INSTALLATION GUIDE

System

SunSentry

Solar Operational Meteorological Monitoring Station

Revision: 04/2025

RELIABLE MONITORING SINCE 1974

Campbell SCIENTIFIC®

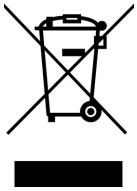
Please read first

About this manual

Please note that this manual was produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this. 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 from Campbell Scientific it will be suitable for use in your country*.

Reference to some radio transmitters, digital cell phones and aerials (antennas) 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.

Recycling information for countries subject to WEEE regulations 2012/19/EU



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, per The Waste Electrical and Electronic Equipment (WEEE) Regulations 2012/19/EU. Campbell Scientific 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 support, please contact Campbell Scientific, or your local agent.

Table of contents

1. Introduction

This document shows the basic steps required to install the SunSentry. More detailed installation information is provided in customized and project specific wiring diagrams, register maps, as well as standard sensor manuals and mount manuals.

The stations are typically installed in the following order:

1. Pile
2. CM400 tower
3. Main met enclosure
4. AC power box
5. Solar panel
6. Crossarm
7. Junction boxes

Tools list:

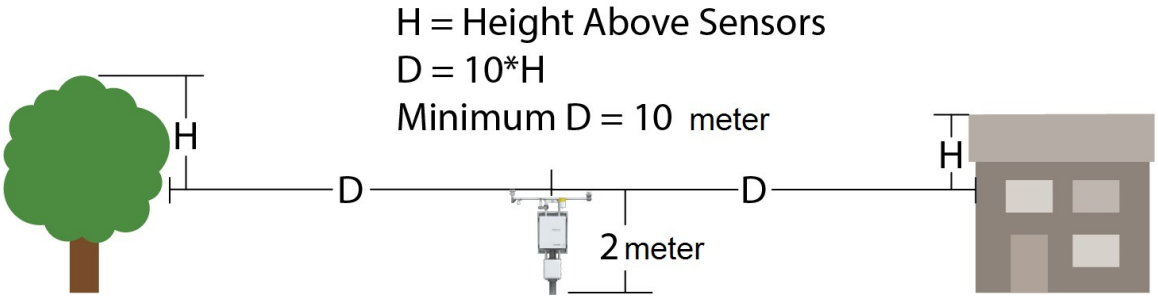
- Compass
- Ladder (recommended)
- Tape measure

> NOTE:
> A second set of wrenches is useful for components that have nuts and bolts combinations.

- Hex key set (US and Metric)
- Screwdrivers large and small, Phillips and straight
- Wire strippers, wire cutters, etc.
- Large hammer
- Zip ties

2. Siting

Locate the SunSentry away from obstructions such as trees and buildings. The horizontal distance from an obstruction should be at least ten times the height of the obstruction. No obstacles should be between the course of the sun and the pyranometers.

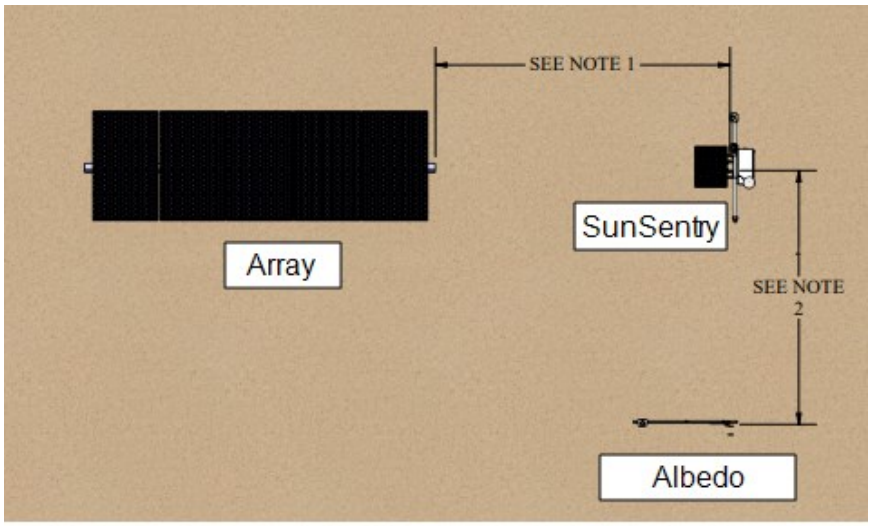


3. Installation procedures

This section provides installation procedures for the instrumentation mounts, enclosures, solar panels, and sensors.

3.1 Driven piles

The SunSentry makes use of available driven piles to mount the enclosures and sensors. The size of compatible piles was chosen to correspond with those commonly used in the construction of solar power plants. The main sensor suite mounts to a driven pile using the CM400 Tower Mount with Crossarm. A separate driven pile is used to mount the optional albedo sensor using the CM410 mount. The following shows the layout of these driven piles.



1. The distance must be enough so that the array does not shade any part of the tower.
2. The distance must be enough so that the tower does not shade any part of the albedo setup or ground.

Refer to Albedo (p. 23) for suggested height of the albedo pile.

Campbell Scientific recommends the use of W6x12 piles.

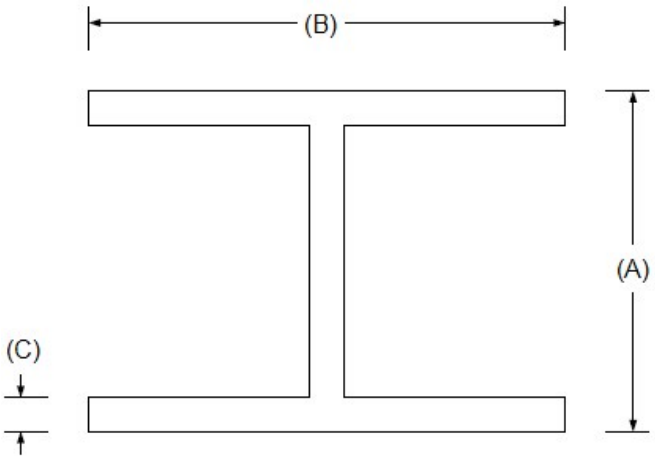


Figure 3-1. H pile dimensions

The CM400 tower mounts to all W6 H-piles or other H-piles with dimensions of:

Section Depth (A in Figure 3-1 [p. 3]): 14 to 19 cm (5.5 to 7.5 in)

Flange Width (B in Figure 3-1 [p. 3]): 7.6 to 12.7 cm (3 to 5 in)

Flange Thickness (C in Figure 3-1 [p. 3]): < 1.3 cm (0.5 in)

For optimal installation that does not require drilling the pile, drive the pile as shown in orientation A (in Figure 3-2 [p. 4]). Orientation B (in Figure 3-2 [p. 4]) will also allow installation of

the CM400 mounting structure. Mounting in orientation B (in Figure 3-2 [p. 4]) requires drilling holes and using ½-13 X 2 inch bolts that must be supplied separately. The pile must have a flange width adequate to accommodate the drilled holes.

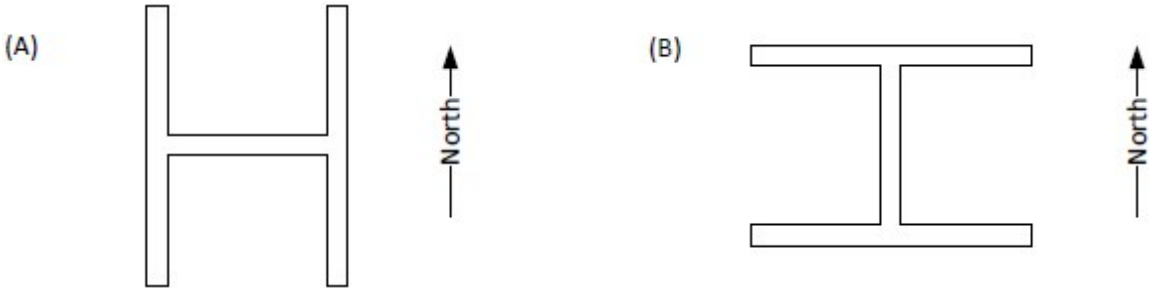


Figure 3-2. H-pile orientation

When using the default mounts provided by Campbell Scientific, the global horizontal irradiance (GHI) pyranometer and all-in-one weather sensors are held at a height approximately 15 cm above the crossarm. As a rough guide, to achieve the sensor mounting heights recommended in Table 3-1 (p. 5), the pile exposure should be as follows:

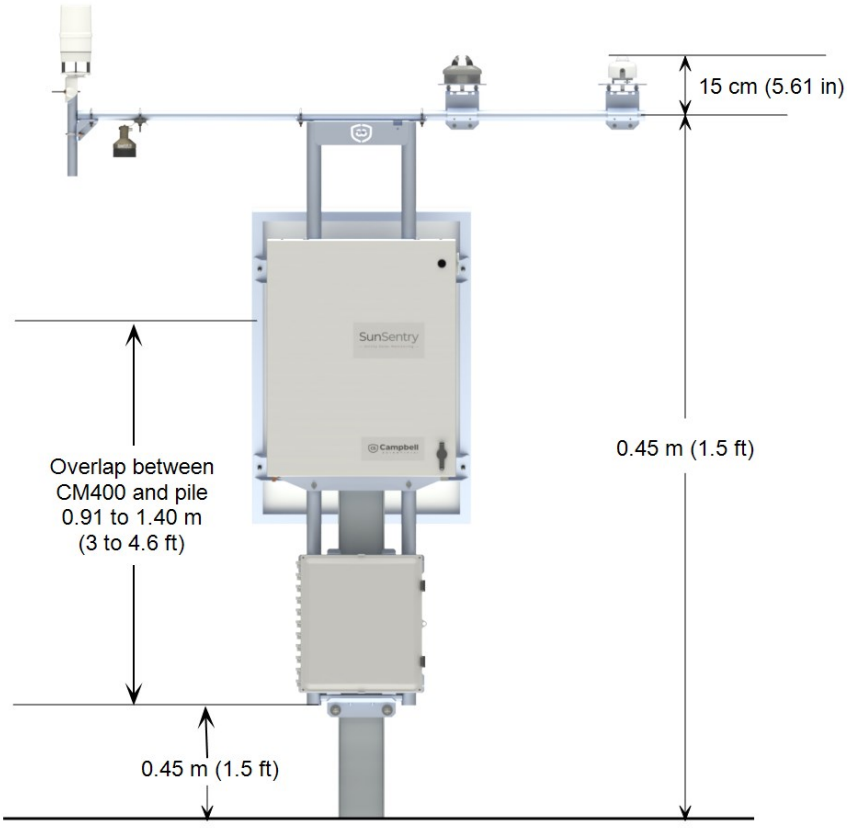
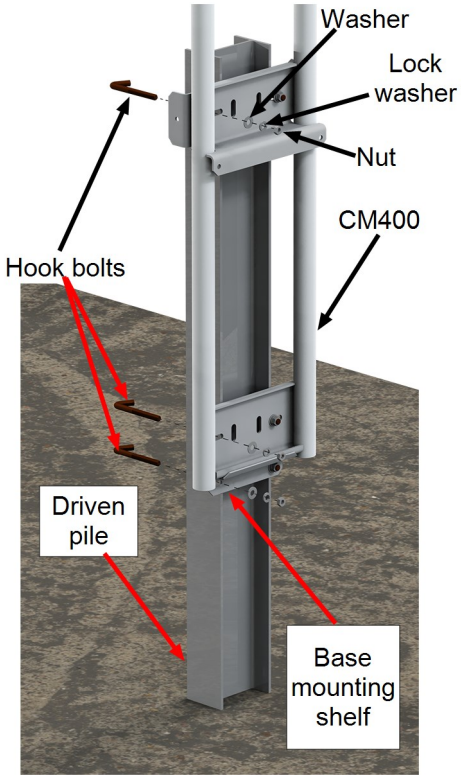


