EnviroSCAN Flat Cap

Installation Manual for Distributors

By
Sentek Pty Ltd
Australia

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This manual describes the EnviroSCAN® FlatCap soil water monitoring system and includes technical information regarding hardware assembly and field installation.

Version 1.0

List of Contents

Acknowledgements

Sentek Pty Ltd is gratefully acknowledging the tireless effort and genius of Peter Tucker, Renmark, SA, in designing the excellent installation tools for EnviroSCAN® Flat Cap.

Sentek Pty Ltd is also gratefully acknowledging Barry Bryant, Course Superintendent and Sam Fraser, Assistant Course Superintendent of the Mount Osmond Golf Club, Mount Osmond, SA, as well as Les Marten, Wall Flat, SA, for the kind provision of test site venues and assistance with the installation of the EnviroSCAN® Flat Cap. The pictures used in this manual are taken at these venues.

We further thank for and acknowledge the support and assistance of Fabian Gallo, Brendan Asher, Onno Schaap, John Floreancig, Miguel Samanes, Kym l'Anson, Francis Andrews and Brad Moyle.

Introduction

"Water management is one of the most critical aspects in maintaining a championship golf course. Excessive moisture will cause a golf course to play sluggish whereas lack of moisture may result in turf decline and thus inconsistent playing conditions. The golf course superintendent must juggle agronomics and playability as it relates to water management. Successful irrigation scheduling will allow the golf course to be not only aesthetically pleasing but also playable and consistent throughout"

From:

"Golf Course Irrigation Scheduling – Juggling Agronomics and Playability"

By:

John J. Gasper, Greens Superintendent, The Ridgewood Country Club, Paramus, N.J.

In:

"The Irrigation Association's International Exposition and Technical Conference Proceedings", November 12-14, 1995, Phoenix, Arizona

EnviroSCAN® FlatCap is a system that provides a reliable and repeatable measurement of soil moisture content in the turf environment. It enables turf managers to 'juggle' the agronomic requirements with players surface grass requirements. Direct measurement of turf grass water use, as it occurs, as opposed to estimated water use using ET models, provides a solid basis for the development of irrigation management strategies for consistent and playable turf on golf courses.

This manual is intended for distributors and professional installers and describes step by step the probe assembly and field hardware installation of EnviroSCAN® FlatCap which is the brother of the highly successful EnviroSCAN " The soil water continuous monitoring system" used world wide in commercial agriculture and scientific research at the highest level.

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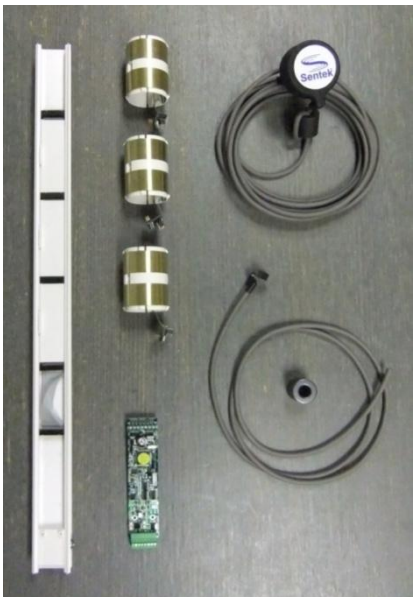
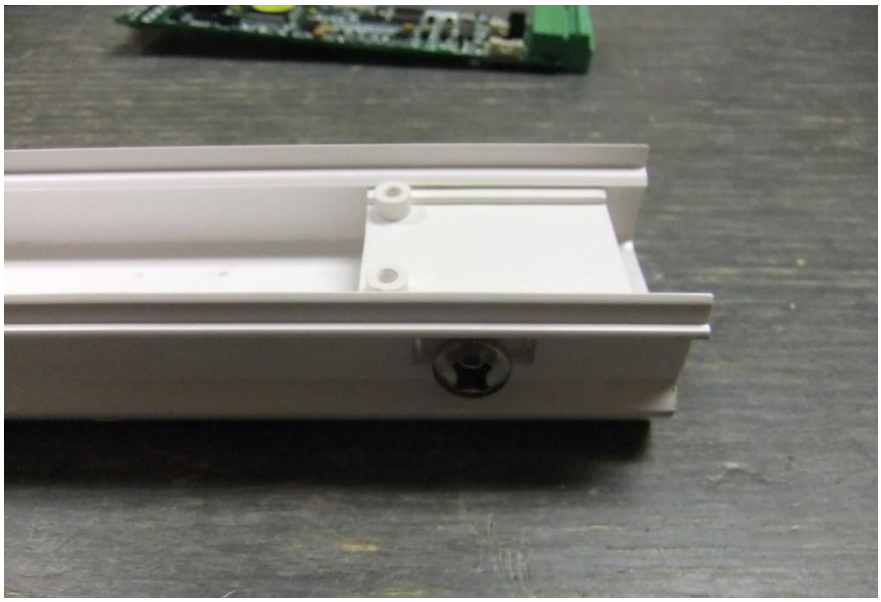
EnviroSCAN® Flat Cap Assembly

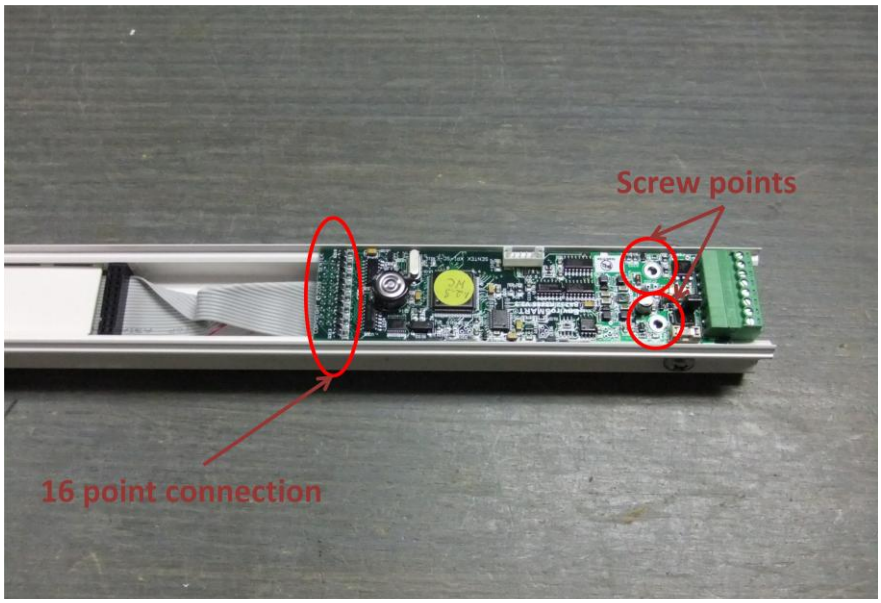


Probe Assembly

Left to right, down:
- Probe Rod (with twist in ribbon cable and Interface Screw Block fitted)
- Sensors (3)
- Interface
- Flat Cap
- Internal Cable
- Ferrite Bead.



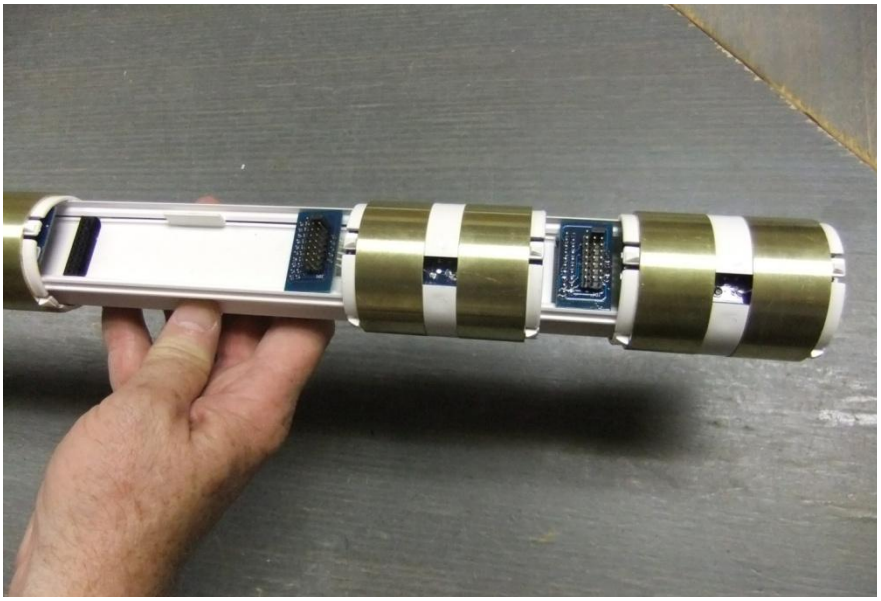
Begin by loosening the Interface Mount screws.



