SENTEK DRILL & DROP

Probe Manual Version 1.5

For Bluetooth probes,

Series II Interface probes, and

Series III probes

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Sentek - Statements of Compliance

FCC note of compliance and statement of liability

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorientation or relocation of the receiving antenna.
- Connection of the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consultation with the dealer or an experienced radio/TV technician.

EMC approvals - Sentek Drill and Drop Bluetooth

The Drill & Drop Bluetooth probe is in compliance with all the applicable essential requirements, and other provisions of the Union Harmonization Legislation:

2014/53/EU Radio Equipment Directive (RED)

The following harmonised standards and technical specifications have been applied:

EN 62479: 2010 (For article 3.1a)
Assessment of the compliance of low power electronic and electrical equipment with the basic restrictions related to human exposure to electromagnetic fields (10 MHz to 300 GHz).

ETSI EN 301 489-1 V2.2.0 (2017-03) (For article 3.1b)
Common technical requirement.

ETSI EN 301 489-17 V3.2.0 (2017-03) (For article 3.1b)
Specific conditions for 2,4 GHz wideband transmission systems, 5GHz high performance RLAN equipment and 5,8 GHz Broadband Data Transmitting Systems.

ETSI EN 300 328 V2.2.0 (2017-11) (For article 3.2)
Electromagnetic compatibility and Radio spectrum Matters (ERM). Wideband transmission systems and Data transmission equipment operating in the 2.4 GHz band. Harmonized EN covering essential requirements under article 3.2 of the R&TTE Directive.

AS/NZS 4268:2017

EMC approvals - Sentek Drill and Drop Series III RS232, RS485

The Drill & Drop Series III RS232, RS285 probe is in compliance with all the applicable essential requirements, and other provisions of the Union Harmonization Legislation:

2014/30/EU EC EMC Directive

The following harmonised standards and technical specifications have been applied:

EN 61326-1: 2013
Electrical equipment for measurement, control and laboratory use – EMC requirements. Part 1: General requirements.

FCC Part 15 Subpart B of the FCC Rules
Radio Frequency Devices – Unintentional Radiators

AS/NZS CISPR 32:2015

EMC approvals - Sentek Drill and Drop Series III SDI-12

The Drill & Drop Series III SDI12 system is in compliance with the following specifications;

CISPR 11:2010 Ed 5.1
Industrial Scientific and Medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement

IEC 6132601:2012 Ed 2
Electrical equipment for measurement, control and laboratory use – EMC requirements. Part 1: General requirements.

FCC Part 15 Subpart B
Radio Frequency Devices – Unintentional Radiators

EMC approvals - Sentek Drill and Drop Series II (interface box)

The Drill & Drop system is in compliance with the following specifications;

FCC Part 15 Subpart B
Radio Frequency Devices – Unintentional Radiators

CISPR 11:2010 Ed 5.1
Industrial Scientific and Medical (ISM) radio-frequency equipment – Electromagnetic disturbance characteristics – Limits and methods of measurement

IEC 6132601:2012 Ed 2
Electrical equipment for measurement, control and laboratory use – EMC requirements. Part 1: General requirements.

RoHS

EN 50581:2012
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances.

Marking

The above EMC approvals allow the product to be marked CE, C-tick and FCC.

Modifications

Any modifications to any part of the equipment or to any peripherals may void the EMC compliance of the equipment.

Radio Interference

The probe is not to be operated in free air as it may cause interference to radio communication devices

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The Drill & Drop Probes

About

Sentek Drill & Drop probes are a fully sealed soil probe, designed for insertion into the ground, to measure soil water content, temperature and optionally, salinity.

The sensors and electronics are encapsulated in the probe plastic with a resin, to prevent water intrusion and to strengthen the probe.

The probe itself is tapered, allowing for a fast and simple undisturbed installation in a majority of soil types using the Sentek tapered auger. This is important as the special installation technique provides high quality data measurements from the true soil profile, not from a surrounding slurry.

The sensors inside the Drill & Drop probe use capacitance (FDR) technology.

Drill & Drop probes can be completely buried and come in a range of cabled and cable-free options.

Probe Length	10.5cm/4"	30cm/12"	60cm/24"	90cm/36"	120cm/48"
Number of Sensors	1	3	6	9	12
Outer Probe Diameter **Top:** **Bottom:**	24.5mm 24mm	30mm 28.75mm	30mm 27.5mm	30mm 26.25mm	30mm 25mm
Connection Protocols Available	SDI-12 only	SDI-12 RS232 RS485 Sentek Bluetooth	SDI-12 RS232 RS485 Sentek Bluetooth	SDI-12 RS232 RS485 Sentek Bluetooth	SDI-12 RS232 RS485 Sentek Bluetooth
Resolution	Moisture = 1:10000 Salinity = 1:3000 Temperature = 0.3°C				
Moisture Precision	±0.03% vol.				
Temperature Accuracy	±2 °C @ 25 °C				
Operating Temperature	-20°C to +60°C				

Overview

This manual covers the physical Characteristics of Drill & Drop probe and it should be used in combination with the appropriate Sentek Hardware manual for which the probe is configured i.e. Sentek MULTI, Sentek PLUS, Sentek SDI-12 or RS232/485 Modbus, Sentek Bluetooth

The Sentek Drill & Drop probe range has various options:

- Drill & Drop Bluetooth
  This probe is fully encapsulated and requires a Bluetooth Low Energy compatible device to test, configure or download data from the probe e.g. Android phone or tablet, Apple iPhone or iPad
- Drill & Drop Series III
  This probe has all the interface and electronics encapsulated in the probe rod with a 5m cable split into two connectors, one for probe test, configuring and programming with the other connector for data transmission.
- Drill & Drop, interface Series II
  This probe has the sensors encapsulated in the probe rod, with a permanent cable to an encapsulated Sentek Interface box (the "Brick"). The interface box also has a 5 m attached data cable. The interface box has a connector for a Probe configuration cable. This cable is used by the Sentek Probe Configuration Utility (PConfig) to do probe test, configuring and programming.

