

CR9000X & CR9000XC Specifications

Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; extended testing over -40° to +70°C range available as an option, excluding batteries. Non-condensing environment is required. To maintain specifications, Campbell Scientific recommends recalibrating dataloggers every two years. We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.

CR9032 CPU MODULE

PROCESSORS: 180 MHz Hitachi SH-4

MEMORY: 128 Mbytes of internal SDRAM for program and data storage. Expanded data storage with PCMCIA type I, type II or type III cards or CompactFlash® cards with an adapter

SERIAL INTERFACES: RS-232 9-pin interface for computer or modem. CS I/O 9-pin interface for CSI peripherals and SDM devices.

ETHERNET INTERFACE: 10baseT/100baseT port for communications over a local network or the Internet.

CR9011 POWER SUPPLY MODULE

VOLTAGE: 9.6 to 18 Vdc

TYPICAL CURRENT DRAIN: Base system with no modules is 500 mA active; 300 mA standby. Current drain of individual I/O modules varies. Refer to specifications for each I/O module for specific values. Power supply module can place the system in standby mode by shutting off power to the rest of the modules.

DC CHARGING: 9.6 to 18 Vdc input charges internal batteries at up to 2 A rate. Charging circuit includes temperature compensation.

INTERNAL BATTERIES: Sealed rechargeable with 14 Ahr (7 Ahr for the CR9000XC) capacity per charge.

EXTERNAL BATTERIES: External 12 V batteries can be connected.

CR9041 A/D and AMPLIFIER MODULE

A/D Conversions: 16-bit, 100 kHz

CR9050 and CR9051E ANALOG INPUT MODULE with RTD

INPUT CHANNELS PER MODULE: 14 Differential (diff) or 28 single-ended (SE)

RANGE, RESOLUTION, AND INPUT NOISE:

| Input Range (mV) | Resolution (1 A/D count) (µV) | Input Noise (µV RMS) | Input Noise (µV RMS) | Max Sample Rates (kHz) |
|------------------|-------------------------------|----------------------|----------------------|------------------------|
| ±5000 | 158.0 | 105 | 130 | 100 |
| ±1000 | 32.0 | 35 | 35 | 100 |
| ±200 | 6.3 | 7 | 7 | 50 |
| ±50 | 1.6 | 4 | 4 | 50 |

Note: Measurement averaging provides lower noise and better resolution.

ACCURACY OF VOLTAGE MEASUREMENTS:

Single-ended & Differential:
±(0.07% of reading + 4 A/D counts) -25° to +50°C
±(0.14% of reading + 4 A/D counts) -40° to +70°C

Dual Differential (two measurements with input polarity reversed):
±(0.07% of reading + 1 A/D count) -25° to +50°C
±(0.14% of reading + 1 A/D count) -40° to +70°C

COMMON MODE RANGE: ±5 V

DC COMMON MODE REJECTION: >120 dB

INPUT RESISTANCE: 2.5 gigaohms typical

MAXIMUM INPUT VOLTAGE WITHOUT DAMAGE:
±20 V CR9050, -40 to +50 V CR9051E

TYPICAL CURRENT DRAIN: 25 mA active

Resistance & Conductivity Measurements (also requires CR9060 Excitation Module)

ACCURACY: ± (0.04% of reading + 2 A/D counts) limited by accuracy of external bridge resistors.

MEASUREMENT TYPES: 6-wire and 4-wire full bridge, 4-wire, 3-wire, and 2-wire half bridge. Uses excitation reversal to remove thermal EMF errors.

CR9052DC ANTI-ALIAS FILTER MODULE

Refer to the CR9052DC documentation

CR9055(E) 50 V-ANALOG INPUT MODULE

INPUT CHANNELS PER MODULE: 14 diff or 28 SE.

RANGE AND RESOLUTION:

| Input Range (V) | Resolution (1 A/D count) (µV) | Input Noise (µV RMS) | Max Sample Rates (kHz) |
|-----------------|-------------------------------|----------------------|------------------------|
| ±50 | 1580 | 1050 | 100 |
| ±10 | 320 | 350 | 100 |
| ±2 | 63 | 85 | 50 |
| ±0.5 | 16 | 60 | 50 |

Note: Measurement averaging provides lower noise and better resolution.

ACCURACY OF VOLTAGE MEASUREMENTS:

Single-Ended & Differential:
±(0.1% of reading + 4 A/D counts) -25° to +50°C
±(0.2% of reading + 4 A/D counts) -40° to +70°C

Dual Differential:
(two measurements with input polarity reversed)
±(0.1% of reading + 1 A/D count) -25° to +50°C
±(0.2% of reading + 1 A/D counts) -40° to +70°C

COMMON MODE RANGE: ±5 V

DC COMMON MODE REJECTION: >62 dB

INPUT RESISTANCE: 100 kohms typical

MAXIMUM INPUT VOLTAGE WITHOUT DAMAGE: ±150 V

TYPICAL CURRENT DRAIN: 15 mA active

CR9058E ISOLATION MODULE

INPUT CHANNELS PER MODULE: 10 isolated, differential; each channel has its own isolation ground for shielded cable connection.

