Smart Water Application Technologies/SWAT Calibration Report

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

Testing Period: September 2009 to July 2010

Product Type: Soil Moisture Sensor

Product Make and Model: Rain Bird SMRT-Y Soil Moisture Sensor

Product Description: Sensor measures absolute volumetric water content using Time Domain Transmissometry (TDT)

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

Phase 1: Indoor Lab Screening Tests - 8th 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 ETo.

Phase 1 Soil Moisture Sensor testing does not test the efficacy of a sensor over the entire range of soil moisture conditions possible nor does Phase 1 measure the integration of a soil moisture 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: Rain Bird SMRT-Y 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.	Equation (Linear)
Test of Soil Moisture Sensor	**Response Function Developed[1]**
Response in Fine-Textured Soil	Linear ($y = 0.780x + 0.0831$)
Response in Medium-Textured Soil	Linear ($y = 0.955x + 0.0646$)
Response in Coarse-Textured Soil	Linear ($y = 1.049x + 0.0416$)
Response in Soil at 15 °C (59 °F)	Linear ($y = 0.894x + 0.0808$)
Response in Soil at 35 °C (95 °F)	Linear ($y = 0.949x + 0.0749$)
Response in Soil Susceptible to Freezing	Linear ($y = 0.802x + 0.0883$)
Response in Fine-Textured Soil to Irrigation with 2.5 dS/m salinity water	Linear ($y = 0.733x + 0.0991$)
Response in Fine-Textured Soil to Irrigation with 5.0 dS/m salinity water	Linear ($y = 0.783x + 0.0511$)
Response in Medium-Textured Soil to Irrigation with 2.5 dS/m salinity water	Linear ($y = 0.947x + 0.0698$)
Response in Coarse-Textured Soil to Irrigation with 2.5 dS/m salinity water	Linear ($y = 1.105x + 0.0436$)
Response in Medium-Textured Soil for six wet/dry cycles	Linear ($y = 0.846x + 0.0922$)

[1]Regression 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

Rain Bird SMRT-Y Soil Moisture Sensor   www.rainbird.com

Operation	Features	Additional Hardware
Digital TDT Absolute VWC using TDT and Digital Signal Processing	• Provides stable readings in all soil types, and in varying temperatures and EC conditions • May be attached to existing valve control wires to simplify installation • Measures soil moisture, temperature and electrical conductivity • Moisture readings from 0 to 100% • Auto-set feature establishes site specific moisture threshold • Watering history records the status of the last seven irrigation events	• SMRT-Y is sold as a kit which includes an irrigation controller interface unit • The SMRT-Y kit is designed to work with most common controllers as an add-on. The device allows or suspends irrigation as the soil moisture level changes relative to a user definable threshold