CR510 Basic Datalogger

Research-grade performance in a small package

System Description

Input/Output Connections

The CR510 can accurately measure a variety of sensors with its complement of precision input/output channels:

- 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 PS100 power supply. The BPALK consists of eight D-cell batteries and the PS100 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 stores up to 62,000 data points. An optional version stores an additional 1 million data points.

Operation in Harsh Environments

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

Datalogger Operating System

Options for the CR510 Operating System (OS) include array-based, table, Pakbus, Modbus, and ALERT. The array-based OS stores arrays of data at specified intervals or when a measured condition has been met. Two final storage areas are provided for storing the arrays. Table OS groups similar data in separate tables. Pakbus OS enables the CR510 to communicate with CR200-series dataloggers that are in the same network. Pakbus OS stores data in the same format as the table OS. Modbus OS allows the CR510 to interface with SCADA or MMI software. ALERT OS allows the CR510 to be used in an ALERT system. You can change or upgrade your OS by using CSOS software.

Cover photos: At left: CR510. At right: A shaft encoder measures water level; the data is transmitted to a base station computer via radio telemetry. The data is subsequently posted to the internet for review by all interested parties.

Telecommunications

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

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

On-site Communications

Our storage modules store data and transfer data and programs; storage modules are not compatible with table and Pakbus datalogger operating systems. Direct communications with a computer is supported via an RS-232 or USB interface. The CR10KD provides on-site data review and program changes.

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.

Support Software

SCWin and PC200W are easy-to-use software that gets you "up and running" quickly. SCWin creates simple CR510 programs, and PC200W handles simple direct communications. Our starter software can be downloaded, at no charge, from www.campbellsci.com/resource.html.

Other Support Software

Compatible software include LoggerNet, our full-featured datalogger support software, and RTDM, which provides many tools for displaying real-time data. 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
- SCADA/Modbus (Optional Operating System required)
- Flood warning/ALERT (Optional Operating System required)
- Alarm and pump actuation
- 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, Campbell Scientific recommends recalibrating dataloggers every two years.

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	*Resolution (µV)*	
Input Range (mV)	*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: ±0.1% of FSR (-25° to 50°C);
±0.05% of FSR (0° to 40°C);
e.g., ±0.1% FSR = ±5.0 mV for ±2500 mV range

INPUT NOISE VOLTAGE (for ±2.5 mV range):
Fast differential: 0.82 µV rms
Slow differential: 0.25 µV rms
Differential with 60 Hz rejection: 0.18 µV 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: ±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 µs	200 kHz
10 mV	2.0 V	10 µs	50 kHz
5 mV	2.0 V	62 µs	8 kHz
2 mV	2.0 V	100 µs	5 kHz

RESOLUTION: 35 ns divided by the number of cycles measured

ACCURACY: ±0.01% of reading (number of cycles ≥100), ±0.03% of reading (number of cycles <100).

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 µs
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 µs time constant. Signals up to 400 kHz will be counted if centered around +2.5 V with deviations ≥ ± 2.5 V for ≥ 1.2 µs.

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 mAhr.

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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