

WATERMARK Soil Moisture Sensor with Voltage Output – MODEL 200SS-V

IRROMETER®

The WATERMARK 200SS-V voltage output sensor is an innovation that combines the patented WATERMARK soil moisture sensor with an integral electronic adapter. This feature provides a linear voltage output which makes the sensor very easy to read by most data loggers or devices that can read a voltage signal. The voltage output signal is temperature compensated and directly proportional to the soil water tension measurement. This value represents the energy a plant's root system uses to draw water from the soil.

In use since 1978, the patented WATERMARK sensor is a solid-state electrical resistance sensing device. The sensor consists of a pair of highly corrosion resistant electrodes that are imbedded within a granular matrix. As the soil water tension changes with water content, the resistance changes as well. The sensor translates the resistance value into a linear voltage output which can be read by a compatible reading device. The reading device can then be configured to display the voltage output in centibars (cb) or kilopascals (kPa) of soil water tension.

OPERATING PRINCIPLE:
The WATERMARK sensor is a resistive device that responds to changes in soil moisture. Once planted in the soil, it exchanges water with the surrounding soil thus staying in equilibrium with it. Soil water is an electrical conductor thereby providing a relative indication of the soil moisture status. As the soil dries, water is removed from the sensor and the resistance measurement increases. Conversely, when the soil is rewetted, the resistance lowers.

The WATERMARK sensor is unique in that it takes its resistive measurement within a defined and consistent internal matrix material, rather than using the surrounding soil as the measurement medium. This unique feature allows the sensor to have a stable and consistent calibration that does not need to be established for every installation.

The relationship of ohm of resistance to centibars (cb) or kilopascals (kPa) of soil water tension is constant. The 200SS-V is internally temperature compensated and converts the resistance value to a voltage output. Compatible reading devices such as a data logger can be calibrated to report soil water tension, or matric potential, since that is the best reference of how readily available soil water is to a plant. The WATERMARK sensor consists of stainless steel electrodes imbedded in an internal granular matrix material that acts like a soil in the way it moves water. This matrix is encased in a hydrophilic material that establishes good hydraulic conductivity with the surrounding soil and is held in place by a durable stainless steel perforated shell with plastic end caps.

SPECIFICATION INFORMATION: The soil moisture measurement device, or sensor, shall represent soil moisture status in units of soil water tension or matric potential, registering in centibars (cb) or kilopascals (kPa) when read with a compatible device using a linear voltage scale. Its construction shall be of the Granular Matrix Sensor (GMS) type and require no on-site calibration

The WATERMARK is designed to be a permanent sensor, placed in the soil to be monitored and "read" as often as necessary with a portable or stationary device. Internally installed gypsum provides some buffering for the effect of salinity levels normally found in irrigated agricultural crops and landscapes.

Features:

- Proven stable calibration
- Inexpensive, easy to install and use
- Fully solid-state
- Will not dissolve in soil
- Not affected by freezing temperatures
- Internally compensated for commonly found salinity levels
- Compatible with voltage reading devices
- Range of measurement from 0 to 239 cb (kPa)
- Does not require the reading device to have a custom electronic circuit to read the WATERMARK sensor
- NO maintenance required

APPLICATIONS INCLUDE • Irrigation Scheduling • Water Table Monitoring • Leak Detection • Agronomy Research • Environmental Monitoring • Anywhere you need to know when or if the soil moisture status is changing

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Specifications –

MATERIALS: Electronic Adapter is housed inside 1/2 in. PVC pipe and pre-mounted on the WATERMARK Sensor which has ABS plastic caps with stainless steel body over a hydrophilic fabric covered granular matrix.

DIMENSIONS –

DIAMETER: .875 in. (22 mm)

LENGTH: 7.25 in. (18.5 cm)

WEIGHT: .4 lb. (181 g)

WIRE LEADS: 10 ft. (3 m), 3 conductor AWG 22 direct burial cable

ELECTRICAL: 3.2-30 volt, 1.5 mA input, polarity protected / 0-3 volt output, linear / 0-239 cb (kPa) = 0 to 2.8 volts linear / 2.9 volts = frozen fault code / 3.0 volts = open circuit fault code.

