513

ADL Series DIN-Rail Mounted Electric Energy Meter

Installation and Operation Instructions V1.0

Acrel Electric Co., Ltd.

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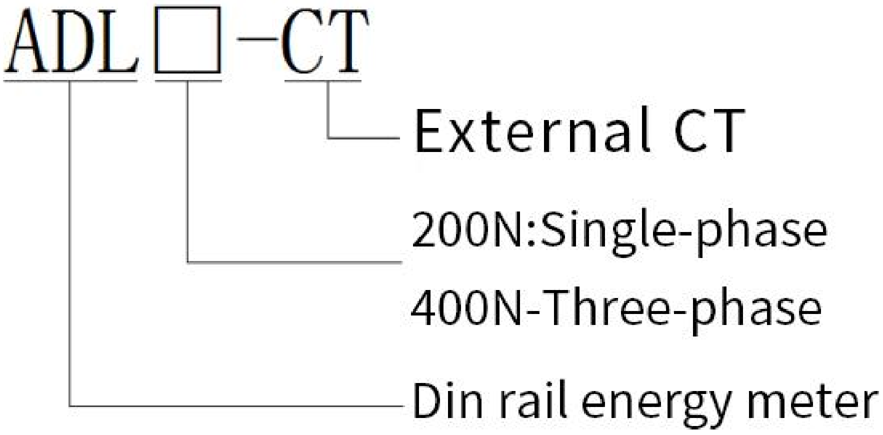
1 Overview

ADL series DIN-rail mounted multifunctional electric energy meter is an intelligent instrument mainly designed for new energy power generation systems such as photovoltaic grid-connected system, micro inverter system, energy storage system, AC coupling system, etc. The product has the advantages of high precision, small volume, high respondent speed and convenient installation. The product has the features of sampling, metering and monitoring power parameters, communicating with an inverter or an energy management system (EMS), realizing the functions of preventing reverse flow, regulating power generation, charging and discharging batteries according to real-time power and accumulated electric energy, and realizing bidirectional metering and household distributed photovoltaic energy management.

2 Description of Model



3 List of Functions

Table 1 List of Function Descriptions

Function	Descriptions	ADL200N-CT	ADL400N-CT
Electric energy	Active energy metering (forward and reverse)	■	■

metering	Reactive energy metering (forward and reverse)	■	■
	Split-phase energy	□	■
Electric quantity measurement	U, I	■	■
	P, Q, S, PF, F	■	■
LCD display	Segmented LCD display	■	■
Key programming	ommunication, transformation ratio and other parameters can be programmable by the key	□	■
Pulse output	Active pulse output	■	■
LED alarm	Operation instructions	□	■
Communication	RS485： Modbus RTU	■	■

4 Technical Parameters

Table 2 Description of Technical Parameters

Item			**Performance Parameters**	
Model Series			ADL200N-CT	ADL400N-CT
Measurement	Grid		Single-phase	Three-phase four-wire, three-phase three-wire, single-phase three-wire
	Voltage	Rated voltage	230	Single-phase: 240/480V
				Three-phase:3×230/400V、3×277/480V
		Overload	1.2 times rating (continuous) 2 times the rating for 1 second	
		Power consumption	<0.2VA	
		Accuracy class	Error ±0.5%	
	Current	Input current	80A, 120A, 200A, 300A	80A, 120A, 200A, 300A, 3×80A, 3×120A, 3×200A, 3×300A
		Overload	1.2 times rating (continuous) 2 times the rating for 1 second	
			<0.2VA	

		Power consumption	
		Accuracy class	Error ±0.5%
	Power		Active, reactive, apparent power, error ±0.5%
	Grid frequency		45~65Hz, error ±0.5%
	Response rate		≤100ms (voltage, current, power)
			≤1s (electrical energy)
Metering	Electric energy		Active energy ：Class B (split current transformer) /Class C (closed current transformer) Reactive energy (Class 2 accuracy)
electromagnetic compatibility	Electrostatic discharge immunity class III		
	Electrical fast transient burst immunity class IV		
	Surge (shock) immunity Class IV		
Security	Power frequency withstand voltage		Between communication and signal input, AC4kV 1min
	Insulation resistance		Input and output terminals to casing >100MΩ
Communication	Interface and communication protocol		RS485 interface and Modbus RTU protocol
	Communication address range		Modbus RTU:1~ 247；
	Baud rate		Support 1200bps-38400bps
Environment	Operating temperature		-40℃～+70℃
	Storage temperature		-40℃～+70℃
	Relative humidity		≤95% (without condensation)
	Altitude		≤3000m

