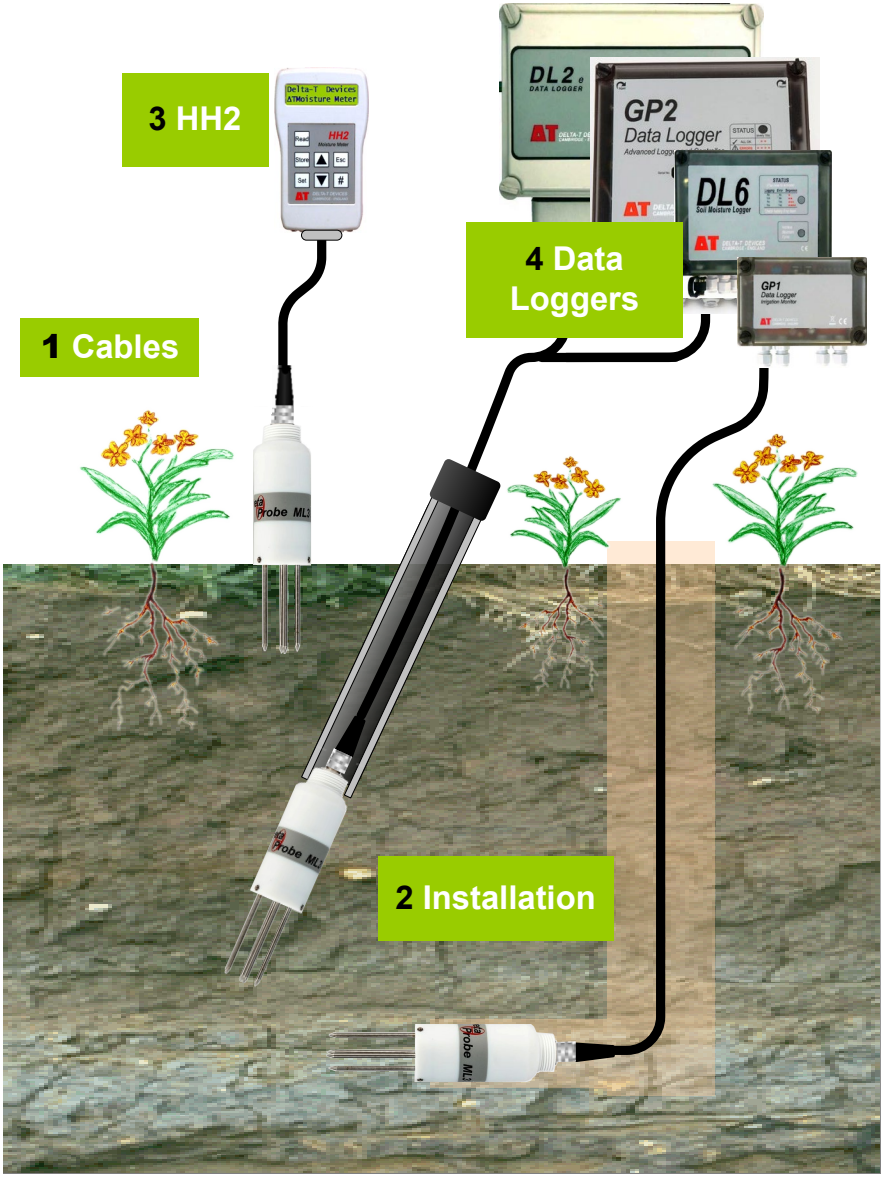
ML3 ThetaProbe

Soil Moisture and Temperature Sensor

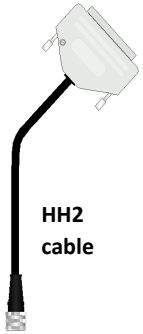
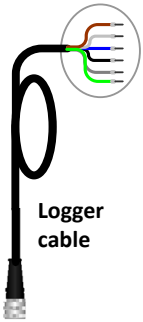
Quick Start Guide *Version 1.0*

Delta-T Devices

ML3 overview



1 Cables and Accessories

 HH2 cable	 Extension cables	 Logger cable
0.9m	5m, 10m, 25m	5m bare end

Extension cables can be joined up.
See specifications for maximum length.
Align connectors carefully before pushing parts together.
Screw together firmly to ensure the connection is water-tight.

2 Installation

Surface installation and spot measurements

- Clear away any stones. Pre-form holes in very hard soils before insertion.
- Push the ML3 into the soil until the rods are fully inserted. Ensure good soil contact.
- If you feel strong resistance when inserting the ML3, you have probably hit a stone. Stop, and re-insert at a new location.

Installing at depth

- Auger a 45mm diameter hole. ~10° to vertical is recommended.
- Fit an extension tube to the ML3 – remember to pass the cable through the extension tube and fit the connector first.
- Push the ML3 into the soil until rods are fully inserted. Ensure good soil contact.

