Remote I/O Module

Preface

Thanks for choosing BLIIoT Remote I/O Module. These operating instructions contain all the information you need for operation of a device in the DAM family.

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Disclaimer

This document is designed for assisting user to better understand the device. As the described device is under continuous improvement, this manual may be updated or revised from time to time without prior notice. Please follow the instructions in the manual. Any damages caused by wrong operation will be beyond warranty.

Revision History

Update Date	Version	Description	Owner
November 23, 2022	V1.1	First Edition	LKY

Content

Shenzhen Beilai Technology Co., Ltd V1.1

1 Product Introduction

1.1 Overview

DAM series I/O module is data acquisition module which features digital input, relay output, analog input, thermal resistance PT100/PT1000 input, and thermocouple input.

DAM series I/O module support MODBUS RTU protocol, communicate through RS-485 serial port, it is widely used in various industrial automation measurement and control systems.

1.2 Model List

I/O Model	Digital Input	Digital Output	Analog Input	RTD	TC
DAM102	2				
DAM104		2			
DAM106	2	2			
DAM108	4				
DAM110		4			
DAM112	4	4			
DAM114			2		
DAM116			4		
DAM118				2	
DAM120				4	
DAM122			2	2	
DAM124			4	4	
DAM128					8
Digital Input: Wet Contact/Dry Contact, compatible with pulse counting, TTL					
Digital Output: Relay (Max 5A/250VAC), Normal Open, compatible with pulse output					
Analog Input: Default is 0/4-20mA 16Bits, other options: 0-5V, 0-10V					
RTD: Default is PT100 2/3 wire, PT1000 is an option.					
TC: Support B, E, J, K, N, R, S, T type Thermocouple					

1.3 Features

➢ Support Modbus RTU protocol

➢ RS485 serial port with ESD protection

➢ DC9～36V power supply with anti-reverse connection protection

➢ Industrial grade chip, reliable performance with in-built watchdog

➢ LED for status indication makes it easy to program in filed

➢ Support configure parameters, load/export profiles via PC

➢ Wall mount or 35mm standard DIN rail installation

➢ Digital Input: Wet Contact/Dry Contact, compatible with pulse counting, TTL

➢ Digital Output: Relay (5A/250VAC), compatible with pulse output

➢ Analog Input: 4~20mA/0-20mA/0~5V/0~10V, 16-bit AD acquisition and processing, the maximum and minimum values of the analog input can be configured, and the actual value can be converted automatically

➢ Thermal Resistance: The accuracy of the PT100 input can be adjusted online through the configuration software

➢ Thermocouple: B, E, J, K, N, R, S, T type Thermocouple, Thermocouple model and compensation can be set online through the configuration software

1.4 Specification

Parameters	Description
Power Supply	DC 9～36V
Power Consumption	Typically≤0.3W; Models with Relay Output≤3W; Peak voltage must not exceed +40V
Communication Protocol	Modbus RTU (RS485, Modbus Address: 1~247)
Isolation	Not isolation. Common ground. Relay contact independent output.
Data Format	"n,8,1", "e,8,1","o,8,1","n,8,2", etc
Baud Rate	2400, 4800, 9600, 19200, 38400, 57600, 115200Bps, etc
Digital Input	Wet contact/Dry contact
	Logic level: 0～0.5V or shorted is 0, +3～30V or open circuit is 1
	Input electrical level range: 0 ~ 30V, limit range is -10 ~ 40V

