

USER'S MANUAL

EMPOWER POWER METER

This document contains the latest technical information about Empower which is a micro-controller based Power meter. The product Empower is sophisticated electronic equipment, and the user is advised to read this User's Manual carefully before attempting to install or operate the equipment.

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Contents

Introduction 4
 The Main Features Available in This Model..... 4
 Front View of the Unit 4
 Technical Specifications 5

Installation and Commissioning..... 6
 Back View 9
 RS485 Connection 10

Operational Details 11
 Programming Mode 12
 Setting CT- primary 12
 Setting a unit address for RS485 port..... 13

 Run Mode 14
 Run Mode Displays 14
 Freezing and unfreezing the displays 17

Communication 18
 Modbus RTU on RS485 Port 18
 Appendix..... 19

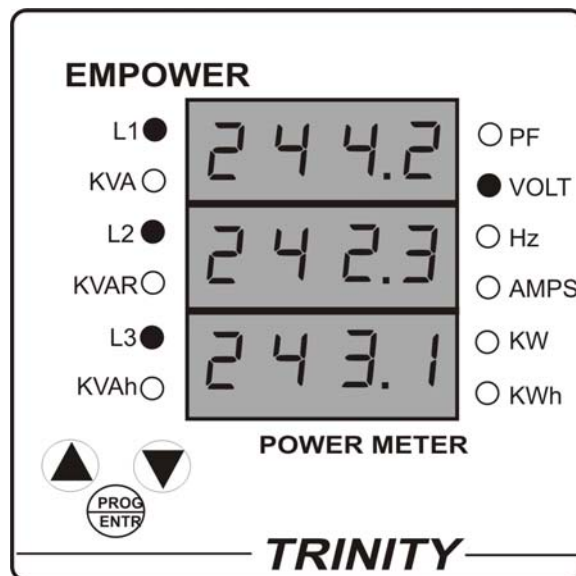
Ordering Options..... 20

Introduction

TRINITY has a host of low cost, easy to use individual and multifunctional meter that offers for all the basic measurement capabilities required to monitor electricity over and above basic metering. These meters also have an RS485 port supporting MODBUS-RTU protocol for integration with SCADA/EMS. The entire range is very rugged and cost-effective. All these products are field proven and more than 100,000 units are active in service.

The Main Features Available in This Model

- All parameters with default accuracy class 1.0S
- Multiparameter Monitoring
- Displays with 0.4" Red Seven Segment with LED indicators
- Measurement of individual voltage and current in three phases
- Measurement of system powers (KW, KVA and KVAR)
- Measurement of three energies (KWh, KVAh and KVARh)
- Frequency and system PF with lead (-) and lag side (+)
- RS485 port with SCADA/EMS using Modbus-RTU protocol.



Front View of the Unit

Technical Specifications

SR. NO	PARAMETERS & OPTIONS	STATISTICS	
1	Volts R-N	Direct Voltage Input : 20 to 300V L-N Burden : 0.5VA Secondary Voltage Input : 63.5V*	
2	Volts Y-N		
3	Volts B-N		
4	Volts RY	Direct Voltage Input : 25 to 500V L-L Burden : 0.5VA Secondary Voltage Input : 110V*	
5	Volts YB		
6	Volts BR		
7	Current R	Secondary Current Input : 5A or 1A (To be specified at the time of Ordering) CT Primary : Site Selectable Range of Reading : 5 –5000A Burden : < 1.0VA Overload (Through CT) : 5A CT = 6A RMS Continuous 1A CT = 1.2A RMS Continuous (Whole Current) : 120% of I _{max} continuous.	
8	Current Y		
9	Current B		
10	Frequency	45 to 55 Hz, Accuracy : 0.3% of Reading	
11	KWh	Range of Reading : 0 to 9999999.0 Accuracy : 1.0S as per IS13779.	
12	KVARh	Range of Reading : 0 to 9999999.0 Accuracy : 1.5% of Reading (Between 0.5 Lag to 0.8 Lead)	
13	KVAh	Range of Reading : 0 to 9999999.0 Accuracy : 1.0% of Reading	
14	System PF	Accuracy : 1% of Reading (IPF _≥ 0.5) Range of Reading : 0.05 to 1.00 Lag/Lead	
15	System KVA	Accuracy : 1.0% of Reading	
16	System KW	Accuracy : 1.0% of Reading (Between 0.5 Lag to 0.8 Lead)	
17	System KVAR	Accuracy : 1.5% of Reading (Between 0.5 Lag to 0.8 Lead)	
18	DISPLAY	0.4" Red Seven Seg.	
19	RS485	For Integration with EMS/SCADA	
20	Bezel	96x96 mm	DIN enclosure
21	Depth	55 mm	

