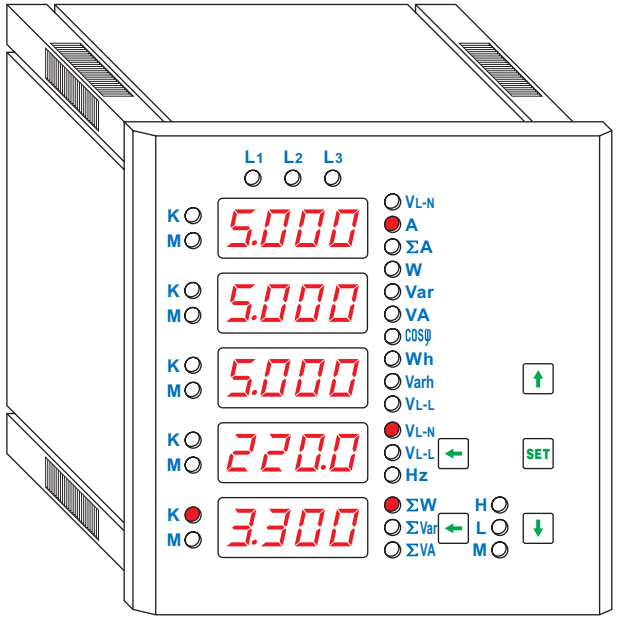
Multifunctional Power Instrument (LED)



Operational Instruction Manual

Digital Multifunctional Power Instrument(LED)

Please read through the manual before installment and operation

Chapter 1. General Introduction

Multifunctional power instrument (instrument for short below) is an electronic measuring instrument developed for the measurement of power all parameters.Measurement of the parameters are displayed on the 5 display.The instrument can measure and manage more than 50 parameters at the same timothy input network, current and voltage ratio can be programmed. Provide the phase voltage (three phase four line), line voltage(three phase three wire), the minimum and maximum values of the phase current and the total current. At the same time, provide the phase current, total current, total active power, total reactive power and the total apparent power demand value.The instrument has four channels switching value input,two channels electric energy pulse output, RS485 communication output,and can extended four channels switching value output or four channels analog quantity output.The instrument can directly replace conventional power transmitter, measuring instrument, electric energy meter and related auxiliary unit.

Chapter 2. Product Function

Ordinary function

- Phase voltage(VL_N): UA, UB, UC
- Line voltage(VL_L): UAB, UBC, UCA
- Phase current and total current: IA, IB, IC,TI(∑A)
- Active power: phase active power and total active power:PA,PB,PC,TP(∑W)
- Reactive power: phase reactive power and total reactive power:QA,QB,QC,TQ(∑var)
- Apparent power: phase apparent power and total apparent power:SA,SB,SC,TS(∑VA)
- Power factor: phase power factor(cosΦ):PFA,PFB,PFC
- Active electric energy(Wh):I-AE(positive active electric energy),E-AE(opposite active electric energy)
- Reactive electric energy(varh):I-rE(positive reactive electric energy),E-rE(opposite reactive electric energy)
- Frequency(Hz):FR
- The average value of phase voltage(VL_N) and line voltage(VL_L):Average_PU,Avergae_LU
- The maximum and minimum value of phase voltage ,phase current and total current:UAmax,UBmax,UCmax,IAmax,IBmax,ICmax, TImax,UAmin,UBmin,UCmin,IAmin,IBmin,ICmin.If the measured value is less than a minimum of record values, measured value is recorded as a new minimum value;If more than a maximum recorded value, measured value is recorded as a new maximum value.
- The demand value (M) of phase current ,total current,total active power,total reactive power and total apparent power:Demand_IA, Demand_IB,Demand_IC,Demand_TI,Demand_TP,Demand_TQ,Demand_TS.Demand value is the average of measured values for demand period, is the mean of measured values, and is updated if new demand value is greater than old.

Extended function

- 4 channels analog quantity output
- 4 channels switch value output
- 4 channels switch value input

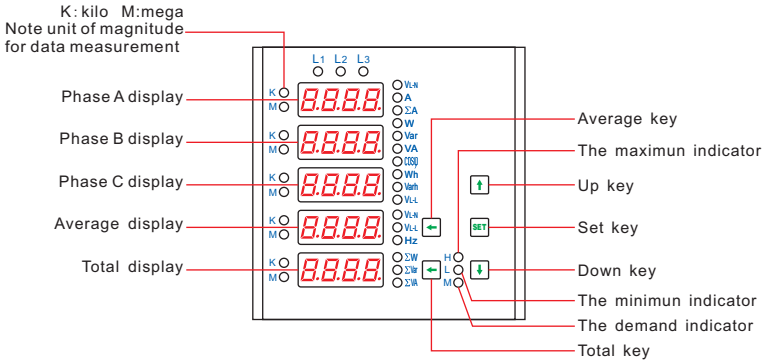
Chapter 3. Technical Parameters

Technical parameters			Index
Input	Net work		Three-phase three-wire, three-phase four- wire
	Voltage	Rated value	AC 100V,400V
		Over load	Consistent:1.2 times instantaneous:2 times /30s
		Comsumption	<0.5VA(each phase)
		Impedance	>500kΩ
	Current	Rated value	AC 1A, 5A
		Over load	Consistent:1.2 times instantaneous:2 times /1s
		Impedance	<2mΩ
	Frequency		45~65Hz
Output	Electric energy	Output mode	Two-channel open-collector optical coupling pulse output
		Pluse constant	Active 3200imp/kwh Reactive 3200imp/kvarh
		Start	On the condition of rated voltage,reference frequency and cosφ=1.0，when load operational current is 0.001In，it can start and measure the electric energy continuously.

Output	Electric energy	Creep	When exerting115% rated voltage and no current in the current circuitry, the instrument is with no electric energy accumulation and pulse output.
	Communi-cation	Output mode	RS485
		Protocol	MODBUS_RTU
		Baud rate	1200,2400,4800, 9600
	Analog quantity	Channel quantity	4 channels
		Output mode	0~20mA, 4~20mA
		Load ability	≤400W
	Switching value	Channel quantity	4 channels
		Output mode	Normally open relay contact output
		Contact capability	AC 240V/2A
	Switching value input		Four channel dry contact input modes
	Display mode		LED(Red)
Measuring accuracy	Voltage, current		±(0.5%FS+one digit)
	Active power, reactive power		±(0.5%FS+one digit)
	Frequency		±0.1Hz
	Power factor		±0.01PF
	Active energy		±0.5%(only for reference, not for meterage)
	Reactive energy		±1.0%(only for reference, not for meterage)
Sourse	Scope		AC 220V,50/60Hz
	Consumption		<5VA
Safety	Withstand voltage	Input and sourse	>2kv50Hz/1min
		Input and output	>1kv50Hz/1min
		Output and sourse	>2kv50Hz/1min
	Insulating resistance		Any two of input, output, source, casing>20MΩ
Environ-ment	Temperature		Operation: -10~50°C
			Storage: -25~70°C
	Humidity		≤85%RH，free of wet and corrosive gas
	Elevation		≤3000m

Chapter 4. Program and usage

4.1 Panel description



4. 2 Description of key function

Average key: Under the measuring display mode,it is used to switch between VL_N and Hz;Under the programming mode,moves the cursor to the left one.

