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ProLinx
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BACnet

ProLinx Gateway

BACnet/IP Client Edition 2

November 24, 2010

PROTOCOL MANUAL

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 our products, documentation, or support, please write or call us.

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ProSoft Technology® Product Documentation

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

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

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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 NON-HAZARDOUS.

D THIS DEVICE SHALL BE POWERED BY CLASS 2 OUTPUTS ONLY.

ProLinx® Products Warnings

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.

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**.

Markings

Electrical Specifications

Label Markings

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

II 3 G

Ex nA nL IIC 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.

Agency Approvals and Certifications

cULus	ISA 12.12.01 Class I, Div 2 Groups A, B, C, D
cULus	C22.2 No. 213-M1987

183151

Contents

1   Start Here

In This Chapter

1.1   System Requirements

The ProSoft Configuration Builder configuration software for the BACnet gateway requires the following minimum hardware and software components:

- Pentium[®] II 450 MHz minimum. Pentium III 733 MHz (or better) recommended
- Supported operating systems:
    o Microsoft Windows Vista
    o Microsoft Windows XP Professional with Service Pack 1 or 2
    o Microsoft Windows 2000 Professional with Service Pack 1, 2, or 3
    o Microsoft Windows Server 2003
- 128 Mbytes of RAM minimum, 256 Mbytes of RAM recommended
- 100 Mbytes of free hard disk space (or more based on application requirements)
- 256-color VGA graphics adapter, 800 x 600 minimum resolution (True Color 1024 × 768 recommended)
- CD-ROM drive

1.2   Package Contents

The following components are included with your BACnet gateway, and are all required for installation and configuration.

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

Qty.	Part Name	Part Number	Part Description
1	BACnet gateway	PLX-####	ProLinx communication gateway
1	Cable	Cable #15, RS232 Null Modem	For RS232 Connection from a PC to the CFG Port of the gateway
Varies	Cable	Cable #9, Mini-DIN8 to DB9 Male Adapter	For DB9 Connection to gateway's Port. One DIN to DB-9M cable included per configurable serial port, plus one for gateway configuration
Varies	Adapter	1454-9F	Adapters, DB9 Female to Screw Terminal. For RS422 or RS485 Connections to each serial application port of the gateway
1	ProSoft Solutions CD		Contains sample programs, utilities and documentation for the BACnet gateway.

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

1.3   Setting Port 0 Configuration Jumpers

Before installing the module on the DIN-rail, you must set the jumpers for the Port 0 application port.

Note: Ethernet-only ProLinx modules do not use the serial port jumper settings. The serial configuration jumper settings on an Ethernet-only module have no effect.
Note: The presence of Port 0 depends on the specific combination of protocols in your ProLinx module. If your module does not have a Port 0, the following jumper settings do not apply.

Port 0 is preconfigured for RS-232. You can move the port configuration jumper on the back of the module to select RS-485 or RS-422.

Note: Some ProLinx modules do not correctly report the position of the port 0 jumper to the Port Configuration page on the Config/Debug menu. In cases where the reported configuration differs from the known jumper configuration, the physical configuration of the jumper is correct.

The following illustration shows the jumper positions for Port 0:
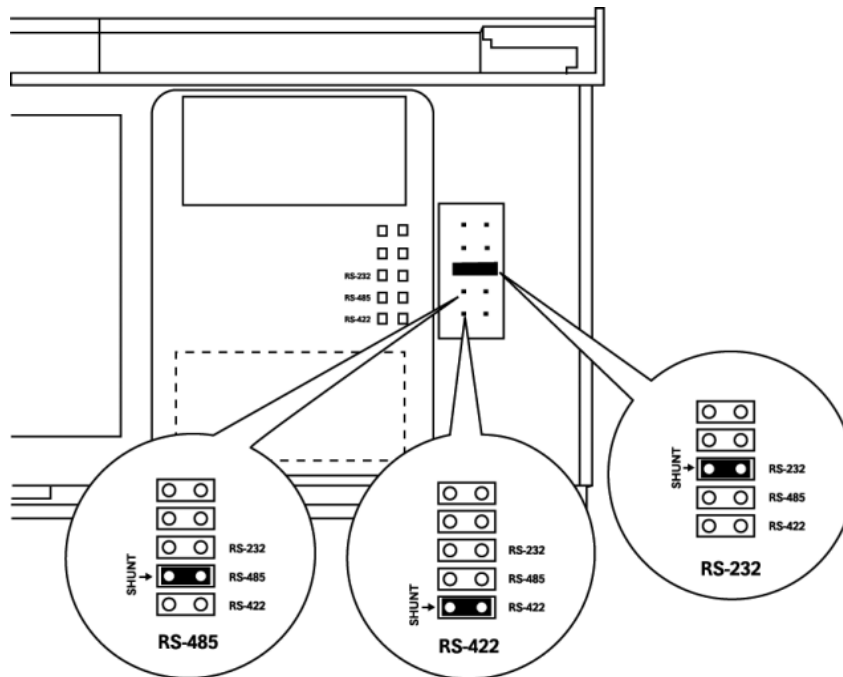
ProLinx 5000/6000 Series Module

1.4   Mounting the Module on the DIN-rail
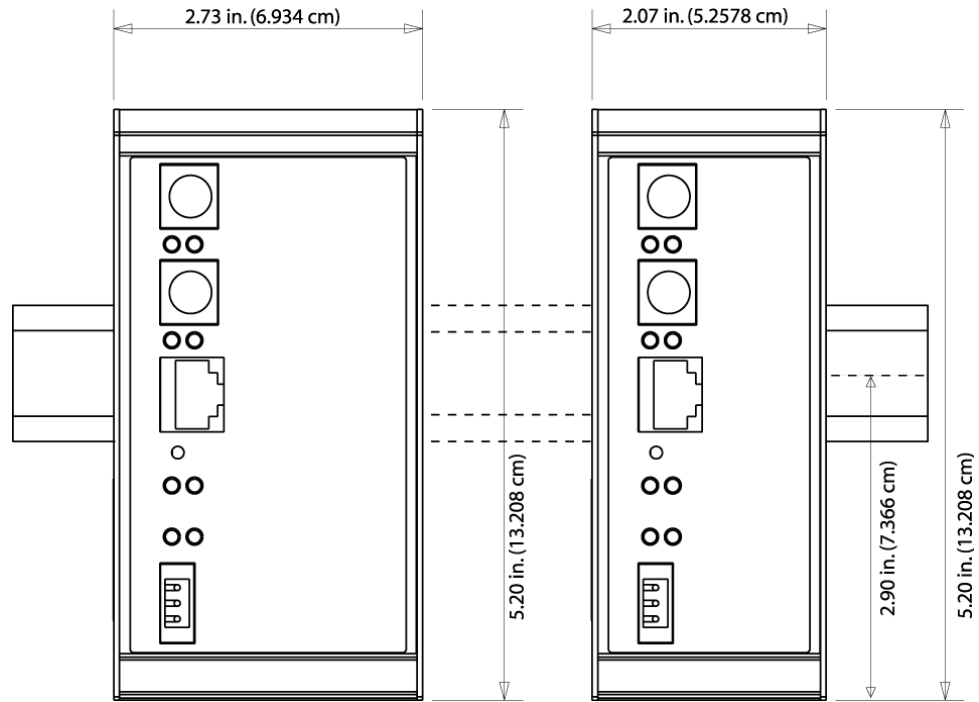
ProLinx 5000/6000 Series gateway

1.5   Connecting Power to the Unit
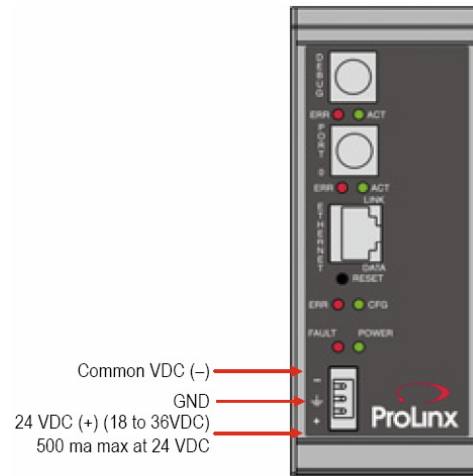
WARNING: Ensure that you do not reverse polarity when applying power to the gateway. This will cause damage to the gateway's power supply.

