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AEM96 Three-phase Electricity Meter

User's Manual (V2.0)

Acrel Co., Ltd.

Declaration

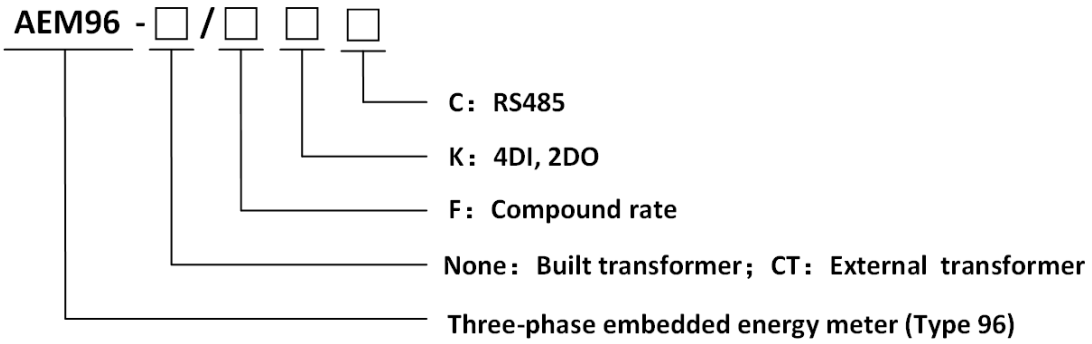
Acrel reserves the right to modify the product specifications herein without notification. Please consult the local agent about the latest specifications before placing a purchase order.

Contents

1 Overview

AEM three-phase embedded multi-function electricity meter is a smart meter designed for power supply system, industrial and mining enterprises and utilities to calculate the electricity consumption and manage the electric demand. It features the high precision, small size and simple installation. It integrates the measurement of all electrical parameters with the comprehensive electricity metering and management provides various data on previous 24 hours, previous 31 days and previous 12 months, checks the 63st harmonic content and the total harmonic content, realizes the remote communication and the remote control with switching input and relay output and boasts the alarm output. It is fitted with RS485 communication port and adapted to MODBUS-RTU or DL/T645-2007 protocol. AEM electricity meter can be used in all kinds of control systems, SCADA systems and energy management systems.

2 List of functions

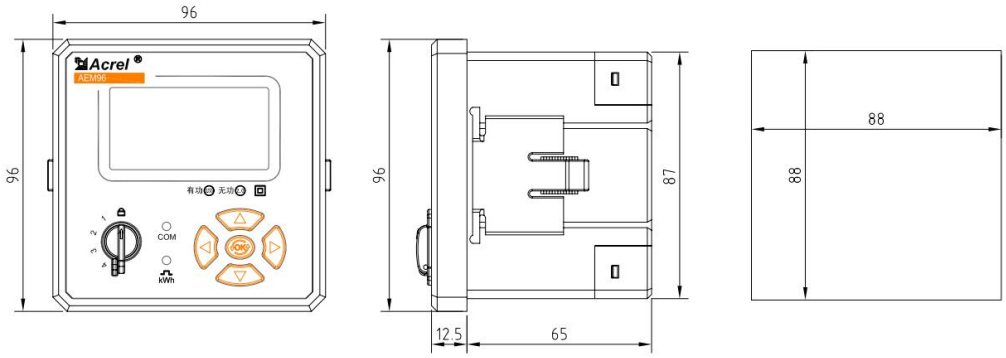


Model	Basic functions	Form	Remark
AEM96	Measurement of all electric parameters in three phases, four-quadrant electricity metering, multi-rate tariff, peak demand, historical data on electricity consumption, Switching input incident record , historical extremes records ,analysis of 63st harmonic content and total harmonic content, A,B,C Three phase and Fundamental parameter(Voltage ,current ,power). switching value, alarm output, RS485 (MODBUS or DL/T645-2007 protocol)	96	1. Historical data on electricity consumption: data on electricity consumption covering previous 12 hours, previous 63 days and previous 12 months 2. Multi-rate tariff: maximum 4 time zones, 4 time schedules, 12 day time periods, 4 tariff rates 3. 2DO4DI

3 Technical parameters

Item			Performance parameters
Specification			3-phase 3-wire, 3-phase 4-wire
Measurement	Voltage	Reference voltage, Un	AC220V、AC100V、AC57.7V
		Measuring range	0.7Un~1.3Un
		Limit voltage	1.9Un
		Power dissipation	<0.05VA (single phase)
		Impedance	>2MΩ
		Accuracy class	RMS, accuracy: 0.2 %
	Current	Measuring range	1.5(6)A
		Power dissipation	<0.05VA (single-circuit rated current)
		Accuracy class	RMS, accuracy: 0.2 %
	Frequency		Active, reactive and apparent power, accuracy: 0.5%
	Line frequency		45-65Hz, accuracy: 0.2 %
	fractional harmonic		2^{nd}–31^{st} harmonic, accuracy: ±5 %
Metering	Electric energy		Active energy ((accuracy class: 0.5S) Reactive energy (accuracy class: 2)
	Clock		≤0.5s/d
Digital signal	Electrical pulse output		1-way active optical coupling output, 1-way reactive optical coupling output
	Switching output		2-way relay output
	Switching input		4-way optical coupling input, , active +12V
Communication	Port and communication protocol		RS485 port: Modbus RTU protocol
	Range of communication address		Modbus RTU: 0-247
	Baud rate		Low rate (1200bps-9600bps) or high rate (1200bps-38400bps)
Environment	Working temperature		-25℃-+60℃
	Extreme working temperature		-35℃-+70℃
	Relative humidity		≤95% (without dewing)
Working power			AC/DC power supply (voltage range: AC85V-265V, DC100-380V) Power dissipation: ≤1W，2VA

