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Professional Fieldbus Connections

ESENET
Ethernet gateway for CANopen genset controls
User manual

Edition 2.0

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ESENET

Ethernet gateway for CANopen genset controls: User manual

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2013-02-19	Added LS-5 configuration and *Easygen*-1000 Modbus table

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Important user information

This manual explains how to install, operate and configure a *ESENET*. This device may only be used for the applications described in this document.

This manual is to be used with a *ESENET* with firmware version 2.1.

These instructions are intended for use by trained specialists in electrical installation and control and automation engineering, who are familiar with the applicable national standards and safety procedures.

Safety Precautions

ELECTRICAL HAZARD

- This equipment must be installed and serviced only by qualified personnel. Such work should be performed only after reading this entire set of instructions.
- Before performing visual inspections, tests, or maintenance on this equipment, disconnect all sources of electric power. Assume that all circuits are live until they have been completely de-energized, tested, and tagged. Pay particular attention to the design of the power system. Consider all sources of power, including the possibility of backfeeding.
- Apply appropriate personal protective equipment and follow safe electrical practices.
- Turn off all power supplying the equipment in which the *ESENET* is to be installed before installing, wiring or removing the *ESENET*.
- Always use a properly rated voltage sensing device to confirm that power is off.
- The successful operation of this equipment depends upon proper handling, installation, and operation. Neglecting fundamental installation requirements may lead to personal injury as well as damage to electrical equipment or other property.

Failure to follow these instructions could result in death or serious injury!

Document conventions

Throughout this manual we use the following symbols and typefaces to make you aware of safety or other important considerations:

	Indicates a potentially hazardous situation that, if not avoided, could result in death or serious injury.
	Indicates a potentially hazardous situation that, if not avoided, could result in damage to equipment.
	Indicates information that is critical for successful application and understanding of the product.
	Provides other helpful user information that does not fall in above categories.
	Provides supplemental user information.
Acronym	This typeface is used to introduce acronyms or product names.
`Command`	This typeface is used to represent commands, prompts, input fields and filenames. In the context of programming it is used for functions, variable names, constants or class names.
`Placeholder`	This typeface is used to represent replacable text. Replaceable text is a placeholder for data you have to provide, like filenames or command line arguments.
`User input`	This typeface is used to represent data entered by the user or buttons.
`Screen output`	Screen output or program listing

Chapter 1. Introduction

The *ESENET* is an Ethernet gateway specifically designed to interface Woodward's *Easygen* series genset controls with Modbus/TCP networks and Toolkit. It interfaces via CAN bus with the Woodward controls.

The *ESENET* takes advantage of the multi-master capability and fast transmission speed of CAN to offer short Modbus/TCP poll cycles as well as concurrent access.

A single *ESENET* added to the CAN network will make all Visualisation Data of connected Woodward CANopen controls available without adding additional load to the CAN bus communication. In addition concurrent and fast read and write access to Parameter IDs is possible utilising parallel CANopen SDO transfers.

In addition to Modbus/TCP access the *ESENET* provides a Toolkit interface. Using this facility you can run local and remote Toolkit sessions from your PC via Ethernet and TCP/IP through the *ESENET* gateway to Woodward controls connected on *ESENET*'s CAN interface.

Usage and configuration of the gateway is simple and conveniently performed using a web browser which connects to the embedded web server.

Common applications include:

- PLC connection
- Operator panel interfacing
- HMIs

- SCADA integration
- Power station automation
- Gen set control
- Remote control & monitoring
- Data logging

Features

The *ESENET* gateway provides the following key features:

- Multiple concurrent Modbus/TCP connections
- Toolkit interface to configure Woodward controls via Ethernet
- Supports *Easygen* 3500, 3400, 3200, 3100, 2000 and 1000 models
- Supports LS-5
- Supports DTSC-200
- Addresses up to 16 controls
- Uses existing CAN wiring
- Fast Modbus poll rates for Visualisation Data (< 7 ms)
- Concurrent reads and writes of Parameter IDs
- Register layout and address range compatible with serial Modbus data protocol 5003 for *Easygen*-3000 devices
- Internal buffer for Visualisation Data
- Supports alternative Modbus register range below address 50000
- Transparent handling of data guarantees future compatibility
- Low configuration overhead, just an IP address
- Embedded web server for easy configuration and commissioning using a web browser
- Firmware upgradeable via Ethernet
- Status LEDs for power, Ethernet link, device status and communication status
- DIN rail mountable
- 24 V DC (10-30 V) power supply

Quick start checklist

- Read this set of instructions properly and in its entirety.
- Mount the unit.
- Connect the power. Do not connect yet CAN bus or serial ports.
- Configure the Ethernet communications settings with a web browser (using an Ethernet crossover cable) or with a terminal program like *HyperTerminal* (using a null modem cable)
- Configure the CAN bus settings.
- Configure the serial line communication settings.
- Configure the operational aspects of the device.
- Wire CAN bus.
- Wire serial line interfaces.

Chapter 2. Description

The power and CAN terminals are placed on the top side of the unit. The RS-232 and Ethernet connectors are placed on the bottom side of the unit as shown in the following illustration:

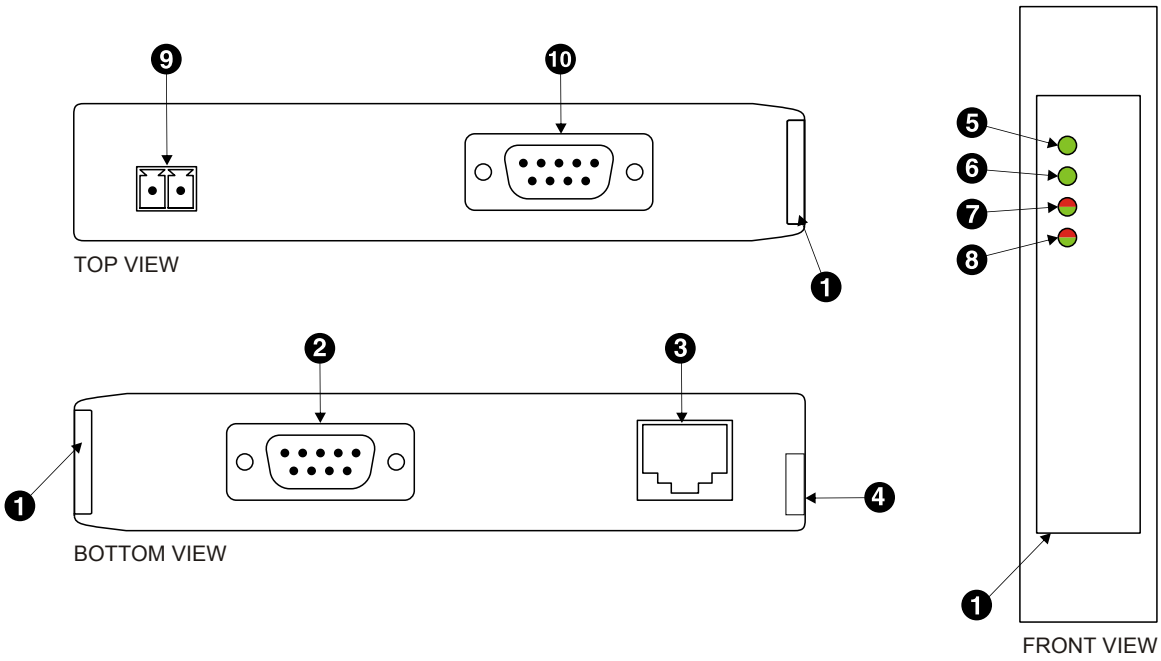


Figure 2.1: Location of connectors

❶ Clear front cover
❷ Diagnostic port connector
❸ Ethernet connector
❹ DIN rail clip
❺ Power LED
❻ Ethernet link LED
❼ Device status LED
❽ Communication status LED
❾ Power terminals
❿ CAN connector

LED indicators

Four LEDs located at the front panel indicate the status of the *ESENET*. The LEDs assist maintenance personnel in quickly identifying wiring or communication errors.

A LED test is exercised at power-up, cycling each LED off, green and then red for approximately 0.25 seconds. At the same time the power-on self test of the device is performed.

The following table outlines the indicator condition and the corresponding status after the power-on self test has been completed:

LED	Function	Condition	Indication
Power	Power	Off	No power applied to the device.
		Green	Power supply OK
Link	Ethernet link	Off	No Ethernet link
		Green	Ethernet link OK
Status1	Device status	Off	The device has an unrecoverable fault; may need replacing.
		Flashing green at 1 s rate	Device operational but needs commissioning due to configuration missing, incomplete or incorrect.
		Green	The device is operating in normal condition.
		Flashing red at 1 s rate	Device operational but has a fault listed which requires acknowledgment.
		Red	The device has an unrecoverable fault; may need replacing. Flashing sequence and rate of Status2 LED indicates fault class.

Table 2.1: LED diagnostic codes

Principles of operation

The *ESENET* acts as a CANopen consumer and monitors the CAN bus for transmission of well-known communciation objects. Once these communication objects identify one of the supported Woodward controls, the *ESENET* starts to buffer all multiplexed visualisation data of such device into its internal data tables.

The *ESENET* also acts as a Modbus server on the Ethernet interface. It accepts connections and Modbus queries from Modbus master devices. The Modbus registers are then served from the *ESENET*'s internal data tables. Because of the data table buffering, the Modbus can be polled independant of CANopen TXPDO transfer cycles. The *ESENET* allows a maximum of 8 connections via Modbus/TCP.

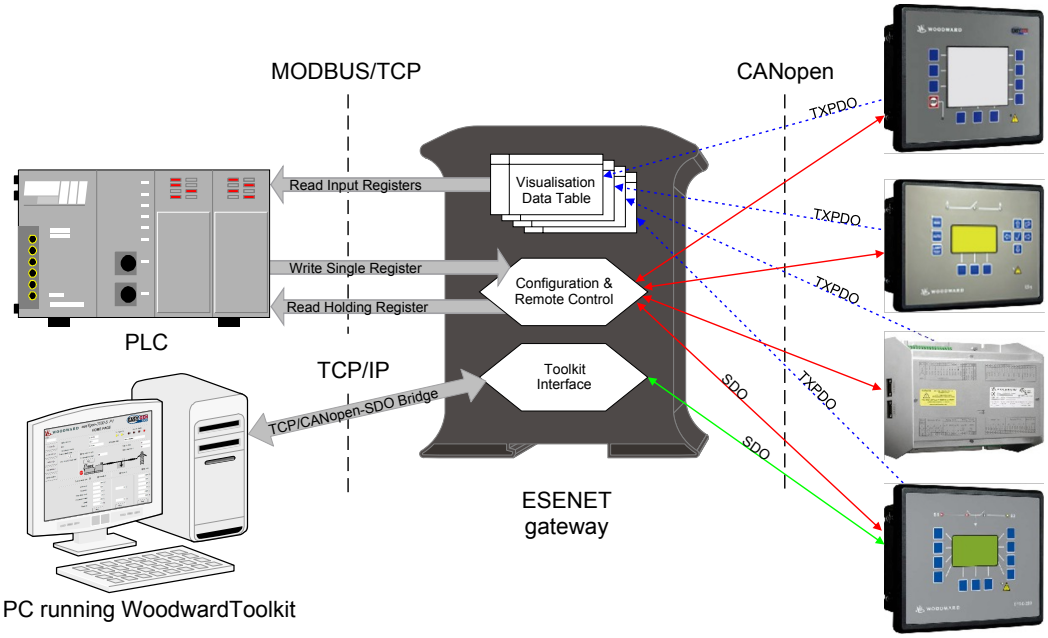


Figure 2.2: Gateway operation

Chapter 3. Installation

Regulatory notes

1. The *ESENET* is suitable for use in non-hazardous locations only.
2. The *ESENET* is not authorized for use in life support devices or systems.
3. Wiring and installation must be in accordance with applicable electrical codes in accordance with the authority having jurisdiction.
4. This is a Class A device and intended for commercial or industrial use. This equipment may cause radio interference if used in a residential area; in this case it is the operator's responsibility to take appropriate measures.
5. The precondition for compliance with EMC limit values is strict adherence to the guidelines specified in this set of instructions. This applies in particular to the area of grounding and shielding of cables.

FCC Notice (USA only)

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

Industry Canada Notice (Canada only)

This Class A digital apparatus complies with Canadian ICES-003.

Unpacking, handling and storage

1. Please read this set of instructions. carefully before fitting it into your system.
2. Keep all original packaging material for future storage or warranty shipments of the unit.
3. Do not exceed the specified temperatures.

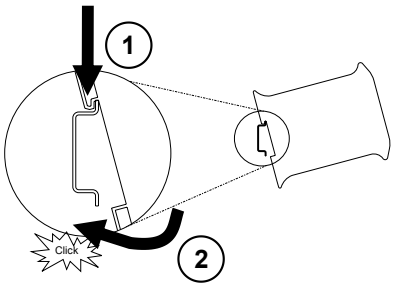
Before connecting anything

1. Before installing or removing the unit or any connector, ensure that the system power and external supplies have been turned off.
2. Check the system supply voltage with a multimeter for correct voltage range and polarity.

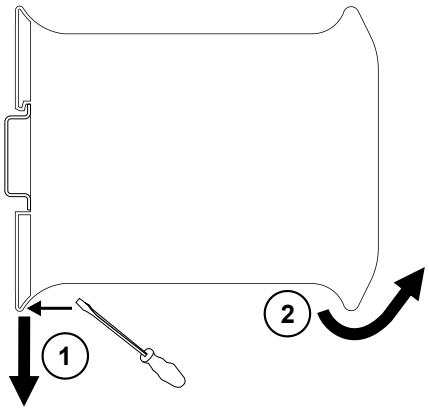
3. Connect the power supply cable and switch on the system power. Check if the Power LED is lit.
4. Turn off system power.
5. Connect all I/O cables.
6. Once you are certain that all connections have been made properly, restore the power.

DIN rail mounting and removal

The *ESENET* gateway is designed to be mounted on a 35 mm DIN rail according to DIN/EN 50022. The enclosure features a 35 mm profile at the back which snaps into the DIN rail. No tools are required for mounting. Please observe the rules outlined in the section called "Mounting rules".



