USER'S MANUAL

E3000

Revenue Meters

This document contains the latest technical information about E3000 which is a micro-controller based Revenue Meter. The unit is tested against latest "MTE" Standard Model PRS400.3 having basic accuracy of 0.02%, and is also traceable to International Standards derived using appropriate ratio techniques.

The product, E3000 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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Introduction

The digital energy meter E3000 is a micro-controller based unit which not only measures a host of electrical parameters to display them on a customized segment LCD with white backlit, but also acts as a comprehensive load control device due to its three numbers of internal latching relay contacts. These latching relays will cut load when either load exceeds KW limit or force tripped from RS485. In addition to this flexibility in terms of load control, the meter also has two serial ports. Both port follows RS485 medium. One port is for EMS/SCADA and second for Remote Display Unit. RS485 supports MODBUS RTU protocol for connections to EMS/SCADA.

The unit is meant for use in three phase four wire systems with Active Power (KW) control. The meter address, tripping parameters, resetting the energy, date & time in RTC are site programmable.

E3000 has dual source input. So when 230Volt AC input applied at dual source input, then meter will register DG Energy.

The Main Features of the unit

- Displays more than 20 Parameters.
- Demand and Maximum Demand for both KW and KVA including date and time of maximum demand occurrence.
- Measurements of Individual voltage, current and PF in three phases.
- Measurements of Energies, system PF, Powers and frequency.
- Internal latching relays for Active Power (KW) control with trip limit and time.
- RS-485 MODBUS-RTU connectivity with field programmable meter address.
- Forcefully latching relays on/off on RS485 communication using EMS.
- Customized Segment LCD with white backlight.

Technical Specifications

Parameters		
Type	**Name**	**Statistics**
INPUT	Three Phases and Neutral of a 3P4W system	
INPUT	Voltage	Direct Voltage Input : Up to 300V L-N, 50-60 Hz.
INPUT	Current	Whole Current Meter with up to 60A rating
INPUT	Power Supply	Auxiliary Supply: Not Needed
OUTPUT	Latching Relay	Three. One on Each Phase. CONTACT: 60A, 250VAC
MEASUREMENT — True RMS Basic Parameters	Voltage (Volts L-N)	VL-N Accuracy : 0.5% of Reading
MEASUREMENT — True RMS Basic Parameters	Current (Amps IR, IY, IB)	Accuracy : 0.25% of Reading
MEASUREMENT — True RMS Basic Parameters	Line Frequency	45 to 55 Hz, Accuracy : 0.3% of Reading
MEASUREMENT — Power	Active Power (P)	Accuracy : 0.5% of Reading (For IPFI>0.5)
MEASUREMENT — Power	Reactive Power (Q)	Accuracy : 1.0% of Reading (Between 0.5 Lag to 0.8 Lead)
MEASUREMENT — Power	Apparent Power (S)	Accuracy : 0.5% of Reading
MEASUREMENT — Power	Power Factor	Accuracy : 0.5% of Reading (IPFI≥0.5) Range of Reading : 0.05 to 1.00 Lag/Lead
MEASUREMENT — Energy	Total Active Energy (KWH)	Accuracy : 0.5 of Reading
MEASUREMENT — Energy	Total Apparent Energy (KVAH)	Accuracy : 0.5% of Reading
MEASUREMENT — Energy	Total Reactive Energy (KVARH)	Accuracy : 1.0% of Reading
MEASUREMENT — Demand	Active Power (KW) Demand – **30-Minute Fixed Window**	
MEASUREMENT — Demand	Apparent Power (KVA) Demand - **30-Minute Fixed Window**	

## Installation and Commissioning

The unit supports only for 3P4W electrical installation and user is advised to read carefully the instructions before installing and commissioning.

