

# **EtherSeries**

## **Modbus Gateway**

### **EMB-2**

## **User's Guide**

Revised March 25, 2004

Firmware Version 1.4

## **FCC Statement**

---

This device complies with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. Operation is subject to the following two conditions:

- (1) This device may not cause harmful interference.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

## **CE Marking Warning**

---

This is a class B product. In a domestic environment this product may cause radio interference in which case the user may be required to take adequate measures.

Copyright © 2002- 2004. All rights reserved.

Version 1.0

All trademarks and trade names are the properties of their respective owners.

# TABLE OF CONTENTS

---

<b>Chapter 1 Introduction.....</b>	<b>1</b>
EtherSeries EMB-02 Functions.....	2
Other Features .....	2
Physical Details .....	4
Configuration Switch.....	5
LED Indicators .....	6
Software Requirements .....	7
<b>Chapter 2 Installation.....</b>	<b>9</b>
Overview.....	9
Quick Start .....	9
Installation .....	10
<b>Chapter 3 Terminal/Telnet Configuration.....</b>	<b>11</b>
Overview.....	11
Terminal Configuration.....	12
Procedure .....	12
Telnet Management .....	13
Terminal/Telnet Interface .....	15
Entering Data.....	16
Menu Options .....	16
Main Menu Option 1. Setting IP Addresses .....	16
Main Menu Option 2. Set Manager/Telnet IP Address .....	18

Main Menu Options 3 & 4. Serial Port Configuration .....	19
Main Menu Option 5. MODBUS TCP Configuration .....	23
Main Menu Option 6. Modbus Serial Configuration .....	25
Main Menu Option 7. Display Configuration Settings .....	28
Main Menu Option 8. Reset Configuration to Default .....	30
Main Menu Option 9. Save and Exit .....	30
Main Menu Option 0. Exit without Saving .....	30
<b>Chapter 4 Browser Management .....</b>	<b>31</b>
Overview.....	31
Connection Procedure .....	31
Web-based Interface .....	33
Serial Port Configuration Screen .....	34
Modbus Configuration Screen .....	35
LAN Configuration Screen.....	36
SNMP Configuration Screen.....	37
Configuration Summary Screen .....	38
Port Activity Screen .....	39
<b>Chapter 5 Operation.....</b>	<b>39</b>
Operation .....	39
<b>Chapter 6 Troubleshooting.....</b>	<b>40</b>
Hardware Problems .....	40
Can't Connect via the LAN.....	41

Other Problems .....	43
Verify Proper Operation .....	44
<b>Appendix A Specifications .....</b>	<b>47</b>
EtherSeries Gateway Specifications.....	47
RS-232 PIN Assignments .....	48
Control Signal Operation .....	49
CABLES .....	51
<b>Appendix B RS-422/ RS-485 Interface .....</b>	<b>53</b>
Introduction.....	53
Changing the Setting.....	53
RS-422 / 4-Wire RS-485 Interface Pinout.....	54
2-Wire RS-485 Interface Pinout .....	55
RS-485 2-wire Fan-out .....	55



# Chapter 1

## Introduction

*This chapter provides an overview of the features and capabilities.*

Congratulations on the purchase of your new EtherSeries Modbus Ethernet Gateway. Interfaces include one 10/100BaseT ethernet interface and two RS-232/422/485 serial9-pin interfaces.

The gateway allows serial MODBUS RTUs to communicate and interoperate with MODBUS/TCP based controllers. The MODBUS standard protocol is an asynchronous protocol designed to connect directly to computer asynchronous ports. MODBUS has been extended to operate over Ethernet using the IP protocol suite. This gateway converts between the MODBUS TCP/IP protocol and MODBUS ASCII/RTU protocols transparently.

Normal operation would consist of one or more Ethernet based computers functioning as Modbus Master and one or more MODBUS slave devices (usually RTUs) connected serially to the gateway.

By using RS-485, multiple MODBUS slave devices may be connected to each of the two serial ports on the EMB-02. If using RS-232, one MODBUS slave device may be connected to each serial port.

The EMB-02 is designed for mounting on a standard DIN rail, or for direct mounting on a wall. For easy connection to your LAN, the gateway supports 10BaseT or 100BaseT with auto-sensing.

## EtherSeries EMB-02 Functions

The gateway allows serial MODBUS RTUs to communicate and interoperate with MODBUS/TCP based controllers. The MODBUS standard protocol is an asynchronous protocol designed to connect directly to computer asynchronous ports. MODBUS has been extended to operate over Ethernet using the IP protocol suite. This gateway converts between the MODBUS TCP/IP protocol and MODBUS ASCII/RTU protocols transparently.

The EMB-02 enables one or more MODBUS controllers to communicate with modes ASCII/RTU based serial RTUs. It will not allow MODBUS/TCP RTUs to operate with a serial MODBUS controller.

## Other Features

### Dual Serial Ports

The EMB-02 contains two serial ports. The two serial ports are independent, and may be used with different hosts and different serial protocols (RTU/ASCII) as well as different MODBUS address ranges and timeouts.

### Multiple Hosts

The EMB-02 may communicate with multiple host controllers.



### **Upgradeable Firmware**

Firmware upgrades are downloadable to the gateway. The utility program required for this, and the actual firmware upgrades, are available from your dealer. A Windows 95/98/XP/NT workstation is required to run the download software.

## Physical Details

The EMB-02 front panel is shown below.



**Figure 1: EtherSeries EMB-02**

<b>1</b>	<b>Power port</b>	Connect the power adapter here.
<b>2</b>	<b>10/100Base-T port</b>	Connect LAN cabling here.
<b>3</b>	<b>Red LED</b>	RUN Indicator
<b>4</b>	<b>Red LED</b>	LAN Indicator.
<b>5</b>	<b>RS-232 Port 1</b>	DE-9 (DB-9) Serial Interface
<b>6</b>	<b>RS-232 Port 2</b>	DE-9 (DB-9) Serial Interface.

