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ADL400

Installation and operation instruction V2.0

ACREL Co.,Ltd

Declaration

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

Manual revision record

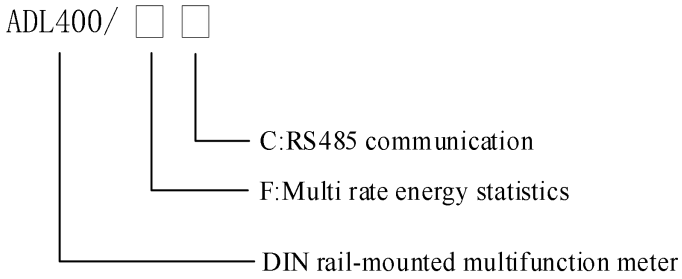
Data	Old	New	Change
2019.11.13		V1.0	1. First version
2020.04.30	V1.0	V1.1	2. Heading 6.2 changed
2020.08.24	V1.1	V1.2	3. Figure 4 and Figure 6 changed
2021.04.08	V1.2	V1.3	4. Correction of key setting flow chart
2022.01.14	V1.3	V1.4	5. Correcte mistakes in data settings 6. Add partial ADDR list 7. Update some notes in ADDR list
2022.03.03	V1.4	V1.5	8. Add description of voltage range in Table 2 9. Modify the maximum baud rate to 38400
2022.07.04	V1.5	V1.6	10. Add some register descriptions to Table 8
2023.02.07	V1.6	V1.7	11. Modify the description of the meter display interface 12. Multi-rate expansion 13. Add new data items to the Modbus protocol address table
2023.03.15	V1.7	V1.8	14. Modify the event record event type description
2024.03.18	V1.8	V1.9	15. Add some descriptions of data units 16. Add default description of key setting items 17. The time zone table expands to 14 segments 18. Modify the description diagram of the optional function 19. Edit the size description image
2025.06.27	V1.9	V1.10	20. Add optional feature F Notes 21. Modify voltage range description 22. Modify wiring diagram terminal identification 23. Add items to Table 2 24. Replace with clearer dimension drawings 25. Modify terminal identification on wiring diagram 26. Add Section 8.5 Symbols 27. Add Section 9 Analysis of common fault 28. Modify notes in the Modbus register list
2025.09.17	V1.10	V2.0	29. Modify Key Process Flowchart 30. Modify Harmonic Section Register Specifications

content

1 General

ADL400 is a smart meter designed for power supply system, industrial and mining enterprises and utilities to calculate the electricity consumption and manage the electric demand. It features the high precision, small size and simple installation. It integrates the measurement of all electrical parameters with the comprehensive electricity metering and management provides various data on previous 48 months, checks the 31st harmonic content and the total harmonic content. It is fitted with RS485 communication port and adapted to MODBUS-RTU .ADL400 can be used in all kinds of control systems, SCADA systems and energy management systems. The meter meet the related technical requirements of electricity meter in the IEC62053-21standards.

2 Type description



Note, after selecting the F function, the meter needs to be calibrated regularly.

3 Function description

Table 1 Function description list

Function	Function description	Function provide
Measurement of energy	Active kWh (positive and negative)	■
	Reactive kvarh (positive and negative)	■
	A,B,C phase positive and negative active energy	■
Measurement of electrical parameters	U\I	■
	P\Q\S\PF\F	■
Measurement of harmonics	2~31ST Voltage and Current harmonic	■
LCD Display	12 bits section LCD display, background light	■
Key programming	3 keys to communication and set parameters	■
Pulse output	Active pulse output	■
Multi-tariff and functions	Date, time	□
	Max demand and occurrence time	□
	Frozen data on last 48 months, last 90days	□

	Adapt 14 time zones, 8 time interval lists, 14 time interval by day and 8 tariff rates	□
Communication	Communication interface: RS485, Communication protocol: MODBUS-RTU	■

Note, ■ indicates standard equipment, and □ indicates optional equipment.

4 Technical parameter

Table 2 technical parameter descriptions

project			**performance parameter**	
Specification			3 phase 3 wires	3 phase 4 wires
Measurement	Voltage	Reference voltage	3×100V, 3×380V, 3×400V	3×57.7/100V, 3×220/380V, 3×230/400V
		Voltage range	L-L: 90V-480V	L-N: 50V-277V
		Consumption	<10VA(Single phase); <2W(Single phase)	
		Impedance	>2MΩ	
		Accuracy class	Error±0.2%	
	Current	Input current	3×1(6)A(transformer connection), 3×10(80)A(direct connection)	
		Consumption	<1VA (Single phase rated current)	
		Accuracy class	Error±0.2%	
	Power		Active, reactive, apparent power, error±0.5%	
	Frequency		45～65Hz, Error±0.2%	
Metering	Energy		Active energy(Accuracy class: 0.5); reactive energy(Accuracy class 2)	
	Clock		≤0.5s/d	
Standards			IEC 61010-1；IEC 61010-2-030	
Overvoltage category			OVC III	
Measurement category			CAT III	
Pollution degree			Class 2	
Digit signal	Energy pulse output		1 active photocoupler output	
pulse	Width of pulse		80±20ms	
	Pulse constant		10000imp/kWh(transformer connection); 400imp/kWh(direct connection)	
communication	Interface and communication protocol		RS485：Modbus RTU	
	Range of communication address		Modbus RTU:1~ 254；	
	Baud rate		1200bps~38400bps	
environment	working temperature		-25℃~+55℃	
	Storage temperature		-40℃~+70℃	
	Use location		Dry location use only; Indoor use only	
	IP Degree of Protection		IP30	
	Relative humidity		≤95%(No condensation)	
	Altitude		≤2000m	