Table 3-1: Required pile exposure	
Sensor mounting height	Pile exposure
2.5 m (8.2 ft)	1.37 to 1.86 m (4.5 to 6.1 ft)

3.2 CM400 mounting structure

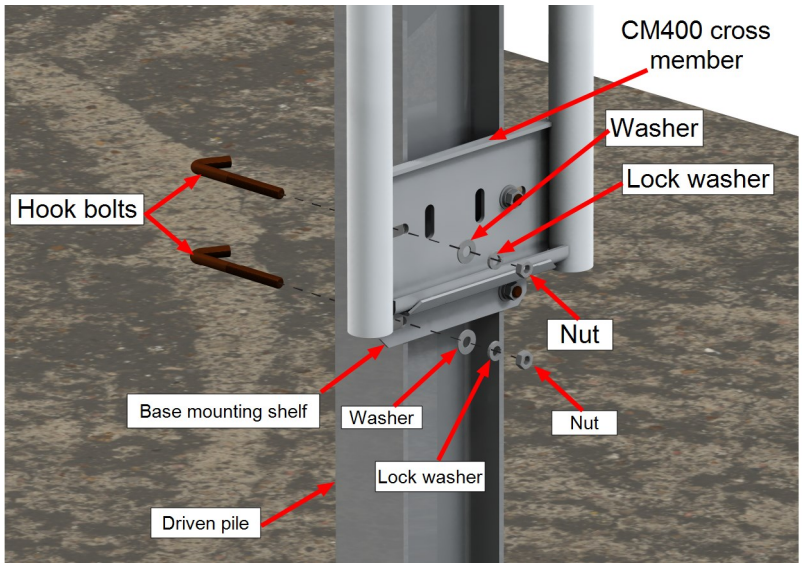
1. Locate the base mounting shelf and use the hook bolts, washer, and nuts to mount the CM400 on the polar (north in northern hemisphere, south in southern hemisphere) side of the pile at a height given by the formula:

   Desired height of sensors – 2.15 m = Bottom of shelf

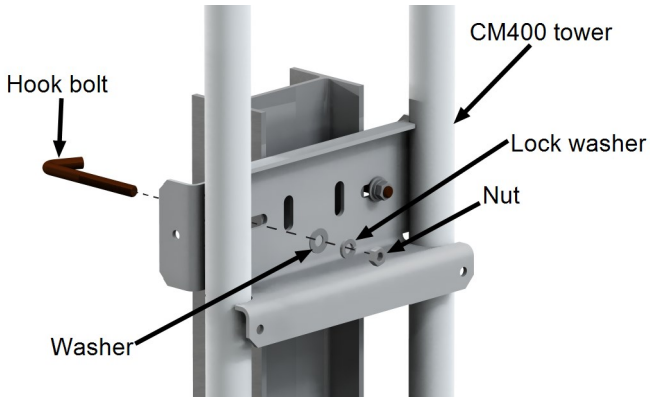


2. Level and center the shelf on the driven pile. The torque applied to the nuts should be 20 to 27 N·m (15 to 20 lbf·ft).

3. Rest the base of the CM400 on the shelf and loosely secure the CM400 using one of the hook bolts, washers, lock washers, and nuts. Ensure the CM400 cross members for attachment to the driven pile are flush with the driven pile.

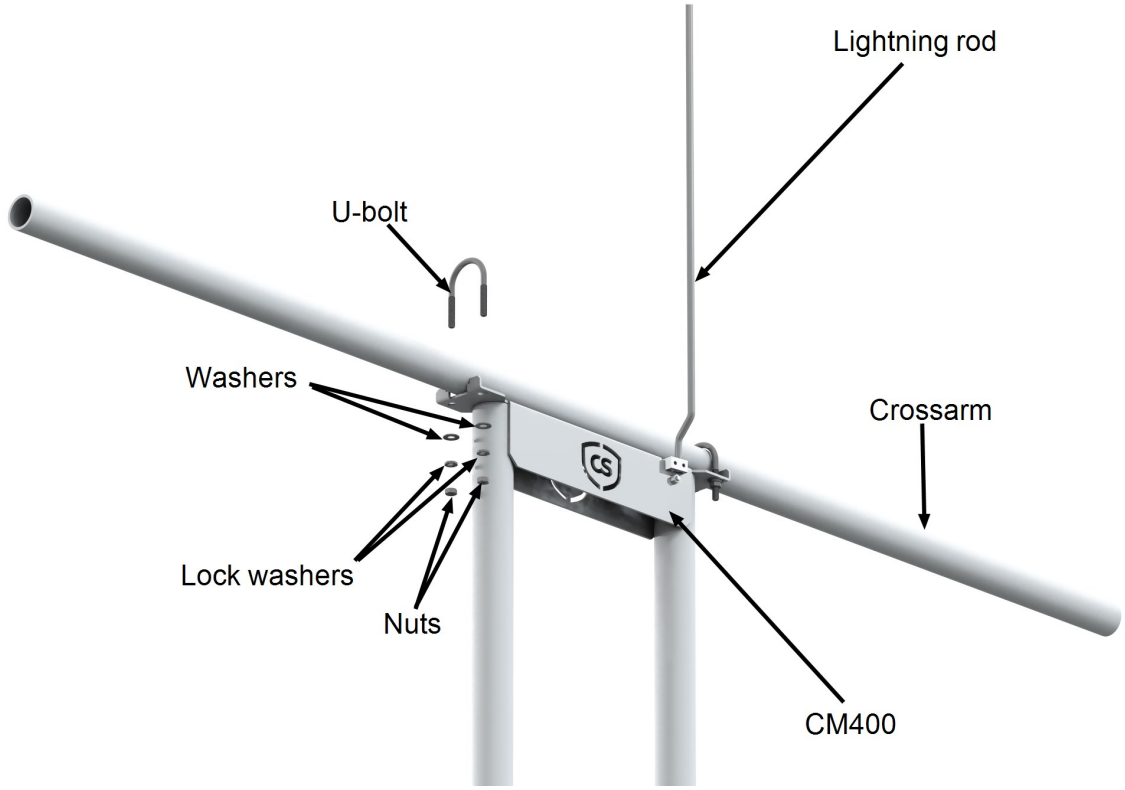


4. Use a spirit level to ensure the CM400 tower is installed vertically and install the remaining three hook bolts with washers and nuts to hand tight. Tighten all the nuts on the hook bolt to a torque of 47 to 54 N·m (~35-40 ft-lbf).



3.3 Crossarm

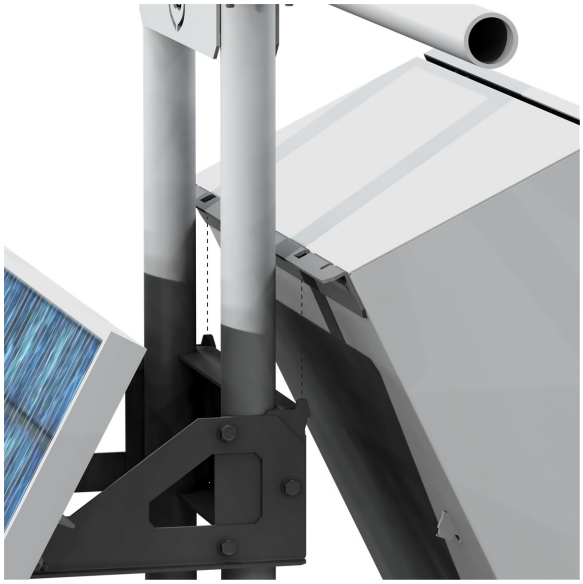
Install the included crossarm on the top of the CM400 using the supplied U-bolts, washers, and nuts. The crossarm should be centered on the top of the CM400 and extend equal distances in the east/west direction.



3.4 Main met enclosure

1. Lift the enclosure so it rests and hangs with the enclosure mounting hooks securely through the slots in the enclosure mounting bracket.

   > NOTE:
   > This step is more easily done by two people.



2. Check that the enclosure mounting hooks are securely embedded through their slots at both locations.
3. Secure the bottom of the enclosure mount to the CM400 by tightening the bolts to 12 to 14 N·m (~9 to 11 lbf·ft).

3.4.1 Battery (UPS version only)

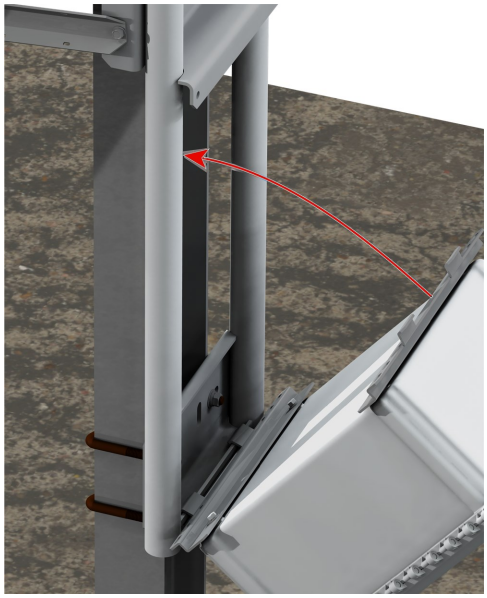
The SunSentry is shipped with the battery bracket mounted to the backplate of the main met enclosure.

