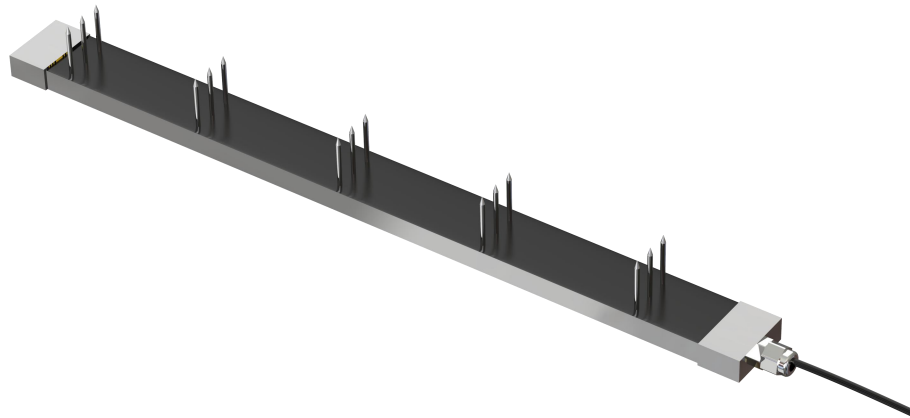


# RS-\***-N01-TR-5**

## Multi Depth Soil Moisture Sensor

### User Manual



## 1. Product Features

- Capable of dynamically monitoring soil electrical conductivity, moisture content, and temperature at multiple layers.
- Fully sealed and corrosion-resistant, suitable for burying in soil or long-term immersion in water.
- Electrodes are made of specially treated alloy materials, resistant to strong external impacts and difficult to damage.
- High accuracy, fast response, and excellent interchangeability. The probe's insertion design ensures precise and reliable measurement performance.

## 2. Technical Parameters

Power Supply (Default)	DC 5-30V
Maximum Power Consumption	1.1W (12V DC power supply)
Operating Temperature	-40°C~+60°C
Internal Chip Heat Resistance	85°C
Electrical Conductivity Parameters	
Range	0-20000μS/cm
Resolution	10μS/cm
Accuracy	±3%FS in the range of 0-10000μS/cm; ±5%FS in the range of 10000-20000μS/cm (Brown soil, 60%RH,25°C)
Soil Moisture Parameters	
Range	0-100%
Resolution	0.10%
Accuracy	±2% within 0-50%, (brown soil, 30%, 25°C) ±3% within 50-100%, (brown soil, 60%, 25°C)
Soil Temperature Parameters	
Range	-40~80°C
Resolution	Resolution: 0.1°C
Accuracy	±0.5°C (25°C)
Electrical Conductivity Temperature Compensation	Internal temperature compensation sensor, range: 0-50°C
Protection Rating	IP68
Probe Materials	Anti-corrosion special electrode

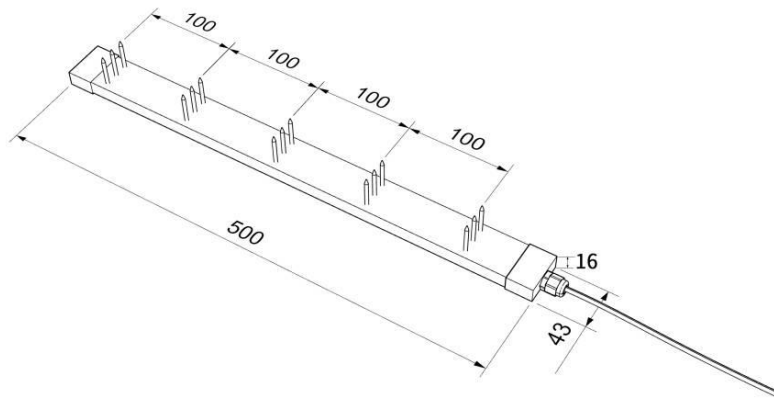
Sealing Material	Black flame retardant epoxy resin
Default Cable Length	1m, cable length can be customized upon request
Output Signal	RS485(ModBus protocol)

