GE Consumer & Industrial

P485 Modbus to Profibus Converter

Instruction Manual

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GE Multilin's Quality Management System is registered to ISO9001:2000

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UL # A3775

GE Consumer & Industrial

P485 Modbus to Profibus Converter

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Chapter 1: Introduction

Getting started

INSPECTING THE PACKAGE AND PRODUCT

Examine the shipping container for obvious damage prior to installing this product; notify the carrier of any damage that you believe occurred during shipment or delivery. Inspect the contents of this package for any signs of damage and ensure that the items listed below are included.

Remove the items from the shipping container. Be sure to keep the shipping container should you need to re-ship the unit at a later date.

In the event there are items missing or damaged, contact the party from whom you purchased the product. If the unit needs to be returned, please use the original shipping container, if possible.

CONTACT INFORMATION

GE Multilin contact information and call center for product support is shown below:

GE Multilin
215 Anderson Avenue
Markham, Ontario
Canada L6E 1B3

- Telephone: 905-294-6222 or 1-800-547-8629 (North America), +34 94 485 88 00 (Europe)

Fax: 905-201-2098 (North America),
+34 94 485 88 45 (Europe)

- E-mail: multilin.tech@ge.com
- Website: http://www.GEmultilin.com

Document conventions

DESCRIPTION

The following conventions are used throughout this document:

- Numbered lists provide sequential steps.
- Bulleted lists provide information, not procedural steps.
- The term 'user' refers to the person or persons responsible for installing the P485 Modbus to Profibus Converter in a network.
- Hexadecimal values are written in the format 0xNNNN, where NNNN is the hexadecimal value.
- Decimal values are represented as NNNN, where NNNN is the decimal value.
- As in all communication systems, the terms "input" and "output" can be ambiguous, since their meaning depends on which end of the link is being referenced. The convention in this document is that "input" and "output" are always being referenced to the master/scanner end of the link (see illustration below).
- The term "sub-network" is interchangeably used for "Modbus network".

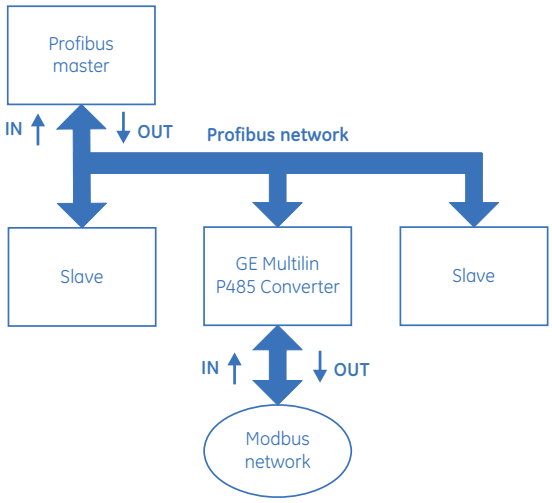


Figure 1-1: Input and output definition

GLOSSARY

The following terminology is used in the P485 manual:

- Broadcaster: A protocol specific node in the sub-network scan that holds transactions destined for all nodes.
- Command: A protocol specific transaction.
- Fieldbus: The network to which the converter is connected (Profibus for P485).
- Frame: A higher level series of bytes forming a complete telegram on the sub-network (Modbus).
- Monitor: A tool for debugging the P485 and network connections.
- Node: A device in the scan list that defines the communication with a slave (GE relay) on the Modbus sub-network.
- Scan list: List of configured slaves with transactions on the sub-network.
- Sub-network: Modbus network that logically is located on a subsidiary level with respect to the fieldbus and to which the P485 acts as a gateway.
- Transaction: A generic building block that is used in the sub-network scan list and defines the data that is sent out the sub-network.

About the P485 Modbus to Profibus Converter

APPLICATION

The P485 Modbus to Profibus Converter (or P485) acts as a gateway between the Modbus protocol and a Profibus-DP network. Integration of industrial devices is enabled without loss of functionality, control, and reliability, both when retrofitting to existing equipment as well as when setting up new installations.

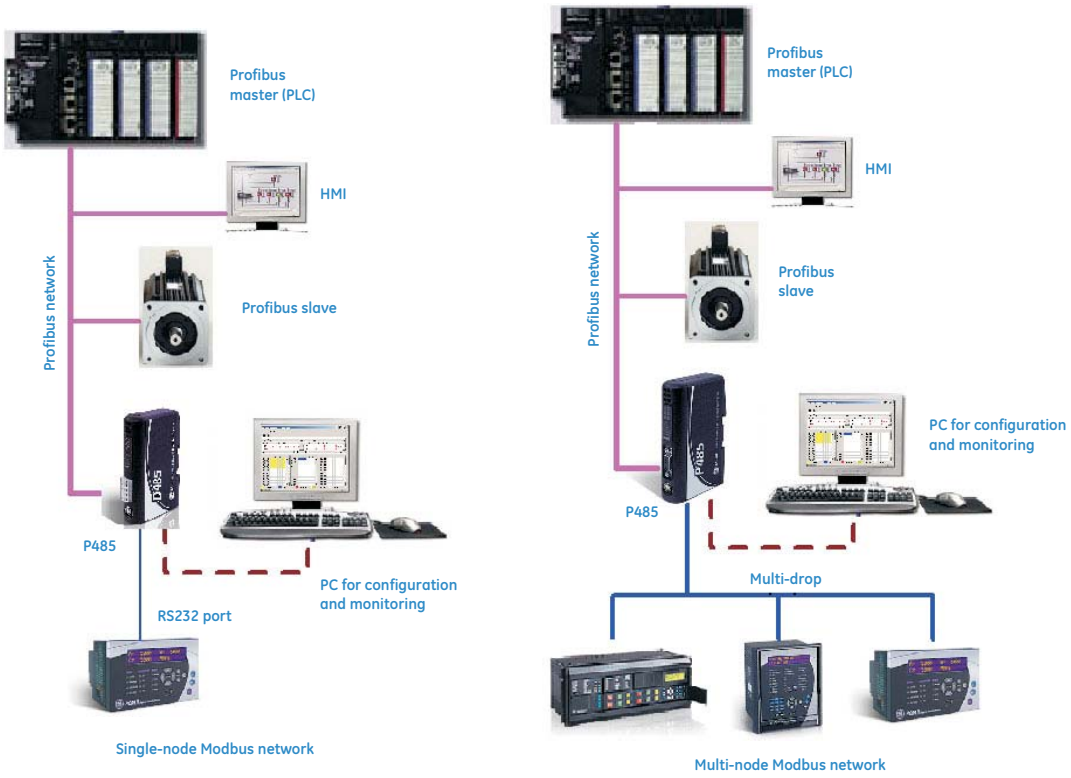


Figure 1-2: Typical applications

Features

GENERAL FEATURES

- DIN-rail mountable
- Save/load configuration in flash
- CE, UL, and cUL marked

MODBUS NETWORK

- RS232/RS422/RS485 communications
- Multi-drop or single-node configurations
- Modbus RTU Master mode
- Supports up to 50 commands
- Configuration via EnerVista P485/D485 Setup software

FIELDBUS INTERFACE FEATURES

- Complete Profibus-DP slave functionality according to IEC 61158
- Node Address range: 1 to 99 using on board switches
- Baud rate range: 9.6 kbps to 12 Mbps. Auto baud rate detection supported.
- Transmission media: Profibus bus line, type A or B specified in IEC 61158

Ordering

ORDER CODES

The following table illustrates the order codes for the P485 Modbus to Profibus Converter.

Table 1–1: P485 order codes

	P485	–	*	
Base unit	P485		**|**	P485 Modbus to Profibus Converter
			C	With configuration cable
			X	No configuration cable

Specifications

MECHANICAL

HOUSING

Plastic housing with snap-on connection to DIN-rail, protection class IP20

DIMENSIONS

L x W x H:	120 mm × 75 mm × 27 mm (4.72-in × 2.95-in × 1.06-in)

PROTECTION CLASS

Protection class:	IP20

ELECTRICAL CHARACTERISTICS

POWER SUPPLY

Power:	24 V ±10% (for use in class 2 circuits)

POWER CONSUMPTION

Maximum power consumption: 280 mA on 24 V

Typically power consumption: approximately 100 mA

COMMUNICATIONS

BAUD RATES

Baud rate (Profibus)	9.6, 19.2, 45.45, 93.75, 187.5, and 500 kbps; 1.5, 3, 6, and 12 Mbps
Baud rate (Modbus)	1200, 2400, 4800, 9600, 19200, 38400, and 57600 bps

I/O DATA

I/O input size:	244 bytes
I/O output size:	244 bytes
Total I/O size:	416 bytes

FEATURES AND INTERFACE

Communication profile:	Profibus-DP
Supported features:	synchronous, freeze, watchdog
Modbus interface:	RS232, RS422, RS485
Profibus interface:	RS485 (type A or B)

ENVIRONMENTAL

RELATIVE HUMIDITY

The product is designed for a relative humidity of 0 to 95% non-condensing

TEMPERATURE

Operating:	0 to 55°C
Non Operating:	–5 to 85°C

EMC COMPLIANCE

CE-MARK

Certified according to European standards unless otherwise is stated

Emission:	according to EN 50081-2:1993
Immunity:	according to EN 61000-6-2:1999

UL/C-UL COMPLIANCE

This unit is an open type listed by the Underwriters Laboratories.

The certification has been documented by UL in file E214107.

P485 Modbus to Profibus Converter

Chapter 2: Installation

Quick install

PROCEDURE

1. Snap the P485 on to the DIN-rail (see *DIN-rail mounting* on page 2–5).
2. Connect the Profibus cable (see *Profibus connector* on page 2–2).
3. Connect the serial Modbus network cable (see *Modbus connector* on page 2–4 for details).
4. Connect a PC using the configuration cable (see *Configuration cable* on page 2–3).
5. Connect the power cable and apply power to the unit (see *Power connector* on page 2–4 for details).
6. Start the EnerVista P485/D485 Setup software.
7. Normally, the EnerVista P485/D485 Setup detects the correct serial port. If this does not occur, select the correct port through the **Port** menu item.
8. Configure the P485 using EnerVista P485/D485 Setup and download the configuration to the unit.
9. Configure and power-up the Modbus network device for communication.

Electrical installation

OVERVIEW

The location of the various electrical connectors is shown below.

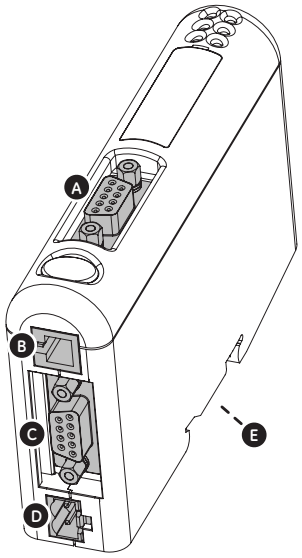


Figure 2-1: P485 electrical connections

PROFIBUS CONNECTOR

The Profibus connector is indicated as **A** in the figure above. This connector is used to connect the P485 to the Profibus network.

The pin assignments for the Profibus connector are shown below.

Table 2–1: Profibus connector pin assignments

Pin	Signal	Description
1	-	-
2	-	-
3	B-Line	Positive RxD/TxD (RS485)
4	RTS *	Request To Send
5	GNDBUS **	Isolated ground from the RS485 side
6	+5 V BUS **	Isolated +5V output from the RS485 side (80 mA maximum)
7	-	-
8	A-Line	Negative RxD/TxD (RS485)
9	-	-

* Used in some equipment to determine the direction of transmission. However, in normal applications only A-Line, B-Line and Shield are used.
** Used for bus termination. Some devices such as optical transceivers (RS485 to fibre optics) may require power from these pins.

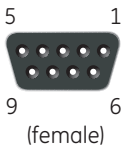


Figure 2-2: Profibus connector

The following Profibus connectors are recommended:

- Profibus Max standard, part number 134928 and Profibus reversed, part number 104577, from http://www.erni.com
- Fast connect bus connector, part number 6GK1500-0FC00 or 6ES7 972-0BA50-0XA0, from http://www.siemens.com

CONFIGURATION CABLE

The PC connector is indicated as **B** in Figure 2-1: P485 electrical connections on page 2–2. This connector is used to connect the P485 to a PC using the configuration cable for configuration and monitoring purposes.

A P485/D485 configuration cable can be purchased from GE Multilin. The wiring for the configuration cable is shown below.

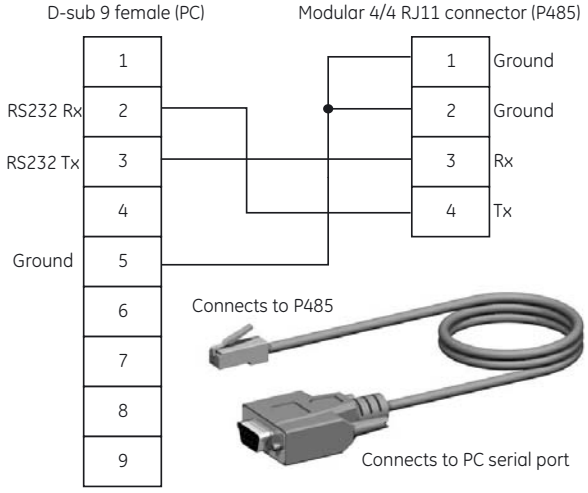


Figure 2-3: Configuration cable

The pinout for the modular 4/4 RJ11 connector (connects to the P485) is shown below.

Table 2–2: Configuration cable pin assignments (P485 end)

Pin	Description
1	Signal ground
2	Signal ground
3	RS232 Rx, data input to P485
4	RS232 Tx, data output from P485

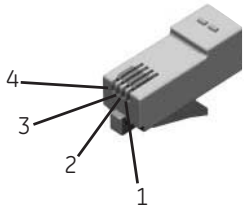


Figure 2-4: Configuration cable (P485 end)

The pinout for the DSUB 9-pin serial plug (connects to the PC) is shown below.

Table 2–3: Configuration cable pin assignments (PC end)

Pin	Description
1	Not connected
2	RS232 Rx, data input to PC
3	RS232 Tx, data output from PC
4	Not connected
5	Ground
6 to 9	Not connected

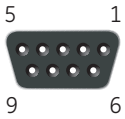


Figure 2-5: Configuration cable (PC end)

MODBUS CONNECTOR

The Modbus connector is indicated as **C** in Figure 2-1: P485 electrical connections on page 2–2. This connector is used to connect the P485 to the serial network. Based on the configuration selected in the EnerVista P485/D485 Setup software, the corresponding signals are activated.

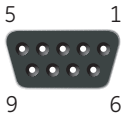


Figure 2-6: Modbus connector

Table 2–4: Modbus connector pin assignments

Pin	Description	RS232	RS422	RS485
1	+5 V output (50 mA max)			
2	RS232 Rx	✓		
3	RS232 Tx	✓		
4	Not connected			
5	Ground	✓	✓	✓
6	RS422 Rx +		✓	
7	RS422 Rx –		✓	
8	RS485 + / RS422 Tx+		✓	✓
9	RS485 – / RS422 Tx–		✓	✓

POWER CONNECTOR

The power connector is indicated as **D** in Figure 2-1: P485 electrical connections on page 2–2. Use this connector to apply power to the P485.

Pin 1: +24 V DC;
Pin 2: ground

NOTE

Use 60/75 or 75°C copper (CU) wire only. The terminal tightening torque must be between 5 to 7 lbs-in (0.5 to 0.8 nm).

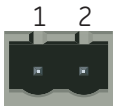


Figure 2-7: Power connector

Mechanical installation

DIN-RAIL MOUNTING

The DIN-rail connector is internally connected to the P485.

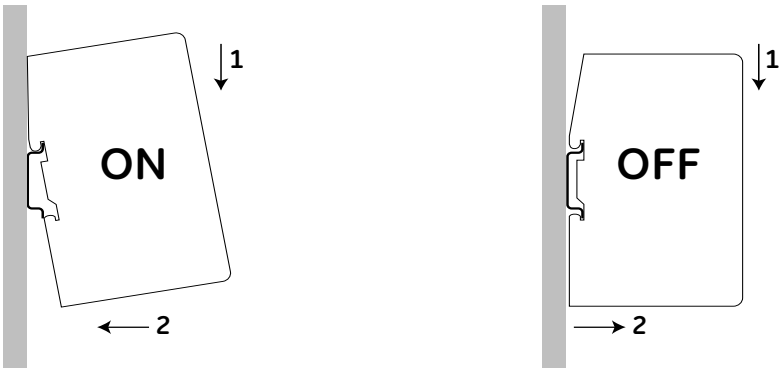


Figure 2-8: Mounting the P485 to the DIN-rail

To snap the P485 *on*, first press the P485 downwards (1) to compress the spring on the DIN-rail connector, then push the P485 against the DIN-rail as to make it snap on (2)

To snap the P485 *off*, push the P485 downwards (1) and pull it out from the DIN-rail (2), as to make it snap off from the DIN-rail.

Indicators and switches

STATUS INDICATORS

The status indicators for the P485 Modbus to Profibus Converter are indicated below.

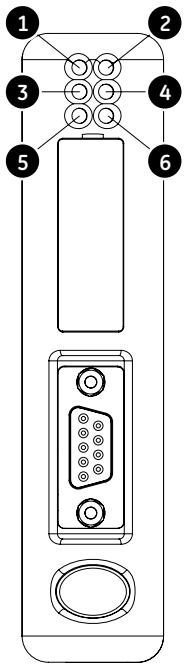


Figure 2-9: P485 status indicators

Table 2–5: P485 status indicators

Number	Description	State	Status
1	Profibus online	Off	Not online
		Green	Online
2	Profibus offline	Off	Not offline
		Red	Offline
3	Not used	-	-
4	Profibus diagnostics	Off	No diagnostics present
		Red, flashing 1 Hz	Error in configuration
		Red, flashing 2 Hz	Error in user parameter data
		Red, flashing 4 Hz	Error in initialisation
5	Subnet status * (Modbus)	Off	Power off
		Green, flashing	Initializing and not running
		Green	Running
		Red	Stopped or subnet error, or timeout
6	Device status	Off	Power off
		Alternating Red/ Green	Invalid or missing configuration
		Green	Initializing
		Green, flashing	Running
		Red, flashing	If the device status LED is flashing in a sequence starting with one or more red flashes, note the sequence pattern and contact GE Multilin

* This LED turns green when all transactions have been active at least once. This includes any transactions using “change of state” or “change of state on trigger”. If a timeout occurs on a transaction, this LED will turn red.

