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CHAPTER 1 – INTRODUCTION

1.1 — About the *ElNet Energy & Power Multimeter*

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, Harmonics, Energy Demands and all electricity related events are recorded in the *ElNet Energy & Power Multimeter.* These are all recorded on a continual basis and can be recalled and shown on the front panel TEXT display of the instrument with a few simple key-strokes any time the user wishes.

The *ElNet Energy & Power Multimeter* is a compact unit, 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 Energy & Power Multimeter* 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 2 years of unusual events.

Readings & history are shown on a 2 X 16 Text Liquid Crystal display.

Each *ElNet Energy & Power Multimeter* is carefully and meticulously manufactured using quality components and the latest production methods. Before leaving the factory each *ElNet Energy & Power Multimeter* 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 Energy & Power Multimeter,* 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, *Using the ElNet Energy & Power Multimeter,* describes in detail the front Panel, functions of the control buttons.

CHAPTER 4, *PARAMETER CONFIGURATION & SETTINGS* explains in detail the minimum parameters settings needed by the ***Senior Electrical Engineer*** to set up and configure the *ElNet Energy & Power Multimeter*

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 Energy & Power Multimeter*, and how to Set Up

CHAPTER 7, *Specifications,* is a detailed list of specifications of the *ElNet Energy & Power Multimeter.*

APPENDIX A, *Installation & Configuration Check List*, provides a Check List to insure no important steps will be missed during the initial set up.

APPENDIX B, *List of Illustrations & Tables,* shows a list of the illustrations and Tables.

INDEX, An *INDEX* is provided to help find a word or a topic easily.

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 power and other power sources are turned off before performing any work on the *ElNet Energy & Power Multimeter.* Failure to do so may result in serious or even fatal injury and/or equipment damage.
- If the *ElNet Energy & Power Multimeter* 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 Energy & Power Multimeter* 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 rear of the *ElNet Energy & Power Multimeter* 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 12- 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 Energy & Power Multimeter*

CONTROL APPLICATIONS Ltd will advise the customer on the proper installation and use of the *ElNet Energy & Power Multimeter*, 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 Energy & Power Multimeter* 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 APPLICATION 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 Energy & Power Multimeter.* 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.

Street Address: 24A HaBarzel St.
Tel-Aviv 69710
Israel
Tel: 972-3-647-4998
Fax: 972-3-647-4598
Electronic Address: cal@ddc.co.il

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 Energy & Power Multimeter*

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 Energy & Power Multimeter* to any power source

2.1 — Contents of packaging

To unpack the *ElNet Energy & Power Multimeter*

The *ElNet Energy & Power Multimeter* is packed and shipped in a carton approximately 18.5 cm long X 10.5 cm wide and 7 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 Energy & Power Multimeter.*

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

1. Your new *ElNet Energy & Power Multimeter.*
2. *ElNet* **TEXT** User Manual (This book).
3. Test Certificate and Certificate of Compliance (C.O.C).
4. 4 X two pole connector plugs
5. 2 X three pole connector plugs
6. 1 X Four pole connector plugs

2.2 — Mechanical mounting

NOTE!

Do not mount the *ElNet Energy & Power Multimeter* too close to any main electrical conductors.

Allow sufficient space to carry out maintenance to the *ElNet Energy & Power Multimeter*

The *ElNet Energy & Power Multimeter* is manufactured with a standard DIN rail mounting. To mount, simply choose a suitable location and click into position.

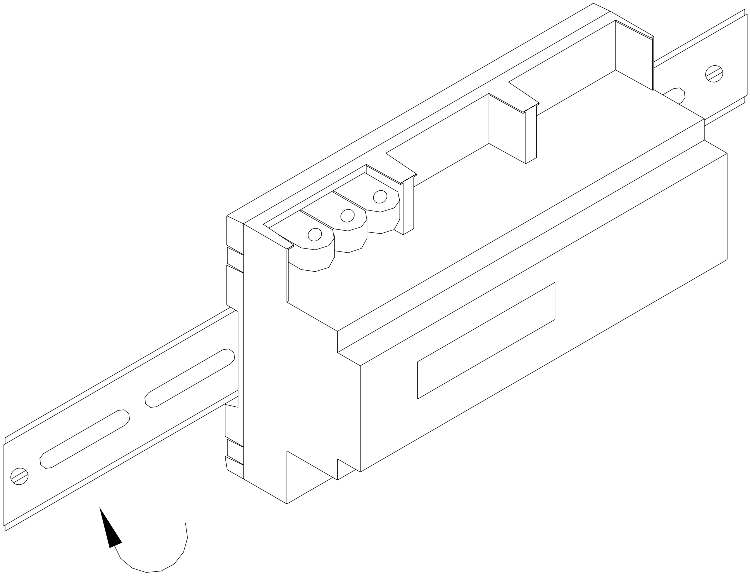


Figure 2-1. **Mount onto DIN Rail**

2.3 — Wiring Schematics

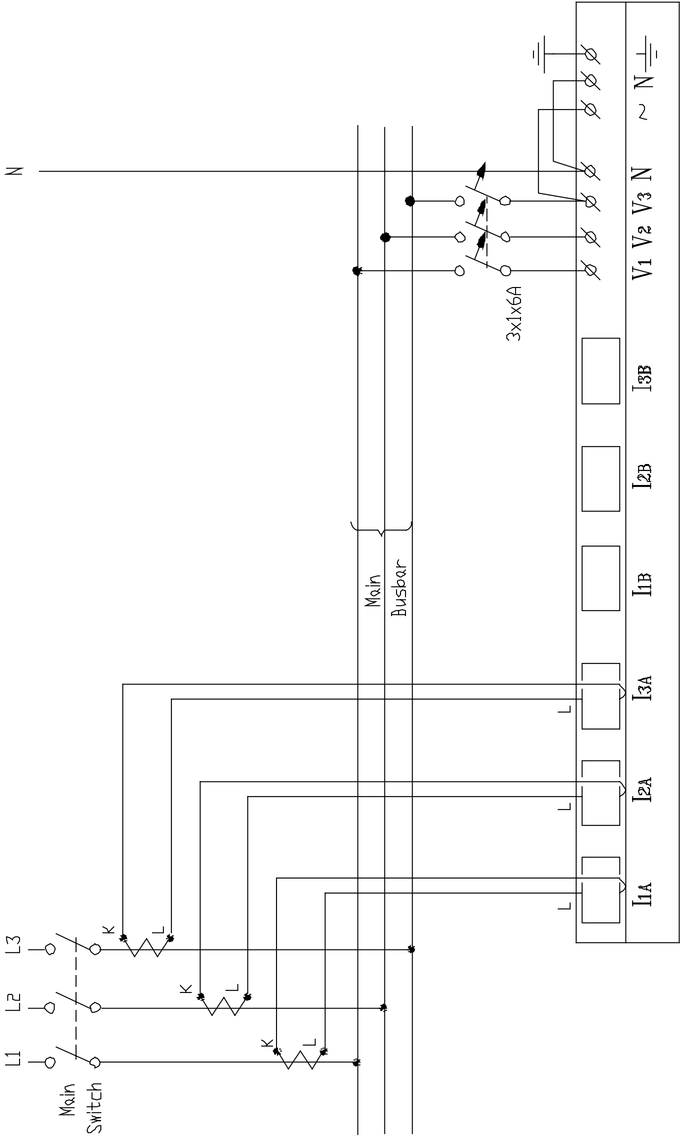

N
L1
L2
L3
Main Switch
K
L
K
L
K
L
Main Busbar
3x1x6A
L
L
L
I1A
I2A
I3A
I1B
I2B
I3B
V1 V2 V3 N
~ N

Figure 2-3. **Schematic Wiring Diagram**

2.4 — Connections

NOTE!

