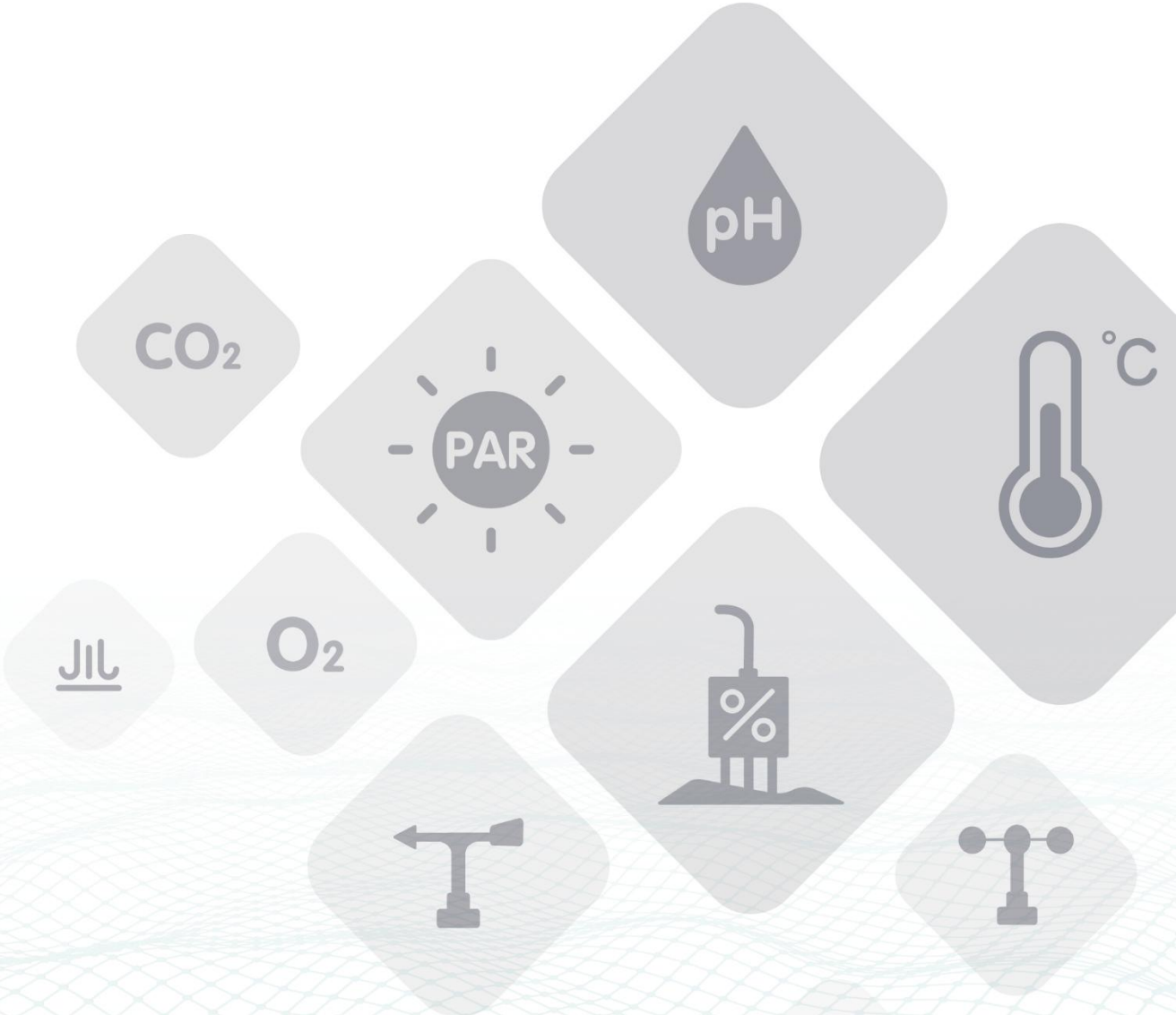
SENSECAP

Multi-Depth Soil Sensor

User Manual

Product Model: S-Multi Soil MTEC-01B

Version：V1.0



1 Product Introduction

This Multi-Soil MT-01 Soil Sensor can monitor soil at different depths in real-time. By measuring the dielectric constant of the soil, this Multi-Soil MT-01 sensor can directly and stably reflect the true moisture content of various soils, and is the internationally standard method of measuring soil moisture. Apply to water-saving in farming, checking the weather, monitoring the environment, growing flowers and vegetables in greenhouses, grassy fields, soil testing, plant cultivation, scientific experiments, and more.