4 Overall dimensions (unit: mm)

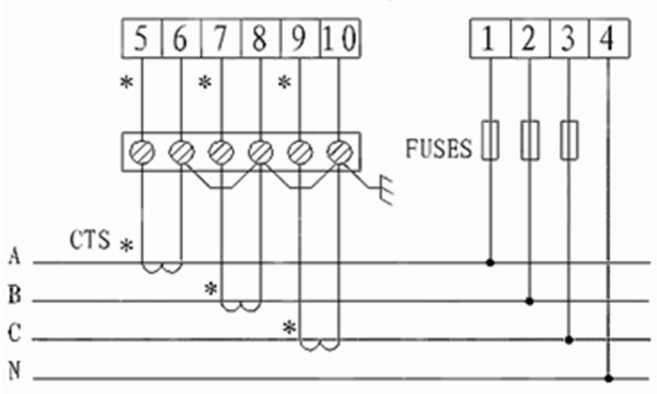


Front View Left View Hole Size

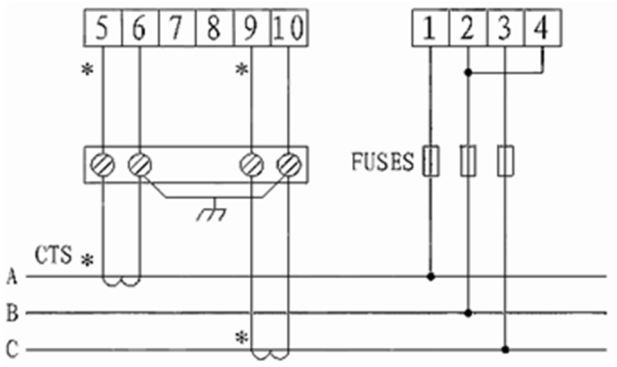
Dimensions of AEM96

5 Wiring and installation

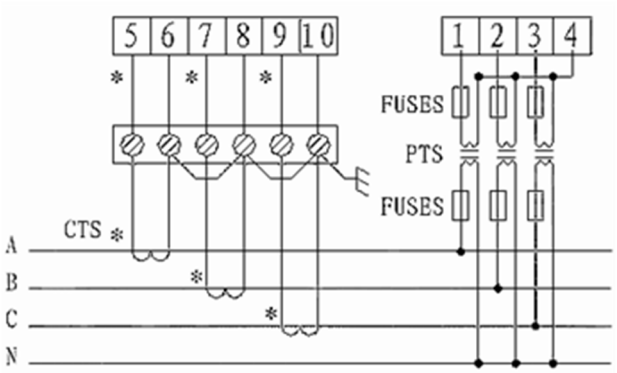
5.1 Voltage and current signal terminals



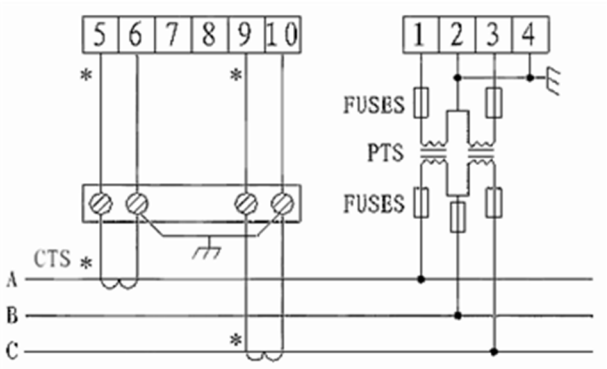
3CT (3-phase 4-wire)



2CT (3-phase 3-wire)

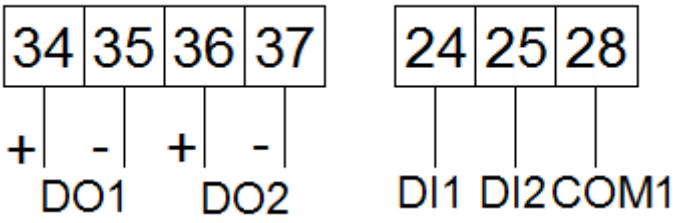


3PT, 3CT (3-phase 4-wire)



2PT, 3CT (3-phase 3-wire)

5.2 Switching input/ output terminals

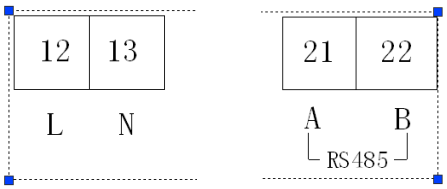


Switching output Switching input

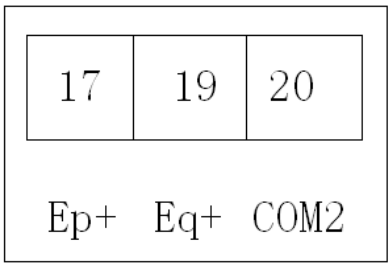
The switching output is realized by relay for remote control and alarm output.

The switching input is realized by switching signal input. The meter has a built-in +12V working power supply so that it does not require external power supply. The meter collects the external break-make information with switching input module and displays it locally. The switching input not only collects and displays the local break-time information but also provides the remote transmission, i.e. remote communication, with RS485.

5.3 Power supply terminal, RS485 communication terminal, pulse output terminal



Auxiliary power supply Communication



Pulse terminals

Note: terminals 17 and 18: active energy pulse terminals; terminals 19 and 20: clock/ reactive energy common pulse terminal, default: clock pulse terminal

6 Main function features

6.1 Measurement

Measure all electrical parameters, including voltage U, current I, active power P, reactive power Q, apparent power S, power factor PF, frequency, 31st harmonic content and total harmonic content. The measured voltage U keeps one decimal place, the measured frequency F keeps two decimal places, the measured current I keeps three decimal places and the measured power P keeps four decimal places.

