

Measurement Device / Wireless Sensors

CR200 Family

*Input/Output Connections
measure, communicate with,
and power sensors*



*RS-232 Port supports
communications with a
computer*

*LEDs indicate datalogger
is scanning, transmitting,
or receiving*

*Antenna connector is provided on the CR205, CR210, and
CR215 for connecting a whip antenna or an antenna cable*

General Description

The CR200-series dataloggers are small measurement and control devices that measure sensors, process the results, and transmit data via their on-board spread spectrum radio (model dependent). These loggers have an operating temperature range of -40°C to $+50^{\circ}\text{C}$, a 12-bit A/D converter, a battery-backed clock, a 1 Hz scan rate, and a table-based memory structure. They communicate using the PakBus™ protocol, which is a simplified variation of Internet protocols.

Program/Data Storage

Programs and data are stored in a non-volatile Flash memory. Approximately 32,000 data points can be stored in the table-based memory structure.

Input/Output Channels

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. Differential measurements are not supported.

Models/Communications

The models available indicate the communications supported. All of the models support direct communications with a PC.

- **CR200**—supports direct RS-232 communications only.
- **CR205**—includes an on-board 915 MHz Spread Spectrum Radio for transmitting data to another CR205 or a Campbell Scientific RF400 Spread Spectrum Radio. The 915 MHz frequency is used in the US/Canada.
- **CR210**—includes an on-board 922 MHz Spread Spectrum Radio for transmitting data to another CR210 or a Campbell Scientific RF410 Spread Spectrum Radio. The 922 MHz frequency is used in Australia/Israel.
- **CR215**—includes an on-board 2.4 GHz Spread Spectrum Radio for transmitting data to another CR215 or a Campbell Scientific RF415 Spread Spectrum Radio. The 2.4 GHz frequency can be used in many countries worldwide.

Enclosures

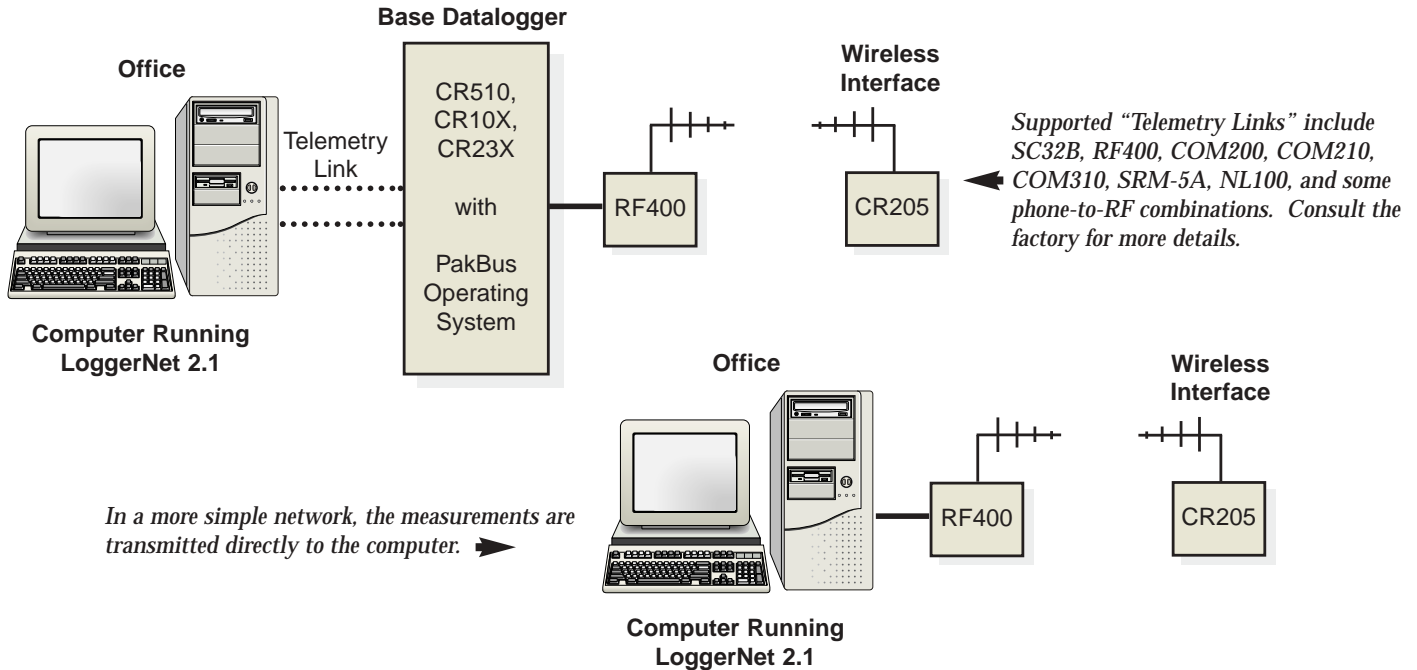
The ENC200 enclosure is a 6.7" x 5.5" x 3.7" enclosure that can house the logger and a small battery, typically the #16869 sealed rechargeable battery. The enclosure has one power connector, one antenna connector, and five compression fittings. A larger enclosure such as our ENC 10/12 or ENC 12/14 is required to house a barometer or a larger battery.



