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Delta-T Devices

[www.delta-t.co.uk](http://www.delta-t.co.uk)

## Soil Moisture Measurement



# The **SM150T** measures soil moisture and temperature with research-grade accuracy.

- Research grade sensor at a great price
- Soil moisture and temperature
- Dependable moisture accuracy  $\pm 3\%$
- Robust and buriable

## Research grade sensor

Patented sensor electronics produce a highly dependable sensor with exceptional salinity and temperature stability.

The SM150T is built to withstand long term burial - the sensor, connectors and cable are all environmentally protected to IP68. Moisture accuracy is 3% (after soil specific calibration) and the built-in temperature sensor achieves 0.5°C accuracy.

## Data logging and readout

The SM150T is a dual purpose probe. It can be used portably for instant moisture readings, or left installed in the soil for continuous logging - to provide moisture and temperature data.

**For installed sensors** - The SM150T can be logged by any Delta-T data logger and by many loggers from other manufacturers (simple 0-1 V output).

**For portable applications** - The SM150T is available as the convenient SM150 Kit, complete with carry case and readout meter (NB: the meter does not provide temperature indication from the SM150T Sensor). Please see page 9 for more about SM150 Kits.

## Installation

The SM150T's sharp pins minimise soil disturbance, preserving the original soil structure around the measurement rods, and making the probe easy to insert and install. For burial at depth the cylindrical shape facilitates installation in augered holes. Optional extension tubes assist with placement and removal (50 cm and 100 cm lengths, connectable).

## Calibration

The SM150T is provided with general calibrations for mineral and organic soils. A two-point soil specific calibration can be performed for greater accuracy if required.

## Applications

- Soil science
- Horticulture
- Irrigation



Brief Specification (full spec on page 14)	
<b>Water content</b>	
<b>Accuracy</b>	$\pm 0.03 \text{ m}^3.\text{m}^{-3}$
<b>Range</b>	0 to $0.7 \text{ m}^3.\text{m}^{-3}$
<b>Temperature</b>	
<b>Accuracy</b>	$\pm 0.5 \text{ }^\circ\text{C}$ , 0 to $+40^\circ\text{C}$ [1]
<b>Output</b>	0 to 1.0 V differential
<b>Power</b>	5 to 15 V, 18 mA for 1 s
<b>Sample Volume</b>	$\sim 55 \times 70 \text{ mm}$ diameter
<b>Size</b>	$143 \times 40 \text{ mm}$ diameter
<b>Environmental</b>	IP68, with Delta-T cables

[1] Figures apply to sensor only and exclude logger or cabling errors

Patents: US7944220, EP1836483, AU2005315407, CN101080631(B)

Ordering Information	
<b>SM150T</b>	Soil moisture sensor with built-in temperature sensor. NB: order cable separately.
<b>SM150-KIT</b>	Portable soil moisture kit including SM150T sensor, HH150 meter, 1 m fitted cable, manuals and carrying case.

See page 13 for cables and accessories

For information on the **SM150T Kit** See page 9



## Product reliability tested to limit

Delta-T is committed to achieving the highest standards of performance and reliability for all our instruments.

Our rigorous testing regime includes water resistance, thermal shock, and Highly Accelerated Life Testing (HALT). HALT simulates many years usage by subjecting an instrument to high temperature over a relatively short period of time - a test would typically subject sensors to 90°C for 80 days, which is the equivalent of 5 years usage at 30°C. At the end of the test the instruments are checked to ensure they are correctly calibrated and functioning perfectly.

Depending on product type, the tests can include:

- Submergence testing
- Hot water leak testing
- Thermal shock testing
- Highly Accelerated Life Testing (HALT)
- Drop testing
- Thermal cycling testing
- Ultraviolet exposure testing
- Solar gain testing
- Water vapour diffusion testing
- Ice heave testing
- Cable strain relief testing
- Electrostatic discharge testing
- Fast transient electrical testing
- Surge testing



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## Soil Moisture - Portable Kits

Most of our soil moisture sensors are available in kit form providing a convenient solution for fast and accurate spot checking of soil moisture. These kits come complete with readout units, accessories and carry cases.

