ADL200W ADL400W Series DIN-Rail Mounted Multifunctional and Dual Circuits Electric Energy Meter With External Current Transformer(WiFi-Halow)

Installation and Operation Instructions

Acrel Electric Co., Ltd.

Statement

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Our Company reserves the right to modify the product specifications described in this manual without further notice. Please consult your local agent for the current specifications of this product before placing an order.

Safe Information

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 follows, depending on the degree of potential danger.

 DANGER
DANGER indicates a hazardous situation which, if not avoided, will result indeath or serious injury. Failure to follow these instructions will result in death or serious injury.

 WARNING
WARNING indicates a hazardous situation which, if not avoided, could resultin death or serious injury.

 CAUTION
CAUTlON indicates a hazardous situation which, if not avoided, could result inminor or moderate iniury.

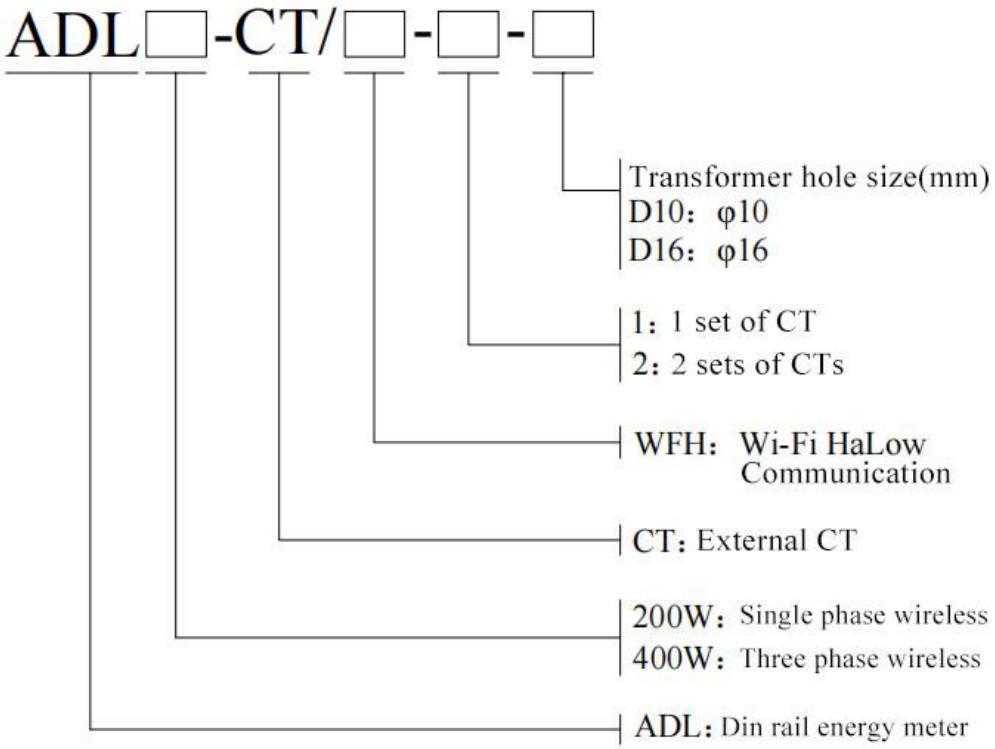
Contents

1 Overview

ADL200W ADL400W Series DIN-Rail Mounted Multifunctional and Dual Circuits Electric Energy Meter With External Current Transformer 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.

It can monitor and measure real-time power and other power parameters, support protocols such as Modbus-TCP and http, and communicate with inverters or energy management systems (EMS) via Wi-Fi HaLow communication to achieve functions such as anti-reverse flow, regulating power generation, and battery charging and discharging. It can be bidirectionally measured to achieve energy management for household distributed photovoltaic systems.

