CR6 Specifications

Electrical specifications are valid over a -40 to +70 °C, non-condensing environment, unless otherwise specified. Extended electrical specifications (noted as XT in specifications) are valid over a -55 to +85 °C non-condensing environment. Recalibration is recommended every three years. Critical specifications and system configuration should be confirmed with Campbell Scientific before purchase.

System specifications

Processor: Renesas RX63N (32-bit with hardware FPU, running at 100 MHz)

Memory:
- Total onboard: 128 MB of flash + 4 MB battery-backed SRAM
  - Data storage: 4 MB SRAM + 72 MB flash (extended data storage automatically used for auto-allocated Data Tables not being written to a card)
  - CPU drive: 30 MB flash
  - OS load: 8 MB flash
  - Settings: 1 MB flash
  - Reserved (not accessible): 10 MB flash
- Data storage expansion: Removable microSD flash memory, up to 16 GB

Physical specifications

Dimensions: 21.0 x 10.2 x 5.6 cm (8.3 x 4.0 x 2.2 in); additional clearance required for cables, wires, and antennas.

Weight/Mass:
- CR6: 0.42 kg (0.92 lb)
- CR6-WiFi: 0.50 kg (1.10 lb)
- CR6-RF451: 0.52 kg (1.15 lb)
- CR6-RF407/412/422/427: 0.51 kg (1.13 lb)

Case Material: High-impact-resistant polycarbonate and UV-resistant TPE, recycle code 7

Dust Plug Material: UV-resistant TPE

Protection: Power inputs are protected against surge, over-voltage, over-current, and reverse power. IEC 61000-4 Class 4 level.

CHG Terminals:
- Voltage Input: 16 to 32 VDC
- Input Current Limit at 12 VDC:
  - 1.2 A @ 20 °C maximum

BAT Terminals:
- 10 to 18 VDC
- 19 VDC sustained voltage limit without damage; transient voltage protected
- 2.5 A max current at 12 VDC at 20 °C

NOTE:
CR6 dataloggers with serial numbers less than 7502 have the following memory specifications:

CPU Drive / Programs: 1 MB flash
USR Drive / Data: 4 MB SRAM (battery backed)

Program Execution Period: 1 ms to 1 day

Real-Time Clock:
- Battery backed while external power is disconnected
- Resolution: 1 ms
- Accuracy: ±3 min. per year, optional GPS correction to ±10 μs, 5.7 ppm

Wiring Panel Temperature: Measured using a thermistor, located on the analog board.
External Batteries:
- Float charge on BAT terminal
- 12 VDC
- Valve-regulated, lead-acid (VRLA)
- 2 to 24 Ah battery typical

USB Power: Functions that will be active with USB 5 VDC include sending programs, adjusting data logger settings, and making some measurements. If USB is the only power source, then the CS I/O port and the 12V and SW12 terminals will not be operational.

Internal Lithium Battery: AA, 2.4 Ah, 3.6 VDC (Tadiran TL 5903/S) for battery-backed SRAM and clock. 3-year life with no external power source.

Average Current Drain:
Assumes 12 VDC on BAT terminals — add 2 mA if using CHG terminals.
- Idle: <1 mA
- Active 1 Hz Scan: 3 mA
- Active 20 Hz Scan: 67 mA
- Serial (RS-232/RS-485): Active + 25 mA
- Ethernet Power Requirements:
  - Ethernet 1 Minute: Active + 1 mA
  - Ethernet Idle: Active + 4 mA
  - Ethernet Link: Active + 47 mA

Vehicle Power Connection: When primary power is pulled from the vehicle power system, a second power supply OR charge regulator may be required to overcome the voltage drop at vehicle start-up.

Wi-Fi Additional Current Contribution at 12 VDC:

<table>
<thead>
<tr>
<th>Mode</th>
<th>Wi-Fi Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Client Mode</td>
<td>7 mA idle, 70 mA communicating</td>
</tr>
<tr>
<td>Access Point Mode</td>
<td>62 mA idle, 70 mA communicating</td>
</tr>
<tr>
<td>Sleep</td>
<td>&lt;1 mA</td>
</tr>
</tbody>
</table>

RF Average Additional Current Contribution at 12 VDC:

<table>
<thead>
<tr>
<th></th>
<th>-RF407, -RF412, -RF427</th>
<th>-RF422</th>
<th>-RF451</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmit</td>
<td>&lt; 80 mA</td>
<td>20 mA</td>
<td>650 mA, maximum</td>
</tr>
<tr>
<td>Idle On</td>
<td>12 mA</td>
<td>9.5 mA</td>
<td>15 mA, maximum</td>
</tr>
<tr>
<td>Idle 0.5 s Power Mode</td>
<td>4 mA</td>
<td>3.5 mA</td>
<td>NA</td>
</tr>
<tr>
<td>Idle 1 s Power Mode</td>
<td>3 mA</td>
<td>2 mA</td>
<td>NA</td>
</tr>
<tr>
<td>Idle 4 s Power Mode</td>
<td>1.5 mA</td>
<td>1.5 mA</td>
<td>NA</td>
</tr>
</tbody>
</table>

Power output specifications
System power out limits (when powered with 12 VDC)

<table>
<thead>
<tr>
<th>Temperature (°C)</th>
<th>Current Limit1 (A)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-40°</td>
<td>3.88</td>
</tr>
<tr>
<td>0°</td>
<td>2.98</td>
</tr>
<tr>
<td>20°</td>
<td>2.50</td>
</tr>
<tr>
<td>50°</td>
<td>1.80</td>
</tr>
<tr>
<td>70°</td>
<td>1.35</td>
</tr>
<tr>
<td>85°</td>
<td>1.00</td>
</tr>
</tbody>
</table>

1 Limited by self-resetting thermal fuse

12 V and SW12 V power output terminals
12V, SW12-1, and SW12-2: Provide unregulated 12 VDC power with voltage equal to the Power Input supply voltage. These are disabled when operating on USB power only.

<table>
<thead>
<tr>
<th>SW12 current limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temperature (°C)</td>
</tr>
<tr>
<td>----------------------</td>
</tr>
<tr>
<td>-40°</td>
</tr>
<tr>
<td>0°</td>
</tr>
<tr>
<td>20°</td>
</tr>
<tr>
<td>50°</td>
</tr>
<tr>
<td>70°</td>
</tr>
<tr>
<td>85°</td>
</tr>
</tbody>
</table>

1 Thermal fuse hold current.

U and C as power output
- C Terminals:
  - Output Resistance (R): 150 Ω
  - 5 V Logic Level Drive Capacity: 10 mA @ 3.5 VDC
  - 3.3 V Logic Level Drive Capacity: 10 mA @ 1.8 VDC
CS I/O pin 1

5 V Logic Level Max Current: 200 mA

Voltage and current excitation specifications

A 12-bit DAC produces voltage and current excitation. When used for resistance measurement, excitation is active only during measurement.

Voltage excitation

Terminals: U1 - U12

Range: ±2500 mV

Resolution: 0.6 mV

Voltage Excitation Absolute Accuracy:

- 0 to 40 °C: ±(0.1% of setting + 1.2 mV)
- −40 to 70 °C: ±(0.1% of setting + 1.5 mV)
- −55 to 85 °C (XT): ±(0.1% of setting + 1.6 mV)

Maximum Source or Sink Current: ±25 mA

Current excitation

Terminals: U1 - U12

Range: ±2.5 mA

Resolution: 0.6 μA

Current Excitation Absolute Accuracy:

- 0 to 40 °C: ±(0.11% of setting + 2.0 μA)
- −40 to 70 °C: ±(0.12% of setting + 2.5 μA)
- −55 to 85 °C (XT): ±(0.13% of setting + 3.0 μA)

Compliance Voltage: ±5 V

Analog measurement specifications

12 universal (U) terminals individually configurable for voltage, thermocouple, thermistor, current loop, ratiometric, static vibrating wire, and period average measurements, using a 24-bit ADC. One channel at a time is measured.

Voltage measurements

Terminals:

- Differential Configuration (H/L): U1/U2 - U11/U12
- Single-Ended Configuration: U1 – U12

Input Resistance: 20 GΩ typical

Input Voltage Limits: ±5 V

Sustained Input Voltage without Damage: ±20 VDC

DC Common Mode Rejection:

- > 120 dB with input reversal
- ≥ 86 dB without input reversal

Normal Mode Rejection: > 70 dB @ 60 Hz

Input Current @ 25 °C: ±2 nA typical

Filter First Notch Frequency (f_N) Range: 5 Hz to 93 kHz (user specified)

Analog Range and Resolution:

<table>
<thead>
<tr>
<th>Notch Frequency (f_N) (Hz)</th>
<th>Range1 (mV)</th>
<th>Differential with Input Reversal</th>
<th>Single-Ended and Differential without Input Reversal</th>
</tr>
</thead>
<tbody>
<tr>
<td>15000</td>
<td>±5000</td>
<td>20.0</td>
<td>30.0</td>
</tr>
<tr>
<td></td>
<td>±1000</td>
<td>4.0</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>±200</td>
<td>1.6</td>
<td>1.8</td>
</tr>
<tr>
<td>50/603</td>
<td>±5000</td>
<td>1.2</td>
<td>5.0</td>
</tr>
<tr>
<td></td>
<td>±1000</td>
<td>0.24</td>
<td>1.1</td>
</tr>
<tr>
<td></td>
<td>±200</td>
<td>0.10</td>
<td>0.24</td>
</tr>
<tr>
<td>5</td>
<td>±5000</td>
<td>0.60</td>
<td>4.9</td>
</tr>
<tr>
<td></td>
<td>±1000</td>
<td>0.12</td>
<td>1.0</td>
</tr>
<tr>
<td></td>
<td>±200</td>
<td>0.05</td>
<td>0.22</td>
</tr>
</tbody>
</table>

1 Range overhead of ~5% on all ranges guarantees that full-scale values will not cause over range
2 Typical effective resolution (ER) in bits; computed from ratio of full-scale range to RMS resolution.
3 50/60 corresponds to rejection of 50 and 60 Hz ac power mains noise.

Accuracy (does not include sensor or measurement noise):

- 0 to 40 °C: ±(0.04% of measurement + offset)
- −40 to 70 °C: ±(0.06% of measurement + offset)
- −55 to 85 °C (XT): ±(0.08% of measurement + offset)
Voltage Measurement Accuracy Offsets:

<table>
<thead>
<tr>
<th>Range (mV)</th>
<th>Differential with Input Reversal</th>
<th>Single-Ended or Differential without Input Reversal</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5000</td>
<td>±10</td>
<td>±40</td>
</tr>
<tr>
<td>±1000</td>
<td>±5</td>
<td>±12</td>
</tr>
<tr>
<td>±200</td>
<td>±2</td>
<td>±6</td>
</tr>
</tbody>
</table>

Measurement Settling Time: 20 µs to 600 ms; 500 µs default

Multiplexed Measurement Time:
Measurement time = INT(multiplexed measurement time • (reps+1)) + 2ms

<table>
<thead>
<tr>
<th>Example fN1 (Hz)</th>
<th>Time2 (ms)</th>
<th>Time2 (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td>15000</td>
<td>2.8</td>
<td>1.4</td>
</tr>
<tr>
<td>60</td>
<td>36</td>
<td>18.1</td>
</tr>
<tr>
<td>50</td>
<td>42.07</td>
<td>21.3</td>
</tr>
<tr>
<td>5</td>
<td>402.7</td>
<td>201.4</td>
</tr>
</tbody>
</table>

1 Notch frequency (1/integration time).
2 Default settling time of 500 µs used.

Resistance measurement specifications
The data logger makes ratiometric-resistance measurements for four- and six-wire full-bridge circuits and two-, three-, and four-wire half-bridge circuits using voltage excitation or for direct resistance measurements using current excitation. Excitation polarity reversal is available to minimize dc error.

Accuracy
Assumes input reversal for differential measurements RevDi fF and excitation reversal RevEx for excitation voltage <1000 mV and excitation current < 1 mA. Does not include bridge resistor errors or sensor and measurement noise.
- 0 to 40 °C: ±(0.02% of voltage measurement + offset)
- 0 to 70 °C: ±0.025% of voltage measurement + offset
- -55 to 85 °C (XT): ±(0.03% of voltage measurement + offset)

Period-averaging measurement specifications
Terminals: U1-U12
Accuracy: ±(0.01% of measurement + resolution), where resolution is 0.13 µs divided by the number of cycles to be measured

Ranges:
- Minimum signal centered around specified period average threshold.
- Maximum signal centered around data logger ground.
- Maximum frequency = 1/(2 * (minimum pulse width)) for 50% duty cycle signals

