USER'S MANUAL

XPERT-PRO

Electrical Power Meter

This document contains the latest technical information about Xpert-pro which is a micro-controller based Electrical Power Meter. The product Xpert-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.

Trinity Energy Systems Pvt. Ltd.

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Contents

Introduction

The electrical power meter, Xpert-pro is a micro-controller based unit which measures various electrical parameters, and sequentially displays on a 128X64 backlit LCD. The meter has four LEDs in the front, one to calibrate energy (KWh), one to indicate the status of RS485 communication and other two shows Status of the Relay.

The unit is meant for use in three phase four wire/ three wire systems. In three phase four wire LT 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 VAC) 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, currents, frequency, power factors, individual Harmonic data as Histogram including Total Harmonic Distortion as well as individual current and voltage waveforms for all three phases. Based on these inputs, the system KVA, KW and KWh can also be 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

- All readings are true RMS measurements
- Site selectable 1A or 5A CT secondary
- CT and PT Ratio site selectable
- Measurement of all three voltages-phase to phase, phase to neutral, all currents in three phases including frequency (Hz)
- Measurement of three powers (KVA, KW and KVAR), three energies (KVAh, KWh and KVARh) for both EB and DG.
- Indication of system PF including individual PF in three phases at lead and lag side
- Demand Measurement - KVA or KW (Site selectable).
- Individual Odd Harmonics up to 15th for voltage and current including THD
- Odd Harmonic data as Histogram for each individual current and voltage

- Individual Current and Voltage Waveforms for each phase of three phases.
- RS-485 port for connection to SCADA/EMS.RS-485 communication with indication RX/TX LED.
- KWh Energy Pulse output on the LED (1000 impulses/KWh basic).
- All parameters with default accuracy class 1.0s
- Two relay contacts for alarm/trip which are programmable for different parameters including (Sliding) Demand powers (KW and KVA).
- In ideal condition the back light will turn off after 5 min. And if any key is pressed back light will on.

Technical Specifications

Parameters			
Type		**Name**	**Statistics**
INPUT		Supply	Three Phases and Neutral of a 3P4W system / Three Phases of a 3P3W system & Phases and Neutral of a 1P2W system
		Voltage	Direct Voltage Input : 25 to 500V L-L, 25 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 : 5 – 5000A Burden : < 1.0VA Overload : 5A CT ⟶ 6A RMS Continuous 1A CT ⟶ 1.2A RMS Continuous
		Power Supply	Auxiliary Supply : 80 - 270 VAC, 50-60 Hz.
OUTPUT		Relay	Two. Individually Field Programmable. 3A @ 230 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 65 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 9999999.9 Accuracy : class 1.0S as per IS13779.
		Total Apparent Energy (KVAh)	Range of Reading : 0 to 9999999.9 Accuracy : 1.0% of Reading
		Total Reactive Energy (KVARh)	Range of Reading : 0 to 9999999.9 Accuracy : 1.5% of Reading
	Power Quality	Individual Wave form for each voltage and current	
		THD for each current and voltage in three phases	
MISCELLANEOUS	Dimensions	Bezel	96 X 96 mm
		Panel Cutout	90 X 90 mm
		Depth of installation	55 mm
		Display	128X64 LCD
		Operating temp	10℃ to 50℃
		Weight	0.35 Kgs (Approx.)
		Min. Operating Current	0.4% to 120% of CT primary
	Comm.	RS485	Modbus-RTU protocol
		Calibration LED.	Red color. 1000 impulses/unit(basic) for KWh

		Communication LED	Dual color LED. Data Receive – Green LED. Data Transmit – Red LED.
		Relay LED	2 Red Color for Relay ON Indication.

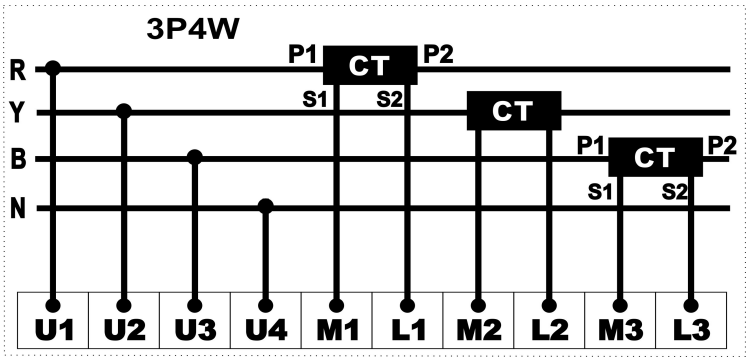
Installation and Commissioning

The unit supports three types of electrical installation such as 3P4W/3P3W/1P2W. According to user's requirement, the three electrical installation types can be selected either.

3P4W Mode Installation

For Installation and Commissioning, proceed the following instructions.

1. Push the unit into the panel and mount it by using the clamps provided. Connect the Auxiliary supply (80 VAC to 270 VAC) to the terminals marked P and N.



