OHTS1020 Isolated Multi-Parameter Soil Sensor

1 Product Overview

The OHTS1020 is an integrated multi-parameter isolated soil sensor capable of simultaneously monitoring soil temperature, volumetric water content (VWC), electrical conductivity (EC), salinity, nitrogen (N), phosphorus (P), potassium (K), and pH value. The temperature measurement unit utilizes an NTC precision thermistor with signal conditioning circuitry, integrating zero-drift compensation and temperature compensation algorithms. Moisture measurement is based on the Frequency Domain Reflectometry (FDR) principle, obtaining volumetric water content through high-frequency detection of soil dielectric permittivity. Electrical conductivity and salinity measurements employ 316L stainless steel probes, supporting temperature compensation to standard conditions at 25°C. Nitrogen, phosphorus, and potassium detection is achieved through an Ion Selective Electrode (ISE) array. pH measurement utilizes a glass electrode or corresponding sensing element. The sensor integrates an electrical isolation module with an isolation voltage of 1500V. The RS485 interface features 5000VRMS (60s) withstand voltage and ±150kV/μs Common-Mode Transient Immunity (CMTI), making it suitable for precision agriculture monitoring in complex electromagnetic environments.

2 Applications

- Water-saving agricultural irrigation systems
- Meteorological and environmental monitoring stations
- Greenhouse environmental control systems
- Flower and vegetable cultivation management
- Grassland and pasture soil monitoring
- Rapid soil testing and surveys
- Scientific research on plant cultivation
- Precision agriculture trials and demonstrations

3 Features

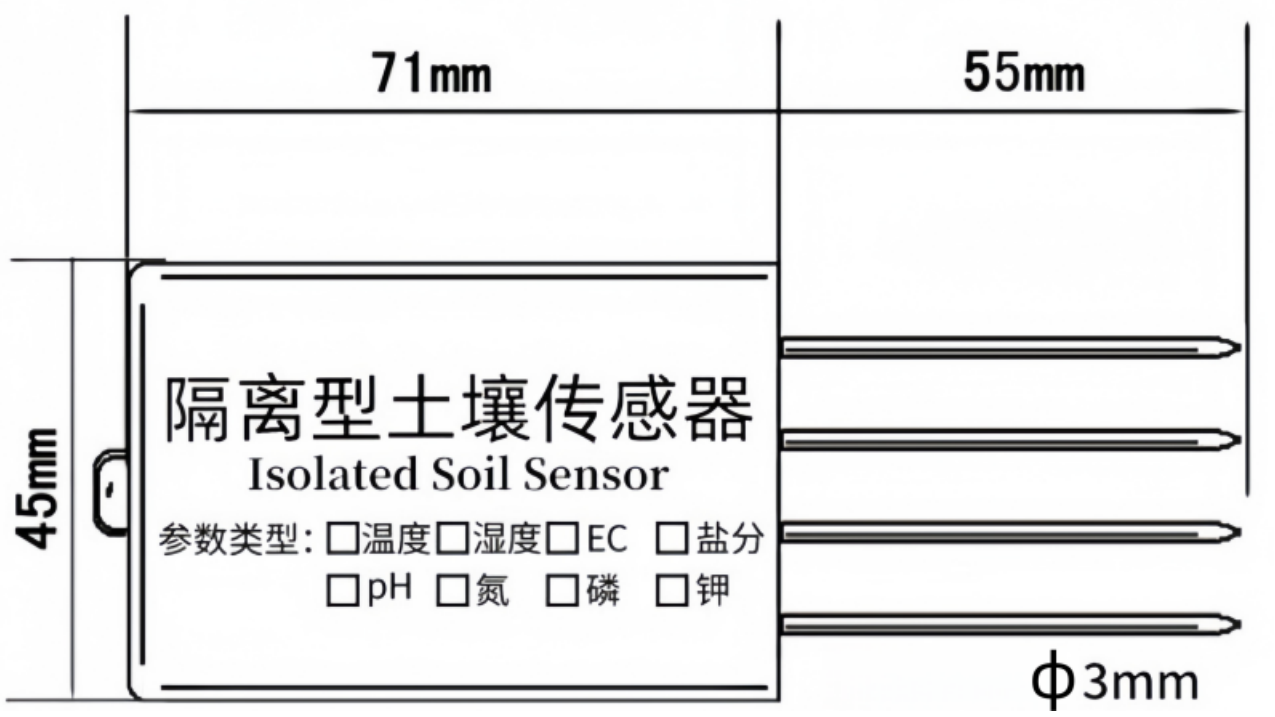
- **Eight-Parameter Integrated Measurement**: Simultaneously acquires soil temperature, moisture, electrical conductivity, salinity, pH, and NPK nutrient data
- **High-Precision FDR Moisture Detection**: Based on dielectric permittivity measurement, directly reflecting true soil volumetric water content
- **Electrical Isolation Design**: Port isolation voltage 1500V, RS485 isolation withstand voltage 5000VRMS, CMTI up to ±150kV/μs
- **Industrial-Grade Protection**: 316L stainless steel probes, ABS engineering plastic and epoxy resin sealing, IP68 protection rating
- **Wide Temperature Operation**: Adapts to ambient temperatures from -30°C to 70°C
- **Fast Response**: Response time less than 1 second, power-on stabilization time 3 seconds
- **Standard Communication Protocol**: RS485 interface, Modbus-RTU protocol, supporting address configuration and broadcast queries

