

Instructions for use of soil water
potential transmitter

JXBS-3001-SWP
Ver1.0

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Chapter 1 Product Introduction

1.1 Product overview

The soil water potential sensor is a sensor independently developed by our company that can measure the change of soil moisture at any point in the soil. It is also a sensor based on the principle of dielectric constant; it can quickly, accurately, and accurately measure the soil moisture in different soil layers. Comprehensive monitoring. Soil moisture plays a very important role in the growth of crops. The soil water potential sensor developed by our company can accurately detect the changes in soil moisture, and improve the soil through the detected data, so that the crops are in the best living environment, thereby increasing yield , And greatly facilitate the customer's systematic assessment of soil conditions.

1.2 Application environment

It is widely used in the monitoring of various environmental humidity such as garden irrigation monitoring, moisture monitoring, farming guidance, water

conservancy construction, mine monitoring, geological prospecting, scientific experiment and pasture planting.

1.3 Product features

- Real-time monitoring of soil moisture at different levels
- Move up and down in the plastic pipe to realize the dynamic observation of the soil moisture content of each soil layer
- The equipment adopts standard modbus protocol

1.4 Product advantages

- Using highly sensitive probes, fast response
- Stable, reliable, accurate measurement
- Small zero drift and good repeatability
- Product protection grade IP67
- The product has passed various environmental tests and has anti-interference ability

1.5 Product parameters

parameter name	Parameter content
Water potential measurement range	0~-100kPa
measurement accuracy	±0.1%F.s
Resolution	0.1kPa
communication method	RS485
Protection level	IP67
Operating temperature	5°C-45°C

Working humidity	0 to 95% (relative humidity), no condensation
DC power supply (default)	12-24V DC
Power consumption	$\leq 0.5W$ (@12V DC, 25°C)
output signal	RS485 output (Modbus protocol)
Working pressure range	0.9-1.1 atm

Chapter 2 Hardware Connection

2.1 Product appearance

The following two pictures are the external dimensions of the 485 version, as shown in the figure:



2.2 Product list

Please check the equipment list before installing the equipment

name	Quantity
High precision sensor	1 set
12V waterproof power supply	1 set (optional)

USB to device	485	1 (optional)	set
Warranty card/certificate		1 份	

2.3 Wiring instructions

The equipment power supply adopts 12V DC power supply. When wiring the 485 signal line, pay attention to the two wires A and B not to be reversed, as shown in the figure (table):



电源：棕色 电源正 (12-24V)
 黑色 电源负
 通信：黄色 485-A
 蓝色 485-B

	Thread color	Description
power supply	brown	Power is positive (12-24V DC)
	black	Power negative
Communication	Yellow	485-A
	(gray) color blue	485-B

The factory default provides 1.25 meters long wire, customers can extend the wire as needed or wire in order. Note that there

is no yellow line in the line sequence that may be provided in some factory batches. At this time, the gray line is equivalent to replace the yellow line.

2.4 Use matters

(1) When using and installing the soil water potential sensor, the two links of using airless water and removing the air in the clay pipe are mainly mastered. The air in the degas cylinder not only affects the measurement accuracy of the instrument and causes delays, but also seriously affects the normal use of the instrument.

(2) Inject airless water (cold boiled water) into the water potential sensor until it is full, stand the sensor upright for 10-20 minutes (without a lid), let the water wet the clay tube, and see water drip from the surface of the clay tube. Then fill the sensor with airless water, seal it with a lid, and put the instrument upright to let the clay tube evaporate in the air. About two hours later, at this time, there will be buried bubbles escaping from the clay tube, piezoelectric sensor, and plexiglass tube. Tap the sensor gently to concentrate the bubbles on the upper part. Then immerse the clay tube in the airless water. At this time, the transmitter reads back to near zero. Open

the lid, refill with airless water, add the cover to seal, and put the instrument upright to let the clay tube evaporate in the air. The above operation is repeated 2-3 times. Repeat the degassing process several times. While degassing, the air in the sensor is automatically discharged and filled with water.

(3) The instrument is used in wet soil to measure the process from wet to dry, and the water potential sensor can start to measure when it is saturated; if it needs to be used in the dry soil, measure the process from dry to wet, the initial content of the dry soil The amount of water must be within the measuring range of the water potential sensor (<0.85 bar). The water potential sensor must be air-dried to reach the suction value of the measured dry soil, and then inserted into the soil for use.

(4) When used outdoors, due to large temperature changes and long service cycles, it is necessary to take some protective measures for the water potential sensor and transmitter. For example, cover the water potential sensor to avoid sunlight trend. In order to reduce temperature fluctuations on the sensor If affected, the sensor can be buried in the soil. In order to prevent the infiltration of moisture in the soil, a plastic tube sealing sleeve is made to protect the sensor.

- (5) Generally speaking, if the air inside the sensor is basically removed before burying, and the soil humidity is within the measuring range of the sensor, it can be maintained continuously for 20-25 days without adding water. When the temperature drops to freezing point, the sensor should be evacuated.
- (6) The clay head should not be oily to avoid clogging the pores and the sensor failure.
- (7) The instrument is usually used in the temperature range of 5~45°C. At the same time, attention should be paid to avoid interference from other electromagnetic fields.

2.5 Measuring method

Select a suitable measurement location, measure the depth according to the need, and carry out the punch test according to the size, fill the pit tightly, and the measuring instrument starts to work. After a period of stability, it can be carried out for several days, months or even longer. Time measurement and recording. The collection method is shown in the figure:



2.6 Notes

- The measuring instrument must be inserted vertically into the test environment
- When the equipment is buried in the test environment, do not press too hard
- Not suitable for absolute moisture measurement of saline-alkali soil, sandy soil, or other powdery objects with high salt content
- Do not use in environments where soil impurities, stones, roots, and hardly dissolve

Chapter 3 Communication Protocol

3.1 Basic communication parameters

parameter	content
coding	8-bit binary
Data bit	8-bit

Parity bit	No
Stop bit	1-bit
Error checking	CRC (Redundant Cyclic Code)
Baud rate	2400bps/4800bps/9600bps can be set, the factory default is 9600bps

3.2 Data frame format definition

Using Modbus-RTU communication protocol, the format is as follows: Time of initial structure ≥ 4 bytes
 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, this transmitter only uses function code 0x03 (read 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.

Interrogation frame

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

Reply frame

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

3.3 Register address

Register address	PLC configuration address	content	operating
0002H	40003	Soil water potential value (unit: 0.1kPa)	Read only
0100H	40101	Device address (0-252)	Read and write
0101H	40102	Baud (2400/4800/9600)	Read and write

3.4 Communication protocol example and explanation

3.4.1 Read the soil water potential value of the device address 0x01

Interrogation frame

address code	function code	starting address	Data length	Check code low bit	Check code high
0x01	0x03	0x00 0x02	0x00 0x01	0x25	0xCA

Reply frame

address code	function code	Effective words	Water potential	Check code Low	Check code High position
0x01	0x03	0x02	0x02 0x92	0x5A	0x3D

Soil water potential: 0292H (hexadecimal) = 658
=> soil water potential = 65.8kPa