To mount the unit on a DIN rail, slot the top part of the *ESENET* into the upper guide of the rail and lower the enclosure until the bottom of the red hook clicks into place.



To remove the *ESENET* from the DIN rail, use a screw driver as a lever by inserting it in the small slot of the red hook and push the red hook downwards. Then remove the unit from the rail by raising the bottom front edge of the enclosure.

Mounting rules

The enclosure provides protection against solid objects according to IP 20 / NEMA Type 1 protection rating. When mounting the unit observe the following rules:

- No water splash and water drops
- No aggressive gas, steam or liquids
- Avoid dusty environments.
- Avoid shock or vibration

- Do not exceed the specified operational temperatures and humidity range.
- Mount inside an electrical switchboard or control cabinet.
- Make sure there is sufficient air ventilation and clearance to other devices mounted next to the unit.
- Observe applicable local regulations like EN60204 / VDE0113.

Powering the ESENET

Before connecting power please follow the rules in the section called "Safety Precautions" and the section called "Before connecting anything".

Power is supplied via a 3.81 mm 2-pin pluggable terminal block located at the top side of the mounted unit (refer to Figure 2.1, "Location of connectors"). The following table and picture shows the power terminal socket pinout:

Pin	Signal	Function
1	V+	Positive voltage supply (10 - 30 V DC)
2	V-	Negative voltage supply, DC power return

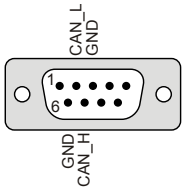
Table 3.1: Power supply connector pinout

Make sure that the polarity of the supply voltage is correct before connecting any device to the serial and CAN ports! A wrong polarity can cause high currents on the ground plane between the V- power supply pin and the CAN port and serial port ground pins, which can cause damage to the device.

Wiring the CAN interface

The CAN interface connects the *ESENET* to the Woodward CANopen based controls.

The CAN connector is a male 9-pin D-sub type located at the top side of the mounted unit (refer to Figure 2.1, "Location of connectors"). It has industry standard CiA DS-102 pinout as shown in the following table and picture:



Pin	Signal	Function
1	NC	
2	CAN_L	CAN_L bus line
3	CAN_GND	CAN ground
4	NC	
5	NC	
6	CAN_GND	CAN ground
7	CAN_H	CAN_H bus line
8	NC	
9	NC	

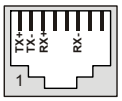
Table 3.2: CAN connector pinout

- The network must be terminated at both ends with its characteristic impedance, typically a 120 Ohm 1/4 W resistor.
- Maximum number of electrically connected CAN nodes is 64 [1].
- Maximum CAN cable length is 250 m (820 ft) and is derated depending on bit rates and cable type.
- Stub connections off the main line should be avoided if possible or at least be kept as short as possible. Stub connections must not have terminating resistors.
- To ensure a high degree of electromagnetic compatibility and surge protection the cable should be twisted pairs and shielded. An additional cable conductor or pair may be used for the CAN_GND reference.

Do *not* connect the cable shield to the CAN_GND pins or the connector shell! Use an external *chassis ground* connection to terminate the shield.

Connecting Ethernet

The following table describes the 10BASE-T Ethernet RJ-45 connector pinout:



Pin	Signal	Function
1	TX+	Non-inverting transmit signal
2	TX-	Inverting transmit signal
3	RX+	Non-inverting receive signal
4		Internal termination network
5		Internal termination network
6	RX-	Inverting receive signal
7		Internal termination network
8		Internal termination network

Table 3.3: Ethernet connector pinout

- We recommend to use Category 5 UTP network cable.
- Maximum cable length is 100 m (3000 ft).

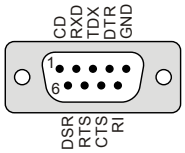
Connecting to the diagnostic port

The device has a RS-232 interface which is used as a diagnostic port and only active after power-up of the device. It allows configuration of the IP settings and reset of the settings to factory defaults via a terminal program.

The Diagnostic port connector is a male 9-pin D-sub type located at the bottom side of the mounted unit (refer to Figure 2.1, "Location of connectors"). It has industry standard

[1]The number of logically adressable units may be less.

EIA-574 data terminal equipment (DTE) pinout as shown in the following table and picture:



Pin	Signal	Function	Direction
1	DCD	Data carrier detect	in
2	RXD	Receive data	in
3	TXD	Transmit data	out
4	DTR	Data terminal ready	out
5	GND	Signal ground	
6	DSR	Data set ready	in
7	RTS	Request to send	out
8	CTS	Clear to send	in
9	RI	Ring indicator	in

Table 3.4: Diagnostic port connector pinout

- Maximum cable length is 15 m (50 ft) or a length equal to a line capacitance of 2500 pF, both at the maximum standard bit rate of 20 kbps. If operating at higher bit rates the maximum cable length drops to 3 m (10 ft) at a bit rate of 57.6 kbps.
- To assure a high degree of electromagnetic compatibility and surge protection the RS-232 cable should shielded. The shield shall be connected to an external chassis ground at the either or both ends, depending on the application.
- The shield must *not* be connected to the GND pin.

To connect the *ESENET* to a PC (Personal Computer) or any other device with data terminal equipment (DTE) pinout you need a null-modem or cross-over cable.

Chapter 4. Ethernet & IP configuration

Before configuring the *ESENET*, obtain a unique static IP address, subnet mask, and default gateway address from your network administrator.

The factory default IP address of the *ESENET* is 169.254.0.10 which is in the Automatic Private IP Addressing (APIPA) address range.

There are several methods of configuring the unit's IP address:

1. Removing your PC from your corporate network and using a cross-over network cable (see the section called "IP setup using a web browser and a cross-over network cable").
2. Via the diagnostic port and a terminal program like *HyperTerminal* (see the section called "IP setup using a terminal program like HyperTerminal").
3. Leaving your PC connected to your corporate network and temporarily changing the IP settings on your PC to match the subnet of the *ESENET* (see the section called "Temporarily changing the IP settings on your PC").

In order to connect to the *ESENET* via TCP/IP, your PC must be on same IP subnet as the gateway. In most situations this means that the first three numbers of the IP address have to be identical.

IP setup using a web browser and a cross-over network cable

This method applies only to operating systems like Windows, which support APIPA (Automatic Private IP Addressing). It also requires your PC to be configured for DHCP. If your computer is configured with a static IP address, follow the procedure in the section called "Temporarily changing the IP settings on your PC".

1. Disconnect your PC from your corporate network. If your computer is configured for DHCP it should now automatically fall back to use a default IP address from the APIPA range 169.254.x.x (Windows PCs only).
2. Connect an Ethernet crossover cable from the *ESENET* to the computer.
3. Start *Internet Explorer*.
4. In the address box, type **`169.254.0.10`** and then press **`Enter`**.
5. Click **`Configuration...`** and then **`Ethernet & IP`** in the menu on the left side of the page.
6. Enter the IP address, subnet mask, and gateway address assigned to your *ESENET*, then click **`Save`**.
7. Reconnect your computer to your corporate network.

IP setup using a terminal program like HyperTerminal

1. Connect a null modem RS-232 cable between your PC and the *ESENET*'s diagnostic port.

2. In Windows XP, click **`Start`**, point to **`All Programs`**, point to **`Accessories`**, point to **`Communications`**, and then click **`HyperTerminal`**.

3. When *HyperTerminal* starts, it opens a dialog box and asks for a name for the new connection. Enter a name (for example, `deviceconfig`) then click **OK**.

4. The `Connect to` dialog opens. Select the COM port you will be using in the `Connect using` drop-down list box, then click **OK**.

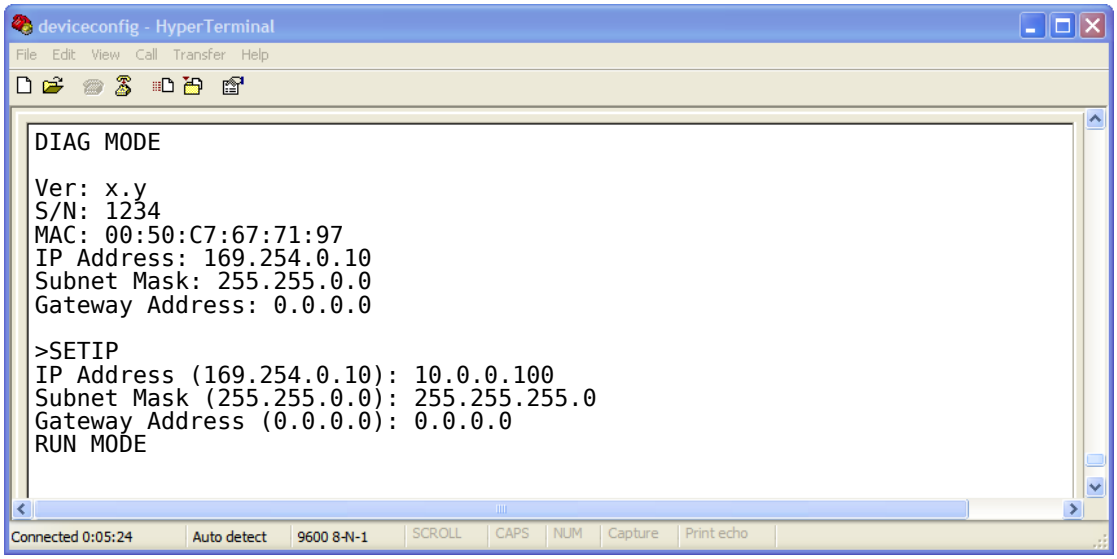
5. Select **`9600`**, **`8`**, **`None`**, **`1`**, **`None`** in the `COM Properties` dialog, then click **OK**.

6. *HyperTerminal* is now connected to the serial line.

7. Keep the **`space`** bar pressed in *HyperTerminal* and power-cycle your device at the same time.

8. A menu should appear after one or two seconds showing device information, the current IP configuration and a > prompt.

9. Type **`SETIP`**, then press **`Enter`** within 10 seconds after the prompt is shown:



10. The device will show current values and prompt for new values for IP address, net mask and gateway address. Enter the new values and press **`Enter`**. A key press must be received at least every 10 seconds otherwise the device will go back to *RUN MODE* and resume normal operation.

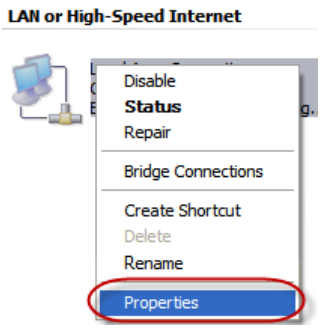
11. The gateway will return to the main prompt. Type **`X`** and press **`Enter`** to leave *DIAG MODE* and resume normal operation indicated with `RUN MODE`.

Temporarily changing the IP settings on your PC

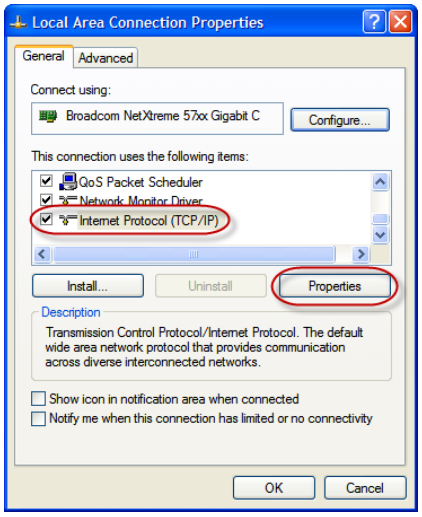
This method involves manually assigning an IP address to your PC in the same subnet as the gateway. The default subnet of the gateway is 169.254.0.0/16.

1. Connect the *ESENET* to your Ethernet network.

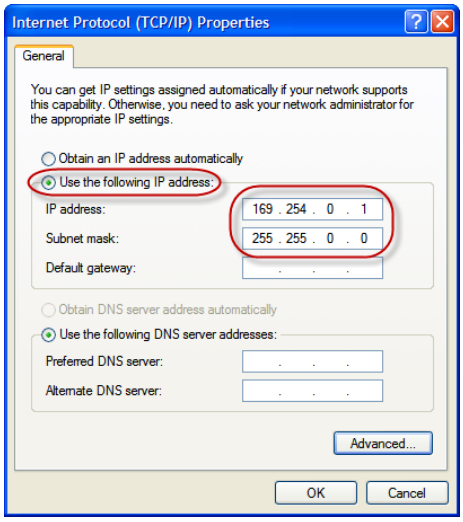
2. On a Windows PC, open the `Control Panel` and double-click on **`Network Connections`**. Right-click on the Network Connection associated with your network adapter and select **`Properties`**:



This will show the `Local Area Connection Properties` Dialog:



3. Select the **Internet Protocol (TCP/IP)** entry and click on **Properties** to open the TCP/IP Properties dialog as shown below:



4. Write down your current settings so they can be restored later.

5. Select **Use the following IP address** and configure a static IP address in the same subnet as the device, for example `169.254.0.1` and the subnet mask `255.255.0.0`. Click **OK** to save the changes.

6. Start *Internet Explorer*.

7. In the address box, type **169.254.0.10** and then press **Enter**.

8. Click **Configuration...** and then **Ethernet & IP** in the menu on the left side of the page.

9. Enter the IP address, subnet mask, and gateway address assigned to your *ESENET*, then click **Save**.

10. Restore your computer's original settings.

Chapter 5. Web browser based management

The *ESENET* incorporates an embedded web server. This allows you to connect to the device and monitor and configure it using a web browser. Most browsers should work, provided they support JavaScript. We recommend *Internet Explorer* 6.0 or higher.

