

# ELNet MC2 and MC8 Color

## Multi Channel Energy meter and Powermeter



## Installation & Operation Manual

Ver. 2.0



CONTROL APPLICATIONS Ltd.

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## CHAPTER 1 - INTRODUCTION

### 1.1. - About the *ELNet MC* Multi Channel Energy meter

All large consumers of electricity e.g. Factories, Hotels, Hospitals, Municipalities, need to know the history of their consumption and the quality of the power supply. Details such as Voltage, Current, Power Factor, Hertz, Neutral Current, Energy Demands, Harmonics and all electricity related events are recorded in the *ELNet* Multi Channel Energy Powermeter. These are all recorded on a continual basis and can be recalled and shown on the front panel display of the instrument with a few simple key-strokes any time the user wishes.

The *ELNet* Multi Channel Energy Powermeter installs onto a standard DIN Rail, and is especially designed to integrate into Building Management Systems.

The Configuration and Setup is menu driven.

Communication with external devices is simple and based on standard known technology.

The *ELNet* Multi Channel Energy Powermeter boasts a new innovative built in “Flash Memory”, which pioneers a new frontier into electrical measurement. It has a 1 MB of ROM with a capacity of recording up to 4 months of energy for each channel.

Each *ELNet* Energy Powermeter is carefully and meticulously manufactured using quality components and the latest production methods. Before leaving the factory each *ELNet* Multi Channel Energy meter & Powermeter is calibrated and sent to the customer accompanied by the test certificate and Certificate Of Compliance (C.O.C).



## 1.2. - How to use this manual

We at CONTROL APPLICATIONS Ltd, envisage this manual to be used by three types of people, i.e. the *Installation Technician*, the *Senior Electrical Engineer* and the end *User*. For this reason this manual is divided into chapters for ease of reference by each of these different people. There could be a situation where two of the abovementioned tasks can be combined, or in a rare instance one person could handle all three tasks.

CHAPTER 1, *Introduction*, describes the **ELNet** Multi Channel Energy Powermeter, its potential users, the readings it can provide and some of its features in brief.

CHAPTER 2, *Installation*, provides detailed instructions for unpacking, mechanical mounting, and electrical wiring up instructions for the *Installation Technician*.

CHAPTER 3, *Operating the ELNet MC*, describes in detail the front Panel, functions of the control buttons.

CHAPTER 4, *CONFIGURATION & SETTINGS* explains in detail the minimum parameters settings needed by the *Senior Electrical Engineer* to set up and configure the **ELNet** Multi Channel Energy Powermeter.

CHAPTER 5, *Front Panel Displays*, is an easy to follow step-by-step guide to obtain readings, and histories for the *User*.

CHAPTER 6, *Communications* gives details about the Communication capabilities of the **ELNet** Multi Channel Energy Powermeter, and how to Set Up.

CHAPTER 7, *Specifications*, is a detailed list of specifications of the **ELNet** Multi Channel Energy Powermeter.



### 1.3.- Safety Information

The purpose of this manual is to help you. Please read the instructions carefully before performing any installation and note any precautions.

#### **WARNING!**

- Ensure that all incoming AC\DC power and other power sources are turned off before performing any work on the **ELNet** Multi Channel Energy Powermeter. Failure to do so may result in serious or even fatal injury and/or equipment damage.
- If the **ELNet** Multi Channel Energy Powermeter is damaged in any way do NOT connect it to any power source.
- To prevent a potential fire or shock hazard, never expose the **ELNet** Multi Channel Energy Powermeter to rain or moisture.
- Keep the surrounding area free of dirt and clutter especially metal objects. Good housekeeping pays.
- Inspect the cables periodically for cracks, kinks or any other signs of wear
- Keep children away.
- Do not pull the cords.
- Users should stay alert and not approach the **ELNet** Multi Channel Energy Powermeter while tired or under the influence of alcohol, medicines or any other chemical substance that would tend to make a person drowsy.
- Do not wear loose clothing or dangling jewelry.
- Above all use common sense at all times.



## 1.4.- Warranty

CONTROL APPLICATIONS Ltd provides a 18- Month warranty against faulty workmanship or components from date of dispatch provided that the product was properly installed and used.

CONTROL APPLICATIONS Ltd does not accept liability for any damage that may be caused by natural disasters (such as floods, fire, earthquake, lightening etc.).

CONTROL APPLICATIONS Ltd does not accept liability for any damage that may be caused by malfunction of the **ELNet** Multi Channel Energy Powermeter.

CONTROL APPLICATIONS Ltd will advise the customer on the proper installation and use of the **ELNet** Multi Channel Energy Powermeter, but will not accept any responsibility that the instrument is suitable for the application for which it was originally purchased.

This warranty may become void if the installation, parameter configuration & setting instructions are not carried out according to the instructions set out by CONTROL APPLICATIONS Ltd.

The **ELNet** Multi Channel Energy Powermeter has no user serviceable parts and should be opened and serviced by a duly qualified authorized representative only. The sensitive electronics could be damaged if exposed to a static environment. This action would void the warranty.

This warranty is limited to the repair and/or replacement at CONTROL APPLICATIONS Ltd sole discretion of the defective product during the warranty period. Repaired or replaced products are warranted for ninety (90) days from the date of repair or replacement, or for the remainder of the original product's warranty period, whichever is longer.



CONTROL APPLICATIONS Ltd is always at your service to advise the customer on any problem that may be encountered regarding any installation, operation, parameter & configuration settings or maintenance.

## 1.5. - Your comments are welcome

CONTROL APPLICATIONS Ltd. Sincerely thank you for choosing our **ELNet** Multi Channel Energy Powermeter. We are confident that it will provide you with many years of trouble free service and give you all the power and energy information and history that you expected from the instrument when you bought it.

While every effort was made to keep the information as reliable, helpful, accurate and up to date as possible, all possible contingencies cannot be covered. Technical or typographical errors could occur, and we would be happy to receive any comments criticisms or notifications of any such errors from you, our valued customer.

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## 1.6. - Disclaimer

Information in this User Manual is subject to change without notice and does not represent a commitment on the part of CONTROL APPLICATIONS Ltd.

CONTROL APPLICATIONS Ltd supplies this User Manual as is without warranty of any kind; either expressed or implied, and reserves the right to make improvements and/or changes in the manual or the product at any time.

While it is the intension of CONTROL APPLICATIONS Ltd to supply the customer with accurate and reliable information in this User Manual, CONTROL APPLICATIONS Ltd assumes no responsibility for its use, or for any infringement of rights of the fourth parties which may result from its use.

This User Manual could contain technical or typographical errors and changes are periodically made to the information herein; these changes may be incorporated in new editions of the publication.



## CHAPTER 2 - INSTALLATION

In this Chapter you will find the information and instructions that the *Installation Technician* needs to mount and connect the *ELNet* Multi Channel Energy Powermeter

### WARNING!

- During operation, hazardous voltages are present in connecting cables and terminal blocks.
- Fully qualified personnel must do all work. Failure to follow this rule may result in serious or even fatal injury to personnel and/or damage to equipment.
- Refer to Section 1.3 Safety information before carrying out any installation.
- Read this manual thoroughly and make sure you understand the contents before connecting the *ELNet* Multi Channel Energy meter & Powermeter to any power source.

### 2.1.- Contents of packaging

**To unpack the *ELNet* Multi Channel Energy Powermeter:**

The *ELNet* Multi Channel Energy Powermeter is packed and shipped in a carton approximately 32 cm long X 22 cm wide and 7.5 cm high.

