

# GRANITE 9 Specifications



Data-  
Acquisition  
System

Electrical specifications are valid over a -40 to +70 °C, non-condensing environment, unless otherwise specified. Extended electrical specifications (noted as XD 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.

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## System specifications

**Processor:** NXP iMX6 Quad core running at 1 GHz

**Memory:**

- 2 GB DDR SDRAM
- 8 GB eMMC NAND OS storage
- 128 MB NOR FLASH
- 4 MB SRAM battery backed
- Data storage expansion: Removable microSD flash memory, up to 16 GB
- USB host provides for portable data storage on a mass storage device (MSD) formatted as FAT32. Not intended for long term unattended data storage other than what is available with [TableFile\(\)](#).

**GRANITE 9 Solid State Drive (SSD):**

- **SSD:** Enhanced MLC
- **SSD (XD):** SLC
- **Total onboard:** 64 GB
- **Humidity:** 8% to 95%, non-condensing

- **JESD219A client work load:** 86 terabytes written (TBW) (standard)
- **Random write:** 914 TBW (XD)
- **Sequential write:** 5333 TBW (XD)
- **Block PE cycle:** 100000 (XD)
- **Data Retention at 40 °C:** 10 years with 10% PE cycle (XD)
- **MTBF (hours) at 25 °C:** 1,500,000 (standard); 2,000,000 (XD)
- **Typical power consumption at 12 VDC:** 120.8 mA (standard); 191.7 mA (XD)
- **Maximum sustained write power consumption at 12 VDC:** 295.8 mA (XD only)

**Real-Time Clock:**

- Battery backed while external power is disconnected
- **Resolution:** 1 ms
- **Accuracy:** ±3 min. per year
- **GPS Phase Lock** to within 200 nS if used

**GPS:**

- SMA Female 50 Ω input impedance
- Active antenna design, 3.3 Vdc
- 25 dBm maximum input
- Integrated SAW filtering and jam resistance
- 1 S time-to-fix during normal operation
- 35 S time-to-fix on power up or reboot
- 13 min. for leap second, once per day auto
- PPS ± 1 μS to full UTC second
- Receive sensitivity -161 dBm

**Wiring Panel Temperature:** Measured using a thermistor, located on the main processor board.

## Physical specifications

**Case Material:** Stainless Steel 304 and Aluminum 6061

**Dimensions:** 21.4 x 12.0 x 5.0 cm (8.4 x 4.7 x 2.0 in); additional clearance required for cables, wires, and antennas.

**Weight/Mass:** 1.0 kg (2.2 lb)

## 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:** 9.6 to 32 VDC
- **Input Current Limit at 12 VDC:**
  - Total system current is fused at 5 A with replaceable automotive mini-blade fuse

**Internal Lithium Battery:** 1/2AA, 1.2 Ah, 3.6 VDC (Tadiran L5902S) for battery-backed memory and clock. 5-year life with no external power source.

### Average Current Drain:

- **Active:** ~6 Watts
  - 24 V input: 255 mA input
  - 12 V input: 495 mA input

**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

## Power output specifications

### System power out limits (when powered with 12 VDC)

Total system current is fused at 5 A with replaceable automotive mini-blade fuse

### 12 V and SW12 power output terminals

12V, SW12-1, and SW12-2: Provide 12 VDC power  $\pm 10\%$  when the power input supply voltage is  $\geq 13.7$  VDC. When the supply voltage is  $< 13.7$  V the output voltage will be at least the supply voltage minus 1.7 volts.

SW12-1 and SW12-2 can be independently set to a regulated 12 V under program control.

**SW12 current limit:** 1100 mA

12 VDC outputs limited to 3300 mA, which is shared by all 12 V outputs including 12V, SW12-1, SW12-2 and CS I/O pin 8.

### 5 V fixed output

5V: One regulated 5 V output. Supply is shared between the 5V terminal and CS I/O pin 1.

