KTH2-E
RS485 Communications
Magnetic Temperature and Humidity Sensor

User Manual



成都亿佰特电子科技有限公司
Chengdu Ebyte Electronic Technology Co.,Ltd.

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Chapter 1: Product Overview

The KTH2-E magnetic-mount RS-485 temperature and humidity transmitter uses a high-precision integrated temperature and humidity sensor as its signal measurement unit. The product features a compact design, small size, and easy installation. The KTH2-E is equipped with an RS-485 communication interface, complies with the standard Modbus-RTU communication protocol, supports flexible configuration of communication addresses and baud rates, and has a maximum communication range of 1,200 meters.

The KTH2-E series features the following characteristics:

1. Standard RS-485 communication, compliant with the Modbus-RTU communication protocol;
2. Typical temperature measurement accuracy of <0.2°C;
3. Wide voltage range, supporting 8–28 V DC input;
4. Magnetic mounting.

The detailed specifications of the KTH2-E are described below.

1.1 Product Specifications

The basic specifications for the KTH2-E product are shown in Table 1-1 below.

Table 1-1: Product Specifications Table

Items		Parameters	Important Notes
Operating Voltage		DC 8–28V	
Standby Power		24V 10mA	
Process medium		Air	
Accuracy	Temperature	±0.2℃	
	Humidity	±1.8 %RH	(60%RH 25°C)
Resolution	Temperature	0.1℃	
	Humidity	0.1%RH	
Stability	Temperature	<±0.03℃/year	
	Humidity	<±0.25 %RH/year	
Temperature Measurement Range		-40℃~85℃	Do not use in highly polluted or dusty environments.
Relative Humidity Range		<100 %	Non-condensing
Storage Temperature		-40℃~105℃	
Operating Temperature		-40℃-85℃	
Communication Methods		RS-485Communications	Slave address1-254
Dimensions		92.7*45.4*25.4mm	
Installation Methods		Magnetic Mount	
Housing Material		ABSEngineering Plastics	

1.2 Product Dimensions and Connectors

1.2.1 Product Dimensions

See Figure 1-1 below for a photo of the KTH2-E product.

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Figure 1-1: Photo of the KTH2-E Product

1.2.2 Product External Interfaces

The product connects using a standard Ethernet cable, which contains 8 wires (4 pairs of twisted pairs). Four of these wires are for power (orange-white (GND), orange (VCC), brown-white (GND), and brown (VCC)), while the remaining four are for communication (green-white (RS485B-), blue (RS485A+), blue-white (RS485B-), and green (RS485A+)). The power supply supports a wide voltage range of 7–36 V DC. When connecting the RS-485 signal lines, ensure that the A and B wires are not reversed. Device addresses on the bus must not conflict (use DIP switches to set the hardware address).

A single-ended Ethernet cable is required at one end; one end is plugged into the module's Ethernet port, and the other end has four wires (two power wires and two signal wires) extending from it. The two power wires are connected to a 12V or 24V power supply, and the two signal wires are connected to pins A and B of the USB-to-485 module, respectively. See Figure 1-2 below for a diagram of the product's external interfaces.

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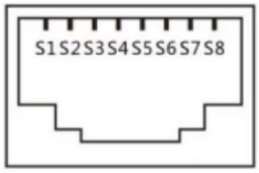
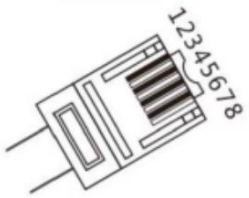
RJ45水晶头	RJ45线序 (T568B)	端口说明
 接以太网口	S1:橙白	电源负
	S2:橙	电源正
	S3:绿白	RS485-
	S4:蓝	RS485+
 RJ-45接头	S5:蓝白	RS485-
	S6:绿	RS485+
	S7:棕白	电源负
	S8:棕	电源正

Figure 1-2: Schematic Diagram of Product Interfaces

1.3 Block Diagram of the Product's Internal Structure

The KTH2-E series products all consist of three main functional modules: a temperature measurement unit, a main control unit, and a communication unit, as shown in Figures 1 – 3 below.

