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AEM72 Three-phase multi-function energy meter

Installation manual V1.1

Acrel Co., Ltd.

State

The company reserves the right to modify the product specifications described in this manual without notice. Before placing an order, please consult your local agent for the current specifications of this product.

Manual revision record：

Date	Old version	New version	Remark
2021.2.14	-	V1.0	Add
2021.9.8	V1.0	V1.1	Added the multi-rate function option and the description of the time display switch

Contents

1 General

AEM72 three-phase multi-function electric energy meter is an intelligent electric energy meter designed mainly for the electric energy statistics and management needs of electric power systems, industrial and mining enterprises and public facilities. The AEM72 three-phase multi-function electric energy meter integrates three-phase electric parameter measurement, electric energy measurement and assessment management, and provides electric energy data statistics for the last 24 o'clock, last 31 days and last 12 months. With 31 sub-harmonic and total harmonic content detection, with switch input and relay output, it can realize "remote signal" and "remote control" functions, and has alarm output, which can be widely used in a variety of control systems, SCADA systems and energy management system. The product meets the requirements of the national standard GB/T 17215.322-2008 "Part 22: 0.2S and 0.5S static active energy meters" and the protocol MODBUS-RTU.

2 Function

Model	Functions	Appearance	Remark
AEM72-C、AEM72-FC	Three-phase power parameter measurement, phase angle of voltage and current, four-quadrant energy metering, multiple rate, maximum demand, historical energy statistics, switching volume event record, historical extreme value record, 31 sub-harmonics and total harmonics Content analysis, phase-separated harmonics and fundamental electrical parameters (voltage, current, power), switch value, alarm output, RS485 (MODBUS or DL/T645-2007 protocol)	72 Square	1、Historical electric energy statistics include: last 12 o 'clock, last 31 days, last 12 months 2. The multi-rate can be set to 4 time zones, two sets of timetables, 12 daily time slots, and 4 fee rates 3. 2DO2DI

Note：F stands for multi-rate function

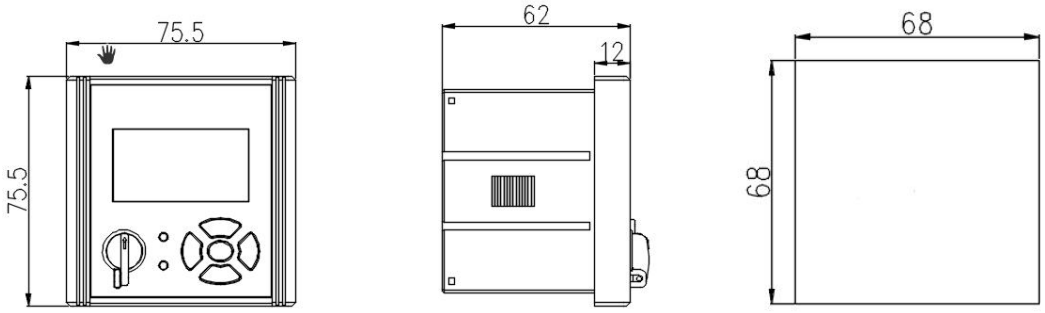
3 Technical parameters

Project			**Parameters**
Specification			3P3L, 3P4L
Measuring	Voltage	Reference voltage Un	3×100V 、 3×380V ； 3×57.7/100V 、 3×220/380V

		Measuring range	0.7Un~1.3Un
		Limit voltage	1.9Un
		Power consumption	<0.05VA(Single phase)
		Impedance	>1.5MΩ
		Accuracy	RMS accuracy 0.2 %
	Current	Measuring range	3×1.5(6)A
		Power consumption	<0.05VA(Single-channel rated current)
		Accuracy	RMS accuracy 0.2 %
	Power		Active, reactive, and apparent power,accuracy 0.5%
	Grid frequency		45～65Hz，accuracy 0.2 %
	Fractional harmonics		2～31 times
	Standards		GB/T 17215.322-2008 DLT645-2007
Metering	Power accuracy		Active energy (accuracy level 0.5S) Reactive energy (accuracy level 2)
	Clock accuracy		≤0.5s/d
Digital signal	Power pulse output		1 active optocoupler output, 1 active optocoupler output (multiplexed with the second switch)；
	DO		2 relay outputs
	DI		2 dry contact inputs
Communication	Interface and communication protocol		RS485: Modbus RTU Protocol or DL/T645-2007
	Communication address range		Modbus RTU:1~ 247;
	Baud rate		1200bps~38400bps
Environment	Working temperature		-20℃~+60℃
	Storing temperature		-30℃~+70℃
	Relative humidity		≤95%（No condensation）
Auxiliary supply			AC and DC power supply(range ：AC85V-265V，DC100-375V) Power consumption：≤2W，10VA

4 Appearance and installation dimensions

4.1 Appearance（Unit：mm）



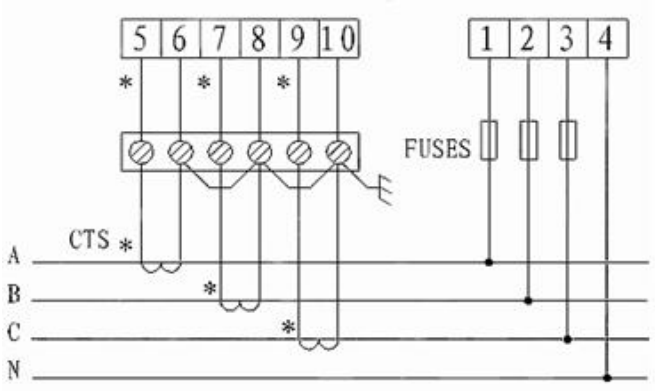
Main view Left view Cut-out size

5 Wiring and installation

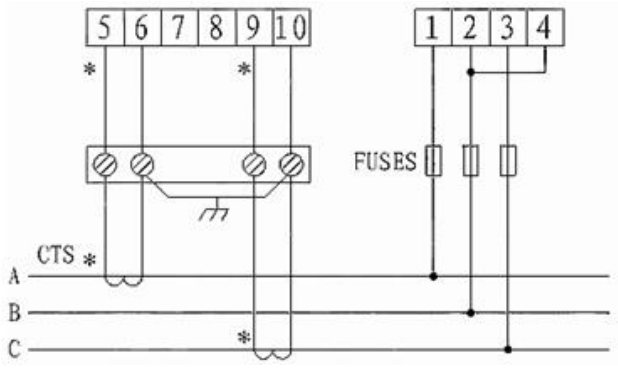
5.1 Wiring

AEM72 can use three-phase four-wire access via current transformers, three-phase three-wire access via current transformers, three-phase four-wire access via voltage and current transformers, and three-phase three-wire access via current and voltage transformers.