5 Dimension drawings (Unit: mm, dimensional tolerance ±1 mm, wiring hole dimensional tolerance ±0.5 mm)

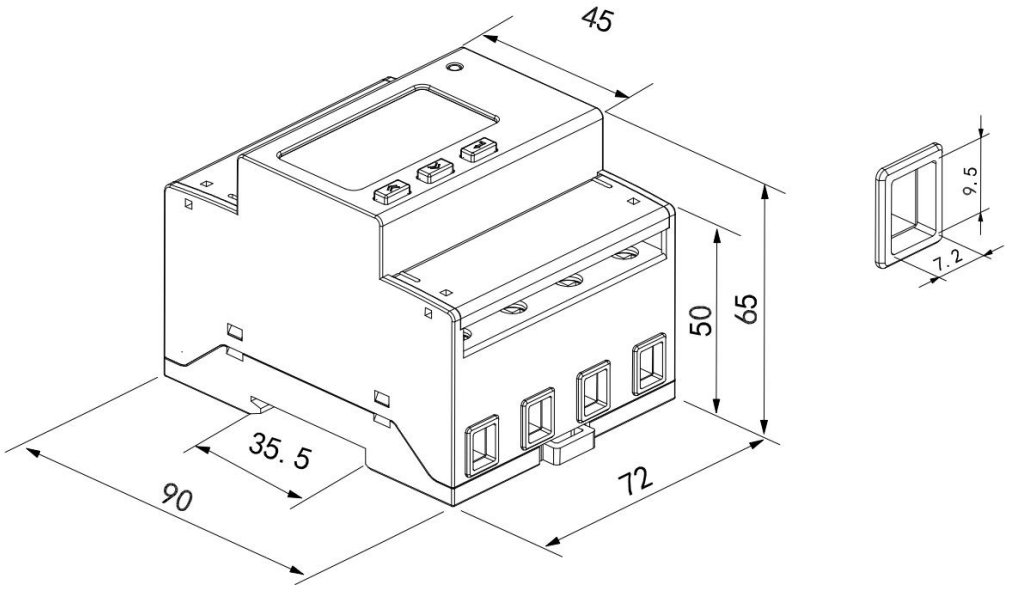


Fig 1 direct connect

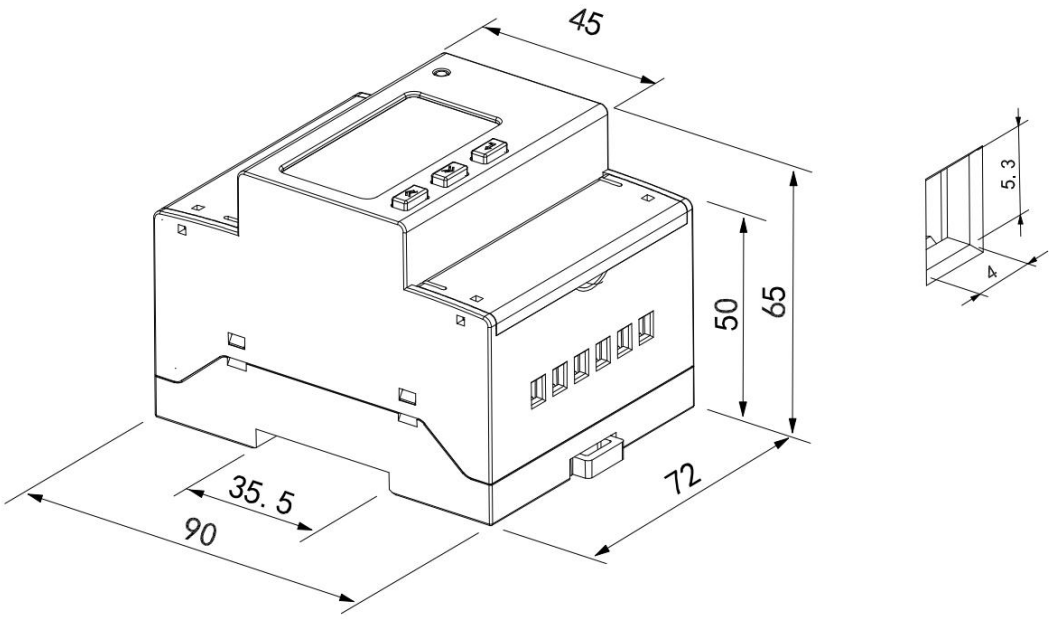


Fig 2 connect via CT

Note, the torque of direct connect should not be greater than 3-4N·m, and the torque of connect via CT should not be greater than 0.5N·m.

6 Wiring and installing

6.1 Wiring sample of voltage and current

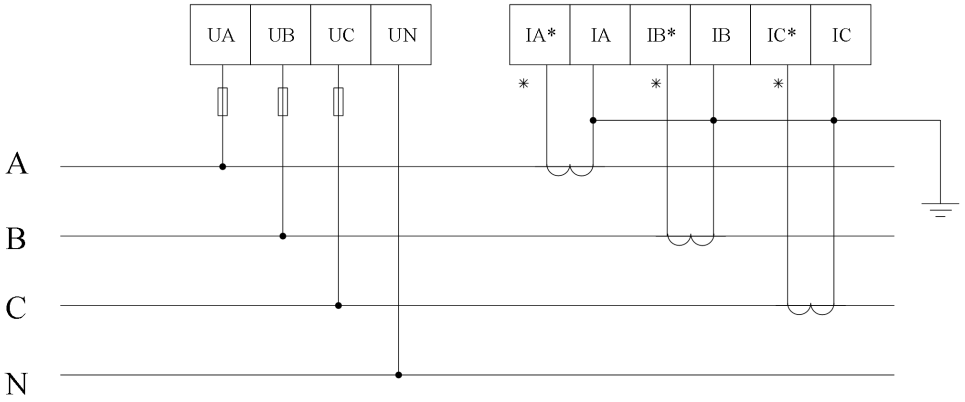


Fig 3 Three phase four lines connect via CT

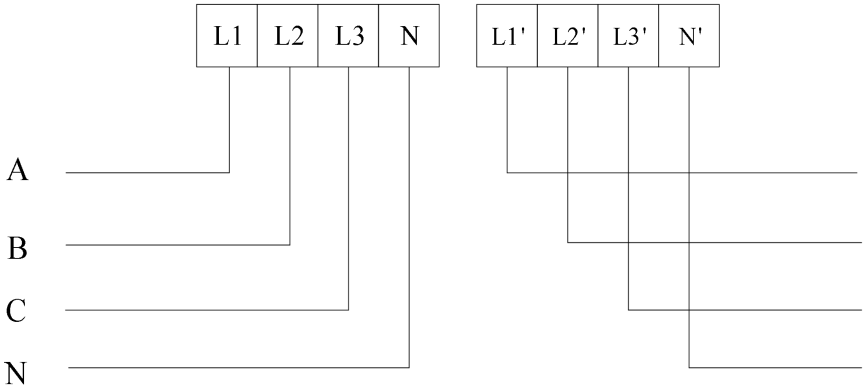


Fig 4 Three phase four lines direct connect

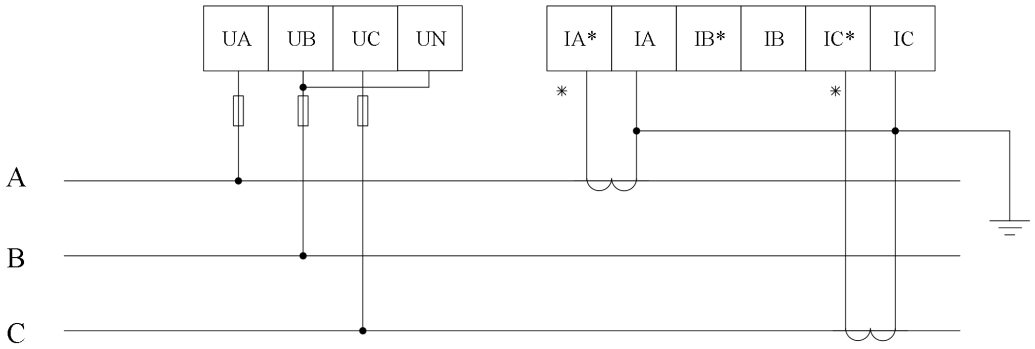


Fig 5 Three phase three lines connect via CT

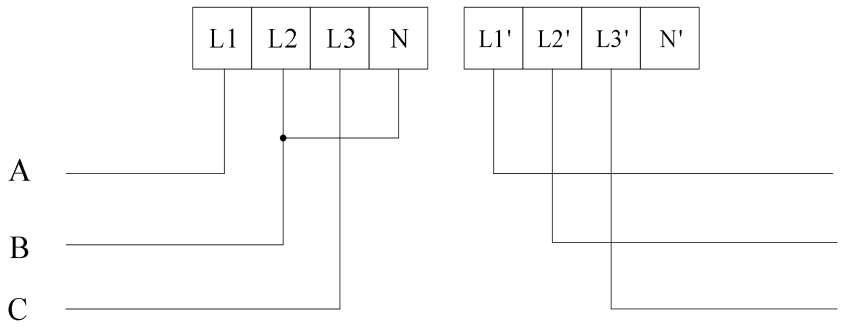


Fig 6 Three phase three lines direct connect

6.2 Wiring diagram of communication and pulse terminals

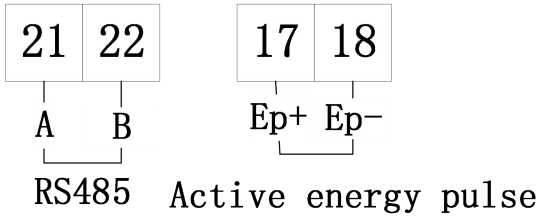


Fig 7 Communication and pulse connection

6.3 Safety instruction

This manual does not contain all of the safety measures for operation of the equipment(module, device),because special operating conditions, and local code requirements or regulations may necessitate further measures. However,it does contain information which must be read for your personal safety and to avoid material damages. This information is highlighted by a warning triangle and is represented as follow.

This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

Installation Requirements

Check that the ambient air temperature and the ambient humidity are within their specified ranges in Environmental Specifications.

Be sure that heat from surrounding equipment does not cause this product to exceed its standard operating temperature.

Overcurrent protection shall be provided in the end installation.

