SMART X72-5F/G Series
SMART POWER ANALYZER

SMART POWER ANALYZER FOR SINGLE AND THREE PHASE ELECTRICAL SYSTEMS

User Manual V1.1

Warnings

Important Safety Information is contained in the Maintenance section. Familiarize yourself with this information before attempting installation or other procedures. Symbols used in this document:

Risk of Danger: These instructions contain important safety information. Read them before starting installation or servicing of the equipment.

Caution: Risk of Electric Shock

1.Introduction

The multifunction energy analyzer SMART X72 series are new-generation intelligent panel meters, used not only in the electricity transmission and power distribution system, but also in the power consumption measurement and analysis in low and middle voltage intelligent power grid.

This document provides operating, maintenance and installation instructions for the Eastron SMART X72 series. The unit measures and displays the characteristics of 1p2w, 2p3w, 3p4w and 3p3w supplies, including voltage, frequency, current, power, active and reactive energy, imported and exported energy, Harmonic, Power factor, Max. Demand etc. Energy is measured in terms of kWh, kVArh and kVAh. Maximum demand current can be measured over preset periods of up to 60 minutes.

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 X72 can be configured to work with a wide range of CTs, giving the unit a wide range of operation. Built-in interface provides RS485 Modbus RTU communication. Digital inputs and outputs are provided for external signal counting and external device control. 30 types parameters can be set for alarm.

The unit uses plug-in terminals for easy wiring and push-in mechanism for quick installation.

1.1 Unit Characteristics

The Unit can measure and display:

- Line voltage and THD% (total harmonic distortion) of all phases
- 2~15th voltage IHD% (Individual Harmonic distortion) of all phases
- 2~15th current IHD% of all phases
- Phase Sequence
- Currents, Current demands of all phases
- Line Frequency
- Active power, reactive power, apparent power, maximum power demand and power factor
- Import / export / total active energy
- Import / export / total reactive energy
- Total active energy of each phase
- DPF (Displacement Power factor, Modbus read only)
- Voltage crest factor (Modbus read only)
- Current K factor (Modbus read only)

This series includes 2 models:

	RS485Modbus	4DI & 2DO	1A/5A CT	333mV/100mA CT
Smart X72-5F	●		●	□
Smart X72-5G	●	●	●	□

●: function covered
□: optional

1.2 Current Transformer Primary Current

SMART X72 series are CT operated meters. The secondary current(CT2) of them are 1A/5A. And the primary current range is 1~9999A. Please set them according to your needs. For example, if using 100/5A CT, please set CT2=5A, CT1=100A.

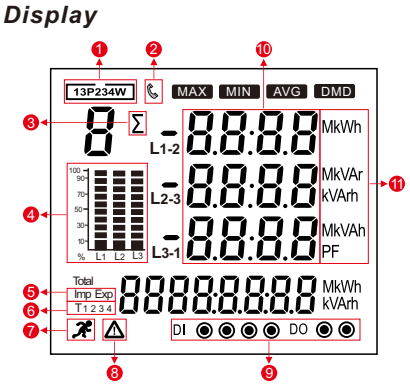
1.3 RS485 Modbus RTU

This unit uses a RS485 serial port with Modbus RTU protocol to provide a means of remote monitoring and controlling. Set-up screens are provided for setting up the communication port.

1.4 Digital Input/Digital Output

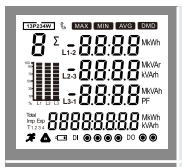
SMART X72-5G support 4 digital inputs and 2 digital outputs. Digital inputs and outputs are provided for external signal counting and external device control. 30 types of parameters can be set for alarm.

1.5 Display



NO.	Descriptions
1	System type
2	The Symbol of RS485 Modbus Communication
3	Σ : Total Value
4	Real-time Power Factor Histogram
5	Imp: Import value, Exp: Export value
6	The Symbol of Multi-tarffis
7	Current Rate Symbol
8	Alarm Symbol
9	Digital Inputs/Digital Outputs
10	Measured Values
11	Measurement Units

2.Start Up Screens

	The first screen lights up all display segments and can be used as a display check.
	The second screen indicates the firmware installed in the unit . Please note: The numbers on the product may vary from those shown here.
	The interface performs a self-test and indicates the result if the test passes.

