PA19 Series Digital Display AC Ammeter

User's Manual

The manual is applied to the following models：

PA194I-2X1/3X1/5X1/AX1/9X1/DX1

PA194I-2K1/3K1/5K1/AK1/9K1/DK1

PA194I-2X4/3X4/AX4/9X4/DX4

PA194I-2K4/3K4/AK4/9K4/DK4

PA194I-5XY1/AXY1/9XY1/DXY1/9XY3/AXY3

PA194I-5KY1/AKY1/9KY1/DKY1/9KY3/AKY3

PA194I-2S1/2S1T/5S1/AS1/9S1/9S1J

PA194I-5SY1/ASY1/9SY1

PA194I-2S4/2S4T/AS4/9S4/9S4J/9S4T/9S4K

PA194I-ASY3/9SY3

PA194I-2D1/2D4/2D4T/9D1/9D4/9D4T

SFERE

CONTENT

1. Safety Instruction

Thank you for choosing the meter researched and developed by Jiangsu Sfere Electric Co., Ltd. In order to ensure you to be convenient to purchase and use the meter safely, correctly and efficiently, please read this instruction carefully before using it, and make sure of paying attention to several points as follows:

◆ Make sure only the qualified technicians perform the installation and maintenance

◆ Before performing external or internal operation of the meter, make sure the input signal and power supply are switched off.

◆ The proper voltage detect device shall always be used to check there is no voltage in every part of meter.

◆ The electrical parameter supplied to the meter should be within the rated range.

The following conditions may result in damage or abnormal operation to the device

◆ The voltage of auxiliary power supply goes beyond the range;

◆ The frequency of power grid goes beyond rated range

◆ Connecting terminal wires without following the requirements.

2. Product instruction

2.1 Overview

PA19 series digital display ammeters are used to measure single phase or three phase AC current in low voltage distribution system. They are equipped with analog output, relay output, digital input and communication supporting Modbus-RTU protocol. Their transmitting ratio also can be changed through programming. There are different choices of outline size for this kind of meters. So they are suitable to replay analog pointer ammeters.

This series digital display AC voltage meters have high environment adaptability because their working temperature range is -40~70℃ and EMC better than III level.

They can be applied in control systems, distribution automation systems, industrial automation systems and intelligent buildings.

PA194I-□X□：Measurement

PA194I-□K□：Measurement & communication & analog output

PA194I-□S□：Measurement & communication & digital input & relay output & analog output (optional)

PA194I-□D□：Measurement & communication & analog output

2.2 Model selection

Model	Phase	Display	Communication	Analog output	Digital input	Relay output	□ outline code					
							2	3	5	9	A	D
PA194I-□X1	single phase	LED	-	-	-	-	■	■	■	■	■	■
PA194I-□XY1		LCD					-	-	■	■	■	■
PA194I-□X4	single phase	LED	-	-	-	-	■	■	-	■	■	■
PA194I-□XY3		LCD					-	-	-	■	■	-
PA194I-□K1	single phase	LED	1	1	-	-	■	■	■	■	■	-
PA194I-□KY1		LCD					-	-	■	■	■	-
PA194I-□K4	single phase	LED	1	1	-	-	■	■	-	■	■	-
PA194I-□KY3		LCD					-	-	-	■	■	-
PA194I-DK	singl	LED	1	-	-	-	-	-	-	-	-	■

1	e											
PA194I-DK 1B	phas e		-	1			-	-	-	-	-	■
PA194I-DK Y1		LCD	1	-			-	-	-	-	-	■
PA194I-□D4 (T)	singl e phas e	LED	1	3	-	-	■	-	-	■	-	-
PA194I-□D1	singl e phas e	LED	1	3	-	-	■	-	-	■	-	-
PA194I-□S 1	singl e phas e	LED	1	-	4	2	■	-	■	■	■	-
PA194I-□S Y1		LCD					-	-	■	■	■	-
PA194I-9S 1J		LED			-							
PA194I-□S 4	singl e phas e	LED	1	-	4	3	■	-	-	■	■	-
PA194I-9S 4J		LED			-	3						
PA194I-9S 4K		LED			4	-						
PA194I-9S 4T		LED			4	3						
PA194I-□S Y3		LCD			4	3	-	-	-	■	■	-

Note:

1. AS4,AS1,ASY3 and ASY1 only have 2 digital inputs and 2 relay outputs;

2. Numbers in the blank indicate channels of corresponding functions;

3. ■ means the corresponding outline is available.

