USER'S MANUAL

POWER PRO

Electrical Power Meter

This document contains the latest technical information about Power Pro which is a micro-controller based digital power meter. The product Power Pro 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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Warranty statement

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Should your Trinity product prove defective during the warranty period, please bring the product securely packaged in its original container or an equivalent, along with proof of the date of original purchase, to our Trinity Dealer or Factory. You are responsible for all costs (shipping, insurance, travel time) in getting the product to the service location. Trinity will, at its option, repair or replace on an exchange basis the defective unit, without charge for parts or labor. When warranty service involves the exchange of the product or of a part, the item replaced becomes Trinity property. The replacement unit may be new or refurbished to the Trinity standard of quality, and at Trinity's option, the replacement may be another model of like kind and quality. Trinity's liability for replacement of the covered product will not exceed the original retail selling price of the covered product. Exchange or replacement products or parts assume the remaining warranty period of the product covered by this limited warranty.

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Contents

Introduction

The digital power meter POWER PRO is a micro-controller based unit which measures electrical parameters, and sequentially displays them on a 16 X 4 or 16X1 backlit LCD.

The unit is meant for use in three phase four wire/ three wire systems. In three phase four wire L.T. systems, it requires four wires from R, Y, B & N, in addition to six wires from the three current transformers mounted on the three phases. It thus uses the three wattmeter method to arrive at the system KVA and KW. On the other hand , for use in three phase three wire system, it requires three phases from the PT secondary (usually 110 V AC) and only four wires from the HT current transformer secondary of two phases. The KVA and KW are calculated by the two wattmeter method.

The unit measures the three phase voltages and currents, frequency and power factors for all three phases. Based on these inputs, the system KVA, KW and KWh are calculated.

*For the correct operation of the unit, the only basic care required is to ensure that the phase sequence of the three phases is R-Y-B and the polarity of the CT secondary is correct***.** The S1 terminal in every CT will go to the M terminal of unit. Similarly, the S2 end of the CT will go to the L terminal of the unit.

The unit is fully solid state and will give years of trouble-free service once installed correctly.

The Main Features available in this Model

- Site selectable 1A or 5A CT secondary selection
- CT and PT Ratio site selectable
- All readings are true RMS measurements
- KVA and KW Demands
- THD for each voltage and current (*optional*)
- RS-485 port for connection to SCADA/EMS (*optional*)
- 16x1 or 16x4 backlit LCD
- Multi-parameter monitoring
- Measures all important Electrical Values
- All parameters with default accuracy class 1.0S
- Compact 96 X 96 DIN enclosure
- Optional one or two relay contacts, for alarm or trip
- Alarm relays are individually programmable for different parameters including Demand.

Power Pro - 16X4
LCD

Power Pro -16X1
LCD

Technical Specifications

Parameters			
Type		**Name**	**Statistics**
INPUT		Supply	Three Phases and Neutral of a 3P4W system / Three Phases of a 3P3W system
		Voltage	Direct Voltage Input : Up to 500V L-L, Up to 300V L-N PT Ratio : Site Selectable Burden : 0.5VA
		Current	Secondary Current Input : 5A or 1A (Site Selectable) CT Ratio : Site Selectable Range of Reading : 0 – 5000A Burden : < 1.0VA Overload : 5A CT = 6A RMS Continuous 1A CT = 1.2A RMS Continuous
		Power Supply	Auxiliary Supply : 80 - 480 VAC, 50-60 Hz.
OUTPUT		Relay	Two. Individually Field Programmable. 5A @ 250 VAC, Resistive Load
MEASUREMENT	True RMS Basic Parameters	Voltage (Volts L-N & L-L)	VL-N - Accuracy : 0.5% of Reading VL-L - Accuracy : 1.0% of Reading
		Current (Amps IR, IY, IB)	Accuracy : 0.25% of Reading
		Line Frequency	45 to 55 Hz, Accuracy : 0.3% of Reading
	Power	Active Power (P)	Accuracy : 1% of Reading (For IPFI>0.5)
		Reactive Power (Q)	Accuracy : 1.5% of Reading (Between 0.5 Lag to 0.8 Lead)
		Apparent Power (S)	Accuracy : 1% of Reading
		Power Factor	For Individual phases and System Accuracy : 1.0% of Reading (I*PF*I≥0.5) Range of Reading : 0.05 to 1.00 Lag/Lead
	Energy	Total Active Energy (KWh)	Range of Reading : 0 to 9999999.0 KWh Accuracy : 1.0S as per IS13779.
		Total Apparent Energy (KVAh)	Range of Reading : 0 to 9999999.0 KVAh Accuracy : 1.0% of Reading
		Total Apparent Energy (KVARh)	Range of Reading : 0 to 9999999.0 KVARh Accuracy : 1.5% of Reading
	Power Quality	THD for each Voltage (Optional)	
		THD for each Current (Optional)	
MISCELLANEOUS	Dimensions	Bezel	96 X 96 mm
		Panel Cutout	90 X 90 mm
		Depth of installation	55 mm
		Display	128X64 LCD
		Operating temp	10°C to 50°C
		Weight	0.35 Kgs (Approx.)
		Min. Operating Current	0.4% to 120% of CT primary
	Comm.	RS485	Modbus-RTU protocol

