

The **ML2x ThetaProbe** measures volumetric soil moisture to within 1%. The ML2x is known worldwide for its accuracy, reliability and ease of use

- ±1% accuracy
- Easy data logger connection (DC in DC out)
- Excellent temperature and salinity stability
- Dual purpose: either hand-held for spot readings or left in situ for data logging

World class performance

With the ThetaProbe type ML2x it's easy to make reliable, accurate soil moisture measurements. Simply insert the probe into the soil, connect to your data logger or meter, provide 5-15V DC at 20mA, and within seconds you can be measuring soil moisture.

The ThetaProbe's 1% accuracy, stability and reliability have made it the preferred choice for thousands of researchers worldwide.

Calibration

After a single two-point gravimetric calibration, ThetaProbes will meet their full 1% accuracy specification for your chosen soil (or other medium).

For convenience, many users simply apply one of the two standard calibrations supplied by Delta-T. These "generalised" mineral or organic calibrations achieve 5% accuracy.

The ML2x has a predictable saline response and can be used even in very saline soils - up to 2000 mS.m⁻¹.

Data logging and readout

Most types of data logger can provide the 5-15V DC required to power the ThetaProbe, and will accept its 0 - 1V DC output signal.

The HH2 Moisture Meter connects to a ThetaProbe to provide a portable system for instantaneous readout of soil moisture (see page 18).

Applications

Typical application areas include:

- **Soil Science**
- **Agriculture**
- **Hydrology**
- **Forestry**
- **Turf grass**

Wherever a soil moisture profile is required, Profile Probes should be considered (see page 10), but note that ThetaProbe accuracy is ±1%, compared to the Profile Probe ±4%.

Horticulture and agriculture

ThetaProbes can be used in a wide range of soils, composts and other growing media. They can be inserted into plant pots, or may be positioned horizontally in a seed tray (minimum 50mm depth of compost).

Sports turf and golf

The ThetaProbe is used by sports turf professionals worldwide to spot check soil moisture content and to monitor the performance of automatic sprinklers. The ThetaKit (see image opposite) includes the ML2x sensor, readout unit and accessories all in one convenient package.

Environmental monitoring

Soil water is increasingly seen as one of the critical components for long-term studies of global climate and local environments. Many automatic weather stations can be expanded to include one or more ThetaProbes.



Brief specification (full specs on page 12)

Range	0 to 0.5 m ³ .m ⁻³ [1]
Accuracy	± 0.01 m ³ .m ⁻³
Output	0 to 1.0V [2]
Power	5 to 15V, ~20mA for 1s
Sample vol	~60 x 30mm diameter
Size	210mm x 40mm diameter
Environmental	IP68

[1] Measures full range up to 1.0 m³.m⁻³ with reduced accuracy

[2] Corresponding to 0 to 0.5 m³.m⁻³

Ordering information

ML2x/w-05 [3]	ThetaProbe terminating in bare wires for data logger terminal blocks, 5m cable
ML2x/d-02	ThetaProbe terminating in 25-way D-connector for HH2 meter, 2m cable
ML2x/t-05 [3]	ThetaProbe terminating in IP68 connector for use with extension tubes, 5m cable
ML/EX50	0.5m extension tube [4]
ML/EX100	1.0m extension tube [4]
ML-RODS-3	Pack of 12 spare rods, Older ThetaProbes need modification
ML-INK1	Insertion kit for pre-forming holes in hard soils
SM-AUG-100	45mm dia. spiral auger to install ThetaProbes SM300s and SM150s at depth, length 1.2m
ML2x-KIT	ThetaKit portable soil moisture kit, includes ML2x/d-02, pack of 4 spare rods, HH2 Meter, insertion kit, manual and case

[3] Other cable lengths available in multiples of 5m up to 100m, e.g. ML2x/w-25

[4] ML2x/d is not suitable for use with extension tubes - use ML2x/t instead

Installation








ThetaProbes are robust, buriable and maintenance-free. They can be inserted into augered holes or positioned in the wall of a trench (which is then carefully back-filled).

Optional extension tubes assist convenient placement and removal when burying at depth. Access holes should be angled to minimise water "tracking".

ML2x ThetaProbe

Outstanding performance for demanding applications

What do you gain when you choose the ThetaProbe?

Feature	Description	Advantage
 <p>DC in, DC out</p>	Requires 5 - 15V DC at 20mA. Provides 0 - 1V DC output (differential). Compatible with HH2 Moisture Meter and most data loggers.	<ul style="list-style-type: none"> • Dual purpose: - for burial and data logging - for hand-held use • Long cable runs possible • Easy to include in large-scale logging set-ups
 <p>100MHz signal</p>	With frequencies below ~30MHz, salinity effects can be a problem. With frequencies above ~250MHz, measuring bound-water in clay soils is a problem. 100MHz is an excellent compromise.	<ul style="list-style-type: none"> • Performs well in most soil types, including clays • Usable in saline soils - up to 2000 mS.m⁻¹ • ±1% accuracy
 <p>4-Rod arrangement</p>	3 rods are arranged in a circle around a central rod. This creates a defined cylindrical zone of measurement, 60mm long x ~30mm diameter.	<ul style="list-style-type: none"> • Holds soil closer to central rod in case of drying and cracking (2 and 3 rod sensors, and particularly flat pcb sensors, don't do this) • Measurements can be made close to the soil surface
 <p>Replacement rods</p>	Made of 3mm diameter, resilient, 304 austenitic stainless steel, with sharpened tips. Rods have threaded ends that screw into ThetaProbe body. The exposed rod length is 60mm.	<ul style="list-style-type: none"> • Withstand repeated insertion in soil. Can be replaced at low cost if bent or damaged • Highly resistant to corrosion • Sharp, narrow rods minimise errors due to soil compaction by the rods
 <p>Compact, cylindrical shape</p>	The ThetaProbe casing is a 40mm diameter tube, with threaded end. Extension tubes (0.5 and 1.0m) screw onto this thread. Case sealed to IP68. Overall length is 210mm.	<ul style="list-style-type: none"> • Easy to insert and remove from augered holes • Rapid attachment of extension tubes • Handy size for portable use • Rugged, waterproof and buriable to 5m
<p>Delta-T support</p>	Thousands of ThetaProbes are in use all over the world. The ML2x design and performance have been refined over many years.	<ul style="list-style-type: none"> • Worldwide availability • Reassurance of quality • Advice on complete systems

Comparison with other techniques

ThetaProbes have some clear advantages over TDR systems. In general terms ThetaProbes are more stable, more reliable at high salinity, easier to log, use less power, have simpler cabling requirements and can be used to make spot readings on the move (as well as being buried for long term logging).

Neutron Probes have many drawbacks when compared with ThetaProbes. They create licensing and safety problems, they cannot measure the top 25cm of soil, they cannot be data logged and the overall cost of ownership is high. (Profile Probes are in many respects an even better alternative to neutron probes – see page 10).

Further information

The ThetaProbe has been jointly developed with the Macaulay Land Use Research Institute (MLURI), as originally described in *ThetaProbe ML2: Principles of Operation and Applications* J.D. Miller and G.J. Gaskin (available for download from www.delta-t.co.uk).



ML2x-KIT ThetaKit

Patents
UK patent 2300485B,
US patent 5804976.

New Model Introduced in 2013

ML3 ThetaProbe

With built-in temperature sensor and extendable cable

Datasheet available www.delta-t.co.uk

Soil Moisture Measurement