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ProLinx[®]
MBP
ProLinx Gateway
Modbus Plus

May 12, 2011

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MBP Protocol Manual

May 12, 2011

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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:

WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIV. 2;

WARNING - EXPLOSION HAZARD - WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES

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

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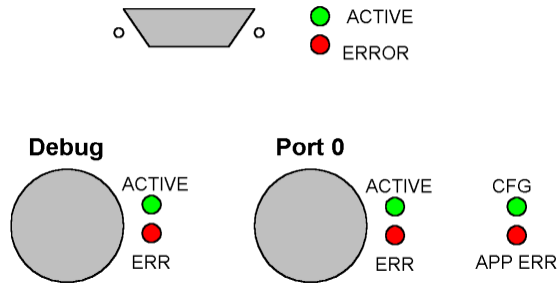
1 Functional Overview

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1.1 Modbus Plus Port

The ProLinx module supports the Modbus Plus protocol on the DB-9 Male Modbus Plus port. The Modbus port is configurable.

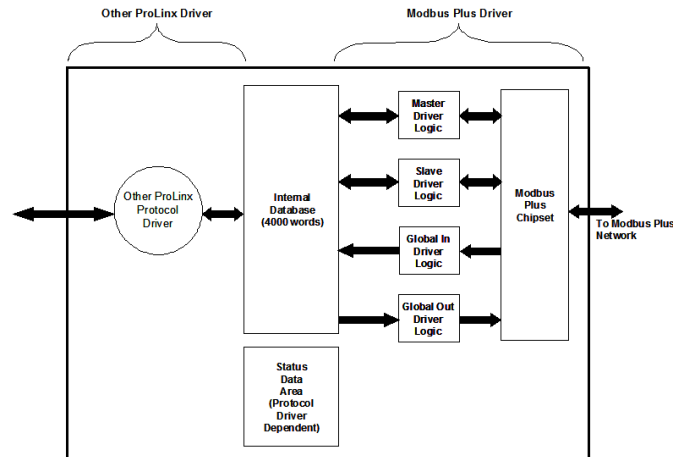


The Modbus Plus port can be used to continuously interface with Modbus Plus devices over a network. The port supports 200 user-defined commands that determine the Modbus Plus messages issued to each individual unit attached to the network.

1.2 Module Internal Database

The internal database is central to the functionality of the module. This database is shared between all the ports on the module 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 Modbus Plus port, status and error information generated by the module can also be mapped into the internal database.



1.2.1 Modbus Plus Port Access to Database

The Modbus Plus driver uses the database in two ways:

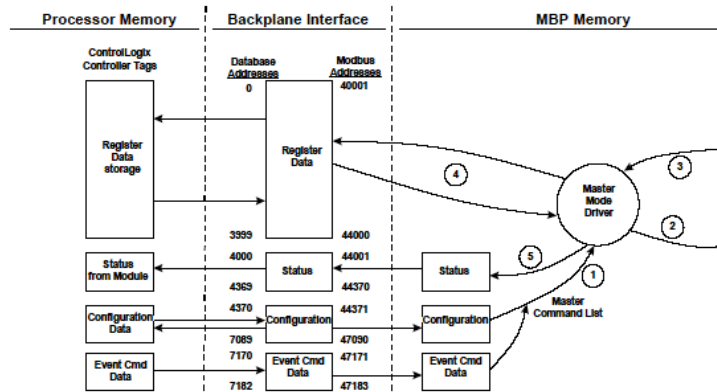
- 1 A read command issued to a Modbus Plus device by the driver will return the foreign device data into the internal database.
- 2 A write command issued to a Modbus Plus device by the driver will use the data in the internal database to write to the foreign device.

External Modbus Plus devices can monitor and control data in this database through the Modbus Plus Port. Setup of the port only requires appropriate values in the CFG file.

1.2.2 Modbus Plus Master Access to Database

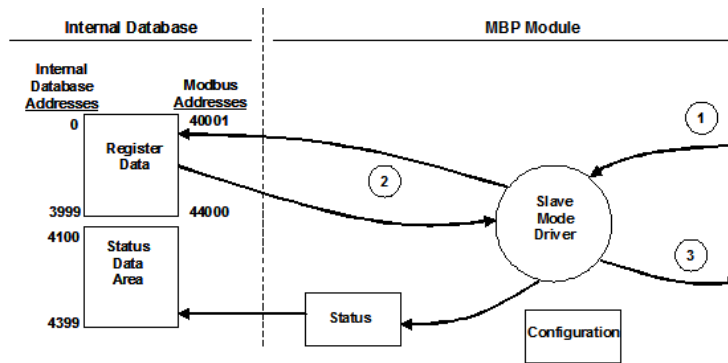
The Master functionality exchanges data between MBP module's internal database and data tables established in one or more Modicon processors or other Modbus Plus slave devices. The command list, defined in the user configuration, defines what data to transfer between the module and each of the slaves on the network. No ladder logic is required in the processor for master functionality, except to assure that sufficient data memory exists.

The following illustration describes the flow of data between the Modbus Plus devices and the internal database.



1.2.3 Modbus Plus Slave Access to Database

The MBP module supports slave functionality using the Modbus Plus protocol. Services supported in the module permit Modbus Plus master applications (that is, HMI software applications, Modicon processors, and so on) to read from and write to the module's database. This section discusses the requirements for attaching to the module using several Modbus Plus master applications.



There is no configuration of the MBP module required to implement Slave functionality other than setting up the network and database parameters in the user configuration file.

