

## SMT-50 Sensor for Soilmoisture and -temperature

### Technical Data and Installation Guide

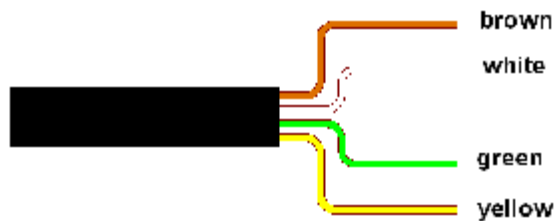


## 1 Technical Data and Wiring

### Technical Data of the Soil Moisture Sensor SMT50:

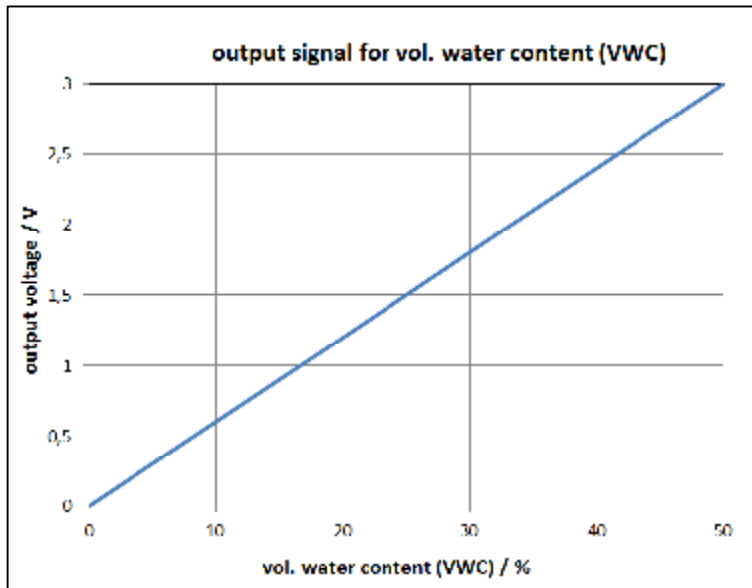
Supply Voltage Range	3.3 - 30 VDC
Current Consumption	ca. 2.7 mA (measured @ 12VDC)
Output Signal Soil Moisture (yellow wire)	0-3V linear
Output Signal Soil Temperature (green wire)	0-3V linear
Measurement Range Soil Moisture	0 – 50 % VWC
Measurement Range Temperature	-20 to +85 °C
Accuracy Soil Moisture Measurement	typ. +/- 3% in Reference Soil Medium
Accuracy 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 <sup>2</sup>
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:



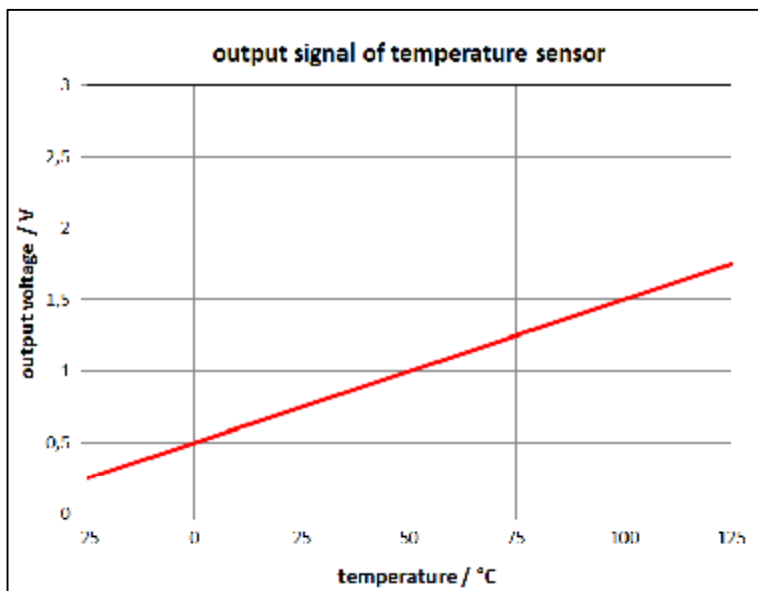
<b>brown</b>	<b>+ Vcc</b>
<b>white</b>	<b>Gnd</b>
<b>green</b>	<b>Output Signal Temperature 0-3V</b>
<b>yellow</b>	<b>Output Signal Soil Moisture 0-3V</b>