Probes come in different lengths from 10 cm (Single Point Sensor) to 120 cm (12 sensors) – see table on previous page. The Single Point Sensor is available as SDI-12 only.

Probes can be configured for various Sentek data transmission units (DTU) Sentek MULTI, Sentek PLUS, Sentek Compact or third-party loggers (SDI-12 and Modbus)

References

- Drill & Drop Installation Manual
- Sentek Probe Configuration Utility
- TriSCAN Agronomic User Manual
- Sentek SDI-12 Series III Probe Interface Manual
- RS232/485 MODBUS Series II Hardware Manual
- Sentek Drill & Drop Bluetooth Probe Manual
- Sentek MULTI Hardware Manual
- Sentek PLUS Hardware Manual
- Sentek PLUS All-in-One & Sentek Compact Hardware Manual
- Sentek SOLO Hardware Manual

Drill & Drop Bluetooth Probe

The Bluetooth probe incorporates a Bluetooth Low Energy device that communicates using a Sentek proprietary GATT Profile that can communicate with a Sentek application in a mobile device.

The probe comes in four sensor configurations of 3, 6, 9 or 12 sensors (30, 60, 90 or 120 cm), all moisture sensors or all TriSCAN sensors, together with a temperature sensor on each sensor.

The probe electronics are encapsulated in the probe rod which is integrated with a battery and a wireless Bluetooth antenna in the probe head.

Once the battery is installed in the probe and the probe is configured, it starts sampling the sensors and continuously advertises its presence to allow a Bluetooth mobile device to connect, configure and download data.

The App can be downloaded from the App Store for iOS devices or the Play Store for Android devices. The App can configure, test, and download data from the probe. With an appropriate Internet connection, the downloaded data can be uploaded by the App to IrriMAX Live.

Probe cables are not required, because all communications are via Bluetooth using the App.

The section *Sentek Bluetooth Technical Specifications* describes the time before readings will be overwritten and expected battery life.

For further information see *Sentek Drill & Drop Bluetooth Probe Manual.*

Drill & Drop Series III Probe

The Series III probe consists of a probe rod with integrated electronics and associated cables. Two probe types are available RS232/RS485 or SDI-12:

- RS232 communication to a Sentek PLUS DTU
- RS485 communication to a Sentek MULTI DTU
- RS232 or RS485 to a third-party Modbus logger
- SDI-12 communications to a third-party SDI-12 logger.

For further information see the appropriate *Sentek SDI-12 Series III Probe Interface Manual* or *RS232/485 MODBUS Series II Hardware Manual.*

Notes:

The Sentek Compact DTU is considered equivalent to the Sentek PLUS DTU.
At present Sentek SOLO is not supported on Series III probes.

SDI-12 probes

The SDI-12 probe consists of the probe rod, containing both the interface and sensors, with a top connector attached to a 5.0 m cable, with a three-pin connector. The 30 cm tail has a 3-pin connector to connect to the 5.0 m cable and bare wires suitable for connection to a third-party logger.

The SDI-12 probe can also be supplied with a permanently wired cable into the side of the probe.

Although the SDI-12 probe comes fully configured, the configuration can be changed with PConfig, using the SDI-12 protocol, connected through a special PConfig programming cable plugged into the 5.0 m cable connector.

The cable has an attached label showing the wire colors, the probe serial number and an indicator of sensor type; Moisture (M) or TriSCAN (T).

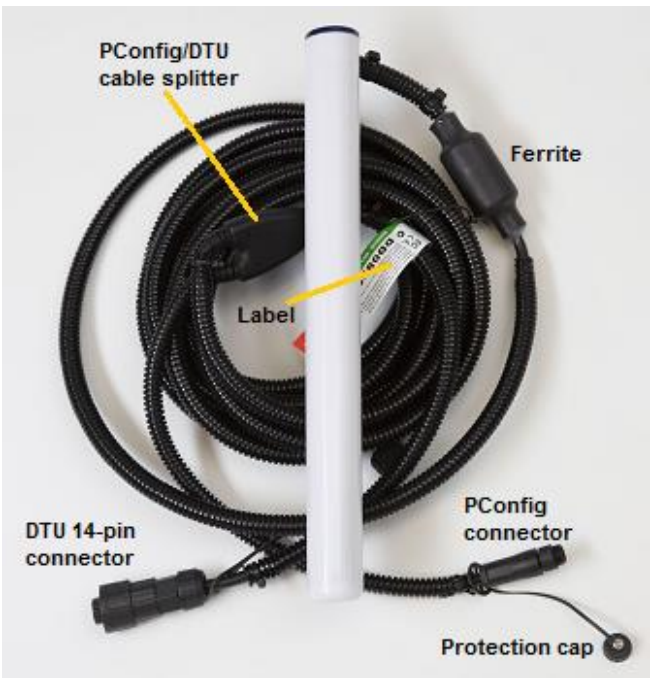
Note:
The sensor type is indicated by the non-punched out colored letter at the label edge.

Moisture probe label

TriSCAN (salinity) probe label

The Serial number is also present on side entry probes. The square QR bar code allows a mobile device to scan and take you to the IrriMAX Live web site.

RS232/RS485 probe



The RS232/RS485 probe is preconfigured with the firmware appropriate to the DTU to which it will be connected i.e. Sentek PLUS, Sentek MULTI, Modbus RS232 or RS485 third party loggers.

You can change the probe type (RS232 or RS485) by uploading new firmware into the probe.

The probe rod contains the sensors and the DTU interface. It has a permanently attached 5.0 m cable. The cable incorporates a noise suppressing ferrite, with the cable end split into two connectors. The 14-pin connector is for DTU communication and the 3-pin connector for PConfig configuration, Test, and firmware update.

