SISTEMES ELECTRÒNICS PROGRÉS

Manual

Watermark Sensor

CODE 06140234

The WATERMARK sensor is a resistive device that responds to changes in soil moisture and is used to measure the water tension in the soil.

It is made up of two concentric electrodes recessed in a special conglomerate supported by a synthetic membrane and encapsulated in a stainless steel sheath.

Soil water is an electrical conductor that provides a relative value of the soil moisture status.

As the soil dries out, water is removed from the sensor and the resistance value increases. On the contrary, when the soil is moist, the resistance decreases.

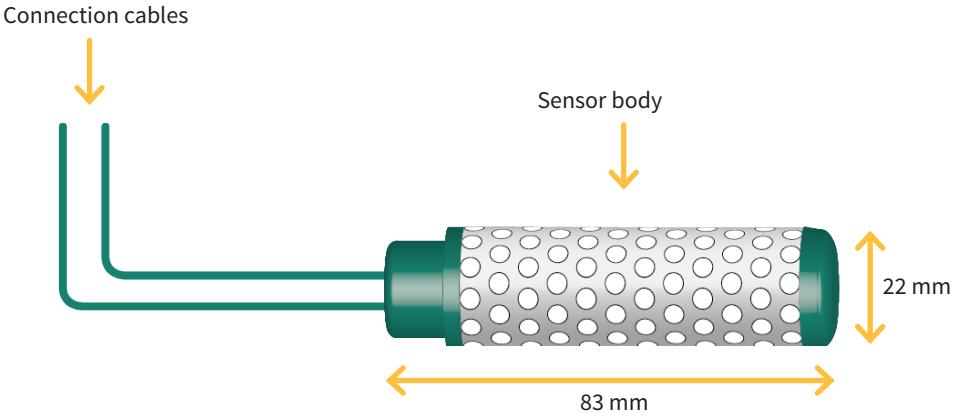
The reading of this sensor is expressed in centibar of water tension in the soil.

Technical specifications

Dimensions	Length: 83 mm - Diameter: 22 mm
Weight	0.067 kg
Reading range	0 to 239 cbar
Cable length	1.5 metres
Soil type	Any

Sensor parts

The following image shows the parts of the sensor and their measurements.



Installation

When selecting the location of the 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 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.

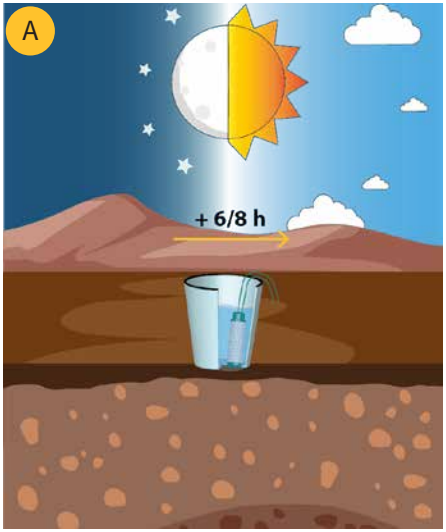
IMPORTANT

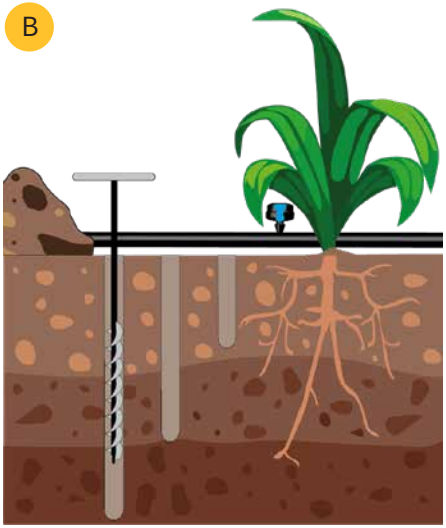
Do not install the sensor in contact with any metal surface, since the sensor's electromagnetic field may be attenuated and therefore affect the measurement result.