Connecting to the ESENET

Once you made sure that your PC is configured to be on the same subnet as the *ESENET*, start your web browser. In the address box, type the IP address of your device (169.254.0.10 is the default), and then press **Enter**. (See Chapter 4, *Ethernet & IP configuration*)

The web browser will establish communication with the embedded web server and an overview page similar to the following picture will appear:

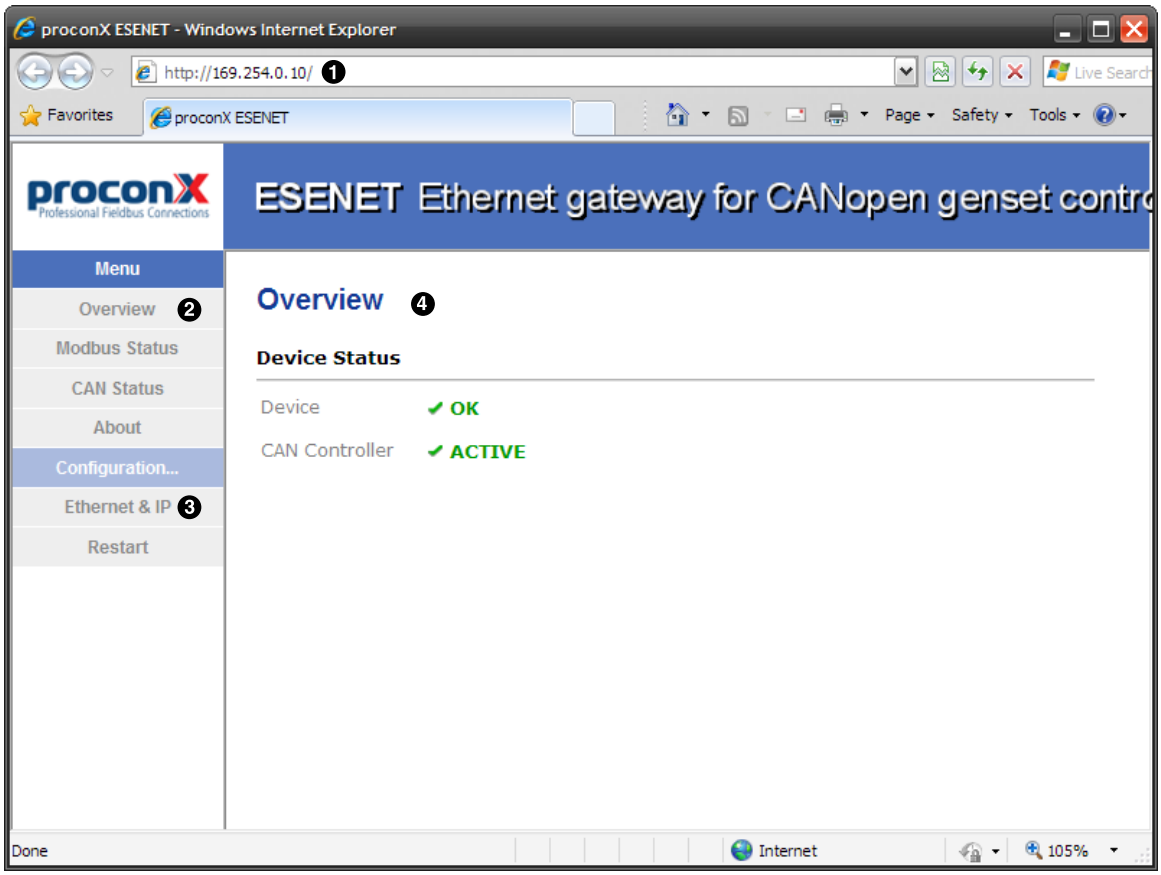


Figure 5.1: Device management and configuration via the web browser

❶ Gateway IP address
❷ Main menu
❸ Configuration sub-menu
❹ Information area

Use the menu bar shown on the left side to navigate the different pages.

In order to connect to the *ESENET* via TCP/IP, your PC must be on same IP subnet as the gateway. In most situations this means that the first three numbers of the IP address have to be identical.

Monitoring and diagnostic

The *ESENET* offers several web pages which allow monitoring of the status of the different communication networks and the device performance.

Device status

The `Overview` page shows the principal device status as shown in the following picture:

Figure 5.2: Overview page

The value shown in the `Device` row represents the device status register which keeps track of run-time faults. All run-time faults are latched and must be reset by the user. The following faults can be listed here:

`OK`
: The device is fault free.

`Watchdog reset`
: This warning indicates that the device was reset by it's internal watchdog supervision circuit.

`Brown out reset`
: This warning indicates that the device was reset by it's internal supply voltage monitoring circuit. This fault occurs when the supply voltage drops below the lower limit.

`Device out of memory`
: This warning indicates that the internal dynamic memory has been exhausted and due to this a certain function could not be completed.

`Device configuration data write failure`
: This alarm indicates that the configuration data could not be written to the non-volatile memory. Configuration data changes will be lost once the device is power-cycled or reset.

`Reset to factory defaults`
This alarm indicates that the device' configuration data was reset to factory defaults. The device requires re-commissioning.

The `CAN controller` status indicates the status of the CAN interface and can be in one of the following states:

`ACTIVE`
The CAN bus is fault free.

`PASSIVE`
CAN's built in fault confinement mechanism has set the node to *error passive state* due to a large number of errors on the CAN bus. This warning indicates a wiring error.

`BUS-OFF`
CAN's built in fault confinement mechanism has set the node to *bus-off* state due to excessive errors on the CAN bus. This alarm indicates a wiring error. The *ESENET* will not transmit or receive any message on the CAN bus once entered this state. The device needs to be manually restarted on order to recover from this fault.

Modbus connection status

The `Modbus Status` page shows status and statistics about the Modbus/TCP traffic. These values provide valuable information used to troubleshoot Modbus network problems. This page is automatically updated every 5 seconds.

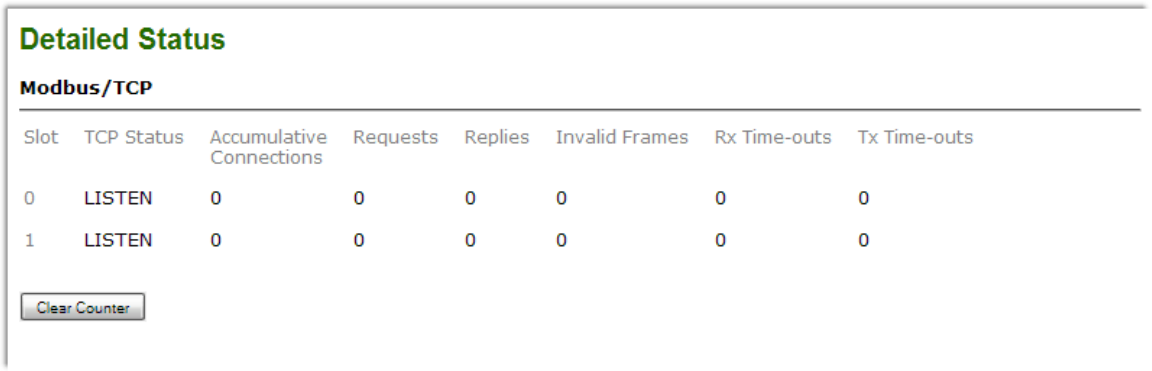


Figure 5.3: Modbus status page

This page shows accumulated readings since the *ESENET* was last activated or reset. If power to the *ESENET* is lost, all cumulative values are reset to zero.

The following statistics are maintained:

`TCP status`
Status of the TCP/IP connection as per TCP finite state machine (refer to RFC 793). If no client is connected the status indicates `LISTEN`. If a client is connected, it's IP address is shown.

`Accumulative connections`
A counter that increments each time a client opens a Modbus/TCP connection.

`Requests`
A counter that increments each time an inbound request message is successfully received.

`Replies`
A counter that is incremented each time a reply message is sent back to the master. This includes exception replies.

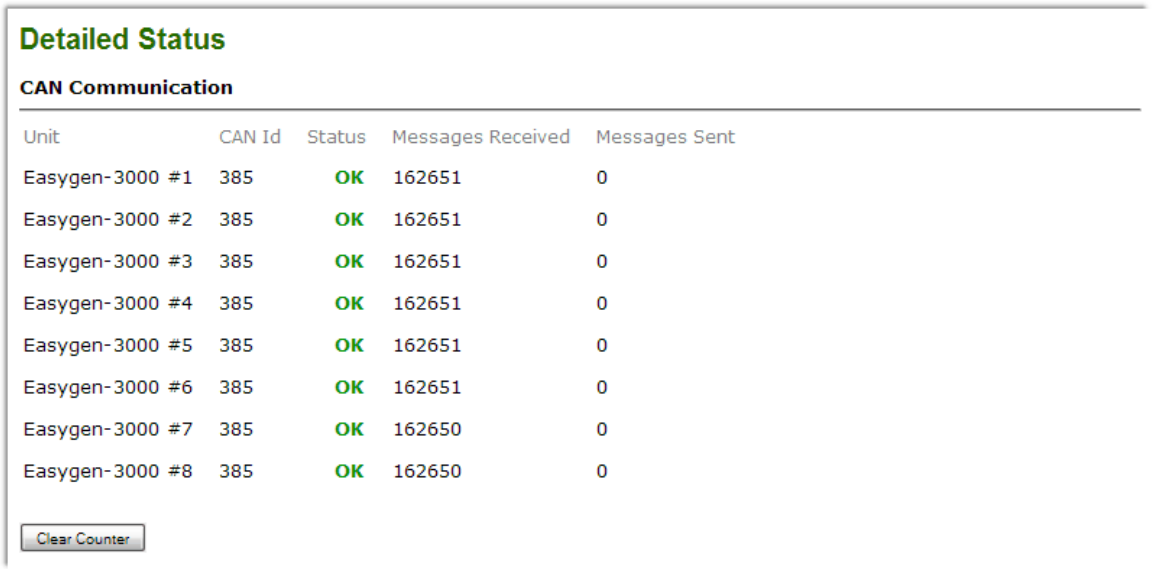
`Rx time-outs`
A counter that increments if the master connection has timed out. Subsequently the connection is terminated by the *ESENET*. A time-out occurs if no Modbus request is received from a connected client within a 10 second period.

`Tx time-outs`
Number time-outs occurred when attempting to send a reply message.

The cumulative diagnostic data is reset when the device is power cycled or reset. The data is also reset by pressing the **`Clear Counter`** button.

CAN communication status

The `CAN Status` page shows status and statistics about the CAN bus traffic. These values provide valuable information used to troubleshoot CAN problems. This page is automatically updated every 5 seconds.



Detailed Status

CAN Communication

Unit	CAN Id	Status	Messages Received	Messages Sent
Easygen-3000 #1	385	OK	162651	0
Easygen-3000 #2	385	OK	162651	0
Easygen-3000 #3	385	OK	162651	0
Easygen-3000 #4	385	OK	162651	0
Easygen-3000 #5	385	OK	162651	0
Easygen-3000 #6	385	OK	162651	0
Easygen-3000 #7	385	OK	162650	0
Easygen-3000 #8	385	OK	162650	0

Clear Counter

Figure 5.4: CAN communication status page

This page shows accumulated readings since the *ESENET* was last activated or reset. If power to the *ESENET* is lost, all cumulative values are reset to zero.

The CAN communication channel between a Woodward CANopen based control and the *ESENET* can be in one of the following states:

`OK`
: The CAN communication channel with the Woodward CANopen based control has been established. The Woodward device is cyclically sending visualisation data via its TXPDO.

`WAIT`
: The presence of a supported Woodward CANopen based control has been detected however the *ESENET* is currently waiting to receive a complete visualisation data set.

`TIME-OUT`
: No CANopen PDO was received for a period of 1 second. A Woodward control must be configured to transmit cyclically visualisation data using a TXPDO with a specific COB-ID number and the correct Data Protocol.

The following statistics are maintained:

`Messages received`
: A counter that increments each time an inbound CANopen PDO matching the shown COB-ID is successfully received.

`Messages sent`
: A counter that is incremented each time a SDO message is sent.

The cumulative diagnostic data is reset when the device is power cycled or reset. The data is also reset by pressing the **`Clear Counter`** button.

Finding the firmware version and serial number

Click on the **`About`** menu entry on the menu bar to show the product information as shown below:

Figure 5.5: About page

This product information is important for service and support inquiries. The following product information is provided:

`Product name`
: The name of the product.

`Hardware version`
ESENET hardware version.

`Firmware version`
The firmware version that is installed on the *ESENET*.

`Serial number`
The serial number of the *ESENET*. The serial number is specific to your device.

Configuring and commissioning

The configuration pages are accessed by clicking on the **`Configuration...`** menu entry on the menu bar which then expands a configuration sub-menu. All configuration settings are kept in the device' non-volatile memory.

If you make changes to any settings, remember to save each page before changing to a different page!

Configuring Ethernet and IP

Select the **`Configuration`**→**`Ethernet & IP`** sub-menu from the menu bar to open the `Ethernet and IP` settings which are shown below:

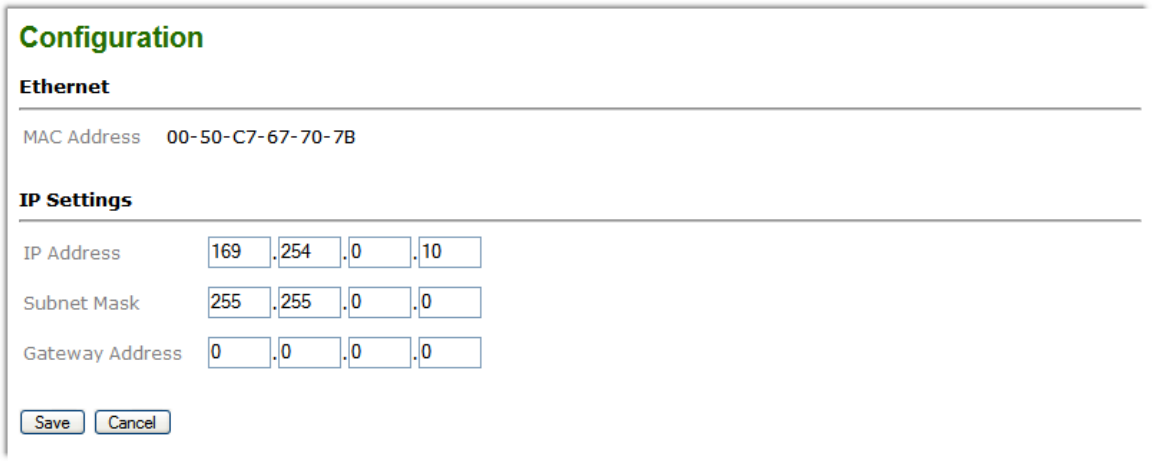


Figure 5.6: Ethernet and IP settings page

The following Ethernet parameters are shown:

`MAC address`
The device' unique MAC address. This number is hard coded and cannot be changed.

