CR6 Specifications

Datalogger

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

> **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.

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/RF452**: 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

Power requirements

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 16 VDC
- 19 VDC sustained voltage limit without damage; transient voltage protected
- 2.5 A max current at 12 VDC at 20° C

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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:

Mode	Wi-Fi Option
Client Mode	7 mA idle, 70 mA communicating
Access Point Mode	62 mA idle, 70 mA communicating
Sleep	<1 mA

RF Average Additional Current Contribution at 12 VDC:

	-RF407, -RF412, -RF427	-RF422	-RF451/RF452
Transmit	< 80 mA	20 mA	650 mA, maximum
Idle On	12 mA	9.5 mA	15 mA, maximum
Idle 0.5 s Power Mode	4 mA	3.5 mA	NA
Idle 1 s Power Mode	3 mA	2 mA	NA
Idle 4 s Power Mode	1.5 mA	1.5 mA	NA

Power output specifications

System power out limits (when powered with 12 VDC)

Temperature (°C)	Current limit[1] (A)
–40°	3.88
0°	2.98
20°	2.50
50°	1.80
70°	1.35
85°	1.00

[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.

SW12 current limits	
Temperature (°C)	**Current limit [1] (mA)**
–40°	1600
0°	1290
20°	1100
50°	830
70°	640
85°	500

[1] Thermal fuse hold current.

U and C as power output

- C Terminals:
  - **Output Resistance (R_o)**: 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

- U Terminals:

	U odd terminals	U even terminals
Voltage Excitation Max Current @ ±2500 mV	±25 mA	±25 mA
Current Excitation Max Current	±2500 µA	±2500 µA
5 V Logic Level Output Resistance (R_O)	75 Ω	150 Ω
5 V Logic Level Max Current @ 3.5 V	20 mA	10 mA
3.3 V Logic Level Output Resistance (R_O)	73 Ω	145 Ω
3.3 V Logic Level Max Current @1.85 V	20 mA	10 mA
U odd terminals: U1, U3, U5, U7, U9, U11. U even terminals: U2, U4, U6, U8, U10, U12		

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_{N1}) Range: 5 Hz to 93 kHz (user specified)

Analog Range and Resolution:

		Differential with input reversal		Single-ended and differential without input reversal	
Notch frequency (f_{N1}) (Hz)	Range[1] (mV)	RMS (µV)	Bits[2]	RMS (µV)	Bits[2]
15000	±5000 ±1000 ±200	20.0 4.0 1.6	19 19 18	30.0 5.5 1.8	18 18 17
50/60[3]	±5000 ±1000 ±200	1.2 0.24 0.10	23 23 22	5.0 1.1 0.24	20 20 20
5	±5000 ±1000 ±200	0.60 0.12 0.05	24 24 23	4.9 1.0 0.22	20 20 20

[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:

	Typical offset (µV RMS)	
Range (mV)	Differential with input reversal	Single-ended or differential without input reversal
±5000	±10	±40
±1000	±5	±12
±200	±2	±6

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

Multiplexed Measurement Time:

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

	Differential with input reversal	Single-ended or differential without input reversal
Example fN1[1] (Hz)	Time[2] (ms)	Time[2] (ms)
15000	2.8	1.4
60	36	18.1
50	42.07	21.3
5	402.7	201.4

[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 `RevDiff` 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)
- **–40 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

Gain code option	Voltage gain	Minimum peak to peak signal (mV)	Maximum peak to peak signal (V)	Minimum pulse width (µs)	Maximum frequency (kHz)
0	1	500	10	2.5	200
1	2.5	50	2	10	50
2	12.5	10	2	62	8
3	64	2	2	100	5

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.

Terminal Pair Configuration	Logic Low	Logic High
5 V	≤ 1.5 V	≥ 3.5 V
3.3 V	≤ 0.8 V	≥ 2.0 V

Maximum Input Voltage: ±20 VDC

Maximum Counts Per Channel: 2^{32}

Maximum Counts Per Scan: 2^{32}

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.

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:

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 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, UART[1], RS-232[2], RS-422[3], RS-485[4], SDM[5], SDI-12[6], I2C[7], and SPI[8] function. Terminals are configurable in pairs for 5 V or 3.3 V logic for some functions.

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[1]Universal Asynchronous Receiver/Transmitter for asynchronous serial communications.

[2]Recommended 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 communications with smart sensors are flexible.

[3]Communications protocol similar to RS-485. Most RS-422 sensors will work with RS-485 protocol.

[4]Recommended Standard 485. A standard defining how two computing devices can communicate with each other.

[5]Synchronous 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.

