



# PR2 Profile Probe Systems

## Easy and accurate soil moisture profiles

- ❑ Soil moisture content - not just trends
- ❑ Low salinity and temperature sensitivity
- ❑ Portable meter option for convenient multi-site measurement
- ❑ Dedicated DL6 Logger option for continuous monitoring

The PR2 Profile Probe uses newly patented <sup>1</sup> sensing technology making it possible to measure soil moisture content in a range of soil types and across a wide range of nutrient levels, including saline soil conditions.



The unique PR2 Profile Probe can be installed for continuous data logging and also be used for multi-site, portable measurements

### Installation and connection

Users can choose between the PR2/4, measuring at 4 depths down to 40 cm, or the PR2/6 measuring at 6 depths down to 100 cm. The nominal sensing depths are 10, 20, 30, 40, 60 and 100 cm.

The PR2 access tube requires an installation hole 27mm in diameter, allowing easy installation and minimal soil disturbance. Access tubes are manufactured to strict tolerances and are exceptionally strong and durable in the soil. Correct installation is essential and we recommend the use of our specially designed augering equipment (see next page).

The PR2 is constructed from the highest grade components and materials to ensure robustness in harsh environments. Reliable, environmentally sealed, IP68 connectors enable a wide range of cable length and connectivity options to be supported. This flexibility makes sensor connection and disconnection quick and easy.

A PR2 combined with an HH2 readout unit enables a single probe to be used at different locations, providing a low cost multi-site solution.

The PR2 can be permanently installed and teamed with the dedicated DL6 Soil Moisture Logger for continuous soil moisture monitoring. Alternatively, for multi-probe applications, the DL2e Logger is ideal, handling combinations of Profile Probes and other environmental sensors (including weather stations).

- ❑ Out of the box solution - supplied with soil calibrations for common soil types <sup>2</sup>
- ❑ IP68 protected connectors for versatile connectivity
- ❑ Uses access tubes for easy probe insertion and removal



1) Patent pending

2) Good accuracy achieved with normal agricultural soils. (Typical mineral and organic calibrations supplied.)  
For less common soils, custom soil calibrations can be used for highest accuracy

# Augering Kits and Access Tube Installation

## Augering and Extraction Kits

### Augering kits for optimal access tube installation

*Delta-T augering kits help you achieve the best possible access tube installation in virtually any soil.* Profile Probes are used in access tubes inserted into carefully pre-augered holes in the soil. Correct access tube installation is absolutely vital for accurate measurement of soil moisture profiles.

To get the best performance from Profile Probes, the augered holes should be straight, smooth sided and the correct diameter. The goal is to produce optimal contact between the soil and the wall of the access tube. However, if substantial stoniness or compaction, or the presence of voids, foreign bodies, or soil instability are features of a particular site, it may not always be possible to install an access tube successfully.

Three types of kit are available (but please note that for dry sandy soils a PR2-AUG2 25mm spiral auger should be ordered in addition to the selected kit).

**PR-ASK1-S, Augering Starter Kit (short)** Only recommended for installing short access tubes (type ATS1, for PR2/4) in soft soil, or if backfilling is acceptable. (For example, in an irrigation monitoring application, where accuracy is not a key concern, an oversized hole could be partially dug out with a small spade and the soil replaced by hand. Only the lower portion of the hole would be augered). Comprises 24mm pilot auger, stabilisation plate, access tube insertion rod and user manual.

**PR-ASK1-L, Augering Starter Kit (long)** For installing both short and long access tubes (types ATS1 and ATL1, for PR2/4 and PR2/6) in most soil types. Based on the PR-ASK1-S (short) kit, plus a finishing auger and a dead-blow mallet.

**PR-AKC1, Complete Augering Kit** For installing both short and long access tubes in most soil types. Based on the PR-ASK1-L (long) kit, with the addition of a carrying bag, cleaning rod and flexicanes.