### SM150 Kit

- Complete low-cost kit
- $\pm 3\%$  accuracy

The SM150 Soil Moisture Kit is an affordable and easy-to-use tool for obtaining reliable moisture measurements with minimal soil or substrate disturbance. The kit's low price and simplicity make it ideal for student projects.



The kit comprises an SM150T Soil Moisture Sensor, a dedicated readout meter and a carry case. The cable and connector are watertight - an essential requirement for potentially wet environments.

The meter displays volumetric water content (% volume)\*.

### Ideal for horticulture

The SM150 Kit comes with substrate calibrations for perlite, coir, peat, and mineral wool, as well as soils - providing a rapid, rugged solution for checking the uniformity of growing conditions for many types of growing media.

### Simple operation

The readout meter is lightweight and is very easy to use, being a readout-only device (no data recording or PC complications). Operation is simple - just insert the SM150T into the soil or substrate and press the Read button to make a reading.

See page 4 for Ordering Information.

Brief Specification	
Accuracy	$\pm 3\%$ (with soil specific calibration)
Range	0 -100% soil water content
Power	2 x AAA batteries approx 10,000 readings
Sampling volume	70 mm x 55 mm diameter cylinder
Environmental	Waterproof (IP68 for sensor only)
Memory	No storage of readings

For information on the WET Kit See page 7



### ML3 ThetaKit

- Class leading  $\pm 1\%$  soil moisture accuracy
- Complete kit with readout unit and case

The ML3 ThetaKit provides researchers with a portable tool for highly accurate, near instantaneous measurement of moisture levels in soils and substrates.



The ThetaKit is easy to use. Simply switch the connected HH2 Moisture Meter on, insert the probe pins fully into the soil, and press the HH2's "Read" button to display the moisture measurement\*. Readings can then be stored with a single button press (if required) - and downloaded to PC later.

The kit comprises an ML3 ThetaProbe Soil Moisture Sensor, an HH2 Moisture Meter (readout unit), replacement sensor rods, and a carry case.

See page 5 for Ordering Information.

### Ideal for sports turf

The ThetaKit enables fast and precise soil moisture management, enabling turf health to be accurately monitored.



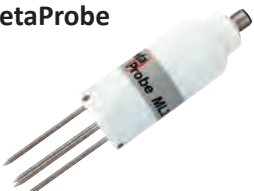


ML3 ThetaKit

Brief Specification	
Accuracy	$\pm 1\%$ (with soil specific calibration)
Range	0 -100% soil water content
Power	9 V PP3 battery approx 5000 readings
Sampling volume	60 mm x 30 mm diameter cylinder
Environmental	Waterproof (IP68 - for sensor only)
Memory	Up to 1500 readings

\* Please note that although the SM150T and ML3 both have a built-in temperature sensor, their accompanying hand held meters do not measure or display temperature.