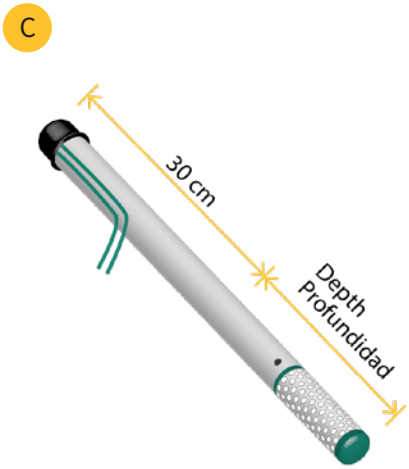
Recommendations to always take into account:

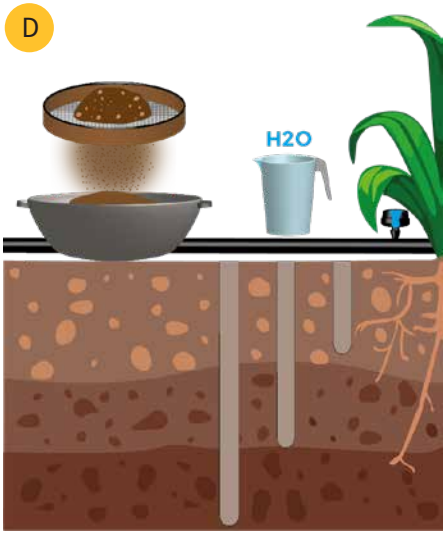
- Take the diameter of the soil particles around the sensor into account and make sure there are no large stones that could negatively affect the measurements.
- Maximise the contact between the sensor surface and the soil at the time of installation. The more homogeneous the terrain, the more precise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

INSTALLATION WITH DRILL









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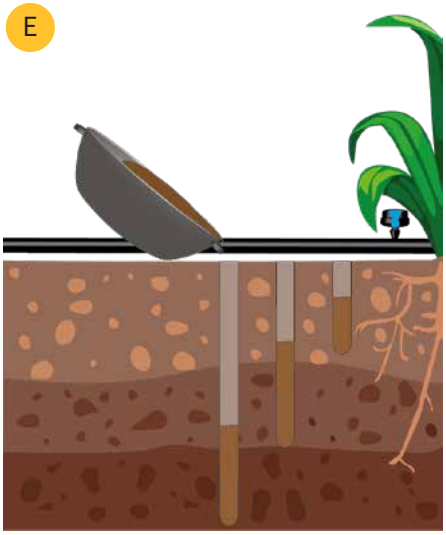

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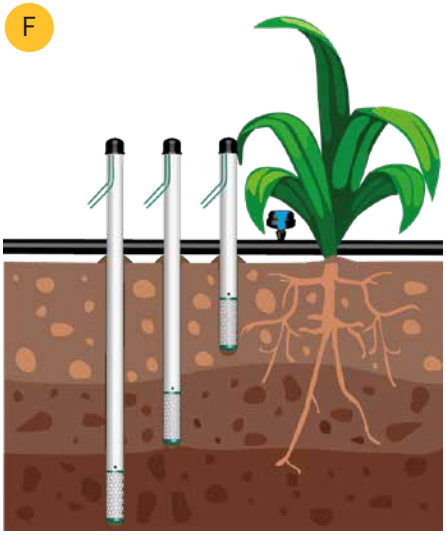


1. Submerge the Watermark sensor in a container of irrigation water overnight so that it is moist and thus responds better to the first irrigations. A
2. Use an auger/drill and a 22 mm drill bit to drill the soil at the point where the probe is to be installed and to the desired depth. The hole must be made at a distance of 15 cm from the drip emitter and 25 cm from another Watermark sensor. B
3. Store the extracted soil in a container to mix it with water later.
4. Take a PVC pipe with a diameter similar to that of the sensor (22 mm) and a length of 30 cm + the depth at which it is installed (for example, if it is installed at a depth of 20 cm, the PVC pipe will be 50 cm). C
5. Make a 6 mm hole approx. 2 cm from the end of the pipe where the sensor will be installed, so that any water trapped in the pipe can drain.
6. Install the sensor at the end of the PVC pipe (where the hole has been made) and pass the cables inside.
7. At the other end of the tube, remove the sensor cables and seal it with a plug or insulating tape to prevent water from entering the tube and giving a false reading.
8. Sift the soil extracted at point 2 and prepare a mud paste by mixing with water to obtain a liquid texture. D
9. Pour the mixture into the hole where the probe is to be installed. E
10. Insert the sensor and observe how it protrudes forming a seal between the soil and the PVC pipe. F
11. If there are more sensors, repeat the steps from the beginning.