1.6 RS-232 Configuration Port Serial Connection
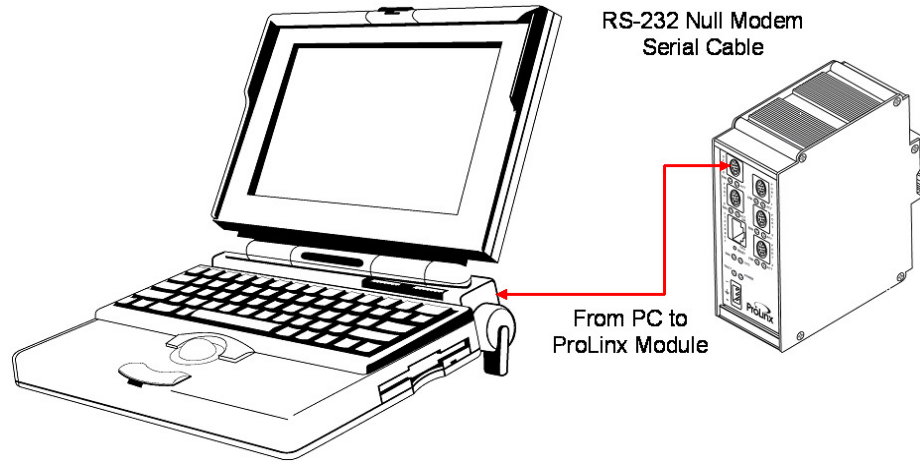
This port is physically a Mini-DIN connection. A Mini-DIN to DB-9 adapter cable is included with the module. This port permits ProSoft Configuration Builder to view configuration and status data in the module and to control the module. The following illustration shows the pinout for communications on this port.
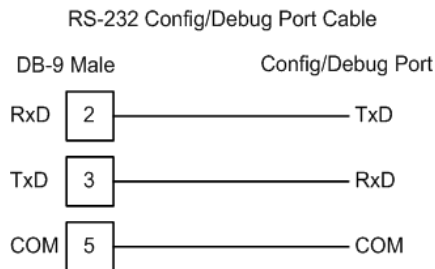
1.7 Installing ProSoft Configuration Builder Software

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 website.

Installing ProSoft Configuration Builder from the ProSoft website

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 Product CD-ROM*, included in the package with your gateway.

Installing 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 **SETUP CONFIGURATION TOOL** 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.

1.7.1 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.**

2   Functional Overview

In This Chapter

The ProLinx BACnet Client driver can be used to interface many different protocols with Ethernet-enabled BACnet devices. The BACnet driver supports a single UDP Client to interface with one or more devices that contain a BACnet server.

The driver interfaces with a common internal database in the gateway. This permits the sharing of data across many different networks. The following illustration shows the functionality of the BACnet Client driver when interfaced with serial communication based networks.
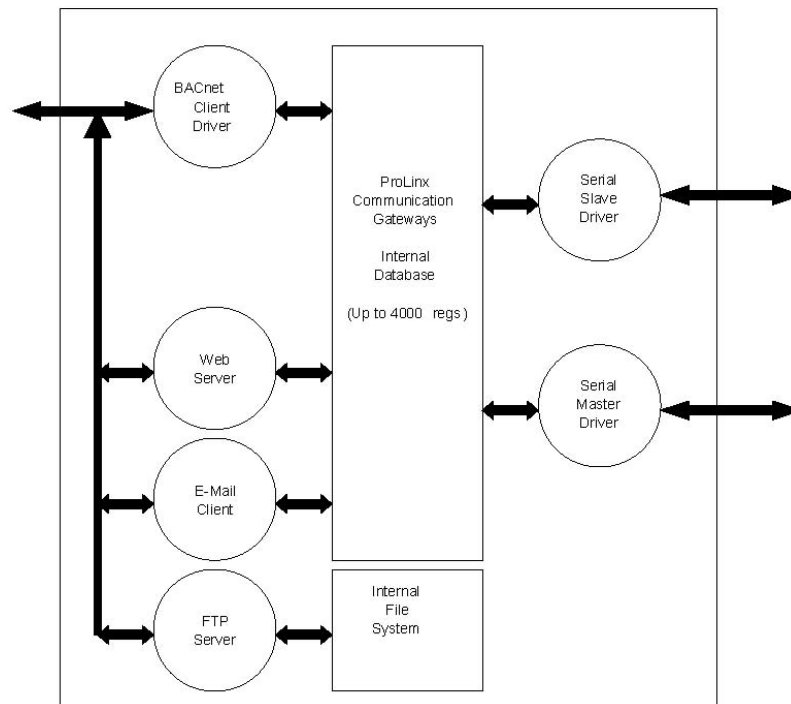
2.1   BACnet/IP Client

General	One UDP Client
Command List	Support for 100 commands, each configurable for command, IP address, register to/from addressing and word/bit count.
Service Port	**1** to **65535**
Function Code	**12**=Read Single Property **14**=Read Multiple Properties **15**=Write Single Property **16**=Write Multiple Properties
Data Type	**0**=Analog Input **1**=Analog Output **2**=Analog Value **3**=Binary Input **4**=Binary Output **5**=Binary Value
Point Count	**1** to **25**

The gateway supports a single independent Client on the IP network using the UDP protocol to interface with processors or devices using a user constructed command list of up to 100 entries. The gateway's internal database is used as the source for write commands to the remote units. Data collected from the remote units using read commands is placed in the gateway's database.
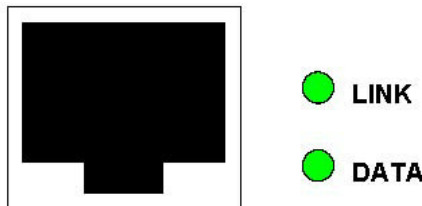
2.1.1 Module Internal Database

The internal database is central to the functionality of the gateway. This database is shared between all the drivers in the gateway and is used as a conduit to pass information from one device on one network to one or more devices on another network. This permits data from devices on one communication port to be viewed and controlled by devices on another port.

In addition to data from the Client, status and error information generated by the gateway can also be mapped into the internal database. Use this data to determine the "health" of the gateway and to determine if commands are being processed successfully.

2.1.2 BACnet/IP Client Access to Database

The Client functionality automatically places data from a BACnet/IP device into the gateway's internal database using read functions, and writes data from the gateway's internal database to the remote unit. The Client driver generates the message to the remote device using the gateway's user-constructed command list. The command list defined in the user configuration determines what data is to be transferred between the gateway and the remote units.

