W.E.T Sensor type WET-1

NEW

- ❑ **Precision Horticulture**
- ❑ **Soil Science Research**

W.E.T sensors are used in soils and growing substrates.

One sensor produces three outputs:

Water content

Electrical Conductivity

Temperature

The new W.E.T Sensor, type WET-1, from Delta-T Devices measures three vital soil properties: Water content, Electrical conductivity (EC) and Temperature.

The W.E.T Sensor has applications in precision horticulture and soil science research and is usable in both soils and growing substrates (see page 2 for details). It is unique in its ability to measure pore water conductivity (EC_p), which is the EC of the water that is available to the plant.

Readout and data storage in the field are handled by the HH2 Moisture Meter (see page 3).

Delta-T gratefully acknowledges the partner organisations that have enabled the development of the W.E.T Sensor:

Institute of Agricultural and Environmental Engineering (IMAG-BV)
P O Box 43, 6700 AA Wageningen, The Netherlands.
Tel: +31.317.476654 Fax: +31.317.425670 Website: www.imag.wag-ur.nl
Designers of the W.E.T. Sensor and the integrated circuit which enables accurate measurement of the permittivity and conductivity of the bulk soil or media.

IMAG

Saint-Gobain Cultilène B.V.
Hoekenidsehof 1, 2665 JZ, Postbus 4, 2665 ZG Bleiswijk, The Netherlands.
Tel: +31.10.5294294 Fax: +31.10.5294299 Website: www.cultilene.nl.
Sponsors of research into horticultural media applications and suppliers of horticultural media calibrations. Exclusive suppliers of horticultural media calibrations to customers in the Netherlands.

Cultilène®

SAINT-GOBAIN CULTILENE

Applied Plant Research
Division Glasshouse Horticulture, (Praktijkonderzoek Plant & Omgeving B.V.)
(former Research Station for Floriculture & Glasshouse
Vegetables), P O Box 8, 2670 AA Naaldwijk, The Netherlands.
Tel: +31.174.636700 Fax: +31.174.636835 Website: www.ppo.dlo.nl.
Developers of the W.E.T calibrations for horticultural media. © 2001

APPLIED PLANT RESEARCH

W.E.T Sensor Specifications

Probe Output:	Range	Accuracy	Resolution	Units
▪ **Bulk conductivity**, EC_b	0 - 200	± 10	1.0	mS.m^{-1}
▪ **Temperature**, °C	-5 - 50	± 1.0	0.1	°C
▪ **Permittivity**, ε [1]	1 - 80	± 2.5	0.1	(no units)
Calculated parameters				
▪ **Volumetric Soil Moisture**, θ	0 - 1	± 0.03 [2]	0.001	m^3.m^{-3}
▪ **Pore water conductivity**, EC_p	depends on water content and conductivity, see graph		1.0	mS.m^{-1}

Environmental	Sensor sealed to IP67, connector sealed to IP65. Operating temperature 0 to 50°C.	Power	Typically 38mA for 2.5 seconds. WET-1/d requires 6 - 10 Volts.
Frequency	20 MHz.	Response time	5s
Calibration	Individual sensor calibrations supplied.	Dimensions & weight	Probe housing: 55 x 45 x 10mm. Rods: 68mm long x 3mm dia. Wt. 75g

Notes:

[1] Permittivity is a measure of the dielectric properties of materials (soil).

[2]] Soil Moisture accuracy specification refer to errors after applying a soil-specific calibration, within 10°C of calibration temperature.
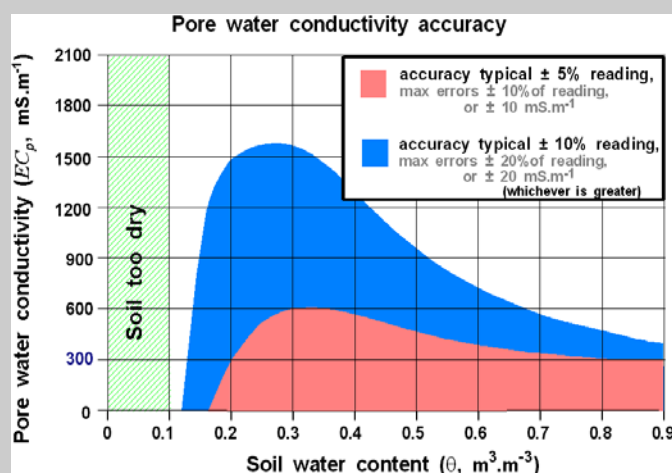
W.E.T Substrate Calibrations Upgrade type WET-CL-1

The WET sensor is particularly valuable in greenhouse or protected environment applications. Special WET-CL-1 calibrations can be ordered, as a set, for a variety of horticultural media: mineral wools (vertical and horizontal measurement), glass wool, coir, peat-based potting mixes and greenhouse "mineral" soils. It should be noted that this upgrade is installed into the HH2 Moisture Meter, not into the sensor itself.

