

ADL3000-E

Installation and operation instruction V2.4

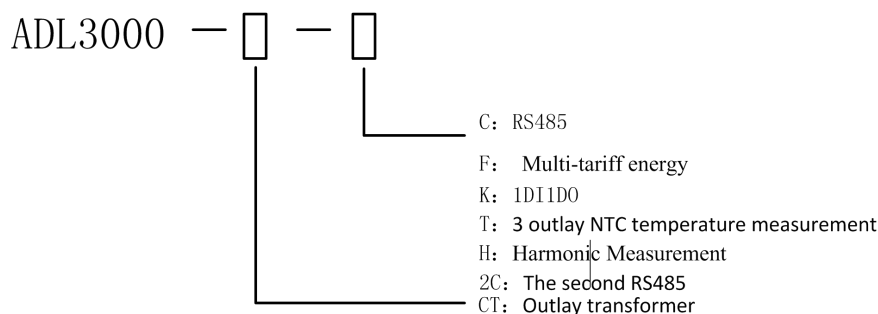
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1 General

ADL3000-E 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 12 months, checks the 31st harmonic content and the total harmonic content, realizes the remote communication and the remote control with switching input and relay output and boasts the alarm output. It is fitted with RS485 communication port and adapted to MODBUS-RTU. ADL3000-E can be used in all kinds of control systems, SCADA systems and energy management systems. All meters meet the related technical requirements of electronic power meter in the IEC62053-21、IEC62053-22 standards.

2 Type description



3 Function description

Function	Function description	Function provide
Measurement of energy	Active energy (positive and negative)	■
	Reactive energy (positive and negative)	■
	A, B, C phase positive active energy	■
Measurement of electrical parameters	U、IP、Q、S、PF、F	■
		■
Measurement of harmonics	2~31 ST Voltage and current harmonic	□Note 1
LCD Display	8 bits section LCD display, background light	■

Mail:sherry@acrel.cn Web: www.acrel.cn

Address:No.523 Jiading district,Shanghai,China.

Tel.:+862169156052 Mobile:+8615921826295 Fax:862169158303

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Key programming	4 keys to communication and set parameters	■
Pulse output	Active pulse output	■
	Reactive pulse output	□Note 2
	Clock pulse output	□Note 2
LED LED alarm	Alarm on voltage loss and over voltage	■
Multi-tariff and functions	Active switch input	□Note 3
	Switch output	□Note 2
	Adapt 4 time zones, 2 time interval lists, 14 time interval by day and 4 tariff rates	□
	Max demanded kWh and time happened	□
	Frozen data on last 48 months, last 90days	□
	Date, time	□
Communication	Infrared communication	■
	The first communication path: Communication interface: RS485, Communication protocol: MODBUS-RTU and DL/T645-07	□
	The second communication path: Communication interface: RS485, Communication protocol: MODBUS-RTU and DL/T645-07	□Note 3
Temperature measurement	Support 3 outlay NTC temperature	□Note 4

“■” means standard, “□” means optional function

Note:

- 1: Harmonic is a standard while choosing outlay transformer, optional for other situation.
- 2: Reactive pulse output, clock pulse output and switching output: Choose one of these three.
- 3: Active switching, the second communication path: Choose one of these two.
- 4: Both 1 and 2 cannot be chosen while choosing temperature measurement.

4 Technical parameters

Specifications		3 phase 3 wires,3 phase 4 wires
Voltage	Reference voltage	3×100V、 3×380V、 3×57.7/100V、 3×220/380V 3X230/400V
	Consumption	<10VA(Single phase)

