

**⚠ Danger and Warning**

The device may only be installed by professionals. Caused any malfunction due to not follow the instructions in this manual, Manufacturers will not bear any responsibility.

**⚠ Electric shock, burning and explosion**

- Devices can only be installed and maintained by qualified staff.
- Before any operation, the device should be isolated from the voltage input and power supply, and short circuit the secondary winding of all current transformers.
- Verify if the device is live before operation.
- All mechanical parts and covers should be restored in place before the device is energized.
- Device in use should be provided with the correct voltage.

*Not paying attention to these precautions may cause serious injury.*

**1. Outline**

**1.1. Function introduction**

KPM51 Single-phase smart power meter Integrates data acquisition and control, it can replace a variety of power meters, relays and other components, suitable for a variety of power system.

KPM51 single-phase smart power meter has RS485 communication interface, can be integrated into any power monitoring system, and we can conveniently achieve monitor and control purposes through the provided management software or other configuration software.

KPM51 single-phase smart power meter is a real measurement instrument based on real RMS, which can accurately measure highly nonlinear loads. The complex frequency-locked sampling technology enables it to accurately measure a variety of power parameters, accuracy is up to 0.2. Users can monitor all measurement data from a remote location on the display interface or using monitoring software.

KPM51 power meter has a variety of extended features to meet the needs of different sites. Flexible input/output configurations make it easy for users to design.

**In any case, the secondary side of the PT must not be short-circuited, and there must be a ground terminal in the secondary circuit of the PT. Otherwise, the component may be damaged or cause serious damage.**

**Current input:** In practical engineering applications, The current measuring circuit usually needs to install the current transformer CT, and the secondary current rating of the CT is 1A or 5A.

The choice of CT is very important, and it is related to the accuracy of many measurement parameters. CT accuracy is better than 0.5% and the capacity is not less than 3VA.

**In any case, the CT circuit is not allowed open circuit, and it is not allowed to install fuses and any form of switch in the CT circuit. In practice, the secondary circuit of the CT must be grounded.**

**Switching input:** KPM51 provides 2 switch input channels for detecting status information such as circuit breaker position signal and tool position signal.

**DC24V power supply:** is provided inside the device. When a digital input function is required at the site, the passive contact signal is externally connected. When the external contact is closed, the corresponding digital input status is also turned on.

**4.3 Output signal**

**Pulse output:** PUMG510 provides active/reactive energy metering, 1 channel active energy pulse output function, adopts optocoupler collector open circuit output, and the method of power quality verification refers to national measurement procedure: standard table pulse error comparison method.

**Electrical characteristics:** open collector voltage  $V_{CC} \leq 48V$ , current  $I_z \leq 50mA$

**Pulse constant:** 3200imp/kWh

**Analog output:** analog output 4mA corresponds to the lower limit of the range, 20mA corresponds to the upper limit of the range. When the range is exceeded, the transmission current increases linearly. The maximum effective output is 120% of the range, the maximum output current is 24mA, and the maximum load resistance is 400 ohms.

**Relay output:** KPM51 provides two relay action modes, the user needs to identify whether the relay is in remote control or local control. In different control modes, the relays operate differently.

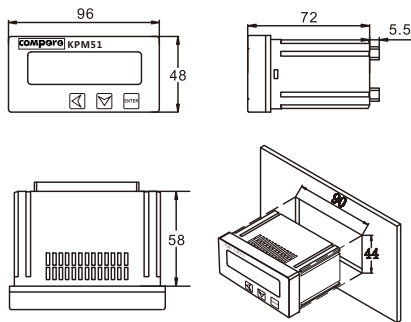
The factory default control mode of the relay is remote control, and the user can modify it to local control or remote control through communication.

**2. Technical parameters**

Working Power	AC 85~265VAC, DC 100~310VDC	
Voltage/Current Input	Rated	Voltage: AC100V, 220V Current: AC 1A, 5A
	Overload	Continuously: 1.2 times Instantly: 2 times/1s < 0.5VA
	Power Consumption	< 0.5VA
measurement accuracy	Voltage/Current: 0.2, Active power: 0.5; Reactive power: Level 1	
Display method	STN Section code LCD display, wide viewing angle, intuitively visible data	
Analog Output(Optional)	1way 4~20mA analog output, programmable selection of any variable	
Communication(Optional)	RS485 port, physical layer isolation, International Standard: MODBUS-RTU, 1200~19200bps	
Switch Input	2-way passive main line contact DI input, internal supply DC24V power source	
Relay Output(Optional)	2-way DO output. Contact capacity 250VAC/5A, 30VDC/5A	
Environment	Operating temperature: -10°C ~ +55°C, Storage temperature: -20°C ~ +75°C	
Electromagnetic Compatibility	Surge (Shock) Immunity	IEC61000-4-2, level 4
	Electrical fast burst immunity	IEC61000-4-5, level 4
	Electrostatic discharge immunity	IEC61000-4-4, level 4
	Shock wave immunity test (GB/T 17626.12-1998) Level3 RF electromagnetic radiation immunity test IEC61000-4-8, level 4	

**3. Installation & Wiring**

**3.1 Product size and installation instruction**



Dimensions (mm)	Mount Depth (mm)	Hole size (mm)
96x48	63.5	91x44

**Remote control:**

The relay is controlled by commands from the PC or PLC via communication.

