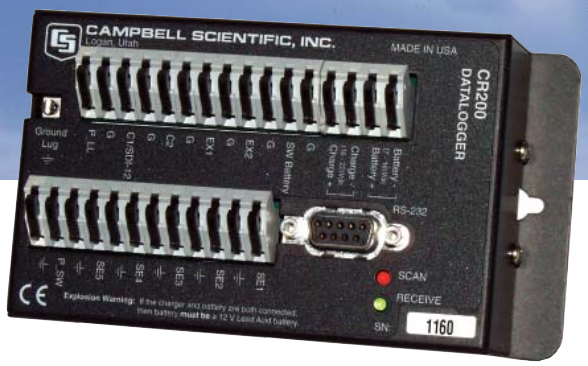
CAMPBELL SCIENTIFIC®

WHEN MEASUREMENTS MATTER



CR200-Series

Dataloggers / Wireless Sensors

Small, Rugged,

Lower-Cost

Datatloggers

CR200-Series[1]

Dataloggers / Wireless Sensors

Input/Output Connections: Measure, communicate with, and power sensors.

RS-232 Port: Supports communications with a computer. The CR295 has a second serial port dedicated for satellite communications.

Antenna Connector: Connects to a whip antenna or an antenna cable (CR206, CR211, and CR216 only).

LEDs: Indicate datalogger is scanning, transmitting, or receiving.

Features

- Campbell Scientific's smallest, lowest cost datalogger
- Optimal for measuring one or two simple sensors
- 512 kbytes of Flash final storage memory; approximately 128,000 data points[2]
- Fastest scan rate of once per second
- 12-bit analog to digital conversions
- Gas Discharge Tube (GDT) protected inputs
- Data values stored in tables with a time stamp and record number
- Battery-backed SRAM and clock that ensure data, programs, and accurate time are maintained while a CR200-series datalogger is disconnected from the main power source
- PakBus® communication protocol used, which is a simplified variation of Internet protocols.

Input/Output Channels

Gas discharge tubes provide rugged electrostatic discharge protection for the inputs. The CR200-series loggers have five single-ended analog inputs, one switch closure pulse input, one low level ac pulse input, two control ports, two excitation channels (2.5 or 5 V), and one switched battery output. One of the control ports can be used as an SDI-12 port. Input voltage range is 0 to +2500 mV with 0.6 mV resolution. Please note that differential measurements are not supported.

Program/Data Storage

Programs and data are stored in a non-volatile Flash memory. Final storage has 512 kbytes of memory that provides approximately 128,000 data points in the table-based memory structure.

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[1]The CR206, CR211, and CR216 dataloggers replaced the CR205, CR210, and CR215 dataloggers on September 15, 2005. The newer dataloggers reflect changes incorporated in the RF401, RF411, and RF416 Spread Spectrum Radios, which replaced the RF400, RF410, and RF415 radios in May 2005. The newer dataloggers can be configured to be used in systems that contain the retired dataloggers and retired radios.

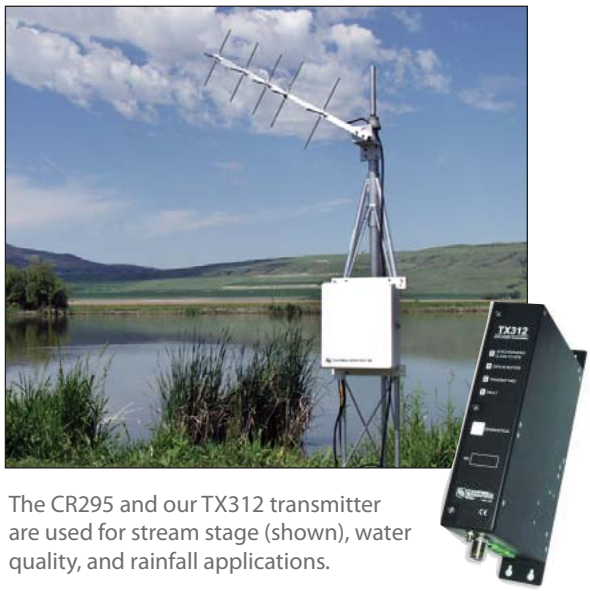
[2]Campbell Scientific is increasing the final storage memory from 128 kbytes to 512 kbytes. Dataloggers with the increased memory have 512k on their label.