1. Place the PS3 battery in the upper portion of the battery bracket in the main met enclosure.
2. Secure the PS3 battery to the bracket using bracket plate and screws.
3. Place the PS4 battery in the lower portion of the battery bracket in the main met enclosure.
4. Secure the PS4 battery to the bracket using bracket plate and screws.
5. Connect the batteries in series (see Battery connections (UPS version only) [p. 30]).

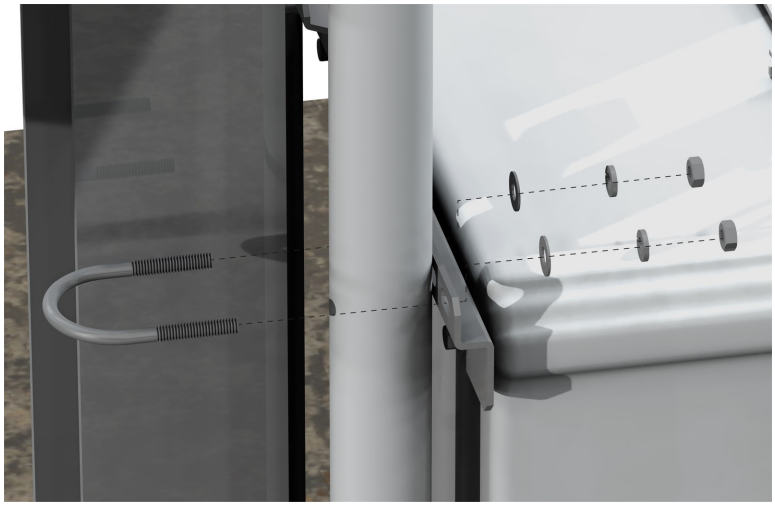
3.5 AC pull box

If the system includes an AC pull box, install the enclosure beneath the Met Enclosure with the following steps:

1. Place the lip of the mount attached to the bottom of the enclosure securely within the CM400.



2. Secure the position of the enclosure with one of the two U-bolts provided.

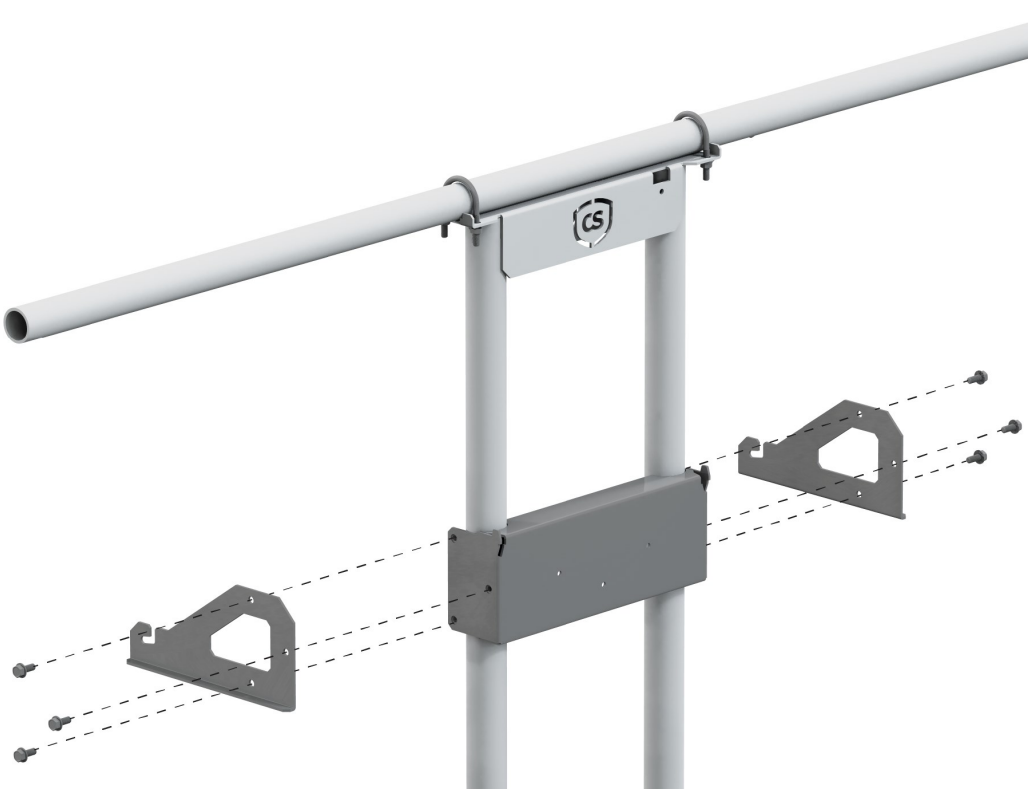


3. Install the second U-bolt and tighten both U-bolts to a torque of 6 to 7 N·m (~4.5 to 5 lbf·ft).

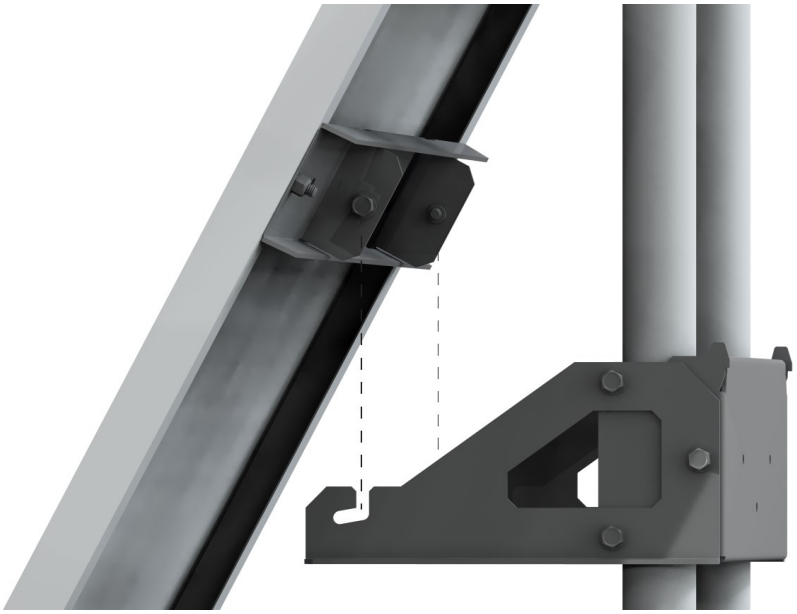
3.6 Solar panel (optional with UPS)

1. Attach the support arms to a solar panel bracket.

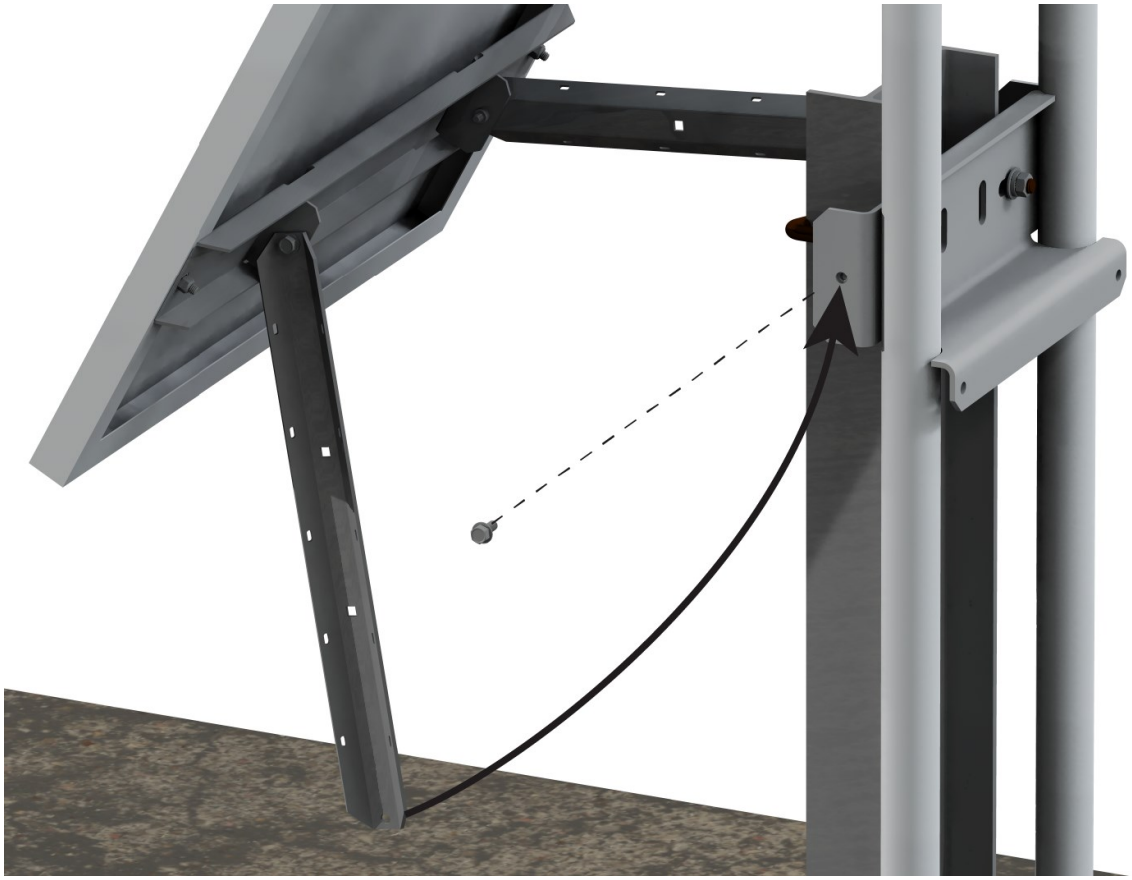
2. On the top bracket, screw in two screws into the threaded holes. Only engage several threads and leave enough of the screw shank exposed to hang the solar panel.
3. Use the serrated flange hex head screws to mount the hangers onto the CM400.