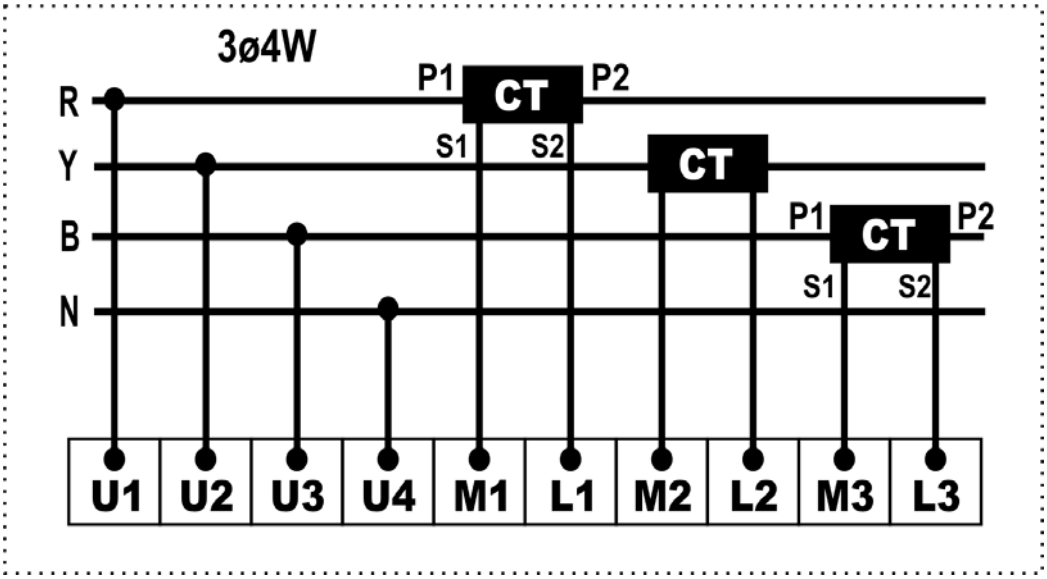
Installation and Commissioning

The Power Pro supports two installation modes – 3P4W and 3P3W. Follow the following steps to install / commission the unit.

3P4W Mode Installation

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

2. Connect the Auxiliary supply (80V AC to 480V 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, on the unit. Make sure that the three phases coming to the unit come through control fuses of 1.0 Amp rating. This will protect the electronics inside from damage due to severe over voltages or phase faults in the system. Connect the neutral to the terminal marked U4.

5. Connect the two wires from the R-phase CT to terminals marked M1 & L1 such that S1 from CT goes to M1 on the unit.

6. Connect the two wires from the Y-phase CT to terminals marked M2 & L2 such that S1 from CT goes to M2 on the unit. If the installation is 3P3W, these two terminals will remain open.

7. Connect the two wires from the B-phase CT to terminals marked M3 & L3 such that S1 from CT goes to M3 on the unit.

8. Switch on the auxiliary supply and also, the three phase supply. The unit will come alive and display "- -TRINITY ESPL- -"for about three seconds.

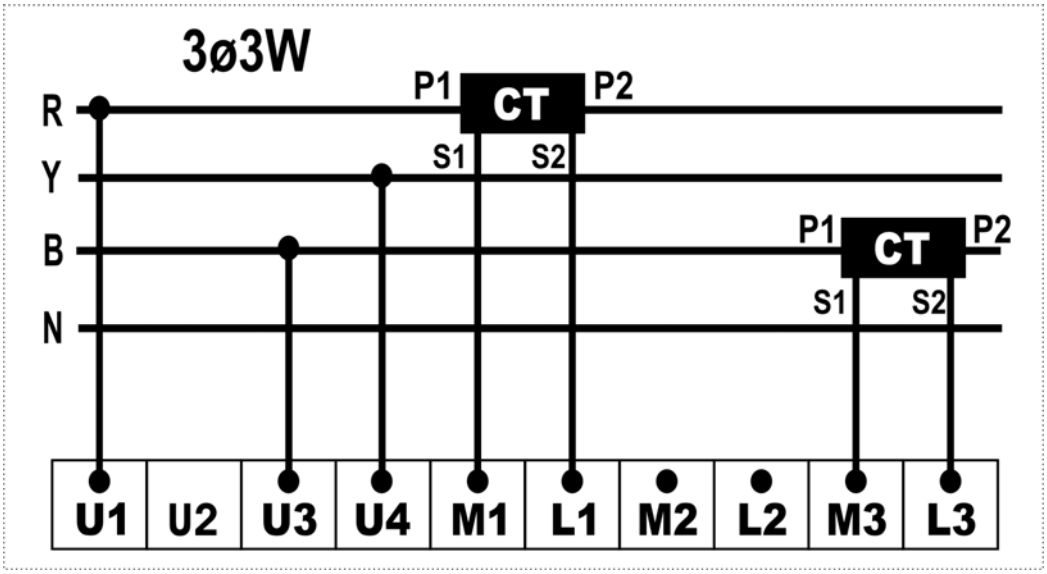
9. Set the correct CT Primary, secondary, PT ratio and scroll seconds etc. on the unit. For this refer to the OPERATIONAL DETAILS chapter.

10. The unit is ready for operation.

3P3W Mode Installation

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

2. Connect the Auxiliary supply (80 V AC to 480 V 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, on the unit. *R phase will go to U1, Y to U4 and B to U3.* Make sure that the three phases coming to the unit come through control fuses of 1.0 Amp rating. This will protect the electronics inside from damage due to severe overvoltages or phase faults in the system.