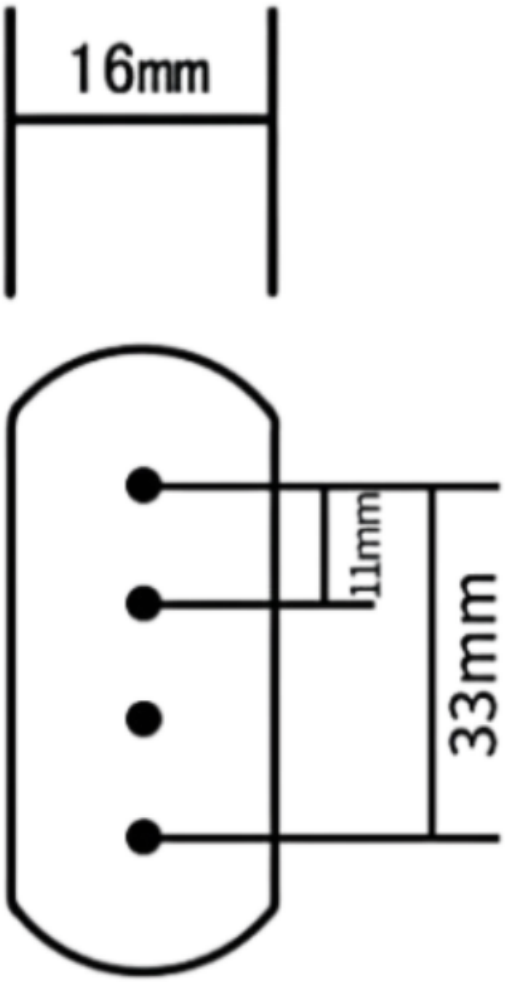
4 Technical Specifications

Parameter Category	Specification	Unit/Remarks
Measured Parameters	Soil Temperature, Soil Volumetric Water Content, Soil Electrical Conductivity (EC), Soil Salinity, Soil N/P/K, Soil pH	-
Temperature Range	-30 ~ 70	°C
Temperature Accuracy	±0.2	°C
Temperature Resolution	0.1	°C
Moisture Range	0 ~ 100	% (m^3/m^3)
Moisture Accuracy	±2 (within 0~50% range)	% (m^3/m^3)
Moisture Resolution	0.1	%
EC/Salinity Range	0 ~ 2000 / 0 ~ 10000 / 0 ~ 20000	μS/cm
EC/Salinity Accuracy	±2 / ±2	%
EC/Salinity Resolution	1	μS/cm
pH Range	3 ~ 10	-
pH Accuracy	±1	-
pH Resolution	0.01	-
N/P/K Range	0 ~ 1999	mg/kg (mg/L)
N/P/K Accuracy	±3	% (mg/kg)
N/P/K Resolution	1	mg/kg (mg/L)
Output Signal	RS485 (Modbus-RTU)	Default Address: 0x01
Supply Voltage	7 ~ 24	V DC
Power Consumption	≤0.3	W
Operating Temperature	-30 ~ 70	°C
Stabilization Time	3	s (after power-on)
Response Time	<1	s
Electrical Isolation	1500	V (isolation voltage)
RS485 Isolation Withstand Voltage	5000	VRMS (60s)
CMTI	±150	kV/μs

5 Physical Specifications

Parameter Category	Specification
Probe Length	55 mm
Probe Diameter	φ3 mm
Probe Material	316L Stainless Steel
Housing Material	ABS Engineering Plastic
Sealing Material	Epoxy Resin
Protection Rating	IP68
Cable Length	Standard 2 m (Customizable, max 1200 m)


71mm
55mm
45mm
隔离型土壤传感器
Isolated Soil Sensor
参数类型: □温度□湿度□EC □盐分
□pH □氮 □磷 □钾
ϕ3mm


16mm
11mm
33mm

6 Installation

The OHTS1020 can be connected to various data loggers, data acquisition cards, or remote data acquisition modules with differential inputs. During installation, the sensor probes should be fully inserted into the soil or substrate to be measured, ensuring intimate contact between the probes and soil to minimize measurement errors.