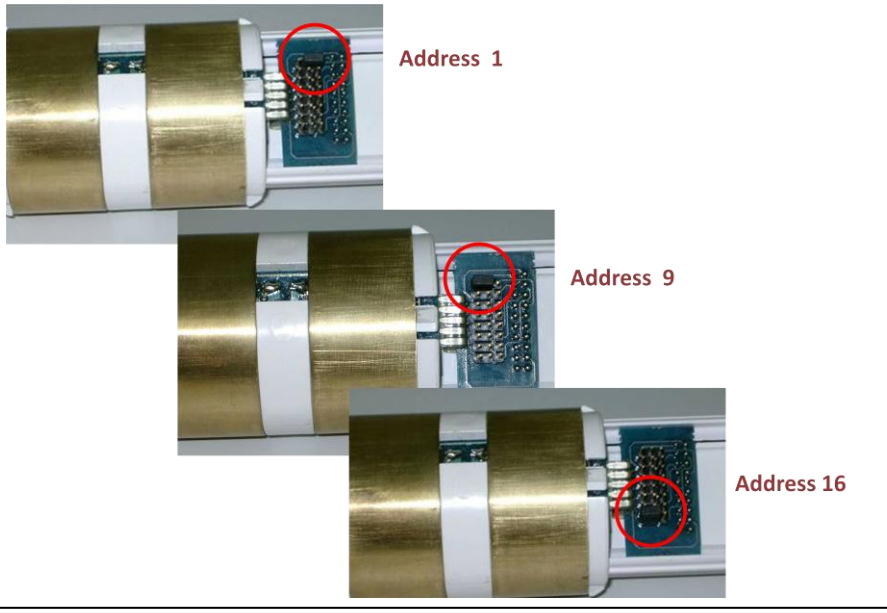
Attach Interface PCB to 16-hole ribbon cable connector.
Fasten the interface to the Interface Mount.
Tighten Interface Mount screws into place.

Slide sensors on and click into place.
Make sure of the correct orientation of the probe: interface is at the bottom.

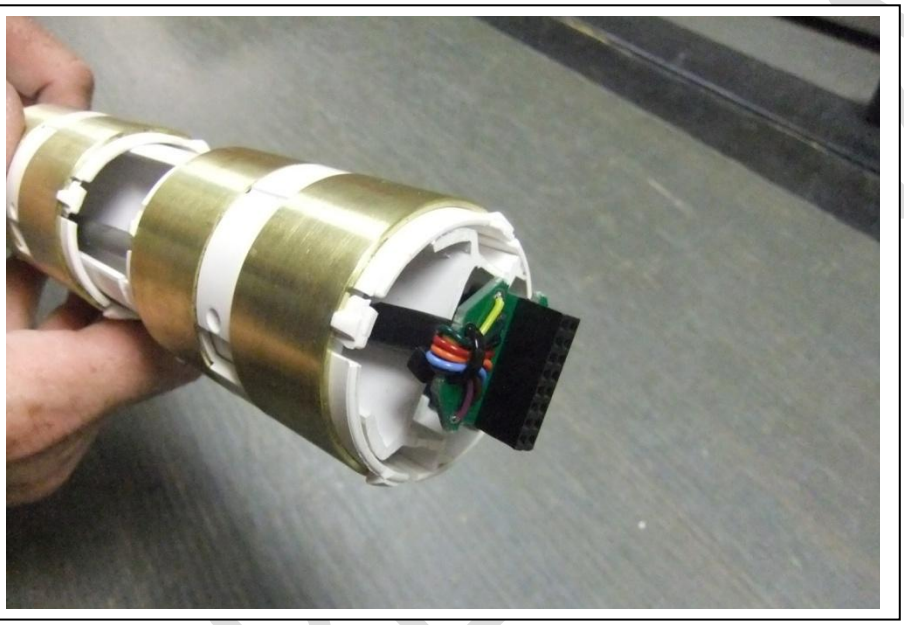
Slide all sensors into place.



Address all sensors.



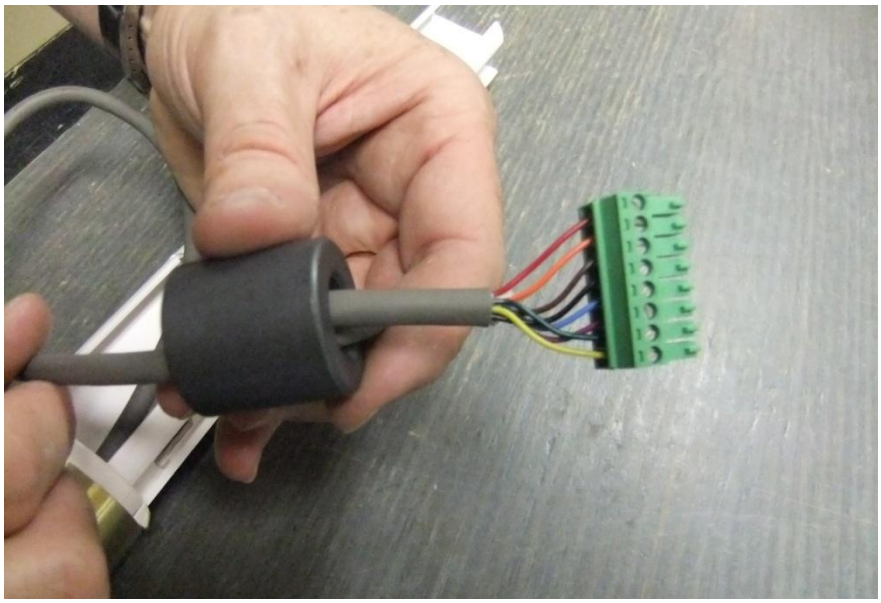
Thread the Internal Probe Cable through the sensors from top to bottom along the back of the probe rod.



Pull the Internal Probe Cable tight.

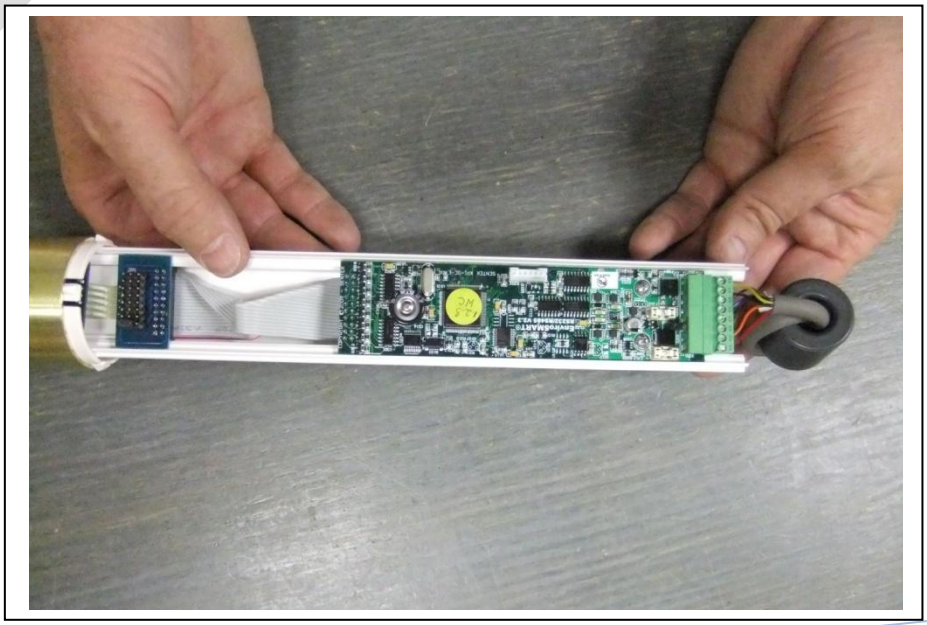
Make a loop in the cable, and squeeze it into position in the back of the probe rod.
Cut to length, allowing enough for fitting of the ferrite bead.
This loop allows extra cable so that the Flat Cap may be disconnected from the probe rod in a fully installed probe at a later date.

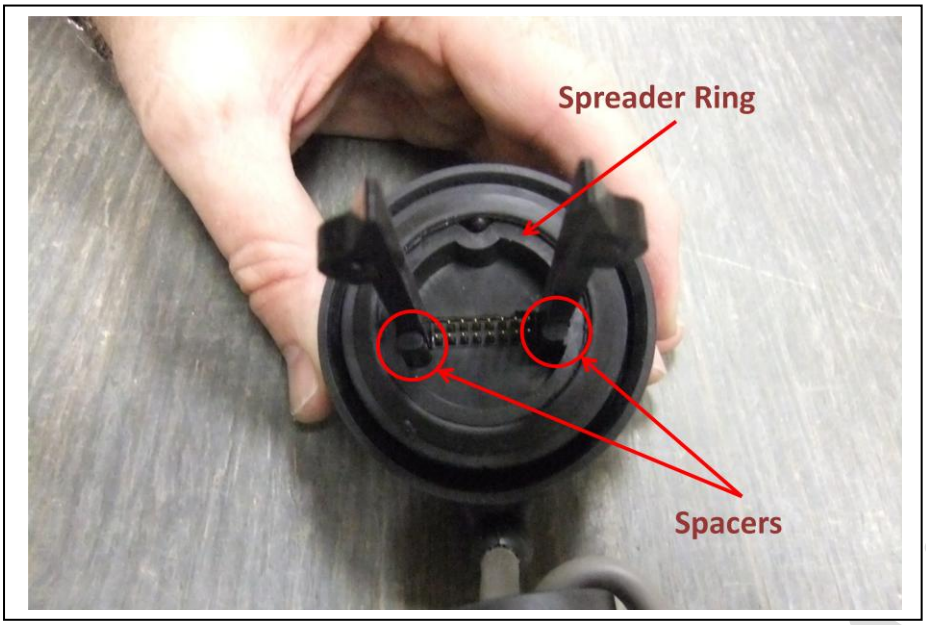
Thread the ferrite bead. Connect the Phoenix Connector (RS232 connections are shown here). Tighten the ferrite bead close to the connector.