Models/Communications

All of the models can communicate with a PC via direct connect, NL100 Ethernet Interface, MD485 multidrop modem, and our digital cellular modems. Data can also be viewed on the CD295 DataView II display or a PDA (PConnect or PConnectCE software required).

Other communications supported are model dependent:

- **CR200**—base model (i.e, only supports direct connect, Ethernet, digital cellular modems, MD485 multidrop modems, CD295 DataView displays, and PDAs).
- **CR206**—includes an internal 915 MHz spread spectrum radio that transmits data to another CR206 datalogger or an RF401 radio*. The 915 MHz frequency is used in the US/Canada.
- **CR211**—includes an internal 922 MHz spread spectrum radio that transmits data to another CR211 datalogger or an RF411 radio*. The 922 MHz frequency is used in Australia/Israel.
- **CR216**—includes an internal 2.4 GHz spread spectrum radio that transmits data to another CR216 datalogger or an RF416 radio*. The 2.4 GHz frequency can be used in many countries worldwide.
- **CR295**—includes an additional 9-pin serial port and an instruction set that allows communications with the TX312 HDR GOES satellite transmitter. The CR295 does not support radio telemetry and calculation of evapotranspiration.



The CR295 and our TX312 transmitter are used for stream stage (shown), water quality, and rainfall applications.

Program Development Tools

Short Cut is available from our website (at no charge) and Resource CD. It is also bundled with PC200W, PC400, and LoggerNet Software.

The programming language of the CR200-series dataloggers is CRBasic. Datalogger programs are developed using a program editor (programs cannot be created or edited in the datalogger). Program editors that can be used with these dataloggers include the CRBasic editor and Short Cut. The CRBasic editor is included in our PC400 and LoggerNet Datalogger Support Software. Short Cut can be obtained, at no charge, from: www.campbellsci.com/downloads

Communication & Data Collection Tools

PC200W

PC200W, our starter communications software, supports direct communications between a PC and a CR200-series datalogger and provides numeric display of measurements PC200W can be obtained, at no charge, from: www.campbellsci.com/downloads

PC400

PC400 Datalogger Support Software supports programming, manual data collection, and data display. Both direct and telemetry communications are supported.

LoggerNet 2.1 or higher

Besides providing all of PC400's functions, LoggerNet Datalogger Support Software supports automatic data collection and PakBus® routing.

**The factory default settings for the logger may not match the settings for the RF401-series radio; therefore, the logger and radio must be reconfigured before communications can take place. The "Quick Reference Guide for Setting Up RF401-to-CR206 Communications" application note provides more information (see www.campbellsci.com/app-notes).*

Enclosures

Applications with minimal power requirements can use the ENC200 enclosure to house the datalogger and the #16869 sealed rechargeable battery. This 6.7" x 5.5" x 3.7" enclosure has one power connector, one antenna connector, and five compression fittings.

At left, an ENC200 enclosure houses a CR206 datalogger and a 16869 battery. This very small enclosure has connectors for the SP5 solar panel and an antenna.

The ENC200 cannot house a barometer or a battery that is larger than the #16869. However, an ENC10/12 or ENC12/14 enclosure is adequate for most CR200-, CR206-, CR211-, or CR216-based systems. An ENC16/18 enclosure can house a CR295-based system.

Power Supply

Sealed rechargeable battery options for the CR200, CR206, CR211, or CR216 include the #17365 7-Ahr battery and the #16869 0.8-Ahr battery. These batteries should be recharged either with a solar panel or ac wall charger. Campbell Scientific offers the SP5-L 5-Watt Solar Panel that attaches directly to the datalogger's terminal strip, and the SP5 5-Watt Solar Panel that plugs into the ENC200's power connector. AC wall charger options are the #15988 wall charger that attaches directly to the datalogger's terminal strip, and the #16876 wall charger that plugs into the ENC200's power connector.

The SP5 and SP5-L capture solar energy via a 72-square inch surface area. These solar panels are suitable for sites with good exposure to sunlight and systems with low power requirements.

Typical power supply for a CR295-based system consists of a BP12 12 Ahr or BP24 24 Ahr battery pack, CH100 regulator, and SP10 10-Watt or SP20 20-Watt solar panel.

Antennas and Antenna Accessories

CR206 and CR211 Antennas

- **14204**—0 dBd, omnidirectional ½ wave whip, jointed, adjustable from 0° to 90°. Connects directly to the datalogger; no antenna cable needed.
- **15970**—1 dBd, dipole supplied with window/wall mount and a 10-foot RG-174 cable for connecting to the datalogger.
- **14221**—3 dBd, omnidirectional with mounts; requires an antenna cable to connect to the datalogger.
- **14201**—9 dBd, Yagi with mounts; requires an antenna cable to connect to the datalogger.

