

# Soil temperature and moisture transmitter (Type 485)

## Chapter 1 Product Introduction

### 1.1 Product overview

This sensor is suitable for the measurement of soil temperature and moisture. It is calibrated by the actual soil drying weighing method after comparing with the German original high-precision sensor, with high accuracy, fast response and stable output. It is less affected by the salt content of the soil and is suitable for various soil qualities. Can be buried in the soil for a long time, resistant to long-term electrolysis, corrosion resistance, vacuum potting, and completely waterproof.

The sensor is widely used in scientific experiments, water-saving irrigation, greenhouses, flowers and vegetables, grassland pastures, soil rapid measurement, plant cultivation, sewage treatment, grain storage, and the measurement of various particulate water content and temperature.

### 1.2 Features

- High measurement accuracy, fast response speed and good interchangeability.

- It is less affected by the salt content of the soil and can be applied to

various soil qualities.

■ The electrode adopts specially processed alloy material, which can withstand strong external impact and is not easy to damage.

■ Completely sealed, resistant to acid and alkali corrosion, can be buried in soil or directly into water for long-term dynamic testing.

■ High precision, fast response, good interchangeability, probe insertion design to ensure accurate measurement and reliable performance.

### 1.3 Main parameters

DC power supply (default): DC 4.5-30V

Maximum power consumption: 0.5W (24V DC power supply)

Working temperature: -40℃~+60℃

Core chip temperature resistance: 85℃

#### Soil moisture parameters

Range: 0-100%

Resolution: 0.1%

Accuracy: 2% within 0-50%, 3% within 50-100%

#### Soil temperature parameter

Range: -40~80℃

Resolution: Resolution: 0.1℃

Accuracy:  $\pm 0.5^{\circ}\text{C}$

Protection level: IP68

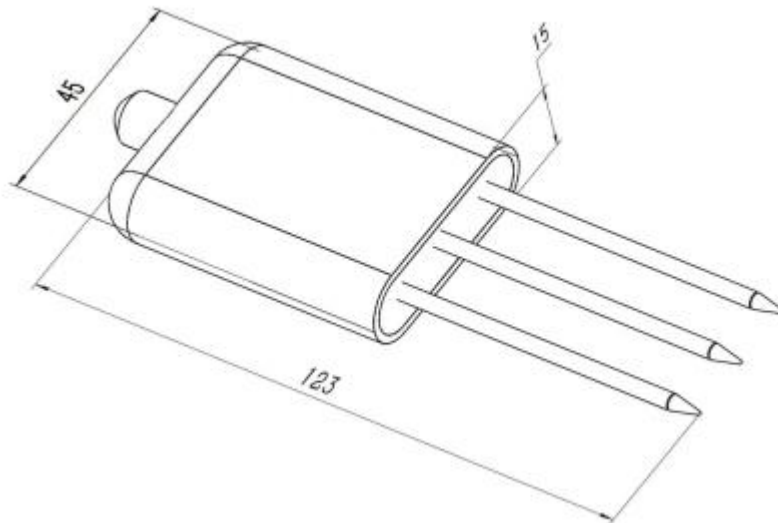
Probe material: anti-corrosion special electrode

Sealing material: black flame retardant epoxy resin

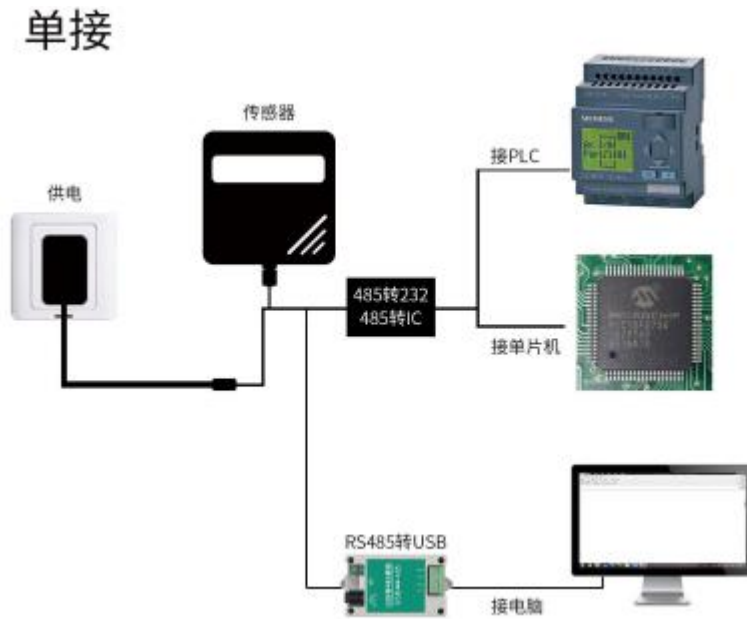
Default cable length: 2 meters

Dimensions: 45\*15\*123mm

Output signal: RS485 (Modbus protocol)

