SMART X96-5

Smart Energy Analyzer for Single and Three Phase Electrical Systems

- Measures kWh, kVarh, kW, kVar, kVA, P, F, PF, Hz, dmd, V, A, etc.
- Bi-directional Measurement IMP & EXP
- Energy Information of Each Phase
- Two Pulse Outputs
- RS485 Modbus RTU
- Total Harmonic Distortion of Voltage and Current
- 2nd~63rd Individual Harmonic Distortion
- Backlit LCD Display for Full Viewing Angles
- Class 1 , Class 0.5S
- Bar Graph for Power Indication
- Dimension 96x96mm
- 1A/5A CT connection

Introduction

The multifunction energy analyzer SMART X96 series is a top new-generation intelligent panel meter, used not only in the electricity transmission and power distribution system, but also in the power consumption measurement and analysis in high voltage intelligent power grid.
This document provides operating, maintenance and installation instructions for the Eastron SMART X96 series. The unit measures and displays the characteristics of single phase two wires, three phase three wires and three phase four wires supplies, including voltage, frequency, current, power and active and reactive energy, imported or exported, Harmonic, Power factor, Max. Demand etc. Energy is measured in terms of kWh, kVArh. Maximum demand current can be measured over preset periods of up to 60minutes. In order to measure energy, the unit requires voltage and current inputs in addition to the supply required to power the product. The requisite current input(s) are obtained via current transformers The SMART X96 can be configured to work with a wide range of CTs, giving the unit a wide range of operation. Built-in interfaces provide pulse and RS485 Modbus RTU outputs. Configuration is password protected.

1. Unit Characteristics

1. 1 The Unit can measure and display:

- Line voltage and THD% (total harmonic distortion) of all phases
- 2~63rd voltage IHD% (Individual Harmonic distortion) of all phases
- Line Frequency
- Currents, Current demands and current THD% of all phases
- 2~63rd current IHD% of all phases
- Active power, reactive power, apparent power, maximum power demand and power factor
- Active energy imported and exported
- Reactive energy imported and exported
- Energy of each phase

1.2 The unit has password-protected set-up screens for:

- **Communication setting:** Modbus address, Baud rate, Parity, Stop bit
- **CT setting:** CT 1 (Primary) , CT2 (Secondary), CT rate
- **PT setting:** PT1 (Primary), PT2 (Secondary) , PT rate
- **Pulse setting:** Pulse output 1, Pulse rate, Pulse time
- **Demand setting:** Demand interval time, demand method
- **Time setting:** Backlit time, display scroll time
- **System configuration:** System type, System connect, Change password, Auto display scroll
- **Reset**

1.3 CT and PT

CT1 (primary current)： 5~9999A
CT2 (secondary current): 1A or 5A
PT1 (primary voltage): 100V ~ 500,000V
PT2 (secondary voltage): 100 to 480 V AC (L-L)

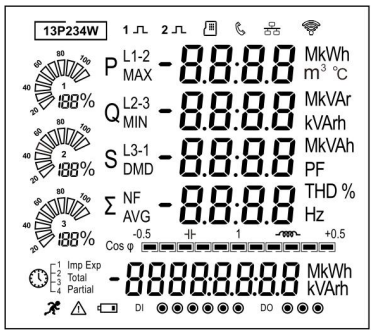
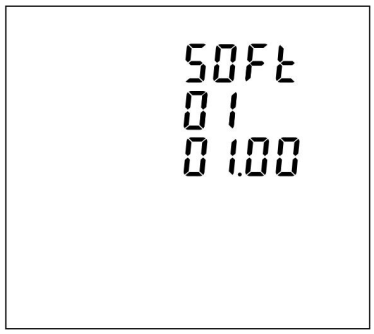
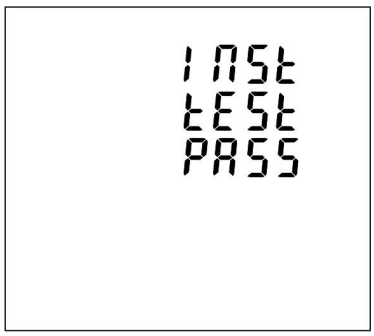
1.4 RS485 Serial-Modbus RTU

This unit uses a RS485 serial port with Modbus RTU protocol to provide a means of remote monitoring and controlling. Please check the Part 4.2 for the details of setting.

1.5 Pulse output

Two pulse outputs indicate real-time energy measurement. Pulse output 1 is configurable, pulse output 2 is fixed to active energy, 3200imp/kWh.

2 . Start up screens

	The first screen lights all LED segments and can be used as a display LED check
	The second screen indicates the software version of the unit. (the left picture is just for reference)
	The unit performs a self-test and the screen indicates if the test is passed.

After a short delay, the default measurement screen appears.

3 . Buttons and Displays

3.1 Buttons Function

Buttons	Click	Press 2S
Ph S ESC	➢ Displays power, voltage, current and energy information of each phase ➢ Escape the menu	➢ Automatic Scroll display ON / OFF
V/A ◀	➢ Display Voltage and current information of the selected system type. (3p4w, 3p3w and 1p2w) ➢ Left side move	➢ Individual Harmonic Distortion of Voltage up to 63rd
MD ▲ PF Hz	➢ Display power factor, frequency, Max. Demand. ➢ Up page or add value	➢ Individual Harmonic Distortion of Current up to 63rd
P ▼	➢ Display active power, reactive power and apparent power information of the selected system type. ➢ Down page or reduce value	
E ◀ ▶	➢ Display total / import / export active or reactive energy information of the selected system type. ➢ Right side move	➢ Set-up mode entry ➢ Confirmation

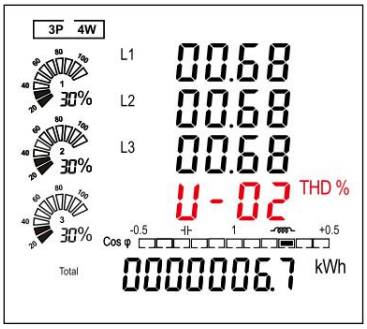
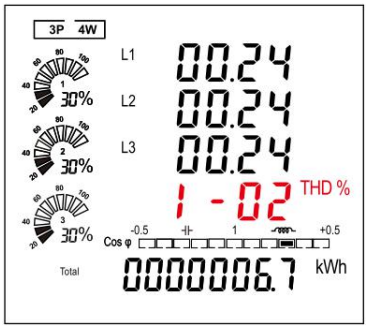
3.2 Display Mode Screen Sequence

Click button	3 Phase 4 Wire		3 Phase 3 Wire		1 Phase 2 Wire	
	Screen	Parameters	Screen	Parameters	Screen	Parameters
Ph S ESC	1	Phase 1 – Power Voltage Current kWh	1	Phase 1 – Power Voltage Current kWh	1	Phase 1 – Power Voltage Current kWh
	2	Phase 2 – Power Voltage Current kWh	2	Phase 2 – Power Voltage Current kWh		
	3	Phase 3 – Power Voltage Current kWh	3	Phase 3 – Power Voltage Current kWh		

