OHTS1024 Soil Multi-Parameter Sensor

1 Product Overview

The OHTS1024 is an integrated multi-parameter sensor for measuring soil temperature, soil volumetric water content (VWC), soil electrical conductivity (EC), and soil pH value. The sensor employs Frequency Domain Reflectometry (FDR) principle for soil moisture measurement, platinum resistance thermometer (PT1000) technology for temperature detection, stainless steel probe contact measurement for soil electrical conductivity, and glass electrode method for soil pH measurement. The sensor integrates signal conditioning circuits, temperature compensation circuits, and data processing modules internally, featuring an RS485 digital output interface with standard Modbus-RTU communication protocol support, suitable for long-term buried in-situ monitoring applications.

2 Applications

- Water-saving agricultural irrigation systems
- Meteorological and environmental monitoring stations
- Greenhouse environment control systems
- Soil moisture rapid detection and monitoring
- Grassland and pasture ecological monitoring
- Precision cultivation of flowers and vegetables
- Plant cultivation scientific research
- Soil physicochemical property experiments
- Agricultural Internet of Things (IoT) data acquisition
- Environmental monitoring network nodes

3 Features

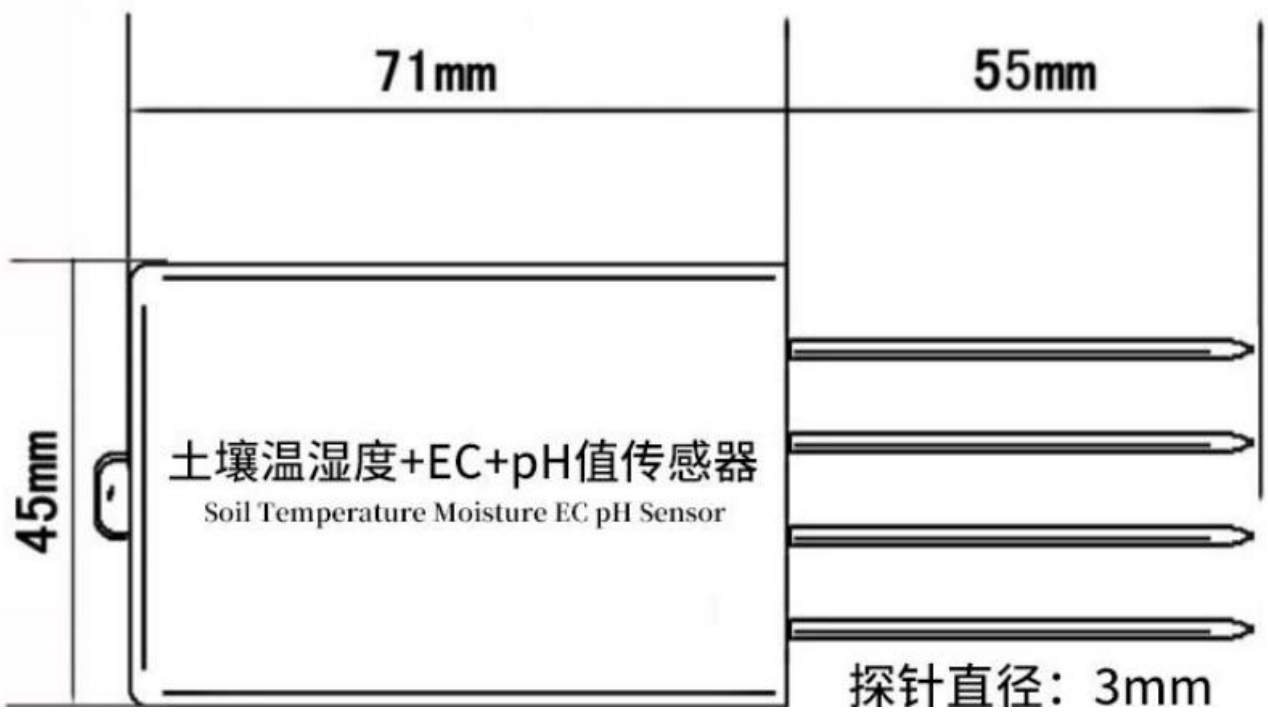
- Four-parameter integrated design simultaneously measuring soil temperature, volumetric water content, electrical conductivity, and pH value
- Soil moisture measurement based on Frequency Domain Reflectometry (FDR) principle, directly reflecting actual soil water content
- Temperature measurement utilizing PT1000 platinum resistance element with zero-drift compensation and temperature compensation circuits
- Electrical conductivity measurement employing 316L stainless steel probes, adaptable to various soil solution environments
- Fully sealed structural design with IP68 ingress protection rating, suitable for long-term buried soil applications
- Measurement response time less than 1 second, stabilization time 3 seconds
- Minimal soil texture influence, applicable to multiple soil types