---

## Configuration Switch

There is a momentary action push button switch on the right of the power connector behind a small hole. Pressing this switch places the unit in configuration mode and is used only when configuring the unit **via the serial port**, as explained in *Chapter 3 - Configuration*. Return from configuration mode by exiting the configuration menu or by power cycling the unit. This switch may be depressed with a tiny screw driver or stiff wire. (A straightened paper clip works nicely).

## LED Indicators

There are two red LED indicators on the panel below the LAN connector and two green LED indicators adjacent to the serial ports.

## LED Indicators

---

- The LAN LED is the Ethernet Status indicator. It is lit when there is a valid 10/100BaseT Ethernet connection.
  - This LED flickers off and on with activity on the Ethernet (even if the activity isn't directly to this unit).
  - The green LEDs flicker off and on with EMB-02 transmit activity on the two serial port.
  - The red RUN LED flickers off and on with ethernet transmit activity from the EMB-02.
-

---

## Package Contents

---

You should find the following items packaged with your EtherSeries product:

- The EtherSeries Unit
- Power Adapter (or power supply)
- This User's Guide

If any of the above are missing, contact your dealer immediately.

## Software Requirements

The EMB-02 supports MODBUS/TCP on the Ethernet interface and MODBUS ASCII and MODBUS RTU on the serial ports.

It may be configured using any terminal or terminal emulation software on a PC via serial port one. Any standard telnet program may be used to telnet to the unit for configuration, or any standard web browser may be used for configuration once the unit has a valid IP address configured. Since any terminal program or web browser may be used when configuring the unit, there is no supplied configuration software.



## Chapter 2

# Installation

*This Chapter details the LAN installation process for the EtherSeries product.*

### Overview

The EtherSeries products may be configured via a serial port, telnet, or web browser. Initially, the configuration of an IP address must be performed using the serial port unless the default IP address of 192.168.1.1 is appropriate for your Ethernet network.

To use LAN based configuration, either *Telnet or Web Browser based*, an IP address must be configured. The default value of 192.168.1.1 may not work with your network.

*Terminal Mode* configuration may be performed at any time, and no IP address is required. See Chapter 3 for details.

### Quick Start

Quick start instructions are on the next page. Installation is an easy process that is basically... ***plug it in, configure IP, configure MODBUS, and configure the serial ports.***

## Installation

### 1. Connect the Network Cable

---

The EtherSeries network interface is auto-sensing. Simply connect your network cable to the appropriate connector on the rear panel.

### 2. Connect the Power Adapter Cable

---

Plug in the power adapter cable. After about a 4 second boot process the unit is ready for operation. Some configurations require wiring to a screw-terminal block.

### 3. Configure an IP Address Information

---

Using either the default address and telnet or a web browser OR using a serial port and a terminal emulation, configure the IP and Modbus/TCP information. At a minimum, the IP address and port number must be configured.

### 4. Configure a Serial Port

---

Configure the appropriate serial ports for the proper Modbus protocol, slave address range, and timeouts.

### 5. Configure the Modbus Host.

---

You are now ready to use the EtherSeries Gateway. Configure the Modbus/TCP host computer and the serial RTUs for proper operation and start using it!



## Chapter 3

# Terminal/Telnet Configuration

*This Chapter describes how to manage the EtherSeries product using Terminal, or Telnet mode. Web Browser mode management is detailed in Chapter 4.*

### Overview

The EtherSeries unit may be managed using any of the following methods:

- **Web Browser** - After installing the unit in your LAN, use your Web Browser for management. See *Chapter 4 - Browser Configuration* for details.
- **Terminal Mode** - Use a serial cable connection and a communication program. This is often required prior to other modes in order to configure a compatible IP address into the unit.
- **Telnet Mode** - After installing the unit in your LAN, manage it using Telnet.

Both *Terminal* and *Telnet* modes provide the same user interface.

## Terminal Configuration

Terminal configuration requires the following:

- PC with terminal emulation program, or a dumb terminal.
- Serial cable to connect the PC to the unit. See the Appendix for cable requirements. A Crossover (null modem) cable is required when using a 9-pin PC port.
- Serial port 1 must be configured as an RS-232 port. This is the factory default configuration.

### Procedure

1. Connect the unit to your PC or terminal.
2. Connect the unit to the power supply.
3. Press the configuration setup switch momentarily. It is located to the side of the power connector and accessed through a small hole. Use a small pen or paper clip to access the switch.
4. Configure the terminal program with the following settings.

Setting	Value
Flow control protocol	None
Speed	9600
Data	8 bits
Parity	None
Stop Bit	1

5. Connect your terminal program to the appropriate port (e.g. COM 1).

6. The configuration program should now start and after a few seconds display a sign-on screen.

If nothing appears on your screen, press ESC.

Refer to the *Terminal/Telnet Interface* chapter for details on using the configuration program.

## Telnet Management

**NOTE: To use telnet, there MUST be compatible IP addresses in both the PC and the unit!**

1. Install the unit into your LAN as described in Chapter 2. Ensure that the unit is powered on.
2. Connect to it with the telnet program on your workstation. A typical command is:

```
telnet IP_Address 8000
```

Where:

IP\_Address is the IP address of the unit.

8000 is the management port number. For example, if the default IP address has not been changed, then you would enter the command:

```
telnet 192.168.1.1 8000
```

### If you can't connect

If the unit does not respond, check the following:

- It is properly installed, LAN connections are OK, and it is powered ON.
- Check that your PC is using a compatible *IP Address* and *Network Mask*.

In Windows, using Control Panel-Network to examine

the Properties for the TCP/IP protocol can check the IP Address and Network Mask. If your PC is NOT using an IP Address within the range 192.168.1.2 to 192.168.1.254, with a Network Mask of 255.255.255.0, then it will not connect to the default IP address.

