ISO 9001-2000 Certified

CONZERV®
Smart Energy Management

PowerCon - EM 6600 Series
Power Quality + Control

1 Measure
2 Detect
3 Control

Conzerv Systems Pvt Ltd (formerly Enercon Systems Pvt Ltd)
44P Electronic City Phase II East Hosur Road Bangalore 560 100 INDIA
T+91 80 4118 9700 F+91 80 4118 9729 E contact@conzerv.com
Customer Help Desk 1800 425 0555 (Toll Free All India from BSNL / MTNL)
Or Call 080 2852 0604 (Standard Charges Apply)

www.conzerv.com

1. General

1.1. Customer Service and Support

Questions? Difficulties? We're here to help. Customer service and support is available via email at support@conzerv.com. Please include the model, serial number and a description with which we can re-create the problem at our Support Centre. You can shorten this time by also including necessary settings, the wiring diagram and the particular readings, which uniquely identify the problem.

Toll free phone support is available in some countries. For the latest phone number list please visit www.conzerv.com

1.2. Product Warranty

CONZERV warrants all products to be free from defects in material, workmanship and title and will be of the kind and quality specified in CONZERVs written description in the manual. The foregoing shall apply only to failures to meet said warranties, which appear within one year from the date of shipping. During the warranty period, CONZERV will, at its option, either repair or replace any product that proves to be defective. Please see the LIMITED WARRANTY CERTIFICATE provided with the product for further details.

1.3. Limitation of Warranty

This warranty does not apply to defects resulting from unauthorized modification, misuse or use for any reason other than electrical power

monitoring.

OUR PRODUCTS ARE NOT TO BE USED FOR PRIMARY OVER-CURRENT PROTECTION. ANY PROTECTION FEATURE IN OUR PRODUCTS IS TO BE USED FOR ALARM OR SECONDARY PROTECTION ONLY.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY IMPLIED WARRANTY OF MERCHANABILITY OR FITNESS FOR A PARTICULAR PURPOSE. CONZERV SHALL NOT BE LIABLE FOR ANY PENAL, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING FROM ANY AUTHORIZED OR UNAUTHORIZED USE OF ANY CONZERV PRODUCT. LIABILITY SHALL BE LIMITED TO THE ORIGINAL COST OF THE PRODUCT SOLD.

1.4. Statement of Calibration

Our instruments are inspected and tested in accordance with specifications published by an independent testing facility.

The accuracy and calibration of our instruments are traceable to the National Institute of Standards and Technology through equipment that is calibrated at planned intervals by comparison to certified standards.

1.5. Disclaimer

The information presented in this publication has been carefully checked for reliability; however, no responsibility is assumed for inaccuracies. The information contained in this document is subject to change without notice.

2. OVERVIEW

The EM 6600 PowerCon meters offer comprehensive three-phase electrical instrumentation and new approach to Energy Management, integrating Control I/Os which enable Process Integration, Breaker Status Detection, Alarm output, basic Demand control outputs and more, directly integrated within the meter. Also basic alarm on over/under Current, Voltage, Power, Power Factor, Frequency, Unbalance Factors or Demands and Pulse Output based on Energy or Reactive Energy in EM 6600.Status monitoring is possible using the 4 digital inputs.

Multiple Wiring Modes

EM 6600 PowerCon meter can be easily used for high voltage or low voltage or three phase three wire or three phase four wire or single phase system.

Small Size and Simple to use

- Size of DIN 96 X 96 and 64mm depth behind panel
- Fixing clips are used for easy installation and removal
- High intensity, large screen LCD display
- Easy access of parameter settings by panel keys or communication port
- Back light on time is selectable which enables to read the display easily in the dim environment.

The EM 6600 PowerCon meter is a high accuracy multi-function meter

- **Measurement**
  - Line to neutral Voltage: V1, V2, V3, VLN avg
  - Line to Line Voltage: V12, V23, V31, VLL avg
  - Current: I1 (A1), I2 (A2), I3 (A3), Iavg (Aavg), In (An)
  - Active Power: per phase and total
  - Reactive Power: per phase and total
  - Apparent Power: per phase and total
  - Power Factor: per phase and average
  - Frequency

- **Power Quality**
  - THD, Even THD and Odd THD of each phase/line voltage
  - Individual Harmonics and Crest factor of phase/line Voltage
  - THD, Even THD and Odd THD of each phase of current
  - Individual Harmonics and K Factor for current
  - Unbalance Factor of Voltage

    Unbalance Factor of Current

- **Statistics**
  - Maximum value of statistics with time stamp
  - Minimum value of statistics with time stamp
  - Maximum of Demand

- **Energy and Demand**
  - kWh of 4 quadrants: Import, Export, Total, Net
  - kVARh of 4 quadrants: Import, Export, Total, Net
  - Demand of Active, Reactive and Apparent Power

- **Communication**
  - RS 485 communication port
  - Modbus RTU Protocol

- **IO's and control**
  - 4 Digital inputs
  - 2 Relay outputs
  - 2 Digital outputs

- **Applications:**
  - Power distribution automation
  - Industry automation
  - Textile ring frame machine
  - Shopping malls, hotels, campus, utility, intelligent buildings
  - Building automation
  - Energy management
  - Large UPS systems
  - Heat treatment, furnace, cement etc

The EM 6600 PowerCon Energy meter is an universal meter. Before use, please program the meter set up (measurement system configuration), PT and CT ratios through the front panel keys. Otherwise, it will read your system incorrectly. Other settings such as communication parameters must also be programmed as needed.

Figure 2.1: The EM 6600 PowerCon meter

2.1. Physical Description

FRONT: The front panel has 4 rows of 4 digits / characters and 5th row of 9 digits for energy, date & time. Four smart-keys make navigating the parameters very quick and intuitive for viewing data and configuring (Setup) the EM 6600.

REAR: The voltage and current terminals and the communication port are located on the back of the meter. Auxiliary power, DI, DO, RO and DI power terminals are also available on the rear side of the meter.

CAUTION: These contain hazardous voltages during operation and must be operated only by qualified and authorized technicians.

2.2. Front Panel

The front panel contains the followin g indicators and controls:

- Four rows of 4 digits each and one separate row of 9 digit for energy reading of multi data LCD display, that displays 4 instantaneous parameters and one integrated parameter at a time. The displayed readings update every second.
- Load bar, which gives a unique analog indication of % loading.
- Four smart keys to scroll through the display pages and to program the meter.

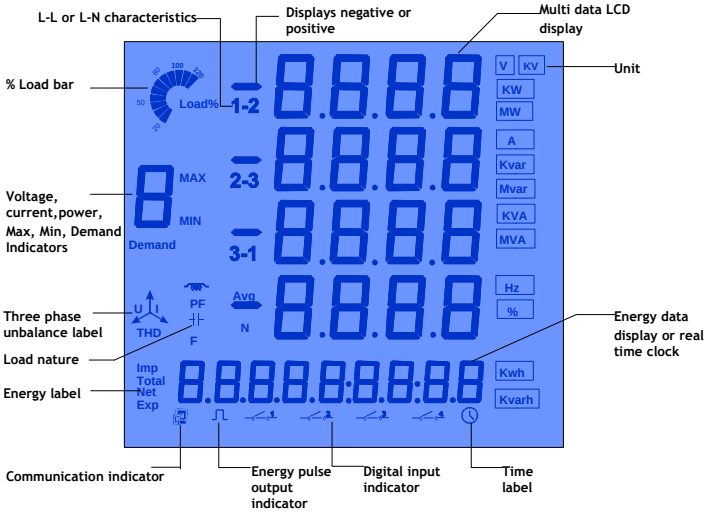


Fig 2.2 The EM 6600 front panel display

2.2.1. The Keys

Four smart keys to operate and navigate the meter through the Keypad Operation (Table 2.1). The display shows where you're headed.

Table 2.1: The Keypad operation Table

	**H (Right) Key** To view THD V, THD I (A) and unbalance factor. While setup edit, to select the next digit (right side)**.**
	**P (Up) Key** To view power parameters, frequency and demand. While set up edit, increases the value of the blinking digit.
	**E (Down) Key** To view energy readings, date & time. While set up edit, decreases the value of the blinking digit.
	**V/A (Enter) Key** To view voltage and current readings, while setup edit, ” SAVE" the selected value and exit from edit mode to the next page.

2.3. EM 6600 Technical Specs

The EM 6600 PowerCon meter is a high-accuracy, low cost, ultra-compact, power and energy meter that offers ISO 9000 quality, accuracy and functional flexibility and MODBUS RTU communications capability.

The EM 6600 PowerCon meter is designed for retrofit application such as replacement of existing analog meters and is also usable as a stand-alone meter in custom panels, PDUs, switchboards, switchgear, UPS's, generator sets, MCCs systems etc.

The EM 6600 PowerCon meter provides easy communication to PLCs, DCS, BMS and other systems through the use of Modbus RTU communications on RS 485, with isolation voltage minimum 2kV for 1 minute, from other circuits.

The EM 6600 PowerCon meter are configurable & user programmable through the front panel or through RS 485.

Table 2.2: Technical Specification

Sensing / Measurement	True RMS, 1 Sec update time
Input Voltage: PT Primary PT Secondary Overload Burden	 100 to 500kVLL ac Editable from 100 to 440VLL Maximum input voltage 480VLL 2 times for continuous, 2500 Vac for 1 Sec (Non recurrence) <0.2 VA
Input Current: CT Primary CT Secondary Overload Burden	 Up to 10000A 5A nominal, Range: 50mA to 6A. 1A nominal, Range: 10mA to 1.2A (ordering option) For 5A meter: 10A for continuous. 100 A for 1 Sec (Non recurrence) <0.2 VA
Aux Supply (Control Power) Power Consumption	85 to 264 V ac or 100 to 300 V dc < 3.5W
Frequency	45Hz to 65Hz
Communication: Protocol Baud Rate	RS 485 2-wire, half -duplex, optical isolated Modbus RTU 1200 to 38400bps
Accuracy	Class 0.5 as per IEC 60687 Class 1.0 as per IEC 61036

Digital Input (DI):	
Optical Isolation	2500Vac RMS
Input Type	Dry or Wet contact (Contact with power supply)
Input resistance	2k ohm (typical)
Input voltage range	5~30V dc
Close voltage	>5V dc
Max input current	20mA
DI Aux Power	15Vdc/1W
Digital Output (DO):	
Output Form	Solid-State, NO
Optical Isolation	2500V ac RMS
Max Positive Voltage	100V dc
Max Positive Current	50mA
Relay Output (RO):	
Output Form	Mechanical Contact
Contact Resistance	30m ohm at 1A
Max Break Voltage	250Vac, 30V dc
Max Break Current	3A
Max Isolated Voltage	4000V ac RMS
Dust & Water Protection	IP 20 (rear), IP 40 (Front)
Environmental	Temperature: Main body: -25ºC to 70ºC Display part: -10ºC to 70ºC Storage: -40ºC to 85ºC Humidity: 5% to 95% non condensing
Standards	Environmental: IEC 60068-2 Safety: IEC 61557-2

	EMC: IEC 61000-4/-2-3-4-5-6-8-11 Dimension: DIN 43700
Weight	350gms approx
Warranty	1 Year

2.3.1. Accuracy

Table 2.3: Accuracy Table

Class 1.0(standard) and Class 0.5 (ordering option)

Parameter	Accuracy		Resolution	Range
	Cl 1.0	Cl 0.5		
Voltage	1.0	0.5	0.1%	40 ~ 276 ac VLN
Current	1.0	0.5	0.1%	1% ~120% CT
Neutral Current	2.0	1.0	0.1%	1% ~120% CT
Power	1.0	0.5	0.1%	0~9999 MW
Reactive Power	1.0	0.5	0.1%	0~9999 MVAR
Apparent Power	1.0	0.5	0.1%	0~9999 MVA
Power factor	1.0	0.5	0.01	±0.02~1.00
Frequency	0.2	0.1	0.01Hz	45~65 Hz
Energy	1.0	0.5	0.1kWh	0~99999999.9 kWh
Reactive energy	1.0	0.5	0.1kVARh	0~99999999.9 kVARh
Harmonics	2.0	1.0	0.01%	0~100%
Unbalance factor	1.0	0.5	0.1%	0~100%

3. Parameters, Features

	Function	Parameter	EM 6610	EM 6620
Real Time Measurement	Line to neutral voltage VLN	V1, V2, V3, VLNavg	▫	▫
	Line to Line voltage VLL	V12, V23, V31, VLLavg	▫	▫
	Current	I1 (A1), I2 (A2), I3 (A3), In (An), Iavg (Aavg)	▫	▫
	Active Power kW	P1 (kW1), P2 (kW2), P3 (kW3), P (kW)	▫	▫
	Reactive Power kVAR	q1 (kVAR1), q2 (kVAR2), q3 (kVAR3), q (kVAR)	▫	▫
	Apparent Power kVA	S1 (kVA1), S2 (kVA2), S3 (kVA3), S (kVA)	▫	▫
	Power factor PF	PF1, PF2, PF3, PF	▫	▫
	Frequency	F	▫	▫
Energy / Demand	Active Energy kWh	Imp - kWh, Exp - kWh, Total - kWh, Net -kWh	▫	▫
	Reactive Energy kVARh	Imp - kVARh, Exp - kVARh, Total - kVARh, Net -kVARh	▫	▫
	Demand kW, kVAR, kVA	P_{Demand}, q_{Demand}, S_{Demand}		▫

	Function	Parameter	EM 6610	EM 6620
Power Quality	Voltage % Unbalance	V	▫	▫
	Current % Unbalance	I (A)	▫	▫
	Voltage THD	Star (wye): THD V1, V2, V3, VLNavg Delta: THD V12, V23, V31, VLLavg	▫	▫
	Current THD	THD I1 (A1), I2 (A2), I3 (A3), Iavg (Aavg)	▫	▫
	Harmonics, individual	2^{nd} to 31^{st}		c
	Voltage Crest Factor (Distortion)	Crest factor of phase/Line voltage		c
	Telephone interference factor (Higher Harmonics)	THFF		c
	Current K factor (Power Quality of current)	K Factor		c

	Function	Parameter	EM 6610	EM 6620
Statistics	MAX with Time Stamp	V^{MAX} 1, 2, 3, V^{MAX} 12, 23, 31 I^{MAX} 1, 2, 3 (A^{MAX} 1, 2, 3) P^{MAX} : kW, kVAR, kVA, PF P^{MAX}_{Demand} : kW, kVAR, kVA, F		▫
	Min with Time Stamp	V_{MIN} 1, 2, 3 V_{MIN} 12, 23, 31 I_{MIN} 1, 2, 3 (A_{MIN} 1, 2, 3) P_{MIN} : kW, kVAR, kVA, PF $P_{MIN\ Demand}$: kW, kVAR, kVA, F		▫
I/O	Digital Input	4 DI -12 to 24V dc, 10 to15 mA (30mA Max)	▫	▫
	Digital Output	2 DO - Max Voltage 100V & Current 50mA	▫	▫
	Relay Output	2 RO -Form A contact 3A/250V ac or 3A/30V dc	▫	▫
Alarm	Over/Under Limit alarm			**c**

	Function	Parameter	EM 6610	EM 6620
Comm	RS 485 Port	Modbus Protocol	▫	▫
TIME	Real Time Clock	Month: Date: Year Hour: Minute: Sec	▫	▫

Note: ▫: Available through display and communication

C: Available through communication only

Min / Max value available through display, but the time stamp is available only through the communication.

The PowerCon meter is an advanced meter with Power Quality features. To align with IEEE 100 recommendations, the Power Parameters are displayed with the IEEE 100 symbols:

P = Active Power (kW),

Q = Reactive Power (kVAR)

S = Apparent Power (kVA)

P, Q and S have specific definitions under IEEE 100. This avoids confusions over informal symbols such as kVA, which has six different definitions.

3.1. Meter Display

Press V/A to display Voltage and Current

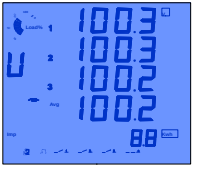


Fig. 3.1.1 Three phase voltage

The display shows V1, V2, V3 and VLN avg (Line to neutral voltage per phase & avg)
eg. V1=100.3V, V2=100.3V, V3=100.2V and VLNavg=100.2V.
The load rating is 50% with an inductive load
The consumed energy is 8.8 kWh.
Pulse output is ON.
Digital inputs DI1, DI2, DI3 are open and DI4 is closed.
Press V/A to display next screen.

Fig. 3.1.2 Three phase current

The display will show I1 (A1), I2 (A2), I3 (A3) and In (An) (current per phase & Neutral)
eg.I1=2.498, I2=2.499, I3=2.491and In=0.008A

Press V/A to display next screen.