Alternatively

- Dig a trench, and install horizontally (see **Overview** diagram).

Note: Extension tubes are available for installing the ML3 in an augered hole.

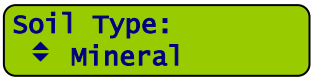
3 HH2 Meter

Note the HH2 does not take ML3 temperature readings.

Use version 2.7 or later of both the PC software HH2Read and the HH2 firmware if possible (or see footnotes).

- Connect the ML3 to the HH2 meter.
- Press **Esc** to turn the meter on, and if necessary press again until the HH2 displays the start-up screen.
- Set the meter to read from an ML3:
  - Press **Set** and scroll down to the **Device** option.
  - Press **Set** again and scroll down to select ML3.
  - Press **Set** to confirm this choice.

- Make sure the HH2 is correctly configured for your soil type:
  - At the start-up screen, press **Set** and scroll down to the **Soil Type** option.
  - Press **Set** again and scroll down to the appropriate soil type (use **Mineral** for sand, silt or clay soils or **Organic** for peaty soils)
  - Press **Set** to confirm this choice.



- Choose the units you want for displaying readings:
  - At the start-up screen, press **Set** and scroll down to the **Display** option.
  - Press **Set** again and scroll down to select units.
  - Press **Set** to confirm this choice.
- Press **Read** to take a reading.

- Press **Store** to save or **Esc** to discard the reading.
- Remove the ML3 from the soil and move to a new location...
- If you have saved data, connect your HH2 to a PC and run ***HH2Read*** to retrieve the readings.

Note: For an upgrade contact Delta-T.
See also: **Support for the ML3 Soil Moisture Sensor with an HH2, HH2 User Manual** and **HH2 User Manual Addendum to V4 for ML3**.

4 Data Loggers

GP2

- 6 ML3s can connect to each GP2. wired as a differential, powered sensors.
- 12 ML3s can be connected if you do not use the temperature sensor. For this you will also need a 5 gland expansion lid GP2-G5-LID.

These details illustrate connection to Channels 1 and 2:

ML3 wiring	*Colour*	*GP2 terminal*
Power 0V/Thermistor LO	brown	**CH1 (PGND)**
Power V+	white	**CH1 (PWR)**
Soil Moisture Signal HI	blue	**CH1 (+)**
Soil Moisture Signal LO	black	**CH1 (-)**
Thermistor HI	grey	**CH2(+) and CH2(-)**
Cable shield	green	**CH1 (PGND)**

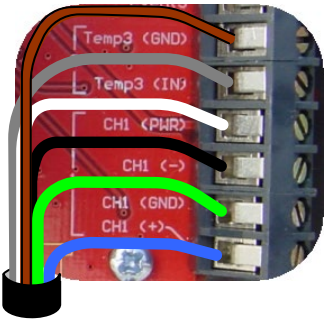
For configuration details see the **DeltaLINK3** software sensor **Info Panel** and **Help** or the **GP2 User Manual.**

* Download the latest version of the DeltaLINK logger software from www.delta-t.co.uk or from our **Software and Manuals CD** issue 3 or later

GP1

- 2 ML3s can connect to each GP1. Each ML3 is wired as a differential, powered sensor.

These details illustrate connection to Channels 1 and 3:



ML3 wiring	*Colour*	*GP1 terminal*
Power 0V and Thermistor LO	brown	**CH1 (GND) or Temp (GND)**
Power V+	white	**CH1 (PWR)**
Soil Moisture Signal HI	blue	**CH1 (+)**
Soil Moisture Signal LO	black	**CH1 (-)**
Thermistor HI	grey	**Temp3 (IN)**
Cable shield	green	**CH1 (GND)**

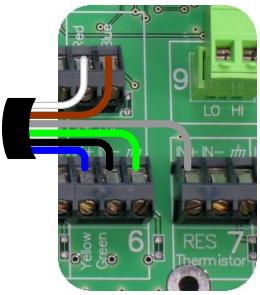
- Using DeltaLINK version 3 or later) configure channel 1 or 2 by choosing “ML3” and channel 3 or 4 by choosing “ML3 Temperature” from the sensor menu.

For configuration details see ***DeltaLINK Help*** and ***Info Panel***.

DL6

- Up to 6 ML3s can connect to a DL6. Each ML3 is wired as a differential, powered sensor.
  A DL6 can only read one ML3 temperature sensor.