Ordering Information

W.E.T Sensor Kit type WET-K1 Comprises WET-1/d-02 W.E.T Sensor, HH2 Moisture Meter (including alkaline battery and comms cable), spare battery, user manuals and WCC2 carrying case. (WET-K1 includes sensor calibrations suitable for a variety of standard soil types).

W.E.T Sensor Kit type WET-H-K2 Comprises WET-1/d-02 W.E.T Sensor, HH2 Moisture Meter (incl alkaline battery and comms cable) fitted with WET-CL-1* (W.E.T substrate calibrations upgrade), spare battery, user manuals and WCC2 carrying case.

W.E.T Sensor type WET-1/d-02 Combined water content, electrical conductivity and temperature probe. Includes sensor calibration on 3.5" disk. 2m cable, with 25-way D-connector, including voltage regulator. (For use with HH2 only).

Moisture Meter type HH2 With integral 25-pin D-connector for sensor or PC connection. Includes connector cap, battery, user manual with PC software and RS232 cable assembly.
(NB: the HH2 can only be configured for use with a single W.E.T Sensor. Swapping between different W.E.T Sensors requires access to a PC and takes a few minutes. It is therefore generally preferable to have an HH2 Moisture Meter dedicated to each W.E.T Sensor.)

W.E.T Substrate Calibrations Upgrade type WET-CL-1* Upgrade of HH2 Moisture Meter with W.E.T substrate calibrations suitable for a variety of horticultural media. NB calibrations are factory installed at Delta-T premises.

In the Netherlands, WET-CL-1 is available exclusively through Saint-Gobain Cultilène B.V.

Moisture Meter type HH2

The Moisture Meter type HH2 is a versatile readout unit for use with Delta-T soil moisture sensors: the Profile Probe, ThetaProbe, Equitensiometer and W.E.T Sensor

- ❑ **Holds multiple user-defined soil types**
- ❑ **Selectable outputs**
- ❑ **Includes PC data collection software**

Simple, versatile operation

The HH2 offers impressive functionality in a compact, hand-held unit, designed for field use. Readings are displayed on the LCD and can be stored to memory for later download to a PC. Up to 2100 time-stamped readings can be stored.

The unit can be operated with one hand, for convenience in the field. Each time-stamped reading includes a unique sample number, a plot identification number (A to Z), and a sensor location number (1 to 255).

Data is transferred to a PC using the RS-232 cable provided with each unit. The HH2Read Windows PC software provides a data import wizard for direct download into Excel or other PC spreadsheet packages, or into irrigation scheduling programs. Alternatively, data can be downloaded in comma-separated ASCII data file (.CSV) format.

Using the HH2 with ThetaProbes and Profile Probes

ThetaProbes When used with ThetaProbes, the HH2 displays and stores single point soil moisture measurements. This creates a compact, system for obtaining soil moisture readings on the move, and is best suited to surface measurements.

Profile Probes When used with Profile Probes, the HH2 reads and stores the soil moisture content at either 4 or 6 depths simultaneously, and can calculate the water deficit at each depth. The HH2 auto-detects the number of sensors present in each Profile Probe.
This combination of Profile Probe and Moisture Meter provides a portable, low cost system for quickly collecting soil moisture profile data. Readings can be taken wherever access tubes have been installed.

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User-defined soil types

Standard, generalised calibrations for mineral and organic soils are supplied with the HH2 . These are suitable for use with the ThetaProbe or the Profile Probe. The software also permits up to 5 extra user-defined soil calibrations to be characterised and stored for later use.
The active soil type can be switched at any time during the collection of data, and can be specified separately for each sensor position on a single profile probe. The unconverted millivolt readings can be stored alongside the soil moisture readings.