<table>
<thead>
<tr>
<th>Gain Code Option</th>
<th>Voltage Gain</th>
<th>Minimum Peak to Peak Signal (mV)</th>
<th>Maximum Peak to Peak Signal (V)</th>
<th>Minimum Pulse Width (µs)</th>
<th>Maximum Frequency (kHz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>500</td>
<td>10</td>
<td>2.5</td>
<td>200</td>
</tr>
<tr>
<td>1</td>
<td>2.5</td>
<td>50</td>
<td>2</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>2</td>
<td>12.5</td>
<td>10</td>
<td>2</td>
<td>62</td>
<td>8</td>
</tr>
<tr>
<td>3</td>
<td>64</td>
<td>2</td>
<td>2</td>
<td>100</td>
<td>5</td>
</tr>
</tbody>
</table>

Static vibrating wire measurement specifications
Up to 6 static vibrating wire measurements without thermistor measurements, or up to 3 static vibrating wire measurements with thermistor measurements. A U terminal pair both excites and measures vibrating wire transducers. Logarithmic sine-wave-frequency excitation is adjustable up to ±6 V (12 V peak-to-peak), programmable from 100 Hz to 6.5 kHz, then followed by frequency domain measurements, one at a time.

Terminals: U1 - U12
Input Resistance: 4.75 kΩ
Measurement Type: Differential voltage
Range: ±200 mV
Accuracy: ±0.013% of reading
Resolution: 0.001 Hz RMS
Measurement Speed (vibrating wire and thermistor combined): < 1 s

Thermistor measurement specifications
6 U terminal pairs can be configured to measure two-wire thermistors directly using an on-board 5 kΩ resistor to complete the bridge. The U terminal pair both excites and measures the thermistor.

Terminals: U1 - U12
Input Resistance: 5 kΩ ±0.1%, 10 ppm/°C completion resistor
Measurement Type: Single-ended voltage
Range: ±5000 mV
Resolution: 0.001 Ω RMS
Accuracy: ±0.25% of reading

Current-loop measurement specifications
The data logger makes current-loop measurements by measuring across a current-sense resistor associated with the RS-485 resistive ground terminal.
NOTE:
Resistance to ground input for non-isolated 0-20 mA and 4-20 mA current loop measurements is available in CR6 data loggers with serial numbers 7502 and greater.

Terminal: RG
Maximum Input Voltage: ±16 V
Resistance to Ground: 101 Ω
Current Measurement Shunt Resistance: 10 Ω
Maximum Current Measurement Range: ±80 mA
Absolute Maximum Current: ±160 mA
Resolution: ≤ 20 nA
Accuracy:
- 0 to 40 °C: ±0.14% of reading
- -40 to 70 °C: ±0.26% of reading

Pulse measurement specifications
The data logger can measure switch closure or high-frequency pulse signals on C and U terminals. Terminals are configured as pairs with options for pull-up or pull-down. Even-numbered U terminals can be configured as low-level AC inputs. Each terminal has its own independent 32-bit counter. Terminal pairs are U1 and U2, U3 and U4, through U11 and U12.

NOTE:
Conflicts can occur when a control port pair is used for different instructions (TimerInput(), PulseCount(), SDI12Recorder(), WaitDigTrig()). For example, if C1 is used for SDI12Recorder(), C2 cannot be used for TimerInput(), PulseCount(), or WaitDigTrig().

Pulse Event: Transition from logic low to logic high.

<table>
<thead>
<tr>
<th>Terminal Pair Configuration</th>
<th>Logic Low</th>
<th>Logic High</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 V</td>
<td>≤ 1.5 V</td>
<td>≥ 3.5 V</td>
</tr>
<tr>
<td>3.3 V</td>
<td>≤ 0.8 V</td>
<td>≥ 2.0 V</td>
</tr>
</tbody>
</table>

Maximum Input Voltage: ±20 VDC
Maximum Counts Per Channel: 2³²
Maximum Counts Per Scan: 2³²
Input Resistance: 5 kΩ
Accuracy: ±(0.02% of reading + 1/scan)

Switch closure input
Terminals: C1-C4, U1-U12
Resistance: Configurable in terminal pairs with 100 kΩ pull-up or pull-down
Maximum Input Frequency: 150 Hz
Minimum Switch Closed Time: 5 ms
Minimum Switch Open Time: 6 ms
Maximum Bounce Time: 1 ms open without being counted

Software Debounce Time: 3.3 ms
High-frequency input
Terminals: C1-C4, U1-U12
Resistance: Configurable in terminal pairs with 100 kΩ pull-up or pull-down
Typical Wave Form: 5 or 3.3 VDC square wave
Maximum Input Frequency: 1 MHz
Low-level AC input
Terminals: U2, U4, U6, U8, U10, U12

NOTE:
When an even numbered U terminal (for example, U2) is used for low-level AC pulse counting, its paired odd numbered terminal (U1 in this example) can be used only for switch-closure or high-frequency pulse counting or in the digital I/O control or state function.

