500 V RMS port signal isolation per UL 1577 3000 VDC min. isolation port to ground and port to logic
Shipped with Each Unit	Mini-DIN to DB-9M serial cables 4-foot RS-232 configuration cable 2.5mm screwdriver CD (docs and Configuration utility) RS-422/485 DB-9 to Screw Terminal Adapter for each serial application port (serial protocols only)

## 5.1.4 Port Physical and Protocol Specifications

### 104 Server Specifications

The 104S gateway acts as a link between the IEC-870-5-104, other protocols and networks, as well as several proprietary interfaces. A 4000-word register space in the gateway exchanges data between the two protocols.

General specifications include:

- Supports storage and transfer of up to 4000 registers between protocols
- User-definable gateway memory usage
- IEC time used by the gateway can be stored in the memory database
- Configures via a user-generated text file download to the gateway
- Protocol implementation conforms to the IEC-870-5-104 specification with fully configurable parameters
- Event Priority Queues available
- Invalid Bit Monitoring available
- Supports Redundant Connections

### Driver Protocol Specifications

#### General Parameters

Internal Database	4000 registers (words) available
Communication parameters	10Base-T half duplex RJ45 Connector Link and Activity LED indicators
Status Data	Status data is returned in a block of counter values allowing communications to be effectively debugged.
Conformance Specifications	See IEC 60870-5-104 Server Interoperability Document (page 127)

### Server Functional Specifications

The 104S gateway accepts commands from one or more remote Client units on the Ethernet network and generates unsolicited messages to the Clients. Unsolicited messages can be sent based on data change events or on a timed cycle. Data transferred to the Client comes from the gateway's internal database. Remote Client devices use the IEC-870-5-104 protocol to control outputs and monitor inputs using the fully-configurable gateway application database. The remote Client devices can overwrite data in the database and, thereby, pass control data to devices connected to the gateway using standard control messages supported by the other gateway protocol.

## 5.2 Command Block Functionality

### 5.2.1 Introduction

The command block functionality allows the gateway to receive requests for special tasks through the other protocol channel (example: Modbus TCP/IP, DF1, and so on). To perform a command block request, a command block must be moved to the ProLinx gateway database starting at a specific address configured by the user. For example, this functionality allows a Modbus TCP/IP client to pass IEC-870-5-104 timestamp events to the IEC-870-5-104 client that is connected to the ProLinx gateway:



### 5.2.2 Configuration

In order to configure the ProLinx gateway to use the mailbox functionality, there are two parameters to be configured:



The DB Input Window Start parameter defines the ProLinx database starting register where the command block request should be transferred to (from the remote node to the ProLinx gateway). For the example above, a Modbus TCP/IP client would send a control block request to the ProLinx gateway starting at database start register 3000. A value of -1 disables this functionality.

The DB Output Window Start parameter defines the ProLinx database starting register where the control block response should be transferred to (from the ProLinx gateway to the remote node). So some control blocks will require a response from the gateway (for example the control block to retrieve the current time from the gateway). For the example above, the remote node must read the control block response from the ProLinx gateway starting at database start register 3100. A value of -1 disables this functionality.

### General Command Block Structure

A command request block will have the following general structure. The command request block should be copied starting at the database address given by the configuration parameter DB Input Window Start:

Word Offset	Description
0	Block ID1 - Command Request Without Response
1	Block ID2 - Command Request With Response
2 to 98	Command Request Data
99	Block ID1 - Command Request Without Response

Where:

- Command Request Without Response Block is transferred from the remote node to the ProLinx gateway to request a special task that does not require data back from the gateway. For example, a Set Time command block sets the gateway time but does not require data back from the gateway.
- Command Request With Response Block requires data back from the gateway. The response block is copied at a different database area. For example, a Get Time command block requests the gateway time information.

So a command block may:

- Perform command request without response only
- Perform command request with response only
- Perform both command request with response and command request without response

The ProLinx gateway recognizes a new block command request if:

- A new command request block ID is received at word offsets 0 and 99
- The same command request block ID is received at word offsets 0 and 99

If these conditions are fulfilled the gateway will process the request and response command blocks.

Once the command response block is processed, the response data will be copied to the ProLinX database with the following structure. The command response block will be copied starting at the database address given by the configuration parameter DB Output Window Start:

Word Offset	Description
0	Block ID2 - Command Request With Response
1	Block ID1 - Command Request Without Response
2 to 98	Command Response Data
99	Block ID2 - Command Request With Response

