Acrel

ADL400

Installation and operation instruction T1.1

ACREL Co.,Ltd

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Manual revision record

| Data	Old	New	Change
2024.8.28		T1.0	1.First version，Add 277/480V options
2024.9.18	T1.0	T1.1	2. Add a fast response address table，Amend the torque of connect via CT

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

ADL400/ ☐ ☐

C:RS485 communication

F:Multi rate energy statistics

Rail type multi-function watt hour meter
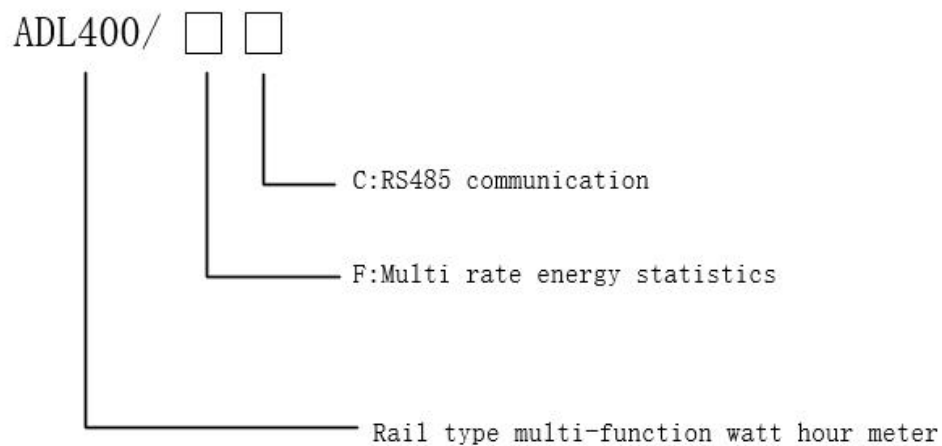
3 Function description

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 split phase 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	∎

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、3×480V	3×57.7/100V 、 3×220/380V 、 3×277/480V
		Voltage range	3×100V - 3×450V	3×57.7/100V - 3×260/450V
		Consumption	<10VA(Single phase)	
		Impedance	>2MΩ	
		Accuracy class	Error±0.2%	
	Current	Input current	3×1(6)A, 3×10(80)A	
		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	
Digit signal	Energy pulse output		1 active photocoupler output	
pulse	Width of pulse		80±20ms	
	Pulse constant		400imp/kWh,10000imp/kWh(Correspond with the basic current)	
communication	Interface and communication protocol		RS485：Modbus RTU	
	Range of communication address		Modbus RTU:1～254；	
	Baud rate		1200bps~38400bps	
envir-onment	working temperature		-25℃~+55℃	
	Relative humidity		≤95%(No condensation)	

