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Manual

Soil moisture sensor SMT50

English

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Content

1 Important notes

Dear customer,

we are pleased that you have decided to buy a quality product from TRUEBNER GmbH. TRUEBNER sensors offer highest reliability, longevity and correspond to the latest state of technology. In order to be able to fully utilize the performance of our sensors and to enjoy them for many years, please read this operating manual carefully. We assume no liability for damages caused by improper or incorrect use.

This operating manual is intended for the soil moisture and temperature sensor SMT50, in the following manual referred to as "sensor" for short.

The warranty period is 12 months. If a defect occurs within this warranty period, please notify us immediately. If technical changes are made to the sensor, the warranty claim will become void.

Manufacturer contact details:

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Technical changes and additions to the description / instructions are reserved.

No liability is assumed for the content, in particular for damage caused by existing, non-existent or incorrect information.

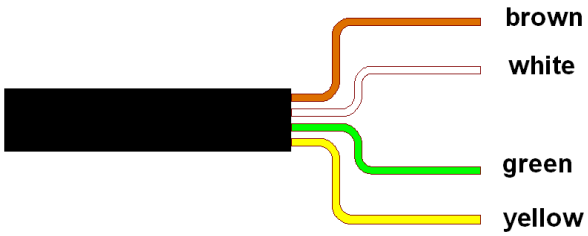
Passing on and changing these operating instructions is not permitted unless expressly approved.

2 Technical Data and Wiring

Technical Data of the Soil Moisture Sensor SMT50:

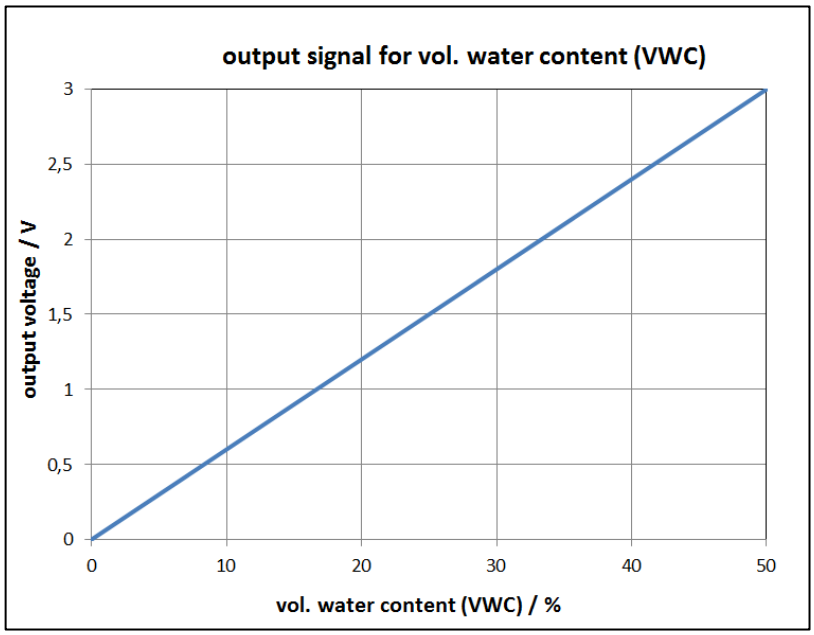
Supply Voltage Range	3.3 - 30 VDC
Current Consumption	ca. 2.7 mA (measured @ 12VDC)
Output Signal Soil Moisture (yellow wire)	0-3V linear
Output Signal Soil Temperature (green wire)	0-3V linear
Measurement Range Soil Moisture	0 – 50 % VWC
Measurement Range Temperature	-20 to +85 °C
Accurracy Soil Moisture Measurement	typ. +/- 3% in Reference Soil Medium
Accurracy Temperature Measurement	typ. +/- 1.0 °C
Measurement Resolution Soil Moisture	8 bit = 0.2 %
Measurement Resolution Temperature	10.0 mV / °C
Output Impedance	10 kOhm
Total Length of Sensor	ca. 135 mm
Length of green Measurement Field	ca. 95 mm
Width of Sensor	ca. 21.5 mm
Weight of Sensor incl. 10m Kabel	ca. 235 g
Standard Cable Length	10 m
Cable Specification	4 x 0.25 mm^2
Cable Jacket Material	very robust polyurethan (PUR)
Setting Time of Output Signal	max. 300 ms
Measurement Principle	FDR (Frequency Domain Response)
Measurement Signal	symmetric, bipolar differential

Wiring:



