217

APM series Power Meters

Installation and Operation Instruction V1.1

安科瑞电气股份有限公司

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1. Overview

APM series power meters of ACREL are power meters that are designed according to IEC standards and synchronized with international advanced technology.

APM series meters have full power measurement, energy statistics, analysis of power quality and network communications and other functions, are mainly used for comprehensive monitoring of the quality of power supply network.

This series of meters use a modular design, with a rich function of the external DI / DO module, AI / AO module, event recording (SOE) module with T-Flash (TF) card, network communication module, can achieve full power measurement of electrical circuit and monitoring of switch status, Dual RS485 with Ethernet interface can realize data copying of RS485 master station, eliminating the need for data switching exchange. PROFIBUS-DP interface can realize high-speed data transmission and networking function.

2. Type and specification

Function			APM800 (class 0.5s)	APM801 (class 0.2s)	APM810 (class 0.5s)
Measured parameters	Total electrical measurement		√	√	√
	Four-quadrant energy		√	√	√
Pulse output of energy	Pulse output of active/reactive energy		√	√	√
Demand	Three-phase current, active power, reactive power, real-time demand of apparent power, and maximum demand (including time stamp)		√	√	√
Extreme value statistics	Extremum of current, line voltage, phase voltage, active power, reactive power, apparent power, power factor, frequency, total harmonic of current, total harmonic of voltage in this month and last month (including time stamp)		√	√	√
Power quality	Unbalance of current, line voltage, phase voltage		√	√	√
	Total (odd, even) harmonic content of voltage and current		×	×	√
	Harmonic content of voltage and current (2-63 times)①		×	×	√
	Voltage crest factor		×	×	√
	Telephone waveform factor		×	×	√
	Current K-factor		×	×	√
Alarm records	A total of 66 kinds of alarm types, each type can record the most recent 16 alarm records, support extended records by TF card		√	√	√
Event log	Record the most recent 128 event records, support extended records by TF card		√	√	√
Communication	Modbus protocol		√	√	√
I/O	2 digital inputs + 2 digital outputs (2DI+2DO)		√	√	√
Extensions	MD82	8 digital inputs + 2 digital outputs with changeover contacts (8DI+2DO)	√	√	√
	MLOG	TF card storage (alarm records, event records, electrical parameters and energy timing records, etc.)	√	√	√
	MA84	8 analog inputs (class 0.5) + 4 analog outputs	√	√	√

		(class 0.5) (8AI+4AO)			
	MCM	1 RS485/Modbus-RTU, support master mode or slave mode	√	√	√
	MCP	1 Profibus-DP	√	√	√
	MCE	1 Ethernet, support Modbus-TCP, http, SMTP, DHCP protocol	√	√	√

Note ①: Accuracy of 2~42 times harmonic measurement in the frequency range of 45~65Hz is 1%, accuracy of 43~63 times harmonic measurement in frequency 50Hz is 2%.

3. Technical Parameters

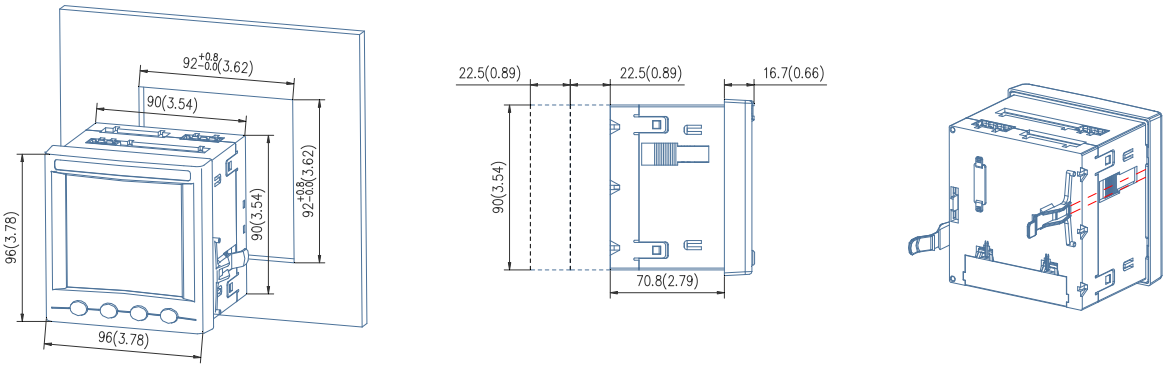
Technical Parameters	Index	
Signal	Electrical network	Three-phase three-wire, three-phase four-wire, see the wiring diagram;
	Frequency	45～65Hz；
	Voltage	Rated value：AC 100V、110V、400V、690V；
		Overload: 1.2 times rated value(continuous); 2 times rated value /1 second;
		Power consumption: < 0.5VA (per channel);
	Current	Rated value: AC 1A, 5A, support 4 mm^2 line access;
		Overload: 1.2 times rated value(continuous); 10 times rated value/1 second;
		Power consumption: < 0.5VA (per channel);
Measurement accuracy	Voltage、current and power	class 0.5s/class 0.2s (APM800、APM810/APM801)
	Active power	class 0.5s/class 0.2s (APM800、APM810/APM801)
	Reactive power	class 2
	Harmonic	1%（2rd~42nd）、2%（43rd~63rd）
Switch inputs	Dry contact inputs, built-in power supply;	
Relay outputs	Contact type: open contact in main part, changeover contact in module; Contact capacity：AC 250V/3A DC 30V/3A；	
Pulse output of energy	Output mode: Optocoupler pulse with open collector; Pulse constant：4000（5A）、8000（1A） imp/kWh；	
Analog outputs	DC 0mA～20mA、4mA～20mA、0V～5V、1V～5V output, accuracy class 0.5%, load resistance ≤ 500Ω;	
Analog iutputs	DC 0mA～20mA、4mA～20mA、0V～5V、1V～5V iutput, accuracy class 0.5%	
Storage card	TF Card Up to 32G Capacity;	
Communication	RS485 interface/Modbus-RTU protocol and DLT645 protocol Profibus-DP interface/Profibus-DP protocol; RJ45 interface (Ethernet) / Modbus-TCP, http, DHCP and other protocols;	
Power supply	Working range: AC/DC 85V～265V or AC/DC 115～415V(P2); Power consumption: Power consumption of the main part ≤ 15VA;	

<table>
<tr><td rowspan="2">Safety</td><td>Power frequency withstand voltage</td><td colspan="2">The power frequency withstand voltage between the shell and the auxiliary power supply, each input and output terminal group is AC 4kV/1min;
The power frequency withstand voltage between the auxiliary power supply and each input and each output terminal group is AC 2kV/1min;
The power frequency withstand voltage between the voltage input and other input/output terminal groups is AC 2kV/1min;
The power frequency withstand voltage between the current input and other input/output terminal groups is AC 2kV/1min;
The power frequency withstand voltage between the relay output and other input/output terminal groups is AC 2kV/1min;
The power frequency withstand voltage between each terminal group of switch input, communication, analog output and pulse output is AC 1kV/1min;</td></tr>
<tr><td>Insulation resistance</td><td colspan="2">Inputs、outputs to the shell>100MΩ；</td></tr>
<tr><td colspan="2">Electromagnetic compatibility</td><td colspan="2">Meet IEC 61000 standard (Level 4);</td></tr>
<tr><td colspan="2">Protection level</td><td colspan="2">Display panel IP52</td></tr>
<tr><td colspan="2">Environment</td><td colspan="2">Operating temperature: -20 °C ~ +65 °C;
Storage temperature: -20°C～+70°C;
Relative humidity: ≤95% without condensation;
Altitude: ≤2500m;</td></tr>
<tr><td colspan="2" rowspan="4">Standards</td><td>IEC 60068-2-1
IEC 60068-2-2
IEC 60068-2-30</td><td>Environmental Testing-Part 2-1:Tests Test A:Cold IDA
Part 2-1:Tests Test B:Dry heat
Part 2-30:Tests Test Db:Damp heat,cyclic(12+12h)</td></tr>
<tr><td>IEC 61000-4</td><td>Electromagnetic compatibility-Testing and measurement techniques</td></tr>
<tr><td>IEC 61557-12</td><td>Electrical safety in low voltage distribution system up to 1000V a.c. and1500V d.c –Equipment for testing,measuring or monitoring of protective measures- Part12：
Performances measuring and monitoring devices(PMD)</td></tr>
<tr><td>IEC 62053-22</td><td>Electricity metering equipment (a.c.)-Particular requirements - Part22:Static meter for active energy（class 0.2s and 0.5s）</td></tr>
</table>

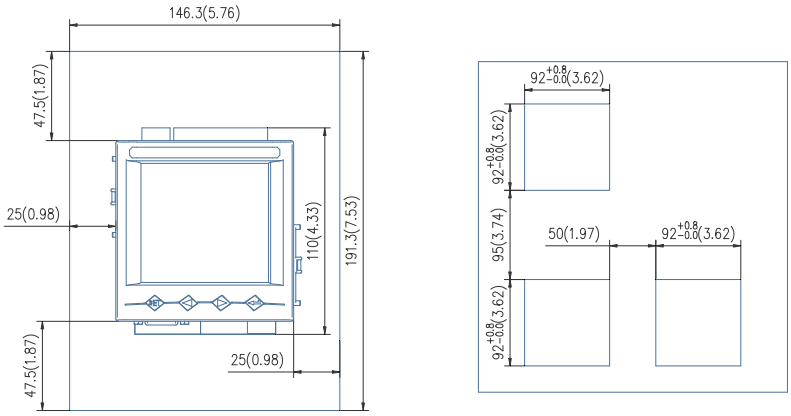
4. Installation and wiring instructions

4.1 Installation dimensions

Meter and panel opening size(unit: mm(in))



Multiple meter installation (unit: mm(in))

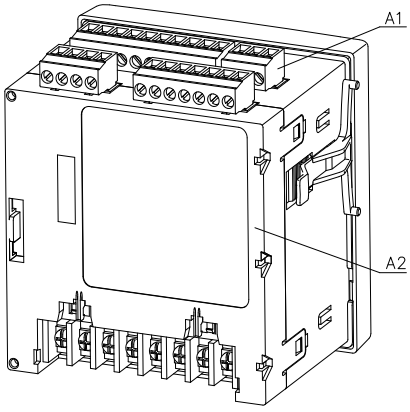


4.2 Wiring method

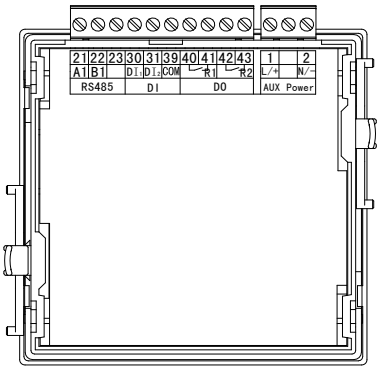
According to different design requirements, it is recommended to add a fuse (BS88 2A gG) to the power supply and voltage input terminals to meet the safety requirements of the relevant electrical specifications.

4.2.1 Main part

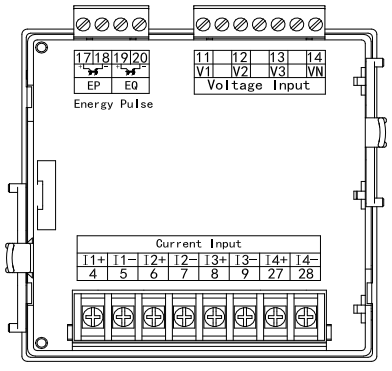
Terminal diagram: "4,5,6,7,8,9" is the current signal input terminal number; "11,12,13,14" the voltage signal input terminal number; "1, 2" is the meter auxiliary power terminal number. "21, 22" is the communication terminal number; "17, 18, 19, 20" is the energy pulse output terminal number; "30, 31, 39" is the switch input terminal number; "40, 41, 42, 43 " is the relay output terminal number. (Figure 1)



(Figure 1)

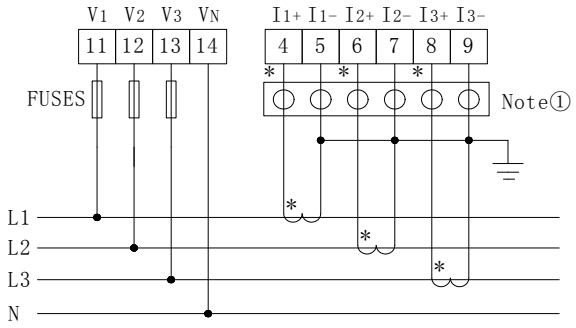


(A1)Auxiliary power supply, etc

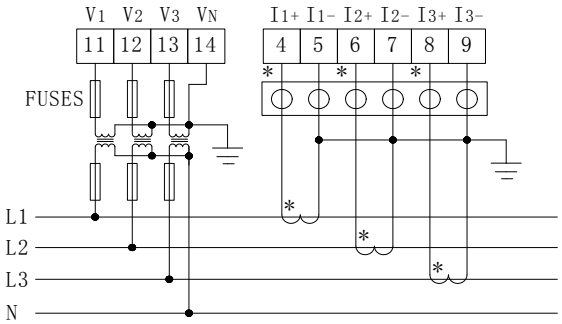


(A2)Input of voltage and current

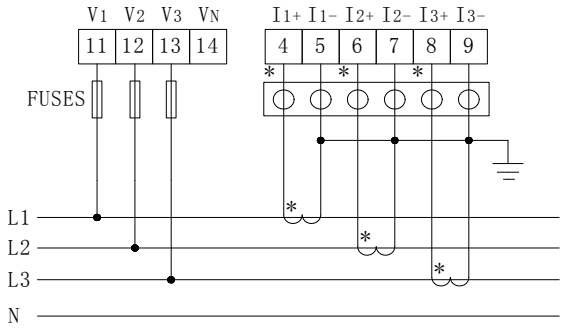
Wiring method of signal input:



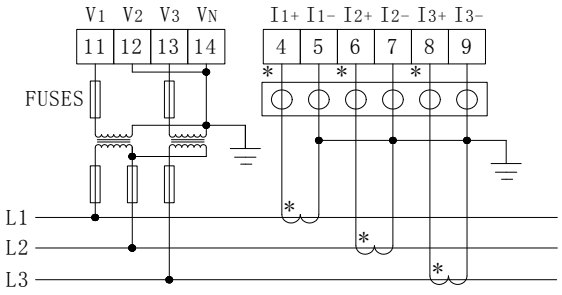
3P4W/3CT(Meter is set to 3P4W)



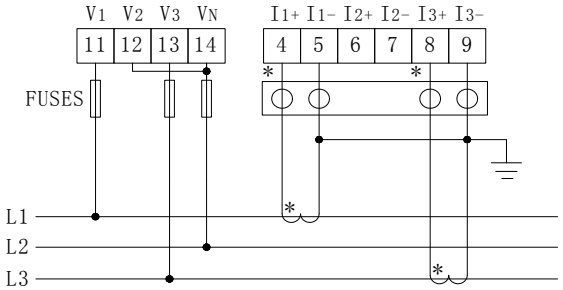
3P4W/3PT+3CT(Meter is set to3P4W)



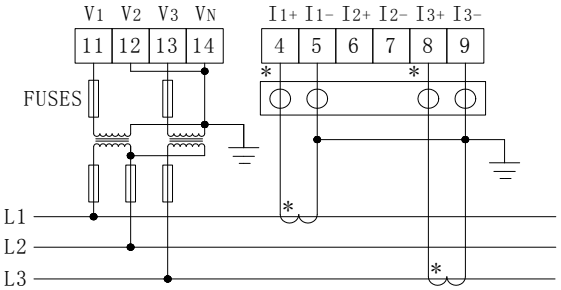
3P3W/3CT(Meter is set to 3P4W) Note②



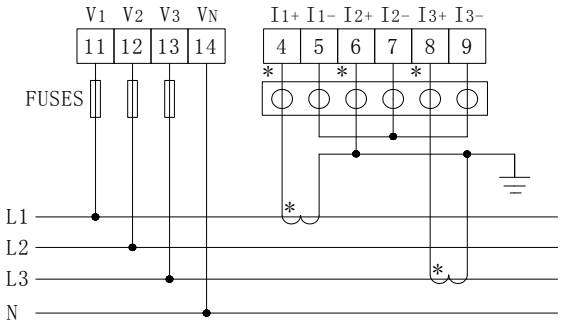
3P3W/2PT+3CT(Meter is set to 3P3W-3CT) Note③



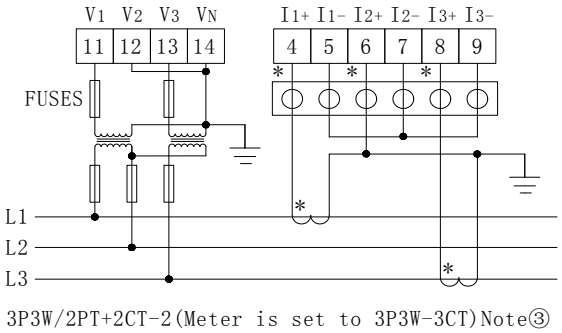
3P3W/2CT(Meter is set to 3P3W-2CT)



3P3W/2PT+2CT-1(Meter is set to 3P3W-2CT)



3P4W/2CT(Meter is set to3P4W)Note②



3P3W/2PT+2CT-2(Meter is set to 3P3W-3CT)Note③

Note①: ○○○○○○ This is a test terminal for shorting the secondary side of the CT.

Note②:Only for balanced three-phase loads.

Note③:Phase B current is only displayed and does not participate in other calculations.

4.2.2 Module parts

Switch module

70	77	71	72	78	73	30	31	32	33	34	35	36	37	39
R1			R2			DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	COM4
继电器输出						开关量输入								
Relay Output						Digital Input								

Analog input and output module

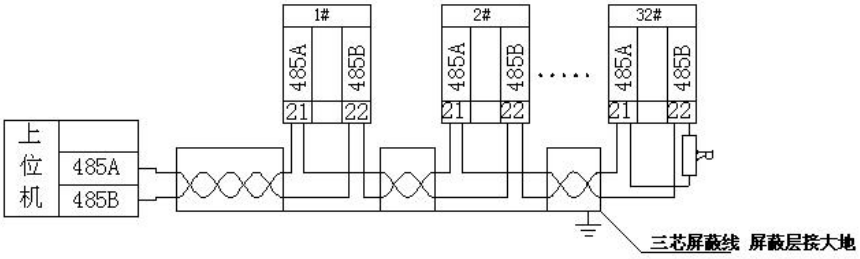
60	61	62	63	64	65	66	67	69	50	51	52	53	59
AI1	AI2	AI3	AI4	AI5	AI6	AI7	AI8	COM2	AO1	AO2	AO3	AO4	COM3
模拟量输入									模拟量输出				
Analog Input									Analog Output				

Ethernet module

24	25	26	LAN	PROFIBUS DP
A2	B2			
RS485				

An example of wiring for the communication is shown in the figure below:

Correct wiring method: Communication Cable shield is connected to earth.



上位机：Host computer

三芯屏蔽线：Three-core shielded wire

屏蔽层接大地：Shield is connected to erath

It is recommended to add a matching resistor between A and B at the end of the meter. The resistance range is 120Ω~10 kΩ.

Note: 1.When the meter has Profibus function, for the related communication configuration and GSD file, please refer to the CD delivered with the meter.

2.The second RS485 communication only supports Modbus 03 command.

5. Packaging

The package contains the following items: Host (including plug-in terminal block), mounting brackets, factory inspection report, certificate (anti-counterfeiting label), installation instructions.

When opening the product packaging, please check carefully whether there is any damage. If any damage occurs, please inform ACREL company or agent promptly, and keep the damaged external packaging. The company will promptly replace it.

6. Engineering Construction Notes

6.1 Voltage input

The input voltage should not exceed 120% of the rated input voltage of the product (100V or 110V or 400V or 690V). Otherwise, the PT should be used; a 1A fuse must be installed on the voltage input; the wiring method of the product must be set according to the PT wiring of the product. The wiring method is as follows:

Wiring method	Selection
2 elements	3P3W
3 elements	3P4W

6.2 Current input

The standard rated input current is 1A or 5A. It requires the use of an external CT (recommended to use a wiring strip, not directly connected to the CT, in order to facilitate disassembly); ensure that the input current corresponds to the voltage, the phase sequence is consistent and the direction is consistent; if There are other meters connected in the CT circuit used, the wiring should be connected in series.

Before removing the current input connection of the product, be sure to disconnect the CT primary circuit or short the secondary circuit!

6.3 Communication Wiring

The meter provides asynchronous half-duplex RS485 communication interface, using MODBUS-RTU protocol, various data information can be transmitted on the communication line.

Theoretically, up to 128 power meters can be connected simultaneously on a single line. Communication address of each power meter can be set. When wiring, keep communication lines away from power cables or other strong electric-magnetic field.

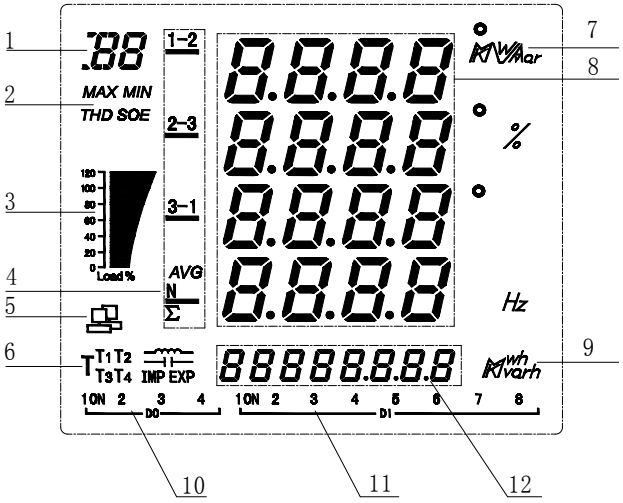
7 Operation instructions

7.1 Display description

APM series uses LCD segment LCD display, the following table shows the segment codes for different characters.

A	b	c	d	E	F	g	H	i/I	
J	K	L	M	n	o	P	q	r	S
t	U	v	W	X	y	Z	-	_	=

The following figure shows the screen when all character fields and indications are all lit.