2 Description of Model



3 List of Functions

Table 1 List of Function Descriptions

Function	Descriptions
Electric energy metering	Active energy metering (forward and reverse)
	Reactive energy metering (forward and reverse)
	Split-phase energy
Electric quantity measurement	U, I
	P, Q, S, PF, F
Communication	RS485、Wi-Fi HaLow

4 Technical Parameters

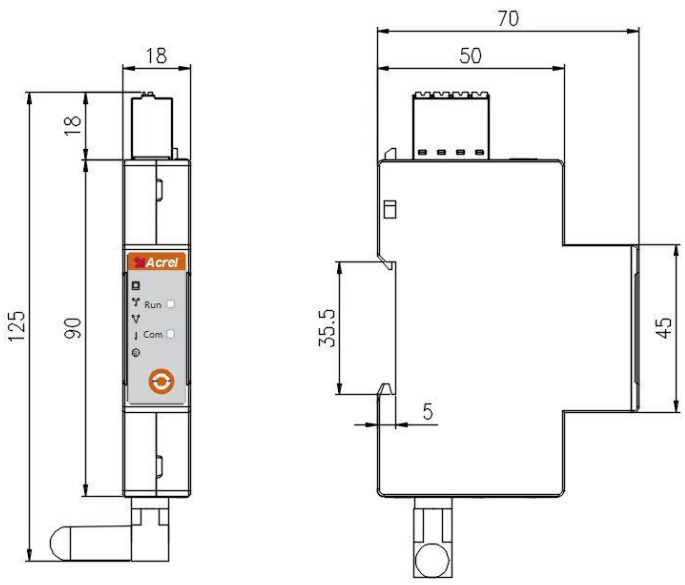
Table 2 Description of Technical Parameters

Item			Performance Parameters	
Model Series			ADL200W	ADL400W
Measurement	Wiring		Single-phase	Three-phase four-wire
	Voltage	Rated voltage	230V	3×230/400V
		Input Range	0.8Unom ~ 1.2Unom	
		Overload	1.2 times rating (continuous) 2 times the rating for 1 second	
		Power consumption	<2w, <10VA	
		Accuracy class	Error ±0.5%	
	Current	Minimum current	0.3A	
		Transitional current(Itr)	1.5A	
		Basic current(Ib)	30A	
		Maxinum current(Imax)	D10：Imax = 80A D16：Imax = 120A	
		Power consumption	<1W, <1VA	
		Accuracy class	Error ±0.5%	
	Power		Active, reactive, apparent power, error ±1.0%	
	Grid frequency		50Hz, error ±0.5%	
	Response rate		50ms (voltage, current, power)	
	Installation category		CAT III	
	overvoltage level		OVC III	
Metering	Active electric energy		Class 1 or B	
electromagnetic compatibility			E2	
Security	Power frequency withstand voltage		Between communication and signal input, AC3kV 1min	
	Insulation resistance		Input and output terminals to casing >100MΩ	
Communication	RS485 interface		Modbus RTU protocol; addr:1~ 247;Baud rate:1200bps-38400bps	
	Wi-Fi HaLow		Operating frequency band:730MHz~950MHz	
Environment	Operating temperature range		-20℃～+55℃	
	Operating temperature range		-20℃～+70℃	
	Storage temperature		-20℃～+70℃	
	Relative humidity		≤95% (without condensation) "Not suitable for damp environments"	
	Altitude		≤2000m	
IP rating			IP20 on terminal strip without protective housing and IP51 in protective housing, per IEC 60529	
Pollution Degree			II	
UC Degree			III	
Installation environment			Indoor use	
Protect Degree			Class II (Double Insulation)	
usage environment			Cabinet mounted(The outer shell cannot be touched)	

usage environment	M1
Transformer Safety characteristics	Insulation resistance: greater than 1000 MΩ under normal conditions; Electric strength resistance: It can withstand 4000V, 50Hz power frequency for 1 minute; Flame retardancy: Conforms to UL94-V0 level;
reference standard	EN IEC 61010-1:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 1: General requirements EN IEC 61010-2-030:2010 Safety requirements for electrical equipment for measurement, control, and laboratory use - Part 2-030: Particular requirements for equipment having testing or measuring circuits EN IEC 61326-1:2021 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 1: General requirements EN IEC 61326-2-1:2021 Electrical equipment for measurement, control, and laboratory use - EMC requirements - Part 2-1: Particular requirements for electromagnetic compatibility testing for electrical equipment for measurement, control, and laboratory use EN 50470-3 Electricity metering equipment (a.c.) - Part 3: Particular requirements - Static meters for active energy (class indexes A, B and C)