Mail:sherry@acrel.cn

Web: www.acrel.cn

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	Impedance	>2MΩ
	Accuracy class	Error±0.2%
	Resolution	0.1V
Current	Input current	3×1(6)A , 3×1(6)A(Outlay transformer), 3×10(80)A
	Consumption	<1VA(Single phase rated current)
	Accuracy	Error±0.2%
	Resolution	0.01A
Frequency	Measuring range	45～65Hz,
	Accuracy	Error±0.2%
	Resolution	0.01Hz
Active power	Accuracy	Active, reactive, apparent power, error±0.5%
	Resolution	0.001kw
Reactive power	Accuracy	0.5%
	Resolution	0.001kVAr
Power factor	Accuracy	0.5%
	Resolution	0.001
Active energy	Accuracy	Class 1
	Resolution	0.01kWh
Reactive energy	Accuracy	Class 2
	Resolution	0.01kVAr
Starting Current		≤ 0.4%Ib
Normal working voltage range operating range		From 80% to 115% normal voltage(Un)
Over current withstand		≥ 30 I _{max} for 0.01 second
Maximum AC voltage withstand in 1 minute		≥4KV
Maximum Impulse volatge withstand (waveform 1.2/50 micro second)		≥ 6kV
Protection against penetration of dust and water (in front)		IP51 conform to IEC62052-11
Temperature		-40℃～99℃
Energy		Active energy(Accuracy class:0.5s, 1), reactive energy(Accuracy class 2)
Clock		≤0.5s/d
Energy pulse output		1 active optocoupler output, 1 reactive optocoupler output
Switching output		1 Switching output
Switching input		1 optocoupler input
Width of pulse		80±20ms
Pulse constant		6400imp/kWh,400imp/kWh(in accordance with the basic current)
Interface and communication		RS485: Modbus RTU/DL/T645-07
Range of communication address		Modbus RTU:1~ 247;

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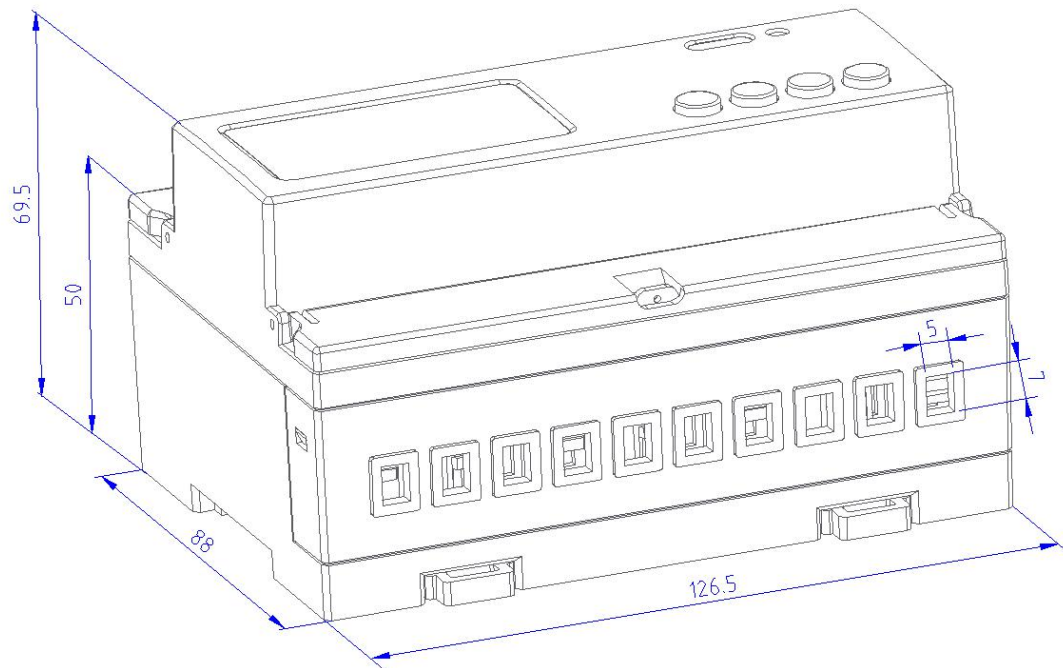
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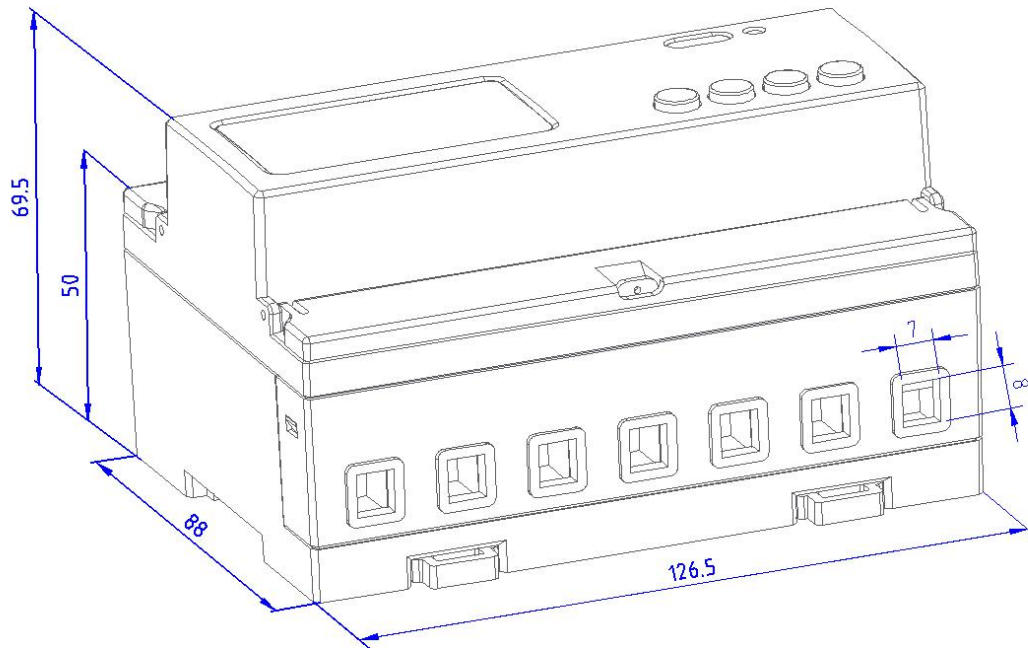
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Baud rate	1200bps~19200bps
Working temperature	-25℃~+55℃
Relative humidity	≤95%(No condensation)

