



*sun***MAX**TM

USER GUIDE

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Chapter 1: Introduction

Overview

sunMAX™ by Ubiquiti Networks is a grid-tie solar solution that utilizes photovoltaic (PV) cells, or solar panels, to convert solar energy into alternating current electricity. Using a watertight roof mounting system, sunMAX offers both portrait and landscape array configurations with easy-to-use software to help you design and implement a fully customizable solar solution.



The sunMAX solar solution should be deployed by an installer trained and familiar with the safety and operational procedures of the sunMAX system and all of its components.

The solar panels are UL listed to standard 1703 and the mounting hardware is UL listed to standard 2703. Please adhere to all applicable codes, required permits, and regulations concerning the installation and inspection requirements as they pertain to your location.

Safety



The following instructions and safety precautions are in place to ensure proper deployment and operation of your solar equipment:

- Use only the materials and tools specified in this guide.
- Do not break or modify any of the solar components or use them outside of their intended use.
- Do not sit or stand on the surface of the *AC Modules*.
- Install components securely to avoid parts from becoming loose or falling off during the installation.
- Only work in dry conditions with dry tools.
- Prevent rafters and sheathing from becoming wet.
- Install each *AC Module* securely to ensure proper operation and grounding of the array.
- *AC Modules* are installed on rooftops where there is danger of slipping or falling. Ladders and scaffolding should be used when climbing onto roofs.
- Do not use chemicals on solar modules when cleaning.
- Do not wear metallic jewelry or any conductive material.
- Do not touch electrical contacts, cables, or wires.
- Artificially concentrated sunlight shall not be directed onto the module or panel.

Recommendations



Note: Become familiar with the installation site and its surroundings by visiting the location prior to the actual install date.



Take the following precautions before starting work:

- Plan the job and visit the site before doing any work.
- Always work with at least one other person on site.
- Inspect power tools before using them.



When conditions make it necessary, tell workers to stop working.

- Do not perform installation in poor weather conditions such as rain, snow, ice, or high winds.



Wear appropriate work clothes and protective equipment.

- Wear gloves when handling sunMAX components. Flashing has sharp edges and will get hot when exposed to sunlight.
- Work clothes for both the upper and lower body should fit well and allow you to move freely.
- Always wear protective equipment such as harnesses and lifelines.
- Wear non-slip shoes. Shoes get dirty when worn on a roof, so keep the soles clean.



Observe safety regulations for ascending and descending ladders and stepladders.

- Ladders from a first-story roof to a second-story roof are very dangerous. Do not set up a ladder on a roof.
- When there is no other choice, straddle the ridge and lay down a rubber anchor mat, and secure the ladder to the mat. Always have one person hold the ladder firmly.
- When you use a two-stage ladder, secure it with ropes or stays to prevent it from sliding sideways, and have two people hold the ladder steady.
- Use ladders with steps broad enough to permit safe work.



When working in high places, wear harnesses and use scaffolding.

- When working at heights of 6' (1.83 m) or more, use scaffolds or other equipment to ensure a stable work platform.
- Scaffolds should be designed and erected by a qualified person.
- When it is difficult to erect a stable work platform, install safety nets, wear harnesses, and take other measures to prevent falls.
- Regulations mandate the use of harnesses. Fasten harnesses securely, and check that the length of lifelines is 6' (1.83 m) or less.
- Attach the support line securely to a metal fixture installed for that purpose on a ridge or beam.



Install enclosures and covers to minimize risks.

- Install enclosures, guardrails, or covers at the end of work decks that are 10' (3.05 m) or more above ground, at openings, and at other dangerous locations.
- When it is extremely difficult to install enclosures, guardrails, or covers, or when they must be removed to work in that location, install a safety net, wear harnesses, and take other measures to prevent falls.



WARNING: Wiring work should be performed according to the provisions of the National Electrical Code. Grounding work and wiring connections to the inverter should be performed by a qualified electrician.

Please adhere to all applicable codes, required permits, and regulations concerning the installation and inspection requirements as they pertain to your location. Pay special attention to Article 110, Chapter 2 Article 250, Chapter 3, Articles 300, 310, 480, and 690.



WARNING: The solar array generates electricity whenever it is exposed to sunlight. Be careful when handling it. There is a danger of shock if you touch the connectors or wires of the electric cables.

Points to Check Before Wiring

- The solar modules generate electricity when exposed to light. You will need to wear insulating gloves.
- You will need a multimeter for volts, amps, resistance, and continuity capable of measuring DC and AC up to 600V and 40A.
- Make sure your tools are insulated.

Wiring Solar Panels

- Never step or sit on the glass surface of the solar modules. The glass may break.
- When you install the solar modules on the mount, never allow an output cable to become caught between the mount and a module frame.
- Ensure that the module connectors are fully inserted. There is a risk of malfunction if they are not pushed all the way in.
- Support output cables to eliminate slack. High winds can blow slack cable against the mount, damaging the cables.

Wiring Solar Arrays to the Inverter

- For wiring through walls, protect the cables with metal conduits, flexible metal conduits as permitted or required by local and national electrical or building codes. Failure to do so can result in shock and short circuits. Always use conduit to protect sections of array output cables that are exposed to sunlight.
- For wiring outdoors, protect cables with PVC conduits, metal conduits, or flexible conduits.
- Prevent water from entering or building up in conduit by using waterproof fittings or duct seal.
- To prevent shock, tape and label the cut ends of array output extension cables (the side opposite to the connector side) before connecting to solar module output cables. Then, tape them again after measuring the voltage of each array.
- To prevent shock when you connect the array output cables to the inverter, remove the tape one cable at a time as you connect the cables.

Measuring Output Voltage

- Ensure that all solar modules are exposed to sunlight. (Remove lightproof sheets, if present.)
- Set the voltmeter measurement range to a DC voltage greater than -32VDC.
- Keep the plus (+) solar array output cables away from the ends of the minus (-) cables, as dangerous arcs can occur. The array output voltage under normal conditions (clear skies) can be very high.

Grounding

- Use a proper ground wire according to your local safety regulations and requirements. For more information, refer to **“Grounding” on page 24** in this User Guide.
- Follow NEC 690 grounding provisions.

- Each sunMAX module is considered to be in compliance with UL 1703 only when the module is mounted in the manner specified by these instructions.
- A sunMAX module with exposed conductive parts is considered to be in compliance with UL 1703 only when it is electrically grounded in accordance with the instructions presented below and the requirements of the National Electrical Code.
- Any module without a frame (laminated) shall not be considered to comply with the requirements of UL 1703 unless the module is mounted with hardware that has been tested and evaluated with the module under this standard or by a field inspection certifying that the installed module complies with the requirements of UL 1703.
- Routine maintenance or servicing of a SunMAX module shall not involve breaking or disturbing the bonding path.
- Grounding connections should only be installed by qualified personnel.
- Only use approved SunMAX hardware to maintain the UL1703, UL2703, UL467 ratings of the installed system in the approved manners described in this manual.

Installation Requirements

- No. 2 Phillips screwdriver
- Leveling string
- Tape measure
- Electric drill
- 3/16" (4.8 mm) long drill bit
- Chalk line
- Chalk stick (for cutting shingle)
- Tin snips or utility knife (for cutting shingle)
- 13 mm wrench (preferably an impact driver)
- Caulking gun
- EPDM-compatible roof caulking
- Shingle ripper or other prybar to remove existing nails

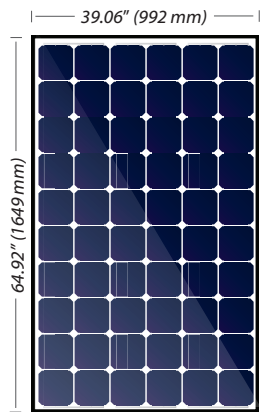
Additional Tile Roof Mount Requirements

- Angle grinder/saw with a masonry blade
- Roofing paper and roofing cement
- Felt paper

Chapter 2: Components

Solar Panel

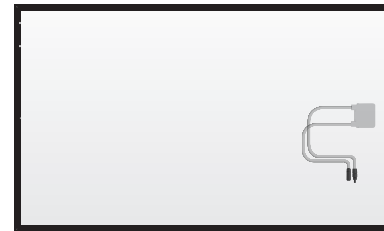
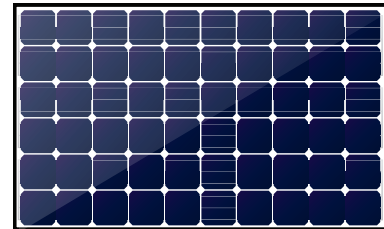
The *Solar Panel*, model SM-SP-260W-DC-EU, can be installed in portrait orientation, landscape orientation, or a combination of both. Prior to transferring the *Solar Panels* to the roof for installation, each will be assembled with cabling and a *Microinverter*. The assembled parts will be referred to as an *AC Module*. Each panel in the array is installed downroof in the lower-edge position, side by side until a row is complete.



Topside View of Solar Panel
(Portrait Orientation)



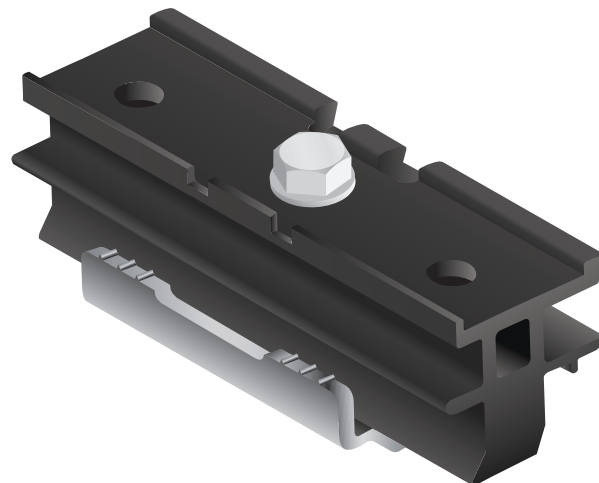
Underside View of Solar Panel
(Portrait Orientation)



(Landscape Orientation)

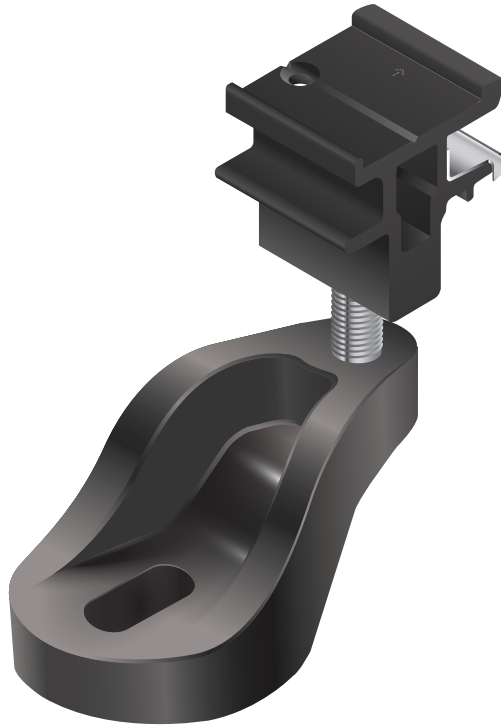
Panel Connector

Panel Connectors, model SM-PC, join solar panels together structurally between adjacent corners and along the outside edges of the *Solar Panels* and bond them together electrically. The arrow located on the top surface of each *Panel Connector* should always point downward towards the *Trim Cover*.



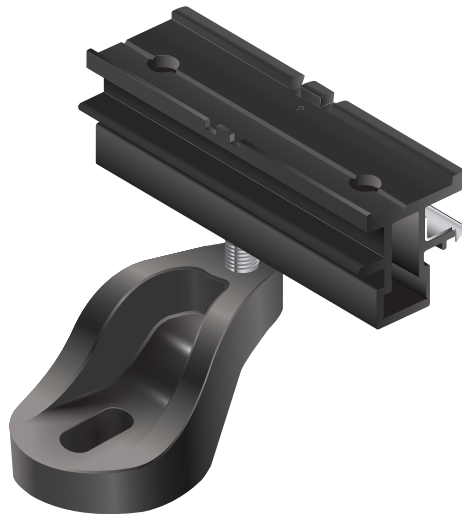
Mounting Assembly

Mounting Assemblies, model SM-MA, provide structural support and 360° adjustment swivel between the *Roof Mount* and outer edges of the *Solar Panel*. The arrow located on the top surface of each *Mounting Assembly* should always point downward towards the *Trim Cover*.



Connector Mount

Connector Mounts, model SM-CM, provide structural support and 360° adjustment between the *Roof Mount* and outer edges of the *Solar Panel* where *Mount Assemblies* would coincide with a *Panel Connector* location. Each *Connector Mount* has an arrow on the top surface of the 360° swivel that should always face forward toward the *Trim Cover*.



Trim Cover Kit

The *Trim Cover Kit* is used to enhance the visual appearance and aesthetics along the entire front edge of the array and help ease installation of the panels. There are three versions of the *Trim Cover Kit*: 1-panel portrait (SM-TC-1P), 2-panel portrait (SM-TC-2P), and landscape (SM-TC-L).



Jumper Cable

Jumper Cables, model SM-JC-4C, connect and extend the *Y-Cables* in adjacent rows together underneath the solar array. *Jumper Cables* attach to the inside edge of the *Solar Panels* using *Cable Support Clips*.



Solar Gateway

The *Solar Gateway*, model SM-SG, communicates with and gathers data from all *Microinverters* in the solar array and sends information to the Ubiquiti® sunMAX cloud management system via the local area network.



Roof Mount Kit

The *Roof Mount Kit*, model SM-RM-C, provides a structural mount between the roof surface and *Mounting Assembly* to support the array. The kit includes the roof mount and mounting hardware, roof flashing, and counter flashing to ensure a watertight installation.



Note: The *Flashing* has sharp edges and will get hot when exposed to sunlight.

Tile Accessory Kit

Used in conjunction with the *Roof Mount Kit*, the *Tile Accessory Kit*, model SM-RM-T, includes additional components required for tile-roof mounting: a threaded stud, extension post, upper aluminum *Flashing*, and counter flashing. The upper aluminum *Flashing* is flexible and can be formed to fit most flat or curved tiles.



Note: The *Flashing* has sharp edges and will get hot when exposed to sunlight.

End Run Connector Kit

The *End Run Connector*, model SM-EC-EU, provides easy adaptation of cabling from the array to the electrical panel feeding the grid. It connects the open-ended Y-cable in your solar array to the house-side wiring that feeds into the electrical panel of your building. The *End Run* is part of a kit and includes the *End Run*, a cabling end cap, and grounding stud with nut.

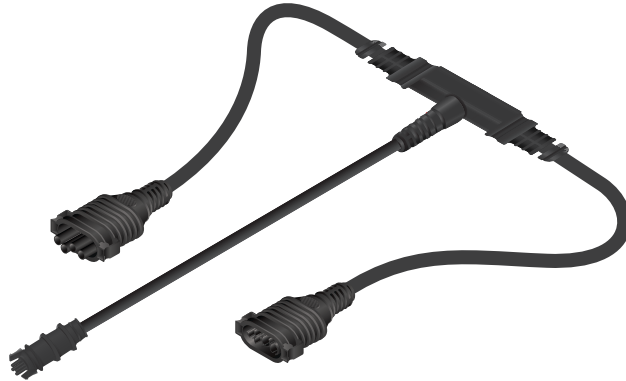


Note: Install the *Solar Panels* so that the *End Run* will terminate near the breaker box or closest to the location where the house-side wiring will penetrate the roof.

Y-Cables

Portrait

The Portrait *Y-Cables*, model SM-YC-P4, are used to connect panels and devices, such as the *Solar Gateway* or *Microinverter*, in a portrait-array configuration.



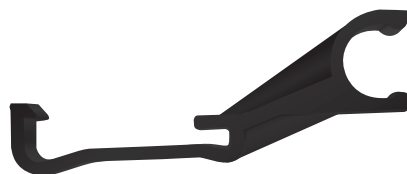
Landscape

The Landscape *Y-Cables*, model SM-YC-L4, are used to connect panels and devices, such as the *Solar Gateway* or a *Microinverter*, in a landscape-array configuration.



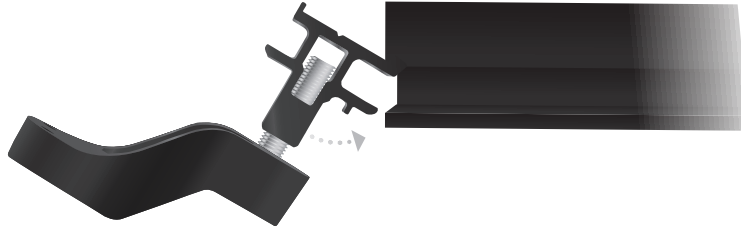
Cable Support Clips

The *Cable Support Clips*, model SM-CC, slide onto the inner frame underneath the *Solar Panel* and pivot down over the outer edge of the frame. *Cable Support Clips* support *Jumper Cables* and *Y-Cables* along the inside edges of the *Solar Panels*.



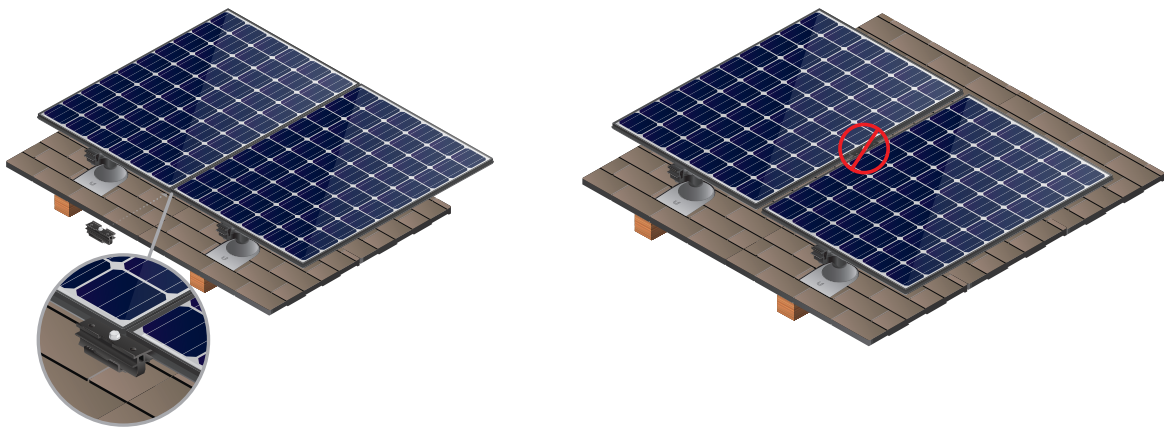
Chapter 3: Component Usage

All sunMAX mounting components are installed into frame of the *Solar Panel* using the same motion. Components hook underneath the outer edge of the panel's frame and then pivot down. Never force a component into place as it can damage the frame of the *Solar Panel*.

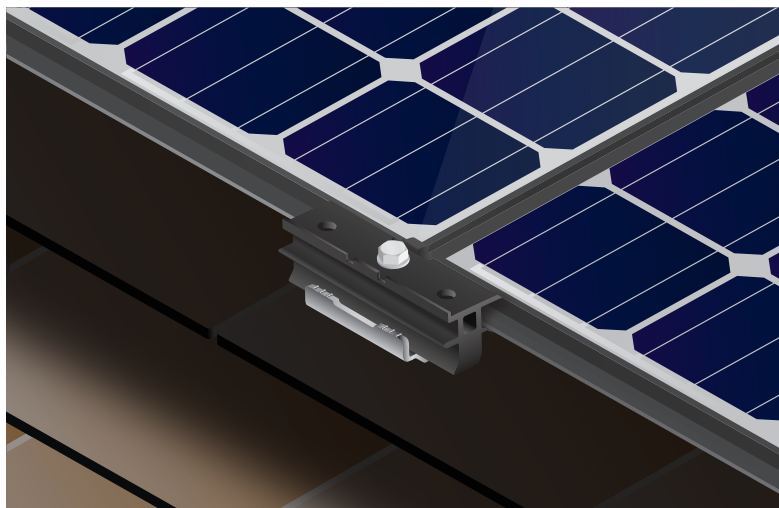


Panel Connectors

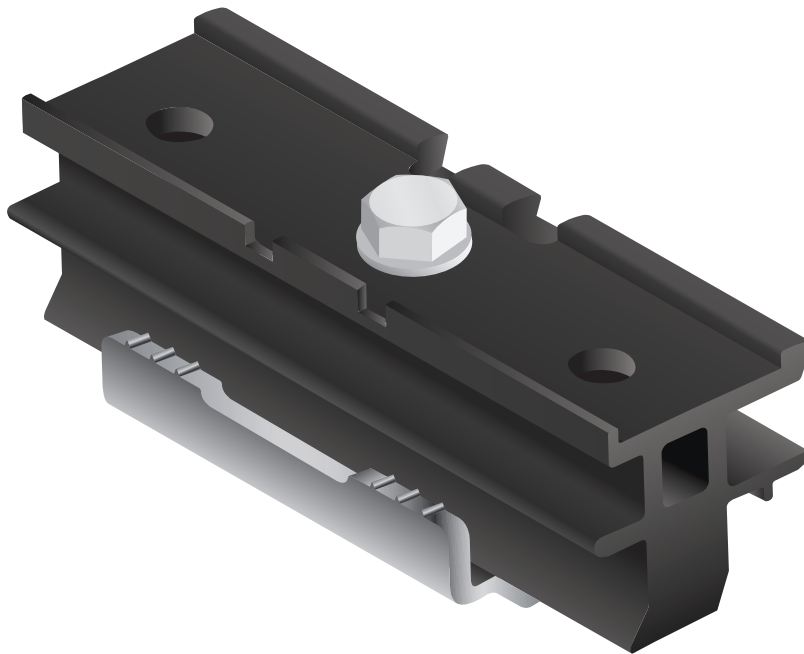
Panel Connectors, model SM-PC, join *Solar Panels* together structurally between adjacent corners and along the outside edges of the *Solar Panels* and bond them together electrically. The arrow located on the top surface of each *Panel Connector* should always point downward towards the *Trim Cover*. Do not install vertically between the panels in your array.



If a *Mounting Assembly* is near a *Panel Connector* location, install the *Panel Connector* first, then install the *Mounting Assembly*.

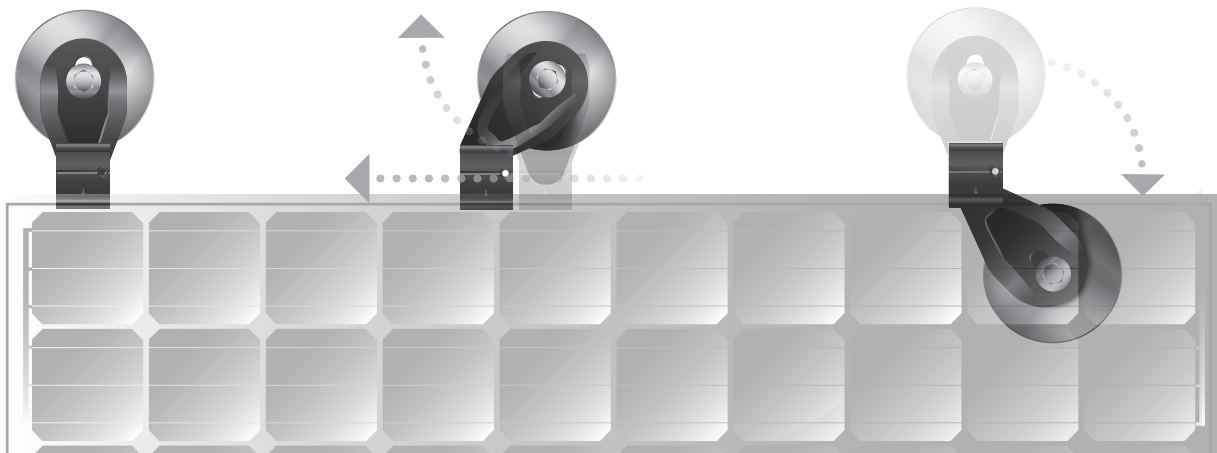


Panel Connectors have preset gaps on them where the *Solar Panels* will fit in as they come together during the installation. Align the preset gaps with the edge of the *Solar Panel* before hooking the *Panel Connector* underneath the frame and pivoting down.



Mounting Assembly

Mounting Assemblies provide structural support and 360° adjustment between the *Roof Mount* and the outer edges of the *Solar Panel*. The *Mounting Assembly* base also slides forward and backward to allow adjustment of the swivel mount position. The arrow located on the top surface of each *Mounting Assembly* should always point downward towards the *Trim Cover*.



Connector Mounts

The same function and installation rules apply to the *Connector Mounts* as well. *Connector Mounts*, model SM-CM, provide structural support and 360° adjustment between the *Roof Mount* and outer edges of the array where *Mounting Assemblies* would coincide with a *Panel Connector* location.