3. Refer to the following section for details on using command line management.

## Terminal/Telnet Interface

The banner screen displays the version number.

```
Modbus Server Gateway V1.2
-----
Device Name: GW005370
Physical Location: Head Office

Configuration setup.

[Press any key to continue]
```

Pressing any key will then take you to the Main Menu.

```
Main Menu
-----
1  Set Local IP Address,
   Subnet Mask, and Gateway Address
2  Set Manager/Telnet IP Address
3  Serial Port 1 Configuration
4  Serial Port 2 Configuration
5  Modbus/TCP Configuration
6  Modbus Serial Configuration
7  Display Configuration Settings
8  Reset Configuration to Default
9  Save and Exit
0  Exit without Saving

Choose a Number =>
```

Each of these menu options is explained in the following pages.

## Entering Data

Enter the number of the field you wish to change, followed (on the same line) by a space and the data for that field.

### Example

On screen one, to set the IP address (field 1) to 192.168.1.10

=>1 192.168.1.10

## Menu Options

### Main Menu Option 1. Setting IP Addresses

Selecting 1 (1 Local IP Address) from the Main Menu will result in a screen which is similar to the following.

Choose a Number =>

```
LOCAL UNIT CONFIGURATION:
  Local Address: 205.166.54.141      Serial NO:
00:60:E9:00:53:70
  Gateway Address: (NOT SET)        Subnet
Mask: 255.255.255.0
  Name of Contact Person: Supervisor
  Device Name: GW005370
  Physical Location: Head Office

IP Fragmentation: ALLOWED

SET LOCAL UNIT CONFIGURATION:
 1 Local IP Address
 2 Gateway IP Address
 3 Subnet Mask
 4 Name of Contact Person
```

```
5 Device Name
6 Physical Location
7 IP Fragmentation [0=ALLOWED, 1=NOT ALLOWED]
0 -- Return to previous menu
```

Enter Command =>

### **1. Local IP Address**

The IP address of this unit on your LAN. The default IP Address is 192.168.1.1

### **2. Gateway IP Address**

If the remote host is not on the same LAN, then the gateway to the other LAN must be entered here.

### **3. Subnet Mask**

The network mask indicates what class of TCP/IP network you have. The default value is for a class “C” network, with up to 255 users. This value should work in small networks. If in doubt, consult your network administrator.

### **4. Name of Contact Person: Supervisor**

This is a text field. It can be used to store the name of the person responsible for the unit.

### **5. Device Name**

This is a text field. It can be used to store a descriptive name for the device.

### **6. Physical Location**

This is a text field. It can be used to store the location of the device.

## 7. IP Fragmentation

Set to 0 if IP fragmentation is allowed, 1 to disallow IP fragmentation.

### Main Menu Option 2. Set Manager/Telnet IP Address

Selecting (2) from the Main Menu will result in the following screen. Caution! If these addresses are set, only those nodes will be allowed to configure the unit.

ANAGER CONFIGURATION:

```
Entry  Manager_IP_Addr
*****
1.      0.0.0.0
2.      0.0.0.0
3.      0.0.0.0
4.      0.0.0.0
```

SET MANAGER CONFIGURATION:

```
set Entry_Number IP_Address
clear Entry_Number
0  --Return to main menu.
```

EXAMPLE: To set entry #3 to IP  
address=138.239.0.24,

```
=> set 3 138.239.0.24
```

EXAMPLE: To clear entry #2 IP address,

```
=> clear 2
```



---

Enter Command =>

This screen shows a table containing four (4) entries. By default, all entries are blank. These entries provide a security feature. Only a user at one of the IP addresses shown can manage the unit. (All users on the LAN can still use the gateway, but not configure it.)

**If the entries are blank, then any user on the LAN can configure the gateway.**

Entries in the table cannot be edited, but commands are provided to insert (SET) and delete (CLEAR) entries.

### Main Menu Options 3 & 4. Serial Port Configuration

Selecting (3) from the Main Menu will result in the following screen for port 1. Selecting (4) from the Main Menu will result in a similar screen for port 2.

#### PORT 1 CONFIGURATION:

Baud Rate:	38400	RTS/CTS Handshake:
	No	
Parity:	EVEN	-Delay after RTS Active:
	0 ms	
Data:	8 Bits	-Wait CTS Active:
	0 ms	
Stop:	1 Bit	-Delay after CTS Active:
	0 ms	
RS485:	4-wire	-Delay dropping RTS:
	0 ms	

#### SET PORT CONFIGURATION:

1 Baud Rate	[0=230400, 1=115200,
2=57600, 3=38400, 4=19200,	

```
5=9600, 6=4800,
7=2400, 8=1200, 9=600, 10=300]
2 Parity bit [0=None, 1=Odd,
2=Even]
3 Data bits [0=7bits, 1=8bits]
4 Stop bits [0=1bit, 1=2bits]
5 RS485 Mode [0=4-wire, 1=2-wire]
6 RTS/CTS Handshake [0=no, 1=yes]
7 Delay after RTS Active [0 - 5000 ms]
8 Wait CTS Active [0 - 5000 ms]
9 Delay after CTS Active [0 - 5000 ms]
10 Delay dropping RTS [0 - 5000 ms]
0 -- Return to previous menu.
EXAMPLE: To set the baud rate to 19200
=> 1 4
```

Enter Command =>

This screen configures the settings for the serial ports. The settings used should match the device connected to the serial ports of the gateway.

### **Baud Rate**

Speeds between 300 bps and 230.4Kbps are supported.

### **Parity**

Configure parity bits for either NONE, ODD, or EVEN to match your serial devices.

### **Data Bits**

Configure the word length to seven or eight bits. This does NOT include the parity bit.

