504

AMB infrared temperature measurement solution

Installation instruction V1.0

Acrel Co., Ltd.

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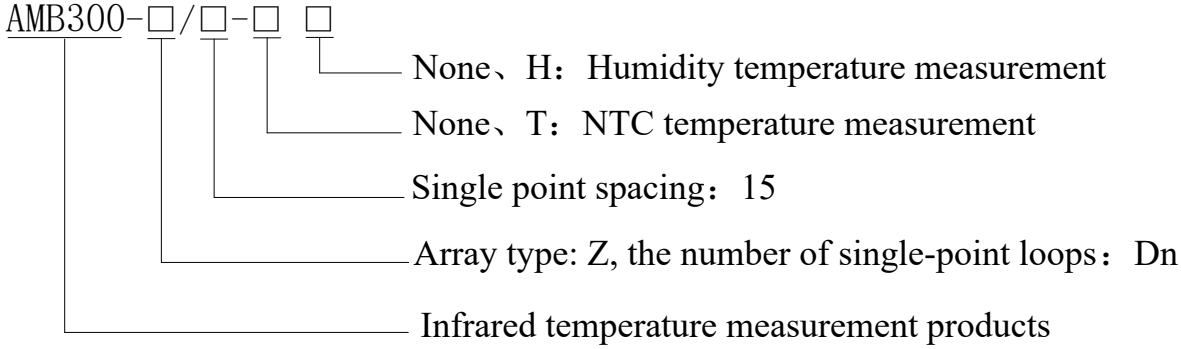
1 General

AMB infrared temperature measurement solution is a non-contact infrared temperature measurement device. The product can solve the problem of safe and accurate temperature measurement of busbar slot, upload the temperature data of each phase in the connector to the background in real time, implement monitoring and warning information, and prompt the management personnel to pay attention to the alarm point or take necessary preventive measures. The device is mainly used in the on-line temperature monitoring system of densely insulated bus connector in various fields.

2 Model specification



Name	Model	Function description
Infrared temperature measurement module	AMB300-Z	Two-bus communication, real-time online detection of a large-scale array temperature. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-Z-T	Two-bus communication, real-time online detection of a large-range array temperature, and an external NTC temperature measurement. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-Z-H	Two-bus communication, real-time online detection of a large-scale array temperature and humidity at the connector. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-Z-TH	Two-bus communication, real-time online detection of a large-range array temperature, humidity at the connector, and an external NTC temperature measurement. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-D1	Two-bus communication, real-time online detection of a single point temperature in a small range. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-D1-T	Two-bus communication, real-time online detection of a single point temperature in a small range, and an external NTC temperature measurement. It needs to be used with an infrared temperature measurement collector and powered by the collector.

	AMB300-D1-H	Two-bus communication, real-time online detection of a small range of single-point temperature and humidity at the connector. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-D1-TH	Two-bus communication, real-time online detection of a single point temperature in a small range, humidity at the connector, and an external NTC temperature measurement. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-D4/15	Two-bus communication, real-time online detection of 4 small-range single-point temperatures, each probe is 15mm apart. It needs to be used with an infrared temperature measurement collector and powered by the collector.
	AMB300-D4/15-T	Two-bus communication, real-time online detection of 4 small-range single-point temperatures, each probe has a distance of 15mm, and an external NTC temperature measurement. It needs to be used with an infrared temperature measurement collector and powered by the collector.
Infrared temperature measurement collector	AMB310	2 channels of downlink two-bus communication, up to160 infrared temperature measurement modules can be collected, 2 channels of RS485 communication to the monitoring system or touch screen, DC 24V-DC30V power supply.

