SISTEMES ELECTRÒNICS PROGRÉS

Manual

Drill & Drop soil water content, temperature and conductivity sensor

CODES:

Hm-Tmp 06140316 (30 cm) | 06140317 (60 cm) | 06140318 (90 cm) | 06140319 (120 cm)
TriScan 06140320 (30 cm) | 06140321 (60 cm) | 06140322 (90 cm) | 06140323 (120 cm)

Sensor made up of different integrated sensors along four possible nozzle lengths (30, 60, 90 and 120 cm), separated every 10 cm.

It is installed perpendicularly to obtain, in any soil profile and in any crop, readings of soil volumetric water content (VWC), temperature and conductivity (VIC: Volumetric ion content, for **TriScan** sensors only).

This capacitance sensor sends an electromagnetic signal to a surrounding volume of soil to measure its moisture content. Unlike other types of sensors, these measure the moisture in a volume of soil, which is much more significant.

The Drill&Drop sensor uses the SDI-12 communication protocol to connect with the different devices. Using this protocol, and through the data bus, more than one sensor can be connected. A unique address will be configured for each of them.

This sensor is designed to operate buried in the soil. If it remains in the open air, the readings may cause radio communication interference to other devices.

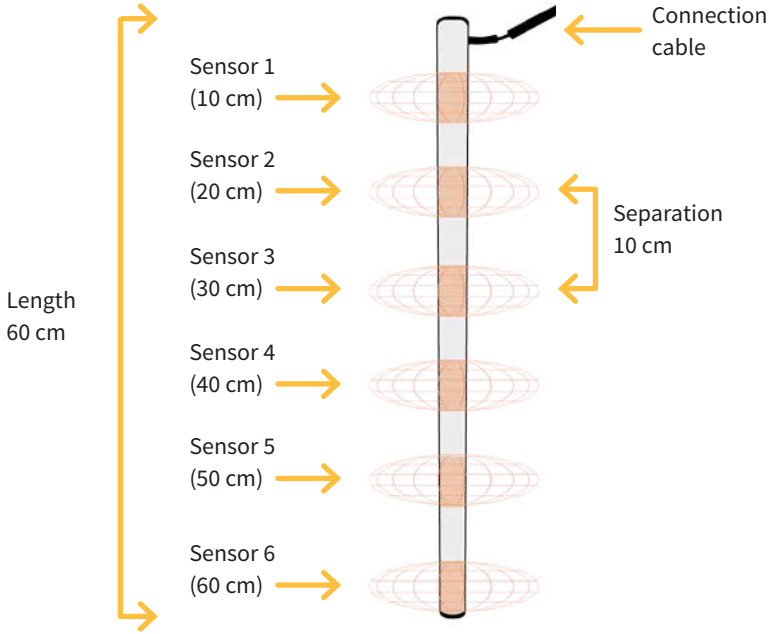
Technical specifications

	Sensor details			
	3 levels	6 levels	9 levels	12 levels
Sensor type	Soil moisture + Temperature + Conductivity (TriScan) or Soil moisture + Temperature (Hm-Tmp)			
Output type	SDI-12 communication bus			
Diameter	Top: 30 mm Bottom: 28.75 mm	Top: 30 mm Bottom: 27.5 mm	Top: 30 mm Bottom: 26.25 mm	Top: 30 mm Bottom: 25 mm
Soil type	Mineral			
Cable	Five metres protected with corrugated tube			
Maximum distance	50 metres between the sensor and the AgroBee-L / A-2500 / A-5500			

Sensor	Reading range	Precision
Soil moisture content	0 - 100%	± 0.03% volume
Temperature	-20ºC to +60ºC	± 2ºC to 25ºC
Conductivity	0 - 10000	-

Sensor parts

The following image shows the parts of the sensor and the volumes of soil measured by each sensor of the Drill&Drop probe (for example, six integrated bi-sensors along 60 cm).



Installation

When selecting the location of the multi-sensor, it is very important to remember that the volume of soil in contact with it has the greatest influence on the sensor reading. Any air pocket or excessive compaction around the multi-sensor can also influence the measurements taken. Avoid creating preferential channels for water to pass between the sensor and the volume of soil in contact.