The top of the probe shows the probe serial number. The Cable has a label attached showing the serial number, an identification of the probe configuration; RS232 with PLUS and RS485 with MULTI or Modbus RS232 or RS485; and an indicator of sensor type; Moisture (M) or TriSCAN (T).

Note:
The sensor type is indicated by the non-punched out colored letter at the label edge.

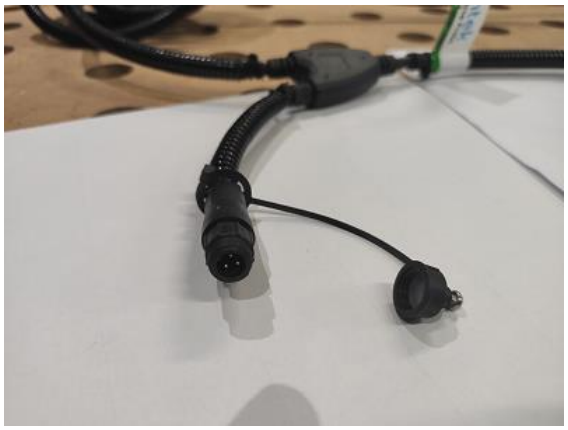
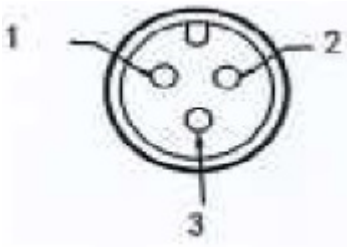
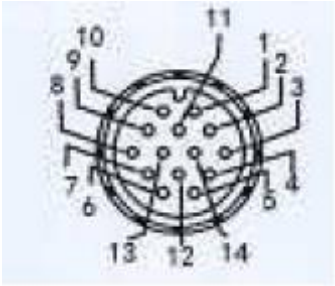
Generic probe label before marking interface type and punching out non-sensor type.

PConfig and DTU Connector cable

Sentek DTU connectors are prewired to use the appropriate pins.

Third party Modbus loggers must be wired as appropriate for RS485 or RS232 operation.

Caution:
RS485 Modbus probes are shipped with a short tail cable which has the wires connecting A & T1 joined (pins 13/14) and B & T2 joined (pins 10/12). For multi-drop Modbus RS485 situations probes not at the end of the cable run must have these two joins disconnected.

3-pin connector (PConfig)	14-pin connector (to DTU)
	
	

Color	Pin No	Signal	Usage
White	1	Gnd	TTL
Red	2	RX	TTL
Green	3	TX	TTL

Color	Pin	Signal	Usage
Red	1	+V	Power
Black	2	0V	Power
Brown	3	Switch out	*RS232*
Orange **	4	TRX	*reserved*
Yellow	5	CTS	*RS232*
Green	6	DTR	*RS232*
Blue	7	TX	*RS232*
Purple	8	RX	*RS232*
Grey	9	RTS	*RS232*
White	10	B	**RS485**
Pink	11	TTX	*Reserved*
Light Green/Black	12	T2	**RS485**
Light Blue/Black	13	A	**RS485**
Light Yellow/Black	14	T1	**RS485**

**** Warning**:
The 14-pin connector cable orange wire (pin 4) **must not** be connected on a PLUS/COMPACT DTU. This is to prevent damage to the PConfig programming cable electronics. It is not connected within a 14-pin to 7-pin conversion cable.

If you manually wire a 14-pin connector with bare wire tail into a 7-pin Buccaneer DTU connector the Orange wire **must not** be connected (to the red wire).

See section *Wiring the Series II Interface box Cable*.

14-Wire tail for Modbus loggers (wire colors are in above table)

	Series III PLUS/MULTI probes are shipped with a Sentek DTU containing a 14-pin connector. Conversion cables are available to connect a Series III probe to an earlier Sentek DTU.  • MULTI 14way to 4way part #61239 • PLUS 14way to 7way part #61238

Sentek Probe Configuration Utility

Warning!
Probes are supplied pre-normalised. Modifying normalization information stored in the Drill & Drop probe may result in incorrect sensor readings.

The Probe Configuration Utility (PConfig) is provided to configure probe interfaces with depth location, normalization values (air and water counts) and calibration information for each sensor installed on the probe. This information is stored in non-volatile memory and is used to produce the calculated value (value that has been processed via the interfaces calibration formula) from each sensor on the probe.

It is not necessary to configure the sensors or normalise Drill & Drop probes as they are sold fully preconfigured and normalised. An optional Drill & Drop PConfig cable is available if required.

See the *Probe Configuration Utility manual* or its online help for further information.

PLUS/MULTI/Compact DTU

The sampling interval, Web URL address etc. in the interface must be setup during commissioning the probe.

Setting the SDI-12 Address

Drill & Drop SDI-12 probes are preconfigured to SDI-12 address 0.

If multiple probes are on the one SDI-12 bus it will be necessary to use either your SDI-12 logger or PConfig to change the SDI-12 address of the probe in the range "0" to "9", "A" to "Z" and "a" to "z".

Note:
On SDI-12 probes, PConfig Sensor Test tab page only shows the calibrated value.

About the SDI-12 Communication

See the *Sentek SDI-12 Series III Probe Interface Manual* for a description of SDI-12 communication to a Sentek probe.

Installation and setup of the Drill & Drop probe

Physical installation at the desired field location is described in the Drill & Drop Installation Manual.

Note:
All Drill & Drop probes are preconfigured and do not need Auto-detect sensors, set depths, or normalise sensors.

Configuring SDI-12 Series III probes

This SDI-12 probe is configured through the on-probe SDI-12 connector. You must use the SDI-12 Programming cable.