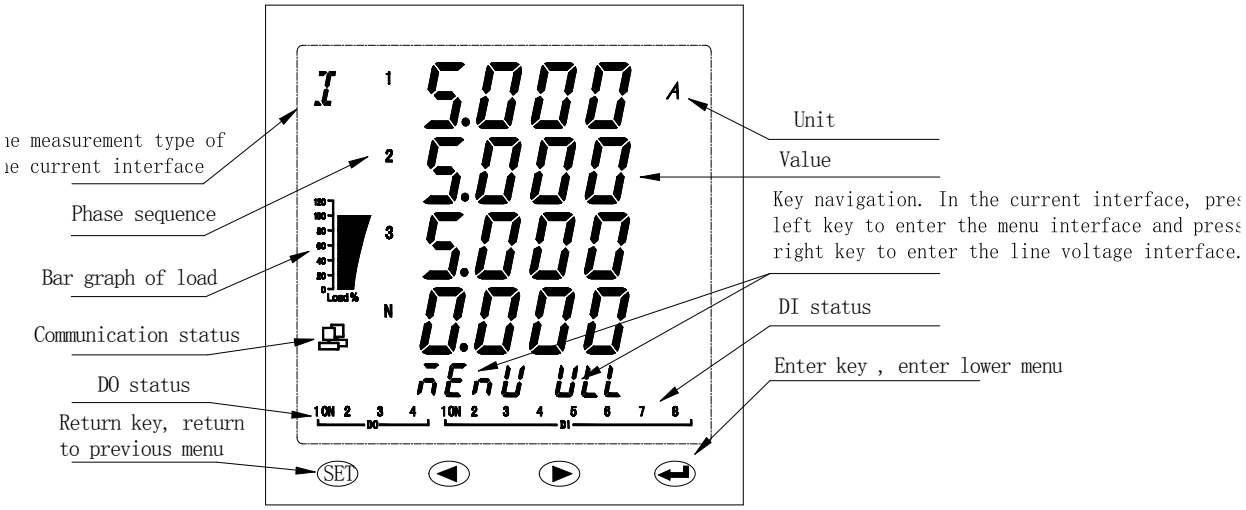


The following table is a description of all the measurement and indication.

No.	Display content	Instruction
1	I/U/P/Q/S/PF/d	Identify what is displayed in the current measurement data display area 8: Current / Voltage / Active Power / Reactive Power / Apparent Power / Power Factor / Demand
	IO/AL/SD	DI, DO, AI, AO status/alarm log/TF card status
2	MAX/ MIN	Records of maximum / minimum
	THD	Total harmonic distortion
	SOE	Sequence Of Event
3	 Display of load size	Indicate the percentage of the current load current relative to the rated current, 90% to 110%, the histogram shows 100%, and so on.
4	1-2,2-3,3-1	1、2、3：Values of ABC three-phase, 1-2,2-3,3-1: Value of the AB, BC, CA three-line
	AVG	Average value
	N	Neutral current
	∑	Total power
5		Lights up to indicate that the current communication is being sent and received normally

	Communication status symbol	
6	IMP/ EXP/⏦/⊣⊢	Absorption total active energy / release total active energy / inductive reactive energy / capacitive reactive energy
7	Unit of measurement data	Current: A, kA; Voltage: V, kV; Active power: kW, MW; Reactive power: kVar, MVar; Apparent power: kVA, MVA; Percentage: %; Frequency: Hz
8	Display area of measurement data	Current, voltage, power, power factor, time, parameter settings, etc.
9	Units of energy	Active energy: kWh, MWh; Reactive energy: kVarh, Mvarh
10	DO status indication	The status of DO1-DO4. The remaining DO can be viewed under the main loop IO
11	DI status indication	The status of DI1-DI8. The remaining DI can be viewed under the main loop IO
12	Energy data area	Left and right navigation bar, corresponding to the left and right buttons menu; Electrical measurement display and parameter setting

The meter will display the model number and version information, and then the current interface will be displayed.



7.2 Panel description

Key description

The four keys are, the SET key, the left key, the right key, and the enter key from left to right.

Key	Function
SET	Return to previous menu
Left	Decrease parameter or switch display page
Right	Increase parameter or switch the display page
Enter	Modify and confirm the parameters or enter the next menu

Extended module indicator light description

	Flashing (1s)	Flashing (0.2s)	Bright	Extinguished
（GREEN）	Module OK	Module error	/	Module is not running

7.3 Display overview

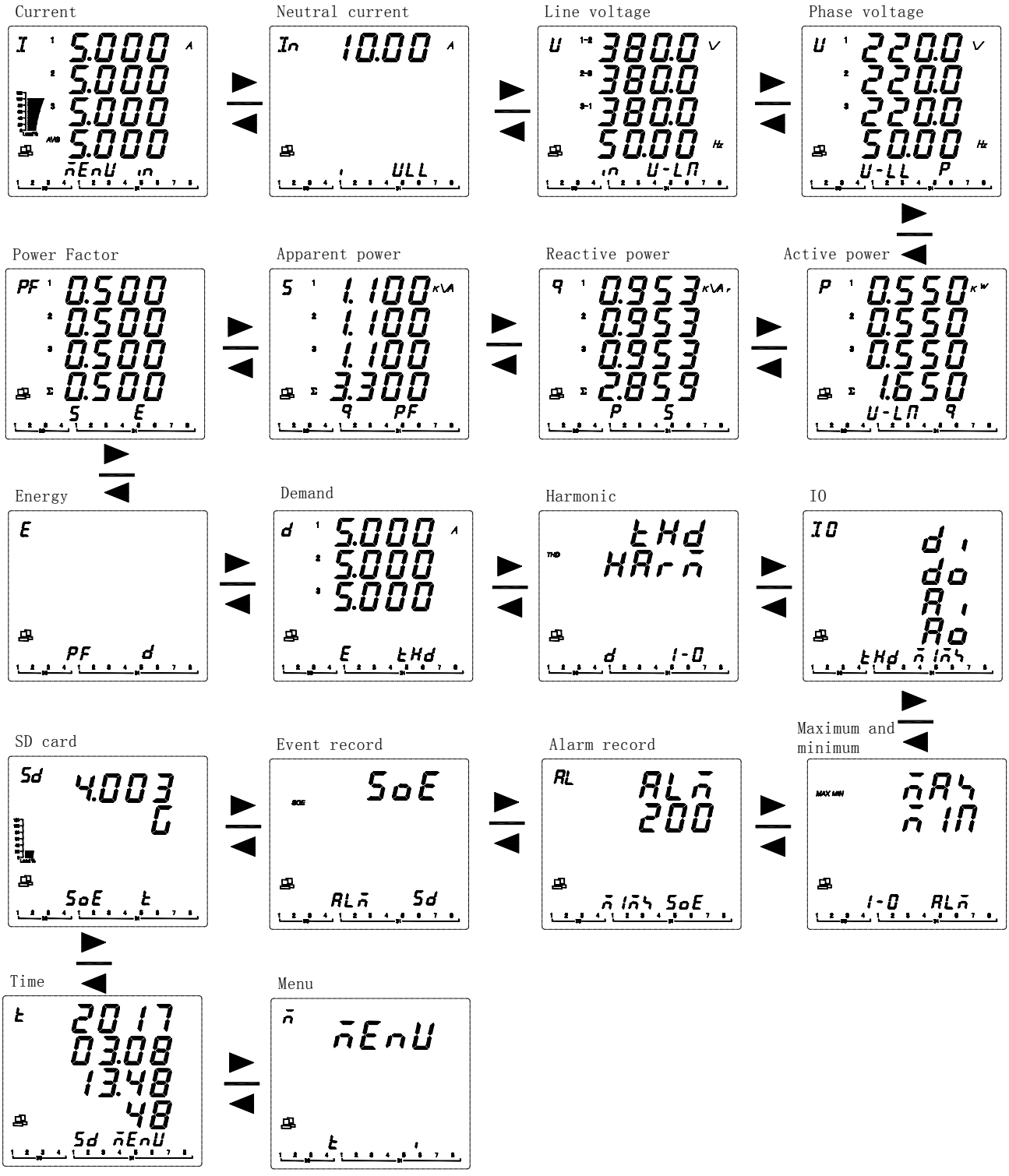
First level menu	Second level menu	Third level menu	Fourth level menu	Note
I (current)	I_Unablance (Unbalance of current)			
	Current phase angle			
In (neutral current)				
ULL (line voltage)	U_Unablance (unbalance of line voltage)			
	Offset (line voltage offset)			
ULN (phase voltage)	V_Unablance (Unbalance of phase voltage)			
	offset (Phase voltage deviation)			
	Angle (Voltage phase angle)			
P (active power)				
Q (reactive power)				
S (apparent power)				
E (energy)	IMP (Absorb active energy)			See energy view for details
	EXP (Release active energy)			
	EQL (Inductive reactive energy)			
	EQC (Capacitive reactive energy)			
d (current demand for three-phase current)	Current active power demand			See demand view for details
	Current reactive power demand			
	Current apparent power demand			
	Phase A current maximum demand and time of occurrence			
	Phase B current maximum demand and time of occurrence			
	Phase C current maximum demand and time of occurrence			
	Active power maximum demand and time of occurrence			
	Reactive power maximum demand and time of occurrence			
	Apparent power maximum demand and time of occurrence			
PF (power factor)				
THD	UH THD (Total harmonic distortion of phase voltage)	2-63 harmonics of three phase voltage		See harmonics for details
	UH ODD (Total odd harmonic distortion of phase voltage)			
	UH EVEN (Total even harmonic distortion of phase voltage)			
	IH THD(Total harmonic distortion of current)	2-63 harmonics of three phase current		
	IH ODD(Total odd harmonic distortion of			

	current)			
	IH EVEN(Total even harmonic distortion of current)			
	CF (Crest factor)			
	THFF (Telephone waveform factor)			
	KF(K factor)			
IO (Inputs and outputs)	DI (Digital input)			See IO for details
	DO (Digital output)			
	AI (Analog input)			
	AO (Analog output)			
MAX/MIN (Maximum and minimum)	I (Current)	Maximum of this month and time of occurrence; Minimum of this month and time of occurrence; Maximum of last month and time of occurrence; Minimum of last month and time of occurrence;		See the maximum and minimum for details
	U (Voltage)			
	P (Active power)			
	Q (Reactive power)			
	S (Apparent power)			
	PF (Power factor)			
	F (Frequency)			
	THD (Total harmonic distortion)			
ALM (Alarm record)	LAST ALM (last 16 alarm records)	Detailed alarm record		See the alarm for details
	AT01 (Overcurrent alarm)	1 A (Phase A overcurrent)	Alarm details	
		2 B (Phase B overcurrent)	…	
		3 C (Phase C overcurrent)	…	
		4 MAX (Maximum overcurrent)	…	
		5 N (Neutral overcurrent)	...	
	AT02 (Undercurrent alarm)	…	...	
	…	…	...	
	AT13 (Other alarm)	…	...	
SOE (Event record)	Record of the last 128 events			
TF (TF card capacity)				
TIME (system time)				
MENU	SET (Settings)			See the system settings for details

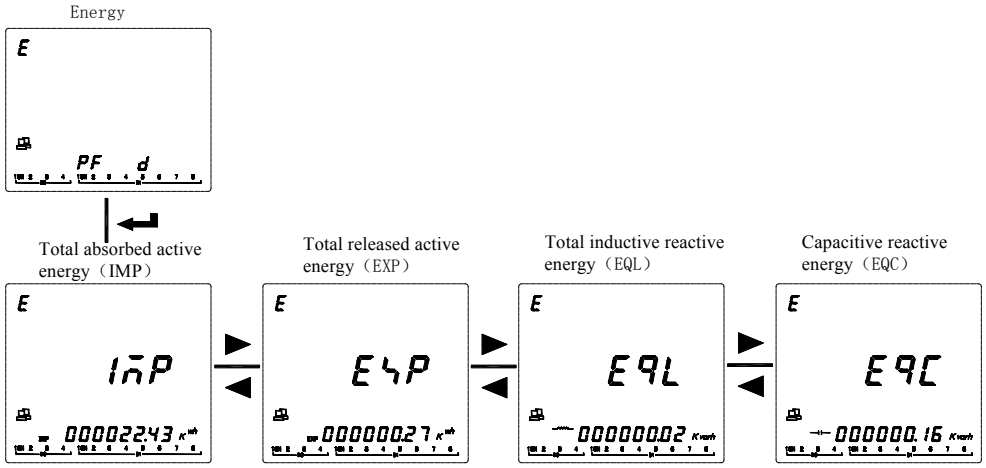
	RST (Reset)	E (Clear energy)		See data reset for details
		dMd (Clear demand)		
		ALM (Clear alarm record)		
		SOE (Clear event record)		
		MAX MIN (Clear extremum)		
		SD (Format TF card)		
	DIAG (diagnosis)	Version, Software number, Module version		

7.4 Measurement Parameters

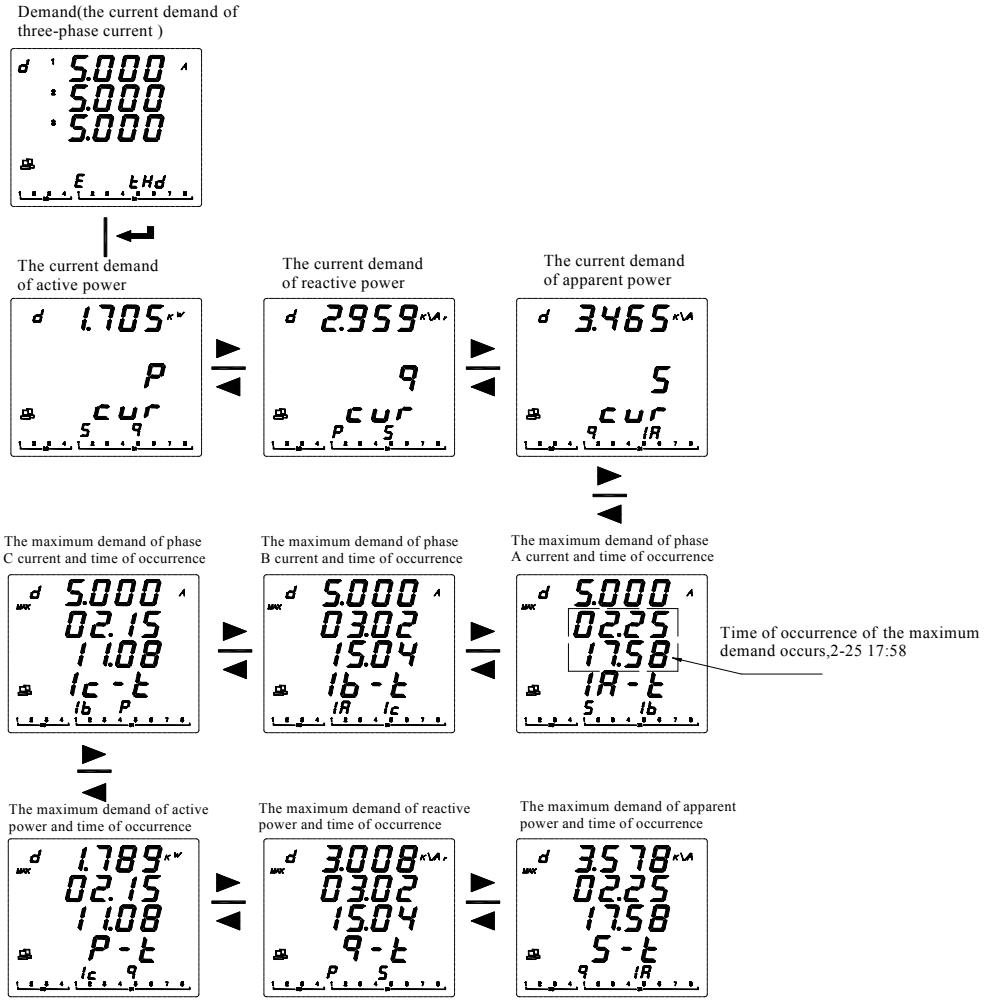
The power parameter overview: After the meter is powered on, the current is displayed. Press the left and right keys to switch the display to the following interface (some parameters need to press the enter key to enter the next level):



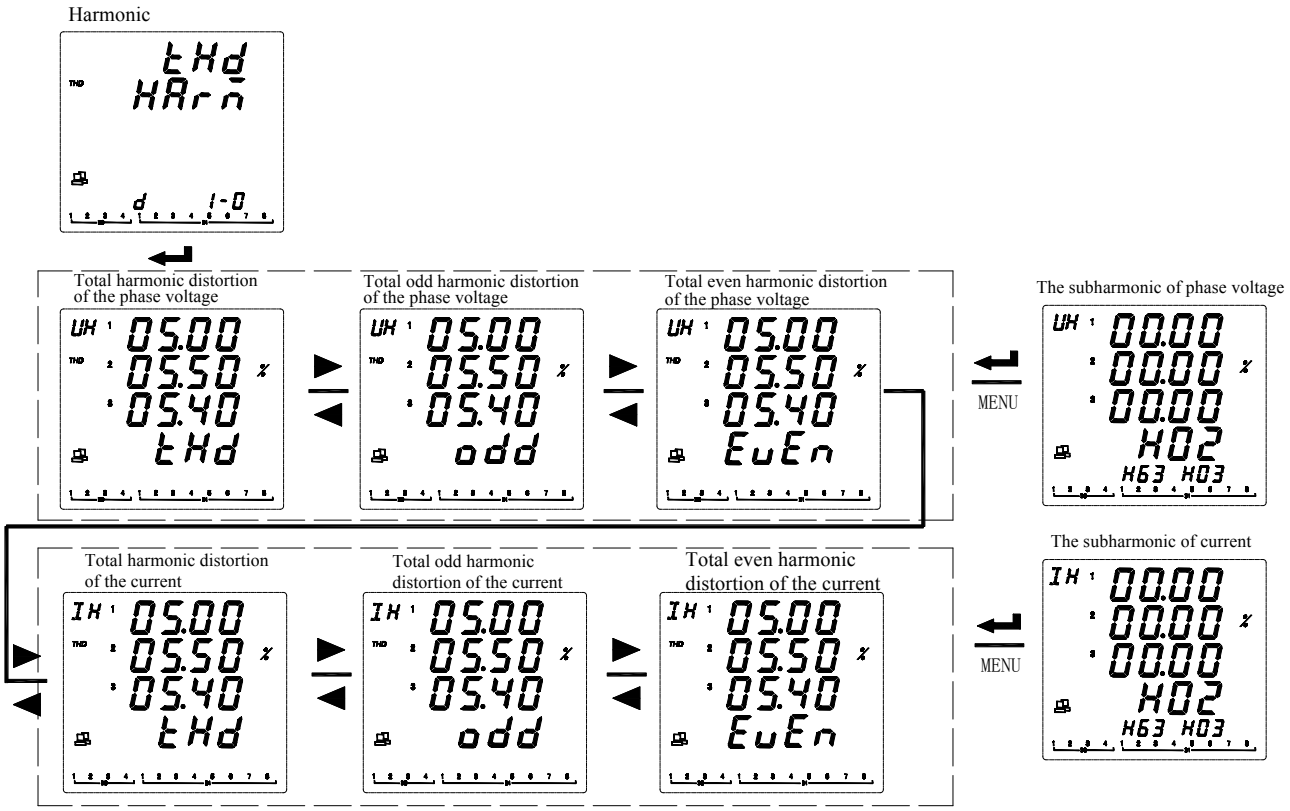
View energy: Press ◂▸ button in the main interface until the current measurement data display area shows E, then press ENTER, press ◂ ▸ button to switch the display: IMP (total absorbed active energy) ←→EXP (total released active energy) ←→ EQL (total inductive reactive energy) ←→ EQC (capacitive reactive energy).



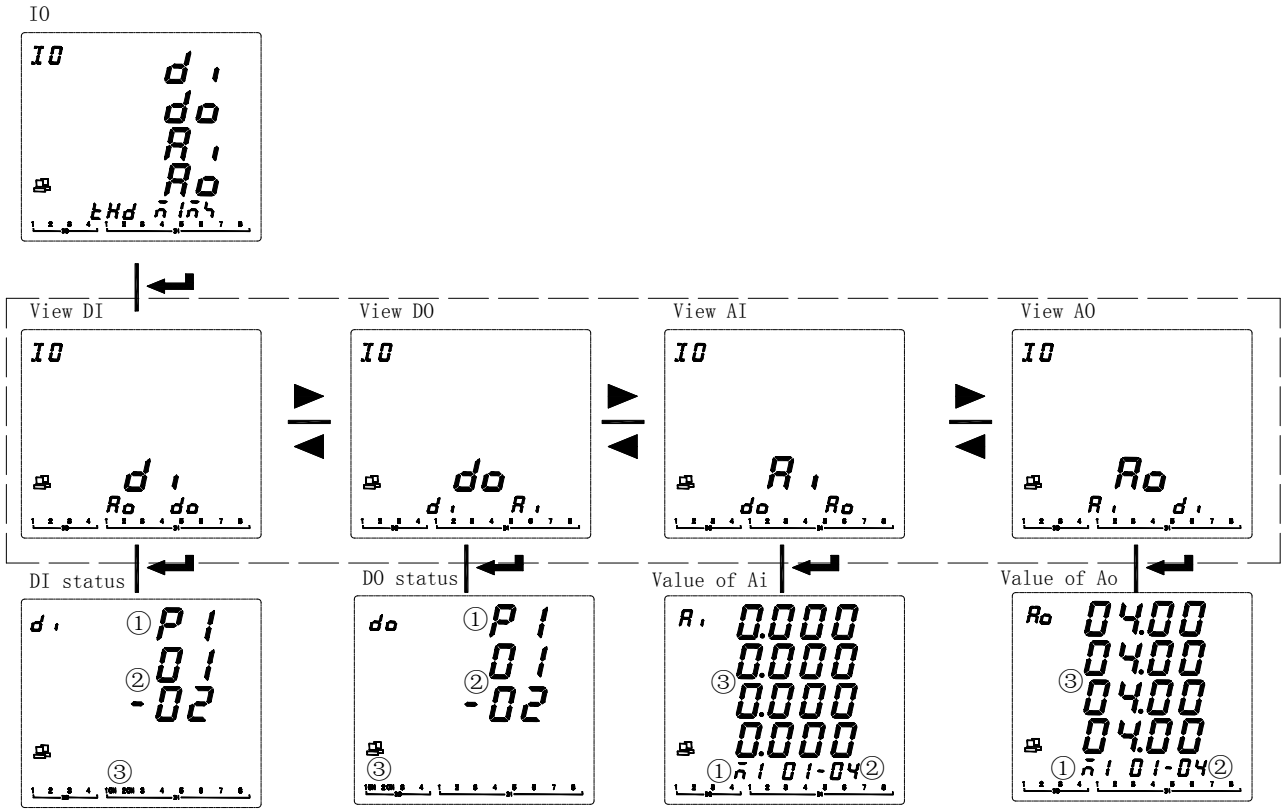
View demand: Press ◂▸ button on the main screen until the current measurement data display area shows d. The measurement data area displays the current demand of three-phase current and press the enter key. Press ◂▸ key to view the current demand of active power, the current demand of reactive power, the current demand of apparent power, the maximum demand of three-phase current and time of occurrence, and the maximum demand of three-phase power and time of occurrence.



