Five-pin soil transmitter (Type 485) manual

Document version：V2.0

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1. Product introduction

1.1 product description

The transmitter has stable performance, high sensitivity, fast response, stable output, and is suitable for various soil qualities. It is an important tool for observing and studying the occurrence, evolution and improvement of saline soil and the dynamics of water and salt. 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. Can be buried in the soil for a long time, resistant to long-term electrolysis, corrosion resistance, vacuum potting, and completely waterproof.

The transmitter 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 for temperature and humidity, electrical conductivity, PH value testing .

1.2 Features

■ The seven items of soil moisture content, electrical conductivity, temperature, nitrogen, phosphorus, potassium, and pH value are combined in one.

■ Low threshold, few steps, fast measurement, no reagents, unlimited detection times.

■ The electrode is made of specially treated 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 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.

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

■ High pH measurement accuracy, up to $\pm$0.3PH accuracy, fast response speed and good interchangeability.

1.3 The main parameters

DC power supply (default)	DC4.5-30V
Power consumption	0.5W (24V DC power supply)
Operating temperature	-20℃~+60℃
Core chip temperature resistance	85℃
Conductivity parameter	Range: 0-20000us/cm Resolution: 1us/cm Accuracy: ±3%FS in the range of 0-10000us/cm; ±5%FS in the range of 10000-20000us/cm
Soil moisture parameter	Range: 0-100% Resolution: 0.1% Accuracy: 2% within 0-50%, 3% within 50-100%
Soil temperature parameter	Range: -40~80°C, resolution: 0.1°C, accuracy: ±0.5℃（25℃）
Soil PH parameter	Range: 3~9PH Resolution: 0.1 Accuracy: ±0.3PH
NPK parameters	Range: 1-1999 mg/kg(mg/L) Resolution: 1 mg/kg(mg/L) Accuracy: ±2%FS
Conductivity temperature compensation	Built-in temperature compensation sensor, compensation range 0-50 °C
Protection level	IP68
Probe material	Anti-corrosion special electrode
Sealing material	Black flame-retardant epoxy resin
Default cable length	2 meters, the cable length can be customized according to requirements
Dimensions	45*15*123mm
output signal	RS485 (Modbus protocol)

Shell size
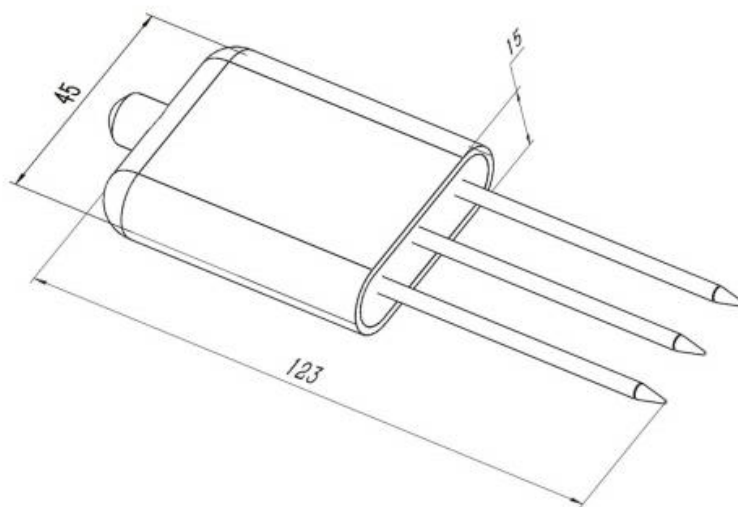
Equipment size drawing (unit: mm)