3. Installation and wiring

3.1 Outline dimension

Outline code	Pointer meter model	Panel（mm^2）	Cut-out（mm^2）	Installation depth（mm）
2	42 square type	120×120	111×111	55.5/76
3	6 square type	83×83	76×76	75
9	9 square type	96×96	91×91	75/98
A	61 square type	74×74	67×67	75/90
5	5 slot type	96×48	91×44	68.5/82

3.2 Installation method

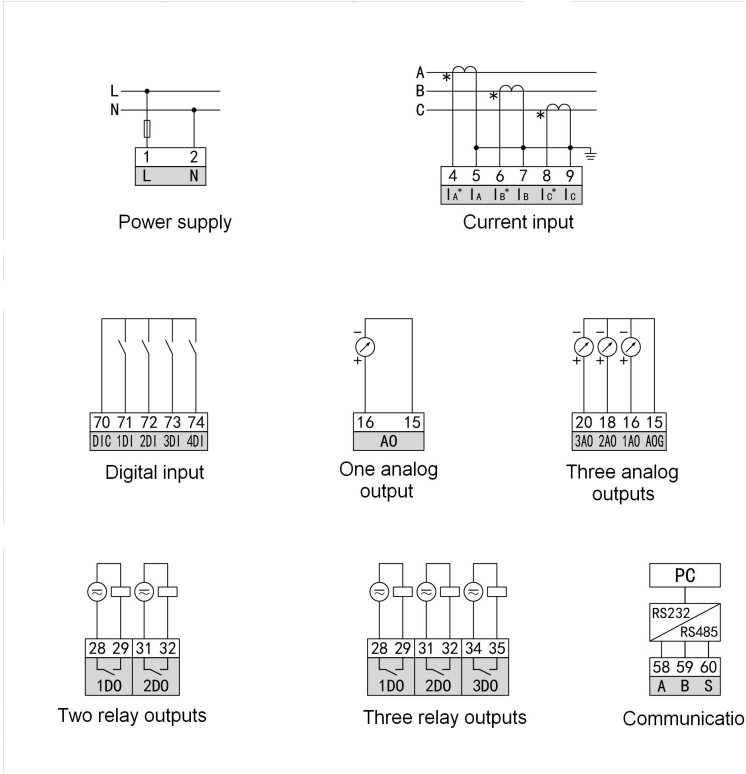
1) On the fixed distribution electric cabinet, choose a suitable place for cutout by size of cut-out;

2) Take off the fixed clip of meter.

3) Insert the meter into the cutout.

4) Push the fixed clip to fix the meter.

3.3 Wiring diagram



Note: upper diagram is for the meters with all functions. If a meter only has some of the functions shown in upper diagram, please refer to the wiring diagram on the case of that meter.

Wiring instruction:

1. Current input: make sure that input current is not larger than rated current, otherwise, please connect CT to meter. For user's convenience, please adopt wiring terminal row.

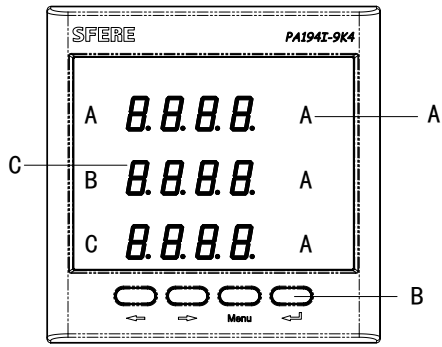
2. Make sure current of three phases corresponding to each other, that means the phase sequence and direction are same.

3. The actual wiring method should be the same with the inner wiring method of the meter.

4. Power supply: AC/DC (80～270)V. User can choose fuse with max. rated current 0.25A.

4. Operation

4.1 Panel instruction



A: Unit and signs

B: Button

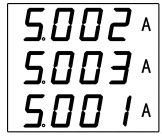
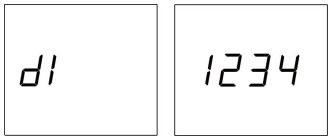
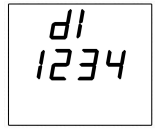
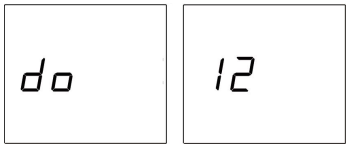
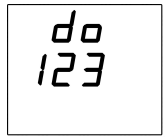
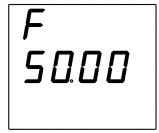
C: Measured value display

PA194I-9K4 panel

4.2 Display

Measurement display interfaces show measured data of current, frequency, digital input and relay output. User can press ◄ or ► button to switch between different interfaces in a cyclic order.

Main measurement display interfaces are as follows：

Single phase ammeter	Three phase ammeter	Instruction
		Current display interface In single phase ammeter：I＝300.0A； In three phase ammeter：Ia=5.002A， Ib=5.003A， Ic=5.001A
		Press ⬅ or ➡ button to switch to digital input interface.
		Press ⬅ or ➡ button to switch to relay output interface.
		Press ⬅ or ➡ button to check frequency data. In left two pictures, F＝50.00Hz.