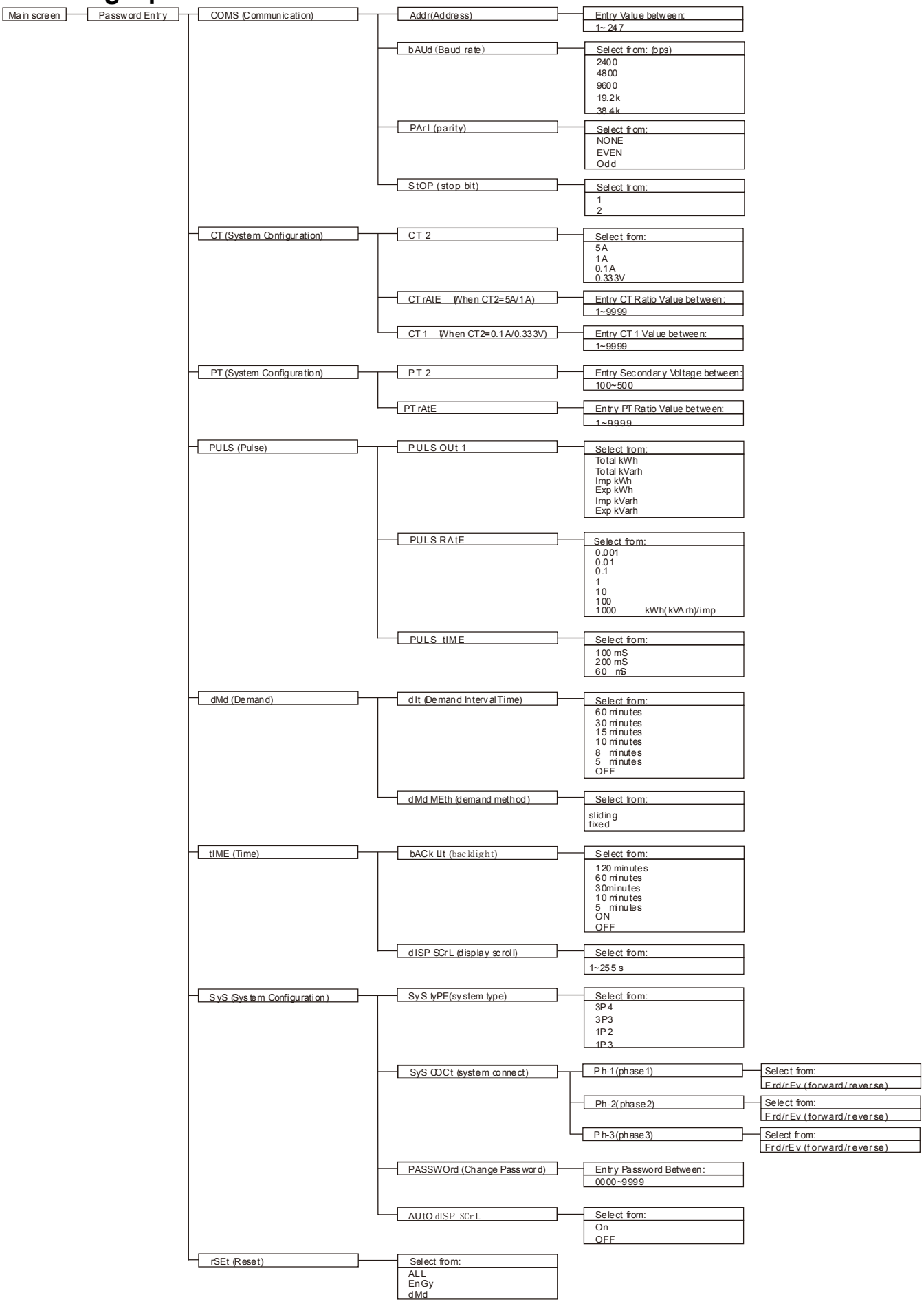
	4	Phase 1 – Power Voltage Current kVarh	4	Phase 1 – Power Voltage Current kVarh	2	Phase 1 – Power Voltage Current kVarh
	5	Phase 2 – Power Voltage Current kVarh	5	Phase 2 – Power Voltage Current kVarh		
	6	Phase 3 – Power Voltage Current kVarh	6	Phase 3 – Power Voltage Current kVarh		
V/A	1	Voltage L1-N Voltage L2-N Voltage L3-N			1	Voltage L1-N
	2	Voltage L1-L2 Voltage L2-L3 Voltage L3-L1	1	Voltage L1-L2 Voltage L2-L3 Voltage L3-L1		
	3	Current L1 Current L2 Current L3 Current Neutral	2	Current L1 Current L2 Current L3	2	Current L1
	4	THD% of Voltage L1 THD% of Voltage L2 THD% of Voltage L3	3	THD% of Voltage L1-2 THD% of Voltage L2-3 THD% of Voltage L3-1	3	THD% of Voltage L1
	5	THD% of Current L1 THD% of Current L2 THD% of Current L3	4	THD% of Current L1 THD% of Current L2 THD% of Current L3	4	THD% of Current L1
	6	Phase Sequence	5	Phase Sequence		
MD PF Hz	1	Total Power Factor Frequency	1	Total Power Factor Frequency	1	Total Power Factor Frequency
	2	PF L1 PF L2 PF L3	2	PF L1 PF L2 PF L3		
	3	Max. DMD of Current L1 Max. DMD of Current L2 Max. DMD of Current L3	3	Max. DMD of Current L1 Max. DMD of Current L2 Max. DMD of Current L3	2	Max. DMD of Current L1
	4	Max. DMD of W Max. DMD of Var Max. DMD of VA	4	Max. DMD of W Max. DMD of Var Max. DMD of VA	3	L1 Max. DMD of W L1 Max. DMD of Var L1 Max. DMD of VA
P	1	Active Power L1 Active Power L2 Active Power L3	1	Active Power L1 Active Power L2 Active Power L3		

	2	Reactive Power L1 Reactive Power L2 Reactive Power L3	2	Reactive Power L1 Reactive Power L2 Reactive Power L3		
	3	Apparent Power L1 Apparent Power L2 Apparent Power L3	3	Apparent Power L1 Apparent Power L2 Apparent Power L3		
	4	Total Active Power Total Reactive Power Total Apparent Power	4	Total Active Power Total Reactive Power Total Apparent Power	1	L1 Active Power L1 Reactive Power L1 Apparent Power
E	1	Total kWh	1	Total kWh	1	Total kWh
	2	Total kVarh	2	Total kVarh	2	Total kVarh
	3	Import kWh	3	Import kWh	3	Import kWh
	4	Export kWh	4	Export kWh	4	Export kWh
	5	Import kVarh	5	Import kVarh	5	Import kVarh
	6	Export KVarh	6	Export KVarh	6	Export KVarh

3.3 Individual Harmonic Distortion:

	Press the button V/A for 2 seconds to check Harmonic distortion of Voltage 2~63rd Harmonic Distortion of Voltage
	Press the button MD PF Hz for 2 seconds to check Harmonic distortion of Current 2~63rd Harmonic Distortion of Current