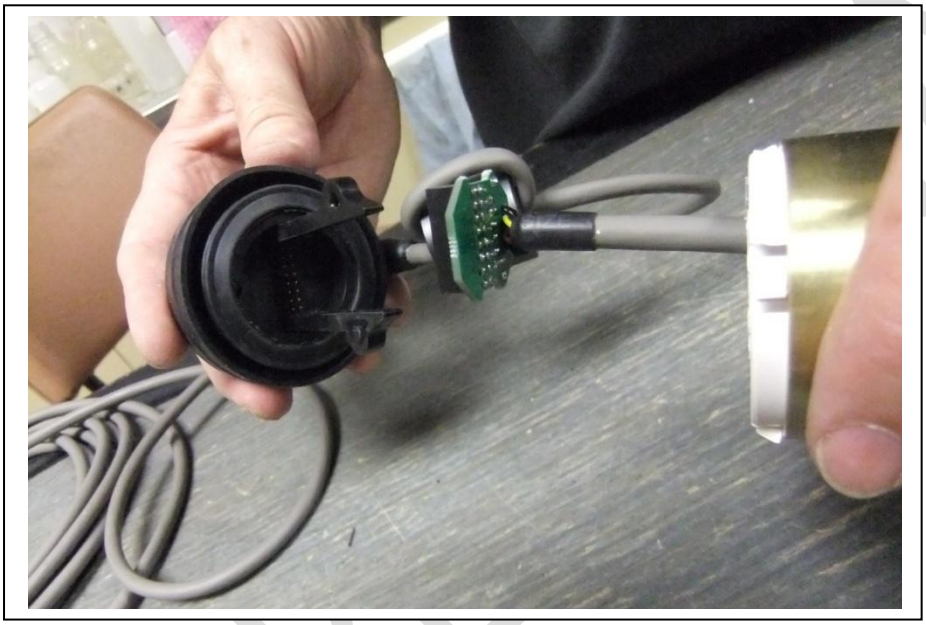


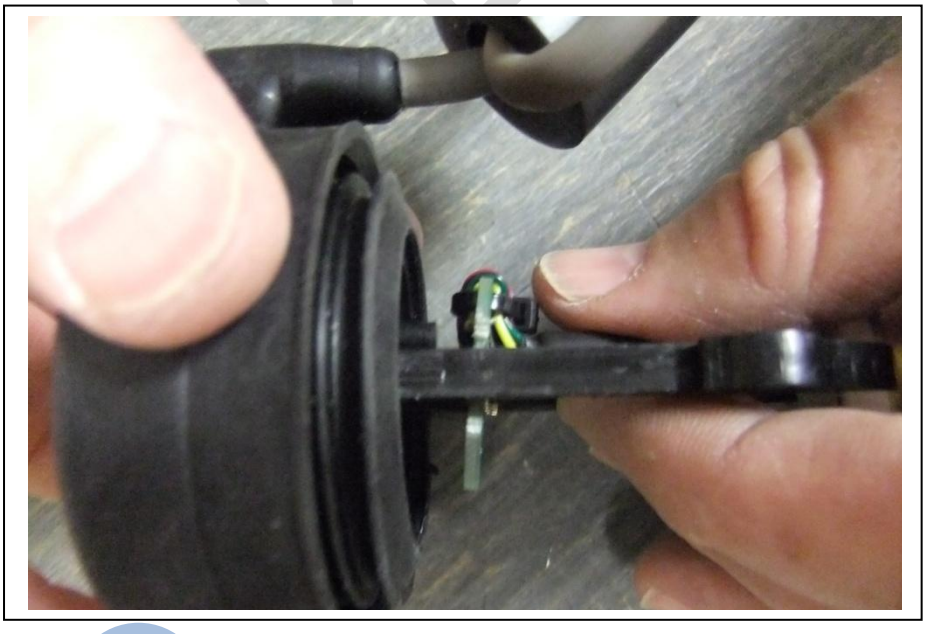
Refit the tension loop.

The completed Interface wiring.









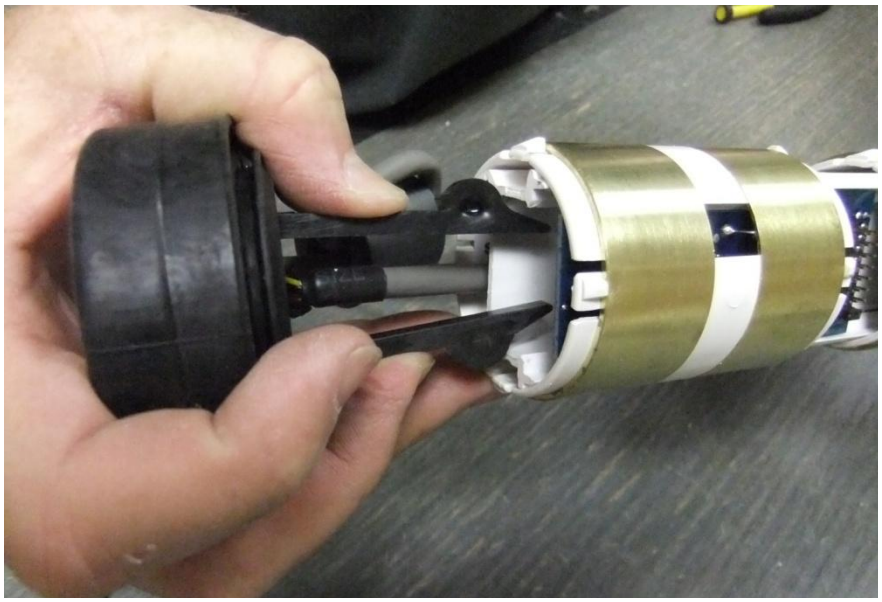
The Flat Cap is made of UV-stable high shore-strength rubber.
The design encapsulates the cable and terminates it at an internal PCB. This ensures that no water infiltration from the cabling is possible.
The Flat Cap contains spacers to guide the Internal Cable PCB into the correct position.
The Flat Cap also contains a plastic Spreader Ring.
This is an important component in providing a rigid non-compressible unit for sealing with the Herbie™ Clip.

Fit the Internal Cable PCB into place.
The correct orientation is such that the Internal Cable is closest to the Flat Cap cable i.e. “cable-to-cable”.

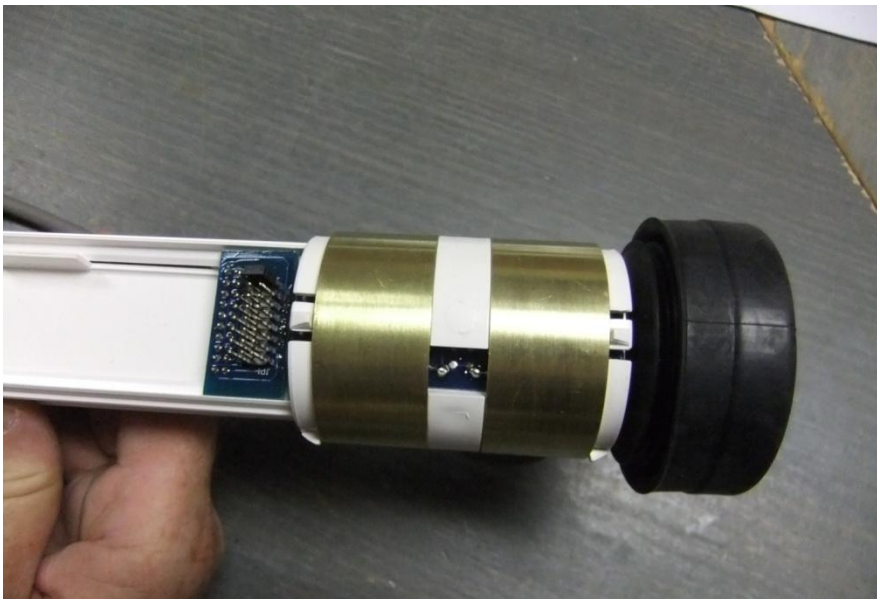
Ensure that the Internal Cable PCB connector engages all 16 pins of the Flat Cap.

The connected Internal Cable PCB.