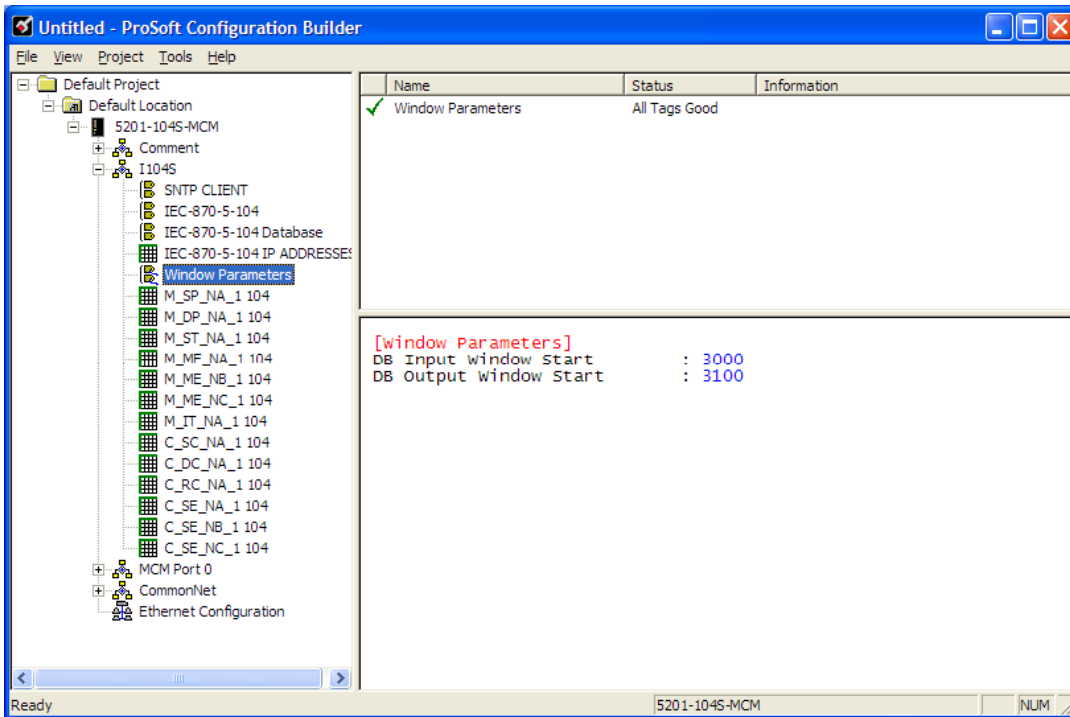
The remote node must therefore read this block from the ProLinX gateway to retrieve the command block response.

### 5.2.3 Command Block List

The following command blocks are supported by the gateway:

Block Range	Mode	Direction	Description
100 and 101	Command Request without Response	Node to ProLinX	Event Data
200 and 201	Command Request without Response	Node to ProLinX	Set Time
200 and 201	Command Request with Response	ProLinX to Node	Get Time
202 and 203	Command Request with Response	ProLinX to Node	Get Event Buffer Counts

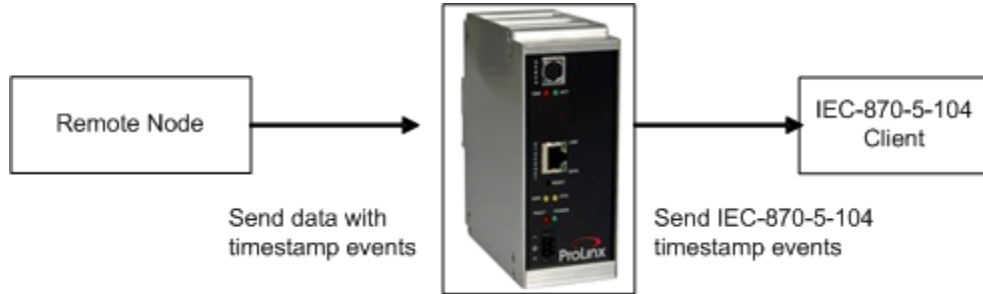
Two block IDs per command type are required to allow the detection of a new block. So the remote node can switch between two block IDs when a new command block for the same type is requested. Even if the block only contains a request with response type, then offsets 0 and 99 must also trigger to a new value to allow the gateway to detect a new block. Follows below some examples to illustrate this functionality. This section will not cover each block structure but will only cover the block transfer mechanism. For these examples consider the default configuration settings:





Example 1 - Command Request Without Response only

For this example, the remote node is passing a timestamp event to be transferred to the remote client connected to the ProLinx gateway.



The following block can be used for the first request.

Command Request Block

Word Offset	Database Address	Value	Description
0	3000	100	Block ID1 - Command Request Without Response
1	3001	0	Block ID2 - Command Request With Response. Move a value of 0 or any other value out of the 200 to 203 range since no data is requested back from the gateway
2 to 10	3002 to 3010	Event Data	Timestamp event
99	3099	100	Block ID1 - Command Request Without Response

Command Response Block

Word Offset	Database Address	Value	Description
0	3100	0	Block ID2 - Command Request With Response.
1	3101	100	Block ID1 - Command Request Without Response
2 to 98	3102 to 3198	Reserved	Reserved - no update
99	3199	0	Block ID2 - Command Request With Response.