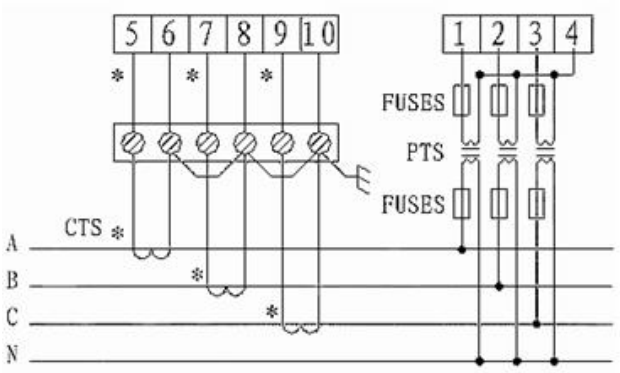
5.1.1 AEM72 voltage and current signal terminals



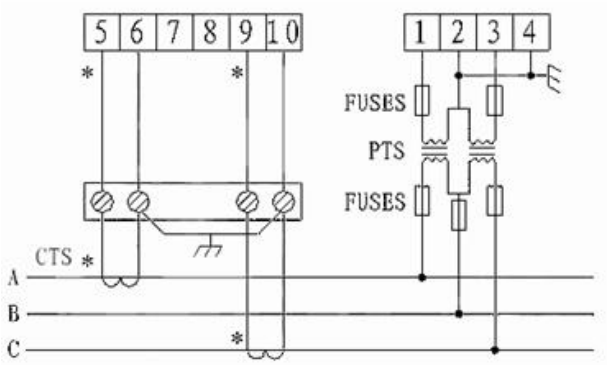
3CT(three-phase four-wire)



2CT(three-phase three-wire)



3PT、3CT(three-phase four-wire)

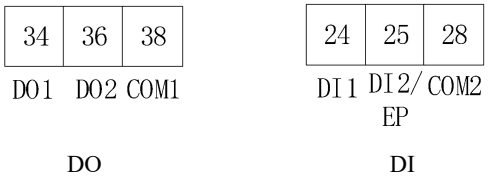


2PT、2CT(three-phase three-wire)

5.2 DI/DO terminal

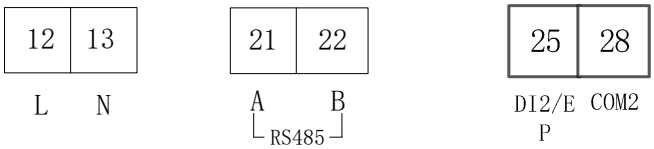
DI adopts the switch signal input mode, and the instrument is equipped with a power supply without external power supply. When the external switch is connected or disconnected, the switch input module collects the switch-on or disconnection information and displays it locally. DI can not only collect and display local switch information, but also realize the remote transmission function through the RS485 of the instrument, that is, the "remote signal" function.

DO is a relay output, which can realize "remote control" and alarm output.



DO DI

5.3 Power terminal, RS485 communication terminal, pulse output terminal



Auxiliary supply Communication Pulse port

Note：25、28 is DI and active energy pulse output pulse multiplexing，The default is DI.

6 Main features

6.1 Measuring function

It can measure full power parameters including voltage U, current I, active power P, reactive power Q, apparent power S, power factor PF, phase angle Φ between voltage and current, voltage unbalance, current unbalance, frequency F. 31 sub-harmonics, odd and even total harmonic content and total harmonic content. One decimal place is reserved for voltage U, 2 decimal places for frequency F, 3 decimal places for current I, 4 decimal places for power P, 2 decimal places for phase angle Φ, and 2 decimal places for unbalance △.For example：U = 220.1V，f = 49.98HZ, I = 1.999A, P = 0.2199KW, Φ= 60.00°, △=0.00%

6.2 Metering function

It can measure the current combined active energy, forward active energy, reverse active energy, inductive reactive energy, capacitive reactive energy, apparent energy.

6.3 Time-sharing function

Two sets of time tables, a year can be divided into 4 time zones, each set of time tables can set 12 day periods,4 rates (F1, F2, F3, F4 namely Sharp, peak, flat, valley). The basic idea of time-of-use billing is to take electric energy as a commodity and use economic levers to reduce the peak and fill in the valley, improve the quality of electricity consumption and improve the comprehensive economic benefits.

6.4 Demand function

The related concepts of demand are as follows：

Demand	The average power measured in the demand period is called demand
Maximum demand	The maximum demand in the specified time zone is called the maximum demand
Slip time	From any moment on, the method of recursively measuring demand according to the time less than the demand period, the measured demand is called slip demand.The recursion time is called slip time.
Demand cycle	The interval between continuous measurements of equal average power, also called window time

The default demand period is 15 minutes, and the slip time is 1 minute.

The demand period and slip time can be set, see 7.3 for details.

It can measure 8 kinds of maximum demand, namely A/B/C three-phase current, forward active power, reverse active power, inductive reactive power, capacitive reactive power, maximum apparent power demand and the time when the maximum demand occurs.

Display real-time 8 kinds of demand, namely A/B/C three-phase current, forward active power, reverse active power, inductive reactive power, capacitive reactive

power, and apparent power demand.

6.5 Historical data statistics function

It can count the historical electric energy at 24 clock, the 31 days, and the last 12 months (including 4 quadrants and electric energy at various rates)

6.6 DI、DO function

There are 2 DO, 2 DI , and DO is relay output, which can realize "remote control" and alarm output. DI can not only collect and display local switch information, but also realize the remote transmission function through the RS485 of the instrument, that is, the "remote signal" function.

7 Operation and display

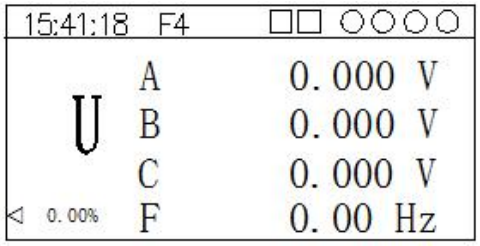
7.1 Button function description

There are a total of 5 buttons, including 4 arrow keys and a middle OK button. Use the OK button to switch the 8 major classification interfaces, and switch the parameters that need to be modified in the programming interface. The left and right buttons switch between different periods of current electric energy in the electric energy display interface, namely sharp, peak, flat, and valley display. In the historical energy statistics interface, it is used to switch the last hour, day, and monthly energy display. In the programming interface, it is used to move the cursor.

7.2 Display

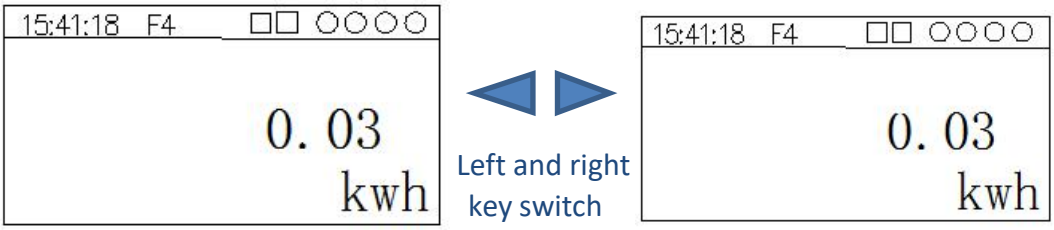
The main body of the display interface can be classified into 8 major interfaces, which can be switched by using the OK button in the middle. The 8 major interfaces are power parameters, current power, historical power statistics by time, historical power daily statistics, historical power monthly statistics, maximum demand, basic information and harmonic content.

