

How to interpret SoilWatch 10 output?

SoilWatch 10 gives output in the specified range i.e. 0-1.1V or 0-3V. The output range is approximate and varies slightly between sensors. The sensor gives output close to 0V when in the air and around 1.1V or 3V in water depending on the version of the sensor.

Battery powered?

When SoilWatch 10 sensor is used in a battery powered application, it is recommended to use a suitable switch (transistor or relay) to turn the sensor for a brief time only. Typical time in which sensor is ready is less than 100ms.

When sensor and microcontroller (or ADC) is powered from a battery, please pay attention to ADC reference voltage. It is recommended to use a constant reference voltage either internal or powering ADC with constant voltage (regulated). The SoilWatch 10 has its own voltage regulator so changes to the power supply voltage don't affect the output of the sensor. If ADC reference voltage will drop with battery discharge then ADC readings will be meaningless.

How to calibrate SoilWatch 10?

There are a few ways to calibrate SoilWatch 10. The one shown here is the easiest one and doesn't require expensive equipment. You can follow other routines as long as you can get reliable measurement points (at least 5-6)

You will need a few things:

- weight scale
- oven
- 2 containers - one slightly taller than the sensor probe (green part) and other around twice as big (to efficiently mix soil in it)
- bucket to accommodate collected soil
- measuring cup

1. Collect the soil from the depth and location. You will need around 10 times the volume of your smaller container.
2. Dry the collected soil in the oven for 24h at 100C. Check every 2-3 hours if the weight of soil changes. If there is no change that means the soil dried completely.
3. Measure the volume of the smaller container. To measure the volume of the container, you can weight it when filled with water and subtract the weight of the empty container.

Because 1g of water is approximately 1ml, then:

$$\text{container volume[ml]} = (\text{container filled with water[g]}) - (\text{empty container[g]})$$

Note the container volume. We will need it later.

4. Fill the smaller container with soil. Do it in layers fairly compacting each. Make sure the soil is uniformly compacted without any air pockets. Enter the sensor into the soil fully and take the measurement. Take few measurements and average results. Note the averaged result in Volts.

Table 1.

VWC[%]	0	5	10	15	20	25	30	35	40	45	50
Sensor output [V]											

5. Calculate the volume of the water needed to achieve the desired VWC.

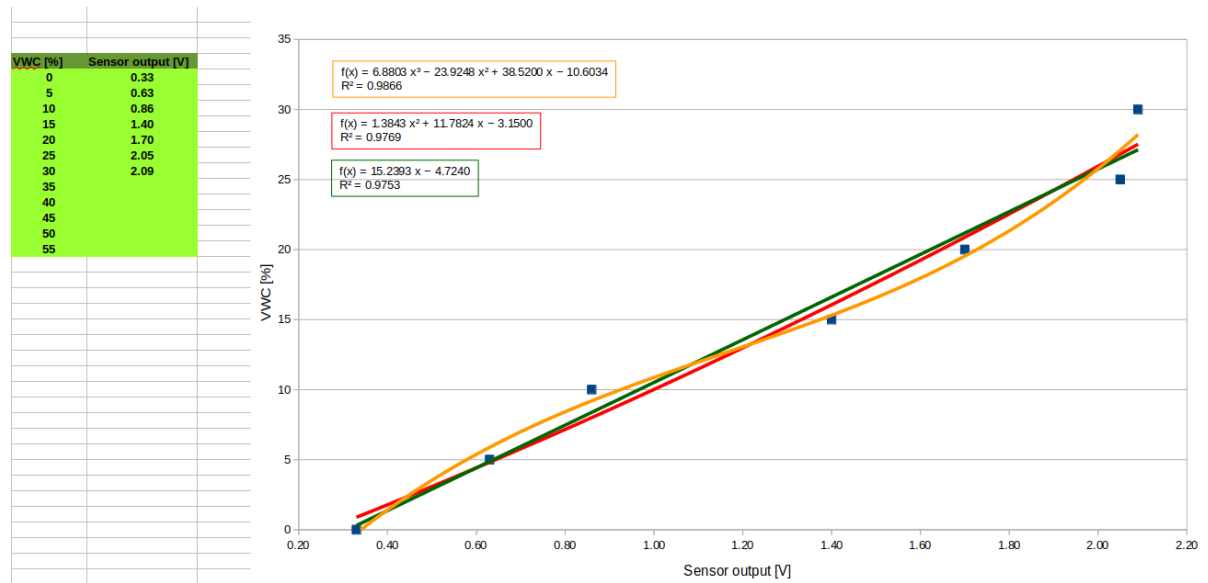
$$\text{Needed water} = (\text{container volume [ml]} * \text{desired VWC}[\%]) / 100$$

Let's assume we have a 480ml container and we want to achieve 5% VWC.

$$\text{Needed water} = (480 * 5) / 100 = 24\text{ml}$$

So we need to add 24ml water to the container to achieve 5% VWC.

6. Add the calculated amount of water to the dried soil in a smaller container. Be careful not to spill any water. Then transfer soil to the bigger container and mix it well. Avoid mixing the soil in conditions where high evaporation occurs i.e. full sun, high temperature and low air moisture.
7. Transfer mixed soil back to the smaller container. Do it in layers as before. Make sure each layer is well and uniformly packed.
8. When all soil is transferred back to the small container, take the measurements. As before take few and note the average result in table 1.
9. Do the steps 5 to 8 till you have all the readings in table 1 or till soil get saturated. You can also measure fewer samples but make sure you take at least 4 or 5 and from the range, you will most likely use the sensor in.
10. When you finished filling table 1 you can enter your results into the provided spreadsheet. You will get the calibration equations instantly. You can choose which will suit your needs the best. The best approximation you will get with the top (orange) third degree polynomial equation, then (red) second degree polynomial equation and the last is (green) liner equation.



Soil moisture calibration spreadsheet