Follow the steps below to install and commission the unit

1. Push the unit into the panel and mount on the wall.
2. Connect the three phases with the phase sequence being R-Y-B to the terminal marked, 1, 4 and 7. Connect the neutral wire to the terminal marked, 10. Make sure that the three phases coming to the meter come through the control fused appropriate Amp rating. This will protect the electronic inside from damage due to severe overvoltage or phase faults in the systems.
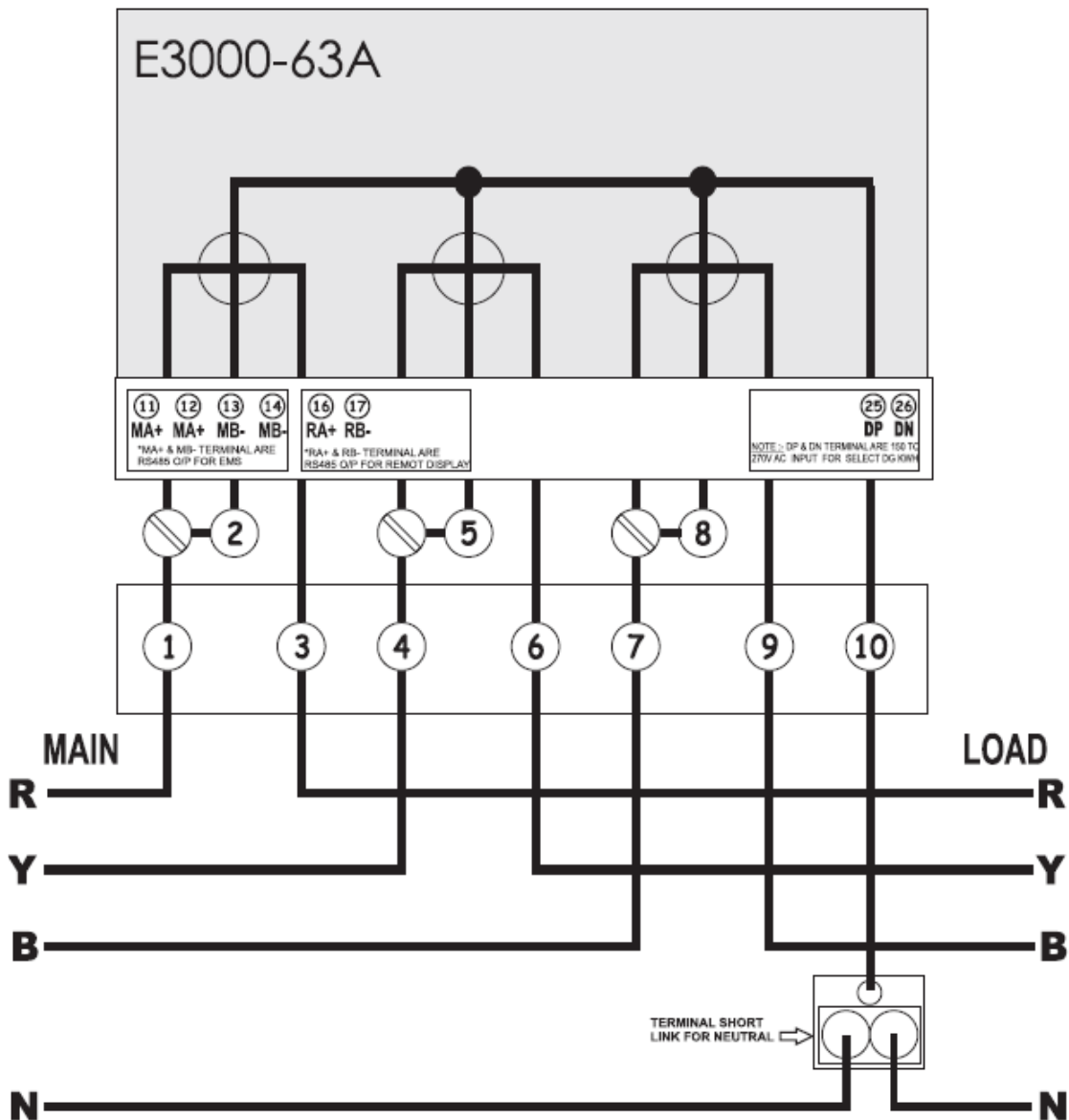
3. The three phases R, Y and B coming from load will connect to the terminals marked 3, 6, and 9, and then connect the neutral wire to the terminal marked 10.

4. In case of DG, the two wires coming from the DG will connect to the terminals marked 25 and 26(DP and DN) with a supply voltage of 150VAC to 270 VAC. Now, switch on the three phase supply, then the unit will display power receiving information such as TESPL, and then the unit comes to RUN mode displaying KWH and increasing value in DG.

5. Firstly, the unit should be programmed for various programmable parameters in the Programming Mode. For this, see 'Operational Details' in the next section.

