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## NETWORK GATEWAY SERIES

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# ICC

INDUSTRIAL CONTROL COMMUNICATIONS, INC.

Collaborative Automation  
Partner Program



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# MBP-100

## MODBUS PLUS

## MULTIPROTOCOL NETWORK GATEWAY

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February 2008  
ICC #10498-3.100-000



## Introduction

Thank you for purchasing the ICC MBP-100 Modbus Plus Multiprotocol Network Gateway. The MBP-100 allows information to be transferred seamlessly among many different fieldbus networks with minimal configuration requirements. The MBP-100 provides one Modbus Plus port, one RS485 port, one RS232 port, and three common serial ports for direct connectivity to Toshiba 7-series, 9-series, 11-series or VF-nC1 Adjustable Speed Drives (ASDs). These various communication ports operate independently, and are configurable along with the unit's internal point database via a serial console interface.

The gateway currently provides support for the following protocols:

- ▶ Modbus RTU (RS485 master & slave)
- ▶ Modbus RTU (RS232 master & slave)
- ▶ Toshiba ASD (common serial master)
- ▶ Toshiba ASD (RS485 master)
- ▶ Mitsubishi 500-series & 700-series ASD (RS485 master)
- ▶ Modbus Plus (host)

New network drivers are continuously being added, and can be downloaded for free from our web site.

Before using the MBP-100 network gateway, please familiarize yourself with the product and be sure to thoroughly read the instructions and precautions contained in this manual. In addition, please make sure that this instruction manual is delivered to the end user of the MBP-100, and keep this instruction manual in a safe place for future reference or unit inspection.

This instruction manual describes the device specifications, wiring methods, maintenance procedures, supported functions, usage methods and firmware update procedure for the MBP-100 network gateway.

For the latest information, support, firmware releases or product configuration files, please visit <http://www.iccdesigns.com>.

Before continuing, please take a moment to ensure that you have received all materials shipped with your kit. These items are:

- MBP-100 gateway
- 2 meter DB9-RJ45 RS232 port cable (part number 10425)
- Documentation CD-ROM



**MBP-100 Modbus Plus Multiprotocol Network Gateway  
User's Manual**

Part Number 10498-3.100-000

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INDUSTRIAL CONTROL COMMUNICATIONS, INC.'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE-SUPPORT DEVICES OR SYSTEMS. Life-support devices or systems are devices or systems intended to sustain life, and whose failure to perform, when properly used in accordance with instructions for use provided in the labeling and user's manual, can be reasonably expected to result in significant injury.

No complex software or hardware system is perfect. Bugs may always be present in a system of any size. In order to prevent danger to life or property, it is the responsibility of the system designer to incorporate redundant protective mechanisms appropriate to the risk involved.

## Usage Precautions

### *Operating Environment*

- Please use the gateway only when the ambient temperature of the environment into which the unit is installed is within the following specified temperature limits:  
Operation: -10 ~ +50°C (+14 ~ +122°F)  
Storage: -40 ~ +85°C (-40 ~ +185°F)
- Avoid installation locations that may be subjected to large shocks or vibrations.
- Avoid installation locations that may be subjected to rapid changes in temperature or humidity.

### *Installation and Wiring*

- Proper ground connections are vital for both safety and signal reliability reasons. Ensure that all electrical equipment is properly grounded.
- Route all communication cables separate from high-voltage or noise-emitting cabling (such as ASD input/output power wiring).

### *ASD Connections*

- Do not touch charged parts of the drive such as the terminal block while the drive's CHARGE lamp is lit. A charge will still be present in the drive's internal electrolytic capacitors, and therefore touching these areas may result in an electrical shock. Always turn all drive input power supplies OFF, and wait at least 5 minutes after the CHARGE lamp has gone out before connecting communication cables.
- To avoid misoperation, do not connect any gateway terminals to either the ASD's E/GND terminals, the motor, or to any other power ground.
- When making common serial connections between the gateway and Toshiba ASDs, do not use cables that exceed 5 meters in length.
- For further drive-specific precaution, safety and installation information, please refer to the appropriate documentation supplied with your drive.
- Internal ASD EEPROMs have a limited life span of write cycles. Observe all precautions contained in this manual and your ASD manual regarding which drive registers safely may and may not be repetitively written to.
- When used without an Auxiliary power source (Toshiba ASD common serial mode), the gateway derives its control power from the connected drives. Therefore, removing power to all connected drives will also cause the gateway to lose power.



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# 1. The Network Gateway Series Concept

The MBP-100 is a member of the ICC Network Gateway Series product family. Members of this family are designed to provide a uniform interface, configuration and application experience. This commonality reduces the user's learning curve, reducing commissioning time while simplifying support. The MBP-100 provides simultaneous support for many different communication protocols, allowing complex interchanges of data among otherwise incompatible networks.

The heart of the Network Gateway Series concept is an element called the "point database". The point database is entirely user-configurable, and provides the mapping information that allows requests from the various supported networks to be interpreted and stored in a common format. This allows data to be routed from any supported network to any other supported network.

Additionally, the point database provides the added benefit of "data mirroring", whereby current copies of point values (populated by a "source port" designation) are maintained locally within the gateway itself. This greatly reduces the request-to-response latency times on the various networks, as requests (read or write) can be entirely serviced locally, thereby eliminating the time required to execute a secondary transaction on a different network.

When properly configured, the gateway will become essentially "transparent" on the networks, and the various network devices can engage in seamless dialogs with each other.

## 2. Mechanical Diagrams

### 2.1 Enclosure

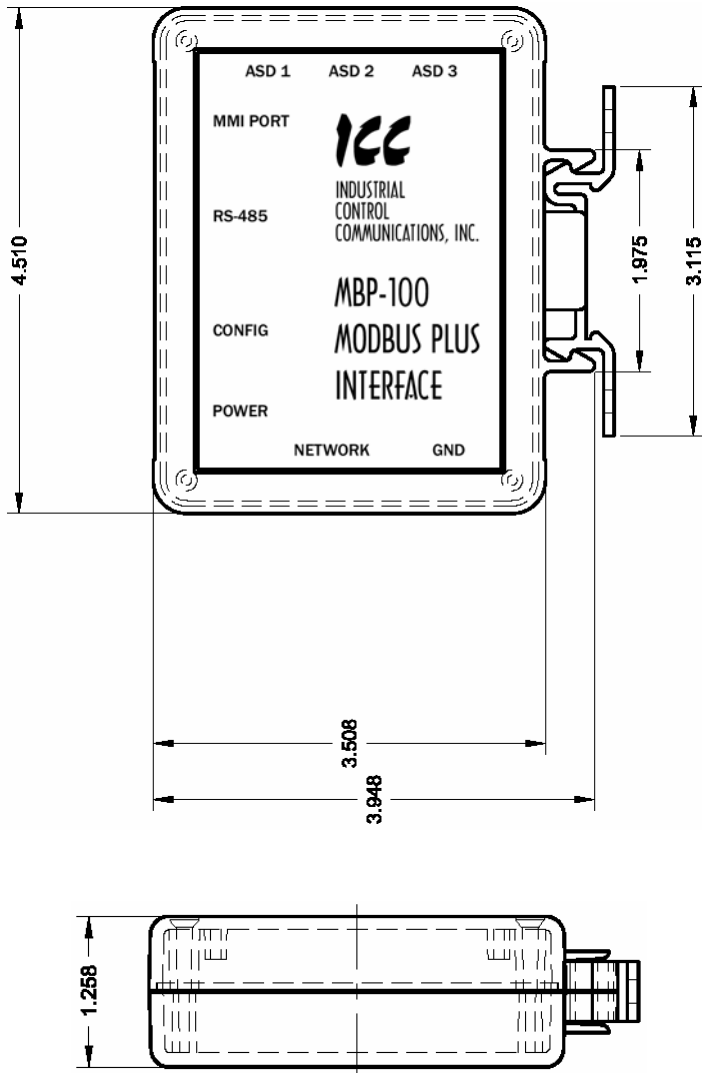


Figure 1: Enclosure Dimensions (units are inches)



## 2.2 Mounting Clip

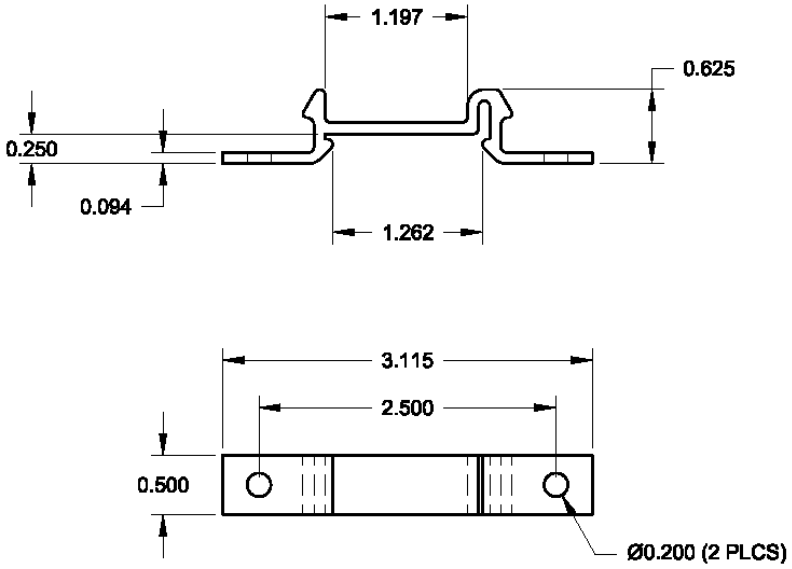
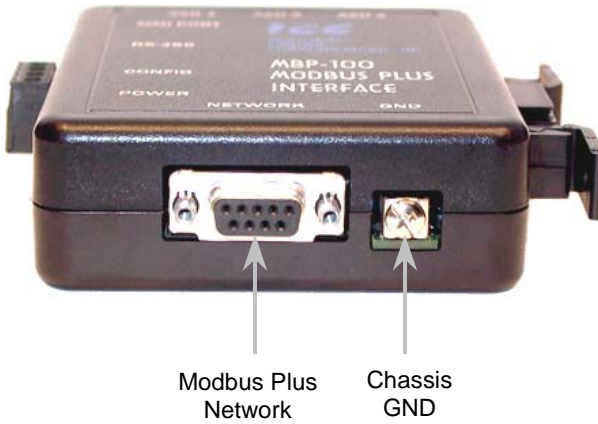
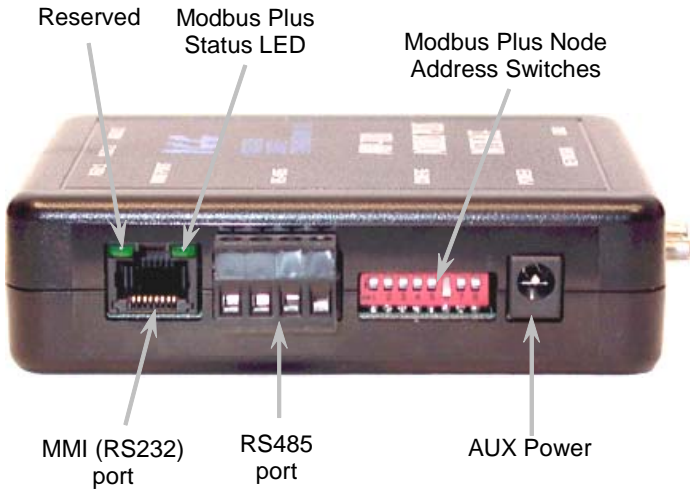


Figure 2: Mounting Clip Dimensions (units are inches)

## 2.3 External Interface



**Figure 3: Bottom View**



**Figure 4: Front View**

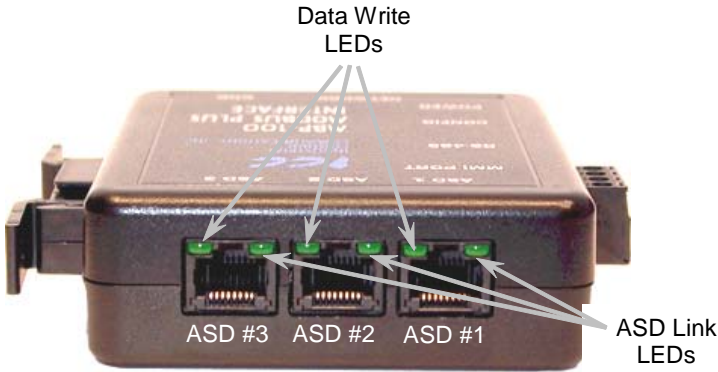


Figure 5: Top View

### 3. Certifications

**Underwriters Laboratories (UL) Listing Mark**

- Listee:  
Industrial Control Communications, Inc.  
1600 Aspen Commons, Suite 210  
Middleton, WI 53562
- UL File number: E236267
- Product: MBP-100 KIT. This kit consists of the MBP-100 unit and a UL Listed Class 2 power supply rated 120VAC input, 9VDC output.



**Underwriters Laboratories (UL) Recognized Component Mark**

- Recognized Company:  
Industrial Control Communications, Inc.  
1600 Aspen Commons, Suite 210  
Middleton, WI 53562
- UL File number: E236267
- Product: MBP-100. This product consists of the MBP-100 unit, which is intended to be supplied power by a low voltage / limited energy source.



## 4. Feature Summary

### **Modbus Plus Port**

Standard DB9 connector. Supports both standard (MSTR) read and write as well as global data read and write instructions. Any internal data point has the option of being mapped to the gateway's "get" or "put" global data. "Get" global data can be configured on a point-by-point basis to originate from any existing device on the network, providing for powerful and efficient peer-to-peer communication.

### **RS485 Port**

One half-duplex 2-wire RS485 port (A / B / Signal Ground / Shield). This port allows a selection of various master and slave protocols to be assigned to it.

### **RS232 Port**

One RS232 port that can be used to configure the unit, update the internal firmware, upload/download configuration files or act as a control protocol port. Use the included DB9-to-RJ45 RS232 cable to interface with this port.

### **Toshiba ASD Ports**

Three common serial (aka logic level) ports for connection of Toshiba 7-series, 9-series, 11-series or VF-nC1 ASDs. ASD connections use the same standard RJ45 style 8-conductor UTP patch cables: any standard CAT5 Ethernet cable (found in most electronics stores) 5 meters or less in length can be used. ASD connections are automatically established and continuously monitored: no drive configuration needs to be performed to connect the unit to the drives. Just plug it in – it's that simple.

### **Power Supply**

When connected to Toshiba ASDs via the ASD1 / ASD2 / ASD3 ports, can be either powered directly from the attached ASDs, or from the auxiliary power ("POWER") input jack. All other non-Toshiba applications require the use of the "POWER" input to supply power to the unit. When more than one power source is connected, the unit will draw its control power from the source with the highest supply voltage.

### **Supported Protocols**

- ▶ Modbus Plus
- ▶ Modbus RTU (RS485 master & slave)
- ▶ Modbus RTU (RS232 master & slave)
- ▶ Toshiba ASD (common serial master)
- ▶ Toshiba ASD (RS485 master)
- ▶ Mitsubishi 500-series & 700-series ASD (RS485 master) (also used by MGI Technologies, Inc. ASDs)



New network drivers are continuously being added, and can be downloaded for free from our web site.

### **Text-Based Console Configuration**

Unit configuration is performed via a text-based console interface, available locally over the RS232 port via a standard PC terminal program such as Microsoft Windows HyperTerminal®.

### **Configuration File Upload/Download**

A unit's configuration can be uploaded from / downloaded to a PC, which provides the capability for PC-based file backup and easy configuration copying to multiple units. Pending availability, sample configuration files and related documentation may also be downloaded from our web site, uploaded to a unit, and custom-modified to suit a specific application.

