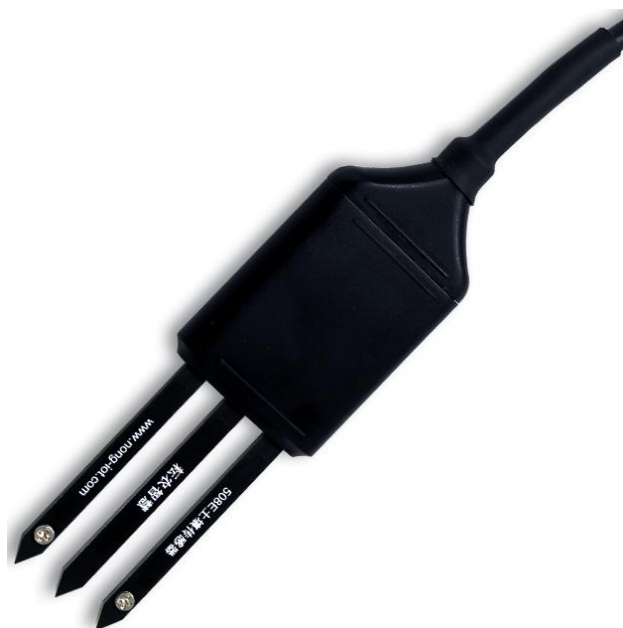# Soil Sensor

508E

Instruction Manual

HANDAN YUNNONG INTELLIGENT AGRICULTURAL TECHNOLOGY CO., LTD.

The 508E sensor adopts a low-power design scheme to simultaneously measure the three parameters of soil temperature, soil volumetric water content and soil electrical conductivity (EC).

Item No.	Parameters
508E-TH	Soil Temperature
508E-E	Soil Conductivity
508E	Soil temperature and humidity and Soil Conductivity

Product Principle：

Soil Temperature: The sensor is equipped with a digital temperature sensing chip on a probe, which uses copper-clad method to increase the temperature transmission efficiency, which is used to measure the temperature of the probe surface, that is, the soil.

Soil Volumetric Water Content: The sensor uses the FDR principle based on the dielectric constant, which has been used to measure the influence of the soil dielectric constant on the transmission of high-frequency signals in order to calculate the soil volume rate in reverse.

Soil Electrical Conductivity (EC): The sensor measures the error by applying alternating current on two metal probe points to calculate the soil conductivity. The alternating current method avoids the bias effect caused by the unidirectional voltage, and at the same time the conductivity measurement is added and the temperature self-correction is added.

The sensor adopts automatic sleep setting and works every 5 minutes. The data change cycle is 5 minutes.
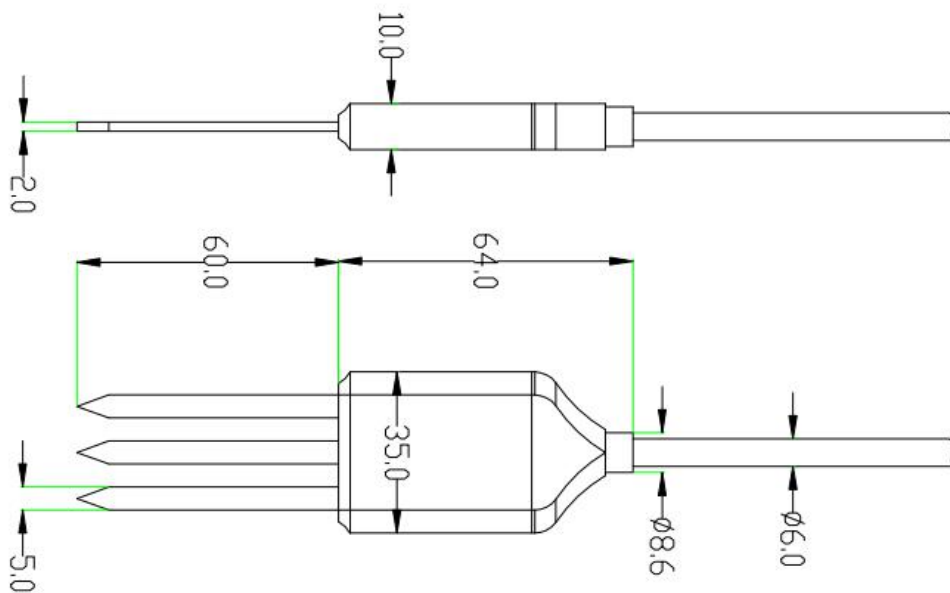
Product Parameter：