Attention: 2*277/480V Only for secondary access

5 Dimension drawings
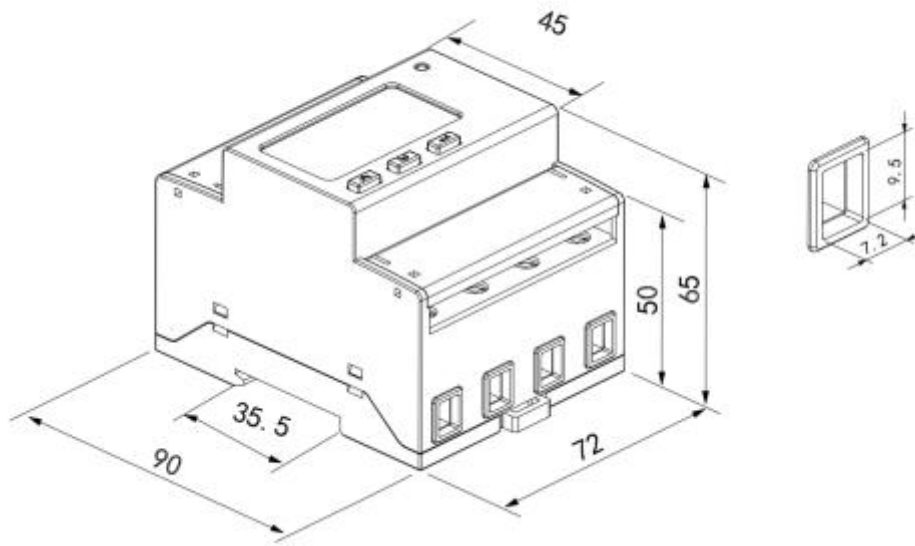
Fig 1   direct connect
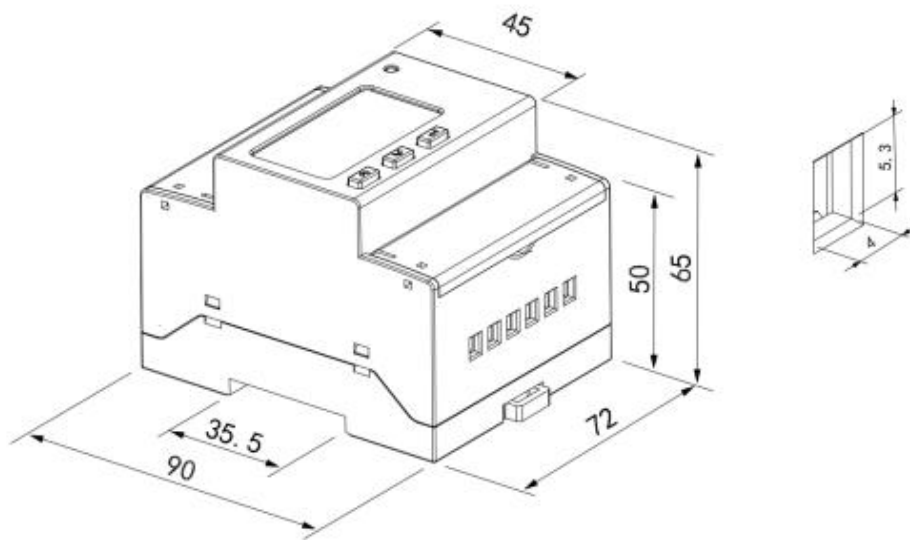

Fig 2   connect via CT

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。

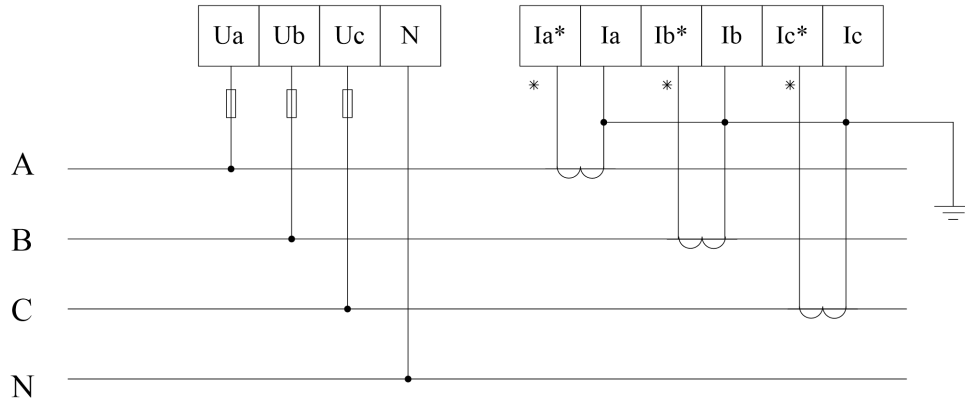# 6 Wiring and installing

6.1 Wiring sample of voltage and current

Ua	Ub	Uc	N

Ia*	Ia	Ib*	Ib	Ic*	Ic

A

B

C

N

Fig 3 Three phase four lines connect via CT

L1	L1'	L2	L2'	L3	L3'	N	N'