After a short delay, the default measurement screen appears.

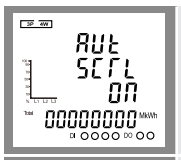
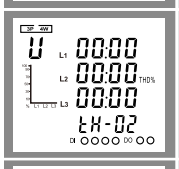
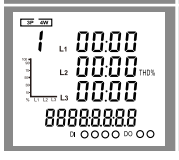
3.Buttons and Displays

3.1 Button Functions

Buttons	Click
V/A	Shot press • Display voltage, current, THD% of voltage, THD% of current information of each phase • Phase sequence • Exit from the menu
	Long press • Automatic scroll display ON/OFF
MD PF Hz	Shot press • Display power factor, frequency, Max. Demand. • Up page or add value
	Long press • Individual Harmonic Distortion of Voltage up to 15th
P	Shot press • Display active power, reactive power and apparent power information • Down page or reduce value
	Long press • Individual Harmonic Distortion of Current up to 15th
E	Shot press • Display total / import / export active or reactive energy information • Right side move
	Long press • Set-up mode entry • Confirmation

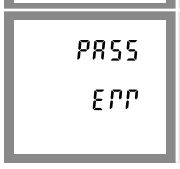
3.2 Display Mode Screen Sequence

Click button	Screen	Parameters
V/A	1	Phase to neutral voltages
	2	Phase to phase voltages
	3	Current on each phase
	4	Voltage THD% of each phase
	5	Current THD% of each phase
	6	Phase Sequence
MD PF Hz	1	Total Power factor Frequency
	2	Power factor of each phase
	3	Max.Current demand of each phase
	4	Max.Power demand of W Max.Power demand of VAr Max.Power demand of VA
P	1	Active power (kW) of each phase
	2	Reactive power (kVAr) of each phase
	3	Apperant power (KVA) of each phase
	4	Total kW, kVAr, kVA
E	1	Total active energy (kWh)
	2	Total reactive energy (kVArh)
	3	Imported active energy (kWh)
	4	Exported active energy (kWh)
	5	Imported reactive energy (kVArh)
	6	Exported reactive energy (kVArh)

	Press V/A for 2 seconds to turn on/off automatic scroll display.
	Press MD PF Hz for 2 seconds to check Harmonic Distortion of Voltage 2~15th.
	Press P for 2 seconds to check Harmonic Distortion of Current 2~15th.

4.Set Up

To enter set-up mode, press the E button for 3 seconds until the password screen appears.

	Setting up is password-protected so you must enter the correct password (default '1000') before processing.
	If an incorrect password is entered, the display will show: PASS Err

Press the button V/A to exit set-up interface.

4.1 Communication

	Parameters such as address, Baud rate, Parity, Stop bit can be selected. Long press E to enter the communication menu, which including Address option.

4.1.1 Modbus Address

	The default address is 001. The address ranges from 001 to 247 press E to activate the modification.
	use MD PF Hz and P buttons to set the address with the range 001~247,and pressing the button for confirmation.

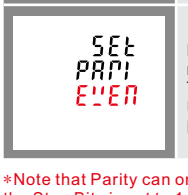
Press E to confirm the setting and press V/A to return to the main set-up menu.

4.1.2 Baud Rate

	Baud rate options: 2.4k, 4.8k, 9.6k, 19.2k, 38.4k The default is 9600bps. From the set-up menu, use MD PF Hz and P buttons to select the baud rate option.
	Press E to enter the selection routine. The baud rate setting will flash. Use MD PF Hz and P buttons to choose Baud rate.

Press E to confirm the setting and press V/A to return to the main set-up menu.

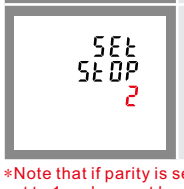
4.1.3 Parity

	Parity Options: NONE, EVEN, ODD. Default Parity : NONE From the communication menu, Use MD PF Hz and P to select the parity options.
	Press E to enter the selection routine. The current setting will flash. Use MD PF Hz and P buttons to choose Parity

*Note that Parity can only be changed to EVEN or ODD when the Stop Bits is set to 1.

Press E to confirm the setting and press V/A to return to the main set-up menu.