CONFIGURATION SWITCHES

The configuration switches are used to set the Profibus node address. Normally, these switches are covered by a plastic hatch. Note that the node address can not be changed during runtime, i.e. the P485 requires a reset for any changes to have effect. Recycle the power supply to reset the module

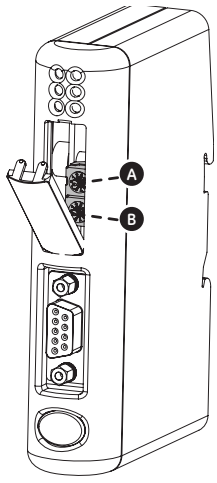


Figure 2-10: P485 configuration switches

The node address is configured using two rotary switches as follows:

Profibus node address = (Switch B× 10) + (Switch A × 1)

For example, to set the node address to 42, set switch A to "2" and switch B to "4".

NOTE

When removing the hatch, avoid touching the circuit boards and components. Exercise caution when using tools to open the hatch.

Profibus installation procedure

PROFIBUS CONFIGURATION TOOL

Each device on a Profibus-DP network is associated with a GSD file, which contains all necessary information about the device. This file is used by the Profibus configuration tool during configuration of the network. The file is available for download at the GE Multilin website at http://www.GEmultilin.com (the GSD file is named 'P48509E5.GSD').

It is necessary to import the GSD file in the Profibus configuration tool in order to incorporate the P485 as a slave in the network. The properties for the P485 must then be configured from the Profibus configuration tool. This includes setting up the node address, input/output data areas and offset address.

- **Node address**: The node address in the Profibus configuration tool should be set to match the one selected using the on board configuration switches of the P485 (see *Configuration switches* on page 2–6).
- **Setting up input/output data areas**: Input/output data are arranged as logic modules in the Profibus configuration tool. Which modules to use depends on the application. The modules are composed together in the "module list" for the P485 device.

  It is possible to select modules freely to compose the required input/output sizes, see example below.

Input/output bytes required	Modules
4 inputs and 2 outputs	4 inputs + 2 outputs
7 inputs and 12 outputs	4 inputs + 2 inputs + 1 input + 8 outputs + 4 outputs
68 inputs	64 inputs + 4 inputs

- **Offset address**: The offset addresses can be chosen freely. However, certain restrictions may apply depending on what PLC/Profibus master is used.

PROFIBUS NETWORK TERMINATION

If the P485 is the last node on a Profibus segment, it is necessary to use a Profibus connector with integrated termination switch.

- **The termination switch should be set to 'ON' if...**
  - The P485 is the last physical node on a network segment
  - No other termination is used at this end of the network
- **The termination switch should be set to 'OFF' if...**
  - There are other nodes on either side of the P485 in the network segment

LINKS

Additional information about the Profibus fieldbus system can be found at http://www.profibus.com.

Troubleshooting

DESCRIPTION

Problem during configuration upload/download. The Config Line LED turns red.

- Serial communication failed – try again.

The serial port seems to be available, but it is not possible to connect to the P485.

- The serial port may be in use by another application. Exit EnerVista P485/D485 Setup and close all other applications including the ones in the system tray and try again.
- Select another serial port and try again.

Poor performance.

- Right click 'Modbus Network' in the Navigation window and select 'Modbus Network Status' to see status/diagnostic information about the Modbus network. If the P485 reports very many re-transmissions, check your cabling and / or try a lower baud rate setting for the sub network (if possible).
- Is the Modbus Network Monitor in EnerVista P485/D485 Setup active? The Modbus network monitor has a negative influence on the overall performance of the P485, and should only be used when necessary.
- Is the Node Monitor in EnerVista P485/D485 Setup active? The node monitor has a negative influence on the overall performance of the P485, and should only be used when necessary.

P485 Modbus to Profibus Converter

Chapter 3: Data exchange

Overview

DESCRIPTION

Data from the fieldbus (Profibus) and the sub network (Modbus) is stored in an internal memory buffer. This is a easy method for data exchange where the fieldbus control system simply reads and writes data to pre-defined memory locations, and the serial sub network also use the same internal memory buffer to read and write data. Refer to Figure 3-2: Data exchange overview on page 3–2 for details.

INTERNAL MEMORY BUFFER STRUCTURE

The internal memory buffer can be seen as a memory space with three different types of data; input data, output data and general data.

- **Input data**: This is data that should be sent to the fieldbus. The P485 can handle up to 244 bytes of input data. The total input/output data must not exceed 416 bytes.
- **Output data**: this is data recieved *from* the fieldbus. The P485 can handle up to 244 bytes of output data.
- **General data**: This data *cannot* be accessed from the fieldbus, and is used for transfers between nodes on the sub-network, or as a general "scratch pad" for data. The P485 can handle up to 1024 bytes of general data.

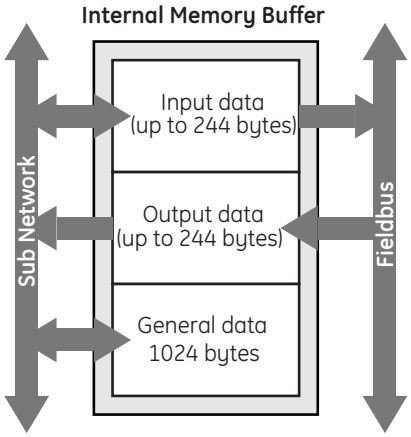


Figure 3-1: Internal memory buffer

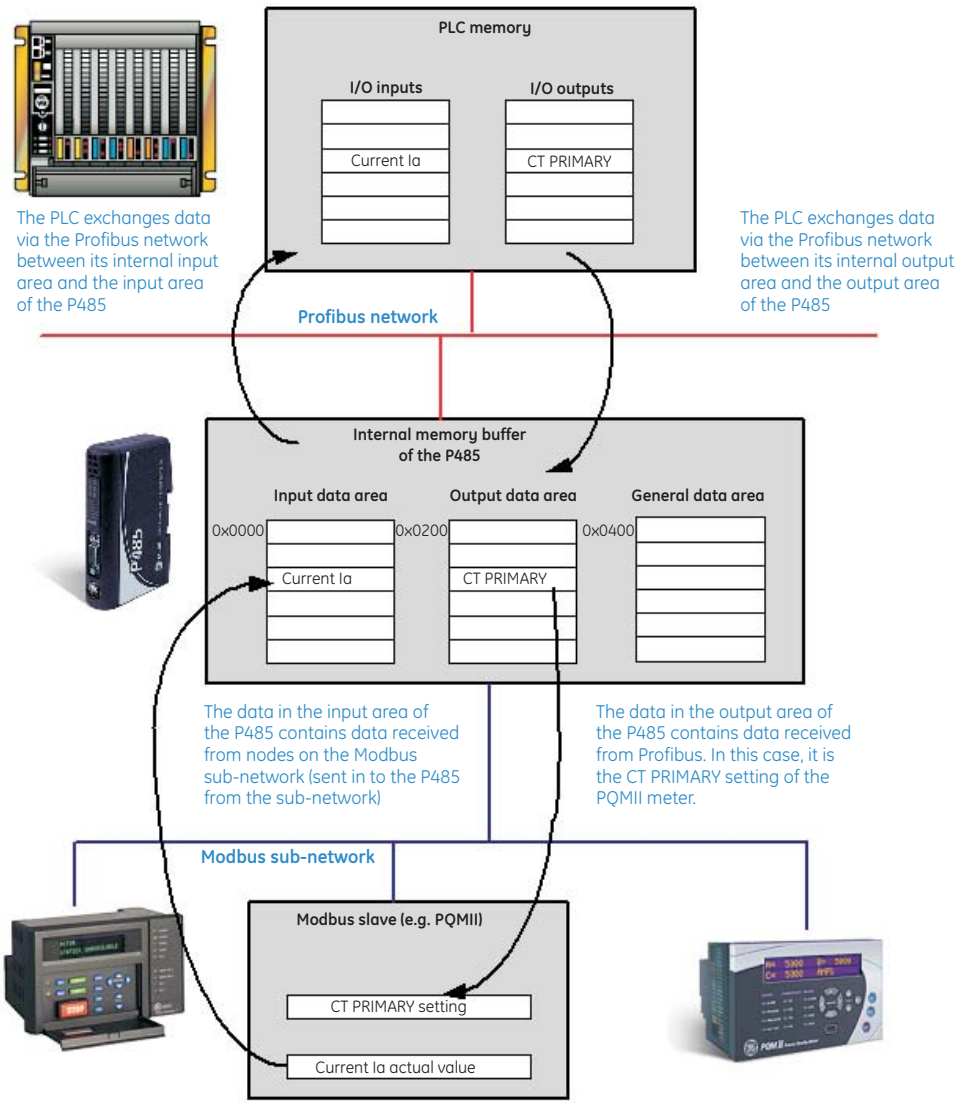


Figure 3-2: Data exchange overview

Memory Map

MEMORY LOCATIONS

When configuring the sub-network, use the memory locations shown below:

Address	Contents	Access
0x0000 to 0x0001	Status register	read/write
0x0002 to 0x00F3	Input data area	read/write
0x00F4 to 0x01FF	Reserved	-
0x0200 to 0x0201	Control register	read only
0x0202 to 0x02F3	Output data area	read only
0x02F4 to 0x03FF	Reserved	-
0x0400 to 0x7FF	General data area	read/write

- **Status register** (0x0000 to 0x0001): If enabled, this register occupies the first two bytes in the input data area. For more information, see *Control and status registers* on page 8–1.
- **Input data area** (0x002 to 0x00F3): This area holds data that should be sent to the fieldbus (see the status and control registers).
- **Control register** (0x0200 to 0x0201): If enabled, these register occupies the first two bytes in the output data area. For more information, see *Control and status registers* on page 8–1.
- **Output data area** (0x200 to 0x2F3): This area holds data received *from* the fieldbus. Data cannot be written to this area.
- **General data Area** (0x0400 to 0x7FF): This data *cannot* be accessed from the fieldbus, and should be used for transfers between nodes on the sub-network, or as a general "scratch pad" for data.

Protocol configuration

DESCRIPTION

In order to be able to communicate on the Modbus sub-network, the P485 must be supplied with a description of the required sub-net protocol. To accomplish this, the EnerVista P485/D485 Setup software features a flexible protocol-programming system, allowing the P485 to interpret and exchange data with almost any serial device on the Modbus sub-network.

COMMUNICATION MODE

The P485 supports the Modbus Master communication mode. In this mode, the P485 is setup to use the Modbus RTU protocol and implements a Modbus master for data exchange between the fieldbus and one or more devices on the sub-network. Refer to Chapter 5 for additional details.

PROTOCOL BUILDING BLOCKS

A description of the building blocks used to describe the sub-net protocol is shown below.

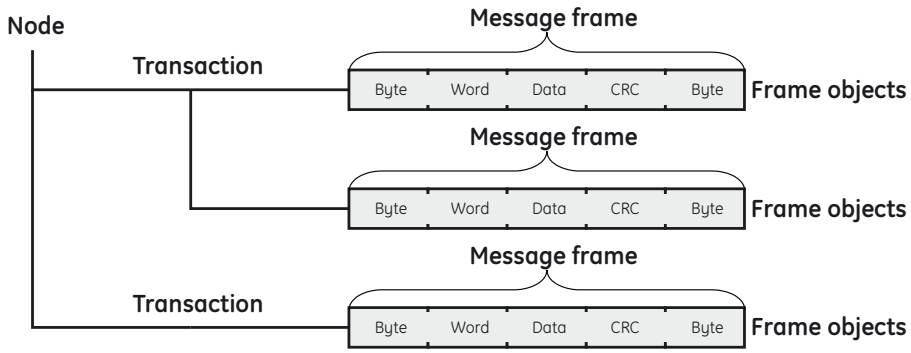


Figure 3-3: Modbus protocol blocks

- **Node**: In the P485, a node holds all transactions and parameters for a particular device on the sub network.
- **Transaction**: Transactions contains messages to be transmitted on the sub-network. A transaction consists of one or more message frames (see figure above), and has a few general parameters to specify how and when the transaction should be used on the sub-network.
- **Commands**: A command is a pre-defined transaction that has been stored in a list in the EnerVista P485/D485 Setup software. This improves readability as well as simplifying common operations by allowing transactions to be stored and reused.

- **Message frame**: The message frame contains a description of what is actually transmitted on the sub-network and consists of frame objects (see figure above).
- **Frame object**: Frame objects are used to compose a message frame. Frame objects include fixed values, dynamic values retrieved from a specified memory location in the P485, or strings.

GE Consumer & Industrial

P485 Modbus to Profibus Converter

Chapter 4: Software overview

Introduction

DESCRIPTION

EnerVista P485/D485 Setup is a PC-based configuration software used to describe the protocol and communication properties for a serial network. When the configuration is finished and the functionality is tested, it is possible to send memory allocation information to a printer using EnerVista P485/D485 Setup.

EnerVista P485/D485 Setup can also be used for troubleshooting and diagnostic of the P485 and the serial network during runtime.

SYSTEM REQUIREMENTS

The following hardware and software is required to use the EnerVista P485/D485 Setup software.

- Pentium 133 MHz or higher
- 10 MB of free space on the hard drive
- 8 MB RAM
- Windows 95/98/NT/2000/XP
- Internet Explorer 4.01 SP1 or higher

Installation procedure

DESCRIPTION

There are two different ways of installing EnerVista P485/D485 Setup; either via the GE EnerVista CD or from the GE Multilin website at http://www.GEmultilin.com.

INSTALLING FROM ENERVISTA CD

Run 'setup.exe' and follow the on screen instructions

INSTALLING FROM THE GE MULTILIN WEBSITE

Download the self-extracting EXE file from the GE Multilin website at http://www.GEmultilin.com.

Using the EnerVista P485/D485 Setup software

DESCRIPTION

When creating a new sub network configuration, EnerVista P485/D485 Setup provides a choice between starting out with a blank configuration, or using a predefined template (configuration wizard).

- **Configuration Wizard**: The wizard option automatically creates a configuration based on information about the sub-network (Modbus) devices; that is, the user simply has to "fill in the blanks".
- **Blank Configuration**: This option should be used when creating a new configuration when the configuration wizard does not fit the application or to modify an existing configuration for a new application. The following chapters will describe the configuration process in detail.

NOTE

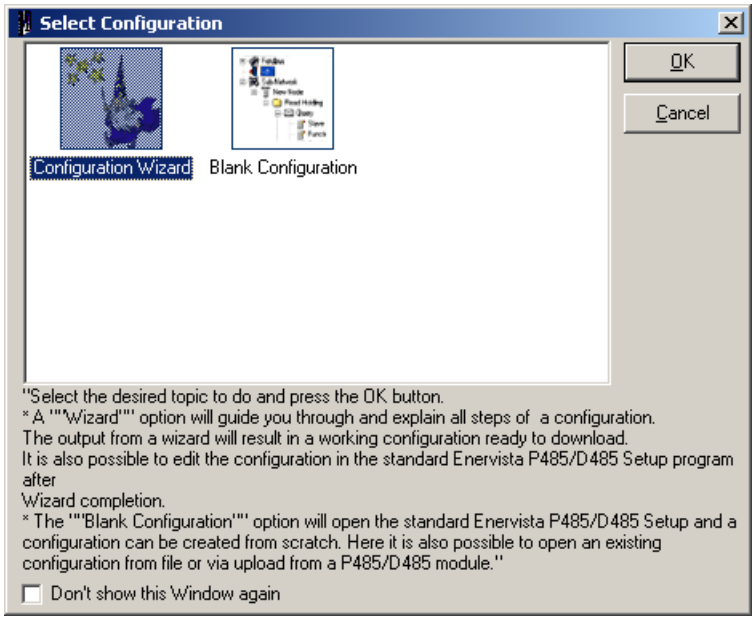
It is recommended to use the configuration wizard for its simplicity of use with GE relays and meters.

The online help system explains each configuration step in detail.

CONFIGURATION WIZARD

The purpose of the configuration wizard is to help you through the process of creating a project with a Modbus RTU sub-network. When the wizard is finished, it is possible to continue editing the project in the configuration tool.

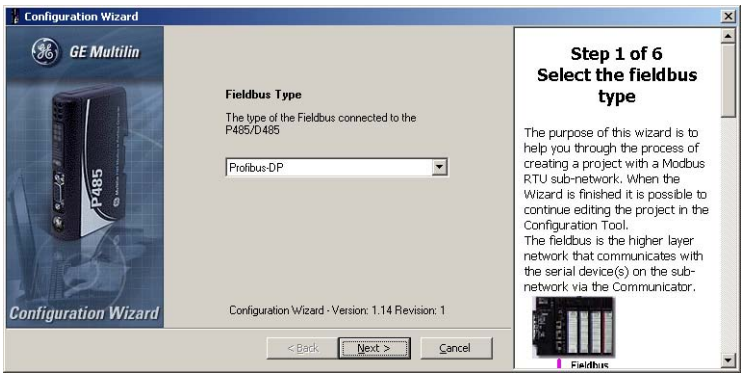
The EnerVista P485/D485 Setup software will open with following screen to select the configuration.



Select **Configuration Wizard** and click on **OK**.

SELECT FIELDBUS TYPE

The first step in the configuration wizard selects the fieldbus type. The fieldbus is the higher layer network that communicates with the serial device(s) on the modbus sub-network via the P485 converter.



Select "Profibus-DP" then click **Next** to continue. A typical Profibus-DP network arrangement is shown below.

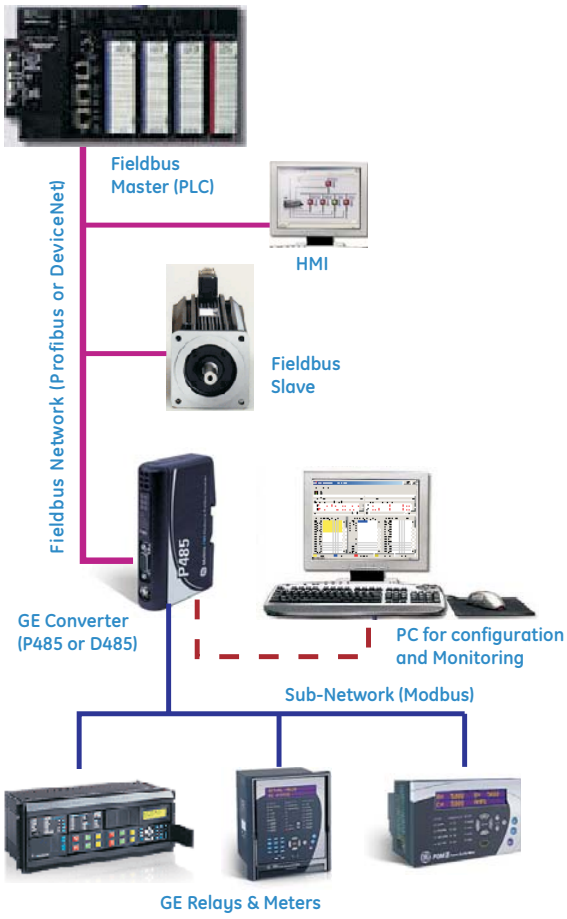


Figure 4-1: Typical network arrangement

NOTE

In the event the wizard cannot handle the specific Modbus command(s) required by the device, use the regular configuration tool or modify the commands produced by the wizard using the regular configuration tool.