A

B

C

N
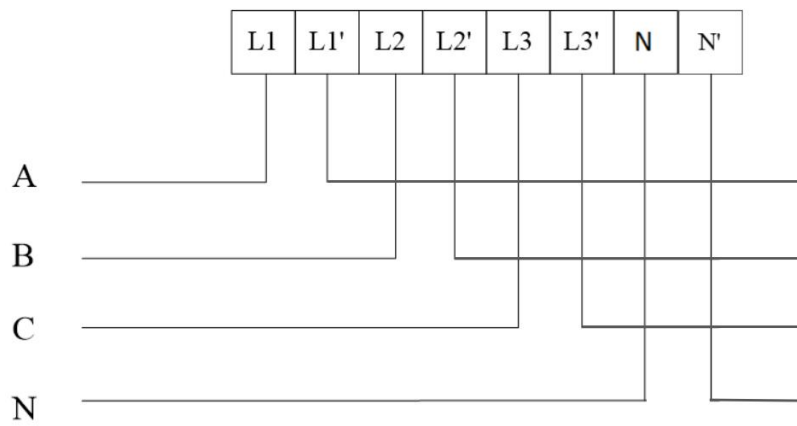
Fig 4 Three phase four lines direct connect

Ua	Ub	Uc	Un

Ia*	Ia	Ib*	Ib	Ic*	Ic

A

B

C
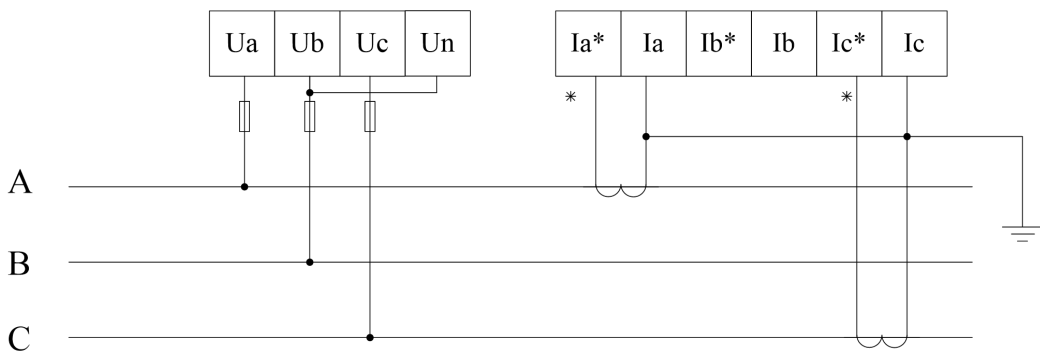
Fig 5 Three phase three lines connect via CT
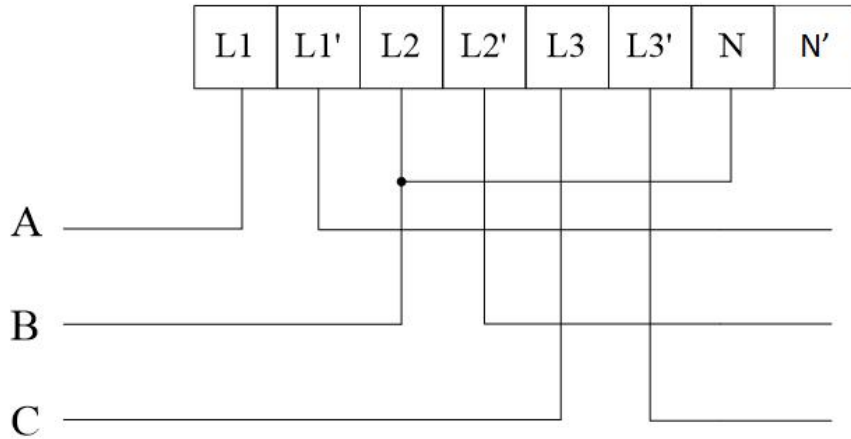
Fig 6 Three phase three lines direct connect

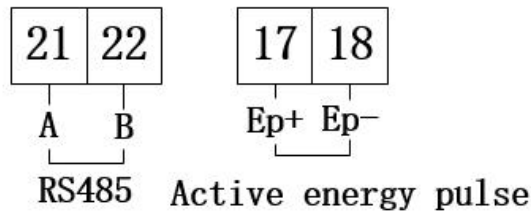## 6.2 Wiring diagram of communication and pulse terminals

