



GRANITE CHASSIS

Chassis for GRANITE
Data-Acquisition Systems



Guarantee

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- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
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About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area: 1 in ² (square inch) = 645 mm ²	Mass: 1 oz. (ounce) = 28.35 g 1 lb (pound weight) = 0.454 kg
Length: 1 in. (inch) = 25.4 mm 1 ft (foot) = 304.8 mm 1 yard = 0.914 m 1 mile = 1.609 km	Pressure: 1 psi (lb/in ²) = 68.95 mb
	Volume: 1 UK pint = 568.3 ml 1 UK gallon = 4.546 litres 1 US gallon = 3.785 litres

In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to European users.

Differences include the U.S standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for British/European use. *Please note, however, that when a power supply adapter is ordered it will be suitable for use in your country.*

Reference to some radio transmitters, digital cell phones and aerials may also not be applicable according to your locality.

Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the European market; in some cases alternatives are offered. Details of the alternatives will be covered in separate manuals.

Part numbers prefixed with a “#” symbol are special order parts for use with non-EU variants or for special installations. Please quote the full part number with the # when ordering.

Recycling information



At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility.

Campbell Scientific Ltd can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories.

For further advice or support, please contact Campbell Scientific Ltd, or your local agent.



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Safety

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND **TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.** FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.eu or by telephoning +44(0) 1509 828 888 (UK). You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General

- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines.**
- Maintain a distance of at least one-and-one-half times structure height, or 20 feet, or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

Table of contents

1. Introduction	1
2. Precautions	2
3. Initial inspection	3
3.1 Inspect packaging	3
3.2 GRANITE CHASSIS parts	4
4. QuickStart	5
5. Overview	7
6. Specifications	9
6.1 Physical specifications	9
6.2 Electrical specifications	10
7. Mounting and installation	11
7.1 Recommended module locations	11
7.2 GRANITE modules	12
7.3 Orientation	12
7.4 Rackmount	12
7.5 Tie-downs	13
8. Wiring	14
8.1 Grounding CHASSIS	14
8.2 Power bus	14
8.3 Routing user-installed cables	16
9. Top and rear panels	16
10. Linking multiple CHASSIS	18
11. Maintenance	18
11.1 Battery maintenance	19

1. Introduction

The GRANITE™ CHASSIS is a strong metal enclosure that delivers optimized thermal management and mounting convenience for a collection of GRANITE-series data acquisition (DAQ) modules. As a system that includes a rechargeable backup battery, it can be portable or stationary. Power can be supplied by AC or DC sources such as solar or rack mounted wall-power. Configuration versatility suits many demanding applications and operational environments.

NOTE:

The terms DAQ and data logger may be used interchangeably throughout this manual. While there may be subtle differences depending on context or opinion, ultimately a DAQ or data logger is the primary controller of a data acquisition system.