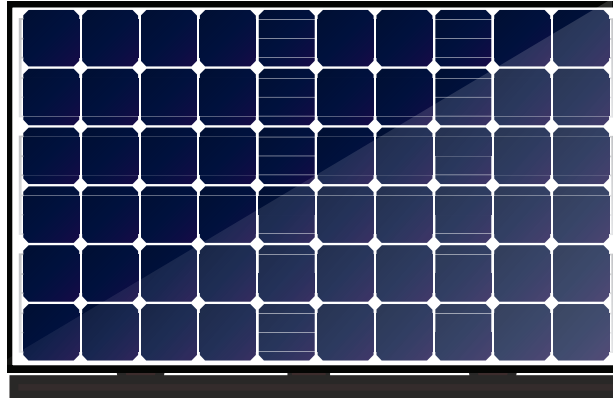
Trim Cover Kit

The *Trim Cover Kit* serves as an assembly aid for alignment and maintains the Class A fire rating when installed. There should always be at least one *Mounting Assembly* and one *Panel Connector* per *Trim Cover*.

There are three different *Trim Covers* available for use depending on the design and orientation of your array: Landscape, 2-Panel Portrait, and 1-Panel Portrait.

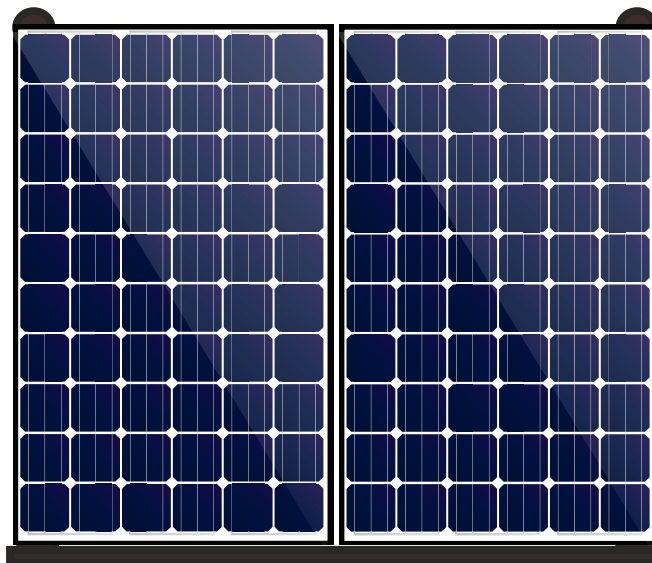
Landscape

In landscape layout, there will be one landscape *Trim Cover* per column. The standard width of one landscape *Trim Cover* is the same width as one *Solar Panel* in landscape orientation.



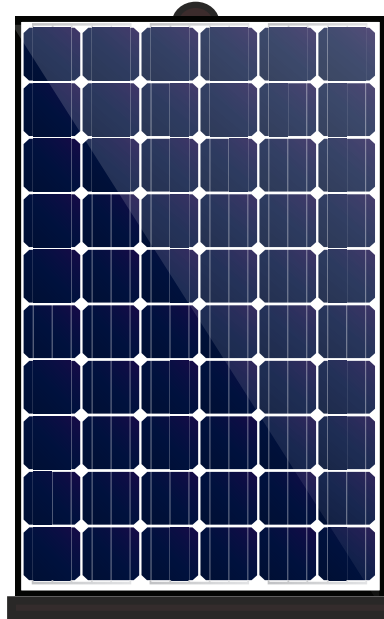
2-Panel Portrait

The 2-Panel Portrait *Trim Cover* is the standard width of two *Solar Panels* in portrait orientation. For every two columns of *Solar Panels* in portrait layout, there will be one *Trim Cover* that extends along the front row of both panels. For example, in an eight-column array of portrait *Solar Panels*, use four of the SM-TC-2P *Trim Covers*.

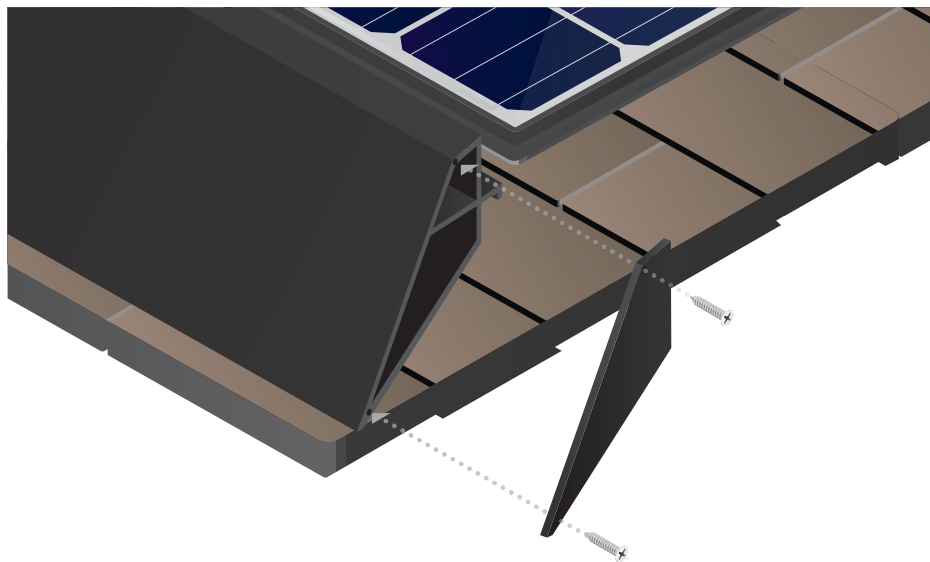


1-Panel Portrait

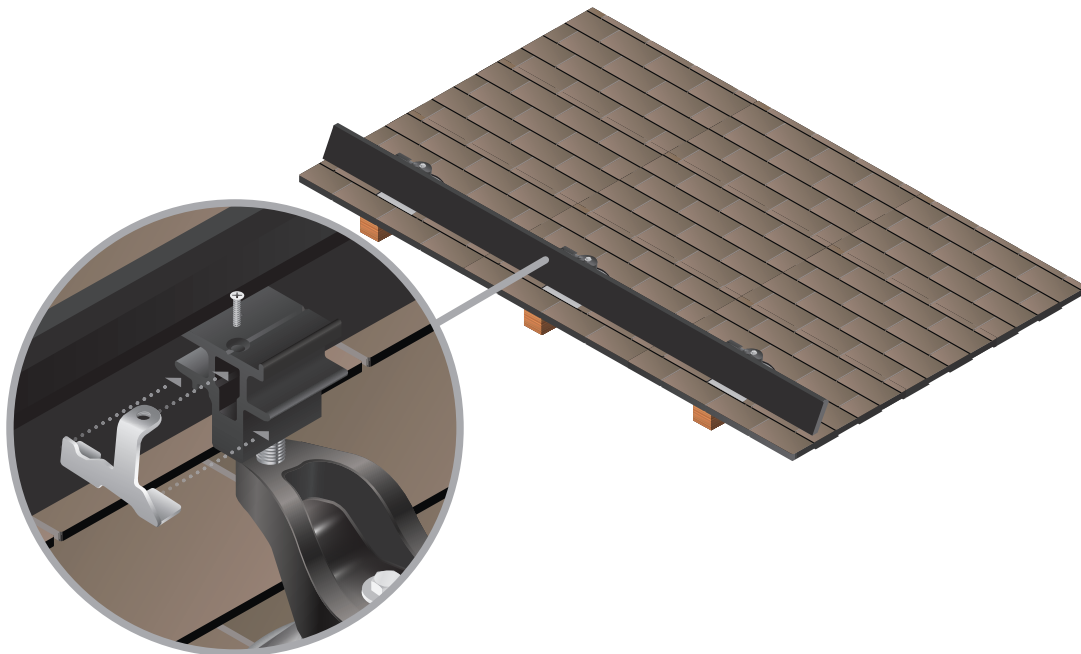
The 1-Panel Portrait *Trim Cover* is used in a solar array where there are an odd number of portrait columns. For example, in an array of three portrait columns, use one 2-Panel Portrait *Trim Cover* and one 1-Panel Portrait *Trim Cover*. The 1-Panel Portrait *Trim Cover* is the standard width of a single *Solar Panel* in portrait orientation.



The *Trim Covers* also come with two end plates. Most solar arrays use multiple *Trim Covers* side by side across the front edge of the array. Once the front edge of your solar array is complete, install an end plate on both ends of the *Trim Cover* using the included mounting screws.

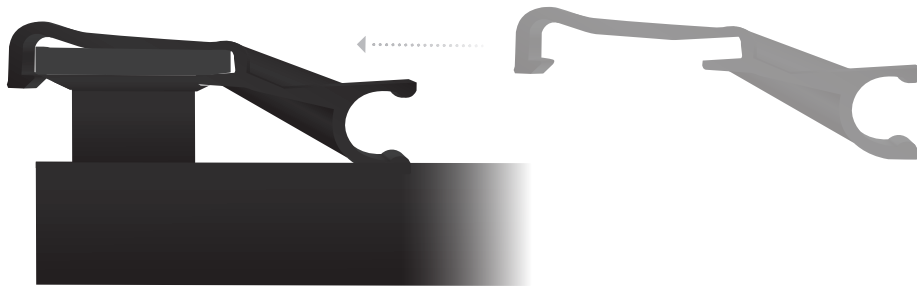


Each *Trim Cover* also comes with a set of trim locks to secure it in place at all *Mounting Assembly* locations along the front edge of the array.



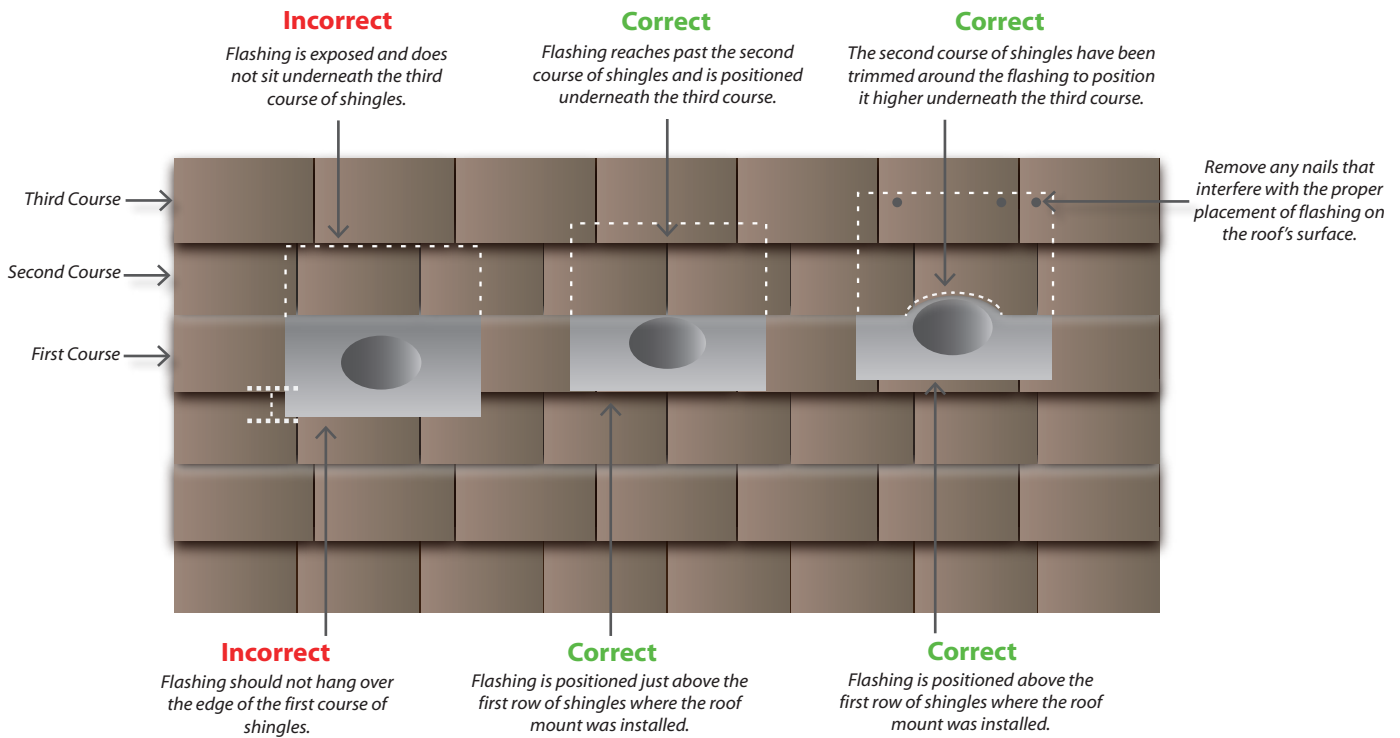
Cable Support Clips

The *Cable Support Clips* slide onto the inner frame underneath the *Solar Panel* and pivot down over the outer edge of the frame. *Cable Support Clips* support *Jumper Cables* and *Y-Cables* along the inside edges of the *Solar Panels*.



Flashing

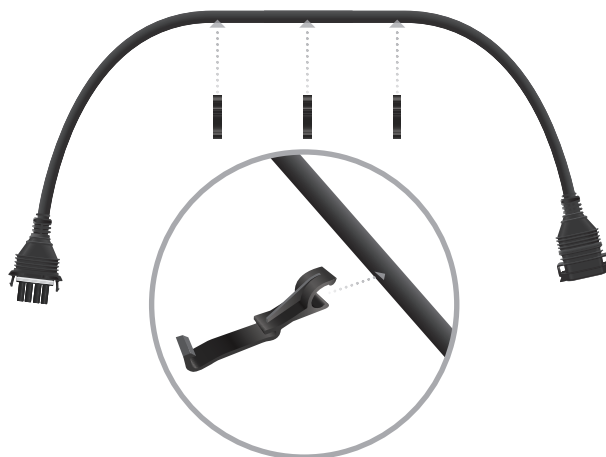
Flashing is placed over each roof mount and helps ensure a watertight installation when positioned properly. The upper edge of the *Flashing* should always be covered by the third course of shingles to prevent water from entering underneath the *Flashing*. The upper edge of the *Flashing* should be covered by at least ¼" (6 mm) of the third course of shingles. The lower edge of the *Flashing* should not extend beyond the edge line of the first course of shingles.



Jumper Cables

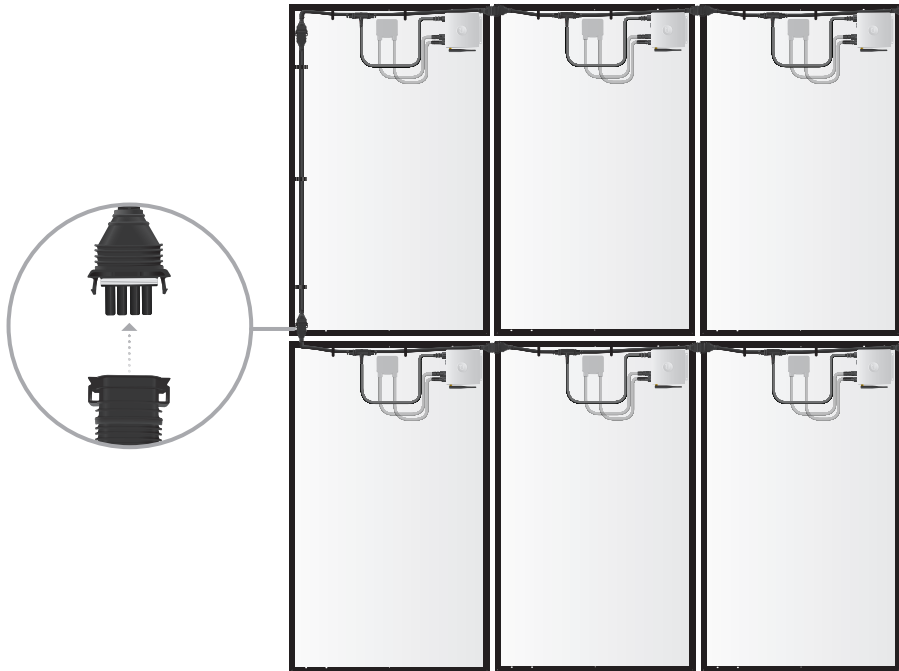
Jumper Cables, model SM-JC-4C, have a male connector and a female connector, one on each end. Each *Jumper Cable* attaches to the inside edge underneath the *AC Modules* using *Cable Support Clips*.

Jumper Cables are used to connect adjacent rows of *AC Modules* together within a single array. In a multi-row system, *Y-Cables* alternate their orientation, ending with a male or female connector every other row.

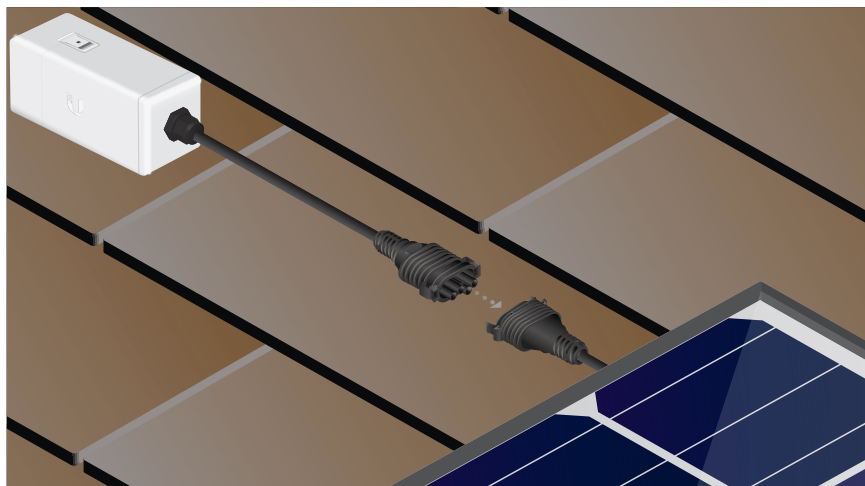


Y-Cables

Y-Cables run along the inside edges of *AC Modules* to allow access to the cable ends during installation. *Y-Cables* come in both portrait and landscape configuration depending on how the *AC Modules* will be installed in the array. *Y-Cables* are reversible and can be installed with a male or female connector on either side of the module. This allows the *End Run* to be installed at a preferred location within the array.



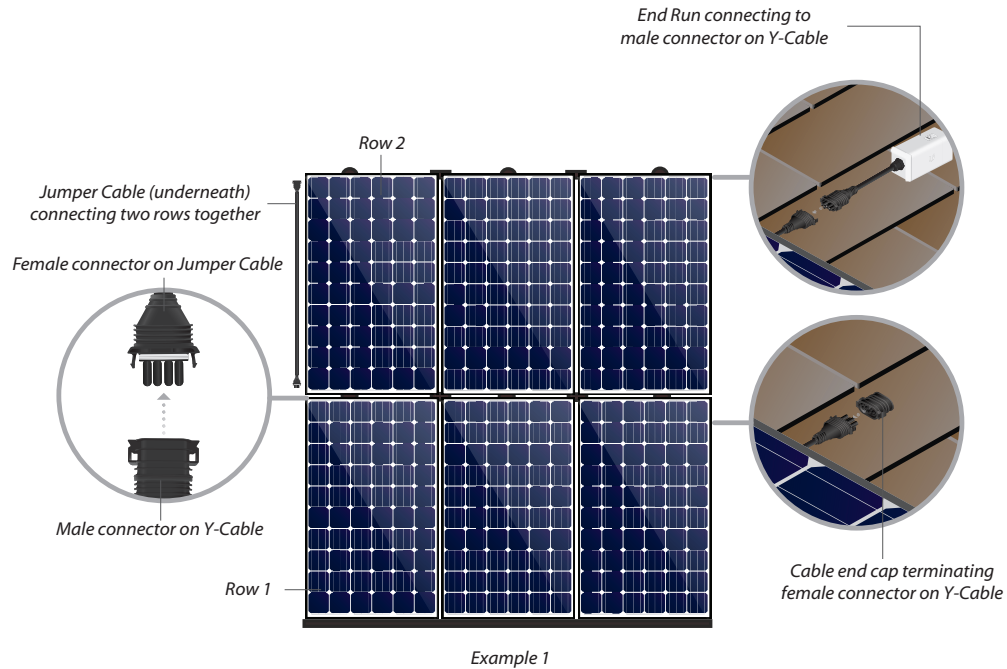
Typically, the *End Run Connector* is installed closest to the main breaker panel or location where the wiring feed will penetrate the roof. Since the *End Run Connector* has a female connector, it should terminate on a row that ends with a male connector.



Here are a few examples:

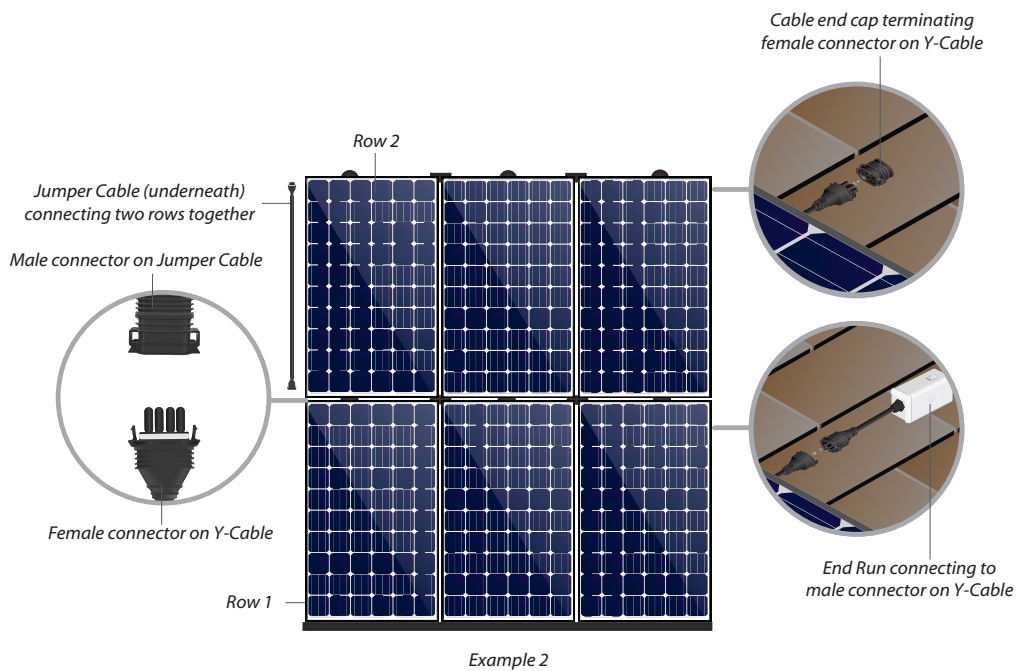
Example 1

Looking top-side down, if you want the *End Run* to terminate on the right side of row two in the array, ensure that the *Y-Cable* coming from the last AC Module in that row has a male connector on it.



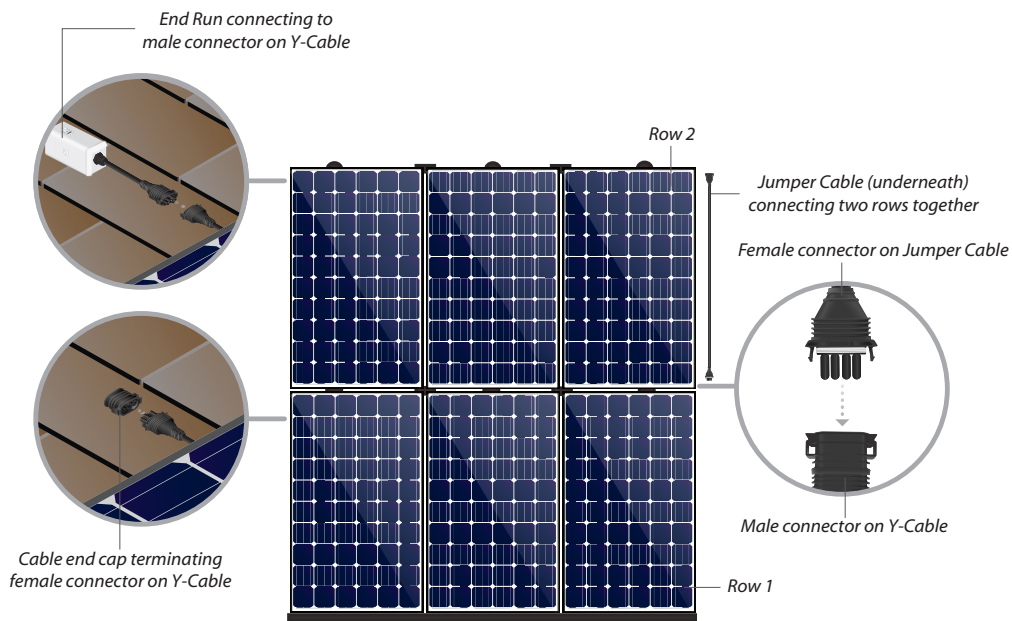
Example 2

Looking top-side down, if you want the *End Run* to terminate on the right side of row one in the array, ensure that the *Y-Cable* coming from the last AC Module in that row has a male connector on it.



