CR1000 Specifications

**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.

<table>
<thead>
<tr>
<th>Range (mV)</th>
<th>DF Res (μV)</th>
<th>Basic Res (μV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5000</td>
<td>667</td>
<td>1333</td>
</tr>
<tr>
<td>±2500</td>
<td>333</td>
<td>667</td>
</tr>
<tr>
<td>±25</td>
<td>3.33</td>
<td>6.7</td>
</tr>
<tr>
<td>±7.5</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td>±0.5</td>
<td>0.33</td>
<td>0.67</td>
</tr>
</tbody>
</table>

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

**ACCURACY**:

- ±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 option)

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

- Offset for DF: 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**:

<table>
<thead>
<tr>
<th>Integration Type/Code</th>
<th>Integration Time</th>
<th>Setting Time</th>
<th>SE w/ No Rev</th>
<th>DF w/ Input Rev</th>
</tr>
</thead>
<tbody>
<tr>
<td>250</td>
<td>250 μs</td>
<td>3 ms</td>
<td>~1 ms</td>
<td>~12 ms</td>
</tr>
<tr>
<td>60 Hz</td>
<td>16.67 ms</td>
<td>3 ms</td>
<td>~20 ms</td>
<td>~40 ms</td>
</tr>
<tr>
<td>50 Hz</td>
<td>20.00 ms</td>
<td>3 ms</td>
<td>~23 ms</td>
<td>~50 ms</td>
</tr>
</tbody>
</table>

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).

<table>
<thead>
<tr>
<th>250 μs Integration</th>
<th>0.34 μV RMS</th>
<th>50/60 Hz Integration</th>
<th>0.19 μV RMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>INPUT LIMITS:</td>
<td>±5 Vdc</td>
<td>DC COMMON MODE REJECTION: &gt;100 dB</td>
<td></td>
</tr>
<tr>
<td>NORMAL MODE REJECTION: 70 dB @ 60 Hz when using 60 Hz rejection</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUSTAINED INPUT VOLTAGE W/O MEASUREMENT CORRUPTION**: ±8.0 Vdc max.

**INPUT CURRENT**: ±1 mA typical, ±6 mA max. @ 50°C; ±0 mA @ 85°C

**INPUT RESISTANCE**: 20 GΩ typical (VX 1–3), 5 MΩ typical (VX 4–16)

**ACCUARY 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)

**INPUT AMPLITUDE AND FREQUENCY**:

- **VX FREQUENCY SWEEP FUNCTION**: Switched outputs provide a programmable sweep 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 156 ms divided by the specified number of cycles to be measured.

**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**: ±0.04% of Voltage Measurement + Offset

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

- Estimated accuracy, Δx (where x is value returned from the measurement with Short = 1, Offset = 0):
  - BRHalf() instruction: Δx = (Vx / V1) - 1 (Vx measured with excitation reversal)
  - BRFull() instruction: Δx = (Vx / V1) - 1 (Vx measured with excitation reversal)

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

- Estimated accuracy, Δx (where x is value returned from the measurement with Short = 1, Offset = 0):
  - BRHalf() instruction: Δx = (Vx / V1) - 1 (Vx measured with excitation reversal)
  - BRFull() instruction: Δx = (Vx / V1) - 1 (Vx measured with excitation reversal)

**PULSE COUNTERS (P1-P2)**

- 2 inputs individually selectable for switch closure, high frequency pulse, or low-level ac.
- Individually configured and meet SDI-12 Standard v. 1.3 for datalogger bridge resistor errors and sensor and measurement noise.

**HIGH-FREQUENCY PULSE MODE**

- Maximum Input Frequency: 250 kHz
- Minimum 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

**INPUT CAPACITANCE**: 100 pF

**INPUT RESISTANCE**: 330 Ω

**Hysteresis**: ±3.125 mV

**Sine Wave**: 1500 Hz (292 MΩ)

**Sine Wave**: 20 kHz (14 MΩ)

**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

**COMMUNICATIONS**

**RS-232 PORTS**

- DCE 9-pin (not electrically isolated) for computer connection or connection of modern not manufactured by Campbell Scientific.
- COM1 to COM4: 4 independent Tx/Rx pairs on control ports (non-isolated); 0 to 5 Vdc UART

**PROTOCOLS SUPPORTED**: Pakbus, Modbus, DNP3, FTP, HTTP, HTML, TOP3, PPP, SMTP, Telnet, NTPC, PTP, 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.

**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 DRAW 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 4.4 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.