The following diagram describes the flow of data between the Client, the internal database and the remote servers.
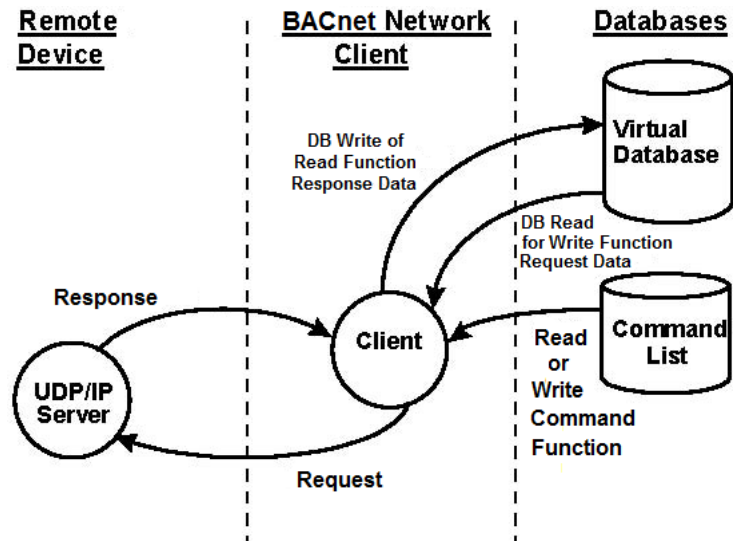
3   BACnet Protocol Configuration

The following steps explain how to configure the BACnet/IP protocol using ProSoft Configuration Builder.

3.1   Configuring the Module

3.1.1 Adding a Module

To add a module to your project

1   Double-click the **DEFAULT MODULE** icon in the left pane to open the *Choose Module Type* dialog box.

Note: ProLinx gateways always combine two or more protocols. The following illustration shows an example ProLinx gateway with BACnet and one other protocol. Please choose the gateway in *ProSoft Configuration Builder* that matches the combination of protocols in your ProLinx gateway.
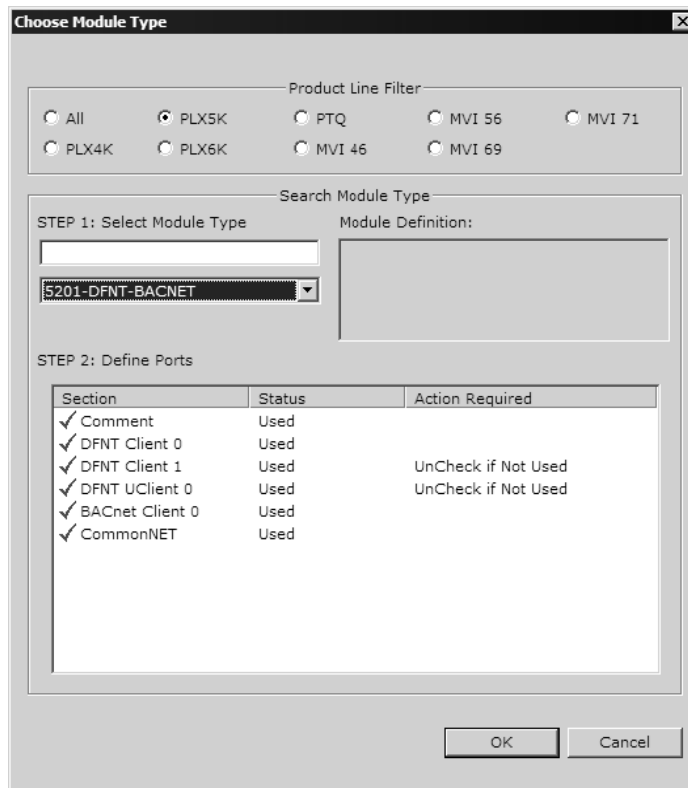
2   In the *Choose Module Type* dialog box, select the module type.