1. Unplug the SDI-12 logger from the probe cable (if needed).
2. Plug the SDI-12 programming cable into the 3-pin connector on the probe cable.
3. Plug the USB connector on the Probe programming cable into a USB port on your computer. The probe is powered through the USB 5V supply.
4. Run PConfig on your computer, select Baud rate Auto, or 1200, and connect to the relevant USB COM port. PConfig connects at 1200 baud and uses SDI-12 communication protocol.
5. If the probe will be used in a multi-drop (a series of probes on one SDI-12 cable), change the SDI-12 probe address to a unique address for each probe, i.e. 0-9, A-Z and a-z. Consult your SDI-12 logger installation instructions for any constrains.

Caution:
PConfig does not support multi-drop, so disconnect other probes from the SDI-12 cable while configuring each probe.

Configuring PLUS, MULTI or Modbus probes

For full setup description, see the appropriate:

- *Sentek PLUS Hardware Manual*,
- *Sentek All-in-One and Sentek Compact Hardware Manual,*
- *Sentek MULTI Hardware Manual*
- *Modbus third party logger documentation*

1. If not already connected, plug the "14-pin DTU Connector cable" into the DTU (or Modbus third party logger). You may need a conversion cable if you have an earlier style Sentek DTU.



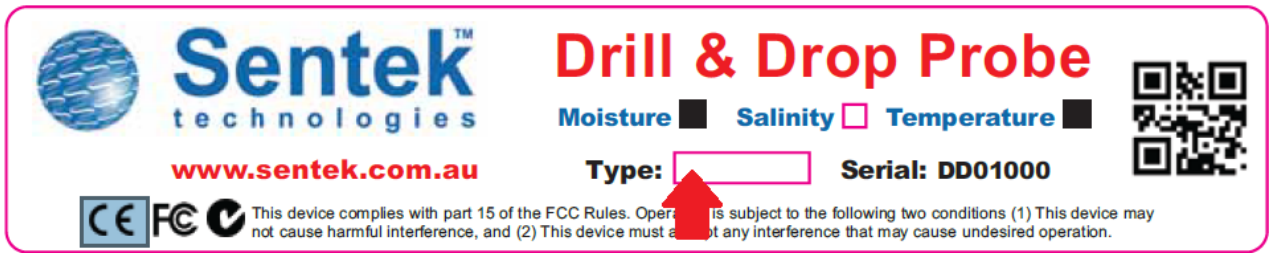
DTU Connector cable, Conversion cable, Modbus cable

2. Plug the probe Programming cable into the "3-pin Connector cable" and into a USB port on your computer.
3. Ensure the DTU (or logger) is powered on.
4. Run PConfig on your computer and connect to the USB COM port.

5. Set required parameters in the PConfig:
   - Synchronise Interface clock to computer clock
   - Enter Upload URL (preconfigured on IrriMAX Live configurations)
   - Sample interval (preconfigured to 30 minutes on IrriMAX Live configurations)
   - Sample upload count (preconfigured to 6, for upload every 3 hours)
   - Ensure you have the SIM card in the DTU modem, the Network tab APN matches the SIM card service provider, and if required the SIM PIN number.
6. Verify the probe is operational by performing
   - PConfig Query All Sensors test, showing the expected number and types of sensors
   - PConfig Modem Test, expect a last response of 040 Success.

Wiring the Series II Interface box Cable

Warning:
Drill & Drop probes are preconfigured, based on the product ordered, with the appropriate firmware and cable plug for Sentek PLUS, Sentek SOLO, Sentek MULTI and Sentek Compact



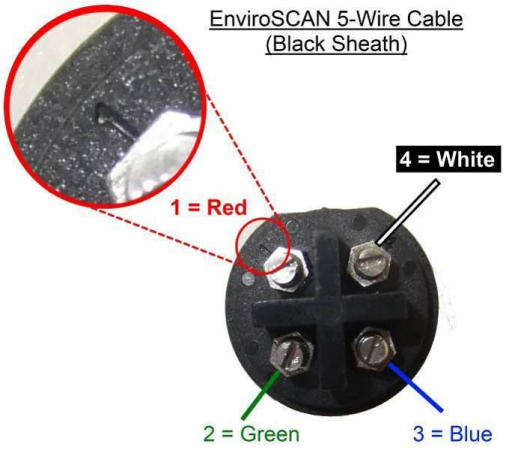
For probes that need to be wired, there are three cable configurations. The "Type" label on the Drill & Drop Interface box identifies which type of probe is relevant.

Caution:
Damage to the Drill & Drop cable may result in moisture entering the cable, resulting in corrosion and device failure.

Sentek MULTI and Modbus RS485 probes

The Sentek MULTI DTU has a built-in connector which uses a four pin "Buccaneer" plug. If required, the probe end connector can be ordered as Sentek Part number:

- 04086 Sentek MULTI, Probe Cable Connector



For detailed wiring steps, see section *Sentek MULTI Probe Cable Connector* in the *Sentek MULTI Hardware Manual.*

A Modbus RS485 probe requires connection to a third-party logger, consequently no cable connector can be specified.

485 Cable	+Vin	0V	A	B	N/C
5-wire cable	Red	Green	Blue	White	Yellow
MULTI Connector Pin	1	2	3	4	

Sentek PLUS, Sentek Compact and Modbus RS232 probes

The Sentek PLUS DTU has a connector which uses a seven pin "Buccaneer" plug. If required, this connector can be ordered as Sentek Part number:

- 61249 Watertight connector, Sentek PLUS, Probe end

For detailed wiring steps, see section *C. Install EnviroSCAN Flat Cap probe* (common to all probe types) in *the Sentek PLUS Hardware Manual.*

A Modbus RS232 probe requires connection to a third-party logger, consequently no cable connector can be specified.