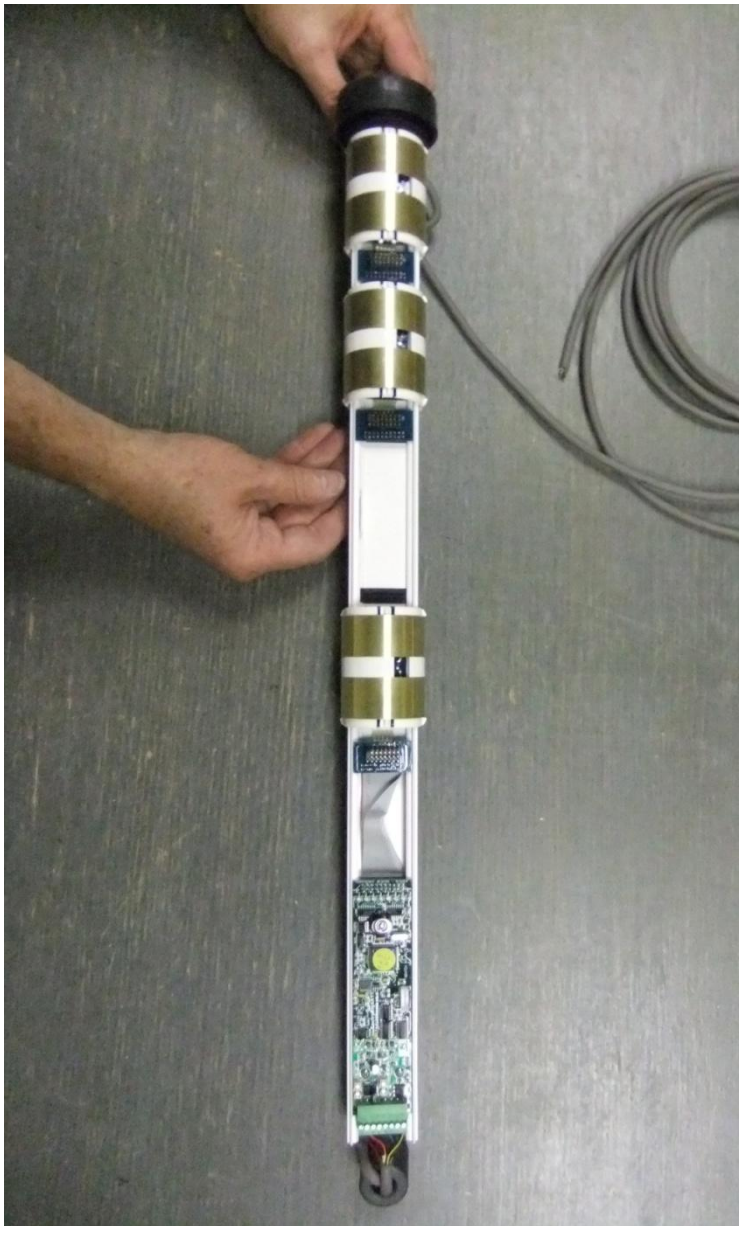
Squeeze the Flat Cap clip inwards and slide into place.
An audible “click” occurs when the clip is fully engaged.
A gentle twist may help in this.



The sensor has been slid down to show the correct position of the Flat Cap clip feet fully engaged.

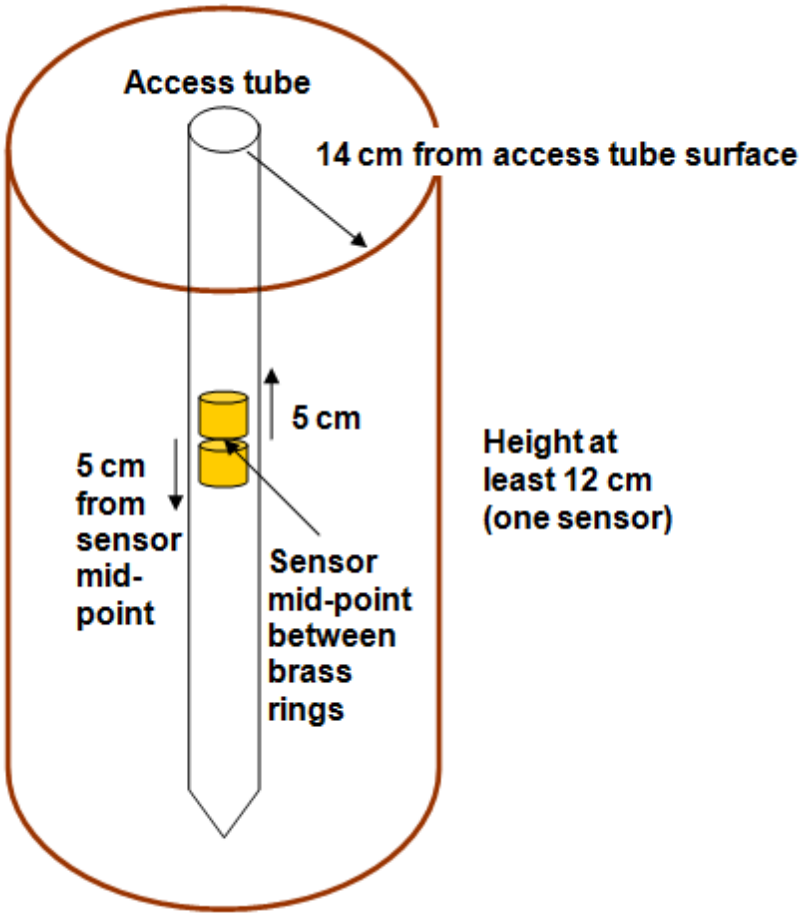


The fully attached Flat Cap with the top sensor in the correct position.



The completed Flat Cap probe.

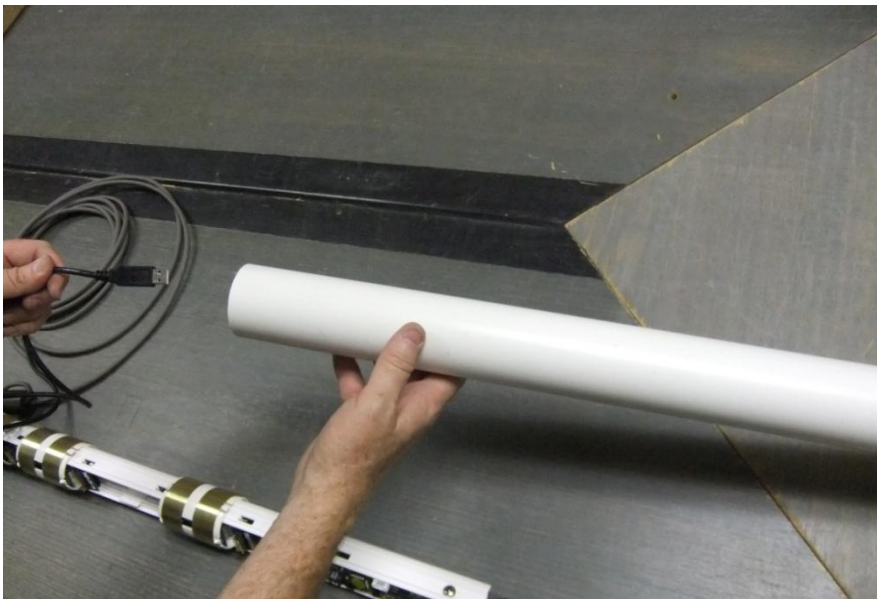
EnviroSCAN® Flat Cap Normalisation



Normalisation

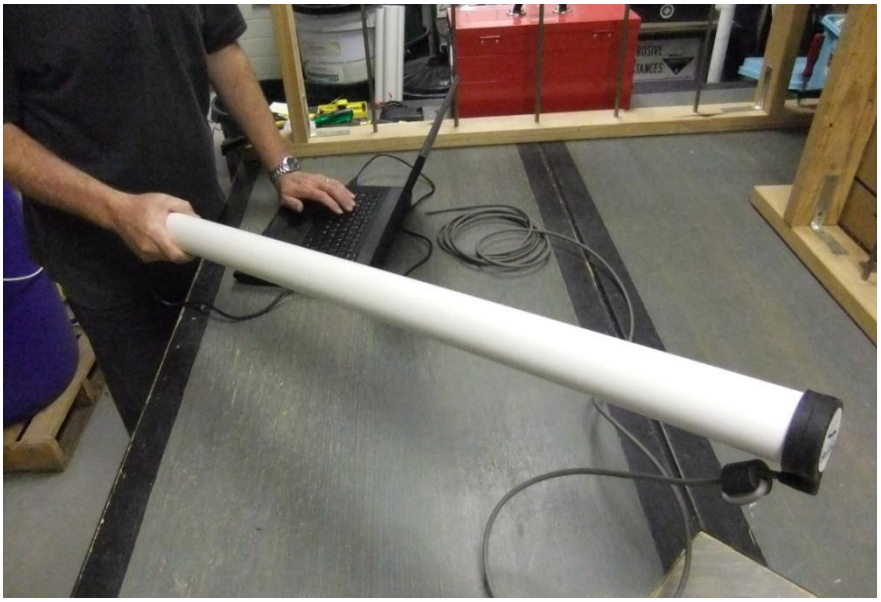
Before a Sentek capacitance sensor can be used, it must have minimum and maximum values set. This is done using air and water.
For scientific applications it is recommended that the Sphere of Influence (SOI) of the EnviroSCAN®, EasyAG® and Diviner 2000® sensors be assumed to extend radially to 14 cm from the surface of the access tube. Axially, the SOI can be assumed to extend 5 cm above and 5 cm below the mid-point between the two adjacent brass rings of the capacitance sensor.