## 3. Equipment installation instructions

### 3.1 Equipment dimensions and inspection height

The product adopts a layered detection structure, with one soil parameter measurement point every 10cm in the subsoil, observing the soil parameters within the corresponding range. As shown in the figure below:

Equipment Dimension Drawing (Unit: mm)



### 3.2 Installation method

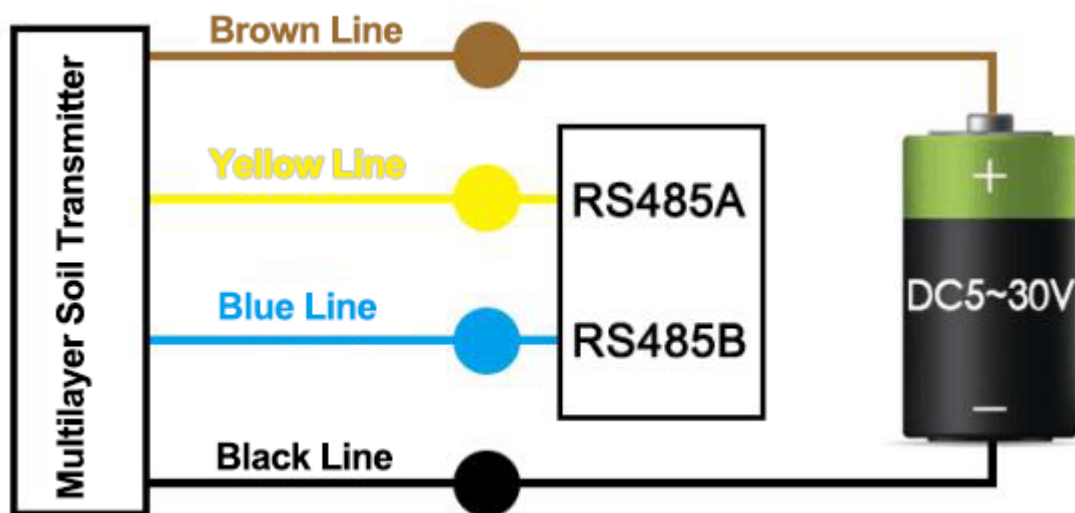
Vertically dig a pit with a diameter of  $>20\text{cm}$ , insert the sensor steel needle horizontally into the wall of the pit at the established depth, fill the pit tightly, and after stabilizing the pit for a certain period of time, you can carry out measurements and recordings for several consecutive days, months, or even a longer period of time.



### 3.3 Product wiring instructions

Wide voltage power input 5~30V is available. 485 signal line wiring, pay attention to the A/B two lines can not be connected to the opposite, the bus more than one device between the address can not conflict.

	Thread color	Description
Power supply	Brown	Power positive (5~30V DC)
	Black	Power Supply Negative
Communication	Yellow	485-A
	Blue	485-B



## 4. Communication protocol

### 4.1 Communication Basic Parameters

Code	8-bit Binary
Data Bits	8-bit
Parity bit	None
Stop Bit	1 bit
Error check	CRC (redundant cyclic code)
Baud rate	2400 bit/s, 4800 bit/s, 9600 bit/s programmable, factory default 4800 bit/s

### 4.2 Data frame format definition

The ModBus-RTU communication protocol is used with the following format:

Initial structure  $\geq$  4 bytes in time

Address code = 1 byte

Function code = 1 byte

Data area = N bytes

Error check = 16 bit CRC code

End structure  $\geq$  4 bytes of time

Address code: Address of the transmitter, unique in the communication network (factory default 0x01).

Function code: Function indication of the command issued by the host, this transmitter uses function code 0x03 (read register data), 0x06 (write register data).

Data area: data area is specific communication data, note that 16bits data high byte in front!

CRC code: two-byte checksum code.