**Output Voltage Diagram of Soil Moisture Sensor SMT50:**



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

$$\text{VWC [\%]} = (U * 50) : 3 \quad \text{Example: } U = 1,2 \text{ Volt} \rightarrow \text{VWC [\%]} = (1,2 * 50) : 3 = 20 \%$$



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

$$T [^{\circ}\text{C}] = (U - 0,5) * 100 \quad \text{Example: } U = 1,2 \text{ Volt} \rightarrow T [^{\circ}\text{C}] = (1,2 - 0,5) * 100 = 70 \text{ }^{\circ}\text{C}$$

## 2 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 maintenance-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 bury the probe in the soil.

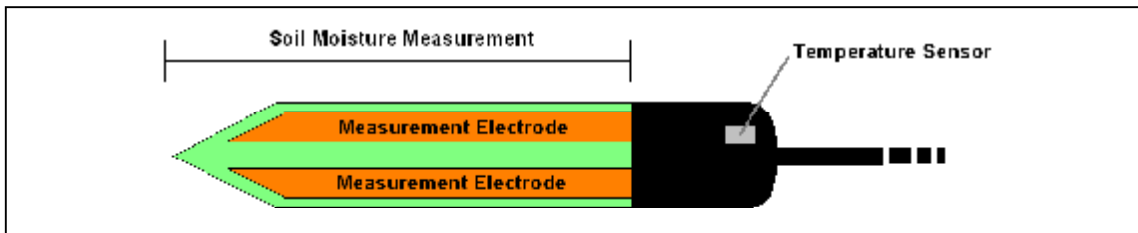


Figure 1: Drawing of the SMT50. The position of the moisture and temperature measurement is illustrated.

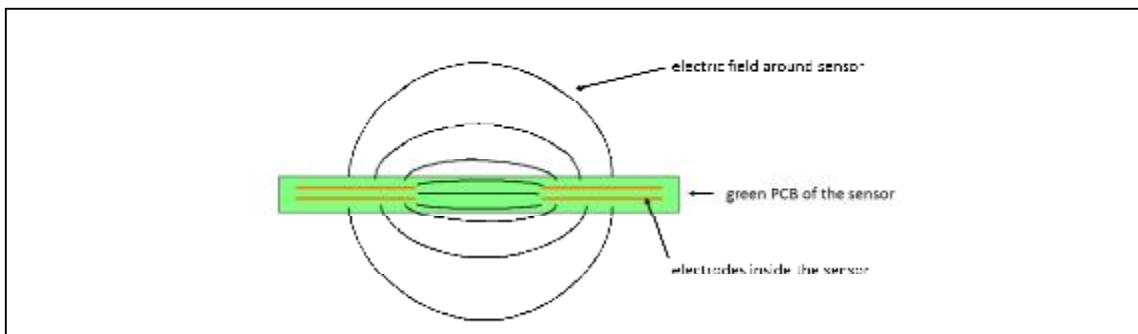


Figure 2: Lateral cut through the green moisture probe. The electric field of the electrodes is illustrated.

### 3 Installation of the SMT50

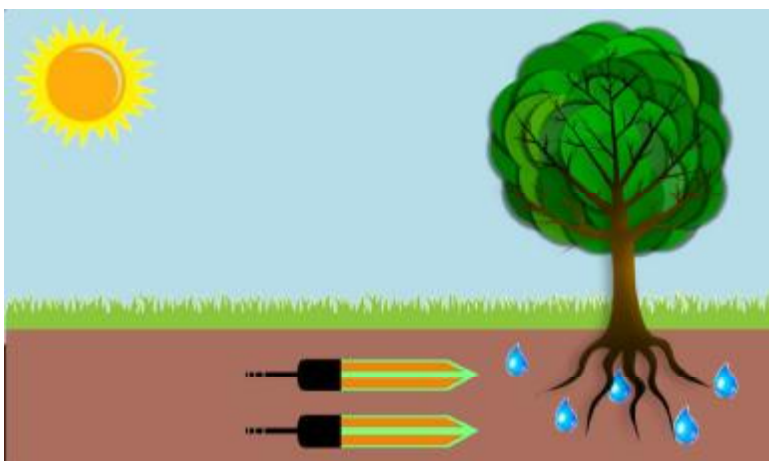
Installation of a capacitive soil moisture probe is simple. However, there are a few important points which should be considered in order to derive a good measurement result.