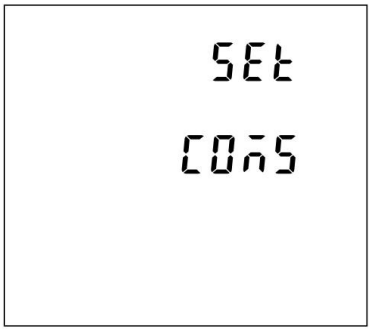
4. Setting-Up


Main screen
Password Entry
COMS (Communication)
Addr(Address)
Entry Value between:
1~247
bAUd (Baud rate)
Select from: (bps)
2400
4800
9600
19.2k
38.4k
PArI (parity)
Select from:
NONE
EVEN
Odd
StOP (stop bit)
Select from:
1
2
CT (System Configuration)
CT 2
Select from:
5A
1A
0.1A
0.333V
CTrAtE (When CT2=5A/1A)
Entry CT Ratio Value between:
1~9999
CT 1 (When CT2=0.1A/0.333V)
Entry CT 1 Value between:
1~9999
PT (System Configuration)
PT 2
Entry Secondary Voltage between:
100~500
PTrAtE
Entry PT Ratio Value between:
1~9999
PULS (Pulse)
PULS OUt 1
Select from:
Total kWh
Total kVarh
Imp kWh
Exp kWh
Imp kVarh
Exp kVarh
PULS RAtE
Select from:
0.001
0.01
0.1
1
10
100
1000 kWh(kVArh)/imp
PULS tIME
Select from:
100 mS
200 mS
60 mS
dMd (Demand)
dIt (Demand Interval Time)
Select from:
60 minutes
30 minutes
15 minutes
10 minutes
8 minutes
5 minutes
OFF
dMd MEth (demand method)
Select from:
sliding
fixed
tIME (Time)
bACk LIt (backlight)
Select from:
120 minutes
60 minutes
30minutes
10 minutes
5 minutes
ON
OFF
dISP SCrL (display scroll)
Select from:
1~255 s
SyS (System Configuration)
SyS tyPE(system type)
Select from:
3P4
3P3
1P2
1P3
SyS COCt (system connect)
Ph-1(phase1)
Select from:
Frd/rEv (forward/reverse)
Ph-2(phase2)
Select from:
Frd/rEv (forward/reverse)
Ph-3(phase3)
Select from:
Frd/rEv (forward/reverse)
PASSWOrd (Change Password)
Entry Password Between:
0000~9999
AUtO dISP SCrL
Select from:
On
OFF
rSEt (Reset)
Select from:
ALL
EnGy
dMd

4.1 Password Entry

Setting-up mode is password protected, so you must enter the correct password. By firmly press the button E for 2 seconds, the password screen appears. The default password is 1000. If an incorrect password is entered, the display shows ERR.

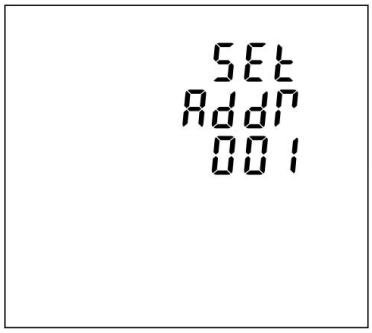
4.2 Communication



The RS485 port can be used for communications using Modbus RTU protocol. Parameters such as Address, Baud rate, Parity, Stop bit can be selected.

Long press E to enter the Address option.

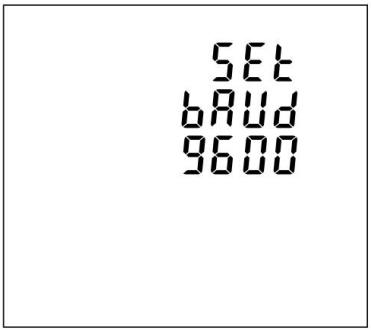
4.2.1 Address



An RS485 network can accommodate up to 255 different devices, each identified by an address.
Modbus address range 001~247
Default 001

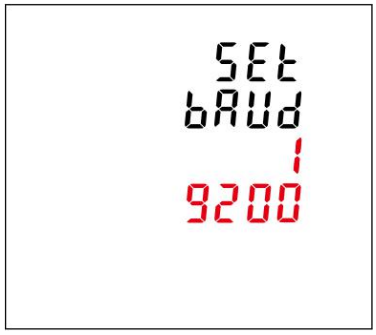
Long press E to enter the selection routine, the address setting will flash. Use MD PF Hz and P , E to set the address with the range 001~247. And press E for confirmation.

4.2.2 Baud rate

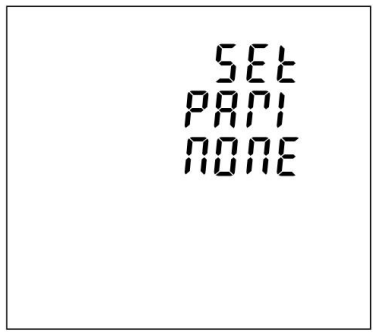
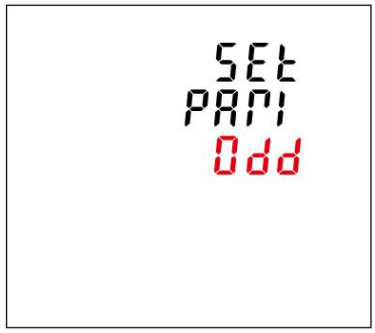


Baud rate options: 2400 4800 9600 19200 38400 (bps).
Default: 9600bps

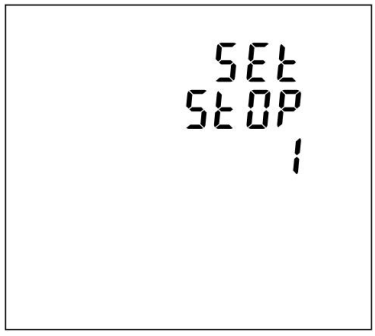
From the Set-up menu, Use MD PF Hz and P to select the Baud rate options. Long press E to enter the selection routine. The Baud Rate setting will flash. Use MD PF Hz and P to choose Baud Rate.

	Example shows: SET Baud rate 19200 (bps) And long press E for confirmation.

4.2.3 Parity

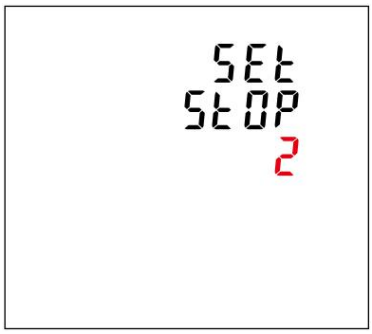
	Parity Options: NONE, EVEN, ODD. Default Parity : NONE Note that if parity is set to ODD or EVEN, Stop Bits will be set to 1 and cannot be changed. From the Set-up menu, Use MD PF Hz and P to select the Parity options. Long press E to enter the selection routine. The Parity setting will flash. Use MD PF Hz and P to choose Parity.
	Example shows: Set Parity: EVEN And long press E for confirmation. Press Ph S ESC to return the main set up menu.
	Example shows: Set Parity: Odd And long press E for confirmation. Press Ph S ESC to return the main set up menu.

4.2.4 Stop bit



Stop Bit options: 1 or 2.
Default Stop Bit : 1
Note that if parity is set to ODD or EVEN, Stop Bits will be set to 1 and cannot be changed.

From the Set-up menu, Use MD PF Hz and P to select the Stop Bit options. Long press E to enter the Stop Bit routine. The Stop Bit setting will flash. Use MD PF Hz and P to choose Stop Bit.



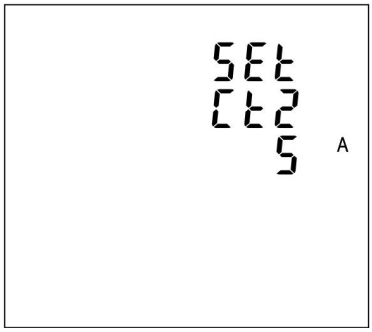
Example shows
Set Stop bit 2

And long press E for confirmation. Press Ph S Esc to return the Communication set up menu.