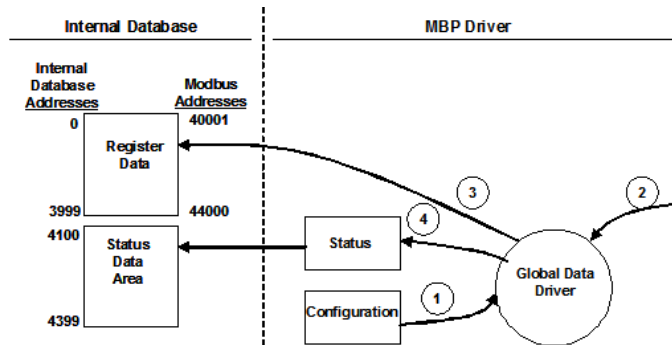
The internal database of the MBP module is used as the source (read requests) and destination (write requests) for requests from remote masters. Access to the database depends on the command type executed to interface with the database. The following table defines the relationship of the module's internal database to the addresses required in the instructions:

Database Address	Modbus Address
0	40001
1000	41001
2000	42001
3000	43001
3999	44000

Before attempting to use the module on a network, verify that the MBP module is correctly configured and connected to the network. Use ProSoft Configuration Builder to confirm proper configuration of the module, and to transfer the configuration files to and from the module.

1.2.4 Modbus Plus Global In Access to Database

The MBP module actively exchanges global in (32 words max. per node) and global out (32 words max.) data on the Modbus Plus network. Priority is given to these data types to provide a high speed mechanism for the transfer of control data.

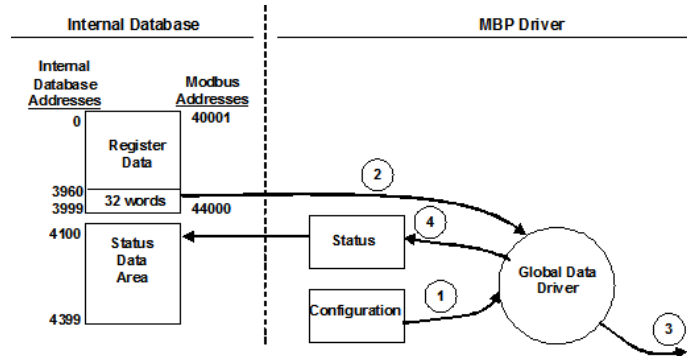


- 1 The Global In driver reads configuration data from the configuration file. This data includes the Device Definition File that includes the node address data, the number of Global In words and where to put this data in the module's internal database.
- 2 During the configuration process, the Input File Map is updated out of the configuration file. The Input File Map informs the module which data registers in the internal database to feed into the module's input image. This operational mode is independent of the Global In mode but is commonly used to transfer global input data from other nodes directly to the processor.
- 3 The Global In Driver monitors Global In data from other nodes on the network. If the data matches one of the node addresses in the Device Definition File and is qualified in terms of length, and so on. the data is accepted.
- 4 After the data is accepted, the data is transferred into the module's internal database. The user via configuration in the Device Definition File determines the location of the data.
- 5 As data is read from the other nodes on the network into the module, an asynchronous process moves the data from the database into the module's input image. The values to be moved are user determined via configuration of the Input File Map. Up to 32 words of data can be transferred in this fashion.
- 6 Status is monitored for each device in the Device Definition File that is expected to return Global In data to the module. This status is updated on an on-going basis and is transferred to the Modbus Plus network for processing. This data includes the node status value and a counter incremented each time global input data is received.

1.2.5 Modbus Plus Global Out Access to Database

When the MBP module's Global Output capability is enabled, up to 32 words of data can be transferred onto the Modbus Plus network by the module. This data, typically reserved for high-speed data such as for application control data, is transmitted each time the module receives the network token.

The number of words transferred to the Modbus Plus network is user determined through the Module Configuration Block. The following flow chart and associated table describe the flow of data into and out of the module.



- 1 The Global Output driver reads configuration data from the configuration file. This data consists of the number of words to be transmitted by the module each time the module has the token. In addition, timing data on the update rate for the Global Out transmission is also obtained from the configuration data.
- 2 The Global Out data image is updated through the module's output image. Based on the update rate configured by the user, the Global Out image in the Modbus Plus chipset will also be updated.
- 3 The Global Output driver in the Modbus Plus chipset will transmit the Global Out data each time the token is received by the module.
- 4 The Global Output driver status is updated in the module's database.

To enable the Global Output Mode, set the Global Output Length parameter to a value between 1 and 32. To disable this feature, set the parameter to a value of zero.

