AT
Delta-T Devices

Soil Moisture Measurement Catalogue

The **HH2 Moisture Meter** provides instant readout from most Delta-T soil moisture sensors.

- Immediate display of water content
- Store up to 1500 readings
- Reads ML3, SM150T, PR2, PR2 SDI-12 or WET Sensor

Overview

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 1500 time-stamped readings can be stored.

Applications
- Reads ML3*, SM150T* and WET Sensors
- Reads PR2/6 and PR2/4 Profile Probes (analog and SDI-12)

Simple versatile operation

The HH2 can be operated with one hand for convenience in the field. Each time-stamped reading includes a unique sample number, a plot identification letter (A to Z) and a sensor location number (1 to 255).

Data is transferred to a PC using the RS232 cable provided with each unit. See ordering information for USB connection.

HH2Read software downloads data in comma-separated ASCII (.csv) format ready for opening in Excel. Data can be merged with existing downloaded data, using the free Dataset Import Wizard.

Reading Profile Probes

The HH2 Moisture Meter can take readings from a PR2 Profile Probe wherever access tubes have been installed. With an installed array of access tubes, one HH2/PR2 combination can profile large areas quickly. The HH2 auto-detects the number of sensors in each Profile Probe.

The HH2 can also display readings from SDI-12 Profiles Probes. Please see page 12 for details.

Buriable Probes ML3 and SM150T Sensors can be buried and connected to a data logger for continuous monitoring - see pages 6 and 7.

Reading WET Sensors

The HH2 is able to display the 3 outputs produced by the WET Sensor and store them until downloaded to a PC. Standard calibrations for Mineral, Organic, Clay, or Sand media can be selected.

In addition, user-defined custom calibrations can be entered for soils and other substrates.

User-selectable options allow pore water and/or bulk conductivity to be displayed, and also the permittivity. The HH2 provides user-selectable temperature compensation.

WET Sensor media calibrations

When the WET Sensor is purchased with an HH2 Moisture Meter it will be equipped with calibrations for generic mineral soils, organic soils, sand soils, clay soils, coir (coco fibre), peat based potting mixes, greenhouse 'mineral' soils, and Stonewool artificial mineral wool substrate (vertical and horizontal measurement).

Water deficit

This reading indicates the amount of water needed (in mm) to restore the soil to field capacity, down to a user-defined rooting depth. The HH2 calculates water deficit from the user-defined field capacity and from readings taken either from a single sensor or the individual sensors of a Profile Probe. The HH2 User Manual contains tables of standard soil classifications and their associated field capacities.

Soil types

Standard calibrations for generalised mineral and organic soils are supplied with the HH2 for use with the ML3*, Profile Probe and SM150T* Sensors. The HH2 also enables up to 5 extra user-defined soil calibrations to be characterised and stored. The soil calibration 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.

Ordering Information

Moisture Meter type HH2 with integral 25-pin D-connector, battery, RS232 cable and 25 to 9 pin adapter.

If the HH2 is intended for use with a single ML3 ThetaProbe or a single WET Sensor it can be ordered as part of a convenient kit - see page 11.

USB to RS232 Adapter Cable type USB-RS232. 100 cm cable, connects 9 pin RS232 to USB (for connection to PC).

Brief Specification (full spec on page 27)

Range	Zero to saturation (soil water content) 0 to 1.5 V (voltage range)
Accuracy	± 0.13% of mV reading ± 1 mV
Resolution	1 mV
Reading storage	Typically 500 to 1500 readings (depends on sensor and settings)
Connection	1 x male 25-pin D-connector used for sensor and RS232 communications
Environmental	IP54, 0 to 40°C (operating)
Size, weight	125 x 80 x 40 mm, 450 g
Battery type, life	9 V alkaline 6LR61 (PP3), ~ 5,000 readings

* NB The ML3 or SM150T can be used as a portable moisture probe with the HH2 Meter but the HH2 does not provide temperature indication from the SM150T or ML3

The **PR2 Profile Probe** provides easy and accurate soil moisture profiles.

- Soil moisture content - not just trends
- Low salinity and temperature sensitivity
- Portable meter option for multi-site measurement
- GP2 and DL6 Logger options for continuous monitoring

SDI-12 version
See page 14

Dual purpose

The unique PR2 Profile Probe can be installed for continuous data logging and can also be used for multi-site, portable measurements with an HH2 hand-held readout unit.

The PR2 uses patented* 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.

Applications
- Soil moisture profiles
- Agriculture
- Hydrology
- Civil engineering

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.

Profile probes are used in access tubes inserted into augered holes in the soil. Access tubes require an installation hole only 27 mm in diameter, allowing easy installation and minimal soil disturbance. They 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).

