POWER LEADER™

Ethernet Gateway

User's Guide

GEH–6505

WARNINGS, CAUTIONS, AND NOTES
AS USED IN THIS PUBLICATION

WARNINGS Warning notices are used in this publication to emphasize that hazardous voltages, currents, or other conditions that could cause personal injury exist in this equipment or may be associated with its use.

Warning notices are also used for situations in which inattention or lack of equipment knowledge could cause either personal injury or damage to equipment.

CAUTIONS Caution notices are used for situations in which equipment might be damaged if care is not taken.

NOTES Notes call attention to information that is especially significant to understanding and operating the equipment.

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REFERENCES POWER LEADER™ is a registered trademark of GE Company.

Modbus RTU is a registered trademark of AEG Schneider Automation.

For details of the Modbus RTU protocol, refer to PI-MBUS-300 Rev. E from Modicon/AEG Schneider Automation.

For details of RS485 communications, refer to the EIA-485 standard.

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Chapter 1 – Introduction

1–1 Overview

The GE POWER LEADER™ Ethernet Gateway (catalog number PLENETG01), shown in Figure 1, is a microprocessor-based device that connects one to four RS485-based Modbus Remote Terminal Unit (RTU) networks to an industry-standard, high-speed Ethernet network. Up to 31 Modbus RTU devices can be connected to each of the Modbus RTU networks.

Figure 1. POWER LEADER Ethernet Gateway.

The Ethernet Gateway works with GE's Power Management Control System (PMCS), a comprehensive power management software platform that acts as the 'host' to RS485 networks attached to the Ethernet Gateway. A special part of the PMCS called the Dynamic Data Exchange (DDE) server is a database that records the addresses and configurations of all attached devices. The Ethernet Gateway serves as a pass-through device, interpreting the addressing information and routing queries from the host to the Modbus RTU networks and passing answers to those queries from the attached devices back to the host.

The Ethernet Gateway strictly conforms to the Modbus RTU protocol, providing the capability to tie the supported Modbus RTU devices into an Ethernet network. Table 1 contains a partial list of devices that are compatible with the Ethernet Gateway and conform to the Modbus RTU standard.

Device	Description
EPM 3710	Full-function, three-phase electronic meter with optional pulse initiation, waveform capture, data logging, and protective relay outputs.
EPM 3720	Full-function, three-phase electronic meter with optional pulse initiation, waveform capture, data logging, protective relay outputs, and harmonic distortion measurements.
Multilin 269 Plus Motor Management Relay	Protection for medium-voltage industrial motors and associated mechanical systems.
Multilin 565 Feeder Management Relay	Complete time-overcurrent phase and ground protection by monitoring feeder phase current and ground current.
Fanuc 90/30 PLC	Programmable logic controller (PLC) for applications from simple relay replacement to midrange process control.
Fanuc 90/70 PLC	Programmable logic controller with multiple processors and programming capabilities for large, high-speed applications.
Modbus Concentrator	Maps addresses of up to 32 attached POWER LEADER communications network (commnet) devices to equivalent Modbus addresses for use with the Ethernet Gateway.

Table 1. Examples of Modbus RTU compatible devices.

NOTE: PMCS is certified for use with power management components manufactured 5/13/96 or later. If your system interfaces to: 1) any trip units, meters, or relays manufactured prior to 5/13/96, or 2) any Spectra RMS™ Circuit Breakers with MicroVersaTrip PM™ Trip Units, please contact the POWER LEADER Customer Support Center at 1-800-843-3742.

As mentioned in Table 1, the Modbus Concentrator allows integration of POWER LEADER commnet devices with Modbus RTU-compatible networks for use with the Ethernet Gateway. See Section 3–5 for more details on the integration of commnet devices into Modbus networks.

Figure 2 illustrates a typical Modbus RTU network connected to a high-speed Ethernet through an Ethernet Gateway.

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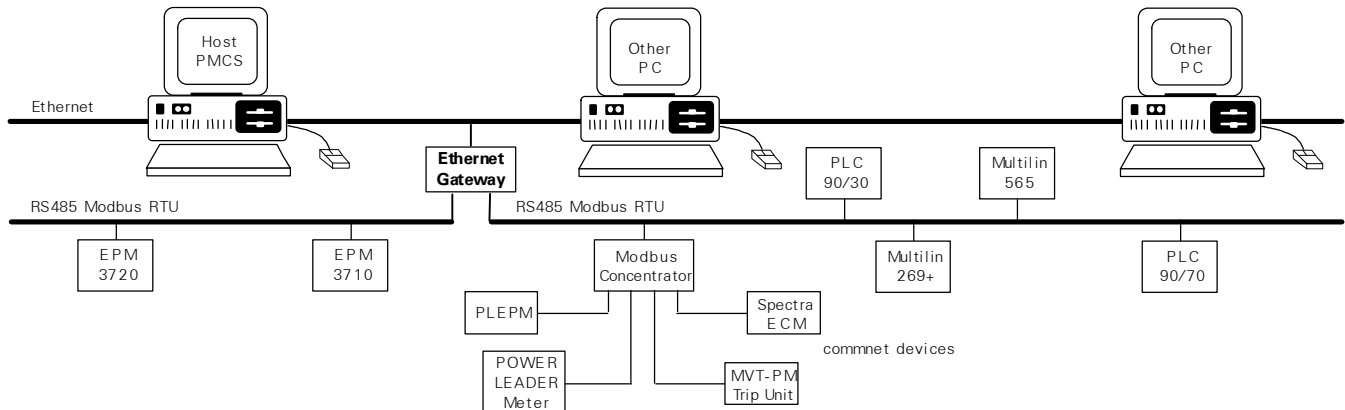
Figure 2. Typical use of Ethernet Gateway.