232 Cable	+Vin	Switch In	Switch out	0V	TX	RX	DTR	CTS	N/C
9 wire cable	Red	Orange	Brown	Black	Blue	Purple	Green	Yellow	Grey
Plus 7-pin Connector	1	wired to Red pin 1	2	3	4	5	6	Center	No pin
Plus 14-pin connector	1	not connected See ** Warning	3	2	7	8	6	5	

If the Sentek PLUS DTU does not have a cable with Buccaneer connector, the Drill & Drop probe cable can be wired directly into connector X2 on the PLUS solar charger board. See section *Sentek PLUS DTU* in the *Sentek PLUS Hardware Manual.*

For Plus 14-pin connector wire colors and codes see section *PConfig and DTU Connector cable.*

**** Warning**:

The 14-pin connector cable orange wire (pin 4) **must not** be connected on a PLUS/COMPACT DTU. This is to prevent damage to the PConfig programming cable electronics. It is not connected within a 14-pin to 7-pin conversion cable.

If you manually wire a 14-pin connector with bare wire tail into a 7-pin Buccaneer DTU connector the Orange wire **must not** be connected (to the red wire).

Drill & Drop Technical Specifications

Sentek Bluetooth Technical Specifications

All sensors and electronics are encapsulated within the probe rod. The probe rod cannot be disassembled, apart from accessing the battery in the top cap.

Bluetooth Low Energy Protocol: Version 4.0 or later

Moisture Sensor Resolution: 1:10000

Moisture Sensor Precision: ±0.03% vol.

TriSCAN Sensor Resolution: 1:3000

TriSCAN Sensor Variation: 0.2%CV

Temperature Sensor Accuracy: ±2 °C @ 25 °C.

Temperature Sensor Resolution: 0.3 °C.

Temperature range (operating): -20 °C to +60 °C.

Voltage Supply: 3.6V Lithium-ion "AA" battery

Warning:
For reliable operation the Sentek supplied high performance lithium-ion battery should be used. Normal 1.5V lithium cells are not suitable.

Maximum stored samples

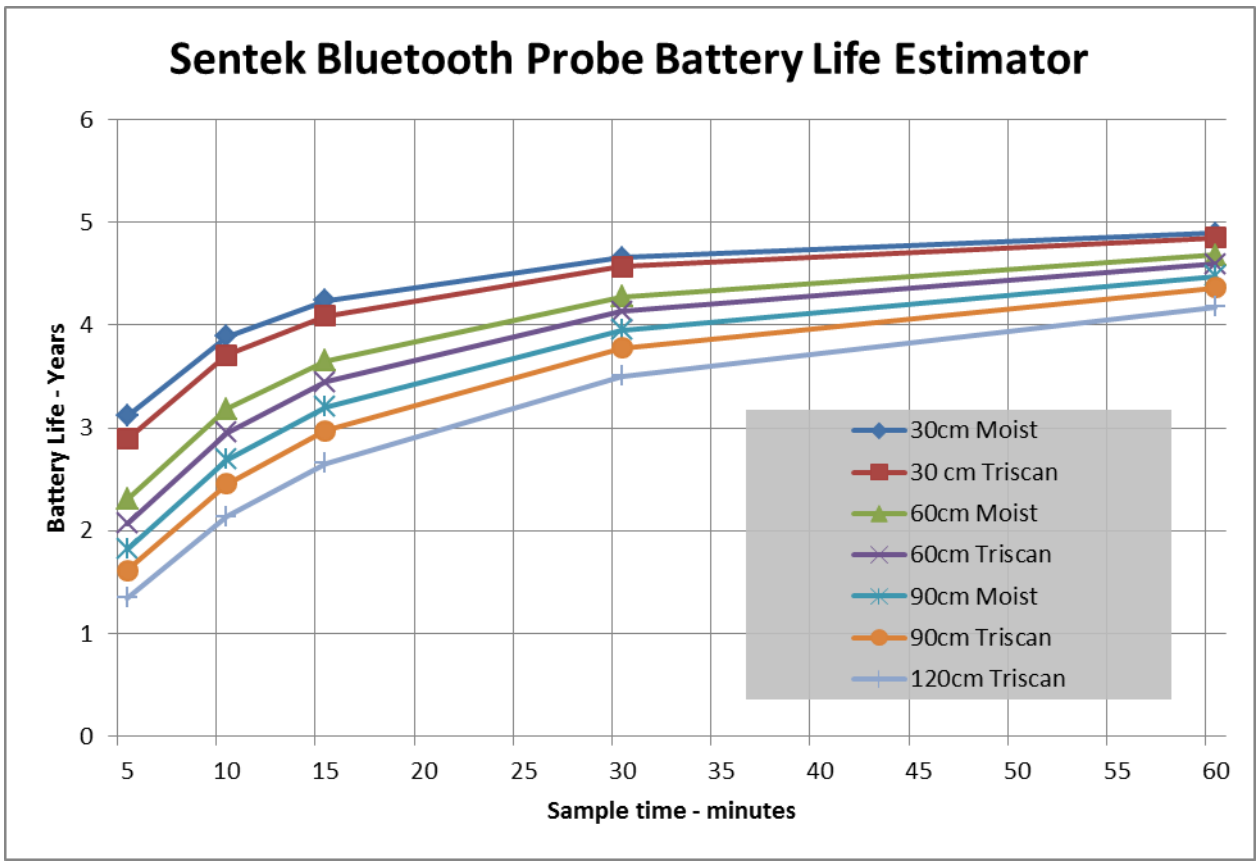
A probe can accumulate about 2000 samples (readings) before the oldest readings are over written. This is about 20 days with a 15 minute sample interval.

The table below is a guide to the time before samples are overwritten for various sample intervals. You must download existing data before this time is exceeded to avoid data loss.