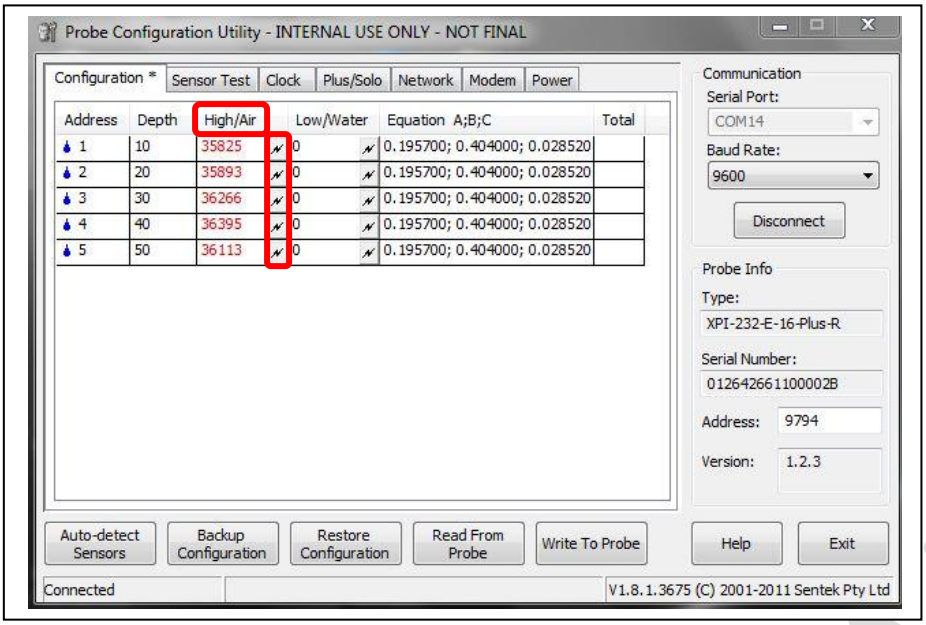
Insert the IP Configuration Cable into a clean, dry access tube of appropriate length for the probe rod.



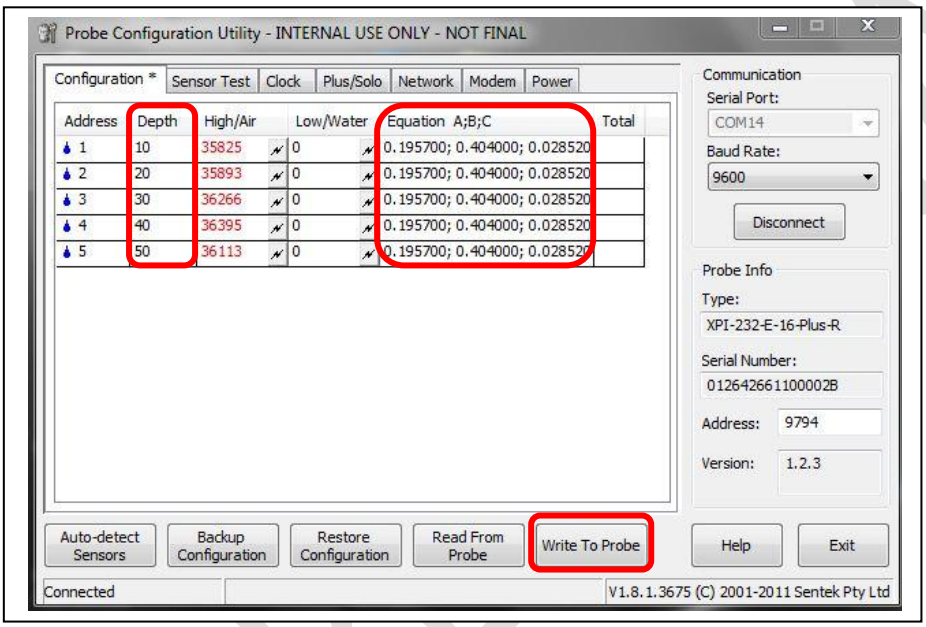
Seal the Flat Cap onto the top of the access tube.
The Herbie™ Clip may be fitted also.

Hold the access tube such that nothing approaches in close proximity of any of the sensors (allow 14cm clear around it).

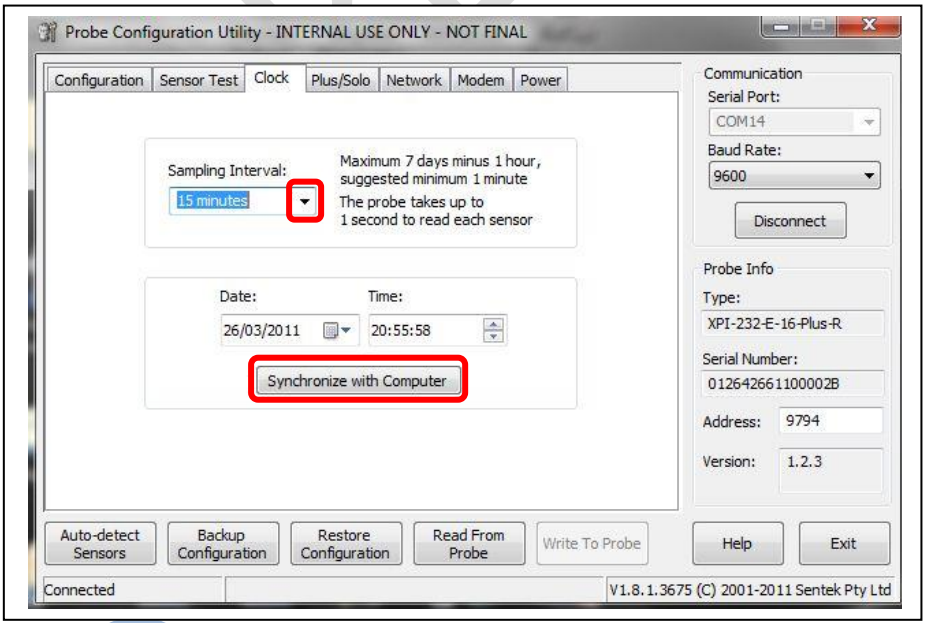




Set the Air Counts using the Probe Configurator software. Click individual sensor settings or column heading to set all sensors.

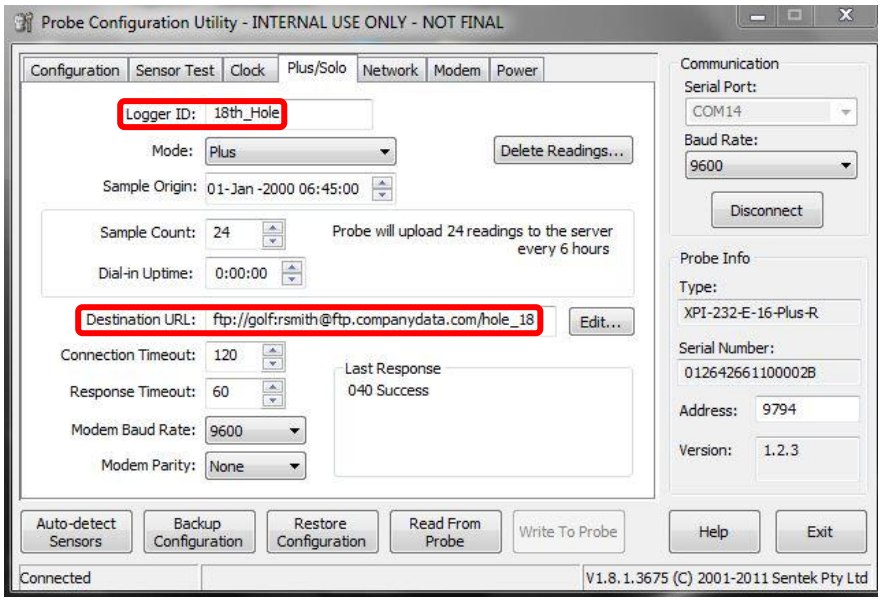


Set the sensor depths and calibration coefficients. Use the default calibration coefficients if you do not have site-specific data.
Write to probe.