1–2 Physical Description

Figure 3 is an outline drawing showing the dimensions of the Ethernet Gateway. Figure 4 is a rear view of the Gateway showing its control power, Ethernet, RS485 and RS232 connections.

The following ports and connections are provided on the Gateway:

- A pair of Ethernet ports provides input and output connections to the either a 10BaseT or a 10Base2 Ethernet network.

- Four RS485 ports support up to four Modbus RTU networks, labeled Network 1 to Network 4, with as many as 31 Modbus devices each and up to 247 Modbus addresses each. RS485 ports are DB-9 (9-pin D shell) connectors with the following pin assignments:

Data -	Pin 1
Data +	Pin 2
Ground	Pin 5

- One RS232 port (also DB-9 style) allows connection of a dumb terminal for configuration and troubleshooting of the Ethernet Gateway

- A standard PC-style power connector for AC control power input.
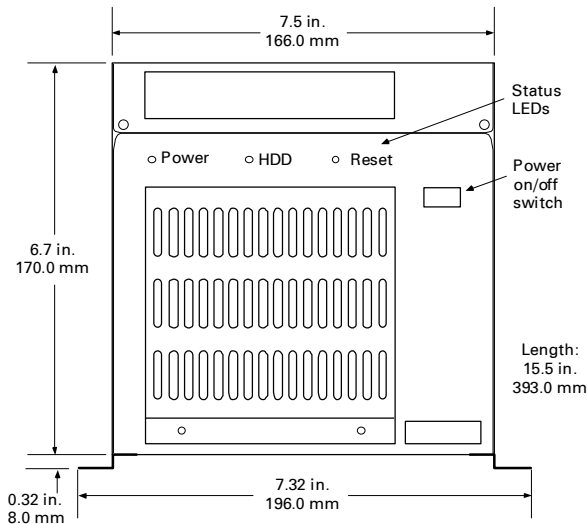
Figure 3. Front view with dimensions.
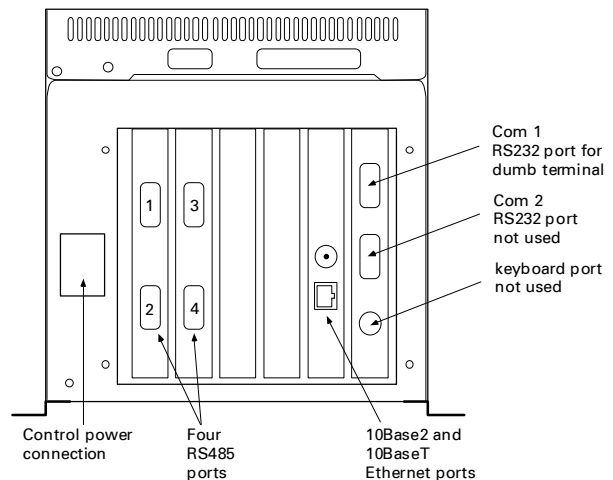
Figure 4. Rear view showing ports.

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1-3 Operational Description

The Ethernet Gateway transparently passes message between the host and devices attached to the Gateway. Figure 5 illustrates the stripping or adding of Ethernet headers to the Modbus messages. This section describes the nature of these messages and how the Gateway routes them. *The following information is not necessary for configuration and use of the Ethernet Gateway, but is provided for users who may be developing custom applications and need such information.*

Message Format

Messages sent from the software to RS485 devices via the Ethernet Gateway have a 15-byte header inserted in front of the message. The header tells the Gateway where to send the message, how long the message is, and if parity errors were encountered. This header has the following format:

SS   DD   EE   NN   CC

SS   Sequence of ten AA hex bytes indicating the start of a message

DD   Destination device port number – the Gateway RS485 port to which the message should be routed (0 - 3)

EE   Error status byte (0 = no parity errors, 1 = parity errors encountered)

NN   Number of bytes in the Modbus message

CC   A one byte checksum calculated by adding the first 14 bytes in the header

The header is stripped off the message by the Gateway and the remainder of the message is sent without changes to the destination device (or interpreted by the Gateway if a configuration message).

Messages from the RS485 devices to the host are processed by adding the 15-byte header onto the start of the message. For messages from devices to the host, the byte in the DD position contains the RS485 port from which the message came.

Cyclic redundancy check (CRC) handling is done by the host on the Ethernet and the RS485 device on the Modbus. The Gateway does not check the CRC when receiving messages from the host or from RS485 devices.
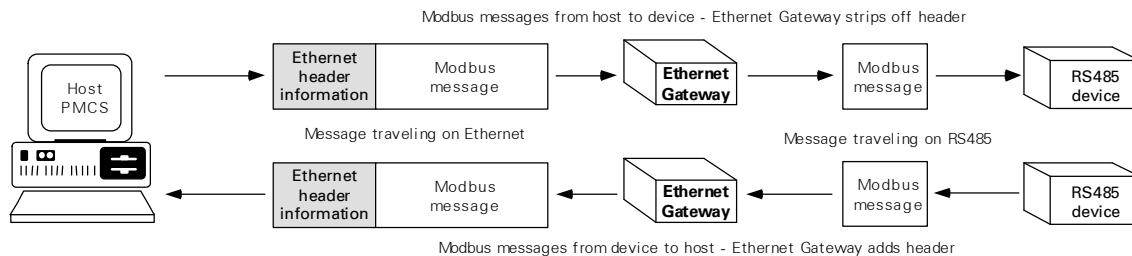
Figure 5. Ethernet headers on Modbus messages.

Gateway/Host Interface

The Gateway uses TCP/IP (Transmission Control Protocol/Internet Protocol) to interface with the host on the Ethernet.