2. 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 three phases coming to the unit come through control fuses of 1.0 Amp rating. This will protect the electronic inside from damage due to severe over voltages or phase faults in the system.

3. Connect the neutral wire to the terminal marked U4.

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 on the unit. Connect the two wires from the Y-phase CT to the terminals marked M2 & L2 such that S1 from the Y-phase CT goes to M2 on the unit. Connect the two wires from the B-phase CT to the terminals marked M3 & L3 such that S1 from CT goes to M3 on the unit.

5. Switch on the three phases supply as well as the auxiliary supply. The unit will come alive and display such as Firmware Version, CT Ratio, Device ID and Installation type and then, the unit enters into Run Mode displaying the first page.

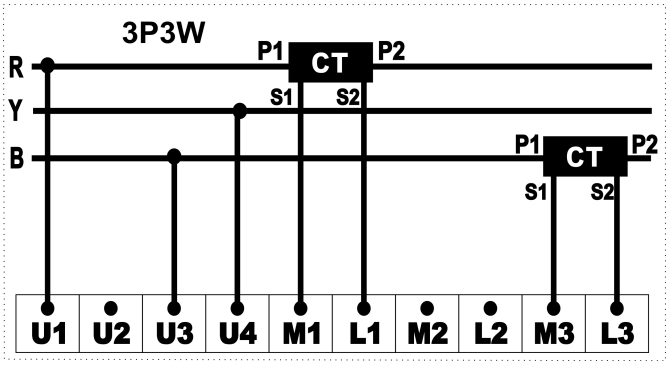
6. The unit should be programmed for all the required parameters which are field programmable and therefore, for selecting the various options supported, refer Operational Details in next section.

7. Now, the unit is ready for operation.

3P3W Mode Installation

For Installation and Commissioning, proceed the following instructions.

1. Push the unit into the panel and mount using the clamps provided. Connect the auxiliary supply (80 VAC to 270 VAC) to the terminal marked P and N.



2. Connect the three phases such as R-phase to the terminal marked U1, Y-phase to the terminal marked U4 and B-phase to the terminal marked U3 respectively. Make sure that the three phases coming to the unit come through control fuse of 1.0 rating.

3. Connect the two wires from R-phase CT to the terminal marked M1 & L1 such that S1 from CT goes to M1. Connect the two wires from B-phase CT to the terminal marked M3 & L3 such that S1 from the CT goes to M3 on the unit.

4. Switch on the three phases supply as well as the auxiliary supply. The unit will come alive and display such as Firmware Version, CT Ratio, Device ID and Installation Type and the unit then, enters into Run Mode displaying the first page.

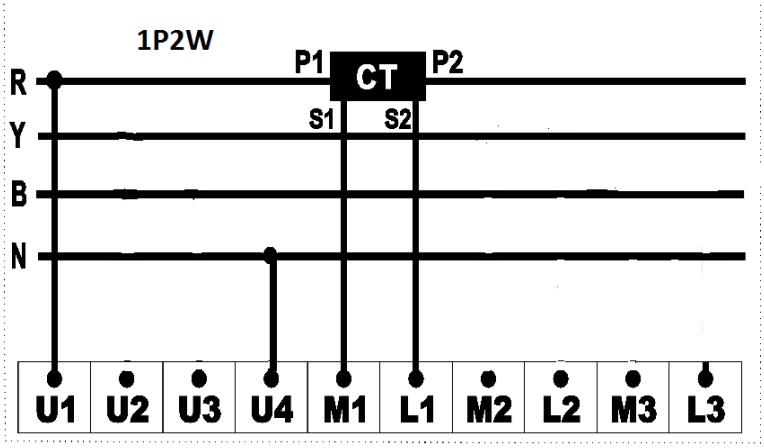
5. The unit should be programmed for all the required parameters which are field programmable and therefore, for selecting the various options supported, refer Operational Details in next section.

6. Now, the unit is ready for operation.

1P2W Mode Installation

For Installation and Commissioning, proceed the following instructions.

1. Push the unit into the panel and mount using the clamps provided. Connect the auxiliary supply (80 VAC to 270 VAC) to the terminal marked P and N.



2. Connect the R-Phase (Single phase) to the terminals marked U1. Make sure that the phase coming to the unit comes through control fuses of 1.0 Amp rating. This will protect the electronic inside from damage due to severe over voltages or phase faults in the system.