SUB-NETWORK PROPERTIES

The second step in the configuration wizard selects the properties for the Modbus sub-network. The data flow for the sub-network is shown below.

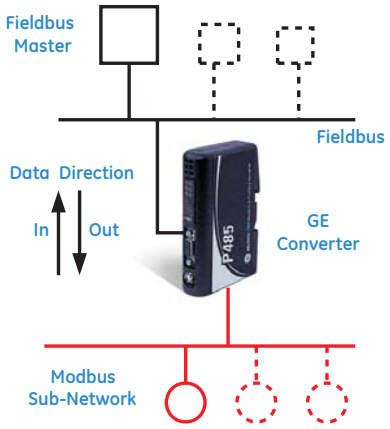


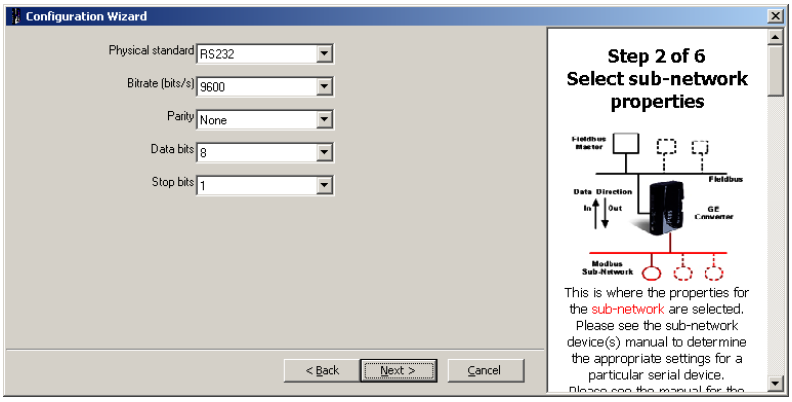
Figure 4-2: Sub-network data flow

Refer to the particular sub-network device manual(s) to determine the appropriate settings and communication options. If multiple devices are being installed on the same sub-network, they must be configurable for a common set of communication parameters.

NOTE

All numerical values are entered and shown in decimal unless otherwise specified.

The sub-network properties window is shown below.



- **Physical standard**: The physical standard can be either RS232, RS485, or RS422.

  RS232 is a point-to-point communication standard; that is, it is only possible to have one sub-network node (Modbus device) connected to the P485 converter when using RS232. RS232 supports a maximum cable length of 15 meters and is full duplex. It uses two signal lines (Rx and Tx) and the signal is measured relative to ground.

  RS485 is a common multi-drop communication standard. It is used with larger cable distances with one or several sub-network nodes (Modbus devices) connected. RS485 supports a maximum of 31 nodes, with half duplex and a total cable length up to 1200 meters. It uses two signal lines (A-line and B-line, twisted pair) with the signal being measured between the two lines.

  RS422 is a common multi-drop communication standard. It is used with larger cable distances with one or several sub-network nodes connected. RS422 supports a maximum of 31 nodes, with full duplex and a total cable length up to 1200 meters. It uses four signal lines (receive A1-B1 and transmit A2-B2, twisted pair) with the signals being measured between the two signal lines A and B.

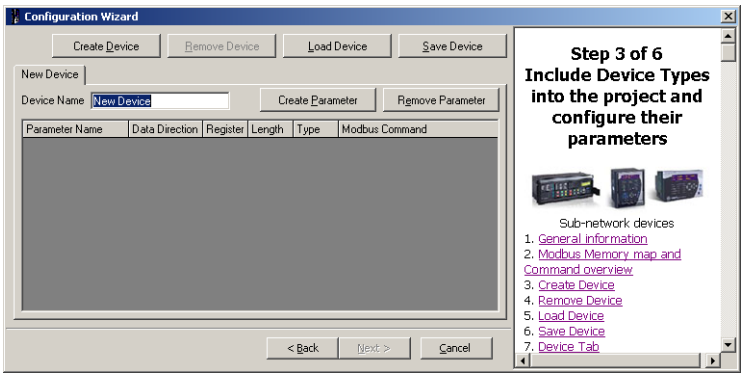
- **Bitrate (bits/s)**: This parameters refers to the speed of the sub-network. Speeds are 1200 to 57600 bps in predefined steps. The bitrate is also referred to as baud rate.

- **Parity**: The parity can be selected as "Odd", "Even", or "None". This is a simple error check method capable of detecting single bit communication errors on a serial network (i.e. the sub-network).
- **Data bits**: There can be "7" or "8" data bits. Generally, 8 data bits are used. This parameter determines how many bits per byte of user data that is transmitted on the sub-network, excluding start, stop and parity bits.
- **Stop bits**: There can be "1" or "2" stop bits. Determines the number of stop bits at the end of each byte sent on the sub-network.

DEVICE TYPES

The third step in the configuration wizard introduces device types into the project and configures their parameters. Every device must be unique. Predefined devices can be loaded from a file, and it is possible to connect devices to the sub-network at a later step in the wizard. Additional devices can be created by editing previously saved devices.

The device types window is shown below.



The Modbus address range, including bit areas and register areas (words), is shown below. The Modbus commands are also shown for the corresponding memory areas. Note that many device manuals ignore the leading digit of the address (i.e. 0, 1, 3 or 4); as such, the address 40001 is often referred to as 0001. The leading digit can be determined from the Modbus command specified.

Address			Command
0x	Output coil (bits)	00001 to 09999	#1 (decimal): Read coil status #15 (decimal): Force multiple cells
1x	Inputs status (bits)	10001 to 19999	#2 (decimal): Read input status
3x	Input status (word)	30001 to 39999	#4 (decimal): Read input registers
4x	Output (word)	40001 to 49999	#3 (decimal): Read holding registers #16 (decimal) Preset multiple registers

Users should consult the instruction manuals of the various network devices to determine the actual Modbus command code(s) implemented or required. This will determine the implied leading digit of the data address (i.e. 0, 1, 3 or 4).

In most GE Multilin relay and meter documentation, Modbus addresses are indicated in hexadecimal form. For the Modicon format used for the P485, convert the hex address to decimal, add 1, then append a prefix of 1, 2, 3, or 4, depending on the type of register. For example, to convert the input register hexadecimal address 0x0300, we have:

1. 0300h = 0768 decimal
2. 0768 decimal + 1 = 0769 decimal
3. change 0769 → 30769 (prefix "3" for input registers)

Therefore, a Modbus hex address of 0x0300 is 30769 in Modicon format.

NOTE

The wizard can accept memory addresses from 0 to 9999 (0x270F). For higher memory addresses, please use the protocol building blocks (refer to *Protocol building blocks* on page 3–3 for additional details).

The **Create Device** button creates a new empty device. A new Device tab will be created. The new device can be named in the **Device Name** text box. The **Remove Device** button removes the selected device.

The **Load Device** button opens the "open file" dialog box. Select a previously stored device to include it into the project. Device files (extension D01) for the most commonly used GE relays and meters are supplied with the EnerVista P485/D485 Setup software.

The **Save Device** button opens the "save device" dialog box. To create similar devices, click on **Save Device** to save a particular device parameter list, then click **Load Device** to recover a duplicate of the device. The duplicate device should be renamed and then modified as required. Devices can also be saved for a use at a later stage. All parameters and address settings are stored in the device file.

The Device tab shows the name of the device and the active node. The tab "in front" of the other tabs is the active one. The active device's parameters are shown in the parameter list below the tab list.

The **Device Name** is typically the technical name or designation of a device found on the devices name plate. Examples are "MM2", "469" and "PQMII". Do not confuse the device name with the node name, which is entered at a later stage. The node name is typically a name that is used to identify the device in your application. Examples are "Lube Pump 1", "Production feeder" and "Main transformer".

The **Create Parameter** button adds a new parameter to the parameter list. The loaded device from previously saved devices can be modified for a new parameter or change in the settings of the parameters. The **Remove Parameter** button removes the selected parameter from the parameter list. To select a parameter simply click the desired parameter in the list. Use the scroll bar to move the list up and down. Click the desired parameter and enter the desired **Parameter Name**. It is recommended that you enter a unique name here. Examples are "Phase A Current Ia", "Voltage Vab", and "VT ratio".

The **Data Direction** column shows if data is read from or written to the device. The P485 converter is the one who reads or writes. It is only possible to read input data; output data can be both read or written. Refer to Figure 4-2: Sub-network data flow on page 4–4 for details.

The **Register** column is where the Modbus register number for the for the parameter in the device is entered. Only register addresses can be entered here (the register address is the absolute address +1). Most device manuals contain the register address but some may provide an absolute address in hexadecimal format. In case absolute addresses are given, the address must be incremented by 1. If the address range covers multiple coils, inputs, or registers, only the start address is entered.

The **Length** column is where the total length of the parameter data is entered. The length is given in bits for the 0x and 1xxxx areas and in words for the 3xxxx and 4xxxx areas. If the parameter data for a device on the sub-network are linearly addressable, then consecutive parameters may be addressed using a single Modbus command from the P485. For example, five parameters each 2 words long can be addressed using a single Modbus command (#16 Preset Multiple Registers) with a total length of 10 (5×2). Reducing the number of transactions initiated by the P485 will optimize communications on the Modbus sub-network.

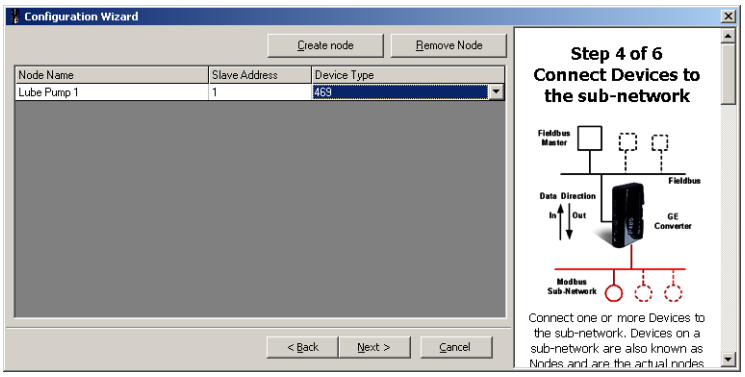
The **Type** column shows the type of data that is referenced for the respective parameter. Possible entries are bit(s) and word(s). This is automatically entered by the wizard based on the selected address and selected direction.

The **Modbus Command** column shows the Modbus command assigned by the wizard. The Modbus command is automatically selected by the wizard based on the selected address and direction.

CONNECTING DEVICES

The fourth step in the configuration wizard connects one or more devices to the sub-network. Devices on a sub-network are also known as nodes (Modbus slave devices) and are the actual nodes that will be physically connected to the Modbus sub-network. It is possible to connect devices of the same device type more than once. The created nodes will be listed to the left.

The Node window is shown below:



The **Create Node** button adds a new node (Modbus slave) to the sub-network. A new row will be added to the node list to the left. The **Remove Node** button to remove the selected node. Select a node in the node list by clicking on the desired node.

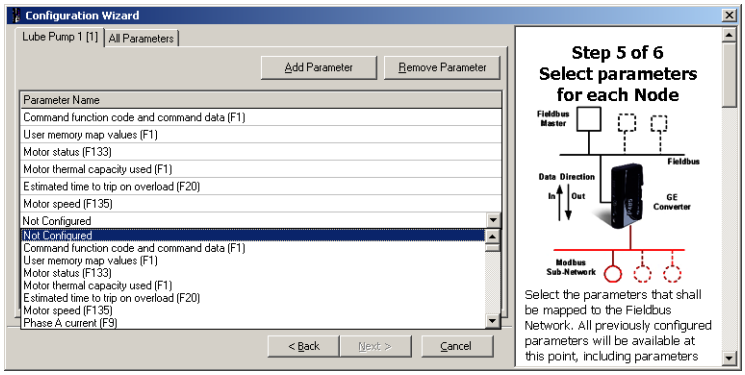
When a new node is created, the wizard assigns it a default name. Enter the desired node name in the Node Name column. The node name is typically a name that identifies the device in your application. Examples are “Lube pump1”, “Production Feeder” and “Main transformer “. Do not confuse the node name with the device name assigned at an earlier stage – the device name is typically the technical name or designation of a device found on the devices name plate (for example, “MM2”, “SR469” and “PQMII”).

Enter the Modbus slave address of the sub-network node in the **Slave Address** column. The wizard automatically assigns a default address which can be changed as needed. The node address must match the slave address setting of the device you are connecting. If you only connect one node, this address setting might be irrelevant, depending on the operation of the device.

The **Device Type** column is where previously configured devices are connected to the sub-network. If you click a row in the device column, a list will appear containing all previously configured device(s). Select the desired device from this list.

SELECTING PARAMETERS FOR EACH NODE

The fifth step in the configuration wizard selects the parameters that shall be mapped to the Fieldbus Network. All previously configured parameters will appear at this point, including parameters saved to a file. All previously configured nodes will appear in the horizontal Node tab list in the upper left of the configuration wizard. Select the All Parameters tab to view the complete list of parameters.



The Node tab in the foreground displays the active node. The number within brackets at the end of the node name is the node Modbus slave address (1 to 255) on the sub-network. Clicking a specific tab will display the parameters currently mapped to this node address.

For example, for “Lube Pump 1[1]”, the name of the node is “Lube Pump 1” and its slave address is 1.

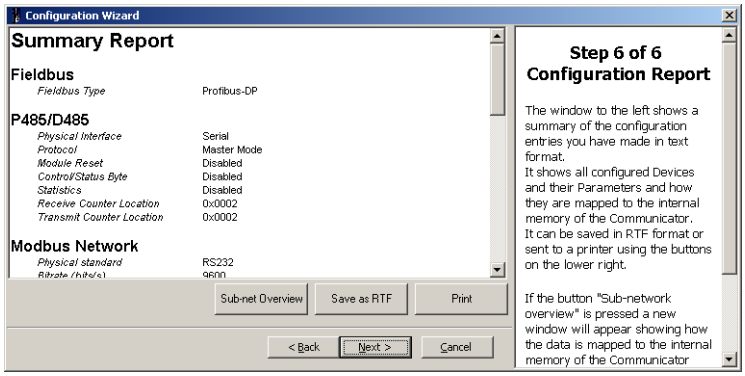
The **All Parameters** tab displays all parameters in the same list. This provides an overview of data transmitted on the sub-network. It is also possible to add or remove parameters on configured nodes in this list by using the **Add Parameter** or **Remove Parameter** buttons.

The **Add Parameter** button adds a new parameter to the selected node. The **Remove Parameter** button remove the selected parameter from the selected node.

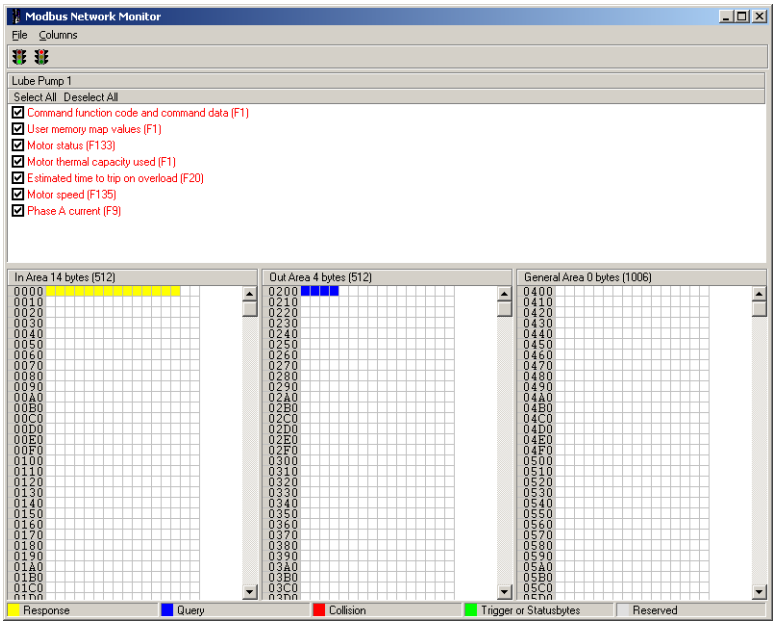
The **Parameter Name** column displays the user-assigned parameter name. When a new parameter is inserted, it is named by the software as “Not Configured”. A list of available parameters will appear when the you click the row. Select the desired parameter by clicking on it in the list.

CONFIGURATION REPORT

The sixth and final step in the configuration wizard displays a summary of the configuration entries. This includes all configured devices, their parameters, and how they are mapped to the internal memory of the P485. This report can be saved in rich text (RTF) format or sent to a printer.



If the **Sub-net Overview** button is pressed, a new window will appears that graphically displays how the data is mapped to the internal memory of the P485.



Configuration main window

DESCRIPTION

The main window is shown below. It is composed of the navigation window, parameter window, information window, and configuration line indicator.

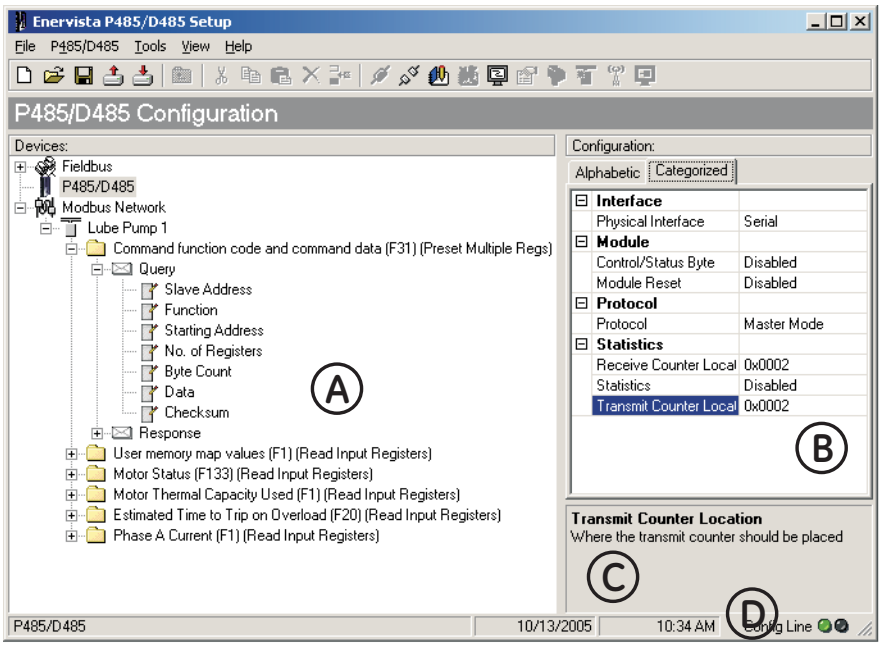
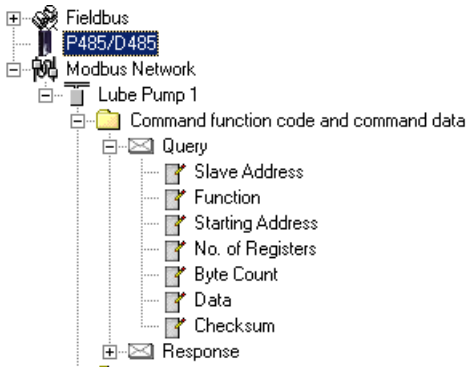


Figure 4-3: Configurator main window

NAVIGATION WINDOW

The navigation window in EnerVista P485/D485 Setup is the main tool for selecting the different levels of the configuration. There are three main levels in the navigation window, namely fieldbus, P485, and Modbus network.

