



# SOIL MOISTURE MONITORING

Optimizes plant growth by monitoring the root zone environment including soil moisture vs. depth profile, salinity (EC) and temperature. Use Soil Moisture Monitoring in irrigated farms to maximize irrigation performance and better manage the application of expensive nutrients. Use in any farm to plan and execute operations on the right fields at the right times.

## Applications

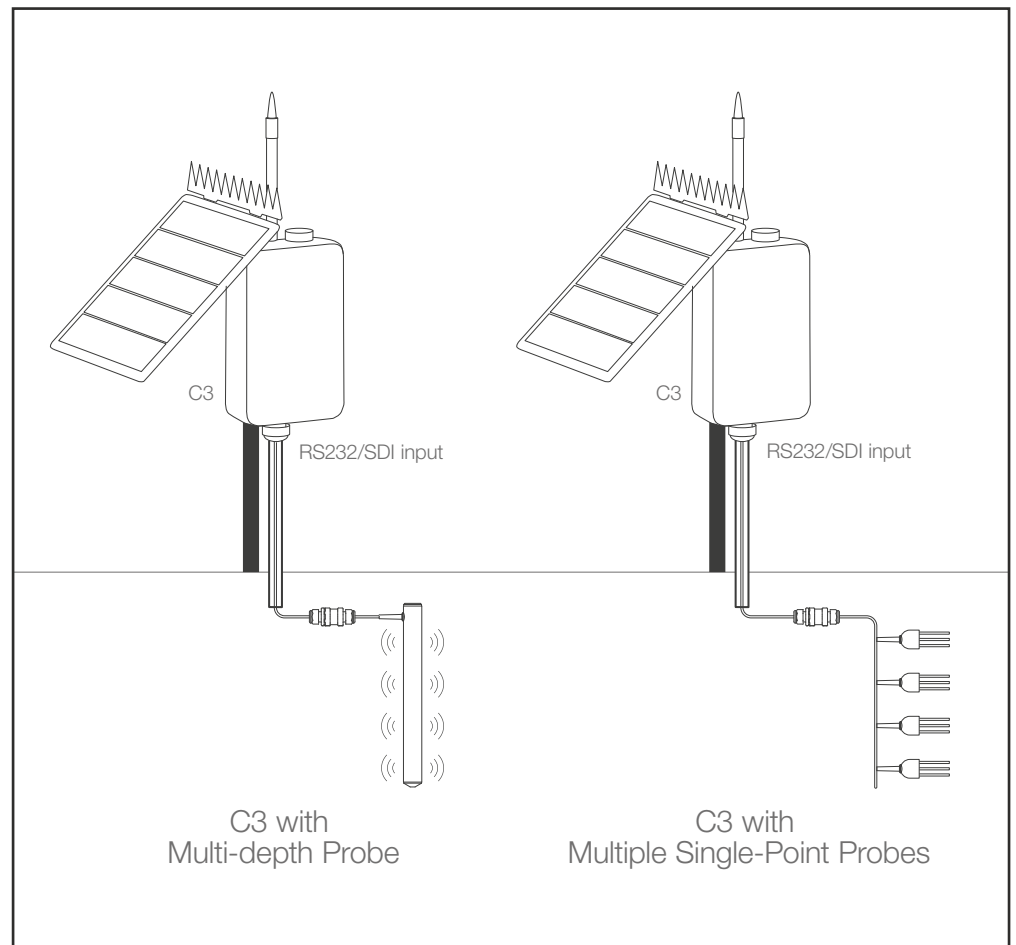
- Irrigation management.
- Nutrient management.
- Timing of field operations.
- Runoff/percolation management.

## Related Solutions

- Irrigation System Health Monitoring.
- Irrigation Scheduling.
- Weather & Environmental Monitoring.

## Observant Platforms

- C3 Gateway.
- C3 Cell.
- C3 Node.
- Solo Cell.



# I/O Type and Connection

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All communication between Observant telemetry platforms and soil moisture probes is through the SDI-12 serial port. Multiple probes can be connected to a single C3 or Solo in a daisy chain configuration. When multiple SDI-12 devices are interfaced with a single C3, it is critical that each device be programmed with a unique address. See the following Observant Technical Note: OBS-USR-TN002 EnviroPro Soil Moisture Probe with C3.

