# CR10X Measurement and Control System

## A Rugged Instrument with Research-Grade Performance

The CR10X is a rugged measurement and control system that delivers accurate, reliable measurements in a variety of applications. Designed for both research and day-to-day monitoring operations, the CR10X combines the ability to measure virtually any sensor with the control capability to respond to specific site conditions (e.g., open flood gates, turn fans off/on). From simple to complex, Campbell Scientific data acquisition systems are at work on every continent, at sea, and in space.

## Measurement Example — Weather Station

**Measurements:** The CR10X measures wind speed and direction, air temperature, relative humidity, precipitation, barometric pressure, soil moisture and temperature, and solar radiation. Scan rates are programmable from 1/64 second to 2.5 hours.

**Data Processing:** Output intervals for raw or processed data are user-specified. Typically, hourly and daily summaries (e.g., maxima, minima, averages, histograms) are stored. Conditional outputs, such as rainfall intensity, can also be processed and stored.

**Data Storage:** The non-volatile Flash memory and lithium-backed SRAM store up to 62,000 data points—equating to more than three months of data when typical hourly and daily outputs are stored from typical meteorological application. An optional memory expansion allows the CR10X to store more than one million data points—or about 12 years' worth of meteorological data.

**Data Retrieval:** Data can be transferred to a computer using telephones (including cellular or voice-synthesized), radio telemetry, short-haul modems, satellite transmitters, multidrop modems, Ethernet, or storage modules.

**12-Volt Power:** The low-power design allows the CR10X to operate up to one year on a 7 Ahr, unregulated 12 Vdc source, depending on scan rate, number of sensors, data retrieval method, and external temperature.

## Measurement and Control Example — Head Gates

**Measurements:** The CR10X measures water level upstream, downstream, and in a diversion ditch.

**Data Storage/Processing/Retrieval:** Data are recorded over time, showing trends. The CR10X calculates flow and summarizes the data as averages, maxima, or totals. A PC, Palm handheld, or keyboard display can show both real-time and summarized data.

**Equipment Control:** The CR10X controls multiple headgates based on measured conditions, flow, or time. The control capabilities of the CR10X allow levels to be maintained, even in the absence of a manager. The gates can also be controlled remotely by the water master if conditions change.

**Alarms:** If high or low water levels are detected, the CR10X can initiate on-site alarms, data or voice-synthesized warning calls, or activate pagers.

**Cover Photos** At left: CR10X. From top right: *Water Resources* Reservoir gate control via radio telemetry, Emery County, Utah; *Industrial/Automotive* Super Comp dragster performance testing, (photo courtesy of RPM photography); *Meteorology* Weather station installation, St. Mary's Lake, Glacier National Park, Montana; *Geotechnical/Historical Preservation* CR10X monitors cracks in the southwest bastion of fort, Castillo de San Marcos National Monument, St. Augustine, Florida.

# Applications

***The measurement precision, flexibility, long-term reliability, and economical price of the CR10X make it ideal for scientific, commercial, and industrial applications.***

## Meteorology

The CR10X is used in long-term climatological monitoring, meteorological research, and routine weather measurement applications. Sensors the CR10X can measure include:

- cup, propeller, and sonic anemometers
- tipping bucket and weighing rain gages
- wind vanes
- evaporation pans and lysimeters
- pyranometers
- ultrasonic distance sensors
- thermistors, thermocouples, and RTDs
- capacitance and strain gage barometric pressure sensors
- RH sensors
- cooled mirror hygrometers

*Weather station at Denali National Park, Alaska, monitors meteorological and soil conditions.*

The CR10X can output data in your choice of units (e.g., wind speed in miles per hour, meters per second, or knots). Standard CR10X outputs include wind vector averaging, sigma, theta, histograms, saturation vapor pressure, and vapor pressure from wet/dry bulb temperatures.

## Air Quality

The CR10X can monitor and control gas analyzers, particle samplers, and visibility sensors. The CR10X can also automatically control calibration sequences and compute conditional averages that exclude invalid data (e.g., data recorded during power failures or calibration intervals).