4.3 CT

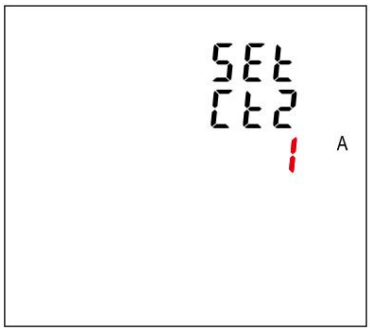
From the main Set-up menu, Use MD PF Hz and P to select the CT option.

4.3.1 CT2



Set secondary current input the meter
Options: 5A or 1A
Default CT2: 5A

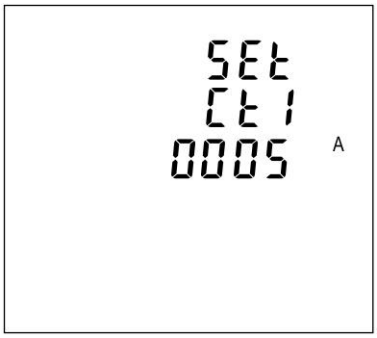
Long press E to enter the CT2 routine. Press E **for 2s, the** CT2 setting will flash. Use MD PF Hz and P to choose CT2 with 5A or 1A.



Example shows :
Set CT2 1A

And long press E for confirmation.

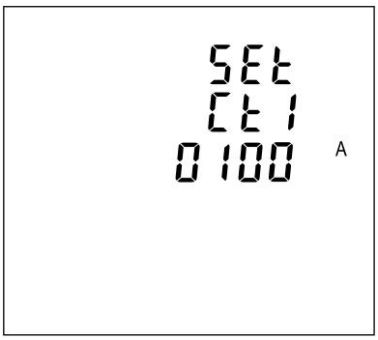
4.3.2 CT1



Set primary current input the meter
Options: 1~9999
Default CT1: 5A

Long press E to enter the CT1 routine. Press E for 2s, the CT1 setting will flash. Use MD PF Hz and P to choose CT1 with 1~9999.

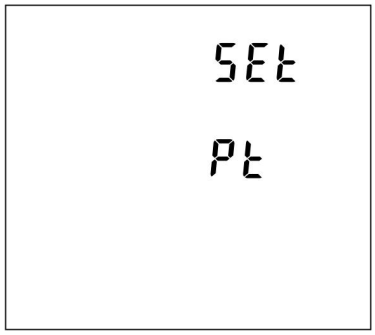
And long press E for confirmation.



Example shows :
Set CT1 100A

And press E for confirmation. Press Ph S to return the CT set up menu.

4.4 PT

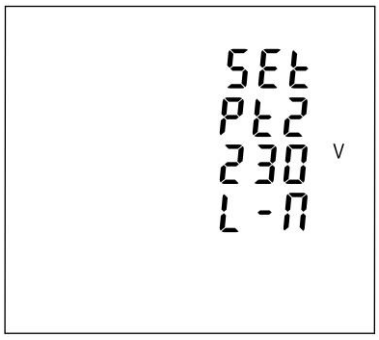


The PT option sets the secondary voltage of the voltage transformer (PT) that give into the meter and the PT rate between the primary voltage to the secondary voltage.

For example: if the PT connect to the meter is 10000/100V (Primary voltage is 10000V, secondary voltage is 100V), then the PT rate is 100.

Long press E to enter the PT2 routine. Press E , the PT2 setting will flash. Use MD PF Hz and P , E to choose PT2 with 174~480.

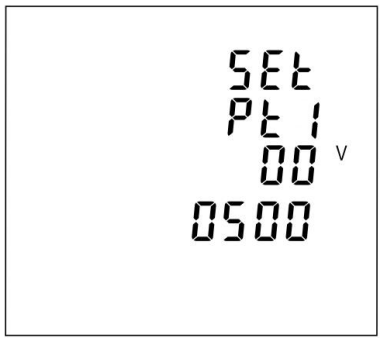
4.4.1 PT2



Set secondary voltage input the meter
Range: 100V ~ 480V
Default: 230V

And long press [E] for confirmation.

4.4.2 PT1

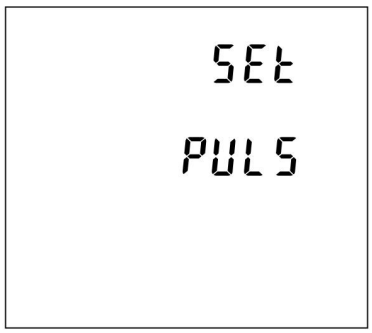


Set primary voltage input the meter
Range: 174V ~ 500000V
Default: 400V

Then press [P] to enter the PT2 routine. press [E] for 2s, the PT2 setting will flash. Use [MD PF Hz] and [P], [E] to select PT2. And long press [E] for confirmation. Press [Ph S esc] to return the PT set up menu.

4.5 Pulse

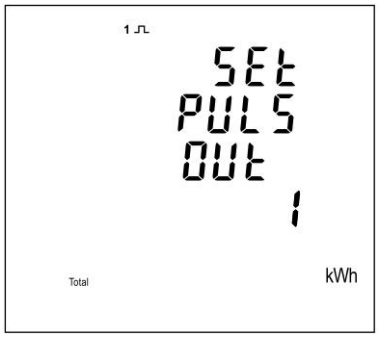
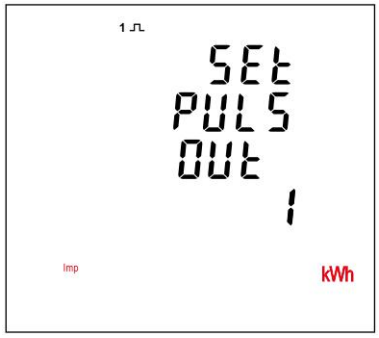
This option allows you to configure the pulse output. The output can be set to provide a pulse for a defined amount of energy active or reactive.



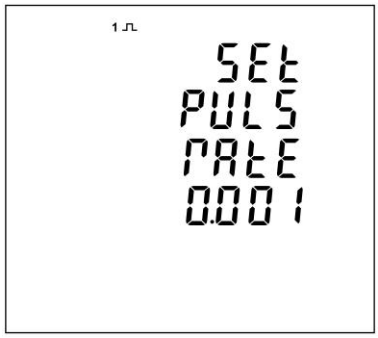
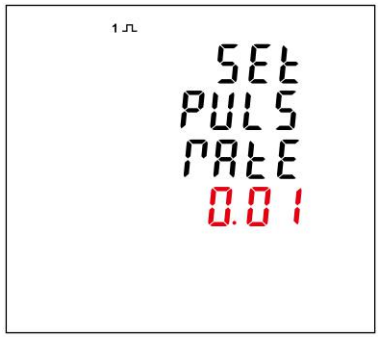
This option sets the pulse output type, pulse rate, duration time.

From the Set-up menu, Use [MD PF Hz] and [P] to select the Pulse option.