Example 3

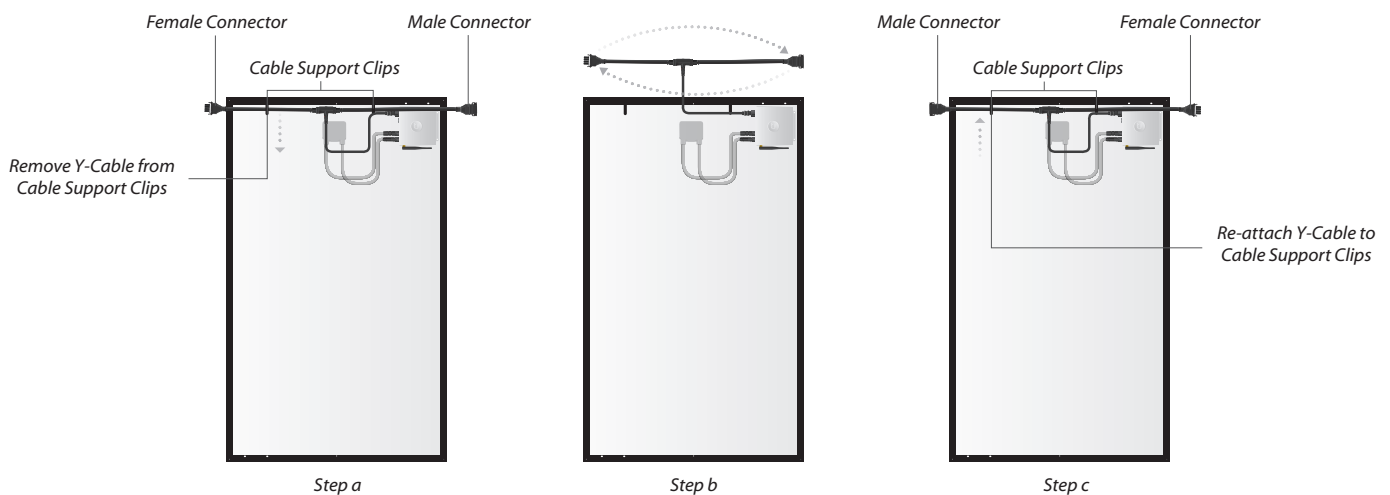
Looking top-side down, if you want the *End Run* to terminate on the left side of row two in the array, ensure that the *Y-Cable* coming from the last *AC Module* in that row has a male connector on it.



Example 3

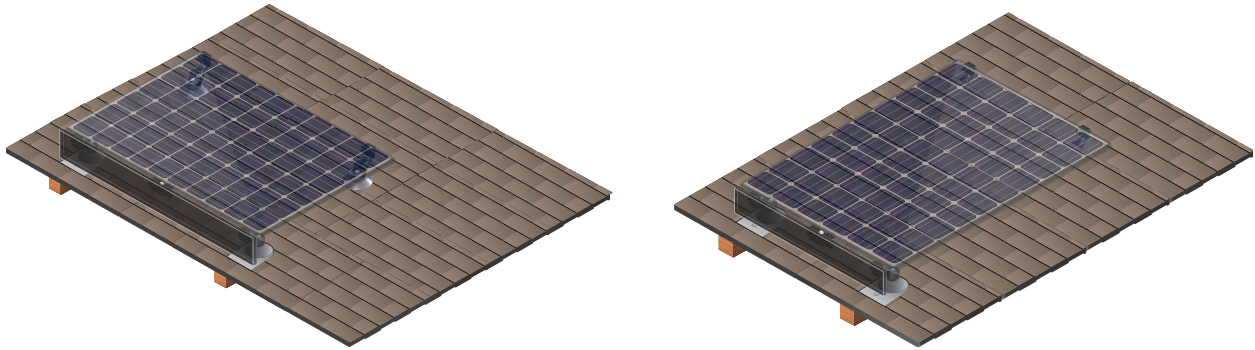
If the *End Run* terminates at the end of a row with a female connector on it, you have two options:

1. Move the *End Run* location to the next row in the array, which ends with a male connector on it.
2. Reverse the orientation of the *Y-Cable* in the current row by performing the following steps:
 - a. Remove the *Y-Cable* from the *Cable Support Clips*.
 - b. Turn the *Y-Cable* over to reverse the male and female connectors.
 - c. Re-attach the *Y-Cable* to the *Cable Support Clips*.



Solar Panel

When installing a single *Solar Panel*, either portrait or landscape, it must have a minimum of four *Mounting Assemblies*. The overhang distance past each mount (on both sides) and the spacing between *Mounting Assemblies* must still adhere to the same specifications as a multi-panel array. For grounding purposes, a *Panel Connector*, along with the appropriate grounding wire, is installed between the *Trim Cover* and the lower edge of the solar array.

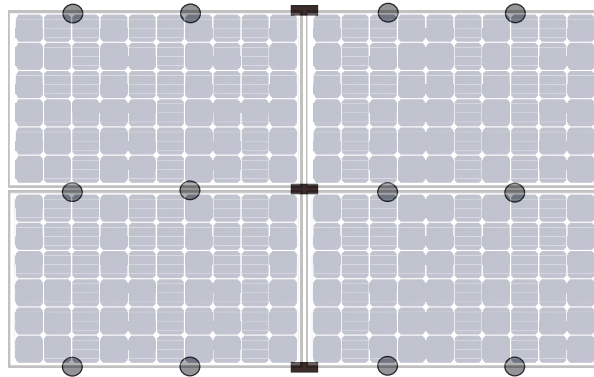


Sample Layout Configurations

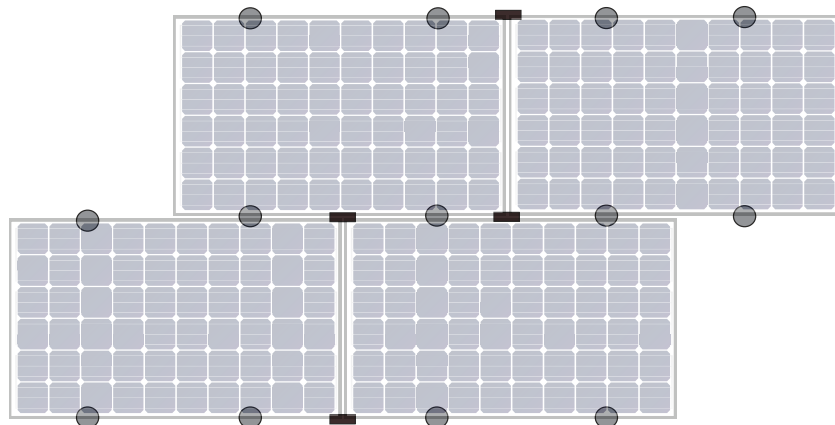
The following illustrations show proper placement of *Panel Connectors* and *Roof Mounts* based on the configuration layout of your solar array.



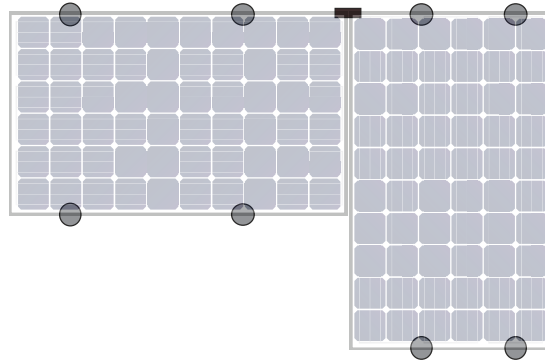
Rectangle Shape (Landscape)



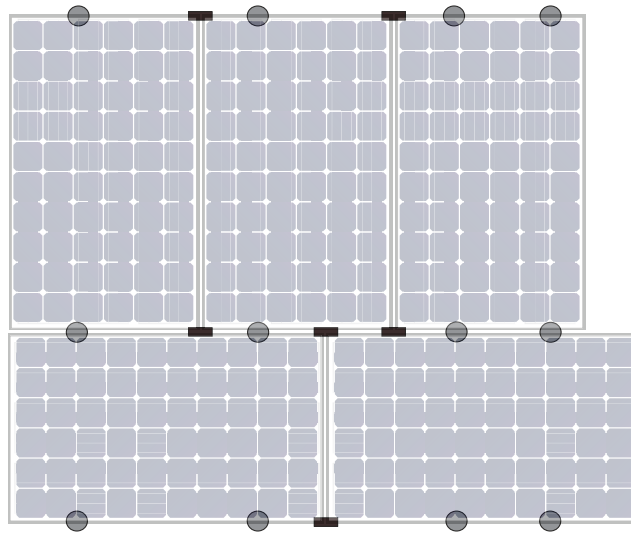
Staggered Rows



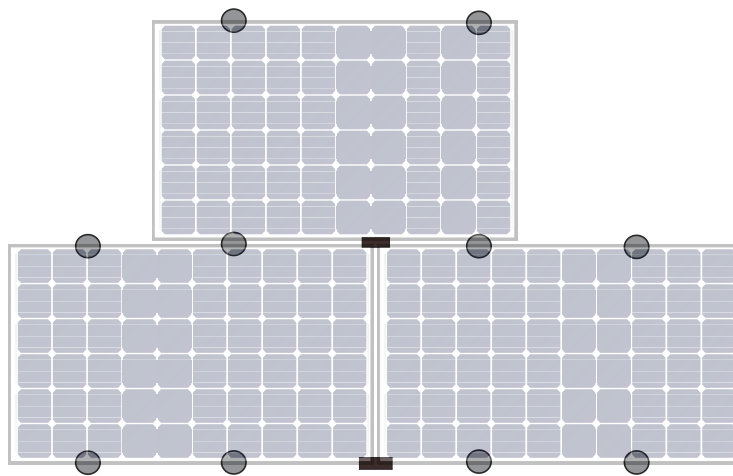
Transitioning from Landscape to Portrait



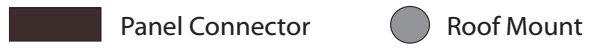
Transitioning from Portrait to Landscape



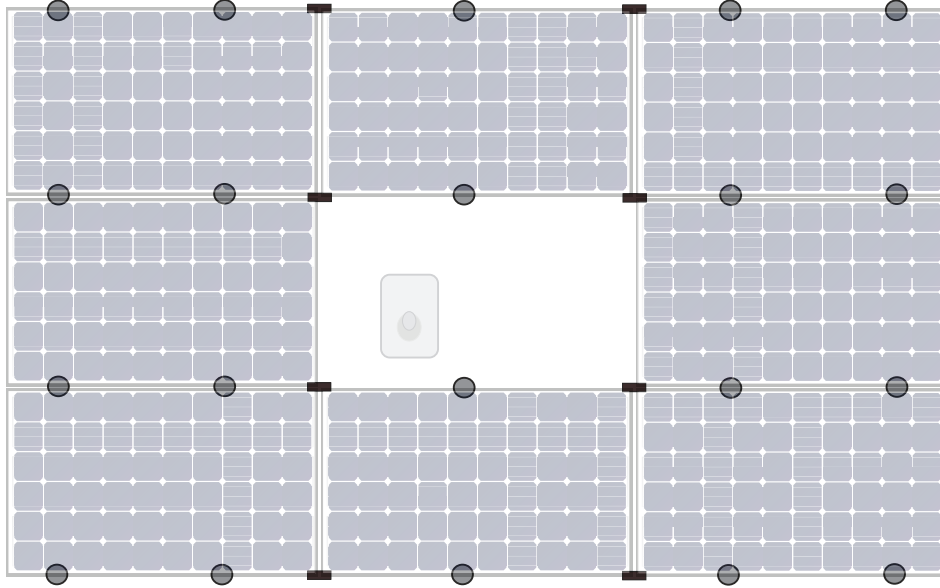
Pyramid Shape



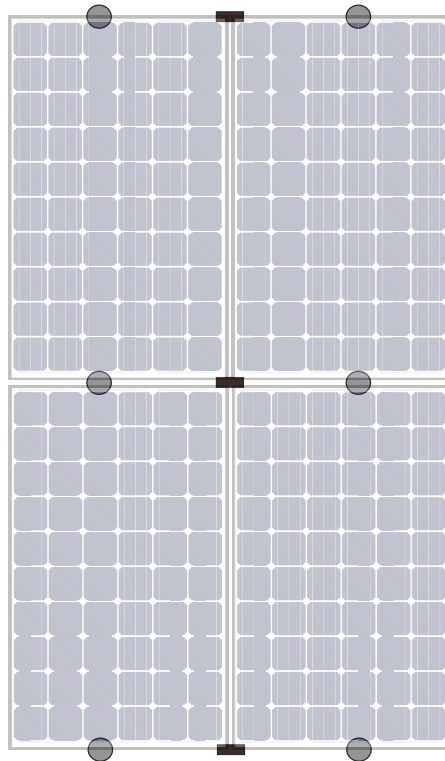
Additional Layout Configurations



Landscape Array Omitting Center AC Module (for Roofing Vent or Pipe)



Rectangle Shape (Portrait)



Chapter 4: Analysis

To determine the maximum amount of spacing when installing your solar system, consider the location and general weather conditions surrounding your install. Refer to the span tables in **“Appendix A: Span Tables” on page 61** to determine the recommended measurements as they pertain to your location.

Snow Loading

To determine the ground snow load at the installation site, consult with your local building and safety department for the specific requirements for your location. *AC Modules* should not be installed in snowdrift areas of the roof.

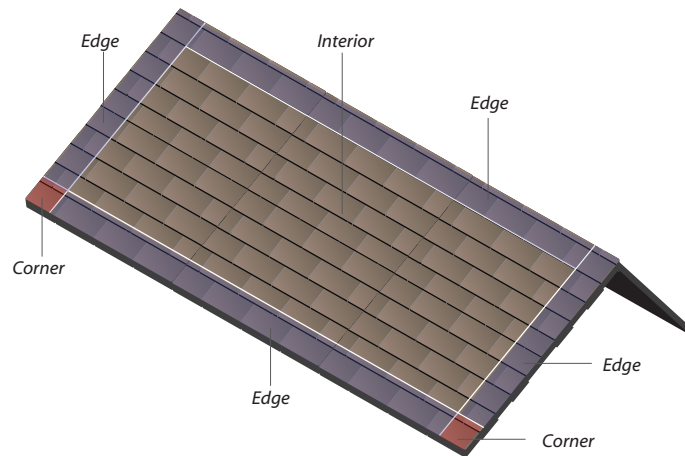
Basic Wind Speed

Determine the wind speed at your installation site and consult your local building and safety department for guidelines.

Roof Zones

Locate the area on the roof where you will be installing the solar array. The roof is divided into three zones: the interior, edges, and corners.

- **Interior** The innermost area surrounded by the edges, also referred to as the field.
- **Edges** The edges are defined as 10% of the least horizontal dimension or a minimum of 3' (0.9 m) from the edge of the roof and represent areas of higher wind load.
- **Corners** The corners are defined as the intersection of two edge zones on the leading edge of the roof. Wind loads are highest in the corner zones and lowest in the interior zone. *AC Modules* should not be mounted in the corner zones.



Exposure Category

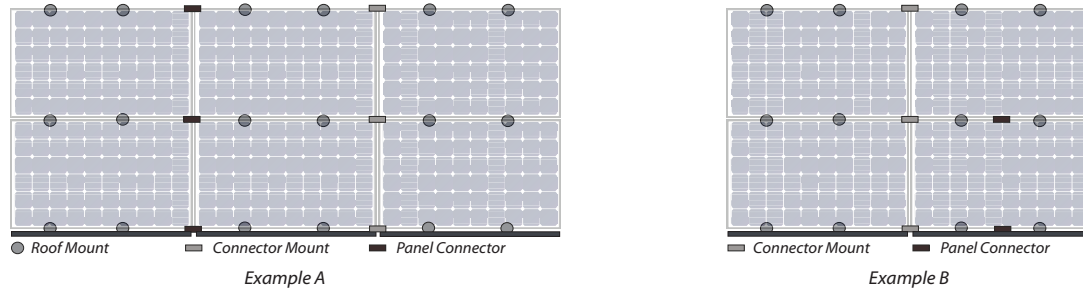
Determine the exposure category of the installation site by using the following guidelines:

- **Category B** Urban, suburban, wooded areas or other terrain with numerous obstructions or closely placed objects having the size of single-family dwellings or larger.
- **Category C** Open terrain with scattered obstructions such as flat open country, grasslands, or shorelines in hurricane-prone regions.
- **Category D** Flat, unobstructed areas within 460 meters of shoreline or areas exposed to wind flowing over open water (excluding shorelines of hurricane-prone regions) for a distance of at least 1.6 km.

Grounding

When mounting components are installed properly, each of the exposed metal components (in the array) are bonded together, requiring only a single equipment grounding conductor (EGC) per array.

When panel connectors are installed, they bond across rows of modules with adjacent panels and/or trim skirts. There should always be at least one panel connector between each row of modules somewhere along the row. This panel connector can sit between modules as a structural component (Example A) or between modules and trim skirts as a bonding component (Example B).



Special Mounting Considerations

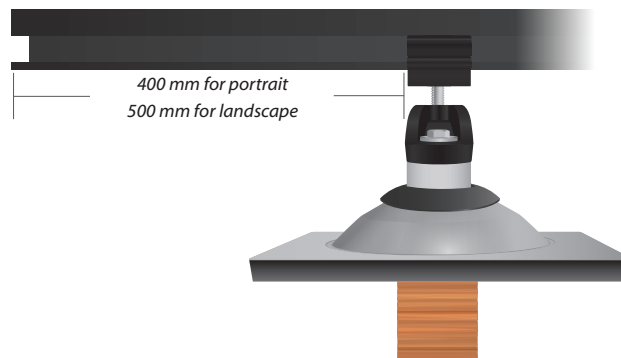
Mounting specifications are based on conditions where:

- The building is not a special-occupancy structure that represents a substantial hazard to human life.
- The building is not an essential facility such as a public school or hospital.
- The building is not located on a bluff or near the top of a hill where topographic effects change.

If your installation site differs from any of the factors above, please consult with Ubiquiti Networks at sunlink.ubnt.com about your particular solar project.

Maximum Cantilever

Cantilever distance is the distance from the outside of the nearest mounting assembly to any unsupported edge of the AC Module, i.e. one that is not connected by a panel connector or connector-mount. For portrait configurations, the maximum distance is 15.75" (400 mm) and for landscape configurations, the maximum distance is 19.69" (500 mm). If necessary, shift the AC Module or mount location to reduce the cantilever distance; this distance applies to any unconnected corner of the array. For arrays with staggered rows of AC Modules, check the cantilever distance on each row individually. For rows with transitions from portrait to landscape, check each of the unconnected ends.

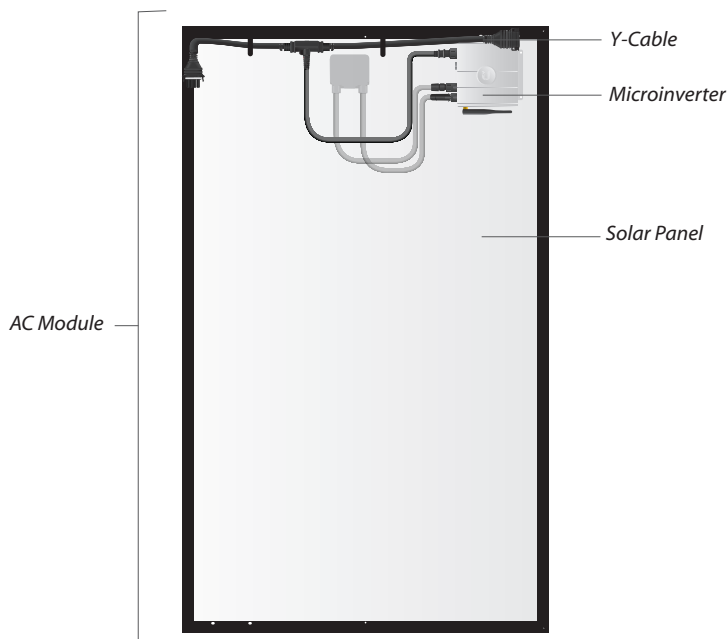


Thermal Expansion

Arrays more than 10 meters long in any direction should be separated by a minimum of 25 mm gap to allow for thermal expansion. This will help prevent damage to the module. Gaps should be located near the center of the array and each array should be grounded individually.

Chapter 5: AC Module Assembly

The *AC Module* is a *Solar Panel* with a *Microinverter* installed. For ease of installation, assemble the *AC Module* and attach the required cabling and support clips prior to transferring the *AC Module* to the roof.



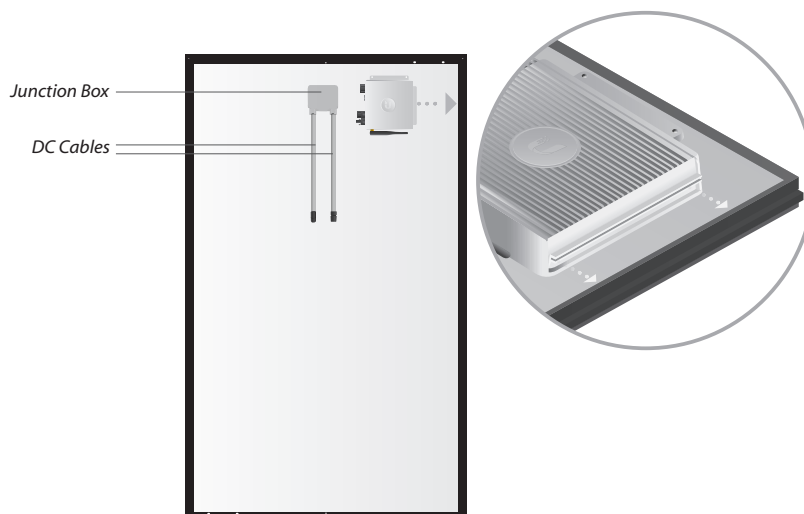
Installing the Microinverter

1. Stand the *Solar Panel* up against a sturdy wall or lay it on a flat surface that will not scratch the top side of the panel. The pre-installed junction box should be facing you on the upper half of the *Solar Panel*.

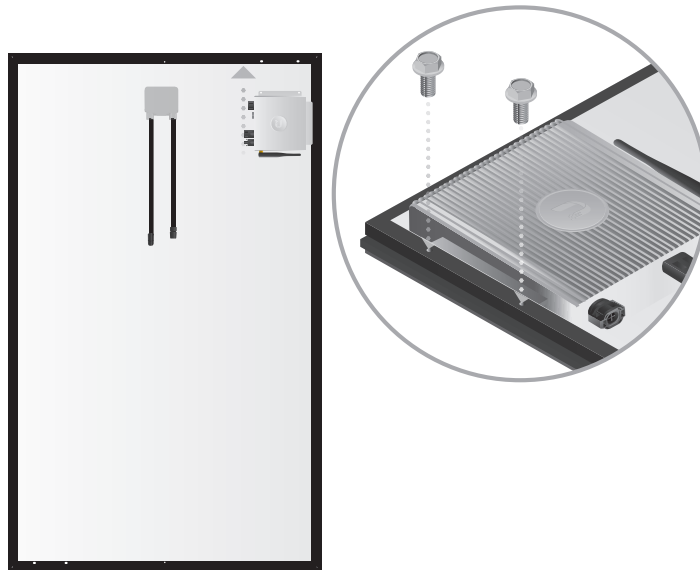


Note: Do not sit or place heavy objects anywhere on the *Solar Panel*.

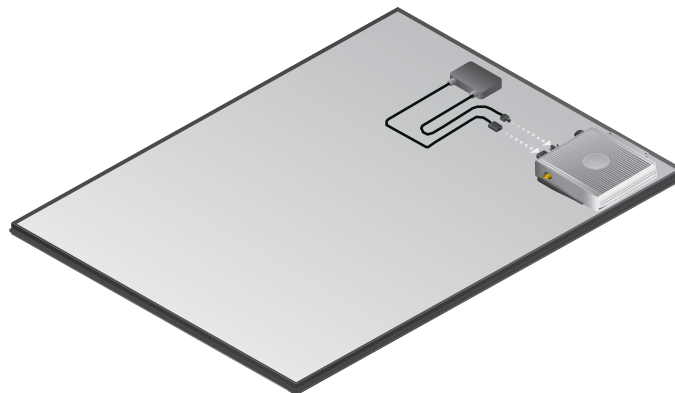
2. Position the *Microinverter* into the *Solar Panel* and slide it up along the edge of the frame until the holes line up at the top. Ensure that the neighboring side of the frame edge sits in the slotted edge of the *Microinverter*, which secures it to the frame.