Before opening the package, ensure the area is static free clean and dry.

Without using any sharp instruments, carefully open the carton of the *ELNet* Multi Channel Energy Powermeter.



Please check the contents of the carton, it should contain:

1. Your new **ELNet** MC Multi Channel Energy Powermeter.
2. **ELNet** MC User Manual. (This book)
3. Test Certificate and Certificate of Compliance. (C.O.C)
4. 8 X six pole connector plugs.
5. 1 X three pole connector plugs.
6. 1 X two pole connector plugs.

## 2.2.- Mechanical Mounting

### NOTE!

Do not mount the **ELNet** Multi Channel Energy Powermeter too close to any main electrical conductors.

Allow sufficient space to carry out maintenance to the **ELNet** Multi Channel Energy Powermeter

The **ELNet** Multi Channel Energy Powermeter is manufactured with a standard DIN rail mounting. To mount, simply choose a secure location inside of cabinet fixture and click into position.



### 2.3. - Wiring Schematics

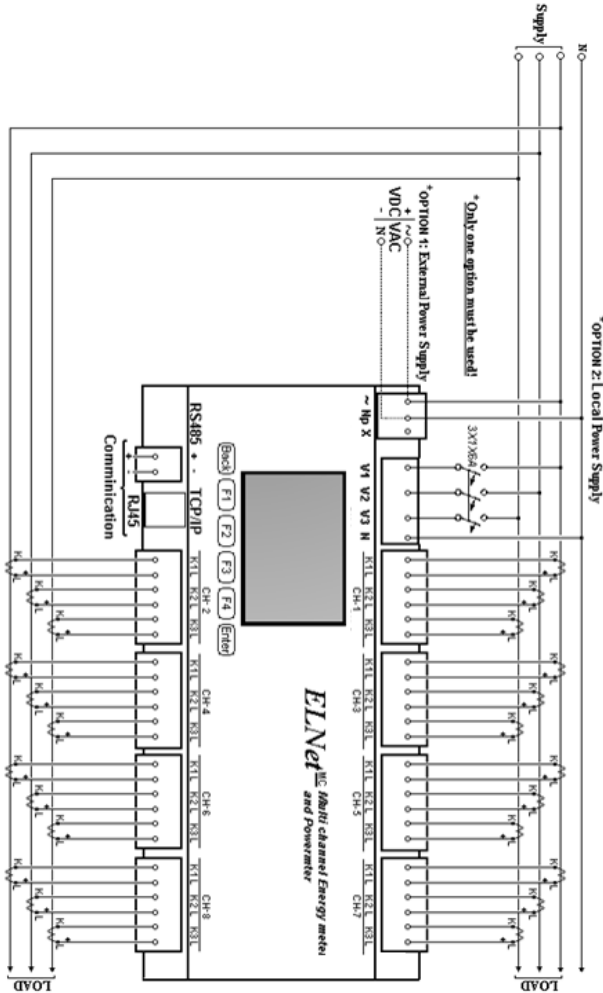


Figure 2.1 Schematic Wiring Diagram "Star" connection

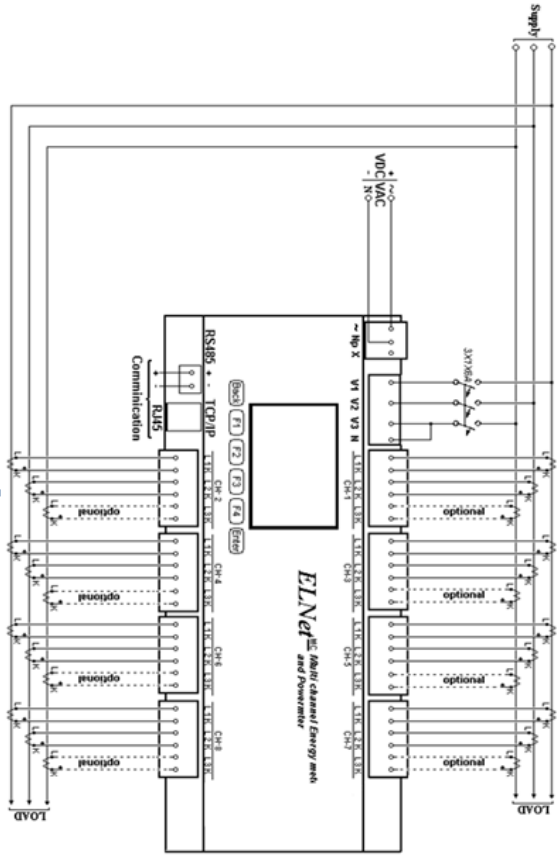


Figure 2.2 Schematic Wiring Diagram "Delta" connection



## 2.4.- Connections

### To connect the *ELNet* Multi Channel Energy Powermeter:

All Connections are made via terminal connector plugs (Voltage input, Power Supply, earth/ground etc.).

Recommended maximum tightening torque for the connector screws is 0.5 Nm.

The CT cores of the *ELNet* Multi Channel Energy Powermeter are located internally in the instrument and the lead from the leg of the external Current Transformer must be connected to the correct terminal connector in order to maintain the correct direction.

#### NOTE!

Ensure all the connections to the leads of the current transformer wiring is secure and there is no mechanical strain on the wire

Connect the lead from side “**L**” to the terminal connector L1 at the relevant channel, connect the lead from side “**K**” to the terminal connector K at the same channel, of the *ELNet* Multi Channel Energy Powermeter.

#### WARNING!

Never allow an open circuit between the two Current Transformers. An open circuit will cause damage to equipment.

Repeat the procedure for **Line 2** and **Line 3**.

Connect the rest the connections to the *ELNet* Multi Channel Energy Powermeter by means of terminal connector plugs.



| Designation    | Description                              | Remarks                                                       |
|----------------|------------------------------------------|---------------------------------------------------------------|
| V1             | Direct from <b>Busbar1</b>               | Through a 6Amp fuse                                           |
| V2             | Direct from <b>Busbar2</b>               | Through a 6Amp fuse                                           |
| V3             | Direct from <b>Busbar3</b>               | Through a 6Amp fuse                                           |
| N              | Direct from Neutral Line                 |                                                               |
| CH1-CH8<br>L1K | From Current Transformer on <b>Line1</b> | Note the correct direction to connect the lead                |
| CH1-CH8<br>L2K | From Current Transformer on <b>Line2</b> | Note the correct direction to connect the lead                |
| CH1-CH8<br>L3K | From Current Transformer on <b>Line3</b> | Note the correct direction to connect the lead                |
| ~              | Power 220 V AC                           | Bridged from measured phase or external AC\DC supply source   |
| Np             | Neutral                                  | Bridged from the neutral Line or external AC\DC supply source |

Table 2.1 **Front Panel Connections**



## CHAPTER 3 - OPERATING the ELNet MC

In this chapter you will find descriptions and functions of the front panel and the control buttons and how to use them.

### 3.1. - Front Panel

#### To operate the front panel:

The Front Panel has a color LCD display screen and six operating buttons located below the screen.

All the readings are shown on a state of the art 320 X 240 resolution graphic screen. How to obtain the readings is explained in detail in Chapter 5.

The Control Buttons and their functions are fully explained in Section 3.2.

