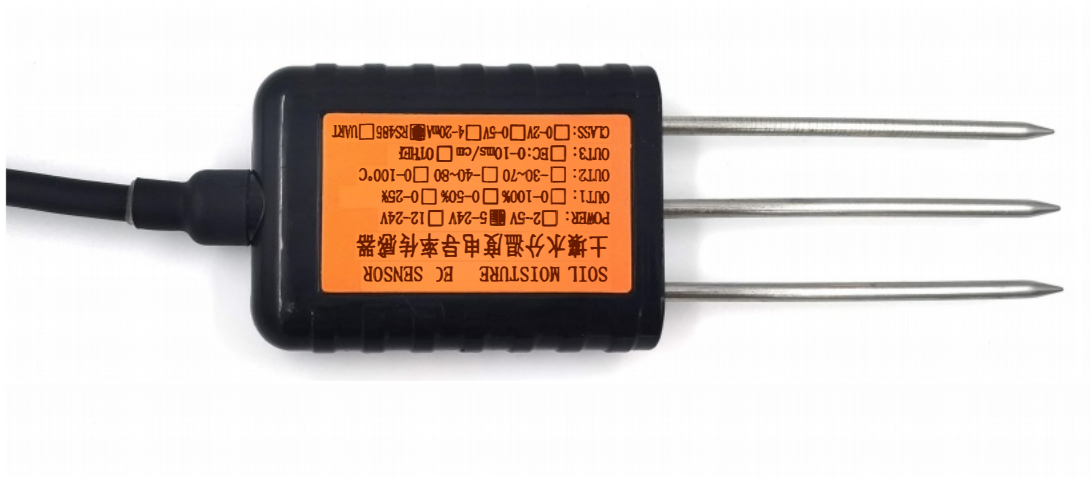


Soil Temp. Humi. EC Sensor

JW-S3S(Z3) Digital Output



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1. Product Introduction

The new developed soil moisture temperature EC three-in-one sensor is a soil sensor developed with a new technical scheme, which can measure soil moisture, temperature and conductivity at the same time, and carry out compensation calculation among parameters, eliminating the influence of conductivity on water, temperature on water and temperature on conductivity, can perform compensation operation and accurate evaluation.

This product can be used to measure the moisture content of saline-alkali land, which is not affected by the salt content of soil and can accurately measure the moisture content of soil.

It adopts imported epoxy resin, high quality stainless steel, more resistance to acid and alkali corrosion, steel needle isolation, never electrolysis, with more than 3 years of service life.

With the multi-directional function of power line, ground line and signal line, can prevent the damage caused by reverse connection, wrong connection and so on.

2. Technical parameter

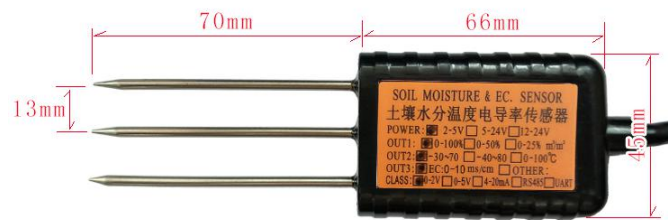
- ※ Working Voltage: DC2-5V; DC5-24V
- ※ Quiescent Current: peak value <30mA · Average<10mA
- ※ Response Time: < 1s
- ※ Measured Stability Time: 2s
- ※ Output: Digital RS485/RS232 Modbus
- ※ Protection Level: IP68
- ※ Working Temperature range: -40°C ~ 85°C
- ※ Measurement Area: center on the central probe in a cylinder withΦ7cm and 10cm height

3. Table of Technical Parameters

Parameters of the category	Moisture	EC (Conductivity)	Temperature
Measuring range	0-100.00%	0-20000uS/cm (25°C) (0-20.0EC)	-40.00°C ~ 85.00°C
Unit	V/V %,Volumetric moisture content of soil	uS/cm, mS/cm	°C centigrade degree
Resolution	0.01%	1 uS/cm	0.01°C
Accuracy	±3%(0-53%) ; ±5%(>53%)	2%FS, 2% of the value	Error < 0.3°C (-10°C ~ 50°C) others <0.6°C
Swap precision	< 3%	< 2%FS	< 0.3°C
Repetition measurement error	< 2%	< 2%FS	< 0.2°C
Response time when powered	1s	1s	1s
Measured stability time	< 2s	< 2s	< 2s
Measurement principle	Frequency domain (FDR) add temperature and conductivity correction	EC measurement, with temperature compensation	RTD Thermal sensor, plus nonlinear correction

4. Product Drawings

- ※ Probe length: 7cm
- ※ Probe diameter: 3mm
- ※ Material: 316 Stainless steel
- ※ Sealing material: Epoxy resin