- Using the mounting bolts, secure the *Microinverter* to the inside edge of the *Solar Panel* using 12 N-m of torque. Ensure that the neighboring edge of the *Microinverter* is still attached to the corner frame edge before inserting the mounting bolts.



- Connect both cables on the junction box to the DC ports on the *Microinverter* until you hear them snap in. Each connector is uniquely shaped to prevent reversal during the installation. The *Solar Panel* will now be referred to as an *AC Module*.



QR Code Labels

The *Microinverter* includes 3 QR code labels, each containing the MAC address of the *Microinverter*. These labels are required to document and commission the system as the array is being installed and should be placed in a convenient, accessible location to be scanned once the system is complete. Two of the labels can be placed on top-facing, opposite corners of the *AC Module* and the remaining label can be placed on a set of plans or on the back of the *AC Module* for future reference.



Sample QR Code Label

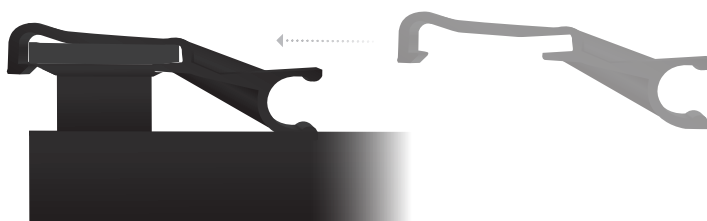
Installing the Cable Support Clips and Y-Cable

Before attaching *Cable Support Clips* and *Y-Cables* to the *AC Module*, decide whether the panels in your solar array will be configured for portrait or landscape orientation.

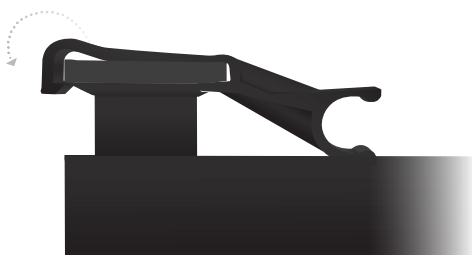
- Portrait *AC Modules* require two *Cable Support Clips* and a *Y-Cable*, model SM-YC-P4.
- Landscape *AC Modules* require three *Cable Support Clips* and a *Y-Cable*, model SM-YC-L4.

Portrait Orientation

1. Stand the *AC Module* up vertically against a wall so that the *Microinverter* is in the upper-right corner as you face the underside surface of the panel.
2. Attach the *Cable Support Clips* to the *AC Module* by performing the following steps:
 - a. Slide the first *Cable Support Clip* onto the inside edge of the frame, halfway between the *Microinverter* and junction box.



- b. Using your thumb, press the top of the *Cable Support Clip* over the front edge of the frame until it snaps into place.

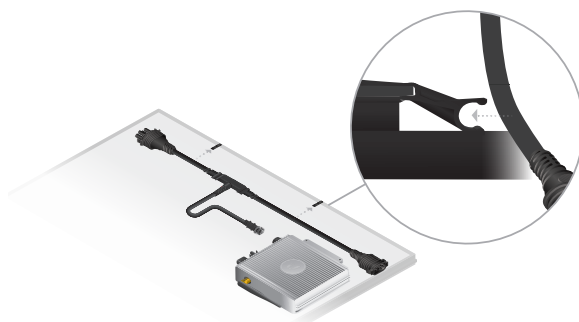


- c. Slide the second *Cable Support Clip* onto the inside edge of the frame, halfway between the junction box and the left corner edge of the *AC Module*.



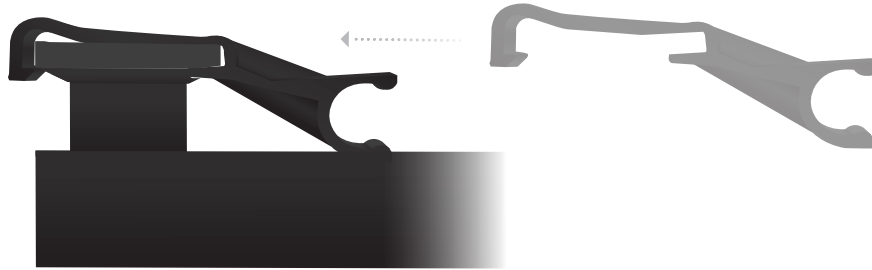
Note: Position the *Cable Support Clips* along the edges of the *AC Module* so that the *Y-Cables* and *Jumper Cables* do not sag during installation.

3. Attach the *Y-Cable* to the *Cable Support Clips*, securing it to the inside edge of the *AC Module*.

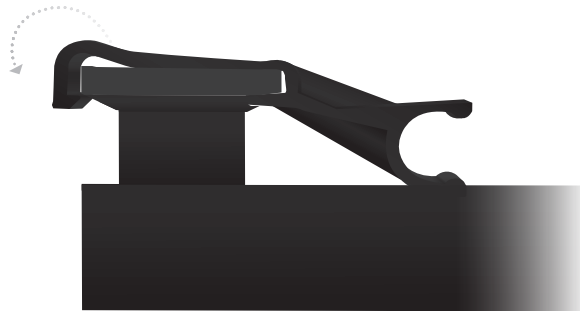


Landscape Orientation

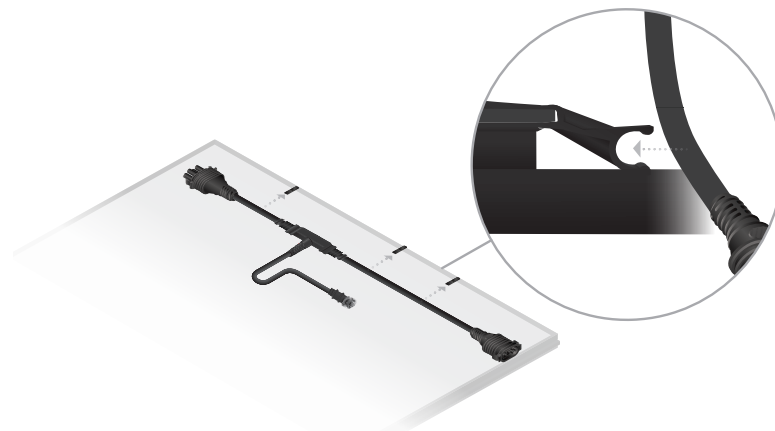
1. Stand the *AC Module* up horizontally against a wall so that the *Microinverter* is in the upper-left corner as you face the underside surface of the panel.
2. Attach the *Cable Support Clips* to the *AC Module* by performing the following steps:
 - a. Slide the first *Cable Support Clip* onto the inside edge of the frame, approximately 305 mm from the right corner edge of the *AC Module*.



- b. Using your thumb, press the top of the *Cable Support Clip* over the front edge of the frame until it snaps into place.

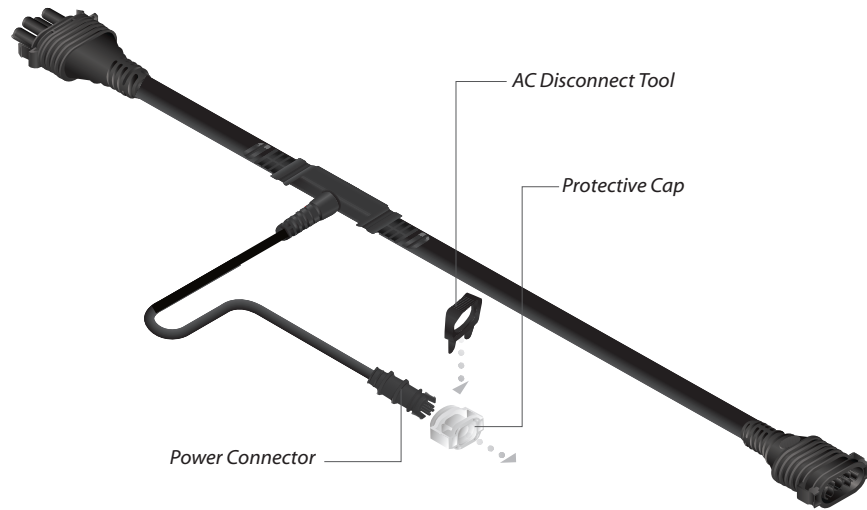


- c. Slide the second *Cable Support Clip* onto the inside edge of the frame, approximately 305 mm from the first *Cable Support Clip*.
 - d. Slide the third *Cable Support Clip* onto the inside edge of the frame, approximately 305 mm from the left corner edge of the *AC Module*.
3. Attach the *Y-Cable* to the *Cable Support Clips*, securing it to the inside edge of the *AC Module*.

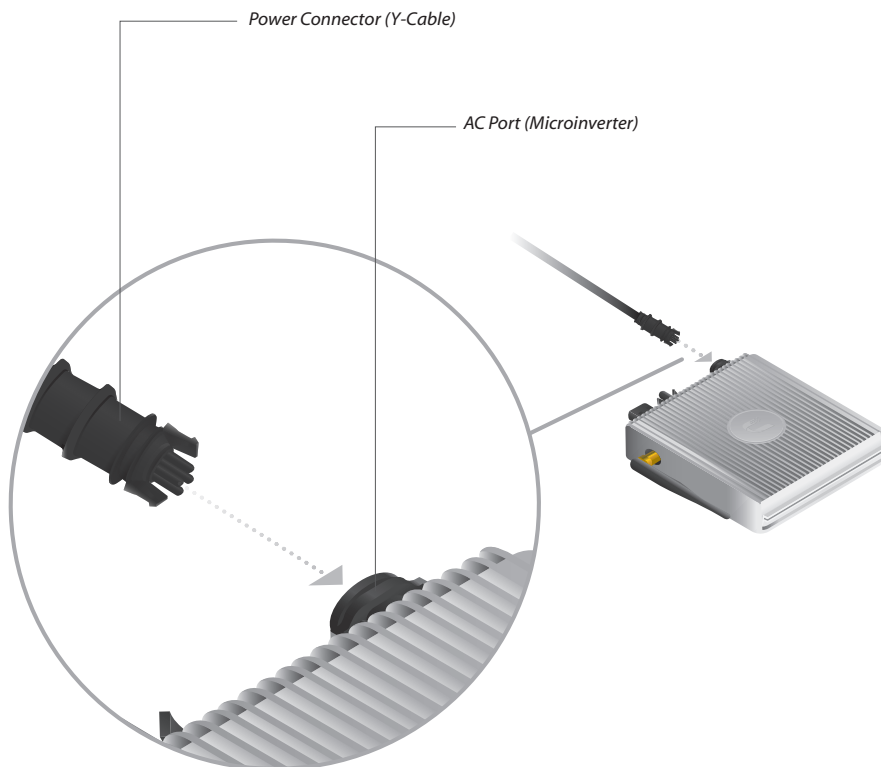


Connecting Y-Cable to Microinverter

1. Using the *AC Disconnect Tool*, remove the *Protective Cap* from the *Power Connector* on the *Y-Cable*.



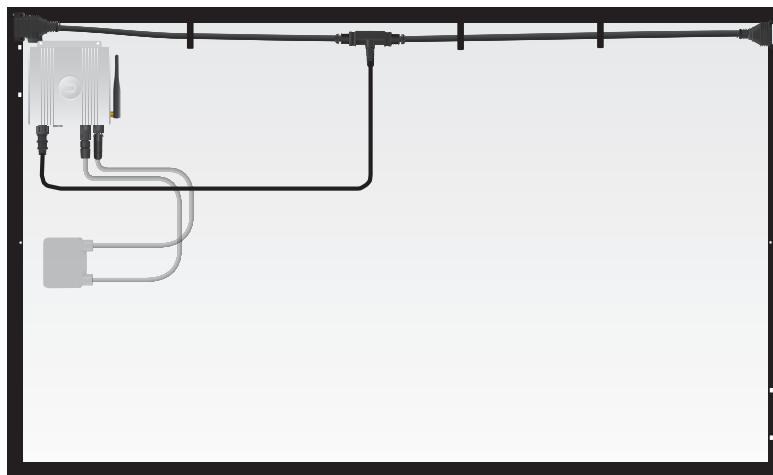
2. Plug the *Power Connector* on the *Y-Cable* into the *AC Port* on the *Microinverter*. The *Power Connector* is keyed to fit one way into the *Microinverter*.



The AC Module is now complete and ready for installation.



Portrait Configuration



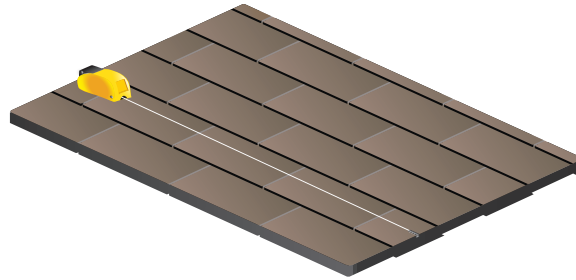
Landscape Configuration

Chapter 6: Installation

Roof Mount and Flashing Installation

Locate on the roof where the solar array will be installed. Ensure that you adhere to all local rules and regulations that correspond to your location in regards to measurements and spacing from roof eaves and ridges. For tile roof installations, refer to **“Appendix B: Tile Roof” on page 67.**

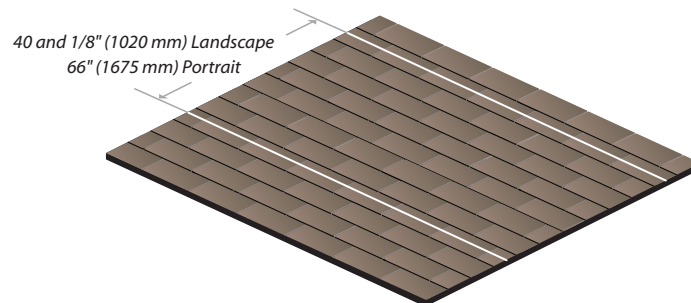
1. Mark the location of the first row of *Roof Mounts* by placing a chalk line horizontally across the roof. This chalk line should be 1.5" (38 mm) up from where the lower edge of the solar array will be installed.



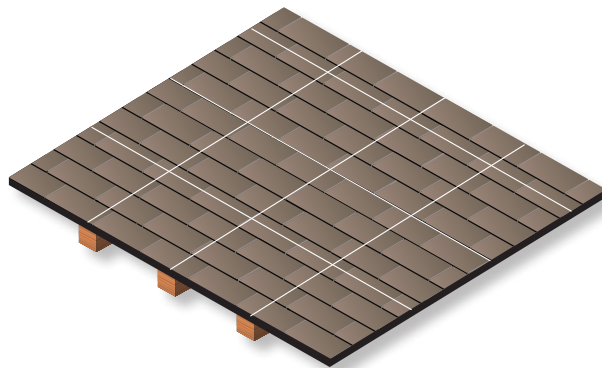
2. Mark the location of the second row of *Roof Mounts* by placing a parallel chalk line above the first, using the following guidelines:

- For portrait configurations, mark 66" (1675 mm) up from the previous chalk line.
- For landscape configurations, mark 40.13" (1020 mm) up from the previous chalk line.

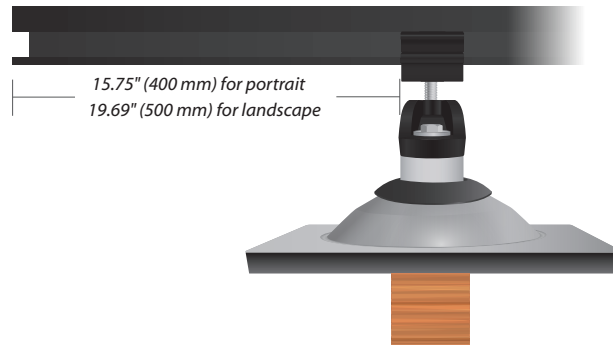
For additional rows, repeat this step as needed.



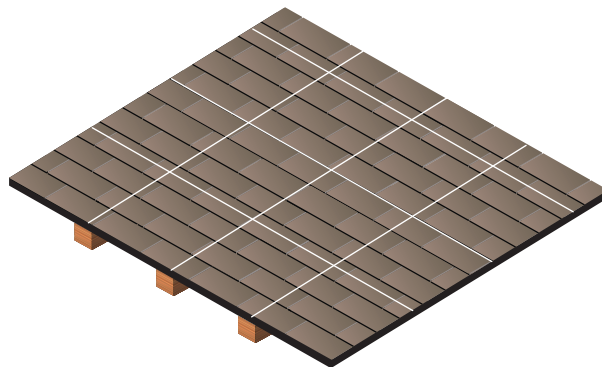
3. Mark the center line of each rafter along each of the horizontal chalk lines. These marks should be within 0.25" (6 mm) of the rafter center line.



4. Identify the first mount location by locating the closest rafter underneath the outside edge of the first *AC Module* in your array. Mark the center of the first rafter that will support the lower-edge corner of the first *AC Module* in your array. Ensure the location does not exceed the maximum cantilever distance of 15.75" (400 mm) for portrait configuration or 19.69" (500 mm) for landscape configuration. If a rafter does not fall within the maximum cantilever distance based on the current chalk line position, shift the *AC Module* position inward to reduce the distance.

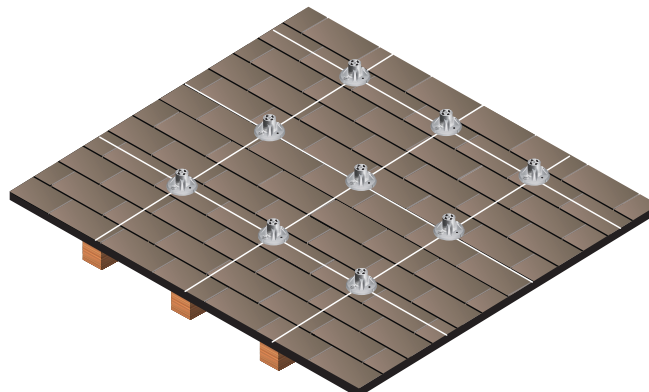


5. Once the first roof mount location is marked, continue to mark additional roof mount locations along each horizontal chalk line, observing the maximum spacing for your location until the desired layout is complete. Check the opposite end of the array to ensure the cantilever distance has not been exceeded at any other locations as well.

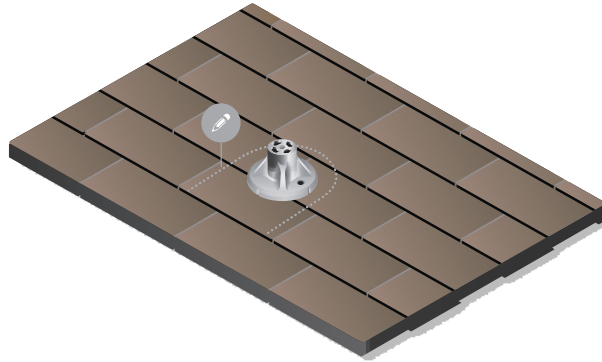


Refer to **“Appendix A: Span Tables”** on page 61 to determine the mount spacing for your particular installation location. This will provide you with the maximum spacing for your roof mounts.

6. Once you’ve determined the proper spacing, place each roof mount in position over the chalk lines. This will mark the mount locations and let you know which shingles to cut.



- The roof shingles need to be cut to allow proper installation of the *Roof Mounts* and *Flashing*. Use a chalk stick to mark a 3" (75 mm) area around the roof mount (to use as a guide) and trim the second course of shingles.



- Once you've trimmed the shingles, position the *Roof Mount* over the rafter center and start predrilling the two holes that will be used to secure the roof mount to the rafter. Use the shingle cutout and the two smaller holes on the roof mount as a guide for positioning.



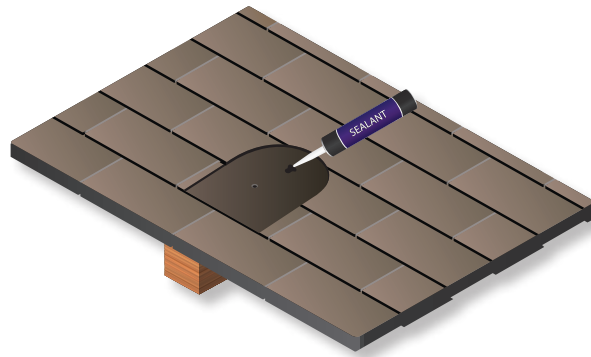
Note: To avoid damaging the roof mount, do not drill the holes completely through with the roof mount in place.



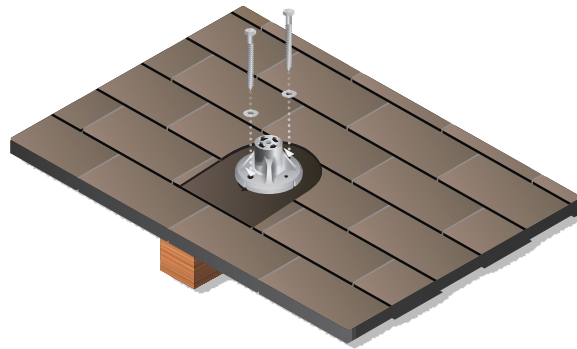
- Remove the roof mount temporarily and finish predrilling two 3/16" (4.8 mm) holes approximately 2" (50 mm) deep.



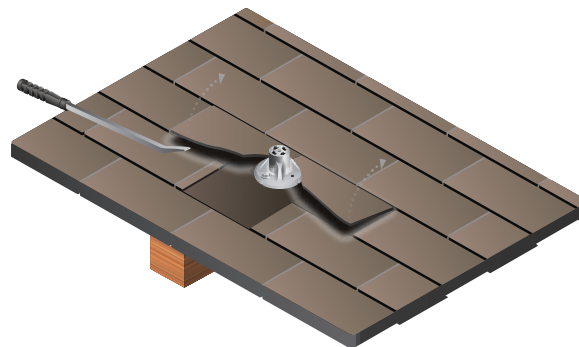
10. Cover both hole openings with roofing sealant. This will ensure a watertight installation once you've secured the lag screws to the rafter.



11. Position the *Roof Mount* into place and tighten the lag screws until the *Roof Mount* is secure.



12. Slide a roofing bar under the shingles to break the bond where the *Flashing* will sit. Remove any nails that will interfere with the installation of *Flashing* and lift up the shingles.



13. Apply roof sealant to the underside of the *Flashing* and in an inverted U shape around the opening.



Wearing gloves is recommended as the *Flashing* has sharp edges and also may become hot when exposed to warm temperatures.

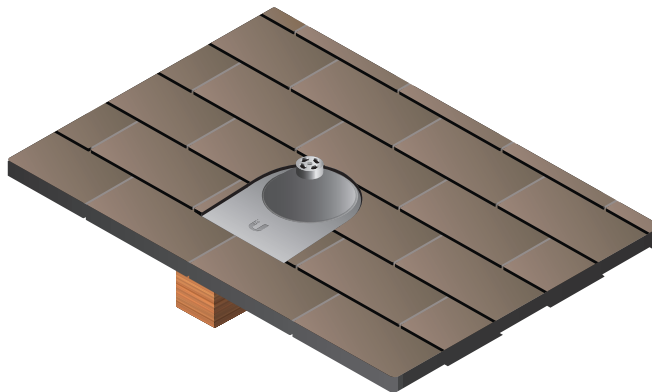


14. Slip the *Flashing* into place underneath the upper course of shingles and lower it over the roof mount. The *Flashing* should be installed with the Ubiquiti logo towards the front.

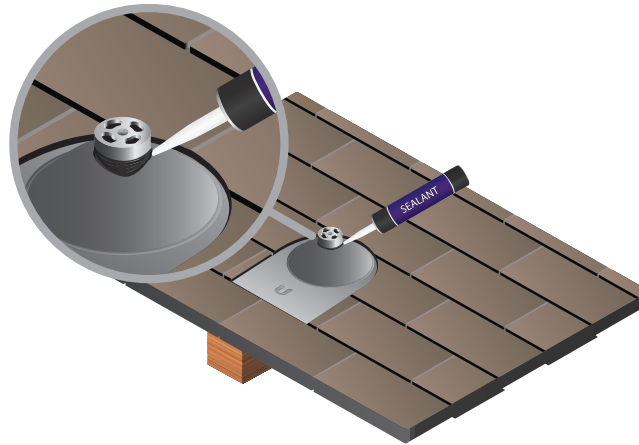


15. Reseat the shingles to cover the *Flashing*. Position the *Flashing* to meet the following criteria:

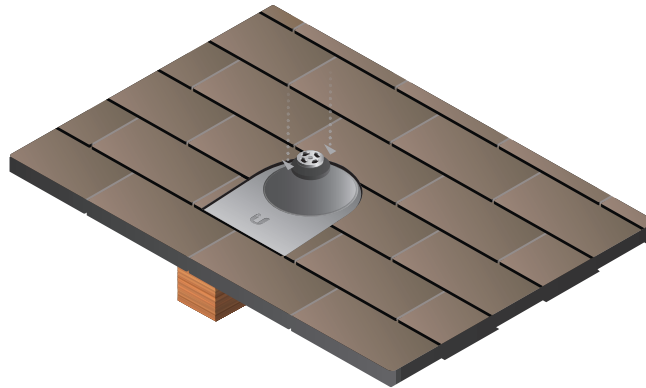
- The lower edge does not extend beyond the first course of shingles.
- The upper edge is located underneath the third course of shingles.



