Soil Tension Sensor user manual

RS-TRZL-N01-1-*

Contents

1. Product introduction 3
1.1 Overview 3
1.2 Features 3
1.3 Technical Parameters 4
1.4 Product selection 4
2. Installation Notes 4
2.1 Dimensions and Detection Height 4
2.2 Pre-installation inspection 5
2.2.1 Equipment List 5
2.2.2 Instructions 5
2.2.3 Location selection 6
2.3 Installation method 6
2.4 Wiring Instructions 9
3. **Communication Protocol** 10
4. Common problems and solutions 11

1. Product introduction

1.1 Overview

The growth of plants requires a certain amount of soil water, and the content of soil water has an important impact on plant growth and development. 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. Soil tension sensors can give such an irrigation point. It can clearly tell the grower whether the plant is short of water, how long it will be short of water, and how often to irrigate. Thereby improving the product and quality of the crop.

In modern agriculture, the role of soil tension sensors is very significant. After the soil tension sensor collects the data of the dynamic content of soil moisture in the planted crops, more precise irrigation measures can be carried out according to the growth of the crops, which can not only record the data of soil tension changes, but also help growers to continuously replenish the soil of crop types Environmental data is of great significance for improving crop varieties, improving crop quality and yield. The product adopts standard Modbus-RTU485 communication, and the longest communication distance is 2000 meters.

The product uses a transparent PVC plastic tube, which can clearly see the amount of remaining water in the equipment, and it is convenient to add water. The product is suitable for places where soil moisture and drought information need to be detected. It is mostly used in agricultural crop planting to monitor whether the crops are short of water, so as to better irrigate the crops.

1.2 Features

- The shell of the product is made of transparent PVC plastic tube, which can directly observe the water level, has a fast response speed, and can effectively sense the soil environment.
- High-quality clay head is selected, which is fast water-permeable and air-tight, and has high sensitivity.
- Not affected by salt ions in the soil, 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 longest communication distance is 2000 meters.
- Support 10-24V wide voltage charging.

1.3 Technical Parameters

Power	DC10-24V
Working Temperature	0℃-60℃
Range	-100kpa-0
Accuracy	±0.5kpa（25℃）
Resolution	0.1kpa
Shell material	Transparent PVC plastic pipe
IP Rate	IP67
Output	RS485(ModbusProtocols)
Power Dissipation	0.8W（DC24V）
Response time	200ms

1.4 Product selection

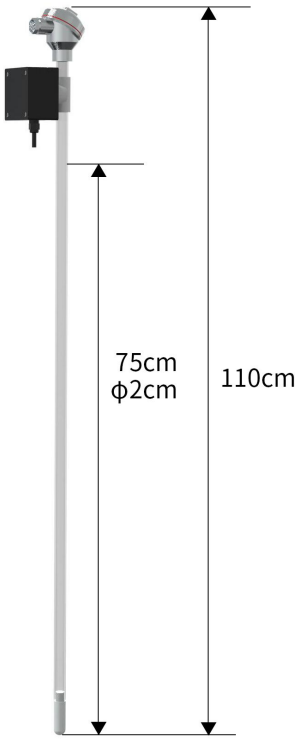
RS-					Name
	TRZL-				Soil Tension Sensor
		N01-			Modbus-RTU485
			1-		Soil Tension Sensor Housing
				15	Measuring depth 15cm
				30	Measuring depth 30cm
				45	Measuring depth 45cm
				60	Measuring depth 60cm
				75	Measuring depth 75cm
				90	Measuring depth 90cm
				105	Measuring depth 105cm
				120	Measuring depth 120cm

2. Installation Notes

2.1 Dimensions 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

(for example, monitor the depth of 75cm). As shown below:



2.2 Pre-installation inspection

2.2.1 Equipment List

One Soil Tension Sensor

A certificate of conformity, a warranty card, etc.

One USB to 485 (optional)

Earth drill (optional)

self-preparation list

Water, buckets, gloves, earth drills (choose according to personal needs)

2.2.2 Instructions

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

2. Exhaust the clay head, unscrew the top end cap, unplug the silicone plug, inject cold boiled water, fill it up, and stand the instrument upright for 10-40 minutes (without the cover), and see water dripping from the surface of the clay head, then Plug the silica gel plug, wrap the clay head with a paper towel to absorb water, and make the soil tension reach 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 into the water, wait for the soil tension to return to less than

-10kpa, fill it up with water again, plug the silicone plug, screw on the top end cap, and set it aside.

Other considerations:

1) The clay head should not be oily, so as not to block the micropores and cause the instrument to fail.