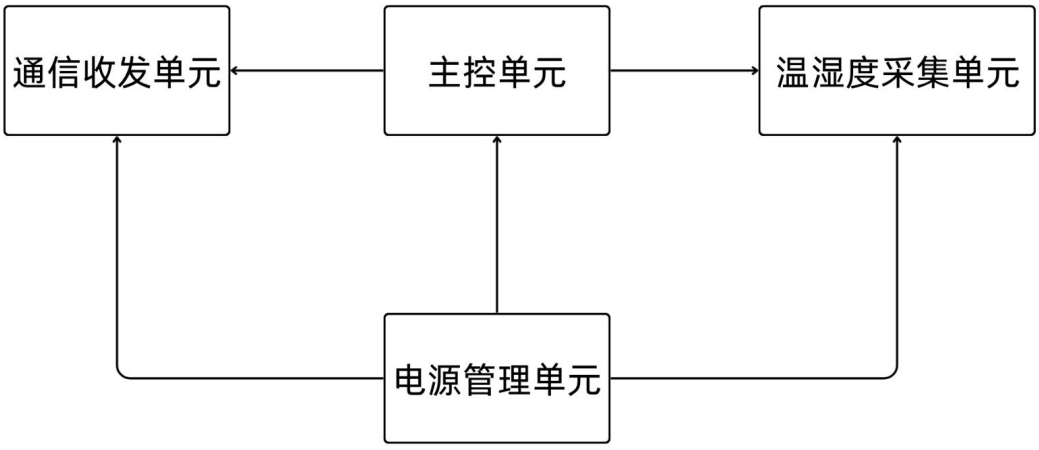


图 1-3 产品内部结构框图

1.4 Product Wiring

KTH2-E: As soon as power is applied, this product collects temperature and humidity data via its temperature and humidity sensors and displays the readings on a digital display. The wiring should be as shown in Figures 1 – 4 below.

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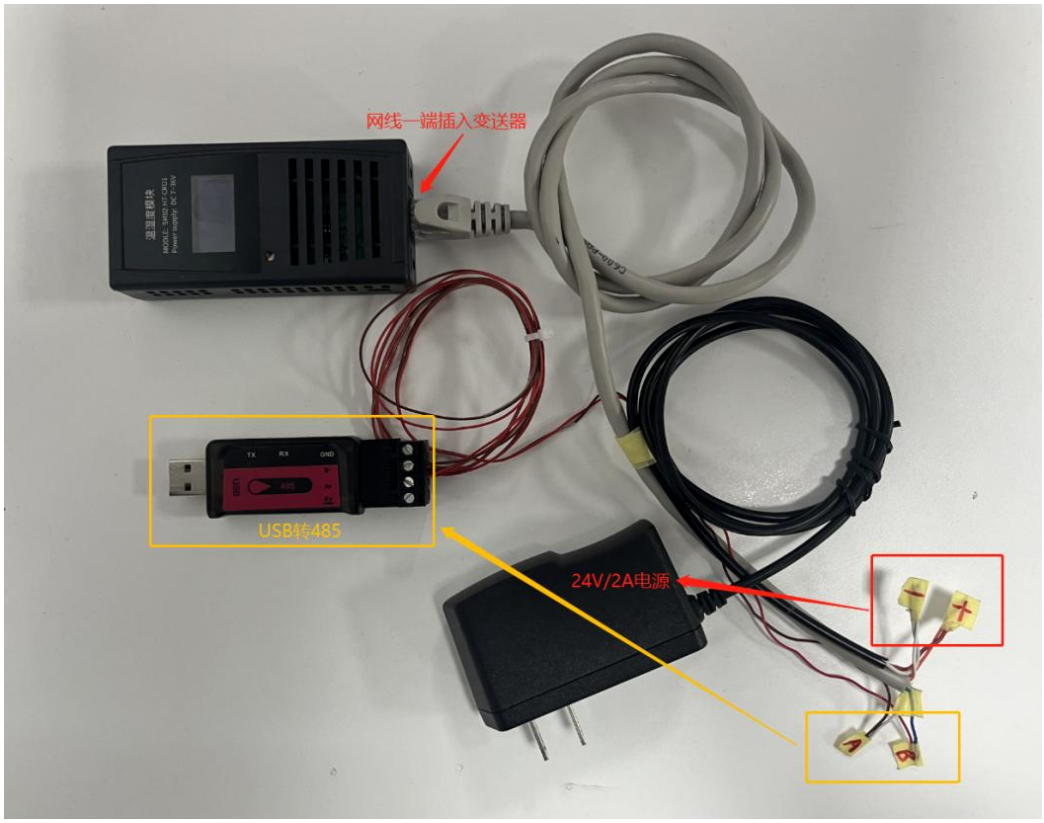


Figure 1-4: KTH2-E Product Wiring Diagram

1.5 How to Configure Hardware Addresses

The DIP switches for setting the station address are located on the side of the module, as shown in Figure 1-5 below.