16. Apply a minimum of ¼" (6 mm) continuous roof caulking around the gap between the *Flashing* and the *Roof Mount*.

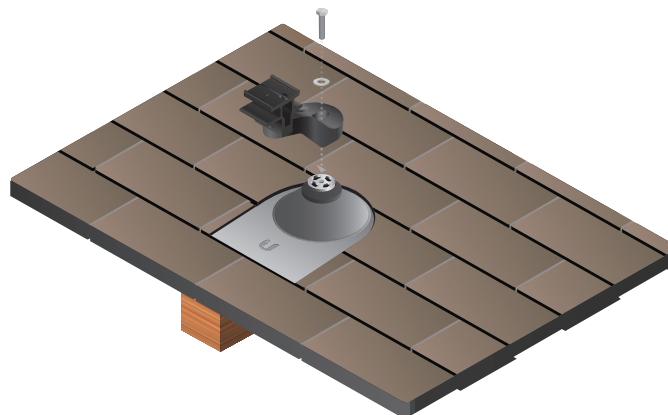


17. Install the rubber counter flashing over the neck of the *Roof Mount* until it is fully seated onto the *Flashing*.

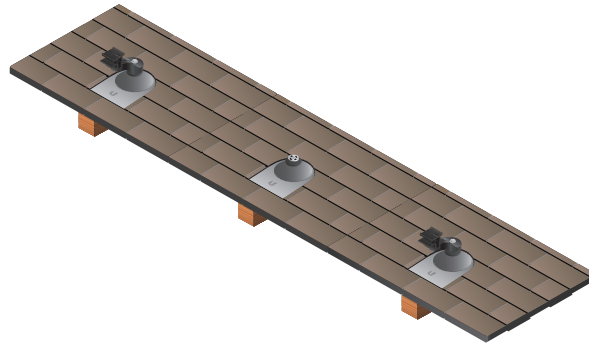


Mounting Assembly Installation

1. Use the mounting hardware to attach *Mounting Assemblies* to the *Roof Mounts*. To begin, only install *Mounting Assemblies* at the two outer locations in the front row of the array. Each *Mounting Assembly* has an arrow on the top surface of the 360° swivel that should always point towards the *Trim Cover*.



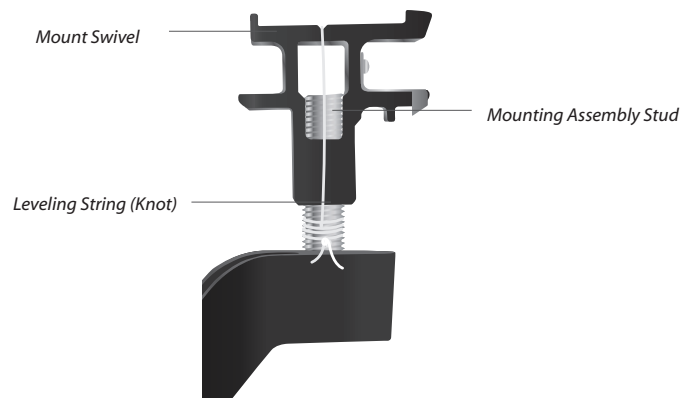
- Secure and tighten each mounting assembly bolt using 14 lb-ft or 19 N-m of torque. The mounting base and swivel portion for each *Mounting Assembly* should be facing downroof as shown.



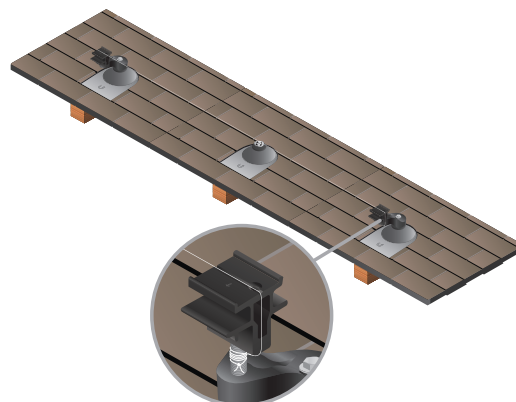
Note: If you need to adjust the position of the *Mounting Assemblies* later, you can loosen the mounting bolts and make the necessary adjustments.

Leveling the Mounting Assemblies

- Using leveling string, tie a knot around the first mounting assembly stud, just below the swivel portion of the *Mounting Assembly*. Ensure that the top portion of the stud can be seen through the opening of the mount swivel. As a starting point, adjust the *Mounting Assembly* to mid-height where the top of the mounting stud is level with the lower lip of the mount swivel.



- Pull the leveling string up and over the top of the mount swivel, extending it all the way to the last *Mounting Assembly* in the row.

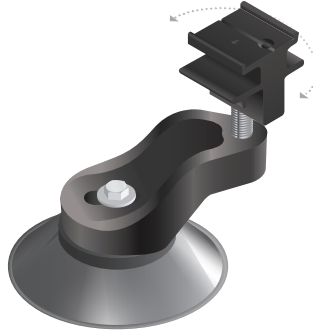


3. Once you've reached the *Mounting Assembly* at the other end of the row, pull the leveling string over the top surface of the mount swivel and tie another knot around the mounting assembly stud as performed in step 1.

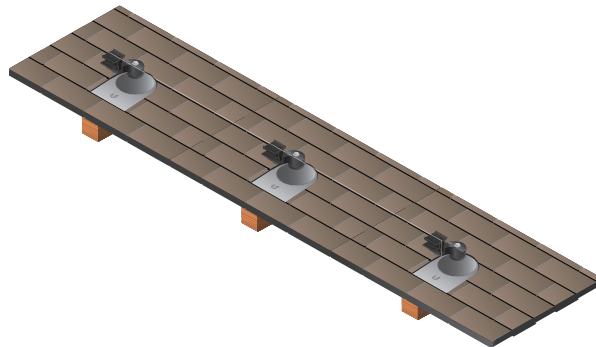


Note: Apply some tension to the string to create a leveling guide between the first and last *Mounting Assemblies*.

4. At both ends of the leveling guide, measure the height between the string and the surface of the roof structure. If the height is not the same at both ends, turn the mount swivel to adjust the height so they are the same. To raise the height, turn the mount swivel counterclockwise. To lower the height, turn the mount swivel clockwise.



5. Once the first and last *Mounting Assemblies* in that row are the same height, adjust the remaining *Mounting Assemblies* by turning the mount swivels (clockwise or counterclockwise) until they are the same height and position as the leveling string.

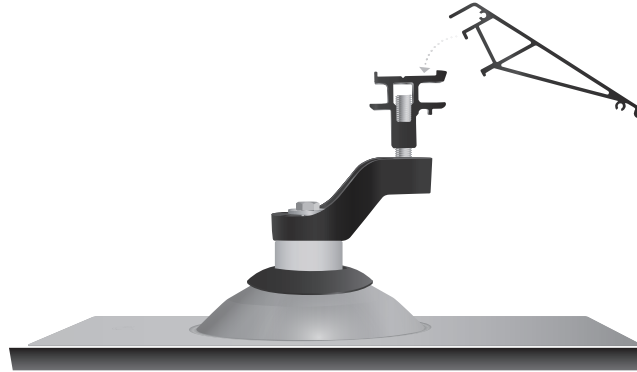


6. Secure and tighten each *Mounting Assembly* bolt using 14 lb-ft or 19 N-m of torque and remove the leveling string before installing the *Trim Cover*.

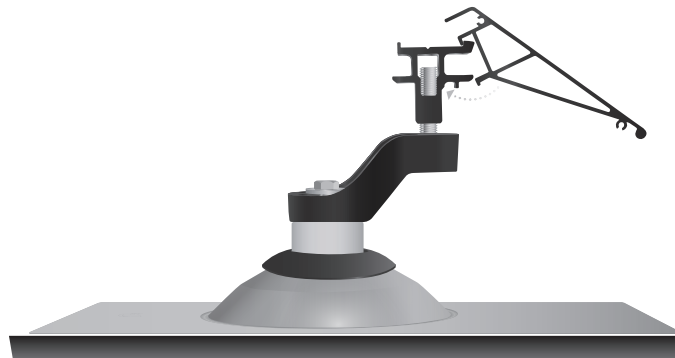
Trim Cover Installation

With all of the *Mounting Assemblies* now at the same height, install the trim cover by following these steps:

1. Hook the *Trim Cover* over the top lip of the *Mounting Assemblies* by placing it horizontally across the mount swivels in row one and rotating it down until it comes to a stop.



2. The trim covers are sized to fit the *AC Module* edges and should be positioned to support each location in which the *AC Modules* will be installed. Ensure that each *Trim Cover* is fully seated on the *Mounting Assemblies* in that row. If more than one *Trim Cover* will be installed, position each additional one side by side until the front row is complete.



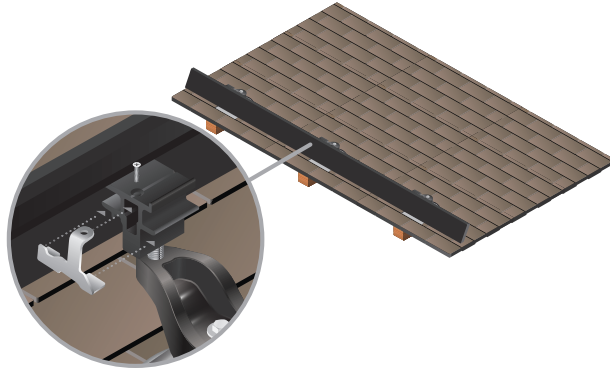
3. Using the included hardware, attach the endcap plates to both of the open ends of the *Trim Cover*. Align the holes in the endcap plate with the pre-drilled holes on the ends of the *Trim Cover* and secure it to each of the sides.



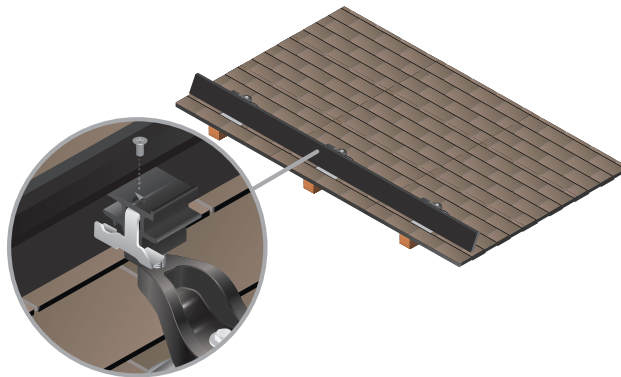
Trim Lock Installation

Once the *Trim Covers* are installed, secure each *Trim Cover* to the *Mounting Assemblies* by installing a trim lock on each mounting swivel.

1. Place and hold the trim lock up against the side of the *Mounting Assembly* and align it underneath the hole located in the mounting swivel.



2. Holding the trim lock in place, insert the trim lock screw through the top of the *Mounting Assembly* and secure the trim lock to the mount swivel. The trim lock will also secure the *Trim Cover* to the *Mounting Assemblies* in row one.

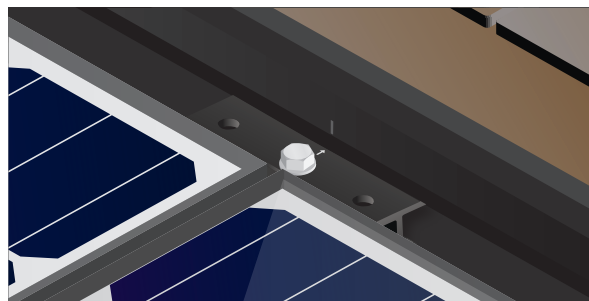


Panel Connector Installation for Trim Cover

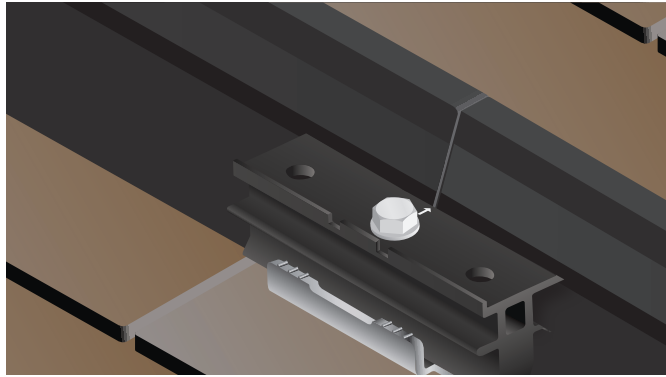
Prior to installing the first row of *AC Modules*, insert *Panel Connectors* into the *Trim Cover* at all locations where *AC Modules* will be installed. If the first row in your solar array will consist of more than one *Trim Cover*, you will also use a *Panel Connector* to join together the ends of adjoining *Trim Covers*.

Each *Panel Connector* has an arrow on the top surface that should point toward the *Trim Cover*. To help with alignment, the arrow on the *Panel Connector* should be aligned with one of the following:

- The alignment mark on all 2-Panel Portrait *Trim Covers*.



- The vertical gap created by the installation of two *Trim Covers* installed side by side.



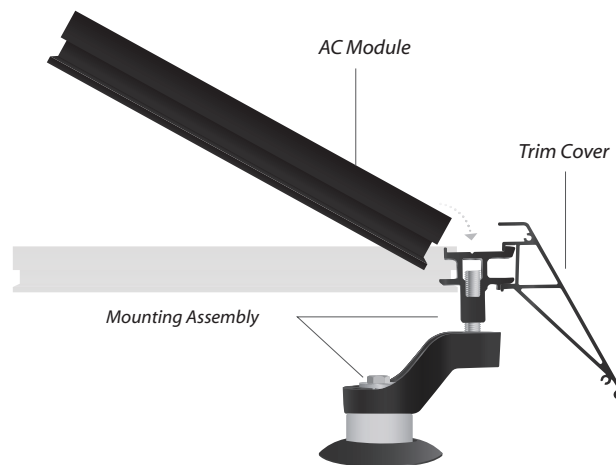
AC Module Installation

With the *Trim Covers* installed properly, follow these steps to install the *AC Modules*:

1. Hook the *AC Module* onto the top lip of the *Mounting Assemblies* in row one and lower it approximately 45° while pulling back slightly on the *AC Module*.



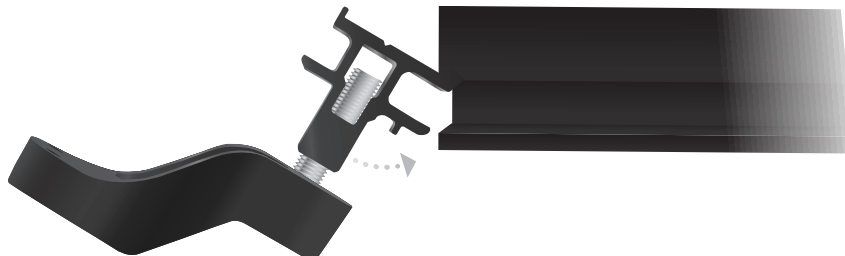
Note: The remaining roof mount locations should not have *Mounting Assemblies* installed yet.



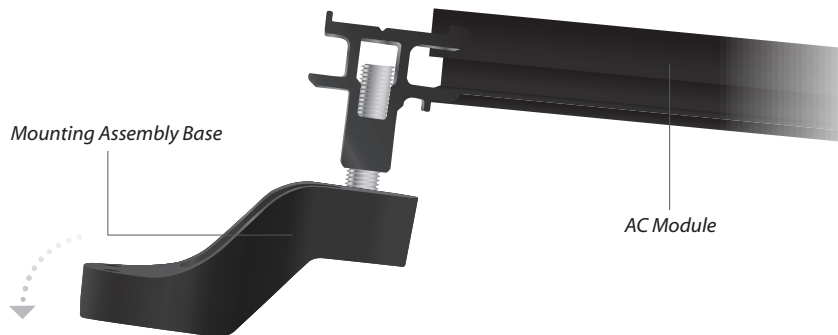
2. Holding the *AC Module* at a 45° angle, hook the *Mounting Assembly* into the edge of the frame, ensuring the arrow is facing forward. Line up the mounting base over the *Roof Mount* as you lower the *AC Module*.



Note: If the *AC Module* will sit on more than one *Mounting Assembly* or *Connector Mount*, ensure that each component is inserted into the top edge of the *AC Module* before securing it to the roof mounts.

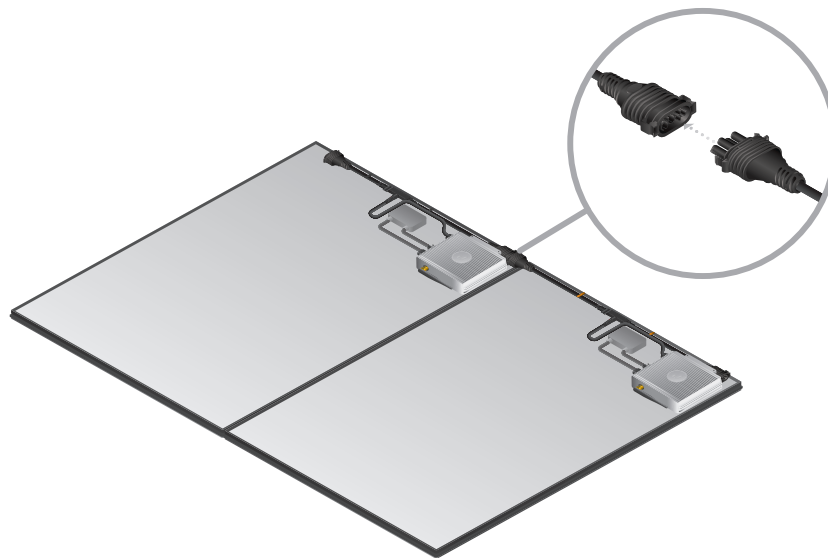


3. While lowering the *AC Module* into place, continue to pull it slightly towards you to ensure it remains hooked onto the swivel mounts in the previous row. Secure the *AC Module* to the *Roof Mounts* using the *Mounting Assembly*. If the *AC Module* is not seated properly or sitting evenly with the mounting hardware in row one, make the necessary adjustments.

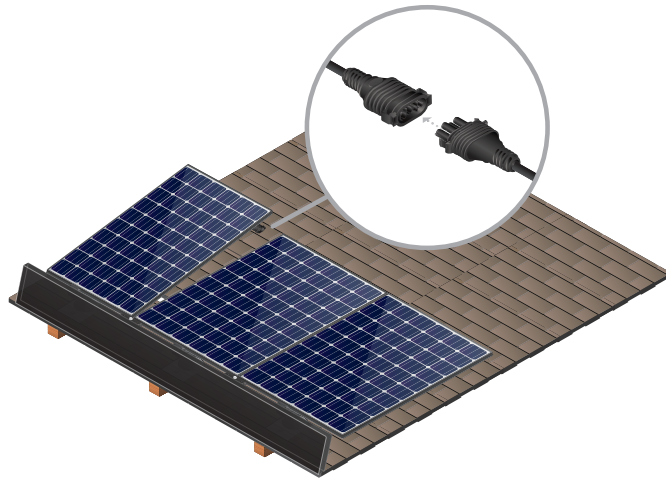


Note: If adjustments need to be made to one or both of the *Mounting Assemblies* in row two, turn the base of the *Mounting Assembly* in either direction to adjust its height. To raise the height, turn the base clockwise. To lower the height, turn the base counterclockwise.

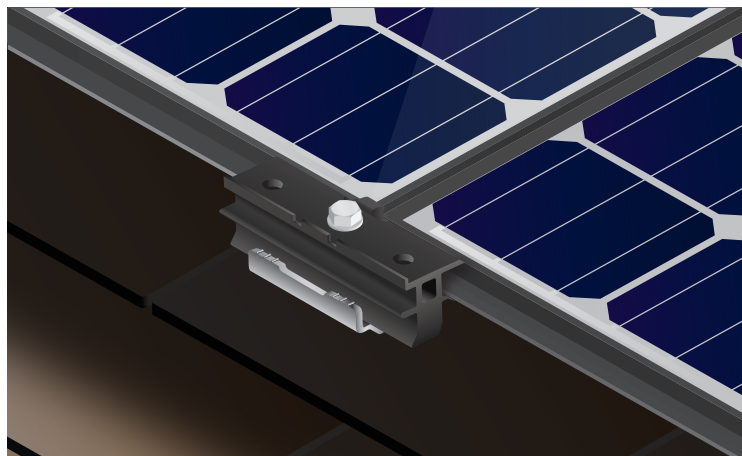
4. Once the *Mounting Assemblies* are all the same height, secure the *AC Module* to the *Roof Mount*.
5. Install the second *AC Module*, like the first, and join them together with a panel connector along the frame corners.
6. For each additional *AC Module* in the array, connect the AC trunk cables underneath before securing the next *AC Module* to the *Roof Mounts*. This ensures easier accessibility to the assembly components underneath.



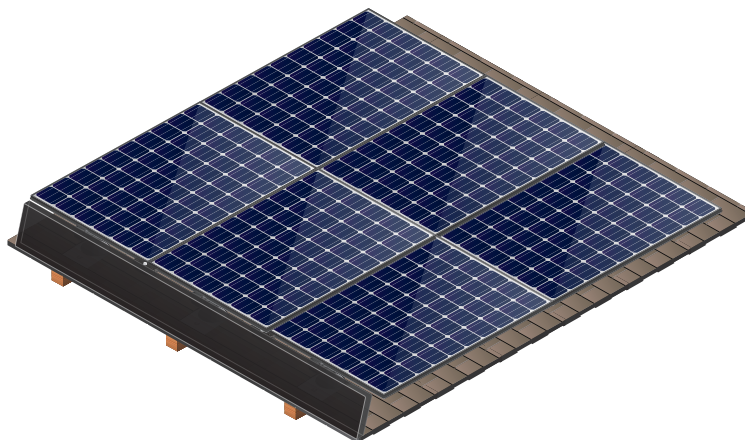
7. Once the trunk cables are connected, lower and secure the *AC Module* into place.



8. If the corner edges of the *AC Modules* do not rest on a *Connector Mount*, use a *Panel Connector* to join the *AC Modules* together. *Panel Connectors* connect *AC Modules* together structurally along the frame edges and bond them together electrically.

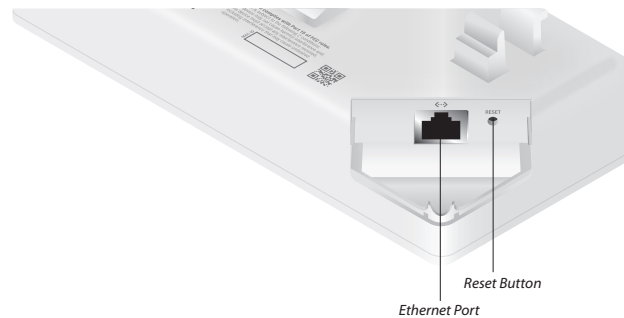


9. Continue installing *AC Modules*, working from side to side, until the layout of your solar array is complete. In a multi-row system, *Jumper Cables* are required to connect the second row of *AC Modules* to the first.



Solar Gateway

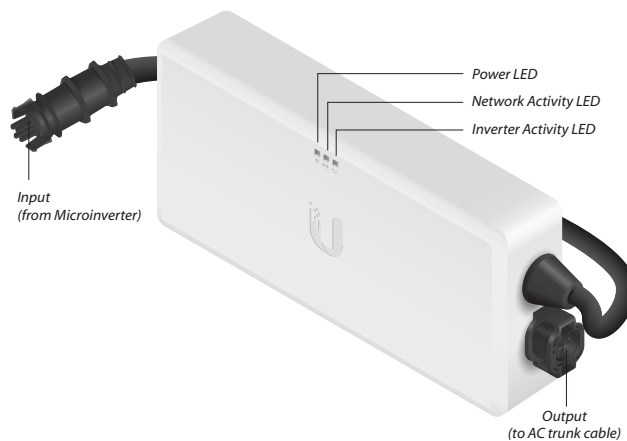
Ports




Ethernet Port This Ethernet port is used to connect the *Solar Gateway* to your LAN.