Fig 7 Communication, pulse connection

7 Function description

7.1 Measurement

It can measure the electrical parameter,include U、I、P、Q、S、PF、F、1~31th 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, one table has fourteen timing, eight rates。

7.4 Demand

The description about 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
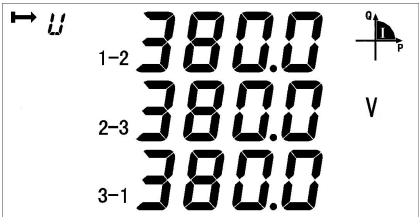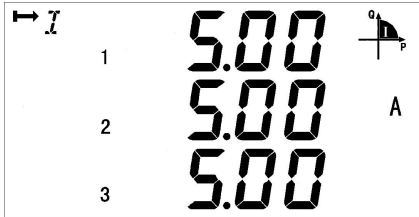
8.1 Key function description

Table 4 Key's function description

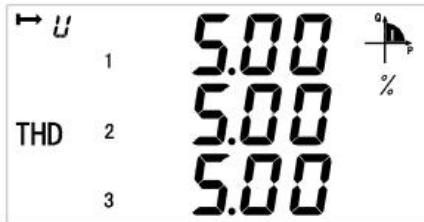| icon	Name	Function
	Voltage and current Up key	Check the voltage and current Leftward and change flash in programming menu
	Power Down key	Check the power Rightward and change the value on flash
	Energy Enter key	Check the energy In/out programming menu Save changes

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. The menu description is listed as below:
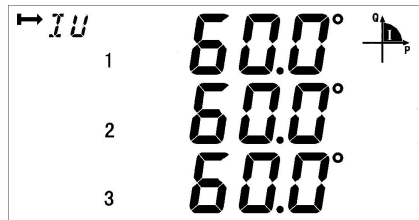
Table 5 display descriptions

	Three-phase voltage	Three phase line voltage
	Three-phase Current	Frequency

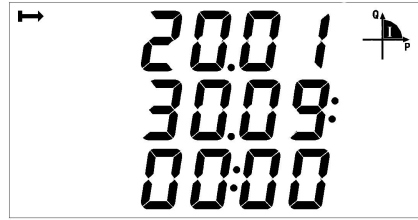|		
	Harmonic content of three phase Voltage	Harmonic content of three phase Current
	Phase angle	Time
	Check bit, baud rate, table address, software version number, full display detection;	
	Three phase active power	Total active power
	Three phase reactive power	Total reactive power
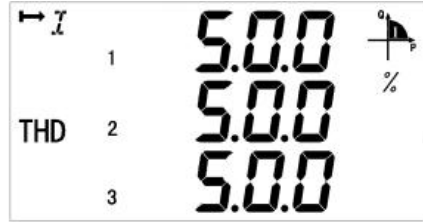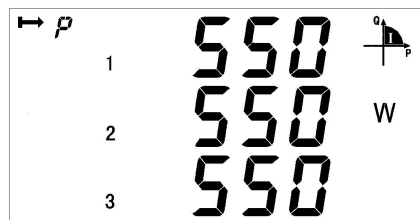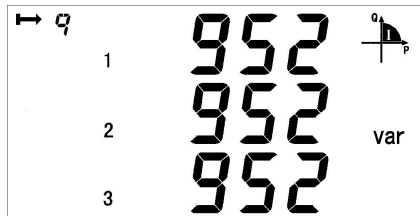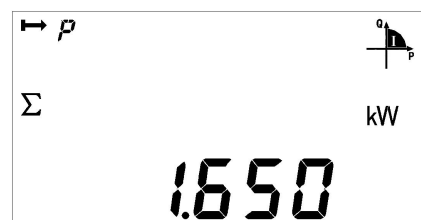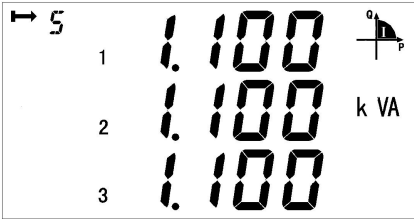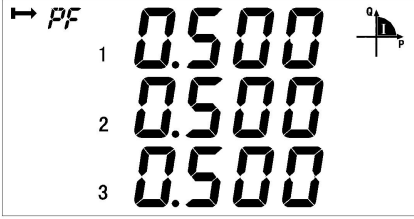
Three phase apparent power |