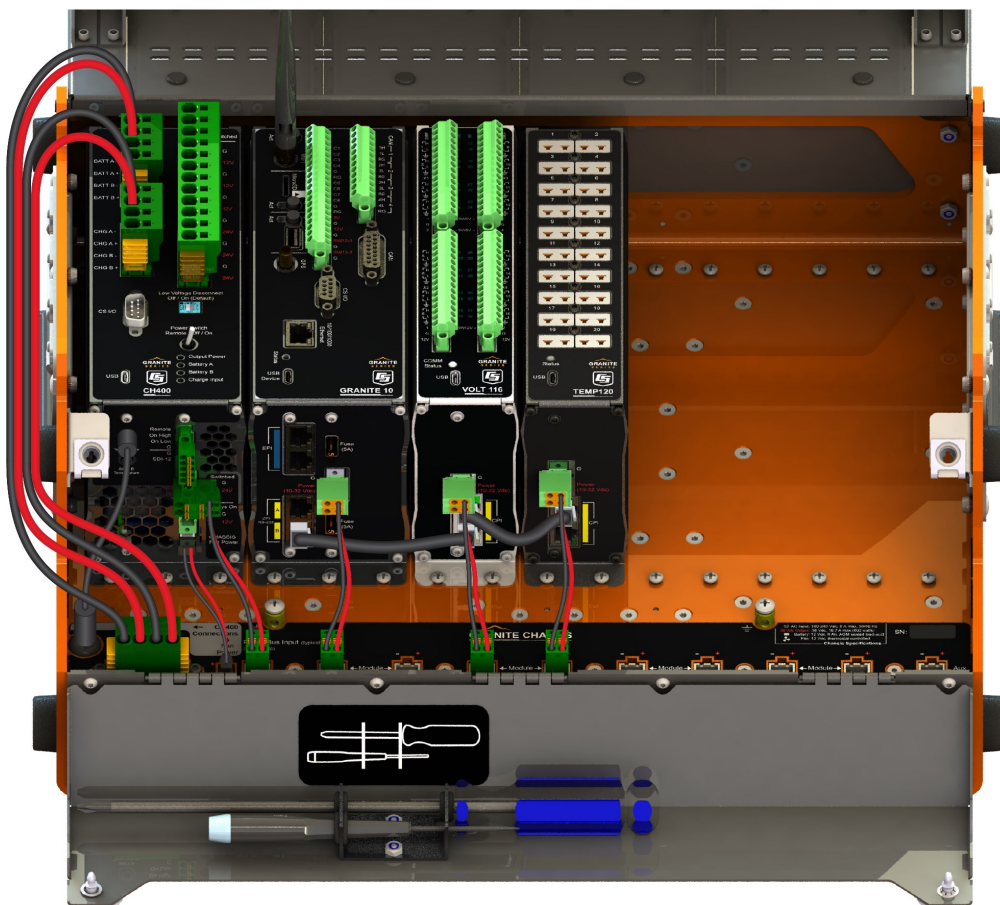


FIGURE 1-1. Typical CHASSIS setup

2. Precautions

- Ensure the CHASSIS is grounded electrically in one of the following ways:
 - AC power source includes a service ground that complies with current national and local building and electrical codes.

NOTE:

The Detachable Power Cord used with the CHASSIS includes a ground conductor; therefore, the CHASSIS will be grounded when the power cord is plugged into a receptacle that has a functioning service ground.

- Vehicle or Earth ground connection is made to either one of the ground lugs inside the CHASSIS when:
 - The CHASSIS is used in vehicle testing applications
 - Service ground does not exist or is not functional
 - The CHASSIS is installed with only a DC power source (for example, a solar panel)

NOTE:



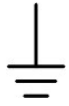


Use the largest gauge wire available, up to 8 AWG, for grounding.

NOTE:

To avoid ground loops, only allow a single path to ground. The second grounding lug is intended to connect subsequent devices that need to be grounded, such as one or more daisy-chained CHASSIS or GRANITE modules that are mounted external to the CHASSIS.

- Always use safe lifting practices when moving the CHASSIS; hold weight firmly with the built-in handles, close to body and lift with legs in a smooth, continuous motion. Do not twist while lifting, and do not attempt to move the CHASSIS with poor leverage, in awkward positions, or with non-fluid motions.
- Wear reinforced-toe footwear when moving the CHASSIS to prevent foot injury that could result from dropping the CHASSIS.
- Do not drop the CHASSIS.

- Removing the CHASSIS panels will expose electrical and mechanical hazards, including AC electrical connections and high-speed fan blades. If required, always remove all power sources including the internal battery prior to removing panels.
- Do not remove any speciality hardware such as star or torx head countersunk screws. See [Maintenance](#) (p. 18).

Table 2-1: Symbols used on the CHASSIS	
Symbol	Description
	Direct current
	Alternating current
	Earth (ground) terminal
	Protective conductor terminal
	Caution, possibility of electric shock

3. Initial inspection







3.1 Inspect packaging



Upon receiving the GRANITE CHASSIS, inspect the packaging and contents for damage. Claims for shipping damage must be filed with the shipping company.

Locate the order packing slip and compare the items listed on the packing slip to the items that were shipped. Report any discrepancies to Campbell Scientific.

3.2 GRANITE CHASSIS parts

Each CHASSIS is shipped with a box of tools and parts used to install GRANITE DAQ and measurement modules (purchased separately). The following table shows the common parts and tools used in CHASSIS setup. Some of the items should be saved for future use.

Description	Image
Module Power Jumper for GRANITE CHASSIS	 A red and black power jumper cable with green terminal connectors at both ends.
12 V Power Jumper for GRANITE CHASSIS	 A red and black power jumper cable with black terminal connectors at both ends.
Green 4-Pin Terminal Connector with Click Lock for GRANITE Products	 A green 4-pin terminal connector with an orange click lock on the side.
Red and Black Power Cables (12 AWG) set of 2, 15-inch for GRANITE CHASSIS	 A set of two 15-inch power cables, one red and one black, with bare wire ends.
Flat-Bladed Screwdriver	 A black-handled flat-bladed screwdriver with a blue logo on the handle.
#2 Phillips Screwdriver, 6-inch shaft	 A blue-handled #2 Phillips screwdriver with a 6-inch shaft.

Description	Image
Screw, #6-32 x 0.437, Self-locking	
15 A Detachable Power Cord	

4. QuickStart

The CHASSIS can be operational within minutes. The following steps are provided as a guide to get started.

WARNING:

Turn power off while installing hardware and making electrical connections.

Set the CH400 **Power Switch** to **Off** before starting installation.

1. Use a #2 Phillips Screwdriver to loosen screws for module mounting.

NOTE:

Mounting screws only need to be loosened two to three turns.

2. Mount the CH400, if used, in left-most position, otherwise mount GRANITE DAQ here. Mount other measurement modules. See [Mounting and installation](#) (p. 11) for more details.