Up key:Under the measuring display mode,it is used to switch between VL_L and VL_N;Under the programming mode,it is used for degressive increase of parameter value or inter the next menu.

Set key: Under the measuring display mode,it is used to switch between Maximum value,Minimum value,Demand value and Real-time measuring value;Press this key to enter the program mode. After input the correct password(factory password: 0001)"Code" prompted by the instrument, it is capable of programming and setting.Under the programming mode, it is used to return to the previous menu when choosing the menu items. The instrumen willing display˝SAVE-YES˝when it return to the measuring display mode from the programming mode, then press the this key to save and qiut.

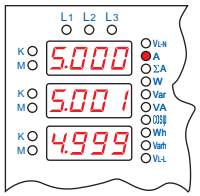
Down key:Under the measuring display mode,it is used to switch between VL_N and VL_L;Under the programming mode,it is used for progressive decrease of parameter value or inter the previous menu.

Total key: Under the measuring display mode,it is used to switch between ΣW and Σvar;Under the programming mode,it is used to return to previous menu and not storing parameters.

4.3 Display mode description

4.3.1 Press Up key and Down key can respectively display power parameters for VL_N, A, ΣA, W,var, VA, cosΦ, Wh, varh,VL_L, Display for the A window displays the A parameter, B window displays the B parameter, C window display C parameters (except ΣA, Wh and varh).

As the following picture shows:



The left picture shows:

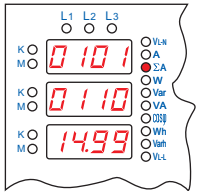
A phase current is IA=5.000A

B phase current is IB=5.001A

C phase current is Ic=4.999A

(VL-N, W indicator lamp is lit up It is the current value for the phase voltage,phase active power and other parameters when VL-N, W indicator lamp is lit up)

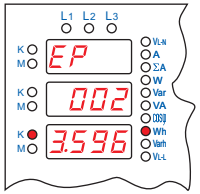
Under the total current display mode,only the C window displays the total current.At the same time,the A window displays status of switching value input.As the following picture shows, thousand, hundred,ten, a corresponding to the fourth, third, second, first switching value input state, "0" means the external switch off, "1" means the external switch on;The B window displays status of switching value output,As the following picture shows, thousand, hundred,ten, a corresponding to the fourth, third, second, first switching value output state, "0" means the external switch off, "1" means the external switch on.



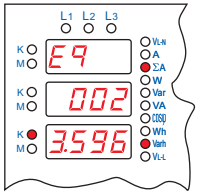
The left picture shows:
Switching value input (4321) :the first and third are on, the remaining are off; switching value output (4321) :the second and the fourth is on , the remainingis off .
Total current TI=14.99A;

The display status of switching value input,switching value output ,and total current.

Under the active electric energy and reactive electric energy display state,A window displays the sign of positive or negative,B and C window display the electric energy value.As the following picture shows,C window corresponding thousand ,hundred, ten, a bits of parameters, B window corresponding million, one hundred thousand ,ten thousand bits of parameters.



Positive active electric energy
(It is opposite active electric energy
when A window displays EP-)



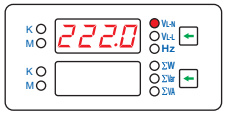
Positive reactive electric energy
(It is opposite reactive electric energy
when A window displays Eq-)

4.3.2 Use Total key can select respectively the current display parameters for Σ W ,Σ var ,Σ VA, it is displayed in the total window, as the following picture shows:

The left picture shows:
Three-phase total active power:Pt=3.300KW

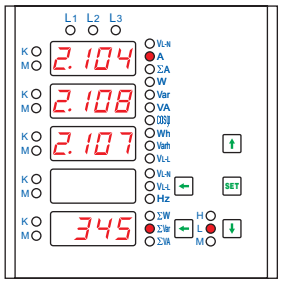
Total active power value display
(It is total reactive power value or total apparent power value when the Σvar or ΣVA indicator is lit up)

4.3.3 Use Total key can select respectively the current display parameters for Avergae_VL_N,Average_VL_L or Frequency，it is displayed in the average window, as the following picture shows:



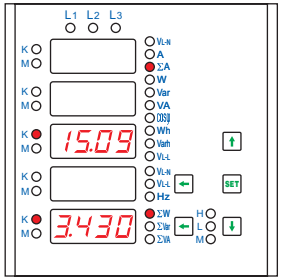
The left picture shows:
Three-phase average phase voltage
Average_PU=220.0V

4.3.4 Press Set button to view the maximum, minimum and demand value.If the current display objects provide maximum value,minimum value and demand value, them are displayed in order of evaluation when press the Set key.If the current display objects not provide maximum value,minimum value and demand value,real-time measurement values are displayed continuously when press the Set key. As the following picture shows:



The left picture shows:
A Phase minimum current value:IAmin=2. 104A
A Phase minimum current value:IBmin=2. 108A
A Phase minimum current value:ICmin=2. 107A
Three-phase minimum reactive power value:
Qrmin=345Var
Note：Start maximum value and munimum value detecting function before viewing maximum value and munimum value.