A future planned option the *ElNet Energy & Power Multimeter* will be the ability to measure electrical properties for two separate electrical systems. The only restrictions envisaged will be physical and geographical constraints

To connect the *ElNet Energy & Power Multimeter*

All Connections, except those to the CT core of the *ElNet Energy & Power Multimeter* are made via terminal connector plugs (Voltage input, Power Supply, earth/ground etc.).
Recommended max. tightening torque for the connector screws is 0.5 Nm
The CT cores of the *ElNet Energy & Power Multimeter* are located externally on the front of the instrument and the lead from the leg of the external Current Transformer must pass through in 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

Insert the lead from side “**L**” of the Current Transformers of **Line 1** through the top of the CT core I1A, of the *ElNet Energy & Power Multimeter.*

NOTE!

- Ensure the leads from leg **“L”** of the Current Transformer on **Line 1** passes through the top of CT core I1A.
- Ensure the other end of the lead emerging from the bottom of C T core I1A is looped back and connected to leg “K” of the Current Transformer on **Line 1**

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 Energy & Power Multimeter* by means of terminal connecto plugs.

Designation	**Description**	**Remarks**
V1	Direct from **Busbar1**	Through a 6Amp fuse
V2	Direct from **Busbar2**	Through a 6Amp fuse
V3	Direct from **Busbar3**	Through a 6Amp fuse
N	Direct from Neutral Line	
I1A	From Current Transformer on **Line1**	Note the correct direction to insert the lead
I2A	From Current Transformer on **Line2**	Note the correct direction to insert the lead
I3A	From Current Transformer on **Line3**	Note the correct direction to insert the lead
~	Power 220 V AC	Bridged from **V**3
N	Neutral	Bridged from the neutral Line
⏚	Earth/Ground	

Table 2-1 **Connections**

CHAPTER 3 — USING THE *ElNet Energy & Power Multimeter*

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 two line TEXT screen and 3 operating buttons located below the screen.

All readings are shown on the 2 X 16 text 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.

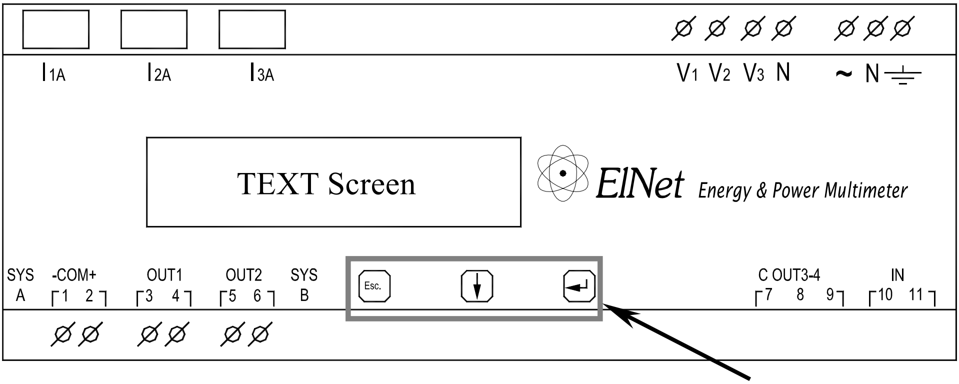

I1A
I2A
I3A
V1 V2 V3 N
~ N
TEXT Screen
ElNet Energy & Power Multimeter
SYS A
-COM+ 1 2
OUT1 3 4
OUT2 5 6
SYS B
Esc.
C OUT3-4 7 8 9
IN 10 11

Figure 3-1. **Front Panel**

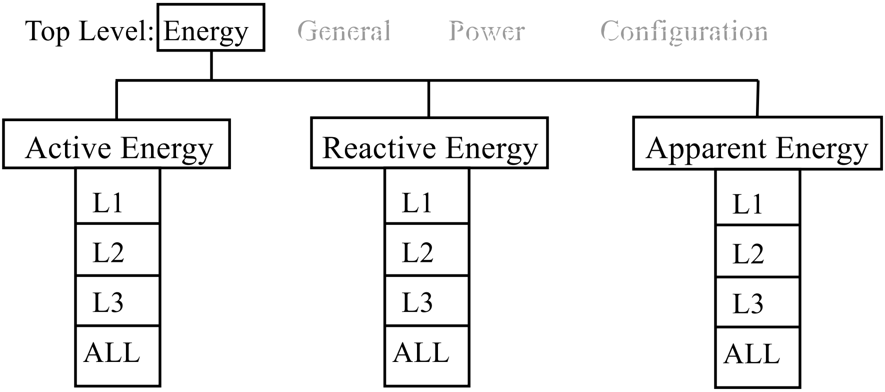
Control Buttons

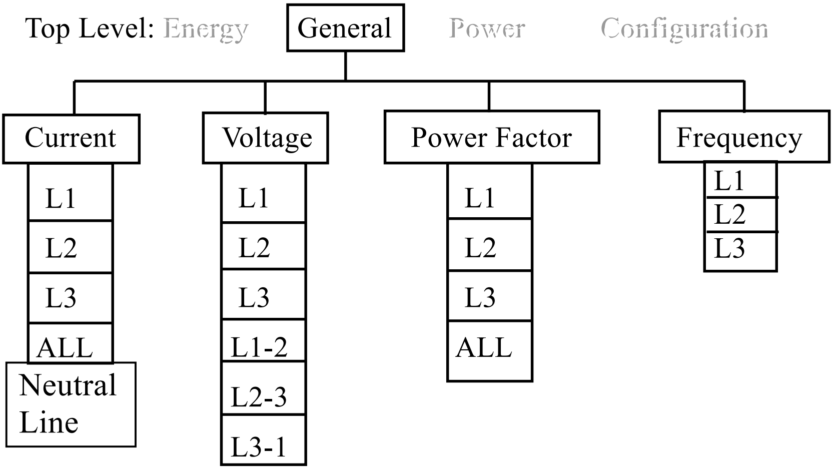
To obtain Readings

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.

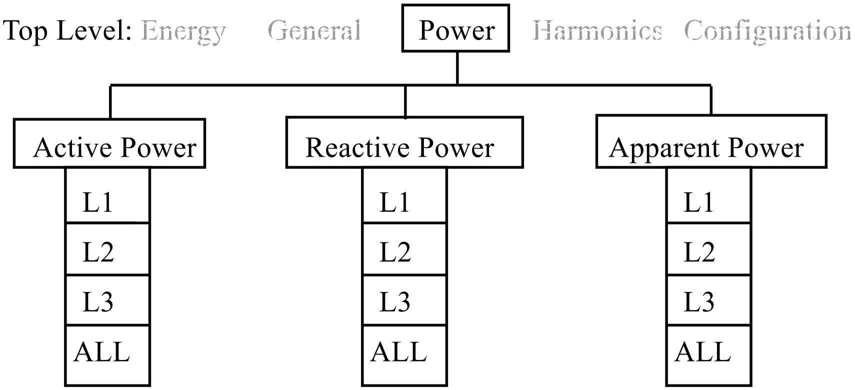
To do this, look in the lowest level for the specific reading required, then go back up and start from the top Level for that reading.