In order to send another command request to pass another event, use the following format:

Command Request Block

Word Offset	Database Address	Value	Description
0	3000	101	Block ID1 - Command Request Without Response
1	3001	0	Block ID2 - Command Request With Response. Move a value of 0 or any other value out of the 200 to 203 range since no data is requested back from the gateway

Word Offset	Database Address	Value	Description
2 to 10	3002 to 3010	Event Data	Timestamp event
99	3099	101	Block ID1 - Command Request Without Response

Command Response Block

Word Offset	Database Address	Value	Description
0	3100	0	Block ID2 - Command Request With Response.
1	3101	101	Block ID1 - Command Request Without Response
2 to 98	3102 to 3198	Reserved	Reserved - no update
99	3199	0	Block ID2 - Command Request With Response.

Example 2 - Command Request with Response Only

For this example, the remote node is requesting the event buffer sizes from the ProLinX gateway. This is an example of a request that requires a response back from the gateway:



The following block can be used for the first request.

Command Request Block

Word Offset	Database Address	Value	Description
0	3000	0	Block ID1 - Command Request Without Response Move a value of 0 or any other value out of the 100 to 101 and 200 to 201 range, because no request without response is performed
1	3001	202	Block ID2 - Command Request With Response.
2 to 98	3002 to 3098	Not Used	Not Used
99	3099	0	Block ID1 - Command Request Without Response Move a value of 0 or any other value out of the 100 to 101 and 200 to 201 range, because no request without response is performed

---

**Command Response Block**

<b>Word Offset</b>	<b>Database Address</b>	<b>Value</b>	<b>Description</b>
0	3100	202	Block ID2 - Command Request With Response.
1	3101	0	Block ID1 - Command Request Without Response
2 to 8	3102 to 3108	Event Buffers	Event Buffers
99	3199	202	Block ID2 - Command Request With Response.

In order to send another command request to pass another event, use the following format:

**Command Request Block**

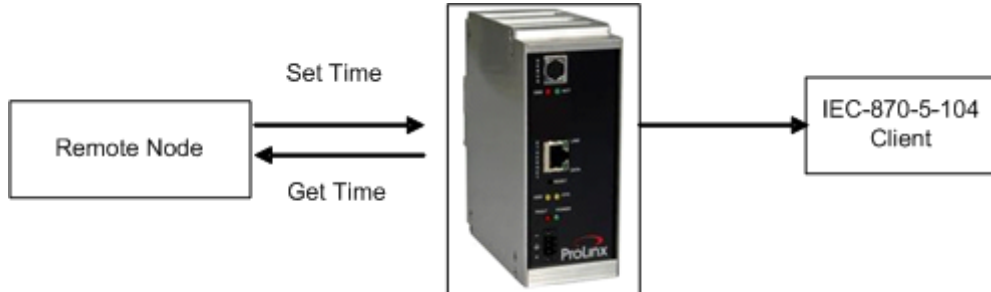
<b>Word Offset</b>	<b>Database Address</b>	<b>Value</b>	<b>Description</b>
0	3000	1	Block ID1 - Command Request Without Response Command Request Without Response Move a value of 0 or any other value out of the 100 to 101 and 200 to 201 range, because no request without response is performed
1	3001	203	Block ID2 - Command Request With Response.
2 to 98	3002 to 3098	Not Used	Not Used
99	3099	1	Block ID1 - Command Request Without Response Command Request Without Response Move a value of 0 or any other value out of the 100 to 101 and 200 to 201 range, because no request without response is performed

**Command Response Block**

<b>Word Offset</b>	<b>Database Address</b>	<b>Value</b>	<b>Description</b>
0	3100	203	Block ID2 - Command Request With Response.
1	3101	1	Block ID1 - Command Request Without Response
2 to 8	3102 to 3108	Event Buffers	Event Buffers
99	3199	203	Block ID2 - Command Request With Response.

Example 3 - Command Request with Response and Command Request Without Response

For this example, the remote node is setting the ProLinx gateway time and at the same time requesting the current time from the gateway.



The following block can be used for the first request.

Command Request Block

Word Offset	Database Address	Value	Description
0	3000	200	Block ID1 - Command Request Without Response (Set Time)
1	3001	200	Block ID2 - Command Request With Response (Get Time)
2 to 8	3002 to 3008	New Time Sent to ProLinx	New Time Sent to ProLinx
99	3099	200	Block ID1 - (Set Time)

Command Response Block

Word Offset	Database Address	Value	Description
0	3100	200	Block ID2 - Command Request With Response (Get Time)
1	3101	200	Block ID1 - Command Request Without Response (Set Time)
2 to 8	3002 to 3008	Current Time sent by ProLinx	Current Time sent by ProLinx
99	3199	200	Block ID2 - Command Request With Response (Get Time)

In order to send another command request to pass another event, use the following format:

---

**Command Request Block**

<b>Word Offset</b>	<b>Database Address</b>	<b>Value</b>	<b>Description</b>
0	3000	201	Block ID1 - Command Request Without Response (Set Time)
1	3001	201	Block ID2 - Command Request With Response (Get Time)
2 to 98	3002 to 3008	New Time Sent to ProLinX	New Time Sent to ProLinX
99	3099	201	Block ID1 - (Set Time)

**Command Response Block**

<b>Word Offset</b>	<b>Database Address</b>	<b>Value</b>	<b>Description</b>
0	3100	201	Block ID2 - Command Request With Response (Get Time)
1	3101	201	Block ID1 - Command Request Without Response (Set Time)
2 to 8	3102 to 3108	Event Buffers	Current Time sent by ProLinX
99	3199	201	Block ID2 - Command Request With Response (Get Time)

The following sections describe the detailed structure of each command block.

