Multi-function power meter

User 's Manual

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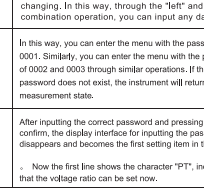
1. Summary

Programmable multi-functional power meter series (digital tube, LCD mode) mainly includes four common sizes of 96.80, 72 and 42, which can be widely used in power system, industrial and mining enterprises, public facilities and intelligent buildings. It can measure all commonly used power parameters, such as three-phase current, voltage, active power, reactive power, electric degree, etc. Because the power meter also has perfect communication networking function, so we call it network power meter. It is very suitable for real-time power monitoring system

2. Parameters

Function			specifications
		Connection	Three phase three wire,three phase four wire.
	V	Rated Value	AC 100V. 220V. 380V. (Please specify when ordering)
		Overload	Continuous 1.2 times instantaneous: 2 times / 10s
		Power Consumption	<1VA (each phase)
		impedance	>300kΩ
		accuracy	0.2 or 0.5 subject to the labeling
	A	Rated Value	AC1A. 5A (Please specify when ordering)
		Overload	Continuous 1.2 times instantaneous: 10 times / 10s
		Power Consumption	<0.4VA (each phase)
		impedance	<20mΩ
		accuracy	0.2 or 0.5 subject to the labeling
		Frequency	40~60Hz
		Power	Active and reactive power
		Electric energy	Four quadrant electric energy measurement, active power accuracy is 0.5%, reactive power is 1%
		display	Programmable settings. Switching. Cycle 3 rows of LED display
power		Operating range	AC. DC 80~270V
		Power consumption	≤1VA
Extended functions		Digital interface	RS485.MODBUS-RTU protocal
		Switch output	2 relay outputs 250VAC (5A) /30VDC (0.5A)
		Switch input	4-way dry contact switch input
		Transmit output	One channel 4-20mA analog output
environment		working environment	-10~55℃
		Storage environment	-20~75℃
safety		Withstand voltage	input and power > 2KV; Input and output > 2KV; Power supply and output > 1.5kV
		insulation	Input, output and power supply are more than 5m Ω
Electro Magnetic compatibility			●Electrostatic discharge immunity test: iec-61000-4-2 Grade 4; Test voltage: 8Kv ●Electrical fast transient burst immunity test: iec61000-4-4 Level 3 test voltage: input 1kV; Auxiliary power supply 2KV ●Surge (impact) immunity test: iec61000-4-5 level 4; Common mode 4KV voltage test

3. Dimensions and installation



Installation dimension：AxB
overall dimension：SxY
Panel size：LxH(mm)

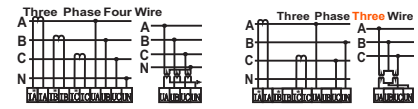
Panel size (LxH) Unit (mm)	Screen fitting size (AxB) Unit (mm)	Hole Opening size (SxY) Unit (mm)	Total length (N) (mm	Depth (M) (mm)
120 x 120	110 x 110	111x 111	99	85
96 x 96	91 x 91	92 x 92	99	85
80 x 80	75 x 75	76 x 76	95	85
72 x 72	66 x 66	68 x 68	95	85
48 x 48	44 x 44	45 x 45	99	85

Installation steps:

1) Remove the mounting card on side 2 from the device.

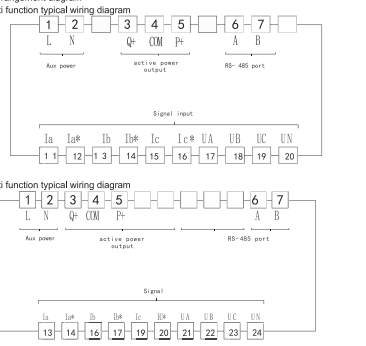
2) Open a hole corresponding to the opening size at the installation position. Insert the instrument into the hole, re install the mounting card on the device from the back and fasten it

4.Wiring and configuration



Terminal arrangement diagram

72Multi function typical wiring diagram



96Multi function typical wiring diagram

Wiring instructions:

a) It is necessary to ensure that the input voltage and current phase sequence are correct, and if not, the measurement data will be inaccurate. b) Voltage input: the input voltage shall not be higher than the rated input voltage of the product (100 V or 400 V),

Otherwise, PI should be considered. In order to facilitate maintenance, it is recommended to use wiring bar.

c) Current input: the standard rated input current is 5 A, and external CT shall be used for those with a value greater than 5A. If other instruments are connected to the CT used, the wiring shall be in series. Before removing the current input connection of the product, it is necessary to disconnect the primary circuit or short circuit of the CT, so it is recommended to use the wiring bar for maintenance.