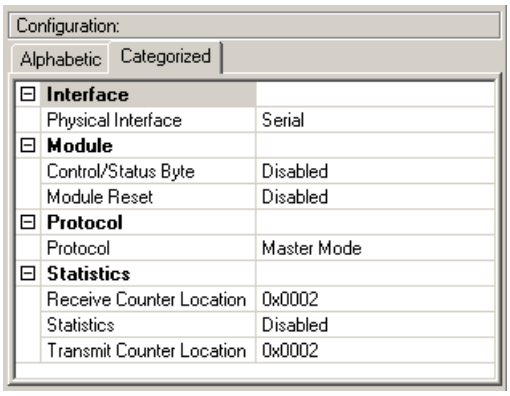


Menu entries preceded by a plus symbol (+) contain more configuration parameters or sub-menus. To gain access to these parameters, the entry must be expanded by clicking the '+' symbol.

By right-clicking entries in this window, a popup menu with functions related to this entry will appear. The options in this popup menu is often also available in the menu bar.

PARAMETER WINDOW

The parameters available in this window is different depending on what is selected in the navigation window. It consists of a grid with parameter names and, on the same row, a field for editing.



The parameters can be displayed in two modes: alphabetic and categorized. Parameter values are entered either using selection box or by entering a value. Values can be entered either in decimal form (for example, 35) or in hexadecimal form (for example, 0x1A).

If a value is entered in decimal format, it will be converted automatically to the equivalent hexadecimal value.

INFORMATION WINDOW

In the right bottom corner of EnerVista P485/D485 Setup, below the parameter window, lies the information window. It contains descriptions of currently marked parameter instances.

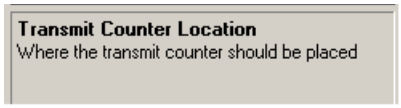


Figure 4-4: Information window

CONFIGURATION LINE INDICATOR

In the lower-right corner of the main window, two lights indicate if a connection has been established between the PC running EnerVista P485/D485 Setup and P485. A green light indicates that the connection is OK, and a red light indicates no connection.

OPTIONS WINDOW

In the main window under tools, select options.

Table 4–1: Options window functions

Function	Description
Warning on delete	When something is to be deleted, a warning window will appear.
Warning on unsaved data	When closing EnerVista P485/D485 Setup with unsaved data, a warning window will appear.
Show Wizard when “New” menu is selected	Each time a new configuration is to be made, the Wizard window will appear.
Language next time the program is launched	Select which language the program should use the next time the program is launched. Presently, only English is supported.
Size of log buffer	Set the size of the log buffer (0 to 512 bytes).
Firmware download	Download the firmware to the P485. Use with caution.
Factory restore	Restores the software on the P485 carrier board, to it´s original state.
Block configuration	Use with caution. When this button is pressed, the configuration will not be accessible and a new configuration has to be downloaded to the module.
Create error log	Creates an error log file.

Fieldbus configuration

DESCRIPTION

During start-up, the fieldbus interface is initialized to fit the configuration created in the EnerVista P485/D485 Setup software. Since EnerVista P485/D485 Setup supports both the P485 and D485 converters, the user must verify that the 'Fieldbus' parameter indicates the correct converter. Additionally, it is possible for advanced users to customize the network interface inside the converter to meet specific application demands (see *Advanced fieldbus configuration* on page 8–5 for details).

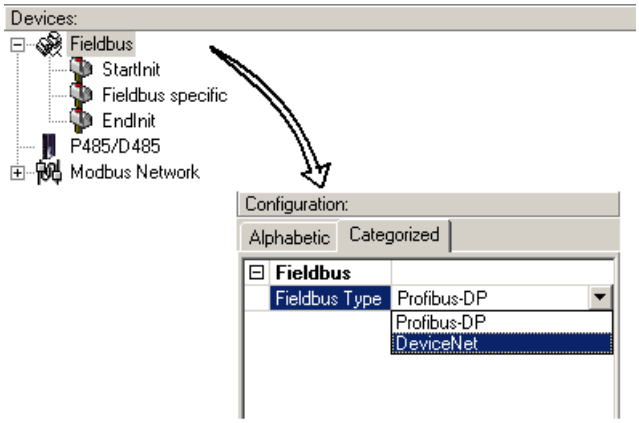


Figure 4-5: Fieldbus configuration

P485/D485 configuration

PARAMETER WINDOW

By selecting 'P485/D485 ' in the Navigation window, basic configuration options for the sub-net will appear in the Parameter window.

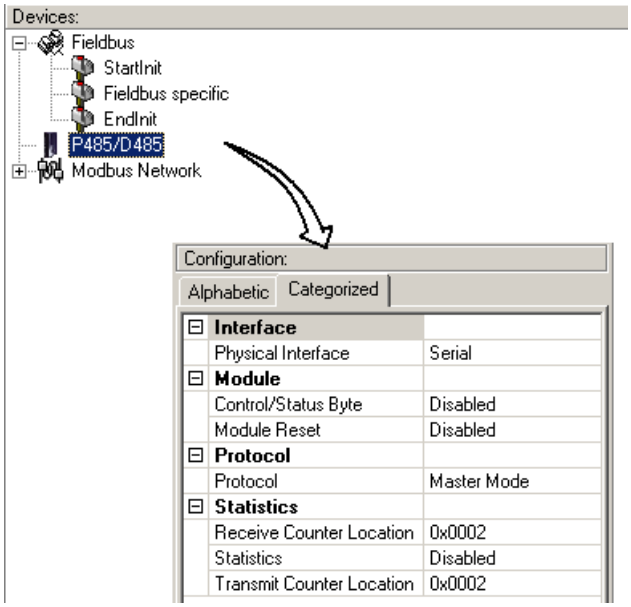


Figure 4-6: P485/D485 configuration

- **Physical interface**: Currently, the P485 supports only a serial interface. The communication settings for the selected interface are available under 'Modbus Network (see *Serial interface settings* on page 4–13 for details).
- **Control/status byte**: This parameter is used to enable/disable the control/status registers (see *Control and status registers* on page 8–1 for details).
  - Enable: enable control/status registers. The “Data Valid” parameter (bit 13 in the control register) must be set by the fieldbus control system to start the sub network communication.
  - Disable: Disables control/status registers.
  - Enable but no start up lock: The control/status registers are enabled, but the fieldbus control system is not required to set the “Data Valid” parameter (bit 13 in the control register).
- **Module Reset**: This parameter defines how the module should behave in the event of a fatal error. If Enabled, the module will reset and restart on a fatal error event, and no error will be indicated to the user. If Disabled, the module will halt and indicate an error.
- **Protocol**: The P485 supports Modbus RTU master mode.
- **Statistics**: If enabled, the receive counter location indicates the number of valid messages received from the subnet. If enabled, the transmit counter location indicates the number of messages sent to the sub network. This function is used primarily for debugging purposes.

Modbus network configuration

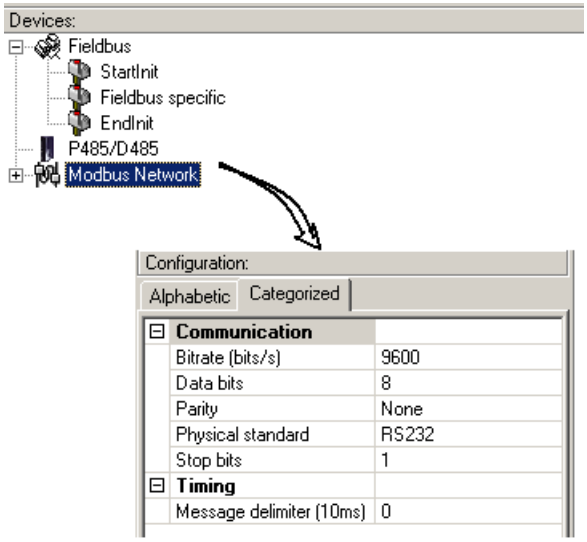
OVERVIEW

When controlling a Modbus sub-network with the P485 it is important to understand functions during starting up. If the P485 starts scanning nodes on the sub-network, before data is received from the fieldbus control system (fieldbus master), values of '00' may be transmitted to the nodes before data is updated the first time from the fieldbus.

See *Input/output data during startup* on page 8–4 for information on how to block transactions until valid data is received.

SERIAL INTERFACE SETTINGS

To be able to communicate on the Modbus network, various communication settings needs to be configured. To gain access to these settings, select 'Modbus Network' in the Navigation window.



Parameter	Description	Range
Bit rate	Selects the bit rate.	1200 to 57600
Data bits	Selects the number of data bits.	7, 8
Parity	Selects the parity.	None, Odd, Even
Physical standard	Selects the physical standard. This setting activates the corresponding signals on the subnet connector.	RS232, RS422, RS485
Start bits	Only one start bit is supported.	1
Stop bits	Either one or two stop bits can be selected.	1, 2

P485 Modbus to Profibus Converter

Chapter 5: Communication model

Introduction

DESCRIPTION

In master mode, the P485 is configured to run as a master on the Modbus sub-network, using a scan-list for communication with the Modbus slave devices. The scan-list is created using EnerVista P485/D485 Setup and can consist of multiple nodes with multiple transactions.

Communications between the P485 and the sub-net nodes (Modbus slaves) is based on transactions with a query/response architecture. The P485 sends out a query on the Modbus sub-network, and the addressed node is expected to send a response to this query. Slave nodes are not allowed to respond without first receiving a query.

An exception to this is broadcaster functionality. Most protocols offer some way of accessing all network nodes. In the P485, this is called a 'broadcaster'. The broadcaster can transmit messages to all nodes on the sub-network without expecting a response.

In Modbus, it is possible to broadcast a message to all nodes by sending a message to node address 0. The Modbus slaves will receive the message, but not Respond to it.

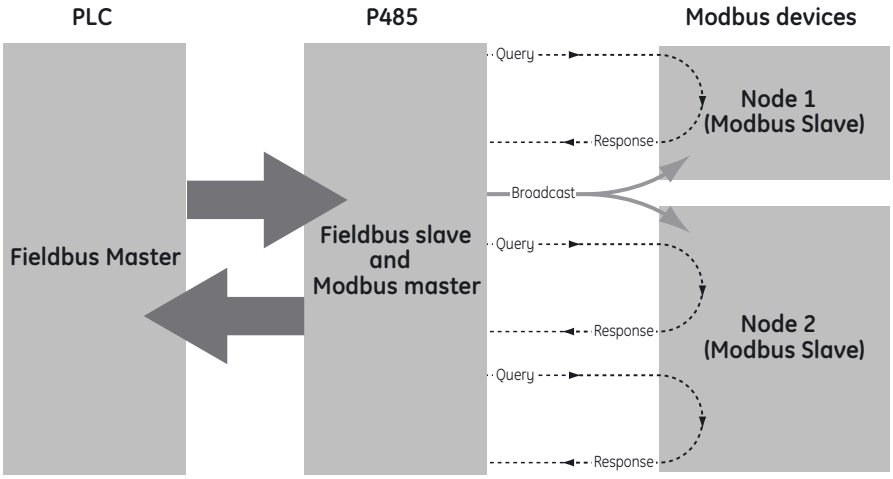


Figure 5-1: Master mode overview

The P485 uses pre-configured Modbus RTU commands, acting as a Modbus RTU master. With Modbus RTU, each transaction is substituted with a pre-defined command that can be selected from a list of available commands.

It is still possible, though, to define custom message frames by creating a transaction instead of selecting a pre-defined command. A command is actually a transaction that has been defined in advance and stored in a list.

SCAN LIST

Once the configuration has been downloaded to the P485, the P485 firmware searches the scan-list, using the defined transactions for communication with the slave-devices.

Each node in the scan-list represents a slave device on the Modbus network. In EnerVista P485/D485 Setup, each node is given a specific name and assigned an address in standard Modbus RTU commands. The address must match the internal setting on the slave device.

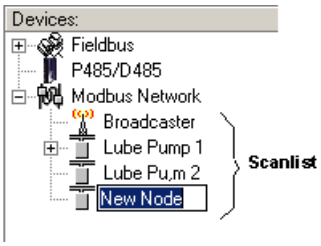


Figure 5-2: P485 scan list

Basic settings

PARAMETER WINDOW

Select 'Modbus Network' in the Navigation window to gain access to basic settings in the Parameter window.

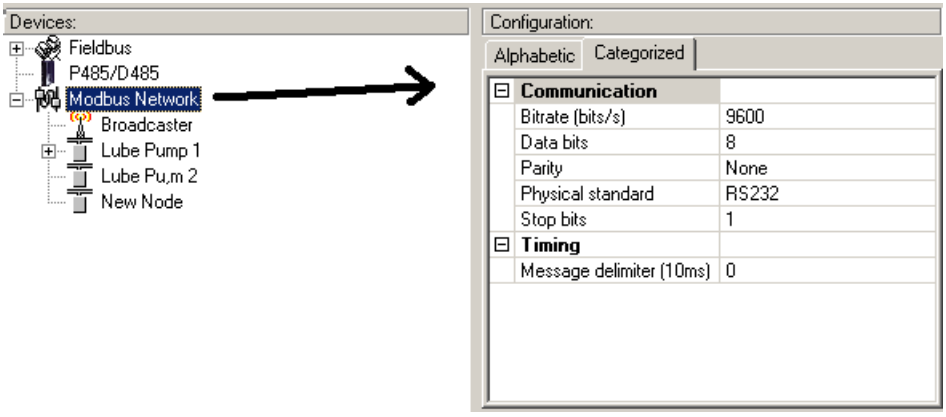


Figure 5-3: Parameter window

COMMUNICATION

Refer to *Serial interface settings* on page 4–13 for details.

MESSAGE DELIMITER

The message delimiter value is the minimum time in steps of 10 ms separating the messages. According to the Modbus specification, the message delimiter has a default setting of 3.5 characters.If this value is set to "0", the P485 will use the Modbus standard 3.5 character message delimiter. The time in milliseconds is then dependent on the selected baud rate, but this is all handled by the P485.

NOTE

Due to its impact on subnet functionality, use caution when changing this parameter.

Nodes

DESCRIPTION

A node in the EnerVista P485/D485 Setup software represents a device on the Modbus sub-network. In it's simplest form, a Node contains of a single transaction, that consists of a Query and a Response.

NODE PARAMETERS

To gain access to these parameters, select the desired node in the navigation window.

- **Slave address**: This setting shall be set to match the Modbus address setting of the destination device.
- **Name**: Node Name. This name will appear in the navigation window.

MODBUS NETWORK MENU

Right-click "Modbus Network" in the Navigation window to gain access to these functions.

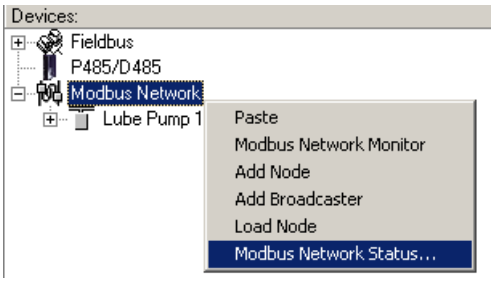


Figure 5-4: Modbus network menu

- **Paste**: Paste a node from the clipboard.
- **Modbus Network Monitor**: Launches the Modbus network monitor. Refer to *Modbus network monitor* on page 7–1 for details.
- **Add Node**: Adds a node to the scanlist.
- **Add Broadcaster**: Adds a broadcaster node to the scanlist.
- **Load Node**: Loads a node previously saved using "Save Node" from the Node menu (see details below).
- **Modbus Network Status**: Displays status/diagnostic information about the Modbus network.

NODE MENU

Right-click on a node in the Navigation window to gain access to these functions.

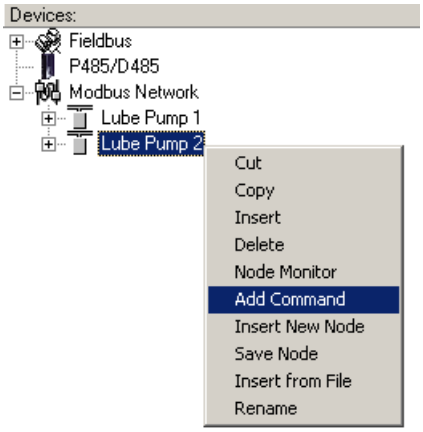


Figure 5-5: Node menu

- **Cut**: Cuts a node to the clipboard.
- **Copy**: Copies a node to the clipboard.

- **Insert**: Insert a node from the clipboard.
- **Delete**: Deletes a node and its configuration from the scan list.
- **Monitor**: Activates the node monitor.
- **Add command**: Adds a pre-defined protocol specific command to the scan list. The list of commands are supplied with the P485 and cannot be changed.
- **Insert new node**: Inserts a new node above the currently selected node.
- **Save node**: Saves the selected node.
- **Insert from file**: Inserts a previously saved node above the currently selected node.

QUERY PARAMETERS

To gain access to these parameters, select a Query in the Navigation window.

