

Soil Moisture Temperature Sensor

User Manual



Thank you for choosing our product!

Due to continuous improvements to our products, the product you purchased may differ from the illustrations in this manual. No further notice will be provided. Please refer to the actual product.

Product Overview

The Soil moisture temperature sensor is a comprehensive soil sensor capable of monitoring up to 8 soil parameters, including soil temperature, moisture (soil water content), pH value, electrical conductivity (EC), salinity, and nitrogen-phosphorus-potassium (NPK) content. It features high accuracy, fast response, and stable output. With minimal influence from soil salinity, it is suitable for various soil types. It can be embedded in soil for long-term use, is resistant to prolonged electrolysis and corrosion, and is vacuum-sealed for complete waterproofing.

This sensor is widely applicable in scientific experiments, water-saving irrigation, greenhouses, flower and vegetable cultivation, grasslands and pastures, soil quick testing, plant cultivation, wastewater treatment, grain storage, and the measurement of moisture and temperature in various granular materials.

Features

- High measurement accuracy, fast response speed, and good interchangeability.
- Minimal influence from soil salinity, suitable for various soil types.
- Electrodes made of specially treated stainless steel, resistant to strong external impacts and durable.
- Fully sealed, resistant to acid and alkali corrosion, and suitable for long-term dynamic detection when embedded in soil or directly placed in water.
- Modular design allows flexible selection of parameters, supporting monitoring of up to 8 soil elements.

Technical Parameters

Power Supply	<input type="checkbox"/> DC 7~30V <input type="checkbox"/> DC5V
Measurement Range	<input type="checkbox"/> Soil Moisture: 0~60% (volumetric water content)
	<input type="checkbox"/> Soil Temperature: -40 - 80°C
	<input type="checkbox"/> Electrical Conductivity: 0~20000 $\mu\text{s}/\text{cm}$
	<input type="checkbox"/> Salinity: 0~10000 mg/L
	<input type="checkbox"/> PH : 3~10 PH
<input type="checkbox"/> Nitrogen-Phosphorus-Potassium (NPK): 0~2000 mg/kg	
Accuracy	Soil Moisture: $\pm 3\%$ (0-35% range) $\pm 5\%$ (35%-60% range)
	Soil Temperature: $\pm 0.5^\circ\text{C}$
	Electrical Conductivity: $\pm 5\%$ (0~1000 $\mu\text{s}/\text{cm}$)
	Salinity: $\pm 5\%$ (0~500 mg/L)

		PH : ±0.3PH
		Nitrogen-Phosphorus-Potassium (NPK): ±2%FS (0~200 mg/kg)
For data exceeding the specified accuracy ranges for electrical conductivity, salinity, and NPK, the values can be used as linear trend indicators.		
Resolution	Soil Moisture: 0.1%	
	Soil Temperature: 0.1°C	
	Electrical Conductivity: 1 us/cm	
	Salinity: 1 mg/L	
	PH : 0.1 PH	
	Nitrogen-Phosphorus-Potassium (NPK): 1mg/kg	
Output Signal	Current	<input type="checkbox"/> 4~20mA (Soil Temperature/Moisture)
	Voltage	<input type="checkbox"/> 0~2.5V <input type="checkbox"/> 0~5V (Soil Temperature/Moisture)
	Serial Port	<input type="checkbox"/> RS485
	Others	
Cable Length		<input type="checkbox"/> Standard: 2.5 meters <input type="checkbox"/> Others:

Load Capability: Current output impedance $\leq 250\Omega$

Voltage output impedance $\geq 1k\Omega$

Operating Environment: Soil Temperature: $-40^{\circ}\text{C} \sim 80^{\circ}\text{C}$; Soil Moisture: $\leq 60\%$

Protection Level: IP68

Probe Material: 304 stainless steel, anti-corrosion aluminum-zinc alloy electrodes

Product Weight: 120 g (for measuring soil temperature and moisture)

Power Consumption: 170 mW / 12V (depending on the specific model)

