



Enclosures



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1. Introduction

Environmental enclosures protect data loggers and components from water and most pollutants. Campbell Scientific standard enclosures include the ENC10/12, ENC10/12R, ENC12/14, ENC14/16, and ENC16/18. The smallest standard enclosure available from Campbell Scientific, the ENC8/10, is covered in a separate manual.

For cable entry, Campbell Scientific offers the following choices:

- One 3.8 cm (1.5 in) diameter conduit
- Two horizontally-arranged 3.8 cm (1.5 in) diameter conduits
- Two vertically-arranged 3.8 cm (1.5 in) conduits (ENC16/18 only)
- Individual compression fittings

Multiple cables can use the conduit(s), whereas each compression fitting only allows a single cable to enter the enclosure. The individual compression fittings provide a more water-tight seal.

Besides standard enclosures, Campbell Scientific offers prewired enclosures that combine flexibility with ease of use. Prewired enclosures include the PWENC12/14, PWENC14/16, and PWENC16/18. Customers have the flexibility to choose their system components, but installation is easy because sensors are simply attached to prewired connectors on the outside of the enclosure.

Prewired enclosures are shipped with the same enclosure supply kit ([Enclosure supply kit](#) (p. 3)) and use the same brackets for mounting to a tripod or a tower ([Attaching an enclosure to a tripod mast](#) (p. 14)). The maintenance information ([When to replace desiccant](#) (p. 25) and [Resistance to weathering](#) (p. 25)) is also applicable to prewired enclosures.

The ENC16/18UL is listed with UL (Underwriters Laboratories), meeting the UL508A Industrial Control Panels Standard. It is meant for use when installation requirements specify UL certification for the enclosure. The ENC16/18UL differs from other Campbell Scientific enclosures by having the ground wire connection made directly inside the enclosure rather than to an external ground lug.

Campbell Scientific also offers a variety of factory installed bulkhead antenna cables. These cables provide a connector for an antenna on the outside of the enclosure used by a modem, radio, or a satellite transmitter.

Campbell Scientific enclosures are manufactured with non-corrosive polyester and reinforced with fiberglass. These white UV-stabilized enclosures reflect solar radiation, reducing

temperature gradients inside the enclosure without requiring a separate radiation shield. A door gasket, external ground lug, stainless steel hinge, and lockable hasp are included. Campbell Scientific enclosures were rated NEMA 6P before being modified to include conduit(s) or compression fittings.

Data loggers, components, and brackets are mounted to an internal plate punched with a grid of half-inch-on-center holes.

An internal backplate is included with each ENC10/12, ENC10/12R, ENC12/14, and ENC14/16 enclosure. Two internal mounting plate options are offered for the ENC16/18 and ENC16/18UL. The –SB option provides a backplate similar to the one included with the other enclosures. The –EL and –ER options provide both a backplate and a sideplate.

2. Precautions

- READ AND UNDERSTAND the [Safety](#) section at the back of this manual.
- Ensure structural integrity of the tripod, mast, or pole during setup and weather extremes to minimize the chance of damaging the enclosure or instruments. Read all instructions carefully.
- Always use the putty from the enclosure supply kit to seal the conduit opening to prevent moisture and insects from entering the enclosure.
- Use the desiccant pack from the enclosure supply kit to lower the humidity inside the enclosure.
- Ensure the enclosure is connected to Earth ground.

3. Initial inspection

3.1 Inspect packaging

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

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

3.2 Enclosure supply kit

Each enclosure is shipped with a sealed plastic bag containing an Enclosure Supply Kit. This kit provides the materials used to seal and desiccate the enclosures. Please note that some of the items should be saved for future use. The contents of the enclosure supply kit include:

Qty.	PN	Description
8	505	#6-32 x .375 in. screws
8	6044	grommets
4	2376	3 cm (1.2 in) cable tie tabs
6	2207	10 cm (4 in) cable ties
6	4005	20 cm (8 in) cable ties
1	28878	humidity indicator card
2	6596	115 g (4 oz) container of sealing putty
4	4905	4-unit desiccant packs
1	6290	Phillips screwdriver
1	25745	PVC coupling

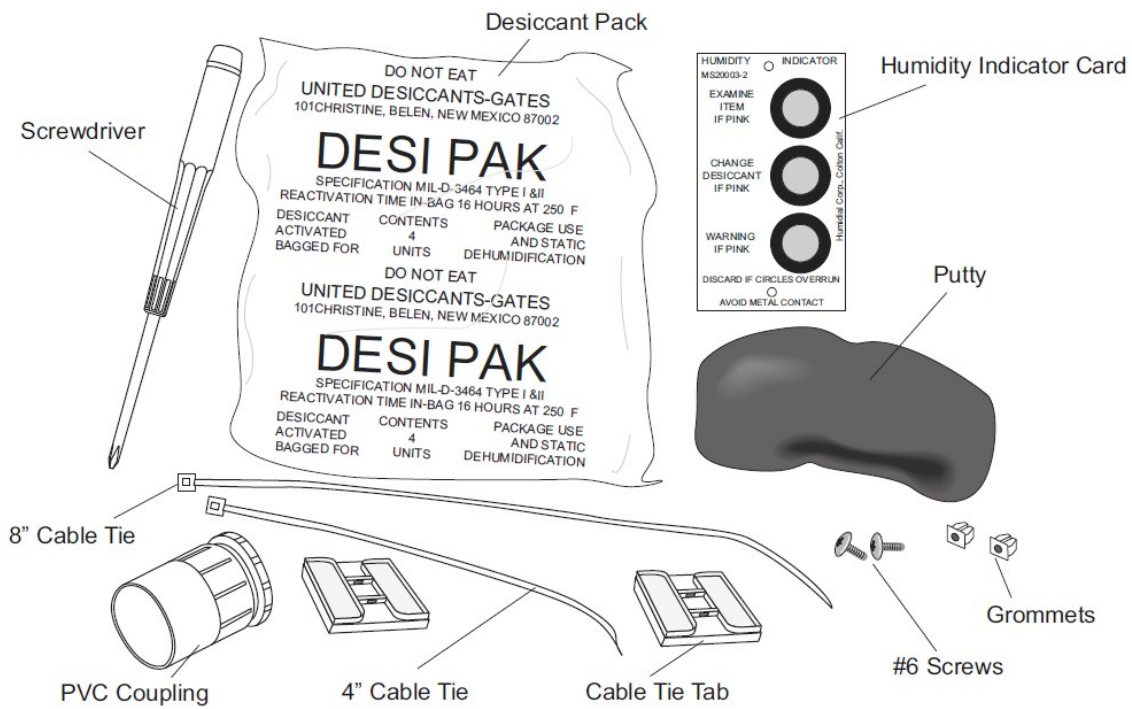


FIGURE 3-1. Components of the Enclosure Supply Kit

3.3 Tools list (for tripod, mast, enclosures, and crossarms)

- 1/2-in and 7/16-in open end wrenches
- adjustable wrench
- Phillips head screw drivers (medium, small)
- Straight bit screwdrivers (large, medium)
- 30 cm (12 in) torpedo level
- side-cut pliers
- pencil
- tape measure
- compass and site declination angle
- shovel
- sledge hammer (for driving ground rod and stakes)
- step ladder

4. QuickStart

4.1 Install system components

When possible, install the data logger and other devices inside the enclosure prior to installing the enclosure in the field. Doing so:

- Ensures all system components fit inside the enclosure
- Allows the components to be wired together in a lab environment resulting in cleaner wiring and providing easier access to wire diagrams and component documentation
- Allows for the assembled system to be fully tested prior to deploying the system to the field
- Shortens installation time in the field

4.2 Install the enclosure

Mount the enclosure to a solid support. [Installation](#) (p. 7) covers mounting the enclosure using several different approved methods.

4.3 Complete the installation

- Finish connecting sensors
- Attach the enclosure to Earth ground. (External ground lug on all versions except ENC16/18UL where the ground is attached directly to the data logger inside the enclosure.)
- Connect external power

5. Specifications

U-bolt spacing:
ENC10/12 (all versions)- 37.6 cm (14.8 in)
ENC12/14 (all versions)- 42.4 cm (16.7 in)
ENC14/16 (all versions)- 47.8 cm (18.8 in)
ENC16/18 (all versions)- 53.2 cm (20.9 in)

Conduit size

(options “-SC”, “-DC”,
“-VC”): 3.8 cm (1.5 in) diameter

ENC10/12

Internal dimensions: 25.4 x 30.5 x 11.4 cm (10 x 12 x 4.5 in)
Weight: 4.1 kg (9 lb)
Entry seals (option “-ES”): 1 medium: 5.1 to 9.9 mm (0.20 to 0.39 in) diameter
2 small: 3.0 to 7.1 mm (0.12 to 0.28 in) diameter

ENC10/12R

Internal dimensions: 25.4 x 30.5 x 14 cm (10 x 12 x 5.5 in)
Weight: 4.1 kg (9 lb)
Entry seals (option “-ES”): 1 medium: 5.1 to 9.9 mm (0.20 to 0.39 in) diameter
2 small: 3.0 to 7.1 mm (0.12 to 0.28 in) diameter

ENC12/14

Internal dimensions: 30.5 x 35.6 x 14 cm (12 x 14 x 5.5 in)
Weight: 5 kg (11.2 lb)
Entry seals (option “-ES”): 2 medium: 5.1 to 9.9 mm (0.20 to 0.39 in) diameter
4 small: 3.0 to 7.1 mm (0.12 to 0.28 in) diameter

ENC14/16

Internal dimensions: 35.6 x 40.6 x 14 cm (14 x 16 x 5.5 in)
Weight: 6.2 kg (13.6 lb)
Entry seals (option “-ES”): 2 large: 9.9 to 14.2 mm (0.39 to 0.56 in) diameter
2 medium: 5.1 to 9.9 mm (0.20 to 0.39 in) diameter
2 small: 4.7 to 7.9 mm (0.19 to 0.31 in) diameter

ENC16/18 and ENC16/18UL

Internal dimensions:	40.6 x 45.7 x 22.9 cm (16 x 18 x 9 in)
Weight:	7.7 kg (17 lb)
Entry seals (option “-ES”):	2 large: 9.9 to 14.2 mm (0.39 to 0.56 in) diameter 2 medium: 5.1 to 9.9 mm (0.20 to 0.39 in) diameter 2 small: 4.7 to 7.9 mm (0.19 to 0.31 in) diameter

PWENC12/14

Internal dimensions:	30.5 x 35.6 x 14 cm (12 x 14 x 5.5 in)
Weight:	5 kg (11.2 lb)

PWENC14/16

Internal dimensions:	35.6 x 40.6 x 14 cm (14 x 16 x 5.5 in)
Weight:	6.2 kg (13.6 lb)

PWENC16/18

Internal dimensions:	40.6 x 45.7 x 22.9 cm (16 x 18 x 9 in)
Weight:	7.7 kg (17 lb)

ENC16/18UL certification: UL508A

EU conformity link: https://s.campbellsci.com/documents/us/compliance/eudoc_weather-resistant-enclosures.pdf 

6. Installation

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6.1 Mounting equipment inside the enclosure

When mounting a data logger and other components inside an enclosure, care must be taken to seal the enclosure openings to prevent moisture and insects from getting into the inside of the enclosure. There are two main methods of passing system cabling into and out of the enclosure: 1.5-inch conduits and individual compression fittings for each cable.

6.1.1 Enclosures with one or two 3.8 cm (1.5 in) conduits

1. If installing the optional Door-Open Indicator Kit, follow the procedure described in [Door switch](#) (p. 27).
2. If installing the 12.7 cm (5 in) or 22.9 cm (9 in) DIN-Rail Mounting Kit, follow the procedure described in [DIN-rail mounting kits](#) (p. 32). These kits facilitate wiring when many wires need to be connected to one terminal.
3. If installing an enclosure stack mounting kit, follow the procedure described in [Mounting kits](#) (p. 40). A stack mounting kit allows components to be raised 3 inches above the backplate, allowing one component to be stacked above another to save space. Raising a component from the backplate is also done to improve access to a component that may be partially blocked by other, taller equipment mounted in the enclosure.