5 Overall Dimensions

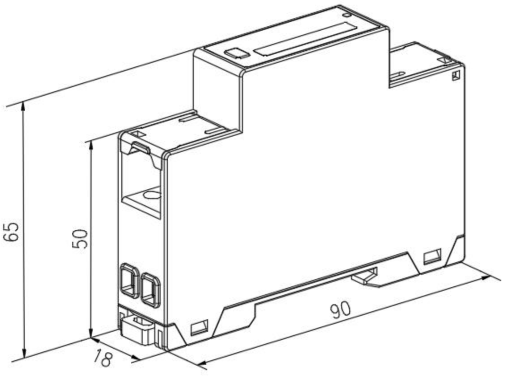


Figure 1 ADL200N-CT

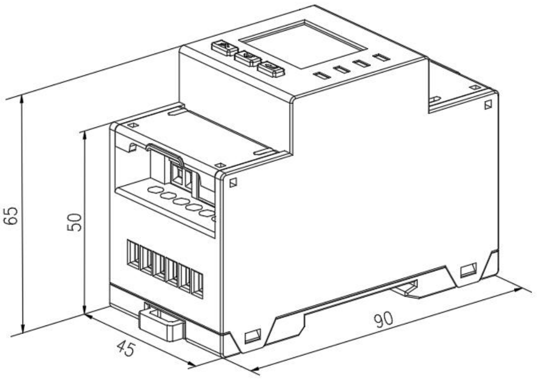


Figure 2 ADL400N-CT

6 Connection and Installation

6.1 Schematic Diagram of Voltage and Current Connection

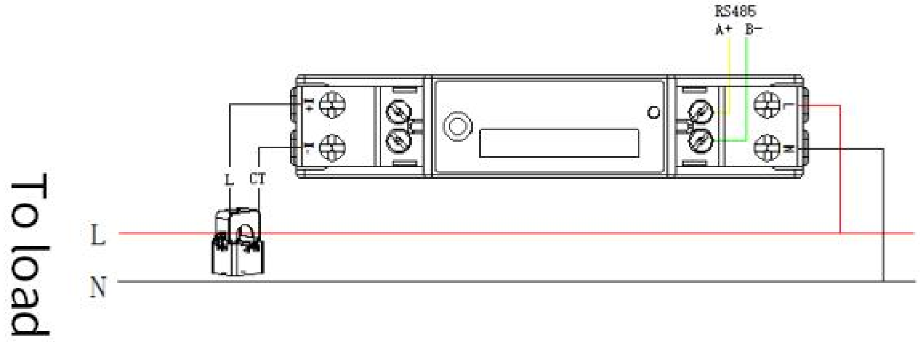

RS485
A+ B-
I+
I-
L
N
L CT
To load
L
N

Figure 3 ADL200N-CT

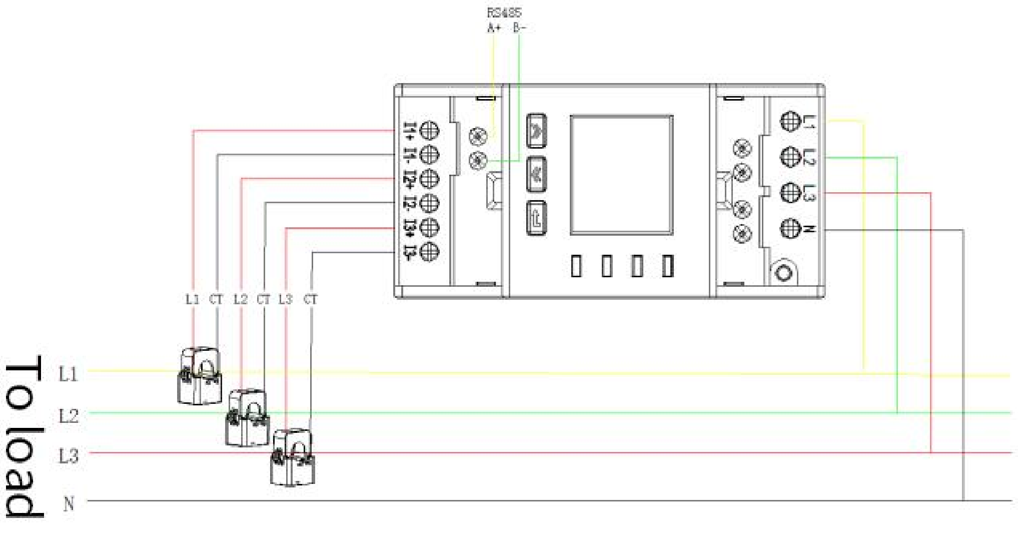

RS485
A+ B-
I1+
I1-
I2+
I2-
I3+
I3-
L1
L2
L3
N
L1 CT L2 CT L3 CT
To load
L1
L2
L3
N

Figure 4 ADL400N-CT Three-phase Four-wire Connection Through Current Transformer

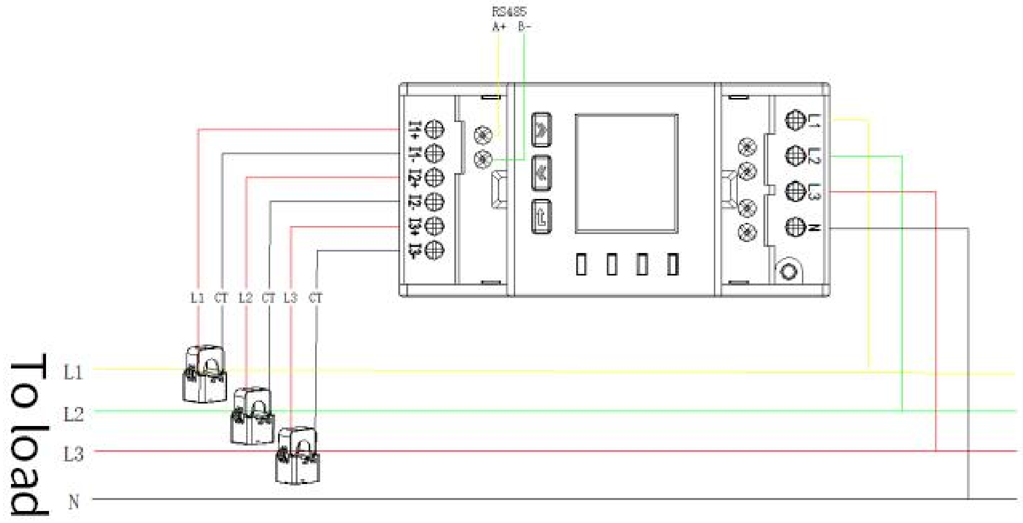

RS485
A+ B-
I1+ I1- I2+ I2- I3+ I3-
L1 L2 L3 N
L1 CT L2 CT L3 CT
To load
L1
L2
L3
N

Figure 5 ADL400N-CT Three-phase Three-wire Connection Through Current Transformer (this connection method is limited to three-phase balance) (instrument is set as 3P4L)