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CR205/RF400-based Wireless Sensor Networks



Program Development Tools

The programming language of the CR200-series loggers is CRBasic. Datalogger programs are developed using a program editor (programs cannot be created or edited in the logger). Program editors that can be used with these loggers include CSIEdit and SCWin. CSIEdit is provided with the loggers and is also included in our LoggerNet Datalogger Support Software. Currently the beta version of SCWin (available from www.campbellsci.com/resource.html) support these loggers.

Communication and Data Collection Tools

PakCom

PakCom software is provided with the CR200-series loggers. PakCom is used to set up the logger and radio, display data tables, and manually collect data. It supports direct and spread spectrum radio communications.

LoggerNet 2.1 or later

LoggerNet Datalogger Support Software supports programming, automatic and manual data collection, and data display. LoggerNet software is required if the logger is used in a wireless sensor network. Both direct and spread spectrum communications are supported.

PakBus ActiveX, PakBus DLL

PakBus ActiveX and PakBus DLL software are provided with the CR200-series loggers. These are Windows and Windows CE Active X components that allow experienced programmers to write their own user interface.

Power Supply

Sealed rechargeable battery options include the #17365 12 V, 7 Ahr battery and the #16869 12 V, 0.8 Ahr battery. These batteries should be recharged either with a solar panel or ac power. Campbell Scientific offers 1.6 W (SP1.6, SP1.6-L) and 5 W (SP5, SP5-L) solar panels. The SP1.6 and SP5 solar panels plug into the ENC200's power connector, and the SP1.6-L and SP5-L connect directly to the logger's terminal strip. Recharging the battery via ac power require either the #15988 or #16876 wall charger. The #15988 charger connects directly to the logger's terminal strip, and the #16876 charger plugs into the ENC200's power connector.

Wireless Sensor Networks

The CR205, CR210, and CR215 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 CR205/RF400-based wireless sensor networks. Our CR210/RF410-based and CR215/RF415-based networks are similar. All wireless sensor networks require LoggerNet 2.1 or higher software. Base dataloggers (CR510, CR10X, or CR23X) must have a PakBus operating system installed, which is available from www.campbellsci.com/upgrades.html.

Antenna Options

CR205 and CR210 Antennas

- 0 dBd, omni-directional, ½ wave, whip, right angle
- 1 dBd Dipole, includes adhesive window/wall mount and 10 ft cable
- 3 dBd, omni-directional (requires antenna cable)
- 9 dBd, Yagi (requires antenna cable)

CR215 Antennas

- 0 dBd, omni-directional, ½ wave, whip
- 13 dBd, Yagi (requires antenna cable)

Antenna Cables

- COAX RPSMA is recommended for lengths less than 10 feet
- COAX NTN is recommended for lengths greater than 10 feet (requires a surge protector kit).

Antenna Surge Protector Kits

- 14962 Surge Protector Kit for CR210 and CR205
- 16982 Surge Protector Kit for CR215

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 loggers can measure are listed below:

- **Barometric Pressure**—CS105 and CS115 barometers
- **Precipitation**—CS700, TE525, TE525WS, TE525MM, and 385 tipping bucket rain gauges
- **Relative Humidity**—CS500 and HMP45C Air Temperature and Relative Humidity probes

Specifications

Electrical specifications are valid over a -40° to +50°C range unless otherwise specified.