Notice:

If some information does not exist or relative information does not work, it means that meter does not have relative function.

5. Setting

There are reading and programming modes in the meter.

5.1 Reading mode

In measurement display interface, keep pressing Menu button for more than three seconds until rEAd appears, then press ↵ button to enter system parameter checking interface. In this interface, the parameters only can be read.

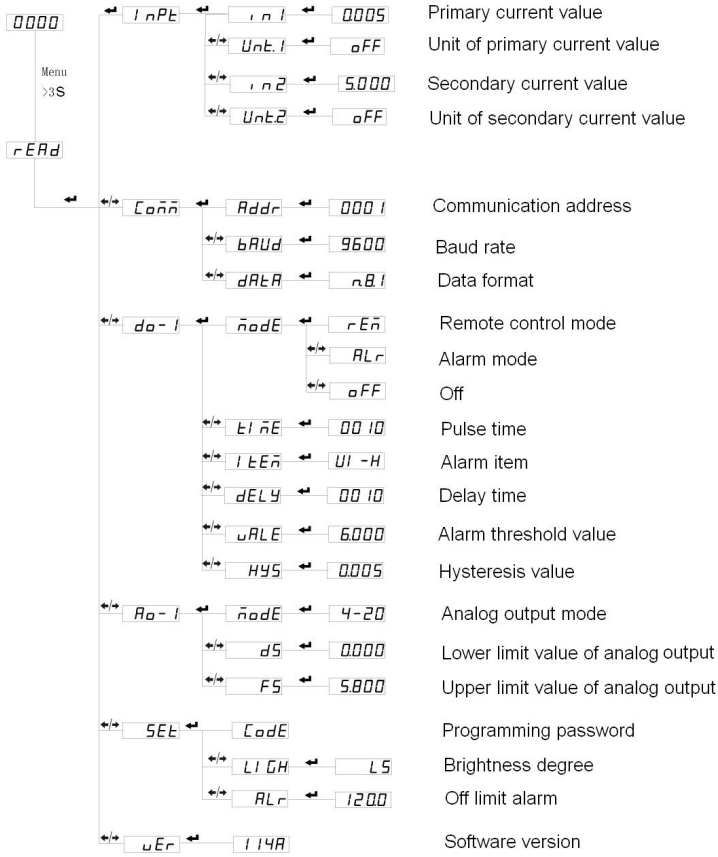


Figure 1. System parameter checking interface of single phase ammeter

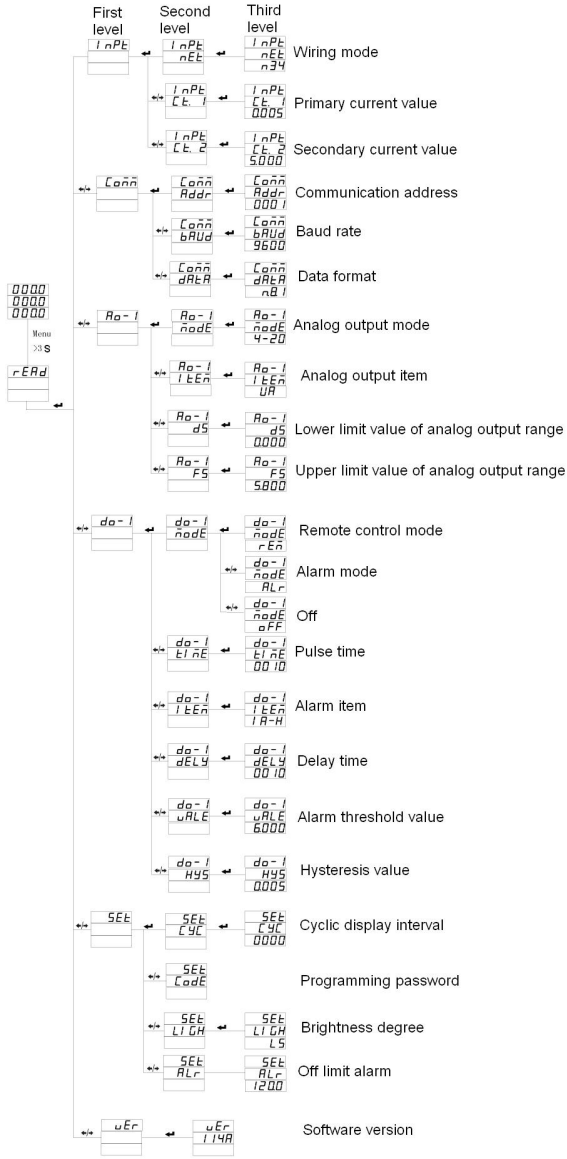


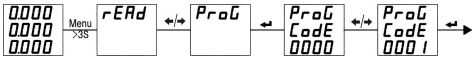
Figure 2 System parameter checking interface of three phase ammeter

Note: display interfaces are slightly different in different models of meters.