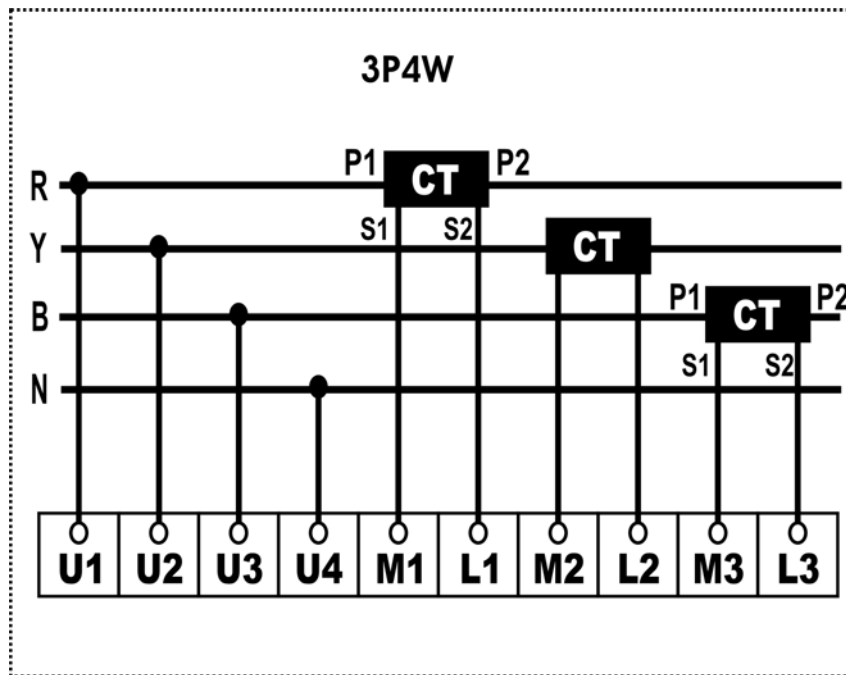
* To be specified at the time of ordering along with PT primary.

Installation and Commissioning

The unit can be used only for either 3P4W or 3P3W according to your ordering option and requirement in your electrical installation.

To install and commission for 3P4W, proceed the following instructions:

