CR3000 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. We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.

ANALOG INPUTS *(SE1-SE28 or DIF1-DIF14)*

14 differential (DF) or 28 single-ended (SE) voltage measurements individually configured. Ratiometric resistive bridge, thermocouple, and period average (frequency) measurements also supported on all analog input channels. Channel expansion provided by AM16/32B and AM25T multiplexers.

RANGES, RESOLUTION: 16-bit basic resolution (Basic Res). **Resolution of DF measurements with input reversal is half the Basic Res (17-bits).**

Input Range (mV)[1]	DF Res (µV)[2]	Basic Res (µV))
±5000	83.33	167
±1000	16.67	33.3
±200	3.33	6.67
±50	0.83	1.67
±20	0.33	0.67

[1]Range overhead of ~9% exists on all ranges to guarantee that the full-scale range values will not cause overrange.

[2]Resolution of DF measurements with input reversal.

ACCURACY[3]:
±(0.04% of reading + offset), 0° to 40°C
±(0.07% of reading + offset), -25° to 50°C
±(0.09% of reading + offset), -40° to 85°C (-XT only)

[3]Accuracy does not include 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 + 5.0 µV

MEASUREMENT SPEED: Time includes 250 µs for conversion to engineering units. For voltage measurements, the CR3000 integrates the input signal.

Integration Type	Integration Time	Settling Time	Measurement Total Time Standard	Input Rev.
250	250 µs	200 µs	~0.7 ms	~1.4 ms
60 Hz filter	16.67 ms	3 ms	~20 ms	~40 ms
50 Hz filter	20.00 ms	3 ms	~23 ms	~46 ms

INPUT NOISE VOLTAGE: For DF measurements with input reversal on ±20 mV input range; digital resolution dominates for higher ranges.

250 µs Integration: 0.4 µV RMS
50/60 Hz Integration: 0.19 µV RMS

INPUT LIMITS: ±5 V

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; ±120 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, -40° to 85°C (-XT only)

PERIOD AVERAGE MEASUREMENTS: Any of the 28 SE analog inputs can be used for period averaging. Accuracy is ±(0.01% of reading + resolution) where resolution is 96 ns divided by the specified number of cycles to be measured.

Input Amplitude & Frequency:

Volt. Gain	Range Code	Signal (peak to peak) Min (mV)	Max (V)[4]	Pulse W. Min. (µs)	Max. Freq. (kHz)[5]
1	mV1000	200	10	2.5	200
5	mV200	20	2	5.0	100
20	mV50	5	2	10.0	50
50	mV20	2	2	25.0	20

[4]Maximum signal must be centered at datalogger ground.
[5]Assuming 50% duty cycle.

ANALOG OUTPUTS *(Vx1-Vx4, Ix1-Ix3, CAO1, CAO2)*

4 switched voltage and 3 switched current outputs for ratiometric sensor/bridge excitation and 2 continuous voltage outputs. Switched outputs active only during measurement, one at a time.

	Range	Res	Current Source/Sink	Compliance Voltage
Vx:	±5 V	0.17 mV	±50 mA	N/A
CAO:	±5 V	0.17 mV	±15 mA	N/A
Ix:	±2.5 mA	0.08 µA	N/A	±5 V

Vx & CAO ACCURACY:
±(0.04% of setting + 0.5 mV), 0° to 40°C
±(0.07% of setting + 0.5 mV), -25° to 50°C
±(0.09% of setting + 0.5 mV), -40° to 85°C (-XT only)

Ix ACCURACY:
±(0.1% of setting + 0.5 µA), 0° to 40°C
±(0.13% of setting + 0.5 µA), -25° to 50°C
±(0.15% of setting + 0.5 µA), -40° to 85°C (-XT only)

Vx 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 CR3000 provides ratiometric measurements of 4- and 6-wire full bridges, and 2-, 3-, and 4-wire half bridges. Precise, dual polarity excitation for voltage or current excitations eliminates DC errors. Offset values are reduced by a factor of 2 when excitation reversal is used.