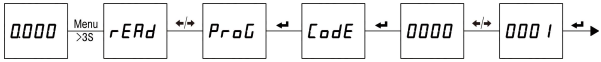
5.2 Programming mode

In measurement display interface, keep pressing Menu button for more than three seconds until rEAd appears, then press ← or → button to switch to ProG. Now press ↵ button to enter program password interface. Press ← or → button to input password (defaulted 0001), and then press ↵ button to enter setting menu. (Note: if the password is not right, Err will appear. Then it returns to program password interface after seven seconds.)

The method of entering setting menu of three phase ammeter is as follows：



The method of entering setting menu of single phase ammeter is as follows：



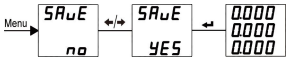
If the parameters of third level data are modified, please press ↵ button to save the modified data and return to secondary level. If user press Menu button, the modified data will not be saved.

If user wants to exit program setting interface, please return to first level of program setting interface, then press SAvE--no, now there are two choices available:

（1）Press ↵ button to exit program setting interface without saving modified data;

（2）Press ← or → button to switch to SAvE--YES, then press ↵ button to exit program setting interface and save modified data.

The method of saving modified data and exiting setting interface of three phase ammeter is as follows：



The method of saving modified data and exiting setting interface of single phase ammeter is as follows：

Setting menu instruction：

First level			**Second level**		**Third level**	
Letter	Instruction		Letter	Instruction	Letter/number	Instruction
InPt	Input	Single Phase	in 1	Primary value of voltage	0000～9999	0～9999
			Unt.1	Primary unit of voltage	oFF or on	Unit oFF means A on means kA
			in 2	Secondary value of voltage	0000~9999	0～9999，（User can not set this）
			Unt.2	Secondary unit of voltage	oFF or on	Unit（User can not set this） oFF means A on means mA
		three phase	CT. 1	Primary value of voltage	0000~9999	Unit kA
			CT. 2	Secondary value of voltage	0000~9999	Unit A（User can not set this）
Con1	Communication		Addr	Meter address	0001~0247	1～247
			bAUd	Baud rate	2400~9600	2400～9600bps
			dAtE	Data format	n8.1	No check one stop bit
					n8.2.	No check, two stop bits
					o8.1	Odd check, one stop bit
					E8.1	Even check, one stop bit
do-1 do-2 do-3	Alarm setting		nodE	Relay mode	ALr	Alarm
					rEn	Remote control
					oFF	Off
			tIME	Relay pulse time	0000~9999	Unit 0.1s
			ItEn	Alarm item	Un-H,I--L etc.	See alarm item setting

		dELY	Relay delay	0000~9999	Unit 0.1s
		uALE	Alarm limit value	0000~9999	Set off limit alarm value (secondary value)
		HYS	Hysteresis value	0000~9999	Set hysteresis value (secondary value)
Ao-1 Ao-2 Ao-3	Analog output setting	mode	Analog output mode	0-20	0～20mA
				4-20	4～20mA
				0-5	0～5mA
				0-5u	0～5V
				1-5u	1～5V
				0.10u	0～10V
		ITEM	Analog output item	UA, IA etc.	see analog output item setting
		dS	Lower limit value of analog output	0000~9999	0≤DS≤0.5*a a: secondary rated value (FS-DS)≥500
		FS	Upper limit value of analog output	0000~9999	0.5*a≤FS≤1.2*a a: secondary rated value (FS-DS)≥500
SEt	System parameter	CYC	Cyclic display period	0000~9999	0~60s
		CodE	Password	0000~9999	Setting password
		LIGH	Brightness	L1~L5	L1 ～ L5, lower to higher brightness degree
		ALr	Flashing alarm	0000~1200	Flashing alarm range is between 30.0 and 120.0% of rated value. 0.0% means this function is off.

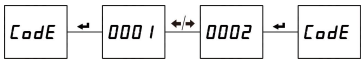
5.3 System setting

E.g. set password to be 2, change cyclic display period to be 3s, choose brightness degree to be L5, and select flashing alarm value to be more than 120% of rated value.

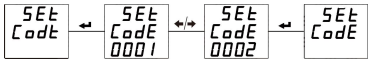
Enter setting interface, press ◄ or ► button to select SEt, then press ↵ button to enter system setting menu. Now press ◄ or ► button again to select specific items and press ↵ button again.