- **Voltage Output:** Regulated 5 V output ( $\pm 5\%$ )
- **Current Limit:** 250 mA

### C as power output

- C Terminals:
  - **Output Resistance ( $R_o$ ):** 150  $\Omega$
  - **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 Current Limit: 250 mA

### CS I/O pin 8

12 V Current Limit: 1100 mA

## Pulse measurement specifications

### 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:**  $\pm 20$  VDC

**Maximum Counts Per Channel:**  $2^{32}$

**Maximum Counts Per Scan:**  $2^{32}$

**Input Resistance:** 5 k $\Omega$

**Accuracy:**  $\pm(6$  ppm of reading + 0.00001)

### Switch closure input

**Terminals:** C1-C8

**Pull-Down Resistance:** Configurable in terminal pairs with 100 k $\Omega$

**Pull-Up Resistance:** Configurable in terminal pairs with 100 k $\Omega$  (weak) or 2.2 k $\Omega$  (strong)

**Maximum Input Frequency:** 250 Hz

**Minimum Switch Closed Time:** 1 ms

**Minimum Switch Open Time:** 1 ms

**Maximum Bounce Time:** 1 ms open without being counted

**Software Debounce Time:** 1 ms

### High-frequency input

**Terminals:** C1-C8

**Pull-Down Resistance:** Configurable in terminal pairs with 100 k $\Omega$

**Pull-Up Resistance:** Configurable in terminal pairs with 100 k $\Omega$  (weak) or 2.2 k $\Omega$  (strong)

**Maximum Input Frequency:** 1 MHz

## 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<sup>1</sup>, RS-232<sup>2</sup>, RS-422<sup>3</sup>, RS-485<sup>4</sup>, SDM<sup>5</sup>, SDI-12<sup>6</sup>, I2C<sup>7</sup>, and SPI<sup>8</sup> 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

**Maximum Input Frequency:** 1 MHz

**Resolution:** 20 ns

### Edge counting

**Terminals:** C1-C8

**Maximum Input Frequency:** 1 MHz

### Quadrature input

**Terminals:** C1-C8 can be configured as digital pairs to monitor the two sensing channels of an encoder.

**Maximum Frequency:** 500 kHz

**Resolution:** 20 ns or 50 MHz

### Pulse-width modulation

**Modulation Voltage:** Logic high

**Maximum Period:** 43 seconds

**Resolution:** 10 ns

### Maximum time between counter or timer instructions

- 86 seconds

## Communications specifications

**Ethernet Port:** RJ45 jack, 10/100/1000 Base Mbps, full and half duplex, Auto-MDIX, magnetic isolation, and TVS surge protection, IEEE 802.3 compliant.

**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, EPI, 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

**USB Host:** USB 2.0 full speed host 12 Mbps, Type-A for mass storage devices

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

**0 – 5 V Serial(C1 to C8):** Eight independent TX/RX pairs

**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 (C1 to C8):** Two full duplex or four half duplex. Optional 120 Ohm termination resistor between pairs.

**RS-422 (C1 to C8):** Two full duplex or four half duplex. Use RS-485 configuration.

**RS-232 (C1 to C8):** Four independent Tx/Rx pairs.

**CPI A/B and RS-232 A/B:** Two RJ45 module ports 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.

**EPI:** One EPI bus. 100 Mbps data rate. IEEE 1588 synchronization to 50 ns. 100 m (330 ft) maximum cable length per network connection. Up to 15 devices. EPI is a proprietary interface for communications between Campbell Scientific data loggers and Campbell Scientific CDM peripheral devices. It is based on Ethernet and IEEE 1588 Precision Time Protocol. It consists of a physical layer definition and a data protocol.

**CPI:** Two independent CPI buses. Up to 1 Mbps data rate each. Synchronization of devices to 5 µs. Total cable length up to 610 m (2000 ft). Up to 20 devices per bus. 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.

**Wireless:** Wi-Fi

<sup>1</sup>Universal Asynchronous Receiver/Transmitter for asynchronous serial communications.

<sup>2</sup>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.

<sup>3</sup>Communications protocol similar to RS-485. Most RS-422 sensors will work with RS-485 protocol.

<sup>4</sup>Recommended Standard 485. A standard defining how two computing devices can communicate with each other.

<sup>5</sup>Synchronous Device for Measurement. A processor-based peripheral device or sensor that communicates with the data logger via hardware over a short distance using a protocol proprietary to Campbell Scientific.

<sup>6</sup>Serial Data Interface at 1200 baud. Communications protocol for transferring data between the data logger and SDI-12 compatible smart sensors.