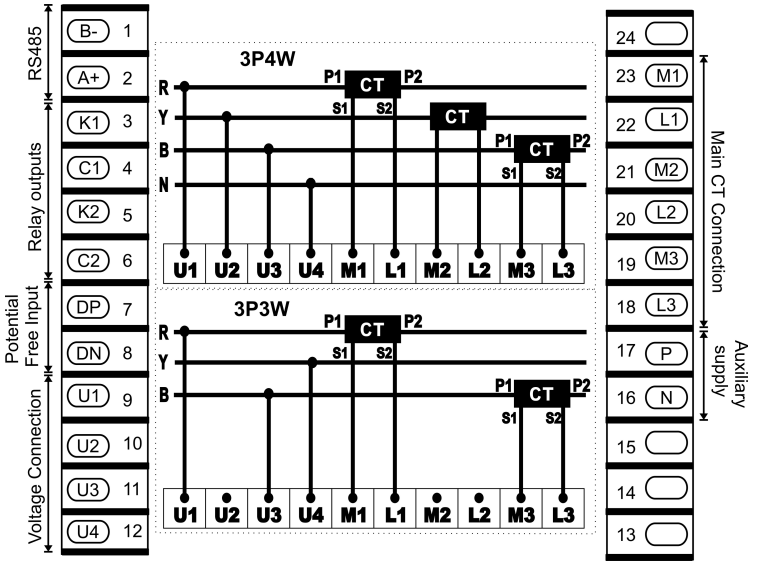
3. Connect the neutral wire to the terminal marked U4.

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 on the unit.

5. Switch on the single phases supply as well as the auxiliary supply. The unit will come alive and display such as Firmware Version, CT Ratio, Device ID and Installation type and then, the unit enters into Run Mode displaying the first page.

6. The unit should be programmed for all the required parameters which are field programmable and therefore, for selecting the various options supported, refer Operational Details in next section.

7. Now, the unit is ready for operation.



Connection Scheme

Operational Details

The electrical power meter, Xpert-Pro is a versatile meter with all the features needed to implement for a robust electrical power 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:

1. Programming Mode
2. Run Mode.

After supplying power (80 VAC to 270 VAC) the unit displays immediately power receiving information such as Firmware version, CT Ratio, Device ID and Installation type on LCD screen and then, the display comes into the first page of Run Mode by default such as shown below.

```
Vry=408.4
Vyb=412.7
Vbr=415.2
49.32Hz
```

Now, the unit can be operated by using the keys provided such as ▲, ▼ and PROG ENTR for both Programming Mode and Run Mode.

Programming Mode

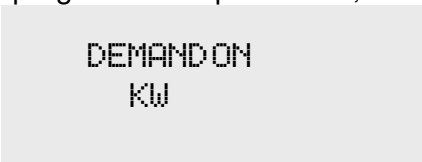
The unit is easy user interface for all the field programmable parameters by pressing ▲, ▼ and PROG ENTR keys provided. In order to program for all the parameters, the user should precede upto 18 parameters with the following displays.

Selecting Demand On and Demand Window

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

To retrieve the DEMAND ON, precede the following instructions.

In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON.



1. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the DEMAND ON by pressing ▲ and ▼ keys according to your desire and then press PROG ENTR key to save the parameter.

2. Press ▲ key to retrieve the next programmable parameter, DEMAND WINDOW and then set as above parameter for the following display.

3. After setting the parameter, the unit will reset and return into Run Mode. In case, your setting is incomplete, precede as above steps 1 and 2.

Selecting Installation Type

The unit supports three types of electrical installation such as 3P4W, 3P3W and 1P2W. So the user should select to either 3P4W or 3P3W or 1P2W accordingly.

To select the Installation Type, precede the following instruction.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit will display the first programmable parameter, DEMAND ON. Press ▲ keys to retrieve the programmable parameter, INSTALLATION TYPE such as shown below.

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the Installation Type to either 3P4W or 3P3W or 1P2W by pressing ▲ and ▼ keys according to your desire and then press PROG ENTR key so as to save the parameter. However, the unit will reset and return into Run Mode.

3. In case, your setting is incomplete, precede as above step 1 and 2.

Selecting PT Gain

The PT Gain is the ratio of PT Primary and PT Secondary which is also selectable at site. The PT Gain should be selected so as to give the actual voltage in your PT operated meter with the following table.

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
690	110	6.2727

To select the PT Gain, precede the following instruction

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ keys to retrieve the programmable parameter, PT GAIN such as shown below.

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the PT GAIN by pressing ▲ and ▼ keys according to your desire and then press PROG ENTR key so to save the parameter. However, the unit will reset and return into Run Mode.

3. In case, your setting is incomplete, precede as above steps 1 and 2.

Setting CT Primary

CT Primary should be selected at site so as to give the actual current for CT operated meters. The CT Primary can be selected from 5 to 5000.

To retrieve the CT Primary, precede the following instructions.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ keys several times to retrieve the programmable parameter, CT PRIMARY such as shown below.

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the CT PRIMARY by pressing ▲ and ▼ keys according to your desire and then press PROG ENTR key to save the parameter. However, the unit will reset and return into Run Mode.