	Pulse counting: The counting sampling frequency is 1KHz, and the width of the high and low levels of the pulse is required to be >1mS; When each channel has a transition from 1 to 0, the count value is incremented by 1; the maximum count value of each channel is 4 bytes: FFFFFFFFH.
Digital Output	Relay 250V*5A(AC) or 14V*20A(DC)
	Can be set as electrical level mode or pulse mode output, the pulse width can be set from 0.1S to 25S
	Support maintaining the relay state after power failure
Analog Input	Input range: Default 0/4-20mA, other options: 0-5V, 0-10V
	Input signal: DC
	Overload capacity: 1.2 times the range, still working; instantaneous (<1S) 3 times the range, not damaged
	Impedance: Voltage channel > 1 kΩ /, current channel ≤ 150Ω
RTD	PT100(Default) or PT1000, 2/3 Wire
Measurement Accuracy	±0.2%FS
TC	B, E, J, K, N, R, S, T type thermocouple
	2 wire input
	Measurement Accuracy: ±0.15%FS (-20°C ~ +85°C)
Working Temperature	-20～+70°C
Storage	-40～+85°C
Humidity	5～95% RH, No condensation (Below 40°C)
Altitude	0～3000 meters
Environment	No explosion, corrosive gas and conductive dust, no significant shaking, vibration and shock
Temperature Drift	≤100ppm/°C
Dimension	110mm×84mm×30mm(L*W*H)
Installation	35mm standard DIN rail installation

Thermocouple: Support B, E, J, K, N, R, S, T type thermocouples

Type	Temperature Measuring Range	Nominal Sensitivity	Cold Junction Temperature Range
B	-250°C ~ +1820°C	10.086 (+500°C ~ +1500°C)	0 ~ 125°C
E	-200°C ~ +1000°C	76.373 (0°C ~ +1000°C)	-55°C ~ +125°C
J	-210°C ~ +1200°C	57.953	-55°C ~ +125°C

		(0°C ~ + 750°C)	
K	-200°C ~ +1372°C	41.276 (0°C ~ + 1000°C)	-55°C ~ +125°C
N	-200°C ~ +1300°C	36.256 (0°C ~ +1000°C)	-55°C ~ +125°C
R	-50°C ~ +1768°C	10.506 (0°C ~ +1000°C)	-50°C ~ +125°C
S	-50°C ~ +1768°C	9.587 (0°C ~ +1000°C)	-50°C ~ +125°C
T	-200°C ~ +400°C	52.18 (0°C ~ +400°C)	-55°C ~ +125°C

1.5 Packing List

1x DAMxxx I/O Module, Wiring terminal, USB, DIN rail bracket
Package does not include any sensor and adapter

2 Installation

DIN Rail or Wall Mounted

2.1 Interface

DC IN 9~36V	+	DC9~36V positive input
	–	DC9~36V negative input
DC Out 9~36V	+	DC9~36V positive output
	–	DC9~36V negative output
RS485	A	Positive
	B	Negative
Digital Input	1	Digital input 1
	GND	Ground for 1~2
	2	Digital input 2
	3	Digital input 3
	GND	Ground for 3~4
	4	Digital input 4
Analog Input	1~4	Analog Input 1~4
	GND	Ground
	1+	Channel 1 Normally Open Contact
	1-	Channel 1 Output ground

| Relay Output	2+	Channel 2 Normally Open Contact
	2-	Channel 2 Output ground
	3+	Channel 3 Normally Open Contact
	3-	Channel 3 Output ground
	4+	Channel 4 Normally Open Contact
	4-	Channel 4 Output ground
PT100	1+	Channel 1 +
	1-	Channel 1 -
	GND	3 Wire System Ground of Channel 1
	2+	Channel 2 +
	2-	Channel 2 -
	GND	3 Wire System Ground of Channel 2
	3+	Channel 3 +
	3-	Channel 3 -
	GND	3 Wire System Ground of Channel 3
	4+	Channel 4 +
	4-	Channel 4 -
	GND	3 Wire System Ground of Channel 4
TC	1+	Thermocouple Channel 1 +
	1-	Thermocouple Channel 1 -
	2+	Thermocouple Channel 2 +
	2-	Thermocouple Channel 2 -
	3+	Thermocouple Channel 3 +
	3-	Thermocouple Channel 3 -
	4+	Thermocouple Channel 4 +
	4-	Thermocouple Channel 4 -
	5+	Thermocouple Channel 5 +
	5-	Thermocouple Channel 5 -
	6+	Thermocouple Channel 6 +
	6-	Thermocouple Channel 6 -
	7+	Thermocouple Channel 7 +
	7-	Thermocouple Channel 7 -
	8+	Thermocouple Channel 8 +
	8-	Thermocouple Channel 8 -

