543

APM830(G2) Power monitoring Meters

Installation and Operation Instruction V1.0

ACREL CO.,LTD

DECLARATION

This company reserve power of revision of product specification described in this manual,without notice.Before ordering,please consult local anget for the latest specification of product.

Content

1. Overview

APM 830(G2)(power meters) are designed according to IEC international standards .APM 830 meters have full power measurement, energy statistics, analysis of power quality Recording function, event recording function (including voltage rise and fall interruption, impulse current, etc.) 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 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. Product model,specification and function

2. 1 Type and specification

Type	APM830(G2)	
Measured parameters	Total electrical measurement	
	Four-quadrant energy	
	Complex rate electric energy	
	Internal temperature measurement of instrument	
Pulse output of energy	Total active power, total reactive power, total apparent power pulse output, second pulse, etc	
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	
	Voltage phase angle, current phase angle	
	Total (odd, even) harmonic content of voltage and current	
	Harmonic content of voltage and current (2-63 times)	
	Voltage crest factor	
	Telephone waveform factor	
	Current K-factor	
	Vector	
	Voltage and current waveform	
	Fundamental voltage and current	
Event log	Record the most recent 128 event records, support extended records by TF card	
	A total of 13 alarm records, including 66 alarm types, each of which can record 128 recent alarm records, supporting the expansion of TF card	
	Transient record, record up to 800 transient waveform records, support TF card expansion record	
Communication	Modbus - RTU protocol	
	DL / T 645 - 2007 protocol (support freeze function)	
I/O	4 digital inputs + 2 digital outputs (4DI+2DO)	
Multiple rate	The multi-rate energy statistics include total, sharp, peak, flat, valley and near-month multi-rate electricity	
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，Configure this function to give MCM function, referred to as MCMP for short.
	MCE	1 Ethernet, support Modbus-TCP, http, SMTP, DHCP protocol，Configure this function to give MCM function, referred to as: MCME
	PNET	1 Profinet Communication
	MLORA	1 Lora Communication
	MWIFI	1 Wifi Communication
	M4G	1 4G Communication

Note:1、When selecting the extended function, the meter can take up to 3 modules. The modules can be the same or different, but MCP\MCE\MLOG cannot select multiple identical modules combined, MCP and MCE only Can choose one, MWIFI and M4G only Can choose one.

2、When multiple modules are used in combination, the following installation sequence rules must be followed: (1) MCP MCE MCM: The installation sequence must be before the other modules (i.e. install this module first) (2) MD82 Mlog: The installation sequence must be after the other modules (i.e. install this module last).

2.2 Technical Parameters

display	Display method	Dot matrix LCD；
	Resolution	192 * 160；
	Backlight	White LED；
	Visible area	69mm*62mm(2.8Inch / 6.66inch)
Signal	Electrical network	Three-phase three-wire, three-phase four-wire, see the wiring diagram;
	Frequency	45～65Hz；
	Voltage	Rated value：AC 3*57.7/100V、AC 3*63.5/110V、AC 3*230/400V、AC 3*400/690V；690V direct connection on voltage input terminal（L-L）
		Overload： 1.2 times rated value(continuous); 2 times rated value /1 second;
		Power consumption: < 0.5VA (per channel);
	Current	Rated value：AC 3x 1 (1.2) A、AC 3x5(6)A， 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	IEC 61557-12 class 0.2
	Voltage imbalance	IEC 61557-12 class 0.2
	Voltage harmonics, current harmonics	IEC 61557-12 class 2 （Note[1]）
	frequency	IEC 61557-12 class 0.2s
	Active power	IEC 61557-12 class 0.2s
	Reactive power	IEC 61557-12 class 1s
	inspecting power	IEC 61557-12 class 0.2

	Active energy	IEC 62053-22 - Active energy0.2S
	Reactive energy	IEC 62053-24 - Reactive energy0.5S
Power Quality	Recording wave	20 waveforms, 10 waves before and after;
	Waveform capture	Each waveform is stored at 128 cycle points; the TF card is supported to expand the recorded data, and the customer needs to manually pull the line chart through Excel.
Switch inputs	Dry contact inputs, built-in power supply; Response time: less than 300ms	
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：10000imp/kWh（default），For details, see 6.2 Input Settings.；	
Analog outputs	DC 0～20mA、4～20mA、0～5V、1～5V Output, accuracy grade 0.5%, load resistance ≤500Ω at current output, load resistance ≥2KΩ at voltage output; overload: 1.2 times rated value (continuous);	
Analog inputs	DC 0～20mA, 4～20mA, 0～5V, 1～5V input, accuracy grade 0.5; overload: 1.2 times rated value (continuous);	
TF Storage card	Standard TF card with 8G capacity, maximum support for TF card with 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; Wireless Interface;	
Power supply	Working range: AC/DC 85V～265V or AC/DC 115～415V(P2); Power consumption: Power consumption of the main part ≤ 15VA;	
Safety	Power frequency withstand voltage	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;
	Insulation resistance	Inputs、outputs to the shell>100MΩ；
Electromagnetic compatibility	Meet IEC 61000 standard (Level 4);	
Environment	Operating temperature：-25℃～+70℃； Storage temperature：-40℃～+85℃； Relative humidity：≤75% without condensation； Altitude：≤2000m；	

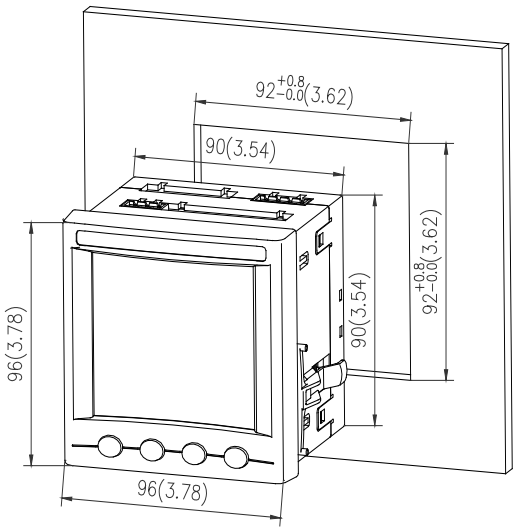
Protection Level	Display panel IP54, with gasket;	
Standards	IEC 60068-2-1 IEC 60068-2-2 IEC 60068-2-30	Environmental Testing-Part 2-1:Tests Test A:Cold IDA Environmental Testing Part 2-2:Tests Test B:Dry heat Environmental Testing Part 2-30:Tests Test Db:Damp heat，cyclic (12+12h)
	IEC 61000-4	Electromagnetic compatibility-Testing and measurement techniques
	IEC 61557-12	Electrical safety in low voltage distribution systems up to 1 000V a.c. and 1 500V d.c –Equipment for testing， measuring or monitoring of protective measures — Part12：Performances measuring and monitoring devices(PMD)
	IEC 62053-22	Electricity metering equipment (a.c.)-Particular requirements - Part22:Static meter for active energy(class 0.2S and 0.5S)
	IEC 62053-24	Electricity metering equipment (a.c.)-Particular requirements - Part24:Static meter for reactive energy at fundamental frequency (classes 0.5S 1S and 1)

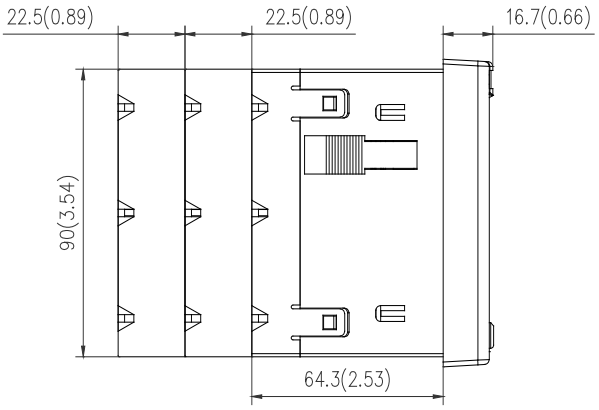
Note 1: Harmonic measurement 2~45 times in the range of frequency 45~65Hz, the error is ±1%, harmonic measurement 46~63 times at frequency 50Hz, the error is ±2%.

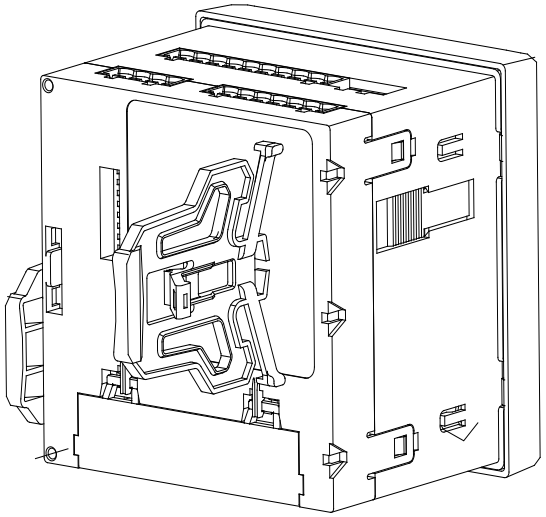
3. Installation and wiring instructions

3. 1 Shape and installation dimensions

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

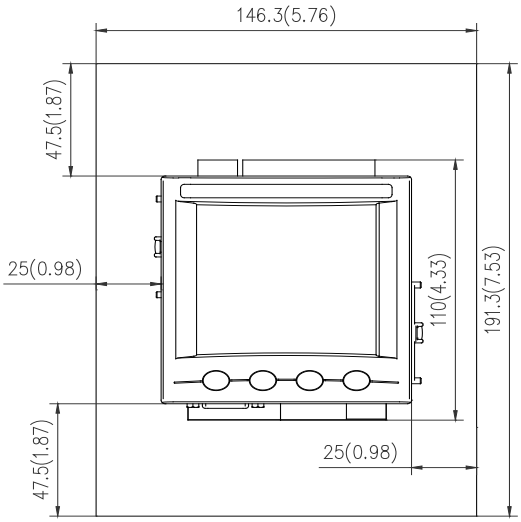


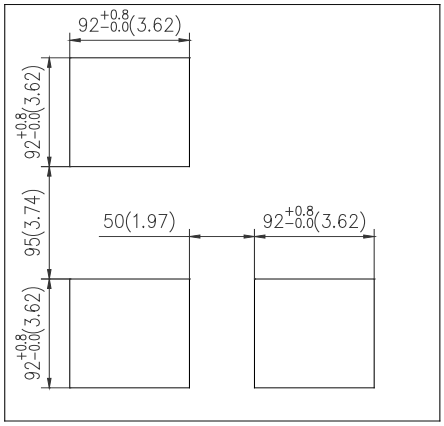




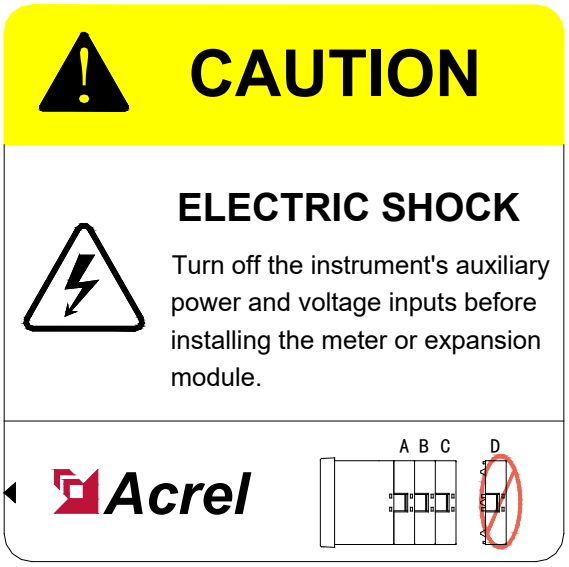
Note:The maximum turning angle is 90°.

Multiple meter installation (unit: mm(in))

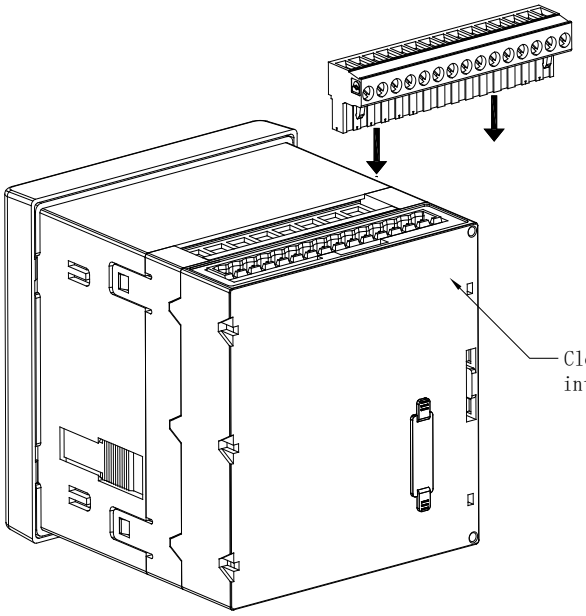




3. 2 Security



3. 3 Assembly



1. Insert the connection terminal into the module

2. Using a cable with a diameter of 0.2 to 0.3 mm, strip 6 mm from the end of each wire and connect it to the terminal and insert the wire into the corresponding position of the connection terminal.

3. The locking torque of the terminal screw is: 0.56~0.79N • m.

Disconnect all power to the meter and equipment that has the meter installed:

1)Disconnect the voltage by disconnecting the fuse on the voltage transformer (PT secondary) or by cutting off the voltage isolation switch.

2)Short-circuit the secondary output of the current transformer (CT).

3)Disconnect the meter control power supply and any power supply to the module.

4)Confirm that the power has been disconnected using a voltage measuring device of the appropriate measuring range.

3. 4 Engineering Construction Precautions

3.4.1 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

3.4.2 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!

3. 4. 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.

3. 4. 4 Supply voltage

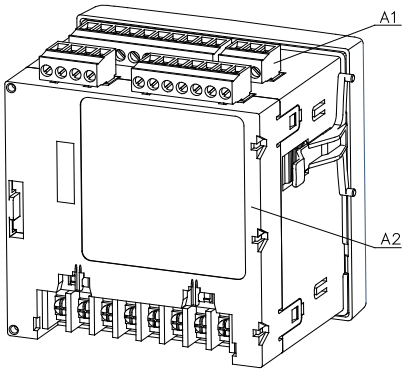
The conventional power supply voltage of the instrument:AC/DC 85-265V;supply voltage with P2 funcion:AC/DC 115-415V.

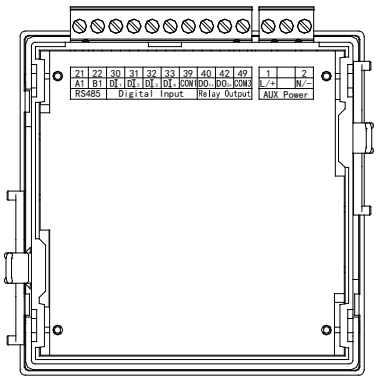
3. 5 Wiring method

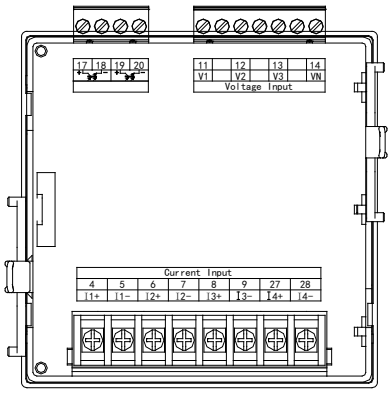
According to different design requirements, it is recommended to add a fuse (BS88 2A gG) to the power supply and voltage input terminals to meet the safety requirements of the relevant electrical specifications.

3. 5. 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, 32, 33, 39" is the switch input terminal number; "40, 42, 49 " is the relay output terminal number. (Figure 1、A1、A2)

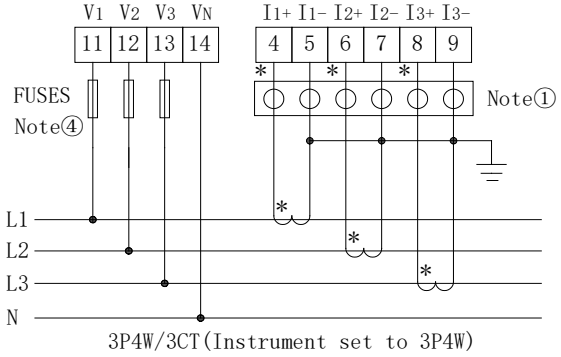




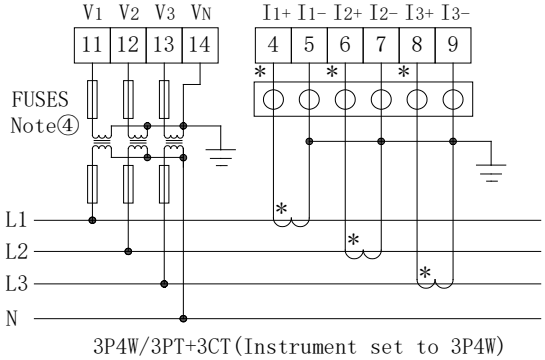


（Figure 1） (A1)Auxiliary power supply, etc (A2)Input of voltage and current

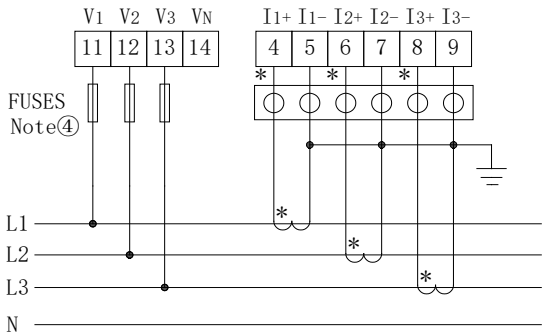
Wiring method of signal input:



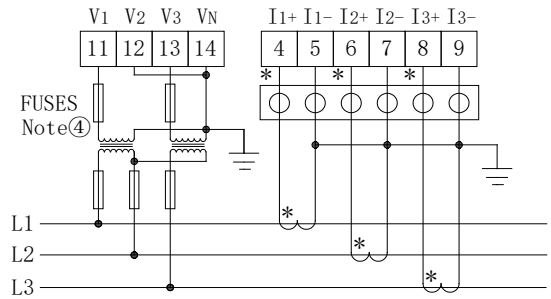
3P4W/3CT(Instrument set to 3P4W)



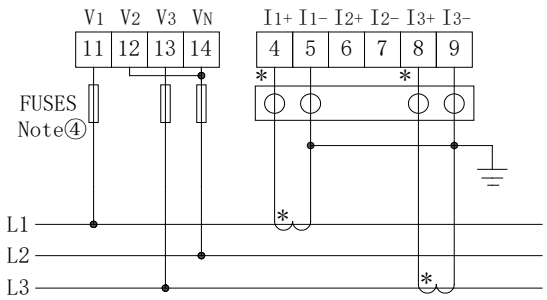
3P4W/3PT+3CT(Instrument set to 3P4W)



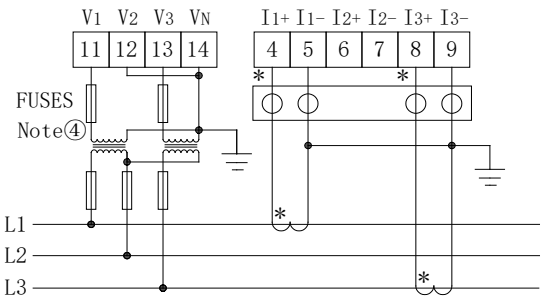
3P3W/3CT(Instrument set to 3P4W) Note②



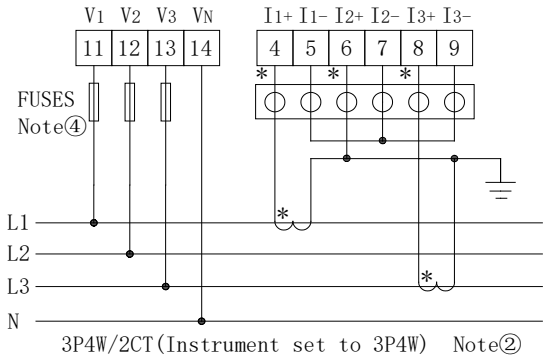
3P3W/2PT+3CT(Instrument set to 3P3W-3CT) Note③



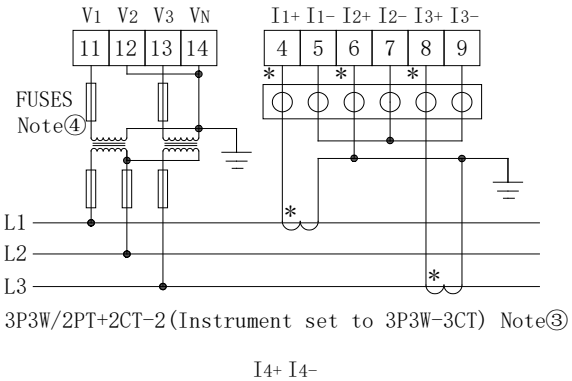
3P3W/2CT(Instrument set to 3P3W-2CT)



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



3P4W/2CT(Instrument set to 3P4W) Note②



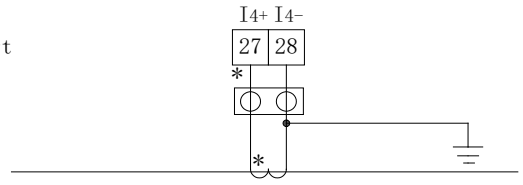
3P3W/2PT+2CT-2(Instrument set to 3P3W-3CT) Note③

Note①: Test terminal for secondary side short connection of CT。

Note②:Applicable only to three-phase balanced load

Note③:B-phase current only shows, not participate in other power calculation

Note④:FUSES must be fused with rated current of 1A



Neutral line current

3.5.2 Module parts

Switch module

70	77	71	72	78	73	30	31	32	33	34	35	36	37	39
R1			R2			DI_1	DI_2	DI_3	DI_4	DI_5	DI_6	DI_7	DI_8	COM_4
继电器输出						开关量输入								
Relay Output						Digital Input								

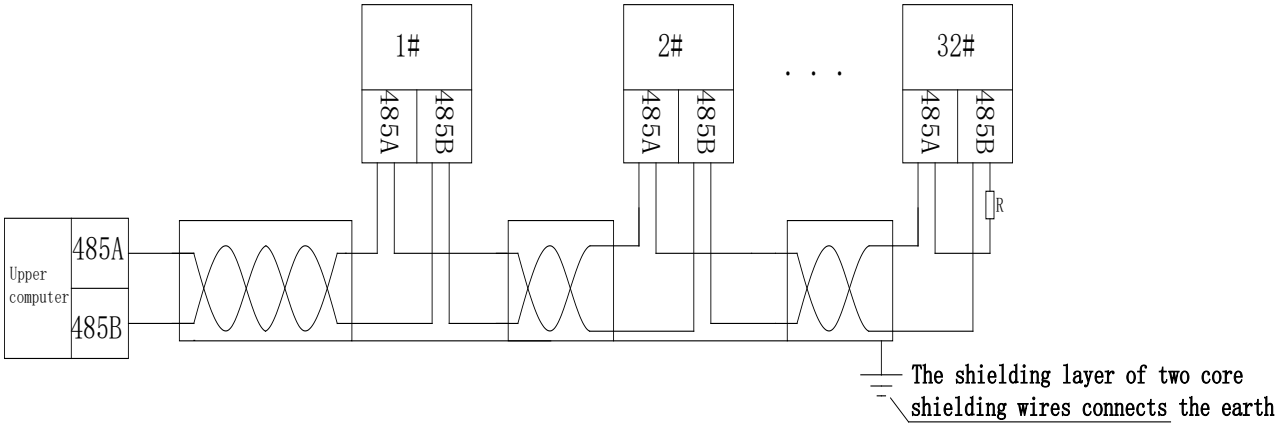
Analog input and output module

60	61	62	63	64	65	66	67	69	50	51	52	53	59
AI1	AI_2	AI_3	AI_4	AI_5	AI_6	AI_7	AI_8	COM_2	AO_1	AO_2	AO_3	AO_4	COM_3
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.