6.4 Disclaimer

If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

6.5 Maintenance

If the meter experiences issues such as a black screen, failure to update data, or communication failure, timely repair requests shall be made.

Users are prohibited from disassembling, modifying without authorization.

If any abnormalities are detected (e.g., smoke, unusual noises, etc.), the power supply must be immediately disconnected, and repairs must be reported.

7 Function description

7.1 Measurement

It can measure the electrical parameter,include U, I, P, Q, S, PF, F, 2~31th harmonic。

Such as:U = 220.1V, F = 49.98Hz,　I = 1.99A，P = 0.439kW

7.2 Metering

Can measure the active energy、forward active energy、reversing active energy、forward reactive energy、reversing reactive energy.

7.3 Timing

Eight timing tables, fourteen time zones, each table has fourteen timing, eight rates。

7.4 Demand

Table 3 Demand description list

Demand	The average power in the demand cycle.
Maximum demand	The maximum value of demand in a period of time.
Slip time	A recurrence method to measure the demand from any time point during a period shorter than the demand period. The demand measured by this means is called sliding demand. The recurrence time is sliding window time.
Demand cycle	The time period between two same average value of demand.

The default demand cycle is 15 minutes, slip time is 1 minute.

The meter can measure 4 kinds of maximum demand: forward active, reversing active, inductive reactive, capacitive reactive maximum demand and the occur time of them.

7.5 History data statistics

The meter can record last 48 months or last 90 days history energy in each tariff.

8 Operation and display

8.1 Key function description

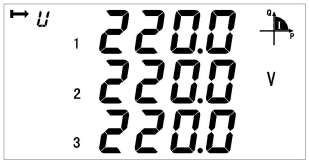
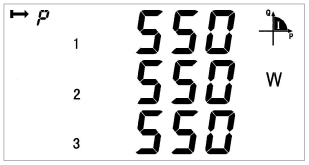
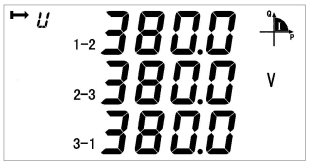
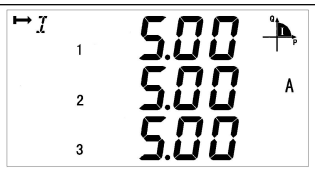
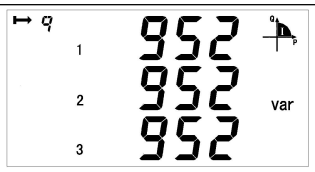
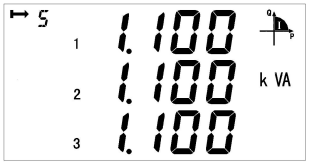
Table 4 Key's function description

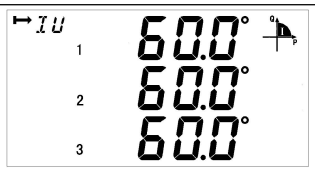
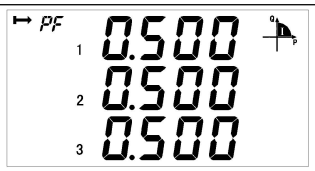
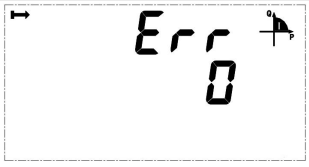
icon	Name	Function
	Voltage and current Up key	Check the voltage and current Leftward and change flash in programming menu
	Power Down key	Check the power Rightward and change the value on flash
	Energy Enter key	Check the energy In/out programming menu Save changes

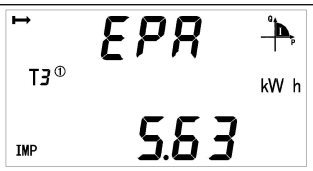
8.2 Display menu

The meter will show the forward active energy after powering. The customers can change the information showing by pressing the keys. After setting the transformation ratio, the data displayed by the meter are all primary-side values, i.e. the actual values incorporating the transformation ratio calculation.The menu description is listed as below.

Table 5 display description

		 (T3 indicates currently running at rate 3, ① indicates currently running at time table 1)
 Three-phase voltage	 Three phase active power	 (Current value is1616.89kWh) Current total active energy Note: Directly connected meters have two decimal places for energy display, while transformers connected meters only display one decimal place.
 Three phase line voltage	 Total active power	 Current rate 1 active energy
 Three-phase current	 Three phase reactive power	 Current rate 2 active energy
 Frequency	 Total reactive power	 Current rate 3 active energy
 Harmonic content of three phase voltage	 Three phase apparent power	 Current rate 4 active energy
 Harmonic content of three phase current	 Total apparent power	 Current forward active total energy

 Phase angle	 Three phase power factor	 Current reversing active total energy
 Time	 Total power factor	 Current total reactive energy
 Check bit, baud rate, meter address		 Current reactive rate 1 energy
 Meter number of 645 protocol		 Current reactive rate 2 energy
 Software version number		 Current reactive rate 3 energy
 Measurement chip error code (0 is normal)		 Current reactive rate 4 energy
 full display detection		 Current forward reactive total energy
		 Current reversing reactive total energy

		 Current forward active energy on A phase
		 Current forward active energy on B phase
		 Current forward active energy on C phase

Note:

1. All the display menus above are in the model of ADL400 three phases four lines with multi-tariff rate function and can be changed by the keys.

2. There will not be power or power factor on each phase and will only show total power and power factor (active, reactive, apparent) under the three phase three lines.

3. There will not be date, time, maximum demand and ratye energy without the function of multi-tariff rate(F).

4. The amount of rate energy displayed is determined by the maximum rate of the set time meter, for example, if the maximum rate set is T5 (rate 5), then the meter displays the rate energy 1-5.

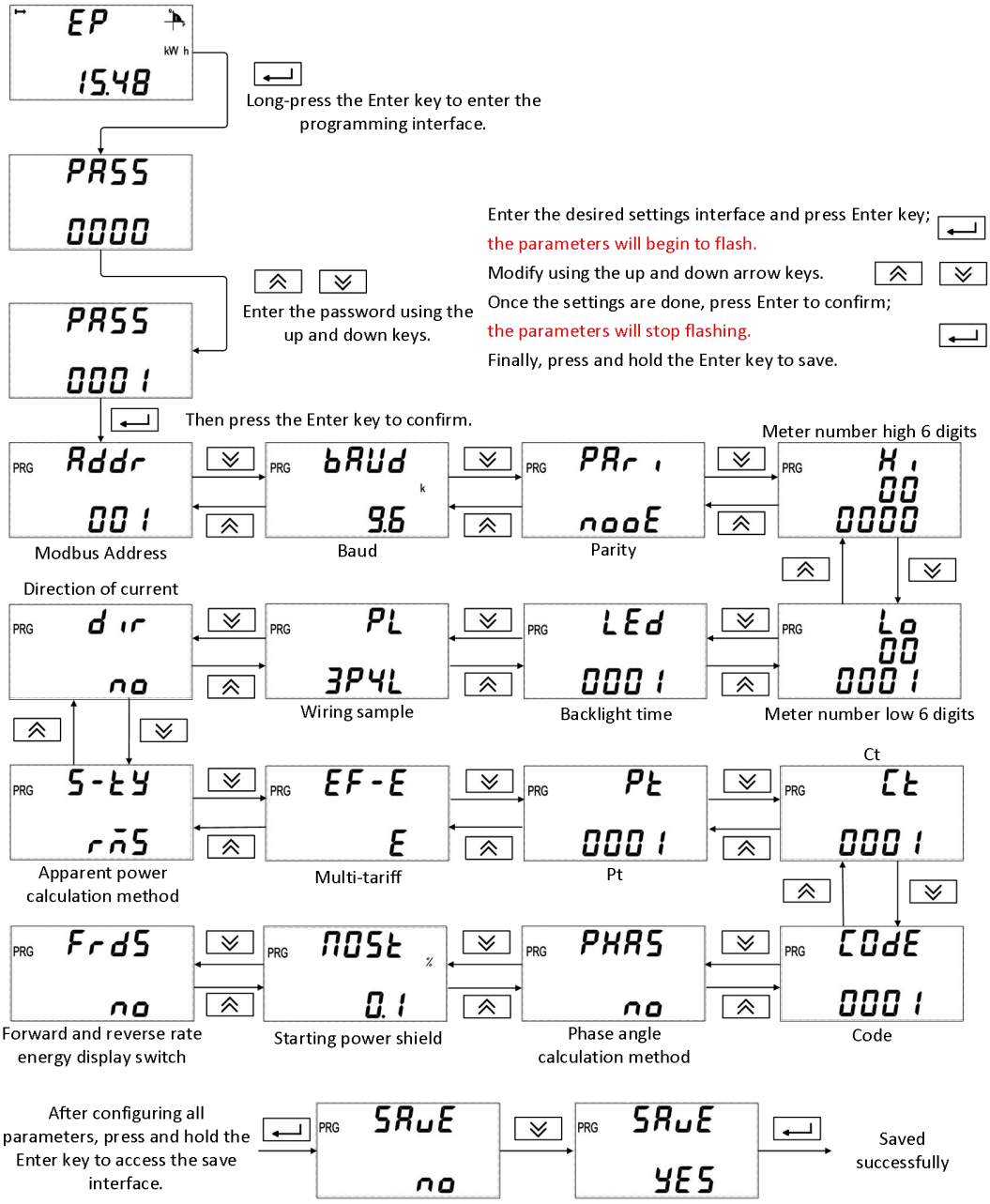
5. The arrow in the upper left corner of the screen represents the DIR setting. From left to right, it indicates that the DIR setting is 0; if the arrow is from right to left, it indicates that the DIR setting is 1.