### **Stop Bits**

Configure the number of stop bits to either one or two.

**RS-485 Mode**

If the port is used for RS-485/422, configure the mode to be either two wire or four wire. If the port is jumpered for RS-232 operation, this setting has no effect.

**Hardware Handshaking**

This option is used to enable or disable RTS/CTS Handshaking typically used with half-duplex modems. Do not confuse this with hardware flow control. The following 4 parameters control the timing and are only valid when handshaking is enabled.

**Delay after RTS Active**

This parameter sets the minimum amount of time to delay after asserting RTS before checking the state of CTS. Set to a value between 0 and 5000 msec (5 seconds).

**Wait CTS Active**

This parameter sets the maximum amount of time to wait for CTS to go active. If CTS does not go active within this time period, the transmission will be aborted.

Set to a value between 0 and 5000 msec (5 seconds).

**Delay After CTS Active**

This parameter sets the minimum amount of time to wait after CTS goes active before transmitting the data. Set to a value between 0 and 5000 msec (5 seconds).

**Delay Dropping RTS**

This is the optional delay that occurs between the end of data transmission and lowering RTS. Set to a value between 0 and 5000 msec (5 seconds).



## Main Menu Option 5. MODBUS TCP Configuration

Selecting (5) from the Main Menu will result in the following screen:

MODBUS/TCP CONFIGURATION:

```
TCP Port: 502
Connection Timeout: 120 seconds
Return Modbus/TCP Exceptions: No
Discard Multiple Polls: Yes
Slave Address 0: Broadcast
Fixed Slave Address: 0
```

SET MODBUS/TCP CONFIGURATION:

```
1 TCP Port
2 Connection Timeout [10 - 3600
seconds]
3 Return Modbus/TCP Exceptions [0=no, 1=yes]
4 Discard Multiple Polls [0=no, 1=yes]
5 Slave Address 0 [0=Map to Addr
1, 1=Broadcast]
6 Fixed Slave Address [0=Not Fixed,
1-247 = Fixed address]
0 -- Return to previous menu
```

EXAMPLE: To set the Connection Timeout to 75 seconds

=> 2 75

Enter Command =>

Use this screen to configure Modbus/TCP configuration values.

## **TCP Port**

This is the TCP/IP port number used by the gateway. It is normally set to port 502.

## **Connection Timeout**

This parameter sets the amount of time the Gateway will hold an idle TCP connection open before closing it. Default is 120 seconds.

## **Return Modbus/TCP Exceptions**

This parameter can be used to inhibit the Gateway from returning the exception codes "No Gateway Path (0x0a)" and "Timeout (0x0b)" in response to these error conditions. This is needed for compatibility with some Modbus Hosts which do not support these exceptions. The default is NO.

## **Discard Multiple Polls**

When enabled, this parameter will cause the Gateway to discard a second query from a host to a Slave Address, if a previous query is currently in-process. This is to guard against a situation where the poll rates are set too high for network conditions, causing the host queries to get out of step with the slave responses.

## **Slave Address 0**

This parameter controls how Modbus/TCP messages with Slave address 0 are handled. When set to Broadcast, the message will be transmitted out both serial ports with the address unchanged. When set to Map to Addr 1, the slave address will be replaced with address 1 and sent to the appropriate serial port. This option is for compatibility with some Modbus/TCP hosts that incorrectly set all queries to Slave address 0.

## Fixed Slave Address

This parameter controls how the Gateway handles the slave address field in the Modbus/TCP query. When set to 0, the Gateway will use the slave address as specified in the query. When set to a value from 1 to 247, the Gateway will ignore the slave address field in the Modbus/TCP query and replace it with the value specified. This option is for compatibility with some Modbus/TCP hosts that do not set the Slave address. When using a fixed address, only one serial port may be used.

## Main Menu Option 6. Modbus Serial Configuration

Selecting (6) from the Main Menu will result in the following screen:

```
MODBUS SERIAL CONFIGURATION:
  Port 1 Modbus Protocol:  RTU          Port 2
Modbus Protocol:  RTU
  Port 1 Slave Address Low:    1        Port 2
Slave Address Low:    1
  Port 1 Slave Address High: 247        Port 2
Slave Address High: 247
  Port 1 Response Timeout:   2000       Port 2
Response Timeout:    250
  Port 1 Character Timeout:   50         Port 2
Character Timeout:   50

SET MODBUS SERIAL CONFIGURATION:
1  Port 1 Modbus Protocol    [0=RTU, 1=ASCII]
2  Port 1 Slave Address Low  [1 - 247]
3  Port 1 Slave Address High [1 - 247]
4  Port 1 Response Timeout   [5 - 5000 ms]
5  Port 1 Character Timeout   [5 - 5000 ms]
6  Port 2 Modbus Protocol    [0=RTU, 1=ASCII]
7  Port 2 Slave Address Low  [1 - 247]
```

```
8 Port 2 Slave Address High [1 - 247]
9 Port 2 Response Timeout   [5 - 5000 ms]
10 Port 2 Character Timeout  [5 - 5000 ms]
0 -- Return to previous menu
```

EXAMPLE: To set the Port 1 Modbus Protocol to RTU

=> 1 0

Enter Command =

Use this screen to configure Modbus serial configuration values. For each of the ports (1 or 2) configure the following...

### **Modbus Protocol**

Select the appropriate Modbus protocol to match the RTU(s) on this port. Select either 0 for RTU or 1 for ASCII

### **Slave Address Low**

Configures the lowest address of an RTU on this port.

### **Slave Address High**

Configures the highest address range of an RTU on this port. If the ranges of port one and port two overlap, addresses in the overlap will be sent to port one.