*Network of approximately 20 stations continuously monitors air quality, northern Oquirrh Mountains, Utah.*

## Agriculture and Agricultural Research

The versatility of the CR10X allows measurement of agricultural processes and equipment in applications such as:

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

*Typical agricultural research sites integrate meteorological, soil, and crop measurements.*

## Soil Moisture

The CR10X is 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 a CR10X to accurately measure soil water content. Multiplexers allow sequential measurement of a large number of probes by one reflectometer, reducing cost per measurement.
- **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.

## Industry

### Vehicle Testing

The CR10X performs well in cold/hot temperature, high altitude, off-highway, and cross-country tests. It can measure temperature, fuel flow, velocity, acceleration, engine RPM, force, displacement, and electrical system load. The CR10X is often interfaced to a dashboard-mounted heads up display for luminescent data display in real time.

### HVAC Systems

The CR10X optimizes HVAC performance by monitoring and controlling pumps, fans, and starter motors.

### Process Control

Both product and assembly line status can be monitored simultaneously, providing on-line quality control while minimizing production down-time.

## Water Resources

The CR10X is well-suited to remote, unattended monitoring of hydrologic conditions. Many hydrologic sensors, including SDI-12 sensors, interface directly to the CR10X.

Typical hydrologic measurements:

- **Water level** is monitored with incremental shaft encoders, double bubblers, ultrasonic level transducers, resistance tapes, or strain gage or vibrating wire pressure transducers. Some shaft encoders require a QD1 Interface. Vibrating wire transducers require an AVW1, AVW4, or AVW100 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 CR10X.
- **Samplers** are controlled by the CR10X 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.

*Datalogger measures water level using a shaft encoder, then calculates flow. The data are telemetered, via radio, to the water master for further processing, review, and archive. Stilling well at diversionary dam, Emery County, Utah.*

## Mining, Earth Science, and Geotechnical

The small size, low power requirements, and wide operating temperature range of the CR10X make it a good choice for these remote, typically harsh applications. Multiple CR10Xs can be accessed via telemetry allowing monitoring and review of measurements across an entire study area. Vibrating wire sensors, strain gages, load cells, pressure transducers, linear and string potentiometers, GPS receivers, and frequency output devices are regularly used in these systems.

## Historical Preservation

*Weather measurements on the Sphinx provided input for its preservation, Cairo, Egypt.*

The CR10X's small size, versatility, and expandability allow it to simultaneously monitor environmental variables that could be detrimental to works of art (e.g., relative humidity, solar radiation, air temperature, water table level, gas concentrations). By using multiplexers or SDMs, these parameters (and others) can be monitored at a number of locations in a building or across a structure. This enables comprehensive monitoring, management, remediation efforts, and documentation.

## Other Applications

- Avalanche control, snow science, and Arctic research
- Highway and pavement studies
- Sporting events
- Space research

*Our dataloggers measured the effects of gravity on a test structure aboard a NASA low-gravity flight.*

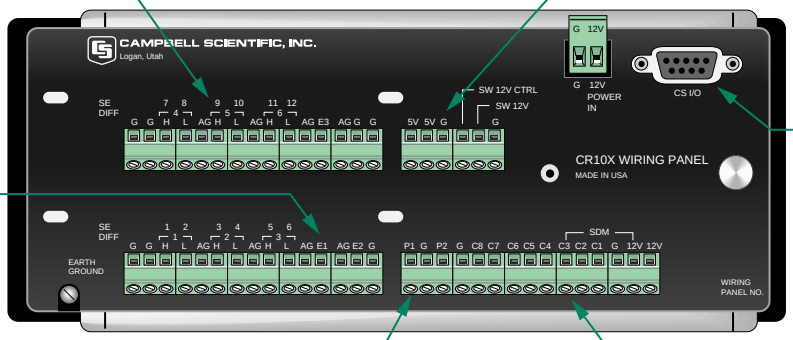
# System Description

***The CR10X consists of a Measurement and Control Module and a detachable Wiring Panel. The Mean Time Between Failures (MTBF) for the CR10X is over 180 years.***

**6 Differential (12 single-ended) Analog Inputs** for measuring voltage levels on five software selectable voltage ranges.

