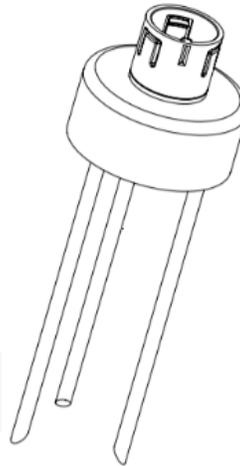


Description and Applications

The Edyza Substrate Sensor EZ-SSP101 measures and reports on VWC, EC and Temperature in various growing substrates such as rockwool, coco coir, and typical potting soils and mixes.

- (1) Volumetric Water Content (VWC)
- (2) Electrical Conductivity (EC)
- (3) Temperature (T)



After calibration, EZ-SSP101 can provide $\pm 0.28\%$ VWC accuracy in a substrate with up to 20 dS/m in salinity. EZ-SSP101 uses a patent-pending technology that compensates for various salinity conditions in the growing substrate in order to accurately measure water content.

The sensor provides 24-hr substrate environmental monitoring on the Edyza wireless network, either as a stand-alone irrigation monitoring solution or in combination with the broad family of Edyza horticulture environmental sensors.

Product Specifications

Model		Substrate (Soil) Sensor EZ-SSP101		
Size	Module Probes (3 each)	See Figure 1 34 mm (1.34") diameter, 94.95 mm (3.73") height 3 mm (0.1181") diameter		
IP Rating		IP-67 (Protection from dust and water ingress up to 1 m submersion, 30 min max.) Also, the Module is custom-designed to withstand typical oil-based pesticides.		
Operating Temperature		-40 to 85 C		
Power		Lithium Battery, 1-2 years' operating life		
Data Connectivity		Edyza wireless network		
		Volumetric Water Content	Electrical Conductivity	Substrate Temperature
Range		0 to 100%	0 dS/m to 20 dS/m	-40 to 85 C
Resolution		0.05%	0.0024 dS/m	0.45 C
Accuracy		$\pm 0.28\%$	$\pm 5\%$	± 2 C

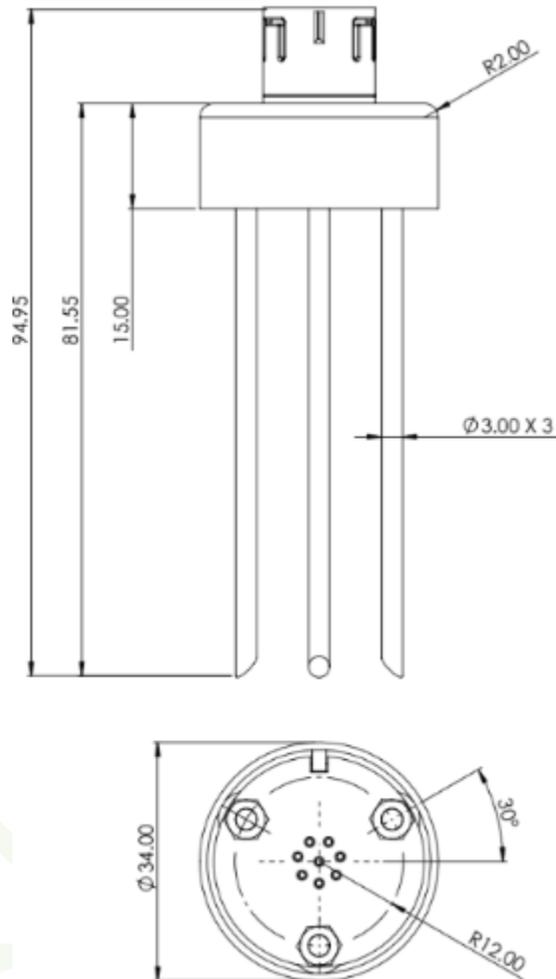


Figure 1. EZ-SSP101 Physical Dimensions (mm)

Installation

Three thin 3mm diameter stainless-steel probes puncture into the substrate to provide the VWC, EC, and T measurements. Figure 2 shows the region of sensing influence around the probes. The measurement region is cylindrical in shape with a diameter of 178mm (7 in) and a height of 89mm (3.5 in). This represents a total sensing volume of 2215 mL (135 cubic inches). It is important that this immediate region around the probes have a uniform density of substrate and is devoid of any air gaps.