5 .Dimension drawings



Picture 1 connect via CT



Picture 2 direct connect

Note: The torque of direct connect should not be greater than $4.0\text{N}\cdot\text{m}$, and the torque of connect via CT should not be greater than $2.0\text{N}\cdot\text{m}$.

6 Wiring and installation

6.1 Wiring of voltage and current

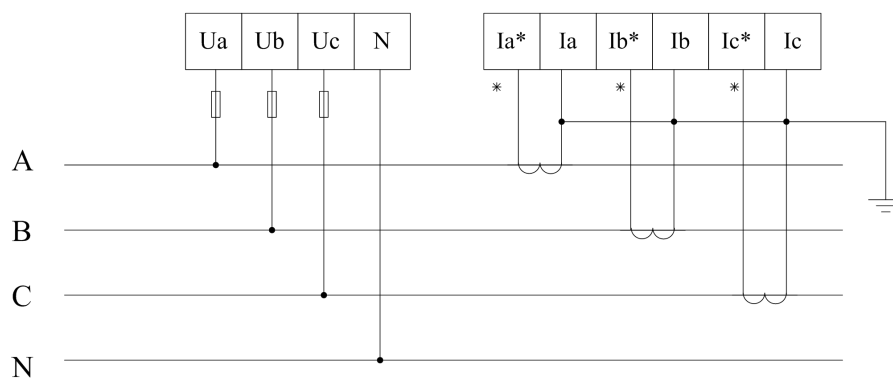


Fig 2 Three phase four lines connect via CT

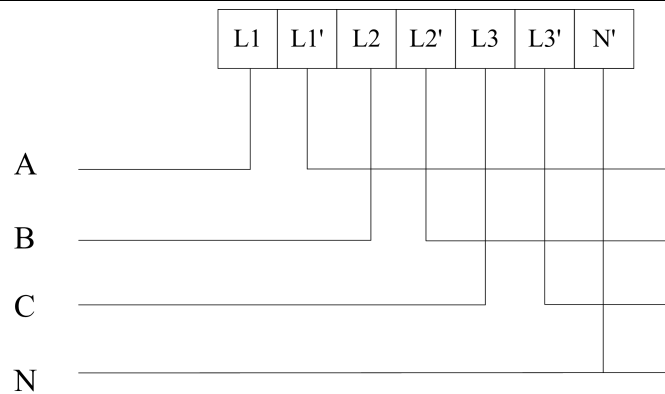


Fig 3 Three phase four lines direct connect

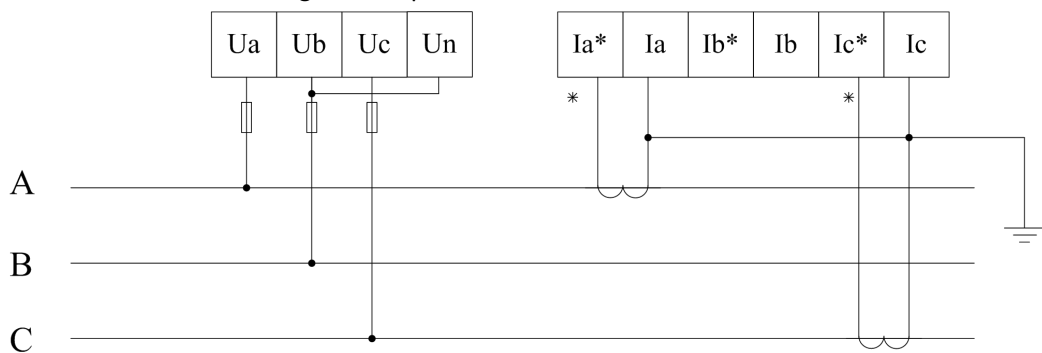


Fig 4 Three phase three lines connect via CT

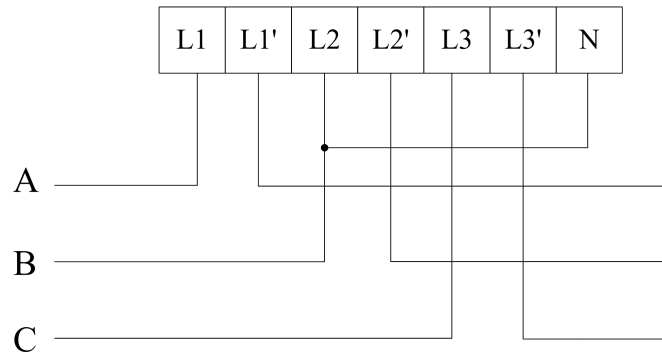


Fig 5 Three phase three lines direct connect

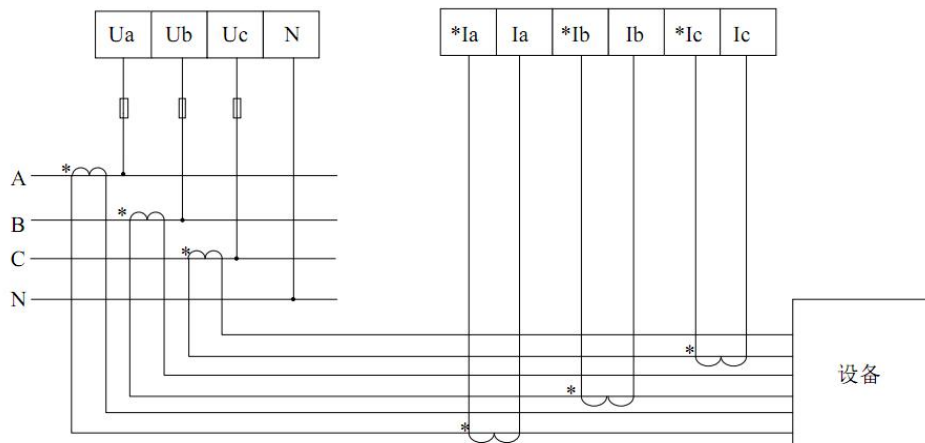


Fig 6 Three phase four lines, 3CT

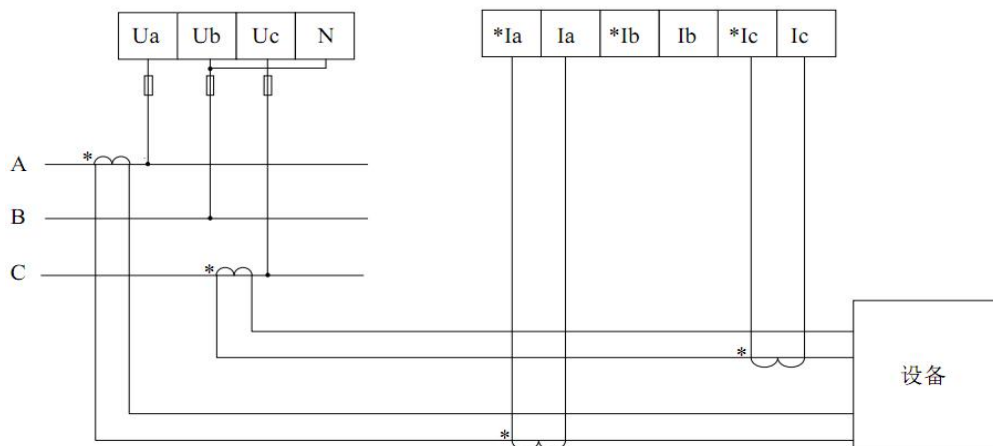


Fig 7 Three phase three lines, 2CT

