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CAMPBELL SCIENTIFIC®
WHEN MEASUREMENTS MATTER

CR1000

Measurement and Control Datalogger

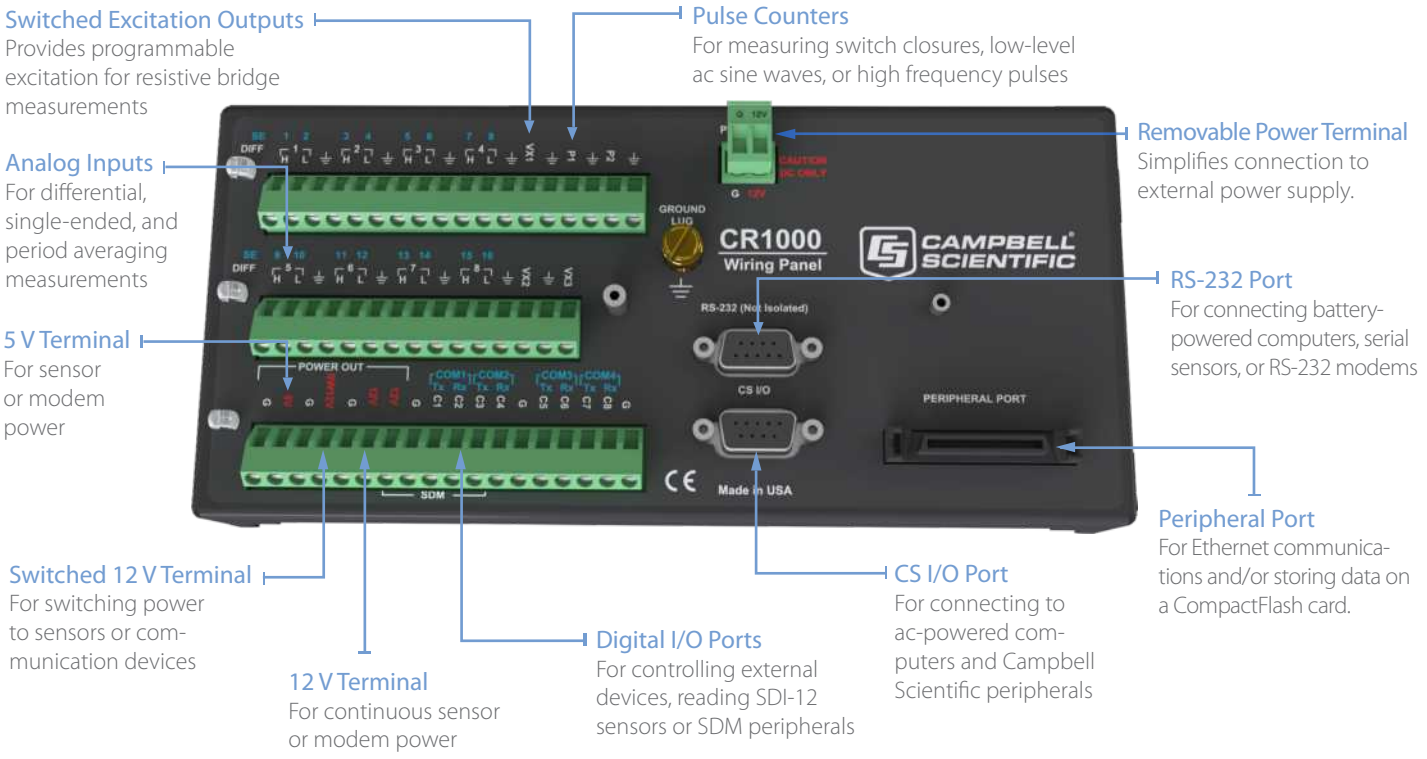
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campbellsci.com/cr1000

CR1000 Measurement and Control Datalogger

The CR1000 provides precision measurement capabilities in a rugged, battery-operated package. It consists of a measurement and control module and a wiring panel. Standard operating range is -25° to +50°C; an optional extended range of -55° to +85°C is available.