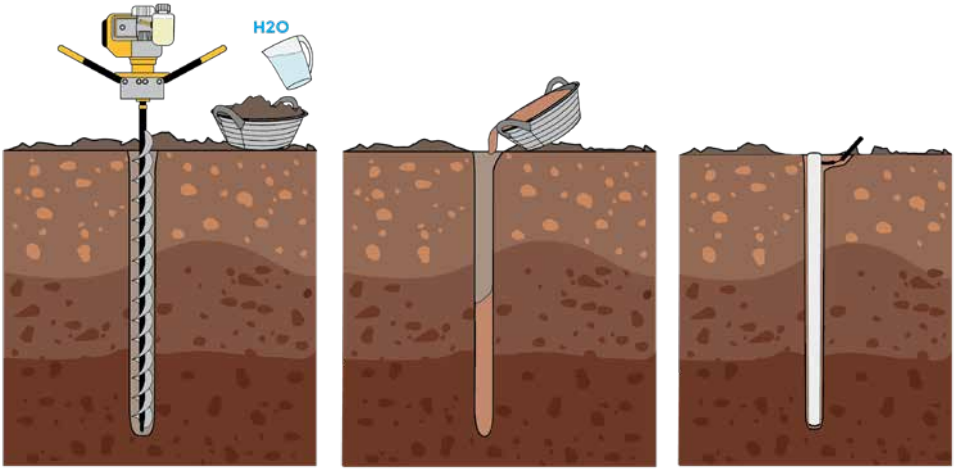
IMPORTANT

Do not install the multi-sensor in contact with any metal surface, since the sensor's electro-magnetic field may be attenuated and therefore affect the measurement result.

Recommendations to always take into account:

- Take the diameter of the soil particles around the multi-sensor into account and make sure there are no large stones that could negatively affect the measurements.
- Maximise the contact between the multi-sensor surface and the soil at the time of installation. The more homogeneous the terrain, the more precise the measurements that can be taken.

INSTALLATION WITH AN AUGER OR BORING TOOL



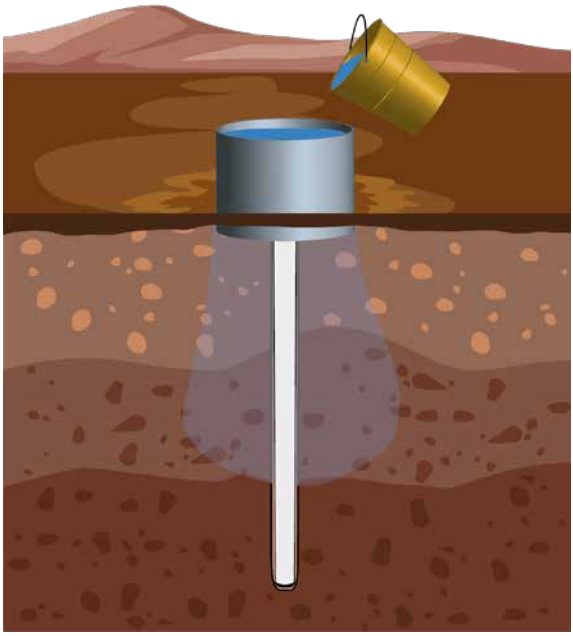
1. Using an auger, drill the soil at the point where the probe is to be installed. Use a 30 mm diameter drill bit to maximise contact with the soil walls and ensure that the drilling is as vertical as possible.
2. After drilling the hole, prepare a liquid mud with the soil extracted from the hole, finely sieved and mixed with water.
3. Pour the mixture into the hole.
4. Insert the sensor into the hole until the junction box is at ground level, without removing the protruding mud.

SOIL INFILTRATION

Once the sensor is installed, it is recommended to infiltrate the soil to achieve saturation and thus be able to view the field capacity value from the programmer.

This infiltration varies with soil texture and will be faster in sandy soils and slower in clay soils.

A ring-shaped container with a diameter and a height of approximately 30 cm is needed. You will also need a bucket of about 50-litre capacity to pour water into the container.



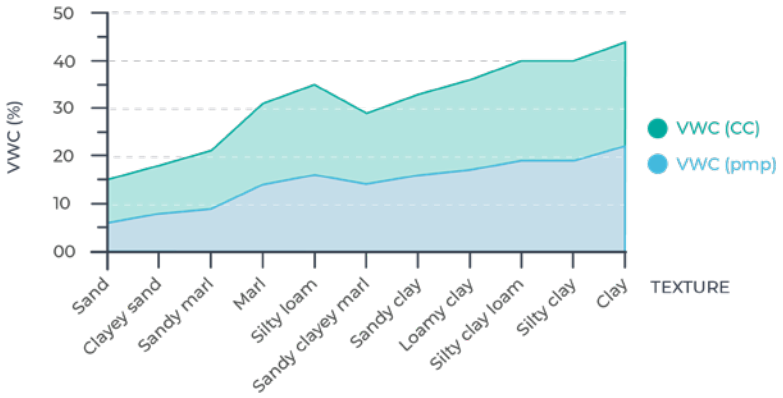
The steps to follow to infiltrate the soil are:

- Place the container in the centre where the Drill&Drop probe is located and bury it about 10 cm.
- Pour 50 litres of water inside the ring in different doses and as the water infiltrates. This operation will take more or less time depending on the type of soil.
- Observe, through the programmer, the reading in % of water content in the soil of each of the sensors at different depths. The expected saturation values for each soil must be higher than the values marked as FC (Field Capacity) in the following table.

Indicative values of the type of soil texture for:

TEXTURE	VWC (FC) % Field capacity	VWC (pmp) % Wilting point	CRAD % Available water retention capacity
Sand	15	6	9
Clayey sand	18	8	10
Sandy marl	21	9	12
Marl	31	14	17
Silty loam	35	16	19
Sandy clayey marl	29	14	15
Sandy clay	33	16	17
Loamy clay	36	17	19
Silty clay loam	40	19	21
Silty clay	40	19	21
Clay	44	22	22

Source: New Mexico State University Climate Centre

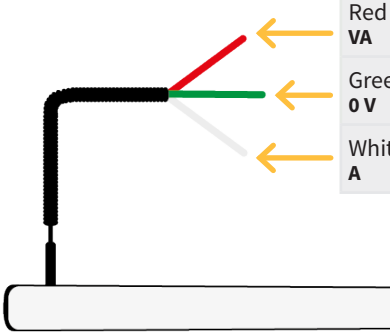


REMOVING THE MULTI-SENSOR

If this sensor is used in different reading points, make sure that the soil is moist before extracting the multi-sensor. The multi-sensor must never be removed by pulling on the cables, as this may damage the internal electronics and render it unusable. Depending on how it is installed, it may be necessary to dig around it, carefully, in order to remove it without damage.

Connections

The Drill&Drop sensor can be connected to the AgroBee-L SDI-12/Nutri module and to the Agrónic 2500/5500 with SDI-12 option. A cable hose is provided for each unit that enables the different connections to be made easily with no need to access the inside of the module. All of the units use the following colour legend:

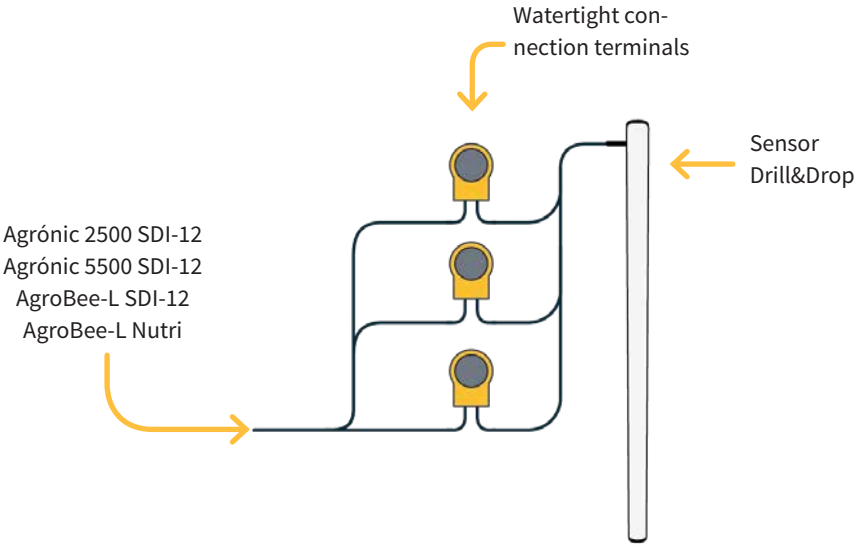


	8 sensors A2500/A5500 SDI-12	*1 sensor* AgroBee-L SDI-12	*1 sensor* AgroBee-L Nutri
Red **VA**	Blue	Green	Grey/pink
Green **0 V**	Brown	White	Black
White **A**	Yellow/green	Brown	Violet

NOTE It is recommended that the cables that remain loose are also connected with a spare 3M connector to avoid possible short circuits or getting wet. These connectors are supplied together with the sensor.

