Three-pin soil NPK storage
（Type 485）

PR-3002-TR-NPK-N01

Ver 2.0

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第 1 章 Product introduction

1.1 product description

The soil NPK storage is a device that supports writing NPK parameters through the 485 command to achieve the purpose of displaying data for on-site users, thereby facilitating the customer's systematic evaluation of soil conditions.

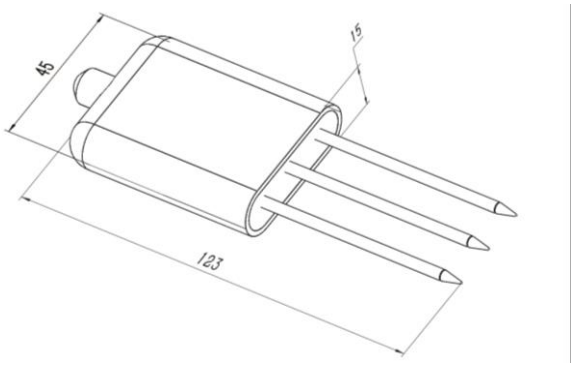
1.2 Features

It is widely used in rice fields, greenhouse planting, rice, vegetable planting, orchard nurseries, flowers and soil research.

1.3 The main parameters

DC power supply (default)	DC 5-30V	
Maximum power consumption	≤0.15W（@12V DC，25℃）	
Operating temperature	0℃~55℃	
NPK parameters (input after measurement by the national standard method)	range	0-2999 mg/kg(mg/L)
	Resolution	1 mg/kg(mg/L)
	Typical accuracy	≤5% (subject to the actual measuring instrument)
Response time	＜1S	
Protection class	IP68	
Steel needle material	Stainless steel	
Sealing material	Black flame retardant epoxy resin	
Default cable length	2 meters, cable length can be customized	
Dimensions	45*15*123mm	
output signal	RS485 (Modbus protocol)	

Shell size



Equipment dimension drawing (unit: mm)

1.4 System frame diagram

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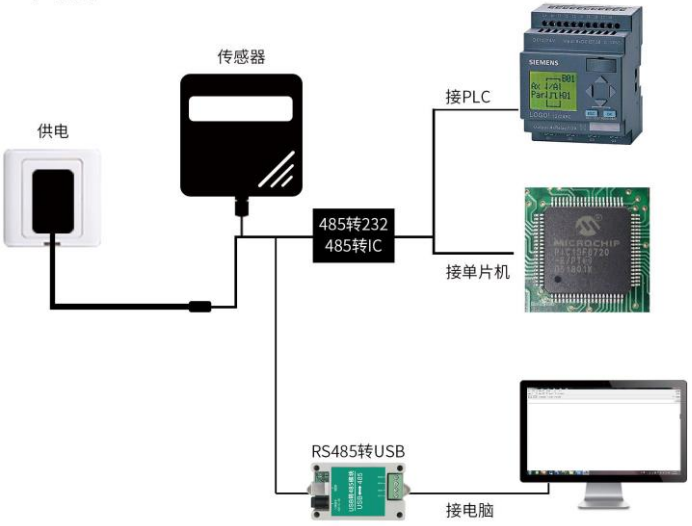

This product can also be used in combination of multiple devices on a 485 bus. In theory, a bus can have 254 485 devices, the other end is connected to a PLC with a 485 interface, connected to a single-chip microcomputer through a 485 interface chip, or use USB to 485 to communicate with Computer connection,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

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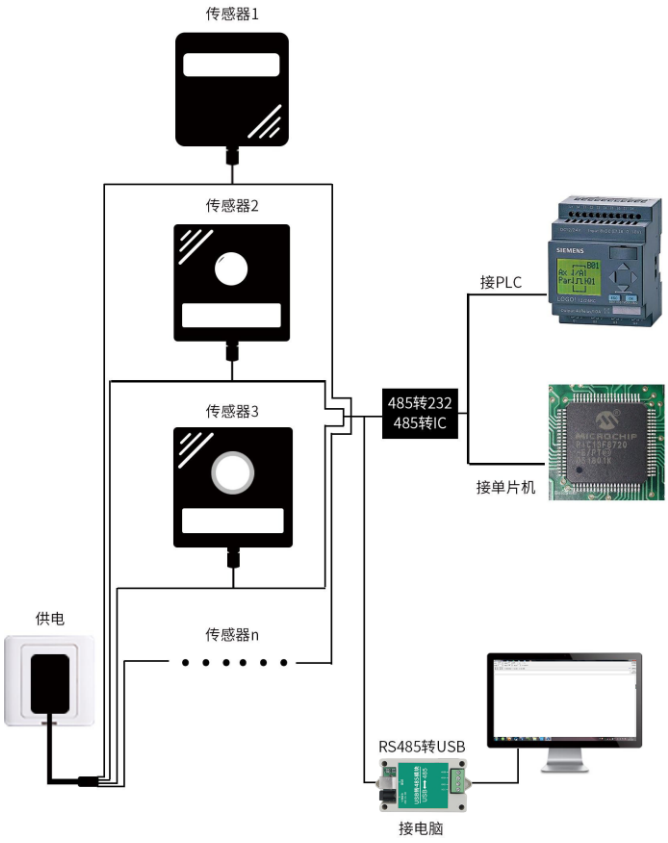