3 Technical parameters

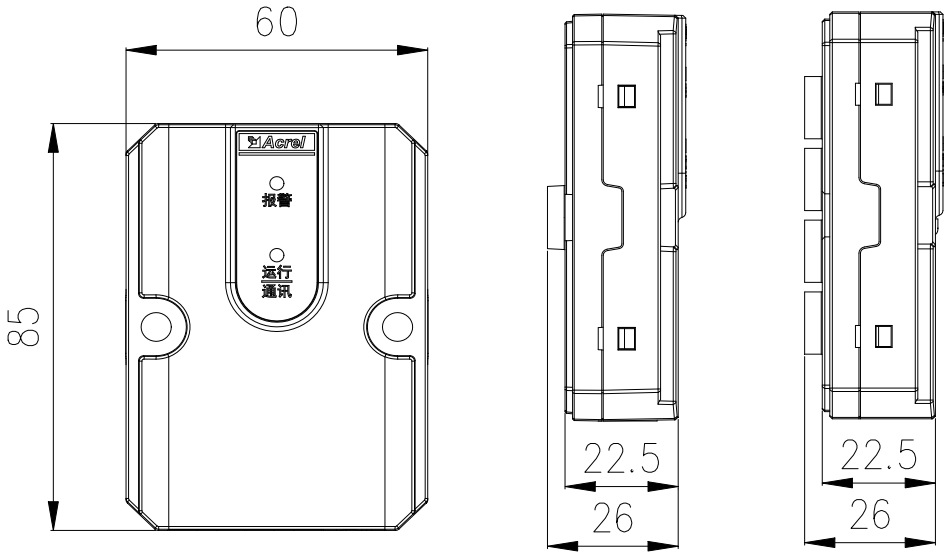
Instrument model		AMB300-Z	AMB300-D4	AMB300-D1
Measurement	Function	Measuring range temperature, display the highest 4 channels, humidity (optional)	4-way temperature	1-way temperature and humidity（optional）
	Range	Temperature -10℃～150℃, humidity 0%RH-95%RH	Temperature -10℃～150℃	Temperature -10℃～150℃，humidity 0%RH-95%RH
	Accuracy	(-10℃～85℃) temperature ±3℃, (85℃～150℃) temperature ±5℃, humidity ±5%RH	(-10℃～85℃)temperature±3℃，（85℃～150℃）temperature±5℃	(-10℃～85℃)temperature±3℃,（85℃～150℃）temperature±5℃，humidity±5%RH
	NTC temperature measurement range (optional）	Temperature -10℃～150℃	Temperature -10℃～150℃	Temperature -10℃～150℃
Auxiliary supply		Power supplied by AMB310	Power supplied by AMB310	Power supplied by AMB310
Communication		Two channels	Two channels	Two channels

Protection level		IP51	IP51	IP51
Pollution level		2	2	2
Electromagnetic compatibility	Antistatic interference	Level 4	Level 4	Level 4
	Anti-electric fast transient burst	Level 4	Level 4	Level 4
Environment	Whole machine temperature	Working：-20℃～85℃ Store：-40℃～70℃	Working：-20℃～85℃ Store：-40℃～70℃	Working：-20℃～85℃ Store：-40℃～70℃
	Humidity	Relative humidity ≤93%, no condensation	Relative humidity ≤93%, no condensation	Relative humidity ≤93%, no condensation
	Altitude	≤2000m	≤2000m	≤2000m

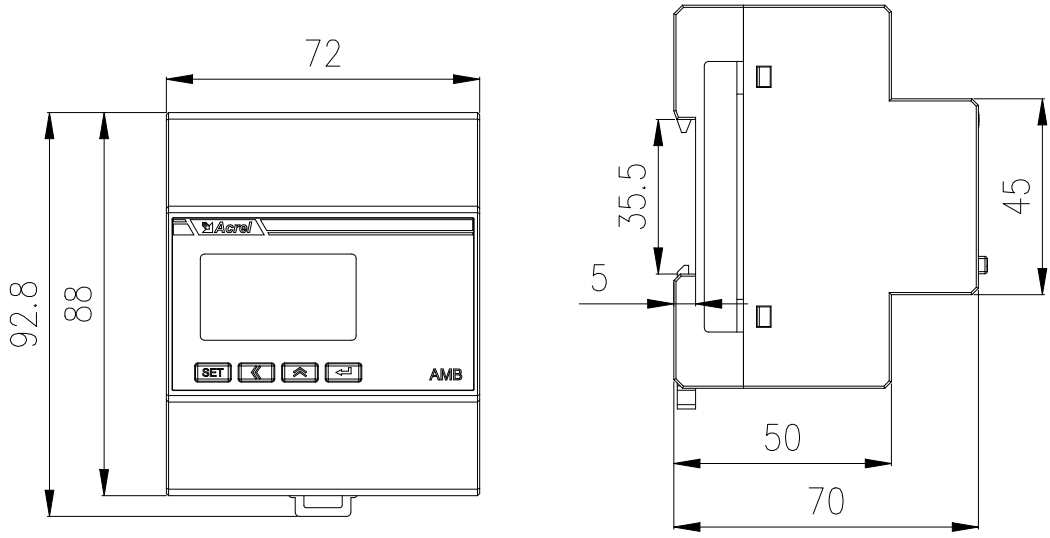
Instrument model		AMB310
Function		2 channels of downlink two-bus communication, data of up to 160 modules can be collected, two channels of 485 communication, the collected temperature data can be uploaded to the background or touch screen
Auxiliary supply		DC 24-30V（Recommended by default 30V）
Communication		Two channels、RS485
Protection level		IP51
Pollution level		2
Electromagnetic compatibility	Antistatic interference	Level 4
	Anti-electric fast transient burst	Level 4
Environment	Whole machine temperature	Working：-20℃～55℃ Store：-40℃～70℃
	Humidity	Relative humidity ≤93%, no condensation
	Altitude	≤2000m