Complete Augering Kit, PR-AKC1. Shows (a) Stabilisation plate (b) Pilot auger (c) Finishing auger (d) Insertion rod (e) Short and long access tubes (not part of PR-AKC1)

### PR-EXK1, Access Tube Extraction Kit

Heavy duty system for removing installed tubes.

**Upgrades** Customers with older augering systems, such as the PR-AK1, may be able to reuse some of the components. Please enquire for further details.

### Augering Kit Features

The key components are:

**Stabilisation plate** to keep the auger vertical. A major contribution to readings errors arises from conical enlargement of the hole (funnelling) during the augering process, especially in the top 30cm. This results in poor contact between the outside surface of the access tube and the surrounding soil. The stabilisation plate minimises this effect. *NB All new augering kits include a stabilisation plate.*

**Insertion rod** to drive the access tube into an augered hole by applying force to the bottom of the tube (normally by hammering). This new technique reduces the flexing that can produce air gaps around the access tube and minimises soil displacement.

**Finishing auger** To expand augered pilot holes to the exact diameter required for an access tube, a new type of auger has been designed. This adjustable finishing auger produces straight, smooth-sided holes in most soil types (see image, left).



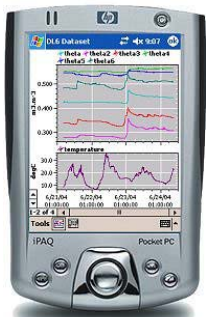
Cutting head of Finishing Auger

Soil type and depth	PR-ASK1-S Starter Kit (short)	PR-ASK1-L Starter Kit (long)	PR-AKC1 Complete Kit
Normal soils, up to 40cm depth	✓	✓✓	✓✓✓
Normal soils, up to 100cm depth	✗	✓✓	✓✓✓
<ul style="list-style-type: none"> <li>For dry, sandy soils the PR2-AUG2 25mm spiral auger should be ordered in addition to the selected augering kit.</li> <li>Only the complete kit includes a carrying bag (all augering items can be ordered individually).</li> </ul>			
<p><b>Key:</b> ✓ = Meets basic need   ✓✓ = Well suited   ✓✓✓ = Well suited &amp; includes items for extra convenience   ✗ = Unsuitable</p>			

## DL6 Data Logger

- ❑ **Ideal for Profile Probes & ThetaProbes**
- ❑ **Complete solution with IP67 weather-proof case and battery power**
- ❑ **Pocket PC interface for data collection and configuration**
- ❑ **16,000 readings**

The DL6 is a dedicated data logger optimised for use with Delta-T soil moisture sensors. It can be used with combinations of ThetaProbes and Profile Probes and also accepts rain gauge and soil temperature probe inputs.



### DeltaLINK Software for Pocket PC

The DL6 Logger interfaces seamlessly with a Pocket PC to allow viewing and analysis of data in the field (as shown above), with later transfer to a PC.

Full PC software capability is available when used with any iPAQ 2200 Series Pocket PC (PDA). The DeltaLINK software and connection cable are available as a kit.

The DL6 is well suited to both research applications and irrigation monitoring. To minimise the need for opening the case, data is collected via an external RS232 socket, and the status of the logger can be checked using a vibration-activated LED.

DL6 Loggers include a novel accelerated logging feature to allow the tracking of wetting fronts.

### DL6 - perfect partner for Profile Probes

The DL6 logs a PR2/6 (100cm depth) or a PR2/4 (40 cm depth).

The PRC/M12-05 cable makes connection easy, and the DL6 PC software simplifies sensor configuration and data collection.

Data sheet available on request.

## HH2 Moisture Meter

- ❑ **Readout and data storage for Profile Probes and other Delta-T soil moisture sensors**
- ❑ **% volume and water deficit readings**

The HH2 is a versatile readout unit that provides an easy and convenient way to display and store readings from Profile Probes. With the HH2 and PR2 combination, a Probe can be moved from access tube to access tube, enabling large amounts of soil moisture data to be collected at multiple sites.