3.1.2 Module Entries

To configure module parameters

1 Click the **[+]** sign next to the module icon to expand module information.
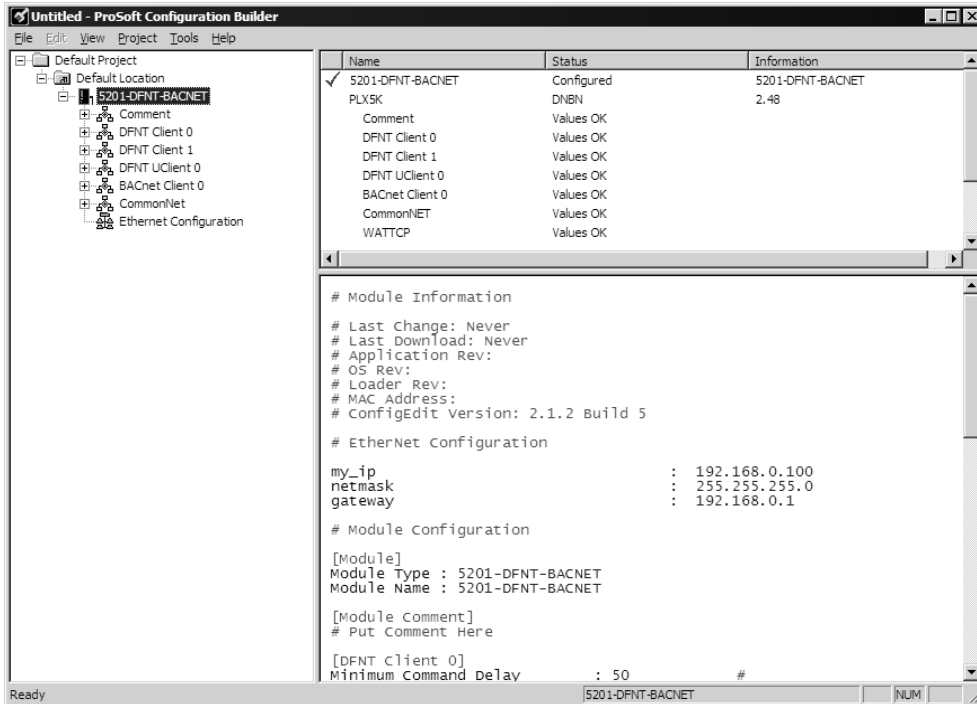
2 Expand any icon in the list to view its configuration tags. Double-click a tag to edit the configuration parameters.
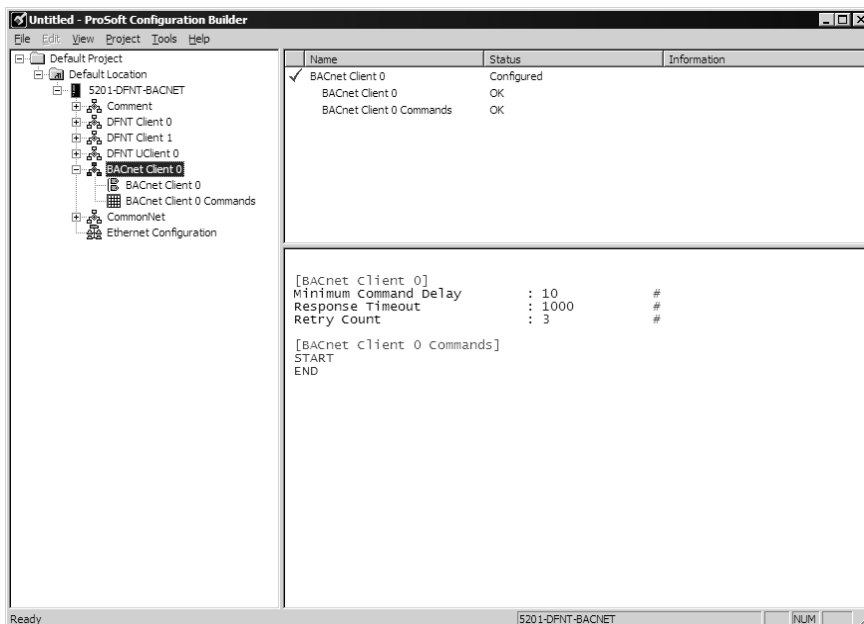
3 For parameter entries, select the parameter in the left pane and make your changes in the right pane.
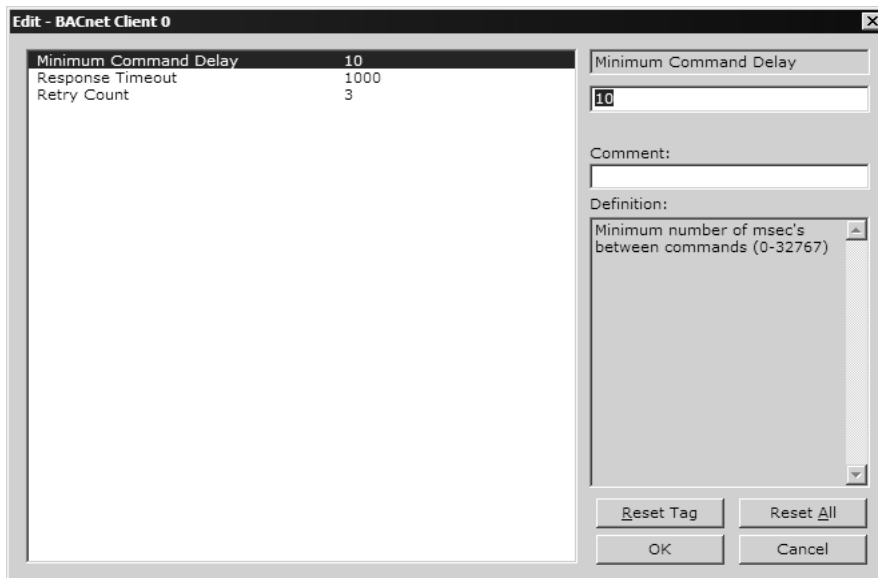
For command list and data map entries, click the **ADD ROW** button to add an item to the list. Click **EDIT ROW** to edit the parameters.
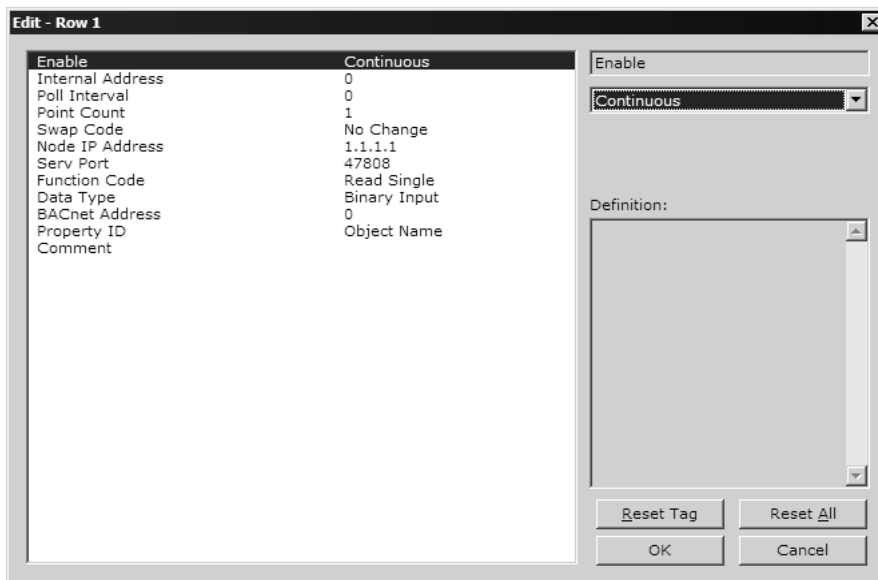
4 Click **OK** to save your changes.

3.1.3 Creating Optional Comment Entries

1 Click the **[+]** to the left of the ⊞🔗 Comment icon to expand the module comments.

2 Double-click the 🅑 Module Comment icon. The *Edit - Module Comment* dialog box appears.
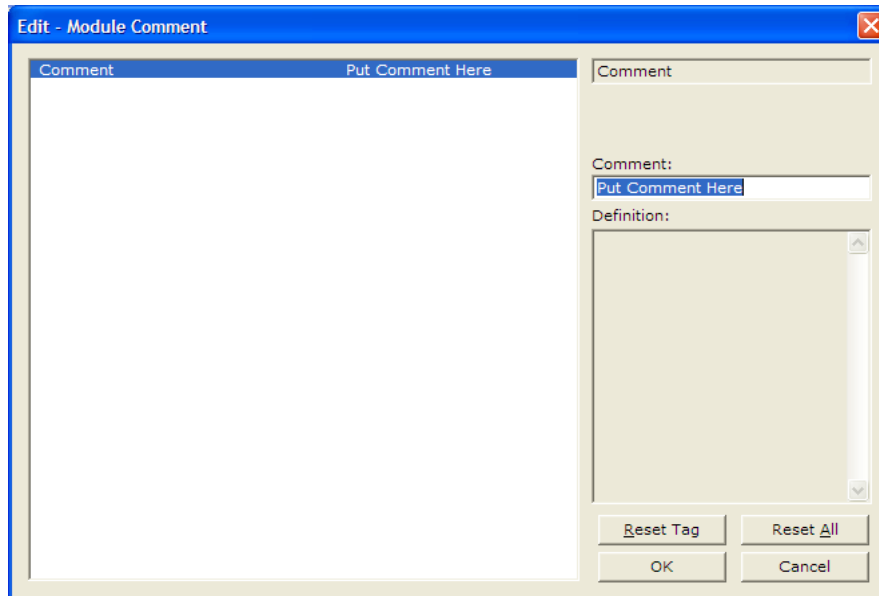
3 Enter your comment and click **OK** to save your changes.

3.1.4 Printing a Configuration File

1 Select the gateway 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 In the *View Configuration* window, open the **FILE** menu, and choose **PRINT.** This action opens the *Print* dialog box.

4 In the *Print* dialog box, choose the printer to use from the drop-down list, select printing options, and then click **OK.**

3.1.5 Downloading a File from PC to the Module

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.
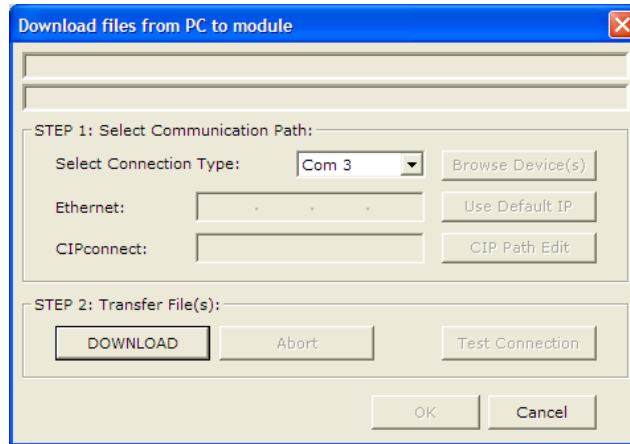
4 Select the **PORT** to use for the download.