6. The 'IMP' in the lower left corner of the screen indicates that the current display is positive energy, while 'EXP' indicates that the current display is negative energy.

8.3 Key Menu

Keep press  at any main menu and get in "PASS" interface, and then press  show "0000", and enter the code. If you enter a wrong code, it will show "fail" and back to main menu; and if you enter a right code, you can set the parameter. After setting the parameter

and keep press , it will show “save” and save the change by pressing in “yes” interface and quit without save by pressing in “no” interface.



8.4 Data settings

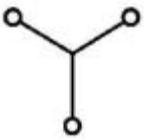
Table 6 Menu description

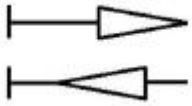
Num	Second menu		
	Symbol	Mean	Range
1	ADDR	Communicate’s ADDR settings	1-254
2	Baud	Baud choose	1200, 2400, 4800, 9600, 19200, 38400

3	Pari	Parity choose	None, Odd, Even
4	LED	Backlight time	0-255minutes, (more than 000 stay light-on) Default value：1min
5	PL	Wiring sample	3P4L:3 phase 4 wires 3P3L:3 phase 3 wires
6	DIR	direction of current	no-Forward yes-Reverse
7	S-TY	Apparent power calculation method	PQS, RMS
8	EF-E	Multi-tariff function	EF-Function on E-Function off
9	Pt	Voltage transformer settings	1-9999
10	Ct	Current transformer settings	1-9999
11	CoDE	Code settings	1-9999
12	PHAS	Phase angle calculation method	No-Angle between each current and each voltage Yes-Angle between three-phase current and phase a voltage
13	nost	Starting power shield	Shielding range:0.1-2.0% (*UnIn)
14	Frds	Forward and reverse rate energy display switch	0-off, 1-on

Note: Marked yellow is the default value.

8.5 Symbols

Number	Symbol	Description
1		Caution
2		Class C
3		Protective class II equipment (Double or reinforced insulation)
4		Three-phase four-wire circuits

5		Bidirectional meter

9 Analysis of common fault

Fault content	Analysis
No display on power	Check whether the power supply voltage is in the work voltage range. Restart the instrument, if the fault is not eliminated, you need to contact our company for repair.
Incorrect reading of voltage an 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 and parity bit in the communication settings are consistent with those of the host computer. Check if the RS485 converter is normal. Parallel connection of 120 ohms or more at the end of the communication.

10 Communication description

The meter adapts MODBUS-RTU protocol, and the baud rate can be chosen from 1200bps、2400 bps、4800 bps、9600bps、19200bps and 38400 bps. The parity defaults to None.

The meter needs shielded twisted pair conductors to connect. Customers should consider the whole network′s parameters such like communication wire′s length, the direction, communication transformer and network cover range, etc.

Note:

1. Wiring should follow the wiring requirements;
2. Connect all the meter in the RS485 net work even some do not need to communication, which is benefit for error checking and testing.
3. Use two color wires in connecting wires and all the A port use the same color.
4. No longer than 1200 meters of RS485 bus line.

10.1 ADDR List

MODBUS-RTU protocol has 03H and 10H command to read and write registers. The following chart is registers′ address list:

Table 8 communication address list

Address	Variable	Length	R/W	Notes
0000H	Current total active energy	4	R	UINT32

0002H	Current spike active energy	4	R	Unit: 0.01kWh (Secondary side data) Particularly, if ct and Pt is not all 1, actual electric energy value should be product of register reading and Pt*ct, except for the specially noted register data.
0004H	Current peak active energy	4	R	
0006H	Current flat active energy	4	R	
0008H	Current valley active energy	4	R	
000AH	Current forward active total energy	4	R	
000CH	Current forward active spike energy	4	R	
000EH	Current forward active peak energy	4	R	
0010H	Current forward active flat energy	4	R	
0012H	Current forward active valley energy	4	R	
0014H	Current reversing active total energy	4	R	
0016H	Current reversing active spike energy	4	R	
0018H	Current reversing Active peak energy	4	R	
001AH	Current reversing active flat energy	4	R	
001CH	Current reversing Active valley energy	4	R	
001EH	Current total reactive energy	4	R	UINT32 Unit: 0.01kvarh (Secondary side data) Particularly, note the same as above.
0020H	Current reactive spike energy	4	R	
0022H	Current reactive peak energy	4	R	
0024H	Current reactive flat energy	4	R	
0026H	Current reactive valley energy	4	R	
0028H	Current forward reactive total energy	4	R	
002AH	Current forward reactive spike energy	4	R	
002CH	Current forward reactive peak energy	4	R	
002EH	Current forward reactive flat energy	4	R	
0030H	Current forward reactive valley energy	4	R	
0032H	Current reversing reactive total energy	4	R	
0034H	Current reversing reactive spike energy	4	R	
0036H	Current reversing reactive peak energy	4	R	
0038H	Current reversing reactive flat energy	4	R	
003AH	Current reversing reactive valley energy	4	R	
003CH	Time：second、minute	2	R/W	Analyse the high and low bits separately
003DH	Time：hour、day	2	R/W	
003EH	Time：month、year	2	R/W	
003FH	Address（high 8 bit） Baud（low 8 bit）	2	R/W	Baud： 0：1200 1：2400 2：4800 3：9600 4：19200 5：38400
0040H	Pulse constant	2	R	UINT16
0041H	First time zone address First time zone start data:day	2	R/W	Time table number： 1：First time table