Benefits and Features

- 4 MB memory*
- Program execution rate of up to 100 Hz
- CS I/O and RS-232 serial ports
- 13-bit analog to digital conversions
- 16-bit H8S Renesas Microcontroller with 32-bit internal CPU architecture
- Temperature compensated real-time clock
- Background system calibration for accurate measurements over time and temperature changes
- Single DAC used for excitation and measurements to give ratio metric measurements
- Gas Discharge Tube (GDT) protected inputs
- Battery-backed SRAM memory and clock ensuring data, programs, and accurate time are maintained while the CR1000 is disconnected from its main power source
- Serial communications with serial sensors and devices supported via I/O port pairs
- PakBus®, Modbus, DNP3, TCP/IP, FTP, and SMTP protocols supported

Measurement and Control Module

The module measures sensors, drives direct communications and telecommunications, reduces data, controls external devices, and stores data and programs in on-board, non-volatile storage. The electronics are RF shielded and glitch protected by the sealed, stainless steel canister. A battery-backed clock assures accurate timekeeping. The module can simultaneously provide measurement and communication functions. The on-board, BASIC-like programming language supports data processing and analysis routines.

Wiring Panel

The CR1000WP is a black, anodized aluminum wiring panel that is compatible with all CR1000 modules. The wiring panel includes switchable 12 V, redistributed analog grounds (dispersed among analog channels rather than grouped), unpluggable terminal block for 12 V connections, gas-tube spark gaps, and 12 V supply on pin 8 to power our COM-series phone modems and other peripherals. The control module easily disconnects from the wiring panel allowing field replacement without rewiring the sensors. A description of the wiring panel's input/output channels follows.

**Originally, the standard CR1000 had 2 MB of data/program storage, and an optional version, the CR1000-4M, had 4 MB of memory. In September 2007, the standard CR1000 started having 4 MB of memory, making the CR1000-4M obsolete. Dataloggers that have a module with a serial number greater than or equal to 11832 will have a 4 MB memory. The 4 MB dataloggers will also have a sticker on the canister stating "4M Memory".*

Analog Inputs
Eight differential (16 single-ended) channels measure voltage levels. Resolution on the most sensitive range is 0.67 µV.

Pulse Counters
Two pulse channels can count pulses from high level (5 V square wave), switch closure, or low level AC signals.

Switched Voltage Excitations
Three outputs provide precision excitation voltages for resistive bridge measurements.

Digital I/O Ports
Eight ports are provided for frequency measurements, digital control, and triggering. Three of these ports can also be used to measure SDM devices. The I/O ports can be paired as transmit and receive. Each pair has 0 to 5 V UART hardware that allows serial communications with serial sensors and devices. An RS-232-to-logic level converter may be required in some cases.

CS I/O Port
AC-powered computers and many communication peripherals connect with the CR1000 via this port. Connection to an AC-powered computer requires either an SC32B or SC-USB interface. These interfaces isolate the computer's electrical system from the datalogger, thereby protecting against ground loops, normal static discharge, and noise.

RS-232 Port
This non-isolated port is for connecting a battery-powered laptop, serial sensor, or RS-232 modem. Because of ground loop potential on some measurements such as low level single-ended measurements, AC-powered computers should use the CS I/O port instead of the RS-232 port (see above).

Peripheral Port
One 40-pin port interfaces with the NL116 Ethernet Interface and CompactFlash Module, the NL121 Ethernet Interface, or the CFM100 CompactFlash® Module.

Switched 12 Volt
This terminal provides unregulated 12 V that can be switched on and off under program control.

Storage Capacity
The CR1000 has 2 MB of flash memory for the Operating System, and 4 MB of battery-backed SRAM for CPU usage, program storage, and data storage. Data is stored in a table format. The storage capacity of the CR1000 can be increased by using a CompactFlash card.

Enclosure/Stack Bracket
A CR1000 housed in a weather-resistant enclosure can collect data under extremely harsh conditions. The 31551 and 31143 stack brackets allow a peripheral to be placed under the mounting bracket, thus conserving space. The 31143 is hinged, allowing easy access to the lower component during wiring or during maintenance.

