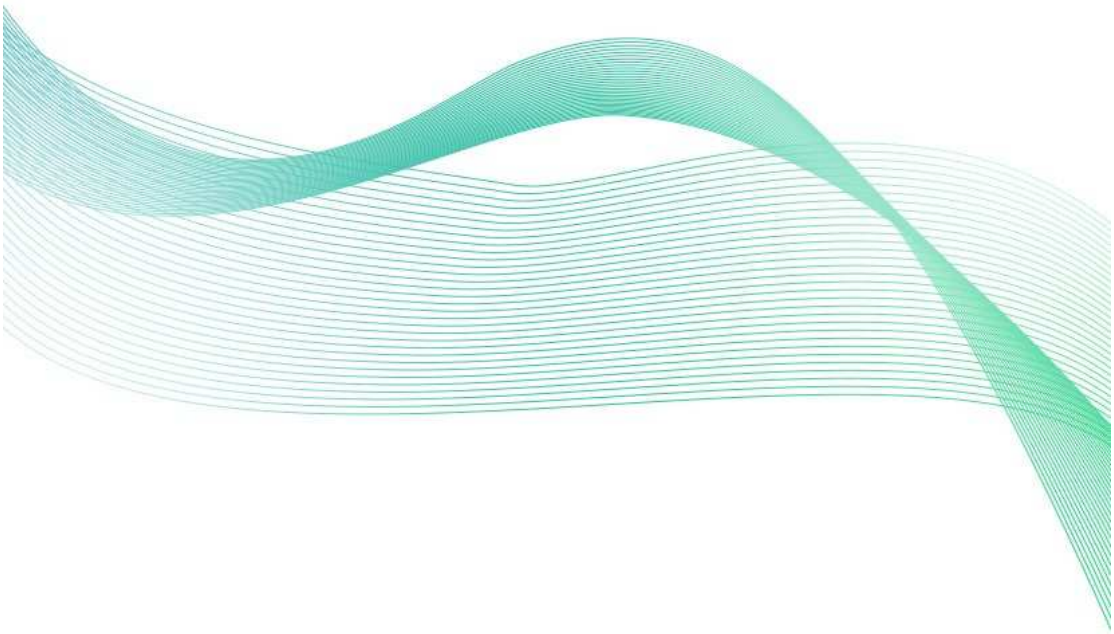
Five-pin soil multi-parameter sensor (485 type)

SN-300 2-TR-*-N01

Ver 2 .0



catalogue

Chapter 1 Product Introduction

1.1 Product Overview

This product features stable performance, high sensitivity, fast response, and stable output, making it suitable for various soil types. It is an essential tool for observing and studying the occurrence, evolution, improvement, and water-salt dynamics of saline soils. By measuring the dielectric constant of 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 in line with current international standards for soil moisture measurement methods. The device can be buried long-term in the soil, resistant to prolonged electrolysis and corrosion, and is vacuum-sealed for complete waterproofing.

Suitable for soil moisture monitoring, scientific experiments, water-saving irrigation, greenhouses, flowers and vegetables, grassland and pasture, soil rapid testing, plant culture, sewage treatment, precision agriculture and other occasions of temperature and humidity, conductivity and PH value testing.

1.2 Functional features

■ Low threshold, few steps, quick measurement, no reagent required, no limit of detection times.