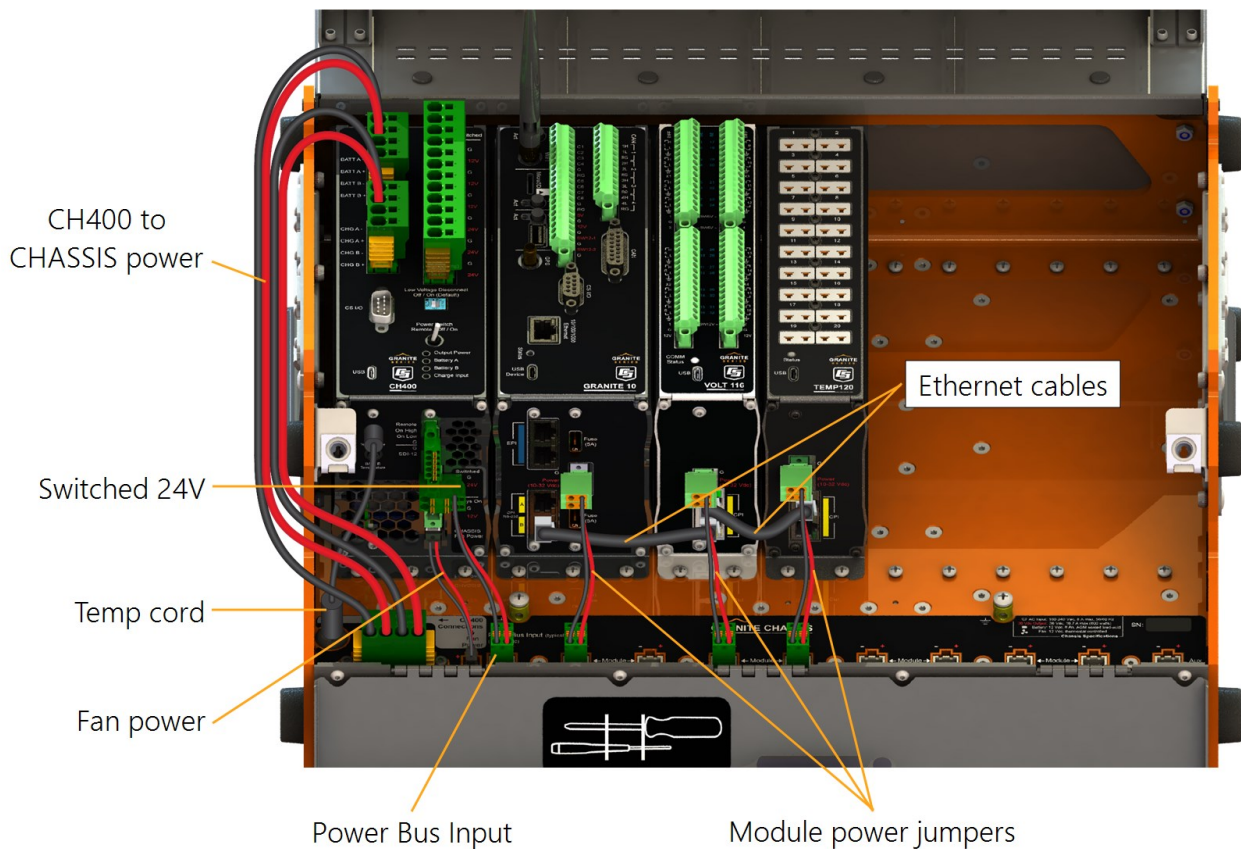


FIGURE 4-1. Typical CHASSIS setup

3. Using the Flat-Bladed Screwdriver press firmly in the small slot of the Green 4-Pin Terminal Connector to open the wire slot. Insert the end of the black wire into the wire slot on the CH400 **BATT A-**. Remove the screwdriver to close the wire slot. Repeat with the red wire in the adjacent CH400 **BATT A+** slot.

TIP:

Wires with ferrules can be pressed firmly into the wire slot. You do not need to open it first.

4. Connect the other end of the black wire to a second Green 4-Pin Terminal Connector on the CHASSIS **BATT -** and the red wire to **BATT +**.
5. In a similar fashion, connect a third Green 4-Pin Terminal Connector from the CH400 **CHG A-** and **CHG A+** to the CHASSIS **CHG -** and **CHG +**.

6. Plug the **Temp** cord, with stereo plug, into the CH400 **BATT A Temperature** port. See [FIGURE 4-1](#) (p. 6) for steps 6 through 10.
7. Install 12 V Power Jumper between the CH400 and CHASSIS **Fan Power** terminals.
8. Connect one Module Power Jumper from the CH400 **Switched 24V** power out to the CHASSIS **Power Bus Input** terminal.
9. Connect Module Power Jumpers between the CHASSIS **Module** terminals and the DAQ and each GRANITE measurement module.
10. Install CPI and EPI (Ethernet) cables between the GRANITE measurement modules and the DAQ.
11. Plug the Detachable Power Cord into the rear of the CHASSIS then into a wall socket.
12. Set the CH400 **Power Switch** to **On**.
13. Check the LED lights on each measurement module to verify they are powered.
14. Set the CH400 **Power Switch** to **Off**.
15. Install the remaining system wiring such as sensors and control devices. Refer to device manuals for more information.
16. Set the CH400 **Power Switch** to **On**.
17. Program the DAQ, configure devices, and test the system. Refer to device manuals for more information.