[6]Serial Data Interface at 1200 baud. Communications protocol for transferring data between the data logger and SDI-12 compatible smart sensors.

[7]Inter-Integrated Circuit is a multi-controller, multi-peripheral, packet switched, single-ended, serial computer bus.

[8]Serial Peripheral Interface - a clocked synchronous interface, used for short distance communications, generally between embedded devices.

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:

Terminal pair configuration	5 V source	3.3 V source
Logic low	≤ 1.5 V	≤ 0.8 V
Logic high	≥ 3.5 V	≥ 2.5 V
C1 - C4	10 mA @ 3.5V	10 mA @ 1.85V
U odd	20 mA @ 3.5V	20 mA @ 1.85V
U even	10 mA @ 3.5V	10 mA @ 1.85V

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, MQTT

Additional Protocols: CPI, PakBus, PakBus Encryption, SDM, SDI-12, Modbus RTU / ASCII / TCP, DNP3, custom user definable over serial, 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, Irridium

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

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/RF452**: Frequency-Hopping Spread-Spectrum (FHSS)
- **RF407, RF412**, and **RF427**: 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 (Europe, Middle East, and Africa)
- **RF427**: 902 to 907.5 MHz/915 to 928 MHz (Brazil)
- **RF451/RF452**: 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/RF452**: 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/RF452**: 50 to 112 user-selectable channels for a given network.

Receive Sensitivity

- **RF407**, **RF412**, and **RF427**: –101 dBm
- **RF422**: –106 dBm
- **RF451/RF452**:
  - –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/RF452**: 115.2 or 153.6 kbps

Maximum nodes in network

- **RF407**, **RF412**, and **RF427**: 50
- **RF422**: 20
- **RF451/RF452**: 4 repeaters

Standards compliance specifications

View compliance and conformity documents at www.campbellsci.com/cr6.

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: Brazil ANATEL standards in Resolution No. 506: 08335-17-10644. View the RF427 Brazilian Certificate of Conformity at www.campbellsci.com/cr6.

RF452 Option:

- United States FCC ID: KNYMM3
- Industry Canada (IC): 2329B-MM3

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, bringing the total to seven years.

Terminal functions

Analog input terminal functions													
	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	RG
Single-Ended Voltage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Differential Voltage	H	L	H	L	H	L	H	L	H	L	H	L	
Ratiometric/Bridge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Vibrating Wire (Static, VSPECT®)	✓		✓		✓		✓		✓		✓		
Vibrating Wire with Thermistor	✓				✓				✓				
Thermistor	✓		✓		✓		✓		✓		✓		
Thermocouple	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Current Loop													✓
Period Average	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Pulse counting terminal functions													
	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	C1-C4
Switch-Closure	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
High Frequency	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Low-level AC		✓		✓		✓		✓		✓		✓	

Analog output terminal functions	
	U1-U12
Switched Voltage Excitation	✓
Switched Current Excitation	✓

Voltage output terminal functions					
	U1-U12	C1-C4	12V	SW12-1	SW12-2
3.3 VDC	✓	✓			
5 VDC	✓	✓			
12 VDC			✓	✓	✓
C and even numbered U terminals have limited drive capacity. Voltage levels are configured in pairs.					

Communications terminal functions																	
	U1	U2	U3	U4	U5	U6	U7	U8	U9	U10	U11	U12	C1	C2	C3	C4	RS-232/ CPI
SDI-12	✓		✓		✓		✓		✓		✓		✓		✓		
GPS Time Sync	PPS	Rx											Tx	Rx	Tx	Rx	
TTL 0-5 V	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
LVTTL 0-3.3 V	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
RS-232													Tx	Rx	Tx	Rx	✓
RS-485 (Half Duplex)													A-	B+	A-	B+	
RS-485 (Full Duplex)													Tx-	Tx+	Rx-	Rx+	
I2C	SCL	SDA	SCL	SDA	SCL	SDA	SCL	SDA	SCL	SDA	SCL	SDA	SCL	SDA	SCL	SDA	
SPI	SCLK	COPI	CIPO		SCLK	COPI	CIPO		SCLKI	COPI	CIPO		SCLK	COPI	CIPO		
SDM	Data	Clk	Enabl		Data	Clk	Enabl		Data	Clk	Enabl		Data	Clk	Enabl		
CPI/ CDM																	✓

Digital I/O terminal functions		
	U1-U12	C1-C4
General I/O	✓	✓
Pulse-Width Modulation Output	✓	✓
Timer Input	✓	✓
Interrupt	✓	✓
Quadrature	✓	✓

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CR1000X Specifications

Datalogger

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

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

Wiring Panel Temperature: Measured using a 10K3A1A BetaTHERM thermistor, located between the two rows of analog input terminals.