The HH2 reads and stores the soil moisture content at either 4 or 6 depths simultaneously, and can calculate the water deficit. The HH2 auto-detects the number of sensors present in each Profile Probe.

Customers who already have an HH2 Readout Unit will require an upgrade prior to using it with a PR2. Please contact Delta-T or your local distributor for further details.

**User-defined soil types** Standard, generalised calibrations for mineral and organic soils are supplied with the HH2. The software also permits up to 5 extra user-defined soil calibrations to be characterised and stored for later use.

### Water Deficit Reading

The HH2 automatically calculates the water deficit, based on data from the individual sensors of a PR2. This indicates the amount of water needed (in mm) to restore the plot to field capacity, down to a user-defined rooting depth. (Requires field capacity value to be input.)



Data sheet available on request

## DL2e Data Logger

- ❑ **High capacity: 15 differential analogue channels, expandable to 60 channels**
- ❑ **Can log large numbers of Profile Probes**
- ❑ **Versatile: logs most types of sensor**

**The DL2e is a weatherproof, programmable data logger, well suited to remote site applications.**

The DL2e can be used with most sensor types and accepts DC, AC, resistance, counter, frequency and status inputs. This makes it ideal for weather station and other multi-sensor environmental monitoring applications.

Communication options include GSM modems for automatic data collection from remote sites.

Data sheet available on request



## PR2 Profile Probe Specifications

<b>Model types</b>	PR2/4 and PR2/6	
<b>Sensing depths</b>	PR2/6: 10, 20, 30, 40, 60, 100 cm PR2/4: 10, 20, 30, 40 cm (nominal)	
<b>Measurement</b>	Volumetric soil moisture content $\theta_v$ ( $\text{m}^3 \cdot \text{m}^{-3}$ or % vol)	
<b>Range</b>	Accuracy figures apply from 0 to $0.4 \text{ m}^3 \cdot \text{m}^{-3}$ Full range is from 0.0 to $1.0 \text{ m}^3 \cdot \text{m}^{-3}$	
<b>Accuracy</b> <sup>[1]</sup> 0.0 to $0.4 \text{ m}^3 \cdot \text{m}^{-3}$	$\pm 0.04 \text{ m}^3 \cdot \text{m}^{-3}$ , 0 to 40°C	Typical, after calibration to a specific soil type
	$\pm 0.06 \text{ m}^3 \cdot \text{m}^{-3}$ , 0 to 40°C	Typical, using the generalised soil calibrations in 'normal' soils
<b>Salinity errors</b>	Included in above accuracy figures (50 to $400 \text{ mS} \cdot \text{m}^{-1}$ , $0.5$ to $4 \text{ dS} \cdot \text{m}^{-1}$ , pore water conductivity).	
<b>Soil sampling volume</b>	Vertically: ~95% sensitivity within $\pm 50\text{mm}$ of upper ring of each pair. Horizontally: ~95% sensitivity within a cylinder of radius 100mm.	
<b>Environment</b>	0 to 40°C for full accuracy specification, -20 to +70°C full operating range. IP67 rated when installed in access tube.	
<b>Response time</b>	Full accuracy achieved within 1 second <sup>[2]</sup>	
<b>Power requirement</b>	Minimum: 5.5V DC with 2m cable, 7.5V with 100m. Maximum: 15V DC. PR2/4 consumption: < 80 mA PR2/6 consumption: < 120 mA	
<b>Outputs</b>	4 (PR2/4) or 6 (PR2/6) analogue voltage outputs: 0 to 1.0V DC corresponding to 0 to $0.6 \text{ m}^3 \cdot \text{m}^{-3}$ (mineral calibration).	
<b>Cable</b>	Standard and extension cables – see Ordering Information.	
<b>Construction</b>	25.4mm polycarbonate with pairs of stainless steel rings.	
<b>Size / weight</b>	PR2/4 length: 750mm	Weight: 0.6kg
	PR2/6 length: 1350mm	Weight: 0.9kg
<p><sup>[1]</sup> Accuracy when installed in the field will depend on soil type, soil homogeneity and the care taken over installation. The quoted accuracy figures were obtained under uniform and controlled conditions.</p> <p><sup>[2]</sup> Minimum 1 second power-up recommended for full accuracy.</p> <p><sup>[3]</sup> 100m is the maximum length for stated performance accuracy. Longer cables can be used and compensated for.</p>		