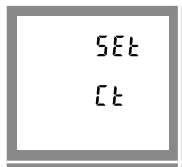
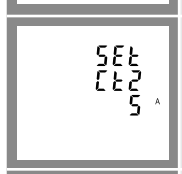
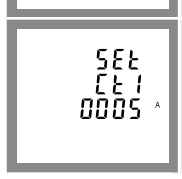
4.1.4 Stop Bits

	Stop Bit options: 1 or 2. Default Stop Bit : 1 From the Communication 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.

*Note that if parity is set to ODD or EVEN, Stop Bits will be set to 1 and cannot be changed.

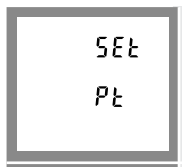
Press E to confirm the setting and V/A press to return to the main set-up menu.

4.2 CT

	From the main set-up menu, Use MD PF Hz and P to select the CT option.
	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.
	Options: 1~9999 Default CT1: 5A Use P 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.

Press E to confirm the setting and press V/A to return to the main set-up menu.

4.3 PT

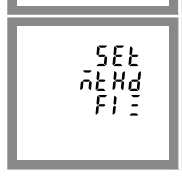
	From the main set-up menu, Use and P to select the PT option.
	Range: 30V ~ 500V Default PT2: 230V Long press E to enter the PT2 routine. Press E for 2s, the PT2 setting will flash. Use MD PF Hz and P to choose PT2 with 30V~500V.
	Range: 30V ~ 9999V Default: 230V Long press E to enter the PT1 routine. Press E for 2s, the PT1 setting will flash. Use MD PF Hz and P to select PT1.

Press E to confirm the setting and V/A press to return to the main set-up menu.

4.4 Demand

	From the set-up menu, Use MD PF Hz and P to select the demand option.

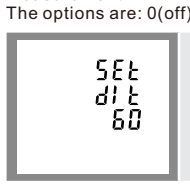
4.4.1 Demand Method

	Use MD PF Hz and P to enter demand calculation method. Options: Fix and Slid
	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 E to confirm the setting and press V/A to return to the main set-up menu.

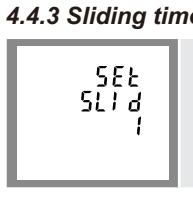
4.4.2 DIT(Demand Integration Time)

This sets the period in minutes over which the current and power readings are integrated for maximum demand measurement.
The options are: 0(off), 5, 8,10,15 ,30,60 minutes

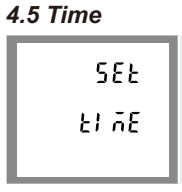
	Press E to enter the selection routine. The current time interval will flash. Use MD PF Hz and P buttons to select the time required. Default:60minutes

Press E to confirm the setting and press V/A to return to the main set-up menu.

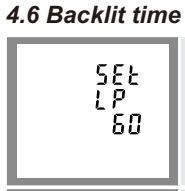
4.4.3 Sliding time

	The screen will show the sliding time for the sliding mode. The sliding time shall be set not longer than the DIT.

4.5 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.

4.6 Backlit 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 E for 2s, the setting will flash. Use MD PF Hz and P to choose options.

Press E to confirm the setting and press V/A to return to the main set-up menu.

4.7 Display scroll time

Options: 1~255s
Default: 5s

Use (MD/PFHz) and (P) to select display scroll time option. Press (E) for 2s, the setting will flash. Use (MD/PFHz) and (P) to choose Options.

Press (E) to confirm the setting and press (V/A) to return to the main set-up menu.

4.8 System

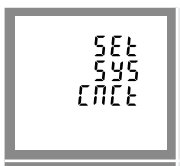
The unit has a default setting of 3 phase 4 wire (3p4w). Use this section to set the type of electrical system.
Options: 3p4w,3p3w,1p2w
From the Set-up menu, Use (MD/PFHz) and (P) to select the system option

4.9 System type

Long press (E) to enter the system type routine. Press (E) for 2s, the setting will flash. Use (MD/PFHz) and (P) to choose options.

Press (E) to confirm the setting and press (V/A) to return to the main set-up menu.

