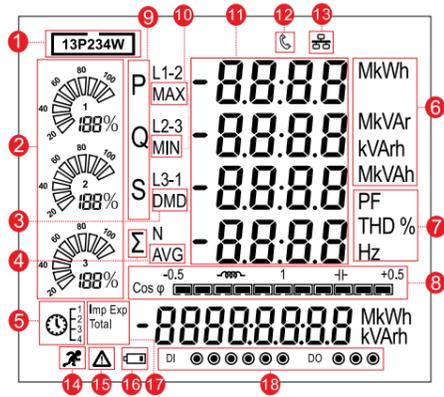




1.5 Ethernet TCP/IP

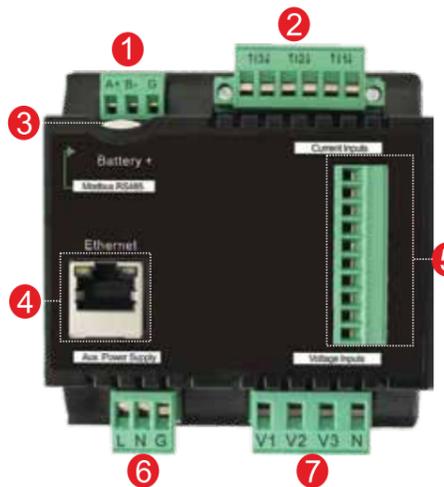
This unit is equipped with an Ethernet(TCP/IP) communication port for rapid and reliable data transfer. It would be easy to integrate the meter into a network. SMART X96-5J can also be set as an RS485 Modbus to TCP/IP gateway.

1.6 Display



NO.	Descriptions
1	System Type
2	Bar Graph for Power Indication
3	DMD: Demand
4	Σ: Total AVG: Average
5	The Symbol of Multi-tariffs
6	Measurement Units
7	PF: Power Factor THD%: Total Harmonic Distortion of Voltage and Current Hz: Frequency
8	The Status Bar of the Total Power Factor
9	P: Active Power, Q: Reactive Power, S: Apparent Power
10	MAX/MIN Values
11	Measured Values
12	The Symbol of RS485 Modbus Communication
13	Ethernet Connection Symbol
14	Current Rate Symbol
15	Alarm Symbol
16	Low Battery Symbol
17	IMP/EXP: Import/Export Value, Total: Total Value
18	Digital Inputs/Digital Outputs

1.7 Parts of Meter



NO.	Descriptions
1	Modbus Communication Terminal
2	Current Inputs Terminal
3	Battery for Real Time Clock(For multi-tariffs)
4	Ethernet Port
5	Digital Inputs/Digital Outputs Terminal (For SMART X96-5G/5I/5J)
6	Aux.Power Supply Terminal
7	Voltage Inputs Terminal

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 software version of the unit. (the left picture is just for reference)

