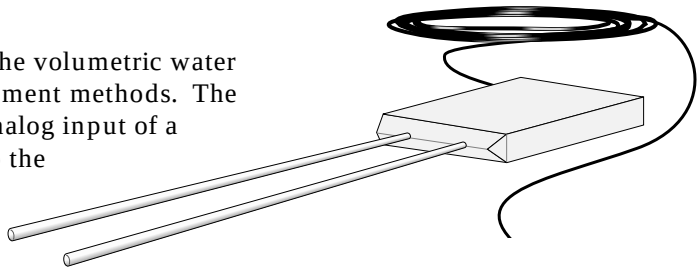
Water Content Reflectometer

Model CS615-L



The CS615-L Water Content Reflectometermeasures the volumetric water content of porous media using time-domain measurement methods. The reflectometer connects directly to the single-ended analog input of a Campbell Scientific, CR510, CR10(X), or CR23X, or to the pulse count channel of a CR510, CR10(X), 21X, CR23X, or CR7 datalogger. The datalogger period or frequency output can be converted to volumetric water content using calibration values. The -L suffix is used to designate the cable length.

The Water Content Reflectometer consists of two stainless steel rods connected to a printed circuit board. A shielded four-conductor cable is connected to the circuit board to supply power, enable the probe, and monitor the pulse output. The circuit board is encapsulated in epoxy. The probe rods can be inserted from the surface or the probe can be buried at any orientation to the surface.

High speed electronic components on the circuit board are configured as a multivibrator. The output of the multivibrator is connected to the probe rods which act as a wave guide. When the multivibrator switches states, the transition travels the length of the rods and is reflected by the rod ends. This reflection provides feedback to switch the state of the multivibrator and initiate a subsequent wave propagation on the rods. The travel time to the end of the rods and back is dependent on the dielectric constant of the material surrounding the rods. Digital circuitry scales the multivibrator output to an appropriate frequency for measurement with a datalogger. The frequency or period is used in a calibration for water content.

Measurements

The CS615 response is dependent on the dielectric constant of the material surrounding the probe rods. Water is the principal contributor to the dielectric constant value, but the solid constituents such as quartz, clay and organic matter also affect the measurement. The same calibration of volumetric water content to probe output signal period may not apply to all soils. Accuracy can be optimized by using calibrations derived for a specific soil. Accuracy of ± 2.0% over the entire water content range and for a wide range of soil types is routinely obtained in our laboratory. Applying the general calibrations from the operating manual provides accuracy of ± 3.0%.

The temperature dependence of the CS615 was evaluated over the range 10° to 30°C on soil samples at constant water content. Measurements on a loamy fine sand at a water content of 0.30 $m^3\ m^{-3}$ yielded a sensitivity of $1.65*10^{-3}\ m^3\ m^{-3}\ °C^{-1}$. The dependence is linear and can be corrected in applications where large temperature fluctuations are likely, such as near the soil surface.

Measurements on saline soils (soil solution electrical conductivity > 2 dS m^{-1}) show a shift in the slope of the water content as a function of CS615 period. The probe response to change in water content is well behaved even at electrical conductivity values >10 dS m^{-1}. However, the calibration must be determined for the specific soil.

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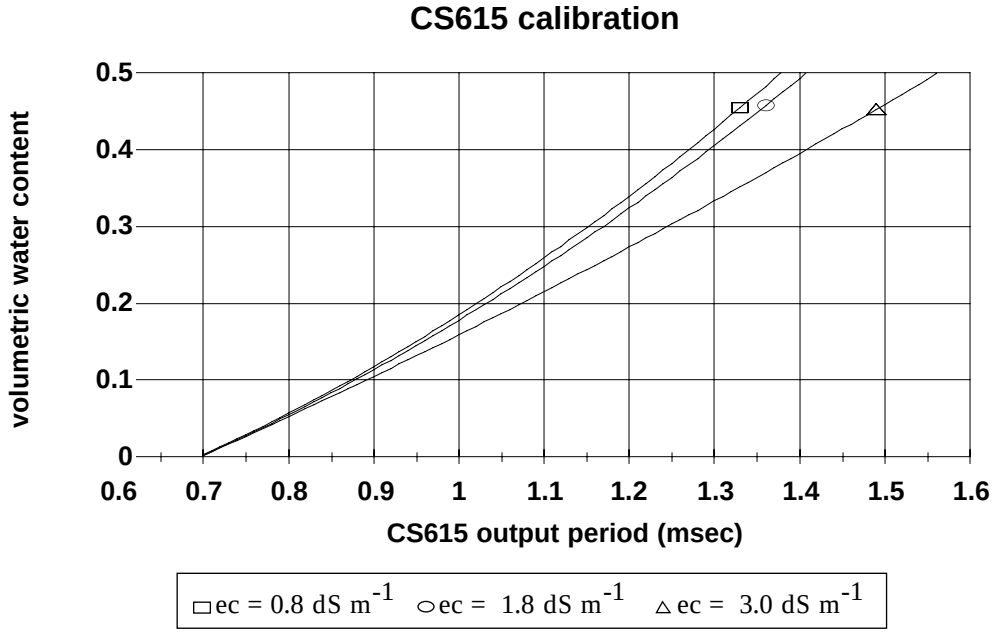

Ordering Information

CS615_L CS615 Water Content Reflectometer. Enter lead length in feet after L.

CS615G CS615 installation tool

CS615P CS615 pilot tool

Specifications

Accuracy: ±2% using calibration for specific soil. Accuracy obtained using general calibration depends on soil texture and mineral composition

Resolution: Using Period Measurement (CR510, CR10(X), CR23X, Instruction 27), 10^{-6} m^3 m^{-3}. Using Pulse Count (Instruction 3), 10^{-4} m^3 m^{-3} with execution interval of 1.0 second, and 10^{-2} m^3 m^{-3} with execution interval of 0.1 second.

Output: Square wave pulse train with amplitude ± 2.5 Vdc

Power: 70 milliamps @ 12 Vdc

Dimensions: Rods: 30.0 cm long
3.2 mm diameter
3.2 cm spacing
Head: 11.0 cm x 6.3 cm x 2.0 cm

Weight: Probe 280 g
Cable approximately 35 g m^{-1}

Cable length: Cables of length 300 meters show no degradation of probe performance. However, cable lengths in excess of 50 meters will compromise protection against electrostatic discharge damage.

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