Calculation Formula

Current Signal Output	
4-20mA	$F = (I - 4) / 16 * 60$
	$T = (I - 4) / 16 * 120 - 40$
Voltage Signal Output	
0-5V	$F = V/5 * 60$
	$T = V/5 * 120 - 40$

F: Represents soil volumetric moisture content, unit: %;

T: Represents soil temperature, unit: °C;

I: Sensor output current value, unit: mA;

V: Sensor output voltage value, unit: V;

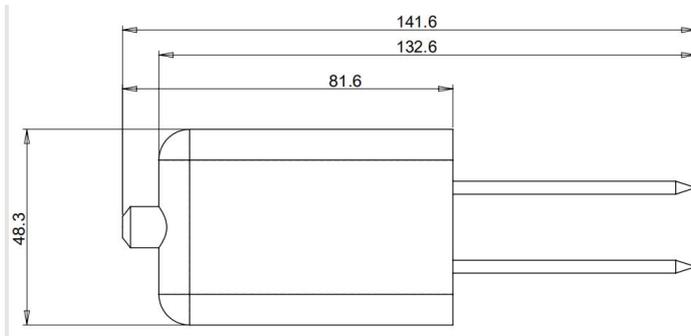
Note: Only soil temperature and soil moisture have analog signal outputs; other parameters do not provide analog signals.

Wiring Method

- (1) If the sensor is equipped with our instrument: Simply connect the sensor to the corresponding interface on the instrument using the sensor cable.
- (2) If the sensor is purchased separately: Refer to the wiring label on the sensor. The default wiring sequence is as follows:

Wire Color	Output Signal	
	Voltage、 Current	RS485
Red	Power Positive	Power Positive
Black		A+
Yellow		B-
Green	Power Negative	Power Negative
White	Analog Signal (Soil Temp/Soil Moisture)	

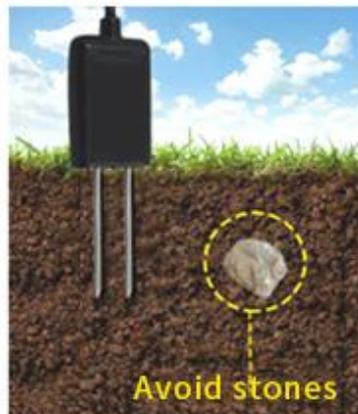
Sensor Structural Dimensions



Installation Instructions

Quick Measurement Method

Choose an appropriate measurement location, avoiding rocks to ensure the steel probes do not come into contact with hard objects. Remove the surface soil to the desired measurement depth while maintaining the original density of the underlying soil. Hold the sensor firmly and insert it vertically into the soil. Avoid shaking the sensor back and forth during insertion. Within a small range of the measurement point, it is recommended to take multiple measurements and calculate the average value.



Buried Measurement Method

Dig a pit with a diameter greater than 20 cm and at the desired measurement depth. Insert the sensor probes horizontally into the pit wall. Fill the pit tightly with soil and allow it to stabilize for some time before performing continuous measurements over several days, months, or even longer periods.



About the Sensor Communication Protocol

If you need to connect multiple sensors to PLC, configuration software, or programmable acquisition instruments, it is recommended to use the standard ModBus-RTU protocol (hexadecimal sending and receiving).

Standard ModBus-RTU Communication Protocol

I. Serial Port Format

Data Bits: 8 bits; Stop Bits: 1 bit; Parity: None; Baud Rate: 9600bps. The serial debugging software should be set to hexadecimal sending and receiving, with a minimum communication interval of 1000ms. The CRC mentioned in the manual is the checksum, occupying 2 bytes.

II. Register Address

The YGC-SM soil comprehensive sensor can integrate up to 8 soil parameters, including: Soil temperature; Soil moisture; Electrical conductivity; Salinity; pH value; Nitrogen, phosphorus, and potassium content in soil. Each parameter corresponds to a specific register address.