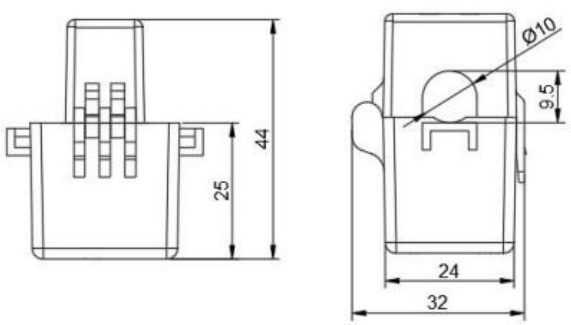
5 Overall Dimensions

5.1 Instrument Dimensions（Unit:mm）

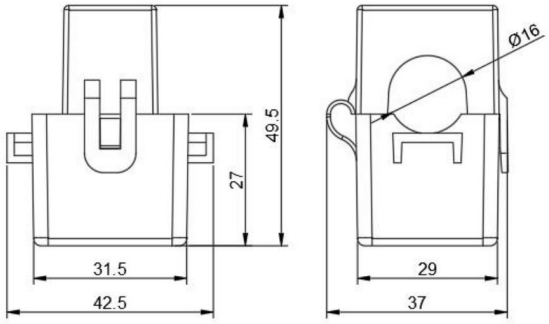


Note: The tolerance of the dimensions is 1mm.

5.2 Transducer Dimensions（Unit:mm）



D10 specification transformer



D16 specification transformer

Note:

1.In the lead wire section of the current transformer, the yellow wire is connected to Phase A, the green wire is connected to Phase B, and the red wire is connected to Phase C.

2.The tolerance of the dimensions is 1mm.

6 safety measures

HAZARD OF ELECTRIC SHOCK, EXPLOSION, OR ARC FLASH

- Apply appropriate personal protective equipment (PPE) and follow safe electrical work practices.
- This equipment does not not require commission before use.
- Turn off all power supplying this device and the equipment in which it is installed before working on it.
- Always use a properly rated voltage sensing device to confirm that all power is off.
- Do not exceed the device's ratings for maximum limits.
- Do not use this device for critical control or protection applications where human or equipment safety relies on the operation of the control circuit.
- Do not use water or any liquid material to clean the product. Use a cleaning cloth to remove dirt.
- The installer is responsible for co-ordinating the rating and the characteristics of the supply side overcurrent protection devices with the maximum current rating.Failure to follow these instructions will result in death or serious injury.

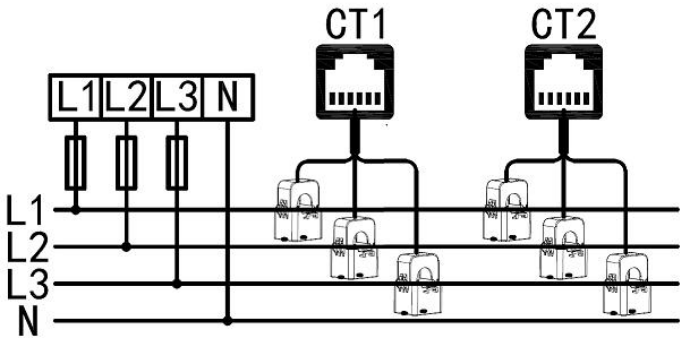
•This is the safety alert symbol. It is used to alert you to potential personal injury hazards. When seeing this symbol, it is necessary to consult the manual.

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

• Do not exceed the device's ratings for maximum limits.

7 Connection and Installation

7.1 Schematic Diagram of Voltage and Current Connection



Note:

1.Only connect Phase A to the single-phase electric meter;

2.Only need connect CT1 to ADL☐-CT/☐-1-☐;

3.For safty reasons,a fuse with a rated current of 5A needs to be connected to the voltage input terminal;

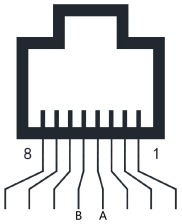
4.Verify that power is OFF before making connections;

5.Each group of CT in ADL200W-CT/☐-☐-☐ has only one phase of transformer, while each group of CT in ADL400W-CT/☐-☐-☐ has three phases of transformer.

WARNING
● Use copper wire rated for 500V. ● Minimum temperature rating of the cable to be connected to the field wiring terminals, 80 °C. **Failure to follow these instructions can result in death, serious injury, or equipment damage.**

AVERTISSEMENT
● Utilisez un fil de cuivre évalué pour 500V. ● Température nominale minimale du câble à connecter aux bornes de câblage sur le terrain, 80 °C. **Le non-respect de ces instructions peut entraîner la mort, des blessures graves ou des dommages à l'équipement.**

7.2 Communication Terminal



RS485

8 Main Functional Features

8.1 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, frequency, forward active electric energy, reverse active electric energy, forward reactive electric energy and reverse reactive electric energy.