6. Now, the unit is ready for the Operation.
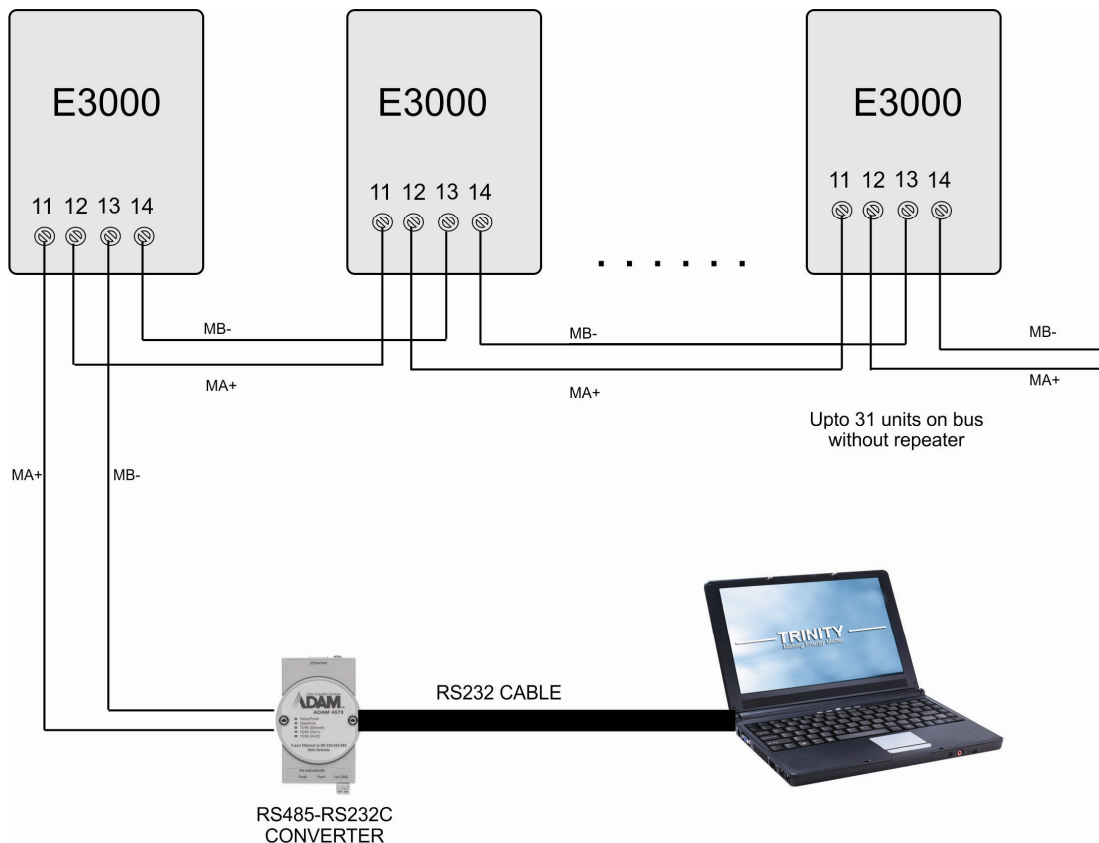
RS485 Connection
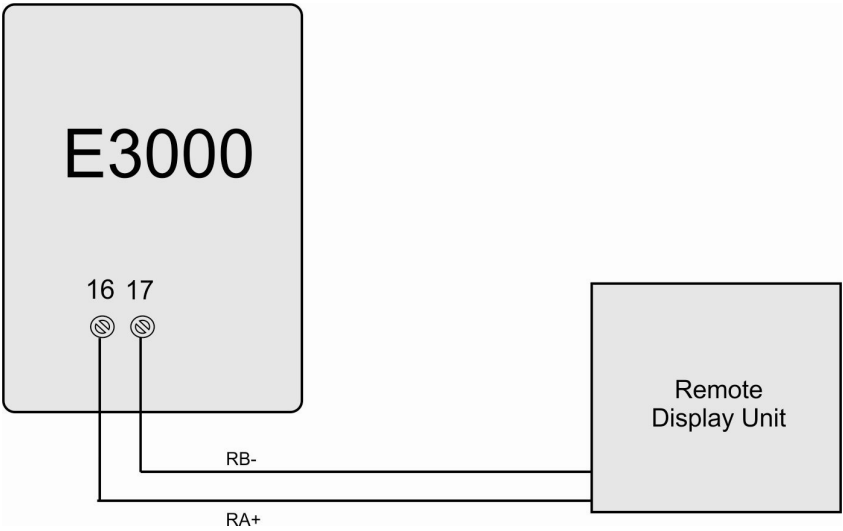
Remote Display Connection