# Capabilities: Soil Moisture Measurement

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## Single vs. Multi-Depth (“Profile”) Probes

Single-position soil moisture can be measured using a single-point capacitance probe, such as the Decagon GS3 or the Stephens HydroProbe II. Moisture can be measured at several positions (depths) in the root zone using a multi-depth probe, such as the Envirotek EnviroPro probe or the AquaCheck Subsurface probe. To measure at multiple depths using a single-point probe, multiple probes must be used.

## Moisture Probe Locations

Divide the farming operation into logical Management Units, where each management unit covers an area of uniform soil type, crop, climate and irrigation method. Examples could be a single block in a drip irrigated field, or a single circle in a center pivot irrigated field. Each management unit should contain a soil moisture probe in the crop root zone at a location that is representative of the entire unit.

## Root Summary

At each moisture probe location, multiple readings can be obtained indicating soil moisture at multiple depths within the root zone profile. To make irrigation decisions, the multiple readings must be mathematically combined into a single number, which represents root zone water content at that location. This is accomplished by calculating a weighted average of readings at each depth, referred to as the “Root Summary”. Weights are specified to produce a Root Summary reading that is appropriate for the geometry of the root zone. Weights can be changed throughout the season as the size of the root zone increases. The Observant platform automatically calculates and plots the Root Summary at each location based on weights that have been input by the user. If no weights are specified, sensor readings at all depths are weighted equally.

## Using Soil Moisture to Plan Irrigation

Soil Moisture is used to plan irrigation through the following process:

1. Determine the Root Summary value for a single probe that corresponds to “Field Capacity.” This can be accomplished by irrigating the root zone to saturation, then recording the Root Summary reading after allowing excess water to drain.
2. Set the upper management boundary (top end of light blue “Full” band) in the Crop Manager screen within Observant Global to the value measured in (1) by clicking on the upper left hand corner of the Root Zone Average graph.
3. Determine the Root Summary value which corresponds to the onset of stress. This is the lowest soil moisture value which supports healthy growing conditions, and soil moisture below this level causes plant stress. Determining this value must be done by observing when the soil has become dry enough to be ready for another irrigation cycle, and may require digging into the root zone.
4. Set the lower management boundary (bottom of the light red “Refill” band) in the Crop Manager screen within Observant Global to the value measured in (3) by clicking on the upper left hand corner of the Root Zone Average graph.
5. Set the management lines corresponding to the top and bottom of the green “Normal” band by selecting values slightly below the Full line set in (2) and slightly above the Stress Onset line set in (4) respectively.
6. Monitor Root Summary vs. time for each management unit via the Crop Manager. For each irrigation event, initiate irrigation when moisture approaches the bottom of the green Normal band and run irrigation long enough to bring moisture close to the top of the band.
7. As irrigation data is collected it can be used by the Observant platform to predict the next time irrigation should be initiated and how much runtime will be required.

## Other Uses for Soil Moisture

In addition to planning irrigation, soil moisture data has many other uses, including:

- Managing deficit irrigation.
- Monitoring soil moisture below the root zone to manage or document percolation/leaching.
- Monitoring soil moisture at the field perimeter to manage or document runoff.
- Ensuring field conditions can support mechanical operations such as planting, spraying and harvest.



## Capabilities: Soil EC Measurement

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Many capacitive soil moisture probes also measure soil EC (salinity), and this information can be accessed by the Observant Global platform through the same SDI-12 connection as soil moisture. EC information can be valuable when growing salt-sensitive crops, especially when using drip irrigation in dry climates where root zone salinity must be actively managed.

EC measurements can also be useful when applying nutrients and other chemicals throughout the season, as most fertilizers directly impact soil salinity. EC measurements can help avoid overuse of fertilizers and damage to salt-sensitive crops by overapplication of chemicals such as sodium hypochlorite.

## Capabilities: Soil Temperature Measurement

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As with EC, many capacitive soil moisture probes also measure soil temperature. Soil temperature can be an important factor in planning germination time and nutrient applications.

## Supported Devices

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- EnviroPro Multi-Depth Capacitance Probe.
- Aquacheck Multi-Depth Capacitance Probe.
- Decagon GS3 Single-Point Capacitance Probe.
- Stephens HydraProbe II Single-Point SMS.