– Soil moisture readings will automatically be temperature compensated.

– When power is applied, a reading will be supplied within 500 ms.

– If power is left applied, a new reading will be provided every second.

– Once power is removed, a minimum off time of 30 seconds is required before power can be re-applied.

WARRANTY: One year

ORDERING INFORMATION: Catalog #200SS-V — WATERMARK Soil Moisture Sensor with Voltage Output

or routine maintenance. It shall be durable, long-lasting, not subject to dissolving in a wet soil environment with an outer surface of stainless steel and ABS and PVC plastic. It shall be the WATERMARK Sensor as manufactured by the IRROMETER Company, Inc. of Riverside, California.

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Installation Instructions —

SENSOR SITE SELECTION — Often more than one sensor should be placed at a given location, at varying depths. For instance, one sensor in the upper portion of the plant's effective root zone and other sensors located deeper into the root zone profile. We refer to this as a "sensing station", and it can give a better representation of the plant's uptake of water. A rule of thumb is one sensing station every 10–20 acres, however more stations may be required based on site conditions such as topography, wind and solar exposure, variations in soil type, irrigation system efficiencies, etc. See information listed below, consult our design guide, or contact us if you have questions about placement.

Note — Our recommendation for anyone using sensors for the first time is to use an adequate number of "stations" over a smaller area to begin with, to get an accurate picture. Then read them regularly over the season to learn the patterns which normally develop.

PLACEMENT —

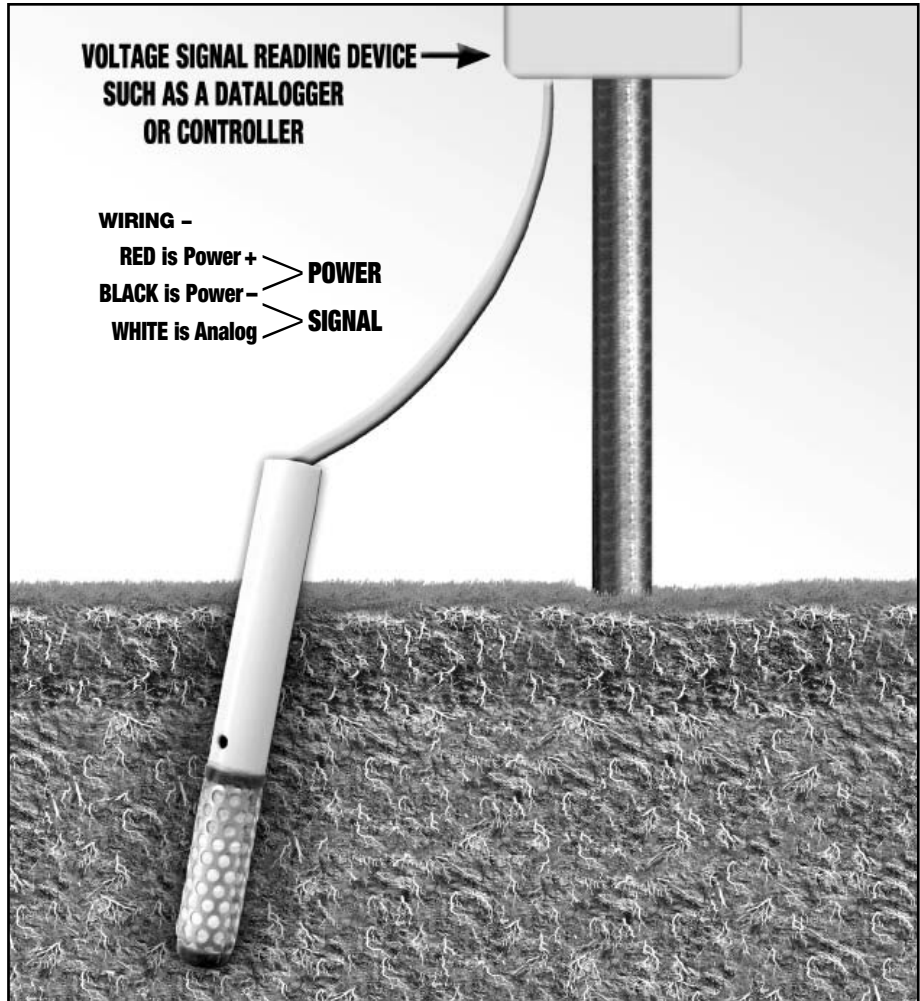
Furrow or Flood Irrigation – Locate sensing station about 2/3 the way down the run, just ahead of the tail or backup water. This is the area where water penetration is usually the poorest. With tree crops, locate sensors on the southwest side of the tree (in the Northern Hemisphere) as this side gets the hot afternoon sun.