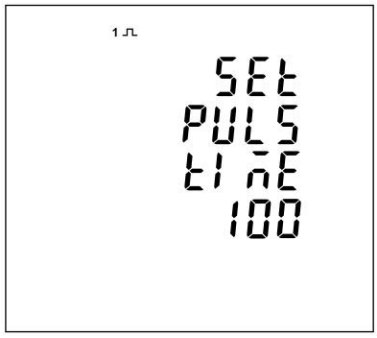
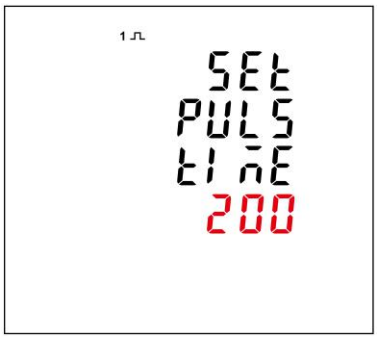
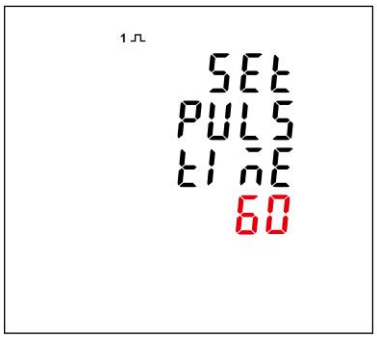
4.5.1 Pulse output1

	Pulse output 1 setting Output type options: total kwh, import kwh, export kwh, total kVarh, import kVarh, Export kVarh. Default: total kWh Long press E to enter the PT Pulse Output 1 routine.
	Example shows: Pulse Output 1: import kWh Options: total kWh, total kVarh, imp kWh,exp kWh, imp kVarh, exp kVarh. press E for 2s,the setting will flash. MD PF Hz and P to choose Options. And long press E for confirmation.

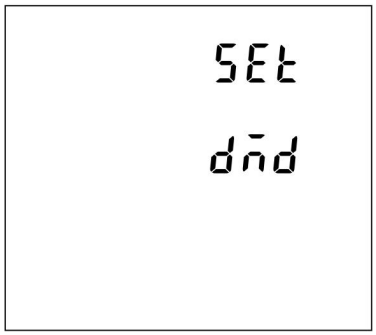
4.5.2 Pulse rate

	Pulse rate options: 0.001 , 0.01 , 0.1 , 1, 10, 100, 1000 kWh / kVarh per Pulse Default : 0.001 kWh / kVarh per pulse Use MD PF Hz and P to select Pulse Rate option. Long press E, the setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation.
	Example shows: Pulse rate: 0.01

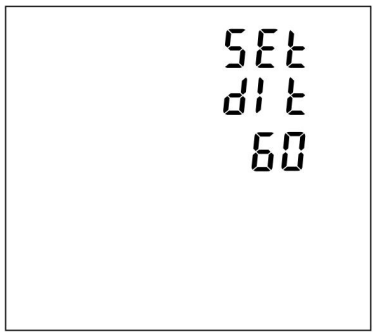
4.5.3 Pulse Duration

	Pulse Duration time option 200, 100, 60mS Default : 100mS Use MD PF Hz and P to enter Pulse duration routine. Long press E, the setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation. Press Ph S esc to return the Pulse Duration set up menu.
	Example shows: Pulse time 200mS
	Example shows: Pulse time 60mS

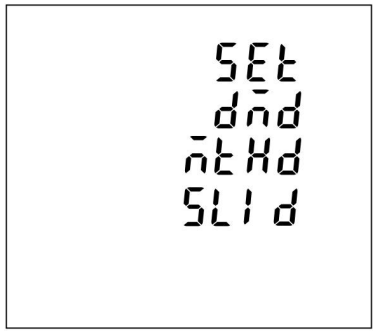
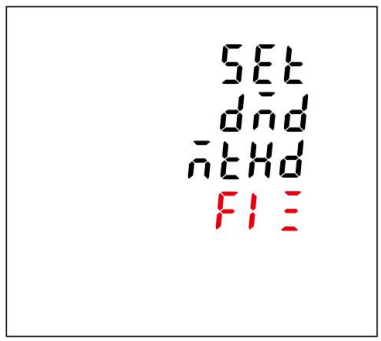
4.6 Demand

	This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement. The options are: OFF, 5, 8, 10, 15,30, 60 minutes. From the Set-up menu, Use MD PF Hz and P to select the Demand option.

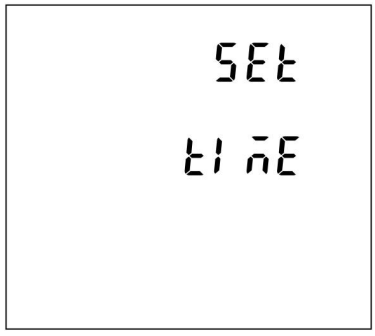
4.6.1 Demand interval time

	The screen will show the currently selected integration time. Default is 60 Long press E to enter the DIT routine. Press E for 2s, the setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation.

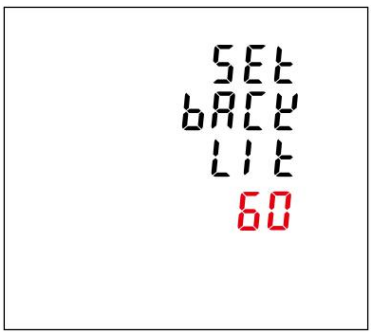
4.6.2 Demand method

	The screen shows the Demand calculation method: Slid Options: Fix and Slid Use MD PF Hz and P to enter Demand calculation method.
	Long press E to enter the routine. The setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation. Press Ph S ESC to return the Demand set up menu.

4.7 Time

	This option sets the backlight lasting time and display scroll time. From the Set-up menu, Use MD PF Hz and P to select the Time option.

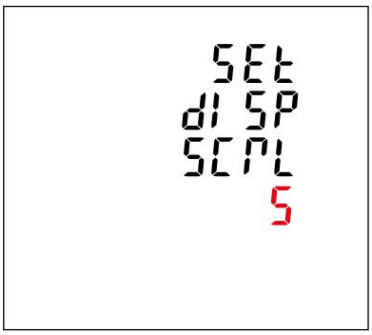
4.7.1 Backlight time



The meter provides a function to set the backlit lasting time.
Options: ON/OFF/5/10/30/60/120 minutes.
Default: 60
If it is seated as 5, the backlit will be off in 5 minutes.
Note: if it is set as ON, the backlit will always be on.

Long press [E] to enter the Backlit time routine. Press [P] for 2s, the setting will flash. Use [MD PF Hz] and [P] to choose Options. And long press [E] for confirmation.

4.7.2 Display scroll time



The meter provides a function to set the Display scroll time.
Options: 1~255s
Default: 5
If it is seated as 5, the display will scroll every 5s.

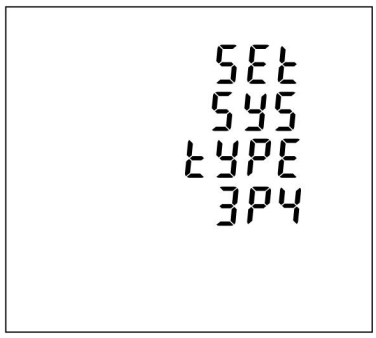
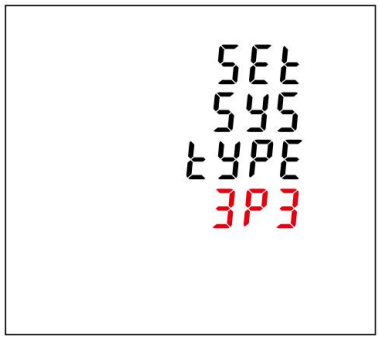
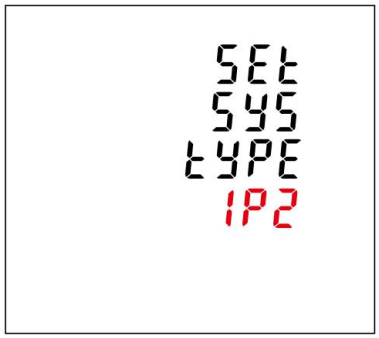
Use [MD PF Hz] and [P] to select Display scroll time option. Press [E] for 2s, the setting will flash. Use [MD PF Hz] and [P] to choose Options. And Long press [E] for confirmation. Press [Ph S esc] to return the Time set up menu.

