BenQ Solar

A division of AU Optronics

BenQ Solar AC Unison Solar Power Systems Installation guide

AC Unison Installation Guide

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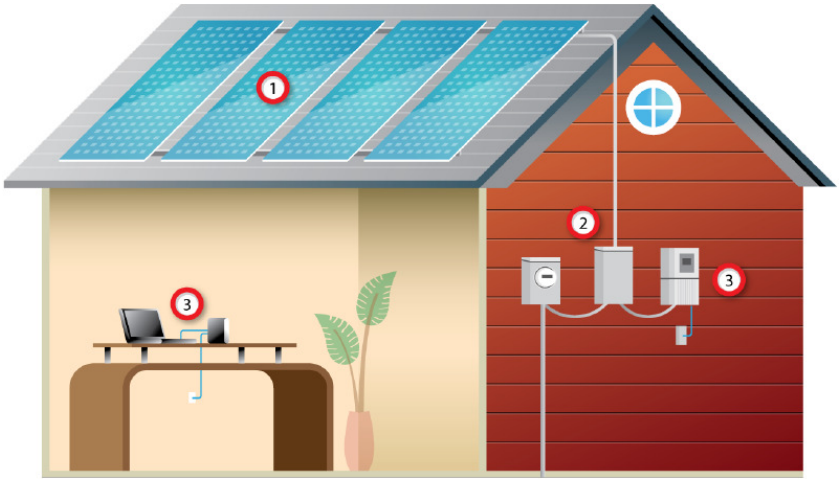
1. AC Unison Solar Power System Overview

The **BenQ Solar AC Unison Solar Power System** consists of three major components, AC Unison Modules, Data Logger and Solar Monitoring System. The following diagram illustrates a typical configuration at a residence. Please carefully read through this installation guide before installation.



1. AC Unison modules
2. The Data Logger is wired to a breaker in the aggregation or service panel.
3. Ethernet cable connecting the Data Logger to the network router enables the Data Logger to upload performance data to the monitoring system.

The **BenQ Solar AC Unison module** represents the latest advancements in PV system safety for both the installer and system owner. AC Unison modules are shipped to the installer with the micro-inverter factory-installed on a standard photo-voltaic solar module. The attached micro-inverter shields the installer, service provider, and module owner from exposure to the potentially lethal DC voltages produced when multiple DC modules are connected in series. AC Unison modules are quickly installed by plugging each module's fully insulated AC power cord into the insulated cord of the neighboring module. The reduced risk has the added benefit of reducing the overall installation and maintenance time. AC Unison modules also improve the energy production of the solar array. Each module has its own independently operating inverter, and therefore is controlled by its own Maximum Power Point Tracker (MPPT). Unlike PV arrays with a centralized inverter, the overall production of an AC array is not governed by the lowest producing module. This means that while one or more modules might have limited or no production due to shading, soiling, or malfunction, the remaining modules continue to produce at peak output levels.

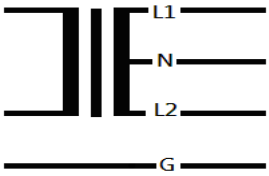
The **BenQ Solar Data Logger** is a gateway device that uses Power Line Communications (PLC) to collect status and performance data from AC Unison modules. Using broadband Internet, the Data Logger then forwards the collected data to the Solar Monitoring System at five minute intervals. When necessary, the Data Logger automatically downloads and installs enhancements, which can include defect fixes, to the software on the Data Logger or, on rare occasions, to the firmware on the micro-inverter. No manual intervention is required during the update process.

The **BenQ Solar Monitoring System** is a web-base data management system that enables module owners, installers, distributors and manufacturers to register solar systems, create and view module layout diagram, monitor and export performance data for both site and individual module, and update system information.