The following Internet protocol (IP) settings can be entered:

`IP address`
The IP address assigned to this device.

`Subnet mask` (also known as indexterm2:[network mask])
If you have a router, enter the subnet mask for the segment to which this device is attached.

`Gateway address`
If your network segment has a router, enter its IP address here. Otherwise leave the address as `0.0.0.0`.

Once you click **Save** the new settings are stored and applied instantly. The new settings are confirmed with the following page:

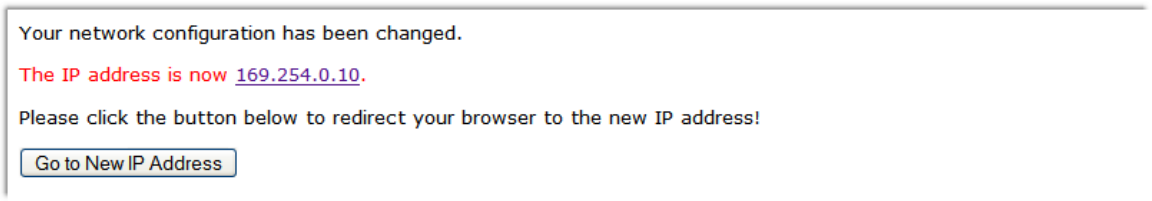


Figure 5.7: IP settings changed confirmation

Please write down the new IP address so you are able to communicate with the device in the future!

Configuring CAN and CANopen

The *ESENET* gateway itself does not require any CANopen configuration. No Node-ID is allocated for the *ESENET* because it operates as a CANopen consumer and client only.

However the CANopen settings of the connected Woodward controls must be configured accordingly. (Refer to Chapter 7,*Configuration of connected Woodward controls*)

Remote restarting the device

You can perform a remote restart of the device from the web interface. A remote restart is similar to power cycling the device. Possibly connected clients are disconnected and communication is interrupted until the device has rebooted.

To perform a remote restart, click on the **`Configuration`** sub-menu and then click on the **`Restart`** menu entry. This will open the device restart page as shown below:

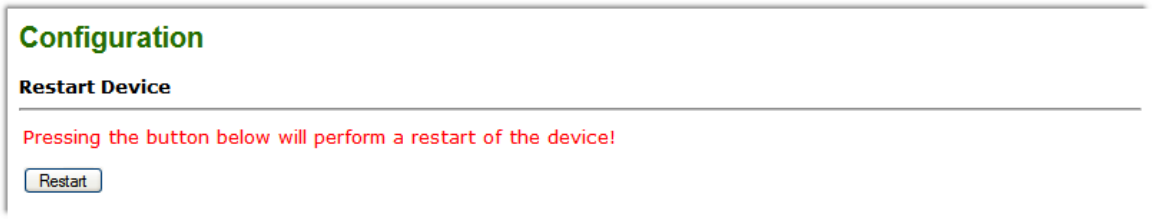


Figure 5.8: Restart device page

Click on the **Restart** button to perform a restart of the device. The restart is confirmed with the following notification:

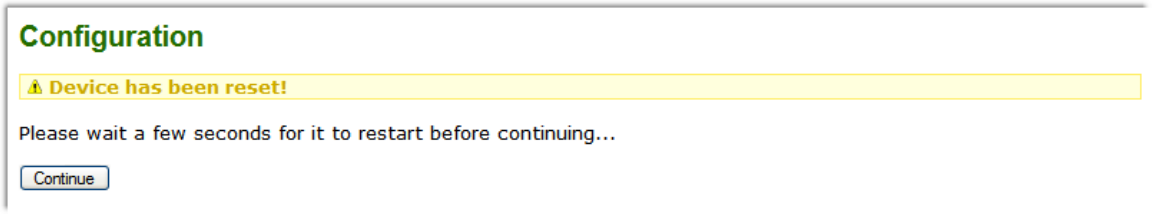
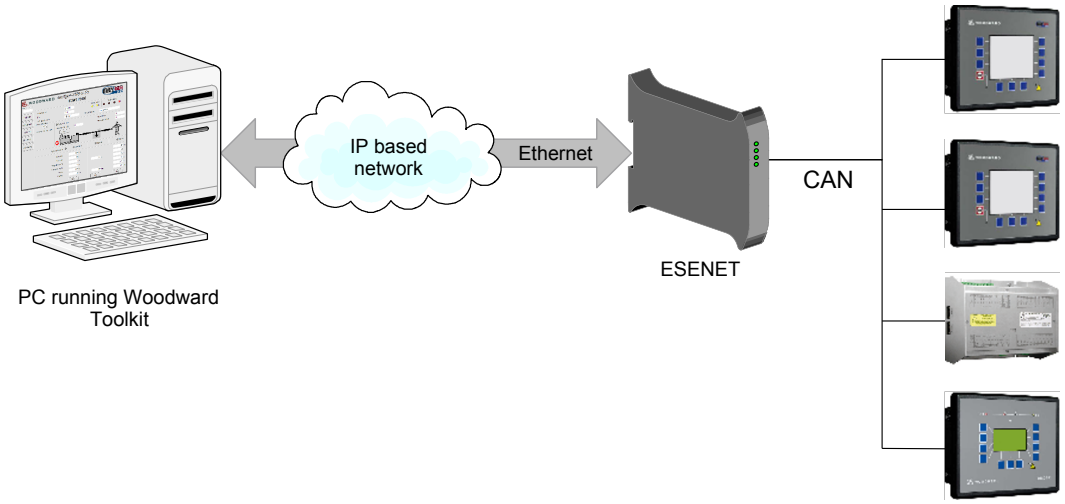


Figure 5.9: Restart confirmation page

Please allow a few seconds before continuing working with the device as it has to fully start-up first, before being able to respond to further web browser requests.

After a remote restart a *Watchdog reset* alarm is shown on the device' home page. This is a side-effect of the remote restart procedure and the alarm shall be ignored and cleared.

Chapter 6. Running Toolkit via the ESENET gateway



Since firmware version 2.0, the *ESENET* offers a TCP/CANopen-SDO bridge which is linked to a virtual CAN port on the Toolkit PC.

Using this facility you can run local and remote Toolkit sessions from your PC via Ethernet and TCP/IP through the *ESENET* gateway to Woodward controls connected on *ESENET*'s CAN interface. The *ESENET* Toolkit interface can be used in parallel with Modbus/TCP connections.

Prerequisites

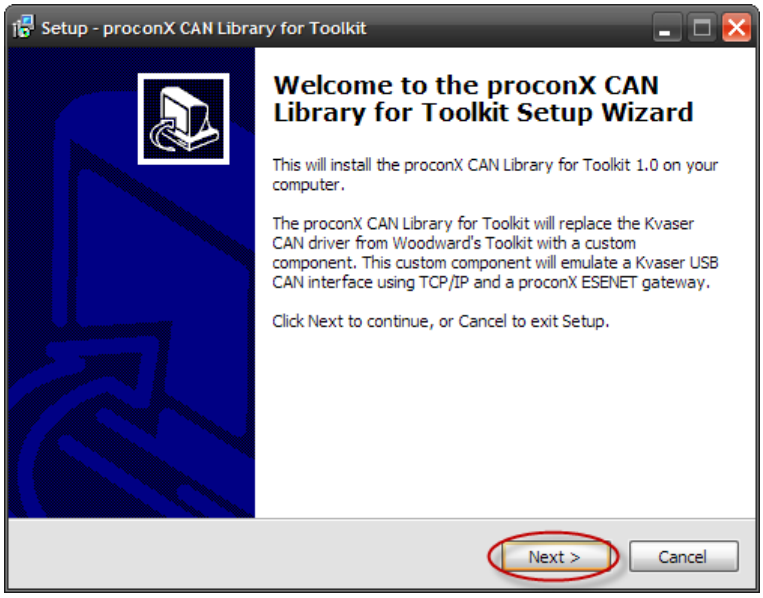
- *ESENET* gateway with firmware 2.0 or above (existing *ESENET* devices can be upgraded)
- *proconX CAN Library for Toolkit* (available from *proconX* web site)
- PC with installed Woodward Toolkit

How it works

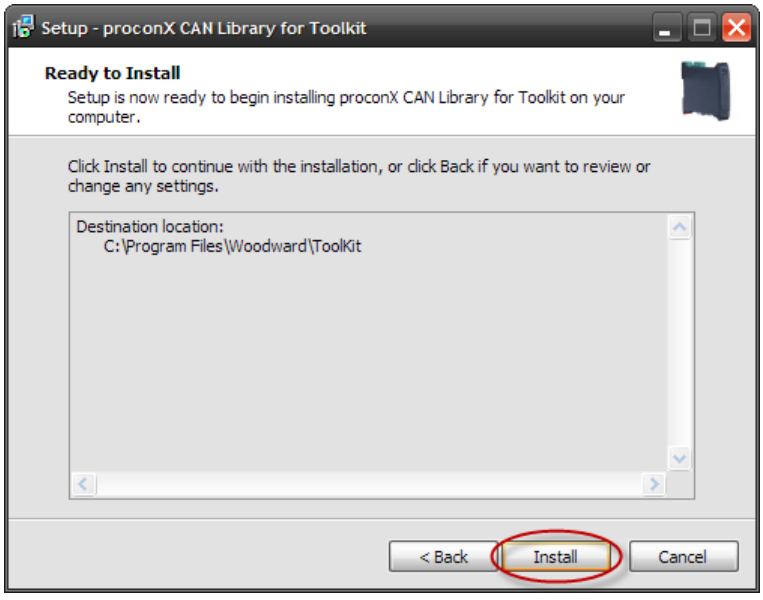
For Toolkit to recognise the *ESENET* gateway as a CAN interface, a virtual CAN port needs to be installed on the Toolkit PC. *proconX* provides a *CAN Library for Toolkit* installer which replaces Tookit's standard Kvaser USB CAN driver with a custom CAN library. This replacement library will emulate a Kvaser USB CAN port using TCP/IP and *ESENET*'s TCP/CANopen-SDO bridge.

Installation

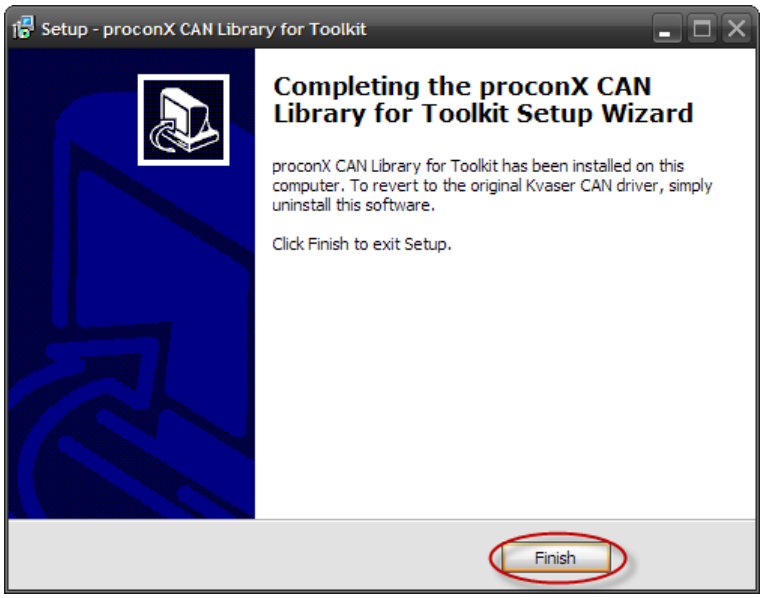
1. To install, run the self-extracting Installer executable and click **Next** to continue:



2. Click **Next** to confirm the installation:



3. The installation is completed, click **`Finish`** to exit the installer:



You can revert back to Toolkit's original Kvaser CAN library by simply uninstalling the proconX *CAN Library for Toolkit*.

Running Toolkit

Launch Toolkit in the usual manner and click on the **`Connect`** button to open the `Select a network` drop-down box. In the `Network` selection list, choose **`USB Kvaser Simulated 1`** as CAN interface and confirm with **`Connect`**.

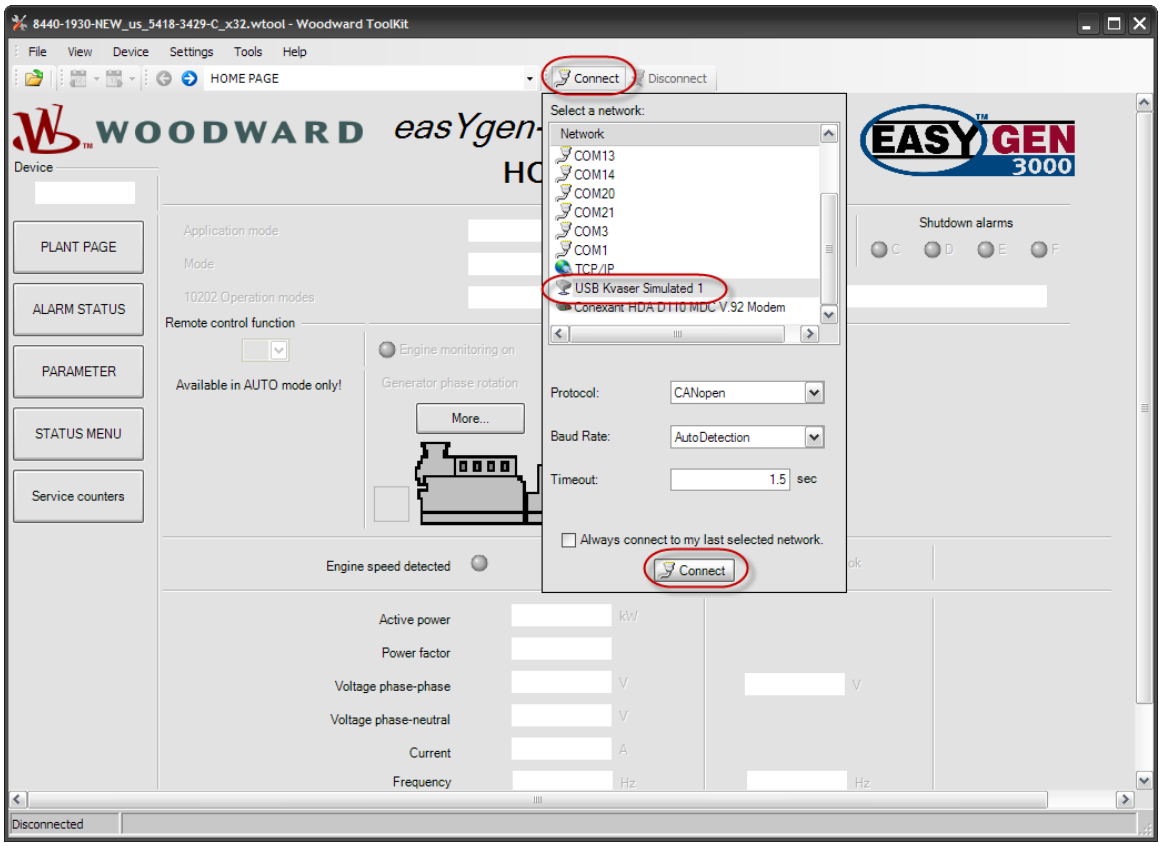


Figure 6.1: Toolkit network selection

The USB `Kvaser Simulated 1` selection will not show if the proconX *CAN Library for Toolkit* is not installed!