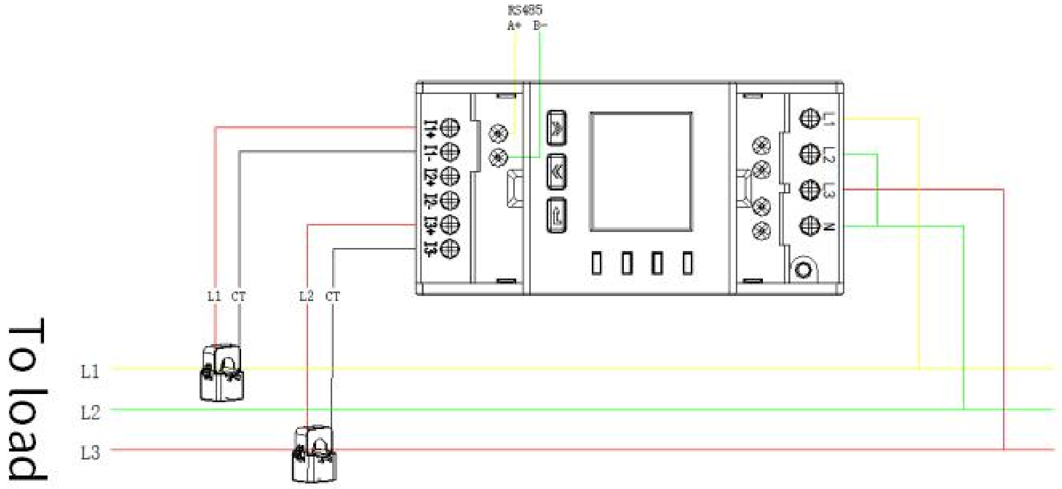

RS485
A+ B-
I1+ I1- I2+ I2- I3+ I3-
L1 L2 L3 N
L1 CT L2 CT
To load
L1
L2
L3

Figure 6 ADL400N-CT Three-phase Three-wire Connection Through Current Transformer (instrument is set as 3P3L)

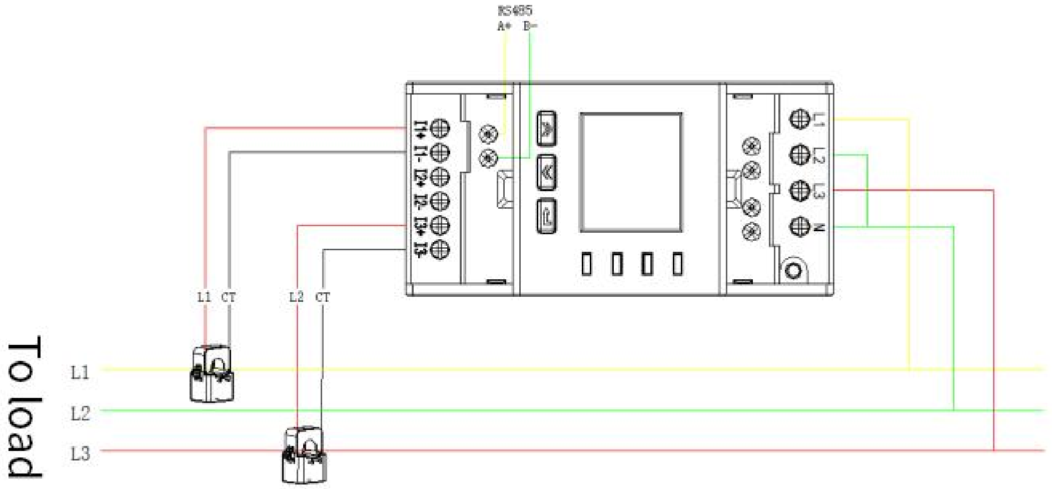

RS485
A+ B-
I1+ I1- I2+ I2- I3+ I3-
L1 L2 L3 N
L1 CT L2 CT
To load
L1
L2
L3

Figure 7 ADL400N-CT Single-phase Three-wire Connection Through Current Transformer

6.2 Functional Terminal

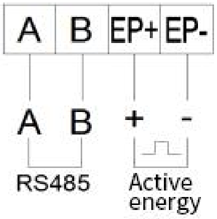


Figure 8 Communication and Pulse Connection

7 Main Functional Features

7.1 Measurement Function

It can measure total power parameters including voltage U, current I, active power P, reactive power Q, apparent power S, power factor PF and frequency. Wherein, the voltage U is reserved with 1 decimal place, the frequency F is reserved with 2 decimal places, the current I is reserved with 2 decimal places, and the power P is reserved with 3 decimal places.

For example, U = 220.1V, f = 49.98Hz, I = 1.99A, P = 0.439kW

The above electrical parameter high-speed response registers are also provided with the instrument, see Chapter 9 “Communication Instructions”.

7.2 Metering Function

It can measure the current combined active electric energy, forward active electric energy, reverse active electric energy, forward reactive electric energy and reverse reactive electric energy.