Figure 1-5: KTH2-E Side DIP Switch

When the DIP switch is set to “ON,” it is considered 1 (ON); when it is not set to “OFF,” it is considered 0 (OFF).

When all DIP switches are set to “OFF,” the module address is the software address. For detailed setup instructions, see Chapter 2.

Station address = the digit set to the “ON” position

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Website Address	1	2	3	4	5	6	Calculation Method
1	1	0	0	0	0	0	$2^{1-1}=2^0=1$
3	1	1	0	0	0	0	$2^{1-1}+2^{2-1}=1+2=3$
7	1	1	1	1	0	0	$2^{1-1}+2^{2-1}+2^{3-1}+2^{4-1}=1+2+4+8=15$
23	1	1	1	0	1	0	$2^{1-1}+2^{2-1}+2^{3-1}+2^{5-1}=1+2+4+16=23$
63	1	1	1	1	1	1	$2^{1-1}+2^{2-1}+2^{3-1}+2^{4-1}+2^{5-1}+2^{6-1}=63$
62	0	1	1	1	1	1	$2^{2-1}+2^{3-1}+2^{4-1}+2^{5-1}+2^{6-1}=62$
Address calculation formula: Sum of 2n-1 in sequential order							

Chapter 2: Modbus RTU Communication Protocol and Register Description

2.1 ModBus RTU Introduction to Communication Protocols

ModBus RTU （Remote Terminal Unit） This is a serial communication protocol based on a master-slave architecture. The physical layer typically employs the RS-485 electrical standard and is suitable for data exchange between industrial field devices. The protocol uses a compact binary data encoding scheme, with each data frame containing an address field, a function code, a data field, and a CRC (Cyclic Redundancy Check) field. It is characterized by high transmission efficiency and strong resistance to interference. In typical applications, a single master station can poll multiple slave devices, supporting register read and write operations. The communication distance and data rate must comply with the RS-485 physical layer specifications.

2.2 Function Codes and Register List

2.2.1 Function Code

The KTH2-E product supports read-only function codes and write function codes; the corresponding function codes are shown in Table 2-1 below.

Table 2-1 KTH2-R Series Product Function Codes

Function Code		Feature Description	Operable Register Addresses
Decimal (0d)	Hexadecimal (0x)		
3	03	Read a Single Register	0x00 - 0x0E 0x300 - 0x301
16	10	Write to Multiple Registers	0x0C - 0x0E
06	06	Writing to a Single Register	0x0C - 0x0E

2.2.2 List of Registers

The register list for the KTH2-E product’s main control unit is shown in Table 2-2 below.

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Table 2-2: KTH2-R Series Product Register List

Register Address	Configuration Address	Quantity	Significance	Status	Data Range
0x00	40001	1	Equipment Model	Read-only	
0x01	40002	1	Device Software Version	Read-only	
0x02	40003	10	Equipment Name	Read-only	
0x0C	40013	1	Device Address	Reading and Writing	0~0xFF
0x0D	40014	1	Serial Port Baud Rate	Reading and Writing	0：1200bps 1：2400bps 2：4800 bps 3：9600 bps（Factory Default） 4：19200 bps
0x0E	40015	1	Serial Port Checksum	Reading and Writing	Serial Port Checksum： 0：No checksum（Factory Default） 1：Odd Parity 2：Even parity
0x0300	40769	1	Temperature value	Read-only	0~0xFFFF
0x0301	40770	1	Humidity Level	Read-only	0~0xFFFF

2.3 Explanation and Analysis of Common Function Codes

When communicating using the Modbus-RTU protocol, the format “Modbus address + function code + operation register address + operation register value + CRC16 checksum” must be followed. The following sections describe the transmission and reception of common operations.

2.3.1 Read Temperature

Note: The physical quantity “temperature” is a signed number. In this design, it will be represented using two’s complement notation; the two’s complement of a positive number is the original number, and the two’s complement of a negative number is the one’s complement of the original number plus 1. Unless otherwise specified, all numbers in the following tables are in hexadecimal.

定义：最低有效位 LSB= 0.1° C 或 0.1%RH

0x03 00The function code corresponding to read-only temperature is 03, and the register address

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for the operation is 0x03 00.