※Set password

Single phase ammeter：

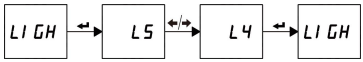


Three phase ammeter：

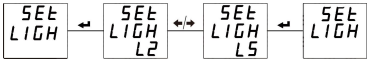


※Choose brightness degree

Single phase ammeter：

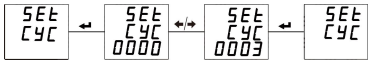


Three phase ammeter：



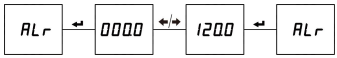
※Change cyclic display period

Three phase ammeter：

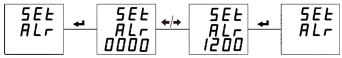


※Select flashing alarm value

Single phase ammeter：



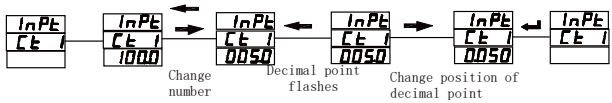
Three phase ammeter：



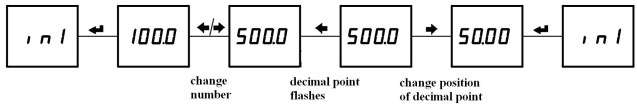
5.4 Input setting

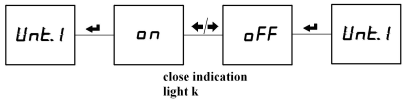
User can change input signal according to actual situation in field. Unit of primary value is A. E.g. set input signal as AC50A/5A (user can not change secondary value 5A). First enter setting menu, second press ◄ or ► button to select InPt, third press ↵ button to enter input signal setting menu. Now press ◄ or ► button again to select specific items and press ↵ button again.

Three phase ammeter：



Single phase ammeter：



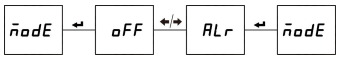


5.5 Relay output setting

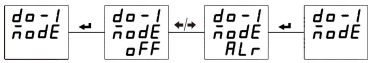
User can change first relay from off to alarm mode, alarm activates after 5 seconds when Phase A current is bigger than 6.000A with hysteresis value of 0.005A. First enter setting interface, second press ← or → button to select do-1, third press ↵ button to enter relay output setting menu. Now press ← or → button again to select specific items and press ↵ button again.

※Set alarm mode

Single phase ammeter：

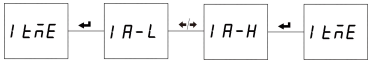


Three phase ammeter：

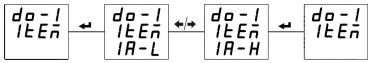


※Set alarm item

Single phase ammeter：

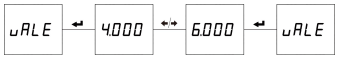


Three phase ammeter：

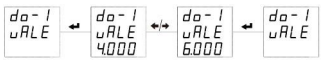


※Set alarm current value

Single phase ammeter：

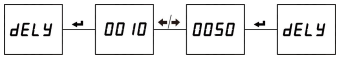


Three phase ammeter：

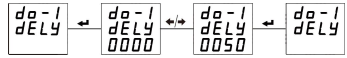


※Set relay delay time

Single phase ammeter：

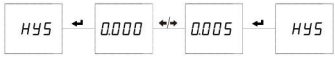


Three phase ammeter：

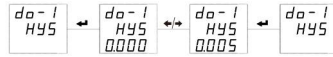


※Set hysteresis value

Single phase ammeter：



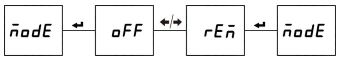
Three phase ammeter：



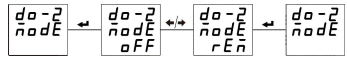
User can change second relay from off to remote control mode, and set remote control pulse time to be 5 seconds. First enter setting interface, second press ◄ or ► button to select do-2, third press ↵ button to enter relay output setting menu. Now press ◄ or ► button again to select specific items and press ↵ button again.

※Set remote control mode

Single phase ammeter：

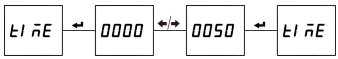


Three phase ammeter：

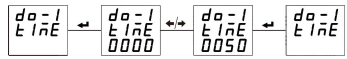


※Set relay pulse time

Single phase ammeter：



Three phase ammeter：

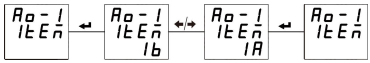


5.6 Analog output setting

E.g. set first analog output as phase A current 0～ corresponds to 4～20mA output. First enter setting menu, second press ◄ or ► button to select Ao-1, third press ↵ button to enter analog output setting menu. Now press ◄ or ► button again to select specific item and press ↵ button again.

