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Soil Moisture Sensor

Product Number: ENSOI-A171

Overview

In an increasingly thirsty world it is critical students understand the basics of agriculture and water conservation. The Soil Moisture sensor is a high performance and accurate soil moisture sensor, used in experiments relating to plant growth and soil moisture. It is also effective when used as a tool to optimize irrigation and to warn of plant stress at the dry or wet ends of the scale.

The sensor is ideal for use in Biology. The Soil Moisture sensor can be connected to all types of einstein™ data loggers.

Typical experiments

Biology

- Effect of Soil Moisture on Plant Growth
- Efficiency of Irrigation systems
- Soil wetness

How it works

The Soil Moisture sensor measures soil moisture by measuring the electric resistance of the soil. Two concentric electrodes are embedded in reference granular matrix material. The matrix material is surrounded by protective synthetic membrane and stored in a stainless case.
This device is buried in the soil, where it becomes as moist as the surrounding soil. As the sensor becomes moister, the electrical resistance of the sensor decreases. The data logger then converts the resistance to cbar (centibar, a unit of pressure).

Sensor specification

Range:	0 – 200 cbar 0 – 200 kPa
Accuracy:	±2 % over entire range
Resolution (12-bit):	0.05 cbar
Default Sampling Rate:	10 samples per second
Operating Temperature Range:	0 to 40 °C (32 to 105 °F)

Technical Notes:

- In gravelly soils and with deeper sensors, carefully install the sensor to prevent damaging the membrane.
- You can solvent weld the 1/2" Class 315 PVC tubing to the sensor collar for easier installation and removal. Use a PVC/ABS cement (IPS Weld-on #794 or equivalent). Seal the upper end of the tube with a piece of tape to prevent water dripping down to the sensor.
- The Soil Moisture sensor uses a default temperature of 24 °C (75 °F) to compensate the soil moisture sensor reading, otherwise the soil moisture reading can be off as much as 1% for every 0.5 °C (1 °F) difference in the soil temperature.

Data logging and analysis

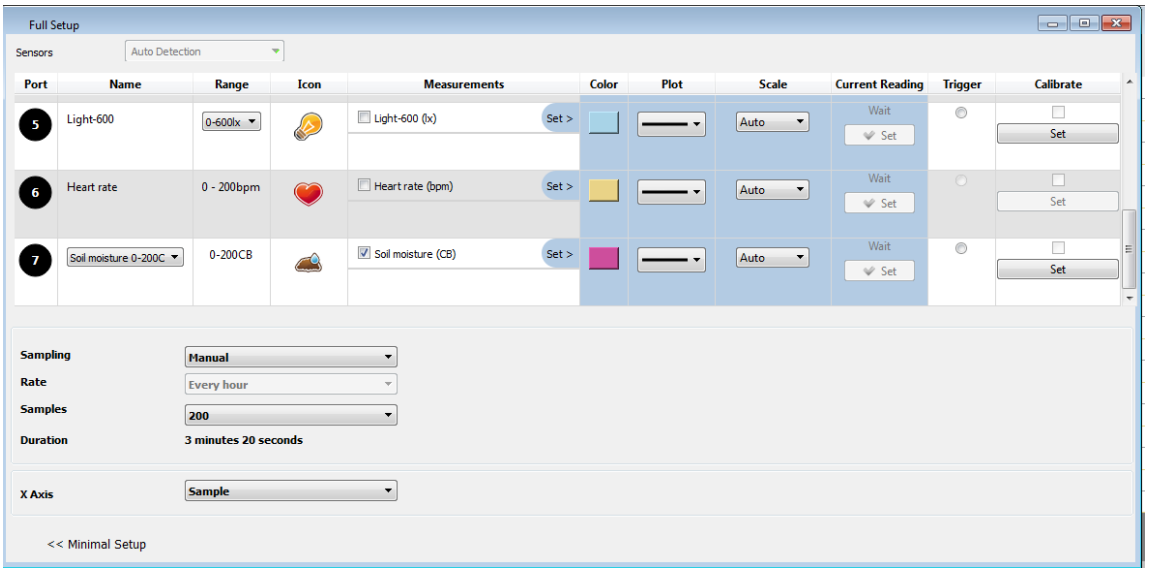
MiLAB™

1. Take your einstein™ Tablet OR pair your einstein™LabMate with your Android or iOS tablet via Bluetooth
2. Insert the BNC/Alligator cable into the amplifier
3. Attach Alligator clips to the BNC/Alligator cable
4. Use the alligator clips to attach the wire ends of the sensor cable to the amplifier
5. Insert the sensor cable into the amplifier via the DT to einstein™ Sensor Adaptor at one end and into one of the sensor ports at the other end
6. Launch MiLAB
7. In Launcher view tap the word Empty and select Soil Moisture from the dropdown menu
8. Make sure the icon next to the sensor ( ) is checked to enable it for logging