1. Push the unit into the panel and mount using the clamps provided on it.

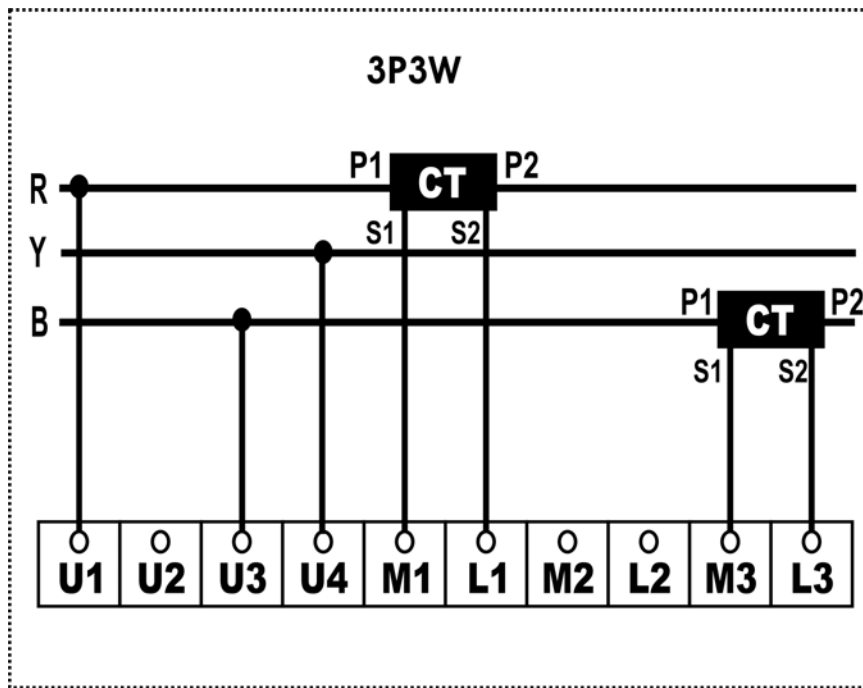


2. Connect the auxiliary supply (80V AC to 270V AC) to the terminals marked P and N.
3. Connect the three phases with the phase sequence being R-Y-B to the terminals marked U1, U2 and U3 respectively. Make sure that the phases coming to the unit come through control fuses of 1.0A rating. This will protect the electronic inside from damage due to severe over voltage or phase faults in the system.
4. Connect the neutral wire to the terminal marked U4.
5. Connect the two wires from the R-phase CT to the terminal marked M1 and L1 such that S1 from CT goes to M1.
6. Connect the two wires from the Y-phase CT to the terminals marked M2 and L2 such that S1 from the CT goes to M2.
7. Connect the two wires from the B-phase CT to the terminals marked M3 and L3 such that S1 from the CT goes to terminal marked M3.

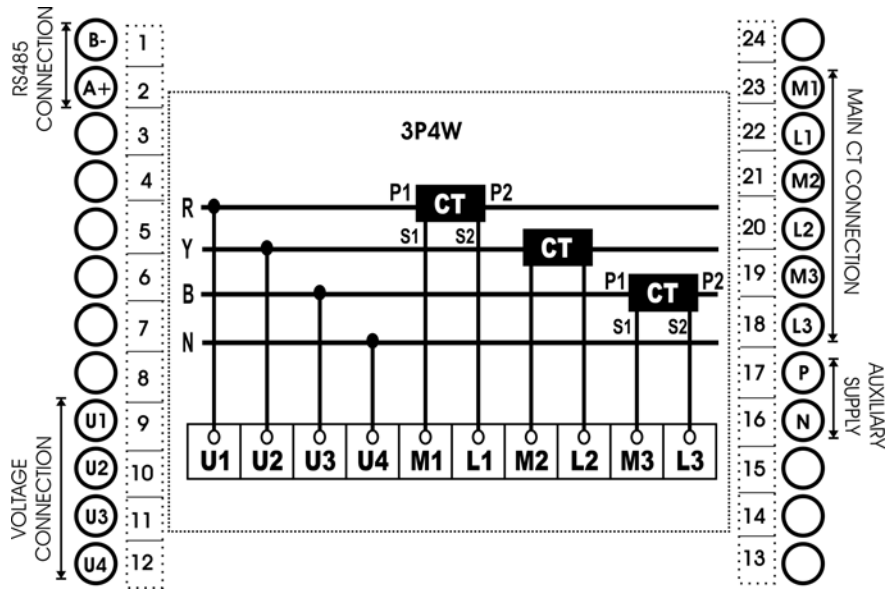
8. Switch on the auxiliary supply as well as three phase supply and then, the unit will come alive in order to display such as TRINITY ESPL, CT ratio, Unit Address and Run Mode respectively.
9. Firstly, user should program the settable parameters, CT-primary and unit address for RS485 communication port. (*Refer Operational Details in the next section*).
10. Now the unit is ready for operation.

To install and commission for 3P3W, proceed the following instructions:

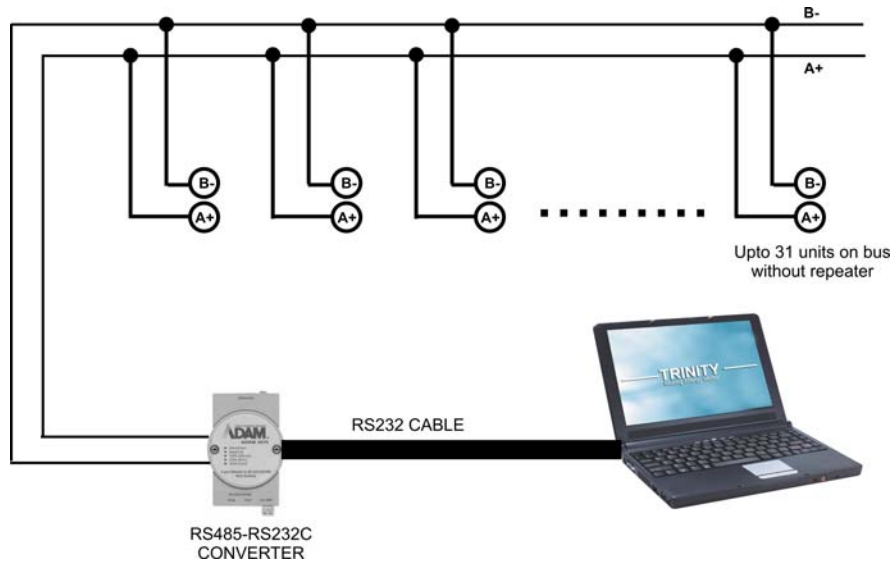
1. Push the unit into the panel and mount using the claim provided on it.