Features:

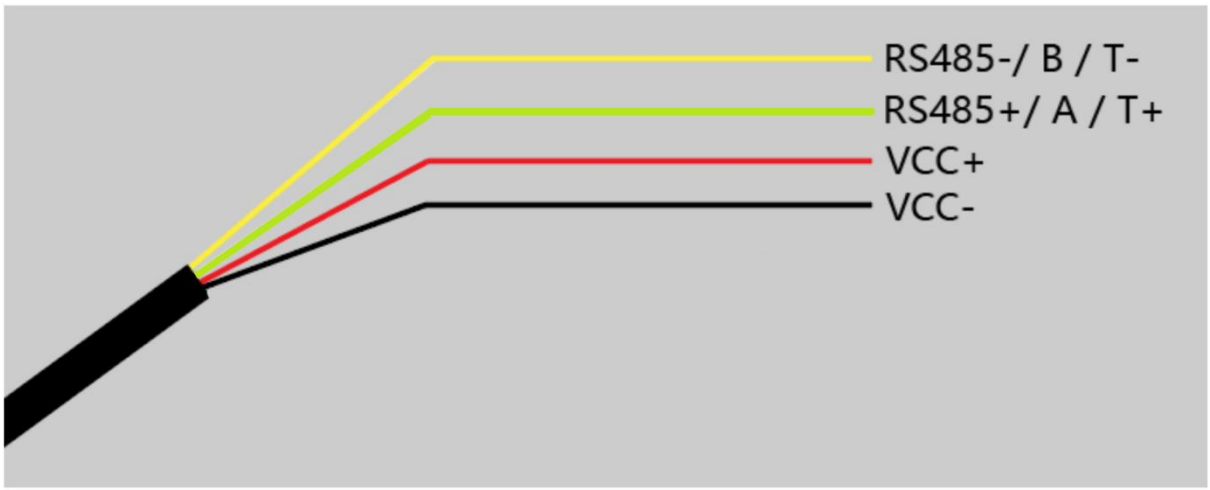
- Soil moisture content, electrical conductivity, and temperature all in one.
- Multi-layer monitoring. Supports 4 layers of soil temperature & moisture & EC monitoring.
- High-quality plastic shell. Anti-aging and resistant to corrosion from acid and alkali in the soil.
- Tight waterproof treatment. It can be immersed in water for a long time without leakage.
- Reliable performance. Measurement accuracy is high, less affected by soil salinity, and applicable to various soil types.
- Multi-directional imitation misconnection protection. With the power line, ground line, and signal line, there is multi-directional anti-wrong connection protection.

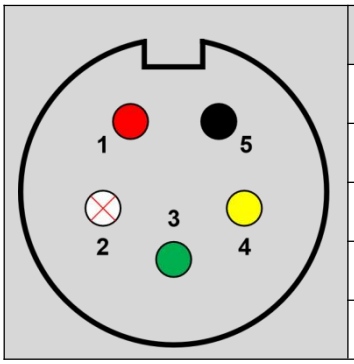
2 Specification

Soil Temperature	
Range	-30 ～ 70 ℃
Accuracy	±0.5 ℃
Resolution	0.1 ℃
Soil Moisture	
Range	0 ～ 70 %
Accuracy	±3 %
Resolution	0.1 %
Electrical Conductivity	
Range	0 ～ 5000 μs/cm Extensible customization range: 0 ～ 20000 μs/cm
Accuracy	±10 %
Resolution	10 μs/cm
General Parameters	
Interface	RS-485
Protocol	MODBUS-RTU RS485
Measurement Point	10cm (4 in) 20cm (8 in) 30cm (12 in) 40cm (16 in)
Measurement Area	Within 10cm outside the surface
Response Time	<100ms
Start-up Time	10 seconds after powering on
Power Supply	12V ～ 24V
Current Consumption	12V /40mA 24V /20mA
Operating Temperature	-10℃ ～ 55℃
IP Rating	IP68
Cable Length	10 meters
Device Weight	1505g