4.8 System

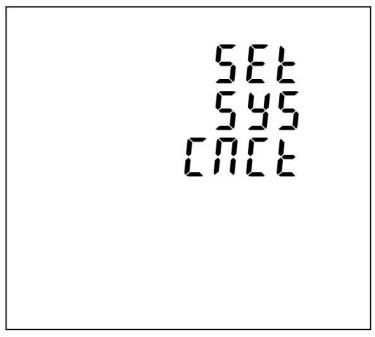
The Unit has a default setting of 3 phase 4 wire (3p4w). Use this section to set the type of electrical system.
Options: 3P34,3P3W,1P2W

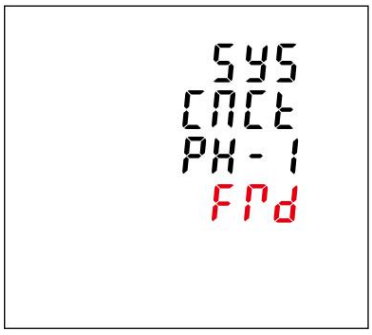
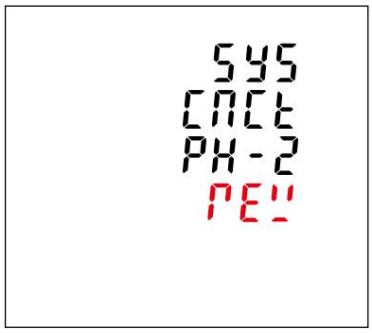
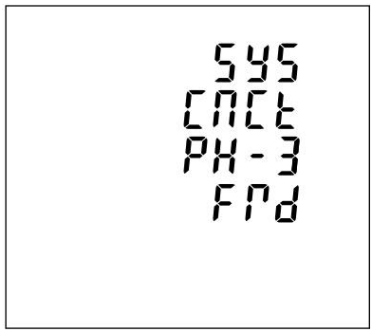
From the Set-up menu, Use [MD PF Hz] and [P] to select the System option

4.8.1 System type

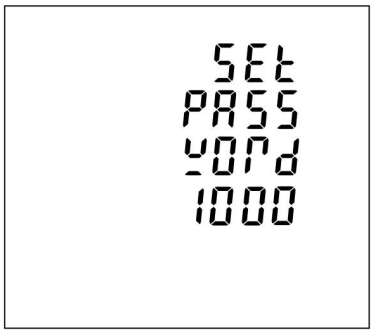
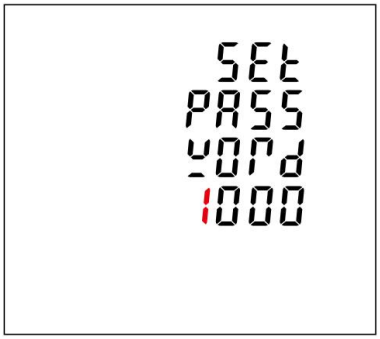
	The screen shows the currently selected power supply is three phase four wire Long press E to enter the System type routine. Press E for 2s, the setting will flash. Use MD PF Hz and P to choose Options. And Long press E for confirmation.
	Example shows: The screen shows the currently selected power supply is three phase three wire
	Example shows: The screen shows the currently selected power supply is single phase two wire

4.8.2 System connect

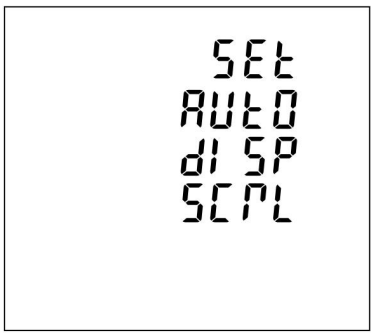
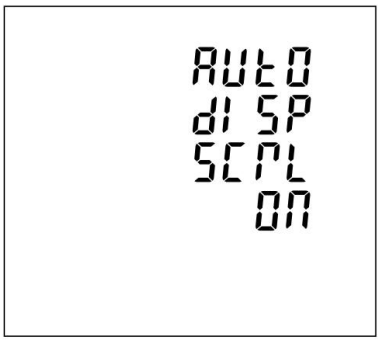
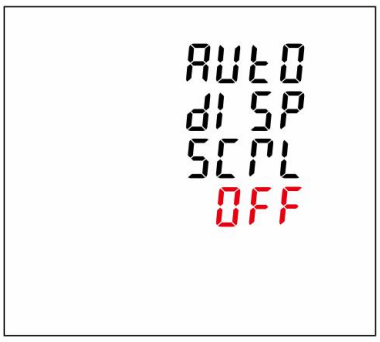
	This unit provides a function with Reverse connected current inputs correction setting. Use MD PF Hz and P to select the correction option.

	Options: Frd (forward) and rEv (reverse) The default is FRD (forward) Long press E to enter the Phase 1 correction. Press E for 2s, the setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation.
	Press P enter Phase 2 correction. Press E for 2s, the setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation.
	Press P enter Phase 3 correction. Press E for 2s, the setting will flash. Use MD PF Hz and P to choose Options. And long press E for confirmation. Press Ph S esc to return the System set up menu.

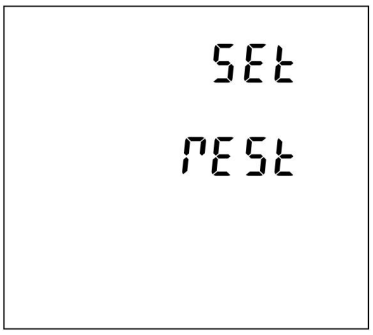
4.8.3 Change password

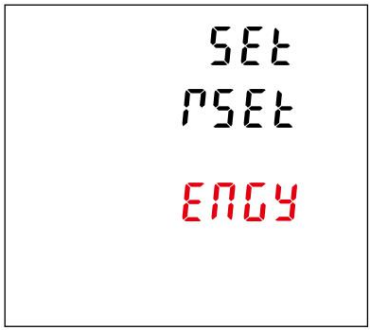
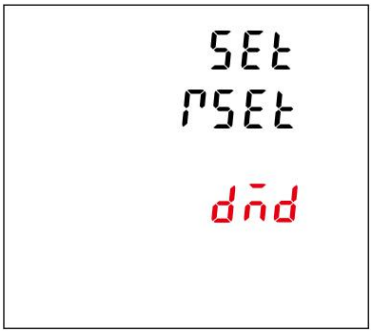
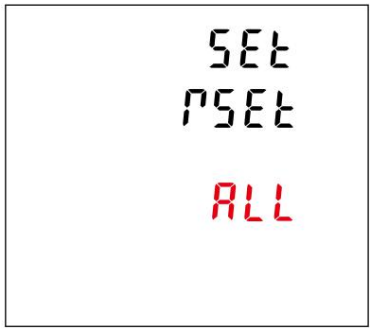
	This unit provides a function with password setting. Default: 1000 Options:0000~99999 Use MD PF Hz and P to select the change password option.
	Press E for 2s, the setting will flash. Use MD PF Hz and P, E to choose Options. And long press E for confirmation.