5. Connect the two wires from the R-phase CT to terminals marked M1 & L1 such that S1 from CT goes to M1 on the unit.

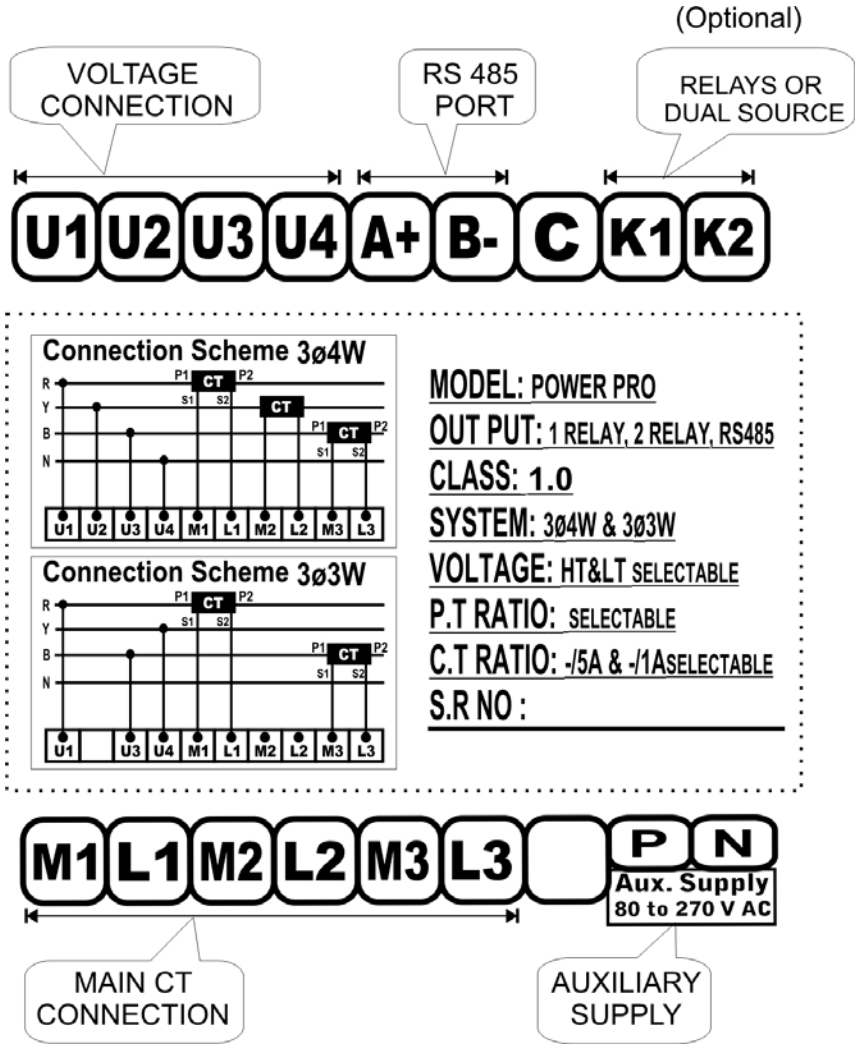
6. Connect the two wires from the B-phase CT to terminals marked M3 & L3 such that S1 from CT goes to M3 on the unit.

7. Switch on the auxiliary supply and also, the three phase supply. The unit will come alive and display "- -TRINITY ESPL- -" for about three seconds.

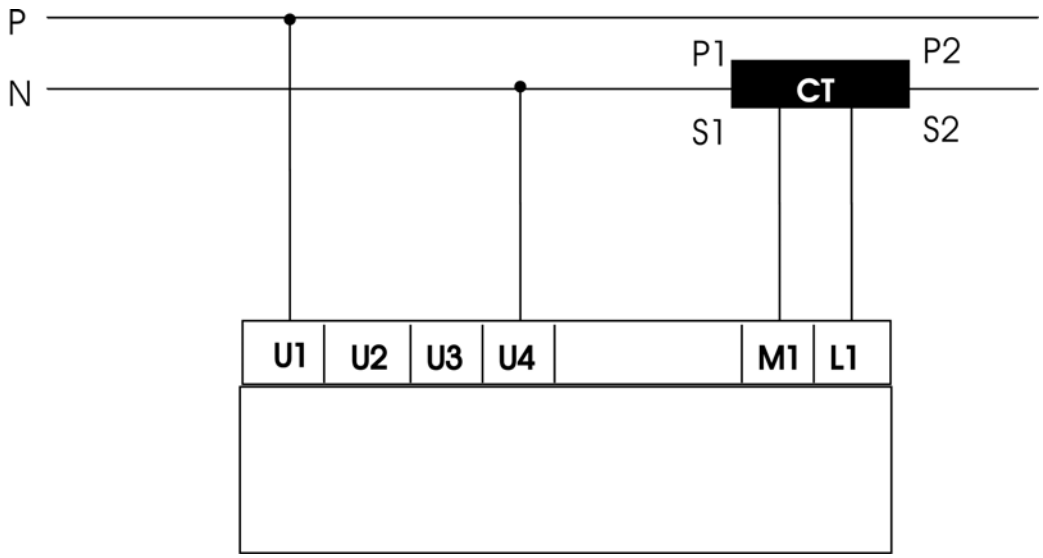
8. Set the correct CT Primary, secondary, PT ratio and scroll seconds etc. on the unit. For this refer to the OPERATIONAL DETAILS chapter.

10. The unit is ready for operation.

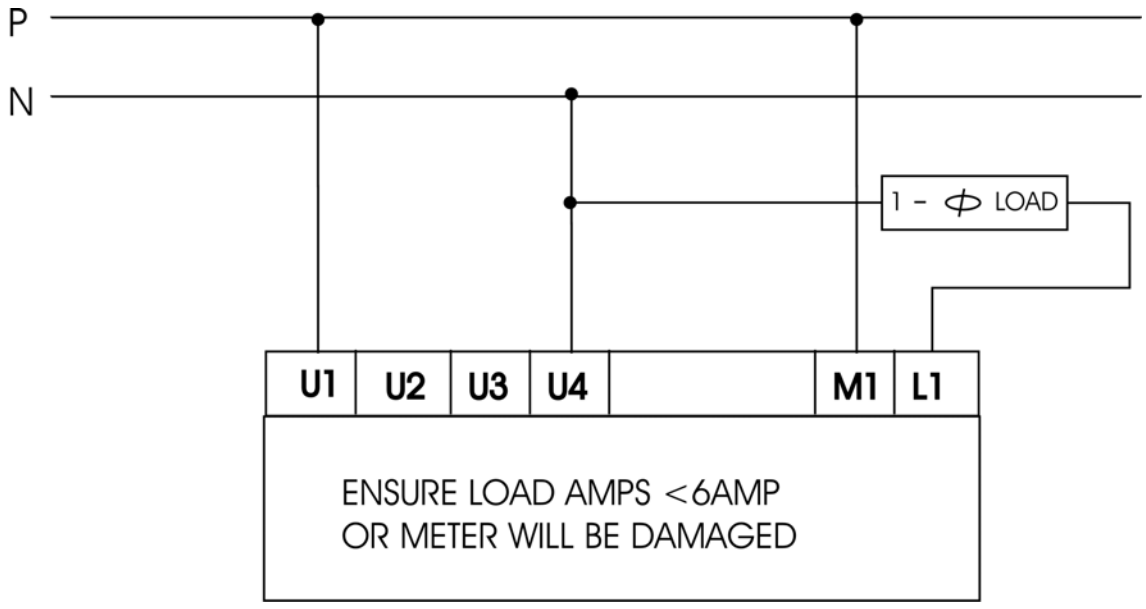
Connection Schemes:



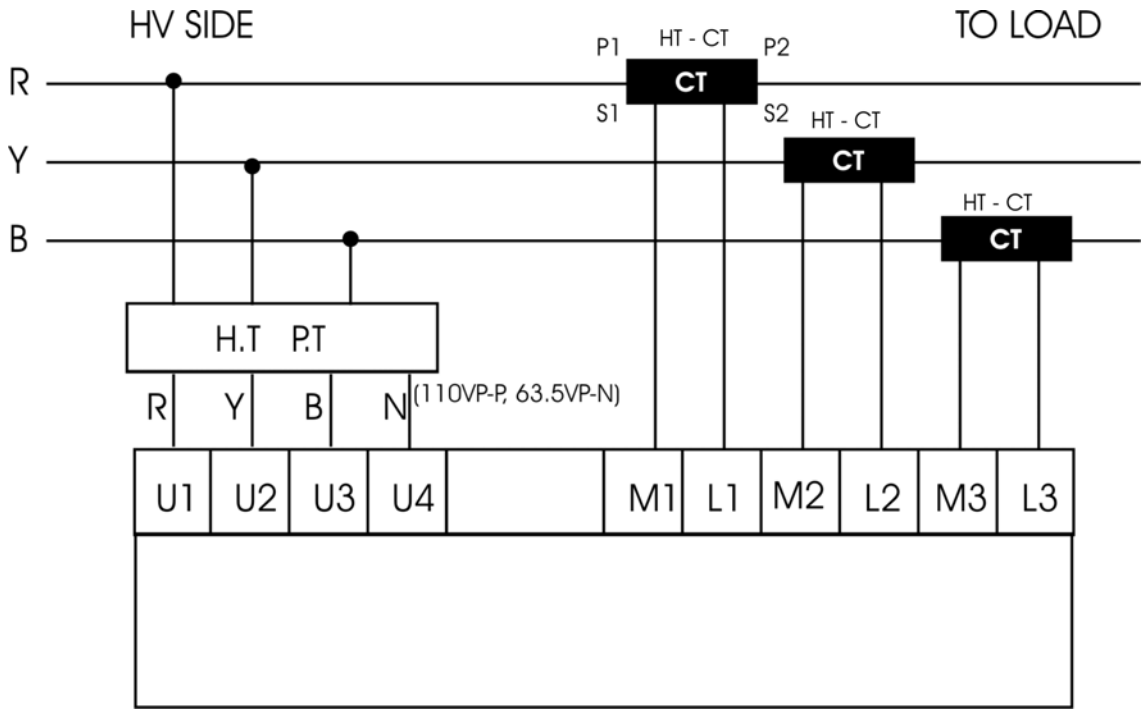
(i) Back View of the Unit



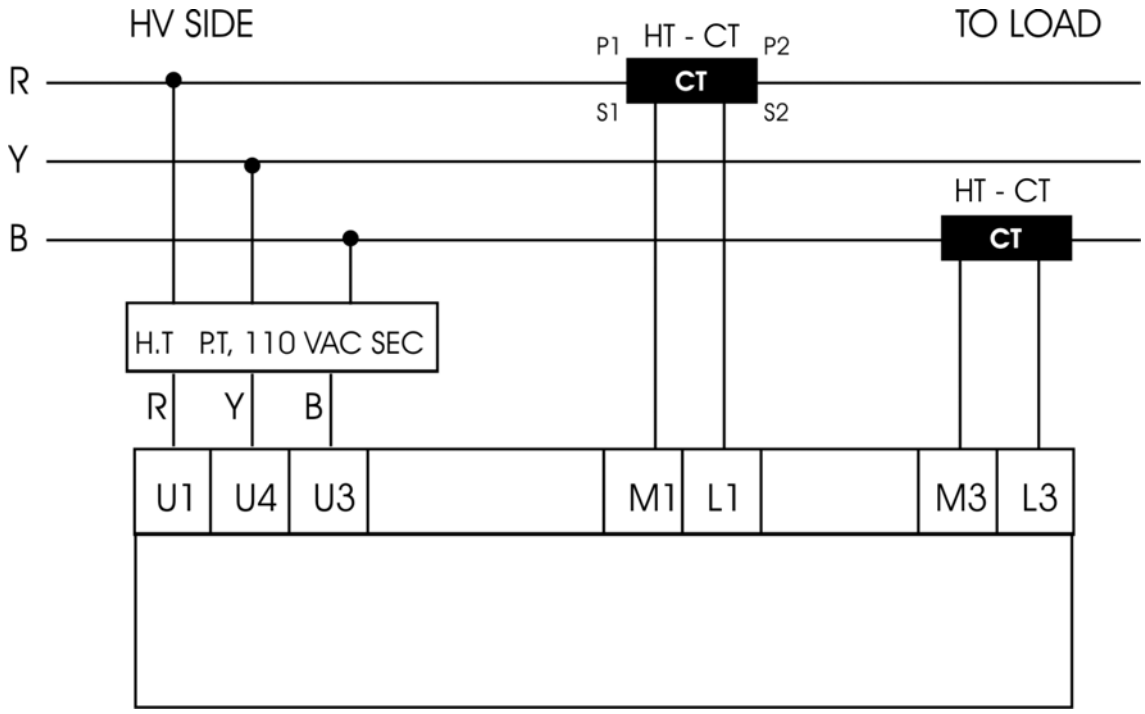
(ii) 1 Phase 2 Wire Connection, CT-Operated



(iii) 1 Phase 2 Wire Connection, Direct Loading



(IV) 3 Phase 4 Wire HT Connection with HT PT having Star Point, and HT CTs



(V) 3 Phase 3 Wire H.T. Connection with HT PT Without Star Point, and HT CTs (2 Nos. Only)

Operational Details

The electrical power meter, Power Pro is a versatile meter, with all the features needed to implement a robust electrical load management system. It can be configured to suit various electrical controls.

This is achieved by making as many parameters field programmable, as possible. In order to configure any parameter and, the parameters measured and calculated by the meter display in two modes, Programming Mode and Run Mode.