2.1 Quick setup -AC Unison module

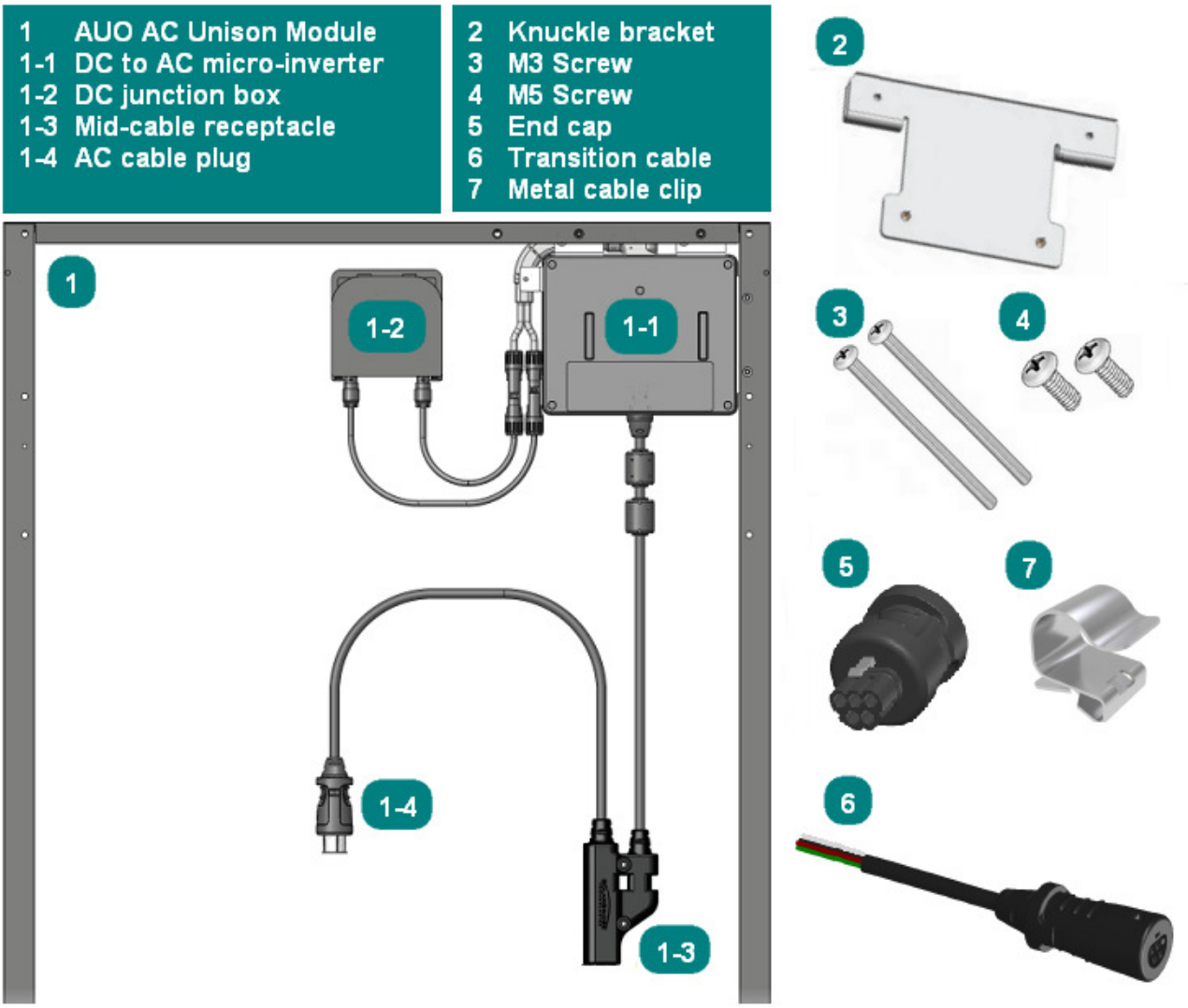
This section contains the essential procedures for installation of BenQ Solar AC Unison modules. Before following the steps described here, it is important to carefully read through the entire Installation Guide. In particular, installer must read Chapter 3 Notice and Safety Instructions and Chapter 4 AC Unison Module before installation.

Please check that the voltage ratings of AC service panels are within the proper range.

240 Volt AC Single Phase **("split phase")**		
L1 to L2	211 to 264 VAC	
L1, L2 to Neutral	106 to 132 VAC	

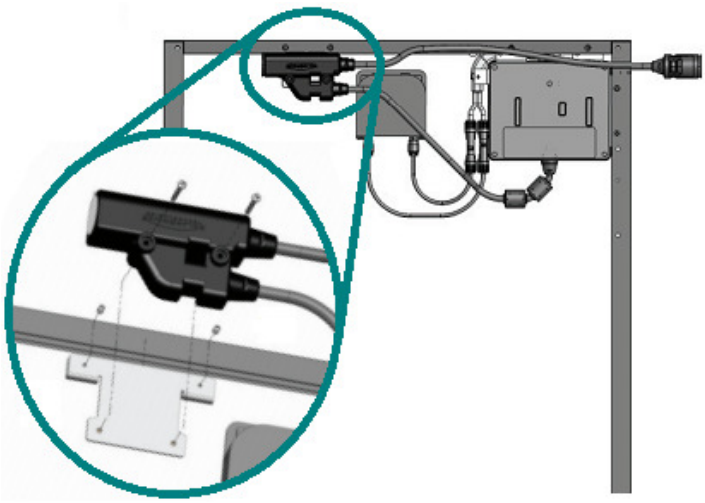
Step 0. Check Components

Please ensure you have the following BenQ Solar components:



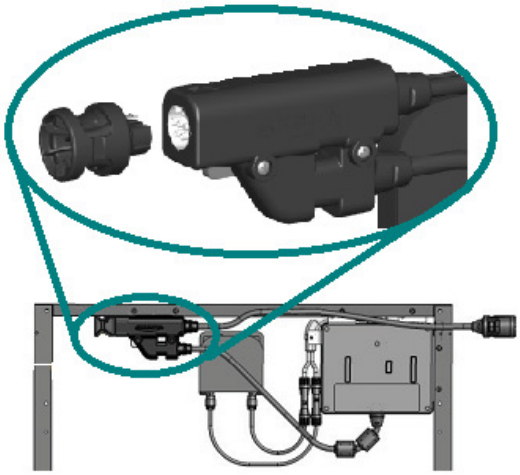
Step 1. Preparation - Attach Mid-cable Receptacle to Module Frame

Attach the metal knuckle bracket (2) to the module frame (near the top left of junction box (1-2)) with two M5 screws (4). Set fixing torque to 20 inch-pounds. Then attach the mid-cable receptacle (1-3) to the metal knuckle bracket (2) with two M3 screws (3). Please set fixing torque to 20 inch-pound. It's suggested to complete Step 1 and Step 2 on the ground before installing the AC Unison modules.

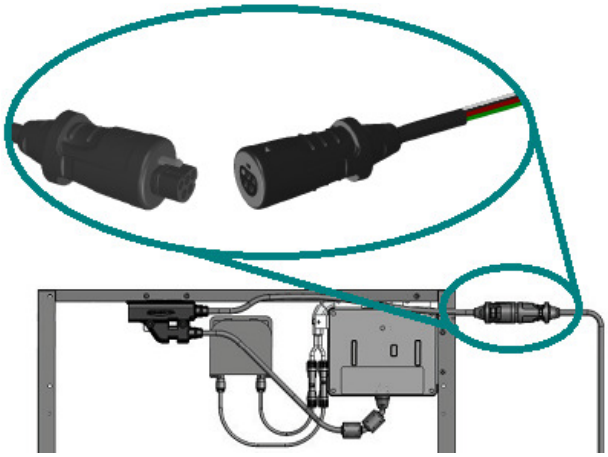


Step 2. Preparation - First and Last Module Only

For the last module in the string, secure the mid-cable receptacle (1-3) with the end cap (5).

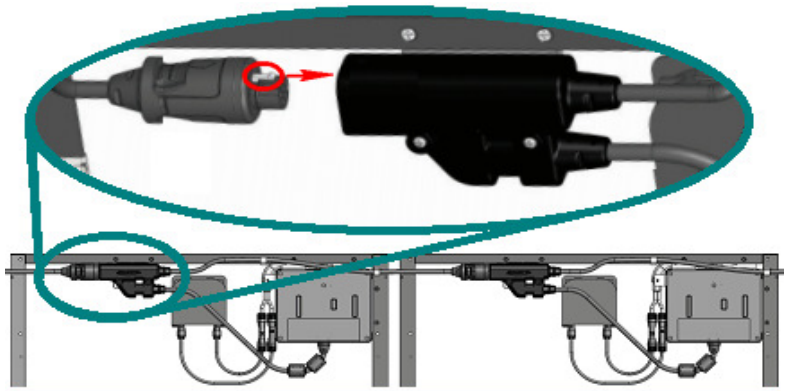


For the first module in the string, connect the AC cable plug (1-4) to transition cable (6).



