

# USER'S MANUAL

## **XPERT**

### Electrical Power Meter

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

The electrical power meter, Xpert is a micro-controller based unit which measures various electrical parameters, and sequentially displays on a 128X64 backlit LCD.

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
- Measurement of both KVA and KW Demands
- Individual Odd Harmonics upto 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
- 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).



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 : 25 to 500V L-L, 20 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 - 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 (For IPFI>0.5) : 1% of Reading
		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 (IPFI≥0.5) Range of Reading : 0.05 to 1.00 Lag/Lead
	Energy	Total Active Energy (KWh)	Range of Reading : 0 to 9999999.0 Accuracy : class 1.0S
		Total Apparent Energy (KVAh)	Range of Reading : 0 to 9999999.0 Accuracy : 1.0% of Reading
		Total Apparent Energy (KVARh)	Range of Reading : 0 to 9999999.0 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
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

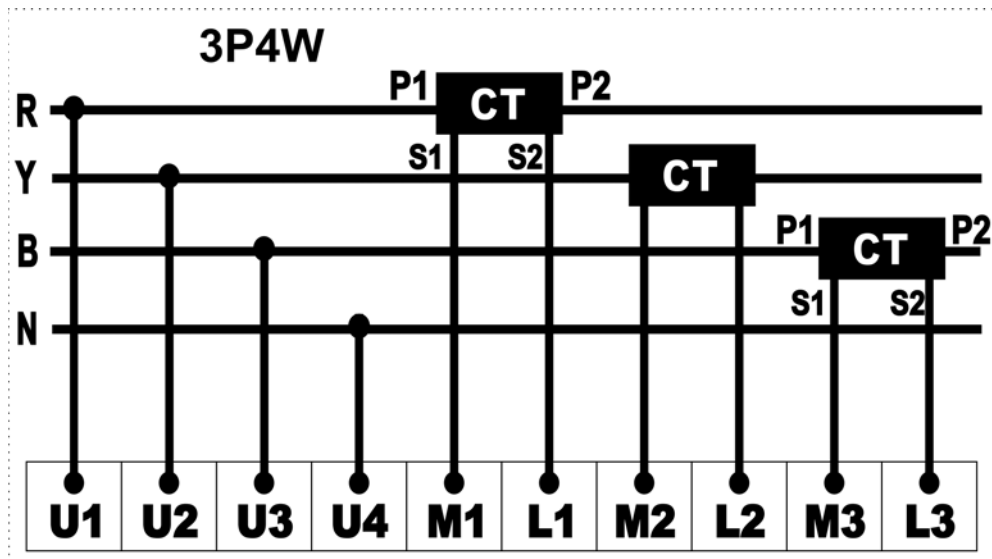
## Installation and Commissioning

The unit supports two types of electrical installation such as 3P4W and 3P3W. According to user's requirement, the two 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 480 VAC) to the terminals marked P and N.



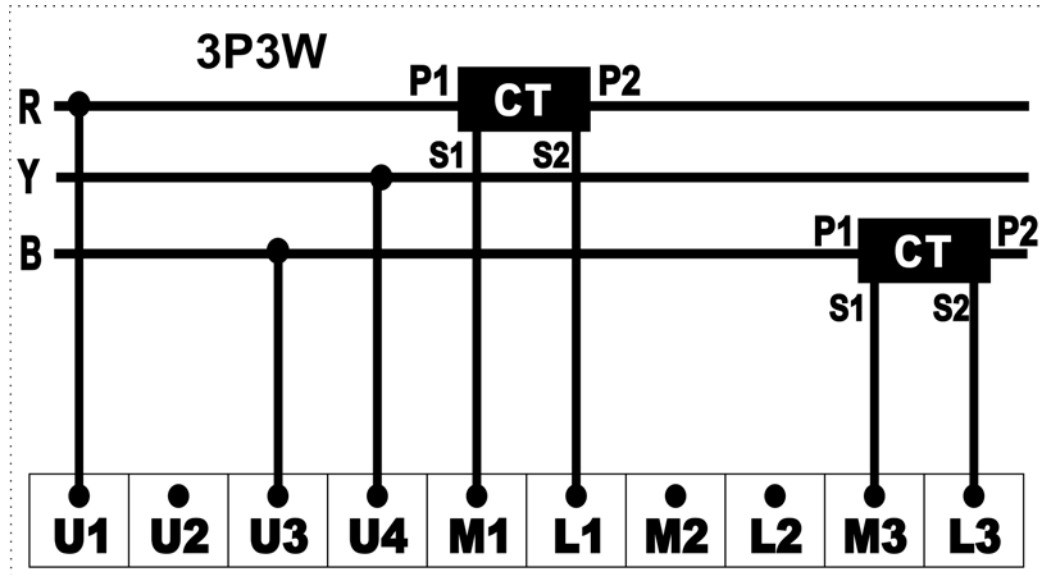
2. Connect the three phases with the phase sequence being R-Y-B to the terminals marked U1, U2 and U3 respectively. Make sure that the three phases coming to the unit come through control fuses of 1.0 Amp rating. This will protect the electronic inside from damage due to severe over voltages or phase 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.