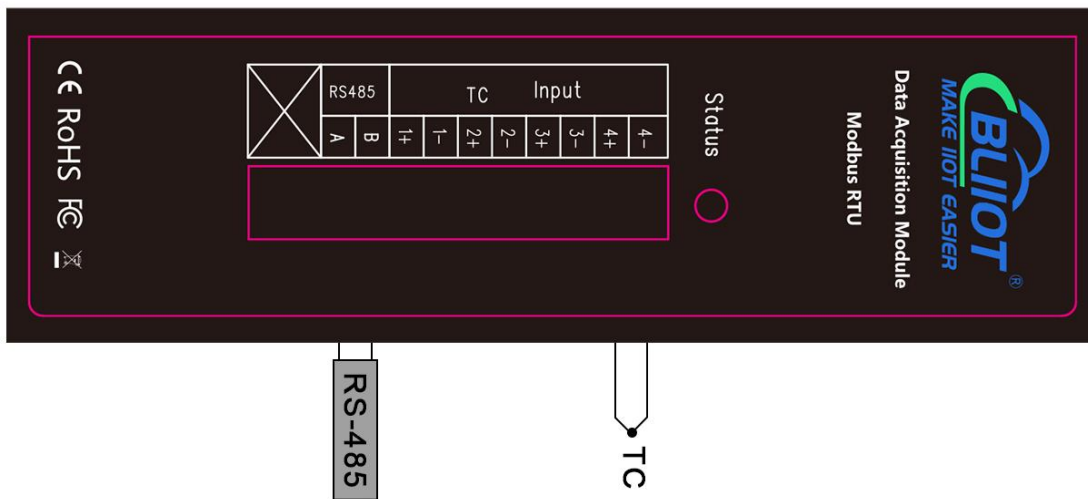## 2.2 Wiring

Digital Input
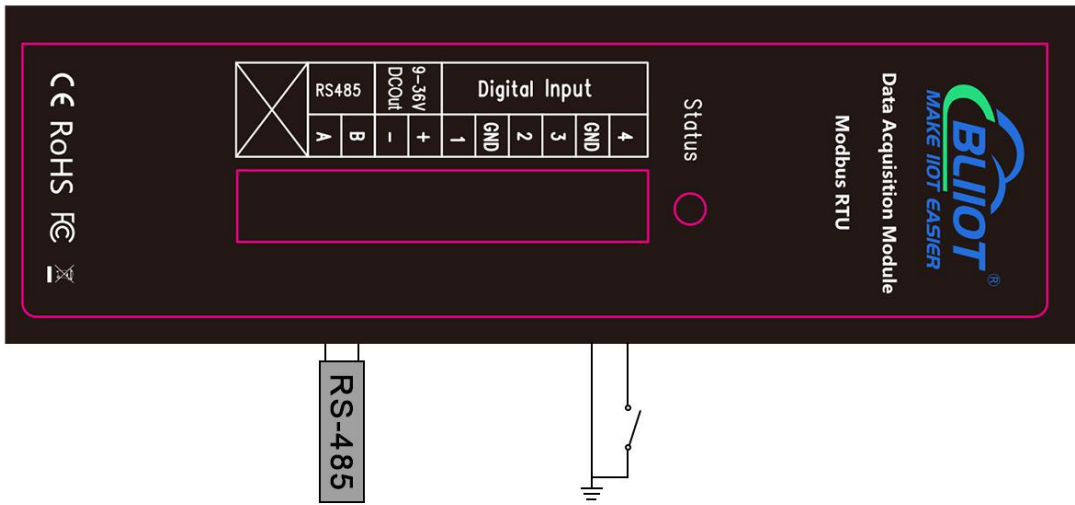
Analog Input
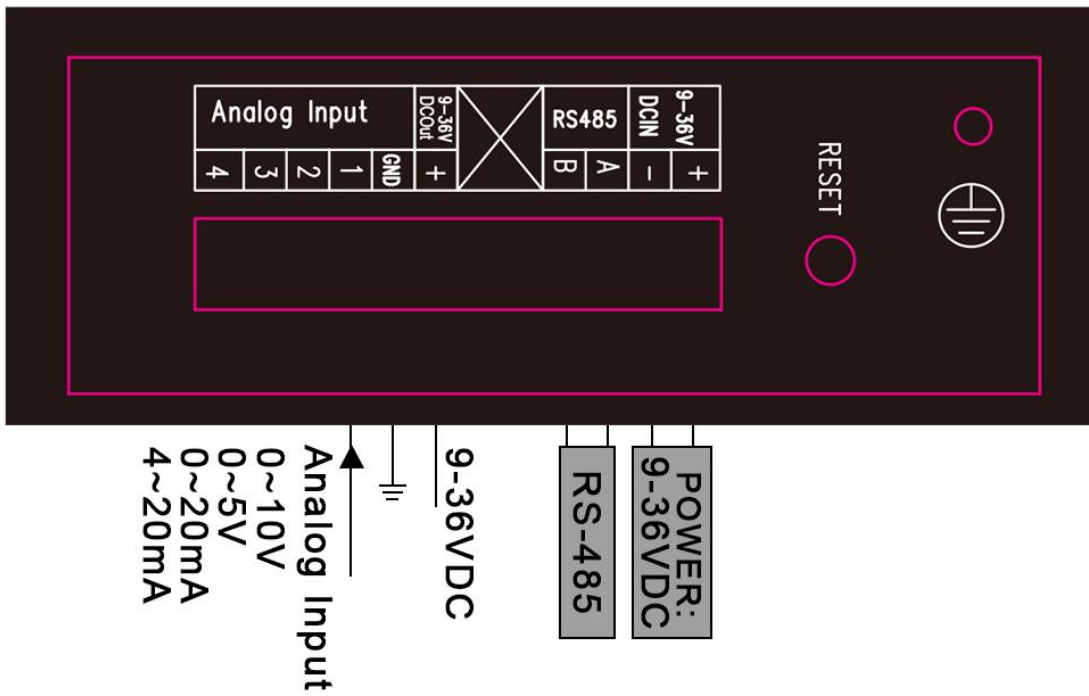
RTD
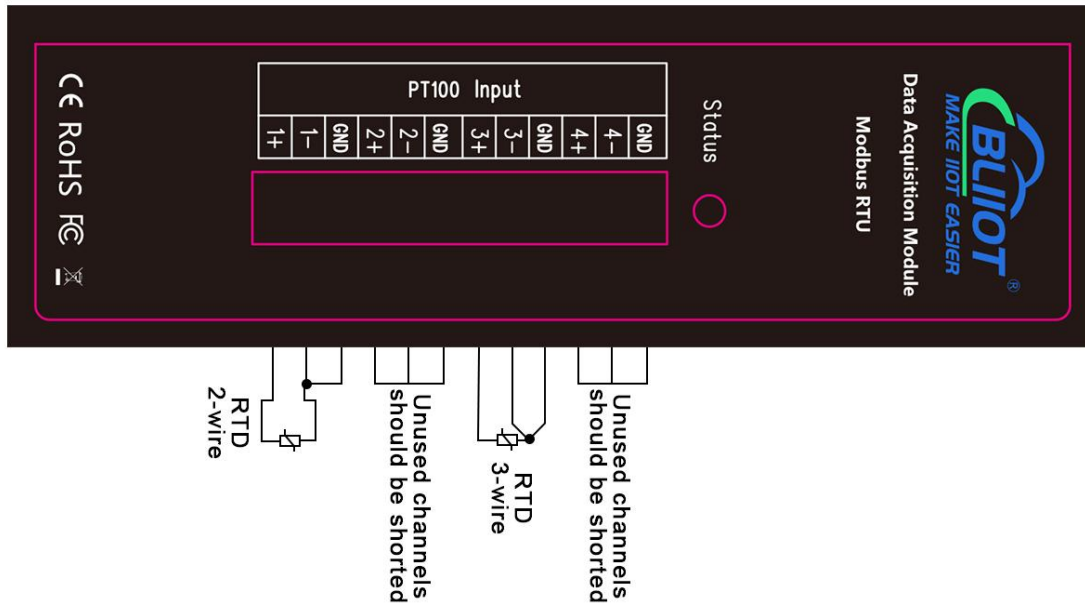
TC

2.3 Testing

● Please refer to the above figure for correct wiring. Make sure to disconnect all signal sources before wiring to avoid danger and damage to equipment. After checking and confirming that the wiring is correct, turn on the power for testing, then the "Status" operating light will illuminate.