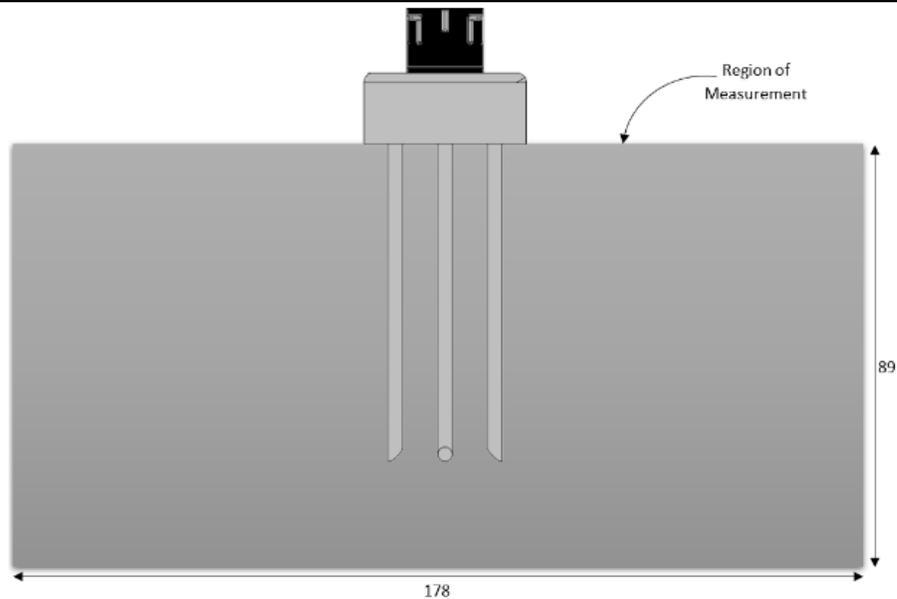


Figure 2. Region of measurement for VWC (mm)

Use and Care

- After each deployment, wipe down each stainless-steel probe using a mild non-abrasive cloth dabbed in isopropyl alcohol (rubbing alcohol).
- The sensing is influenced by large metal objects such as poles or stakes in the measurement region. These metallic objects can adversely influence the electric fields generated by the sensing needles which may affect performance. Additionally, ensure that there are no large roots between the needles which can adversely affect the accuracy of EC measurement.
- Ensure that the probes do not come in contact with oil, moisturizers, or other oil-based products that can result in a layer of insulation around the needles which will affect EC measurements.
- The probes are sharp, take care to prevent injury and damage to crops and equipment.

Calibration

VWC Calibration

EZ-SSP101 sensor is factory calibrated against a gravimetric VWC measurement method.

The process involves preparing the substrate to a known VWC value and then using a force gauge to constantly monitor the weight of the substrate-water mix as it slowly air dries. Meanwhile, the EZ-SSP101 VWC sensor is collecting the soil capacitance which is then fitted to the gravimetric VWC values using linear regression analysis.

The substrate used for calibration is a fresh bag of “Miracle-gro Seed Starting Potting Mix”, with a weight of 3.5 pounds (1610g). The substrate is first air-dried and sieved through a 2mm sieve to a uniform concentration.

Substrate (Soil) Sensor
EZ-SSP101
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Subsequently, the substrate is then put into a plastic bucket that is 7 inches in diameter and then compacted to a height of 3.5 inches which represents a volume of 2215mL resulting in a dry bulk density of 0.72 g/cm³. 200mL of water, which represents 9% VWC is then added to the soil and thoroughly mixed and then compacted to 3.5 inches height. EZ-SSP101 is then inserted at the center of the soil-water mix and the entire plastic bucket is then hung from a Torbal FB50 force gauge that is continuously reporting the total weight of the system through a USB interface to a computer.

Figure 3 shows the data from a calibration process. CS is the soil capacitance measured in picofarad. Grav VWC is the measurement from force gauge. And, Sensor VWC is the filtered linearly fitted VWC value from EZ-SSP101.

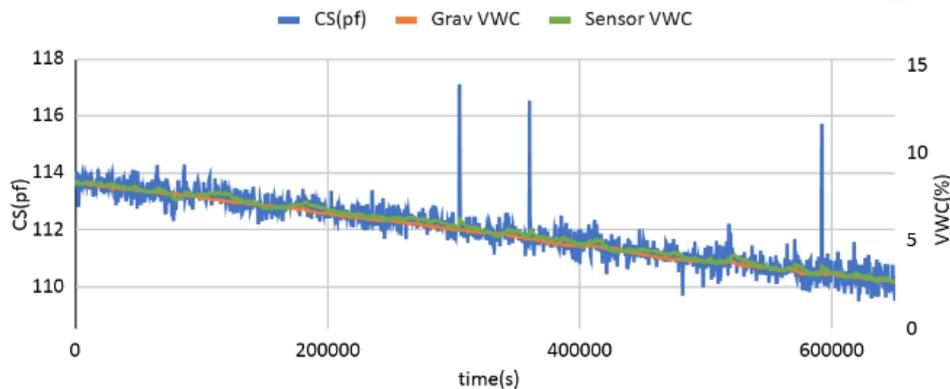


Figure 3. VWC Sensor Calibration Setup and Data

EC Calibration

EC calibration is done by comparing the readings from EZ-SSP101 EC raw conductivity output to standard EC calibration solutions. A simple 2-point calibration is used:

- (1) Standard EC solutions, one at 0.1 dS/m and the second at 1.4 dS/m, are filled in two 100mL beakers.
- (2) EZ-SSP101 is inserted into the first beaker, and
- (3) 30 readings are collected over a period of 15 minutes.

Subsequently, the EZ-SSP101 is removed from the first beaker, then rinsed with deionized water and inserted into the second beaker. Yet another 30 readings are collected over 15-minute time interval. Results from these two readings are then used to provide a 2-point calibration of the raw conductivity data from the sensor.

About Edyza

Ubiquitous Sensor Platforms for Horticulture and other Controlled Environments

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