0042H	First time zone start data:month Second time zone address	2	R/W	2：Second time table 3：Third time table 4：Fourth time table 5：Fifth time table 6：Sixth time table 7：Seventh time table 8：Eighth time table
0043H	Second time zone start data:day Second time zone start data:month	2	R/W	
0044H	Third time zone address Third time zone start data:day	2	R/W	
0045H	Third time zone start data:month Fourth time zone address	2	R/W	
0046H	Fourth time zone start data:day Fourth time zone start data:month	2	R/W	
0047H-0060H	Reserve			
0061H	Voltage of A phase	2	R	Unit：0.1V (Secondary side data)
0062H	Voltage of B phase	2	R	
0063H	Voltage of C phase	2	R	
0064H	Current of A phase	2	R	Unit：0.01A (Secondary side data)
0065H	Current of B phase	2	R	
0066H	Current of C phase	2	R	
0067H-0076H	Reserve			
0077H	Frequency	2	R	UINT16, Unit：0.01Hz
0078H	Voltage between A-B	2	R	Unit：0.1V (Secondary side data)
0079H	Voltage between C-B	2	R	
007AH	Voltage between A-C	2	R	
007BH	Forward active maximum demand	2	R	UINT16 Unit：0.001kW/kvar Sequence of occurrence time: minute, hour, day, month
007CH	Time of occurrence for the forward active maximum amount:minute, hour	2	R	
007DH	Time of occurrence for the forward active maximum amount:day, month	2	R	
007EH	Reversing active maximum demand	2	R	
007FH	Time of occurrence for the Reversing active maximum demand amount:minute, hour	2	R	
0080H	Time of occurrence for the Reversing active maximum demand amount:day, month	2	R	
0081H	Maximum forward demand for reactive power	2	R	
0082H	Time of occurrence for the forward reactive maximum amount:minute, hour	2	R	
0083H	Time of occurrence for the forward reactive maximum amount:day, month	2	R	
0084H	Maximum reversing demand for reactive power	2	R	

0085H	Time of occurrence for the reversing reactive maximum amount:minute, hour	2	R	
0086H	Time of occurrence for the reversing reactive maximum amount:day, month	2	R	
0087H	Forward active energy of A phase	4	R	UINT32 Unit: 0.01kWh (Secondary side data)
0089H	Forward active energy of B phase	4	R	
008BH	Forward active energy of C phase	4	R	
008DH	PT	2	R/W	UINT16
008EH	CT	2	R/W	
008FH-0091H	Reserve			
0092H	Zero sequence current	2	R	UINT16, Unit: 0.01A (Secondary side data)
0093H	Voltage imbalance	2	R	UINT16 Resolution：0.1%
0094H	Current imbalance	2	R	
0095H	Parity bit（high 8 bit） Stop bit（low 8 bit）	2	R/W	Parity bit： 0：None 1：Odd 2：Even Stop bit： 0：one stop bit 1：two stop bit
0096H-00A5H	Reserve			
00A6H	Code	2	R/W	1-9999
00A7H-00C9H	Reserve			
00CAH	The back light time	2	R/W	0-255min, 0 means solid
00CBH-0120H	Reserve			
0121H	Daily frozen time:Hour	2	R/W	Analyse the high and low bits separately
0122H	Monthly frozen time:day、hour	2	R/W	
0123H-0124H	Reserve			
0125H	Period 1 Rate Code/Period 1 Start: Minute	2	R/W	The first set of time table Rate Code: 0: No rate 1: T1 2: T2 3: T3 4: T4 5: T5 6: T6 7: T7 8: T8 (Typically, T1-T8 are set by default from high rates
0126H	Period 1 Start: Hour/Period 2 rate code	2	R/W	
0127H	Period 2 Start: Minute/Period 2 Start: Hour	2	R/W	
0128H	Period 3 Rate Code/Period 3 Start: Minute	2	R/W	
0129H	Period 3 Start: Hour/Period 4 rate code	2	R/W	
012AH	Period 4 Start: Minute/Period 4 Start: Hour	2	R/W	
012BH	Period 5 Rate Code/Period 5 Start: Minute	2	R/W	
012CH	Period 5 Start: Hour/Period 6 rate code	2	R/W	
012DH	Period 6 Start: Minute/Period 6 Start: Hour	2	R/W	
012EH	Period 7 Rate Code/Period 7 Start: Minute	2	R/W	
012FH	Period 7 Start: Hour/Period 8 rate code	2	R/W	
0130H	Period 8 Start: Minute/Period 8 Start: Hour	2	R/W	
0131H	Period 9 Rate Code/Period 9 Start: Minute	2	R/W	

0132H	Period 9 Start: Hour/Period 10 rate code	2	R/W	to low rates, such as: T1 spike, T2 peak, T3 flat, T4 valley, T5 deep valley.)
0133H	Period 10 Start: Minute/Period 10 Start: Hour	2	R/W	
0134H	Period 11Rate Code/Period 11Start: Minute	2	R/W	
0135H	Period 11 Start: Hour/Period 12 rate code	2	R/W	
0136H	Period 12 Start: Minute/Period 12 Start: Hour	2	R/W	
0137H	Period 13 Rate Code/Period 13 Start: Minute	2	R/W	
0138H	Period 13 Start: Hour/Period 14 rate code	2	R/W	
0139H	Period 14 Start: Minute/Period 14 Start: Hour	2	R/W	
013AH-014EH	The second set of time table	42	R/W	Same as above
014FH-0163H	Reserve			
0164H	Active power of A phase	4	R	INT32 Unit：0.001kW (Secondary side data)
0166H	Active power of B phase	4	R	
0168H	Active power of C phase	4	R	
016AH	Total active power	4	R	
016CH	Reactive power of A phase	4	R	INT32 Unit：0.001kvar (Secondary side data)
016EH	Reactive power of B phase	4	R	
0170H	Reactive power of C phase	4	R	
0172H	Total reactive power	4	R	
0174H	Apparent power of A phase	4	R	UINT32 Unit：0.001kVA (Secondary side data)
0176H	Apparent power of B phase	4	R	
0178H	Apparent power of C phase	4	R	
017AH	Total apparent power	4	R	
017CH	Power factor of A phase	2	R	INT16 Resolution：0.001
017DH	Power factor of B phase	2	R	
017EH	Power factor of C phase	2	R	
017FH	Total power factor	2	R	
0180H	Maximum demand for forward active power on the day	2	R	UINT16 Unit:0.001kW/kvar Sequence of occurrence time: minute, hour.
0181H	Occur time:minute、hour	2	R	
0182H	Maximum demand for reverse active power on the day	2	R	
0183H	Time of occurrence: minute, hour	2	R	
0184H	Maximum demand for forward reactive power on the day	2	R	
0185H	Time of occurrence: minute, hour	2	R	
0186H	Maximum demand for reverse reactive power on the day	2	R	
0187H	Time of occurrence: minute, hour	2	R	
0188H	Maximum demand for forward active power last day	2	R	
0189H	Time of occurrence: minute, hour	2	R	
018AH	Maximum demand for reverse active power last day	2	R	

018BH	Time of occurrence: minute, hour	2	R	
018CH	Maximum demand for forward reactive power last day	2	R	
018DH	Time of occurrence: minute, hour	2	R	
018EH	Maximum demand for reverse reactive power last day	2	R	
018FH	Occur time:minute, hour	2	R	
0190H	Maximum demand for forward active power last 2 days	2	R	
0191H	Time of occurrence: minute、hour	2	R	
0192H	Maximum demand for reverse active power last 2 days	2	R	
0193H	Occur time:minute、hour	2	R	
0194H	Maximum demand for forward reactive power last 2 days	2	R	
0195H	Time of occurrence: minute、hour	2	R	
0196H	Maximum demand for reverse reactive power last 2 days	2	R	
0197H	Time of occurrence: minute、hour	2	R	
0198H	Current forward active demand	2	R	
0199H	Current reversing active demand	2	R	
019AH	Current forward reactive demand	2	R	
019BH	Current reversing reactive demand	2	R	
019BH-019FH	Reserve			
01A0H	Active power of A phase	4	R	INT32 Unit：0.0001kW (Secondary side data)
01A2H	Active power of B phase	4	R	
01A4H	Active power of C phase	4	R	
01A6H	Total active power	4	R	
01A8H	Reactive power of A phase	4	R	INT32 Unit：0.0001kvar (Secondary side data)
01AAH	Reactive power of B phase	4	R	
01ACH	Reactive power of C phase	4	R	
01AEH	Total reactive power	4	R	
01B0H	Apparent power of A phase	4	R	UINT32 Unit：0.0001kVA (Secondary side data)
01B2H	Apparent power of B phase	4	R	
01B4H	Apparent power of C phase	4	R	
01B6H	Total apparent power	4	R	
01B8H-01FFH	Reserve			
0200H	Maximum voltage on A phase	2	R	UINT16 (Secondary side data) Units are as follows: Voltage 0.1V Current 0.01A
0201H	Date of occurrence：month、day	2	R	
0202H	Time of occurrence：hour、minute	2	R	
0203H	Maximum voltage on B phase and occurrence time	6	R	

