

Analog Soil Moisture Sensor With Electrical Conductivity User Manual



Chapter 1 Product Introduction

1.1 Product Overview

This sensor offers stable performance and high sensitivity, making it an essential tool for observing and researching the formation, evolution, and remediation of saline-alkali soils, as well as water-salt dynamics. By measuring the dielectric constant of the soil, it provides a direct and stable reflection of the actual moisture content of various soil types. It measures soil moisture as a percentage by mass, in accordance with current international standards for soil moisture measurement.

1.2 Applications

Suitable for soil moisture monitoring, scientific experiments, water-saving irrigation, greenhouse cultivation, flower and vegetable farming, grassland and pasture management, rapid soil testing, plant cultivation, wastewater treatment, precision agriculture, and other related fields.

1.3 Product Features

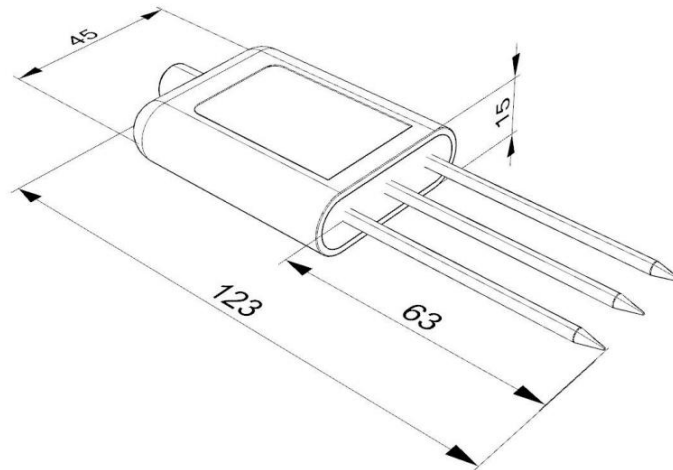
- Can also be used to measure the conductivity of water-fertilizer integrated solutions, as well as other nutrient solutions and growing media.
- The electrodes are made of specially treated stainless steel, capable of withstanding strong external impacts and resistant to damage.
- Fully sealed and resistant to acid and alkali corrosion, it can be buried in soil or placed directly in water for long-term dynamic monitoring.
- High accuracy, fast response, and good interchangeability; the probe's insertable design ensures precise measurements and reliable performance.

1.4 Key Specifications

Parameter	Specification
Power Supply (Default)	DC 10–30V
Max Power Consumption	Current Output: 0.4W (12V DC); Voltage Output: 0.3W (12V DC)
Operating Temperature	-40°C to +60°C
Internal Chip Temperature Limit	85°C
Conductivity Range	0–10000 $\mu\text{S}/\text{cm}$
Conductivity Accuracy	$\pm 3\%$ FS (standard solution, 60%, 25°C)
Soil Moisture Range	0–100%

Soil Moisture Accuracy	0–50%: $\pm 2\%$ (@ standard sample, 30%, 25°C); 50–100%: $\pm 3\%$ (@ standard sample, 60%, 25°C)
Conductivity Temp Compensation	Built-in sensor, range 0–50°C
Protection Rating	IP68
Probe Material	Corrosion-resistant special electrode
Sealing Material	Black flame-retardant epoxy resin
Cable Length	2 m (customizable)
Dimensions	45 × 15 × 123 mm
Output Signal	4–20 mA / 0–5V / 0–10V
Load Capacity	Current Output: $\leq 600\Omega$; Voltage Output: $\leq 250\Omega$

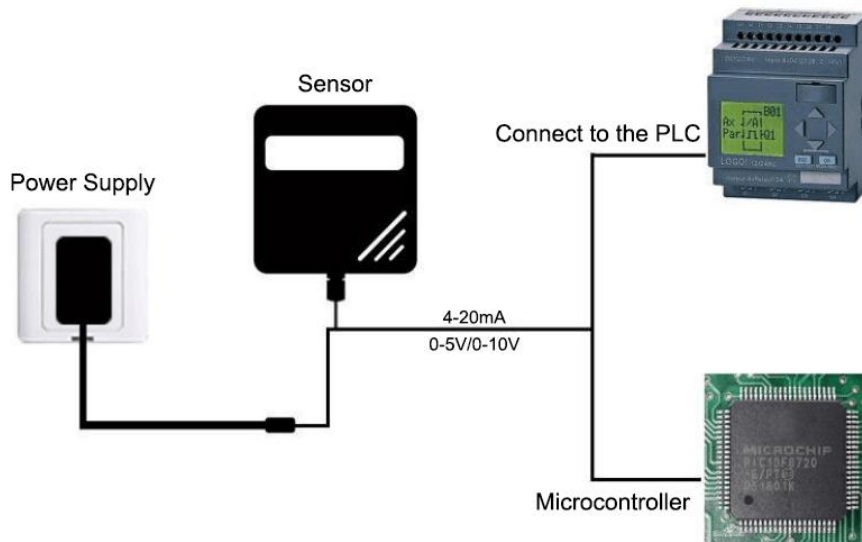
Size (Unit:mm)