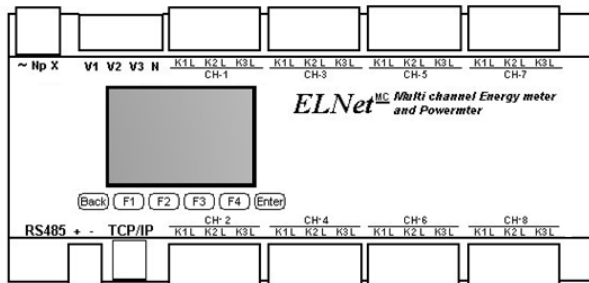


Figure 3.1

### Front Panel

#### To obtain Readings:

All information contained in the Powermeter is viewed by navigating through a logical Hierarchy Menu. To arrive at each reading, follow a logical step-by-step procedure starting from Top Level and progress down to 2nd Level, 3rd Level etc.





## 3.2. - Control Buttons

### Functions of the Control Buttons:

The **ELNet** Multi Channel Energy Powermeter has six Control Buttons. With these buttons the User and Senior Electrical Engineer can achieve all the functions necessary.

The Control Buttons are arranged on a keypad below the display screen and require slight finger pressure to click.

- Button “ENTER” accepts the choice and executes the commands.
- Button “F1”, “F2”, “F3”, “F4” performs the function that the arrow above is pointing to (e.g. move the cursor), or selects the prompt that the arrow is pointing to.
- Button “BACK” returns to the previous step or to the Main Menu.

NOTE!

In the event of a general power failure, the **ELNet** Multi Channel Energy Powermeter returns to the last screen displayed.



## CHAPTER 4 - CONFIGURATION & SETTINGS

In this chapter you will find instructions to set the minimum settings that are necessary to allow the *ELNet* Multi Channel Energy Powermeter to function properly.

### WARNING!

- The selection, installation and settings of the Current Transformer are the most vital and fundamental action required to ensure the accurate functioning of the *ELNet* Multi Channel Energy Powermeter.
- It is essential to know the ratio of the Current Transformer being installed into the system in order to set the parameter for the Current Transformer correctly.
- All three main current Lines MUST have Current Transformers of the same ratio installed onto them.



## 4.1. - Settings for Current Transformer

To set or change settings for Current Transformer:

4.1.1. From the Main Menu Scroll to "Technical" and click "Enter".

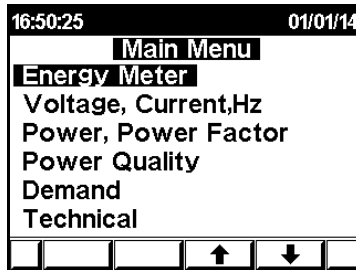


Figure 4.1 Main Menu

4.1.2. The Enter Code screen appears, please insert the password. (The default password is "1").

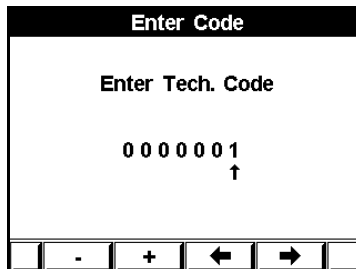


Figure 4.2 Enter Code Screen

4.1.3. Scroll to "Transformer Ratio" and click "Enter".

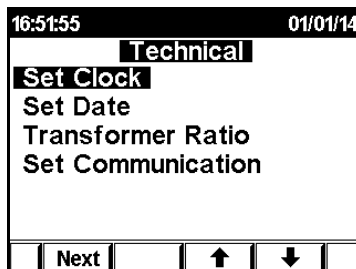


Figure 4.3 Technical Menu



- 4.1.4. The Transformer Ratio screen appears. Select the ratio type per **Line**, per **Channel** or per **All** at once, by scrolling to the relevant menu and clicking "Enter".

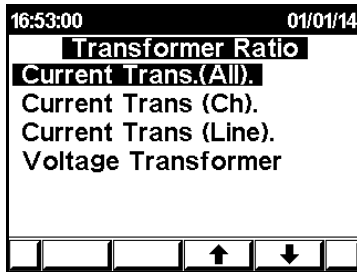


Figure 4.4 Transformer Ratio Menu

- 4.1.5. In order to define the CT ratio per Channel or Line, Scroll to the desirable menu by using the arrow buttons (F1, F2, and F3 & F4) and click "Enter".

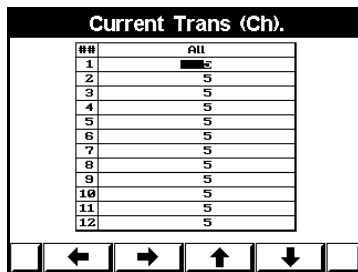


Figure 4.5 Current Transformer Screen

- 4.1.6. Set Current Transformer Ratio screen appears, use the arrow buttons (F1, F2, F3 & F4) to change the value, when finished click "Enter".

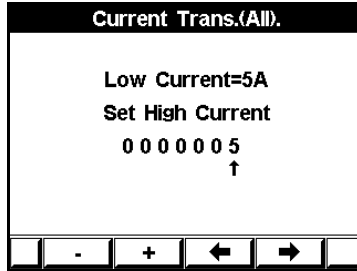


Figure 4.6 Current Transformer Ratio Input Screen

## 4.2. - Settings for Voltage Transformer

To set or change settings for Voltage Transformer:

- 4.2.1. Access to Transformer Ratio Menu by repeating steps 4.1.1 to 4.1.4 scroll to **Voltage Transformer** and click "Enter".

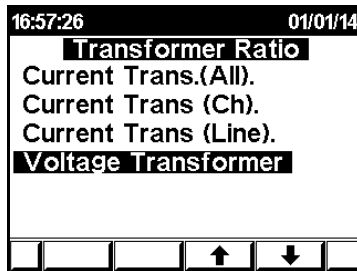


Figure 4.7 Voltage Transformer Screen

- 4.2.2. The Set Voltage Transformer Ratio screen appears, use the arrow buttons (F1, F2, and F3 & F4) to change the value, when finished click "Enter".

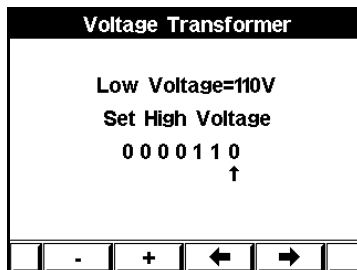


Figure 4.8 Voltage Transformer Ratio Input Screen



## 4.3. - Time Settings

To set Time:

4.3.1. Access the Setup screen by repeating steps 4.1.1 - 4.1.2 from the chapter 4.1.

4.3.2. Scroll to **Set Clock** and press "Enter".

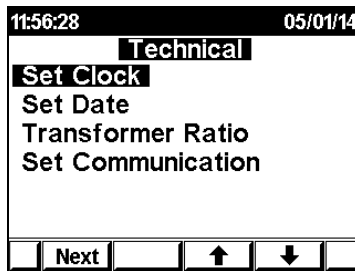


Figure 4.9 Technical Menu

The Set Clock screen appears:

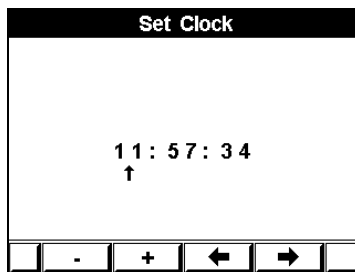


Figure 4.10 Set Clock Screen

4.3.3. Use the "Left", "Right", "+" & "-" buttons to setup the clock, when finished press "Enter".



## 4.4. - Date Settings

To set Date:

4.4.1. Access the Setup screen by repeating steps 1-2 from the chapter 4.2.

4.4.2. Scroll to **Set Date** and press "Enter".

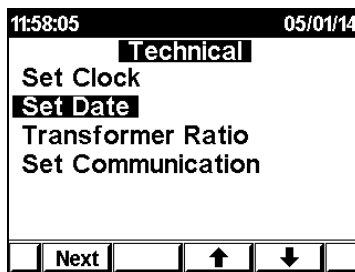


Figure 4.11 Technical Menu

The Set Date screen appears:

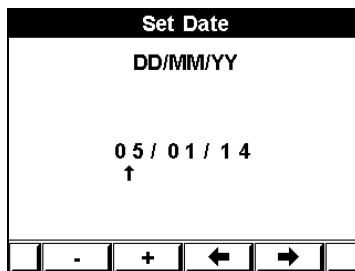


Figure 4.12 Set Date Screen

4.4.3. Use the "Left", "Right", "+" & "-" buttons to setup the Date, when finished press "Enter".



## 4.5. - Delta/Star Electrical network definition:

The **ELNet MC** can be installed in two types of electrical networks:

- DELTA: a system without neutral line  
STAR: a system with neutral line

In order to change the type of the electrical network connection of the **ELNet MC**, see Section 4.1 for instructions to arrive at the **Technical Menu**.

4.5.1. From Technical Menu click on the "Next" button, then scroll to "**Wiring**" and click "ENTER".

The **Connection** screen appears:

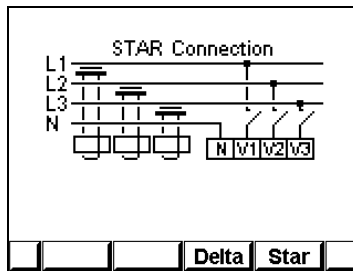


Figure 4.13 Wiring Connections

4.5.2. Use "F3" or "F4" buttons in order to change the connection type. When you are using "DELTA" networks, the currents (line currents) and the voltages (between phases) are not in the same phase offset therefore part of the measurements are not applicable and part of the display screens which exists in Star mode are not applicable as well.





## 4.6. - Electrical Connection Check

The proper current direction connection ("K" and "L") between the External CT and the ELNet is very important in case that the energy direction is monitored and the energy should be logged as Import (consumed) or Export (produced) modes.

ELNet energy powermeter can auto correct the wrong current direction wiring (in case the Export energy is not required to be logged).

As default the device is defined to perform the auto correction. In order to change these settings and deactivate or activate the auto correction mode:

4.6.1. From the Main Menu Scroll to "**Technical**" and click "Enter".

4.6.2. Click on the "Next" button, then scroll and access to the "Wiring" menu.

The **Wiring** screen appears:

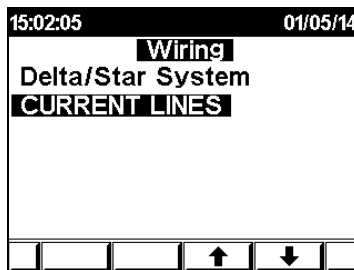


Figure 4.14 Wiring Connections

4.6.3. Scroll to "**Current Lines**" and click "ENTER".



The **Connection** screen appears:

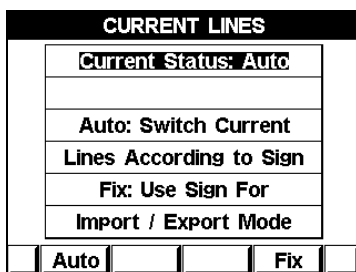


Figure 4.15 **Wiring Connections**

- 4.6.4. In order to activate the unit in auto correction mode, press on the Auto button, in order to cancel the auto correction mode press on the Fix button (careful – in Fix mode the proper wiring of K and L direction is important!).



## CHAPTER 5 - PANEL DISPLAYS

In this chapter you will find instructions on how to obtain the readings that the *ELNet MC* Multi Channel Energy Powermeter provides, e.g., Current, Voltage Power, Power Factor and Energy.

### 5.1. - Current, Voltage & Frequency

#### 5.1.1 Electrical Measurements per channel.

1. From the Main Menu scroll to **Voltage, Current, Hz** and press "Enter".

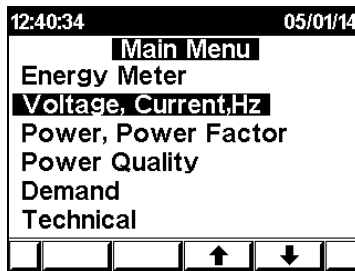


Figure 5.1 Main Menu

2. The **Electrical Metering** screen appears.

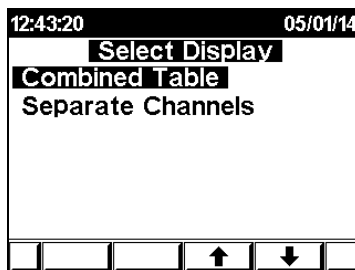


Figure 5.2 Electrical Metering



### 3. Scroll to **Separate Channels** and press "Enter".

The **Voltage** screen appears:

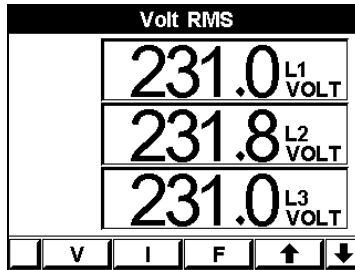


Figure 5.3 Voltage Line to N Screen

- Use "F1" in order to display voltage Line to Line values.
- Use "F2" in order to display Current per channel values. At the Current display screen use up/down arrow buttons ("F4" and "Enter") to scroll between the channel readings.
- Use "F3" in order to display Frequency values .

#### 5.1.2 Combined Total Current measurement Table.

The ELNet MC has 24 current inputs which are monitored in separate as well as per channel in total.

In order to receive the information of the total current (Line 1 + Line 2 + Line 3) per channel of ELNet MC:

1. From the Main Menu scroll to **Voltage, Current, Hz** and press "Enter".

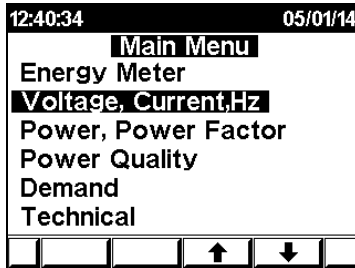


Figure 5.4 Main Menu

2. The **Electrical Metering Menu** screen appears.

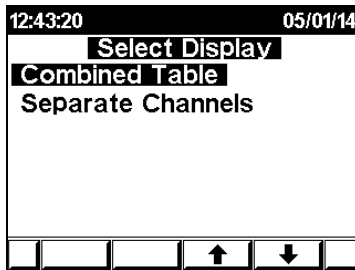


Figure 5.5 Electrical Metering Menu

3. Scroll to **Combined Table** and press "Enter".

The **Total Current Table** screen appears:

| Total Current (L1+2+3). AMP |        |    |        |
|-----------------------------|--------|----|--------|
| 1                           | 32.465 | 7  | 32.470 |
| 2                           | 32.447 | 8  | 32.485 |
| 3                           | 32.467 | 9  | 32.470 |
| 4                           | 32.487 | 10 | 32.483 |
| 5                           | 32.502 | 11 | 32.476 |
| 6                           | 32.467 | 12 | 32.486 |
|                             | P      | Q  | S      |
|                             |        |    | PF     |