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.

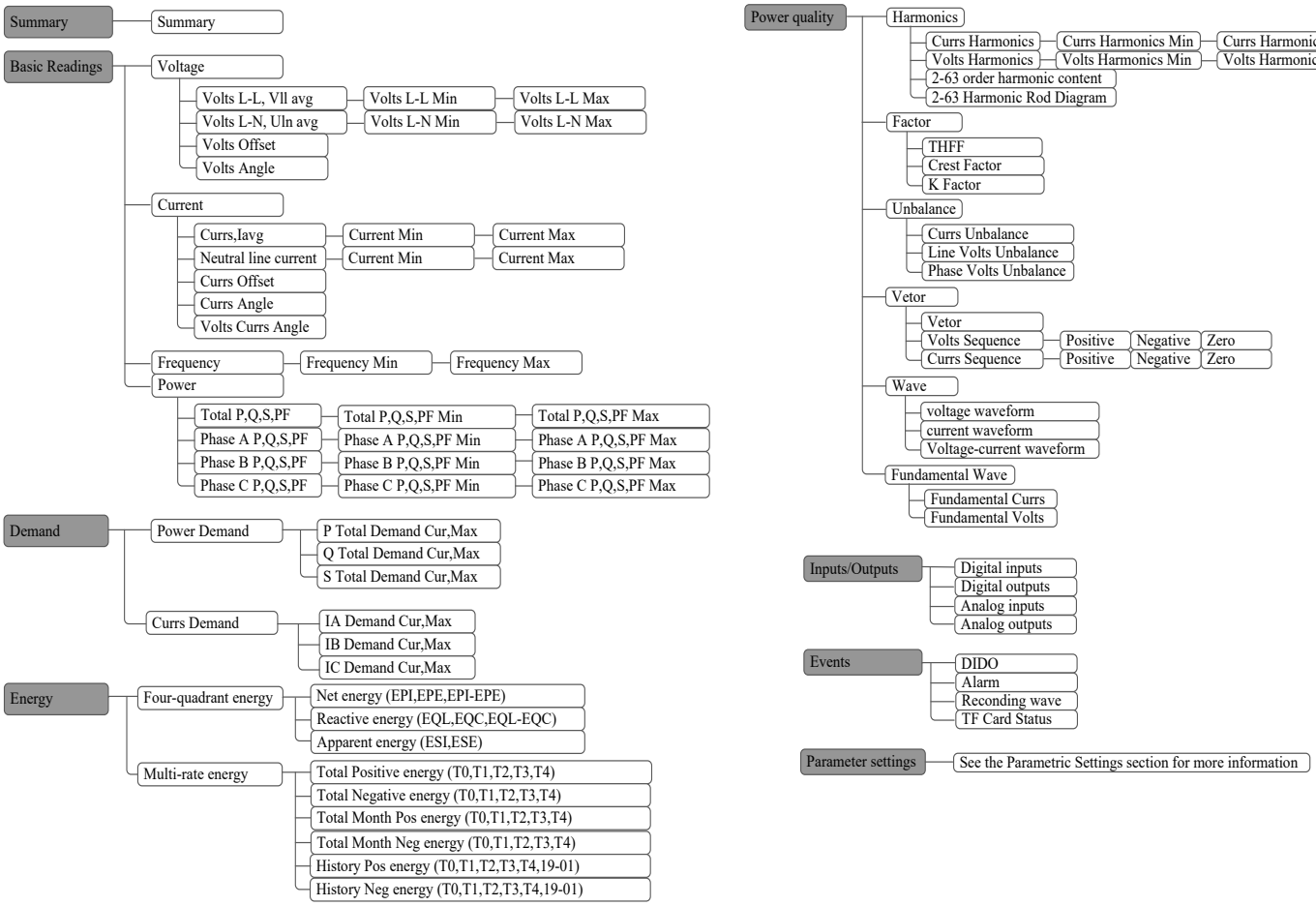
Note: 1.When the meter has Profibus function, for the related communication configuration and GSD file, please refer to the CD delivered with the meter.

4. Operation instructions

4. 1 Expansion Module Indicator Description

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

4. 2 Menu Structure Description



4. 3 navigation button character number description

symbol	description
Menu	Press this button to enter the menu interface
Esc	Press this button to return to the first level menu
＞	To the right, press the button to display the cursor to move to the right one position or jump to the right one screen
＜	To the left, press the button to display the cursor to move one position to the left or to the left screen
∧	Up, press this button to jump to the previous screen or the current menu interface to page up
∨	Down, press this button to jump to the next screen or the current menu interface to page down
※	Press this button to enter the third level menu

√	Confirm or enter the interface
◇	Press this button to collapse the secondary menu
• • •	Press this button to return to the third level menu
Exit	Set the interface to exit, press 2 times or more to exit without saving settings.
SaveExit	Exit after saving settings
Enter	Confirm access to settings
+	Data increment
-	Declining data

4. 4 Display overview

First level menu	Second level menu	Third level menu	Note
Overview			Line voltage average, current average, total P, positive active energy Imp
Basic electrical parameter	Voltage	Maximum value minimum value	Line voltage, phase voltage, deviation, angle, and average, maximum, and minimum values.
	Current	Maximum value minimum value	Three-phase current value, neutral current, deviation, angle, voltage and current angle, and average, maximum, and minimum values.
	frequency	Maximum value minimum value	Frequency value and maximum and minimum values.
	power	Maximum value minimum value	Phase separation P, Q, S, PF and total P, Q, S, PF and maximum and minimum values.
Demand	Power demand		Current total P, Q, S demand and forward P, Q, S maximum and reverse P, Q, S, including time stamp.
	Current demand		Current current per phase and maximum value, including timestamp.
Electric energy	Four quadrant power		Positive active energy EPI, reactive energy EQL, apparent energy ESI reverse active energy EPE, reactive energy EQC, apparent energy ESE, net active energy EPI-EPE, net reactive energy EQL-EQC, net apparent power ESI-ESE (The meter defaults to the power state, then the above formula is established; if the meter is in the power generation state, the net active energy EPE-EPI, reactive energy EQC-EQL, apparent energy ESE-ESI)
	Complex rate electric energy		Total forward multi-rate electricity (total, sharp, peak, flat, valley), total reverse multi-rate electricity (total, sharp, peak, flat, valley), total positive multi-rate electricity this month (total, Sharp, peak, flat, valley), total reverse multi-rate electric energy (total, sharp, peak,

			flat, valley) and historical December reverse and reverse multi-rate electric energy (total, sharp, peak, flat, Valley)
Power quality	harmonic	Maximum, minimum,total parity	Current total harmonic, current total harmonic content, voltage total harmonic, voltage total harmonic content, voltage and current fractional harmonic content, current total odd harmonic content, current total even harmonic content, voltage total odd Subharmonic content, total harmonic even harmonic content, maximum and minimum current harmonic content, and maximum and minimum voltage harmonic content
	factor		Telephone waveform factor, voltage peak coefficient, current K coefficient
	Unbalance		Voltage/current imbalance
	Vector		Vector, voltage sequence component (positive sequence, negative sequence, zero sequence), current sequence component (positive sequence, negative sequence, zero sequence)
	Waveform		Current voltage waveform, current current waveform, in-phase voltage and current waveform.
	Fundamental wave		Fundamental voltage and current
input Output	Switch input		Current status of the digital input (DI1-DI30)
	Switch output		Current state of the digital output (DO1-DO30)
	Analog input		Current analog input value (AI1-AI32) and inverse display value (This interface has numerical display when configuring expansion module MA84. If there is no expansion module, this interface is 0)
	Analog output		Current analog output value (AO1-AO32) (This interface has a numerical value when configuring the expansion module MA84. If there is no expansion module, this interface is 0)
record	DIDO record		DIDO closes the record, the instrument body stores up to 128 DIDO event records (when the main record is full, the new data covers the old data; if the expansion module MLOG is configured, the data can be synchronized to the TF card, when the TF card data is full The customer needs to manually clear the data in the TF card and clear the TF card data. For details, see the 11-fault troubleshooting analysis. The MLOG indicator of the expansion module is not flashing properly.)

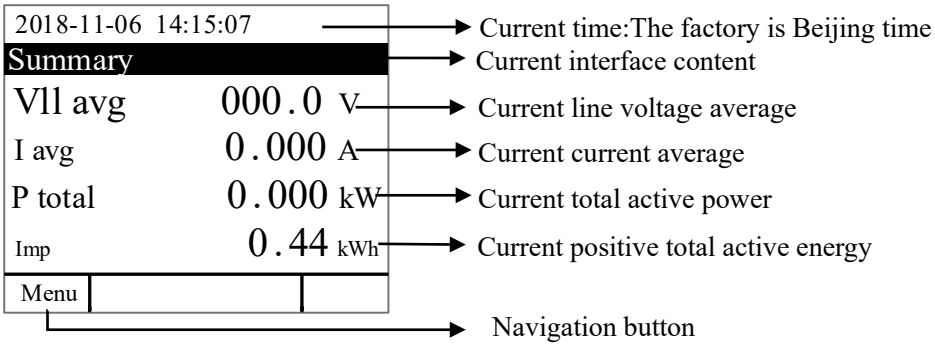
	alarm record		At the current Alarm 1, 2 state, the instrument main body stores up to 16 recent alarm records, and 13 types of alarm types are 128. When the main record is full, the new data covers the old data; if the expansion module MLOG is configured, the data can be synchronized to In the TF card, when the TF card data is full, the customer needs to manually clear the data in the TF card, and clear the TF card data. For details, see the MLOG indicator of the expansion module of the 11 troubleshooting analysis is not normal.)
	Recording record		Voltage interruption, voltage swell, voltage sag, inrush current waveform and measured value
	TF card storage status		No TF Card：No TF card, please refer to 11 failure analysis for details. TF Error：The TF card is damaged, and the data in the TF cannot be written or read. For details, please refer to 11 Failure Analysis. TF Full：The TF card storage is full and needs to be manually cleared by the customer. For details, please refer to 11 Failure Analysis. Check Ini File：The APM800Config.ini configuration file in the TF card is incorrect. For details, see 11 Failure Analysis. The TF card storage is full and needs to be manually cleared by the customer. For details, please refer to 11 Failure Analysis. The normal working status of the TF card is as follows: Free Size:TF card remaining storage capacity Total Size：TF card total capacity Xx recording events are being stored, and the meter displays that the recorded data is being synchronized to the TF card.
parameter settings	Input settings		Phase line, primary side voltage, secondary side, primary side current, secondary side current, nominal voltage, current, pulse constant, pulse output, voltage, current shielding setting
	Communication settings		nstrument 485 address, baud rate, check digit, instrument Profibus address, 645 address, TCP port, IP address, subnet mask, default gateway settings
	Alarm system		Alarm type, alarm action value, etc.
	DO settings		DO channel, output selection and delay setting

	AI settings		AI channel, type, decimal point, and numeric settings
	AO settings		AO channel, type, decimal point, and numeric settings
	Multiple rate setting		Time zone group selection setting, time period peak flat valley setting, switching date setting
	Recording setting		Trigger recording settings: impulse current, voltage swell, voltage sag, voltage interruption threshold setting, voltage harmonics, DI trigger
	Demand setting		Demand sliding window, cycle setting
	System settings		Language, password, backlight, contrast, extreme self-clearing time, imbalance algorithm, time setting
	Clear settings		Clear power, clear demand, clear extremes, clear alarm and switch records, clear transient waveform recording language, password, backlight, contrast, extreme self-clearing time, unbalance algorithm, time setting
	Version Information		Instrument software version information, instrument internal temperature, alarm special symbol description

4. 5 Interface Introduction

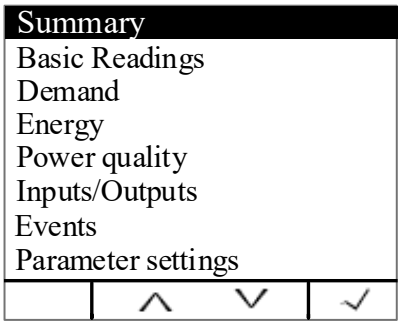
4.5.1 Main interface

The instrument is displayed as the instrument model and version information, and then the overview interface is displayed. The default main interface of the instrument is the overview interface. The main interface can be set. For details, refer to the default interface settings of 7.11 system settings.



4.5.2 Menu interface

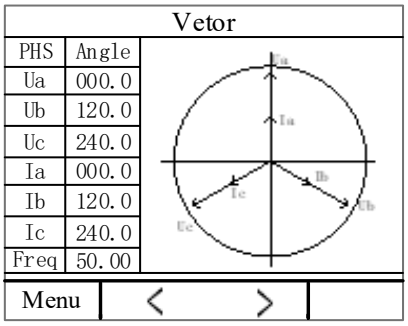
The main interface press Menu to enter the menu interface.



4.5.3 Vector interface

The main interface press Menu to enter the menu interface. Press ∨ until “Power Quality” is highlighted and

press √ to display the power quality. Press ∨ until “Vector” is highlighted and press √ to display the vector. Press < or > to switch the voltage sequence component and current sequence component. Press Menu to return to the menu interface.

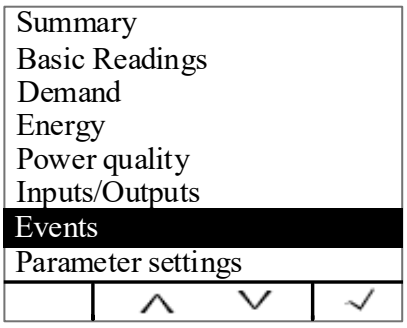


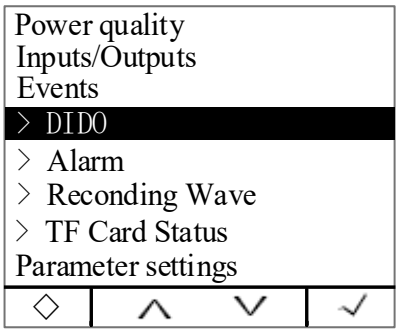
5. View data information

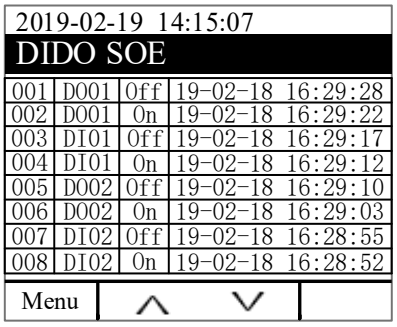
5. 1 Viewing event records

5.1.1 View DIDO records

On the main screen, press Menu to enter the menu interface, press ∨ until “Event Log” is highlighted, and press √ to display the event log. Press ∨ until “DIDO Record” is highlighted, press √ to display the DIDO record. Event records can be generated when the DI/DO status changes, and the instrument body can store up to 128 event records. If the MLOG expansion module (including the TF card) is configured, all DIDO record data will be automatically synchronized to the TF card for storage.



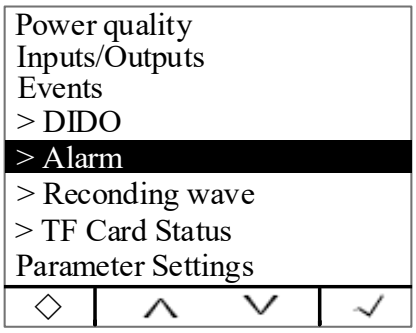


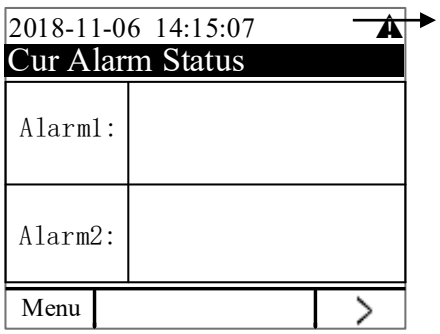


Note: The stored records are in the first-in, first-out principle. If the main body 128 records are full, the new records cover the old records.

5.1.2 View alarm information

On the main screen, press Menu to enter the menu interface, press ∨ until “Event Log” is highlighted, and press √ to display the event log. Press ∨ until “Alarm Record” is highlighted, press √ to view the current alarm status; press > to view the alarm event record, press ∧ or ∨ to view the latest 16 alarm records in chronological order; press > to view each alarm category record , press ∧ or ∨ to view the last 128 alarm records in chronological order.





Special symbol, this symbol indicates that the alarm is on. If the meter has an alarm, it has this alarm symbol in the time bar. You need to check the alarm type on this interface. For other special symbols, please refer to Note in the version information in 7.13.

TAPM series of meters can record 66 kinds of alarms, which are divided into 13 kinds of alarm categories (AT01 overcurrent, AT02 undercurrent, etc., see Table 1). Each alarm category contains several alarm subclasses (such as AT01 overcurrent classification alarm with A). Phase overcurrent, B phase overcurrent, C phase overcurrent, etc., see Table 1). A maximum of 16 alarm records can be recorded for each alarm subclass. When the number of alarm records is 16 or more, the first-in first-out principle is executed, and the newly generated alarm will automatically overwrite the oldest record. Each alarm record contains alarm value, alarm group, alarm action (action or recovery), and alarm time. If the extended MLOG module (including the TF card) is configured, all alarm data will be automatically synchronized to the TF card for storage.

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

Table 1: **Alarm classification description:**

Alarm categories	Alarm content	Alarm communication code
AT01 (Overcurrent)	Phase A overcurrent	0
	Phase B overcurrent	1
	Phase C overcurrent	2
	Maximum overcurrent	3
	Neutral overcurrent	4
AT02 (Undercurrent)	Phase A undercurrent	5
	Phase B undercurrent	6
	Phase C undercurrent	7
	Minimum undercurrent	8
	Neutral undercurrent 1	9
AT03 (Overvoltage)	Phase A overvoltage	12
	Phase B overvoltage	13
	Phase C overvoltage	14
	Maximum phase overvoltage	15
	Phase AB overvoltage	16
	Phase BC overvoltage	17
	Phase CA overvoltage	18
	Maximum line overvoltage	19
AT04 (Undervoltage)	Phase A undervoltage	20

	Phase B undervoltage	21
	Phase C undervoltage	22
	Minimum phase undervoltage	23
	Phase AB undervoltage	24
	Phase BC undervoltage	25
	Phase CA undervoltage	26
	Minimum line voltage undervoltage	27
AT05 (Overpower)	Total active overpower	31
	Total reactive overpower	32
	Total apparent overpower	33
AT06 (Underpower)	Total active underpower	34
	Total reactive underpower	35
	Total apparent underpower	36
AT07 (Demand alarm)	Overdemand alarm of active power	59
	Underdemand alarm of active power	60
AT08 (Power factor alarm)	Total over power factor	37
	Total under power factor	38
AT09 (Total Harmonic Alarm)	Over THD of Phase A current	41
	Over THD of Phase B current	42
	Over THD of Phase C current	43
	Over THD of phase A voltage	44
	Over THD of phase B voltage	45
	Over THD of phase C voltage	46
AT10 (Total Even Harmonic Alarm)	Over TEHD of Phase A current	47
	Over TEHD of Phase B current	48
	Over TEHD of Phase C current	49
	Over TEHD of Phase A voltage	50
	Over TEHD of Phase B voltage	51
	Over TEHD of Phase C voltage	52
AT11 (Total odd harmonics Alarm)	Over TOHD of Phase A current	53
	Over TOHD of Phase B current	54
	Over TOHD of Phase C current	55
	Over TOHD of Phase A voltage	56
	Over TOHD of Phase B voltage	57
	Over TOHD of Phase C voltage	58
AT12	DI1 ON/OFF	62
	DI2 ON/OFF	63
	DI3 ON/OFF	64

	DI4 ON/OFF	65
AT13（Other）	Max unbalanced current	10
	Max unbalanced phase voltage	28
	Max unbalanced line voltage	29
	Over Frequency	39
	Under Frequency	40
	Current Loss	11
	Voltage Loss	30
	Phase Reversal	61

5.1.3 View transient records：

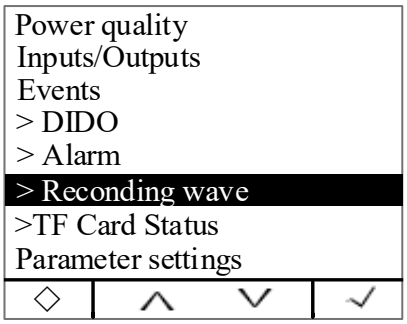
The types of transient events are: voltage swell, voltage sag, voltage interruption and inrush current. The threshold setting of the transient alarm event can be changed to the “Occurrence Setting” in “Parameter Setting”.

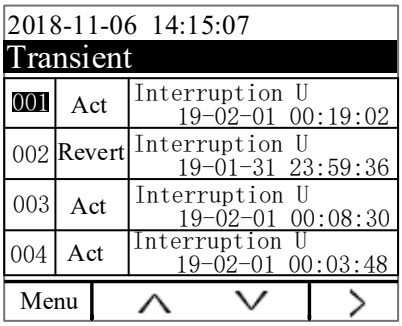
After the transient event occurs, the meter saves the corresponding transient event record, including the transient event action time, reset time and transient event type, to help you quickly analyze and solve the power quality problem.

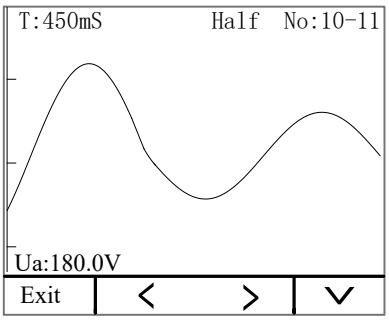
Transient events can record up to 800 events. When the number of records reaches the upper limit, the first-in, first-out principle is adopted, and the new records cover the old records.

The following is an example of viewing a transient record:

On the main interface, press Menu to enter the menu interface, press ∨ until “Event Record” is highlighted, press √ to display the event record, press ∨ until “Transient Record” is highlighted, press ∨ to view the transient record in chronological order. , press > to view the waveform of the currently highlighted transient record. Press < or > on the waveform interface to view the waveform left or right, and press ∧ or ∨ to switch between Ua, Ub, Uc, Ia, Ib, Ic waveforms. Press Exit to exit.







Note：

1、Transient records only save 10 waveforms before and after the event, 128 points per waveform；

2、T：450mSIndicates the timing from the time the event was recorded；

3、Half No:10-11 indicates that the current window displays the 10th to 11th half waves.

5.1.4 View TF card data record

The data log files included in the TF card are: Alarm (alarm data), Energy (timed recording power data), Harmonic (harmonic data), Maintain (basic parameter data), Record (timed recording electrical parameter data), SOE (event) Record data), Wave (waveform record), APM800Config.ini (parameter record file setting), ReadMe.txt

(guide).

Note: If the system time is set incorrectly, the TF card will not be recognized, and the configuration file APM800Config.ini is applicable to APM800/801/810/830.

① Alarm data: Open the Alarm folder, the folder contains sub-folders named “Year_Month” (for example: 2018_02), and the sub-folder contains the .csv record file named “Alarm Type” (eg: Over THD) .csv), you can view the alarm data. The log file contains: date; time; alarm group; alarm type; alarm value; alarm status.

Note: Alarm status: Swell Pickup is triggered by alarm and Swell dropout is recovered by alarm.

② Alarm data: Open the Alarm folder, the folder contains the sub-folder named “Year_Month” (for example: 2018_02), and the sub-folder contains the .csv record file named “Alarm Type” (eg: Over THD) .csv), you can view the alarm data. The log file contains: date; time; alarm group; alarm type; alarm value; alarm status.

Note: Alarm status: Swell Pickup is triggered by alarm and Swell dropout is recovered by alarm.

③ View the timed energy record data: Open the Energy folder. The folder contains the .csv record file (2018_02.csv) named after “Year_Month” to view the timed power record data. The log file contains: date; time; positive active energy; reverse active energy; inductive reactive energy; capacitive reactive energy; positive active energy in T1 period; positive active energy in T2 period; positive active energy in T3 period; The active energy is positive in the T4 period.