Reset Button This button resets the *Solar Gateway* back to factory defaults. Press and hold the *Reset* button for more than 10 seconds while the *Solar Gateway* is powered on.


LEDs and Connectors



LEDs

 **Power** The *Power LED* will light steady green when the device is connected to a power source. The LED may change color during general system activity.

 **Network Activity** The *Network Activity LED* will light steady green when the network and cloud are connected. It will light red if a network connection cannot be established

 **Inverter Activity** The *Inverter Activity LED* will light steady green when all *Microinverters* are detected. It will light yellow if one or more of the *Microinverters* are missing and light red if errors are detected.


Connectors

The *Solar Gateway* has two external connectors.

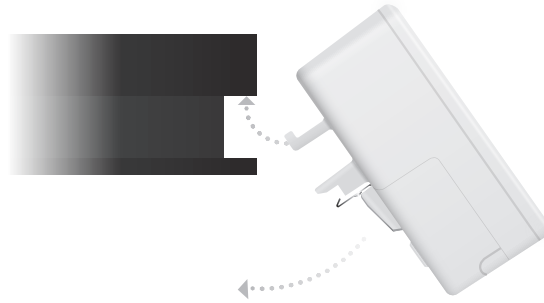
Input Connects the *Solar Gateway* to the *Microinverter*.

Output Connects the AC cable to the *Solar Gateway*.

Installation

 **WARNING:** Before installing this product, disconnect the solar system from the grid or any source of power to prevent shock or damage.

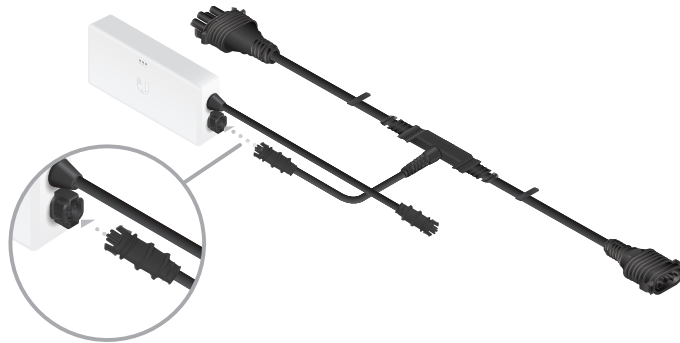
1. Tilt the *Solar Gateway* forward and hook it underneath the upper edge of the solar module railing. Rotate it down until it stops and rests along the side of the *AC Module*.



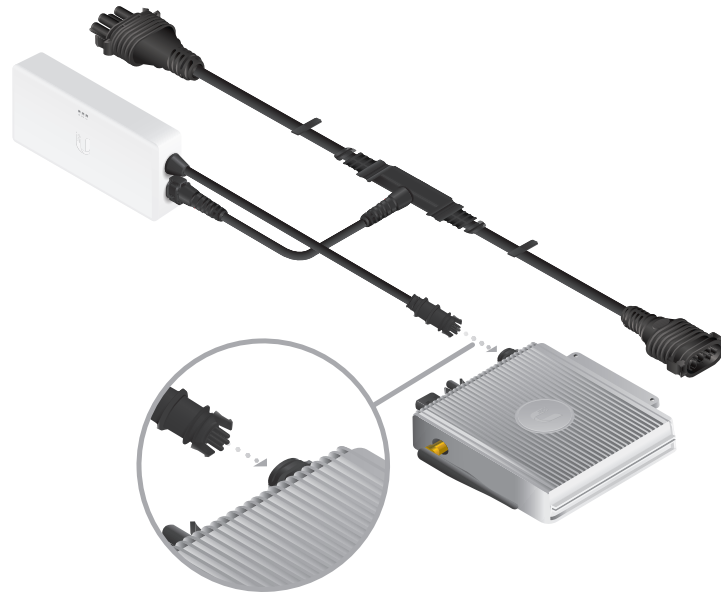
2. Use the *AC Disconnect Tool* to disconnect the AC trunk cable from the *Microinverter*.



3. Connect the AC trunk cable to the *Output* connector on the *Solar Gateway*.



4. Connect the *Input* cable on the *Solar Gateway* to the four-prong connector on the *Microinverter*.



Setup Using the Mobile App

The *sunMAX Install* app allows you to set up the *Solar Gateway* on your network to communicate with the Ubiquiti cloud management software. Download the *sunMAX Install* app on your mobile device from the Google Play™ Store (Android).

1. Launch the app once your download is complete.
2. Type your username and password into their corresponding fields. If you would like the *sunMAX* app to remember your password, tap **Remember my password** prior to signing in.



Note: The username and password are created when you register online at <https://account.ubnt.com/login>

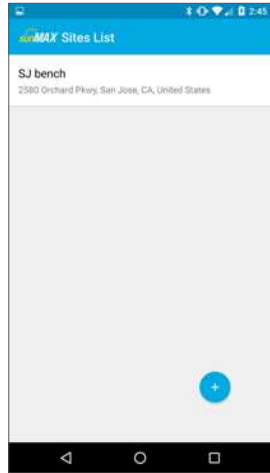
3. Tap **Sign In** to sign into the app and proceed.



4. Tap a site from the **Sites List** to view the details associated with that specific customer address.



Note: To add a new site, tap the **+** icon and enter the *Site Name* and *Address* of the new location in the fields provided. This includes selecting the appropriate country and regulatory region as well. When you are finished, tap the **✓** icon in the upper left corner or tap **Done**.



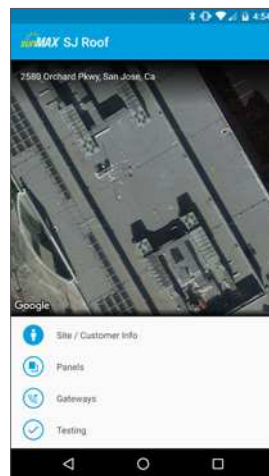
Existing Locations



Add New Location

When the *Site Dashboard* screen appears, you will see four options: *Site/Customer Info*, *Panels*, *Gateways*, and *Testing*.

- **Site/Customer Info** Allows you to view or edit the address and regulatory region for the selected site.
- **Panels** Allows you to scan and provision solar panels for the selected site.
- **Gateways** Allows you to start setting up the *Solar Gateway(s)* for the selected site.
- **Testing** Allows you to view the status of the *Solar Gateway(s)* and *AC Modules* for the selected site, including the amount of power being produced by the array.

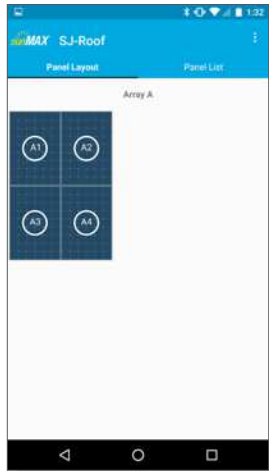


5. To continue the installation process, tap **Panels** from the *Site Dashboard* screen.

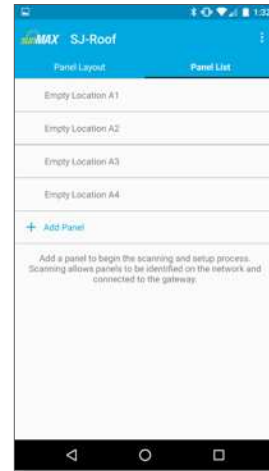
Panels

When the *Panels* screen appears, you will see two tabs: *Panel Layout* and *Panel List*.

- **Panel Layout** Displays the site layout created using the sunMAX design tool.
- **Panel List** Allows you to create a new site design by adding panels to the layout and showing them in a list view. Each *Empty Location* signifies a place holder where a panel hasn't been adopted yet.



Panel Layout



Panel List

Scan With Existing Layout

1. Scan one of the QR code labels that came with the corresponding *Microinverter*. See **“QR Code Labels”** on **page 26** for more information.



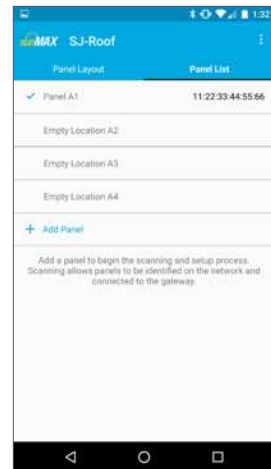
- After scanning the QR code label associated with its corresponding *Microinverter*, the selected panel name will light up blue in the app, indicating that the panel was provisioned successfully.




Note: In the *Panel List* view, the MAC address will also be displayed next to the panel name.



Panel Layout - A1 Installed



Panel List - A1 Installed

- Repeat steps one through four until the array design is completely provisioned. When you are finished, tap  to go back to the *Site Dashboard* screen.

Scan Without Layout

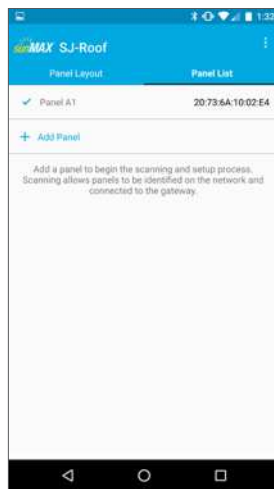
- If you are creating a new panel design or changing an incorrect panel configuration, it is recommended that you delete all existing panels before you begin, otherwise you may end up with unused panel numbers. Tap **Add Panel** to add new locations and adopt a panel.




2. Scan one of the QR code labels that came with the corresponding *Microinverter*. See **“QR Code Labels”** on **page 26** for more information.



3. After scanning the QR code label associated with its corresponding *Microinverter*, the panel name (along with its MAC address) will appear in the list of *Panel Scans*. This indicates that the panel was added successfully.



4. Repeat steps two through four until all panels have been added. When you are finished, tap  to go back to the *Site Dashboard* screen.

Solar Gateway

1. To begin setting up the *Solar Gateway*, tap *Gateways* on the *Site Dashboard* screen.



2. When prompted for a connection type to your local network, tap **Ethernet** to use a wired connection or **airGateway** to use the included *airGateway* to connect to a Wi-Fi network.

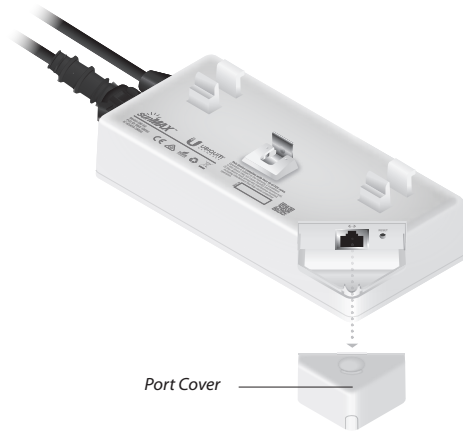


3. Scan the QR code to complete the pairing process and proceed to the section (in this user guide) that corresponds with your selection in step two: **“Ethernet” on page 52** or **“AirGateway” on page 53**.

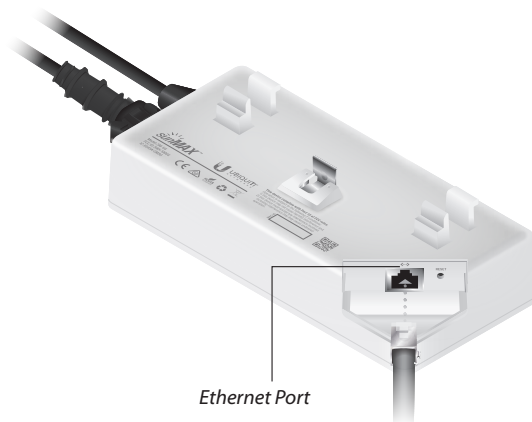


Ethernet

1. Connect an Ethernet cable to your *Solar Gateway* by performing steps a-c and tap **Next** when finished.
 - a. Remove the *Port Cover* from the *Solar Gateway*.



- b. Connect an Ethernet cable from your home network to the *Ethernet Port* on the *Solar Gateway*.



- c. Reseat the *Port Cover* on the *Solar Gateway*.



2. Proceed to **“End Run Installation”** on page 55.

AirGateway

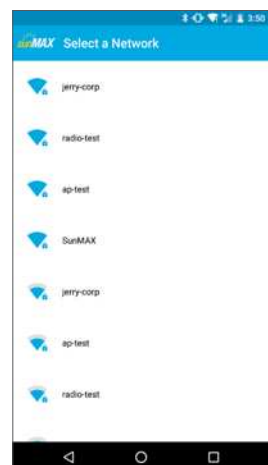
1. Connect the *airGateway* to the *PoE Adapter* and tap **Next**.



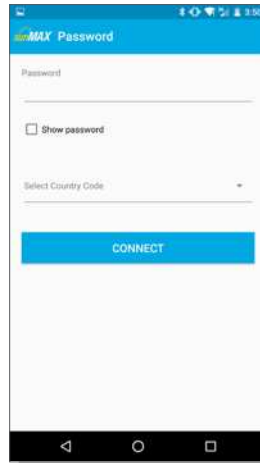
2. Connect the Ethernet port from the Solar Gateway to the *PoE* port on the *airGateway* and connect the power cord to the *PoE Adapter*. Tap **Next** when you are finished.



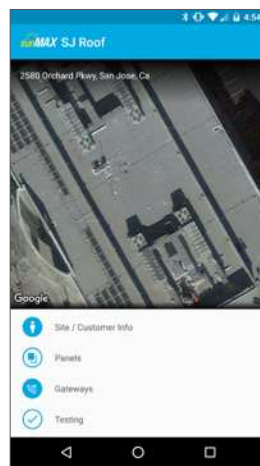
3. When the list of discovered wireless networks appears, tap the Wi-Fi network you will be connecting to.



4. When prompted, enter the criteria for your Wi-Fi network. Type your password in the *Password* field and tap **Select Country Code** to select your country. When you are finished, tap **Connect**.






5. When the app returns to the *Site Dashboard* screen, the *Gateways* icon will be solid blue, indicating successful installation of the gateway.



End Run Installation

Safety

-  Prior to the installation of the *End Run*, ensure the main breaker and any alternate power sources are turned off so the main panel is not energized.
-  Ensure that you do not cut or damage the insulation of any wires.
-  Adhere to local guidelines for all wire gauges and installation requirements.

Items Required

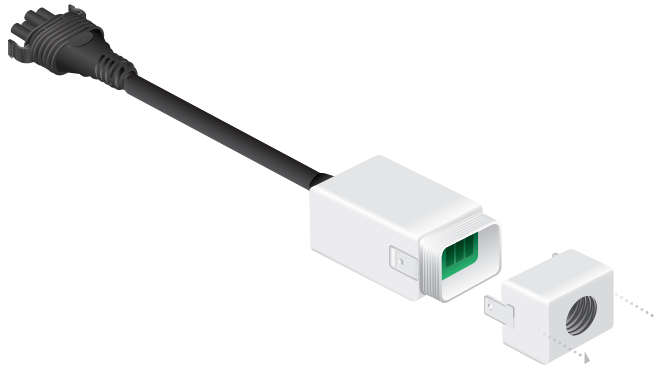
- Small flat blade screwdriver
- Wire stripper
- #2 Phillips screwdriver
- 13 mm wrench
- ½" NPT conduit connector for *SM-EC-NA*
- Liquid-tight flexible metal conduit (LFMC) or EMT tubing
- 10-12 AWG (3.3-5.3 mm²) THWN-2 differently colored wire
- 6 AWG (13.3 mm²) copper grounding wire



SM-EC-NA

Hardware Installation

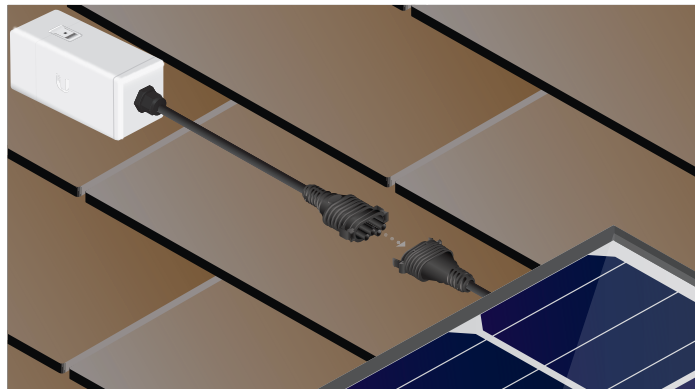
1. Using a flat blade screwdriver, remove the *End Run* cover by gently prying the locking tabs outward and sliding the cover off.



2. Locate the open connector at the end of your array of *AC Modules* and connect the end run cable to the *Y-Cable* until it is firmly seated.

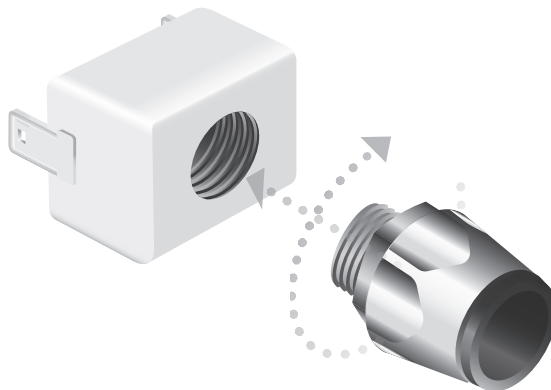


Note: One *End Run* can support up to 15 continuous *AC Modules* in an array. Solar arrays comprised of more than 15 *AC Modules* will require additional *End Run* assemblies.

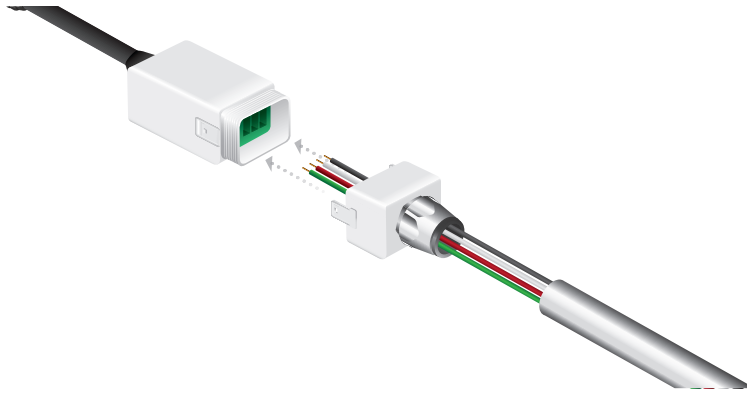


SM-EC-NA connecting to solar array

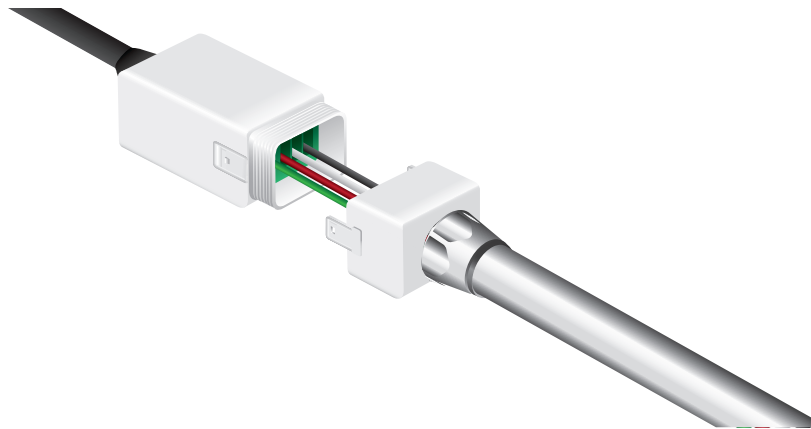
3. Thread the conduit connector into the *End Run* cover.



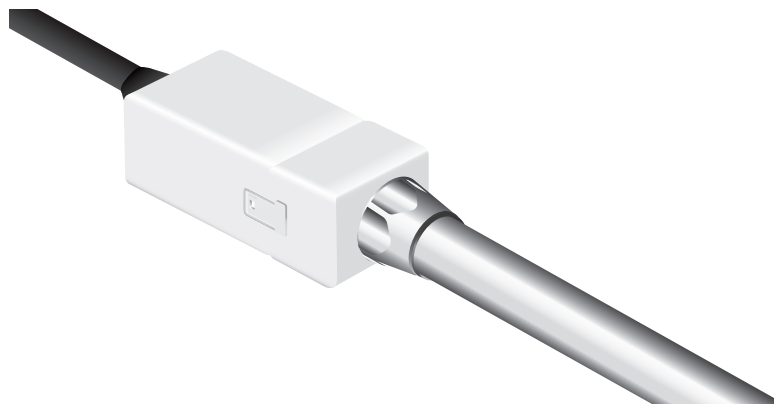
4. Feed the house-side wiring through the conduit and the cover of the *End Run* assembly.



5. Secure the conduit to the conduit connector and insert the appropriate wires into their respective terminal block locations (L1-N-L2-GND) inside the *End Run* housing.



6. Slide the *End Run* housing into the cover until it snaps securely in place and pull back on the wiring from the other end to reduce the slack.



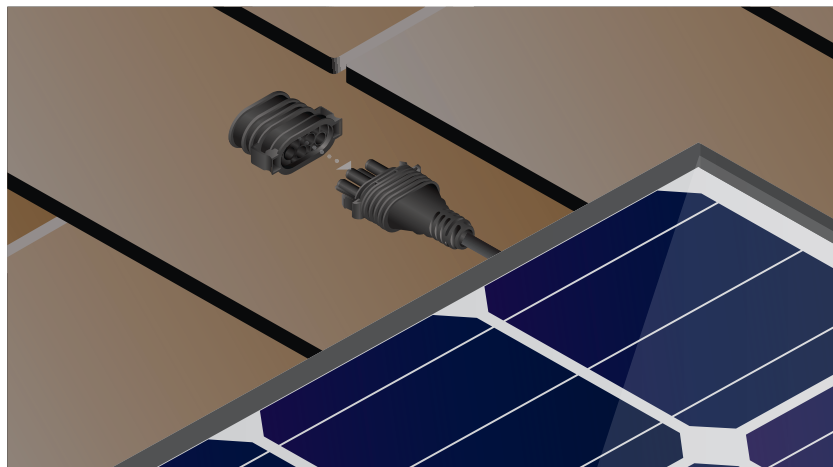
7. Position the *End Run* underneath and in line with the outside edge of the *AC Module*, preferably with the conduit side facing in the downroof position.



8. Spread the conduit support clamps open and fit them over the conduit with the non-threaded screw hole facing out. Twist the screw into the clamp until the screw thread is visible and protruding from the opposite side.
9. Hook the conduit clamp on the inside lip of the *AC Module* and then over the outer lip. Tighten the screw on each conduit clamp to support the conduit on the *AC Module*.



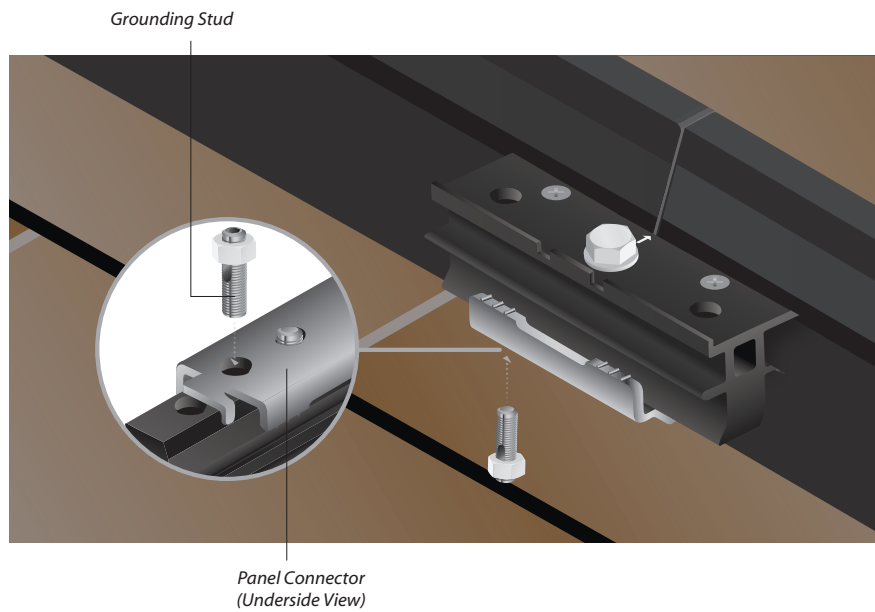
10. On the opposite end of the row of *AC Modules*, terminate the open *Y-Cable* using the *Cable End Cap*.