The 14201 Yagi antenna is intended for longer transmission distances.

CR216 Antennas

- **16005**—0 dBd, ½ wave whip articulating. Connects directly to the datalogger; no antenna cable needed.
- **16755**—13 dBd, Yagi with mounts; requires an antenna cable to connect to the datalogger.

Antenna Cables

- **COAXRPSMA-L**—low-loss RG58 cable that is recommended for lengths less than 10 feet.
- **COAXNTN-L**—low-loss RG8 cable that is recommended for lengths greater than 10 feet; requires a 14962 or 16982 surge protector kit.

Antenna Surge Protector Kits

- **14462**—Surge Protector Kit for the CR211 or CR206; requires the COAXNTN-L cable.
- **16982**—Surge Protector Kit for CR216; requires the COAXNTN-L cable.

Compatible Sensors**

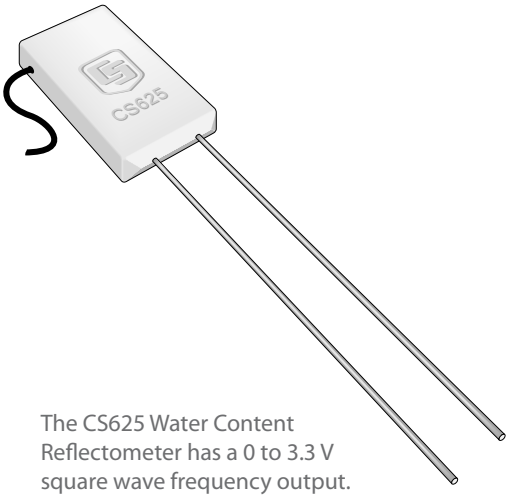
The CR200-series loggers can measure a variety of sensors including SDI-12 sensors and 4 to 20 mA sensors.

The parameters and sensors in which the CR200-series dataloggers can measure are listed below:

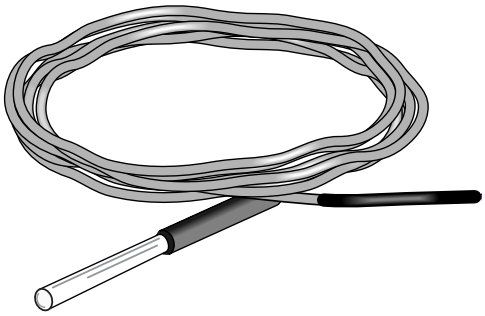
- **AC Current**—CS15 Current Transformer. *Our CS10 is not compatible.*
- **Barometric Pressure**—CS100 and CS106 barometric pressure sensors.
- **Evaporation**—255-100 Evaporation Gauge.
- **Leaf Wetness**—237 and LWS leaf wetness sensors.
- **Multiparameter**—WXT520 Weather Transmitter.
- **Precipitation**—TE525, TE525WS, TE525MM, TB4, TB4MM, CS700, and 385 tipping bucket rain gages.
- **Relative Humidity**—CS215, HMP50, and HMP45C air temperature and relative humidity probes.
- **Snow Depth**—SR50A Sonic Ranging Sensor.
- **Soil Volumetric Water Content**— EasyAG probe, EnviroSMART probe, and CS625 reflectometer. *Our CS616 and Hydrosense are not compatible.*
- **Solar Radiation**—CS300 Pyranometer. *Our LI200X, LI190SB, LP02, CMP3, NR-LITE, NR01, CNR1, and CNR2 probes are not compatible.*
- **Temperature**—109 Temperature Probe and 109SS Temperature Probe for Harsh Environments. *Other temperature probes listed on our price lists including our 107/108 thermistors and thermocouples are not compatible.*
- **Water Level**— CS408, CS450, CS455, and CS460 pressure transducers; CS410 Shaft Encoder; CS470 and CS471 compact bubblers; CS475, CS476, and CS477 pulse radar sensors, and SR50A Sonic Ranging Sensor. *Our CS431 pressure transducer and DB1 Double Bubbler are not compatible.*
- **Water Quality**—CS525 ISET pH probe, OBS-3+ Turbidity Probe, CS511 Dissolved Oxygen Probe, 109 Temperature Probe, and 109SS Temperature Probe for Harsh Environments. *Our CS547A, CSIM11, and CSIM11-ORP probes are not compatible.*
- **Wind Speed and Direction**—014A, 034B, 03101, 03002, 05103, 05106, 05305, and WindSonic4 sensors. *The WindSonic1 and CSAT3 are not compatible.*

Sensors Developed for CR200-series Dataloggers

The CS15 consists of a CR Magnetic's CR8459 Current Transformer that was modified to measure the approximate current over a 0 to 125 A range.