8.2 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.

9 Indicator lights, buttons and nameplate signs

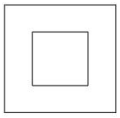
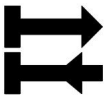
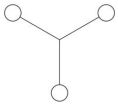
9.1 Indicator light description

Indicator name	illustrate
RUN	Operation indicator light flashes at 1HZ frequency during normal operation
COM	Flashes during normal communication

9.2 Key description

When the button is pressed for 3 seconds, the instrument will reactivate the hot spot, which will be turned off after 5 minutes.

9.3 Nameplate sign description

Nameplate sign	illustrate
	The accuracy of active energy is class B
	Double insulation
	Safety warning sign
	Bidirectional measurement
	Single measuring unit active power meter
	Three measuring unit active power meter

10 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.

The Wi-Fi Halow communication of the instrument supports protocols such as Modbus-TCP and http. Operating frequency band: 730MHz~950MHz; 802.11ah.When using Wi-Fi for communication, it is necessary to pay attention to the placement of the router, device compatibility, network security Settings (such as strong passwords, encryption methods), frequency band and channel selection, avoiding signal interference, controlling the number of connected devices, and regularly checking firmware updates and monitoring network status to ensure the safe, stable and efficient operation of the network.

10.1 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	World Length	Type	Unit	Note
0000H	slave address	R/W	1	uint16		1-247
000BH	feature code	R	1	uint16		The high byte is fixed as 0xAC. The low byte represents the type of electric meter, as follows: 0x01: Single-channel CT - Single-phase electric meter; 0x02: Single-channel CT - Three-phase electric meter; 0x03: Dual-channel CT - Single-phase electric meter; 0x04: Dual-channel CT -

						Three-phase electric meter.
000CH	the phase - sequence detection result of the first channel	R	1	uint16		the upper 8-bits (polarity of the mutual inductor) bit8:Phase A bit9:Phase B bit10:Phase C 1 indicates that the polarity is reversed the lower 8-bits (Phase sequence): 0：ABC 1：BAC 2：ACB 3：CBA 4：CAB 5：BCA
000DH	phase sequence adjustment of the first channel.	R/W	1	uint16		0：ABC 1：BAC 2：ACB 3：CBA 4：CAB 5：BCA
000EH	polarity adjustment of the current transformer of the first channel	R/W	1	uint16		bit0:Phase A Bit1:Phase B Bit2:Phase C
000FH	the phase - sequence detection result of the second channel	R	1	uint16		the upper 8-bits (polarity of the mutual inductor) bit8:Phase A bit9:Phase B bit10:Phase C 1 indicates that the polarity is reversed the lower 8-bits (Phase sequence): 0：ABC 1：BAC 2：ACB 3：CBA 4：CAB 5：BCA
0010H	phase sequence adjustment of the second channel	R/W	1	uint16		0：ABC 1：BAC 2：ACB 3：CBA 4：CAB 5：BCA