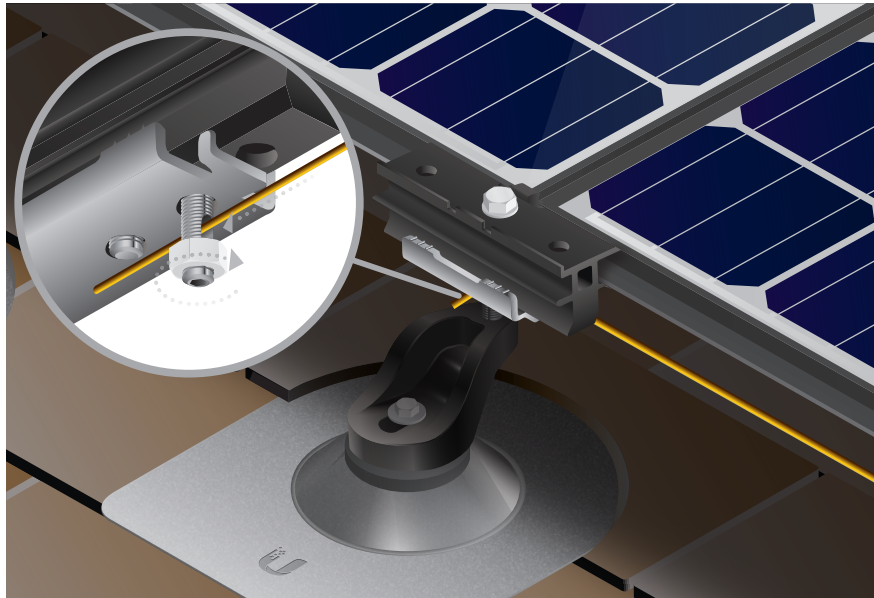
11. Install the *Grounding Stud* into the pre-threaded hole located underneath any *Panel Connector* in the array.



Note: A *Grounding Stud* can ground up to 60 *AC Modules* if they are connected together using *Panel Connectors*.



12. Insert one end of the copper grounding wire into the grounding stud and torque the hex nut to 7.4 lb-ft or 10 N-m.



13. Ensure you label the *End Run* wires and complete the house-side wiring according to local rules and regulations.

Appendix A: Span Tables

Exposure Category B

Interior Zone

Roof Zone	Roof Slope	Ground Snow Load (psf)	Wind Speed (mph) ¹							
			85	90	100	110	120	130	140	150
Interior	0-7° <2:12	0	48"	48"	48"	48"	24"	24"	24"	24"
		10	48"	48"	48"	48"	24"	24"	24"	24"
		20	48"	48"	48"	48"	24"	24"	24"	24"
		30	48"	48"	48"	48"	24"	24"	24"	24"
		40	48"	48"	48"	48"	24"	24"	24"	24"
		50	48"	48"	48"	48"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"
	>7-27° 2:12 - 6:12	0	48"	48"	48"	48"	24"	24"	24"	24"
		10	48"	48"	48"	48"	24"	24"	24"	24"
		20	48"	48"	48"	48"	24"	24"	24"	24"
		30	48"	48"	48"	48"	24"	24"	24"	24"
		40	48"	48"	48"	48"	24"	24"	24"	24"
		50	48"	48"	48"	48"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"
	>27-45° 7:12 - 12:12	0	48"	48"	48"	48"	48"	48"	24"	24"
		10	48"	48"	48"	48"	48"	48"	24"	24"
		20	48"	48"	48"	48"	48"	48"	24"	24"
		30	48"	48"	48"	48"	48"	48"	24"	24"
		40	48"	48"	48"	48"	48"	48"	24"	24"
		50	48"	48"	48"	48"	48"	48"	24"	24"
		60	48"	48"	48"	48"	48"	48"	24"	24"
		70	48"	48"	48"	48"	48"	48"	24"	24"
		75	48"	48"	48"	48"	48"	48"	24"	24"

¹ In accordance with ASCE 7-05

24" = 609.6 mm | 48" = 1219.2 mm

Edge Zone

Roof Zone	Roof Slope	Ground Snow Load (psf)	Wind Speed (mph) ¹							
			85	90	100	110	120	130	140	150
Edge	0-7° <2:12	0	48"	48"	48"	24"	24"	24"	24"	24"
		10	48"	48"	48"	24"	24"	24"	24"	24"
		20	48"	48"	48"	24"	24"	24"	24"	24"
		30	48"	48"	48"	24"	24"	24"	24"	24"
		40	48"	48"	48"	24"	24"	24"	24"	24"
		50	48"	48"	48"	24"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"
	>7-27° 2:12 - 6:12	0	48"	48"	24"	24"	24"	24"	24"	24"
		10	48"	48"	24"	24"	24"	24"	24"	24"
		20	48"	48"	24"	24"	24"	24"	24"	24"
		30	48"	48"	24"	24"	24"	24"	24"	24"
		40	48"	48"	24"	24"	24"	24"	24"	24"
		50	48"	48"	24"	24"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"
	>27-45° 7:12 - 12:12	0	48"	48"	48"	48"	48"	24"	24"	24"
		10	48"	48"	48"	48"	48"	24"	24"	24"
		20	48"	48"	48"	48"	48"	24"	24"	24"
		30	48"	48"	48"	48"	48"	24"	24"	24"
		40	48"	48"	48"	48"	48"	24"	24"	24"
		50	48"	48"	48"	48"	48"	24"	24"	24"
		60	48"	48"	48"	48"	48"	24"	24"	24"
		70	48"	48"	48"	48"	48"	24"	24"	24"
		75	48"	48"	48"	48"	48"	24"	24"	24"

¹ In accordance with ASCE 7-05

24" = 609.6 mm | 48" = 1219.2 mm

Exposure Category C

Interior Zone

Roof Zone	Roof Slope	Ground Snow Load (psf)	Wind Speed (mph) ¹							
			85	90	100	110	120	130	140	150
Interior	0-7° <2:12	0	48"	48"	48"	24"	24"	24"	24"	24"
		10	48"	48"	48"	24"	24"	24"	24"	24"
		20	48"	48"	48"	24"	24"	24"	24"	24"
		30	48"	48"	48"	24"	24"	24"	24"	24"
		40	48"	48"	48"	24"	24"	24"	24"	24"
		50	48"	48"	48"	24"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"
	>7-27° 2:12 - 6:12	0	48"	48"	48"	24"	24"	24"	24"	24"
		10	48"	48"	48"	24"	24"	24"	24"	24"
		20	48"	48"	48"	24"	24"	24"	24"	24"
		30	48"	48"	48"	24"	24"	24"	24"	24"
		40	48"	48"	48"	24"	24"	24"	24"	24"
		50	48"	48"	48"	24"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"
	>27-45° 7:12 - 12:12	0	48"	48"	48"	48"	48"	24"	24"	24"
		10	48"	48"	48"	48"	48"	24"	24"	24"
		20	48"	48"	48"	48"	48"	24"	24"	24"
		30	48"	48"	48"	48"	48"	24"	24"	24"
		40	48"	48"	48"	48"	48"	24"	24"	24"
		50	48"	48"	48"	48"	48"	24"	24"	24"
		60	48"	48"	48"	48"	48"	24"	24"	24"
		70	48"	48"	48"	48"	48"	24"	24"	24"
		75	48"	48"	48"	48"	24"	24"	24"	24"

¹ In accordance with ASCE 7-05

24" = 609.6 mm | 48" = 1219.2 mm

Edge Zone

Roof Zone	Roof Slope	Ground Snow Load (psf)	Wind Speed (mph) ¹									
			85	90	100	110	120	130	140	150		
Edge	0-7° <2:12	0	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		10	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		20	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		30	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		40	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		50	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		60	24"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		70	24"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		75	24"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
	>7-27° 2:12 - 6:12	0	48"	48"	24"	24"	24"	24"	24"	24"	24"	N/A
		10	48"	48"	24"	24"	24"	24"	24"	24"	24"	N/A
		20	48"	48"	24"	24"	24"	24"	24"	24"	24"	N/A
		30	48"	48"	24"	24"	24"	24"	24"	24"	24"	N/A
		40	48"	48"	24"	24"	24"	24"	24"	24"	24"	N/A
		50	48"	48"	24"	24"	24"	24"	24"	24"	24"	N/A
		60	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		70	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
		75	48"	24"	24"	24"	24"	24"	24"	24"	24"	N/A
	>27-45° 7:12 - 12:12	0	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		10	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		20	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		30	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		40	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		50	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		60	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		70	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"
		75	48"	48"	48"	48"	48"	24"	24"	24"	24"	24"

¹ In accordance with ASCE 7-05

24" = 609.6 mm | 48" = 1219.2 mm

Exposure Category D

Interior Zone

Roof Zone	Roof Slope	Ground Snow Load (psf)	Wind Speed (mph) ¹								
			85	90	100	110	120	130	140	150	
Interior	0-7° <2:12	0	48"	48"	24"	24"	24"	24"	24"	24"	24"
		10	48"	48"	24"	24"	24"	24"	24"	24"	24"
		20	48"	48"	24"	24"	24"	24"	24"	24"	24"
		30	48"	48"	24"	24"	24"	24"	24"	24"	24"
		40	48"	48"	24"	24"	24"	24"	24"	24"	24"
		50	48"	48"	24"	24"	24"	24"	24"	24"	24"
		60	48"	48"	24"	24"	24"	24"	24"	24"	24"
		70	48"	48"	24"	24"	24"	24"	24"	24"	24"
		75	48"	48"	24"	24"	24"	24"	24"	24"	24"
	>7-27° 2:12 - 6:12	0	48"	48"	24"	24"	24"	24"	24"	24"	24"
		10	48"	48"	24"	24"	24"	24"	24"	24"	24"
		20	48"	48"	24"	24"	24"	24"	24"	24"	24"
		30	48"	48"	24"	24"	24"	24"	24"	24"	24"
		40	48"	48"	24"	24"	24"	24"	24"	24"	24"
		50	48"	48"	24"	24"	24"	24"	24"	24"	24"
		60	24"	24"	24"	24"	24"	24"	24"	24"	24"
		70	24"	24"	24"	24"	24"	24"	24"	24"	24"
		75	24"	24"	24"	24"	24"	24"	24"	24"	24"
	>27-45° 7:12 - 12:12	0	48"	48"	48"	24"	24"	24"	24"	24"	24"
		10	48"	48"	48"	24"	24"	24"	24"	24"	24"
		20	48"	48"	48"	24"	24"	24"	24"	24"	24"
		30	48"	48"	48"	24"	24"	24"	24"	24"	24"
		40	48"	48"	48"	24"	24"	24"	24"	24"	24"
		50	48"	48"	48"	24"	24"	24"	24"	24"	24"
		60	48"	48"	48"	24"	24"	24"	24"	24"	24"
		70	48"	48"	48"	24"	24"	24"	24"	24"	24"
		75	48"	48"	48"	24"	24"	24"	24"	24"	24"

¹ In accordance with ASCE 7-05

24" = 609.6 mm | 48" = 1219.2 mm

Edge Zone

Roof Zone	Roof Slope	Ground Snow Load (psf)	Wind Speed (mph) ¹								
			85	90	100	110	120	130	140	150	
Edge	0-7° <2:12	0	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		10	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		20	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		30	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		40	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		50	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		60	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		70	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		75	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
	>7-27° 2:12 - 6:12	0	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		10	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		20	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		30	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		40	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		50	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		60	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		70	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
		75	24"	24"	24"	24"	24"	24"	24"	N/A	N/A
	>27-45° 7:12 - 12:12	0	48"	48"	48"	24"	24"	24"	24"	24"	24"
		10	48"	48"	48"	24"	24"	24"	24"	24"	24"
		20	48"	48"	48"	24"	24"	24"	24"	24"	24"
		30	48"	48"	48"	24"	24"	24"	24"	24"	24"
		40	48"	48"	48"	24"	24"	24"	24"	24"	24"
		50	48"	48"	48"	24"	24"	24"	24"	24"	24"
		60	48"	48"	48"	24"	24"	24"	24"	24"	24"
		70	48"	48"	48"	24"	24"	24"	24"	24"	24"
		75	48"	48"	48"	24"	24"	24"	24"	24"	24"

¹ In accordance with ASCE 7-05

24" = 609.6 mm | 48" = 1219.2 mm

Appendix B: Tile Roof

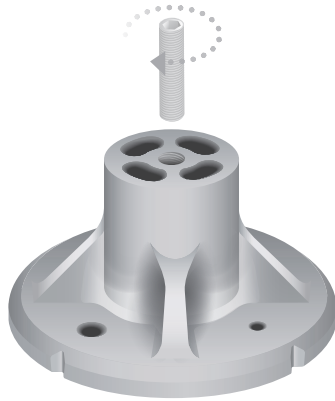
Additional Tile Roof Mount Requirements

- Angle grinder/saw with a masonry blade
- Roofing paper and roofing cement

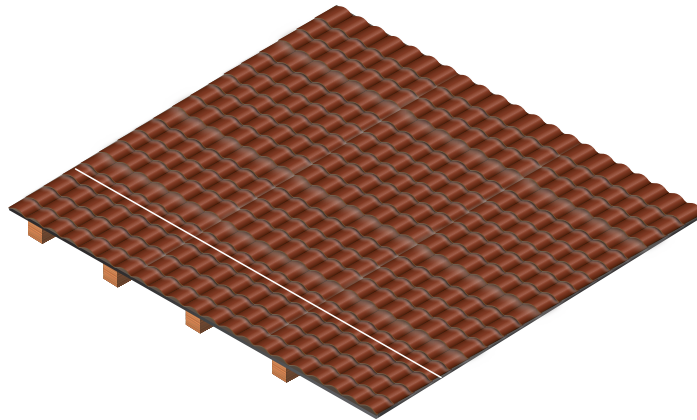
Roof Mount and Flashing Installation

Subflashing

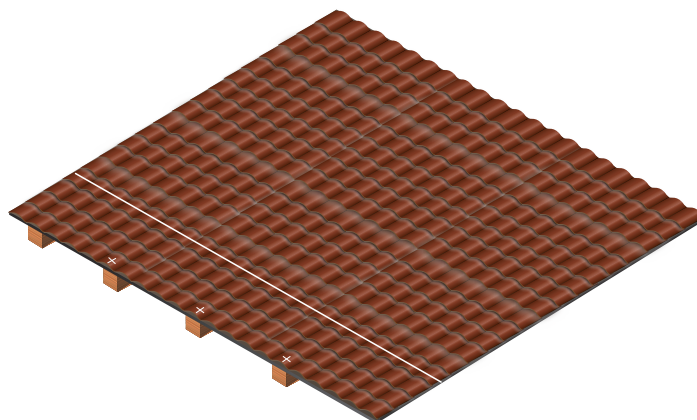
1. Install the threaded studs into the *Roof Mounts* by turning them clockwise until they bottom out.



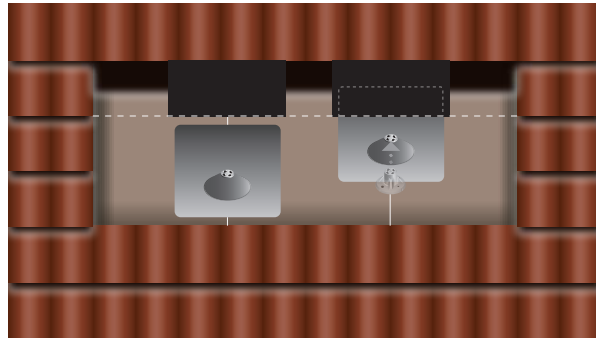
2. Mark the location of the first row of *Roof Mounts* by placing a chalk line horizontally across the roof. This chalk line should be 1.5" (38 mm) up from where the lower edge of the *AC Module* will sit.



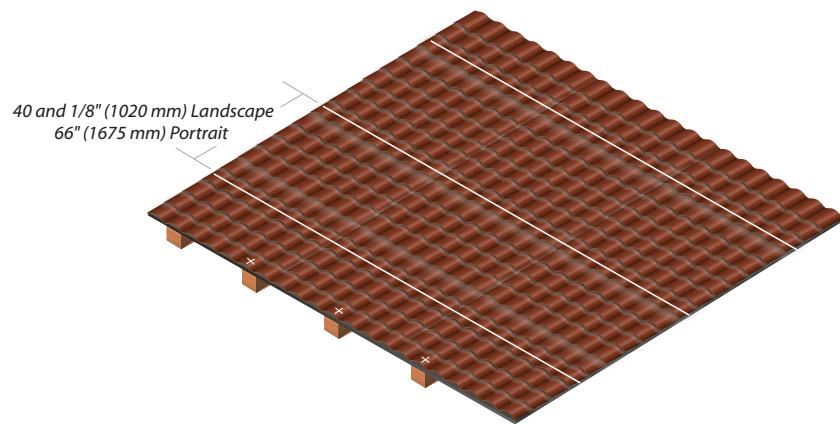
3. Mark the front edge of a row of tiles to designate the location of the roof's rafters.



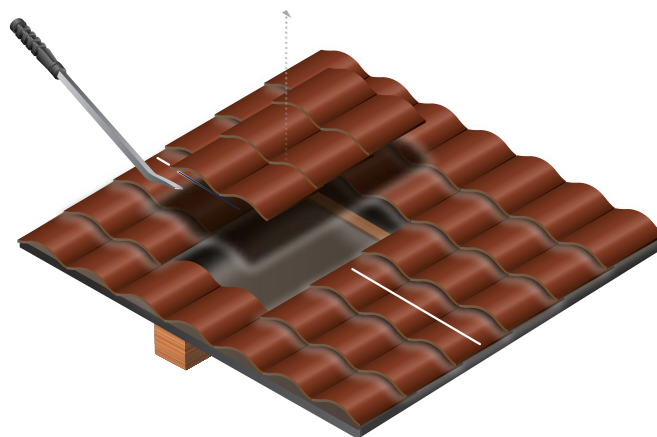
4. Using the larger, upper *Flashing* as a guide, ensure that the upper edge of the *Flashing* will sit at least 1" (25 mm) under the front edge of tiles in the course above. If the *Flashing* does not extend up underneath the course of tiles above, adjust it along the vertical chalk line until it does.



5. Mark the location of the second row of *Roof Mounts* by placing a parallel chalk line above the first, using the following guidelines:
- For portrait configurations, mark 66" (1675 mm) up from the previous chalk line.
 - For landscape configurations, mark 40.13" (1020 mm) up from the previous chalk line.
- For additional rows, repeat this step as needed.

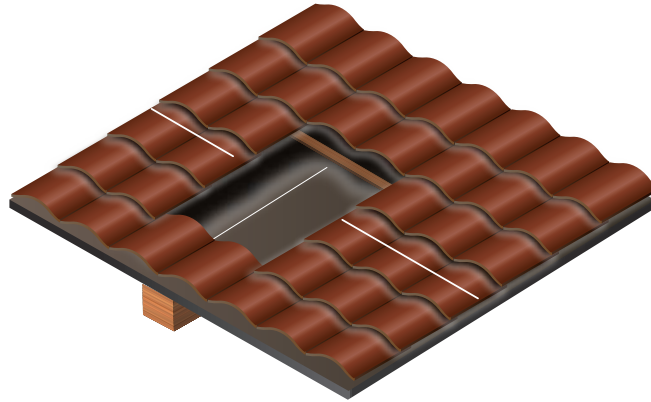


6. Use a roofing bar, remove the tiles from locations where *Roof Mounts* will be installed.

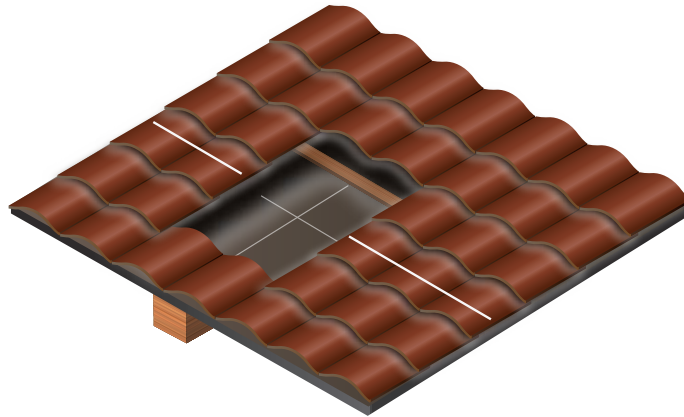


7. Clear the mounting surface area of any dirt or debris.

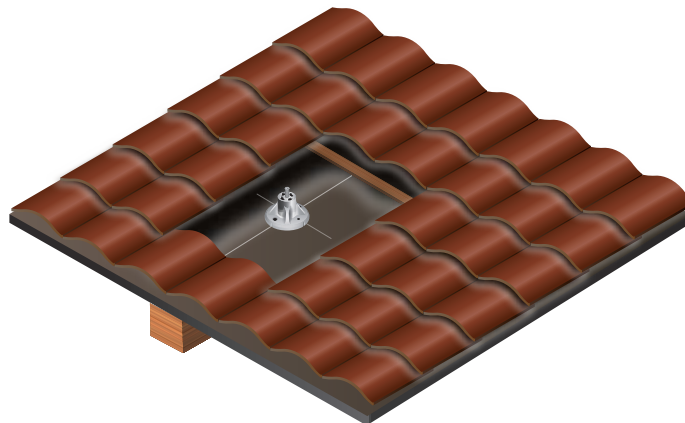
8. Using chalk or crayon, locate and mark the vertical rafter locations on the underlayment surface.



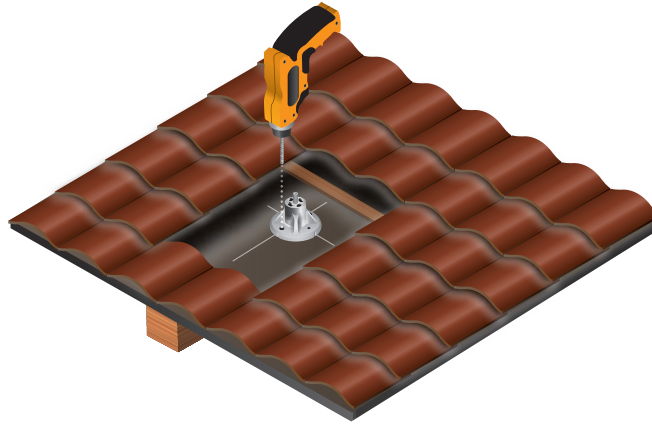
9. Transfer the horizontal chalk lines from the tiles to the underlayment below.



10. Place a *Roof Mount* on the underlayment and line up the vertical holes in the mount base with the chalk line.

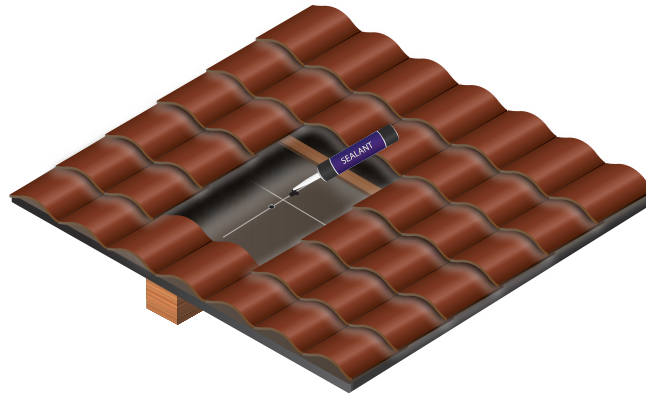


11. Pre-drill two penetration points along the vertical axis using the roof mount holes as your template. To avoid damaging the roof mount base, do not drill all the way through to the rafter with it in place.

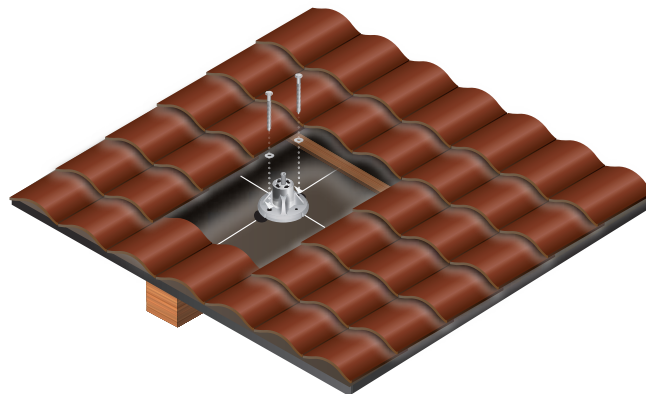


12. Remove the *Roof Mount* and complete the two pre-drilled holes that you started until they penetrate the roof's surface and drill into the rafter approximately 2.5" (63.5 mm) down.