Sampling interval	Logging time
1 min	1.3 days
5 min	6.7 days
15 min	20.1 days
30 min	40.3 days
1 hr	80.3 days
2 hr	156 days
4 hr	295 days
6 hr	422 days

Battery Life

The following graph shows the typical battery life (in years) for the Bluetooth Probe 3.6V Lithium-ion battery. As shown TriSCAN probes have slightly shorter battery live than moisture only probes. The greatest effect is the number of sensors (probe length). The default sample rate is 30 minutes, which is suitable for most applications.



Series III RS232/RS485 Technical Specification

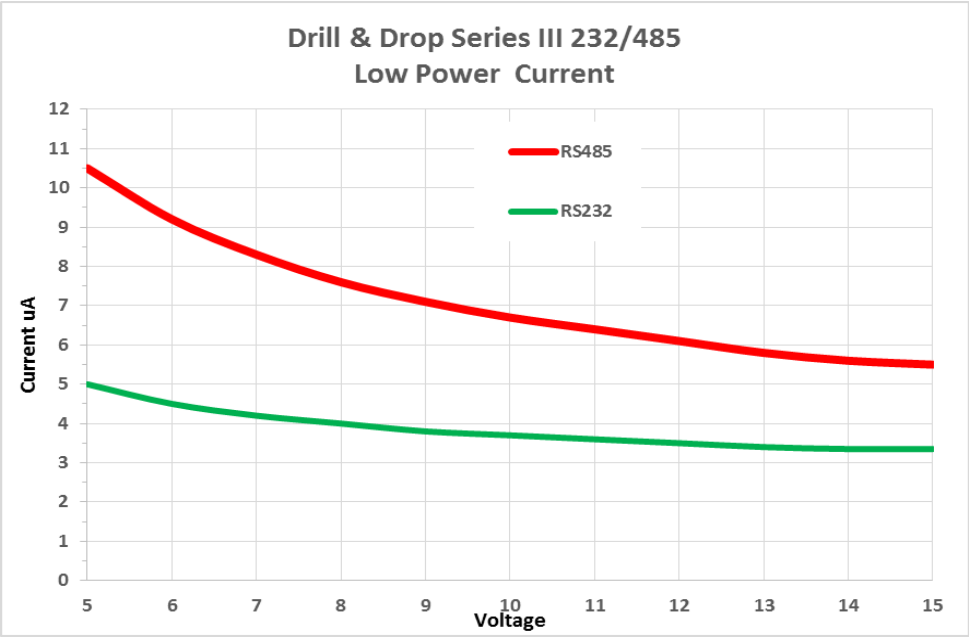
Moisture Sensor Resolution:	1:10000
Moisture Sensor Precision:	±0.03% vol.
TriSCAN Sensor Resolution:	1:3000
TriSCAN Sensor Variation:	0.2%CV
Temperature Sensor Accuracy:	±2 °C @ 25 °C.
Temperature Sensor Resolution:	0.3 °C.
Temperature range (operating):	-20 °C to +60 °C.
Voltage Supply (+Vin):	Modbus and Plus 5 to 15 Volts DC, Nominal 12V
	MULTI 6.5 to 15 Volt DC, nominal 12 Volt
TTL Interface baud rate:	1200, 2400, 9600 (default), 19200 and 38400 bits per second

Current consumption and Time to sample:

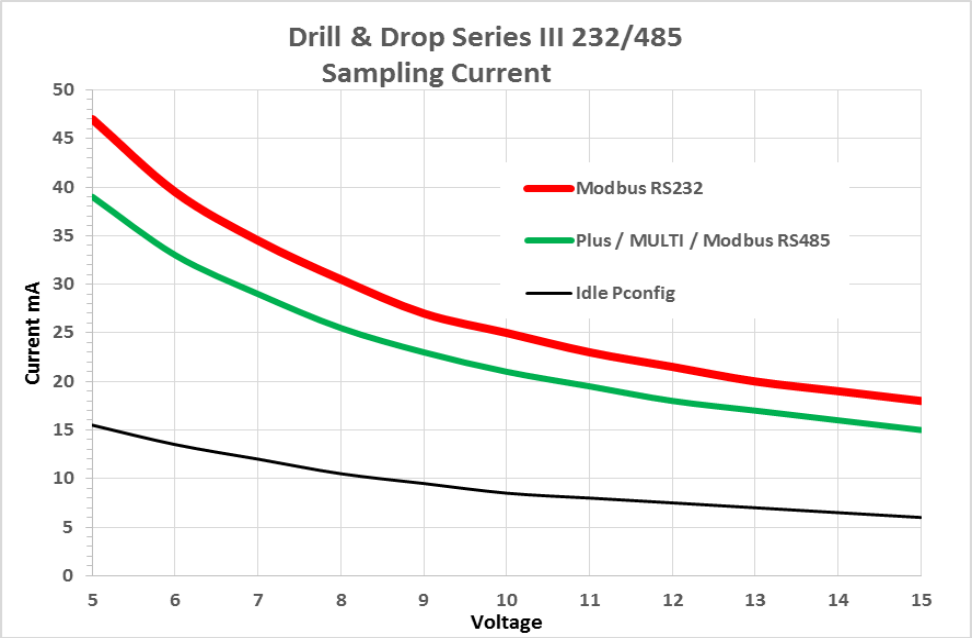
See graphs below showing the Low power and sampling current. The sampling current may be combined with the measurement time graph, also below, to estimate energy consumption.