Example: U = 220.1V, f = 49.98HZ, I = 1.999A, P = 0.2199KW

6.2 Metering

Meter the current combined active energy, positive active energy, negative active energy, inductive reactive energy and capacitive reactive energy.

6.3 Tiered pricing

Set four time schedules and 4 time zones of year. A time schedule includes 12 day time periods and 4 rates (F1, F2, F3 and F4: sharp rate, peak rate, flat rate and off rate). The basic idea of tiered pricing structure is to consider the electric energy as a commodity. The electricity price is higher during the sharp and peak periods while it is relatively lower during the off period. By means of economic lever, such pricing structure will balance the electricity consumption between sharp and peak periods and off period, improve the service efficiency of utility and increase the overall economic benefits.

6.4 Demand

Demand-related concepts are listed as follows:

Demand	Average power measured during the demand period
Max. demand	Maximum amount of demand during a specified period of time
Sliding window time	A recurrence method to measure the demand from any time point during a period shorter than the demand period. The demand measured by this means is called sliding demand. The recurrence time is sliding window time.
Demand	Time interval when the same average power is measured continuously, also known as

period	window time

The default demand period is 15 minutes and the default sliding window time is 1 minute.

Both demand period and sliding window time are adjustable. Refer to the details of setting in 7.3.

Measure four maximum demands, i.e. positive active, negative active, inductive reactive and capacitive reactive demands and the time of maximum demand.

6.5 Historical data

Record the historical data on electricity consumption covering previous 24 hours, previous 31 days and previous 12 months (including four quadrant and multi-rate tariff).

6.6 Switching input/ output

There are two-way switching output and four-way switching input. The switching output is realized by relay for remote control and alarm output. The switching input not only collects and displays the local break-time information but also provides the remote transmission, i.e. remote communication, with RS485.

7 Operations and display

7.1 Key functions

There are four keys, i.e. four direction keys and one OK in the middle. Operate OK to make a change among eight screens and parameters to be modified on the programming screen. Operate keys Left and Right to change the display of current energy during sharp, peak, flat or off period on screen Energy Display (AEM96) and the display of historical data on energy during previous hour, day or month on screen Historical Data and to move the cursor on screen Programming.

7.2 Screens

There are mainly eight screens. Operate OK to make a change among eight screens. They are Electrical Parameters, Current Energy, Historical Hourly Data, Historical Daily Data, Historical Monthly Data, Maximum Demand, Basic Information and Harmonic Content.

Electrical Parameters Make a change among voltage, current, active power, reactive power, apparent power and power factor by keys Up and Down. Except power factor, Make a change among display of all electric parameters Maximum, Minimum and occurrence time by keys

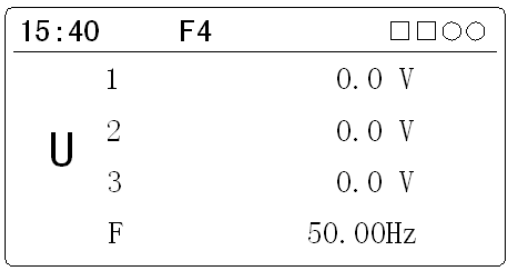
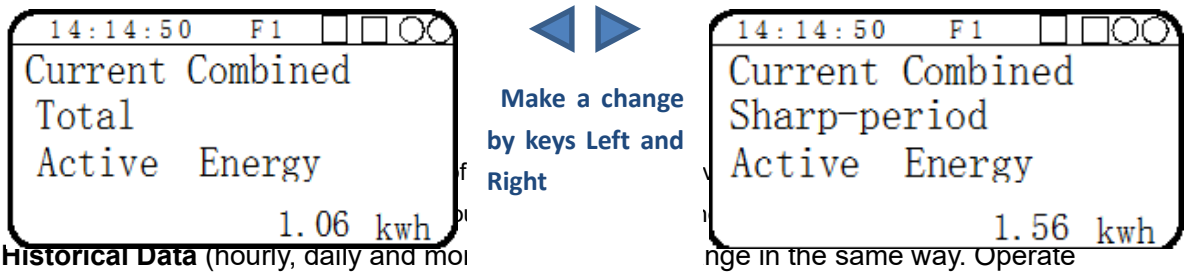


Fig. 1.1 Voltage

Current Energy Make change of current combined active energy, positive active, negative active, inductive reactive and capacitive reactive energy by keys Up and Down and change the display of current energy during sharp, peak, flat or off period by keys Left and Right.



Historical Data (hourly, daily and mo nge in the same way. Operate keys Up and Down to change the time point and keys Left and Right to change the type of historical data. The previous time point is shown in the left lower corner of screen. The meaning of time point varies with the type of historical data.