5 Click the **DOWNLOAD** button.

3.2   BACnet Client 0

The *BACnet Client 0* section of the configuration specifies the parameters for the BACnet Client to be emulated on the gateway. The command list for the Client is entered in a separate section.
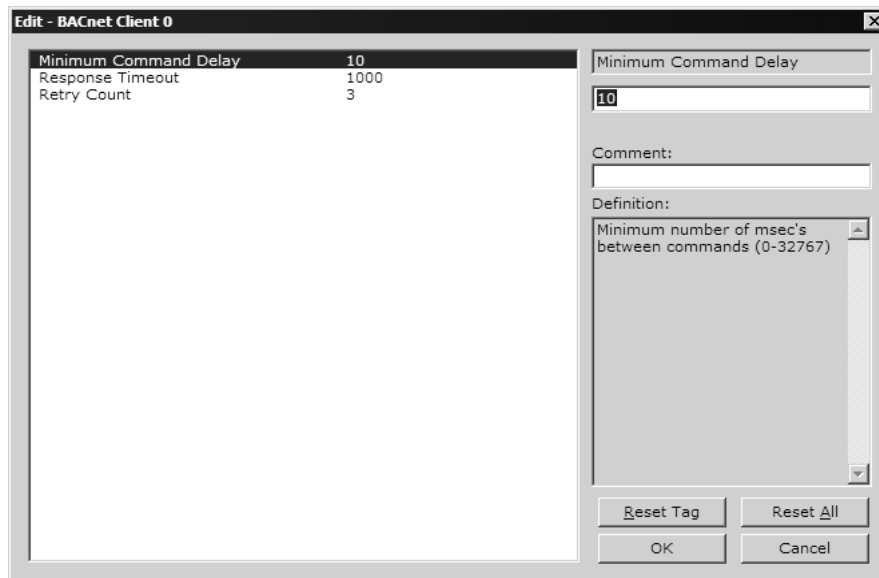
3.2.1   Minimum Command Delay

0 to **32767**

This parameter specifies the number of milliseconds to wait between the initial issuances of a command. It can be used to delay all commands sent to servers to avoid "flooding" the network. This parameter does not affect retries of a command, as they are issued when failure is recognized.

3.2.2   Response Timeout

0 to **65535** milliseconds

This is the time in milliseconds that a Client will wait before re-transmitting a command if no response is received from the addressed server. The value to use depends on the type of communication network used, and the expected response time of the slowest device on the network.

3.2.3   Retry Count

0 to **10**

This parameter specifies the number of times a command will be retried if it fails.

3.3   BACnet Client 0 Commands

The *BACnet Client 0 Commands* section defines the BACnet commands to be issued for data collection and control of the remote units on the UDP/IP network. The gateway supports numerous commands to interface with many different units and data types. For the commands to operate correctly, the server device must be configured correctly. An incorrectly configured server is the primary cause of user problems with the gateway.
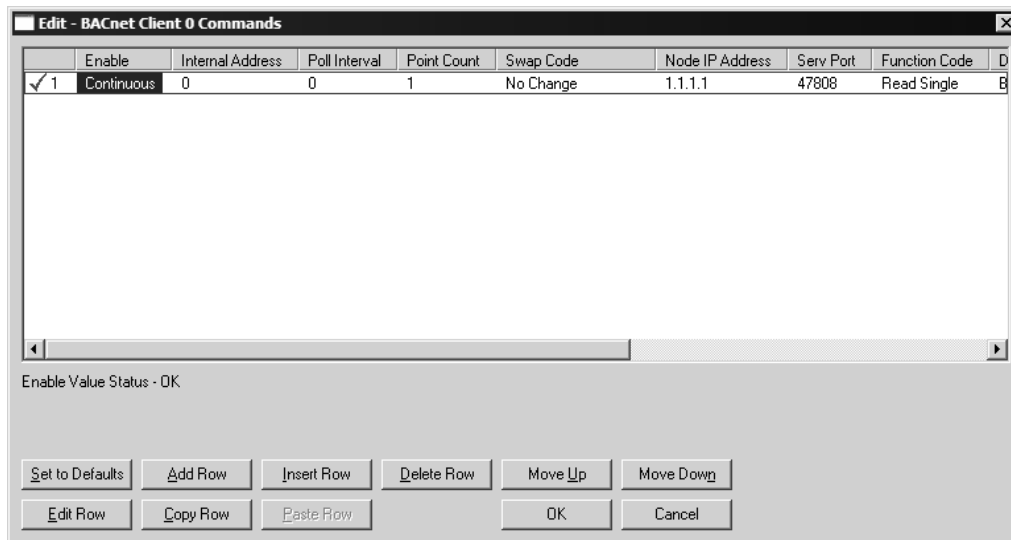
3.3.1 Command List Overview

In order to interface the ProLinx gateway with BACnet Server devices, you must construct a command list. The commands in the list specify the server device to be addressed, the function to be performed (read or write), the data area in the device to interface with, and the registers in the internal database to be associated with the device data.

Up to 100 commands can be entered in the command list for the Client port. The command list is processed from top (command #1) to bottom. A *Poll Interval* parameter is associated with each command to specify a minimum delay time in tenths of a second between issuances of the command. If the user specifies a value of **10** for the parameter, the command will be executed no more frequently than every one (1) second.

Write commands have a special feature, as they can be set to execute only if the data area associated with the write command changes. If the register data values in the command have not changed since the command was last issued, the command will not be executed. If the data in the command has changed since the command was last issued, the command will be executed. Use of this feature can lighten the load on the network. In order to implement it, set the *Enable* parameter for the command to **CONDITIONAL**. Care should be taken when using this option, as the UDP protocol does not guarantee the delivery of each message. Therefore, after the write message is executed and after its retry count has expired, it will not be sent out again until the data changes in the gateway's database. The remote device may never receive the write message. Because of this problem, this option should only be utilized on networks where the message is guaranteed to get through and be processed by the server.

The gateway supports numerous commands, allowing it to interface with a wide variety of devices.

3.3.2 Commands Supported by the Gateway

The format of each command in the list is the same for all operations. The first part of the record contains information relating to the communication gateway, and the second part contains information required to interface with the BACnet server device. The Client supports the two basic functions: read and write. Within each of these, a single or multiple point function is also supported.

Care must be taken to configure the command list parameters to allow the commands to interface with the server device and its database. The commands will execute properly only if these parameters are set correctly.

3.3.3 Command Entry Formats

The following table shows the structure of the configuration data necessary for each of the supported commands.

	Gateway Information Data ←					→	Device Information Data				
Column #	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
Function Code	**Enable Code**	**Internal Address**	**Poll Interval Time**	**Point Count**	**Swap Code**	**IP Address**	**Service Port**	**BACnet Function**	**Data Type**	**BACnet Address**	**Property**
FC 12	0/1	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	12	0	AI Point Address	ID Code
FC 14	0/1	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	14	0	AI Point Address	ID Code
FC 12	0/1	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	12	1	A0 Point Address	ID Code
FC 14	0/1	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	14	1	A0 Point Address	ID Code
FC 15	0/1/2	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	15	1	A0 Point Address	ID Code
FC 16	0/1/2	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	16	1	A0 Point Address	ID Code
FC 12	0/1	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	12	2	AI Point Addres	ID Code
FC 14	0/1	Property Dependent	1/10 Sec	Count	Code	xxx.xxx.xxx.xxx	47808	14	2	AI Point Address	ID Code
FC 12	0/1	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	12	3	BI Point Address	ID Code
FC 14	0/1	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	14	3	BI Point Address	ID Code
FC 12	0/1	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	12	4	B0 Point Address	ID Code
FC 14	0/1	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	14	4	B0 Point Address	ID Code
FC 15	0/1/2	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	15	4	B0 Point Address	ID Code
FC 16	0/1/2	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	16	4	B0 Point Address	ID Code
FC 12	0/1	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	12	5	BI Point Address	ID Code
FC 14	0/1	Property Dependent	1/10 Sec	Count	0	xxx.xxx.xxx.xxx	47808	14	5	BI Point Address	ID Code

The first part of the record is the Prolinx gateway information, and the second part contains the information required to interface with the server device.