Communication Protocols
The CR1000 supports the PakBus, Modbus, DNP3, TCP/IP, FTP, and SMTP communication protocols. With the PakBus protocol, networks have the distributed routing intelligence to continually evaluate links. Continually evaluating links optimizes delivery times and, in the case of delivery failure, allows automatic switch over to a configured backup route.

The Modbus RTU protocol supports both floating point and long formats. The datalogger can act as a slave and/or master.

The DNP3 protocol supports only long data formats. The dataloggers are level 2 slave compliant, with some of the operations found in a level 3 implementation.

The TCP/IP, FTP, and SMTP protocols provide TCP/IP functionality when the CR1000 is used in conjunction with an NL241, NL201, NL116, or NL121. Refer to the CR1000 manual for more information.

Power Supplies
Typically, the CR1000 is powered with a PS200, PS150, or BPALK. The PS200 and PS150 provide a 7 Ah sealed rechargeable battery that should be connected to a charging source (either a power converter or solar panel). The BPALK consists of eight non-rechargeable D-cell alkaline batteries with a 7.5 Ah rating at 20°C.

Also available are the BP7, BP12, and BP24 battery, which provide nominal ratings of 7, 12, and 24 Ah, respectively. The BP7 is typically used instead of the PS150 or PS200 when the battery needs to be mounted under the 31143 Hinged Stack Bracket. The BP12 and BP24 batteries are for powering systems that have higher current drain equipment such as satellite transmitters. The BP7, BP12, and BP24 should be connected to a regulated charging source (e.g., a CH200 or CH150 connected to a unregulated solar panel or power converter).



The PS200 (above) and CH200 can monitor charge input voltage, battery voltage, on-board temperature, battery current, and load current.

Communication Options

To determine the best option for an application, consider the accessibility of the site, availability of services (e.g., cellular phone or satellite coverage), quantity of data to collect, and desired time between data-collection sessions. Some communication options can be combined—increasing the flexibility, convenience, and reliability of the communications.

Keyboard Display

The CR1000KD can be used to program the CR1000, manually initiate data transfer, and display data. The CR1000KD displays 8 lines by 21 characters (64 by 128 pixels) and has a 16-character keyboard. Custom menus are supported allowing customers to set up choices within the datalogger program that can be initiated by a simple toggle or pick list. One CR1000KD can be carried station to station in a CR1000 network.

Mountable Displays

The CD100 and CD295 can be mounted in an enclosure lid. The CD100 has the same functionality and operation as the CD1000KD, allowing both data entry and display without opening the enclosure. The CD295 displays real-time data only.



The CD100 has a vacuum flourescent display for responsive use through a very wide operating temperature range.

iOS Devices and Android Devices

An iOS device or Android device can communicate with the datalogger or connect to the LoggerNet network using Apps available, at no charge, from the Apple Store or Google Play.

Direct Links

AC-powered computers connect with the datalogger's CS I/O port using an SC32B or SC-USB interface. These interfaces provide optical isolation. A battery-powered laptop can be attached to the CR1000's RS-232 port via an RS-232 cable—no interface required.

External Data Storage Devices

A CFM100 or NL116 module can store the CR1000's data on an industrial-grade CompactFlash (CF) card. The CR1000 can also store data on an SC115 2 GB Flash Memory Drive.

Short Haul Modems

The SRM-5A RAD Short Haul Modem supports communications between the CR1000 and a computer using a four-wire unconditioned line (two twisted pairs).

Multidrop Interface

The MD485 intelligent RS-485 interface permits a computer to address and communicate with one or more dataloggers over the CABLE2TP two-twisted pair cable. Distances up to 4000 feet are supported.

Internet and IP Networks

Campbell Scientific offers several interfaces that enable the CR1000 to communicate with a computer using TCP/IP.

Radios

Radio frequency (RF) communications are supported using narrowband UHF, narrowband VHF, spread spectrum, or meteor burst radios. Line-of-sight is required for all of our RF options.