5. Overview

GRANITE-series DAQs and GRANITE expansion peripherals, though independently modular, can be mounted in one or more CHASSIS to improve convenience in portability, gain efficiency in testing operations, and optimize overall system performance.

The GRANITE CHASSIS includes a high performance 8-Ah onboard battery. Typically this battery is trickle charged using a CH400 (see [FIGURE 4-1](#) (p. 6)) or other regulator such as the one built-in to the GRANITE 6 DAQ. See the following figure. For complex battery configurations refer to the CH400 product manual.

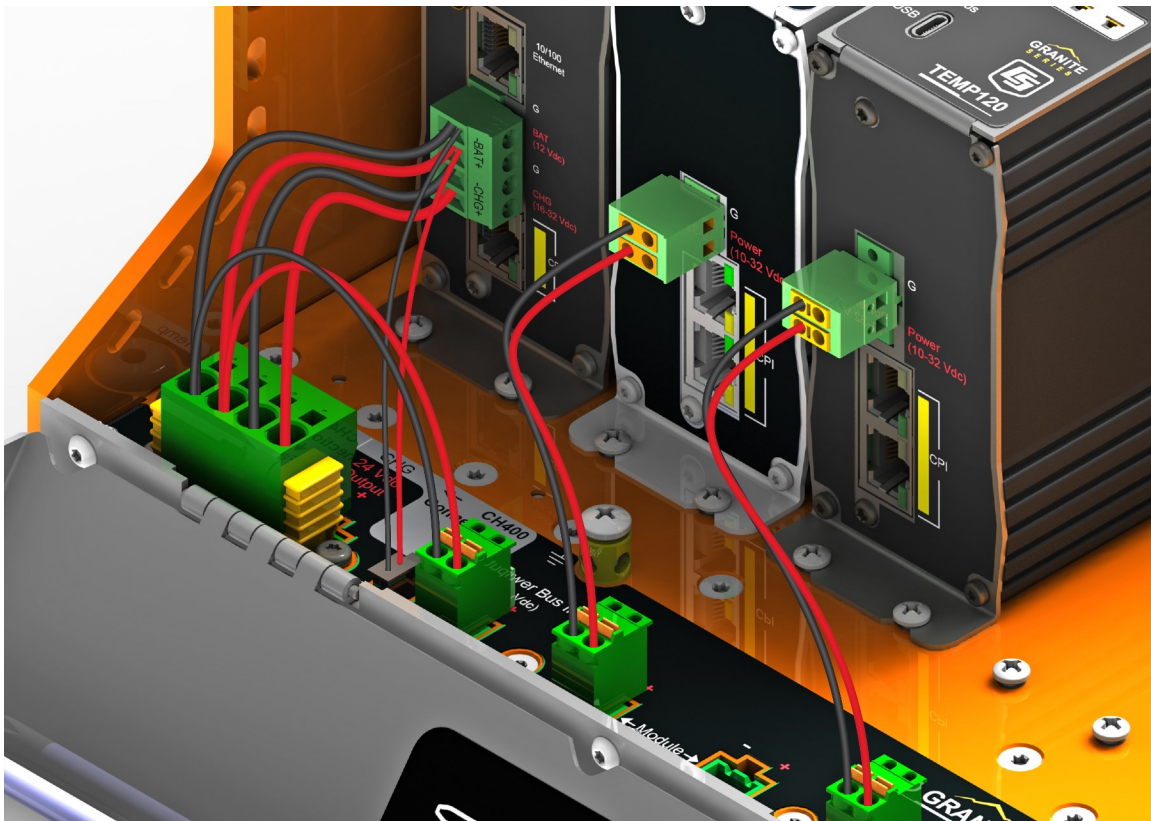


FIGURE 5-1. Typical wiring for GRANITE 6

Features:

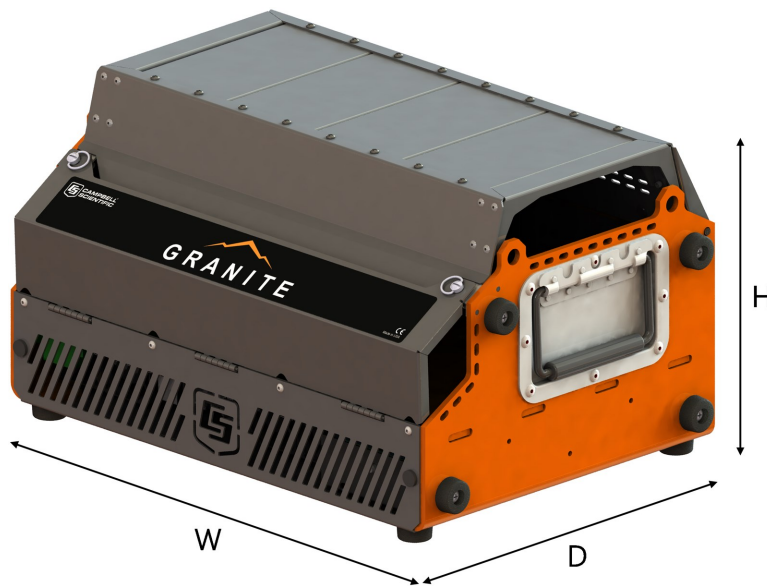
- Three CHASSIS power configuration options:
 - 36 VDC, 600 W AC/DC Power Supply
 - 24 VDC, 250 W AC/DC Power Supply
 - No internal power supply
- User-customizable top and rear panels
- Configurable layout
- High-performance operations even at maximum operating temperatures

