TR06ZL-N01-1-*
Soil tension sensor
User Manual

SIBO.X INDUSTRIAL CO.,LTD.
Add: No. Building 1, No. 1, Jingshi Road, Cicheng Town Industrial Park, Jiangbei District, Ningbo City, Zhejiang, China
https://www.sbxsun.com
Email: info@sbxsun.com
Tel: +86-15958288207

Table of Contents

1.Product introduction

1.1 Product overview

1.1 The growth of plants requires a certain amount of soil water, and the content of soil water has an important impact on the growth and development of plants. With the development of agriculture, the requirements for crop yield and quality are getting higher and higher, so it is necessary to know the precise irrigation cycle of plants and give them an irrigation time point. The soil tension sensor can give such an irrigation point. It can clearly tell the grower whether the plant is short of water, how often it will be short of water, and how often it will be irrigated. Thereby improving the product and quality of crops.

In modern agriculture, the role of soil tension sensors is very significant. After the soil tension sensor collects the soil moisture dynamic content data of the planted crops, more precise irrigation measures are carried out according to the growth of the crops. Not only can it record the soil tension change data, but it can also help the grower continue to replenish the soil of the crop species. Environmental data are of great significance for improving crop varieties and improving crop quality and yield. The product adopts standard Modbus-RTU485 communication, which can communicate up to 2000 meters.

The product adopts transparent PVC plastic pipe, which can clearly see the amount of water remaining in the equipment, which is convenient for adding water. The product is suitable for places that need to detect soil moisture and drought information, and is mostly used in agricultural crop planting to monitor whether the crop is lacking water, so as to better water the crop.

1.2 Features

The product shell adopts transparent PVC plastic pipe, which can directly observe the water level, has a fast response speed, and effectively perceives the soil environment.

Choose high-quality clay heads, which are fast permeable and airtight, and have high sensitivity.

It is not affected by salt ions in the soil, and agricultural activities such as chemical fertilizers, pesticides, and irrigation will not affect the measurement results, and the data is accurate.

The product adopts the standard Modbus-RTU485 communication mode, and the farthest communication is 2000 meters.

Support 10-24V wide voltage charging.

1.3 Technical Parameters

Power supply	10-24V wide DC power supply

Operating temperature	0℃-60℃
Measuring range	-100kpa-0
measurement accuracy	±0.5kpa (25℃)
Resolution	0.1kpa
Shell material	Transparent PVC plastic pipe
Protection level	IP67
output signal	RS485 (Modbus protocol)
Power consumption	0.8W (DC24V power supply)
Response time	200ms

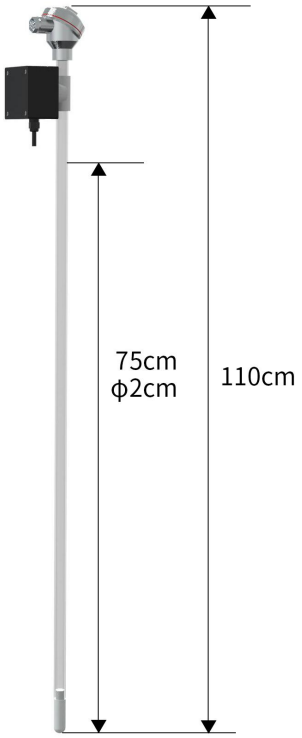
1.4 product model

TR06ZL-				Soil tension sensor
	N01-			Standard Modbus-RTU485 communication
		1-		Soil tension sensor housing
			15	Measuring depth 15cm
			30	Measuring depth 30cm
			45	Measuring depth 45cm
			60	Measuring depth 60cm
			75	Measuring depth 75cm
			90	Measuring depth 90cm
			105	Measuring depth 105cm
			120	Measuring depth 120cm

2. Equipment installation instructions

2.1 Equipment size and detection height

The product adopts a bottom monitoring structure, insert the bottom of the device into the soil to the depth that needs to be monitored, and monitor the soil tension at this depth (such as monitoring a depth of 75cm). As shown below:



2.2 Inspection before equipment installation

2.2.1 Equipment List

One soil tension sensor

One copy of certificate, warranty card, etc.