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

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

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

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

1.3 Main parameters

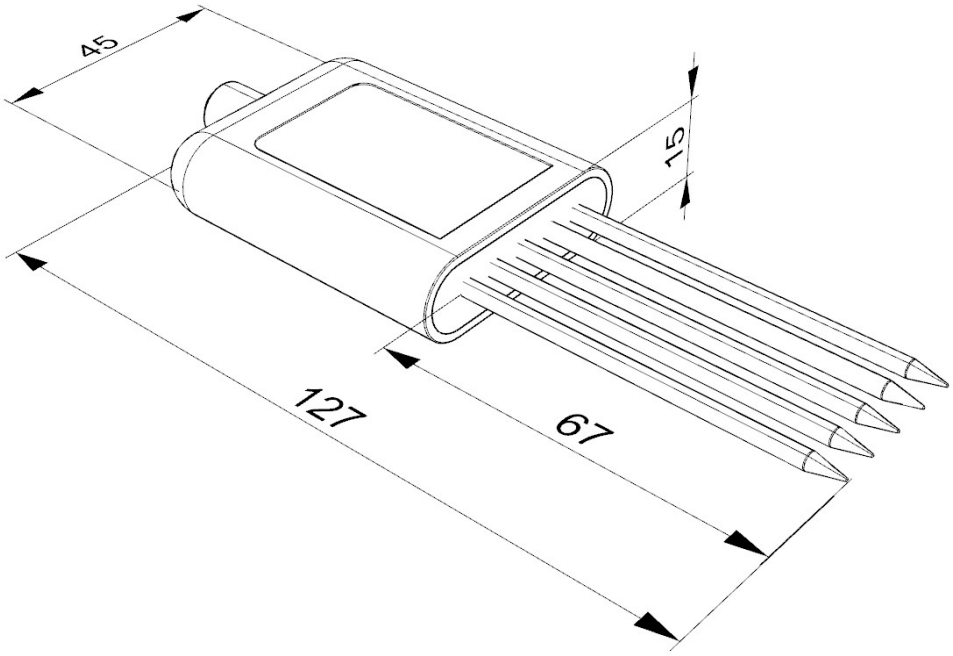
DC power supply (default)	DC 4.5-30V
maximum power dissipation	0.5W (24V DC supply)

working temperature	-20℃~+60℃	
The kernel chip is heat resistant	85℃	
stabilization time	≤5min	
Conductivity parameter	range	0-20000 μS/cm
	resolution ratio	1 μS/cm
	Typical accuracy	The range of 0-10000 μS/cm is ±3%FS; the range of 10000-20000 μS/cm is ±5%FS; (Brown soil, 60%,25℃)
Soil moisture parameters	range	0-100%
	resolution ratio	0.1%
	accuracy	0-50% ± 2%, @ (brown soil, 30%,25℃) 50-100% ± 3%, @ (brown soil, 60%,25℃)
Soil temperature parameters	range	-40~80℃
	resolution ratio	Resolution: 0.1℃
	accuracy	±0.5℃（25℃）
Soil PH parameter	range	3~9PH
	resolution ratio	0.1
Nitrogen, phosphorus, potassium parameters (Measured by national standard instrument and input)	range	0-2999 mg/kg(mg/L)
	resolution ratio	1 mg/kg(mg/L)
	Typical accuracy	≤5% (subject to actual measuring instrument)
Conductivity temperature compensation	Built-in temperature compensation sensor, compensation range 0-50℃	
levels of protection	IP68	
Pin insertion material	Corrosion resistant special electrode	

sealing material	Black flame retardant epoxy resin
The default cable length	2 m, cable length can be customized according to requirements
outline dimension	45*15*123mm
output signal	RS485 (Mod Bus protocol)

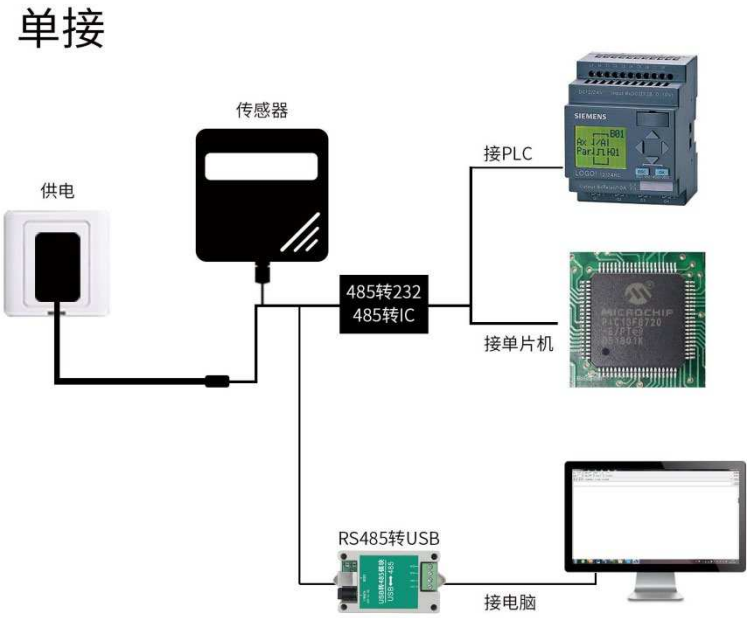
Note: The performance data stated above are obtained under test conditions using our test system and software. To continuously improve the product, we reserve the right to change the design functions and specifications without further notice.