6. Specifications

6.1 Physical specifications

Dimensions

CHASSIS dimensions (without power cord)	With bumpers	Without bumpers
Width (W)	45.4 cm (17.98 in)	44.8 cm (17.65 in)
Depth (D)	31.0 cm (12.21 in)	31.0 cm (12.21 in)
Height (H)	25.3 cm (9.95 in)	24.4 cm (9.61 in)



Weight

CHASSIS only, no battery: 10.6 kg (23.3 lb)

Battery: 3.0 kg (6.7 lb)

CHASSIS with GRANITE modules
(typical): 20.4 kg (45.0 lb)

Operation and storage temperature

Operation:	-40 to 70 °C (-40 to 158 °F)
Storage:	-55 to 85 °C (-67 to 185 °F)

Thermal performance

Thermal power dissipation:	135 W (at 70 °C)
Fan set points (left to right):	53, 40, 45, 50 °C with 5 °C hysteresis

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6.2 Electrical specifications

AC input power

-36V	100 to 240 VAC, 8 A max, 50/60 Hz
-24V	100 to 240 VAC, 3.5 A max, 50/60 Hz

DC output power from power supply

-36V	36 VDC, 16.7 A max (600 Watts)
-24V	24 VDC, 10.4 A max (250 Watts)

AC input connector (as applicable): IEC C14

AC input cable (as applicable): 100-240 VAC, 8 A max, 50/60 Hz, NEMA 5-15P to IEC C13

Current drain, CHASSIS only (modules not included)

Fans: 250 mA (3 Watts) per fan when running, thermostat controlled

Illumination LED: 30 mA when on

Battery: 12 VDC, 8 Ah, AGM sealed lead-acid in metal casing

Maximum recommended storage time before recharge: 24 months at 25 °C or 12.0 VDC, whichever is earlier

Atmospheric pressure range: Vacuum to 8 atmospheres

7. Mounting and installation

7.1 Recommended module locations	11
7.2 GRANITE modules	12
7.3 Orientation	12
7.4 Rackmount	12
7.5 Tie-downs	13

7.1 Recommended module locations

Maintain a 5 cm (2 in) minimum clearance in front of and behind the CHASSIS to facilitate unrestricted air flow. Air flow direction is from front to rear when fans are on.

To deliver optimal thermal performance where maximum heat dissipation is needed, mount the CH400 (when used) in the position furthest to the left as shown in the following image. For wiring convenience, mount the DAQ (GRANITE 6, GRANITE 9, GRANITE 10) next to the CH400. Mount measurement modules in remaining locations. When observing these mounting recommendations, the battery temperature is reduced, improving performance.

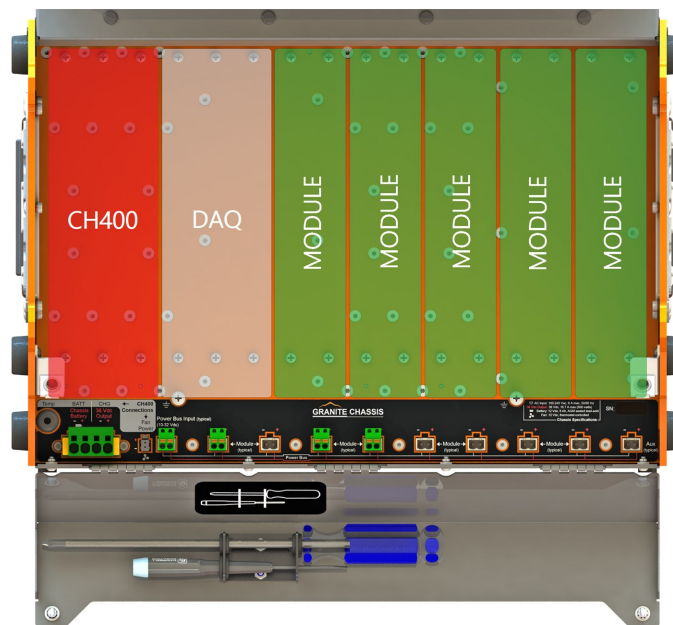


FIGURE 7-1. Typical module mounting locations

7.2 GRANITE modules

GRANITE modules mount in the CHASSIS using pre-installed anti-vibration screws; they simply need to be tightened when GRANITE modules are installed. If a screw is damaged, or the anti-vibration patch wears off, it may be replaced.

NOTE:

When removing a mounting screw entirely, resistance may be felt as the screw is backed out. Similarly, when reinstalling, there will be some resistance; be certain not to cross thread the screw.

