

Ceres CS1 Soil Sensor



TENETICS, LLC

Advanced Wireless for Agriculture

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Getting Started

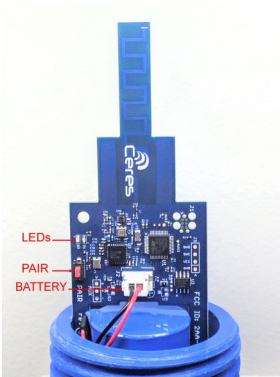
Congratulations on selecting Ceres for your precision agriculture needs. This manual will help you get your CS1 Soil Sensor installed and running in less than 5 minutes.

Overview



The CS1 Soil Sensor is an advanced wireless data logger, sensor, and controller designed for agriculture. The self-contained system measures soil moisture and temperature levels every 15 minutes and transmits them to a Ceres Gateway using proprietary long-range wireless technology. Ceres Gateways forward your data to secure online storage which can be accessed any time using your smart-phone or computer.

Controls



Unscrew the top (cap) to access the sensor controls.

- LEDs show the sensor status
- PAIR button is used to activate the sensor and pair it with a gateway
- The white BATTERY connector is used to connect the battery or disconnect it for shipping/storage

Avoid exposing the electronic controls to

Adding (Pairing) a new sensor: as easy as 1,2,3

Bring your new sensor to your installed Ceres gateway and:

1. Plug the sensor's battery into the connector as shown in the Controls section. Make sure the red wire is by the + symbol.
2. Press and release the yellow PAIR button on your Ceres gateway to enter pairing mode; the yellow light will start blinking to show the gateway is in pairing mode.
3. Press and release the PAIR button on your Ceres CS1; after 2-3 seconds, the yellow LED on the CS1 will blink several times to indicate successful pairing.
4. Repeat step 3 if needed.

Screw the CS1 cap on tightly and you're ready to deploy your sensor.

Location and Deployment

Your CS1 should be located in soil with the same drainage and exposure as the crops to be monitored. Prepare the soil exactly as you would for a seedling: augur the soil to create a planting hole, remove rocks and sticks, insert the probes fully into the soil until the base of the sensor is flush with the ground. Pack soil back into the hole to eliminate large air pockets.

For accurate moisture readings, the soil around the sensor must hold water in the same way as the soil around your crops and soil must fill the space between the probes.

Pro Tips:

- For tall crops, place a fiberglass marker next to the sensor.
- Remove the sensor before cultivating or harvesting.
- **Do not** hammer or force the sensor into the ground

Advanced Installation

Use the Ceres app for Android for easier management of your paired CS1 devices. The app helps you name your sensors as you install them and automatically records their GPS location on the map display.

- Launch the Ceres App
- Select Equipment->Sensors->Install
- Scan the QR or bar code on your sensor
- Give your sensor a name (e.g. Cabbage Patch)
- Press Install and deploy your sensor.

Wireless Link Test

Press and release the PAIR button on your paired CS1 and it will transmit a message to the gateway; the gateway will then transmit a response to the CS1. The yellow LED on the CS1 will blink 1-5 times to indicate the strength of the 2-way wireless link.

Storage

At the end of the season, you may remove and store your CS1 sensors. Carefully remove the sensor from the ground, loosening the soil first if it has become compacted. You may also disconnect the battery to save power. Clean the sensor with running water before opening it and replace the cap before storing. Do not get water or soil inside the CS1.

Un-Pairing

To permanently un-pair a sensor from a gateway, bring the sensor near the gateway and press and hold the PAIR button on the sensor for 5-10 seconds. The LED will blink twice to show that un-pairing is complete.

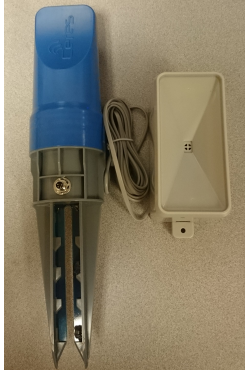
Rain Gauge Option

Rainfall varies considerably over small areas and understanding the natural irrigation your crops have received will help you optimize irrigation. Without a rain gauge, Ceres uses the nearest weather station data, but measuring the rainfall directly on your farm is the most accurate solution.



If your CS1 includes the optional rain-gauge (krg) feature and connector, you can use it to log and report rainfall for your farm:

1. mount the rain gauge on a pole in a suitable location where it will receive unobstructed rainfall.
2. For trouble-free operation, cover the drainage holes on the bottom of the gauge with mesh netting to keep bugs out.
3. Deploy your paired CS1 near the rain gauge as described above.
4. Connect the rain gauge to the CS1 external connector: carefully align the 4 pins of the connector, push gently to seat the pins, then rotate the outer shell clockwise until finger-tight.



Valve Control Option

The valve control option allows your CS1 to remotely control drip-irrigation **with no additional batteries or wires**.

When the soil is too dry (according to a threshold you set), the valve is opened to allow water into your drip-irrigation system. When soil moisture levels are sufficient (according to another threshold you set), the valve is closed.



To deploy a Ceres valve:

1. Install a Ceres valve between your water source and drip-irrigation tape.
2. You **MUST** install a suitable filter between your water source and the valve (you should do this with any valve because sand and other debris can cause it to jam or fail resulting in over-watering). Valves and filters should be regularly inspected and cleaned.
3. Connect the valve wire to the CS1 external connector: carefully align the 4 pins of the connector, push gently to seat the pins, then rotate the outer shell clockwise until finger-tight.



IMPORTANT: Ceres uses high-quality brass and stainless valves, but any mechanical valve can jam or fail. While Ceres makes every effort to alert you to failures, it is ultimately the responsibility of the user to ensure that irrigation controls are inspected regularly and working properly.

Specifications

Power

- A lithium primary battery supplies power for years of reliable operation and will exceed the life of the sensor.

Physical

- 12.5" x 2.5" and 250g
- -40 to +85C operating temperature range
- IP67 rated for outdoor use

Wireless

- Long range sub-GHz frequency band
- Secure frequency hopping spread spectrum (FHSS)
- Advanced filtering resists cellular and pager interference

Sensing

- Non-contact VHF soil moisture sensing for >5% accuracy.
- Soil temperature sensing at 2" and 4" depths. +/-1C accuracy.

Processor

- 32-bit microprocessor with 4Mb flash storage
- Digital encryption and authentication

FCC Notice

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

Changes or modifications not expressly approved by the party responsible for compliance could void your authority to operate the equipment.

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:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

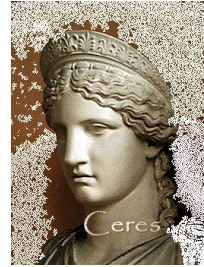
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Who we are

Tenetics is committed to bringing precision agriculture to small and medium-sized farms. Our Ceres wireless products help you monitor and manage your farm from your computer or smart-phone.

Ceres is designed for agriculture:

- Easy installation
- Maintenance free
- Long wireless range
- Wide operating temperature
- Rugged outdoor reliability



Ceres (Demeter) was the Greek and Roman goddess of agriculture. “Cereal” comes from her name.

Contact Us

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