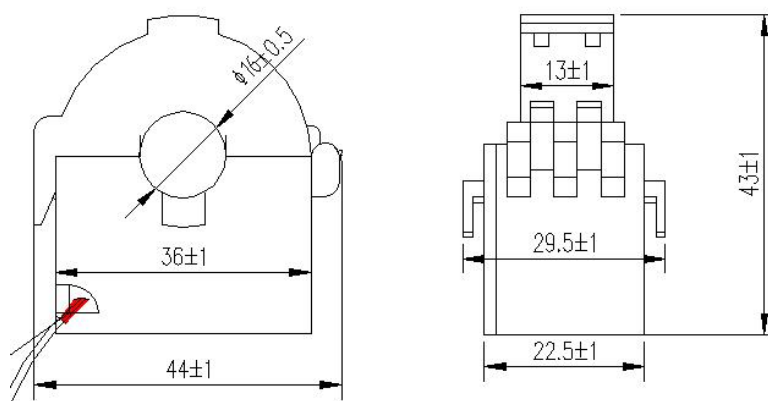


Fig 8 Dimensions of transformer

Note: The method of wiring is: input downward and output downward.

6.2

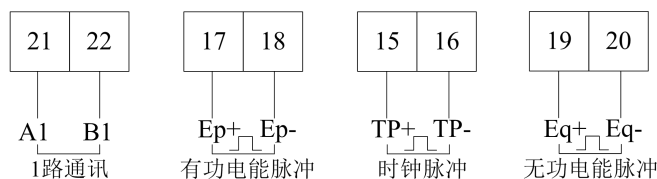
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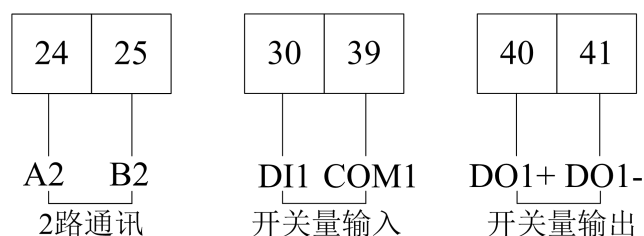
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Switching input, output, NTC temperature measurement.



A1,B1:1 modbus-RTU RS485 Ep+ Ep-: active energy impulse TP+,TP-:clock impulse
Eq+,Eq-:reactive energy impulse

Fig 9 Communication, pulse connection



A2,B2:2 channel Modbus-RTU RS485 DI1,COM1:Digital input DO1,DO1-:Digital output

Fig 10 Communication, pulse connection

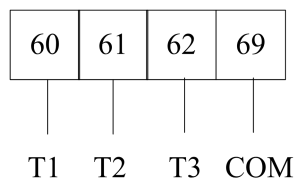


Fig 11 Outlay NTC temperature measurement

Switching output is relay output, can achieve the remote-control and alarm output.