7.3 Orientation

The CHASSIS is designed to sit on a horizontal surface or be mounted such that the GRANITE mounting plane is horizontal, whether sitting on a flat surface or installed in a rack system. Although there are bumpers on the sides, the CHASSIS should not normally be placed in operation on its side without provision to prevent tipping and falling.

7.4 Rackmount

Attach the CHASSIS to sliding extendable rails in a 48 cm (19 in) wide server rack using the Rackmount, Slide-Rail Kit for GRANITE CHASSIS.

Recommended installation sequence:

1. Loosely mount slide rails to rack interface brackets using #8-32 screws and nuts.
2. Mount slide rails with brackets to server rack uprights using #10-32 screws and cage nuts.
3. Attach CHASSIS rackmount bracket to slide rails using #8-32 hardware.
4. Align bracket to rails and tighten screws.
5. Remove eight rubber bumpers from both sides of the CHASSIS.
6. Carefully set CHASSIS on rackmount brackets (like a shelf).
7. Install 8 #10-32 x 0.250 truss-head screws through rackmount bracket into the CHASSIS and tighten.

Verify the CHASSIS slides in and out of rack smoothly with no interference; adjust and re-tighten fasteners as needed.

TIP:

Leave slack in fixed cables, such as sensor cables, to allow for cable movement. Use a cable management arm (purchased separately) to keep cable bundles organized and movable.

7.5 Tie-downs

Four ear loops on the CHASSIS provide anchor points to secure the CHASSIS.



FIGURE 7-2. Ear loop locations

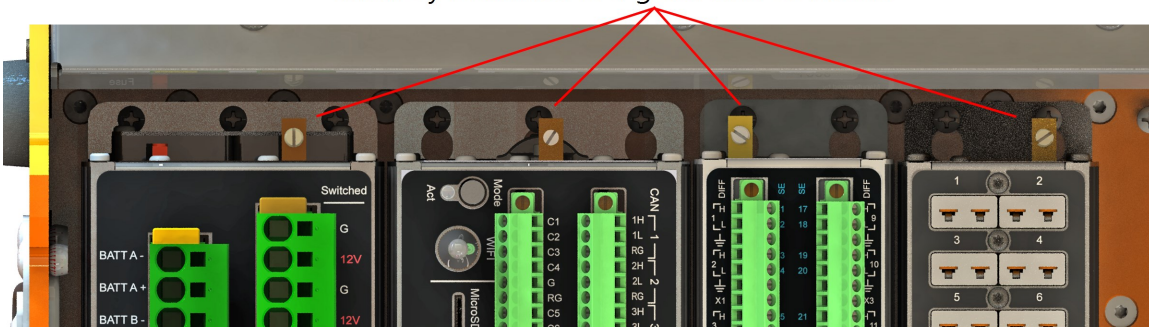
8. Wiring

8.1 Grounding CHASSIS	14
8.2 Power bus	14
8.3 Routing user-installed cables	16

8.1 Grounding CHASSIS

It is not necessary to use ground lugs on the rear of the GRANITE modules as long as the GRANITE modules are clamped down tightly to the CHASSIS frame. In most cases, use a single ground path to avoid ground loops.

Individual module grounds are not required when a module is securely mounted in a grounded CHASSIS.



When plugged into a properly grounded AC circuit, the CHASSIS is adequately grounded through the ground pin on the AC plug. When using multiple wall-plugged CHASSIS, do not daisy chain the CHASSIS grounds.

Connect at least one CHASSIS ground lug to vehicle ground, or earth ground for stationary deployments.

See also [Precautions](#) (p. 2).

8.2 Power bus

Terminals labelled **Module Power** are common. The power voltage plugged into one of these will be distributed along this power bus. 24 VDC is recommended; however, voltage that is within the required range of the connected modules is acceptable.

NOTE:

Measurement modules accept maximum voltage of 32 VDC.

There are ten connectors labelled **Module Power** — eight are intended for onboard modules, two may be used for external modules or additional daisy-chained CHASSIS.

A special-built cable provided with the CHASSIS has a unique connector to connect to the CH400 **Fan Power**. When the CH400 is not used, the user will need to supply 12 VDC and ensure correct polarity.

WARNING:

Exceeding 12 VDC to the terminal labelled **Fan Power** will damage the fans.