Note: The meter records 1 time energy data (primary side) by default for 1 hour. It also includes the positive active energy in each time period. The time interval can be set. The time interval unit is Hour.

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 energy	IMP(T4)	Positive active energy in T4 period

④ View harmonic data: Open the Harmonic folder. The folder contains subfolders named “Year_Month” (for example: 2018_03). The subfolder contains the .csv record file named “Year_Month_Date” (Such as: 2018_03_31.csv), you can view harmonic data. The log file contains: date; time; three-phase phase-separated voltage, current total harmonic value (maximum, minimum); three-phase phase-separated voltage, total odd-order harmonic of the current, even harmonic value (maximum, minimum)); three-phase phase-separated voltage and current fractional harmonic values (maximum, minimum, recorded 2-63th harmonic data).

Note: The meter records 1 harmonic data (primary side) by default for 1 minute, the time interval can be set, and the time interval unit is minute.

⑤ View the main parameter change record: Open the Maintain folder, the folder contains the "Maintain.csv" record file, you can view the parameter change record. The record file contains: date; time; parameter type (such as:

primary side voltage value, current value ; secondary side voltage and current value; 485 communication address and baud rate); new parameter value.

⑥ View the timed electrical parameter record data: Open the Record folder, the folder contains the sub-folder named “Year_Month” (for example: 2018_03), and the sub-folder contains the .csv record named “Year_Month_Date” The file (eg 2018_03_31.csv) can be used to view the timed electrical parameter record data. The log file is as follows:

Note: The meter records 1 electric parameter data (primary side) by default for 1 minute, the time interval can be set, and the time interval unit is minute.

Symbol	Instruction	Symbol	Instruction	Symbol	Instruction
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)	Line voltage average	QB(Var)	Phase B reactive power
IN(A)	Neutral current	UA_UBL(%)	Phase A voltage imbalance	QC(Var)	Phase C reactive power
I_AVG(A)	Average current	UB_UBL(%)	Phase B voltage imbalance	QT(Var)	Total reactive power
IA_UBL(%)	Phase A current imbalance	UC_UBL(%)	Phase C voltage imbalance	SA(VA)	A phase apparent power
IB_UBL(%)	Phase B current imbalance	U_LN_UBL(%)	Phase voltage imbalance	SB(VA)	B phase apparent power
IC_UBL(%)	Phase C current imbalance	UAB_UBL(%)	AB line voltage imbalance	SC(VA)	C phase apparent power
I_UBL(%)	Current imbalance	UBC_UBL(%)	BC line voltage imbalance	ST(VA)	Total apparent power
UA(V)	Phase A voltage	UCA_UBL(%)	CA line voltage imbalance	F(Hz)	frequency
UB(V)	Phase B voltage	U_LL_UBL(%)	Line voltage imbalance	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)	Phase voltage average	PB(W)	Phase B active power	PFC	Phase C power factor
UAB(V)	Phase AB line voltage	PC(W)	Phase C active power	PF	Power factor

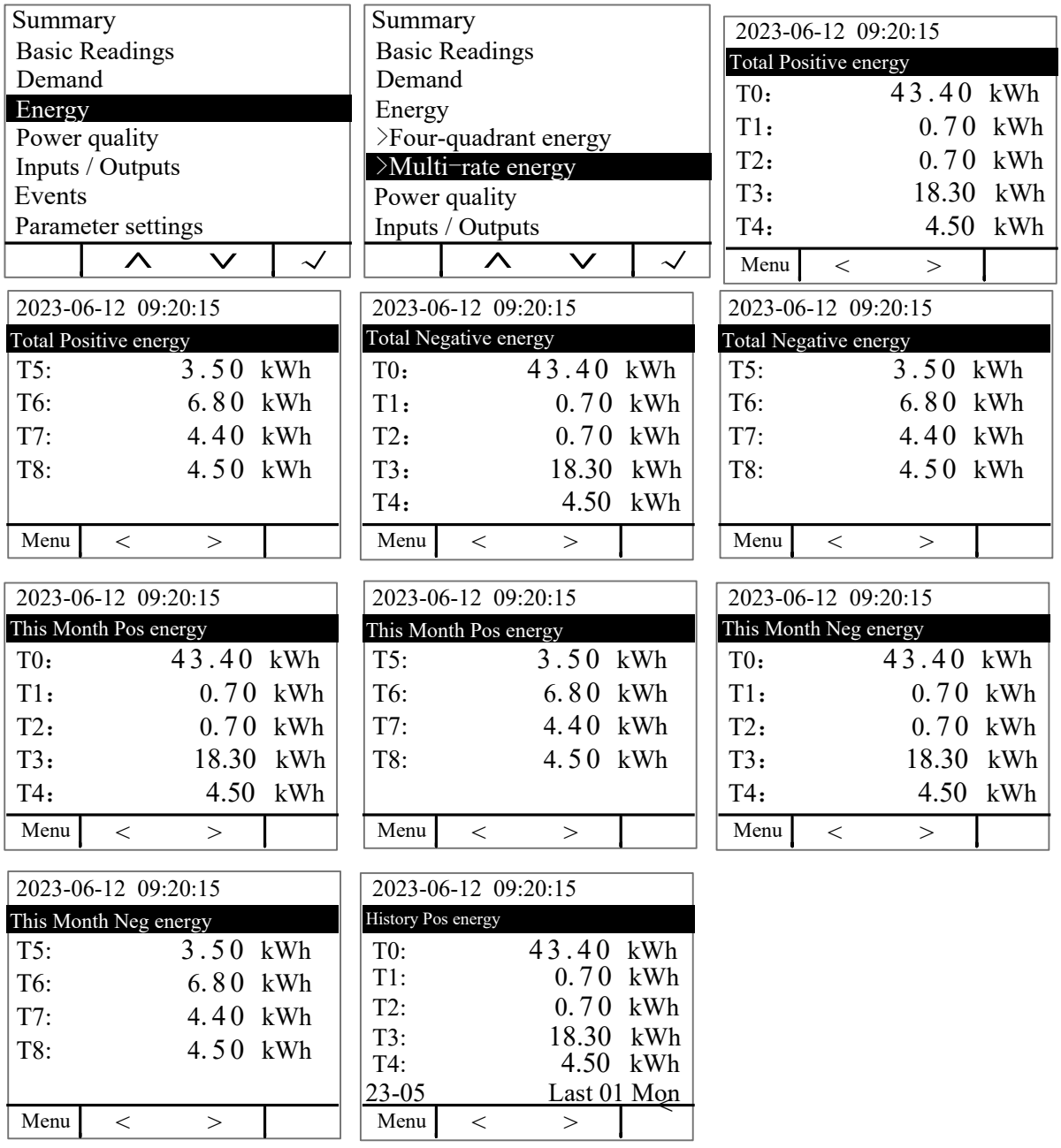
⑦ View event record data: Open the SOE folder, and the folder contains the .csv record file named “Year_Month” (for example: 2018_03.csv) to view the event log data. The log file contains: date; time; DIDO serial number; action type.

⑧ View waveform record data: Open the Wave folder, which contains the .csv record file named “year, month, day, minute, minute, and millisecond” (for example, 20190112153520_170.csv) to view the waveform data. The log file contains: sequence number, ABC voltage and current sample value, ABC voltage and current rms value.

Note: The data in the TF card is read-only, the file record data is excel, please open with Microsoft Office Excel07 version and 07 version, with some data loss below Microsoft Office Excel07 version or WPS open, when TF card After the data storage is full, the customer needs to manually clear the data in the TF card, and clear the TF card data. For details, see the MLOG indicator of the expansion module of the 11 troubleshooting analysis.

5. 2 Viewing Multiple-rate energy

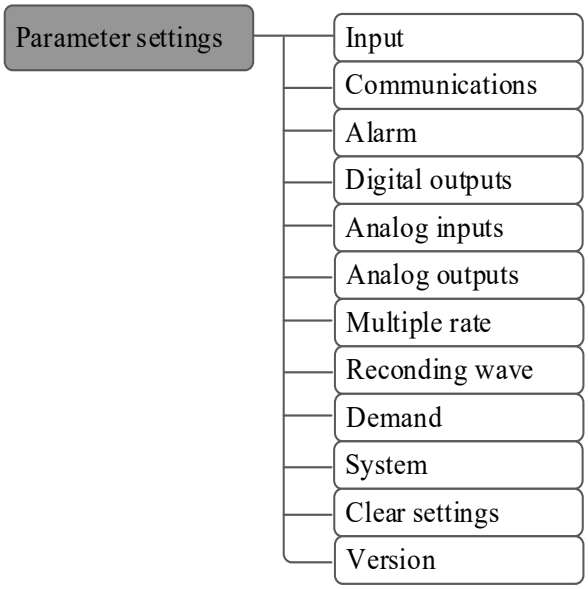
On the main screen, press "Menu" to enter the menu screen, press ∨ until "Energy" is highlighted, press √ to display the "Four-quadrant energy" option and Press √ to display the "Four-quadrant energy" option and the "Multiple-rate energy" option. Press ∨ until "Multiple-rate energy" is highlighted, press √ to display "Total Positive energy", press > to display "Total Negative energy", Press > to display "This month's positive energy", press > to display "This month's Negative energy", press > to display "Historical positive energy" (continue to press > to view the last 12 months at most).



6. Parameter setting

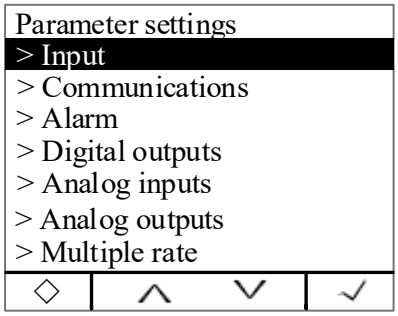
6. 1 Parameter setting interface

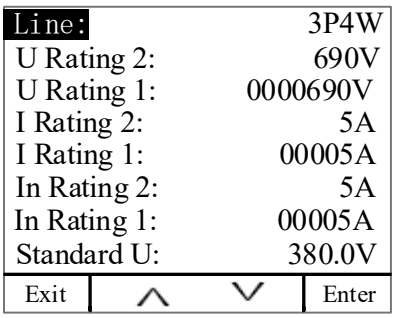
The parameter setting interface is divided into the following parts: input setting, communication setting, alarm setting, DO setting, AI setting, AO setting, multi-rate setting, recording setting, demand setting, system setting, clear setting, version information.

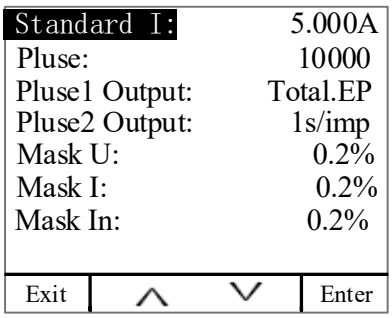


6. 2 Input settings

On the main interface, press Menu to enter the menu interface, press ∨ until “Parameter Setting” is highlighted, and press √ to enter the parameter setting interface. Press ∨ until “Input Settings” is highlighted, press √ to enter the input settings interface. Press ∧ or ∨ to switch the input setting item, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above steps to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.







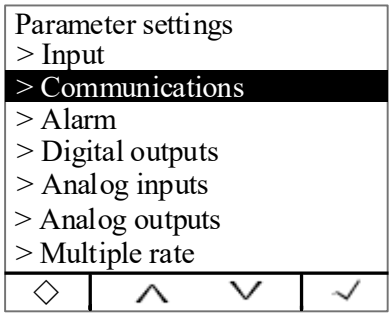
Setting up projects	Range	Explain	Setting Basis
Phase line	3P4W 3P3W-3CT 3P3W-2CT	Current instrument wiring mode	The setting must be correct to reflect the actual connection method of the detection point. The wrong wiring mode setting will

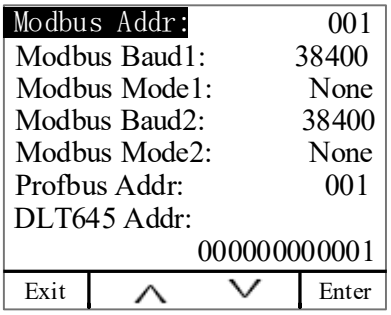
			cause the data measured by the device to be completely wrong.
Secondary side of voltage	100V、110V、400V、690V	A/B/C or AB/BC/CA three-phase secondary side voltage rating, this parameter affects the measurement results of the device.	Input settings are made according to the field test requirements, and the meter displays the measurement results as one measurement
Voltage primary side	50~1999999 V	A/B/C or AB/BC/CA three-phase primary side voltage rating, this parameter affects the measurement results of the device.	
Secondary side of current	1A、5A	A/B/C three-phase secondary side current rating, this parameter affects the measurement results of the device.	
Current side	1~59999A	A/B/C three-phase primary side current rating, this parameter affects the measurement results of the device.	
Neutral current secondary side	1A、5A	N-phase secondary side current rating, this parameter affects the measurement results of the device.	
Neutral current first side	1~59999A	N-phase primary side current rating, this parameter affects the measurement results of the device.	
nominal voltage	10~999.9V	The theoretical voltage value affects the judgment of the voltage above and below the limit in the transient event judgment (the nominal voltage is the line voltage at 3P3W)	Set to the secondary side phase voltage value according to the actual situation on site, the mains supply is usually set to 230V.
Nominal current	0.1~9.999A	Theoretically, the current value in most cases affects the transient current impulse current judgment.	Set to the secondary side phase current value according to the actual situation on site.
Pulse constant	100~99900	Number of pulses per kWh (kvar, kVA)	According to user requirements, the default value is 10000.
Pulse 1 output	Total merit, total reactive power, total vision	Set the energy pulse type of the 17 and 18 pulse output terminals	According to user needs settings, the default is always active.

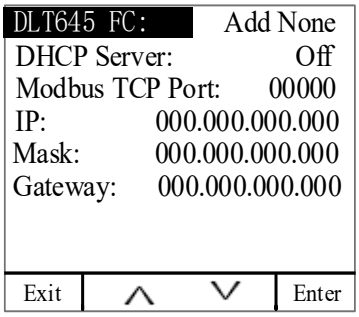
Pulse 2 output	1s/imp、 0.01kwh、 0.1kwh、 1.0kwh、 10kwh、 100kwh	Set the type of 19, 20 pulse output terminals. 1s/imp: second pulse output 0.01kwh: indicates that every 0.01kwh of active energy meter outputs 1 pulse output, 0.1kwh, 1.0kwh, 10kwh, 100kwh and so on.	According to user requirements, the default is 1s/imp.
Voltage shielding	0~9.99%	Voltage measurement mask value	According to user requirements, the default value is 0.20%.
Current shielding	0~9.99%	Current measurement mask value	According to user requirements, the default value is 0.20%.
Center line current shield	0~9.99%	Centerline current measurement mask value	According to user requirements, the default value is 0.20%.

6. 3 Communication Setting

On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "Communication Settings" is highlighted, press √ to enter the communication settings interface. Press ∧ or ∨ to switch the communication setting item, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above steps to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.







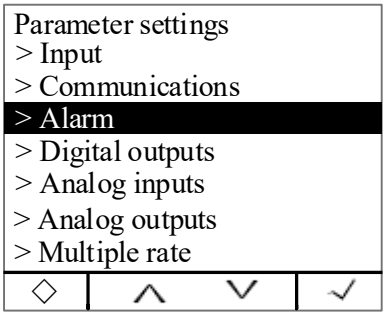
Setting item	range
Modbus address	1~247
1st baud rate	1200，2400，4800，9600，19200，38400
1st check digit	No parity, 2 stop bits, odd parity, even parity
2nd baud rate	1200，2400，4800，9600，19200，38400
2nd check digit	No parity, 2 stop bits, odd parity, even parity
Profibusaddress	1~126

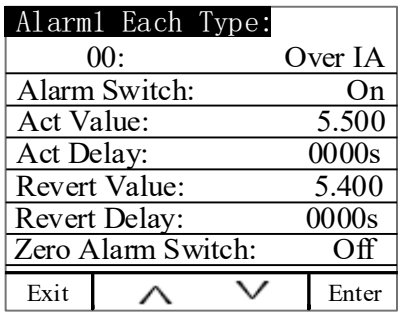
DLT645 address	0~999999999999
DLT645 Leader	Add None(No preamble)、Add 4 0xfc(Add 4 0xFC)
Automatic acquisition IP	Close, open
Modbus TCP port	1~59999
IP address	000.000.000.000（If the expansion module MCE is not configured, the default is 0. If the force expansion module MCE is configured, it is 192.168.8.150.）
Subnet mask	000.000.000.000（If the expansion module MCE is not configured, the default is 0. If the force expansion module MCE is configured, it is 255.255.255.0.）
Default gateway	000.000.000.000（If the expansion module MCE is not configured, the default is 0. If the force expansion module MCE is configured, it is 192.168.8.1.）

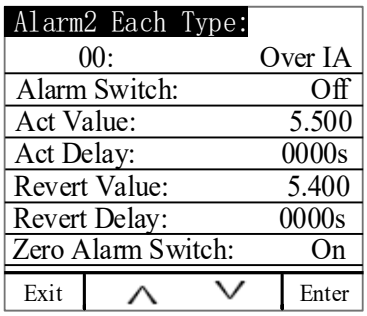
6. 4 Alarm Settings

On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "Alarm Setting" is highlighted, press √ to enter the alarm setting interface. Press ∧ or ∨ to switch the item of alarm setting, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above steps to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.

Alarm type reference 5.1.2 View alarm table 1: Alarm classification description







Setting up projects	Range	Explain
Alarm 1 types	Refer to 5.1.2 View Alarm Table 1: Alarm Classification Description	
Alarm switch	Open close	Turn alarms on or off
Action threshold	-9999~9999	Alarm action value, unit and decimal point position are consistent with the meter display value
Action delay	0~9999	Alarm delay value, in seconds
Reset threshold	-9999~9999	Alarm recovery value, unit and decimal point position are consistent with the meter display

		value
Reset delay	0~9999	Alarm recovery delay value, accurate to the second
Zero alarm switch	Open close	Zero alarm enable, valid when low alarm

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.

Alarm Type Description：

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.

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:

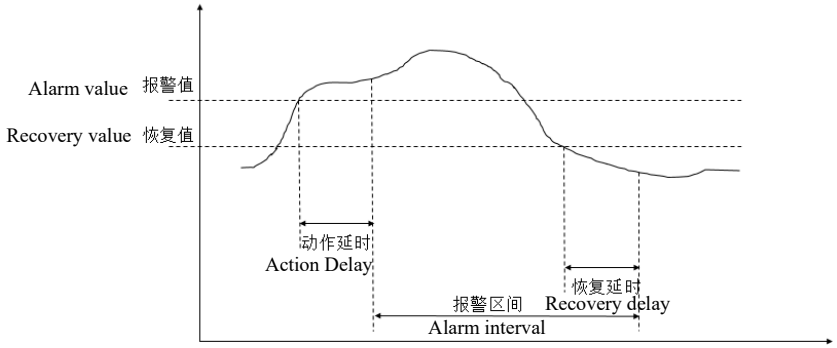
The three-phase current is greater than the recovered value and meets the delay time

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

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.

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

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



Examples are as follc

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).

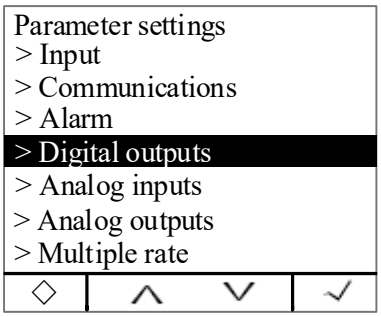
Recovered value: The recovered value is a primary value. For example, if the recovered value is set to 5.400A, after Phase A overcurrent alarm has occurred, when Phase A current value is lower than 5.400A, the released alarm condition is triggered and the timer starts. .

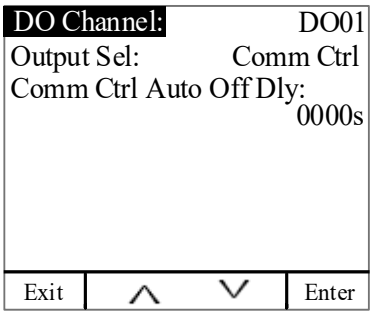
Recovered delay time: When the triggered alarm condition is released, if Phase A current value has been lower than 5.400A, the released alarm record will be generated after the setted delay time (accurate to second), and the alarm group (Alarm1), alarm type (Phase A overcurrent), the released alarm time (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.

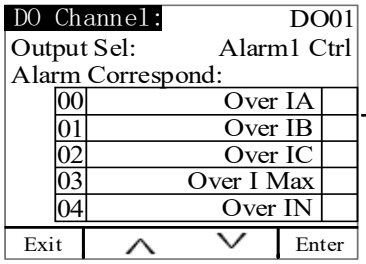
Note: The alarm is invalid when both the action value and the recovered value are zero.

6. 5 DO Settings

On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "DO Setting" is highlighted, press √ to enter the DO setting interface. Press ∧ or ∨ to switch the item set by DO, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above steps to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.







Here, you need to check the alarm type associated with DO. For the specific alarm type, please refer to Table 1 in 5.1.2, that is, the DO action when the alarm is generated. If it is not checked, it is not associated, that is, DO does not operate when the alarm is generated.

Setting item	range	Description
DO channel	DO01~DO30	DO channel selection
Output selection	Alarm 1 control, alarm 2 control, communication control	DO Control method selection
Communication control self-breaking delay	0~9999s	It is valid when communication control. When set to 0, it is the level control mode. When it is not 0, it is the pulse control mode. After the delay setting time is disconnected, the unit is s.
Alarm corresponding to	See alarm type description	

DO enable		
DI1	Normally open, normally closed	DI initialization state, when the DI state is changed by the initial state, and the DO is associated with the alarm, the DO action
DI2	Normally open, normally closed	
DI3	Normally open, normally closed	
DI4	Normally open, normally closed	

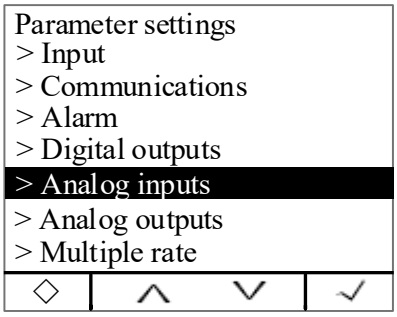
Note：

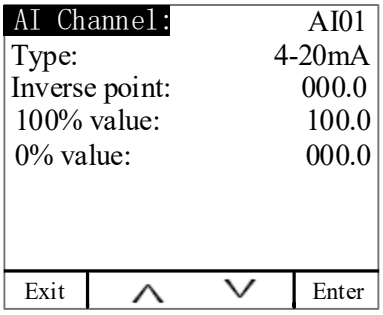
1. Example: When DO1 selects the output control mode as alarm 1 control or alarm 2 control, and associates A phase over current alarm and A phase over power alarm, the rest are not associated. When the alarm is generated when the A phase overcurrent or the A phase over power occurs, the DO1 action occurs.

2. Before selecting the alarm type associated with DO, you need to confirm that the alarm type is checked in the alarm setting. If it is not checked, DO will not be able to operate when the alarm condition is generated.

6. 6 AI Setting

On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "AI Setting Lights up" is displayed, press √ to enter the AI setting interface. Press ∧ or ∨ to switch the item set by AI, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above input settings to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.