1.3 Single Port With Dual Media-Redundant Connector Operation

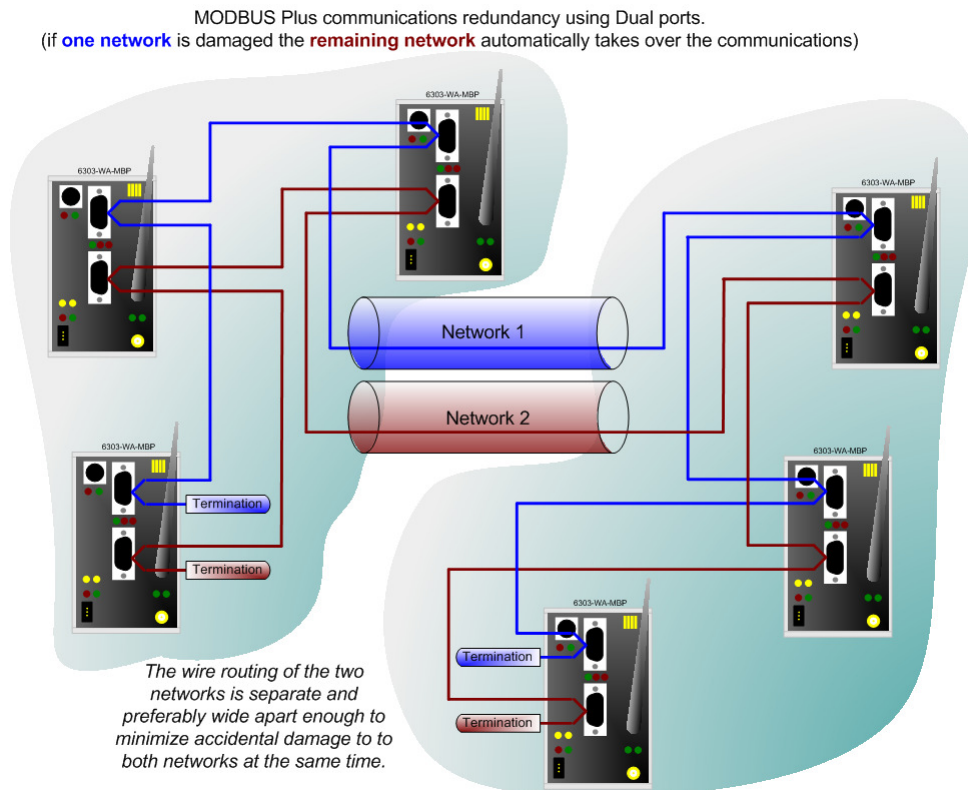
Some Modbus Plus modules are equipped with a second, redundant Modbus Plus Connector. A Dual Connector Modbus Plus network is implemented in the following way:

- The primary network connects to Connector 1 on all modules.
- The secondary (backup) network connects to Connector 2 on all modules.

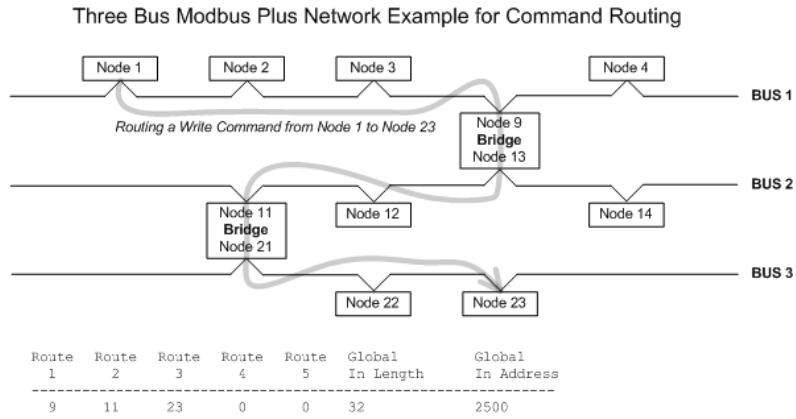
If the primary network connected through Connector 1 fails (for example, if a cable is cut or disconnected), the network connected through Connector 2 will become active, maintaining the connection between devices.

Important: All Modbus Plus nodes on a network must be equipped with dual connectors in order to implement redundant connector operation.

Refer to the following illustration for an example of redundant connector operation on a Modbus Plus network.



1.4 Command Routing



2 Port Physical and Protocol Specifications

In This Chapter

- ❖ Functional Specifications - Modbus Plus..... 18
- ❖ General Specifications - ProLinx 19
- ❖ Hardware Specifications..... 20

2.1 Functional Specifications - Modbus Plus

The Modbus Plus (MBP) protocol driver operates as a single, peer-to-peer Modbus Plus port with dual media-redundant connectors. The two connectors cannot be configured as separate MBP ports. They are for physical cabling redundancy only.

General Parameters

Modbus Function Codes	3: Read Multiple Data Registers (MSTR 2) 16: Write Multiple Data Register (MSTR 1) Global data read (32 words per node max.) Global data write (32 words per node max.)
-----------------------	--

Address Scope	1 to 64
---------------	---------

Modbus Plus Functioning as a Master

Command List	Up to 200 commands on the master port, fully configurable for function, slave address, register to/from addressing and word count
--------------	---

Polling of command list	Configurable polling of command list, including continuous read or write commands and write on change of data (Function Code 16 Write command only)"
-------------------------	--

Modbus Plus Functioning as a Slave

Node address	1 to 64 (software selectable)
--------------	-------------------------------

2.2 General Specifications - ProLinx

The gateway is enclosed in a sturdy extruded aluminum case which uses DIN-rail-mounting.

Hardware	One (1) Ethernet port for Modbus TCP/IP and IEC 61850 communication
Software	NetView Configuration Software for configuration and diagnostic viewing NetView Tag Monitor for viewing live tag data ProSoft Discovery Service for setting a temporary IP address
Configuration Storage	Configuration settings saved on a removable 1GB industrial SD Card NetView Configuration Software saves configuration information to an offline file.