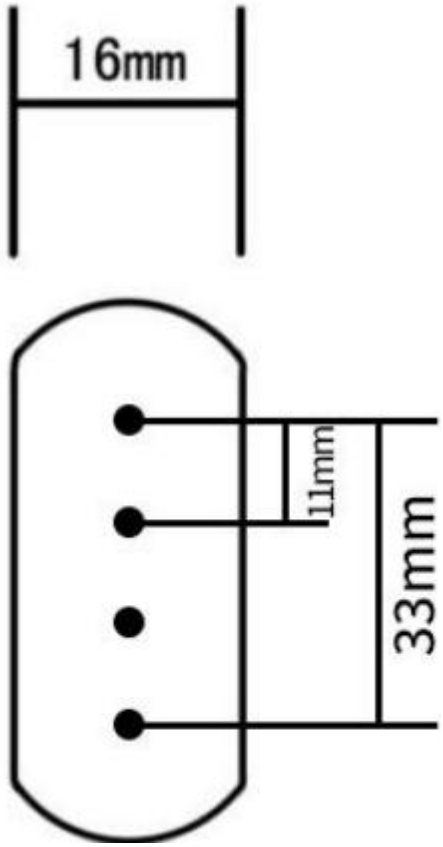
- Standard Modbus-RTU protocol output, compatible with various data acquisition devices

4 Technical Specifications

Parameter	Specification	Remarks
Measured Parameters	Soil Temperature, Soil Volumetric Water Content, Soil Electrical Conductivity, Soil pH Value	-
Temperature Range	$-30 \sim 70^{\circ}\mathrm{C}$	Customizable to $0 \sim 50^{\circ}\mathrm{C}$ or other ranges
Temperature Accuracy	$\pm 0.2^{\circ}\mathrm{C}$	-
Temperature Resolution	$0.1^{\circ}\mathrm{C}$	-
Moisture Range	$0 \sim 100\%(\mathrm{m}^3/\mathrm{m}^3)$	Customizable to specific ranges such as 30%, 50%, etc.
Moisture Accuracy	$\pm 2\%(\mathrm{m}^3/\mathrm{m}^3)$	Within $0 \sim 50\%(\mathrm{m}^3/\mathrm{m}^3)$ range
Moisture Resolution	0.1%	-
Conductivity Range	$0 \sim 2000\,\mu\mathrm{S/cm}$, $0 \sim 10000\,\mu\mathrm{S/cm}$, $0 \sim 20000\,\mu\mathrm{S/cm}$	Multiple ranges selectable
Conductivity Accuracy	$\pm 2\%$	-
Conductivity Resolution	$1\,\mu\mathrm{S/cm}$	-
pH Range	$3 \sim 10$	-
pH Accuracy	± 1	-
pH Resolution	0.01	-
Output Signal	RS485	Standard Modbus-RTU protocol
Default Address	0×01	Supports broadcast address $0 \times \mathrm{FE}$
Supply Voltage	$7 \sim 24\,\mathrm{V\,DC}$	-
Operating Temperature	$-30^{\circ}\mathrm{C} \sim 70^{\circ}\mathrm{C}$	-
Stabilization Time	$3\,\mathrm{s}$	After power-on
Response Time	$< 1\,\mathrm{s}$	-