Send	ModBus Address	Function Code	Operand Register Address	Operand Register Values	CRC16Check digit
	01	03	03 00	00 01	84 4E

① Assume that the temperature at this moment is 15.0°C

Receive	ModBus Address	Function Code	Number of bytes returned	Register contents	CRC16Check digit
	01	03	02	00 96	38 2A

The received response was "01 03 02 00 96 38 2A." The process for converting this to an actual temperature is as follows:

0x00 96 = 0d150 = 150 * 1LSB = 15.0° C

② Suppose the temperature at this moment is -21.7° C

Receive	ModBus Address	Function Code	Number of bytes returned	Register values	CRC16Check digit
	01	03	02	FF 27	B9 AE

The received response was "01 03 02 FF 27 B9 AE." The process for converting this to the actual temperature is as follows:

0xFF 27 (two's complement) = 0x80 D9 = 0d(-217) = -217 * 1LSB = -21.7° C

2.3.2 Read Humidity

The function code for read-only humidity is 03, and the register address for the operation is 0x03 01.

Send	ModBus Address	Function Code	Operand Register Address	Operand Register Values	CRC16Check digit
	01	03	03 01	00 01	D5 8E

Assuming the humidity is 41.3% RH at this time

Receive	ModBus Address	Function Code	Number of bytes returned	Register values	CRC16Check digit
	01	03	02	01 9D	78 7D

The response received was "01 03 02 01 9D 78 7D." The process for converting this to actual humidity is as follows:

0x01 9D = 0d413 = 413 * 1LSB = 41.3%RH

2.3.3 Simultaneously read temperature and humidity

Send	ModBus Address	Function Code	Operand Register Address	Operand Register Values	CRC16Check digit
	01	03	03 00	00 02	C4 4F

Receive	ModBus Address	Function Code	Number of bytes returned	Register contents	CRC16Check digit
	01	03	04	01 02 02 88	5B 09

The received response was "01 03 04 01 02 02 88 5B 09." The process of converting this into

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actual temperature and humidity values is as follows:

0x01 02 = 0d258 = 258 * 1LSB = 25.8° C；

0x02 88 = 0d648 = 648 * 1LSB = 64.8%RH。

2.3.4 Configuring Serial Port Parameters

This example demonstrates how to use function code 0x10 to change the baud rate to 9600 bps.

Send	Address	Function Code	Register Address	Number of Registers	Length	Data	CRC16Check digit
	01	10	00 0D	00 01	02	00 03	E7 4C

Receive	ModBus Address	Function Code	Register Address	Number of Registers	CRC16Check digit
	01	10	00 0D	00 01	90 0A

2.3.5 Set the Modbus Address

This example demonstrates how to use function code 0x10 to change the default address of 0x01 to 0x0A.

Send	Address	Function Code	Register Address	Number of Registers	Length	Data	CRC16Check digit
	01	10	00 0C	00 01	02	00 0A	26 9B

Receive	ModBus Address	Function Code	Register Address	Number of Registers	CRC16Check digit
	01	10	00 0C	00 01	C1 CA

2.3.6 Query Module Address via Broadcast

If you forget the Modbus address of a module, you can use the broadcast method to query the address of a single module. For example, in Section 2.3.5 above, the module address was changed to 0x0A. In this case, you can use the following command to query the address of that module.

Send	ModBus Address	Function Code	Operand Register Address	Operand Register Values	CRC16Check digit
	00	03	00 0C	00 01	45 D8

Receive	ModBus Address	Function Code	Number of bytes returned	Return Value	CRC16Check digit
	0A	03	02	00 0A	9D 82

The Modbus address received at this point is the address of this module.

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Chapter 3: Host Computer User Guide

This section will introduce three methods for using the host computer: (temperature and humidity host computer, Modbus poll, and Modbus scan).

3.1 Installing the Host Computer Driver

If you have never used a USB-to-485 (USB-to-TTL) adapter before, or if your computer does not have the CH340 driver installed, you must install the driver first; if you already have the CH340 driver, you can skip Section 3.1.

The steps for installing the host computer driver are as follows:

1. Find the CH340 driver, click “Download Materials,” and obtain the product documentation;
   CH340 Driver - Chengdu Kejiexun Electronics Technology Co., Ltd.