View harmonic (APM810 only): Press ◂▸ key on the main screen until the current measurement data display area shows THD, the measurement data area shows THD, HARM, and press the enter key. Press the ◂▸ key to view the total harmonic distortion of the voltage, the total odd harmonic distortion of the voltage, the total even harmonic distortion of the voltage even, the total harmonic distortion of the current, the total odd harmonic distortion of the current, and the total even harmonic distortion of the current. After you press the enter key at the total harmonic distortion of voltage (or current) interface, you can view the subharmonics.


Harmonic
THD
tHd
HArn
d
1-0
Total harmonic distortion of the phase voltage
UH 1
THD 2
3
05.00
05.50
05.40
%
tHd
Total odd harmonic distortion of the phase voltage
odd
Total even harmonic distortion of the phase voltage
EuEn
MENU
The subharmonic of phase voltage
00.00
H02
H63 H03
Total harmonic distortion of the current
IH 1
Total odd harmonic distortion of the current
Total even harmonic distortion of the current
The subharmonic of current

View IO (Input and output): Press ◂▸ key on the main screen until the current measurement data display area shows IO, and the measurement data area shows DI, DO, AI, AO, press enter. Press the ◂▸ keys to select the information to be viewed (DI: digital input, DO: digital output, AI: analog input, AO: analog output).



① P1:Main part; M1:Module 1 M2:Module 2,and so on.

② Take DI for example, DI1-DI2 status is indicated at ③,others is similar.

③ Indicate status or values of DI/DO/AI/AO.

View maximum and minimum values: Press ◂▸ key on the main screen until the current measurement data display area shows MAX MIN and press enter. Press ◂▸ key to select the extreme value record of the electric parameters (I, U, P, Q, S, PF, F, THD, etc.) to be viewed and press the Enter key. Press the ◂▸ key to view the current month's maximum value, the current month's minimum value, the previous month's maximum value, the previous month's minimum value, and the time of occurrence of the selected electrical parameter. When a month span occurs, the extreme value of this month is automatically deposited into the extreme value of the previous month.

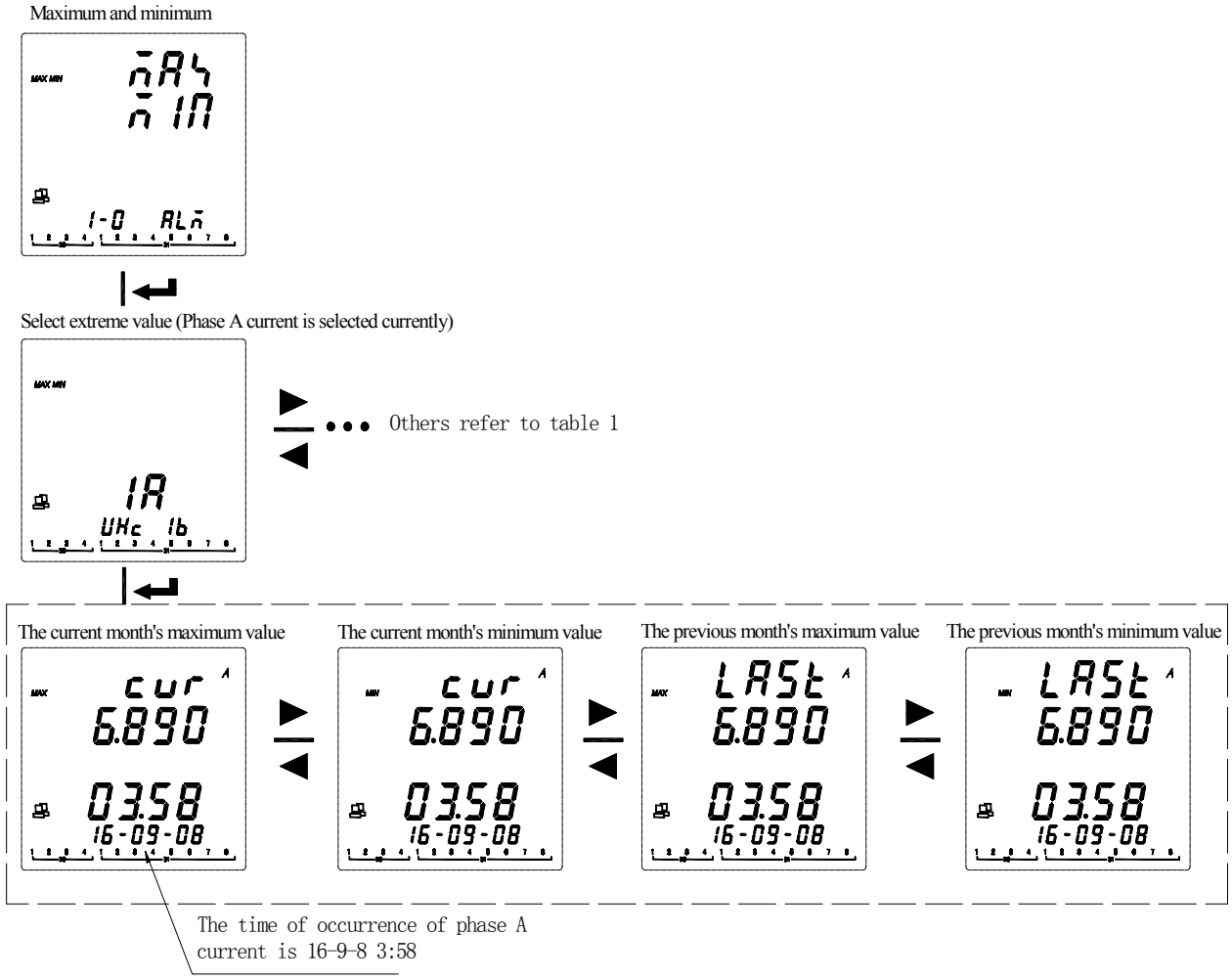


Table 1: Extreme Values and symbol description

Symbol	Instruction	Symbol	Instruction	Symbol	Instruction
IA	Phase A current	PT	Total active power	IHC	Total harmonic of Phase C current
IB	Phase B current	QA	Phase A reactive power	UHA	Total harmonic of Phase A voltage
IC	Phase C current	QB	Phase B reactive power	UHB	Total harmonic of Phase B voltage
IN	Neutral current	QC	Phase C reactive power	UHC	Total harmonic of Phase C voltage
IAV	Average current	QT	Total reactive power		
UA	Phase A voltage	SA	Phase A apparent power		
UB	Phase B voltage	SB	Phase B apparent power		
UC	Phase C voltage	SC	Phase C apparent power		
ULN（AVG）	Average phase voltage	ST	Total apparent power		
UAB	Phase AB line voltage	PFA	Phase A power factor		
UBC	Phase BC line voltage	PFB	Phase B power factor		
UCA	Phase CA line voltage	PFC	Phase C power factor		
ULL（AVG）	Average line voltage	PFT	Total power factor		
PA	Phase A active power	F	Frequency		
PB	Phase B active power	IHA	Total harmonic of Phase A current		
PC	Phase C active power	IHB	Total harmonic of Phase B current		

View the alarm: Press ◄► on the main screen until AL is displayed in the current measurement data display area, ALM is displayed in the measurement data area, and then press the Enter key. You can view the last 16 alarm records (Last Alm) in chronological order and view alarm records by alarm type.

APM series of meters can record 66 kinds of alarms, divided into 13 kinds of alarm categories (AT01 overcurrent, AT02 undercurrent, etc., see Table 2), each type of alarm includes a number of alarm subcategories (for example, the AT01 overcurrent alarm includes Phase A overcurrent, Phase B overcurrent, Phase C overcurrent, etc., see Table 2). Each alarm subclass can record up to 16 alarm records. When there are 16 or more alarm records, the principle of first in, first out is implemented. The newly generated alarm will automatically overwrite the oldest record. Each alarm record contains the alarm value, alarm group, alarm action (action or recovery), and alarm time. If an expansion module (including a TF card) is purchased, all alarm data will be automatically synchronized to the TF card for storage.

Note: The TF card cannot record all more than 16 alarm records that were simultaneously generated within 2 seconds.

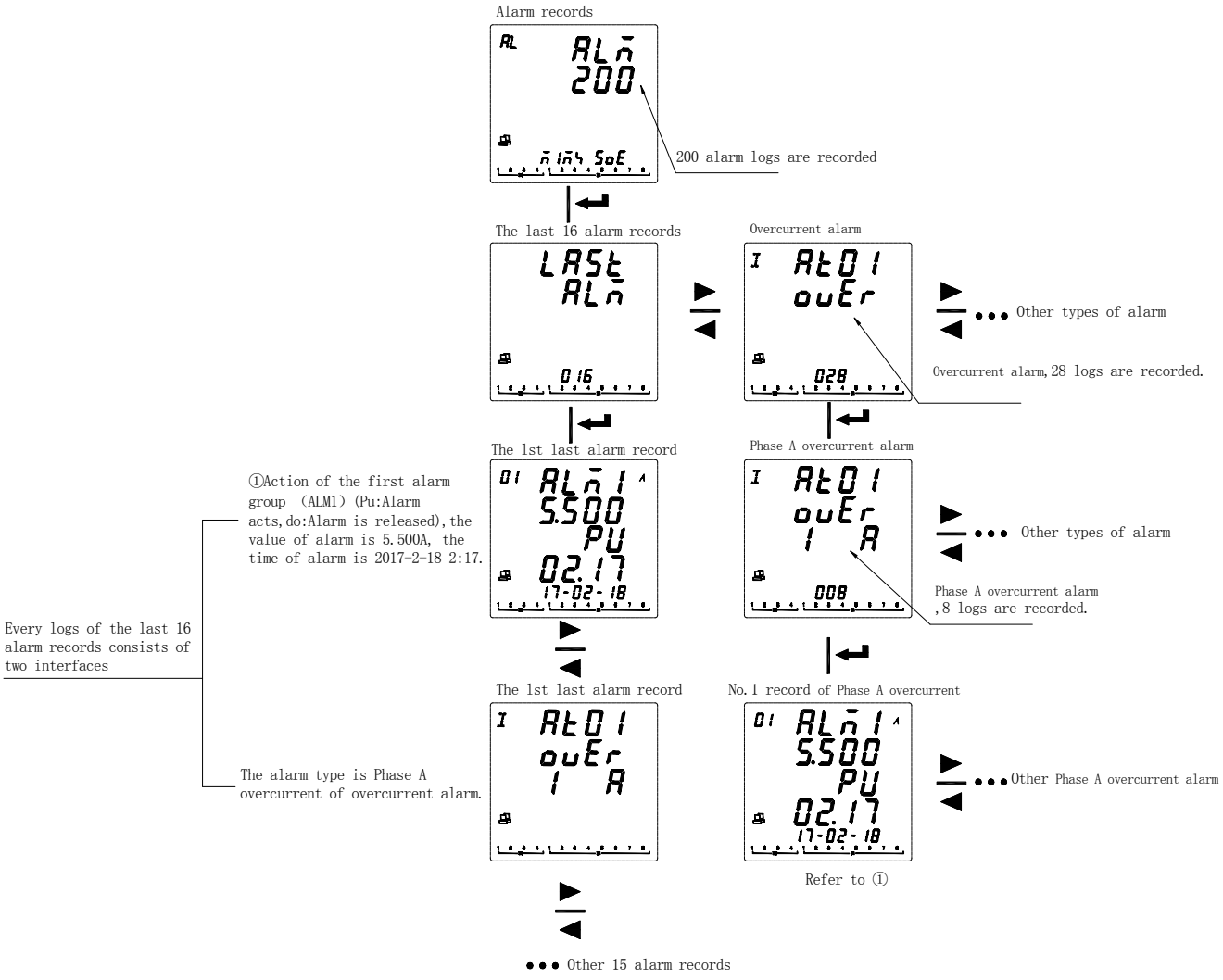


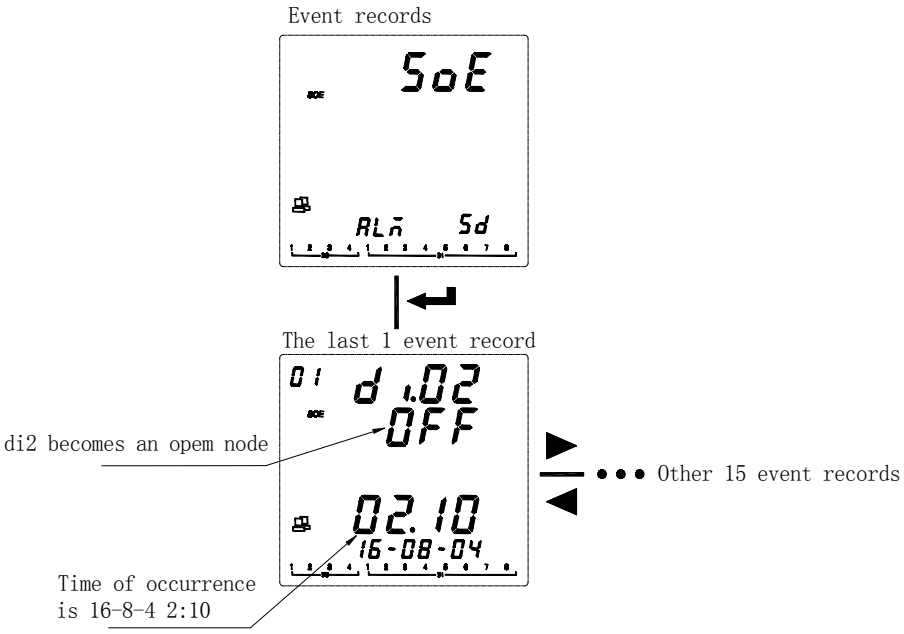
Table 2: Alarm classification description:

Alarm categories	Alarm subcategories		Alarm content	Alarm communication code
	Symbol I	Symbol II		
AT01 (Overcurrent)	I Over	1 A	Phase A overcurrent	0
		2 B	Phase B overcurrent	1
		3 C	Phase C overcurrent	2
		4 MAX	Maximum overcurrent	3
		5 N	Neutral overcurrent	4
AT02 (Undercurrent)	I Unde	1 A	Phase A undercurrent	5
		2 B	Phase B undercurrent	6
		3 C	Phase C undercurrent	7
		4 MAX	Minimum undercurrent	8
		5 N	Neutral undercurrent l	9
AT03 (Overvoltage)	U Over	1 A	Phase A overvoltage	12
		2 B	Phase B overvoltage	13
		3 C	Phase C overvoltage	14
		4 L-N	Maximum phase overvoltage	15
		5 AB	Phase AB overvoltage	16
		6 BC	Phase BC overvoltage	17
		7 CA	Phase CA overvoltage	18
		8 L-L	Maximum line overvoltage	19
AT04 (Undervoltage)	U Unde	1 A	Phase A undervoltage	20
		2 B	Phase B undervoltage	21
		3 C	Phase C undervoltage	22
		4 L-N	Minimum phase undervoltage	23
		5 AB	Phase AB undervoltage	24
		6 BC	Phase BC undervoltage	25
		7 CA	Phase CA undervoltage	26
		8 L-L	Minimum line voltage undervoltage	27
AT05 (Overpower)	P Over	1 P	Total active overpower	31
		2 Q	Total reactive overpower	32
		3 S	Total apparent overpower	33
AT06 (Underpower)	P Unde	1 P	Total active underpower	34
		2 Q	Total reactive underpower	35
		3 S	Total apparent underpower	36
AT07 (Demand alarm)	Pd dMd	1 Over	Overdemand alarm of active power	59
		2 Unde	Underdemand alarm of active power	60
AT08 (Power factor alarm)	PF PF	1 Over	Total over power factor	37
		2 Unde	Total under power factor	38
AT09 (Total	THD	1 IA	Over THD of Phase A current	41

Harmonic Alarm)		2 IB	Over THD of Phase B current	42
		3 IC	Over THD of Phase C current	43
		4 UA	Over THD of phase A voltage	44
		5 UB	Over THD of phase B voltage	45
		6 UC	Over THD of phase C voltage	46
AT10 (Total Even Harmonic Alarm)	EVEN	1 IA	Over TEHD of Phase A current	47
		2 IB	Over TEHD of Phase B current	48
		3 IC	Over TEHD of Phase C current	49
		4 UA	Over TEHD of Phase A voltage	50
		5 UB	Over TEHD of Phase B voltage	51
		6 UC	Over TEHD of Phase C voltage	52
AT11 (Total odd harmonics Alarm)	Odd	1 IA	Over TOHD of Phase A current	53
		2 IB	Over TOHD of Phase B current	54
		3 IC	Over TOHD of Phase C current	55
		4 UA	Over TOHD of Phase A voltage	56
		5 UB	Over TOHD of Phase B voltage	57
		6 UC	Over TOHD of Phase C voltage	58
AT12	di	1 di1	DI1 ON/OFF	62
		2 di2	DI2 ON/OFF	63
		3 di3	DI3 ON/OFF	64
		4 di4	DI4 ON/OFF	65
AT13（Other）	Oth	1 I-Ubl	Max unbalanced current	10
		2 U-Ubl L-N	Max unbalanced phase voltage	28
		3 U-Ubl L-L	Max unbalanced line voltage	29
		4 F Over	Over Frequency	39
		5 F Unde	Under Frequency	40
		6 I Loss	Current Loss	11
		7 U Loss	Voltage Loss	30
		8 PHA Rev	Phase Reversal	61

View event record (SOE): When the DI/DO status is changed, event records can be generated. The main body can store up to 128 event records.If you purchased an expansion module (including a TF card), all event log data will be automatically synchronized to the TF card for storage.

Note: The TF card cannot record all more than 16 alarm records that were simultaneously generated within 2 seconds.



See the TF card data record: After power off, remove the TF card and use a card reader or other device to plug it into the computer for reading.

①Alarm data: Double-click to open the Alarm folder, double-click the corresponding month folder, use Excel to open different types of .csv log file, you can view the alarm data.

②Event record data: Double-click to open the SOE folder, use Excel to open different months of .csv record file, you can view the SOE data.

③View the timed electrical parameter record data: Double-click to open the Record folder, use Excel to open the .csv record file for different months, you can view the timed electrical parameter record data.

Symbol	Content	Symbol	Content	Symbol	Content
IA(A)	Phase A current	UBC(V)	Phase BC line voltage	PT(W)	Total active power
IB(A)	Phase B current	UCA(V)	Phase CA line voltage	QA(Var)	Phase A reactive power
IC(A)	Phase C current	U_LL_AVG(V)	Average line voltage	QB(Var)	Phase B reactive power
IN(A)	Neutral current	UA_UBL(%)	Unbalance of Phase A voltage	QC(Var)	Phase C reactive power
I_AVG(A)	Average current	UB_UBL(%)	Unbalance of Phase B voltage	QT(Var)	Total reactive power

IA_UBL(%)	Unbalance of Phase A current	UC_UBL(%)	Unbalance of Phase C voltage	SA(VA)	Phase A apparent power
IB_UBL(%)	Unbalance of Phase B current	U_LN_UBL(%)	Unbalance of phase voltage	SB(VA)	Phase B apparent power
IC_UBL(%)	Unbalance of Phase C current	UAB_UBL(%)	Unbalance of AB line voltage	SC(VA)	Phase C apparent power
I_UBL(%)	Unbalance of current	UBC_UBL(%)	Unbalance of BC line voltage	ST(VA)	Total apparent power
UA(V)	Phase A voltage	UCA_UBL(%)	Unbalance of CA line voltage	F(Hz)	Frequency
UB(V)	Phase B voltage	U_LL_UBL(%)	Unbalance of line voltage	PFA	Phase A power factor
UC(V)	Phase C voltage	PA(W)	Phase A active power	PFB	Phase B power factor
U_LN_AVG(V)	Average phase voltage	PB(W)	Phase B active power	PFC	Phase C power factor
UAB(V)	AB line voltage	PC(W)	Phase C active power	PF	Total power factor

④View the timed energy record data: Double-click to open the Energy folder, use Excel to open the .csv record file for different months, you can view the timed energy record data.

Symbol	Content	Symbol	Content
IMP	Positive active energy	IMP(T1)	Positive active energy during T1 period
EXP	Reverse active energy	IMP(T2)	Positive active energy during T2 period
EQL	Inductive reactive energy	IMP(T3)	Positive active energy during T3 period
EQC	Capacitive reactive power	IMP(T4)	Positive active energy during T4 period

7.5 System Settings

To set up the APM series meter, follow the instructions below:

① Press ◂▸ at the measurement screen until Menu is selected and press ENTER.

② Press ◂▸ until Set is selected and press ENTER.

③ Enter your password. The default password is 0001 and the universal password is 0510.

④ Select the parameters to be modified.

Modify the parameters as follows:

①When a value or character is selected, flashing indicates that it can be modified.

② 1)For values that do not need to distinguish ones, tens,hundreds, thousands, use the ◂▸ keys to change the currently selected value.

2 ） To achieve the method to increase or decrease the value of ones, tens,hundreds, thousands, you need to press ◂ to select the bit that need to be modified, and press ▸ to change the value of the selected bit.

③ Press Enter to save the changes and move to the next area.

④ Press the SET button before saving,prompt for saving will appear. Press the left or right key to select yes/no. When you select yes, press Enter to save the setting parameters. When you select no, press Enter will not to save the setting parameters.

