



WHEN MEASUREMENTS MATTER

# CR1000

Measurement and Control Datalogger

*Rugged, Reliable, and Ready  
for any Application*



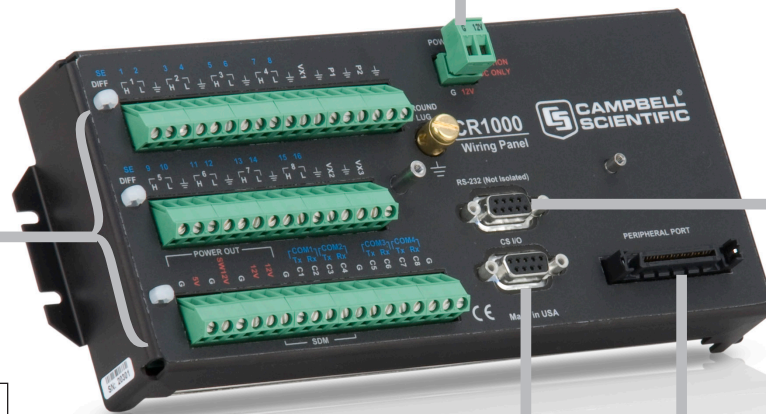
# CR1000 Measurement and Control Datalogger

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.

**Input/Output Terminals**—Individually configured for ratiometric resistive bridge, thermocouple, switch closure, high frequency pulse, low-level ac, serial sensors, and more.

**Removable Power Terminal**—simplifies connection to external power supply.

**RS-232**—provides a 9-pin DCE port for connecting a battery-powered laptop, serial sensors or RS-232 modems.



**CS I/O Port**—connects with AC-powered PCs and communication peripherals such as phone, RF, short-haul, and multidrop modems.

**Peripheral Port**—allows data to be stored on a CompactFlash card and/or supports Ethernet communications.

## 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 time-keeping. 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  $\mu\text{V}$ .

## 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 PCs and many communication peripherals connect with the CR1000 via this port. Connection to an AC-powered PC requires either an SC32B or SC-USB interface. These interfaces isolate the PC'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 (e.g., low level single-ended measurements), AC-powered PCs should use the CS I/O port instead of the RS-232 port (see above).

## Peripheral Port

One 40-pin port interfaces with the NL115 Ethernet Interface and CompactFlash Module, the NL120 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 28960 Enclosure Stack Mounting Kit allows a small peripheral to be placed under the mounting bracket, thus conserving space.

## 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.

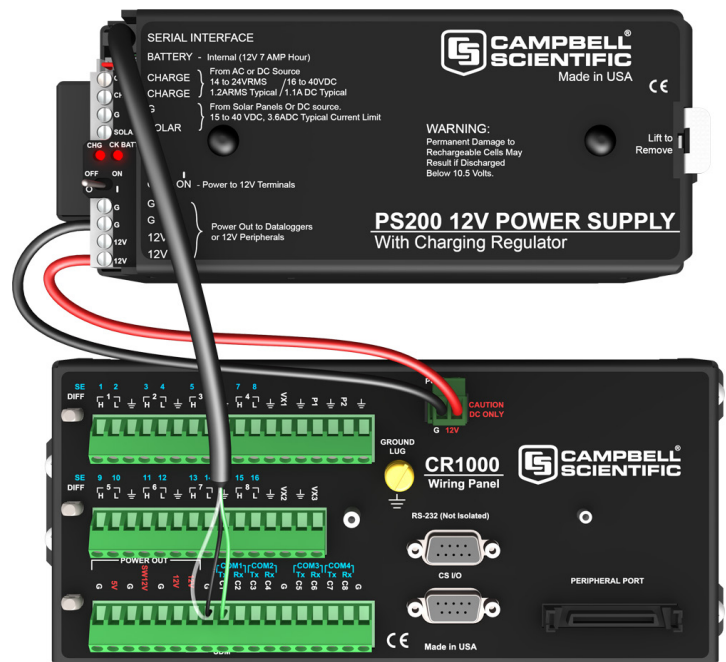
The DNP3 protocol supports only long data formats. The dataloggers are level 2 slave compliant, with some of the operations found in a level 3 implementation.

The TCP/IP, FTP, and SMTP protocols provide TCP/IP functionality when the CR1000 is used in conjunction with an NL240, NL201, NL115, or NL120. 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 wall charger 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 BP12 and BP24 battery packs, which provide nominal ratings of 12 and 24 Ah, respectively. These batteries should be connected to a regulated charging source (e.g., a CH200 or CH150 connected to a unregulated solar panel or wall charger).



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 from 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.

### iOS Devices and Android Devices

An iOS device or Android device can be used to view and collect data, set the clock, and download programs. To use an iOS or Android device, go to the Apple Store or Google Play and purchase our LoggerLink Mobile Apps.

### Direct Links

AC-powered PCs connect with the datalogger's CS I/O port via 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 NL115 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 PC via a four-wire unconditioned line (two twisted pairs).

### Multidrop Interface

The MD485 intelligent RS-485 interface permits a PC 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 PC via TCP/IP.

### Radios

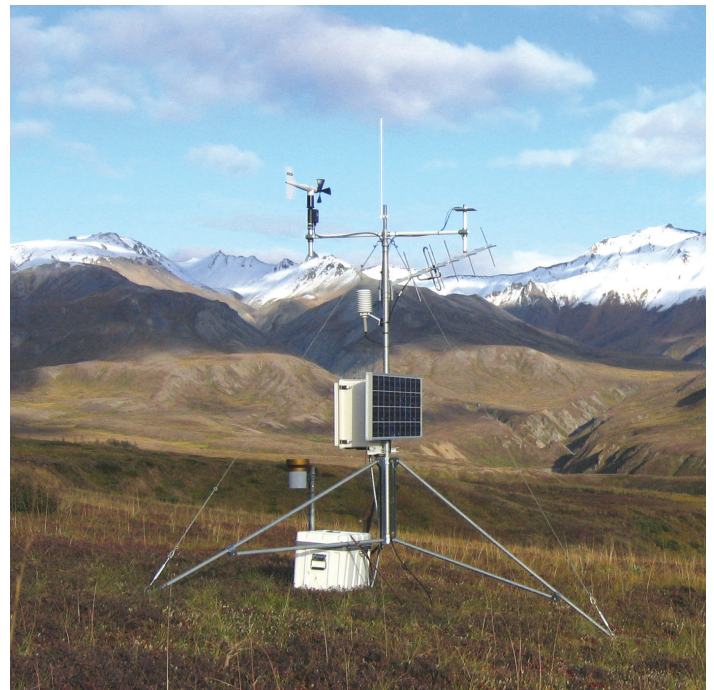
Radio frequency (RF) communications are supported via narrow-band UHF, narrowband VHF, spread spectrum, or meteor burst radios. Line-of-sight is required for all of our RF options.

### Telephone Networks

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

### Satellite Transmitters

Satellite transmitters offered by Campbell Scientific include a NESDIS-certified GOES transmitter, an Argos transmitter, and an Iridium transmitter. Satellite telemetry offers an alternative for remote locations where phone lines or RF systems are impractical.



This weather station at Denali National Park, Alaska, transmits data via a GOES satellite transmitter.