Figure 5.6 Total Current Table



## 5.2. - Power and Power Factor

### 5.2.1 Power and Power Factor per Channel.

1. From the Main Menu scroll to **Power, Power Factor** and press "Enter".

The **Power Menu** screen appears:

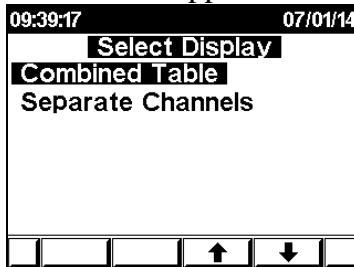


Figure 5.7 Power Menu Screen

2. Scroll to **Separate Channels** and press "Enter".

The **Active Power** of channel 1 appears:

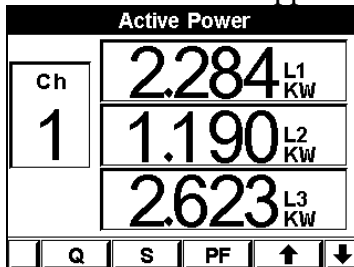


Figure 5.8 Active Power Ch1

- Use "F1" in order to display the **Reactive Power (Q)**.
- Use "F2" in order to display the **Apparent Power (S)**.
- Use "F3" in order to display the **Power Factor (PF)**.

In order to scroll between the channels use the up/down arrow buttons ("F4" and "Enter").



## 5.2.2 Combined Power/Power Factor Table.

1. From the Main Menu scroll to **Power, Power Factor** and press "Enter".

The **Power Menu** screen appears:

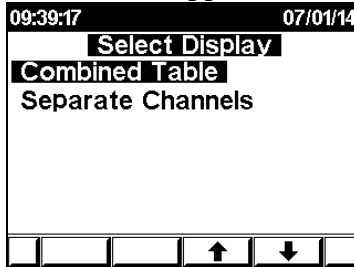


Figure 5.9 Power Menu Screen

2. Scroll to **Combine Table** and press "Enter".

The **Total Active Power** table appears:

| Active Power, KW |       |    |       |    |  |
|------------------|-------|----|-------|----|--|
| 1                | 5.974 | 7  | 5.997 |    |  |
| 2                | 5.980 | 8  | 5.980 |    |  |
| 3                | 5.985 | 9  | 5.985 |    |  |
| 4                | 6.004 | 10 | 5.985 |    |  |
| 5                | 6.006 | 11 | 5.987 |    |  |
| 6                | 6.000 | 12 | 5.985 |    |  |
|                  | I     | Q  | S     | PF |  |

Figure 5.10 Total Active Power Table

- Use "F2" in order to display the **Reactive Power (Q)**.
- Use "F3" in order to display the **Apparent Power (S)**.
- Use "F4" in order to display the **Power Factor (PF)**.

## 5.3. - Energy Displays

The *ELNet* Multi Channel Energy Powermeter provides up to 24 sub-meters with separate measurement and energy registers. Each sub-meter accumulates the data in separate per 3 current inputs (3 Lines) or to be used as a total three phase meter.

### 5.3.1 Import Energy per Channel.

1. From the Main Menu scroll to **Energy Meter** and press "Enter".
2. Scroll to "**Separate Channels**" menu and press "Enter".  
The **Energy Meter** screen appears:

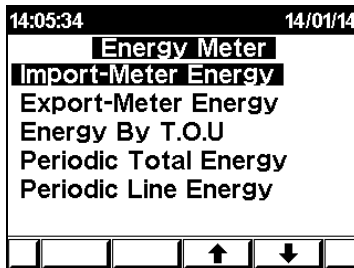


Figure 5.11 Energy Meter

3. Scroll to "**Import-Meter Energy**" and press "Enter".  
The **channel-1 Import Energy** screen appears:

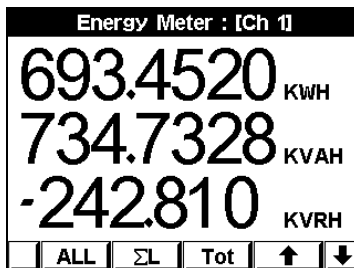


Figure 5.12 Channel-1 Import Energy





This screen presents the total Import (consumed) Energy per each Channel.

- Use “F1” in order to display the **Energy** per tariff (RT).
- Use “F2” in order to display the **Energy** per phase (Line).
- Use “F3” in order to display in separate each energy type **Active, Reactive** or **Apparent**.

In order to Scroll between the channels use the up\down arrow buttons ("F4" and "Enter").

### 5.3.2 Export Energy per Channel.

As default the device performs a current auto correction (to consume the Import Energy only). In order to log the Export Energy, deactivate the "auto correction" mode (Section 4.6).

1. Follow the instructions in steps 1 up to 3 from Section 5.3.1 in order to arrive to **Energy Menu**.
2. Scroll to "**Export-Meter Energy**" and press "Enter".

The **channel-1 Export Energy** screen appears:

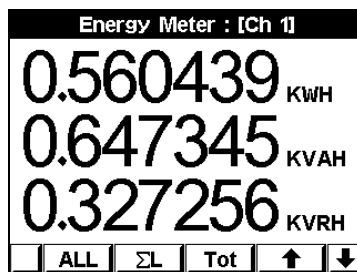


Figure 5.13 Channel-1 Export Energy

This screen presents the total Export Energy per Channel.



- Use “F1” in order to display the **Energy** per tariff (RT).
- Use “F2” in order to display the **Energy** per phase (Line).
- Use “F3” in order to display in separate the energy per type **Active, Reactive** or **Apparent**.

In order to scroll between the channels, use the up/down arrow buttons ("F4" and "Enter").

### 5.3.3 Energy by T.O.U per Channel.

ELNet MC Multi Channel Energy Powermeter provides the ability to see the energy by TOU (time of usage) per channel per line.

1. Follow the instruction steps 1 up to 3 from Section 5.3.1 in order to arrive to the **Energy Menu**.
2. Scroll to **Meter By TOU** and press "Enter".

The **channel-1 TOU Energy** screen appears:

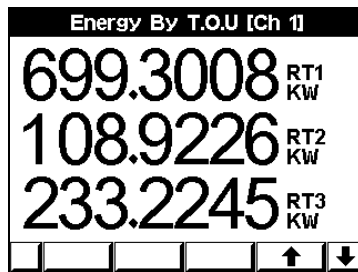


Figure 5.14 Channel-1 TOU Energy

In order to scroll between channels use the up/down arrow buttons ("F4" and "Enter").



## Periodic Energy per Channel:

The ELNet MC accumulates the energy in total and per-line registers by TOU, the user can display the accumulated data over the MC's display by simply selecting historical time interval for the data (selecting two dates, e.g.: the first and last date of month):

1. Follow the steps 1 up to 3 from section 5.3.1 in order to arrive to the **Energy Menu**.
2. Scroll to **Periodic Total/Line Energy** and press "Enter".
  - By using "F1" (DATE) the user can define the two dates in order to set the period of time for calculating the consumed active energy in this period:

- Periodic Line Energy Only:

By using "F2" The **ELNet** will display the amount of the active energy consumed for each rate:

RT1 = Rate number 1

RT2 = Rate number 2

RT3 = Rate number 3

ALL= All rates

By Using "F3" The **ELNet** will display the amount of active energy, from the selected dates:

MON+ = Change the date by adding a month.

- Periodic Total Energy Only:

By using "F2" and "F3" The **ELNet** will display the amount of active energy, from the selected dates:

MON+ = Change the date by adding a month.