The power parameter interface uses the up and down keys to switch the display type, respectively displaying voltage, current, active power, reactive power, apparent power, power factor, voltage and current phase angle. In addition to the power factor, voltage and current phase angles, pressing the left and right keys can switch to display the maximum, minimum and occurrence time of the current electrical parameters.



Voltage interface

Current energy interface, use the up and down keys to switch the current combined active energy, forward active, reverse active, inductive reactive, capacitive reactive energy, and apparent energy, and the left and right keys to switch the total,sharp, peak, flat, and valley energy display.Use the left and right keys to switch the display as shown in the figure below:



Energy interface

Historical data statistics energy interface (hour, day, month) has the same switching method, the up and down keys switch the time point, the left and right keys switch the energy type, and the historical time point is displayed in the lower left corner of the interface, which has different meanings according to different time points in the statistical interface

XX – XX:In hour statistic, it means DD-HH, the former represents the day, and the latter represents the hour.

In daily statistics, it means MM-DD, the former represents the month, and the latter represents the day.

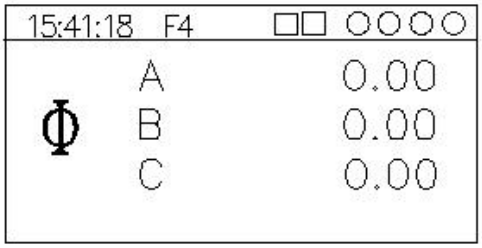
In monthly statistics, it means YY-MM , the former represents the year, and the latter represents the month.

Maximum demand interface Press the up and down keys to switch, and display the current maximum demand for forward active power, reverse active power, inductive reactive power, capacitive reactive power, A-phase current, B-phase current, C-phase current, and maximum apparent power in turn.

·····Press the left and right keys to switch, the current real-time maximum demand for forward active power, reverse active power, inductive reactive power, capacitive reactive power, A-phase current, B-phase current, C-phase current, and visual Maximum demand in power.

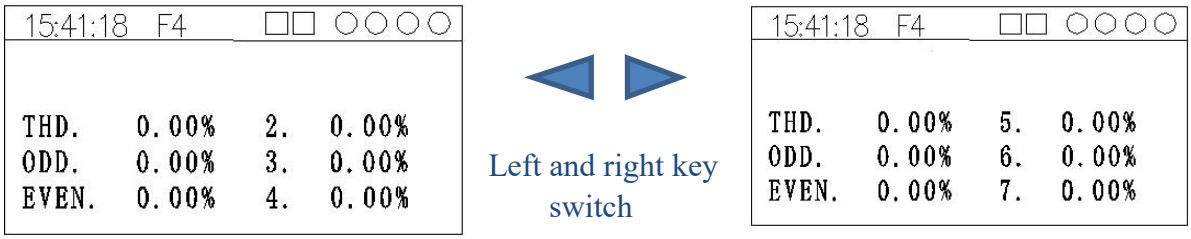
Basic information interface Including communication address, baud rate, protocol, PT, CT, error and version number indication.

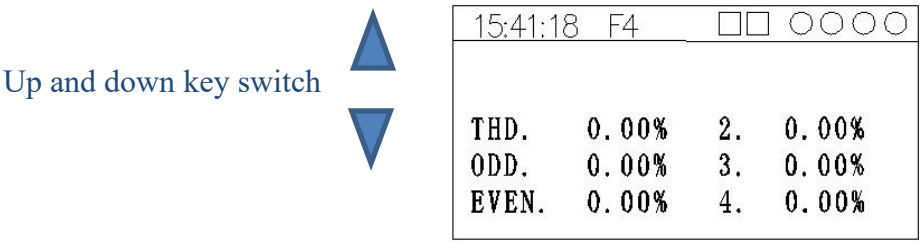
Voltage and current phase angle Showing the phase angle of A, B, C three-phase current and voltage. (When there is only three-phase four-wire, the following figure shows)



Phase angle display interface

Harmonic content display interface Containing the display of 31 sub-harmonics and total harmonic content. The displayed harmonic order (odd stands for odd harmonic total, eve stands for even harmonic total), press the up and down keys to switch the current display Harmonic type (In turn Ua, Ub, Uc, Ia, Ib, Ic).





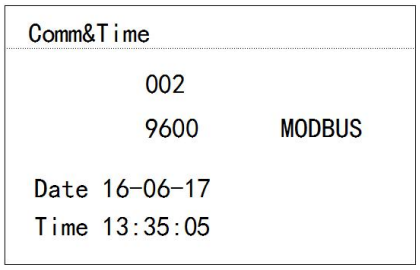
Harmonic display interface

7.3 Programming interface and programming operation

The knob on the left side of the instrument is the programming selection key. The programming interfaces 1, 2, 3, and 4 can be selected to represent communication time setting, system setting, opening setting, and first set of timetable setting.

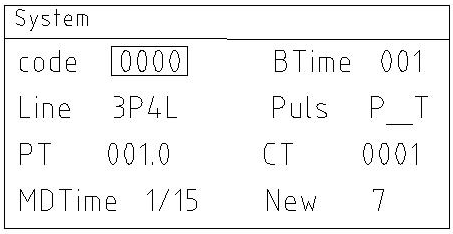
Before entering each programming interface, you need to enter a password. If the password is correct, you can enter the corresponding programming interface. If the password is wrong, you cannot enter the programming interface. Wait for the password to be entered again.

7.3.1 This programming interface mainly sets communication-related and time parameters, such as address, baud rate, etc. The setting interface is shown in the figure as follows：



Communication and time setting interface

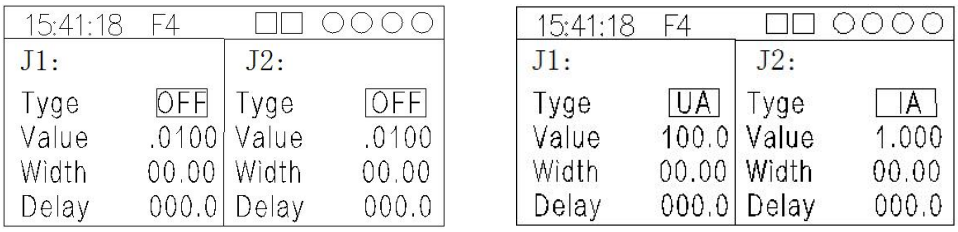
7.3.2 This programming interface mainly sets system parameters, such as password, backlight time, wire system, demand cycle, PT, CT, contrast, etc. The setting interface is shown in the figure below



System parameter setting interface

Code is the password;
BTime is the backlight time, set to 0 when the screen is always on;
Line is the choice of line system;
Puls is the function selection of terminal 19. When P_Q is selected, terminal 19 outputs reactive pulse, and when P_T is selected, terminal 19 outputs time pulse;
MDTime is the demand cycle and slip time. There are four options, namely the demand cycle 15 minutes, 30 minutes, 45 minutes, and 60 minutes. The corresponding slip time is also proportional. The principle is demand cycle/slip time. Time = 15;

