

Smart Water Application Technologies/SWAT Calibration Report

Testing Agency: Center for Irrigation Technology <http://cati.csufresno.edu/cit/>

Testing Period: July 2007 to October 2008

Product Type: Soil Moisture Sensor

Product Make and Model: Decagon ECH2O EC-5 Soil Moisture Sensor

Product Description: Sensor measures soil volumetric water content

SWAT Protocol*: Turf and Landscape Irrigation Equipment - SOIL MOISTURE SENSORS

Phase 1: Indoor Lab Screening Tests - 4th Draft Testing Protocol

The concept of soil moisture sensors has an extensive history of scientific study and documentation. The objective of Phase 1 lab tests is to determine sensor calibration curves over a range of conditions that affect soil moisture, including soil type, temperature and salinity. Phase 1 testing determines sensor response over manufacturer specified test ranges to continue into Phase 2. At that time the soil sensor will be integrated with an irrigation controller to measure irrigation adequacy and efficiency in a virtual landscape using the current performance criteria of 0.40 inches of rainfall and 2.50 inches of ET_o.

Phase 1 Soil Moisture Sensor testing does not test the efficacy of a sensor over the entire range of soil moisture conditions possible and does not measure the integration of a soil sensor with a controller to manage irrigation.

Sensor performance curves were developed to determine the relationship between sensor readings and soil moisture content for a soil filled container. Relationships are determined for a range of soil textures, ambient temperatures and water conductivity values.

*All SWAT protocols may be viewed at www.irrigation.org

Phase 1 SWAT Calibration Summary: Decagon ECH2O EC-5 Soil Moisture Sensor

Measures are between field capacity (i.e. practical soil water holding capacity) and a selected drying range specified by the manufacturer over which the sensor was tested.

Test of Soil Moisture Sensor	Response Function Developed ¹
Response in Fine-Textured Soil	Linear (Y = 0.7499X + 0.1538)
Response in Medium-Textured Soil	Linear (Y = 0.9367X + 0.0665)
Response in Coarse-Textured Soil	Linear (Y = 0.9622X + 0.0469)
Response in Soil at 20 °C (68 °F)	Linear (Y = 0.8238X + 0.0646)
Response in Soil at 30 °C (86 °F)	Linear (Y = 0.9824X + 0.0441)
Response in Soil Susceptible to Freezing	Linear (Y = 0.721X + 0.0793)
Response in Fine-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear (Y = 0.8343X + 0.1498)
Response in Medium-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear (Y = 0.7243X + 0.0400)
Response in Medium-Textured Soil to Irrigation with 3.0 dS/m salinity water	Linear (Y = 0.6452X + 0.0676)
Response in Coarse-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear (Y = 1.047X + 0.0103)

¹Regression equations of the data gathered vs. moisture content as measured by gravimetric sampling, or the measured weight of water in the soil samples. The dynamics of variable manufacture selected calibration endpoints preclude the applicability of correlation coefficients for inter-test or inter-sensor comparisons. A Nonlinear designation means a regression equation other than a straight line was used to best describe the relationship.

Product Detail Supplied by Manufacturer

Decagon ECH2O EC-5

www.fertileearth.com

Operation	Features	Additional Hardware
Digital Absolute-reading soil moisture sensor device	<input type="checkbox"/> Measures dielectric constant. Stable readings regardless of soil conditions <input type="checkbox"/> Small profile facilitates use for a broad range of irrigation applications <input type="checkbox"/> Ability to act as a moisture transducer in a closed-loop irrigation system <input type="checkbox"/> Can measure soil and irrigation system properties for auto-control system setup <input type="checkbox"/> No post-install adjustments needed.	Automatic control equipment <input type="checkbox"/> Fertile Earth ProMeter (available from MorpH2O): Versatile suspended cycle and cycle interrupt add on device. <input type="checkbox"/> Compatible with all 24 volt solenoids <input type="checkbox"/> Compatible with irrigation clocks that output 24 volts to control solenoids <input type="checkbox"/> Integrates at the decoder stage of 2-wire systems