### 5.2.4 Event Data Command Block

This functionality allows a remote node to pass timestamp events to be transferred to the IEC-870-5-104 client connected to the ProLinx gateway. The following tables describe structure of the event data command block.

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

#### Request Block

Each Event Request block can send up to 10 events to the gateway. Refer to Events (page 75) for more information about timestamped events. This block should only be used to pass events with a predefined timestamp (the gateway will also send timestamped events when database values change). While using the Event Request block, disable the events for those specific points (page 49) to avoid multiple event generation (caused by point value update through the database).

Start Word	End Word	Data Field(s)	Description
0	0	Block ID	100 or 101 = Set Time (Block ID1)
1	1	Data block being requested	Block ID2 (Command Request With Response)
2	2	Event Count	Number of events present in the block. This field can have a value from 1 to 12.
3	10	Event #1	Event data to add to event message queue.
11	18	Event #2	Event data to add to event message queue.
19	26	Event #3	Event data to add to event message queue.
27	34	Event #4	Event data to add to event message queue.
35	42	Event #5	Event data to add to event message queue.
43	50	Event #6	Event data to add to event message queue.
51	58	Event #7	Event data to add to event message queue.
59	66	Event #8	Event data to add to event message queue.
67	74	Event #9	Event data to add to event message queue.
75	82	Event #10	Event data to add to event message queue.
83	90	Event #11	Event data to add to event message queue.
91	98	Event #12	Event data to add to event message queue.
99	99	Block ID	100 or 101 = Set Time (Block ID1)

Each event contains the following data structure:

Start Byte	End Byte	Data Field(s)	Description
0	1	DB Index	This is the index for the point in the gateway's database. This corresponds to the order of point definition for the gateway data types. This is not the point address for the event.
2	2	ASDU	This is the ASDU data type for the event message. <ul style="list-style-type: none"><li>▪ 1=single point,</li><li>▪ 3=double-point,</li><li>▪ 5=step,</li><li>▪ 9=normalized,</li><li>▪ 11=scaled,</li><li>▪ 13=short-float</li><li>▪ 15=integrated total.</li></ul>
3	3	Qualifier	This is the qualifier code for the event message. Refer to the IEC protocol specification for a full listing of valid qualifier codes for each ASDU type.
4	5	Year	This field contains the four-digit year for the event.
6	6	Month	This field contains the month value for the event. Valid entry for this field is in the range of 1 to 12.
7	7	Day	This field contains the day value for the event. Valid entry for this field is in the range of 1 to 31.
8	8	Hour	This field contains the hour value for the event. Valid entry for this field is in the range of 0 to 23 (bits 0 to 4). Bit 7 of the byte can be used to set the summer time flag (0=standard, 1=summer time)
9	9	Minute	This field contains the minute value for the event. Valid entry for this field is in the range of 0 to 59 (bits 0 to 5). Bit 7 of the byte can be used to set the invalid bit for the time (0=valid, 1=invalid).
10	11	Seconds & Milliseconds	This field contains the seconds and milliseconds value for the event. Valid entry for this field is in the range of 0 to 59,999.
12	15	Data	These bytes contain the data for the event. For single- and double-point, step events, the first byte is used. For measured value events, the first two bytes are used. For integrated total and short-float events, all four bytes are used.

### 5.2.5 Set Time Command Block

This functionality allows a remote node to set the clock of the ProLinx gateway.

#### Request Block

The following table describes the structure of the Set Time command block.

Start Word	End Word	Description
0	0	200 or 201 = Set Time (Block ID1)
1	1	Block ID2 (Command Request With Response)
2	2	Year
3	3	Month
4	4	Day
5	5	Hour
6	6	Minutes
7	7	Seconds & milliseconds
8	98	Reserved for future use
99	99	200 or 201 = Set Time (Block ID1)



### 5.2.6 Get Time Command Block

This functionality allows a remote node to retrieve the clock data from the ProLinx gateway

#### Request Block

The following table describes the structure of the Get Time command block.