**Local control:**

The relay is controlled by an electrical parameter inside the meter as a response to a set point control alarm condition. When the relay is in the remote control mode, even if the local control condition is reached, the relay cannot be operated and the relay must be set to the local control mode.

The two relays operate as follows

**Remote control:**

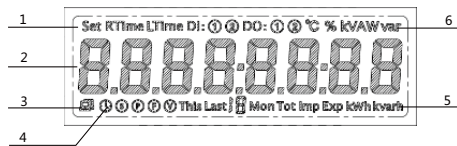
The relay closes by accepting a PC or PLC command. The relay status will remain until the PC or PLC issues a release command or the instrument loses power

**Local control:**

When the trigger relay's alarm signal is generated, the relay operates. The relay is not released until all the alarm conditions that triggered the relay have disappeared or the meter has lost power. If the meter resumes power and the alarm condition still exists, the relay will act again.

**5. Operating instructions**

**5.1. Interface display**



index	Display content	Detailed Description
1	Menu indication	Including: setting, running time, load time indication
2	Measurement data display area	Display main measurement data: voltage, current, power, power factor, power, frequency, temperature, parameter settings, etc.
3	Communication indication	If two small computers all faded, that there is no communication message; two small computers all show that the communication transceiver normal.
4	Time indication	Display when displaying time or time statistics
5	Power type	Display: Import electrical energy; export electrical energy; total electrical energy.
6	Electrical parameter unit symbol	voltage : V , kV ; current : A , kA ; active power : W , kW ; reactive power var , kvar ; Apparent power : VA , kVA ; temperature : °C

**5.2 operation display**

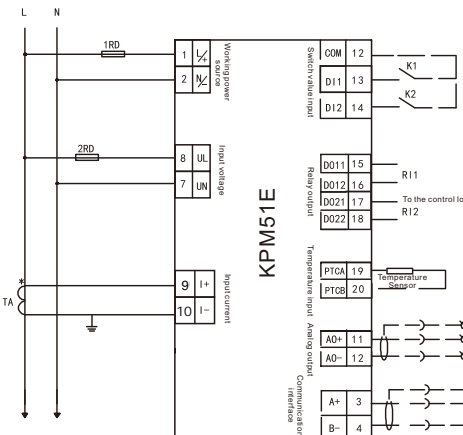
There are three touch keys on the front panel, the three keys are marked as key left [Left Arrow], key down [Down Arrow], key enter [Enter]. Through the operation of three keys can be achieved in different measurement data display and parameter settings.

**3.2 Terminal description**

11	12	13	14	15	16	17	18	19	20
AO+	COM/AO-	D11	D12	DO11	DO12	DO21	DO22	PTCA	PTCB
Analog output		Switch input		Relay output1		Relay output2		Temperature output	
1	2	3	4	5	6	7	8	9	10
L/+	N/-	A+	B-	P+	P-	UN	U	I+	I-
Working power		Communication		Pulse		Voltage input		Current input	

Terminal 12 is the common terminal COM of the digital input and the AO of the analog output.

**3.3 Typical wiring**



**4 Function instruction**

**4.1 Working power**

The auxiliary power supply for the meter is 85~265VAC (50/60Hz) or 100~310VDC so that the power supply can be supplied by an independent power supply circuit or can be obtained from the measured circuit. If the power quality of the power supply is poor or there is serious interference, it is recommended to install an isolation transformer or EMC filter in the power supply circuit.

**4.2 Input signal**

**Voltage input:** The input voltage should not exceed 120% of the rated input voltage, otherwise, the installation of PT should be considered. It is recommended to install a fuse (typically 1A250Vac) in the voltage input signal loop.

Key name	Functional description
Left key	Switching the display interface of the basic measurement parameters; in the parameter setting state, it is used to move the bit to be modified; long press the switch setting interface and the measurement parameter display interface
Down key	In the display state, it is used to cyclically display various electrical parameters. In the parameter setting state, it is used to increase the value of the modified bit.
ENTER	Enter the programming state; in the parameter setting state is used to enter the menu, programming parameters and confirmation.