2.3 Hardware Specifications

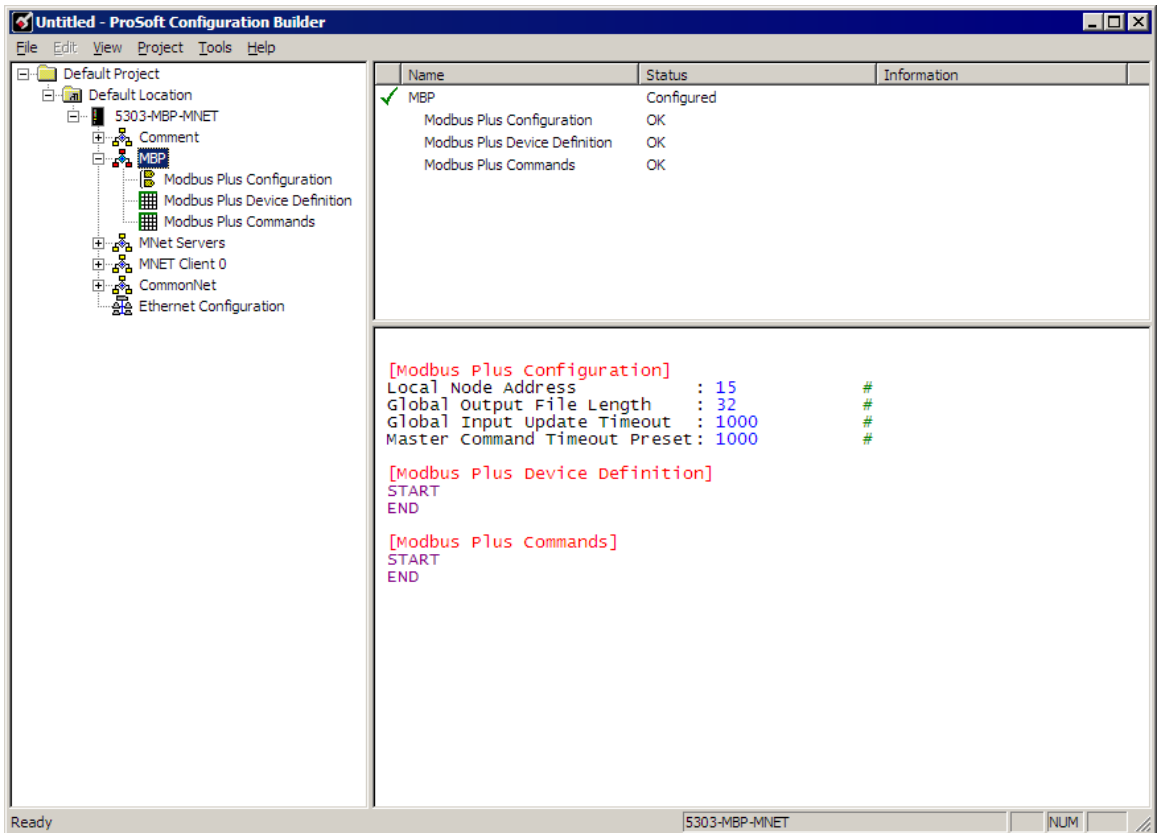
Specification	Description
Power Supply	24 Vdc nominal 18 Vdc to 32 Vdc allowed Positive, Negative, GND Terminals 2.5 mm screwdriver blade
Current Load	500 mA maximum @ 32 Vdc maximum
Operating Temperature	-4°F to 122°F (-20°C to 50°C)
Storage Temperature	-40°F to 185°F (-40°C to 85°C)
Relative Humidity	5% to 95% (with no 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 modules)	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 modules only)	10 Base-T half-duplex RJ45 Connector Link LED and Activity LED indicators Electrical Isolation 1500 Vrms at 50 Hz to 60 Hz for 60 seconds, 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 modules only)	RS-232/422/485 RS-232 handshaking configurable RS-422/485 DB-9 to Screw Terminal Adapter Note: The number of serial application ports depends on the module type, and the combination of protocols.
Serial Port Isolation	2500 Vrms 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 2.5 mm screwdriver CD (docs and configuration utility) RS-422/485 DB-9 to Screw Terminal Adapter for each serial application port (serial protocols only)

3 MBP Protocol Configuration

In This Chapter

- ❖ [Modbus Plus Configuration] 22
- ❖ [Modbus Plus Device Definition]..... 24
- ❖ [Modbus Plus Commands] 26

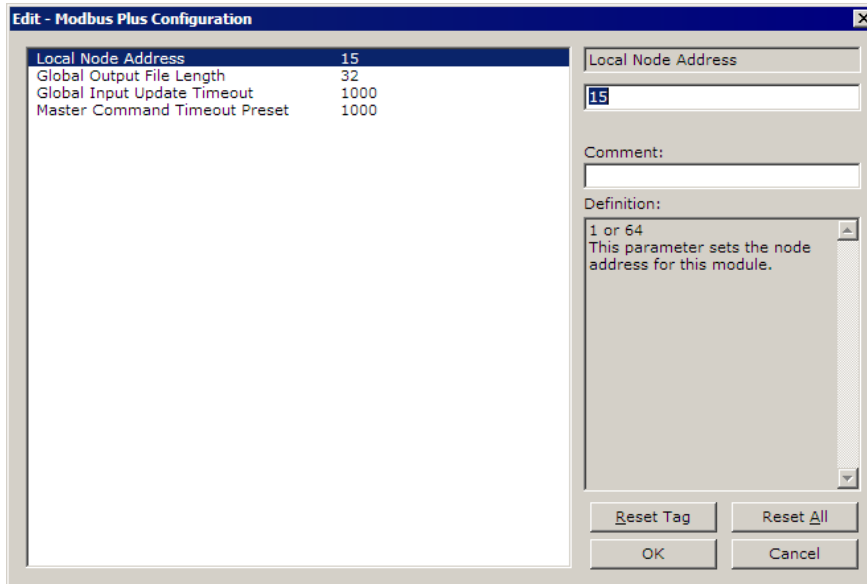
The following illustration shows typical examples of the Modbus Plus Configuration, Modbus Plus Device Definition, and Modbus Plus Commands sections for the MBP protocol.