Figure 3-1 CH340 Driver Storage Locations

2. After downloading and extracting the files, open the folder and select the appropriate driver;

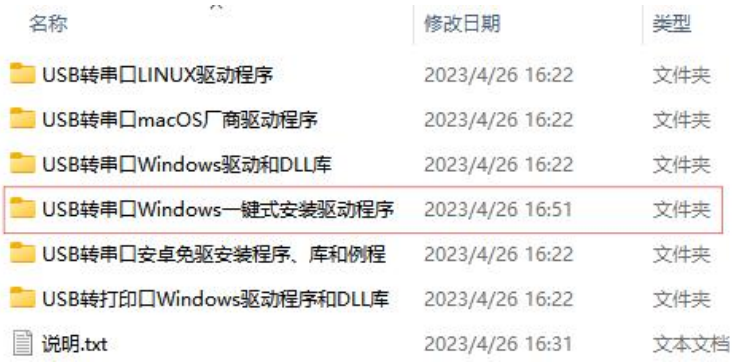


Figure 3-2 Driver Directory

3. Once opened, double-click CH341SER.EXE;

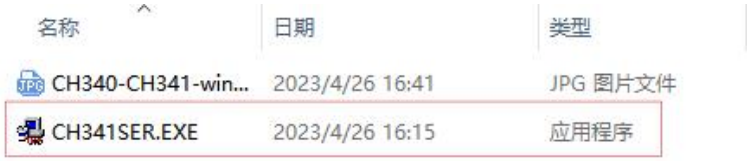


Figure 3-3 Application Content

4. Click “Install”;

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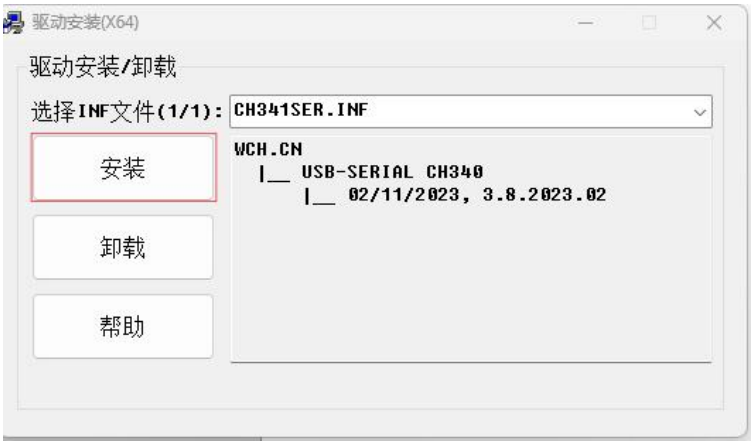


Figure 3-4: Driver Installation Interface

5. After successful installation, the following message will appear:

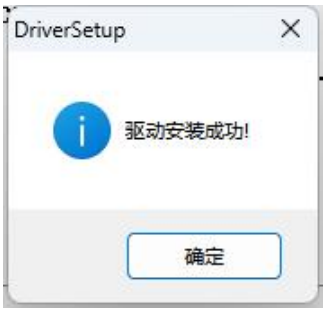


Figure 3-5: Message indicating successful driver installation

6. After connecting the USB-to-485 device to the computer, open Device Manager; the host computer will automatically detect the port.

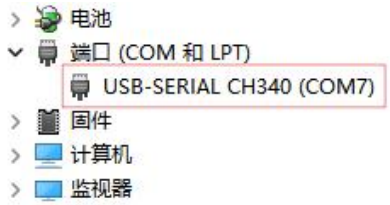


Figure 3-6 Host Computer Port Directory

3.2 User Manual for Temperature and Humidity Host Computer Software

3.2.1 Preparation Before Use

Before using the host computer, you should first connect the external hardware and install the appropriate serial port drivers on the host computer. This section will not provide detailed instructions on hardware connections. (For specific hardware connection instructions, see “Section 1.2.2.”)

The following section describes the interface and operation of the temperature and humidity control system.

3.2.2 User Interface Guide

For serial communication, the appropriate serial port parameters must be configured; see Figure 3-7 below for details.