4. Hang the solar panel by the bolts on the solar panel bracket.



5. Secure the support arms to the CM400 bracket.



6. When the solar panel is securely held in place, tighten all screws to 14 to 17 N m (~11 to 12.5 lbf ft).

3.6.1 Solar panel angle

The support arms have several different lengths they can be assembled. The available mounting angles are: 30, 45, and 60. Table 3-2 (p. 13) suggests optimal angles for the solar panel through a range of latitudes.

Table 3-2: Solar panel tilt angle[1]

Site latitude (N or S)	Tilt angle
0° – 27°	30°
28° – 42°	45°
>43°	60°

[1]From *Design Aids for Small PV Power Systems*, Solorex Corp.

Figure 3-3. Solar panel at 60° angle

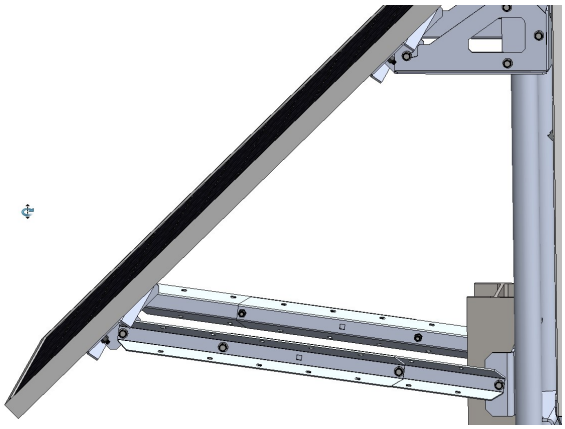


Figure 3-4. Solar panel at 45° angle

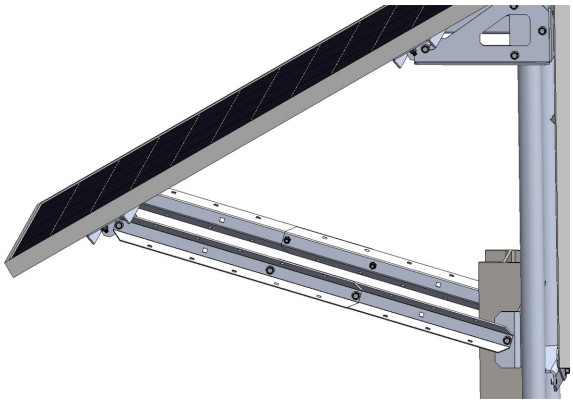


Figure 3-5. Solar panel at 30° angle

3.7 Sensors on main CM400 tower

Often an all-in-one weather sensor (ClimaVue 40), irradiance (MS-80SH, SPN1), rain gauge, hail sensor, and snow depth sensor are mounted to the main CM400 tower with the crossarm.

> NOTE:
> The sensor suite selected for each SunSentry system is flexible to suit the needs of each project. A full list of sensors currently supported by the SunSentry can be found at www.campbellsci.com/sunsentry. The following sections highlight recommended sensors for a SunSentry deployment, along with high-level details that are important to consider. Refer to the sensor manuals for more information about the sensors.

> NOTE:
> The sensors should have been configured for this SunSentry system prior to installation. The Modbus address, SDI-12 addresses, and communications protocol settings must match the

configuration settings in the user interface. Refer to the SunSentry Operations and Maintenance manual available at www.campbellsci.com/sunsentry for more information.

3.7.1 All-in-one weather sensor

1. Attach the cable to the connector. Only hand tighten the connectors.

   CAUTION:
   Hand tighten only! Using tools to tighten the connectors can permanently weld the stainless steel connectors together.

2. Mount the sensor to the mounting tube using the CM221 bracket and the 3659 pipe or the 17387 mounting kit. Use the V-bolt, washers, and nuts (Figure 3-6 [p. 15]) to tighten the V-bolt nuts until hand-tight.

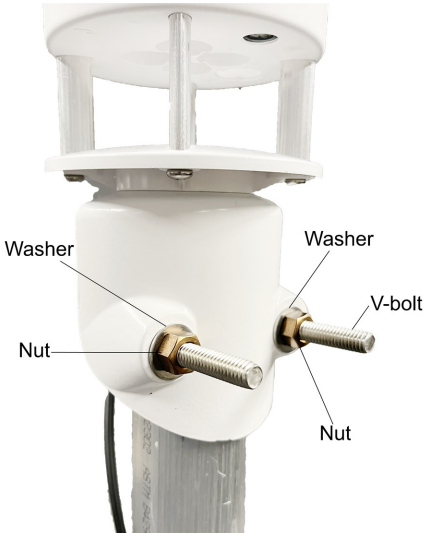
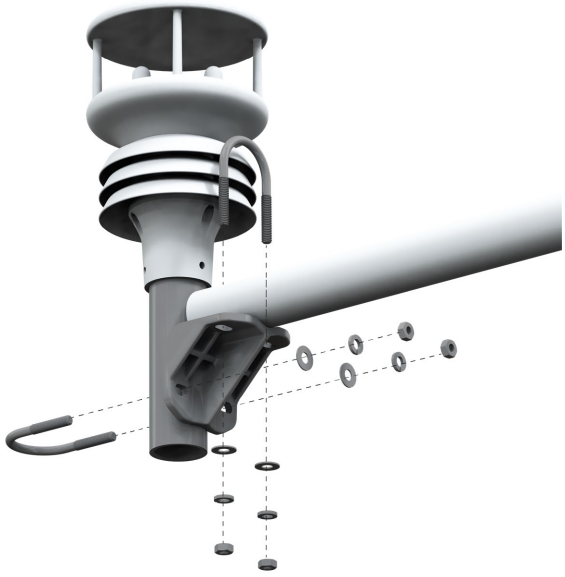


Figure 3-6. ClimaVue 40 mounted to a pole with V-bolt and nuts

CAUTION:
Do not over-tighten V-bolt as it will cause the plastic to break.

3. Attach the mounting tube to the crossarm.



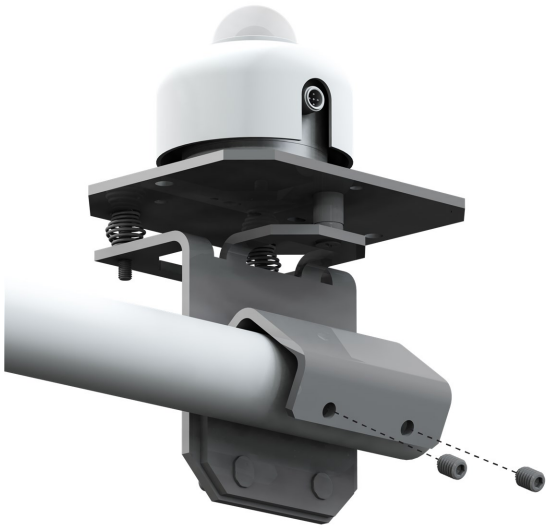
4. Orient the ClimaVue 40 so the **N** points to magnetic north (Figure 3-7 [p. 16]). Refer to the following:
   www.geosats.com/magdecli.html or
   www.ngdc.noaa.gov/geomag/declination.shtml.

Figure 3-7. N on the ClimaVue 40

> NOTE:
> Sensors are leveled after all the equipment is installed because the installation process can alter leveling. See Level sensors (p. 22) for more information.

3.7.2 Irradiance sensor

1. Connect the cable to the irradiance sensor.
2. Mount the CM256 mounting bracket to the crossarm.
3. Secure the irradiance sensor to a CM256 mounting bracket.



> NOTE:
> Sensors are leveled after all the equipment is installed because the installation process can alter leveling. See Level sensors (p. 22) for more information.

3.7.3 Rain gauge (not required if using the ClimaVue 40)

1. Loosen the thumbscrews holding the funnel on the bucket and then take the funnel off the top of the bucket.
2. Remove the small rubber band securing the tipping bucket, which protects it during shipping.

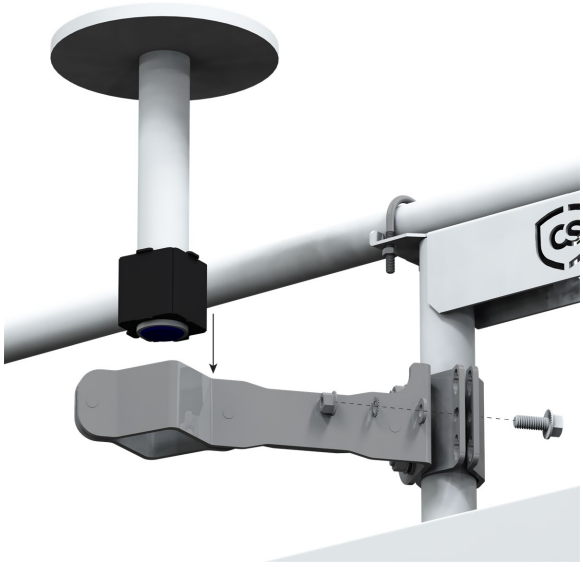
3. Use the hose clamps to mount the rain gauge to a pole on the CM400.

4. Seat the funnel back onto the rain gauge, and push the funnel all the way down until it is fully seated on the main body.
5. Hand tighten the thumb screws (if present) to secure the funnel to the body.

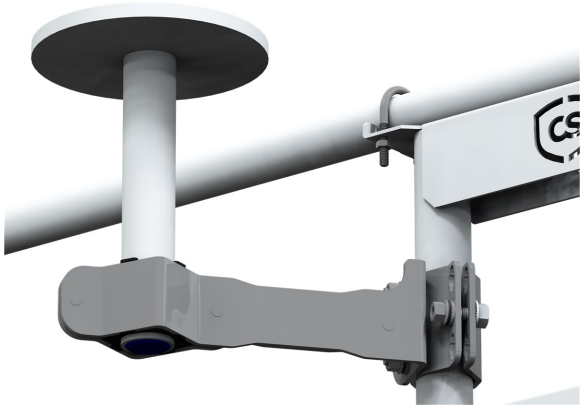
> NOTE:
> Press either end of the bucket down against its stop to make sure the bucket is NOT hung up in the center before hand tightening the thumb screws.