The switch input adapts the method of on-off signal input and powered by outer power supply. It can be gotten by meter when there is a change of on or off via a switching input module. The parameter of switching input can not only get and show the state of local switching information but also achieve the communication via RS485, which called "remote information" function.

Note: (17-18) are active energy pulse, (60,61,62,69) are NTC temperature measurement port, (15,16) are clock pulse, (19,20) are reactive energy pulse, (40,41) are switch output and multiplex with (60,61), (24,25) are 2 path of communication, (31,32) are switch input and multiplex with (62,69).

7 Function description

7.1 Measurement

The meter can measure all electrical parameters such as voltage, current, active power, reactive power, apparent power, power factor, frequency, 31st harmonic and total harmonic. The value format of voltage, current, frequency and power are listed as below.

Example: $U = 220.1V$, $f = 49.98Hz$, $I = 1.99A$, $P = 0.439kW$

7.2 Calculating

The meter can calculate the current active energy, forward active energy, reversing active energy, forward reactive energy and reversing reactive energy.

7.3 Timing sharing function

The meter has 2 time lists, and can be divided into 4 time zones per year. Each time list can be divided into 8 time periods and 4 tariff (F1、F2、F3、F4). The main purpose of multi-tariff is promote the energy efficiency and economic benefits.

7.4 Demand function

There are some definitions on demand:

Demand	The average power in the demand cycle.
Maximum demand	The maximum value of demand in a period of 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 demands: forward active, reversing active, inductance performance reactive, capacitance performance reactive maximum demand and the occur time.

7.5 Historical data statistics

The meter can record historical data in the last 48 months or last 90 days.

7.6 Switching input and output

The switch input adapts the method of on-off signal input and powered by outer power supply. It can be gotten by meter when there is a change of on or off via a switching input module. The parameter of switching input can not only get and show the state of local switching information but also achieve the communication via RS485, which called "remote information" function.

7.7 Temperature measurement

The meter support three path of outlay NTC temperature measurement, the range of temperature is $-40^{\circ}C \sim 99^{\circ}C$.

Mail:sherry@acrel.cn Web: www.acrel.cn

Address:No.523 Jiading district,Shanghai,China.

Tel.:+862169156052 Mobile:+8615921826295 Fax:862169158303

8 Operation and display

8.1 Button function description

Button symbol	name	Function
	Menu	Enter/quit menu
	Voltage and current, up	Check the voltage and current Leftward and change flash in programming menu
	Power, down	Check the power Rightward and change the value on flash
	Energy, enter	Check the energy Enter in programming menu

8.2 Display

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:

	Voltage on A, B, C phase, Current on A, B, C phase, Frequency, Date, Time, Address, Version, Test on display
	Total active/reactive/apparent power and on A, B, C phase, Total power factor and on A, B, C phase, Forward/reversing active/reactive maximum demand
	Total forward/reserving active/reactive energy, forward/reserving active/reactive spike/peak/flat/valley energy, forward active energy on A, B, C phase.

Note:

1 All the display menus above are in the model of ADL3000-E 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.



Current forward active energy 12.34kWh



Current reversing active energy 12.34kWh



Current forward reactive energy 12.34kWh



Current forward active energy 12.34kWh



Current power is 1.234kW



Current forward active demand is 1.234kW



Voltage on A phase is 123.4V



Temperature on T1 is 25.5 cent degree

Current on A phase is 12.34A



Temperature on T2 is 25.5 cent degree



Temperature on T3 is 25.5 cent degree

Note: There are parts of the display function, and other menus are familiar with the example above. The customers can understand the meaning refer to the above examples.

8.3 Button Menu

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 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

Num	Main menu		Secondary menu		
	Symbol	Mean	Symbol	Meaning	Range
1	BUS	Communicati	ADDR	Address setting	1-247

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Web: www.acrel.cn

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		on settings	Baud	Baud rate	19200、9600、 4800、2400、1200
			Parity	Parity	None、Even
			HI	Device ID (H)	000000-999999
			LO	Device ID (L)	000000-999999
2	SyS	System settings	PL	Network	3 phase 4 lines 3 phase 3 lines
			EF.E	Multi-tariff rate	EF: Multi-tariff rate E: No multi-tariff rate
			CoDE	Code setting	1-9999
			LED	Time of light	1-9999
3	In.	Transformer settings	Pt	Voltage transformer	1-9999
			Ct	Current transformer	1-9999

Note: Customers can choose None or Even under Modbus protocol, and default Even under DL/T645 protocol.