2. Connect the auxiliary supply (80V AC to 270V AC) to the terminals marked P and N.
3. Connect the three phases with the phase sequence being R-Y-B to the terminals marked U1, U4 and U3 respectively. Make sure that the phases coming to the unit come through control fuses of 1.0A rating. This will protect the electronic inside from damage due to severe over voltage or phase faults in the system.
4. Connect the two wires from the R-phase CT to the terminals marked M1 and L1 such that S1 from CT goes to M1.
5. Connect the two wires from the B-phase CT to the terminals marked M3 and L3 such that S1 from the CT goes to the terminal marked M3.
6. Switch on the auxiliary supply as well as three phases supply and then, the unit will come alive in order to display such as TRINITY ESPL, CT ratio, unit Address and Run Mode respectively.
7. Firstly, user should program the settable parameters, CT-primary and unit address for RS485 communication port as required. (*Refer Operational Details in the next section*).
8. Now, the unit is ready for operation.



Back View



RS485 Connection

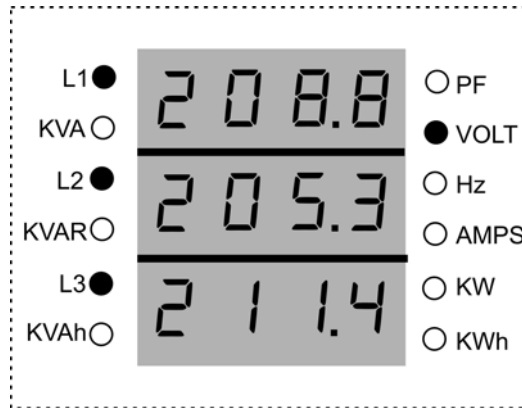
Operational Details




The Power Meter, Empower is a versatile meter, with all the features needed to implement for a robust electrical load measurement. It can be configured to monitor most electrical parameters and communication needs and, is also achieved by making field programmable parameters, as possible.

There are basically two modes of operation in Empower:





1. Programming Mode
2. Run Mode

After supplying power (80 VAC - 270 VAC), the unit displays immediately power receiving information, TRINITY ESPL on Red Seven Segment screen and by default, the display comes into Run Mode such as shown below.



Now, the unit can be operated for both the Programming Mode and Run Mode by pressing the keys such as ,  and .


Programming Mode

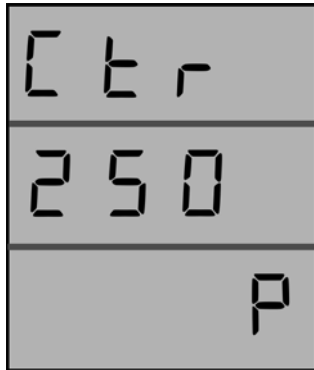
In order to operate for all the field programmable parameters, it is easy user interface by pressing the keys such as, ,  and  keys. Once the unit displays CT-PRIMARY, press  key to move into the next programmable parameter, UNIT ADDRESS for RS485 communication.





Setting CT- primary

The CT-primary is settable from 5 to 5000 and, should be set so as to give actual current values in an electrical installation.

To set the CT-primary, proceed the following instructions:

1. Press  key for about 4 to 5 seconds on Run Mode display.
2. The unit will enter into Programming Mode display with settable parameter, CT-PRIMARY such as shown below.




3. Press  key. Immediately, P starts blinking with an interval of one second which shows that the parameter is now settable. Set the CT-primary by using  and  keys until the desired value is received and then press  key to confirm the set value.
4. Now, the unit will reset and return into Run Mode.





Setting a unit address for RS485 port

The unit has the provision to specify a meter address at site for RS485 port. This address can be set starting from 1 to 255 with a fixed baud rate of 9600.

To set the CT-primary, proceed the following instruction:

1. Press  key for about 4 to 5 seconds on Run Mode display.
2. The unit will enter into Programming Mode display with the settable parameter, unit ADDRESS such as shown below.