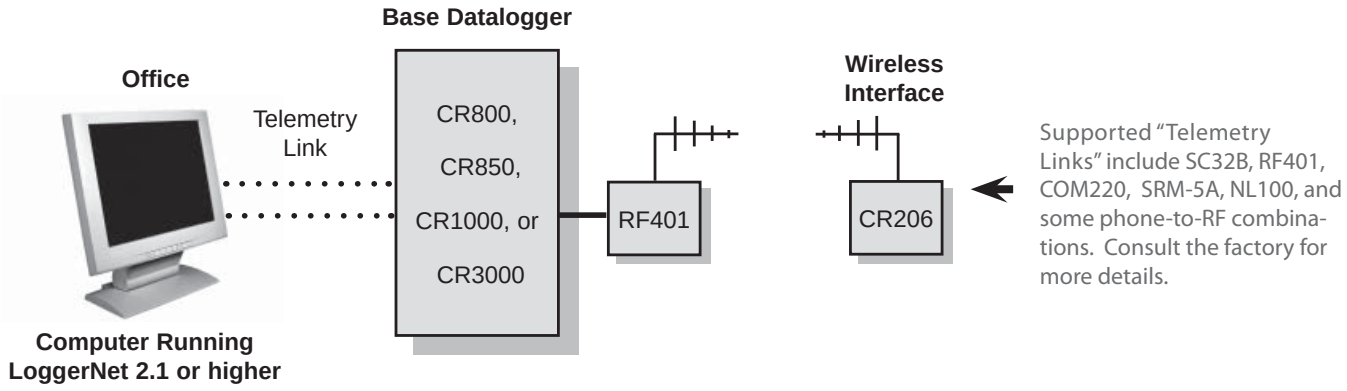
The CS625 Water Content Reflectometer has a 0 to 3.3 V square wave frequency output.

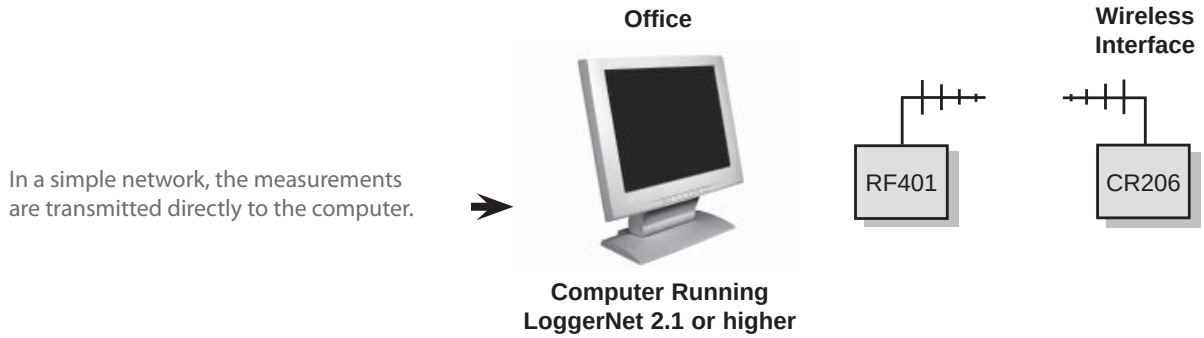


The 109 thermistor can measure air, water, or soil temperature from -50° to +70°C. This probe outputs a signal of 0 to 2.2 volts.

***The CR200-series dataloggers cannot make differential measurements and are not compatible with the fuel moisture/temperature, geographic position, present weather, soil heat flux, soil matric water potential, strain, and surface temperature sensors listed on our price lists. Campbell Scientific's SDM devices and multiplexers are also not supported.*

CR206/RF401-based Wireless Sensor Networks





Applications

Wireless Sensor Networks

The CR206, CR211, and CR216 can be used in a wireless sensor network. Wireless sensor networks are appealing because they are often more economical than trenching, laying conduit, and pulling wire. In some applications, cabled sensors are impractical due to man-made or natural causes, including construction, lightning, moving platforms, agricultural production, or bodies of water.

