Electrical conductivity soil temperature moisture

3 IN 1 transmitter

(Type 485)

Chapter 1 Product Introduction

1.1 Product overview

The sensor has stable performance and high sensitivity, and is an important tool for observing and studying the occurrence, evolution, improvement and water-salt dynamics of saline soil. By measuring the dielectric constant of the soil, it can directly and stably reflect the true moisture content of various soils. It can measure the volume percentage of soil moisture, which is a soil moisture measurement method that meets the current international standards.

The sensor is suitable for soil moisture monitoring, scientific experiments, water-saving irrigation, greenhouses, flowers and vegetables, grassland pastures, soil rapid testing, plant cultivation, sewage treatment, precision agriculture and other occasions.

1.2 Features

■ The three parameters of soil moisture content, electrical conductivity and temperature are combined into one.

■ It can also be used for the conductivity of water and fertilizer integrated solutions, as well as other nutrient solutions and substrates.

■ The electrode is made of specially treated stainless steel, which can withstand strong external impact and is not easy to damage.

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

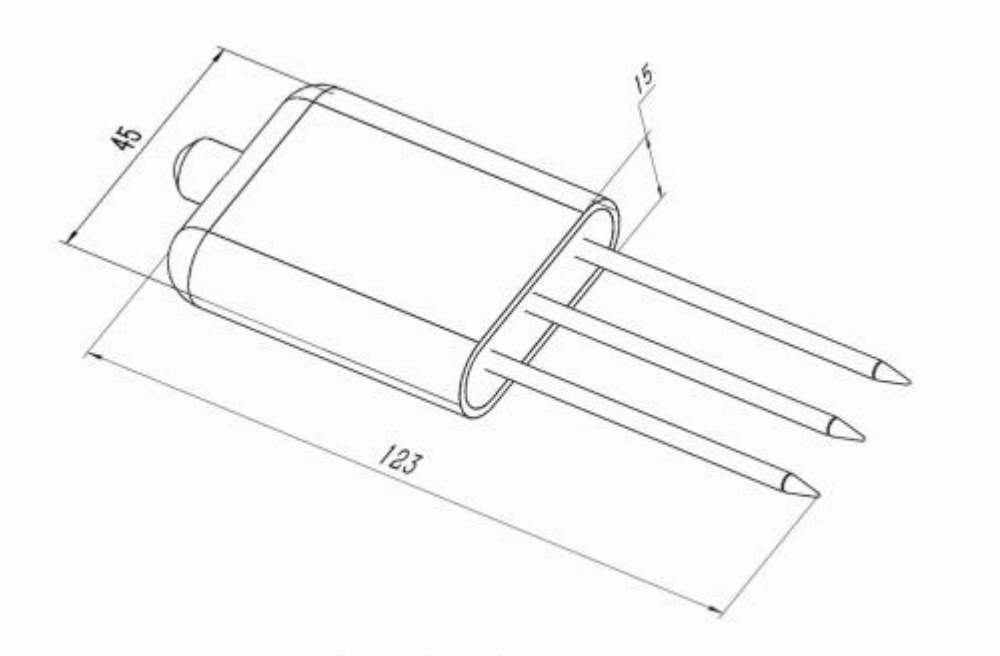
■ High precision, fast response, good interchangeability, probe insertion design to ensure accurate measurement and reliable performance.

1.3 Main parameters

DC power supply (default)	DC 4.5-30V	
Maximum power consumption	0.7W (24V DC power supply)	
Operating temperature	-40℃~+60℃	
Core chip temperature resistance	85℃	
Conductivity parameter	Range	0-20000us/cm
	Resolution	1us/cm
	Precision	±3%FS in the range of 0-10000us/cm; ±5%FS in the range of 10000-20000us/cm