### **Network Timeout Action**

A per-port and per-point 2-level configurable network timeout action can be programmed that allows each internal point to have its own unique "fail-safe" condition in the event of a network interruption.

### **Indicators**

2 green LEDs exist on each of the ASD ports and on the RS232 port connector. Refer to section 10 for more detailed information about the LED indicators and their meanings.

### **Field-Upgradeable**

As new firmware becomes available, the unit can be upgraded in the field by the end-user. Refer to section 17 for more information.

### **Versatile 3-Way DIN-Rail Mounting System**

The unit's enclosure is provided with a mounting clip attached to the rear of the unit. This clip allows the unit to be mounted 3 different ways:

- For DIN rail mounting, snap the mounting clip onto a standard DIN rail, and then snap the unit enclosure onto the clip's retaining tabs. This allows easy removal or repositioning of the unit on the DIN rail during wiring.
- For panel mounting, the mounting clip can be bolted directly to a flat panel via the two bolt holes at the top and bottom of the clip. Refer to section 2.2 for mounting clip mechanical details. Once the mounting clip is securely attached to the panel, the unit enclosure can be snapped onto the clip's retaining tabs.
- For fixed DIN rail mounting, a combination of the above two techniques can be employed. First, snap the mounting clip onto a DIN rail and position it in its desired location. Then, the mounting clip can be bolted to the DIN rail support panel, securing it in place. Lastly, the unit can be snapped onto the fixed mounting clip.

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In all cases, the unit can be easily unsnapped from the mounting clip to temporarily provide easier access to the chassis ground terminal or network connector.

## 5. Installing the Gateway

The gateway's installation procedure will vary slightly depending on the chosen mounting method and the networks that will be used.

### 5.1 RS-485 Network in Use

Note that in order to power the unit when not connecting to Toshiba ASDs via the common serial ports, the optional 120VAC/9VDC power supply (ICC part number 10456) or a user-supplied power source meeting the requirements outlined in section 12 must also be installed.

1. Mount the unit via the desired method (refer to page 12 for more information).
2. Connect the Modbus Plus network to the "NETWORK" DB9 connector. Be sure to follow all published guidelines pertaining to Modbus Plus network connections, layout and routing.
3. Connect the RS485 network to the pluggable terminal block. Refer to section 6 for detailed connection information. Ensure that the terminal block is fully seated into the terminal block header, and route the network cable such that it is located well away from any electrical noise sources, such as ASD input power or motor wiring. Also take care to route the cable away from any sharp edges or positions where it may be pinched.
4. Take a moment to verify that the gateway and all network cables have sufficient clearance from electrical noise sources such as drives, motors, or power-carrying electrical wiring.
5. Connect the power supply to the gateway's "POWER" jack.

## 5.2 Toshiba ASD (Common Serial) Network in Use




The gateway connects to each drive via the drive's common serial (logic level) communication port, typically located on either the main drive control board (G7, S11), on the front of the drive enclosure under a small snap-on cover (A7, S9), on the right-hand side of the drive enclosure under a small snap-on cover (S7), or on the bottom side of the drive enclosure (VF-nC1). Although in general no drive parameters need to be configured in order to use the gateway, it is advantageous to check that the drive's common serial communication data rate is set to its maximum speed. Because the gateway will communicate to each drive only at the drive's configured data rate, this will provide the fastest response time for drive-to-network data transfers. For information on checking the drive's common serial communication data rate, refer to the appropriate manual supplied with your drive.

Note that the common serial communication parameters of each drive are handled independently by the gateway, which means that different drive families may be connected to different channels of the unit in any combination, and that the drives connected to each channel may simultaneously communicate to the unit at completely different baud rates, parity settings, etc.

Drives can be connected to the gateway on any ASD channel in any order or combination. When more than one drive is connected to the unit, or if the optional auxiliary power supply is used, the gateway will draw its control power from the source with the highest power supply voltage.

Installation of the gateway should only be performed by a qualified technician familiar with the maintenance and operation of the connected drives. To install the gateway, complete the steps outlined in the following sections related to your specific drive.

### 5.2.1 Installation for G7 ASDs




1. Mount the unit via the desired method (refer to page 12 for more information).
2.  **CAUTION!** Verify that all input power sources to the drives to be connected have been turned OFF and are locked and tagged out.
3.  **DANGER!**  Wait at least 5 minutes for the drive's electrolytic capacitors to discharge before proceeding to the next step. **Do not touch any internal parts with power applied to the drive, or for at least 5 minutes after power to the drive has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.** Verify that the CHARGE LED has gone out before continuing the installation process.



4. Remove the drive's front cover / open the drive's cabinet door (refer to the appropriate drive manual for instructions how to do this).
5. The drive's LCD panel (also called the "Electronic Operator Interface" or "EOI") can communicate with the drive via either the RS485/RS232 channel (CNU1/CNU1A) or the common serial channel (CNU2/CNU2A). Because the gateway uses the common serial channel, the LCD panel must be configured to use the RS485/RS232 channel. If the drive to be connected is currently using CNU2 (on the drive control board) and CNU2A (on the LCD panel), then this connection must first be switched over to CNU1 (on the drive control board) and CNU1A (on the LCD panel). Refer to Toshiba's documentation for any precautions or notices regarding this connection change. If the LCD panel is already connected via the RS485/RS232 channel, then no change is required.
6. Configure the drive's LCD panel to communicate via the RS485/RS232 channel by setting parameter "Communication Setting Parameters...Communication Settings...Select LCD Port Connection" to "RS485/232 serial".
7. Connect the drive's common serial communication port (CNU2) to one of the ASD channels of the gateway with the communication cable (communication cable is not included with the gateway kit). When choosing cables for this connection, standard 24 AWG category 5 (CAT5) unshielded twisted-pair (UTP) 8-conductor cables found in Ethernet networks in most office environments can be used. The maximum allowable length for these cables is 5 meters. Although there are many varieties and styles of CAT5 UTP cables available, ICC strongly recommends using only high-quality cables from reputable manufacturers to guarantee optimal noise immunity and cable longevity. Ensure that each end of the cable is fully seated into the modular connectors, and route the cable such that it is located well away from any drive input power or motor wiring. Also take care to route the cable away from any sharp edges or positions where it may be pinched.
8. Reinstall the drive's front cover / close the drive's cabinet door.
9. Repeat steps 2-8 to connect other drive(s) as needed.
10. Connect the Modbus Plus network to the "NETWORK" DB9 connector. Be sure to follow all published guidelines pertaining to Modbus Plus network connections, layout and routing.
11. If an auxiliary power supply is going to be used, connect it to the gateway's "POWER" jack.
12. Take a moment to verify that the gateway and all network cables have sufficient clearance from drives, motors, or power-carrying electrical wiring.
13. Turn the power sources to all connected drives ON, and verify that the drives function properly. If the drives do not appear to power up, or do not function properly, immediately turn power OFF. **Repeat steps 2 and 3 to remove all power from the drives.** Then, verify all connections. Contact

ICC or your local Toshiba representative for assistance if the problem persists.

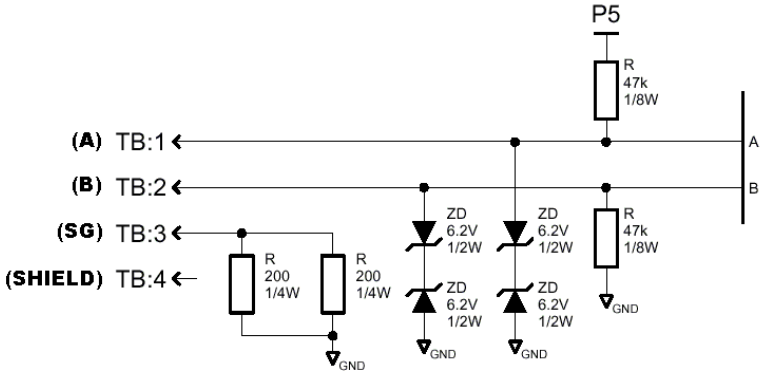
## 5.2.2 Installation for S7, S9, S11, A7 and VF-nC1 ASDs

1. Mount the unit via the desired method (refer to page 12 for more information).
2.  **CAUTION!** Verify that all input power sources to the drives to be connected have been turned OFF and are locked and tagged out.
3.  **DANGER!**  Wait at least 5 minutes for the drive's electrolytic capacitors to discharge before proceeding to the next step. **Do not touch any internal parts with power applied to the drive, or for at least 5 minutes after power to the drive has been removed. A hazard exists temporarily for electrical shock even if the source power has been removed.** Verify that the CHARGE LED has gone out before continuing the installation process.
4. Remove the drive's common serial communication port cover if it has one (refer to the appropriate drive manual for instructions how to do this). Do not discard this cover, as it should be reinstalled to minimize contamination of the port's electrical contacts if the gateway is ever disconnected from the drive.
5. Connect the drive's common serial communication port to one of the ASD channels of the gateway with the communication cable (communication cable is not included with the gateway kit). When choosing cables for this connection, standard 24 AWG category 5 (CAT5) unshielded twisted-pair (UTP) 8-conductor cables found in Ethernet networks in most office environments can be used. The maximum allowable length for these cables is 5 meters. Although there are many varieties and styles of CAT5 UTP cables available, ICC strongly recommends using only high-quality cables from reputable manufacturers to guarantee optimal noise immunity and cable longevity. Ensure that each end of the cable is fully seated into the modular connectors, and route the cable such that it is located well away from any drive input power or motor wiring. Also take care to route the cable away from any sharp edges or positions where it may be pinched.
6. Repeat steps 2-5 to connect other drive(s) as needed.
7. Connect the Modbus Plus network to the "NETWORK" DB9 connector. Be sure to follow all published guidelines pertaining to Modbus Plus network connections, layout and routing.
8. If an auxiliary power supply is going to be used, connect it to the gateway's "POWER" jack.

9. Take a moment to verify that the gateway and all network cables have sufficient clearance from drives, motors, or power-carrying electrical wiring.
10. Turn the power sources to all connected drives ON, and verify that the drives function properly. If the drives do not appear to power up, or do not function properly, immediately turn power OFF. **Repeat steps 2 and 3 to remove all power from the drives.** Then, verify all connections. Contact ICC or your local Toshiba representative for assistance if the problem persists.

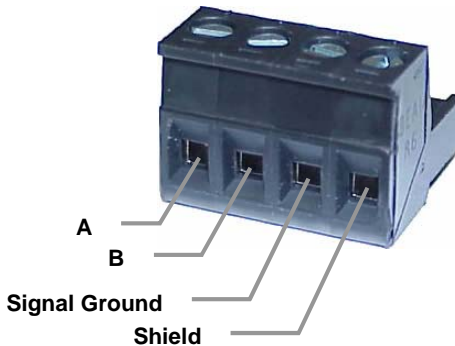
## 6. RS485 Port Electrical Interfaces

In order to ensure appropriate network conditions (signal voltage levels, etc.) when using the gateway's RS485 port, some knowledge of the network interface circuitry is required. Refer to Figure 6 for a simplified network schematic of the RS485 interface circuitry. Note that the "Shield" terminal has no internal connection: its purpose is simply to provide a cable shield chaining location between devices. The shield is then typically connected to ground at one location only.



**Figure 6: RS485 Interface Circuitry Schematic**

Figure 7 details the specific network connections to the RS485 terminal block.



**Figure 7: RS485 Terminal Block Connections**

## 7. Environmental Specifications

Item	Specification
Operating Environment	Indoors, less than 1000m above sea level, do not expose to direct sunlight or corrosive / explosive gasses
Operating Temperature	-10 ~ +50°C (+14 ~ +122°F)
Storage Temperature	-40 ~ +85°C (-40 ~ +185°F)
Relative Humidity	20% ~ 90% (without condensation)
Vibration	5.9m/s <sup>2</sup> {0.6G} or less (10 ~ 55Hz)
Grounding	Non-isolated, referenced to power source ground
Cooling Method	Self-cooled

## 8. Maintenance and Inspection

Preventive maintenance and inspection is required to maintain the gateway in its optimal condition, and to ensure a long operational lifetime. Depending on usage and operating conditions, perform a periodic inspection once every three to six months. Before starting inspections, disconnect all power sources.

### **Inspection Points**

- Check that the network cable(s) are properly terminated in the terminal block(s), and ensure that pluggable terminal blocks are fully seated in their headers. Reseat if necessary.
- Check that there are no defects in any attached wire terminal crimp points. Visually check that the crimp points are not damaged or loose.
- Visually check all wiring and cables for damage. Replace as necessary.
- Clean off any accumulated dust and dirt.
- If use of the gateway is discontinued for extended periods of time, apply power at least once every two years and confirm that the unit still functions properly.
- Do not perform hi-pot tests on the gateway, as they may damage the unit.

Please pay close attention to all periodic inspection points and maintain a good operating environment.

## **9. Storage and Warranty**

### **9.1 Storage**

Observe the following points when the gateway is not used immediately after purchase or when it is not used for an extended period of time.

- Avoid storing the unit in places that are hot or humid, or that contain large quantities of dust or metallic dust. Store the unit in a well-ventilated location.
- When not using the unit for an extended period of time, apply power at least once every two years and confirm that it still functions properly.

### **9.2 Warranty**

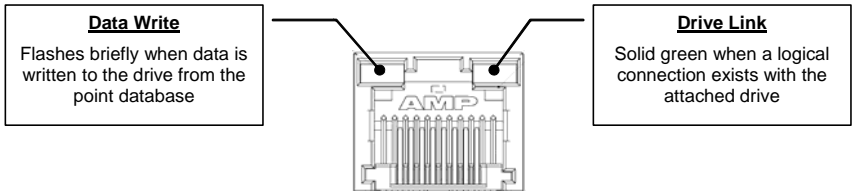
The gateway is covered under warranty by ICC, Inc. for a period of 12 months from the date of installation, but not to exceed 18 months from the date of shipment from the factory. For further warranty or service information, please contact Industrial Control Communications, Inc. or your local distributor.

## 10. LED Indicators

The gateway contains several different LED indicators, each of which conveys important information about the status of the unit and connected networks. These LEDs and their functions are summarized here.

### 10.1 Toshiba ASD Common Serial Port Indicators

Each Toshiba ASD common serial port RJ45 connector contains two integrated green LEDs. Figure 8 indicates the functions of these LEDs.

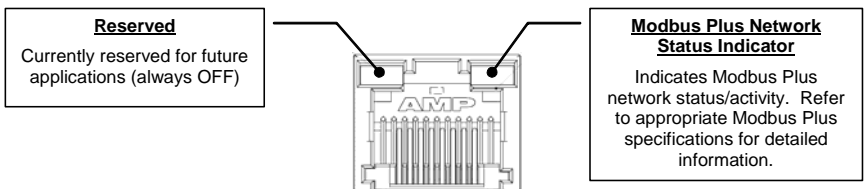


**Figure 8: Toshiba Drive Connector Indicators**

The Data Write indicator is useful for confirming that a specific drive is having data written to it, while the Drive Link indicator provides an easy method of determining that the gateway and drive are successfully exchanging data, independent of any other network activity.

### 10.2 RS232 (MMI) Port Indicators

The RS232 port RJ45 connector also contains two integrated green LEDs. Figure 9 indicates the functions of these LEDs.



**Figure 9: RS232 Port Indicators**



# 11. Configuration Switches

There are eight configuration DIP switches (marked “CONFIG”) located on the front side of the gateway. Switches #1 - #6 set the Modbus Plus station address of the gateway (refer to Table 1). Note that whenever the station addressing switches (#1 - #6) are changed, power must be cycled to the gateway to validate the change.

