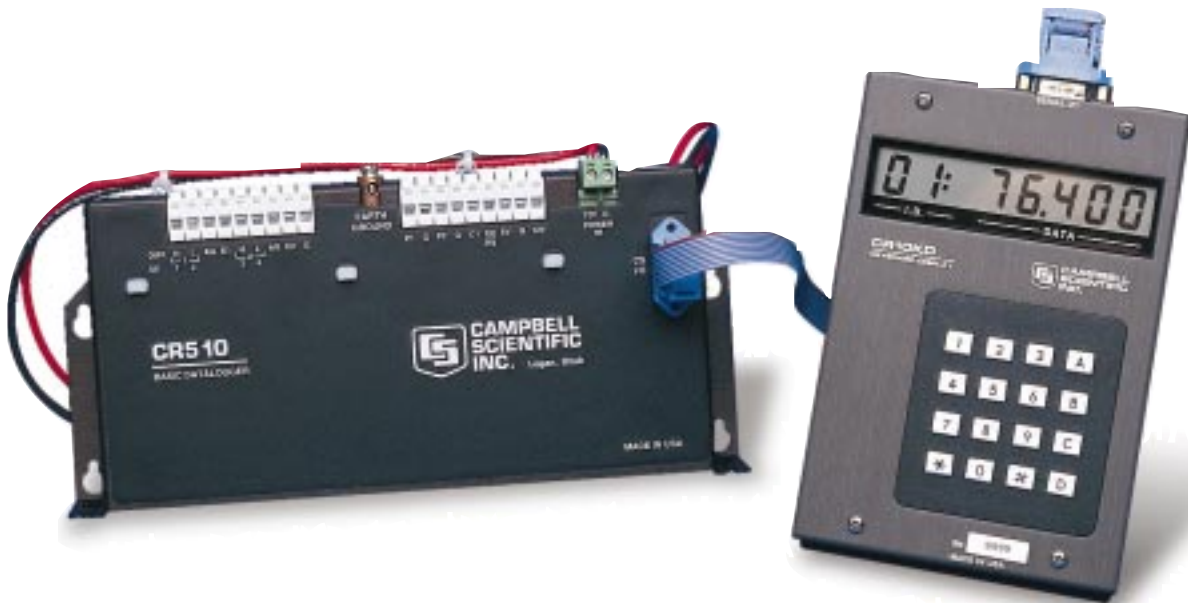


CR510 Basic Datalogger

Research-grade performance in a small package



System Description

Input/Output Connections

The CR510 provides precision channels that allow you to accurately measure a variety of sensors:

- Two differential (four single-ended) analog channels
- Two pulse counting channels (an additional channel [C2/P3] can also be configured to count switch closures)
- Two switched excitation channels
- Two digital I/O ports (both ports support SDI-12 sensors; control port C1 also supports output control of external devices)
- 5 and 12 V power terminals
- 9-pin CS I/O port

12-Volt Powered

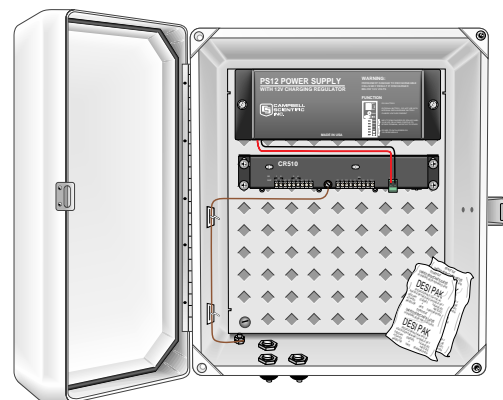
Any 12 VDC source can power the CR510; it typically uses our BPALK or PS12LA power supply. The BPALK consists of eight D-cell batteries and the PS12LA includes a sealed rechargeable battery that can be float-charged with a solar panel or AC power.

Storage Capacity

Data and programs are stored either in non-volatile Flash memory or battery-backed SRAM. The CR510 has two Final Storage areas that store up to 62,000 data points. Optional versions store up to 2 million data points.

Operation in Harsh Environments

The standard operating temperature range is -25°C to $+50^{\circ}\text{C}$; an extended range of -55°C to $+85^{\circ}\text{C}$ is available. A CR510 housed in an enclosure with desiccant is protected from humidity and most contaminants.



Our weather-resistant enclosures (model 6447 10" x 12" shown), rechargeable power supplies, and the CR510's minimal power requirements allow extended field use.

Cover photos: At left: CR510. At right: A shaft encoder measures water level; the data is transmitted to a base station via radio telemetry.

Telecommunications

Telecommunication options include multidrop (coaxial cable) and short-haul modems, radios (UHF, VHF, spread spectrum), telephones (including cellular and voice-synthesized), and satellite transmitters.

On-site Communications

Data and program transfer and storage capabilities are provided by our storage modules.

Direct communication to the serial port of a computer, printer, or display is supported via RS-232 interfaces. For simple on-site data review and program changes, the CR10KD is recommended.

