



Soil Moisture Sensor Types

This is Grower Guide #1 in our ***Soil Moisture Sensor Series*** of guides. This guide provides an overview of the common sensor types and how they work so you can make the best decision for your vineyard.

The three most common methods used to measure soil moisture in vineyards are:

- Matric Potential or Tensiometer
- Capacitance Volumetric
- Time-Domain Reflectometry and Time-Domain Transmissometry Volumetric (TDR/TDT Volumetric)

Related Guides:

- **Guide #1 - Soil Moisture Sensor Types**
- [Guide #2 - Selecting the Location to Install Soil Moisture Sensors](#)
- [Guide #3 – Soil Moisture Sensor Placement – Depth, Drip Emitter, and Vine Considerations](#)
- [Guide #4 – Understanding Soil Moisture Monitoring](#)



Type	Measures	How it Works	Pros	Cons	Best Use
Matric Potential or Tensiometer	Matric potential (also referred to as soil water potential, water tension, or soil water suction) measures how tightly water is held to the soil, which corresponds to water available to plant roots.	<p>Some devices, such as tensiometers, read soil water suction directly.</p> <p>Others, such as electrical resistance devices, indicate suction indirectly.</p> <p>Commonly installed into the soil at multiple depths.</p>	<p>Inexpensive, \$50-100 per sensor depth depending on size, easy installation.</p> <p>Using these sensors, it is possible over a season or two to determine soil tension (centibar) levels at field capacity (“full”), wilting point (“empty”), and maximum depletion point.</p>	<p>Need regular service, high maintenance, better suited to coarse soils, water “tension” has a different meaning in different soils.</p> <p>Provides qualitative measures of soil moisture which indicate when to apply water but are limited in their ability to indicate how much water to apply.</p>	Small vineyard with moderate to coarse soil and few monitoring sites, close by for easy observation and maintenance.
Capacitance Volumetric	Measure volumetric or relative water content using the dielectric permittivity of soil.	<p>Excitation is placed in soil by the sensor and the frequency of that wave is affected by dielectric permittivity, which is affected by the water content.</p> <p>The greater the soil water content, the smaller the frequency. Volumetric water content can be used to help decide when to irrigate and how much water to apply.</p>	<p>Low maintenance and works well with logged/graphical data, reproducible info season-to-season.</p> <p>Sensors can be purchased as individual sensor units or built into a probe or profiler to measure soil moisture at multiple depths.</p>	<p>Special equipment is required for installation.</p> <p>Higher cost of \$200-300 per sensor or \$1000 per multi-sensor probe.</p> <p>Measures water content in a relatively small volume of soil, so it is highly affected by soil conditions immediately next to the sensor.</p>	Best for areas with prolonged dry periods or larger vineyards that rely on irrigation year-round. Commonly used with logged or telemetry-delivered continuous data systems, at multiple locations and depths. Software and dashboard views make for easy decision-making.
TDR/TDT Volumetric	Similar to capacitance sensors, Time Domain Reflectometry (TDR) and Transmissometry (TDT) sensors measure volumetric water content (if calibrated) or relative water content (if not calibrated) using high-frequency electromagnetic waves.	<p>The waves are passed along two or three parallel probes, and the time required for the wave to pass through the soil or to be reflected generates the dielectric constant, which relates to volumetric water content.</p> <p>Commonly installed into the soil at multiple depths.</p>	<p>Low maintenance works well with logged/graphical data; reproducible data from season to season; large sensor size measures water content in a larger volume of soil, improving accuracy.</p> <p>Volumetric water content can be used to help decide when to irrigate and how much water to apply.</p>	The larger size makes installation more complicated, special equipment necessary, less accurate in clay or saline soils, and higher cost of \$200-300 per sensor.	Best for soils with high sand content. Larger equipment is needed to install, such as access to an in-row backhoe to excavate the installation zone. Commonly used with logged or telemetry-delivered continuous data systems at multiple locations and depths.

Suggested Manufacturers & Models

- In areas where growers rely on irrigation to get through the season, select a soil moisture sensor that includes a data logger (or telemetry to a computer/tablet) to track soil moisture patterns over a prolonged period to allow for precise and efficient irrigation scheduling.
- For growers in areas that may experience occasional draught conditions, point measurements can usually suffice as you only need spot soil data to prevent short-term vine stress. Prolonged irrigation scheduling is usually not as critical in these situations.
- If you are choosing to use individual sensors instead of a probe, you will need to purchase multiple sensors to place at different depths of grapevine root growth to get a comprehensive measurement.

Measurement	Manufacturer	Models	Data Logger Included
Matric Potential	Irrrometer	Watermark ¹	No
	METER Group	Teros 21, Teros 22	No
Tensiometers	Irrrometer	SR, LT, MLT	No
	Soilmoisture Equipment Corp.	TS25 JetFill Probe	No
Capacitance Volumetric	Adcon	EnviroPro Probe	Yes
	AquaCheck	AquaCheck Probe	Yes
	HSTI	Hydrascout Probe (SensorInsight) ²	Yes (SensorInsight)
	METER Group	Teros 10, Teros 11, Teros 12, Teros 54 Probes	No (10, 11, 12), Yes (54)
	Sentek	Enviroscan Probe	No
	Spectrum Technologies	WaterScout Sensor	Yes
TDR/TDT Volumetric	Acclima	TDT, SDI-12	Yes
	Campbell Scientific	CS650, CS655	Yes
	Environmental Sensors	Gro-Point Classic, Pro	Yes
	Soilmoisture Equipment Corp.	GroPoint Probe	Yes

¹ Watermark by Irrrometer is preferred for low-cost, manual monitoring (small vineyards).

² SensorInsight's Hydrascout is the overall preferred and recommended remote soil moisture monitoring solution. SensorInsight is a Preferred Vendor of Virtual Viticulture Academy and provides a **15% discount** on online pricing to Members. [Learn more.](#)





Figure 1: An example of an Irrometer Watermark Soil Moisture Sensor.



Figure 2: An example of an exposed Hydrascout Probe from HSTI.

Related Grower Guides

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- [Guide #4 – Understanding Soil Moisture Monitoring](#)
- [Installing a Capacitance Soil Moisture Probe in the Vineyard](#)
- [Installing Capacitance Soil Moisture Sensors in the Vineyard](#)

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