Programming Mode

After power on supplying voltage 80 VAC to 480 VAC, the unit displays immediately power receiving information "--TRINITY ESPL--" on LCD screen and by default, the display comes into Run mode:

Selecting Demand Parameter

Demand on can be selected for the calculation of Demand. The unit supports demand based on either KVA or KW, for an integration period of 30/15 minutes.

To set **Demand on**, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt **DEMAND ON** in Programming Mode as shown below display.

2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter to KVA or KW by pressing ▲ and ▼ keys.

3. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, Meter Address. If the Meter Address is not desired parameter, press ▲ key to go to the next desired parameter.

4. Otherwise, press **PROG** key to return into Run Mode.

Setting Meter Address for RS485 Port

The Power Pro meter has the provision to specify the meter address at site. The address can be set starting from 1 to 128.

To set the meter address, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt **DEMAND ON** in Programming Mode. Press ▲ key to reach Meter Address (ADDR) such as shown below display.

2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter by pressing ▲ and ▼ keys.
3. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, Alarm value.
4. If **Alarm Value** parameter is not desired, go to the next desired parameter to by pressing ▲ and ▼ keys.
5. Otherwise, press **PROG** key to return into Run Mode.

Operation of Alarm Contact (Relay Contact)

The meter has two alarm contacts. The relay contact is rated at 5A @ 250 VAC. The contact is normally open. The operation of the relay contact can be programmable at site. For this specification, there are three parameters to be programmed:

a. The **Alarm Parameter** for which the alarm has to be generated should be selected from any one of the following: Avg. Volt, Avg. Amps, KVA, KW, KVAR, and PF.

b. The **Alarm Values** which are programmable from 0005 to 5000 should be selected for which the alarm parameter has to be generated.

c. The **Time Delay** for a selected alarm parameter should be also set from 005 seconds to 180 seconds.

Understanding Hysteresis

There is a time delay involved in switching ON and OFF the relay. Also, if there is no hysterisis in the switching operation of the relay, there is bound to be frequent switching of the relay near the alarm value. To avoid this, a band of 5 % is added to the programmed value, which acts when the time to switch off the relay comes .e.g. Say, the parameter is set to KW; the value for operating the relay is programmed to 100 and the time delay is set to 30 seconds. The relay will, thus

operate when the KW crosses 100, ***and stays more than 100 for 30 seconds continuously.***

The relay will now open when the KW falls below 95, ***and stays that way for 30 seconds continuously.***

Thus, there is a time delay involved, and also a 5% band. However, since Demand is already an integrated parameter, there is only 2 seconds delay involved when the alarm contact is set for KW Demand.

In case of PF, the hysterisis is not there. However, PF has a multiplying factor (MF) of 1000. Thus, a PF value of 0.987 is set as 987. All this is summarized below:

Sr. No.	Alarm parameter	Relay switches on at	Relay switches off at	Settable Time Delay
1.	Avg. Volts	>Set value	<95 % of set value	005 to 180 sec.
2.	Avg. Amps.	>Set value	<95 % of set value	005 to 180 sec.
3.	KVA	>Set value	<95 % of set value	005 to 180 sec.
4.	KW	>Set value	<95 % of set value	005 to 180 sec.
5.	KVAR	>Set value	<95 % of set value	005 to 180 sec.
6.	Demands	>Set value	<95 % of set value	2 sec.(fixed)
7.	PF	<Set value	>Set value	005 to 180 sec.

To set **alarm value**, **alarm parameter** and **alarm delay**, follow the instructions below:

Setting Alarm 1 Value

1. Press **PROG** key for four seconds. The display will prompt **DEMAND ON** in Programming Mode.
2. Press ▲ key to reach Alarm 1 Value (**TRIP1 VAL**) such as shown below display.

3. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter value by pressing ▲ and ▼ keys

4. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, Alarm parameter.

Setting Alarm 1 Parameter

5. Press **ENTR** key to set Alarm 1 parameter. Immediately, "**P**" starts blinking which indicates that the parameter (**TRIP1 ON**) can now be changed such as shown below display.

6. Set the Alarm parameter according to your requirement by pressing ▲ and ▼ keys
7. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, Alarm Delay.

Setting Alarm 1 Delay

8. Press **ENTR** key to set the Alarm Delay. Immediately, "**P**" starts blinking which indicates that the parameter (**TIME LIMIT1**) can now be changed such as shown below display.

9. Set the Alarm Delay according to your requirement by pressing ▲ and ▼ keys
10. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, Alarm 2 value.
11. If the Alarm 2 value is not desired, go to the desired parameters by pressing ▲ and ▼ keys.
12. Otherwise, press **PROG** key for four seconds to return into Run Mode.

Similarly, Setting Alarm 2 Value, Alarm 2 Parameter and Alarm 2 Delay can be also done in the next three consecutive parameters.

Current Transformer (CT) Ratios:

Of the two current transformers ratio, CT Primary is settable from 0005 to 5000 whereas CT Secondary is settable as 1 or 5.

To set both the **CT Primary** and **CT Secondary**, follow the instructions below:

Selecting CT Primary

1. Press **PROG** key for four seconds. The display will prompt **DEMAND ON** in Programming Mode. Press ▲ key to reach CT primary such as shown below

display.

2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter by pressing ▲ and ▼ keys.
3. Press **ENTR** key so as to save the parameters and proceed to the next programmable parameter, CT Secondary.

Selecting CT Secondary

4. Press **ENTR** key to set CT Secondary. Immediately, "**P**" starts blinking which indicates that the parameter (**CT_SEC**) can now be changed such as shown below display.

5. Set the parameter to 1 or 5 by pressing ▲ and ▼ keys
6. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, PT Gain.
7. If **PT Gain** parameter is not desired, go to the desired parameters by pressing ▲ and ▼ keys.
8. Otherwise, press **PROG** key to return into Run Mode.

Selecting PT Gain

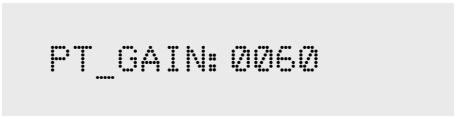
The unit can have a **PT Gain** (PT Ratio) programmed at site (for HT PT based installations) in between primary voltage and secondary voltage. **PT Gain** is selectable from one of the following values: 1, 30, 60, 100, 200, 300, 600, 1200, 3.7727 and 4.0000.