Operational Details

The unit, E3000 is a versatile meter with the feature needed to implement with a robust electrical system and can also be configured to suit for most electrical revenue purpose. The unit is achieved by making as many parameters field programmable, as much as possible. There are basically two modes of operation:

1. Programming Mode
2. Run Mode.

After supplying power (**100 VAC to 440 VAC**) to the three phases, the unit comes to Run Mode by default after displaying power receiving information, TESPL such as shown below.

```
1
429.63
     KWH
```

Programming Mode

The unit has various user interface programmable parameters and the Programming Mode can also be easily interfaced by using the keys **PROG**, **UP** and **DOWN**. The unit is designed with a fixed password protection,"**1947**". The user will therefore enter a password before entering into Programming Mode. Now, in Run Mode, press PROG key for about 5 seconds and then, the password display will prompt such shown below.

```
Pro6 - - - -
```

To enter the password, press PROG key again that will start blinking first digit as zero and is also showing that the password can be entered. Now, press UP key to set to 1; press PROG key to shift to second digit and enter 9 by pressing UP or DOWN keys. Likewise, enter 4 and 7 also, and then press PROG key to enter into Programming mode. In case, the password entered is wrong, the unit will show Error (ERR) and return into Run mode. Enter again the exact password as steps before.

On other hand, the password prompt will return into Run Mode, unless the password is entered for about **30 seconds**. Or, if the unit is in Programming Mode and keys are not operated for about **30 seconds**, unit will return to Run Mode.

Setting Unit Address

For RS485 communication, the Unit Address can be set from 1 to 255 with an inbuilt and fixed baud rate of 9600.

There is also an option for user to cut power off forcefully using RS485. User can connect the load using EMS or manually in last parameter, "Ftri P nO/YS" of Programming Mode which will prompt when user has forcefully tripped the load/relays.

To set the Unit Address, proceed the following instructions.

1. After entering the password, the unit will enter into Programming Mode and display first programmable parameter, UNIT ADDRESS such as shown below.

$$Add- 1$$

2. Press PROG key. Immediately, the parameter will start blinking which shows that the parameters can now be changed. Set the parameter by pressing UP or DOWN keys and press PROG key again to confirm the setting. The parameter blinked will also stop blinking.

3. To set for next parameter, press UP key and set as steps before. Otherwise, press PROG key to return into Run mode or unit will automatically leave the programming mode after 30 seconds if no keys are pressed.

Setting EB TRIP LIMIT, TRIP DELAY and TRIP OFF TIME on KW

The unit has relay for tripping on KW limit with a settable value from 5KW to 60KW. The TRIP DELAY is the time duration for which the relay will wait for setting time duration before switching off. The TRIP DELAY is settable from 1 to 15 minutes. TRIP OFF TIME is the time duration for which the load will be switched off with selected time duration before switching on. This TRIP OFF TIME is settable from 2 to 60 minutes.

For example, the TRIP Parameters are set such that:
TRIP LIMIT – 25 KW
TRIP DELAY – 5 MINUTES
TRIP OFF TIME – 15 MINUTES.
 The unit will check continuously for system KW value. If KW will exceed its limit say 30 KW then the unit will keep a watch on this value for next 5 minutes. If the value of KW remains above 25 for this 5 Minutes then the unit will cut off the load by tripping the relays off. This load will remain cut off from the mains till next 15 Minutes as set in the TRIP OFF TIME parameter. After this duration the unit will again switch ON the relays and load will be connected to mains. In this state the TRIP LED will

remain ON. If the value of KW will remain above its tripping limit only for 3 minutes then in this particular case the trip action will not be performed and hence the load will not be cut from the mains.

To set the trip parameters, proceed the following instructions.