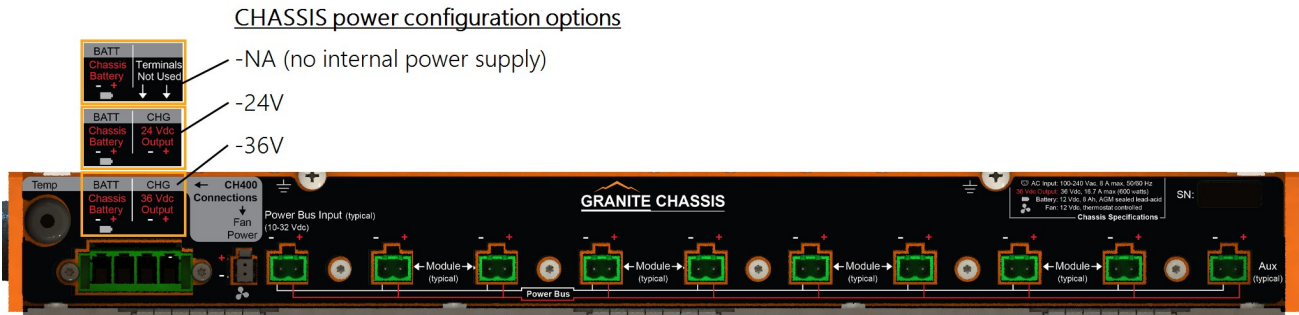


FIGURE 8-1. Power bus

The Green 4-Pin Terminal Connector connects two components: the left side to the internal CHASSIS 12 V AGM battery, and the right side to internal power when there is an AC/DC power supply present. The output voltage on this side is the same as indicated in red text on the label. It will be one of the following:

- 0 VDC (no internal power supply)
- 24 VDC nominal
- 36 VDC nominal

The **Temp** cord, with stereo plug, reads a temperature sensor mounted next to the internal CHASSIS battery. This cord plugs into the **BATT A Temperature** or **BATT B Temperature** port on the CH400. When the CH400 is not used, tie this cable out of the way.

8.3 Routing user-installed cables

Several obround holes provide locations to secure cable ties for cable management and strain relief.



FIGURE 8-2. Cable management holes

9. Top and rear panels

Solid aluminium top and rear panels are removable. Take out the four Phillips screws in each top panel to remove them. For the rear panel, loosen the Phillips screws to slide it up and off the keyhole mounting slots.

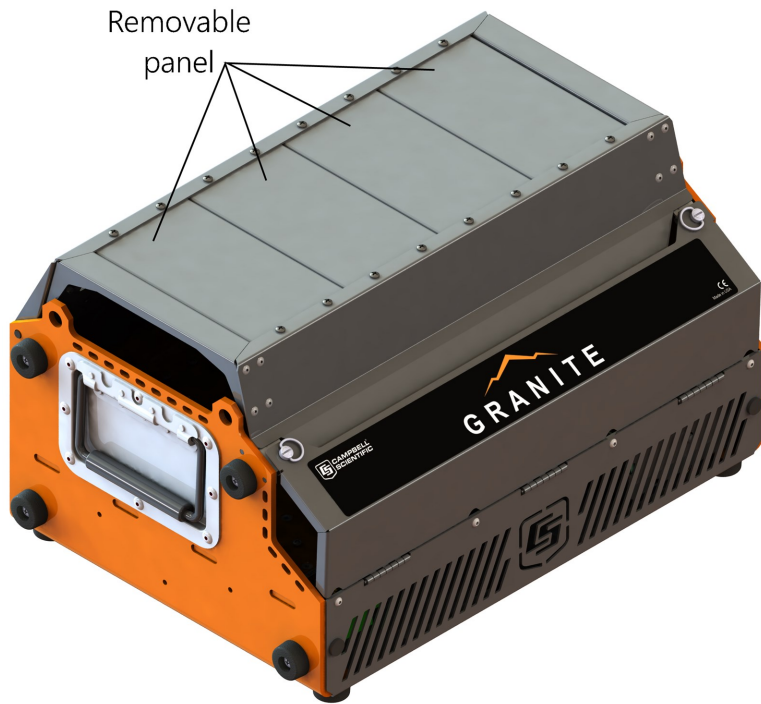


FIGURE 9-1. Top panels

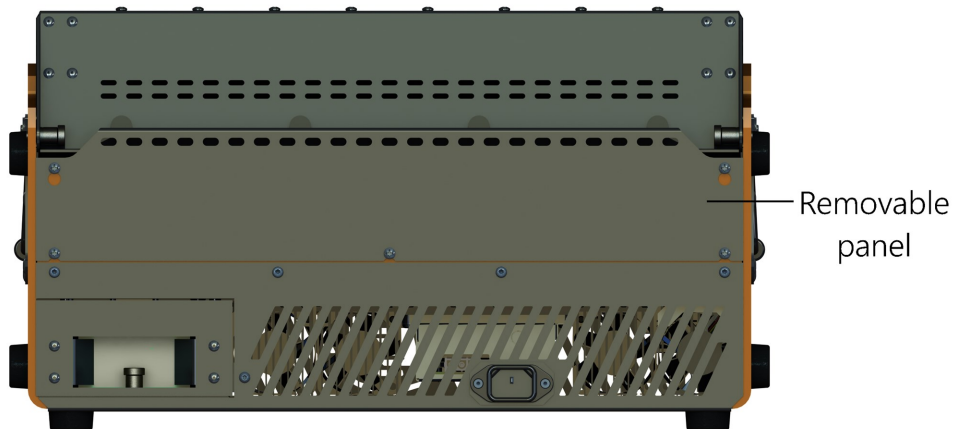


FIGURE 9-2. Rear panel

The removable panels can be customized by Campbell Scientific or others. For example, add cutouts for quick-attach connectors. Speak with a Campbell Scientific Sales Engineer about customization.