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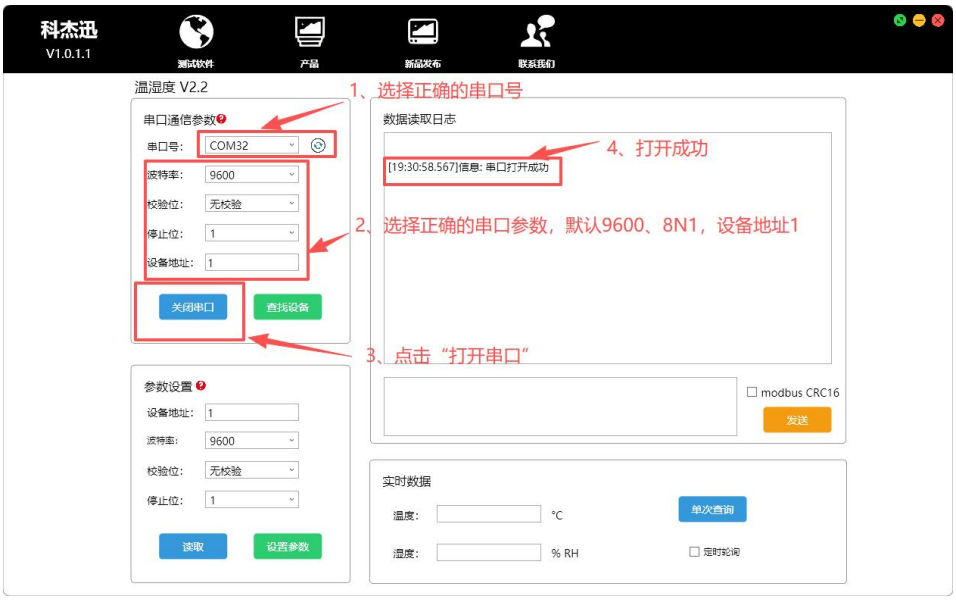


Figure 3-7: Temperature and Humidity Host Computer Interface

3.2.3 Instructions for Modifying Address and Serial Port Parameters

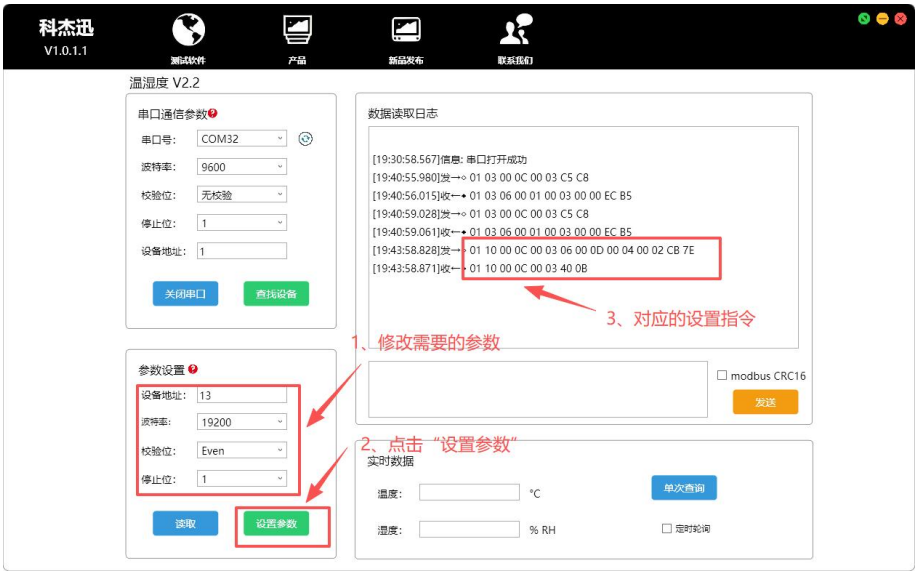


Figure 3-8: Interface for Modifying Address and Serial Port Parameters

3.2.4 Instructions for Reading Temperature and Humidity

As shown in Figure 3-9 below, the periodic polling cycle reads data approximately once every 250 ms.