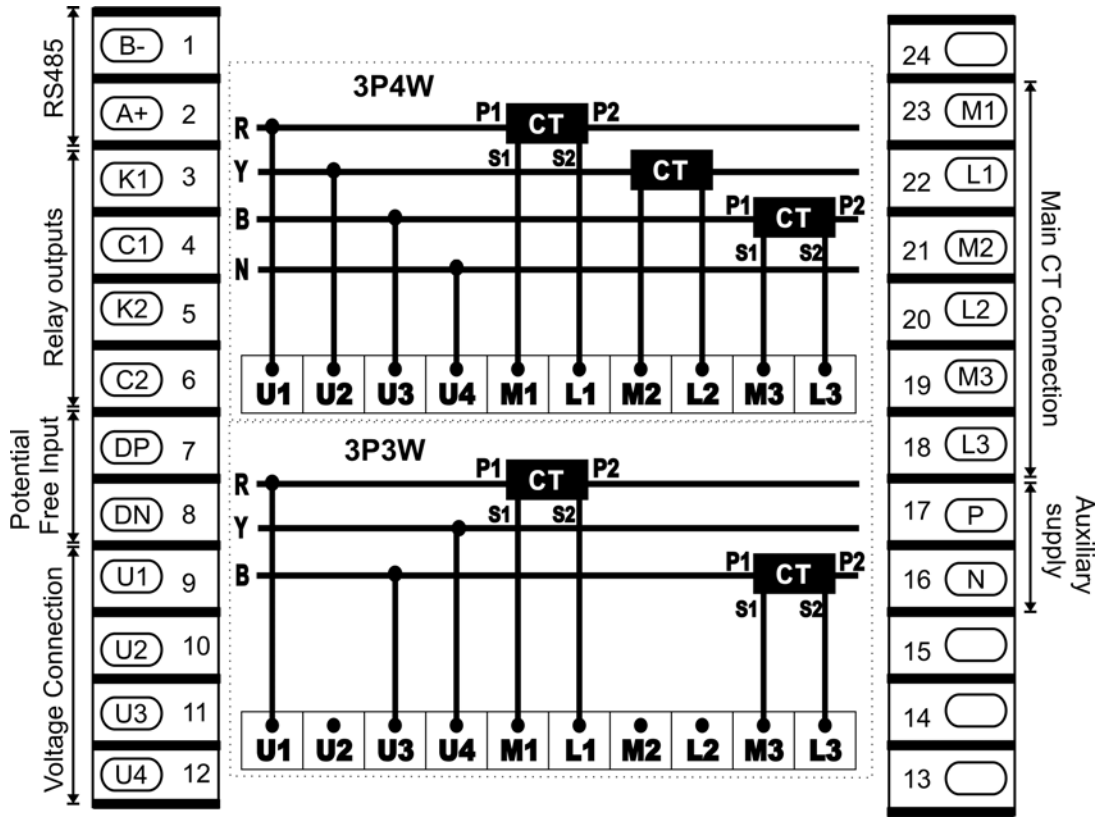
### 3P3W Mode Installation

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 480 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.