To ensure the water tightness of the module's hose wire connections, it is recommended to use waterproof terminals. The connection through these terminals must be made without stripping the cable wires.

As connection elements, those of the 3M Scotchlok series (www.3m.com) can be used; ES Caps from TYCO Electronics (www.tycoelectronics.com); or the Cellpack splicing and resin diversion kits (www.cellpackiberica.com).



Compatibility table

AGRÓNIC 2500	AGRÓNIC 4000	AGRÓNIC 5500	AGRÓNIC 7000	AGRÓNIC BIT
+ option SDI-12		+ option SDI-12		
✓		✓		

AGROBEE-L	AGROBEE	A. MONOCABLE	AGRÓNIC RADIO
+ AgroBee-L SDI-12 or Nutri			
✓			

Sensor configuration

The sensor acts by delivering a current or a voltage proportional to what it measures. The format indicates the sensor units and the relationship between the voltage read by the input and the sensor reading values.

A format with at least two calibration points needs to be configured for the sensor calculation and is configured from the programmer menu as follows.

Go to:

Function | Settings | Analogue Sensors | Formats (Always validate with the Enter key)

Once in the "**Formats**" menu, configure the settings as shown in the table.

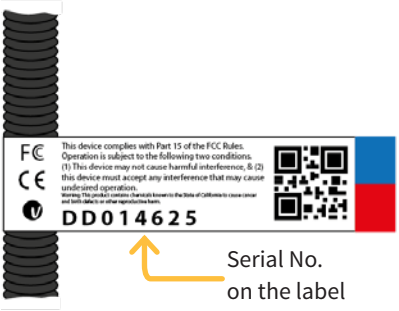
- For A-2500 and A-5500 units, choose format numbers between 22 and 31.
- For the AgroBee-L SDI-12 and AgroBee-L Nutri models, the formats are auto-assigned when the analogue sensor is configured.

Drill&Drop sensor format				
Setting	Default value			
	Value 1	Value 2		Value 3
	VWC [%]	VIC [](1)	EC [dS/m](2)	Tempera-ture [°C]
No. of integers	3	5	1	2
No. of decimals	1	0	3	1
Sign	no	No	No	Yes
Units	%	-	dS/m	ºC
Calibration Point 1				
Real value	800 mV	800 mV	800 mV	800 mV
Logical value	000.0%	0	0.660 dS/m	-20.0ºC
Calibration Point 2				
Real value	4000 mV	4000 mV	4000 mV	4000 mV
Logical value	100.0%	10000	7.660 dS/m	+60.0ºC

(1): VIC (Volumetric Ion Content): Only available on the TriScan model. Not applicable on the AgroBee-L NUTRI

(2): EC (Electrical conductivity): Only available on the TriScan model when the serial number is greater than 13000. Only for sandy and sandy loam soils with low ion exchange capacity. Not applicable on the AgroBee-L NUTRI.

The serial number can be found on the following parts of the sensor:



Troubleshooting

THE SENSOR DOES NOT RESPOND

- Check the supply voltage that the device (AgroBee-L or AgroBee) supplies to the sensor.
  - If the voltage is **equal to or greater than 10 V**, it is correct.
  - If the voltage is **less than 10 V**, there is an over-consumption and the problem is possibly in the sensor or sensors.

To check this voltage in the same module, a Module Reader is needed (only in AgroBee-L) and it is carried out as follows:
ENT. QUERY DIG.-ANAL. | VDC SENSORS

- Check that the connection is correct according to the table detailed in this manual (page 6).

SENSOR READING (%) TOO HIGH

- Check that the soil is not too compacted during installation. Too high a density can cause the sensor reading to be higher.
- Make sure that the soil that has been configured is correctly selected on the device where it will be connected. Each soil needs a specific calibration equation.

SENSOR READING (%) TOO LOW

- Check that there are no air pockets around the sensor body.
- Make sure that the soil that has been configured is correctly selected on the device where it will be connected. Each soil needs a specific calibration equation.

Further information

VIDEOS FOR INSTALLATION WITH AUGER AND SENSOR REMOVAL

For further information about the sensor, please see the manufacturer's generic video:

https://youtu.be/BAqgKxR0-_Q

For further information about the sensor, please see the manufacturer's generic video:

https://youtu.be/u31l0vPW514

Sistemes Electrònics Progrés, S.A.
Polígon Industrial, C/ de la Coma, 2 | 25243 El Palau d'Anglesola | Lleida | España
Tel. 973 32 04 29 | info@progres.es | www.progres.es
R-2381