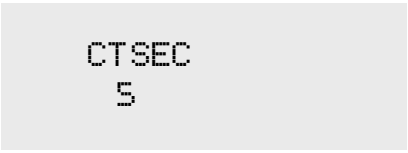
3. In case, your setting is incomplete, precede as above steps 1 and 2.

Setting CT Secondary

CT Secondary should be selected at site so as to give the actual current for CT operated meters. CT Secondary can be selected to either 1 or 5.

To retrieve the CT Secondary, precede the following instructions.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ keys several times to retrieve the programmable parameter, CT Secondary such as shown below.



2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the CT SECONDARY by pressing ▲

and ▼ keys according to your desire and then press PROG ENTR key to save the parameter. However, the unit will reset and return into Run Mode.

3. In case, your setting is incomplete, precede as above steps 1 and 2.

Setting Device ID along with Baud Rate for RS485 port

The unit supports Modbus RTU on RS485 communication port for downloading the live data at site and the Device ID should therefore be set starting from 1 to 255. According to your requirement the Baud Rate can also be selected to 4800 or 9600 or 19200.

To retrieve the DEVICE ID, precede the following instructions.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ keys several times to retrieve the programmable parameter, DEVICE ID such as shown below.

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the DEVICE ID by pressing ▲ and ▼ keys according to your desire and then press PROG ENTR key to save the parameter.

3. Press ▲ key to retrieve the next programmable parameter, BAUD RATE and then set as above parameter for the following display.

4. After setting, the unit will reset and return into Run Mode. In case, your setting is incomplete, proceed as above steps 1 and 2.

Setting K1 On, K1 Value and K1 Time for an Alarm Parameter

The meter has two relays for an alarm contacts. The relay contact is rated 3A @ 230 VAC. The contact is normally open where the operation of the relay contact can be programmable at site. For this specification, there are three parameters to be programmed such as shown below:

a. The **Alarm Parameter (K1 ON)** for which the alarm has to be generated

should be selected from any one of the following: Demand, Avg. Volt, Avg. Amps, KVA, KW, KVAR, and PF.

b. The **Alarm Values (K1 Value)** which are programmable from 5 to 5000 should be selected for which the alarm parameter has to be generated. In case of PF, the Alarm value can be set from 60 to 100.

c. The **Time Delay** (**K1 Time**) for a selected alarm parameter should be also set from 5 seconds to 180 seconds. In case of Demand, it will be fix 2 seconds.

Understanding Hysteresis

There is a time delay involved in switching ON and OFF the relay. Also, if there is no hysteresis 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 Demand.

In case of PF, the hysteresis is not there. However, PF has a multiplying factor (MF) of 100. Thus, a PF value of 0.98 is set as 98. 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 retrieve the K1 On, K1 Value and K1 Time, precede the following instructions.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ keys several times to retrieve the programmable parameter, K1 ON such as shown below.

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the K1 ON by pressing ▲ and ▼ keys according to your desired parameter and then press PROG ENTR key to save the parameter.

3. Press ▲ key to retrieve the next programmable parameter, K1 VALUE and then set as above parameter for the following display.

4. After setting K1 VALUE, press ▲ key to retrieve the next programmable parameter, K1 TIME and then set as above parameter for the following display.

5. To retrieve to the next desired parameter, K2 ON, press ▲ key so as to set as before. Or else, PROG ENTR key for about five seconds to return into Run Mode.

Setting K2 On, K2 Value and K2 Time for an Alarm Parameter

To set K2 ON, K2 VALUE and K2 TIME, proceed as before K1 ON, K1 VALUE and K1 TIME.

Auto scrolling the Run Mode pages

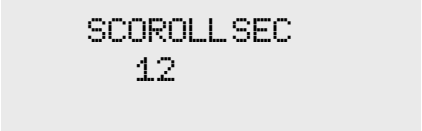
Scroll second is settable from 5 to 12 seconds. The unit will either continue to display the parameter steadily or scroll automatically. If the SCROLL SECOND is set to Zero, the unit will be in FREEZE mode, and will not scroll automatically.

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

To scroll the Run Mode pages, precede the following instruction.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ key several times

to retrieve the programmable parameter, AUTOSCROLL SECOND such as shown below.



2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be set. Set the SCROLL SECOND according to your desire by pressing ▲ or ▼ keys and then press PROG ENTR key to save the parameter.

3. To retrieve to the next desired parameters, press ▲ key so as to set as before. Or else, press PROG ENTR key for about five seconds to return into Run Mode.

Setting Time to Run Hour and Load Run Hour

The unit supports two types of times: (i) Run Hour (ii) Load Run Hour. User should select one of these options. Run Hour is the time to be counted since the unit receives power. Load Run Hour is the time to be counted since the Load receives energy.

To set this time, follow the instructions below:

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ keys several times to retrieve the programmable parameter, Time such as shown below.

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the TIME by pressing ▲ and ▼ keys according to your desire and then press PROG ENTR key to save the parameter. However, the unit will reset and return into Run Mode.