8 Operation and Display

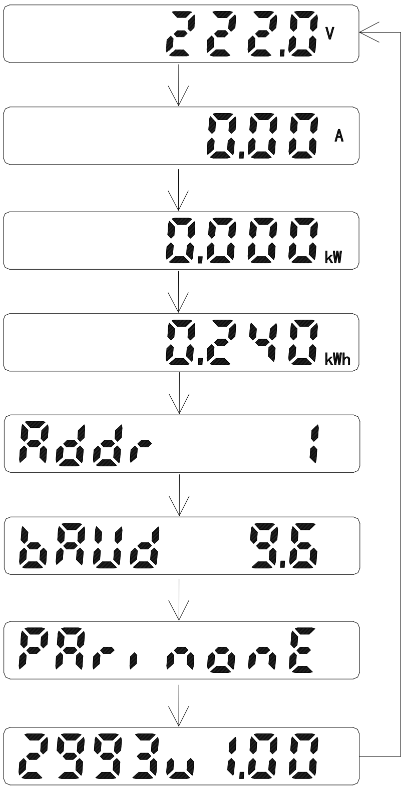
8.1 Key Function Description

Table 4 Key Function Description

Key Icon	Key Name	Key Functions
▲	Up	When switching the interface to the left, show left shift and flicker shift in programming interface
▼	Down	When switching the interface to the right, show right shift and modify flicker in programming interface
↵	Programming confirmation	View submenu, confirm the saving setting in the programming interface

8.2 Display Interface

ADL200N：


222.0 V
0.00 A
0.000 kW
0.240 kWh
Addr 1
bAUd 9.6
PAri nonE
2993u 1.00

The interface can be switched by pressing the key or the interface can be displayed automatically and circularly