XX-XX: DD-HH, i.e. day-hour in the hourly data mode

MM-DD, i.e. month-day in the daily data mode

YY-MM, i.e. year-month in the monthly data mode

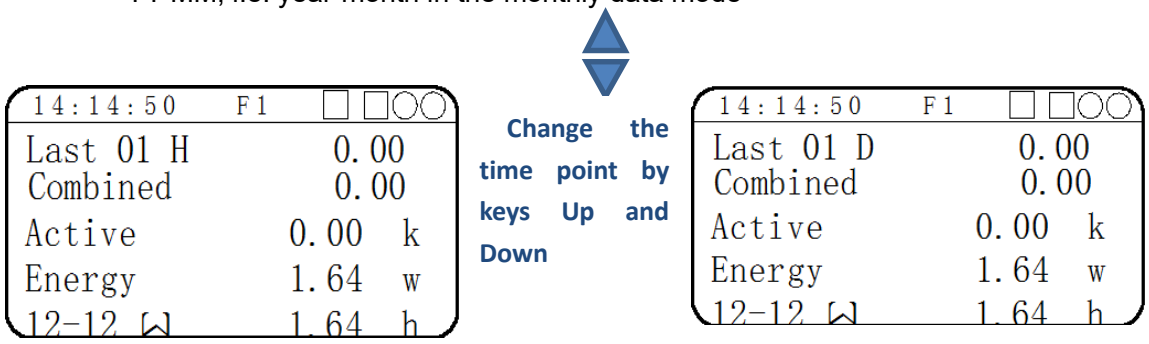


Fig. 1.3 Historical Data

Active energy during the previous hour Sharp Peak Flat Off Total

Active energy during the previous day Sharp Peak Flat Off Total

Maximum Demand Operate keys Up and Down to display the maximum positive active demand, negative active demand, inductive reactive demand and capacitive reactive demand in turn.

Basic Information Display the communication address, baud rate, protocol, PT, CT, fault and version number.

Harmonic Content Display 31st harmonic content and total harmonic content. Operate keys Left and Right to check the number of current harmonic and keys Up and Down to check the type of current harmonic (Ua, Ub, Uc, Ia, Ib, Ic in turn).

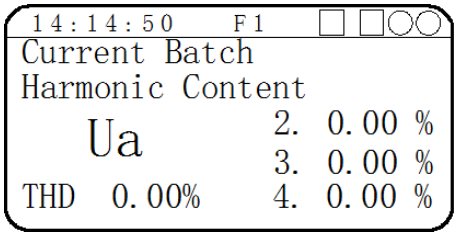


Fig. 1.4 Harmonic Content

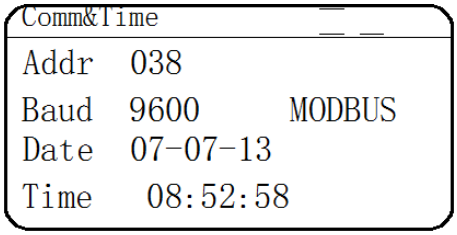
Current harmonic content

7.3 Programming screen and operations

Operate the knob on the left of meter to select a programming screen. Programming screens 1, 2, 3 and 4 are used to set the communication time, system parameters, switching output and 1st time schedule.

To enter a programming screen, input a correct password. If the password is wrong, the corresponding screen will not be accessible and system will wait the user to input a correct password.

1.Set parameters relating to communication and time, such as address and baud rate on this screen. The English screen of Model AEM96 is shown as follows:



(AEM96)

Fig. 1.5 Communication and Time Setting

Address

Baud rate

Address

Baud rate

Protocol

Date

Time

2.Set system parameters, such as password, backlight time, line system, demand period, PT and CT on the screen as shown.

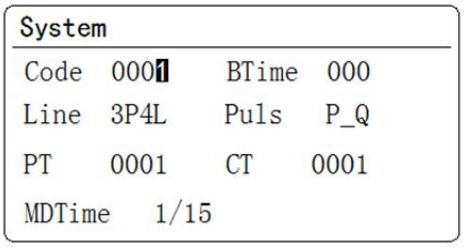


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Fig. 1.6 System Parameter Setting

Code: password

BTime: backlight time. The screen will be always bright if the BTime is set to 0.

Line: selection of line system

Puls: function selection of terminal 19. Terminal 19 outputs the reactive pulse if P_Q is selected. Terminal 19 outputs the time pulse if P_T is selected.

MDTime: demand time and sliding window time. It has four options of demand time, i.e. 15 minutes, 30 minutes, 45 minutes and 60 minutes. The sliding window time is proportional to the demand period. In principle, the ratio of demand time to the sliding window time is 15.

3. Set the type of switching output and alarm on the screen. The switching value can be set to be alarm output, threshold value of alarm output, delay time, pulse width or otherwise. The English screen of Model AEM96 is shown as follows:

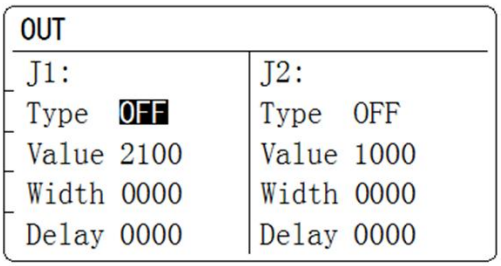

Fig. 1.7 Alarm Setting

Type: type of alarm. Selection of OFF indicates the remote control rather than alarm output. And such selection invalidates other selections on the screen. Besides OFF, user may select the type of alarm <> of U and I. Ux and Ix reflects the alarm output if any voltage or current meets requirements. M1 to M4 four reperesents forward demand for active power、 reversing demand for active power、forward demand for reactive power、 reversing demand for reactive power;

Value: threshold value of alarm. Keep the same decimal places as voltage or current value. If the value is set to 1000 in the type U, for example, it means 100.0v. If the value is set to 1000 in type I, for example, it means 1.000A.

Width: pulse width. An alarm is a level output if the width is set to zero. It is normally closed if requirements are met and normally open if requirements are not met. If the width is set to 60, for example, rather than 0, the relay is closed for 600ms when requirements are met. In other words, the unit is 10ms.

Delay: alarm delay. If it is set to zero, an alarm will be given without delay. If the setting is not zero, an alarm will be given after delay for tx100ms (t: delay setting).