Step 3. Connect Mid-cable Receptacle with AC Cable Plug

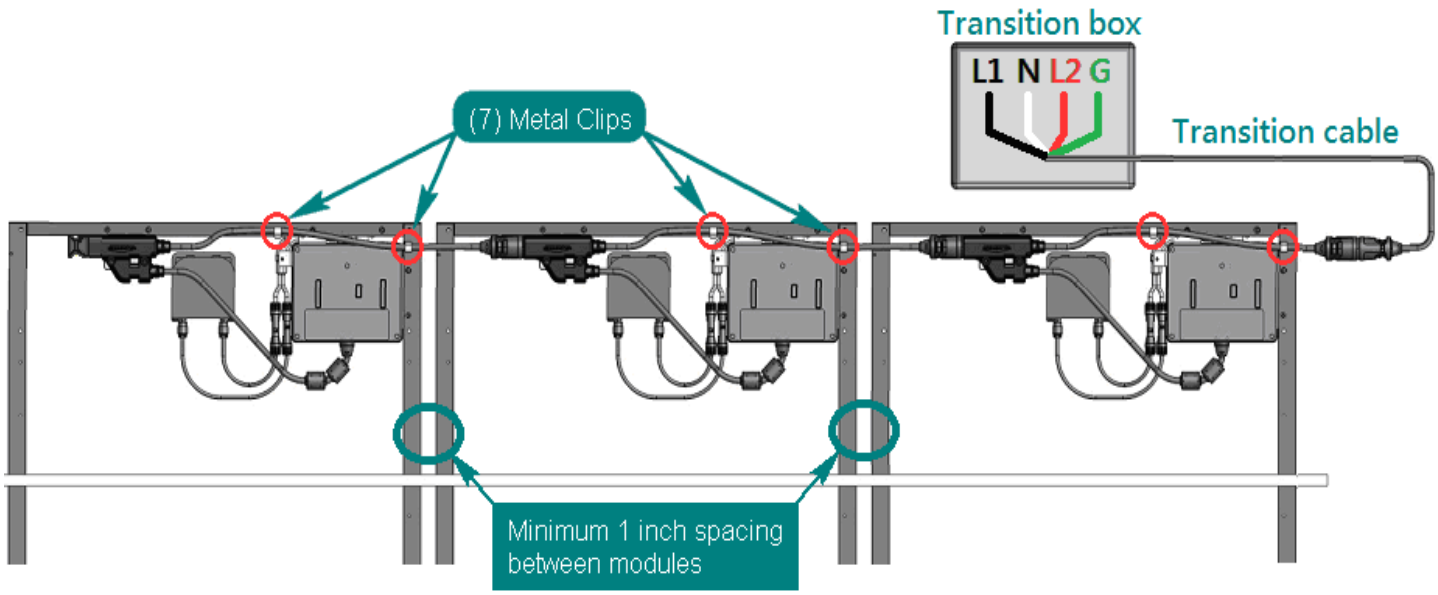
Remove the protective sticker on the mid-cable receptacle (1-3) and connect this receptacle with the AC cable plug (1-4) of the next module. The AC cable plug includes a latch that snaps securely into the receptacle. Press the plug firmly into the receptacle until you hear the latch click. Continue connecting subsequent modules to the end of string. Note: This step should only be performed at the location of installation (Rooftop).



With the latch pointing up, connect the plug with the receptacle. When it's hard to see the plug, installer can touch the latch to identify the direction of connection.

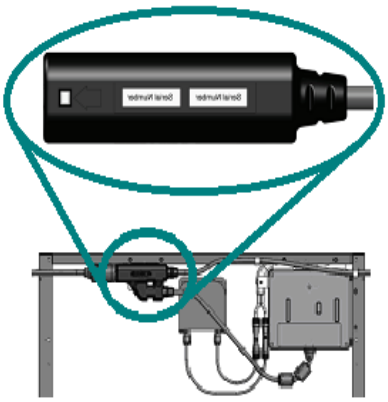
Step 4. Fix AC Cable to Module Frame

The following diagram shows a system with three AC Unison modules. The AC cables are fixed to the module frames with metal clips (7). Allow approximately 1 inch spacing between the AC Unison modules. Please ensure that all AC wiring is supported and connections are secured. The Installed system must be approved by authorized inspector before connecting to utility grid.



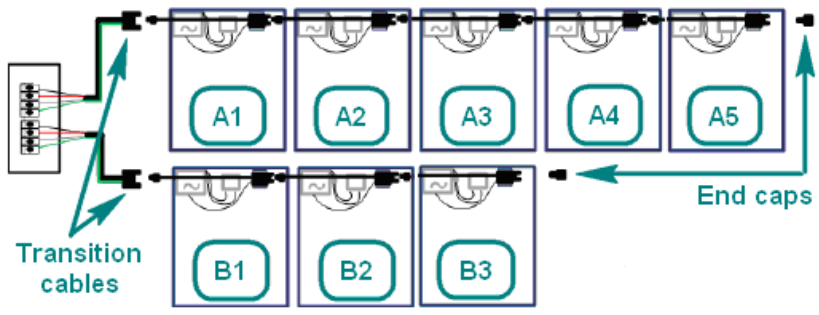
Step 5. Tear off S/N Sticker for System Layout Table

For troubleshooting purposes, please tear off one S/N sticker on the mid cable receptacle of each AC Unison module, and paste it on the BenQ Solar AC Unison System Layout table. Following the installation, this information is recreated within the BenQ Solar Monitoring system for module level performance monitoring.