## Soil Moisture Sensor Specifications

	Soil water content	Multi-parameter	
<b>Sensor</b>	<b>PR2 and PR2 SDI-12</b> 	<b>SM150T</b> 	<b>ML3 ThetaProbe</b> 
<b>Measurement</b>	Volumetric water content	Volumetric water content and soil temperature	Volumetric water content and soil temperature
<b>Accuracy</b>	$\pm 0.04 \text{ m}^3.\text{m}^{-3}$ (4%) With soil-specific calibration	$\pm 0.03 \text{ m}^3.\text{m}^{-3}$ (3%) With soil-specific calibration	$\pm 0.01 \text{ m}^3.\text{m}^{-3}$ (1%) With soil-specific calibration
<b>Soil moisture measurement range</b>	Full accuracy over: <b>0 to 0.4 m<sup>3</sup>.m<sup>-3</sup></b>	Full accuracy over: <b>0 to 0.7 m<sup>3</sup>.m<sup>-3</sup></b>	Full accuracy over: <b>0 to 0.5 m<sup>3</sup>.m<sup>-3</sup></b>
	Full range: 0 to 1.0 m <sup>3</sup> .m <sup>-3</sup>	Full range: 0 to 1.0 m <sup>3</sup> .m <sup>-3</sup>	Full range: 0 to 1.0 m <sup>3</sup> .m <sup>-3</sup>
<b>Salinity range</b>	<b>50 to 400 mS.m<sup>-1</sup></b>	<b>50 to 500 mS.m<sup>-1</sup></b>	<b>50 to 500 mS.m<sup>-1</sup></b>
	Salinity errors included in specification	Salinity errors < 0.035 m <sup>3</sup> .m <sup>-3</sup> from 0.05 to 0.4 m <sup>3</sup> .m <sup>-3</sup> . Can be calibrated up to 2,000 mS.m <sup>-1</sup>	Salinity errors < 0.035 m <sup>3</sup> .m <sup>-3</sup> from 0.05 to 0.4 m <sup>3</sup> .m <sup>-3</sup> . Can be calibrated up to 2,000 mS.m <sup>-1</sup>
<b>Temperature range</b>	Full accuracy over: <b>0 to 40°C</b>	Full accuracy over: <b>0 to 40°C</b>	Full accuracy over: <b>0 to 40°C</b>
<b>Output</b>	<b>0 to 1.0 V</b> differential See page 12 for PR2 SDI-12	<b>0 to 1.0 V</b> differential Corresponding to 0 to ~0.6 m <sup>3</sup> .m <sup>-3</sup>	<b>0 to 1.0 V</b> differential Corresponding to 0 to ~0.6 m <sup>3</sup> .m <sup>-3</sup>
	PR2/6: x6 outputs, PR2/4: x4	Resistance 5.8Ω to 28kΩ for temp sensor	Resistance 5.8Ω to 28kΩ for temp sensor
<b>Power requirement</b>	<b>5.5 to 15 V</b> PR2/6: ~120 mA for 1 s PR2/4: ~80 mA for 1 s See page 12 for PR2 SDI-12	<b>5 to 14 V, ~18 mA for 1 s</b>	<b>5 to 14 V, ~18 mA for 1 s</b>
	Minimum 7.5 V with 100 m cable	Minimum 5.5 V with 100 m cable	Minimum 5.5 V with 100 m cable
<b>Environmental</b>	<b>IP67</b> (when installed in access tube)	<b>IP68</b> , -40 to +70°C	<b>IP68</b> , -40 to +70°C
<b>Sample volume</b>	~95% sensitivity within a cylinder of <b>diameter 200 mm</b>	<b>~55 x 70 mm diameter</b>	<b>~60 x 30 mm diameter</b>
	Sample volume is weighted towards soil immediately surrounding the rods or rings	Sample volume is weighted towards soil immediately surrounding the rods	Sample volume is weighted towards soil immediately surrounding the rods
<b>Dimensions and weight</b>	PR2/6: <b>length 1350 mm</b> PR2/4: <b>length 750 mm</b> Both: <b>25.4 mm diameter</b>	Overall: <b>158 x 40 mm dia</b> Rods: 60 mm x 3.2 mm dia	Overall: <b>158 x 40 mm dia</b> Rods: 60 mm x 3.2 mm dia (Rods are replaceable)
	PR2/6: 1.2 kg, PR2/4: 0.8 kg	Weight: 0.1 kg (excl. cable)	Weight: 0.1 kg (excl. cable)
<b>Sensor calibrations</b>	Individual sensors are interchangeable	Individual sensors are interchangeable	Individual sensors are interchangeable
	Recalibration advised every 3 years (depending on use)	Recalibration advised every 5 years (depending on use)	Recalibration advised every 5 years (depending on use)
<b>Soil calibrations</b>	Generalised <b>Mineral</b> and <b>Organic</b> soil calibrations are supplied	Generalised <b>Mineral</b> and <b>Organic</b> soil calibrations are supplied	Generalised <b>Mineral</b> and <b>Organic</b> soil calibrations are supplied
<b>Applications</b>	Provides rapid moisture content readings in a vertical soil profile. Used in access tubes for easy insertion and removal. Can be left installed for data logging or used with the HH2 for multi-site portable readings.	High quality entry level sensor suited to precision agriculture and research. It is a cost effective alternative where ML3 levels of accuracy are not required. It combines research-grade soil moisture and temperature measurement (when fully buried).	Versatile, high accuracy sensor recognized as the "gold standard" for the precise determination of soil moisture content. Also provides soil temperature when fully buried.