DC-offset rejection: Internal AC coupling eliminates DC-offset voltages up to ±0.05 VDC
Input Hysteresis: 12 mV at 1 Hz

Low-Level AC Pulse Input Ranges for U Terminals:

<table>
<thead>
<tr>
<th>Sine wave (mV RMS)</th>
<th>Range (Hz)</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>1.0 to 20</td>
</tr>
<tr>
<td>200</td>
<td>0.5 to 200</td>
</tr>
<tr>
<td>2000</td>
<td>0.3 to 10,000</td>
</tr>
<tr>
<td>5000</td>
<td>0.3 to 20,000</td>
</tr>
</tbody>
</table>

Digital input/output specifications
Terminals configurable for digital input and output (I/O) including status high/low, pulse width modulation, external interrupt, edge timing, switch closure pulse counting, high-frequency pulse counting, UART1, RS-232², RS-422³, RS-485⁴,

¹Universal Asynchronous Receiver/Transmitter for asynchronous serial communications.
²Recommended Standard 232. A loose standard defining how two computing devices can communicate with each other. The implementation of RS-232 in Campbell Scientific data loggers to computer communications is quite rigid, but transparent to most users. Features in the data logger that implement RS-232 communication with smart sensors are flexible.
³Communications protocol similar to RS-485. Most RS-422 sensors will work with RS-485 protocol.
⁴Recommended Standard 485. A standard defining how two computing devices can communicate with each other.
SDM1, SDI-12, I2C3, and SPI4 function. Terminals are configurable in pairs for 5 V or 3.3 V logic for some functions.

NOTE: Conflicts can occur when a control port pair is used for different instructions (TimerInput(), PulseCount(), SDI12Recorder(), WaitDigTrig()). For example, if C1 is used for SDI12Recorder(), C2 cannot be used for TimerInput(), PulseCount(), or WaitDigTrig().

Maximum Input Voltage: ±20 V

Logic Levels and Drive Current:

<table>
<thead>
<tr>
<th>Terminal Pair Configuration</th>
<th>5 V Source</th>
<th>3.3 V Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>Logic low</td>
<td>≤ 1.5 V</td>
<td>≤ 0.8 V</td>
</tr>
<tr>
<td>Logic high</td>
<td>≥ 3.5 V</td>
<td>≥ 2.5 V</td>
</tr>
<tr>
<td>C1 - C4</td>
<td>10 mA @ 3.5 V</td>
<td>10 mA @ 1.85 V</td>
</tr>
<tr>
<td>U odd</td>
<td>20 mA @ 3.5 V</td>
<td>20 mA @ 1.85 V</td>
</tr>
<tr>
<td>U even</td>
<td>10 mA @ 3.5 V</td>
<td>10 mA @ 1.85 V</td>
</tr>
</tbody>
</table>

Edge timing

Terminals: C1-C4, U1-U12

Maximum Input Frequency: ≤ 1 kHz

Resolution: 520 ns

Edge counting

Terminals: C1-C4, U1-U12

Maximum Input Frequency: ≤ 2.2 kHz

Quadrature input

Terminals: C1-C4 and U1-U12 can be configured as digital pairs to monitor the two sensing channels of an encoder.

Maximum Frequency: 2.5 kHz

Resolution: 31.25 µs or 32 kHz

Pulse-width modulation

Modulation Voltage: Logic high

Maximum Period: 128 seconds

Resolution:

- 0 to ≤ 5 ms: 1/12 MHz or 83.33 ns
- > 5 to ≤ 300 ms: 187.62 kHz or 5.33 µs
- > 300 ms: 1/32 kHz or 31.25 µs

Communications specifications

Ethernet Port: RJ45 jack, 10/100Base Mbps, full and half duplex, Auto-MDIX, magnetic isolation, and TVS surge protection.