Physical specifications

Dimensions: 23.8 x 10.1 x 6.2 cm (9.4 x 4.0 x 2.4 in); additional clearance required for cables and wires.

Weight/Mass: 0.86 kg (1.9 lb)

Case Material: Powder-coated aluminum

Power requirements

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

Power In Terminal:

- **Voltage Input**: 10 to 18 VDC
- **Input Current Limit at 12 VDC**:
  - 4.35 A at -40 °C
  - 3 A at 20 °C
  - 1.56 A at 85 °C
- 30 VDC sustained voltage limit without damage.

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 5V, 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 POWER IN terminals.

- **Idle**: <1 mA
- **Active 1 Hz Scan**: 1 mA
- **Active 20 Hz Scan**: 55 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

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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.

Power output specifications

System power out limits (when powered with 12 VDC)

Temperature (°C)	Current limit[1] (A)
–40°	4.53
20°	3.00
70°	1.83
85°	1.56
[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.

SW12 current limits	
Temperature (°C)	**Current limit [1] (mA)**
–40°	1310
0°	1004
20°	900
50°	690
70°	550
80°	470
[1] Thermal fuse hold current.	

5 V fixed output

5V: One regulated 5 V output. Supply is shared between the 5V terminal and CS I/O DB9 5 V output.

- **Voltage Output**: Regulated 5 V output (±5%)
- **Current Limit**: 230 mA

C as power output

- C Terminals:
  - **Output Resistance (R_o)**: 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 excitation

VX: Four independently configurable voltage terminals (VX1-VX4). When providing voltage excitation, a single 16-bit DAC shared by all VX outputs produces a user-specified voltage during measurement only.VX terminals can also be used to supply a selectable, switched, regulated 3.3 or 5 VDC power source to power digital sensors and toggle control lines.

	Range	Resolution	Accuracy	Maximum source/sink current[1]
Voltage Excitation	±4 V	0.06 mV	±(0.1% of setting + 2 mV)	±40 mA
Switched, Regulated	+3.3 or 5 V	3.3 or 5 V	±5%	50 mA
[1] Exceeding current limits causes voltage output to become unstable. Voltage should stabilize when current is reduced to within stated limits.				

Analog measurement specifications

16 single-ended (SE) or 8 differential (DIFF) terminals individually configurable for voltage, thermocouple, current loop, ratiometric, and period average measurements, using a 24-bit ADC. One channel at a time is measured.

Voltage measurements

Terminals:

- **Differential Configuration**: DIFF 1H/1L – 8H/8L
- **Single-Ended Configuration**: SE1 – SE16

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: ±1 nA typical

Filter First Notch Frequency (f_{N1}) Range: 0.5 Hz to 31.25 kHz (user specified)

Analog Range and Resolution:

		Differential with input reversal		Single-ended and differential without input reversal	
Notch frequency (f_{N1}) (Hz)	Range[1] (mV)	RMS (µV)	Bits[2]	RMS (µV)	Bits[2]
15000	±5000	8.2	20	11.8	19
	±1000	1.9	20	2.6	19
	±200	0.75	19	1.0	18
50/60[3]	±5000	0.6	24	0.88	23
	±1000	0.14	23	0.2	23
	±200	0.05	22	0.08	22
5	±5000	0.18	25	0.28	25
	±1000	0.04	25	0.07	24
	±200	0.02	24	0.03	23

[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)

Voltage Measurement Accuracy Offsets:

	Typical offset (µV RMS)	
Range (mV)	Differential with input reversal	Single-ended or differential without input reversal
±5000	±0.5	±2
±1000	±0.25	±1
±200	±0.15	±0.5

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

Multiplexed Measurement Time:

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

	Differential with input reversal	Single-ended or differential without input reversal
Example fN1[1] (Hz)	Time[2] (ms)	Time[2] (ms)
15000	2.04	1.02
60	35.24	17.62
50	41.9	20.95
5	401.9	200.95

[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. Excitation polarity reversal is available to minimize dc error.

Accuracy:

Assumes input reversal for differential measurements `RevDiff` and excitation reversal `RevEx` for excitation voltage <1000 mV. Does not include bridge resistor errors or sensor and measurement noise.