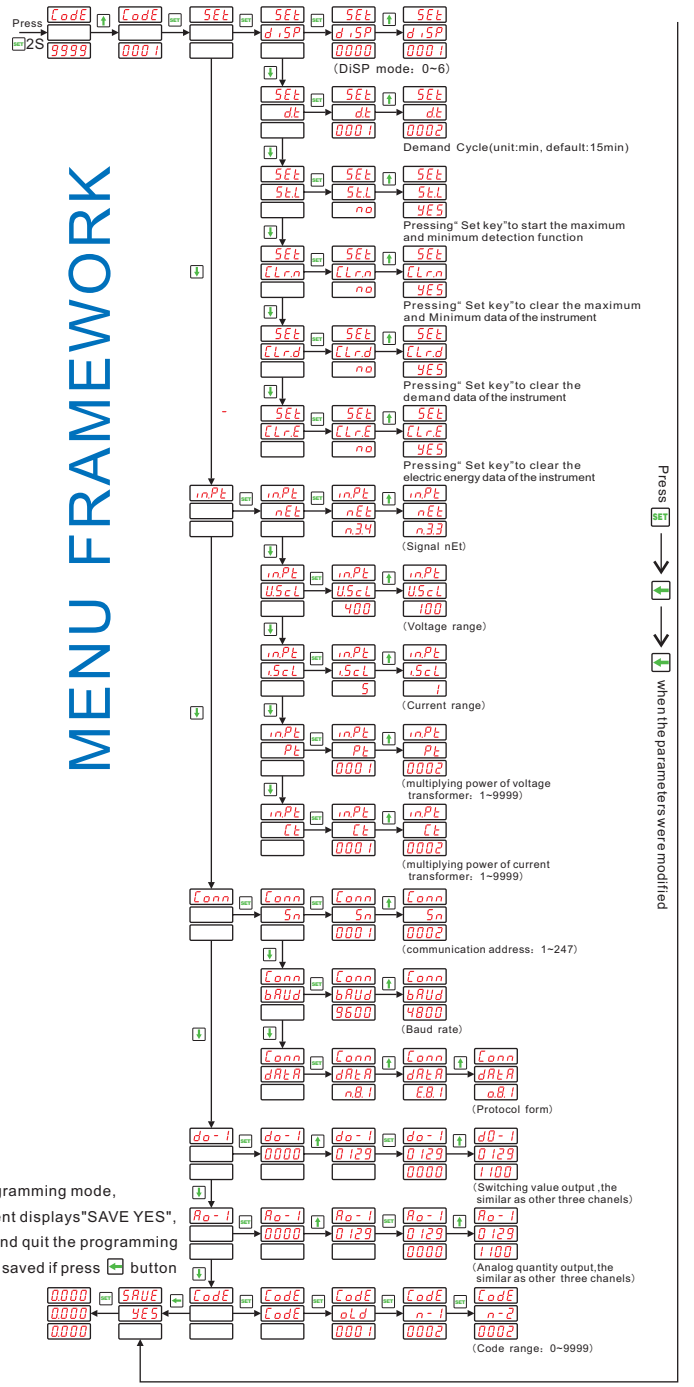
It is the minimum value of phase voltage or total current when the VL_N or ΣVA indicator is lit up.
It is the maximum value of parameters when the H indicator is lit up.



The left picture shows:
The demand value of total current:
Demand_TI=15. 09KA
The demand value of total active power:
Demand_TP=3. 430KW
Note: view the demand value at least need to wait for a demand cycle.

They are phase current and total reactive or apparent when A indicator and ΣVar or ΣVA indicator are lit up.

4.4 Menu framework



4.5 Menu significations

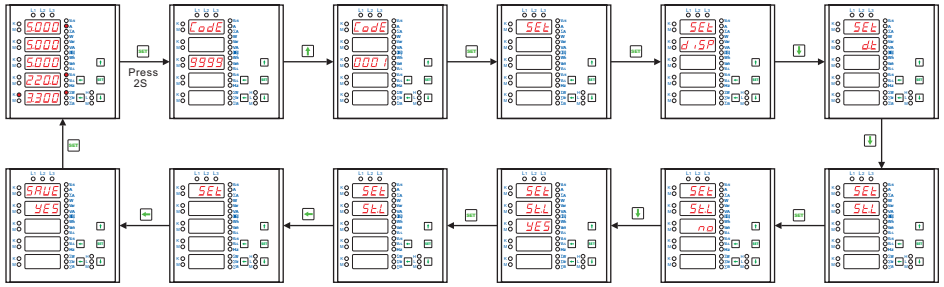
Under the programmable mode, five menu setting items including of setting(SEt), input(inPt), communication(Conn), switching value output(do1-4), annlog quantity(Ao1-4), modify password(CodE) and LED display hierarchical menuframework management are provided in this instrument. Row 1 displays the first-tier menu; row 2 displays the second-tier menus; row 3 displays the parameter value.

First-tier menu	Second-tier menu	Parameter value	Description
CodE		0~9999	Prompt the input programmable password is codE, and can only enter the programmable mode with correct password.(Factory CodE:0001)
SEt	diSP	0~12	Select display mode “diSP”
	dt	1~60	Demand Cycle(unit:min, default:15min)
	StL	YES/NO	Pressing“ Set key”to start the maximum and minimum detection function
	CLrn	YES/NO	Pressing“ Set key”to clear the maximum and Minimum data of the instrument
	CLrd	YES/NO	Pressing“ Set key”to clear the demand data of the instrument
	CLrE	YES/NO	Pressing“ Set key”to clear the electric energy data of the instrument
inPt	nEt	n.3.4 n.3.3	Select input network “nEt”,n.3.3 : three-phase three-wire n.3.4 : three-phase four-wire
	USCL	400V 100V	Select measuring range of voltage : 400V or 100V
	iSCL	5A/1A	Select measuring range of current : 5A or 1A
	Pt	1~9999	Set multiplying power of voltage transformer (Primary value/second value of voltage transformer)
	Ct	1~9999	Set multiplying power of current transformer (Primary value/second value of current transformer)
Conn	Sn	1~247	Set RS485 communication address “Sn”
	bAUd	9600 4800	Select communication baud rate“bAud”:1200,2400,4800 or 9600
	dAtA	n.8.1 o.8.1 E.8.1	Protocol form n.8.1 : n-no check, 8-eight data bits, 1-one stop bit o.8.1 : o-odd check, 8-eight data bits, 1-one stop bit E.8.1 : o-even check, 8-eight data bits, 1-one stop bitt
do-1	0~255	0~9999	Select the first-channel alarm output object , and set the higher and lower limit of alarm output range
Ao-1	0~255	0~9999	Select the first-channel transmitting output object , and set the higher and lower limit of transmitting output range
CodE	oLd	0~9999	Current code
	n-1	0~9999	Input new code first time
	n-2	0~9999	Input new code second time