RANGE, RESOLUTION, AND INPUT RESISTANCE:

| Input Range (Vdc) | Resolution w/o Averaging (µV) | Resolution w/ Averaging (µV) | Input Resistance (kohms) |
|-------------------|-------------------------------|------------------------------|--------------------------|
| ±2 | ±10 | ±2 | 10,000 |
| ±20 | ±100 | ±20 | 88.9 |
| ±60 | ±300 | ±60 | 269 |

ACCURACY:

Gain Error: ±0.02% of reading (-40° to +50°C), ±0.07% of reading (-40° to +70°C)

Offset Error: ±0.01% of FSR (-40° to +50°C), ±0.01% of FSR (-40° to +70°C)

INPUT TO SYSTEM GROUND CMRR db:

| Input Range (Vdc) | DC | 60 Hz | 300 Hz | 2 kHz |
|-------------------|------|-------|--------|-------|
| ±2 | >160 | 93.3 | 81.0 | 70.7 |
| ±20 | >160 | 99.1 | 88.8 | 71.6 |
| ±60 | >160 | 94.6 | 85.3 | 66.7 |

INPUT TO INPUT CROSSTALK db:

| Input Range (Vdc) | DC | 60 Hz | 300 Hz | 2 kHz |
|-------------------|--------|--------|--------|-------|
| ±2 | < -160 | -121.3 | -108.8 | -94.3 |
| ±20 | < -160 | -120.8 | -98.6 | -96.1 |
| ±60 | < -160 | -108.7 | -87.9 | -82.5 |

MINIMUM SCAN TIME PER MODULE (for VoltDiff or TCDiff):
1460 µs with no input reversal and no open circuit detection; selecting input reversal (Rev parameter = 1) adds 2300 µs to the minimum scan time and selecting open circuit detection (voltage range = V2C) adds 1460 µs to the minimum scan time. If the scan time is insufficient, the CR9000X will report an error at compile time.

MAXIMUM CONTINUOUS VOLTAGE W/O DAMAGE:

| Input Range (Vdc) | H to L (Vdc) | ISO Ground (Vdc) | System Ground (Vdc) | System Ground (Vdc) |
|-------------------|--------------|------------------|---------------------|---------------------|
| ±2 | ±208 | ±109 | ±360 | ±469 |
| ±20 | ±223 | ±121 | ±360 | ±481 |
| ±60 | ±448 | ±233 | ±360 | ±593 |

MAXIMUM ESD VOLTAGE ON INPUTS: ±5000V

TYPICAL CURRENT DRAIN: 360 mA operating, 5 mA standby

CR9060 EXCITATION MODULE

TYPICAL CURRENT DRAIN: 108 mA quiescent, 125 mA active

Analog Outputs

ANALOG OUTPUTS PER MODULE: 10 switched, 6 continuous

SWITCHED: Provides excitation for resistance measurements. Only one output can be active at a time.

CONTINUOUS: All outputs can be active simultaneously.

RANGE: ±5 V

ACCURACY: ± (0.2% of output ±4 mV)

RESOLUTION: 12-bit A/D (2.4 mV)

OUTPUT CURRENT: ±50 mA

Digital Control Outputs

CONTROL CHANNELS PER MODULE: 8

OUTPUT VOLTAGES (no load):

High: 5.0 V ±0.2 V
Low: < 0.2 V

OUTPUT RESISTANCE: 100 ohms

CR9071E COUNTER & DIGITAL I/O MODULE

Counter Channels

COUNTER CHANNELS PER MODULE: 12

MAXIMUM COUNTS PER INTERVAL: 2³² Max. counts per interval will never be reached because with a maximum input frequency of 1 MHz, the 32-bit counter will go 71.58 minutes before it rolls over. The maximum CR9000X scan rate is 1 minute.

SWITCH CLOSURE MODE (4 channels)

Minimum switch closed time: 5 ms
Minimum switch open time: 6 ms
Maximum bounce time: 1 ms open without being counted

HIGH FREQUENCY MODE (all channels)

Minimum pulse width: 500 ns
Maximum input frequency: 1 MHz
Thresholds: Pulse counted on transition from below 1.5 V to above 3.5 V
Maximum input voltage: ±20 V

Note: Because of the pulse channels' input filter with a 200 ns time constant, higher frequencies will require larger input transitions.

LOW LEVEL AC MODE (8 channels)

Input hysteresis: 10 mV
Minimum ac voltage: 25 mV RMS
Maximum input voltage: ±20 V
Frequency range:

| (mV RMS) | RANGE (Hz) |
|----------|---------------|
| 25 | 1 to 10,000 |
| ≥50 | 0.5 to 20,000 |

TYPICAL CURRENT DRAIN: 35 mA

Digital Inputs/Outputs

I/O CHANNELS PER MODULE: 16

OUTPUT VOLTAGES (no load)

High: 5.0 V ±0.2 V
Low: < 0.2 V

OUTPUT RESISTANCE: 320 ohms

INPUT STATE:

High: 3.5 to 5 V
Low: -0.5 to 1.2 V

INPUT RESISTANCE: 100 kOhms

Interval Measurement

I/O CHANNELS: Resolution is the scan rate

PULSE CHANNELS

Maximum interval: 1 minute
Resolution: 40 ns

TRANSIENT PROTECTION

All analog and digital inputs and outputs use gas discharge tubes and transient filters to protect against high-voltage transients. Digital I/Os also have over-voltage protection clamping.

PHYSICAL

Size

LAB ENCLOSURE: 15.75"L x 9.75"W x 8"D (40 x 24.8 x 20.3 cm)

FIBERGLASS ENVIRONMENTAL ENCLOSURE:
18"L x 13.5"W x 9"D (45.7 x 34.3 x 22.9 cm)

CR9000XC: 10"L x 11"W x 9"D (25.4 x 27.9 x 22.9 cm)

Weight

LAB ENCLOSURE: 30 lbs including modules (13.6 kg)

FIBERGLASS ENVIRONMENTAL ENCLOSURE:
42 lbs including modules (19.1 kg)

CR9000XC: 27 lbs including modules (12.3 kg)

REPLACEMENT BATTERIES: 6.4 lbs (2.9 kg)

ADDITIONAL MODULES: 1 lb each (0.5 kg)

WARRANTY

Three years against defects in materials and workmanship.