CAUTION:

Always remove panels from the CHASSIS prior to performing customization to avoid damage to or debris within the CHASSIS or GRANITE components.

10. Linking multiple CHASSIS

The CHASSIS holds up to eight measurement modules but there are ten **Module** terminals. The right-most terminal is labelled **Aux**. Use custom-built longer Module Power Jumper cables to connect additional CHASSIS. 12 AWG wire is recommended.

1. Set the CH400 **Power Switch** to **Off**.
2. When not on AC power, use 8 AWG wire to connect the **Ground Lug** from one CHASSIS to the other.
3. Connect one side of the long Module Power Jumper cable to **Aux** of the first CHASSIS and the other end to the second CHASSIS **Power Bus Input** terminal.
4. Set the CH400 **Power Switch** to **On**.

11. Maintenance

Keep the GRANITE CHASSIS clean and dry.

The GRANITE CHASSIS can be expected to deliver many years of reliable service. Eventual maintenance includes battery and cooling fan replacements. See [Battery maintenance](#) (p. 19).

Only access hardware and fasteners with Phillips heads. Star or torx heads should not be adjusted by user to prevent loosening components that must be kept tight for proper performance.

Do not loosen countersunk fasteners visible from the CHASSIS top mounting surface. These fasteners secure components to the underside, including heat sinks, heat dissipation plates, and other hardware.

WARNING:

Loosening countersunk fasteners could damage components and negatively affect CHASSIS performance.

11.1 Battery maintenance

The CHASSIS battery is a sealed, metallic canister, lead-acid AGM battery, 12 VDC nominal. It will charge and provide power across all operating temperatures, especially at extremes. Other battery types, such as lithium-ion, are cold-temperature limited.

It is best practice to keep the CHASSIS plugged into a power source such as: wall, vehicle, or solar. When not feasible to do so, a healthy battery that is disconnected from all loads will typically maintain its charge for up to six months. Recharge the CHASSIS battery before use when it has been left for six months or more without a charging source.

Battery life is a function of many variables, including number of charge cycles, depth of discharge, and operating temperatures.

NOTE:

Before replacing the CHASSIS battery, collect all data from the DAQ.

Battery replacement procedure:

1. Unplug Detachable Power Cord (if present).
2. Unplug Green 4-Pin Terminal Connector.
3. Pull knob up.
4. Partially slide drawer out.

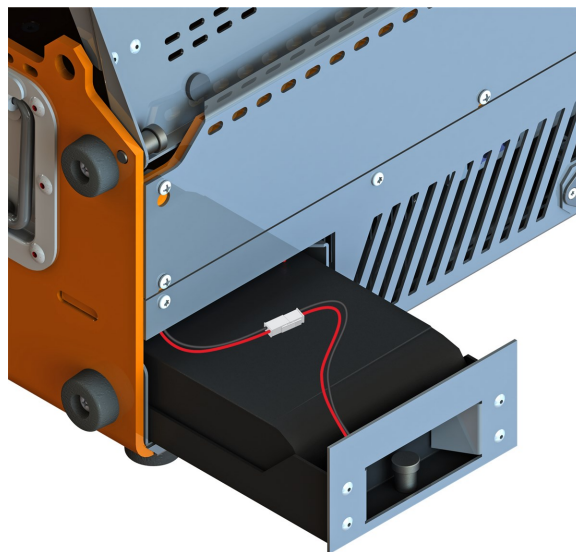


FIGURE 11-1. Battery drawer

5. Unplug the battery connector.
6. Slide the drawer out the rest of the way.
7. Remove the battery.

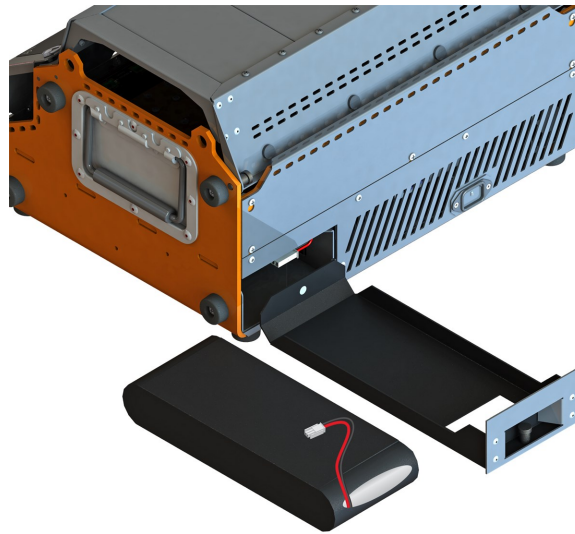


FIGURE 11-2. Battery removed from drawer

8. Install a new battery.
9. Slide the drawer in, connecting the battery plug when about half way, then slide it the rest of the way in.
10. Ensure the knob seats again completely.
11. Plug the Green 4-Pin Terminal Connector back in.
12. Plug in the Detachable Power Cord (if present).



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