Shell size



Equipment size diagram (unit: mm)

1.4 System framework diagram



This product can also combine multiple sensors on one 48 5 bus. Theoretically, one bus can support up to 254485 sensors. At the other end, connect a PLC with a 48 5 interface, or link to a microcontroller via a 48 5 interface chip. Alternatively, use a USB-to-48 5 adapter to connect to a computer. Configuration and testing can be performed using the sensor configuration tool provided by our company (when using this configuration software, only one device can be connected).

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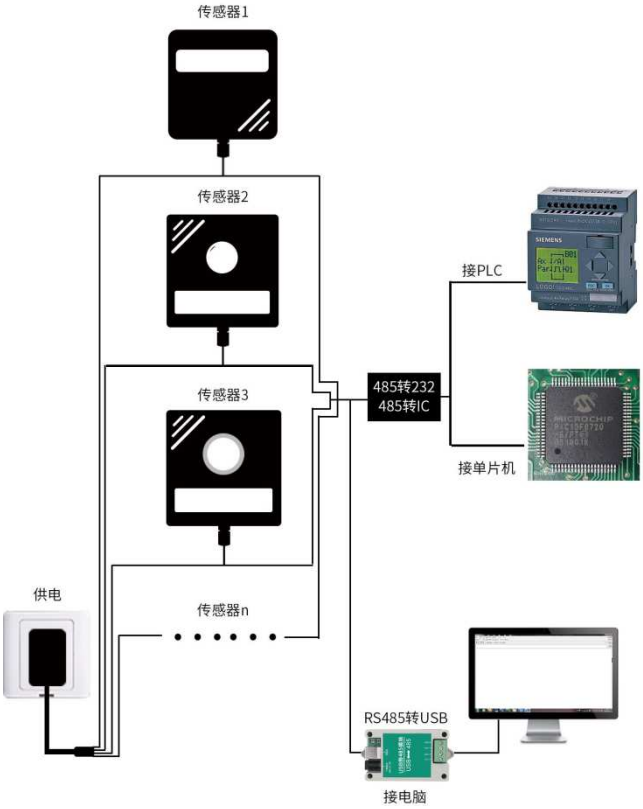


1. Product selection

SN-				Company code
	300 2-			
		TR-		Soil testing casing
			NPKPH-	nitrogen phosphorus and potassium PH
			TH NPK PH-	Temperature, water, nitrogen, phosphorus, potassium and PH
			ECNPKPH-	Conductivity nitrogen phosphorus potassium PH
			ECTHNPKPH-	Conductivity temperature water nitrogen phosphorus potassium PH
			N01	RS485 (Mod Bus-RTU protocol)

Chapter 2 Hardware connections

2.1 Inspection before equipment installation

equipment list:

■ 1 set of equipment

■ Certificate of conformity, wiring description, etc

■USB to 485 (optional)

2.2 Interface description

The wide voltage power supply input can be 4.5~30V. When wiring the 485 signal line, pay attention to that A/B lines should not be connected in reverse, and the addresses of multiple devices on the bus should not conflict.