A dialog box will open and ask for the IP address of the connected *ESENET* gateway. Enter the correct IP address for the *ESENET* gateway and click **OK**.

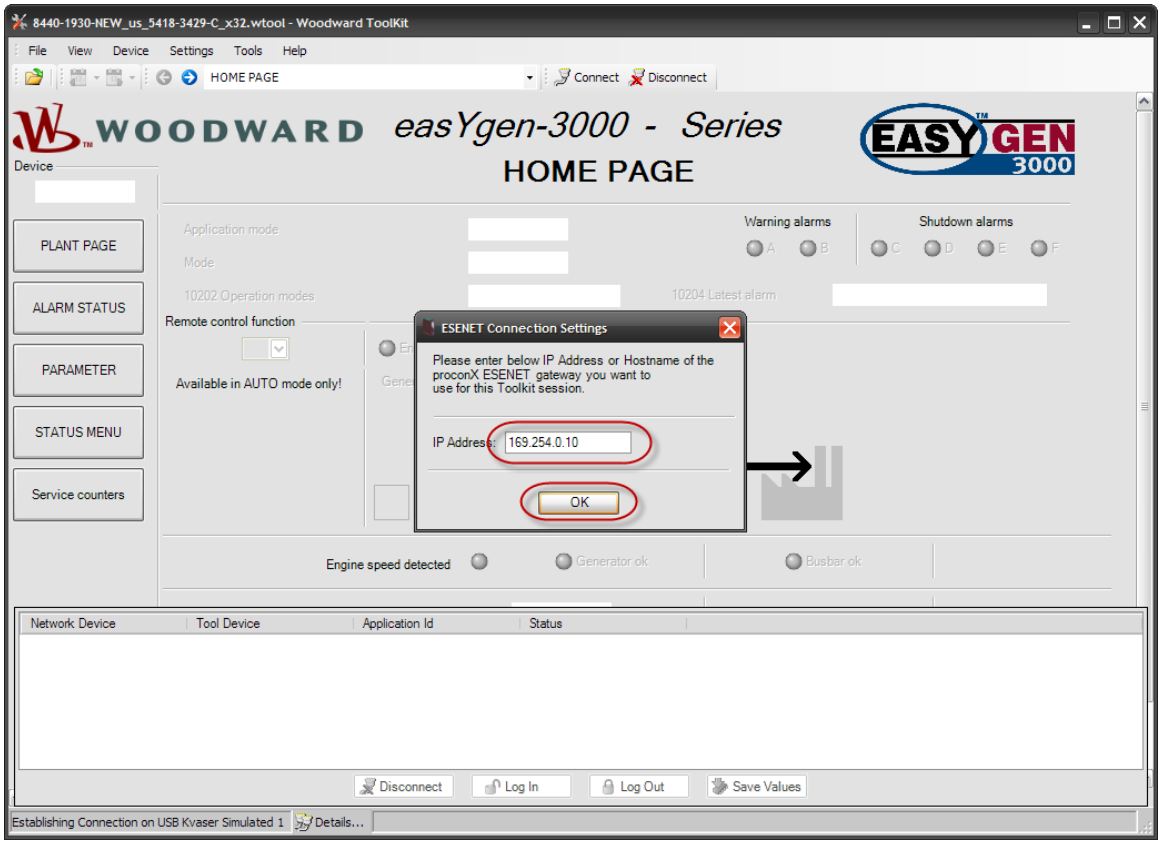


Figure 6.2: Entering the ESENET gateway's IP address in Toolkit

On successful connection, the status in Toolkit's status line will change from `Establishing Connection on USB Kvaser Simulated 1` to `Connected on USB Kvaser Simulated 1` as shown below:

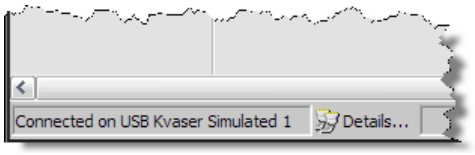


Figure 6.3: Successful CAN over TCP/IP connection

In case of a connection error or a communication error, the Toolkit status will revert back to either `Establishing Connection` or `Reconnecting`. In this case terminate the session and establish a new session by clicking **`Disconnect`** and **`Connect`** again.

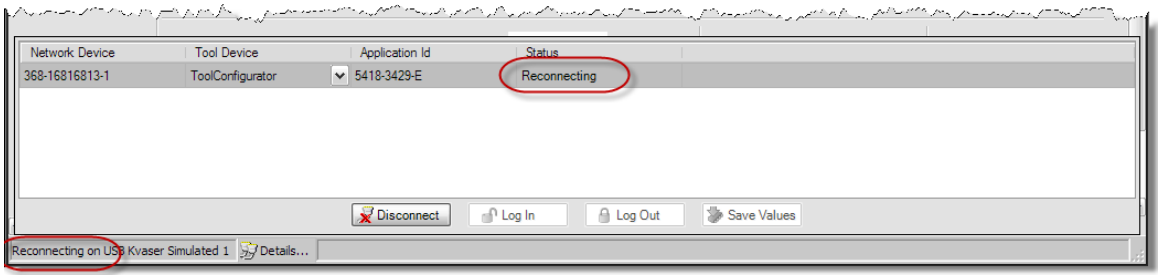


Figure 6.4: Example of Toolkit indicating a communication error

TCP Ports

The TCP/CANopen-SDO bridge uses the same TCP port as Modbus/TCP which is port 502. Using the same port as Modbus/TCP simplifies router configuration for VPN applications.

Chapter 7. Configuration of connected Woodward controls

The *ESENET* has been designed to keep the configuration effort required to connect the gateway with Woodward CANopen devices to a minimum. In most situations no additional configuration is necessary to get the *ESENET* communicating with an *Easygen*-3000 series control. For a LS-5 control the Node-ID has to be changed from the default value of 33 to be in the range of 1-16. Other Woodward controls like the DTSC-200 may require some configuration changes for settings like CAN baudrate and the TXPDO COB-IDs.

The following list of Woodward CAN device parameters affect the operation of the *ESENET* gateway and their setting should be checked during installation and commissioning:

- CAN baudrate
- CANopen Node-ID
- COB-ID of Transmit PDOs (TXPDO)
- Data Protocol of the Transmit PDOs (TXPDO)

CAN baudrate

For all CAN devices the CAN baudrate must be set to 250 kBit/s.

CANopen Node-ID and TXPDO COB-ID

To minimise the configuration effort, there is a fixed relationship between the CANopen Node-ID, the Modbus Slave ID and the TXPDO COB-ID which is documented in the table below. The relationship follows the rules of the CANopen Predefined Connection Set PDO assignments. *Easygen*-3000 and LS-5 controls use the COB-ID range from 385 to 400 and the DTSC-200 devices from 1153 to 1168.

Modbus Slave ID	CANopen Node-ID	Easygen-3000/LS-5 TXPDO COB-ID dec (hex)	DTSC-200 TXPDO COB-ID dec (hex)
1	1	385 (0x181)	1153 (0x481)
2	2	386 (0x182)	1154 (0x482)
3	3	387 (0x183)	1155 (0x483)
4	4	388 (0x184)	1156 (0x484)
5	5	389 (0x185)	1157 (0x485)
6	6	390 (0x186)	1158 (0x486)
7	7	391 (0x187)	1159 (0x487)
8	8	392 (0x188)	1160 (0x488)
9	9	393 (0x189)	1161 (0x489)
10	10	394 (0x18A)	1162 (0x48A)
11	11	395 (0x18B)	1163 (0x48B)
12	12	396 (0x18C)	1164 (0x48C)

Modbus Slave ID	CANopen Node-ID	Easygen-3000/LS-5 TXPDO COB-ID dec (hex)	DTSC-200 TXPDO COB-ID dec (hex)
13	13	397 (0x18D)	1165 (0x48D)
14	14	398 (0x18E)	1166 (0x48E)
15	15	399 (0x18F)	1167 (0x48F)
16	16	400 (0x190)	1168 (0x490)

Table 7.1: Modbus Slave ID, CANopen Node-ID & COB-ID relationships

Data Protocol of the Transmit PDOs

The Data Protocol of the Transmit PDOs must be set according to the Woodward CANopen device used. The following tables shows the supported Data Protocols.

Woodward CAN device	Data protocol	Mapped Object ID	TXPDO COB-ID range dec (hex)
Easygen-3000 series	5003	n/a	385 (0x181) - 400 (0x190)
LS-5	5103	n/a	385 (0x181) - 400 (0x190)
Easygen-1000 series	4000 or 4003	n/a	385 (0x181) - 400 (0x190)
Easygen-2000 series	5100 or 5101	n/a	385 (0x181) - 400 (0x190)
DTSC-200	4700 or 4701	03190	1153 (0x481) - 1168 (0x490)

Table 7.2: Supported Data Protocols

Specific information for Easygen-3000 series controls

The most convenient way to configure the *Easygen* is using Woodward's Toolkit software. Below are Toolkit screenshots of the relevant menus.

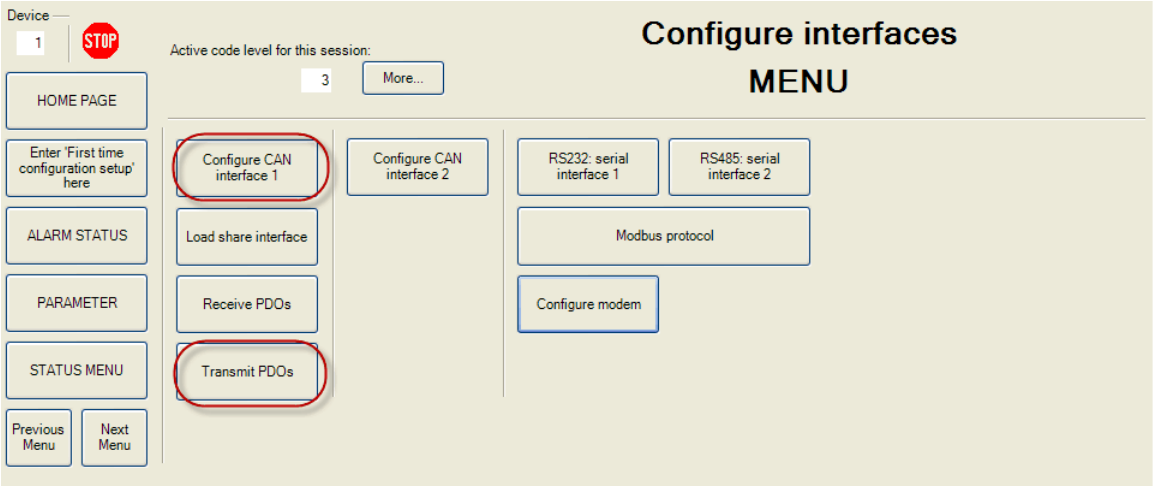


Figure 7.1: "Configure interfaces" menu in Woodward Toolkit

CAN interface

From Woodward's Toolkit software select the **`Configure CAN interface 1`** page as shown below:

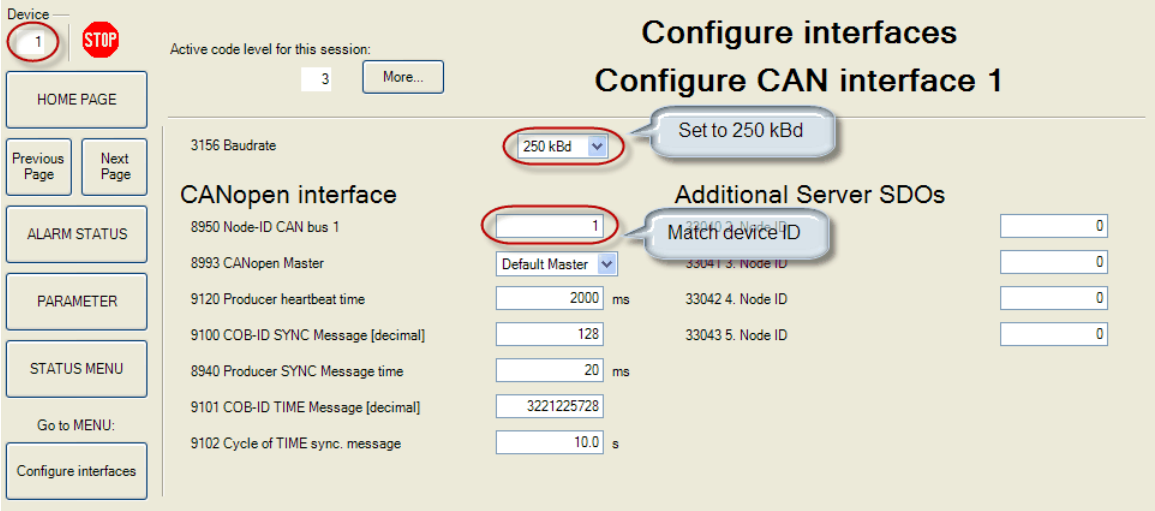


Figure 7.2: "Configure CAN interface 1" menu in Woodward Toolkit

- Parameter *3156 Baudrate* must be set to `250 kBd`.
- Parameter *8950 Node-ID* should match the device ID. It must be in the range of 1 to 16 and a unique number in the network. This value also determines the Modbus Slave ID under which the *Easygen* data can be retrieved.