The Gateway initially opens a socket and waits for a host device to attempt to connect with the socket.

Once a connection is established, data messages may be transmitted to the Gateway (and ultimately the RS485 devices) and messages from RS485 devices passed to the host.

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1–4 Specifications

The specifications of the Ethernet Gateway are listed in Table 2.

Parameter	Value
Control power	90–132 Vac or 180–264 Vac, 47–63 Hz; autoranging Power supply =150 VA min *(contact your GE sales representative for additional voltage options.)*
Modbus communications	Four RS485 ports, 1200 baud, 2400 baud, 4800 baud, 9600 baud and 19.2 Kbaud.
Ethernet communications	One PCL-843 16-bit Ethernet card; supports 10BaseT or 10Base2 transport mediums.

Standards
  UL Listed
  CSA Certified
	
	508 & 840
	C22.2 No. 14

Table 2. POWER LEADER Ethernet Gateway specifications.

1–5 Environmental Requirements

The environmental requirements of the Ethernet Gateway are listed in Table 3.

Parameter	Value
Operating temperature	0° C to +50° C
Storage temperature	–20° C to +80° C
Relative humidity	10% to 95% noncondensing
Vibration response and endurance	IEC 255–21–1 Severity Class 1
Fast transient surge	ANSI C37.90.1
Radiated EMI withstand	ANSI C37.90.2
Electrostatic discharge	IEC 801–2 Severity Class 4

Table 3. POWER LEADER Ethernet Gateway environmental requirements.

1–6 Terminology

Following are definitions of some of the terms used in this document.

POWER LEADER – The GE family of comprehensive power management devices and system software used to minimize downtime and overall power cost.

PMCS – Power Management Control System software.

SCADA (supervisory control and data acquisition) – A group of systems including power management and control systems.

DCS (distributed control system) – A group of systems including building automation and status monitoring systems.

Ethernet – An open, industry-standard, high-performance network communications protocol that operates on 10BaseT or 10Base2 transport mediums and yields communications rates up to 10 megabits per second.

Modbus RTU (Remote Terminal Unit) – An open, industry-standard, high-performance network communications protocol developed by Modicon/AEG Schneider Automation.

Modbus-compatible device – Any device equipped with a Modbus RTU communications port.

Modbus master – A host computer running PMCS software.

RS485/EIA485 – A physical standard for multi-drop, high-speed, noise-tolerant communications over a twisted pair network; often used with the Modbus RTU protocol.

Commnet – A GE proprietary communications network standard.

Commnet-compatible device – Any meter, relay, trip unit, or other device equipped with a commnet communications port.

Commnet segment – A group of one to four commnet-compatible devices (including at most one waveform-capturing meter) with all communication ports wired to a single Concentrator commnet port.

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Chapter 2 – Installation

2–1 Mounting

The Ethernet Gateway may be mounted on a horizontal surface or on a wall, preferably inside an enclosure or switchgear lineup. The Gateway should be mounted so that it is spaced from enclosure walls or from other components in the enclosure. A minimum of two inches clearance should be allowed along the long sides of the Gateway, and at least six inches clearance on the ends to allow for ventilation and cable access. To wall mount the Ethernet Gateway, attach the brackets to the chassis using six of the provided screws through the six holes on the inner edges of the mounting brackets. Then use the remaining four screws to secure the chassis to the wall through the holes in the outer edges of the brackets. Be sure that the chassis is mounted securely. The hole pattern for the mounting flanges of the Ethernet Gateway is shown in Figure 6.
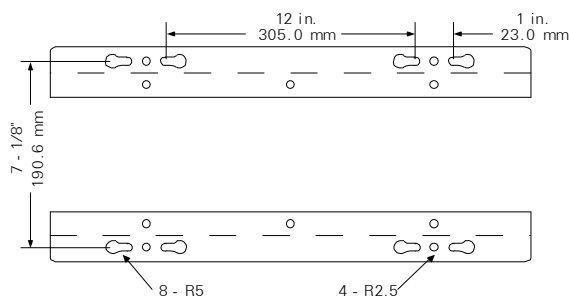
Figure 6. Mounting hole pattern for Ethernet Gateway.

2–2 Control Power Connections

Connect the control power cable included with the Ethernet Gateway to the standard PC-style power outlet on the rear of the enclosure, as shown in Figure 7. See Section 1–4 for appropriate control power voltage ranges.

The ON switch for the Ethernet Gateway is located on the front panel. Make sure the Gateway is mounted in a location where the power switch is not likely to be accidentally hit or switched off.
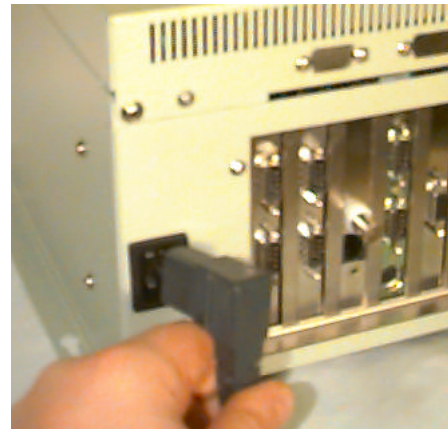
Figure 7. Connecting control power to the Ethernet Gateway.