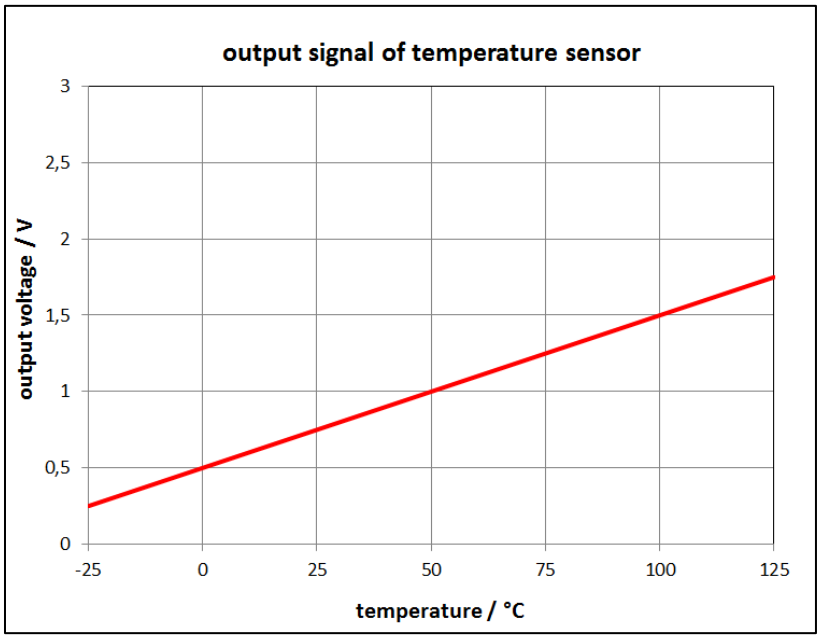
brown	**+ Vcc**
white	**Gnd**
green	**Output Signal Temperature 0-3V**
yellow	**Output Signal Soil Moisture 0-3V**

Output Voltage Diagram of Soil Moisture Sensor SMT50:



Equation for calculating the VWC from the measured output voltage U:

VWC [%] = (U * 50) : 3 Example: U = 1,2 Volt → VWC [%] = (1,2 * 50) : 3 = 20 %



Equation for calculating the temperature T from the measured output voltage U:

T [°C] = (U – 0,5) * 100 Example: U = 1,2 Volt → T [°C] = (1,2 – 0,5) * 100 = 70 °C

3 Functional principle of the sensor SMT50

The soil moisture sensor SMT50 is a maintenance-free capacitive probe. Capacitive probes have several advantages against other soil moisture sensors. They respond immediately to changes in the volumetric soil moisture content and there are no bare metal electrodes in contact with the soil. There is no corrosion of the sensor. The SMT50 is very robust, durable and maintence-free.

Capacitive soil moisture sensors generate an alternating electric field around its measurement electrodes. The electric field penetrates the surrounding soil. The electric circuit inside the sensor measures the resulting total capacitance of the electrodes which depends on the volumetric water content of the soil. The higher the volumetric water content, the higher is the resulting capacitance. The measured value is computed by an integrated microcontroller and converted to a linear voltage output signal (0…3V, yellow wire).

The temperature is measured by an additional temperature sensor which is located inside the black housing of the sensor. The linear temperature signal is output on the green wire. For a correct soil temperature measurement it is important to fully burry the probe in the soil.

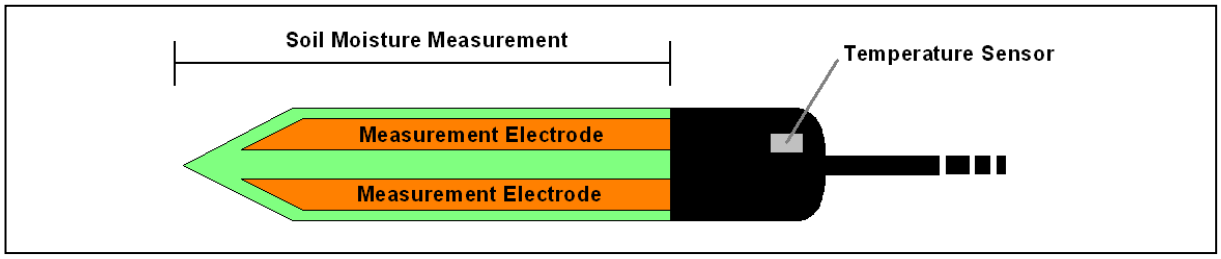


Figure 1: Drawing of the SMT50. The position of the moisture and temperature measurement is illustrated.