**3 Switched Excitation Channels** for precision excitation of sensors or short-term actuation of external devices. Excitation is programmable over a ±2500 mV range.

**2 Pulse Counting Channels** for switch closures, high frequency pulses, or low level ac measurement.




**Power and Ground Connections** for 12 V external batteries or peripherals or for 5 V peripherals. Switched 12 V terminal is controlled by any digital output.

**9-Pin CS I/O Port** for connection of data storage, retrieval, and telecommunications peripherals.

**8 Digital Inputs/Outputs** for output control, sensing status, and reading SDM peripherals or SDI-12 sensors.

## 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 multi-tasking operating system allows simultaneous measurement and communication.

The CR10X contains a comprehensive set of processing, math, and program control instructions to build a datalogger program. The maximum rate the CR10X can execute its program is 64 times per second. (The maximum rate a single input can be measured is 750 samples per second.) Data and programs are stored either in non-volatile Flash memory or battery-backed SRAM. The standard memory stores 62,000 data points in two Final Storage areas. Optional versions store up to one million data points.

Several operating system options are available. The standard operating system stores data in an array-based format. This format stores arrays of data at specified intervals or when some other set condition has been met. An operating system that stores data in a table-based format is available. The table-based format allows you to group and store like-data in seperate tables. Other optional operating systems support Modbus and ALERT protocols. Modbus protocol enables the CR10X to interface with SCADA and MMI software packages. ALERT protocol allows the CR10X to be used in an ALERT system. CSOS Downloading Software allows you to change or upgrade the operating system without opening the CR10X and changing hardware.

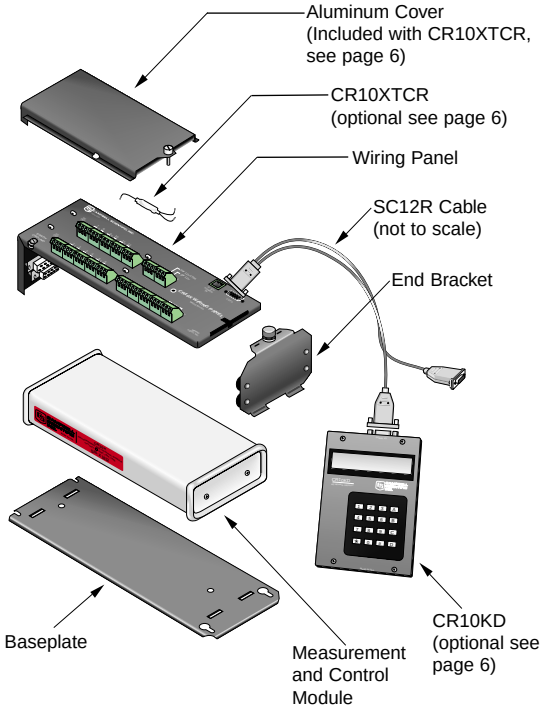
Standard operating range is -25° to +50°C. With the extended range option, the CR10X's electronics are tested and guaranteed over a -55° to +85°C range.

## SC12 and SC12R Cables

The SC12 is a ribbon cable connects communication devices to the CR10X's 9-pin port. The SC12 is shipped with most of our communication devices, including our phone modems, satellite transmitters, and keyboard display. The SC12R cable is a rugged, temperature resistant alternative (purchased separately).

## Wiring Panel

The Wiring Panel consists of a top and side panel, end bracket, and baseplate. The top panel includes screw terminals for sensor connections and a 9-pin CS I/O port; the end bracket attaches the Wiring Panel to the Control Module and to an enclosure-mounted or free-standing baseplate. The Control Module easily disconnects from the Wiring Panel allowing field replacement without rewiring the sensors. Gas tubes on the wiring panel provide rugged electrostatic discharge protection.



# Peripherals

***Typical field-based CR10X systems include a data retrieval option, power supply, and environmental enclosure. Peripherals that expand the CR10X's measurement and control capabilities are also available.***

## Data Storage and Retrieval Options

To determine the best option for your application, consider the accessibility of your site, availability of services (e.g., cellular phone or satellite coverage), quantity of data to collect, and desired time between data-collection sessions.