3.7.4 Hail sensor

1. Use the screws, washers, lock washers, and nuts to secure the bracket to a CM400 pole.



2. Place the hail sensor in the bracket.



3.7.5 SnowVue 10 mounting

When mounting the SnowVue 10, the beam angle needs to be considered. Mount the SnowVue 10 so that the face of the transducer is perpendicular to the intended target surface. The SnowVue 10 has a beam angle of approximately 30 degrees, which means that objects outside this 30-degree beam will neither be detected nor interfere with the intended target. Any unwanted target must be outside the 30-degree beam angle.

If not using the CM400 tower, use the following formula and Figure 3-8 (p. 20) to help site the SnowVue 10:

Clearance radius formula:

$CONE_{radius} = 0.268(CONE_{height})$

where

$CONE_{radius}$ = clearance radius in the same measurement units as the $CONE_{height}$

> **NOTE:**
> Because of the difficulty of measuring from the grill itself, most users measure the distance from the target to the outer edge of the plastic transducer housing (Figure 3-9 [p. 20]) and then add 8 mm (0.3 in) to the measured distance.

$CONE_{height}$ = distance from ground surface to the reference point (front grill)

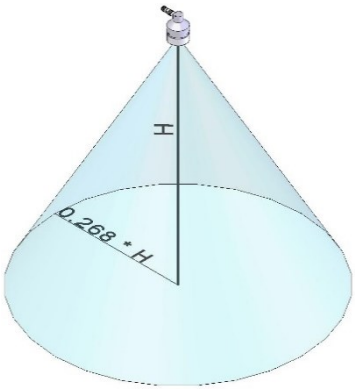


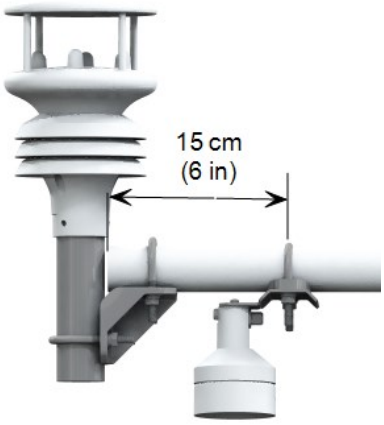
Figure 3-8. Beam angle clearance

> **NOTE:**
> This height is used in the ***Web UI*** for zeroing the measurements.

Figure 3-9. Depth of space from edge of transducer housing to grill

1. Secure the top of the SnowVue 10 to the SnowVue 10 mounting bracket (pn 19517) using the two screws.

2. Place the SnowVue 10 on the crossarm with the center of its U-bolt at 15 cm ±1.3 cm (6-in ±0.5 in) from the end of the crossarm. This placement assumes the crossarm is centered on the driven pile and at a height of 2.34 m (92 in).



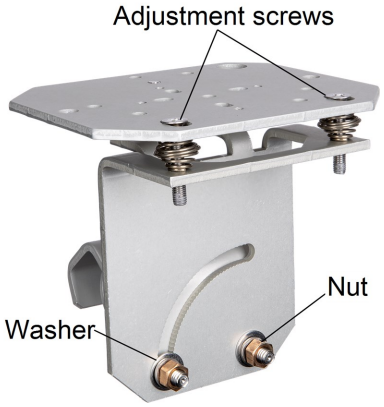
3. Mount the SnowVue 10 to the crossarm using the U-bolts, washers, and large lock washers.

4. Connect the cable.

3.7.6 Level sensors

The sensors are leveled after mounting all the equipment because equipment installation can affect leveling.

1. Use the sensor bubble level to level each irradiance sensor using the adjustment screws of the CM256 mount.



2. Verify CM256 mounting hardware is firmly tightened, and that the mounting bracket is at the desired angle.
3. For the ClimaVue 40, use a torpedo level or the bubble level underneath the sensor to level it (Figure 3-10 [p. 23]). The angle of the instrument mount may need to be adjusted if the mast is not vertical. Shims can be added between the top of the mast and the bottom of the ClimaVue 40 to achieve level. The sensor must be within ±2° of dead level (0, 0) in both the X and Y directions to accurately measure rainfall and solar radiation. The ±2° can be confirmed by viewing the tilt values on the ***Web UI*** **Modbus Map** screen (**Register 42043 – Weather1_ClimaVue40_XOrientation** and **Register 42045 - Weather1_ClimaVue40_ YOrientation**).

Figure 3-10. Bubble level on the ClimaVue 40

4. Once level, tighten the V-bolt nuts by hand until hand-tight, then gently tighten with a wrench and recheck the level.

> **CAUTION:**
> Do not over-tighten V-bolt as it will cause the plastic to break.

3.8 Albedo

Albedo measurements are a supported feature of the SunSentry system (sensors and accessories sold separately). This measurement is made using two pyranometers, typically a pair of class A or class C sensors. One pyranometer faces upward, and one faces downward. The CM275 Albedometer Mounting Stand co-locates both sensors on a single bracket that is mounted to the CM410 Pile Mount Crossarm for Albedo are or to another horizontal crossarm such as the CM206.

Mount the albedo away from obstructions that could block or otherwise interfere with incoming sunlight. Similar to the CM400 (SunSentry met station mount), the CM410 (Pile Mount Arm for Albedo) is designed to mount a remote albedometer to a separate driven pile (e.g., W6x12). Refer to Driven piles (p. 2) for information about orientation and recommended site placement.

The following table and figures show the suggested pile and mounting plate heights. The top of the pile should be at least 1.09 m (43 in) and less than 1.58 m (62.5 in) above flat ground. Figure 3-12 (p. 24) shows the ideal mid-range of 1.34 to 1.42 m (53 to 56 in).

Table 3-3: Albedo mounting height		
Albedo height m (ft)	Pile height m (ft)	Plate height m (ft)
1.50 (4.92)	1.09 (3.58)	0.67 (2.21)
1.75 (5.74)	1.42 (4.67)	0.92 (3.03)
2.0 (6.56)	1.58 (5.21)	1.17 (3.85)