CPU and Storage

- 128 kByte Flash Final Storage; data format is 4 bytes per data point (table-based)
- 6.5 kByte Flash Program Storage
- Fastest scan rate once per second

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: $0 \leq V < 2.5$ Vdc
- Measurement resolution: 0.6 mV
- Measurement Accuracy
 - Typical: $\pm(0.25\%$ of reading + 1.2 mV offset) over -40° to +50°C
 - Worst-case: $\pm(1\%$ of reading + 2.4 mV offset) over -40° to 50°C

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

- **Snow Depth**—SR50 Ultrasonic Distance Sensor
- **Soil Water Potential**—257 Matric Potential Block. *Our 229 sensor is not compatible.*
- **Soil Volumetric Water Content**—CS625 Water Content Reflectometer (developed specifically for the CR200-series dataloggers). *Our CS616 and CS620 sensors are not compatible.*
- **Temperature**—109 Temperature Probe (developed specifically for the CR200-series dataloggers). *Other temperature probes listed on our US Price List including our 107/108 probes and thermocouples are not compatible.*
- **Water Level**—SR50 Ultrasonic Distance Sensor, SDI-12 encoders, and SDI-12 transducers (CS408, CS445). *Our DB1 Double Bubbler, non-SDI-12 encoders (CS410), and non-SDI-12 transducers (CS400, CS405, CS420, CS425, and CS431) are not compatible.*
- **Water Quality**—109 Temperature Probe and SDI-12 water quality probes. *Our CS547A, CS511, CSIM11, CSIM11-ORP, and OBS-3 probes are not compatible.*
- **Wind Speed and Direction**—014A, 034B, 03101, 03001, 05103, 05106, 05305, and CS800 sensors. *The CSAT3 3-D Sonic Anemometer is not compatible.*

Note: The CR200-series dataloggers cannot make differential measurements and are not compatible with the solar radiation, duff moisture, fuel moisture/temperature, geographic position, leaf wetness, and soil heat flux sensors listed on our price lists. Campbell Scientific's SDM devices and multiplexers are also not supported.

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 μ A @ 2.7 Vdc
- Maximum input voltage: 4 Vdc

Half Bridge Measurements

- Accuracy: Relative to the excitation. Using +2.5 Vdc excitation, is $\pm(0.06\%$ of reading + 2.4 mV)

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

Switched Battery (SW BATTERY)

- Switched under program control
- 300 mA minimum current available

Specifications (continued)

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 (CR205, CR210), ~36 mA (CR215)
 - Radio transmit ~75 mA (CR205, CR210, CR215)
- Average continuous current drain:
 - Radio always on ~20 mA (CR205, CR210), ~36 mA (CR215)
 - Radio in 1 s duty cycle ~2.2 mA (CR205, CR210), ~4 mA (CR215)
 - Radio in 8 s duty cycle ~0.45 mA (CR205, CR210), ~0.8 mA (CR215)

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
- 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 >2V
- Minimum input: 20 mV RMS
- Maximum frequency: 1 kHz
- Maximum input: ±20 V

Note: P_LL, C1, & C2 can be used for switch closure using the battery voltage and a 20 kOhm pull-up resistor. If the dc offset is >0.5 V, then AC coupling is required.

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

Communications

- Serial Interface: Female RS-232 9-pin interface for logger-to-PC communications

- On-board Spread Spectrum Radio
 - 915 MHz (CR205), 922 MHz (CR210), or 2.4 GHz (CR215)
 - 1 mile transmission range with 0 dBd ¼ wave antenna (line-of-sight), 900 MHz radios
 - 0.6 miles (1 km) transmission range with 0 dBd ½ wave antenna (line-of-sight), 2.4 GHz radio
 - Up to 10 mile range 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

Power

- Battery voltage range: 7 to 16 Vdc (can program datalogger to measure internal battery voltage)
- Battery: 12 Vdc sealed rechargeable with on-board charging circuit. Alkaline cells, lithium, or other non-rechargeable battery types may be connected if the charging circuit is not used (i.e. nothing connected to charging terminals).
- Charger input voltage: 16 to 22 Vdc
- Shelf life of clock's backup battery: 5 years

CE Compliance (as of 03/02)

Standard(s) to which conformity is declared:
EN55022: 1995 and EN61326: 1998

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.

Case

- Aluminum case with spring-loaded terminals
- Dimensions (including terminals): 5.5" x 3" x 2" (14.0 x 17.6 x 5.1 cm)
- Custom case: available for OEM applications; contact Campbell Scientific

Warranty: One year covering parts and labor.



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