- **Minimum time between broadcasts (10 ms)**: The value entered here is only valid if a broadcast command is specified in the scan-list and the value specifies how long the P485 should wait after the broadcast was sent until the next command in the scan-list will be sent. This time should be selected such that all slave-devices connected to the P485 have time to finish the handling of the broadcast. The unit is milliseconds (ms) and the entered value is multiplied by 10, which means that the shortest time is 10 ms.
- **Offline options for fieldbus**: This parameter defines the behavior of the P485 in case the Profibus network goes off-line and the selection affects the data that is sent out the Modbus network
  - Clear: All data destined for the slave devices is cleared (set to 0).
  - Freeze: All data destined for the slave device is frozen.
  - NoScanning: The updating of the Modbus network is stopped.
- **Offline options for Modbus network**: This parameter defines the behavior of the P485 in case the Modbus network goes offline and the selection affects the data that is reported to the fieldbus master.
  - Clear: All data destined for the fieldbus master is cleared (set to 0).
  - Freeze: All data destined to fieldbus is frozen.

Offline options for Modbus networks are configured separately for each command.

- **Reconnect time (10 ms)**: This parameter specifies how long the P485 should wait before trying to re-connect a disconnected node. A node gets disconnected if the max number of retries is reached. The unit is milliseconds (ms) and the entered value is multiplied by 10, which means that the shortest time is 10 ms.
- **Retries**: This parameter specifies how many times a time-out can occur in sequence before the slave is disconnected.
- **Timeout time (10 ms)**: This parameter specifies the time the P485 waits for a response from the slave-device. If this time is exceeded the P485 re-sends the command until the “retries” parameter value is reached.

  The unit is milliseconds (ms) and the entered value is multiplied by 10, which means that the shortest time is 10 ms.
- **Trigger byte address**: This parameter specifies location in the internal memory buffer where the trigger byte is located. In P485 a trigger byte is implemented to support non-cyclic data that means that the Profibus master has the ability to notify the P485 when it should send a specific command to a slave.

  To use this functionality correctly the Profibus master should update the data area associated with the trigger byte, and then update the trigger byte. The trigger byte should be incremented by one for activation.

  This parameter has no affect unless the “Update mode” parameter is set to “Change of state on trigger”.

- **Update mode**: This parameter is used to specify when the command should be sent to the slave. The following modes are possible:
  - Cyclically: The command is sent to the slave at the time interval specified in the "Update time" parameter.
  - On data change: The command is sent to the slave when the data area connected to this command changes.
  - Single shot: The command is sent to the slave once at start-up.
  - Change of state on trigger: The command is sent to the slave when the trigger byte value is changed.
- **Update time (10 ms)**: This parameter specifies with what frequency this command will be sent. The unit is milliseconds (ms) and the entered value is multiplied by 10, which means that the shortest time is 10 ms.

RESPONSE PARAMETERS

To gain access to these parameters, select a Response in the Navigation window.

- **Trigger byte**: This parameter disables and enables the trigger functionality for the response. If the "trigger byte" is enabled then the P485 will increase the byte at the "trigger byte address" by one when the P485 receives new data from the Modbus network. This will notify the Profibus master of updated data.
- **Trigger byte address**: This parameter is used to specify the address in the internal memory buffer where the trigger byte is located. Valid settings range from 0x0002 to 0x00F3.

P485 Modbus to Profibus Converter

Chapter 6: Frame and command editors

Frame editor

DESCRIPTION

The frame editor makes it easier to add specific custom commands. The same parameters are available in both the frame editor and the parameter window, but in the frame editor presents the message frames in a more visual manner than the navigation / parameter window.

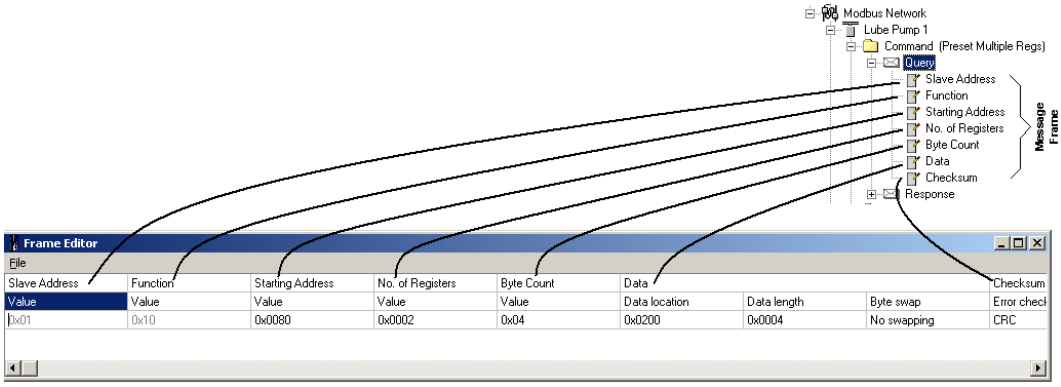
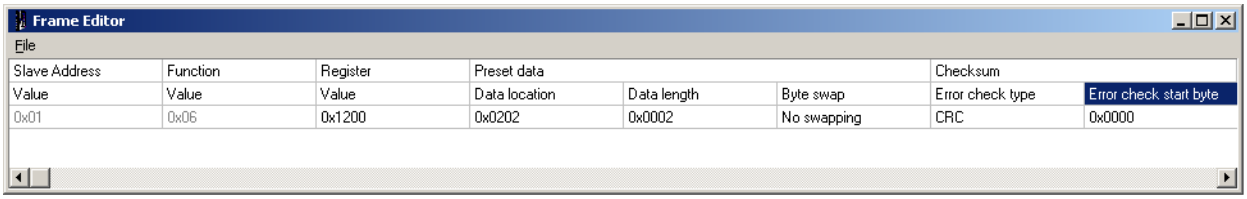


Figure 6-1: Frame editor window

EXAMPLE

Consider the following frame. The first byte holds the slave address (0x01) followed by the function code (0x06). The next word is the register address of the device where data is to be written (0x1200). This is a query command – the data is to be sent to the slave device and therefore is to be fetched from the OUT area starting at 0x0202. The next word indicates the data size (in bytes) to be written (in this case, 0x0002).



Slave Address	Function	Register	Preset data			Checksum	
Value	Value	Value	Data location	Data length	Byte swap	Error check type	Error check start byte
0x01	0x06	0x1200	0x0202	0x0002	No swapping	CRC	0x0000

This command will allocate two bytes of output data in the OUT area and no swapping will occur. The data is followed by a two-byte CRC error check field and the CRC calculation starts with the first byte in the frame (0x0000).

The same steps are required for the response frame. If the response holds data, it should be allocated in the input area that starts at address 0x002. To apply the changes, select **File > Apply Changes**. To exit without saving, select **File > Exit**.

Command editor

GENERAL

The command editor makes it possible to add custom commands to the P485.

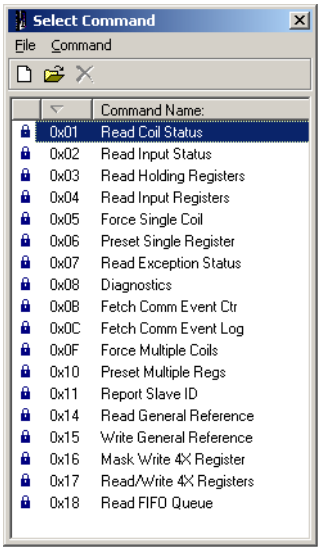


Figure 6-2: Select command window

To open the command editor, right click a node and select 'Add Command'. A list of predefined commands will appear.

To add a new command to the command list, select 'Add Command' in the 'Command' menu. To edit a previously defined command, highlight the command in the command list, and select 'Edit Command' in the 'Command' menu.The following window pops up upon selecting 'Edit Command' or 'Add Command'.

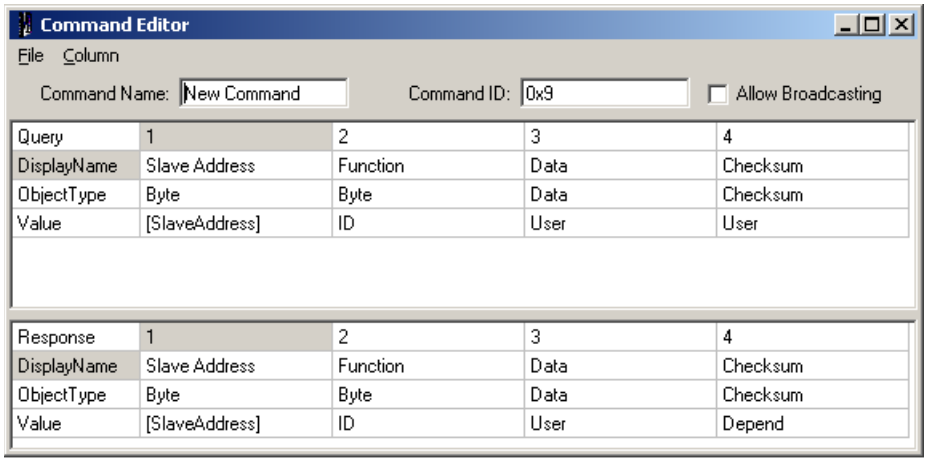


Figure 6-3: Command editor

SPECIFYING A NEW COMMAND

Select 'Add Command' as described earlier.

This example is taken from a Modbus RTU implementation, which means that the frame will always consist of one byte for slave address, one byte for function code and two bytes for CRC. Furthermore, each command always consists of a query and a response.

The Modbus RTU specific frame objects are already in place and a data object is inserted between the function code and the CRC. These objects cannot be moved or deleted, however it is possible to add objects between the function code and the CRC.

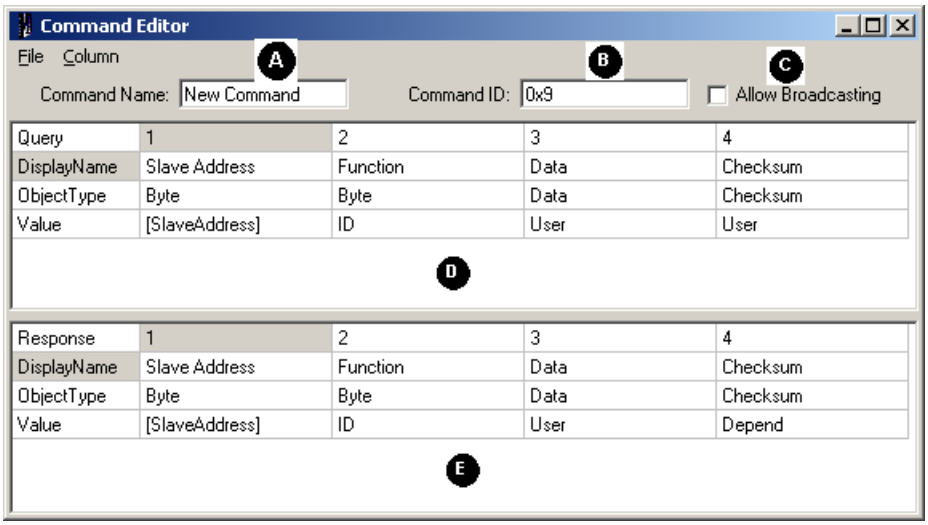


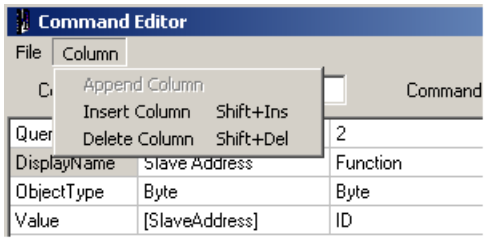
Figure 6-4: Specifying a new command

First, enter a name for the command in the Command Name field (A) and an identifier in the Command ID field (B). If the command is allowed to be broadcast on the sub-network, check the **Allow Broadcasting** check box (C).

The Query (D) field has the following characteristics:

Query	**Column**			
	1: Slave Address.	**2: Modbus Function Code**	**3: See below**	**4: Error Check field.**
DisplayName	Slave Address	Function	Data	Checksum
	Protocol specific; cannot be altered.		(See below)	
Object Type	Byte	Byte	Data	Checksum
	Modbus defines this object as a byte.		(See below)	
Value	[SlaveAddress]	ID	User	User
	Linked to the actual 'Slave Address' parameter in the parameter window.	This value is linked to the Command ID field.	(See below)	Linked to "User". Determined by user at configuration by selecting the Error Check object in the parameter window.

It is not possible to alter the contents of columns 1, 2 and 4, as these are pre-defined commands. However, on column 3 there are two possible actions: Insert Column and Delete Column. These actions are available in the Columns menu.



Column 3 in the Command Editor is where objects can be added for custom commands. Supported objects are Byte, Word, DWord, Data and Error Check. In this Modbus example it makes no sense to add an Error Check object since it is already incorporated in the standard frame but all other objects could be added in any way.

The “response” field (E) is defined much in the same way as the “query”, with the difference that a “response” can depend on what is entered in the “query”

Query	**Column**			
	1: Slave Address.	**2: Modbus Function Code**	**3: See below**	**4: Error Check field.**
DisplayName	Slave Address	Function	Data	Checksum
	See Query	See Query	See Query	See Query
Object Type	Byte	Byte	Data	Checksum
	See Query	See Query	See Query	See Query
Value	[SlaveAddress]	ID	User	Depend
	See Query	See Query	See Query	Object has same setting as the corresponding Query object. It also will appear as non-editable in the parameter window (see below)

If ‘Depend’ is selected then this object in the “response” will get the same setting as the corresponding object in the “query”, furthermore the object will appear as non-editable in the parameter window (see below).

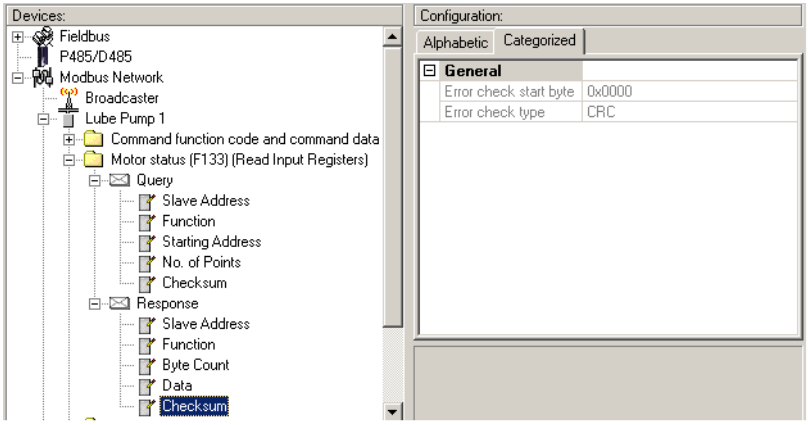


Figure 6-5: Main window

P485 Modbus to Profibus Converter

Chapter 7: Modbus network and node monitors

Modbus network monitor

GENERAL

The Modbus network monitor is intended to simplify configuration and troubleshooting of the Modbus network. It's main function is to display the data allocated for Modbus network communication and detect if any area has been allocated twice; that is, if a collision has occurred.

All configured nodes, together with the commands, are listed in the middle of the screen (B). Selecting and deselecting commands makes it possible to view any combination of allocated data.

NOTE

The Modbus network monitor has a negative influence on the overall performance of the P485. Therefore the monitor functionality should be used with care.

OPERATION

The Modbus network monitor window is shown below.

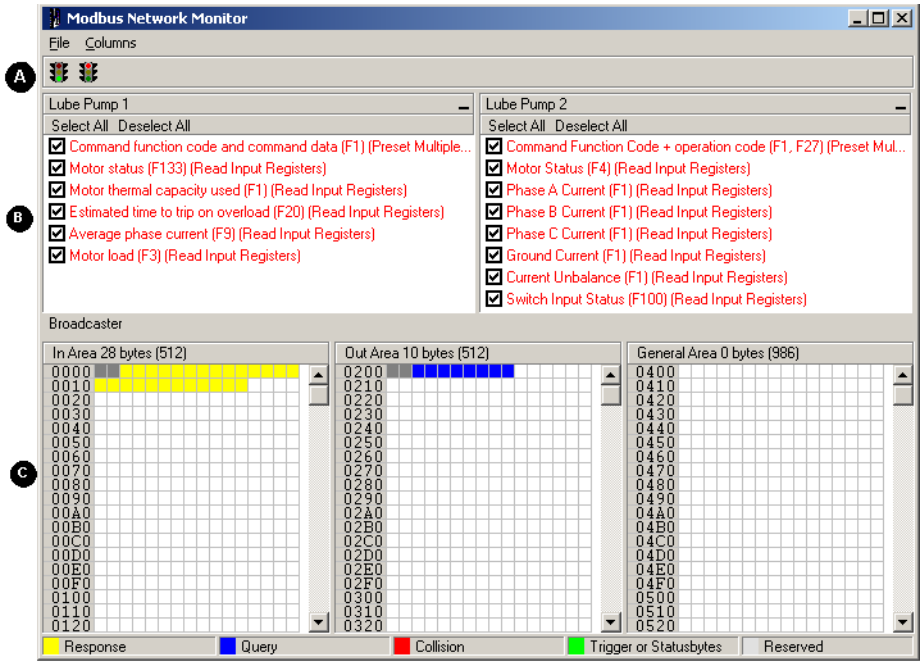


Figure 7-1: Modbus network monitor

A: Start / Stop sub network scanning

These icons are used to start / stop the scanning of the Modbus network. To stop the scanning, click on the red light. To start scanning again, simply click on the green light.

Start **Stop**

B: Nodes / Transactions

To view data blocks linked to a single command, select the command and the data will appear in the monitor area, see below. (C)

C: Monitor Area: Input / Output / General Data Areas

These areas display the data allocated in the input, output and general data areas. This information is color coded as follows:

- **White**: No data allocated.
- **Yellow**: Data allocated by a response/consume transaction.
- **Blue**: Data allocated by a query/produce transaction.
- **Red**: Collision. This area has been allocated more than once.
- **Grey**: Data allocated by the control/status registers.

Node monitor

GENERAL

The node monitor functionality provides an aid when setting up the communication with the slave-devices on the Modbus network.

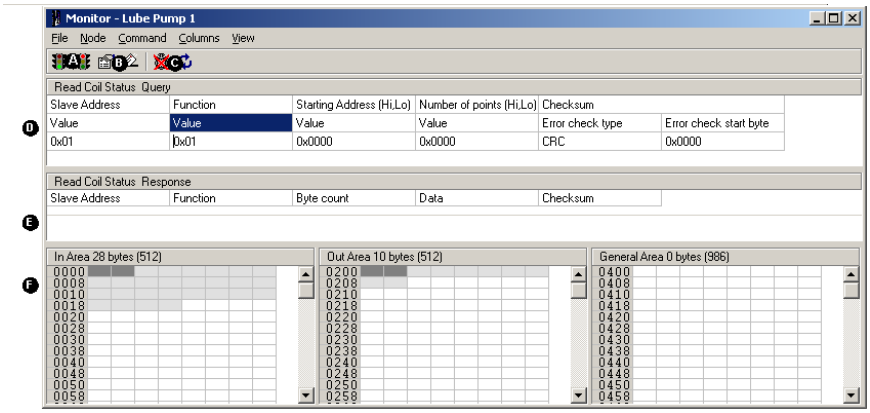
It offers an easy way of testing a specific command on a node, and monitor the result. It also provides an overview of the memory used by the node.