In the normal electric parameter measurement state, press [Left Arrow] or [Down Arrow] to display the following parameters in turn.

- Voltage (V), Current (A), Active Power (KW)
- Reactive power (Kvar), apparent power (KVA), Power factor
- Frequency (Hz), Active Energy (KWh), Reactive Power (Kvarh)
- Temperature (°C) Working time load time
- Digital input Relay output

Press and hold the [Left Arrow] on the parameter measurement interface to enter the password input interface. The default password is 6666. After the password is entered, press [Enter] to confirm. If the input is correct, enter the parameter setting interface. If the input is wrong, return to the input password display surface. Press [Down Arrow] on the parameter setting interface to switch the parameter item to be modified. Press [Left Arrow] to enter the modification status of the parameter size, accompanied by the flashing of the modified character. After the modification is completed, press the [Enter] to confirm. You can modify the next parameter, or press and hold the [Left Arrow] to exit the modification state of the parameter and return to the measurement interface.

When the user does not press the button within 30 seconds of the parameter modification state, it will automatically return to the measurement display interface of the electric parameter.

**5.3 Factory default value**

Parameter	Character	Default value	Implication
Password protection	PASS	6666	Used to protect non-staff to modify instrument parameters
Transmitting project	An	Ua	U , I , P , Q , S , PF , F
Voltage ratio	Pt_U	1	Voltage transformer ratio (1~9999)
Current ratio	Ct_I	1	Current transformer ratio (1~9999)
communication address	Adr	1	The address of the meter when the network is in communication 1~247
Baud rate	bAUd	9600	Communication Baud rate 1200~19200bps
Data format	dAtA	81n	Data frame format : 8 data bits, one parity bit and one stop bit (81N,81E,81O)
Backlight lighting time	BLt	10	units : minute ; if set to 0, the backlight will never go out; set to other values, the last time after the delay set the time off (0~120).
Clearing power	cLR Eny	Cleared	Used to remove electrical energy parameters

## 6. Communication

KPM51 Single-phase smart power meter provides MODBUS-RTU communication protocol, one start bit, 8-bit data bits, 1/0 parity bit, 1/2 stop bits, each byte length of 11 bits.

Supported baud rates: 1200, 2400, 4800, 9600, 19200(bps).  
Factory default communication parameters: 9600bps, no parity, one stop bit.

RTU mode format for each byte:

1 start bit + 8 data bits + 1 parity bit + 1 stop bit

The format of the data frame is as follows:

Address field + Command field + Data field + CRC check area

Supported function codes			
DEC	HEX	Definition	Operation description
01	0x01	Read relay output	Read one or more relay outputs
02	0x02	Read switch input	Read one or more switch input
03	0x03	Read register data	Read the value of one or more registers
05	0x05	Write a single relay output	Control 1-way to close or disconnect the relay
16	0x10	Write multiple registers	Write multiple register data at a time

### 6.1 Relay output control and status reading

This area stores the relay status. The user can read the current status using the Modbus protocol 01H function code and use the function code 05H to control the output.

Address	Parameter	Numerical range	Data type	Read-write property
0000H	Relay1 (DO1)	1=ON, 0=OFF	Bit	R/W
0001H	Relay2 (DO2)	1=ON, 0=OFF	Bit	R/W

#### 6.1.1 Read relay output status (function code 01H)

Request data frame: Read the status of Relay1 or Relay2.

Addr	Fun	Start Reg hi	Start Reg lo	Reg Num hi	Reg Num lo	CR C16 hi	CR C16 lo
01H	01H	00H	00H	00H	02H	xxH	xxH

Response Data Frame: The slave responds to the host's data frame. Contains slave address, function code, data byte count, relay status data, and CRC error check. Each relay state in the packet occupies one bit (1 = ON, 0 = OFF), the lowest bit of the first byte is the relayed relay status value, the rest of the order to the high order, useless bits filled with 0.

Read the contents of the digital output status response example.

Addr	Fun	Byte count	Data	CRC16 hi	CRC16 lo
01H	01H	01H	03H	11H	89H

Data byte content (Relay1 and Relay2 are closed)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	0	0	0	1	1

#### 6.1.2 Relay control (function code 05H)

Note that the control relay 0x0000 is the relay separation, 0xFF55 relay closure

Addr	Fun	DO addr hi	DO addr lo	Value hi	Value lo	CRC 16 hi	CRC 16 lo
01H	05H	xx	xx	AAH	55H	xxH	xxH

Response data frame

Addr	Fun	DO addr hi	DO addr lo	Value hi	Value lo	CRC 16 hi	CRC 16 lo
01H	05H	xx	xx	FFH	00H	xxH	xxH

### 6.2 Read switch input status (function code 02H)

Query data frame: This function allows the user to obtain the status of the binary input DI ON / OFF (1 = ON, 0 = OFF). In addition to the slave address and the function field, the data frame needs to include the initial address and the number of DIs to be read in the data field. The address of DI in KPM51 starts at 0000H (DI1 = 0000H, DI2 = 0001H ... and so on).