MON- = Change the date by subtracting a month.



- In order to scroll between different channels use the “F4” and "Enter" buttons.

## 5.4. - Power Quality

The ELNet MC Energy Powermeter can be used as a power quality analyzer, the unit monitors on minute bases the partial harmonics of voltage and current, per line per channel. In addition the MC also provides the THD of voltage and current. In order to see the power quality data:

1. From the Main Menu scroll to **Power Quality** and press "Enter".

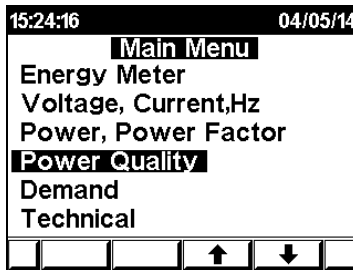


Figure 5.15 Power Quality Menu

The **Power Quality** screen appears:

| Harmonics Table % [Ch 6] |         |    |         |      |  |
|--------------------------|---------|----|---------|------|--|
| ##                       | Volt L1 | ## | Volt L1 |      |  |
| 1                        | 100.00  | 9  | 0.16    |      |  |
| 2                        | 0.27    | 10 | 0.15    |      |  |
| 3                        | 0.28    | 11 | 0.26    |      |  |
| 4                        | 0.25    | 12 | 0.06    |      |  |
| 5                        | 0.54    | 13 | 0.13    |      |  |
| 6                        | 0.22    | 14 | 0.12    |      |  |
| 7                        | 0.11    | 15 | 0.23    |      |  |
| 8                        | 0.21    | 16 | 0.07    |      |  |
| THD                      | 1.18    |    |         |      |  |
|                          | V       | I  | Line    | Next |  |

Figure 5.16 Power Quality Screen



2. Use the F1 & F2 buttons in order to select the harmonics type to be displayed: Voltage or Current).
3. Use the F3 button to switch between lines.
4. Use the F4 button (Next) to access the next harmonics (17-32).
5. Use the Enter button (arrow up) in order to scroll between channels.

## 5.5. Demand

The max demand is most important information for understanding the load behavior. The max demand reading is based on last 15 (adjustable) minutes running average. In order to view the readings:

1. From the Main Menu scroll to **Demand** and press "Enter".

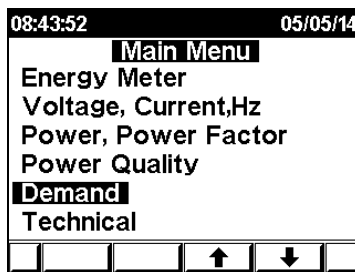


Figure 5.17 Demand Screen



The **Demand** screen appears:

| Demand |       |                   |
|--------|-------|-------------------|
| Ch#    | 1     |                   |
| Line   | Amper | Date & Time       |
| L1     | 58.24 | 11/03/14 15:41:34 |
| L2     | 57.53 | 06/03/14 14:30:23 |
| L3     | 59.81 | 23/03/14 12:23:47 |
| ALL    | 172.5 | 23/03/14 12:23:47 |
| KW     | 0.115 | 05/05/14 08:34:57 |

↑   ↓   CLR

Figure 5.18 **Demand Screen**

2. Use the "UP" and "DOWN" F1 & F2 buttons to scroll between the channels.



## CHAPTER 6 - COMMUNICATION

### MODBUS Protocol:

The **ELNet MC** Multi Channel Energy Powermeter has a serial and TCP/IP interface ports, allowing direct interface with an external communication network supporting the MODBUS Protocol.

MODBUS is an Industry Standard, widely known and commonly used communications protocol. Using MODBUS provides communication between a PC and up to 247 Powermeter slaves on a common line - the PC being the **master** and the powermeters the **slaves**. The PC initiates the transaction (either a query or broadcast) and the Powermeter/s responds. Powermeters respond to the **master** PC's request, but will not initiate any transmission on its own. The PC sends a single Query transaction and the Powermeter responds in a single response frame and is capable of only one query and one response at a time.

### 6.1 - MODBUS Framing

#### 6.1.1 RTU Transmission Mode

MODBUS uses the standard Remote Terminal Unit (RTU) transmission mode. RTU mode sends data in 8-bit binary EVEN parity or 8-bit binary NO parity data format. For the **ELNet MC** Multi Channel Energy Powermeter to successfully communicate, choose one in the communication Set Up.



| Field     | No. of bits |
|-----------|-------------|
| Start bit | 1           |
| Data bits | 8           |
| Parity    | 1           |
| Stop bit  | 1           |

Table 6.1 **RTU Data Format**

### 6.1.2 The RTU Frame Format

Query and response information is sent in frames. Each frame contains:

- Address
- Function (See Section 6.1.4 for descriptions of functions),
- Data
- Check

| Address | Function | Data         | Check   |
|---------|----------|--------------|---------|
| 8 bits  | 8 bits   | $N * 8$ bits | 16 bits |

Table 6.2 **R T U Message Frame Format**

If the receiving device (Powermeter) detects a time laps of five characters, then it will assume the message is incomplete and will flush the frame. The device then assumes that the next byte received will be an address. The maximum query and response message length is 256 bytes including check characters.





### 6.1.3 Address Field

Each Powermeter is designated in a network system by a user assigned address. The Address can be any number between 1 and 247. The Powermeter will only respond to its own specifically assigned address.

### 6.1.4 Function Field

The function field contains the code that tells the Powermeter what action to perform.

The *ELNet MC* Multi Channel Energy Powermeter uses and responds to four standard Message Format Functions.

**Function 03**

**Function 04**

**Function 06**

**Function 16**

| Function           | Meaning in MODBUS        | Action                                                |
|--------------------|--------------------------|-------------------------------------------------------|
| <b>Function 03</b> | Read holding register    | Obtain data from Powermeter (Read register)           |
| <b>Function 04</b> | Read input register      | Obtain data from Powermeter (Read register)           |
| <b>Function 06</b> | Preset single register   | Transmit data to Powermeter (Write single register)   |
| <b>Function 16</b> | Preset multiple register | Transmit data to Powermeter (Write multiple register) |

Table 6.3 **Function Codes**



### 6.1.5 Data Field

The Data field contains the body of the message and contains instructions from the PC **master** to the Powermeter **slave** to perform a particular action or respond to a query. The reply message from the Powermeter will be information contained in one or more of its registers.

### 6.1.6 Check Field

The error check field contains the result of Cyclical Redundancy Check (CRC). The start of the message is ignored in calculating the CRC.

For more detailed information on CRC, refer to the MODBUS Protocol Reference Guide.

## 6.2- Registers for ELNet MC Energy Powermeter

The *ELNet MC* Multi Channel Energy Powermeter is capable of supporting either Function 03 or Function 04 Message Format (see Table 6-3). In a reply to a query from the PC **master** for a reading from a particular field, the response from the Powermeter can be either in Format 03 or Format 04 but will depend on which Format the query was originally sent.

The difference is significant because by using Function 03 the ELNet Pico will only send the INTERGER part of the field value requested and the PC **master** will only display the INTERGER part of the field value.



Function 04, on the other hand, is capable of sending two separate halves of the full FLOAT requested information (each half contained in a separate register). Then it is the task of the PC **master** to merge the two halves into a full FLOAT reply (For more detailed information See IEEE Standard 754 Floating-Point).

E.G. 1: If the user's PC **master** supports Function 03, then the reply will contain the INTERGER part of the field only.