Figure 3 shows the correct installation of the SMT50. It is mandatory to fully bury 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 upright 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.

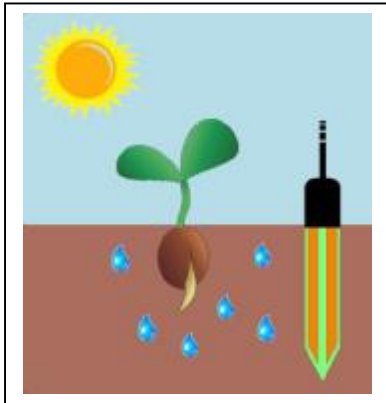
The cable of the SMT50 is very robust and can directly be buried inside any type of soil. However, sometimes it can make sense to protect the cable against animal bites by using an additional ductwork.



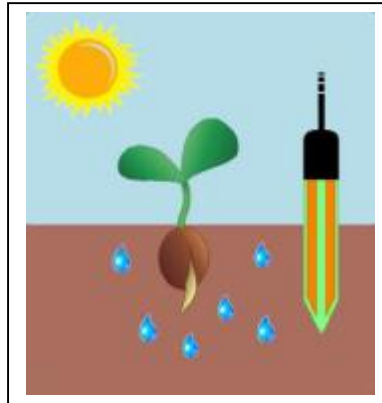
**Figure 3:** Correct Installation of the Soil Moisture Sensor SMT50

# Installation Guide SMT50 V1.0

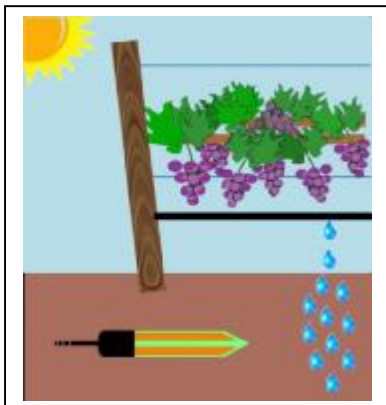
## Typical installation errors:



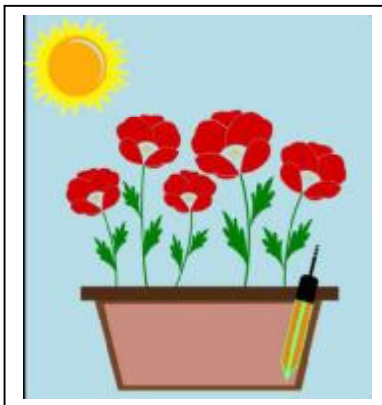
**Mistake 1:** Temperature sensor is not buried in the soil  
→ Wrong temperature measurement



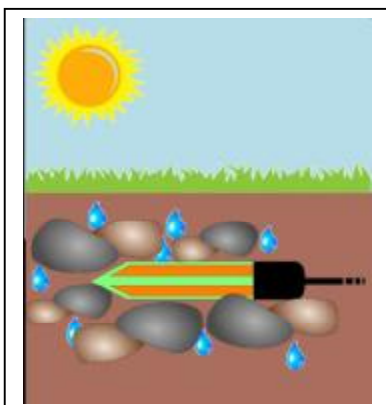
**Mistake 2:** Measurement electrodes not fully buried  
→ Wrong moisture measurement



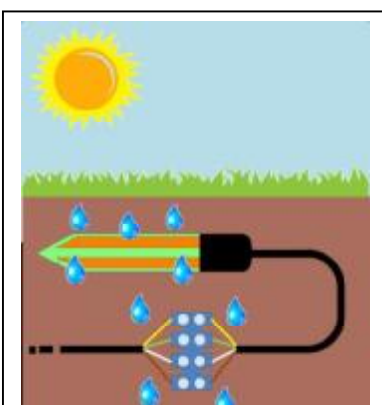
**Mistake 3:** Large distance between sensor and dripping lines  
→ Sensor reacts to late / no reaction



**Mistake 4:** Sensor is positioned too 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