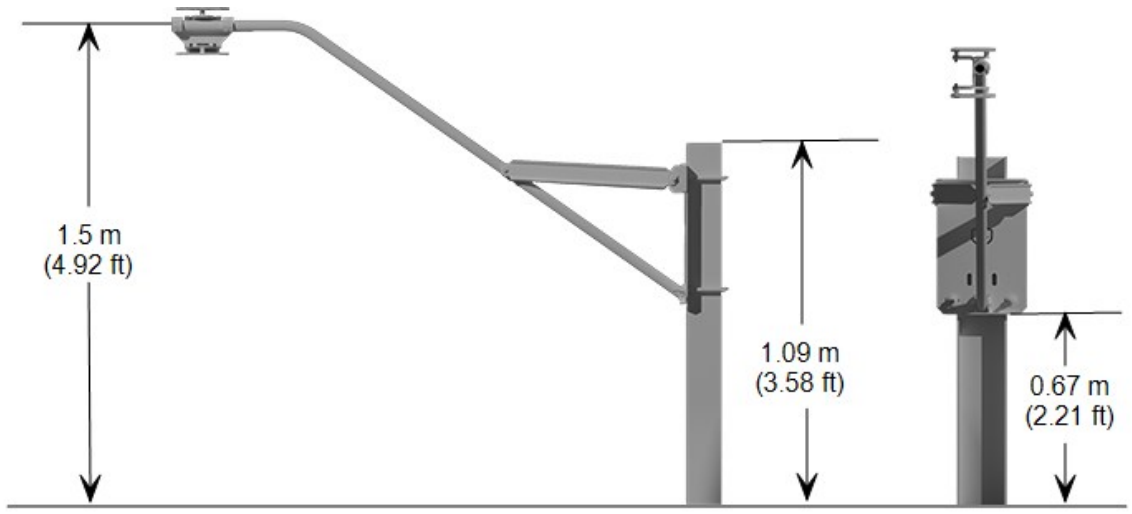


Figure 3-11. 1.5 meter albedo height

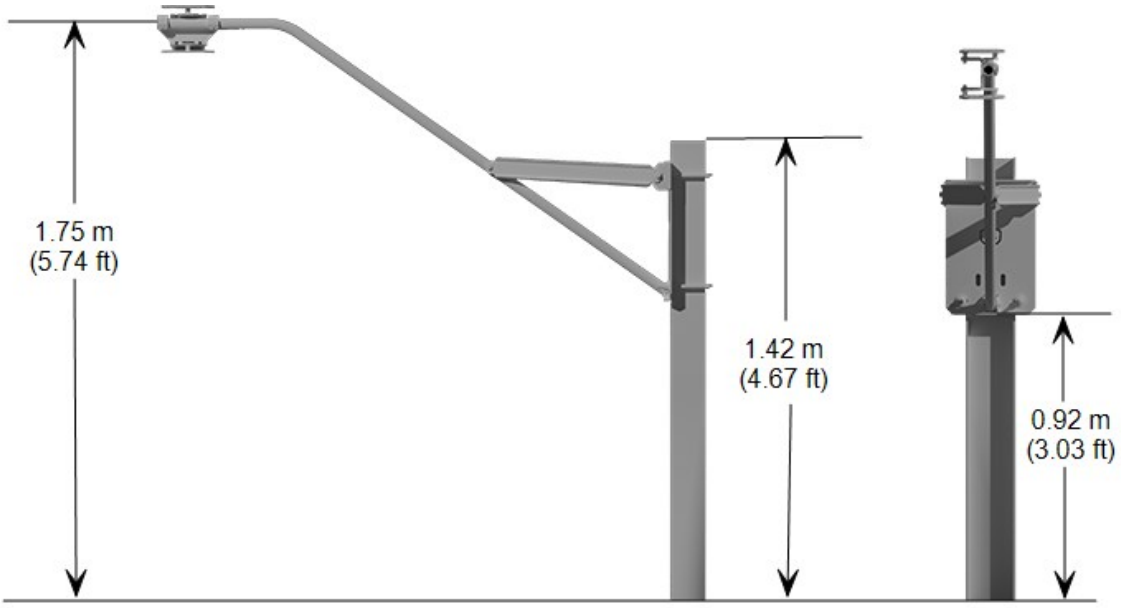


Figure 3-12. 1.75 meter albedo height

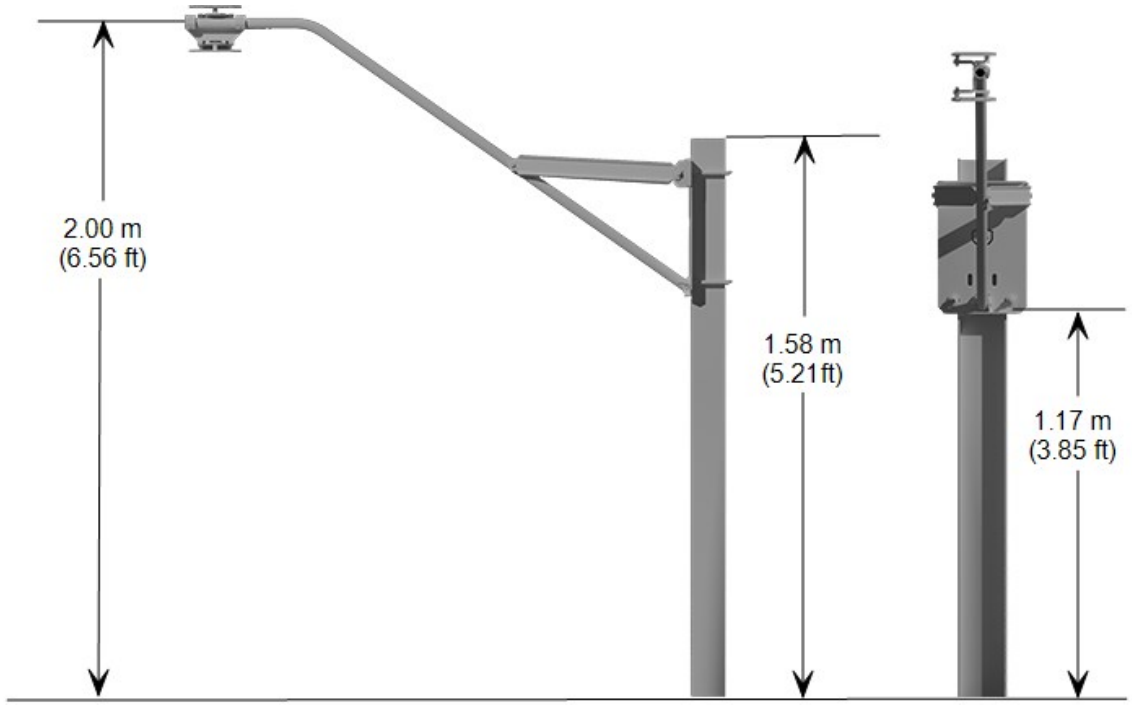
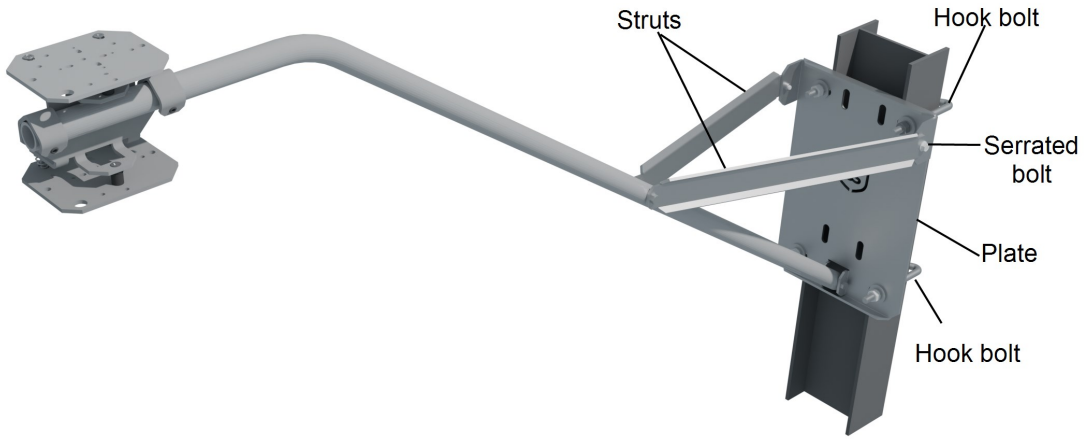


Figure 3-13. 2 meter albedo height

Mounting procedure:

1. Mount plate to pile using hook bolts. Ensure vertical edges of plate are plumb. Bottom of plate should be 28 to 44 inches above the ground for the installed albedo height to be within the industry recommended height of 1.5 to 2 meters (59 to 78.7 inches) above the ground. Tighten nuts to 15 to 20 ft-lb initially.



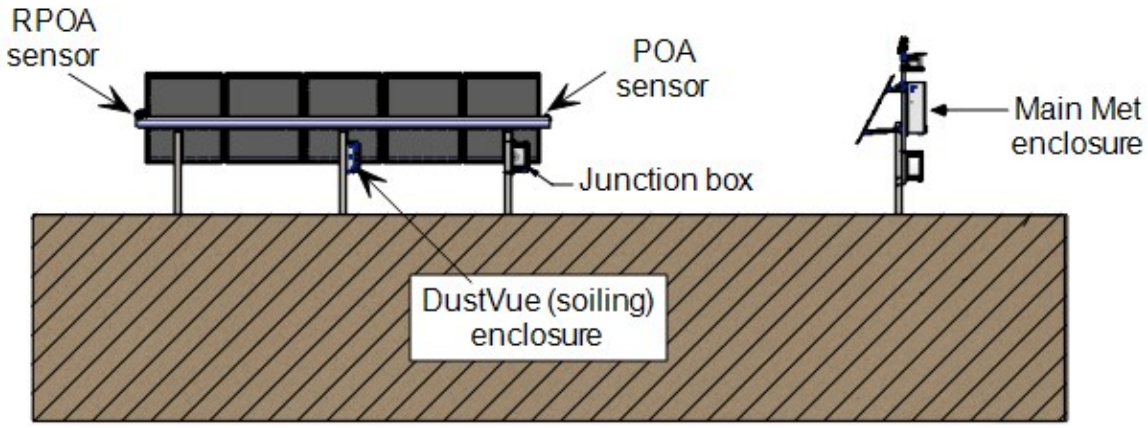
2. Loosely install struts using serrated bolts, threaded only partway to allow strut rotation.

3. Install the arm to plate flanges using a long bolt and nuts. Loosely tighten nuts, ensuring that the arm can freely rotate.
4. Attach the arm to the struts using second long bolt and nuts. Loosely tighten nuts to allow adjustment of arm. Distal end of albedo pipe should be approximately horizontal.
5. Tighten all bolts and nuts, ensuring to maintain proper alignment.
6. Mount the sensors on the CM275 bracket. Refer to the sensor manuals for more information.
7. Slide the albedo sensor on the end of the arm and secure it to the arm using the mounting hardware.

8. Route the cables down the arm to the enclosure.
9. Connect the cable wires to the terminal buses inside the enclosure (see RS-485 BUS [p. 34]).
10. Secure the cables to the arm by using cable ties.

3.9 Junction boxes sensors

The optional junction boxes are used to consolidate multiple sensors to a single communications and power cable connected to the main met enclosure. The DustVue soiling sensor, CS241DM back of module sensors, plane of array (POA), and rear plane of array (RPOA) sensors are optional sensors typically connected to terminal blocks in the junction boxes.



NOTE:
While surge protection and isolation are standard features of the SunSentry, some projects may require options to enhance these features.

3.9.1 Soiling assembly

Typically, the DustVue is used for the soiling assembly. The DustVue consists of a DustVue enclosure and two CS241 back-of-panel temperature sensors. A clean and a dirty solar panel are required. The DustVue will work with any photovoltaic (PV) panel up to 700 W. Smaller wattage panels can be used.

1. Mount solar panels used for the soiling measurement in the same plane as production solar panels.
2. Secure the CS241 sensors to the back of the solar panels.

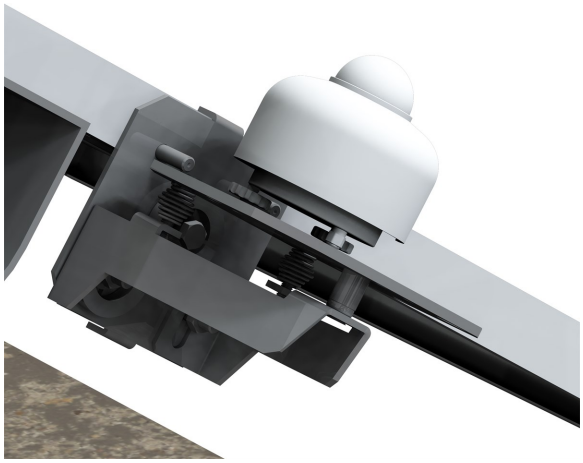
3. Mount the DustVue enclosure.

4. Connect the solar panel and CS241 cables to the proper connector on the DustVue (clean/soilied), and the power/communication cable to the junction box or SunSentry main met enclosure as appropriate.
5. Enable the termination resistor on the CS241 that is furthest away from the junction box.

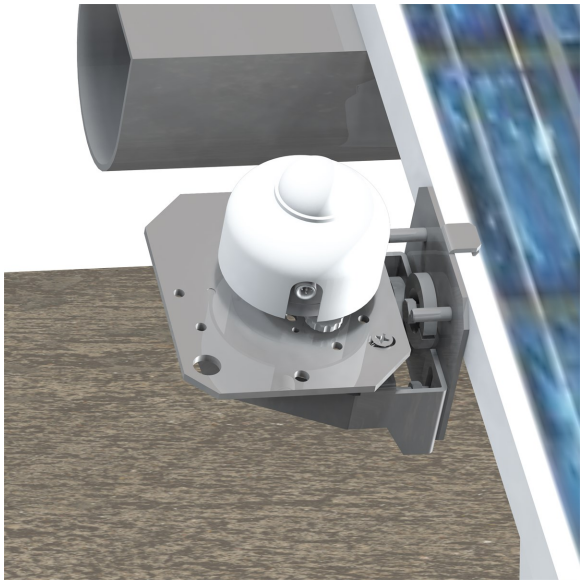
3.9.2 Plane of array (POA) and rear plane of array (RPOA) mounting

Irradiance sensors are used for the optional plane of array (POA) and rear plane of array (RPOA) measurements. Several irradiance sensors and mounts are available. As an example, this section shows the irradiance sensors being mounted directly to the solar panel using the CM268 mounting bracket. Campbell Scientific also offers the CM261 Single-Axis Tracker Mounting Stand and CM266 Unistrut Mount.