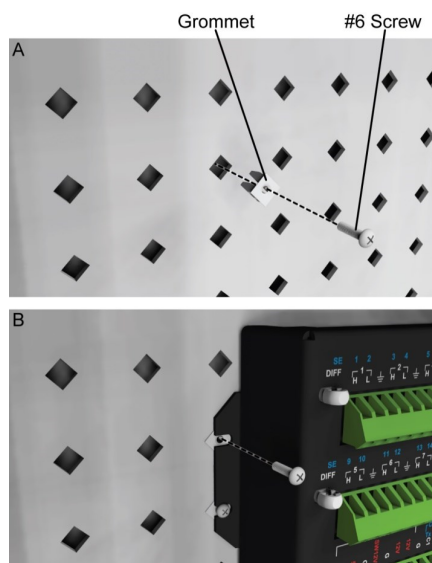


FIGURE 6-1. Securing components to the enclosure backplate

4. Use the #6 screws and plastic grommets to mount additional components to the enclosure backplate (see [FIGURE 6-1](#) (p. 8)). Data loggers, power supplies, and most components are usually attached to the backplate prior to shipment from the factory or are supplied with additional screws and grommets.

To insert the grommet, push the points of the flanges into the center of any square hole. To remove a grommet without damage, remove the enclosure backplate and use pliers to pinch the grommet flanges together.

NOTE:

Remember to allow space for cables and cable connectors.

5. If desired, use the PVC coupling included with the enclosure supply kit to reduce the conduit opening to 1.3 cm (0.5 in). Route the sensor cables through the enclosure conduit to the data logger and component terminal strips. When using the ENC16/18UL, also route the ground wire through the conduit opening to the data logger inside the enclosure. If multiple components need to be grounded inside the UL enclosure, install a terminal strip for all ground connections.
6. Connect sensors and components to the data logger as described in the sensor and component manuals.
7. Strain relief the sensor wires to the data logger strain relief flanges with the 10 cm (4 in) cable ties.

- Secure sensor and component cables to the side of the enclosure using 20 cm (8 in) cable ties and cable tie tabs (see [FIGURE 6-2](#) (p. 10)).

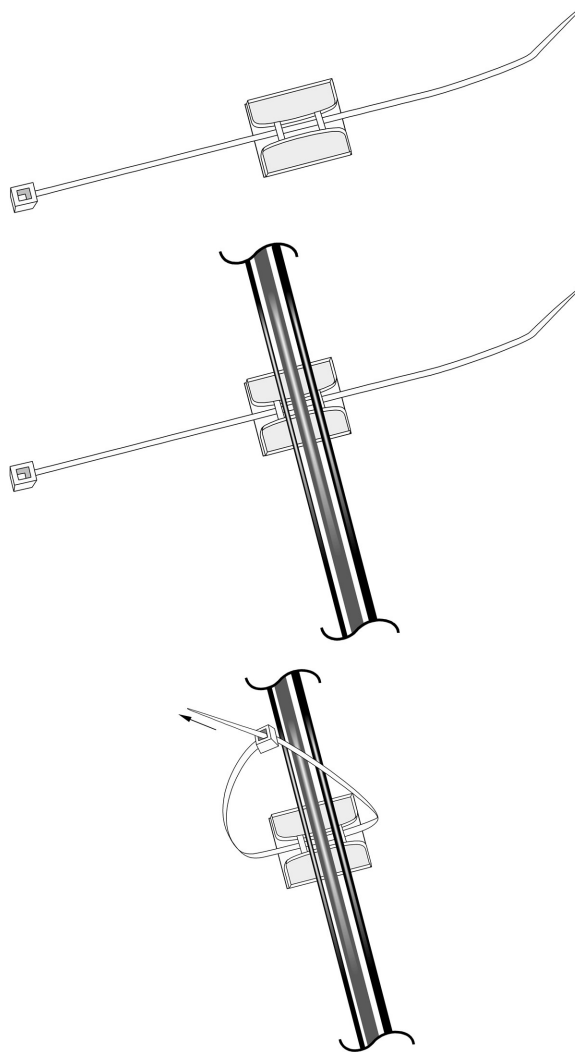


FIGURE 6-2. Securing cables to the cable tie tabs

NOTE:

The adhesive of the cable tie tab may not stick during extremely cold temperatures or extremely high humidity. In these situations, fasten the cable tie tab to the backplate using a #6 screw and grommet or run the cable tie through two of the enclosure backplate holes.

NOTE:

Refer to [FIGURE 6-3](#) (p. 11) for steps 9–12.

- Place two of the desiccant packs from the Enclosure Supply Kit inside of the enclosure. Reseal the other two inside the plastic bag to use later (see [When to replace desiccant](#) (p. 25)).
- Remove the backing from the humidity indicator card and attach the card to the right side of the enclosure.
- Place a roll of putty around the sensor cables where they enter the enclosure.
- Press the putty around the cables and into the conduit to form a tight seal.

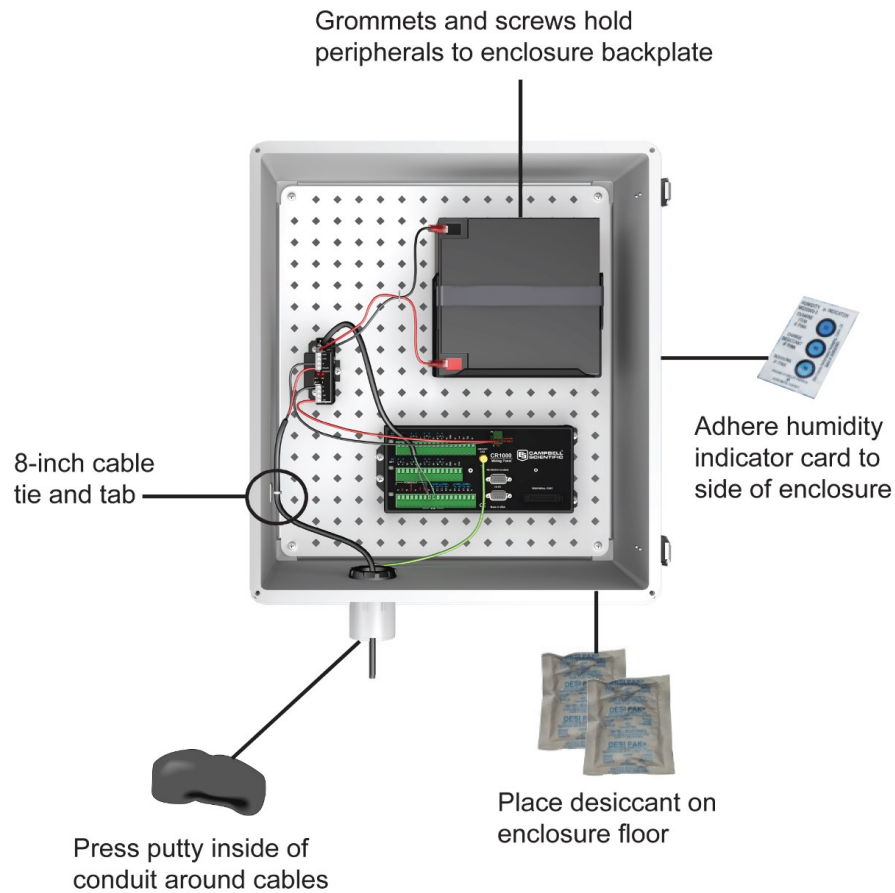


FIGURE 6-3. An ENC12/14 with one 1.5-inch conduit houses a data logger and BP24 power supply. Door not shown.

6.1.2 Enclosures with individual compression fittings

- If installing the optional Door-Open Indicator Kit, follow the procedure described in [Door switch](#) (p. 27).

2. Use the #6 screws and plastic grommets to mount additional components to the enclosure backplate (see [FIGURE 6-1](#) (p. 8)). Data loggers, power supplies, and most components are usually attached to the backplate prior to shipment from the factory or are supplied with additional screws and grommets.

To insert the grommet, push the points of the flanges into the center of any square hole (see A in [FIGURE 6-1](#) (p. 8)). To remove a grommet without damage, remove the enclosure backplate and use pliers to pinch the grommet flanges together.

NOTE:

Remember to allow space for cables and cable connectors.

3. Route each sensor and component cable through a unique compression fitting ([FIGURE 6-4](#) (p. 12)). When using the ENC16/18UL, also route the ground wire through a compression fitting to the data logger inside the enclosure. If multiple components need to be grounded inside the UL enclosure, install a terminal strip for all ground connections.

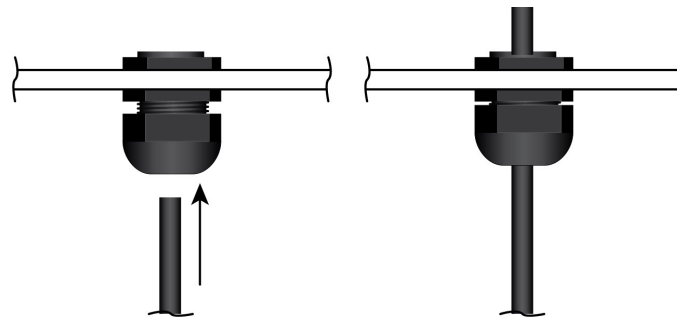


FIGURE 6-4. Cable inserted into compression fitting

4. Connect sensors and components to the data logger as described in the sensor and component manuals.
5. Strain relief the sensor wires to the data logger strain relief flanges with the 10 cm (4 in) cable ties.
6. Secure sensor and component cables to the side of the enclosure using 20 cm (8 in) cable ties and cable tie tabs (see [FIGURE 6-2](#) (p. 10)).

NOTE:

The adhesive of the cable tie tab may not stick during extremely cold temperatures or extremely high humidity. In these situations, fasten the cable tie tab to the backplate using a #6 screw and grommet or run the cable tie through two of the enclosure backplate holes.

NOTE:

Refer to [FIGURE 6-5](#) (p. 13) for steps 7–9.

7. Place two of the desiccant packs from the Enclosure Supply Kit inside of the enclosure. Reseal the other two inside the plastic bag to use later (see [When to replace desiccant](#) (p. 25)).
8. Remove the backing from the humidity indicator card and attach the card to the right side of the enclosure.
9. Rotate each compression fitting so that the fitting clamps tightly against the sensor cable to provide a water-tight seal (see [FIGURE 6-4](#) (p. 12)).

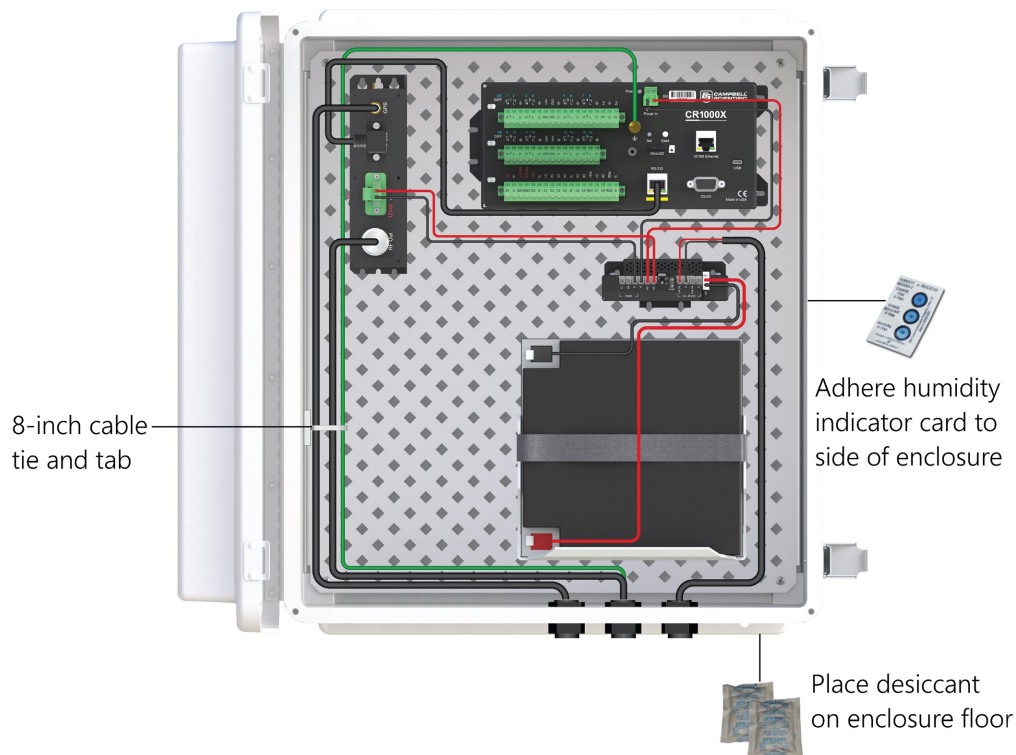


FIGURE 6-5. This ENC16/18 enclosure with the “-ES” option houses the equipment commonly used in a GOES satellite system

6.2 Attaching an enclosure to a tripod mast

The “-MM” mount option is intended for mounting an enclosure to the mast of a tripod. An enclosure ordered with this option will be shipped with a three-piece bracket mounted to the top of the enclosure and an identical three-piece bracket mounted to the bottom of the enclosure (see [FIGURE 6-6](#) (p. 14), [FIGURE 6-7](#) (p. 15), and [FIGURE 6-8](#) (p. 15)).