2–3 Ethernet Connection

10BaseT and 10Base2 connections are provided on the back of the Ethernet Gateway to connect the Gateway to the Ethernet network, as shown in Figure 8. The Gateway is equipped with a PCL-843 16-bit Ethernet card.
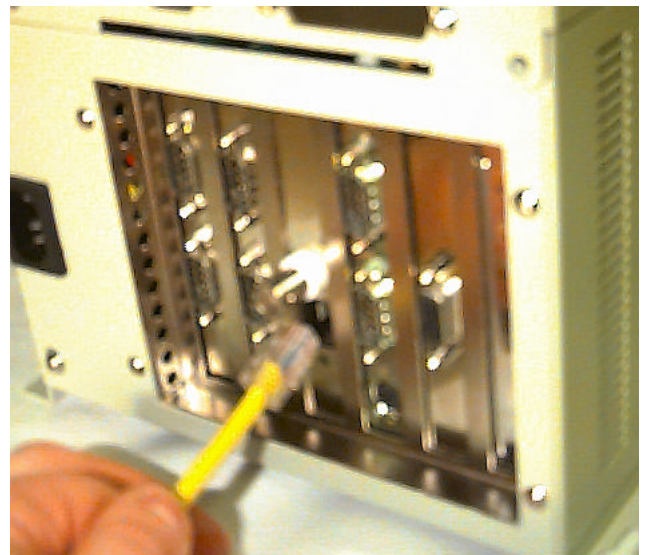
Figure 8. Making the Ethernet connection to the Gateway.

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Chapter 2 – Installation

2–4 Modbus Connection

The Modbus RTU networks should be connected to the RS485 ports on the back of the Ethernet Gateway, as shown in Figure 9.
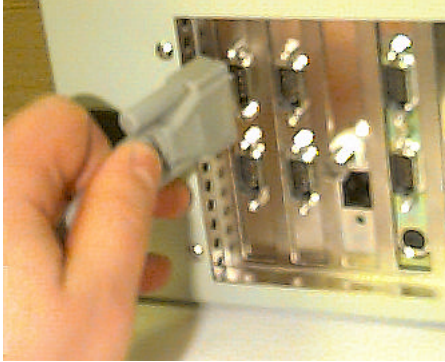
Figure 9. Connecting an RS485 network to the Ethernet Gateway.

Per the EIA-485 standard, the RS485 networks must be terminated at both ends. Position the Ethernet Gateway at one end of the RS485 networks, as it is internally terminated. The user must ensure that the final device on each network is terminated correctly, as shown in Figure 10.
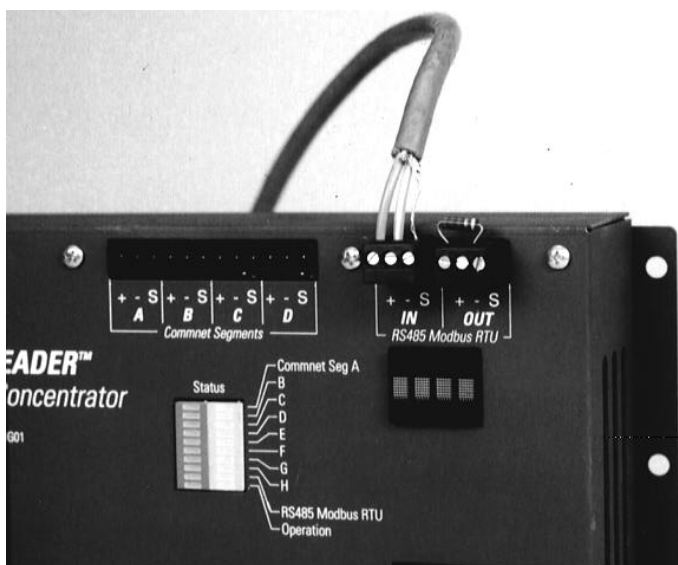
Figure 10. Terminating an RS485 network at the last device.

2–5 Diagnostic Connection

The RS232 port on the back of the Ethernet Gateway is provided for connection of a dumb terminal to the Gateway. The terminal may be used for configuring the Ethernet Gateway's settings or for diagnostic purposes. For diagnostic purposes, the Gateway may be set to display all messages and traffic on the terminal so that problems may be tracked down and corrected. To connect a terminal (usually a laptop computer running Windows' Terminal accessory software) to the Gateway, plug its RS232 cable into the RS232 port on the back of the Ethernet Gateway, as shown in Figure 11.

*Figure 11. Connecting a dumb terminal to the RS232 port.*

2–6 Wiring Rules – Modbus Networks

When wiring Modbus RTU devices to an Ethernet Gateway, follow the wiring rules below to ensure proper configuration. Refer to GEH-6502, the *PMCS Network Architecture Guide*, for specific examples of correct and incorrect configurations.

1. Up to 31 Modbus devices may be attached to a single Modbus network. RS485 repeaters do not have Modbus addresses, but do count as devices toward the 31 physical devices per network limit.

2. Every device on a single Modbus network must have a unique address. (Devices on different networks may use the same Modbus address, i.e., it is acceptable to have a device addressed as device 10 on Network 1 and another device addressed as device 10 on Network 2.) Use the Modbus address worksheets (at the end of this

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manual) to record the devices attached to each network and verify that each device on each network has a unique address.

3. Modbus Concentrators may be used to add POWER LEADER commnet devices to a Modbus network. The Concentrator assigns a Modbus-equivalent address to each commnet device attached to it. See Section 2-7 for a discussion of commnet and Modbus-equivalent addresses.

NOTE: While Modbus Concentrators are counted as regular Modbus devices, the commnet devices attached to Modbus Concentrators do NOT count toward the 31 device/network limit, but ARE considered in the 247 address/network limit.

4. No connections between Modbus networks are permitted, either directly or through repeaters.

5. Modbus networks are constrained to a maximum 4,000 feet of communication cable without repeaters.

6. RS485 repeaters may be used to extend the wiring length of a Modbus network or to provide isolation between runs of cable in a Modbus network. Refer to GEH-6502 for appropriate wiring lengths with repeaters.