7.5.1 System Settings Overview (SET):

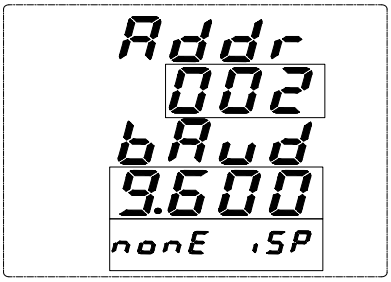
First level	Second level	Third level	Range
Bus (communication)	BUS 1 (First way)	Addr	Address:1-247
		Baud	Baud rate: 1200,2400,4800,9600,19200,38400
		Mode	Mode: None 1sp (No parity, 1 stop bit) None 2sp (No parity, 2 stop bits) Odd 1sp (Odd check, 1 stop bit) Even 1sp (Even parity, 1 stop bit)
	BUS2	Same as BUS1	Extended RS485 module
	DLT 645	Addr	645 Address: 0-999999999999
	Profibus	Addr	Profibus Address: 1-127
SYS (System)	Rto.i	I Pri	Primary rated current: 1A-32760A =Pri*Scale (See current ratio setting)
		I Scal	
		I Sec	Secondary rated current rating: 1A, 5A
		In Pri	Primary neutral rated current: 1A-32760A =Pri*Scal
		In Scal	
		In Sec	Secondary neutral rated current rating: 1A, 5A
	Rto.u	U Pri	Primary rated voltage: 100V-1200kV =Pri*Scal
		U Scal	
		U Sec	Secondary rated voltage rating: 100V, 110V, 400V, 690V

	Line		Wiring: 3P3W_3CT: Three-phase three-wire 3CT 3P3W_2CT: Three-phase three-wire 2CT 3P4W: Three-phase four-wire
	nom	U.nom	Nominal value of secondary voltage,used to calculate voltage deviation
		F.nom	Nominal value of frequency used to calculate frequency deviation.
	Puls		Pulse constant: 0-9999, see system setup section
ALM (Alarm)	AL1		The first group of alarms: see the alarm setting section for details.
	AL2		The second group of alarms
dMd (Demand)	Wid		Window sliding time: 1, 2, 3, 5 minutes
	Pd		Period: 5-60 minutes
Ubl (Unbalance)	Meth		Calculation method of unbalance: Absolute (Absolute value algorithm) (The difference between the maximum value deviating from the average and average value) / average *100% Rated (Rated algorithm) If the average value of the denominator in the above equation is less than the rated value, the denominator is the rated value.
Di-o (Digital inputs and outputs)	DI	Init	Initial state: N-C (Normally open) / N-O (Normally closed)
	DO	Init	Initial state: N-C (Normally open) / N-O (Normally closed)
		TYPE	ALM1 (Associated with alarm 1, see DO setting) ALM2 (Associated with alarm 2, see DO setting) COM (Communication control)
		DLY	Effective when controlled by communication. When it is set to 0, it is the level control mode. If it is not 0, it is the pulse control mode. After the delay time is set, it will be disconnected. Unit: 1 second.
Ai-o (Analog inputs and outputs)	AI	TYPE	Input Type: 0-20mA, 4-20mA, 0-5V, 1-5V
		Dot	Decimal point: 0-3
		High	High value of display: 0-9999
		Low	Low value of display: 0-9999
	AO	TYPE	Output Type: 0-20mA, 4-20mA, 0-5V, 1-5V
		SEL	Select the corresponding signal, and see the analog output set.
		High	Corresponding value of high point of analog output (Primary value)
		Low	Corresponding value of low point of analog output (Primary value)
		ofs	Offset (Based on 16mA/4V)
nET (Ethernet)	IP		IP address
	SUB		Subnet mask
	GATE		Gateway
	PORT		Port number: 1-9999
Time	Minute, second, year, month, day		**See the time setting section**
PASS	set		Password of parameter setting: 0-9999

(Password)	rst		Reset password: 0-9999
LCD (Backlight)			0: Always bright Non-zero: After delaying the setted value, the backlight goes off in units of seconds.

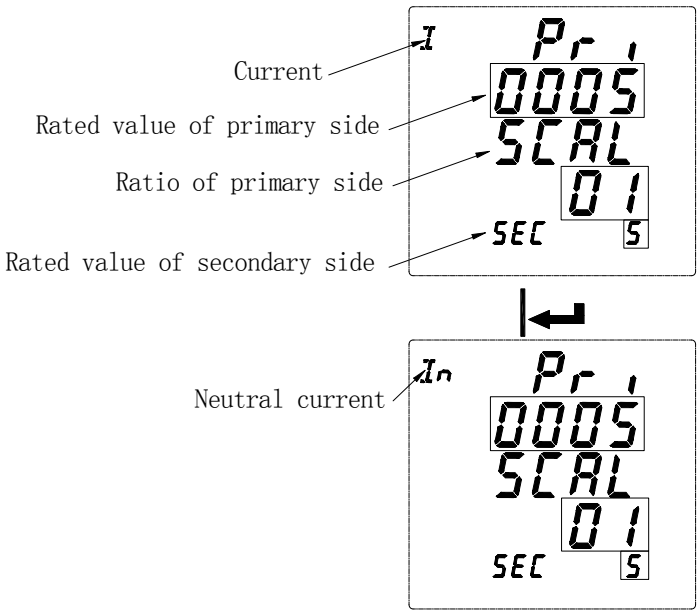
7.5.2 Communication settings

1. After entering setup mode (the same settings below), press ◂▸ until BUS is selected and press Enter.
2. Press the ◂▸ keys to select the communication parameters (bus1/bus2/DLT645/Profibus) and press the Enter key.
3. Set ADDR (communication address), range: 1-247 and press the Enter key.
4. Select bAUd (baud rate) and press the Enter key.
5. Select Mode (check mode and stop bit) and press the Enter key.
6. Press the SET button to return to the R485 BUS interface.



7.5.3 System setting (Current ratio)

1. Press ◂▸ until SYS is selected and press the Enter key.
2. Press ◂▸ until Rto.i is selected and press the Enter key.
3. Input the rated value of primary side current(I Pri) and press the Enter key.
4. Enter the ratio of primary side current (SCALE), optional *01, *10 times, used to set the primary side current greater than 9999A, the actual rated value of primary side current is Pri*SCAL, If you need to set the primary side current to 10000A, you can set Pri=1000, SCAL=10;
5. Select the value of rated secondary side current (I Sec) and press the Enter key.
6. Enter the the rated value of primary side (In Pri), the ratio of primary side (SCAL), and the rated value of secondary side (In Sec) for the neutral current. Refer to steps 3, 4, and 5.



7.5.4 Voltage ratio setting refers to current ratio setting

For example: If the current input is connected by external CT and the rated value is 40A/5A, set the rated value of primary side current to 40A, the scale value to 1, and the rated value of secondary current to 5A. Neutral current setting is the same. If the voltage input is connected by external PT and the rated value is: 6000V/400V, then set the rated value of the primary voltage to 6000V, the scale value to 1, and the rated value of secondary voltage to 400V.

7.5.5 Pulse constant setting (Only APM801 can be set)

When the pulse constant is set to 0, the default is 8000 when the rated value of the secondary side current is 1A, and the default is 4000 when the rated value of the secondary side current is 5A. When the pulse constant is set to non-zero, the actual pulse constant is the setted value*100. For example, if the set value is 50, the actual pulse constant is 5000.

Note: ① The primary value must be greater than or equal to the secondary value.

② Only the APM801 can set the pulse constant.

7.5.6 Alarm Settings

1. Press ◂▸ until ALM is selected and and press the Enter key.
2. Press ◂▸ key to select the alarm group (a total of two groups of alarms) and press the Enter key.
3. Press the ◂▸ keys to select the alarm category (Refer to Table 2 of 7.4 Alarm View) and press the Enter key.
4. Under the alarm category, select the alarm subclass (Refer to Table 2 of 7.4 Alarm View) and press Enter key.
5. Enable selected alarm type（ENABLE or disable selected alarm type（DISABLE）and press the enter key.
6. Input the value of alarm action (primary value). For some parameters, you can set the negative value. Press the

◄► key at the same time to switch the positive and negative signs and press the enter key.

7. Enter the delay time of alarm action and press the enter key.

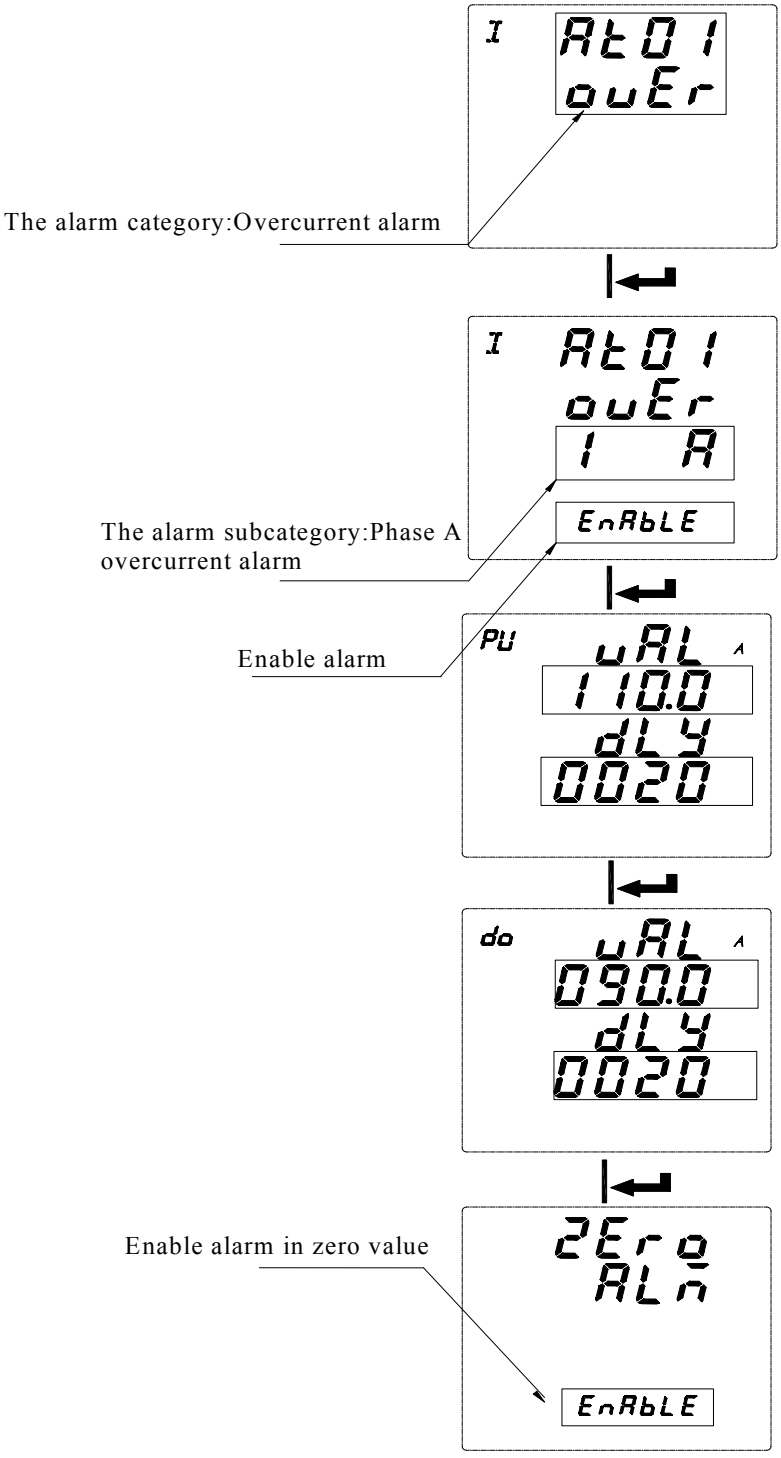
8. Enter the recovery value of alarm (primary value) and press the enter key.

9. Enter the delay time of alarm recovery and press the enter key.

10. Enable alarm in zero value(low value of alarm is effective) and press the enter key.

11. Return to the third step and make other alarm settings.

12. Press the SET button to return.



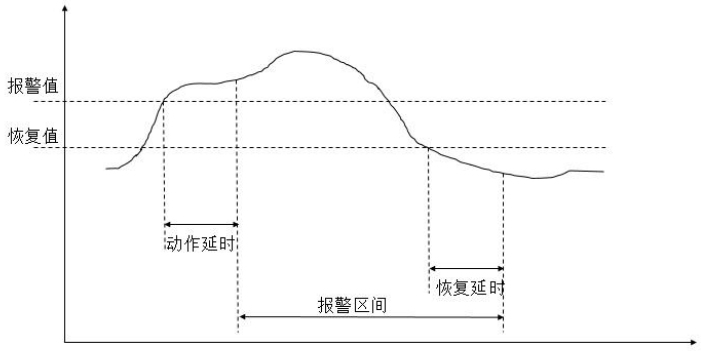
The parameter symbol description for settings

	Indication area symbol	Symbols of display area	Range
Enable settings			ENABLE,DISABLE
Parameter settings	PU（Pick Up）	VAL (Alarm value)	0-9999
		dLy (Alarm delay value, accurate to second)	0-9999

	Do(Drop Out)	VAL (Recovery value)	0-9999
		dLy (Recovery delay value, accurate to second)	0-9999
		ZERO ALM (Enable or disable zero alarm)	ENABLE，DISABLE

Note: For high alarm types, the recovered value must be less than the alarm value. For low alarm types, the recovered value must be greater than the alarm value.

The following is a schematic of how the meter handles alarm parameters.



报警值：Alarm value

恢复值：Recovery value

动作时间：Action time

报警区间：Alarm interval

恢复延时：Delay time of recovery

Alarm description:

The meter has two groups of alarms. Each group of alarms can detect a variety of alarm conditions, including changes in the inputs of the electronic parameters, phase loss, reverse phase sequence, unbalance, and harmonics. The switch input and reverse phase sequence only need to set the enable bit, and other alarms need to set the alarm condition.

7.5.7 Alarm Type Description

7.5.7.1 Electric parameter alarm

Overcurrent: Zero alarm setting does not apply to overcurrent alarm. When the single phase current is greater than or equal to the action value and meets the set action delay time, the single phase overcurrent alarm starts; when the single phase current is lower than the set recovered value and meets the delay time. The single phase overcurrent alarm is released.

Undercurrent: When the single phase current is lower than or equal to the action value and meets the set action delay time,the single phase undercurrent alarm starts; when the single phase current is greater than the recovered value and meets the delay time, the single phase undercurrent alarm is released.

Note: When undercurrent alarm and zero alarm is enabled, single phase current is equal to 0, the alarm is

valid; when undercurrent is enabled and zero alarm is forbidden, when single phase current is equal to 0, the alarm is invalid.

7.5.7.2 Phase current loss alarm

When any current (not all current) is equal to or lower than the action value and meets the delay time, phase A current loss alarm occurs; and when any of the following conditions occurs, the alarm is released:

The three-phase current is greater than the recovered value and meets the delay time

The three-phase current is lower than the phase loss action value.

7.5.7.3 Reverse phase sequence alarm:

The values of action and recovery and delay time are not applicable to the reverse phase sequence alarm. When the phase sequence is not ABC normal phase sequence, an inverse phase sequence alarm is generated.

7.5.7.4 DI alarm

When the DI state changes from the initial state, an alarm is generated.

Examples are as follows:

Set Phase A overcurrent alarm of the first group of alarm enabled.

Action value: The action value is a primary value. For example, if the alarm value is set to 5.500A, when Phase A current value exceeds 5.500A, the alarm condition is triggered and the timer starts.

Action delay time: When the alarm condition is triggered, if Phase A current value exceeds 5.500A, an alarm record will be generated after the setted delay time (accurate to the second), Alarm group (alarm 1), alarm type (Phase A overcurrent), alarm time (eg: 2017-5-12 14:15:20) will be recorded. If DO is associated with this alarm, the DO acts (see DO settings).

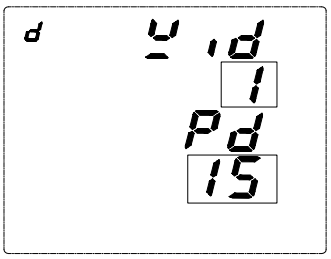
Recovered value: The recovered value is a primary value. For example, if the recovered value is set to 5.400A, after Phase A overcurrent alarm has occurred, when Phase A current value is lower than 5.400A, the released alarm condition is triggered and the timer starts. .

Recovered delay time: When the triggered alarm condition is released, if Phase A current value has been lower than 5.400A, the released alarm record will be generated after the setted delay time (accurate to second), and the alarm group (Alarm1), alarm type (Phase A overcurrent), the released alarm time (eg 2017-5-12 14:17:20) will be recorded. If DO is associated with this alarm, the DO returns to its initial state. It can be calculated that the alarm duration is 2 minutes.

Note: The alarm is invalid when both the action value and the recovered value are zero.

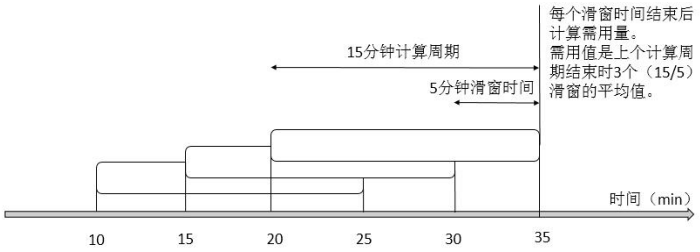
7.5.8 Demand setting

1. Press ◂▸ until you select dMd and press the Enter key.
2. Set the window time (Wid) (1, 2, 3, 5) and press the Enter key.
3. Set the demand period (Pd) (1-60), which must be set to an integral multiple of the sliding window time and press the Enter key.
4. Press the SET button to return.



Demand calculation method:

APM series meters use the sliding window method to calculate the demand. In the sliding window calculation cycle, select a calculation period (Period) and a sliding window (Width). The calculation cycle of sliding window must be divided equally. For example, three 5-minute sliding windows (Wid = 5, Pd = 15) are set in a 15 minute calculation cycle. Refresh the current demand at the end of each sliding window. The schematic diagram is as follows:



15 分钟计算周期：15 minutes of calculation period

5 分钟计算周期：5 minutes of calculation period

每个滑窗时间结束后计算需用量：

Calculate the demand after each sliding window time.

需用值是上个周期结束时 3 个（15/5）滑窗时间的平均值：

The demand value is the average value of the three sliding window time at the end of the last calculation period.

7.5.9 do settings

1. Press ◂▸ until dio is selected and press the Enter key.
2. Press ◂▸ until do is selected and press the Enter key.
3. Press the ◂▸ keys to select the do number (each main part contains 2 DO outputs and each MD82LOG module adds 2 DO outputs) and press the Enter key.
4. Press the ◂▸ keys to select Normally Open (N-O) or Normally Closed (N-C) and press the Enter key.
5. Press ◂▸ key to select the do output control mode. ALM1 (alarm group 1) and ALM2 (alarm group 2) are the alarm controls, and COM is the communication control. Press the Enter key.
6. 1) If you select the alarm (ALM1 or ALM2) control, press ◂▸ key to select the alarm category, press the Enter key.Select the alarm subclass, press the Enter ke.Select whether to enable,press the Enter key. A DO can select multiple alarms for combined alarms.

   2) If communication (COM) control is selected, modify the delay (DLY)time ranged 0-9999, unit 1 second.

When it is set to 0, it is a level control. When it is not 0, it is a pulse mode control,and it is disconnected after the delay time is set.

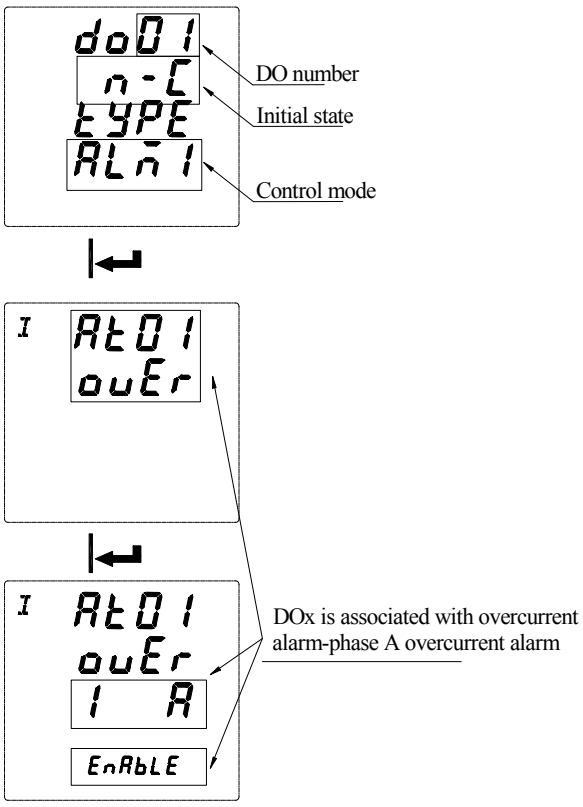
7. Press the SET button to return.

Note:

① **When the output control mode of do1 is selected as ALM (ALM1 or ALM2), and is not associated (DISABLE)with any alarm of ALM or associated with all alarms (ENABLE), When any alarm of this group (ALM1 or ALM2)is generated , do1 will act.**

② **When the output control mode of do1 is selected as ALM (ALM1 or ALM2) and associated (ENABLE) with Phase A overcurrent alarm and Phase A overpower alarm and not associated (DISABLE) with the other alarms. After the setting is completed, do1 acts when Phase A overcurrent or Phase A overpower alarm occurs.**

③ **Before selecting the alarm type associated with do, make sure that the alarm type is enabled in the alarm setting. If it is not enabled, the do does not act when this alarm condition occurs.**



7.5.10 Analog input setting (valid with analog module)

1. Press ◂▸ until Aio is selected and press the Enter key.

2. Press ◂▸ until Ai is selected and press the Enter key.

3. Press ◂▸ until the Ai channel to be modified is selected and press the Enter key.

4. Select the input type (make sure the input type is current input or voltage input, current input can choose 0-20mA, 4-20mA, voltage input can choose 0-5V, 1-5V). Press the Enter key.

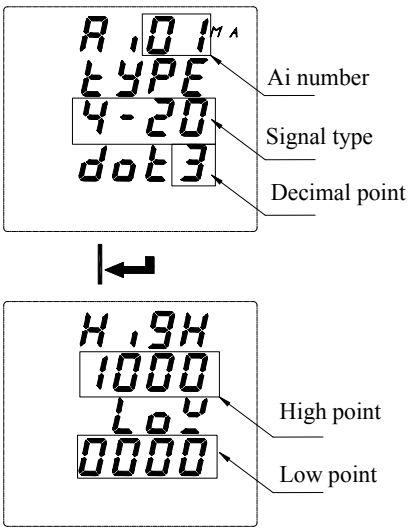
5. Select the decimal point of display and press the Enter key.

6. Set the high value of the signal input corresponding to displayed value and press the Enter key.

7. Set the low value of the signal input corresponding to displayed value and press the Enter key.

8. Press the SET button to return.

For example: Ai1 is set to 4-20mA input and the decimal point is set to 1. The displayed value of high point of is set to 1000 and the displayed value of low point is set to 0. When the Ai1 signal input is 20mA, the displayed value is 100.0. When the signal input is 4mA, the displayed value is 0. When the signal input is 12mA, the displayed value is 50.0.



7.5.11 Analog output setting (Valid with analog module)

1. Press ◄► until Aio is selected and press the Enter key.

2. Press ◄► until Ao is selected and press the Enter key.

3. Press ◄► until the Ao channel to be modified is selected and press the Enter key.

4. Select the output type and press the Enter key.

5. Select the output corresponding signal (see Table 3) and press the Enter key.

6. Set the actual value of high point of the output corresponding to the signal and press the Enter key.

7. Set the actual value of low point of the output corresponding to the signal and press the Enter key.

8. Output offset, as a percentage of the reference value of 16mA (current output) or 4V (voltage output) and press the Enter key.