4 External structure

4.1 Dimensions **Unit:mm**



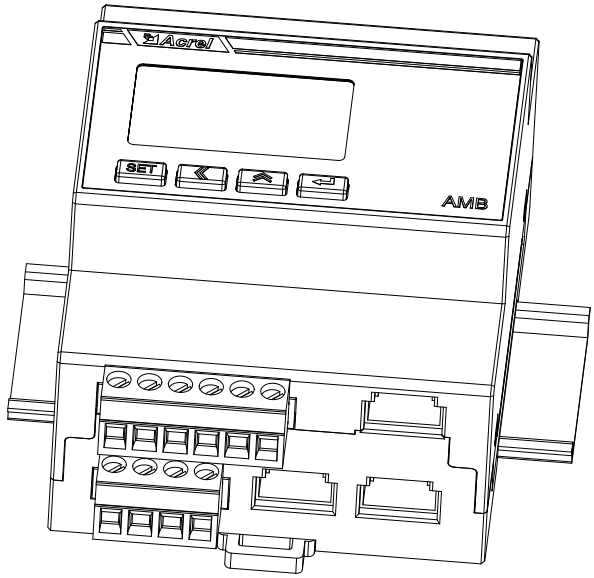
AMB300



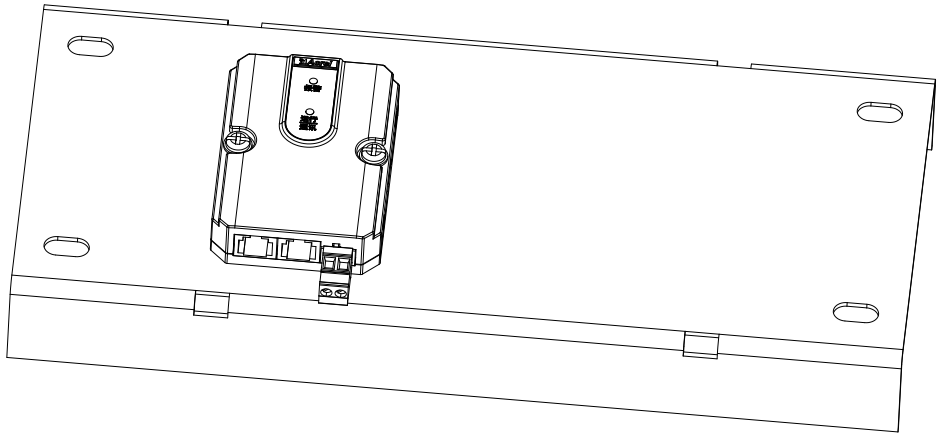
AMB310

4.2 Installation method

AMB310 adopts DIN35mm rail type installation, AMB300 adopts screw fixed installation.

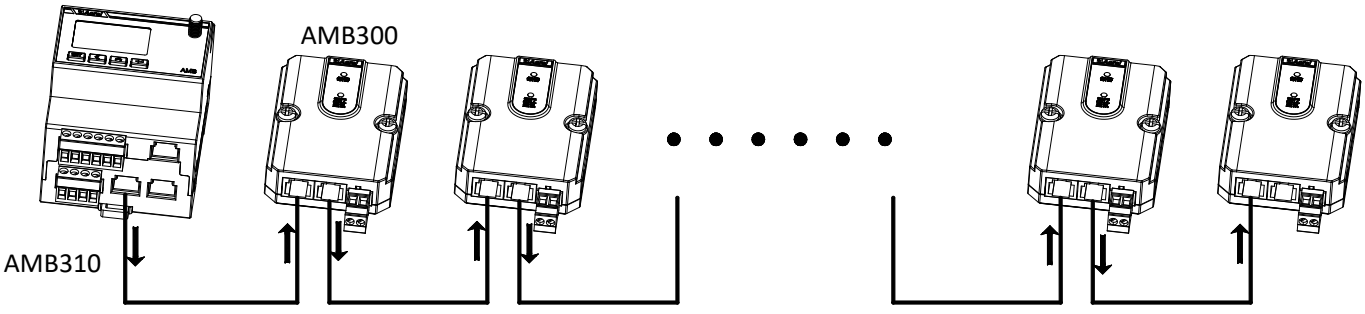


AMB310



AMB300

4.3 Collector connection method



The arrow in the figure above indicates the direction of 24-30V signal output. The communication port needs to use a SHIELDED RJ45 cable. The left RJ45 port on the AMB300 module in the figure above is the signal incoming port, and the right RJ45 port is the signal outgoing port, which is used to connect to the incoming port of the next module.