Internet Protocols: Ethernet, PPP, RNDIS, ICMP/Ping, Auto-IP (APIPA), IPv4, IPv6, UDP, TCP, TLS (v1.2), DNS, DHCP, SLAAC, Telnet, HTTP(S), SFTP, FTP(S), POP3/TLS, NTP, SMTP/TLS, SNMPv3, CS I/O IP

Additional Protocols: CPI, PakBus, PakBus Encryption, SDM, SDI-12, Modbus RTU / ASCII / TCP, DNP3, custom user definable over serial, UDP, NTCIP, NMEA 0183, I2C, SPI

USB Device: Micro-B device for computer connectivity

CS I/O: 9-pin D-sub connector to interface with Campbell Scientific CS I/O peripherals.

0 – 5 V Serial (U1 to U12, C1 to C4): Eight independent TX/RX pairs

SDI-12 (C1, C3, U1, U3, U5, U7, U9, U11): Eight independent SDI-12 compliant terminals are individually configured and meet SDI-12 Standard v 1.4

RS-485 (C1 to C4): One full duplex or two half duplex

RS-422 (C1 to C4): One full duplex or two half duplex

RS-232/CPI: Single RJ45 module port that can operate in one of two modes: CPI or RS-232. CPI interfaces with Campbell Scientific CDM measurement peripherals and sensors. RS-232 connects, with an adapter cable, to computer, sensor, or communications devices serially.

CPI: One CPI bus. Up to 1 Mbps data rate. Synchronization of devices to 5 µs. Total cable length up to 610 m (2000 ft). Up to 20 devices. CPI is a proprietary interface for communications between Campbell Scientific data loggers and Campbell Scientific CDM peripheral devices. It consists of a physical layer definition and a data protocol.

Antenna Connection:

- Wi-Fi
- SS 900 MHz
- 2.4 GHz

Wireless: Wi-Fi, VHF, UHF, spread spectrum, ELOS

Hardwired: Multi-drop, short haul, RS-232, fiber optic

Satellite: GOES, Argos, Inmarsat Hughes, Iridium

Wi-Fi option specifications

WLAN (Wi-Fi) (CR6-WiFi only)

Maximum Possible Over-the-Air Data Rates: <11 Mbps over 802.11b, <54 Mbps over 802.11g, <72 Mbps over 802.11n

Operating Frequency: 2.4 GHz, 20 MHz bandwidth

Antenna Connector: Reverse Polarity SMA (RPSMA)

Antenna (shipped with data logger): Unity gain (0 dBd), 1/2 wave whip, omnidirectional. Features an articulating knuckle joint that can be oriented vertically or at right angles

Supported Technologies: 802.11 b/g/n, WPA/WPA2-Personal, WPA/WPA2-Enterprise Security, WEP

---

1Synchronous Device for Measurement. A processor-based peripheral device or sensor that communicates with the data logger via hardwire over a short distance using a protocol proprietary to Campbell Scientific.

2Serial Data Interface at 1200 baud. Communication protocol for transferring data between the data logger and SDI-12 compatible smart sensors.

3Inter-Integrated Circuit is a multi-master, multi-slave, packet switched, single-ended, serial computer bus.

4Serial Peripheral Interface - a clocked synchronous interface, used for short distance communications, generally between embedded devices.
**Client Mode:** WPA/WPA2-Personal and Enterprise, WEP

**Access Point Mode:** WPA2-Personal

**Receive Sensitivity:** -97 dBm

**RF radio option specifications**

**Antenna Terminal:** Reverse Polarity SMA (RPSMA)

**Radio Type**
- **RF407, RF412, RF427, and RF451:** Frequency Hopping Spread Spectrum (FHSS)
- **RF422:** SRD860 Radio with Listen before Talk (LBT) and Automatic Frequency Agility (AFA)

**Frequency**
- **RF407:** 902 to 928 MHz (US, Canada)
- **RF412:** 915 to 928 MHz (Australia, New Zealand)
- **RF422:** 863 to 870 MHz (European Union)
- **RF427:** 902 to 907.5 MHz/915 to 928 MHz (Brazil)
- **RF451:** 902 to 928 MHz

**Transmit Power Output** (software selectable)
- **RF407** and **RF412:** 5 to 250 mW
- **RF422:** 2 to 25 mW
- **RF427:** 5 to 250 mW
- **RF451:** 10 mW to 1,000 mW

**Channel Capacity**
- **RF407:** Eight 25-channel hop sequences sharing 64 available channels.
- **RF412:** Eight 25-channel hop sequences sharing 31 available channels.
- **RF422:** Ten 30-channel hop sequences (default), software configurable to meet local regulations; 10 sequences for reducing interference through channel hop.
- **RF427:** Eight 25-channel hop sequences sharing 43 available channels.
- **RF451:** 50 to 112 user-selectable channels for a given network.