1.5 product model

PR-					company code
	3002-				
		TR-			Soil Detection Shell
			N-		soil nitrogen storage
			P-		soil phosphorus storage
			K-		soil potassium storage
			NPK-		Three-in-one storage of soil nitrogen, phosphorus and potassium
				N01	RS485 (Modbus protocol)

第 2 章 hardware connection

2.1 Equipment pre-installation inspection

- Equipment List:
- · One device
- Certificate, Warranty Card

2.2 Interface Description

The power interface is wide voltage power input 5-30V. When wiring the 485 signal line, pay attention that the two lines A and B cannot be reversed, and the addresses of multiple devices on the bus cannot be conflicted.

2.2.1 Equipment wiring

thread color	illustrate	Remark
brown	Power is positive	5~30V DC
black	power ground	GND
yellow	485-A	485-A
blue	485-B	485-B

第 3 章 Instructions

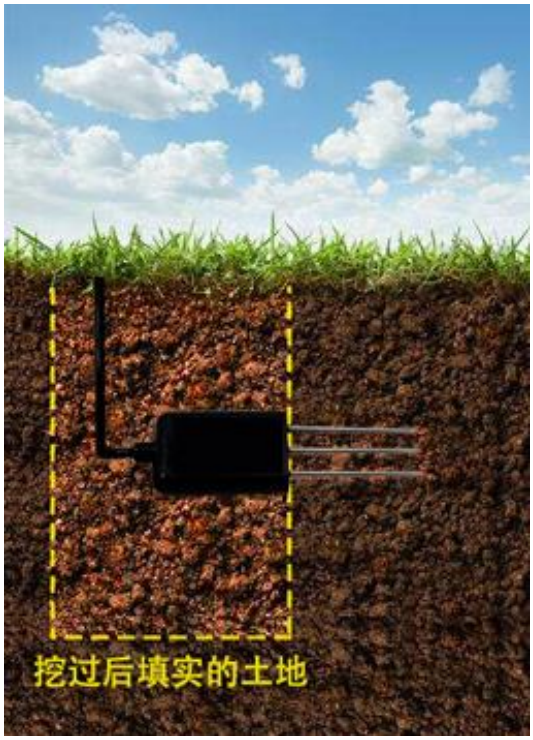
3.1 Quick test method

Select a suitable measurement location, avoid stones, ensure that the steel needle does not touch hard objects, discard the topsoil according to the required measurement depth, maintain the original tightness of the soil below, firmly hold the

device and insert it into the soil vertically. It is not allowed to shake left and right. It is recommended to measure multiple times within a small range of a measuring point to obtain an average value.

3.2 Buried Surveying

Dig a pit with a diameter > 20cm vertically, insert the equipment steel needle into the pit wall horizontally 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 Precautions

1. The steel needle must be fully inserted into the soil when measuring.
2. Avoid direct sunlight on the device 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, do not pull the lead wire of the device forcibly, and do not beat or violently hit the device.
4. The protection level of the equipment is IP68, and the whole equipment can be soaked in water.
5. Due to the existence of radio frequency electromagnetic radiation in the air, it is not suitable to be energized in the air for a long time.

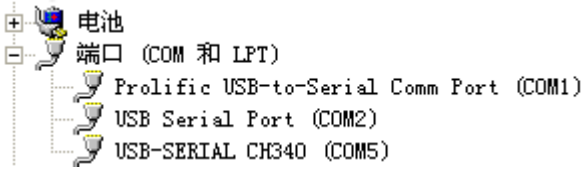
第 4 章 Configuration software installation and use

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

Note that there is only one device on the 485 bus when using automatic acquisition by software.

4.1Connect the device to the computer

After the device is correctly connected to the computer via USB to 485 and provides 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 

Just 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 the technician for help.

4.2 Use of equipment monitoring software

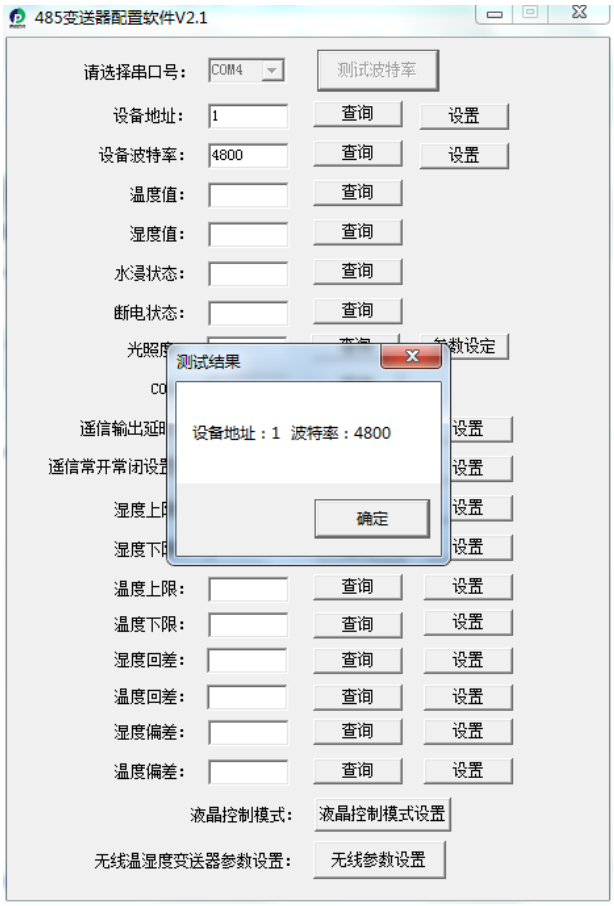
①. The configuration interface is shown in the figure. First, obtain the serial port number according to the method in Chapter 3.1 and select the correct serial port.