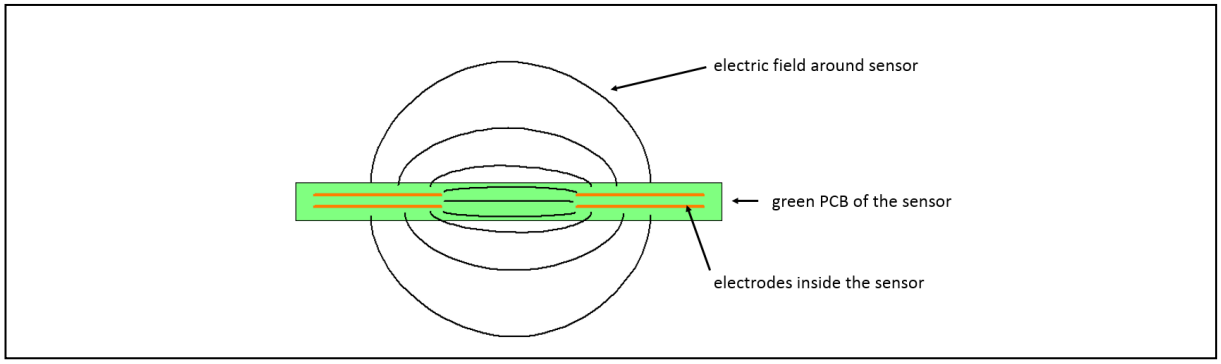


Figure 2: Lateral cut through the green moisture probe. The electric field of the electrodes is illustrated.

4 Installation of the SMT50

Installation of a capacitive soil moisture probe is simple. However, there are a few important points which should be considered in order to derive a good measurement result.

Figure 3 shows the correct installation of the SMT50. It is mandatory to fully burry the probe including the black housing. A very good contact to the surrounding soil with no air gaps is very important because air gaps will lead to wrong soil moisture measurements. The density of the surrounding soil will influence the measurement signal. Make sure, the soil is properly compressed.

For irrigation purpose the SMT50 should be installed close to the roots of the plants. The ideal orientation of the sensor is a horizontal position. It is important to turn the sensor in an uprigth position so that no water can be accumulated on the surface of the green measurement area.

Sometimes it can be useful to embed two or more sensors in different depths. Then it is possible to see the penetration of the waterfront during the irrigation process. Based on this data the irrigation can be optimized.

Do not use a hammer for installation of the SMT50. If the soil is very compressed, it is recommended to use a punch or to soften up the soil by adding water.

The cable of the SMT50 is very robust and can directly be burried inside any type of soil. However, sometimes it can make sense to protect the cable against animal bites by using an additional ductwork.

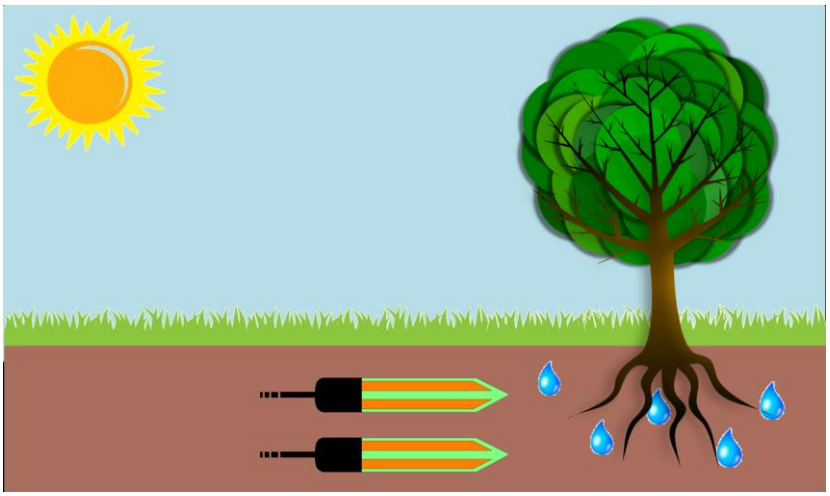
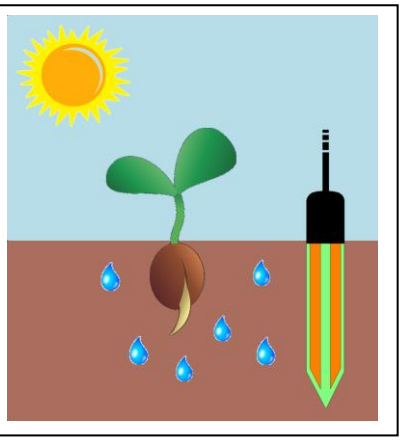


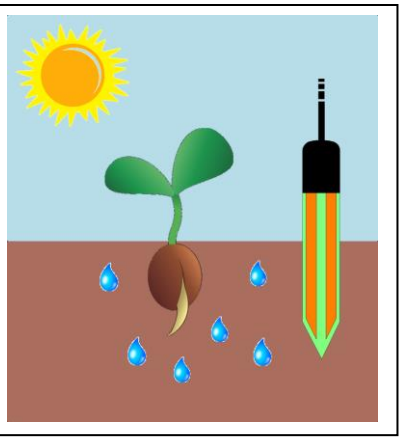
Figure 3: Correct Installation of the Soil Moisture Sensor SMT50