VOLTAGE RATIO ACCURACY[1]: Assuming excitation voltage of at least 500 mV, and not including bridge resistor errors

$\pm(0.02\%$ of voltage reading + offset$)/V_x$, 0° to 40°C
$\pm(0.025\%$ of voltage reading + offset$)/V_x$, -25° to 50°C
$\pm(0.03\%$ of voltage reading + offset$)/V_x$, -40° to 85°C

[1]Accuracy does not include 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 + 5.0 µV

ACCURACY WITH CURRENT EXCITATION[1]: Assuming excitation current of at least 500 µA.

$\pm(0.02\%$ of voltage reading + offset$)/I_x$, 0° to 40°C
$\pm(0.025\%$ of voltage reading + offset$)/I_x$, -25° to 50°C
$\pm(0.03\%$ of voltage reading + offset$)/I_x$, -40° to 85°C (-XT)

[1]Accuracy does not include 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 + 5.0 µV

DEDICATED PULSE COUNTERS *(P1-P4)*

Four inputs individually selectable for switch closure, high frequency pulse, or low-level AC. Independent 24-bit counters (16.8 x 10^6 counts) for each input.

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:
Voltage Thresholds: Count upon transition from below 0.9 V to above 2.2 V after input filter with 1.2 µs time constant.
Maximum Input Voltage: ±20 V
Maximum Input Frequency: 250 kHz

LOW LEVEL AC MODE: Internal AC coupling removes DC offsets up to ±0.5 V.

Input Hysteresis: 12 mV @ 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 CONTROL PORTS *(C1-C8, SDM)*

8 digital control ports (C1-C8) having multiple function capability including digital control outputs, digital control interrupts, pulse counting, switch closure, frequency/period measurements, edge timing, SDI-12 communication, and asynchronous communications (UARTs). 3 ports are dedicated for SDM communications.

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

INPUT HYSTERESIS: 1.4 V

INPUT RESISTANCE: 100 kohms

HIGH FREQUENCY MAX: 400 kHz

SWITCH CLOSURE FREQUENCY MAX: 150 Hz

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

OUTPUT RESISTANCE: 330 ohms

ADDITIONAL DIGITAL PORTS: SDM-C1, SDM-C2, SDM-C3 are dedicated for measuring SDM devices.

SWITCHED 12 V *(SW12V)*

Two independent 12 V unregulated sources 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

COMMUNICATION

RS-232 PORTS:
9-pin: DCE (electrically isolated) for computer or non-CSI modem connection
COM1 to COM4: Four independent Tx/Rx pairs on control ports (non-isolated); 0 to 5 V UART
Baud Rate: Selectable from 300 to 115.2 kbps.
Format: 7, 8 data bits; 1, 2 stop bits; odd, even, or no parity

CS I/O PORT: Interface with CSI peripherals.

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

SDM PORT: Interface with CSI Synchronous Devices for Measurement

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

SYSTEM

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

PROGRAM EXECUTION INTERVALS: 10 ms to 30 min. @ 10 ms increments

PROCESSOR: Renesas H8S 2674 (16-bit CPU with 32-bit internal core)

MEMORY: 2 MB of Flash for operating system; 4 MB of battery-backed SRAM for CPU usage, program storage and data storage

CLOCK ACCURACY: ±3 min. per year

SYSTEM POWER REQUIREMENTS

VOLTAGE: 10 to 16 VDC

TYPICAL CURRENT DRAIN: Sleep Mode: 2 mA
1 Hz Sample Rate (one fast SE meas.): 3 mA
100 Hz Sample Rate (one fast SE meas.): 10 mA
100 Hz Sample Rate (one fast SE meas. w/RS-232 communications): 38 mA
Display on: add 1 mA to current drain
Backlight on: add 42 mA to current drain

INTERNAL BATTERIES: 10 Ahr alkaline or 7 Ahr rechargeable base. 1200 mAhr lithium battery for clock and SRAM backup typically provides 3 years of back-up.

EXTERNAL BATTERIES: 12 VDC nominal; reverse polarity protected.

PHYSICAL SPECIFICATIONS

SIZE: 9.5" x 7.0" x 3.8" (24.1 x 17.8 x 9.6 cm). Terminal strips extend 0.875" (2.2 cm) and terminal strip cover extends 1.575" (4.0 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

3 years against defects in materials and workmanship.