Attach the enclosure to the mast as follows:

1. Position the enclosure on a side of the mast facing away from the equator.
2. Place the enclosure at the desired height, typically 1 m (3 ft) from the ground.
3. Use the furnished 2-inch U-bolts to secure the enclosure to the tripod mast.
4. Route the 14 AWG wire from the brass tripod ground clamp to the enclosure ground lug. Strip 2.5 cm (1 in) of insulation from each end of the wire and insert the end of the wire into the ground lugs and tighten.



FIGURE 6-6. An enclosure with the “-MM” mounting option attaches to a tripod mast via U-bolts



FIGURE 6-7. This exploded view shows the components of a "-MM" bracket



FIGURE 6-8. An enclosure attached to a tripod mast

6.3 UT6, UT10, UT20, and UT30 tower installation

The “–TM” option is used to attach an enclosure to a tower. An enclosure ordered with the “–TM” option will be shipped with a three-piece bracket mounted to the top of the enclosure and an identical three-piece bracket mounted to the bottom of the enclosure. This mounting bracket option uses the same three-piece brackets as the “–MM” option, except the pieces are rearranged so that the flanges are on the side of the bracket instead of in the middle. The distance between the centers of each flange needs to be 26 cm (10.25 in) for the UT6 and UT10, or 43 cm (17 in) for the UT20 and UT30 (see [FIGURE 6-9](#) (p. 17), [FIGURE 6-10](#) (p. 17), and [FIGURE 6-11](#) (p. 18)).

Attach the enclosure to the UT10 tower legs as follows:

NOTE:

Enclosures with the “–TM” option are shipped configured for the UT6 and UT10 towers. Steps 1 through 3 of the following procedure are for configuring the bracket for attachment to a UT20 or UT30 tower. When mounting to a UT6 or UT10, begin on step 4.

1. Remove the bolts and nuts connecting the bracket to the enclosure.
2. Slide out the flange sections so that the distance between the centers of each flange is 43 cm (17 in) (see [FIGURE 6-9](#) (p. 17)).
3. Reattach the bracket to the enclosure using the original bolts and nuts.
4. Position the enclosure on a side of the tower facing away from the equator.
5. Place the enclosure at the desired height, typically 1 m (3 ft) from the ground.
6. Use the furnished 1.5-inch U-bolts to secure the enclosure to the tower legs.
7. Route the 14 AWG wire from the brass tower ground clamp to the enclosure ground lug. Strip 2.5 cm (1 in) of insulation from each end of the wire and insert the end of the wire into the ground lugs and tighten.

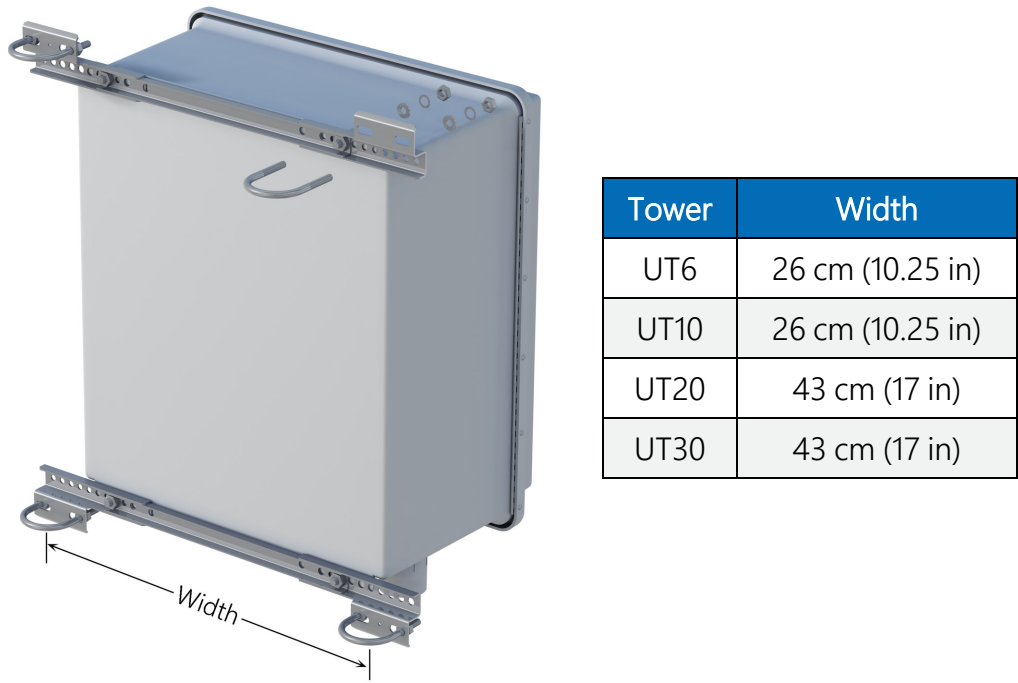


FIGURE 6-9. Enclosure brackets configured for a tower mount

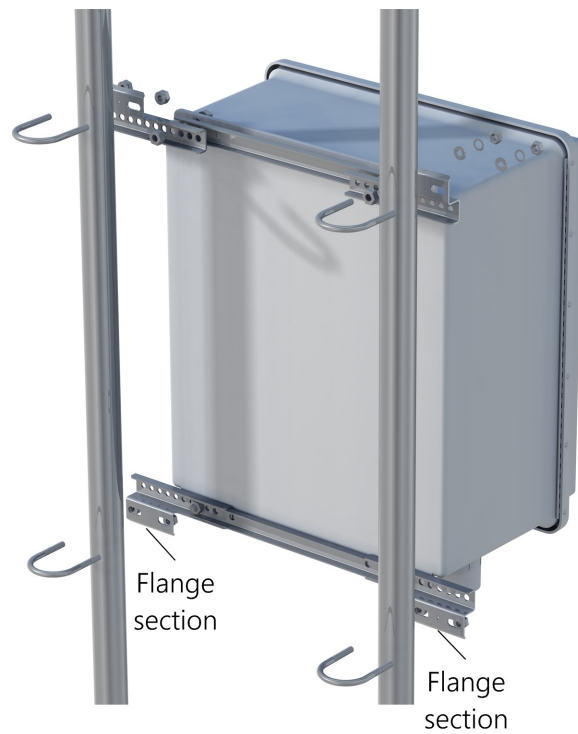


FIGURE 6-10. This exploded view shows the components of a "-TM" bracket option

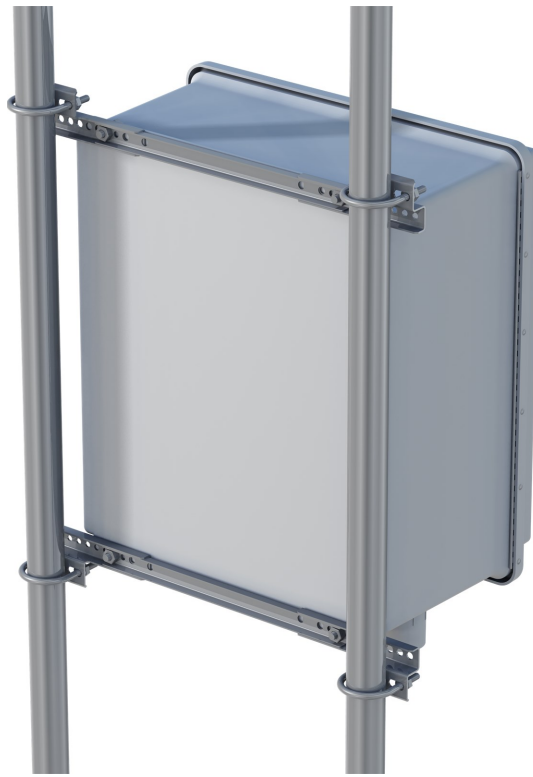


FIGURE 6-11. An enclosure attached to two tower legs

6.4 Mounting an enclosure on a tripod leg base

The “-LM” mount option is intended for attaching an enclosure to the leg base of a, CM106B, CM106BK, CM110, CM115, CM120, CM106, or CM106K tripod.

An enclosure ordered with this option will be shipped with a -LM mounting bracket attached to each side of the enclosure (see [FIGURE 6-12](#) (p. 19)) and a U-bolt bracket. An enclosure mount receiver must also be attached to some tripods (see [FIGURE 6-13](#) (p. 19)).

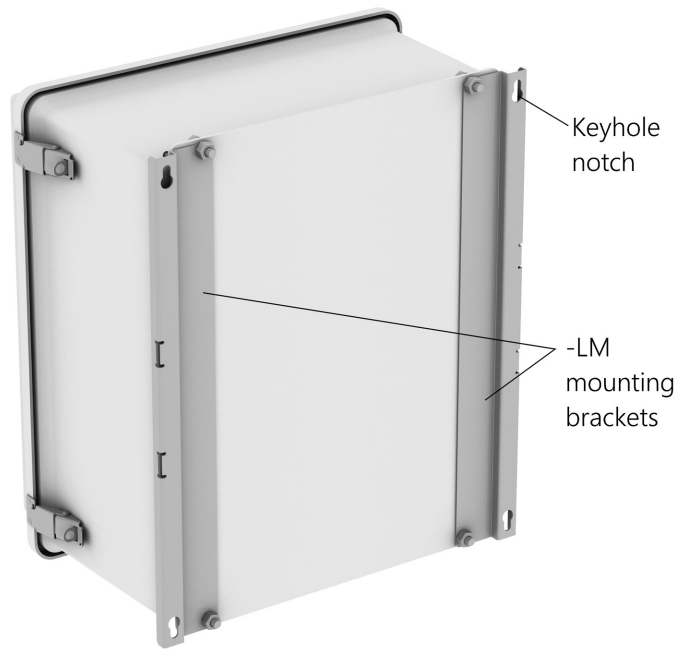


FIGURE 6-12. Tripod leg base –LM mounting brackets

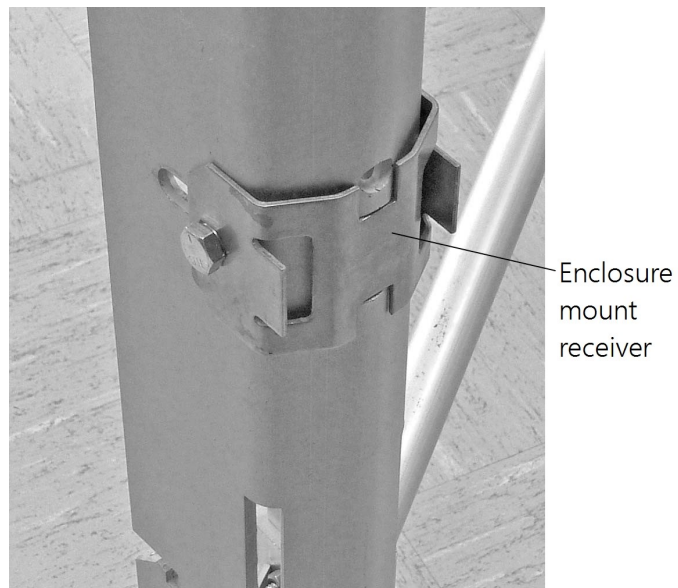


FIGURE 6-13. Enclosure mount receiver

NOTE:

For tripods requiring the enclosure mount receiver, the receiver may not be pre-installed on the tripod at the factory. In this situation, the receiver and mounting hardware will be shipped with the tripod and will need to be installed as shown in [FIGURE 6-13](#) (p. 19). The CM106B, CM106BK, CM106 and CM106K tripods have flanges built into the tripod base and do not require the enclosure mount receiver.

Attach the enclosure to the leg base:

1. For the CM110, slide the keyhole notch in one of the upper corners of the –LM mounting bracket over the extended Phillips head screw located on the tripod (see A in [FIGURE 6-14](#) (p. 20)). The CM106B, CM106BK, CM106 and CM106K have mounting hooks extending from the tripod body in place of the Phillips screws (see B in [FIGURE 6-14](#) (p. 20)).