9. Press the SET button to return.

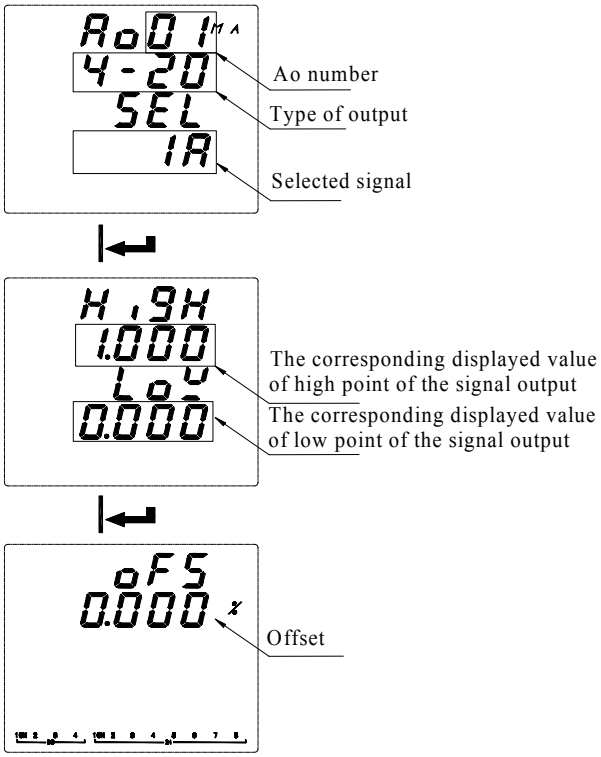


Table 3: Output Signals

No.	Symbol	Instruction	No.	Symbol	Instruction
0	IA	Phase A current	13	QA	Phase A reactive power
1	IB	Phase B current	14	QB	Phase B reactive power
2	IC	Phase C current	15	QC	Phase C reactive power
3	UA	Phase A voltage	16	QT	Total reactive power
4	UB	Phase B voltage	17	SA	Phase A apparent power
5	UC	Phase C voltage	18	SB	Phase B apparent power
6	UAB	Phase AB line voltage	19	SC	Phase C apparent power
7	UBC	Phase BC line voltage	20	ST	Total apparent power
8	UCA	Phase CA line voltage	21	PFA	Phase A power factor
9	PA	Phase A active power	22	PFB	Phase B power factor
10	PB	Phase B active power	23	PFC	Phase C power factor
11	PC	Phase C active power	24	PF	Total power factor
12	PT	Total active power	25	F	Frequency

For example:

When Ao1 is set to 4-20mA output, the signal is selected as IA (Phase A current), the corresponding signal of output high point is 5.000A, and the corresponding signal of output low point is 0.000A. When Phase A current value is 5A, Ao1 output is 20mA; when Phase A current value is 0A, Ao1 output is 4mA; when Phase A current value is 2.5A, Ao1 output is 12mA. If the actual output is 3.99mA at 0A, then the offset can be set to (4-3.99)/16 = 0.062% to make the zero output be 4mA.

7.5.12 Time setting

1. Press ◂▸ until Time is selected and press the Enter key.

2. Set hour (H), press the Enter key.

3. Set minute (M), press the Enter key.

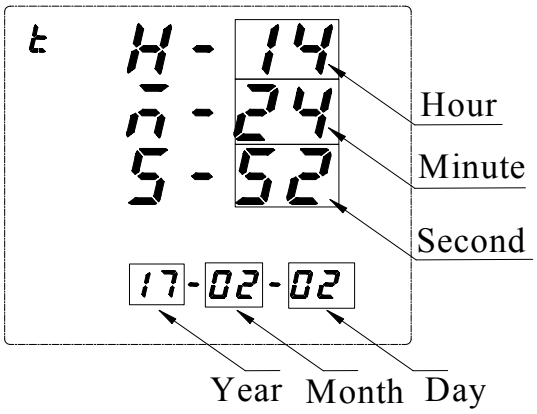
4. Set second (S), press the Enter key.

5. Set year and press the Enter key.

6. Set month and press the Enter key.

7. Set day and press the Enter key.

8. Press the SET button to return.



7.5.13 Network settings

1. Press ◂▸ until NET is selected and press the Enter key.

2. Enter the IP address and press the Enter key.

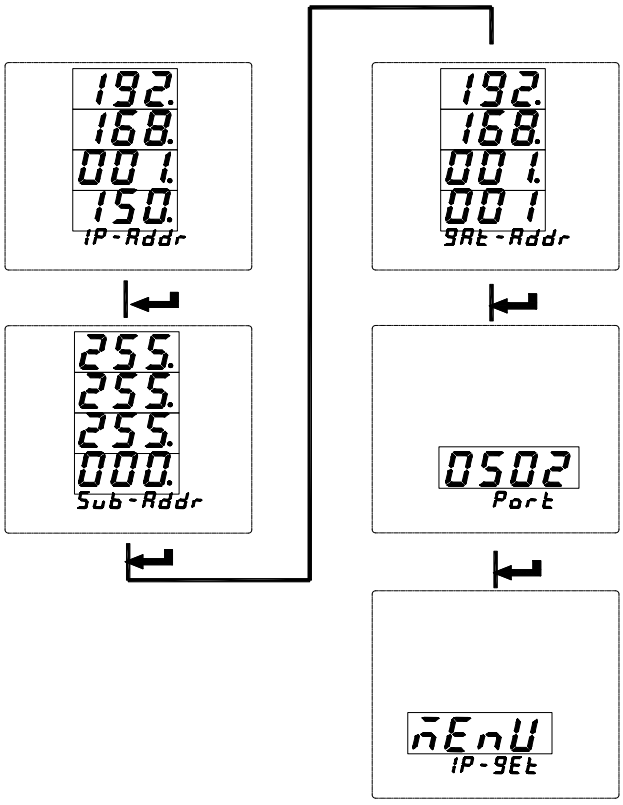
3. Enter the Subnet Mask (SUB) address and press the Enter key.

4. Enter the gateway address (GAT) and press the Enter key.

5. Enter the port address and press the Enter key.

6. Set the acquisition mode of IP address, MANU for manual acquisition, DHCP for automatic acquisition, press the Enter key.

7. Press the SET button to return.



7.5.14 Recording configuration of TF card

1. Insert the TF card into the computer, find the corresponding drive letter and open it.

2. Double-click to open APM800Config.ini.

3. [INTERVAL] is a configuration area of sampling interval.

   Parameter (minute), indicates the recording interval of electrical parameter in minutes and range (1-30).

   Energy (hour), indicates the recording interval of energy in hours and range (1-12).

   [PARAMETER] is the configuration area to record the electrical parameter. For example: IA=1 means to record Phase A current, IA=0 means not to record Phase A current.

   [ENERGY] is the configuration area to record energy configuration. For example: IMP = 1 means to record absorbed active energy, and IMP = 0 means not to record absorbed active energy.

4. Save after configuration is complete.

7.6 Resetting data

In order to reset the data of APM series meter, please follow the instructions below:

①Press ◂▸ at the measurement screen until Mune is selected and press the ENTER key.

②Press ◂▸ until Rst is selected and press the ENTER key.

③Enter your password. The default password is 0001 and the universal password is 0510.

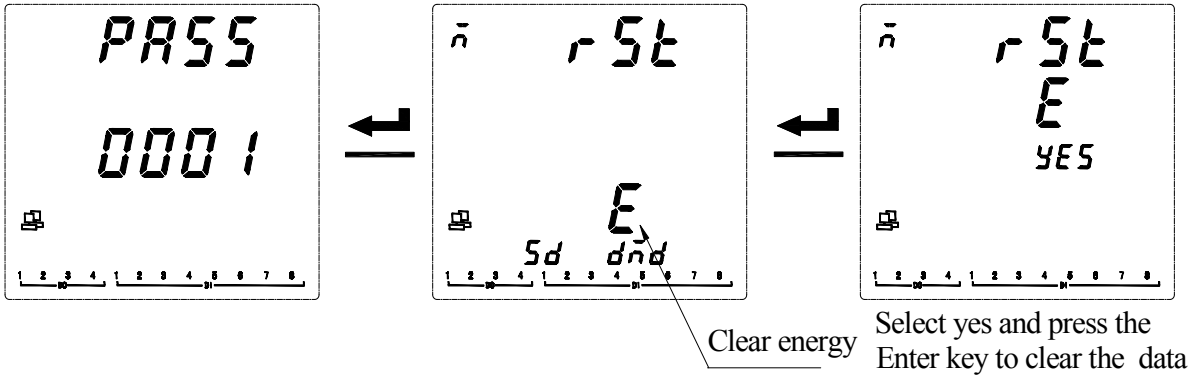
④Select the data to be reset and press the ENTER key.Refer to the following table.

⑤Press left or right key to select yes to clear the corresponding data, and select no to cancel.

Symbol	Instruction

E	Clear energy
dMd	Clear demand
ALM	Clear alarm records
SOE	Clear event records
MIMX	Clear maximum and minimum
SD	Format TF card

The following is an example of clearing energy:



8. Ethernet Communication Guide

8.1 Ethernet Parameter Modification

8.1.1 Modification by Button

Refer to 7.5 Network Settings of System Settings

8.1.2 Modification by Modbus Communication

Follow these steps to modify the Ethernet parameters:

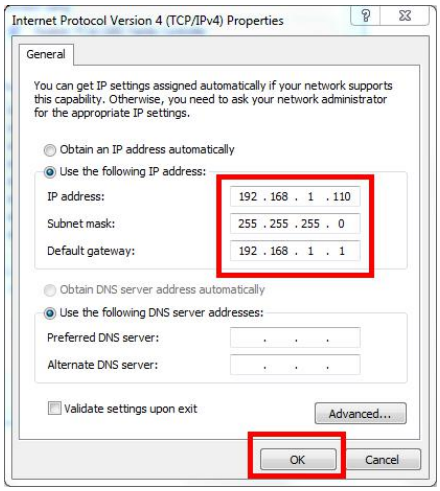
1) Send the command 0xABCD to the register with the address 29 to enter the Ethernet setting mode; Send the command 0 to the register with the address 29 to exit the Ethernet setting mode, and the modified parameters are not saved at this time.
2) The new value can be written to the register after entering the Ethernet setting mode. If the Ethernet mode is not entered, the modification is invalid.
3) Send the command 0XABCD to the the register with the address 37 to save the changes. After it is written successfully, the Ethernet module enters the restart mode. After the Ethernet module restarts successfully, the host can read the Ethernet parameters correctly.

8.1.3 Modification by Web Pages

Local network settings

Firstly, enter the operating system (take win7 as an example), use the mouse to click on the network icon on the bottom right corner, click on "Open Network and Sharing Center", click on the change adapter settings, right-click the local connection, click properties, double-click Internet Protocol Version 4 (TCP / IPv4), you will

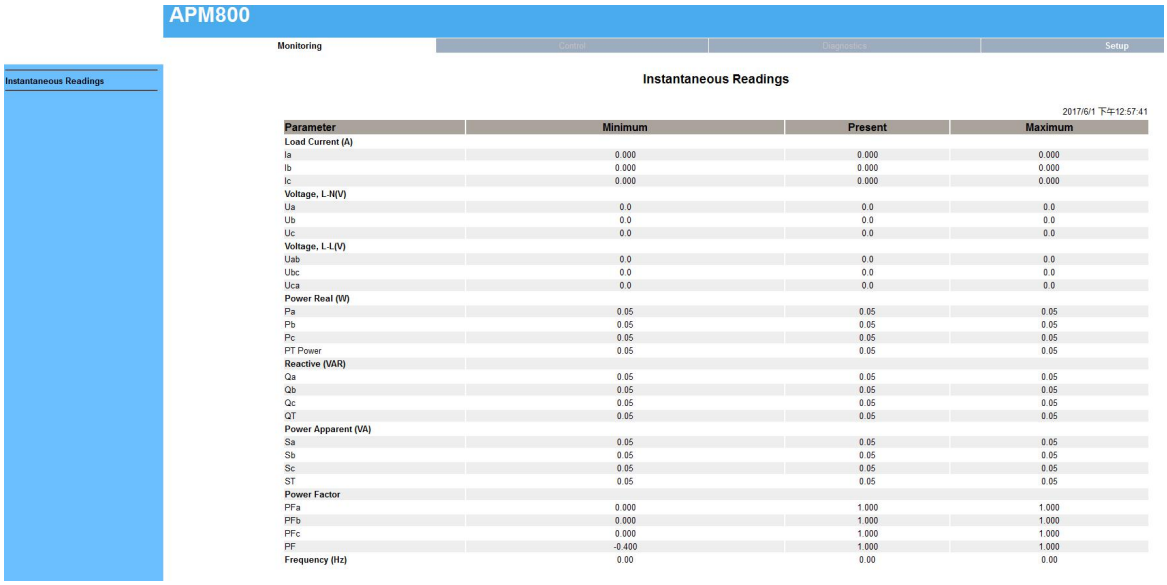
see the page shown below. Please follow the instructions, select "Use the following IP address", and fill in the IP address 192.168.1.110 (the same subnet), the subnet mask 255.255.255.0, the default gateway 192.168.1.1 (The DNS part can be left blank). Click OK on the page and click OK on the Local Area Connection Properties page to wait for system to complete configuration.



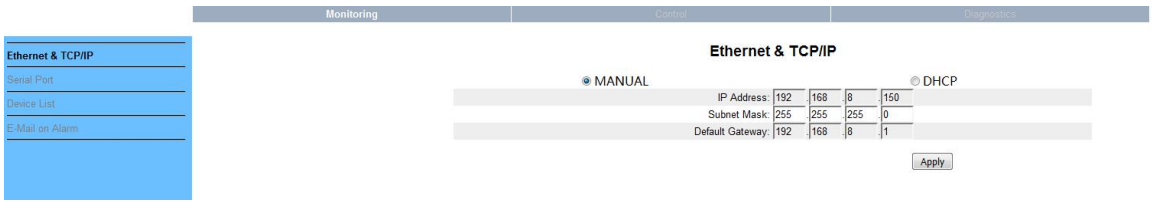
Connect the Ethernet module and the computer with a twisted-pair B cable, power the meter. If the local connection on the bottom right corner of the computer monitor is connected at this point, you can continue to the next step. Otherwise, power off the meter, check the network cable and network settings.

WEB page configuration

Open Internet Explorer, enter the Ethernet IP address in the address bar (http://192.168.1.150/, factory default setting), and the login screen shown in the figure below will appear.



Click Setup to enter the Ethernet & TCP/IP configuration interface, as shown below:



After the modification is completed, click Apply to wait for it to take effect.

8.2 Extension of RS485 Communication

8.2.1 Extending RS485 Communication as a Modbus Slave Station

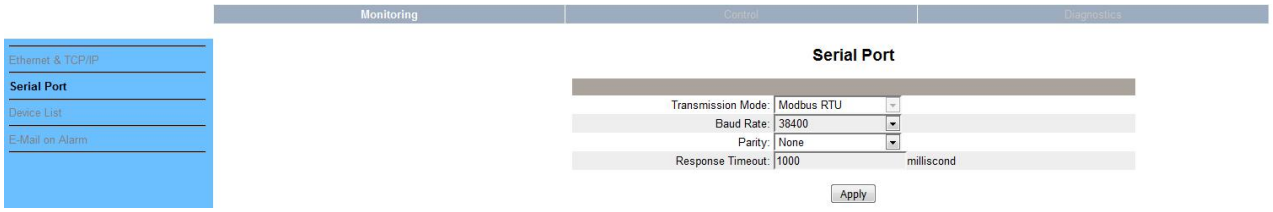
When the second communication serves as a slave station, as the first channel RS485 communication, only supports the 0x03 command and does not support the 0x10 command. Refer to Chapter 8 for the address table.

8.2.2 Extending RS485 Communication as modbus Master

When the extended communication is used as a master station, a small serial port server can be implemented in conjunction with the Ethernet interface.

Parameter configuration of extended serial port

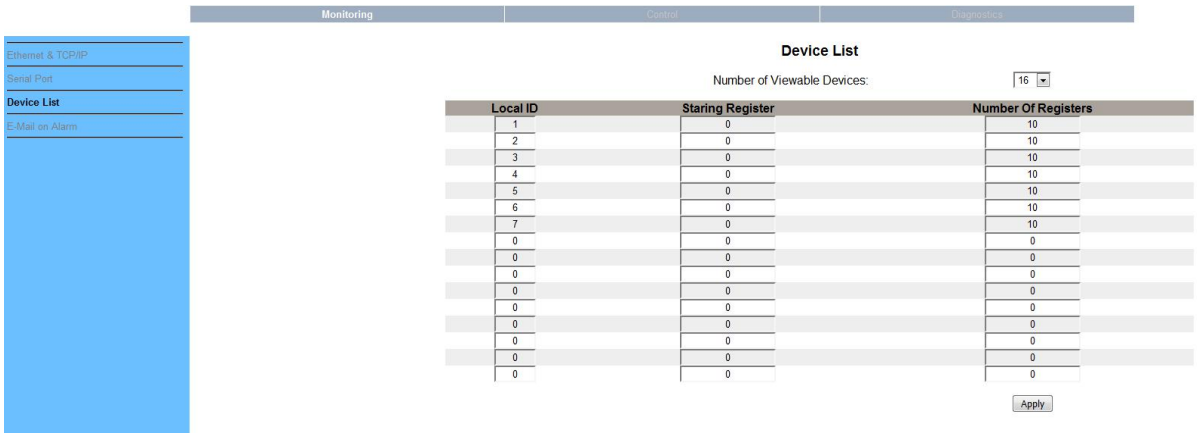
According to the operation method of 8.1.3, after connecting the Ethernet module, click setup->Serial Port to enter the serial port settings, and set the baud rate, parity bit and response time. Click Apply after you finish to wait for it to take effect. As shown below:



Parameter configuration of Modbus master

According to the operation method of 8.1.3, after connecting the Ethernet module, click setup->Device List to enter the parameter configuration of Modbus master, as shown below. The user can configure up to 128 lines of 03 Read commands. Each command contains the Modbus slave address, the start register address, and the number of registers. Click Apply to wait for the configuration to take effect.

The module will read data from the slave according to the configuration. The read data is stored in a register beginning with address 40000. This data can be read by Modbus-Tcp. The first configuration shown below is to read 10 data from register 0 of the slave with the address 1 and the second is configured to read 10 data from register 0 of the slave with the address 2. You can read the register 40000-40009 by Modbus-Tcp to get 10 data from register 0 of the slave with the address 1 and read 40010-40019 to get 10 data from register 0 of the slave with the address 2.



8.3 Modbus_TCP Communication Example (Using ModScan Software)

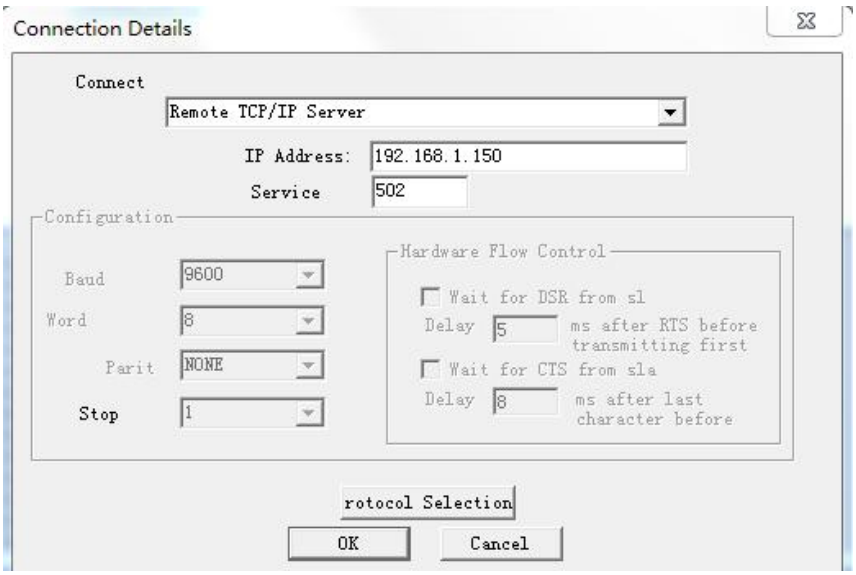
When using the Ethernet Modbus_TCP protocol, only the 03 (read holding register) command is supported.

Open the ModScan32 software and set it as shown below. Click Connect and select Remote TCP/IP Serever.

IP Address: The IP address of the Ethernet module (eg 192.168.1.150)

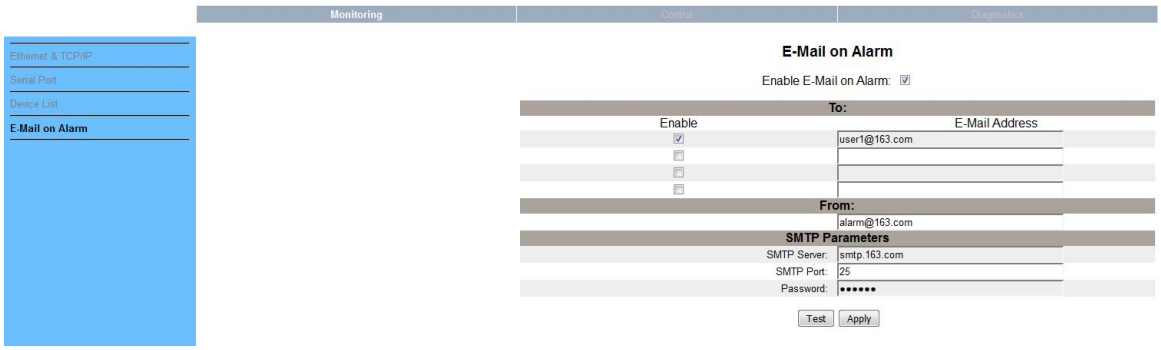
Service: Port number 502

Click OK button.



8.4 Mail Setting

The user can receive alarm notifications via email. According to the operation method of 8.1.3, after connecting the Ethernet module, click Setup->E-Mail on Alarm to enter the email setting. The user need to set up a sending email (From:alarm@163.com as shown below) and a password (Password), up to four receiving emails (To:user1@163.com as shown below) and email server settings, email server address and port settings can be found at the email service provider website. As shown in the following figure, user1@163.com will receive an alarm notification email from alarm@163.com when an alarm occurs.