1.4 System framework diagram
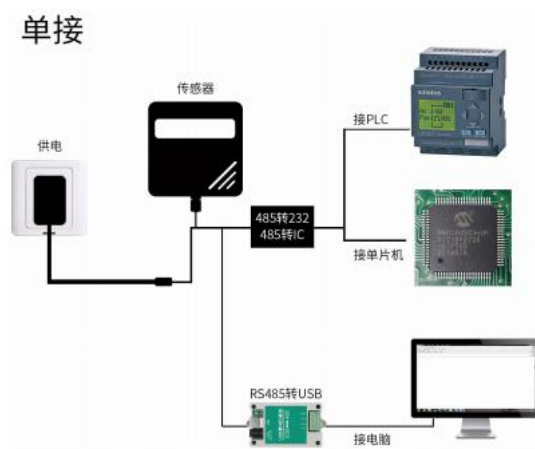
This product can also be combined with multiple sensors on a 485 bus. In theory, a bus can be used for 254 485 sensors, and the other end is connected to a PLC with a 485 interface, and a single-chip microcomputer is connected through a 485 interface chip, or USB to 485 can be used to connect with Computer 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).
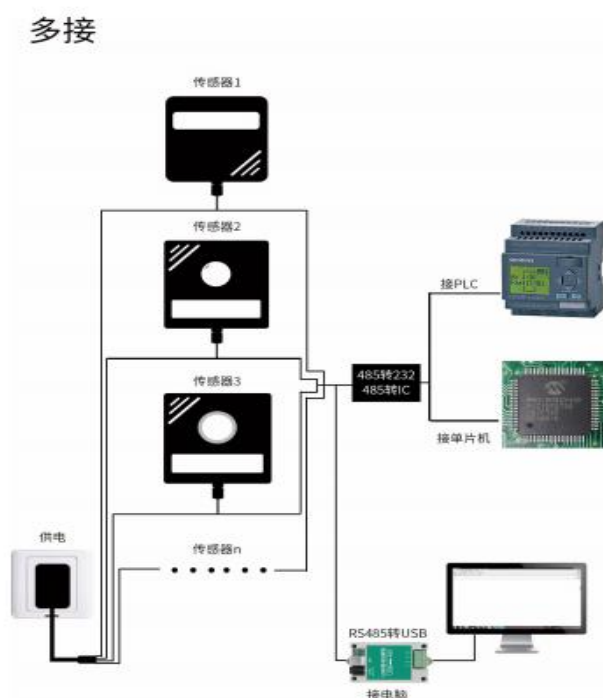
1.5 product model

VMS-				Company code
	3001-			
		TR-		Soil detection housing
			NPKPH-	NPK PH transmitter
			THNPKPH-	Temperature Moisture Nitrogen Phosphorus Potassium PH Transmitter
			ECNPKPH-	Conductivity Nitrogen, Phosphorus and Potassium PH

				ECTHNPKPH-		Transmitter
						Conductivity Temperature Moisture Nitrogen Phosphorus Potassium PH Transmitter
				THPH-		Temperature moisture PH transmitter
				ECPH-		Conductivity PH transmitter
				ECTHPH-		Conductivity temperature moisture PH value transmitter
					N01	RS485 (Modbus-RTU protocol)

2.Hardware connection

2.1Inspection before equipment installation

Check the equipment list before equipment installation:

■Transmitter equipment 1

■Certificate of conformity, wiring instructions, etc.

■USB to 485 (optional)

2.2 Interface Description

Wide voltage power input can be 4.5~30V. When wiring the 485 signal line, pay attention to the A/B two lines can not be reversed, and the addresses of multiple devices on the bus can not conflict.

2.2.1 Sensor wiring

Line color	Description	Remarks
brown	Power supply	4.5~30V DC
black	Power ground	GND
yellow	485-A	485-A
blue	485-B	485-B
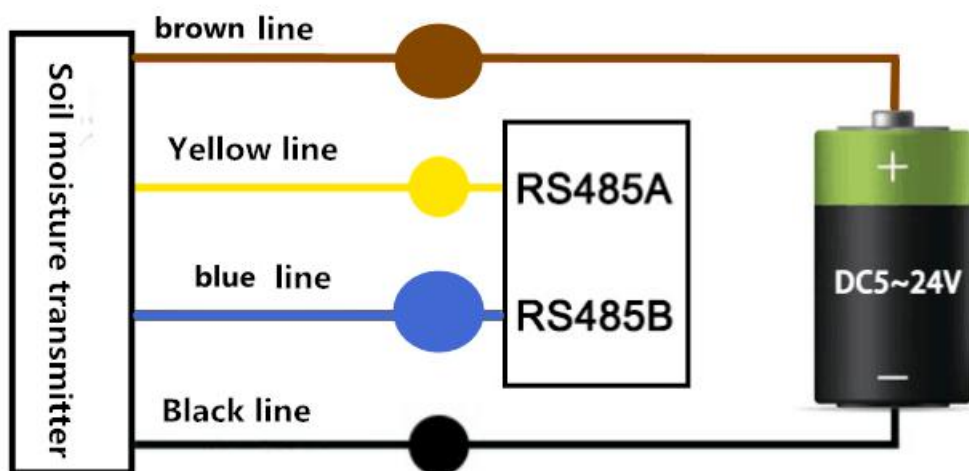
3.Instructions

Since the electrode directly measures the conductivity of the soluble salt ions in the soil, the soil volumetric water content needs to be higher than about 20% in order to accurately reflect the conductivity of the soil. In the long-term observation, the measured value after irrigation or

rainfall is closer to the true level. If you conduct a quick test, you can first water the soil to be tested,

Measure after the moisture has penetrated sufficiently.