Satellite Transmitters

The CR1000 can transmit data using the Argos, Iridium, Inmarsat BGAN, GOES, or Meteosat satellite systems. Satellite telemetry offers an alternative for remote locations where phone lines or RF systems are impractical.

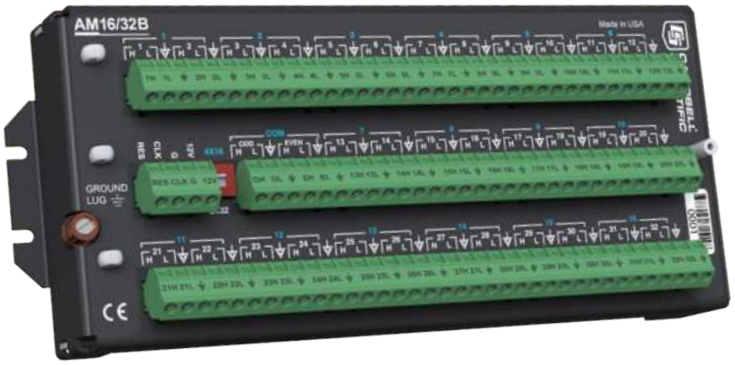
Telephone Networks

The CR1000 can communicate with a computer using landlines or cellular transceivers. A voice synthesized modem enables anyone to call the CR1000 via phone and receive a verbal report of real-time site conditions.



In Virginia, our RF500M Narrowband Radio Modem provides time- and event-driven ALERT data transmission.

Channel Expansion



The CR1000 is compatible with the AM16/32B (shown above) and AM25T multiplexers.

4-Channel Low Level AC Module

The LLAC4 is a small peripheral device that allows customers to increase the number of available low-level ac inputs by using control ports. This module is often used to measure up to four anemometers, and is especially useful for wind profiling applications.

Synchronous Devices for Measurement (SDMs)

SDMs are addressable peripherals that expand the datalogger's measurement and control capabilities. For example, SDMs are available to add control ports, analog outputs, pulse count channels, interval timers, or even a CANbus interface to the system. Multiple SDMs, in any combination, can be connected to one datalogger.

Multiplexers

Multiplexers increase the number of sensors that can be measured by a CR1000 by sequentially connecting each sensor to the datalogger. Several multiplexers can be controlled by a single CR1000.

Software

Starter Software

Our easy-to-use starter software is intended for first time users or applications that don't require sophisticated communications or datalogger program editing. SCWin Short Cut generates straight-forward datalogger programs in four easy steps. PC200W allows customers to transfer a program to, or retrieve data from a CR1000 via a direct communications link. At www.campbellsci.com/downloads, the starter software can be downloaded at no charge. .

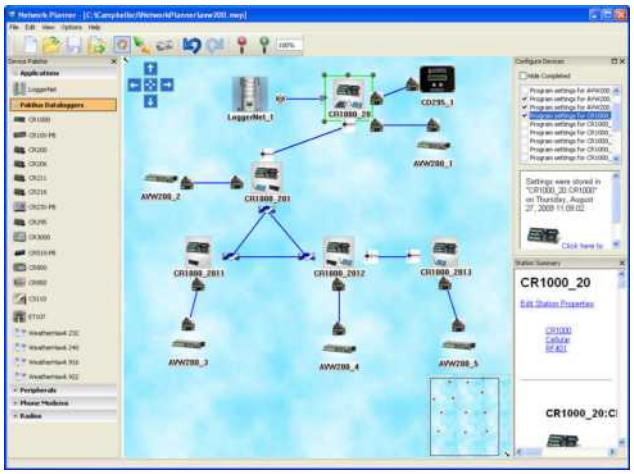
Datalogger Support Software

Our datalogger support software packages provide more capabilities than our starter software. These software packages contains program editing, communications, and display tools that can support an entire datalogger network.