**Receive Sensitivity**
- **RF407, RF412, and RF427:** –101 dBm
- **RF422:** –106 dBm
- **RF451:**
  - –108 dBm at 115.2 kbps for 10^{-4} BER
  - –103 dBm at 153.6 kbps for 10^{-4} BER

**RF Data Rate**
- **RF407, RF412, and RF427:** 200 kbps
- **RF422:** 10 kbps
- **RF451:** 115.2 or 153.6 kbps

**Standards compliance specifications**


**Shock and Vibration:** MIL-STD 810G methods 516.6 and 514.6

**Protection:** IP50

**EMI and ESD protection:**
- **Immunity:** Meets or exceeds following standards:
  - **ESD:** per IEC 61000-4-2; ±15 kV air, ±8 kV contact discharge
  - **Radiated RF:** per IEC 61000-4-3; 10 V/m, 80-1000 MHz
  - **EFT:** per IEC 61000-4-4; 4 kV power, 4 kV I/O
  - **Surge:** per IEC 61000-4-5; 4 kV power, 4kV I/O
  - **Conducted RF:** per IEC 61000-4-6; 10 V power, 10 V I/O
- Emissions and immunity performance criteria available on request.

**RF407 Option**
- United States FCC Part 15.247: MCQ-XB900HP
- Industry Canada (IC): 1846A-XB900HP
- Mexico IF: RCPDIXB15-0672-A1

**RF412 Option**
- **ACMA RCM**
- United States FCC Part 15.247:
  - **MCQ-XB900HP**
  - Industry Canada (IC): 1846A-XB900HP

**RF422 Option:** View EU Declaration of Conformity at www.campbellsci.com/cr6.

**RF427 Option**

**RF451 Option**
- United States FCC ID: KNYAMM0921TT
- Industry Canada (IC): 2329B-AMM0921TT

**WiFi Option**
- United States FCC ID: XF6-RS9113SB
- Industry Canada (IC): 8407A-RS9113SB

**NOTE:** The user is responsible for emissions if changing the antenna type or increasing the gain.

**Warranty**

**Standard:** Three years against defects in materials and workmanship.

**Extended (optional):** An additional four years against defects in materials and workmanship, bringing the total to 7 years.
## Terminal functions

### Analog input terminal functions

<table>
<thead>
<tr>
<th></th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U4</th>
<th>U5</th>
<th>U6</th>
<th>U7</th>
<th>U8</th>
<th>U9</th>
<th>U10</th>
<th>U11</th>
<th>U12</th>
<th>RG</th>
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</thead>
<tbody>
<tr>
<td>Single-Ended Voltage</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Differential Voltage</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td>H</td>
<td>L</td>
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<td>H</td>
<td>L</td>
<td>H</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Ratiometric/Bridge</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<td>✓</td>
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</tr>
<tr>
<td>Vibrating Wire (Static, VSPECT®)</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Vibrating Wire with Thermistor</td>
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<td>✓</td>
<td>✓</td>
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<tr>
<td>Thermistor</td>
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<tr>
<td>Thermocouple</td>
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<tr>
<td>Current Loop</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Period Average</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<td>✓</td>
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</table>

### Pulse counting terminal functions

<table>
<thead>
<tr>
<th></th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U4</th>
<th>U5</th>
<th>U6</th>
<th>U7</th>
<th>U8</th>
<th>U9</th>
<th>U10</th>
<th>U11</th>
<th>U12</th>
<th>C1-C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch-Closure</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>High Frequency</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>Low-level Ac</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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</table>

### Analog output terminal functions

<table>
<thead>
<tr>
<th></th>
<th>U1-U12</th>
<th>C1-C4</th>
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</thead>
<tbody>
<tr>
<td>Switched Voltage Excitation</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Switched Current Excitation</td>
<td>✓</td>
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### Voltage output terminal functions

<table>
<thead>
<tr>
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<th>U1-U12</th>
<th>C1-C4</th>
<th>12V</th>
<th>SW12-1</th>
<th>SW12-2</th>
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<tbody>
<tr>
<td>3.3 VDC</td>
<td>✓</td>
<td>✓</td>
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<tr>
<td>5 VDC</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 VDC</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