0206H	Maximum voltage on C phase and occurrence time	6	R	Active power 0.001kW Reactive power 0.001kvar Apparent power 0.001kVA
0209H	Maximum current on A phase and occurrence time	6	R	
020CH	Maximum current on B phase and occurrence time	6	R	
020FH	Maximum current on B phase and occurrence time	6	R	
0212H	Maximum active power on A phase	4	R	
0214H	Date of occurrence：month、day	2	R	
0215H	Time of occurrence：hour、minute	2	R	
0216H	Maximum active power on B phase and occurrence time	8	R	
021AH	Maximum active power on C phase and occurrence time	8	R	
021EH	Maximum total active power and occurrence time	8	R	
0222H	Maximum reactive power on A phase and occurrence time	8	R	
0226H	Maximum reactive power on B phase and occurrence time	8	R	
022AH	Maximum reactive power on C phase and occurrence time	8	R	
022EH	Maximum total reactive power and occurrence time	8	R	
0232H	Maximum apparent power on A phase and occurrence time	8	R	
0236H	Maximum apparent power on B phase and occurrence time	8	R	
023AH	Maximum apparent power on C phase and occurrence time	8	R	
023EH	Maximum total apparent power and occurrence time	8	R	
0242H	Minimum voltage on A phase and occurrence time	6	R	
0245H	Minimum voltage on B phase and occurrence time	6	R	
0248H	Minimum voltage on C phase and occurrence time	6	R	
024BH	Minimum current on A phase and occurrence time	6	R	
024EH	Minimum current on B phase and occurrence time	6	R	

0251H	Minimum current on C phase and occurrence time	6	R	
0254H	Minimum active power on A phase and occurrence time	8	R	
0258H	Minimum active power on B phase and occurrence time	8	R	
025CH	Minimum active power on C phase and occurrence time	8	R	
0260H	Minimum total active power and occurrence time	8	R	
0264H	Minimum reactive power on A phase and occurrence time	8	R	
0268H	Minimum reactive power on B phase and occurrence time	8	R	
026CH	Minimum reactive power on C phase and occurrence time	8	R	
0270H	Minimum total reactive power and occurrence time	8	R	
0274H	Minimum apparent power on A phase and occurrence time	8	R	
0278H	Minimum apparent power on B phase and occurrence time	8	R	
027EH	Minimum apparent power on C phase and occurrence time	8	R	
0280H	Minimum total apparent power and occurrence time	8	R	
0285H-06FFH	Reserve			
0700H-0714H	The third set of time table	42	R/W	Same as the first set of time table
0715H-0729H	The fourth set of time table	42	R/W	
072AH-073EH	The fifth set of time table	42	R/W	
073FH-0753H	The sixth set of time table	42	R/W	
0754H-0768H	The seventh set of time table	42	R/W	
0769H-077DH	The eighth set of time table	42	R/W	
077EH-077FH	Reserve			
0780H	Fifth time zone address Fifth time zone start data:day	2	R/W	Time table number： 1：First time table 2：Second time table 3：Third time table 4：Fourth time table 5：Fifth time table 6：Sixth time table 7：Seventh time table
0781H	Fifth time zone start data:month Sixth time zone address	2	R/W	
0782H	Sixth time zone start data:day Sixth time zone start data:month	2	R/W	
0783H	Seventh time zone address Seventh time zone start data:day	2	R/W	

0784H	Seventh time zone start data:month Eighth time zone address	2	R/W	8：Eighth time table
0785H	Eighth time zone start data:day Eighth time zone start data:month	2	R/W	
0786H	Ninth time zone address Ninth time zone start data:day	2	R/W	
0787H	Ninth time zone start data:month Tenth time zone address	2	R/W	
0788H	Tenth time zone start data:day Tenth time zone start data:month	2	R/W	
0789H	Eleventh time zone address Eleventh time zone start data:day	2	R/W	
078AH	Eleventh time zone address Twelfth time zone start data:day	2	R/W	
078BH	Twelfth time zone start data:month Twelfth time zone address	2	R/W	
078CH	Thirteenth time zone start data:day Thirteenth time zone start data:month	2	R/W	
078DH	Thirteenth time zone address Fourteenth time zone start data:day	2	R/W	
078EH	Fourteenth time zone address Fourteenth time zone start data:day	2	R/W	
F000H-F006H	serial number	14	R	BCD code

10.2 Primary and secondary data

10.2.1 Floating point electrical parameter data

Secondary side data without multiplication of the variable ratio				
5300H	Voltage of A phase	4	R	Float Unit:V
5302H	Voltage of B phase	4	R	
5304H	Voltage of C phase	4	R	
5306H	Voltage between A-B	4	R	
5308H	Voltage between C-B	4	R	
530AH	Voltage between A-C	4	R	
530CH	Current of A phase	4	R	Float Unit:A
530EH	Current of B phase	4	R	
5310H	Current of C phase	4	R	
5312H	Active power of A phase	4	R	Float Unit:W
5314H	Active power of B phase	4	R	
5316H	Active power of C phase	4	R	
5318H	Total active power	4	R	
531AH	Reactive power of A phase	4	R	Float

531CH	Reactive power of B phase	4	R	Unit:var
531EH	Reactive power of C phase	4	R	
5320H	Total reactive power	4	R	
5322H	Apparent power of A phase	4	R	
5324H	Apparent power of B phase	4	R	Float
5326H	Apparent power of C phase	4	R	Unit:VA
5328H	Total apparent power	4	R	
532AH	Power factor of A phase	4	R	
532CH	Power factor of B phase	4	R	
532EH	Power factor of C phase	4	R	
5330H	Total power factor	4	R	
5332H	frequency	4	R	Float Unit:Hz
5334H	zero line current	4	R	Float Unit:A
Primary side data that has been multiplied by the variable ratio				
0800H	Voltage of A phase	4	R	
0802H	Voltage of B phase	4	R	
0804H	Voltage of C phase	4	R	Float
0806H	Voltage between A-B	4	R	Unit:V
0808H	Voltage between C-B	4	R	
080AH	Voltage between A-C	4	R	
080CH	Current of A phase	4	R	
080EH	Current of B phase	4	R	Float
0810H	Current of C phase	4	R	Unit:A
0812H	zero line current	4	R	
0814H	Active power of A phase	4	R	
0816H	Active power of B phase	4	R	Float
0818H	Active power of C phase	4	R	Unit:kW
081AH	Total active power	4	R	
081CH	Reactive power of A phase	4	R	
081EH	Reactive power of B phase	4	R	Float
0820H	Reactive power of C phase	4	R	Unit:kvar
0822H	Total reactive power	4	R	
0824H	Apparent power of A phase	4	R	
0826H	Apparent power of B phase	4	R	Float
0828H	Apparent power of C phase	4	R	Unit:kVA
082AH	Total apparent power	4	R	
082CH	Power factor of A phase	4	R	
082EH	Power factor of B phase	4	R	
0830H	Power factor of C phase	4	R	
0832H	Total power factor	4	R	
0834H	frequency	4	R	Float Unit:Hz
0836H	Voltage imbalance	4	R	
0838H	Current imbalance	4	R	