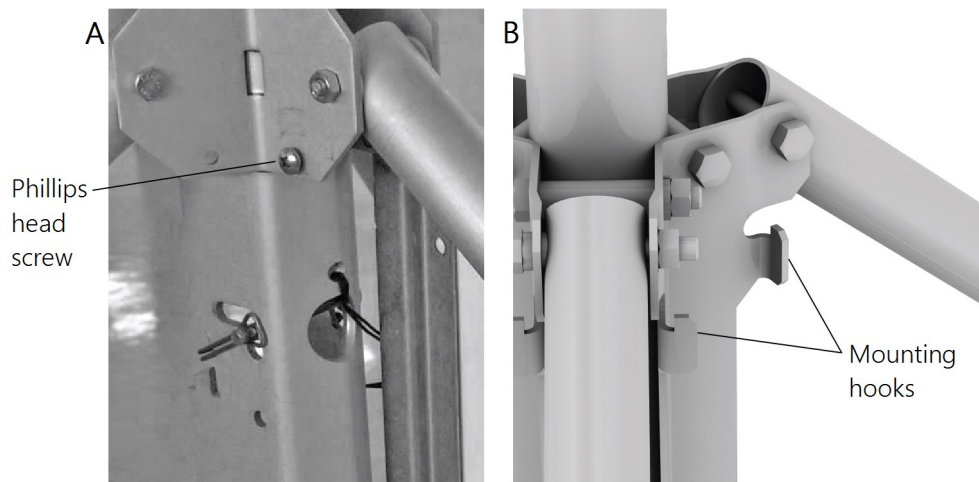


FIGURE 6-14. Upper mount location on CM110 (A) and CM106B (B)

2. One of the notches at the lower end of the enclosure mounting bracket will now align with the flange on the lower tripod base (or the enclosure mount receiver on the CM110). Slide the enclosure mounting bracket onto the flange (see [FIGURE 6-15](#) (p. 21)).

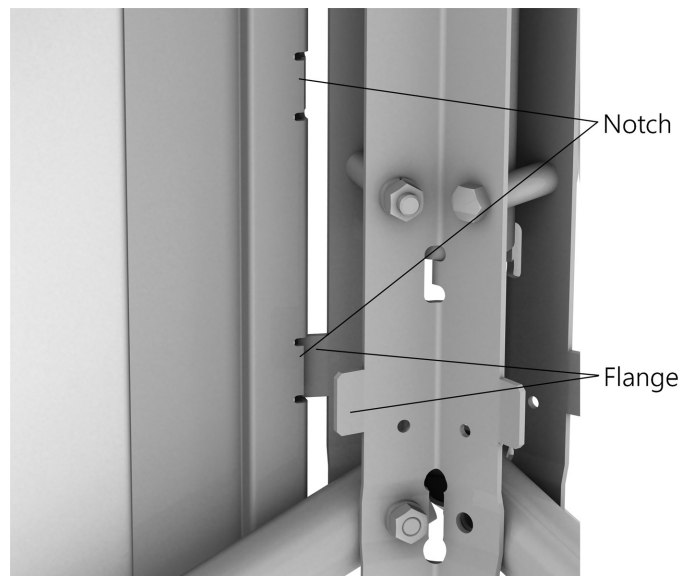


FIGURE 6-15. Flange connection (CM106B).

3. Slide the U-bolt bracket onto the outer –LM mounting bracket (see [FIGURE 6-16](#) (p. 21)). Use the furnished 2.5-inch U-bolt to secure the –LM mounting bracket to a tripod. The CM106K requires a user-supplied 5/16-18 x 1.5 inch U-bolt due to the smaller tripod leg size.

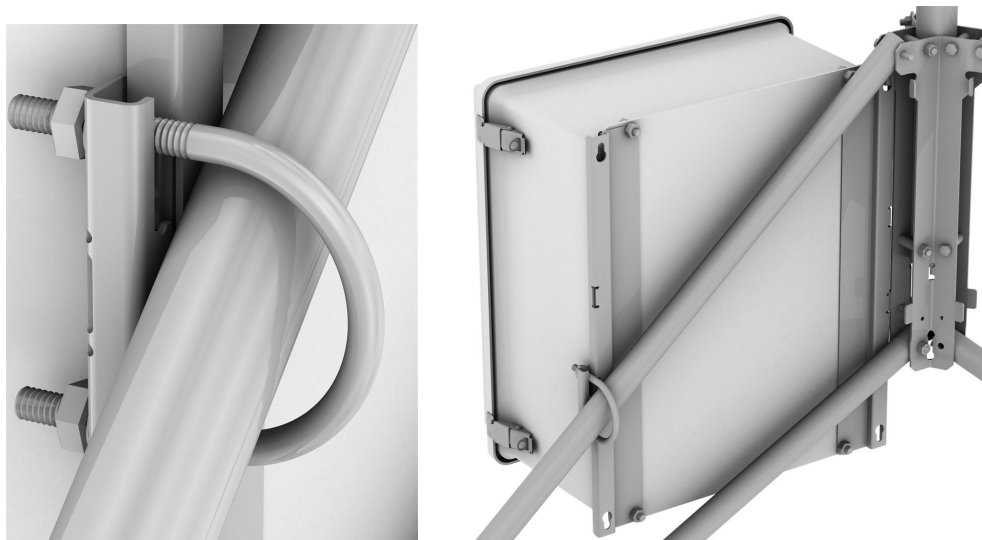


FIGURE 6-16. U-bolt connection

4. Route the 14 AWG wire from the brass tripod ground clamp to the enclosure ground lug. Strip 2.5 cm (1 in) of insulation from each end of the wire and insert the end of the wire into the ground lugs and tighten.

6.5 Mounting more than one enclosure on a tripod leg

It is possible to mount two enclosures back-to-back on most current Campbell Scientific tripods. If the enclosures are different sizes, mount the smaller enclosure first, followed by the larger enclosure. If the enclosures are the same size, use two 5/16-18 x 3.5 inch bolts in place of U-bolts to anchor the two enclosures together.

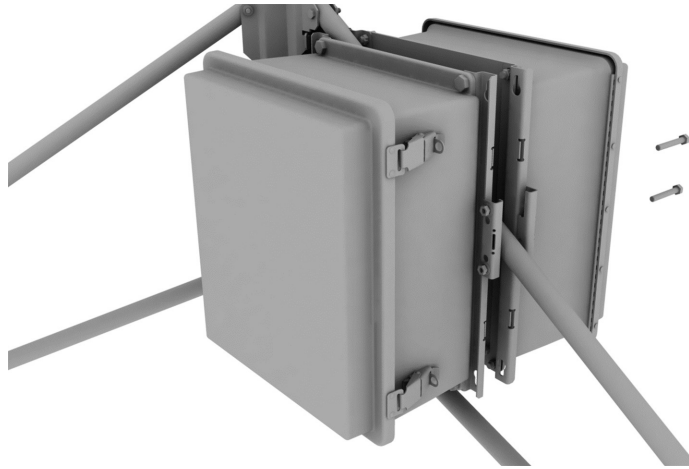


FIGURE 6-17. Mounting two enclosures on a single tripod leg

6.6 Pole mount

The “-PM” mount option is intended for mounting an enclosure to a vertical pole. An enclosure ordered with this option will be shipped with brackets, metal bands, and mounting hardware needed to secure the enclosure. The metal bands are routed through the brackets, and then around a vertical pole. They are anchored in place using screw clamps.

Attach the enclosure to a vertical tube as follows:

1. Position a bracket at the top of the enclosure as shown in [FIGURE 6-18](#) (p. 23). Secure it with a bolt, washer, and locknut at each end. Attach the lower bracket in the same manner, rotating the bracket so it extends below the enclosure.

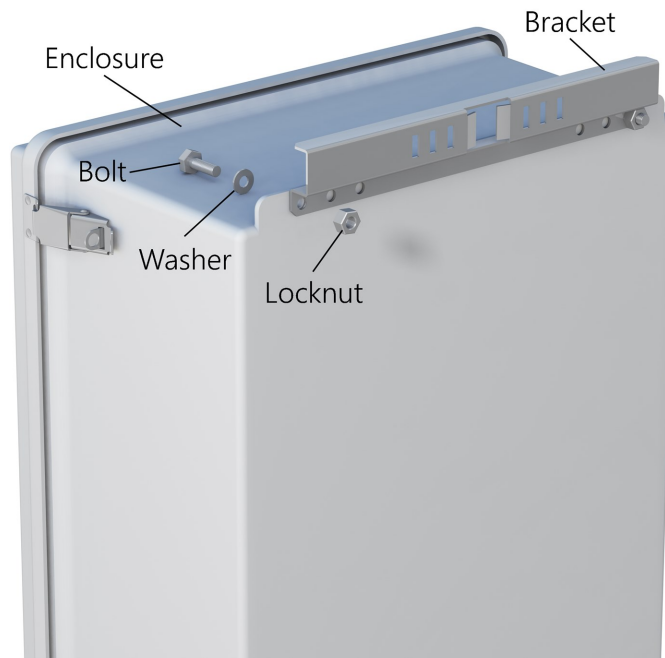


FIGURE 6-18. Attaching the pole mount bracket

2. Feed a metal band through the openings in each bracket as shown in [FIGURE 6-19](#) (p. 23). Use the closest set of holes for smaller poles and the farthest set of holes for larger poles.

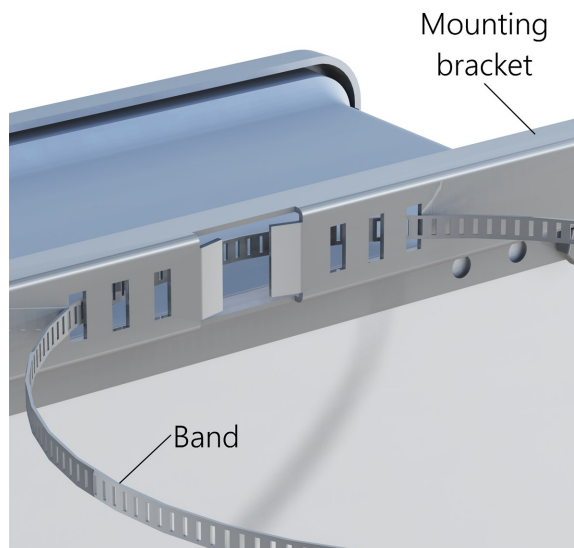


FIGURE 6-19. Inserting the metal band

3. Position the enclosure on the side of the pole facing away from the equator.

4. Place the enclosure at the desired height. Please note that the recommended cable lengths for the sensors assume the bottom of the enclosure is mounted 1 m (3 ft) from the ground.
5. Insert the tab on the end of the screw threads (FIGURE 6-20 (p. 24)) into the hole at one end of the upper strap.

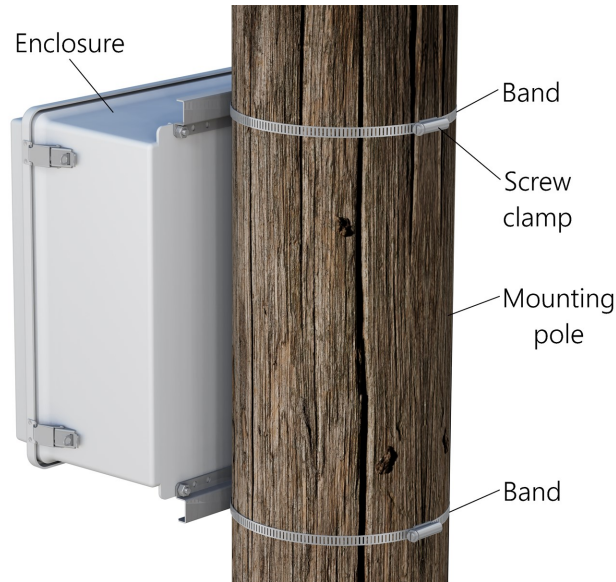


FIGURE 6-20. Securing the enclosure to a pole

6. Pull the strap tight around the pole to determine which hole to insert the screw clamp at the other end of the strap. Insert the clamp into this hole.
7. Use metal shears to remove any excess strap, leaving a small amount for adjustments.
8. Insert the screw threads into the screw clamp and tighten, using a flathead screwdriver or nut driver.
9. Repeat steps 5–8 for the lower strap.
10. Ensure the enclosure is properly grounded through the use of a ground rod or similar device.

7. Maintenance

7.1 When to replace desiccant

The humidity indicator card or optional CS210 Enclosure Humidity Sensor indicates when the desiccant needs to be replaced.

CAUTION:

Because desiccant is inexpensive, Campbell Scientific recommends replacing desiccant packets rather than attempting to reactivate the desiccant.