Note: 1. The network cable should be above CAT5E.

2. A collector (AMB310) has two interfaces on the downstream two buses. Each interface is installed with a maximum of 80 infrared temperature measurement modules, and the length of each two buses is less than or equal to 250 meters.

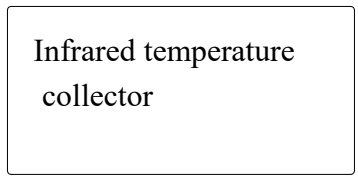
5 Operation Guide

5.1 Button Description

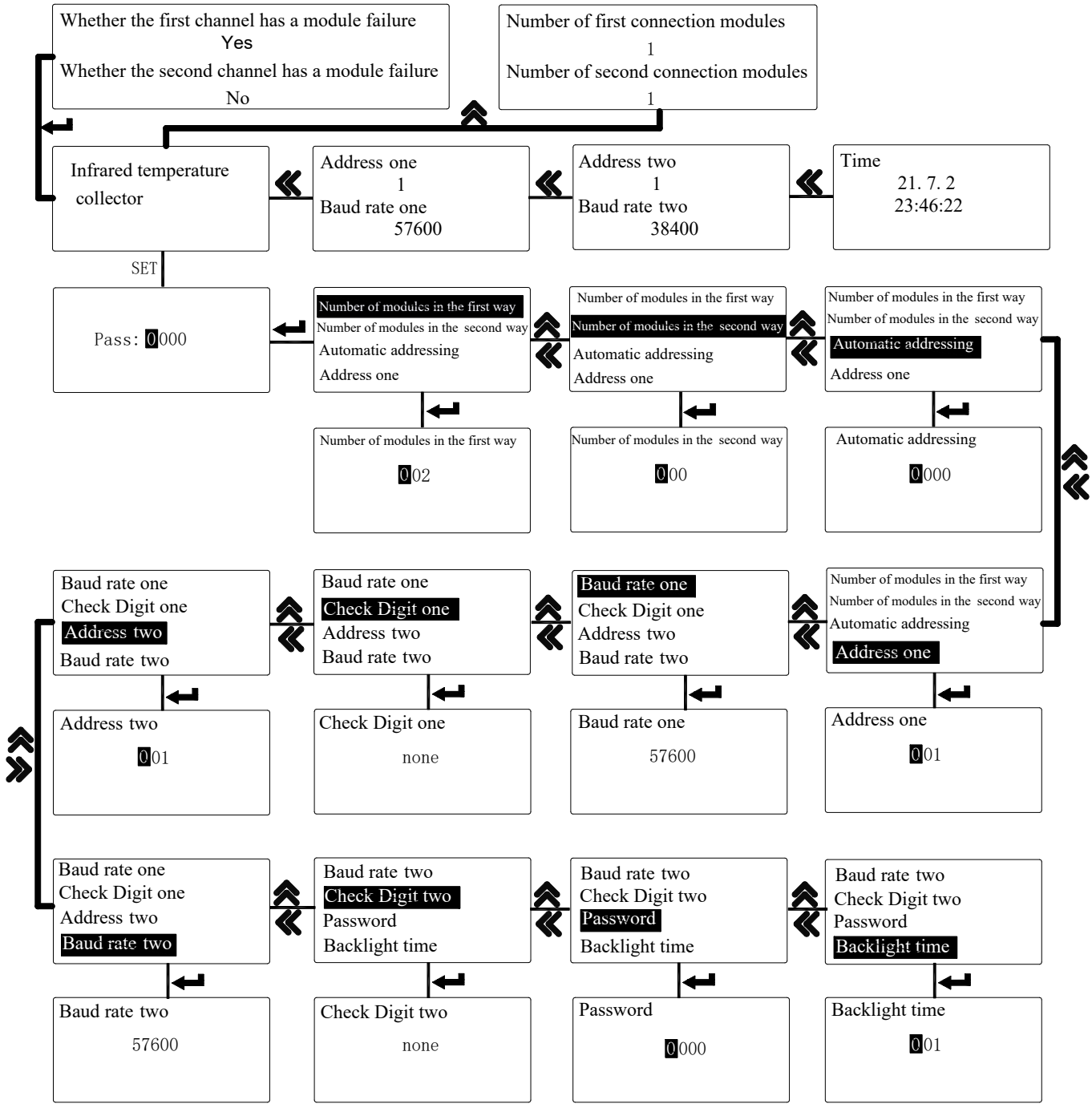
SET Set button	In non-programming mode: Press this key to enter the programming mode, the device prompts you to enter the password, or return to the menu of the previous level; In programming mode: Used to return to the previous menu or exit the programming mode.
Left button Up button	Non-programming mode: used to switch the display interface; Programming mode: Used for sibling menu switching and light shift.
Enter button	Programming mode: Used to confirm the selection of menu items, that is, enter the next level menu.