1.5 System Architecture Diagram

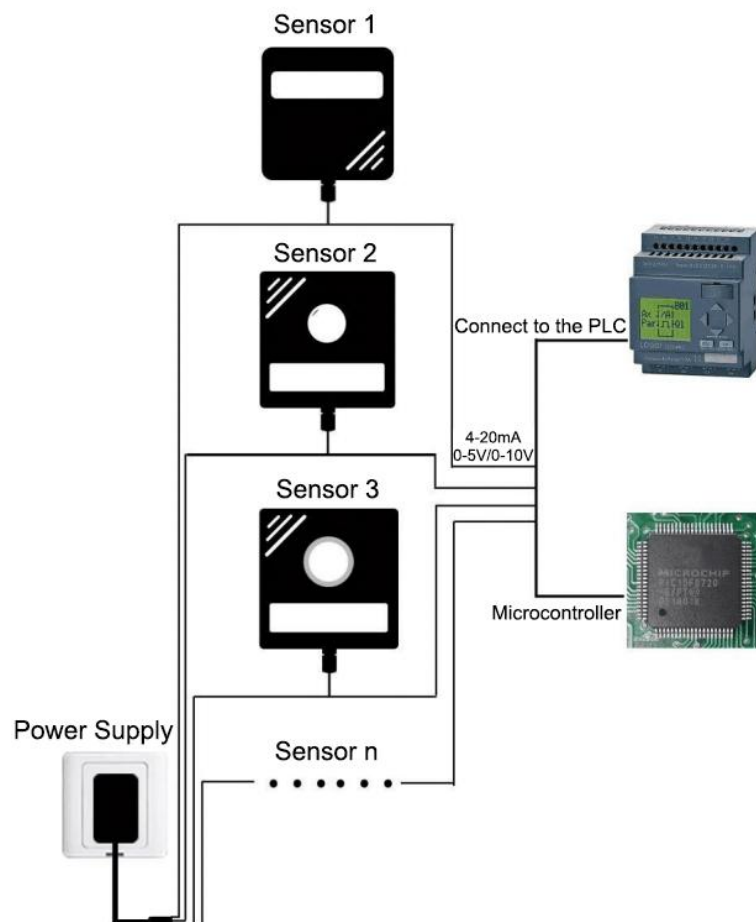
When the system needs to be connected to an analog sensor, simply power the device and connect the analog output wire to the DI port of the microcontroller or PLC. Then, write the corresponding data acquisition program based on the conversion formula provided below.

Single Connection



When the system needs to connect multiple analog sensors, each sensor must be connected to a separate analog input pin on a microcontroller or a digital input (DI) port on a PLC. At the same time, you should write the corresponding data acquisition program based on the conversion formulas provided below.

Multiple Connections



Chapter 2 Hardware Connection

2.1 Pre-installation Check

Equipment List:

- 1 temperature and humidity transmitter
- Certificate of Conformity, Warranty Card

2.2 Interface Specifications

Devices with 4–20 mA or 0–5 V output require a wide-range DC power supply of 10–30 V.

Devices with 0–10 V output require a DC power supply of 18–30 V.

2.2.1 Sensor Wiring

Wire Color	Description	Notes
Brown	Power Positive	Power type, refer to power supply specifications
Black	Power Negative / Conductivity Signal Negative / Moisture Signal Negative	GND
Blue	Conductivity Signal Positive	Conductivity Signal Output
Yellow	Moisture Signal Positive	Moisture Signal Output

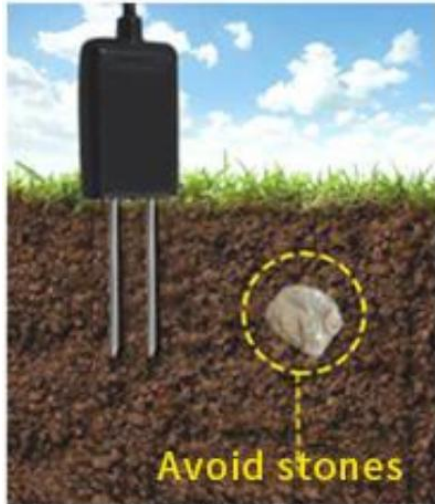
Chapter 3 Usage Instructions and Precautions

Since the electrodes directly measure the conductivity of soluble salt ions in the soil, the soil's volumetric moisture content must be above approximately 20% for the soluble ions to accurately reflect the soil's conductivity. During long-term monitoring, measurements taken after irrigation or rainfall are closer to actual conditions. For rapid testing, water the soil to be tested first, and wait until the moisture has fully penetrated before taking a measurement.

When measuring on relatively hard surfaces, first drill a hole (the diameter of which should be smaller than that of the probe), then insert the probe into the soil, compact the soil, and proceed with the measurement. The sensor should be protected from severe vibration and impact, and must never be struck with a hard object. Since the sensor is housed in a black casing, exposure to intense sunlight can cause it to heat up rapidly (reaching temperatures as high as 50°C or higher). To prevent excessive heat from affecting temperature measurements, ensure the sensor is shaded and protected during field or outdoor use.