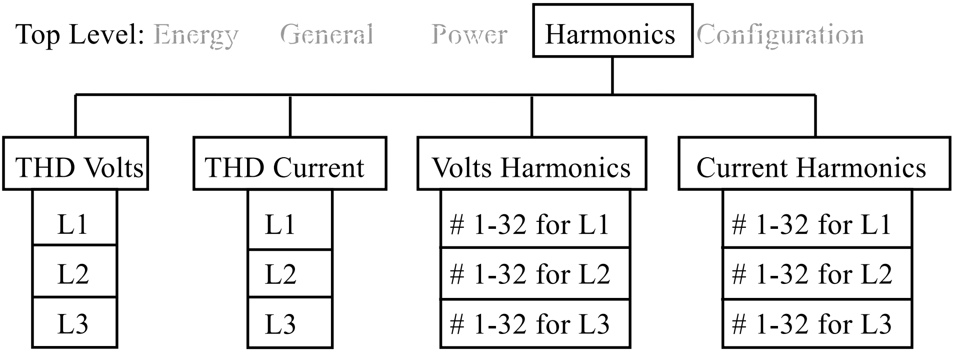
Hierarchy of Menus


Top Level:
Energy
General
Power
Configuration
Active Energy
L1
L2
L3
ALL
Reactive Energy
L1
L2
L3
ALL
Apparent Energy
L1
L2
L3
ALL

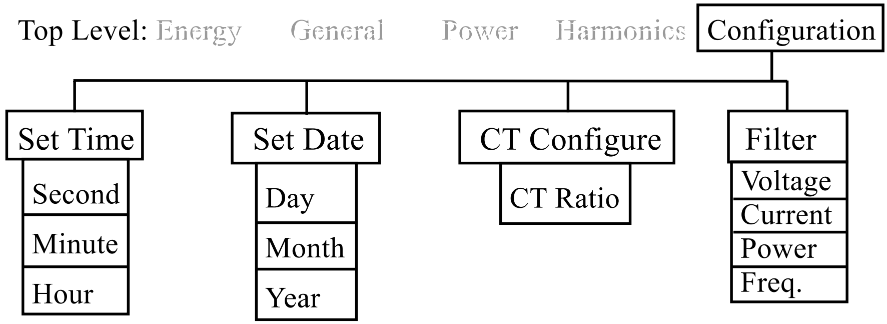

Top Level:
Energy
General
Power
Configuration
Current
L1
L2
L3
ALL
Neutral Line
Voltage
L1
L2
L3
L1-2
L2-3
L3-1
Power Factor
L1
L2
L3
ALL
Frequency
L1
L2
L3

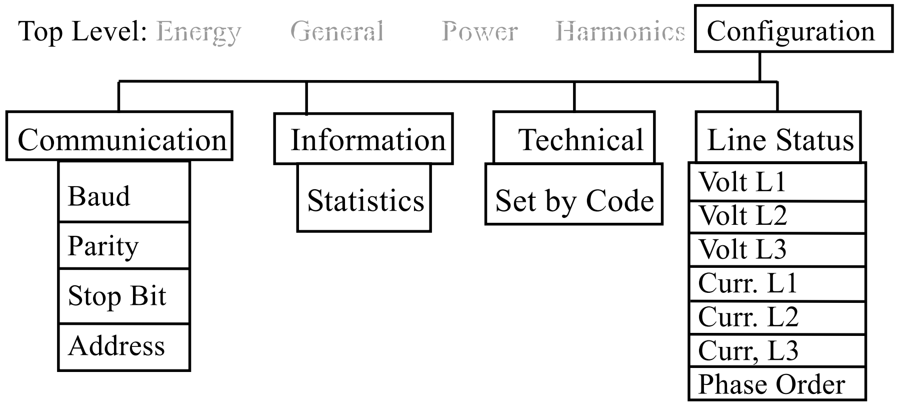
Hierarchy of Menus Continued


Top Level: Energy
General
Power
Harmonics
Configuration
Active Power
L1
L2
L3
ALL
Reactive Power
L1
L2
L3
ALL
Apparent Power
L1
L2
L3
ALL


Top Level: Energy
General
Power
Harmonics
Configuration
THD Volts
L1
L2
L3
THD Current
L1
L2
L3
Volts Harmonics
# 1-32 for L1
# 1-32 for L2
# 1-32 for L3
Current Harmonics
# 1-32 for L1
# 1-32 for L2
# 1-32 for L3

Hierarchy of Menus Continued


Top Level: Energy
General
Power
Harmonics
Configuration
Set Time
Second
Minute
Hour
Set Date
Day
Month
Year
CT Configure
CT Ratio
Filter
Voltage
Current
Power
Freq.


Top Level: Energy
General
Power
Harmonics
Configuration
Communication
Baud
Parity
Stop Bit
Address
Information
Statistics
Technical
Set by Code
Line Status
Volt L1
Volt L2
Volt L3
Curr. L1
Curr. L2
Curr, L3
Phase Order

3.2 — Control Buttons

Function of the Control Buttons

The *ElNet Energy & Power Multimeter* has three control buttons arranged below the display screen. These require slight finger pressure to click. The ***User*** and ***Senior Electrical Engineer*** use these Control Buttons to view readings and perform all the Set Up functions.

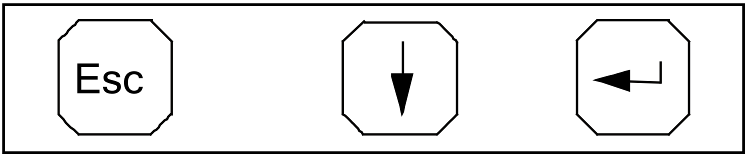


Figure 3-2. **Control Buttons**

Button ↵ moves to the next level down (the one the arrow is pointing to).

OR

selects a field to be set or changed (during Set UP)

Button ↓ is a spin control that rolls the text upwards one line per click

OR

at the lowest level, rolls to each reading of that group

OR

modifies the selected field (during Set UP)

Button Esc returns to the previous step

NOTE!

In the event of a general power failure, the ***ElNet Energy & Power Multimeter*** returns to the last screen displayed.

CHAPTER 4 — PARAMETER CONFIGURATION & SETTINGS

In this chapter you will find instructions to set the minimum settings that are necessary to allow the *ElNet Energy & Power Multimeter* to function properly.

WARNING!

- The selection, installation and settings of the Current Transformer is the most vital and fundamental action required to ensure the accurate functioning of the *ElNet Energy & Power Multimeter*.
- 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

Hierarchy Tree of Current Transformer Settings

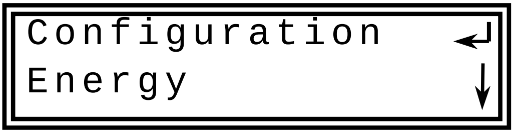
Top Level — Configuration
    2nd Level — CT Configure
        3rd Level — Set CT Screen # 1
            4th Level —Set CT Screen # 2

To set or change settings for Current Transformer

NOTE!

> The most important setting necessary for the proper functioning of the *ElNet Energy & Power Multimeter* is the Current Transformer setting.

1 From the Main Menu roll to `Configuration`



```
Configuration   ↵
Energy          ↓
```

2 Click ↵

3 Roll to `CT Configure`

```
CT Configure      ↵
Filter            ↓
```

4 Click ↵

The **Set Current Transformer** Screen # 1 appears

```
CT= 0005 -> 5
To Set CT    ...↵
```

Figure 4-1. **Set Current Transformer Screen # 1**

5 Click ↵

The **Set Current Transformer** Screen # 2 appears

```
CT= 0005 -> 5
Set CT Value
```

Figure 4-2. **Set Current Transformer Screen # 2**

6 Click ↓ to change CT Value

NOTE!

Each click rolls the value up by 5 units.

4.2 — Phase Order Check

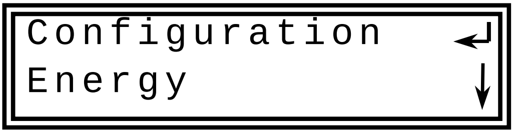
NOTE!

To avoid any problems arising from incorrect Voltage Connections or accidental reversal of Current Transformer Connections, it is necessary to perform a Phase Order Check before continuing.