5.2 Button operation interface

After the instrument is powered on, the screen shows the startup interface as shown in the figure below: infrared temperature collector, and you can switch the interface、、 for viewing parameters through, and, press up once to enter the interface of address one, press up twice to enter the interface of address two, press three times to enter the time interface; Press the up key to enter the interface of the number of connection modules, press the Enter key to enter the interface of whether the module is faulty. Press the button SET to enter the password screen. Enter the default password (0000) to enter the communication parameter options screen: Number of first module, number of second module, automatic addressing, Address 1, baud rate 1, check bit 1, Address 2, Baud rate 2, check bit 2, Password, backlight. The specific operation flowchart is as follows:



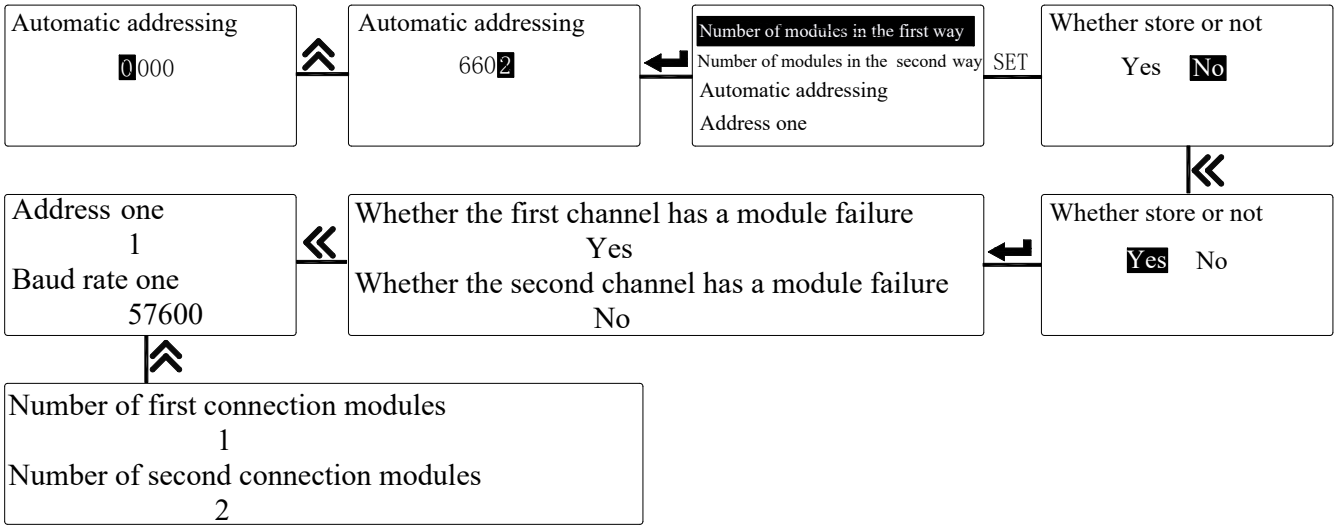
Boot screen



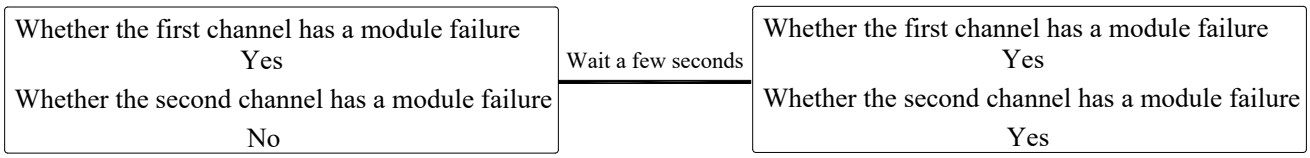
Communication parameter options screen

The default baud rate is 57600. You can press up to set the baud rate to 2400, 4800, 9600, 19200, and 38400. The default parity bit is None. You can set the parity bit to odd or even by pressing the up key.

Automatic addressing interface Settings: Input 6601 for the first circuit and input 6602 for the second circuit. The first circuit and the second circuit cannot be addressed at the same time. Take the second circuit as an example to operate: Press the enter button to return to the option interface, press set button to enter the storage interface, select 'Yes', namely save finished, at this point in the loop connecting two module, the module number is 2, switch to a trouble-free interface, if pulled out a module connection, wait for a few seconds later, the second channel for module fault interface displayed as' Yes'.