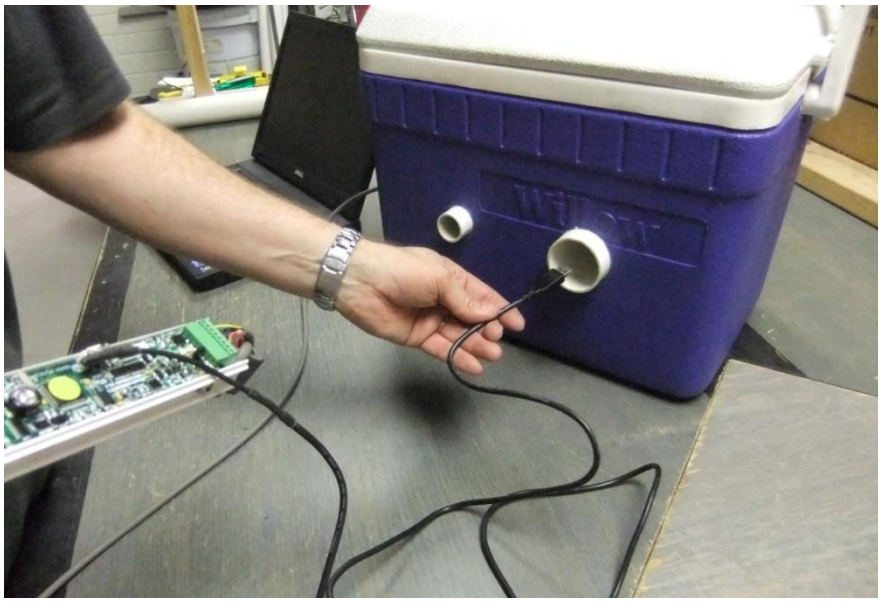


Set the clock and sampling interval.

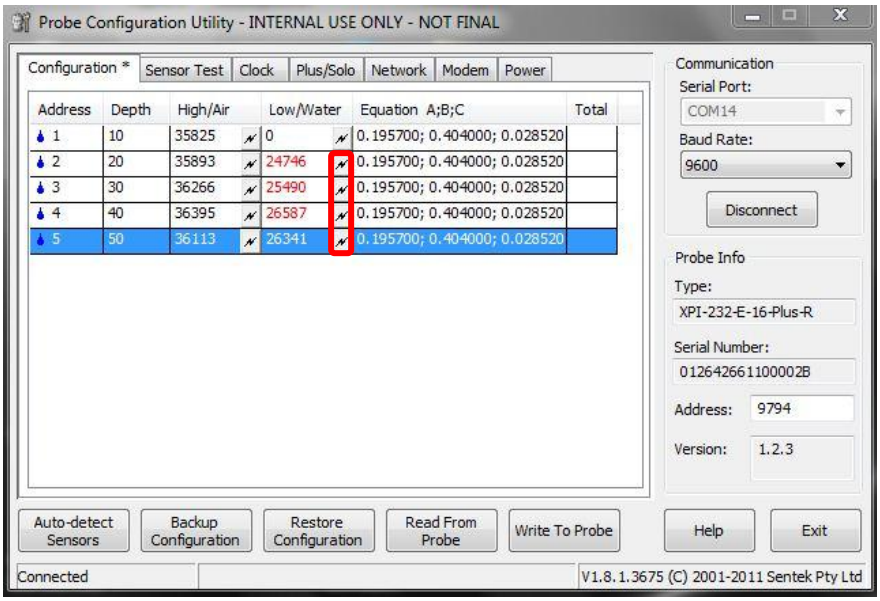
Set the logger ID and URL address as required.



Thread the IP Cable through the access tube in a water filled Normalization Container.



Insert the sensors and perform Water Counts for all sensors except the top one.

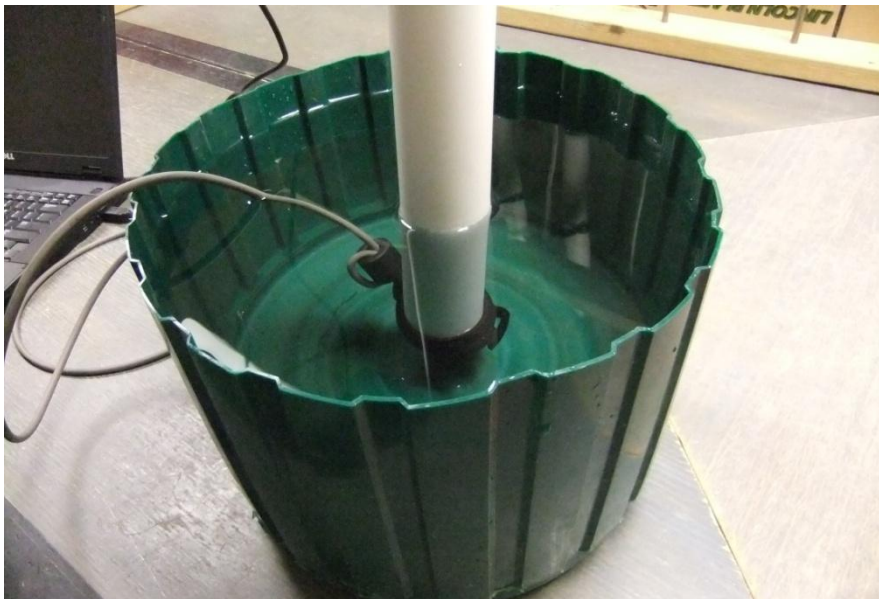


Set the Water Counts individually.

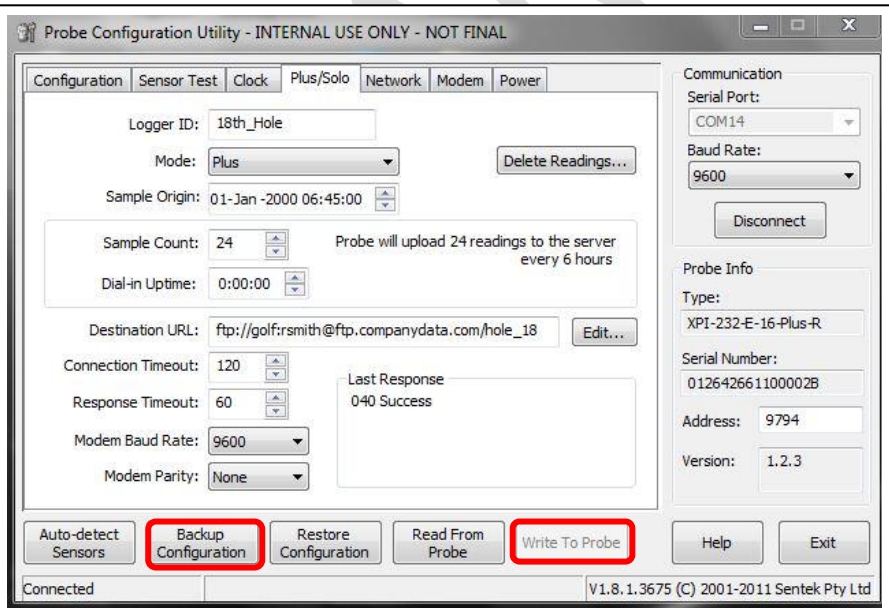
The top sensor cannot be normalized in the Normalization Container as there is a volume of air around it.

Remove the probe from the Normalization Container and insert it into an access tube. The access tube can be one prepared with a groove or not. Tighten the Flat Cap onto the top of the access tube with a Herbie™ Clip.

Immerse the top of the probe in a suitable depth of water and perform the Water Count with the Probe Configurator software.



Write the probe configuration to the logger and back it up to a safe area on your computer. The probe is now fully normalized and ready for use.



Water normalization in a deep water container.
Open-ended access tube for normalization of Flat Cap.
Closed-ended access tube for normalization of lower sensors.

The normalization procedure can be simplified with complete probe immersion in a deep water container and front-panel connection to a Sentek DTU system.

EnviroSCAN® Flat Cap Installation

Select position of Sentek Data Transmission Unit (DTU) and Flat Cap probe location.

Use a sod cutter to cut sods from the DTU position to Flat Cap probe location and place to one site.

Use a trenching shovel to excavate a trench approx. 30cm deep from DTU position to where you wish to install the Flat Cap probe.

Protect the probe cable with a sturdy conduit.

To pull probe cable through conduit simply attach probe cable to “Pull-Wire” of the conduit.

Pull the probe cable through using the “Pull-Wire” at the other end of the conduit.

Secure the end of the probe cable with a knot. Before laying the conduit and the cable into the trench, proceed with the installation of the probe access tube.

Place the large Turf cutter on the spot where the probe is to be installed.

Use the sledge hammer to insert the Turf Cutter into the grass.

Gently twist the tool and carefully lift the sod.

Set the sod aside with most of its root system intact.

Carefully place the base plate of the tripod into the excavated circular hole.

Secure tripod with pins.

Insert pins by hammering to full depth.

Loosen tripod thumb screws and insert handle of sledge hammer into tripod.
Level the tripod by leaning on the hammer handle until the levelling bubble is centred.

The tripod levelling bubble is centred enabling a straight auguring process.
Disengage the access tube retention tooth.

Use the metal Cutting Edge to remove the sharp internal edge of the access tube.

Place Cutting Edge into access tube and gently tap it on a hard surface to fully insert it.

Insert 47 mm Auger into access tube and auger out soil to a depth no greater than 10 cm ahead of the access tube.