**Table 1: Modbus Plus Station Addressing**

SW1	SW2	SW3	SW4	SW5	SW6	Addr
ON	ON	ON	ON	ON	ON	1
OFF	ON	ON	ON	ON	ON	2
ON	OFF	ON	ON	ON	ON	3
OFF	OFF	ON	ON	ON	ON	4
ON	ON	OFF	ON	ON	ON	5
OFF	ON	OFF	ON	ON	ON	6
ON	OFF	OFF	ON	ON	ON	7
OFF	OFF	OFF	ON	ON	ON	8
ON	ON	ON	OFF	ON	ON	9
OFF	ON	ON	OFF	ON	ON	10
ON	OFF	ON	OFF	ON	ON	11
OFF	OFF	ON	OFF	ON	ON	12
ON	ON	OFF	OFF	ON	ON	13
OFF	ON	OFF	OFF	ON	ON	14
ON	OFF	OFF	OFF	ON	ON	15
OFF	OFF	OFF	OFF	ON	ON	16
ON	ON	ON	ON	OFF	ON	17
OFF	ON	ON	ON	OFF	ON	18
ON	OFF	ON	ON	OFF	ON	19
OFF	OFF	ON	ON	OFF	ON	20
ON	ON	OFF	ON	OFF	ON	21
OFF	ON	OFF	ON	OFF	ON	22
ON	OFF	OFF	ON	OFF	ON	23
OFF	OFF	OFF	ON	OFF	ON	24
ON	ON	ON	OFF	OFF	ON	25
OFF	ON	ON	OFF	OFF	ON	26
ON	OFF	ON	OFF	OFF	ON	27
OFF	OFF	ON	OFF	OFF	ON	28
ON	ON	OFF	OFF	OFF	ON	29
OFF	ON	OFF	OFF	OFF	ON	30
ON	OFF	OFF	OFF	OFF	ON	31
OFF	OFF	OFF	OFF	OFF	ON	32

SW1	SW2	SW3	SW4	SW5	SW6	Addr
ON	ON	ON	ON	ON	OFF	33
OFF	ON	ON	ON	ON	OFF	34
ON	OFF	ON	ON	ON	OFF	35
OFF	OFF	ON	ON	ON	OFF	36
ON	ON	OFF	ON	ON	OFF	37
OFF	ON	OFF	ON	ON	OFF	38
ON	OFF	OFF	ON	ON	OFF	39
OFF	OFF	OFF	ON	ON	OFF	40
ON	ON	ON	OFF	ON	OFF	41
OFF	ON	ON	OFF	ON	OFF	42
ON	OFF	ON	OFF	ON	OFF	43
OFF	OFF	ON	OFF	ON	OFF	44
ON	ON	OFF	OFF	ON	OFF	45
OFF	ON	OFF	OFF	ON	OFF	46
ON	OFF	OFF	OFF	ON	OFF	47
OFF	OFF	OFF	OFF	ON	OFF	48
ON	ON	ON	ON	OFF	OFF	49
OFF	ON	ON	ON	OFF	OFF	50
ON	OFF	ON	ON	OFF	OFF	51
OFF	OFF	ON	ON	OFF	OFF	52
ON	ON	OFF	ON	OFF	OFF	53
OFF	ON	OFF	ON	OFF	OFF	54
ON	OFF	OFF	ON	OFF	OFF	55
OFF	OFF	OFF	ON	OFF	OFF	56
ON	ON	ON	OFF	OFF	OFF	57
OFF	ON	ON	OFF	OFF	OFF	58
ON	OFF	ON	OFF	OFF	OFF	59
OFF	OFF	ON	OFF	OFF	OFF	60
ON	ON	OFF	OFF	OFF	OFF	61
OFF	ON	OFF	OFF	OFF	OFF	62
ON	OFF	OFF	OFF	OFF	OFF	63
OFF	OFF	OFF	OFF	OFF	OFF	64

Switches #7 and #8 perform the following functions:

Switch #7 .....RS232 port selection switch. When “OFF” at unit startup, the RS232 port will act as the serial console, regardless of the port’s configuration or protocol assignment (refer to section 14 for more information on the serial console). When “ON” at unit startup, the RS232 port carries whatever protocol (if any) was assigned to it at configuration time. Note that the state of this switch is only detected when the gateway boots up.

Switch #8 .....Firmware update switch. Place in “OFF” position for normal operation, and in the “ON” position only when new firmware is to be downloaded to the unit. Refer to section 17 for more information.

## 12. Auxiliary Power Supply

The ICC part #10456 120VAC/9VDC power supply can be used to power the unit via the “POWER” input. If providing your own auxiliary power supply, ensure that it adheres to the following specifications:



Connection diagram.....  
Voltage rating..... 9 - 40VDC  
Current rating..... 500mA (@9VDC)

The gateway’s “POWER” input uses the CUI, Inc. PJ-002A (2.1mm x 5.5mm) or equivalent DC power jack, which mates with the PP-002A (2.1mm x 5.5mm) or equivalent power plug.

## 13. Unit Configuration Concepts

### 13.1 Port and Protocol Configuration

Each of the communication ports can be individually configured or enabled/disabled. It is important to note that with one exception, the ports function independently of one another, and can operate simultaneously. For example, a Modbus RTU slave request on the RS485 port and a Modbus Plus request can *simultaneously* access the same internal point. The sole exception to this functionality is that the RS485 port and the ASD1 port are internally shared, which means that they both cannot be active simultaneously. Also, the RS485 port's configuration has priority over that of the ASD1 port: if any protocol is assigned to the RS485 port, then the ASD1 port will be automatically disabled. Note, however, that the ASD2 and ASD3 ports will at all times operate independently of all other network ports.

Although each communication port can be configured via the serial console interface, their configuration selections vary slightly. The Toshiba ASD common serial ports have a simple enable/disable selection. The RS232 and RS485 ports can be disabled, or can have one of a selection of control protocols assigned to them. The Modbus Plus port is always enabled.

Along with the protocol selection for the RS232/RS485 ports, each of these ports also has a corresponding baudrate, parity, address and timeout time assignment. Note that not all assignable protocols support the same range of configuration options: therefore be sure to assign a valid entry in all cases (for example, a Modbus RTU slave's "address" assignment must be in the range 1-247 to comply with the Modbus specification). Also note that certain protocols may not make use of all available configuration options (e.g. certain protocols operate only at one specified baudrate regardless of the "baudrate" selection value). The protocol-specific sections of this manual will document these cases.

### 13.2 Timeout Configuration

The gateway's points can be configured to perform a specific set of actions when primary communications are lost on one or more of its various networks. This allows each point to have its own unique "fail-safe" condition in the event of a network interruption. There are three separate elements that define the network timeout behavior:

- A port's network timeout time
- A point's "Timeout Enable" selection
- A point's "Timeout Value" setting

The **timeout time** is adjustable in 1s increments from 0 to 500s.

The default timeout time in all cases is 0, which disables network timeout handling. When nonzero, timeout processing does not begin until after a valid network packet has been received by the unit on that port.

When the timeout time is nonzero and a communication interruption is detected, the **timeout enable** selections for each point are inspected. Those points that are found to have their timeout enable selections set to “enabled” will then have their configured **timeout values** automatically written to their assigned “source port” objects. This mechanism provides for a flexible set of device failsafe conditions to be established on a point-by-point basis.

### 13.3 Point Configuration

As mentioned in section 1, the Network Gateway Series concept revolves around a central “point database”, containing the value and access characteristics for each network. With respect to the Network Gateway Series, a “point” is simply an object that defines some sort of network access, mapping and configuration data, as well as a single “value” attribute that can be read from or written to by various communication ports or protocols.

The only restriction placed on this “central clearinghouse” concept is that only one port can autonomously update the point’s value, “mirroring” its designated object for other protocols to access. What this means is that although any protocol can read from or write to a point’s internal value, most of the time that point’s value will simply be mirroring a remote data object that resides on one of the gateway’s subnets. The selection of what a specific point is to mirror is performed via its “source port” selection.

For example, a point may be configured to contain Toshiba ASD parameter mapping and Modbus master ID and register mapping information. However, because both of these protocols act as “master” protocols, only one of them can be allowed to continuously update the point’s value. If both master protocols could simultaneously update the point’s internal value, it would erratically alternate back and forth between the values designated by the Toshiba parameter and Modbus register objects. Any “slave” protocol (Modbus RTU slave, Modbus Plus MSTR reads & writes, etc.) can read from or write to a point at any time, but only the protocol designated by the point’s “source port” assignment will autonomously update the point’s value independent of any other protocol traffic.

The “source port” designation also determines where a new point value will be written to when a “slave” protocol writes a new value to the point. For example, if the Modbus Plus connection is used to write new data that changes the value of a point, how do we know where this new value will exit the gateway to arrive at its final destination? The answer is that any new point values written by “slave” protocols will generate “write” transactions only on the “source port”.

This concept may best be further explained by way of a representative scenario. For example, let's assume that the gateway's RS485A port has been designated to be a Modbus Master. Let's further assume that the "Modbus Master" portion of point #5 indicates an "Address" value of 8 and "Register" value of 14, and that point #5's "Source Port" selection is set to "RS485A". What this means is that independent of any other gateway traffic, point #5 will continuously attempt to update its internal value by making requests to the RS485A port. And, because the RS485A port has been designated as a Modbus Master, then the "Modbus Master" portion of point #5's configuration will be referenced by the update task, and point #5's value will therefore always be mirroring the value of (holding or input, depending on the configuration) register #14 of remote Modbus station address #8 connected to the Modbus subnet attached to the gateway's RS485A port. Perhaps register #14 of Modbus station address #8 is a monitor item, indicating the pressure in compressor tank. Whenever the tank's pressure changes, therefore, the value of point #5 will automatically update to reflect the new value read from the remote device. Once the tank's pressure reading has been brought into the gateway, it can then be retrieved by any protocol (or ALL the protocols) currently assigned to the gateway's other communication ports.

As a modification to the previous example, let's assume this time that register #14 of Modbus remote station address #8 is the speed command of a conveyor belt. In this case, point #5 of the gateway will be mirroring the current speed command of the conveyor, in a similar fashion to how it previously mirrored the compressor tank's pressure. This time, however, the speed command represents something that can also be written to. Therefore, any new data value that is written to point #5 from any other port connection will automatically cause a "write holding register" transaction to occur on the RS485A Modbus master port, updating the value of register #14 on remote Modbus station #8, causing the conveyor to accelerate (or decelerate) to the new speed.

Note that it is also perfectly acceptable to have a point's "source port" assigned to "NONE". All this means that this point will not be autonomously updated (i.e. that it will not automatically mirror anything.) In a sense, it will simply be "scratchpad memory" that the various ports and protocols can use to exchange information among themselves.

Although the various configuration possibilities may seem overwhelming at first, it is clear that the gateway can perform powerful and flexible routing algorithms. Through configuration experience, the "in" and "out" data flows will become more clear.

## **13.4 General Configuration Procedure**

Now that we have had a brief tutorial on port and point configuration, we can proceed on to how these elements fit into the overall configuration procedure. The general configuration procedure steps can be summarized as follows:

1. Access the serial console configuration interface via Hyperterminal or other text-based console program.
2. Assign (or enable/disable) the desired protocols and their characteristics to the specific communication ports.
3. Perform the desired per-protocol mapping and definition assignments for each point, including the name, timeout and "source port" assignments.
4. Exit the serial console, which will prompt you to update the gateway's internal configuration file and then reboot the unit.
5. Download a copy of the unit's configuration file to your PC for backup purposes.

Of course, it is possible to simplify or even eliminate some of these steps by starting your configuration from a pre-existing point database file (either downloaded from the internet or previously-created by the user), and then simply modifying those elements necessary to match your application.

## 14. Console Access

### 14.1 RS232

The console is accessible via an RS232 interface for direct connection to a computer's serial (COM) port. This is performed by connecting the unit's RS232 (MMI) port to the computer's serial port via the included serial cable.

#### 14.1.1 Requirements

All that is needed is a computer with a serial (COM) port containing some sort of communications software (such as HyperTerminal, included with Microsoft Windows operating systems) and the included DB9-RJ45 RS232 port cable (part number 10425). Any communications software and PC will work, provided they support ASCII communications at 38.4kbaud.

#### 14.1.2 Connection

The gateway ships from the factory with a dust cover installed in the RS232 (MMI) port. To minimize contamination of the port's electrical contacts, keep this dust cover in place whenever the RS232 port is not in use.

Connect the RJ45 end of the RS232 cable to the gateway's RS232 port, and connect the DB9 end to the computer's serial port. Make sure that CONFIG switch #7 is in the "OFF" (up) position to force the RS232 port to act as the serial console. If the unit is currently using the RS232 port for control protocol communication, then it must be rebooted (powered down and then back up again) with CONFIG switch #7 in the OFF position to enable the serial console on the RS232 port.

#### 14.1.3 Application Configuration

As previously mentioned, any PC communication software and PC serial port can be used. The software configuration example given here will be for Windows HyperTerminal communicating via COM1.

Figure 10 shows the "Connect To" tab of the properties window for COM1. Figure 11 shows the window that appears when "Configure" is selected in the "Connect To" tab. Figure 12 shows the "Settings" tab of the properties window. Most of these settings are their default values: usually the only change needed is the "Bits per second" setting shown in Figure 11.

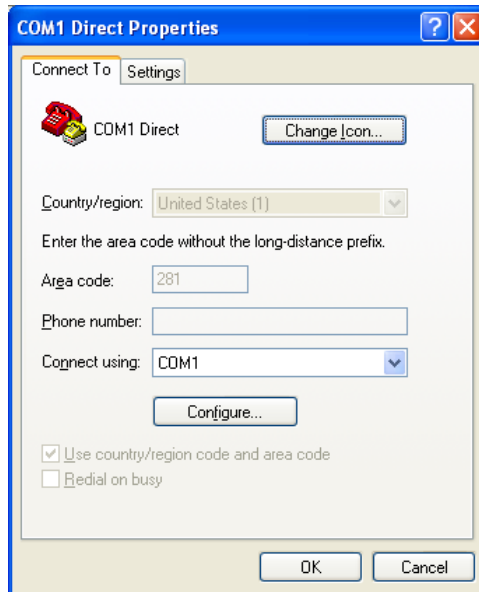


Figure 10: HyperTerminal Properties...Connect To

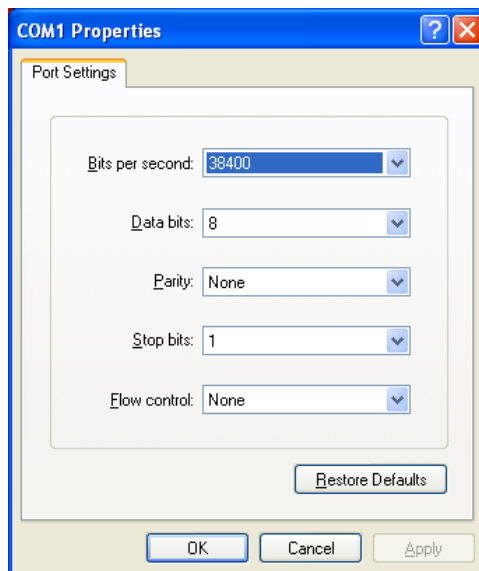


Figure 11: HyperTerminal Properties...Connect To...Configure



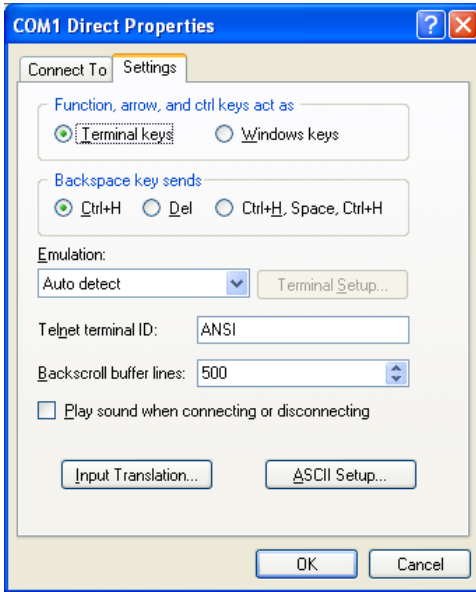


Figure 12: HyperTerminal Properties...Settings

## 14.2 Invocation

The console provides standard access and editing methods for the various configuration items (ports, points and their associated attributes). It is important to note that whenever you modify the point database and are ready to restart the gateway (“exit”), you must save the database to the internal file system prior to restarting or your changes will be lost. The console will automatically ask you if you would like to save the database to the file system every time you exit even if you did not modify it. If the database was unchanged, then saving is not required. Before modifying the configuration, it is a recommended practice to download a configuration file to your PC for backup purposes, so that the original configuration can be restored if any unintended changes are made.