3. Press  key. Immediately, P starts blinking with an interval of one second which shows that the parameter is now settable. Set the ADDRESS by using  and  keys until the desired value is received and then, press  key to confirm the set value.
4. Now, the unit will reset and return into Run Mode.

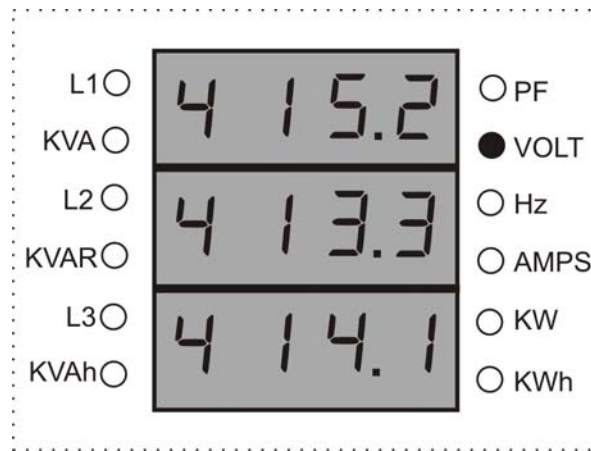
Run Mode

In the run mode, the various parameters calculated by the EMPOWER are displayed on different pages on a three lines of 0.4" Red Seven Segment. There are ten parameters which display on different pages with the system values.

Run Mode Displays

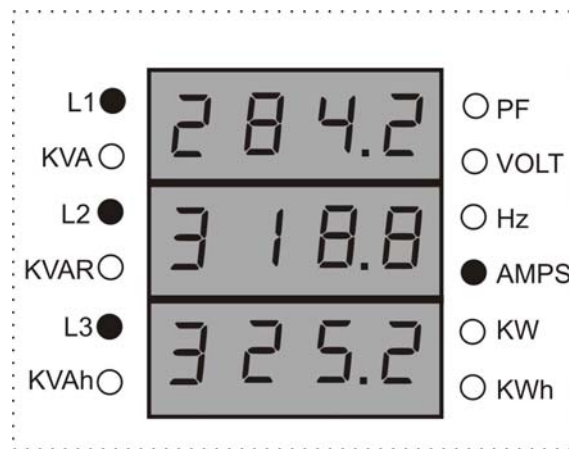
The Run mode displays will autscroll by default and stay for each page for an interval of 7 to 8 seconds.

Page 1



The LED indicator glows on VOLT with respect to L1, L2 and L3 which shows individual phase to phase voltage of R-Y-B on first row, second row and third row display respectively.

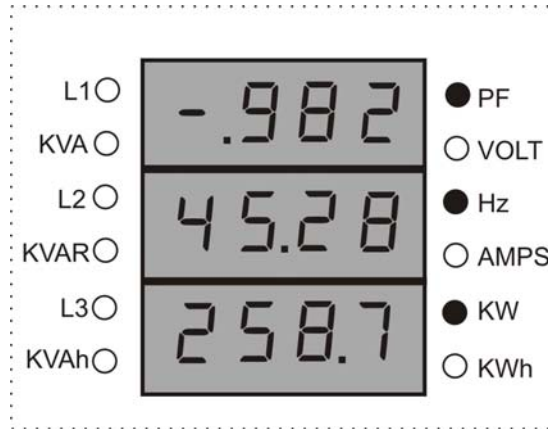
Page 2



The LED indicator glows on AMPS with respect to L1, L2 and L3 which shows

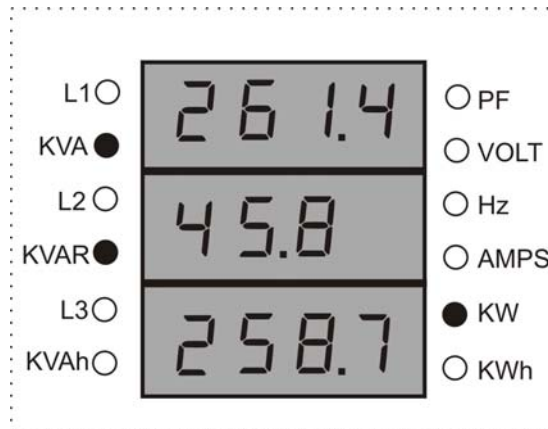
individual phase current values of R-Y-B on first row, second row and third row display respectively. If current (I) < 1000 which takes one digit after decimal. Or else, current (I) ≥ 1000 which doesn't take any digit after decimal.