Fig. 3.1.3 Three phase voltage

The display will show V12, V23, V31 and VLLavg (Line to line voltage & average).eg. V12=173.2V, V23=173.2V, V31=173.1V and VLLavg=173.2V

Press V/A to go to next display

Fig. 3.1.4 Three phase current

The display will show I1 (A1), I2 (A2), I3 (A3) and Iavg (Aavg) (current/phase & average).eg. I1=2.498A, I2=2.499A, I3=2.491A and Iavg=2.496A

Press V/A again to display voltage (Back to first display, i.e. Fig 3.1.1)

Note: When the meter is set to "2LL", there is no line to neutral voltage and neutral current, hence only Fig.3.1.3 & Fig 3.1.4 will be displayed.

Press P to display Power parameters.

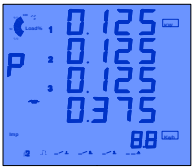


Fig. 3.1.5 Three-phase power

The display will show P1 (kW1), P2 (kW2), P3 (kW3), Psum (kWtot) (Active Power per phase &total).

eg. P1=0.125kW, P2=0.125kW, P2=0.125kW and Psum=0.375kW

Press P to go to next display

Fig. 3.1.6 Three phase Reactive power

The display will show q1 (kVAR1), q2 (kVAR2), q3 (kVAR3), qsum (kVARtot), (Reactive power per phase & total).

eg.q1=0.217kVAR, q2=0.216kVAR, q3=0.216kVAR and qsum=0.649kVAR

Press P to display next screen.

Fig. 3.1.7 Three phase apparent power

The display will show S1 (kVA1), S2 (kVA2), S3 (kVA3) and Ssum (kVAtot) (Apparent power per phase & total)

eg. S1=0.250kVA, S2=0.250kVA, S3=0.249kVA and sum=0.749kVA

Press P to display the next screen

Fig. 3.1.8 Three phase PF

The display will show PF1, PF2, PF3 and PF (Power factor per phase & average)

eg. PF1=0.500, PF2=0.500, PF3=0.500 and PF=0.500

Press P to display the next screen.

Fig. 3.1.9 System power & power factor

The display will show Psum (kWtot), qsum (kVARtot), Ssum (kVAtot) and PF

eg. Psum=0.375, qsum=0.649kVAR, Ssum=0.749 and PF=0.500

Press P to go to next display.

Fig. 3.1.10 System power & frequency

The display will show Psum (kWtot), qsum (kVARtot), Ssum (kVAtot) and F. eg. Psum=0.375kW, qsum=0.649kVAR, Ssum=0.749kVA and F=50.00Hz

Press P to display the next display

Fig. 3.1.11 System power demand

The display will show Dmd_P (kW), Dmd_q (kVAR), Dmd_S (kVA) (Active Power Demand, Reactive Power Demand, Apparent Power Demand)

eg. Dmd_P=0.375kW, Dmd_q=0.649kVAR, Dmd_S=0.749kVA

Press P to display active power again (back to first screen, i.e., fig 3.1.5)

Note: 1.Only EM 6620 has the function of demand.

2. When the meter is set to "2LL", there is no phase power.

Press H to display Power quality parameters

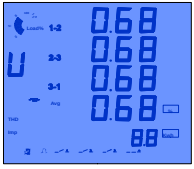


Fig. 3.1.12 THD of line to line voltage

When the wiring of the voltage input is 2LL, the display will show THD_V12, THD_V23, THD_V31 and THD_VLL (THD of line-to-line voltage & average).

eg. THD_V12 = 0.68%, THD_V23 = 0.68%, THD_V31 = 0.68% and THD_VLL=0.68%

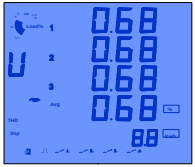


Fig. 3.1.13 THD of line to neutral voltage

When the wiring of the voltage is set to be 2LN or 3LN. The display will show THD_V1, THD_V2, THD_V3 and THD_VLN (THD of Line to neutral voltage & average)

eg. THD_V1=0.68%, THD_V2=0.68%, THD_V3=0.68% and THD_VLN=0.68%.

Press H to go to next display

Fig. 3.1.14 THD of line current

The display will show THD_I1 (A1), THD_I2 (A2), THD_I3 (A3) and THD_Iavg (Aavg) (THD of phase current & average)

eg. THD_I1=0.68%, THD_I2=0.68%, THD_I3=0.68% and THD_Iavg=0.68%

Press H to display next screen

Fig. 3.1.15 Unbalance factor

The display will show voltage unbalance factor and current unbalance factor.

eg. Voltage unbalance factor=0.8%, current unbalance factor =0.9%

Press H again to display voltage THD (ie. fig 3.1.13)

Press E to display Energy and real time clock

Fig. 3.1.16 Import energy

The display will show kWh_Imp (consumption energy)

eg. kWh_Imp=8.8kWh

Press E to display next screen

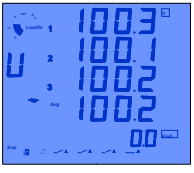


Fig. 3.1.17 Export energy

The display will show kWh_Exp (generation energy)

eg. kWh_Exp=0.0kWh

Press E for the next display

Fig. 3.1.18 Total energy

The display will show kWh_total (absolute sum of Imp and Exp energy)

eg. kWh_total=8.8kWh

Press E to display the next screen

Fig. 3.1.19 Net Energy

The display will show kWh_net (algebraic sum of Imp and Exp energy)

eg. kWh_net=8.8kWh

Press E to display the next screen.

Fig. 3.1.20 Inductive reactive energy

The display will show kVARh_Imp (inductive reactive energy)

eg. kVARh_Imp=15.2kVARh

Press E to go to next screen.

Fig. 3.1.21 Capacitive reactive energy

The display will show kVARh_Exp (capacitive reactive energy)

eg. kVARh_Exp0.0=kVARh

Press E to go the next screen

Fig. 3.1.22 Total reactive energy

The display will show kVARh_total (absolute sum of the reactive energy)

eg. kVARh _total=15.2kVARh

Press E to display the next screen.

Fig. 3.1.23 Net reactive energy

The display will show kVARh _net (algebraic sum of reactive energy)

eg. kVARh _net=15.2kVARh

Press E to go to the next screen.

Fig. 3.1.24 Date

The display will show date. Format: mm: dd: yyyy

eg. Date is Jan.18.2002

Press E to go to the next screen.

Fig. 3.1.25 Time

The display will show time. Format: hh:mm:ss

eg. Time is 13:20:29

Press E again to go back to the first screen kWh_Imp (Fig.3.1.16).

Note: The date and time is displayed only in EM 6620.

Display of statistical data:

To display the maximum and minimum values of the meter, press P and V/A keys simultaneously.

Note: The time stamp for these values is accessible only through communication.

Fig. 3.1.26 Max phase voltage

The display will show the max value for the line to neutral voltage.

eg. V1max=100.3V, V2max=100.2V, V3max=100.4V

Now press P to display the min value of voltage

Fig. 3.1.27 Min phase voltage

The display will show the min line to neutral voltage.

eg. V1min=0.0V, V2min=0.0V, V3min=0.0V

Press P again to view the max value of voltage and vice versa.

Press V/A to display the max and min value for line-to-line voltage.

Fig. 3.1.28 Max line voltage

eg.V12max=173.2V, V23max=173.3V, V31max=173.1V

Press V/A to display max and min current values

Fig. 3.1.29 Max current

eg. I1max=2.498A, I2max=2.499A, I3max=2.491A

Now press P to change the display from max value to min value and vice versa.

Press V/A to display max and min values for power and power factor.

Fig. 3.1.30 Max value of power

eg. maximum active power Pmax=0.375W, maximum reactive power qmax=0.649W, total system maximum apparent power Smax=0.749kVA

Average power factor PFmax=1.000

Press P to display the minimum values and vice versa.

Press V/A to display the max value for demand and frequency

Fig. 3.1.31 Max value of demand and frequency

eg. max total active power demand Dmd_Pmax=0.375kW, maximum total reactive power demand Dmd_Pmax=0.649kVAR, maximum total apparent power demand Dmd_Pmax=0.749kVA,

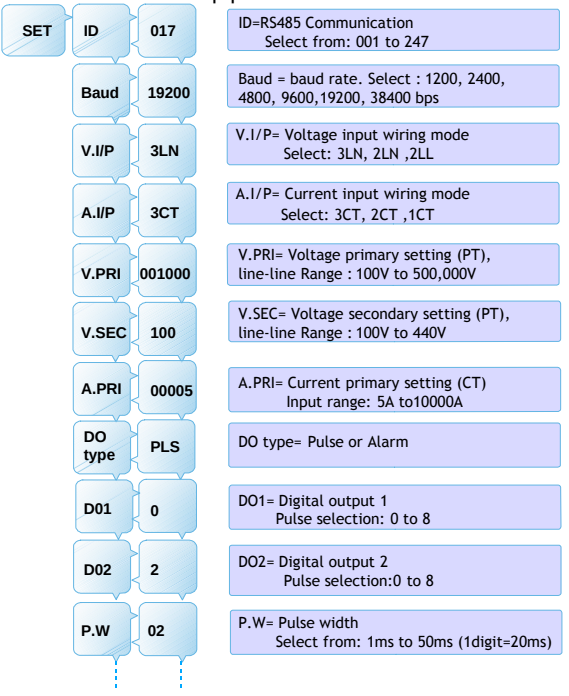
Max frequency F=50.00Hz

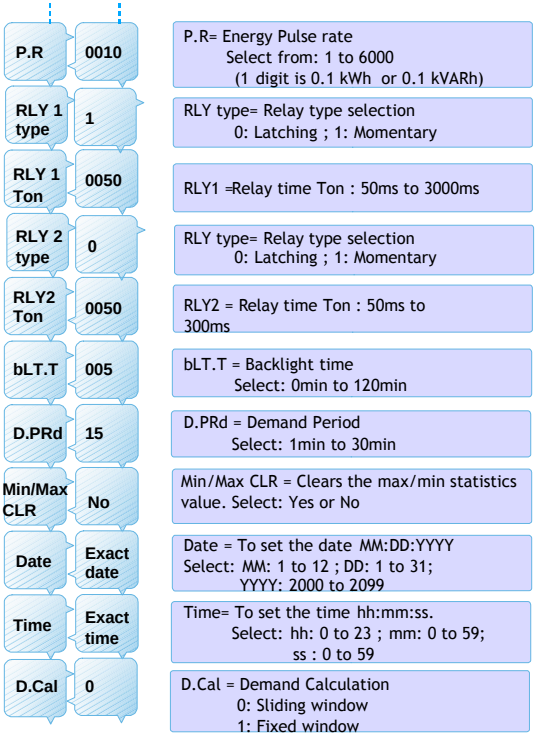
Press P key to view the minimum values

Again press V/A to display the first screen (max/min phase voltage)

3.2. PROG Menu – Setup parameters

The entire list of set up parameters in PROG Menu are listed




P.R
0010
P.R= Energy Pulse rate
Select from: 1 to 6000
(1 digit is 0.1 kWh or 0.1 kVARh)
RLY 1 type
1
RLY type= Relay type selection
0: Latching ; 1: Momentary
RLY 1 Ton
0050
RLY1 =Relay time Ton : 50ms to 3000ms
RLY 2 type
0
RLY type= Relay type selection
0: Latching ; 1: Momentary
RLY2 Ton
0050
RLY2 = Relay time Ton : 50ms to 300ms
bLT.T
005
bLT.T = Backlight time
Select: 0min to 120min
D.PRd
15
D.PRd = Demand Period
Select: 1min to 30min
Min/Max CLR
No
Min/Max CLR = Clears the max/min statistics value. Select: Yes or No
Date
Exact date
Date = To set the date MM:DD:YYYY
Select: MM: 1 to 12 ; DD: 1 to 31;
YYYY: 2000 to 2099
Time
Exact time
Time= To set the time hh:mm:ss.
Select: hh: 0 to 23 ; mm: 0 to 59;
ss : 0 to 59
D.Cal
0
D.Cal = Demand Calculation
0: Sliding window
1: Fixed window

3.3. Edit Setup parameters

To enter the parameter settings, press H and V/A keys simultaneously

Caution: Setting changes should be only performed by qualified personnel after reading this manual.

During edit set up use the following keys-

- H key: selects the next digit, one digit at a time.
- P key: increment the value
- E key: decrement the value
- V/A key: save and moves to the next setup page

Press H and V/A keys simultaneously to exit from any setup page

Note: When H and V/A keys are pressed simultaneously to exit from setup page the settings on the current page will not be saved.

Password is required to enter the parameter setting mode. The password is 4 digits decimal number from 0000 to 9999. The factory default is 0000.

After entering the correct access code, press V/A key to display the first setting page else return to the metering data display page. The password entry display is as shown below.

Fig.3.3.1 Password entry

Caution: Please remember to note the new password in a safe and known place, whenever the existing password is changed. Correct password entry is necessary to enter/edit the setup.

How to set communication address?

Fig. 3.3.2 Communication address

Choose the address from 1 to 247

Fig 3.3.2.shows the address 17

To change the address, press H key to select digits, then press P to increment or E to decrement the change in value

Once selected press V/A to save and exit to the next page

Note: Ensure each meter on RS485 network has a unique address to adhere to the Modbus RTU protocol.

How to set Baud rate?

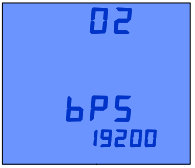


Fig. 3.3.3 Baud Rate

Communication setting is 8 data bit, no parity, 1 start bit & 1 stop bit. Baud rate can be adjusted from 1200, 2400, 4800, 9600, 19200, 38400. Fig 3.3.3 shows baud rate as 19200.

To change the settings press P key to increment or E to decrement the value. Once the baud rate is set, press V/A key to save and go to the next screen.

How to set input voltage wiring?

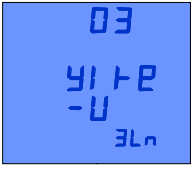


Fig. 3.3.4 Input voltage setting

The input voltage can be set as 3LN, 2LN and 2LL. Fig. 3.3.4 displays the input voltage settings as 3LN. To change this setting press P and/or E to scroll through the selection. Once selected press V/A to save and go to next display.

How to set current input wiring?

Fig. 3.3.5 Input current setting

The current input can be one of these modes: 3CT, 2CT and 1CT.Fig. 3.3.5 shows 3CT.To change this setting press P and/or E to scroll through the selection. Once selected press V/A to save and go to next display.

How to set Primary voltage PT1?

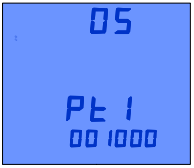


Fig. 3.3.6 PT1 setting

PT1 value (an integer) range from 100 to 500000, Unit is Volt.

Fig. 3.3.6 shows 1000V

To change this value, press H key to select the digits, then press P key and/or E key to change the values.

Now press V/A to save and go to the next page.

How to set Secondary voltage PT2?

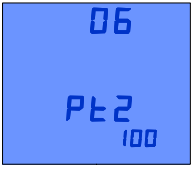


Fig. 3.3.7 PT2 setting

PT2 value (an integer) range from 100 to 440, Unit is Volt.

Fig. 3.3.7 shows 100V.

To change this value, press H key to select the digits, then press P key and/or E key to change the values.

Now press V/A to save and go to the next page.

Note: If there is no PT on the voltage input side of the EM 6600 meter, then PT1 and PT2 should be the same and equal to the input rating voltage.

How to set Primary current CT1?

Fig. 3.3.8 CT1 setting

CT1 value (an integer) range for 5A meter: 5 to 10000A and 1A meter: 1 to 10000A. Unit is Amps. Fig. 3.3.8 shows 5A.To change this value, press H key to select the digits, then press P key and/or E key to change the values.

Now press V/A to save and go to the next page.

How to set Digital Output mode?

Fig. 3.3.9 Digital Output

Digital output mode can be set as alarm output or pulse output. Fig 3.3.9 shows the output is set to pulse (PLS).To change this digital output press P and/or E key to scroll through the available selection.

How to set Digital Output 1 (DO1) -

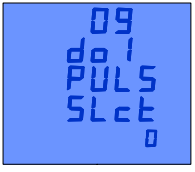


Fig. 3.3.10 Digital Output 1(DO1)

DO1 can be selected from 0 to 8, where 0 to 8 represent the energy parameters. Fig. 3.3.10 shows the DO1 as 0. To change this digital output press P and/or E key to scroll through the available selection (Table 3.1)

Once selected press V/A to save and go to the next page.