Installation Steps:

1. Select a representative measurement location, avoiding hard obstacles such as stones or concrete
2. Insert vertically or at an angle into the soil, ensuring the probes are completely buried (the full 55mm probe length must enter the soil)
3. Avoid forceful hammering or insertion into hard soil clumps to prevent probe bending or damage
4. Provide strain relief for the cable exit portion; avoid pulling directly on the cable
5. Connect the RS485 communication cable and power supply lines, completing electrical connections according to the wiring definition section

7 Wiring Definition

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

8 Communication Protocol and Data Conversion

Communication Interface: RS485
Protocol Standard: Modbus-RTU
Default Configuration: Baud rate 9600 bps, Data bits 8, Stop bits 1, Parity None
Default Address: 0x01

8.1 Modifying Device Address

Use Function Code 0x06 to modify the device address; the target register address is 0x0030.

Request Frame Format:

Original Address	Function Code	Register High	Register Low	New Address High	New Address Low	CRC16 Low	CRC16 High
0x01	0x06	0x00	0x30	0x00	0x02	0x08	0x04

Note: If the original address is forgotten, broadcast address 0xFE may be used. When using the broadcast address, only a single slave device may be connected to the bus, and the address field in the response frame will still contain the original address.

8.2 Data Query and Conversion

Use Function Code 0x03 to read measurement data, starting address 0x0000, reading 8 registers.

Request Frame:

Address	Function Code	Start Address High	Start Address Low	Register Quantity High	Register Quantity Low	CRC16 Low	CRC16 High
0x01	0x03	0x00	0x00	0x00	0x08	0x44	0x0C

Response Data Conversion Formulas:

Let R be the unsigned integer value returned by the register (hexadecimal to decimal conversion):

Soil Temperature (Register 0):

$$T = \begin{cases} R \times 0.1 & \text{if } R \leq 32767 \\ (R - 65536) \times 0.1 & \text{if } R > 32767 \end{cases} \quad [^\circ\text{C}]$$

Note: Negative numbers are represented in two's complement form; e.g., 0xFFDD = -35, corresponding to -3.5°C.

Soil Moisture (Register 1):

$\theta = R \times 0.1 \quad [\%]$

Soil Salinity (Register 2):

$S_{salt} = R \quad [\mu\text{S/cm}]$

Soil Electrical Conductivity (Register 3):

$EC = R \quad [\mu\text{S/cm}]$

Soil pH Value (Register 4):

$pH = R \times 0.01 \quad [pH]$

Soil Nitrogen Content (Register 5):

$N = R \quad [\text{mg/kg}]$

Soil Phosphorus Content (Register 6):

$P = R \quad [\text{mg/kg}]$

Soil Potassium Content (Register 7):

$K = R \quad [\text{mg/kg}]$

9 Precautions

Warning:

- Wiring must strictly follow the wire sequence definitions; incorrect wiring may result in damage to the device or connected instruments
- Input supply voltage must not exceed 24V DC; overvoltage will cause permanent hardware damage

Operational Notes:

- Please read this technical document completely before use
- Do not force the probes into soil containing stones or hard clumps to avoid bending or damaging the probes
- When removing the sensor from soil, grasp the sensor body; do not pull directly on the cable
- During measurement, ensure probes are fully inserted into the soil/substrate to reduce contact errors and improve measurement accuracy
- For long-term burial in strongly corrosive soils, periodic calibration is recommended to maintain measurement accuracy

10 After-Sales Guarantee & Support

This product is provided with a 12-month warranty from the date of shipment. During the warranty period, failures caused by product quality issues (excluding human damage, misuse, or force majeure factors) will be repaired or replaced free of charge by the manufacturer. After the warranty period expires, the manufacturer provides paid repair services, charging only for material costs.

For technical support, please contact the manufacturer for technical consultation.

11 Manufacturer Information

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12 Revision History

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