Automatic address setting interface



Module fault interface display

6 Communication description

6.1 General

The AMB300 is only used for internal two-bus communication, and the AMB310 uses modbus-RTU. The default parameters are as follows:

Communication method	Baud rate	Data bits	Check code
485	57600	8	N

Note: N means no check bit;

Error detection: CRC16 (cyclic redundancy check)

6.2 Agreement

When a data frame arrives at the terminal device, it enters the addressed device through a simple “port”, and the device removes the “signal” of the data frame."Envelop" (data header), read the data, if there is no error, execute the task requested by the data, and then add the data generated by itself to the obtained "envelope", and return the data frame to the sender. Returned The response data contains the following content: terminal slave address (Address),the executed command (Function), the requested data (Data) generated by the executed command, and a CRC check code (Check). If any error occurs, there will be no successful response, or an error indication frame will be returned.

6.2.1 Data frame format

Address	Function	Data	Check
8-Bits	8-Bits	NX8-Bits	16-Bits

6.2.2 Address domain

The address field is at the beginning of the frame and consists of one byte (8-bits, 8-bit binary code). The decimal number ranges from 0 to 255 and is used only in our system 1 to 247, other addresses are reserved. These bits indicate the address of the user-specified terminal device that will receive data from the host connected to it. The address of each terminal device on the same bus must be unique; only the terminal addressed will respond to a query containing that address. When the terminal sends back a response, the slave address data in the response tells the host which terminal is communicating with it.

6.2.3 Function domain

The function domain code tells the terminal being addressed what function to perform. The following table lists the function codes used in this series of meters and their meanings

Meaning and function.

Code (hexadecimal)	Significance	Behavior
03H	Read holding register	Get the current binary value in one or more holding registers
10H	Preset multiple registers	Load specific binary values into a series of holding registers

6.2.4 Data domain

The data field contains the data required by the terminal to perform a specific function or the data collected when the terminal responds to a query. These data may be numerical values, parameter addresses or setting values.

For example, the function domain tells the terminal to read a register, and the data domain needs to specify which register to start and how many data to read. The embedded address and data vary according to the type and the difference between the slaves.

6.2.5 Check domain

This domain uses CRC16 cyclic redundancy check, allowing the host and terminal to check errors in the transmission process. Sometimes due to electrical noise and other interference, when a set of data is transmitted from one device to another, some changes may occur on the line. Error checking can ensure that the host or slave does not respond to the changed data, which improves Improve the safety, reliability and efficiency of the system.

6.3 Error checking method

The error check (CRC) field occupies two bytes and contains a 16-bit binary value. The CRC value is calculated by the transmitting device and then attached to the data frame. The receiving device recalculates the CRC value when receiving the data, and then compares it with the value in the received CRC field. If the values are not equal, an error occurs.

During CRC operation, first preset a 16-bit register to all 1s, and then continuously calculate the 8 bits in each byte of the data frame with the current value of the register, only 8 data per byte Bit participates in generating CRC, start bit, stop bit and possible parity bit will not affect CRC. When generating the CRC, the 8 bits of each byte are XORed with the contents of the register, and then the result is shifted to the low bit, and the high bit is supplemented with "0", and

the least significant bit (LSB) is shifted out and checked. If it is 1, This register will perform an exclusive OR operation with a preset fixed value (0A001H). If the lowest bit is 0, no processing will be performed.

CRC generation process:

1 Preset a 16-bit register as 0FFFFH (all 1), which is called CRC register.

The 8 bits of the first byte in is xOR with the low byte in the CRC register, and the result is stored back in the CRC register.

2 Perform an exclusive OR operation on the 8 bits of the first byte in the data frame and the low byte in the CRC register, and store the result back to the CRC register.

3 Shift the CRC register one bit to the right, fill the highest bit with 0, and shift the lowest bit out and detect it.

4 If the lowest shift is 0: repeat step 3 (the next shift); If the lowest shift is 1: XOR the CRC register with a preset fixed value (0A001H).

5 Repeat steps 3 and 4 until 8 shifts. In this way, a complete 8-bit is processed.

6 Repeat steps 2 to 5 to process the next 8 bits until all bytes are processed.

7 The final CRC register value is the CRC value.

In addition, there is a method to calculate CRC by using look-up tables. Its main feature is fast calculation speed, but the tables require a larger storage space. This method will not be repeated here, please refer to related materials.