2–7 Modbus Equivalent Addresses

A maximum of 31 Modbus devices can be supported on a single RS485 network of the Ethernet Gateway. However, the Modbus RTU protocol permits up to 247 individual addresses to be recognized. These additional 216 addresses may be utilized by commnet devices attached to a special Modbus device, the Modbus Concentrator.

Commnet is a communications protocol utilized by many of the devices from GE's POWER LEADER family of power management devices. The Modbus Concentrator is a Modbus RTU device that permits commnet devices to be assigned Modbus-equivalent addresses. Each Modbus Concentrator keeps track of up to 32 commnet devices and directs traffic between the Modbus network and the commnet devices. To the Modbus network, the commnet devices appear as valid Modbus addresses.

To provide seamless integration of commnet-compatible devices into the Modbus RTU network, the Concentrator directly maps commnet addresses to equivalent Modbus addresses. The valid range of commnet addresses recognized by the concentrator is 300–514. These addresses are one-to-one mapped to the equivalent Modbus address range of 33–247.

For a more detailed discussion of commnet devices and the function of the Modbus Concentrator, see GEH-6491, the *Modbus Concentrator Users Guide.*

Table 4 lists commnet devices supported by the Modbus Concentrator (and the Ethernet Gateway).

Device	Description
POWER LEADER EPM	Full-function, three-phase electronic meter with optional pulse initiation; simple retrofit to existing electromechanical installations. See GEH–6302 for a full description.
POWER LEADER Meter	Full-function three-phase meter with optional protective relaying and waveform capture. See GEH–5892.
POWER LEADER MDP Overcurrent Relay	Three-phase and ground protection against overloads and rapid detection of short circuits. See GEK–100682.
Spectra ECM™	Advanced motor protection in full-voltage-nonreversing (FVNR) and full-voltage-reversing (FVR) combination starter applications. See GEH–6435.
MicroVersaTrip PM™ trip unit in Spectra RMS™ molded-case circuit breakers	Overcurrent protection and optional full-function metering and protective relaying. See GEH–5934.
MicroVersaTrip PM™ trip unit in AKR, Power Break® and Power Break® II insulated-case circuit breakers.	Overcurrent protection and optional full-function metering and protective relaying. See GEH–6273.

Table 4. POWER LEADER commnet devices supported by the Modbus Concentrator.

Chapter 3 – Configuration

The Ethernet Gateway needs to be properly configured to communicate with your RS485 networks. Two items are critical to proper performance of your Gateway: the Gateway's Ethernet address and the RS485 port communication settings. The Gateway's Ethernet address should be set so that the host software will know how to address messages to the Gateway. You must configure the Ethernet Gateway with the appropriate baud rate and communications settings for each RS485 port to match attached RS485 network. After initial setup, you should only need to make changes to the Gateway's settings after adding devices or making system changes.

Follow the instructions in Section 3-1 to perform the initial configuration. After the network is operational, you may make configuration changes through the dumb terminal. These procedures are described in the following sections.

In all cases, be sure to save any configuration changes to the Gateway's hard drive (option 12) for safe retrieval in the event of a power loss.

3–1 Configuration Procedure

Configuration of the Gateway requires a dumb terminal with RS232 port set to 19.2 Kbps, 8 data bits, no parity, and 1 stop bit. The easiest way to do this is to use a portable computer with an RS232 port, and run the Terminal accessory program from Windows.

Use a null modem cable to attach the laptop to the RS232 port of the Gateway, power up the laptop and launch the Terminal program (located in the Accessories program group in the Windows program manager). Click on the Settings menu, then choose Communications. Set your communications options to look like figure 12.

When you have set your communications options, close the options window and power up the Gateway (the ON switch is located on the front panel).

When the Gateway finishes powering up, the following message is transmitted to the terminal:

`Powerup complete; Gateway active.`
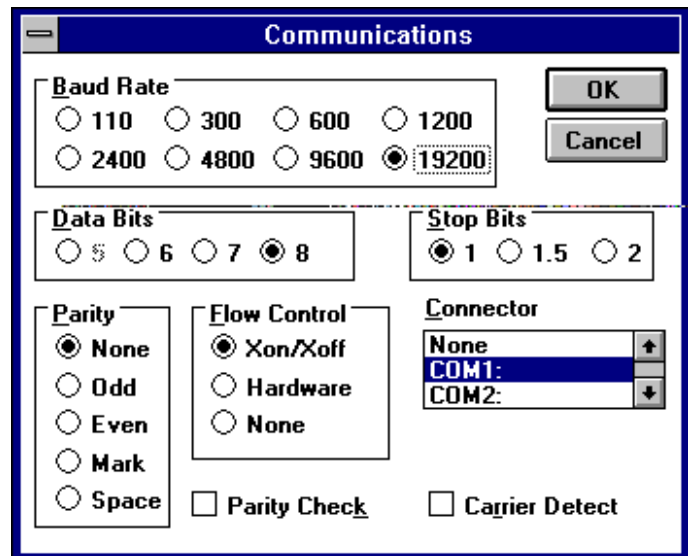
Figure 12. Terminal communications settings.

You are now ready to configure the Gateway, as outlined below:

1. Type SET (must be typed in capital letters) then press <ENTER> to bring up the configuration menu. If you make an error typing in this string, wait ten seconds and try again.