2.2.1, sensor wiring

Line color	explain	remarks
brown	Power is positive	4.5~30V DC
black	Power ground	GND
yellow	485-A	485-A
blue	485-B	485-B

Chapter 3 Usage

Due to the electrodes directly measuring the conductivity of soluble salt ions in the soil, the soil moisture content must be above about 20% for the soluble ions to accurately reflect the soils conductivity. Over long-term observations, measurements taken after irrigation or rainfall are closer to the true levels. For quick tests, water can be applied to the soil first, and measurements taken once the water has fully penetrated.

If measuring on a relatively hard surface, drill a hole first (the hole diameter should be smaller than the probe diameter), then insert the probe into the soil and compact it before measuring; the transmitter should be protected from violent vibrations and impacts, and must not be struck with hard objects. Since the transmitter is black-coated, it can rapidly heat up under intense sunlight (up to 50℃ or more). To prevent excessive temperature from affecting the temperature measurement of the transmitter, please take precautions against direct sunlight and protection when using it in fields or outdoors.

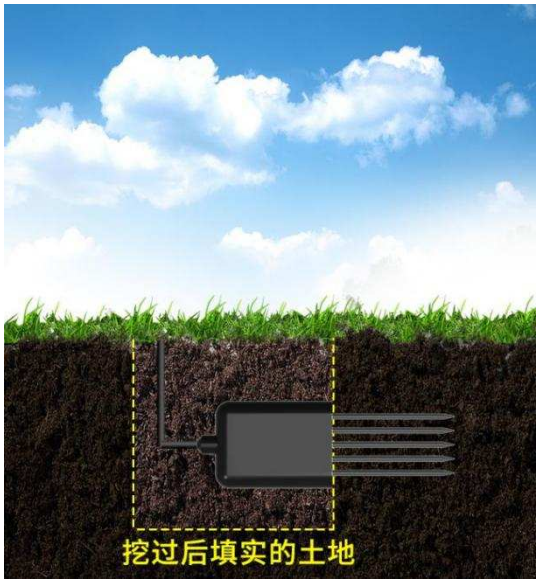
3.1 Speed test method

Select the appropriate measurement location, avoid the stone, ensure that the steel

needle does not touch the hard object, throw away the surface soil according to the required measurement depth, keep the original looseness of the soil below, hold the sensor vertically inserted into the soil, do not shake left and right when inserting, it is recommended to measure multiple times in a small range of a measurement point to obtain the average value.

3.2 Ground measurement method

The pit with a vertical excavation diameter>20cm is inserted horizontally into the pit wall at the predetermined depth, and the pit is filled in firmly. After a period of time, continuous measurement and recording can be carried out for several days, months or even longer.



3.3 Precautions

1. The steel needle must be fully inserted into the soil during measurement.

2. Avoid direct exposure to strong sunlight to cause high temperature of the transmitter. Pay attention to lightning strike in field use.

3. Do not bend the steel needle violently, do not pull the transmitter lead wire forcefully, do not drop or strike the transmitter violently.

4. The transmitter protection level IP68 can immerse the transmitter in water.

5. Due to the presence of radio frequency electromagnetic radiation in the air, it is not advisable to be in an electric state for a long time in the air.

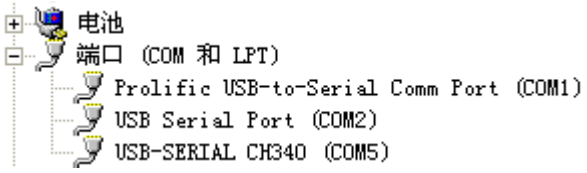
Chapter 4 Configuration software installation and use

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

Note that when using software automatic acquisition, it is necessary to ensure that there is only one sensor on the 485 bus.

4.1 Sensor access to computer

After connecting the sensor to the computer via USB to 485 and providing power, you can see the correct COM port in the computer ("My Computer-Properties-Device Manager-Ports" to view the COM port).



Open the data package, select "Debug software" --- "485 parameter configuration software", find open. 

If you do not find a COM port in the device manager, it means that you have not installed a USB to 485 driver (in the package) or have not installed the driver correctly. Please contact a technician for help.