	String A	String B	String C	String D	String E
1					
2					
3					
4					
5					
6					
7					
8					

System Layout Example: 5 modules in string A and 3 modules in string B



System Layout Table

	String A	String B
1		
2		
3		
4		
5		

BenQ Solar AC Unison System Layout Table

System Installer: _____

Site of Installation: _____

Date of Installation:_____

	String A	String B	String C	String D	String E
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					

Important

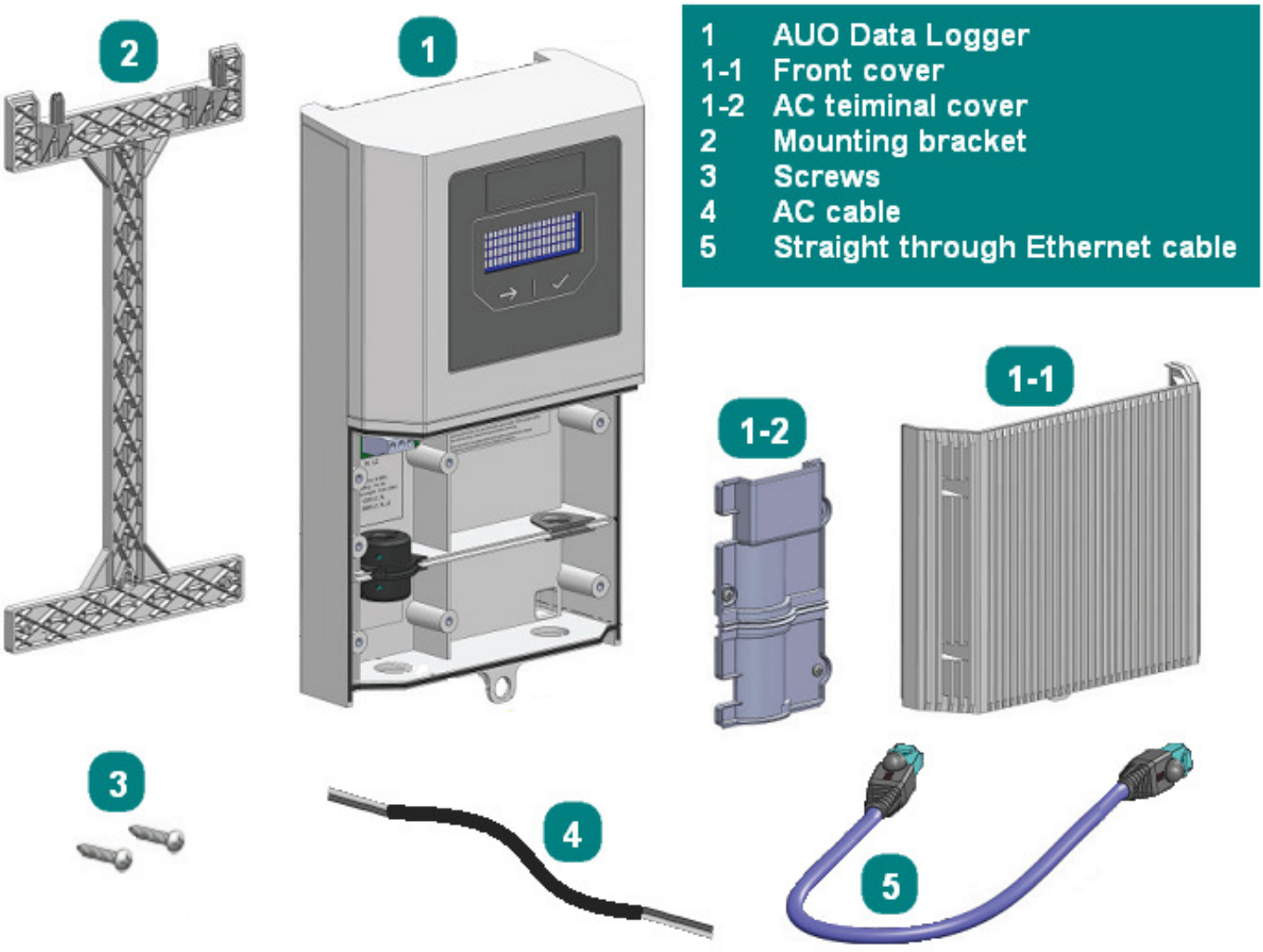
Due to AC cable constraints, do not exceed seventeen AC Unison modules in one string. The first module of each string (e.g. A1 and B1) should be connected to the transition box, whereas the last module of each string must be sealed with the supplied end cap. ***- Please Print This Page -***

2.2 Quick setup –Data logger

This section contains the essential procedures for installation of BenQ Solar Data Logger. Before following the steps described here, it is important to carefully read through the entire installation guide. In particular, installer must read Chapter 3 Notice and Safety Instructions and Chapter 5 Data Logger before installing Data Logger.

