Product introduction

The soil temperature, moisture and conductivity integrated sensor has stable performance and high sensitivity, and is an important tool for observing and studying the occurrence, evolution, improvement and water-salt dynamics of saline soil. It can measure soil temperature, soil moisture and soil conductivity at the same time; by measuring the dielectric constant of soil, it can directly and stably reflect the real moisture content of various soils. The soil moisture sensor can measure the volume percentage of soil moisture and is a soil moisture measurement method in line with current international standards.

It is suitable for soil moisture monitoring, scientific experiments, agricultural irrigation, greenhouses, flowers and vegetables, grassland pastures, soil rapid testing, plant cultivation and other occasions.

Has the following characteristics:

(1) Three parameters of soil temperature, soil moisture and electrical conductivity are combined into one.

(2) It can also be used for the conductivity of water and fertilizer integrated solution, as well as other nutrient solutions and substrates.

(3) The electrode is made of alloy material with special treatment, which can withstand strong external impact and is not easy to be damaged.

(4) Completely sealed, resistant to acid and alkali corrosion, and can be buried in soil or directly into water for long-term dynamic testing.

(5) High precision, fast response, good interchangeability, probe insertion design ensures accurate measurement and reliable performance.

(6) Perfect protection circuit.

Technical Parameters

Soil temperature:
Range: -40~80℃; Resolution: 0.1℃;
Accuracy: ±0.5℃
Soil Moisture:
Range: 0-100%; Resolution: 0.1%;
Accuracy: 5%
Soil conductivity:
Range: 0-10000us/cm
Resolution: 1us/cm within 0-10000us/cm
Accuracy: ±5% in the range of 0-10000us/cm
Conductivity temperature compensation, built-in temperature compensation sensor, compensation range 0-50℃
Supply voltage: DC5V-24V or DC12V-24V Signal output: RS485, Modbus protocol Measurement principle:
Soil Moisture FDR Method, Soil Conductivity AC Bridge Method
Protection grade: IP68 can be used for a long time when immersed in water
Operating environment: -40~85℃
Probe material: anti-corrosion special electrode
Sealing material: black flame retardant epoxy resin
Installation method: all buried or all probes are inserted into the measured medium
Default cable length: 5 meters;
Connection method:
Pre-installed cold-pressed terminal
Dimensions: 45*15*135mm
Electrode length: 50mm

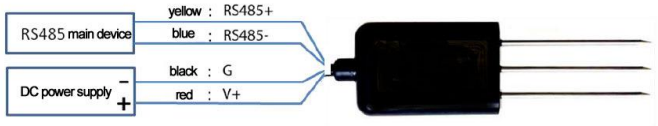
Connection method

(1) If equipped with the weather station produced by our company, directly use the sensor cable to connect the sensor to the corresponding interface on the weather station.

(2) If the transmitter is purchased separately, the matching line sequence of the transmitter is as

follows：

Line color	Output signal
	Communication type
Red	+
Black	-
Yellow	A+/TX
Blue	B-/RX



Installation and Measurement

Since the electrode directly measures the conductivity of the soluble salt ions in the soil, the soluble ions in the soil can correctly reflect the conductivity of the soil when the soil volumetric water content is higher than about 20%. In long-term observations, measurements after irrigation or rainfall are closer to the true level. If a quick test is performed, the soil to be tested can be watered first, and the measurement can be performed after the water has fully penetrated.

(1) Quick measurement method: Select a suitable measurement location, avoid stones, ensure that the electrode does not touch hard objects such as stones, and plan the topsoil according to the required measurement depth to maintain the original tightness of the soil below. , Hold the sensor body vertically and insert it into the soil, do not shake it back and forth, left and right when inserting, and ensure that it is in close contact with the soil. In a small range of a measuring point, it is recommended to measure multiple times to obtain an average.

(2) Buried measurement method: According to the required depth, vertically dig a pit with a diameter greater than 20 cm, and the depth is according to the measurement needs, and then insert the sensor steel needle into the pit wall horizontally at a given depth, and bury the pit and compact it to ensure that the electrode and the soil in close contact. After a period of stabilization, measurements and recordings can be made for days, months, or even longer.

If you measure on a hard surface, you should drill a hole first (the hole diameter should be smaller than the diameter of the probe), then insert it into the soil and compact the soil before measuring; the sensor should prevent violent vibration and impact, and it should not be knocked with hard objects. Since the sensor is packaged in black, the temperature of the sensor will rise rapidly (up to 50°C or more) under strong sunlight. In order to prevent excessive temperature from affecting the temperature measurement of the sensor, please pay attention to shading and protection when using it in the field or outdoors.