1. After entering the password, the unit will enter into Programming Mode and display first programmable parameter, UNIT ADDRESS. Press UP key to enter into TRIP LIMIT such as shown below.

```
1

tr-L 25
```

2. The digit 1 at the top of the left corner shows the trip parameter is for EB only. Press PROG key. Immediately, the parameter will start blinking which shows that the parameters can now be changed. Set the parameter by pressing UP or DOWN keys and press PROG key again to confirm the setting. The parameter blinked will also stop blinking. To set for next parameter, TRIP OFF TIME, press UP key to display with the following display.

```
1      TIME

trI P 10
```

3. Now, set the TRIP TIME as steps before. And press UP key again to set the next parameter, TRIP OFF TIME with the following display.

```
1      TIME

OFF 60
```

4. Now, set the TRIP OFF TIME as steps before. To set for next parameter, press UP key and set as steps before. Otherwise, press PROG key to return into Run mode.

Setting DG TRIP LIMIT on KW, TRIP DELAY and TRIP OFF TIME

The DG TRIP parameters are also same as EB TRIP parameter and can be entered by pressing UP key from the above EB tripping programmable parameters till the DG TRIP parameter displays such as shown below.

```
  2
  ┣┍-L    ЧО
```
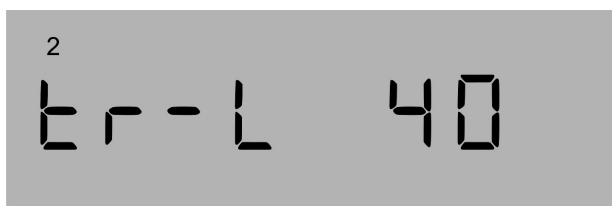
The digit 2 at the top of the left corner shows the trip parameter is for DG only. Set DG TRIP parameters such as TRIP LIMIIT, TRIP DELAY and TRIP OFF TIME as same as EB TRIP parameters with the steps before.

Setting Time and Date with RTC

The Time and Date are RTC where the Time can be set with the format of hour, minutes, seconds i.e., HH-MM-SS and the Date can be set with the format of date, month and year. i.e, DD-MM-YY format.

To set Time and Date, proceed the following instructions.

1. After entering the password, the unit will enter into Programming Mode and display first programmable parameter, UNIT ADDRESS. Press UP key till the unit enters into TIME such as shown below.

```
         TIME
   IO- I2-56
```

2. Press PROG key. Immediately, HH will start blinking which shows that the hour can now be changed. Set hour by pressing UP or DOWN keys and press PROG key to confirm the setting which will now start blinking to MM. Press UP key or DOWN key to set it, and then press PROG key to confirm the minute setting that will blink to SS. Similarly, set second by pressing UP or DOWN key and press PROG key to confirm the setting which will now stop blinking. To set DATE, press UP key such as shown below.

```
         DATE
   IO- IO- I I
```
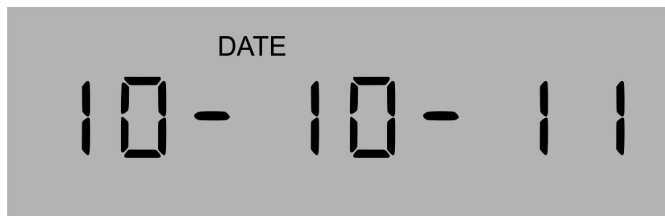
3. Now, set DATE as steps before. And press UP key again to set the next parameter. Otherwise, press PROG key to return into Run Mode.

Resetting Energies

The energies KWH, KVAH and KVARH can be reset to zero.

To reset Energies, proceed the following instructions.

1. After entering the password, the unit will enter into Programming Mode and display first programmable parameter, UNIT ADDRESS. Press UP key till Reset Energy displays such as shown below.

```
r5t-n0
  KWH KVAH KVARH
```

2. Press PROG key. Immediately, the parameter will start blinking which shows that the parameters can now be changed. Reset the parameter to YES by pressing UP or DOWN keys and press PROG key again to confirm the setting. The parameter will also stop blinking. After the energy is reset the unit will restart in RUN mode.
3. To set for next parameter, press UP key and set as steps before. Otherwise, press PROG key to return into Run mode.

Resetting Maximum Demand

The Maximum Demand KW, KVA can be reset to zeroes.

To reset Maximum Demand, proceed the following instructions.