Note: the specific wiring mode and technical parameters are subject to the product wiring diagram

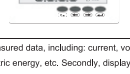
5.Display and operation guide

This section describes the human-machine interface of the instrument in detail, including data reading, setting relevant parameters and local operation

5.1 Digital LED screen display

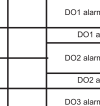
The panel of the instrument is composed of three rows of nixie tubes and four buttons, with intuitive display and simple operation

The right figure shows the contents of the instrument panel. The following table is a description of the display.

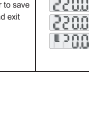
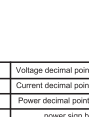
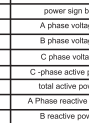
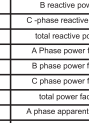
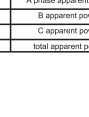


1	Full screen digital tube LED	Mainly display the measured data, including: current, voltage, power, power factor, frequency, electric energy, etc. Secondly, display parameters and local operation
2	Unit indicator	When the K light is on, the unit of voltage is kV, and so on
3	Unit prompt of measurement data	Voltage unit v. current unit A. power unit W Var
4	4 operation keys	Four keys can be used to switch display data or set instrument data
5	Data symbol indication	When the power or power factor is displayed, if the corresponding data is negative, the corresponding indicator lights up
6	Displays the instructions for the items	When V is on, it means that the displayed data is three-phase voltage; When a is on, it means that the displayed data is three-phase current; reason by analogy

5.2 LED digital tube display measurement status data reading

PAGE	Content	Instructions
Voltage display		The voltage ua.ub.uc (three-phase four wire) and uab.ubc.uca (three-phase three wire) are displayed respectively, in V and kV when k is on. In the left figure, UA = 220.0 v. Ub=220 .1 V. Uc=220 .3 V Stay In this page, press and hold the Enter key to switch the display line voltage or phase voltage.

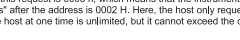
5.2LED Digital tube display measurement status data reading

Page	Instructions	
Volt display		The voltage ua.ub.uc (three-phase four wire) and uab.ubc.uca (three-phase three wire) are displayed respectively, in V and kV when k is on. In the left figure, UA = 220.0 v. Ub=220 .1 V. Uc=220 .3 V. stay In this page, press and hold the Enter key to switch the display line voltage or phase voltage
Current		The three-phase current ia.ib.ic is respectively displayed in a, and Ka when k is on. In the left figure, IA = 500.0a. Ib=500 .1 A. Ic=500 .2 A.
Power display		The total active power, total reactive power, total power factor, active power and reactive power are respectively displayed in W. VaR and kW. KVA when k is on. In the left figure, P = 1.650kw, q = 2.58kvar, power factor is 0.501. Press enter.
Positive active energy display		Display positive active power value, the second row of nixie tube is high 4 bits, the third row of nixie tube is low 4 bits, forming an 8-bit value. The left figure shows that the value of active electric energy is 20368.7kwh. If m light is on, it means the unit of electric energy is MWh. At this time, press the OK key to display EPE and reverse active electric energy.
Positive reactive energy display		Display positive reactive energy value, the second row of nixie tube is high 4 bits, the third row of nixie tube is low 4 bits, forming an 8-bit value. The figure on the left shows that the reactive energy value is 234.67kvarh. If m light is on, it means that the unit of electric energy is mvarh. At this time, press the OK key to display EQC and reverse reactive energy.
Frequency display		It shows the system frequency, which is now 50.02 Hz.