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

3) Check regularly, fill the sensor with cold boiled water, once every half a month to a month (or wait for the water level to drop to the top of the air collecting pipe), and do not loosen the sensor during the filling process.

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

2.2.3 Location selection

- Installation of equipment after planting of crops;
- The installation location needs to be flat;
- Under the condition of comprehensive irrigation, the area with less water is preferred as the monitoring location; under the condition of partial irrigation, the wet area is selected as the monitoring location;
- Select the location where the crop growth is balanced and can represent the growth of most crops;
- To understand the root distribution of the monitored crops, generally choose a location closer to the water-absorbing roots of the crops.

Note: The installation site of the equipment should be selected on a relatively high ground to prevent rainwater from pouring back into the equipment, which may cause equipment short circuit or line failure.

2.3 Installation method

Step 1: Use an earth drill to drill holes in the right place

1. Put the soil drill with a diameter of 20mm vertically on the ground, hold the handle tightly with both hands and turn it slowly clockwise. (Note: Don't use too much force, be sure to turn it slowly for a few more circles to prevent the drill bit from running off to the hole.)

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

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

Step 2: Make the Slurry

1. Pick out impurities in the soil, such as stones, grass roots, clods that are not easy to dissolve, etc. Grind the soil finely to allow it to mix with the mud.

2. Pour in an appropriate amount of water and stir until it becomes viscous; generally, the loam mud should not be thicker than "sesame sauce"; and the mud is finished.

Step 3: Grout Installation

1. Slowly pour the mud 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, turn it slowly in one direction and press down, if the speed is too fast, the air bubbles may not be completely discharged. (Note: the sensor cannot be pulled up during the process of turning and pressing down to prevent the gas from being sucked into the hole again)

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

Step 4: The installation is complete

Data collection can be carried out 24 hours after the device is connected to the power line and the 485 communication line.

1. Sandy soil installation points

Sandy soil installation is the same as the standard installation steps of loam soil, it should be noted that sufficient water should be prepared. Before grouting, pour water into the hole, wetting the entire wall until excess water emerges from the bottom of the hole. Then follow the steps to slowly pour the mud into the hole, about 1/2 of the hole. The rest of the installation steps can refer to the installation of loam soil.

2. Clay installation points

The installation of the clay is done after drilling holes to collect the soil, and after removing impurities, soak the clay in water for more than 4 hours to soften the clay and make it easier to form a relatively uniform mud. After soaking, stir it into a viscous shape and grout it. The rest of the installation steps can refer to the installation of loam soil.

2.4 Wiring Instructions

Power and 485 signal

Wide voltage power supply input 10~24V can be used. When wiring the 485 signal line, pay attention that the A\B lines cannot be reversed, and the addresses of multiple devices on the bus cannot conflict.

	Line color	explanation
Power	Brown	+（10~24V DC）
	Black	-
Communication	Green	485-A
	Blue	485-B

3. Communication Protocol

3.1 Communication Basic Parameters

Code	8-bit binary
Data bits	8 Bit
Parity bits	No
Stop Bit	1 Bit
Error check	CRC (redundant cyclic code)
Baud Rate	2400bit/s, 4800bit/s, 9600bit/s can be set, the factory default is 4800bit/s

3.2 Data frame format definition

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

Time for initial structure ≥ 4 bytes

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error checking = 16-bit CRC code

Time to end structure ≥ 4 bytes

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

Function code: the instruction function instruction sent by the host, the transmitter uses function code 0x03 (read register data), 0x06 (write 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 inquiry frame structure:

Address	Function Code	Register start address	Register length	Low bit of check code	High bit of check code
1 bit	1 bit	2 bit	2 bit	1 bit	1 bit

Slave response frame structure:

Address	Function Code	Effective bit number	Data Area 1	Data Area 2	Nth data area	Check Code
1 bit	1 bit	1 bit	2 bit	2 bit	2 bit	2 bit

3.3 Register address

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

3.4 Communication Protocol Example and Explanation

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

Query frame (hex):

Address	Function Code	Register start address	Register length	Low bit of check code	High bit of check code
0x01	0x03	0x00 0x00	0x00 0x01	0x84	0x0A

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

Address	Function Code	Return the effective number of bits	Tension value	Low bit of check code	High bit of check code

0x01	0x03	0x02	0xFF 0x9B	0xB8	0x1F

Tension calculation:

Tension data is uploaded in complement form

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

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

4. 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 (factory defaults are all 1).

3) Baud rate, parity mode, data bit, stop bit error.

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

5) If there are too many devices or the wiring is too long, the nearby power supply should be added, a 485 booster should be added, and a 120Ω terminal resistance should be added at the same time.

6) The USB to 485 driver is not installed or damaged

7) The equipment is damaged.