Battery-Backed SRAM and Clock

When the CR510 is disconnected from its 12 V power source, a user-replaceable internal battery retains programming and data, and powers the clock.



Up to 254 sites can be interrogated over a UHF or VHF frequency.

Ease of Use

Free software, shipped with the CR510 and also available from our Web site, allows you to choose compatible sensors, select scan and data output intervals, and output a wiring diagram to connect your sensors.

Support Software

Our computer software simplifies the exchange of data, programs, and commands between the CR510 and a PC. Software that is compatible with the CR510 includes Short Cut Program Builder, PC200W Starter Software, PC208W Datalogger Support Software, and Real-Time Data Monitor (RTDM). For more information, see our software literature.

Transient Protected

Encased in metal with gas discharge tubes on the panel, the CR510 has EMI filtering and ESD protection on all input and output connections.

Small Package

Built with surface-mount technology, the CR510 is a small (8.4" x 1.5" x 3.9"), lightweight (15 oz.) datalogger.

Sensors and Applications

The measurement precision, long-term reliability, and economical price of the CR510 make it ideal for a variety of applications that require a small number of sensors. Compatible sensors include:

- SDI-12 sensors
- Pressure transducers
- Shaft encoders
- Ultrasonic level sensors
- Flow meters
- Conductivity sensors
- pH sensors
- Thermistors
- Tipping bucket and weighing rain gages
- Wind vanes
- Anemometers
- Relative humidity sensors
- Pyranometers
- Leaf wetness sensors
- Fuel moisture/temperature sensors

The CR510 supports many water resources, agricultural, and meteorological applications including:

- Water level/stage
- Well draw-down test
- Water quality
- Alarm and pump actuation
- SCADA/Modbus
- Flood warning/ALERT
- Disease forecasting
- Wind studies



The CR510 supports many applications including the monitoring of fire conditions.

Note: The CR510 does not support multiplexers, SDM devices, or thermocouples. If you need additional channels for future use, consider a CR10X.

CR510 Specifications

Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; non-condensing environment required. To maintain electrical specifications, yearly calibrations are recommended.

PROGRAM EXECUTION RATE

System tasks initiated in sync with real-time up to 64 Hz. One measurement with data transfer is possible at this rate without interruption.

ANALOG INPUTS

NUMBER OF CHANNELS: 2 differential or 4 single-ended, individually configured.

RANGE AND RESOLUTION:

Full Scale Input Range (mV)	Resolution (μ V)	
	Differential	Single-Ended
± 2500	333	666
± 250	33.3	66.6
± 25	3.33	6.66
± 7.5	1.00	2.00
± 2.5	0.33	0.66

INPUT SAMPLE RATES: Includes the measurement time and conversion to engineering units. The fast and slow measurements integrate the signal for 0.25 and 2.72 ms, respectively. Differential measurements incorporate two integrations with reversed input polarities to reduce thermal offset and common mode errors.

Fast differential voltage:	4.2 ms
Slow differential voltage:	9.2 ms
Differential with 60 Hz rejection:	25.9 ms

ACCURACY: $\pm 0.1\%$ of FSR (-25° to 50°C);
 $\pm 0.05\%$ of FSR (0° to 40°C);
e.g., $\pm 0.1\%$ FSR = ± 5.0 mV for ± 2500 mV range

INPUT NOISE VOLTAGE (for ± 2.5 mV range):

Fast differential:	0.82 μ V rms
Slow differential:	0.25 μ V rms
Differential with 60 Hz rejection:	0.18 μ V rms

COMMON MODE RANGE: ± 2.5 V

DC COMMON MODE REJECTION: > 140 dB

NORMAL MODE REJECTION: 70 dB (60 Hz with slow differential measurement)

INPUT CURRENT: ± 9 nA maximum

INPUT RESISTANCE: 20 Gohms typical

ANALOG OUTPUTS

DESCRIPTION: 2 switched excitations, active only during measurement, one at a time.

RANGE: ± 2.5 V

RESOLUTION: 0.67 mV

ACCURACY: ± 2.5 mV (0° to 40°C);
 ± 5 mV (-25° to 50°C)

CURRENT SOURCING: 25 mA

CURRENT SINKING: 25 mA

FREQUENCY SWEEP FUNCTION: The switched outputs provide a programmable swept frequency, 0 to 2.5 V square wave for exciting vibrating wire transducers.

RESISTANCE MEASUREMENTS

MEASUREMENT TYPES: The CR510 provides ratiometric bridge measurements of 4- and 6-wire full bridge, and 2-, 3-, and 4-wire half bridges. Precise dual polarity excitation using any of the switched outputs eliminates dc errors. Conductivity measurements use a dual polarity 0.75 ms excitation to minimize polarization errors.

ACCURACY: $\pm 0.02\%$ of FSR plus bridge errors.

PERIOD AVERAGING MEASUREMENTS

DEFINITION: The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 4 single-ended analog input channels can be used. Signal attenuation and ac coupling is typically required.