083AH	Current forward active demand	4	R	Float Unit:kW
083CH	Current reversing active demand	4	R	
083EH	Current forward reactive demand	4	R	Float Unit:kvar
0840H	Current reversing reactive demand	4	R	
0842H	Current total active energy	4	R	UINT32 Unit: 0.1kWh (Primary side data)
0844H	Current spike active energy	4	R	
0846H	Current peak active energy	4	R	
0848H	Current flat active energy	4	R	
084AH	Current valley active energy	4	R	
084CH	Current forward active total energy	4	R	
084EH	Current forward active spike energy	4	R	
0850H	Current forward active peak energy	4	R	
0852H	Current forward active flat energy	4	R	
0854H	Current forward active valley energy	4	R	
0856H	Current reversing active total energy	4	R	
0858H	Current reversing active spike energy	4	R	
085AH	Current reversing Active peak energy	4	R	
085CH	Current reversing active flat energy	4	R	
085EH	Current reversing Active valley energy	4	R	
0860H	Current total reactive energy	4	R	UINT32 Unit: 0.1kvarh (Primary side data)
0862H	Current reactive spike energy	4	R	
0864H	Current reactive peak energy	4	R	
0866H	Current reactive flat energy	4	R	
0868H	Current reactive valley energy	4	R	
086AH	Current forward reactive total energy	4	R	
086CH	Current forward reactive spike energy	4	R	
086EH	Current forward reactive peak energy	4	R	
0870H	Current forward reactive flat energy	4	R	
0872H	Current forward reactive valley energy	4	R	
0874H	Current reversing reactive total energy	4	R	
0876H	Current reversing reactive spike energy	4	R	
0878H	Current reversing reactive peak energy	4	R	
087AH	Current reversing reactive flat energy	4	R	
087CH	Current reversing reactive valley energy	4	R	

10.2.2 Eight rates energy data

E200H	Current total active energy	4	R	UINT32 Unit: kWh (Secondary side data) Note that the model number distinguishes decimal places. Instrument transformer
E202H	Current rate 1 (spike) active energy	4	R	
E204H	Current rate 2 (peak) active energy	4	R	
E206H	Current rate 3 (flat) active energy	4	R	
E208H	Current rate 4 (valley) active energy	4	R	
E20AH	Current rate 5 active energy	4	R	
E20CH	Current rate 6 active energy	4	R	

E20EH	Current rate 7 active energy	4	R	access: 4 decimal places Direct access: 2 decimal places
E210H	Current rate 8 active energy	4	R	
E212H	Current forward active total energy	4	R	
E214H	Current forward active rate 1 energy	4	R	
E216H	Current forward active rate 2 energy	4	R	
E218H	Current forward active rate 3 energy	4	R	
E21AH	Current forward active rate 4 energy	4	R	
E21CH	Current forward active rate 5 energy	4	R	
E21EH	Current forward active rate 6 energy	4	R	
E220H	Current forward active rate 7 energy	4	R	
E222H	Current forward active rate 8 energy	4	R	
E224H	Current reversing active total energy	4	R	
E226H	Current reversing active rate 1 energy	4	R	
E228H	Current reversing active rate 2 energy	4	R	
E22AH	Current reversing active rate 3 energy	4	R	
E22CH	Current reversing active rate 4 energy	4	R	
E22EH	Current reversing active rate 5 energy	4	R	
E230H	Current reversing active rate 6 energy	4	R	
E232H	Current reversing active rate 7 energy	4	R	
E234H	Current reversing active rate 8 energy	4	R	
E236H	Current total reactive energy	4	R	UINT32 Unit: kvarh (Secondary side data) Note that the model number distinguishes decimal places: Instrument transformer access: 4 decimal places Direct access: 2 decimal places
E238H	Current rate 1 (spike) reactive energy	4	R	
E23AH	Current rate 2 (peak) reactive energy	4	R	
E23CH	Current rate 3 (flat) reactive energy	4	R	
E23EH	Current rate 4 (valley) reactive energy	4	R	
E240H	Current rate 5 reactive energy	4	R	
E242H	Current rate 6 reactive energy	4	R	
E244H	Current rate 7 reactive energy	4	R	
E246H	Current rate 8 reactive energy	4	R	
E248H	Current forward reactive total energy	4	R	
E24AH	Current forward reactive rate 1 energy	4	R	
E24CH	Current forward reactive rate 2 energy	4	R	
E24EH	Current forward reactive rate 3 energy	4	R	
E250H	Current forward reactive rate 4 energy	4	R	
E252H	Current forward reactive rate 5 energy	4	R	
E254H	Current forward reactive rate 6 energy	4	R	
E256H	Current forward reactive rate 7 energy	4	R	
E258H	Current forward reactive rate 8 energy	4	R	
E25AH	Current reversing reactive total energy	4	R	
E25CH	Current reversing reactive rate 1 energy	4	R	
E25EH	Current reversing reactive rate 2 energy	4	R	
E260H	Current reversing reactive rate 3 energy	4	R	
E262H	Current reversing reactive rate 4 energy	4	R	

E264H	Current reversing reactive rate 5 energy	4	R	
E266H	Current reversing reactive rate 6 energy	4	R	
E268H	Current reversing reactive rate 7 energy	4	R	
E26AH	Current reversing reactive rate 8 energy	4	R	
E26CH	Forward active energy of A phase	4	R	UINT32 Unit: kWh (Secondary side data) Note the same
E26EH	Forward active energy of B phase	4	R	
E270H	Forward active energy of C phase	4	R	
E272H	Reversing active energy of A phase	4	R	
E274H	Reversing active energy of B phase	4	R	
E276H	Reversing active energy of C phase	4	R	
E278H-E2FFH	Reserve			
E300H	Current total active energy	4	R	UINT32 Unit: 0.1kWh (Primary side data)
E302H	Current rate 1 (spike) active energy	4	R	
E304H	Current rate 2 (peak) active energy	4	R	
E306H	Current rate 3 (flat) active energy	4	R	
E308H	Current rate 4 (valley) active energy	4	R	
E30AH	Current rate 5 active energy	4	R	
E30CH	Current rate 6 active energy	4	R	
E30EH	Current rate 7 active energy	4	R	
E310H	Current rate 8 active energy	4	R	
E312H	Current forward active total energy	4	R	
E314H	Current forward active rate 1 energy	4	R	
E316H	Current forward active rate 2 energy	4	R	
E318H	Current forward active rate 3 energy	4	R	
E31AH	Current forward active rate 4 energy	4	R	
E31CH	Current forward active rate 5 energy	4	R	
E31EH	Current forward active rate 6 energy	4	R	
E320H	Current forward active rate 7 energy	4	R	
E322H	Current forward active rate 8 energy	4	R	
E324H	Current reversing active total energy	4	R	
E326H	Current reversing active rate 1 energy	4	R	
E328H	Current reversing active rate 2 energy	4	R	
E32AH	Current reversing active rate 3 energy	4	R	
E32CH	Current reversing active rate 4 energy	4	R	
E32EH	Current reversing active rate 5 energy	4	R	
E330H	Current reversing active rate 6 energy	4	R	
E332H	Current reversing active rate 7 energy	4	R	
E334H	Current reversing active rate 8 energy	4	R	
E336H	Current total reactive energy	4	R	UINT32 Unit: 0.1kvarh (Primary side data)
E338H	Current rate 1 (spike) reactive energy	4	R	
E33AH	Current rate 2 (peak) reactive energy	4	R	
E33CH	Current rate 3 (flat) reactive energy	4	R	
E33EH	Current rate 4 (valley) reactive energy	4	R	

E340H	Current rate 5 reactive energy	4	R	
E342H	Current rate 6 reactive energy	4	R	
E344H	Current rate 7 reactive energy	4	R	
E346H	Current rate 8 reactive energy	4	R	
E348H	Current forward reactive total energy	4	R	
E34AH	Current forward reactive rate 1 energy	4	R	
E34CH	Current forward reactive rate 2 energy	4	R	
E34EH	Current forward reactive rate 3 energy	4	R	
E350H	Current forward reactive rate 4 energy	4	R	
E352H	Current forward reactive rate 5 energy	4	R	
E354H	Current forward reactive rate 6 energy	4	R	
E356H	Current forward reactive rate 7 energy	4	R	
E358H	Current forward reactive rate 8 energy	4	R	
E35AH	Current reversing reactive total energy	4	R	
E35CH	Current reversing reactive rate 1 energy	4	R	
E35EH	Current reversing reactive rate 2 energy	4	R	
E360H	Current reversing reactive rate 3 energy	4	R	
E362H	Current reversing reactive rate 4 energy	4	R	
E364H	Current reversing reactive rate 5 energy	4	R	
E366H	Current reversing reactive rate 6 energy	4	R	
E368H	Current reversing reactive rate 7 energy	4	R	
E36AH	Current reversing reactive rate 8 energy	4	R	
E36CH	Forward active energy of A phase	4	R	UINT32 Unit: 0.1kWh (Primary side data)
E36EH	Forward active energy of B phase	4	R	
E370H	Forward active energy of C phase	4	R	
E372H	Reversing active energy of A phase	4	R	
E374H	Reversing active energy of B phase	4	R	
E376H	Reversing active energy of C phase	4	R	

10.3 History energy frozen time and history energy data

ADL400's registers on frozen by day and by month.