Table3.1: Digital Output Values

Settings	Value	Description
0	No output	No output
1	kWh _ Imp	Consumption active energy
2	kWh_ Exp	Generation active energy
3	kVARh_ Imp	Inductive reactive energy
4	kVARh _ Exp	Capacitive reactive energy
5	kWh _ total	Total energy (absolute sum)
6	kWh _ net	Net energy (algebraic sum)
7	kVARh _ total	Total reactive energy (absolute sum)
8	kVARh _ net	Net reactive energy (algebraic sum)

How to set Digital Output 2 (DO2) -

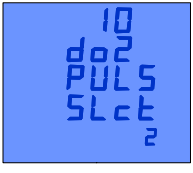


Fig. 3.3.11 Digital Output 2(DO2)

DO2 can be selected from 0 to 8, where 0 to 8 represent the energy values.

Fig. 3.3.11 shows the DO2 as 2.

To change this digital output press P and/or E key to scroll through the available selection (Table 3.1)

Once selected press V/A to save and go to the next page.

How to set digital output pulse width?

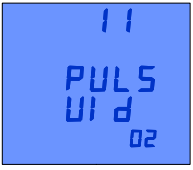


Fig. 3.3.12 Digital Output pulse width

Digital output pulse width (an integer) range from 1 to 50. (One digit = 20ms)

Fig. 3.3.12 shows 02 pulse width (ie. 1=20ms, 2x20ms=40ms, 25=500ms, 50= 1000ms)

Press H key for the right shift, P or E key to increase or decrease the value

Now press V/A to "SAVE" the selected value and go to the next display.

How to set energy pulse rate?

Fig. 3.3.13 Digital Output pulse rate

The energy pulse rate ranges from 1 to 6000. (One digit is 0.1 kWh or 0.1 kVARh)

Fig. 3.3.13 shows 10 energy pulse rate (10x0.1 kWh=1kWh per pulse)

Press P or E key to increase or decrease the value

Now press V/A to "SAVE" the selected value and go to the next display.

EM 6600 has 2 relay outputs, each output has 2 modes: latching and momentary.

For latching mode, the relay can be used as two-output status "on" or "off".

For momentary mode, the relay changes from "off" to "on" for a period Ton and then goes off.

Ton settings: 50 to 300ms; 0: latching and 1: momentary.

How to set Relay mode?

Fig. 3.3.14 Relay 1 mode

Fig. 3.3.14 shows the relay1 mode set to momentary (1).

Fig. 3.3.15 Relay 1 closing time

To set Relay 1 close time-

When the relay mode1 is set as momentary, the closing time Ton is effective and also displayed. Fig. 3.3.15 shows as Ton =50ms.

Ton ranges from 50 to 3000ms in steps of 1ms.

Press V/A to "SAVE" the selected value and go to the next display screen.

Note: If the relay mode1 is set as latching, the relay 1 closing time setting Ton has no effect on the relay state, however Ton is displayed.

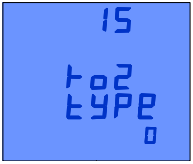


Fig.3.3.16. Relay 2 mode

Relay 2 mode can be set either 0 or 1, where 0 represents latching and 1 represents momentary.

Fig 3.3.16 shows relay mode 2 is set as latching (0).

Press V/A to save and go to the next display.

Fig. 3.3.17 Relay 2 closing time

When the relay mode2 is set as momentary, the closing time Ton is effective and also displayed.

Ton ranges from 50 to 3000ms in steps of 1ms.

Fig 3.3.17 displays Ton=50ms.

Press V/A to save and go to the next display screen.

Note: If the relay 2 mode is set as latching, the relay 2 closing time setting Ton has no effect on the relay state, however Ton is displayed.

How to set backlight time?

Fig. 3.3.18 Backlight time

To save energy and improve the component life, LCD backlight will turn OFF if there is no key press for a period of time. The ON time can be selected from 0 to 120 minutes. The backlight will be always ON if the setup value is 0.Fig. 3.3.18 the backlight is set to turn off automatically after 5 minutes.

Press V/A to save and go to the next page.

How to set demand window time?

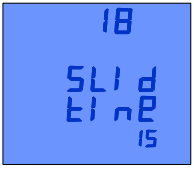


Fig. 3.3.19 Demand window period

Demand period (sliding/fixed) ranges from 1 to 30 minutes in steps of 1 minute.

In fig. 3.3.19 the demand window period is set for 15minutes.

To change these settings, press H key to select the digits and then press P key and/or E key to increment or decrement the value.

Now press V/A to save and go to the next display.

How to clear max and min values?

Fig. 3.3.20 Clearance of max and min value

This screen allows you to clear all the max and min statistical values.

Change to "yes" and then press V/A to clear all max and min values.

To change "yes" or "no" press P or E key.

Now press V/A to save and go to the next display.

How to set the date?

Fig. 3.3.21 Date format

The display date format is MM: DD: YY; MM - month 1 to 12; DD - day 1 to 31; YYYY - year 2000 to 2099.

Press H to select the month, date or year.

Now press P or E key to increase or decrease the value.

Press V/A to save and go to the next display.

How to set time?

Fig. 3.3.22 Time format

The display format is hh:mm:ss, wherein hh - hours 1 to 24; mm- minutes 1 to 59, ss - seconds 1 to 59.

Press H to select the hour, minute and seconds.

Now press P or E key to increase or decrease the value

Press V/A to save and go to the next display.

How to set password?

Fig. 3.3.23 Password setting

This screen allows the user to program the password setting.

The password is a four-digit decimal number, ranging from 0000 to 9999. The factory default is 0000.

Ensure that any changes to the access code are recorded and kept in a safe place.

Press H key to select the digits.

Press P or E key to increase or decrease the value.

Press V/A key to save and go to the next display.

How to set demand calculation method?

Fig. 3.3.24 Demand calculation

This screen allows you to set the demand calculation as sliding window or fixed window.

1 – fixed window; 0 – sliding window.

Fig. 3.3.24 shows the sliding window.

How to exit from the setting mode?

Press H and V/A keys simultaneously.

4. Explanation of parameters

The EM 6600 can measure, locally display and remotely transfer over MODBUS RTU, the following electrical parameters over the input range with an accuracy of Class 1.0 or better for Volts and Amps, Power and Energy functions, Class 0.5 is optional.

Voltage (V): True RMS value of three lines to neutral voltages, three line-to-line voltages and their average.

Current (A): True RMS value of three phase currents, neutral current and their average.

Active Power (P, kW): Three phase active power and system total active power.

Reactive power (Q, kVAR): Three phase reactive power and system total reactive power.

Apparent power (S, kVA): Three phase apparent power and system total apparent power.

Frequency (F): The frequency of any available phase voltage input is measured as system frequency.

Active Energy (kWh): Active energy is time integral of active power. The unit is kWh. As power has direction, positive means consumption (Import) and negative means generating (Export).

Total: Absolute sum of import and export Active energy.

Net: Algebraic sum of import and export Active energy.

Reactive Energy: Reactive energy is time integral of Reactive power.

As the reactive power has direction, positive means inductive (Import) and negative means capacitive (Export).

Total: Absolute sum of import and export reactive energy.

Net: Algebraic sum of import and export reactive energy. Each of the four reactive energies are measured and stored independently.

Demand: Demand of power, reactive power and apparent power. The demand statistics method in EM 6620 is user selectable sliding window or fixed window. The Demand period can be selected between 1 to 30 minutes. In case of sliding window, the window slides one minute each time. eg. The sliding window time is 3 minutes and if average power of the first minute is 12, average power of the second minute is 14 and average power of the third minute is 10, then the total demand of the 3 minutes is (12+14+10)/3=12 at the end of the three minute. If another minute passed, the average power of the minute is 8, then the total power demand of the last three minute is (14+10+8)/3=10 at the end of the fourth minute. The function of demand is available only in EM 6620.

Crest factor (CF): The crest factor is used to express the distortion of the waveform. This is an important factor to scale the influence to the system insulation.

$$CF = 1.414 \sum_{h=1}^{50} \frac{Vh}{V1}$$

In this expression V1 is the RMS of fundamental and Vh is the RMS of the

h^{th} harmonic. The function of Crest factor only exists in EM 6620.

Total harmonic distortion: This factor is often used to express the power quality of the electric power system.

$$THD = \sqrt{\sum_{h=2}^{50}\left(\frac{Vh}{V1}\right)^2} \times 100\%$$

In the expression, V1 is the RMS of fundamental wave and Vh is the RMS of the h^{th} harmonic: This function exists in EM 6610 and EM 6620.

$$HRVh = \frac{Vh}{V1} \times 100\%$$

Each harmonic rate: The percentage of each harmonic divided by fundamental

$$HRIh = \frac{Ih}{I1} \times 100\%$$

Total Even harmonics distortion: Root of the sum of each even harmonics square.

Total Odd harmonics distortion: Root of the sum of each odd harmonics square.

Telephone Interference Factor (THFF): The interference factor to telephone communication system.

$$THFF = \sqrt{\sum_{h=1}^{100}\left[\frac{50 \times h \times Ph \times Vh}{800 \times 1000 \times V1}\right]^2} \times 100\%$$

In this expression the Vh is the voltage of the h[th] harmonic and the Ph is coefficient, which is defined by CCITT committee.

The function of the THFF exists in EM 6620.

K factor: This is an important factor to scale the power quality of current.

$$Kfactor = \frac{\sum_{n=1}^{k}(n \times Fn)^2}{\sum_{n=1}^{k}(Fn)^2}$$

In this expression, the Fn is the RMS of the n[th] harmonic**.**

Three phase unbalance factor: Three phase voltage unbalance factor and three phase current unbalance factor can be measured in PowerCon. The unbalance factor is expressed in percentage.

$$Voltage\ unbalanace\ \ factor = \frac{(The\ Max\ different\ value\ of\ \ three\ voltages)}{(Average\ value\ of\ \ three\ voltages)}$$

$$Current\ unbalanace\ \ factor = \frac{(The\ Max\ different\ value\ of\ \ three\ Currents)}{(Average\ value\ of\ \ three\ \ \ Currents)}$$

Max/Min statistics: The maximum and minimum value of the metering data is stored in NV-RAM and can be accessed or cleared from front panel or through communication in EM 6620. These metering data are line to neutral voltage, line to line voltage, current, active power, reactive power, apparent power, power factor, frequency, demand.

Real time clock: There is a real time clock in EM 6620. The date, month, year, hour, minute and second can be read or set from front panel or through communication.

Phase Angle: The phase angle difference gives the phase angle relationship between the voltage and current. It is from 0 to 360^{o} . When the wiring of voltage input is set to be 2LL, it gives the phase difference V23, I1 (A1), I2 (A2), I3 (A3) relative to V12. When the wiring of voltage input is set to be 2LN and 3LN, it gives the phase difference V2, V3, I1 (A1), I2 (A2), I3 (A3) relative to V1

Alarm:

In EM6620, when the metering data crosses the pre-set limit (HI or LO) for over preset time interval, the alarm will trigger. The digital output (DO) can be used as trigger for Visual or Audio annunciation of any one alarm. Alarm Setup is done via the PC. It is too complex to implement via the keypad. Up to 9 Alarms can be defined.

The example below shows the first Alarm being Defined and Triggered.

Start	
Enable Alarm 1	Enable the first Alarm
Par1: = Alarm Parameter	Define the Alarm parameter
REF1: = Limit	Set the Alarm limit
Limit_t := time	Set time limit to the limit _t
Set HI (>) or LO (<)	Select HI or LO Alarm sign
Set DO	Set associated digital output (DO)
If Par1 or < REF1="True" and Last_ time >Limit_t Then {record an event Output associated DO}	If Crossed Limit? (HI or LO) also crossed time limit? then, Record the value, date and time and set the related Digital Output(DO)
end	Finish

All Alarm registers should be set in order to finish the above process. Else the others will get blanked out (deactivated). The registers are preset

through communication.

Alarms enable register: register Alarm, bit0~bit8 corresponding to Alarms1 to 9Alarms. Bit (n) =0 Disable the n^{th} Alarm

Bit (n) =1 Enable the n^{th} Alarm

The 9 Alarm parameters (Par1 to Par9) can be any of the 34 parameters.

Table 4.1. Alarm Parameter Codification for Setup

Par Num	**0**	**1**	**2**	**3**	**4**
Par Name	F	V1	V2	V3	VLNavg
Par Num	**5**	**6**	**7**	**8**	**9**
Par Name	V12	V23	V31	VLLavg	I1
Par Num	**10**	**11**	**12**	**13**	**14**
Par Name	I2	I3	Iavg	In	P1
Par Num	**15**	**16**	**17**	**18**	**19**
Par Name	P2	P3	Psum	q1	q2
Par Num	**20**	**21**	**22**	**23**	**24**
Par Name	q3	qsum	S1	S2	S3
Par Num	**25**	**26**	**27**	**28**	**29**
Par Name	Ssum	PF1	PF2	PF3	PF
Par Num	**30**	**31**	**32**	**33**	**34**
Par Name	V_unbl	I_unbl	Dmd_P	Dmd_q	Dmd_S

CAUTION: These alarms are meant for rapid control action, rather than for mere Max or Min storage. Therefore, they are not slowed down by Min / Max event storage. They are also not slowed by buffering during editing. This means that you cannot edit only one alarm. All alarms settings need to be written in Unison. Changing one setting alone will reset the others (Blank them out). ConPAD helps you Setup Alarms effectively. Similarly, since the events are not stored for posterity, they will be lost on Power fail.

Limit setting register: register REF1 to REF9

The setting of the REF register should be the HI (upper limit) or the LO (low Limit) of the parameter. The range of the parameter limit is related to the format of the register.

Time limit setting register: register Limit_t

Limit_t is the time interval limit. It is an integer from 0 to 255. One digit is 300ms.

Zero means no time limit. Trigger the record and alarming output immediately on the over limitation.

All the Alarm has the same time limit. If the Limit_t=20, the time limitation is 20x300=6000ms.

Alarm sign register: Alarm Sign1 to Alarm Sign9

Sign=0, select <, the low limit

Alarm Sign=1, select >, the up limit

The DO select register:

Associated DO1 register bit0~bit8 correspond to the first to ninth Alarm.

Bit (n) =0, DO1 do not associate with the n^{th} Alarm

Bit (n) =1, DO1 associate with the n^{th} Alarm

Associated DO2 register bit0~bit8 correspond to the first to ninth Alarm.

Bit (n) =0, DO2 do not associate with the n^{th} Alarm

Bit (n) =1, DO2 associate with the n^{th} Alarm

Example: If current I1 goes over the HI (upper limit) and time interval limit 15 Seconds, then trigger the over limit alarm record and DO1 output. The CT ratio of the current I1 is 200: 5.

The HI (upper limit) of current I1 is set to be 180A.

The setting of the registers is as follows

Enable the Alarm1: Alarm register bit (0) =1

The current I1 is number 9.The setting of the Par1 is 9.

The relation of real current and the data stored in register is,

Real current= (data in registerxCT1/5)/1000

The CT1 is 200 and up limit of current is 180A, then the data in register is 4500. The setting of the REF1 is 4500. Time limit is 15 Seconds and the one digit is 300ms, then the setting of Limit_t1 is 50.

As it is the up limit, the Alarm_Sign1 should be 1.

Use DO1 as alarm signal output, then the bit 0 of the associated DO1 should be 1.The output mode of DO should be set alarming through front panel or communication. Only recent 9 groups of the alarming record can be stored in memory of EM 6620.

The format of the record:

Table 4.2 Alarm Record

Address	Value	Notes
Alarm record address	Alarm parameter number: Par	Refer to Table 4.1
Address+1	Alarm value	Records alarm value
Address+2	Year	Parameter
Address+3	Month	Alarm date
Address+4	Date	
Address+5	Hour	
Address+6	Minute	Alarm time
Address+7	Second	

When the alarm parameters resume normal (no longer over the limit), it is also recorded.

User can get the total period of over limit time.

Note: When the alarming parameter resume to normal, the highest bit of Par bit 15 is set to be 1.

Energy pulse output: The two digital outputs (DO) can be selected as energy pulse output.

Any two of the 8 energy and reactive energy can be assigned to be as the pulse output. The pulse width and pulse rate (constant) can be set, while pulse width means how long the duration of the pulse is and pulse rate (constant) means how much energy that one pulse is represented.

When the energy accumulates to the setting limit, there will be a pulse output from the assigned DO port.

Pulse output assignment register: any integer from 0 to 8. The digit 0 means no assignment, while 1 to 8 corresponding to kWh_Imp, kWh _Exp, kVARh_Imp, kVARh _Exp, kWh _total, kWh _net, kVARh _total and kVARh _net respectively.

Pulse rate (constant) register: any integer from 1 to 6000. One digit represents 0.1kWh or kVARh. This value is the minimum resolution of energy pulse output.

Pulse width setting register: any integer from 1 to 50. One digit represents 20ms.

The minimum time interval between two adjoining output pulses is 20ms in PowerCon. If the pulse width is 20ms, then maximum number of output pulses is 25 in one second. If the pulse width is 80ms, then the maximum number of output pulse is 10.