Start Word	End Word	Description
0	0	Block ID1 (Command Request Without Response)
1	1	200 or 201 = Get Time (Block ID2)
2	2	Year
3	3	Month
4	4	Day
5	5	Hour
6	6	Minutes
7	7	Seconds & milliseconds
8	98	Reserved for future use
99	99	Block ID1 (Command Request Without Response)

#### Response Block

Start Word	End Word	Description
0	0	200 or 201 = Get Time (Block ID2)
1	1	Block ID1 (Command Request Without Response)
2	2	Year
3	3	Month
4	4	Day
5	5	Hour
6	6	Minutes
7	7	Seconds & milliseconds
8	98	Reserved for future use
99	99	200 or 201 = Get Time (Block ID2)

### 5.2.7 Get Event Buffer Sizes Command Block

This functionality allows a remote node to retrieve the event buffer space of each data type. The following tables describe the structure of the Get Event Buffer Sizes command block:

#### Request Block

Start Word	End Word	Description
0	0	Block ID1 (Command Request Without Response)
1	1	202 or 203 = Get Event Buffer Count (Block ID2)
2	2	Reserved
3	98	Reserved
99	99	Block ID1

#### Response Block

Start Word	End Word	Description
0	0	202 or 203 = Get Event Buffer Count (Block ID2)
1	1	Block ID1 (Command Request Without Response)
2	2	Single point event buffer space
3	3	Double point event buffer space
4	4	Step point event buffer space
5	5	Normalized event buffer space
6	6	Scaled event buffer space
7	7	Short-float event buffer space
8	8	Integrated totals event buffer space
9	98	Reserved
99	99	202 or 203 = Get Event Buffer Count (Block ID2)

## 5.3 SNTP Support

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

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

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

### 5.3.1 SNTP Status Data

The status data for the SNTP driver is located at the virtual database addresses shown in the following table. The data area is initialized with zeros whenever the gateway is initialized. This occurs during a cold-start (power-on), reset (reset push-button pressed) or warm-boot operation (commanded or loading of new configuration).

SNTP Client Status	
4030	Time is valid
4031	Request count
4032	Response count
4033	Computation count
4034	Clock set count
4035	Timeout error count

The gateway's data mapping feature can be utilized to move this data into the gateway's database area. This way the data can be made available to all drivers on the gateway for use on any of the connected networks. If it is not mapped into the gateway's database, the data will only be available through the Configuration/Debug Port.

The *Time is Valid* status register will be set to 1 if the SNTP time is valid. If the time is not valid, the register will be set to 0. All the other registers are counters used to determine the functionality of the driver.

This version of the driver supports SNTP Revision 3 and stratum between 1 and 14.

## 5.4 Server Error and Status Data

The Driver Error and Status Data areas represent a collection of status, diagnostic and troubleshooting registers which may prove helpful in troubleshooting the 104S network and port operation. The data map functionality of the gateway must be utilized to map this data into the application gateway database area (memory word addresses 0 to 3999). All or any portion of the data can be moved using the Data Map.

The data area is initialized with zeros whenever the gateway is initialized. This occurs during a cold-start (power-on), reset (reset push-button pressed) or a warm-boot operation (commanded or loading of new configuration).

Status Register	Name	Description
10200	t0 Timeout Count	This word contains the number of t0 errors recognized by the gateway.
10201	t1 Timeout Count	This word contains the number of t1 errors recognized by the gateway.
10202	t2 Timeout Count	This word contains the number of t2 errors recognized by the gateway.
10203	t3 Timeout Count	This word contains the number of t3 errors recognized by the gateway.
10204	Sequence Error Count	This word contains the number of sequence errors recognized by the gateway. When the send sequence number received by the gateway does not match the expected sequence number, the connection is closed and this counter is incremented.
10205	Bad Address Error Count	This word contains the number of messages received from the remote host that do not contain a valid common ASDU address in the packet.
10206	Length Error Count	This word contains the number of messages received from the remote host that do not have a valid length field.
10207	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.
10208	Transmit Frame Count	This word contains the number of message frames sent to the host from the unit.
10209	Socket State Value (socket 0)	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

Status Register	Name	Description
10210	Socket Open Count (socket 0)	This word contains the number of times the socket listen function executed.
10211	Socket Close Count (socket 0)	This word contains the number of times an active close function executed.
10212	Socket Connect Count (socket 0)	This word contains the number of times a connection was established with the remote host unit.
10213	Host IP Address (socket 0)	IP address of the client connected to the server.
...		
10222		
10223	StartDT active (socket 0)	This word contains the current StartDT state as follows: 0 = The gateway has not received the most recent STARTDT request through this socket or there has been no communication with the remote host unit. 1 = The gateway has received the most recent STARTDT request through this socket (therefore will be reporting data to the remote client connected through this socket),
10223	No Valid Data (socket 0)	Not Used.
...		
10249		
10250	Socket State Value (socket 1)	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
10251	Socket Open Count (socket 1)	This word contains the number of times the socket listen function executed.
10252	Socket Close Count (socket 1)	This word contains the number of times an active close function executed.
10253	Socket Connect Count (socket 1)	This word contains the number of times a connection was established with the remote host unit.