**Telephone Networks** use landlines or cellular transceivers for communications between the datalogger and PC. Our voice-synthesized modem allows a CR10X "speak" to you or transmit data to a computer.

**Radio Frequency (RF) Communications** are supported via UHF, VHF, spread spectrum, or meteor burst radios.

**Direct Links** use the SC32A RS-232 Interface to provide an optically isolated connection between the CR10X and a laptop or desktop computer.

**Palm™ Handhelds** can communicate with the CR10X via a serial cable and PConnect Software (purchased separately). On-site communications supported include setting the datalogger's clock, monitoring real-time data, retrieving stored data, and transferring datalogger programs. Contact Campbell Scientific about compatibility with Handspring Inc.'s Visor™.

**Short Haul Modems** provide local communications between the CR10X and a PC with an RS-232 serial port.

**Multidrop Interface** links a central computer to as many as 200 dataloggers on a single coaxial cable.

**Satellite Transmitters** transmit data via the GOES, Argos, or INMARSAT-C satellite systems. Campbell Scientific's SAT HDR GOES transmitter has been certified by NESDIS for High Data Rates (HDR).

**Ethernet Communications Peripherals** allow the CR10X to communicate over a local network or the Internet.

**Storage Modules** reliably store data and datalogger programs. This allows you to transport programs between the datalogger and PC or use the storage modules to serve as an independent backup of the datalogger data.

**CR10KD Keyboard Display** programs the CR10X, manually initiates data transfer, and displays data. One CR10KD can be carried from station to station in a CR10X network.

## Thermocouple Reference Thermistor

Campbell Scientific offers the CR10XTCR which provides a temperature reference for thermocouple measurements. It requires one single-ended analog input channel. A cover that reduces temperature gradients along the input terminals is included.

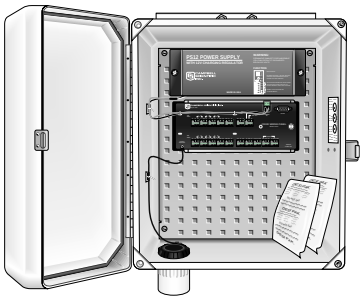
## Channel Expandability

The already formidable measurement and control capabilities can be expanded using CSI multiplexers and Synchronous Devices for Measurement (SDMs). SDMs are addressable peripherals that expand digital I/O ports, plus interval channels analog output ports, and datalogger measurement capabilities. Up to 16 SDMs can be connected to three CR10X control ports.

*The INMARSAT-C satellite system provides telecommunications for remote Argentine stations where phone lines are impractical.*

Multiplexers increase the number of sensors that can be measured by a CR10X by sequentially connecting each sensor to the datalogger. Several multiplexers can be connected to, and controlled by, a single CR10X.

## Enclosures



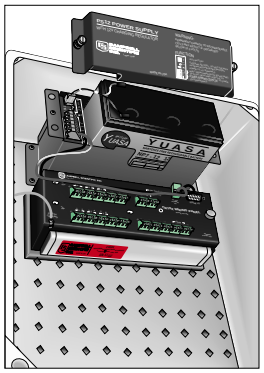
*A CR10X housed in an enclosure with desiccant is protected from humidity and most contaminants.*

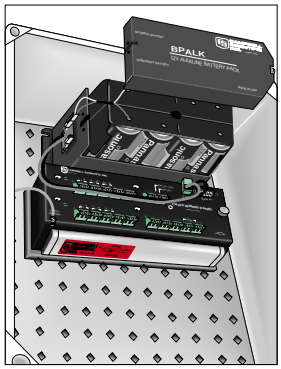
A CR10X housed in a weather-resistant enclosure can collect data under extremely harsh conditions. The enclosure protects the CR10X from dust, water, sunlight, or pollutants. Typically a 12" x 14" or 16" x 18" enclosure is used. They are NEMA 4X enclosures modified for cable entry. The enclosures attach to a flat surface, 1.00" to 1.25" IPS pipe, or vertical mast or leg of a tripod or tower. These white fiberglass-reinforced polyester enclosures are UV-stabilized and reflect solar radiation, reducing temperature gradients inside the housing. An internal mounting plate is prepunched for easy system configuration and exchange of equipment in the field. A lockable hasp adds security.

