



# CS650-LC

## 30 cm Water Content Reflectometer for ET107 Stations



### Overview

The CS650-LC is a multiparameter smart sensor that uses innovative techniques to monitor soil volumetric-water content, bulk electrical conductivity, and temperature. This sensor is used with the ET107 Weather Station.

**Note:** The cable connector for this sensor is suitable for use with an ET107 station. For other cable termination options, use the [CS650](#) sensor instead.

### Detailed Description

The CS650-LC consists of two 30-cm-long stainless steel rods connected to a printed circuit board. The circuit board is encapsulated in epoxy and a shielded cable is attached to the circuit board for data logger connection.

The CS650-LC measures propagation time, signal attenuation, and temperature. Dielectric permittivity, volumetric water content, and bulk electrical conductivity are then derived from these raw values.

Measured signal attenuation is used to correct for the loss effect on reflection detection and thus propagation time

measurement. This loss-effect correction allows accurate water content measurements in soils with bulk EC  $\leq 3 \text{ dS m}^{-1}$  without performing a soil specific calibration.

Soil bulk electrical conductivity is also calculated from the attenuation measurement. A thermistor in thermal contact with a probe rod near the epoxy surface measures temperature. Horizontal installation of the sensor provides accurate soil temperature measurement at the same depth as the water content. Temperature measurement in other orientations will be that of the region near the rod entrance into the epoxy body.

### Specifications

Sensing Volume	7800 cm <sup>3</sup> (~7.5 cm radius around each probe rod and 4.5 cm beyond the end of the rods)	protection against electrostatic discharge and surge.
Electromagnetic	CE compliant Meets EN61326 requirements for	
		Operational Temperature -10° to +70°C
		Sensor Output SDI-12; serial RS-232

Measurement Time	3 ms to measure; 600 ms to complete SDI-12 command
Power Supply Requirements	6 to 18 Vdc (Must be able to supply 45 mA @ 12 Vdc.)
Maximum Cable Length	610 m (2000 ft) combined length for up to 10 sensors connected to the same data logger control port
Rod Spacing	32 mm (1.3 in.)
Ingress Protection Rating	IP68
Rod Diameter	3.2 mm (0.13 in.)
Rod Length	300 mm (11.8 in.)
Probe Head Dimensions	85 x 63 x 18 mm (3.3 x 2.5 x 0.7 in.)
Cable Weight	35 g per m (0.38 oz per ft)
Probe Weight	280 g (9.9 oz) without cable

### Current Drain

Active (3 ms)	<ul style="list-style-type: none"> <li>› 45 mA typical (@ 12 Vdc)</li> <li>› 35 mA (@ 18 Vdc)</li> <li>› 80 mA (@ 6 Vdc)</li> </ul>
Quiescent	135 $\mu$ A typical (@ 12 Vdc)

### Electrical Conductivity

Range for Solution EC	0 to 3 dS/m
Range for Bulk EC	0 to 3 dS/m

Accuracy	$\pm$ (5% of reading + 0.05 dS/m)
Precision	0.5% of BEC

### Relative Dielectric Permittivity

Range	1 to 81
Accuracy	<ul style="list-style-type: none"> <li>› <math>\pm</math>1.4 (for solution EC <math>\leq</math> 1.0 dS/m for 40 to 81 range)</li> <li>› <math>\pm</math>(2% of reading + 0.6) for solution EC <math>\leq</math> 3 dS/m (for 1 to 40 range)</li> </ul>
Precision	< 0.02

### Volumetric Water Content

-NOTE-	Using Topp Equation ( $m^3/m^3$ )
Range	5% to 50%
Accuracy	$\pm$ 3% VWC (typical in mineral soils, where solution EC $\leq$ 3 dS/m)
Precision	< 0.05%

### Soil Temperature

Range	-10° to +70°C
Accuracy	$\pm$ 0.5°C (for probe body buried in soil)
Precision	$\pm$ 0.02°C

For comprehensive details, visit: [www.campbellsci.com/cs650lc](http://www.campbellsci.com/cs650lc) 



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