Mode: **Series III RS232/RS485**

RS232/RS485 Low power current

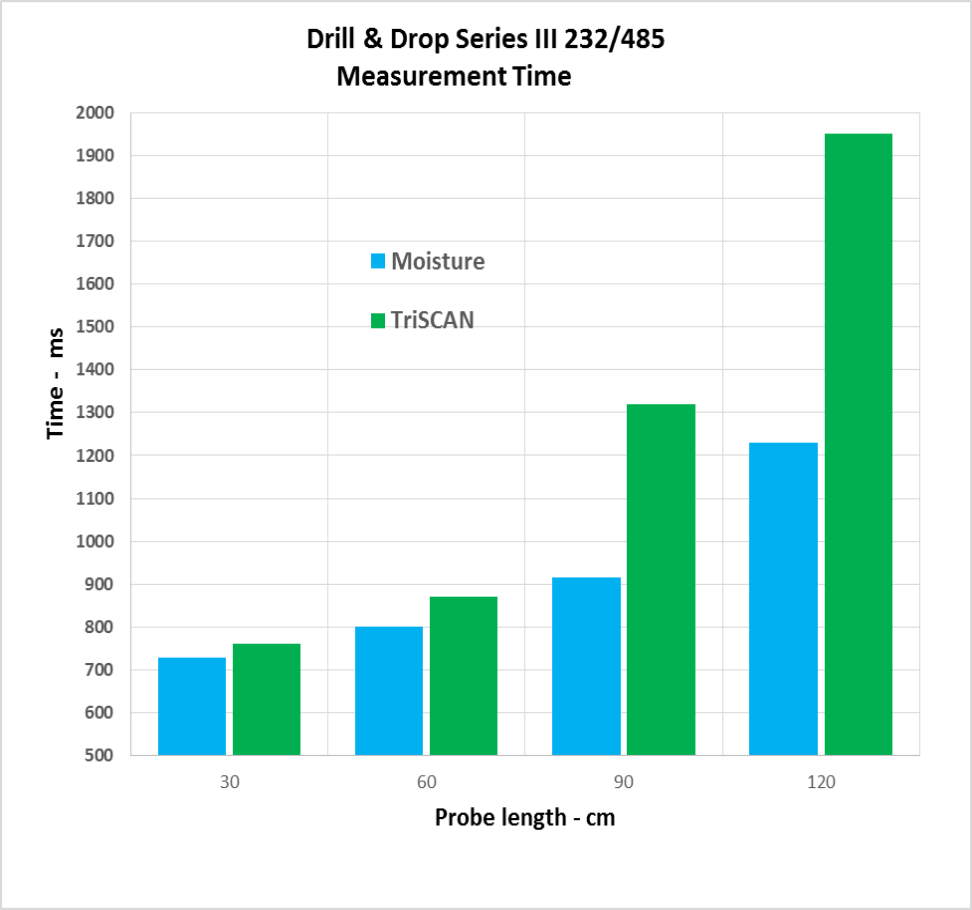


RS232/RS485 Sampling Current



Mode: **Series III RS232/RS485**

RS232/RS485 Measurement time



SDI-12 Series III Technical Specifications

All sensors and electronics are encapsulated within the probe rod. The cable to the probe rod cannot be disconnected.

SDI-12 Protocol: Version 1.3

Sensors are measured starting from the bottom sensor (3, 6, 9 or 12)

Moisture Sensor Resolution: 1:10000

Moisture Sensor Precision: ±0.03% vol.

TriSCAN Sensor Resolution: 1:3000

TriSCAN Sensor Variation: 0.2%CV

Temperature Sensor Accuracy: ±2 °C @ 25 °C.

Temperature Sensor Resolution: 0.3 °C.

Temperature range (operating): -20 °C to +60 °C.

Voltage Supply (+Vin): 2.7V to 15 Volts DC, Nominal 12V

Note: Operating below 5V the probes will still drive the SDI-12 data line at the 5V SDI-12 specification so the logger will also need to be 5V tolerant. Above 15V the probe will draw higher current (up to about 100 mA). If the probe is operated above 15V for extended time permanent damage may result.

Single Point Sensor Voltage Supply (+Vin): 5V to 15 Volts DC, Nominal 12V

Note: Single Point Sensor SDI-12 probes draw a fixed current, independent of the input voltage (+Vin), as follows:

Salinity	6.9 mA
Moisture	6.1 mA
Temperature	3.2 mA
Idle	2.0 mA
Low power	0.6 mA.