Total apparent power |
| |

Three phase power factor |

Total power factor |
| | T3 represents the normal period, ① represents the first time table

(Current value is1616.89kWh)

Current total active energy |

Current spike active energy |
| |

Current peak active energy |

Current flat active energy |
| |

Current valley active energy |

Current forward active total energy |

EP T3① kW h EXP **0.00**	**E9** T3① kvarh **16.81**
Current reversing active total energy	Current total reactive energy
E9.t1 T3① kvarh **10.00**	**E9.t2** T3① kvarh **6.00**
Current reactive spike energy	Current reactive peak energy
E9.t3 T3① kvarh **0.80**	**E9.t4** T3① kvarh **0.01**
Current reactive flat energy	Current reactive valley energy
E9 T3① kvarh IMP **16.81**	**E9** T3① kvarh EXP **0.0.0**
Current forward reactive total energy	Current reversing reactive total energy
EPA T3① kW h IMP **5.63**	**EPb** T3① kW h IMP **5.63**
Current forward active energy on A phase	Current forward active energy on B phase
EPC T3① kW h IMP **5.63**	
Current forward active energy on C phase	
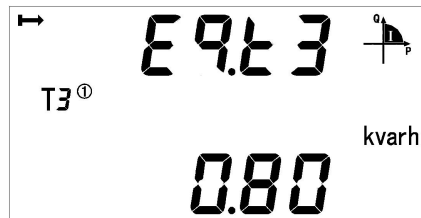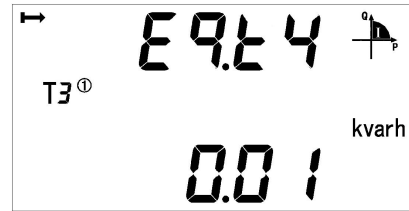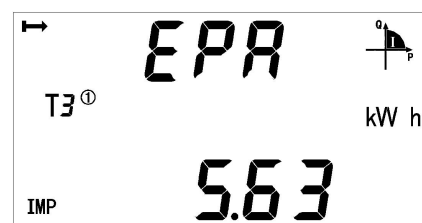
Note:

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 energy by time without the function of multi-tariff rate.

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 When the energy is displayed, when the number of digits exceeds 4 digits, it is displayed in two lines, and it can be read continuously. The graph below shows an electrical energy value of 1616.89 kWh. The direct access model energy data shows 2 decimal places, and the secondary access model energy data shows 1 decimal place.

