CR1000 Specifications

Electrical specifications are valid over a -25° to +50°C, non-condensing environment, unless otherwise specified. Recalibration recommended every two 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. Channel expansion provided by multiplexers.

RANGES and RESOLUTION: Basic resolution (Basic Res) is the A/D resolution of a single conversion. Resolution of DF measurements with input reversal is half the 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

[1]Range overhead of ~9% on all ranges guarantees that full-scale values will not cause over range.
[2]Resolution of DF measurements with input reversal.

ACCURACY[3]:
±(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 only)

[3]Accuracy 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[5]	
			SE w/ No Rev	DF w/ Input Rev
250	250 µs	450 µs	~1 ms	~12 ms
60 Hz[4]	16.67 ms	3 ms	~20 ms	~40 ms
50 Hz[4]	20.00 ms	3 ms	~25 ms	~50 ms

[4]AC line noise filter.
[5]Includes 250 µs for conversion to engineering units.

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

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 Gohms 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 only)

ANALOG OUTPUTS (Vx1-Vx3)
3 switched voltage, sequentially active only during measurement.

RANGE AND RESOLUTION: Voltage outputs programmable between ±2.5 V with 0.67 mV resolution.

V_x ACCURACY: ±(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 only)

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

CURRENT SOURCING/SINKING: ±25 mA

RESISTANCE MEASUREMENTS
MEASUREMENT TYPES: Ratiometric measurements of 4- and 6-wire full bridges, and 2-, 3-, and 4-wire half bridges. Precise, dual polarity excitation for voltage excitations eliminates dc errors. Offset values are reduced by a factor of two when excitation reversal is used.

VOLTAGE RATIO ACCURACY[6]: Assuming excitation voltage of at least 1000 mV, not including bridge resistor error.

$$\pm(0.04\% \text{ of voltage reading} + \text{offset})/V_x$$

[6]Accuracy does not include the sensor and measurement noise. The 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

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)[7]		Min Pulse Width (µV)	Max[8] Freq (kHz)
		Min. (mV)	Max (V)		
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

[7]With signal centered at the datalogger ground.
[8]The maximum frequency = 1/(twice minimum pulse width) for 50% of duty cycle signals.

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: 16.7×10^6

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 edge timing, subroutine interrupts/wake up, switch closure pulse counting, high frequency pulse counting, asynchronous communications (UARTs), SDI-12 communications, and SDM communications.

HIGH-FREQUENCY 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 ohms
INPUT STATE: high 3.8 to 16 V; low -8.0 to 1.2 V
INPUT HYSTERESIS: 1.4 V
INPUT RESISTANCE: 100 kohm with inputs <6.2 Vdc
220 ohm 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 @ 20°C, 650 mA @ 50°C, 360 mA @ 85°C.

CE COMPLIANCE
STANDARD(S) TO WHICH CONFORMITY IS DECLARED: IEC61326:2002

COMMUNICATIONS
RS-232 PORTS:
9-pin: DCE (not electrically isolated) for battery-powered computer or non-CSI modem connection.
COM1 to COM4: Four 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 CSI telecommunication peripherals

SDI-12: Digital control ports 1, 3, 5, and 7 are individually configured and meet SDI-12 Standard version 1.3 for datalogger mode. Up to ten SDI-12 sensors are supported per port.

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

PROTOCOLS SUPPORTED: PakBus, Modbus, DNP3, FTP, HTTP, XML, POP3, SMTP, Telnet, NTCIP, NTP, SDI-12, SDM

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, program storage and final data storage.

RTC CLOCK ACCURACY: ±3 min. per year. Correction via GPS optional.

RTC CLOCK RESOLUTION: 10 ms

SYSTEM POWER REQUIREMENTS
VOLTAGE: 9.6 to 16 Vdc

EXTERNAL BATTERIES: 12 Vdc nominal (power connection is reverse polarity protected)

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

TYPICAL CURRENT DRAIN:
Sleep Mode: 0.7 mA typical; 0.9 mA max.
1 Hz Sample Rate (1 fast SE meas.): 1 mA
100 Hz Sample Rate (1 fast SE meas.): 16.2 mA
100 Hz Sample Rate (1 fast SE meas. w/RS-232 communication): 27.6 mA
Optional Keyboard Display On (no backlight): add 7 mA to current drain
Optional Keyboard Display On (backlight on): add 100 mA to current drain

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.

WEIGHT (datalogger + base): 1 kg (2.1 lb)

WARRANTY
3 years against defects in materials and workmanship.