To enter the console, simply type “menu” and press the Enter key. You will then be notified that all communication tasks will be terminated for the duration of the editing (refer to Figure 13). It is important to ensure that all connected devices are in a safe state such that loss of communications will not pose a danger to equipment or personnel. Exiting the console will reset the gateway and restart network communications using the current configuration data.

At most console prompt locations, typing “x” will return you to the previous menu, and typing “menu” will return you to the main menu. Also note that console commands are not case-sensitive.

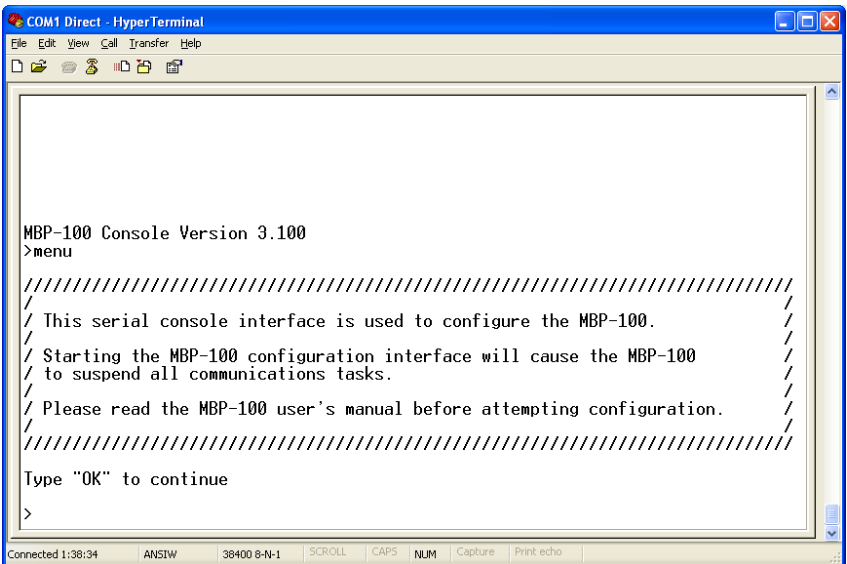
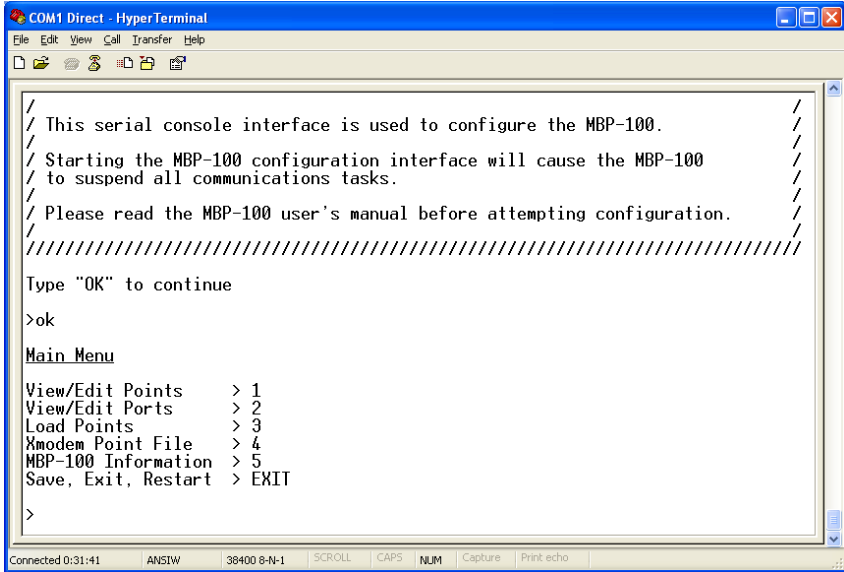


Figure 13: Console Invocation

## 14.3 Main Menu

The main menu is shown in Figure 14. All gateway configuration is performed by “drilling down” into progressively lower-level menus.



**Figure 14: Console Main Menu**

All navigation and data entry commands are input by simply entering the menu selection number to the right of the “>” symbol along with any required data fields at the console prompt. In Figure 14, for example, entering the menu selection number “1” (without the quotation marks) will bring up the View/Edit Points submenu. Throughout this manual, example console entry strings will be provided enclosed in quotation marks to delineate them from the description text: whenever actually entering the console strings, however, do not include the quotation marks.

When additional data fields are required with a data entry command, they will be indicated by square brackets (“[...]”) after the menu selection number. All data entry commands and data fields must be separated by spaces. Because data entry commands and data fields are delineated by spaces, spaces are therefore not allowed within data fields (such as name strings). In these cases, it is usually convenient to use an underscore “\_” in place of a space. For example, attempting to enter a point’s name as “My point” would result in an error, but “My\_point” would be perfectly acceptable.

## 14.3.1 View/Edit Points

Main menu selection number 1 displays a screen which shows a summary of the current point configuration (see Figure 15). This screen only displays the point number and the point name: in order to access more detailed point information, menu selection number 1 “Edit/View a Point” must be entered with the additional argument of the targeted point’s number. The syntax used to edit/view point #1 is shown at the bottom of Figure 15.

Only 10 points are shown at a time (of 100 total available in the unit). Menu selection 2 “More Points” allows the next 10 points to be viewed.

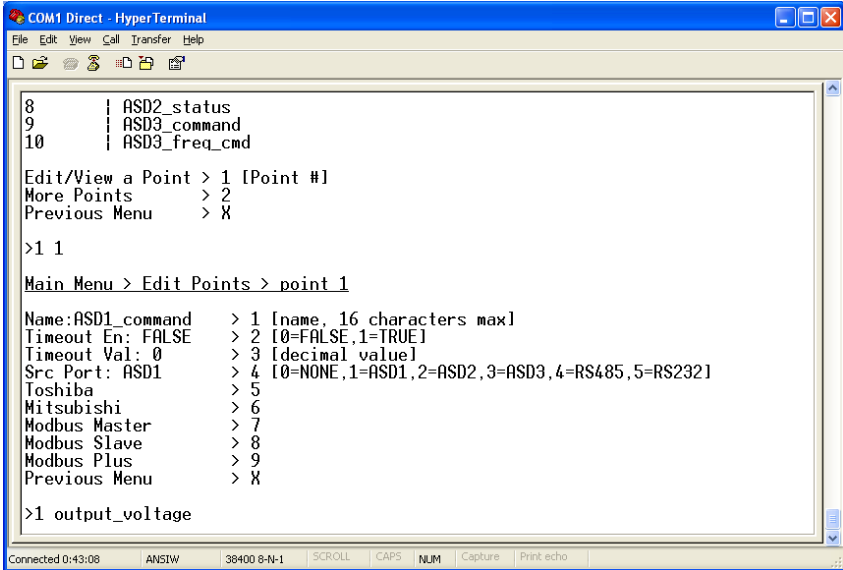
```

COM1 Direct - HyperTerminal
File Edit View Call Transfer Help
MBP-100 Information > 5
Save, Exit, Restart > EXIT
>1
Main Menu > Edit Points
Point # | Name
-----|-----
1      | ASD1_command
2      | ASD1_freq_cmd
3      | ASD1_output_freq
4      | ASD1_status
5      | ASD2_command
6      | ASD2_freq_cmd
7      | ASD2_output_freq
8      | ASD2_status
9      | ASD3_command
10     | ASD3_freq_cmd
Edit/View a Point > 1 [Point #]
More Points      > 2
Previous Menu    > X
>1 1_
Connected 0:29:41  ANSIW  38400 8-N-1  SCROLL  CAPS  NUM  Capture  Print echo
  
```

**Figure 15: View/Edit Points**

Entering “1” with a point’s number (such as “1 1”, as shown at the bottom of Figure 15) at the Edit Points submenu will display and allow editing of that point’s mapping and definition information. Refer to Figure 16 for an example.

When editing a point, the top half of the screen (menu selections 1-4) contains point attributes that are protocol-independent. The bottom half of the screen (menu selections 5-9) contains the menu options for editing point attributes that are protocol-specific.



**Figure 16: Edit a Point**

- **Edit Name:** Menu selection number 1 allows you to change the point's name. For example, the bottom of Figure 16 shows an example of changing point #1's name to output\_vol tage. The point's name is purely for user recognition of a point, and has no bearing upon communications functionality. To clear the point's name field, just enter the menu selection ("1") with no additional argument.
- **Edit Timeout Enable:** Menu selection number 2 allows you to change the point's timeout enable selection. Refer to section 13.2 for more information about timeout processing.
- **Edit Timeout value:** Menu selection number 3 allows you to change the point's timeout data value. Refer to section 13.2 for more information about timeout processing.
- **Edit Source Port:** Menu selection 4 allows you to change the point's source port. Refer to section 13.3 for more information about source ports.
- **Edit Toshiba, Mitsubishi, Modbus Master/Slave/Plus:** Menu selections 5-9 allow you to edit/view protocol-specific point attributes. Enter the menu selection corresponding to the protocol you wish to edit/view.

## Toshiba Point Attributes

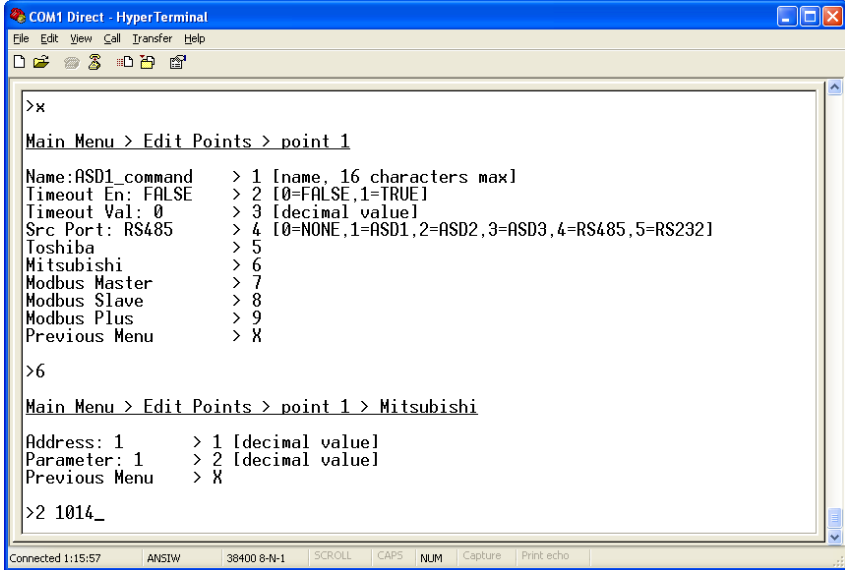
```

COM1 Direct - HyperTerminal
File Edit View Call Transfer Help
[Icons]
>1 1
Main Menu > Edit Points > point 1
Name:ASD1_command > 1 [name, 16 characters max]
Timeout En: FALSE > 2 [0=FALSE,1=TRUE]
Timeout Val: 0 > 3 [decimal value]
Src Port: RS485 > 4 [0=NONE,1=ASD1,2=ASD2,3=ASD3,4=RS485,5=RS232]
Toshiba > 5
Mitsubishi > 6
Modbus Master > 7
Modbus Slave > 8
Modbus Plus > 9
Previous Menu > X
>5
Main Menu > Edit Points > point 1 > Toshiba
Address: 1 > 1 [decimal value]
Parameter: FA00 > 2 [hexadecimal value]
Previous Menu > X
>2 FA04_
Connected 0:07:30 ANSIW 38400 8-N-1 SCROLL CAPS NUM Capture Print echo
  
```

**Figure 17: Edit Toshiba Attributes**

- Edit Address:** Menu selection 1 allows you to edit the network address of the Toshiba ASD that this point refers to. This address field is only used in conjunction with the Toshiba RS485 protocol: Toshiba common-serial port connections are point-to-point, and therefore do not require targeting a drive at a specific address.
- Edit Parameter:** Menu selection 2 allows you to edit the Toshiba ASD parameter that this point will access. Figure 17 shows an example of how to change the current setting of FA00 to FA04 (which would be a typical change if the Toshiba RS485 protocol were to be used with this point). Note that Toshiba parameter values must be entered in hexadecimal format.

## Mitsubishi Point Attributes



```

COM1 Direct - HyperTerminal
File Edit View Call Transfer Help
Main Menu > Edit Points > point 1
Name:ASD1_command > 1 [name, 16 characters max]
Timeout En: FALSE > 2 [0=FALSE,1=TRUE]
Timeout Val: 0 > 3 [decimal value]
Src Port: RS485 > 4 [0=NONE,1=ASD1,2=ASD2,3=ASD3,4=RS485,5=RS232]
Toshiba > 5
Mitsubishi > 6
Modbus Master > 7
Modbus Slave > 8
Modbus Plus > 9
Previous Menu > X

>6
Main Menu > Edit Points > point 1 > Mitsubishi
Address: 1 > 1 [decimal value]
Parameter: 1 > 2 [decimal value]
Previous Menu > X

>2 1014_

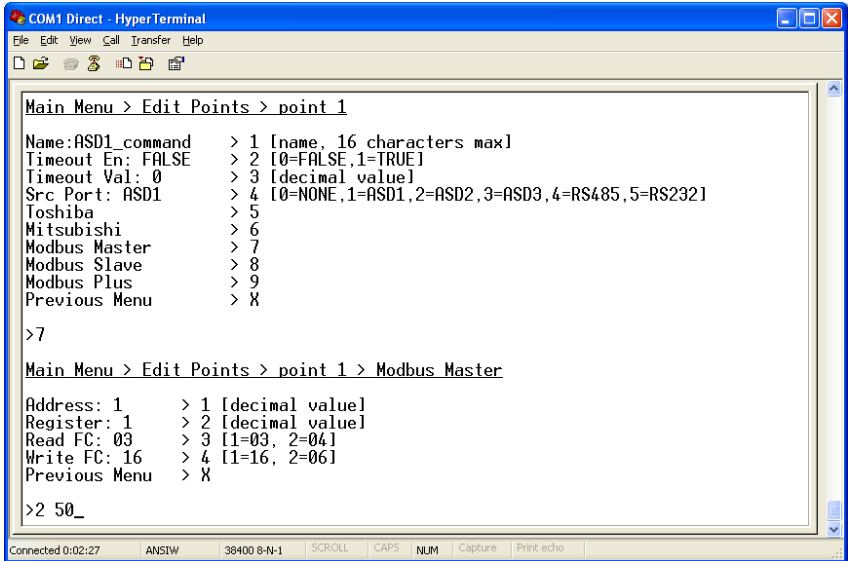
```

Connected 1:15:57 ANSIW 38400 8-N-1 SCROLL CAPS NUM | Capture Print echo

**Figure 18: Edit Mitsubishi Attributes**

- **Edit Address:** Menu selection 1 allows you to edit the network address of the Mitsubishi ASD that this point refers to.
- **Edit Parameter:** Menu selection 2 allows you to edit the Mitsubishi ASD parameter that this point will access. Figure 18 shows an example of how to change the current setting of 1 to 1014.