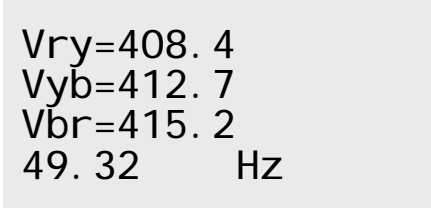
Connection Scheme

## Operational Details




The electrical power meter, Xpert 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 480 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
49.32 Hz
```

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


## Programming Mode

The unit is easy user interface for all the field programmable parameters by pressing ▲, ▼ and  keys provided. In order to program for all the parameters, the user should proceed upto 17 parameters with the following displays.



### Selecting Installation Type

The unit supports two types of electrical installation such as 3P4W and 3P3W and so the user should select to either 3P4W or 3P3W accordingly.

To select the Installation Type, proceed the following instruction.

1. In Run Mode, press  key for about five seconds and then the unit will display the first programmable parameter, INSTALLATION TYPE such as shown below.





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

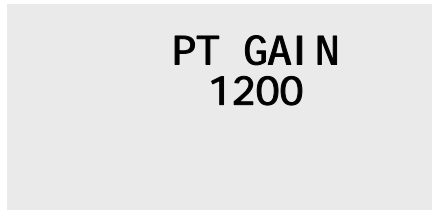
### Selecting PT Gain





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

To select the PT Gain, proceed the following instruction

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





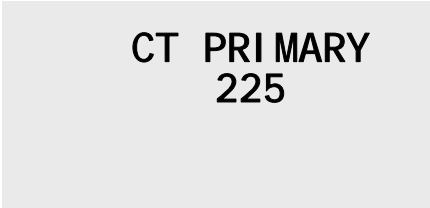
2. Press  key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the PT GAIN by pressing  and  keys according to your desire and then press  key so to save the parameter. However, the unit will reset and return into Run Mode.
3. In case, your setting is incomplete, proceed 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, proceed the following instructions.

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





CT PRIMARY  
225

2. Press  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  key to save the parameter. However, the unit will reset and return into Run Mode.
3. In case, your setting is incomplete, proceed 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, proceed the following instructions.

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





CT SECONDARY  
5

2. Press  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  key to save the parameter. However, the unit will reset and return into Run Mode.
3. In case, your setting is incomplete, proceed as above steps 1 and 2.

### 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, proceed the following instructions.

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



DEMAND ON  
KW

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





DEMAND WINDOW  
30

4. After setting the parameter, the unit will reset and return into Run Mode. In case, your setting is incomplete, proceed 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 1200 or 2400 or 4800 or 9600 or 19200.

To retrieve the DEVICE ID, proceed the following instructions.

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



DEVICE ID  
255

2. Press  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  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.



BAUD RATE  
9600

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 Trip1 On, Trip1 Value and Time Limit1 for an Alarm Parameter

The meter has two relays for an alarm contacts. The relay contact is rated 5A @ 250 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 (Trip1)** 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 (Trip1 Value)** which are programmable from 5 to 5000 should be selected for which the alarm parameter has to be generated.
- c. The **Time Delay (Time Limit1)** for a selected alarm parameter should be also set from 5 seconds to 180 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 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 retrieve the Trip1 On, Trip1 Value and Time Limit1, proceed the following instructions.

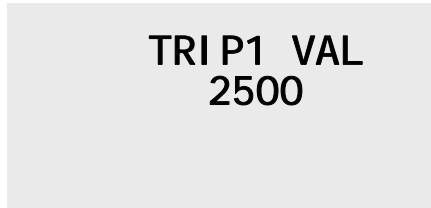
1. In Run Mode, press  key for about five seconds and then the unit displays the first programmable parameter, INSTALLATION TYPE. Press  keys several times to retrieve the programmable parameter, TRIP1 ON such as shown below.




2. Press  key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Select the TRIP1 ON by pressing  and .

keys according to your desired parameter and then press  key to save the parameter.

3. Press  key to retrieve the next programmable parameter, TRIP1 VALUE and then set as above parameter for the following display.





TRIP1 VAL  
2500

4. After setting TRIP1 VALUE, press  key to retrieve the next programmable parameter, TIME LIMIT1 and then set as above parameter for the following display.



TIME LIMIT1  
45

5. To retrieve to the next desired parameter, TRIP2 ON, press  key so as to set as before. Or else,  key for about five seconds to return into Run Mode.

#### Setting Trip2 On, Trip2 Value and Time Limit2 for an Alarm Parameter



To set TRIP2 ON, TRIP2 VALUE and TIME LIMIT2, proceed as before TRIP1 ON, TRIP1 VALUE and TIME LIMIT1.

#### Autoscrolling the Run Mode pages

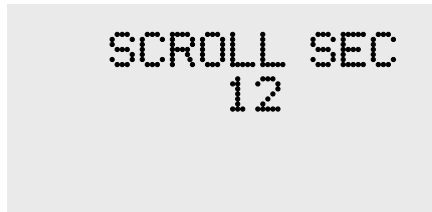
Scroll second is settable from 5 to 12 seconds. The unit will either continue to display the parameter steadily or scroll automatically. If the SCROLL SECOND is set to Zero, the unit will be in FREEZE mode, and will not scroll automatically.







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, proceed the following instruction.

1. In Run Mode, press  key for about five seconds and then the unit displays the first programmable parameter, INSTALLATION TYPE. Press  key several times to retrieve the programmable parameter, AUTOSCROLL

SECOND such as shown below.





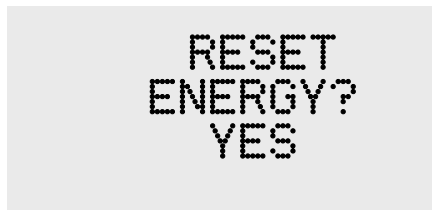
2. Press  key again. Immediately 'P' starts blinking which shows that the parameter can now be set. Set the SCROLL SECOND according to your desire by pressing  or  keys and then press  key to save the parameter.
3. To retrieve to the next desired parameters, press  key so as to set as before. Or else, press  key for about five seconds to return into Run Mode.







### 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, proceed the following instruction.

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





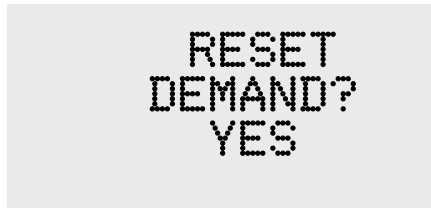
2. Press  key again. Immediately 'P' starts blinking which shows that the parameter can now be selected. Set the RESET ENERGY to YES by pressing  or  keys and then press  key to save the parameter.
3. To retrieve to the next desired parameters, press  key so as to set as before. Or else, press  key for 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, proceed the following instructions.

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





2. Press  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  key to save the parameter.
3. To retrieve to the next desired parameters, press  key so as to set as before. Or else, press  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 autoscale to Mega from Kilo when the value crosses 10,000. e.g., KWh $\geq$ 10000.0, it will show as 10.000 MWh.

There are 29 pages in 3P4W and 21 pages in 3P3W 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.

---