2. The terminal displays the configuration menu:

```
Change which setting:
1.   RS485 Port 1 baud rate: 19200
2.   RS485 Port 1 settings: N-8-1
3.   RS485 Port 2 baud rate: 19200
4.   RS485 Port 2 settings: N-8-1
5.   RS485 Port 3 baud rate: 19200
6.   RS485 Port 3 settings: N-8-1
7.   RS485 Port 4 baud rate: 19200
8.   RS485 Port 4 settings: N-8-1
9.   Message monitoring: Enabled, all ports
10.  Ethernet driver: DIX Ethernet
11.  Run gateway diagnostics
12.  Save configuration and exit
13.  Discard configuration and exit
14.  Default configuration and exit

For GE Internal Use Only
15.  Gateway socket identifier: ****
16.  Gateway IP address: 123.145.51.126
17.  Gatway subnet mask: 255.255.255.0
18.  PC/TCP kernel serial number: **************
19.  PC/TCP kernel authentication key: **************
20.  Update gateway software
21.  Router = 0.0.0.0, 0.0.0.0, 0.0.0.0
22.  MAC Address: 00:00:00:00:00
```

Figure 13. Ethernet Gateway configuration menu.

Enter the setting number you want to change, then press <ENTER>.

NOTE: The lower portion of the Configuration Menu is labeled Advanced Options. These options are for use ONLY by GE technical support personnel. Do NOT select any of these options. IF YOU ACCIDENTALLY SELECT ANY ADVANCED OPTION FROM THE CONFIGURATION MENU, PRESS <ESC> TO EXIT, THEN PRESS <ENTER> TO RETURN TO THE CONFIGURATION MENU.

3. At the prompt, enter the new setting, then press <ENTER>. If you enter an invalid value, the following message will be displayed:

```
Invalid entry, press <ENTER> to continue.
```

Pressing <ENTER> returns you to the configuration menu.

NOTE: Pressing <ESC> while entering a new value for a setting discards the changes and redisplays the configuration menu.

4. Configure parameters as desired, by repeating steps 2 and 3.

5. When you are finished making changes, select option 12, SAVE CONFIGURATION AND EXIT. The configuration file on drive A is modified with the new parameters and the terminal displays the following message:

```
Configuration saved.
```

If an error has been made, select option 13, DISCARD CONFIGURATION AND EXIT. The currently displayed settings are discarded and the following message is displayed on the terminal:

```
Configuration discarded.
```

Correct the error by repeating steps 1–3.

6. When you have saved the configuration and exited, the Ethernet Gateway is ready for operation. Turn off the unit until the rest of the network is ready for operation.

3–2 Ethernet Gateway IP Address

Ethernet Gateway's IP address must be properly set for it to receive messages sent by the host software. Consult your LAN personnel or system administrator for assistance in selecting the correct IP address. Follow Section 3–7 to modify the IP address.

WARNING: Setting the Ethernet Gateway to an incorrect or conflicting IP address can cause SERIOUS network problems. ALWAYS consult your LAN personnel or system administrator before making any changes to the IP address.

3–3 Baud Rate Specification

You must configure the baud rate and communications settings on each RS485 port to match the baud rate on the attached RS485 network. The Gateway supports RS485 speeds of 1200 baud, 2400 baud, 4800 baud, 9600 baud and 19.2 Kbaud. Default settings are 19.2 Kbaud, 8 data bits, no parity, 1 stop bit.

Each network's baud rate depends on the devices attached to it – see GEH-6502, the *PMCS Network Architecture Guide*, for more details on this.

To configure the baud rate and communications settings for any of the four RS485 ports, follow Section 3-1, referencing the special instructions given below regarding the communications options.

Table 5 lists the valid entries for options 1 through 8 of the Configuration menu, relating to the baud rate and communications settings of RS485 ports.

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Chapter 3 – Configuration

Option Number:	Valid Entries at Prompt:	
1 = RS485 Port 1	0 = 1200 baud	4 = 19200 baud
3 = RS485 Port 2	1 = 2400 baud	5 = 38400 baud
5 = RS485 Port 3	2 = 4800 baud	6 = 57600 baud
7 = RS485 Port 4	3 = 9600 baud	
2 = RS485 Port 1	Data Bits:	0 = 7 data bits
4 = RS485 Port 2		1 = 8 data bits
6 = RS485 Port 3	Stop Bits:	0 = 1 stop bit
8 = RS485 Port 4		1 = 2 stop bits
	Parity:	0 = None
		1 = Even
		2 = Odd

Table 5. RS485 Port Settings.

1. Follow the procedure outlined in Section 3-1 to configure the Gateway.

2. At the Configuration menu, select the option number, then press <ENTER>. At the prompt, enter the new setting, then press <ENTER>. For options 1, 3, 5, and 7, enter the new setting from the options in Table 5, then press <ENTER>. For options 2, 4, 6, and 8, enter each new parameter as prompted, using the correct entries from Table 5. If you enter an invalid value, the following message display:

   ```
   Invalid entry, press <ENTER> to continue.
   ```

   Press <ENTER> to return to the Configuration menu.

NOTE: Pressing <ESC> while entering a new value for a setting discards the changes and redisplays the Configuration menu.

---

3. Follow steps 5 and 6 of Section 3-1 to save any changes and exit configuration mode.

3–4 Message Monitoring

For diagnostic purposes, you may want to monitor message traffic across the RS485 ports. This can be done on a terminal connected to the RS232 port. You may monitor messages on any single RS485 port or on all four ports simultaneously.

Selecting menu item 14 allows you to select whether or not messages are sent to the RS232 port in monitor mode and which RS485 ports are to be monitored. The following prompt appears:

```
Message monitoring:
    0 - disable,
    1 - RS485 port 1 only,
    2 - RS485 port 2 only,
    3 - RS485 port 3 only,
    4 - RS485 port 4 only,
    5 - all RS485 ports
```

Enter your selection from the above choices.

3–5 Ethernet Driver

Menu item 10 permits the Ethernet driver to be selected. Most systems utilize DIX Ethernet; a handful use IEEE Ethernet. The Gateway defaults to the DIX Ethernet driver. If your network does not function under DIX Ethernet and you have eliminated all other potential sources of trouble, change the driver setting to IEEE Ethernet and retry communications. If this does not resolve the problem, contact Customer Service.