## Modbus Master Point Attributes



```

COM1 Direct - Hyper Terminal
File Edit View Call Transfer Help
Main Menu > Edit Points > point 1
Name:ASD1_command > 1 [name, 16 characters max]
Timeout En: FALSE > 2 [0=FALSE,1=TRUE]
Timeout Val: 0 > 3 [decimal value]
Src Port: ASD1 > 4 [0=NONE,1=ASD1,2=ASD2,3=ASD3,4=RS485,5=RS232]
Toshiba > 5
Mitsubishi > 6
Modbus Master > 7
Modbus Slave > 8
Modbus Plus > 9
Previous Menu > X
>7
Main Menu > Edit Points > point 1 > Modbus Master
Address: 1 > 1 [decimal value]
Register: 1 > 2 [decimal value]
Read FC: 03 > 3 [1=03, 2=04]
Write FC: 16 > 4 [1=16, 2=06]
Previous Menu > X
>2 50_
Connected 0:02:27 ANSIW 38400 8-N-1 SCROLL CAPS NUM Capture Print echo

```

Figure 19: Edit Modbus Master Attributes

- **Edit Address:** Menu selection 1 allows you to edit the network address of the Modbus slave that this point refers to.
- **Edit Register:** Menu selection 2 allows you to edit the Modbus holding register or input register that this point will access. The type of register accessed (holding or input) will be determined on the basis of the “Read FC” setting (see below). Figure 19 shows an example of how to change the current setting of register 1 to register 50.
- **Read FC:** Menu selection 3 allows you to choose the Modbus “read” function code that will be used to read from the designated register. The default setting of function code 03 (read holding registers) will access a holding register on the remote device. By selecting function code 04 (read input registers), a Modbus input register will be accessed instead.
- **Write FC:** Menu selection 4 allows you to choose the Modbus “write” function code that will be used to write to the designated holding register (this setting does not apply to input registers, as they are read-only). The default setting is function code 16 (preset multiple registers). Alternatively, this setting can be changed to function code 06 (preset single register) in order to connect to those Modbus slave devices that do not support function code 16.



## Modbus Slave Point Attributes

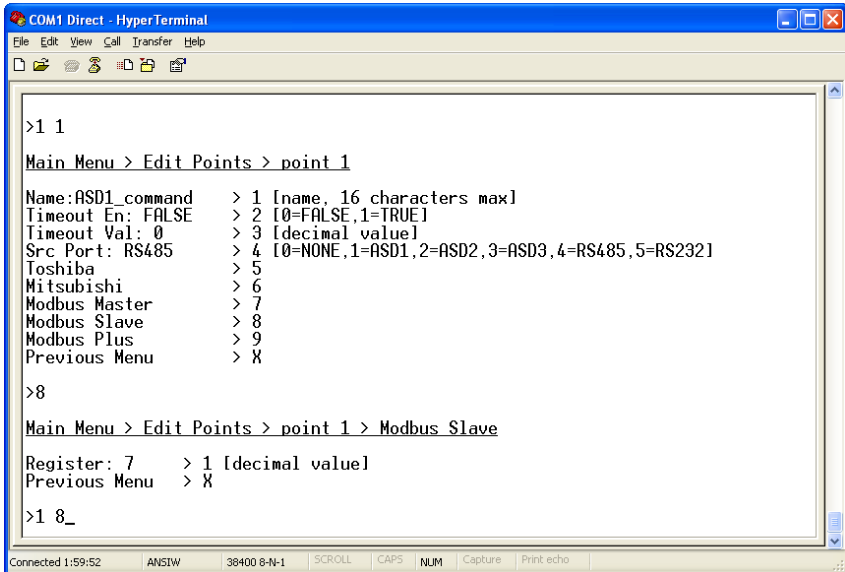
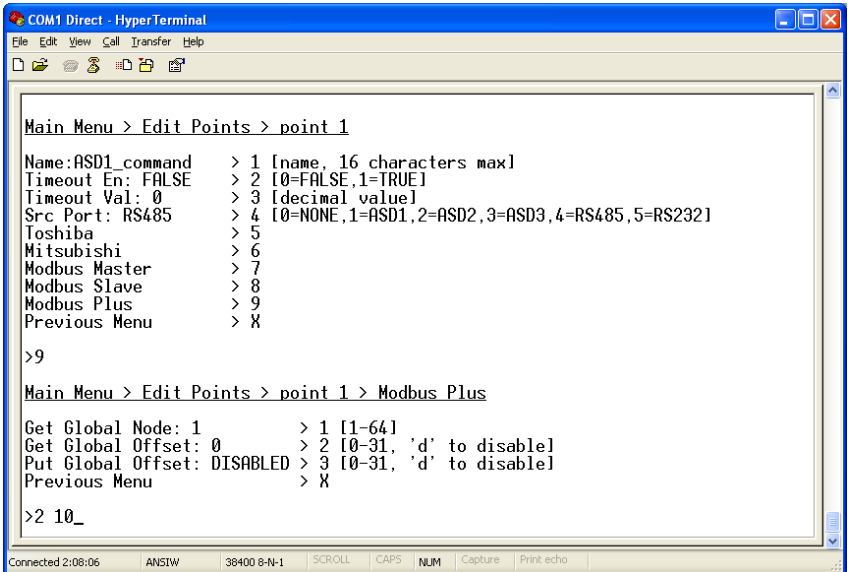


Figure 20: Edit Modbus Slave Attributes

- Edit Register:** Menu selection 1 allows you to assign a Modbus register (accessible as either a holding register or input register) to this point. Figure 20 shows an example of how to change the current setting of 7 to 8. Note that this Modbus register index is used whether accessing the point via Modbus RTU or Modbus Plus MSTR commands.

## Modbus Plus Point Attributes



```

COM1 Direct - Hyper Terminal
File Edit View Call Transfer Help
Main Menu > Edit Points > point 1
Name:ASD1_command > 1 [name, 16 characters max]
Timeout En: FALSE > 2 [0=FALSE,1=TRUE]
Timeout Val: 0 > 3 [decimal value]
Src Port: RS485 > 4 [0=NONE,1=ASD1,2=ASD2,3=ASD3,4=RS485,5=RS232]
Toshiba > 5
Mitsubishi > 6
Modbus Master > 7
Modbus Slave > 8
Modbus Plus > 9
Previous Menu > X
>9
Main Menu > Edit Points > point 1 > Modbus Plus
Get Global Node: 1 > 1 [1-64]
Get Global Offset: 0 > 2 [0-31, 'd' to disable]
Put Global Offset: DISABLED > 3 [0-31, 'd' to disable]
Previous Menu > X
>2 10_
Connected 2:08:06 ANSW 38400 8-N-1 SCROLL CAPS NUM Capture Print echo
  
```

**Figure 21: Edit Modbus Plus Attributes**

- Edit Get Global Node:** Menu selection 1 allows modification of the selected node on the network from which this point will consume (get) global data. This value is ignored if the “Get Global Offset” is “DISABLED”.
- Edit Get Global Offset:** Menu selection 2 allows modification of the offset within the Get Global Node's data block that this point will consume (get) from. Figure 21 shows an example of changing this point's “get” offset from 0 to 10 in node #1's data block. When set to “DISABLED”, this point will not consume any global data.
- Edit Put Global Offset:** Menu selection 3 allows modification of the offset within the gateway's global data block that will be populated with this point's “value” attribute. When set to “DISABLED”, this point will not produce any global data.

## **Implementing Global Data**

As indicated above, three global data configuration items exist for each point in the point database: a “get” node, a “get” offset, and a “put” offset. If a given point is intended to be accessed only via standard MSTR write and read commands (MSTR functions 1 and 2, respectively), then both the “get” and “put” offsets should be set to “DISABLED”. Standard MSTR read and write commands can then be used to access the point by targeting its “Modbus Slave Register” assignment.

If global data is to be used, however, then one of the global data selections must be enabled by programming it with an offset value (in the case of a “put”), or with a node address and an offset value (in the case of a “get”). If the point is to be written to by another device on the Modbus Plus network, then the MBP-100 must be configured to “get” data from that selected device’s global data block. If the point’s value is to be broadcast to the network, however, then the MBP-100 will “put” the point’s value into its own global data block, where other network nodes can “get” the data if desired. It is even possible to configure a specific point to both “get” and “put” global data (in effect performing global data “relaying”).

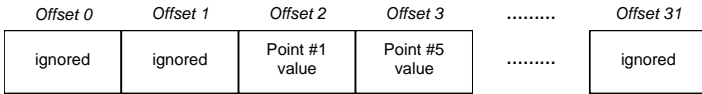
Because the gateway can be configured to retrieve global data from any offset (offset values 0-31) from any node (address values 1-64), very powerful peer-to-peer networking configurations can be created that entirely bypass the need for a PLC “master” executing MSTR instructions. The only configuration constraint with respect to global data is that “put” offsets must be unique. For example, if point #9 has been assigned a “put” offset of 5 (meaning that this point’s value will be placed in the 6<sup>th</sup> word from the start of the gateway’s global data), and if point #13 is also assigned a “put” offset of 5, then only the value of the point with the larger numerical index (in this case, point #13) would appear at the duplicated offset. “Get” global data configuration has no such limitation: it is perfectly acceptable for multiple points to consume data from the same offset in a common node’s global data block. This type of configuration may be particularly useful in synchronized systems, for example, where multiple points (and their associated devices on other networks) follow a “leader” value being broadcast by a single Modbus Plus node.

As a brief example of a global data implementation, Table 2 shows how 12 points in the point database might be configured for a specific application. Note that some points are consuming global data, some points are producing global data, and some points do not access global data at all (either they are not being used for Modbus Plus access, or they are accessed only via “standard” MSTR read or write commands).

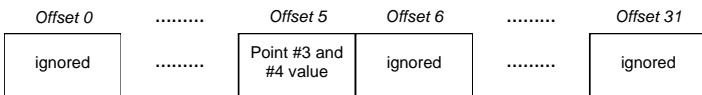
**Table 2: Global Data Assignment Example (x=Don't Care)**

Point #	Get Node	Get Offset	Put Offset	Note
1	3	2	DISABLED	Get from node #3
2	x	DISABLED	DISABLED	No global data access
3	8	5	DISABLED	Get from node #8
4	8	5	DISABLED	Get from node #8
5	3	3	DISABLED	Get from node #3
6	x	DISABLED	0	Put
7	x	DISABLED	1	Put
8	x	DISABLED	4	Put
9	x	DISABLED	DISABLED	No global data access
10	x	DISABLED	5	Put
11	x	DISABLED	7	Put
12	x	DISABLED	8	Put

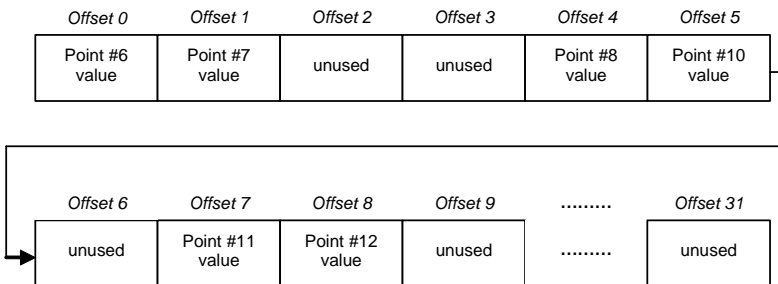
With the indicated global data assignments, we can get a logical overview of the three relevant global data areas from Figure 22, Figure 23 and Figure 24.



**Figure 22: "Get" Global Data From Node Address #3**



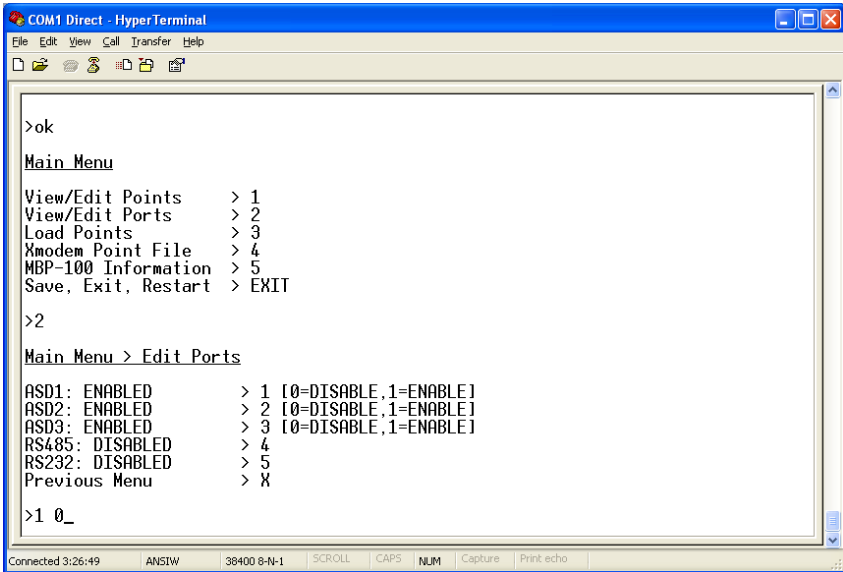
**Figure 23: "Get" Global Data From Node Address #8**



**Figure 24: "Put" Global Data From MBP-100**

## 14.3.2 View/Edit Ports

Main menu selection number 2 displays a screen which shows a summary of the current port configuration (see Figure 25). This screen only displays the current protocol selected for each port: in order to access more detailed port information, select the menu number corresponding to the desired port. Menu selections 1-3 correspond to the Toshiba common serial ASD ports, and these contain no other port configuration other than enable/disable. The syntax used to disable port ASD1 is shown at the bottom of Figure 25.