```
Ur=408.4    U
Uy=413.9    U
Ubr=415.3   U
49.59      Hz
```

The first page shows phase to phase voltage in three phases with system frequency. In case, PT ratio  $>1.0$ , the voltages will autoscale 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 negative (-ve) 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
```

The sixth page shows Reactive Energy (KVARh).

---

```
DG KVAh  
0.00  
DG KWh  
0.00
```

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

---

```

DG KVARh
0.00
    
```

The eighth page shows Reactive Energy (KVARh) 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.

---

```

Urn=238.6      V
Uyn=235.7      V
Ubn=240.8      V
    
```

The tenth page shows phase to neutral voltage in three phases. In case, PT ratio >1.0, the voltages will autoscale 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.

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

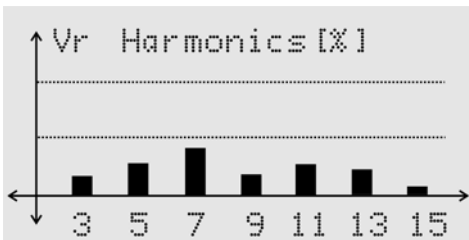
The twelfth page shows odd harmonics from 3rd to 15th for current in R-phase with percentage form. Likewise, the odd harmonics for current in Y-phase and B-phase will also be shown on 14th and 16th pages respectively.