5 Physical Specifications

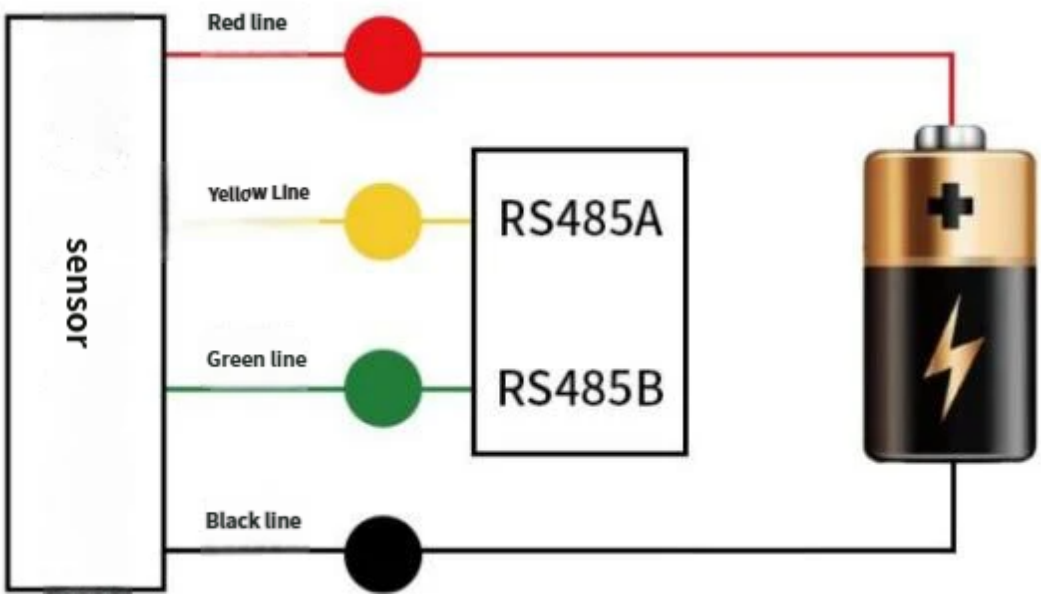




Parameter	Specification
Probe Material	316L Stainless Steel
Housing Material	ABS Engineering Plastic
Sealing Material	Epoxy Resin
Protection Rating	IP68
Cable Specification	Standard 2 m (customizable, maximum 1200 m)

6 Installation

The OHTS1024 sensor can be connected to various data acquisition devices, data acquisition cards, or remote data acquisition modules with differential input capabilities.



Installation Steps:

1. Select a representative soil monitoring point, avoiding areas with stones or hard soil clumps
2. Insert the sensor probes vertically into the target soil depth, ensuring full contact between probes and soil
3. After burial, ensure the epoxy resin sealed portion is completely buried in the soil
4. Connect the communication cable to the data acquisition device, ensuring correct RS485 bus connection
5. Wait for the 3-second stabilization time after power-on before data reading

7 Wiring Definition

Wire Color	Definition	Description
Red	VCC	Power Positive (7 ~ 24 V DC)
Black	GND	Power Negative/Ground
Yellow	A+	RS485 Signal Positive
White	B-	RS485 Signal Negative

Note: Actual wire colors subject to physical product; please refer to product labeling during wiring.