The diagrams at the top of the page depict our CR206/RF401-based wireless sensor networks. Our CR211/RF411-based and CR216/RF416-based networks are similar. All wireless sensor networks require LoggerNet 2.1 or higher software. The base datalogger must use the PakBus communication protocol (e.g., CR800, CR850, CR1000, CR3000). The PakBus protocol was optional for our retired CR510, CR10X, and CR23X dataloggers; the PakBus operating system is available, at no charge, from www.campbellsci.com/downloads for these dataloggers.

Other Applications

- **Aquaculture**—monitors and records water quality around the clock providing continuous data that can be used to identify trends and improve production.
- **Rural Water**—provides continuous monitoring of the water system regardless of time of day or time of year. All monitored sites can be networked into one integrated system.
- **Water Level/Flow**—measures level in many environments including wells, dams, streams, weirs, and water treatment or wastewater treatment plants. Compatible with shaft encoder, pressure transducers, compact bubblers, radar water level sensors, and sonic ranging sensor.
- **Water Quality**—monitors and records water temperature, pH, dissolved oxygen, and turbidity.
- **Wind Energy**—can be deployed in a wireless network configuration to provide cost effective monitoring at each level of a wind assessment tower while avoiding long cables.

CR200-series Datalogger Specifications

Electrical specifications are valid over a -40° to +50°C range unless otherwise specified; non-condensing environment required. We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.

ANALOG INPUTS; DIGITAL I/O

Channels SE1 to SE5 can be individually configured for single-ended measurement or digital I/O.

SINGLE-ENDED MEASUREMENT (SE1 TO SE5):
- Analog Input Range: 0 ≤ V < 2.5 Vdc
- Measurement Resolution: 0.6 mV
- Measurement Accuracy
  - Typical: ±(0.25% of reading + 1.2 mV offset) over -40° to +50°C
  - Worst-case: ±(1% of reading + 2.4 mV offset) over -40° to 50°C

DIGITAL I/O (SE1 TO SE5):
- Input/Output High State: 2.1 to 3.3 Vdc
- Input/Output Low State: <0.9 Vdc
- Output High State: 3.3 V (no load)
- Drive Current: 220 µA @ 2.7 Vdc
- Maximum Input Voltage: 4 Vdc

HALF BRIDGE MEASUREMENTS:
- Accuracy: Relative to the excitation. Using +2.5 Vdc excitation, is ±(0.06% of reading + 2.4 mV)/(2.5 Vdc)

PERIOD AVERAGING (SE1 TO SE4):
- Maximum Input Voltage: 4 Vdc
- Frequency Range: 0 to 150 kHz
- Voltage Threshold: counts cycles on transition from <0.9 Vdc to >2.1 Vdc

EXCITATION CHANNELS (EX1 AND EX2):
- Range: Programmable 0, 2.5, 5 Vdc, or off (floating)
- Accuracy: ±25 mV on +2.5 Vdc range, ±125 mV on +5.0 Vdc range
- Maximum Current: 25 mA on +2.5 Vdc range, 10 mA on +5.0 Vdc range

CONTROL PORTS (C1 AND C2)

DIGITAL I/O:
- Voltage Level When Configured as Input: <0.9 Vdc (low state) to >2.7 Vdc (high state)
- Voltage Level When Configured as Output: 0 V (low state), 5 Vdc (high state) (no load)
- Logic Level: TTL
- Drive Current: 1.5 mA @ 4.5 V

SDI-12: SDI-12 sensors connect to C1

PULSE COUNTERS

SWITCH CLOSURE (P_SW):
- Maximum Count Rate: 100 Hz
- Minimum Switch Open Time: 5 ms
- Minimum Switch Closed Time: 5 ms
- Maximum Bounce Time: 4 ms

PULSE COUNT (P_SW, C1, AND C2):
- Voltage Threshold: count on transition from <0.9 V to >2.7 Vdc
- Minimum Pulse Width: 320 µs
- Maximum Input Frequency: 1 kHz
- Max Input Voltage: C1 & C2 (6.5 V), P_SW (4 Vdc)

LOW LEVEL AC (P_LL):
- Voltage Threshold: <0.5 to >2 V
- Minimum Input: 20 mV RMS
- Maximum Frequency: 1 kHz
- Maximum Input: ±20 V
- *Note: C1 and C2 can be used for switch closure using the battery voltage and a 100 kOhm pull-up resistor. If the dc offset is >0.5 V, then AC coupling is required.*