The PC **master** requests the Voltage from Line1, and the actual Voltage in that field is 230.5 Volts.

Function 03 will respond with the INTEGER only i.e. 230V.

E.G. 2: If the user PC master supports Function 04, then the reply will contain the information stored in the two registers assigned to that field and will contain the full, accurate reply.

The PC master requests the Voltage from Line1, and the actual Voltage in that field is 230.5 Volts.

Function 04 will respond with a composite reply of both register 1 and 2 giving the full FLOAT value (in IEEE Format) from that field i.e. 230.5V.

### 6.2.1 Registers addressess

The **ELNet MC** MODBUS registers addresses are updated all the time and can be downloaded from the following web site:

[http://getelnet.com/documents\\_and\\_updates/elnet\\_comm.pdf](http://getelnet.com/documents_and_updates/elnet_comm.pdf)

The MODBUS registers addresses numbering order specify at the above mentioned web address set as a defaults but can be changed in order to be fit to the SCADA/HMI drivers.



## 6.3- Communication Connections

The ELNet MC Multi Channel Energy Powermeter supports RS-485 and TCP IP communication. Connections are provided on the bottom front terminal of the device. (Please refer to section 2.4) and are made by means of the connectors provided.

## 6.4- Communication Settings

To enable the *User* to connect the ELNet MC Multi Channel Energy meter & Powermeter to a PC computer for successful communications, the Communication Setup parameters of both must match; i.e. the port of the PC and the configuration settings of the Power meter.

- Address
- Baud Rate
- Parity
- IP address (in case of Ethernet TCP / IP communication)

### 6.4.1 Communication Address

Each Power meter in a communication system must have its own unique address.

Since the *ELNet MC* Multi Channel Energy Powermeter works on MODBUS, the available addresses are - from '1' to '247'.

### 6.4.2 Baud Rate

The Baud Rate is the communication speed in Bits per second (BPS) that the *ELNet MC* Multi Channel Energy Powermeter



communicates with the PC. The better the communication line Quality, the faster the communications may be.

If the communication line is routed through a “noisy” environment, it may be necessary to decrease the Baud Rate.

Available Baud Rates for the *ELNet MC* Multi Channel Energy Powermeter:

|       |     |
|-------|-----|
| 300   | bps |
| 600   | bps |
| 1200  | bps |
| 2400  | bps |
| 4800  | bps |
| 9600  | bps |
| 19200 | bps |
| 38400 | bps |

### 6.4.3 Parity

The choices of parity are either NONE or EVEN (see Section 6.1.1 for description of Parity).



## 6.5- Serial Communication Set Up

### 6.5.1 To set up the Address/Baud Rate/Parity/Max :

1. Access the "Technical" screen as explained in previous chapters. Look at chapter 4.1, steps 1-2.
2. Scroll to "Set Communication" and press "Enter".

The Communication screen appears:

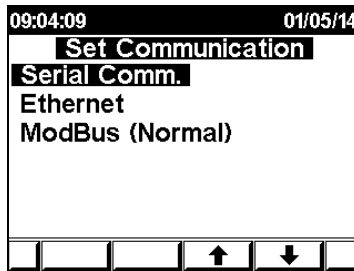


Figure 6.1 Set Communication

3. Scroll to "Serial Communication" and press "Enter".

The following screen appears:

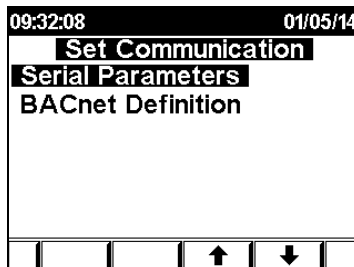


Figure 6.2 Serial Communication Screen



The **Set Communication** screen appears:

| Set Communication |      |
|-------------------|------|
| ADDRESS           | 30   |
| BAUDRATE          | 4800 |
| PARITY            | EVEN |
| Max               | 12   |

[-] [+] [Up] [Down]

Figure 6.3 Set Communication Screen

4. Use the "Up", "Down" to set any desired configuration (Address/Baud Rate/Parity/Max) and set the desired value by using (+ -).

## NOTE!

When the selection is made it takes immediate affect with no further action required.



## 6.5.2 To set up the BACnet Definitions:

1. Access the **Serial Communication** menu as explained in chapter 6.5.1, steps 1-3.

The **Set Communication** screen appears:

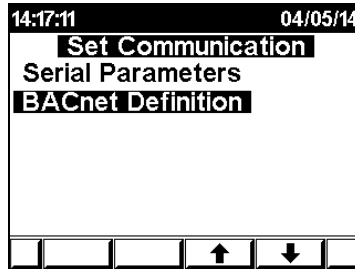


Figure 6.4 Set Communication Screen

2. Scroll to **BACnet Definition** and press "Enter".

The **BACnet Definition** screen appears:

| BACnet Definition |              |        |
|-------------------|--------------|--------|
| ##                | Description  | Value  |
| 1                 | Instance No. | 0      |
| 2                 | MAC Address. | 0      |
| 3                 | Max Master.  | 127    |
| 4                 | MSTP Status  | OFF    |
| 5                 | MSTP Mode    | Master |
| 6                 | BBMD T.T.L.  | 60000  |
| 7                 | BBMD Port    | 47808  |
| 8                 | BBMD IP.     | .IP.   |

Figure 6.5 BACnet Definition Screen





3. Use the "Up" and "Down" buttons to select the required configuration (**Instance No, Mac Address, Max Master, MSTP Status, MSTP Mode, BBMD T.T.L, BBMD Port, BBMD IP**) and press "Enter".
4. Use the + and - buttons to determine the desired value and press "Enter".

For example the **BACnet Instance number** setting screen:

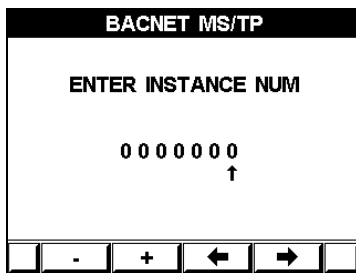


Figure 6.6 BACnet Definition Screen

## NOTE!

When the selection is made it takes immediate affect with no further action required.



## 6.6- Ethernet Communication Set UP.

### 6.6.1 To set up the IP Address:

1. From the main menu scroll to Technical menu and access the "**Set Communication**" screen as explained in chapter 6.5.1, steps 2-3.
2. Scroll to "**Ethernet**" and press "Enter".

The **Ethernet** screen appears:

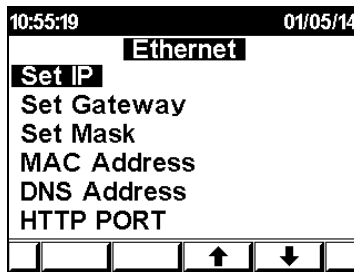


Figure 6.7 **Ethernet Communication**

3. Scroll to "**Set IP Address**" and press "Enter".

The "**Set IP Address**" screen appears:

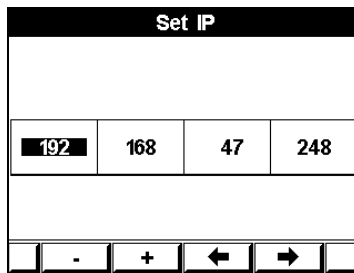


Figure 6.8 **Set IP Address**



4. Use the "**Left**", "**Right**" (F3 & F4 buttons) to scroll between the numbers and set the desired value by using the + and - (F1 & F2 buttons).

