

# 229, CE4, CE8

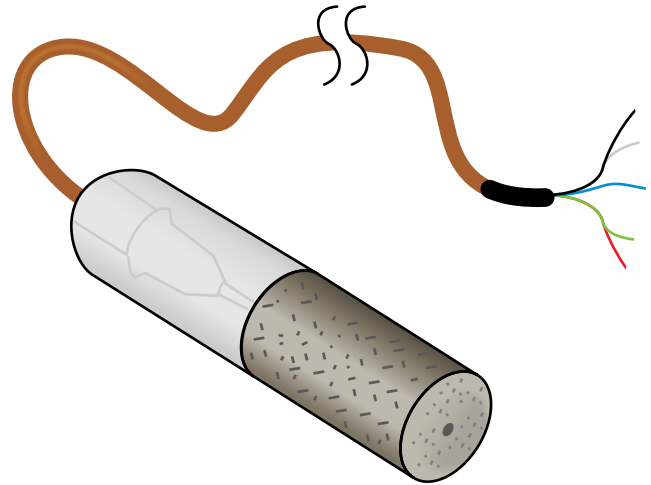
## Water Matric Potential Sensor & Current Excitation Modules



Campbell Scientific's 229-L Water Matric Potential Sensor measures soil water potential from -10 to 2500 kPa. The sensor consists of a heating element and thermocouple placed in epoxy in a hypodermic needle, which is encased in a porous ceramic matrix.

To calculate soil water matric potential, a current excitation module applies a 50 mA current to the 229's heating element, and the 229 thermocouple measures the temperature rise. The magnitude of the temperature rise varies according to the amount of water in the porous ceramic matrix, which changes as the surrounding soil wets and dries. Soil water matric potential is determined by applying a second-order polynomial equation to the temperature rise. Users must individually calibrate each of their 229 sensors in the soil type in which the sensors will reside.

A Campbell Scientific datalogger controls the current excitation module, measures the thermocouple, and calculates soil water matric potential. The 229 is not compatible with our CR200-series or CR510 dataloggers.



### Current Excitation Modules

Either a CE4 or CE8 current excitation module can provide a constant current to the heating element of the 229. The CE4 and CE8 differ only in the number of 229 sensors to which they source current. The CE4 sources current for up to four 229s, and the CE8 sources current for up to eight. Both modules require a 12 Vdc power source.

The number of 229 sensors measured by one datalogger can be increased by connecting a CE4 or CE8 to one or more AM16/32-series multiplexers. Up to four multiplexers can be connected to the CE4, and up to eight multiplexers can be connected to the CE8.

Please note that both the CE4 and CE8 modules switch currents that are greater than 30 mA, which degrades the contact surfaces of the mechanical relays. Therefore the multiplexer channels to which the CE4 or CE8 have been connected may become unsuitable for other applications (refer to the multiplexer manuals for more information).



The CE4 can source current for four 229 sensors directly. The outputs of the CE4 can be connected to as many as four multiplexers, greatly expanding system capacity.



The CE8 can source current for eight 229 sensors directly. The outputs of the CE8 can be connected to as many as eight multiplexers, greatly expanding system capacity.

## Ordering Information

### Water Matric Potential Sensor

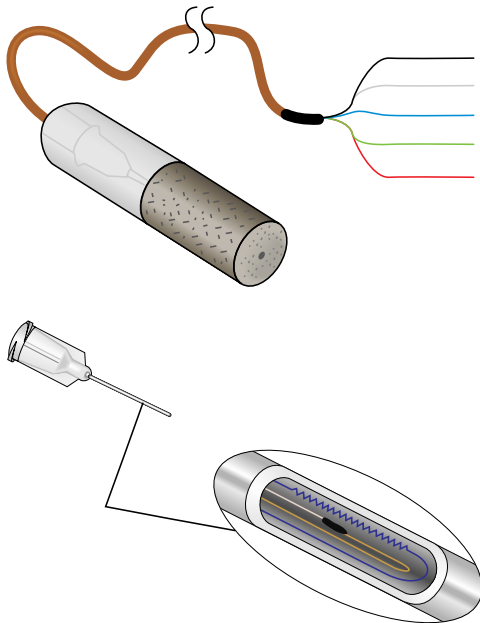
**229-L** Heat Dissipation Matric Potential Sensor with user-specified lead length. Enter lead length, in feet, after the -L. Recommended length is 25, 50, 75, or 100 ft (8, 15, 23, or 31 m). Must choose a cable termination option (see below).

### Cable Termination Options (choose one)

- PT** Cable terminates in stripped and tinned leads for direct connection to a datalogger/current excitation module terminals.
- PW** Cable terminates in connector for attachment to a prewired enclosure.

### Current Excitation Modules (choose one)

- CE4** 4-Channel Current Excitation Module
- CE8** 8-Channel Current Excitation Module



A 229 Heat Dissipation Matric Water Potential Sensor is shown at the top. The hypodermic assembly (without epoxy and ceramic) is shown just below. Cutaway view shows longitudinal section of the needle with heater and thermocouple junction.

## Specifications

### 229 Water Matric Potential Sensor

<b>Measurement Range:</b>	-10 to -2500 kPa
<b>Measurement time:</b>	30 seconds typical
<b>Thermocouple type:</b>	copper/constantan (type T)
<b>Heater resistance:</b>	~34 ohms
<b>Resolution:</b>	~1 kPa at matric potentials greater than -100 kPa
<b>Dimensions</b>	
<b>Diameter:</b>	0.6" (1.5 cm)
<b>Length:</b>	2.4" (6.0 cm)
<b>Weight</b>	
<b>229:</b>	0.35 oz (10 g)
<b>Cable:</b>	~0.25 oz/ft (23 g/m)

### CE4/CE8 Current Excitation Modules

<b>Output:</b>	50 mA $\pm$ 1 mA per channel, regulated
<b>Output channels</b>	
<b>CE4:</b>	4
<b>CE8:</b>	8
<b>Current drain while active:</b>	25 mA + (50 mA) • (the number of 229s connected to the CE4 or CE8 output channels)
<b>Dimensions</b>	
<b>CE4:</b>	4.5 inch x 2.1 inch x 1.1 inch 11.5 cm x 5.4 cm x 2.7 cm
<b>CE8:</b>	6.5 inch x 2.1 inch x 1.1 inch 16.5 cm x 5.4 cm x 2.7 cm
<b>Weight</b>	
<b>CE4:</b>	4.6 oz (131 g)
<b>CE8:</b>	6.5 oz (184 g)