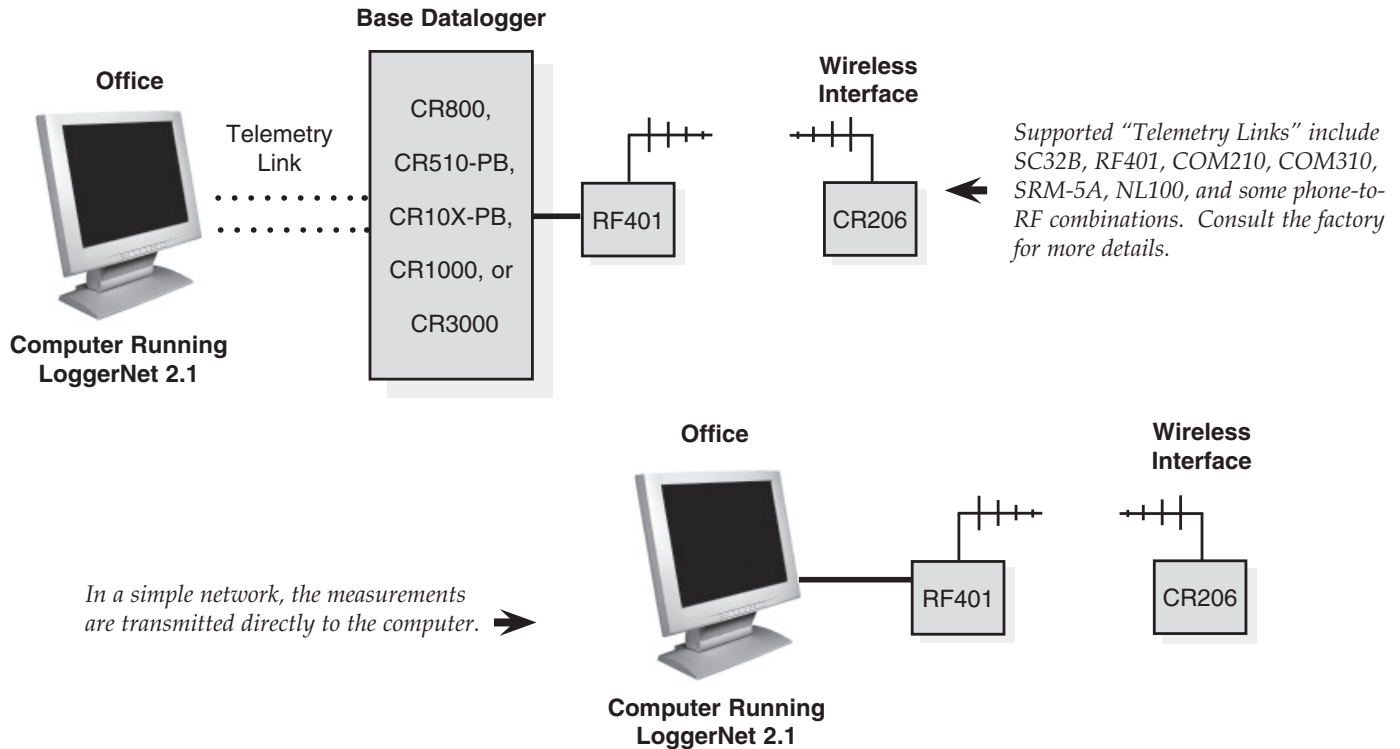


CR206/RF401-based Wireless Sensor Networks



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 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 and 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 are supported.

LoggerNet 2.1 or later

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

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 (i.e. a CR800, CR1000, CR3000, CR510-PB, or CR10X-PB). For the CR510 or CR10X the "-PB" PAKBUS operating system is available, at no charge, from: www.campbellsci.com/downloads

Enclosures

Applications with minimal power requirements can use the ENC200 enclosure to house the logger 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.

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 or ENCSAT enclosure is recommended for a CR295-based system.

Power Supply

Sealed rechargeable battery options for the CR200, CR206, CR211, or CR216 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-L, SP1.6) and 5 W (SP5-L, SP5) solar panels. The SP1.6-L and SP5-L solar panels connect directly to the datalogger's terminal strip, and the SP1.6 and SP5 plug into the ENC200's power connector. Recharging the battery via ac power requires 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.

