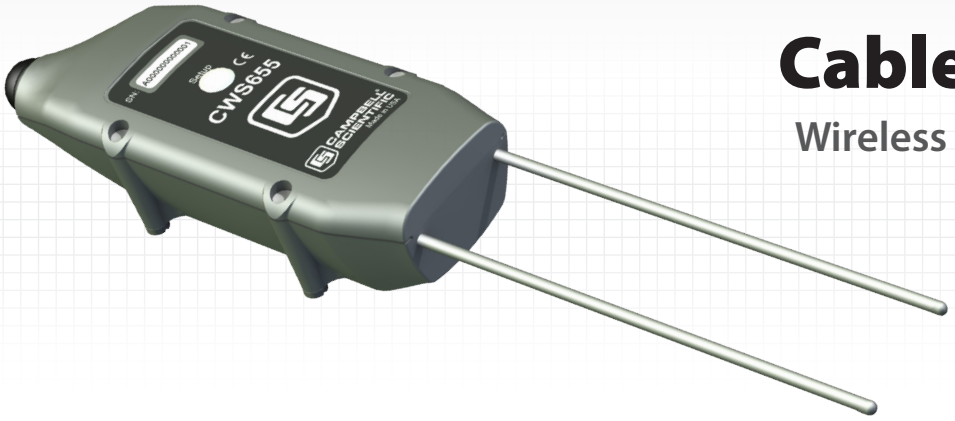
CAMPBELL SCIENTIFIC
WHEN MEASUREMENTS MATTER

CWS655, CWS655A, CWS655E

Wireless Soil-Water Reflectometers



Cable-Free Sensors

Wireless network means flexibility, cost savings, time savings

Overview

The CWS655, CWS655A, and CWS655E are wireless versions of our CS655 soil water reflectometer. They have 12 cm rods and monitor soil volumetric water content, bulk electrical conductivity, and temperature. These reflectometers have an internal spread spectrum radio[a] that transmits data to a CWB100-series wireless base station or to another wireless sensor.

Benefits and Features

- Versatile sensor—measures dielectric permittivity, bulk electrical conductivity (EC), and soil temperature
- Measurement corrected for effects of soil texture and electrical conductivity
- Internal frequency-hopping, spread spectrum radio provides longer range and less interference
- Battery-powered using either alkaline batteries or a rechargeable battery and a solar cell
- A reliable, low maintenance, low power method for making measurements in applications where cabled sensors are impractical or otherwise undesirable
- Transmissions can be routed through up to three other wireless sensors
- Compatible with Campbell Scientific's CR6, CR800, CR850, CR1000, and CR3000 dataloggers

Technical Description

The CWS655 series 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 allows accurate water content measurements in soils with bulk ≤3.7 dS m^{-1} without performing a soil-specific calibration.

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

The reflectometer can route its transmissions through up to three other wireless sensors. A datalogger is connected to a CWB100-series base station for processing and storing the data. The reflectometer interfaces with a PC for configuration via the A205 CWS Sensor to PC Interface.

[a]*The internal radio in the wireless sensor is not meant to move a lot of data quickly. It takes 15 to 30 s per hop when moving data from a sensor, through a sensor used as a repeater, and ending up at the base radio. Going through three repeaters could take a data packet anywhere from 45 to 90 s to get to the base radio.*

Models

Model	Where Used	Frequency (MHz)	Compatible Base Stations	Compatible Wireless Sensors
CWS655	U.S., Canada	910 to 918	CWB100	CWS900, CWS220
CWS655A	Australia, New Zealand	920 to 928	CWB100A	CWS900A, CWS220
CWS655E	Europe	868	CWB100E	CWS900E, CWS220E

Why Wireless?

- Require less installation time and labor than running cables through conduit or burying them in trenches
- Can be used in buildings where local fire codes preclude the use of Santaprene-jacketed cables
- Ideal for applications that would require long cable lengths, which often decrease the quality of the measurement
- Use fewer datalogger channels

Ordering Information

Wireless Reflectometers

CWS655 Wireless Soil Water Probe, 900 MHz

CWS655A Wireless Soil Water Probe for Australia, 922 MHz

CWS655E Wireless Soil Water Probe for Europe, 868 MHz

Power Options (choose one)

-ALK Alkaline Battery with Lid

-RC Battery with Solar Panels

Sensor-to-PC Interface

A205 CWS Sensor to PC Interface allows sensor to be configured via our Wireless Sensor Planner, Network Planner, or Device Configuration Utility software. One A205 is required per wireless system.

Specifications

- Power: 2 AA batteries with a battery life of 1 year assuming sensor samples taken every 10 minutes. Optional solar charging available.
- Average Current Drain: 300 µA with 15 minute polling
- Operating Temperature Range: -25° to +50°C
- Operating Relative Humidity Range: 0 to 100% RH
- Weather Resistance: IP67 rating for sensor and battery pack (battery pack must be properly installed); each sensor is leak tested
- Body Dimensions: 14.5 x 6 x 4.5 cm (5.7 x 2.4 x 1.77 in)
- Rod Length: 12 cm (4.7 in)
- Rod Diameter: 3.2 mm (0.13 in.)
- Weight: 216 g (7.6 oz)

Soil Temperature

- Measurement Range: -10° to + 70°C
- Accuracy[b]: ±0.5°C for probe body buried in soil
- Precision[c]:±0.02°C

Relative Dielectric Permittivity Measurements

- Range: 1 to 81
- Accuracy[b]
  1 to 40 Range: ±(3% of reading + 0.8) for solution EC ≤8 dS m^{-1}
  40 to 81 Range: ±2 for solution EC ≤2.8 dS m^{-1}
- Precision[c]: <0.02

Volumetric Water Content Measurements

- Range: 5% to 50%
- Accuracy[b]: ±3% typical in mineral soils, where solution EC ≤10 dS m^{-1}
- Precision[c]: <0.05%

Bulk Electrical Conductivity Measurements

- Range: 0 to 8 dS m^{-1}
- Accuracy[b]: ±(5% of reading + 0.05)
- Precision[c]: 0.5% of BEC

Internal 25 mW FHSS Radio

- FHSS Channel
  CWS655, CWS655A: 50
  CWS655E: 16
- Transmitter Power Output: 25 mW (+14 dBm)
- Receiver Sensitivity: -110 dBm (0.1% frame error rate)
- Typical Current Drain
  Standby: 3 µA
  Receive: 18 mA (full run)
  Transmit: 45 mA
  Average Operating Current with 1 s Access Time: 15 µA
- Quality of Service Management: RSSI
- Additional Features: GFSK modulation, data interleaving, forward error correction, BCH (31,21), data scrambling

[b] Accuracy specifications are based on laboratory measurements in a series of solutions with dielectric permittivities ranging from 1 to 81 and solution electrical conductivities ranging from 0 to 3 dS m^{-1}.

[c] Precision describes the repeatability of a measurement. It is determined for the reflectometer by taking repeated measurements in the same material.