ADL400N：

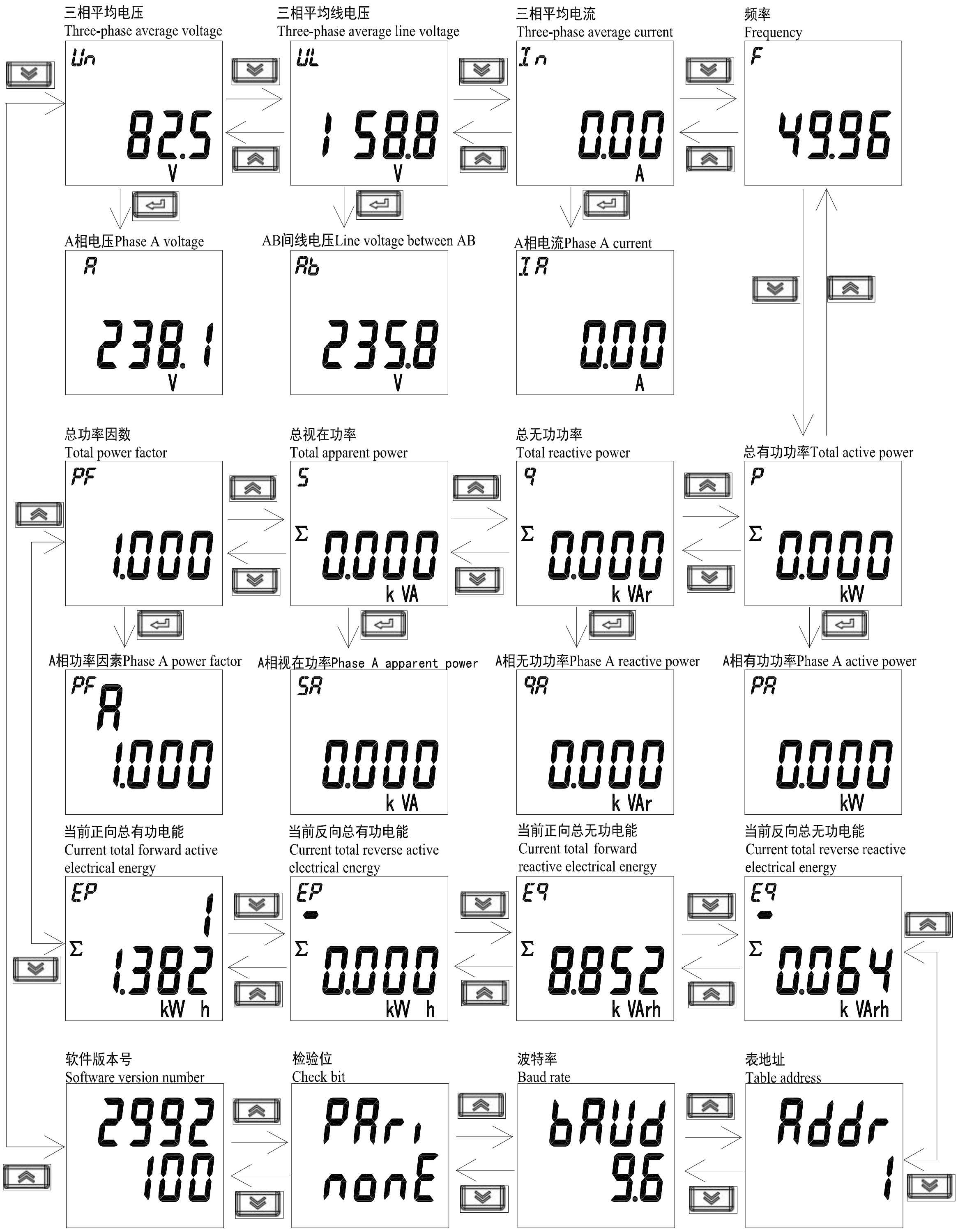
