

### Smart Water Application Technologies/SWAT Calibration Report

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

**Testing Period:** October 2011 to April 2012

**Product Type:** Soil Moisture Sensor

**Product Make and Model:** UgMO ProHome PH100WS

**Product Description:** Sensor measures moisture content in Time Domain Transmissometry

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

**Phase 1: Indoor Lab Screening Tests - 7th 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 within a 30 day period of time.

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](http://www.irrigation.org)

### Phase 1 SWAT Calibration Summary: UgMO ProHome PH100WS

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 <sup>1</sup>
Response in Fine-Textured Soil	Linear (y = 0.178x + 0.3325)
Response in Medium-Textured Soil	Linear (y = 1.016x + 0.0609)
Response in Coarse-Textured Soil	Linear (y = 0.784x + 0.0184 )
Response in Soil at 15 °C (59 °F)	Linear (y = 1.036x + 0.0489)
Response in Soil at 35 °C (95 °F)	Linear (y = 0.944x + 0.0988)
Response in Soil Susceptible to Freezing	Linear (y = 0.926x + 0.0566)
Response in Fine-Textured Soil to Irrigation with 2.5 dS/m salinity water	Linear (y = 0.306x + 0.2915)
Response in Fine-Textured Soil to Irrigation with 5.0 dS/m salinity water	Linear (y = 0.179x + 0.3044)
Response in Medium-Textured Soil to Irrigation with 2.5 dS/m salinity water	Linear (y = 0.996x + 0.0737)
Response in Coarse-Textured Soil to Irrigation with 2.5 dS/m salinity water	Linear (y = 0.675x + 0.0322)
Response in Medium-Textured Soil for six wet/dry cycles	Linear (y = 0.997x + 0.0816)

<sup>1</sup>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

**UgMO ProHome (PH100WS)**

[www.ugmo.com](http://www.ugmo.com)

Operation	Features	Additional Hardware
Frequency domain, two frequency (one for soil moisture, another for salinity), capacitive type sensor with digital signal processing	<ul style="list-style-type: none"> <li>Measures soil moisture, temperature, and salinity (conductivity)</li> <li>Soil moisture measurement unaffected by a wide range of salinity levels.</li> <li>Low sensor to sensor variation allows for no site or sensor calibration.</li> <li>Sensor is small, battery powered with no cabling (data is sent wirelessly)</li> </ul>	<ul style="list-style-type: none"> <li>Irrigation control systems available:               <ul style="list-style-type: none"> <li>UG1000C Controller 12/24 zone irrigation controller, internet monitoring/configuration/control and flow meter compatible</li> <li>UG1000B Internet Bridge: WAN agnostic internet bridge for internet sensor monitoring, configuration and control</li> <li>PH100 Base Station: 6 zone interrupter with zone-by-zone control of conventional irrigation controllers.</li> </ul> </li> </ul>



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