Monitoring
Control
Diagnostics
Ethernet & TCP/IP
Serial Port
Device List
E-Mail on Alarm
E-Mail on Alarm
Enable E-Mail on Alarm:
To:
Enable
E-Mail Address
user1@163.com
From:
alarm@163.com
SMTP Parameters
SMTP Server:
smtp.163.com
SMTP Port:
25
Password:
Test
Apply

9. Analysis of common fault

Fault content	Analysis	Note
No display on power	Check whether the power supply voltage is in the working voltage range.	
Incorrect reading of voltage and current	Check the rated voltage and current of the primary side and secondary side is correct. Check whether the wiring mode setting is consistent with the actual wiring. Check voltage transformer, current transformer is in good condition.	
Incorrect power or power factor	Check whether the wiring mode setting is consistent with the actual wiring. Check the voltage and current phase sequence is correct.	
Communication is abnormal	Check whether the address, baud rate, parity, etc. in the communication settings are consistent with the host computer. Check the RS485 converter is normal. Parallel over 120 Ω resistance at the end of communication.	
Ethernet communication is abnormal	Check whether the IP address, subnet mask, gateway address, and port number settings are correct. Check whether the host computer and the meter network address is the same network segment	
The extended module flashes red	As with the TF card, check if the TF card is loose or damaged (view in communication or display). If there is still a malfunction and the fault is not eliminated after the meter is restarted, it is necessary to return to the factory for repair.	

Address: Yulv Road 253, Madong Industrial Park, Jiading, Shanghai

Fax: (86)21-69158303

Service hotline: 800-820-6632

Website: www.acrel.cn

E-mail: ACREL001@vip.163.com

P.C.: 201801

Production base: Jiangsu Acrel Electric Appliances Manufacturing Co., Ltd,

Address: Dongmeng Road 5, Nanzha Street, Jiangyin City

Tel./fax: (86)0510-86179970

P.C.: 214405

E-mail: JY-ACREL001@vip.163.com

Modbus-TCP/IP

1. General communication architecture

A communicating system over MODBUS TCP/IP may include different types of device:

--A MODBUS TCP/IP Client and Server devices connected to a TCP/IP network.

--The Interconnection devices like bridge, router or gateway for interconnection between the TCP/IP network and a serial line sub-network which permit connections of MODBUS Serial line Client and Server end devices.

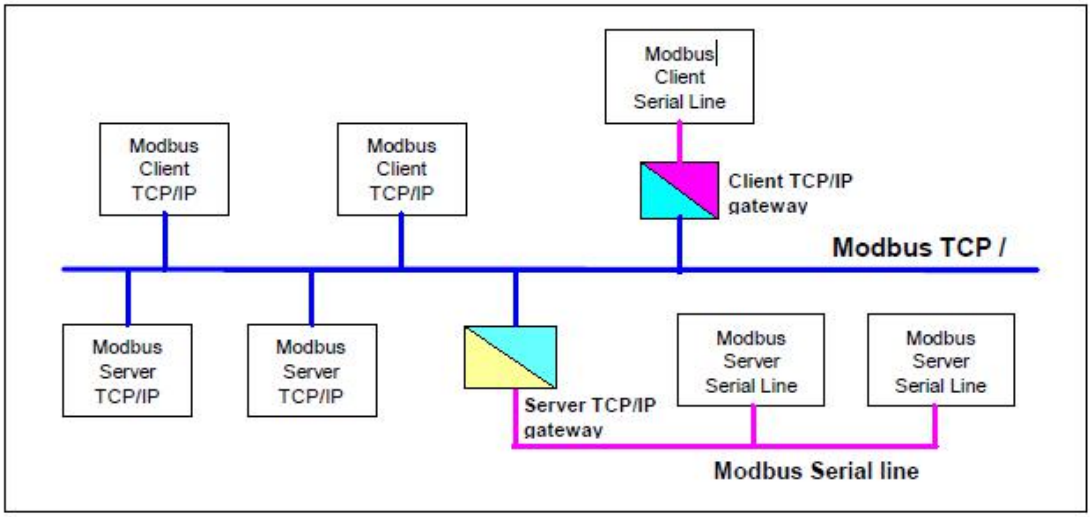


Figure 1: MODBUS TCP/IP communication architecture）

The MODBUS protocol defines a **simple Protocol Data Unit (PDU)** independent of the underlying communication layers. The mapping of MODBUS protocol on specific buses or networks can introduce some additional fields on the **Application Data Unit (ADU)**.

The client that initiates a MODBUS transaction builds the MODBUS Application Data Unit. The function code indicates to the server which kind of action to perform.

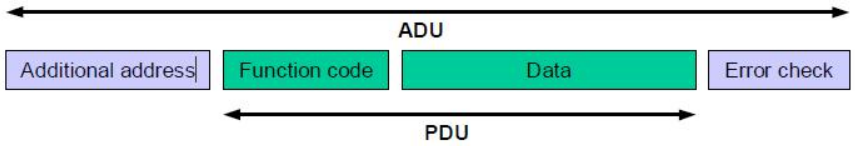


Figure 2: General MODBUS frame

2. MODBUS On TCP/IP Application Data Unit

This section describes the encapsulation of a MODBUS request or response when it is carried on a MODBUS TCP/IP network.

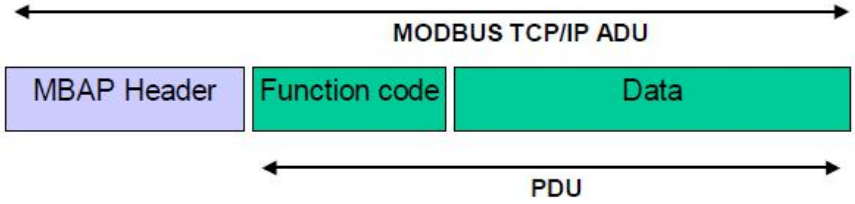


Figure 3:MODBUS request/response over TCP/IP

A dedicated header is used on TCP/IP to identify the MODBUS Application Data Unit. It is called the MBAP header (MODBUS Application Protocol header)

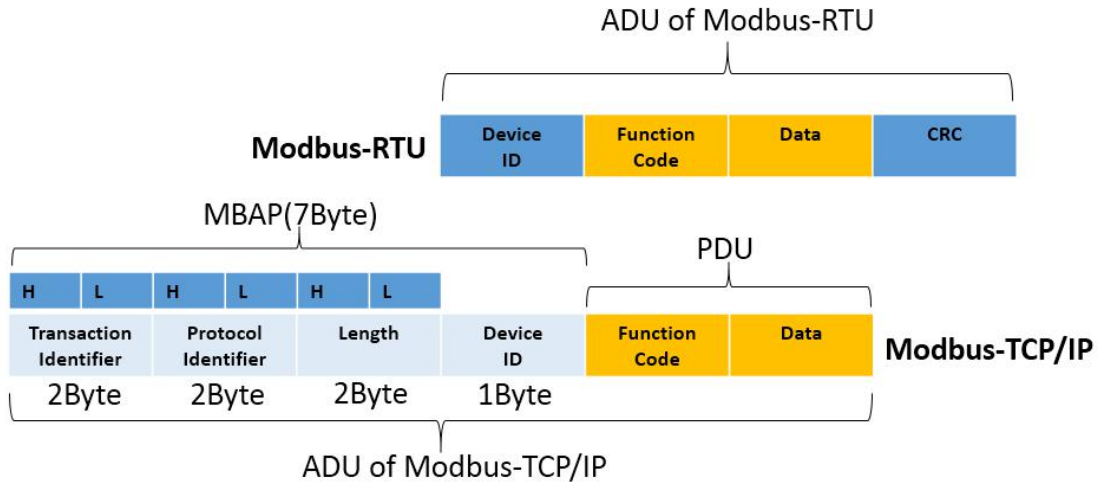


Figure 4:The diffrences of modbus frame between Modbus TCP/IP and Modbus RTU

3. MBAP Header descriptio

The MBAP Header contains the following fields:

Fields	Length	Description	Client	Server
Transaction Identifier	2Byte	Identification of a MODBUS Request / Response transaction	Initialized by the Client	Recopied by the server from the received request
Protocol Identifier	2Byte	0x00:MODBUS protocol	Initialized by the client	Recopied by the server from the received request
Length	2Byte	Number of following bytes	Initialized by the client (request)	Initialized by the server (Response)
Device ID	1Byte	Identification of a remote slave connected on a serial line or on other buses	Initialized by the client	Recopied by the server from the received request

The header is 7 bytes long:

Transaction Identifier: It is used for transaction pairing, the MODBUS server copies in the response the transaction identifier of the request.

For example：Client may creat the transaction identifier in sequence from 0x0001(0x00(H) 0x01(L)).

Protocol Identifier: It is used for intra-system multiplexing. The MODBUS protocol is identified by the value 0x00.

Length: The length field is a byte count of the following fields, including the Device ID and data fields.

For example: If a client want to read severial holding registers(function code 0x03),then the length will be 0x0006(Byte) including device ID(1Byte),function code (1Byte),start address(2Byte),number of registers(2Byte

Device ID: This field is used for intra-system routing purpose. It is typically used to communicate to a MODBUS or a MODBUS+ serial line slave through a gateway between an Ethernet TCP-IP network and a MODBUS serial line. This field is set by the MODBUS Client in the request and must be returned with the same value in the response by the server. **For example**: If the device ID of the meter is 1, then the byte of device ID should be 0x01.

All Modbus/TCP ADU are sent via TCP on registered port 502.

4. Example

In this case we will use the TCP communication tool to show that how to establish a connecting from the computer to power meter. In this scene power meter is as a server. Make sure the setting of Ethernet parameters in meter are same as following:

IP：192.168.8.220

Port：502

Device ID：0x01

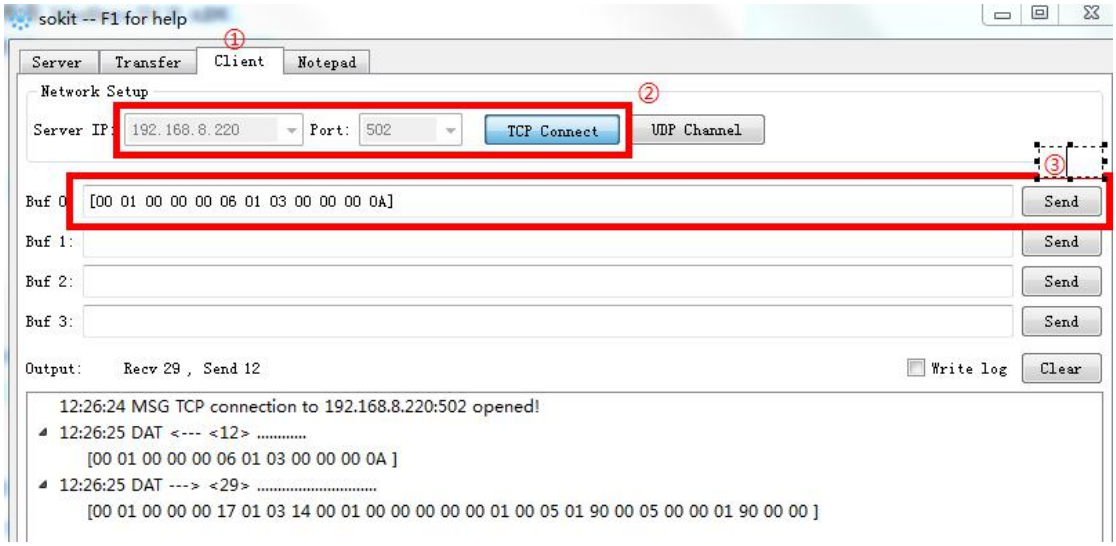
The PC is as a client, with the IP address (for example:192.168.8.110) which must be in the same subnet with the IP of the power meter. To read 0x000A holding registers from the address of 0x0000, take the following steps

1. Double click to open ‘sokit.exe’ 

,and switch to the lable page of ‘Client’.

2. Fill in the IP(192.168.8.220) and the port(502) of the network multi-functional power meter(server),and click the button of “TCP connect”.

3. In ‘Buf 0’,fill in the frame([00 01 00 00 00 06 01 03 00 00 00 0A], hexdecimal characters) including ‘[]’ to send,and click the button of ‘Send’.



Explanation：

Transaction Identifier	Protocol Identifier	Length	Unit Identifier	Function code	Start Address	Number of Registers
00 01	00 00	00 06	01	03	00 00	00 0A
	modbus	bytes of the following fields	device ID	read holding registers		

1.Register listing

Register	Description	unit	Data Type	Parameters
0	Meter address(COMM1)		Int16 (RW)	Range :1-247
1	Baud rate(COMM1)		Int16 (RW)	0：38400 1：19200 2：9600 3：4800 4：2400 5：1200
2	Parity(COMM1)		Int16 (RW)	0：None Parity with one stop bit 1：None Parity with two stop bits 2：Odd Parity with one stop bit 3：Even Parity with one stop bit
3	System Type		Int16 (RW)	Lower 7 bit： 0:3P3W_2CT, 1:3P4W, 2:3P3W_3CT
4	Nominal Secondary Current		Int16 (RW)	1A or 5A
5	Nominal Secondary Voltage L-L		Int16 (RW)	100V、110V、400V、690V
6	Nominal Primary Current	1A	Int16 (RW)	0-32760A
7-8	Nominal Primary Voltage L-L	1V	Int32 (RW)	0-1200KV
	Meter address(COMM2)			
10	Baud rate(COMM2)		Int16 (RW)	0：38400 1：19200 2：9600 3：4800 4：2400 5：1200
11	Parity(COMM2)		Int16 (RW)	0：None Parity with one stop bit 1：None Parity with two stop bits 2：Odd Parity with one stop bit 3：Even Parity with one stop bit
20	Year		Int16 (RW)	0-99
21	Month		Int16 (RW)	1-12
22	Day		Int16 (RW)	1-31
23	Hour		Int16 (RW)	0-23
24	Minute		Int16 (RW)	0-59
25	Second		Int16 (RW)	0-59
29	Enable change parameter of Ethernet from RS485 Port		Int16 (RW)	code: 0XABCD
30-31	IP Address		Int32 (RW)	Sample：192.168.3.8 ADDR 30:C0A8H ADDR 31: 0308H

32-33	Subnet Mask		Int32 (RW)	Sample：255.255.255.0 ADDR 32：FFFFH； ADDR 33：FF00H
34-35	Gateway		Int32 (RW)	Sample：192.168.3.1 ADDR 34：C0A8H； ADDR 35：0301H
36	Port Number		Int16 (RW)	0-9999
37	The code for Save the parameter of Ethernet		Int16 (RW)	code: 0XABCD
38	SD Storage State		Int16 (RO)	0,0x11：No SD Card 0x22：Bad SD Card 0x33：SD work well 0x44： Full storage 0x55：Formating 0x66：Error in Configuration File
39	SD Total capacity	1M	Int16 (RO)	Unit : Megabytes
40	SD Residual capacity	1M	Int16 (RO)	Unit : Megabytes
46-241	Reserve			
242	Current, Neutral	0.001	Int16 (RO)	Secondary
243	Voltage A-N	0.1	Int16 (RO)	Secondary
244	Voltage B-N	0.1	Int16 (RO)	Secondary
245	Voltage C-N	0.1	Int16 (RO)	Secondary
246	Voltage A-B	0.1	Int16 (RO)	Secondary
247	Voltage B-C	0.1	Int16 (RO)	Secondary
248	Voltage C-A	0.1	Int16 (RO)	Secondary
249	Current, Phase A	0.001	Int16 (RO)	Secondary
250	Current, Phase B	0.001	Int16 (RO)	Secondary
251	Current, Phase C	0.001	Int16 (RO)	Secondary
252	Nominal Frequency	0.01Hz	Int16 (RO)	
253-254	Active Power, Phase A	0.01W	Int32 (RO)	Secondary
255-256	Active Power, Phase B	0.01W	Int32 (RO)	Secondary
257-258	Active Power, Phase C	0.01W	Int32 (RO)	Secondary
259-260	Active Power, Total	0.01W	Int32 (RO)	Secondary
261-262	Reactive Power, Phase A	0.01Var	Int32 (RO)	Secondary
263-264	Reactive Power, Phase B	0.01Var	Int32 (RO)	Secondary
265-266	Reactive Power, Phase C	0.01Var	Int32 (RO)	Secondary
267-268	Reactive Power, Total	0.01Var	Int32 (RO)	Secondary
269-270	Real Power, Phase A	0.01VA	Int32 (RO)	Secondary
271-272	Real Power, Phase B	0.01VA	Int32 (RO)	Secondary
273-274	Real Power, Phase C	0.01VA	Int32 (RO)	Secondary
275-276	Real Power, Total	0.01VA	Int32 (RO)	Secondary
277	Active Power Factor, Phase A	0.001	Int16 (RO)	Secondary
278	Active Power Factor, Phase B	0.001	Int16 (RO)	Secondary
279	Active Power Factor, Phase C	0.001	Int16 (RO)	Secondary

280	Active Power Factor, Total	0.001	Int16 (RO)	Secondary
300-301	Active Energy In (EPI)	1WH	Int32 (RO)	Secondary
302-303	Active Energy Out (EPE)	1WH	Int32 (RO)	Secondary
304-305	Reactive Energy In(EQL)	1WH	Int32 (RO)	Secondary
306-307	Reactive Energy Out (EQC)	1WH	Int32 (RO)	Secondary

Register	Description	Unit	Data Type	Parameters
1100-1101	Current, Phase A	0.001A	Int32 (RO)	Primary
1102-1103	Current, Phase B	0.001A	Int32 (RO)	Primary
1104-1105	Current, Phase C	0.001A	Int32 (RO)	Primary
1106-1107	Current, Neutral	0.001A	Int32 (RO)	Primary
1108-1109	Current, Average	0.001A	Int32 (RO)	Primary
1110	Current Unbalance, Phase A	0.1%	Int16 (RO)	Primary
1111	Current Unbalance, Phase B	0.1%	Int16 (RO)	Primary
1112	Current Unbalance, Phase C	0.1%	Int16 (RO)	Primary
1113	Current Unbalance, Max	0.1%	Int16 (RO)	Primary
1114-1119	Reserve			
1120-1121	Voltage Phase A-N	0.1V	Int32 (RO)	Primary
1122-1123	Voltage Phase B-N	0.1V	Int32 (RO)	Primary
1124-1125	Voltage Phase C-N	0.1V	Int32 (RO)	Primary
1126-1127	Voltage Average L-N	0.1V	Int32 (RO)	Primary
1128-1129	Voltage Phase A-B	0.1V	Int32 (RO)	Primary
1130-1131	Voltage Phase B-C	0.1V	Int32 (RO)	Primary
1132-1133	Voltage Phase C-A	0.1V	Int32 (RO)	Primary
1134-1135	Voltage Average (L-L)	0.1V	Int32 (RO)	Primary
1136	Voltage Unbalance Phase A-N	0.1%	Int16 (RO)	Primary
1137	Voltage Unbalance Phase B-N	0.1%	Int16 (RO)	Primary
1138	Voltage Unbalance Phase C-N	0.1%	Int16 (RO)	Primary
1139	Voltage Unbalance, L-N	0.1%	Int16 (RO)	Primary
1140	Voltage Unbalance, Phase A-B	0.1%	Int16 (RO)	Primary
1141	Voltage Unbalance, Phase B-C	0.1%	Int16 (RO)	Primary
1142	Voltage Unbalance, Phase C-A	0.1%	Int16 (RO)	Primary
1143	Voltage Unbalance,L-L	0.1%	Int16 (RO)	Primary
1144-1149	Reserve			
1150-1151	Active Power, Phase A	0.01W	Float (RO)	Primary
1152-1153	Active Power, Phase B	0.01W	Float (RO)	Primary
1154-1155	Active Power, Phase C	0.01W	Float (RO)	Primary
1156-1157	Active Power, Total	0.01W	Float (RO)	Primary
1158-1159	Reactive Power, Phase A	0.01Var	Float (RO)	Primary
1160-1161	Reactive Power, Phase B	0.01Var	Float (RO)	Primary
1162-1163	Reactive Power, Phase C	0.01Var	Float (RO)	Primary
1164-1165	Reactive Power, Total	0.01Var	Float (RO)	Primary
1166-1167	Real Power, Phase A	0.01VA	Float	Primary

			(RO)	
1168-1169	Real Power, Phase B	0.01VA	Float (RO)	Primary
1170-1171	Real Power, Phase C	0.01VA	Float (RO)	Primary
1172-1173	Real Power, Total	0.01VA	Float (RO)	Primary
1174-1178	Reserve			
1179	Nominal Frequency	0.01Hz	Int16 (RO)	Same as Address 252
1180	Active Power Factor, Phase A	0.001	Int16 (RO)	Same as Address 277
1181	Active Power Factor, Phase B	0.001	Int16 (RO)	Same as Address 278
1182	Active Power Factor, Phase C	0.001	Int16 (RO)	Same as Address 279
1183	Active Power Factor, Total	0.001	Int16 (RO)	Same as Address 280
1184-1199	Reserve			
1200-1201	Current Demand MAX, Phase A	0.001A	Int32 (RO)	Primary
1202-1203	Data and time the Current Demand MAX，Phase A		Int16 (RO)	BIT12~BIT15:Year BIT8~BIT12:Month BIT0~BIT7:Day
			Int16 (RO)	BIT8~BIT12:Hour BIT0~BIT7: Minute
1204-1205	Current Demand MAX, Phase B	0.001A	Int32 (RO)	Primary
1206-1207	Data and time the Current Demand MAX，Phase B		Int16 (RO)	BIT12~BIT15:Year BIT8~BIT12:Month BIT0~BIT7:Day
			Int16 (RO)	BIT8~BIT12:Hour BIT0~BIT7: Minute
1208-1209	Current Demand MAX, Phase C	0.001A	Int16 (RO)	Primary
1210-1211	Data and time the Current Demand MAX，Phase C		Int16 (RO)	BIT12~BIT15:Year BIT8~BIT12:Month BIT0~BIT7:Day
			Int16 (RO)	BIT8~BIT12:Hour BIT0~BIT7: Minute
1212-1213	Active Power Demand MAX，Total	0.01W	Float (RO)	Primary
1214-1215	Data and time the Active Power Demand MAX ,Total		Int16 (RO)	BIT12~BIT15:Year BIT8~BIT12:Month BIT0~BIT7:Day
			Int16 (RO)	BIT8~BIT12:Hour BIT0~BIT7: Minute
1216-1217	Reactive Power Demand MAX，Total	0.01Var	Float (RO)	Primary
1218-1219	Data and time the Reactive Power Demand MAX ,Total		Int16 (RO)	BIT12~BIT15:Year BIT8~BIT12:Month BIT0~BIT7:Day
			Int16 (RO)	BIT8~BIT12:Hour BIT0~BIT7: Minute
1220-1221	Real Power Demand MAX，Total	0.01VA	Float (RO)	Primary
1222-1223	Data and time the Real Power		Int16 (RO)	BIT12~BIT15:Year

	Demand MAX ,Total			BIT8~BIT12:Month BIT0~BIT7:Day
			Int16 (RO)	BIT8~BIT12:Hour BIT0~BIT7: Minute
1224-1249	Reserve			
1250-1251	Current Demand MAX, Phase A	0.001A	Int32 (RO)	Primary
1252-1253	Current Demand MAX, Phase B	0.001A	Int32 (RO)	Primary
1254-1255	Current Demand MAX, Phase C	0.001A	Int32 (RO)	Primary
1256-1259	Reserve			
1260-1261	Active Power Demand , Total	0.01W	Float (RO)	Primary
1262-1263	Reactive Power Demand , Total	0.01Var	Float (RO)	Primary
1264-1265	Real Power Demand，Total	0.01VA	Float (RO)	Primary
1266-1287	Reserve			
1288	Current coefficient		Int16 (RW)	Used to set the alarm value and read the alarm record value. If the current coefficient is -3, the Phase A overcurrent alarm action value (register 1301) is set to 6000, then the actual alarm value is 6000*10^(-3) = 6.000A
1289	Neutral current coefficient		Int16 (RW)	Refer to register 1288
1290	Voltage coefficient		Int16 (RW)	Refer to register 1288
1291	Power coefficient		Int16 (RW)	Refer to register 1288
1292-1299	Reserve			
1300	The first group of alarms: Phase A overcurrent alarm		Int16 (RW)	When Bit0 is 1, the alarm is enabled, when Bit0 is 0, the alarm is disabled; When Bit1 is 1, the zero-value alarm is disabled, when Bit1 is 0, the zero-value alarm is enabled.
1301	Alarm action value		Int16 (RW)	Primary. Range: 0 ~ 9999. If the current coefficient is -3, Phase A overcurrent alarm action value is set to 6000, then the actual alarm value is 6000*10^(-3) = 6.000A,other situation is similar..
1302	Alarm delay time	1s	Int16 (RW)	Range: 0 ~ 9999.
1303	Alarm recovery value		Int16 (RW)	Primary. Range:0～9999
1304	Delay time of Recovery	1s	Int16 (RW)	Range: 0 ~ 9999.