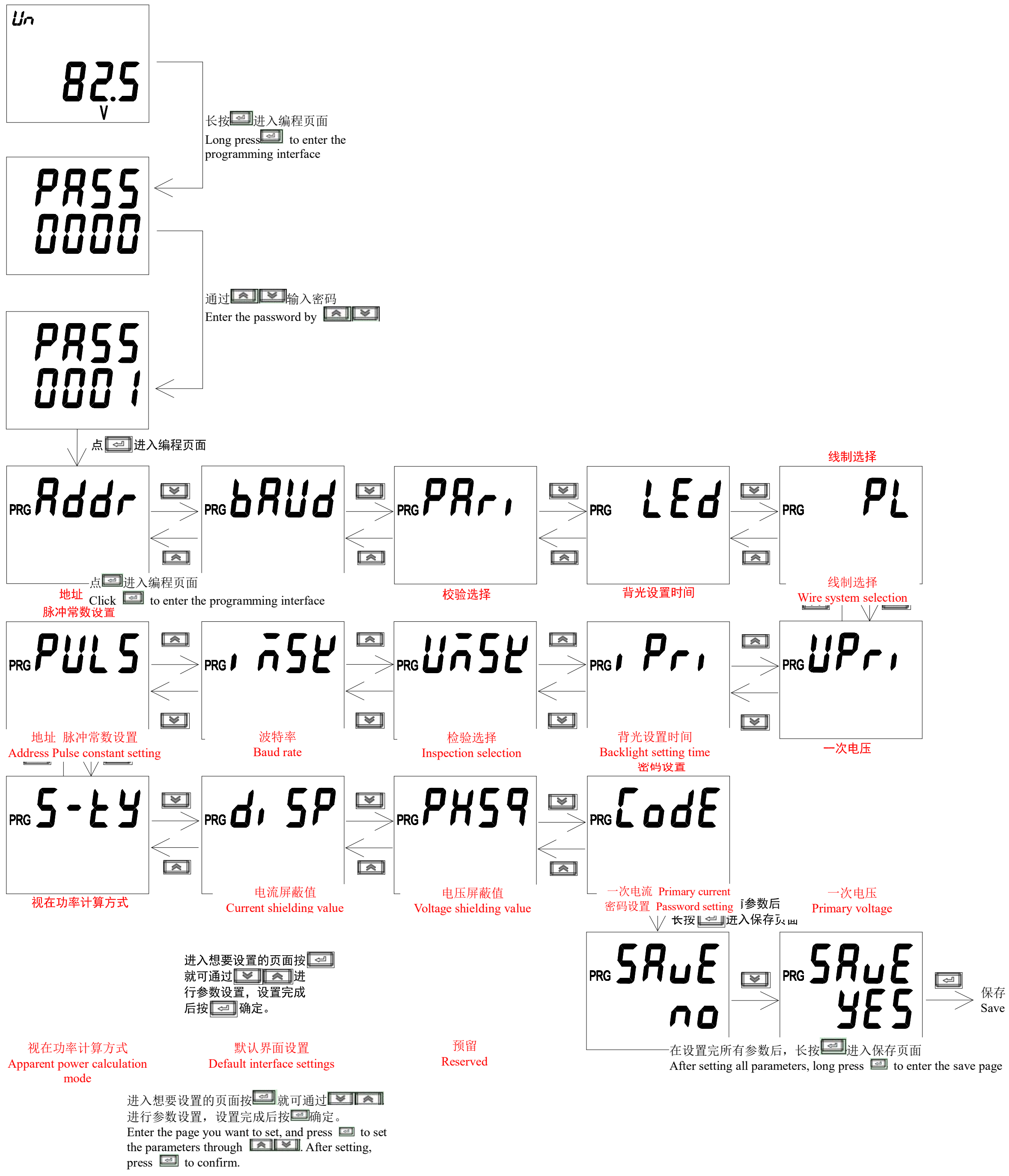