Remove auger from the access tube and clean out soil into a bucket to maintain a clean installation site.

Alternately use the auger and sledge hammer to remove the soil just ahead of the Cutting Edge.

Do not take too much soil each time or the tube will not track in a straight path.

If you have to cut the tube short , then re-grooving is required. Please refer to later section page....

The final insertion is done using the Yellow Nylon Dolly.

Continue hammering until 2 cm before the grooved indicator.

Remove the tripod pins using the Tommy Bars.

Remove the tripod.

Apply Methylated Spirits to the rag cleaning tool.

Insert rag tool into the access tube and push down.

Repeat swiping action until access tube is clean.
Wait a couple of minutes for the Methylated Spirits to evaporate.

Inspect the inside of the access tube with a light on a string to confirm that it is clean.

Insert Bottom Stopper into access tube.

Tighten the bottom stopper near the top of the access tube until it is firm.

Attach and secure the bung tightening tool onto auger extension.

Fit bung tightening tool to bung.

Push bung down into the access tube to full depth.
The Bung will come to rest on top of cutting edge.
Tighten the bottom stopper to gentle firmness by rotating the auger handle clockwise.
Disengage the Bung Tightening Tool with a fast final clockwise twist and upward lift.

Use a marking pen to indicate the position of the cable entry into the Flat Cap probe.

Protect against entry of dirt into the access tube with a temporary plastic black cap.

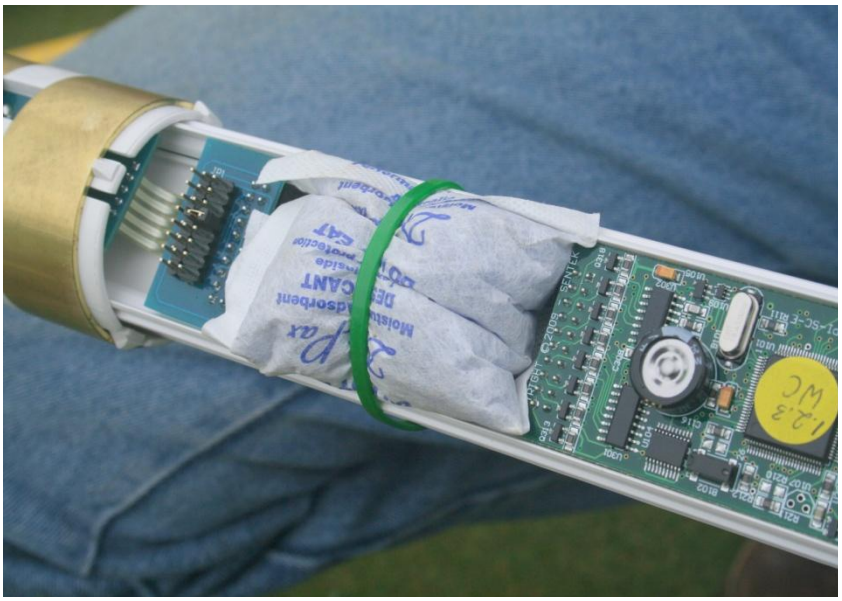
Use a spatula to cut a channel for the probe cable.

Prepare a deep channel for an extra loop in the cable.

Prepare the probe and cable for installation.

Remove probe electronics from transport access tube.

Attach a fresh silica gel bag with a cable tie as shown.



Carefully insert the probe electronics into the installed access tube.

Align cable from Flat Cap probe with trench.

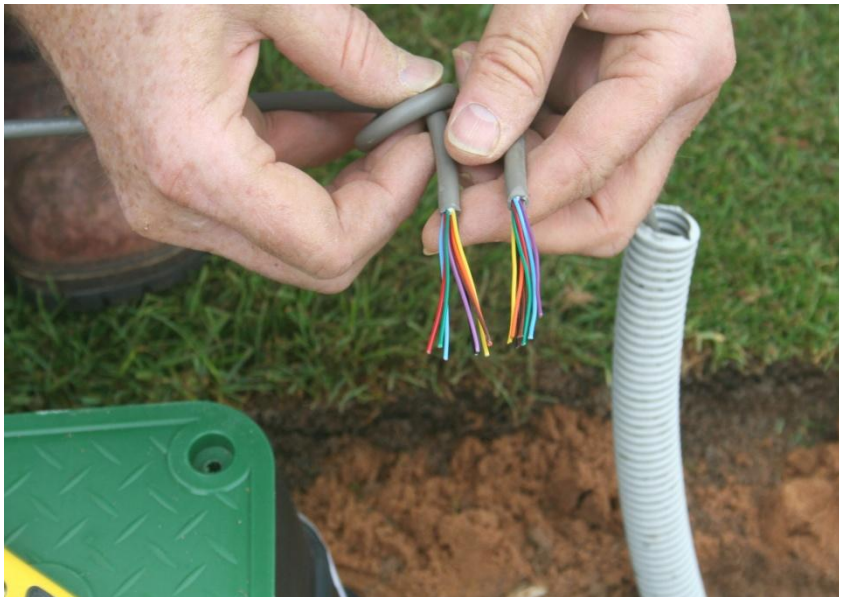
Ensure Ferrite Bead is as close as possible to Flat Cap.

Seal the cable entry into conduit with silicone.

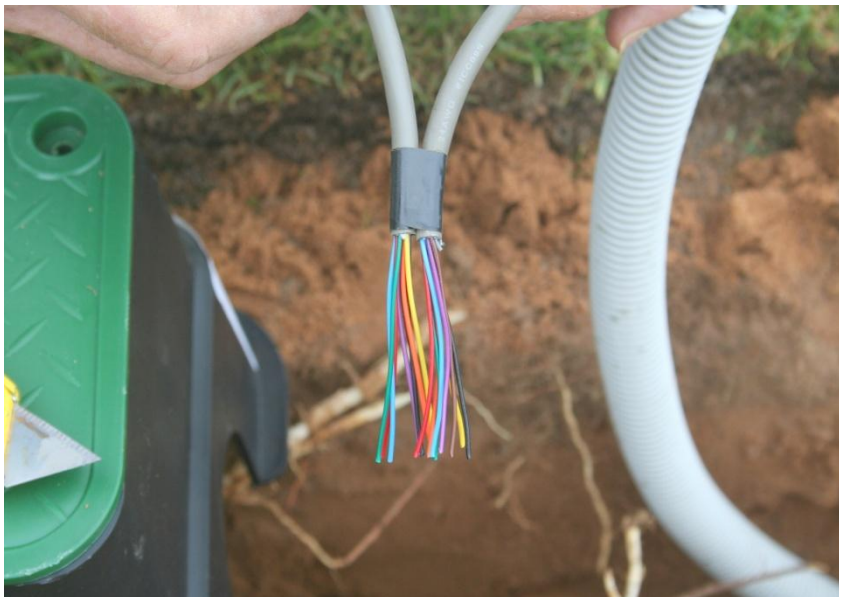
Allow enough cable to make a loop so that maintenance of the probe can be done at a later date.

Warning: Ensure that the cable is buried deeper than the extent of the large Turf Cutter fully inserted.

Remove 50 mm of cable sheath.



Position the cable leading to the probe and cable leading to the data transmission unit next to each other.
Ensure that the cable leading to the DTU is also protected by conduit.



Affix position of both cables with tape.

Connect same coloured cables with Scotch-Loks®.

Squeeze Scotch-Loks® firmly to ensure good connection.

Inspect each Scotch-Lok® to ensure wires are connected and have not slipped.

The completed cable join between DTU cable and Probe cable.

Ensure excess cable for servicing is left in a loop at the joining point of DTU cable and probe cable.

Position a valve box over the cable join.

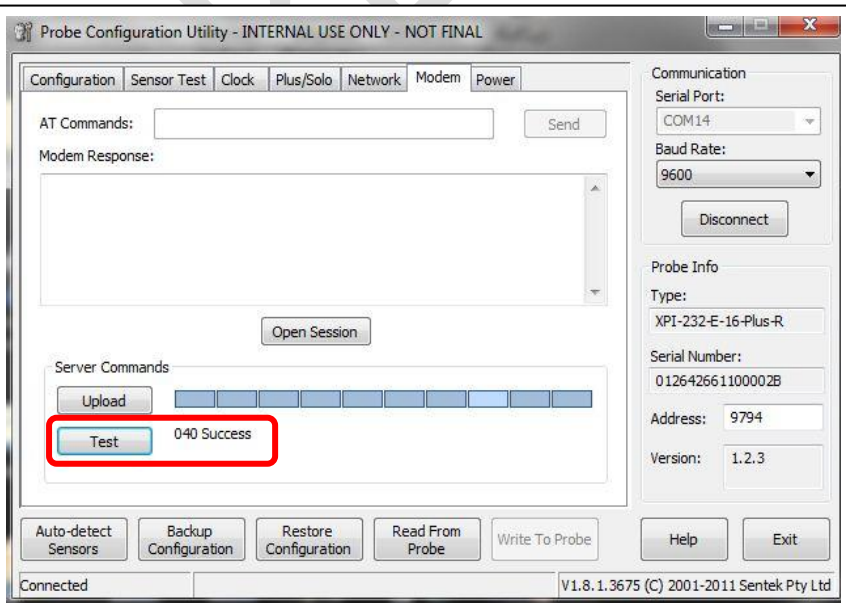
Use a tent peg and a cable tie to keep cable join above ground level.