Setting item	range				Description
AI channel	AI01~AI32				Analog input channel selection
Type	None、4-20mA、0-20mA、1-5V、0-5V、0-10V				Analog input type
Decimal point	0000	000.0	00.00	0.000	Analog input signal corresponding value decimal point
100% Corresponding value	-9999~9999	-999.9~999.9	-99.99~99.99	-9.999~9.999	Analog input high point signal corresponds to the high point value of the parameter
0% Corresponding	-9999~9999	-999.9~999.9	-99.99~99.99	-9.999~9.999	Analog input low signal corresponds to the low value of the

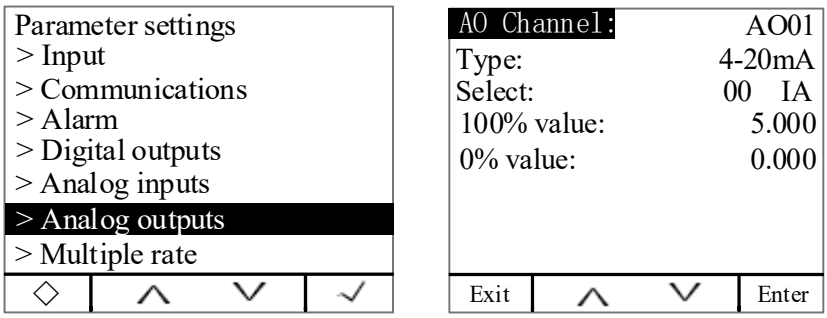
value					parameter

Example: AI1 is set to 4-20mA input and the decimal point is set to 000.0. The 100% value is set to 100.0 and the zero percent value is 000.0. When the AI1 signal input is 20 mA, the displayed value is 100.0. When the signal input is 4 mA, the display value is 0.0. When the signal input is 12mA, the display value is 50.0.

Note:This configuration is only applicable when configuring the external expansion module MA84.

6. 7 AO Setting

On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "AO Setting" is displayed, press √ to enter the AO setting interface. Press ∧ or ∨ to switch the item set by AO, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above steps to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.



Setting item	range	Description
AO channel	AO01~AO32	Analog output channel selection
Type	None、4-20mA、0-20mA、1-5V、0-5V、	Analog output type
select	See output corresponding parameters, see note 1	A variety of parameters can be associated, see Note 1. The output value of AO varies with the value of the associated parameter. If the frequency is associated, then the frequency of the AO changes as the frequency changes.
100% Corresponding value	Determined based on the associated signal	AO output high point corresponding parameter value
0% Corresponding value	Determined based on the associated signal	AO output low point corresponding parameter value

Note[1]

Analog output selection corresponding parameter

Serial number	parameter	parameter	Serial number	parameter	parameter

00	IA (Phase A current)	09	PA (A phase active power)	18	SB (B phase apparent power)
01	IB (Phase B current)	10	PB (B phase active power)	19	SC (C phase apparent power)
02	IC (Phase C current)	11	PC (C phase active power)	20	ST (total apparent power)
03	UA (A phase voltage)	12	PT (total active power)	21	PFA (A phase power factor)
04	UB (B phase voltage)	13	QA (A phase reactive power)	22	PFB (B phase power factor)
05	UC (C phase voltage)	14	QB (B phase reactive power)	23	PFC (C phase power factor)
06	UAB(AB line voltage)	15	QC (C phase reactive power)	24	PF (power factor)
07	UBC(BC line voltage)	16	QT (total reactive power)	25	F(frequency)
08	UCA(CA line voltage)	17	SA (A phase apparent power)		

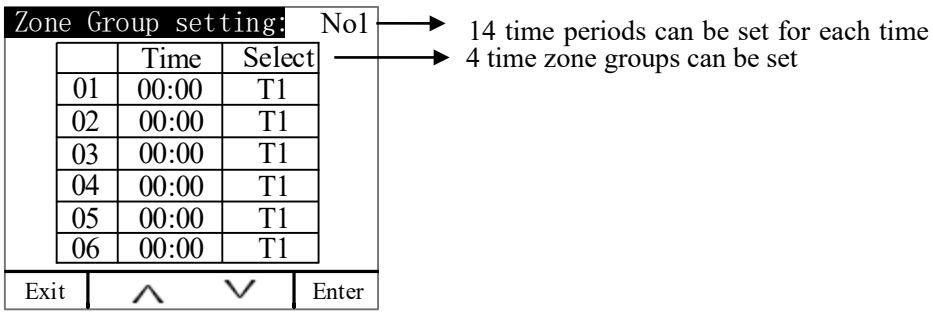
For example: When AO1 is set to 4-20mA output, the signal selection is 00 IA (A phase current), the output high point corresponding signal is 5.000A, and the output low point corresponding signal is 0.000A. When the A phase current value is 5A, the AO1 output is 20mA; when the A phase current value is 0A, the AO1 output is 4mA; when the A phase current value is 2.5A, the AO1 output is 12mA.

Note：This configuration is only applicable when the external expansion module MA84 is configured.

6. 8 Multiple rate setting

On the main interface, press Menu to enter the menu interface, press ∨ until “Parameter Setting” is highlighted, and press √ to enter the parameter setting interface. Press ∨ until “Multi Rate Set” is displayed, press √ to enter the multi-rate setting interface. Press ∧ or ∨ to switch the item set by the multiple rate, press Enter to enter the setting of the item, press + or - to change, press > to shift, after the current item setting is changed, press Exit to exit the item setting. Continue to repeat the above steps to modify the settings. After the change is completed, press Exit to enter the password. The default password is 0001 (customer can change the password according to the password setting set by 7.11 system. If you forget the password, you need to contact us). Press SaveExit to save the changes and exit, press Esc to exit without saving the changes.

6.8.1 Time zone group selection setting

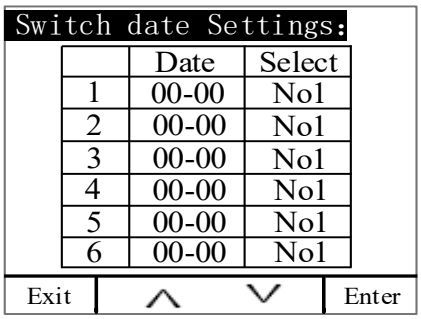


Each time period is divided into 14 intervals, as described in the table below.

Serial number	time	select	description
01	00:00	level	Indicates that the rate is flat during the time period from 00:00 to 01:00.
02	01:00	level	Indicates that the rate is flat during the period from 01:00 to 03:00.
03	03:00	level	Indicates that the rate is flat from 03:00 to 05:00.
04	05:00	level	Indicates that the rate is flat from 05:00 to 07:00.
05	07:00	peak	Indicates that the rate is peaked between 07:00 and 09:00
06	09:00	peak	Indicates that the rate is peaked between 09:00 and 10:00
07	10:00	tip	Indicates that the rate is tipped between 10:00 and 12:00
08	12:00	tip	Indicates that the rate is tipped between 12:00 and 13:00
09	13:00	tip	Indicates that the rate is tipped between 13:00 and 15:00
10	15:00	peak	Indicates that the rate is peaked between 15:00 and 17:00
11	17:00	peak	Indicates that the rate is between 17:00 and 19:00.
12	19:00	peak	Indicates that the rate is peaked between 19:00 and 21:00
13	21:00	Valley	Indicates that the rate is in the valley between 21:00 and 23:00.
14	23:00	Valley	Indicates that the rate is in the valley between 23:00 and 00:00.

Note：When manually setting or communicating to write the rate period, you must ensure that the time set in the next period is greater than the time set in the previous period.

6.8.2 Switch Switch date settings

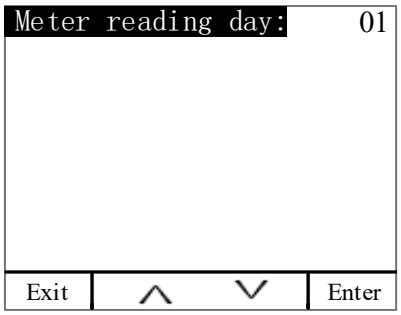


Switch the date setting, up to 6 date segments, as described in the table below.

Serial number	date	select	description
1	01-01	No1	Indicates that the multi-rate energy is calculated using time period 1 from January 1 to March 1.
2	03-01	No2	Indicates that the multi-rate electric energy is calculated using time period 2 from March 1 to May 1.
3	05-01	No2	Indicates that the multi-rate energy is calculated using time period 2 from May 1 to July 1.
4	07-01	No3	Indicates that the multi-rate electric energy is calculated using time period 3 from July 1 to September 1.
5	09-01	No3	Indicates that the multi-rate electric energy is calculated using time period 3 from September 1 to November 1.
6	11-01	No4	Indicates that the multi-rate electricity is calculated using time period 4 from November 1 to January 1.

6.8.3 Meter reading day

Set a monthly fixed meter reading date



Note：

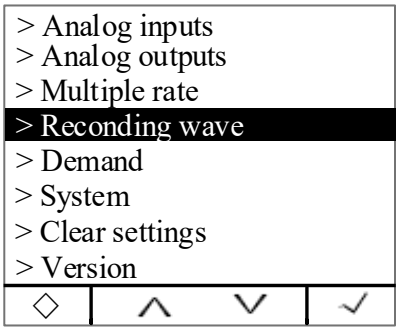
1、The multi-rate electric energy meter can set up to four time tables, six time zones, each set of time tables for 14 periods. There are 8 kinds of rates (T1 (tip), T2 (peak), T3 (flat), T4 (valley), T5(deep valley), T6, T7, T8) to complete the electric energy. The time-sharing measurement can be set by pressing the button and communication.

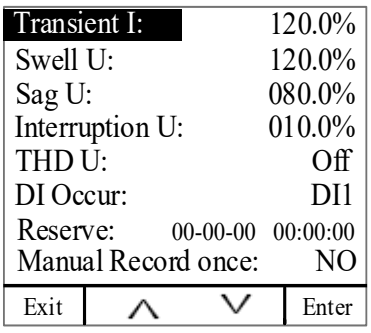
2、T represents the total multi-rate active energy for the month or history.

3、The meter reading date is the natural day. It is recommended to set it to 1. At the end of each month, from 23:59:59, the next month will call the active energy IMP (T0-T8, T) of the current month at 00:00:00. Put into the active energy display interface of last month, the active energy value of last month is put into the active energy display interface of last month, and the active energy display value of this month is cleared.

6. 9 Recording settings

On the main interface, press Menu to enter the menu interface, press ∨ until “Parameter Setting” is highlighted, and press √ to enter the parameter setting interface. Press ∨ until “Transient Settings” is displayed, press √ to enter the transient setting interface. Press ∧ or ∨ to switch the item of the transient setting, press Enter to enter the setting of the item, press + or - to change. After the change is completed, press Exit, enter the password in the pop-up window, press SaveExit to save the changes and exit, press Esc to exit without saving the changes.



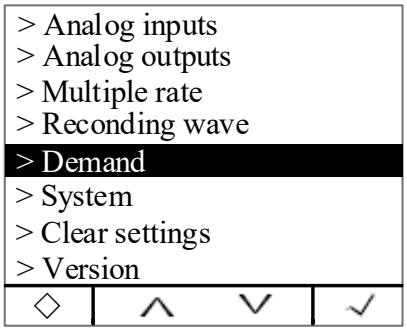


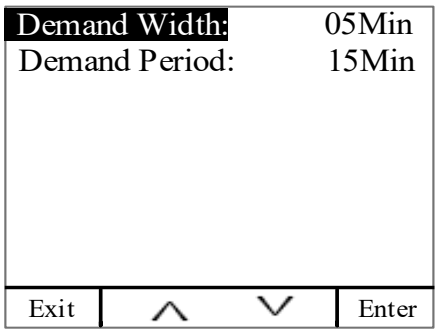
Setting item	range	Description
electric shock	105.0~200.0%	The current threshold (the nominal current multiplied by this parameter) affecting the inrush current event affects the judgment result of the inrush current event, and the stricter the power quality requirement is, the smaller the value is.
Voltage rise	105.0~200.0%	When the sag event is judged, the real-time voltage RMS value is

		required to be higher than the threshold value (nominal voltage multiplied by this parameter), which affects the judgment result of the swell event, and the stricter the power quality requirement, the smaller the value.
Voltage dip	10.0~95.0%	When the sag event is judged, the real-time voltage RMS value is required to be lower than the threshold value (nominal voltage multiplied by this parameter), which affects the judgment result of the sag event. The stricter the power quality requirement is, the larger the value is.
Voltage interruption	0~50.0%	When the interrupt event is judged, the real-time voltage RMS value is required to be lower than the threshold value (nominal voltage multiplied by this parameter), which affects the judgment result of the interrupt event. The stricter the power quality requirement is, the larger the value is.
DI trigger	DI1~DI2	It only supports the recording function when the 2-channel DI triggering on the main body of the instrument is supported.
Reservation recording	00-00-00 00：00：00	The format corresponds to year-month-day hour: minute: second. After modifying the date time, save the change settings. When the system time reaches the set reservation recording time, record the waveform.
Manually recording once	Yes、No	The default is No. When you change to Yes, press √ to record the wave immediately.

6. 10 Demand settings

On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "demand setting" is highlighted, press √ to enter the demand setting interface. Press ∧ or ∨ to switch the item of demand setting, press Enter to enter the setting of the item, press + or - to change. After the change is completed, press Exit, enter the password in the pop-up window, press SaveExit to save the changes and exit, press Esc to exit without saving the changes.

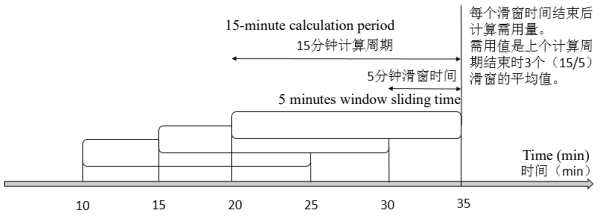




Setting item	range
Demand width	1，2，3，5Min
Demand cycle	5-60Min (set according to the required width, must be an integral multiple of the required width)

Demand calculation method：

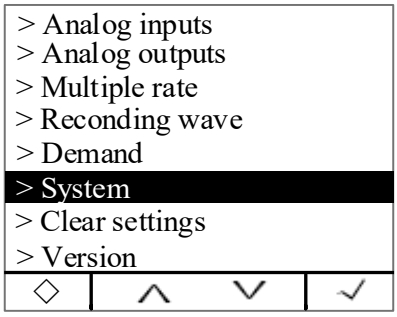
The APM series meters use the sliding window method to calculate the required amount. In the sliding window calculation cycle, select a calculation cycle and a sliding window. The sliding window must divide the calculation period equally. For example: set three 5 minute sliding windows in the 15-minute calculation cycle. Refresh the current demand at the end of each sliding window. The schematic diagram is as follows:

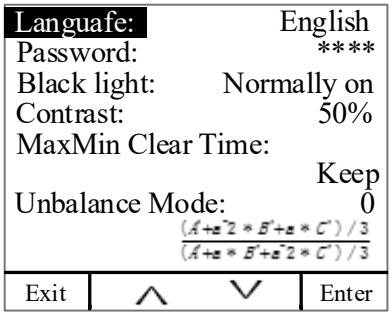


At the end of each sliding window time, the required amount is calculated. The required value is the average of three (15/5) sliding windows at the end of the last calculation cycle.

6. 11 System settings

On the main interface, press Menu to enter the menu interface, press ∨ until “Parameter Setting” is highlighted, and press √ to enter the parameter setting interface. Press ∨ until “System Settings” is highlighted, press √ to enter the system settings interface. Press ∧ or ∨ to switch the system settings, press Enter, enter the password in the pop-up window, press Clr&Exit to wait for the clearing, press Esc to clear the project data, and press Exit to exit.





Setting item	range	description
language	Chinese, English, the factory default setting is Chinese	Change the instrument display language
password	0000~9999，The factory default is 0001, customers can modify the settings themselves. If you forget your password, you need to contact me.	Change the original password and change it.
Backlight time	Constantly bright, 1~9999, the meter defaults to always bright	1~9999: After delaying the set value, the backlight is off, in seconds.
Contrast	1~99%，The meter default is 50%	Change meter display contrast, default is 50%
Extreme self-clearing time	Always keep, re-statistics every month, re-statistics every day, re-statistics every hour, re-statistic every 30 minutes, re-statistic every 15 minutes, the meter defaults to keep	Extreme statistical time

Unbalanced calculation mode	$0=\frac{(A'+a^2*B'+a*C')/3}{(A'+a*B'+a^2*C')/3}$ Negative order imbalance degree $1=\frac{(A'+B'+C')/3}{(A'+a*B'+a^2*C')/3}$ Zero-order unbalance $2=\frac{max-min}{max}$ $3=\frac{max\{\|A-avg\|,\|B-avg\|,\|C-avg\|\}}{ave}$ $4=\frac{max\{\|A-ave\|,\|B-ave\|,\|C-ave\|\}}{rating}$ In the above algorithm Algorithm 0, 1 reference GB/T 15543-2008 Algorithm 2 reference Q/GDW 1519-2014 Algorithm 3 reference IEEE std 1159 1995-RECOMMENDED PRACTICE FOR MONITORING ELECTRIC POWER QUALITY Algorithm 4, our company A、B、C：Effective value of each phase A'、B'、C'：Phase vector max：Three phase maximum min：Three-phase minimum avg：Three-phase average rating 为：Rating *The meter default is 0*	5 different imbalance algorithms, customers can set according to their needs. When conditions permit, try to use algorithm 0 or algorithm 1. If the condition is not allowed, it is recommended to use algorithm 3 or algorithm 4. In addition, it should be noted that the imbalance calculation is a relative percentage, and the calculation should be considered at the same time. The magnitude of the load rate is large for the unbalanced calculation under the condition of small load rate, and the impact and harm are small.
Time	yy-mm-dd hh:mm:ss	Display format is year, month, day, hour, minute, second
Default interface	Off (default is off) Overview, current line voltage, current current, frequency, total power, active power demand, active energy, reactive energy, apparent energy, total forward rate power, total reverse rate power, total current harmonics, voltage Total harmonics, vector graphics, voltage sequence components, current sequence components, DIDO event records, current alarm status, transient records, TF card storage status	After 1 minute without any operation, the meter jumps back to the main interface, after the instrument is powered off.

6. 12 Clear settings

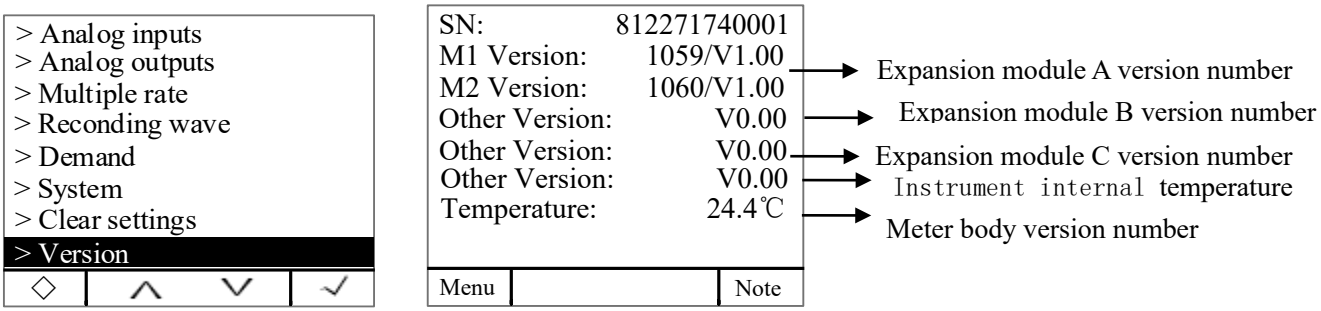
On the main interface, press Menu to enter the menu interface, press ∨ until "Parameter Setting" is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "Clear Settings" is highlighted, press √ to enter the

clear settings interface. Press ∧ or ∨ to switch to clear the set item, press Enter, enter the password in the pop-up window, press Clr&Exit to wait for the clearing, press Esc to clear the project data, and press Exit to exit.

project	Description
Clear power	Clear power
Clear demand	Clear power demand, current demand
Clear extreme value	Clear the maximum and minimum values of voltage, current and other electrical parameters
Clear alarm and switch records	Clear alarm record and switch record
Clear transient waveform record	Clear voltage waveform records such as voltage interruption, sag, sag, and inrush current

6. 13 version information

On the main interface, press Menu to enter the menu interface, press ∨ until the parameter setting is highlighted, and press √ to enter the parameter setting interface. Press ∨ until "Version Information" is highlighted, press √ to enter the version information. Contains meter version information, module version information, and meter internal temperature.



Press Note to view the description of the alarm symbol in the display area in the upper right corner of the meter.

6. 14 TF card record configuration

1.Read the data in the TF card using a card reader on the computer

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.

Note：If the meter displays Check Ini File, that is, the meter configuration file is wrong, after disconnecting the power (refer to 3.3 assembly), after using the card reader to format the TF on the computer, re-load the meter and re-power it to see if the meter works normally. This configuration operation is restricted only when the external expansion module MLOG is configured.

7. Modbus Communication instructions

7. 1 Intruduction

The APM series network power meter communication uses the MODBUS-RTU communication protocol. The MODBUS protocol defines the check code and data sequence in detail. These are the necessary contents for specific data exchange.

The first communication supports 0x03 (read holding register), 0x16 (write multiple registers), 0x01 (read coil status), 0x02 (read input status), 0x05 (write single coil) function code.

If the second communication or Ethernet communication (MODBUS-TCP) is extended, only the 0x03 (read holding register) function code is supported.