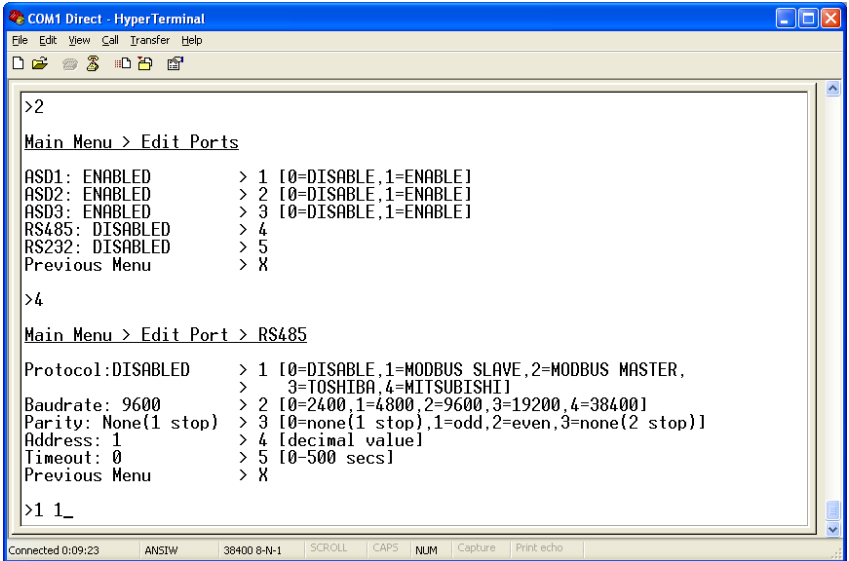


```

COM1 Direct - HyperTerminal
File Edit View Call Transfer Help
Main Menu
View/Edit Points > 1
View/Edit Ports > 2
Load Points > 3
Xmodem Point File > 4
MBP-100 Information > 5
Save, Exit, Restart > EXIT
>2
Main Menu > Edit Ports
ASD1: ENABLED > 1 [0=DISABLE,1=ENABLE]
ASD2: ENABLED > 2 [0=DISABLE,1=ENABLE]
ASD3: ENABLED > 3 [0=DISABLE,1=ENABLE]
RS485: DISABLED > 4
RS232: DISABLED > 5
Previous Menu > X
>1 0_
Connected 3:26:49 ANSIW 38400 8-N-1 SCROLL CAPS NUM Capture Print echo
  
```

Figure 25: View/Edit Ports

## RS485/232 Port Configuration



```

COM1 Direct - Hyper Terminal
File Edit View Call Transfer Help
Main Menu > Edit Ports
ASD1: ENABLED > 1 [0=DISABLE,1=ENABLE]
ASD2: ENABLED > 2 [0=DISABLE,1=ENABLE]
ASD3: ENABLED > 3 [0=DISABLE,1=ENABLE]
RS485: DISABLED > 4
RS232: DISABLED > 5
Previous Menu > X
>4
Main Menu > Edit Port > RS485
Protocol:DISABLED > 1 [0=DISABLE,1=MODBUS SLAVE,2=MODBUS MASTER,
3=TOSHIBA,4=MITSUBISHI]
Baudrate: 9600 > 2 [0=2400,1=4800,2=9600,3=19200,4=38400]
Parity: None(1 stop) > 3 [0=none(1 stop),1=odd,2=even,3=none(2 stop)]
Address: 1 > 4 [decimal value]
Timeout: 0 > 5 [0-500 secs]
Previous Menu > X
>1 1_
Connected 0:09:23 AN5TW 38400 8-N-1 SCROLL CAPS NUM Capture Print echo
  
```

**Figure 26: Edit Port Configuration**

- Edit Protocol Selection:** Menu selection 1 allows you to change what serial protocol is running on the selected port. Note that not all ports run the same protocols. Figure 26 shows an example of changing the protocol selection on the RS485 port from Disabled to Modbus Slave.
- Edit Baudrate:** Menu selection 2 allows you to change the baudrate for the selected port. Note that the baudrate for some protocols is determined by the specification, and these will therefore ignore this setting.
- Edit Parity:** Menu selection 3 allows you to change the parity for the selected port. Note that the parity for some protocols is determined by the specification, and these will therefore ignore this setting.
- Edit address:** Menu selection 4 allows you to edit the network address that the selected port will respond to. This setting is applicable for slave protocols only.
- Edit Timeout:** Menu selection 5 allows you to edit the timeout time for the selected port. Refer to section 13.2 for more information on timeout processing.

### 14.3.3 Load Points

Main menu selection number 3 allows the retrieval of a predefined configuration into working memory (see Figure 27). Loading one of these configurations overwrites the existing point configuration.

Currently, entering submenu selection 1 returns the gateway's configuration to its factory default state.

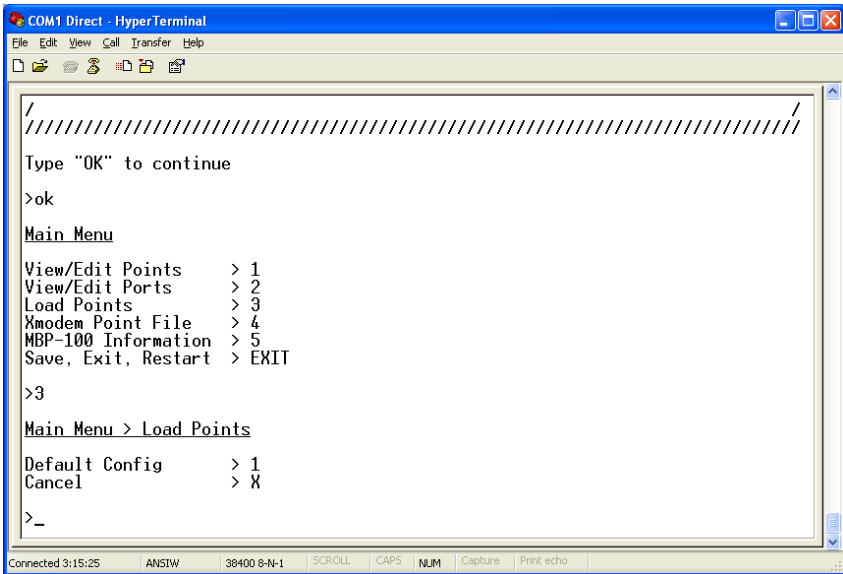


Figure 27: Loading a Point File

### 14.3.4 Xmodem Point File

Main menu selection number 4 gives access to the “xmodem” command, which allows unit configuration files to be transferred between the gateway and a PC. Whenever unit configuration is completed, it is strongly recommended that a backup copy of the configuration file be downloaded from the unit to a PC. One reason for this is in case it becomes necessary to restore a previous configuration at a later time. Another reason is that it may be desirable to load multiple units with the same configuration. Configuration files contain all point and port settings. A downloaded configuration file can be uploaded to any MBP-100, allowing the user to clone multiple units with the same configuration.

Two different variations of the Xmodem protocol are supported (CRC and Checksum) for those serial communication packages that only support one or the other. However, some programs can automatically adapt to the user's selection, making the specific Xmodem protocol selection arbitrary. The first

argument of the xmodem command indicates the mode, and must be set to either "/crc" for Xmodem CRC mode, or "/cs" for Xmodem checksum mode.

As mentioned above, configuration files can be both downloaded and uploaded. The second argument in the xmodem command indicates the action to take, and must be set to either "/d" to download the configuration file from the unit, or "/u" to upload a configuration file to the unit.

Figure 28 shows an example of initiating an Xmodem download in CRC mode. Once the message "The MBP-100 is ready to send its configuration file via Xmodem...Download the file now" appears, the user has 30 seconds to start the Xmodem download. This can be performed in HyperTerminal by clicking the "receive" button (📁) on the tool bar. Figure 29 shows the dialog box that will appear after clicking the "receive" button. Specify the folder in which to place the received file, select Xmodem as the receiving protocol, and click "Receive". One last dialog box will prompt the user to name the received file, and then the transfer will begin. This will only take several seconds to complete, and at the conclusion the console will indicate the status of the transfer and return to the entry menu.

```
COM1 Direct - HyperTerminal
File Edit View Call Transfer Help
Save, Exit, Restart > EXIT
>4
Main Menu > Xmodem Points

Usage:
"xmodem <mode> <action>"
Xmodem is used to upload or download a configuration file.

<mode> must be one of the following:
"/crc" - transfer the file via Xmodem CRC mode.
"/cs" - transfer the file via Xmodem Checksum mode.

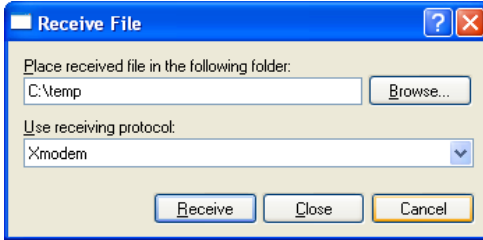
<action> must be one of the following:
"/u" - upload a configuration file to the unit.
"/d" - download the current configuration file from the unit.

>xmodem /crc /d
The MBP-100 is ready to send its configuration file via Xmodem...
Download the file now.
-


Connected 1:48:20 ANSIW 38400 8-N-1 SCROLL CAPS NUM Capture Print echo
```

**Figure 28: "Xmodem" Command Overview and Implementation**



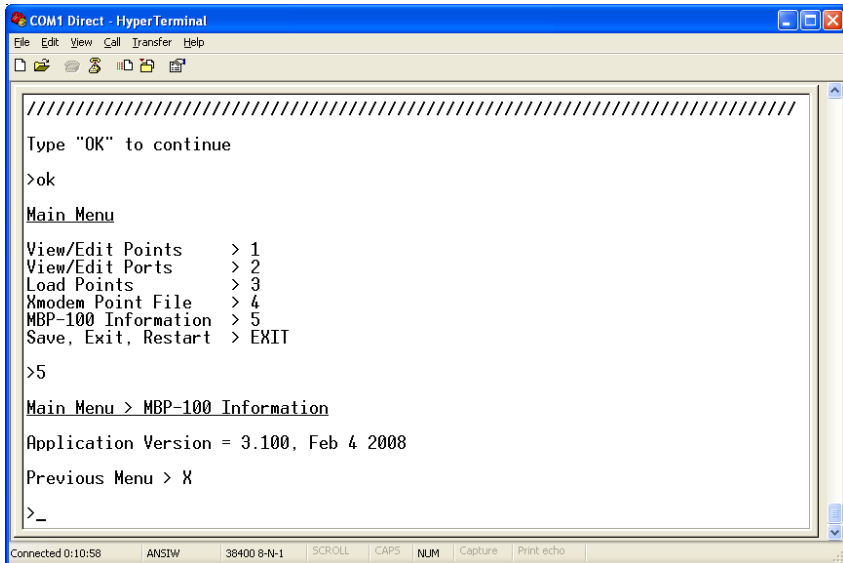


**Figure 29: HyperTerminal receive file dialog box**

When uploading a file, the procedure is similar to downloading. Enter “/u” instead of “/d” for the action parameter of the xmodem command. Once the xmodem upload command is entered, the user will have 30 seconds to click the “send” button (  ) on the tool bar in HyperTerminal and initiate the Xmodem upload transaction. Upon successful completion of the Xmodem upload, the integrity of the file will be checked and, if valid, will be copied to both the unit’s working memory and flash file system. The previous configuration cannot be recovered (unless a corresponding configuration file exists, of course).

### 14.3.5 MBP-100 Information

Main menu selection 5 provides some basic information about the gateway, such as firmware version (see Figure 30).



**Figure 30: MBP-100 Information**

## 15. Protocol-Specific Information

This section will discuss topics that are specific to each of the available network selections.

### 15.1 Modbus

The gateway supports Modbus slave and master functionality via Modbus RTU. The slave implementations share common access methods, which is to say they support the same functions and reference the internal points via a common “Modbus Slave” register assignment. Other notes of interest are:

- Points are addressed by their assigned holding register (4X reference) or input register (3X reference) via Modbus slave protocols.
- Points can access both holding registers (4X references) and input registers (3X references) via Modbus master protocols.
- Supported Modbus slave functions are indicated in Table 3.

**Table 3: Supported Modbus Slave Functions**

Function Code	Function
1	Read coils
2	Read input status
3	Read multiple registers
4	Read input registers
5	Write coil
6	Write single register
8	Diagnostics (subfunction 0 only)
15	Force multiple coils
16	Write multiple registers

- Register number entry radix is decimal (e.g. 10 = 10<sub>10</sub>)
- Configuration tip: Improved network utilization may be obtained by appropriately grouping points into blocks having contiguous register assignments. In this way, the “read multiple registers”, “read input registers” and “write multiple registers” functions can be used to perform transfers of larger blocks of registers using fewer Modbus transactions compared to a situation where the read/write registers were arranged in an alternating or scattered fashion.

- Because the transaction is handled locally within the gateway, write data checking is not available. For example, if a write is performed to a register with a data value that is out-of-range of the corresponding “source port” object, no Modbus exception will be immediately returned. However, the point will always reflect the “source port” status and object value. In other words, if such an out-of-range write attempt is performed, the unsuccessful “source port” network write can be observed by reading the current (unchanged) value of the point during a subsequent Modbus transaction.

### 15.1.1 Coil & Discrete Input Mappings

The Modbus slave implementation provides read/write support for coils (0X references) and read-only support for discrete inputs (1X references). These will collectively be referred to from here on out as simply “discretes”. Accessing discretes does not reference any new physical data: discretes are simply indexes into various bits of Modbus registers. What this means is that when a discrete is accessed, it is resolved by the gateway into a specific register, and a specific bit within that register. The pattern of discrete-to-register/bit relationships can be described as follows:

Discrete 1...16 map to register #1, bit0...bit15 (bit0=LSB, bit15=MSB)

Discrete 17...32 map to register #2, bit0...bit15, and so on.

Arithmetically, the discrete-to-register/bit relationship can be described as follows: For any given discrete, the register in which that discrete resides can be determined by:

$$register = \left\lfloor \frac{discrete + 15}{16} \right\rfloor \quad \dots Equation 1$$

Where the bracket symbols “ $\lfloor \ ]$ ” indicate the “floor” function, which means that any fractional result (or “remainder”) is to be discarded, with only the integer value being retained.

Also, for any given discrete, the targeted bit in the register in which that discrete resides can be determined by:

$$bit = (discrete - 1) \% 16 \quad \dots Equation 2$$

Where “discrete”  $\in [1..65535]$ , “bit”  $\in [0..15]$ , and “%” is the modulus operator, which means that any fractional result (or “remainder”) is to be retained, with the integer value being discarded (i.e. it is the opposite of the “floor” function).

From these equations, it can be seen that the largest register number that can be accessed via this discrete-to-register mapping method is 4096 (which contains discrete #65535).

For clarity, let's use Equation 1 and Equation 2 in a calculation example. Say, for instance, that we are going to read coil #34. Using Equation 1, we can determine that coil #34 resides in register #3, as  $\lfloor 3.0625 \rfloor = \lfloor 3 r1 \rfloor = 3$ . Then, using Equation 2, we can determine that the bit within register #3 that coil #34 targets is  $(34-1)\%16 = 1$ , as  $33\%16 = \text{mod}(3 r1) = 1$ . Therefore, reading coil #34 will return the value of register #3, bit #1.

Note that this discrete-to-register/bit relationship holds true regardless of whether or not register #3 is assigned to a point. If register #3 is not assigned to a point, then a Modbus exception will be returned. Either way, coil #34 will always access register #3, bit #1.

### 15.1.2 Modbus RTU Slave

- Broadcast (for functions 5, 6, 15 and 16) is supported.
- Network characteristics selections
  - Baud rate: 2400 / 4800 / 9600 / 19200 / 38400 bps
  - Parity: odd / even / none (1 stop bit) / none (2 stop bits)

### 15.1.3 Modbus RTU Master

- Supported Modbus master functions are indicated in Table 4. These functions are automatically invoked by the gateway in response to point read or write requests. The specific read or write function code used depends on the point's assigned configuration.

**Table 4: Supported Modbus Master Functions**

Function Code	Function
3	Read multiple registers
4	Read input registers
6	Write single register
16	Write multiple registers

- The slave response timeout (in seconds) is assigned via the designated port's "Timeout" selection. If "0" is chosen (an invalid timeout time), the gateway will use a 2s timeout by default.
- Network characteristics selections
  - Baud rate: 2400 / 4800 / 9600 / 19200 / 38400 bps
  - Parity: odd / even / none (1 stop bit) / none (2 stop bits)

- Note that various manufacturers will document their Modbus slave products in different ways. In particular, according to the Modbus specification, registers have two different indices at which they can be referenced: their “known as” value (which starts at number 1) and their “addressed as” value (which is always 1 less than the “known as” value). The “known as” value is typically the number that is presented for human entry or consumption, while the “addressed as” value is the number that appears “on the wire” when the Modbus packet is sent from master to slave. This gateway follows this generally-accepted industry paradigm, where a point’s configured Modbus master “register” value is decremented by 1 before it is placed “on the wire”. Some vendors, however, will document their slave device’s “addressed as” values in their literature, which means that these register indices must have 1 added to them when entered into the gateway’s “Modbus master register” field.

For example, the Toshiba VF-AS1/G9 drive’s Modbus RTU slave protocol implementation & corresponding user’s manual references all internal ASD parameters using “addressed as” values. This means that (in addition to the required conversion from Toshiba’s native hexadecimal radix to the Modbus protocol’s natural decimal radix) these parameter values must have 1 added to them when they are to be accessed via an ICC gateway executing the Modbus RTU master protocol.

e.g. VF-AS1/G9 “command 1” parameter is documented to be FA00 in the Toshiba literature. Converting this to decimal, we arrive at a value of 64000. To allow a point in the gateway’s database to correctly access the “command 1” parameter via Modbus RTU, therefore, that point’s Modbus master “register” attribute must be set to 64001 (which will result in an address value of 64000 (0xFA00) “on the wire”).