3.1 [Modbus Plus Configuration]

The [Modbus Plus Configuration] section of the **CFG** file sets general characteristics of the Modbus Plus port.

Example



Parameter Description

The following section lists the parameters.

3.1.1 Local Node Address

1 to 64

This value defines the Modbus Plus Node Address for the module. A valid node address must be entered for the module to operate, and the address must be unique on the network. Valid values are between 1 and 64, inclusive.

3.1.2 Global Output File Length

0 to 32

This value defines the number of Global Output words to be placed on the Modbus Plus network. If the value is set to 0, no global output data will be placed on the network. Values of 1 to 32 represent the number of words to be used by the module. This data must be transferred from the processor to the module.

Important: ProLinx Modbus Plus modules use memory addresses 3960 to 3991. If you plan to use Global Output Data, you must not use this memory area for normal data transfer, otherwise data may be overwritten and unpredictable results may occur.

3.1.3 Global Input Update Timeout

0 to 65535

This value defines the timeout period (0 to 65535 milliseconds) for receiving Global Input Data from other nodes on the network. After the timeout period has been exceeded, the Timeout Error will be returned in the Global In Update Status data set. A value of 0 will result in the default value of 1000 milliseconds (1 second).

3.1.4 Master Command Timeout Preset

0 to 65535

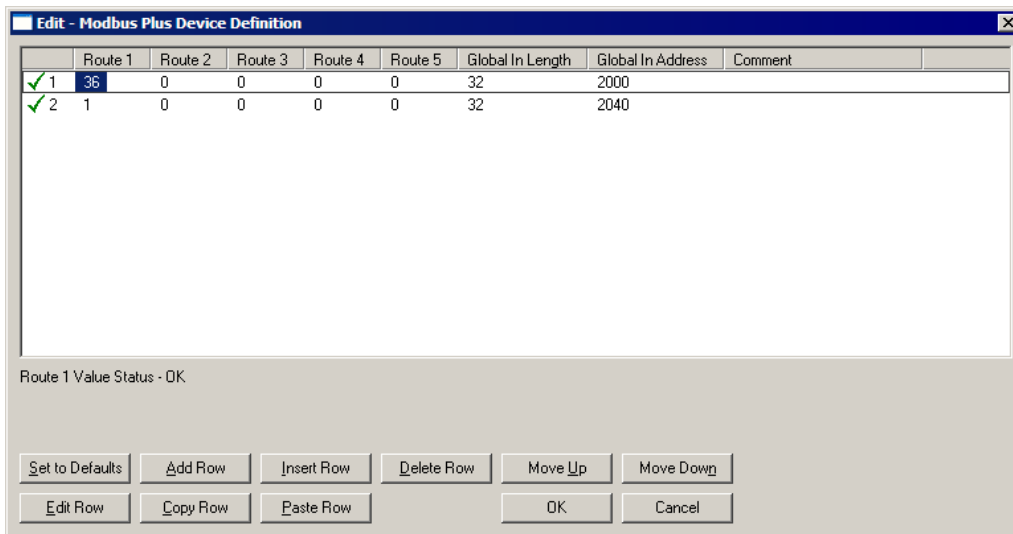
This parameter defines the number of milliseconds (0 to 65535) to wait for a response to a master command issued by the module on the network. If a timeout condition exists for a command, it will be reflected in the Master Command List Status data area. A value of 0 will result in a value of 1000 (1 second) for the parameter.

3.2 [Modbus Plus Device Definition]

The Modbus Plus Device Definition portion of the file represents the roadmap to get data from one destination to the next. If the Modbus Plus is going to be configured to operate in the Global In and/or Master Command modes, the Modbus Plus Device Definition file must be set up. This file allows the user to configure specific operating parameters for each device on the Modbus Plus network.

Each Modbus Plus device on the network must be defined in the [Modbus Plus Device Definition] section of the configuration file. The table starts after the START label and continues until the END label.

Example



Parameter Description

The following section lists the parameters.

3.2.1 Route Values

1 to 64

The Routing Path is required by the Modbus Plus module and the Modbus Plus chipset to address specific nodes on the network. The routing path allows the module to support the addressing of nodes separated by Bridge Multiplexers, and to define Data Slave input paths for devices requiring path specifications (that is, other ModConnect Program devices). Up to 64 devices may be defined in this section.

Note the following when entering addresses:

Programmable Controllers: When addressing these devices, the last non-zero byte in the routing specifies the network node address.

Example: 6 0 0 0 0

Addresses a PLC at Node Address 6.

ModConnect Type Devices: When addressing these devices, including other MBP modules, the next-to-last non-zero value specifies the Slave Data Path to use (1 to 64). An incorrect value in the Slave Data Path will cause communications to fail.

Example: 6 1 0 0 0

Addresses Node Address 6 through Slave Data Path 1.

3.2.2 Global In Length

0 to 32

The Global Input Length defines how many words of Global Input Data the module will be expecting from each of the network nodes. If less data is returned, an error code is returned to the module status table and the data is rejected.

Conversely, if more data is returned, it is accepted and no error is flagged.

Valid values range from 0 to 32. Note that a value of 0 tells the MBP module not to request Global Data from a node.