## Power Supplies

Any 12 Vdc source can power the CR10X; a PS12LA or BPALK is typically used. The PS12LA includes one 7 Ahr rechargeable battery, charged with ac power (requires the optional wall charger) or a solar panel. The BPALK consists of eight non-rechargeable D-cell alkaline batteries with a 7.5 Ahr rating at 20°C. An external AA-cell pack that supplies power while the D-cells are replaced is included.

The BP12 and BP24 battery packs are also available. The BP12 and BP24 have nominal ratings of 12 and 24 Ahrs, respectively. The batteries should be connected to a charging regulator, typically our CH12R, and a charging source. For information about analyzing your system's power requirements, see our Power Supply brochure or Application Note 5-F. Both can be obtained from www. campbellsci.com




*Minimal power requirements allow extended field use while powered by the PS12LA (left) or the BPALK (right).*

*Systems that include high current drain peripherals such as satellite transmitters or are located where it's inconvenient to replace batteries might require batteries with larger Ahr capacities than our PS12LAs or BPALKs. Campbell Scientific offers the BP12 and BP24 battery packs for these systems.*

# Software Packages

***Campbell Scientific software supports datalogger programming, communications between the datalogger and PC, and data display. Brief descriptions follow; for more information, see our literature or Web site.***

## Getting Started

**PCTour for Windows** provides a quick tutorial that introduces you to the CR10X and our PC208W software.

**SCWin** program builder creates datalogger programs requiring only sensor measurement and data output. It supports most of the sensors on our U.S. price lists.

**PC200W** starter software allows you to transfer a program to, or retrieve data from, a CR10X via a direct communications link (i.e., an optically isolated RS-232 interface or a similar device).

*SCWin, PCTour for Windows, and PC200W are available at no charge from http://www.campbellsci.com/resource.html*

## Datalogger Support Software

LoggerNet 2.0 and PC208W are our full-featured software. They support:

- direct connection and telecommunications links
- scheduled data collection
- programming for most commercially available sensors as well as devices such as SDMs, multiplexers, and relays
- storage module communication
- report generation

## Real-Time Data Monitor (RTDM)

RTDM allows experienced users to create custom graphic screens. RTDM supports automatic generation of JPEG output for Internet display. Developer and display-only versions are also available.

*RTDM is powerful, versatile software that can display real-time or archived data in bar, lines, area, or point charts. Automatic generation of JPEG outputs facilitates displaying information on Internet pages.*

# CR10X Specifications

***Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; non-condensing environment required. To maintain electrical specifications, yearly calibrations are recommended.***

## PROGRAM EXECUTION RATE

Program is synchronized with real-time up to 64 Hz. One channel can be measured at this rate with uninterrupted data transfer. Burst measurements up to 750 Hz are possible over short intervals.

## ANALOG INPUTS

NUMBER OF CHANNELS: 6 differential or 12 single-ended, individually configured. Channel expansion provided by AM16/32 or AM416 Relay Multiplexers and AM25T Thermocouple Multiplexers.

ACCURACY: ±0.1% of FSR (-25° to 50°C);
±0.05% of FSR (0° to 40°C);
e.g., ±0.1% FSR = ±5.0 mV for ±2500 mV range

RANGE AND RESOLUTION:

| *Full Scale Input Range (mV)* | *Resolution (µV) Differential* | *Resolution (µV) Single-Ended* |
|---|---|---|
| ±2500 | 333 | 666 |
| ±250 | 33.3 | 66.6 |
| ±25 | 3.33 | 6.66 |
| ±7.5 | 1.00 | 2.00 |
| ±2.5 | 0.33 | 0.66 |

INPUT SAMPLE RATES: Includes the measurement time and conversion to engineering units. The fast and slow measurements integrate the signal for 0.25 and 2.72 ms, respectively. Differential measurements incorporate two integrations with reversed input polarities to reduce thermal offset and common mode errors.