5.3 Parameter setting operation

After the instrument is powered on, it will enter the normal measurement state. Sometimes, it is necessary to set the instrument parameters according to the site conditions, such as voltage ratio, current ratio and communication address. At this time, these data must be set through key operation

The four buttons below the instrument panel from left to right are as follows:



Set key: press the key to cancel the operation or select the operation function or return to the previous menu;
Left key: press the key to change the flashing bit when modifying data;

Right button: press the key to change the nixie tube data between 0-1 when modifying the data; Enter key: press the key to confirm the function or enter the next level menu;

When changing the parameters of the instrument by pressing the key, you need to enter a simple password to enter it, so that you can prevent the accidental touch of the key on site from changing the setting data of the instrument. You can enter different menus by inputting different passwords, and the items set in each menu are different. The items that can be set are indicated by the specific characters displayed on the first or third line of nixie tube. Sometimes these characters are not very intuitive, and you need to carefully "operate the character description" table.

Led Digital tube display	Explanation of meaning	LED Digital tube display	Explanation of meaning
0000	password	Pt	Input voltage ratio
3P3L	Three phase three wire network	3P4L	Three phase four wire network
Ct	Input current ratio	Addr	Communication address
obj	object	An	Analog quantity
HZ	Frequency	EPt	Positive active energy
EP-	Negative active energy	EPL	Forward reactive energy
Eq-	Negative reactive energy	yES	yes
yES	preservation	No	no

The most common parameters need to be set are voltage ratio, current ratio, wiring mode and communication address. The following is a specific column to illustrate the operation steps

operation	display	explanation
When the instrument is in the measuring state, press the "set" key once.	CodE 0000	Prompt to enter the password, at the same time, the third line displays 0000. By continuously pressing the "left key", the data of flashing bit is constantly switched between individual bit and ten bit. If you press the "left key", the blank bit is constantly changing. In this way, through the "left" and "right" combination operation, you can input any data.
Change the password to 0010 through the combination of "left" and "right"	CodE 0011	In this way, you can enter the menu with the password of 0001. Similarly, you can enter the menu with the password of 0002 and 0003 through similar operations. If the password does not exist, the instrument will return to the measurement state.
Press enter to confirm the password and enter the menu	SEt	After inputting the correct password and pressing enter to confirm, the display interface for inputting the password disappears and becomes the first setting item in the menu 。 Now the first line shows the character "PT", indicating that the voltage ratio can be set now.

➢ Select the setting item in the menu

There can be several setting items in a setting menu, which can be selected by pressing "left" or "right" button separately.

operation	Display	Explanation
Enter the menu with password 0002 and display the first item in the menu.	InPt PT	The first line character "PT" indicates that it is the item to set the voltage ratio. Voltage transformation ratio is the ratio of primary side voltage to secondary side voltage. If the primary side voltage is 10 kV and the secondary side voltage is 100 V, then Pt = 10 kV / 100 V = 100
Press the Right click to switch to the next setting item.	InPt Ct	The first line character "CT" indicates the item of setting current ratio. Current ratio is the ratio of primary current to secondary current. If the primary current is 600 a and the secondary current is 5 A, then CT = 600 A / 5 a = 120
Press the Right click to switch to the next setting item.	InPt nEt	The first line character "line" indicates the item to set the wiring mode. There are two connection modes: "3p4l" (three-phase four wire), "3p3l" (three-phase three wire).
Press the Right button click to switch to the next setting item.	Addr	The first line character "addr" indicates the communication address of the instrument in the communication state, and the address value is set according to the actual situation.
Press the Right button click to switch to the next setting item.	CLrE	The first line of character "clre" indicates the item of electric energy, which can be cleared according to the actual situation.
If you continue to press the "right" button, the project will switch to the state of setting "PT".	InPt PT	Through the "left button" or "right button", you can switch between these items until you select the desired setting item.

➢ Setting parameters for a specific project

Through the above two steps, we can enter the menu and select a specific item. The following describes how to set the parameters of the corresponding item. The following example is to modify the current ratio and wiring mode, and other parameter settings are similar.

