



HydraProbe

Reliable soil insight

HydraProbe is a rugged soil sensor with patented technology that provides continual, consistent accuracy measuring the three most significant soil parameters simultaneously—moisture, salinity and temperature.

As the most scientifically researched soil sensor available, it has been depended on by the USDA, NOAA, farmers, leading irrigation companies, and many universities for over 20 years. It's been engineered to be exceptionally rugged and will provide data you can trust year after year.



STEVENS
MEASUREMENTS TO MIND



The Science Behind HydraProbe

The HydraProbe's "dielectric impedance" measurement principle differs from TDR, capacitance, and frequency soil sensors by taking into account the energy storage and energy loss across the soil area using a 50 MHz radio frequency wave.

Unlike other soil sensors, this unique, patented method separates the energy storage (real dielectric permittivity) from the energy losses (imaginary dielectric permittivity). The HydraProbe's detailed mathematical and signal characterization of the dielectric spectrum helps factor out errors in the soil moisture measurement such as temperature effects, errors due to salinity, and soil type.

This method has passed the most rigorous scientific peer review from dozens of journals such as the Vadose Zone Journal, American Geophysical Union, and The Journal of Soil Science Society of America.

5-YEAR WARRANTY

Fully potted electronics—
fully immersible in water

**Maintains accuracy for
years with NO CALIBRATION**

Strong, non-corrosive high
grade stainless steel tines

Durable 18 gauge, UV resistant high-
density polyethylene cable can remain
buried or be exposed to the elements

Patented Sensor Technology

HydraProbe uses unique "Coaxial Impedance Dielectric Reflectometry" to provide consistent long-term accuracy of moisture, bulk EC and temperature in any soil type. This also provides low inter-sensor variability, so every sensor measures the same without the need to calibrate.



MOISTURE



SALINITY
(BULK EC)



TEMPERATURE

HydraProbe to Go

The HydraProbe Field Portable puts the power of HydraProbe in the palm of your hand.

Take soil measurements anywhere for those applications not requiring a permanent soil monitoring system. Your Apple or Android device communicates wirelessly with the HydraProbe using an ad-hoc wi-fi radio link.

Simply insert the probe into the soil, and tap on the "Sample" button in the HydroMon or POGOTurfPro app. The GPS location, date and time of each measurement is recorded along with the soil measurement data. All data can be saved and emailed as a .CSV file for analysis in Excel.



RELIABLE

Continual, long-term data without calibration.

- Stable—no sensor drift, ensuring continual accuracy.
- Patented technology that accurately measures moisture and bulk electrical conductivity permits more accurate optimization of watering and fertilization than with just moisture.
- Depended on by the USDA, NOAA, leading irrigation companies, and many universities for over 20 years. Used by the USDA Soil Climate Analysis Network for ground truthing of satellite-based soil imaging.
- Soil moisture calibration has been rigorously peer-reviewed, making it one of the most trusted soil sensors available.

RUGGED

Durable stainless steel tines, fully potted components, compact sealed design and a 5-year warranty.

- Can remain in-situ indefinitely, or relocated and redeployed without worry.
- Ideal for remote locations, harsh environments and applications where data is critical.
- Enables measurement of native (undisturbed) soil, even hard-packed clay.
- Industry-leading 5-year warranty.

SIMPLE

Set it and forget it.

- Repeatable accuracy and stability without the need for calibration in most soils.
- Digital sensor using the SDI-12 or RS485 protocol—no setup, just connect to data logger. Compatible with any SDI-12/RS485 capable data logger.
- Zero maintenance required.

ACCURATE

Consistent research-grade accuracy every season, every location.

- Unparalleled spatial and temporal measurement consistency. No sensor-to-sensor variations across locations, seasons, soil types or moisture range.
- Instant measurement of the 3 most significant soil parameters simultaneously.
- Unlike most TDR or capacitance-based sensors, HydraProbe is less sensitive to changes in temperature, salinity, and soil mineralogy.

