

Smart Water Application Technologies/SWAT Calibration Report

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

Testing Period: May 2008 to November 2008

Product Type: Soil Moisture Sensor

Product Make and Model: Acclima Digital TDT Sensor Model ACC-SEN-TDT

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 do 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: Acclima Digital TDT ACC-SEN-TDT 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.

Functions

Test of Soil Moisture Sensor	Response Function Developed ¹
Response in Fine-Textured Soil	Linear $(Y = 0.781X + 0.0994)$
Response in Medium-Textured Soil	Linear $(Y = 0.9233X + 0.0739)$
Response in Coarse-Textured Soil	Linear $(Y = 0.995X + 0.058)$
Response in Soil at 20 °C (68 °F)	Linear $(Y = 0.997X + 0.0478)$
Response in Soil at 30 °C (86 °F)	Linear $(Y = 0.8697X - 0.0735)$
Response in Soil Susceptible to Freezing	Linear $(Y = 0.9558X + 0.0743)$
Response in Fine-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear $(Y = 0.7384X + 0.1612)$
Response in Medium-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear $(Y = 0.988X + 0.0699)$
Response in Medium-Textured Soil to Irrigation with 3.0 dS/m salinity water	Linear $(Y = 0.962X + 0.0692)$
Response in Coarse-Textured Soil to Irrigation with 1.5 dS/m salinity water	Linear $(Y = 1.0974X + 0.041)$

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

Acclima TDT ACC-SEN-TDT Soil Moisture Sensor

www.acclima.com

Operation	Features	Additional Hardware
Digital Signal Processing, Absolute Time Domain Transmissometer	<ul style="list-style-type: none"> <input type="checkbox"/> Provides stable readings across wide range of soil temperature and EC conditions <input type="checkbox"/> Can act as a moisture transducer in a closed-loop irrigation system without need for periodic adjustment <input type="checkbox"/> Can measure soil and irrigation system properties; thereby, can setup control system automatically. <input type="checkbox"/> After setup and install, no future adjustment needed. 	<p>Closed-loop irrigation control systems available:</p> <ul style="list-style-type: none"> <input type="checkbox"/> <u>CS3500 Water on Demand</u>: 2-wire, 64 zone, internet accessible, onboard data storage, 4 simultaneous zone scheduling with flow control, setup/reporting software <input type="checkbox"/> <u>SC24/36 Suspended Cycle</u>: Conventional wired, 24/36 zone, 4 simultaneous zone scheduling with flow control <input type="checkbox"/> <u>SC6/12 Suspended Cycle</u>: Conventional wired 6/12 zone residential, indoor and outdoor models, microclimate control <input type="checkbox"/> <u>SCX Suspended Cycle Add on Device</u>: Interrupts conventional timers, auto setup, performance reporting