Page 3



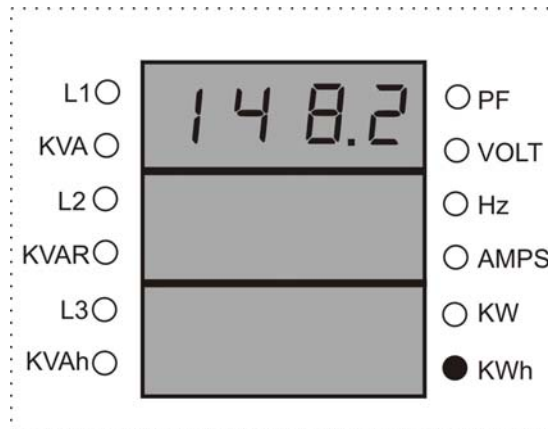
The LED indicators glow on system PF, Hz and active power (KW) which shows their values on first row, second row and third row displays respectively.

Page 4



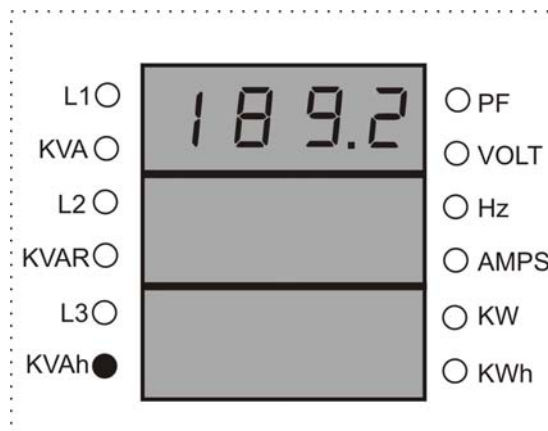
The LED indicator glow on system apparent power (KVA), Reactive power (KVAR) and Active power (KW) which shows their values on first row, second row and third row displays respectively.

Page 5

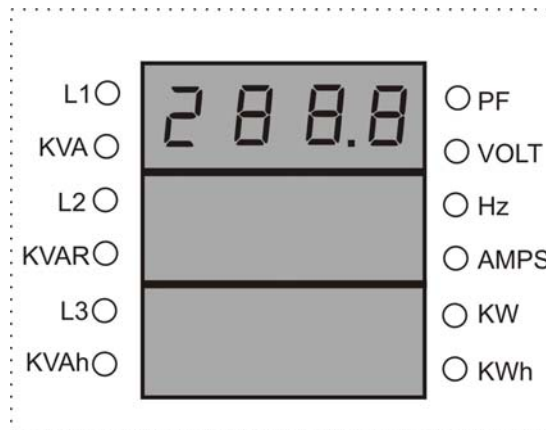


The LED indicator glows on Total Active Energy (KWh) which shows its value on fifth display. If KWh < 100 which takes two digits after decimal. Or else, KWh ≥100 which takes one digit after decimal.

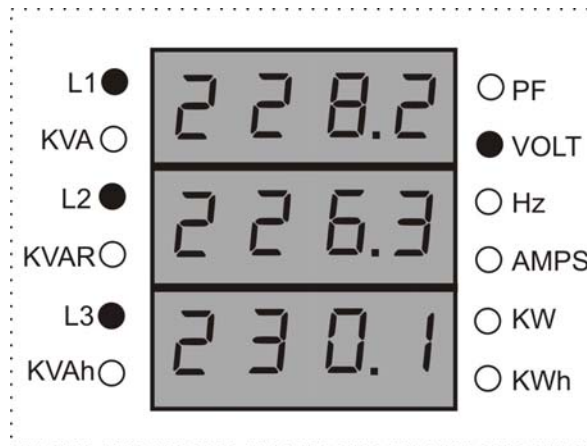
Page 6



The LED indicator glows on Total Apparent Energy (KVAh) which shows its value on sixth display. If KVAh < 100 which takes two digits after decimal. Or else, KVAh >100 which takes one digit after decimal.





The display shows Total Reactive energy (KVARh). If KVARh < 100 which takes two digits after decimal. Or else, KVARh ≥ 100 which takes one digit after decimal.