3. In case, your setting is incomplete, precede as above steps 1 and 2.

Resetting Energy

The three energies such as KWh, KVAh and KVARh for both EB and DG can be reset. In case, RESET ENERGY is set to YES, for all the values of energies in Run Mode will be reset to zeroes.

To select the RESET ENERGY, precede the following instruction.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit displays the first programmable parameter, DEMAND ON. Press ▲ key several times to retrieve the programmable parameter, RESET ENERGY such as shown below.

```
RESET
ENERGY
YES?
```

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Set the RESET ENERGY to YES by pressing ▲ or ▼ keys and then press PROG ENTR key to reset all energy parameter.

3. To retrieve to the next desired parameters, press ▲ key so as to set as before. Or else, press PROG ENTR key for about five seconds to return into Run Mode.

Resetting Demand Power

Both KW_D and KVA_D can be reset with their maximum Demand Power (MAX DMD). In case, Demand Power is set to YES, both the Demand Powers including Maximum Demand will be replaced by zeroes in Run Mode.

To select the Reset Demand, precede the following instructions.

1. In Run Mode, press PROG ENTR key for about five seconds and then the unit will display the first programmable parameter, DEMAND ON. Press ▲ key several times to retrieve the programmable parameter, RESET DEMAND such as shown below.

```
RESET
DEMAND
YES?
```

2. Press PROG ENTR key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Set RESET DEMAND to YES by pressing ▲ or ▼ keys and then press PROG ENTR key to reset all Demand parameter.

3. To retrieve to the next desired parameters, press ▼ key so as to set as before. Or else, press PROG ENTR key for about five seconds to return into Run Mode If your setting is completed.

Run Mode

In the run mode, the various parameters calculated by the meter display on different pages with 128X64 LCD backlit and are also true rms measurement. However, all the Power values displayed will auto scale to Mega from Kilo when the KVA value crosses 10,000. e.g., KVA≥10000.0, it will show as 10.00 MVA.

There are 30 pages in 3P4W, 22 pages in 3P3W, and 15 pages in 1P2W with its individual and system values in three phases.

Run Mode in 3P4W

In case, the pages are frozen, each page can be altered by pressing ▲ and ▼ keys so as to display such as below pages.

```
Vry=408.4
Vyb=413.9
Vbr=415.3
49.59  Hz
```

The first page shows phase to phase voltage in three phases with system frequency. In case, PT ratio >10.0, the voltages will auto scale to KV.

```
Ir=29.18
Iy=29.24
Ib=32.21
```

The second page shows R-phase, Y-phase and B-phase current in three phases.

```
PF
R 0.797 LG
Y 0.784 LG
B 0.813 LG
```

The third page shows the individual PF in R-phase, Y-phase and B-phase with lagging PF. In case of leading PF, the unit will show “LD” sign for all three individual phases.

```
KVA=21.61
KW=17.24
KVAr=13.09
PF=0.796 LG
```

The fourth page shows the three powers such as KVA, KW and KVAR including system PF to lag side.

```
KVAh
35.09
KWh
29.42
```

The fifth page shows both Apparent Energy (KVAh) and Active energy (KWh).

```
KVArh
24.40
TEB
00000:15:50
```

The sixth page shows Reactive Energy (KVARh) and time for EB.

```
DG KVAh
5.09
DG KWh
2.42
```

The seventh page shows Apparent Energy (KVAh) and Active energy (KWh) for DG.

```
DG KVArh
4.40
TDG
00000:05:10
```

The eighth page shows Reactive Energy (KVARh) and time for DG.

```
KVA_D
10
MAX DMD
40
```

The ninth page shows user defined instantaneous KVA demand (KVA_D) power with the maximum demand (MAX DMD) power occurrence recorded. In case, user defined parameter is KW, the page will display KW_D instead.

```
Vrn=238.6
Vyn=235.7
Vbn=240.8
```

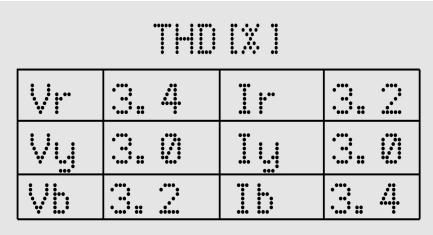
The tenth page shows phase to neutral voltage in three phases. In case, PT ratio >10.0, the voltages will auto scale to KV.

Vr Hrm [%]		9TH	0.9
3rd	2.1	11th	0.9
5th	1.2	13th	0.8
7th	0.5	15th	0.4

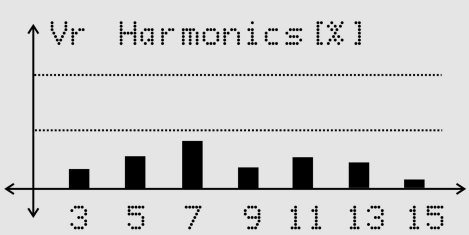
The eleventh page shows odd harmonics from 3rd to 15th for voltage in R-phase with percentage form. Likewise, the odd harmonics for voltage in Y-phase and B-phase will also be shown on 13th and 15th pages respectively.