In practice the pulse width and the pulse ratio are selected according to system power. The relation of the two parameters should satisfied following expression:

$$Pulseratio > \frac{(pulsewidth + 1) \times P\max}{18000}$$

In the above equation, the Pmax is the maximum active power or reactive power. The unit is kW or kVAR. Recommend pulse ratio is 3 to 5 times the right side value of the above expression.

Relay output: The two-relay output (option) in PowerCon can be used to control electric switch or equipment. There are two output modes of the relay, latching or momentary. Momentary mode is often used to control the electric switch. The closing time interval can be selected between 50ms to 3000ms.

5. Installation

5.1. Input Ratings

Auto-ranging voltage inputs should allow direct connection up (480V) or V sec editable 100 to 440 V.

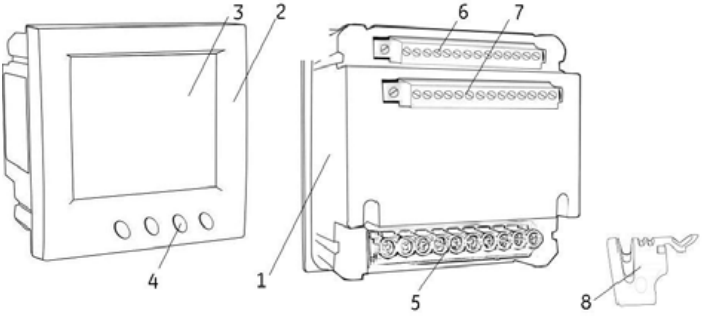
- Supports (field configurable) direct 4-Wire Star (Wye), 3-Wire Star (Wye), 3- Wire Delta configurations and single phase via Star (Wye) Phase1
- 3-phase voltage and current inputs
    - Volts: 48 to 277 Vac Line-Neutral
        - 80 to 480 Vac Line - Line
    - Overload - 2 times of nominal continuous, 2500V for 1 sec, Hz 50/60
    - Amps: 5A: 50 mA to 6 A, Overload: 10 A continuous, 100 A for 1 second. 1A option: 10mA to 1.2A.
    - Burden (Load): Less than 0.2 VA per Volt/Ampere input
    - Frequency: 45 to 65 Hz
    - Auxiliary power supply: 85 to 264 Vac or 100 to 300 Vdc

5.2. Mechanical Installation

The EM 6600 PowerCon meter is panel-mounted and has reliable, rear-mounted terminal strips rated for 480V. The 92 x 92 mm cutout and 96 x 96 mm bezel dimensions adhere to DIN IEC 61554 and DIN 43700.

Depth required behind the panel is 64 mm, plus space for wiring. Two side clamps are provided for firm mounting.

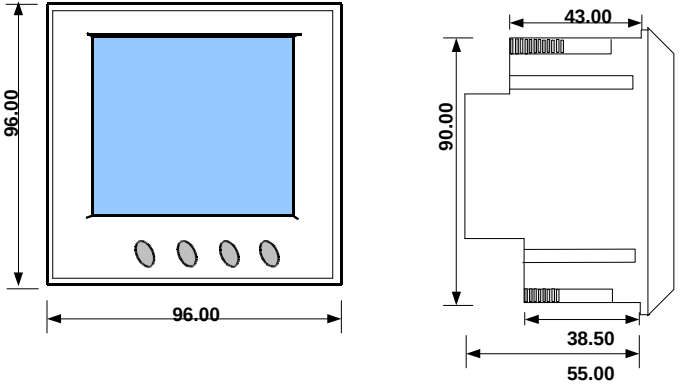
The construction of EM 6600 PowerCon is as shown below:



1. Enclosure: The EM 6600 PowerCon meter cover is made of high strength anti-combustion engineering plastic.
2. Front Casing.
3. LCD display: Large bright blue backlit LCD.

4. Key: Smart 4 keys to select display and to set meter parameters.
5. Input terminals: For voltage and current wiring.
6. Auxiliary terminals: For auxiliary power supply, communications, and digital inputs.
7. Auxiliary terminals: For DI power, digital input, digital output & relay output.
8. Installation clip: To fix the meter to the panel.

5.3. Dimensions

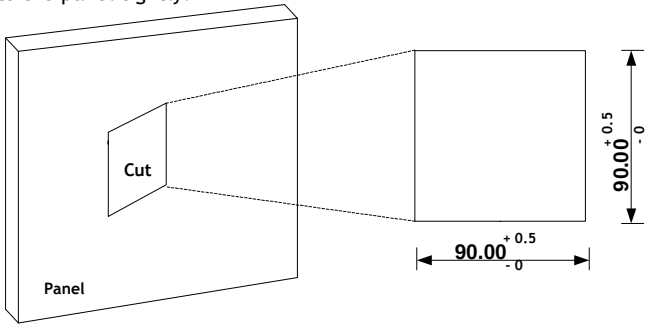


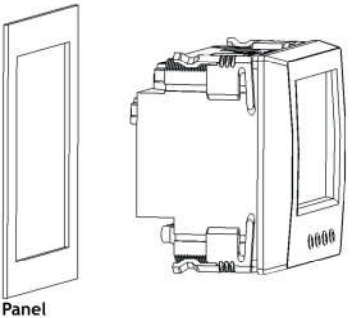
5.4. Installation Procedure

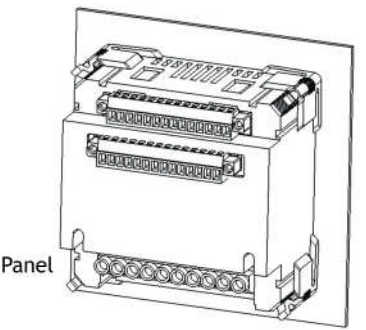
5.4.1. Panel Mounting for New Installations

The following procedure describes the installation of EM 6600.

- Cut a square hole on the switchgear panel as below
- Remove the installation clips from the meter and insert to the square hole from the front side.
- Later insert the installation clips back and adjust the meter so as to fit to the panel tightly.

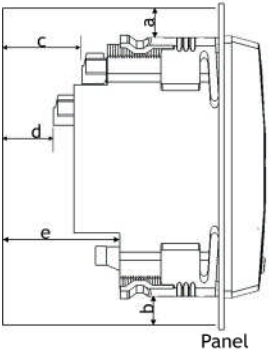


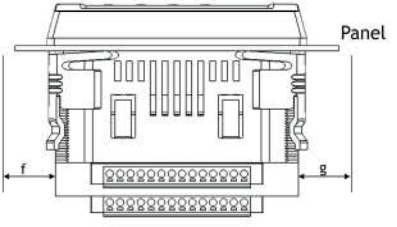

Panel


Panel

Space required for installation

The space around the meter should be large enough so that the removing of the meter and the terminal wiring can be easily done. The recommended minimum space around the meter is as below :





Environment Temparature	Minimum Distance(mm)						
	a	b	c	d	e	f	g
< 50°C	25	25	38	38	64	25	25
≥ 50°C	38	38	51	51	76	38	38

5.4.1.1. *Location and Mounting considerations*

DANGER :

All Installation, wiring and periodic maintenance of the EM 6600 as well as its associated circuits involve high voltages and currents. While this manual suggests several safety and reliability steps, it must be used in conjunction with the safety codes in force at your location. Failure to practice safe working procedures is likely to cause damage to the installation, severe injury and / or death. All work including handling of electrical circuits during Installation, wiring and periodic maintenance, must be done only by qualified personnel.

Neither CONZERV nor its agents may be held responsible for damage or death arising out of the wiring and / or PT, CT or other external circuits.

The covers of the EM 6600 should never be dismantled or opened. There are no user-serviceable parts inside. The EM 6600 contains high-precision components, which require special handling available only at authorized CONZERV service locations. High voltages are likely to be present inside even after the EM 6600 has been switched off. Opening the covers of the EM 6600 and/or any attempts to dismantle, service, repair or modify the unit by unauthorized persons may cause severe injury, will damage the unit and will also render CONZERV's warranty void.

5.4.2. Usage

First decide on how the EM 6600 is going to be used. If you do not already have an energy management program in operation, then your energy consultant should be able to help you identify which load(s) offer maximum savings potential. This will help you decide which point is to be monitored, where the readings will be viewed from, who must have access to the instrument and how often. For best performance, choose a location, which provides all the required signals with minimum wiring lengths.

5.4.3. Panel Considerations and Environment

The EM 6600 PowerCon Source Energy Meter is a high - precision measuring instrument and its operating environment is of utmost importance. For maximum performance, the instrument should be mounted in a dry, dust-free location, away from the heat sources and strong electromagnetic fields. To operate reliably, the following conditions must be met:

Environmental Conditions-

Operating Temperature	-25° C to 70° C, Meter -10° C to 70° C, Display -40° C to 85° C, Storage
Relative Humidity	5% to 95%, non-condensing

The EM 6600 PowerCon Source Energy meter should be separated from other equipment and sufficient space must be provided all around for cooling air to rise vertically past the instrument. The cooling air

temperature must be below the specified operating temperature.

The panel or housing, in which the EM 6600 is mounted, should protect it from dust, moisture, oil, corrosive vapors, etc.

The panel doors must be easily opened to provide easy access to the EM 6600 wiring for trouble-shooting. Allow clearance if the unit is going to swing out, as well as adequate slack in the wiring. Allow space for terminal blocks, CT shorting blocks, fuses, auxiliary contractors and other necessary components.

5.4.3.1. *Viewing*

For ease of operation, in the location should be preferably at, or slightly above, eye-level. For viewing comfort, minimize glare and reflections from strong light sources.

5.4.3.2. *Mounting*

Before mounting and wiring, the Setup procedure should have been completed.

The EM 6600 is panel mountable

Panel cut-out	92+0.5-0 (w) x 92+0.5-0 mm (h) DIN IEC 61554 and DIN 43700
Panel Thickness	0.5 to 4.0 mm
Instrumental Bezel dimensions	96 x 96mm
Mounting Clamp	4 nos
Voltage and current terminals Auxiliary and other terminals	Combination Phillips & Slotted head Screw driver will be provided

The cut out should be punched with the proper tool and should be free from burrs.

Before wiring, insert the EM 6600 into the cut out from the front. Then, fasten all the 4 side clamps from the rear.

6. Electrical Installation

DANGER :

All Installation, wiring and periodic maintenance of the EM 6600 as well as its associated circuits involve high voltages and currents. While this manual suggests several safety and reliability steps, it must be used in conjunction with the safety codes in force at your location. Failure to practice safe working procedures is likely to cause damage to the installation, severe injury and / or death. All work including handling of electrical circuits during Installation, wiring and periodic maintenance, must be done only by qualified personnel.

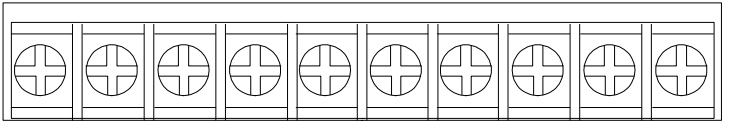
Neither CONZERV nor its agents may be held responsible for damage or death arising out of the wiring and / or PT, CT or other external circuits.

The covers of the EM 6600 should never be dismantled or opened. There are no user-serviceable parts inside. The EM 6600 contains high-precision components, which require special handling available only at authorized CONZERV service locations. High voltages are likely to be present inside even after the EM 6600 has been switched off. Opening the covers of the EM 6600 and/or any attempts to dismantle, service, repair or modify the unit by unauthorized persons may cause severe injury, will damage the unit and will also render CONZERV's warranty void.

6.1. Terminal Details

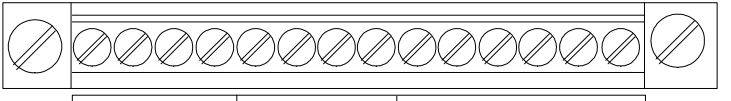
There are three terminal on the back of EM 6600, a voltage and current input terminal, an auxiliary terminal, and an I/O terminal.

Voltage and Current input terminals



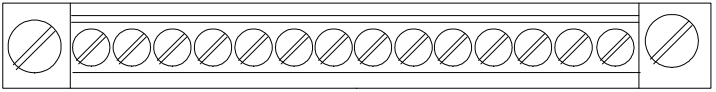
VOLTAGE INPUTS				CURRENT INPUTS					
V1	V2	V3	Vn	S1 A1	S2	S1 A2	S2	S1 A3	S2
1	2	3	4	5	6	7	8	9	10

Auxiliary terminals



RS-485				DIGITAL IN				AUX Power					
+	-	E	NC	DI1+	DI1-	DI1+	DI2-	NC	L	NC	N	NC	G
11	12	13	14	15	16	17	18	19	20	21	22	23	24

Auxiliary terminal – I/O



DIGITAL IN				DC OUT		RELAY OUT				DIGITAL OUT			
D13+	D13-	D14+	D14-	V+	V-	R11	RI2	R21	R22	DO1+	DO1-	DO2+	DO2-
25	26	27	28	29	30	31	32	33	34	35	36	37	38

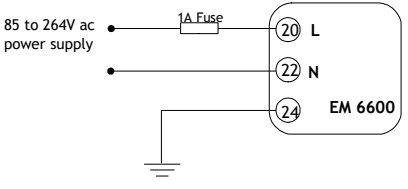
6.2. Auxiliary (Control) Power Supply

The EM 6600 PowerCon meter requires a single-phase ac / dc Auxiliary (control) power supply to power up its internal electronic circuitry.

External surge suppressors are necessary in the auxiliary supply circuit for proper operation during extreme surge conditions, where the voltage surges exceed the auxiliary supply limits (E.g. Rural areas and outlying areas prone to lightning strikes).

Auxiliary power supply range: 85 to 264V ac or 100 to 300V dc

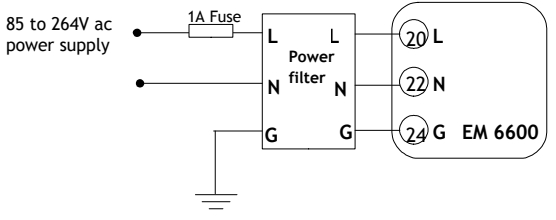
A fuse (1A at 250V ac) should be used in the auxiliary power supply circuit.



DANGER : Do not feed the EM 6600 auxiliary power supply terminals with a voltage greater than the rating marked on the label. The EM 6600 will be permanently damaged and CONZERV's Warranty shall be void.

A fuse (typical 1A/250Vac) should be used in auxiliary power supply loop. No.24 terminal must be connected to the safety earth system of switchgear. An isolated transformer or EMI filter should be used in the auxiliary power supply loop if there is power quality problem in the power supply.

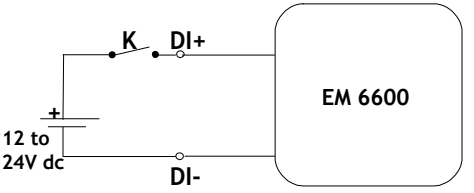
Note: Use a suitable filter if there is EMI problem.



Choice of wire of power supply could be AWG 22-16 or 0.6-1.3mm^2

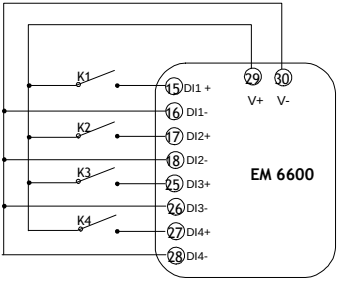
6.3. Digital Input

PowerCon meter has 4 digital inputs (dry or wet contact). The terminals for these inputs are DI1+, DI1- (terminals 15, 16), DI2+, DI2- (terminals 17, 18), DI3+, DI3- (terminals 25, 26) and DI4+, DI4-(terminals 27, 28).



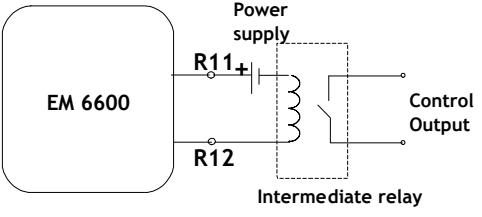
Auxiliary power supply is provided for the convenient of the factory field used. The power supply voltage is 15V dc (1 W). The wiring terminals are V+ and V- (terminals 29 and 30).

This power supply cannot be used for other purposes.



6.4. Relay Output

There are two relay outputs available in the PowerCon models. The terminals are R11, R12 (terminals 31, 32) and R21, R22 (terminals 33, 34). These two relay outputs are used to provide remote control electric switches in the power system. The relay outputs are mechanical Form A contacts rated at 3A/250V ac or 3A/30V dc. An intermediate relay is recommended as shown in the figure below.