9 Communication description

The meter adapts MODBUS-RTU protocol, and the baud rate can be chosen from 1200bps、2400 bps、4800 bps、9600bps and 19200 bps. The parity is 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:

Wiring should follow the wiring requirements;

Connect all the meter in the RS485 net work even some do not need to communication, which is benefit for error checking and testing;

Use two color wires in connecting wires and all the A port use the same color.

No longer than 1200 meters of RS485 bus line.

9.1 Modbus protocol address table

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

Address	Variable	Length	R/W	Notes
---------	----------	--------	-----	-------

Mail:sherry@acrel.cn Web: www.acrel.cn

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0000H	total active energy	4	R	
000AH	forward total active energy	4	R	
0014H	reverse total active energy	4	R	
001EH	Total reactive energy	4	R	
0028H	forward total reactive energy	4	R	
0032H	reverse total reactive energy	4	R	
003CH	Date, time	6	R/W	
003FH high byte	First communication path: Address	1	R/W	1~247
003FH low byte	First communication path: Baud rate	1	R/W	1: 9600pbs 2: 4800pbs 3: 2400pbs 4: 1200pbs
0040H	Pulse constant	2	R	
0041H ... 0046H	4 time zones	3×4	R/W	Time zone table
0047H ... 0052H	1-8period of time Parameters setting information	3×8	R/W	The first time list
0053H ... 0060H	1-9period of time Parameters setting information	3×9	R/W	The second time list
0061H	Voltage of A phase	2	R	
0062H	Voltage of B phase	2	R	
0063H	Voltage of C phase	2	R	

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0064H	Current of A phase	2	R	
0065H	Current of B phase	2	R	
0066H	Current of C phase	2	R	
0067H-0076H	Reserve	2	R	
0077H	Frequency	2	R	
0078H	Voltage between A-B	2	R	
0079H	Voltage between C-B	2	R	
007AH	Voltage between A-C	2	R	
007CH	Time of occurrence for the forward active maximum amount	4	R	
007EH	Reversing active maximum demand	2	R	
007FH	Time of occurrence for the reversing active maximum amount	4	R	
0081H	Maximum forward demand for reactive power	2	R	
0082H	Time of occurrence for the forward reactive maximum amount	4	R	
0083H	Maximum reversing demand for reactive power	2	R	
0085H	Time of occurrence for the reversing reactive maximum amount	4	R	
0087H	Forward active electric energy of A phase	4	R	
0089H	Forward active electric energy of B phase	4	R	
008BH	Forward active electric energy of C phase	4	R	

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008DH	Voltage transformer PT	2	R/W	
008EH	Current transformer CT	2	R/W	
008FH High byte	Threshold of voltage	1	R/W	
008FH Low byte	State of loss voltage	1	R	
0090H	Reserve	2	R	
0091H High byte	Running state 1	1	R/W	
0091H Low byte	Running state 2	1	R/W	
0092H	Zero sequence current	2	R	
0093H	Voltage unbalance	2	R	unit 0.1%
0094H	Current unbalance	2	R	
0095H	First communication path: Check byte (High 8 bits) Stop byte (Low 8 bits)	2	R/ W	校 验 位 testing byte: 0: none 2: even stop byte: 0: 1 stop byte 1: 2 stop bytes
0096H	Second communication path: Address (High 8 bits) Baud rate (Low 8 bits)	2	R/ W	Same as the first communication path
0097H	Second communication path: Check byte (High 8 bits) Stop byte (Low 8 bits)	2	R/ W	Same as the first communication path

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0098H-00B1	Reserved			
00B2H ... 00BAH	9-14 period of time Parameters setting information			The first time list
00BBH ... 00C3H	9-14 period of time Parameters setting information			The second time list
00C4H ... 0163H	Reserved			
0164H	Active power of A phase	4	R	
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	
016EH	Reactive power of B phase	4	R	
0170H	Reactive power of C phase	4	R	
0172H	Total reactive power	4	R	