MODBUS Communication protocol

Communication parameters: baud rate 9600, 8 data bits, no parity bit
The interval between two communications should be at least 1000ms or more
【1】Write the device address
Send: 00 10 Address CRC (5 bytes)
Returns: 00 10 CRC (4 bytes)
Description: 1. The address bit of the read and write address command must be 00
2. Address is 1 byte, the range is 0-255
For example: send 00 10 01 BD C0
Return: 00 10 00 7C

【2】 Read the device address
Send: 00 20 CRC (4 bytes)
Returns: 00 20 Address CRC (5 bytes)
Description: Address is 1 byte, the range is 0-255
For example: send 00 20 00 68
Return: 00 20 01 A9 C0

A. Read real-time data:
Suppose the device address is: 0x01, the valid range is 0~254, and 0 is the broadcast address.
Such as sending: 01 03 00 00 00 03 05 CB

No.	implication	Excursion	byte count	explanation

1	Device address	0	1	Unique address of the device
2	Opcode (Read)	1	1	Fixed value 0x03
3	Register start number	2	2	The first register number read
4	Read the number of registers	3	2	3 sensor parameters
5	CRC16 check	6	2	low front high back

Return：01 03 06 xx xx xx xx xx xx CRC16

No.	Implication	Excursion	Byte count	explanation
1	Address field	0	1	Address(0x01)
2	Opcodes	1	1	Read only(0x03)
3	Data Length Field	2	1	Data Length
4	Data Field	3	2	Soil temperature: 0x7FFF table invalid/missed
		5	2	Soil Moisture: 0x7FFF table invalid/missed
		7	2	EC: 0x7FFF table invalid/missed
5	Check Field	9	2	low front high back

Opcode: fixed at 0x03, that is, read operation, other operations are not supported.

Register address starting number: range 0-15, indicating the first register number to be read.

Number of registers: the range is 1-16, which means that the last register number + 1 is read. The read data does not include the register content of this number, but is only used as the end marker, and its value must be greater than or equal to the "start number".

B.The device returns a data frame:

01 03 06 xx xx xx xx xx xx CRC16

Data length: Does not contain itself, only the number of bytes in the data field, the maximum is 6, and the minimum is 0.

Determined according to the "start number" and "number of registers" of the read instruction sequence.

Data length = (end number – number of registers)*2

Communication example (obtain data from 3 sensors):

Send：01 03 00 00 00 03 05 CB

Return:01 03 06 01 10 00 B0 06 20 E2 F8

01 10 It is soil temperature data, which is a hexadecimal integer, converted into decimal is 272, and the soil temperature resolution is 0.1, which is 27.2 ℃;

00 B0 It is soil moisture data, which is a hexadecimal integer, converted to decimal is 176, and the soil moisture resolution is 0.1, which is 17.6%;

06 20 It is EC data, a hexadecimal integer, converted to decimal is 1568, the conductivity resolution is 1, which is 1568us/cm;

C.CRC16 Calculation of check code

1) Preset a 16-bit register as hexadecimal FFFF (that is, all 1s); call this register a CRC register;

2) XOR the first 8-bit binary data (that is, the first byte of the communication information frame) with the lower 8 bits of the 16-bit CRC register, and place the result in the CRC register;

3) Shift the contents of the CRC register to the right by one bit (toward the lower bit) and fill the highest bit with 0, and check the shifted out bit after the right shift;

4) If the shift out bit is 0: repeat step 3 (shift right one bit again);

If the shift-out bit is 1: XOR the CRC register with

the polynomial A001 (1010 0000 0000 0001);
5) Repeat steps 3 and 4 until right-shifting 8 times, so that the entire 8-bit data has been processed;
6) Repeat step 2 to step 5 to process the next byte of the communication information frame;
7) After all bytes of the communication information frame are calculated according to the above steps, the high and low bytes of the obtained 16-bit CRC register are exchanged;
8) The content of the CRC register finally obtained is the CRC16 code. (Note that the obtained CRC code is the order of low front and high back)

D. Channel data conversion

For example, the temperature hexadecimal code is **"00 C3"**, which is converted into binary to "0000000 11000011", and the first bit of its binary is **"0"**, so its value is a positive number. The method converts the decimal value **"195"**, and finally multiplies it by 0.1 to get the final result **"19.5"**.

For another example, the temperature hexadecimal code is **"FF 3D"**, which is converted into binary as **"11111111 00111101".** The first bit of the binary is **"1"**, so its value is negative.
The specific conversion steps are as follows:
(1) Replace the first bit of its binary with **"0"** to get: **"01111111 00111101"**
(2) After inverting the last 15 digits, we get: **"00000000 11000010"**
(3) After adding **"1"**, we get: **"00000000 11000011"**
(4) According to the positive number representation method in 1, the decimal value **"195"** is obtained
(5) **"-195"** because it is a negative value
(6) The result is divided by 10, the final result is **"-19.5"**

Then: **00 C3 → 19.5**℃
FF 3D → -19.5℃

Instruction manual

Wire the sensor according to the instructions in the wiring method, then insert the sensor probe pin into the soil to be measured, turn on the power supply and the switch of the collector, and you can obtain the soil temperature, soil moisture, and soil conductivity values at the measurement point.

Notice

1. Please check whether the packaging is in good condition, and check whether the product model is consistent with the selection;
2. Do not connect with live power. After the wiring is completed and checked, the power can be turned on;
3. The length of the sensor line will affect the output signal of the product. Do not arbitrarily change the components or wires that have been soldered when the product leaves the factory. If you need to change it, please contact the manufacturer;
4. The sensor is a precision device, please do not disassemble it by yourself, or touch the surface of the sensor with sharp objects or corrosive liquids, so as not to damage the product;
5. Please keep the verification certificate and qualification certificate, and return it together with the product during maintenance.

Trouble clearing

1. During the actual application test, the display device indicates that the value is 0 or not within the range. It may be caused by the wiring problem that the acquisition device cannot obtain information correctly. Please check whether the wiring is correct and firm;
2. If it is not for the above reasons, please contact the manufacturer.

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