5. Wiring Definition

5.1 Overall dimensions (see figure below)

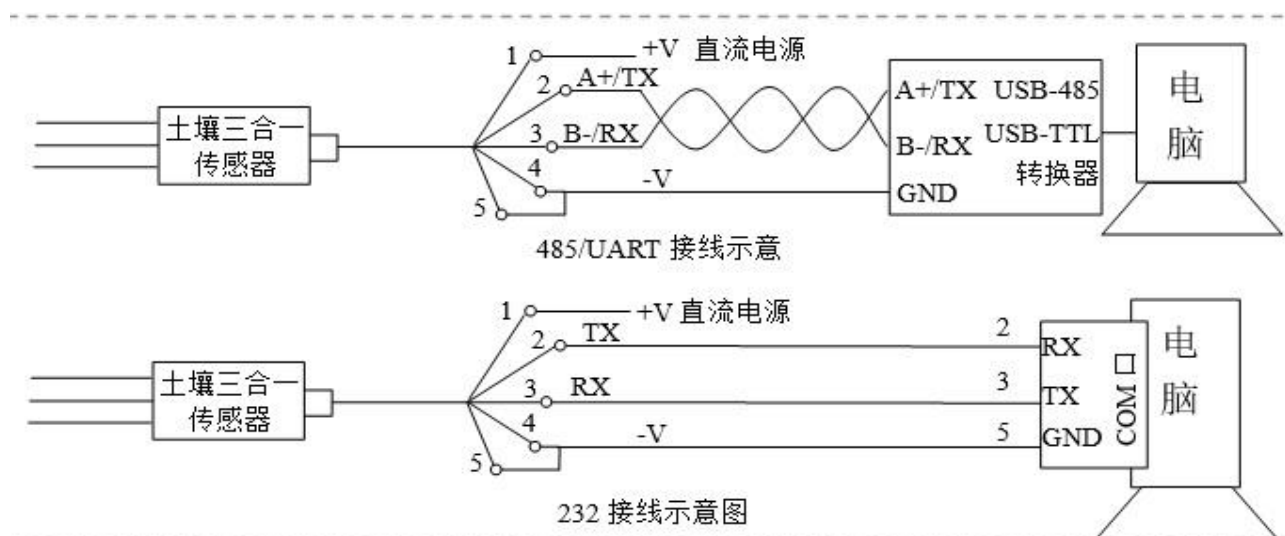
※Cable length: 3.5 m as standard (RVVP4*0.3) · can customized

5.2 Lead definition and wiring instructions(4 core shielded wire)

1. **Brown** : VCC 2. **Blue** : GND 3. **Black** : 485A+ /232TX 4. **Gray** : 485B- /232RX 5. **Shielding layer** : SET end

5.3 Lead definition and wiring instructions (5 core sheath wire)

1. **Red** : VCC 2. **Black** : GND 3. **Green** : 485A+ /232TX 4. **Yellow** : 485B- /232RX 5. **White** : SET end



Mark : When the SET end (terminal) is connected to the negative pole of the power supply, it is in the collection mode; when the SET terminal is connected to the positive pole of the power supply, it is in the setting mode.

6. How To Use

6.1 Communication Parameter Setting

The SET end of the sensor is connected to a high level, and the sensor is in the setting mode, allowing the modification of the internal EEPROM. The communication parameters displayed by the sensor at this

time are fixed as: station address: 255, 9600, n, 8,1. You can set the sensor parameters to change the value of registers 0x200-0x204.

The SET end of the sensor is connected to a low level, and the sensor is in acquisition mode. At this point, the communication parameters set inside the sensor will take effect, that is, the communication will run according to the parameters defined by 0x200-0x204.

In acquisition mode, the internal parameters cannot be modified, even if the sensor responds to the write command · Internal parameters will not be modified.

6.2 Soil measurement

Surface instant measurement: Choose a suitable measurement site, avoid rocks, and ensure that the steel needle will not hit anything hard. Cut the topsoil according to the required measuring depth to maintain the original tightness of the soil below. Hold the sensor and insert it vertically into the soil, do not move it from side to side during insertion. Multiple measurements and averaging are recommended for a small range of measurement points.

Buried measurement: Dig a hole with a diameter of more than 20cm vertically, insert the steel needle of the sensor horizontally into the wall of the hole at a given depth, fill the hole tightly, and measure and record it for several days, months or even longer after it is stabilized for a period of time.

7. Attention

1. The steel needles must all be inserted into the soil during the measurement
2. Avoid excessive temperature caused by direct sunlight on the sensor body. Lightning protection should be paid to field use.
3. Do not bend the steel needle violently, do not pull the lead wire of the sensor; do not beat or slam the sensor violently.
4. The protection level of the sensor is IP68, the sensor can be wholly soaked in water.
5. When multiple sensors are installed in close proximity and powered on at the same time, the installation interval shall not be less than 10cm.
6. Due to the presence of radio frequency electromagnetic radiation in the air, It is not advisable to stay in the state of power in the air for a long time.