The digital input terminal DI1 to DI2 correspond to Bit0 to Bit1.

The following example shows the state of the DI1 to DI2 read from the slave address 01

Addr	Fun	DI start reg hi	DI start reg lo	DI num hi	DI num lo	CRC 16 hi	CRC 16 lo
01H	02H	00H	00H	00H	02H	xx	xx

Response data frame: The response contains the slave address, function code, number of data, packet and CRC check, each DI in the packet occupies one bit (1 = ON, 0 = OFF). The lowest bit of the first byte is the addressed DI1 value, the other is followed by the higher order, and the useless bit is filled with 0.

The following table shows an example of the read digital input status (DI1=ON, DI2=ON) response.

Addr	Fun	Byte count	Data	CRC16 hi	CRC16 lo
01H	02H	01H	03H	E1H	89H

Data byte content (Relay1 is closed)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
0	0	0	0	1	0	1	1

## 6.3 System parameter read and write

This area stores system parameters related to equipment operation, including communication, voltage ratio, current ratio and other parameters. It can be read by Modbus protocol 03H function code or with 10H function code.

Address	Parameter	Data range	Type of data
0000H	Password	Used to protect non-staff to modify instrument parameters	Word
0001H	Communication Add.	MODBUS communication add:1~247	Word
0002H	Baud rate and check method	Baud rate (Bit0-7): 0:1200, 1:2400, 2:4800, 3:9600, 4:19200. Data format (Bit8-15): 0: 8,1,n 1:8,1,e 2:8,1,o	Word
0003H	Voltage ratio	( 1~9999 )	Word
0004H	Current ratio	( 1~9999 )	Word
0006H	Transmitter settings	Can be set: voltage, current, active power, reactive power, Apparent power, power factor, frequency.	Word
0007H	Backlight time	0~120 (minutes) 0: never go out	Word
000CH	Clear power	Command word 0x5578, immediately clear power	Word
000DH	Error indication	0: No fault 1: Faulty	Word

## 6.4 Basic measurement parameter area

Basic measurement area mainly measuring basic voltage, current, power, power factor Number.

The parameters of this area are real-time measurement parameters, which are read by Modbus protocol 03H function code, which is read-only data. The data format is floating point data, and the data in this area has been multiplied by the ratio, which is the real-time data of one measurement.

Address	Parameter	Type of data	Unit
0030H	Voltage U	Floating point number	V
0032H	Current I	Floating point number	A
0034H	System active power P	Floating point number	W
0036H	System reactive power Q	Floating point number	var
0038H	System apparent power S	Floating point number	VA
003AH	System power factor PF	Floating point number	
003CH	System frequency F	Floating point number	HZ
003EH	Active energy	Floating point number	KWH
0040H	Active energy	Floating point number	KvarH
0042H	Temperature	Floating point number	°C

## 7. Common malfunction analysis

- Nothing is displayed after the unit is powered on
  - Check if the supply voltage and other wiring are correct, also the supply voltage should be within the operating range
  - Turn off the device and the host computer, and then reboot
- The device is not working properly after power on
  - Turn off the device and the host computer, and then reboot
- Voltage or current readings incorrect
  - Check if the wiring mode setting matches the actual wiring mode
  - Check whether the voltage transformer (PT) and current transformer (CT) ratio are set correctly
  - Check if GND is grounded properly
  - Check if the shield is grounded
  - Check if the voltage transformer (PT) and current transformer (CT) are intact
- The power or power factor reading is incorrect, but the voltage and current readings are correct
  - Compare the voltage and current input of the actual wiring and wiring diagram, and check if the phase relationship is correct
- RS-485 communication is not working properly
  - Check whether the communication baud rate, ID and communication protocol

- settings of the host computer are consistent with the meter
- Please check the data bits, stop bits, parity settings and the host computer is consistent
  - Check if the RS-232 / RS-485 converter is working properly
  - Check if there are the problems in the entire communications network lines (Such as short circuit, open circuit, grounding, if the shield is properly grounded at one end, etc.)
  - Turn off the device and the host computer, and then reboot
  - If the communication line is longer, it is recommended to parallel connect a 100

~200Ω matching resistors at the end of the communication line

**Note: If there are any unsolved problems, please contact our company's after-sales service department.**

## 8 Contact details

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