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 Buttons Function

Buttons	Click	Press 2s
	<ul style="list-style-type: none"> Displays power, voltage, current and energy information of each phase Exit from the menu 	<ul style="list-style-type: none"> Automatic scroll display ON/OFF
	<ul style="list-style-type: none"> Display voltage and current information of the selected system type. (3p4w, 3p3w and 1p2w) Phase sequence Left side move 	<ul style="list-style-type: none"> Individual Harmonic Distortion of Voltage up to 63rd
	<ul style="list-style-type: none"> Display power factor, frequency, Max. Demand. Max. and Min.of current and voltage Up page or add value 	<ul style="list-style-type: none"> Individual Harmonic Distortion of Current up to 63rd
	<ul style="list-style-type: none"> Display active power, reactive power and apparent power information of the selected system type. Down page or reduce value 	<ul style="list-style-type: none"> Running hour Full screen checking Modbus / Ethernet setting information Tariff information
	<ul style="list-style-type: none"> Display total / import / export active or reactive energy information of the selected system type. 4 tariffs energy and RTC Right side move 	<ul style="list-style-type: none"> 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	
	1	Phase 1 - Power Voltage Current kWh			1	Phase 1 - Power Voltage Current kWh	
	2	Phase 2 - Power Voltage Current kWh					
	3	Phase 3 - Power Voltage Current kWh					
	4	Phase 1 - Power Voltage Current kWh			2	Phase 1 - Power Voltage Current kWh	
	5	Phase 2 - Power Voltage Current kWh					
	6	Phase 3 - Power Voltage Current kWh					
	1	Voltage L1-N Voltage L1-N Voltage L1-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 THD% of Voltage L2 THD% of Voltage L3	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			
		1	Total Power Factor Frequency	1	Total Power Factor Frequency	1	Total Power Factor Frequency
		2	PF L1 PF L2 PF L3				
		3	Max. DMD of Current L1 Max. DMD of Current L2 Max. DMD of Current L3	2	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	3	Max. DMD of W Max. DMD of VAr Max. DMD of VA	3	Max. DMD of W Max. DMD of VAr Max. DMD of VA
	5	Max. Voltage L1 - N Max. Voltage L2 - N Max. Voltage L3 - N	4	Max. Voltage L1 - L2 Max. Voltage L2 - L3 Max. Voltage L3 - L1	4	Max. Voltage L1 - N	
	6	Min. Voltage L1 - N Min. Voltage L2 - N Min. Voltage L3 - N	5	Min. Voltage L1 - L2 Min. Voltage L2 - L3 Min. Voltage L3 - L1	5	Min. Voltage L1 - N	
	7	Max. Current L1 Max. Current L2 Max. Current L3 Max. Current Neutral	6	Max. Current L1 Max. Current L2 Max. Current L3	6	Max. Current L1	
	8	Min. Current L1 Min. Current L2 Min. Current L3 Min. Current Neutral	7	Min. Current L1 Min. Current L2 Min. Current L3	7	Min. Current L1	
	9	Max. of W Max. of VAr Max. of VA	8	Max. of W Max. of VAr Max. of VA	8	Max. of W Max. of VAr Max. of VA	
	10	Min. of W Min. of VAr Min. of VA	9	Min. of W Min. of VAr Min. of VA	9	Min. of W Min. of VAr Min. of VA	
	1	Active Power L1 Active Power L2 Active Power L3					
	2	Reactive Power L1 Reactive Power L2 Reactive Power L3					
	3	Apparent Power L1 Apparent Power L2 Apparent Power L3					
	4	Total Apparent Power Total Reactive Power Total Apparent Power		Total Apparent Power Total Reactive Power Total Apparent Power	1	Total Apparent Power Total Reactive Power Total Apparent Power	
	1	Total kWh	1	Total kWh	1	Total kWh	
	2	Total kVAh	2	Total kVAh	2	Total kVAh	
	3	Import kWh	3	Import kWh	3	Import kWh	
	4	Export kWh	4	Export kWh	4	Export kWh	
	5	Import kVAh	5	Import kVAh	5	Import kVAh	
	6	Export kVAh	6	Export kVAh	6	Export kVAh	
	7	T1 kWh	7	T1 kWh	7	T1 kWh	
	8	T2 kWh	8	T2 kWh	8	T2 kWh	
	9	T3 kWh	9	T3 kWh	9	T3 kWh	
	10	T4 kWh	10	T4 kWh	10	T4 kWh	
	11	Date	11	Date	11	Date	
	12	Time	12	Time	12	Time	

1. 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 1p2w, 3p4w and 3p3w supplies, including voltage, frequency, current, power, active and reactive energy, imported or exported energy, harmonic, power factor, max. demand etc. Energy is measured in terms of kWh, kVAh 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 X96 Series can be configured to work with a wide range of CTs, giving the unit a wide range of operation. Built-in interfaces provides RS485 Modbus RTU and Ethernet TCP/IP communication. Digital inputs and outputs are provided for external signal counting and external device control. 30 types of 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
- 2-63rd voltage IHD% (Individual Harmonic distortion) of all phases
- Line Frequency
- Phase Sequence
- 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
- Max / Min.Current and voltage, Max.current demand
- Import / export / total active energy
- Import / export / total reactive energy
- Total active energy of each phase
- Multi Tariff active energy
- DPF (Displacement Power factor, Modbus read only)
- Voltage crest factor (Modbus read only)
- Current K factor (Modbus read only)

	RS485 Modbus	4DI & 2DO	Ethernet port	Ethernet gateway
Smart X96-5F	•			
Smart X96-5G	•	•		
Smart X96-5H	•		•	
Smart X96-5I	•	•	•	
Smart X96-5J	•	•	•	•



1.2 Current Transformer Primary Current

SMART X96 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 X96-5G/I/J 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.