## 6.6.2 To set up the MAC Address:

1. Access the "**Ethernet**" screen by repeating steps 1-2 as explained in chapter 6.6.1.
2. Scroll to "**Mac-Address**" and press "Enter".  
The **Mac Address** screen appears:

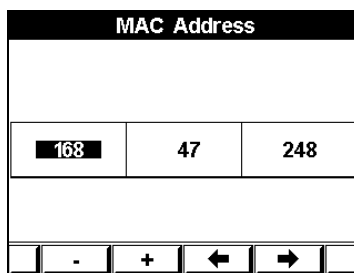


Figure 6.9 Mac Address Input Screen

3. Use the "Left", "Right" (F3 & F4 buttons) to scroll between the numbers and set the desired value by using "+", "-" (F1 & F2 buttons).

## 6.6.3 To set up the Mask menu:

1. Access the "**Ethernet Communication**" screen by repeating steps 1-2 as explained in chapter 6.6.1



2. Scroll to "**TCP-Mask**" and press "Enter".  
The **Set Mask** screen appears:

| Set Mask |     |     |   |
|----------|-----|-----|---|
| 255      | 255 | 240 | 0 |
| -        | +   | ←   | → |

Figure 6.10 Mask Address Input Screen

1. Use the "Left", "Right" (F3 & F4 buttons) to scroll between the numbers and set the desired value by using "+", "-" (F1 & F2 buttons).

#### 6.6.4 To set up the GateWay:

1. Access the "**Ethernet Communication**" screen by repeating steps 1-2 as explained in chapter 6.6.1
2. Scroll to "**TCP – Gateway**" and press "Enter".

The **Gateway** screen appears:

| Set Gateway |     |    |     |
|-------------|-----|----|-----|
| 192         | 168 | 33 | 254 |
| -           | +   | ←  | →   |

Figure 6.11 Gateway Input Screen



3. Use the "Left", "Right" (F3 & F4 buttons) to scroll between the numbers and set the desired value by using "+", "-" (F1 & F2 buttons).

### 6.6.5 To set up the DNS Address:

1. Access the "**Ethernet Communication**" screen by repeating steps 1-2 as explained in chapter 6.6.1.
2. Scroll to "**DNS Address**" and press "Enter".

The **DNS Address** screen appears:

| DNS Address |    |   |   |
|-------------|----|---|---|
| 194         | 90 | 1 | 5 |
| -           | +  | ← | → |

Figure 6.12 DNS Address Input Screen

3. Use the "Left", "Right" (F3 & F4 buttons) to scroll between the numbers and set the desired value by using "+", "-" (F1 & F2 buttons).



### 6.6.6 To set up the HTTP PORT:

1. Access the "**Ethernet Communication**" screen by repeating steps 1-2 as explained in chapter 6.6.1.
2. Scroll to "**HTTP PORT**" and press "Enter".  
The **HTTP PORT** screen appears:

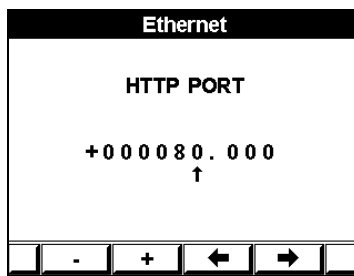


Figure 6.13 HTTP PORT Screen

3. Use the "Left", "Right" (F3 & F4 buttons) to scroll between the numbers and set the desired value by using "+", "-" (F1 & F2 buttons).

### 6.6.7 To set up the ModBus type:

1. Access the "**Ethernet Communication**" screen by repeating steps 1-2 as explained in chapter 6.6.1.



2. Scroll to "**ModBus**" and press "Enter" button in order to switch between the modes (Normal, Ex. Swap, and Swap).

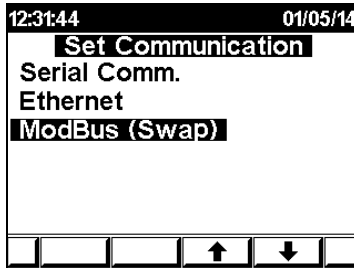


Figure 6.14 ModBus Screen

## 6.7- Communication with UniArt Software

CONTROL APPLICATIONS Ltd propriety software, “UniArt” is used to **Read** and **Write** Registers of the *ELNet MC* Multi Channel Energy Powermeter. Each Item number in the Registers Table is a unique field containing information. The UniArt software manages each Item number as a parameter. Refer to the UniArt manual how to set up parameters.



### To read fields using UniArt:

1. Find the reading required in the MODBUS Registers Table.
2. Note the Item Number from the Registers Table.
3. Go to the correct File number.

Since File capacity in UniArt is limited to 128 parameters, the information contained in the ELNet MC fields is stored in several files.

File number is determined by the Item number

File # 0 contains Item number 1 - 128

File # 1 contains Item number 129 – 256

File # 2 contains Item number 257 – 384

File # 3 contains Item number 385 – 512

Go to the correct Point number within that file

Point number is determined by the formula:

$$\text{Item number} - [\text{FILE X 128}] = \text{Point Number}$$

E.G. 1: If the user wishes to read Voltage Line 2 (Item No 2),

By applying the formula:  $2 - [0 \times 128] = 2$

File = 0 and Point within that file = 2

E.G. 2: If the user wishes to read 30th Harmonics for Volts Line1 (Item No 330), By applying the formula:

$330 - [2 \times 128] = 74$

File = 2 and Point within that file = 74

E.G. 3: If the user wishes to read 7th Harmonic for Current Line 3 (Item No 467), By applying the formula:

$467 - [3 \times 128] = 83$

File = 3 and Point number within that file = 83



**More Examples:**

| <b>E.G. No</b> | <b>Item No</b> | <b>Field Description</b>                    | <b>File</b> | <b>Point</b> |
|----------------|----------------|---------------------------------------------|-------------|--------------|
| 1              | 2              | Voltage Line 2                              | 0           | 2            |
| 2              | 330            | 30 <sup>th</sup> Harmonics for Volts Line1  | 2           | 74           |
| 3              | 467            | 7 <sup>th</sup> Harmonic for Current Line 3 | 3           | 83           |
| 4              | 128            |                                             | 0           | 128          |
| 5              | 129            |                                             | 1           | 1            |
| 6              | 256            |                                             | 1           | 128          |
| 7              | 257            |                                             | 2           | 1            |
| 8              | 384            | 20 <sup>th</sup> Harmonics for Volts Line 3 | 2           | 128          |
| 9              | 385            | 21 <sup>st</sup> Harmonics for Volts Line3  | 3           | 1            |

Table 6.4 **Function Codes**



## CHAPTER 7 — SPECIFICATIONS

| Item                      | Description               |
|---------------------------|---------------------------|
| Power requirements        | 85-250VAC, 60/50 Hz, 60VA |
| Dimensions                | (HxWxD) 110x300x60 mm     |
| Shipping Weight           | 1,250 gr                  |
| Voltage limits            | 1000VAC                   |
| Current limits            | 20A                       |
| Enclosure material        | ABS + Antiflame           |
| Display                   | Liquid Crystal 4 X 40     |
| Operating temperature     | -20 - + 60 C              |
| Storage temperature       | -20 - + 80 C              |
| Humidity                  | 0- 90 RH%                 |
| Voltage input terminals   | VL – E10 1708             |
| Communication port        | RS485, Ethernet TCP\IP    |
| Mounting                  | Standard DIN Rail         |
| Digital Inputs (optional) | Dry contact               |

All technical specifications are subject to change without notice.