1. Mount sensor on CM268 plate.



2. Place CM268 solar panel lip.



3. Tighten nuts to secure the bracket to the solar panel.
4. Use the sensor bubble level to level each pyranometer using the adjustment screws of the CM268 mount.

4. Field wiring

> NOTE:
> Use the *Web UI* to configure the system before making field connections. To use the *Web UI*, the data logger must be connected to a USB port on the computer. The *Web UI* is available at www.linktodevice.com, and can also be accessed using the default RNDIS IP address of 192.168.66.1 as long as that has not been reconfigured. After configuration, the *Web UI* will provide wiring information for connecting the sensors in your SunSentry station.

The following sections provide wiring tables for the field connections. To simplify wiring, the SunSentry uses multi-level terminal blocks with push in connections (Figure 4-1 [p. 30]). Campbell Scientific recommends keeping the cable lengths as short as possible, preferably shorter than 10 m (32 ft). Cable lengths longer than 10 m (32 ft) should use surge protection devices (SPD) to prevent surges from harming the equipment. Refer to Surge protection (p. 36) for more information.

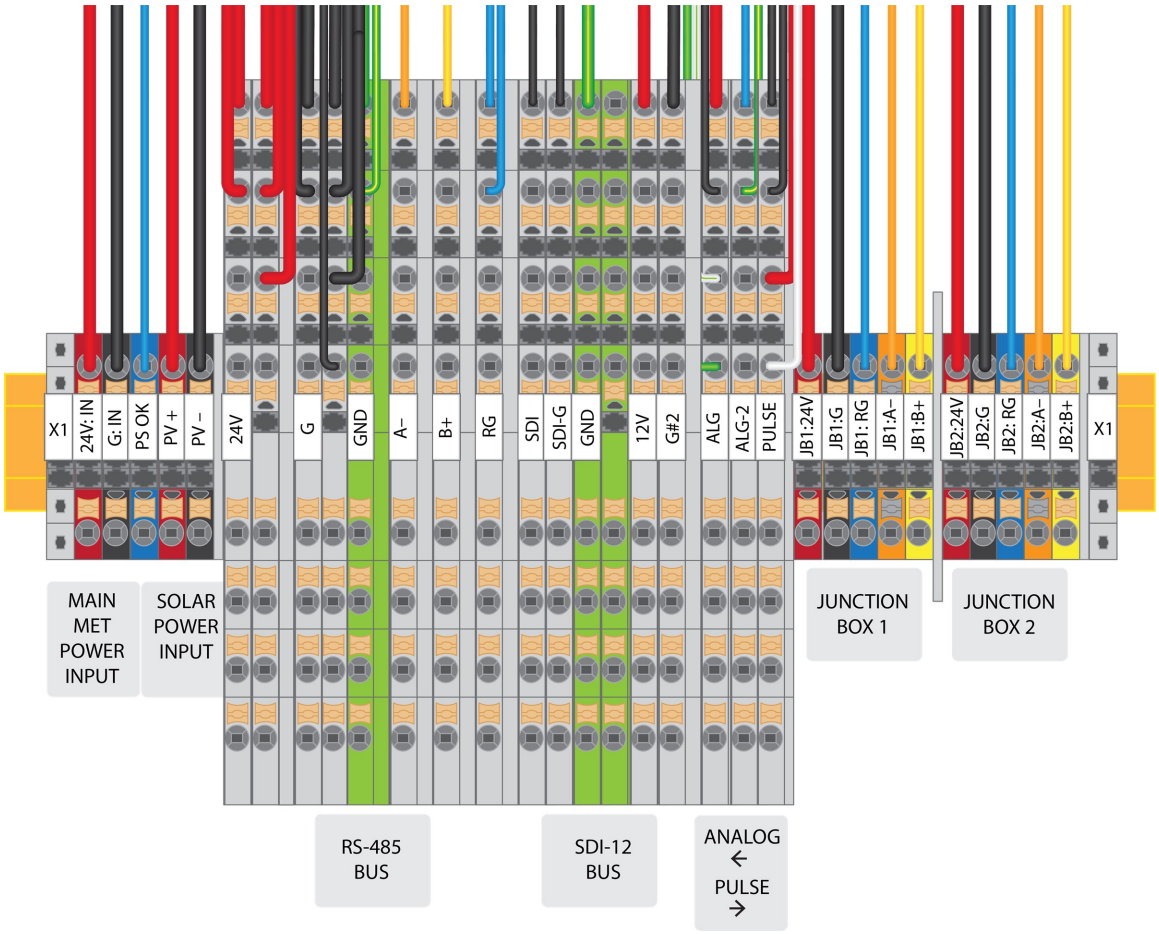


*Figure 4-1. **X1** terminal block housed in the main met enclosure*

4.1 Power inputs

> **NOTE:**
> SunSentry systems without the UPS option require AC or DC power source when commissioning the system. When an AC source is not available at the site, an alternate power source must be provided such as an AC generator or battery pack. A 12 VDC battery can be used temporarily to power the main met station for commissioning. Some sensor functions, such as heaters, will not be activated when using 12 VDC power.

The AC power box and the solar panels connect to the **X1** terminal block and the batteries are connected to the **X2** terminal block. The connections are described in the following sections.

4.1.1 Battery connections (UPS version only)

Figure 4-2 (p. 31) shows the **X2** terminal block. The batteries are wired in a series (Table 4-1 [p. 31]).

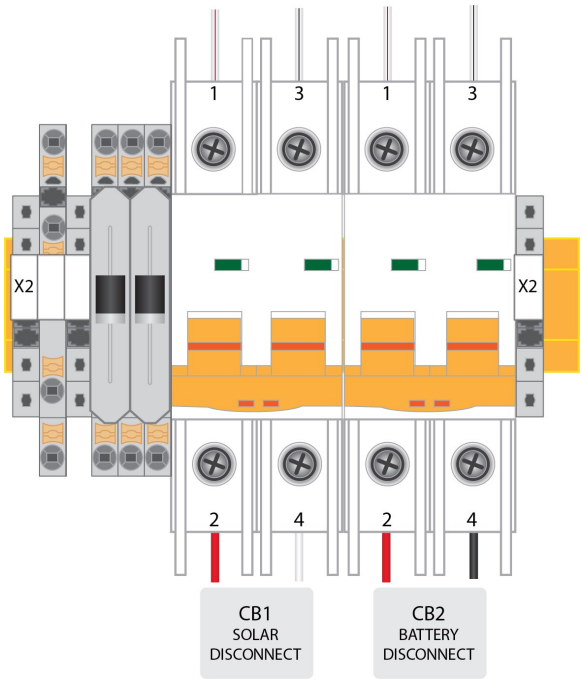


*Figure 4-2. **X2** terminal block*

Table 4-1: Battery connections			
Wire color	PS 3 battery terminal	PS 4 battery terminal	X2 terminal block
Red	+		CB2-2
Red	–	+	
Black		–	CB2-4

4.1.2 POWER INPUT on X1 terminal block

Figure 4-3 (p. 32) shows the power inputs on the **X1** terminal block. Table 4-2 (p. 32), and Table 4-3 (p. 32) provide the wiring. Campbell Scientific supplies the 14 AWG cable for connecting the AC power box to the **X1** terminal block. 14 AWG is the minimum gage wire required for providing 24 VDC to the main met station. If the AC box is not used and power is supplied from some other source, 14 AWG or larger cable can be used.

Power source more that 15 m (50 feet) from the main met station requires 12 AWG or greater wire. Power source more that 30 m (10 feet) from the main met station requires 10 AWG or greater wire.

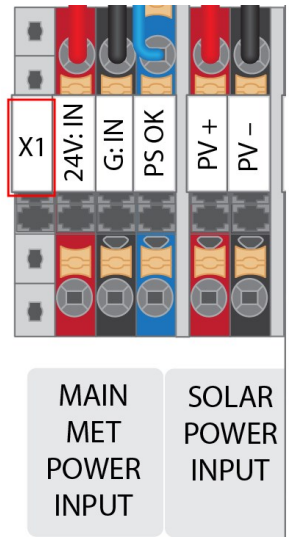


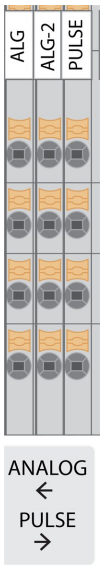
Figure 4-3. Power terminals

Table 4-2: AC power box to main met enclosure connections			
AC power box	Wire color	Function	MAIN MET POWER INPUT terminals on X1 terminal block
24V	Red	Power	24V:IN
G	Black	Ground	G:IN
PS OK	Blue		PS OK

Table 4-3: Solar panel connections			
Solar panel terminal	Wire color	Function	SOLAR POWER INPUT terminals on X1 terminal block
Solar panel +	Red	Power	PV+
Solar panel –	Black	Ground	PV–

4.2 ANALOG/PULSE

The TE525 tipping bucket rain gauge and optional SPN1 sunshine pyranometer are connected to the **ANALOG/PULSE** terminals on the **X1** terminal block in the main met enclosure.



4.3 SDI-12 BUS

Figure 4-4 (p. 33) shows the **SDI-12 BUS** on the **X1** terminal block. SDI-12 sensors such as the SnowVue 10 and the hail sensor connect to the **SDI-12 BUS**.

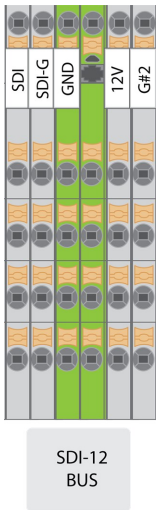


Figure 4-4. SDI-12 BUS

4.4 RS-485, junction box 1, and junction box 2 connections

The RS-485 bus, junction box 1, and junction box 2 are wired to separate C terminals (communication ports) on the data logger. Connections to the X1 terminal block is described in the following sections.

4.4.1 RS-485 BUS

Figure 4-5 (p. 34) shows the **RS-485 BUS** on the **X1** terminal block. Modbus sensors such as the MetSens500 or ClimaVue 40 all-in-one weather sensor, MS-80SH pyranometer (used for GHI), and MS-40SH pyranometer (used for albedo up and down) connect to the **RS-485 BUS**.