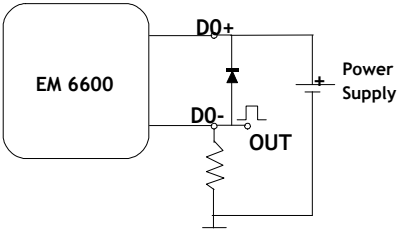


There are two relay output modes: latching and momentary. For the latching mode, the relay can output two states: on or off. For the momentary mode, the relay output changes from off to on for a period of time Ton and than goes off. The Ton value can be setting from 50 to 3000ms. The relay output wiring should be AWG22 ($0.5mm^2$) to AWG16 ($1.5mm^2$).

6.5. Digital Output

There are two 2 digital outputs available for the PowerCon. The terminals of the digital outputs are DO1+, DO1- (terminals 35, 36) and DO2+, DO2- (terminals 37, 38). The digital outputs can be used as energy pulse outputs or over limit alarming outputs.

Pulse Output



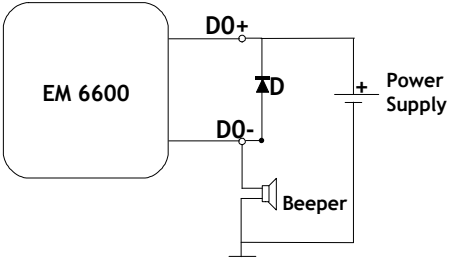
The maximum output voltage and current are 100V and 50mA, respectively. Negative voltage is forbidden. When the digital output is used as a pulse output, DO1 and DO2 can be programmed as energy pulse outputs. For example, DO1 is used as active energy pulse output and DO2 is used as reactive energy pulse output. The pulse width and pulse constant are programmable.

When the digital output is used as an over limit alarm output, the upper and lower limit parameters, time interval, and output port are programmable.

The digital output wiring should be AWG22 (0.5mm^2) to AWG16 (1.5mm^2)

A circuit of the alarming output with a beeper is shown below.

Alarm Output



6.6. PTs and CTs

Large electrical installations have high voltages and currents, which may exceed the direct connection rating of the meter. In this case, Potential Transformers (PTs) and Current Transformers (CTs) are used to precisely "step down" or reduce the voltage and current level to suit the meter rating. Potential Transformers usually have a full-scale output of 110V ac RMS line-line and Current Transformers, a full-scale output of 5A or sometimes 1A.

The PTs (Potential Transformers) and CTs (Current Transformers) must be planned, installed and tested by a qualified electrical contractor before wiring the meter. The accuracy of the measurement also depends on the accuracy and phase – angle error of the PTs and CTs. Instrument Class 1 or better PTs and CTs are recommended. Do not use protection class (10P10, etc.) CTs to feed the EM 6600; they have poor accuracy and phase characteristics.

Ensure that the CT primary rating has been selected so that your normal load variation lies between 40% and 80% of its full scale. If your CT is over-rated, say if the load is always less than 10% of the CT primary rating, accuracy suffers. On the other hand, if the CT is under-rated, then you may exceed its full-scale and burn out both the CT and the EM 6600.

6.6.1. PT, CT Wiring

The PTs and CTs must have adequate VA rating to support the burden (loading) on the secondary. You may want to support the auxiliary supply burden from one of the PTs. CT wiring can impose additional burden (loading) on the CT. For example, if the CT has a 5A secondary and the wire resistance is 1.0 Ω, then the CT has to support an additional burden of 5VA.

The EM 6600 should be conveniently located for easy connections of voltage (PT) and Current (CT) signals, the auxiliary (control) supply.

The EM 6600's Field Programmable PT (Primary or secondary) and CT (Primary) Settings may be utilized to calibrate out the PT and CT amplitude error, for improved accuracy.

6.7. Voltage signal Connections

For proper meter operation, the voltage connection must be maintained. The voltage must correspond to the correct terminal. The cable required to terminate the voltage sense circuit should have an insulation rating greater than 480V ac and a current rating greater than 0.1A.

There are 4 input voltage terminals marked V1, V2, V3 and Vn. See the wiring diagrams that follow, for details.

6.8. PT Connection

The EM 6600 directly accepts LT voltage inputs of up to 480 Vac RMS Line to Line (277 VLN). Voltages greater than this, typically HT systems, must be connected through Potential Transformers (PTs). The EM 6600 allows field programming of both PT Primary and Secondary voltages. See the voltage input overload graph for more detail.

Field Programmable PT Primary range : **0.1 to 500 kVac.**

Field Programmable PT Secondary range : **100 to 440Vac**

EM 6600 Voltage Input burden :< **0.2 VA per input.**

IMPORTANT: The PT primary and secondary values must be user programmed before using the meter. Otherwise, the readings will be wrong.

6.8.1. Selecting the Voltage Fuses

We strongly recommend using fuses on each of the sense voltages and the control / auxiliary power, although connection diagrams often do not show them. Use a 1A fuse on each voltage input.

6.8.2. Current Signal Connections

The meter accepts up to 6A ac RMS per channel directly. Above that, a Current Transformer must be interposed to scale down the current.

There are three pairs of current input terminals marked A1, A2 and A3. Each pair of input terminal is labeled as (S1, S2) and has an arrow indicating the direction of current flow. For proper measurements, the phase identification as well as the polarity of the current signals must be correct. The forward flow (import by consumer) current direction must be into the S1 terminal and the exit from the S2 terminal. Please maintain the correct sequence and polarity to avoid wrong readings.

Any unused current input terminals (e.g. A2 (S1, S2) for Delta) must be shorted together. The shorted terminals do not need to be grounded.

Install the wiring for the current circuit at 600V ac insulation as a minimum. The cable connection should be rated for 10A or greater and have a cross-sectional area of 16A WG minimum.

6.9. CT Connections

Mount the current transformers (CTs) as close as possible to the meter for best accuracy. The following table illustrates the maximum recommended distances for various CT sizes, assuming the connection is via 16A WG cable. Field Programmable CT Primary range: 5A to 10000A ac.

CT Secondary : 5A ac

Other values are also programmable to compensate CT errors if desired.

EM 6600 CT Burden :< 0.2VA per input.

See the Setup (Field Programming) section for programming details.

IMPORTANT: The CT Primary and Secondary values must be User Programmed before using the Meter. Otherwise, the readings will be wrong.

Note: With PowerCon - range CTs, select the best range for programming the EM 6600. Do not change the range thereafter without re-programming the EM 6600; the EM 6600 will read erroneous values.

6.9.1. CT Polarity

When the meter is connected using the CTs, you must maintain the correct CT polarities. CT polarities are dependent upon correct connections of CT leads, and upon the direction the CTs are facing when clamped around conductors. The dot on the CT must face the line side; the corresponding secondary connection must connect to the appropriate input on the meter.

6.9.2. CT Connection Reversal

To check the polarity of the CT after the meter has been installed, simply look at the phase-wise active power P (kW) readings to see that each of the readings are positive (assuming you are consuming power). If one of the kW readings is negative, that particular phase CT is reversed and must be corrected.

7. Connection Diagrams

Choose the diagram below that best describes your application. You must ensure that the CT phase and corresponding PT phase are identical and that the CT polarity is correct as explained in "CT Polarity" above. Follow the outlined procedure to verify correct connection.

7.1. Three Phase Wiring

The EM 6600 has the following wiring configuration:

Voltage Input Wiring

- 3 phase 4 wire wye (3LN)
- 3 phase 4 wire 2PT wye (2LN)
- 3 phase 3 wire open delta (2LL)

Current Input Wiring

- 3CT
- 2CT
- 1CT

The above voltage input wiring can be combined with any current wiring connection.

7.1.1. Voltage Input Wiring

The nominal voltage input for EM 6600 is 230 V ac (L-N). For the three-phase systems less than 480 Vac (L-L), the voltage input can be directly connected to the meter. The maximum line-to-neutral voltage for V1, V2, and V3 should be lower than 276 Vac. If the input voltage is higher than 276 Vac, then a PT should be used. A fuse (typically 1 A at 250 Vac) should be used in voltage input circuit. In high voltage systems, PTs should be used to transform the high voltage into measurement range of the EM6600.The voltage input wiring can be up to 6mm^2 in size.

Note: In no circumstance the secondary of PT to be shorted. The secondary of PT should be well grounded at one end.

3-phase 4 wire Star / wye (3LN):

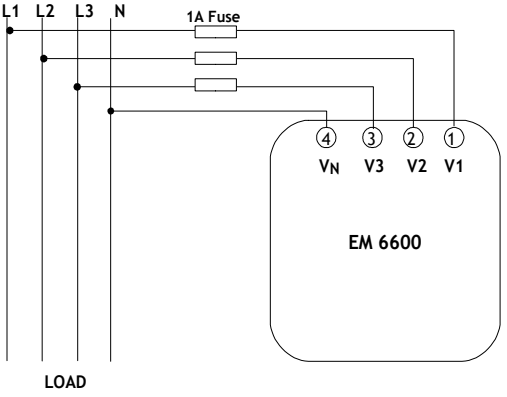


Fig 7.1 (a) 3LN Direct Connection

3 phase 4-wire wye connections are preferably used for low voltage power distribution.

Fig 7.1(a) illustrates the Direct connection, however it can be used for high voltage systems as shown in Fig 7.1 (b).

Note: The voltage input of EM 6600 should be set to 3LN for both voltage input wiring.

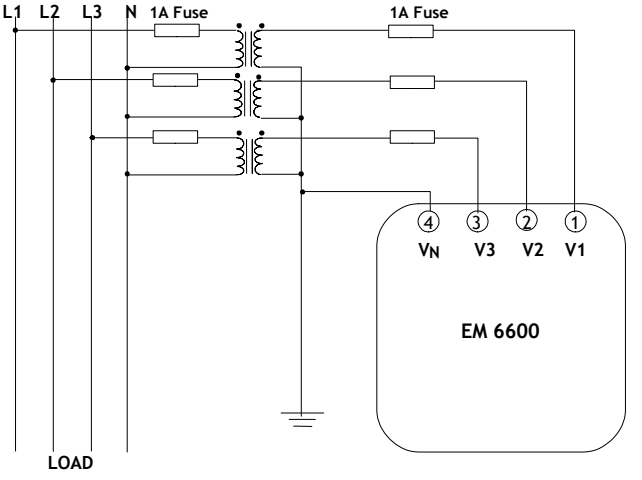


Fig 7.1(b) 3LN with 3PT

3Phase 3 –wire direct connection mode (3LN)

In a 3-Phase 3-Line system, power line L1, L2, L3 is connected to V1, V2 and V3 directly. VN is floated. The voltage input mode of the PowerCon should be set 3LN.

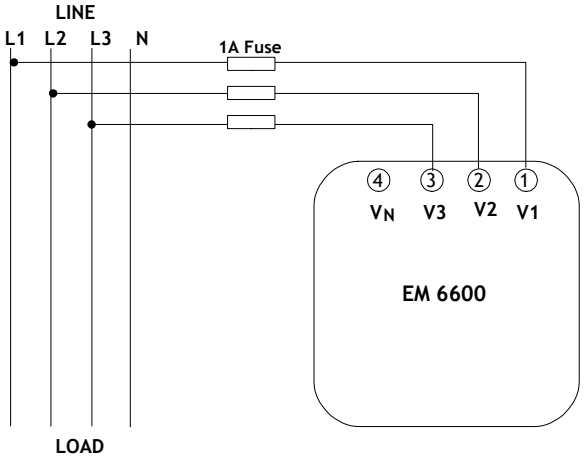


Fig 7.1(c) 3LN 3Phase, 3-Line direct connection

3-phase 4-wire 2PT (2LN):

In some 3-Phase 4-Line Wye system, 2PT Wye mode is often used (fig 7.1(d)) It is supposed that the 3 phases of power system are balance. The voltage of V2 is calculated according to the V1 and V3. The voltage input mode of the PowerCon should be set 2LN for 2PT voltage input wiring mode.

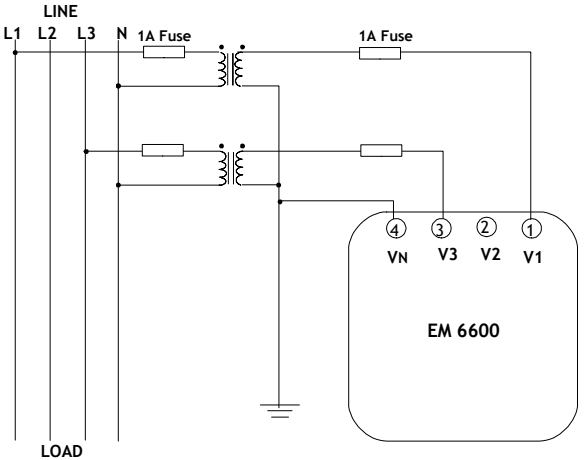


Fig.7.1 (d) 2LN with 2 PTs

3-phase 3-line open delta (2LL):

Open delta wiring mode is often used in high voltage system. V2 and VN connected together in this mode. The voltage input mode of the PowerCon should be set 2LL for voltage input wiring mode.

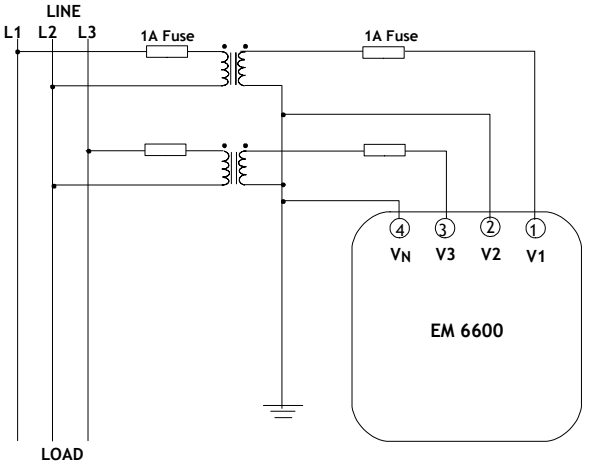


Fig.7.1 (e) 2LL with 2 PTs

7.1.2. Current Input Wiring

3 CT Wiring: All currents inputs of three-phase system can be considered as 3CT types, whether there are 2 or 3 CTs in the input side.

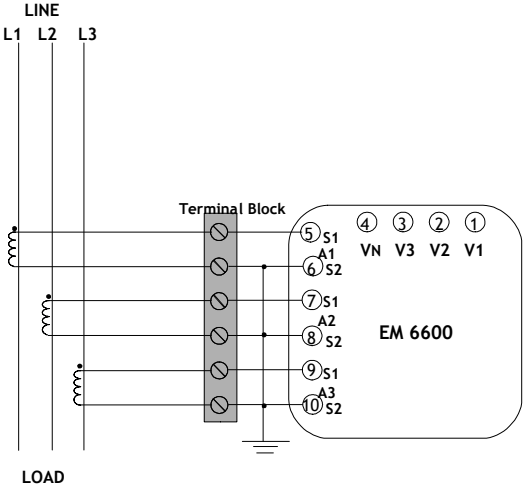


Fig.7.1 (f) 3CT wiring

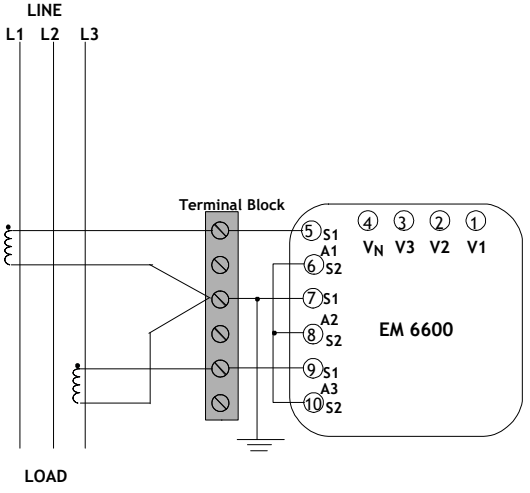


Fig.7.1 (g) 3CT wiring for 2 CTs

Note: All the current inputs can be considered as 3CT types for three phase (2 or 3CTs in the input side)

2CT Wiring

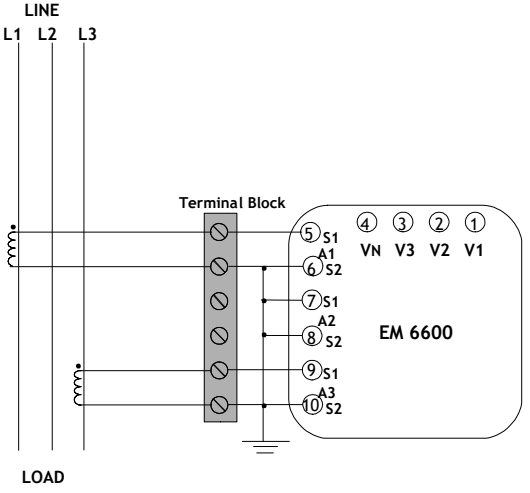


Fig.7.1 (h) 2CT wiring

1 CT wiring: The 1CT wiring scheme can be used for three-phase balanced systems. The remaining two currents are calculated by the EM 6600 according to the supposed balance.