operation	display	explanation
Enter the menu with code 0010, press "left" or "right" to switch to modify the current ratio "CT" item	InPt Ct	The first line character "CT" indicates the item of setting current ratio.
Press enter button for one time	InPt Ct 0001	After pressing "enter", the third row displays the current CT value, and the last data is flashing. This data can be modified at this time.
Through the combination operation of "left key" and "right key", change the data to the desired data.	InPt Ct 0120	Change the number in the third row to the data you want. If the primary current is 600 a and the secondary current is 5 A, then CT = 600 A / 5 a = 120
Press enter to confirm the current change.	InPt Ct	Press enter to confirm the current change. At this time, the data of CT will be changed to 120, and the data of the third line will disappear. You can select other items to modify.
Set the voltage ratio and communication address. After the operation, select the setting wiring mode item.	InPt nEt	Similarly, we can set the voltage ratio and communication address. The setting method of these parameters is the same as the setting method of current ratio in the previous example, which will not be repeated here.
Press the enter key	InPt nEt n34	After pressing "enter", the third line shows the current wiring mode "3p4l", which means three-phase four wire system, The data in the third line is flashing, which means it can be modified.

➢ Select the setting item in the menu

There can be several setting items in a setting menu, which can be selected by pressing "left" or "right" button separately.

operation	display	explanation
Press right key	InPt nEt n34	Press the Right key to select the actual wiring mode, as shown in the figure. Now "3p3l" means three-phase three wire system.
Press right key	InPt nEt	Press "enter" to confirm the selected wiring mode, then the third line of data disappears and returns to the state of optional setting item.

➢Exit the menu and save the data

Through the previous three steps, you can enter the menu and select an item to set its parameters. After setting all the items to be set, you need to exit the menu correctly and save the set data.

operation	display	explanation
For example, after setting the parameters, stay in the connection mode item.	InPt	For example, after setting the parameters, stay in the connection mode item (you can also stop in other settings). At this time, there is no data in the third line. In this state, you can exit the menu.
Press the set key	SAVE YES	After pressing the "se t" key (be careful not to press it repeatedly), the first line shows "sav e" meaning to save, and the third line shows "yes" and flashes
Press enter to save the data and exit the menu.	2200 2200 3200	Press "enter" once to save the data and exit the menu. The instrument will run according to the newly set data. The set new data will always be valid unless it is reset. If the "se t" key is pressed, the data will not be saved and the menu will exit, and the instrument will operate according to the original data. Parameters can be set repeatedly.

6、Communication Guide

The instrument provides serial asynchronous half duplex RS 485 communication interface and adopts Modbus RTU protocol. This section mainly describes how to use software to operate the instrument through communication port.

➢Agreement overview

Modbus communication protocol is a common communication protocol, master-slave reply connection (half duplex). The master station (such as PC) sends a signal to address a terminal device (such as em600). The addressed terminal device sends a response signal to the host. The information transmission is asynchronous and takes byte as unit. The word format of the instrument is "one start bit, eight data bits, no parity check bit, one stop bit". The setting of communication software should be consistent with the setting of the instrument. The communication baud rate of the instrument is 9600 BPs, and the communication address of the instrument can be set arbitrarily.

The query message frame of host query includes device address code, function code, data information code and check code. The address code indicates the slave device to be selected; The function code tells the selected slave what function to perform; The data segment contains other additional information about the function to be performed by the slave device. For example, in the read command, the additional information of the data segment includes the register from which to read and the number of registers to read; The check code is used to verify the correctness of a frame of information, and provides a method for the slave device to verify whether the message content is correct. It adopts the calibration rules of CRC 16.

Data query application details

When the slave responds, if the slave generates a normal response, there are slave address code, function code, data information code and CRC 16 check code in the response message. The data information code includes the data collected from the device, such as register value or status. If an error occurs, we agree that the slave will not respond.

The upper computer software can send commands to the instrument, requiring the instrument to return specific data to achieve the "remote signaling" function.

The following example reads the data of three voltages of the meter with address 01. (hexadecimal data)

01H	03H	00 H	02H	00H	03H	A4H	OBH
Instrument address	Operation command	Register address H	Register address low	Request word length	Request word length	CRC code low byte	CRC code height byte

Note: 1. The operation command can be 03 h or 04 h, both of which are the commands to return data;

2 register address 0002 h, which indicates the address of UA voltage in this instrument. Then there is the address information table of the instrument, according to which the register address data of each communication can be determined;

3 the length of "word" in this request is 0003 h, which means that the instrument is required to return data of three consecutive "words" after the address is 0002 H. Here, the host only requests 3 data, and the number of data requested by the host at one time is unlimited, but it cannot exceed the defined address range.