COMMUNICATIONS

SERIAL INTERFACE: Female RS-232 9-pin interface for logger-to-PC communications

ON-BOARD SPREAD SPECTRUM RADIO:
- Frequency: 915 MHz (CR206), 922 MHz (CR211), or 2.4 GHz (CR216)
- Transmission Range: 1 mile with 0 dBd ¼ wave antenna (line-of-sight) and 900 MHz radios; 0.6 miles (1 km) with 0 dBd ½ wave antenna (line-of-sight) and 2.4 GHz radio; up to 10 miles with higher gain antenna (line-of-sight)
- RF4XX used as a base station radio

AVAILABLE RADIO TRANSMISSION MODES:
- Always on, program controlled
- Cycle Time: 1 or 8 s cycles; on for 100 ms every period; checks for incoming communication
- Scheduled Transmission Time: off until transmission time
- PakBus® packet switching network protocol

CLOCK ACCURACY

8.2 minutes/month @ -40° to +50°C; 1 minute/month @ +25°C

CPU AND STORAGE

FINAL STORAGE: 512 kbyte Flash, data format is 4 bytes per data point (table-based)

PROGRAM STORAGE: 6.5 kbyte Flash

FASTEST SCAN RATE: once per second

SWITCHED BATTERY (SW BATTERY)

Switched under program control; 300 mA minimum current available

POWER

BATTERY VOLTAGE RANGE: 7 to 16 Vdc (can program datalogger to measure internal battery voltage)

MAX. CONTINUOUS BATTERY CHARGING CURRENT:
0.9 A @ 20°C; 0.65 A @ 50°C

RECOMMENDED BATTERIES: 12 Vdc, 7 Ahr or smaller sealed rechargeable battery when connected to the on-board charging circuit. Using larger batteries with the datalogger's built-in charger may result in excessive PC board heating. This is especially a concern when the battery is deeply discharged or failing with a shorted cell.
- Alkaline cells, lithium, or other non-rechargeable battery types may be connected if the charging circuit is not used (i.e., nothing connected to Charge terminals).

CHARGER INPUT VOLTAGE: 16 to 22 Vdc

SOLAR PANEL: 10 W or smaller when using on-board charging circuit.

WALL CHARGER: 1 A or smaller when using on-board charging circuit.

SHELF LIFE OF CLOCK'S BACKUP BATTERY: 5 years

CURRENT DRAIN (@12 V)

QUIESCENT CURRENT DRAIN:
- No Radio or Radio Powered Off: ~0.2 mA

ACTIVE CURRENT DRAIN:
- No radio ~3 mA
- Radio receive ~20 mA (CR206, CR211), ~36 mA (CR216)
- Radio transmit ~75 mA (CR206, CR211, CR216)

AVERAGE CONTINUOUS CURRENT DRAIN:
- Radio always on ~20 mA (CR206, CR211), ~36 mA (CR216)
- Radio in 1 s duty cycle ~2.2 mA (CR206, CR211), ~4 mA (CR216)
- Radio in 8 s duty cycle ~0.45 mA (CR206, CR211), ~0.8 mA (CR216)

CE COMPLIANCE (as of 03/02)

CE COMPLIANT DATALOGGERS: CR200, CR206, CR211, CR216

STANDARD(S) TO WHICH CONFORMITY IS DECLARED: IEC61326:2002

EMI AND ESD PROTECTION

IMMUNITY: Meets or exceeds following standards:
- ESD: per IEC 1000-4-2; ±8 kV air, ±4 kV contact discharge
- RF: per IEC 1000-4-3; 3 V/m, 80-1000 MHz
- EFT: per IEC 1000-4-4; 1 kV power, 500 V I/O
- Surge: per IEC 1000-4-5; 1 kV power and I/O
- Conducted: per IEC 1000-4-6; 3 V 150 kHz-80 MHz

Emissions and immunity performance criteria available on request.

PHYSICAL

CASE DESCRIPTION: Aluminum with spring-loaded terminals

DIMENSIONS (including terminals): 5.5" x 3" x 2" (14.0 x 17.6 x 5.1 cm)

WEIGHT:
CR200 or CR295: 8.5 oz (242 g)
CR206, CR211, or CR216: 9.5 oz (271 g)

CUSTOM CASE: available for OEM applications; contact Campbell Scientific

WARRANTY

One year covering parts and labor.

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