3 Hardware overview

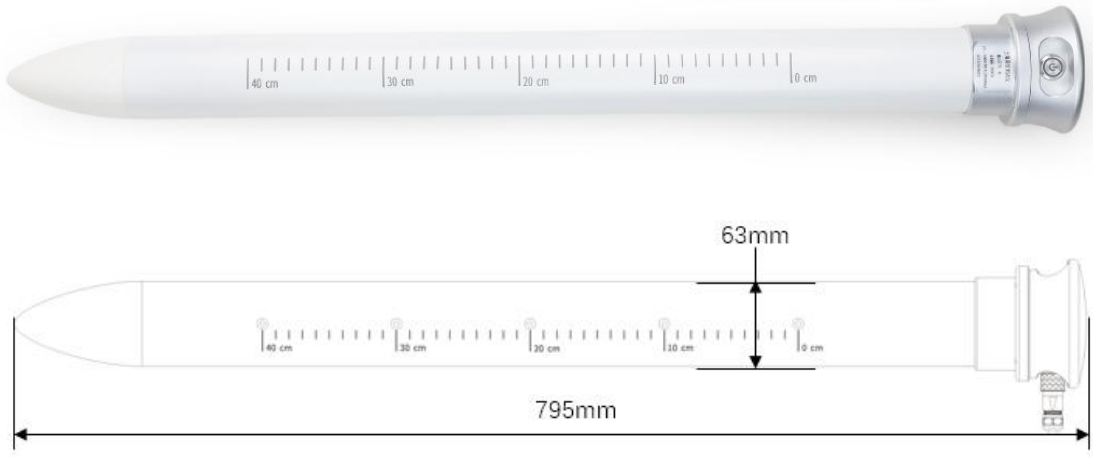
3.1 Wiring





Aviation Connector	Sensor Wire	Description
1	VCC+	DC 12-24V
2	NC	No connect
3	RS485 A	-
4	RS485 B	-
5	GND	Ground

3.2 Dimensions



4 Installation

Set monitoring locations:

Use an earth auger to drill holes at suitable locations, then remove impurities from the removed earth, rub it fine, and add water to make a slurry.

Grouting installation:

Slowly pour the mud into the hole and turn the sensor down slowly in one direction. Until some of the mud is spilled and the 0 scale line is level with the ground surface.

Notice: Installation should be done slowly, do not pull the sensor upwards to avoid air entering the hole and affecting the measurement.

Wait for mud to stabilize:

After completing the installation, it is necessary to wait for a period of time until the slurry has stabilised and returned to its normal state before starting monitoring.

5 RS485 Modbus Protocol

5.1 Modbus Protocol

Modbus Protocol is widely used to establish master-slave communication between intelligent devices or sensors. A MODBUS message sent from a master to a slave contains the address of the slave, the function code (e.g. 'read register' or 'write register'), the data, and a checksum (LRC or CRC).

Multi-Soil MT-01 sensor with RS485 interface supports Modbus protocol. The communication parameters to factory default values for: **Baud rate 9600 bps, one start bit, 8 data bits, no parity, one stop bit.**

Communication protocol is Modbus RTU protocol. Communication parameters can be changed by the setup program or MODBUS command, after the communication parameters are changed, the sensor is required to re-enter the sensor to be effective.