The first group of other alarm settings: refer to Phase A overcurrent alarm

1305	Phase B overcurrent alarm	1310	Phase C overcurrent alarm	1315	Maximum overcurrent alarm
1320	Neutral overcurrent alarm	1325	Phase A undercurrent alarm	1330	Phase B undercurrent alarm

1335	Phase C undercurrent alarm	1340	Minimum undercurrent alarm	1345	Neutral undercurrent alarm
1350	Maximum current unbalance alarm	1355	Current loss alarm	1360	Phase A overvoltage alarm
1365	Phase B overvoltage alarm	1370	Phase C overvoltage alarm	1375	Maximum phase overvoltage alarm
1380	AB line overvoltage alarm	1385	BC line overvoltage alarm	1390	CA line overvoltage alarm
1395	Maximum line overvoltage alarm	1400	Phase A undervoltage alarm	1405	Phase B undervoltage alarm
1410	Phase C undervoltage alarm	1415	Minimum phase undervoltage alarm	1420	AB line undervoltage alarm
1425	BC line undervoltage alarm	1430	CA line undervoltage alarm	1435	Minimum line undervoltage alarm
1440	Maximum phase voltage unbalance alarm	1445	Maximum line voltage unbalance alarm	1450	Line voltage loss alarm
1455	Total active overpower alarm	1460	Total reactive overpower alarm	1465	Total apparent overpower alarm
1470	Total active underpower alarm	1475	Total reactive underpower alarm	1480	Total apparent underpower alarm
1485	Over power factor alarm	1490	Under power factor alarm	1495	Over frequency alarm
1500	Under frequency alarm	1505	Over total harmonic of Phase A current alarm	1510	Over total harmonic of Phase B current alarm
1515	Over total harmonic of Phase C current alarm	1520	Over total harmonic of Phase A voltage alarm	1525	Over total harmonic of Phase B voltage alarm
1530	Over total harmonic of Phase C voltage alarm	1535	Over total even harmonic of Phase A current alarm	1540	Over total even harmonic of Phase B current alarm
1545	Over total even harmonic of Phase C current alarm	1550	Over total even harmonic of Phase A voltage alarm	1555	Over total even harmonic of Phase B voltage alarm
1560	Over total even harmonic of Phase C voltage alarm	1565	Over total odd harmonic of Phase A current alarm	1570	Over total odd harmonic of Phase B current alarm
1575	Over total odd harmonic of Phase C current alarm	1580	Over total odd harmonic of Phase A voltage alarm	1585	Over total odd harmonic of Phase B voltage alarm
1590	Over total odd harmonic of Phase C voltage alarm	1595	Over total demand of active power alarm	1600	Under total demand of active power alarm
1605	Reverse phase sequence alarm	1610	DI1 digital input alarm	1615	DI2 digital input alarm
1620	DI3 digital input alarm	1625	DI4 digital input alarm		

The second group of alarm settings: refer to Phase A overcurrent alarm

1750	Phase A overcurrent alarm	1755	Phase B overcurrent alarm	1760	Phase C overcurrent alarm
1765	Maximum overcurrent alarm	1770	Neutral overcurrent alarm	1775	Phase A undercurrent alarm
1780	Phase B undercurrent alarm	1785	Phase C undercurrent alarm	1790	Minimum undercurrent alarm
1795	Neutral undercurrent alarm	1800	Maximum current unbalance alarm	1805	Current loss alarm
1810	Phase A overvoltage alarm	1815	Phase B overvoltage alarm	1820	Phase C overvoltage alarm
1825	Maximum phase overvoltage alarm	1830	AB line overvoltage alarm	1835	BC line overvoltage alarm
1840	CA line overvoltage alarm	1845	Maximum line overvoltage alarm	1850	Phase A undervoltage alarm
1855	Phase B undervoltage alarm	1860	Phase C undervoltage alarm	1865	Minimum phase undervoltage

					alarm
1870	AB line undervoltage alarm	1875	BC line undervoltage alarm	1880	CA line undervoltage alarm
1885	Minimum line undervoltage alarm	1890	Maximum phase voltage unbalance alarm	1895	Maximum line voltage unbalance alarm
1900	Line voltage loss alarm	1905	Total active overpower alarm	1910	Total reactive overpower alarm
1915	Total apparent overpower alarm	1920	Total active underpower alarm	1925	Total reactive underpower alarm
1930	Total apparent underpower alarm	1935	Over power factor alarm	1940	Under power factor alarm
1945	Over frequency alarm	1950	Under frequency alarm	1955	Over total harmonic of Phase A current alarm
1960	Over total harmonic of Phase B current alarm	1965	Over total harmonic of Phase C current alarm	1970	Over total harmonic of Phase A voltage alarm
1975	Over total harmonic of Phase B voltage alarm	1980	Over total harmonic of Phase C voltage alarm	1985	Over total even harmonic of Phase A current alarm
1990	Over total even harmonic of Phase B current alarm	1995	Over total even harmonic of Phase C voltage alarm	2000	Over total even harmonic of Phase A voltage alarm
2005	Over total even harmonic of Phase B voltage alarm	2010	Over total even harmonic of Phase C voltage alarm	2015	Over total odd harmonic of Phase A current alarm
2020	Over total odd harmonic of Phase B current alarm	2025	Over total odd harmonic of Phase C current alarm	2030	Over total odd harmonic of Phase A voltage alarm
2035	Over total odd harmonic of Phase B voltage alarm	2040	Over total odd harmonic of Phase C voltage alarm	2045	Over total demand of active power alarm
2050	Under total demand of active power alarm	2055	Reverse phase sequence alarm	2060	DI1 digital input alarm
2065	DI2 digital input alarm	2070	DI3 digital input alarm	2075	DI4 digital input alarm

Note: The action value of unbalance is the register value *0.1%, the action value of power factor is the register value *0.001, the action value of harmonic alarm is the register value *0.01%, and the action value of frequency alarm is the register value *0.01Hz.

Register (WORD)	Description		Unit	Data Type	Note
2200	Event record 1			UInt16 (RO)	When Bit15 is 1, it means DI. When it is 0, it means DO. When Bit14 is 1, it means ON. When it is 0, it means OFF. Low byte indicates DI/DO number。
2201		Year、Month		UInt16 (RO)	High byte:Year; Low byte: Month
2202		Day、Hour		UInt16 (RO)	High byte: Day ; Low byte: Hour
2203		Minute、 second		UInt16 (RO)	High byte:Year; Low byte: Month

Other event records: Refer to event record 1

2204	Event record 2	2208	Event record 3	2212	Event record 4	2216	Event record 5	2220	Event record 6
2224	Event record 7	2228	Event record 8	2232	Event record 9	2236	Event record 10	2240	Event record 11
2244	Event record 12	2248	Event record 13	2252	Event record 14	2256	Event record 15	2260	Event record 16

Note: To read the most recent 128 event records, you can read the register 20000-20513, refer to the format of register 2200-2203.

Register (WORD)	Description		Unit	Data Type	Note
2300	Recent alarm record 1	Alarm type		UInt16 (RO)	High byte: Alarm group; Low byte: Alarm type (refer to 7.4 to view alarms - Communication number of alarm classification description)
2301		Year、Month		UInt16 (RO)	High byte: Year; Low byte: Month
2302		Day、Hour		UInt16 (RO)	High byte: Day ; Low byte: Hour
2303		Minute、second		UInt16 (RO)	High byte:Year; Low byte: Month
2304		Alarm value		UInt16 (RO)	Primary
2305		Alarm status		UInt16 (RO)	1: Alarm acts 0: Alarm released

Other recent alarm records: Refer to recent alarm record 1

2306	Alarm record 2	2312	Alarm record 3	2318	Alarm record 4	2324	Alarm record 5	2330	Alarm record 6
2336	Alarm record 7	2342	Alarm record 8	2348	Alarm record 9	2354	Alarm record 10	2360	Alarm record 11
2366	Alarm record 12	2372	Alarm record 13	2378	Alarm record 14	2384	Alarm record 15	2390	Alarm record 16

Classification of alarm records (16 for each type of alarm, polling display, latest record covers the earliest record automatically): Refer to recent alarm record 1 for data format.

10000	Phase A overcurrent alarm (16 in total, the same below)	10096	Phase B overcurrent alarm	10192	Phase C overcurrent alarm
10288	Maximum overcurrent alarm	10384	Neutral overcurrent alarm	10480	Phase A undercurrent alarm
10576	Phase B undercurrent alarm	10672	Phase C undercurrent alarm	10768	Minimum undercurrent alarm
10864	Neutral undercurrent alarm	10960	Maximum current unbalance alarm	11056	Current loss alarm
11152	Phase A overvoltage alarm	11248	Phase B overvoltage alarm	11344	Phase C overvoltage alarm
11440	Maximum phase overvoltage alarm	11536	AB line overvoltage alarm	11632	BC line overvoltage alarm
11728	CA line overvoltage alarm	11824	Maximum line overvoltage alarm	11920	Phase A undervoltage alarm
12016	Phase B undervoltage alarm	12112	Phase C undervoltage alarm	12208	Minimum phase undervoltage alarm
12304	AB line undervoltage alarm	12400	BC line undervoltage alarm	12496	CA line undervoltage alarm
12592	Minimum line undervoltage alarm	12688	Maximum phase voltage unbalance alarm	12784	Maximum line voltage unbalance alarm
12880	Line voltage loss alarm	12976	Total active overpower alarm	13072	Total reactive overpower alarm
13168	Total apparent overpower alarm	13264	Total active underpower alarm	13360	Total reactive underpower alarm
13456	Total apparent underpower alarm	13552	Over power factor alarm	13648	Under power factor alarm
13744	Over frequency alarm	13840	Under frequency alarm	13936	Over total harmonic of Phase A current alarm
14032	Over total harmonic of Phase	14128	Over total harmonic of Phase C	14224	Over total harmonic of Phase A

	B current alarm		current alarm		voltage alarm
14320	Over total harmonic of Phase B voltage alarm	14416	Over total harmonic of Phase C voltage alarm	14512	Over total even harmonic of Phase A current alarm
14608	Over total even harmonic of Phase B current alarm	14704	Over total even harmonic of Phase C current alarm	14800	Over total even harmonic of Phase A voltage alarm
14896	Over total even harmonic of Phase B voltage alarm	14992	Over total even harmonic of Phase C voltage alarm	15088	Over total odd harmonic of Phase A current alarm
15184	Over total odd harmonic of Phase B current alarm	15280	Over total odd harmonic of Phase C current alarm	15376	Over total odd harmonic of Phase A voltage alarm
15472	Over total odd harmonic of Phase B voltage alarm	15568	Over total odd harmonic of Phase C voltage alarm	15664	Over total demand of active power alarm
15760	Under total demand of active power alarm	15856	Reverse phase sequence alarm	15952	DI1 digital input alarm
16048	DI2 digital input alarm	16144	DI3 digital input alarm	16240	DI4 digital input alarm

Register (WORD)	Description	Unit	Data Type	Note
2500	Function selection of relay 1		UInt16 (RW)	0: Remote control; 1: First group alarm; 2: Second group alarm
2501-2531	Function selection of relay 2-32			Same as function selection of relay 1
2532	Output pulse width of relay 1 (effective by remote control)	1s	Int16 (RW)	When the delay time 0, it is a level trigger mode; when it is greater than 0, it is a pulse trigger mode.
2533-2563	Output pulse width of relay 2-32 (effective by remote control)			Same as output pulse width of relay 1
2564-2569	Reserve			
2570-2571	Initial state of switch input		Int32 (RW)	Bits0:DI1, and so on, Bits31:DI32; 1: Initial state is ON; 0: Initial state is OFF
2572-2573	Initial state of switch output		Int32 (RW)	Bits0:DO1, and so on, Bits31:DO32; 1: Initial state is ON; 0: Initial state is OFF
2574-2579	Reserve			
2580-2581	Current status of switch input		Int32 (RO)	Bits0:DI1, and so on, Bits31:DI32; 1: Initial state is ON; 0: Initial state is OFF
2582-2583	Current status of switch output		Int32 (RW)	Bits0:DO1, and so on, Bits31:DO32; 1: Initial state is ON; 0: Initial state is OFF
2584-2589	Reserve			
2590-2601	Associated alarm configuration of relay 1		Int32(RW)*6	**See 2.9 DO settings in the instructions**

Associated alarm configuration of other relays: Refer to associated alarm configuration of relay 1.

2602	Associated alarm configuration of relay 2	2614	Associated alarm configuration of relay 3	2626	Associated alarm configuration of relay 4
2638	Associated alarm configuration	2650	Associated alarm configuration of	2662	Associated alarm configuration

	of relay 5		relay 6		of relay 7
2674	Associated alarm configuration of relay 8	2686	Associated alarm configuration of relay 9	2698	Associated alarm configuration of relay 10
2710	Associated alarm configuration of relay 11	2722	Associated alarm configuration of relay 12	2734	Associated alarm configuration of relay 13
2746	Associated alarm configuration of relay 14	2758	Associated alarm configuration of relay 15	2770	Associated alarm configuration of relay 16
2782	Associated alarm configuration of relay 17	2794	Associated alarm configuration of relay 18	2806	Associated alarm configuration of relay 19
2818	Associated alarm configuration of relay 20	2830	Associated alarm configuration of relay 21	2842	Associated alarm configuration of relay 22
2854	Associated alarm configuration of relay 23	2866	Associated alarm configuration of relay 24	2878	Associated alarm configuration of relay 25
2890	Associated alarm configuration of relay 26	2902	Associated alarm configuration of relay 27	2914	Associated alarm configuration of relay 28
2926	Associated alarm configuration of relay 29	2938	Associated alarm configuration of relay 30	2950	Associated alarm configuration of relay 31
2962	Associated alarm configuration of relay 32				

Register (WORD)	Description		Unit	Data Type	Note
3000-3001	Positive active energy(IMP)		1Wh	Float (RO)	Primary energy
3002-3003	Reverse active energy (EXP)		1Wh	Float (RO)	Primary energy
3004-3005	Inductive reactive energy (EQL)		1varh	Float (RO)	Primary energy
3006-3007	Capacitive reactive energy (EQC)		1varh	Float (RO)	Primary energy
3500-3501	Maximum of Phase A current in this month	Maximum	0.001A	Int32 (RO)	Primary
3502		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3503		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3504		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3505-3509	Maximum of Phase B current in this month				Same as maximum of Phase A current in this month
3510-3514	Maximum of Phase C current in this month				Same as maximum of Phase A current in this month
3515-3519	Maximum of neutral current in this month				Same as maximum of Phase A current in this month
3520-3524	Maximum of average current in this month				Same as maximum of Phase A current in this month
3525-3526	Maximum of Phase A	Maximum	0.1V	Int32 (RO)	Primary
3527		Year and month of		Int16 (RO)	High byte: Year; Low byte: Month

	voltage in this month	occurrence			
3528		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3529		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3530-3534	Maximum of Phase B voltage in this month				Same as maximum of Phase A current in this month
3535-3539	Maximum of Phase C voltage in this month				Same as maximum of Phase A current in this month
3540-3544	Maximum of average phase voltage in this month				Same as maximum of Phase A current in this month
3545-3549	Maximum of AB line voltage in this month				Same as maximum of Phase A current in this month
3550-3554	Maximum of BC line voltage in this month				Same as maximum of Phase A current in this month
3555-3559	Maximum of CA line voltage in this month				Same as maximum of Phase A current in this month
3560-3564	Maximum of average line voltage in this month				Same as maximum of Phase A current in this month
3565-3566	Maximum of Phase A active power in this month	Maximum	0.01W	Float (RO)	Primary
3567		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3568		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3569		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3570-3574	Maximum of Phase B active power in this month				Same as maximum of Phase A active power in this month
3575-3579	Maximum of Phase C active power in this month				Same as maximum of Phase A active power in this month
3580-3584	Maximum of total phase active power in this month				Same as maximum of Phase A active power in this month
3585-3586	Maximum of Phase A reactive power in this month	Maximum	0.01Var	Float (RO)	Primary
3587		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3588		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3589		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3590-3594	Maximum of Phase B reactive power in this month				Same as maximum of Phase A reactive power in this month

3595-3599	Maximum of Phase C reactive power in this month				Same as maximum of Phase A reactive power in this month
3600-3604	Maximum of total reactive power in this month				Same as maximum of Phase A reactive power in this month
3605-3606	Maximum of Phase A apparent power in this month	Maximum	0.01VA	Float (RO)	Primary
3607		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3608		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3609		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3610-3614	Maximum of Phase B apparent power in this month				Same as maximum of Phase A apparent power in this month
3615-3619	Maximum of Phase C apparent power in this month				Same as maximum of Phase A apparent power in this month
3620-3624	Maximum of total apparent power in this month				Same as maximum of Phase A apparent power in this month
3625-3626	Phase A power factor in this month	Maximum	0.001	Int32 (RO)	Primary
3627		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3628		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3629		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3630-3634	Phase B power factor in this month				Same with Phase A power factor in this month
3635-3639	Phase C power factor in this month				Same with Phase A power factor in this month
3640-3644	Total power factor in this month				Same with Phase A power factor in this month
3645-3646	Frequency in this month	Maximum	0.01	Int32 (RO)	Primary
3647		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3648		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3649		Minute and second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
3650-3651	THD of Phase A current in this month	Maximum	0.01%	Int32 (RO)	
3652		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
3653		Day and hour of occurrence		Int16 (RO)	High byte: Day; Low byte: Hour
3654		Minute and		Int16 (RO)	High byte: Minute; Low byte: Second

		second of occurrence			
3655-3659	Maximum THD of Phase B current in this month				Same as THD of Phase A current in this month
3660-3664	Maximum THD of Phase C current in this month				Same as THD of Phase A current in this month
3665-3669	Maximum THD of Phase A voltage in this month				Same as THD of Phase A current in this month
3670-3674	Maximum THD of Phase B voltage in this month				Same as THD of Phase A current in this month
3675-3679	Maximum THD of Phase C voltage in this month				Same as THD of Phase A current in this month

Minimum in this month, maximum in previous month, minimum in last month: Refer to maximum in this month.