Robust

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

Data logging

The GP2 and DL6 data loggers are well suited to Profile Probe recording.

See comparison table on opposite page.

Brief Specification (full spec on page 16)	
Range	0 to 0.4 m³.m⁻³ [1]
Accuracy	± 0.04 m³.m⁻³
Output	**PR2/6:** 6 x 0 to 1.0 V [2] **PR2/4:** 4 x 0 to 1.0 V
Power	5.5 to 15 V [3] **PR2/6:** ~120 mA for 1 s **PR2/4:** ~80 mA for 1 s
Sensing depths (nominal)	**PR2/6:** 10, 20, 30, 40, 60, 100 cm **PR2/4:** 10, 20, 30, 40 cm
Sampling volume	**Vertically:** ~95% sensitivity within ± 50 mm of upper rings **Horizontally:** ~95% sensitivity within 200 mm diameter
Size (length x dia)	**PR2/6:** 1350 mm x 25.4 mm **PR2/4:** 750 mm x 25.4 mm
Environmental	**IP67** (when installed in access tube)
Access tubes	
Size (length x dia)	**ATL1:** 1154 mm x 28 mm **ATS1:** 554 mm x 28 mm

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

[2] Corresponding to 0 to 0.6 m³.m⁻³

[3] 5.5 V DC with 2 m cable, 7.5 V with 100 m

(Above) PR2/6 Profile Probe with HH2 Moisture Meter.
(Right) PR2/4 Profile Probe

HH2 Moisture Meter

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. (See page 10).

Ordering Information	
PR2/4	Profile Probe, 40 cm**.
PR2/6	Profile Probe, 100 cm**.
All Profile Probes are fitted with an IP68 connector and come with a protective tube. ****Cable must be ordered separately.**	
Standard cables	
PRC/d-HH2	1.5 m cable, IP68 M12 connector to 25-way D-socket. Connects PR2 to HH2 Moisture Meter.
PRC/M12-05	5 m cable, IP68 M12 connectors. Connects PR2 to GP2 or DL6 Logger.
PRC/w-05	5 m cable, IP68 M12 connector to bare wire. Connects PR2 to loggers.
Extension cables	
EXT/8W-05	5 m extension cable, M12.
EXT/8W-10	10 m extension cable, M12.
EXT/8w-25	25 m extension cable, M12.
The EXT/8W - xx cables can be connected together to create custom lengths - then fitted to a PRC/M12-05 or PRC/w-05 cable for data logger connection.	
Access tubes and PR2 accessories	
ATS1	Short access tube, includes cap, bung and collar. (PR2/4).
ATL1	Long access tube, includes cap, bung and collar. (PR2/6).
PR2-SP	Profile Probe spares kit.
PR-CB2	Protective carrying bag suitable for PR2 and HH2.

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

The **PR2 SDI-12** is a digital alternative to the analog PR2 Profile Probe.

- Multiple PR2 SDI-12s connect to a compatible data logger via a single cable
- Enables the creation of low cost highly flexible sensor networks
- Compatible with existing PR2 access tubes and augering kits
- Flexible integration with 3rd party SDI-12 hardware
- Low power design; ideal for remote sites

Overview

The PR2 SDI-12 Profile Probe builds on the reputation and field proven technology of the analog PR2. By adopting the widely used SDI-12 interface (v1.3) the PR2 SDI-12 can be integrated with an even wider range of data loggers, sensors and equipment.

SDI-12 is an established communication standard adopted by many manufacturers of environmental monitoring and control equipment. It is popular because it allows large numbers of sensors (from many vendors) to be connected to a logger via a simple cable network, thereby reducing the cost and complexity of wiring large sensor installations.

Cables and connectors

The PR2 SDI-12 has a high quality, stainless steel IP67 rated connector (M12 x 5-way) - connecting to the standard Delta-T range of M12 x 5-way cables and accessories. The M12 x 5-way cables are also compatible with Delta-T's ML3, SM150T and EQ3 sensors.

(NB: The M12 x 8-way range of cables used for analog PR2 connection is not compatible with the SDI-12 version of the PR2. Analog and SDI-12 sensors cannot be mixed on the same cable system).

GP2 SDI-12 Data Logger

The SDI-12 enabled GP2 Data Logger and DeltaLINK Software enable quick and easy creation of sensor networks - without the need to resort to the often complex programming methods typically employed by other manufacturers.

The SDI-12 Profile Probe's electronics have been designed to improve power efficiency - reducing the overall power requirement. This is an important advantage for applications at remote sites.