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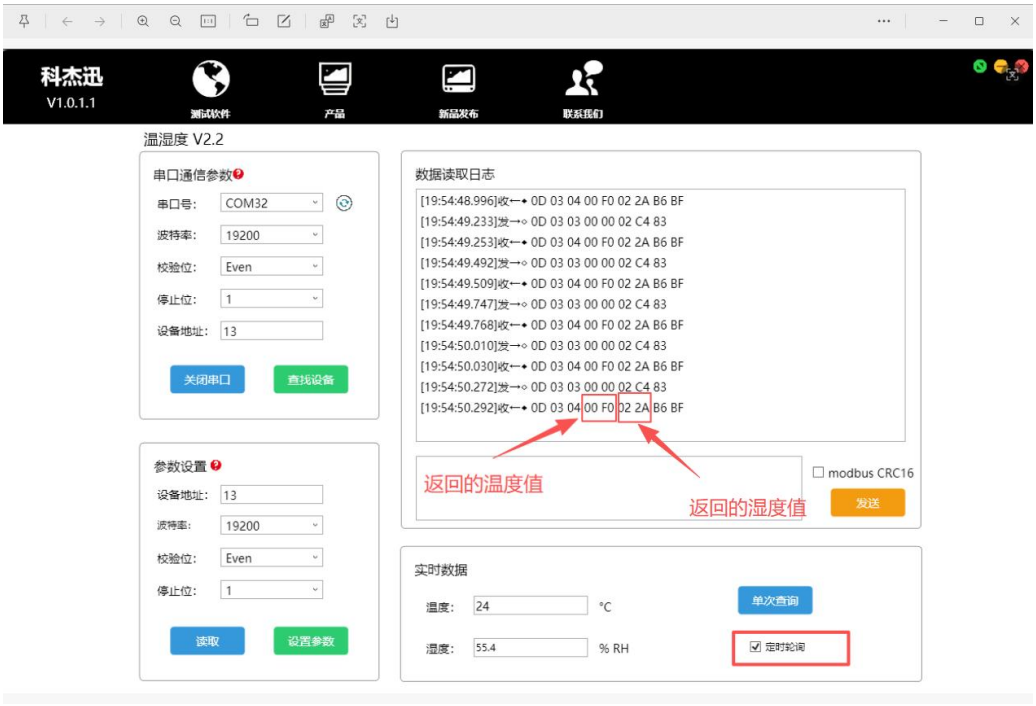


Figure 3-9 Temperature and Humidity Reading Interface

Temperature Calculation: (Resolution: 0.1°C)

Hexadecimal 0x00F0 => Decimal 240 => 240 × 0.1°C = 24.0°C

Humidity Calculation: (Resolution: 0.1% RH)

Hexadecimal 022A => Decimal 554 => 554 × 0.1%RH = 55.4%RH

3.3 ModBus Poll Software Documentation

3.3.1 Preparation Before Use

Before use, ensure the following are prepared: installation of the ModBus poll software, hardware connections (as described in Section 1.2.2), a USB-to-485 module, and installation of the CH340 driver on the host computer. This section will not cover these topics in further detail.

3.3.2 Software Interface Guide

Open the Modbus poll software, click “Connection” to access the connection settings, and in the area shown in the figure below, select the serial port, choose the inserted serial port number (COM13 in this example), set the baud rate to 9600, data bits to 8, parity to None, and stop bits to 1. Then, select the RTU communication mode on the right and click “OK.”

See Figure 3-10.

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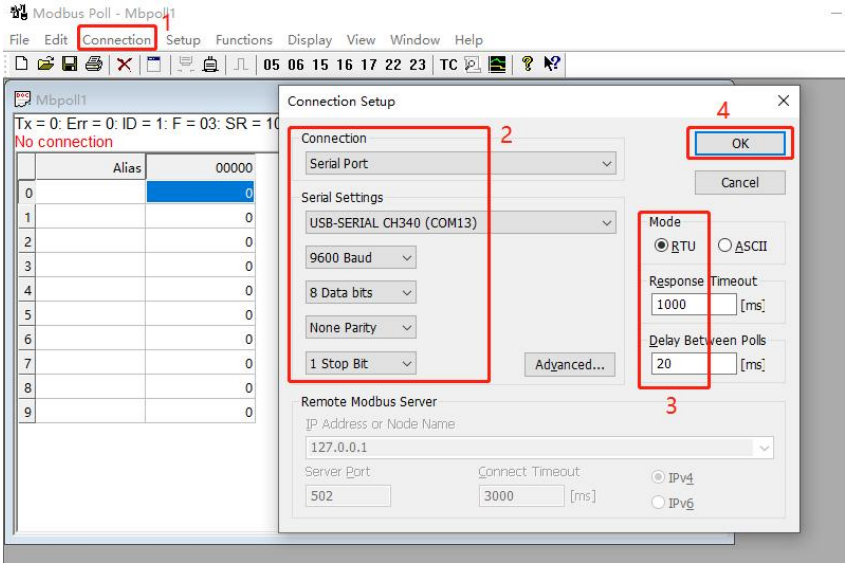


Figure 3-10 Modbus Poll Software Configuration Interface

3.3.3 Read the Interface Instructions

Click “Setup” to enter the settings, enter the station address and slave ID (default is 1), select the corresponding function code (default is 03), enter the corresponding register start address (see the table below; default is 0x0300, which corresponds to 768 in decimal), set the number of registers to read to 2 (temperature, humidity), set the read time to the default of 1000 milliseconds, click ‘Apply’ on the right, and then click “OK.”