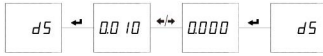
※Analog output item

Three phase ammeter：

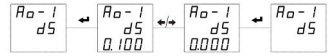


※Set lower limit value of analog output

Single phase ammeter：

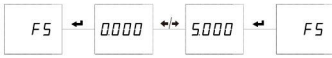


Three phase ammeter：

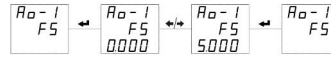


※Set upper limit value of analog output

Single phase ammeter：



Three phase ammeter：



Note：1）User can not set analog output mode such as 4～20mA；

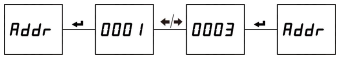
2）Analog output item of single phase ammeter is defaulted to be current. User can not change it.

5.7 Communication setting

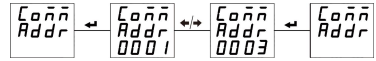
E.g. set communication address to be 3, select baud rate as 9600bps, choose data format as no check mode. First enter setting menu, second press ⬅ or ➡ button to select Conn, third press ↵ button to enter communication menu. Now press ⬅ or ➡ button to select specific items and press ↵ button again.

※Set communication address

Single phase ammeter：

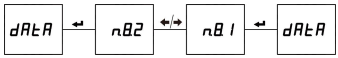


Three phase ammeter：

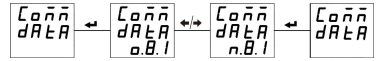


※Set data format

Single phase ammeter：

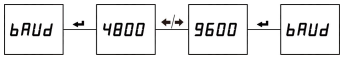


Three phase ammeter：

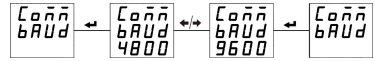


※Set baud rate

Single phase ammeter：



Three phase ammeter：



6. Common problems and troubleshooting

6.1 About communication

The meter does not send data back

First make sure the communication setting information of the meter such as subordinate machine address, baud rate and check mode corresponds to the requirements of host computer. If several meters on spot do not send data back, please check whether the communication bus on spot is connected correctly and whether RS485 converter working normally.

If there is only one meter or a few meters communicate abnormally, related communication bus is also needed to be checked. You may check whether there is an error in the host computer by exchanging the subordinate machine addresses of normal meter and abnormal meter. Besides you may check whether there is a fault in the meter by exchanging the installation positions of normal and abnormal meters.

The data sent back by the meter is incorrect

Communication data which is opened to users includes primary grid float type data and secondary grid int/long type data. Please read the instruction for data storage address and format in communication address table carefully, and make sure to transmit data according to relative format.

It is suggested to download testing software MODSCAN32 for checking MODBUS-RTU communication protocol from our homepage. This software adopts standard MODBUS-RTU protocol which can display data in the formats such as integer, float and hexidecimal, so that you can compare the data with measured data displayed on the meter directly.

Communication indication sign

There is a communication indication sign in the display interface of meters. If a meter receives communication data during communication test process, this communication sign will flash.

6.2 Measured data is not correct

First make sure that the meter has been input right voltage. The multimeter is used for measuring voltage. Electric quantity displayed on the meter is the value of primary grid; it may lead to wrong electric quantity display if the ratio of voltage transformer does not conform to that of transformer in-service. The defaulted voltage range is not allowed to be modified after delivery. Connection network is available to be modified according to actual connection on spot, but the connection mode set in programming shall correspond with the actual connection method, otherwise it may lead to wrong display.

6.3 Meter does not work

Ensure proper auxiliary supply （AC/DC80-270V） is linked to the auxiliary supply terminal. As the meter may be damaged by auxiliary supply voltage which is beyond rated range and can not recovery. Use multi-meter to measure the voltage of auxiliary supply, if the meter does not display when the voltage is proper, please electrify again.

6.4 Other phenomena

Please contact our technical service department to give a detailed description of the field condition. Our technicians will analyze possible causes according to your description. The company will appoint technicians to deal with problems on spot as soon as possible if the problem can not be settled after oral communication.

7. Technical specification

Electrical feature		
Accuracy		0.2%, 0.5%(defaulted)
Data refresh rate		1s
Input	Rated value	AC 1A, 5A
	Range	(0.005 ～ 1.2)In
	Overload	Continuous 1.2In，Instantaneous 10In/5s
	Frequency	45～65Hz
Power supply	Working range	AC 80～270V （50/60Hz）, DC 80～270V、DC 24V
	Consumption	≤5VA
Digital input		Dry contact mode
Relay output		Contact capacity (resistive)：AC 5A/250V, DC 5A/30V
Analog output	Current output	DC 4～20mA, 0～20mA etc.， load ≤350Ω
	Voltage output	DC 0～5V, 1～5V etc.， load ≥20kΩ
Communication		RS485 interface，Modbus-RTU protocol，baud rate 2400～9600bps
Environment		
Protection degree		Panel IP64， case IP20
Working temperature		-40～70℃（LED）, -25～70℃（LCD）
Storage temperature		-40～85℃
Relative humidity		≤93%RH
Insulating ability		Between power and input or output≥AC2kV, Between input and output≥AC1kV
Altitude		2500m