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 functional status of the device.

④. If the test is unsuccessful, please re-check the wiring of the equipment and the installation of the 485 driver.



第 5 章 letter of agreement

5.1 Communication basic parameters

coding	8 bit binary
data bits	8 bits
parity bit	none
stop bit	1 person
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: This product uses function codes 0x03, 0x06, 0x10, etc.

Data area: The data area is the specific communication data, pay attention to the high byte of the 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	Check code high
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave response frame structure:

address code	function code	number of valid 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

5.3 register address

register address	PLC or configuration address	content	operate	Definition description
001E H	40031 (decimal)	Temporary value of nitrogen content	read and write	Nitrogen content value written or test value 1
001F H	40032 (decimal)	Temporary value of phosphorus content	read and write	Written phosphorus content value or test value 2
0020 H	40033 (decimal)	Temporary value of potassium content	read and write	Written potassium value or test value3
03E8 H	41001 (decimal)	The coefficient of the temporary storage value of nitrogen content is 16 digits higher	read and write	floating point number
03E9 H	41002 (decimal)	The lowest 16 digits of the coefficient of the temporary storage value of nitrogen content	read and write	
03EA H	41003 (decimal)	Deviation value of nitrogen content temporary value	read and write	integer
03F2 H	41011 (decimal)	The coefficient of temporary storage value of phosphorus content is 16 digits higher	read and write	floating point number (IEEE754 standard floating point)
03F3 H	41012 (decimal)	The low sixteen digits of the coefficient of	read and write	

		temporary storage value of phosphorus content		
03F4 H	41013 (decimal)	Deviation value of temporary storage value of phosphorus content	read and write	
03FC H	41021 (decimal)	The coefficient of temporary storage value of potassium content is 16 digits higher	read and write	integer floating point number
03FD H	41022 (decimal)	The lowest sixteen digits of the coefficient of temporary storage value of potassium content	read and write	
03FE H	41023 (decimal)	Deviation value of temporary value of potassium content	read and write	(IEEE754 standard floating point)
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 for 4800 2 for 9600

1: When the 001EH register is not written, the value in the register is f1 (conductivity measurement value). After the 001EH register is written, the register stores the written value.

2: When the 001FH register is not written, the value in the register is f2 (conductivity measurement value). After the 001FH register is written, the register stores the written value.

3: When the 0020H register is not written, the value in the register is f3 (conductivity measurement value). After the 0020H register is written, the register stores the written value.

5.4 Communication protocol example and explanation

5.4.1Example: Read the temporary storage value of nitrogen content at device address 0x01

query frame

address code	function code	initial address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x00 0x1E	0x00 0x01	0xE4	0x0C

acknowledgment frame

address code	function code	Returns the number of valid bytes	temporary value	Check code low byte	Check code high byte
0x01	0x03	0x02	0x00 0x20	0xB9	0x9C

Calculation of temporary storage value of nitrogen content:

Temporary storage value of nitrogen content: 0020 H (hexadecimal) = 32 => nitrogen = 32mg/kg

5.4.2Example: Read the temporary storage value of phosphorus content at device address 0x01

query frame

address code	function code	initial address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x00 0x1F	0x00 0x01	0xB5	0xCC

acknowledgment frame

address code	function code	Returns the number of valid bytes	temporary value	Check code low byte	Check code high byte
0x01	0x03	0x02	0x00 0x25	0x79	0x9F

Calculation of temporary storage value of phosphorus content:

Temporary storage value of phosphorus content: 0025 H (hexadecimal) = 37 => phosphorus = 37mg/kg

5.4.3Example: Read the temporary storage value of potassium content at device address 0x01

query frame

address code	function code	initial address	Data length	Check code low byte	Check code high byte
0x01	0x03	0x00 0x20	0x00 0x01	0x85	0xC0

acknowledgment frame

address code	function code	Returns the number of valid bytes	temporary value	Check code low byte	Check code high byte
0x01	0x03	0x02	0x00 0x30	0xB8	0x50

Calculation of temporary storage value of potassium content:

Temporary storage value of potassium content: 0030 H (hexadecimal) = 48 => potassium = 48mg/kg

第 6 章 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 lines are reversed.

④. If the number of devices is too much or the wiring is too long, power supply should be provided nearby, add 485 booster, and increase 120Ω terminal resistance at the same time.

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

⑥, equipment damage.