The correspondence between the register address and the MODBUS communication channel is shown in the table below:

Register Address	Channel	Data Description
0x0000	Channel 1 (Soil Temp) Signed value (-40~80°C)	0x7FFF (invalid/disconnected) 0x01 0x2C=30.0°C
0x0001	Channel 2 (Soil Moisture) Signed value (0~60%)	0x7FFF (invalid/disconnected) 0x01 0x23=29.1%
0x0002	Channel 3 (Electrical Conductivity) Signed value (0-20000) us/cm	0x7FFF (invalid/disconnected) 0x01 0xF4=500us/cm

0x0003	Channel 4 (Salinity) Signed value (0-10000) mg/L	0x7FFF (invalid/disconnected) 0x00 0xFA=250mg/L
0x0004	Channel 5 (pH Value) Signed value (3-10) PH	0x7FFF (invalid/disconnected) 0x00 0x46=7.0 PH
0x0005	Channel 6 (Nitrogen Content) Signed value (0-2000) mg/kg	0x7FFF (invalid/disconnected) 0x00 0xE1=225 mg/kg
0x0006	Channel 7 (Phosphorus Content) Signed value (0-2000) mg/kg	0x7FFF (invalid/disconnected) 0x00 0x64=100 mg/kg
0x0007	Channel 8 (Potassium Content) Signed value (0-2000) mg/kg	0x7FFF (invalid/disconnected) 0x00 0xA0=160 mg/kg

III. Communication Format

【1】 Write Device Address (e.g., set address to 01)

Send	00	06	00	20	00	01	48	11
Explanation	Address	Write	Starting Address		New Address		CRC Checksum	
Response	00	06	00	20	E1		FD	
Explanation	Address	Write	Starting Address		CRC Checksum			

Return 01 86 **** means the configuration failed.

【2】 Read Device Address (e.g., read device at address 1)

Send	00	03	00	20	00	01	84	11
Explanation	Address	Read	Starting Address		Number of Points		CRC Checksum	
Response	00	03	02		00	01	44	44
Explanation	Address	Read	Data Length		Device Data		CRC Checksum	

【3】 Read Register Data (e.g., read data from device at address 1)

Send	01	03	00	00	00	08	44	09
Explanation	Address	Read	Starting Address		Number of Points		CRC Checksum	
Response	01	03	10		00	26	01	23
Explanation	Address	Read	Data Length		Soil Temp		Soil Moisture	
Response	01	F4	00	FA	00	46	00	17
Explanation	Electrical Conductivity		Salinity		PH		Nitrogen Content	
Response	00	0A	00		11		1A	BC
Explanation	Phosphorus Content		Potassium Content				CRC Checksum	

The data returned by the sensor is: 0x0026, 0x0123, 0x01F4, 0x00FA, 0x0046, 0x0017, 0x000A, 0x0011.

0x0026 is the soil temperature value. Converted to decimal, it is 38, indicating a soil temperature of 3.8°C. (1 decimal place)

0x0123 is the soil moisture value. Converted to decimal, it is 291, indicating the soil volumetric moisture content is 29.1%. (1 decimal place)

0x01F4 is the electrical conductivity. Converted to decimal, it is 500, indicating the soil electrical conductivity is 500 us/cm.

0x00FA is the salinity. Converted to decimal, it is 250, indicating the soil salinity is 250 mg/L.

0x0046 is the pH value. Converted to decimal, it is 70, indicating the soil pH value is 7.0 PH. (1 decimal place)

0x0017 is the nitrogen content. Converted to decimal, it is 23, indicating the soil nitrogen content is 23 mg/kg.

0x000A is the phosphorus content. Converted to decimal, it is 10, indicating the soil phosphorus content is 10 mg/kg.

0x0011 is the potassium content. Converted to decimal, it is 17, indicating the soil potassium content is 17 mg/kg.

Note: Individual parameter values can also be read separately based on the register address.

Example: Reading 2 registers to obtain only soil temperature and moisture values

【4】 Read soil temperature and moisture register data (e.g., address is 1)

Send	01	03	00	00	00	02	C4	0B
Explanation	Address	Read	Starting Address		Number of Points		CRC Checksum	
Response	01	03	04		00	26	01	23
Explanation	Address	Read	Data Length		Soil Temp		Soil Moisture	
Response	5B				B1			
Explanation	CRC Checksum							

The sensor returns data 0x0026 and 0x0123.