3680	Minimum of Phase A current in this month	3685	Minimum of Phase B current in this month	3690	Minimum of Phase C current in this month
3695	Minimum of neutral current in this month	3700	Minimum of average current in this month	3705	Minimum of Phase A voltage in this month
3710	Minimum of Phase B voltage in this month	3715	Minimum of Phase C voltage in this month	3720	Minimum of average voltage in this month
3725	Minimum of AB line voltage in this month	3730	Minimum of BC line voltage in this month	3735	Minimum of CA line voltage in this month
3740	Minimum of average line voltage in this month	3745	Minimum of Phase A active power in this month	3750	Minimum of Phase B active power in this month
3755	Minimum of Phase C active power in this month	3760	Minimum of total active power in this month	3765	Minimum of Phase A reactive power in this month
3770	Minimum of Phase B reactive power in this month	3775	Minimum of Phase C reactive power in this month	3780	Minimum of total reactive power in this month
3785	Minimum of Phase A apparent power in this month	3790	Minimum of Phase B apparent power in this month	3795	Minimum of Phase C apparent power in this month
3800	Minimum of total apparent power in this month	3805	Minimum of Phase A power factor in this month	3810	Minimum of Phase B power factor in this month
3815	Minimum of Phase C power factor in this month	3820	Minimum of total power factor in this month	3825	Minimum of frequency in this month
3830	Minimum THD of Phase A current in this month	3835	Minimum THD of Phase B current in this month	3840	Minimum THD of phase current in this month
3845	Minimum THD of Phase A voltage in this month	3850	Minimum THD of Phase B voltage in this month	3855	Minimum THD of Phase C voltage in this month
3860	Maximum of Phase A current in last month	3865	Maximum of phase current in last month	3870	Maximum of Phase C current in last month
3875	Maximum of neutral current in last month	3880	Maximum of avreage current in last month	3885	Maximum of Phase A voltage in last month
3890	Maximum of Phase B voltage in last month	3895	Maximum of Phase C voltage in last month	3900	Maximum of average voltage in last month
3905	Maximum of AB line voltage in	3910	Maximum of BC line voltage in	3915	Maximum of CA line voltage in

	last month		last month		last month
3920	Maximum of average line voltage in last month	3925	Maximum of Phase A active power in last month	3930	Maximum of Phase B active power in last month
3935	Maximum of Phase C active power in last month	3940	Maximum of total active power in last month	3945	Maximum of Phase A reactive power in last month
3950	Maximum of Phase B reactive power in last month	3955	Maximum of Phase C reactive power in last month	3960	Maximum of total reactive power in last month
3965	Maximum of Phase A apparent power in last month	3970	Maximum of Phase B apparent power in last month	3975	Maximum of Phase C apparent power in last month
3980	Maximum of total apparent power in last month	3985	Maximum of Phase A power factor in last month	3990	Maximum of Phase B power factor in last month
3995	Maximum of Phase C power factor in last month	4000	Maximum of total power factor in last month	4005	Maximum of frequency in last month
4010	Maximum THD of Phase A current in last month	4015	Maximum THD of Phase B current in last month	4020	Maximum THD of Phase C current in last month
4025	Maximum THD of Phase A voltage in last month	4030	Maximum THD of Phase B voltage in last month	4035	Maximum THD of Phase C voltage in last month
4040	Minimum of Phase A current in last month	4045	Minimum of Phase B current in last month	4050	Minimum of Phase C current in last month
4055	Minimum of neutral current in last month	4060	Minimum of average current in last month	4065	Minimum of Phase A voltage in last month
4070	Minimum of Phase B voltage in last month	4075	Minimum of Phase C voltage in last month	4080	Minimum of average voltage in last month
4085	Minimum of AB line voltage in last month	4090	Minimum of BC line voltage in last month	4095	Minimum of CA line voltage in last month
4100	Minimum of average line voltage in last month	4105	Minimum of Phase A active power in last month	4110	Minimum of Phase B active power in last month
4115	Minimum of Phase C active power in last month	4120	Minimum of total active power in last month	4125	Minimum of Phase A reactive power in last month
4130	Minimum of Phase B reactive power in last month	4135	Minimum of Phase C reactive power in last month	4140	Minimum of total reactive power in last month
4145	Minimum of Phase A apparent power in last month	4150	Minimum of Phase B apparent power in last month	4155	Minimum of Phase C apparent power in last month
4160	Minimum of total apparent power in last month	4165	Minimum of Phase A power factor in last month	4170	Minimum of Phase B power factor in last month
4175	Minimum of Phase C power factor in last month	4180	Minimum of total power factor in last month	4185	Minimum of frequency in last month
4190	Minimum THD of Phase A current in last month	4195	Minimum THD of Phase B current in last month	4200	Minimum THD of Phase C current in last month
4205	Minimum THD of Phase A voltage in last month	4210	Minimum THD of Phase B voltage in last month	4215	Minimum THD of Phase C voltage in last month

Register (WORD)	Description	Unit	Data Type	Note
4500-4561	2nd-63rd harmonic of Phase A	0.01%	Int16 (RO)	

	current			
4562-4623	2nd-63rd harmonic of Phase B current	0.01%	Int16 (RO)	
4624-4685	2nd-63rd harmonic of Phase C current	0.01%	Int16 (RO)	
4686-4747	2nd-63rd harmonic of Phase A voltage	0.01%	Int16 (RO)	
4748-4809	2nd-63rd harmonic of Phase B voltage	0.01%	Int16 (RO)	
4810-4871	2nd-63rd harmonic of Phase C voltage	0.01%	Int16 (RO)	
4872	THD of Phase A current	0.01%	Int16 (RO)	
4873	THD of Phase B current	0.01%	Int16 (RO)	
4874	THD of Phase B current	0.01%	Int16 (RO)	
4875	THD of Phase A voltage	0.01%	Int16 (RO)	
4876	THD of Phase B voltage	0.01%	Int16 (RO)	
4877	THD of Phase C voltage	0.01%	Int16 (RO)	
4878	Total odd harmonic distortion (TOHD) of Phase A current	0.01%	Int16 (RO)	
4879	TOHD of Phase B current	0.01%	Int16 (RO)	
4880	TOHD of Phase C current	0.01%	Int16 (RO)	
4881	TOHD of Phase A voltage	0.01%	Int16 (RO)	
4882	TOHD of Phase B voltage	0.01%	Int16 (RO)	
4883	TOHD of Phase C voltage	0.01%	Int16 (RO)	
4884	Total even harmonic distortion (TEHD) of Phase A current	0.01%	Int16 (RO)	
4885	TEHD of Phase B current	0.01%	Int16 (RO)	
4886	TEHD of Phase C current	0.01%	Int16 (RO)	
4887	TEHD of Phase A voltage	0.01%	Int16 (RO)	
4888	TEHD of Phase B voltage	0.01%	Int16 (RO)	
4889	TEHD of Phase C voltage	0.01%	Int16 (RO)	
4890-4891	Total RMS value of phase A fundamental current	0.001A	Int32 (RO)	Primary
4892-4893	Total RMS value of phase B fundamental current	0.001A	Int32 (RO)	Primary
4894-4895	Total RMS value of phase C fundamental current	0.001A	Int32 (RO)	Primary
4896-4897	Total RMS value of phase A fundamental voltage	0.1V	Int32 (RO)	Primary
4898-4899	Total RMS value of phase B fundamental voltage	0.1V	Int32 (RO)	Primary
4900-4901	Total RMS value of phase C fundamental voltage	0.1V	Int32 (RO)	Primary
4902-4903	Total RMS value of Phase A	0.001A	Int32 (RO)	Primary

	harmonic current					
4904-4905	Total RMS value of Phase B harmonic current		0.001A	Int32 (RO)	Primary	
4906-4907	Total RMS value of Phase C harmonic current		0.001A	Int32 (RO)	Primary	
4908-4909	Total RMS value of Phase A harmonic voltage		0.1V	Int32 (RO)	Primary	
4910-4911	Total RMS value of Phase B harmonic voltage		0.1V	Int32 (RO)	Primary	
4912-4913	Total RMS value of Phase C harmonic voltage		0.1V	Int32 (RO)	Primary	
4914-5399	Reserve					
5400	Setting of the 1st transmission output	Transmission type and signal selection		Int16 (RW)	High byte: Transmission type (1:4-20mA, 2:0-20mA, 3:1-5V, 4:0-5V) Low Byte: Signal Selection (Refer to Table 3 in 7.5 System Setup - Analog Output Settings)	For example: 4-20mA is selected for the transmission type, and phase A current is selected for the signal. The corresponding value of the high point is 5000, and the corresponding value of the low point is 0, and the actual decimal point of the current display is 3 bits. When the actual current value of phase A is 5.000A, the transmission output is 20mA. When the actual current value of phase A current is 0, the output is 4 mA. When the actual current value of phase A is 2.500 A, the transmission output is 12 mA.
5401		Corresponding value of the high point		Int16 (RW)	Primary	
5402		Corresponding value of the low point		Int16 (RW)	Primary	

Other settings of transmission output: refer to setting of the 1st transmission output

5403	Setting of the 2nd transmission output	5406	Setting of the 3rd transmission output	5409	Setting of the 4th transmission output
5412	Setting of the 5th transmission output	5415	Setting of the 6th transmission output	5418	Setting of the 7th transmission output
5421	Setting of the 8th transmission output	5424	Setting of the 9th transmission output	5427	Setting of the 10th transmission output
5430	Setting of the 11th transmission output	5433	Setting of the 12th transmission output	5436	Setting of the 13th transmission output
5439	Setting of the 14th transmission	5442	Setting of the 15th transmission	5445	Setting of the 16th transmission

	output		output		output
5448	Setting of the 17th transmission output	5451	Setting of the 18th transmission output	5454	Setting of the 19th transmission output
5457	Setting of the 20th transmission output	5460	Setting of the 21st transmission output	5463	Setting of the 22nd transmission output
5466	Setting of the 23rd transmission output	5469	Setting of the 24th transmission output	5472	Setting of the 25th transmission output
5475	Setting of the 26th transmission output	5478	Setting of the 27th transmission output	5481	Setting of the 28th transmission output
5484	Setting of the 29th transmission output	5487	Setting of the 30th transmission output	5490	Setting of the 31st transmission output
5493	Setting of the 32nd transmission output	5496		5499	

Register (WORD)	Description		Unit	Data Type	Note	
5600	Setting of the 1st analog input	Input type and decimal point of display		Int16 (RW)	High byte: Input type (1:4-20mA, 2:0-20mA, 3:1-5V, 4:0-5V) Low Byte: Decimal point of display (0-3)	For example: 4-20mA is selected for the input type , and decimal point is 3 digits. The display value of input high point is set to 5000, and the display value of input low point is 0. When the analog input is 20mA, the display value is 5.000, when the analog input is 4mA, the display value is 0.000, and when the analog input is 12mA, the display value is 2.500.
5601		Display value of input high point		Int16 (RW)	The display value of input high point （0-9999）	
5602		Display value of input low point		Int16 (RW)	The display value of input low point （0-9999）	

Other settings of analog input: Refer to the 1st analog input settings

5603	Setting of the 2nd analog input	5606	Setting of the 3rd analog input	5609	Setting of the 4th analog input
5612	Setting of the 5th analog input	5615	Setting of the 6th analog input	5618	Setting of the 7th analog input
5621	Setting of the 8th analog input	5624	Setting of the 9th analog input	5627	Setting of the 10th analog input
5630	Setting of the 11th analog input	5633	Setting of the 12th analog input	5636	Setting of the 13th analog input
5639	Setting of the 14th analog input	5642	Setting of the 15th analog input	5645	Setting of the 16th analog input
5648	Setting of the 17th analog input	5651	Setting of the 18th analog input	5654	Setting of the 19th analog input
5657	Setting of the 20th analog input	5660	Setting of the 21st analog input	5663	Setting of the 22nd analog input
5666	Setting of the 23rd analog input	5669	Setting of the 24th analog input	5672	Setting of the 25th analog input
5675	Setting of the 26th analog input	5678	Setting of the 27th analog input	5681	Setting of the 28th analog input
5684	Setting of the 29th analog input	5687	Setting of the 30th analog input	5690	Setting of the 31st analog input

5693	Setting of the 32nd analog input				

Register (WORD)	Description	Unit	Data Type	Note
5696-5727	Inverse value of No.1-32 analog Input		Int16 (RO)	Inverse value of No.1-32 analog Input
5728-5759	The actual value of No.1-32 analog Input	0.001	Int16 (RO)	The unit is mA when the input selection is 4-20mA or 0-20mA, and the unit is V when 1-5V or 0-5V is selected.

Note: 1. Read-write property: "RO" is read-only, parameter is read with 0X03H command; "R/W" is readable and writable, and system parameter is written with 0X10H command. Do not write data to unlisted or unwritable Address.

2、For Int32 type data, the high bits are in the front and the low bits are in the back

2. Correspondence between communication value and actual value

It is agreed that Val_t is the communication readout value and Val_s is the actual value.

2.1 Voltage, Current, Power Factor, Frequency, Unbalance (Secondary)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies 1 word. The correspondence between the communication value and the actual secondary measurement value is shown in the following table:

Applicable parameters	Resolution	Correspondence	Unit
Voltage ,Uan、Ubn、Ucn、Uab、Ubc、Uca	0.1V	Val_s＝Val_t*0.1	V
Current ,I_A、I_B、I_C	0.001A	Val_s＝Val_t*0.001	A
Power factor, PF_A、PF_B、PF_C、PF 总	0.001	Val_s＝Val_t*0.001	No unit
Frequency, F	0.01Hz	Val_s＝Val_t*0.01	Hz
Unbalance ,I(ubl)，ULL(ubl),ULN(ubl)	0.1	Val_s＝Val_t*0.1	%

For example: To read phase A voltage Uan, the data can be read at address 243 in Int16eger reading mode by MODSCAN, the communication read-out value Val_t is 2200,then Val_t = 2200*0.1=220V.

2.2 Voltage, Current, Power Factor, Frequency, Unbalance (Primary)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. The voltage and current occupy 2 words, and the power factor, frequency, and unbalance occupy 1 byte. The correspondence between the communication value and the actual secondary measurement value is shown in the following table:

Applicable parameters	Resolution	Correspondence	Unit
Voltage,Uan、Ubn、Ucn、Uab、Ubc、Uca	0.1V	Val_s＝Val_t*0.1	V
Current ,I_A、I_B、I_C	0.001A	Val_s＝Val_t*0.001	A
Power factor, PF_A、PF_B、PF_C、PF_{Total}	0.001	Val_s＝Val_t*0.001	No unit
Frequency, F	0.01Hz	Val_s＝Val_t*0.01	Hz
Unbalance ,I(ubl)，ULL(ubl),ULN(ubl)	0.1	Val_s＝Val_t*0.1	%

For example: To read phase A voltage Uan, the data can be read at address 1120-1121 in Int16eger reading mode by MODSCAN,the communication read-out value is 9 at address 1120, communication read-out value is 10176 at address 1121,that is, communication read-out value Val_t is 9*65536+10176 = 600000, then Val_s = Val_t*0.1=600000*0.1=60kV.

2.3 Active power, reactive power, apparent power and energy (Secondary side; W/Var/VA/kWh)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies 1 word. The power resolution 0.01, the correspondence between the communication value and the actual value is as follows: Val_s=Val_t*0.01; The energy resolution is 1, and the correspondence between the communication value and the actual value is as follows: Val_s=Val_t*1; where Val_t=first word×65536+second word.

For example: To read phase A active power Pa, the data can be read at address 253-254 in Int16eger reading mode by MODSCAN ,the communication read-out value is 1 at address 253 and 26000 at address 254, that is ,Val_t=1×65536+26000=91536, then Val_s = Val_t*0.01 = 915.36W.

For example: To read positive active energy IMP, the data can be read at address 300-301 MODSCAN in Int16eger reading mode by MODSCAN , the communication read-out

value is 0 at address 300 and 19000 at address 301, that is, Val_t=0x65536+19000=19000, then Val_s =Val_t*1=19000Wh=19kWh.

2.4 Active power, reactive power, apparent power and energy (primary side; W/Var/VA/kWh)

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies a float (two words). The power resolution is 0.01, and the correspondence between the communication value and the actual value is as follows: Val_s=Val_t*0.01; the energy resolution is 1, and the correspondence between the communication value and the actual value is as follows: Val_s=Val_t*1; Val_t is calculated as follows:

The floating point variable data type value uses the sign bit to represent the sign of the data, and the exponent and mantissa represent the size of the data. The data format used by the meter is the IEEE754 data format, which has 24-bit precision, and the high bit of mantissa is always "1", so it is not saved and the distribution of bits is as follows:

1 sign bit, 8 exponent bits, 23 mantissas bits, the sign bit is the highest bit, and the mantissa is the lowest 23 bits.

Specific examples are as follows:

Read-out number (2word, arranged from highest to lowest ,4 bytes in total (0x474B, 0xAC00), 32bit):

Sign bit S , Index bit E , Mantissa M

Sign bit S=0，("1" is negative, "0" is positive)

Calculate the index E=10001110 and convert it into a decimal number 142;

Calculate the mantissa M=100 1011 1010 1100 0000 0000 into a decimal number 4959232.

Calculation formula: primary side power

$$= (-1)^S \times 2^{(E-127)} \times \left(1 + \frac{M}{2^{23}}\right)$$

The result of the above example is as follows:

$$\left(-1\right)^0 \times 2^{\left(142\ -\ 127\right)} \times \left(1 + \frac{4959232}{2^{23}}\right) = 52140 = 521.4\text{kWh}$$

For example: To read phase A active power PA, the data can be read at address 1150-1151 in Floating Pt reading mode by MODSCAN,the read-out value Val_t=110000, then Val_s =Val_t*0.01=1100W.

For example: To read phase positive active energy IMP, the data can be read at address 3050-3051 in Floating Pt reading mode by MODSCAN,the read-out value Val_t=589000, then Val_s ＝Val_t*1=589000Wh=589kWh.

2.5 Harmonic data of voltage and current

The series of measured values are read with 03 command of the Modbus-RTU communication protocol. Each item occupies 1 word. The resolution is 0.01, and the correspondence between the communication value and the actual value is as follows: Val_s=(Val_t*0.01).

For example: To read current 3rd harmonic content, the data can be read at address 4501 in Integer reading mode by MODSCAN, the communication readout Val_t is 157, then Val_s = (Val_t*0.01)%=1.57%.

2.6 Demand

Demand includes three phase currents and active power, reactive power, and the maximum demand of apparent power and time of

occurrence. The demand data format is as follows:

Address	Address 1	Address 2	Address 3			Address 4	
Content	H16	L16	H8		L8	H8	L8
	INT32		H4	L4			
	Demand value		Year (Only a bit is reserved, ten bit needs to be filled in according to the current time)	Month	Day	Hour	Minute

Note: H8 indicates eight high bits, L8 indicates eight low bits,and others are similar.

Take reading the maximum demand of phase A current (1200~1203) as an example, the read-out value is 0x0000 0x157C 0x7512 0x0E16

Address	1200	1201	1202			1203	
Content	H16	L16	H8		L8	H8	L8
			H4	L4			
	0x0000	**0x157C**	**0x7**	**0x5**	**0x12**	**0x0E**	**0x16**
	Demand value		Year	Month	Day	Hour	Minute
Analysis	0*65536+0x157C=5500		17 (ten bit needs to be filled in according to the current time)	5	18	14	22

The maximum demand for Phase A current is: At 14:22 on May 18, 2017, the demand value is 5.500A.

2.7 Event Record

Event record 1 - event record 16, recorded in order of time, that is, event record 1 records the data of the most recent event, and event record 16 records the data of the earliest event, the data format of each event record is as follows:

Address	Address 1									Address 2		Address 3		Address 4	
内容 Content	H8								L8	H8	L8	H8	L8	H8	L8
	B7	B6	B5	B4	B3	B2	B1	B0							
	0：DO 1：DI	0:Open 1:Closed							Switch number	Year	Month	Day	Hour	Minute	Second

Take reading the event record 1 (2200~2203) as an example, the read-out value is **0x4000 0x1101 0x160D 0x3820.**

Address	2200									2201		2202		2203	
Content	H8								L8	H8	L8	H8	L8	H8	L8
	B7	B6	B5	B4	B3	B2	B1	B0							
	0	**1**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0x11**	**0x01**	**0x16**	**0x0D**	**0x38**	**0x20**
	0：DO 1：DI	0:Open 1:Closed							Switch number	年 Year	Month	Day	Hour	Minute	Second
Anal	DO	Closed							DO1	17	1	22	14	56	32

ysis															

DO1 changed from open to closed at 14:56:32 on January 22,2017.

2.8 Alarm Record

The data format of the alarm record is as follows:

Address	Address 1		Address 2		Address 3		Address 4		Address 5	Address 6
内容 Content	H8	L8	H8	L8	H8	L8	H8	L8		
	Alarm group 0: The alarms of the first group 1: The alarms of the second group	Alarm type (Refer to 7.4 Alarms viewing - entry number for alarm classification description)	Year	Month	Day	Hour	Minute	Second	Alarm value	Alarm status

Take reading the latest alarm record (2300-2305) as an example, the read-out value is 0x000C 0x1101 0x160E 0x3820 0x0960 0x0001.

Address	2300		2301		2302		2303		2304	2305
Content	H8	L8	H8	L8	H8	L8	H8	L8		
	0x00	**0x0C**	**0x11**	**0x01**	**0x16**	**0x0E**	**0x38**	**0x20**	**0x0960**	**0x0001**
	Alarm group	Alarm type	Year	Month	Day	Hour	Minute	Second	Alarm value	Alarm status
Analysis	The alarms of the first group	Phase A overvoltage alarm	17	1	22	14	56	32	2400	Act

Phase A overvoltage alarm (the first group of alarms) occurs at 14:56:32, January 22, 2017, the alarm value is 240.0V.

2.9 DO Settings

Associated alarm configuration format of do settings is as follows:

Address	Address 1				Address 2		
Content	H16				L16		
	INT32						
	B31	B30	B29	…	B2	B1	B0
	Associated with the alarm number 31 of the first group (Alarm of over active power)			...and so on			Associated with the alarm number 0 of the first group (phase A

							overcurrent alarm) (1: valid; 0: invalid)
Address	Address 3		Address 4				
Content	H16		L16				
	INT32						
	B31	B14	B13	…	B2	B1	B0
	Associated with the alarm number 63 of the first group (DI2 alarm)			...and so on			Associated with the alarm number 32 of the first group (Alarm of over reactive power)
Address	Address 5		Address 6				
Content	H16		L16				
	INT32						
	B31	B30	B29	…	B2	B1	B0
	Associated with the alarm number 31 of the second group (Alarm of over active power)			...and so on			Associated with the alarm number 0 of the second group (phase A overcurrent alarm)
Address	Address 9		Address 10				
Content	H16		L16				
	INT32						
	B31	B14	B13	…	B2	B1	B0
	Associated with the alarm number 63 of the second group (DI2 alarm)			...and so on			Associated with the alarm number 31 of

Address	Address 3			Address 4			
Content	H16			L16			
	INT32						
	B31	B30	B29	…	B2	B1	B0
	Associated with the alarm number 63 of the first group (DI2 alarm)			...and so on			Associated with the alarm number 32 of the first group (Alarm of over reactive power)
Address	Address 5			Address 6			
Content	H16			L16			
	INT32						
	B31	B30	B29	…	B2	B1	B0
	Associated with the alarm number 65 of the first group (DI4 alarm)			…			Associated with the alarm number 64 of the first group (DI3 alarm)
Address	Address 7			Address 8			
Content	H16			L16			
	INT32						
	B31	B30	B29	…	B2	B1	B0
	Associated with the alarm number 31 of the second group (Alarm of over active power)			...and so on			Associated with the alarm number 0 of the second group (phase A overcurrent alarm)
Address	Address 9			Address 10			
Content	H16			L16			
	INT32						
	B31	B30	B29	…	B2	B1	B0
	Associated with the alarm number 63 of the second group (DI2 alarm)			...and so on			Associated with the alarm number 31 of

							the second group (Alarm of over reactive power)
Address	Address 11				Address 12		
Content	H16				L16		
	INT32						
	B31	B30	B29	…	B2	B1	B0
				…		Associated with the alarm number 65 of the second group (DI4 alarm)	Associated with the alarm number 64 of the second group (DI3 alarm)

Take reading the associated alarm settings of DO1 (2590-2601) as an example, the read-out value is 0x0000 0x0007 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000 0x0000

Address	2590				2591		
Content	H16				L16		
	INT32						
	B31	B30	B29	…	B2	B1	B0
	0	**0**	**0**	**0**	**1**	**1**	**1**
	Associated with the alarm number 31 of the first group (Alarm of over active power)			...and so on			Associated with the alarm number 0 of the first group (phase A overcurrent alarm)

The remaining addresses in this example are all 0 and are no longer listed.

If the current DO1 function is controlled by the alarm of the first group, in this example, DO1 is associated with the phase A overcurrent alarm, the phase B overcurrent alarm, and the phase C overcurrent alarm of the first group.