Sprinkler Irrigation – Even though the distribution is typically more uniform with sprinkler irrigation, there can be great differences in penetration and holding capacity due to soil variations, interfaces and contour. These various sites make good locations for sensor stations. With tree crops, locate sensors at the drip line of the canopy being sure that they are not obstructed from the sprinkler's distribution. With row crops, locate sensors right in the plant row.

Center Pivot Irrigation – Place sensors at 4–5 locations down the length of the pivot (between towers) just ahead of the "start" point. Additional locations at "hot spots" (good or poor production areas of the field) can help give a better overall view of the field. Be sure to use enough "sensing stations".

Drip or Micro Irrigation – Sensors must be located in the wetted area. With drip emitters, this is usually 12–18 in. (30–45 cm) from the emitter. With micro-sprinklers, usually 24–36 in. (60–90 cm) is best. Monitor often enough to get a good overall picture of the field, or irrigation "block", and consider the soil variations which exist. Keep in mind that light soils dry very quickly and heavy soils more slowly.

DEPTH — This depends on the rooting depth of your crop, but can also be affected by soil depth and texture. With shallow rooted vegetable crops, one depth may be adequate (root system less than 12 in. [30 cm]). With deeper rooted row crops (small grains, vines and trees) you need to measure soil moisture in at least two



depths. With deep well-drained soils, crops will generally root deeper – if moisture is available. With coarse, shallow or layered soils, root systems may be limited in depth. In general, sensors must be located in the effective root system of the crop. Guidelines on proper depths for specific crops and conditions can be obtained from IRROMETER as well as your local farm advisor.

INSTALLATION — Soak the sensors overnight in irrigation water. Always "plant" a wet sensor. If time permits, wet the sensor for 30 minutes in the morning and let dry until evening, wet for 30 minutes, let dry overnight, wet again for 30 minutes the next morning and let dry again until evening. Soak over the next night and install WET. This will improve the sensor response in the first few irrigations.

Make a sensor access hole to the desired depth with an IRROMETER installing tool or a 7/8 in. (22 mm) O.D. rod. Fill the hole with water and push the sensor down into the hole so it "bottoms out". A length of 1/2 in.

PVC pipe can be coupled onto the sensor and can be used to push in the sensor. A good snug fit in the soil is important. This PVC pipe can be solvent welded to the sensor.

If the PVC extension pipe is not left on the sensor, then backfill the hole so the sensor is buried. If the PVC pipe is left on, then compact the soil around the surface to seal off the hole. The PVC pipe acts as a conduit for the sensor's wires. Label each sensor wire to indicate the measurement depth.

For very coarse or gravelly soils, an oversized hole (1–1.25 in. [25 mm – 32 mm]) may be needed to prevent abrasion damage to the sensor membrane. In this case, auger a hole to the desired depth and make a thick slurry with the soil and some water. Fill the hole with this slurry and then install the sensor. This will "grout in" the sensor to ensure a snug fit.

If sensors are removed, clean and dry them. They can be stored indefinitely in a clean, dry location. Always soak before re-installation.

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