7.1.1 Humidity indicator card

The humidity indicator card has three colored circles that indicate the percentage of humidity. Desiccant packets inside the enclosure should be replaced with fresh packets when the upper dot on the indicator begins to turn pink. The indicator card does not need to be replaced unless the colored circles overrun.

7.1.2 Optional CS210 humidity sensor

The CS210 Enclosure Humidity Sensor contains an Elan HM2000 series precision bulkpolymer relative humidity sensor to measure relative humidity inside an enclosure. When the measurements exceed 35% relative humidity, replace the desiccant packets. Refer to the CS210 manual for sensor specifications, installation procedures, and programming information.

7.2 Resistance to weathering

Enclosures are coated to protect them from UV rays and other weathering. However, the outer surface of enclosures exposed to extreme weather (rain, wind, and/or UV rays) may erode so that glass fibers become apparent. The depth of the erosion is superficial and only affects the aesthetic appeal; it does not reduce the effectiveness in protecting equipment.

Customers who are worried about weathering can periodically rub the enclosure exterior with petroleum jelly or a carnauba-based car wax. The appearance of an enclosure that has already been eroded can be sprayed with clear acrylic paint or coated with primer and white paint. Follow the procedure provided in either [Clear acrylic paint](#) (p. 26) or [Primer and white paint](#) (p. 26) to ensure proper bonding.

7.2.1 Clear acrylic paint

1. Use a rag and possibly a solvent to clean the outside of the enclosure. Solvents that can be used include rubbing alcohol, a water solution of alkaline or caustic salts, household cleaning products, aromatic hydrocarbon solvents (benzene, xylene), butyl acetate, and glycol acetate.
2. If a solvent was used, carefully rinse and dry enclosure.
3. Use a fine grain sandpaper to gently sand the enclosure surface; if the surface of the enclosure is sufficiently rough, this step may be skipped.
4. Spray with clear acrylic paint.

CAUTION:

Properly ventilate the area while using solvent and paint. Wear safety goggles, mask, and gloves while sanding.

7.2.2 Primer and white paint

1. Use a rag and possibly a solvent to clean the outside of the enclosure. Solvents that can be used include rubbing alcohol, a water solution of alkaline or caustic salts, household cleaning products, aromatic hydrocarbon solvents (benzene, xylene), butyl acetate, and glycol acetate.
2. If a solvent was used, carefully rinse and dry enclosure.
3. Use a fine grain sandpaper to gently sand the enclosure surface; if the surface of the enclosure is sufficiently rough, this step may be skipped.
4. Spray with primer that is compatible with fiberglass.
5. Paint the enclosure with a white paint that is compatible with fiberglass and resistant to extreme weather. The paint must be white because the white color reflects solar radiation.

CAUTION:

Properly ventilate the area while using solvent and paint. Wear safety goggles, mask, and gloves while sanding.

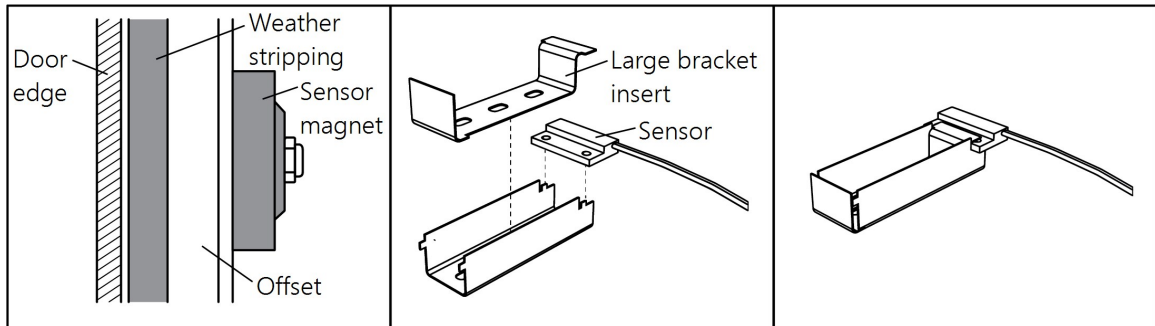
Appendix A. Door switch

A.1 Installation procedure

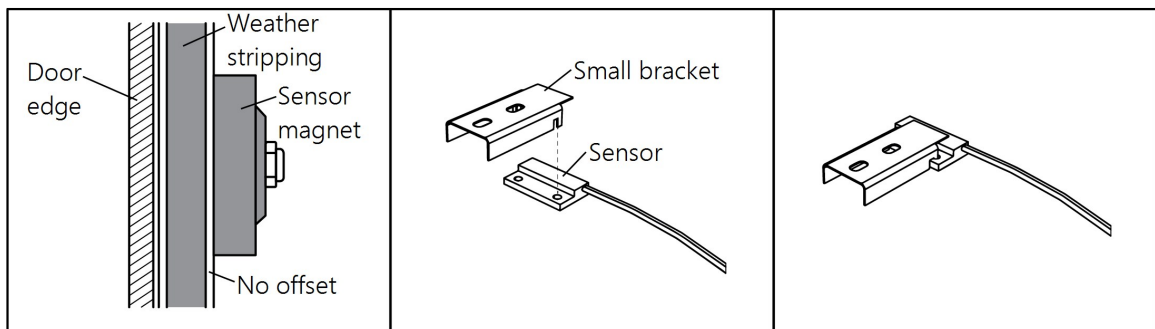
WARNING:

Do not install the Door-Open Indicator Kit on the ENC16/18UL. Installing the door switch in the ENC16/18UL will invalidate the UL certification for the enclosure. Use a non-UL certified enclosure when a door-open indicator is needed.

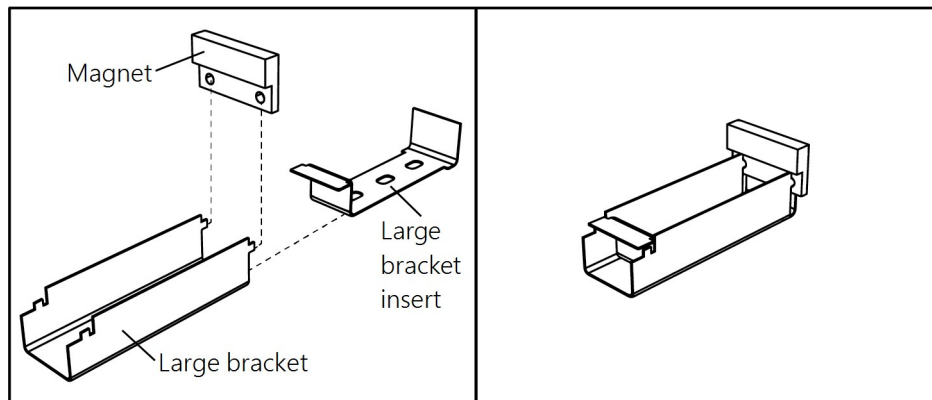
1. The Door-Open Indicator Kit contains several small brackets used to mount the sensor and magnet to the enclosure and door. Which brackets are used depends on the style of enclosure. Use the following guide to determine the proper brackets:
 - a. The door-open indicator is mounted at the upper right corner of the enclosure. If there is an offset near the edge of the enclosure door, the sensor will be mounted with the brackets shown.



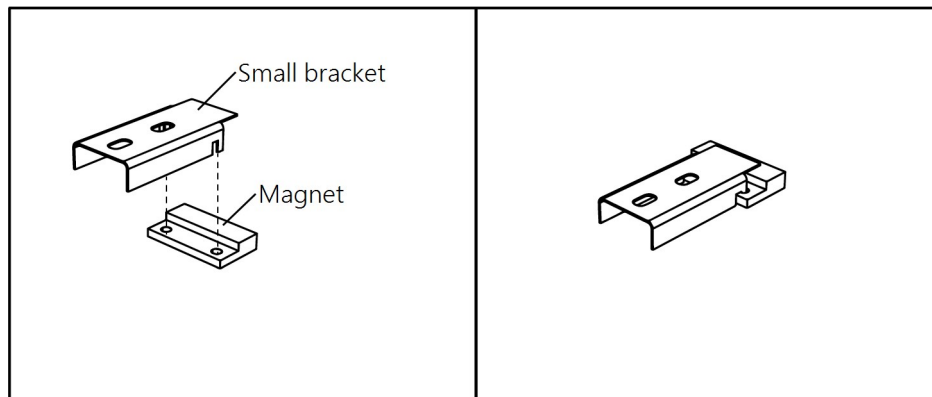
- b. If there is no offset near the edge of the enclosure door, use the bracket shown.



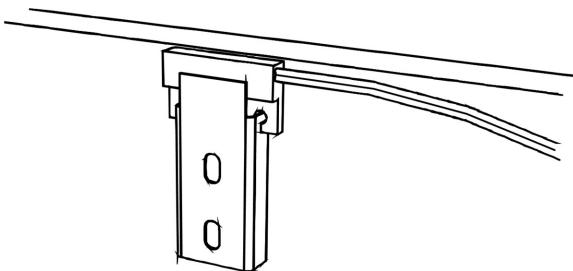
- c. The bracket used for mounting the sensor magnet in the door depends on the depth of the door. If the door face is flat, the sensor magnet is mounted as shown.



- d. If the door face is extended, the sensor magnet is mounted as shown.



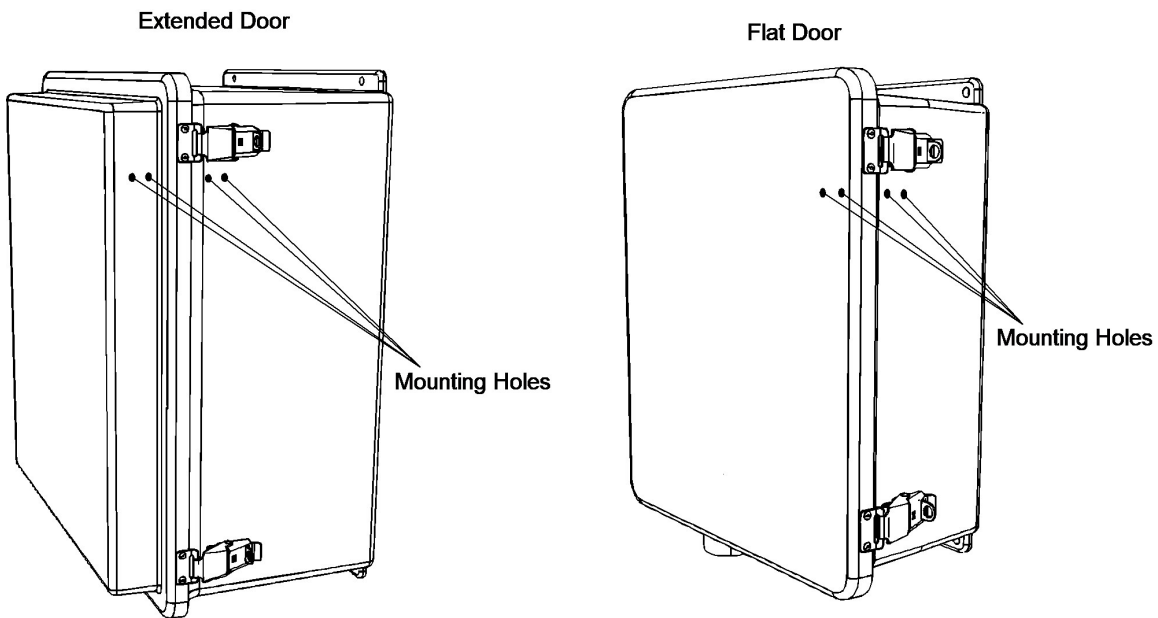
2. Using the brackets determined in step 1, assemble the sensor and place it in the upper right corner of the enclosure. Align the top of the sensor with the inside edge of enclosure as shown. Do not allow the sensor to extend beyond the edge of the enclosure. Using a marker, mark the locations for two mounting holes to secure the sensor bracket.



3. Assemble the sensor magnet with the bracket determined in step 1. Place the bracket in position so the edge of the sensor magnet does not extend beyond the internal edge of the door. Mark the locations for two mounting holes to secure the sensor magnet bracket.

NOTE:

The mounting holes for the sensor magnet bracket must align with the holes for the sensor bracket for the door open switch to function properly.