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

3.1Quick 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. 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
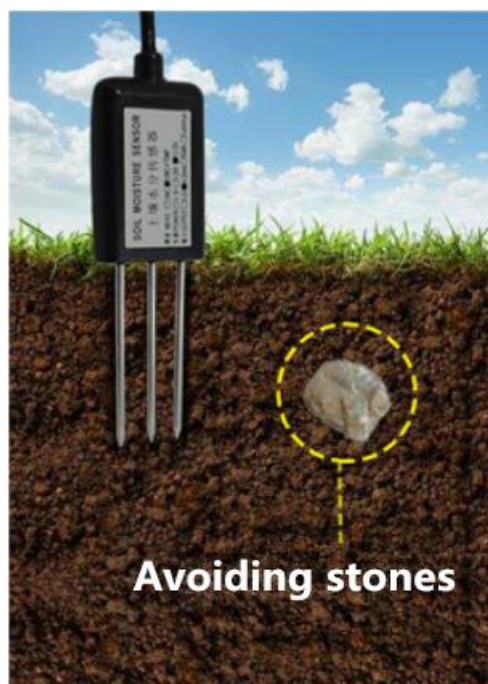
3.2Buried measurement method

Dig a pit with a diameter of >20cm vertically, insert the transmitter steel needle horizontally

into the pit wall at a predetermined depth, and fill the pit tightly. After a period of stability, measurement and measurement can be carried out for several days, months or even longer. recording.

Filled soil after excavation

3.3Note:

1. All steel needles must be inserted into the soil during measurement.
2. Avoid strong sunlight directly shining on the transmitter and cause excessive temperature. Pay attention to lightning protection when using in the field.
3. Do not bend the steel needle violently, pull the lead wire of the transmitter forcefully, and do not hit or violently hit the transmitter.
4. The transmitter protection level is IP68, and the transmitter can be soaked 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.

4. Configuration software installation and use

Our company provides the supporting "485 parameter configuration software", which can conveniently 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 to automatically acquire.

4.1Connect the sensor to the computer

After connecting the sensor to the computer through USB to 485 and supplying power,

you can see the correct COM port in the computer (check the COM port in "My Computer－Properties－Device Manager－Port").
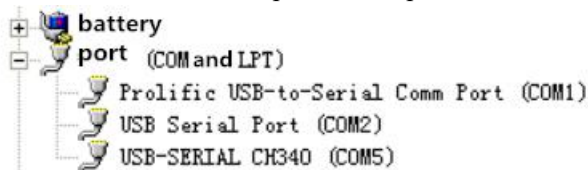
Open the data package, select "Debugging software" --- "485 parameter configuration software",


find the _____can be opened.

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.
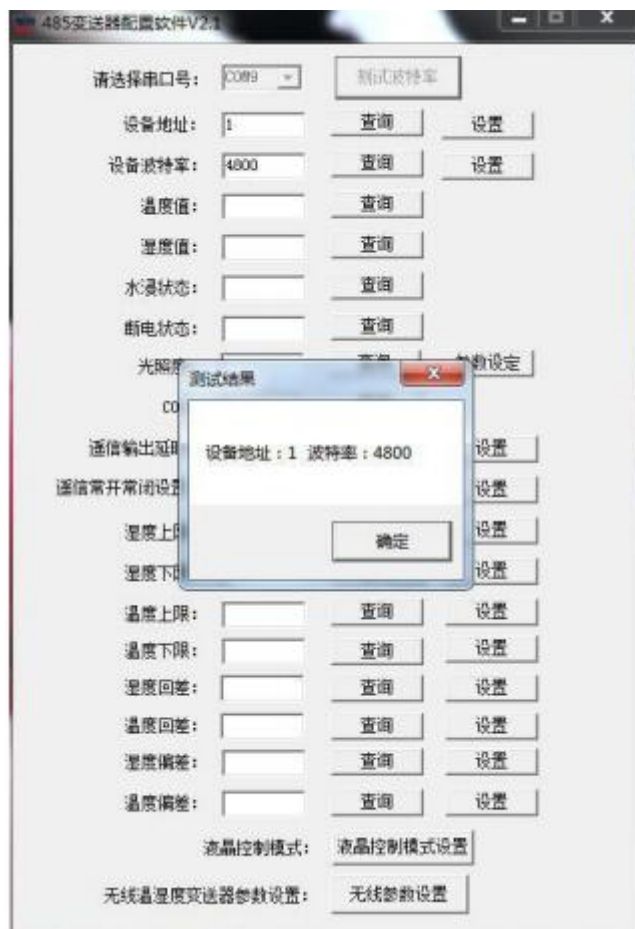
5. letter of agreement