3.2.3 Global In Address

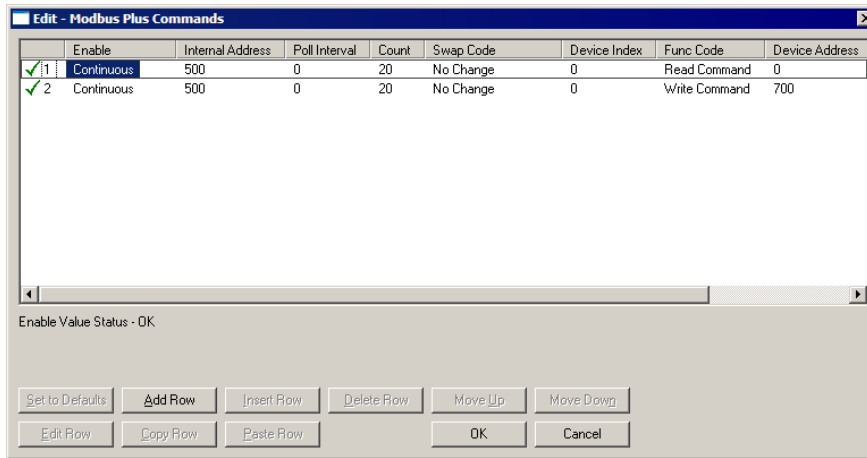
0 to 3999

The Global Input Address tells the module where to place the Global Input Data received from the network nodes into the module's database. Valid locations are from 0 to 3999.

3.3 [Modbus Plus Commands]

The [Modbus Plus Commands] sections defines the commands to issue from the module to other devices on the Modbus Plus network. Commands are entered in the columns between the START and END labels. This section may contain up to 200 commands.

Example



Parameter Description

The following section lists the parameters.

3.3.1 Enable

This field defines how to execute the command:

- Disable (0): disables the command. The command will not execute during the normal polling sequence.
- Continuous (1): executes the command during each scan of the command list if the Poll Interval Time is set to zero (0). If the Poll Interval Time is set, the command will be executed when the interval timer expires.
- Event Command (2): The command executes only if the internal data associated with the command changes. This value is only valid for WRITE commands.

3.3.2 Internal Address

0 to 3999

This field specifies the internal database register to be associated with the command.

- If the command is a read function, the data read from the slave device will be placed starting at the register value entered in this field.
- If the command is a write function, the data written to the slave device will be sourced from the address specified.

3.3.3 Poll Interval

0 to 65535

This parameter specifies the minimum interval to execute continuous commands (Enable code of 1). The parameter is entered in units of seconds. Therefore, if a value of 10 is entered for a command, the command will execute no more frequently than every 10 seconds.

3.3.4 Count

1 to 125

This parameter specifies the number of registers to associate with the command. Functions 5 and 6 ignore this field as they only apply to a single data point.

For functions 3 and 16, this parameter sets the number of registers to be associated with the command.

3.3.5 Swap Code

NONE

SWAP WORDS

SWAP WORDS & BYTES

SWAP BYTES

This parameter defines if and how the order of bytes in data received or sent is to be rearranged. This option exists to allow for the fact that different manufacturers store and transmit multi-byte data in different combinations. This parameter is helpful when dealing with floating-point or other multi-byte values, as there is no one standard method of storing these data types. The parameter can be set to rearrange the byte order of data received or sent into an order more useful or convenient for other applications. The following table defines the valid *Swap Code* values and the effect they have on the byte-order of the data.

Swap Code	Description
NONE	No change is made in the byte ordering (1234 = 1234)
SWAP WORDS	The words are swapped (1234=3412)
SWAP WORDS & BYTES	The words are swapped, then the bytes in each word are swapped (1234=4321)
SWAP BYTES	The bytes in each word are swapped (1234=2143)

These swap operations affect 4-byte (or 2-word) groups of data. Therefore, data swapping using these *Swap Codes* should be done only when using an even number of words, such as when 32-bit integer or floating-point data is involved.

3.3.6 Device Index

The Master Driver uses this value to reference the Device Definition File. The Master Driver obtains the Route Path data from the [Modbus Plus Device Definition] section. A value of 0 corresponds to the first device defined in the Device Definition Table.

3.3.7 Function Code

3, 16

This parameter specifies the Modbus function to be executed by the command. A value of 3 = Read Command (Type 2). A value of 16 = Write Command (Type 1).

3.3.8 Device Address

This parameter specifies the starting Modbus register or digital point address to be considered by the command in the Modbus slave device. Refer to the documentation of each Modbus slave device on the network for their register address assignments.

4 Communication Port Cables

In This Chapter

- ❖ Modbus Plus Connections..... 30

This section contains information on the cable and pin assignments for the ProLinx module's serial ports (RS-232/422/485) and the application port. The ProLinx module will come with one to five serial ports, depending on the configuration purchased. In all cases, the protocol serial ports will have the same pin-outs.

Example: The 5602-RIO-MCM4 module contains five serial communication ports: four configurable Modbus ports and a Configuration/ Debug port. The 5601-RIO-MCM module contains two serial communication ports: one configurable Modbus port and a Configuration/Debug port.

Each serial port is a Mini-DIN physical connection. A 6-inch "Mini-DIN to DB-9M" cable is provided for each active protocol port. The DB-9M provides connections for RS-232, RS-422 and RS-485. The diagrams in the following topics detail the pin assignments for several possible physical connections.