### **Response Timeout**

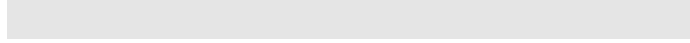
This parameter specifies the maximum amount of time to wait for the first character of a response from a slave device

### **Character Timeout**

This parameter specifies the maximum amount of time to wait for reception of successive characters. For Modbus/RTU mode, this timer is used to determine the end-of-message. The



specification defines this to be 3.5 character times, but in practice this is usually too short as 5 to 10 msec delays are common.



## Main Menu Option 7. Display Configuration Settings

Selecting (7) from the Main Menu will display the following information:

Modbus Server Gateway: V1.2

### LOCAL UNIT CONFIGURATION:

Local Address: 205.166.54.141      Serial NO: 00:60:E9:00:53:70  
Gateway Address: (NOT SET)      Subnet Mask: 255.255.255.0  
Name of Contact Person: Supervisor  
Device Name: GW005370  
Physical Location: Head Office

IP Fragmentation: ALLOWED

### MANAGER CONFIGURATION:

Entry Manager\_IP\_Addr

\*\*\*\*\*

1. 0.0.0.0
2. 0.0.0.0
3. 0.0.0.0
4. 0.0.0.0

[Press any key to continue]

### PORT 1 CONFIGURATION:

Baud Rate: 38400	RTS/CTS Handshake:	No
Parity: EVEN	-Delay after RTS Active:	0 ms
Data: 8 Bits	-Wait CTS Active:	0 ms
Stop: 1 Bit	-Delay after CTS Active:	0 ms
RS485: 4-wire	-Delay dropping RTS:	0 ms

---

**PORT 2 CONFIGURATION:**

Baud Rate: 19200      RTS/CTS Handshake:      No  
Parity:      NONE      -Delay after RTS Active:      0 ms  
Data:      8 Bits      -Wait CTS Active:      0 ms  
Stop:      1 Bit      -Delay after CTS Active:      0 ms  
RS485:      4-wire      -Delay dropping RTS:      0 ms

[Press any key to continue]

**MODBUS/TCP CONFIGURATION:**

TCP Port:      502  
Connection Timeout:      120 seconds  
Return Modbus/TCP Exceptions: No  
Discard Multiple Polls:      Yes  
Slave Address 0:      Broadcast  
Fixed Slave Address:      0

**MODBUS SERIAL CONFIGURATION:**

Port 1 Modbus Protocol: RTU      Port 2 Modbus Protocol: RTU  
Port 1 Slave Address Low:      1      Port 2 Slave Address Low:      1  
Port 1 Slave Address High: 247      Port 2 Slave Address High: 247  
Port 1 Response Timeout: 2000      Port 2 Response Timeout: 250  
Port 1 Character Timeout: 50      Port 2 Character Timeout: 50

[Press any key to continue]

**CURRENT STATISTICS:**

Network packets received: 595  
Network packets transmitted: 144  
Network packet errors: 0  
Port bytes received: 0  
Port bytes transmitted: 0

[Press any key to continue]

This option displays the configuration and some counters.

## **Main Menu Option 8. Reset Configuration to Default**

Selecting (8) from the Main Menu will restore all values to their default values.

If using Telnet or web browser configuration, the connection will be lost when the hardware reboots. To reconnect, you must use the default IP Address of 192.168.1.1 or change the IP address before rebooting with main menu option 7. The preferred method is to restore defaults with menu item 8, and then ***BEFORE REBOOTING***, change the IP information by using submenu 1 so your PC will still be able to connect to the gateway when it reboots.

## **Main Menu Option 9. Save and Exit**

Selecting (9) from the Main Menu will store the configuration details in the gateway and exit the configuration program.

If using Telnet, the connection will be lost when rebooting. If you have changed the IP Address, you must use the new IP Address when you reconnect.

## **Main Menu Option 0. Exit without Saving**

Selecting (0) from the Main Menu will exit the configuration program without saving any data you have entered.

# Chapter 4

# Browser

# Management

*This Chapter describes how to manage the EtherSeries Gateway using a Web Browser.*

## Overview

This method uses your Web Browser to manage the gateway. This provides a more user-friendly interface than the Telnet/Terminal method.

- The unit must be installed in your **LAN and have a compatible IP address** before this configuration method can be used.
- Most Browsers will work. The only requirement is that they support HTML tables and forms. If your browser uses a proxy, the proxy function may need to be disabled.

## Connection Procedure

To establish a connection to the gateway , follow this procedure:

1. Install the unit in your LAN as described in Chapter 2. Ensure that it is powered on and there is a link light on the hub or ethernet switch.

2. Start your Web browser.
3. In the *Address* box of your browser, enter the following:

`http://IP_Address`

( *IP\_Address* is the IP address of the gateway)

For example, if the default IP address has not been changed, then you would enter the command:

`http://192.168.1.1`

### **If you can't connect**

If it does not respond, check the following:

- The gateway is properly installed, LAN connections are OK, and it is powered ON.
- Check that your PC is using a compatible *IP Address* and *Network Mask*.

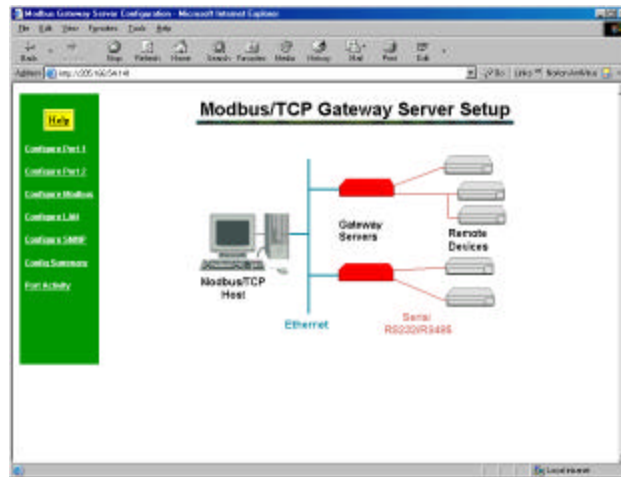
In Windows98, using Control Panel-Network to examine the Properties for the TCP/IP protocol can check the IP Address and Network Mask.