Communication Address Table

Register (WORD)	Description	unit	Data Type	Parameters
0	address		Int16 (RW)	Range：1~247
1	Baud rate		Int16 (RW)	0：38400 1：19200 2：9600(default) 3：4800 4：2400 5：1200
2	Calibration method		Int16 (RW)	0：None Parity with one stop bit(default) 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)	1-32760A
7-8	Nominal Primary Voltage L-L	1V	Int32 (RW)	100V-1200KV
10	Baud rate(COMM2,slave)		Int16 (RW)	0：38400 1：19200 2：9600 3：4800 4：2400 5：1200
11	Parity(COMM2,slave)		Int16 (RW)	0：None Parity with one stop bit(default) 1：None Parity with two stop bits 2：Odd Parity with one stop bit 3：Even Parity with one stop bit
12	Reserved			

13	Neutral current secondary side rating		Int16 (RW)	1Aor 5A
14	Neutral current primary side rating	1A	Int16 (RW)	1A-32760A
15	Pulse constant	100	Int16 (RW)	100-10000
16	Unbalance algorithm		Int16 (RW)	Unbalance algorithm(0-4)
18	Profibus address		Int16 (RW)	range：1~126
19	Internal temperature	0.1℃	Int16 (RW)	range-400~1250
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	Write IP enable		Int16 (RW)	code: 0XABCD
30-31	IP address		Int32 (RW)	Eg：192.168.1.150。 Address:30:C0A8H 地址 31: 0196H
31-32	Subnet mask		Int32 (RW)	Eg：255.255.255.0。 Address32：FFFFH；Address33：FF00H
33-35	Gateway address		Int32 (RW)	Eg：192.168.1.1。 Address34：C0A8H；Address35：0101H
36	Port Number		Int16 (RW)	0~9999
37	IP address allocation		Int16 (RW)	0 Manual：；1： Automatic(DHCP)
38	Set IP mode		Int16 (RW)	code: 0XABCD
40	SD Storage State		Int16 (RO)	0,0x11：No TF module or no card 0x22：TF card error 0x33：TF card is normal 0x44：Full storage 0x55：Full storage 0x66：Error in Configuration File
41	TF Total capacity	1M	Int16 (RO)	Unit : Megabytes
42	TF Residual capacity	1M	Int16 (RO)	Unit : Megabytes
46-48	645Table number			
60	Nominal current	0.001A	Int16 (RO)	Secondary side nominal current for calculating voltage deviation
61	Nominal voltage	0.1V	Int16 (RO)	Secondary side nominal voltage for calculating voltage deviation
62	Nominal frequency	0.01Hz	Int16 (RO)	Nominal frequency used to calculate frequency deviation

81-83	MAC address			
89	Pulse output selection			High byte0=second pulse 1-5as followed0.01、0.1、1、10、100kwh/imp Low byte0=Total merit 1-5Total reactive、total apparent（The fundamental wave is active, the fundamental wave is reactive, and the fundamental wave is visible -> the specified model is available.）
90	Power on page			
91	Voltage shielding	0.01%		0~999 （9.99%）
92	Current shielding	0.01%		0~999 （9.99%）
93	Neutral current shielding	0.01%		0~999 （9.99%）
94	Whether the digital display mode is fixed or dynamic			0,1
95	Digital display does not move			8000-9999
96	language			0,1
97	Demand width			1 2 3 5
98	Demand cycle			1~60
99	Maximum data time			0~5express different meanings 0：keep 1：monthly recalculation 2：data recalculation 3：recalculation every hour 4：recalculation every 30 minute 5：recalculation every 15 minute
100	Shock electric	0.1%		1000~9999 （999.9%）
101	Voltage rise	0.1%		1000~9999 （999.9%）
102	Voltage dip	0.1%		100~1000 （100.0%）
103	Loss voltage	0.1%		0~500 （50.0%）
104	Voltage over harmonic	0.01%		0~10000 （100.00%）
105	Current over harmonic	0.01%		0~10000 （100.00%）
106-119	reserved			
120	Blast cooling value(module 1)	0.1℃	Int16 (RW)	0-9999
121	Hysteresis of blast cooling	0.1℃	Int16 (RW)	0-9999
122	Delay of blast cooling	1s	Int16 (RW)	0-9999
123	Heating for rise temperature value	0.1℃	Int16 (RW)	0-9999

124	Hysteresis of heating for rise temperature	0.1℃	Int16 (RW)	0-9999
125	Delay of heating for rise temperature	1s	Int16 (RW)	0-9999
126	Heating for dehumidification value	0.1%	Int16 (RW)	0-9999
127	Hysteresis of heating for dehumidification	0.1%	Int16 (RW)	0-9999
128	Delay of heating for dehumidification	1s	Int16 (RW)	0-9999
129	Blast cooling value(module 2)	0.1℃	Int16 (RW)	0-9999
130	Hysteresis of blast cooling	0.1℃	Int16 (RW)	0-9999
131	Delay of blast cooling	1s	Int16 (RW)	0-9999
132	Heating for rise temperature value	0.1℃	Int16 (RW)	0-9999
133	Hysteresis of heating for rise temperature	0.1℃	Int16 (RW)	0-9999
134	Delay of heating for rise temperature	1s	Int16 (RW)	0-9999
135	Heating for dehumidification value	0.1%	Int16 (RW)	0-9999
136	Hysteresis of heating for dehumidification	0.1%	Int16 (RW)	0-9999
137	Delay of heating for dehumidification	1s	Int16 (RW)	0-9999
138	Blast cooling value(module 3)	0.1℃	Int16 (RW)	0-9999
139	Hysteresis of blast cooling	0.1℃	Int16 (RW)	0-9999
140	Delay of blast cooling	1s	Int16 (RW)	0-9999
141	Heating for rise temperature value	0.1℃	Int16 (RW)	0-9999
142	Hysteresis of heating for rise temperature	0.1℃	Int16 (RW)	0-9999
143	Delay of heating for rise temperature	1s	Int16 (RW)	0-9999
144	Heating for dehumidification value	0.1%	Int16 (RW)	0-9999
145	Hysteresis of heating for dehumidification	0.1%	Int16 (RW)	0-9999
146	Delay of heating for dehumidification	1s	Int16 (RW)	0-9999

147-241	reserved			
242	Neutral current	0.001A	Int16 (RO)	Secondary side
243	A phase voltage	0.1V	Int16 (RO)	Secondary side
244	B phase voltage	0.1V	Int16 (RO)	Secondary side
245	C phase voltage	0.1V	Int16 (RO)	Secondary side
246	AB line voltage	0.1V	Int16 (RO)	Secondary side
247	BC line voltage	0.1V	Int16 (RO)	Secondary side
248	CA line voltage	0.1V	Int16 (RO)	Secondary side
249	A phase current	0.001A	Int16 (RO)	Secondary side
250	B phase current	0.001A	Int16 (RO)	Secondary side
251	C phase current	0.001A	Int16 (RO)	Secondary side
252	frequency	0.01Hz	Int16 (RO)	
253-254	A phase active power	0.01W	Int32 (RO)	Secondary side
255-256	B phase active power	0.01W	Int32 (RO)	Secondary side
257-258	C phase active power	0.01W	Int32 (RO)	Secondary side
259-260	Total active power	0.01W	Int32 (RO)	Secondary side
261-262	A phase reactive power	0.01Var	Int32 (RO)	Secondary side
263-264	B phase reactive power	0.01Var	Int32 (RO)	Secondary side
265-266	C phase reactive power	0.01Var	Int32 (RO)	Secondary side
267-268	Total reactive power	0.01Var	Int32 (RO)	Secondary side
269-270	A phase apparent power	0.01VA	Int32 (RO)	Secondary side
271-272	B phase apparent power	0.01VA	Int32 (RO)	Secondary side
273-274	C phase apparent power	0.01VA	Int32 (RO)	Secondary side
275-276	Total apparent power	0.01VA	Int32 (RO)	Secondary side
277	A phase power factor	0.001	Int16 (RO)	
278	B phase power factor	0.001	Int16 (RO)	
279	C phase power factor	0.001	Int16 (RO)	
280	Power factor	0.001	Int16 (RO)	
300-301	Positive active energyEPI	1WH	Int32 (RO)	Secondary side
302-303	Reverse active energy EPE	1WH	Int32 (RO)	Secondary side
304-305	Positive reactive energy EQL	1WH	Int32 (RO)	Secondary side
306-307	Reverse active energy EQC	1WH	Int32 (RO)	Secondary side
308-317	Total forward rate（Total peak flat valley）			
318-327	Monthly positive rate			
328-337	Positive rate for the previous month			
338-347	Last month's positive rate			
348-357	Total reverse rate			

358-367	Monthly reverse multi-rate			
368-377	Previous month reverse multi-rate			
378-387	Last month reverse multi-rate			
388-389	Positive apparent energy			
390-391	Reverse apparent energy			
392-393	Net active energy			
394-395	Net reactive energy			

Eight rate address table: (T1 tip , T2 peak, T3 flat, T4 valley, T5 deep valley, T6-T8 temporarily reserved)

Register (WORD)	Name	Resolution	Data Type (Read Write Attribute)	Remarks
7728	Total positive active energy (T)	1WH	Uint32 (RO)	Secondary side electrical energy
772A	Total positive active tip energy (T1)	1WH	Uint32 (RO)	Secondary side electrical energy
772C	Total positive active peak energy (T2)	1WH	Uint32 (RO)	Secondary side electrical energy
772E	Total positive active flat energy (T3)	1WH	Uint32 (RO)	Secondary side electrical energy
7730	Total positive active valley energy (T4)	1WH	Uint32 (RO)	Secondary side electrical energy
7732	Total positive active deep valley energy (T5)	1WH	Uint32 (RO)	Secondary side electrical energy
7734	Reserved(T6)	1WH	Uint32 (RO)	Secondary side electrical energy
7736	Reserved(T7)	1WH	Uint32 (RO)	Secondary side electrical energy
7738	Reserved(T8)	1WH	Uint32 (RO)	Secondary side electrical energy
773A	Total positive active energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
773C	Total positive active tip energy of this month (T1)	1WH	Uint32 (RO)	Secondary side electrical energy
773E	Total positive active peak energy of this month(T2)	1WH	Uint32 (RO)	Secondary side electrical energy
7740	Total positive active flat energy of this month(T3)	1WH	Uint32 (RO)	Secondary side electrical energy
7742	Total positive active valley energy of this month(T4)	1WH	Uint32 (RO)	Secondary side electrical energy
7744	Total positive active deep valley energy of this month(T5)	1WH	Uint32 (RO)	Secondary side electrical energy

7746	Reserved(T6)	1WH	Uint32 (RO)	Secondary side electrical energy
7748	Reserved(T7)	1WH	Uint32 (RO)	Secondary side electrical energy
774A	Reserved(T8)	1WH	Uint32 (RO)	Secondary side electrical energy
7824	Total reversed active energy (T)	1WH	Uint32 (RO)	Secondary side electrical energy
7826	Total reversed active tip energy (T1)	1WH	Uint32 (RO)	Secondary side electrical energy
7828	Total reverse active peak energy (T2)	1WH	Uint32 (RO)	Secondary side electrical energy
782A	Total reverse active flat energy (T3)	1WH	Uint32 (RO)	Secondary side electrical energy
782C	Total reverse active valley energy (T4)	1WH	Uint32 (RO)	Secondary side electrical energy
782E	Total reverse active deep valley energy (T5)	1WH	Uint32 (RO)	Secondary side electrical energy
7830	Reserved(T6)	1WH	Uint32 (RO)	Secondary side electrical energy
7832	Reserved(T7)	1WH	Uint32 (RO)	Secondary side electrical energy
7834	Reserved(T8)	1WH	Uint32 (RO)	Secondary side electrical energy
7836	Total reverse active energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
7838	Total reverse active tip energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
783A	Total reverse active peak energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
783C	Total reverse active flat energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
783E	Total reverse active valley energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
7840	Total reverse active deep valley energy of this month (T)	1WH	Uint32 (RO)	Secondary side electrical energy
7842	Reserved(T6)	1WH	Uint32 (RO)	Secondary side electrical energy
7844	Reserved(T7)	1WH	Uint32 (RO)	Secondary side electrical energy
7846	Reserved(T8)	1WH	Uint32 (RO)	Secondary side electrical energy
7530	Total positive active energy (T)	1WH	Float (RO)	Primary side electrical energy
7532	Total positive active tip energy (T1)	1WH	Float (RO)	Primary side electrical energy
7534	Total positive active peak energy (T1)	1WH	Float (RO)	Primary side electrical energy
7536	Total positive active flat energy (T1)	1WH	Float (RO)	Primary side electrical energy
7538	Total positive active valley energy (T1)	1WH	Float (RO)	Primary side electrical energy
753A	Total positive active deep valley energy (T1)	1WH	Float (RO)	Primary side electrical energy
753C	Reserved(T6)	1WH	Float (RO)	Primary side electrical energy
753E	Reserved(T7)	1WH	Float (RO)	Primary side electrical energy
7540	Reserved(T8)	1WH	Float (RO)	Primary side electrical energy
7542	Total positive active energy of this month (T)	1WH	Float (RO)	Primary side electrical energy
7544	Total positive active tip energy of this	1WH	Float (RO)	Primary side electrical energy

	month (T1)				
7546	Total positive active peak energy of this month (T2)		1WH	Float (RO)	Primary side electrical energy
7548	Total positive active flat energy of this month (T3)		1WH	Float (RO)	Primary side electrical energy
754A	Total positive active valley energy of this month (T4)		1WH	Float (RO)	Primary side electrical energy
754C	Total positive active deep valley energy of this month (T5)		1WH	Float (RO)	Primary side electrical energy
754E	Reserved(T6)		1WH	Float (RO)	Primary side electrical energy
7550	Reserved(T7)		1WH	Float (RO)	Primary side electrical energy
7552	Reserved(T8)		1WH	Float (RO)	Primary side electrical energy
7554	History January energy	Total positive active energy (T)	1WH	Float (RO)	Primary side electrical energy
7556		Total positive active tip energy (T1)	1WH	Float (RO)	Primary side electrical energy
7558		Total positive active peak energy (T2)	1WH	Float (RO)	Primary side electrical energy
755A		Total positive active flat energy (T3)	1WH	Float (RO)	Primary side electrical energy
755C		Total positive active valley energy (T4)	1WH	Float (RO)	Primary side electrical energy
755E		Total positive active deep valley energy (T5)	1WH	Float (RO)	Primary side electrical energy
7560		Reserved(T6)	1WH	Float (RO)	Primary side electrical energy
7562		Reserved(T7)	1WH	Float (RO)	Primary side electrical energy
7564		Reserved(T8)	1WH	Float (RO)	Primary side electrical energy

7566	History February positive active energy	7578	History March positive active energy	758A	History April positive active energy
759C	History May positive active energy	75AE	History June positive active energy	75C0	History July positive active energy
75D2	History August positive active power	75E4	History September positive active energy	75F6	History October positive active power
7608	History November positive active power	761A	History December positive active power		

Register (WORD)	Name	Resolution	Data Type (Read Write Attribute)	Remarks
762C	Reverse total active energy (T)	1WH	Float (RO)	Primary side electrical energy
762E	Reverse total active tip energy (T1)	1WH	Float (RO)	Primary side electrical energy

7630	Reverse total active peak energy (T2)		1WH	Float (RO)	Primary side electrical energy
7632	Reverse total active flat energy (T3)		1WH	Float (RO)	Primary side electrical energy
7634	Reverse total active valley energy (T4)		1WH	Float (RO)	Primary side electrical energy
7636	Reverse total active deep valley energy (T5)		1WH	Float (RO)	Primary side electrical energy
7638	Reserved (T6)		1WH	Float (RO)	Primary side electrical energy
763A	Reserved (T7)		1WH	Float (RO)	Primary side electrical energy
763C	Reserved (T8)		1WH	Float (RO)	Primary side electrical energy
763E	Total reversed active energy of this month (T)		1WH	Float (RO)	Primary side electrical energy
7640	Total reversed active tip energy of this month (T1)		1WH	Float (RO)	Primary side electrical energy
7642	Total reversed active peak energy of this month (T2)		1WH	Float (RO)	Primary side electrical energy
7644	Total reversed active flat energy of this month (T3)		1WH	Float (RO)	Primary side electrical energy
7646	Total reversed active valley energy of this month (T4)		1WH	Float (RO)	Primary side electrical energy
7648	Total reversed active deep valley energy of this month (T5)		1WH	Float (RO)	Primary side electrical energy
764A	Reserved (T6)		1WH	Float (RO)	Primary side electrical energy
764C	Reserved (T7)		1WH	Float (RO)	Primary side electrical energy
764E	Reserved (T8)		1WH	Float (RO)	Primary side electrical energy
7650	History January energy	Reverse total active energy (T)	1WH	Float (RO)	Primary side electrical energy
7652		Reverse tip active energy (T1)	1WH	Float (RO)	Primary side electrical energy
7654		Reverse peak active energy (T2)	1WH	Float (RO)	Primary side electrical energy
7656		Reverse flat active energy (T3)	1WH	Float (RO)	Primary side electrical energy
7658		Reverse valley active energy (T4)	1WH	Float (RO)	Primary side electrical energy
765A		Reverse deep valley active energy (T5)	1WH	Float (RO)	Primary side electrical energy
765C		Reserved (T6)	1WH	Float (RO)	Primary side electrical energy
765E		Reserved (T7)	1WH	Float (RO)	Primary side electrical energy
7660		Reserved (T8)	1WH	Float (RO)	Primary side electrical energy

7662	History February reverse	7674	History March reverse	7686	History April reverse

	active energy		active energy		active energy
7698	History May reverse active energy	76AA	History June reverse active energy	76BC	History July reverse active energy
76CE	History August reverse active power	76E0	History September reverse active energy	76F2	History October reverse active power
7704	History November reverse active power	7716	History December reverse active power		

Register(WORD)	name	Unit	Data Type	Parameters
1100-1101	A phase current	0.001A	Int32 (RO)	Primary
1102-1103	B phase current	0.001A	Int32 (RO)	Primary
1104-1105	C phase current	0.001A	Int32 (RO)	Primary
1106-1107	Neutal current	0.001A	Int32 (RO)	Primary
1108-1109	Average current	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	Current angle between IA and IB	0.1°	Int16 (RO)	
1115	Current angle between IB and IC	0.1°	Int16 (RO)	
1116	Current angle between IC and IA	0.1°	Int16 (RO)	
1117-1119	ABC current deviation	0.1%		
1120-1121	A phase voltage	0.1V	Int32 (RO)	Primary
1122-1123	B phase voltage	0.1V	Int32 (RO)	Primary
1124-1125	C phase voltage	0.1V	Int32 (RO)	Primary
1126-1127	Average phase voltage	0.1V	Int32 (RO)	Primary
1128-1129	AB line voltage	0.1V	Int32 (RO)	Primary
1130-1131	BC line voltage	0.1V	Int32 (RO)	Primary
1132-1133	CA line voltage	0.1V	Int32 (RO)	Primary
1134-1135	Average line voltage	0.1V	Int32 (RO)	Primary
1136	Voltage Unbalance Phase A	0.1%	Int16 (RO)	Primary
1137	Voltage Unbalance Phase B	0.1%	Int16 (RO)	Primary
1138	Voltage Unbalance Phase C	0.1%	Int16 (RO)	Primary
1139	Voltage Unbalance MAX	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	Maximum line voltage imbalance	0.1%	Int16 (RO)	Primary
1144	Voltage angle between UA and UB	0.1°	Int16 (RO)	
1145	Voltage angle between UB and UC	0.1°	Int16 (RO)	
1146	Voltage angle between UC and UA	0.1°	Int16 (RO)	
1147-1149	ABC voltage deviation	0.1%		
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	Apparent power,phase A	0.01VA	Float (RO)	Primary
1168-1169	Apparent power,phase B	0.01VA	Float (RO)	Primary
1170-1171	Apparent power,phase C	0.01VA	Float (RO)	Primary
1172-1173	Apparent power,Total	0.01VA	Float (RO)	Primary
1174-1176	ABC voltage and current angle	0.1		
1179	frequency	0.01Hz	Int16 (RO)	Primary
1180	Power factor,phase A	0.001	Int16 (RO)	Primary
1181	Power factor,phase B	0.001	Int16 (RO)	Primary
1182	Power factor,phase C	0.001	Int16 (RO)	Primary
1183	Power factor	0.001	Int16 (RO)	Primary
1190	voltage crest factor,phase A	0.001	Int16 (RO)	
1191	voltage crest factor,phase B	0.001	Int16 (RO)	
1192	voltage crest factor,phase C	0.001	Int16 (RO)	
1193	Telephone waveform factor,phase A	0.01	Int16 (RO)	
1194	Telephone waveform factor,phase B	0.01	Int16 (RO)	
1195	Telephone waveform factor,phase C	0.01	Int16 (RO)	
1196	Phase A current K factor	0.01	Int16 (RO)	
1197	Phase B current K factor	0.01	Int16 (RO)	

1198	Phase C current K factor	0.01	Int16 (RO)	
1200-1201	A phase current maximum demand	0.001A	Int32 (RO)	Primary
1202-1203	Data and time the Current Demand MAX，Phase A	month、day	Int16 (RO)	High byte: month Low byte: day
		hour 、mimute	Int16 (RO)	High byte: hour Low byte: minute
1204-1207	Current Demand MAX, Phase B			Same phase A current
1208-1211	Current Demand MAX, Phase C			Same phase A current
1212-1213	Active Power Demand MAX，Total	0.01W	Float (RO)	Primary
1214-1215	Data and time the Active Power Demand MAX ,Total	year 、month、day	Int16 (RO)	High byte high four: year High byte fourth place: month Low byte: day
		hour 、minute	Int16 (RO)	High byte: hour Low byte: minute
1216-1219	Reactive Power Demand MAX，Total			Same total active power
1220-1223	Real Power Demand MAX，Total			Same total active power
1250-1251	Current demand,phase A	0.001A	Int32 (RO)	Primary
1252-1253	Current demand,phase B	0.001A	Int32 (RO)	Primary
1254-1255	Current demand,phase C	0.001A	Int32 (RO)	Primary
1260-1261	Active Power Demand , Total	0.01W	Float (RO)	Primary
1262-1263	Reactive Power Demand , Total	0.01Var	Float (RO)	Primary
1264-1265	Total power demand	0.01VA	Float (RO)	Primary
1266-1267	A phase voltage positive sequence	0.1V	Int32 (RO)	Primary
1268-1269	Phase B voltage negative sequence	0.1V	Int32 (RO)	Primary
1270-1271	Phase C voltage zero sequence	0.1V	Int32 (RO)	Primary
1272-1273	A phase current positive sequence	0.001A	Int32 (RO)	Primary
1274-1275	B phase current negative sequence	0.001A	Int32 (RO)	Primary
1276-1277	C phase current zero sequence	0.001A	Int32 (RO)	Primary

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
1300	The first group of alarms: Phase A overcurrent alarm		UInt16 (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 enabled, when Bit1 is 0, the zero value alarm is disabled;
1301	Alarm action value		UInt16 (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	UInt16 (RW)	range：0～9999
1303	Alarm recovery value		UInt16 (RW)	Primary. Range：0～9999
1304	Delay time of Recovery	1s	UInt16 (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 over voltage alarm	1370	Phase C over voltage alarm	1375	Maximum phase overvoltage alarm
1380	Phase AB over voltage alarm	1385	Phase C over voltage alarm	1390	CA line over voltage alarm
1395	Maximum line over voltage alarm	1400	Phase A under voltage alarm	1405	Phase B under voltage alarm
1410	Phase C under voltage alarm	1415	Minimum phase under voltage alarm	1420	AB line unde rvoltage alarm
1425	BC line under voltage alarm	1430	CA line under voltage alarm	1435	Minimum line under voltage 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	1520	Over total harmonic of Phase A	1525	Over total harmonic of Phase B

	current alarm		voltage alarm		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 set of alarm settings: refer to the first set of alarm A phase overcurrent alarm

1750	Phase A over current alarm	1755	Phase B over current alarm	1760	Phase C over current 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 under power alarm	1925	Total reactive under power alarm
1930	Total apparent under power 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	2025	Over total odd harmonic of	2030	Over total odd harmonic of Phase

	B current alarm		Phase C current alarm		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	Action information		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:Second

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.

10000-10767	Overcurrent alarm (16 in total, the same below)
10768-11535	Undercurrent alarm event
11536-12303	Overvoltage alarm event
12304-13071	Undervoltage alarm event
13072-13839	Overpower alarm event
13840-14607	Underpower alarm event
14608-15375	Demand alarm event
15376-16143	Power factor alarm event
16144-16911	Total harmonic alarm event
16912-17679	Total even harmonic alarm event
17680-18447	Total odd harmonic alarm event
18448-19215	Digital input alarm event
19216-19983	Other alarm events

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 of relay 5	2650	Associated alarm configuration of relay 6	2662	Associated alarm configuration 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
3008	Positive apparent power			
3010	Reverse apparent power			
3012	Net active energy			
3014	Net reactive energy			
3050-3190	Total, this month, historical January to December positive			

	energy (total peak, flat valley, five groups)				
3190-3330	Total, this month, historical January to December positive energy (total peak, flat valley, five groups)				
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 voltage in this month	Maximum	0.1V	Int32 (RO)	Primary
3527		Year and month of occurrence		Int16 (RO)	High byte: Year; Low byte: Month
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 second of occurrence		Int16 (RO)	High byte: Minute; Low byte: Second
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 B 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 Phase average voltage in last month
3905	Maximum of AB line voltage in last month	3910	Maximum of BC line voltage in last month	3915	Maximum of CA line voltage in 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	4000	Maximum of total power factor in	4005	Maximum of frequency in last

	factor in last month		last month		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 Phase C 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 current	0.01%	Int16 (RO)	
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 C 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	Total even harmonic distortion (TEHD) of Phase B current	0.01%	Int16 (RO)	
4886	Total even harmonic distortion (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 harmonic current	0.001A	Int32 (RO)	Primary
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	

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 output	5442	Setting of the 15th transmission output	5445	Setting of the 16th transmission 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	5496		5499	

	transmission output				
5496-5528	Transmitting output value				

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

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**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.

7. 1. 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.

7. 1. 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.

7. 1. 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.

7. 1. 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:

$$(-1)^0 \times 2^{(142-127)} \times \left(1+\frac{4959232}{2^{23}}\right) = 52140 \text{ wh} = 52.14 \text{ kWh}$$

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.

7. 1. 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%.

7.1.6 **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	Address1	Address2	Address3			Address4	
Content	H16	L16	H8			H8	L8
	INT32		H4	L4	8		
	Demand value		Year (Only a bit is reserved, ten bit needs to be filled in according to the current time)	Month		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.