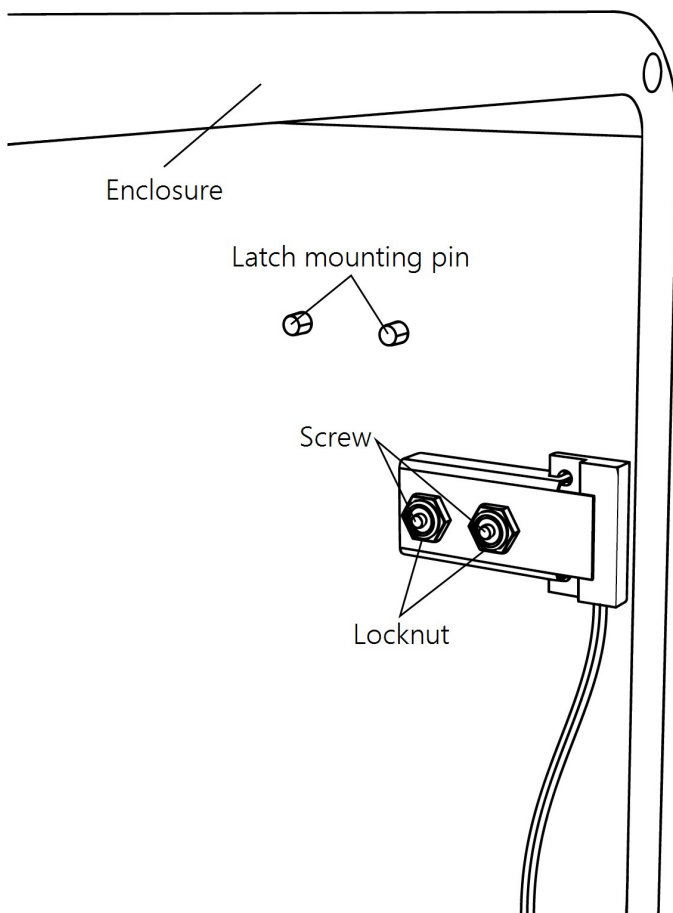


4. Drill small pilot holes for all four mounting holes from the inside of the enclosure.
5. Drill the final holes for the brackets from the outside of the enclosure using a 4 mm or #22 (0.157 inch) drill bit.

NOTE:

Drilling the holes in this manner will prevent the enclosure finish from cracking.

6. From the outside of the enclosure, insert two screws through the newly drilled holes.
7. Place the assembled sensor bracket over the two screws, making sure the sensor is aligned with the inside edge of the enclosure. Secure the bracket in place with two locknuts.



8. From the outside of the enclosure door, insert two screws through the new holes in the enclosure door.
9. Place the assembled sensor magnet bracket over the two screws, making sure the sensor magnet is aligned with the inside edge of the door. Secure the bracket in place with two locknuts.

A.2 Example program

The door switch has two wires and is connected to the **5V** terminal and a **Control** terminal. In this example for the CR1000X terminal **C1** is used. With minor adjustments, this program can be used with other data loggers.

The example program demonstrates two methods to record data. The first method maintains a schedule, recording the door status at regular intervals. The second method adds a record to the table only when the door is opened or closed.

The program also includes the option to turn on a Wi-Fi connection if the CR1000X is attached to an NL241. The NL241 must be configured in the Device Configuration Utility to **Create a Network** in the **Wi-Fi** tab under the **Deployment** tab.

CRBasic Example 1: Door switch example

```
'Program Name: DoorSwitchWithEventTable.CR1X
'This program creates a record each time the enclosure door opens or closes.
'It also records the door status at regular intervals.

' Door Switch Wiring
' +5V black - power to door switch
' C1 black - signal to control port 1
'////////////////////////////////////// DECLARATIONS ////////////////////////////////////////
Public Door_Open As Boolean
Dim LastDoorState As Boolean

'////////////////////////////////////// OUTPUT SECTION ////////////////////////////////////////
'Records when door opens or closes
DataTable(DoorEvent,Door_Open <> LastDoorState,100)
  Sample(1,Door_Open,Boolean)
EndTable

DataTable(DoorStatus,true,-1)
  DataInterval(0,5,Min,10)
  Sample(1,Door_Open,Boolean)
EndTable

'////////////////////////////////////// PROGRAM ////////////////////////////////////////
BeginProg
  'Powers on NL241 attached to CS I/O for 5 minutes on powerup
  IPNetPower (3,1,300)
  Scan(1,Sec, 3, 0)

  ' Measure Door switch
  PortGet (Door_Open,C1)

  'Powers on NL241 attached to CS I/O for 5 minutes if door open. This
  'section not required if only the door status is required.
  If (Door_Open)Then
    IPNetPower (3,1,300)
  EndIf

  CallTable DoorEvent
  CallTable DoorStatus
  LastDoorState = Door_Open 'Preserve door switch state for next scan.
NextScan

EndProg
```

Appendix B. DIN-rail mounting kits

B.1 Introduction

Space inside an enclosure is limited. DIN rails provide a convenient way to connect a large variety of electrical components in a small space. The modular design allows the installer to configure the connections in the most efficient manner possible to suit their needs. Individual components simply snap into place on the rail. Having the components close together helps keep the wiring organized and maintain a clean enclosure.

A DIN rail is capable of holding a wide variety of wire connectors, fused terminal blocks, surge protectors, circuit breakers, and power supplies. End cap/separators are used to cover the open side of a terminal strip when it would be exposed. [FIGURE B-5](#) (p. 35) shows the open side of a terminal strip. The end cap/separators also act as spacers to separate different types of terminal blocks. Jumpers are used to electrically connect the terminals. A stopper needs to be on each end of the terminal strip assembly.

Campbell Scientific DIN-rail mounting kits facilitate wiring when many wires need to be connected to one terminal. DIN rails are available in multiple lengths from 15 cm to 52 cm (6 inches to 20-5/8 inches). Each kit contains one DIN-rail mounting bracket, screws, grommets, washers, DIN-rail end caps, and DIN-rail stoppers. A complete configuration will also include terminal blocks, end cap/separators, and jumpers ([FIGURE B-1](#) (p. 33)). The DIN-rail end caps, terminal blocks, and DIN-rail stoppers are mounted onto the DIN-rail bracket. The DIN-rail bracket is mounted to an enclosure backplate using the kit screws and grommets.



FIGURE B-1. Enclosure with DIN rail and other components

B.2 Installation procedure

1. Slide a DIN-rail end cap onto each end of the DIN rail ([FIGURE B-2](#) (p. 33)).

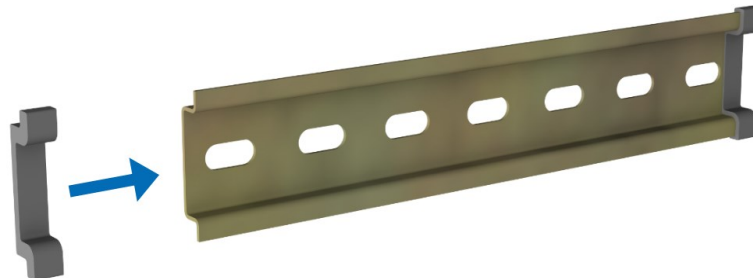


FIGURE B-2. DIN-rail end caps

2. Locate the position to mount the DIN rail inside the enclosure (FIGURE B-3 (p. 34)). There must be sufficient room on all sides to provide clearance for any component mounted on the DIN rail. Note the location of the backplate mounting holes at either end of the DIN rail.

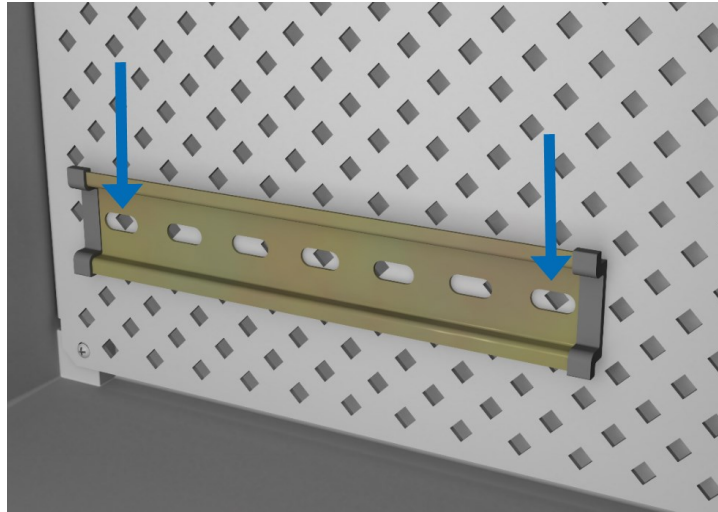


FIGURE B-3. Determining the DIN-rail mounting hole locations

3. Insert grommets into the two holes noted in step 2 (FIGURE B-4 (p. 34)). Secure the DIN rail to the backplate with the screws and washers included with the DIN rail. If a ground wire is included, slide the eyelet on one end of the ground wire over one of the mounting screws prior to securing the DIN rail. The other end of the ground wire is secured to the enclosure ground terminal.

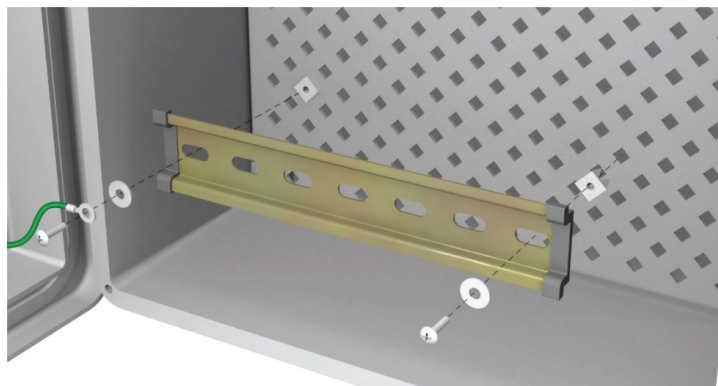


FIGURE B-4. Mounting the DIN rail and ground wire

4. Determine the mounting order for the DIN-rail components. The order of components should provide for the simplest wiring later. Avoid positioning components so wires must pass back and forth over other components. It is also beneficial to mount components with the same profile next to one another to reduce the number of end cap/separators required.
5. Starting at one end, mount the DIN-rail components on the rail. One end of each component is designed to catch one side of the rail. The other end of the component then snaps into place when the component is pressed against the rail (FIGURE B-5 (p. 35)). Place DIN-rail stoppers and end cap/separators next to components when the profiles of two adjacent components differ, when a gap between two components is desired, or when the last component is mounted to the DIN rail (FIGURE B-6 (p. 36)).