Power supply voltage: DC6-24V

Power: ≤0.05W

Instantaneous current: ≤15mA average current < 3mA

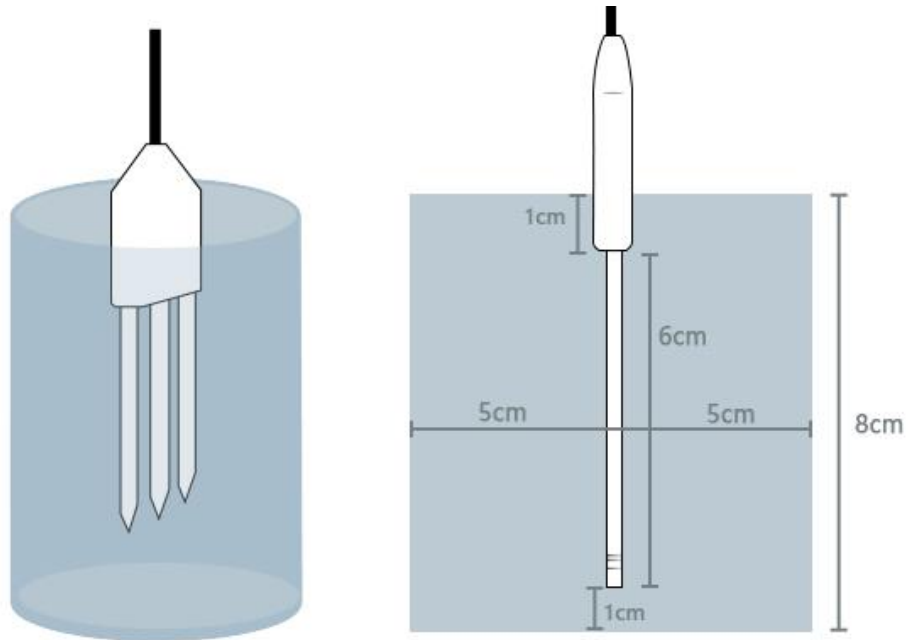| Parameters	Measuring Range	Resolution	Accuracy
Soil Temperature	-20-80℃	0.1℃	±0.5℃
Soil Volume Yield	0-100%VOL	0.1%	±3%（0-45%），±5%（>45%）
Soil Conductivity	0-6000uS/CM	10uS	±5%

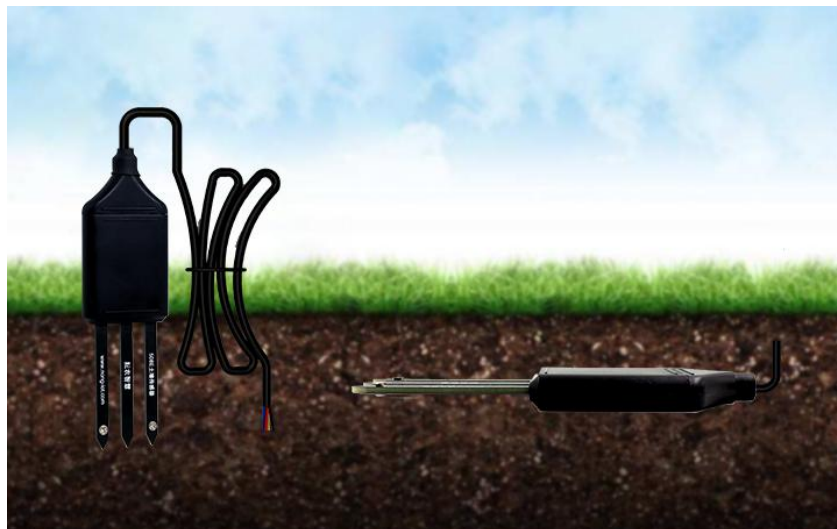**Product Size：**

Product Installation：

Effective measuring range:

As shown in the figure, the height of the cylinder is 8cm, the radius is 5cm, and the length of the probe is 1cm deep in the water. Avoid big rocks or tree roots within this effective range.

Installation method:

Two ways to bury

Wiring Instructions：

Thread Color	Definition
Red	Power is Positive
Black	Power Negative
Yellow	RS485A
Blue	RS485B

Precautions For Use:

Pay attention to ensure that the probe is in full contact with the soil during installation

The accuracy of soil volume concentration can only ensure that the soil temperature is higher than 0°C (dielectric constant changes greatly when water freezes)

The accuracy of soil conductivity only guarantees that the soil temperature is higher than 0℃ and the volume of soil exceeds 20% VOL

It should be ensured that the two probe points of soil conductivity are clean. When the probe points are oily, it will greatly affect the accuracy of the conductivity.