Up to 50 SDI-12 PR2/6 Profile Probes, or up to 62 SDI-12 PR2/4s, can be connected to a single GP2 SDI-12 Data Logger (subject to cable length and power requirements- see GP2 manual for details).
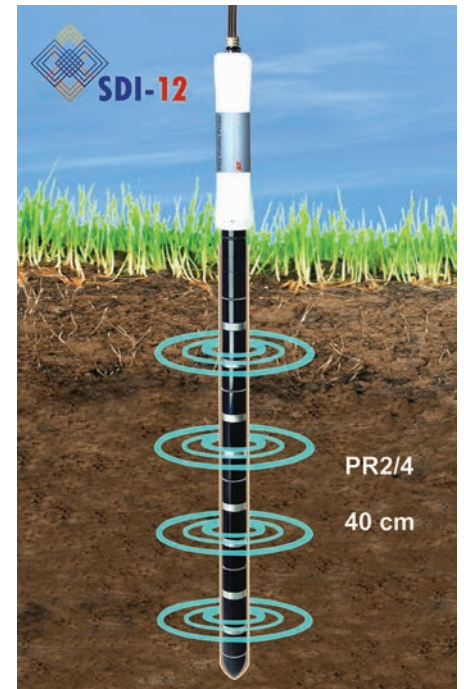
In addition to SDI-12 inputs, the GP2 can log 12 analog channels.
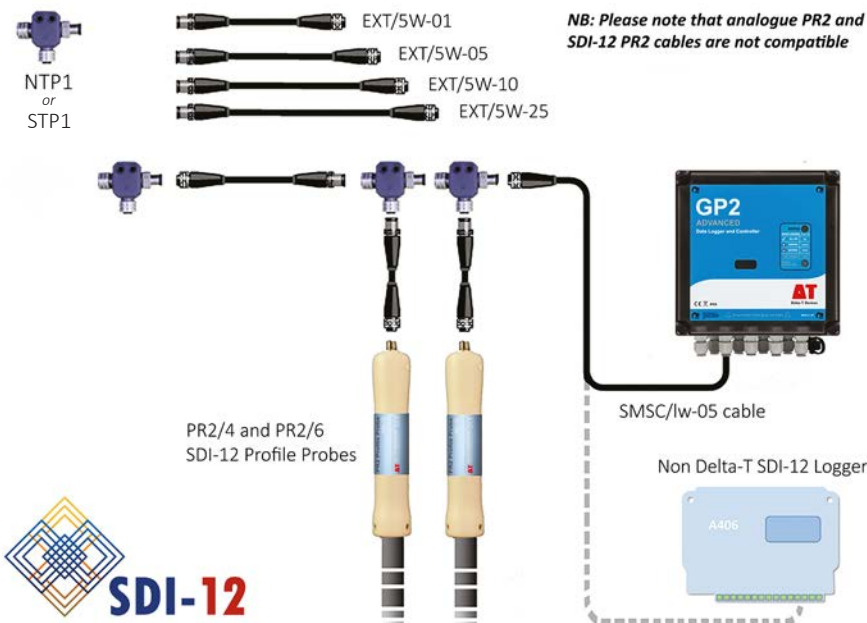
Cost saving with SDI-12

- Lower cost cabling- uses standard Delta-T M12 x 5-way cable system
- Lower cost data logging for multi-probe installations
- Same price as analog PR2 Probe

Ordering Information

PR2/4-SDI-12	Profile Probe 40 cm SDI-12 interface.
PR2/6-SDI-12	Profile Probe 100 cm SDI-12 interface.

Cables must be ordered separately - see diagram below and cable information on page 15.

All Profile Probe accessories, such as augering kits and access tubes, are compatible with the SDI-12 version. Cables are an exception: the analog PR2 and SDI-12 PR2 cables are not compatible.

See page 13 for details of PR2 accessories.

Use of PR2 SDI-12 Senors with Data Logger

EXT/5W-01
EXT/5W-05
EXT/5W-10
EXT/5W-25

NTP1 or STP1

NB: Please note that analogue PR2 and SDI-12 PR2 cables are not compatible

PR2/4 and PR2/6 SDI-12 Profile Probes

SMSC/lw-05 cable

Non Delta-T SDI-12 Logger

HH2 Moisture Meter

The HH2 Moisture Meter can display readings from the PR2 SDI-12 Profile Probe*. This is a great advantage for customers who value the freedom to use SDI-12 Profile Probes in both installed and portable applications. Pre-February 2017 HH2s can be upgraded at low cost (via firmware) to enable PR2 SDI-12 readout. (Also requires new HH2 to PR2 cable)

For more information on upgrading firmware please contact our Tech Support department: tech.support@delta-t.co.uk

* Please note that the HH2 only reads SDI-12 digital data from the PR2 SDI-12 Probe - it is not a general purpose SDI-12 meter.