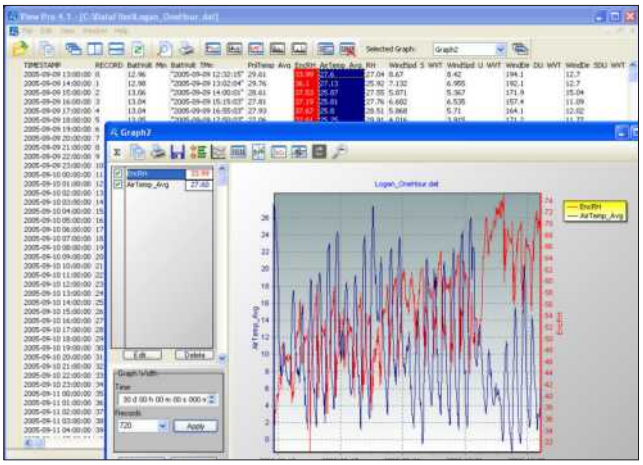
PC400, our mid-level software, supports a variety of telemetry options, manual data collection, and data display. For programming, it includes both Short Cut and the CRBasic program editor. PC400 does not support combined communication options (e.g., phone-to-RF), PakBus® routing, and scheduled data collection.

RTDAQ is an ideal solution for industrial and real-time users desiring to use reliable data collection software over a single telecommunications medium, and who do not rely on scheduled data collection. RTDAQ's strength lies in its ability to handle the display of high speed data.

LoggerNet is Campbell Scientific's full-featured datalogger support software. It is referred to as "full-featured" because it provides a way to accomplish almost all the tasks you'll need to complete when using a datalogger. LoggerNet supports combined communication options (e.g., phone-to-RF) and scheduled data collection.



The Network Planner generates device settings and configures the LoggerNet network map for PakBus networks.



Both LoggerNet and RTDAQ use View Pro to display historical data in a tabular or graphical format.

Applications

The measurement precision, flexibility, long-term reliability, and economical price of the CR1000 make it ideal for scientific, commercial, and industrial applications.

Meteorology

The CR1000 is used in long-term climatological monitoring, meteorological research, and routine weather measurement applications.



Our rugged, reliable weather station measures meteorological conditions at St. Mary's Lake, Glacier National Park, MT.

Sensors the CR1000 can measure include:

- cup, propeller, and sonic anemometers
- tipping bucket rain gages
- wind vanes
- pyranometers
- ultrasonic ranging sensor
- thermistors, RTDs, and thermocouples
- barometers
- RH probes
- Cooled mirror hygrometers

Agriculture and Agricultural Research

The versatility of the CR1000 allows measurement of agricultural processes and equipment in applications such as:

- plant water research
- canopy energy balance
- plant pathology
- machinery performance
- frost prediction
- crop management decisions
- food processing/storage
- integrated pest management
- irrigation scheduling



This vitaculture site in Australia integrates meteorological, soil, and crop measurements.

Wind Profiling

Our data acquisition systems can monitor conditions at wind assessment sites, at producing wind farms, and along transmission lines. The CR1000 makes and records measurements, controls electrical devices, and can function as PLCs or RTUs. Because the datalogger has its own power supply (batteries, solar panels), it can continue to measure and store data and perform control during power outages. Typical sensors for wind assessment applications include, but are not limited to:

- cup, propeller, and sonic anemometers (up to 10 anemometers can be measured by using two LLAC4 peripherals)
- wind vanes
- thermistors, RTDs, and thermocouples
- barometers
- pyranometers

For turbine performance applications, the CR1000 monitors electrical current, voltage, wattage, stress, and torque.



Photo courtesy npower renewables

A Campbell Scientific system monitors an offshore wind farm in North Wales.

Soil Moisture

The CR1000 are compatible with the following soil moisture measurement technologies:

- **Soil moisture blocks** are inexpensive sensors that estimate soil water potential.
- **Matric water potential sensors** also estimate soil water potential but are more durable than soil moisture blocks.
- **Time-Domain Reflectometry Systems (TDR)** use a reflectometer controlled by the datalogger to accurately measure soil water content. Multiplexers allow sequential measurement of a large number of probes by one reflectometer.
- **Self-contained water content reflectometers** are sensors that emit and measure a TDR pulse.
- **Tensiometers** measure the soil pore pressure of irrigated soils and calculate soil moisture.