| | |
|---|---|
| Fast single-ended voltage: | 2.6 ms |
| Fast differential voltage: | 4.2 ms |
| Slow single-ended voltage: | 5.1 ms |
| Slow differential voltage: | 9.2 ms |
| Differential with 60 Hz rejection: | 25.9 ms |
| Fast differential thermocouple: | 8.6 ms |

INPUT NOISE VOLTAGE (for ±2.5 mV range):
Fast differential: 0.82 µV rms
Slow differential: 0.25 µV rms
Differential with 60 Hz rejection: 0.18 µV rms

COMMON MODE RANGE: ±2.5 V

DC COMMON MODE REJECTION: >140 dB

NORMAL MODE REJECTION: 70 dB (60 Hz with slow differential measurement)

INPUT CURRENT: ±9 nA maximum

INPUT RESISTANCE: 20 Gohms typical

## ANALOG OUTPUTS

DESCRIPTION: 3 switched, active only during measurement, one at a time.

RANGE: ±2.5 V

RESOLUTION: 0.67 mV

ACCURACY: ±5 mV; ±2.5 mV (0° to 40°C)

CURRENT SOURCING: 25 mA

CURRENT SINKING: 25 mA

FREQUENCY SWEEP FUNCTION: The switched outputs provide a programmable swept frequency, 0 to 2.5 V square wave for exciting vibrating wire transducers.

## RESISTANCE MEASUREMENTS

MEASUREMENT TYPES: The CR10X provides ratiometric bridge measurements of 4- and 6-wire full bridge, and 2-, 3-, and 4-wire half bridges. Precise dual polarity excitation using any of the switched outputs eliminates dc errors. Conductivity measurements use a dual polarity 0.75 ms excitation to minimize polarization errors.

ACCURACY: ±0.02% of FSR plus bridge resistor error.

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## PERIOD AVERAGING MEASUREMENTS

The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 12 single-ended analog input channels can be used. Signal attentuation and ac coupling are typically required.

INPUT FREQUENCY RANGE:

| *Signal peak-to-peak[1] Min.* | *Max.* | *Min. Pulse w.* | *Max Freq.[2]* |
|---|---|---|---|
| 500 mV | 5.0 V | 2.5 µs | 200 kHz |
| 10 mV | 2.0 V | 10 µs | 50 kHz |
| 5 mV | 2.0 V | 62 µs | 8 kHz |
| 2 mV | 2.0 V | 100 µs | 5 kHz |

[1]Signals centered around datalogger ground
[2]Assuming 50% duty cycle

RESOLUTION: 35 ns divided by the number of cycles measured

ACCURACY: ±0.03% of reading

TIME REQUIRED FOR MEASUREMENT: Signal period times the number of cycles measured plus 1.5 cycles + 2 ms

## PULSE COUNTERS

NUMBER OF PULSE COUNTER CHANNELS: 2 eight-bit or 1 sixteen-bit; software selectable as switch closure, high frequency pulse, and low level ac.

MAXIMUM COUNT RATE: 16 kHz, eight-bit counter; 400 kHz, sixteen-bit counter. Channels are scanned at 8 or 64 Hz (software selectable).

SWITCH CLOSURE MODE
Minimum Switch Closed Time: 5 ms
Minimum Switch Open Time: 6 ms
Maximum Bounce Time: 1 ms open without being counted

HIGH FREQUENCY PULSE MODE
Minimum Pulse Width: 1.2 µs
Maximum Input Frequency: 400 kHz
Voltage Thresholds: Count upon transition from below 1.5 V to above 3.5 V at low frequencies. Larger input transitions are required at high frequencies because of input filter with 1.2 µs time constant. Signals up to 400 kHz will be counted if centered around +2.5 V with deviations ≥ ±2.5 V for ≥ 1.2 µs.
Maximum Input Voltage: ±20 V

LOW LEVEL AC MODE
(Typical of magnetic pulse flow transducers or other low voltage, sine wave outputs.)