1. After entering the password, the unit will enter into Programming Mode and display first programmable parameter, UNIT ADDRESS. Press UP key till MAXIMUM DEMAND displays such as shown below.

```
MD
r5t-n0
  KW  KVA  KVAR
```

2. Press PROG key. Immediately, the parameter will start blinking which shows that the parameters can now be changed. Reset the parameter to YES by pressing UP or DOWN keys and press PROG key again to confirm the setting. The parameter will also stop blinking and immediately the unit will restart in RUN mode.

Run Mode

In the run mode, the various parameters measured/calculated by the meter are TRUE RMS values and displayed on different pages on a customized segment LCD. Make sure that for your exact power analysis, all the programmable parameter has been specified properly.

The pages auto-scroll by default and also the pages can be scrolled by pressing UP or DOWN keys. For more convenience to analyze the parameters in Run mode pages, the pages can be frozen by pressing **PROG** key. Subsequently, the parameters will start blinking and will not change the current page unless and until pressed by **UP or DOWN** keys. To unfreeze the pages, press **PROG** key again that will stop blinking and then, the pages will start auto-scrolling. Each page is displayed for 8 seconds.

Display	Description
1 429.63 KWH	The first page shows Active Energy (KWH). The numeral 1 at the top page shows the energy is for EB.
2 0.00 KWH	The second page shows Active Energy (KWH). The numeral 2 at the top page shows KWH is for DG. When connected to DG, KWH value will show on this page.
1 7.54 KVARH	The third page shows Reactive Energy (KVARH). The numeral 1 at the top page shows the unit is for EB.
2 0.00 KVARH	The fourth page shows Reactive Energy (KVARH). The numeral 2 at the top page shows the Reactive energy is for DG. When connected to DG, KVARH will display.

|	
1 **429.73** KVAH	The fifth page shows Apparent Energy (KVAH). The numeral 1 at the top page shows KVAH is for EB.
2 **0.00** KVAH	The sixth page shows Apparent Energy (KVAH). The numeral 2 at the top page shows the KVAH is for DG. When the unit is connected to DG, the KVAH value will display on this page.
1 **240.12** V	The seventh page shows R-Phase Voltage. The numeral 1 at the top page shows the voltage is R-Phase.
2 **240.08** V	The eight page shows Y-Phase Voltage. The numeral 2 at the top page shows the voltage is Y-Phase.
3 **240.05** V	The ninth page shows B-Phase Voltage. The numeral 2 at the top page shows the voltage is B-Phase.
1 **30.94** A	The tenth page shows R-Phase Current. The numeral 1 at the top page shows the Current is R-Phase.
2 **30.10** A	The eleventh page shows Y-Phase Current. The numeral 2 at the top page shows the Current is Y-Phase.

3

30.24

A
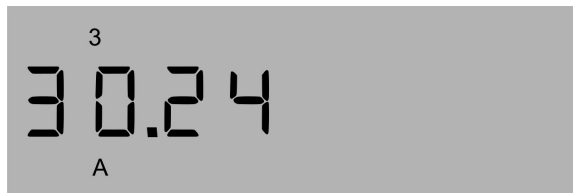
The twelfth page shows B-Phase Current. The numeral 3 at the top page shows the Current is B-Phase.

1

0.999

P F

The thirteenth page shows R-Phase PF with LAG side. The numeral 1 at the top page shows the PF is R-Phase. In case, the PF is on LEAD side, - sign will indicate to all three phases and system PF. e.g., -0.999.

2

0.999

P F

The fourteenth page shows Y-Phase PF with LAG side. The numeral 2 at the top page shows the PF is Y-Phase.

3

0.999

P F

The fifteenth page shows B-Phase PF with LAG side. The numeral 3 at the top page shows PF is B-Phase.

1.000

P F

The sixteenth pages shows system PF with LAG side.

50.00

H Z

The seventeenth page shows system Frequency (HZ).