3–6 Gateway Diagnostics

Selecting menu item 11 exits the Gateway software and runs the Gateway diagnostics program. The Gateway Diagnostics menu shown in Figure 14 is displayed on the terminal.

```
Gateway Diagnostics
options:
1.   Display IP address and subnet mask
2.   Perform RS485 loopback test
3.   Perform ethernet test
4.   Exit program

For GE Internal Use Only
5.   Perform network test
```

Figure 14. Gateway Diagnostics menu.

Display Socket, IP Address and Subnet Mask

Select menu item 1 to display the IP address and subnet mask for the Gateway.

RS485 Loop-back Test

Select menu item 2 to perform a loop-back test on an RS485 port. The loop-back test is useful for identifying the RS485 ports and for testing communications on an RS485 port. To complete this test, you will need a short RS485 cable, available at an electronics retailer.

The RS485 port being tested is connected to another RS485 port and a test message is transmitted from the port being tested. The following prompt appears:

```
Before running this test, make sure the
loop-back cable is connected between two
RS485 ports.
```

```
RS485 port to test (1 – port 1, 2 – port
 2, 3 – port 3, 4 – port 4):
```

Enter the port to be tested: 1, 2, 3, or 4. The following message displays:

```
Transmitting 256 bytes on port X...
```

(where X is the port being tested).

If the loop-back is successful, the following message will be displayed:

```
Loop-back test passed.
Message received on port Y, 256 bytes.
Press <ENTER>
```

(where Y is the loop-back port).

If the loop-back is unsuccessful, the following message displays:

```
Loop-back test failed
Press <ENTER>
```

Default settings on the RS485 ports for the loop-back tests are 115.2 Kbps, 8-N-1.

Ethernet Test

Select menu item 3 to test the Gateway's internal Ethernet connections. This performs a self-test of the Gateway's Ethernet card to ensure that it is functioning correctly. The following message displays:

```
Performing ethernet test...
```

If the test passes, the following message displays:

```
Ethernet test passed
Press <ENTER>
```

If the test fails, the following message displays:

```
Ethernet test failed
Press <ENTER>
```

In either case, pressing <ENTER> returns you to the diagnostics menu.

Exit Diagnostics Program

Select menu item 4 to exit the Gateway diagnostic software and reload the Gateway software.

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Chapter 3 – Configuration

Network Test – FACTORY USE ONLY

NOTE: A client program may be requested from GE to run on the host when performing the network test. The client attempts to establish a connection to a server (the Gateway) with the specified IP address, subnet mask and port number.

Menu item 5 is for factory testing of the network. End users should NOT select this option. This test attempts to communicate with a host across the Ethernet. To complete this test, you will need an RS232 null modem cable, available at an electronics retailer. Before performing this test, the host PC must be running the client software mentioned above, and must be connected to the Ethernet Gateway via the null modem cable.

When you select menu item 4, the following message is displayed:

```
Before proceeding with this test, make
sure that the ethernet gateway is
connected to the host and the client
program is running on the host.
Press <ENTER> to continue...
```

If the network test passes, the following message is displayed:

```
Connection with client established.
      Network test passed.
         Press <ENTER>
```

If the network test fails, the following message is displayed:

```
Timeout: connection with client failed.
       Network test failed.
          Press <ENTER>
```

In either case, pressing <ENTER> returns you to the diagnostics menu.

3–7 Advanced Options – Technical Support Personnel ONLY

Ordinarily these options will have been configured by the system integrator or direct from the factory; you should NOT alter any of the settings from the advanced options area of the Configuration menu.

WARNING: ALTERING ANY OF THESE SETTINGS MAY RENDER THE ETHERNET GATEWAY INOPERABLE. IF YOU ACCIDENTALLY SELECT ANY OPTION FROM THE ADVANCED SETTINGS, PRESS <ESC> TO EXIT, THEN PRESS<ENTER> TO RETURN TO THE CONFIGURATION MENU.

Select menu item 15 to modify the Gateway socket identifier. The format is: ####.

Select menu item 16 to modify the Gateway Internet Protocol (IP) address. Enter the IP address in dot notation, e.g., 123.145.51.126.

Select menu item 17 to modify the Gateway subnet mask. Enter the subnetwork mask in dot notation, e.g., 255.255.255.0.

Select menu item 18 to modify the FTP PC/TCP kernal serial number. The number has the following format: 1234-5678-9012.

Select menu item 19 to modify the FTP PC/TCP kernal authentication key. The number has the following format: 1234-5678-9012.

Select menu item 21 to modify the Gateway Router. This item has the following format: 0.0.0.0, 0.0.0.0, 0.0.0.0 Note that the Router numbers may have multiple digits in each placeholder, and each set of four numbers represents one router; for example, 205.109.43.11, 0.0.0.0, 0.0.0.0 is configured for one router. The Gateway may be configured with a maximum of three routers.

Updating the Gateway Software

Option 20 of the Configuration menu allows updating of the Ethernet Gateway's operating software and is for use ONLY by factory service personnel.

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Chapter 4 – Operation

The Ethernet Gateway, once properly configured, requires no user intervention for operation.

During normal operation, the Ethernet Gateway passes messages to and from the attached Modbus devices and translates these messages between the Ethernet and Modbus RTU protocols.

Should power to the Ethernet Gateway be interrupted, communications between the host and the RS485 networks will resume automatically and immediately when power is restored.

Likewise, if the Ethernet connection or any of the RS485 connections are broken, communications will be immediately resumed when the connections are restored.