If your PC is NOT using an IP Address within the range 192.168.1.2 to 192.168.1.254, with a Network Mask of 255.255.255.0, it will not be able to communicate with the gateway.

4. Once connected, you will see the first screen. Refer to the following section for details on using the Web-based interface.

## Web-based Interface

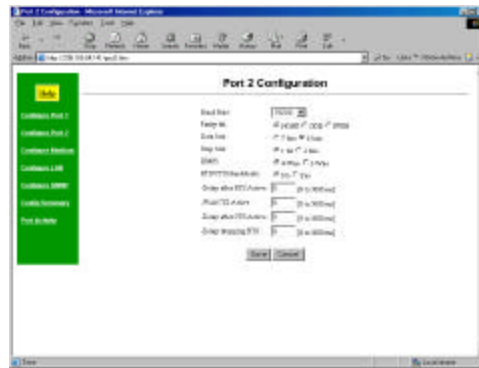
The first screen is similar to Figure 2.



**Figure 1: Sign on Screen**

- Use the menu bar on the left to navigate to the desired screen.
- On-line help is available on each screen.
- Each screen is explained in the following sections.
- Details for each field are given in the previous chapter under similar sections.

## Serial Port Configuration Screen

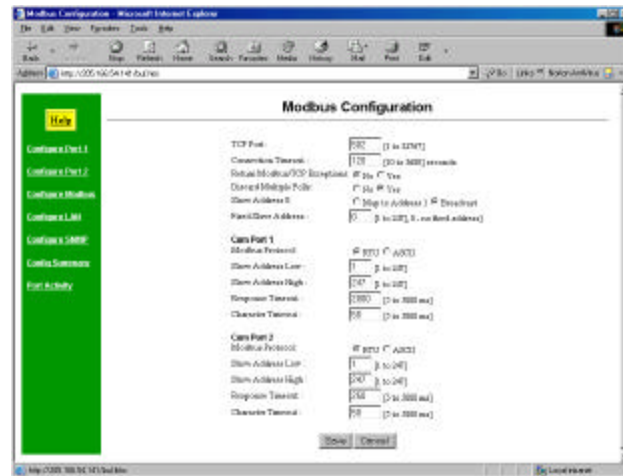


**Figure 2: Serial Configuration Screen**

This screen allows you to configure the Serial Ports one and two. The settings used should match the device connected to this serial port. See Chapter 3 for details on these settings. There will be one screen for each serial port. The screen will only include the field “RS-485” if the port is jumpered for RS-485.



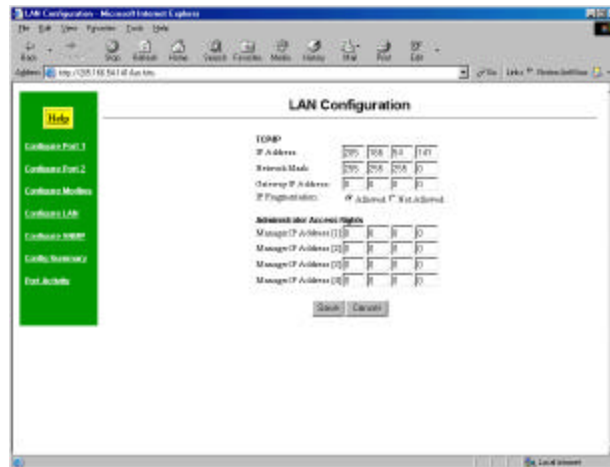
## Modbus Configuration Screen



**Figure 3:Modbus Configuration**

This screen is used to configure all Modbus parameters. Note that two menus are used for these values in the Telnet Configuration method... “Configure Modbus/TCP” and “Configure Modbus Serial”.

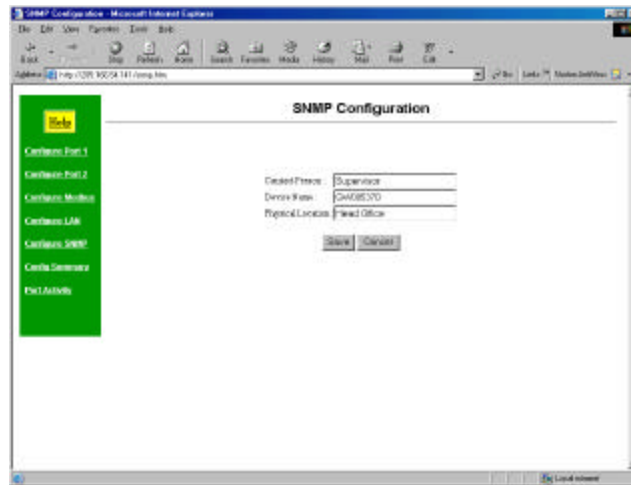
## LAN Configuration Screen



**Figure 4: LAN Configuration Screen**

This screen is used to configure the LAN parameters. See Chapter 3 for details.

## SNMP Configuration Screen



**Figure 5: SNMP Configuration Screen**

### Overview

This screen may be ignored if SNMP is not used.

The text fields, commonly used in SNMP (Simple Network Management Protocol) Programs to identify this device when browsing the network, are required for SNMP operation. The community name should be changed from the default.