7.1.7 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	Address1									Address2		Address3		Address4	
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 event record 1 (2200-2203) as an example, the reading 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	Year	Month	Day	Hour	Minute	Second
Analysis	DO	Closed							DO1	17	1	22	14	56	32

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

7. 1. 8 **Alarm Record**

The data format of the alarm record is as follows:

Address	Address1		Address2		Address3		Address4		Address5	Address6
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

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

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 group	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

7.1.9 DO Setting

Associated alarm configuration format of do settings is as follows:

Address	Address1							Address2	
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	Address3							Address4	
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	Address5							Address6	
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	Address7							Address8	
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	Address9							Address10	
Content	H16							L16	
	INT32								
	B31			B14	B13	…	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	Address11							Address12	
Content	H16							L16	
	INT32								

	B31	B30	B29	…	B2	B1	B0
				…		Associated with the alarm number 63 of the second group (DI2 alarm)	Associated with the alarm number 31 of the second group (Alarm of over reactive power)

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.

8. Ethernet Communication Guide

8.1 Ethernet Parameter Modification

8.1.1 Modification by Button

Refer to 6.3 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.

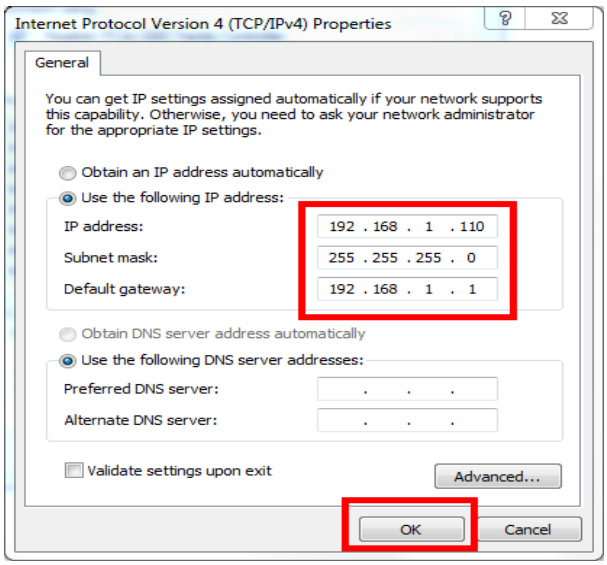
2) The new value can be written to the register after entering the Ethernet setting mode. If the Ethernet mode is not entered, the modification is invalid.

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

1、Local network settings

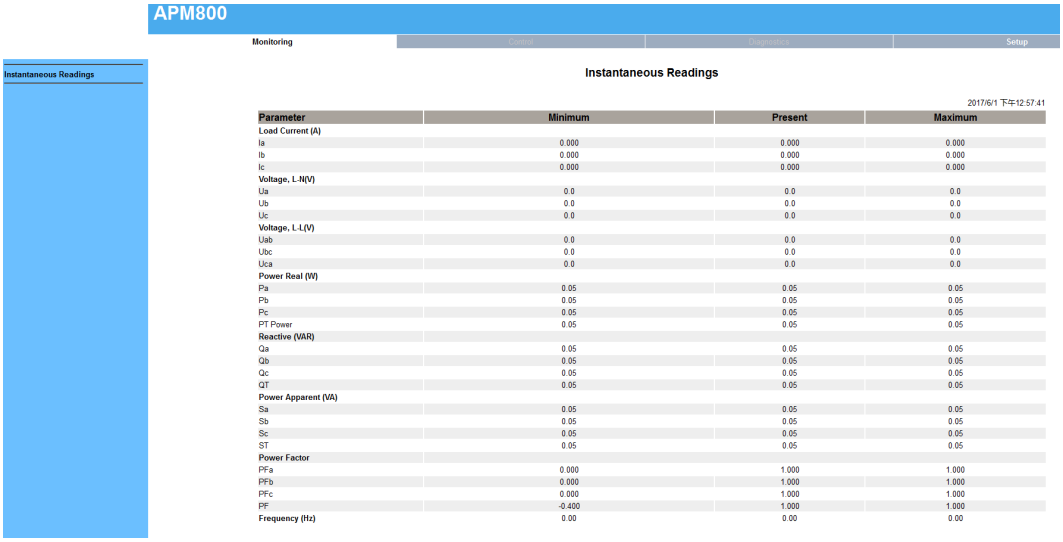
Firstly, enter the operating system (take win7 as an example), use the mouse to click on the network icon on the bottom right corner, click on "Open Network and Sharing Center", click on the change adapter settings, right-click the local connection, click properties, double-click Internet Protocol Version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



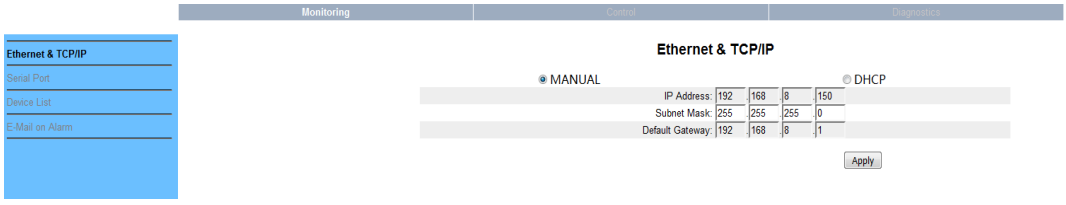
Connect the Ethernet module and the computer with a twisted-pair B cable, power the meter. If the local connection on the bottom right corner of the computer monitor is connected at this point, you can continue to the next step. Otherwise, power off the meter, check the network cable and network settings.

2、**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

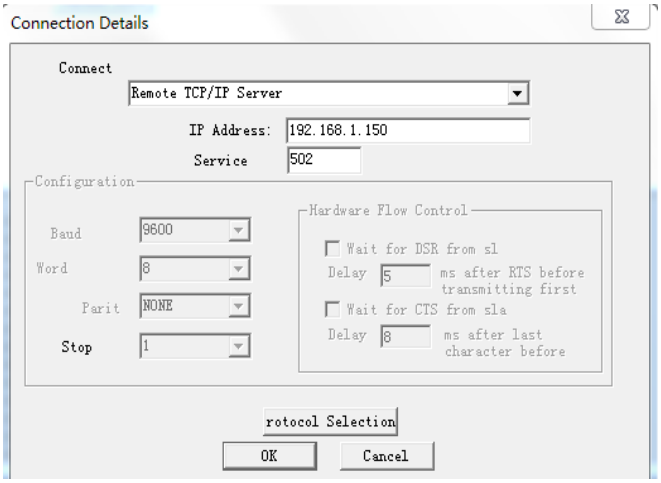
Extended 485 communication does not support the DLT-645 protocol and only supports the Modbus-RTU protocol.

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 Modbus_TCP communication (Using ModScan software)

When using the Ethernet Modbus_TCP protocol, it supports 0x01 (read coil status), 0x02 (read input status), 03 (read hold register), 0x05 (write single coil). (Note: When using the 01, 02, and 05 commands, they all correspond to the APM8xx meter's own information. DI1 and DO1 correspond to the starting address 0.)



The contents of the following address table are for Modbus TCP operation only. (Related to the slave information read by the user)

Register (WORD)	Name	Resolution	Data type (Read-write attribute)	Note
39992-39993	Group 32-1 slave status		Int32 (RO)	The high byte is first, the low byte is after, bit0 is the first group state, and 1 is the read failure, and the corresponding cache is cleared.
39994-39995	Group 64-33 slave status		Int32 (RO)	The same as above
39996-39997	Group 96-65 slave status		Int32 (RO)	The same as above
39998-39999	Group 128-97 slave status		Int32 (RO)	The same as above
40000-57999	Information area read from slave station		RO	Example is as follow
58000	Read slave station timeout	1ms	UInt16(RW)	Example is as follow
58001	Slave station access interval time	1ms	UInt16(RW)	Example is as follow
58002	Group 1 slave station address		UInt16(RW)	1-247 (Slave address station, does not take effect when set to 0)
58003	Group 1 communication start address		UInt16(RW)	0-65535
58004	Group 1 communication length		UInt16(RW)	1-125(Does not take effect when set to 0)
58005-58385	Group 2-128 slave station settings		UInt16(RW)	Same as58002-58004
58386-58399	Reserved			
58400-58527	Failure rate		UInt16(RO)	Communication reads state of each group, the slave access failure rate of last 20 visits, 100% means the

				disconnection and clear cache
58600-58728	Number of errors		UInt16(RO)	The cumulative number of failures used to debug slave access
58800-58928	Number of transmissions		UInt16(RO)	The cumulative number of transmissions used to debug slave access

E.g:

The settings are as follows: The first group slave station address is 1, the start address is set to 0, the communication length is 125, the second group slave station address is 2, the start address is 20, and the communication length is 125, the read information area 40000-40124 corresponds to the information of the first group of slave station addresses 0-125, 40125-40249 corresponds to the information of the second group of slaves station 20-144, and so on, when the communication length of the 128 groups of devices is 125, the corresponding information area is 40000 -55999. If fail to read the information from the slave station, the read information area corresponding to the slave station is 0.

Baud rate (bps)	Read slave station timeout (Recommended setting time)	Slave station access interval time (recommended setting time)
1200	2500ms	10-20ms
2400	2000ms	10-20ms
4800	1500ms	10-20ms
⩾9600	1000ms	10-20ms

8. 2. 3 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.

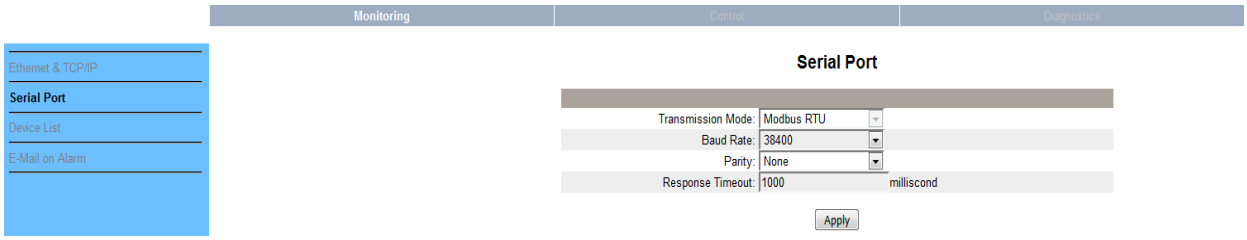
Extended serial port parameter configuration

Method1：

6. 3 Refer to bus1 in the communication settings of 7.5 system settings to modify the parameters of bus2.

Method2：

According to the operation method of 8.1.3, after connecting the Ethernet module, click Setup->Serial Port to enter the serial port setting, and set the baud rate, check digit and response time. Click Apply when you are done to wait for it to take effect. As shown below:



Modbus master parameter reading

According to the operation method of 8.1.3, after connecting the Ethernet module, click Setup->Device List to enter the Modbus master parameter reading, as shown below.

1. Number of Viewable: Users can configure up to 128 groups of 03 read commands of slaves.

2. Local ID: Meter Slave Address

3. Starting Register: Start Register Address

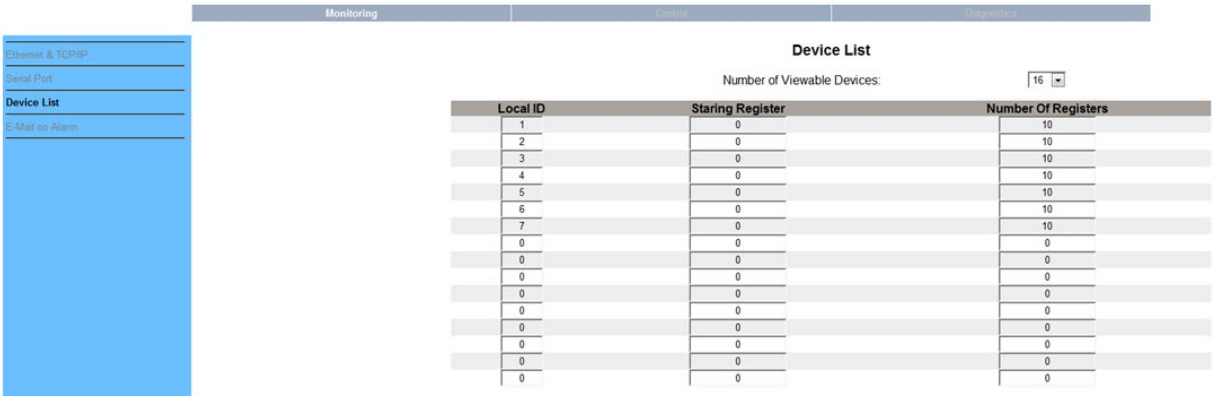
4. Number Of Register: The length of the register.

Note: If you need to modify the above parameters, please refer to 9.2.2 to modify the settings with the corresponding address by Modbus-TCP. After the 9.2.2 setting is completed, click Device List to refresh again.

The module will read the data from the slave according to this configuration. The read data is stored in registers starting with address 40000, which can be read by Modbus-Tcp.

For example: Read by Modbus-Tcp, the first one is to read 10 data starting from register 0 with slave address 1 and read

40000-40009, the second is to read 10 data starting from register 0 with slave address 2, read 40010-40019, and so on.



9. DL/T-645 Communication Guide

It mainly describes how to use the software to control the series of instruments through the communication port. Mastering the content requires you to have a knowledge base of the DL/T645-2007 agreement and read through all the other sections of this volume to gain a comprehensive understanding of the product features and application concepts. This chapter includes: DL/T645-2007 protocol brief, communication application format, local application details and parameter address table.

9.1 DL/T645-2007Brief description of the agreement

The instrument uses a communication protocol conforming to the DL/T645-2007 specification. The DL/T645-2007 protocol defines the check code, data, sequence, etc., which are all necessary for specific data exchange. The DL/T645-2007 protocol uses a master-slave acknowledgment connection (half-duplex) on a single communication line, which means that signals are transmitted in opposite directions on a single communication line. First, the signal of the host computer is addressed to a unique terminal device (slave), and then the response signal from the terminal device is transmitted to the host in the opposite direction. Brief description of the agreement.

The DL/T645-2007 protocol only allows communication between the host (PC, PLC, etc.) and the terminal device, and does not allow data exchange between independent terminal devices, so that the terminal devices do not occupy the communication line when they initialize. It is limited to responding to the inquiry signal arriving at the unit.

9.2 transmission method

The transmission method refers to a series of independent data structures in a data frame and a limited rule for transmitting data. The following describes a transmission method compatible with the DL/T645-2007 protocol-RTU mode.

Bit per byte

1 start bit

8 data bits, the smallest valid bit is sent first

1 even parity

1 stop bit

Error checking and verification

9.3 protocol

When the data frame arrives at the terminal device, it enters the addressed device through a simple "port" that removes the "envelope" (data header) of the data frame, reads the data, and executes the data if there are no errors. The requested task, then it adds the data it generates to the obtained "envelope" and returns the data frame to the sender. The returned response data includes the following contents: the terminal slave address (Address), the executed command (Function), the requested data generated by the execution command (Data), and a check code (Check). No error will occur if any error occurs, or an error indication frame will be returned.

9.3.1 Data frame format

68H	A0	A1	A2	A3	A4	A5	68H	C	L	DI0	DI1	N1	···	Nm	CS	16H
Starter	Address field						Frame start	Control	Data length	Data		data			Check	Terminator

			code		identification		code	

a)Frame starter 68H

Identifies the beginning of a frame of data, the value is 68H

b) Address field A0~A5

The address field consists of 6 bytes (8-bit binary code) with 2 bits of BCD code per byte. The address length can be up to 12 decimal digits. These bits indicate the address of the user-specified terminal device that will receive the host data from it. The address of each terminal device must be unique, and only the addressed terminal will respond to the query containing the address. When the terminal sends back a response, the slave address data in the response tells the host which terminal is communicating with it. When the address is 999999999999H, it is the broadcast address. Valid only for special commands, such as broadcast time, broadcast freeze, etc. The broadcast command does not require a slave to answer.

When the address field is transmitted, the low byte is first and the high byte is after.

c) Control code C

The function field code tells the terminal which is being addressed which function to perform. The table below lists the function codes used in this series of instruments, as well as their meaning and function.

Code	significance	behavior
11H	Reading data	Read data from APM Series meters
91H	Read data response	APM series instrument response to read data
14H	Write data	Write data to APM
94H	Write data response	APM series instrument response to write data
D4H 或 D1H	Error response	Received data error

d) Data field (data identification and data) length L

The byte length of the data field. When reading data, L≤200, when writing data, ≤50, when L=0, it means no data field.

e) Data field DATA

The data field includes data identification, password, operator code, data, frame number, etc., and its structure changes with the function of the control code. When transmitting, the sender adds 33H to the byte, and the receiver subtracts 33H by byte.

f) Error check CS

The sum of the modulo 256 of all bytes from the start of the frame start to the check code, that is, the binary arithmetic sum of each byte, excluding the overflow value exceeding 256.

g) End character 16H

Identify the end of a frame of data

transmission

a) Leading byte

Before sending frame information, you can transmit 1 to 4 bytes of FEH to wake up the receiver.

b)Transmission order

All data items are transmitted first with the low byte and then with the high byte. The transmitted data item (except the switching amount) is the compressed BCD code of the actual data plus 33H. If the external host reads the positive active energy of the APM series meter, the meter address is 1:

Host sending：FE FE 68 01 00 00 00 00 00 68 11 04 33 33 34 33 B3 16

APM Series instrument response(15.82kWh)：68 01 00 00 00 00 00 68 91 08 33 33 34 33 B5 48 33 33 9A 16

c) Transmission response rate

Each communication is initiated by the primary station transmitting a request command frame to the slave selected by the information frame address field, and the requested slave responds according to the requirements of the control code in the command frame.

Response delay after receiving the command frame：≤500ms

Pause time between bytes：≤6 bytes of transmission time, when this time is exceeded, the APM series instrument considers it a new data frame

d)Error control

The byte check is even parity, and the frame check is a vertical information checksum. The receiver abandons the information frame regardless of whether an even check or a vertical information checksum error is detected, and does not respond.

e) Transmission rate

initial rate：9600bps

set to：1200、2400、4800、9600、19200bps

9.3.2 Data identification table

variable name	Send a sample (using address 1 as an example, the user can set according to actual needs, the address high is filled with "00000000")	Return bytes	Return data format (secondary)	Return data unit
Phase A voltage	68 01 00 00 00 00 00 68 11 04 33 34 34 35 B6 16	2	XXX.X	V
Phase B voltage	68 01 00 00 00 00 00 68 11 04 33 35 34 35 B7 16	2	XXX.X	V
Phase C voltage	68 01 00 00 00 00 00 68 11 04 33 36 34 35 B8 16	2	XXX.X	V
Read voltage data block	68 01 00 00 00 00 00 68 11 04 33 32 34 35 B4 16	2*3	XXX.X	V
Phase A current	68 01 00 00 00 00 00 68 11 04 33 34 35 35 B7 16	3	XXX.XXX	A
Phase B current	68 01 00 00 00 00 00 68 11 04 33 35 35 35 B8 16	3	XXX.XXX	A
Phase C current	68 01 00 00 00 00 00 68 11 04 33 36 35 35 B9 16	3	XXX.XXX	A
Read current block	68 01 00 00 00 00 00 68 11 04 33 32 35 35 B5 16	3*3	XXX.XXX	A
Total active power	68 01 00 00 00 00 00 68 11 04 33 33 36 35 B7 16	3	XX.XXXX	kW
Phase A active power	68 01 00 00 00 00 00 68 11 04 33 34 36 35 B8 16	3	XX.XXXX	kW
Phase B active power	68 01 00 00 00 00 00 68 11 04 33 35 36 35 B9 16	3	XX.XXXX	kW
Phase C active power	68 A0 00 00 00 00 00 68 11 04 33 36 36 35 BA 16	3	XX.XXXX	kW
Active power data block	68 01 00 00 00 00 00 68 11 04 33 32 36 35 B6 16	3*4	XX.XXXX	kW
Total reactive power	68 01 00 00 00 00 00 68 11 04 33 33 37 35 B8 16	3	XX.XXXX	kvar
Phase A reactive power	68 01 00 00 00 00 00 68 11 04 33 34 37 35 B9 16	3	XX.XXXX	kvar
Phase B reactive power	68 01 00 00 00 00 00 68 11 04 33 35 37 35 BA 16	3	XX.XXXX	kvar
Phase C reactive power	68 01 00 00 00 00 00 68 11 04 33 36 37 35 BB 16	3	XX.XXXX	kvar
Reactive power data block	68 01 00 00 00 00 00 68 11 04 33 32 37 35 B7 16	3*4	XX.XXXX	kvar
Total apparent power	68 01 00 00 00 00 00 68 11 04 33 33 38 35 B9 16	3	XX.XXXX	kVA
A phase apparent power	68 01 00 00 00 00 00 68 11 04 33 34 38 35 BA 16	3	XX.XXXX	kVA
B phase apparent power	68 01 00 00 00 00 00 68 11 04 33 35 38 35 BB 16	3	XX.XXXX	kVA
C phase apparent power	68 01 00 00 00 00 00 68 11 04 33 36 38 35 BC 16	3	XX.XXXX	kVA
Apparent power block	68 01 00 00 00 00 00 68 11 04 33 32 38 35 B8 16	3*4	XX.XXXX	kVA
Power factor	68 01 00 00 00 00 00 68 11 04 33 33 39 35 BA 16	2	X.XXX	
Phase A power factor	68 01 00 00 00 00 00 68 11 04 33 34 39 35 BA 16	2	X.XXX	
Phase B power factor	68 01 00 00 00 00 00 68 11 04 33 35 39 35 BA 16	2	X.XXX	
Phase C power factor	68 01 00 00 00 00 00 68 11 04 33 36 39 35 BA 16	2	X.XXX	
Power factor block	68 01 00 00 00 00 00 68 11 04 33 32 39 35 B9 16	2*4	X.XXX	
Total active energy	68 01 00 00 00 00 00 68 11 04 33 33 33 33 B2 16	4	XXXXXX.XX	kWh

Positive active energy	68 01 00 00 00 00 00 68 11 04 33 33 34 33 B3 16	4	XXXXXX.XX	kWh
Reverse active energy	68 01 00 00 00 00 00 68 11 04 33 33 35 33 B4 16	4	XXXXXX.XX	kWh
Inductive reactive energy	68 01 00 00 00 00 00 68 11 04 33 33 36 33 B5 16	4	XXXXXX.XX	kvarh
Capacitive reactive energy	68 01 00 00 00 00 00 68 11 04 33 33 37 33 B6 16	4	XXXXXX.XX	kvarh
Four quadrant energy data block	68 01 00 00 00 00 00 68 11 04 33 33 32 33 B1 16	4*5	XXXXXX.XX	kWh/ kvarh
Positive active multiple rate total energy	68 01 00 00 00 00 00 68 11 04 33 33 34 33 B3 16	4	XXXXXX.XX	kWh
Positive active rate	68 01 00 00 00 00 00 68 11 04 33 34 34 33 B4 16	4	XXXXXX.XX	kWh
Positive active complex rate peak energy	68 01 00 00 00 00 00 68 11 04 33 35 34 33 B5 16	4	XXXXXX.XX	kWh
Positive active multi-rate Flat electric energy	68 01 00 00 00 00 00 68 11 04 33 36 34 33 B6 16	4	XXXXXX.XX	kWh
Positive active multi-rate Valley power	68 01 00 00 00 00 00 68 11 04 33 37 34 33 B7 16	4	XXXXXX.XX	kWh
Current positive active energy data block	68 01 00 00 00 00 00 68 11 04 33 32 34 33 B2 16	4*5	XXXXXX.XX	kWh
Last January, positive reactive power, total energy	68 01 00 00 00 00 00 68 11 04 34 33 34 33 B4 16	4	XXXXXX.XX	kWh
Last January, positive reactive rate, sharp energy	68 01 00 00 00 00 00 68 11 04 34 34 34 33 B5 16	4	XXXXXX.XX	kWh
Positive power rate peak power in January	68 01 00 00 00 00 00 68 11 04 34 35 34 33 B6 16	4	XXXXXX.XX	kWh
Last January, positive reactive rate, flat energy	68 01 00 00 00 00 00 68 11 04 34 36 34 33 B7 16	4	XXXXXX.XX	kWh
Last January, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 34 37 34 33 B8 16	4	XXXXXX.XX	kWh
Positive active energy data block in January	68 01 00 00 00 00 00 68 11 04 34 32 34 33 B3 16	4*5	XXXXXX.XX	kWh
Last February, positive reactive power, total energy	68 01 00 00 00 00 00 68 11 04 35 33 34 33 B5 16	4	XXXXXX.XX	kWh
Last February, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 35 34 34 33 B6 16	4	XXXXXX.XX	kWh
Last February, positive active rate, peak energy	68 01 00 00 00 00 00 68 11 04 35 35 34 33 B7 16	4	XXXXXX.XX	kWh
Last February, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 35 36 34 33 B8 16	4	XXXXXX.XX	kWh
Last February, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 35 37 34 33 B9 16	4	XXXXXX.XX	kWh
Last February Positive active energy data block	68 01 00 00 00 00 00 68 11 04 35 32 34 33 B4 16	4*5	XXXXXX.XX	kWh