INPUT FREQUENCY RANGE:

Signal peak-to-peak ¹ Min.	Max.	Min.	Max
		Pulse w.	Freq. ²
500 mV	5.0 V	2.5 μ s	200 kHz
10 mV	2.0 V	10 μ s	50 kHz
5 mV	2.0 V	62 μ s	8 kHz
2 mV	2.0 V	100 μ s	5 kHz

RESOLUTION: 35 ns divided by the number of cycles measured

ACCURACY: $\pm 0.03\%$ of reading

TIME REQUIRED FOR MEASUREMENT: Signal period multiplied by the number of cycles measured plus 1.5 cycles + 2 ms.

PULSE COUNTERS

NUMBER OF CHANNELS: 2 eight-bit or 1 sixteen-bit; software selectable as switch closure, high frequency pulse, or low-level ac modes. An additional channel (C2/P3) can be software configured to read switch closures at rates up to 40 Hz.

MAXIMUM COUNT RATE: 16 kHz, eight-bit counter; 400 kHz, sixteen-bit counter. Channels are scanned at 8 or 64 Hz (software selectable).

SWITCH CLOSURE MODE:

Minimum Switch Closed Time:	5 ms
Minimum Switch Open Time:	6 ms
Maximum Bounce Time:	1 ms open without being counted

HIGH FREQUENCY PULSE MODE:

Minimum Pulse Width:	1.2 μ s
Maximum Input Frequency:	400 kHz
Maximum Input Voltage:	± 20 V
Voltage Thresholds:	Count upon transition from below 1.5 V to above 3.5 V at low frequencies. Larger input transitions are required at high frequencies because of input filter with 1.2 μ s time constant. Signals up to 400 kHz will be counted if centered around +2.5 V with deviations $\geq \pm 2.5$ V for ≥ 1.2 μ s.

LOW LEVEL AC MODE:

(Typical of magnetic pulse flow transducers or other low voltage, sine wave outputs.)

Input Hysteresis:	14 mV
Maximum ac Input Voltage:	± 20 V
Minimum ac Input Voltage:	

(Sine wave mV rms)*	Range (Hz)
20	1 to 1000
200	0.5 to 10,000
1000	0.3 to 16,000

*16-bit config. or 64 Hz scan req'd for freq. > 2048 Hz

DIGITAL I/O PORTS

DESCRIPTION: Port C1 is software selectable as a binary input, control output, or as an SDI-12 port. Port C2/P3 is input only and can be software configured as an SDI-12 port, a binary input, or as a switch closure counter (40 Hz max).

OUTPUT VOLTAGES (no load): high 5.0 V ± 0.1 V; low < 0.1 V

OUTPUT RESISTANCE: 500 ohms

INPUT STATE: high 3.0 to 5.5 V; low -0.5 to 0.8 V

INPUT RESISTANCE: 100 kohms

SDI-12 INTERFACE STANDARD

DESCRIPTION: Digital I/O Ports C1-C2 support SDI-12 asynchronous communication; up to ten SDI-12 sensors can be connected to each port. Meets SDI-12 standard Version 1.2 for datalogger and sensor modes.

EMI and ESD PROTECTION

The CR510 is encased in metal and incorporates EMI filtering on all inputs and outputs. Gas discharge tubes provide robust ESD protection on all terminal block inputs and outputs. The following European CE standards apply.

EMC tested and conforms to BS EN61326:1998.

Details of performance criteria applied are available upon request.

CPU AND INTERFACE

PROCESSOR: Hitachi 6303.

PROGRAM STORAGE: Up to 16 kbytes for active program; additional 16 kbytes for alternate programs. Operating system stored in 128 kbytes Flash memory.

DATA STORAGE: 128 kbytes SRAM standard (approximately 62,000 values). Additional 2 Mbytes Flash available as an option.

OPTIONAL KEYBOARD DISPLAY: 8 digit LCD (0.5" digits).

PERIPHERAL INTERFACE: 9 pin D-type connector for keyboard display, storage module, modem, printer, card storage module, and RS-232 adapter.

BAUD RATES: Selectable at 300, 1200, and 9600, 76,800 for certain synchronous devices. ASCII communication protocol is one start bit, one stop bit, eight data bits (no parity).

CLOCK ACCURACY: ± 1 minute per month

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 Vdc

TYPICAL CURRENT DRAIN: 1.3 mA quiescent, 13 mA during processing, and 46 mA during analog measurement.

BATTERIES: Any 12 V battery can be connected as a primary power source. Several power supply options are available from Campbell Scientific. The model CR2430 lithium battery for clock and SRAM backup has a capacity of 270 mAh.

PHYSICAL SPECIFICATIONS

SIZE: 8.4" x 1.5" x 3.9" (21.3 cm x 3.8 cm x 9.9 cm). Additional clearance required for serial cable and sensor leads.

WEIGHT: 15 oz. (425 g)

WARRANTY

Three years against defects in materials and workmanship.

We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.

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