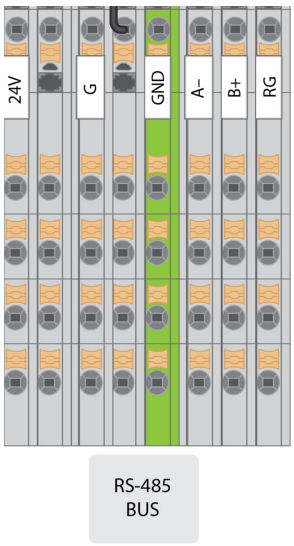


Figure 4-5. RS-485 BUS

4.4.2 JUNCTION BOX

Up to two junction boxes can be connected to the **X1** terminal block in the main met enclosure (see Table 4-4 [p. 35]). Campbell Scientific provides 24 AWG cables for junction box connections.

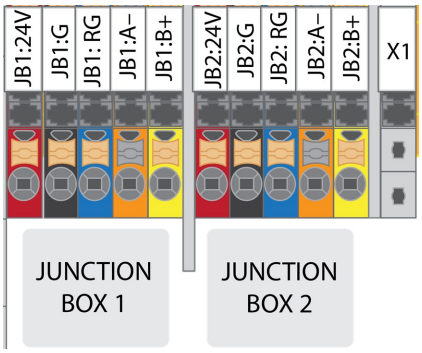


Table 4-4: JUNCTION BOX to main met enclosure connections		
Junction box terminal	Function	JUNCTION BOX terminals on X1 terminal block
JB:24V	24 V power	JB:24V
JB:G	Power ground	JB:G
JB:RG	Shield[1]	
JB:A–	RS-485 A(–)	JB:A–
JB:B+	RS-485B(+)	JB:B+
[1]Do not terminate the shield wire at the main met enclosure.		

4.4.3 Sensor-to-junction box connections

The soiling sensor, CS241DM back of module sensors, plane of array (POA), and rear plane of array (RPOA) sensors are optional sensors connected to terminal blocks in up to two junction boxes. The *Web UI* provides wiring information for connecting these sensors.

4.5 Communications wiring

Campbell Scientific offers additional 24 V and G terminals in the AC power box to power communications peripherals, such as fiber converters. Devices connected to these terminals will not be powered if the AC mains loses power. The customer provides the optional fiber converter and cables. The TCP/IP cable connects to the CR1000Xe data logger housed in the main enclosure.

Table 4-5: Communication connections		
AC power box	Fiber converter	Main met enclosure CR1000Xe
24V	24 V In	
G	Ground In	
	TCP/IP	TCP/IP Ethernet

4.6 Surge protection

The following schematics show wiring when using surge protection devices (SPD) to protect the Modbus and SDI-12 sensors.

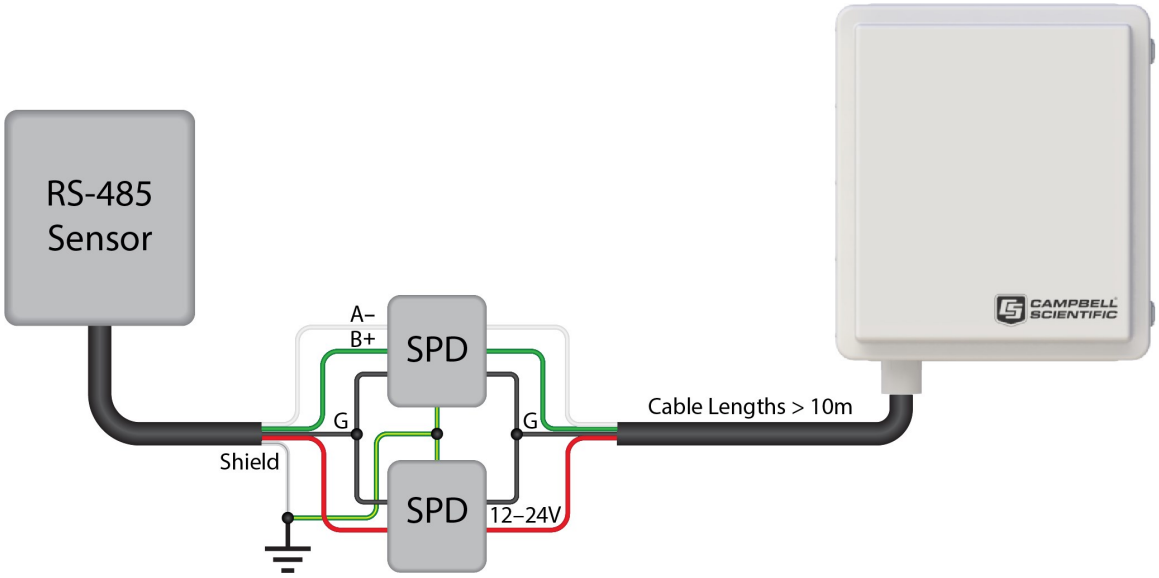


Figure 4-6. Recommended surge protection for Modbus sensors when cables are longer than 10 m

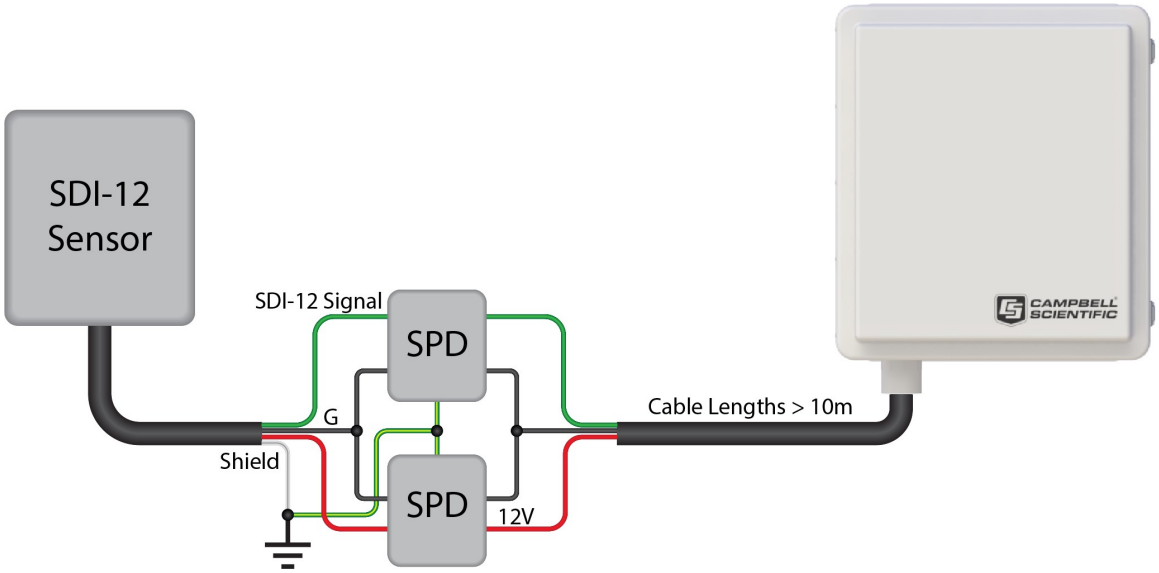


Figure 4-7. Optional surge protection for SDI-12 sensors when cables are longer than 10 m

Limited warranty

Covered equipment is warranted/guaranteed against defects in materials and workmanship under normal use and service for the period listed on your sales invoice or the product order information web page. The covered period begins on the date of shipment unless otherwise specified. For a repair to be covered under warranty, the following criteria must be met:

1. There must be a defect in materials or workmanship that affects form, fit, or function of the device.

2. The defect cannot be the result of misuse.

3. The defect must have occurred within a specified period of time; and

4. The determination must be made by a qualified technician at a Campbell Scientific Service Center/ repair facility.

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2. Batteries; and

3. Any equipment which has been subjected to misuse, neglect, acts of God or damage in transit.

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Other manufacturer's products, that are resold by Campbell Scientific, are warranted only to the limits extended by the original manufacturer.

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Products may not be returned without prior authorization. Please inform us before returning equipment and obtain a **return material authorization (RMA) number** whether the repair is under warranty/guarantee or not. See Limited warranty for information on covered equipment.

Campbell Scientific regional offices handle repairs for customers within their territories. Please see the back page of the manual for a list of regional offices or visit www.campbellsci.com/contact to determine which Campbell Scientific office serves your country.

When returning equipment, a RMA number must be clearly marked on the outside of the package. Please state the faults as clearly as possible. Quotations for repairs can be given on request.

It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment. In support of this policy, when equipment is returned to Campbell Scientific, Logan, UT, USA, it is mandatory that a "Declaration of Hazardous Material and Decontamination" form be received before the return can be processed. If the form is not received within 5 working days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. For details on decontamination standards specific to your country, please reach out to your regional Campbell Scientific office.

> NOTE:
> All goods that cross trade boundaries may be subject to some form of fee (customs clearance, duties or import tax). Also, some regional offices require a purchase order upfront if a product is out of the warranty period. Please contact your regional Campbell Scientific office for details.

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, 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, 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.

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.

Use and disposal of batteries

- Where batteries need to be transported to the installation site, ensure they are packed to prevent the battery terminals shorting which could cause a fire or explosion. Especially in the case of lithium batteries, ensure they are packed and transported in a way that complies with local shipping regulations and the safety requirements of the carriers involved.
- When installing the batteries follow the installation instructions very carefully. This is to avoid risk of damage to the equipment caused by installing the wrong type of battery or reverse connections.
- When disposing of used batteries, it is still important to avoid the risk of shorting. Do not dispose of the batteries in a fire as there is risk of explosion and leakage of harmful chemicals into the environment. Batteries should be disposed of at registered recycling facilities.

Avoiding unnecessary exposure to radio transmitter radiation

- Where the equipment includes a radio transmitter, precautions should be taken to avoid unnecessary exposure to radiation from the antenna. The degree of caution required varies with the power of the transmitter, but as a rule it is best to avoid getting closer to the antenna than 20 cm (8 inches) when the antenna is active. In particular keep your head away from the antenna. For higher power radios (in excess of 1 W ERP) turn the radio off when servicing the system, unless the antenna is installed away from the station, e.g. it is mounted above the system on an arm or pole.

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.

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