三相平均电压
Three-phase average voltage
Un
82.5
V
三相平均线电压
Three-phase average line voltage
UL
158.8
V
三相平均电流
Three-phase average current
In
0.00
A
频率
Frequency
F
49.96
A相电压Phase A voltage
A
238.1
V
AB间线电压Line voltage between AB
Ab
235.8
V
A相电流Phase A current
IA
0.00
A
总功率因数
Total power factor
PF
1.000
总视在功率
Total apparent power
S
Σ 0.000
k VA
总无功功率
Total reactive power
q
Σ 0.000
k VAr
总有功功率Total active power
P
Σ 0.000
kW
A相功率因素Phase A power factor
PF
A
1.000
A相视在功率Phase A apparent power
SA
0.000
k VA
A相无功功率Phase A reactive power
qA
0.000
k VAr
A相有功功率Phase A active power
PA
0.000
kW
当前正向总有功电能
Current total forward active electrical energy
EP
1
Σ 1.382
kW h
当前反向总有功电能
Current total reverse active electrical energy
EP
-
Σ 0.000
kW h
当前正向总无功电能
Current total forward reactive electrical energy
Eq
Σ 8.852
k VArh
当前反向总无功电能
Current total reverse reactive electrical energy
Eq
-
Σ 0.064
k VArh
软件版本号
Software version number
2992
100
检验位
Check bit
PAri
nonE
波特率
Baud rate
bAUd
9.6
表地址
Table address
Addr
1

Figure 9 Description of Display Interface

Note: The above is only a part of the display interface. Phase A, B and C can be switched by Enter key (phases between AB, BC and AC are for the same reason). The display mode of other interfaces is similar to that shown in the above figure. The display meaning can be judged according to the information displayed in the interface.

8.3 Programming Interface

When in any display item, press ⏎ for a long time to enter the "PASS" interface. There is a prompt for password, and the default password is 0001, and then press ⏎ again. If the password is incorrectly entered, return to "0000" to re-enter; If the password is entered correctly, the parameters can be set. Press ⏎ for a long time to enter the "SAVE" interface, press ▼ to switch to "YES", then press ⏎ to SAVE and exit, and press ⏎ when switching to "NO" to exit directly, with no need to “SAVE”.


Un
82.5 V
长按⏎进入编程页面
Long press ⏎ to enter the programming interface
PASS 0000
通过▲▼输入密码
Enter the password by ▲▼
PASS 0001
点⏎进入编程页面
PRG Addr
PRG bAUd
PRG PAri
PRG LEd
PRG PL
线制选择
点⏎进入编程页面
地址
Click ⏎ to enter the programming interface
脉冲常数设置
校验选择
背光设置时间
线制选择
Wire system selection
PRG PULS
PRG InSt
PRG UnSt
PRG IPri
PRG UPri
地址 脉冲常数设置
Address Pulse constant setting
波特率
Baud rate
检验选择
Inspection selection
背光设置时间
Backlight setting time
密码设置
一次电压
PRG S-tY
PRG diSP
PRG PHSq
PRG CodE
视在功率计算方式
电流屏蔽值
Current shielding value
电压屏蔽值
Voltage shielding value
一次电流 Primary current
密码设置 Password setting
参数后
长按⏎进入保存页面
一次电压
Primary voltage
PRG SAuE no
PRG SAuE YES
保存
Save
进入想要设置的页面按⏎就可通过▼▲进行参数设置，设置完成后按⏎确定。
在设置完所有参数后，长按⏎进入保存页面
After setting all parameters, long press ⏎ to enter the save page
视在功率计算方式
Apparent power calculation mode
默认界面设置
Default interface settings
预留
Reserved
进入想要设置的页面按⏎就可通过▼▲进行参数设置，设置完成后按⏎确定。
Enter the page you want to set, and press ⏎ to set the parameters through ▲▼. After setting, press ⏎ to confirm.