## 15.2 Modbus Plus

- Supported MSTR functions are indicated in Table 5.

**Table 5: Supported MSTR Functions**

Function Code	Function
1	Write Registers
2	Read Registers
5	Write Global Data
6	Read Global Data

- Modbus Plus register assignments are common between the Modbus Plus and Modbus RTU Slave protocols. In other words, when a point in the point database has been assigned a “Modbus Slave” register index, both Modbus Plus and Modbus RTU Slave protocols will access that point’s value by referencing the same register index.
- Configuration tip: Improved network utilization may be obtained by appropriately grouping points into blocks having contiguous “Modbus Slave” register assignments. In this way, the “read registers” and “write registers” functions can be used to perform transfers of larger blocks of registers using fewer Modbus Plus transactions compared to a situation where the read/write registers were arranged in an alternating or scattered fashion.
- Because the transaction is handled locally within the gateway, write data checking is not available. For example, if a write is performed to a register with a data value that is out-of-range of the corresponding “source port” object, no Modbus Plus exception will be immediately returned. However, the point will always reflect the “source port” status and object value. In other words, if such an out-of-range write attempt is performed, the unsuccessful “source port” network write can be observed by reading the current (unchanged) value of the point during a subsequent Modbus Plus transaction.

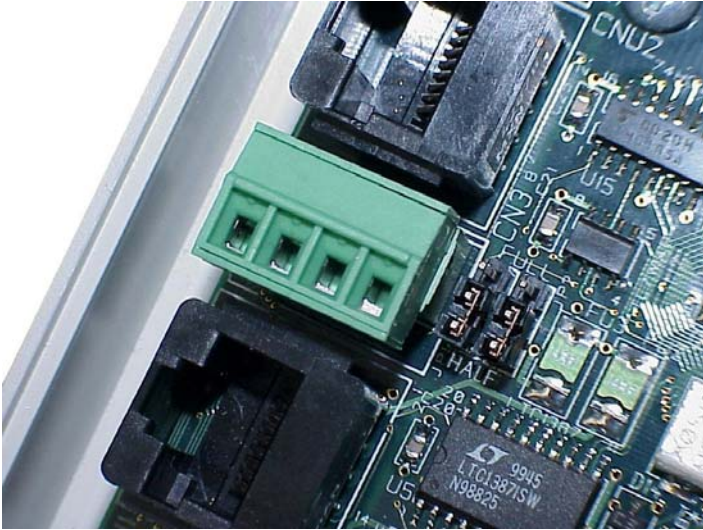
## 15.3 Toshiba Common Serial ASD Protocol

- The gateway can act as a Toshiba ASD master via its dedicated common serial (TTL) port connections. All Toshiba drives that include a common serial port are supported.
- No configuration is necessary, as the gateway automatically adapts to the ASD's configured characteristics.
- The RS485 port and the ASD1 port of the gateway are internally shared, which means that they both cannot be active simultaneously. Also, the RS485 port's configuration has priority over that of the ASD1 port: if any protocol is assigned to the RS485 port, then the ASD1 port will be automatically disabled. Note, however, that the ASD2 and ASD3 ports will at all times operate independently of all other network ports.
- All parameter writes use the drive's RAM / EEPROM data write ("W") command. For all writes that target the drive's EEPROM, be sure to follow Toshiba's guidelines regarding the number of times a specific parameter can be written without risk of EEPROM damage.
- Point parameter number entry radix is hexadecimal (e.g. 10 = 0x0010 or 16<sub>10</sub>)

## 15.4 Toshiba RS485 ASD Protocol

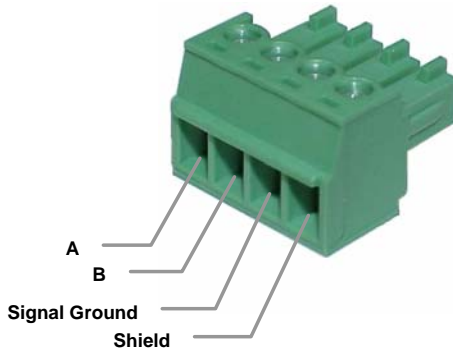
- The gateway can act as a Toshiba ASD master via its RS485 port. All Toshiba drives that implement the Toshiba protocol and provide either a built-in or option-based RS485 port are supported.
- Because the gateway implements a 2-wire (half-duplex) RS485 network, the drive(s) involved must also be connected via 2-wire mode. Optionally, it is also possible to convert the gateway's network from 2-wire (half-duplex) to 4-wire (half-duplex) via an external repeater such as the 485OPIN from B&B Electronics (<http://www.bb-elec.com>).
- Note that Toshiba 7-series drives configured for 2-wire mode (F821=0) shipped prior to early 2006 may exhibit an issue that can cause their RS485 ports to stop communicating after a certain amount of time. Please contact Toshiba technical support to confirm your configuration prior to using 2-wire RS485 mode on these drives.
- The required drive configuration will vary depending on the specific drive(s) involved. In general, most parameters are freely configurable to match the gateway's port settings (baud rate, parity etc.) The most critical selection, however, is that if the drive is directly connected to the gateway via 2-wire mode, then the drive must be properly configured for 2-wire RS485. Note

that this may involve hardware configuration in addition to parameter changes. For example, G7/Q7/H7-series drives have duplex selection jumpers located on the drive's control board near the communication ports. For these drives, both jumpers must be placed in the "HALF" position. Refer to Figure 31 for an example detailed view of correctly-positioned duplex selection jumpers.



**Figure 31: RS485 Terminal Block (CN3) and Duplex Selection Jumpers**

- The Toshiba RS485 terminal block connections for G7/Q7/H7/W7 drives are shown in Figure 32 for reference only. Because there are many possible RS485 port configurations & options available for the various Toshiba drives, please refer to the relevant Toshiba documentation for your drive.



**Figure 32: G7/Q7/H7 RS485 Terminal Block (CN3) Connections**



- The RS485 port and the ASD1 port of the gateway are internally shared, which means that they both cannot be active simultaneously. Also, the RS485 port's configuration has priority over that of the ASD1 port: if any protocol is assigned to the RS485 port, then the ASD1 port will be automatically disabled. Note, however, that the ASD2 and ASD3 ports will at all times operate independently of all other network ports.
- All parameter writes use the drive's RAM / EEPROM data write ("W") command. For all writes that target the drive's EEPROM, be sure to follow Toshiba's guidelines regarding the number of times a specific parameter can be written without risk of EEPROM damage.
- The drive response timeout (in seconds) is assigned via the designated port's "Timeout" selection. If "0" is chosen (an invalid timeout time), the gateway will use a 1s timeout by default.
- Network characteristics selections
  - Baud rate: 2400 / 4800 / 9600 / 19200 / 38400 bps
  - Parity: odd / even / none (1 stop bit) / none (2 stop bits)
- Point parameter number entry radix is hexadecimal (e.g. 10 = 0x0010 or 16<sub>10</sub>)

## 15.5 Mitsubishi ASD Protocol

- The gateway acts as a Mitsubishi protocol master via its RS485 port. Adjustable speed drives such as the FR-A500/E500/F500 series and F700-series that support the Mitsubishi protocol can be accessed. Also supported are MGI Technologies, Inc. M3000, M4000 and M5000-series drives that support the Mitsubishi protocol.
- For 500-series drives, the gateway can connect to the ASD via either the PU (panel) connector, or via an optional FR-A5NR computer link board. Because the ASDs externally present a 4-wire RS485 network, connecting them to the gateway requires jumpering the network wires for 2-wire format (i.e. connecting SDA-RDA and SDB-RDB).

### When Using an FR-A5NR Card

Connect as shown in Figure 33.

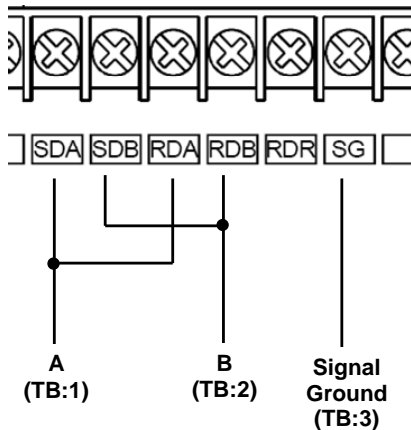
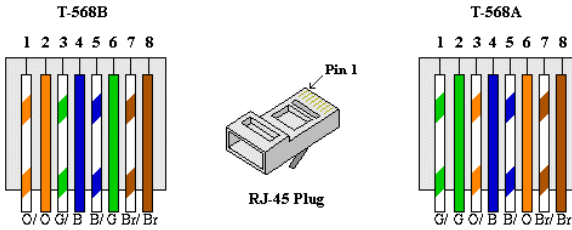


Figure 33: FR-A5NR Connections

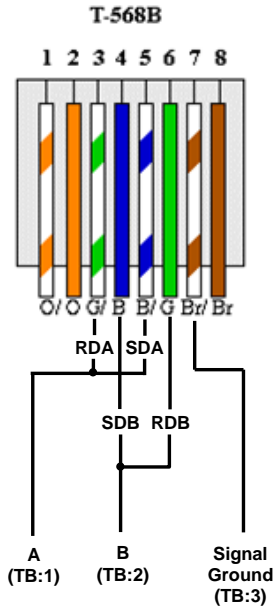
### When Using the PU Port

Connecting to the drive's RJ-45 PU port will likely require building a custom cable. For simplicity, a standard 8-conductor Ethernet patch cable can be used as a starting point. There are two standard color schemes for the wire pairs in such cables as defined by the Electronic Industry Association / Telecommunications Industry Association (EIA-TIA). These two standards are called T-568B and T-568A (refer to Figure 34). The most common color scheme is T-568B, and will therefore be the one used for this example connection. If starting with a cable wired according to the T-568A specification, just interchange the colors to achieve the same pin connections.

Connect as shown in Figure 35.

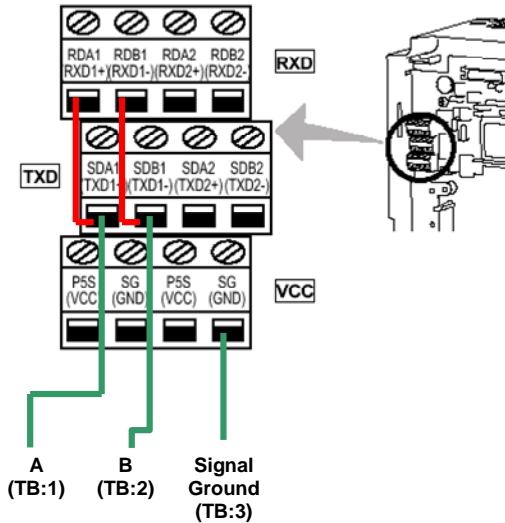


**Figure 34: EIA/TIA Wiring Standards**



**Figure 35: PU Port Connections**

- For 700-series drives, the gateway can connect to the ASD via either the PU (panel) connector as indicated in Figure 35, or via the on-board RS485 terminals. Because both of these ports externally present a 4-wire RS485 network, connecting them to the gateway requires jumpering the network wires for 2-wire format (i.e. connecting SDA-RDA and SDB-RDB). When using the on-board RS485 terminals, connect as shown in Figure 36.



**Figure 36: 700-Series ASD Connections**

- Note that although the 700-series ASD also supports the Modbus RTU protocol, the initial ASD firmware did not support the Modbus RTU protocol in 2-wire format. Therefore, using the Mitsubishi protocol may be the only available method to communicate with the gateway (ASD parameter 549 must be "0"). Contact Mitsubishi Technical Support for more information.
- The slave response timeout is determined via the gateway's RS485 port timeout value setting. If the timeout value is set to 0, a default timeout time of 2s is used.
- ASD communication characteristics are dictated by parameters 117-124 (PU port) and 331-341 (RS485 port). Most of these parameters can be set as desired by the user. However, the following parameters must be set as indicated to successfully connect to the gateway:

Parameter 119/333 (stop bits/data bits)..... *Must be set for 8 data bits*  
 Parameter 123/337 (wait time setting) ..... *Must be set to 9999*  
 Parameter 124/341 (CR/LF selection) ..... *Must be set to 1 (CR only)*

- ASD parameter number entry radix is decimal (e.g. 10 = 10<sub>10</sub>)
- Any numerically-addressed parameter defined by the Mitsubishi protocol reference manual is directly accessible (base frequency = parameter #3, etc.). However, some ASD data objects do not have parameter numbers assigned by Mitsubishi. For these data objects, the additional parameter numbers indicated in Table 6 have been assigned. For further information

on these parameters, please refer to the relevant Mitsubishi documentation.

**Table 6: Additional Mitsubishi Parameter Assignments**

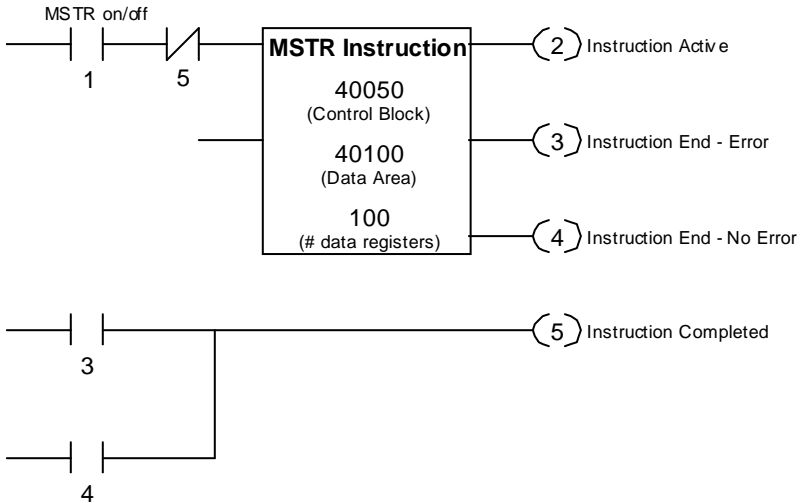
<b>Parameter Number</b>	<b>Item</b>
1000	Second parameter switch-over
1001	Frequency command (RAM)
1002	Frequency command (EEPROM)
1003	Frequency monitor
1004	Output current monitor
1005	Output voltage monitor
1006	Special monitor
1007	Special monitor selection number
1008	Most recent #1 and #2 alarms / alarm clear
1009	Most recent #3 and #4 alarms
1010	Most recent #5 and #6 alarms
1011	Most recent #7 and #8 alarms
1014	Inverter status monitor / operation command
1015	Operation mode acquisition
1016	All parameter clear
1017	Inverter reset

## 16. Modicon PLC Programming Examples

This section of the manual is being provided solely as a brief overview of the general ladder logic program architecture that can be used to interface with the MBP-100 over a Modbus Plus network. For the most detailed information available, the appropriate Modicon PLC Programming Manual should always be consulted.

### 16.1 Ladder Logic and MSTR Instructions

Modicon PLCs that support Modbus Plus communications implement a special instruction, called MSTR, which allows them to initiate Modbus Plus message transactions via ladder logic. An example of a ladder logic program that implements the MSTR instruction is shown in Figure 37.



**Figure 37:** Program Example for Modbus Plus Communications

## 16.1.1 MSTR Parameters

- The number in the top portion of the MSTR block is the address of the first of six registers in the **Control Block**, and is generally configured as indicated in Table 7.