4.10 System connect



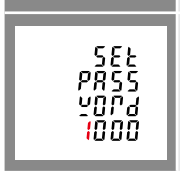
This unit provides a function with reverse connected current inputs correction setting. Use (MD/PFHz) and (P) to select the correction option.
Options: Frd (forward) and REV (reverse)
The default is FRD (forward)

Long press (E) to enter the Phase 1, 2,3 correction. Press (E) for 2s, the setting will flash. Use (MD/PFHz) and (P) to choose options.

Press (E) to confirm the setting and press (V/A) to return to the main set-up menu.

4.11 Change password

This unit provides a function with password setting.
Default: 1000
Options:0000~99999
Use (MD/PFHz) and (P) to select the change password option.

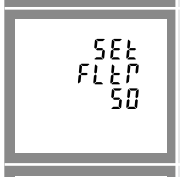


Press (E) for 2s, the setting will flash. Use (MD/PFHz) and (P) to choose options.

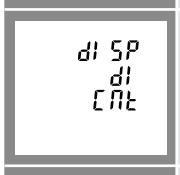
Press (E) to confirm the setting and press (V/A) to return to the main set-up menu.

4.12 Digital input(DI)

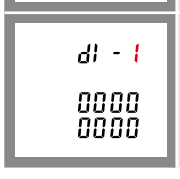
This option is to set digital input parameter.
Long pressing (E), getting to the sub-menu



This is to set filtering time for a digital input signal.
Left picture shows 100ms
Options: 0~255s

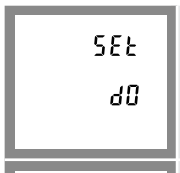


This screen is to check the counting number of each digital inputs.
Use (E), user can see counting numbers.

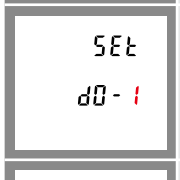


Left picture shows digital input 1, counting number is 8.
Pressing (MD/PFHz) and (P), user can see counting number of different digital inputs.

4.13 Digital output(DO)

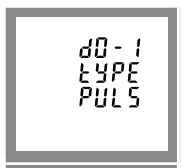


This option is to set digital output parameter.
Long pressing (E), getting to the sub-menu



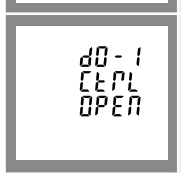
Long pressing (E), user can setting the parameter and checking the status of DO-1.
Use (MD/PFHz) and (P), user can choose different digital output.

This screen is to set the alarm information link to DO-1
For details, please refer to part 4.14



This screen is to set the digital output Type for DO-1
Left picture shows LEVE
LEVE = Level
PULS = Pulse

This screen is to set the output width of DO-1
Left picture shows 1000ms
Options: 50~3000ms



This screen is to control the status of DO-1 relay
Left picture shows the status is open

4.14 Alarm setting of DO

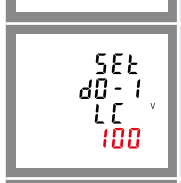
This option is to set alarm for DO.

The Alarm can be linked to the parameters below: U1, U2, U3, Unav (L-N),U12, U23, U31, Uuav (L-L) I1, I2, I3, Iav, In,P1, P2, P3, P-total Q1, Q2, Q3, Q-total, S1, S2, S3, S-total PF1, PF2, PF3, PF-total,F (frequency)
Null means the alarm is not linked to any parameter.

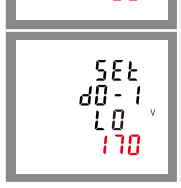
This option is set the DO action delay time. The unit is ms.
Left picture shows 200ms.

This option is to set the high value for DO-1 close.
Left picture shows HC (High value to Close) 1000V, that means when the U1 reaches to 1000V, the DO-1 will close.

This option is to set the high value for DO-1 open.
Left picture shows HO (High value to Open) 800V, that means when the U1 drops to 800V, the DO-1 will open.

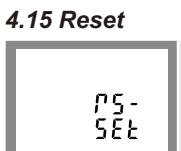


This option is to set the Low value for DO-1 Close.
Left picture shows LC (Low value to Close) 100V, that means when the U1 drops to 100V, the DO-1 will open.



26 This option is to set the Low value for DO-1 open.
Left picture shows LO (Low value to Open) 170V, that means when the U1 returns to 170V, the DO-1 will open.