8 Communication Protocol and Data Conversion

8.1 Communication Parameters

- **Interface Standard**: RS485
- **Protocol Type**: Modbus-RTU
- **Baud Rate**: 9600 bps
- **Data Bits**: 8 bits
- **Parity**: None
- **Stop Bits**: 1 bit
- **Default Device Address**: 0 × 01

8.2 Register Definitions

Register Address	Parameter Name	Data Type	Unit/Description
0×0000	Soil Temperature	Signed 16-bit Integer	$^{\circ}\mathrm{C}$, scaled 10×
0×0001	Soil Moisture	Unsigned 16-bit Integer	$\%(\mathrm{m}^3/\mathrm{m}^3)$, scaled 10×
0×0002	Soil Electrical Conductivity	Unsigned 16-bit Integer	$\mu\mathrm{S/cm}$
0×0003	Soil pH Value	Unsigned 16-bit Integer	Scaled 100×
0×0030	Device Address	Unsigned 16-bit Integer	Read/Write address register

8.3 Data Conversion Rules

Temperature Conversion:

$$T = \frac{\text{Register Value}}{10}$$

Where the temperature value is signed, with negative numbers represented in two's complement.

Moisture Conversion:

$$\theta = \frac{\text{Register Value}}{10}$$

Unit: $\%(\mathrm{m}^3/\mathrm{m}^3)$.

Electrical Conductivity Conversion:

$$\mathrm{EC} = \text{Register Value}$$

Unit: $\mu\mathrm{S/cm}$.

pH Value Conversion:

$$\mathrm{pH} = \frac{\text{Register Value}}{100}$$

8.4 Address Modification Command

Changing device address from 0×01 to 0×02:

Original Address	Function Code	Starting Register High	Starting Register Low	New Address High	New Address Low	CRC16 Low	CRC16 High
0×01	0×06	0×00	0×30	0×00	0×02	0×08	0×04

Note: If the original address is forgotten, the broadcast address $0 \times \mathrm{FE}$ *can be used for query or modification; however, only one slave device may be connected on the RS485 bus when using the broadcast address.*

8.5 Data Query Command

Query soil temperature, moisture, electrical conductivity, and pH value (reading 4 registers):

Address	Function Code	Starting Register Address High	Starting Register Address Low	Register Count High	Register Count Low	CRC16 Low	CRC16 High
0×01	0×03	0×00	0×00	0×00	0×04	0×44	0×09

Normal Response Frame Example:

Field	Value	Parsing
Address	0×01	-
Function Code	0×03	-
Data Length	0×08	8 bytes of data
Register 0 High	$0 \times FF$	Soil Temperature: $-3.5^{\circ}C$
Register 0 Low	$0 \times DD$	Two's complement representation of negative number
Register 1 High	0×01	Soil Moisture: 35.6%
Register 1 Low	0×64	-
Register 2 High	0×04	Soil Electrical Conductivity: $1234\ \mu S/cm$
Register 2 Low	$0 \times D2$	-
Register 3 High	0×02	Soil pH Value: 6.86
Register 3 Low	$0 \times AE$	-
CRC16 Low	0×86	-
CRC16 High	0×12	-

9 Precautions

- Please read this technical documentation completely before installation
- Do not force the probe into soil containing stones or hard clumps to avoid mechanical damage to the probe
- When removing the sensor from soil, do not pull the cable directly; grasp the sensor body to pull it out
- The sensor probe should be fully inserted into the soil to ensure tight contact with the soil, reducing operational errors and improving measurement accuracy
- The sensor sealing portion must be completely buried in the soil to ensure the effectiveness of the IP68 protection rating
- When using the broadcast address ($0 \times FE$), only a single device may be connected on the RS485 bus

10 After-Sales Guarantee and Support

- **Warranty Period**: 12 months from the date of shipment
- **Warranty Coverage**: Failures due to product quality issues (non-human damage) are eligible for free repair or replacement services
- **Warranty Exclusions**: After the warranty period expires, only cost fees will be charged; failures caused by human damage or force majeure are not covered by the free warranty
- **Technical Support**: Product usage consultation and technical problem resolution provided

11 Manufacturer Information

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12 Revision History

Version	Date	Description	Author
V1.0	-	Initial Version	Shanghai OrangeHorse Electronic Technology Co., Ltd.