The following table is shown the values of **PT Gain** to be selected.

PT Primary	PT Secondary	PT Gain (PT Ratio)
No multiply factor		1
3300	110	30
6600	110	60
11000	110	100
22000	110	200
33000	110	300
66000	110	600
132000	110	1200
415	110	3.7727
440	110	4.0000

To select the **PT gain**, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt **DEMAND ON** in Programming Mode. Press ▲ key to reach **PT Gain** such as shown below display.



2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter by pressing ▲ and ▼ keys.
3. Press **ENTR** key so as to save the parameter and proceed to the next programmable parameter, **Installation type**.
4. If the Installation type is not desired, go to the next desired parameter by pressing ▲ and ▼ keys
5. Otherwise, press **PROG** key to return into Run Mode.

Selecting Installation Type

According to your electrical installation types, Power pro supports two types of installation: **3P4W** Installation and **3P3W** Installation parameters. This installation type of parameter is programmable.

To select the Installation type, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt DIMAND ON in programming mode. Press ▲ key to reach the Installation type (**INST.)** such as shown below display.

2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter to 3P3W or 3P4W according to your installation type by pressing ▲ and ▼ keys.
3. Press **ENTR** key so as to save the parameters and proceed to the next programmable parameter, **Reset energy**.
4. If the Reset Energy is not desired, go to the desired parameter.
5. Otherwise, press **PROG** key for four seconds to return into Run Mode. *Now, the unit will accept the new installation type and also reset!*

Resetting Energy and Demand

The energy and demand can be reset in programmable parameter. In order to reset energy parameter (KWh, KVAh, KVARh) and demand parameter (KVA_D,

KW_D), the two parameters should be reset to YES.

This feature should be used judiciously. It also reflects in the recorded data.

To reset the energy and demand, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt DEMAND ON in Programming Mode. Press ▲ key to reach Reset Energy (**RESET_E**) such as shown above display.
2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Reset the parameter by pressing ▲ key.
3. Press **ENTR** key so as to proceed to the next programmable parameter, Reset Demand as shown in above display.

4. Press **ENTR** key to reset Demand (**RESET_D**). Immediately, P starts blinking which indicates that the parameter can now be changed.
5. Reset the parameter by pressing ▲ key and then press **ENTR** key so as to proceed to the next parameter, Scroll.
6. If Scroll is not desired parameter, go to the desired parameter by pressing ▲ and ▼ keys.
7. Otherwise, press **PROG** key for four seconds to return into Run Mode.

Selecting Scroll Seconds

The Scroll Page Time is settable from 05 to 12 seconds. The unit will either continue to display the parameter steadily or scroll automatically. If the scroll seconds is set to Zero, the unit will be in FREEZE mode, and will NOT scroll automatically. In this case, the user can view the next or previous parameter by using the ▲ and ▼ keys.

In case, the scroll seconds value is set from 5 to 12 seconds, the unit will automatically scroll to the next parameter every scroll seconds in Run Mode.

In order to scroll the Run Mode display, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt **Demand On** in Programming Mode. Press ▲ key to reach Scroll parameter such as shown below display.

2. Press **ENTR** to set Scroll Second. Immediately, **P** starts blinking which indicates that the parameter can now be changed. Set Scroll Second by pressing ▲ and ▼ keys.

3. Press **ENTR** key so as to save and proceed to the next programmable parameter, BAUDRATE. If Baudrate is not desired parameter, go to the desired parameter by pressing ▲ and ▼ keys.
4. Otherwise, press **PROG** key for four second to return into Run Mode.

Selecting Baud Rate for RS 485

The unit supports RS485 with the following Baud Rates: 1200, 2400, 4800, 9600 and 19200. User can download live data using software utility provided by Trinity.

To set Baudrate, follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt DIMAND ON in programming mode. Press ▲ key to reach BAUDRATE such as shown below display.

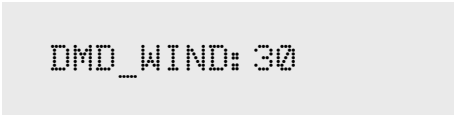
2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter to either 19200 or 9600 by pressing ▲ and ▼ keys according to your requirement.
3. Press **ENTR** key so as to save the parameters and proceed to the next programmable parameter, **Demand Window**. If Demand Window is not desired, go to the desired parameter by pressing ▲ and ▼ keys.
4. Otherwise, press **PROG** key for four seconds to return into Run Mode.

Selecting Demand Intervals

Demand On must be selected for the calculation of Demand. The unit supports demand based on either KVA or KW, for an integration period of 30 or 15 minutes.

To select for Demand Interval (Demand Window), follow the instructions below:

1. Press **PROG** key for four seconds. The display will prompt DEMAND ON in the Programming Mode. Press ▲ key to reach Demand Intervals (**DMD_WIND**) such as shown below display.



2. Press **ENTR** key. Immediately, "**P**" starts blinking which indicates that the parameter can now be changed. Set the parameter to either 30 or 15 by pressing ▲ and ▼ keys.

3. Press **ENTR** key so as to save the parameters and return to the first programmable parameter, **Demand On**.
4. If the operational settings are completed, press **PROG** key for four seconds to return into Run Mode.

Run Mode

In the run mode, the various parameters calculated by the meter are displayed on different pages on a 16 X 1 or 16X4 (optional) backlit LC Display. There are 16 parameters and 12 parameters which are displaying for the various system values of parameters in 3P4W and 3P3W.