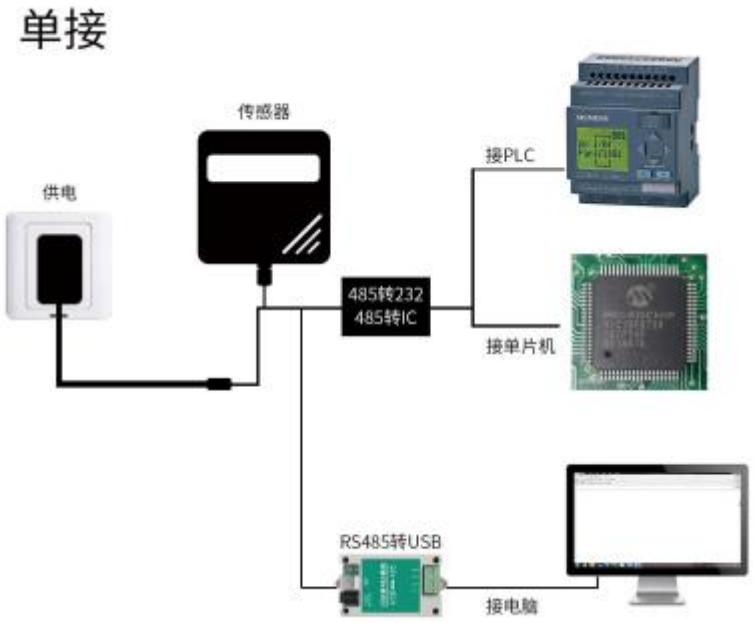
Soil moisture parameters	Range	0-100%
	Resolution	0.1%
	Precision	Within 0-50% ± 2%, within 50-100%
Soil temperature parameter	Range	-40~80℃
	Resolution	Resolution: 0.1℃
	Precision	±0.5℃
Conductivity temperature compensation	Built-in temperature compensation sensor, compensation range 0-50℃	
Protection level	IP68	
Probe material	Anti-corrosion special electrode	
Sealing material	Black flame-retardant epoxy resin	
Default cable length	2M	
Dimensions	45*15*123mm	
output signal	RS485 (Modbus protocol)	

Shell size

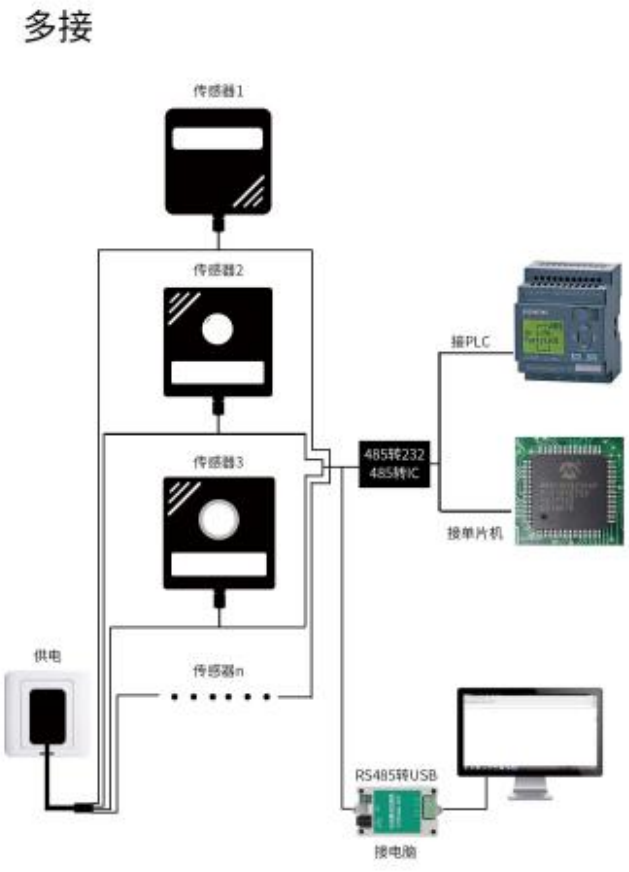


设备尺寸图（单位：mm）

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. 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).



Chapter 2 Hardware Connection

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 and B that cannot be reversed, and the addresses of multiple devices on the bus cannot be conflicted.