One USB to 485 (optional)

Soil drill (optional)

Prepare your own checklist

Water, bucket, gloves, soil drill (choose according to personal needs)

2.2.2 How to use the equipment

1. Prepare cold boiled water (there is no air in the water), boil tap water for 20 minutes, and let it cool for later use.

2. Exhaust the clay head, unscrew the top end cap, unplug the silica gel plug, fill in cold water, fill up, stand the instrument upright for 10-40 minutes (do not add a cover), and see water dripping from the surface of the clay head, then Plug the silica gel plug and wrap the clay head with a paper towel to absorb water so that the soil tension reaches about -40kpa. If you see bubbles rising, you can also shake the device to exhaust as much as possible. Repeat this process 2-3 times.

3. Submerge the clay head in the water, wait for the soil tension to return to within -10kpa, fill up again with water, plug the silica gel plug, screw on the top end cap, and set aside.

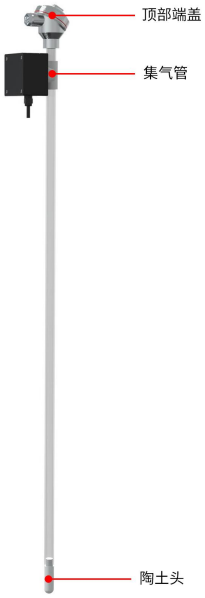
Other considerations:

1) Avoid greasy dirt on the clay head to avoid clogging the micropores and causing the instrument to malfunction.

2) The measuring range of the instrument is -100Kpa-0. When this limit is exceeded, the instrument will leak air due to the rupture of the wall of the clay head tube, making the instrument useless.

3) Regularly check, fill the sensor with cold boiling water, fill it once every half a month to a month (or wait for the water level to drop to the top of the gas collection pipe). Do not loosen the sensor during the filling process.

4) Before the temperature drops to 0℃, the outdoor instruments should be withdrawn to avoid freezing and cracking.



2.2.3 Installation location selection

- Install equipment after the crops are sowed;
- The installation location needs to be flat;
- Under the condition of full irrigation, the area with less water is preferred as the monitoring location; under the condition of local irrigation, the wet area is selected as the monitoring location;
- Choose a position where the growth of crops is balanced and can represent the growth of most crops;
- Understand the root distribution of the monitored crop, and generally choose a location close to the water-absorbing root system of the crop.

Note: The installation site of the equipment should be selected at a relatively high terrain to prevent rainwater from pouring into the equipment and causing short circuits or line failures.

2.3 Installation method

Step 1: Use a soil drill to drill holes in the right position

1. Put the 20mm diameter soil drill upright on the ground, hold the handle with both hands and press it down and slowly rotate it clockwise. (Note: Don't use too much force, make sure to rotate a few more times slowly to prevent the drill bit from running off to the hole.)

2. Take the soil drill out of the hole, put it in a bucket, and collect the soil in the soil drill into the bucket for the next step and mud.

3. Repeat the above-mentioned drilling and soil extraction, and in the process, try to put the sensor into the hole gently (do not force the device to touch the bottom) to test whether the depth of the hole is appropriate; if there is a jam, then Use soil drills to make corrections to ensure that the sensor is placed and taken out smoothly; until the depth of the hole is flush with the installation position marked by the sensor, the drilling is completed.

Step 2: Make the mud

1. Pick out impurities in the soil, stones, grass roots, and insoluble clods. Rub the soil finely to mix with the mud.

2. Pour in an appropriate amount of water and stir well until it becomes viscous; the loam mud is generally not thicker than "sesame paste"; and the mud is completed.

Step 3: grouting installation

1. Pour the mud slowly into the hole, about 1/2 of the hole; it can be increased or decreased according to the actual situation.