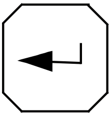
Top Level — Configuration
  2nd Level — Line Status
    3rd Level — Check Line Status **Volts Line 1,2 & 3**
      Check Line Status **Current Line 1,2 & 3**
      Check **Phase Order**

To perform Line Status Check (Connection Check) & Phase Order Check

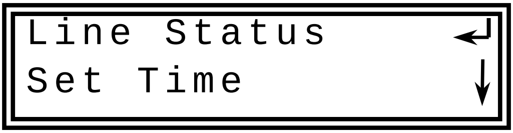
1 From the Main Menu roll to `Configuration`



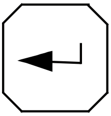
```
Configuration  ↵
Energy         ↓
```

2 Click 

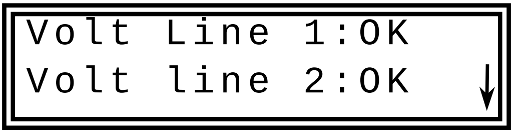
3 Roll to `Line Status`



```
Line Status    ↵
Set Time       ↓
```

4 Click 

The **Line Status & Phase Order** screen appears



```
Volt Line 1:OK
Volt line 2:OK  ↓
```

Figure 4-3. **Check Volt & Current Connections**

5 Roll to `Volts Line1,2 & 3`

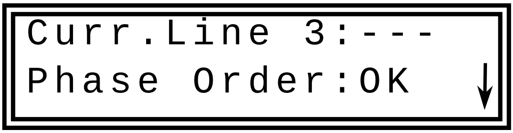
6 Roll to `Curr. Line1,2 & 3`

Voltage and Current Messages

Table 4-1 **Voltage and Current Messages**

Message	Voltage	Current
OK	Voltage present on Lines	Current present in Lines and synchronized with Voltage Lines
OPP	Not Applicable	Wired in incorrect direction
NO	No Voltage	No current

7 Roll to Phase Order



```
Curr.Line 3:---
Phase Order:OK  ↓
```

Figure 4-4. **Check Phase Order**

Phase Order Messages

Message	Voltage
OK	Correct Phase Order of Voltage Connections
OPP	Incorrect Phase Order i.e. Line 2 does not follow Line 1 and/or Line 1 does not follow Line3

Table 4-2 **Phase Order Messages**

4.3 — Clock Settings

Hierarchy Tree of Clock Settings

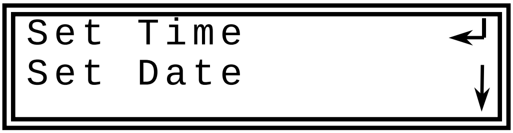
Top Level — Configuration
    2nd Level — Set Time
        3rd Level — Set Time Screen # 1
            4th Level —Set Time Screen # 2

To set Time

1 From the Main Menu roll to `Configuration`

2 Click ↵

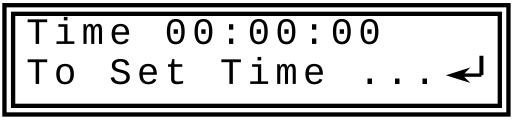
3 Roll to `Set Time`



```
Set  Time       ↵
Set  Date       ↓
```

4 Click ↵

The **Set Time** Screen # 1 appears

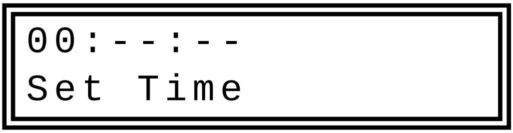


```
Time 00:00:00
To Set Time ...↵
```

Figure 4-5. **Set Time Screen # 1**

5 Click ↵

The **Set Time** Screen # 2 appears



```
00:--:--
Set Time
```

Figure 4-6. **Set Time Screen # 2**

Click ↵ to select Hours Minutes Seconds

Click ↓ to change Hours (24 hour clock), Minutes, Seconds

4.4 — Date Settings

Hierarchy Tree of Date Settings

Top Level — Configuration
  2nd Level — Set Date
    3rd Level — Set Date Screen # 1
      4th Level —Set Date Screen # 2

To set Date

1 From the Main Menu roll to `Configuration`

2 Click ↵

3 Roll to `Set Date`

```
Set Date          ↵
CT Configure      ↓
```

4 Click ↵

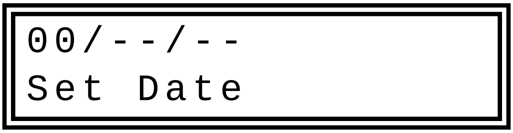
The **Set Date** Screen # 1 appears

```
Date 00/00/00
To Set Date ...↵
```

Figure 4-7. **Set Date Screen # 1**

5 Click ↵

The **Set Date** Screen # 2 appears



```
00/--/--
Set Date
```

Figure 4-8. **Set Date Screen # 2**

Click ↵ to select Day, Month, Year (up to 99)

Click ↓ to change, Day, Month, Year

4.5 — Filter Settings

All readings in the *ElNet Energy & Power Multimeter* are read and displayed every second. In a “noisy” system these readings would show wild fluctuations. Fluctuations can be “smoothed” out by applying Time Average Filters.

Time Average Filters utilizes the “Sliding Window” method. A calculation is made of the sum of a preset number of readings, divided by the same number to gives a new continuously moving average. This new calculated reading appears as the new reading every second

Recommended factory setting = 3 seconds.

NOTE!

The Time Average Filter does not affect any internal calculations or accumulation of data.

Hierarchy Tree of Filter Settings

Top Level — Configuration
    2nd Level — Set Filter
        3rd Level — Set Voltage Filter
                        Set Current Filter
                        Set Power Filter
                        Set Frequency Filter

To set Voltage, Current, Power, or Frequency Filters

All 4 Filter settings procedures are identical

1 From the Main Menu roll to `Configuration`

2 Click ↵

3 Roll to `Filter`

4 Click ↵

5 Roll to either Voltage, Current, Power, or Frequency Filters

6 Click ↵

The **Set Filter** screen appears

```
Volt.Filter=   1
Press ↵ To Set
```

Figure 4-9. **Set Filter Screen**

7 Click ↵ to set Filter (one second per click)

NOTE!

Filter settings can be set between 1 and 50 seconds

4.6 — Reset Energy Values

Hierarchy Tree of Reset Energy Values

Top Level — Configuration
    2nd Level — Technical

To Reset Energy Values

1 From the Main Menu roll to `Configuration`

2 Click ↵

3 Roll to `Technical`

4 Hold ↵ for 4 seconds

The **Enter Command Code** screen appears

```
Enter Cmd Code
   000
```

Figure 4-10. **Enter Command Code**

5 Roll the code till **642**

6 Click ↵

NOTE!

> If you overrun the code, continue to 999 and start again.

The **Energy Reset** screen appears for 1 second

```
Energy Reset..
Done !!
```

Figure 4-11. **Energy Reset**

CHAPTER 5 — Text Panel Displays

In this chapter you will find instructions on how to obtain the readings that the *ElNet Energy & Power Multimeter* provides, e.g., Current, Voltage Power, Power Factor, Energy, and Harmonics.

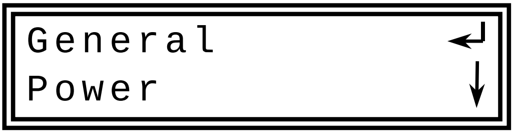
5.1 — Current

Hierarchy Tree of Current displays

Top Level — General
    2nd Level — Current
        3rd Level — Current for **Line 1 Line 2 & Line 3**

To display Current for all 3 Phases

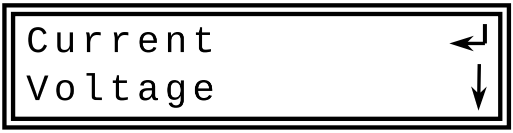
1 From the Main Menu roll to `General`



```
General   ↵
Power     ↓
```

2 Click ↵

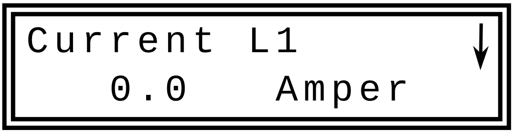
3 Roll to `Current`



```
Current          ↵
Voltage          ↓
```

4 Click ↵

The **Current Screen** Appears



```
Current L1       ↓
   0.0   Amper
```

Figure 5-1. **Current Screen**

5 Roll to `Current` Line 2 and Line 3

6 Click Esc to return to `General` Menu

7 Click Esc to return to Main Menu

5.2 — Current in Neurtal Line

By using Vector calculations the *ElNet Energy & Power Multimeter* calculates the Current in the Neutral Line.

To display Current in Neutral Line

Repeat Steps 1 to 5 as found in Section 5.1.