Status Register	Name	Description
10254	Host IP Address (socket 1)	IP address of the client connected to the server.
...		
10263		
10264	StartDT active (socket 1)	This word contains the current StartDT state as follows: 0 = The gateway has not received the most recent STARTDT request through this socket or there has been no communication with the remote host unit. 1 = The gateway has received the most recent STARTDT request through this socket (therefore will be reporting data to the remote client connected through this socket).
10223	No Valid Data (socket 1)	Not Used.
...		
10299		

### 5.5 Command Qualifiers

Qualifier Code	Description
0	No additional definitions (Module will use Long duration pulse for this qualifier selection).
1	Short pulse duration (circuit breaker), determined by user-set parameter in gateway. This is supported in the gateway for single and dual point commands.
2	Long duration pulse (control relay), duration determined by user-set parameter in gateway. This is supported in the gateway for single and dual point commands.
3	Persistent output of control. This is supported in the gateway for all output data types.
4 to 8	Reserved for standard definitions of standard - NOT SUPPORTED
9 to 15	Reserved for the selection of other predefined functions - NOT SUPPORTED
16 to 31	Reserved for special use (private range) - NOT SUPPORTED

## 5.6 Parameter Qualifiers

Type of Parameter	Description
0	Not used.
1	Threshold value (deadband). This parameter is used as the value of variation from the last reported event value to generate events. Each measured value has a user-assigned deadband value. The low and high limit parameter values are computed using the value entered for each measure data point. This parameter can be set and read by the controlling device (client).
2	Smoothing factor (filtered time constant) - NOT SUPPORTED
3	Low limit for transmission of metered values. This value is used as the lower limit for event generation. The value of this parameter is determined based on the value of the last reported event and the deadband set for the specific point. This parameter can be read by the controlling device (client).
4	High limit for transmission of measured values. This value is used as the upper limit for event generation. The value of this parameter is set based on the value of the last reported event and the deadband for the specific point. This parameter can be read by the controlling device (client).
5 to 31	Reserved for standard definitions of standard - NOT SUPPORTED
32 to 63	Reserved for special use - NOT SUPPORTED.

## 5.7 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.

### **5.7.1 System or device**

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

### **5.7.2 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 246 (default). The maximum length may be reduced by the system.

246 Maximum length of APDU per system



### 5.7.3 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)

<input checked="" type="checkbox"/>	<1>	:= Single-point information	M_SP_NA_1
<input checked="" type="checkbox"/>	<3>	:= Double-point information	M_DP_NA_1
<input checked="" type="checkbox"/>	<5>	:= Step position information	M_ST_NA_1
<input type="checkbox"/>	<7>	:= Bitstring of 32 bit	M_BO_NA_1
<input checked="" type="checkbox"/>	<9>	:= Measured value, normalized value	M_ME_NA_1
<input checked="" type="checkbox"/>	<11>	:= Measured value, scaled value	M_ME_NB_1
<input checked="" type="checkbox"/>	<13>	:= Measured value, short floating point value	M_ME_NC_I
<input checked="" type="checkbox"/>	<15>	:= Integrated totals	M_IT_NA_1
<input type="checkbox"/>	<20>	:= Packed single-point information with status change detection	M_PS_NA_1
<input type="checkbox"/>	<21>	:= Measured value, normalized value without quality descriptor	M_ME_ND_1
<input checked="" type="checkbox"/>	<30>	:= Single-point information with time tag CP56Time2a	M_SP_TB_1
<input checked="" type="checkbox"/>	<31>	:= Double-point information with time tag CP56Time2A	M_DP_TB_1
<input checked="" type="checkbox"/>	<32>	:= Step position information with time tag CP56Time2A	M_ST_TB_1
<input type="checkbox"/>	<33>	:= Bitstring of 32 bit with time tag CP56Time2A	M_BO_TB_1
<input checked="" type="checkbox"/>	<34>	:= Measured value, normalized value with time tag CP56Time2A	M_ME_TD_1
<input checked="" type="checkbox"/>	<35>	:= Measured value, scaled value with time tag CP56Time2A	M_ME_TE_1
<input checked="" type="checkbox"/>	<36>	:= Measured value, short floating point value with time tag CP56Time2A	M_ME_TF_1
<input checked="" type="checkbox"/>	<37>	:= Integrated totals with time tag CP56Time2A	M_IT_TB_1
<input type="checkbox"/>	<38>	:= Event of protection equipment with time tag CP56Time2A	M_EP_TD_1
<input type="checkbox"/>	<39>	:= Packed start events of protection equipment with time tag CP56time2A	M_EP_TE_1
<input type="checkbox"/>	<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)