Any errors encountered by the Ethernet Gateway will result in a message being sent back to the host, where it will be interpreted and displayed for corrective action by the operator.

All processing error messages are sent to the RS232 port. Processing error messages are listed in Section 5-1 of this manual.

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Chapter 5 – Errors and Diagnostic Messages

Chapter 5 – Diagnostic Messages and Errors

5–1 Monitor Mode

The Ethernet Gateway can be set to send diagnostic messages to the RS232 port to be displayed on a terminal (see Chapter 3). These diagnostic messages can be very useful in tracking down errors in configuration or device addressing.

Diagnostic messages sent to the RS232 port in monitor mode have the following format:

```
TTTTTTTTT DDD *HH* *BB BB BB*<CR><LF>
```

Table 6 explains what each field means:

Field	Meaning
TTTTTTTTT	The relative time of the message in timer ticks. This rolls over every 1,000,000,000 timer ticks.
DDD	Indicates the direction of the message: E-n (n = 1,2,3 or 4) indicates a message sent from the Ethernet Gateway to RS485 port number 1,2,3 or 4 n-E indicates a message sent from RS485 port number 1,2,3 or 4 to the Ethernet Gateway
HH	Header byte added to regular Modbus message. Printed as two hex digits.
BB BB BB	Binary data of regular Modbus message. Printed as two hex digits.

Table 6. Diagnostic messages key.

5–2 Processing Error Messages

Table 7 gives error messages that may be generated by the Gateway and displayed at the PMCS host.

Message	Meaning
Error - Buffer Overflow	One or more buffers have overflowed.
Error - Writing to Flash ROM	An attempt to write to flash ROM (drive A) has failed.
Error - Reading Flash ROM	An attempt to read the flash ROM (drive A) has failed.

Table 7. Error message key.

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Chapter 6 – Troubleshooting Guide

The following guide is provided for troubleshooting and isolating common problems. It does not cover every possible condition. Contact the ED&C Customer Support Center at 800-843-3742 if the problem is not resolved by these procedures.

Symptom	Possible Cause	Corrective Action
1. No response at either host PC or dumb terminal from the Ethernet Gateway.	Lack of power. Ethernet Gateway internal failure.	Check that control power cable is working and correctly connected. Remove and reapply power to the Ethernet Gateway to see if the failure clears itself (possibly caused by external noise). Contact Customer Support if the problem persists. WARNING: *Voltages hazardous to personnel and equipment may be present at the power connection.*
2. No response at host PC from the Ethernet Gateway, but terminal connection is OK.	Faulty Ethernet wiring between Ethernet Gateway and host PC Ethernet driver may be incorrect.	Check that the Ethernet connector is properly wired and firmly seated. Test wiring for continuity and polarity to host PC. Check with your system administrator as to which Ethernet driver is being used (DIX or IEEE). Make sure Gateway is set accordingly (Section 3-5).
3. Ethernet connections OK, but no response from RS485 device(s).	Faulty RS485 wiring between Ethernet Gateway and RS485 networks. Lack of control power at RS485 device(s).	Check that the RS485 connector is properly wired and firmly seated. Test wiring for continuity and polarity on RS485 wiring. Check that control power present and correctly connected at device(s).
4. Some devices on RS485 networks not recognized at host.	Addressing problems or too many devices on segment	Refer to Section 5-1 to diagnose the precise problem and correct accordingly.

Configuration Worksheets

RS485 Port Configuration Worksheets

Use the following worksheets to record the devices attached to the Ethernet Gateway for reference and troubleshooting. Record the Ethernet Gateway's Ethernet address on the first page only, then fill in the information on the Modbus devices attached to each network: device type and physical location, and the Modbus address assigned to it.

Ethernet Gateway Address:

RS485 Port 1 Worksheet

Baud Rate for RS485 Port 1

Modbus Network	Device Number	Device Type & Physical Location / Notes	Modbus Address
1	1		
1	2		
1	3		
1	4		
1	5		
1	6		
1	7		
1	8		
1	9		
1	10		
1	11		
1	12		
1	13		
1	14		
1	15		
1	16		
1	17		
1	18		
1	19		
1	20		
1	21		
1	22		
1	23		
1	24		
1	25		
1	26		
1	27		
1	28		
1	29		
1	30		
1	31		

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RS485 Port 2 Worksheet

Baud Rate for RS485 Port 2 [   ]

Modbus Network	Device Number	Device Type & Physical Location / Notes	Modbus Address
2	1		
2	2		
2	3		
2	4		
2	5		
2	6		
2	7		
2	8		
2	9		
2	10		
2	11		
2	12		
2	13		
2	14		
2	15		
2	16		
2	17		
2	18		
2	19		
2	20		
2	21		
2	22		
2	23		
2	24		
2	25		
2	26		
2	27		
2	28		
2	29		
2	30		
2	31		

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RS485 Port 3 Worksheet

Baud Rate for RS485 Port 3 ☐

Modbus Network	Device Number	Device Type & Physical Location / Notes	Modbus Address
3	1		
3	2		
3	3		
3	4		
3	5		
3	6		
3	7		
3	8		
3	9		
3	10		
3	11		
3	12		
3	13		
3	14		
3	15		
3	16		
3	17		
3	18		
3	19		
3	20		
3	21		
3	22		
3	23		
3	24		
3	25		
3	26		
3	27		
3	28		
3	29		
3	30		
3	31		

RS485 Port 4 Worksheet

Baud Rate for RS485 Port 4

Modbus Network	Device Number	Device Type & Physical Location / Notes	Modbus Address
4	1		
4	2		
4	3		
4	4		
4	5		
4	6		
4	7		
4	8		
4	9		
4	10		
4	11		
4	12		
4	13		
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4	28		
4	29		
4	30		
4	31		

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