Following modbus function code are supported by sensor:
Modbus Function Code 0x03: used for reading holding register.
Modbus Function Code 0x04: used for reading input register.
Modbus Function Code 0x06: used for writing single holding register.
Modbus Function Code 0x10: used for writing multiple

5.2 Modbus Registers

Parameter Name	Register Address	Parameter Type	Modbus Function number	Parameter Range and Description
Soil Temperature (10cm)	0x0000 /0	INT16, read	3/4	-32768-32767 Divide by 10 to get the true value Unit: ℃
Soil Moisture (10cm)	0x0001 /1	UINT16, read	3/4	0-1000 Correspond to 0-100%
Soil EC (10cm)	0x0002 /2	UINT16, read	3/4	0-500 Correspond to 0-5000 μs/cm
Soil Temperature (20cm)	0x0003 /3	INT16, read	3/4	-32768-32767 Divide by 10 to get the true value Unit: ℃
Soil Moisture (20cm)	0x0004 /4	UINT16, read	3/4	0-1000 Correspond to 0-100%
Soil EC (20cm)	0x0005 /5	UINT16, read	3/4	0-500 Correspond to 0-5000 μs/cm
Soil Temperature (30cm)	0x0006 /6	INT16, read	3/4	-32768-32767 Divide by 10 to get the true value Unit: ℃
Soil Moisture (30cm)	0x0007 /7	UINT16, read	3/4	0-1000 Correspond to 0-100%
Soil EC (30cm)	0x0008 /8	UINT16, read	3/4	0-500 Correspond to 0-5000 μs/cm
Soil Temperature (40cm)	0x0009 /9	INT16, read	3/4	-32768-32767 Divide by 10 to get the true value Unit:℃
Soil Moisture (40cm)	0x000A /10	UINT16, read	3/4	0-1000 Correspond to 0-100%
Soil EC (40cm)	0x000B /11	UINT16, read	3/4	0-500 Correspond to 0-5000 μs/cm
Slave ADDRESS	0x0100 /256	UINT16, Read/Write	3/6/16	0-255 Default is **49**(Dec)

5.3 Reading Sensor Data

Reads data (**soil temperature, soil moisture, soil EC**) from the sensor (address **49**, decimal)

Master Send:
31 03 0000 000C 403F (CRC Checksum)

Sensor Response:
31 03 18 00D3 (Soil Temperature-10cm) 0110 (Soil Moisture-10cm) 0028 (Soil EC-10cm) 00D0 (Soil Temperature-20cm) 0121 (Soil Moisture-20cm) 0032 (Soil EC-20cm) 00CD (Soil Temperature-30cm) 012E (Soil Moisture-30cm) 003C (Soil EC-30cm) 00CB (Soil Temperature-40cm) 0138 (Soil Moisture-40cm) 0041 (Soil EC-40cm) 62D9 (CRC Checksum)

Data representation:
Soil Temperature: INT16 format, divide by 10 to get real value in ℃
Soil Moisture: UINT16 format, divide by 10 to get real value in %(m^3/m^3)
Soil EC: UINT16 format, multiply by 10 to get the true value in μs/cm

For example, the data above indicates that:
10cm: Soil Temperature: 21.1℃, Soil Moisture: 27.2%(m^3/m^3), Soil EC: 400 μs/cm;
20cm: Soil Temperature: 20.8℃, Soil Moisture: 28.9%(m^3/m^3), Soil EC: 500 μs/cm;
30cm: Soil Temperature: 20.5℃, Soil Moisture: 30.2%(m^3/m^3), Soil EC: 600 μs/cm;
40cm: Soil Temperature: 20.3℃, Soil Moisture: 31.2%(m^3/m^3), Soil EC: 650 μs/cm;

5.4 Modify Modbus Address

Set default Modbus address (49 in decimal) to **02**:

Slave Addr	Function Code	Register Addr H	Register Addr L	Register Data H	Register Data L	CRC16 H	CRC16 L
31	**06**	**01**	**00**	**00**	**02**	**0C**	**07**

Repeat the sent command if the sensor **successfully receives and modifies the address.**

Use the **broadcast command** to set the sensor address to **03**:

Slave Addr	Function Code	Register Addr H	Register Addr L	Register Data H	Register Data L	CRC16 H	CRC16 L
FF	**06**	**01**	**00**	**00**	**03**	**DC**	**38**

Repeat the sent command if the sensor **successfully receives and modifies the address.**

Notice: Make sure that only **one slave** is connected when using the broadcast address to modify the sensor address.

6 Document Version

Version	Date	Description	Editor
V1.0	1/24/2025	First edition	Leo Liu