7.3.3 This programming interface sets the type of DO and alarm, in which you can set whether DO is an alarm output, the alarm threshold, delay time, pulse width, etc. of the alarm output, and the display is shown in the following figure:



Alarm setting interface

Type is the type of alarm. If OFF is selected, it means it is not an alarm output. It is a remote control function. After selecting OFF, other settings in the interface are invalid. Except for OFF, you can select U, I, and two types of data <> alarm types,

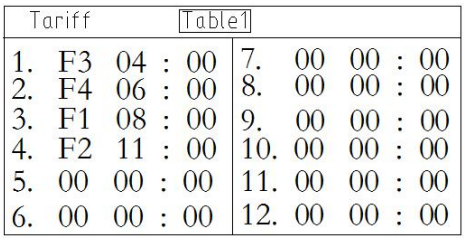
among which Ux, Ix Indicates the alarm output when any voltage or current meets the conditions, M1 to M4 respectively represent the forward active demand, the reverse active demand, the forward reactive power demand, and the reverse reactive power demand;

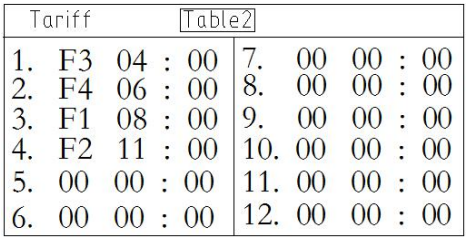
Value is the alarm threshold, the voltage unit is V, the current unit is A, and the power and demand units are kW, both of which are secondary values.

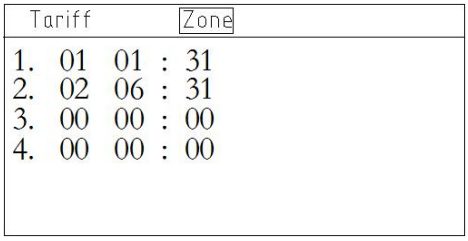
Width is the pulse width. When this value is set to 0, the alarm is level output, normally closed when the condition is met, and normally open when the condition is not met; if it is not zero, for example, set to 1.00, the relay will be closed for 1s after the condition is met, that is, the unit is 1s;

Delay is the alarm delay. When it is set to 0, there is no delay, and it will respond immediately. If it is not 0, it will be responded after a delay of 10.0 seconds if it is set to 10.0.

7.3.4 This programming interface can set two time periods table, switch the time period at Table1, F1, F2, F3, F4 represent 4 different time periods of sharp, peak, flat, and valley respectively, (Table1 represents time period 1, Table2 represents time period two, Zone represents The time zone can be set.) Its interface is as shown in the figure below.







Timetable setting interface

Table1 interface shows the flat period from 4 am to 6 am, the trough period from 6-8 o'clock, the sharp period from 8-11 o'clock, and the peak period from 11 to 4 o'clock the next day;

The Zone interface shows that the first time period is measured from January 31 to June 31, and time period 2 is used from after June 31 to January 31 of the next year.

Note: Since the multiple rate is an optional function, when the multiple rate is selected, the upper right corner of the conventional display will display the time and

current rate, but if there is no optional multiple rate, the upper right corner will not display Time and current rate.

8 Communication description

The RS485 communication interface of the instrument supports MODBUS-RTU communication protocol and DL/T645-2007 power protocol. The baud rate of the communication port can be set between 1200bps, 2400 bps, 4800 bps, 9600bps, and the check digit is no check.
The RS485 communication port of the instrument requires a shielded twisted pair connection, and the layout of the entire network should be considered when wiring: such as the length and direction of the communication cable, the location of the host computer, the matching resistance at the end of the network, the communication converter, and the scalability of the network , Network coverage, environmental electromagnetic interference and other factors must be considered comprehensively.
Note:
①Strictly construct in accordance with the requirements in the wiring project;
②For instruments that do not need to communicate temporarily, they must be connected to the RS-485 network to facilitate diagnosis and testing;
③When connecting RS-485 cables, try to use double-color twisted-pair cables. All 485 communication ports "A" are connected to the same color, and "B" is connected to another color.
④ The RS-485 bus (from the communication port of the host computer to the communication port of any connected instrument terminal) is no more than 1200 meters in length.

8.1 Modbus protocol register address table

The indicator supports the 03H and 10H commands in the MODBUS-RTU protocol. 03H means reading multiple registers, and 10H means writing multiple registers. Please check the protocol data format by yourself. The following table is the register address table of the instrument:

Address	Data	Length (bytes)	Remark
0000H	Address	2	
0001H	Baud rate	2	1:9600;2:4800;3:2400;4:1200
0002H	Operation control	2	Note 1
0003H	Backlight time	2	
0004H	VT (voltage transformation ratio)	2	Keep 1 decimal place If the value is 10, VT=10 x 0.1=1.0
0005H	CT (current transformation ratio)	2	

0006H	Multiplexed pulse selection	2	0:Active pulse;1:DI2 enable
0007H	Pulse constant	2	
0008H	Slip time/demand cycle	2	
0009H	Password	2	
000AH	Date	6	Second, minute, hour, day, month, year
000DH	Time zone	16	The singular register is the table number of the four time periods, and the even register is the date (high digit is month, and low digit is day)
0015H	Timetable 1	48	The singular register is 12 rate periods, the even register is time (the high is hour, the low is minute)
002DH	Timetable 2	48	Same as above
0045H	J1 control	2	Relay 1: 0: open; 1: close
0046H	J2 control	2	Relay 2: 0: open; 1: close
0047H	Switch status	2	Note 4
0048H	J1 output pulse width	2	Note 2
0049H	J1 alarm type		
004AH	J1 alarm threshold		
004BH	J1 alarm delay		
004CH	J2 output pulse width		
004DH	J2 alarm type		
004EH	J2 alarm threshold		
004FH	J2 alarm delay		
0050H	A Phase voltage	2	Keep 1 decimal place, unsigned integer If the value is 2201, Then U=2201*0.1=220.1V
0051H	B Phase voltage		
0052H	C Phase voltage		
0053H	AB line voltage		
0054H	BC line voltage		
0055H	CA line voltage		
0056H	A Phase current	2	Keep 3 decimal places, unsigned integer If the value is 5004, Then I=5004*0.001=5.004A
0057H	B Phase current		
0058H	C Phase current		
0059H	Neutral current		
005AH	A active power	2	Keep 4 decimal places, unsigned integer If the value is 11720,
005BH	B active power		
005CH	C active power		