Parameter	Value	Description
Enable	**0**, **1** or **2**	This field defines whether the command is to be executed and under what conditions.
		<table><tr><th>Value</th><th>Description</th></tr><tr><td>**0=DISABLED**</td><td>The command is disabled and will not be executed in the normal polling sequence.</td></tr><tr><td>**1=CONTINUOUS**</td><td>The command executes with each scan of the command list if the *Poll Interval* is set to zero. If the *Poll Interval* is set to a nonzero value, the command executes when the interval timer expires.</td></tr><tr><td>**2=CONDITIONAL**</td><td>The command executes only if the data associated with the command changes. This value is valid only for write commands.</td></tr></table>
Internal Address	Dependent on Property ID code utilized	This parameter is used to specify the location in the gateway's internal database to be associated with the command. For read operations, this parameter sets the starting address of the area in the database where the data received from the device will be placed. For write operations, it sets the starting address of the area from which the data will be sourced. The *Internal Address* is property dependent as listed in a following table (use the Property List to find data size lengths for each property). Refer to the discussion contained in this section for a further description of this field.
Poll Interval	**0** to **65535**	This parameter specifies the minimum interval for continuous command execution (*Enable* = **CONTINUOUS**). The parameter is entered in units of 0.1 seconds. Therefore, if a value of **10** is entered for a command, the command will execute no more frequently than every 1 second.
Point Count	**1** to **25**	This parameter specifies the number of points to be associated with the command. This value should be set to **1** for function codes 12 and 15.
Swap Code	**0**, **1**, **2** or **3**	This parameter defines if the data received from the Server is to be ordered differently than received from the Server device. 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 Server devices. This parameter can be set to order the register data received in an order useful by other applications. The following table defines the values and their associated operations:
		<table><tr><th>Swap Code</th><th>Description</th></tr><tr><td>**0=NO CHANGE**</td><td>No change is made in the byte ordering</td></tr><tr><td>**1=WORD SWAP**</td><td>The words are swapped</td></tr><tr><td>**2=WORD AND BYTE SWAP**</td><td>The words are swapped, then the bytes in each word are swapped</td></tr><tr><td>**3=BYTE SWAP**</td><td>The bytes in each word are swapped</td></tr></table>
Node IP Address	xxx.xxx.xxx.xxx	The IP address of the device being addressed by the command.
Service Port	**1** to **65535**	The *Service Port* address for most BACnet applications is **47808** (=0xBAC0). Enter this value in decimal format. If the server requires a different service port address (it is not compliant), enter the value required in this field.
Function Code	**12**, **14**, **15** or **16**	This field defines the function to be performed by the command. Valid function codes used by the module are as follows: **12=READ SINGLE PROPERTY**, **14=READ MULTIPLE PROPERTIES**, **15=WRITE SINGLE PROPERTY** and **16=WRITE MULTIPLE PROPERTIES**.

Parameter	Value	Description
Data Type	**0**, **1**, **2**, **3**, **4** or **5**	This field defines the data type to be interfaced with on the server device. The Data Type Codes used by the module are as follows: **0**=ANALOG INPUT, **1**=ANALOG OUTPUT, **2**=ANALOG VALUE, **3**=BINARY INPUT, **4**=BINARY OUTPUT and **5**=BINARY VALUE.
BACnet Address	Device Dependent	This parameter specifies the starting point address for the selected data type in the server device.
Property ID	**0** to **65535**	The Property ID is a value from **0** to **65535** (Present Value = **85** and Status Flags = **111**). Please refer to the remote device's documentation to determine which property identification codes are supported. For write commands (function codes 15 and 16), the property value is always set to **85** by the driver.

The following table lists the property identification codes used in the BACnet protocol and supported by the driver.

Property Code	Description	Length	Data Type			
			AI	AO	BI	BO
75	Object Identifier	4-bytes	R	R	R	R
77	Object Name	Character String	R	R	R	R
79	Object Type	Byte (Enumerated)	R	R	R	R
85	Present Value	4-byte Real (AI/AO), Bit(BI/BO)	R	W	R	W
111	Status Flags	Byte (Bit encoded)	R	R	R	R
36	Event State	Byte (Enumerated)	R	R	R	R
81	Out-of-service	Bit	R	R	R	R
117	Engineering units	Byte (Enumerated)	R	R		
69	Minimum Present Value	4-byte Real	O	O		
65	Maximum Present Value	4-byte Real	O	O		
106	Resolution	4-byte Real	O	O		
118	Update Interval	Unsigned	O			
22	COV Increment	4-byte Real	O	O		
113	Time Delay	Unsigned	O	O	O	O
17	Notification Class	Unsigned	O	O	O	O
45	High-Limit	4-byte Real	O	O		
59	Low-Limit	4-byte Real	O	O		
25	Deadband	4-byte Real	O	O		
52	Limit Enable	Byte (Bit encoded)	O	O		
35	Event Enable	Byte (Bit encoded)	O	O	O	O
0	Acked Transitions	Byte (Bit encoded)	O	O	O	O
72	Notify Type	Byte (Enumerated)	O	O	O	O
28	Description	Character String	O	O	O	O
31	Device Type	Character String	O	O	O	O
103	Reliability	Byte (Enumerated)	O	O	O	O
104	Relinquish Default	Byte (Enumerated)		R		R
84	Polarity	Byte (Enumerated)			R	R

Property Code	Description	Length	Data Type			
			AI	AO	BI	BO
46	Inactive Text	Character String			O	O
4	Active Text	Character String			O	O
15	Change of State Count	Unsigned			O	O
33	Elapsed Active Time	Unsigned32			O	O
6	Alarm Value	Byte (Enumerated)			O	
66	Minimum Off Time	Unsigned32				O
67	Minimum On Time	Unsigned32				O
40	Feedback Value	Byte (Enumerated)				O

R=Read-only required by all devices.
W=Read/Write required by all devices.
O=Read-only and is optional for device.
If cell is blank, the property is not supported for the data type.

Please review the BACnet Protocol Specification for a complete discussion of each of the property identification codes and for the definition of the enumerated values. Care must be taken when designing the application to make sure command message data does not overlap. Consult the server device documentation to verify that the data type, point number, function and property identification code are supported.

The Property ID column determines the Internal Address field. Use the previously provided Property ID table to determine the data type used with the point.

Data Length	Internal Address Offset
Bit	Bit offset from start of database (packed data) (0 to 64000) - Each data point uses a single bit in the database.
Byte	Byte offset from start of database (0 to 7999) - Each data point uses a single byte in the database.
Unsigned	(Byte offset)*2 from start of database (0 to 3999) - Each data point uses two bytes (one word register) in the database.
Unsigned32	(Byte offset)*4 from start of database (0 to 2999) - Each data point uses four bytes (two word registers) in the database.
4-Bytes	(Byte offset)*4 from start of database (0 to 2999) - Each data point uses four bytes (two word registers) in the database.
4-Byte Real	(Byte offset)*4 from start of database (0 to 2999) - Each data point uses four bytes (two word registers) in the database.
Character String	Byte offset from start of database (0 to 7999) - Each data point uses the number of bytes required to store the character string. Care should be used with these property types to make sure the database of one point does not overlap that of another.