6.4 Correspondence address table

Communication parameter address table

Number	Address	Variate	Remark	Length (bytes)	Unit	Type of data
1	0x0000	Address1	R/W	2		u16
2	0x0001	Baud rate|Check Digit	R	2	High byte baud rate | low parity bit	u16
3	0x0002	Address2	R/W	2		u16
4	0x0003	Baud rate|Check Digit	R	2	High byte baud rate | low parity bit	u16
5	0x0004	Year and month	R/W	2	High byte year|low month	u16
6	0x0005	Day and hour	R/W	2	High byte day|low hour	u16
7	0x0006	Minute and second	R/W	2	High byte minute|low second	u16
8	0x0007	Start address of the first route		2		u16
9	0x0008	Number of modules in the second channe2		2		u16
10	0x0009	Start address of the second route		2		u16
11	0x000A	Number of modules in the second channel		2		u16

12	0x000B	Automatic addressing enabled		2	Write 0x6601 for the first channel automatic addressing, write 0x6602 for the second channel automatic addressing	u16
13	0x000C	Spare		2		u16
14	0x000D	Spare		2		u16
15	0x000E	Spare		2		u16
16	0x000F	Spare		2		u16
Temperature measurement module serial number: 1	0x0010	Address	R/W	2		u16
	0x0011	Type	R	2	0: Matrix type 1: Four-point type	u16
	0x0012	Baud rate	R	2		u16
	0x0013	Check Digit	R	2		u16
	0x0014	Over-temperature forecast alarm threshold	R	2	0.1℃	s16
	0x0015	External NTC forecast alarm	R	2	0.1℃	s16
	0x0016	Humidity forecast alarm threshold	R	2	0.10%	u16
	0x0017	Spare	R	2		u16
	0x0018	Internal temperature	R	2	0.1℃	s16
	0x0019	Operating Voltage	R	2	0.1 V	u16
	0x001A	Humidity	R	2	0.10%	u16
	0x001B	Spare	R	2		u16
	0x001C	External NTC	R	2	0.1℃	s16
	0x001D	Single point 1	R	2	0.1℃	s16
	0x001E	Single point 2	R	2	0.1℃	s16
	0x001F	Single point 3	R	2	0.1℃	s16
	0x0020	Single point 4	R	2	0.1℃	s16
	0x0021	Single point MAX	R	2	0.1℃	s16
	0x22-0x31	The matrix has an average of 16 points	R	32	0.1℃	s16
	0x0032	Matrix average MAX1	R	2	MAX（1>2>3>4）	s16
	0x0033	Matrix average MAX2	R	2	0.1℃	s16
	0x0034	Matrix average MAX3	R	2	0.1℃	s16
	0x0035	Matrix average MAX4	R	2	0.1℃	s16

	0x0036	Spare	R	2		u16
	0x0037	Emissivity	R	4	Default is 1	float
	0x0038					
2	0x0039	Module 2				
3	0x0062	Module 3				
4	0x008B	Module 4				
5	0x00B4	Module 5				
...	...	...				
180	0x1CBB	Module 180				

AMB310 communication alarm address table

	Address	**R/W**	**Length (bytes)**	**Type of data**	**Status bit**							
The first communication alarm of the slave	0x04000	R	2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave16	Slave15	Slave14	Slave13	Slave12	Slave11	Slave10	Slave9
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave8	Slave7	Slave6	Slave5	Slave4	Slave3	Slave2	Slave1
	0x04001		2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave32	Slave31	Slave30	Slave29	Slave28	Slave27	Slave26	Slave25
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave24	Slave23	Slave22	Slave21	Slave20	Slave19	Slave18	Slave17
	0x04002	R	2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave48	Slave47	Slave46	Slave45	Slave44	Slave43	Slave42	Slave41
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave40	Slave39	Slave38	Slave37	Slave36	Slave35	Slave34	Slave33
	0x04003		2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave64	Slave63	Slave62	Slave61	Slave60	Slave59	Slave58	Slave57
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave56	Slave55	Slave54	Slave53	Slave52	Slave51	Slave50	Slave49
	0x04004	R	2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave80	Slave79	Slave78	Slave77	Slave76	Slave75	Slave74	Slave73
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave72	Slave71	Slave70	Slave69	Slave68	Slave67	Slave66	Slave65
	Address	**R/W**	**Length (bytes)**	**Type of data**	**Status bit**							

The second communication alarm of the slave	0x4010	R	2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave16	Slave15	Slave14	Slave13	Slave12	Slave11	Slave10	Slave9
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave48	Slave47	Slave46	Slave45	Slave44	Slave43	Slave42	Slave41
	0x4011		2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave32	Slave31	Slave30	Slave29	Slave28	Slave27	Slave26	Slave25
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave24	Slave23	Slave22	Slave21	Slave20	Slave19	Slave18	Slave17
	0x4012	R	2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave48	Slave47	Slave46	Slave45	Slave44	Slave43	Slave42	Slave41
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave40	Slave39	Slave38	Slave37	Slave36	Slave35	Slave34	Slave33
	0x4013		2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave64	Slave63	Slave62	Slave61	Slave60	Slave59	Slave58	Slave57
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave56	Slave55	Slave54	Slave53	Slave52	Slave51	Slave50	Slave49
	0x4014	R	2	u16	Bit15	Bit14	Bit13	Bit12	Bit11	Bit10	Bit9	Bit8
					Slave80	Slave79	Slave78	Slave77	Slave76	Slave75	Slave74	Slave73
					Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
					Slave72	Slave71	Slave70	Slave69	Slave68	Slave67	Slave66	Slave65