- 0 to 40 °C: ±(0.01% of voltage measurement + offset)
- –40 to 70 °C: ±(0.015% of voltage measurement + offset)
- –55 to 85 °C (XT): ±(0.02% of voltage measurement + offset)

Period-averaging measurement specifications

Terminals: SE1-SE16

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

Gain code option	Voltage gain	Minimum peak to peak signal (mV)	Maximum peak to peak signal (V)	Minimum pulse width (µs)	Maximum frequency (kHz)
0	1	500	10	2.5	200
1	2.5	50	2	10	50
2	12.5	10	2	62	8
3	64	2	2	100	5

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.

Terminals: RG1 and RG2

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: ±(0.1% of reading + 100 nA) @ -40 to 70 °C

Pulse measurement specifications

Two inputs (P1-P2) individually configurable for switch closure, high-frequency pulse, or low-level AC measurements. See also Digital input/output specifications (p. 4). Each terminal has its own independent 32-bit counter.

> **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 VDC

Maximum Counts Per Channel: 2^{32}

Maximum Counts Per Scan: 2^{32}

Input Resistance: 5 kΩ

Accuracy: ±(0.02% of reading + 1/scan)

Switch closure input

Terminals: C1-C8

Pull-Up Resistance: 100 kΩ to 5 V

Event: Low (<0.8 V) to High (>2.5 V)

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

High-frequency input

Terminals: C1-C8

Pull-Up Resistance: 100 kΩ to 5 V

Event: Low (<0.8 V) to High (>2.5 V)

Maximum Input Frequency: 250 kHz

Low-level AC input

Minimum Pull-Down Resistance: 10 kΩ to ground

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:

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 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, UART[1], RS-232[2], RS-422[3], RS-485[4], SDM[5], SDI-12[6], I2C[7], and SPI[8] 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()`.

Terminals: C1-C8

Maximum Input Voltage: ±20 V

Logic Levels and Drive Current:

Terminal pair configuration	5 V source	3.3 V source
Logic low	≤ 1.5 V	≤ 0.8 V
Logic high	≥ 3.5 V	≥ 2.5 V

Edge timing

Terminals: C1-C8

---

[1]Universal Asynchronous Receiver/Transmitter for asynchronous serial communications.

[2]Recommended 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 communications with smart sensors are flexible.

[3]Communications protocol similar to RS-485. Most RS-422 sensors will work with RS-485 protocol.

[4]Recommended Standard 485. A standard defining how two computing devices can communicate with each other.

[5]Synchronous 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.

[6]Serial Data Interface at 1200 baud. Communications protocol for transferring data between the data logger and SDI-12 compatible smart sensors.

[7]Inter-Integrated Circuit is a multi-controller, multi-peripheral, packet switched, single-ended, serial computer bus.

[8]Serial Peripheral Interface - a clocked synchronous interface, used for short distance communications, generally between embedded devices.

Maximum Input Frequency: ≤ 1 kHz

Resolution: 500 ns

Edge counting

Terminals: C1-C8

Maximum Input Frequency: ≤ 2.3 kHz

Quadrature input

Terminals: C1-C8 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

Maximum Period: 36.4 seconds

Resolution:

- **0 – 5 ms**: 83.33 ns
- **5 – 325 ms**: 5.33 µs
- **> 325 ms**: 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, MQTT

Additional Protocols: CPI, PakBus, PakBus Encryption, SDM, SDI-12, Modbus RTU / ASCII / TCP, DNP3, custom user definable over serial, 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.

SDI-12 (C1, C3, C5, C7): Four independent SDI-12 compliant terminals are individually configured and meet SDI-12 Standard v 1.4.

RS-485 (C5 to C8): One full duplex or two half duplex

RS-422 (C5 to C8): 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.

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

Satellite: GOES, Argos, Inmarsat Hughes, Irridium

Standards compliance specifications

View compliance and conformity documents at www.campbellsci.com/cr1000x.

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

Protection:

- Wiring panel: IP40
- Measurement module when connected to the wiring panel: IP65

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.

Warranty

Standard: Three years against defects in materials and workmanship.

Extended (optional): An additional four years, bringing the total to seven years.

Terminal functions

Analog input terminal functions																		
SE DIFF	1 2 ┌1┐ H L		3 4 ┌2┐ H L		5 6 ┌3┐ H L		7 8 ┌4┐ H L		9 10 ┌5┐ H L		11 12 ┌6┐ H L		13 14 ┌7┐ H L		15 16 ┌8┐ H L		RG1	RG2
Single-Ended Voltage	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Differential Voltage	H	L	H	L	H	L	H	L	H	L	H	L	H	L	H	L		
Ratiometric/Bridge	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Thermocouple	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Current Loop																	✓	✓
Period Average	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

Pulse counting terminal functions			
	P1	P2	C1-C8
Switch-Closure	✓	✓	✓
High Frequency	✓	✓	✓
Low-level AC	✓	✓	

Analog output terminal functions	
	VX1-VX4
Switched Voltage Excitation	✓

Voltage Output						
	C1-C8[1]	VX1-VX4	5V	12V	SW12-1	SW12-2
5 VDC	✓	✓	✓			
3.3 VDC	✓	✓				
12 VDC				✓	✓	✓

[1] C terminals have limited drive capacity. Voltage levels are configured in pairs.