NOTES
- The length of the Character String type is variable and may cause for a read operation to overwrite other data if not enough space is allocated for each string.
- The binary input present value (property 85) returned from a read statement is placed at the bit offset in the internal address.
- The bit offset in the internal database is used for the binary output read and write operations.

Command list example:

```
[BACnet Client 0 Commands]
#
# This section contains the commands that will be issued by the BACnet client
# service. Each valid command will be issued to the unit specified using the
# command data entered by the user.
#
# LOCATION  :
# DATE     :
# CONFIGURED BY:
# MODIFIED  :
#
#  1       2      3      4    5 6                     7    8    9   10   11
#        DB    Poll    Reg Swap                    Serv Func Data Point Prop
#Enab  Addr  Delay Count Code Node IP Address     Port Code Type Addr Code
START
 0    305      0      7   1 192.168.0.110     47808   14    1    1   85
 0   1500      0      7   1 192.168.0.110     47808   16    1    1   85
 0    200      0      1   1 192.168.0.110     47808   12    0    1   85
 0    205      0     24   1 192.168.0.110     47808   14    0    1   85
 0    300      0      1   1 192.168.0.110     47808   12    1    1   85
 0    315      0      7   3 192.168.0.110     47808   14    1    1   69
 0    325      0      7   3 192.168.0.110     47808   14    1    1   65
 0    800      0      1   0 192.168.0.110     47808   12    3    1   85
 0    816      0     10   0 192.168.0.110     47808   14    3    1   85
 0    832      0      1   0 192.168.0.110     47808   12    4    1   85
 0    848      0      6   0 192.168.0.110     47808   14    4    1   85
 0   1600      0      1   0 192.168.0.110     47808   15    4    2   85
 0   1600      0      4   0 192.168.0.110     47808   16    4    3   85
 0    864      0      4   0 192.168.0.110     47808   14    4    3   85
END
```

3.4   Ethernet Port Configuration - wattcp.cfg

The wattcp.cfg file must be set up properly in order to use a TCP/IP network connection. The ProLinx Reference Guide provides detailed information on setting up this file, as well as how to load it to ProLinx modules.
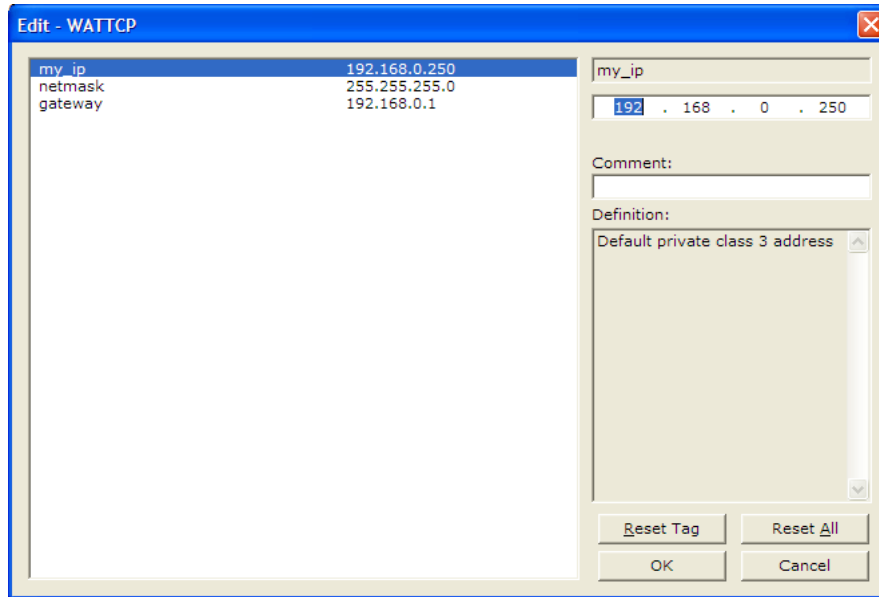
4   Client Error/Status Data

The second and most thorough troubleshooting method for debugging the operation of the BACnet/IP driver (and the module in general) is the powerful Debug port on the module which provides much more complete access to the internal operation and status of the module. Accessing the Debug capabilities of the module is accomplished easily by connecting a PC to the Debug port and loading a terminal program such as ProSoft Configuration Builder or HyperTerminal.

4.1 Client Error/Status Data

The Client connection Error and Status Data areas are discussed in this section

The error/status data table is located at a virtual address assigned by ProLinx. If this data is moved to the gateway's database using the gateway's data mapping feature, it will be available to the other protocol supported on the gateway. If it is not mapped into the gateway's database, the data will only be available through the Configuration/Debug Port.

The data area is initialized with zeros whenever the module 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).

Note: The ProLinx Reference Guide contains detailed information on accessing the contents of the following registers.

4.1.1 BACnet Client 0 Status

The following table lists the data areas that can be mapped from the virtual addresses into the gateway's internal database.

Status Register	Description
12300	Command Request Count
12301	Command Response Count
12302	Command Error Count
12303	Number of Request Packets
12304	Number of Response Packets
12305	Errors Sent
12306	Errors Received
12307	Configuration Error Word
12308	Current Error
12309	Last Error
12310 to 12409	Command List Errors (1 word register for each command)
12410 to 12499	No Valid Data

4.2   BACnet Client Command List Error Data

Each command in the command list for the BACnet Client has a reserved word value for a status/error code. This error data list can be read using the Debug/Config Port and can be placed in the gateway's internal database.

The first word in the register location defined contains the status/error code for the first command in the Client's command list. Each successive word in the command error list is associated with the next command in the list. Therefore, the size of the data area depends on the number of commands defined. The structure of the data area is displayed in the following tables.

4.2.1   BACnet Client 0 (Command List Error Data)

Internal Database Address	Offset	Description
12310	0	Command #0 Error Status
12311	1	Command #1 Error Status
12312	2	Command #2 Error Status
12313	3	Command #3 Error Status
12314	4	Command #4 Error Status
	.	.
	.	.
	.	.
12407	97	Command #97 Error Status
12408	98	Command #98 Error Status
12409	99	Command #99 Error Status

Note that the values in the Command List Error Status tables are initialized to zero (0) at power-up, cold boot and during warm boot. Refer to the following topic containing Error Codes to interpret the status/error codes present in the data area.

4.3   Error Codes

The gateway's error codes are listed in this section. Error codes returned from the command list process are stored in the command list error memory region. A word is allocated for each command in the memory area.

Use the error codes returned for each command in the list to determine the success or failure of the command. If the command fails, use the error code to determine the cause of failure.

Note: The gateway-specific error codes are returned from within the gateway and never from an attached server device.

4.3.1   BACnet Client Protocol Error Codes

These are error codes that are part of the BACnet protocol or are extended codes unique to this gateway. The standard BACnet error codes can be found in the BACnet Protocol Standard, section 21.