▮ Response data frame

01H	03H	06H	08H	97H	08H	98H	08H	99H	EOH	06H
Instrument address	Operation command	Returned Number of bytes	Data 1 High position of	Data 1 The low position of	Data 2 High position of	Data 2 The low position o	Data 3 High positio n of	Data 3 The low position o	CRC code Low byte	CRC code High byte

This returns the data representation

UA=0897H=2199V，UB=0898H=2200V，UC=0899H=2201V

Response data frame

The data returned by the instrument needs to be calculated according to a certain relationship to get the actual data.

The correspondence between the communication value and the actual value is shown in the table below (Val t is the communication value and val s is the actual value)

Applicable paramet ers	Correspondence	Unit
Volt Value UA、UB、UC	Val _ s=Val _ t/10*PT	V
Current Value IA、IB、IC	Val _ s=Val _ t/1000*CT	A
Each phase power value PA、PB、PC、QA、	Val _ s=Val _ t/10*PT*CT	Watt, VaR, VA
Total power valuePS、QS、S	Val _ s=Val _ t*PT*CT	Watt, VaR, VA
Primary value of electrical measurement	Val _ s=Val _ t	Kilowatt hour
Power factor value PFA、PFB、PFC、PFS	Val _ s=Val _ t/1000	No unit
FREQUE NCY FR	Val _ s=Val _ t/100	(Hz)

address (HEX)	project	describe	Data Format	Data length (byte)	illustrate
0000	MM	programming password	BCD	2	2 Byte 1 ~ 9999
0001	DZ	Instrument address	char	1	1 byte, 1 ~ 254
	TXK	communication control word	char	1	See bit address description
0002	XS1	Power Display Selection	char	1	reserve
	SRS	Wiring mode selection	char	1	See bit address description
0003	PT	Voltage multiplier	uInt16	2	PT= Voltage 1 Second test /2 Subtest (1~ 9999)
0004	CT	Current rate	uInt16	2	CT= Current 1 Second test /2 times test (1~ 9999)
0005		DO1 alarm parameters	uInt16	2	Parameter description see appendix 1
0006		DO1 alarm type	char	1	
0007		DO2 alarm parameters	uInt16	2	
		DO2 alarm type	char	1	
0008		DO3 alarm parameters	uInt16	2	
0009		DO3 alarm type	char	1	
000A		DO4 alarm parameters	uInt16	2	
		DO4 alarm type	char	1	
000B		AO1 alarm parameters	uInt16	2	Parameter description see appendix 2
000C		AO2 alarm parameters	uInt16	2	
000D		AO2 alarm type	char	1	
000E		AO3 alarm parameters	uInt16	2	
000F		AO3 alarm type	char	1	
0010		AO4 alarm parameters	uInt16	2	
		AO4 alarm type	char	1	
0011-0020		reserve		32	
0021	DIO/Info	switch information	char	1	Switch output status byte
			char	1	Switch input status byte
0022		reserve		2	

0023	DPT	Voltage decimal point position	char	1	the description of voltage, current and power parameters
	DCT	Current decimal point position	char	1	
0024	DPQ	Power decimal point position	char	1	
	SIGN	power sign bit	char	1	
0025	Ua	A phase voltage	uInt16	2	
0026	Ub	B phase voltage	uInt16	2	
0027	Uc	C phase voltage	uInt16	2	
0065-0066	PC	C -phase active power	float	4	Voltage unit V,Current unit A, Active power unit Wh, Reactive power unit varh,Apparent power unit VA
0067-0068	P.S.	total active power	float	4	
0069-006A	QA	A Phase reactive power	float	4	
006B-006C	QB	B reactive power	float	4	
006D-006E	QC	C -phase reactive power	float	4	
006F-0070	QS	total reactive power	float	4	
0071-0072	PFA	A Phase power factor	float	4	
0073-0074	PFB	B phase power factor	float	4	
0075-0076	PFC	C phase power factor	float	4	
0077-0078	PFS	total power factor	float	4	
0079-007A	SA	A phase apparent power	float	4	
007B-007C	SB	B apparent power	float	4	
007D-008E	SC	C apparent power	float	4	
007F-0080	SS	total apparent power	float	4	