Last March, the positive energy rate , total energy	68 01 00 00 00 00 00 68 11 04 36 33 34 33 B6 16	4	XXXXXX.XX	kWh
Last March, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 36 34 34 33 B7 16	4	XXXXXX.XX	kWh
Last March, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 36 35 34 33 B8 16	4	XXXXXX.XX	kWh
Last March, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 36 36 34 33 B9 16	4	XXXXXX.XX	kWh
Last March, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 36 37 34 33 BA 16	4	XXXXXX.XX	kWh
Last March Positive active energy data block	68 01 00 00 00 00 00 68 11 04 36 32 34 33 B5 16	4*5	XXXXXX.XX	kWh
Last April, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 37 33 34 33 B7 16	4	XXXXXX.XX	kWh
Last April, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 37 34 34 33 B8 16	4	XXXXXX.XX	kWh
Last April, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 37 35 34 33 B9 16	4	XXXXXX.XX	kWh
Last April, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 37 36 34 33 BA 16	4	XXXXXX.XX	kWh
Last April, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 37 37 34 33 BB 16	4	XXXXXX.XX	kWh
Last April Positive active energy data block	68 01 00 00 00 00 00 68 11 04 37 32 34 33 B6 16	4*5	XXXXXX.XX	kWh
Last May, positive energy rate , total energy	68 01 00 00 00 00 00 68 11 04 38 33 34 33 B8 16	4	XXXXXX.XX	kWh
Last May, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 38 34 34 33 B9 16	4	XXXXXX.XX	kWh
Last May, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 38 35 34 33 BA 16	4	XXXXXX.XX	kWh
Last May, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 38 36 34 33 BB 16	4	XXXXXX.XX	kWh
Last May, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 38 37 34 33 BC 16	4	XXXXXX.XX	kWh
Last May Positive active energy data block	68 01 00 00 00 00 00 68 11 04 38 32 34 33 B7 16	4*5	XXXXXX.XX	kWh
Last June, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 39 33 34 33 B9 16	4	XXXXXX.XX	kWh
Last June, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 39 34 34 33 BA 16	4	XXXXXX.XX	kWh
Last June, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 39 35 34 33 BB 16	4	XXXXXX.XX	kWh
Last June, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 39 36 34 33 BC 16	4	XXXXXX.XX	kWh
Last June, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 39 37 34 33 BD 16	4	XXXXXX.XX	kWh

Last June Positive active energy data block	68 01 00 00 00 00 00 68 11 04 39 32 34 33 B8 16	4*5	XXXXXX.XX	kWh
Last July, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 3A 33 34 33 BA 16	4	XXXXXX.XX	kWh
Last July, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 3A 34 34 33 BB 16	4	XXXXXX.XX	kWh
Last July, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 3A 35 34 33 BC 16	4	XXXXXX.XX	kWh
Last July, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 3A 36 34 33 BD 16	4	XXXXXX.XX	kWh
Last July, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 3A 37 34 33 BE 16	4	XXXXXX.XX	kWh
Last July Positive active energy data block	68 01 00 00 00 00 00 68 11 04 3A 32 34 33 B9 16	4*5	XXXXXX.XX	kWh
Last August, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 3B 33 34 33 BB 16	4	XXXXXX.XX	kWh
Last August, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 3B 34 34 33 BC 16	4	XXXXXX.XX	kWh
Last August, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 3B 35 34 33 BD 16	4	XXXXXX.XX	kWh
Last August, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 3B 36 34 33 BE 16	4	XXXXXX.XX	kWh
Last August, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 3B 37 34 33 BF 16	4	XXXXXX.XX	kWh
Last August Positive active energy data block	68 01 00 00 00 00 00 68 11 04 3B 32 34 33 BA 16	4*5	XXXXXX.XX	kWh
Last September, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 3C 33 34 33 BC 16	4	XXXXXX.XX	kWh
Last September, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 3C 34 34 33 BD 16	4	XXXXXX.XX	kWh
Last September, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 3C 35 34 33 BE 16	4	XXXXXX.XX	kWh
Last September, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 3C 36 34 33 BF 16	4	XXXXXX.XX	kWh
Last September, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 3C 37 34 33 C0 16	4	XXXXXX.XX	kWh
Last September Positive active energy data block	68 01 00 00 00 00 00 68 11 04 3C 32 34 33 BB 16	4*5	XXXXXX.XX	kWh
Last October, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 3D 33 34 33 BD 16	4	XXXXXX.XX	kWh
Last October, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 3D 34 34 33 BE 16	4	XXXXXX.XX	kWh
Last October, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 3D 35 34 33 BF 16	4	XXXXXX.XX	kWh
Last October, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 3D 36 34 33 C0 16	4	XXXXXX.XX	kWh

Last October, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 3D 37 34 33 C1 16	4	XXXXXX.XX	kWh
Last October, Positive active energy data block	68 01 00 00 00 00 00 68 11 04 3D 32 34 33 BC 16	4*5	XXXXXX.XX	kWh
Last November, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 3E 33 34 33 BE 16	4	XXXXXX.XX	kWh
Last November, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 3E 34 34 33 BF 16	4	XXXXXX.XX	kWh
Last November, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 3E 35 34 33 C0 16	4	XXXXXX.XX	kWh
Last November, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 3E 36 34 33 C1 16	4	XXXXXX.XX	kWh
Last November, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 3E 37 34 33 C2 16	4	XXXXXX.XX	kWh
Last November, Positive active energy data block	68 01 00 00 00 00 00 68 11 04 3E 37 34 33 BD 16	4*5	XXXXXX.XX	kWh
Last December, the positive energy rate total energy	68 01 00 00 00 00 00 68 11 04 3F 33 34 33 BF 16	4	XXXXXX.XX	kWh
Last December, positive active rate, sharp energy	68 01 00 00 00 00 00 68 11 04 3F 34 34 33 C0 16	4	XXXXXX.XX	kWh
Last December, positive active rate peak energy	68 01 00 00 00 00 00 68 11 04 3F 35 34 33 C1 16	4	XXXXXX.XX	kWh
Last December, positive active rate, flat energy	68 01 00 00 00 00 00 68 11 04 3F 36 34 33 C2 16	4	XXXXXX.XX	kWh
Last December, positive active rate, valley energy	68 01 00 00 00 00 00 68 11 04 3F 37 34 33 C3 16	4	XXXXXX.XX	kWh
Last December, Positive active energy data block	68 01 00 00 00 00 00 68 11 04 3F 32 34 33 BE 16	4*5	XXXXXX.XX	kWh
Data	68 01 00 00 00 00 00 68 11 04 34 34 33 37 B8 16	4	YYMMDDWW	Year, month and day
Time	68 01 00 00 00 00 00 68 11 04 35 34 33 37 B9 16	3	HHFFMM	Hour, minute, second
Positive active maximum demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 33 33 34 34 B4 16	8	XX.XXXX YYMMDD hhmm	kW Year, month, day Hour, minute
Reverse active maximum demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 33 33 35 34 B5 16	8	XX.XXXX YYMMDD hhmm	Ditto
Perceptual reactive maximum demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 33 33 36 34 B6 16	8	XX.XXXX YYMMDD hhmm	
Capacitive reactive maximum demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 33 33 37 34 B7 16	8	XX.XXXX YYMMDD hhmm	

Forward apparent maximum demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 33 33 3C 34 BC 16	8	XX.XXXX YYMMDD hhmm	
Reverse apparent maximum demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 33 33 3D 34 BD 16	8	XX.XXXX YYMMDD hhmm	
The maximum active demand and time of occurrence in the first settlement date	68 01 00 00 00 00 00 68 11 04 34 33 34 34 B5 16	8	XX.XXXX YYMMDD hhmm	
Reverse active maximum demand and time of occurrence on the first settlement date	68 01 00 00 00 00 00 68 11 04 34 33 35 34 B6 16	8	XX.XXXX YYMMDD hhmm	
Maximum demand and time of inductive reactive power on the first settlement date	68 01 00 00 00 00 00 68 11 04 34 33 36 34 B7 16	8	XX.XXXX YYMMDD hhmm	
Capacitive reactive maximum demand and time of occurrence on the first settlement date	68 01 00 00 00 00 00 68 11 04 34 33 37 34 B8 16	8	XX.XXXX YYMMDD hhmm	
The maximum demand and time of occurrence in the positive view on the first settlement date	68 01 00 00 00 00 00 68 11 04 34 33 3C 34 BD 16	8	XX.XXXX YYMMDD hhmm	
The maximum demand and time of occurrence in the reverse view on the first settlement date	68 01 00 00 00 00 00 68 11 04 34 33 3D 34 BE 16	8	XX.XXXX YYMMDD hhmm	
The maximum active demand and time of occurrence in the last 2 settlement days	68 01 00 00 00 00 00 68 11 04 35 33 34 34 B6 16	8	XX.XXXX YYMMDD hhmm	
…	68 01 00 00 00 00 00 68 11 04 35 33 … 34 … 16	8	XX.XXXX YYMMDD hhmm	
…	…			
The maximum active demand and time of occurrence on the 12th settlement date	68 01 00 00 00 00 00 68 11 04 3F 33 34 34 C0 16	8	XX.XXXX YYMMDD hhmm	kW Year, month, day Hour, minute
…	68 01 00 00 00 00 00 68 11 04 3F 33 … 34 … 16	8	XX.XXXX YYMMDD hhmm	Ditto
Phase A voltage 1st harmonic content	68 01 00 00 00 00 00 68 11 04 34 34 3D 35 C0 16	2	XX.XX	%
Phase A voltage 2nd harmonic content	68 01 00 00 00 00 00 68 11 04 35 34 3D 35 C1 16	2	XX.XX	%
Phase A voltage 3rd harmonic content	68 01 00 00 00 00 00 68 11 04 36 34 3D 35 C0 16	2	XX.XX	%
Phase A voltage 4th harmonic content	… 37 … CS 16	2	XX.XX	%
…	…	…	…	…
Phase A voltage 21 harmonic content	68 01 00 00 00 00 00 68 11 04 48 34 3D 35 D4 16	2	XX.XX	%

Phase B voltage 1st harmonic content	68 01 00 00 00 00 00 68 11 04 34 35 3D 35 C1 16	2	XX.XX	%
B phase voltage 2nd harmonic content	68 01 00 00 00 00 00 68 11 04 35 35 3D 35 C2 16	2	XX.XX	%
B phase voltage 3rd harmonic content	68 01 00 00 00 00 00 68 11 04 36 35 3D 35 C2 16	2	XX.XX	%
B phase voltage 4th harmonic content	… 37 … CS 16	2	XX.XX	%
…	…			
B phase voltage 4th harmonic content	68 01 00 00 00 00 00 68 11 04 48 35 3D 35 D5 16	2	XX.XX	%
Phase C voltage 1st harmonic content	68 01 00 00 00 00 00 68 11 04 34 36 3D 35 C2 16	2	XX.XX	%
phase c voltage 2nd harmonic content	68 01 00 00 00 00 00 68 11 04 35 36 3D 35 C3 16	2	XX.XX	%
Phase C voltage 3rd harmonic content	68 01 00 00 00 00 00 68 11 04 36 36 3D 35 C4 16	2	XX.XX	%
Phase c voltage 4th harmonic content	… 37 … CS 16	2	XX.XX	%
…	…			
Phase C voltage 21 harmonic content	68 01 00 00 00 00 00 68 11 04 48 36 3D 35 D6 16	2	XX.XX	%
Phase A current 1st harmonic content	68 01 00 00 00 00 00 68 11 04 34 34 3E 35 C1 16	2	XX.XX	%
phase A current 2nd harmonic content	68 01 00 00 00 00 00 68 11 04 35 34 3E 35 C2 16	2	XX.XX	%
Phase A current 3rd harmonic content	68 01 00 00 00 00 00 68 11 04 36 34 3E 35 C3 16	2	XX.XX	%
Phase A current 4th harmonic content	… 37 … CS 16	2	XX.XX	%
…	…			
Phase A current 21 harmonic content	68 01 00 00 00 00 00 68 11 04 48 34 3E 35 D5 16	2	XX.XX	%
Phase B current 1st harmonic content	68 01 00 00 00 00 00 68 11 04 34 35 3E 35 C2 16	2	XX.XX	%
B phase current 2nd harmonic content	68 01 00 00 00 00 00 68 11 04 35 35 3E 35 C3 16	2	XX.XX	%
Phase B current 3rd harmonic content	68 01 00 00 00 00 00 68 11 04 36 35 3E 35 C4 16	2	XX.XX	%
B phase current 4th harmonic content	… 37 … CS 16	2	XX.XX	%
…	…			
Phase B current 21 harmonic content	68 01 00 00 00 00 00 68 11 04 48 35 3E 35 D6 16	2	XX.XX	%
Phase C current 1 harmonic content	68 01 00 00 00 00 00 68 11 04 34 36 3E 35 C3 16	2	XX.XX	%
Phase C current 2nd harmonic content	68 01 00 00 00 00 00 68 11 04 35 36 3E 35 C4 16	2	XX.XX	%
Phase C current 3rd harmonic content	68 01 00 00 00 00 00 68 11 04 36 36 3E 35 C5 16	2	XX.XX	%
Phase C current 4th harmonic content	… 37 … CS 16	2	XX.XX	%
…	…			
Phase C current 21 harmonic content	68 01 00 00 00 00 00 68 11 04 48 36 3E 35 D7 16	2	XX.XX	%
Phase A voltage waveform distortion	68 01 00 00 00 00 00 68 11 04 33 34 3B 35 BD 16	2	XX.XX	%
B phase voltage waveform distortion	68 01 00 00 00 00 00 68 11 04 33 35 3B 35 BE 16	2	XX.XX	%
Phase C voltage waveform distortion	68 01 00 00 00 00 00 68 11 04 33 36 3B 35 BF 16	2	XX.XX	%
Phase A current waveform distortion	68 01 00 00 00 00 00 68 11 04 33 34 3C 35 BE 16	2	XX.XX	%
Phase B current waveform distortion	68 01 00 00 00 00 00 68 11 04 33 35 3C 35 BF 16	2	XX.XX	%
Phase C current waveform distortion	68 01 00 00 00 00 00 68 11 04 33 36 3C 35 C0 16	2	XX.XX	%
(previous time) timed freezing time	68 01 00 00 00 00 00 68 11 04 34 33 33 38 B8 16	5	YYMMDD hhmm	Year, month and day
(1 time) timed to freeze positive active energy	68 01 00 00 00 00 00 68 11 04 34 34 33 38 B9 16	4*5	XXXXXX.XX	kWh

(1 time) timed frozen reverse active energy	68 01 00 00 00 00 00 68 11 04 34 35 33 38 BA 16	4*5	XXXXXX.XX	kWh
(1 time) Timing freeze positive active demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 34 3C 33 38 C1 16	8	XX.XXXX YYMMDD hhmm	kW Year, month and day
(1 time) Timing freeze reverse active demand and time	68 01 00 00 00 00 00 68 11 04 34 3D 33 38 C2 16	8	XX.XXXX YYMMDD hhmm	kW Year, month and day
(Last 1) timed frozen variable data	68 01 00 00 00 00 00 68 11 04 34 43 33 38 C8 16	3*8	kW kW kW kW kvar kvar kvar kvar	Total active power Phase A active power Phase B active power Phase C active power Total reactive power Phase A reactive power Phase B reactive power Phase C reactive power
(Previous 2) timing freezing time	68 01 00 00 00 00 00 68 11 04 35 33 33 38 B9 16	5	YYMMDD hhmm	Year, month and day
…	68 01 00 00 00 00 00 68 11 04 35 … 33 38 … 16			
(previous 3 times) timing freezing time	68 01 00 00 00 00 00 68 11 04 36 33 33 38 BA 16	5	YYMMDD hhmm	Year, month and day
…	68 01 00 00 00 00 00 68 11 04 36 … 33 38 … 16			
…	…			
(previous 12 times) timing freezing time	68 01 00 00 00 00 00 68 11 04 3F 33 33 38 C3 16	5	YYMMDD hhmm	Year, month and day
…	68 01 00 00 00 00 00 68 11 04 36 … 33 38 … 16			
(previous time) instantaneous freezing time	68 01 00 00 00 00 00 68 11 04 34 33 34 38 B9 16	5	YYMMDD hhmm	Year, month and day
(last time) freeze forward active energy instantaneously	68 01 00 00 00 00 00 68 11 04 34 34 34 38 BA 16	4*5	XXXXXX.XX	kWh
(last time) freeze reverse active energy instantaneously	68 01 00 00 00 00 00 68 11 04 34 35 34 38 BB 16	4*5	XXXXXX.XX	kWh
(1 time) instantaneous freezing positive	68 01 00 00 00 00 00 68 11 04 34 3C 34 38 C2 16	8	XX.XXXX	kW

active demand and time of occurrence			YYMMDD hhmm	Year, month day,hour, miunte
(1 time) instantaneous freezing reverse active demand and time of occurrence	68 01 00 00 00 00 00 68 11 04 34 3D 34 38 C3 16	8	XX.XXXX YYMMDD hhmm	kW Year, month day,hour, miunte
(1 time) instantaneous freeze variable data	68 01 00 00 00 00 00 68 11 04 34 43 34 38 C9 16	3*8	kW kW kW kW kvar kvar kvar kvar	Total active power Phase A active power Phase B active power Phase C active power Total reactive power Phase A reactive power Phase B reactive power Phase C reactive power
(2 times) instantaneous freeze time	68 01 00 00 00 00 00 68 11 04 35 33 34 38 BA 16	5	YYMMDD hhmm	Year, month and day
…	68 01 00 00 00 00 00 68 11 04 35 … 34 38 … 16			
(Last 3 times) instantaneous freezing time	68 01 00 00 00 00 00 68 11 04 36 33 34 38 BB 16	5	YYMMDD hhmm	Year, month and day
…	68 01 00 00 00 00 00 68 11 04 36 … 34 38 … 16			
…	…			
(Last 12 times) instantaneous freezing time	68 01 00 00 00 00 00 68 11 04 3F 33 34 38 C4 16	5	YYMMDD hhmm	Year, month and day
…	68 01 00 00 00 00 00 68 11 04 3F … 34 38 … 16			

10. Profibus-DP guide

10.1 Profibus-DP Protocol overview

This chapter briefly introduces the Profibus-DP protocol. If you are familiar with this section, you can directly read the communication configuration of Section 10.2.

10.1.1 Profibus-DP Introduction

Profuse is a fieldbus solution integrating H1 (process) and H2 (factory automation). It is an international, open fieldbus standard and one of the eight fieldbuses in the international standard IEC61158. Profibus can spread digital

automation equipment from low-level (sensor/actuator) to intermediate-level execution level (cell level). According to the application characteristics and different needs of users, Profibus provides three compatible version communication protocols:FMS 、PA and DP .

Profibus-DP Used for communication between unit level control devices and distributed I/O in automation systems.

Profibus-DP Using Layer 1, Layer 2 and User Interface layers, Layers 3-7 are unused, and this streamlined architecture ensures high-speed data transfer. The direct data link mapping program DDLM provides access to Layer 2. The user interface specifies the application functions of the device, the behavior of the Profibus-DP system and the device. Profibus-DP is especially suitable for communication between PLCs and on-site hierarchical I/O devices. The communication between the master stations is the token mode, the master-slave mode between the master station and the slave station, and a mixture of the two methods.

10.1.2 Profibus-DP physical layer

1、Transmission medium.

PROFIBUS-DP transmission technology adopts RS485 transmission, and the transmission medium can select two types of wires: type A and type B, A is a shielded twisted pair, and B is a common twisted pair. However, in the EN50 170 standard, the type A wire is specified, and the type A has a larger extended length than the type B, as shown in Table 6.

Table6：Line A　Line B Description

Cable parameter	A type	B type
Characteristic impedance(Ω)	135~165Ω (f＝3MHz~20MHz)	100~130Ω (f＞100kHz)
Unit length capacitance(PF/m)	＜30pF/m	＜60pF/m
Loop resistance(Ω/km)	≤110Ω/km	-
Core cross-sectional area(mm2)	≥0.34mm2(22 AWG)	≥0.22mm2(22 AWG)

2、Transmission distance

The standard Profibus-DP supports the following transmission rates: (unit: kbps) 9.6, 19.2, 31.25, 45.45, 93.75, 187.5, 500, 1500, 3000, 6000, 12000. The input data and output data of each DP slave are up to 244B. When using shielded twisted pair cable, the longest communication distance is 9.6km (requires additional relay), and the maximum length is 90km when using fiber optic cable.

The maximum cable length of each segment of Profibus-DP is related to the transmission rate. Different media, different baud rates, and different distances that signals can be transmitted are shown in Table 7.

Table 7：Transmission rate and distance relationship table

Baud rate kbps/s	9.6	19.2	93.75	187.5	500	1500	3000	6000	12000
(Line A) cable length m	1200	1200	1200	1000	400	200	200	100	100
(Line B) cable length	1200	1200	1200	600	200	Not recommended	Not recommended	Not recommended	Not recommended

m									

Note: This transmission distance refers to the distance without repeaters (repeaters). In addition, the transmission distance is a theoretical value, and the actual transmission distance is also affected by the on-site environment.

10.1.3 PROFIBUS-DP Bus network structure

PROFIBUS supports bus, star and tree topologies. A bus topology, as shown in Figure 1. The standard Profibus-DP system can connect up to 127 stations (station numbers from 0 to 126, without repeaters). PROFIBUS supports repeater connections. If a repeater is used, the cable length and the number of connected stations can be increased.PROFIBUS

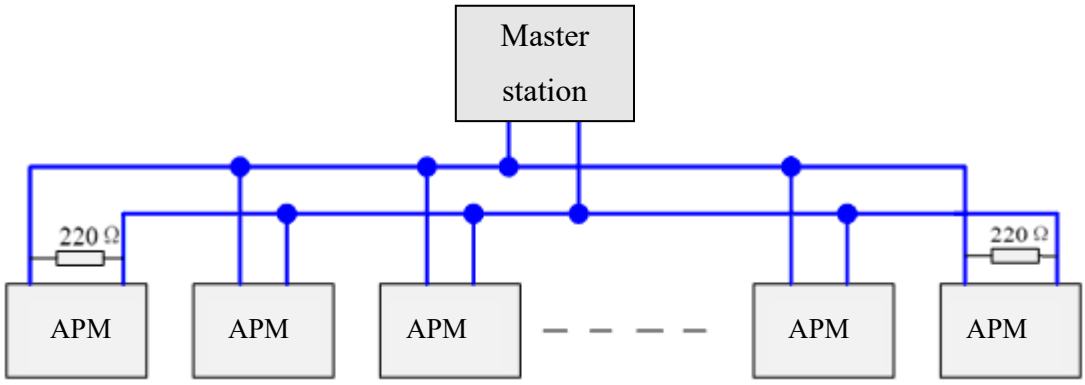


图 1 DP Bus topology

According to the EIA RS485 standard, in order to minimize cable reflection and ensure the noise level defined on the data line, at each end of the data transmission cable, a terminating resistor connected as follows must be used to terminate a network segment. The bus terminator is shown in Figure 2.