AMB300 communication parameter address table

Number	**Address**	**Variate**	**Remark**	**Length (bytes)**	**Unit**	**Type of data**
1	0x0000	Address	R/W	2		u16
2	0x0001	Type	R	2	0：Matrix 1：Four-point	u16
3	0x0002	Baud rate	R	2		u16
4	0x0003	Check Digit	R	2		u16
5	0x0004	Over-temperature forecast alarm threshold	R	2	0.1℃	s16
6	0x0005	External NTC forecast alarm	R	2	0.1℃	s16
7	0x0006	Humidity forecast alarm threshold	R	2	0.1 %	u16
8	0x0007	Spare	R	2		u16

9	0x0008	Internal temperature	R	2	0.1℃	s16
10	0x0009	Operating Voltage	R	2	0.1 V	u16
11	0x000A	Humidity	R	2	0.1 %	u16
12	0x000B	Spare	R	2		u16
13	0x000C	External NTC	R	2	0.1℃	s16
14	0x000D	Single point 1	R	2	0.1℃	s16
15	0x000E	Single point 2	R	2	0.1℃	s16
16	0x000F	Single point 3	R	2	0.1℃	s16
17	0x0010	Single point 4	R	2	0.1℃	s16
18	0x0011	Single point MAX	R	2	0.1℃	s16
19	0x12-0x21	The matrix has an average of 16 points	R	32	0.1℃	s16
20	0x0022	Matrix average MAX1	R	2	MAX（1>2>3>4）	s16
21	0x0023	Matrix average MAX2	R	2	0.1℃	s16
22	0x0024	Matrix average MAX3	R	2	0.1℃	s16
23	0x0025	Matrix average MAX4	R	2	0.1℃	s16
24	0x0026	Spare	R	2		u16
25	0x0027	Emissivity	R	4	Default is 1	float
26	0x0028					

6.5 Communication application

The examples in this section should use the following format as much as possible (data is in hexadecimal)

Addr	Fun	Data start		Data #of		CRC16	
		reg Hi	reg Lo	reg Hi	reg Lo	Lo	Hi
01H	03H	00H	00H	00H	06H	CRC_L	CRC_H
Address	Function code	Data start address		Number of data read		Cyclic redundancy check code	

6.5.1 Read data

Example 1: Read A temperature data

Query data frame	01 03 00 1D 00 01 14 0C
Return data frame	01 03 02 01 0E 38 10

Instruction:

01: Slave address

03: Function code

04: Hexadecimal, decimal is 4, which means there are 4 bytes of data behind

5a50: Cyclic Redundancy Check Code

For the data processing method, see: 6.4 Communication parameter address table

The processing is as follows: 010E (hexadecimal)=270 (decimal) The temperature is 27.0℃

6.5.2 Write data

Example 2: Set the address of the first collector (control word: 0008H)

Write data frame	01 10 00 00 00 01 02 00 02 27 91
Return data frame	01 10 00 00 00 01 01 C9

Instruction:

Write 2 to address 0, then the first address becomes 2.

7 Common fault diagnosis and troubleshooting methods

7.1 The device does not work normally after power-on

*Power on the device again, remove the safety base of the device and reinstall it.

7.2 Abnormal RS-485 communication

*Check whether the communication baud rate, ID and communication protocol settings of the host computer are consistent with the device;

*Please check whether the settings of the data bit, stop bit, and parity bit are consistent with the upper computer;

*Check whether the RS-232/RS-485 converter is normal;

*Check whether there are any problems with the entire communication network (short circuit, open circuit, grounding, whether the shielded wire is correctly grounded, etc.);

*Turn off the device and host computer, and then restart;

*For the long communication line, it is recommended to connect a matching resistance of about 100 to 200 ohms in parallel at the end of the communication line.

7.3 Abnormal wireless communication

*Check whether the communication frequency band setting of the wireless master station is consistent with the device;

*Check whether there is co-frequency interference in the wireless frequency band on site;

*Check whether the wireless network signal of the communication frequency band of the required master station covers the equipment;

*Turn off the device and host computer, and then restart.