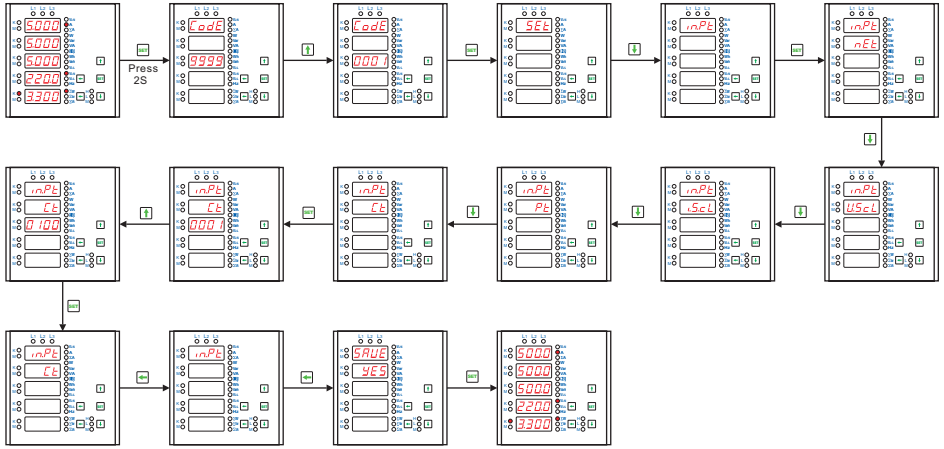
4.6 Programming operation examples

The measuring range of instruments has been set as the same parameters provided by users at thefactory. Users should check if the input network, voltage/current measuring range and transformer multiplying power are consistent with the actual input again before use.

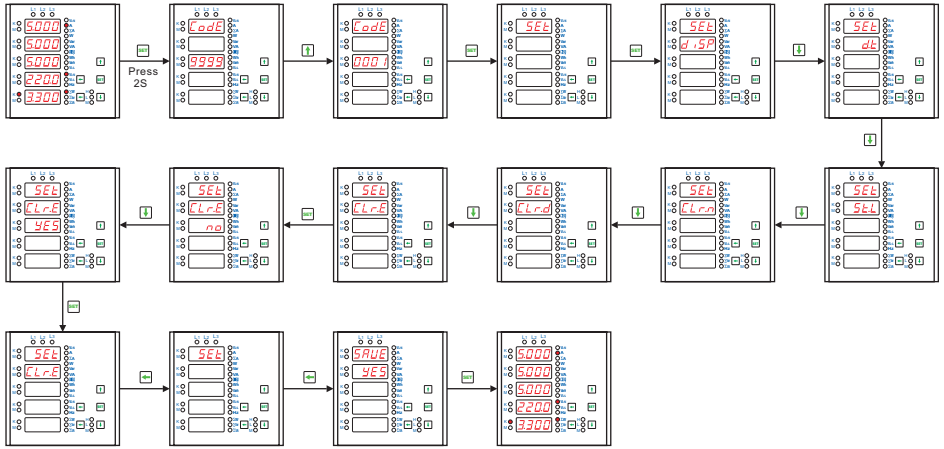
4.6.1 Start the maximum and minimum detection function



4.6.2 Set current rate, change the rate from 1(5/5A) to 100(500/5A)



4.6.3 clear the electric energy data



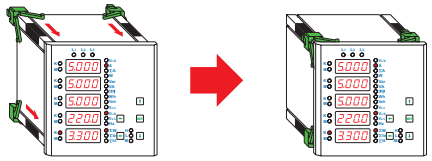
Chapter 5. Installment and wiring

5.1 Shape and cutout hole dimension(unit: mm)

Shape	Panel dimension		Case dimension			Cutout hole dimension	
	W	H	W	H	D	W	H
96×96Square	96	96	90	90	83	92	92

5.2 Method of installation

Choose the corresponding hole cutout dimension from the table above , make a hole in the installation screen, insert the instruments into the hole, place the four clamping pieces into the clamping holder and push and tighten them by hand.



5.3 Wiring instructions

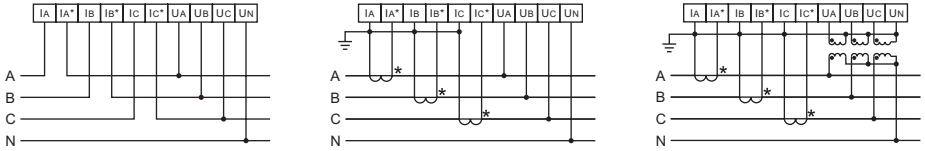
5.3.1 Terminal arrangement and function declaration of instrument(please accord to the one of instrument case)

Auxiliary power supply (POWER): AC 220V,50/60Hz(Can customize other values)

Electrical quantity signal input : A , B and C three-phase AC current or voltage signal input port, and I* is current live wire. When connect, please ensure the phase sequence and polarity of input signal respond with the terminals to avoid indicating value error. When the voltage is higher than the rated input voltage of the product,you should consider of using PT and installing fuse of 1A at the voltage input port; while the current is higher than rated input current of the product, you should consider of using the exterior CT

5.3.2 Typical connection

Three-phase four-wire

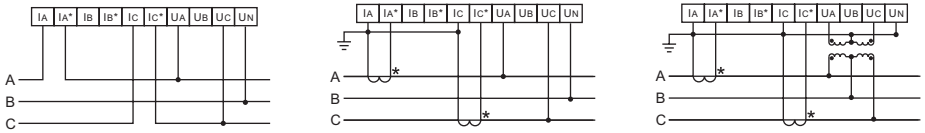


Voltage≤600V,input directly
Current≤5A,input directly

Voltage≤600V,input directly
Current>5A,input via CT

Voltage>600V,input via PT
Current>5A,input via CT

Three-phase three-wire



Voltage≤600V,input directly
Current≤5A,input directly

Voltage≤600V,input directly
Current>5A,input via CT

Voltage>600V,input via PT
Current>5A,input via CT

5.3.3 Energy signal output: P+ is the active energy pulse output + port, Q+ is the reactive energy pulse output + port, P-Q- are the active/reactive electrical pulse output port. Output mode: open-collector optical coupling output; open-collector voltage VCC≤48V; current Iz≤50mA. The energy pulse output corresponds with these condary data. When measuring the primary energy, it needs to multiply the PT multiplying power and CT multiplying power to get the primary data.

5.3.4 RS485 communication connection

The instrument supplies a RS485 communication interface and applies MODBUS_RTU communication protocol (see the appendix). Up to thirty-two instrument can be connected in one communication line at one time. Each instrument should have the only communication address in the circuitry. Communication connection should use the shielded twisted paired with copper mesh, whose diameter should be not less than 0.5mm. Communication line should be far away from the high-voltage cables or other highfield environment and the maximum transmission distance is 1200 m. The typical network connections are shown in the following figure and users can choose other suitable connect mode under specific conditions.

5.3.5 Switching value input(DI input):DI1~DI4 are 1~4 way dry contact input port, inside of the instrument there is power supply of +5V.