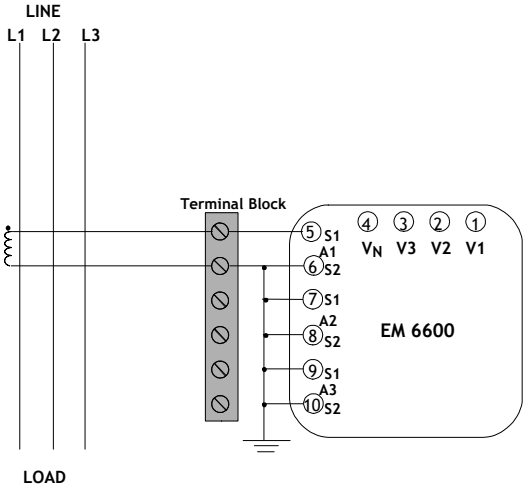


Fig.7.1 (i) 1CT wiring

7.1.3. Frequently used Connections

The voltage and current wiring are combined below.

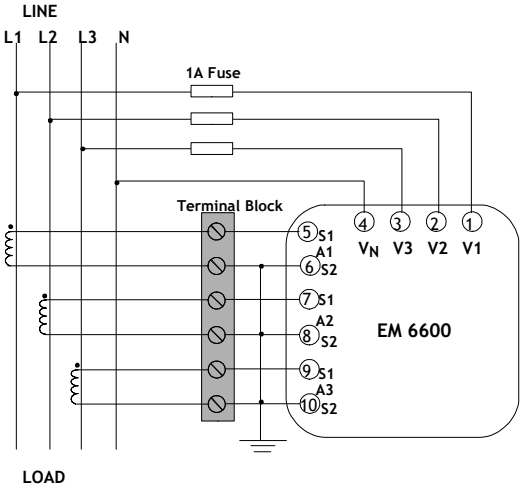


Fig.7.2 (a) 3LN, 3CT with 3CTs

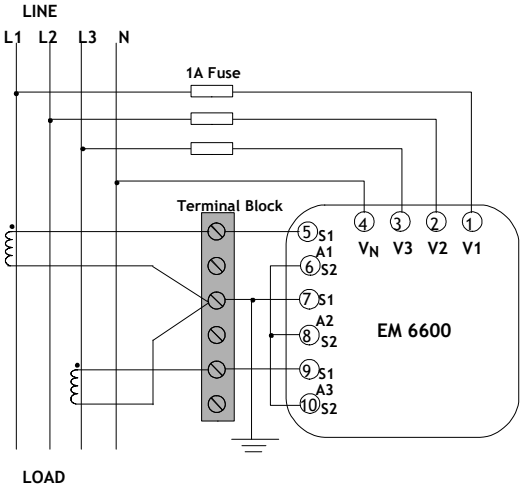


Fig 7.2 (b) 3LN, 3CT with 2CTs

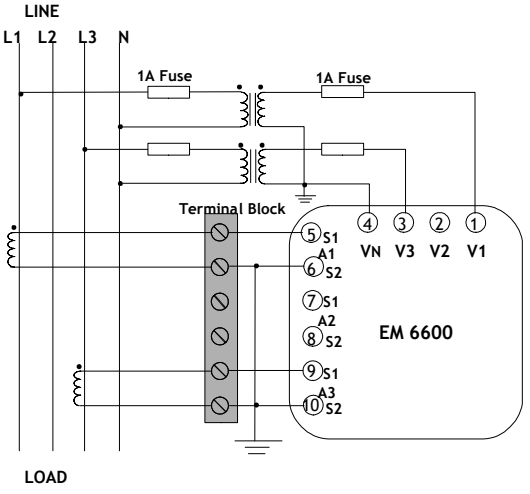


Fig 7.2 (c) 2LN, 2CT

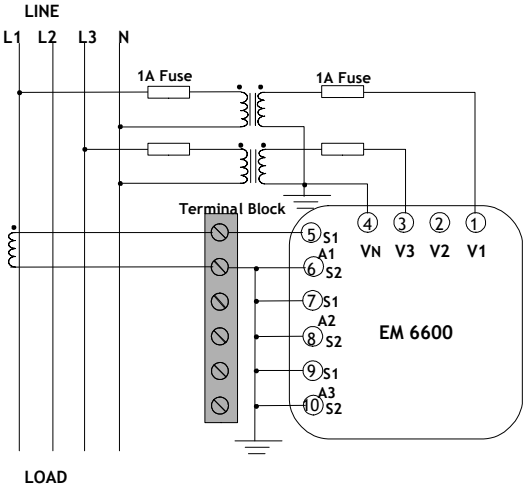


Fig 7.2 (d) 2LN, 1CT wiring

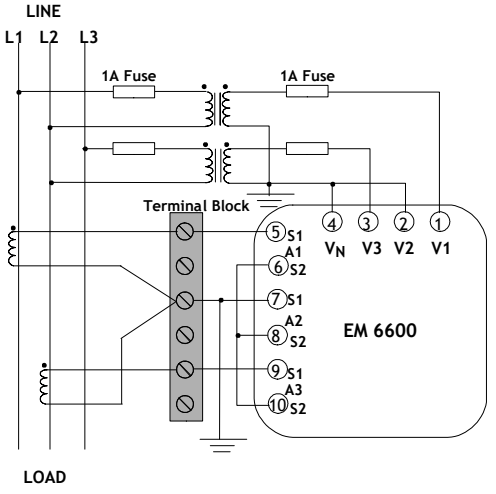


Fig 7.2 (e) 2LL, 3CT with 2CT wiring

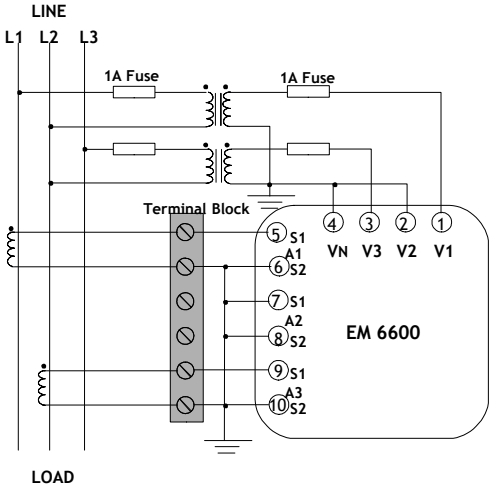


Fig 7.2 (f) 2LL, 2CT wiring

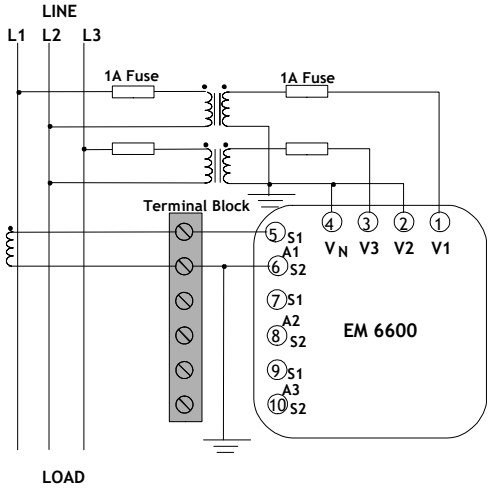


Fig 7.2 (g) 2LL, 1CT wiring

7.1.4. Single Phase

2 - LINE (Wiring mode setting: 3LN, 3CT)

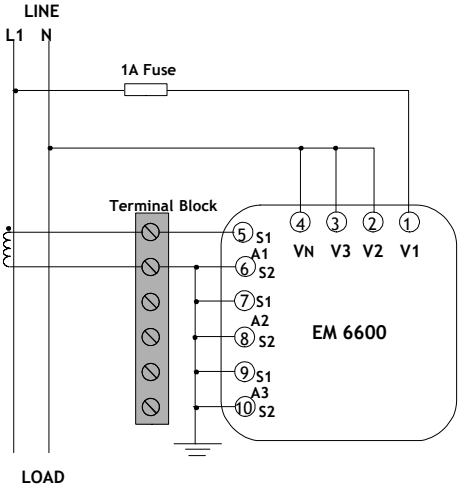


Fig 7.3 (a) 1 phase 2 line (3LN, 3CT)

Note: Fig 7.3 (a) is applicable only for the phase display and communication data (real time data) of 1 phase.

Single Phase 3 Line (Wiring mode setting: 3LN, 3CT)

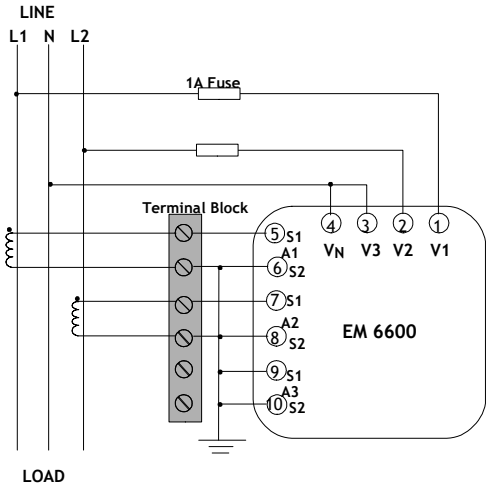


Fig 7.3(b) 1 phase 3 line

Note: Fig 7.3 (b) is applicable only for the phase display and communication data of 1phase, 3 wire

8. Communication Installation

8.1. RS-485

The communication port and protocol of PowerCon are RS485 and Modbus-RTU. The terminals of communication are +, -, and E (11, 12, 13). Up to 32 devices can be connected on a RS485 bus. Use good quality shielded twisted pair cable, AWG22 (0.5mm^2) or larger. The overall length of the RS485 cable connecting all devices can not exceed 1200m (4000ft). PowerCon is used as a slave device of master like PC, PLC, data collector or RTU. If the master does not have RS485 communication port, a converter has to be used. Normally a RS232/RS485 or USB/RS485 is adopted. The topology of RS485 net can be line, circle and star.

- Line Mode: The connection from master to PowerCon meter in line mode is individually in the RS485 network. If communication quality is poor, it is normally added to the circuit beside the last PowerCon meter.
- Circle Mode: EM 6600 meters are connected in a closed circle when high reliability is desired. In some cases, there is no need of anti-signal reflecting resistor.
- Star Mode: The RS485 network is connected in a wye format. Anti signal reflecting resistors may be required in each line.

The following wiring are advisable to ensure excellent quality communication: Good quality shielded twisted pair of cable AWG22 (0.6mm^2) or larger.

■ The shield of each segment of the RS485 cable must be connected to the ground at one end only.

■ Keep cables away as much as possible from sources of electrical noise.

■ Use RS232/RS485 or USB/RS485 converters with optical isolated outputs and surge protection.

8.2. Modbus Registers

The Modbus RTU protocol is used for communication in EM 6600. The data format and error check method are defined in the protocol and the half-duplex query and respond modes have been adopted in Modbus. There is only one master device in the communication network. All other devices are slaves waiting for the master query.

The transmission mode defines the data structure within a frame and the rules used to transmit data

Mode of Transmissions

Coding System	8 bit binary
Start Bit	1
Data Bits	8
Parity	No parity
Stop bit	1
Error Checking	CRC Check

Data Frame Format

Address	8 Bits
Function Code	8 Bits
Data	N x 8 Bits
Error Check	16 Bits

Address field: The address field of a message frame contains eight bits. Valid slave device addresses are in the range of 0 to 247. A master addresses a slave by placing the slave address in the address field of the message. When the slave sends its response, it places its own address in this address field of the response to let the master know which slave is responding.

Function field: The function code field of a message frame contains eight bits. Valid codes are in the range of 1 to 255. When a message is sent from a master to a slave device, the function code field tells the slave what action to perform.

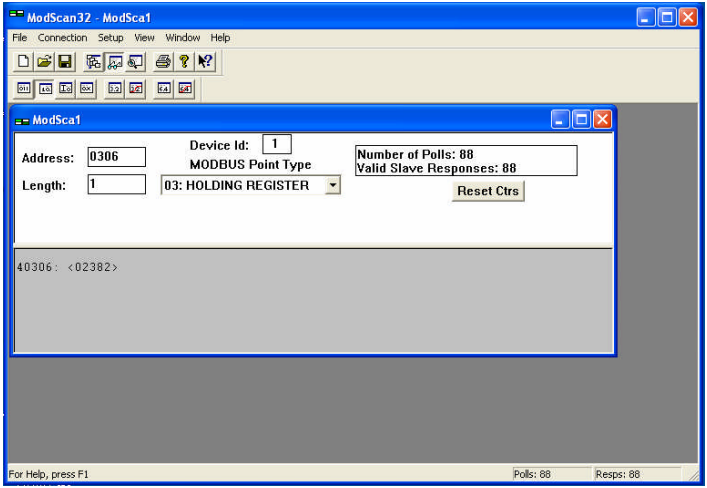
The EM 6600 supports the below function codes

Code	Function
01: Read relay output status	Identifies the current status of the relay output.
02: Read digital input status	Identifies the current status of the digital input.
03: Read data	Identifies the current binary value in one or more registers.
05: Control relay output.	Forces the relay state to on or off.
16: Preset multiple registers	Places specific binary values into a series of consecutive registers.

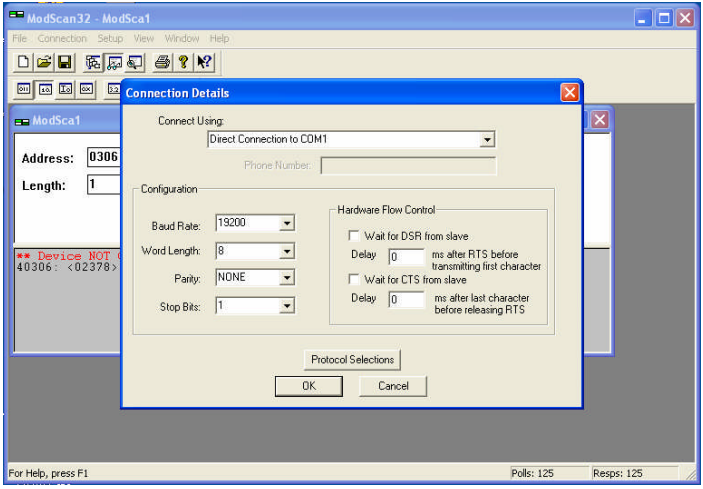
Communication test: EM 6620 was tested successfully for communication using MODSCAN Software as Modbus master in PC. Details regarding the settings made in MODSCAN are given below.

Settings in MODSCAN v3.D05-00 Software to establish communication with EM 6600: Free Demo MODSCAN Software can be downloaded from http://www.win-tech.com. E.g. To Read the voltage V1 from 0131H Register, please follow the instructions-

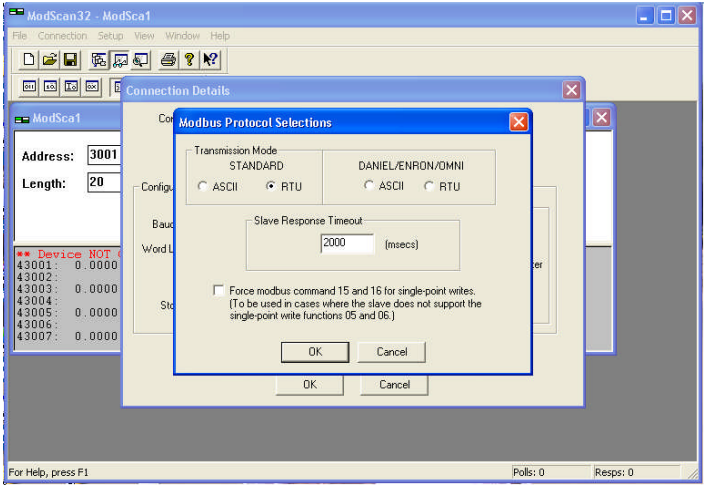
Step1: After starting the Modscan, to read voltage V1, enter Address as 306 (013H = 305 decimal); Length as 1; Device ID as 1; Modbus Point type as 03: HOLDING REGISTER as shown below



Step 2: Modify the connection details: Click on the connection->Connect, you will see the Connection Detail Window. Change all the settings to match with the below shown screen which are default settings of EM 6620.