Typical installation errors:



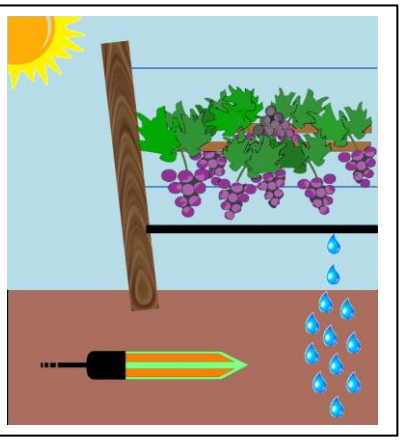
Mistake 1: Temperature sensor is not burried in the soil

→ Wrong temperature measurement



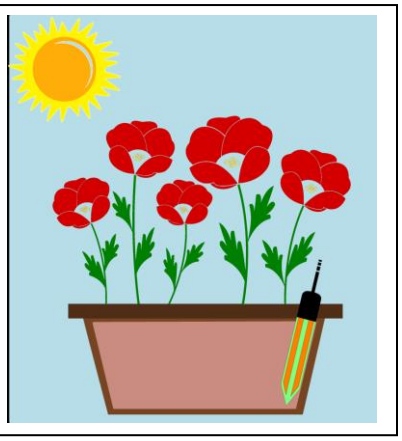
Mistake 2: Measurement electrodes not fully burried

→ Wrong moisture measurement



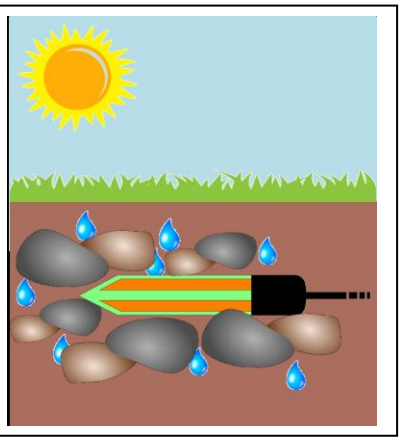
Mistake 3: Large distance between sensor and dripping lines

→ Sensor reacts to late / no reaction



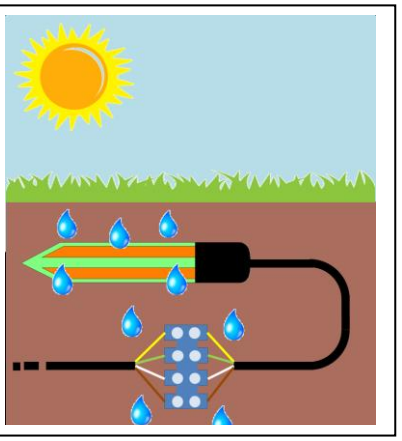
Mistake 4: Sensor is positioned to close to the wall of a pot

→ Wrong moisture measurement



Mistake 5: Sensor is inside granular material with air gaps

→ Wrong moisture measurement



Mistake 6: Cable connections inside the (wet) soil

→ Wrong output signal of the sensor

5 Frequently asked questions

1) Does the sensor has to be silted during installation?

   No, it is sufficient to bury and then tamp the soil. However, always make sure that the sensor has good contact with the soil and that there are no air gaps between the sensor and the soil. Air gaps disturb the moisture measurement result.

2) May the cable be extended?

   Yes, the cable may be extended. However, it must be ensured very carefully that the connection is protected against moisture. Under no circumstances should the connection be in the soil. Insulating tape and heat shrinking tubing do not provide sufficient protection against moisture!

3) Is there a minimum size of the planter?

   Yes, the active electrical measuring field of the sensor has a volume of up to one liter and is uniformly distributed around the sensor. The sensor should therefore not be used in planters with a volume of less than 1 litre and should have a sufficient distance to the wall and the bottom of the planters (recommended >5 cm).

4) Do roots damage the sensor?

   No, the sensor is very robust. It does not harm the sensor if roots grow around it.

5) The sensor does not supply an output signal (any more). What could be the reason?

   In most cases, the wires of the cable are connected incorrectly, the power supply is not available properly or there is a cable interruption (animal bite!). Please check the pin assignment and the complete connection cable of the sensor. For sensors with digital interface, check the correct address.

6) If there is frost, the sensor displays an incorrect soil moisture value?

   Capacitive sensors measure the liquid water in the soil. When it freezes, the liquid water turns into ice. However, ice cannot be measured correctly by the sensor. Soil moisture measurement only works up to freezing point. Irrigation at temperatures below the freezing point is normally not useful anyway.