



Product Manual

Soil Moisture Sensor SMS-10

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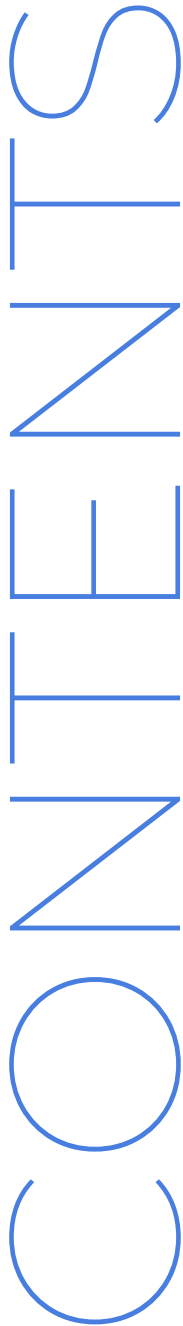
ABOUT THIS DOCUMENT

This manual contains instructions for installing and operating the Soil Moisture Sensor SMS-10.

The manual is intended for personnel familiar with the rules for performing installation work in the field of electronic and electrical equipment.

wanwave LTD. reserves the right to make changes to this document related to improving equipment and software, as well as to eliminate document deficiencies.

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1. BASIC INFORMATION ABOUT THE DEVICE AND ITS PURPOSE

1.1 General information

Full name of the device:

wanwave Soil Moisture Sensor SMS-10

Abbreviated name of the device:

SMS-10

1.2 Purpose and operating principles of the device

The Soil Moisture Sensor (SMS) is an autonomous **wanwave**-based tensiometer designed for continuous, 24/7 automated monitoring of soil moisture where it is installed. The sensor continuously measures the capillary component of soil moisture potential and is available in different versions, varying in body length designed to measure moisture at depths ranging from 20 to 150 centimeters.

SMS-10 automatically transmits soil moisture data wirelessly at pre-configured intervals, with the transmission frequency set by the manufacturer.

The sensor is suitable for use on both stationary and mobile applications.

1.3 Compliance with requirements and standards

The sensor operates in any of the following unlicensed frequency ranges (the specific range will be set for you, in accordance with your territory's regulations, as part of the manufacturing process): 863.0-870.0 MHz, 920.0-925.0 MHz.

1.4 Delivery set

An SMS-10 installation kit is supplied with the following items:

- SMS-10 with pre-installed:
 - Internal **wanwave** LPWAN antenna;
 - Internal battery.
- Product passport.

1.5 Additional equipment

For operation of the sensor, the following is additionally required:

- Fastener kit for installing the sensor on the manhole cover or the well wall.

2. OPERATING THE SENSOR

2.1 Purpose and Operating Principles

2.1.1 Method of operation

The sensor operates on the principle of a tensiometer—a device that measures the capillary (matric) component of soil moisture potential. This capillary component determines the amount of moisture available to a plant's root system, regardless of soil type. It indicates the "effort" a plant must exert to extract water from the soil but does not provide information about the absolute water content. Other indicators, such as soil water volume, should be interpreted based on the soil's characteristics. For example, to achieve the same moisture potential for a plant, soil with over 35% clay content requires twice as much water by volume compared to sandy soil.

The key component of the sensor is a ceramic tip that allows water to either flow into the soil or be absorbed into the sensor's body. Inside the sensor body, there is water and an air chamber. Changes in water levels inside the sensor cause variations in pressure, which are measured by a digital pressure sensor.

Below is a table presenting average sensor readings and their corresponding soil moisture levels:

Sensor readings	Suction pressure value	Soil moisture
0	> 550h Pa	Drought. Urgently requires watering.
From 1 to 45	300 hPa - 550 hPa	Dry. Needs watering.
From 46 to 80	100 hPa - 300 hPa	Optimal
From 81 to 100	0 hPa - 100 hPa	Excessive

2.1.2 Server Communication

The sensor automatically transmits the measured capillary soil moisture potential wirelessly to a server at regular intervals. The data transmission interval is set by the manufacturer (see Section 2.3.2).

2.1.3 Unique Identifier

Each sensor has a unique, unalterable hardware identifier (network address), programmed at the manufacturing stage.

- This identifier remains constant throughout the product's lifecycle.

2.1.4 Wireless Communication Security

The combination of data transmission technologies and message integrity checks ensures:

- Protection against denial of service attacks.
- Prevention of false messages.
- Continuous monitoring of product functionality.

2.1.5 Firmware Integrity

The sensor operates without an external operating system. Key security features include:

- Integrity checks are performed during firmware loading.
- Debugging modes, memory rewrite capabilities, and input/output ports are disabled.
- Protection against unauthorized modifications to firmware and memory data.

The sensor's robust design and secure communication protocols ensure reliable and secure operation in monitoring underground utility access points.