Run Mode in 3P4W and 3P3W

Display in Run Mode	Descriptions
Vry=402.4	The first display shows phase to phase voltage between R-phase and Y-phase.
Vyb=407.6	The second display shows phase to phase voltage between Y-phase and R-phase.
Vbr=530.8	The third display shows phase to phase voltage between B-phase and R-phase. *(This display is not there in 3P3W mode).*
Ir=202.96	The fourth display shows current in R-phase.
Iy=239.96	The fifth display shows current in Y-phase. *(This display is not there in 3P3W mode)*
Ib=137.21	The sixth display shows current in B-phase.
KWh=14.19	The seventh display shows Active energy.
PF0.98 0.89 0.76	The eighth display shows three phase individual power factor. *(This display is not there in 3P3W mode)*

KVA=236.13	The ninth display shows Apparent power.
KW=168.73	The tenth display shows Active power.
KVAR=166.88	The eleventh display shows Reactive power.
KVAh=26.9	The twelfth display shows Apparent energy.
KVARh=19.8	The thirteen display shows Reactive energy.
49.43 Hz 0.989 LG	The fourteenth display shows prevailing line frequency and system power factor with lead (LD) and lag (LG) indication.
KW_D=0040 0261	The fifteenth display shows user defined KW demand parameter. The first four digits show the instantaneous value and the second four digits show the maximum demand value recorded. If user defined KVA demand in programmable parameter, this display will show KVA demand.
V 2.5 6.8 2.5 %	This display shows voltage THD in percentage form for each individual phase to neutral (R-Y-B). (*Y-phase=6.8 is not there in 3P3W mode).*
I 2.3 2.2 1.8 %	This display shows current THD in percentage form for each individual phase to neutral. (*Y-phase=2.2 is not there in 3P3W mode).*

KV419 161 426	The display shows three phase individual voltage of phase to neutral (R-Y-B). If PT Gain is equal to 1, then the display will show **Vpn**. *(This display is not there in 3P3W mode)*

Ordering Options

Power Pro can be ordered in the following options, according to your requirements.

<table>
<tr><th colspan="3">POWER PRO
Load Manager/ Maximum Demand Controller</th></tr>
<tr><th>Model</th><th>Features of Parameters Displayed on Power Pro</th><th>Optional features to be specified while ordering</th></tr>
<tr><td rowspan="4"> 

16X1 LCD</td><td rowspan="8">• Volts L-N, Volts L-L(Average & Phasewise), Current (Total & Phasewise),
• Power: KW, KVA, KVAR, Power Factor; (Total & Phasewise), Frequency.
• Energy: KWh, KVAh, KVARh, (Total & Phasewise)
• Max. Demand, Active & Apparent Power (KW or KVA), Sliding window,
• THD for each voltage & current (optional)
• RS485 port for Communication EMS/ PLC/ SCADA(Optional)
• Dual Source Measurement (optional)
• Alarm on: Avg. V, Avg. A, PF, KVA-Demand, KW-Demand
• Two individually programmable relays 5A @ 230 VAC, Resistive load (optional).</td><td>16X1 display</td></tr>
<tr><td>16X4 display</td></tr>
<tr><td>Dual Source</td></tr>
<tr><td>THD for V & I</td></tr>
<tr><td rowspan="4"> 

16X4 LCD</td><td>1 Relay Output</td></tr>
<tr><td>2 Relay Outputs</td></tr>
<tr><td>RS485</td></tr>
</table>

Control Output

The relay contacts provided in Power Pro are rated for 5A @ 250V AC. There are two relays in Power Pro which are programmable for the various parameters according to your requirements. These are also protected by snubbers against fast voltage transients which occur when inductive loads are switched off.

Thus, the following points are to be taken care of when using these relay contacts:

- Use 250V AC coils only in the contactors. DO NOT use 440V AC coils.
- DO NOT switch small loads like electronic Hooters, small relays with 250V AC coils etc., directly from the relay contact of Power Pro. If done so, the small leakage current from the snubbers will not allow these loads to be switched off fully. Thus, the electronic hooters will give a low hum continuously, and the small relays will switch on but not switch off.
- Use these relay contacts to switch an Auxiliary contactor and put the load on the contactor contacts.

Relays for Alarm Action

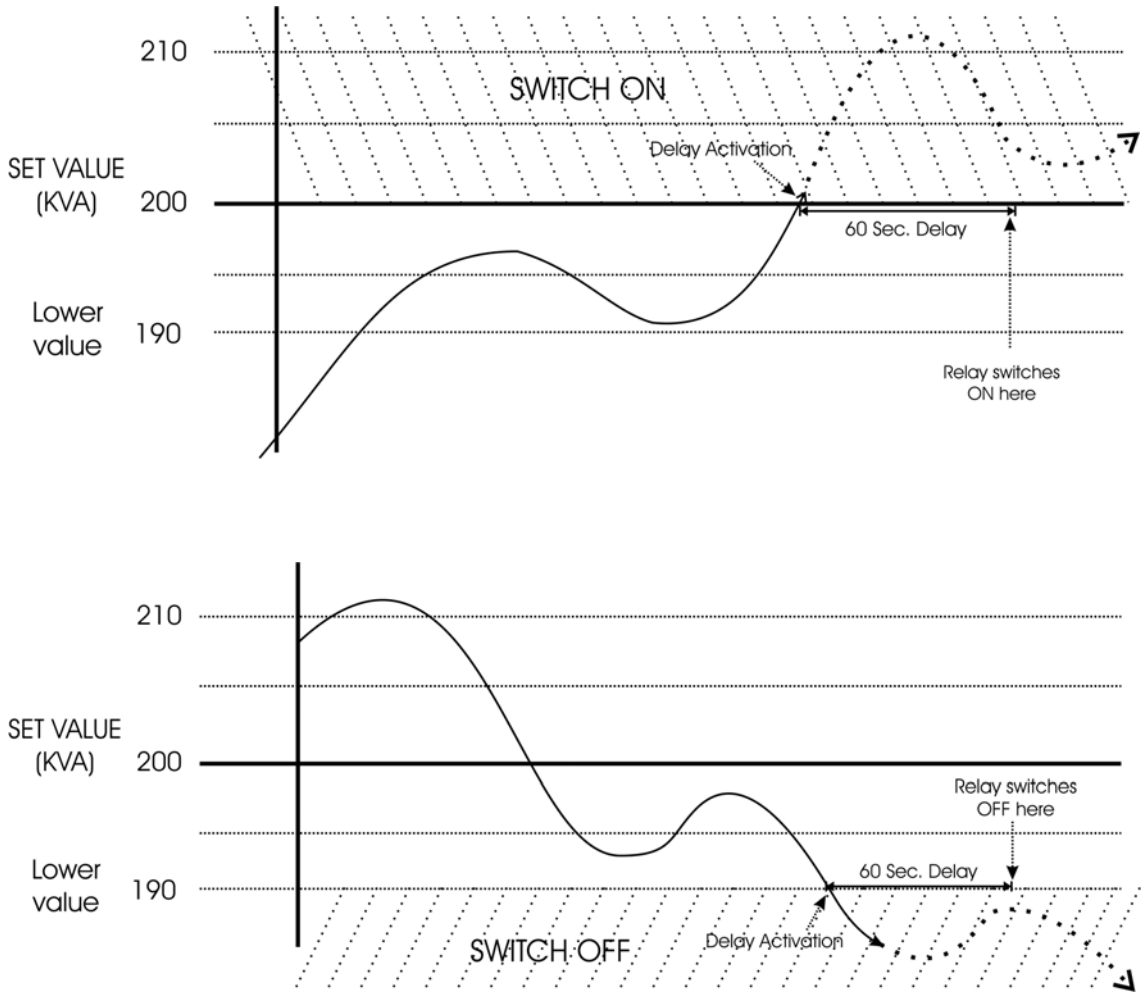
The relays can be programmed to operate for Alarm/Trip functions. Each relay is independently programmable for the parameter on which to operate, time delay before operation, and values for the operation to be triggered and release values.