Ir Hrm [%]		9TH	0.9
3rd	2.0	11th	1.1
5th	1.0	13th	1.2
7th	1.1	15th	0.2

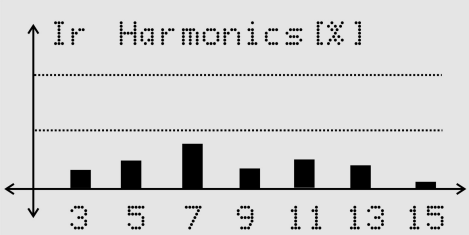
The twelfth page shows odd harmonics from 3rd to 15th for current in R-phase with percentage form. Likewise, the odd harmonics for current in Y-phase and B-phase will also be shown on 14th and 16th pages respectively.



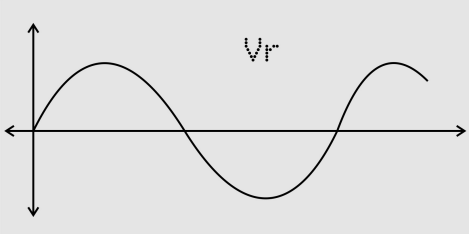
The seventeenth page shows total Odd Harmonics Distortions for both voltage and current in R-Y-B phases with percentage form.



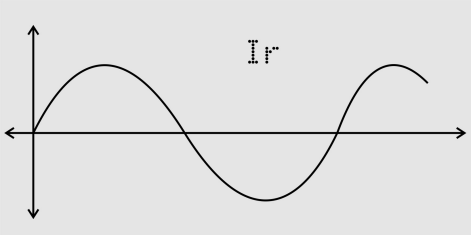
The eighteenth page shows Odd Harmonics Histogram for voltage in R-phase with percentage form. Likewise, Odd Harmonics Histogram for voltages in both Y-phase and B-phase will also be shown on 20th and 22nd pages respectively.



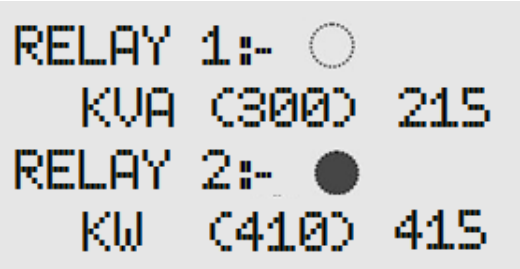
The nineteenth page shows Odd Harmonics Histogram for current in R-phase with percentage form. Likewise, Odd Harmonics Histogram for current in both Y-phase and B-phase will also be shown on 21st and 23rd pages respectively.



The twenty fourth page shows the Waveform for voltage in R-phase. Here user can see if harmonic distortion is occurring in the wave form due to non-linear loads like rectifier and UPS etc. Likewise, the wave form for voltage in both Y-phase and B-phase will also be shown on 26th and 28th pages.



The twenty fifth page shows the Waveform for current in R-phase. Here user can see if harmonic distortion is occurring in the wave form due to non-linear loads like rectifier and UPS etc. Likewise, the wave form for current in both Y-phase and B-phase will also be shown on 27th and 29th pages.



The 30th display page shows relay status with its selected parameter for which alarm has to be generated. Value displayed in bracket indicates the value programmed for assigned parameter. Value displayed without bracket indicates run time value of assigned parameter.

Run Mode in 3P3W

The similar pages for the various parameters including Harmonic values, Histograms and Waveforms such as shown before in 3P4W can also be seen in 3P3W except the individual PF in three phases.

Run Mode in 1P2W

The similar pages for the various parameters including Harmonic values, Histograms and Waveforms such as shown before in 3P4W can also be seen in 1P2W for single phase Voltage & Current. In 1P2W mode, it considers R-Phase Voltage & Current for measurement.

Control Outputs

The relay contacts are rated 3A@230 VAC of which the two relays are programmable for the various alarm parameters according to your requirements. Hence, the relays are protected by snubbers against fast voltage transients occurred when inductive loads are switched off.

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

- Use 230V AC coils only in the contactors. DO NOT use 440V AC coils.
- DO NOT switch small loads like electronic Hooters, small relays with 230V AC coils etc., directly from the relay contact of XPERT-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.