About Bulk EC (Salinity)

- The bulk EC (electrical conductivity) of the soil is correlated to the soil's salinity because salts when mixed with water will conduct electricity. The bulk EC parameter is sometimes called "salinity".
- Many nutrients are salts—a source of salinity. Nutrient accumulation, poor drainage and saline irrigation water can lead to the unwanted buildup of salinity in soil.
- High bulk EC can affect moisture readings and create errors with capacitance based moisture sensors. HydraProbe's soil moisture measurement is less sensitive to salinity than other capacitance based probes.
- The soil bulk EC can change dramatically with water content and can be affected by the quality of the irrigation water, fertilization, drainage, and other natural processes.
- Compaction, clay content and organic matter, can influence moisture holding trends over time, also affecting bulk EC capacities in soil.
- The effect of bulk EC on the moisture availability to a plant's roots is great. As salinity changes the water needs also change.
- A temperature corrected bulk EC parameter is available so the user can make comparison independent of soil temperature.
- Because Hydra Probe also measures the dielectric permittivities, algorithms can be applied to approximate the EC of the soil pore water allowing for better soil salinity characterizations.

TECHNICAL SPECIFICATIONS

MEASUREMENT	ACCURACY	RANGE	RESOLUTION
Real dielectric permittivity (isolated)	$\leq \pm 0.5\%$ or ± 0.2 dielectric units	1 to 80 where 1 = air, 80 = distilled water	0.001
Soil moisture for inorganic & mineral soil	± 0.01 WFV for most soils $\pm \leq 0.03$ max for fine textured soils*	From completely dry to fully saturated (from 0% to 100% of saturation)	0.001
Bulk electrical conductivity	$\pm 2.0\%$ or 0.02 S/m whichever is typically greater*	0 to 1.5 S/m	0.001
Temperature**	$\pm 0.3^\circ\text{C}$	-10°C to $+60^\circ\text{C}$	0.1°C
Inter-sensor variability	± 0.012 WFV ($\theta\text{ m}^3\text{ m}^{-3}$)	n/a	

*Accuracy may vary with some soil textures. ** Extended temperature range sensor (down to -40°C) available

ELECTRICAL AND COMMUNICATION

	SDI-12	RS485
Power supply	9-20 VDC	9-20 VDC
Power consumption	<1 mA idle / 10 mA active	<10 mA idle / 30 mA active
Cable	3-wire: power, ground, data	4-wire: power, ground, com+, com-
Max. cable length	60 m (197 ft.)	1,219 m (4,000 ft.) Non-spliced: 304.8 m (1,000 ft.)
Baud Rate	1200	9600
Communication protocol	SDI-12 Standard v. 1.2	Custom or open spec
Addressing	Serial; allows multiple sensors to be connected to any RS485 or SDI-12 data logger via a single cable.	

ENVIRONMENTAL

Operating Temperatures	<ul style="list-style-type: none"> In soils: freezing to $+60^\circ\text{C}$ Standard temperature probe range: -10°C to $+60^\circ\text{C}$ Extended temperature probe range: -40°C to $+65^\circ\text{C}$*
Storage Temperatures	-40°C to $+65^\circ\text{C}$
Water Resistance	Tolerates continuous full immersion
Cable	18 gauge (20 gauge for RS-485/analog), UV resistant, direct burial
Vibration and shock resistance	Excellent; potted components in PVC housing and 304 grade stainless steel tines

PHYSICAL

Length	4.9" (124 mm)
Diameter	1.6" (42 mm). Optional slim housing version available: 1.4" (35.8 mm)
Weight	7 oz. (200 g). Optional slim housing version available: 6.5 oz. (184 g)
Cable weight	0.86 oz/ft (80g/m)
Sensing volume (cylindrical region)	Length: 2.2" (5.7 cm) Diameter: 1.2" (3.0 cm)

* "Extended Temperature Range" version available, which can measure down to -40°F (-40°C) for research, cold-climate, high-altitude, arctic applications or any other measurement situation where there will be significant below-freezing ground temperatures.

ORDERING INFORMATION

PART #	DESCRIPTION
93640-025 / 63646-025	HydraProbe with 25' (7.62 m) cable, SDI-12 / RS485
93640-050 / 63646-050	HydraProbe with 50' (15.24 m) of cable, SDI-12 / RS485
93640-100 / 63646-100	HydraProbe with 100' (30.48 m) of cable, SDI-12 / RS485
93633-003	HydraProbe Field Portable

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