2.2 Switching On the Sensor

To switch the sensor on or off do the following:

1. **Remove the Cover:** Unscrew and remove the cover from the sensor housing.
2. **Access the Switch:** Pull out the board and use the switch marked “Switch” in Fig. 1 to turn the sensor on or off.
3. **Replace the Cover:** Close and screw the cover on.

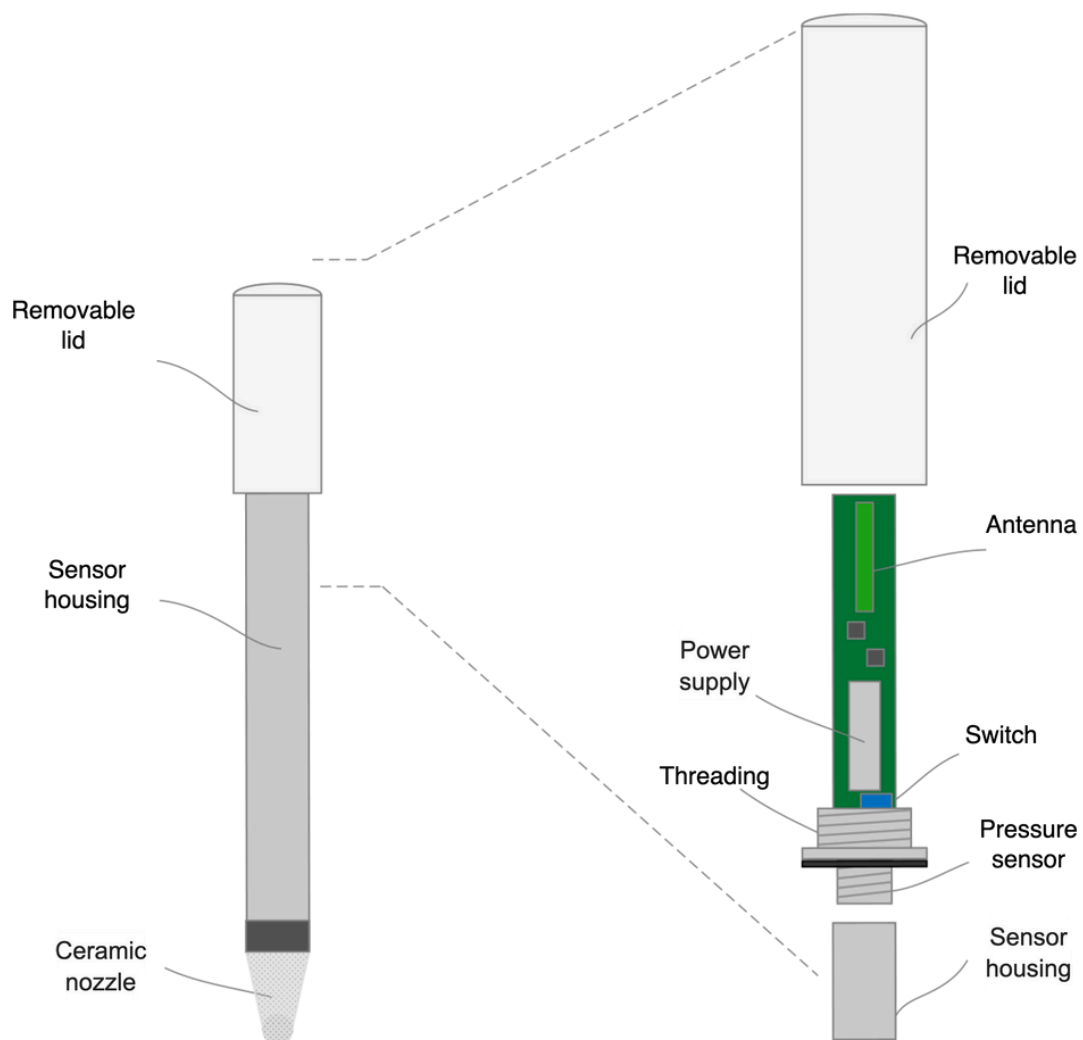


FIG. 1 LOCATION OF THE MAIN COMPONENTS OF THE SENSOR

2.3 Sensor operating parameters

2.3.1 Configurable Parameters of the Sensor

The sensor allows for factory configuration of specific operational parameters to meet individual requirements:

1. Interval Between Sensor Messages:

- Defines the time period for transmitting periodic messages that indicate the capillary component of the soil moisture potential

2.3.2 Default Factory Parameter Settings

When ordered, the sensors are pre-configured with the following default values:

- **Interval Between Sensor Messages:** 2 hours.

These default settings ensure reliable and consistent operation under typical conditions. For custom configurations, adjustments must be specified during the ordering process.

