

**Sensor Installation Instructions —**

**SENSOR SITE SELECTION** — Often more than one sensor should be placed at a given location, at varying depths, such as, one sensor in the upper portion of the plant's effective root zone and another sensor(s) 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 (4-8 hectare), 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. (30-45cm) from the emitter. With micro-sprinklers, usually 24-36 in. (60-90cm) 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. [30cm]). 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. (22mm) O.D. rod. Fill the bottom of the hole with a thick slurry made of soil removed from the hole and water, then firmly push the sensor down into the mud in the bottom of the hole. This will "grout in" the sensor to ensure maximum surface contact between the sensor surface and the surrounding soil. A length of 1/2 in. class 315 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. (See IRROMETER support sheet #952)

If the PVC extension pipe is not left on the sensor, backfill the hole so the sensor is buried. If the PVC pipe is left on, 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.

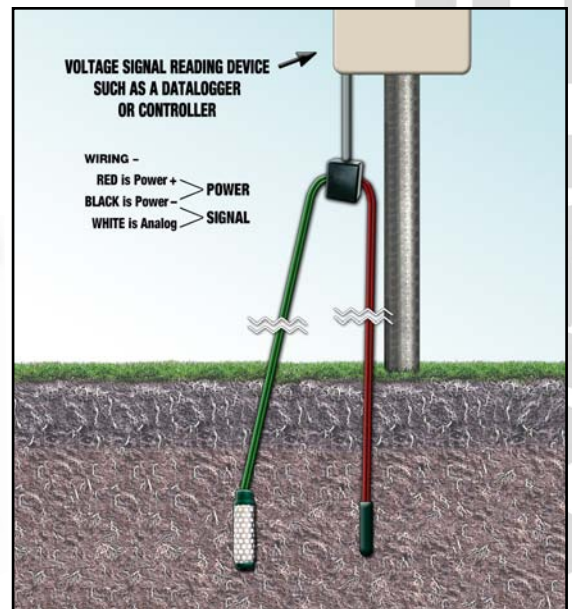
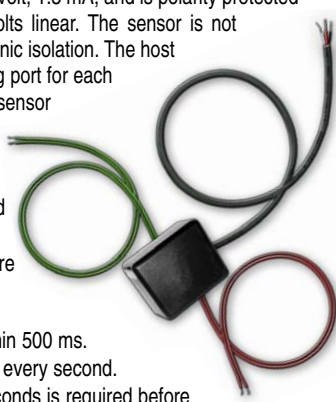
For very coarse or gravelly soils, an oversized hole (1-1.25 in. [25mm - 32mm]) may be needed to prevent abrasion damage to the sensor membrane. In this case, auger a hole to the desired depth and make a thick slurry with the soil and some water. Fill the hole with this slurry and then install the sensor.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

If sensors are removed, clean by rinsing with water and wiping with a soft cloth. Air dry and store indefinitely in a clean, dry location. Always soak before re-installation.

**200SS-VA Voltage Adapter Wiring Instructions —**

A complete assembly consists of the 200SS-VA and any 200SS Series WATERMARK Sensor. A 200TS Temperature Sensor can be added if temperature compensation is desired. The 200SS-VA is meant for use on non-earth grounded (battery powered) reading devices. Wire the WATERMARK Sensor and Temperature Sensor (if applicable) to the Voltage Adapter connecting green wires to green wires and red wires to red wires as shown in the drawing. Wire the adapter to a compatible voltage reading device using RED for (+) and BLACK for (-) and WHITE for signal as shown in the drawing. The Voltage Adapter accepts an electrical input of 3.2- 30 volt, 1.5 mA, and is polarity protected / 0-2.8 volt output, linear / 0-239 cb (kPa) = 0 to 2.8 volts linear. The sensor is not galvanically isolated and 200SS-VA does not provide galvanic isolation. The host logger must provide galvanically isolated power and analog port for each sensor to prevent cross talk between multiple sensors and sensor to earth currents. The sensor may be used singly in battery operated loggers without isolation, or in multiples if power and ground can be switched independently to each sensor. Additional circuitry may be necessary on earth grounded systems. (See 200SS-V-6 on reverse)