13. Apply roofing sealant to both pre-drilled holes, completely covering both openings.



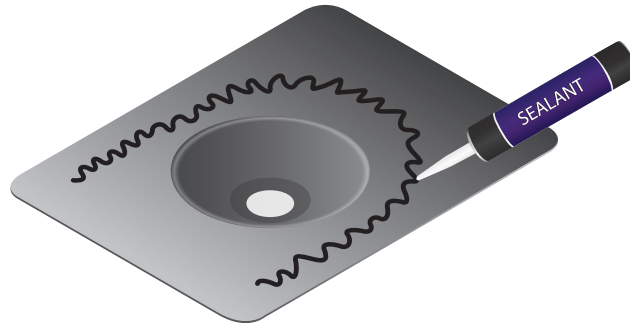
14. Place the roof mount back into position, lining up the larger vertical holes with the pre-drilled holes on the roof's underlayment. Using the lag bolts, secure the roof mount to the underlayment. To prevent damaging the surface of the roof, do not overtighten the lag bolts.



With the roof mount in place, use one of the two methods available to install the subflashing: **"Bibbing Method" on page 71** or **"Three-Course Method" on page 73**. Both methods are just as effective, but use different material to cover the flashing. Bibbing uses roofing paper and the three-course method uses roofing cement and felt paper. Please proceed to the section that applies to the installation method of your choice.

Bibbing Method

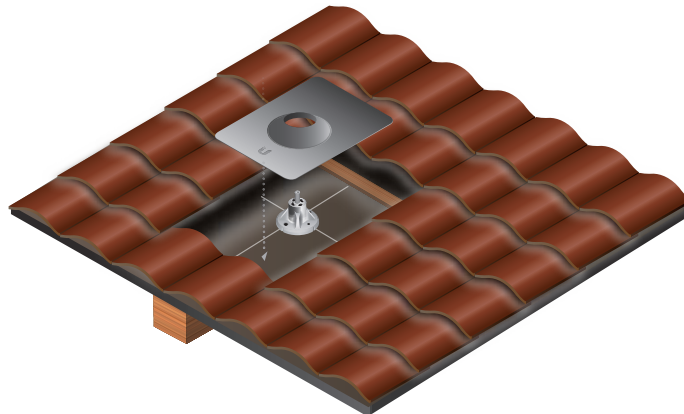
1. Cut a piece of roofing paper about 14" (350 mm) wide that extends up underneath the next course of underlayment above the roof mount.
2. Apply roofing sealant, in the shape of an arch, to the underside surface of the subflashing. The non-sealed end should face downroof.



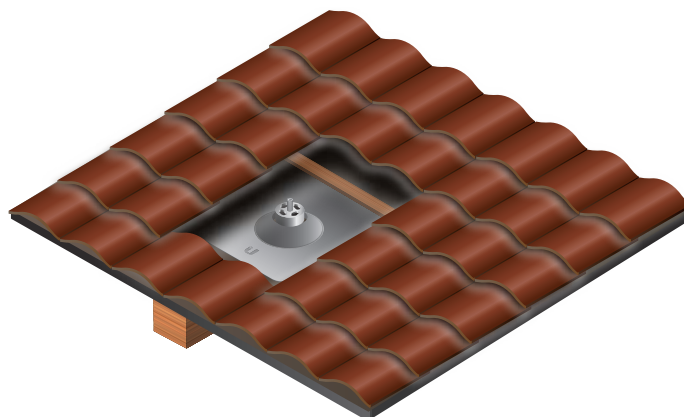
3. Place the subflashing over the roof mount with the Ubiquiti logo facing downroof.



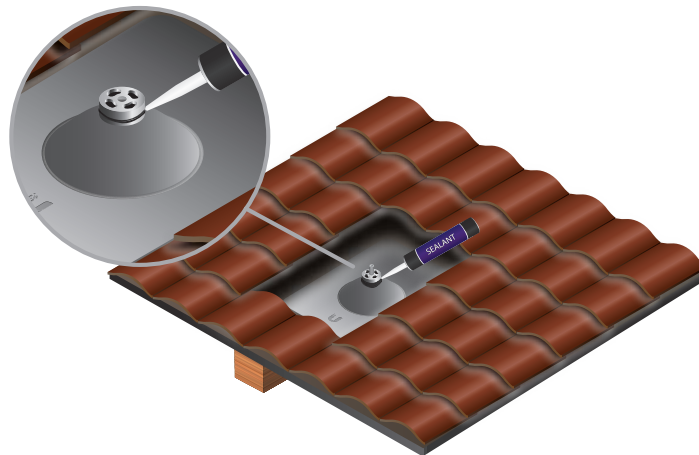
Note: If the batten prevents proper placement of the roofing paper or subflashing, use a roofing bar to pry and lift the batten high enough to slide under. If necessary, remove any nails or staples securing the batten to the underlayment surface.



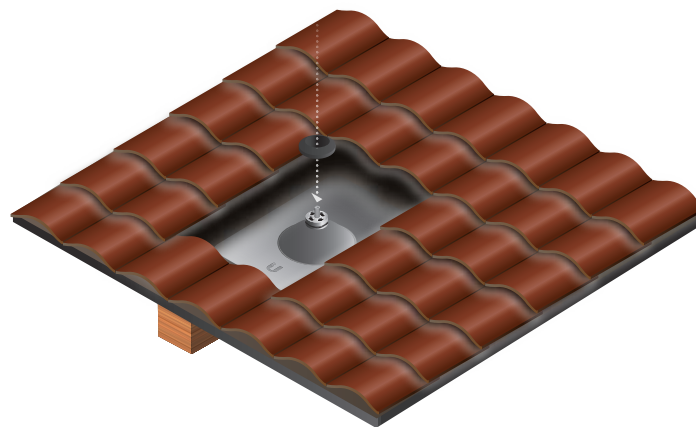
4. Press the subflashing firmly down onto the underlayment to ensure a watertight installation.



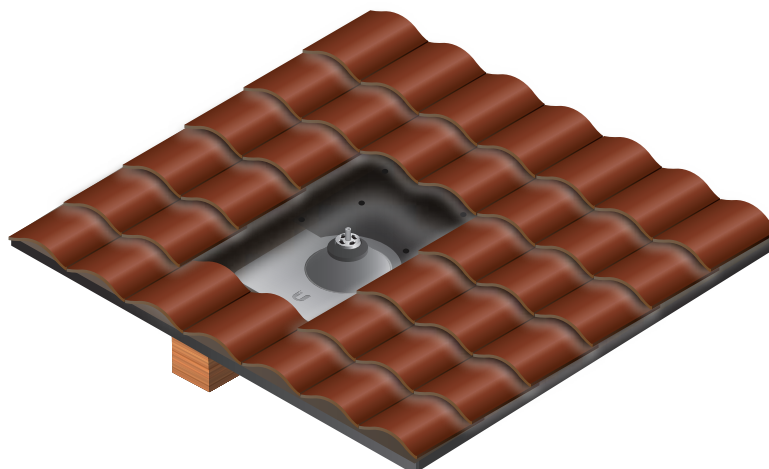
5. Apply a minimum of 0.25" (6 mm) continuous roofing sealant around the gap between the subflashing and the neck of the roof mount.



6. Install the rubber counter flashing over the neck of the roof mount and press it down firmly onto the roofing sealant you applied in the previous step.



7. Cut a piece of felt paper and place over the top half of the subflashing, including the edges, and ensure that it rests flush on its surface.



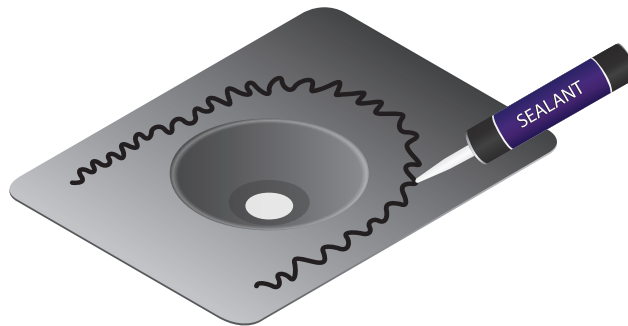
- If necessary, secure the felt paper in place using roofing nails. Apply roofing cement over the head of each nail, covering it at least 1" (25 mm) all the way around and 0.13" thick (3 mm).



- Reinstall any battens that may have been loosened during the installation of the subflashing.
- Refer to **"Upper Flashing" on page 75** to complete the installation.

Three-Course Method

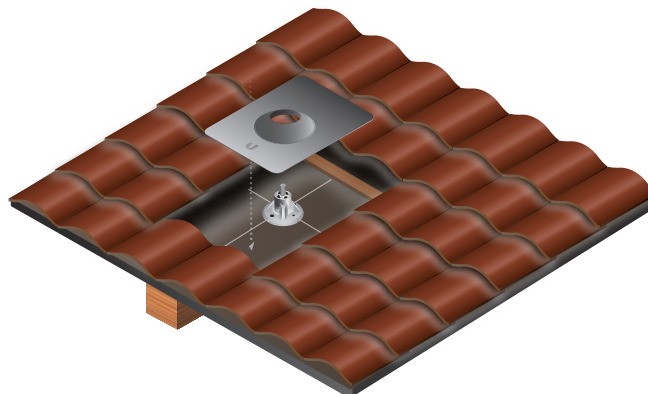
- Apply roofing sealant, in the shape of an arch, to the underside surface of the subflashing. The non-sealed end should face downroof.



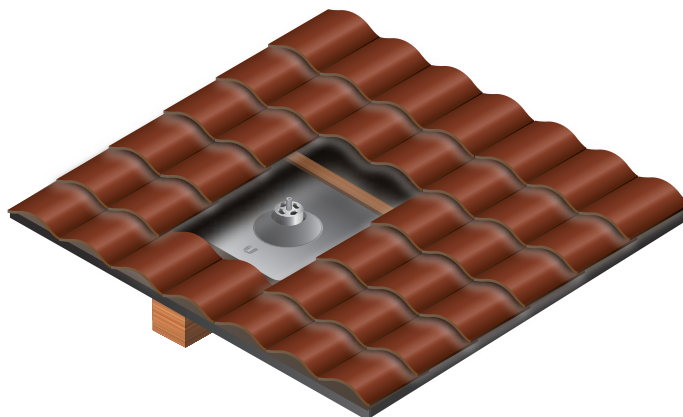
- Place the subflashing over the roof mount with the Ubiquiti logo facing downroof.



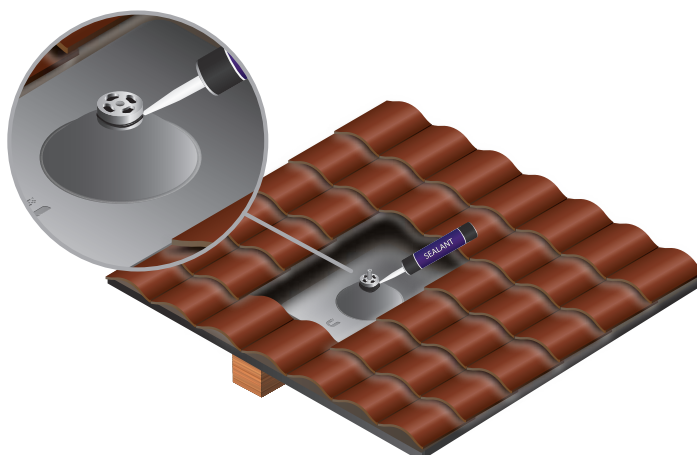
Note: If the batten obstructs proper placement of the subflashing, use a roofing bar to pry and lift the batten high enough to slide the subflashing under. If necessary, remove any nails or staples securing the batten to the underlayment surface.



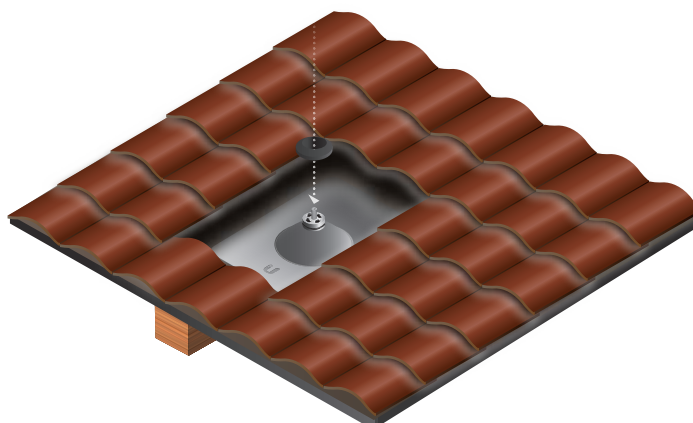
3. Press the subflashing firmly down onto the underlayment to ensure a watertight installation.



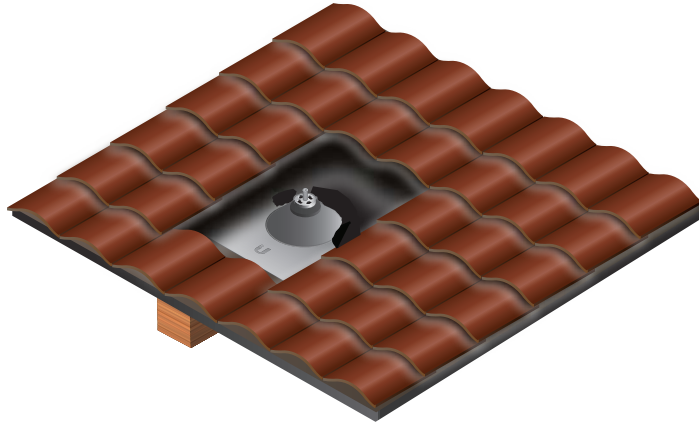
4. Apply a minimum of 0.25" (6 mm) continuous roofing sealant around the gap between the subflashing and the neck of the *Roof Mount*.



5. Install the rubber counter flashing over the neck of the roof mount and press it down firmly onto the roofing sealant.



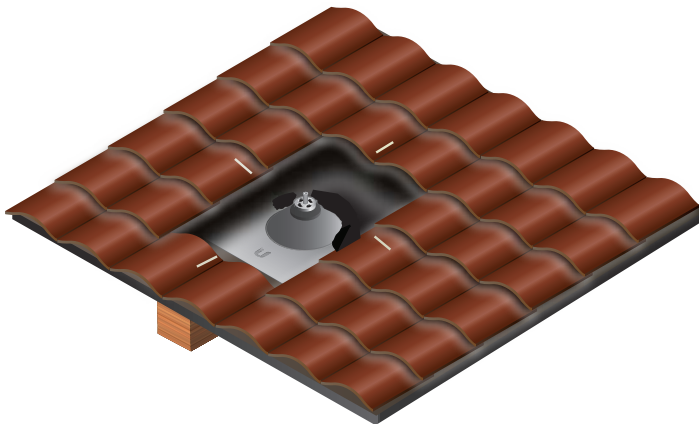
6. Apply a layer (0.13" or 3 mm minimum thickness) of elastomeric roof cement around the top three sides of the subflashing. The cement should cover at least 2" (50 mm) on both the flashing and the roof surface.



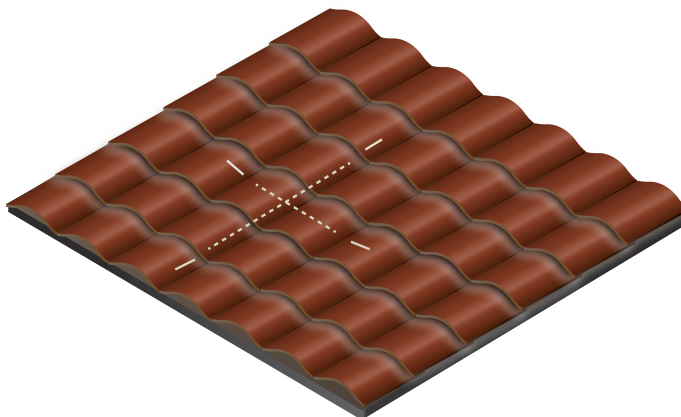
7. Cut a piece of reinforcing fabric and press it into the cemented area before it dries. Then apply another layer (0.13" or 3 mm minimum thickness) of elastomeric roof cement over the fabric.

Upper Flashing

1. Mark the tiles surrounding each mount location in order to identify the center of the *Roof Mount*.



2. Replace the tile(s) above the *Roof Mount* and mark the area of the tile that needs to be cut in order to expose the *Roof Mount* and subflashing. You can use the same tile mark to locate the center of the *Roof Mount* below.



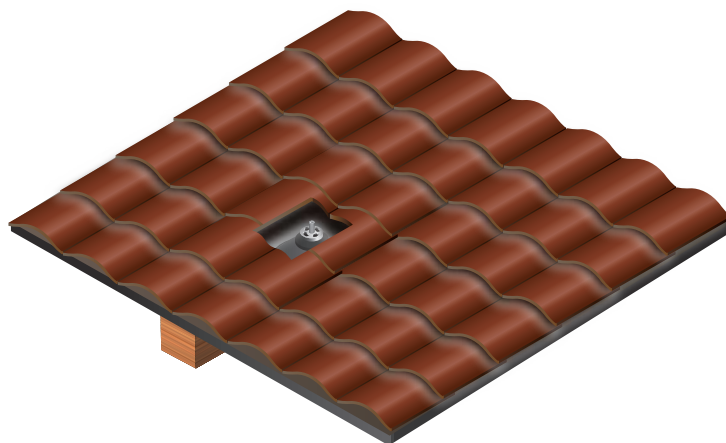
3. Remove the tile(s) and cut out the marked section to expose the roof mount and subflashing. Use caution when cutting to avoid breaking or damaging the tile(s).



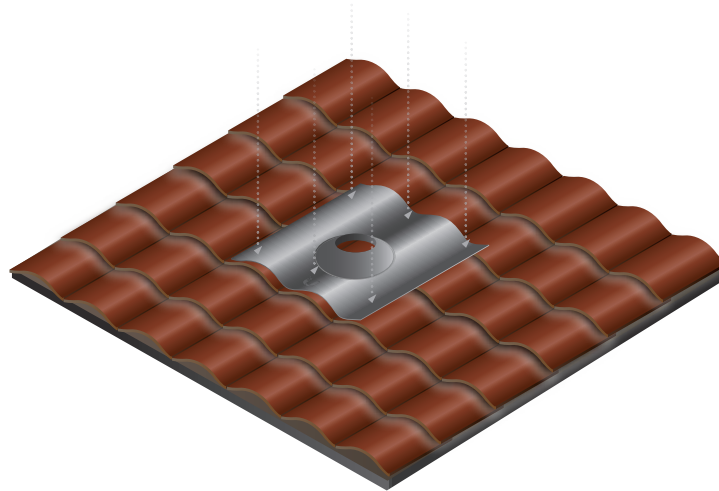
Note: Use a diamond cutting blade or a masonry core bit to create an opening in the tile(s).



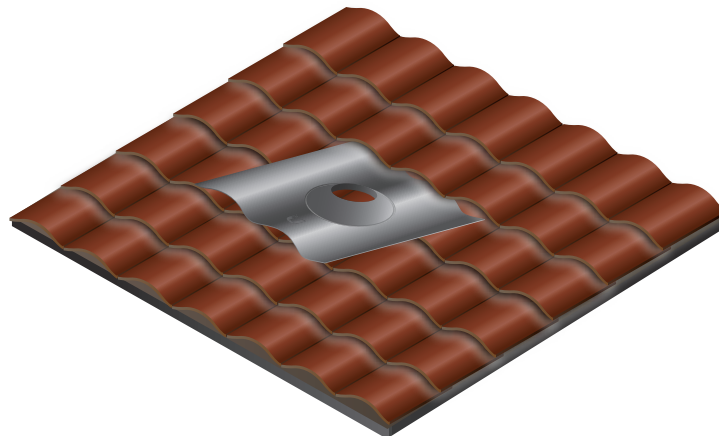
4. Replace the tile(s) and ensure you have access to the top surface of the *Roof Mount* below.



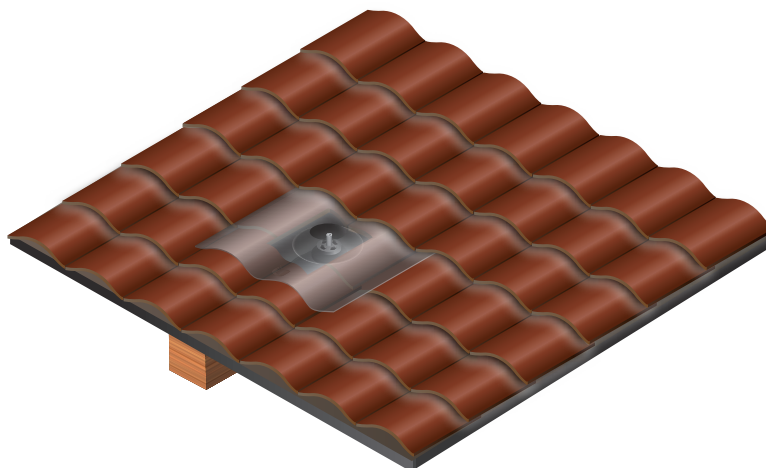
5. For curved tiles, the upper *Flashing* needs to be shaped to the profile of the roof's tiles. Position the opening of the *Flashing* directly over the *Roof Mount* and form the *Flashing* to the curvature of the tiles.



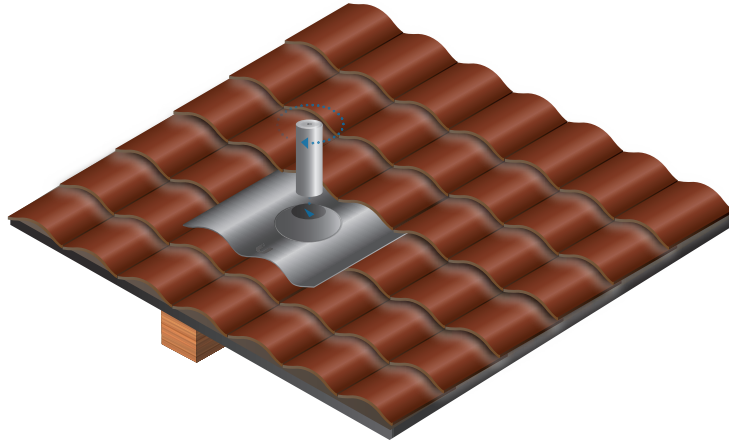
6. Slide the top edge of the *Flashing* underneath the course of tiles above.



7. Center the opening in the *Flashing* directly over the center of the *Roof Mount* below.



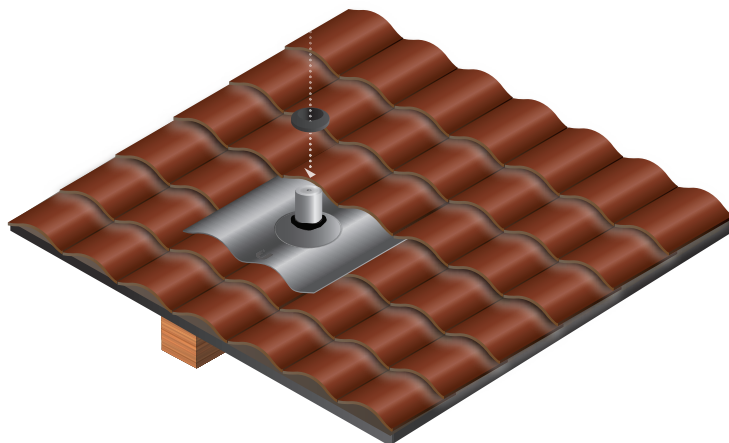
8. Install the extension post onto the threaded stud below by lowering it through the *Flashing* and turning it clockwise until it bottoms out.



9. Apply a minimum of 0.25" (6 mm) of continuous roofing sealant around the gap between the *Flashing* and the neck of the extension post.



10. Install the rubber counter flashing over the neck of the extension post and slide it down firmly onto the roofing sealant you applied in the previous step.



With the *Roof Mounts* and *Flashing* in place, refer to **"Mounting Assembly Installation" on page 36** to continue the installation of your solar array.

Revision History

Revision No.	Date	Description
01	07/31/2015	Changed component description requirements in Chapters 2 and 3. Also changed the term 'AC Module' to 'solar panel' since the Microinverter is installed separately.
02	10/13/2015	Updated description for Cantilever Distance on page 24.
03	03/04/2016	Changed End Run note on page 52 from 16 AC Modules per End Run, to 15. [One <i>End Run</i> can support up to 15 continuous <i>AC Modules</i> in an array. Solar arrays comprised of more than 15 <i>AC Modules</i> will require additional <i>End Run</i> assemblies.]
04	04/03/2016	Revised array diagrams. Added QR code label description on page 26.
05	05/25/2016	Update Mobile App section in Chapter 6.
06	07/22/2016	Updated installation section for SM-SG in Chapter 6.
07	08/30/2016	Added footnote to span tables in Appendix A.

Appendix C: Contact Information

Ubiquiti Energy Support

Ubiquiti Energy Support Engineers are located around the world and are dedicated to helping customers resolve software, hardware compatibility, or field issues as quickly as possible. We strive to respond to support inquiries within a 24-hour period.

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