005DH	Total active power		
005EH	A reverse active power		
005FH	B reverse active power		
0060H	C reverse active power		
0061H	Total reverse active power		
0062H	A apparent power		
0063H	B apparent power		
0064H	C apparent power		
0065H	Total apparent power		
0066H	A power factor	2	Keep 3 decimal places, unsigned integer If the value is 999, Then the value=999*0.001=0.999
0067H	B power factor		
0068H	C power factor		
0069H	Total power factor		
006AH	Power direction	2	Note 3
006BH	Frequency	2	Keep 2 decimal places, unsigned integer If the value is 5002, Then the value=5002*0.01=50.02Hz
006CH	Current positive active power demand	2	Keep 4 decimal places, unsigned integer If the value is 11202 Then the value=11202*0.0001=1.1202kW
006DH	Current reverse active power demand	2	
006EH	Current positive reactive power demand	2	
006FH	Current reverse reactive power demand	2	
0070H	Maximum demand for positive active power	2	Same as current demand
0071H	Time of occurrence	4	Minute, hour, day, month
0073H	Maximum reverse active power demand	2	Same as current demand
0074H	Time of occurrence	4	Minute, hour, day, month
0076H	Maximum forward reactive power demand	2	Same as current demand
0077H	Time of occurrence	4	Minute, hour, day, month
0079H	Maximum reverse reactive power demand	2	Same as current demand
007AH	Time of occurrence	4	Minute, hour, day, month

007CH	Current combined active total energy	4	Keep 2 decimal places, unsigned integer If the value is 120201, Then the value=120201*0.01=1202.01kWh
007EH	Current positive active total energy	4	
0080H	Current reverse active total energy	4	
0082H	Current positive reactive total energy	4	
0084H	Current reserve reactive total energy	4	
0086H	Current combined active sharp energy	4	
0088H	Current combined active peak energy	4	
008AH	Current combined active flat energy	4	
008CH	Current combined active valley energy	4	
008EH	Current positive active sharp energy	4	
0090H	Current positive active peak energy	4	
0092H	Current positive active flat energy	4	
0094H	Current positive active valley energy	4	
0096H	Current reverse active sharp energy	4	
0098H	Current reverse active peak energy	4	
009AH	Current reverse active flat energy	4	
009CH	Current reverse active valley energy	4	
009EH	Current positive reactive sharp energy	4	
00A0H	Current positive reactive peak energy	4	
00A2H	Current positive reactive flat energy	4	
00A4H	Current positive reactive valley energy	4	
00A6H	Current reverse reactive sharp energy	4	
00A8H	Current reverse reactive peak energy	4	
00AAH	Current reverse reactive flat energy	4	
00ACH	Current reverse reactive valley energy	4	
00AEH	A phase combined active total energy	4	
00B0H	A phase positive active total energy	4	
00B2H	A phase reserve active total energy	4	

00B4H	A phase positive reactive total energy	4	
00B6H	A phase reserve reactive total energy	4	
00B8H	B phase combined active total energy	4	
00BAH	B phase positive active total energy	4	
00BCH	B phase reserve active total energy	4	
00BEH	B phase positive reactive total energy	4	
00C0H	B phase reserve reactive total energy	4	
00C2H	C phase combined active total energy	4	
00C4H	C phase positive active total energy	4	
00C6H	C phase reserve active total energy	4	
00C8H	C phase positive reactive total energy	4	
00CAH	C phase reserve reactive total energy	4	
00CCH	A phase voltage total distortion	2	Keep 2 decimal places, unsigned integer (0.01%) If the value is 2425, Then the value=2425*0.01=25.24%
00CDH	B phase voltage total distortion		
00CEH	C phase voltage total distortion		
00CFH	A phase current total distortion		
00D0H	B phase current total distortion		
00D1H	C phase current total distortion		
00D2H	A phase voltage sub-harmonic content (2-31 times)	2×30	The length of each harmonic is 2 bytes Keep 2 decimal places, unsigned integer (0.01%) If the value is 2425, Then the value=2425*0.01=25.24%
00F0H	B phase voltage sub-harmonic content (2-31 times)	2×30	
010EH	C phase voltage sub-harmonic content (2-31 times)	2×30	
012CH	A phase current sub-harmonic content (2-31 times)	2×30	
014AH	B phase current sub-harmonic content (2-31 times)	2×30	
0168H	C phase current sub-harmonic content (2-31 times)	2×30	
0186H	A phase fundamental voltage	2	Keep 1 decimal place, unsigned integer If the value is 2201, Then U=2201*0.1=220.1V
0187H	B phase fundamental voltage		
0188H	C phase fundamental voltage		
0189H	A phase harmonic voltage		
018AH	B phase harmonic voltage		

018BH	C phase harmonic voltage		
018CH	A phase fundamental current	2	Keep 3 decimal places, unsigned integer If the value is 5004, Then I=5004*0.001=5.004A
018DH	B phase fundamental current		
018EH	C phase fundamental current		
018FH	A phase harmonic current		
0190H	B phase harmonic current		
0191H	C phase harmonic current		
0192H	A phase fundamental active power	2	Keep 4 decimal places, unsigned integer If the value is 11720, Then the value=11720*0.0001=1.1720kW
0193H	B phase fundamental active power		
0194H	C phase fundamental active power		
0195H	Total fundamental active power		
0196H	A phase fundamental reactive power		
0197H	B phase fundamental reactive power		
0198H	C phase fundamental reactive power		
0199H	Total fundamental reactive power		
019AH	A phase harmonic active power		
019BH	B phase harmonic active power		
019CH	C phase harmonic active power		
019DH	Total harmonic active power		
019EH	A phase harmonic reactive power		
019FH	B phase harmonic reactive power		
01A0H	C phase harmonic reactive power		
01A1H	Total harmonic reactive power		
01A2H	Voltage unbalance	2	Keep 2 decimal places, unsigned integer (0.01%) If the value is 2201, The value is 2201*0.01=22.01%
01A3H	Current unbalance		
01A4H	Current A and voltage A phase angle	2	Keep 2 decimal places, unsigned integer (0.01°) If the value is 9011, Then U=9011*0.01=90.11°
01A5H	Current B and voltage B phase angle		
01A6H	Current C and voltage C phase angle		
01A7H	Positive apparent electric energy	4	Keep 2 decimal places, unsigned integer If the value is 120201, Then the value=120201*0.01=1202.01kWh
01A9H	Sharp electric energy	4	
01ABH	Peak electric energy	4	
01ADH	Flat electric energy	4	
01AFH	Valley electric energy	4	
01B1H	A phase current real-time demand	2	Keep 4 decimal places, unsigned