4.1 Modbus Plus Connections

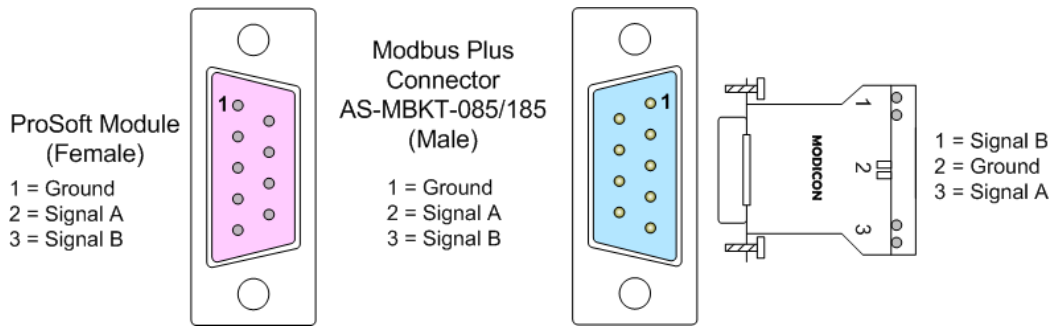
The MBP module has two physical Modbus Plus connectors for media Redundancy with DB-9 Female plugs located on the front of the module.

Modicon provides two different Modbus Plus connectors to ease installation. These connectors are as follows:

Modicon Part Number	Description
AS-MBKT-085	Inline Connector
AS-MBKT-185	Terminating Connector

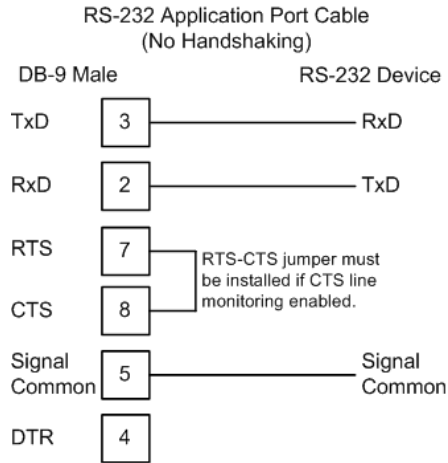
The actual cable installation and the wiring of the cable to the connectors is fully documented in the Modicon publication *Modicon Modbus Plus Network Planning and Installation Guide - Pub No. GM-Modbus Plus L-001*.

If the Modicon connectors are not available during installation, the following pin out applies to the DB-9 Modbus Plus port connections:



4.1.1 Port 0: RS-232 - Null Modem (without Hardware Handshaking)

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



Note: If the port is configured with the "Use CTS Line" set to 'Y', then a jumper is required between the RTS and the CTS line on the module connection. Refer to the *ProLinx Reference Guide* for more information.

5 LED Indicators

Troubleshooting the operation of the MBP ports can be performed using several methods.

The first and quickest is to scan the LEDs on the module 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 other LEDs can be found in the *ProLinx Reference Guide* or in the product User Manual.

5.1 LEDs for the Modbus Plus Port

The following table lists LED status descriptions of the Modbus Plus module.

LED	Status	Indication
ACT (Green)	6 flashes per second.	The Modbus Plus is working normally in that it is successfully receiving and passing the token. All nodes on the link should be flashing in this pattern.
	1 flash per second	This node is off-line after just being powered up, or after exiting the four flashes per second mode. In this state, the node monitors the network and builds a table of active nodes and token-holding nodes. It remains in this state for 5 seconds, then attempts to go to its normal operating state.
	2 flashes, then OFF for 2 seconds	The node is hearing the token being passed among other nodes, but is never receiving the token. Check the network for an open circuit or defective termination.
	3 flashes, then off for 1.7 seconds	The node is not hearing any other nodes. It is periodically claiming the token but finding no other node to pass it to. Check the network for an open circuit or a defective termination.
	4 flashes, then OFF for 1.4 seconds	The node has heard a valid message from another node that is using the same address as this node. The node remains in this state as long as it continues to hear the duplicate address. If the duplicate address is not heard for 5 seconds, the node then changes to the pattern of one flash every second.
ERR (RED)	Off	Normal State: When the error LED is off and the port is actively transferring data, there are no communication errors.
	Blink	If the LED blinks momentarily, a message error has been detected on the cable path.
	On	If the LED is on steady, a hard fault has occurred either in the cable or in a node device connected to the cable. Also, the LED will be on steady if none of the commands in the Master Command list are successfully being completed.

6 Serial Port Modbus Error and Status Data

In This Chapter

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The second and most thorough troubleshooting method for debugging the operation of the MBP 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.

6.1 Viewing Error and Status Data

The following topics list the register addresses that contain error and status data. Use the Database View Option from the ProLinx Main Menu to view the contents of each register.

Each driver maintains its error and status data in virtual database registers. In order for a protocol driver to use this data, it must be mapped into the module's internal database registers (0 to 3999). Data Map Facility describes this process. The *ProLinx Reference Guide* provides complete information on viewing registers.

6.2 Global Input Update Status

The following table lists the status registers that contain global input status information for each MBP device. The global input update status register range is 4100 to 4169. Registers 4164 to 4169 are reserved as spares.

Status Register	Description
4100	Global In Update Stat - Device #1
4101	Global In Update Stat - Device #2
4102	Global In Update Stat - Device #3
4103	Global In Update Stat - Device #4
4104	Global In Update Stat - Device #5
-	----
4162	Global In Update Stat - Device #63
4163	Global In Update Stat - Device #64
4164	Spare
4165	Spare
4166	Spare
4167	Spare
4168	Spare
4169	Spare

6.2.1 Global In Status Code Definitions

Any of the following status codes may be present in any of the Global In Update Stat registers listed in the previous table. The following table describes these codes:

Status Code	Description
0x01	Updating - All Normal
0x02	
0x04	
0x08	Global Update Timeout
0x10	Global Data Not Configured
0x20	
0x40	Invalid Global Data Length
0x80	

6.3 Master Command Status

The following table lists the registers that contain Master Command Status error codes for each device. The register address range is 4170 to 4369.