5.3.6 Switching output and ananlog transmitting output: can support four-channel switching value output and four-channel analog transmitting output.

Chapter 6. Communication protocol

6.1 This series instrument are provided with Rs485 communication interface and apply MODBUS_RTU communication protocol.

Start	Address code	Function code	Data sector	CRC code	End
Halt time more than three bytes	1byte	1byte	Nbyte	2byte	Halt time more than three bytes

6.2 Communication message transmitting process

When communication instructions transmit from master device to slave device, the slave device with corresponding address code receives communication orders and reads the massage according to functional code and relational requirements. After successful CRC verification without error, the corresponding operation will be conducted and the result (data), including address code, function code, data after execution and CRC verification code, is returned to the master device. In case of CRC verification failure, no message would be returned.

6. 2. 1 Address code:

Address code is the first byte (8 bits) of each communication message frame, from 1 to 247. Every slave device must have the only address code and only the slave device conforming to the address code can respond and return the message. When the slave device returns the message, all of the return data start with each address code. The address code sent by master device shows the receiving address of slave device, while the address code returned by slave device shows the returning slave address. The responding address code shows where the message comes from.

6. 2. 2 Function code

Function code is the second byte of each communication message frame. The master device sends and tells that what operation the slave device should carry out by means of function code. Then the slave device responds. The functional code returned by slave device is the same as the one sent by master device, which shows that slave device has responded the master device and carry out the relational operation. The instrument supports three function codes as following:

Function code	Definition	Operation
03H	Read register	Read data of one or multiple resigister

6.2.3 Data sector

Data sector are different following the different function code. These data could be numerical value, reference address and so on. For different slave device, the address and data information are different (There should be communication information table). The master device utilizes the communication order (Function code03H) to read and amend the data register of the slave device. The data length read out or written in should not exceed the effective range of the data register address once.

6.3 16-bit CRC verification code . Algorithm of CRC code:

6.3.1 Presetting a 16-bit register to hex FFFF (namely 1 for all bits in binary system). The register is called CRC register;

6.3.2 XORing the first 8-bit binary data (the first byte of the communication message frame) with the low 8-bit of 16-bit CRC register, then storing the result in CRC register;

6.3.3 Right-shifting the register data by one bit (towards lower bit) and filling the highest bit with 0, then verificationing the shift-out bit;

6.3.4 If the shift-out bit is 0, repeat step 3 (right-shifting one more bit);If the shift-out bit is1, XOR the CRC register data with polynomial A001 (1010 0000 0000 0001);

6.3.5 Repeating step 3 and step 4 until all of the 8-bit data have been processed after 8 right-shift operations

6.3.6 Repeating step 2 to step 5 to process the next byte of the communication message frame;

6.3.7 When calculation procedures of the first 5 bytes in the communication message frame are completed, the 16-bit CRC verification code will be generated in the 16-bit CRC register.

6.4 MODBUS_RTU address information form(the address is demonstrated with decimal system);

Modbus address	Parameter code	Description	Explanation
Programming information			
0	Code	Programming password	1~9999
1	xs	Display mode	1byte
	dz	Communication address	1byte，1~247
2	PT	Multiplying power of potential transformer	1~9999
3	CT	Multiplying power of current transformer	1~9999
4~6	Reserve		
Switch value output, analog quantity output			
7	DO1-Addr	Switch value output 1	Chapter 8. Switch value module
8	DO1-Data		

9	DO2-Addr	Switch value output 2	Chapter 8. Switch value module
10	DO2-Data		
11	DO3-Addr	Switch value output 3	
12	DO3-Data		
13	DO4-Addr	Switch value output 4	
14	DO4-Data		
15	AO1-Addr	Analog quantity output 1	Chapter 9. Analog quantity module
16	AO1-Data		
17	AO2-Addr	Analog quantity output 2	
18	AO2-Data		
19	AO3-Addr	Analog quantity output 3	
20	AO3-Data		
21	AO4-Addr	Analog quantity output 4	
22	AO4-Data		
23~53	Reserve		
Power sign information			
54	SING	Power sign bit	
Data of switch value and electrical quantity			
55	DI	Switch value input	Switch value input part
56	DO	Switch value output	Switch value output part
57, 58	UA	A-phase voltage	2 words (4 bytes) floating-point representation data, IEEE-754 data format standard.All data is primary data,then by the ratio of the value. The unit of voltage V, The unit of current A, active power unit KW,reactive power unit Kvar, apparent power unit KVA, the unit of frequency Hz.
59, 60	UB	B-phase voltage	
61, 62	UC	C-phase voltage	
63, 64	UAB	AB-line voltage	
65, 66	UBC	BC-line voltage	
67, 68	UCA	CA-line voltage	
69, 70	IA	A-phase current	
71, 72	IB	B-phase current	
73, 74	IC	C-phase current	
75, 76	PA	A-phase active power	
77, 78	PB	B-phase active power	
79, 80	PC	C-phase active power	
81, 82	PS	Total active power	
83, 84	QA	A-phase reactive power	
85, 86	QB	B-phase reactive power	
87, 88	QC	C-phase reactive power	
89, 90	QS	Total reactive power	
91, 92	SA	A-phase apparent power	
93, 94	SB	B-phase apparent power	
95, 96	SC	C-phase apparent power	
97, 98	SS	Total apparent power	
99, 100	PFA	A-phase power factor	
101, 102	PFB	B-phase power factor	
103, 104	PFC	C-phase power factor	
105, 106	PFS	Total power factor	
107, 108	FR	Frequency	
109~128	Reserve		
electric energy information			
129, 130	WPP	Primary positive active energy	2 words (4 bytes) floating-point representation data, IEEE-754 data format standard.All data is primary data,then by the ratio of the value. The unit of voltage V, The unit of current A, active power unit KW,reactive power unit Kvar, apparent power unit KVA, the unit of frequency Hz.
131, 132	WPN	Primary opposite active energy	
133, 134	WQP	Primary positive reactive energy	
135, 136	WQN	Primary opposite reactive energy	
137, 138	EPP	Secondary positive active energy	
139, 140	EPN	Secondary opposite active energy	
141, 142	EQP	Secondary positive reactive energy	
143, 144	EQN	Secondary opposite reactive energy	