NOTE

Using the node monitor has a negative influence on the overall performance of the P485. Therefore the monitor functionality should be used with care.

OPERATION

The node monitor window is shown below.



A: Start / Stop Node Communication

These icons are used to start / stop a node. Stopping is done by clicking the red light and could be seen as a temporary removal of the node, i.e no data will be sent to the node but it is still available. To start the node again, simply click on the green light.

Start Stop

This is a powerful feature when there is a problem with a particular node; the other nodes can be disconnected, helping to isolate the problem.

NOTE

If the control and status registers are enabled, the subnet cannot be started or stopped without being activated from the fieldbus.

B: Select/Send Command

Select the command to monitor using the 'Select' icon, and click 'Send' to send the command.

Select Send

C: Data Update ON/OFF

These icons are used to turn the monitor functionality ON or OFF (see 'Monitor Area' below).

Update OFF Update ON

D: Command Area

This area displays the currently selected command.

E: Response Area

This area displays the response of a previously sent command.

F: Monitor Area

This area provides an overview of the data sent/received from the node. Areas in dark grey are reserved for the status/control registers.

Areas displayed in light grey are data objects used by the node. If data updating is enabled (see sub-section C above) the contents of these areas are also displayed in hex.

P485 Modbus to Profibus Converter

Chapter 8: Advanced functions

Control and status registers

DESCRIPTION

The control/status registers forms an interface for exchanging information between the fieldbus control system and the P485.

The main purpose of these registers is to report Modbus network related problems to the fieldbus control system. This interface is also used to ensure that only valid data is going out on the sub-network and that valid data is reported back to the fieldbus control system. See 8-4 “Input/output data during startup”.

Using these registers, it is also possible for the fieldbus control system to instruct the P485 to enable / disable specified nodes.

By default, these registers are located in the internal memory buffer at 0x000 - 0x001 (Status Register) and 0x200 - 0x201 (Control Register), however they can be disabled using EnerVista P485/D485 Setup, see *Modbus network configuration* on page 4–13. Disabling these registers will release the 2 reserved bytes in the internal memory buffer, however, the Status and Control functionality will not be available.

The handshaking procedure described on page 8-3 must be followed for all changes to these registers

CONTROL REGISTER (PROFIBUS CONTROL SYSTEM TO P485)

Bytes 0 and 1 of the control register are shown below.

Byte 0 (Offset 0x200)								Byte 1 (Offset 0x201)							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	Control Code					Data							

Bits	Name	Description
15	Handshake Confirmation Bit (CR_HS_CONFIRM)	When the Profibus control system has read the new information from the status register, it should set this bit to the same value as bit 15 in the status register
14	Handshake Toggle Bit (CR_HS_SEND)	The fieldbus (Profibus) control system should toggle this bit when new information has been written in the control register.
13	Data Valid (CR_DV)	This bit is used to indicate to the P485 if the data in the output data area is valid or not. The bit shall be set by the fieldbus control system when new data has been written (1 indicates data is valid; 0 indicates that data is NOT valid)
12 to 8	Control Code (CR_EC)	See table below.
7 to 0	Data (CR_ED)	See table below.

CONTROL CODES

The following control codes are recognized by the P485 and can be used by the fieldbus control system.

Code	Name	Description
0x10	DISABLE_NODE	Slave address of the node to disable. This instructs the P485 to disable a specific node from the sub network communication
0x11	ENABLE_NODE	Slave address of the node number to enable. This instructs the P485 to enable a specific node to be active in the sub network communication
0x12	ENABLE_NODES	Number of nodes to enable. This instructs the P485 to enable a number of nodes from a complete configuration

STATUS REGISTER (P485 TO FIELDBUS CONTROL SYSTEM)

The status codes below are handled by the P485 and reported to the fieldbus control system using the status code and data bits in the status register. The meaning of these bits are different depending on the used communication model.

Byte 0 (Offset 0x200)								Byte 1 (Offset 0x201)							
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	Status Code					Data							

Bits	Name	Description
15	Handshake Toggle Bit (SR_HS_SEND)	The P485 toggles this bit when new information is available in the status register.
14	Handshake Confirmation Bit (SR_HS_CONFIRM)	When the P485 has read the new information from the control register, it sets this bit to the same value as bit 14 in the control register
13	Data Valid (SR_DV)	Indicates to the fieldbus control system if the data in the input data area is valid or not. The bit is set by the P485 when new data has been written (1 indicates data is valid; 0 indicates that data is NOT valid).
12 to 8	Status Code (SR_EC)	Status code, see table below.
7 to 0	Data (SR_ED)	Status user data, see table below.

STATUS CODES

The status codes are described in the following table.

Code	Error	Description
0x00	Re-transmission	Number of re-transmissions. Reports the total number of re-transmissions on the subnetwork
0x01	Single node missing	Slave address of the missing node. Reports if a node is missing
0x02	Multiple nodes missing	Number of missing nodes. Reports if multiple nodes are missing
0x03	Overrun	Slave address of the node that sent too much data. Reports if more data than expected was received from a node
0x04	Other error	Slave address. Reports unidentified node
0x1F	No error	Normal Condition

HANDSHAKING PROCEDURE

The handshake bits are used to indicate any changes in the status and control registers. The procedure below must be followed for all changes to these registers with the exception of the handshake bits themselves (bits 14 and 15).

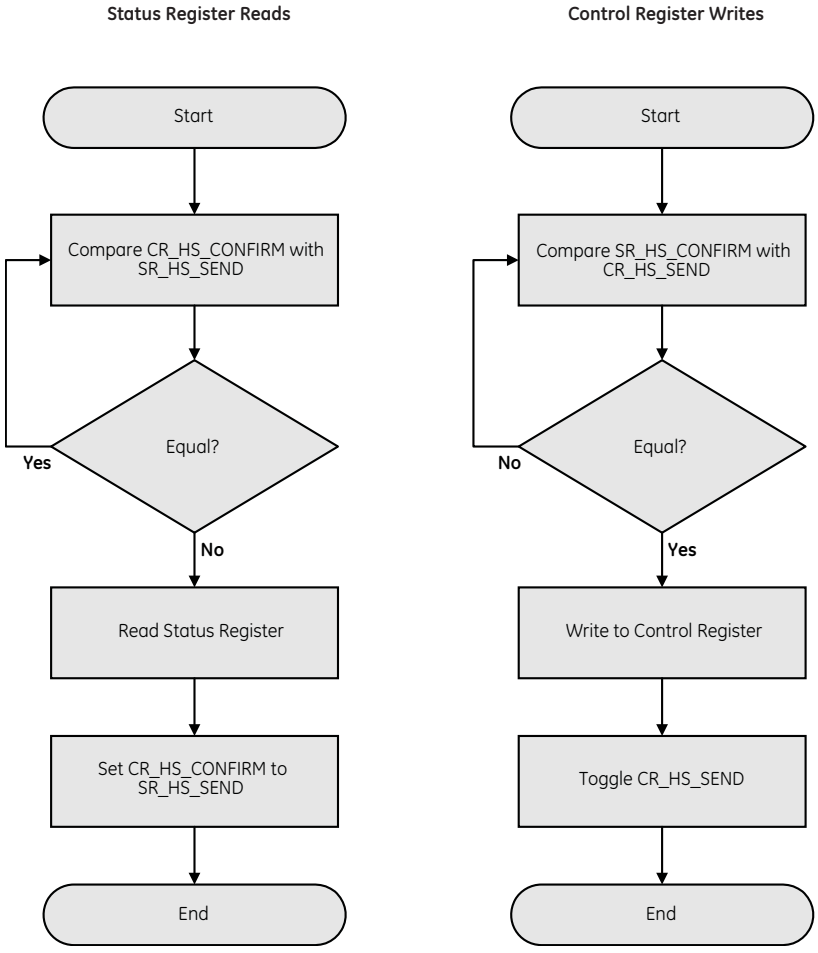


Figure 8-1: Handshaking flowchart

Input/output data during startup

DESCRIPTION

This section is only relevant when the control/handshake registers are enabled.

Bit 13 in the control register is used to ensure data consistency during start-up and at fieldbus off-line/on-line transitions. The bit should be treated as follows:

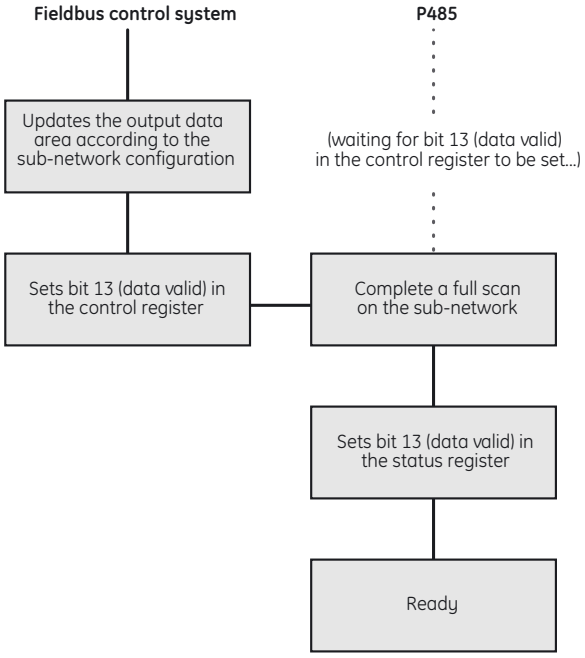


Figure 8-2: Input/output data during startup

When the fieldbus changes from off-line to on-line state, the fieldbus control system should clear (0) the 'data valid' bit in the control register. The P485 will then clear the 'data valid' bit in the status register.

During startup, the P485 waits for the fieldbus control system to set the 'data valid' bit in the control register. Before this is done, it will not communicate with the devices on the Modbus network.

The 'data valid' bit in the status register may in some cases be delayed. This latency can be caused by a missing node or a bad connection to a node with a long timeout value assigned to it.

Therefore, the fieldbus control system should not wait for this bit to be set before communicating with the sub-network devices. It should be considered as an aid for the fieldbus control system to know when all data has been updated.

NOTE

As with all changes to these registers, the handshaking procedure (refer to *Handshaking procedure* on page 8–3) must be followed.

Advanced fieldbus configuration

MAILBOX COMMAND

This advanced function is specifically designed for DeviceNet converter (D485) and not for Profibus converter (P485). Right clicking on the Fieldbus submenu items gives option of inserting a mailbox. Users are advised not to use this option for the P485.

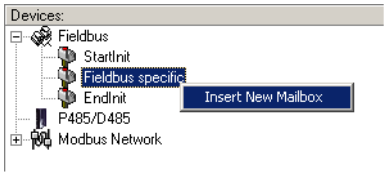


Figure 8-3: Mailbox command

CAUTION

Incorrect usage of mailbox commands may permanently damage the converter. For additional information, consult the product support team at GE Multilin.

P485 Modbus to Profibus Converter

Chapter 9: Application example

Introduction

OVERVIEW

The chapter describes how to configure the P485 Modbus to Profibus Converter to allow GE Multilin relays and meters to communicate on a Profibus Network. The GE Multilin MM2 Motor Manager 2 and PQMII Power Quality Meter are used as examples.

GE Multilin relays and meters support a very useful feature called the Modbus User Map in their software. This feature can be used in configuring the P485 to reduce the number of Modbus transactions and improve communication speed.

It is assumed that the reader is familiar with serial communication, Profibus networks, and PLC architecture.

EQUIPMENT AND DOCUMENTS

The examples in this chapter make use of the following equipment and documentation

- P485 Modbus to Profibus Converter
- RS485 cable to connect P485 to the relays/meters (MM2 and PQMII)
- Enervista P485/D485 Setup software with configuration cable
- GSD file for the P485
- standard Profibus cable with connectors
- 24 V DC power supply for the P485
- PLC with Profibus master card
- PQMII Power Quality meter and instruction manual (publication code GEK-106435D)
- Enervista PQMII Setup software
- MM2 relay and instruction manual (publication code GEK-106294B)
- MM2PC software

SYSTEM SETUP

This chapter describes how to set up the P485 with MM2 relay and PQMII meter to read and write parameters. It can also be used as a guideline to setup the P485 Modbus to Profibus Converter for communication with any GE Multilin relays.

The PQMII and MM2 devices are serially connected (daisy-chained) through RS485. The following data is set up for the PQMII:

- Read phase current Ia, Ib, and Ic actual values from memory locations 0240h to 0242h
- Read average current from memory location 0244h
- Read neutral current from memory location 0245h
- Read average phase voltage from memory location 0286h to 0287h

The following data is set up for the MM2:

- Read motor status from memory location 0023h
- Read switch input status from memory location 0010h
- Read motor load from memory location 0035h
- Read thermal capacity from memory location 0036h
- Read metered voltage from memory location 0040h
- The START A (command code 0x0005) and STOP (command code 0x0004) commands using Modbus function 10h: *Preset multiple registers*.

The memory addresses below are taken from the PQMII and MM2 instruction manuals available at http://www.GEmultilin.com. For the PQMII, we have:

Type	Parameter	Address	Format	Read/write
Actual values	Phase current Ia	0x0240	F1	Read only
Actual values	Phase current Ib	0x0241	F1	Read only
Actual values	Phase current Ic	0x0242	F1	Read only
Actual values	Average phase current	0x0244	F1	Read only
Actual values	Neutral current	0x0245	F1	Read only
Actual values	Average phase voltage (2 words)	0x0286	F3	Read only

For the MM2, we have:

Type	Parameter	Address	Format	Read/write
Actual values	Motor status	0x0023	F7	Read only
Actual values	Switch input status	0x0010	F100	Read only
Actual values	Motor Load	0x0035	F1	Read only
Actual values	Thermal Capacity	0x0036	F1	Read only
Actual values	Voltage	0x0040	F1	Read only
Commands	Command function code	0x1160	F1	Read/write
Commands	Command operation code	0x1161	F22	Read/write

The write command returns data in the response that should not be visible from the Fieldbus. Also, the write commands should only be sent if the data from the Profibus master has changed.

If the P485 detects a timeout while talking to the devices (PQMII and/or MM2), it should try to re-establish communications before it considers the device in subnet is missing (**Number of retries**), and then try again after some time (**Reconnect time**).

The serial communication parameters are set to 19200 bps, with no parity, 1 stop bit, and 8 data bits. The physical interface is set to RS485.

Modbus user map setup

DESCRIPTION

GE Multilin Relays and Meters support the Modbus User Map feature in their software. This feature can be used with the P485 to reduce the number of Modbus transactions and improve communication speed.

PQMII USER MAP

There are six parameters to be read from PQMII as indicated in the previous section. Normally, six read input register command transactions are required to read these parameters. However, these parameters can be grouped together with the Modbus User Map feature and read using only one read input register command transaction.

Set the Modbus User Map for the PQMII as follows.

1. Start the Enervista PQMII Setup software.
2. Establish communication between the device and PC.
3. Select the **Setpoint > User Map** menu item.
4. Set the user map registers as follows and save to the meter.

User map address	Parameter	User map data address
0000	0x0240	0x0100
0001	0x0241	0x0101
0002	0x0242	0x0102
0003	0x0244	0x0103
0004	0x0245	0x0104
0005	0x0286	0x0105

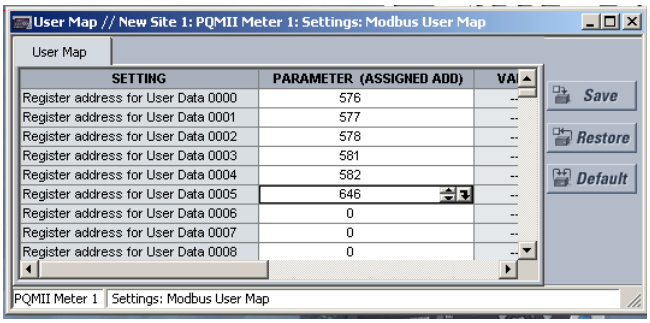


Figure 9-1: PQMII meter user map setting

The six parameters are now mapped to user memory map data at 0x0100 to 0x0106. These parameters can now be read by one *Read input data register* command at 0x0100 with register length = 7 words (note that average phase voltage value is in 32-bit).

MM2 USER MAP

As indicated earlier, there are five parameters to be read from MM2. Normally, five read input register command transactions are required to read these five parameters. However, all the parameters can be grouped together using the Modbus User Map feature and read using only one read input register command transaction.

Set the Modbus User Map for the MM2 as follows.

1. Start the MM2PC software.
2. Establish communications between the device and PC.
3. Select the **Setpoint > User Map** menu item.

4. Set the user map registers as follows and save to the relay.

User map address	Parameter	User map data address
1280	0x0023	0x0100
1281	0x0010	0x0101
1282	0x0035	0x0102
1283	0x0036	0x0103
1284	0x0040	0x0104

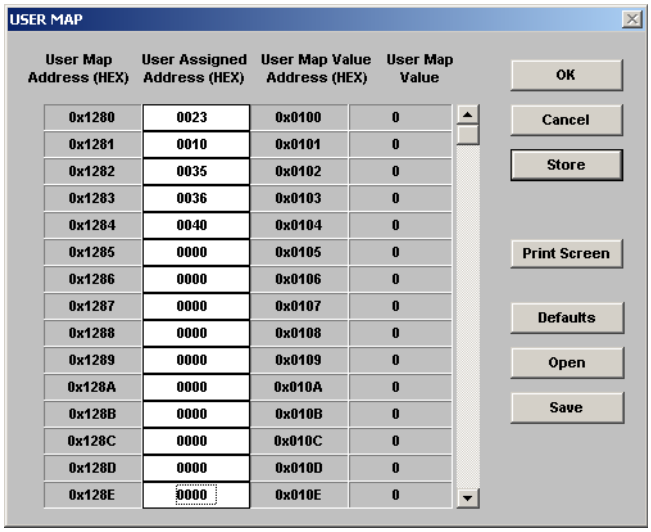


Figure 9-2: MM2 meter user map setting

The five parameters are now mapped to user memory map data at 0x0100 to 0x0104. These parameters can now be read by one *Read input data register* command at 0x0100 with register length = 5 words.

System configuration

OVERVIEW

An overview of the system configuration described in this document is shown below.