2. Slowly put the sensor into the hole, slowly turn it in one direction and press it down. If the speed is too fast, the bubbles may not be discharged completely. (Note: Do not pull up the sensor during the process of turning and pressing again to prevent gas from being sucked into the hole again)

3. When the sensor is installed to the correct depth (zero scale line is flush with the ground), some mud will overflow around the equipment, and the grouting is completed. (Note: Remove excess mud beyond 3CM around the sensor to prevent agglomeration from affecting moisture infiltration)

Step 4: Installation is complete

Data collection can be performed 24 hours after the equipment is connected to the power line and the 485 communication line.

1. The main points of sand installation

The sandy soil installation is the same as the loam standard installation procedure. It should be noted that sufficient water must be prepared. Before grouting, pour water into the hole and wet the entire wall of the hole until excess water appears at the bottom of the hole. Then follow the steps to slowly pour the mud into the hole, about half of the hole. The rest of the installation steps can refer to the installation of loam.

2. Clay installation points

Installation of the clay After drilling the hole to collect the soil, after cleaning up the impurities, soak the clay in water for more than 4 hours to soften the clay and make it easier to live into a more uniform slurry. After the soaking is complete, stir it into a viscous shape, and just grouting. The rest of the installation steps can refer to the installation of loam.

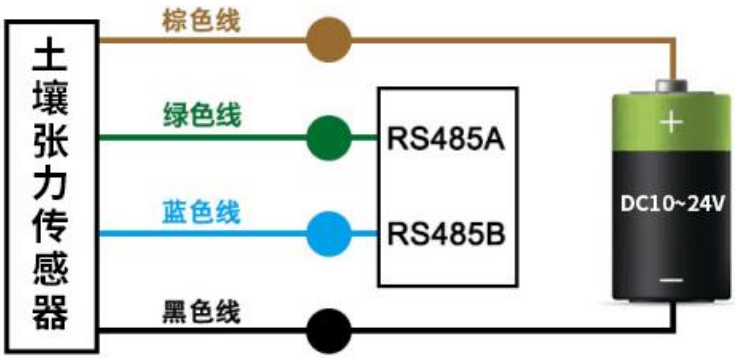
2.4 Product wiring instructions

Power and 485 signal

Wide-voltage power input can be 10~24V. When wiring the 485 signal line, pay attention to the two wires A\B not to be reversed, and the addresses of multiple devices on the bus cannot be conflicted.

	Thread color	Description
Electricity source	brown	Positive power supply (10~24V DC)
	black	Power negative

through	green	485-A
letter	blue	485-B



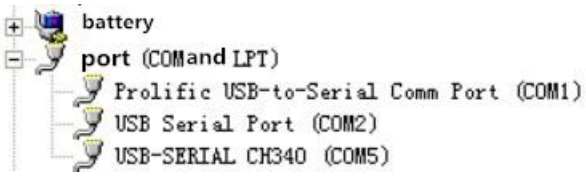
3. Configuration software installation and use

3.1 Software selection

Open the data package, select "Debugging Software" --- "485 Parameter Configuration Software", find and open it. Note: When using the configuration software to change the address and baud rate, only one device can be connected.