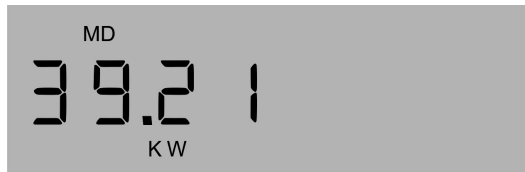|	
21.60 KW	The eighteenth page shows system Active Power (KW).
0.50 KVAR	The nineteenth page shows system Reactive power (KVAR).
21.50 KVA	The twentieth page shows system Apparent power (KVA).
d - 1.62 KVA	The twenty-first page shows Rising demand of KVA. The rising demand calculation method is based on fixed window method for 30 minutes interval with respect to internal RTC.
MD 39.24 KVA	The twenty-second page shows maximum Demand (MD) of KVA. The MD will be logging when Rising Demand is greater than last MD. The unit reflects Date & Time of MD occurrence.
MD TIME 03:59:13 KVA	The twenty-third page shows the time for maximum demand occurrence of KVA.
MD DATE 03 - 10 - 11 KVA	The twenty-fourth page shows the date for Maximum Demand occurrence of KVA.

TRINITY

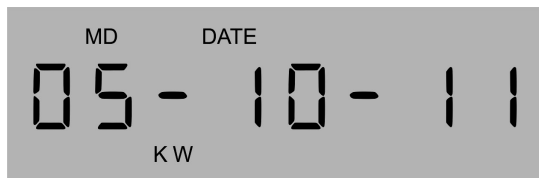|	
d - 1.9 2 K W	The twenty-fifth page shows Rising Demand of KW.
MD 3 9.2 1 K W	The twenty-sixth page shows Maximum Demand of KW. MD occurrence is same as KVA MD occurrence mentioned before.
MD TIME 03:59: 13 K W	The twenty-seventh page shows the time for Maximum Demand occurrence of KW.
MD DATE 0 5 - 1 0 - 1 1 K W	The twenty-eighth page shows the date for Maximum Demand occurrence of KW.
TIME 1 1 - 4 5 - 4 3	The twenty-ninth page shows the time in RTC.
DATE 1 0 - 1 0 - 1 1	The thirtieth page shows the date in RTC.
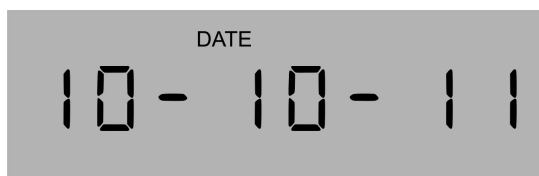
Communication

E3000 provide the industry standard RS-485 communication port. These options make it possible for a user to select E3000 to provide power and energy information into a variety of existing or new control systems and communication networks.

Modbus RTU on RS 485 Port

For connection to a PLC/SCADA software, E3000 supports an RS485 port with MODBUS-RTU protocol support. 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. See INDEX in last section.

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

The register map is described in Appendix. If illegal address is sent in query or host, try to read more than 200 bytes of data in one query except message is generated. The parameter's name and address are also mentioned.

If an attempt is made to read from some address other than the valid addresses, the exception response is sent.

EXCEPTION CODE

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

Unit address	83	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 200 bytes of the data, this code is return.

Appendix

Sr. No.	ADDRESS	PARAMETER
1	40200	Vrms - R Phase
2	40202	Vrms - Y Phase
3	40204	Vrms - B Phase
4	40206	Irms - R Phase
5	40208	Irms - Y Phase
6	40210	Irms - B Phase
7	40212	PF - R Phase
8	40214	PF - Y Phase
9	40216	PF - B Phase
10	40218	System PF
11	40220	System KVA
12	40222	System KW
13	40224	System KVAR
14	40226	Frequency
15	40228	EB KWH
16	40230	EB KVARH
17	40232	EB KVAH
18	40234	DG KWH
19	40236	DG KVARH
20	40238	DG KVAH
21	40240	KW Demand
22	40242	Max KW Demand
23	40244	MD KW Year
24	40246	MD KW Month
25	40248	MD KW Date
26	40250	MD KW Hour
27	40252	MD KW Minutes
28	40254	MD KW Seconds
29	40256	KVA Demand
30	40258	Max KVA Demand
31	40260	MD KVA Year
32	40262	MD KVA Month
33	40264	MD KVA Date
34	40266	MD KVA Hour
35	40268	MD KVA Minutes
36	40270	MD KVA Seconds
37	40272	EB Trip Limit
38	40274	EB Trip Delay
39	40276	EB Off Time
40	40278	DG Trip Limit

41	40280	DG Trip Delay
42	40282	DG Off Time
43	40284	EB Status
44	40286	Trip Status
45	40288	Year
46	40290	Month
47	40292	Date
48	40294	Hour
49	40296	Minutes
50	40298	Seconds