See Figure 3-11.

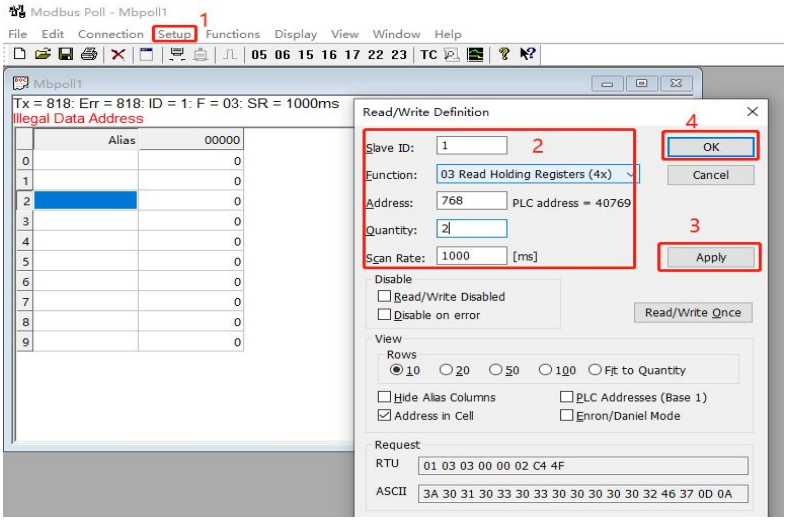


Figure 3-11 Modbus Poll Settings Interface

At this point, there are no red error messages on the host computer, indicating that communication with the module has been successful. In the software, register address 768 corresponds to the temperature value, and register address 769 corresponds to the humidity value. Multiplying the output values by 0.1 yields the actual temperature and humidity readings (temperature = 269 × 0.1 = 26.9 °C; humidity = 678 × 0.1 = 67.8% RH).

Figure 3-12 shows the read screen after configuration is complete.

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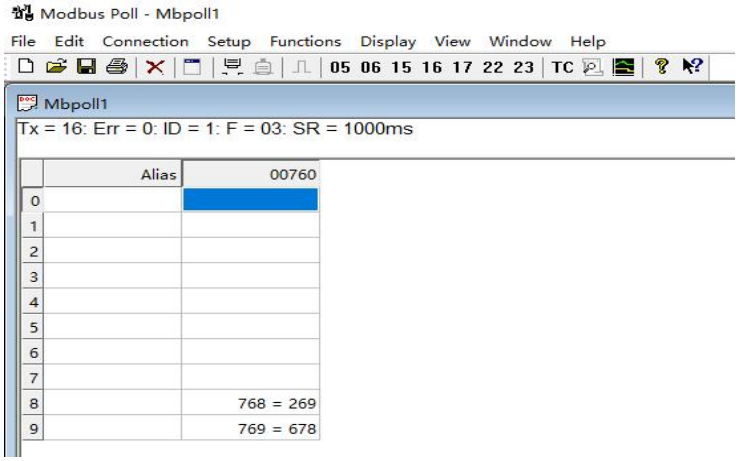


Figure 3-12 Modbus Poll Read Interface

3.4 ModBus Scan Software Manual

3.4.1 Preparation Before Use

Before use, ensure the following are prepared: the ModBus Scan software is installed, the hardware is connected (as described in Section 1.2.2), a USB-to-485 module is available, and the CH340 driver is installed on the host computer. This section will not cover these steps in detail.

3.4.2 Software Interface Description

Open the Modbus Scan software, click “Connection Settings” in the menu bar to establish a connection. When the connection details dialog box appears, select the appropriate serial port (COM13 in this example), set the baud rate to 9600 and the data bits to 8 (i.e., the word length), set the parity bit to ‘None’ and the stop bit to 1, click “Protocol Selection,” choose the RTU protocol, and finally click “OK” to close the dialog box.

See Figures 3-13 and 3-14 below.



- Figure 3-13: Modscan Software Connection Interface

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Revision History

Version	Revisions	Maintainer	Revision Date
V1.0	Initial Version	RH	2026-4-10
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Note: This product must not be used in military or life-safety-related scenarios. Users are solely responsible for any consequences resulting from unauthorized use.

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