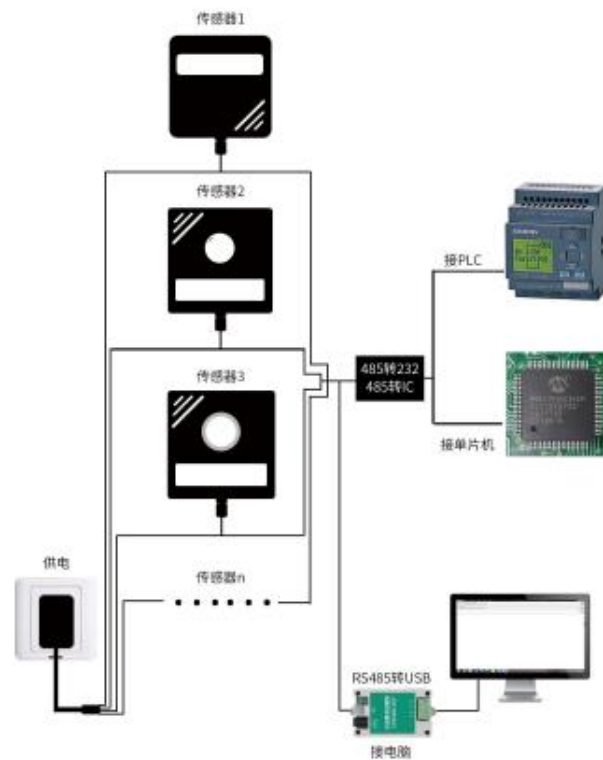


#### 1.4 System framework diagram



This product can also be used in combination with multiple sensors on a 485 bus. In theory, one bus can be used for 254 485 sensors, and the other end is connected to a PLC with a 485 interface, and a single-chip microcomputer is connected through a 485 interface chip, or USB to 485 can be used Computer connection, use the sensor configuration tool provided by our company to configure and test (only one device can be connected when using the configuration software).

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## 2.2 Interface description

The power interface is a wide voltage power input, which can be 4.5-30V.

When wiring the 485 signal wire, pay attention to the two wires A\B not reversed, and the addresses of multiple devices on the bus cannot conflict.

### 2.2.1 Sensor wiring



Brown: power supply ( 4.5-30V DC)

Black: power ground (GND)

Yellow: 485-A

Blue: 485-B

## Chapter 3 How to Use

### 3.1 Quick test method

Select a suitable measurement location, avoid rocks, ensure that the steel needle does not touch hard objects, throw away the surface soil according to the required measurement depth, maintain the original tightness of the soil below, hold the sensor vertically and insert it. Do not shake left and right. It is recommended to measure multiple times for average value within a small range of a measuring point.



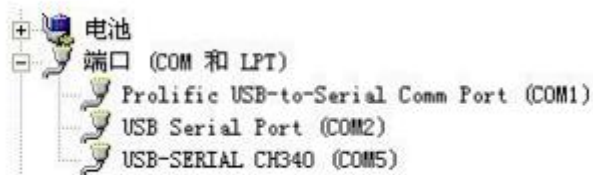
### 3.2 Buried measurement method

Dig a pit with a diameter of  $>20\text{cm}$  vertically, insert the sensor needle horizontally into the pit wall at a predetermined depth, and fill the pit tightly. After a period of stability, measurement and recording can be carried out for several days, months or even longer.



### 3.3 Matters needing attention

1. All steel needles must be inserted into the soil during measurement.
2. Avoid strong sunlight directly shining on the sensor to cause excessive temperature. Pay attention to lightning protection in the field.
3. Do not bend the steel needle violently, pull the lead wire of the sensor forcefully, and do not hit or hit the sensor violently.
4. The sensor protection grade is IP68, and the sensor can be soaked in water.
5. Due to the presence of radio frequency electromagnetic radiation in the air, it is not suitable to stay in the air for a long time with electricity.



Open the data package, select "Debug software" --- "485 parameter



configuration software", find RS485ControlV 21.exe open.

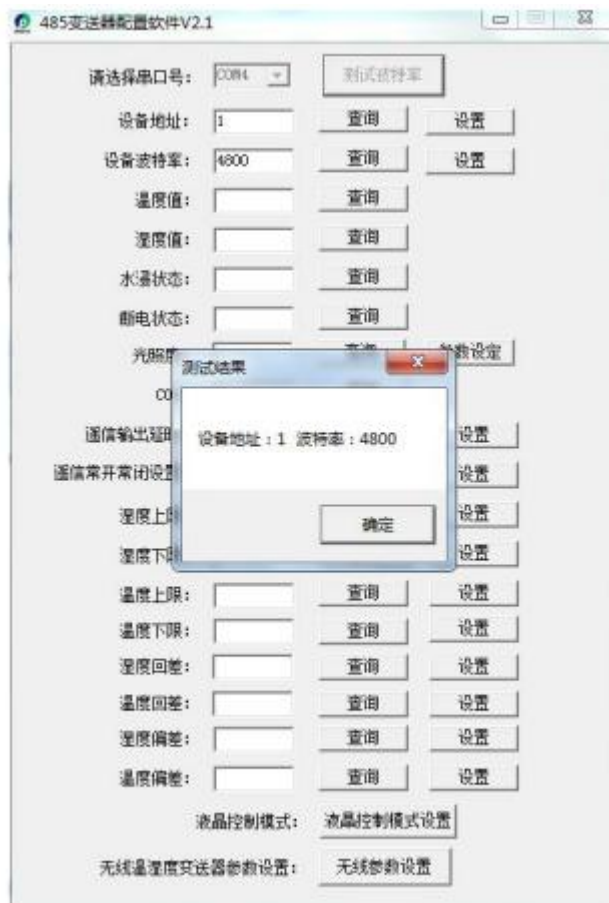
If the COM port is not found in the device manager, it means you have not installed USB to 485