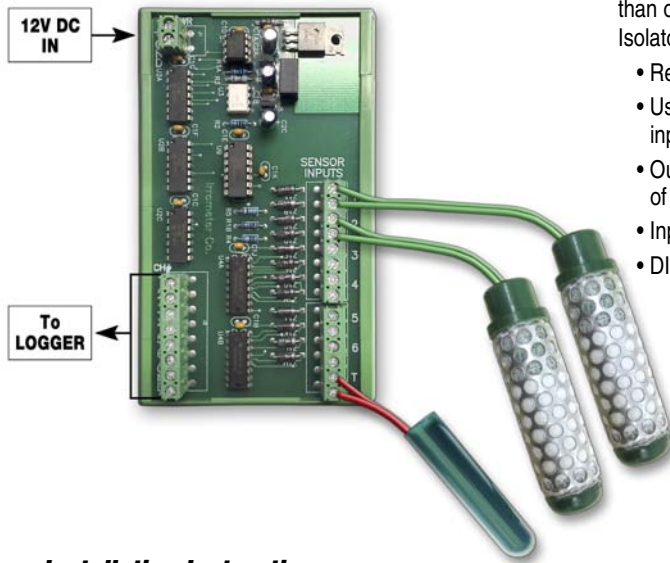
- Soil moisture readings will automatically be temperature compensated when adding a 200TS soil temperature sensor.
- When power is applied, a reading will be supplied within 500 ms.
- If power is left applied, a new reading will be provided every second.
- Once power is removed, a minimum off time of 30 seconds is required before power can be re-applied.



**WATERMARK**

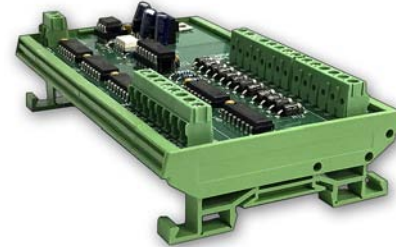
# Voltage Output Adapter for WATERMARK Soil Moisture Sensor – MODEL 200SS-VA and 200SS-V-6

## 200SS-V-6 Isolator



When using an earth grounded reading device OR when using more than one WATERMARK per reading device, the 200SS-V-6 Channel Isolator provides these features:

- Reads and galvanically isolates up to six WATERMARK sensor inputs
- Uses one soil Temperature Sensor to compensate all six WATERMARK inputs. *(Optional)*
- Outputs values just like the 200SS-VA, as a 0-2.8 volt linear reference of soil water tension from 0 to 239 centibars (kPa)
- Input 12V DC 10 mA
- DIN rail mountable



### Installation Instructions —

The Voltage Output 6 Channel Isolator (200SS-V-6) works much like 6 WATERMARK Voltage Adapters (200SS-VA) in one unit. It is designed to be installed inside a weatherproof enclosure using the DIN rail mounting hardware included with your purchase.

#### Wire:

- WATERMARK Sensors to Ports 1-6.
- Temperature Sensor (if applicable) to the port marked "T"
- Voltage output to CH #1-6 and GND
- Power terminals of your selected reading device to Input 12V DC.

The Isolator accepts an electrical input of 12 volts, 10 mA, and is polarity protected / 0-2.8 volt output, linear / 0-239 cb (kPa) = 0 to 2.8

volts linear. Up to 6 sensors are galvanically isolated to prevent cross talk between multiple sensors and sensor to earth currents.

- Soil moisture readings will automatically be temperature compensated when adding a 200TS soil temperature sensor, otherwise they will default to 75° F.
- When power is applied, a reading will be supplied sequentially on Channel 1-6 within 3 seconds.
- If power is left applied, a new reading will be provided every 10 seconds.
- Once power is removed, a minimum off time of 30 seconds is required before power can be re-applied.

WATERMARK

FT	METERS	AWG	VOLTAGE CABLE WIRING –
150	46	26	The table to the left presents recommended maximum limits for twisted cable extensions to the 200SS-VA voltage adapter or 200SS-V-6 voltage output Isolator. Following these guidelines should ensure that the voltage loss created by the wire length will not exceed 1 Centibar/kPa of the calibrated value.
200	61	24	
300	91	22	
500	152	20	This table is based on the loss to the analog signal returned from the sensor. Extending the cable also creates loss on the voltage supplied to the sensor. In order to use the table above as a guideline we recommend the minimum supplied voltage be at least 3.3V.
800	244	18	
1200	366	16	
2000	610	14	

**SENSOR WIRING** — Additional wire can be added to the sensors for long distances. Please adhere to the following wire size recommendations when adding wire:

DISTANCE	WIRE SIZE
Up to 1000 ft. (300 m)	AWG UF 18 (1.02 mm, 0.82 sq mm)
1001 to 2000 ft. (600 m)	AWG UF 16 (1.29 mm, 1.31 sq mm)
2001 to 3000 ft. (900 m)	AWG UF 14 (1.63 mm, 2.08 sq mm)

Multi-conductor wire can be used and twisted pairs are not necessary. All splices should be made with direct burial type waterproof splices, Spears DBY® or similar. Be sure to record each pair of sensor wires indicating what type of sensor is attached and the placement depth per station.

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