C and even numbered U terminals have limited drive capacity. Voltage levels are configured in pairs.
## Communications terminal functions

<table>
<thead>
<tr>
<th></th>
<th>U1</th>
<th>U2</th>
<th>U3</th>
<th>U4</th>
<th>U5</th>
<th>U6</th>
<th>U7</th>
<th>U8</th>
<th>U9</th>
<th>U10</th>
<th>U11</th>
<th>U12</th>
<th>C1</th>
<th>C2</th>
<th>C3</th>
<th>C4</th>
<th>RS-232/232 CPI</th>
</tr>
</thead>
<tbody>
<tr>
<td>SDI-12</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<td>✓</td>
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<tr>
<td>GPS Time Sync</td>
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<td></td>
<td>PPS</td>
<td>Rx</td>
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<tr>
<td>TTL 0-5 V</td>
<td>Tx</td>
<td>Rx</td>
<td>Tx</td>
<td>Rx</td>
<td>Tx</td>
<td>Rx</td>
<td>Tx</td>
<td>Rx</td>
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<td>Rx</td>
<td>Tx</td>
<td>Rx</td>
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</tr>
<tr>
<td>LVTTL 0-3.3 V</td>
<td>Tx</td>
<td>Rx</td>
<td>Tx</td>
<td>Rx</td>
<td>Tx</td>
<td>Rx</td>
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<tr>
<td>RS-232</td>
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<td>Rx</td>
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<td>✓</td>
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</tr>
<tr>
<td>RS-485 (Half Duplex)</td>
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<td>A-</td>
<td>B+</td>
<td>A-</td>
<td>B+</td>
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</tr>
<tr>
<td>RS-485 (Full Duplex)</td>
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<td></td>
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<td>Tx-</td>
<td>Tx+</td>
<td>Rx-</td>
<td>Rx+</td>
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<tr>
<td>I²C</td>
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<tr>
<td>SPI</td>
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<td>SDM</td>
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<tr>
<td>CPI/CDM</td>
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</tr>
</tbody>
</table>

## Digital I/O terminal functions

<table>
<thead>
<tr>
<th></th>
<th>U1-U12</th>
<th>C1-C4</th>
</tr>
</thead>
<tbody>
<tr>
<td>General I/O</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Pulse-Width Modulation Output</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Timer Input</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Interrupt</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Quadrature</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
Campbell Scientific regional offices

Australia
Location: Garbutt, QLD Australia
Phone: 61.7.4401.7700
Email: info@campbellsci.com.au
Website: www.campbellsci.com.au

Brazil
Location: São Paulo, SP Brazil
Phone: 11.3732.3399
Email: vendas@campbellsci.com.br
Website: www.campbellsci.com.br

Canada
Location: Edmonton, AB Canada
Phone: 780.454.2505
Email: dataloggers@campbellsci.ca
Website: www.campbellsci.ca

China
Location: Beijing, P. R. China
Phone: 86.10.6561.0080
Email: info@campbellsci.com.cn
Website: www.campbellsci.com.cn

Costa Rica
Location: San Pedro, Costa Rica
Phone: 506.2280.1564
Email: info@campbellsci.cc
Website: www.campbellsci.cc

France
Location: Vincennes, France
Phone: 0033.0.1.56.45.15.20
Email: info@campbellsci.fr
Website: www.campbellsci.fr

Germany
Location: Bremen, Germany
Phone: 49.0.421.460974.0
Email: info@campbellsci.de
Website: www.campbellsci.de

India
Location: New Delhi, DL India
Phone: 91.11.46500481.482
Email: info@campbellsci.in
Website: www.campbellsci.in

South Africa
Location: Stellenbosch, South Africa
Phone: 27.21.8809960
Email: sales@campbellsci.co.za
Website: www.campbellsci.co.za

Spain
Location: Barcelona, Spain
Phone: 34.93.2323938
Email: info@campbellsci.es
Website: www.campbellsci.es

Thailand
Location: Bangkok, Thailand
Phone: 66.2.719.3399
Email: info@campbellsci.asia
Website: www.campbellsci.asia

UK
Location: Shepshed, Loughborough, UK
Phone: 44.0.1509.601141
Email: sales@campbellsci.co.uk
Website: www.campbellsci.co.uk

USA
Location: Logan, UT USA
Phone: 435.227.9120
Email: info@campbellsci.com
Website: www.campbellsci.com