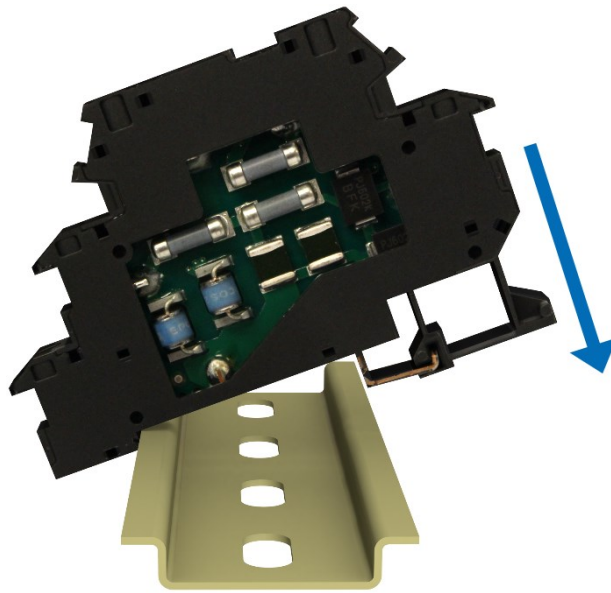


FIGURE B-5. Mounting a DIN-rail component

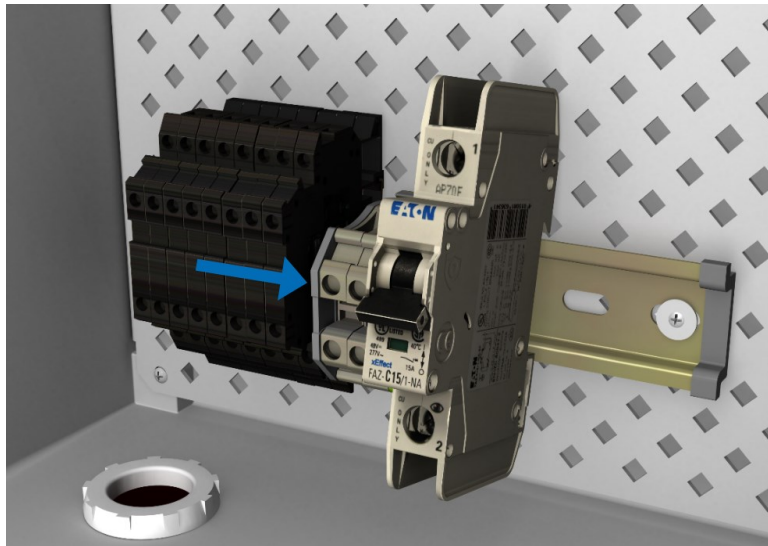


FIGURE B-6. DIN rail with components

6. Apply any labels needed to identify specific connections ([FIGURE B-7](#) (p. 36)).

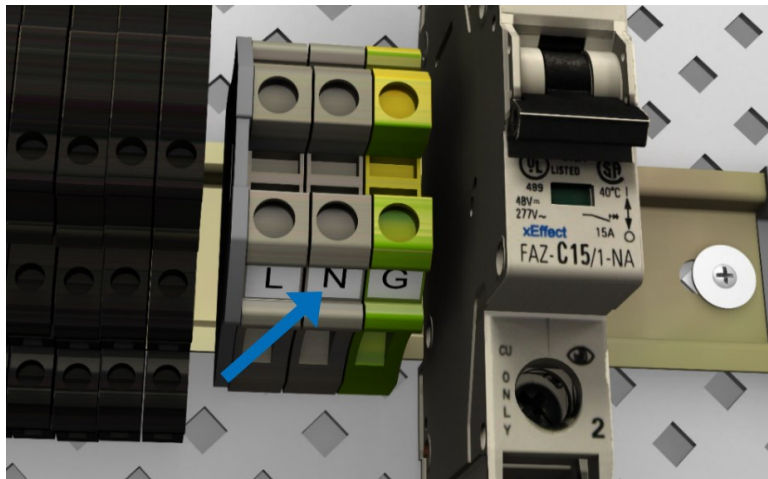


FIGURE B-7. Applying labels

- Attach wire jumpers between the DIN-rail components and other equipment inside the enclosure. If it is necessary to use jumpers to join two components, press each jumper firmly into the receptacles on each component (FIGURE B-8 (p. 37)). To keep the enclosure organized, wiring ducts with covers are available to keep the loose wires gathered together (FIGURE B-9 (p. 37)).

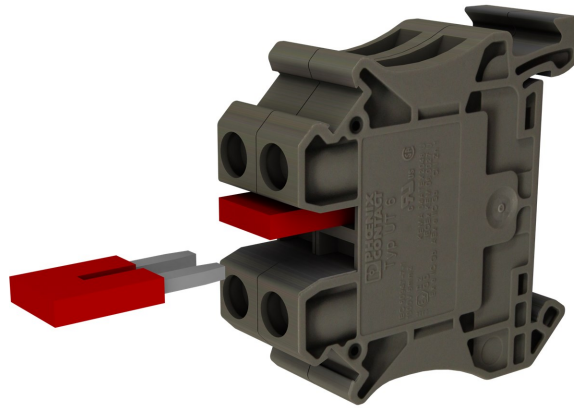


FIGURE B-8. Attaching wire jumpers

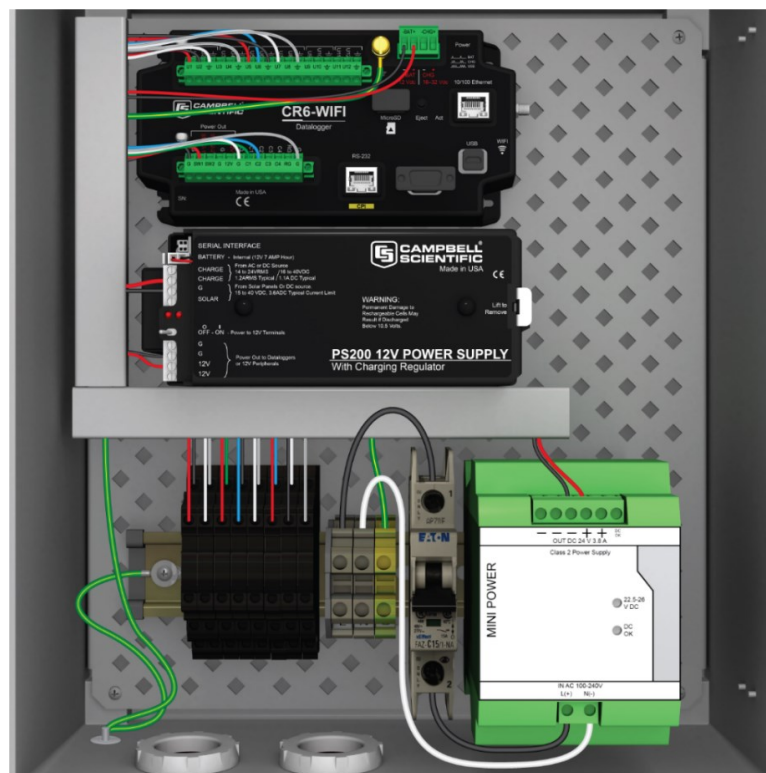


FIGURE B-9. Wiring the DIN-rail components to other equipment in the enclosure

- The terminals on DIN-rail components may be secured by screws or spring clamps. To open the spring clamp, insert a small flathead screwdriver as shown in [FIGURE B-10](#) (p. 38) to open the terminal. The wire end is inserted into the spring, and then the screwdriver is removed to close the terminal.

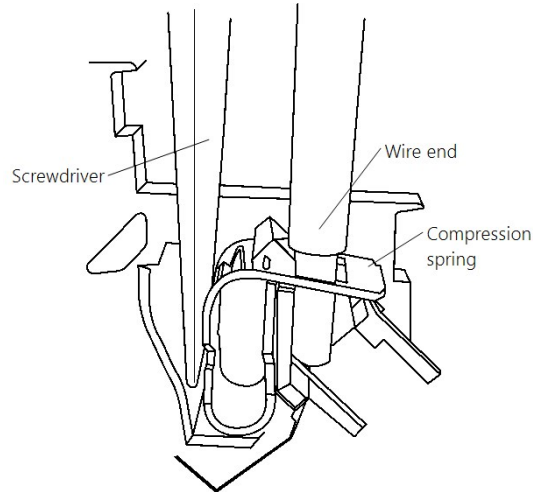


FIGURE B-10. Securing a wire with a spring clamp

- Attach any wires coming from outside the enclosure to the DIN-rail components (FIGURE B-11 (p. 39)). Do not attach any voltage sources, such as AC power or a solar panel, until all other terminal connections have been made and verified.

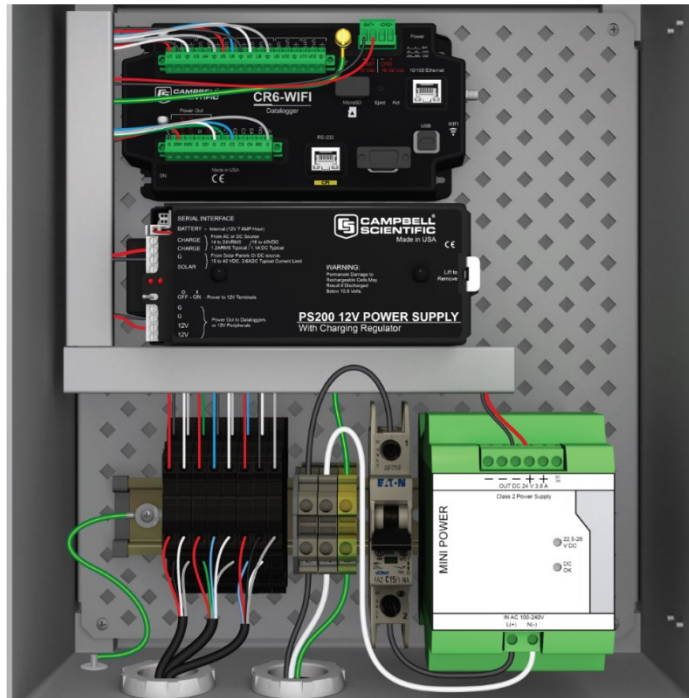


FIGURE B-11. Attaching external wiring

Appendix C. Mounting kits

C.1 Hinged enclosure stack mounting kit overview

The Hinged Enclosure Stack Mounting Kit is used to raise a component 7.62 cm (3 in) above the surface of the backplate, allowing a second component to be mounted under the first. This is beneficial when an enclosure nears its holding capacity of components. The stack mounting kit is hinged, allowing easy access to the lower component during wiring or during maintenance. For example, [FIGURE C-1](#) (p. 40) and [FIGURE C-2](#) (p. 41) show two typical uses of the stack mounting kit.

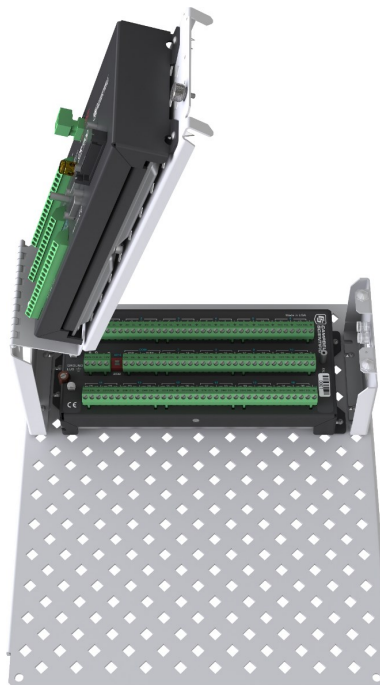


FIGURE C-1. Mounting a CR1000X above an AM16/32B (hinge open)

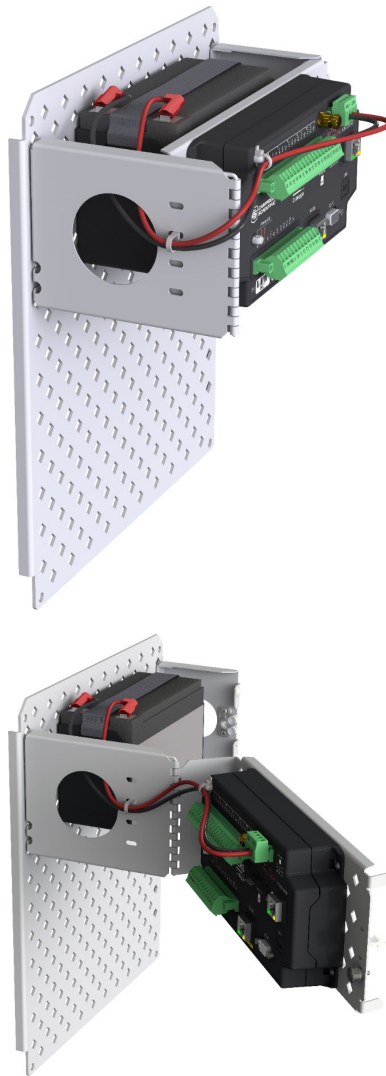


FIGURE C-2. Mounting a CR6 above a BP7 with the hinge closed and with the hinge opened

The Hinged Enclosure Stack Mounting Kit consists of a hinge plate, hinge pin, two legs, four grommets, and four screws (FIGURE C-3 (p. 42)). The component to be raised is mounted directly to the hinge plate using the grommets and screws. The plate has the same half-inch diamond grid pattern for the grommets found in Campbell Scientific enclosures. This allows the raised area to be tailored to the component size. FIGURE C-4 (p. 42) shows a fully assembled stack mounting kit without any components.

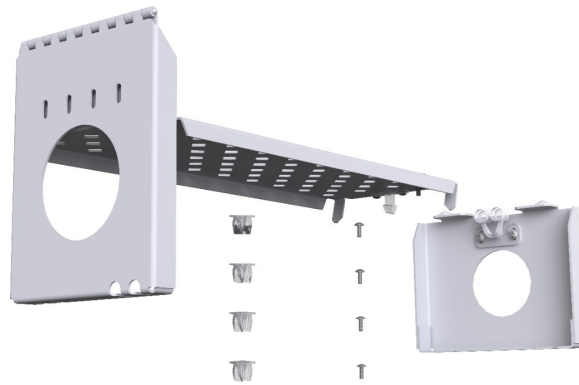


FIGURE C-3. Hinged Stack Mounting Kit components



FIGURE C-4. Hinged Stack Mounting Kit

C.2 Hinged enclosure stack mounting kit installation

1. Determine the spacing needed between the two legs and which holes on the backplate will be used to mount the stack mounting kit.
2. Secure the legs to the backplate using screws and grommets. Mount the stack mounting kit so the hinge is positioned on the left (or top, if mounting the kit vertically). If a component is to be mounted under another and shares the same mounting holes as the leg, mount the pieces in the following order: backplate, grommet, leg, component, screw.
3. Install the lower component onto the backplate using screws and grommets. Connect any required wiring.
4. Insert grommets into the hinge plate where required for the component to be mounted on the hinge plate.
5. Place the top component into position on the hinge plate, and then secure it with screws.

