Product introduction

The Conduit Multi-Layer Soil Moisture Sensor is a high precision, high sensitivity soil moisture temperature measurement instrument that uses the FDR principle to measure the moisture content of each soil layer based on the frequency change of electromagnetic waves emitted bAy the monitor in substances with different dielectric constants, and measures the temperature of each soil layer using a high precision digital temperature sensor.

The optional earth disaster version also has a built-in tilt sensor, using proven electrostatic capacity 3D-MEMS technology. The tilt sensor detects acceleration, measures the earth's gravitational component in the direction of the measurement, and outputs a sinusoidal function of the angle of inclination, which calculates the angle of inclination. Can be built-in lithium battery, provide RS485 output or through the 4G wireless network to transmit data to the Internet of Things data platform, real-time computer and mobile phone to view the data, convenient and fast, greatly meet the needs of all aspects of use.

● The sensor has the characteristics of low power consumption, small size, simple installation, operation and maintenance.

●With multi-depth moisture, temperature change measurement capability, standard depth 10cm, 20cm, 30cm, 40cm, up to 10 layers of customised monitoring nodes, real-time monitoring, fast and convenient;

●Using high-quality plastic pipe, which can prevent aging and is more resistant to corrosion of acid, alkali and salt in the soil;

● Using epoxy resin as sealing material, it can be immersed in water for a long time without leakage;

●High measurement accuracy and reliable performance;

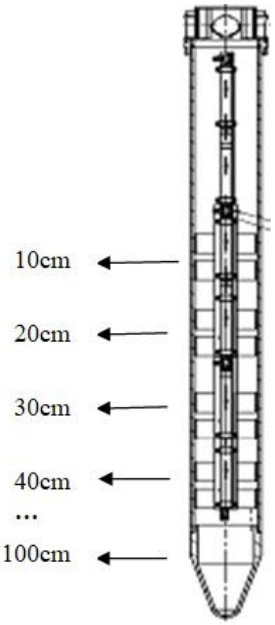
●Support RS485 digital output and 4G wireless network data transmission according to requirements;

●Optional GPS, inclination measurement and vibration alarm function;

●Multi-directional anti-wrong connection protection for power line and signal line.

This sensor is suitable for water-saving agricultural irrigation, greenhouse greenhouse vegetables, flowers and horticulture, grass pasture, soil quick test, plant culture, scientific experiments and other fields.

Structural diagram



Technical Parameters

Power supply method	DC12V or solar powered	
Output	RS485 (MODBUS protocol)	
Soil volumetric	Measuring range	Dry to moisture-saturated soil
moisture content	Measurement accuracy	±3%（laboratory）
	Resolution	0.1%
Soil temperature	Measuring range	-40℃～80℃
	Measuring accuracy	±0.5℃
	Resolution	0.1℃
GPS positioning (optional)	Positioning accuracy within 10m	
Inclination measurement (optional)	Built-in high-performance 3-axis inclination sensor, angle resolution 0.005 degrees	
Vibration alarm (optional)	Report GPS data when the product is shaken	
Overall dimensions	Diameter ϕ63mm, length varies with the number of collection points, standard length is about 1000mm.	
Power consumption	Power consumption is less than 1mA during sleep and less than 70mA during sampling.	

Working Environment	-40℃～80℃, 0-100%RH
Protection class	IP67 for above-ground part, IP68 for underground part

Connection method

Line color	Line Definition
Red	Power Positive
Black	Power Ground
Yellow	RS485+
Blue	RS485-

Installation position

Moisture monitoring stations (points) should be representative of the main crops and typical soils of the region in which they are located, and the indicators collected should be able to reflect the actual local conditions.

The deployment of moisture monitoring stations (points) should be comprehensively determined in accordance with the local soil type, planting structure and topographical and geomorphological conditions. Therefore, in principle, the representative plots with the largest area representing the planted crops and soil types in the region should be selected. In areas with great changes in soil and terrain conditions, the topographic and geomorphological conditions and the signal requirements for information transmission should also be taken into consideration, and representative plots with flat terrain should be selected as far as possible.

The monitoring station (point) should be arranged in a flat plot about 20m away from the edge of the representative plot or the roadside, avoiding low-lying places prone to waterlogging, and keeping a distance of more than 50m from ditches and water supply channels, so as to avoid the influence of lateral seepage of water from ditches on the water content of the soil.

The representative plot in the hilly area should be larger than 1 mu in area and should be located in the plot with smaller slope drop but larger area, not in the bottom of the ditch and the plot with large slope; the representative plot in the plain area should be larger than 10 mu in area and should be located in the flat and not easy to be waterlogged plot. In order to maintain the consistency and continuity of moisture monitoring data, the monitoring location should be relatively stable and should not be changed once determined.