6 Roll to `Current In Neutral line`

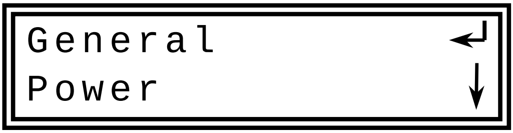
5.3 — Voltage

Hierarchy Tree of Voltage displays

Top Level — General
  2nd Level — Voltage
    3rd Level — Voltage for **Line 1 Line 2 & Line 3**
      Voltage between **Line 1-2 Line 2-3 Line 3-1**

To display Voltage for all 3 Phases and across Phases

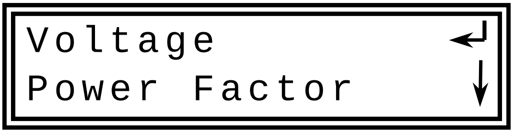
1 From the Main Menu roll to `General`



```
General ↵
Power   ↓
```

2 Click ↵

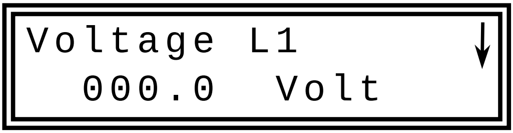
3 Roll to `Voltage`



```
Voltage          ↵
Power Factor     ↓
```

4 Click ↵

The **Voltage Screen** Appears



```
Voltage L1       ↓
  000.0  Volt
```

Figure 5-2. **Voltage Screen**

5 Roll to Voltage **Line 2, Line 3**
Voltage between **Line 1-2 Line 2-3 Line 3-1**

Parameter	Description	Units
L1	Voltage from **Line1** to Neutral	Volts
L2	Voltage from **Line2** to Neutral	Volts
L3	Voltage from **Line3** to Neutral	Volts
L12	Voltage across **Line1** and **Line2**	Volts
L23	Voltage across **Line2** and **Line3**	Volts
L13	Voltage across **Line1** and **Line3**	Volts

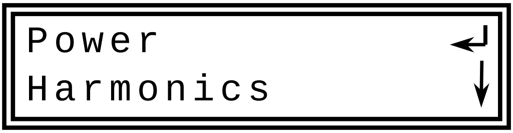
5.4 — Active Power (P)

Hierarchy Tree of Active Power displays

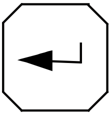
Top Level — Power
2nd Level — Active Power
3rd Level —Active Power for **Line 1 Line 2 & Line 3**
Active Power for **All Lines**

To display Active Power for all 3 phases

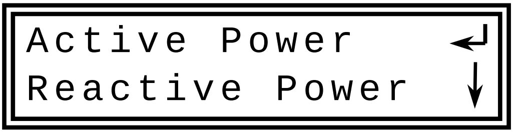
1 From the Main Menu roll to `Power`



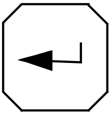
```
Power       ↵
Harmonics   ↓
```

2 Click 

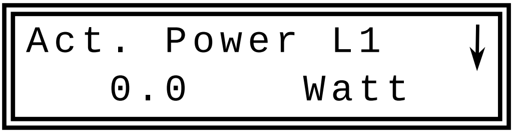
3 Roll to `Active Power`



```
Active Power       ↵
Reactive Power     ↓
```

4 Click 

The **Active Power** Screen Appears



```
Act. Power L1      ↓
   0.0     Watt
```

Figure 5-3. **Active Power Screen**

5 Roll to Active Power Line 2, Line 3, ALL

Parameter	Description	Unit
P	Active Power for each Line	Watts
Q	Reactive Power for each Line	VAR
S	Apparent Power for each Line	VA
Σ P	Total Active Power for all 3 Lines	Watts
Σ Q	Total Reactive Power for all 3 Lines	VAR
Σ S	Total Apparent Power for all 3 Lines	VA
PF	Power Factor	

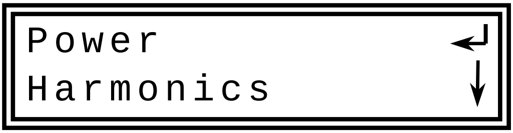
5.5 — Reactive Power (Q)

Hierarchy Tree of Reactive Power displays

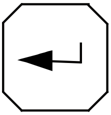
Top Level — Power
    2nd Level — Reactive Power
        3rd Level —Reactive Power for **Line 1 Line 2 & Line 3**
            Reactive Power for **All Lines**

To display Reactive Power for all 3 phases

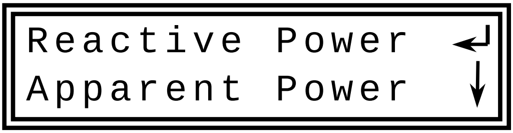
1 From the Main Menu roll to `Power`



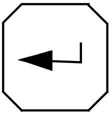
```
Power      ↵
Harmonics  ↓
```

2 Click 

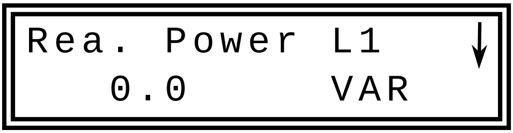
3 Roll to `Reactive Power`



```
Reactive Power  ↵
Apparent Power  ↓
```

4 Click 

The **ReActive Power Screen** Appears



```
Rea. Power L1      ↓
   0.0      VAR
```

↵

Figure 5-4. **Reactive Power Screen**

5 Roll to `Active Power` Line 2, Line 3, ALL

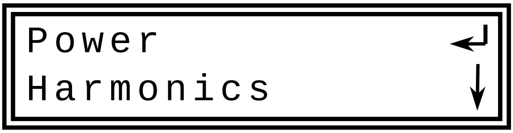
5.6 — Apparent Power (S)

Hierarchy Tree of Reactive Power displays

Top Level — Power
  2nd Level — Apparent Power
    3rd Level — Apparent Power for **Line 1 Line 2 & Line 3**
      Apparent Power for **All Lines**

To display Apparent Power for all 3 phases

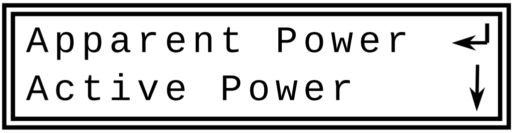
1 From the Main Menu roll to `Power`



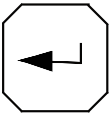
```
Power              ↵
Harmonics          ↓
```

2 Click ↵

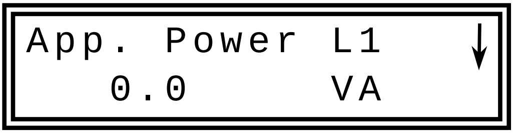
3 Roll to `Apparent Power`



```
Apparent Power ↵
Active Power   ↓
```

4 Click 

The **Apparent Power Screen** Appears



```
App. Power L1  ↓
   0.0     VA
```

Figure 5-5. **Apparent Power Screen**

5 Roll to `Apparent Power` Line 2, Line 3, ALL

5.7 — Overall Power Factor and PF for each Phase

Hierarchy Tree of Power Factor displays

Top Level — General
    2nd Level —Power Factor
        3rd Level —Power Factor **Line 1 Line 2 & Line 3 ALL**

To display Power Factor for all 3 phases

1 From the Main Menu roll to `General`

2 Click ↵

3 Roll to `Power Factor`

```
Power Factor     ↵
Frequency        ↓
```

4 Click ↵

The **Power Factor Screen** Appears

```
Power Factor     ↓
   0.0
```

Figure 5-6. **Power Factor Screen**

5 Roll to `Power Factor` Line 2, Line 3, ALL

5.8 — Frequency

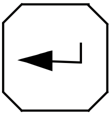
Hierarchy Tree of Frequency displays.