## Configuration Summary Screen

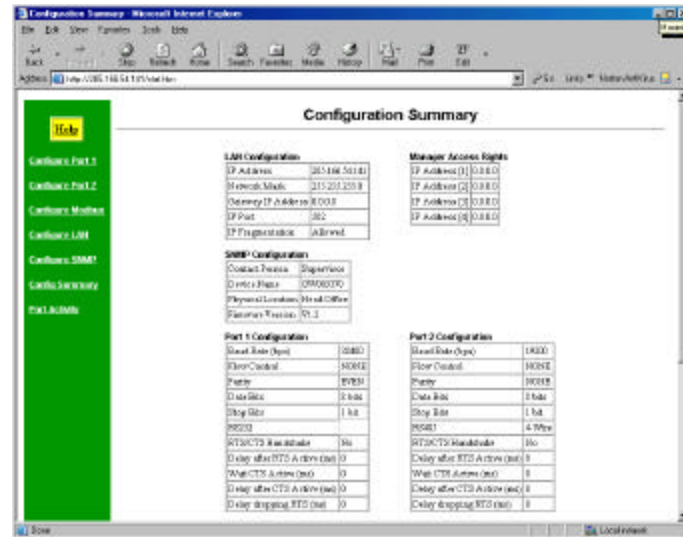
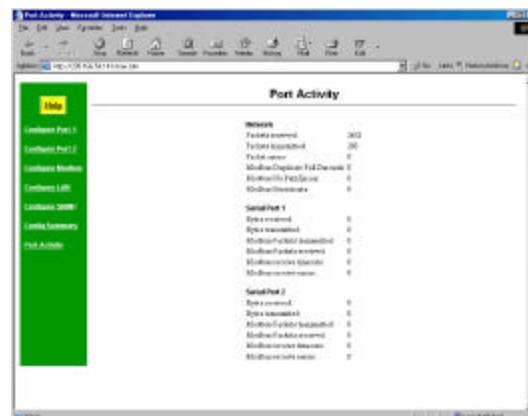


Figure 6: Configuration Summary Screen  
(Top portion shown)

### Operation

- This screen displays all current settings for this gateway.
- Clicking the "Set to Defaults" button will restore ALL values to their factory default values. When this is done, the unit will reboot, and the existing connection will be lost. You must reconnect using the default IP Address of 192.168.1.1.



## Port Activity Screen

Figure 7: Port Activity Screen

### Operation

- This screen displays all current activity for the LAN port and both serial ports.
- Values are described in Chapter 3.

## Chapter 5 Operation

*This Chapter explains how to use the EtherSeries gateway, once it is installed and configured.*

### Operation

The gateway allows serial MODBUS RTUs to communicate and interoperate with MODBUS/TCP based controllers. The MODBUS standard protocol is an asynchronous protocol designed to connect directly to computer asynchronous ports. MODBUS has been extended to operate over Ethernet using the IP protocol suite. This gateway converts between the MODBUS TCP/IP protocol and MODBUS ASCII/RTU protocols transparently.

Normal operation would consist of one or more Ethernet based computers functioning as Modbus Master and one or more MODBUS slave devices (usually RTUs) connected serially to the gateway.

By using RS-485, multiple MODBUS slave devices may be connected to each of the two serial ports on the EMB-02. If using RS-232, one MODBUS slave device may be connected to each serial port.

## Chapter 6

# Troubleshooting

*This chapter outlines some problems that may occur during installation or operation and some possible solutions to them.*

If you follow the suggested troubleshooting steps and the EtherSeries gateway still does not function properly, please contact your dealer for further advice.

### Hardware Problems

**Before anything else, check that all cables are wired correctly and properly connected.**

**P:** All the LEDs are off.

**S:** Check the power supply or power connection.

**P:** When using 10/100Base-T cabling, the unit does not work.

**S:** Check the Hub's link LED for the port to which the gateway is connected. If it is off, make sure the network cable between the unit and hub is in good condition.

## Can't Connect via the LAN

**P:** Can't connect to the gateway using Telnet or Web Browser.

**S:** Check the following:

- Start troubleshooting from a known state. Power the unit OFF and ON to reboot.
- Is a proper IP address configured?
- “Ping” the unit to see if it responds. From the Windows command prompt or “Run” dialog box, use the command:

```
ping IP_Address
```

Where IP\_Address is the IP Address of the gateway (e.g. ping 192.168.1.1 ). If it does not respond, then check all LAN connections. If the LAN connection are OK, the problem is in the LAN addresses or routing. **The most common problem cause is incorrect IP addressing. Make sure the workstation and gateway have compatible IP addresses.**

- It may be that your "arp table" contains invalid entries. You can clear the "arp table" by rebooting, or, on Windows95 , by typing the following command at the command prompt or *Run* dialog box.: `arp -d`
- Check that you have used the correct port address for telnet access. The address is “8000” for configuration.
- MOST connection problems are due to incorrect RS-232 wiring. Remember that there is no "standard" RS-232 wiring between devices. You may need to contact your vendor for appropriately wired cables.

- In some cases, “smart” hubs and switches must be power-cycled to clear their internal arp cache. This is often a problem on test bench setups where IP addresses are moved between different equipment or a unit is moved between ethernet switch receptacles.



## Other Problems

**P:** Can't run the configuration program using a serial cable connection.

**S:** Check that:

- The communication parameters are set properly.
- Disconnect and reconnect the power supply.
- Power is available... a LED is on.
- The terminal program is operating properly. Try a loopback connector at the gateway end of the cable to verify program operation and the proper COM: port.
- The most common problems causing this symptom are incorrect RS-232 wiring or the Windows Hyperterm program not operating correctly.

**P:** Can't drive more than three RS-485 2-wire loads.

**S:** Read the section on RS-422 2-wire fan-out and configure the unit appropriately.

**P:** Unable to poll some addresses.

**S:** Read the section on modbus configuration. If port one and port two addresses overlap, the overlapped addresses are only sent out port one.

## Verify Proper Operation

Once the gateway is installed on your Network, verify proper operation by testing its functionality. SCADA networks vary greatly, so there is no simple way to describe testing all possibilities. Use a scientific method and keep careful records of all installation and troubleshooting steps. For example, consider the following method...