Maximum value, minimum value, demand value(primary side,floating data)			
145, 146	UAmax	A phase voltage maximum	2 words (4 bytes) floating-point representation data, IEEE-754 data format standard.All data is primary data,then by the ratio of the value. The unit of voltage V, The unit of current A, active power unit KW,reactive power unit Kvar, apparent power unit KVA, the unit of frequency Hz.
147, 148	UBmax	B phase voltage maximum	
149, 150	UCmax	C phase voltage maximum	
151, 152	UAmin	A phase voltage minimum	
153, 154	UBmin	B phase voltage minimum	
155, 156	UCmin	C phase voltage minimum	
157, 158	Average_PU	Average value of phase voltage	
159, 160	Average_LU	Average value of line voltage	
161, 162	IAmax	A phase current maximum	
163, 164	IBmax	B phase current maximum	
165, 166	ICmax	C phase current maximum	
167, 168	TImax	Total current maximum	
169, 170	IAmin	A phase current minimum	
171, 172	IBmin	B phase current minimum	
173, 174	ICmin	C phase current minimum	
175, 176	TImin	Total current minimum	
177, 178	TI	Total current	
179, 180	Demand_IA	Aphase current demand value	
181, 182	Demand_IB	B phase current demand value	
183, 184	Demand_IC	C phase current demand value	
185, 186	Demand_TI	Total current demand value	
187, 188	TPmax	Total active power maximum	
189, 190	TPmin	Total active power minimum	
191, 192	Demand_TP	Total active power demand value	
193, 194	TQmax	Total reactive power maximum	
195, 196	TQmin	Total reactive power minimum	
197~198	Demand_TQ	Total reactive power demand value	
199, 200	TSmax	Total apparent power maximum	
201, 202	TSmin	Total apparent power minimum	
203, 204	Demand_TS	Total apparent power demand value	

Part of the control word

Part of the control word		
Parameter	Significance	
Communication control word TXK-BIT:76543210 Baud rate and data format	Data format:BIT5，BIT4	00:N.8.1
		01:E.8.1
		10:O.8.1
	Baud rate:BIT1，BIT0	00:1200
		01:2400
		10:4800
		11:9600
Input control word SRS-BIT:76543210 Input network and range	Input network:BIT2	0:three-phase four line 1:three-phase three line
	Voltage range:BIT1	0:400V 1:100V
	Current range:BIT0	0:5A 1:1A

Switch register description

DI register	BIT31~8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Switch port	Resever					DI4	DI3	DI2	DI1
Reset	0					0	0	0	0
DO register	BIT31~8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Switch port	Resever					DO4	DO3	DO2	DO1
Reset	0					0	0		0

The position of the DI register significance: 1 :on (switch quantity input),
0 :off (no switch quantity input)

The position of the DO register significance：1: relay closed, 0 : relay released

Power sign register description

Power sign register	BIT15~8	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Parameter	Resever	TQ	QC	QB	QA	TP	PC	PB	PA

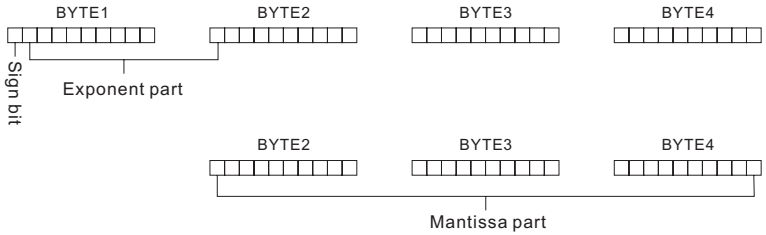
Note:

1: PA, PB, PC, TP: A phase active power, B phase active power, C phase active power ang total active power.
QA, QB, QC, TQ: A phase reactive power, B phase reactive power, C phase reactive power ang total reactive power.

2: bit significance: 0--positive，1--opposite

Note：Description of data format

Data type “float” :four-byte floating data,apply IEEE-754 standard. The level code and mantissa express the magnitude of number. The description according to byte is as following:



Sign bit: SIGN=0 is poative, SIGN=1 is oppsite;

Exponent part: E=Exponent part-126;

Mantissa parts: M = mantissa parts make up the highest bit is 1;

Data results：REAL=SIGN×2^{E}×M/(256×65536).

For example: energy data which read from the address table to know electric energy (positive active absorption) is: (Byte mode, compatible with the old standard) 92 (005CH) length of 4 (0004H).

Master divice：01H 04H 00 5CH 00 04H 31 DBH

Slave divice：01 04H 04H 50 80 00 00H EBH 6CH(50 80 00 00 is active energy, EBH, 6CH is low byte and high byte of CRC verification code)

Data representation: SIGN (sign bit = 0, positive), Exponent part: EX = A1H-126 = 35,

Mantissa part: 08 00 00H

Electric energy：2^{35}×80.00 00H/100 00 00H=17179869184Wh=17179869KWh

6.5 Communication messages Example

Read the data(function code:03H): this function can make the user to get the terminal equipment acquisition, recording data and system parameter. The host one request the number of data collected not to be unlimited,but can not beyond the defined the address range.

For example,from one host the terminal equipment address is from 45(OCH) machine,read 3 data IA,IB,IC(Data frame date each address for 2 words, the IA word address start from 45H data length is 6 (06H) words, word Word communication。

Inquire data frames(master device)

Address code	Function code	Address of start register		Register quantity		CRC verification code	
		High byte	Low byte	High byte	Low byte	Low byte	High byte
01H	03H	00H	45H	00H	06H	D4H	1DH

Respond to data frames（master device）

Address code	Function code	Byte number	Data1~12	CRC verification code	
				Low byte	High byte
01H	03H	00H	43556680H、43203040H、42DDCC80H	D4H	1DH

Indicate：IA=43556680H(213.4A)、IB=43203040H(160.1A)、IC=42DDCC80H(110.8A)

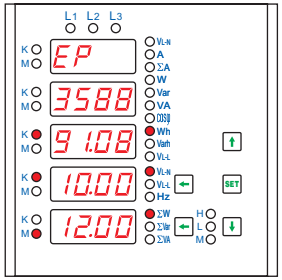
Chapter 7. The Electric Energy Pulse

The multifunctional network Power instrument provides active and reactive energy measurement, 2-way power pulse output and RS485. The digital interface completes energy data display and rhomboides. 3 rows of 12 digits LED active energy (positive) Reactive energy (inductive) 1 shows the measured data; open collector optocoupler relay power pulse (Resistance signal) achieves active power (positive) and reactive power (reverse) Remote, a remote computer using the final End, PIE, DI switch acquisition module, collecting instrument to achieve the total energy accumulated pulse measurement. The use of output or the output power accuracy test methods (national measurement procedures: the standard table Pulse error ratio method).