This product uses the rate-fixed dielectric constant to affect the transmission of high-frequency signals to reverse the volume of the soil. The two parameters are in a linear relationship. Users who have higher requirements for the volume of the soil can perform the second rate on the sensor. set.

MODBUS RTU Communication Protocol

(For 508E Series Sensors)

Baud Rate: 9600

Data Bit: 8

Stop Bit: 1

Verification Bit: none

1.1 CRC description:

In all the following descriptions, the two bytes of CRC16 in the MODBUS RTU protocol are in accordance with the MODBUS regulations: the low byte comes first, and the high byte comes after.

In the following description, it is assumed that the sensor address is 0xFF (the sensor specified address is FF)

1.2 Rules for returning error codes:

The sensor does not return an error code when receiving incorrect commands (including CRC16 validation errors). The host computer can consider that the command has failed when the return data is not received 100ms after the command is issued, and the command can be re-sent.

2.1 Standard MODBUS register description

Special attention: The number or length of registers in the MODBUS command totals two bytes and 16 bits as a unit (high byte in front and low byte in the back), instead of single byte 8 bits as a unit.

If it exceeds the range, the output result of the sensor will be unpredictable. The user should

ensure that the MODBUS command conforms to this manual in the software design of the host computer. The user should ensure that the address and quantity of the register in the command are within the specified range of the system.

Input register: read with function code 03

Address	Operating	Content	Remarks
0x0000	Read only	Soil volumetric water content, magnified 10 times of hexadecimal number, such as 0x012C means the water content is 30.0%VOL	
0x0001	Read only	Soil temperature, magnify 100 times plus 20 hexadecimal number, such as 0x0FA0 means temperature is 20.0℃	
0x0002	Read only	Conductivity (EC), hexadecimal number, such as 0x012C means the conductivity is 300uS/cm	

Internal register: read with function code 03; write with function code 06

Address	Operating	Content	Remarks
0x0000	Read only	Sensor address, range 0x01-0xFF (decimal), factory setting is 0xFF	

Note: The data in the address part is 16 binary representation, for example: address 20 (decimal) code conversion 0x14

The following is an example of how to use Modbus RTU commands to access system registers:

1. Read multiple input registers (3 real-time data) commands

Send: FF 03 00 00 00 03 10 15

FF	03	00 00	00 03	10 15
System address	function code	Register address	Number of registers	CRC16 check bit automatically generated by software

Answer: FF 03 06 01 2C 01 00 00 56 78 C4

The data segment data is:

FF	03	06	01 2C 01 00 00 56	78 C4
System address	function code	Number of data segment bytes	Data segment data	CRC16 check bit

2. Read the address register command

Send: 00 03 00 00 00 01 85 DB

00	03	00 00	00 01	85 DB
	function code	Register address	Number of registers	CRC16 check bit automatically generated by software

Answer: 00 03 02 00 01 44 44

00	03	02	00 01	44 44
	Function code	Number of bytes in the data segment	Data segment data	CRC16 check bit

Data segment data is 0x0001 = 01   Indicates system address 01

3、Modify internal register (system address) command (replace the address with 0x33)

Send: 00 06 00 00   00 33 C8 0E

00	06	00 00	00 33	C8 0E
	Function code	Register address	New address	CRC16 check bit

Answer: 00 06 00 00   00 33 C8 0E   (Indicates successful modification)

00	06	00 00	00 33	C8 0E
	Function code	Starting Address	New address	CRC16 check bit

Remarks:

The default update time of the three soil parameters is 5 minutes. When fast observation is needed, the AT+CALIBRATION=1# command can be sent.

Switch to the test mode, the update time is changed to 3 seconds, the command will not be saved after power off.

Without re-powering on, you can send AT+CALIBRATION=0# command to switch the sensor back to working mode and update in 5 minutes.

Warranty and after-sales:

Warranty commitment: The product has a 12-month warranty period from the date of delivery (product problems caused by failure to follow the corresponding technical requirements or other human operations).

After-sales commitment: Users can consult related technical issues and obtain clear solutions by telephone. If it is a product quality problem, it can be returned to the factory for repair or replacement.

After-sales contact email: info@nong-iot.com