**Table 7: MSTR Control Block Format**

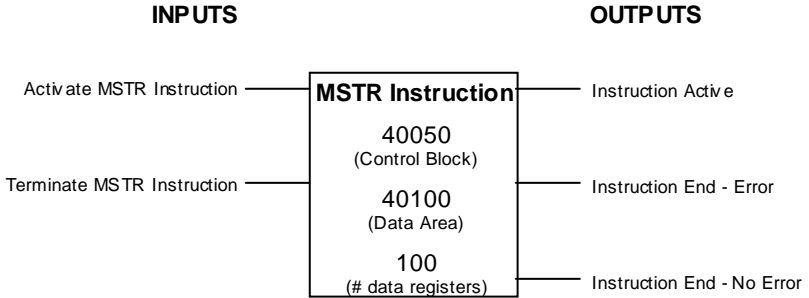
Address	Description	Parameters
4x	Identifies which MSTR function is to be executed. The MBP-100 supports read, write, global read, and global write.	1 = Write Registers 2 = Read Registers 5 = Write Global Data 6 = Read Global Data
4x + 1	Error code (Hex)	Read Only
4x + 2	Number of consecutive registers to read or write (n)	1 <= n <= # data registers
4x + 3	Starting register (s)	1 <= s <= (65535-n)
4x + 4	Destination node address	2 – 64
4x + 5	Master node address	1

There are small differences in the Control Block configuration depending on the selected MSTR function and whether or not network elements such as routers exist. Specific examples of each MSTR function can be found in sections 16.3 through 16.6. These examples assume a single network segment (no routers).

- The number in the middle portion of the MSTR block is the address of the first register in the **Data Area**. For write functions, the Data Area is the location of the source (write) data. For read functions, the Data Area is the destination of the returned read data.
- The number in the bottom portion of the MSTR block is the **Number of Data Registers**. This number defines the maximum number of registers in the data area. Register “4x + 2” in the Control Block must be less than or equal to this number. Also, each individual MSTR function has a maximum value for this number, which is discussed in sections 16.3 through 16.6.

## 16.1.2 MSTR Inputs and Outputs

Figure 38 indicates the inputs and outputs associated with MSTR instructions.



**Figure 38:** MSTR Inputs and Outputs

## 16.2 MSTR Function Error Codes

Table 8 indicates the error codes that may be output in the “4x+1” location of the MSTR control block. These specific error codes can be generated by the MBP-100. Additional error codes may be generated from other sources on the Modbus Plus network.

**Table 8: MSTR Error Codes**

Error Code (Hex)	Meaning
3001	Slave device does not support the requested function
3002	Nonexistent slave device registers requested
3003	Invalid data value requested

## 16.3 MSTR Read Example

The following example demonstrates how to use the MSTR instruction to read 2 registers starting at register 1 from an MBP-100 located at Modbus Plus network address 2.

1. Set up a ladder logic program as shown in Figure 37. Set the top portion of the MSTR Instruction to 40050. This will be the starting address of the MSTR Control Block. Set the control block registers to the following values:



Address	Description	Register Value
40050	MSTR function (read)	2
40051	Error code	Read Only
40052	Number of consecutive registers to read	2
40053	Starting register	1
40054	Destination node address	2
40055	Master node address	1

- Set the middle portion of the MSTR instruction to 40100. This will be the starting address of the MSTR Data Area. This is the location that will contain the read data returned from the MSTR transaction.

Address	Value
40100	Value of register 1 @ network address 2
40101	Value of register 2 @ network address 2

- In this case, we are accessing two registers, so set the bottom portion of the MSTR instruction ("number of registers") to 2. In the case of MSTR reads, this number cannot be greater than 125 by definition.
- Initiate the read command by closing internal relay 1. The data response will be seen in the MSTR Data Area (register 40100).

## 16.4 MSTR Write Example

The following example demonstrates how to use the MSTR instruction to write 4 registers starting at register 1 to an MBP-100 located at Modbus Plus network address 32.

- Set up a ladder logic program as shown in Figure 37.
- Set the top portion of the MSTR Instruction to 40060. This will be the starting address of the MSTR Control Block. Set the Control Block registers to the following values:

Address	Description	Register Value
40060	MSTR function (write)	1
40061	Error code	Read Only
40062	Number of consecutive registers to write	4
40063	Starting register	1
40064	Destination node address	32
40065	Master node address	1

- Set the middle portion of the MSTR instruction to 40200. This will be the starting address of the MSTR Data Area. This is the location that will contain the write data to be used in the MSTR write transaction.

Address	Value
40200	Value to write to register 1 @ network address 32
40201	Value to write to register 2 @ network address 32
40202	Value to write to register 3 @ network address 32
40203	Value to write to register 4 @ network address 32

- In this case, we are accessing four registers, so set the bottom portion of the MSTR instruction (“number of registers”) to 4. In the case of MSTR writes, this number cannot be greater than 100 by definition.
- Initiate the write command by closing internal relay 1. The data at registers 40200, 40201, 40202, and 40203 will be written to registers 1, 2, 3 and 4, respectively, of the MBP-100 located at network address 32.

## 16.5 MSTR Global Read Example

The following example demonstrates how to use the MSTR instruction to read 32 words of global data from an MBP-100 located at Modbus Plus network address 10.

- Set up a ladder logic program as shown in Figure 37.
- Set the top portion of the MSTR Instruction to 40070. This will be the starting address of the MSTR Control Block. Set the control block registers to the following values:

Address	Description	Register Value
40070	MSTR function (global read)	6
40071	Error code	Read Only
40072	Number of consecutive registers to read	32
40073	Number of words available to read	Read Only
40074	Destination node address	10
40075	Master node address	1

- Set the middle portion of the MSTR instruction to 40300. This will be the starting address of the MSTR data area. This is the location that will contain the data returned from the MSTR global data read transaction.

Address	Value
40300	Value at offset 0 in global data from network address 10
40301	Value at offset 1 in global data from network address 10
:	:
40300+n	Value at offset n in global data from network address 10
:	:
40331	Value at offset 31 in global data from network address 10

4. In this case, we are accessing 32 words of global data, so set the bottom portion of the MSTR instruction (“number of registers”) to 32. In the case of MSTR global reads, this number cannot exceed 32 by definition.
5. Initiate the global read command by closing internal relay 1. The data response will be seen in the MSTR Data Area (starting at register 40300).

## 16.6 MSTR Global Write Example

The following example demonstrates how to use the MSTR instruction to write 32 words of global data from a Modbus Plus master located at network address 1. Once written, any node on the Modbus Plus network will have access to this global data. The same global data values will continue to be available until another global data write occurs. Global data can only be cleared by performing a global data write with a length of 0 words.

1. Set up a ladder logic program as shown in Figure 37.
2. Set the top portion of the MSTR Instruction to 40080. This will be the starting address of the MSTR Control Block. Set the control block registers to the following values:

Address	Description	Register Value
40080	MSTR function (global write)	5
40081	Error code	Read Only
40082	Number of consecutive registers to write	32

3. Set the middle portion of the MSTR instruction to 40400. This will be the starting address of the MSTR Data Area. This is the location of the data that will be written to the master’s network global data.

Address	Value
40400	Value to write to offset 0 in the master’s global data
40401	Value to write to offset 1 in the master’s global data
:	:
40400+n	Value to write to offset n in the master’s global data
:	:
40431	Value to write to offset 31 in the master’s global data

4. In this case, we are writing 32 words of global data, so set the bottom portion of the MSTR instruction (“number of registers”) to 32. In the case of MSTR global writes, this number cannot exceed 32 by definition.
5. Initiate the global write command by closing internal relay 1. The data at registers 40400-40431 will be written to the master’s (station address 1) global data.

## 17. Firmware Updates

The gateway's embedded firmware resides in flash memory that can be updated in the field. Firmware updates may be released for a variety of reasons, such as custom firmware implementations, firmware improvements and added functionality as a result of user requests.

ICC is continually striving to enhance the functionality and flexibility of our products, and we therefore periodically release new embedded firmware to achieve these goals and meet customer requests. Flash firmware files and all related documentation (such as updated user manuals) can be downloaded as complete board support packages (referred to as BSPs) from <http://www.iccdesigns.com>. It is suggested that users check this Internet site prior to installation, and then periodically afterwards to determine if new support packages have been released and are available to upgrade their units.

### 17.1 Requirements

Besides the new firmware file, firmware updates require a PC with a Windows operating system (Windows 95 or newer) and a serial port, the RFU PC application (refer to section 17.3), and the RS232 cable included with the gateway kit (ICC part number 10425).

Please be sure to read the firmware release notes and updated user's manual (included with the BSP) for any important notices, behavior precautions or configuration requirements prior to updating your firmware. For example, upgrading to a new firmware version may affect user-defined configuration files: prior to starting an update procedure always back up your configuration file to a PC for later recovery if necessary.

### 17.2 Connection



**IMPORTANT:** Note that the gateway will not be operating its system control and communication tasks while its internal firmware is being updated. Therefore, be sure to shut down the system to a known safe state prior to initiating the firmware update procedure.

The gateway ships from the factory with a dust cover installed in the RS232 port. To minimize contamination of the port's electrical contacts, keep this dust cover in place whenever the RS232 port is not in use.

Connect the RJ45 end of the RS232 cable to the gateway's RS232 (MMI) port, and connect the DB9 end to the computer's serial port. Move CONFIG switch #8 to the "ON" (down) position: this will place the gateway into the "firmware download" mode. Whenever CONFIG switch #8 is "ON", the gateway can only

download firmware to its flash memory: all other application functions (such as communications, console access etc.) will be disabled.

## 17.3 Using the RFU Utility

Support for downloading new application firmware to the gateway is provided by the free Rabbit Field Utility (RFU), which is a 32-bit application that runs on Microsoft Windows platforms. The RFU utility can be downloaded from ICC's website at <http://www.iccdesigns.com>. When downloading a new gateway application BSP, always confirm that you also have the latest version of RFU, as new .BIN firmware files contained in BSPs may require functionality found only in the most recent RFU versions for successful downloading.

The remainder of this section will detail the RFU utility configuration and firmware download procedures.

### 17.3.1 Required Files

When first downloaded, the RFU utility files are compressed into one self-extracting .EXE distribution file. Create a folder (such as c:\RFU), place the distribution file in this folder, and then execute it. This will extract the compressed files into that same folder. The distribution file is then unneeded and can be deleted if desired. To run the RFU utility, double-click on the RFU.EXE file icon.

### 17.3.2 First-Time Configuration

The first time the RFU utility is run on a computer, several configuration items need to be confirmed. These configuration items are retained in the computer's registry from that point on, so reconfiguration is not required unless certain parameters (such as which serial port to use on the computer) are changed.

The two configuration items that need to be confirmed are the communications and bootstrap loaders path. First, select the "Setup...Communications" menu item (refer to Figure 39).

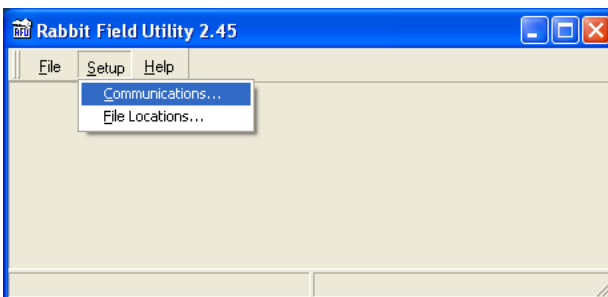
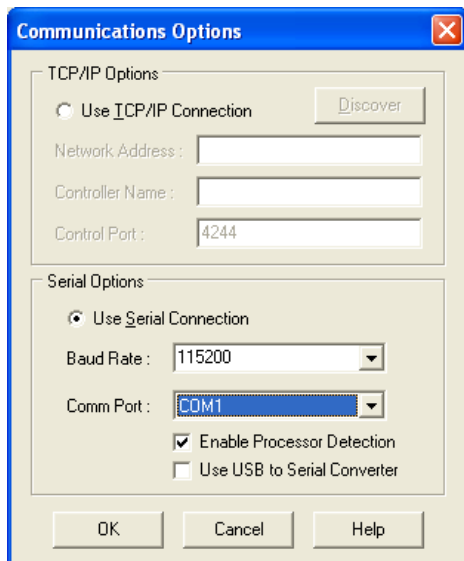


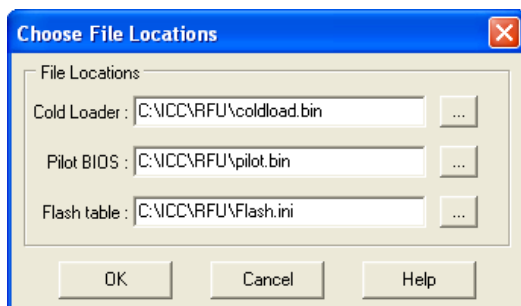
Figure 39: RFU Main Screen

The Communications Options window shown in Figure 40 then appears. Confirm that the settings are as shown, with the possible exception of the “Comm Port” settings, which depends on the COM port you are using. Click “OK” when complete.



**Figure 40: Communications Options Window**

Next, select the “Setup...File Locations” menu item from the main screen. The “Choose File Locations” window shown in Figure 41 then appears. Confirm that the correct paths to the referenced files are entered. Enter the correct paths if necessary.



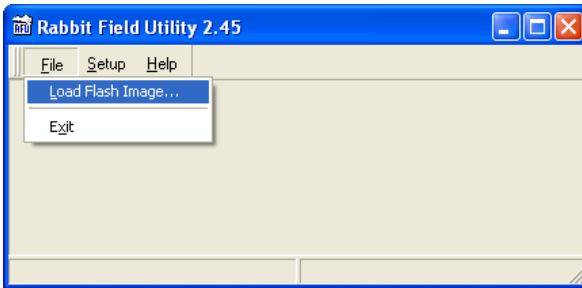
**Figure 41: Choose File Locations Window**

## 17.3.3 Transmitting Firmware Files

When a board support package (BSP) has been downloaded and unzipped, the flash firmware file will be the one with “.BIN” as its file name extension.

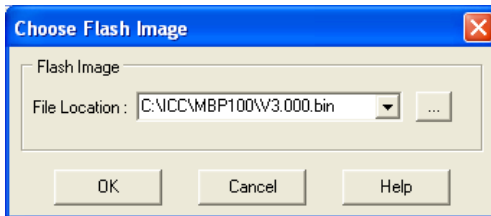
Once the RFU utility has been configured, the flash firmware files can be downloaded to the gateway by two different methods. The simplest way is to drag the application firmware .BIN file's icon and drop it onto the RFU utility's main screen. This will automatically initiate the download process.

Alternatively, select the “File...Load Flash Image” menu item (refer to Figure 42).



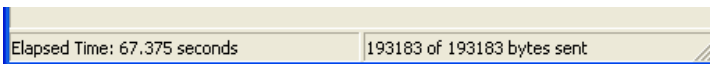
**Figure 42: Load Flash Image Menu Selection**

The flash image (.BIN file) selection window will then appear (refer to Figure 43). Browse to the location of the flash image file and select it. Clicking “OK” will then initiate the download process.



**Figure 43: Flash File Selection Window**

While downloading, the RFU utility will indicate the download status. Once complete, summary information will be displayed in the bottom status bar (see Figure 44).



**Figure 44: Summary Information**

## 17.4 Wrap-Up

Once downloading is complete, close the RFU utility, move CONFIG switch #8 back to the "OFF" (up) position to exit "firmware download" mode, and cycle power momentarily to the unit by either disconnecting the auxiliary power supply and/or powering down all connected drives or momentarily removing all drive communication cables from the unit.

When the unit powers up again, it will be running the new application firmware. If the new firmware version release notes indicated that the configuration file might need to be reloaded, then do so at this point.

When completed with RS232 port use, remove the RS232 cable and reinstall the port dust cover to minimize contamination of the port's electrical contacts.





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