4. Set the first time schedule on the screen. F1, F2, F3 and F4 indicate the sharp, peak, flat and off periods. The following figure illustrates the screen:

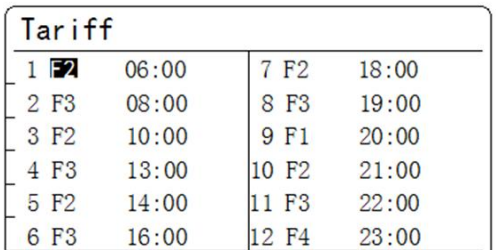

Fig. 1.8 Time Schedule Setting

8 Communication instructions

RS485 port of electricity meter supports the MODBUS-RTU communication protocol. The baud rate of communication port can be set to 600bps, 1200bps, 2400bps, 4800bps, 9600bps, 19200bps and 38400bps. The check digit is set to None.

RS485 port is connected with shielded twisted wire. The wiring must consider the network layout, such as the length and route of communication line, position of host computer, network end resistor, communication converter, network expandability, network coverage and environmental electromagnetic interference.

注：

Note:

1.The wiring work must observe applicable requirements strictly.

2.Even though some meters do not require the communication temporarily, it is still necessary to connect them to RS-485 network for troubleshooting and test.

3.Select the double-color twisted wire, wherever possible, for RS-485 connection. For all RS485 ports, the color of wire at side A is same and the color of wire at side B is same too.

4.The maximum length of RS-485 bus (from the communication port of host computer to the end communication port of any connected meter) is 1200m.

8.1 Address list

The meter supports command 03H and 10H in the MODBUS-RTU protocol. Command 03H is to read several registers and command 10H is to write several registers. Users are responsible for checking the protocol data format. The following table lists the addresses of meter registers.

Address	Data	Length	Remark
0000H	Address	2	
0001H	Baud rate	2	1:9600;2:4800;3:2400;4:1200
0002H	Running control byte	2	Note 1
0003H	Backlight time	2	
0004H	VT	2	Unsigned int
0005H	CT	2	
0006H	Common pulse selection	2	0: reactive pulse; 1: clock pulse
0007H	Pulse constant	2	
0008H	Sliding window time/ demand period	2	
0009H	Password	2	
000AH～000CH	Date time	6	second 、Minute 、 hour 、day、month、Year
000DH～0014H	Time zone	16	Odd registers are number of 4 time lists, even registers are date(month on high byte, day on low byte)
0015H～002CH	Time schedule 1(old)	48	Odd registers are 12 periods of rate, even registers are time(hour on high byte, minute on low byte)
002DH～0044H	Time schedule 2(old)	48	Same as above
7200H～7217H	Time schedule 1(new)	48	Even registers are 12 periods of rate, odd registers are time(hour on high byte, minute on low byte)
7218H～722FH	Time schedule 2(new)	48	Same as above
7230H～7247H	Time schedule 3(new)	48	Same as above
7248H～725FH	Time schedule 4(new)	48	Same as above
0045H	J1 control	2	Rely 1: 0 disconnect; 1 connect
0046H	J2 control	2	Rely 2: 0 disconnect; 1 connect
0047H	Status of switching value	2	Note 4
0048H	J1 output pulse width	2	Note 2
0049H	Type of J1 alarm		
004AH	Threshold value of J1 alarm		
004BH	Delay of J1 alarm		
004CH	J2 output pulse width		
004DH	Type of J2 alarm		
004EH	Threshold value of J2 alarm		
004FH	Delay of J2 alarm		
0050H	UA	2	Unsigned int
0051H	UB		

0052H	UC		
0053H	UAB		
0054H	UBC		
0055H	UCA		
0056H	IA	2	Unsigned int
0057H	IB		
0058H	IC		
0059H	IN		
005AH	PA	2	4 decimal places Unsigned int
005BH	PB		
005CH	PC		
005DH	PT		
005EH	QA		
005FH	QB		
0060H	QC		
0061H	QT		
0062H	SA		
0063H	SB		
0064H	SC		
0065H	ST		
0066H	PFA	2	3 decimal places, unsigned int
0067H	PFB		
0068H	PFC		
0069H	PF		
006AH	Power direction	2	Note 3
006BH	Frequency	2	2 decimal placles, unsigned int
006CH	Current forward demand for active power	2	4 decimal places, unsigned int
006DH	Current reversing demand for active power	2	
006EH	Current forward demand for reactive power	2	
006FH	Current reversing demand for reactive power	2	
0070H	Maximum forward demand for active power	2	
0071H～0072H	Time of occurrence	4	Minute 、 hour 、day、 month
0073H	Maximum reversing demand for active power	2	
0074H～0075H	Time of occurrence	4	Minute 、 hour 、day、 month
0076H	Maximum forward demand for active power	2	
0077H～0078H	Time of occurrence	4	Minute 、 hour 、day、 month

0079H	Maximum reversing demand for active power	2	
007AH～007BH	Time of occurrence	4	Minute 、 hour 、day、 month
007CH～007DH	Current combined total active energy	4	2 decimal places, unsigned int
007EH～007FH	Current forward total active energy	4	
0080H～0081H	Current reversing total active energy	4	
0082H～0083H	Current forward total reactive energy	4	
0084H～0085H	Current reversing reactive energy	4	
0086H～0087H	Current Sharp-period combined active energy	4	
0088H～0089H	Current Peak-period combined active energy	4	
008AH～008BH	Current Flat-period combined active energy	4	
008CH～008DH	Current valley-period combined active energy	4	
008EH～008FH	Current forward active energy on Sharp-period	4	
0090H～0091H	Current forward active energy on Peak-period	4	
0092H～0093H	Current forward active energy on Flat-period	4	
0094H～0095H	Current forward active energy on Valley-period	4	
0096H～0097H	Current reversing active energy on Sharp-period	4	
0098H～0099H	Current reversing active energy on Peak-period	4	
009AH～009BH	Current reversing active energy on Flat-period	4	
009CH～009DH	Current reversing active energy on Valley-period	4	
009EH～09FH	Current forward reactive energy on Sharp-period	4	
00A0H～00A1H	Current forward reactive energy on Peak-period	4	
00A2H～00A3H	Current forward reactive energy on Flat-period	4	
00A4H～00A5H	Current forward reactive energy on Valley-period	4	