Air Quality

The CR1000 can monitor and control gas analyzers, particle samplers, and visibility sensors. The datalogger can also automatically control calibration sequences and compute conditional averages that exclude invalid data (e.g., data recorded during power failures or calibration intervals).

Road Weather/RWIS

Our fully NTCIP-compliant Environmental Sensor Stations (ESS) are robust, reliable weather stations used for road weather/RWIS applications. A typical ESS includes a tower, CR1000, two road sensors, remote communication hardware, and sensors that measure wind speed and direction, air temperature, humidity, barometric pressure, solar radiation, and precipitation.

Water Resources/Aquaculture

Our CR1000 is well-suited to remote, unattended monitoring of hydrologic conditions. Most hydrologic sensors, including SDI-12 probes, interface directly to the CR1000.

Typical hydrologic measurements:

- **Water level** is monitored with incremental shaft encoders, double bubblers, ultrasonic ranging sensors, resistance tapes, strain gage pressure transducers, or vibrating wire pressure transducers. Vibrating wire transducers require an CDM-VW300-series, AVW200-series or another vibrating wire interface.
- **Well draw-down tests** use a pressure transducer measured at logarithmic intervals or at a rate based on incremental changes in water level.
- **Ionic conductivity measurements** use one of the switched excitation ports from the datalogger.
- **Samplers** are controlled by the CR1000 as a function of time, water quality, or water level.
- **Alarm and pump actuation** are controlled through digital I/O ports that operate external relay drivers



A turbidity sensor was installed in a tributary of the Cedar River watershed to monitor water quality conditions for Seattle, Washington.

Vehicle Testing

This versatile, rugged datalogger is ideally suited for testing cold and hot temperature, high altitude, off-highway, and cross-country performance. The CR1000 is compatible with our SDM-CAN interface and GPS16X-HVS receiver.



Vehicle monitoring includes not only passenger cars, but airplanes, locomotives, helicopters, tractors, buses, heavy trucks, drilling rigs, race cars, and motorcycles.

The CR1000 can measure:

- **Suspension**—strut pressure, spring force, travel, mounting point stress, deflection, ride.
- **Fuel system**—line and tank pressure, flow, temperature, injection timing.
- **Comfort control**—ambient and supply air temperature, solar radiation, fan speed, ac on and off, refrigerant pressures, time-to-comfort, blower current.
- **Brakes**—line pressure, pedal pressure and travel, ABS, line and pad temperature.
- **Engine**—pressure, temperature, crank position, RPM, time-to-start, oil pump cavitation.
- **General vehicle**—chassis monitoring, road noise, vehicle position and speed, steering, air bag, hot/cold soaks, wind tunnels, traction, CANbus, wiper speed and current, vehicle electrical loads.

Other Applications

- Eddy covariance systems
- Wireless sensor/datalogger networks
- Fire weather
- Geotechnical
- Mesonet systems
- Avalanche forecasting, snow science, polar, high altitude
- Historic preservation

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 configuredinput 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

[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 option 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*[4] *SE w/ No Rev*	*Total Time*[4] *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

[4]Includes 250 µs for conversion to engineering units.

[5]AC 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 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. (mV)*[6]	*Signal (peak to peak) Max (V)*[7]	*Min Pulse Width (µV)*	*Max*[8] *Freq (kHz)*
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

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

[7]With signal centered at the datalogger ground.

[8]The 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)

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

[10]Estimated accuracy, ΔX (where X is value returned from the measurement with Multiplier = 1, Offset = 0):
BrHalf() instruction: $\Delta X = \Delta V_1/V_X$
BrFull() instruction $\Delta X = 1000 \cdot \Delta V_1/V_X$, expressed as mV•V^{-1}.
ΔV^{-1} is calculated from the ratiometric measurement accuracy. See Resistance Measurements Section in the manual for more information.

[11]Offsets 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: 16.7x10^6

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 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.

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Campbell Scientific, Inc.
December 18, 2017

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