#### Host query frame structure:

Address Code	Function Code	Register Starting Address	Register Length	Check Code Low	Check Code High
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

#### Slave answer frame structure:

Address Code	Function Code	Effective Byte Count	Data Section 1	Data Section 2	Data Section N	Check Code
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

## 4.3 Register address

Depending on how the device is installed, different soil layers are different ModBus addresses, respectively, addresses 1-5, the top device address is 1, the next device address is 2 ..... and so on, the fifth device address is 5.

Register Address	PLC or Group Address (Decimal)	Content	Operation	Definition Description
0000 H	40001	Moisture Content	Read Only	Real-time value of moisture content ( $\times 10$ )
0001 H	40002	Temperature Value	Read Only	Real-time temperature value ( $\times 10$ )
0002 H	40003	Conductivity	Read Only	Real-time conductivity value
0003 H	40004	Salinity	Read Only	Real-time salinity value
0004 H	40005	Total Dissolved Solids (TDS)	Read Only	Real-time TDS value
0022 H	40035	Conductivity Temperature Coefficient	Read/Write	0-100 corresponds to 0.0%-10.0%, default is 0
0023 H	40036	Salinity Coefficient	Read/Write	0-100 corresponds to 0.0-10.0, default is 55 (5.5)
0024 H	40037	TDS Coefficient	Read/Write	0-100 corresponds to 0.0-10.0, default is 50 (5.0)
0030 H	40049	Measurement Logic Switch	Read/Write	0: Normal measurement logic, 1: Alternate measurement logic, default is 0
0050 H	40081	Temperature Calibration Value	Read/Write	Integer ( $\times 10$ )
0051 H	40082	Moisture Calibration Value	Read/Write	Integer ( $\times 10$ )
0052 H	40083	Conductivity Calibration Value	Read/Write	Integer
07D0 H	42001	Device Address	Read/Write	1-254 (default is 1)
07D1 H	42002	Device Baud Rate	Read/Write	0: 2400, 1: 4800, 2: 9600

Description: 0030H register, the normal measurement logic is that all five layers are turned on for measurement, and when the host asks for the corresponding layer, the data will be uploaded immediately, the advantage of this program is the fast response speed; the low-power measurement logic is that the default measurement is not performed, and when the host asks for which layer, the corresponding layer will be turned on for measurement, and after the measurement is completed and the data is replied to, it will be restored to the state of non-measurement, the advantage of this program is that the device has a low power consumption. Customers can choose their own measurement program according to the actual situation on site.

## 4.4 Communication protocol examples and explanations

Example: Read the temperature and moisture value at device address 0x01.

Interrogation frame (hexadecimal):

Address Code	Function Code	Starting Address	Data Length	Check Code Low	Check Code High
0x01	0x03	0x00 0x00	0x00 0x02	0xC4	0x0B

Answer frame (hexadecimal): (e.g. reads temperature -10.1°C, moisture 65.8%):

Address Code	Function Code	Valid Byte Count	Moisture Value	Temperature Value	Check Code Low	Check Code High
0x01	0x03	0x04	0x00 0xEB	0xFF 0x9B	0x8A	0x5C

Temperature Moisture Value Calculation:

Moisture value: 00EB H = 235 => Moisture = 23.5 %.

When the temperature is below 0 °C the temperature data is uploaded as complementary code.

Temperature: FF9B H (hex) = -101 => Temperature = -10.1 °C

## 5. Common Problems and Solutions

Device cannot connect to PLC or computer

Possible causes:

- 1)The computer has multiple COM ports and the port selected is incorrect.
- 2)The device address is wrong, or there is a device with duplicate address.
- 3)Baud rate, parity mode, data bit, stop bit error.
- 4)The 485 bus is disconnected, or the A and B lines are reversed.
- 5)The number of devices is too many or the wiring is too long, the power supply should be nearby, add 485 enhancer, and increase the 120Ω termination resistor at the same time.
- 6)USB to 485 driver is not installed or damaged.
- 7)The device is damaged.