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THD [%]			
Vr	3.4	Ir	3.2
Vy	3.0	Iy	3.0
Vb	3.2	Ib	3.4

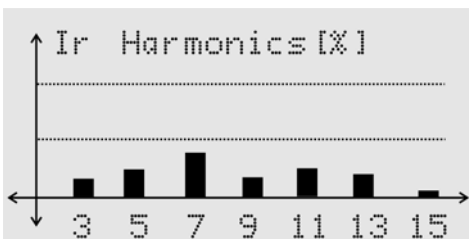
The seventeenth page shows total Odd Harmonics Distortions for both voltage and current in R-Y-B phases with percentage form.

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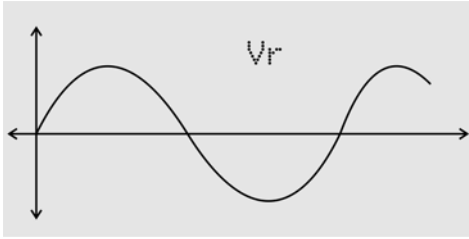
The eighteenth page shows Odd Harmonics Histogram for voltage in R-phase with percentage form. Likewise, Odd Harmonics Histogram for voltages in both Y-phase and B-phase will also be shown on 20th and 22nd pages respectively.

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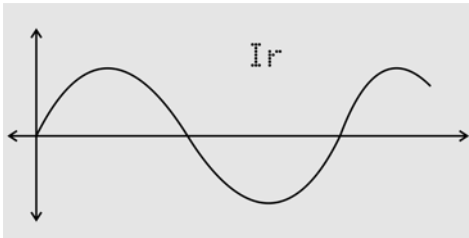
The nineteenth page shows Odd Harmonics Histogram for current in R-phase with percentage form. Likewise, Odd Harmonics Histogram for current in both Y-phase and B-phase will also be shown on 21st and 23rd pages respectively.

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The twenty fourth page shows the Wave Form 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.

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The twenty fifth page shows the Wave Form 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.

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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.

## Control Outputs

The relay contacts are rated 5A@250 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 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 XPERT. 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

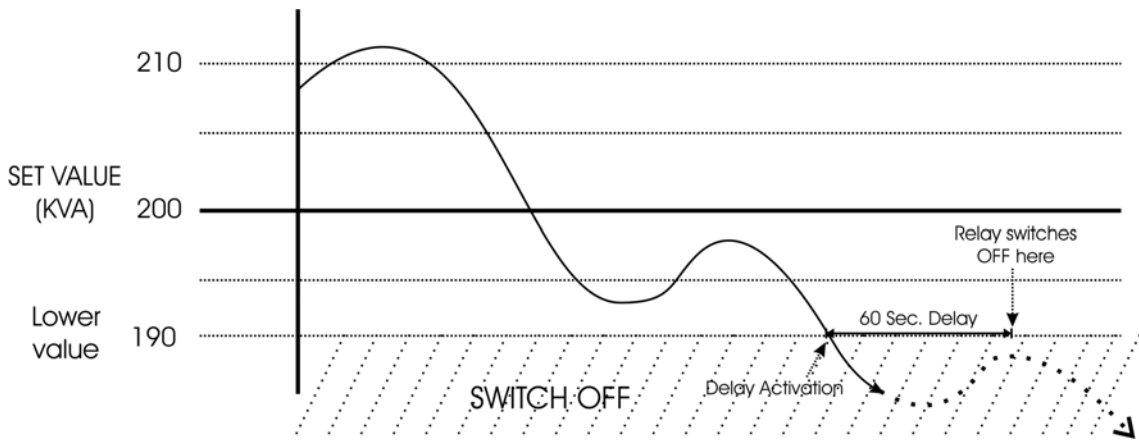
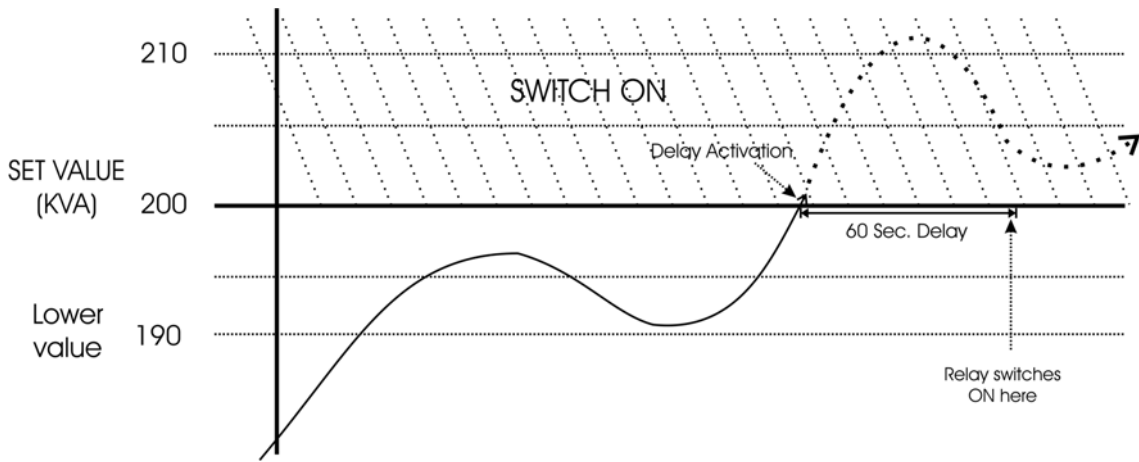
The relays can be programmed to operate for Alarm/Trip functions. Each relay is independently programmable for the parameter on which to operate, time delay before operation, and values for the operation to be triggered and released values.