WATER RETENTION THRESHOLDS IN THE SOIL

Maximum: Field capacity

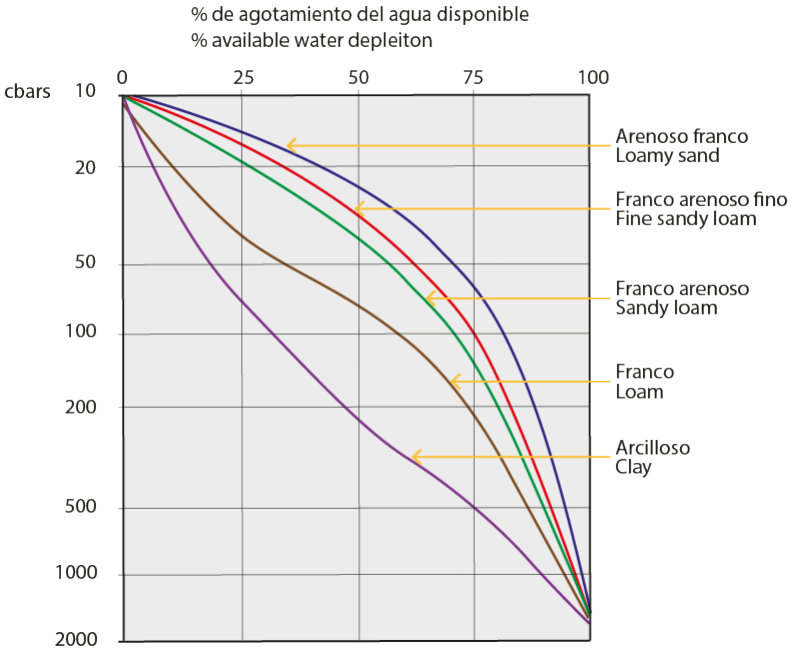
It is the water content in the saturated soil after heavy irrigation is applied and when the drainage rate changes from fast to slow. This point is achieved when all gravitational water has been drained and all spaces are filled with water. Field capacity is normally achieved two or three days after irrigation when the soil water tension is approximately 0.3 bar (30 cbar or 3 m water column) in clay soils or 0.1 bar in medium-texture soils.

Minimum: Permanent wilting point

It is the water content in the soil at which plants cannot recover and wilt even when sufficient moisture is added. This parameter can vary depending on the plant species and soil type and is determined by greenhouse experiments. This point is reached when the water tension in the soil reaches approx. 15 bar.

Available water: the water retained between the field capacity and the permanent wilting point.

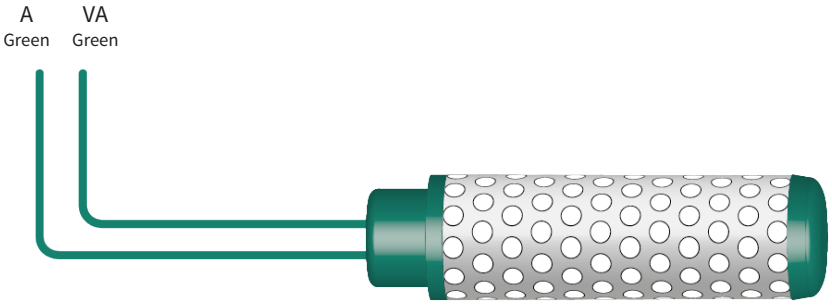
Tension curves - depletion of available water according to soil type:



Connections

The Watermark sensor can be connected to the Watermark, AgroBee and AgroBee-L model Watermark transmitter. A terminal/connector or 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 unit. They all use the following colour legend:

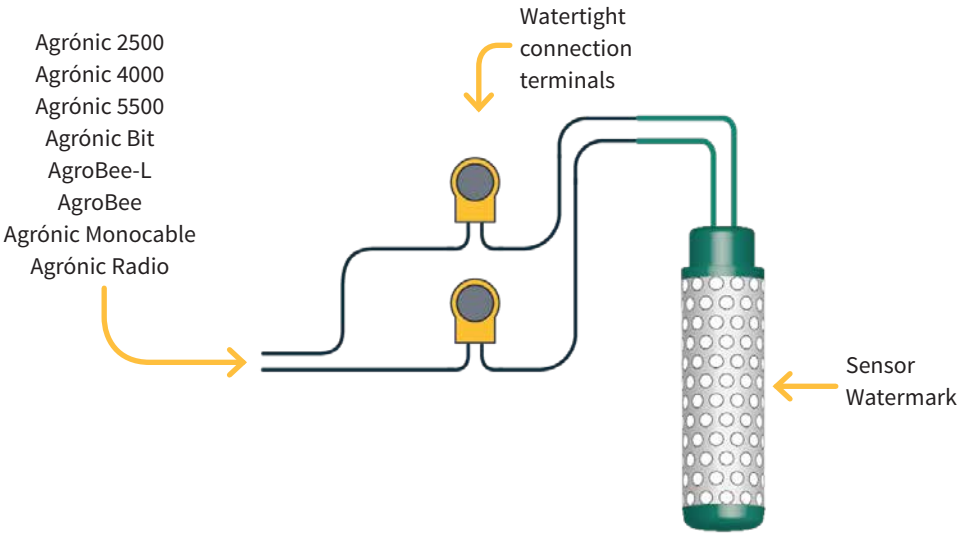
	3 sensors AgroBee-L Watermark	*3 sensors* AgroBee Watermark	*3 sensors* Transmitter 3 Watermarks
Green **A**	A1	A2	A3
Green **VA**	V1	V2	V3



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
+ 3 Watermark transmitter	+ 3 Watermark transmitter	+ 3 Watermark transmitter	+ 3 Watermark transmitter	+ 3 Watermark transmitter
✓	✓	✓	✓	✓

AGROBEE-L	AGROBEE	A. MONOCABLE	AGRÓNIC RADIO
AgroBee-L Watermark	AgroBee Watermark	+ 3 Watermark transmitter	+ 3 Watermark transmitter
✓	✓	✓	✓

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, A-4000, A-5500 and A-Bit units, choose format 3 (cbar).
- For the A-7000 unit, choose format 13 (cbar).
- For AgroBee / AgroBee-L Watermark models, the format is auto-assigned when the analogue sensor is configured.

Watermark sensor format	
Setting	Format 3
	Humidity [cbar]
No. of integers	3
No. of decimals	1
Sign	no
Units	cbar
Calibration Point 1	
Real value	800 mV
Logical value	000.0 cbar
Calibration Point 2	
Real value	4000 mV
Logical value	239.0 cbar

Troubleshooting

THE SENSOR DOES NOT RESPOND

- Check the supply voltage that the device 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.
- Check that the AgroBee, AgroBee-L and A-Radio devices have a minimum power-on time of 1 second configured.
- Check that the connection is correct according to the table detailed in this manual (page 7).

INCORRECT SENSOR READING

- Check the sensor.
  - Partially immerse the sensor in water for at least 30 minutes. The sensor reading after this time should be between 0 and 5 cbar.
  - Let the sensor air dry for 30 to 48 hours. Depending on the ambient temperature, humidity and air movement, values from 0 to 150 cbar or more will have to be read during this time.
  - Put the sensor back in water and the reading should be between 0 and 5 cbar again after 5 minutes.
  - If all the above points are correct, it means that the sensor is in perfect condition.
- Check the sensor installation.
  - The sensor may have air pockets around it. This can happen when the hole made to install the sensor is too big. Re-installing the sensor somewhere else nearby should fix the problem.
  - The sensor may be installed outside of the active root area or irrigation water is not reaching the sensor area. This can happen if the sensor is installed on rock or under a hardened impermeable layer of soil. Re-installing the sensor somewhere else nearby should fix the problem.
  - If the soil dries out to the point where readings greater than 80 cbar are observed, contact between the sensor and the soil may be lost. If irrigation only partially re-wets the soil (soil suction above 40 cbar), it will not fully re-wet the sensor and this can result in consistently high readings. Thoroughly re-wetting the soil and the sensor usually restores contact. This is most often seen on heavier soils during periods of peak crop water demand, when irrigation may not be sufficient. Plotting the readings on a graph provides the best indication of this type of behaviour.

Further information

VIDEO FOR INSTALLATION WITH DRILL

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

https://youtu.be/GnpsO97a9lE

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