MiLAB™Desktop

1. Pair your einstein™LabMate with your PC, MAC, or Linux machine via Bluetooth, or connect it via the USB cable (found in the einstein™LabMate™ box).
2. Insert the sensor cable into one of the sensor ports via the DT to einstein™ Sensor Adaptor
3. Launch MiLAB

4. Click on Full Set up in the Current Setup Summary Box
5. Scroll down to the box marked “Empty” and select Soil moisture from the dropdown list



6. In Full Setup, you will be able to program the data logger’s sample rate, number of samples, units of measurement, and other options
7. Click the Run button ( )on the main toolbar of the Launcher View to start logging

Experiment set up

The Soil Moisture sensor comes equipped with:

- Soil Moisture probe
- Soil Moisture sensor
- BNC alligator clip cable
- DT-to-einstein™adaptor
- EN Sensor cable

1. Soak the Soil Moisture sensor overnight in water. Always *plant* a wet Soil Moisture sensor. This will improve sensor response during the first several irrigations.
2. Make sensor access holes to the depth required with a 7/8” (22.5 mm) diameter rod. For very coarse or gravely soils, an oversize hole of 1” to 1 1/4” may be needed to prevent abrasion damage to the Soil Moisture sensor membrane. In this case, mix soil and water to a creamy consistency and place one or two tablespoons into the installation hole.
3. Always install sensors in the active root system of the crop with a snug fit in the soil. The biggest problem in obtaining good Soil Moisture sensor readings is lack of a snug fit. The ideal method of making the access hole is to use a post-hole digger (or similar tool). This makes an oversize hole for the upper portion and an exact sized hole at the bottom where the sensor is located.

Caution: In gravelly soils and with deeper sensors, carefully install the sensor to prevent damaging the membrane.

4. Fill the hole with water and push the sensor down into the hole so it reaches the bottom. A length of 1/2” Class 315 PVC tubing fits snugly over the sensor collar and can be used to push the sensor. A good snug fit in the soil is important.
5. Carefully refill the access hole with soil and tamp it down to eliminate any air pockets.
6. Connect the Soil Moisture sensor to the Soil Moisture adaptor.
7. Connect the adaptor to the BNC/Alligator cable and then to the data logger.
8. After you have installed the Soil Moisture sensors, the sensors will need one or two irrigation cycles to acclimate to the soil conditions and provide better accuracy.

Reading the Results:

Soil moisture (cbar)	Soil condition
0-10	Saturated Soil. Occurs for a day or two after irrigation.
10-20	Soil is adequately wet (except coarse sands which are drying out at this range).
30-60	Usual range to irrigate or water (except heavy clay soils). Irrigate at the upper end of this range in cool humid climates and with higher water-holding capacity soils.
60-100	Usual range to irrigate heavy clay soils.
100-200	Soil is becoming dangerously dry for maximum production. Proceed with caution.

The Soil Moisture sensor comes with:

- Soil Moisture sensor
- Amplifier
- BNC/Alligator Cable

Troubleshooting

Use these tests to verify the correct operation of the Soil Moisture sensor:

1. With the sensor submerged in water, it should show a reading between 0 and 5 cbar. If no values are displayed use the Set Zero procedure as described in the MiLAB™ documentation.
2. Let the sensor air dry for 30 to 48 hours. Depending on ambient temperature, humidity, and air movement, the reading should be at least 150 cbar.
3. Put the sensor back in the water. The reading should run right back to 0 to 5 within 1 to 2 minutes.
4. If the sensor does not pass these tests, please contact Fourier technical support.

Technical support

For technical support, you can contact the Fourier Education's technical support team at:
Web: www.einsteinworld.com/support
Email: support@fourieredu.com
Phone (in the US): (877) 266-4066

Copyright and Warranty

All standard Fourier Systems sensors carry a one (1) year warranty, which states that for a period of twelve months after the date of delivery to you, it will be substantially free from significant defects in materials and workmanship.
This warranty does not cover breakage of the product caused by misuse or abuse.
This warranty does not cover Fourier Systems consumables such as electrodes, batteries, EKG stickers, cuvettes and storage solutions or buffers.