Table 9 Frozen time communicate address

Address	Name	R/W	Note
0121H	Frozen time by day	R/W	Null (High byte) Hour(Low byte)
0122H	Frozen time by month	R/W	Day(High byte) Hour(Low byte)

ADL400 can achieve the history energy statistic in last 48 months and last 90days. (Each tariff rate of energy can be recorded.) The historical energy can be read by blocks or individually, with a total length of 34 registers, and list below is the registers' name.

Table 10 History energy communicate address

Address	Name
6000H	Assemblage of last 1 day's demand and energy
6022H	Assemblage of last 2 day's demand and energy
…	…
6BD2H	Assemblage of last 90 day's demand and energy
reserve	reserve
7000H	Assemblage of last 1 month's demand and energy
7022H	Assemblage of last 2 month's demand and energy
…	…
763EH	Assemblage of last 48 month's demand and energy

Data list	Name	Note
6000H	Frozen time:YY-MM	
6001H	Frozen time: DD-hh	
6002H	total active energy	UINT32 Unit: 0.01kWh (Secondary side data)
6004H	Spike active energy	
6006H	peak active energy	
6008H	flat active energy	
600AH	valley active energy	
600CH	total reactive energy	UINT32 Unit: 0.01kvarh (Secondary side data)
600EH	Spike reactive energy	
6010H	peak reactive energy	
6012H	flat reactive energy	
6014H	valley reactive energy	
6016H	Total amount of phase A forward active energy	UINT32 Unit: 0.01kWh (Secondary side data)
6018H	Total amount of phase B forward active energy	
601AH	Total amount of phase C forward active energy	
601CH	Maximum active demand	UINT16 Unit: 0.001kW (Secondary side data)
601DH	Occurrence time: mm-hh	
601EH	Occurrence time : DD-MM	
601FH	Maximum reactive demand	UINT16 Unit: 0.001kvar (Secondary side data)
6020H	Occurrence time: mm-hh	
6021H	Occurrence time: DD-MM	

Eight-rate historical energy can be read through blocks with a length of 44 registers, each of which is ordered and the contents are as follows:

Table 11 Eight-rate historical energy

Address	Name
2000H	Assemblage of last 1 day's energy
202CH	Assemblage of last 2 day's energy
…	…
2F4CH	Assemblage of last 90

Data list	Name	
2000H	Frozen time:YY-MM	
2001H	Frozen time: DD-hh	
2002H	Total active energy	UINT32 Unit: kWh
2004H	Rate 1 (spike) active energy	

	day's energy
reserve	reserve
4000H	Assemblage of last 1 month's energy
402CH	Assemblage of last 2 month's energy
…	…
4814H	Assemblage of last 48 month's energy

		(Secondary side data) Note that the model number distinguishes decimal places: Instrument transformer access, 4 decimal places Direct access, 2 decimal places
2006H	Rate 2 (peak) active energy	
2008H	Rate 3 (flat) active energy	
200AH	Rate 4 (valley) active energy	
200CH	Rate 5 active energy	
200EH	Rate 6 active energy	
2010H	Rate 7 active energy	
2012H	Rate 8 active energy	
2014H	Total reactive energy	UINT32 Unit: kvarh (Secondary side data) Note the same
2016H	Rate 1 (spike) reactive energy	
2018H	Rate 2 (peak) reactive energy	
201AH	Rate 3 (flat) reactive energy	
201CH	Rate 4 (valley) reactive energy	
201EH	Rate 5 reactive energy	
2020H	Rate 6 reactive energy	
2022H	Rate 7 reactive energy	
2024H	Rate 8 reactive energy	
2026H	Forward active energy of A phase	UINT32 Unit: kWh (Secondary side data) Note the same
2028H	Forward active energy of B phase	
202AH	Forward active energy of C phase	

10.4 Sub harmonic data

ADL400 has function of harmonic. The function includes 2-31st harmonic statistics of voltage and current, harmonic voltage and current of each phase apparently, harmonic active/reactive power of each phase apparently, fundamental voltage and current of each phase apparently and fundamental active/reactive power of each phase apparently.

Table 12 Harmonics data address

Address	Name	Length	R/W	Note
05DDH	THDUa	2	R	Total distortion rate of voltage and current on each phase UINT16 Resolution：0.01%
05DEH	THDUb	2	R	
05DFH	THDUc	2	R	
05E0H	THDIa	2	R	
05E1H	THDIb	2	R	
05E2H	THDIc	2	R	
05E3H	THUa	2×30	R	Harmonic content of 2nd to 31st harmonics in each phase voltage UINT16, Resolution：0.01%
0601H	THUb	2×30	R	
061FH	THUc	2×30	R	
063DH	THIa	2×30	R	Harmonic content of 2nd to 31st harmonics in each phase current
065BH	THIb	2×30	R	

0679H	THIc	2×30	R	UINT16, Resolution：0.01%
0697H	Fundamental voltage on A phase	2	R	UINT16 Unit: 0.1V
0698H	Fundamental voltage on B phase	2	R	
0699H	Fundamental voltage on C phase	2	R	
069AH	Harmonic voltage on A phase	2	R	
069BH	Harmonic voltage on B phase	2	R	
069CH	Harmonic voltage on C phase	2	R	
069DH	Fundamental current on A phase	2	R	UINT16 Unit: 0.01A
069EH	Fundamental current on B phase	2	R	
069FH	Fundamental current on C phase	2	R	
06A0H	Harmonic current on A phase	2	R	
06A1H	Harmonic current on B phase	2	R	
06A2H	Harmonic current on C phase	2	R	
06A3H	Fundamental active power on A phase	2	R	INT16 Unit: 0.001kW
06A4H	Fundamental active power on B phase	2	R	
06A5H	Fundamental active power on C phase	2	R	
06A6H	Total fundamental active power	2	R	
06A7H	Fundamental reactive power on A phase	2	R	INT16 Unit: 0.001kvar
06A8H	Fundamental reactive power on B phase	2	R	
06A9H	Fundamental reactive power on C phase	2	R	
06AAH	Total fundamental reactive power	2	R	
06ABH	Harmonic active power on A phase	2	R	INT16 Unit: 0.001kW
06ACH	Harmonic active power on B phase	2	R	
06ADH	Harmonic active power on C phase	2	R	
06AEH	Total harmonic active power	2	R	
06AFH	Harmonic reactive power on A phase	2	R	INT16 Unit: 0.001kvar
06B0H	Harmonic reactive power on B phase	2	R	
06B1H	Harmonic reactive power on C phase	2	R	
06B2H	Total harmonic reactive power	2	R	

10.5 SOE record

Address	Name
3001H	Last event record
3002H	Last 2 event record
…	…
3064H	Last 100 event record

Data list	Name
0000H	Occur date: YY-MM
0001H	Occur time: DD-hh
0002H	Occur time: mm-ss
0003H	Event number
0004H	Event details

Event num	Name
0100	Power on
0200	Clear

Details	Note
0001	Clear current energy
0002	Clear history energy

0700	Time calibration

0003	Clear maximum demand
0004	Clear history energy
0005	Clear maximum value
0006	Clear out

Example: The address is 001 at present, and we send the code: 01 03 30 01 00 06 9B 08 to get the last event record, and the slave station will give back: 01 03 0C 12 01 08 0A 01 01（2018/1/8 10:1:1）01 00（powered） 00 00（no details） 00 00（reserved） 80 23.