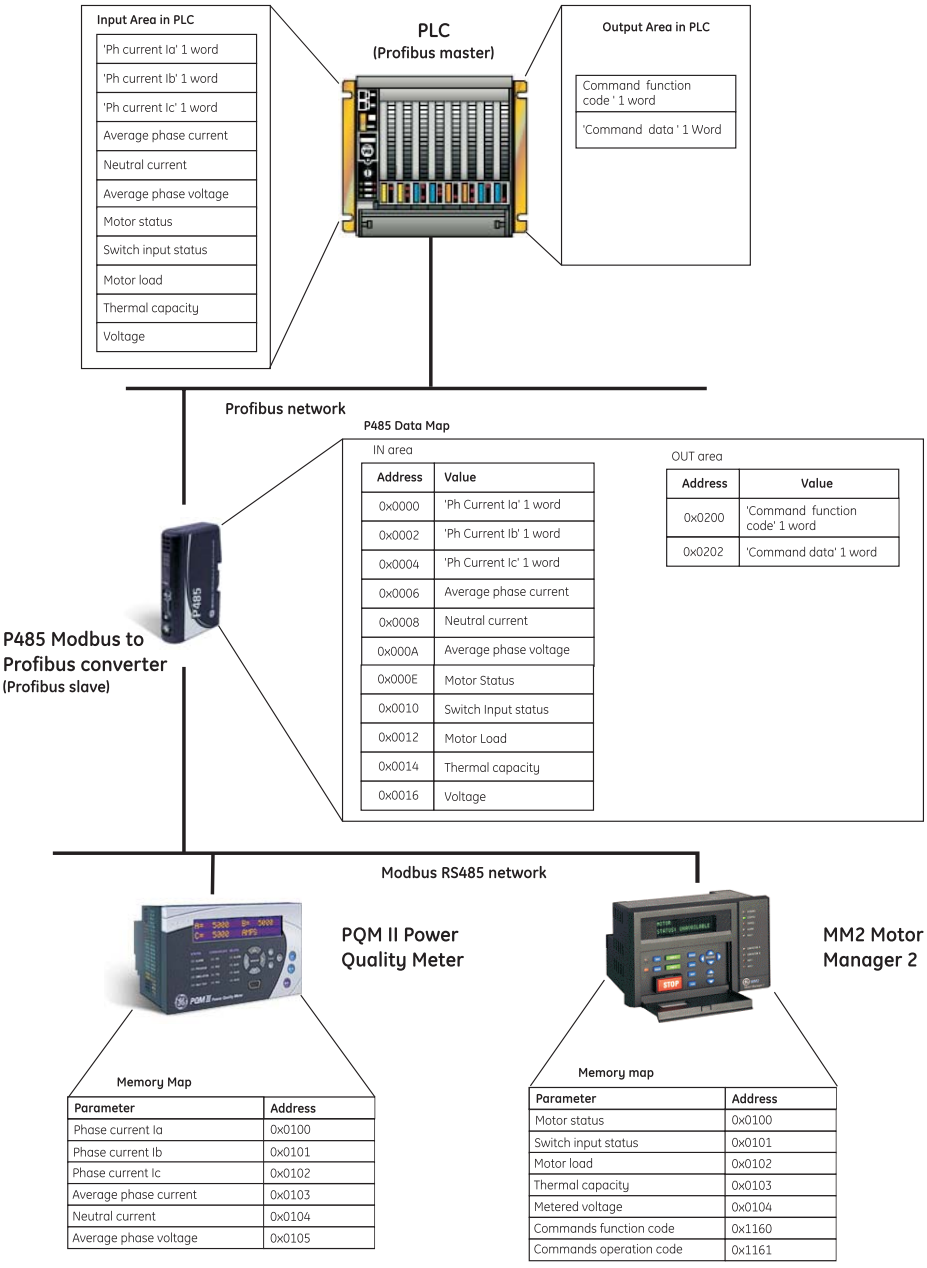


Figure 9-3: System configuration

The following procedures describe how to configure for the P485 with the PQMII and MM2. It is assumed that the reader has some basic knowledge of the Modbus RTU protocol and Profibus communication protocol.

INSTALLING THE ENERVISTA P485/D485 SETUP SOFTWARE

The following procedure describes how to configure the EnerVista P485/D485 Setup software.

1. Install the EnerVista P485/D485 Setup software.
2. Connect the configuration port of P485 to the PC via the configuration cable.
3. Connect the devices (PQMII and MM2) to P485 through the DB-9 Modbus network connector using the proper RS485 connections shown below.

DB9 pin	Description
5	Ground
8	RS485 +
9	RS485 –

STARTING THE CONFIGURATION WIZARD

Start the P485 configuration wizard as follows.

1. Launch the Enervista P485/D485 Setup software.
2. A window for selecting a configuration will be displayed. Select the **Configuration Wizard** icon.

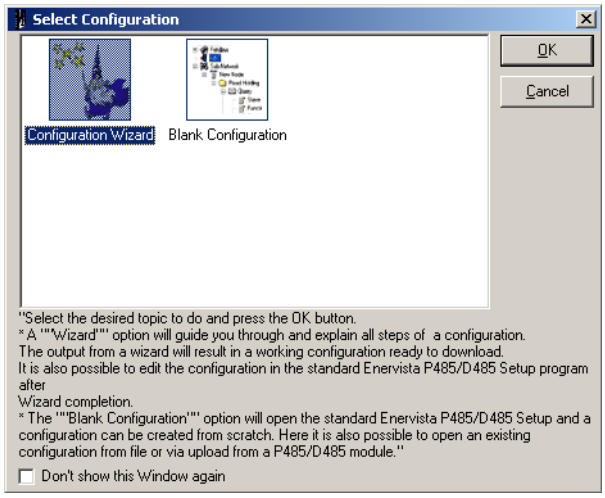


Figure 9-4: Select configuration wizard

3. Click **OK** to proceed to step 1 of the configuration wizard.

STEP 1: SELECTING THE FIELDBUS TYPE

The first step in the configuration wizard is setting the fieldbus type.

1. Set the **Fieldbus type** to "Profibus-DP".

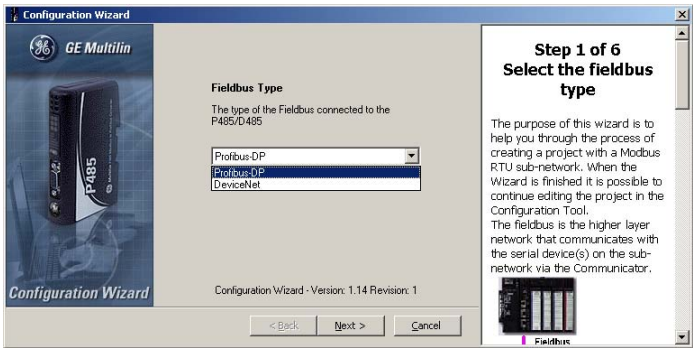


Figure 9-5: Select fieldbus type

2. Click **Next** to proceed to step 2 of the configuration wizard.

STEP 2: SELECTING THE SUB-NETWORK PROPERTIES

The second step in the configuration wizard is to select the sub-network properties.

1. Set the Modbus network properties as follows: baud rate to 19200, with 8 data bits, no parity, RS485 physical standard, and 1 stop bit.

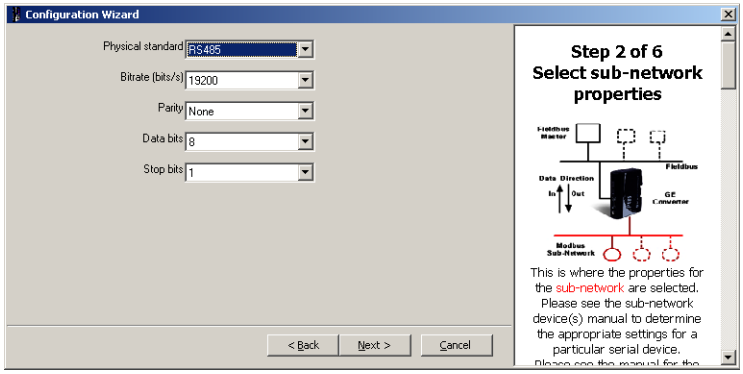


Figure 9-6: Modbus network properties

2. Click **Next** to proceed to step 3 of the configuration wizard.

STEP 3: INCLUDE DEVICE TYPES

The third step in the configuration wizard is to include device types. The PQMII and MM2 devices are added in this step.

1. The configuration wizard gives the option to create a configuration for a new device or to load a configuration of saved device.

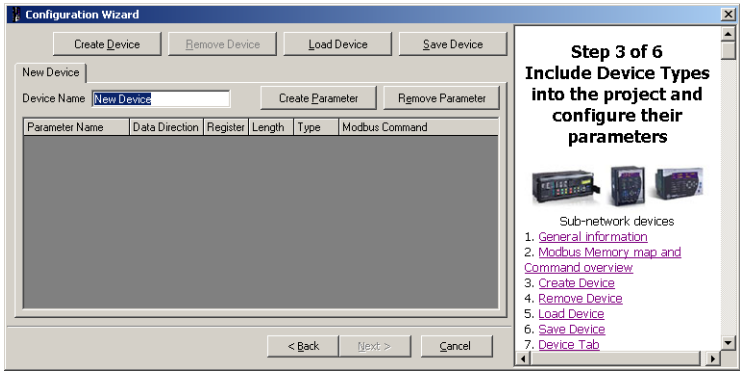


Figure 9-7: Device types

2. Configuration files for MM2 and PQMII are supplied with the Enervista P485/D485 Setup software. Click the **Load Device** button to see the available configuration files.

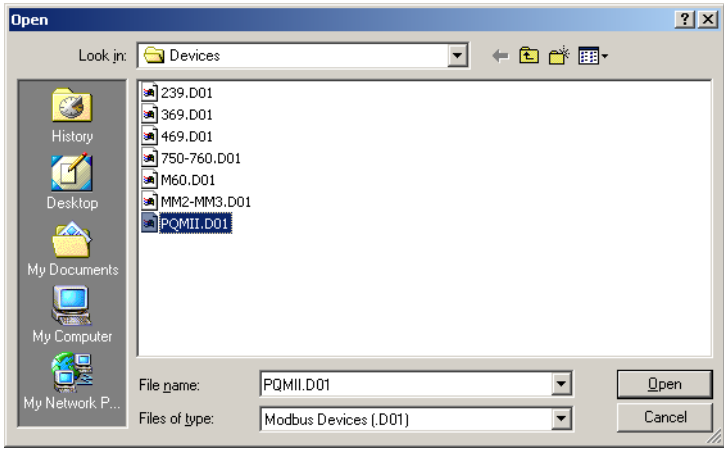


Figure 9-8: Available Modbus devices

3. Select the **PQMII.D01** file from the list and click on **Open**.
4. The software will display a list of the most commonly used parameters configured for the PQMII.

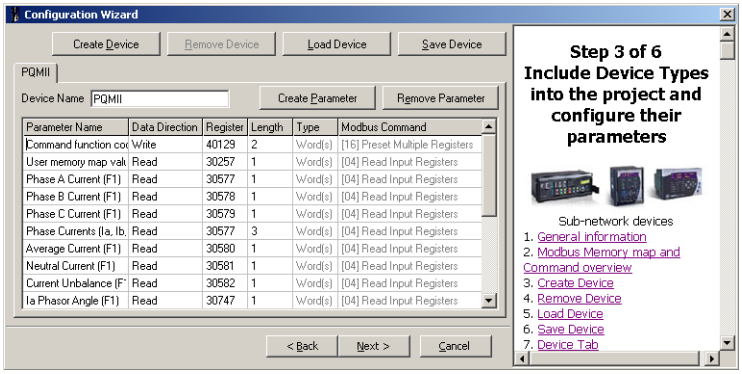


Figure 9-9: Parameters configured for PQMII

5. The Modbus User Map values are already present in the configuration file; as such, it is not required to create the new parameters. However, it is necessary to save number of registers to be read. Change the data length to 7 words as required.
6. Similarly, load the configuration file for MM2 by clicking the **Load Device** button and selecting the **MM2-MM3.D01** file.

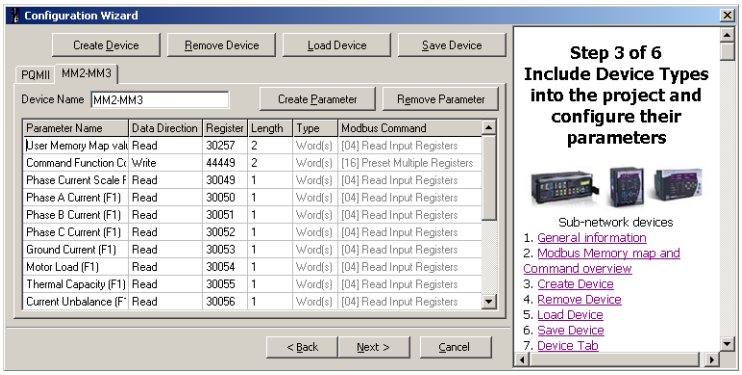


Figure 9-10: Parameters configured for the MM2

7. The software will display a list of the most commonly used parameters configured for the MM2. The Modbus User Map values are already present in the configuration file; as such, it is not required to create the new parameters. However, it is necessary to save number of registers to be read. Change the data length to 5 words as required.
8. The Motor Start A command and Motor Stop command can be executed using command function + operation code.
9. Save this device configuration by clicking the **Save Device** button.
10. Click **Next** to proceed to step 4 of the configuration wizard.

STEP 4: CONNECT DEVICES TO THE SUB-NETWORK

The fourth step in the configuration wizard is to connect the configured device types to the sub-network. The PQMII and MM2 devices are connected in this step.

1. Click **Next** to proceed to create nodes on Modbus network as shown below.

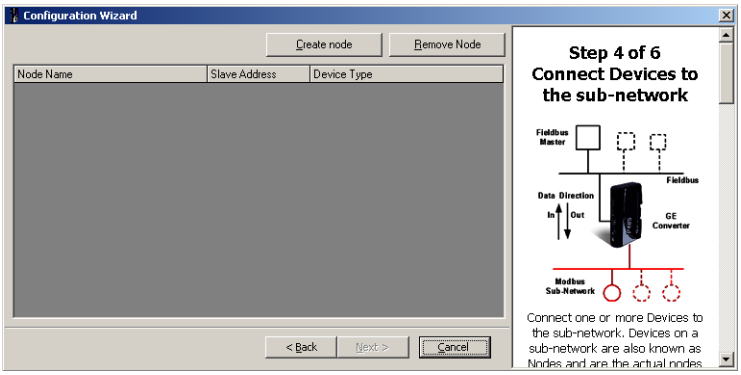


Figure 9-11: Connect devices to sub-network

2. There are two nodes on the Modbus network: the PQMII meter and the MM2 relay. To insert a node, click the **Create Node** button.
3. Set the **Node Name** as "PQMII Meter", the **Slave Address** to "20", and the **Device Type** to "PQMII".

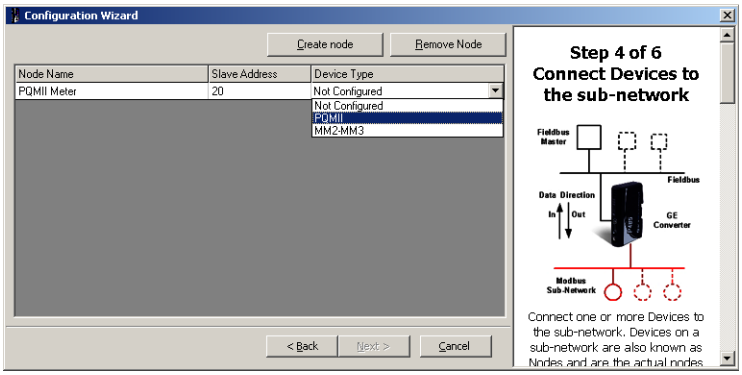


Figure 9-12: Node for PQMII meter

4. Similarly create another node for the MM2. Set the **Node Name** as "MMII Relay", the **Slave Address** to "4", and the **Device Type** as "MM2-MM3".

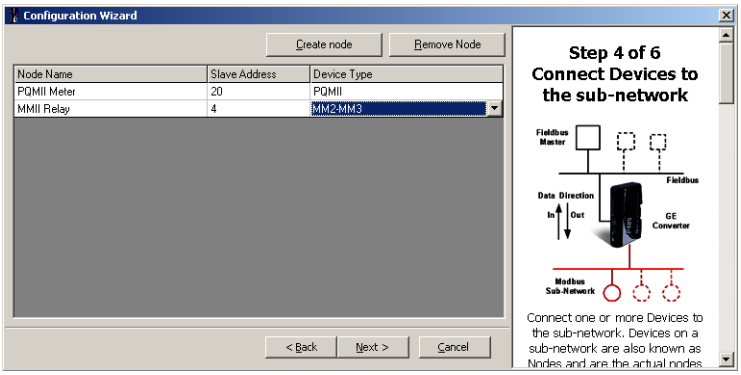


Figure 9-13: Node for MM2 relay

5. Click **Next** to proceed to step 5 of the configuration wizard.

STEP 5: SELECT PARAMETERS FOR EACH NODE

The fifth step in the configuration wizard is to select parameters for each node. The parameters for the PQMII and MM2 devices are selected in this step.