0x0026 is the soil temperature value. Converted to decimal, it is 38, indicating a soil temperature of 3.8°C. (1 decimal place). 0x0123 is the soil moisture value. Converted to decimal, it is 291, indicating the soil volumetric moisture content is 29.1%. (1 decimal place)

【5】 Read Device Communication Baud Rate (e.g., baud rate = 9600)

Send	01	03	00	10	00	01	85	CF
Explanation	Address	Read	Starting Address		Number of Points		CRC Checksum	
Response	01	03	02		00	02	39	85
Explanation	Address	Read	Data Length		Device Data		CRC Checksum	

Baud rate = data × 4800. For the returned data 00 02, Baud rate = 4800 * 2 = 9600.

【6】 Write Device Communication Baud Rate (e.g., set baud rate to 9600)

Send	01	06	00	10	00	02	09	CE
Explanation	Address	Write	Starting Address		New Baud Rate		CRC Checksum	
Response	01	06	00	10	E0		15	
Explanation	Address	Write	Starting Address		CRC Checksum			

Baud rate = data * 4800. Write data 00 02, then baud rate = 4800 × 2 = 9600. Supported baud rates are 4800, 9600, 14400, 19200, 38400, 57600, 115200. If other unsupported baud rates are written, the device will automatically revert to 9600 after a restart.

Return 01 86 **** means the configuration failed.

Precautions

1. Please check whether the packaging is intact and verify that the product model matches the selected specifications.
2. Do not connect wires while the device is powered. Ensure all connections are correct before powering on the device.
3. The length of the sensor cable may affect the output signal. Do not modify the product arbitrarily. If modification is necessary, please contact the manufacturer.
4. The sensor is a precision instrument. During use, do not disassemble it, or use sharp objects or corrosive liquids to contact the surface of the sensor to avoid damaging the product.
5. During measurement, the probe must be fully inserted into the soil.
6. Avoid direct exposure to strong sunlight, which may cause overheating of the sensor. When used outdoors, take precautions against lightning strikes.
7. Do not bend the probe violently or insert it with excessive force. Avoid pulling or repeatedly tugging on the sensor cable, as this may cause the cable to break at the root and become irreparable.
8. Due to the presence of radio frequency electromagnetic radiation in the air, it is not recommended to leave the sensor powered on in the air for extended periods.
9. When measuring frozen soil layers, the moisture readings may be inaccurate and show lower values, requiring user compensation. This product is suitable for measuring ordinary soils such as loam, black soil, and red soil. It is not suitable for absolute moisture measurements of saline-alkali soil, sandy soil, or other powdery materials with high salt content.
10. The soil moisture calculated by this sensor refers to soil volumetric water content (also known as soil volume moisture content), which is commonly referred to as "soil moisture" or "soil humidity." The volumetric water content is the ratio of the volume of water in the soil to the total volume of the soil. A reading of 0% represents completely dry soil with no water, while 60% indicates that 60 volumes of water are present in 100 volumes of soil. Due to the soil's limited water-absorbing capacity, it is impossible to have a volumetric water content of 100%.

Troubleshooting

1. Incorrect readings for analog signal or RS485 output: This may be due to wiring issues or communication port failures, resulting in the inability to retrieve correct data. Please check whether the wiring is correct and secure, and verify whether the communication port is occupied or the port settings are incorrect.
2. If the above issues are not the cause, please contact the manufacturer.

Selection Table

Model	Power Supply	Output	Description
YGC -SM			Soil Comprehensive Sensor
	5V		5V Power Supply
	KV		7-30V Power Supply
		V	0-5V
		V2	0-2.5V
		A1	4-20mA
		W2	RS485 (Modbus)
<p>Example: YGC-SM-5V-W2 Soil Comprehensive Sensor, 5V Power Supply, RS485 Output.</p>			