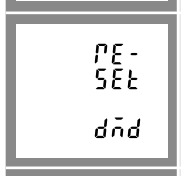
4.15 Reset



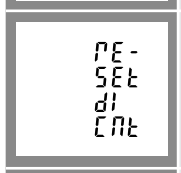
This unit provides a function with reset for different information.
Long press (E), user can get into sub-menu. Use (MD/PFHz) and (P) to select the reset option.

This option is to reset active energy.

This option is to reset reactive energy.



This option is to reset demand.



This option is to reset counting number of digital inputs.

This option is to reset all information.

5.Specifications

Input	
Nominal input voltage	0-276V AC (L-N) 0-480V AC(L-L)
Max. continuous input overload voltage	120% of nominal
Max. short duration input voltage	2 x nominal voltage for 1 second
Nominal input voltage burden	< 0.2VA per phase
Nominal input current	5A
Nom. Input current burden	< 0.1 VA
Max. continuous input overload current	120% of nominal
Max. short duration input current	20 x nominal current for 1 second
Auxiliary Power Supply	
Operating range	65-276V AC/90- 380V DC
Supply burden	< 2W / 10 VA
Accuracy	
Voltage (V)	0.5% of range maximum
Current (A)	0.5% of range maximum
Frequency (Hz)	0.2% of mid-frequency
Power factor (PF)	1% of unity (0.01)
Active power (W)	1.0% of range maximum
Reactive power (VAr)	1.0% of range maximum
Apparent power (VA)	1.0% of range maximum
Active energy (kWh)	Class 0.5S IEC62053-22
Reactive energy (kVArh)	2% of range maximum
THD	2% to 15th harmonic
Measured Range	
Voltage (V)	50-276 VAC(L-N)/50-480VAC(L-L)
Current (A)	5 – 120% of nominal
Frequency (Hz)	45– 66 Hz
Power (W, VAr, VA)	5 – 120% of nominal (bi-directional)
Energy	8digits, up to 9999999.9 kWh
Power factor	4 quadrant
THD	0 – 40% up to 15th harmonic
Environment	
Operating temperature	−25°C to +55°C
Storage temperature	-40°C to +70°C
Relative humidity	0 to 95%, non-condensing
Shock	30g in 3 planes
Vibration	10Hz to 50Hz, IEC 60068-2-6, 2g
Dielectric Voltage	4kV between voltage and current to earth
Altitude	2000m
Warm-up	5 seconds
Modbus	
Bus type	RS485(semi-duplex)
Protocol	Modbus RTU/Modbus TCP
Baud rate	2400/4800/9600/19200/38400bps
Address range	1-247
Communication distance	1000M
Parity	EVEN/ODD/NONE
Data bit	8
Stop bit	1
Enclosure	
Enclosure Style	DIN 72 panel mount
Dimensions	72x72x68 mm
Panel cut-out	67x67mm
Panel thickness	1-3 mm
Protection rating	IpS1 (Indoor)
Material	UL 94-VO
Weight	220 g
Cable size	0.05mm-4mm stranded wire
Terminals	Voltage: Shrouded screw-clamp.

6.Maintenance

In normal use, little maintenance is needed. As appropriate for service conditions, isolate electrical power, inspect the unit and remove any dust or other foreign material present. Periodically check all connections for freedom from corrosion and screw tightness, particularly if vibration is present. The front of the case should be wiped with a dry cloth only. Use minimal pressure, especially over the viewing window area. If necessary wipe the rear case with a dry cloth. If a cleaning agent is necessary, isopropyl alcohol is the only recommended agent and should be used sparingly. Water should not be used. If the rear case exterior or terminals should be contaminated accidentally with water, the unit must be thoroughly dried before further use. Should it be suspected that water might have entered the unit, factory inspection and refurbishment is recommended.
In the unlikely event of a repair being necessary, it is recommended that the unit be returned to the factory or nearest Eastron distributor.

7.Installation

The unit may be mounted in a panel of any thickness up to a maximum of 3 mm. Leave enough space behind the instrument to allow for bends in the connection cables. The unit is intended for use in a reasonably stable ambient temperature within the range -25°C to +55°C. Do not mount the unit where there is excessive vibration or in excessive direct sunlight.

7.1 Safety

The unit is designed in accordance with IEC 61010-1:2010 – Permanently connected use, Normal condition. Installation category III, pollution degree 2, basic insulation for rated voltage.