00A6H～00A7H	Current reversing reactive energy on Sharp-period	4	
00A8H～00A9H	Current reversing reactive energy on Peak-period	4	
00AAH～00ABH	Current reversing reactive energy on Flat-period	4	
00ACH～00ADH	Current reversing reactive energy on valley -period	4	
00AEH～00AFH	Total amount of phase A combined active energy	4	
00B0H～00B1H	Total amount of phase A positive active energy	4	
00B2H～00B3H	Total amount of phase A negative active energy	4	
00B4H～00B5H	Total amount of phase A positive reactive energy	4	
00B6H～00B7H	Total amount of phase A negative active energy	4	
00B8H～00B9H	Total amount of phase B combined active energy	4	
00BAH～00BBH	Total amount of phase B positive active energy	4	
00BCH～00BDH	Total amount of phase B negative active energy	4	
00BEH～00BFH	Total amount of phase B positive reactive energy	4	
00C0H～00C1H	Total amount of phase B negative reactive energy	4	
00C2H～00C3H	Total amount of phase C combined active energy	4	
00C4H～00C5H	Total amount of phase C positive active energy	4	
00C6H～00C7H	Total amount of phase C negative active energy	4	
00C8H～00C9H	Total amount of phase C positive reactive energy	4	
00CAH～00CBH	Total amount of phase C negative reactive energy	4	
00CCH	THDUa	2	2 decimal places, unsigned int
00CDH	THDUb		
00CEH	THDUc		

00CFH	THDIa		
00D0H	THDIb		
00D1H	THDIc		
00D2H～00EFH	THUa (2^{nd}-31^{st} harmonic)	2×30	Each harmonic length is a register. 2 decimal places, unsigned int
00F0H～010DH	THUb (2^{nd}-31^{st} harmonic)	2×30	
010EH～012BH	THUc (2^{nd}-31^{st} harmonic)	2×30	
012CH～0149H	THIa (2^{nd}-31^{st} harmonic)	2×30	
014AH～0167H	THIb (2^{nd}-31^{st} harmonic)	2×30	
0168H～0185H	THIc (2^{nd}-31^{st} harmonic)	2×30	
0186H	phase A fundamental voltage	2	1 decimal places, unsigned int
0187H	phase B fundamental voltage		
0188H	phase C fundamental voltage		
0189H	phase A harmonic voltage		
018AH	phase B harmonic voltage		
018BH	phase C harmonic voltage		
018CH	phase A fundamental current	2	3 decimal places, unsigned int
018DH	phase B fundamental current		
018EH	phase C fundamental current		
018FH	phase A harmonic current		
0190H	phase B harmonic current		
0191H	phase C harmonic current		
0192H	phase A fundamental active power	2	4 decimal places, unsigned int
0193H	phase B fundamental active power		
0194H	phase C fundamental active power		
0195H	Total fundamental active power		
0196H	phase A fundamental reactive power		
0197H	phase B fundamental reactive power		
0198H	phase C fundamental reactive power		
0199H	Total fundamental reactive power		
019AH	phase A harmonic active power		
019BH	phase B harmonic active power		
019CH	phase C harmonic active power		
019DH	Total harmonic active power		
019EH	phase A harmonic reactive power		
019FH	phase B harmonic reactive power		
01A0H	phase C harmonic reactive power		
01A1H	Total harmonic reactive power		
01A2H	Voltage imbalance	2	2 decimal places, unsigned int
01A3H	Current imbalance		

01A4H	The angle between the A current and the A voltage	2	2 decimal places, unsigned int
01A5H	The angle between the B current and the B voltage		
01A6H	The angle between the C current and the C voltage		
01A7H～01A8H	Positive apparent energy	4	2 decimal places, unsigned int
01A9H～01AAH	Apparent electrical energy on the Sharpe cycle	4	
01ABH～01ACH	Peak apparent electrical energy	4	
01ADH～01AEH	Normal apparent electrical energy	4	
01AFH～01B0H	Apparent electrical energy in the valley period	4	
01B1H	The current A-phase current is required in real time	2	3 decimal places, unsigned int
01B2H	The current B-phase current is required in real time	2	
01B3H	The current C-phase current is required in real time	2	
01B4H	Current apparent power real-time demand	2	
01B5H	A phase current maximum demand	2	
01B6H～01B7H	Time of occurrence	4	Minutes, hours, days, months
01B8H	B phase current maximum demand	2	
01B0H～01B1H	Time of occurrence	4	Minutes, hours, days, months
01BBH	C phase current maximum demand	2	
01BCH～01BDH	Time of occurrence	4	Minutes, hours, days, months
01BEH	Apparent power maximum demand	2	
01BFH～01C0H	Time of occurrence	4	Minutes, hours, days, months
01C1H	Odd-sequence total harmonic number of phase A voltages	2	2 decimal places, unsigned int
01C2H	Odd-sequence total harmonic number of phase B voltages	2	
01C3H	Odd-sequence total harmonic number of phase C voltages	2	
01C4H	Odd-order total harmonic number of phase A currents	2	
01C5H	Odd-order total harmonic number of phase B currents	2	
01C6H	Odd-order total harmonic number of phase C currents	2	
01C7H	The number of even-order total harmonics of the A-phase voltage	2	