Water Deficit Reading

This reading indicates the amount of water needed (in mm) to restore the plot to field capacity, across a user-defined rooting depth. The HH2 automatically calculates the water deficit, based on data from a ThetaProbe or the individual sensors of a PR1 within that depth.
Field capacity (or "refill point") is user-defined. The HH2 User Manual contains tables of standard soil classifications and their equivalent field capacity values.

A single HH2 Moisture Meter can be used to read a large number of in-situ ThetaProbes or Profile Probes, or combinations of both - by connection to each sensor in turn.

Using the HH2 with W.E.T Sensors

The HH2 is able to display and store the 3 outputs produced by the W.E.T Sensor: water content, electrical conductivity and soil temperature. The outputs can be stored in the HH2 for subsequent downloading to a PC using HH2 Read PC software. In the W.E.T Sensor mode, standard calibrations for Mineral, Organic, Clay, or Sand media can be selected. In addition, five user defined custom soil calibrations can be entered.

The HH2 can only be configured for use with a single W.E.T Sensor. Swapping between different W.E.T Sensors requires access to a PC and takes a few minutes, and it is therefore generally preferable to have an HH2 Moisture Meter dedicated to each W.E.T Sensor.

Special Calibrations for horticultural media Special WET-CL-1 calibrations can be ordered, as a set, for a variety of horticultural media: mineral wools (vertical and horizontal measurement), glass wool, coir, peat-based potting mixes and greenhouse "mineral" soils.

Water Deficit The water deficit capability of the HH2 can be used with the W.E.T sensor in a similar manner to the Profile Probe and ThetaProbe (see previous page).

Other options   User-selectable options allow pore water and/or bulk conductivity to be displayed, and additionally, the pemittivity.

Temperature Compensation Electrical conductivity is a means of estimating the ionic content of soil pore water, and as electrical conductivity varies with temperature, readings may need to be adjusted to a standard temperature. The HH2 provides user-selectable temperature compensation.

HH2 Output options

Measurement	Theta Probe	Profile Probe	WET	Equi-tensio-meter
Soil moisture content ($m^3.m^{-3}$ or % Vol)	✔	✔	✔	
Water deficit (mm)	✔	✔	✔ *	
Unconverted mV output	✔	✔		✔
Temperature			✔	
Pore Water Conductivity (EC_p) $mS.m^{-1}$, $mS.cm^{-1}$ or $\mu S.cm^{-1}$ **			✔	
Soil Permittivity (ε_b)			✔	
Soil bulk conductivity (EC_b) $mS.m^{-1}$, $mS.cm^{-1}$ or $\mu S.cm^{-1}$ * *			✔	

* But not a typical application for the W.E.T Sensor   ****** Selectable

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Upgrading older versions of the HH2 Moisture Meter

Do you need to upgrade your Moisture Meter? The W.E.T Sensor cannot be used with an older version of the HH2 unless it has been upgraded. It makes good sense to upgrade for most other applications too, and if your HH2 is not running PROM 2.00, we recommend that you upgrade now. The PROM (firmware), the PC Software and the User Manual have been updated. The main improvements are: support for new sensor types, the provision of a "Dataset Import Wizard" and the introduction of wider soil specific calibration coefficients for Profile Probe users. PROM 2.00 has been fitted in all HH2s made since April 2002. To check your HH2's PROM version, run HH2-Read on your PC and click on the "version" button.

How to get your Moisture Meter upgraded *NB: upgrades have to be performed by Delta-T Devices.* The order description is:

❑ *HH2 Moisture Meter, Factory Upgrade, type HH2-UPGD1, includes installation of new firmware version 2.0, HH2-READ PC Software, and provision of latest version of User Manual*

Please contact Delta-T or your local distributor for prices and to make arrangements for returning your HH2.

Moisture Meter type HH2 Specification - update

Specifications are unchanged from those given on page 8 of the *Soil and Plant Water Measurement* catalogue, except for increases in the number of readings stored, as detailed below:

Device	Memory capacity	
	Minimum	*Typical*
ThetaProbe	227	2186
Profile Probe (PR1/6)	166	782
Profile Probe (PR1/4)	221	1042
W.E.T Sensor	204	1272
Minimum = all reading options changed for each reading		

Representative:

For HH2 Ordering Information please see page 2

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