Driver (included in the data package) or driver is not installed correctly, please contact technical staff for help.



## 4.2 Use of sensor monitoring software

- ①. The configuration interface is shown in the figure. First, obtain the serial port number according to the method in chapter 3.1 and select the correct serial port.
- ②. Click the test baud rate of the software, the software will test the baud rate and address of the current device, the default baud rate is 4800bit/s, and the default address is 0x01.
- ③. Modify the address and baud rate according to the needs of use, and at the same time query the current function status of the device.
- ④. If the test is unsuccessful, please recheck the equipment wiring and 485 driver installation.



## Chapter 5 Communication Protocol

### 5.1 Basic communication parameters

Code	8-bit binary
Data bit	8-bit
Parity bit	no
Stop bit	1 bit
Error checking	CRC (Redundant Cyclic Code)
Baud rate	2400bit/s, 4800bit/s, 9600 bit/s can be set, the factory default is 4800bit/s

## 5.2 Data frame format definition

Using Modbus-RTU communication protocol, the format is as follows:

Initial structure  $\geq$  4 bytes time

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

Time to end structure  $\geq$  4 bytes

Address code: the address of the transmitter, which is unique in the communication network (factory default 0x01).

Function code: the command function instruction issued by the host, this transmitter only uses function code 0x03 (read register data).

Data area: The data area is the specific communication data, pay attention to the high byte of 16bits data first!

CRC code: two-byte check code.

Host query frame structure:

address code	function code	Register start address	Register length	Check code low bit	Check code high
1 byte	1 byte	2 byte	2 byte	1 byte	1 byte

Slave machine response frame structure:

address	function	Effective	A data	Second	Data	Check
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code	code	bytes	area	data area	area N	code
1 byte	1 byte	1 byte	2 byte	2 byte	2 byte	2 byte

### 5.3 Register address

Register address	PLC or configuration address	content	operating	Definition description
0000 H	40001 (decimal)	Moisture content	Read only	Real-time value of water content (expanded 10 times)
0001 H	40002 (decimal)	Temperature value	Read only	Real-time temperature value (expanded 10 times)
0050 H	40081 (decimal)	Temperature calibration value	Read and write	Integer (expanded by 10 times)
0051 H	40082	Water	Read and	Integer

	(decimal)	content calibration value	write	(expanded by 10 times)
07D0 H	42001 (decimal)	Device address	Read and write	1~254 (factory default 1)
07D1 H	42002 (decimal)	Device baud rate	Read and write	0 means 2400  1 is 4800  2 is 9600

Note: Single moisture equipment has no temperature value and temperature calibration value registers

#### 5.4 Communication protocol example and explanation

Example: Read the temperature and humidity value of the device address 0x01

Inquiry frame (hexadecimal):

address code	function code	initial address	Data length	Check code low bit	Check code high
0x01	0x03	0x00 0x00	0x00 0x02	0xC4	0x0B

Response frame (hexadecimal): (for example, the temperature is -9.7℃

and the humidity is 48.6%RH)

address code	function code	Returns the number of valid bytes	Humidity value	Temperature value	Check code low bit	Check code high
0x01	0x03	0x04	0x01 0xE6	0xFF 0x9F	0x1B	0xA0

Temperature calculation:

When the temperature is lower than 0 °C, the temperature data is uploaded in the form of complement code.

Temperature: FF9F H (hexadecimal) = -97 => temperature = -9.7°C

Humidity calculation:

Humidity: 1E6 H (hexadecimal) = 486 => Humidity = 48.6%RH

## Chapter 6 Common Problems and Solutions

No output or output error

possible reason:

- ①. The computer has a COM port and the selected port is incorrect.
- ② The baud rate is wrong.
- ③ The 485 bus is disconnected, or the A and B wires are connected reversely.

- ④. If there are too many devices or too long wiring, power supply should be nearby, add 485 booster, and add  $120\Omega$  terminal resistance.
- ⑤ The USB to 485 driver is not installed or damaged.
- ⑥ The equipment is damaged.