### Augering Kits - Ordering Information

**PR-ASK1-S** Augering starter kit (short) For access tube installation (short tubes only). Includes 24mm pilot auger, stabilisation plate, access tube insertion rod and user manual.

**PR-ASK1-L** Augering starter kit (long) For access tube installation (long or short tubes). Includes all items in PR-ASK1-S Kit, plus finishing auger and mallet.

**PR-AKC1** Augering kit (complete) For access tube installation (long or short tubes). Includes all items in PR-ASK-L Kit, plus, flexicanes, carrying bag and cleaning rod.

**PR-AUG2** 25mm spiral auger, for dry, sandy soils.

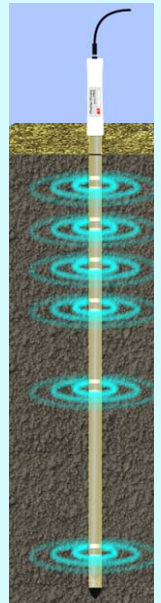
*For details of individual augering items, please enquire*

### Differences between the PR1 and PR2

The PR1 Profile Probe was an excellent choice for measuring water content profiles in sandy and silty soils, but has now been discontinued. The PR2 is designed for optimal performance in all soil types, even in difficult soils such as heavy clay and saline soils. It features:

- ❑ **Completely new, patented sensing electronics to meet the needs of scientific researchers and discerning growers**
- ❑ **Polycarbonate rod for optimal dielectric properties, improved performance and superior dimensional stability**
- ❑ **Environmentally sealed IP68 connector for versatile connectivity**

The PR2 uses the same access tubes as the PR1, making it easy to upgrade existing installations. However, please see page 2 for information on the importance of correct installation.



### Profile Probe - Ordering information

**PR2/4** Profile Probe, 40cm (no cable)

**PR2/6** Profile Probe, 100cm (no cable)

All Profile Probes come fitted with IP68 connector and are supplied with user manual, protective tube, spare centring springs and O-rings. NB CABLE MUST BE ORDERED SEPARATELY.

#### Standard cables for PR2:

**PRC/d-HH2** 1.5m cable, IP68 M12 connector to 25-way D-socket (IP54). Connects PR2 to HH2 Moisture Meter.

**PRC/M12-05** 5m cable, IP68 M12 connector to IP68 M12 connector. Connects PR2 to DL6 Soil Moisture Logger.

**PRC/w-05** 5m cable, IP68 M12 connector to bare wire. Cable connects PR2 to DL2e and other data loggers.

#### Extension cables for PR2:

**EXT/M12-05** 5m cable, IP68 M12 connector to IP68 M12 connector. Connects to PR2, or to any EXT/M12 cable. (Cable is identical to item PRC/M12-05).

**EXT/M12-10** 10m cable, IP68 M12 connector to IP68 M12 connector. Cable connects to PR2, or to any EXT/M12 cable.

**EXT/M12-25** 25m cable, IP68 M12 connector to IP68 M12 connector. Cable connects to PR2, or to any EXT/M12 cable.

#### Access tubes and Profile Probe accessories:

**ATS1** Access tube – short, 554mm x 28mm diameter. Includes cap, bung and collar. For use with PR2/4.

**ATL1** Access tube – long, 1154mm x 28mm diameter. Includes cap, bung and collar. For use with PR2/6.

**PR2-SP** PR2 Profile Probe spares kit

**PR-CB2** Protective carrying bag suitable for Profile Probe and HH2 Moisture Meter or Pocket PC. Includes space for access tube cleaning rod.