<input checked="" type="checkbox"/>	<45>	:= Single command	C_SC_NA_1
<input checked="" type="checkbox"/>	<46>	:= Double command	C_DC_NA_1
<input checked="" type="checkbox"/>	<47>	:= Regulating step command	C_RC_NA_1
<input checked="" type="checkbox"/>	<48>	:= Set point command, normalized value	C_SE_NA_1
<input checked="" type="checkbox"/>	<49>	:= Set point command, scaled value	C_SE_NB_1
<input checked="" type="checkbox"/>	<50>	:= Set point command, short floating point value	C_SE_NC_1
<input type="checkbox"/>	<51>	:= Bitstring of 32 bit	C_BO_NA_1
<input checked="" type="checkbox"/>	<58>	:= Single command with time tag CP56Time2a	C_SC_TA_1
<input checked="" type="checkbox"/>	<59>	:= Double command with time tag CP56Time2A	C_DC_TA_1
<input checked="" type="checkbox"/>	<60>	:= Regulating step command with time tag CP56Time2A	C_RC_TA_1
<input checked="" type="checkbox"/>	<61>	:= Set point command, normalized value with time tag CP56Time2A	C_SE_TA_1
<input checked="" type="checkbox"/>	<62>	:= Set point command, scaled value with time tag CP56Time2A	C_SE_TB_1
<input checked="" type="checkbox"/>	<63>	:= Set point command, short float value with time tag CP56Time2A	C_SE_TC_1
<input type="checkbox"/>	<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)

<input checked="" type="checkbox"/>	<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)

<input checked="" type="checkbox"/>	<100>	:= Interrogation command	C_IC_NA_1
<input checked="" type="checkbox"/>	<101>	:= Counter interrogation command	C_CI_NA_1
<input checked="" type="checkbox"/>	<102>	:= Read command	C_RD_NA_1
<input checked="" type="checkbox"/>	<103>	:= Clock synchronization command	C_CS_NA_1
<input checked="" type="checkbox"/>	<105>	:= Reset process command	C_RP_NC_1
<input checked="" type="checkbox"/>	<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)

- |                                     |       |   |           |
|-------------------------------------|-------|---|-----------|
| <input checked="" type="checkbox"/> | <110> | := Parameter of measured value, normalized value              | P_ME_NA_1 |
| <input checked="" type="checkbox"/> | <111> | := Parameter of measured value, scaled value                  | P_ME_NB_1 |
| <input checked="" type="checkbox"/> | <112> | := Parameter of measured value,<br>short floating point value | P_ME_NC_1 |
| <input type="checkbox"/>            | <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)

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

## **5.7.4 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								
<3>	M DP NA 1	X		X	X								X								
<5>	M ST NA 1	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																				
<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																	
<31>	M DP TB 1			X																	
<32>	M ST TB 1			X																	
<33>	M BO TB 1																				
<34>	M ME TD 1			X																	
<35>	M ME TE 1			X																	
<36>	M ME TF 1			X																	
<37>	M IT TB 1			X															X		
<38>	M EP TD 1																				
<39>	M EP TE 1																				
<40>	M EP TF 1																				
<45>	C SC NA 1					X	X	X	X	X											
<46>	C DC NA 1					X	X	X	X	X											
<47>	C RC NA 1					X	X	X	X	X											
<48>	C SE NA 1					X	X	X	X	X											
<49>	C SE NB 1					X	X	X	X	X											
<50>	C SE NC 1																				
<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																				
<113>	P AC NA 1																				
<120>	F FR NA 1																				
<121>	F SR NA 1																				
<122>	F SC NA 1																				
<123>	F LS NA 1																				
<1124>	F AF NA 1																				
<125>	F SG NA 1																				
<126>	F DR TA 1																				

## 5.7.5 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)

- global
  - group 1
  - group 2
  - group 3
  - group 4
  - group 5
  - group 6
  - group 7
  - group 8
  - group 9
  - group 10
  - group 11
  - group 12
  - group 13
  - group 14
  - group 15
  - group 16
- Addresses per group have to be defined

Clock synchronization

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

- Clock synchronization
- Optional

Command transmission

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

- Direct command transmission
- Direct set point command transmission
- Select and execute command
- Select and execute set point command
- C\_SE\_ACTTERM used <sup>note 2</sup>
- 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 <sub>0</sub>	60 seconds	Time-out of connection establishment	60 seconds
t <sub>1</sub>	15 seconds	Time-out of send or test APDUs	
t <sub>2</sub>	10 seconds	Time-out for acknowledges in case of no data messages (t <sub>2</sub> < t <sub>1</sub> )	
t <sub>3</sub>	20 seconds	Time-out for sending test frames in case of a long idle time	

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



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

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

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

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

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

Port number

Parameter	Value	Remarks
Port number	2404	In all cases

RFC 2200 suite

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

- Ethernet 802.3
- Serial X.21 interface
- Other selection from RFC 2200:

## 5.8 104S v2 Database Design Forms

### *In This Chapter*

- ❖ M\_SP\_NA\_1, M\_DP\_NA\_1, M\_ST\_NA\_1 and M\_IT\_NA\_1 Form ..... 139
- ❖ M\_ME\_NA\_1 and M\_ME\_NB\_1 Form..... 141
- ❖ Form for all C\_ (Command) data types, except C\_RC\_NA\_1 ..... 143
- ❖ C\_RC\_NA\_1 Form..... 145