8. MODBUS-RTU Communication Protocol

What is a function code: the contents of the second byte sent by the host. Where 03 and 04 function codes means to read register values; 06 function code means to write a single register; 16 function code means to write multiple registers; 17 function code means to read device ID. No responses to other function codes.

Acronym description:

TT: station address, address range 1-255;

SS: starting address, 2 bytes, high bytes in front;

NN: number of registers ($NN \leq 11$), 2 bytes, high byte in front;

MM: number of bytes, 1 byte in front;

RR: register address, one set of 2 bytes, high bytes in front;

VV: register value, one set of 2 bytes, high bytes in front;

CRC: CRC check code;

?? : the version number

1) 03, 04 function code, Read a single (or multiple) register (One time at most 8 registers)

Host send : TT 03 SS SS NN NN CRC1 CRC2 · 8 bytes

Vice device response : TT 03 MM VV VV ° ° ° CRC1 CRC2 · at most 21 bytes

2) 06 Function code, write a single register

Host send : TT 06 RR RR VV VV CRC1 CRC2 · 8 bytes

Vice device response : TT 06 RR RR VV VV CRC1 CRC2 · 8 bytes

3) 16 (0X10) function code · write multiple registers

Host send : TT 10 SS SS NN NN MM VV VV ... CRC1 CRC2 · at most $9+16=25$ bytes

Vice device response : TT 10 SS SS NN NN CRC1 CRC2 · 8 bytes

4) 17 (0X11) function code · Read the device ID

Host send : TT 11 CRC1 CRC2 · 4 bytes

Vice device response : TT 11 0B "BGT-SEC-485??" CRC1 CRC2 · 19 bytes

For example:

(The SET end of the sensor is connected to the negative terminal of the power supply, which is in the acquisition mode, the station address is the factory default value 254) :

Host send : *FE 03 00 00 00 03 11 C4*

Meaning of data :

FE-station address 254 ; *03*-function code ; *00 00* register starting address ; *00 03*-read 3 registers

Sensor response : *FE 03 06 05 DC 09 EC 00 C8 76 F8*

Meaning of data :

FE-station address 254 ; *03*-function code ; *06*-number of bytes ; *05 DC*-To convert to decimal is 1500 · divide 100 equal to 15 · means moisture 15% ; *09 EC*-converted to decimal is 2540 · divide 100 equal to 25.4 · means temperature is 25.4°C ; *00 C8*-To convert to decimal is 200 · Means the conductivity is 200 uS/cm °

Users can send instructions in a fixed format : *FE 03 00 00 00 03 11 C4* , to obtain sensor moisture, temperature and conductivity data.

The internal register address of sensor:

Register address	Register address HEX	Content	Read-write	Range	Function code	Numerical meaning	Marks
00	00	Soil moisture (temperature conductivity compensation)	Read only	0-10000	3/4	0.00-100.00%	
01	01	soil temperature	Read only	-4000~+8000	3/4	-40.0°C~80.00°C*	
02	02	EC Conductivity (temperature compensation)	Read only	0-20000	3/4	0-20000(uS/cm)	Can be greater than 20000
03	03	Salinity TDS (water temperature compensation)	Read only	0-5000	3/4	0-5000(ppm)	Standby, uncalibrated
04	04	Moisture original AD value	Read only	0-65535	3/4	Moisture original AD value	
05	05	Soil moisture (no compensation)	Read only	0-10000	3/4	0.00-100.00%	
06	06		Read only	0-65535	3/4	0-65535	Factory use
07	07		Read only	0-65535	3/4	0-65535	Factory use
08	08	Original conductivity (with temperature drift compensation)	Read only	0-65535	3/4	0-65535	
09	09	Conductivity AD value	Read only	0-65535	3/4	0-65535	
10	0A	Sensor self temperature	Read only	-400-800	3/4	-40.0°C~80.0°C*	uncalibrated
33	0X 21	Moisture temperature compensation coefficient	Read-write	-200~200	3/6/16	-2.00~+2.00	Default 1

* : Signed binary number representation, Binary complement representation.

Register address	Register address HEX	Content	Read-write	Range	Function code	Numerical meaning	Marks
512	0X200	Station address	Read-write	1-255	3/6/16	MODBUS station address	
513	0X201	Baud-rate	Read-write	0-5	3/6/16	0-1200 1-2400 2-4800 3-9600 · default 4-19200 5-38400	
514	0X202	Odd-even check	Read-write	0,1,2	3/6/16	0-No check, default 1-odd check 2-even check	
515	0X203	Receive stop bit	Read-write	0,1	3/6/16	0-1 stop bite · default 1-2 stop bite	
516	0X204	Send stop bit	Read-write	0,1	3/6/16	0-1 stop bite 1-2 stop bite · default	

Marks: Serial communication is a fixed 8-bit data bit.

Register declaration :

Register address **0X00-0X0A** is Read-only area and can read the measured data. Register address **0X200-0X204** is read-write area and can write communication parameters. Registers with the Register address of **0X20-0X36** are the factory settings area, users are not suggested to change that.