01B2H	B phase current real-time demand	2	
01B3H	C phase current real-time demand	2	
01B4H	Real-time demand for current apparent power	2	
01B5H	Maximum demand of A phase current	2	Same as current demand
01B6H	Time of occurrence	4	Minute, hour, day, month
01B8H	Maximum demand of B phase current	2	Same as current demand
01B0H	Time of occurrence	4	Minute, hour, day, month
01BBH	Maximum demand of C phase current	2	Same as current demand
01BCH	Time of occurrence	4	Minute, hour, day, month
01BEH	Maximum demand of apparent power	2	Same as current demand
01BFH	Time of occurrence	4	Minute, hour, day, month
01C1H	A phase voltage odd harmonics	2	Keep 2 decimal places, unsigned integer (0.01%) If the value is 2425, Then the value=2425*0.01=25.24%
01C2H	B phase voltage odd harmonics	2	
01C3H	C phase voltage odd harmonics	2	
01C4H	A phase current odd harmonics	2	
01C5H	B phase current odd harmonics	2	
01C6H	C phase current odd harmonics	2	
01C7H	A phase voltage even harmonics	2	
01C8H	B phase voltage even harmonics	2	
01C9H	C phase voltage even harmonics	2	
01CAH	A phase current even harmonics	2	
01CBH	B phase current even harmonics	2	
01CCH	C phase current even harmonics	2	
01CDH	Total current combined reactive power	4	Keep 2 decimal places, unsigned integer If the value is 120201, Then the value=120201*0.01=1202.01 kvar·h
01CFH	First quadrant reactive energy	4	
01D1H	Second quadrant reactive energy	4	
01D3H	Third quadrant reactive energy	4	
01D5H	Fourth quadrant reactive energy	4	

8.2 Historical power data reading

The first address of the interval (high byte)	Historical data type
11-28	Last 1 o'clock-24 o'clock
29-47	Last 1 day-31 day
48-53	Last 1 month-31 month

Offset address of each section (low byte)	Data type
00	Record date and time
03	Historical total combined active energy
05	Historical total positive active energy
07	Historical total reverse active energy
09	Historical total positive reactive energy
0B	Historical total reverse reactive energy
0D	Historical combined of active sharp energy
OF	Historical combined of active peak energy
11	Historical combined of active flat energy
13	Historical combined of active valley energy
15	Historical positive active sharp energy
17	Historical positive active peak energy
19	Historical positive active flat energy
1B	Historical positive active valley energy
1D	Historical reserve active sharp energy
1F	Historical reserve active peak energy
21	Historical reserve active flat energy
23	Historical reserve active valley energy

25	Historical positive reactive sharp energy
27	Historical positive reactive peak energy
29	Historical positive reactive flat energy
2B	Historical positive reactive valley energy
2D	Historical reserve reactive sharp energy
2F	Historical reserve reactive peak energy
31	Historical reserve reactive flat energy
33	Historical reserve reactive valley energy
35	A phase combined active total energy
37	A phase positive active total energy
39	A phase reserve active total energy
3B	A phase positive reactive total energy
3D	A phase reserve reactive total energy
3F	B phase combined active total energy
41	B phase positive active total energy
43	B phase reserve active total energy
45	B phase positive reactive total energy
47	B phase reserve reactive total energy
49	C phase combined active total energy
4B	C phase positive active total energy
4D	C phase reserve active total energy

4F	C phase positive reactive total energy
51	C phase reserve reactive total energy
53	Apparent total energy
55	Apparent sharp energy
57	Apparent peak energy
59	Apparent flat energy
5B	Apparent valley energy

The register address of historical electric energy reading is divided into two parts: high byte and low byte. When reading, bytes in the two tables need to be splicing to get the register address. For example, when reading 4 bytes, the total electric energy of historical forward reactive power can be found in the table as 1409H.

8.3 Historical alarm output reading

The first address of the interval (high byte)	Historical data type
03	Alarm output event record

Offset address of each section (low byte)	Data type
00	Last time alarm output record
05	Last second alarm output record
0A	Last third alarm output record
0F	Last fourth alarm output record
14	Last fifth alarm output record
19	Last sixth alarm output record
1E	Last seventh alarm output record
23	Last eighth alarm output record
28	Last ninth alarm output record
2D	Last tenth alarm output record

Remarks: The length of each event record is 5 words, and the specific data arrangement refers to the following table:

Register address	Event name	Data type	Remark
0300H	Last time alarm output record	Seconds and minutes of the occurrence	High byte is second
0301H		Hours and days of the occurrence	High byte is hour
0302H		Months and years of the occurrence	High byte is month
0303H		Switch status and number	High byte: DO port number (0: DO1, 1: DO2) Low byte: switch status (0: open, 1: closed)
0304H		Alarm type	High byte: over-limit type (0: more than the threshold, 1: less than the threshold) Low byte: specific alarm parameters (see note 2)

8.4 Historical switch input event reading

The first address of the interval (high byte)	Historical data type
03	Alarm output event record

Offset address of each section (low byte)	Data type
32	Last time alarm input record
37	Last second alarm input record
3C	Last third alarm input record
41	Last fourth alarm input record
46	Last fifth alarm input record
4B	Last sixth alarm input record
50	Last seventh alarm input record
55	Last eighth alarm input record
5A	Last ninth alarm input record
5F	Last tenth alarm input record

Remarks: The length of each event record is 5 words, and the specific data arrangement refers to the following table:

Register address	Event name	Data type	Remark
0332H	Last time alarm output record	Seconds and minutes of the occurrence	High byte is second
0333H		Hours and days of the occurrence	High byte is hour
0334H		Months and years of the occurrence	High byte is month
0335H		Switch status and number	High byte: DI port number (0: DI1, 1: DI2) Low byte: switch status (0: open, 1: closed)
0336H		Reserved	

8.5 Record reading of extreme value and occurrence time

Maximum record：

The first address of the interval (high byte)	Historical data type
04	Monthly record of extreme value and occurrence time
05	Record of extreme value and occurrence time in last month
06	Record of extreme value and occurrence time in last two months
07	Record of extreme value and occurrence time in last three months

Offset address of each section (low byte)	Data type
00	A phase voltage maximum value and occurrence time record
03	B phase voltage maximum value and occurrence time record
06	C phase voltage maximum value and occurrence time record
09	The maximum value of the AB line voltage and the occurrence time record
0C	The maximum value of the BC line voltage and the occurrence time record
0F	The maximum value of the CA line voltage and the occurrence time record

12	A phase current maximum value and occurrence time record
15	B phase current maximum value and occurrence time record
18	C phase current maximum value and occurrence time record
1B	Three-phase current vector sum maximum value and occurrence time record
1E	A phase active power maximum value and occurrence time record
21	B phase active power maximum value and occurrence time record
24	C phase active power maximum value and occurrence time record
27	Total active power maximum value and occurrence time record
2A	A phase reactive power maximum value and occurrence time record
2D	B phase reactive power maximum value and occurrence time record
30	C phase reactive power maximum value and occurrence time record
33	Total reactive power maximum value and occurrence time record
36	A phase apparent power maximum value and occurrence time record
39	A phase apparent power maximum value and occurrence time record
3C	A phase apparent power maximum value and occurrence time record
3F	Total apparent power maximum value and occurrence time record

Minimum record：

The first address of the interval (high byte)	Historical data type
04	Monthly record of extreme value and occurrence time
05	Record of extreme value and occurrence time in last month
06	Record of extreme value and occurrence time in last two months
07	Record of extreme value and occurrence time in last three months