01C8H	The number of even-order total harmonics of the B-phase voltage	2	
01C9H	The number of even-order total harmonics of the C-phase voltage	2	
01CAH	The total number of harmonics of the even sequence of phase A currents	2	
01CBH	The total number of harmonics of the even sequence of phase B currents	2	
01CCH	The total number of harmonics of the even sequence of phase C currents	2	
01CDH～01CEH	The total amount of reactive electrical energy at present	4	2 decimal places, unsigned int
01CFH～01D0H	Reactive energy in the current first quadrant	4	
01D1H～01D2H	Reactive energy in the current second quadrant	4	
01D3H～01D4H	Reactive energy in the current third quadrant	4	
01D5H～01D6H	Reactive energy in the current fourth quadrant	4	
7000H～703DH	THUa (2^{nd}-63^{rd} harmonic)	2×62	Each harmonic length is a register. 2 decimal places, unsigned int
703EH～707BH	THUb (2^{nd}-63^{rd} harmonic)	2×62	
707CH～70B9H	THUc (2^{nd}-63^{rd} harmonic)	2×62	
70BAH～70F7H	THIa (2^{nd}-63^{rd} harmonic)	2×62	
70F8H～7135H	THIb (2^{nd}-63^{rd} harmonic)	2×62	
7136H～7173H	THIc (2^{nd}-63^{rd} harmonic)	2×62	
7174H	UA crest coefficient	2	3 decimal places, unsigned int
7175H	UB crest coefficient	2	
7176H	UC crest coefficient	2	
7177H	IA crest coefficient	2	
7178H	IB crest coefficient	2	
7179H	IC crest coefficient	2	
717AH	A-phase telephone harmonic coefficient	2	2 decimal places, unsigned int
717BH	B-phase telephone harmonic coefficient	2	
717CH	C-phase telephone harmonic coefficient	2	
717DH	The K factor of the A-phase current	2	2 decimal places, unsigned int
717EH	The K factor of the B-phase current	2	
717FH	The K factor of the C-phase current	2	

Note 1

Running control byte	
High byte	Low byte
Line system	Protocol

Note 2

Type of alarm	
High byte	Low byte
0: disable the alarm function	0：>;1: <
1-4：UA、UB、UC、Ux	
5-8：IA、IB、IC、Ix	
9-12：PA、PB、PC、PT	

Output pulse width
0: level output
>0: pulse width in 0.1s
Delay of alarm
0: no delay
>0: delay in 0.01s

Note 3

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

Each byte represents one power direction. In details, 1 represents the reversing direction and 0 represents the forward direction.

Note 4： (0x47)

Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
				DI3	DI2	DI1	DI0

1 connect 0 disconnect

8.2 Historical data reading

Starting address of interval (high byte)	Type of historical data
11-28	Previous 1 hour- previous 24 hours
29-47	Previous 1 day- previous 31 days
48-53	Previous 1 month – previous 12 month

Offset address of interval (low byte)	Data type
00	Recording date time
03	Total amount of historical combined active energy
05	Total amount of historical forward active energy
07	Total amount of historical reversing active energy
09	Total amount of historical forward reactive energy
0B	Total amount of historical reversing reactive energy

0D	Sharp-period amount of historical combined active energy
0F	Peak-period amount of historical combined active energy
11	Flat-period amount of historical combined active energy
13	Valley-period amount of historical combined active energy
15	Sharp-period amount of historical forward active energy
17	Peak-period amount of historical forward active energy
19	Flat-period amount of historical forward active energy
1B	Valley -period amount of historical forward active energy
1D	Sharp-period amount of historical reversing active energy
1F	Peak-period amount of historical reversing active energy
21	Flat-period amount of historical reversing active energy
23	Valley -period amount of historical reversing active energy
25	Sharp-period amount of historical forward reactive energy
27	Peak-period amount of historical forward reactive energy

29	Flat-period amount of historical forward reactive energy
2B	Valley -period amount of historical forward reactive energy
2D	Sharp-period amount of historical reversing reactive energy
2F	Peak-period amount of historical reversing reactive energy
31	Flat-period amount of historical reversing reactive energy
33	Valley-period amount of historical reversing reactive energy
35	Total amount of phase A combined active energy
37	Total amount of phase A forward active energy
39	Total amount of phase A reversing active energy
3B	Total amount of phase A forward reactive energy
3D	Total amount of phase A reversing reactive energy
3F	Total amount of phase B combined active energy
41	Total amount of phase B forward active energy
43	Total amount of phase B reversing active energy
45	Total amount of phase B forward reactive energy
47	Total amount of phase B reversing reactive energy
49	Total amount of phase C combined active energy
4B	Total amount of phase C forward active energy

4D	Total amount of phase C reversing active energy
4F	Total amount of phase C forward reactive energy
51	Total amount of phase C reversing reactive energy

The register address of historical data is divided into two parts, high byte and low byte. Combining bytes in two tables and then getting the register address of historical data. For example, if you want to read the total amount of historical forward reactive energy for the previous 4 hours, the address will be 1409H.

8.3 Historical Alarm output reading

Starting address of interval (high byte)	Type of historical data
	Alarm output event log

Offset address of interval (low byte)	Data type
00	Last 1 alarm output record
05	Last 2 alarm output record
0A	Last 3 alarm output record
0F	Last 4 alarm output record
14	Last 5 alarm output record
19	Last 6 alarm output record
1E	Last 7 alarm output record
23	Last 8 alarm output record
28	Last 9 alarm output record
2D	Last 10 alarm output record

ADDRH ADDRL	event names	Data type	Note
0300H	The previous alarm output record	Occurrence time (minute, second)	high byte : seconds
0301H		Occurrence time (hour, day)	high byte : Hours
0302H		Occurrence time of Month and year	high byte : Month
0303H		switch status and number	high byte :DO number(0 : DO1, 1 :DO2) Low byte: switch status(0: off, 1: on)
0304H		alarm type	high byte : Limit Alarm (0 :over threshold , 1 :below threshold) Low byte: Alarm parameters (Note 2)