Top Level — General
  2nd Level — Frequency
    3rd Level — Frequency for **Line 1 Line 2 & Line 3**

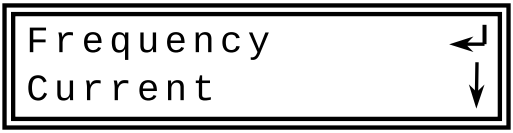
To display Frequency for all 3 phases

1 From the Main Menu roll to `General`

2 Click

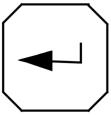


3 Roll to `Frequency`

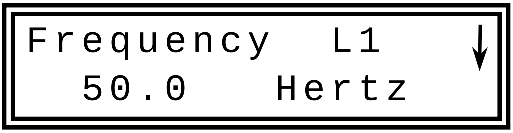


```
Frequency      ↵
Current        ↓
```

4 Click



The **Frequency Screen** Appears



```
Frequency   L1   ↓
   50.0    Hertz
```

Figure 5-7. **Frequency Screen**

5 Roll to `Frequency` line1, Line 2, Line 3.

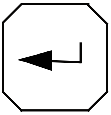
5.9 — Active Energy

Hierarchy Tree of Active Energy displays

Top Level — Energy
  2nd Level — Active Energy
    3rd Level — Active Energy for **Line 1 Line 2 & Line 3**
      Active Energy for **All Lines**

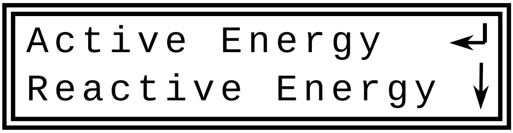
To display Active Energy for all 3 phases

1 From the Main Menu roll to `Energy`

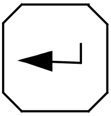


2 Click

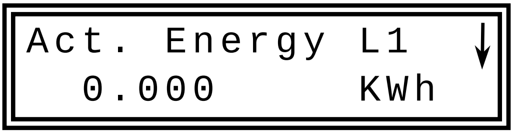
4 Roll to `Active Energy`



```
Active Energy   ↵
Reactive Energy ↓
```

5 Click 

The **Active Energy** Screen Appears



```
Act. Energy L1   ↓
  0.000      KWh
```

Figure 5-8. **Active Energy Screen**

6 Roll to `Active Energy` Line 1, Line 2, Line 3, ALL

5.10 — Reactive Energy

Hierarchy Tree of Reactive Energy displays

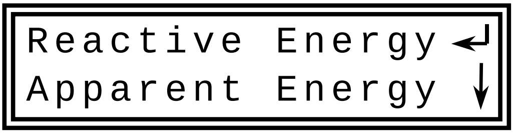
Top Level — Energy
  2nd Level — Reactive Energy
    3rd Level — Reactive Energy for **Line 1 Line 2 & Line 3**
      Reactive Energy for **All Lines**

To display Reactive Energy for all 3 phases

1 From the Main Menu roll to `Energy`

2 Click ↵

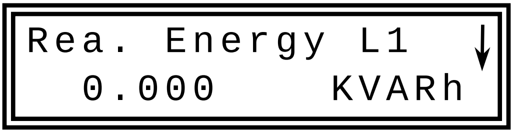
3 Roll to `Reactive Energy`



```
Reactive Energy ↵
Apparent Energy ↓
```

4 Click ↵

The **ReActive Energy** Screen Appears



```
Rea. Energy L1   ↓
  0.000     KVARh
```

Figure 5-9. **Active Energy Screen**

5 Roll to `Reactive Energy` Line 2, Line 3, ALL

5.11 — Apparent Energy

Hierarchy Tree of Apparent Energy displays

Top Level — Energy
    2nd Level — Apparent Energy
        3rd Level — Apparent Energy for **Line 1 Line 2 & Line 3**
            Apparent Energy for **All Lines**

To display Apparent Energy for all 3 phases

1 From the Main Menu roll to `Energy`

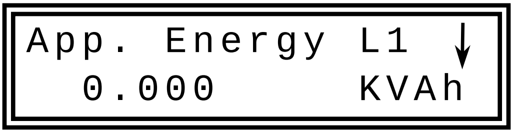
2 Click ↵

3 Roll to `Apparent Energy`

```
Apparent Energy ↵
Taoz (Rates)    ↓
```

4 Click ↵

The **Apparent Energy** Screen Appears



```
App. Energy L1  ↓
  0.000      KVAh
```

Figure 5-10. **Apparent Energy Screen**

5 Roll to `Apparent Energy` Line 2, Line 3, ALL

5.12 — Harmonics

NOTE!

> Poor Harmonics could invoke a fine and can be improved by adding capacitors or simply switching a suspect appliance off and noting any improvement.

The *ElNet Energy & Power Multimeter* is capable of displaying Volt and Current Harmonics.

In addition, Total Harmonics Distortion (THD) for Volts and Current can also be displayed on the TEXT Screen.

5.12.1.— Voltage Total Harmonic Distortion (THD)

Hierarchy Tree of Voltage Total Harmonic Distortion displays

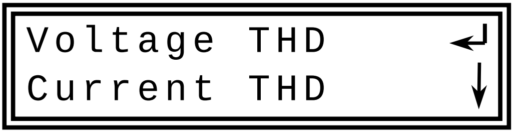
Top Level — Harmonics
  2nd Level — Voltage THD
    3rd Level — Voltage THD. % for **Line 1**, **Line 2 & Line 3**

To display Voltage Total Harmonic Distortion (THD)

1 From the Main Menu roll to `Harmonics`

2 Click ↵

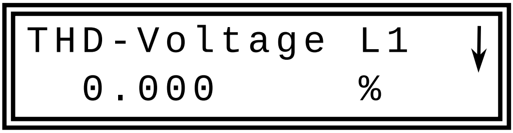
3 Roll to `Voltage THD`



```
Voltage THD     ↵
Current THD     ↓
```

4 Click ↵

The **THD – Voltage** Screen Appears



```
THD-Voltage L1  ↓
  0.000     %
```

Figure 5-11.**Voltage Total Harmonics Distortion Screen**

5 Roll to `THD Voltage` for Line 2 and Line 3

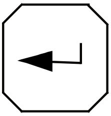
5.12.2.— Current Total Harmonic Distortion (THD)

Hierarchy Tree of Current Total Harmonic Distortion displays

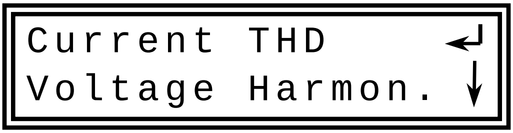
Top Level — Harmonics
    2nd Level — Current THD
        3rd Level —Current THD. % for **Line 1**, **Line 2 & Line 3**

To display Current Total Harmonic Distortion (THD)

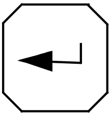
1 From the Main Menu roll to `Harmonics`

2 Click 

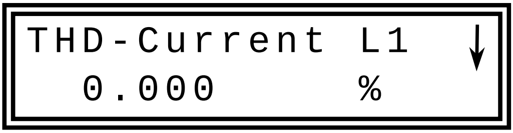
3 Roll to `Current THD`



```
Current THD      ↵
Voltage Harmon.  ↓
```

4 Click 

The **THD –Current** Screen Appears



```
THD-Current L1   ↓
  0.000     %
```

Figure 5-12.**Current Total Harmonics Distortion Screen**

5 Roll to `THD Current %` for Line 2 and Line 3

5.12.3.— Voltage Harmonics

Hierarchy Tree of Volt Harmonics displays

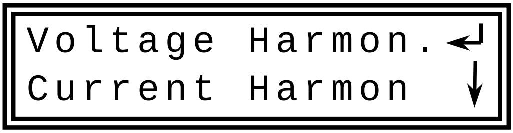
Top Level — Harmonics
    2nd Level — Voltage Harmonics
        3rd Level — Volt Harmonics from 1st to 32nd for **Line 1**,**2 &3**

To display Volt Harmonics From 1st to 32nd

1 From the Main Menu roll to `Harmonics`

2 Click ↵

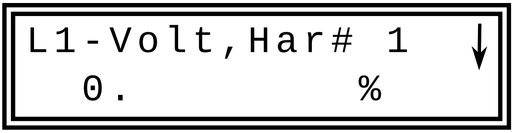
3 Roll to `Voltage Harmonics`



```
Voltage Harmon.↵
Current Harmon  ↓
```

4 Click ↵

The **Voltage Harmonics** Screen Appears



```
L1-Volt,Har# 1  ↓
  0.         %
```