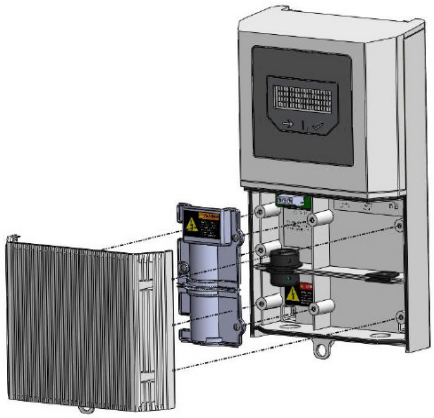
Step 0. Check Components

Please ensure that you have the following components. Note that AC cable and straight through Ethernet cable are provided by the system installer.



Step 1. Remove Front Cover

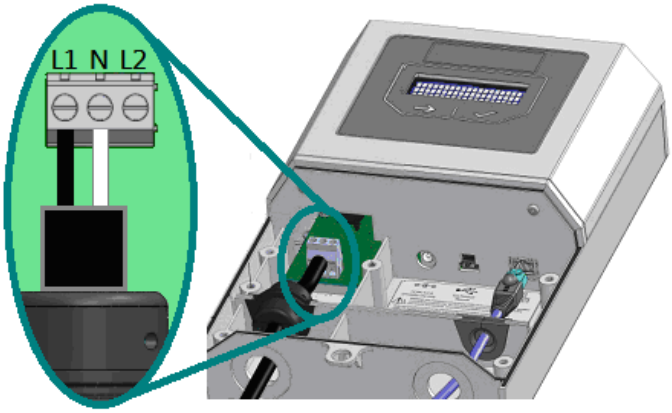
Remove the screws and the front cover (1-1) of the Data Logger (1). Then remove the screws and AC terminal cover (1-2).



Step 2. Connect AC Cable and Ethernet Cable

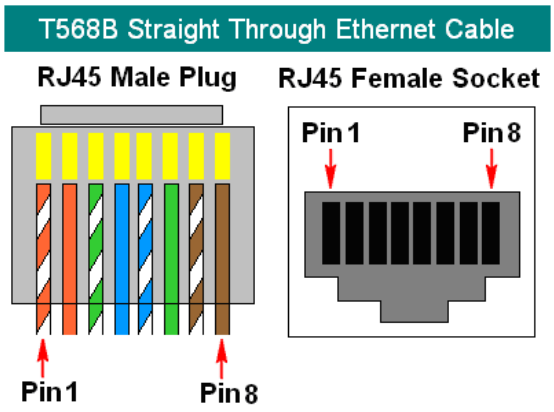
AC Power

Feed the AC cable (4) through the bottom left opening of Data Logger (1) housing to reach the AC terminal. Connect the L1 terminal to the "Hot" (Black) wire of split-phase system and the N terminal to the neutral (White) wire.



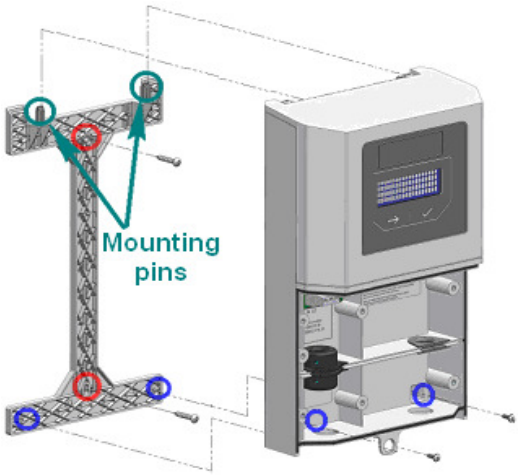
Internet

Remove the warning label on the network socket. Use T568B straight through Ethernet cable (5) to connect the network socket to a 10/100Base-T network router with broadband internet access. T568B standard is shown below. Use Ethernet cable testing kit to check cable connections if necessary.



Step 3. Mount the Data Logger on the Wall

With the mounting pins pointing up, secure the mounting bracket (2) to the wall with two suitable screws and anchors (provided by installer). Then mount the Data Logger (1) as shown. Secure the Data Logger (1) in place by inserting the provided screws (3) in the anchor holes as shown below. When installing indoors, insert the screws in the lower right only. This prevents user from opening the AC terminal cover (1-2) when relocating the Data Logger (1).