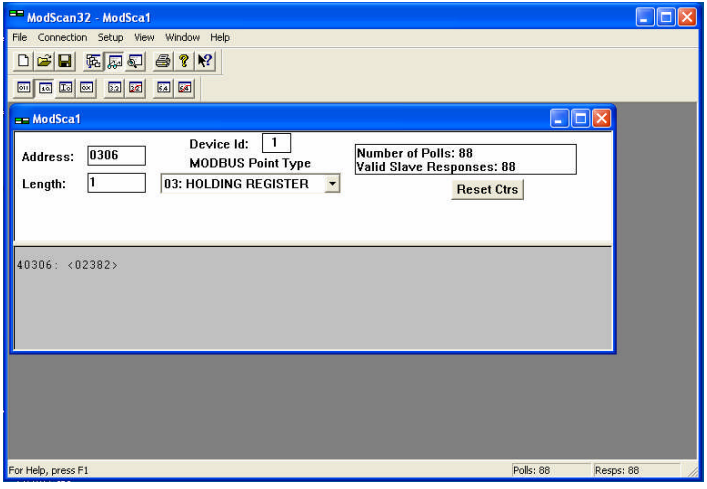
Step3: Set the Modbus protocol selections: **On "Connection details"** window (shown in previous step), click on the **"Protocol Selections"** button. Set the settings of the protocol as shown below and click OK buttons in all the windows.



Step 4: After clicking OK buttons, the MODSCAN Software starts polling the configured COM port for the Device ID 1 and 131H register. It displays the readings as shown below. To get actual value displayed by EM6620, apply the relationship formula mentioned in below address map for voltage V1.

Eg. For V1, The relation ship formula is $U=R_x x(PT1/PT2)/10$, default, PTI= PT2=220V. The Rx is register content from below screen it is 2382. So the V1 shown by meter is 238.2V. Like this we can read all the parameters using Modscan.

Modscan Demo software will stop pooling after 3.5 minutes on successful communication.



This shows that the meter is communicating with the MODBUS MODSCAN Master Software successfully on the PC. The meter is MODBUS Comply.

Data Address Table

EM 6620 measures more data than EM6610 in the series product. The measured data in shadow only exists in EM 6620.

Basic Analog Measurement: Function code:03 Read Only Registers			
Address	**Parameter**	**Range**	**Type**
0130H	Frequency F	0~7000	word
0131H	Phase voltage V1	0~65535	word
0132H	Phase voltage V2	0~65535	word
0133H	Phase voltage V3	0~65535	word
0134H	Average phase voltage VLNavg	0~65535	word
0135H	Line Voltage V12	0~65535	word
0136H	Line Voltage V23	0~65535	word
0137H	Line Voltage V31	0~65535	word
0138H	Average Line Voltage VLLavg	0~65535	word
0139H	Current I1 (A1)	0~65535	word
013AH	Current I2 (A2)	0~65535	word
013BH	Current I3 (A3)	0~65535	word
013CH	Average Current Iavg (Aavg)	0~65535	word

013DH	Neutral Line Current In	0~65535	word
013EH	Phase Active Power P1	-32768~32767	Integer
013FH	Phase Active Power P2	-32768~32767	Integer
0140H	Phase Active Power P3	-32768~32767	Integer
0141H	System Active Power Psum	-32768~32767	Integer
0142H	Phase Reactive Power q1	-32768~32767	Integer
0143H	Phase Reactive Power q2	-32768~32767	Integer
0144H	Phase Reactive Power q3	-32768~32767	Integer
0145H	System Reactive Power qsum	-32768~32767	Integer
0146H	Phase Apparent Power S1	0~65535	word
0147H	Phase Apparent Power S2	0~65535	word
0148H	Phase Apparent Power S3	0~65535	word
0149H	System Apparent Power Ssum	0~65535	word
014AH	Phase Power Factor PF1	-1000~1000	Integer
014BH	Phase Power Factor PF2	-1000~1000	Integer
014CH	Phase Power Factor PF3	-1000~1000	Integer
014DH	System Power Factor	-1000~1000	Integer
014EH	Voltage Unbalance Factor V_unbl	0~3000	word
014FH	Current Unbalance Factor I_unbl	0~3000	word
0150H	Load Type RT (L/C/R)	76/67/82	word
0151H	Active power Demand Dmd_P	-32768~32767	Integer

0152H	Reactive power Demand Dmd_q	-32768~32767	Integer
0153H	Apparent Power Demand Dmd_S	0~65535	word

The relationship between the numerical value and the real physical value is as follows (Rx is the numerical value in the register of PowerCon)

Parameter	Relationship	Unit
Voltage V1, V2, V3, V12, V23, V31, VLLavg	U=Rx×(PT1/PT2)/10	Volt (V)
Current I1, I2, I3, Iavg, In	I =Rx×(CT1/5)/1000	Amp (A)
Active power P1, P2, P3, Psum, Active power Demand Dmd_P	P=Rx×(PT1/PT2)×(CT1/ 5)	Watt (W)
Reactive Power q1, q2, q3, qsum, Reactive Power Demand Dmd_q	Q=Rx×(PT1/PT2)×(CT1/5)	VAR
Apparent Power S1, S2, S3, Ssum Apparent Demand Power Dmd_S	S=Rx×(PT1/PT2)×(CT1/5)	VA
Power Factor PF1, PF2, PF3, PF	PF=Rx/1000	NA
Frequency	F=Rx/100	Hz
Load Type RT (L/C/R)	ASCII of L, C, R Low 8 bit of Register	NA
Voltage or Current Unbalance Factor V_unbl, I_unbl	unbl=(Rx/10000)×100%	NA

Energy Management: Function code:03 Read 16, Preset, Read/Write access				
Address	**Parameters**	**Range**	**Type**	**Rd / Wr**
0156H(High 16 Bit)	Import Energy kWh_Imp	0~99999999.9	Dword	R/W
0157H(Low 16 bit)				
0158H(High 16 Bit)	Export Energy kWh_Exp	0~99999999.9	Dword	R/W
0159H(Low 16 bit)				
015AH(High 16 Bit)	Import Reactive Energy kVARh_Imp	0~99999999.9	Dword	R/W
015BH(Low 16 bit)				
015CH(High 16 Bit)	Export Reactive Energy kVARh_Exp	0~99999999.9	Dword	R/W
015DH(Low 16 bit)				
015EH(High 16 Bit)	Absolute Sum of Energy kWh_total	0~99999999.9	Dword	R/W
015FH(Low 16 bit)				
0160H(High 16 Bit)	Algebra Sum of Energy kWh_net	0~99999999.9	Dword	R/W
0161H(Low 16 bit)				
0162H(High 16 Bit)	Absolute Sum of Energy kVARh_total	0~99999999.9	Dword	R/W
0163H(Low 16 bit)				
0164H(High 16 Bit)	Algebra Sum of	0~99999999.9	Dword	R/W

0165H(Low 16 bit)	Energy kVARh _net			
0166H (High 16 Bit)	Apparent Energy kVAh	0~99999999.9	Dword	R/W
0166H (Low 16 Bit)				

Function Code: 03: Energy data converting table		
Parameter	**Relationship**	**Unit**
Energy kWh_Imp, kWh_Exp, kWh_total, kWh _net	kWh =Rx / 10	kWh
Reactive Energy kVARh_Imp, kVARh _Exp, kVARh _total, kVARh _net	kVARh =Rx / 10	kVARh

Power Quality Measurements				
Address	**Parameter**	**Range**	**Type**	**Type of access**
0168H	Total Harmonic Distortion of V1 or V12, THD_V1	0~10000	word	R
0169H	Total Harmonic Distortion of V2 or V23, THD_V2	0~10000	word	R
016AH	Total Harmonic Distortion of V3 or V31, THD_V3	0~10000	word	R
016BH	Average Total Harmonic Distortion of Voltage, THD_V	0~10000	word	R
016CH	Total Harmonic Distortion of I1, THD_I1	0~10000	word	R
016DH	Total Harmonic Distortion of I2, THD_I2	0~10000	word	R
016EH	Total Harmonic Distortion of I3, THD_I3	0~10000	word	R
016FH	Average Total Harmonic Distortion of Current, THD_I	0~10000	word	R
0170H-018DH	Harmonic Content of V1 or V12 (2^{nd} to 31^{st})	0~10000	word	R

018EH	Total Odd Harmonic Distortion of V1 or V12	0~10000	word	R
018FH	Total Even Harmonic Distortion of V1 or V12	0~10000	word	R
0190H	Crest factor of V1 or V12	0~65535	word	R
0191H	Telephone interference factor of V1 or V12, THFF	0~10000	word	R
0192H-01AFH	Harmonic Content of V2 or V23 (2^{nd} to 31^{st})	0~10000	word	R
01B0H	Total Odd Harmonic Distortion of V2 or V23	0~10000	word	R
01B1H	Total Even Harmonic Distortion of V2 or V3	0~10000	word	R
01B2H	Crest factor of V2 or V23	0~65535	word	R
01B3H	Telephone interference factor of V2 or V23, THFF	0~10000	word	R
01B4H-01D1H	Harmonic Content of V3 or V31 (2^{nd} to 31^{st})	0~10000	word	R
01D2H	Total Odd Harmonic Distortion of V3 or V31	0~10000	word	R
01D3H	Total Even Harmonic	0~10000	word	R

	Distortion of V3 or V31			
01D4H	Crest factor of V3 or V31	0~65535	word	R
01D5H	Telephone interference factor of V3 or V31, THFF	0~10000	word	R
01D6H-01F3H	Harmonic Content of I1 (2nd to 31st)	0~10000	word	R
01F4H	Total Odd Harmonic Distortion of I1	0~10000	word	R
01F5H	Total Even Harmonic Distortion of I1	0~10000	word	R
01F6H	K Factor of I1	0~65535	word	R
01F7H-0214H	Harmonic Content of I2 (2 nd to 31st)	0~10000	word	R
0215H	Total Odd Harmonic Distortion of I2	0~10000	word	R
0216H	Total Even Harmonic Distortion of I2	0~10000	word	R
0217H	K Factor of I2	0~65535	word	R
0218H-0235H	Harmonic Content of I3 (2nd to 31st)	0~10000	word	R
0236H	Total Odd Harmonic	0~10000	word	R

	Distortion of I3			
0237H	Total Even Harmonic Distortion of I3	0~10000	word	R
0238H	K Factor of I3	0~65535	word	R

The relationship between numerical value in the register of PowerCon and the physical value is as follows

(Rx is the numerical value in register of PowerCon)

Parameter	Relationship	Unit
THD	THD=Rx / 10000×100%	NA
Harmonic Content	HDn=Rx / 10000 ×100%	NA
Odd THD	HDo=Rx / 10000 ×100%	NA
Even THD	HDe=Rx / 10000×100%	NA
Crest Factor	CF=Rx / 1000	NA
K Factor	KF=Rx / 10	NA
THFF	THFF=Rx / 10000×100%	NA

Max/Min Statistics Value with Time Stamps: Function code: 03					
Address	**Parameter**		**Range**	**Object Type**	**Type of access**
0239H	V1max		0~65535	word	R
023AH	Time Stamp of V1max	year	2000~2099	word	R
023BH		mon	1~12	word	R
023CH		day	1~31	word	R
023DH		hour	0~23	word	R
023EH		min	0~59	word	R
023FH		sec	0~59	word	R
0240H	V2max		0~65535	word	R
0241H	Time Stamp of V2max	year	2000~2099	word	R
0242H		mon	1~12	word	R
0243H		day	1~31	word	R
0244H		hour	0~23	word	R
0245H		min	0~59	word	R
0246H		sec	0~59	word	R
0247H	V3max		0~65535	word	R
0248H	Time	year	2000~2099	word	R

0249H		mon	1~12	word	R
024AH		day	1~31	word	R
024BH		hour	0~23	word	R
024CH		min	0~59	word	R
024DH		sec	0~59	word	R
024EH	V12max		0~65535	word	R
024FH	Time Stamp of V12max	year	2000~2099	word	R
0250H		mon	1~12	word	R
0251H		day	1~31	word	R
0252H		hour	0~23	word	R
0253H		min	0~59	word	R
0254H		sec	0~59	word	R
0255H	V23max		0~65535	word	R
0256H	Time Stamp of V23max	year	2000~2099	word	R
0257H		mon	1~12	word	R
0258H		day	1~31	word	R
0259H		hour	0~23	word	R
025AH		min	0~59	word	R
025BH		sec	0~59	word	R

025CH	V31max		0~65535	word	R
025DH	Time Stamp of V31max	year	2000~2099	word	R
025EH		mon	1~12	word	R
025FH		day	1~31	word	R
0260H		hour	0~23	word	R
0261H		min	0~59	word	R
0262H		sec	0~59	word	R
0263H	I1max		0~65535	word	R
0264H	Time Stamp of I1max	year	2000~2099	word	R
0265H		mon	1~12	word	R
0266H		day	1~31	word	R
0267H		hour	0~23	word	R
0268H		min	0~59	word	R
0269H		sec	0~59	word	R
026AH	I2max		0~65535	word	R
026BH	Time Stamp of I2max	year	2000~2099	word	R
026CH		mon	1~12	word	R
026DH		day	1~31	word	R
026EH		hour	0~23	word	R

026FH		min	0~59	word	R
0270H		sec	0~59	word	R
0271H	I3 max		0~65535	word	R
0272H	Time Stamp of I3max	year	2000~2099	word	R
0273H		mon	1~12	word	R
0274H		day	1~31	word	R
0275H		hour	0~23	word	R
0276H		min	0~59	word	R
0277H		sec	0~59	word	R
0278H	Pmax		-32768~32767	Integer	R
0279H	Time Stamp of Pmax	year	2000~2099	word	R
027AH		mon	1~12	word	R
027BH		day	1~31	word	R
027CH		hour	0~23	word	R
027DH		min	0~59	word	R
027EH		sec	0~59	word	R
027FH	qmax		-32768~32767	Integer	R
0280H	Time Stamp of qmax	year	2000~2099	word	R
0281H		mon	1~12	word	R

0282H		day	1~31	word	R
0283H		hour	0~23	word	R
0284H		min	0~59	word	R
0285H		sec	0~59	word	R
0286H	Smax		0~65535	word	R
0287H	Time Stamp of Smax	year	2000~2099	word	R
0288H		mon	1~12	word	R
0289H		day	1~31	word	R
028AH		hour	0~23	word	R
028BH		min	0~59	word	R
028CH		sec	0~59	word	R
028DH	PFmax		-1000~1000	Integer	R
028EH	Time Stamp of PFmax	year	2000~2099	word	R
028FH		mon	1~12	word	R
0290H		day	1~31	word	R
0291H		hour	0~23	word	R
0292H		min	0~59	word	R
0293H		sec	0~59	word	R
0294H	Fmax		0~7000	word	R

0295H	Time Stamp of Fmax	year	2000~2099	word	R
0296H		mon	1~12	word	R
0297H		day	1~31	word	R
0298H		hour	0~23	word	R
0299H		min	0~59	word	R
029AH		sec	0~59	word	R
029BH	Dmd_Pmax		-32768~32767	Integer	R
029CH	Time Stamp of Dmd_Pmax	year	2000~2099	word	R
029DH		mon	1~12	word	R
029EH		day	1~31	word	R
029FH		hour	0~23	word	R
02A0H		min	0~59	word	R
02A1H		sec	0~59	word	R
02A2H	Dmd_qmax		-32768~32767	Integer	R
02A3H	Time Stamp of Dmd_qmax	year	2000~2099	word	R
02A4H		mon	1~12	word	R
02A5H		day	1~31	word	R
02A6H		hour	0~23	word	R
02A7H		min	0~59	word	R

02A8H		sec	0~59	word	R
02A9H	Dmd_Smax		0~65535	word	R
02AAH	Time Stamp of Dmd_Smax	year	2000~2099	word	R
02ABH		mon	1~12	word	R
02ACH		day	1~31	word	R
02ADH		hour	0~23	word	R
02AEH		min	0~59	word	R
02AFH		sec	0~59	word	R
Min Record					
02B0H	V1min		0~65535	word	R
02B1H	Time Stamp of V1min	year	2000~2099	word	R
02B2H		mon	1~12	word	R
02B3H		day	1~31	word	R
02B4H		hour	0~23	word	R
02B5H		min	0~59	word	R
02B6H		sec	0~59	word	R
02B7H	V2 min		0~65535	word	R
02B8H	Time Stamp of V2min	year	2000~2099	word	R
02B9H		mon	1~12	word	R

02BAH	Time Stamp of V3min	day	1~31	word	R
02BBH		hour	0~23	word	R
02BCH		min	0~59	word	R
02BDH		sec	0~59	word	R
02BEH	V3 min		0~65535	word	R
02BFH	Time Stamp of V12min	year	2000~2099	word	R
02C0H		mon	1~12	word	R
02C1H		day	1~31	word	R
02C2H		hour	0~23	word	R
02C3H		min	0~59	word	R
02C4H		sec	0~59	word	R
02C5H	V12 min		0~65535	word	R
02C6H	Time Stamp of V23min	year	2000~2099	word	R
02C7H		mon	1~12	word	R
02C8H		day	1~31	word	R
02C9H		hour	0~23	word	R
02CAH		min	0~59	word	R
02CBH		sec	0~59	word	R
02CCH	V23 min		0~65535	word	R