Place cover on valve box and bury to correct height; slightly below ground level.

Continue burying cable in conduit and connect cable terminal to DTU.

Remove probe again from access tube for final communication Test Upload.

Plug IP Config cable into TTL connector of interface and perform Test Upload.



Perform a Test upload to ensure that communications are all working.
The message “040 Success” should be returned.

Replace Flat Cap probe into access tube and use firm downward pressure until the Flat Cap audibly “snaps” into place.

Fit the Herbie™ Clip to the top of the Flat Cap.

Tighten the Herbie™ Clip with pliers.

Remove the sod from the large Turf Cutter.

Lay onto ground surface.

Position the small Turf Cutter in the centre of the sod and push it in.

Carefully remove the centre core.

Make a cut on one side to allow for the cable.

Re-insert the sod around the installed Flat Cap probe.

Use firm pressure to re-seat the sod.
Use finger pressure in close proximity to Flat Cap to ensure good tube-to-soil contact.

Brush the site clean from soil and debris.

Repair tripod pin holes with soil.

Flat Cap Probe installation completed.

Refill the trench and smooth the surface with shovel. Connect the probe cable to the DTU.

Replace the sods and repair the site.

Fasten the valve box lid.

The completed installation.

Ready to start recording.....

EnviroSCAN® Flat Cap Maintenance

Recommended Maintenance Schedules

⊡ 12 months

- Check probe and access tube for moisture
- Replace silica gel bag
- Check Flat Cap for cracks or breakages
- Check cable for damage to outer sheath and wires

Begin by switching off the power to the probe.

To gain access to a previously installed Flat Cap probe, start by loosening the soil immediately around the Flat Cap. The small Turf Cutter is ideal for this.

Push in small Turf Cutter with a rotating motion.

Use small hand trowel to remove loosened soil around the Flat Cap.

Use your fingers to finalize cleaning around Flat Cap.

Centralize large Turf cutter on top of Flat Cap and use a sledge hammer to hammer this tool into the soil.

Warning:

Do not insert the large Turf Cutter to its full depth as it may cut the cable.

Rotate tool by a small fraction (about 10 – 15 degrees).

Carefully lift large Turf Cutter with the soil and set aside.

Use your hands to remove loose soil and place into a container.

Remove Herbie Clip® from Flat Cap.
Use gentle pressure to lever the flat off the access tube.
If the Flat Cap cannot be removed in this way then use the Cap Removal Pliers and Clamping Plate (refer next page).

Open EnviroSCAN® Flat Cap Clamping Plate. This clamp holds the probe in position in loose sand and at the same time provides a leverage point for the Cap Removal Pliers (see next page).

Place Clamping Plate around Flat Cap.

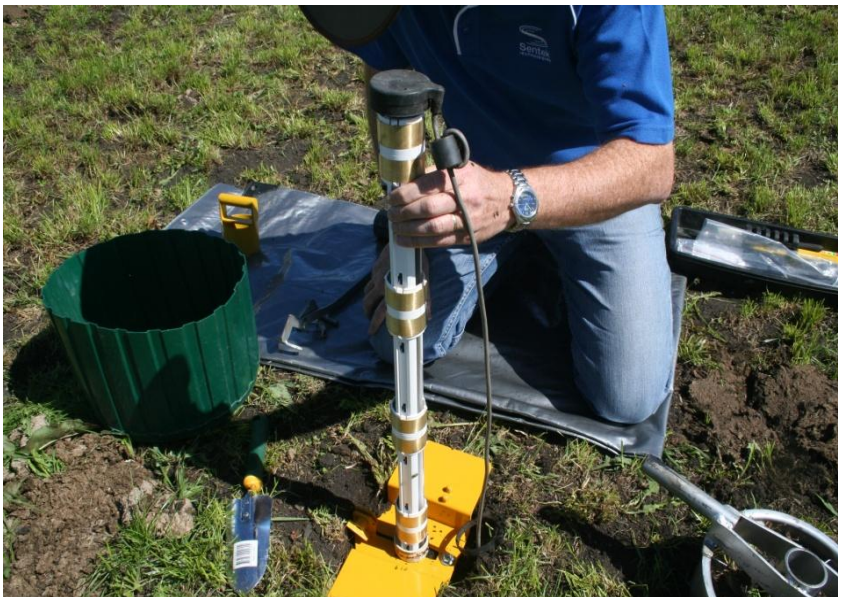
Tighten thumb screw of Clamping Plate to secure solid grip on probe.

Place Cap Removal Pliers between the pins on the Clamping Tool and around Flat Cap.

Push down the handle of the Cap Removal Pliers to separate Flat Cap from access tube.

Again make sure that power is switched off to the probe.

Pull probe out of the access tube.



Unclick and slide the top sensor down by 4cm.

Push in clips of Top Cap Assembly to release Flat Cap from probe rod.

Remove Flat Cap from probe rod.

Unplug Flat Cap sensor board from Top Cap Assembly.

The probe can now be completely removed from the access tube and inspected.

Clean the outside of the access tube using a cloth soaked in methylated spirits.

Use a brush to remove soil from the Top Cap assembly.

For hard to remove soil particles or stones use a screw driver. Be careful not to scratch any of the rubber ridges.

Protect the top of the access tube with a plug to prevent dirt falling inside it.

Remove Clamping Plate.

Reinsert serviced probe into the access tube.

Line up Flat Cap electronic board with Top Cap assembly.

....and plug them together.

Now push Top Cap Assembly back onto the probe rod until the clips audibly click in and are fully seated.

Now slide top sensor back into position and click into probe rod.

Plug sensor back into probe rod.

Gently push the probe back into access tube.

Line up Flat Cap cable exit point with a mark on the access tube and original cable trench.

Apply firm pressure with both hands to re-seat Flat Cap onto the access tube.

Re-attach the Herbie Clip® around the Flat Cap.

Tighten the Herbie Clip® with a pair of pliers.

Loop the cable and position it about 20 cm away from the probe.

Fill the cable trench with soil and compact down.

Repack the soil taken from around the probe around the Flat Cap.

Use your fingers to neatly pack the soil.

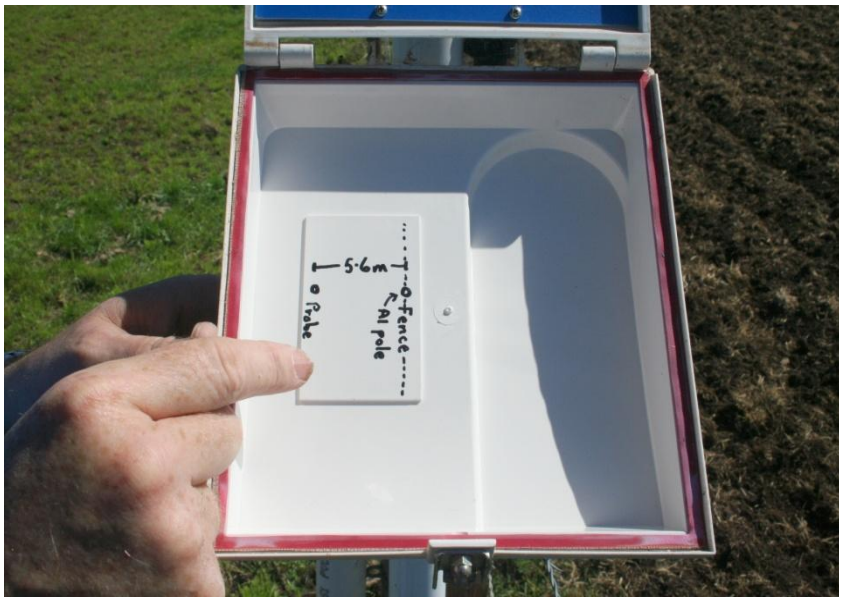
Position the large Turf Cutter with the grass sod set aside previously over the Flat Cap and gently push out the circular grass sod.

Centralize the grass sod around the Flat Cap.

Use your fingers to compact the grass sod firmly down.

The Flat Cap probe is now reinstalled.

Plug your lap-top into the Data Transmission Unit (DTU) and check the sensor readings.



Ensure there is a drawing inside the DTU box indicating the distance and direction of the probe location in relation to the DTU pole. This will allow easy location of the probe at the next service call.

The service call is finished.

Re-Grooving of EnviroSCAN Flat Cap Access Tube

If you need to cut the top of the access tube off for any reason, it can be re-grooved in the field using the Groove Tool.

The access tube can be “squared off” by applying downward pressure and rotating the tool clockwise. Then position the tool at the second stop (engaging the spring lever).

Rotate the tool by 2 complete turns.
A ribbon of plastic will be produced as the groove is made.