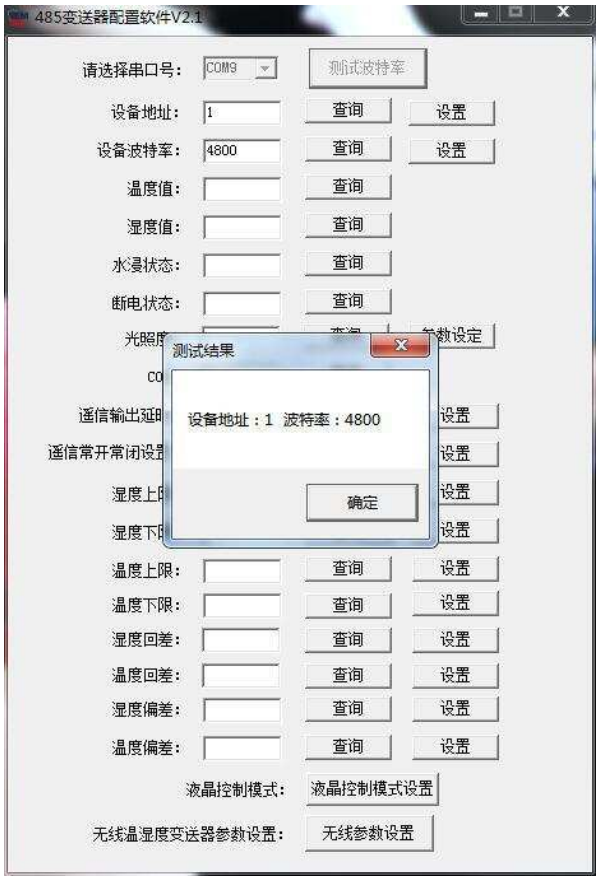
4.2 Use of sensor monitoring software

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, and the software will test the current devices baud rate and address. The default baud rate is 4800bit/s, and the default address is 0x01.

③ Modify the address and baud rate according to the use needs, and query the current function status of the device.

④ If the test fails, please check the equipment wiring and 485 drive installation again.



Chapter 5 Communication Protocols

5.1 Basic communication parameters

code	Eight-bit binary
data bit	Eight
parity check bit	not have
stop bit	1 position
error check	CRC (Redundant cyclic code)
Baud rate	2400bit/s, 4800bit/s, 9600 bit/s can be set, and the default factory setting is 4800bit/s

5.2 Definition of data frame format

The Mod Bus-RTU communication protocol is adopted, and the format is as follows:

Initial structure time in bytes

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16-bit CRC code

End the structure at a time of at least four bytes

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

Function code: This product uses function codes 0x03,0x06,0x10, etc.

Data area: The data area is specific communication data. Note that the high byte of 16bits data is in front!

CRC code: a two-byte check code.

Host inquiry frame structure:

address code	FC	Register starting address	register length	Check code low position	Check code high
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

From the machine response frame structure:

address code	FC	Number of valid bytes	Data Zone 1	Second data area	The N data area	check code
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

5.3 Register address

Register address	PLC or configuration address	content	operate	defined declaration
0000 H	40001 (base 10)	rate of water content	read only	Real-time water content (10 times expanded)
0001 H	40002 (base 10)	temperature scale	read only	Real-time temperature values (10 times expanded)
0002 H	40003 (base 10)	conductivity	read only	Real-time conductivity value
0003 H	40004 (base 10)	PH price	read	Real-time PH values (expanded by