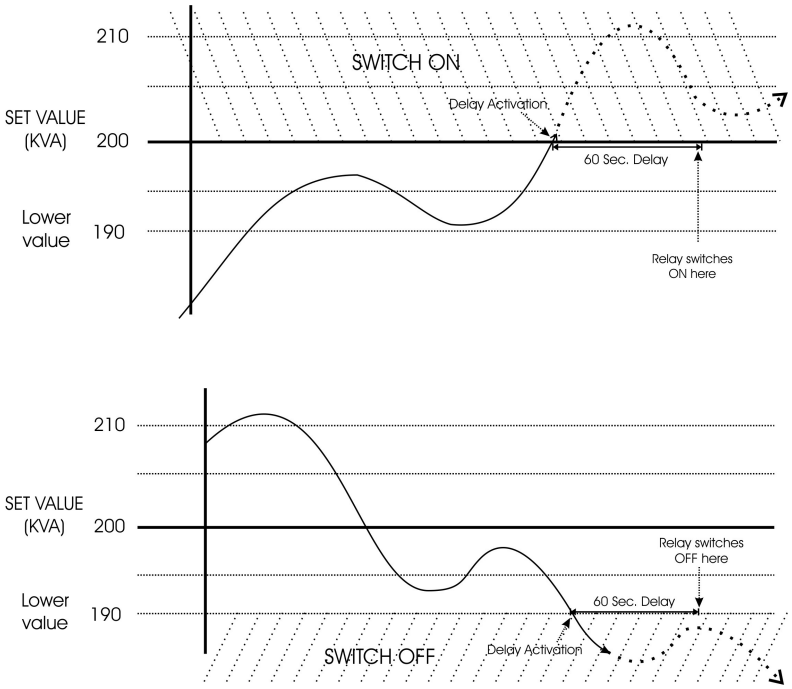
Relays for Alarm Action

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 released values.

The two relays for alarm parameters should, therefore be programmed at site such as shown below.

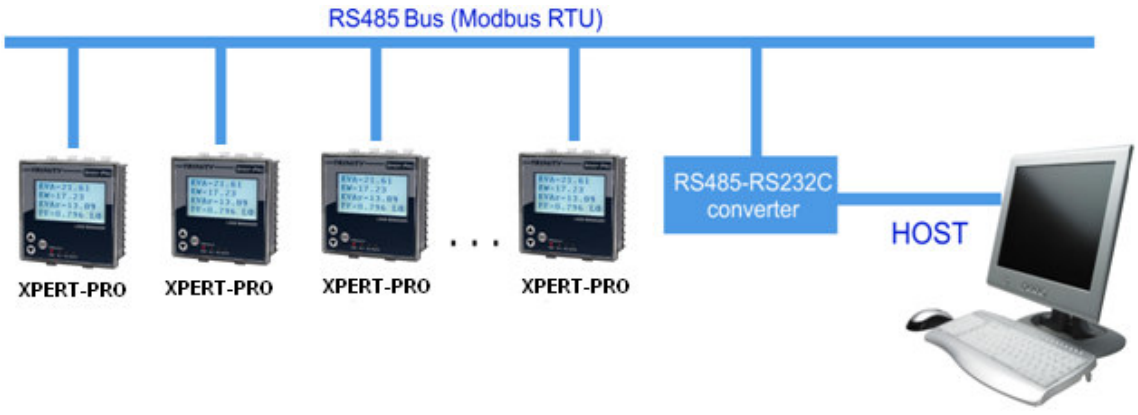
SL NO.	Alarm Relay 1	SL NO.	Alarm Relay 2
1.	K1 VAL:200	4.	K2 VAL:98
2.	K1 ON:KVA	5.	K2 ON:PF
3.	K1 TIME:060	6.	K2 TIME:120

In order to program alarm parameters for 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 for 60 seconds continuously. That is why a band (hysteresis) of 5% is added to the programmed value.



In case of PF, the hysteresis is not applicable and the operation is also reversed. It has a multiplying factor (MF) of 100. Thus, a PF value of 0.98 is set as 98. Thus, when the PF value falls below 98, the relay will wait for 120 seconds and then close the switch. However, the relay will open when PF crosses 98 with the specified delay.

Communication



RS485 CONNECTION

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

Modbus RTU on RS485 Port

In order to download live data for the various system parameters, user can use RS485 connecting to SCADA or EMS software. XPERT-PRO supports an RS485 port with MODBUS-RTU protocol. 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: 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 254 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

Address	3P4W	3P3W	1P2W	MF
200	Vrn	Vry	Volts	x100
202	Vyn	Reserve	Reserve	x100
204	Vbn	Vbr	Reserve	x100
206	Avg. Vpn	Reserve	Reserve	x100
208	Vry	Reserve	Reserve	x100
210	Vyb	Reserve	Reserve	x100
212	Vbr	Reserve	Reserve	x100
214	Avg. Vpp	Avg. Vpp	Reserve	x100
216	Ir	Ir	Amps	x100
218	Iy	Reserve	Reserve	x100
220	Ib	Ib	Reserve	x100
222	Avg. I	Avg. I	Reserve	x100
224	Reserve	Reserve	Reserve	
226	Reserve	Reserve	Reserve	
228	Reserve	Reserve	Reserve	
230	Frequency	Frequency	Frequency	x100
232	System PF	System PF	System PF	x1000
234	PF_R	Reserve	Reserve	x1000
236	PF_Y	Reserve	Reserve	x1000
238	PF_B	Reserve	Reserve	x1000
240	System KW	System KW	System KW	x100
242	System KVAR	System KVAR	System KVAR	x100