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

3.3 Individual Harmonic Distortion

Press the button for 2 seconds to check Harmonic Distortion of Voltage

2-63rd Harmonic Distortion of Voltage

Press the button for 2 seconds to check Harmonic Distortion of Current

2-63rd Harmonic Distortion of Current

4. Set Up

Config. page	Function	Range or Selection	Factory setting
1	Password Entry	0000-9999	1000
2	Communication		
2.1	Modbus Address	001-247	001
2.2	Baud Rate	2400/4800/9600 19200/38400 (bps)	9600(bps)
2.3	Parity	NONE, EVEN, ODD	NONE
2.4	Stop Bit	1 or 2	1
3	CT		
3.1	CT2	1A or 5A	5A
3.2	CT1	1-9999A	5A
4	PT		
4.1	PT2	50-600V	230V
4.2	PT1	50-600000V	230V
5	Demand		
5.1	Demand Method	Fix and Slid	Fix
5.2	Demand Interval Time/Block Time	1-60minutes	60minutes
5.3	Sliding Time	Not longer than the DIT	
6	Time		
6.1	Backlight Time	ON/OFF/5/10/30 /60/120 minutes	60minutes
6.2	Display Scroll Time	1-255s	5s
6.3	System RTC	YYYY-MM-DD & HH-MM-SS	
6.4	Tariff Time	1.time segment number, range from 01 to 08; 2.starting time of this time segment, format:HH-MM, 3.FEE1 - Tariff 1, range 1-4.	
7	System		
7.1	System Type	3P4W, 3P3W, 1P2W	3P4W
7.2	System Connect	Frd (forward) and Rev (reverse)	Frd (forward)
7.3	Change Password	0000-9999	1000
7.4	Automatic Display Scroll	on or off	off
8	Digital Input (DI)		
8.1	Filtering Time	000-999ms	100ms
8.2	Counting Number		
9	Digital Outputs (DO)	DO-1 or DO-2	DO-1
9.1	Alarm Setting of DO	Thirty objects	Null
9.2	DO Action Delay Time	000-999ms	200ms LEVE (Level)
9.3	High Value to Close	-9999-9999	1000
9.4	High Value to Open	-9999-9999	800
9.5	Low Value to Close	-9999-9999	100
9.6	Low Value to Open	-9999-9999	110
9.7	Digital Output Type	LEVE (Level) or PULS (Pulse)	
9.8	Status of Relay	Open or Close	Open
10	Ethernet Communication		
10.1	IP Address	xxx.xxx.xxx.xxx	192.168.1.200
10.2	Subnet Mask	xxx.xxx.xxx.xxx	255.255.255.000
10.3	Default Gateway	xxx.xxx.xxx.xxx	192.168.1.1
10.4	IP Port	0000-9999	0502
10.5	Ethernet Mode	SLAV (slave) or MAST (Master)	SLAV (slave)
11	SOE Information		
11.1	Event		
11.2	Date and Time of Event	YYYY-MM-DD & HH-MM-SS	
12	Reset	Reset option	
12.1	Reset Energy Information	Yes/No	
12.2	Reset the Demand Information	Yes/No	
12.3	Reset the Max. and Min. Information	Yes/No	
12.4	Reset the SOE Information	Yes/No	
12.5	Reset Digital Input Counting	Yes/No	
12.6	Reset All Information	Yes/No	

5. Specifications

Input	
Nominal input voltage	50-345V AC (L-N) 87-600V AC(L-L)(on request)
Max. short duration input voltage	2x nominal voltage for 1 second
Nominal input voltage burden	< 0.2VA per phase
Nominal input current	5A
Nom. Input current burden	< 0.1VA
Max. continuous input overload current	120% of nominal
Max. short duration input current	0.5x nominal current for 0.5 second
Auxiliary Power Supply	
Operating range	65-480V AC/80-660V DC
Supply burden	< 2W / 10VA

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)	0.5% 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)	Class 1.0 IEC62053-24
THD	2% to 63rd harmonic
Measured Range	
Voltage (V)	50-345V AC (L-N) 87-600V AC(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 quadrants
THD	0-40% up to 63rd harmonic
Environment	
Operating temperature	-30°C to +70°C
Storage temperature	-40°C to +80°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
Digital Output	
Number/Type	2-electromagnetic relay
Output Frequency	1 Hz maximum
Switching Current	250 Vac at 3.0 Amps, 100k cycles
Isolation	2.5 kVac for 1 min
Digital Input	
Number	4
Input Resistance	10kΩ
Maximum Frequency	1kHz
Response Time	10 milliseconds
Isolation	2.5 kVac for 1 min
Enclosure	
Enclosure Style	DIN 96 panel mounted
Dimensions	96x96x73.5 mm
Panel cut-out	92x92mm
Panel thickness	1-3 mm
Protection rating	IP51 (indoor)
Material	UL 94-VO
Weight	280-330 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.