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.	TRIP1VAL: 200	4.	TRIP2VAL: 987
2.	TRIP1 ON: KVA	5.	TRIP2 ON: PF
3.	TIME LIMIT1: 060	6.	TIME LIMIT2: 120

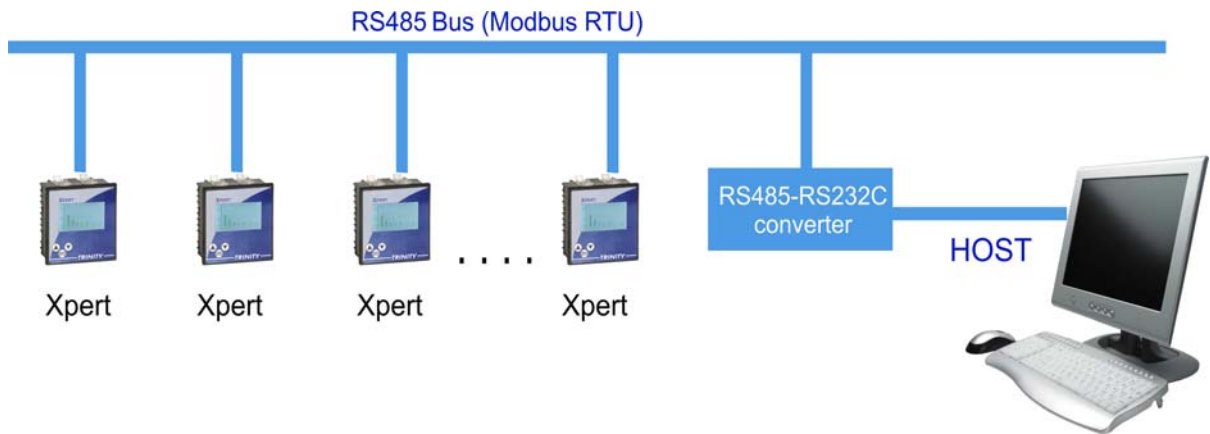
In order to program alarm parameters for one or two relays, user can select any one of the following parameters: Avg. Volt  $[(V_{ry}+V_{yb}+V_{br})/3]$ , Avg. Amps  $[(I_r+I_y+I_b)/3]$ , KVA, KW, KVAR, DMND (demand), and PF.

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 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 the switch. However, the relay will open when PF crosses 987 with the specified delay.

## Communication



### RS485 CONNECTION

The industrial standard RS-485 communication port option is also available in **XPERT**. This option makes it possible for a user to select **XPERT** 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 a SCADA or EMS software. XPERT 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: 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 exception message is generated. The parameters name, address and multiplication factor are also mentioned.

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

Appendix

3 phase 3000-3019	R phase 3030-3049	Y phase 3060-3079	B phase 3090-3109	MF
3000-KVA	3030-KWh	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

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

P.O No. : .....

Customer : .....

Sr. No. : .....

Result of Test : .....

Remarks : .....

Test engineer : .....

Date : .....