

CR1000 Specifications

Electrical specifications are valid over a -25° to +50°C, non-condensing environment, unless otherwise specified. Recalibration recommended every three years. Critical specifications and system configuration should be confirmed with Campbell Scientific before purchase.

PROGRAM EXECUTION RATE

10 ms to one day @ 10 ms increments

ANALOG INPUTS (SE1-SE16 or DIFF1-DIFF8)

8 differential (DF) or 16 single-ended (SE) individually configured input channels. Channel expansion provided by optional analog multiplexers.

RANGES and RESOLUTION: Basic resolution (Basic Res) is the A/D resolution of a single A/D conversion. A DF measurement with input reversal has better (finer) resolution than Basic Res.

Range (mV) ¹	DF Res (µV) ²	Basic Res (µV)
±5000	667	1333
±2500	333	667
±250	33.3	66.7
±25	3.33	6.7
±7.5	1.0	2.0
±2.5	0.33	0.67

¹Range overhead of ~9% on all ranges guarantees that full-scale values will not cause over range.

²Resolution of DF measurements with input reversal.

ACCURACY³:

±(0.06% of reading + offset), 0° to 40°C

±(0.12% of reading + offset), -25° to 50°C

±(0.18% of reading + offset), -55° to 85°C (-XT option only)

³Accuracy does not include the sensor and measurement noise. Offsets are defined as:

Offset for DF w/input reversal = 1.5·Basic Res + 1.0 µV

Offset for DF w/o input reversal = 3·Basic Res + 2.0 µV

Offset for SE = 3·Basic Res + 3.0 µV

ANALOG MEASUREMENT SPEED:

Integration Type/Code	Integration Time	Settling Time	Total Time ⁴	
			SE w/ No Rev	DF w/ Input Rev
250	250 µs	3 ms	~1 ms	~12 ms
60 Hz ⁵	16.67 ms	3 ms	~20 ms	~40 ms
50 Hz ⁵	20.00 ms	3 ms	~25 ms	~50 ms

⁴Includes 250 µs for conversion to engineering units.

⁵AC line noise filter.

INPUT NOISE VOLTAGE: For DF measurements with input reversal on ±2.5 mV input range (digital resolution dominates for higher ranges).

250 µs Integration: 0.34 µV RMS

50/60 Hz Integration: 0.19 µV RMS

INPUT LIMITS: ±5 Vdc

DC COMMON MODE REJECTION: >100 dB

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

INPUT VOLTAGE RANGE W/O MEASUREMENT

CORRUPTION: ±8.6 Vdc max.

SUSTAINED INPUT VOLTAGE W/O DAMAGE: ±16 Vdc max.

INPUT CURRENT: ±1 nA typical, ±6 nA max. @ 50°C; ±90 nA @ 85°C

INPUT RESISTANCE: 20 GΩ typical

ACCURACY OF BUILT-IN REFERENCE JUNCTION

THERMISTOR (for thermocouple measurements):

±0.3°C, -25° to 50°C

±0.8°C, -55° to 85°C (-XT option only)

ANALOG OUTPUTS (VX1-VX3)

3 switched voltage, sequentially active only during measurement.

RANGE AND RESOLUTION:

Channel	Range	Resolution	Current Source/Sink
(VX 1-3)	±2.5 Vdc	0.67 mV	±25 mA

ANALOG OUTPUT ACCURACY (VX):

±(0.06% of setting + 0.8 mV), 0° to 40°C

±(0.12% of setting + 0.8 mV), -25° to 50°C

±(0.18% of setting + 0.8 mV), -55° to 85°C (-XT option only)

VX FREQUENCY SWEEP FUNCTION: Switched outputs provide a programmable swept frequency, 0 to 2500 mv square waves for exciting vibrating wire transducers.

PERIOD AVERAGE

Any of the 16 SE analog inputs can be used for period averaging. Accuracy is ±(0.01% of reading + resolution), where resolution is 136 ns divided by the specified number of cycles to be measured.

INPUT AMPLITUDE AND FREQUENCY:

Voltage Gain	Input Range (±mV)	Signal (peak to peak)		Min Pulse Width (µV)	Max ⁸ Freq (kHz)
		Min. (mV) ⁶	Max (V) ⁷		
1	250	500	10	2.5	200
10	25	10	2	10	50
33	7.5	5	2	62	8
100	2.5	2	2	100	5

⁶Signal centered around Threshold (see PeriodAvg() instruction).

⁷With signal centered at the datalogger ground.

⁸The maximum frequency = 1/(twice minimum pulse width) for 50% of duty cycle signals.

RATIOMETRIC MEASUREMENTS

MEASUREMENT TYPES: Provides ratiometric resistance measurements using voltage excitation. 3 switched voltage excitation outputs are available for measurement of 4- and 6-wire full bridges, and 2-, 3-, and 4-wire half bridges. Optional excitation polarity reversal minimizes dc errors.

RATIOMETRIC MEASUREMENT ACCURACY:^{9,10,11}

±(0.04% of Voltage Measurement + Offset)

⁹Accuracy specification assumes excitation reversal for excitation voltages < 1000 mV. Assumption does not include bridge resistor errors and sensor and measurement noise.

¹⁰Estimated accuracy, ΔX (where X is value returned from the measurement with Multiplier = 1, Offset = 0):

BrHalf() instruction: ΔX = ΔV_x/V_x

BrFull() instruction ΔX = 1000·ΔV_x/V_x, expressed as mV·V⁻¹.