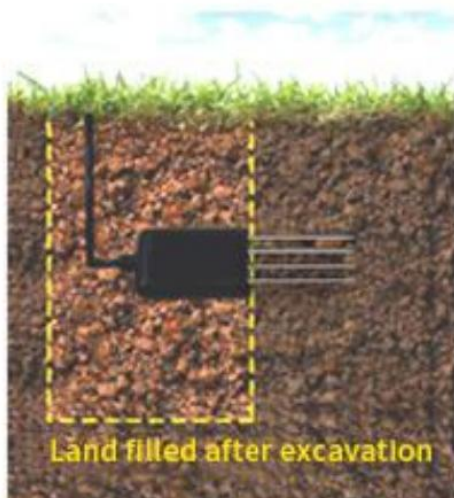
3.1 Rapid Measurement Method

Select a suitable measurement location, avoiding rocks, and ensure the steel probe does not come into contact with hard objects. Remove the topsoil to the desired measurement depth, maintaining the original compaction of the underlying soil. Hold the sensor firmly and insert it vertically into the soil; do not wobble it from side to side during insertion. It is recommended to take multiple measurements within a small area at each measurement point and calculate the average value.



3.2 Burying Method

Dig a vertical hole with a diameter greater than 20 cm. Depending on the measurement requirements, insert the sensor probe horizontally into the hole wall at the specified depth. Fill the hole tightly, allow it to settle for a period of time, and then proceed with measurements and recordings over a period of several days, months, or even longer.



3.3 Precautions

1. Warning: Risk of Personal Injury

This device must not be used as a safety device, emergency stop device, or in any situation where a device failure could result in personal injury.

2. Limitations of Use

This device is intended solely for its intended use and within the authorized scope.

Before installation, operation, or maintenance, you must carefully read and understand the relevant instructions in the technical manual.

Failure to comply with the above warnings and guidelines may result in death or serious personal injury.

3. During measurement, the steel probe must be fully inserted into the soil.
4. Avoid direct exposure of the sensor body to strong sunlight, which may cause overheating. Take precautions against lightning strikes when using the device outdoors.
5. Do not forcefully bend the steel pins, do not pull on the sensor cables with excessive force, and do not drop or subject the sensor to violent impacts.
6. The sensor has an IP68 protection rating and can be fully submerged in water.
7. Due to the presence of radio frequency electromagnetic radiation in the air, the device should not remain powered on for extended periods while exposed to the air.

Chapter 4 Meaning of Analog Parameters

4.1 Calculation of Current-Type Output Signal Conversion

For example, for a range of 0–10,000 $\mu\text{S}/\text{cm}$ with a 4–20 mA output, when the output signal is 12 mA, calculate the current conductivity. The span of this conductivity range is 10,000. Expressed using a 16 mA current signal,

$10000/16 \text{ mA} = 625 \mu\text{S}/\text{cm}$, meaning that a current of 1 mA represents a conductivity of 625 $\mu\text{S}/\text{cm}$. The measured value is $12 \text{ mA} - 4 \text{ mA} = 8 \text{ mA}$,
 $8 \text{ mA} \times 625 = 5000 \mu\text{S}/\text{cm}$. Thus, the current conductivity is 5000 $\mu\text{S}/\text{cm}$.

4.2 Calculation for Voltage-Type Output Signal Conversion

For example, with a range of 0–10,000 $\mu\text{S}/\text{cm}$ and a 0–5 V output, calculate the current conductivity when the output signal is 2.5 V.

The span of this conductivity range is 10,000, expressed as a 5 V voltage signal: $10,000/5 \text{ V} = 2,000/\text{V}$,

meaning that a voltage of 1 V represents a conductivity of 2000 $\mu\text{S}/\text{cm}$. The measured value is $2.5 \text{ V} - 0 \text{ V} = 2.5 \text{ V}$; $2.5 \text{ V} \times 2000 = 5000 \mu\text{S}/\text{cm}$. Thus, the current conductivity is 5000 $\mu\text{S}/\text{cm}$.

Chapter 5 Warranty Information

This product is covered by a 12-month warranty period starting from the date of purchase (subject to valid proof of purchase). During the warranty period, under normal use and maintenance, if a malfunction is caused by defects in materials or workmanship, and after verification by our company, we will provide free repair or replacement of parts. After the warranty period expires, we will continue to provide lifetime paid repair services.

The following situations are not covered by the warranty:

1. Damage to the equipment caused by incorrect installation or operation.
2. The product has been disassembled, repaired, modified, or altered by personnel not authorized by our company, or the user has replaced any internal components on their own.

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3. Damage caused by negligent use or the ingress of water or other substances into the device.
4. Malfunctions or damage resulting from accidents or natural disasters.
5. Malfunctions or damage resulting from operation outside the working parameters listed in the product specifications.