● Default configuration: Address 1, baud rate 9600bps, data format "n,8,1";

Users can change the settings by configuration software.

● If the host computer only has RS-232 interface, it can be connected to the 485 network through the RS-232/RS-485 converter; it is recommended to use a 485 converter with isolation to improve the reliability of the system;

The A+ terminals of all devices on a bus are connected in parallel, and the B- terminals are connected in parallel, and the connection cannot be reversed. Also, the GND should connect together then connect to the Communication GND.

The RS485 network usually allow to connect maximum 32 device. if the device more than 32, then please use the RS485 repeater to extend it. The RS-485 network should use the shield twist cable, the shield should connect to GND independently.

The RS485 network communication distance maximum is 1200m, when the communication baud rate is high will cause the communication distance short, in this case, please use the RS485 repeater.

At the end of the RS485 network, if the communication quality is not good then usually should connect a 120~300Ω/0.25W termination resistors. If the communication quality is good then no need to connect this resistor.

● The thermal resistance signal input can be connected in a 2-wire or 3-wire system, please refer to the above diagram; when the sensor is not far from the module and the resistance of the wire is negligible, a 2-wire system can be used (when connected to a two-wire system, PT - short to GND); if the distance is long, it should be connected in 3-wire system; for unused channels, PTA, PTB and AGND should be shorted.

● The the factory default refresh cycle of analog measurement data is 1.44S/time, 0.24S~2.4S, it can be set by yourself, and the interval is 0.24S;

The longer the data update period, the better the stability of the data, and it is recommended to use 1-2S;

2.4 Setting

1) Connect USB to DAM I/O module through RS485 serial port
2) Connect DAM I/O module to PC by USB, and install USB Driver to the computer
3) Open configuration software, choose the correct "COM port" and "Model number" to start configuring.

3 Modbus Register

Modbus RTU Protocol

3.1 Digital I/O Modbus Register List

Model: DAM102, DAM104, DAM106, DAM108, DAM110, DAM112

Table 1: Digital Output, Function code 01/05/0F

Address	Definition	Description
0000H	DO1	1st digital output:＝1 triode close,＝0 open.
0001H	DO2	2nd digital output:＝1 triode close,＝0 open.
0002H	DO3	3rd digital output:＝1 triode close,＝0 open.
0003H	DO4	4th digital output:＝1 triode close,＝0 open.

Table 2: Digital Input, Function code 02

Address	Definition	Description
0000H	DI1	1st digital input:＝0 (0~0.5VDC) short/close, ＝1 (3~30VDC) Open/no signal.
0001H	DI2	2nd digital input:＝0 (0~0.5VDC) short/close, ＝1 (3~30VDC) Open/no signal.
0002H	DI3	3rd digital input:＝0 (0~0.5VDC) short/close, ＝1 (3~30VDC) Open/no signal.
0003H	DI4	4th digital input:＝0 (0~0.5VDC) short/close, ＝1 (3~30VDC) Open/no signal.

If the digital input=0, it means closed, if digital input=1, it means open or no signal

Table 3: Holding register, function code:03/10H

Address	Definition	Description

9C4AH 9C4BH	DI1_Cnt	1st DI 32 bytes pulse counter; 4 bytes, MSB first
9C4CH 9C4DH	DI2_Cnt	2nd DI 32 bytes pulse counter; 4 bytes, MSB first
9C4EH 9C4FH	DI3_Cnt	3rd DI 32 bytes pulse counter; 4 bytes, MSB first
9C50H 9C51H	DI4_Cnt	4th DI 32 bytes pulse counter; 4 bytes, MSB first