Transmit PDOs

In order for the *ESENET* gateway to receive cyclic data updates from the *Easygen*, one of the five available Transmit PDOs (TXPDO) must be configured. Typically Tranmsit PDO 1 is already pre-configured for that purpose, but any of the five TXPDOs could be used for that purpose.

If for example Transmit PDO 1 is used, then:

- parameter *9600 COB-ID* must be set to `384 + Node-ID`,
- parameter *8962 Selected Data Protocol* to `5003` and
- parameter *9602 Tramsission type* to `255`.

In the following example for an *Easygen* with device ID of 1 and Node-ID of 1, the Transmit PDO 1 is used to send data updates every 20 ms:

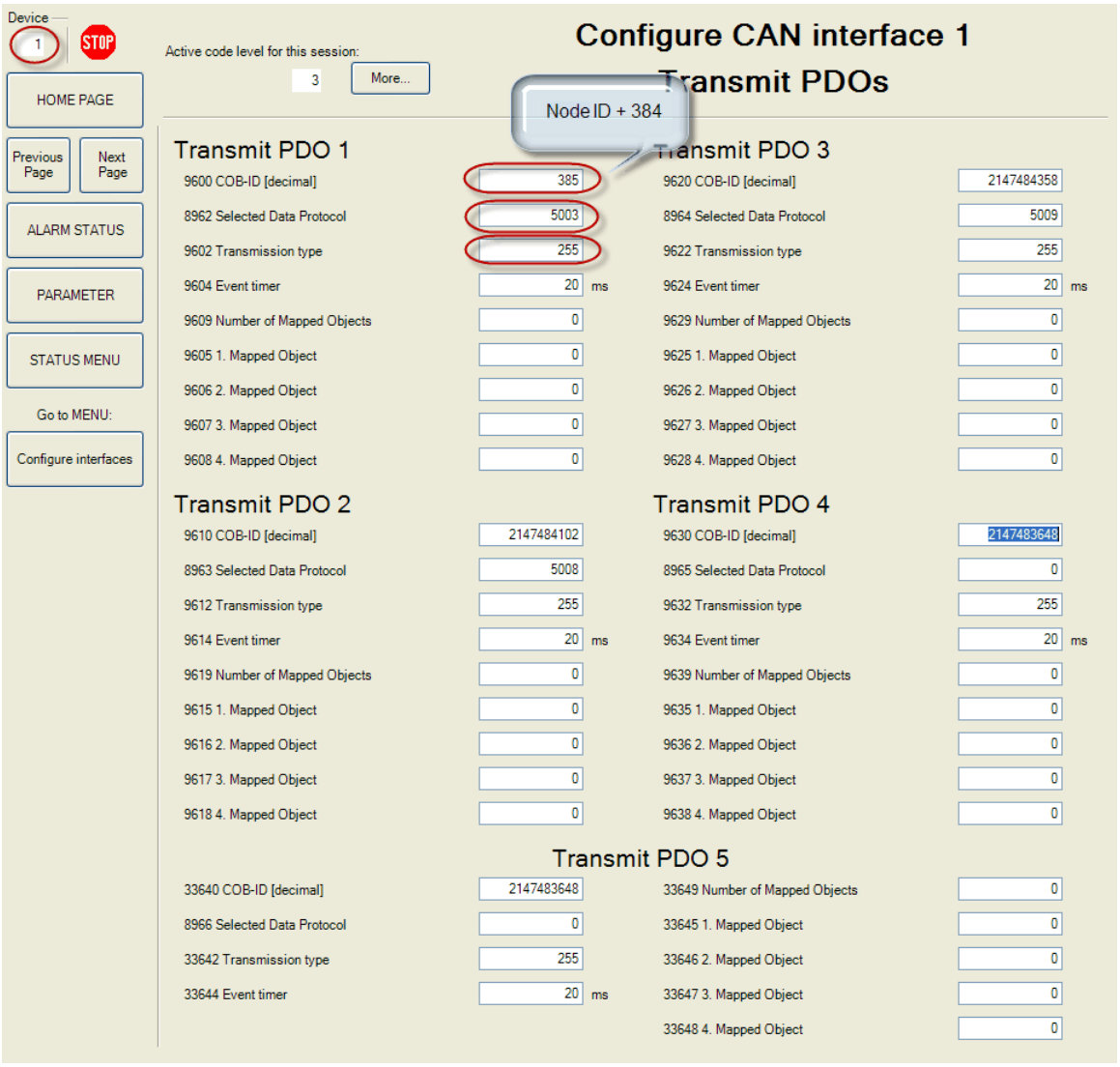


Figure 7.3: "Transmit PDOs" menu in Woodward Toolkit

All COB-IDs used in the CAN network must be unique. Please make sure that a COB-ID is only configured once. If TXPDO or RXPDO COB-ID entries are referring to an already used COB-ID, either disable that PDO or change the COB-ID.

Specific information for LS-5 controls

The LS-5 CANopen parameters are configured using Woodward's Toolkit software. Below are Toolkit screenshots of the relevant menus.

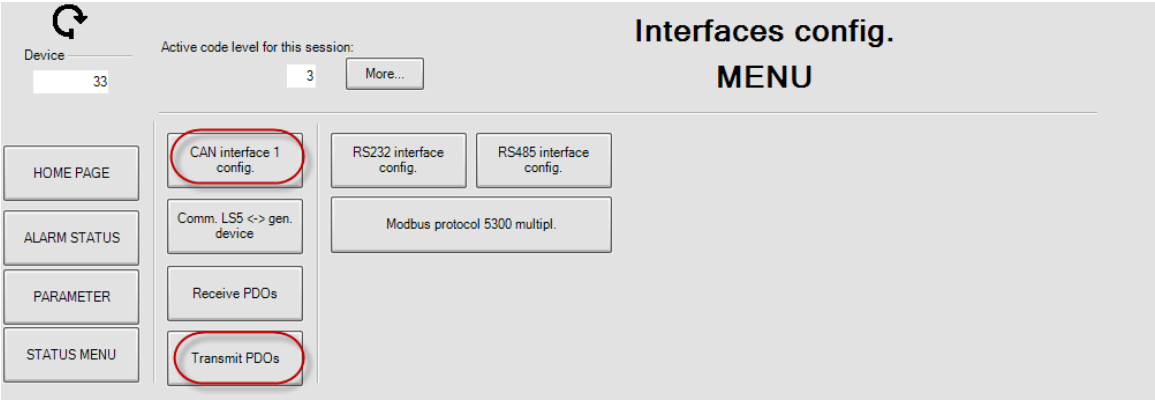


Figure 7.4: "Interfaces config" menu in Woodward Toolkit

CAN interface

From Woodward's Toolkit software select the **`CAN interface 1 config`** page as shown below:

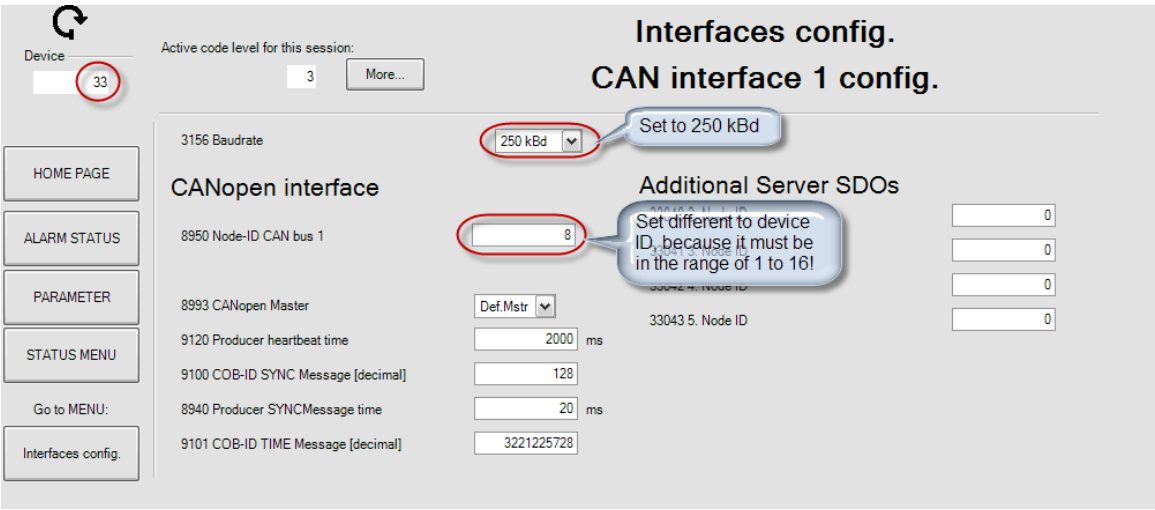


Figure 7.5: "CAN interface 1 config" menu in Woodward Toolkit

- Parameter *3156 Baudrate* must be set to `250` kBd.
- Parameter *8950 Node-ID* must be changed to be in the range of 1 to 16 and a unique number in the network. This value also determines the Modbus Slave ID under which the LS-5 data can be retrieved. One could for example use Node-IDs 1 to 8 for *Easygens* and Node-IDs 8 to 16 for LS-5s.

Transmit PDOs

In order for the *ESENET* gateway to receive cyclic data updates from the LS-5, one of the five available Transmit PDOs (TXPDO) must be configured. Typically Tranmsit PDO 1

is already pre-configured for that purpose, but any of the five TXPDOs could be used for that purpose.

If for example Transmit PDO 1 is used, then:

- parameter *9600 COB-ID* must be set to `384 + Node-ID`,
- parameter *8962 Selected Data Protocol* to `5301` and
- parameter *9602 Tramsission type* to `255`.

In the following example for an LS-5 with device ID of 33 but Node-ID of 8, the Transmit PDO 1 is used to send data updates every 20 ms:

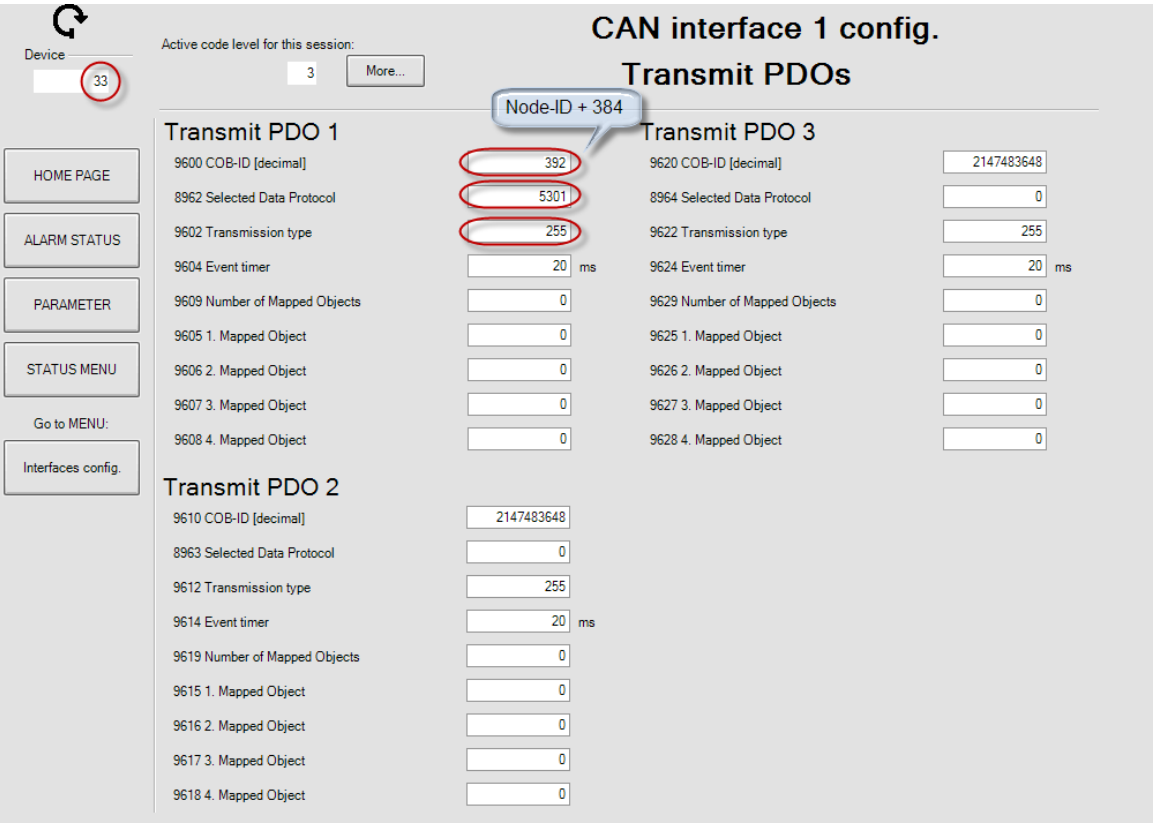


Figure 7.6: "Transmit PDOs" menu in Woodward Toolkit

All COB-IDs used in the CAN network must be unique. Please make sure that a COB-ID is only configured once. If TXPDO or RXPDO COB-ID entries are referring to an already used COB-ID, either disable that PDO or change the COB-ID.

Specific information for DTSC-200 controls

The DTSC-200 CANopen parameters are configured using Woodward's LeoPC software. Below are LeoPC screenshots of the relevant parameters.