8.4 Historical Switching input reading

Starting address of interval (high byte)	Type of historical data
03	Switching input incident record

Offset address of interval (low byte)	Data type
32	Last 1 Switching input record
37	Last 2 Switching input record
3C	Last 3 Switching input record
41	Last 4 Switching input record
46	Last 5 Switching input record
4B	Last 6 Switching input record
50	Last 7 Switching input record
55	Last 8 Switching input record
5A	Last 9 Switching input record
5F	Last 10 Switching input record

ADDRH ADDRL	event names	Data type	Note
0332H	Last 1 Switching input record	Occurrence time of seconds and minutes	high byte : seconds
0333H		Occurrence time of Hours and days	high byte : Hours
0334H		Occurrence time of Month and year	high byte : Month
0335H		switch status and number	high byte :DO number(0: DI1, 1: DI2, 2: DI3, 3: DI4) Low byte: switch status(0: off, 1: on)
0336H		reservation	

8.5 Record of extreme value and occurrence time

Maximum records:

Starting address of interval (high byte)	Type of historical data
04	Extremum of the month and Occurrence time
05	Extremum of last 1 month and Occurrence time
06	Extremum of last 2 month and Occurrence time
07	Extremum of last 3 month and Occurrence time

Offset address of interval (low byte)	Data type
00	Voltage of A phase maximum value and occurrence time
03	Voltage of B phase maximum value and occurrence time
06	Voltage of C phase maximum value and occurrence time
09	Voltage between A-B maximum value and occurrence time
0C	Voltage between A-B maximum value and occurrence time
0F	Voltage between A-B maximum value and occurrence time
12	Electricity of A phase maximum value and occurrence time
15	Electricity of B phase maximum value and occurrence time
18	Electricity of C phase maximum value and occurrence time
1B	Three phase current vector sum maximum value and occurrence time
1E	Active power of A phase maximum value and occurrence time

21	Active power of B phase maximum value and occurrence time
24	Active power of C phase maximum value and occurrence time
27	Total active power maximum value and occurrence time
2A	Reactive power of A phase maximum value and occurrence time
2D	Reactive power of B phase maximum value and occurrence time
30	Reactive power of C phase maximum value and occurrence time
33	Total reactive power maximum value and occurrence time
36	Apparent power of A phase maximum value and occurrence time
39	Apparent power of B phase maximum value and occurrence time
3C	Apparent power of C phase maximum value and occurrence time
3F	Total apparent power maximum value and occurrence time

Minimum record:

Starting address of interval (high byte)	Type of historical data
04	Extremum of the month and Occurrence time
05	Extremum of last 1 month and Occurrence time
06	Extremum of last 2 month and Occurrence time
07	Extremum of last 3 month and Occurrence time

Offset address of interval (low byte)	Data type
42	Voltage of A phase Minimum Value and occurrence time
45	Voltage of B phase Minimum Value and occurrence time
48	Voltage of C phase Minimum Value and occurrence time
4B	Voltage between A-B Minimum Value and occurrence time
4E	Voltage between B-C Minimum value and occurrence time
51	Voltage between C-A Minimum value and occurrence time
54	Electricity of A phase Minimum value and occurrence time

57	Electricity of B phase Minimum value and occurrence time
5A	Electricity of C phase Minimum value and occurrence time
5D	Three phase current vector sum Minimum value and occurrence time
60	Active power of A phase Minimum value and occurrence time
63	Active power of B phase Minimum value and occurrence time
66	Active power of C phase Minimum value and occurrence time
69	Total active power Minimum value and occurrence time
6C	Reactive power of A phase Minimum value and occurrence time
6F	Reactive power of B phase Minimum value and occurrence time
72	Reactive power of C phase Minimum value and occurrence time
75	Total reactive power Minimum value and occurrence time
78	Apparent power of A phase Minimum value and occurrence time
7B	Apparent power of B phase Minimum value and occurrence time
7E	Apparent power of C phase Minimum value and occurrence time
81	Total apparent power Minimum value and occurrence time

Note：The record of every extreme value and occurrence time is 6 bits, and the data configuration can be refered as below:

ADDRH ADDRL	event names	Data type	Note
0400H	Maximum voltage of A phase and occurrence time	The data of Maximum voltage of A phase	data and decimal place refer to address table 8.1
0401H		Occurrence time of minutes and hours	high byte : minutes
0402H		Occurrence time of Days and months	high byte : Days

8.6 read records from a historical demand

Starting address of interval (high byte)	Type of historical data
08	Historical Demand record

Offset address of interval (low byte)	Data type
00	Last 1 month Demand
0C	Last 2 month Demand
18	Last 3 month Demand
24	Last 4 month Demand
30	Last 5 month Demand
3C	Last 6 month Demand
48	Last 7 month Demand
54	Last 8 month Demand
60	Last 9 month Demand
6C	Last 10 month Demand
78	Last 11 month Demand
84	Last 12 month Demand

Note：The length of each event record is 24 bits, and the data configuration can be referred as below:

ADDRH ADDRL	event names	Data type	Note
0800H	Last 1 Switching input record	Forward active demand	Demand Data
0801H		Occurrence time of seconds and minutes	high byte : minutes
0802H		Occurrence time of Days and months	high byte : Days
0803H		reversing active demand	Demand Data
0804H		Occurrence time of minutes and hours	high byte : minutes
0805H		Occurrence time of Days and months	high byte : Days
0806H		forward reactive demand	Demand Data
0807H		Occurrence time of minutes and hours	high byte : minutes
0808H		Occurrence time of Days and months	high byte : Days
0809H		reversing reactive demand	Demand Data
080AH		Occurrence time of minutes and hours	high byte : minutes
080BH		Occurrence time of Days and months	high byte : Days