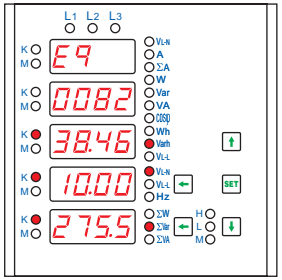
7.1 Electrical Characteristics: open collector voltage VCC ≤ 48V, current Lz ≤ 50mA.

7.2 Pulse constant: 3200imp/KWh. Its meaning is: When the instrument outputs a pulse when the accumulation of 1KWh. Number 3200, should be emphasized that 1KWh 2 test for the electricity energy data, in PT, CT of the Case, the relative pulse data corresponding to the N-1 measured power for the 1KWh × PT × CT.

7.3 Application examples: PLC terminal using the pulse counting device, assuming that the length of time taken T Set number of pulses into N, instrument input: 10KV/100V, 400A/5A, the period instrument . Table electricity accumulation: N/3200 × 100 × 80-degree power.



Positive active electric energy:
358891.08KWh



Positive reavtive electric energy:
8238.46Kvarh

Chapter 8. Switch value module

The instrument offers 4 channels switch value input function and 4 channel opto-couple relay's switch value output function.4 channels switch value input adopt the way of dry node resistor switch signal input.When it is connected for external part,the module DI via instrument switch input will collect the connecting information and display as 1;when it is disconnected for the external part, the module DI via instrument switch input will collect the disconnecting information and display as 0.The switch value input module can not only collect and display the local switch information,but also can realize the remote transmitting function with the instrument's RS 485 digital connecting interface,it is function of "remote signalling" The switch value outpuf function of 4 channel opto-couple relay, can be used as the alarm caution, output function for protect controlling and so on.When the switch value is effective,relay output is opening and switch value is closed,the relay output will be closed also.

Electric parameter:Switch value input DI:connecting resistor R>100KΩ,Switch value output DO:AC 250V,0.1A

Register:DIO information register:this register show the status information for 4 channel switch value and 4 channel switch value output.

DIO Register	BIT7	BIT6	BIT5	BIT4	BIT3	BIT2	BIT1	BIT0
Switch port	DO4	DO3	DO2	DO1	DI4	DI3	DI2	DI1
Reposition	0	0	0	0	0	0	0	0

The low 4 byte of the DIO register(BIT3,BIT2,BIT1,BIT0)is the status information for switch value input.If the register display as 0000 0101, it means the channel 3 and channel 1 for switch value input is closed;channel 4 and channel 2 is open.

The high 4 byte of the DIO register(BIT7,BIT6,BIT5,BIT4)is the status information for switch value output.If the register display as 1101 000, it means the channel 9, 10 and 7 connect with channel 8,3,and 4;disconnect with channel 5 and 6.All the DIO information can be displayed on the LED screen of the instrument.

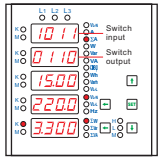
The parameter for each switch value alarm output value use the DOSI-3 continuous address space to save.For example:Channel 1 will use address:the 3 byte of 10,11,12.The lowest byte(address 10)save the parameter of alarm output target.If the UA's low alarm parameter is 1, high alarm is 129;0 means the remote controlling.The another two bytes(address 11 and 12) are the off-limit alarm parameter.The other 3 channels are the same like channel 1.For the corresponding address space checking,please have a reference of the address form.

Project	variable	Significance:DOSi(BYTE2, BYTE1, BYTE0)
Switch value output 1	DOS1	BYTE2(0~225), alarm project,1~26 correspond electricity address table corresponding to the 26 electrical quantities low alarm; and greater than 128(129~154)into a corresponding high alarm, data formats are the same as MODBUS address information table in power information description. Note that the decimal point position information.
Switch value output 2	DOS2	
Switch value output 3	DOS3	
Switch value output 4	DOS4	

8.1 Examples

8.1.1Switch value input function:

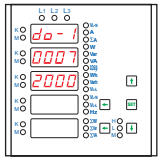
The switch module has the collecting function for 4 channels switch input.When collecting is inputed the signal,the instrument's LED screen may display"-1 open" or "-0 closed".This is used as the local supervisor for the switch signal.Change the instrument to the display status of the switch information,the last four digits of the lowest row on the LED screen display the status information of switch input.From the left to the right,it is channel 1,channel 2,channel 3 and channel 4.With the RS 485 interface,the users can transmitting the switch register's information to the remote computer's terminal.The picture on the right shows:Channel 4,3 and 1 are on;Channel 2 is off.



8.1.2 Switch value output function:

The picture shows the channel 1 and 4 is closed;channel 2 and 3 is open.The another function of the switch value output module is off-limited alarm output.Set the range for the parameters.When the parameter is off-limited the range,the correspondingswitch value output interface is open,the screen will display 1.When the signal is in the range,the screen will display 0.Programming example:For the instrument 10KV/100V,400A/5A,set the DO1 as UA>11KV alarm,DO2 as IA>400A alarm,DO3 as PF<0.9 alarm,DO4 as F >51.00HZ, the controlling word should be:

The setting for switch value parameters DOI can also be realized via key programming.In the programming operation,menu DOSI item's parameter is the corresponding DOI parameter.See the right picture:The first line showing DO-1 means the item setted is switch value output module 1;Line 2 showing 0007 is the alarm item,7:IA low alarm.Line 3 showing 2000 means the area of the alarm,when the IA<2000, DO1 output alarm signal,as relay is open.



Switch value output and analog quantity output electric quantity parallel table

Project	Switch value output		analog quantity output	
	Corresponding parameter (lower alarm)	Corresponding parameter (higher alarm)	Corresponding parameter (0~20mA)	Corresponding parameter (4~20mA)
UA(A-phase voltage)	1	129	1	129
UB(B-phase voltage)	2	130	2	130
UC(C-phase voltage)	3	131	3	131
UAB(AB-line voltage)	4	132	4	132
UBC(BC-line voltage)	5	133	5	133
UCA(CA-line voltage)	6	134	6	134
IA(A-phase current)	7	135	7	135
IB(B-phase current)	8	136	8	136
IC(C-phase current)	9	137	9	137
PA(A-phase active power)	10	138	10	138
PB(B-phase active power)	11	139	11	139
PC(C-phase active power)	12	140	12	140
PS(Total active power)	13	141	13	141
QA(A-phase reactive power)	14	142	14	142
QB(B-phase reactive power)	15	143	15	143
QC(C-phase reactive power)	16	144	16	144
QS(Total reactive power)	17	145	17	145
PFA(A-phase power factor)	18	146	18	146
PFB(B-phase power factor)	19	147	19	147
PFC(C-phase power factor)	20	148	20	148
PFS(Total power factor)	21	149	21	149
SA(A-phase apparent power)	22	150	22	150
SB(B-phase apparent power)	23	151	23	151
Sc(C-phase apparent power)	24	152	24	152
SS(Total apparent power)	25	153	25	153
F(frequency)	26	154	26	154