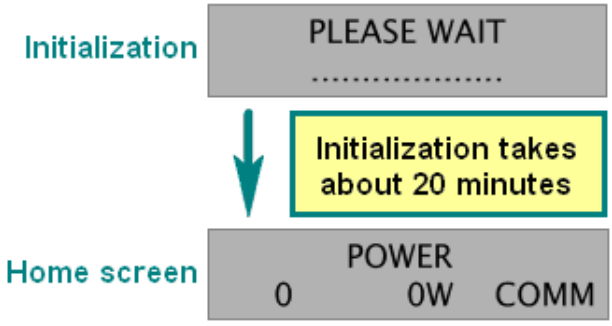


Step 4. Replace Front Cover

Replace the AC terminal cover (1-2) and secure the screws. Then replace the front cover (1-1) and secure the screws as shown in Step 1.

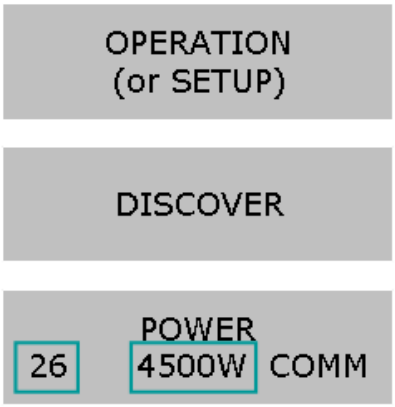
Step 5. Startup

Connect the AC cable (4) to the transition box. The Data Logger (1) will automatically boot up when it detects utility power. The Data Logger (1) will display the "PLEASE WAIT" message during its initialization process. Please allow about 20 minutes for the Data Logger to fully start up. **Do not disconnect the AC power supply during this process.** Once the initialization process has completed, the LCD displays the shown "HOME SCREEN".



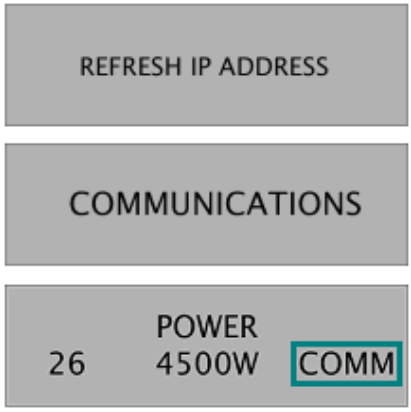
Step 6. Discover Micro-Inverter

Navigate the Data Logger's menu by pressing ⇨ for the next menu and ✓ to enter/select. Please enter the "OPERATION (or SETUP)" menu and select the "DISCOVER" function. After this "Discovery" process, the LCD will display the number of modules discovered and real-time power generation.



Step 7. Check Internet Connection

If the right side of Home Screen displays "NOCOMM", please check that Data Logger has the correct internet setting and Ethernet cable as described in Step 2. Then enter the "Communication" menu and select the "Refresh IP" function. After this process, the Home Screen should display "COMM", which indicates that the Data Logger has an internet connection.



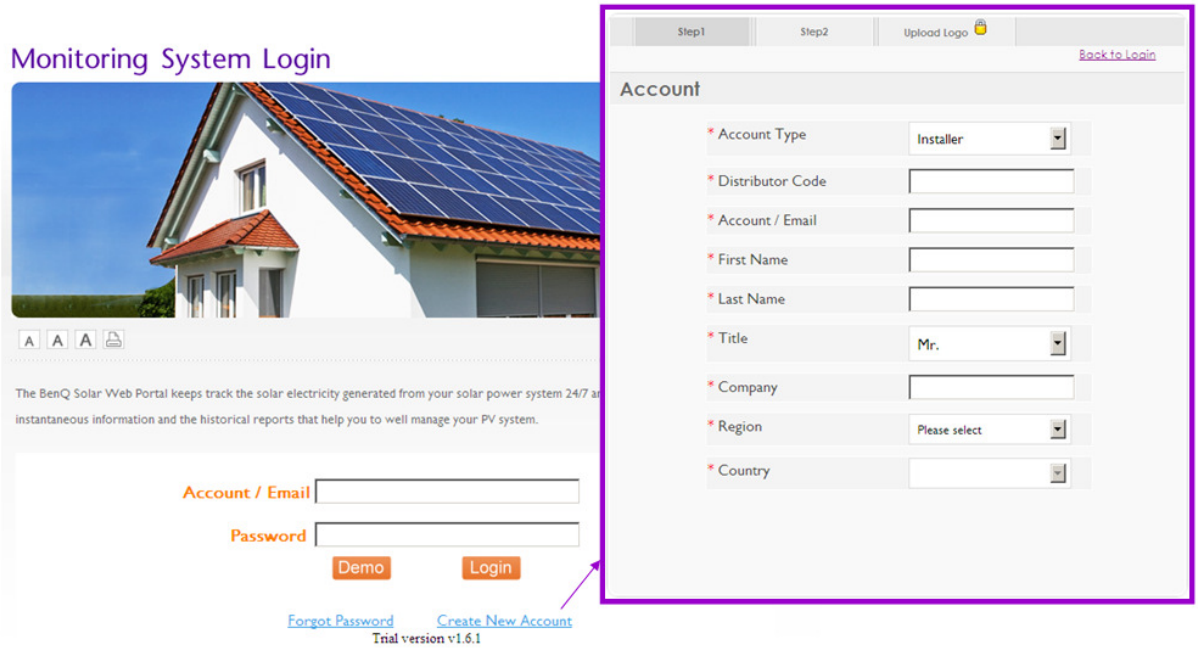
2.3 Quick setup – Solar monitoring system