EMC	
Electrostatic discharge surge immunity	IEC 61000-4-2-III
Radiated, radio-frequency, electromagnetic field immunity	IEC 61000-4-3-III
Electrical fast transient/burst immunity	IEC 61000-4-4-Ⅳ
Surge immunity	IEC 61000-4-5-Ⅳ
Immunity to conducted disturbances, induced by radio-frequency fields	IEC 61000-4-6-III
Power frequency magnetic field immunity	IEC 61000-4-8-III
Voltage dips, short interruptions and voltage variations immunity	IEC 61000-4-11-III

Appendix 1 Alarm items and units of relative alarm threshold

Three phase ammeter

No.	Alarm item	Unit of alarm value
0	IA-H（Phase A high current alarm）	0.001A
1	IA-L（Phase A low voltage alarm）	
2	Ib-H（Phase B high voltage alarm）	
3	Ib-L（Phase B low voltage alarm）	
4	IC-H（Phase C high voltage alarm）	
5	IC-L（Phase C low voltage alarm）	
6	3I-H（One of three phases high voltage alarm）	
7	3I-L（One of three phases low voltage alarm）	
8	F -H（High frequency alarm）	0.01Hz
9	F -L（Low frequency alarm）	
10	dI1.H（Relay activates when first digital input conducts.）	Alarm value is not needed to be set in relay linkage mode.

11	dI1.L（Relay activates when first digital input opens.）	
12	dI2.H（Relay activates when second digital input conducts.）	
13	dI2.L（Relay activates when second digital input opens.）	
14	dI3.H（Relay activates when third digital input conducts.）	
15	dI3.L（Relay activates when third digital input opens.）	
16	dI4.H（Relay activates when fourth digital input conducts.）	
17	dI4.L（Relay activates when fourth digital input opens.）	

Single phase ammeter

No.	Alarm item	Unit of alarm value
0	I--H（Phase A high voltage alarm）	0.001A
1	I--L（Phase A low voltage alarm）	
2	F -H（High frequency alarm）	0.01Hz
3	F -L（Low frequency alarm）	
4	dI1.H（Relay activates when first digital input conducts.）	Alarm value is not needed to be set in relay linkage mode.
5	dI1.L（Relay activates when first digital input opens.）	
6	dI2.H（Relay activates when second digital input conducts.）	
7	dI2.L（Relay activates when second digital input opens.）	
8	dI3.H（Relay activates when third digital input conducts.）	
9	dI3.L（Relay activates when third digital input opens.）	
10	dI4.H（Relay activates when fourth digital input conducts.）	
11	dI4.L（Relay activates when fourth digital input opens.）	

Appendix 2 Modbus-RTU Communication address information list

◆ **Read grid data through function code 0x03/0x04**

Address	Format	Data instruction	Unit	R/W
Primary grid data				
0x12	float	Phase A current	A	R
0x14	float	Phase B current	A	R
0x16	float	Phase C current	A	R
0x18～0x2A	float	Reserved		
0x2C	float	Frequency	Hz	R
0x2E～0x32	float	Reserved		
0x34	float	Average value of three phase voltages	A	R
Secondary grid data				
Address	**Format**	**Data instruction**	**Proportion**	**R/W**
0x100～0x101	Bit[32]	Relay output status Bit[0]-Bit[2]	0: open 1: activate	R
0x102～0x103	Bit[32]	Digital input status Bit[0]-Bit[3]	0: open 1: closed	R
0x104～0x10B	int	Reserved		
0x10C	int	Phase A voltage	0.001A	R
0x10D	int	Phase B voltage	0.001A	R
0x10E	int	Phase C voltage	0.001A	R
0x10F～0x11F	int	Reserved		
0x120	int	Frequency	0.01Hz	R

◆ **Read status information of relay through function code 0x01, and control relay through function code 0x05, 0x0F.**

Address	Format	Data content	Data instruction	R/W
0000 （fixed address）	Bit	First relay	0：off 1：closed	R/W
	Bit	Second relay	0：off 1：closed	R/W
	Bit	Third relay	0：off 1：closed	R/W

◆ **Remotely control relay through function code 0x05, 0x0F**

Address	Format	Data content	Data instruction	R/W
0000	Bit	First relay	0：off 1：closed	R/W
0001	Bit	Second relay	0：off 1：closed	R/W
0002	Bit	Third relay	0：off 1：closed	R/W