1. Verify that the gateway has a proper LAN connection by pinging it. If it responds to a ping then...
2. Verify the unit's configuration by using telnet to port 8000 or by checking it using a web browser. If it looks good then...
3. Attempt a poll from the Modbus polling master computer. If that works correctly, you're ready to continue with Modbus operation. IF not...
4. Check the gateway's statistics to see if it received the LAN activity and passed the polls to a serial port. If not, there is likely a problem with IP addressing or the host computer is not configured correctly for the gateway's LAN. If the gateway receives the LAN packets and doesn't pass them to the serial port, then check its configuration. If the counters indicate that the poll was passed to the serial port, but there's no response...
5. Verify correct RS-232/RS-485 jumpers and configuration. Verify cabling to the RTU. One of these is likely incorrect. Or...
6. Verify the RTU configuration. Perhaps it's not correctly configured.





# Appendix A

## Specifications

### EtherSeries Gateway Specifications

- Flash Memory: 512 Kbytes
- SRAM: 256 Kbytes
- EEPROM: 512 Bytes
- LAN Buffer: 2 Kbytes
- RS-232 Buffer: 4 Kbytes
- RS-232/485: two male DE-9 connectors (PC DB-9)
- RS-232 speed: Up to 230 Kbps
- Network: Ethernet 10Base-T/ 100Base-T
- CPU: 16 Bit
- Power: 9 to 36 VDC (12VDC @ 260 ma) or Optional power supplies
- Switch: Configuration Mode
- LED indicators: 4 multi-purpose
- Default IP address: 192.168.1.1
- Telnet management port: 8000
- Operational Temperature -40C to +70C

## RS-232 PIN Assignments

The EtherSeries RS-232 port wiring is identical to a standard PC 9 pin DE-9P COM: port. It operates as a DTE device. The chart below details signal directions and names.

Serial Port Pin Assignments		
Pin	Signal Name	Type
1	Carrier Detect (CD)	In
2	Receive (Rx)	In
3	Transmit (Tx)	Out
4	Data Terminal Ready	Out
5	Signal Ground (GND)	Power
6	Data Set Ready (DSR)	In
7	Request to Send (RTS)	Out
8	Clear to Send (CTS)	In
9	Ring Indicator (RI) <b>(Not used)</b>	In

---

## Control Signal Operation

### DCD

Input, ignored

### Receive Data

Input, data into the unit

### Transmit Data

Output, Data from the unit. The Etherseries unit only transmits when it has characters to send, and if handshaking is enabled, when the CTS input is asserted.

### DTR

Output. Signal is asserted when the unit is powered on.

### Signal Ground

Common ground

### DSR

Input, ignored.

### RTS

Output. If handshaking is disabled, this signal is always asserted. If handshaking is enabled, it will be asserted when the gateway has a packet to transmit on the serial port and it will be de-asserted when transmission is complete.

### CTS

Input. When handshaking is disabled, this signal is ignored. When handshaking is enabled, the gateway will wait for CTS to be asserted before transmitting a packet on the serial port.

## Ring Indicator

Not used



## CABLES

Commonly used cable connections:

### To PC 9-pin COM: port

SS-1		PC
1,6	——	4
2	——	3
3	——	2
4	——	1,6
5	——	5
7	——	8
8	——	7

This null-modem crossover cable is easily made by combining two "PC-Direct" adapter hoods with a mux-mux crossover cable from DCB. This cable is used for configuration and is available from your dealer. This is commonly called a "PC-to-PC null modem cable".

### Gateway to RTU

Since RTUs vary in pinout configuration, no standard cable may be specified. Since the gateway pinout is similar to a PC COM: port when configured in RS-232 mode, a PC-to-RTU cable may be used that is the same cable that works between YOUR PC and YOUR RTU.

Note that if the RTU has a pinout similar to a PC, then a cross-over (null-modem) cable must be used.



## Appendix B

# RS-422/ RS-485 Interface

*This Appendix describes the RS-422/485 interface. This interface option may be jumper configured in the field or pre-configured at the factory.*

### Introduction

The 9-pin serial connector may be used for either RS-232 or RS-422 (4-wire RS-485 point-to-point) operation by changing internal jumpers.

### Changing the Setting

Remove the main board from the case by removing two screws from the rear panel. There is a row of jumpers and three rows of pins adjacent to the serial connector.

### RS-232 Setting

ALL jumpers should be placed in the positions nearest the board edge.

## RS-422/4-Wire RS-485 Setting

ALL jumpers should placed in the positions furthestmost from the board edge.

### RS-422 / 4-Wire RS-485 Interface Pinout

Serial Port Pin Assignments		
Pin	Signal Name	Type
1	No Connection	N/A
2	No Connection	N/A
3	Receive Data (Rx-)	In
4	Transmit Data (Tx-)	Out
5	Signal Ground (GND)	N/A
6	No Connection	N/A
7	No Connection	N/A
8	Receive Data (Rx+)	In
9	Transmit Data (Tx+)	Out

## 2-Wire RS-485 Interface Pinout

Serial Port Pin Assignments		
Pin	Signal Name	Type
1	No Connection	N/A
2	No Connection	N/A
3	Receive Data (Rx-)	In/Out
4	No Connection	N/A
5	Signal Ground (GND)	N/A
6	No Connection	N/A
7	No Connection	N/A
8	Receive Data (Rx+)	In/Out
9	No Connection	N/A

## RS-485 2-wire Fan-out

Since this unit is most often used as an RS-485 2-wire end-point, it is delivered with terminating resistors installed internally. With this termination installed the RS-485 2-wire interface will reliably drive three RS-485 loads.

If more than 3 devices are required, the terminating resistor pack may be removed. Without the terminating resistor pack, up to 31 devices may be used on the RS-485 line. However, all RS-485 standard rules must still be observed.