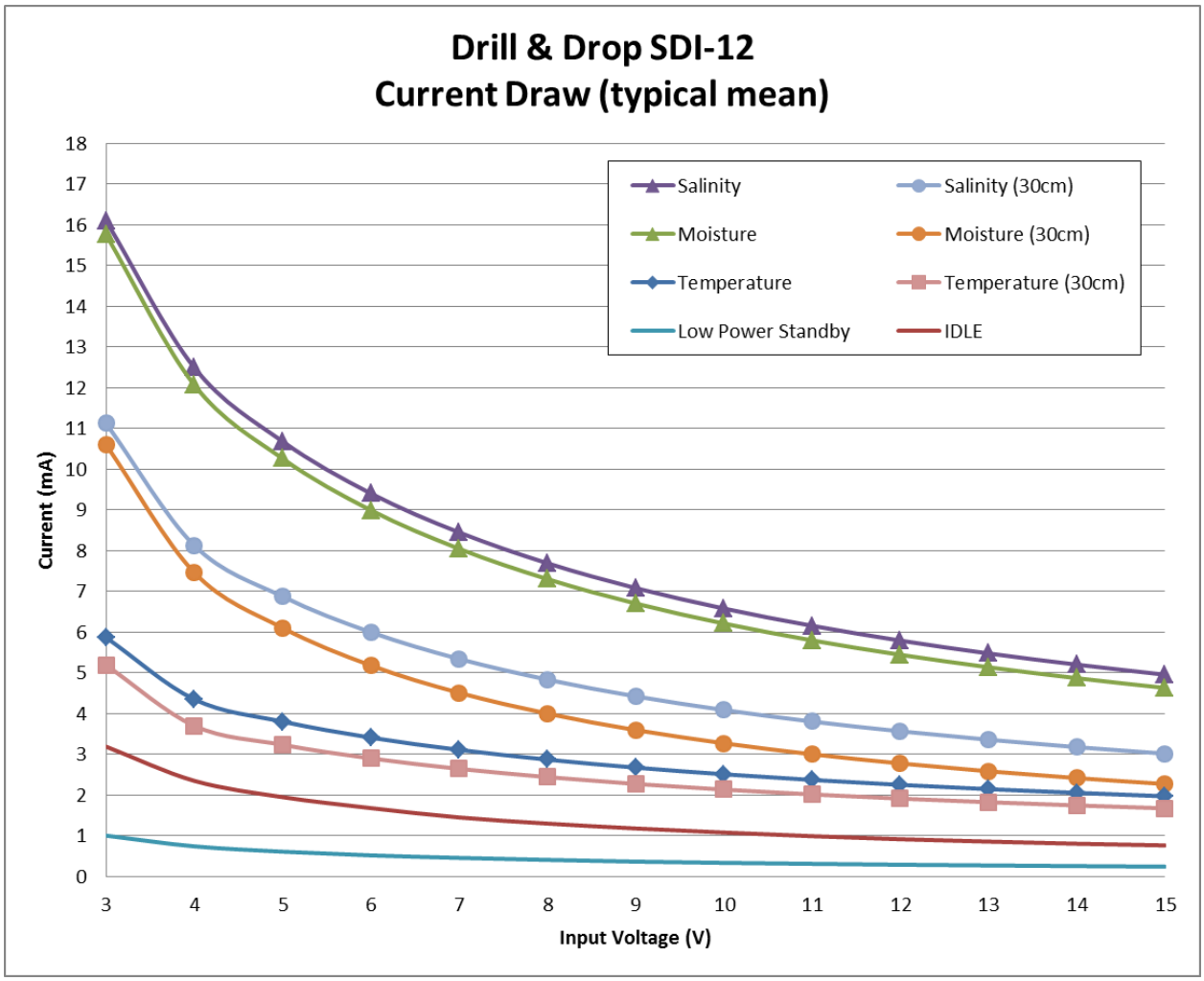
Time to Sample Sensors:

See following table (typical values for SDI-12 firmware version 1.1.3)

SDI-12 Command	Sensor type	Measurement Time (ms)			
		30 cm	60 cm	90 cm	120 cm
C!	Moisture	742	768	1278	1872
C1!	Salinity	817	930	1539	2244
C2!	Temperature	72	174	306	468
M!	Moisture values 1 – 9	742	768	1278	1404
M1!	Moisture values 10 – 12	x	x	x	868
M2!	Salinity values 1 – 9	817	930	1539	1683
M3!	Salinity values 10 – 12	x	x	x	961
M4!	Temperature values 1 – 9	72	174	306	351
M5!	Temperature values 10 – 12	x	x	x	117

Current consumption:

This graph shows the typical current consumption for each sensor. More sensors results in the same current drawn for a longer time. 30cm (3 sensors) probes draw less current than longer probes.



Sentek Series II interface Box D&D probe Technical Specification

All probe sensors are encapsulated within the probe rod. The interface box (Series II) is also encapsulated and its cable to the probe rod cannot be disconnected.

Sensors are measured starting from the bottom sensor (6 or 12)

Moisture Sensor Resolution: 1:10000

Moisture Sensor Precision: ±0.03% vol.

TriSCAN Sensor Resolution: 1:3000

TriSCAN Sensor Variation: 0.2%CV

Temperature Sensor Accuracy: ±2 °C @ 25 °C.

Temperature Sensor Resolution: 0.3 °C.

Temperature range (operating): -20 °C to +60 °C

Voltage Supply (+Vin): Modbus and Plus 4.5V to 15 Volts DC, Nominal 12V

MULTI 6.5 to 15 Volt DC, nominal 12 Volt

Current consumption:	400µA standby @ 12 V DC
	9mA Active @ 12 V DC
	25mA @ 12 V DC** Average current over sensor sampling period.
	800uA standby @ 6 V DC
	16mA Active @ 6 V DC
	45mA @ 6 V DC ** Average current over sensor sampling period.

Current is measure at the interface; production version 2.4 manufactured in 2013.

Time to sample 12 sensors:	1.8 seconds for Moisture and Temperature
	(approx. 150 ms per sensor **)
	2.2 seconds for Moisture, TriSCAN and Temperature
	(approx. 180 ms per sensor **)
Time to sample 6 sensors:	1.1 seconds for Moisture and Temperature
	(approx. 215 ms per sensor **)
	1.3 seconds for Moisture, TriSCAN and Temperature
	(approx. 180 ms per sensor **)

**** Note:**
Sensor measurement time is approximate and an average of the total time to measure all sensor types at a single depth.

TTL Interface baud rate:	1200, 2400, 9600 (default), 19200 and 38400 bits per second

Maintenance

Storage

When not installed in soil, Drill & Drop probes should be stored in a sheltered environment, shielded from extreme temperatures, direct sunlight, and high humidity.

Probes should be stored flat to avoid warping of the probe shape. Leaning probes against a wall for an extended period should be avoided.

Some bend in a Drill & Drop probe is acceptable and should not interfere with the installation of the probe in the majority of soil types. A general guide for an acceptable bend is 5mm of deflection for a 120cm probe; i.e. probe laid on a true straight edge, with no part of the probe more than 5mm from the reference edge.

Cable

Corroded, shorting and broken wires can affect the operation of the equipment. Regular inspection of the cabling for damage from insects, animals or machinery should be carried out. If necessary, the cabling can be elevated or buried away from potential damaging elements.

Sentek recommends protecting exposed cable with some form of conduit.

Connectors

The connectors fitted to Drill & Drop probes are designed to resist dust and moisture when installed and connected correctly. The connectors will lose their water resistance when not used correctly.

To avoid cross threading the locking ring, be sure that the two halves of the connectors are pushed flat all the way together before screwing them tight.

Ensure sealing caps are used on each connector when disconnected.