Status Register	Description
4170	Master Command Status: #1
4171	Master Command Status: #2
4172	Master Command Status: #3
4173	Master Command Status: #4
4174	Master Command Status: #5
-	----
4368	Master Command Status: #199
4369	Master Command Status: #200

6.3.1 Master Command Status Error Code Definitions

The following error codes may be present in the Master Command Status error code registers listed in the previous table. The following table lists each of the codes and associated definition.

High Byte	Low Byte	Description
0x00		Normal: Driver will reset when processing commands.
0x01		Command has completed successfully.
0x02		Routing Errors
	0x01	No response received: Is addressed unit online?
	0x02	Program access denied.
	0x04	Exception response received.
	0x08	Invalid node type in routing path.
	0x10	Slave rejected the Modbus command: Invalid input path?
	0x20	Initiated transaction forgotten by slave.
	0x40	Unexpected master output path received.
	0x80	Unexpected response received.
0x04		Configuration Errors
	0x01	Invalid configuration for command.
	0x02	Invalid command type: 1=Write, 2=Read, All other errors.
	0x04	
	0x08	
	0x10	
	0x20	
	0x40	
	0x80	

6.4 Miscellaneous Module Status

The following table lists the registers that contain miscellaneous module status error codes. Miscellaneous module status codes are contained in register addresses 4370 to 4399.

Status Register	Description
4370	Module Status - Software Reset Response
4371	Peer Status
4372	Token Pass Counter
4373	Token Rotation Time
4374-H	Communication Failed Error Counter
4374-L	Communication Retry Counter
4375-H	No Response Received Error Counter
4375-L	Good Received Packet Success Counter
4376-H	Unexpected Path Error Counter
4376-L	Exception Response Received Error Counter
4377	Data Master Output Path 1 & 2 Counter
4378	Data Master Output Path 3 & 4 Counter
4379	Data Master Output Path 5 & 6 Counter
4380	Data Master Output Path 7 & 8 Counter
4381	Data Slave Output Path 1 & 2 Counter
4382	Data Slave Output Path 3 & 4 Counter
4383	Data Slave Output Path 5 & 6 Counter
4384	Data Slave Output Path 7 & 8 Counter
4385	Global Out Update Status
4386	Global Out Update Counter
4387	Data Transfer Read Counter
4388	Data Transfer Write Counter
4389	Data Parse Counter
4390	Spare
4391	Spare
4392	Data Transfer Error Counter
4393	Product ID
4394	Product ID
4395	Revision Level
4396	Batch Number
4397	MBP Update Processing Time
4398	Global In Update Time
4399	Global Out Update Time

6.4.1 Module Status Values

The following table lists the module status values that may be found in register 4370:

Normal Operation Codes	Description
0x00	Interface is operational.
Interface Crash Codes	
0x01	2-second Interface Timeout
0x02	Bad Interface Opcode
0x03	Interface Data Error
0x04	Interface Test Error
0x05	Interface X-Fer Done Error
0x06	Bad Interface Path
0x07	Bad Interface State
0x08	Bad Interface Length
0x09	Global Data Length Error
0x0A	Global Data Address Error
0x0B	Global Data Not Present
Fatal Crash Codes	
0x81	PROM Checksum Error
0x82	Internal RAM Data Test Error
0x83	External RAM Data Test Error
0x84	External RAM Address Test Error
0x85	Bad Confidence Test Index
0x86	External Int 0 Event Error
0x87	External Int 1 Event Error
0x88	DMA Int 0 Event Error
0x89	Comm. Int Event Error
0x8A	XMIT-No Good Event Error
0x8B	No Response Timeout MAC State
0x8C	No Response Timeout MAC Idle
0x8D	Receive OK MAC State
0x8E	Transmit OK MAC State
0x8F	No Receive Buffer Free
0x90	Bad Input Transfer Length
0x91	Reserved Rev Buffer Error
0x92	Bad Trans Control State
0x93	Bad Word Request Bit
0x94	Node Queue Overflow
0x95	Bad Data Queue Error
0x96	Empty Data Path Error
0x97	Bad Path Search Index
0x98	Bad Data Slave Path

6.4.2 Peer Status Codes

The following status codes can appear in register 4371.

Status Code	Description
0	Updating: All Normal
32	Normal Link Operation
64	Never Getting Token
96	Sole Station
128	Duplicate Station

6.4.3 Global Out Update Status

The following status codes can appear in register 4385.

Status Code	Description
0x01	Updating All OK
0x02	Not Assigned
0x04	Not Assigned
0x08	Global Update Timeout (not transmitted in 500 milliseconds)
0x10	Global Data Not Configured (length set to zero)
0x20	Not Assigned
0x40	Invalid Global Data Length (Length > 32 words)
0x80	Not Assigned.

7 Support, Service & Warranty

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- ❖ LIMITED WARRANTY..... 47

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

7.1 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.

7.1.1 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.

7.1.2 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.

7.1.3 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:

ScanPort Adapters

- 1500 - All
- 1550 - Can be repaired only if defect is the power supply
- 1560 - Can be repaired only if defect is the power supply

inRAx Modules

- 3150 - All
- 3170 - All
- 3250
- 3300
- 3350
- 3600 - All
- 3700
- 3750
- 3800-MNET

ProLinx Standalone Gateways

- 4xxx - All (No hardware available to do repairs)

7.2 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.

7.2.1 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 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.

7.2.2 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.

7.2.3 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 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.

7.2.4 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.

7.2.5 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.

7.2.6 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.

7.2.7 Time Limit for Bringing Suit

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

7.2.8 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.

7.2.9 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.

7.2.10 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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