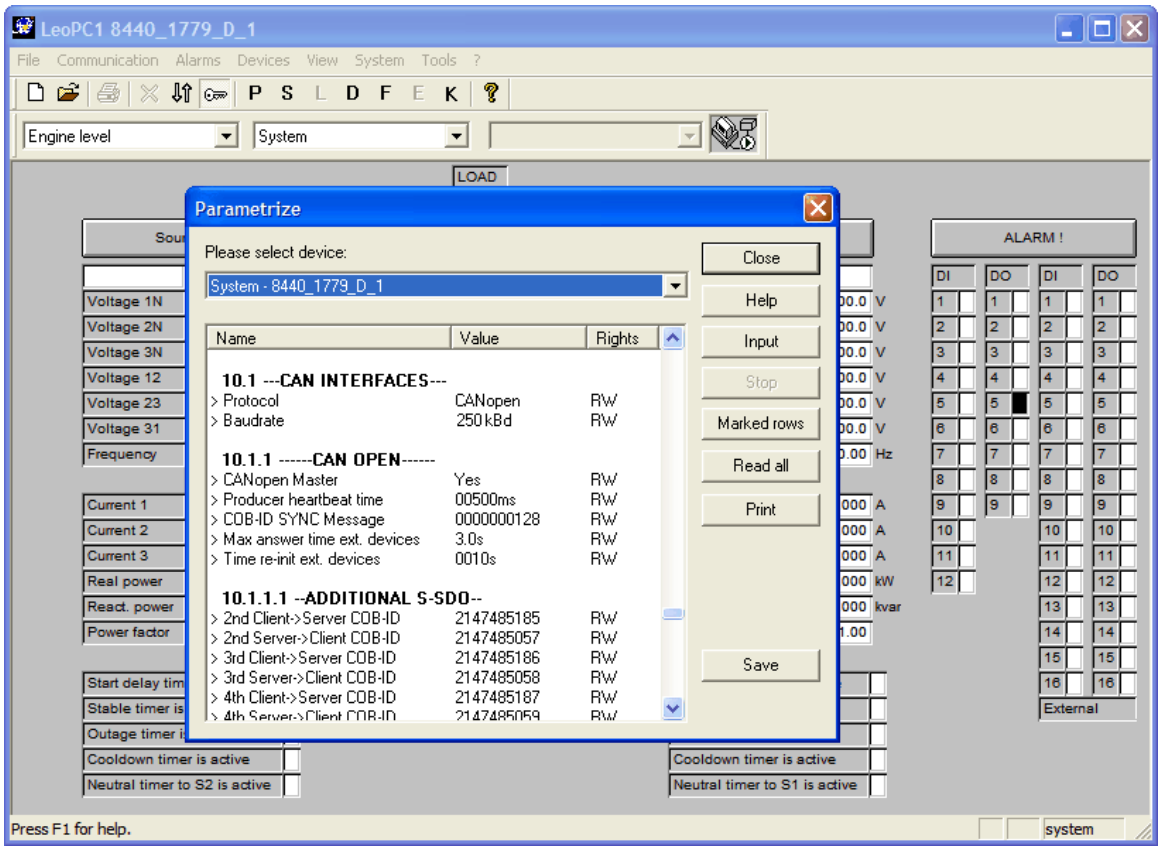


Figure 7.7:Parametrize dialog in LeoPC software

CAN interfaces

- Parameter *Device number* determines the Modbus Slave ID under which the DTSC-200 data can be retrieved. It must be set to a unique number in the network.
- Parameter *Protocol* must be set to CANopen and
- parameter *Baudrate* to 250 kBd.

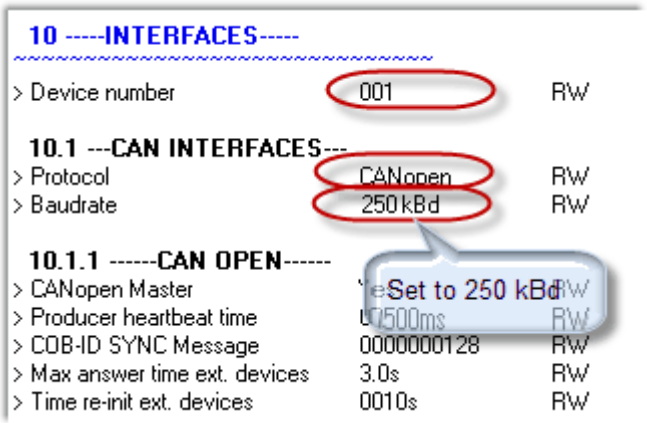


Figure 7.8: DTSC-200 CAN interfaces section in "Parametrize" dialog of LeoPC software

Transmit PDOs

In order for the *ESENET* gateway to receive cyclic data updates from the *Easygen*, one of the four available Transmit PDOs (TXPDO) must be configured. Typically Tranmsit PDO 4 is already pre-configured for that purpose, but any of the four TXPDOs could be used for that purpose. Other TXPDOs which transmit on COB-IDs reserved for the *Easygen* (for example 385 and 386) must be disabled or changed to a different COPB-ID range.

If for example Transmit PDO 4 is used, then the following changes are required:

- TPDO 1 (COB-ID 385) disabled or changed to a different range,
- TPDO 2 (COB-ID 386) disabled or changed to a different range,
- TPDO 3 can stay configured if set to to COB-ID `1152 + Node-ID`,
- TPDO 4 parameter *COB-ID* set to `1152 + Node-ID`,
- TPDO 4 parameter *Transmission type* set to `255`,
- TPDO 4 parameter *1. Mapped Object* set to `03190` in order to select Data Protocol 4700 and the other mapped objects to `00000`.

In the following example for a DTSC-200 with device ID of 1, the Transmit PDO 4 is used to send data updates every 20 ms. TXPDO 1 and 2 are disabled because the use COB-IDs reserved for the *Easygen*.

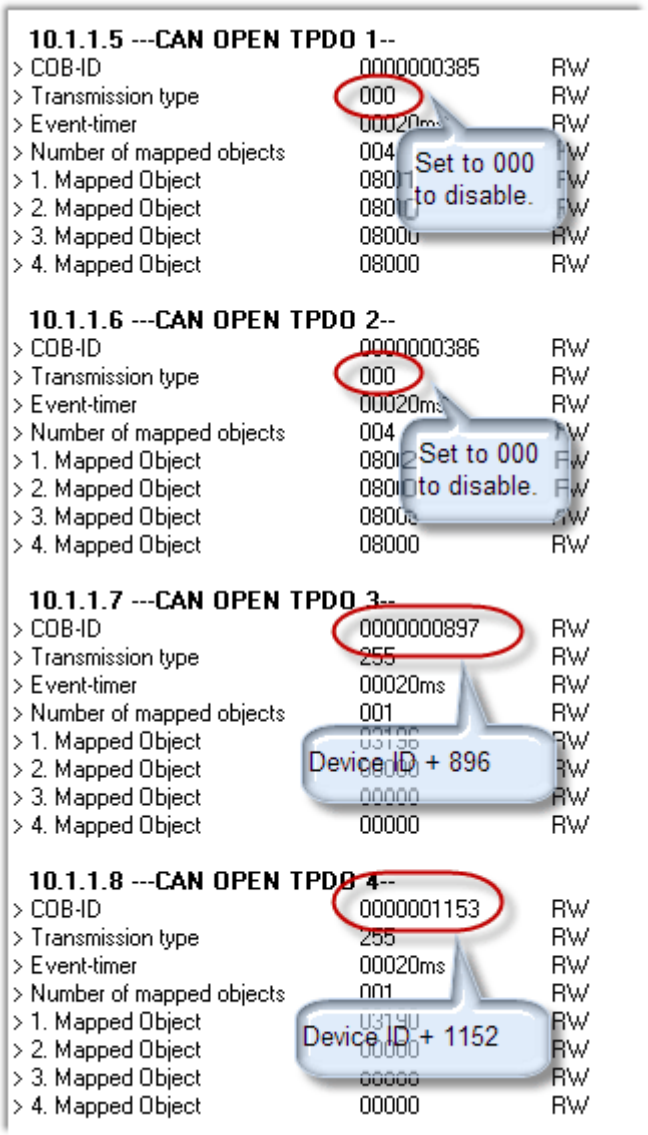


Figure 7.9: TPDO section in "Parametrize" dialog of Woodward's LeoPC software

All COB-IDs used in the CAN network must be unique. Please make sure that a COB-ID is only configured once. If TXPDO or RXPDO COB-ID entries are referring to an already used COB-ID, either disable that PDO or change the COB-ID.

Chapter 8. Modbus data reference

This chapter describes how process data and configuration data of the Woodward controls are organized in logical blocks and accessed via Modbus.

The *ESENET* supports two principal Modbus data tables one for visualisation and one for configuration & remote control. These data tables are organised in a similar manner to the serial Modbus adress ranges of the Woodward controls. This allows an easy transition from serial Modbus to Modbus/TCP.

The Visualisation Data Table is located at start address 50001 and the Configuration & Control data table is located at start address 1 up to address 49999.

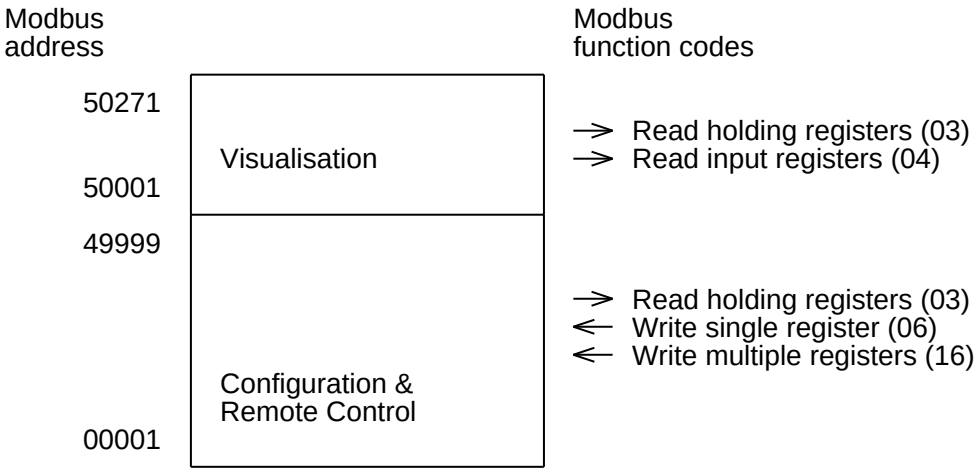


Figure 8.1: Modbus data table structure

Modbus Slave IDs

The Modbus Slave ID (also known as Unit Identifier or Slave Address) is used to address individual Woodward controls. There is a fixed relationship between the CANopen Node-ID and the Modbus Slave ID which is documented in the table below.

Modbus Slave ID	CANopen Node-ID
1	1
2	2
3	3
4	4
5	5
6	6
7	7

Modbus Slave ID	CANopen Node-ID
8	8
9	9
10	10
11	11
12	12
13	13
14	14
15	15
16	16

Table 8.1: Modbus Slave ID and CANopen Node-ID relationship

Visualisation Data Table

The Visualisation Data Table provides a very fast and efficient means to read important process data. Because the visualisation data is buffered in the *ESENET* gateway, the data is replied instantly without blocking the PLC's Modbus/TCP master communication channel.

The Visualisation Data Table is a dedicated buffer area in the *ESENET* gateway which is filled in the background by the Woodward control through cyclically transmitted PDOs. Therefore the structure and layout of the Visualisation Data Table depends on the Woodward control used and the configured Data Protocol. The *ESENET* does not perform any modification to the representation of the data values.

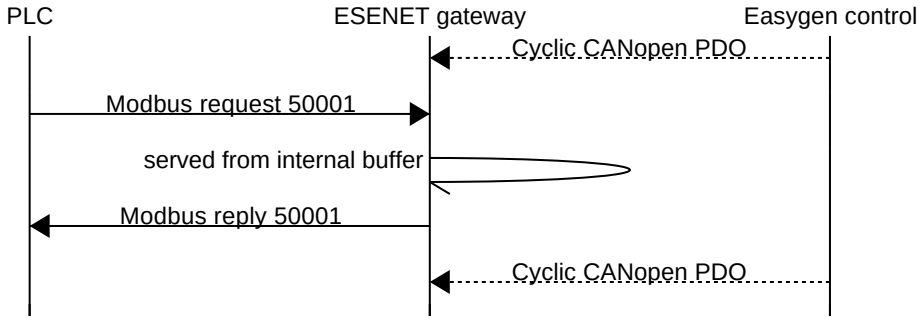


Figure 8.2: Message sequence chart for visualiation data

The Visualisation Data Table is located in the so called *Input register* block, which sometimes is also identified with offset 3:00000. The block is accessed using Modbus function code 04 *Read input registers*.

Registers in this data table can only be accessed if the CAN communication between *ESENET* and the Woodward control has been established. If this is not the case, Modbus exception code 0B *Gateway target device failed to respond* is returned, indicating the Woodward control is not present on the CAN bus.

Please consult the appropriate Woodward manual for exact layout, encoding and representation of the data in the Visualisation Data Table. Some examples for the most commonly used Woodward controls are shown in the following tables:

Easygen-3000

Address block	Register address	Easygen-3000 interface manual designator
3	50001	Protocol-ID, always 5003
3	50002	Pickup speed
…	…	…[a]
3	50268	Exhaust Gas Temp

[a]For details refer to Woodward's "easYgen-3000 Series Manual"

Table 8.2: Modbus register addresses for Easygen-3000 series visualisation data

If no response was obtained from the addressed Woodward control, Modbus exception code 0B *Gateway target device failed to respond* is returned.

LS-5

Address block	Register address	LS-5 interface manual designator
3	50001	Protocol-ID, always 5103
3	50002	System A total reactive power
…	…	…[a]
3	50090	Digital information

[a]For details refer to Woodward's "LS-5 Series Circuit Breaker Control Manual"

Table 8.3: Modbus register addresses for LS-5 series visualisation data

If no response was obtained from the addressed Woodward control, Modbus exception code 0B *Gateway target device failed to respond* is returned.

