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° to +50°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.
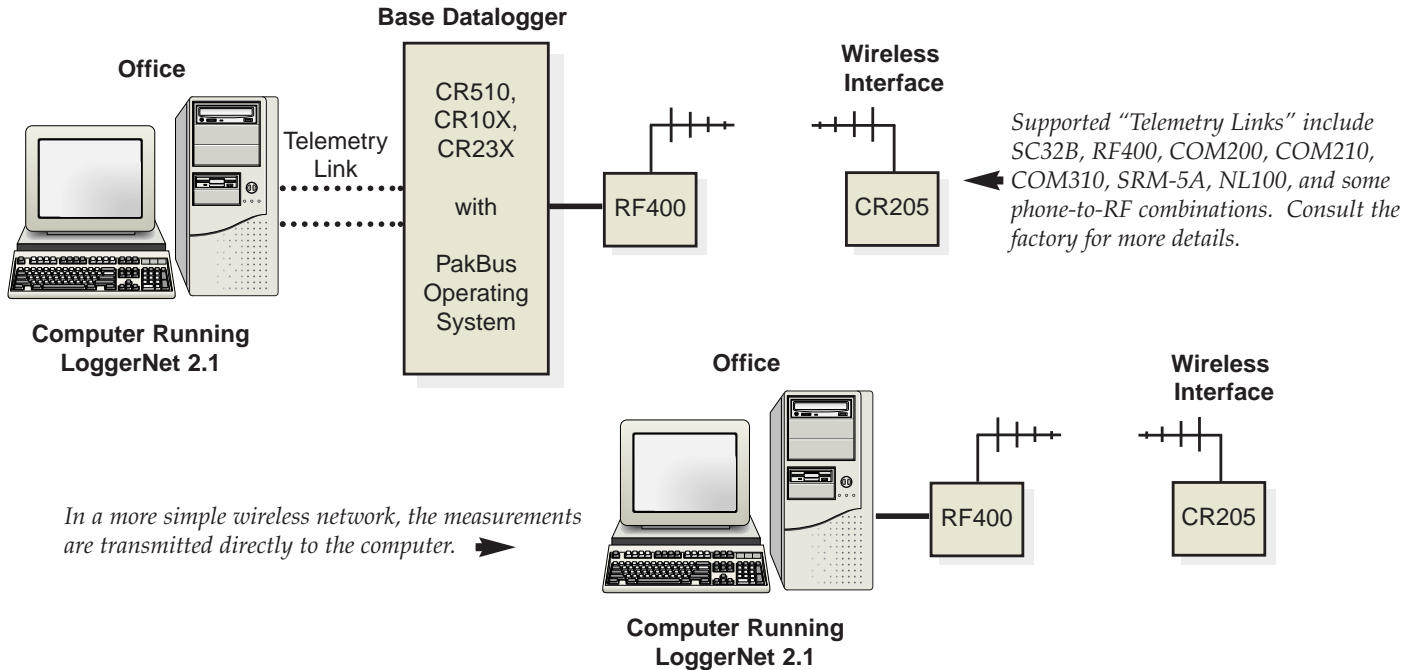
- **CR200**—supports direct RS-232 communications only.

- **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.

CR205/RF400-based Wireless Sensor Networks

Base Datalogger

Office

Telemetry Link

CR510, CR10X, CR23X

with

PakBus Operating System

RF400

Wireless Interface

CR205

Computer Running LoggerNet 2.1

Supported "Telemetry Links" include SC32B, RF400, COM200, COM210, COM310, SRM-5A, NL100, and some phone-to-RF combinations. Consult the factory for more details.

Office

Wireless Interface

RF400

CR205

In a more simple wireless network, the measurements are transmitted directly to the computer.

Computer Running LoggerNet 2.1

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) provides support for the CR200-series 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

Lithium, alkaline, or sealed lead acid batteries can be used to power the loggers, or the loggers can be directly powered using a 16 to 22 Vdc power supply. The battery voltage range is 7 to 16 Vdc. The logger can be programmed to measure the battery voltage. A charger for 12 Vdc sealed rechargeable lead acid batteries is built into the logger.

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. Furthermore, problems in buried or submerged sensor leads are often difficult to diagnose and expensive to repair. In contrast, wireless sensor network components are generally accessible and easy to swap out.

The diagrams at the top of the page describe 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, which is available from www.campbellsci.com/upgrades.html.

Antenna Options

Options for the CR205 and CR210
- 0 dBd, omni-directional, ¼ wave, whip antenna
- 0 dBd, omni-directional, ½ wave, whip antenna, right angle
- 3 dBd, omni-directional (requires antenna cable)
- 6 dBd, Yagi antenna (requires antenna cable)
- 9 dBd, Yagi antenna (requires antenna cable)

Options for the CR215
- 0 dBd, omni-directional, ¼ wave, whip antenna
- 13 dBd, Yagi antenna (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 14462 Surge Protector Kit).

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
- **Snow Depth**-—SR50 Ultrasonic Distance Sensor
- **Soil Water Potential**—257 Matric Potential Block. *Our 229 sensor is not compatible.*
- **Soil Volumetric Water Content**—CS625 Handheld Water Content Sensor (developed specifically for the CR200-series dataloggers). *Our CS616 Water Content Reflectometer and CS620 Handheld Water Content Sensor 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. *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, 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, leaf wetness, and soil heat flux sensors listed on our price lists. Campbell Scientific's SDM devices and multiplexers are also not supported.

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 kByte Flash Program Storage

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: ±(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
- Drive current: 220 µA @ 2.7 Vdc
- Maximum input voltage: 4 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

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)

Excitation Channels: (EX1 and EX2)

- Range: programmable +2.5 or +5 Vdc
- 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

Half Bridge Measurements

- Accuracy: Relative to the excitation. Using +2.5 Vdc excitation, its ±(0.06% of reading + 2.4 mV)

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, P_LL, C1, and C2)

- Voltage threshold: count on transition from <0.9 V to >2.7 Vdc
- Maximum input frequency: 1 kHz
- Maximum input voltage: 5.0 Vdc

Low Level ac (P_LL)

- Minimum input: 20 mV RMS
- Maximum frequency: 1 kHz

Note: P_LL, C1, & C2 can be used for switch closure using the battery voltage and a 100 kOhm pull-up resistor.

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)
- 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)

- 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, 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

Switched Battery (SW BATTERY)

- Switched under program control
- 300 mA minimum current available

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.

CAMPBELL SCIENTIFIC, INC.

815 W. 1800 N. • Logan, Utah 84321-1784 • (435) 753-2342 • FAX (435) 750-9540
Offices also located in: Australia • Brazil • Canada • England • France • South Africa • Spain

Distributor in South Africa
Inteltronics Instrumentation
Uitsig, De Kroon, Brits
P.O. Box 181, Brits, 0250, S.A
TEL: +27 (0)12 250 2403
FAX: +27 (0)12 250 2809
E-mail: itronics@icon.co.za
Web Site: www.inteltronics.co.za