			only	10 times)
0004H	40005 (base 10)	Temporary nitrogen content value	read-write	The nitrogen content value or test value written in[1]
0005H	40006 (base 10)	Temporary phosphorus content value	read-write	The phosphorus content value or test value written in[2]
0006H	40007 (base 10)	Potassium content provisional value	read-write	The potassium content value or test value written in[3]
0007 H	40008 (base 10)	salinity	read only	Real-time salinity values (for reference only)
0008 H	40009 (base 10)	Total dissolved solids TDS	read only	TDS real-time values (for reference only)
0022 H	40035 (base 10)	Conductivity temperature coefficient	read-write	0-100 corresponds to 0.0%-10.0% The default is 0.0%
0023 H	40036 (base 10)	Salinity coefficient	read-write	0-100 corresponds to 0.00-1.00 default 55 (0.55)
0024 H	40037 (base 10)	TDS coefficient	read-write	0-100 corresponds to 0.00-1.00 default 5 0 (0.5)
0050 H	40081 (base 10)	Temperature calibration value	read-write	Integers (expanded by 10 times)
0051 H	40082 (base 10)	Moisture content calibration value	read-write	Integers (expanded by 10 times)
0052 H	40083 (base 10)	Conductivity calibration value	read-write	integer
0053 H	4008 4 (base 10)	PH calibration value	read-write	integer
0 4 E8 H	4 1257 (base 10)	The nitrogen content temporary storage value coefficient is high sixteen bits	read-write	floating number (IEEE754 Standard floating point)
0 4 E 9 H	4 1258 (base 10)	The nitrogen content	read-write	

		temporary storage value coefficient is low sixteen bits		
0 4 E A H	4 1259 (base 10)	The deviation value of the nitrogen content temporary storage value	read-write	integer
0 4F2 H	4 1267 (base 10)	The phosphorus content temporary storage value coefficient is high sixteen bits	read-write	floating number (IEEE754 Standard floating point)
0 4F3 H	4 1268 (base 10)	The phosphorus content temporary storage value coefficient is low sixteen bits	read-write	
0 4F4 H	4 1269 (base 10)	The deviation value of the temporary storage value of phosphorus content	read-write	integer
0 4FC H	4 1277 (base 10)	The potassium content is temporarily stored at a high coefficient of sixteen bits	read-write	floating number (IEEE754 Standard floating point)
0 4FD H	4 1278 (base 10)	The temporary storage value coefficient of potassium content is low sixteen bits	read-write	
0 4FE H	4 1279 (base 10)	The deviation	read-	integer

		value of the temporary storage value of potassium content	write	
07D0 H	42001 (base 10)	device address	read-write	1~254 (factory default 1)
07D1 H	42002 (base 10)	Device baud rate	read-write	0 represents 2400 1 represents 4800 2 represents 9600

When the 1:0004H register does not perform a write operation, the value in the register is f1 (the measured conductivity). After the 0004H register performs a write operation, the register stores the written value.
When the 2:0005H register does not perform the write operation, the value in the register is f2 (the measured conductivity value). After the 0005H register performs the write operation, the register stores the written value.
When the 3:0006H register does not perform the write operation, the value in the register is f3 (the measured conductivity value). After the 0006H register is executed the write operation, the register stores the written value.

5.4 Example and explanation of communication protocol

For example, read the parameter value of the four-in-one device for conductivity, temperature and moisture (address 0x01)

Inquiry frame

address code	FC	start address	DL	Check code low byte	Check code high byte
0x 01	0x0 3	0x00 0x0 0	0x00 0x0 4	0x 44	0x 09

acknowledgement frame

address code	FC	Return valid Number of bytes	Moisture value	temperature scale	Conductivity value	PH price	check code lower byte	check code high byte
0x 01	0x0 3	0x0 8	0x02 0x92	0xFF 0x9B	0x03 0xE8	0x00 0x38	0x57	0xB6

Temperature calculation:

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

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

Water content calculation:

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

Conductivity calculation:

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

PH value calculation:

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

Chapter 6 Common Problems and Solutions

6.1 Pay attention to no output or output error

probable cause:

① The computer has a COM port, and the selected port is not correct.

②, baud rate error.

③ The 485 bus is disconnected, or the A and B lines are connected in reverse.

④ If the number of devices is too large or the wiring is too long, power supply should be provided nearby, add 48 5 enhancer, and add 120Ω terminal resistor at the same time.

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

⑥. Equipment damage.