Figure 5-13.**Volt Harmonics from 1st to 32nd Screen**

5 Click ↓ to change to **Line 1, Line 2 & Line 3**

6 Click ↵ to read Harmonics % from 1st to 32

5.12.4.— Current Harmonics

Hierarchy Tree of Current Harmonics displays

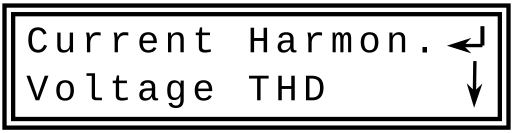
Top Level — Harmonics
    2nd Level — Current Harmonics
        3rd Level — Current Harmonics from 1st to 32nd **Line 1,2 &3**

To display Current Harmonics From 1st to 32nd

1 From the Main Menu roll to `Harmonics`

2 Click ↵

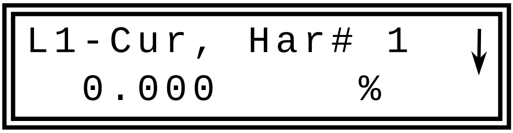
3 Roll to `Current Harmonics`



```
Current Harmon.↵
Voltage THD    ↓
```

4 Click ↵

The **Current Harmonics** Screen Appears



```
L1-Cur, Har# 1   ↓
  0.000     %
```

Figure 5-14.**Current Harmonics from 1st to 32nd Screen**

5 Click ↓ to change to Line 1, Line 2 & Line 3

6 Click ↵ to read Harmonics % from 1st to 32

CHAPTER 6 — Communications

MODBUS Protocol

The *ElNet Energy & Power Multimeter* has a serial interface port allowingt 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 iniate 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 Energy & Power Multimeter* 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 (Powermeter) then assumes that the next byte received will be an address. The maximum query and response message length is 256 bytes includuing 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 it's 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 Energy & Power Multimeter* uses and responds to four standard Message Format Functions.

Function 03
Function 04
Function 06
Function 16

Function	Meaning in MODBUS	Action
Function 03	Read holding register	Obtain data from Powermeter (Read register)
Function 04	Read input register	Obtain data from Powermeter (Read register)
Function 06	Preset single register	Transmit data to Powermeter (Write single register)
Function 16	Preset multiple register	Transmit data to Powermeter (Write multiple registers)

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 particuler action or respond to a query. The reply message from the Powermeter will be information contained in one or more of it's 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 Energy & Power Multimeter*

The *ElNet Energy & Power Multimeter* is capable of supporting either Function 03 or Function 04 Message Format(See Table 1-3). 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 qeuery was originally sent.

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

No	MODBUS Register	Field Description	Type
1	1-2	Voltage Line 1	Read
2	3-4	Voltage Line 2	Read
3	5-6	Voltage Line 3	Read
4	7-8	Voltage between line 1 and Line 2	Read
5	9-10	Voltage between line 2 and Line 3	Read
6	11-12	Voltage between line 3 and Line 1	Read
7	13-14	Current in Line 1	Read
8	15-16	Current in Line 2	Read
9	17-18	Current in Line 3	Read
10	19-20	Active Power Line 1	Read
11	21-22	Active Power Line 2	Read
12	23-24	Active Power Line 3	Read
13	25-26	Combined Active Power Line 1+2 +3	Read
14	27-28	Apparent Power Line 1	Read
15	29-30	Apparent Power Line 2	Read
16	31-32	Apparent Power Line 3	Read
17	33-34	Combined Apparent Power Line 1+2+3	Read
18	35-36	Reactive Power Line 1	Read
19	37-38	Reactive Power Line 2	Read
20	39-40	Reactive Power Line 3	Read
21	41-42	Combined Reactive Power Line 1+2+3	Read
22	43-44	Power Factor Line 1	Read
23	45-46	Power Factor Line 2	Read
24	47-48	Power Factor Line 3	Read

25	49-50	Combined Power Factor for Line 1+2+3	Read
26	51-52	Frequency Line 1	Read
27	53-54	Frequency Line 2	Read
28	55-56	Frequency Line 3	Read
29	57-58	Current Neutral Line	Read
30	59-60		
31	61-62		
32	63-64		
33	65-66		
34	67-68		
35	69-70		
36	71-72		
37	73-74		
38	75-76		
39	77-78		
40	79-80	Active Energy	Read
41	81-82	Reactive Energy	Read
42	83-84	Apparent Energy	Read
43	85-86		Read
44	87-88	Time from 01 01 2000 in seconds	Read
45	89-90	ADDRESS	Read
46	91-92	BAUD RATE	Read
47	93-94	PARITY	Read
48	95-96	Current Transformer Ratio	Read/Write
49	97-98	Timed average Voltage	Read/Write
50	99-100	Timed average Current	Read/Write

51	101-102	Timed average Power	Read/Write
52	103-104	Timed avaerge Frequqncy	Read/Write
53	105-106	THD for Volts Line 1	Read
54	107-108	THD for Volts Line 2	Read
55	109-110	THD for Volts Line 3	Read
56	111-112	THD for Current Line 1	Read
57	113-114	THD for Current Line 2	Read
58	115-116	THD for Current Line 3	Read
59			
60	119-120	Active Power Line 1	Read
61	121-122	Active Power Line 2	Read
62	123-124	Active Power Line 3	Read
63	125-126	Reactive Power Line 1	Read
64	127-128	Reactive Power Line 2	Read
65	129-130	Reactive Power Line 3	Read
66	131-132	Apparent Power Line 1	Read
67	133-134	Apparent Power Line 2	Read
68	135-136	Apparent Power Line 3	Read
301	601-602	1st Harmonics for Volts **Line 1**	Read
302	603-604	2nd Harmonics for Volts **Line 1**	Read
⇓	⇓	⇓	⇓
331	661-662	31st Harmonics for Volts **Line 1**	Read
332	663-664	32nd Harmonics for Volts **Line 1**	Read
333	665-666	1st Harmonics for Volts **Line 2**	Read

334	667-668	2nd Harmonics for Volts **Line 2**	Read
⇓	⇓	⇓	⇓
363	725-726	31st Harmonics for Volts **Line 2**	Read
364	727-728	32nd Harmonics for Volts **Line 2**	Read
365	729-730	1st Harmonic for Volts **Line 3**	Read
366	731-732	2nd Harmonics for Volts **Line 3**	Read
⇓	⇓	⇓	⇓
395	789-790	31st Harmonics for Vots **Line 3**	Read
396	791-792	32nd Harmonics for Volts **Line 3**	Read
397	793-794	1st Harmonics for Current **Line 1**	Read
398	795-796	2nd Harmonics for Current **Line 1**	Read
⇓	⇓	⇓	⇓
427	853-854	31st Harmonics for Current **Line 1**	Read
428	855-856	32nd Harmonics for Current **Line 1**	Read
429	857-858	1st Harmonics for Current **Line 2**	Read
430	859-860	2nd Harmonics for Current **Line 2**	Read
⇓	⇓	⇓	⇓
459	917-918	31st Harmonics for Current **Line 2**	Read
460	919-920	32nd Harmonicsfor Current **Line 2**	Read
461	921-922	1st Harmonics for Current **Line 3**	Read
462	923-924	2nd Harmonics for Current **Line 3**	Read
⇓	⇓	⇓	⇓
491	981-982	31st Harmonics for Current **Line 3**	Read
492	983-984	32nd Harmonics for Current **Line 3**	Read

Table 6-4 **Registers**

6.3 — Communication Connections

The *ElNet Energy & Power Multimeter* communicates through RS485. The connections can be seen from the front, (bottom left) and are made by means of the connectors provided.