Alarm parameter calculation method:

Numerical calculation of electrical parameters of alarm limits: take the range 's highest value 4 number, get a 4 bit integer ratio. The alarmValue and range of values is equal to a set value and reference value ratio.

$$\text{Set value} = \frac{\text{Alarm value} \times \text{Reference value}}{\text{Range value}}$$

If the instrument' s parameters are 400V，800A/5A

Setting requirements	Alarm condition	Range value	Reference value	Programming parameters	
				Electricity parameters	Set value
Voltage alarm	UA>400V	400	4000	129	4000
	UB>430V			130	4300
	UC<80V			3	800
Current alarm	IA>800A	800	8000	135	8000
	IB<400A			8	4000
	IC<70A			9	7000
Power alarm	PA>320KW	320K	3200	138	3200
	PS>980KW	960K	9600	141	9800
	PS<560KW			13	5600
Power factor alarm	PFA>0. 866	1	1000	146	866
	PFS>0. 9			149	900
	PFS<0. 5			21	500

Chapter 9. Analog transmitting output module

The instrument can offer the function of four-channel analog transmitting output.Each channel can choose to set any of the 26 parameters, with the instrument's function for analog transmitting output module, to reach the function of parameter 's analog transmitting output (0-20mA/4-20mA).The corresponding relation can be set at random.

9.1 Parameter:output 0-20mA,4-20mA,class:0.5

Overload:120% effective output,the maximum current:24mA,the maximum volt:16V

Load:Rmax=400Ω

9. 2 Application example

For 10KV/100V,400A/5A instrument settings: AO1-UA:0~10KV/4~20mA; AO2-IA:0~400A/4~20mA;AO3-PS:0~12MW/0~20mA; AO4-QS:0~12MVar/0~20mA;

Classification	Analog transmitting output	Control word (high byte first)		
		BYTE2	BYTE1	BYTE0
Analog transmitting output1	UA:4~20mA	128+1=129	1000(03HE8H)	
Analog transmitting output2	IA:4~20mA	128+7=135	4000(0FHA0H)	
Analog transmitting output3	PS:0~20mA	13	1200(04HB0H)	
Analog transmitting output4	QS:0~20mA	17	1200(04HB0H)	

The electrical parameters of transmitting output values are calculated from range: the top 4 bits of the number, a 4 bit integer ratio. Then the transmitting value and range value ratio is equal to the set value and reference value ratio.

$$\text{Set value} = \frac{\text{Transmitting value} \times \text{Reference value}}{\text{Range value}}$$

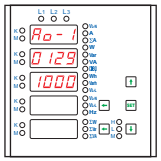
Note: when the transmission value errors, modify the corresponding set value.

If the instrument' s parameters are 400V，800A/5A

Setting requirements	Transmission condition	Range value	Reference value	Programming parameters	
				Electricity parameters	Set value
Voltage transmitting	UA:0~400V/4~20mA	400	4000	129	4000
	UB:0~420V/4~20mA			130	4300
	UC:0~350V/0~20mA			3	3500
Current transmitting	IA:0~800A/0~20mA	800	8000	7	8000
	IA:0~800A/4~20mA			135	8000
	IB:0~900A/4~20mA			136	9000
Power transmitting	PA:0~320KW/0~20mA	320K	3200	10	3200
	PS:0~960KW/4~20mA	960K	9600	141	9800
Power factor transmitting	PFA:0~1/0~20mA	1	1000	18	1000
	PFS:0~0.9/4~20mA			19	900

The users may set the parameters for the transmitting output via the plate key-pressing setting.In the programming operation,AOSI menu item is the transmitting module parameter setting parameter. See the right picture for parameter setting,programming item AO-1:transmitting output channel 1; 0129=128+1:choose the UA as 4-20mA as the transmitting output,and the corresponding volt for 20mA is 10KV,setting as 1000.

For example,in the internet 10KV/100V,the transmitting output function is finished as:transmitting output loop 1,UA:0-10KV/4-20mA.



Chapter 10. FAQ and Solutions

10.1 About the inaccuracy measuring for the U,I,P and so on

Firstly,the users have to be sure that the right volt and current signal have already reach to the instrument.The users may use the multimeter to test the volt signal,or if needed,use pincerlike meter to test the current signal.Secondly,make sure the connecting of the signal line is correct,for example the leading-in interface for the current signal;check each phase sequence is right.The instrument can view the power display,only if the reverse electricity input,the active power will be in minus while the active power symbol will be plus if the instrument used normally.If the active power symbol is minus,it may means the wrong connecting for current leading-in line or the wrong connecting of the phase sequency.Another thing should be noted that the electricity value the instrument displayed is primary Grid values.If the set for the PT and CT rate of the instrument is different from the actual used rate,the instrument may also display the wrong electricity value.

10.2 About the inaccuracy energy read,energy data not saved

The energy accumulated value of the instrument is based on the power measuring.Check firstly whether the instrument's power value is conforming to the actual load.The instrument support the bidirectional energy computation.With the wrong connecting and minus total active power,the energy will accumulateto the reverse active energy and the positive active energy not.The problem appearing most is the wrong connecting for the CT leading-in line and leading-out line.If the energy data fails to be saved,please check whether there is any load for the instrument.Counting the load,the instrument will keep accumulating.

10.3 The instrument isn't lighting

Make sure suitable auxiliary power (AC/DC 85-265V) has already added to the instrument's auxiliary power interface.The volt exceeding the auxiliary power may damage the instrument and can not be recovered.The users can use the multimeter to test the volt value of the auxiliary power.If the power volt tests fine and there is nothing displayed on the screen of the instrument,the users may consider about cutting off the electricity and connecting it again.If the instrument still doesn't display normally,please contact with our technical department.

10.4 About RS 485 communication,there is no returning data from the instrument

Firstly,make sure the instrument's communicating setting information,such as the slave device's address,baud rate,checking ways is confirming to the core device.If there is more than one instrument that doesn't have the data returned,please check the connecting of main communicating line is right and also the RS 485 converter works fine.If there is only one instrument or few instrument communicate exceptionally,the users should also check the relevant communicating lines.Excluding or confirm the core device software problem with the way to modify the exception situation and slave device address.Or excluding or confirm the instrument problems with the way of testing the exception and instrument installation address.