2.2.1 Sensor wiring

Thread color	illustrate	Remark
Brown	Power supply	4.5~30V DC
black	Power ground	GND
yellow	485-A	485-A
blue	485-B	485-B

Chapter 3 How to Use

Since the electrode directly measures the electrical conductivity of the soluble salt ions in the soil, the volumetric water content of the soil must be higher than about 20% when the soluble ions in the soil can accurately reflect the electrical conductivity of the soil. In the long-term observation, the measured value after irrigation or rainfall is closer to the true level. If you perform a quick test, you can water the tested soil first, and then perform the measurement after the water is fully penetrated.

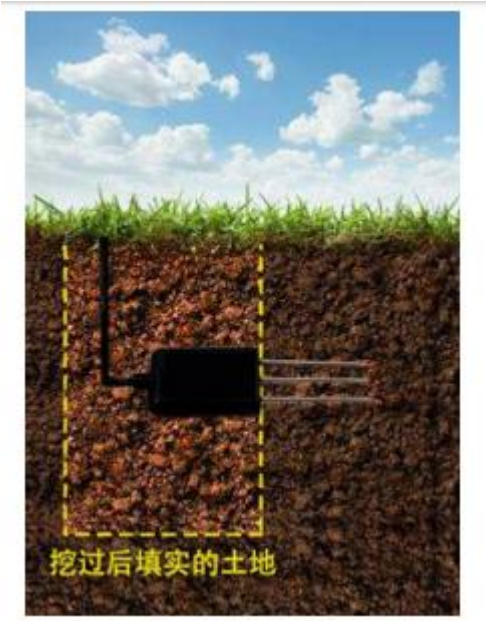
If you are measuring on a hard surface, you should drill holes first (the diameter of the probe should be smaller than the diameter of the probe), then insert the soil and compact the soil before measuring; the sensor should be protected from severe vibration and impact, let alone knocked with hard objects. Because the sensor is a black package, the sensor will heat up rapidly (up to 50℃) under strong sunlight. In order to prevent excessive temperature from affecting the temperature measurement of the sensor, please pay attention to shading and protection when using it in the field or in the field. .

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 into the soil, insert Do not shake left and right. It is recommended to measure multiple times to find the average value within a small range of a measuring point.

3.2 Buried measurement method

Dig a pit with a diameter of >20cm 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 and cause the temperature to be too high. Pay attention to lightning protection when using 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 completely immersed in water.

5. Due to the presence of radio frequency electromagnetic radiation in the air, it is not suitable to stay energized in the air for a long time.

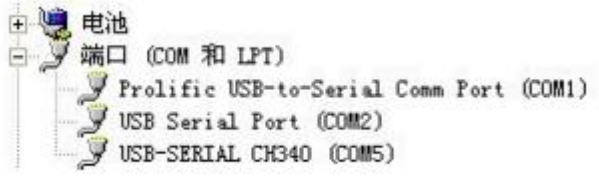
Chapter 4 Configuration Software Installation and Use

Our company provides the supporting "485 parameter configuration software", which can easily use the computer to read the parameters of the sensor, and at the same time flexibly modify the device ID and address of the sensor.

Note that you need to ensure that there is only one sensor on the 485 bus when using the software for automatic acquisition.

4.1 Connect the sensor to the computer

After the sensor is correctly connected to the computer via USB to 485 and supplied with power, you can see the correct



Open the data package, select "Debugging Software" --- "485 Parameter Configuration Software", find and open it. 

If the COM port is not found in the device manager, it means that you have not installed the USB to 485 driver (included in the data package) or the driver has not been installed correctly, please contact a technician for help.