ΔV⁻¹ is calculated from the ratiometric measurement accuracy. See Resistance Measurements Section in the manual for more information.

¹¹Offsets are defined as:

Offset for DIFF w/input reversal = 1.5·Basic Res + 1.0 µV

Offset for DIFF w/o input reversal = 3·Basic Res + 2.0 µV

Offset for SE = 3·Basic Res + 3.0 µV

Excitation reversal reduces offsets by a factor of two.

PULSE COUNTERS (P1-P2)

2 inputs individually selectable for switch closure, high frequency pulse, or low-level ac. Independent 24-bit counters for each input.

MAXIMUM COUNTS PER SCAN: 16.7x10⁶

SWITCH CLOSURE MODE:

Minimum Switch Closed Time: 5 ms

Minimum Switch Open Time: 6 ms

Max. Bounce Time: 1 ms open w/o being counted

HIGH-FREQUENCY PULSE MODE:

Maximum Input Frequency: 250 kHz

Maximum Input Voltage: ±20 V

Voltage Thresholds: Count upon transition from below 0.9 V to above 2.2 V after input filter with 1.2 µs time constant.

LOW-LEVEL AC MODE: Internal ac coupling removes ac offsets up to ±0.5 Vdc.

Input Hysteresis: 12 mV RMS @ 1 Hz

Maximum ac Input Voltage: ±20 V

Minimum ac Input Voltage:

Sine Wave (mV RMS)	Range(Hz)
20	1.0 to 20
200	0.5 to 200
2000	0.3 to 10,000
5000	0.3 to 20,000

DIGITAL I/O PORTS (C1-C8)

8 ports software selectable, as binary inputs or control outputs. Provide on/off, pulse width modulation, edge timing, subroutine interrupts / wake up, switch closure pulse counting, high frequency pulse counting, asynchronous communications (UARTs), and SDI-12 communications. SDM communications are also supported.

LOW FREQUENCY MODE MAX: <1 kHz

HIGH-FREQUENCY MODE MAX: 400 kHz

SWITCH-CLOSURE FREQUENCY MAX: 150 Hz

EDGE TIMING RESOLUTION: 540 ns

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

OUTPUT RESISTANCE: 330 Ω

INPUT STATE: high 3.8 to 16 V; low -8.0 to 1.2 V

INPUT HYSTERESIS: 1.4 V

INPUT RESISTANCE: 100 kΩ with inputs <6.2 Vdc

0.220 kΩ with inputs ≥6.2 Vdc

SERIAL DEVICE/RS-232 SUPPORT: 0 to 5 Vdc UART

SWITCHED 12 VDC (SW-12)

1 independent 12 Vdc unregulated source is switched on and off under program control. Thermal fuse hold current = 900 mA at 20°C, 650 mA at 50°C, 360 mA at 85°C.

COMPLIANCE INFORMATION

VIEW EU DECLARATION OF CONFORMITY AT:

www.campbellsci.com/cr1000

www.campbellsci.com/cr1000kd

COMMUNICATIONS

RS-232 PORTS:

DCE 9-pin: (not electrically isolated) for computer connection or connection of modems not manufactured by Campbell Scientific.

COM1 to COM4: 4 independent Tx/Rx pairs on control ports (non-isolated); 0 to 5 Vdc UART

Baud Rates: selectable from 300 bps to 115.2 kbps.

Default Format: 8 data bits; 1 stop bits; no parity

Optional Formats: 7 data bits; 2 stop bits; odd, even parity

CS I/O PORT: Interface with telecommunications peripherals manufactured by Campbell Scientific.

SDI-12: Digital control ports C1, C3, C5, and C7 are individually configured and meet SDI-12 Standard v 1.3 for datalogger mode. Up to 10 SDI-12 sensors are supported per port.

PERIPHERAL PORT: 40-pin interface for attaching CompactFlash or Ethernet peripherals

PROTOCOLS SUPPORTED: PakBus, AES-128 Encrypted PakBus, Modbus, DNP3, FTP, HTTP, HTML, POP3, PPP, SMTP, Telnet, NTCIP, NTP, SDI-12, SDM, TLS.

SYSTEM

PROCESSOR: Renesas H8S 2322 (16-bit CPU with 32-bit internal core running at 7.3 MHz)

MEMORY: 2 MB of flash for operating system; 4 MB of battery-backed SRAM for CPU usage and final data storage; 512 kB flash disk (CPU) for program files.

REAL-TIME CLOCK ACCURACY: ±3 min. per year.

Correction via GPS optional.

REAL-TIME CLOCK RESOLUTION: 10 ms

SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 Vdc

INTERNAL BATTERIES: 1200 mAh lithium battery for clock and SRAM backup that typically provides three years of backup

EXTERNAL BATTERIES: Optional 12 Vdc nominal alkaline and rechargeable available. Power connection is reverse polarity protected.

TYPICAL CURRENT DRAIN at 12 Vdc:

Sleep Mode: < 1 mA

1 Hz Sample Rate (1 fast SE measurement): 1 mA

100 Hz Sample Rate (1 fast SE measurement): 16 mA

100 Hz Sample Rate (1 fast SE measurement w/RS-232 communication): 28 mA

Active external keyboard display adds 7 mA (100 mA with backlight on).

PHYSICAL

DIMENSIONS: 23.9 x 10.2 x 6.1 cm (9.4 x 4 x 2.4 in); additional clearance required for cables and leads.

MASS/WEIGHT: 1 kg / 2.1 lb

WARRANTY

3 years against defects in materials and workmanship.