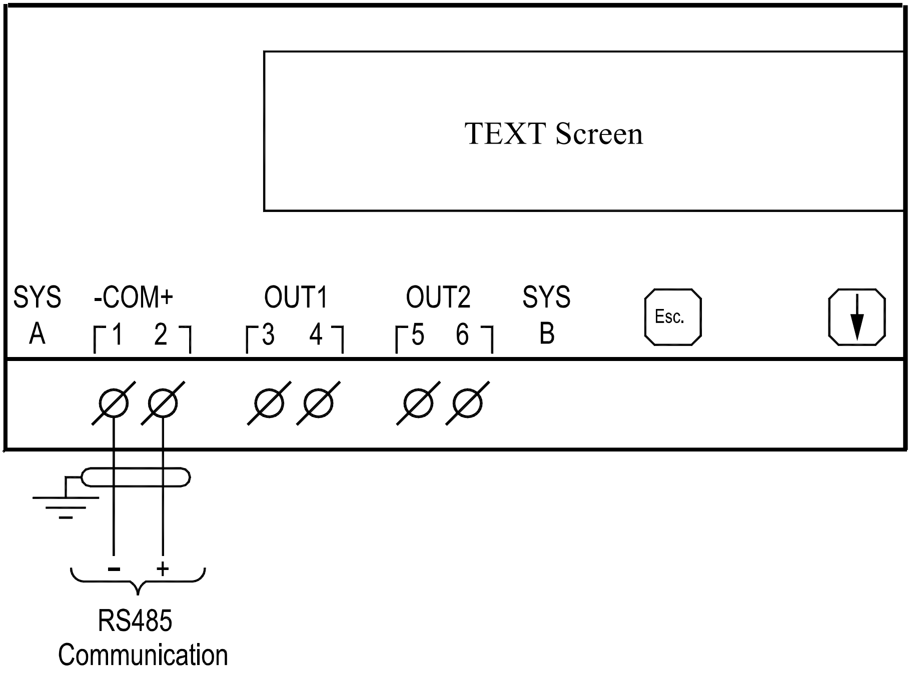

TEXT Screen
SYS A
-COM+
1 2
OUT1
3 4
OUT2
5 6
SYS B
Esc.
–
+
RS485
Communication

Figure 6-1. **Communication Connections**

Pin Designation	Description
COM – 1	– of RS485
COM + 2	+ of RS485
⏚	Earth/Ground

Table 6-5 **Connections**

6 4 — Communication Settings

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

Address
Baud Rate
Parity
Stop Bit

6.4.1 — Address

Each Powermeter in a communication system must have it's own unique address.

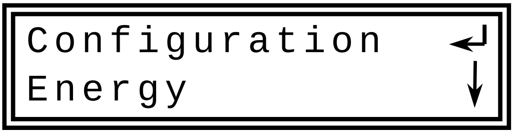
Because the *ElNet Energy & Power Multimeter* works on MODBUS, the available addresses are from '1' to '31'

Hierarchy Tree of Address Setup

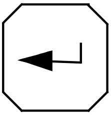
Top Level — Configuration
    2nd Level — Communication
        3rd Level — Address

To set up Address

1 From the Main Menu roll to `Configuration`

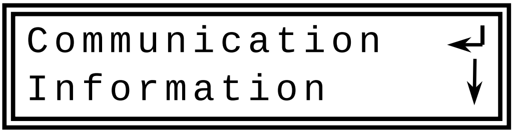


```
Configuration  ↵
Energy         ↓
```

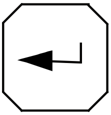


2 Click

3 Roll to `Communication`

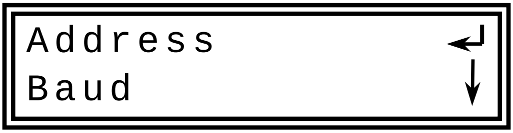


```
Communication  ↵
Information    ↓
```



4 Click

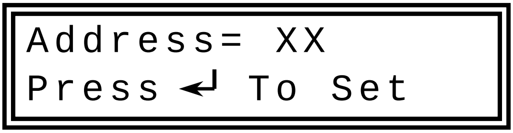
5 Roll to `Address`



```
Address        ↵
Baud           ↓
```

6 Click ↵

The **Set Address** Screen # 1 appears



```
Address= XX
Press ↵ To Set
```

Figure 6-2. **Set Address Screen**

7 Click ↵ to set Address

6.4.2 — Baud Rate

The Baud Rate is the communication speed in Bits per second (BPS) that the *ElNet Energy & Power Multimeter* communicates with the PC **master**. 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 Energy & Power Multimeter: -*

300 bps
600 bps
1200 bps
2400 bps

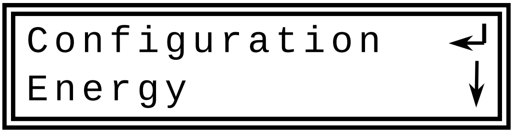
4800 bps
9600 bps
19200 bps
38400 bps

Hierarchy Tree of Baud Rate Setup

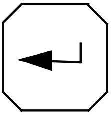
Top Level — Configuration
  2nd Level — Communication
    3rd Level — Baud Rate

To set Baud Rate

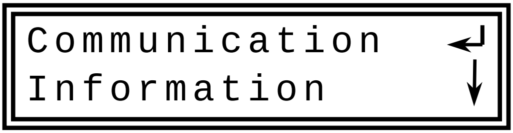
1 From the Main Menu roll to `Configuration`



```
Configuration  ↵
Energy         ↓
```

2 Click 

3 Roll to `Communication`



```
Communication  ↵
Information    ↓
```

4 Click ↵

5 Roll to Baud

```
Baud          ↵
Parity        ↓
```

6 Click ↵

The **Set Baud** Screen appears

```
Baud=     XXXXX
Press ↵ To Set
```

Figure 6-3. **Set Baud Rate Screen**

7 Click ↵ to change Baud Rate

6.4 3 — Parity

The choices of parity are either EVEN or NONE.

Hierarchy Tree of Parity Setup

Top Level — Configuration
  2nd Level — Communication
    3rd Level — Parity

To set Parity

1 From the Main Menu roll to `Configuration`

2 Click ↵

3 Roll to `Communication`

```
Communication  ↵
Information    ↓
```

4 Click ↵

5 Roll to `Parity`

```
Parity         ↵
Stop Bit       ↓
```

6 Click ↵

The **Set Parity** Screen appears

```
Parity=XXXX
Press ↵ To Set
```

Figure 6-4. **Set Parity Screen**

6.4.4 — Stop Bit

The choice of parity is either 1 or 2.

Hierarchy Tree of Stop Bit Setup

Top Level — Configuration
    2nd Level — Communication
        3rd Level — Stop Bit

To set Stop Bit

1 From the Main Menu roll to `Configuration`

2 Click ↵

3 Roll to `Communication`

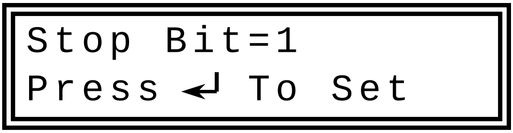
```
Communication  ↵
Information    ↓
```

4 Click ↵

5 Roll to `Stop Bit`

6 Click ↵

The **Set Stop Bit** Screen appears



```
Stop Bit=1
Press ↵ To Set
```

Figure 6-5. **Set Stop Bit Screen**

CHAPTER 7 — Specifications

Item	Description
Power requirements	110/230VAC,60/50 Hz, 30VA
Dimensions	(HxWxD) 96x159x57 mm
Shipping Weight	450 gr
Voltage limits	1000VAC
Current limits	50A
Enclosure material	ABS + Antiflame
Display	Liquid Crystal 2 X 16
Operating temperature	-20 - + 60 C
Storage temperature	-20 - + 80 C
Humidity	0- 90 RH%
Voltage input terminals	VL – E10 1708
Communication port	RS485
Mounting	Standard DIN Rail
Overload Protection	1 Amp Fuse

All technical specifications are subject to change without notice.

Appendix A — Installation & Configuration Check List

INSTALLATION CHECK LIST

Description	Date	Signature
Check contents of packaging		
Remove from packaging		
Mount Multimeter		
Connect Multimeter power supply		
Connect 3 Current Transformer		
Connect 3 Voltage lines		
Connect Neutral line		
Set parameter for Current Transformer		
Connect Communication lines		

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