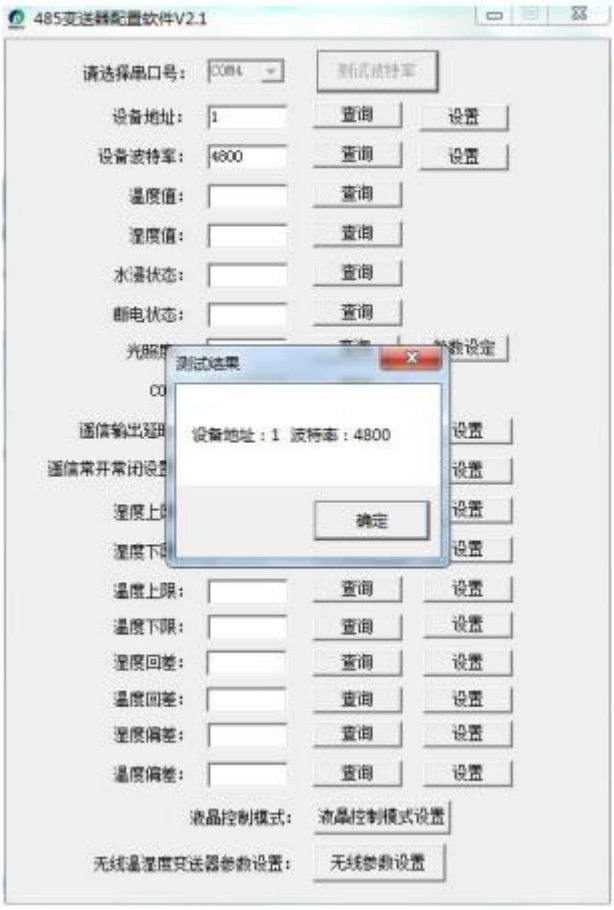
4.2 Use of sensor monitoring software

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, you can 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 ≥ 4 bytes of time

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

Time to end structure ≥ 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 the 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 code	function code	Number of valid bytes	Data area	Second data area	Data area N	Check 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	operate	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)
0002 H	40003 (decimal)	Conductivity	Read only	Real-time conductivity value
0003 H	40004 (decimal)	salinity	Read only	Salinity real-time value
0004 H	40005 (decimal)	Total dissolved solids TDS	Read only	TDS real-time value
0022 H	40035 (decimal)	Conductivity temperature coefficient	Read and write	0-100 corresponds to 0.0%-10.0% Default 0.0%
0023 H	40036 (decimal)	Salinity coefficient	Read and write	0-100 corresponds to 0.00-1.00 Default 55 (0.55)

0024 H	40037 (decimal)	TDS coefficient	Read and write	0-100 corresponds to 0.00-1.00 Default 50 (0.5)
0050 H	40081 (decimal)	Temperature calibration value	Read and write	Integer (expanded by 10 times)
0051 H	40082 (decimal)	Water content calibration value	Read and write	Integer (expanded by 10 times)
0052 H	40083 (decimal)	Conductivity calibration value	Read and write	Integer
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: There is no temperature value and calibration value register for conductivity moisture equipment

5.4 Communication protocol example and explanation

Example: Read the conductivity and temperature and moisture value of a three-in-one device with conductivity, temperature and moisture (address 0x01)

Interrogation frame:

address code	function code	Start address	Data length	Check code low bit	Check code high
0x01	0x03	0x00 0x00	0x00 0x03	0x05	0xCB

Reply frame

address code	function code	Returns number of valid bytes	Moisture value	Temperature value	Conductivity value	Check code low byte	Check code high byte
0x01	0x03	0x06	0xFF 0x9B	0x00 0x9C	0x03 0xE8	0xD8	0x0F

Temperature calculation:

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

Temperature: FF9B H (hexadecimal) = -101 => temperature = -10.1℃

Moisture calculation:

Moisture: 292 H (hexadecimal) = 658 => Humidity = 65.8%, that is, the soil volumetric moisture content is 65.8%.

Conductivity calculation:

Conductivity: 3E8 H (hexadecimal) = 1000 => Conductivity = 1000 us/cm

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 the number of equipment is too much or the wiring is too long, power supply should be nearby, add 485 booster, and add 120Ω terminal resistance at the same time.

⑤ The USB to 485 driver is not installed or damaged.

⑥ The equipment is damaged.