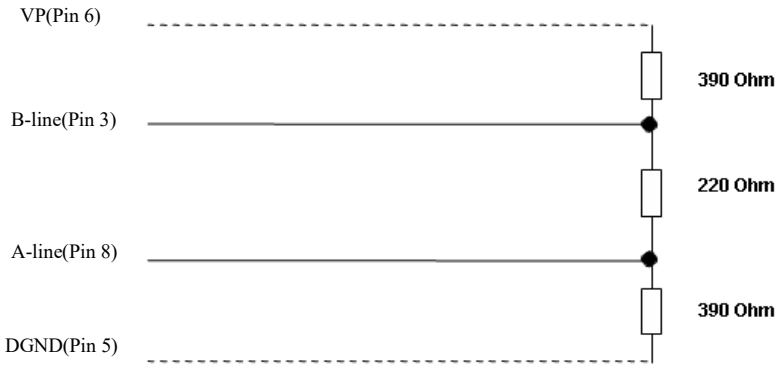


Figure 2 PROFIBUSCable terminator for cable (pin number of 9-pin D-type connector)

Profibus's bus terminator consists of a pull-up resistor and a pull-down resistor. When there is no station transmitting data on the bus (ie idle time), these two resistors force different state voltages to a certain value, thus ensuring that there is on the bus. A certain idle potential. The station designated as the terminating bus (common with the bus terminator) needs to be added to the "terminator", also known as the active terminal. To achieve impedance matching and enhance anti-interference ability. For the A-type cable, connect 220Ω active termination resistor.

The above information is for reference only. Due to the high content of Profibus-DP, please refer to the PROFIBUS installation related specifications for details.

10.2 Profibus Communication function configuration

10.2.1 Profibus Communication variable table

When communicating with the Profibus protocol, the APM series programmable smart meter needs to use the

communication variables of this document. Chapter 8 Communication Description Section is invalid.

APM series multi-function electrical measuring instrument, its communication protocol is developed according to DPV0. DPV0 is a periodic data exchange, that is, in each DP cycle, the exchanged data is periodic data.

The input data is: the response data fed back to the DP master by the multi-function electrical measuring instrument (APM series meter → DP master station).

The output data is: the DP master sends to the multi-function electrical measuring instrument (DP master → APM series instrument), the instrument without switching output function (ie no DO function), no output data.

The processing of the cyclic data is done in the PLC by programming the input data and the output data. The length of the input and output exchange data depends on the hardware configuration GSD file type.

(1) Profibus input data address table, as shown in Table 3. Its high byte is first and the low byte is after. For example, [2][3], [2] is the high byte (high 8 bits), [3] is the low byte (lower 8 bits), and so on.

(2) If you want to set the APM series instrumentation parameters, you need to refer to Chapter 7 for manual setting, or refer to Chapter 8 for setting by modbus-rtu protocol. You can not use Profibus remote operation setting.

(3) After the instrument is powered on, if the instrument slave address is changed (address setting value range 1~126), the instrument needs to be powered on again, and the changed slave address can be valid (this function follows the PROFIBUS-DP protocol).

(4) After Profibus communication, the baud rate is adaptive from 9.6 kbit/s to 12000 kbit/s, and no baud rate is required.

APM_Profibus Communication variable table

Input data Address table	parameter name	remark		type	word
[00][01] [02][03]	Output switch state DO	[00]：High 8 bits, reserved [01]：Low 8 bits Bit7-Bit2:reserved Bit0: D01 Output switch quantity 1 Bit1: D02 Output switch quantity 2 So on... Bit31: DO32 Output switch quantity 32		2 word	1、2
[04][05] [06][07]	Input switch state DI	Bit0: DI1 Output switch quantity 1 Bit1: DI2 Output switch quantity 2 Bit2: DI3 Output switch quantity 3 Bit3: DI4 Output switch quantity 4 So on... Bit31: DI32 DO32 Output switch quantity 32		2word	3、4
[8][9]	Phase voltage Uan	Secondary side	Voltage decimal point: 1 16-bit unsigned	1 word	5
[10][11]	Phase voltage Ubn	Secondary		1 word	6

		side			
[12][13]	Phase voltage Ucn	Secondary side		1 word	7
[14][15]	Line voltage Uab	Secondary side		1 word	8
[16][17]	Line voltage Ubc	Secondary side		1 word	9
[18][19]	Line voltage Uca	Secondary side		1 word	10
[20][21]	Phase current Ia	Secondary side	Current decimal point number: 3 16-bit unsigned	1 word	11
[22][23]	Phase current Ib	Secondary side		1 word	12
[24][25]	Phase current Ic	Secondary side		1 word	13
[26][27]	Neutral current	Secondary side		1 word	14
[28][29] [30][31]	Total active power P total	Secondary side	Active power, Reactive power, inspecting power Decimal points: 2 32-bit signed	2 word	15、16
[32][33] [34][35]	Total reactive power Q total	Secondary side		2 word	17、18
[36][37] [38][39]	Total apparent power S	Secondary side		2 word	19、20
[40][41]	Power factor	Secondary side	Decimal points: 3 16-bit signed	1 word	21
[42][43]	frequency	Secondary side	Decimal points: 2 16-bit unsigned	2 word	22
[44][45]	Phase A current total harmonic distortion rate	A phase current total harmonic content; Decimal points: 2 (16-bit unsigned)		1 word	23
[46][47]	Phase B current total harmonic distortion rate	The total harmonic content of phase B current; Decimal points: 2 (16-bit unsigned)		1 word	24
[48][49]	Phase C current total harmonic distortion rat	C phase current total harmonic content; Decimal points: 2 (16-bit unsigned)		1 word	25
[50][51]	Phase A voltage total	A phase voltage total harmonic		1 word	26

	harmonic distortion rate	content; Decimal points: 2 (16-bit unsigned)		
[52][53]	Phase B voltage total harmonic distortion rate	B phase voltage total harmonic content; Decimal points: 2 (16-bit unsigned)	1 word	27
[54][55]	Phase C voltage total harmonic distortion rate	C phase voltage total harmonic content; Decimal points: 2 (16-bit unsigned)	1 word	28
[56][57] [58][59]	Positive active energy	Secondary side EPI	2 word	29、30
[60][61] [62][63]	Reverse active energy	Secondary side EPE	2 word	31、32
[64][65] [66][67]	Positive reactive energy	Secondary side EQL	2 word	33、34
[68][69] [70][71]	Reverse reactive energy	Secondary side EQC	2 word	35、36
[72][73] [74][75]	Positive total active energy	Secondary side electrical energy Decimal points: 3 32-bit signed	2 word	37、38
[76][77] [78][79]	Positive tip active energy		2 word	39、40
[80][81] [82][83]	Positive peak active energy		2 word	41、42
[84][85] [86][87]	Positive flat active energy		2 word	43、44
[88][89] [90][91]	Positive valley active energy		2 word	45、46
[92][93]	AI1	Analog input Decimal points: 3 16-bit unsigned	1 word	47
[94][95]	AI2		1 word	48
[96][97]	AI3		1 word	49
[98][99]	AI4		1 word	50
[100][101]	AI5		1 word	51
[102][103]	Secondary current value	Secondary current (1A or 5A) Decimal points: 0 16-bit unsigned	1 word	52
[104][105]	Secondary side voltage value	Secondary side voltage (100V, 110V, 400V, 690V) Decimal points: 0	1 word	53

		16-bit unsigned		
[106][107]	Primary current value	Primary current (1-32760A) Decimal points: 0 16-bit unsigned	1 word	54
[108][109]	Primary side voltage value	Primary side voltage (100V-1200KV) Decimal points: 0 32-bit unsigned	2 word	55、56
[110][1111]	Secondary side neutral current value	Secondary current (1A or 5A) Decimal points: 0 16-bit unsigned	1 word	57
[112][113]	Primary side neutral current value	Primary current (1-32760A) Decimal points: 0 16-bit unsigned	1 word	58

(5)Output parameter 1 word (DP master → APM series meter), configuration table is as follows：

outpu	parameter name	Numerical range	Remarks
[00][01]	Control(word)	01]Low 8 digits Bit0: DO1 Bit1: DO2 Bit2-Bit7: Reserved	0：disconnect 1：closure
		[00]High 8 Bit15: permission modification enabled Bit14-Bit8: Reserved	When this bit is 1, it is valid for the operation of bit0 and bit1. When 0, the operation is invalid.

Note: PROFBUS-DP V0 is a cyclic data exchange. It should be used with caution for control information to avoid damage caused by repeated settings and loop settings

Example: If you want to operate on the DO switch, you need to operate according to the current DO state. Assume that the current state of D0 is: DO1 is closed, D02 is off. If you want to close DO2, the output control word is: 8003 (hexadecimal). If the output control word is 8002, closing DO3 will also turn DO1 off.

Conversion relationship between communication value and actual value

Correspondence between communication value and actual value (available Val_t is the communication readout value and Val_s is the actual value)

The correspondence between the communication value and the actual secondary side measurement value is as follows：

Applicable parameters	Correspondence	Unit
Voltage Uan、Ubn、Ucn、Uab、Ubc、Uca	Val_s＝Val_t /10	V

Current IA、IB、IC	Val_s＝Val_t /1000	A
Power factor PFA、PFB、PFC、PFS	Val_s＝Val_t /100	No unit
Frequence FR	Val_s＝Val_t /100	Hz
Voltage total harmonic distortion rate THDUa、THDUb、THDUc Current total harmonic distortion rate THDIa、THDIb、THDIc	Val_s＝Val_t /100	%

2、Voltage, current, power factor, frequency

Each electrical parameter occupies 1 WORD, taking the A-phase voltage Uan as an example. The communication readout value Val_t is 2200, then the actual value is:Val_s ＝Val_t / 10＝2200/10＝220Ⅴ。

3、Power, reactive power, apparent power(Secondary; W/Var/VA)

Each electrical parameter occupies 2 WORDs, and the correspondence between the communication value and the actual value is: Val_s=Val_t /100; where Val_t=the first word×65536+the second word. Taking the A-phase active power Pa as an example, the communication value is read from the address [24][25], and the communication value is 26000 from the address [26][27], that is, Val_t=1×65536+26000=91536 , the corresponding actual value is: Val_s = Val_t / 100 = 915.36W.

4、Voltage and current harmonic data (voltage total harmonic distortion rate, current total harmonic distortion rate)

Each electrical parameter occupies 1 WORD, and the correspondence between the communication value and the actual value is：

Val_s=(Val_t/100)%. Taking the total harmonic distortion rate of phase A voltage as an example, the readout communication value Val_t is 157, then the actual value is Val_s=(Val_t / 100)%=1.57%, that is, the total harmonic distortion rate of phase A voltage is 1.57%.

5、Energy data (primary side)

The value of the primary side of the energy is the floating point variable data type. It uses the sign bit to represent the sign of the number, and the step code and the mantissa to represent the size of the number. The data format adopted by the instrument is IEEE754 data format with 24-bit precision. The high bit of the mantissa is always "1", so it is not saved. The bit distribution is as follows：

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

Specific examples are as follows：

Read number：0 10001110 100 1011 1010 1100 0000 0000b

Sign bit S=0，(“1”negative，“0”positive)；

Calculation index E=10001110，Turn into a decimal number 142；

Calculate mantissa M=100 1011 1010 1100 0000 0000，Turn into a decimal number 4959232。

Calculation formula：

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

The calculation result in the above example is:

$$(-1)^{0} \times 2^{(142-127)} \times \left(1 + \frac{4959232}{2^{23}}\right) = 52140 \text{ wh} = 52.14 \text{ kWh}$$

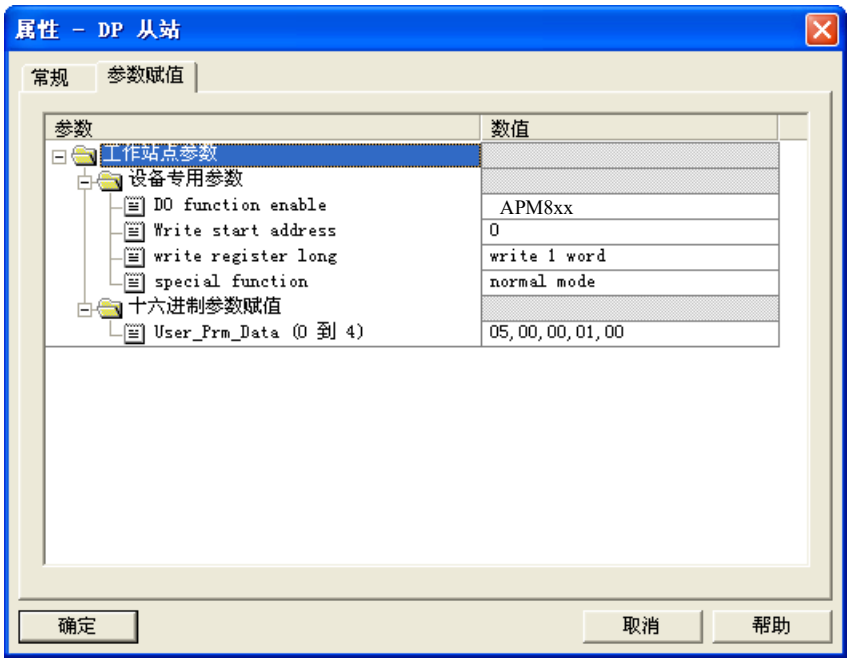
10.2.2 About the GSD file description

GSD File access:

The instrument's GSD file can be downloaded from the company's website at www.acrel.cn or from our customer service.

CD mode is sent with the product

When configuring the PROFIBUS master station, after loading the GSD file of the APM series instrument, the user parameters adopt the default values and do not need to be changed, as shown in the figure below.



11. Profinet

PROFINET is a fieldbus communication system based on industrial Ethernet and IT standards, which has more advantages than PROFIBUS, so it is more and more widely used in the field of automation control.

11.1 Connection Preparation

11.1.1 Transmission media and connectors

PROFINET supports 100 Mbit Ethernet100BASE-TX, two pairs of shielded twisted pair cables (GP2X2 series) are used as short-distance signal transmission (compatible with conventional 8-core network cables), and

RJ45(commonly known as crystal head) connectors are used as wiring terminals.

As shown in Figure 1, the production standards of network cables are:

T568A standard: White green, green, white orange, blue, white blue, orange, white brown, brown.

T568B standard: White orange, orange, white green, blue, white blue, green, white brown, brown.

Sequence: 12345678 from left to right. The four-core cable only needs to be connected to 1236.

As shown in Figure 2, the 4-core network cable is directly connected and cross-connected, and as shown in Figure 3, the 8-core network cable is directly connected and cross-connected. All the wiring modes in the figure can communicate normally.

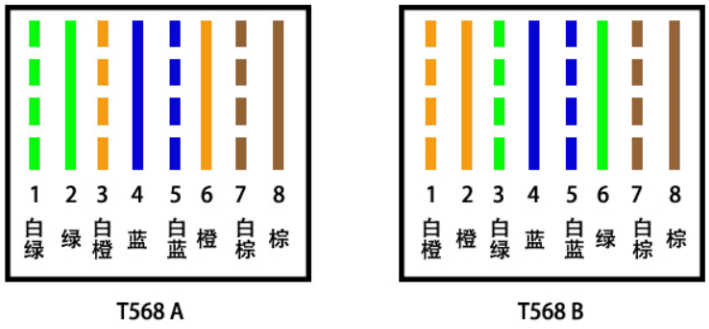


Figure 1

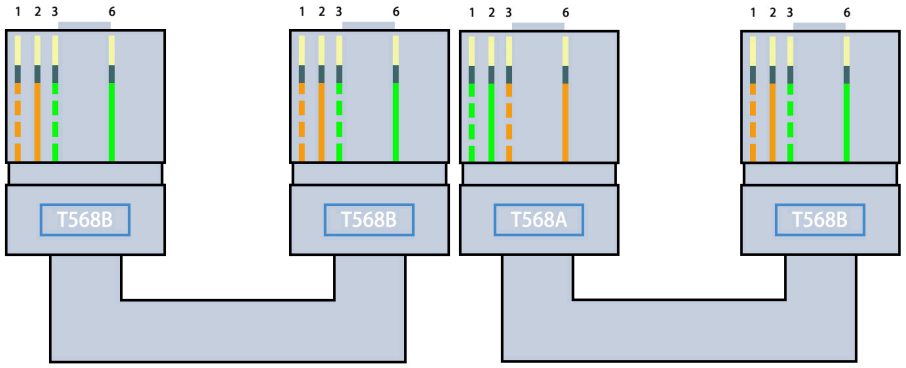


Figure 2

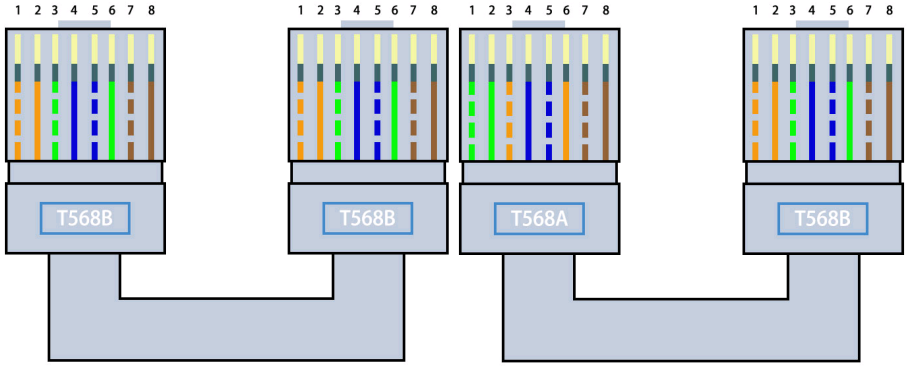


Figure 3

11.1.2 Topological structure

PROFINET networks support linear, star, tree, ring, and hybrid network topologies.

Line topology: APM's PROFINET communication module has a double network port with switch function, and the second network port can be used to achieve line connection in line topology.

Star topology: When devices are located close to each other, for example, when the devices are installed in the control cabinet, the star topology is suitable and switches are used to connect APMs for short-distance areas.

Tree topology: Several stars are connected into a tree network, and finally a hierarchical network of factory

automation is formed.

Ring topology: Several switches are used to form a backbone ring network using optical fiber connections. Field devices can be connected to switches using a mixed topology, and the field network and upper-layer network are also connected through switches.

11.2 Communication address table

The default address table is as follows:

Input data Address table	parameter name	remark	type	word
[0][1]	DO status	Bito corresponds to DO1	word	1
[2][3]	DI status	Bito corresponds to DI1	word	2
[4][5]	Phase voltage Uan	Secondary side Voltage decimal point: 1 16-bit unsigned	word	3
[6][7]	Phase voltage Ubn		word	4
[8][9]	Phase voltage Ucn		word	5
[10][11]	Line voltage Uab		word	6
[12][13]	Line voltage Ubc		word	7
[14][15]	Line voltage Uca		word	8
[16][17]	Phase current Ia	Secondary side Current decimal point number: 3 16-bit unsigned	word	9
[18][19]	Phase current Ib		word	10
[20][21]	Phase current Ic		word	11
[22][23]	Neutral current In		word	12
[24][25]	Frequency F	Decimal points: 2 16-bit unsigned	word	13
[26][27] [28][29]	Total active power P total	Secondary side Decimal points: 2 32-bit signed	2 word	14，15
[30][31] [32][33]	Total reactive power Q total	Secondary side Decimal points: 2 32-bit signed	2 word	16，17
[34][35] [36][37]	Total apparent power S	Secondary side Decimal points: 2 32-bit signed	2 word	18，19

[38][39]	Power factor	Decimal points: 3 16-bit signed	word	20
[40][41] [42][43]	Positive active energy	Secondary side EPI Decimal points: 3 32-bit signed	2 word	21，22
[44][45] [46][47]	Reverse reactive energy	Secondary side EPE Decimal points: 3 32-bit signed	2 word	23，24
[48][49] [50][51]	Positive reactive energy	Secondary side EQL Decimal points: 3 32-bit signed	2 word	25，26
[52][53] [54][55]	Reverse reactive energy	Secondary side EQC Decimal points: 3 32-bit signed	2 word	27，28
[56][57]	Secondary current value	Secondary current (1A or 5A) Decimal points: 0 16-bit unsigned	word	29
[58][59]	Secondary side voltage value	Secondary side voltage (100V, 110V, 400V, 690V) Decimal points: 0 16-bit unsigned	word	30
[60][61]	Primary current value	Primary current (1-32760A) Decimal points: 0 16-bit unsigned	word	31
[62][63] [64][65]	Primary side voltage value	Primary side voltage (100V-1200KV) Decimal points: 0 32-bit unsigned	2word	32，33

Note: The high byte comes first, the low byte comes last, such as [0][1], [0] is the high 8 bits, [1] is the low 8 bits, and so on. The power is stored in 4-byte hexadecimal system, with high word in front and low word in back. The unit of measurement is: kWh; Power metering value = high power word /0xffff+ Low power word.

12. Analysis of common fault

Fault content	Analysis
No display on power	Check whether the power supply voltage is in the working voltage range. Continue to malfunction, after disconnecting the power supply (refer to 3.3 assembly for details), re-insert the main body and the module, restart the instrument after 1 minute, if the fault is not eliminated, you need to contact our company for repair;
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 if the wiring mode setting is consistent with the actual situation; Check if the voltage and current phase sequence is correct;
Communication is abnormal	Check whether the address, baud rate, check digit, etc. in the communication settings are consistent with the host computer; Check if the RS485 converter is normal; Parallel connection of 120 ohms or more at the end of the communication;
Expansion module MCE communication is not normal	Check whether the IP address, subnet mask, gateway address, port number, etc. are set correctly. Check if the host computer and the instrument network address are on the same network segment.
Expansion module MCP communication is abnormal	Check if the Profibus address is correct; Whether the Profibus interface is loose; Continue to malfunction, after disconnecting the power supply (refer to 3.3 assembly for details), re-insert the main body and the module, restart the instrument after 1 minute, if the fault is not eliminated, you need to contact our company for repair;
The expansion module MLOG indicator is not blinking properly.	1. Check if the TF card is loose and the TF card is damaged (check it in communication or display); 2, TF Error: The TF card is damaged, and the data in the TF cannot be written or read. After disconnecting the power supply (refer to 3.3 assembly for details), take out the TF card and replace it with a new TF card; 3, TF Full: TF card storage is full, after disconnecting the power, after using the card reader to read the data in the TF card on the computer, the customer needs to manually delete the unnecessary data; 4, Check Ini File: INI card in the TF configuration file is wrong, after disconnecting the power, use the card reader to format the TF card on the computer, please note that this operation will delete all data in the TF card, if necessary, Please backup the data in advance; 5, No TF Card: After disconnecting the power supply (refer to 3.3 assembly for details), remove the module and the main body, disconnect the module circuit board, and clean the TF card contact point; 6. Check whether the instrument time is accurate. If the instrument system time is set incorrectly, the TF card will not be read. 7. Continuous fault, after disconnecting the power supply (refer to 3.3 assembly for details), re-insert the main body and module, restart the instrument after 1 minute, if the fault is not eliminated, you need to contact our company for repair;
The expansion module indicator blinks abnormally	Continue to malfunction, after disconnecting the power supply (refer to 3.3 assembly for details), re-insert the main body and the module, restart the instrument after 1 minute, if the fault is not eliminated, you need to contact our company for repair.

13. Package

The package contains the following items: instrument (including plug-in terminal block), mounting bracket, certificate (anti-counterfeit label), installation and operating instructions.

When opening the product packaging, please check carefully for damage. If there is any damage, please inform ACREL company or agent in time, and please keep the damaged outer packaging, the company will replace it in time.

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