Offset address of each section (low byte)	Data type
42	A phase voltage minimum value and occurrence time record
45	B phase voltage minimum value and occurrence time record
48	C phase voltage minimum value and occurrence time record
4B	The minimum value of the AB line voltage and the occurrence time record
4E	The minimum value of the BC line voltage and the occurrence time record
51	The minimum value of the CA line voltage and the occurrence time record
54	A phase current minimum value and occurrence time record
57	B phase current minimum value and occurrence time record
5A	C phase current minimum value and occurrence time record
5D	Three-phase current vector sum minimum value and occurrence time record
60	A phase active power minimum value and occurrence time record
63	B phase active power minimum value and occurrence time record
66	C phase active power minimum value and occurrence time record
69	Total active power minimum value and occurrence time record

6C	A phase reactive power minimum value and occurrence time record
6F	B phase reactive power minimum value and occurrence time record
72	C phase reactive power minimum value and occurrence time record
75	Total reactive power minimum value and occurrence time record
78	A phase apparent power minimum value and occurrence time record
7B	A phase apparent power minimum value and occurrence time record
7E	A phase apparent power minimum value and occurrence time record
81	Total apparent power minimum value and occurrence time record

Remarks: The length of each extreme value and occurrence time record is 3 words, and the specific data arrangement refers to the following table:

Register address	Event name	Data type	Remark
0400H	A phase voltage maximum value and occurrence time record	Extreme value specific data	For specific data types and decimal places, please refer to 8.1 address table
0401H		Minutes and hours of occurrence	High byte is minute
0402H		Day and month of occurrence	High byte is day

8.6 Historical demand record reading

The first address of the interval (high byte)	Historical data type
08	Historical demand records
09	Historical demand records

Offset address of each section (low byte)	Data type
00	Demand records of last months
0C	Demand records of last two months
18	Demand records of last three months
24	Demand records of last

	four months
30	Demand records of last five months
3C	Demand records of last six months
48	Demand records of last seven months
54	Demand records of last eight months
60	Demand records of last nine months
6C	Demand records of last ten months
78	Demand records of last eleven months
84	Demand records of last twelve months

Remarks: The length of each event record is 12 words, and the specific data arrangement refers to the following table:

Register address	Event name	Data type	Remark
0800H	Last switch input record	Positive active power demand	Demand data
0801H		Minutes and hours of occurrence	High byte is minute
0802H		Days and months of occurrence	High byte is day
0803H		Reserve active power demand	Demand data
0804H		Minutes and hours of occurrence	High byte is minute
0805H		Days and months of occurrence	High byte is day
0806H		Positive reactive power demand	Demand data
0807H		Minutes and hours of occurrence	High byte is minute
0808H		Days and months of occurrence	High byte is day

0809H		Reserve reactive power demand	Demand data
080AH		Minutes and hours of occurrence	High byte is minute
080BH		Days and months of occurrence	High byte is day

Register address	Event name	Data type	Remark
0900H	Last switch input record	A phase current demand	Demand data
0901H		Minutes and hours of occurrence	High byte is minute
0902H		Days and months of occurrence	High byte is day
0903H		B phase current demand	Demand data
0904H		Minutes and hours of occurrence	High byte is minute
0905H		Days and months of occurrence	High byte is day
0906H		C phase current demand	Demand data
0907H		Minutes and hours of occurrence	High byte is minute
0908H		Days and months of occurrence	High byte is day
0909H		Apparent power demand	Demand data
090AH		Minutes and hours of occurrence	High byte is minute
090BH		Days and months of occurrence	High byte is day

8.7 Special command format for reading energy data

**Main send：01 03 10 00 00 0E CRC

**Respond：01 03 1C 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 crc1 crc2

The return data is in order: combined total active power/forward active power/reverse active power/forward reactive power/reverse reactive power/apparent energy/combined total reactive power

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XXXXXX.XX represents the integer and decimal places of the measured value or stored value; NNNNNN.NN represents the integer and decimal places of the set value; YY represents the year; MM represents the month; DD represents the day; WW represents the week; hh represents the hour; mm Represents minutes; ss represents seconds; it is expressed as a two-digit decimal number unless otherwise specified.

Data identification				Data Format	Data length (bytes)	Unit	Function		Project name
DI3	DI2	DI1	DI0				read	write	
04	00	04	01	NNNNNNNNNNNN	6		*	*	Communication address
04	00	04	02	NNNNNNNNNNNN	6		*	*	Model number
04	00	01	01	YYMMDDWW	4	Year month day week	*	*	Date
04	00	01	02	hhmmss	3	Hour minute and second	*	*	Time
04	01	00	00	MMDDNN	3		*	*	Time zone
04	01	00	01	hhmmNN	3		*	*	Timetable 1
04	01	00	02	hhmmNN	3		*	*	Timetable 2
04	00	04	0E						Change protocol
02	01	01	00	XXX.X	2	V	*		A phase voltage
02	01	02	00	XXX.X	2	V	*		B phase voltage
02	01	03	00	XXX.X	2	V	*		C phase voltage
02	02	01	00	XXX.XXX	3	A	*		A phase current
02	02	02	00	XXX.XXX	3	A	*		B phase current
02	02	03	00	XXX.XXX	3	A	*		C phase current
02	03	00	00	XX.XXX	3	KW	*		Total active power
02	03	01	00	XX.XXX	3	KW	*		A active power
02	03	02	00	XX.XXX	3	KW	*		B active power
02	03	03	00	XX.XXX	3	KW	*		C active power

02	04	00	00	XX.XXX	3	Kvar	*		Total reactive power
02	04	01	00	XX.XXX	3	Kvar	*		A reactive power
02	04	02	00	XX.XXX	3	Kvar	*		B reactive power
02	04	03	00	XX.XXX	3	Kvar	*		C reactive power
02	05	00	00	XX.XXX	3	KVA	*		Total apparent power
02	05	01	00	XX.XXX	3	KVA	*		A apparent power
02	05	02	00	XX.XXX	3	KVA	*		B apparent power
02	05	03	00	XX.XXX	3	KVA	*		C apparent power
02	06	00	00	X.XXX	2		*		Total power factor
02	06	01	00	X.XXX	2		*		A power factor
02	06	02	00	X.XXX	2		*		B power factor
02	06	03	00	X.XXX	2		*		C power factor
00	00	00	00	XXXXX X.XX	4	KWh	*		Total active energy
00	01	00	00	XXXXX X.XX	4	KWh	*		Total positive active energy
00	02	00	00	XXXXX X.XX	4	KWh	*		Total reserve active energy
00	03	00	00	XXXXX X.XX	4	KWh	*		Total positive reactive energy
00	04	00	00	XXXXX X.XX	4	KWh	*		Total reserve reactive energy
00	15	00	00	XXXXX X.XX	4	KWh	*		A phase positive active energy
00	29	00	00	XXXXX X.XX	4	KWh	*		B phase positive active energy
00	3D	00	00	XXXXX X.XX	4	KWh	*		C phase positive active energy
01	01	00	00	XX.XXX X	8	KW	*		Current maximum demand for positive active power
01	02	00	00	XX.XXX X	8	KW	*		Current maximum demand for reserve active power
01	03	00	00	XX.XXX X	8	KW	*		Current maximum demand for positive reactive power
01	04	00	00	XX.XXX X	8	KW	*		Current maximum demand for reserve reactive power
01	09	00	00	XX.XXX X	8	KW	*		Current maximum demand
01	10	00	00	XXX.XX	3	A	*		A phase maximum