4.8.4 Automatic display scroll

	This unit provides a function with automatic display scroll setting. Options: on and off There are two ways: ① Use MD PF Hz and P to select the automatic display scroll option. Press E for 2s, the setting will flash. Use MD PF Hz and P to choose options “On” or “Off”. And long press E for confirmation.
	② Escape the Setting menu. Long press Ph S ESC for 2 secs. For example, the screen shows the currently selected Automatic Scroll display ON.
	Long press Ph S ESC for 2 secs, then the screen shows the currently selected Automatic Scroll display OFF.

4.9 Reset

	This unit provides a function with reset for Energy and Demand, and ALL. Use MD PF Hz and P to select the Reset option.

	Long press E to enter the Energy routine. Press E for 2s, the setting will flash, then long press E to confirm the reset.
	Then press P enter Demand Reset routine. Press E for 2s, the setting will flash, then long press E to confirm the reset.
	Then press P enter ALL Reset routine. Press E for 2s, the setting will flash, then long press E to confirm the reset. Press Ph S ESC to return the Reset set up menu.

5. Specification

5.1 Measured Parameters

The unit can monitor and display the following parameters of a single phase, 3-phase 3-wire or 3-phase 4-wire supply.

5.1.1 Voltage and Current

Phase to neutral voltage 100 to 276 V a.c (not for 3p3w supplies)
Voltage between phases 174 to 480V a.c (3p supplies only)
Installation Category III (600V)
Rated Current: 1A or 5A
Current input range: 5%~120% Ib
Percentage total voltage harmony distortion (THD%) for each phase to N
Percentage current harmonic distortion for each phase
Current on each phase

5.1.2 Power factor and Frequency and Max. demand

Frequency in Hz (45~66Hz)
Instantaneous power: Power 0 to 999MW
Reactive Power 0 to 999MVAr

Volt-amps 0 to 999 MVA

Maximum demanded power since last Demand reset Power factor

Maximum demand current, since the last Demand reset (three phase supplies only)

5.1.3 Energy Measurements

Imported active energy	0 to 9999999.9 kWh
Exported active energy	0 to 9999999.9 kWh
Imported reactive energy	0 to 9999999.9 kVArh
Exported reactive energy	0 to 9999999.9 kVArh
Total active energy	0 to 9999999.9 kWh
Total reactive energy	0 to 9999999.9 kVArh

5.2 Accuracy

- Voltage VL-N 0.5%
- Voltage VL-L 0.5%
- Current 0.5%
- Frequency 0.1
- Active power 0.5%
- Apparent power 0.5%
- Reactive power 1%
- Power factor 0.01
- Active energy IEC62053-21 Cl.1 or IEC62053-22 Cl.0.5S
- Reactive energy IEC62053-23 Cl.2
- THD 1%

5.3 Display

Liquid crystal display with backlit (360° full viewing angles)
4 lines, 4 digits per line to show electrical parameters
5th line, 8 digits to show energy
Bar graph for power indication
Display update time: 1 sec. for all parameters
Display scrolling: automatic or manual (Programmable)

5.4.1 Pulse Output

The pulse outputs can be set to generate pulses to represent kWh/kVarh
Pulse constant: 0.001/0.01/0.1/1/10/100/1000 kwh or kVarh per Pulse
Pulse width: 200/100/60 ms.
The pulse output is passive type, complies with IEC62053-31 Class A.

5.4.2 Modbus RTU

Interface standard and protocol: RS485 and MODBUS RTU
Communication address: 1~247
Transmission mode: Half duplex
Data type: Floating point
Transmission distance: 1000m Maximum
Transmission speed: 2400bps~38400bps
Parity: None (default), Odd, Even
Stop bits: 1 or 2

Response time: <100 mS

For Modbus RTU, the following RS485 communication parameters can be configured from the Set-up menu:

Baud rate 2400, 4800, 9600, 19200, 38400
Parity none/odd/even
Stop bits 1 or 2
RS485 network address *nnn* – 3-digit number, 001 to 247

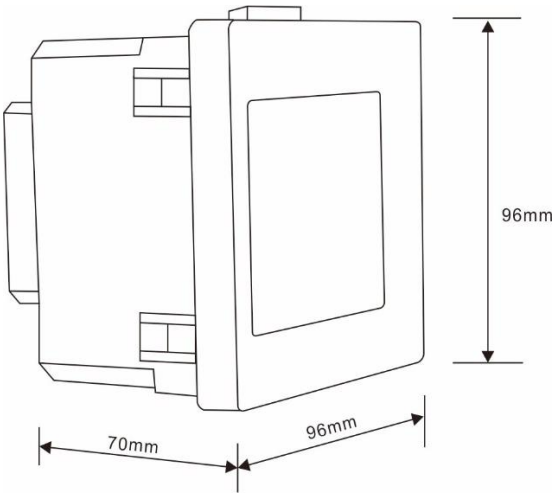
5.4.3 Environment

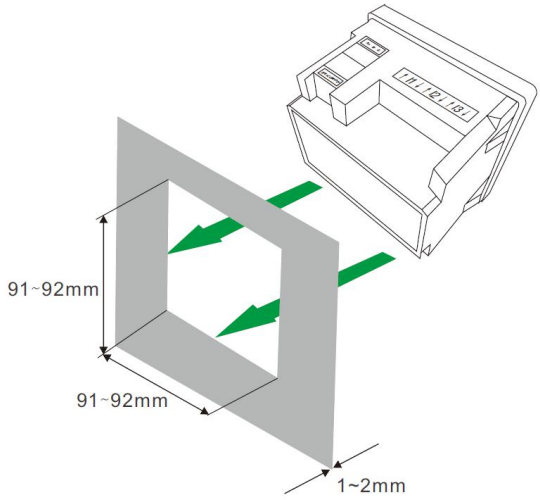
- Operating temperature -25°C to +55°C
- Storage temperature -40°C to +70°C
- Relative humidity 0 to 95%, non-condensing
- Altitude <2000 meters
- Vibration 10Hz to 50Hz, IEC 60068-2-6, 2g
- Pollution degree II

5.4.4 Mechanics

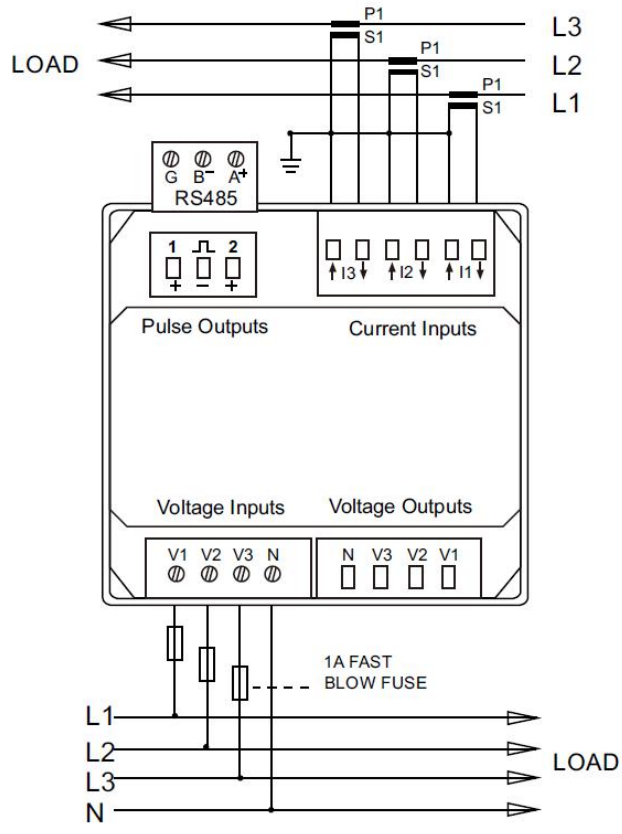
- DIN rail dimensions 96x 96mm (WxH)
- Mounting Panel mounting
- Material Self-extinguishing UL 94 V-0