Battery Replacement

The meter provides multi tariffs and RTC, it has a 3V DC battery as backup power supply. When the battery voltage is lower than 2.4V DC, the meter LCD will show warning symbol. The user needs to replace the battery with a new one.

Warning When you replace the battery, make sure the meter's voltage input must be disconnected.

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 -30°C to +70°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 61010-1:2017 - Permanently connected use, Normal condition. Installation category III, pollution degree 2, basic insulation for rated voltage.

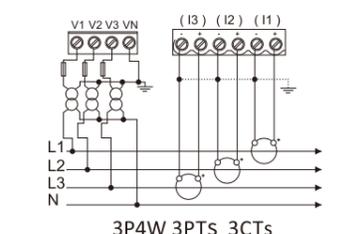
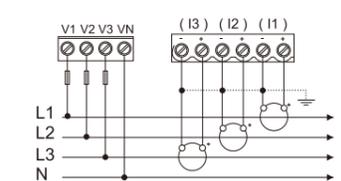
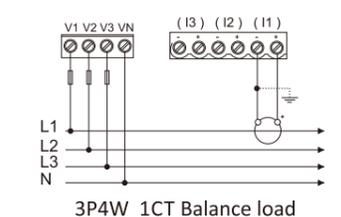
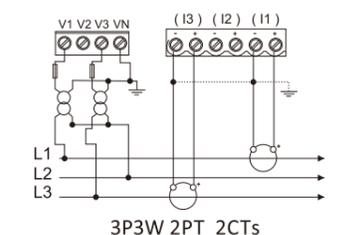
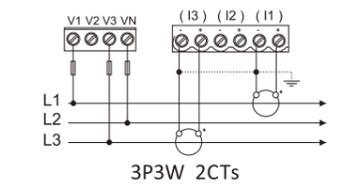
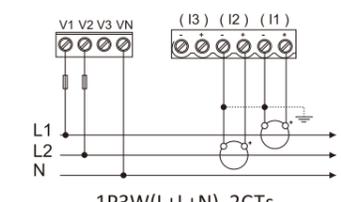
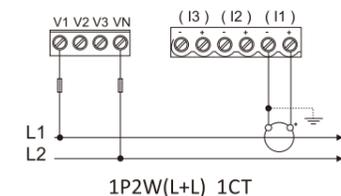
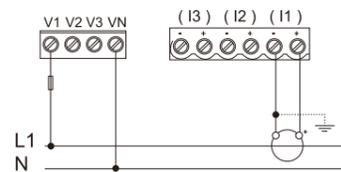
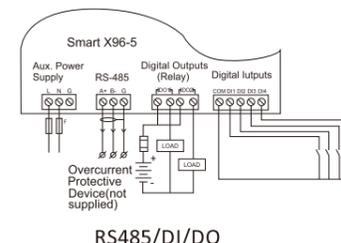
7.2 EMC Installation Requirements

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.

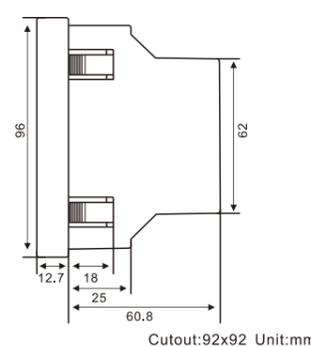
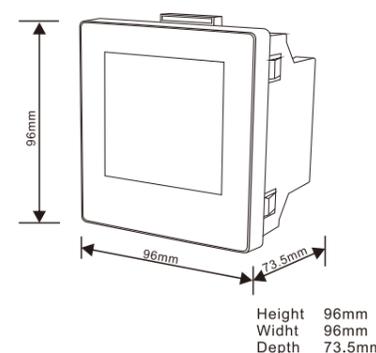


7.5 Wiring Diagram



- 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.
- Terminals should not be user accessible after installation and external installation provisions must be sufficient to prevent hazards under fault conditions.
- 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.
- The unit does not have internal fuses therefore external fuses must be used for protection and safety under fault conditions.
- Never open-circuit the secondary winding of an energized current transformer.
- This product should only be operated with CT secondary connections Earthed.
- 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



7.4 Mounting