DTSC-200

Address block	Register address	DTSC-200 interface manual designator
3	50001	Protocol-ID, 4700 or 4701
3	50002	Source 2: Voltage 12
…	…	…[a]
3	50088	Timer state feedback signals
…	…	…
3	50104[b]	Source 1: Positive re-active energy counter

[a]For details refer to Woodward's "DTSC-200 Series Interfaces — Interface Description Manual"

[b]Addresses > 50088 only available with data protocol 4701

Table 8.4: Modbus register addresses for DTSC-200 visualisation data

Easygen-1000

The following table describes the layout of the Modbus data tables when interfacing to the *Easygen*-1000 using Data Protocol Parameter No. 3190/Object 2C76h.

Address block	Register address	Mux	Word size	Parameter #	Easygen-1000 interface manual designator
3	50001	0	16 bit	n/a	Protocol-ID, 4003
3	50002	0	32 bit	108	Generator: Voltage V L12
3	50004	1	16 bit	144	Generator: Frequency
3	50005	1	32 bit	114	Generator: Voltage V L1N
3	50007	2	16 bit	147	Mains: Frequency f 123
3	50008	2	32 bit	109	Generator: Voltage V L23
3	50010	3	16 bit	160	Generator: Power factor cosf L1
3	50011	3	32 bit	115	Generator: Voltage V L2N
3	50013	4	16 bit	141	Mains: Power factor cosf L1
3	50014	4	32 bit	110	Generator: Voltage V L31
3	50016	5	16 bit	10100	Engine speed
3	50017	5	32 bit	116	Generator: Voltage V L3N
3	50019	6	16 bit	10110	Battery voltage
3	50020	6	32 bit	118	Mains: Voltage V L12
3	50022	7	16 bit	10111	Analog input [T1]
3	50023	7	32 bit	121	Mains: Voltage V L1N
3	50025	8	16 bit	10112	Analog input [T2]
3	50026	8	32 bit	119	Mains: Voltage V L23
3	50028	9	16 bit	10106	Discrete inputs, status
3	50029	9	32 bit	122	Mains: Voltage V L2N
3	50031	10	16 bit	10107	Relay outputs, status
3	50032	10	32 bit	120	Mains: Voltage V L31
3	50034	11	16 bit	10201	System status
3	50035	11	32 bit	123	Mains: Voltage V L3N
3	50037	12	16 bit	10131	Alarm classes
3	50038	12	32 bit	111	Generator: Current I L1
3	50040	13	16 bit	10139	Discrete inputs with alarm class
3	50041	13	32 bit	112	Generator: Current I L2
3	50043	14	16 bit	10133	Alarms 1
3	50044	14	32 bit	113	Generator: Current I L3
3	50046	15	16 bit	10134	Generator, watchdog 1
3	50047	15	32 bit	134	Mains: Current I L1
3	50049	16	16 bit	10135	Mains, watchdog 1
3	50050	16	32 bit	136	Generator: Reactive power Q
3	50052	17	16 bit	10137	Analog inputs, wire break
3	50053	17	32 bit	135	Generator: Real power P
3	50055	18	16 bit	10141	Analog inputs

Address block	Register address	Mux	Word size	Parameter #	Easygen-1000 interface manual designator
3	50000	18	32 bit	140	Mains: Real power P L1
3	50058	19	16 bit	10200	System status
3	50059	19	32 bit	150	Mains: Reactive power Q
3	50061	20	16 bit	10306	Generator: power factor cosphi
3	50062	20	16 bit	10301	Mains: power factor cosphi
3	50063	20	16 bit	10305	Mains: reactive power Q
3	50064	21	16 bit	10302	Generator: real power P
3	50065	21	16 bit	10303	Generator: reactive power Q
3	50066	21	16 bit	10304	Mains: real power P
3	50067	22	16 bit	10138	Generator, watchdog 2
3	50068	22	32 bit	2520	Real energy
3	50070	23	16 bit	10140	Flag of the LogicsManager
3	50071	23	32 bit	2522	Reactive energy
3	50073	24	16 bit	10202	Parameter 10202
3	50074	24	32 bit	159	Generator: Calculated ground current
3	50076	25	16 bit	10307	External discrete inputs with alarm class
3	50077	25	32 bit	10308	Parameter 10308
3	50079	26	16 bit	8003	External relay outputs, status
3	50080	26	32 bit	8013	External discrete inputs, status

Table 8.5: Modbus register addresses for Easygen-1000 series visualisation data

For details about physical units and encoding of the value, please refer to chapter "CANopen: Mapping-Parameter" in the "easYgen-1000 Series - Interface" manual.

Modbus function codes

The *ESENET* supports the Modbus function codes 03, 04, 06 and 16. A maximum of 125 16-bit words can be requested with Modbus command 04.

Modbus function code	Function name	Access	Max. number of 16-bit words per transaction	Address block
04	Read input registers	read	125	3:00000
03	Read holding registers	write	125	4:00000
06	Write single register	write	1	4:00000
16	Write multiple registers	write	2	4:00000

Table 8.6: Supported Modbus function codes

Modbus exception codes

The following table lists the Modbus exception responses sent by the *ESENET* gateway instead of a normal response message in case of an error:

Modbus exception code	Exception name	Reason
01	Illegal function	A Modbus master sent a Modbus function which is not supported by the gateway. Please refer to the documentation of the individual data tables for valid function codes.
02	Illegal data address	A Modbus master queried a non-existing Modbus address or the queried range points outside of a data table. Please refer to the documentation of the individual data tables for valid address ranges.
03	Illegal value	A Modbus master sent a Modbus message which's structure or implied length is invalid.
0B	Gateway target device failed to respond	A Modbus master tries to access data which is unavailable because no response was obtained from the target Woodward unit. Usually means that the unit is not present on the CAN bus.

Table 8.7: Modbus exception codes

Chapter 9. Decommissioning

Before disconnecting the *ESENET* unit please follow the rules in the section called “Safety Precautions”.

Disconnecting

1. Ensure that the system power and external supplies have been turned off.
2. Disconnect power supply plug.
3. Disconnect all I/O cables.
4. Remove the *ESENET* from the DIN rail following the procedure described in the section called “DIN rail mounting and removal”.

Disposal

This product must be disposed of at a specialized electronic waste recycling facility. Do not dispose of in domestic waste.

Appendix A.Specifications

Product name	**ESENET**
Interfaces	
Ethernet	1
Serial ports	1 for diagnostics (RS-232)
CAN	1
User interface	
LED indicators	Power (green), Ethernet link (green), 2 status (bi-color red/green)
Monitoring & configuration	Web browser based
Diagnostic	
High availability features	Watchdog supervision, brown-out detection
CAN interface	
Connector	male 9-pin D-sub, CiA DS-102 pin-out
Physical layer	ISO 11898
Isolation	non-isolated
Speed	250 kBit/s
Max. number of connected nodes	64
Protocols	CANopen consumer & client
Number of adressable nodes	16
Diagnostic port	
Connector	male 9-pin D-sub, DTE, EIA-574 pin-out
Physical layer	EIA-232-F
Isolation	n/a
Signals	RXD, TXD, RTS, CTS, DTR, DSR, DCD, RI
Speed	9600 bps
Protocols	ASCII terminal
Ethernet port	
Connector	8-pin RJ-45 socket for Cat 5 UTP
Physical & Data Link Layer Layer	IEEE 802.3i 10BASE-T
Isolation	1.5 kV galvanic
Speed	10 Mbit/s
Max. cable length	100 m (328 ft)
Ethernet frame types	802.3
Protocols	Modbus/TCP slave, HTTP, IP, TCP, ARP
Concurrent connections	8 Modbus/TCP, 2 HTTP
Power supply	
Connector	3.81 mm 2-pin pluggable terminal block header
Voltage	10-30 V DC
Current	30 mA typical @ 24 V DC
Intrinsic consumption	750 mW
Electromagnetic compatibility	
Emissions (radiated and conducted)	AS/NZS CISPR 22 / EN 55022 (Class A)
Immunity	EN 55024

Electrostatic discharge	EN 61000-4-2
Radiated RF	EN 61000-4-3
Fast transients	EN 61000-4-4
Conducted RF	EN 61000-4-6
Enclosure	
Material	Self-extinguishing PC/ABS blend (UL 94-V0)
Mounting	35 mm DIN rail (EN 60715)
Classification / Type rating	IP 20 / NEMA Type 1
Cooling	Convection
Environmental	
Operating temperature	0 to 60 °C / 32 to 140 °F
Storage temperature	-25 to 85 °C / -13 to 185 °F
Humidity	10 to 95% non condensing
Operating ambience	Free from corrosive gas, minimal dust
Physical	
Dimensions	101 x 22.5 x 120 mm / 3.98 x 0.886 x 4.72 in
Weight	0.13 kg / 0.287 lb
Compliance	
Australia	C-Tick
Europe	CE, RoHS
USA	FCC Part 15 (Class A)
Canada	ICES-003 (Class A)

Dimensions

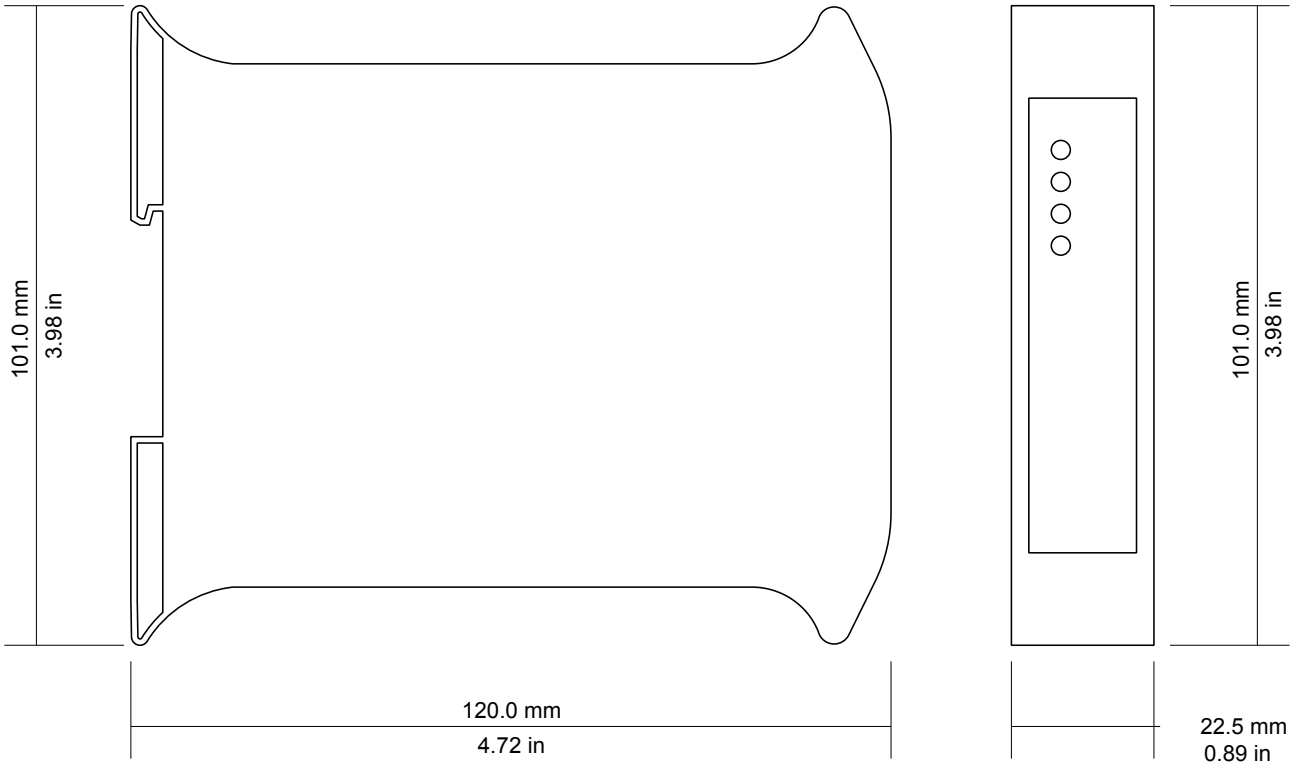


Figure A.1: Enclosure dimensions

Glossary

10BASE-T
: 10 Mbit/s twisted pair Ethernet standard. Standardized in IEEE 802.3i

APIPA
: Automatic Private IP Addressing

CAN
: Controller area network. Standardized in ISO 11898.

CANopen
: Internationally standardized (EN 50325-4) CAN-based higher-layer protocol for embedded control systems.

CiA DS-102
: Standard for the pinout of CAN connectors

Class A
: Class A equipment is that used in commercial or light industrial environments.

COB-ID
: Unique CANopen Communication Object Identifier.

DIN rail
: 35 mm wide mounting bracket standardized in DIN/EN 50022.

DTE
: Data terminal equipment. DTE and DCE devices have different pinouts for RS-232 connectors. A PC for example is a DTE.

EIA-232
: Standard for serial transmission of data between two devices, also known as RS-232 and V.24.

EIA-574
: Standard for the pinout of serial D-sub connectors.

EMC
: Electromagnetic compatibility

EMI
: Electromagnetic interference

ESD
: Electrostatic discharge. ESD can damage electronic equipment.

IEEE
: Institute of Electrical and Electronics Engineers

IP
: Ingress Protection Rating standardized in IEC 60529. Standard for various grades of electrical enclosures.

ISO
: International Standards Organisation

MAC address
: Every piece of Ethernet hardware has a unique number assigned to it called it's MAC address. MAC addresses are administered and assigned by the IEEE organization.

Modbus
: Fieldbus protocol used in the process automation industry. It uses a master and slave structure. Originally developed by Modicon, now part of Schneider Automation.

NEMA
: National Electrical Manufacturers Association. NEMA defines standards for various grades of electrical enclosures.

Node
: A communications device on the network

PC/ABS
: Polycarbonate-ABS. Widely used thermoplastic material.

PDO
: CANopen Process Data Object. Process data the device is either producing or consuming.

PLC
: Programmable Logic Controller

Predefined Connection Set
: The CANopen Predefined Connection Set defines standard COB-IDs for PDOs and SDOs.

RS-232
: See *EIA-232*.

RXPDO
: CANopen Receive Process Data Object. Process data the device is consuming.

SDO
: CANopen Service Data Object.

TXPDO
: CANopen Transmit Process Data Object. Process data the device is producing.

UL 94
: Plastics flammability standard released by Underwriters Laboratories of the USA.

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