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.
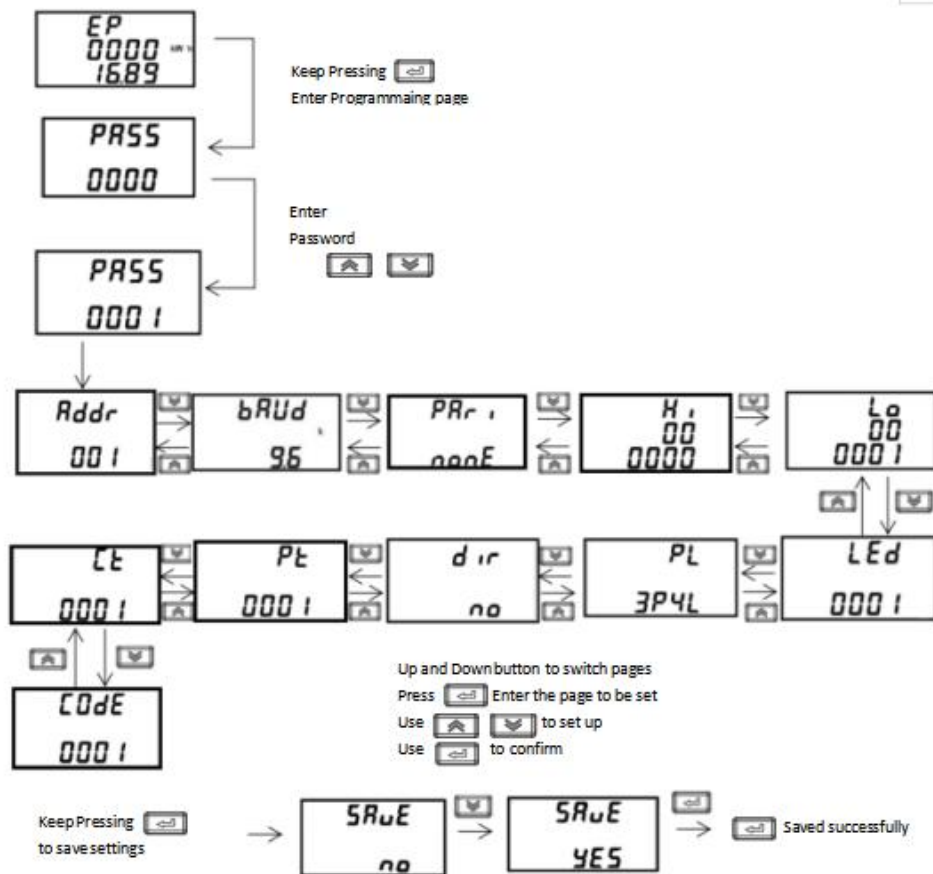
8.4 Data settings

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	time-sharing measurement 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)

Note: Marked yellow is the default value.

9 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.

9.1 ADDR List

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

Address	Name	R/W	Length (Bytes)	Type	Unit	Note
008DH	PT	R/W	1	uint16		
008EH	CT	R/W	1	uint16		
1000H	slave address	R/W	1	uint16		1-247
1001H	baud rate	R/W	1	uint16		1200，2400，4800，9600，19200，38400，
1002H	parity	R/W	1	uint16		Low byte 0：None 1：Odd 2：Even High byte 0：1stop 1：1.5stop

						2：2stop
1010H	Grid	R/W	1	uint16		0:3P4L 1:3P3L
101DH	Password	R/W	1	uint16		1-9999
1035H	Apparent power calculation mode	R/W	1	uint16		0：RMS 1：PQS
2000H	A-phase voltage	R	2	float	V	
2002H	B-phase voltage	R	2	float	V	
2004H	C-phase voltage	R	2	float	V	
2006H	AB-line voltage	R	2	float	V	
2008H	BC-line voltage	R	2	float	V	
200AH	CA-line voltage	R	2	float	V	
200CH	A-phase current	R	2	float	A	
200EH	B-phase current	R	2	float	A	
2010H	C-phase current	R	2	float	A	
2012H	N-phase current	R	2	float	A	
2014H	A-phase active power	R	2	float	kW	
2016H	B-phase active power	R	2	float	kW	
2018H	C-phase active power	R	2	float	kW	
201AH	Total active power	R	2	float	kW	1.Slow register
201CH	A-phase reactive power	R	2	float	Kvar	
201EH	B-phase reactive power	R	2	float	Kvar	
2020H	C-phase reactive power	R	2	float	Kvar	
2022H	total reactive power	R	2	float	Kvar	
2024H	A-phase apparent power	R	2	float	KVA	
2026H	B-phase apparent power	R	2	float	KVA	
2028H	C-phase apparent power	R	2	float	KVA	
202AH	Total apparent power	R	2	float	KVA	
202CH	A-phase power factor	R	2	float		
202EH	B-phase power factor	R	2	float		
2030H	C-phase power factor	R	2	float		
2032H	Total power factor	R	2	float		
2034H	Frequency	R	2	float	Hz	
2100H	A-phase voltage	R	2	float	V	1.Fast register （response rate <=100ms）
2102H	B-phase voltage	R	2	float	V	
2104H	C-phase voltage	R	2	float	V	
2106H	AB-line voltage	R	2	float	V	
2108H	BC-line voltage	R	2	float	V	