				X					demand of current
01	11	00	00	XXX.XX X	3	A	*		B phase maximum demand of current
01	12	00	00	XXX.XX X	3	A	*		C phase maximum demand of current
02	80	00	04	XX.XXX X	8	KW	*		Current active power demand
02	80	00	05	XX.XXX X	8	KW	*		Current reactive power demand
02	0A	FF	FF	XX.XX	2	%	*		Voltage harmonic content
02	0A	01	01	XX.XX	2	%	*		A Phase voltage 1st harmonic content
			…						A Phase voltage …th harmonic content
			15						21st harmonic content of phase A voltage
02	0A	02	01	XX.XX	2	%	*		B Phase voltage 1st harmonic content
			…						B Phase voltage …th harmonic content
			15						21st harmonic content of phase B voltage
02	0A	03	01	XX.XX	2	%	*		C Phase voltage 1st harmonic content
			…						C Phase voltage …th harmonic content
			15						21st harmonic content of phase C voltage
02	0B	FF	FF	XX.XX	2	%	*		Current harmonic content
02	0B	01	01	XX.XX	2	%	*		A Phase current 1st harmonic content
			…						A Phase current …th harmonic content
			15						21st harmonic content of phase A current
02	0B	02	01	XX.XX	2	%	*		B Phasecurrent 1st harmonic content
			…						B Phase current …th harmonic content

			15						21st harmonic content of phase B current
02	0B	03	01	XX.XX	2	%	*		C Phase current 1st harmonic content
			…						C Phase current …th harmonic content
			15						21st harmonic content of phase C current
00	00	FF	00	XXXXX X.XX	4	KWh	*		Current total active energy data block
00	01	FF	00	XXXXX X.XX	4	KWh	*		Current positive active energy data block
00	02	FF	00	XXXXX X.XX	4	KWh	*		Current reserve active energy data block
00	03	FF	00	XXXXX X.XX	4	Kvar	*		Current positive reactive energy data block
00	04	FF	00	XXXXX X.XX	4	Kvar	*		Current reserve reactive energy data block
02	01	FF	00	XXX.X	2	V	*		Voltage block
02	02	FF	00	XXX.XX X	3	A	*		Current block
02	03	FF	00	XX.XXX X	3	KW	*		Active power block
02	04	FF	00	XX.XXX X	3	Kvar	*		Reactive power block
02	05	FF	00	XX.XXX X	3	KVA	*		Apparent power block
02	06	FF	00	X.XXX	2		*		Power factor block
00	01	FF	01	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last month
00	02	FF	01	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last month
00	03	FF	01	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last month
00	04	FF	01	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last month
00	01	FF	02	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last

									two months
00	02	FF	02	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last two months
00	03	FF	02	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last two months
00	04	FF	02	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last two months
00	01	FF	03	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last three months
00	02	FF	03	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last three months
00	03	FF	03	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last three months
00	04	FF	03	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last three months
00	01	FF	04	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last four months
00	02	FF	04	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last four months
00	03	FF	04	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last four months
00	04	FF	04	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last four months
00	01	FF	05	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last five months
00	02	FF	05	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last five months
00	03	FF	05	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last five months
00	04	FF	05	XXXXX	4	Kvar	*		Reserve reactive

				X.XX					energy data block in the last five months
00	01	FF	06	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last six months
00	02	FF	06	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last six months
00	03	FF	06	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last six months
00	04	FF	06	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last six months
00	01	FF	07	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last seven months
00	02	FF	07	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last seven months
00	03	FF	07	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last seven months
00	04	FF	07	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last seven months
00	01	FF	08	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last eight months
00	02	FF	08	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last eight months
00	03	FF	08	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last eight months
00	04	FF	08	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last eight months
00	01	FF	09	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last nine months
00	02	FF	09	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last nine months

00	03	FF	09	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last nine months
00	04	FF	09	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last nine months
00	01	FF	0A	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last ten months
00	02	FF	0A	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last ten months
00	03	FF	0A	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last ten months
00	04	FF	0A	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last ten months
00	01	FF	0B	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last eleven months
00	02	FF	0B	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last eleven months
00	03	FF	0B	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last eleven months
00	04	FF	0B	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last eleven months
00	01	FF	0C	XXXXX X.XX	4	KWh	*		Positive active energy data block in the last twelve months
00	02	FF	0C	XXXXX X.XX	4	KWh	*		Reserve active energy data block in the last twelve months
00	03	FF	0C	XXXXX X.XX	4	Kvar	*		Positive reactive energy data block in the last twelve months
00	04	FF	0C	XXXXX X.XX	4	Kvar	*		Reserve reactive energy data block in the last twelve months
05	00	01	01	XXXXX X.XX	4	KWh	*		Positive active energy in the last day

05	00	01	…	XXXXX X.XX	4	KWh	*		Positive active energy in the last … day
05	00	01	1F	XXXXX X.XX	4	KWh	*		Positive active energy in the last 31 days
05	00	02	01	XXXXX X.XX	4	KWh	*		Reserve active energy in the last day
05	00	02	…	XXXXX X.XX	4	KWh	*		Reserve active energy in the last … day
05	00	02	1F	XXXXX X.XX	4	KWh	*		Reserve active energy in the last 31 days
05	00	03	01	XXXXX X.XX	4	KWh	*		The combined reactive power of the last day 1 electric energy
05	00	03	…	XXXXX X.XX	4	KWh	*		The combined reactive power of the last…day 1 electric energy
05	00	03	1F	XXXXX X.XX	4	KWh	*		The combined reactive power of the last 31 days 1 electric energy
05	00	04	01	XXXXX X.XX	4	KWh	*		The combined reactive power of the last day 2 electric energy
05	00	04	…	XXXXX X.XX	4	KWh	*		The combined reactive power of the last…day 2 electric energy
05	00	04	1F	XXXXX X.XX	4	KWh	*		The combined reactive power of the last 31 days 2 electric energy

Note 1：

Operation control word	
High byte	Low byte
Wiring	Protocol

Note 2：

Alarm type	
High byte	Low byte
0:Turn off the alarm function	0：>;1: <
1-4：UA、UB、UC、Ux	
5-8：IA、IB、IC、Ix	
9-12：PA、PB、PC、PT	
13-16：M1、M2、M3、M4	

Output pulse width
0：Level mode output
>0：The unit of pulse width is 0.1s
Alarm delay
0：No delay
>0：The delay unit is 0.01s

Note 3：

D7	D6	D5	D4	D3	D2	D1	D0
Qt	Qc	Qb	Qa	Pt	Pc	Pb	Pa

Each bit represents a power direction, 1 is reverse, 0 is forward

Note 4：DI state (0x47)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
						DI2	DI1

1 is closed, 0 is open

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