1. Parameters can now be added to each node. The tabs indicate the node name and slave address

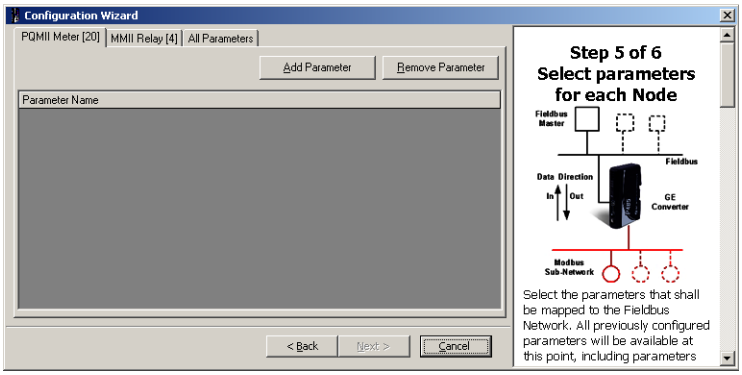


Figure 9-14: Select parameter window

2. To add parameter for the PQMII meter. select the "User memory map value (F1)" item from the drop-down list.

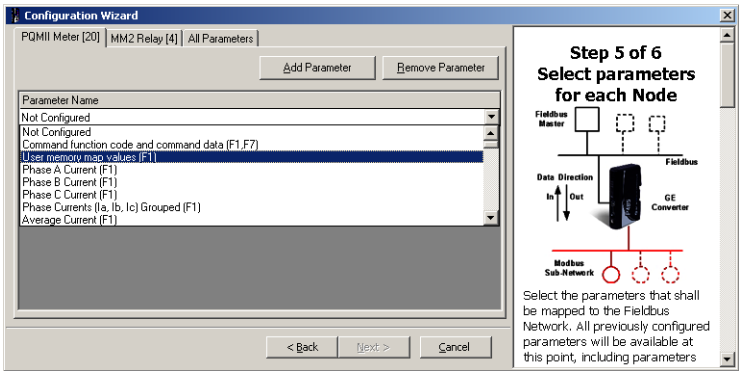


Figure 9-15: Choosing parameters for the PQMII meter node

3. Select parameters for MM2 relay by click on the **MM2 Relay (4)** tab followed by the **Add Parameters** button. Choose the following parameters from the drop-down list:

   User memory map values (F1)
   Command function code + operation code (F22)

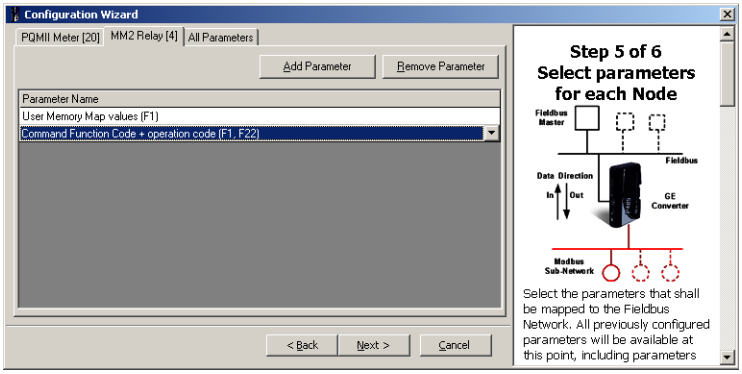


Figure 9-16: Choosing parameters for the MM2 relay node

4. The values in the bracket indicate Modbus data format codes – refer to the instruction manuals for details.

5. Click **Next** to proceed to the final step of the configuration wizard

STEP 6: CONFIGURATION REPORT

The final step in the wizard provides a configuration report for the device.

1. If desired, click on **Print** to print the configuration report.

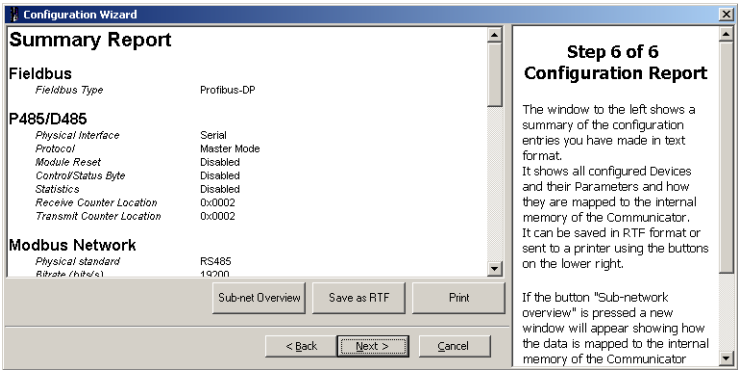


Figure 9-17: Configuration report

2. For future reference, saved the file in RTF format by clicking the **Save as RTF** button and selecting an appropriate directory.
3. Click the **Sub-net Oveview** button to view the data mapping.

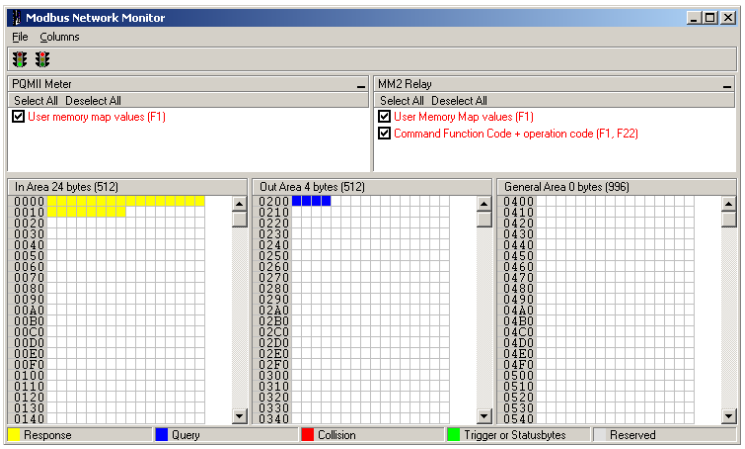


Figure 9-18: Modbus network monitor

4. Close the Modbus network monitor window.
5. Click on **Next** to complete the configuration wizard.

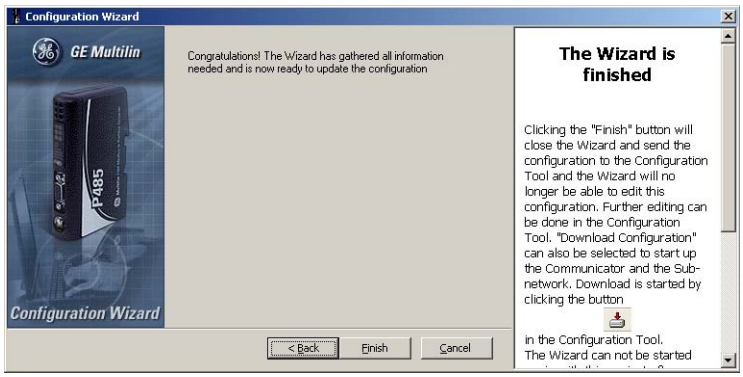
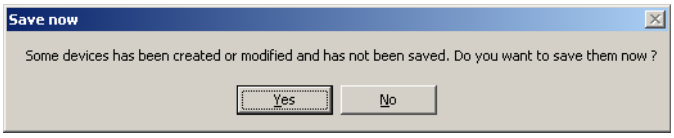


Figure 9-19: Wizard finished

SAVING DEVICE DATA

After the configuration wizard is complete, the software will prompt to save the device data (if necessary).



Click on **Yes** to save the device. The data can be saved in the same or different device files.

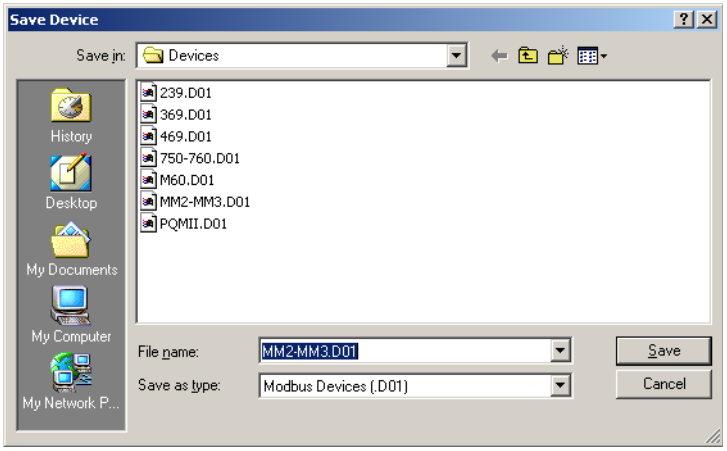
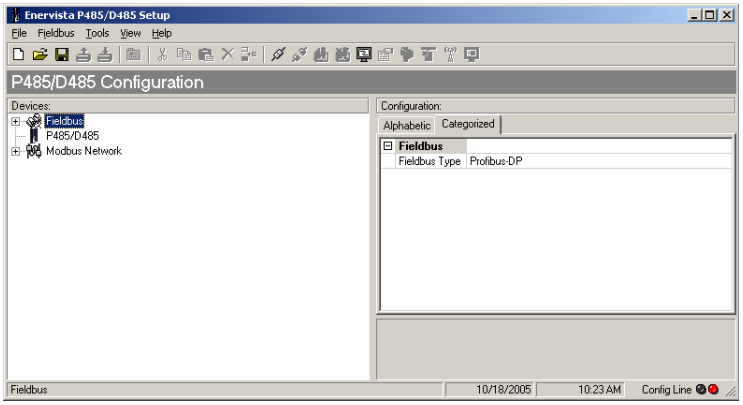


Figure 9-20: Save device file

CONFIGURING THE QUERIES

The main screen will appear after the wizard is closed.



1. Expand the **Modbus Network** item in the tree. All the configured parameters will appear as commands.

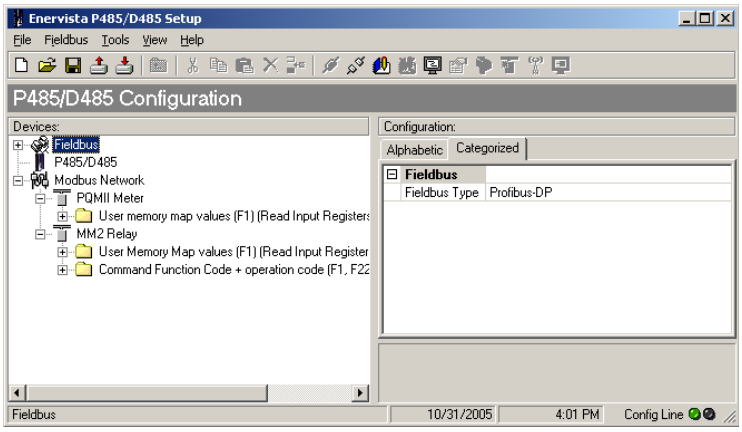


Figure 9-21: Expanding the tree

2. Expand the **User memory map values (F1)** command in the **PQMII Meter** item and click on **Query**.

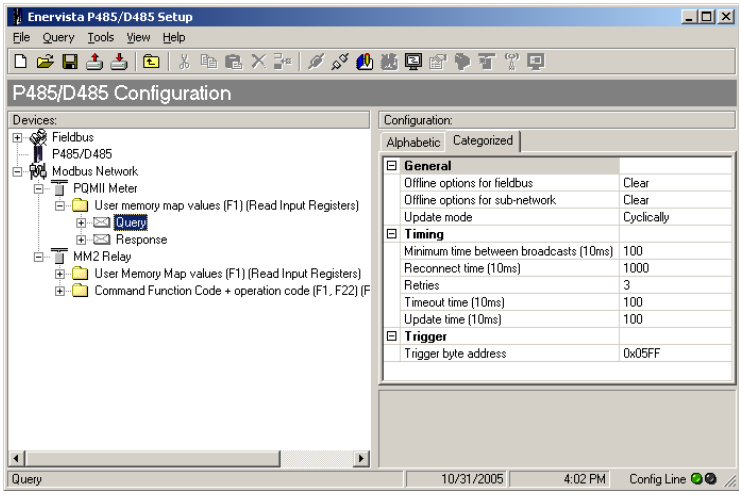


Figure 9-22: Expand query

3. Change the **Reconnect time** to 5 seconds by changing the value to 500 (500 × 10 ms = 5 seconds) and the **Retries** to 5.

4. Verify that the data **Update mode** is "Cyclically" with default **Update time** of 100 × 10 ms = 1000 ms. This can be changed to any value between 10 ms (1 × 10 ms) to 655350 ms (65535 × 10 ms).

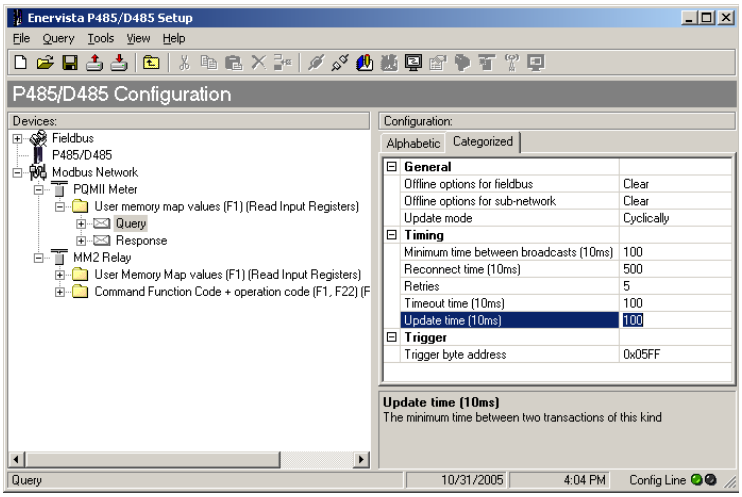


Figure 9-23: Changing configuration parameters for a query

5. Expand the **User memory map values (F1)** command in the **MM2 Meter** item and click on **Query**. Set the configuration parameters as above.

6. Expand the **Command Function code + operation code (F1, F22)** command in the **MM2 Meter** item and click on **Query**.

7. Set the following configuration parameters.

   Offline option for Fieldbus = Freeze
   Offline Options for sub-network = Freeze
   Upload mode = On data change
   Reconnect time = 500 (5 sec)
   Retries = 5

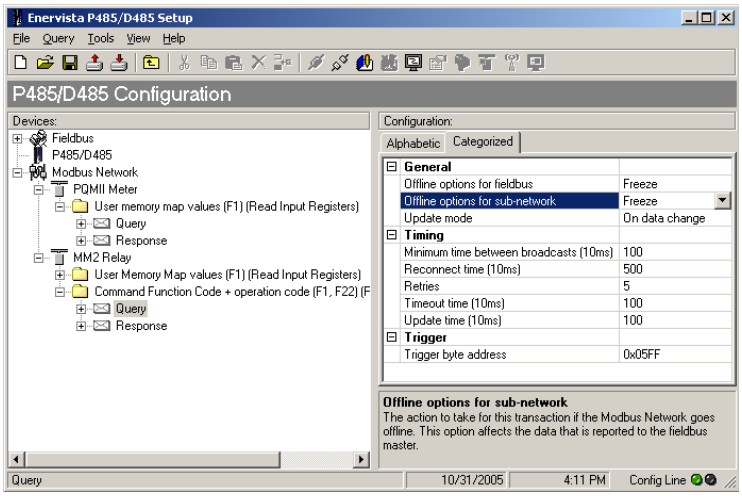


Figure 9-24: Query parameters for the command function

DOWNLOADING THE CONFIGURATION FILE

Save the configuration file for future use. The save command is available in **File** menu. The following procedure demonstrates how to save the configuration file to the P485.

1. To open the saved configuration file, select the **File > Open** menu item. The following window will appear.

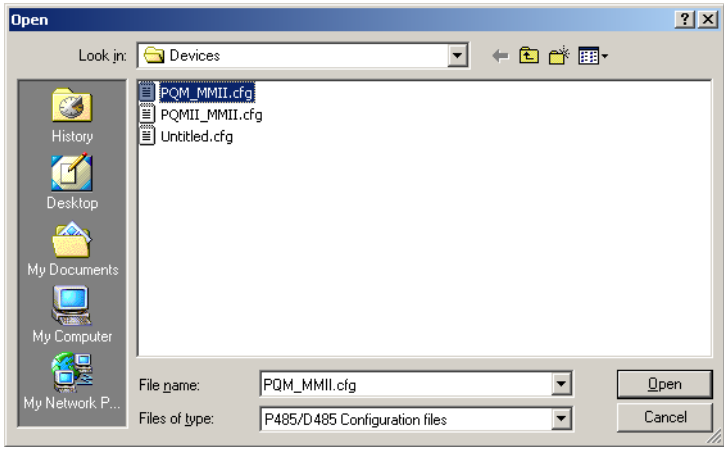


Figure 9-25: Opening a saved configuration file

2. To connect to the P485, select the **Tools > Port** menu item, then select the port connected to P485.
3. Click on the **Connect** icon.
4. Verify that the green LED is shown in the right corner of the configuration tool, then click the download icon in the toolbar. The download in progress bar will appear.

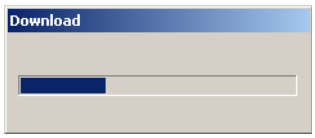


Figure 9-26: Download in progress

5. If the P485 does not respond to the download, ensure all connections are OK and that the port selection is valid. On some laptop computers, it might be worth trying the other serial ports. Also ensure that no other software (such as any PLC communication drivers) are blocking access to the serial ports.

Profibus network setup

DESCRIPTION

Each device on a Profibus-DP network is associated with a GSD file that contains all necessary information about the device. This file is used by the Profibus configuration tool during configuration of the network. The file is available for download at the GE Multilin website at http://www.GEmultilin.com (the GSD file is named **P48509E5.GSD**).

It is necessary to import the GSD file in the Profibus configuration tool to incorporate the P485 as a slave in the network. The properties for the P485 must then be configured from the Profibus configuration tool. This includes setting up the node address, input/output data areas and offset address.

- **Node address**: The node address in the Profibus configuration tool should be set to match the one selected using the on board configuration switches of the P485.
- **Setting up input/output data areas**: Input/output data are arranged as logic modules in the Profibus configuration tool. Which modules to use depends on the application. The modules are composed together in the module list for the P485 device. It is possible to select modules freely to compose the required input/output sizes, In the previous example, where there are 24 bytes of input and 4 bytes of output, the following modules can be configured.

  24 bytes input and 6 bytes output = 16 inputs + 8 inputs + 4 outputs
- **Offset address**: The offset addresses can be chosen freely. However, certain restrictions may apply depending on what PLC/Profibus master is used.

If the P485 is the last node on a Profibus segment, it is necessary to use a Profibus connector with the integrated termination switch. The termination switch should be set to ON if the P485 is the last physical node on the network and no other termination is used at this end of the network.

GE Consumer & Industrial

P485 Modbus to Profibus Converter

Chapter 10: Miscellaneous

Revision history

RELEASE DATES

Table 10–1: Release dates

Manual	Part No.	Revision	Release Date
GEK-113190	1601-0237-A1	1.0x	December 15, 2005

CHANGES TO THE MANUAL

As this is the first version of the P485 Modbus to Profibus Converter manual, there are no changes to report.

Warranty

GE MULTILIN WARRANTY STATEMENT

General Electric Multilin (GE Multilin) warrants each device it manufactures to be free from defects in material and workmanship under normal use and service for a period of 24 months from date of shipment from factory.

In the event of a failure covered by warranty, GE Multilin will undertake to repair or replace the device providing the warrantor determined that it is defective and it is returned with all transportation charges prepaid to an authorized service centre or the factory. Repairs or replacement under warranty will be made without charge.

Warranty shall not apply to any device which has been subject to misuse, negligence, accident, incorrect installation or use not in accordance with instructions nor any unit that has been altered outside a GE Multilin authorized factory outlet.

GE Multilin is not liable for special, indirect or consequential damages or for loss of profit or for expenses sustained as a result of a device malfunction, incorrect application or adjustment.

For complete text of Warranty (including limitations and disclaimers), refer to GE Multilin Standard Conditions of Sale.

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P485 Modbus to Profibus Converter

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