2.4 Routine Maintenance

2.4.1 Maintenance Frequency

The frequency of maintenance for the sensor is dependent on its operating conditions.

2.4.2 Maintenance Procedures

Routine maintenance tasks include:

- Checking the integrity of the sensor housing;
- Checking the integrity of the ceramic nozzle;
- Checking the position of the sensor in the soil;
- The presence of water in the sensor housing.

Proper and regular maintenance is essential for reliable sensor operation, especially in challenging environments.

2.4.3 Sensor Preservation and Reactivation

To prepare the sensor for storage during sub-zero temperatures, follow these preservation steps:

- Remove the sensor from the soil.
- Unscrew the removable cover from the sensor housing.
- Power off the sensor.
- Remove the sensor board along with the nipple from the housing.
- Drain any water from the sensor housing.
- Dry the sensor housing and sensor board by placing them in a warm, dry environment for 24 hours.

Store the sensor indoors in its original packaging.

3. INSTALLATION

3.1 Installation Procedure

Follow these steps to properly install the sensor:

- **Select an appropriate installation site:**
 - Verify the radio signal from the chosen location
 - Avoid installing the sensor within one meter of underground structures, reservoirs, foundations, or other permanent structures.
- **Prepare a hole in the soil for the sensor:**
 - Prepare a hole to match the desired depth of soil moisture measurement, ensuring a diameter of 35-40 mm. Remove any foreign materials such as grass, hay, or moss from the hole. It is recommended to sprinkle the bottom of the hole with moist soil.
 - Use a drill to create the hole for the sensor.
- **Fill the sensor with water:**
 - Unscrew the removable cover from the sensor body.
 - Unscrew the nipple and remove the sensor board from the housing.
 - Immerse the sensor body vertically in water, ensuring the ceramic tip is fully submerged, and let it soak for 15 minutes.
 - Pour water into the sensor body, filling it to 2/3 of its height.
 - Without tilting the sensor body, securely reinstall and screw the nipple along with the sensor board.
 - Without tilting the sensor body, turn on the sensor using the switch located on the sensor board.
 - Without tilting the sensor body, reinstall and screw on the removable cover.
- **Power on the sensor** (as outlined in Section 2.2, “Turning the Sensor On and Off”).
- **Install the sensor into the prepared location:**
 - Once filled with water, install the sensor vertically into the pre-prepared hole in the soil, ensuring it is not tilted.
 - Fill the space around the sensor body in the hole with moistened soil.
- **Verify the sensor's functionality:** Verify the sensor's operability through the [wanwave](#) portal.

To ensure measurement accuracy:

- Ensure there is good contact between the ceramic tip and the soil.
- Avoid compacted soil at the contact point. Do not use a hammer or apply excessive force during installation.
- Allow up to one hour after installation for the sensor readings to stabilize.
- Ensure that the ceramic tip remains free of oils, fats, or other substances that could clog its pores during installation.

4 TECHNICAL SUPPORT

4.1 Requesting support

For technical assistance, contact the **wanwave** support team at support@wanwave.com. Note that support will be provided based on the SLA terms provided at the time of purchase of the equipment.

To ensure a faster and more effective response, please include the following details in your inquiry:

- **Organization Name:** Provide the name of your organization and the contact information for the person requesting support.
- **Issue Description:** Clearly describe the nature of the issue and the time it occurred.
- **Device Information:** Include the device number.
- **Visual Documentation:** Attach relevant screenshots or photographs that illustrate the problem, if applicable.

Providing this information will help expedite the resolution process.

5 TECHNICAL SPECIFICATIONS

5.1 Manufacturer Information

Manufacturer

wanwave LTD.

Physical address

12 Woodlands Park, Bridgend, CF33 6DY, UK

Mailing address

12 Woodlands Park, Bridgend, CF33 6DY, UK

Contact information

info@wanwave.com

Technical support

support@wanwave.com

5.2 Main parameters and characteristics

The sensor has the following parameters and characteristics:

#	PARAMETER	UNIT	VALUE
1	Autonomous operation time (not less than)	months	24
2	Accuracy of measurement in the range from +5°C to +60°C (no more than)	%	±2
3	Maximum measurement depth	mm	1500
4	Measurement time (no more than)	ms	200
5	Time of measurement and transmission via radio channel (no more than)	ms	1700
6	Operating temperature range	°C	From +5 to +60
7	Protection against external influences (in accordance with IEC 60529:2013)	Class	IP67
8	Power supply	Type	Autonomous
9	Nominal supply voltage	V	3.6
10	Battery Type	Type	14505
11	Frequency range	MHz	863.0 - 870.0 920.0 - 925.0
12	Transmitter output power	mW	25
13	Length of unique identifier	bit	32
14	Probability of non-delivery in the radio coverage area of a message about a manhole opening	-	10^{-1}

THANK YOU

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