Input Hysteresis: 14 mV

Maximum ac Input Voltage: ±20 V

Minimum ac Input Voltage:

| (Sine wave mV RMS) | Range (Hz) |
|---|---|
| 20 | 1.0 to 1000 |
| 200 | 0.5 to 10,000 |
| 1000 | 0.3 to 16,000 |

## DIGITAL I/O PORTS

8 ports, software selectable as binary inputs or control outputs. 3 ports can be configured to count switch closures up to 40 Hz.

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

OUTPUT RESISTANCE: 500 ohms

INPUT STATE: high 3.0 to 5.5 V; low -0.5 to 0.8 V

INPUT RESISTANCE: 100 kohms

## SDI-12 INTERFACE STANDARD

Digital I/O Ports C1-C8 support SDI-12 asynchronous communication; up to ten SDI-12 sensors can be connected to each port. Meets SDI-12 Standard version 1.2 for datalogger and sensor modes.

## CR10XTCR THERMOCOUPLE REFERENCE

POLYNOMIAL LINEARIZATION ERROR: Typically <±0.5°C (-35° to +50°C), <±0.1°C (-24° to +45°C).

INTERCHANGEABILITY ERROR: Typically <±0.2°C (0° to +60°C) increasing to ±0.4°C (at -35°C).

## CE COMPLIANCE (as of 09/01)

STANDARD(S) TO WHICH CONFORMITY IS DECLARED:
EN55022: 1995 and EN61326: 1998

## EMI and ESD PROTECTION

IMMUNITY: Meets or exceeds following standards:
ESD: per IEC 1000-4-2; ±8 kV air, ±4 kV contact discharge
RF: per IEC 1000-4-3; 3 V/m, 80-1000 MHz
EFT: per IEC 1000-4-4; 1 kV power, 500 V I/O
Surge: per IEC 1000-4-5; 1 kV power and I/O
Conducted: per IEC 1000-4-6; 3 V 150 kHz-80 MHz

Emissions and immunity performance criteria available on request.

## CPU AND INTERFACE

PROCESSOR: Hitachi 6303

PROGRAM STORAGE: Up to 16 kbytes for active program; additional 16 kbytes for alternate programs. Operating system stored in 128 kbytes Flash memory.

DATA STORAGE: 128 kbytes SRAM standard (approximately 60,000 data values). Additional 2 Mbytes Flash available as an option.

OPTIONAL KEYBOARD DISPLAY: 8-digit LCD (0.5" digits)

PERIPHERAL INTERFACE: 9 pin D-type connector for keyboard display, storage module, modem, printer, card storage module, and RS-232 adapter.

BAUD RATES: Selectable at 300, 1200, 9600 and 76,800 bps for synchronous devices. ASCII communication protocol is one start bit, one stop bit, eight data bits (no parity).

CLOCK ACCURACY: ±1 minute per month

## SYSTEM POWER REQUIREMENTS

VOLTAGE: 9.6 to 16 Vdc

TYPICAL CURRENT DRAIN: 1.3 mA quiescent, 13 mA during processing, and 46 mA during analog measurement.

BATTERIES: Any 12 V battery can be connected as a primary power source. Several power supply options are available from Campbell Scientific. The Model CR2430 lithium battery for clock and SRAM backup has a capacity of 270 mAhr.

## PHYSICAL SPECIFICATIONS

SIZE: 7.8" x 3.5" x 1.5" - Measurement & Control Module; 9" x 3.5" x 2.9" - with CR10WP Wiring Panel. Additional clearance required for serial cable and sensor leads.

WEIGHT: 2 lbs

## WARRANTY

Three years against defects in materials and workmanship.

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

**CAMPBELL SCIENTIFIC, INC.**
815 W. 1800 N. • Logan, Utah 84321-1784 • (435) 753-2342 • FAX (435) 750-9540
Offices also located in: Australia • Brazil • Canada • England • France • South Africa • Spain

**Inteltronics Instrumentation**
Uitsig, De Kroon, Brits
P.O. Box 181, Brits, 0250, S.A
TEL: +27 (0)12 250 2403
FAX: +27 (0)12 250 2809
E-mail: itronics@icon.co.za
Web Site: www.inteltronics.co.za