Thus, one or two (optional) relays should be programmed for an alarm action in the programmable parameters according to your requirement as shown below:

SL NO.	Alarm Relay 1 (to be programmed)	SL NO.	Alarm Relay 2 (to be programmed)
1.	TRIP1VAL: 200	4.	TRIP2VAL: 987
2.	TRIP1 ON: KVA	5.	TRIP2 ON: PF
3.	TIME LIMIT1: 060	6.	TIME LIMIT2: 120

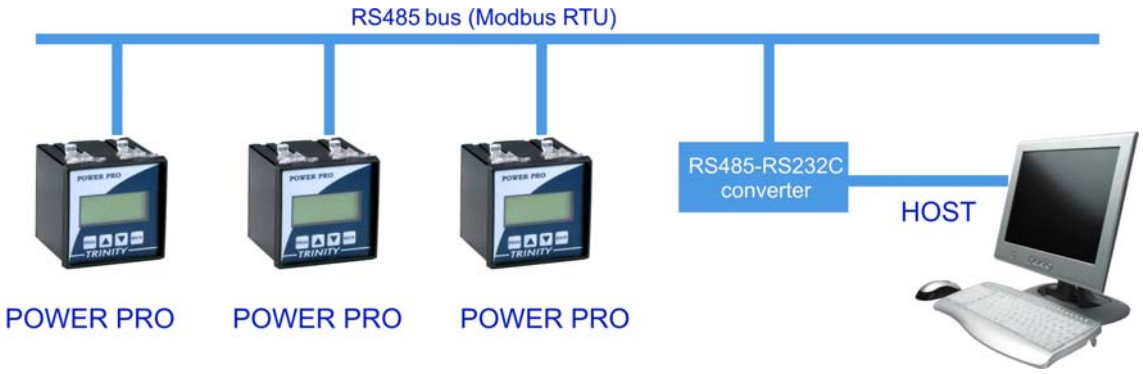
In order to program alarm parameters in one or two relays, user can select any one of the following parameters: Avg. Volt [(Vry+Vyb+Vbr)/3], Avg. Amps [(Ir+Iy+Ib)/3], KVA, KW, KVAR, DMND (demand), and PF.

For example, in case of Alarm Relay 1, the parameter is set to KVA; the value for operating the relay is programmed to 200 and the time delay is set to 60 seconds. The relay will, thus operate when the KVA crosses 200, *and stays more than 200 for 60 seconds continuously.* The relay will now open when the KVA falls below 190, *and stays that way for 60 seconds continuously.* That is why a band (hysterisis) of 5 % is added to the programmed value.



In case of PF, the hysterisis is not there and the operation is also reversed. It has a multiplying factor (MF) of 1000. Thus, a PF value of 0.987 is set as 987. Thus, when the PF value falls below 987, the relay will wait for 120 seconds and then close. However, the relay will open when PF crosses 987 with the specified delay.

Communication



RS485 CONNECTION

The industry standard RS-485 communication port option is also available in **Power Pro**. This option makes it possible for a user to select **Power Pro** to provide power and energy information into a variety of existing or new control systems and communication networks.

Modbus RTU on RS 485 Port

In order to download live data for the various system parameters, user can use RS485 connecting to a SCADA or EMS software. Power Pro supports an RS485 port with MODBUS-RTU support. The station id for every meter is site selectable, and so is the baud rate. 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: 1200 or 2400 or 4800 or 9600 or 19200 /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 except 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 1

RS485 Parameters Address with THD

3 phase 3000-3019	R phase 3030-3049	Y phase 3060-3079	B phase 3090-3109	MF
3000-KVA	3030-KWh	3060-(Vr-THD)	3090-DMND	X100
3002-KW	3032-KVAh	3062-(Ir-THD)	3092-MAX. DEMAND	X100
3004-KVAr	3034-KVARh	3064-(Vy-THD)	3094-(Vb-THD)	X100
3006-PF	3036-**Hz**	3066-(Iy-THD)	3096-(Ib-THD)	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

Appendix 2

RS485 Parameters Address including Dual with THD

3 phase 3000-3019	R phase 3030-3049	Y phase 3060-3079	B phase 3090-3109	MF
3000-KVA	3030-KWh	3060 DG-KWh	3090-DMND	X100
3002-KW	3032-KVAh	3062-(DG-KVAh)	3092-MAX. DEMAND	X100
3004-KVAr	3034-KVARh	3064-(DG-KVARh)	3094-(Vb-THD)	X100
3006-PF	3036-**Hz**	3066-(Vy-THD)	3096-(Ib-THD)	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
3014-(Vr-THD)	3044-(Ir-THD)	3074-(Iy-THD)	-	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, 03: if the address is not a valid, start address or host has requested more than 32 bytes of data, this code is returned.

P.O No. : ……

Customer : ……

Sr. No. : ……

Result of Test : ……

Remarks : ……

Test engineer : ……

Date : ……