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0174H	Apparent power of A phase	4	R	
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	
017DH	Power factor of B phase	2	R	
017EH	Power factor of C phase	2	R	
017FH	Total power factor	2	R	
0180H	Maximum forward active demand a day	2	R	
0181H	Occur time	2	R	
0182H	Maximum reversing active demand a day	2	R	
0183H	Occur time	2	R	
0184H	Maximum forward reactive demand a day	2	R	
0185H	Occur time	2	R	
0186H	Maximum reversing reactive demand a day	2	R	
0187H	Occur time	2	R	
0188H	Maximum forward active demand last day	2	R	
0189H	Occur time	2	R	
018AH	Maximum reversing active demand last day	2	R	

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018BH	Occur time	2	R	
018CH	Maximum forward reactive demand last day	2	R	
018DH	Occur time	2	R	
018EH	Maximum reversing reactive demand last day	2	R	
018FH	Occur time	2	R	
0190H	Maximum forward active demand last 2 days	2	R	
0191H	Occur time	2	R	
0192H	Maximum reversing active demand last 2 days	2	R	
0193H	Occur time	2	R	
0194H	Maximum forward reactive demand last 2 days	2	R	
0195H	Occur time	2	R	
0196H	Maximum reversing reactive demand last 2 days	2	R	
0197H	Occur time	2	R	
0198H	forward active demand	2	R	
0199H	reversing active demand	2	R	
019AH	forward reactive demand	2	R	
019BH	reversing reactive demand	2	R	
019BH-01FFH	Reserved			
0200H	Maximum voltage on A phase	2	R	
0201H	Occur date	2	R	
0202H	Occur time	2	R	

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0203H	Maximum voltage on B phase and occur time	6	R
0206H	Maximum voltage on C phase and occur time	6	R
0209H	Maximum current on A phase and occur time	6	R
020CH	Maximum current on B phase and occur time	6	R
020FH	Maximum current on C phase and occur time	6	R
0212H	Maximum active power on A phase	4	R
0214H	Occur date	2	R
0215H	Occur time	2	R
0216H	Maximum active power on B phase and occur time	8	R
021AH	Maximum active power on C phase and occur time	8	R
021EH	Maximum active power and occur time	8	R
0222H	Maximum reactive power on A phase and occur time	8	R
0226H	Maximum reactive power on B phase and occur time	8	R
022AH	Maximum reactive power on C phase and occur time	8	R
022EH	Maximum reactive power and occur time	8	R
0232H	Maximum apparent power on A phase and occur time	8	R
0236H	Maximum apparent power on B phase and occur time	8	R
023AH	Maximum apparent power on C phase and occur time	8	R
023EH	Maximum apparent power and occur time	8	R
0242H	Minimum voltage on A phase and occur time	6	R
0245H	Minimum voltage on B phase and occur time	6	R
0248H	Minimum voltage on C phase and occur time	6	R
024BH	Minimum current on A phase and occur time	6	R

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024EH	Minimum current on B phase and occur time	6	R	
0251H	Minimum current on C phase and occur time	6	R	
0254H	Minimum active power on A phase and occur time	8	R	
0258H	Minimum active power on B phase and occur time	8	R	
025CH	Minimum active power on C phase and occur time	8	R	
0260H	Minimum active power and occur time	8	R	
0264H	Minimum reactive power on A phase and occur time	8	R	
0268H	Minimum reactive power on B phase and occur time	8	R	
026CH	Minimum reactive power on C phase and occur time	8	R	
0270H	Minimum reactive power and occur time	8	R	
0274H	Minimum apparent power on A phase and occur time	8	R	
0278H	Minimum apparent power on B phase and occur time	8	R	
027EH	Minimum apparent power on C phase and occur time	8	R	
0280H	Minimum apparent power and occur time	8	R	
0285H-1FFFFH	Reserve			
2000H	T1 temperature	2	R	
2001H	T2 temperature	2	R	
2002H	T3 temperature	2	R	