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















**5.8.4 C\_RC\_NA\_1 Form**

Point Number	Database Address	Monitor Point #	Monitor Database Address



## 6 Support, Service & Warranty

### *In This Chapter*

- ❖ How to Contact Us: Technical Support..... 147
- ❖ Return Material Authorization (RMA) Policies and Conditions..... 148
- ❖ LIMITED WARRANTY..... 150

### 6.1 How to Contact Us: Technical Support

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

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

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

- 1 Module configuration and associated ladder files, if any
- 2 Module Operation
  - Configuration/Debug status information
  - LED patterns
- 3 Details about the serial, Ethernet or fieldbus devices interfaced with, if any.

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

<b>Internet</b>	Web Site: <a href="http://www.prosoft-technology.com/support">www.prosoft-technology.com/support</a> E-mail address: <a href="mailto:support@prosoft-technology.com">support@prosoft-technology.com</a>
<b>Asia Pacific</b> (location in Malaysia)	Tel: +603.7724.2080, E-mail: <a href="mailto:asiapc@prosoft-technology.com">asiapc@prosoft-technology.com</a> Languages spoken include: Chinese, English
<b>Asia Pacific</b> (location in China)	Tel: +86.21.5187.7337 x888, E-mail: <a href="mailto:asiapc@prosoft-technology.com">asiapc@prosoft-technology.com</a> Languages spoken include: Chinese, English
<b>Europe</b> (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: <a href="mailto:support.EMEA@prosoft-technology.com">support.EMEA@prosoft-technology.com</a> Languages spoken include: French, English
<b>Europe</b> (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: <a href="mailto:mea@prosoft-technology.com">mea@prosoft-technology.com</a> Languages spoken include: English, Hindi
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<b>Brasil</b> (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: brasil@prosoft-technology.com Languages spoken include: Portuguese, English

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

The following RMA Policies and Conditions (collectively, "RMA Policies") apply to any returned Product. These RMA Policies are subject to change by ProSoft without notice. For warranty information, see Limited Warranty (page 150). In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

### 6.2.1 All Product Returns:

- a) In order to return a Product for repair, exchange or otherwise, the Customer must obtain a Return Material Authorization (RMA) number from ProSoft and comply with ProSoft shipping instructions.
- b) In the event that the Customer experiences a problem with the Product for any reason, Customer should contact ProSoft Technical Support at one of the telephone numbers listed above (page 147). A Technical Support Engineer will request that you perform several tests in an attempt to isolate the problem. If after completing these tests, the Product is found to be the source of the problem, we will issue an RMA.
- c) All returned Products must be shipped freight prepaid, in the original shipping container or equivalent, to the location specified by ProSoft, and be accompanied by proof of purchase and receipt date. The RMA number is to be prominently marked on the outside of the shipping box. Customer agrees to insure the Product or assume the risk of loss or damage in transit. Products shipped to ProSoft using a shipment method other than that specified by ProSoft, or shipped without an RMA number will be returned to the Customer, freight collect. Contact ProSoft Technical Support for further information.
- d) A 10% restocking fee applies to all warranty credit returns, whereby a Customer has an application change, ordered too many, does not need, etc. Returns for credit require that all accessory parts included in the original box (i.e.; antennas, cables) be returned. Failure to return these items will result in a deduction from the total credit due for each missing item.

### **6.2.2 Procedures for Return of Units Under Warranty:**

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

- a) A replacement module will be shipped and invoiced. A purchase order will be required.
- b) Credit for a product under warranty will be issued upon receipt of authorized product by ProSoft at designated location referenced on the Return Material Authorization
  - i. If a defect is found and is determined to be customer generated, or if the defect is otherwise not covered by ProSoft's warranty, there will be no credit given. Customer will be contacted and can request module be returned at their expense;
  - ii. If defect is customer generated and is repairable, customer can authorize ProSoft repair the unit by providing a purchase order for 30% of the current list price plus freight charges, duties and taxes as applicable.

### **6.2.3 Procedures for Return of Units Out of Warranty:**

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

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

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

## 6.3 LIMITED WARRANTY

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

### 6.3.1 What Is Covered By This Warranty

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

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

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

### **6.3.3 Disclaimer Regarding High Risk Activities**

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

### **6.3.4 Intellectual Property Indemnity**

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

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

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

### **6.3.5 Disclaimer of all Other Warranties**

The Warranty set forth in What Is Covered By This Warranty (page 150) are in lieu of all other warranties, express or implied, including but not limited to the implied warranties of merchantability and fitness for a particular purpose.



### **6.3.6 Limitation of Remedies \*\***

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

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

### **6.3.7 Time Limit for Bringing Suit**

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

### **6.3.8 No Other Warranties**

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

### **6.3.9 Allocation of Risks**

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

### ***6.3.10 Controlling Law and Severability***

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

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