5.1 Basic communication parameters

Code	8-bit binary
Data bit	8 digits
Parity bit	no
Stop bit	1 person
Error check	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

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

Initial structure ≥ 4 bytes of time

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Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

End structure ≥ 4 bytes of time

Address code:It is 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 16bits data high byte first!

CRC code: Two-byte check code.

Host inquiry frame structure:

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

Slave machine response frame structure:

address code	function code	Effective number of bytes	Data area	Second data area	Nth data area	Check code
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

5.3Register address

Register address	PLC or configuration address	Content	Operation	Definition description
0000 H	40001 (decimal)	Moisture content	Read only	Real-time value of water content (expanded by 10 times)
0001 H	40002 (decimal)	Temperature	Read only	Real-time

		value		temperature value (expanded 10 times)
0002 H	40003 (decimal)	Conductivity	Read-only	Conductivity real-time value
0003 H	40004 (decimal)	PH value	Read only	PH real-time value (expanded ten times)
0004H	40005 (decimal)	Nitrogen content	Read only	Actual value of nitrogen content
0005H	40006 (decimal)	Phosphorus content	Read only	Actual value of phosphorus content
0006H	40007 (decimal)	Potassium content	Read only	Actual value of potassium content
0007 H	40008 (decimal)	Salinity	Read only	Salinity real-time value
0008 H	40009 (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 system)	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	Read and write	Integer (extended

		calibration value		by 10 times)
0051 H	40082 (Decimal)	Water content calibration value	Read and write	Integer (extended by 10 times)
0052 H	40083 (Decimal)	Conductivity calibration value	Read and write	Integer
0053 H	40083 (Decimal)	PH calibration value	Read and write	Integer
04E8 H	41001 (decimal)	Nitrogen content coefficient 16 high	Read and write	Real value (IEEE754 standard floating point type)
04E9 H	41002 (decimal)	Nitrogen content coefficient lower 16 bits	Read and write	
04EA H	41003 (decimal)	Nitrogen content calibration value	Read and write	Integer
04F2 H	41011 (decimal)	Phosphorus content coefficient 16 high	Read and write	Real value (IEEE754 standard floating point type)
04F3 H	41012 (decimal)	Phosphorus content coefficient lower 16 bits	Read and write	
04F4 H	41013 (decimal)	Phosphorus content calibration value	Read and write	Integer
04FCH	41021 (decimal)	Potassium content coefficient 16 high	Read and write	Real value (IEEE754 standard floating point type)
04FDH	41022 (decimal)	Potassium content coefficient lower	Read and write	

		16 bits		
04FE H	41023 (decimal)	Potassium content 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 means 4800 2 means 9600

5.4 Communication protocol example and explanation

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

Inquiry frame

address code	function code	starting address	Data length	Check code low	Check code high
0x01	0x03	0x00 0x00	0x00 0x04	0x44	0x09

Response frame

address code	function code	Number of bytes	Humidity value	Temperature value	PH value	Check code low	Check code high
0x01	0x03	0x08	0x02 0x92	0xFF 0x9B	0x00 0x38	0x57	0xB6

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

PH value calculation:

PH value: 38H (hexadecimal) = 56 => PH value = 5.6

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. There are too many devices or the wiring is too long, the nearest power supply should be added, and a 485 booster should be added and a 120 Ω terminal resistance should be added at the same time.

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

⑥ The equipment is damaged.

7.Contact details

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