Table 4: Counter, Holding register, function code:03/10H

Address	Definition	Description
9C40H	Mod	Device Model number
9C41H	Ver	Version
Above mentioned items are READ ONLY, below mentioned items can READ and WRITE.		
9C42H	ADDR	Device Address; 1~247; 0 is the broadcast address.
9C43H	COM1	COM setting: high-order 8 bytes reserved. The low-order bytes low 3 bytes baud rate: 0:115200; 1:57600; 2:38400; 3:19200; 4:9600; 5:4800; 6:2400; 7:1200 The lowest 3rd~7th bytes in the low-order bytes is data format: 00 stands for 10bits, equal to n,8,1; 50 stands for 11bits, Even-parity check: e,8,1; 58 stands for 11bits, Odd Parity Check: o,8,1; 20 stands for 11 bits, non parity, 2 is stop bit, n,8,2; Default is 4, equal to 9600bps. (9600, 8.N.1)

9C44H	DO1-PUL	DO1 output type control: BIT15=1 : Pulse Output control; BIT15=0 : TTL. Low-order 8 byte: Pulse Width(time): 1~250 = 0.1~25.0 seconds; Default Value: 10 (one second)
9C45H	DO2-PUL	DO2 output type control, detail description as same as above DO1.
9C46H	DO3-PUL	DO3 output type control, detail description as same as above DO1.
9C47H	DO4-PUL	DO4 output type control, detail description as same as above DO1.
9C48H	DI Pulse Counter	Low-order 4 byte is the Pulse Counter: BIT0=1, Enable the DI1 as a Pulse Counter, =0: Disable BIT1=1, Enable the DI2 as a Pulse Counter, =0: Disable BIT2=1, Enable the DI3 as a Pulse Counter, =0: Disable BIT3=1, Enable the DI4 as a Pulse Counter, =0: Disable
9C49H	Function when Power Failure	Low-order 2 byte is the additional function when the power failure: BIT0=1: Save the pulse counter value; BIT0=0 : Don't save the pulse counter value; BIT1=1 : Keep the relay status; BIT1=0 : Don't keep the relay status.

3.2 Analog/PT100 Input Register List

Model: DAM114, DAM116, DAM118, DAM120, DAM124

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Table 1: Holding register, function code:03/06/10H

Address	Definition	Description
9C40H	Mod	Device Model number
9C41H	Ver	Version
9C42H	AdVal[1]	1st PT100 ADC_Value, range:0-65535, for adjust the temperature
9C43H	AdVal[2]	2nd PT100 ADC_Value, range:0-65535, for adjust the temperature
9C44H	AdVal[3]	3rd PT100 ADC_Value ,range:0-65535, for adjust the temperature
9C45H	AdVal[4]	4th PT100 ADC_Value ,range:0-65535, for adjust the temperature
9C46H	AdVal[5]	1st AIN ADC_Value, range:0-65535, for adjust at site
9C47H	AdVal[6]	2nd AIN ADC_Value, range:0-65535, for adjust at site
9C48H	AdVal[7]	3rd AIN ADC_Value , range:0-65535, for adjust at site
9C49H	AdVal[8]	4th AIN ADC_Value, range:0-65535, for adjust at site
9C4AH	AI1	The 1st Analog Input: 1. If enable the Max/Min, then it will calculate the real value of the sensors. 2. If disable the Max/Min: a) 0～10000 correspond to 0～10V b) 0～10000 correspond to 0～5V c) 0～10000 correspond to 0～20mA d) 0～10000 correspond to 4～20mA
9C4BH	AI2	2nd Analog Input, detail description as same as above AI1.
9C4CH	AI3	3rd Analog Input, detail description as same as