3.2 Parameter setting

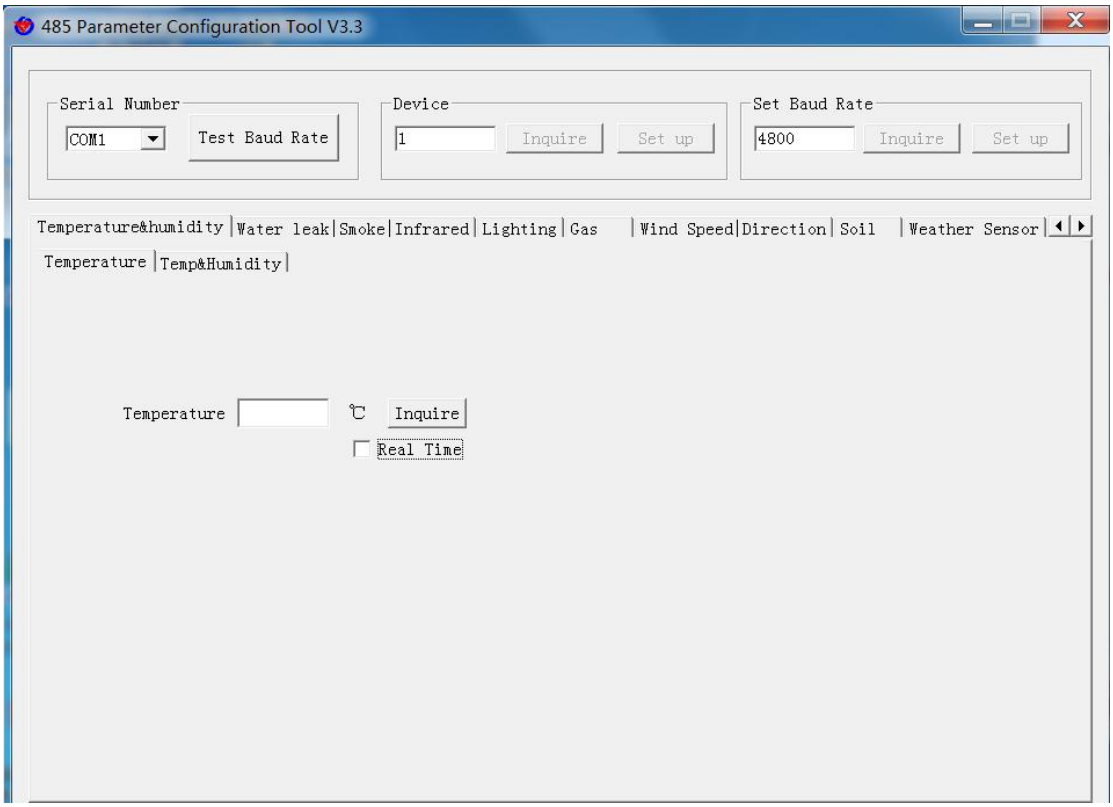
①. Select the correct COM port (check the COM port in "My Computer—Properties—Device Manager—Port"). The following figure lists the driver names of several different 485 converters.



② Connect only one device alone and power it on, 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.


485 Parameter Configuration Tool V3.3
Serial Number
COM1
Test Baud Rate
Device
1
Inquire
Set up
Set Baud Rate
4800
Inquire
Set up
Temperature&humidity
Water leak
Smoke
Infrared
Lighting
Gas
Wind Speed
Direction
Soil
Weather Sensor
Temperature
Temp&Humidity
Temperature
℃
Inquire
Real Time

4. Communication protocol

4.1 Basic communication parameters

Code	8-bit binary
Data bit	8-bit
Parity bit	no
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

4.2 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. The transmitter uses function codes 0x03 (read register data) and 0x06 (write register data).

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 bit	High bit of check code
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Slave machine 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

4.3 Register address

Register address	PLC or configuration address	content	Function code (hexadecimal)
0000 H	40001	Soil tension value	03/04
0001 H	40002	(16-bit signed number, the actual value is expanded by 10 times)	03/04

4.4 Communication protocol example and explanation

Example: Read the soil tension value of device address 0x01

Inquiry frame (hexadecimal):

address code	function code	initial address	Data length	Check code low bit	High bit of check code
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

Response frame (hexadecimal): (for example, the tension value is -10.1kpa)

address code	function code	Returns the number of valid bytes	Tension value	Check code low bit	High bit of check code
0x01	0x03	0x02	0xFF 0x9B	0xB8	0x1F

Tension calculation:

The tension data is uploaded in the form of complement

FF9B is hexadecimal, converted to decimal to -101, tension value = reading value *0.1= -101*0.1= -10.1kpa

Tension value: FF9B (hexadecimal) = -101 => Tension value = -10.1kpa

5.Common problems and solutions

The device cannot connect to the PLC or computer

possible reason:

1) The computer has multiple COM ports, and the selected port is incorrect

2) The device address is wrong, or there are devices with duplicate addresses (the factory defaults are all 1).

3) The baud rate, check method, data bit, stop bit are wrong.

4) The 485 bus is disconnected, or the A and B wires are reversed

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

6) USB to 485 driver is not installed or damaged

7) The equipment is damaged