<sup>7</sup>Inter-Integrated Circuit is a multi-controller, multi-peripheral, packet switched, single-ended, serial computer bus.

<sup>8</sup>Serial Peripheral Interface - a clocked synchronous interface, used for short distance communications, generally between embedded devices.

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

**Satellite:** GOES, Argos, Inmarsat Hughes, Iridium

## Wi-Fi specifications

WLAN (Wi-Fi)

**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

## Standards compliance specifications

View compliance and conformity documents at [www.campbellsci.com/granite9](http://www.campbellsci.com/granite9)

**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.
- 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 two years, bringing the total to five years.

# Global Sales and Support Network

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## Campbell Scientific Regional Offices

### Australia

**Location:** Garbutt, QLD Australia  
**Phone:** 61.7.4401.7700  
**Email:** [info@campbellsci.com.au](mailto:info@campbellsci.com.au)  
**Website:** [www.campbellsci.com.au](http://www.campbellsci.com.au)

### Brazil

**Location:** São Paulo, SP Brazil  
**Phone:** 11.3732.3399  
**Email:** [vendas@campbellsci.com.br](mailto:vendas@campbellsci.com.br)  
**Website:** [www.campbellsci.com.br](http://www.campbellsci.com.br)

### Canada

**Location:** Edmonton, AB Canada  
**Phone:** 780.454.2505  
**Email:** [dataloggers@campbellsci.ca](mailto:dataloggers@campbellsci.ca)  
**Website:** [www.campbellsci.ca](http://www.campbellsci.ca)

### China

**Location:** Beijing, P. R. China  
**Phone:** 86.10.6561.0080  
**Email:** [info@campbellsci.com.cn](mailto:info@campbellsci.com.cn)  
**Website:** [www.campbellsci.com.cn](http://www.campbellsci.com.cn)

### Costa Rica

**Location:** San Pedro, Costa Rica  
**Phone:** 506.2280.1564  
**Email:** [info@campbellsci.cc](mailto:info@campbellsci.cc)  
**Website:** [www.campbellsci.cc](http://www.campbellsci.cc)

### France

**Location:** Montrouge, France  
**Phone:** 0033.0.1.56.45.15.20  
**Email:** [info@campbellsci.fr](mailto:info@campbellsci.fr)  
**Website:** [www.campbellsci.fr](http://www.campbellsci.fr)

### Germany

**Location:** Bremen, Germany  
**Phone:** 49.0.421.460974.0  
**Email:** [info@campbellsci.de](mailto:info@campbellsci.de)  
**Website:** [www.campbellsci.de](http://www.campbellsci.de)

### India

**Location:** New Delhi, DL India  
**Phone:** 91.11.46500481.482  
**Email:** [info@campbellsci.in](mailto:info@campbellsci.in)  
**Website:** [www.campbellsci.in](http://www.campbellsci.in)

### South Africa

**Location:** Stellenbosch, South Africa  
**Phone:** 27.21.8809960  
**Email:** [sales@campbellsci.co.za](mailto:sales@campbellsci.co.za)  
**Website:** [www.campbellsci.co.za](http://www.campbellsci.co.za)

### Spain

**Location:** Barcelona, Spain  
**Phone:** 34.93.2323938  
**Email:** [info@campbellsci.es](mailto:info@campbellsci.es)  
**Website:** [www.campbellsci.es](http://www.campbellsci.es)

### Thailand

**Location:** Bangkok, Thailand  
**Phone:** 66.2.719.3399  
**Email:** [info@campbellsci.asia](mailto:info@campbellsci.asia)  
**Website:** [www.campbellsci.asia](http://www.campbellsci.asia)

### UK

**Location:** Shephed, Loughborough, UK  
**Phone:** 44.0.1509.601141  
**Email:** [sales@campbellsci.co.uk](mailto:sales@campbellsci.co.uk)  
**Website:** [www.campbellsci.co.uk](http://www.campbellsci.co.uk)

### USA

**Location:** Logan, UT USA  
**Phone:** 435.227.9120  
**Email:** [info@campbellsci.com](mailto:info@campbellsci.com)  
**Website:** [www.campbellsci.com](http://www.campbellsci.com)