7.2 EMC Installation Requirements

Whilst this unit complies with all relevant EU EMC (electro-magnetic compatibility) regulations, any additional precautions necessary to provide proper operation of this and adjacent equipment will be installation dependent and so the following can only be general guidance:
Avoid routing wiring to this unit alongside cables and products that are, or could be, a source of interference.
The auxiliary supply to the unit should not be subject to excessive interference. In some cases, a supply line filter may be required.
To protect the product against incorrect operation or permanent damage, surge transients must be controlled. It is good EMC practice to suppress transients and surges at the source. The unit has been designed to automatically recover from typical transients; however in extreme circumstances it may be necessary to temporarily disconnect the auxiliary supply for a period of greater than 10 seconds to restore correct operation. Screened communication leads are recommended and may be required. These and other connecting leads may require the fitting of RF suppression components, such as ferrite absorbers, line filters etc., if RF fields cause problems.
It is good practice to install sensitive electronic instruments that are performing critical functions in EMC enclosures that protect against electrical interference causing a disturbance in function.

Warning

1.During normal operation, voltages hazardous to life may be present at some of the terminals of this unit. Installation and servicing should be performed only by qualified, properly trained personnel abiding by local regulations. Ensure all supplies are de-energized before attempting connection or other procedures.

2.Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.

3.This unit is not intended to function as part of a system providing the sole means of fault protection - good engineering practice dictates that any critical function be protected by at least two independent and diverse means.

4.The unit does not have internal fuses therefore external fuses must be used for protection and safety under fault conditions.

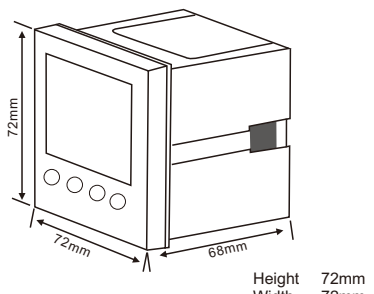
5.Never open-circuit the secondary winding of an energized current transformer.

6.This product should only be operated with CT secondary connections Earthed.

7.If this equipment is used in a manner not specified by the manufacturer, protection provided by the equipment may be impaired.

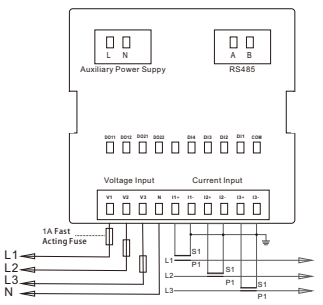
Auxiliary circuits (communication & relay outputs) are separated from metering inputs and 110-400V auxiliary circuits by at least basic insulation. Such auxiliary circuit terminals are only suitable for connection to equipment which has no user accessible live parts. The insulation for such auxiliary circuits must be rated for the highest voltage connected to the instrument and suitable for single fault condition. The connection at the remote end of such auxiliary circuits should not be accessible in normal use. Depending on application, equipment connected to auxiliary circuits may vary widely.

7.3 Dimensions

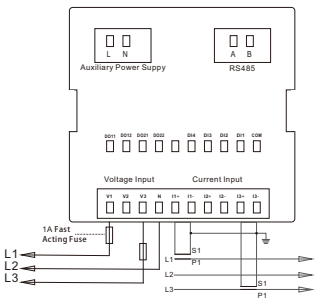


Height 72mm
Width 72mm
Depth 68mm

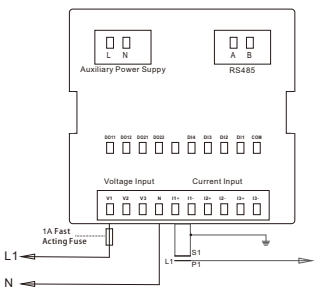
7.5 Wiring Diagram



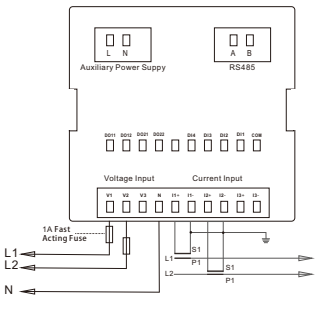
3-Phase 4-Wire



3-Phase 3-Wire



1-Phase 2-Wire



2-Phase 3-Wire

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