◆ **Read status of digital input through function code 0x02**

Address	Format	Data content	Data instruction	R/W
0000 （fixed address）	Bit	First digital input	0：off 1：closed	R
	Bit	Second digital input	0：off 1：closed	R
	Bit	Third digital input	0：off 1：closed	R
	Bit	Fourth digital input	0：off1：closed	R

Modbus-RTU message format instruction

Read the status of relay output（Function code 0x01）

	Frame structure	Address code	Function code	data code		CRC check code
				initial relay address	Number of relay	
Host request	Byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
	Data range	1～247	0x01	0x0000 （fixed）	0x0001～ 0x0004	CRC16
	Message example	0x01	0x01	0x00 0x00	0x00 0x02	0xBD 0xCB

				data code		
slave response	frame structure	address code	function code	byte of register	register value	CRC check code
	Byte	1 byte	1 byte	1 byte	1 byte	2 bytes
	Message example	0x01	0x01	0x01	0x03	0x11 0x89

Remark: the register value in the slave response indicates the state of the relay. Beginning from the lowest bit of the byte, each number corresponds to the state of a loop of relay output. “1” indicates the relay is closed, while “0” indicates the relay is cut off. In the upper list, the register value “0x03” corresponds to “0000 0011” in binary system which means the first and second loop of relays are closed.

Read the state of digital input（Function code 0x02）

				data code		
Host request	Frame structure	address code	function code	initial switch address	number of switches	CRC check code
	Byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
	Data range	1～247	0x02	0x0000	0x0001～0x000C	CRC16
	Message example	0x01	0x02	0x00 0x00	0x00 0x04	0x79 0xC9
Slave response	Data structure	address data	function code	data code		CRC check code
				byte of register	register value	
	Byte	1 byte	1 byte	1 byte	1 byte	2 bytes
	Message example	0x01	0x02	0x01	0x02	0x20 0x49

Remark: the register value in the slave response indicates the state of digital input. Beginning from the lowest bit of the byte, each number corresponds to the state of a loop of digital inut. “1” indicates the switch is closed, while “0” indicates the

switch is cut off. In the upper list the register value "0x02" is "0000 0010" in binary system which means second loop of digital input is closed.

Read data register value（function code 0x03/0x04）

	Frame structure	address code	function code	data code		CRC check code
				initial register address	number of register	
Host request	Byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
	data range	1～247	0x03/0x04		max 48	CRC16
	message example	0x01	0x03	0x00 0x06	0x00 0x06	0Xe4 0x36
	frame structure	address code	function code	data code		CRC check code
				byte of register	register value	
slave response	byte	1 byte	1 byte	1 byte	12 bytes	2 bytes
	message example	0x01	0x03	0x0C	（12-byte data）	（CRC16）

Remark: the initial register address in host inquiry is the initial address of the data collected from primary grid or secondary grid. The number of register indicates the length of the data. In the upper list the register address "0x00 0x06" indicates the initial address of phase voltage float data of three phases, and the number of register "0x00 0x06" indicates the length of the data includes three Word data and three float data. Please refer to appendix 1 MODBUS-RTU communication address information table.

Remotely-control single relay output（function code 0x05）

host request	frame structure	address code	function code	data code		CRC check code
				initial relay address	relay action value	
	byte	1byte	1byte	2 bytes	2 bytes	2 bytes
	data range	1～247	0x05	0x0000～0x0003	0xFF00/0x0000	CRC16
	message example	0x01	0x05	0x00 0x00	0xFF 0x00	0x8C 0x3A
slave response	frame structure	address code	function code	data code		CRC check code
				initial relay address	relay action value	
	byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes
	message example	0x01	0x05	0x00 0x00	0xFF 0x00	0x8C 0x3A

Remark: in host request, the relay action value “0xFF00” indicates the relay is closed, while “0x0000” indicates the relay is cut off. If you want to perform remotely control, please make sure the relay is working in “remotely control” mode.

Remotely-control multi-relay output（function code 0x0F）

host request	frame structure	address code	function code	data code				CRC check code
				initial relay address	number of relay	number of data byte	relay action value	
	byte	1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte	2 bytes
	data	1～247	0x0F	0x0000	0x0001～	0x01		CRC16

	range				0x0004			
	message example	0x01	0x0F	0x00 0x00	0x00 0x03	0x01	0x07	0xCE 0x95
slave response	frame structure	address code	function code	data code				CRC check code
				initial relay address		number of relay		
	byte	1 byte	1byte	2bytes		2bytes		2 bytes
	message example	0x01	0x0F	0x00 0x00		0x00 0x03		0x15 0xCA

Remark: in the host inquiry, beginning from the lowest bit of relay action value, each bit corresponds to a loop of relay output. “1” indicates the relay is closed, while “0” indicates the relay is cut off. In the upper list, relay action value “0x07”is “0000 0111”in binary system, which means the first, second and third loops of relay are closed.

The information in this document is subject to change without further notice.

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