Communications terminal functions									
	C1	C2	C3	C4	C5	C6	C7	C8	RS-232/CPI
SDI-12	✓		✓		✓		✓		
GPS	PPS	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
TTL 0-5 V	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
LVTTL 0-3.3 V	Tx	Rx	Tx	Rx	Tx	Rx	Tx	Rx	
RS-232					Tx	Rx	Tx	Rx	✓
RS-485 (Half Duplex)					A-	B+	A-	B+	

Communications terminal functions									
	C1	C2	C3	C4	C5	C6	C7	C8	RS-232/CPI
RS-485 (Full Duplex)					Tx-	Tx+	Rx-	Rx+	
I2C	SDA	SCL	SDA	SCL	SDA	SCL	SDA	SCL	
SPI	SCLK	COPI	CIPO		SCLK	COPI	CIPO		
SDM[1]	Data	Clk	Enabl		Data	Clk	Enabl		
CPI/CDM									✓

[1] SDM can be on either C1-C3 or C5-C7, but not both at the same time.

Communications functions also include Ethernet and USB.

Digital I/O terminal functions	
	C1-C8
General I/O	✓
Pulse-Width Modulation Output	✓
Timer Input	✓
Interrupt	✓
Quadrature	✓

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PS150

12 V Power Supply with Charging Regulator and 7 Ah Sealed Rechargeable Battery

ETL Listed Class 2 Power Supply

Overview

The PS150 is a 12 Vdc power supply that includes a rechargeable 7 Ah valve-regulated lead-acid (VRLA) battery and charging regulator. Charging power for the PS150 is typically supplied by an unregulated solar panel, AC/AC transformer, or AC/DC converter. The PS150 provides charging with temperature compensation for optimal charging and battery life. A maximum power point tracking algorithm is incorporated for solar inputs to maximize available solar charging resources.

The PS150 is ETL certified. The ETL Mark is proof of product compliance to North American safety standards.

Benefits and Features

- Protects against high-amperage and high-voltage damage to power supply
- Battery reversal protection
- Allows simultaneous connection of two charging sources (e.g., solar panel, ac wall charger)
- ETL listed Class 2 power supply

Detailed Description

The PS150 is a micro-controller-based smart charger with temperature compensation that optimizes battery charging and increases the battery's life. Two input terminals enable simultaneous connection of two charging sources. They also incorporate a maximum power point tracking algorithm for solar inputs that maximizes available solar charging resources.

The PS150 has several safety features intended to protect the charging source, battery, charger, and load devices. Battery-reversal protection is included, as well as ESD and surge protection on all of the PS150 inputs and outputs.

The PS150 replaced the PS100.

Specifications

Operational Temperature	-40° to +60°C (VRLA battery manufacturers state that "heat kills batteries" and recommend operating batteries at ≤ 50°C.)

Dimensions	19.3 x 7.6 x 10.6 cm (7.5 x 3 x 4.2 in.)

CHARGE - CHARGE Terminals (AC or DC Source)

AC	18 to 24 VRMS (internally limited to 1.2 ARMS)
DC	16 to 40 Vdc (internally limited to 0.85 Adc)

SOLAR Terminals (Solar Panel or Other DC Source)

-NOTE-	*Battery voltages below 8.7 V may result in < 3.0 A current limit because of fold-back current limit.*
Input Voltage Range	15 to 40 Vdc
Maximum Charging Current	4.0 Adc typical (3.2 to 4.9 Adc depending upon individual charger)

Quiescent Current

No Charge Source Present	160 µA at 13.7 Vdc
No Battery Connected	930 µA at 30 V input voltage (ac or dc)

Battery Charging

-NOTE-	*The "T" represents temperature in degrees Celsius.*
FLOAT Charging	$Vbatt(T) = 13.65\ V - (24\ mV) \times (T - 25) + (0.24\ mV) \times (T - 25)^2$
Accuracy	±1% (on charging voltage over -40° to +60°C)

Power Out (+12 Terminals)

Voltage	Unregulated 12 V from battery (4.65 A solid-state circuit breaker)
Standards	ETL Listed Class 2 power supply