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		above AI1.
9C4DH	AI4	4th Analog Input, detail description as same as above AI1.
9C4EH	PT1	1st channel for measuring the temperature, unit :0.1°C Int, the actual value=DATA/10, unit:°C
9C4FH	PT2	2nd channel for temperature, detail description as same as above PT1.
9C50H	PT3	3rd channel for temperature, detail description as same as above PT1.
9C51H	PT4	4th channel for temperature, detail description as same as above PT1.
Above mentioned items are READ ONLY, below mentioned items can READ and WRITE.		
9C52H	ADDR	Device Address; 1~247; 0 is the broadcast address.
9C53H	COM1	COM setting: high-order 8 bytes reserved. The low-order bytes low 3 bytes baud rate: 0:115200; 1:57600; 2:38400; 3:19200; 4:9600; 5:4800; 6:2400; 7:1200 The lowest 3rd~7th bytes in the low-order bytes is data format: 00 stands for 10bits,equal to n,8,1; 50 stands for 11bits, Even-parity check: e,8,1; 58 stands for 11bits, Odd Parity Check: o,8,1; 20 stands for 11 bits, non parity, 2 is stop bit,n,8,2; Default is 4, equal to 9600bps. (9600, 8.N.1)
9C54H	AIMode1	Analog input model1 setting, low-order 2 bytes 0:0-5V; 1:0-10V;

		2:0-20mA; 3:4-20mA; Highest order byte b7=1 is enable the Max/Min; 0= disable
9C55H	AIMode2	AIN 2 Setting, as same as the AIMode1
9C56H	AIMode3	AIN 3 Setting, as same as the AIMode1
9C57H	AIMode4	AIN 4 Setting, as same as the AIMode1
9C58H	AdMax1	AIN1 Max Range, default: 5000
9C59H	AdMax2	AIN2 Max Range, default: 5000
9C5AH	AdMax3	AIN3 Max Range, default: 5000
9C5BH	AdMax4	AIN4 Max Range, default: 5000
9C5CH	AdMin1	AIN1 Min Range, default: 0
9C5DH	AdMin2	AIN2 Min Range, default: 0
9C5EH	AdMin3	AIN3 Min Range, default: 0
9C5FH	AdMin4	AIN4 Min Range, default: 0
9C60H	Pt_0C[1]	1st PT100 input calibrated values in 0°C Remark: To testing the PT100 in 0°C,or connect to a 100R resistance to get the ADC_Value, then use this value to adjust the accuracy, Default:4500
9C61H	Pt_0C[2]	2nd PT100 input calibrated values in 0°C
9C62H	Pt_0C[3]	3rd PT100 input calibrated values in 0°C
9C63H	Pt_0C[4]	4th PT100 input calibrated values in 0°C
9C64H	Pt_50C[1]	1st PT100 input calibrated values in 50°C Remark: To testing the PT100 in 50°C, or connect to a 100R resistance to get the ADC_Value, then use this value to adjust the accuracy.
9C65H	Pt_50C[2]	2nd PT100 input calibrated values in 50°C
9C66H	Pt_50C[3]	3rd PT100 input calibrated values in 50°C

| 9C67H | Pt_50C[4] | 4th PT100 input calibrated values in 50°C |

If the PT100 temperature sensor cannot measuring the correct value, then need to adjust it, for 0°C(Pt_0Cx) and 50°C(Pt_50Cx).

3.3 Thermocouple Input Modbus Register List

__Model: DAM128__

Table 1: Holding register, function code:03/06/10H

Address	Definition	Description
9C40H	Mod	Device Model number
9C41H	Ver	Version
9C42H	AdVal[1]	1st channel for measuring the temperature, unit :0.1°C Int, the actual value=DATA/10, unit:°C
9C43H	AdVal[2]	2nd channel for temperature, detail description as same as above
9C44H	AdVal[3]	3rd channel for temperature, detail description as same as above
9C45H	AdVal[4]	4th channel for temperature, detail description as same as above
9C46H	AdVal[5]	5th channel for temperature, detail description as same as above
9C47H	AdVal[6]	6th channel for temperature, detail description as same as above
9C48H	AdVal[7]	7th channel for temperature, detail description as same as above
9C49H	AdVal[8]	8th channel for temperature, detail description as same as above

4 Warranty

1) This equipment will be repaired free of charge for any material or quality problems within one year from the date of purchase.

2) This one-year warranty does not cover any product failure caused by man-made damage, improper operation, etc.

5 Technical Support

Shenzhen Beilai Technology Co., Ltd.

Website: https://www.bliiot.com