02CDH	Time Stamp of V23min	year	2000~2099	word	R
02CEH		mon	1~12	word	R
02CFH		day	1~31	word	R
02D0H		hour	0~23	word	R
02D1H		min	0~59	word	R
02D2H		sec	0~59	word	R
02D3H	V31min		0~65535	word	R
02D4H	Time Stamp of V31min	year	2000~2099	word	R
02D5H		mon	1~12	word	R
02D6H		day	1~31	word	R
02D7H		hour	0~23	word	R
02D8H		min	0~59	word	R
02D9H		sec	0~59	word	R
02DAH	I1min		0~65535	word	R
02DBH	Time Stamp of I1min	year	2000~2099	word	R
02DCH		mon	1~12	word	R
02DDH		day	1~31	word	R
02DEH		hour	0~23	word	R
02DFH		min	0~59	word	R

02E0H		sec	0~59	word	R
02E1H	I2min		0~65535	word	R
02E2H	Time Stamp of I2min	year	2000~2099	word	R
02E3H		mon	1~12	word	R
02E4H		day	1~31	word	R
02E5H		hour	0~23	word	R
02E6H		min	0~59	word	R
02E7H		sec	0~59	word	R
02E8H	I3min		0~65535	word	R
02E9H	Time Stamp of I3min	year	2000~2099	word	R
02EAH		mon	1~12	word	R
02EBH		day	1~31	word	R
02ECH		hour	0~23	word	R
02EDH		min	0~59	word	R
02EEH		sec	0~59	word	R
02EFH	Pmin		-32768~32767	Integer	R
02F0H	Time Stamp of Pmin	year	2000~2099	word	R
02F1H		mon	1~12	word	R
02F2H		day	1~31	word	R

02F3H		hour	0~23	word	R
02F4H		min	0~59	word	R
02F5H		sec	0~59	word	R
02F6H	qmin		-32768~32767	Integer	R
02F7H	Time Stamp of qmin	year	2000~2099	word	R
02F8H		mon	1~12	word	R
02F9H		day	1~31	word	R
02FAH		hour	0~23	word	R
02FBH		min	0~59	word	R
02FCH		sec	0~59	word	R
02FDH	Smin		0~65535	word	R
02FEH	Time Stamp of Smin	year	2000~2099	word	R
02FFH		mon	1~12	word	R
0300H		day	1~31	word	R
0301H		hour	0~23	word	R
0302H		min	0~59	word	R
0303H		sec	0~59	word	R
0304H	PF min		-1000~1000	Integer	R
0305H		year	2000~2099	word	R

0306H		mon	1~12	word	R
0307H		day	1~31	word	R
0308H		hour	0~23	word	R
0309H		min	0~59	word	R
030AH		sec	0~59	word	R
030BH	F min		0~7000	word	R
030CH	Time Stamp of Fmin	year	2000~2099	word	R
030DH		mon	1~12	word	R
030EH		day	1~31	word	R
030FH		hour	0~23	word	R
0310H		min	0~59	word	R
0311H		sec	0~59	word	R
0312H	Dmd_Pmin		-32768~32767	Integer	R
0313H	Time Stamp of Dmd_Pmin	year	2000~2099	word	R
0314H		mon	1~12	word	R
0315H		day	1~31	word	R
0316H		hour	0~23	word	R
0317H		min	0~59	word	R
0318H		sec	0~59	word	R

0319H	Dmd_qmin		-32768~32767	Integer	R
031AH	Time Stamp of Dmd_q min	year	2000~2099	word	R
031BH		mon	1~12	word	R
031CH		day	1~31	word	R
031DH		hour	0~23	word	R
031EH		min	0~59	word	R
031FH		sec	0~59	word	R
0320H	Dmd_Smin		0~65535	word	R
0321H	Time Stamp of Dmd_S min	year	2000~2099	word	R
0322H		mon	1~12	word	R
0323H		day	1~31	word	R
0324H		hour	0~23	word	R
0325H		min	0~59	word	R
0326H		sec	0~59	word	R

Date and timetable

Function code: 03 for reading, 16 for presetting				
Address	**Parameter**	**Range**	**Type**	**Type of access**
032AH	year	2000~2099	word	R/W
032BH	mon	1~12	word	R/W
032CH	day	1~31	word	R/W
032DH	hour	0~23	word	R/W
032EH	min	0~59	word	R/W
032FH	sec	0~59	word	R/W

Alarm Parameter Register Setting Function Code:03 for Reading, 16 for Presetting				
Address	**Parameter**	**Range**	**Type**	**Type of access**
0330H	9 Alarm enable Register	Bit 0~8 corresponding to 1st ~9th Alarm	Integer	R/W
0331H	Time limit Register	0~255	Integer	R/W
0332H	DO1 Alarm selection Register	Bit0~8 corresponding to 1st ~9th Alarm 1:Yes 0:No	Integer	R/W
0333H	DO2 Alarm selection Register	Bit0~8 corresponding to 1st ~9th Alarm 1:Yes 0:No	Integer	R/W
0334H	1st Alarm Parameter selection Register, Par1	0~34	Integer	R/W
0335H	Relation symbol selecting register, Alarm_sign1	0: < low limit 1:> up limit	Integer	R/W

0336H	Limit value for 1st Alarm, REF1	Related with parameter	Integer	R/W
0337H	2nd Alarm Parameter selection Register, Par2	0~34	Integer	R/W
0338H	Relation symbol selecting register, Alarm_sign2	0:< low limit 1:> up limit	Integer	R/W
0339H	Limit value for 2nd Alarm, REF2	Related with parameter	Integer	R/W
033AH	3rd Alarm Parameter selection Register, Par3	0~34	Integer	R/W
033BH	Relation symbol selecting register, Alarm_sign3	0: < low limit 1:> up limit	Integer	R/W
033CH	Limit value for 3rd Alarm, REF3	Related with parameter	Word or Integer	R/W
033DH	4th Alarm Parameter selection Register, Par4	0~34	Integer	R/W
033EH	Relation symbol selecting	0: < low limit 1:> up limit	Integer	R/W

	register: Alarm _sign4			
033FH	Limit value for 4th Alarm, REF4	Related with parameter	Word or Integer	R/W
0340H	5th Alarm Parameter selection Register, Par5	0~34	Integer	R/W
0341H	Relation symbol selecting register, Alarm_sign5	0: < low limit 1:> up limit	Integer	R/W
0342H	Limit value for 5th Alarm, REF5	Related with parameters	Word or Integer	R/W
0343H	6th Alarm Parameter selection Register, Par6	0~34	Integer	R/W
0344H	Relation symbol selecting register, Alarm_sign6	0: < low limit 1:> up limit	Integer	R/W
0345H	Limit value for 6th Alarm, REF6	Related with parameters	Word or Integer	R/W
0346H	7th Alarm Parameter selection Register, Par7	0~34	Integer	R/W

0347H	Relation symbol selecting register, Alarm_sign7	0: < low limit 1:> up limit	Integer	R/W
0348H	Limit value for 7th Alarm, REF7	Related with parameters	Word or Integer	R/W
0349H	8thAlarm Parameter selection Register, Par8	0~34	Integer	R/W
034AH	Relation symbol selecting register, Alarm_sign8	0: < low limit 1:> up limit	Integer	R/W
034BH	Limit value for 8th Alarm, REF8	Related with parameters	Word or Integer	R/W
034CH	9th Alarm Parameter selection Register, Par9	0~34	Integer	R/W
034DH	Relation symbol selecting register, Alarm_sign9	0: < low limit 1:> up limit	Integer	R/W
034EH	Limit value for 9th Alarm, REF9	Related with parameters	Word or Integer	R/W

Alarm Recording Function code: 03 for Reading				
Address	**Parameter**	**Range**	**Type**	**Type of access**
0354H	Over limit Status of the 9 Alarms	Bit0~8 corresponding to 1st ~9th Alarm 0: No 1: Yes	Integer	R
0355H	Parameter Number of the 1st Alarm record	0~34	word	R
0356H	Parameter Value of the 1st Alarm Record	-32768~32767	Integer	R
0357H	Year of 1st Alarm Record	2000~2099	word	R
0358H	Month of 1st Alarm Record	1~12	word	R
0359H	Date of 1st Alarm Record	1~31	word	R
035AH	Hour of 1st Alarm Record	0~23	word	R
035BH	Minute of 1st Alarm Record	0~59	word	R
035CH	Second of 1st Alarm Record	0~59	word	R
035DH	Parameter	0~34	word	R

	Number of the 2nd Alarm record			
035EH	Parameter Value of the 2nd Alarm Record	-32768~32767	Integer	R
035FH	Year of 2nd Alarm Record	2000~2099	word	R
0360H	Month of 2nd Alarm Record	1~12	word	R
0361H	Date of 2nd Alarm Record	1~31	word	R
0361H	Date of 2nd Alarm Record	1~31	word	R
0362H	Hour of 2nd Alarm Record	0~23	word	R
0363H	Minute of 2nd Alarm Record	0~59	word	R
0364H	Second of 2nd Alarm Record	0~59	word	R
0365H	Parameter Number of the 3rd Alarm record	0~34	word	R
0366H	Parameter Value of the 3rd Alarm Record	-32768~32767	Integer	R
0367H	Year of 3rd Alarm Record	2000~2099	word	R
0368H	Month of 3rd	1~12	word	R

	Alarm Record			
0369H	Date of 3rd Alarm Record	1~31	word	R
036AH	Hour of 3rd Alarm Record	0~23	word	R
036BH	Minute of 3rd Alarm Record	0~59	word	R
036CH	Second of 3rd Alarm Record	0~59	word	R
036DH	Parameter Number of the 4th Alarm record	0~34	word	R
036EH	Parameter Value of the 4th Alarm Record	-32768~32767	Integer	R
036FH	Year of 4th Alarm Record	2000~2099	word	R
0370H	Month of 4th Alarm Record	1~12	word	R
0371H	Date of 4th Alarm Record	1~31	word	R
0372H	Hour of 4th Alarm Record	0~23	word	R
0373H	Minute of 4th Alarm Record	0~59	word	R
0374H	Second of 4th Alarm Record	0~59	word	R
0375H	Parameter	0~34	word	R

	Number of the 5th Alarm record			
0376H	Parameter Value of the 5th Alarm Record	-32768~32767	Integer	R
0377H	Year of 5th Alarm Record	2000~2099	word	R
0378H	Month of 5th Alarm Record	1~12	word	R
0379H	Date of 5th Alarm Record	1~31	word	R
037AH	Hour of 5th Alarm Record	0~23	word	R
037BH	Minute of 5th Alarm Record	0~59	word	R
037CH	Second of 5th Alarm Record	0~59	word	R
037DH	Parameter Number of the 6th Alarm record	0~34	word	R
037EH	Parameter Value of the 6th Alarm Record	-32768~32767	Integer	R
037FH	Year of 6th Alarm Record	2000~2099	word	R
0380H	Month of 6th Alarm Record	1~12	word	R
0381H	Date of 6th Alarm	1~31	word	R

	Record			
0382H	Hour of 6th Alarm Record	0~23	word	R
0383H	Minute of 6th Alarm Record	0~59	word	R
0384H	Second of 6th Alarm Record	0~59	word	R
0385H	Parameter Number of the 7th Alarm record	0~34	word	R
0386H	Parameter Value of the 7th Alarm Record	-32768~32767	Integer	R
0387H	Year of 7th Alarm Record	2000~2099	word	R
0388H	Month of 7th Alarm Record	1~12	word	R
0389H	Date of 7th Alarm Record	1~31	word	R
038AH	Hour of 7th Alarm Record	0~23	word	R
038BH	Minute of 7th Alarm Record	0~59	word	R
038CH	Second of 7th Alarm Record	0~59	word	R
038DH	Parameter Number of the 8th Alarm record	0~34	word	R

038EH	Parameter Value of the 8th Alarm Record	-32768~32767	Integer	R
038FH	Year of 8th Alarm Record	2000~2099	word	R
0390H	Month of 8th Alarm Record	1~12	word	R
0391H	Date of 8th Alarm Record	1~31	word	R
0392H	Hour of 8th Alarm Record	0~23	word	R
0393H	Minute of 8th Alarm Record	0~59	word	R
0394H	Second of 8th Alarm Record	0~59	word	R
0395H	Parameter Number of the 9th Alarm record	0~34	word	R
0396H	Parameter Value of the 9th Alarm Record	-32768~32767	Integer	R
0397H	Year of 9th Alarm Record	2000~2099	word	R
0398H	Month of 9th Alarm Record	1~12	word	R
0399H	Date of 9th Alarm Record	1~31	word	R
039AH	Hour of 9th Alarm	0~23	word	R

	Record			
039BH	Minute of 9th Alarm Record	0~59	word	R
039CH	Second of 9th Alarm Record	0~59	word	R

Phase angle recording

The phase differences between voltage or Current and V1 (or V12) are recorded.

Function Code: 03 for reading				
Address	**Parameter**	**Range**	**Type**	**Type of access**
039DH	Phase difference V1/V2	0~3600	Integer	R
039EH	Phase difference V1/V3	0~3600	Integer	R
039FH	Phase difference V1/I1	0~3600	Integer	R
03A0H	Phase difference V1/I2	0~3600	Integer	R
03A1H	Phase difference V1/I3	0~3600	Integer	R
03A2H	Phase difference V12/V23	0~3600	Integer	R
03A3H	Phase difference V12/I1	0~3600	Integer	R
03A4H	Phase difference V12/I3	0~3600	Integer	R

The relation between record numerical data and physical data is: (Rx is numerical data) - $Phase\ angle\theta = Rx/10(Degree)$

PowerCon Parameter Settings Function code:03 for Reading, 16 for presetting				
Address	**Parameter**	**Range**	**Type**	**Type of access**
0100H	Access Code	0~9999	word	R/W
0101H	Communication Address	1~247	word	R/W
0102H	Baud Rate	600~38400	word	R/W
0103H	Voltage Input Wiring Type	0:3LN, 1:2LN, 2:2LL	word	R/W
0104H	Current Input Wiring Type	0:3CT, 1:1CT, 2:2CT	word	R/W
0105H	PT1 (High 16 bit)	100~500000	Dword	R/W
0106H	PT1 (Low 16 bit)			
0107H	PT2	100~400	word	R/W
0108H	CT1	5~10000	word	R/W
0109H	DO type	0:Pulse Output 1:Alarm Output	word	R/W
010AH	Energy parameter	0~8	word	R/W

	number associated with DO1			
010BH	Energy parameter number associated with DO2	0~8	word	R/W
010CH	Pulse Width	1~50	word	R/W
010DH	Pulse Rate	1~6000	word	R/W
010EH	Relay1 Working Mode	0: Latch 1: Momentary	word	R/W
010FH	Relay1 Pulse Width	50~3000	word	R/W
0110H	Relay2 Working Mode	0: Latch 1: Momentary	word	R/W
0111H	Relay2 Pulse Width	50~3000	word	R/W
0112H	LCD Back light Time	0~120	word	R/W
0113H	Demand Time	1~30	word	R/W
0114H	Clear Max/Min Values	0 or 1	word	R/W
0115H	Demand selection	0: Sliding window 1: Fixed window	word	R/W

Status Input (DI)

Function code: 02 for Reading

Address	Parameter	Range	Type	Type of access
0000H	DI1	1 :ON, 0 :OFF	Bit	R
0001H	DI2	1 :ON, 0 :OFF	Bit	R
0002H	DI3	1: ON, 0 :OFF	Bit	R
0003H	DI4	1 :ON, 0: OFF	Bit	R

Relay Status and control

Function code: 01 for Reading, 05 for Controlling

Address	Parameter	Range	Type	Type of access
0000H	Relay1	1 :ON, 0 :OFF	Bit	R/W
0001H	Relay2	1 :ON, 0 :OFF	Bit	R/W

1. Type: Bit-binary bit, word-unsign integer of 16 bit, Integer-Sign integer of 16 bit, Dword-unsign integer of 32 bit.

2. Type of Access: R-Read only, Digital input Relay status and Data are read by using function code 02, 01 and 03 respectively. R/W-Read and Write, Data is written by using function code 16 and control command is written by using function code 05. Writing to

read only field is forbidden and will cause malfunction.

3. Energy data is represented in 32 bits. Both high 16 bit and low 16 bits have successive address alone. The high 16 bit data should be multiplied by 65536 and plus low 16 bit data to get the energy data in master software. The unit is 0.1kWh or 0.1kVARh. It will be clear to zero and start again when energy data accumulate to 1x109 kWh (kVARh). The energy register can be cleared or preset through communication.

9. Ordering Information

Model No.	Accuracy	CT Secondary
☐ EM 6610	☐ Cl 1.0 ☐ Cl 0.5	☐ 1A ☐ 5A
☐ EM 6620	☐ Cl 1.0 ☐ Cl 0.5	☐ 1A ☐ 5A

END OF DOCUMENT