210AH	CA-line voltage	R	2	float	V	
210CH	A-phase current	R	2	float	A	
210EH	B-phase current	R	2	float	A	
2110H	C-phase current	R	2	float	A	
2112H	N-phase current	R	2	float	A	
2114H	A-phase active power	R	2	float	kW	
2116H	B-phase active power	R	2	float	kW	
2118H	C-phase active power	R	2	float	kW	
211AH	Total active power	R	2	float	kW	
211CH	A-phase reactive power	R	2	float	Kvar	
211EH	B-phase reactive power	R	2	float	Kvar	
2120H	C-phase reactive power	R	2	float	Kvar	
2122H	total reactive power	R	2	float	Kvar	
2124H	A-phase apparent power	R	2	float	KVA	
2126H	B-phase apparent power	R	2	float	KVA	
2128H	C-phase apparent power	R	2	float	KVA	
212AH	Total apparent power	R	2	float	KVA	
212CH	A-phase power factor	R	2	float		
212EH	B-phase power factor	R	2	float		
2130H	C-phase power factor	R	2	float		
2132H	Total power factor	R	2	float		
2134H	Frequency	R	2	float	Hz	
3000H	active electric energy	R	4	double	kWh	
3004H	forward active electric energy	R	4	double	kWh	
3008H	reverse active electric energy	R	4	double	kWh	
300CH	reactive electric energy	R	4	double	kVarh	
3010H	forward reactive electric energy	R	4	double	kVarh	
3014H	reverse reactive electric energy	R	4	double	kVarh	
3018H	apparent electric energy	R	4	double	kVAh	
301CH	active electric energy of phase A	R	4	double	kWh	
3020H	forward active electric energy of phase A	R	4	double	kWh	
3024H	reverse active electric energy of phase A	R	4	double	kWh	
3028H	reactive electric energy of phase A	R	4	double	kVarh	
302CH	forward reactive electric energy of phase A	R	4	double	kVarh	

3030H	reverse reactive electric energy of phase A	R	4	double	kVarh	
3034H	active electric energy of phase B	R	4	double	kWh	
3038H	forward active electric energy of phase B	R	4	double	kWh	
303CH	reverse active electric energy of phase B	R	4	double	kWh	
3040H	reactive electric energy of phase B	R	4	double	kVarh	
3044H	forward reactive electric energy of phase B	R	4	double	kVarh	
3048H	reverse reactive electric energy of phase B	R	4	double	kVarh	
304CH	active electric energy of phase C	R	4	double	kWh	
3050H	forward active electric energy of phase C	R	4	double	kWh	
3054H	reverse active electric energy of phase C	R	4	double	kWh	
3058H	reactive electric energy of phase C	R	4	double	kVarh	
305CH	forward reactive electric energy of phase C	R	4	double	kVarh	
3060H	reverse reactive electric energy of phase C	R	4	double	kVarh	

Headquarters: Acrel Co., LTD.

Address: No.253 Yulv Road Jiading District, Shanghai，China

TEL.: 0086-21-69158338   0086-21-69156052   0086-21-59156392   0086-21-69156971

Fax: 0086-21-69158303

Web-site: www.acrel-electric.com

E-mail: ACREL008@vip.163.com

Postcode: 201801

Manufacturer: Jiangsu Acrel Electrical Manufacturing Co., LTD.

Address: No.5 Dongmeng Road,Dongmeng industrial Park, Nanzha Street,Jiangyin City,Jiangsu Province,China

TEL：0086-510-86179966

Fax：0086-510-86179975

Web-site: www.jsacrel.com

Postcode: 214405

E-mail: sales@email.acrel.cn