6. Dimensions

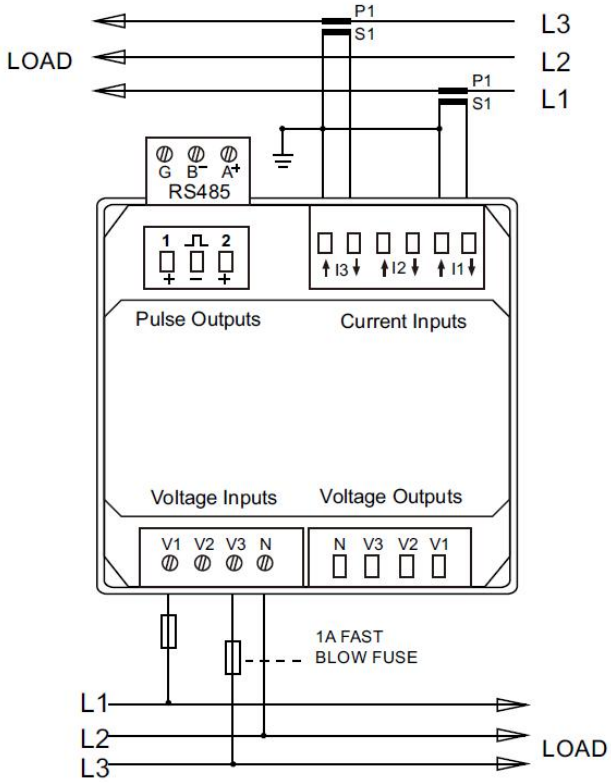




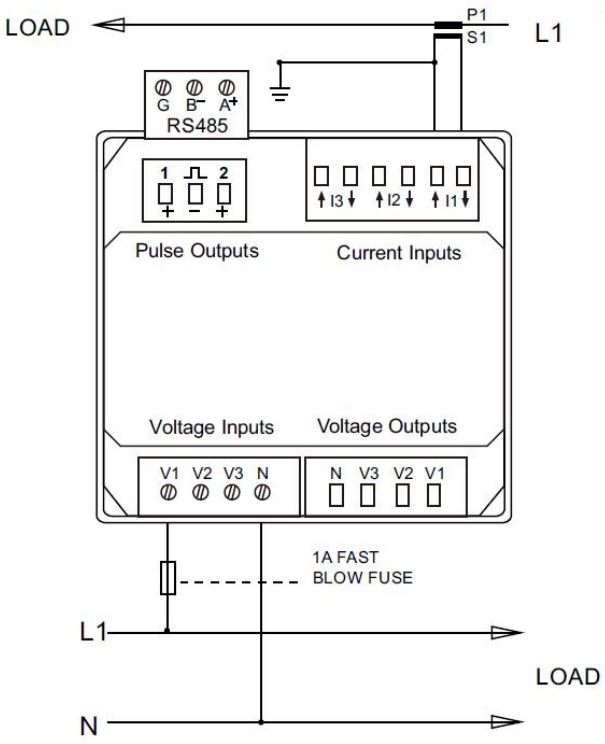
7. Wiring Diagram



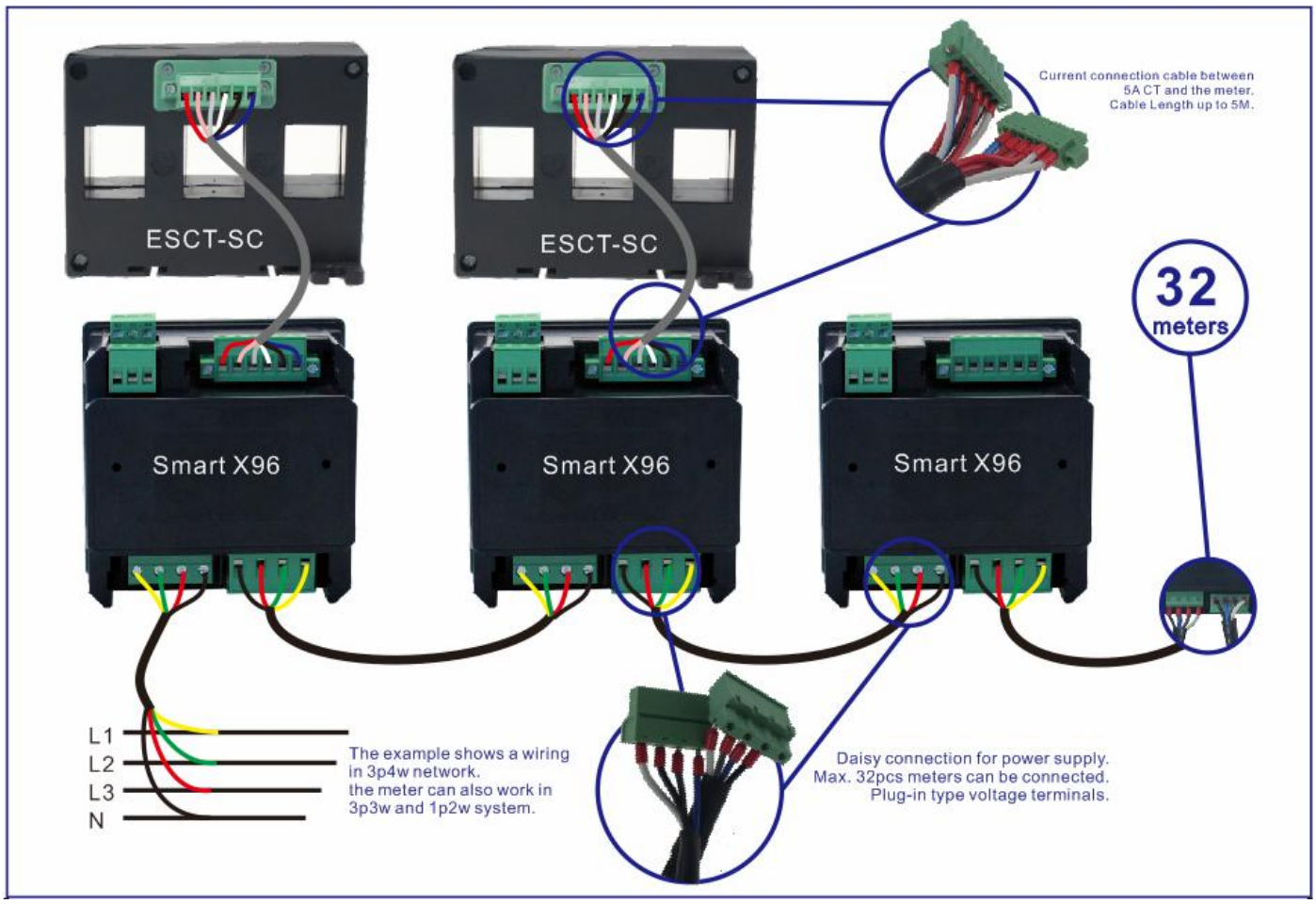
(3 phase 4 wires)



(3 phase 3 wires)



(1 phase 2 wires)



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