8.4 Settable Data Items

Table 7 Description of Setting Menu

Symbol	Meaning	Scope
Addr	slave address	1-247
bAud	Baud rate	38.4：38400 19.2：19200 9.6：9600 4.8：4800 2.4：2400 1.2：1200
PAri	parity	None、Even、Odd
LEd	Backlight time (reserved)	0-999s
PL	Grid	3P4L: Three-phase four-wire 3P3L:三相三线 3P3L: Three-phase three-wire
UPri	Primary voltage	0.1-9999999.9V
iPri	Primary current	0.01-999999. 99A
UMSK	Voltage shielding value	0-99.99%
iMSK	Current shielding value	0-99.99%
PULS	Pulse constant	1-99999
S-ty	Apparent power calculation mode	RMS: RMS calculation method PQS: PQS calculation method
diSP	Power-on default interface	Auto: Automatic wheel display Others: Other interfaces
PHSq	Reserved	
CoDE	Password	1-9999

9 Communication Instructions

The instrument RS485 communication interface supports MODBUS-RTU communication protocol. The baud rate of communication interface can be set between 1,200bps, 2,400 bps, 4,800 bps, 9,600bps, 19,200 bps and 38,400 bps, and the check bit is no check.

The RS485 communication interface of the instrument requires shielded twisted pair connection, and the layout of the whole grid should be considered when wiring: For example, the length and direction of communication cable, the position of upper computer, the matching resistance at the end of the grid, the communication converter, the scalability of the grid, the coverage of the grid, the electromagnetic interference of the environment and other factors should be considered comprehensively.

Note:

1. It shall strictly construct according to the requirements in the wiring project;

2. For instruments that do not need communication temporarily, they should be connected to RS-485 grid for diagnosis and test;

3. When connecting RS-485 cable, try to use two-color twisted pair. All 485 communication ports "A" are terminated in the same color, and "B" is terminated in another color.

4. The length of RS-485 bus (from the communication interface of the upper computer to any connected instrument terminal communication interface) shall not exceed 1,000 meters.

9.1 Address Table

Meter supports 03H command and 10H command in MODBUS-RTU protocol, in which 03H for reading multiple registers and 10H for writing multiple registers. Please check the protocol data format by yourself. The following table is the register address table of the meter:

Table 8 Communication Address Table

Address	Name	R/W	Length (Bytes)	Type	Unit	Note
1000H	slave address	R/W	1	uint16		1-247
1001H	baud rate	R/W	1	uint16		1200，2400，4800，9600，19200，38400，
	parity	R/W	1	uint16		0：None 1：Odd 2：Even 0：1　1stop 1：1.5　1.5stop 2：2　2stop
1010H	Grid	R/W	1	uint16		0:3P4L 1:3P3L
1011H	rated second voltage	R/W	1	uint16	0.1V	0.1-999. 9V
1012H	rated second current	R/W	1	uint16	0.01A	0.01-999. 99A
1015H	rated primary voltage	R/W	1	uint32	0.1V	0.1-99999.9V
1017H	rated primary current	R/W	1	uint32	0.01A	0.01-9999. 99A
101DH	Password	R/W	1	uint16		1-9999
101EH	Pulse constant	R/W	1	uint16		1-99999
101FH	Voltage shielding value	R/W	1	uint16	0.01%	
1020H	Current shielding value	R/W	1	uint16	0.01%	
1023H	Power-on default interface	R/W	1	uint16		0: Automatic wheel display Others: Other interfaces
1035H	Apparent power calculation mode	R/W	1	uint16		0：RMS 1：PQS
2000H	A-phase voltage	R	2	float	V	1.Slow register

2002H	B-phase voltage	R	2	float	V	2.ADL200N only has A-phase data
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	
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.Slow register （response rate <=100ms） 2.ADL200N only has A-phase data
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	