244	System KVA	System KVA	System KVA	x100
246	KW_R	Reserve	Reserve	x100
248	KW_Y	Reserve	Reserve	x100
250	KW_B	Reserve	Reserve	x100
252	KVAR_R	Reserve	Reserve	x100
254	KVAR_Y	Reserve	Reserve	x100
256	KVAR_B	Reserve	Reserve	x100
258	KVA_R	Reserve	Reserve	x100
260	KVA_Y	Reserve	Reserve	x100
262	KVA_B	Reserve	Reserve	x100
264	KW Rising Demand	Reserve	Reserve	x100
266	KW_Max_Demand	Reserve	Reserve	x100
268	KVA Rising Demand	Rising Demand	Rising Demand	x100
270	KVA Max Demand	Max Demand	Max Demand	x100
272	DG KWh	DG KWh	DG KWh	x100
274	DG KVARh	DG KVARh	DG KVARh	x100
276	EB KWh	EB KWh	EB KWh	x100
278	EB KVARh	EB KVARh	EB KVARh	x100
280	Reserve	Reserve	Reserve	
282	DG KVAh	DG KVAh	DG KVAh	x100
284	EB KVAh	EB KVAh	EB KVAh	x100
286	3rd HVr	3rd HVr	3rd HV	x100
288	5th HVr	5th HVr	5th HV	x100
290	7th HVr	7th HVr	7th HV	x100
292	9th HVr	9th HVr	9th HV	x100
294	11th HVr	11th HVr	11th HV	x100
296	13th HVr	13th HVr	13th HV	x100
298	15th HVr	15th HVr	15th HV	x100
300	THD Vr	THD Vr	THD V	x100
302	3rd HIr	3rd HIr	3rd HI	x100
304	5th HIr	5th HIr	5th HI	x100
306	7th HIr	7th HIr	7th HI	x100
308	9th HIr	9th HIr	9th HI	x100
310	11th HIr	11th HIr	11th HI	x100
312	13th HIr	13th HIr	13th HI	x100
314	15th HIr	15th HIr	15th HI	x100
316	THD Ir	THD Ir	THD I	x100
318	3rd HVy	Reserve	Reserve	x100
320	5th HVy	Reserve	Reserve	x100

322	7th HVy	Reserve	Reserve	x100
324	9th HVy	Reserve	Reserve	x100
326	11th HVy	Reserve	Reserve	x100
328	13th HVy	Reserve	Reserve	x100
330	15th HVy	Reserve	Reserve	x100
332	THD Vy	Reserve	Reserve	x100
334	3rd HIy	Reserve	Reserve	x100
336	5th HIy	Reserve	Reserve	x100
338	7th HIy	Reserve	Reserve	x100
340	9th HIy	Reserve	Reserve	x100
342	11th HIy	Reserve	Reserve	x100
344	13th HIy	Reserve	Reserve	x100
346	15th HIy	Reserve	Reserve	x100
348	THD Iy	Reserve	Reserve	x100
350	3rd HVb	3rd HVb	Reserve	x100
352	5th HVb	5th HVb	Reserve	x100
354	7th HVb	7th HVb	Reserve	x100
356	9th HVb	9th HVb	Reserve	x100
358	11th HVb	11th HVb	Reserve	x100
360	13th HVb	13th HVb	Reserve	x100
362	15th HVb	15th HVb	Reserve	x100
364	THD Vb	THD Vb	Reserve	x100
366	3rd HIb	3rd HIb	Reserve	x100
368	5th HIb	5th HIb	Reserve	x100
370	7th HIb	7th HIb	Reserve	x100
372	9th HIb	9th HIb	Reserve	x100
374	11th HIb	11th HIb	Reserve	x100
376	13th HIb	13th HIb	Reserve	x100
378	15th HIb	15th HIb	Reserve	x100
380	THD Ib	THD Ib	Reserve	x100
382	DG Status	DG Status	DG Status	x1

DEFINING MULTIPLICATION FACTOR

- **Hz** has a multiplication factor of 100. If Hz is 48.33, and then it is sent as 4833.
- For providing resolution, all parameters except PF 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, For LAG side PF value of 0.987 is sent as 987.For For LEAD side PF value of 0.987 is sent as 1987. Here for LEAD side PF, 1000 is added with PF value to indicate LEAD side PF.
- DG status has MF of 1. if DG is ON, it will send 1 else it will send 0.

- 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 254 bytes of data, this code is returned.

P.O No. : ……

Customer : ……

Sr. No. : ……

Result of Test : ……

Remarks : ……

Test engineer : ……

Date : ……