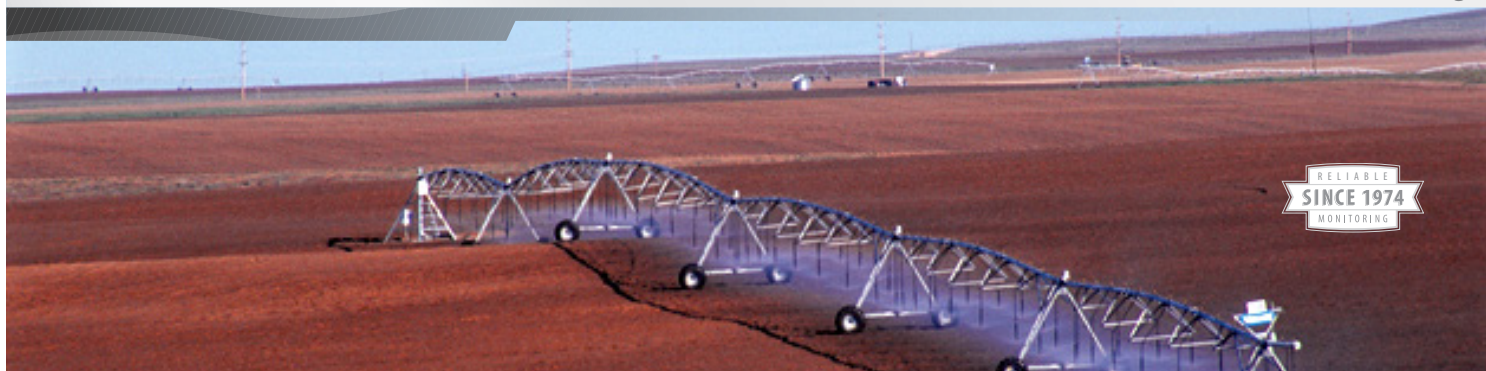




Soil Science and Soil Moisture




Products for Stand-Alone Soil Monitoring



Campbell Scientific instruments are used in a wide variety of soil-science applications. Multiple sensors can be networked in hard-wired or wireless systems to create soil-moisture profiles, while portable, hand-held systems can make point measurements to verify

irrigation scheduling or to perform site surveys. Campbell soil sensor products are key to agricultural research, irrigation scheduling, forestry, watershed studies, leak detection, slope stability, and many other disciplines.

MAJOR SYSTEMS

	Measurements	Datalogger	Power	Communications
TDR200-Based Time-Domain Reflectometry Non-destructive in-situ soil measurements 	soil water content, soil electrical conductivity, rock mass deformation, cable integrity, water level detection	CR1000X, CR1000, CR3000, CR800, CR850, CR6	Typically datalogger's sealed rechargeable 12 Vdc battery recharged by a 10 W solar panel.	cellular, DNP3, email, fiber optic, field display, FTP, Modbus, NTCIP, radio, satellite, serial, TCP/IP, Wi-Fi
HS2 HydroSense II Soil Moisture Measurement System Fast and Portable 	soil water content	NA (stand alone system)	6 Vdc, 4 AA batteries	handheld display, bluetooth
HS2P HydroSense II with Insertion Rod Soil Moisture Measurement System Fast and Portable 	soil water content	NA (stand alone system)	6 Vdc, 4 AA batteries	display, bluetooth

Custom Systems

Most of the systems we sell are customized. Tell us what you need and we'll help you configure a system that meets your exact needs.

Dataloggers used in Soil Science

Our measurement systems are based around programmable dataloggers that measure the sensors, then process, store, and transmit the data. We offer a family of reliable battery-powered dataloggers that have wide operating temperature ranges and ample input channels for commonly used sensors. Our dataloggers interface directly to most sensors, eliminating external signal conditioning. If needed, channel capacity can be expanded using multiplexers.



Our dataloggers also feature programmable scan rates, measurement types, and recording intervals and provide onboard statistical and mathematical functions for on-site data management.



Sensors used in Soil Science Measurements

We can measure nearly every commercially available soil sensor, including tensiometers, heat flux plates, thermocouples, psychrometers,

lysimeters, and gypsum blocks. Below is a discussion of the soil water content and soil water matric potential sensors we manufacture.

Soil Water Content

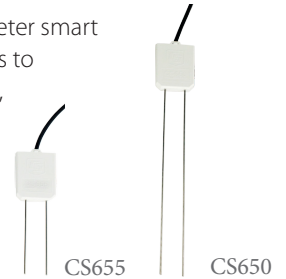
We measure soil water content using methods that are sensitive to soil dielectric constant. Our TDR200-based system uses proven time-domain reflectometry (TDR) to accurately and reliably measure soil volumetric water content and bulk electrical conductivity in soils over a wide range of textures and soluble salt concentrations.



This system uses coaxial multiplexers to connect the TDR200 to up to 512 TDR probes. The TDR200 features lower current demand and a typical measurement time of two seconds. The operating temperature range of -25° to +85°C covers typical applications, as well as monitoring frost depth. Windows support software provides setup, troubleshooting, and display of waveforms and measurements. A customized 16-inch-by-18-inch environmental enclosure is configured to easily mount and protect a Campbell

Scientific datalogger, 12 Vdc power supply, TDR200, and eight-channel multiplexer.

The CS650 and CS655 are multiparameter smart sensors that use innovative techniques to monitor soil volumetric water content, bulk electrical conductivity, and temperature. They estimate soil-water content for a wide range of mineral soils. Measurements are corrected for effects of soil texture and electrical conductivity.



For portable volumetric water content measurements, the HS2 HydroSense® II and HS2P HydroSense II Pole systems provide a probe and output display. They can be carried from site-to-site to provide immediate soil water content readings.

Soil Water Matric Potential

Sensors from Campbell Scientific that measure soil water matric potential use heat dissipation and electrical resistance methods. The 229 Matric Potential Sensor covers a water potential range from -10 J/kg to -104 J/kg by using the temperature response



of a heating element embedded in a ceramic matrix. A constant current source is available for reliable and precise heating. Sixteen 229 sensors are easily multiplexed to a single datalogger differential input channel using a multiplexer. Watermark and Delmhorst electrical resistance sensors provide an inexpensive method of measuring smaller matric potential ranges.

Soil Science and Soil Moisture Case Studies

Our systems have helped a variety of organizations reach their goals. The following are just a few of these:

Campbell Scientific TDR system monitors for dangerous slope movement at three segments of railway track above the coastal bluffs in Del Mar, California.

www.campbellsci.com/slope-monitor

Schafer & Associates of Bozeman, Montana are using our instrumentation to monitor the performance of Acid Rock Drainage (ARD) caps.

www.campbellsci.com/acid-rock-drainage

Washington State University's AgWeatherNet (AWN) is a large automated network composed almost entirely of our products. The AWN stations measure soil temperature and meteorological conditions.

www.campbellsci.com/agweathernet



In Del Mar, California, a tractor-mounted trencher installed coaxial cable for monitoring slope stability using our TDR system.