Installation Methods and Notes

1. Make holes with the soil extraction auger, holding the handle firmly with both hands and turning it clockwise with downward pressure;

2. Pull out and clean the soil auger after it is full and repeat the process until the depth is met;

3. Put the sensor into the hole that has been punched, and put it in and take it out should be smooth. If it is not smooth, please use the earth auger to enlarge the hole where it is not smooth;

4. Prepare the mud, the mud should not be too thin or too thick, pour the mud into the hole, about half of the hole, then insert the sensor into the hole, rotate the sensor left and right to make the mud evenly distributed around the sensor;

5. When the transducer is installed to the appropriate depth (ground plane and the 0cm point of the transducer are on a horizontal plane), some mud overflow will accumulate around the mounting holes, at which point the installation is complete;

6. Tilt the solar panel at an angle of about 45° to the south and install it so that it receives the

maximum amount of sunlight. After the bracket is installed, connect the waterproof plug on the solar panel connecting cable to the power data port on the moisture meter.

Installation Precautions:

1 Hole punching should be vertically downward;

2 The depth of the hole is increased by 5cm on top of the installation depth to ensure that there is enough space to compress air at the bottom of the installation;

3 It is strictly prohibited to knock the moisture meter with heavy objects;

4 Confirm that the switch button of the moisture meter is open and the instrument is working.

MODBUS-RTU communication protocol

I. Serial Port Format

Data bits: 8 bits

Stop bit: 1 or 2 bits

Parity bit: None

Baud rate: 9600, two communication intervals of 1000ms or more.

Second, the communication format

[1] Read device address

Send: 00 20 CRC (4 bytes)

Return: 00 20 Adress CRC (5 bytes)

Example: Send 00 20 00 68

Return 00 20 01 A9 C0

[2] Write device address

Send: 00 10 Adress CRC (5 bytes)

Return: 00 10 CRC (4 bytes)

Note:

1. The address bit of the Read/Write Address command must be 00.

2. Address is 1 byte, the range is 0-255.

Example: Send 00 10 01 BD C0

Return 00 10 00 7C

[3] Read real-time data

For example, send 01 03 00 00 00 07 CRC

Data Description:

Implications	Bytes	Description
Device Address	1	Device unique address 0-255
Operation Code	1	Fixed value 0x03
Register start number	2	First register number read
Number of registers to read	2	Number of elements to read
CRC16 checksum	2	Low before high after

Return data：01 03 0E 2E E0 00 EA 01 1A 00 EB 01 1B 00 EC 01 1C CRC

Data Description:

Meaning	Bytes	Description
Address Code	1	Device unique address
Operation Code	1	Read operation 03
Data Length	2	
Data field	Maximum 64	Channel 1: Voltage Channel 2: Soil moisture 1 Channel 3: Soil temperature 1 Channel 4: Soil moisture 2 Channel 5: Soil temperature 2 And so on .....
Check digit	2	Low front and high back

For example, three layers of soil temperature and moisture

Send：01 03 00 00 00 07 04 08

Return：01 03 0E 2E E0 00 EA 01 1A 00 EB 01 1B 00 EC 01 1C D4 95

2E E0 is the voltage, which is a hexadecimal integer, converted to decimal is 12000, i.e. the voltage value is 12.000V.

00 EA is the first soil moisture value, which is a hexadecimal integer that converts to decimal is 234, i.e. the first soil moisture content is 23.4%.

01 1A is the first soil temperature value, which is a hexadecimal integer that converts to decimal is 282, i.e., the first soil temperature value is 28.2°C.

00 EB is the second layer soil moisture value, which is a hexadecimal integer that converts to decimal is 235, i.e. the second layer soil moisture content is 23.5%.

01 1B is the second layer soil temperature value, which is a hexadecimal integer that converts to decimal is 283, i.e., the second layer soil temperature value is 28.3°C.

00 EC is the third layer soil moisture value, which is a hexadecimal integer that converts to decimal is 236, i.e., the third layer soil moisture content is 23.6%.

01 1C is the third layer soil temperature value,

which is a hexadecimal integer that converts to decimal is 284, i.e., the third layer soil temperature value is 28.4°C.

P.S. Steps for calculating the CRC code:

1, preset the 16-bit register to hexadecimal FFFF (i.e., all 1s). Call this register the CRC register;

2、Isolate the first 8-bit data with the low bit of the 16-bit CRC register and put the result in the CRC register;

3, shift the contents of the register one bit to the right (towards the low bit), fill the highest bit with 0, and check the lowest bit;

4, if the lowest bit is 0: repeat step 3 (shift again)

If the lowest bit is 1: the CRC register is iso-orthogonal to the polynomial A001 (1010 0000 0000 0001);

5. Repeat steps 3 and 4 until it is shifted right 8 times so that the entire 8-bit data is all processed;

6, repeating steps 2 to 5 for the next 8-bit data processing;

7, the final CRC register obtained is the CRC code;

8、When putting the CRC result into the information frame, the high and low bits will be exchanged, with the low bit coming first.

Notice

1, please check whether the packaging is intact, and check whether the product model is consistent with the selection;

2, do not be wired with electricity, wiring is completed to check that there is no error before powering up;

3, the sensor line length will affect the product output signal, do not change the use of the product has been welded at the factory components or wires, if there is a need to change, please contact the manufacturer;

4, the sensor is a precision device, the user in the use of the user do not disassemble, with sharp objects or corrosive liquids in contact with the sensor surface, in order to avoid damage to the product;

5、Please keep the calibration certificate and certificate of conformity, and return them together with the product when repairing.

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