6. Close the open end of the hinge plate and secure it with the thumb screw. Connect any required wiring.

NOTE:

When wiring the component mounted on the hinge plate, always route the wires from right to left, and then over the hinge. This allows the hinge to be opened without putting stress on any wiring. Holes are provided in the leg to secure the wiring with zip ties.

C.3 Enclosure leg stack mounting kit overview

The Enclosure Leg Stack Mounting Kit is used to raise a component 7.62 cm (3 in) above the surface of the backplate. This is beneficial when an enclosure nears its holding capacity of components. Using the stack mounting kit allows one component to be stacked above another, saving space in the enclosure. For example, [FIGURE C-5](#) (p. 44) and [FIGURE C-6](#) (p. 45) show a CR1000X mounted above an AM16/32B. Any component mounted below a component being stacked must be fully wired prior to installing the top component. Note that in this example, the four grommets used to mount the CR1000X to the extension legs use the same hole pattern as the CR1000X.

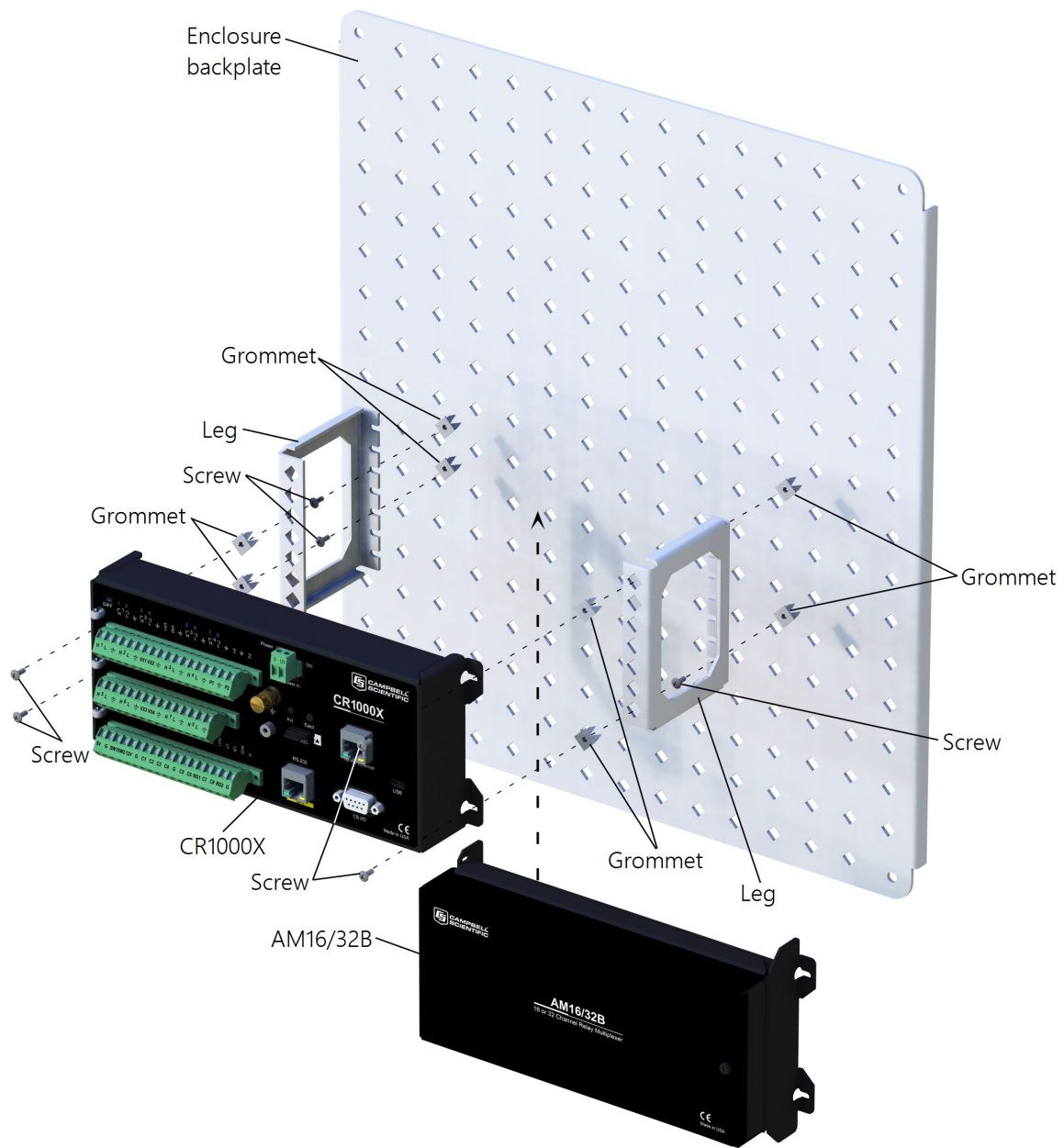


FIGURE C-5. Exploded view of a CR1000X and AM16/32B mounted on a Stack Mounting Kit

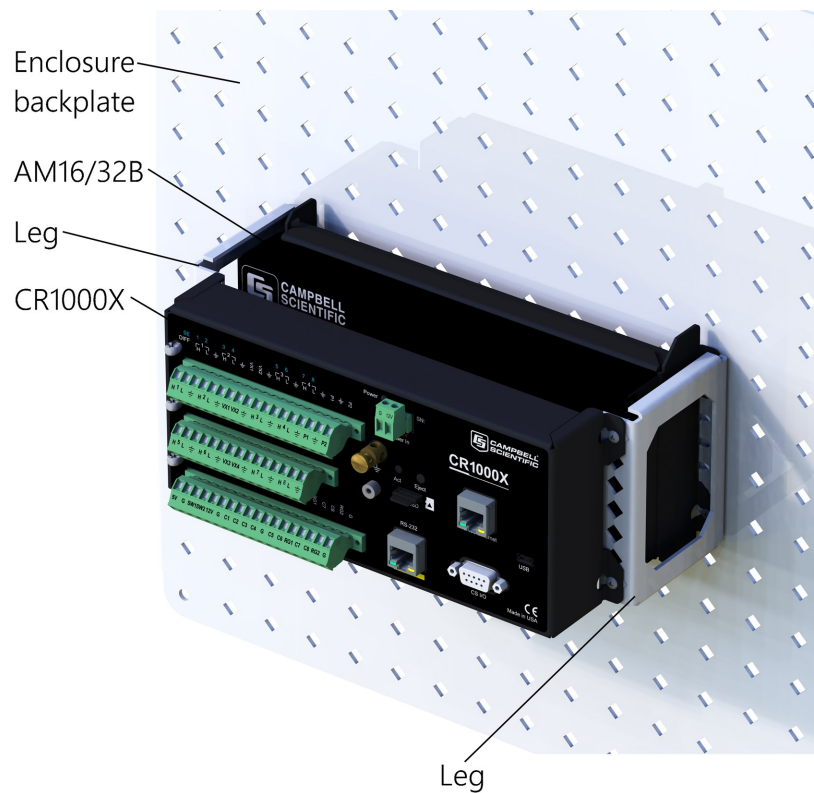


FIGURE C-6. Assembled view of CR1000 and AM16/32B mounted on a Stack Mounting Kit

The Enclosure Leg Stack Mounting Kit consists of two legs, eight grommets, and eight screws (FIGURE C-7 (p. 45)). The component to be raised is mounted directly to the two legs using the grommets and screws. This allows the raised area to be tailored to the component size. FIGURE C-8 (p. 46) shows a CR1000X mounted to the legs.

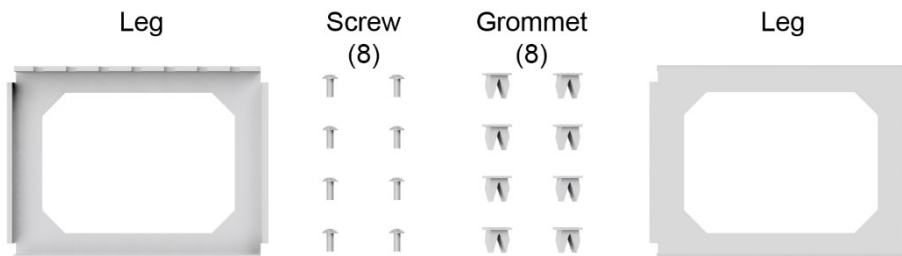


FIGURE C-7. Contents of Enclosure Leg Stack Mounting Kit

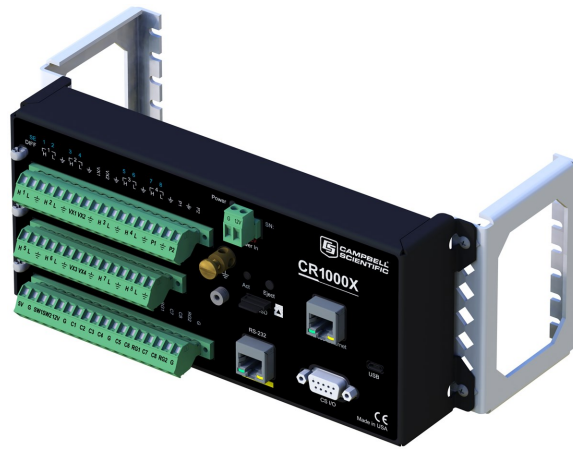


FIGURE C-8. CR1000X mounted to stack mounting kit legs

C.4 Enclosure leg stack mounting kit installation

1. Determine the spacing needed between the two legs.
2. Secure the legs to the backplate using screws and grommets. If a component is to be mounted under another and shares the same mounting holes as the leg, mount the pieces in the following order: backplate, grommet, leg, component, screw.
3. Fully wire the bottom component before proceeding.
4. Insert grommets into the two legs where required for the component to be mounted on the legs.
5. Place the top component in position and secure it with screws.

Appendix D. Keeping insects out of the enclosure

Campbell Scientific has published an application note regarding how to keep pests away from the equipment. It is found on the Campbell Scientific website (www.campbellsci.com/app-notes) and is called "Keeping Pests Away from Equipment (5-Y)."

Here are three methods from the application note on how to keep insects out of the enclosure.

1. Place moth balls or crystals in enclosures to prevent fire ants, wasps, spiders, and other insects from nesting.

CAUTION:

The fumes of moth balls or crystals could be hazardous. Therefore, enclosures that contain moth balls or crystals should be opened in a well-ventilated area.

2. Put animal ear tags in the enclosure. Some ear tags are treated with an insecticide. Talk with personnel in an agricultural store to determine the best ear tag for controlling the pests in the area. (This technique originated in southern Texas.)
3. Apply petroleum jelly to the enclosure gasket. This discourages ants and other insects from chewing on the gasket.

Limited warranty

Products manufactured by Campbell Scientific are warranted by Campbell Scientific to be free from defects in materials and workmanship under normal use and service for twelve months from the date of shipment unless otherwise specified on the corresponding product webpage. See Product Details on the Ordering Information pages at www.campbellsci.com[↗]. Other manufacturer's products, that are resold by Campbell Scientific, are warranted only to the limits extended by the original manufacturer.


Refer to www.campbellsci.com/terms#warranty[↗] for more information.

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Products shipped to Campbell Scientific require a Returned Materials Authorization (RMA) or Repair Reference number and must be clean and uncontaminated by harmful substances, such as hazardous materials, chemicals, insects, and pests. Please complete the required forms prior to shipping equipment.

Campbell Scientific regional offices handle repairs for customers within their territories. Please see the back page for the Global Sales and Support Network or visit www.campbellsci.com/contact  to determine which Campbell Scientific office serves your country.

To obtain a Returned Materials Authorization or Repair Reference number, contact your CAMPBELL SCIENTIFIC regional office. Please write the issued number clearly on the outside of the shipping container and ship as directed.

For all returns, the customer must provide a "Statement of Product Cleanliness and Decontamination" or "Declaration of Hazardous Material and Decontamination" form and comply with the requirements specified in it. The form is available from your CAMPBELL SCIENTIFIC regional office. Campbell Scientific is unable to process any returns until we receive this statement. If the statement is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

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.com. 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

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations.
- 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, 6 meters (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.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

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.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.
- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

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.



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