0011H	polarity adjustment of the current transformer of the second channel	R/W	1	uint16		bit0:Phase A Bit1:Phase B Bit2:Phase C
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		lower byte 0：None 1：Odd 2：Even higher byte 0：1stop 1：2stop
1009H	SnNum	R/W	7	uint16		ASCII
2100H	A-phase voltage	R	2	float	V	The electrical parameter data of the first circuit
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	W	
2116H	B-phase active power	R	2	float	W	
2118H	C-phase active power	R	2	float	W	
211AH	Total active power	R	2	float	W	
211CH	A-phase reactive power	R	2	float	Var	
211EH	B-phase reactive power	R	2	float	Var	
2120H	C-phase reactive power	R	2	float	Var	
2122H	total reactive power	R	2	float	Var	
2124H	A-phase apparent power	R	2	float	VA	
2126H	B-phase apparent power	R	2	float	VA	
2128H	C-phase apparent power	R	2	float	VA	
212AH	Total apparent power	R	2	float	VA	
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	
2300H	A-phase voltage	R	2	float	V	The electrical parameter data of the second circuit
2302H	B-phase voltage	R	2	float	V	
2304H	C-phase voltage	R	2	float	V	
2306H	AB-line voltage	R	2	float	V	
2308H	BC-line voltage	R	2	float	V	
230AH	CA-line voltage	R	2	float	V	
230CH	A-phase current	R	2	float	A	
230EH	B-phase current	R	2	float	A	
2310H	C-phase current	R	2	float	A	
2312H	N-phase current	R	2	float	A	
2314H	A-phase active power	R	2	float	W	
2316H	B-phase active power	R	2	float	W	
2318H	C-phase active power	R	2	float	W	
231AH	Total active power	R	2	float	W	
231CH	A-phase reactive power	R	2	float	Var	
231EH	B-phase reactive power	R	2	float	Var	
2320H	C-phase reactive power	R	2	float	Var	
2322H	total reactive power	R	2	float	Var	
2324H	A-phase apparent power	R	2	float	VA	
2326H	B-phase apparent power	R	2	float	VA	
2328H	C-phase apparent power	R	2	float	VA	
232AH	Total apparent power	R	2	float	VA	
232CH	A-phase power factor	R	2	float		
232EH	B-phase power factor	R	2	float		
2330H	C-phase power factor	R	2	float		
2332H	Total power factor	R	2	float		
2334H	Frequency	R	2	float	Hz	
3000H	active electric energy	R	4	double	kWh	The first circuit electrical energy
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	
3100H	active electric energy	R	4	double	kWh	The second circuit electrical energy
3104H	forward active electric energy	R	4	double	kWh	
3108H	reverse active electric energy	R	4	double	kWh	
310CH	reactive electric energy	R	4	double	kVarh	
3110H	forward reactive electric energy	R	4	double	kVarh	
3114H	reverse reactive electric energy	R	4	double	kVarh	
3018H	apparent electric energy	R	4	double	kVAh	
311CH	active electric energy of phase A	R	4	double	kWh	

3120H	forward active electric energy of phase A	R	4	double	kWh	
3124H	reverse active electric energy of phase A	R	4	double	kWh	
3128H	reactive electric energy of phase A	R	4	double	kVarh	
312CH	forward reactive electric energy of phase A	R	4	double	kVarh	
3130H	reverse reactive electric energy of phase A	R	4	double	kVarh	
3134H	active electric energy of phase B	R	4	double	kWh	
3138H	forward active electric energy of phase B	R	4	double	kWh	
313CH	reverse active electric energy of phase B	R	4	double	kWh	
3140H	reactive electric energy of phase B	R	4	double	kVarh	
3144H	forward reactive electric energy of phase B	R	4	double	kVarh	
3148H	reverse reactive electric energy of phase B	R	4	double	kVarh	
314CH	active electric energy of phase C	R	4	double	kWh	
3150H	forward active electric energy of phase C	R	4	double	kWh	
3154H	reverse active electric energy of phase C	R	4	double	kWh	
3158H	reactive electric energy of phase C	R	4	double	kVarh	
315CH	forward reactive electric energy of phase C	R	4	double	kVarh	
3160H	reverse reactive electric energy of phase C	R	4	double	kVarh	

11 Common Fault Analysis

11.1 Abnormal Voltage, Current, and Power Indications

(1) Inspection: Check whether the actual wiring is the same as the requirements of the wiring diagram, pay attention to whether the voltage wiring order is correct, and whether the direction of the current transformer's secondary winding and phase sequence are correct.

(2) Measurement: If the wiring is correct, use a multimeter in continuity test mode to measure the external circuit connections related to the problem. Check for continuity between the terminals of the external circuit and the instrument terminals.

Note: When inspecting current and voltage circuits, ensure that the signal current and voltage are disconnected to ensure personal safety.

11.2 Communication Fault

(1) When there is A communication failure in the RS485 communication mode: Check whether the communication wiring is correct and whether A and B are connected in reverse.

(2) When the Wi-Fi HaLow communication method fails:Check whether the parameters such as the ssid and key are configured correctly.

12 Transportation and Storage

The packaging of the instrument should use environmentally friendly materials. The instrument and its accessories, when packaged, should be stored in a ventilated and dry place to avoid moisture and corrosion by gases. The storage temperature should be between -20°C and +70°C, with a relative humidity not exceeding 75%.

13 Warranty and Service

The manufacturer offers a triple guarantee on product quality. Within 24 months from the date of manufacture, if the user fully complies with the usage conditions specified in this manual and finds the instrument damaged during use, our company will be responsible for repairing or replacing it free of charge.

14 Care and maintenance

This meter does not require regular maintenance.