

# CR10X 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

Program is synchronized with real-time up to 64 Hz. One channel can be measured at this rate with uninterrupted data transfer. Burst measurements up to 750 Hz are possible over short intervals.

## ANALOG INPUTS

NUMBER OF CHANNELS: 6 differential or 12 single-ended, individually configured. Channel expansion provided by AM16/32 or AM416 Relay Multiplexers and AM25T Thermocouple Multiplexers.

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 =  $\pm 5.0$  mV for  $\pm 2500$  mV range

RANGE AND RESOLUTION:

Full Scale Input Range (mV)	Resolution ( $\mu$ V)	
	Differential	Single-Ended
$\pm 2500$	333	666
$\pm 250$	33.3	66.6
$\pm 25$	3.33	6.66
$\pm 7.5$	1.00	2.00
$\pm 2.5$	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 single-ended voltage:	2.6 ms
Fast differential voltage:	4.2 ms
Slow single-ended voltage:	5.1 ms
Slow differential voltage:	9.2 ms
Differential with 60 Hz rejection:	25.9 ms
Fast differential thermocouple:	8.6 ms

INPUT NOISE VOLTAGE (for  $\pm 2.5$  mV range):

Fast differential:	0.82 $\mu$ V rms
Slow differential:	0.25 $\mu$ V rms
Differential with 60 Hz rejection:	0.18 $\mu$ V rms

COMMON MODE RANGE:  $\pm 2.5$  V

DC COMMON MODE REJECTION: >140 dB

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

INPUT CURRENT:  $\pm 9$  nA maximum

INPUT RESISTANCE: 20 Gohms typical

## ANALOG OUTPUTS

DESCRIPTION: 3 switched, active only during measurement, one at a time.

RANGE:  $\pm 2.5$  V

RESOLUTION: 0.67 mV

ACCURACY:  $\pm 5$  mV;  $\pm 2.5$  mV (0° to 40°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 CR10X 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 resistor error.

## PERIOD AVERAGING MEASUREMENTS

The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 12 single-ended analog input channels can be used. Signal attenuation and ac coupling are typically required.

INPUT FREQUENCY RANGE:

Signal peak-to-peak <sup>1</sup> Min.	Max.	Min. Pulse w.	Max Freq. <sup>2</sup>
500 mV	5.0 V	2.5 $\mu$ s	200 kHz
10 mV	2.0 V	10 $\mu$ s	50 kHz
5 mV	2.0 V	62 $\mu$ s	8 kHz
2 mV	2.0 V	100 $\mu$ s	5 kHz

<sup>1</sup>Signals centered around datalogger ground

<sup>2</sup>Assuming 50% duty cycle

RESOLUTION: 35 ns divided by the number of cycles measured

ACCURACY:  $\pm 0.01\%$  of reading (number of cycles  $\geq 100$ )  
 $\pm 0.03\%$  of reading (number of cycles  $< 100$ )

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

## PULSE COUNTERS

NUMBER OF PULSE COUNTER CHANNELS: 2 eight-bit or 1 sixteen-bit; software selectable as switch closure, high frequency pulse, and low level ac.

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  $\mu$ s  
Maximum Input Frequency: 400 kHz  
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  $\mu$ s time constant. Signals up to 400 kHz will be counted if centered around  $\pm 2.5$  V with deviations  $\geq \pm 2.5$  V for  $\geq 1.2$   $\mu$ s.  
Maximum Input Voltage:  $\pm 20$  V

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:  $\pm 20$  V

Minimum ac Input Voltage:

(Sine wave mV RMS)	Range (Hz)
20	1.0 to 1000
200	0.5 to 10,000
1000	0.3 to 16,000

## DIGITAL I/O PORTS

8 ports, software selectable as binary inputs or control outputs. 3 ports can be configured to count switch closures up to 40 Hz.

OUTPUT VOLTAGES (no load): high 5.0 V  $\pm 0.1$  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

Digital I/O Ports C1-C8 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.

## CR10XTCR THERMOCOUPLE REFERENCE

POLYNOMIAL LINEARIZATION ERROR: Typically  $\leq \pm 0.5^\circ\text{C}$  (-35° to +50°C),  $\leq \pm 0.1^\circ\text{C}$  (-24° to +45°C).

INTERCHANGEABILITY ERROR: Typically  $\leq \pm 0.2^\circ\text{C}$  (0° to +60°C) increasing to  $\pm 0.4^\circ\text{C}$  (at -35°C).

## CE COMPLIANCE (as of 09/01)

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;  $\pm 8$  kV air,  $\pm 4$  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.

## 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 60,000 data 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, 9600 and 76,800 bps for synchronous devices. ASCII communication protocol is one start bit, one stop bit, eight data bits (no parity).

CLOCK ACCURACY:  $\pm 1$  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: 7.8" x 3.5" x 1.5" - Measurement & Control Module; 9" x 3.5" x 2.9" - with CR10WP Wiring Panel. Additional clearance required for serial cable and sensor leads.

WEIGHT: 2 lbs

## 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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