

# CR23X 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 100 Hz. Two fast (250  $\mu$ s) single-ended measurements can write to final storage at 100 Hz. Burst measurements to 1.5 kHz are possible over short intervals.

## ANALOG INPUTS

DESCRIPTION: 12 differential or 24 single-ended, individually configured. Channel expansion provided through AM16/32 or AM416 Relay Multiplexers and AM25T Thermocouple Multiplexers.

ACCURACY:  $\pm 0.025\%$  of FSR, 0° to 40°C  
 $\pm 0.05\%$  of FSR, -25° to 50°C  
 $\pm 0.075\%$  of FSR, -40° to 80°C; (-XT only)

Note:  $\pm 5 \mu$ V offset voltage error is possible with single-ended (SE) measurements.

### RANGES AND RESOLUTION:

Input Range (mV)	Resolution ( $\mu$ V) Diff.	Resolution ( $\mu$ V) SE	Accuracy (mV) (-25° to 50°C)
$\pm 5000$	166	333	$\pm 5.00$
$\pm 1000$	33.3	66.6	$\pm 1.00$
$\pm 200$	6.66	13.3	$\pm 0.20$
$\pm 50$	1.67	3.33	$\pm 0.05$
$\pm 10$	0.33	0.66	$\pm 0.01$

INPUT SAMPLE RATES: Includes the measurement time and conversion to engineering units. Differential measurements incorporate two integrations with reversed input polarities to reduce thermal offset and common mode errors. Fast measurement integrates the signal for 250  $\mu$ s; slow measurement integrates for one power line cycle (50 or 60 Hz).

Fast single-ended voltage:	2.1 ms
Fast differential voltage:	3.1 ms
Slow single-ended voltage (60 Hz):	18.3 ms
Slow differential voltage (60 Hz):	35.9 ms
Fast differential thermocouple:	6.9 ms

INPUT NOISE VOLTAGE: Typical for  $\pm 10$  mV Input Range; digital resolution dominates for higher ranges.

Fast differential:	0.60 $\mu$ V rms
Slow differential (60 Hz):	0.15 $\mu$ V rms
Fast single-ended:	1.20 $\mu$ V rms
Slow single-ended (60 Hz):	0.30 $\mu$ V rms

COMMON MODE RANGE:  $\pm 5$  V

DC COMMON MODE REJECTION: >100 dB

NORMAL MODE REJECTION: 70 dB @ 60 Hz when using 60 Hz rejection

SUSTAINED INPUT VOLTAGE WITHOUT DAMAGE:  $\pm 16$  Vdc max.

INPUT CURRENT:  $\pm 2.5$  nA typ.,  $\pm 10$  nA max. @ 50°C

INPUT RESISTANCE: 20 Gohms typical

ACCURACY OF BUILT-IN REFERENCE JUNCTION THERMISTOR (for thermocouple measurements):

$\pm 0.25^\circ\text{C}$ , 0° to 40°C
$\pm 0.5^\circ\text{C}$ , -25° to 50°C
$\pm 0.7^\circ\text{C}$ , -40° to 80°C (-XT only)

## ANALOG OUTPUTS

DESCRIPTION: 4 switched, active only during measurement, one at a time; 2 continuous.

RANGE: Programmable between  $\pm 5$  V

RESOLUTION: 333  $\mu$ V

ACCURACY:  $\pm 5$  mV;  $\pm 2.5$  mV (0° to 40°C)

CURRENT SOURCING: 50 mA for switched; 15 mA for continuous

CURRENT SINKING: 50 mA for switched, 5 mA for continuous (15 mA for continuous with Boost selected in P133).

FREQUENCY SWEEP FUNCTION: The switched outputs provide a programmable swept frequency, 0 to 5 V square wave for exciting vibrating wire transducers.

## RESISTANCE MEASUREMENTS

MEASUREMENT TYPES: The CR23X provides ratio-metric measurements of 4- and 6-wire full bridges, and 2-, 3-, and 4-wire half bridges. Precise, dual polarity excitation using any of the 4 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 ( $\pm 0.015\%$ , 0° to 40°C) plus bridge resistor error.

## PERIOD AVERAGING MEASUREMENTS

DESCRIPTION: The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 24 SE analog inputs 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	10.0 V	2.5 $\mu$ s	200 kHz	
40 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: 12 ns divided by the number of cycles measured

ACCURACY:  $\pm 0.01\%$  of reading

## PULSE COUNTERS

DESCRIPTION: Four 8-bit or two 16-bit inputs selectable for switch closure, high frequency pulse, or low-level AC. Counters read at 10 or 100 Hz.

MAXIMUM COUNT RATE: 2.5 kHz and 25 kHz, 8-bit counter read at 10 Hz and 100 Hz, respectively; 400 kHz, 16-bit counter.

### 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 +2.5 V with deviations  $\pm 2.5$  V for 1.2  $\mu$ s.  
Maximum Input Voltage:  $\pm 20$  V

### LOW LEVEL AC MODE:

Internal ac coupling removes dc offsets up to  $\pm 0.5$  V.  
Input Hysteresis: 15 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

DESCRIPTION: 8 ports selectable as binary inputs or control outputs. Ports C5-C8 capable of counting switch closures and high frequency pulses.

HIGH FREQUENCY MAX: 2.5 kHz

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

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 SUPPORT

DESCRIPTION: Digital I/O Ports C5-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 sensors mode.

## 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;  $\pm 8$  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

PROCESSORS: Hitachi 6303; Motorola 68HC708 supports communications.

PROGRAM STORAGE: Up to 16 kbytes for active program; additional 16 kbytes for alternate programs. Operating system stored in 512 kbytes Flash memory.

DATA STORAGE: 1 Mbyte Flash standard. Additional 4 Mbytes Flash available as an option.

DISPLAY: 24-character-by-2-line LCD

SERIAL INTERFACES: Optically isolated RS-232 9-pin interface for computer or modem. CS 9-pin I/O interface for peripherals such as storage modules or CSI modems.

BAUD RATES: Selectable at 300, 1200, 2400, 4800, 9600, 19.2K, 38.4K, and 76.8K. ASCII protocol is one start bit, eight data bits, no parity, one stop bit.

CLOCK ACCURACY:  $\pm 1$  minute per month, -25° to +50°C;  $\pm 2$  minutes per month, -40° to +85°C

## SYSTEM POWER REQUIREMENTS

VOLTAGE: 11 to 16 Vdc

TYPICAL CURRENT DRAIN: 2 mA quiescent with display off (2.5 mA max), 7 mA quiescent with display on, 45 mA during processing, and 70 mA during analog measurement.

INTERNAL BATTERIES: 10 Ahr alkaline or 7 Ahr rechargeable base. 1800 mAhr lithium battery for clock and SRAM backup typically provides 10 years of service.

EXTERNAL BATTERIES: Any 11 to 16 Vdc battery may be connected; reverse polarity protected.

## PHYSICAL SPECIFICATIONS

SIZE: 9.5" x 7.0" x 3.8" (24.1 cm x 17.8 cm x 9.6 cm). Terminal strips extend 0.4" (1.0 cm) and terminal strip cover extends 1.3" (3.3 cm) above the panel.

WEIGHT: 3.6 lbs (1.6 kg) with low-profile base  
8.3 lbs (3.8 kg) with alkaline base  
10.7 lbs (4.8 kg) with rechargeable base

## 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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