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

Antenna Options

CR206 and CR211 Antennas

- **14204**—0 dBd, omnidirectional ½ wave whip, jointed, adjustable from 0° to 90°. Connects directly to 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.
- **14203**—3 dBd with cable clamp mounts; requires an antenna cable to connect to datalogger.
- **14201**—9 dBd, Yagi with mounts; requires an antenna cable to connect to datalogger.



The 14201 Yagi antenna is intended for longer transmission distances.

CR216 Antennas

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

Antenna Cables

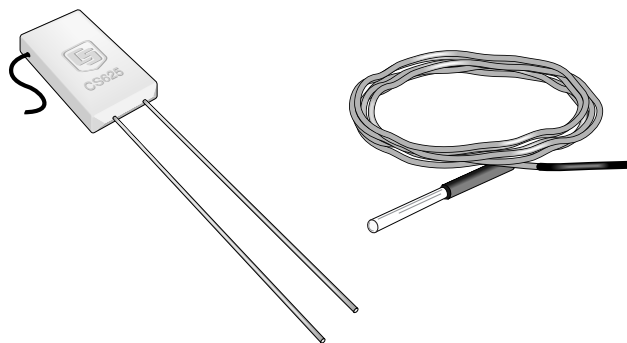
- **COAXRPSMA**—low-loss RG58 cable that is recommended for lengths less than 10 feet.
- **COAXNTN**—low-loss RG8 cable that is recommended for lengths greater than 10 feet; requires a surge protector kit.

Antenna Surge Protector Kits

- **14962**—Surge Protector Kit for CR211 and CR206; requires COAXNTN-L cable.
- **16982**—Surge Protector Kit for CR216; requires 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 CS625 (left) and 109 (right) probes were developed specifically for use with the CR200-series dataloggers.

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

- **Barometric Pressure**—CS100, CS105, and CS115 barometers.
- **Leaf Wetness**—237 Leaf Wetness Sensor.
- **Precipitation**—TE525, TE525WS, TE525MM, TB4, CS700, and 385 tipping bucket rain gages.
- **Relative Humidity**—CS215, HMP50, and HMP45C Air Temperature and Relative Humidity probes.
- **Snow Depth**—SR50 Ultrasonic Distance Sensor.
- **Soil Volumetric Water Content**—CS625 reflectometer. *Our CS616 and CS620 sensors are not compatible.*
- **Soil Water Potential**—257 Matric Potential Block. *Our 229 sensor is not compatible.*
- **Solar Radiation**—CS300 Pyranometer. *Our LI200X, LI190SB, LP02, CMP3, SP-LITE, NR-LITE, CNR1, and Q7.1 probes are not compatible.*
- **Temperature**—109 thermistor. *Other temperature probes listed on our price lists including our 107/108 thermistors and thermocouples are not compatible.*
- **Water Level**—SR50 Ultrasonic Distance Sensor, CS410 Shaft Encoder, and SDI-12 transducers (CS408, CS445). *Our DB1 Double Bubbler and non-SDI-12 transducers (CS420, CS425, CS431, CS440) are not compatible.*
- **Water Quality**—109 Temperature Probe, CS512 Dissolved Oxygen Probe, and SDI-12 water quality probes. *Our CS547A, CSIM11, CSIM11-ORP, and OBS-3+ probes are not compatible.*
- **Wind Speed and Direction**—014A, 034B, 03101, 03001, 05103, 05106, 05305, CS800, and WindSonic 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 geographic position, fuel moisture/temperature, and soil heat flux sensors listed on our price lists. Campbell Scientific's SDM devices and multiplexers are also not supported.

CR200-series Datalogger Specifications

Electrical specifications are valid over a -40° to $+50^{\circ}$ C range unless otherwise specified; non-condensing environment required.

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 $+50^{\circ}$ C
Worst-case: $\pm(1\%$ 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 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)

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
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: 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.

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 $\frac{1}{4}$ wave antenna (line-of-sight) and 900 MHz radios; 0.6 miles (1 km) with 0 dBd $\frac{1}{2}$ 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 $+50^{\circ}$ C; 1 minute/month @ $+25^{\circ}$ C

CPU AND STORAGE

FINAL STORAGE: 128 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)

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

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)

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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