Standard BACnet Errors

Error Word			
MSB	**LSB**	**Group**	**Description**
0x00	E-Code*	Device Error	The LSB contains the error code for this device error.
0x01	E-Code*	Object Error	The LSB contains the error code for this object error.
0x02	E-Code*	Property Error	The LSB contains the error code for this property error.
0x03	E-Code*	Resource Error	The LSB contains the error code for this resource error.
0x04	E-Code*	Security Error	The LSB contains the error code for this security error.
0x05	E-Code*	Service Error	The LSB contains the error code for this service error.
0x06	E-Code*	VT Error	The LSB contains the error code for this virtual terminal error.
0x40	A-Code*	Abort Message	Response is an abort message. The abort code is stored in the LSB.
0X80	R-Code*	Reject Message	Response is a reject message. The rejection code is stored in the LSB.

E-Code*: Refer to the BACnet specification Section 21 for a complete listing of the error codes.
A-Code*: Refer to the BACnet specification Section 21 for a complete listing of the abort codes.
R-Code*: Refer to the BACnet specification Section 21 for a complete listing of the reject reason codes.

4.3.2 Gateway-specific Error Codes

The following error codes are specific to the gateway's BACnet driver.

Parsing Errors

Error Word			
MSB	**LSB**	**Group**	**Description**
0x20	0x0x	Context Tag Error	Error in the open or close tag for tag level 0 or the tag is missing.
0x20	0x1x	Context Tag Error	Error in the open or close tag for tag level 1 or the tag is missing.
0x20	0x2x	Context Tag Error	Error in the open or close tag for tag level 2 or the tag is missing.
0x20	0x3x	Context Tag Error	Error in the open or close tag for tag level 3 or the tag is missing.
0x20	0x4x	Context Tag Error	Error in the open or close tag for tag level 4 or the tag is missing.
0x20	0x5x	Context Tag Error	Error in the open or close tag for tag level 5 or the tag is missing.
0x20	0x04	Parse Error	Error found when parsing application data type 0x04. The most likely cause is that the length in the application tag was not set to a value of four.
0x20	0x08	Parse Error	Error found when parsing application data type 0x05. The most likely cause is that the length in the application tag was not set to a value of eight.
0x20	0x0A	Parse Error	Error found when parsing application data type 0x0A. The most likely cause is that the length in the application tag was not set to a value of four.
0x20	0x0B	Parse Error	Error found when parsing application data type 0x0B. The most likely cause is that the length in the application tag was not set to a value of four.
0x20	0x0C	Parse Error	Error found when parsing application data type 0x0C. The most likely cause is that the length in the application tag was not set to a value of four.

Network Errors

Error Word			
MSB	**LSB**	**Group**	**Description**
0xFF	0xDC	Socket	Response timeout after message poll. The server did not respond to the request in the user set response timeout period.
0xFF	0xDE	Socket	Could not allocate memory area for the UDP socket
0xFF	0xDF	Socket	Failed to open UDP socket to selected server before transmitting a request message.

Command List Parsing

Error Word

MSB	LSB	Group	Description
0xFF	0x01	Command Param	Error while reading in a command. Not enough parameters are present in the current command record to construct a command.
0xFF	0x02	Command Param	Invalid type code entered for the enable field. Only values of 0 to 2 are accepted.
0xFF	0x03	Command Param	Count value in command set to zero. This parameter must be set to a value greater than or equal to 1 and less than 25.
0xFF	0x04	Command Param	Invalid swap code entered for command. Values of 0 to 3 are only those accepted by the program.
0xFF	0x05	Command Param	Invalid function code entered. This parameter must have one of the following values: 12, 14, 15 or 16.
0xFF	0x06	Command Param	Invalid datatype selected for the command. This parameter must be set to one of the following values: 0=analog input, 1=analog output, 3=binary input or 4=binary output.
0xFF	0x07	Command Param	Invalid property value for the command. Refer to the property list for all available properties supported by the program. This does not imply that all servers will contain this property for every object type.

5 Reference

In This Chapter

5.1 Command Configuration Form

This section contains a form that can be used to design the command list for an application.

BACnet Command List Form

Gateway Information Data ←					→ Device Information Data					
1	2	3	4	5	6	7	8	9	10	11
Enable Code	Internal Address	Poll Interval Time	Point Count	Swap Code	IP Address	Service Port	BACnet Function	Data Type	BACnet Address	Property

6   Support, Service & Warranty

In This Chapter

Contacting 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 and any unusual behavior
3 Configuration/Debug status information
4 LED patterns
5 Details about the serial, Ethernet or fieldbus devices interfaced to the module, if any.

Note: *For technical support calls within the United States, an after-hours answering system allows 24-hour/7-days-a-week pager access to one of our qualified Technical and/or Application Support Engineers. Detailed contact information for all our worldwide locations is available on the following page.*

Internet	Web Site: www.prosoft-technology.com/support E-mail address: support@prosoft-technology.com
Asia Pacific (location in Malaysia)	Tel: +603.7724.2080, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Asia Pacific (location in China)	Tel: +86.21.5187.7337 x888, E-mail: asiapc@prosoft-technology.com Languages spoken include: Chinese, English
Europe (location in Toulouse, France)	Tel: +33 (0) 5.34.36.87.20, E-mail: support.EMEA@prosoft-technology.com Languages spoken include: French, English
Europe (location in Dubai, UAE)	Tel: +971-4-214-6911, E-mail: mea@prosoft-technology.com Languages spoken include: English, Hindi
North America (location in California)	Tel: +1.661.716.5100, E-mail: support@prosoft-technology.com Languages spoken include: English, Spanish
Latin America (Oficina Regional)	Tel: +1-281-2989109, E-Mail: latinam@prosoft-technology.com Languages spoken include: Spanish, English
Latin America (location in Puebla, Mexico)	Tel: +52-222-3-99-6565, E-mail: soporte@prosoft-technology.com Languages spoken include: Spanish
Brasil (location in Sao Paulo)	Tel: +55-11-5083-3776, E-mail: brasil@prosoft-technology.com Languages spoken include: Portuguese, English

6.1 Return Material Authorization (RMA) Policies and Conditions

The following Return Material Authorization (RMA) Policies and Conditions (collectively, "RMA Policies") apply to any returned product. These RMA Policies are subject to change by ProSoft Technology, Inc., without notice. For warranty information, see Limited Warranty (page 47). In the event of any inconsistency between the RMA Policies and the Warranty, the Warranty shall govern.

6.1.1 Returning Any Product

a) In order to return a Product for repair, exchange, or otherwise, the Customer must obtain a Return Material Authorization (RMA) number from ProSoft Technology and comply with ProSoft Technology 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 43). 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 Technology, 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 Technology using a shipment method other than that specified by ProSoft Technology, 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.

6.1.2 Returning Units Under Warranty

A Technical Support Engineer must approve the return of Product under ProSoft Technology'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 Technology 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 Technology 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 Technology to repair the unit by providing a purchase order for 30% of the current list price plus freight charges, duties and taxes as applicable.

6.1.3 Returning Units Out of Warranty

a) Customer sends unit in for evaluation to location specified by ProSoft Technology, 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:

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

6.2 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 Technology, Incorporated (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.

6.2.1 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 warranteed in the terms specified above for new Product, provided said warranty will be for the period remaining on the original new equipment warranty or, if the original warranty is no longer in effect, for a period of 90 days from the date of repair.

6.2.2 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.

6.2.3 Disclaimer Regarding High Risk Activities

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

6.2.4 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.

6.2.5 Disclaimer of all Other Warranties

The Warranty set forth in What Is Covered By This Warranty (page 47) 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.

6.2.6 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.

6.2.7 Time Limit for Bringing Suit

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

6.2.8 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.

6.2.9 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.

6.2.10 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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