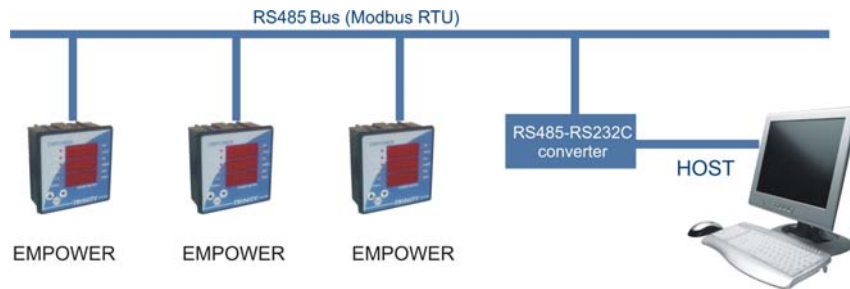


The LED indicator glows on VOLT which shows individual phase to neutral voltage of R-Y-B on first row, second row and third row display respectively.

Freezing and unfreezing the displays

The Run Mode Display is in scroll mode by default, i.e. each page is displayed for about 7-8 seconds, after which the next page is automatically shown. To freeze the display at a particular page, press  key. The LEDs will start blinking to indicate that the display is frozen. Now it is also possible to go to the next or previous page by using ▲ and ▼ keys respectively. To unfreeze the display and start autoscrolling again, press  key.

Communication



UNIT CONNECTED TO RS485 PORT

The industrial standard RS-485 communication port option is also available in Empower. This option makes it possible for a user to select Empower to provide power and energy information into a variety of existing or new control systems and communication networks such as EMS/PLS/SCADA.

Modbus RTU on RS485 Port

In order to download live data for the various system parameters, user can use RS485 connecting to a SCADA or EMS software. Empower supports an RS485 port with MODBUS-RTU protocol. The station ID for every meter is site selectable. The data which can be read using MODBUS query # 3 (Read Holding Registers) is provided in an address map, with the applicable multiplication factors, vide **Appendix**.

Communication line parameters: 9600/8/N/1.

The register map is described in Appendix. All addresses are in decimal whose parameters are unsigned long. If illegal address is sent in query or host, try to read more than 32 bytes of data in one query exception message is generated. The parameters name, address and multiplication factor are also mentioned.

Reserved values are for future uses which are transmitted as zeroes. Please refer to the address map for the various parameters in Appendix.

Appendix

3 phase 3000-3019	R phase 3030-3049	Y phase 3060-3079	B phase 3090-3109	MF
3000-KVA	3030-KWh	Reserved	Reserved	X100
3002-KW	3032-KVAh	Reserved	Reserved	X100
3004-KVAr	3034-KVARh	Reserved	Reserved	X100
3006-PF	3036-Hz	Reserved	Reserved	X1000
3008-Avg.VLL	3038-Vry	3068-Vyb	3098-Vbr	X100
3010-Avg. VLN	3040-Vr	3070-Vy	3100- Vb	X100
3012-Avg. Amps.	3042-Ir	3072-Iy	3102-Ib	X100

DEFINING MULTIPLICATION FACTOR

- **Hz** has a multiplication factor of 100 & not 1000. e.g. If Hz is 48.33, and then it is sent as 4833.
- For providing resolution, all parameters except PT are multiplied with 100 before transmitting. Thus if the KVA value is 278.99, it is sent out as 27899. PF has MF of 1000, instead of 100. Thus, a PF value of 0.987 is sent as 987.
- If an attempt is made to read some address other than the valid addresses, the exception response is sent.

EXPEPTION CODE

In the event that the query from the HOST has no communication error, but there is some error in specifying the address of registers to be read, the meter returns an exception message. The format of the exception message will be as under:

Unit Address	0X83	Exception code	CRC	CRC
--------------	------	----------------	-----	-----

Exception Code can have only one value, 02: if the address is not a valid, start address or host has requested more than 32 bytes of data, this code is returned.

Ordering Options

Empower can be ordered with the following options according to your requirements.

Empower Power Meter	
Technical Specification	Options
Installation	<input type="checkbox"/> 3P4W installation <input type="checkbox"/> 3P3W installation
For H.T application (only if meter is to be used for HT line)	PT-Primary.....KV. PT-secondary.....V.
CT secondary (Current)	<input type="checkbox"/> 5A <input type="checkbox"/> 1A
Communication	<input type="checkbox"/> RS485 port with Modbus-RTU protocol. <input type="checkbox"/> None

P.O No. :

Customer :

Sr. No. :

Result of Test :

Remarks :

Test engineer :

Date :