These details illustrate connection to channels 6 & 7:



ML3 wiring	*Colour*	*DL6 terminal*
Power 0V Thermistor LO	brown	**0V**
Power V+	white	**V+**
Soil Moisture Signal HI	blue	**IN+**
Soil Moisture Signal LO	black	**IN-**
Thermistor HI	grey	**RES IN+**
Cable shield	green	⏚

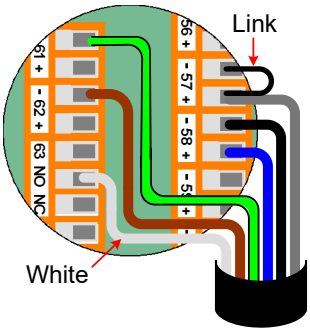
- Using DeltaLINK version 3 or later configure channel 6 by choosing “ML3” and channel 7 by choosing “ML3 Temperature” from the sensor menu.

* Download the latest version of the DeltaLINK logger software from www.delta-t.co.uk
or from our **Software and Manuals DVD**

DL2e

- Up to 30 ML3s each with a temperature sensor can be connected to a fully expanded DL2e logger.
  Up to 60 ML3s may be connected if not using the temperature sensor.
- Each ML3 is connected as a differential, powered sensor.

These details illustrate connection to Channels 57 and 58 using a LAC1 input card configured in 15-channel mode, and warm-up channel 63:



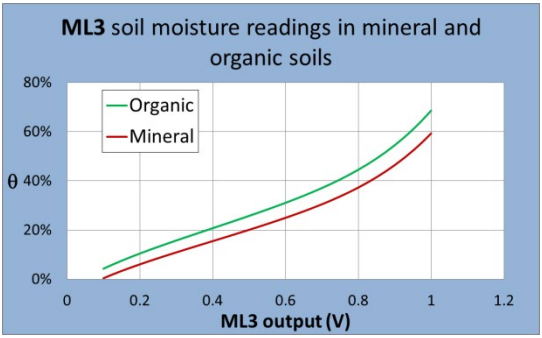
ML3 wiring	*Colour*	*DL2e terminal*
Power 0V Thermistor LO	brown	**CH62- or 61-**
Power V+	white	**CH63 NO**
SM Signal HI	blue	**CH58+**
SM Signal LO	black	**CH58-**
Thermistor +	grey	**CH57+ and CH57-**
Cable shield	green	**CH61- or 62-**

- Configure the chosen DL2e logger channels by selecting the appropriate ML3 sensor types from the LS2Win sensor library.
  You need Ls2Win version 1.0 SR10 or later*.

* Download the latest version of the Ls2Win logger software from www.delta-t.co.uk or from our **Software and Manuals DVD.**

Other data loggers

- Connect the ML3 soil moisture output as a differential powered sensor. Configure the logger input as a voltage sensor, using the look-up tables or polynomial coefficients given in the **ML3 User Manual**.
- Connect the temperature sensor as a resistance sensor. Use a look-up table in the logger software to convert the measured resistance to temperature. See Appendix 2 of the ML3 User Manual



Note: The ML3 has been optimised for a 0.5 to 1 second warm-up period.
Do not power the sensor continuously.

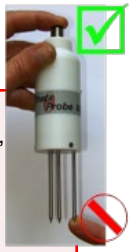
5 Specifications *(for full specification see ML3 User Manual)*

Volumetric water content sensor	
Accuracy	±1% vol over 0 to 50 % vol and 0-40°C (using soil specific calibrations) *
Measurement range	0 to 100% vol with reduced accuracy**
Salinity error	≤3.5% vol over 50 to 500 mS.m^{-1} and 0-50% vol
Output signal	0-1V differential ≈ 0 to 60% nominal
Output compatible with	GP1, GP2, DL6, DL2e, HH2
Temperature sensor	*ML3 must be fully buried to accurately measure soil temperature*
Sensor accuracy	±0.5°C over 0-40°C* *not including logger or cabling error*
Output	Resistance: 5.8kΩ to 28kΩ*
Output compatible with	GP2, GP1, DL6* DL2e
Cabling error contribution (to temperature reading)	0°C for GP2, GP1 & DL6 (any cable length) 0°C for DL2e (with 5m cable).*
Maximum cable length	100m (GP2, GP1 & DL6 data loggers) 100m (DL2e: water content measurement) 25m (DL2e: temperature measurement)
Power requirement	5-14VDC, 18mA for 1s
Operating range	-20 to +60°C
Environment	IP68
Dimensions/Weight	170.5 x 39.8 mm diameter/ 138 gm

* Note: See **ML3 User Manual.**

** In water with no soil present the reading may not be 100% vol. See the ML3 User Manual.

6 Care and Safety



- Do not touch the rods or expose them to other sources of static damage, particularly when powered up.
- Keep the ML3 in its protective tube when not in use.
- Ensure that the connectors are clean, undamaged and properly aligned *before* pushing the parts together. Screw together firmly for water-tight seal.
- Do not pull the sensor out of the soil by its cable.
- If you feel strong resistance when inserting into soil, it is likely you have encountered a stone. Stop pushing and re-insert at a new location.

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