The BenQ Solar Monitoring System is a web-base data management system that enables module owners, installers, distributors and manufacturers to register solar systems, create and view module layout diagram, monitor and export performance data for both site and individual module, and update system information. This section contains the essential procedures for Solar Monitoring System registration. For more detailed description, please

refer to the complete Solar Monitoring System User guide.

Creating installer account

If this is your first time using BenQ Solar Web Portal, please create a new installer account. The BenQ Solar Web Portal can be accessed from the BenQ Solar website at www.benqsolar.com or directly at http://www.benqsolar.com/?sn=1163&lang=en-US. The distributor code for registration is provided to installers by BenQ Solar Authorized Distributors. After signing up, installers should receive an email with default login password for the registered account. On the first login, please read through the Terms of Use and click Accept if you agree.

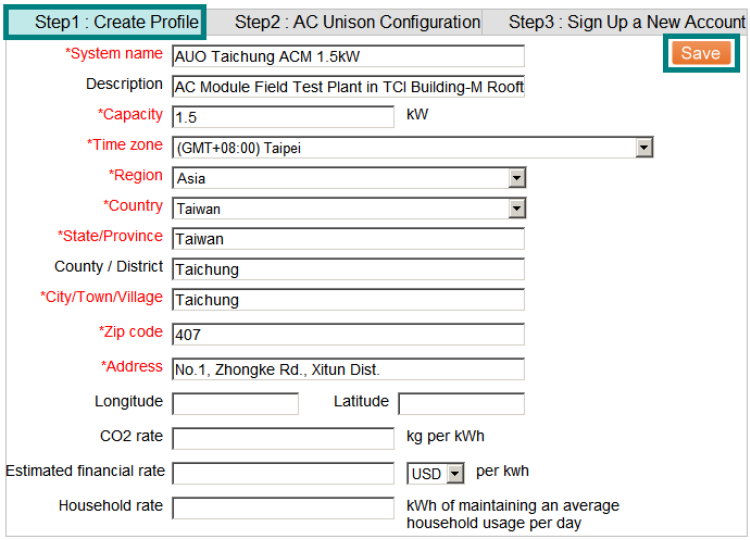


Step 0. Register a New System

Please Login BenQ Solar Monitoring System via http://www.benqsolar.com/?sn=905&lang=en-US with your installer account. You will then arrive at the main All Systems page. Then select Register A New System and enter the serial number of the installed BenQ Solar Data Logger.

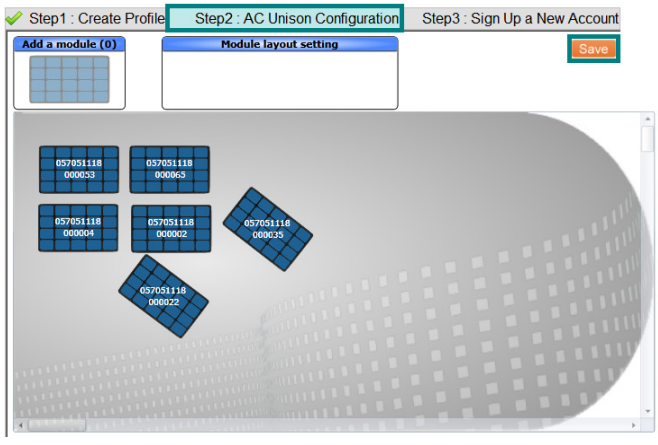
Step 1. Create Profile

Under the Create Profile tab, enter the details of the system installation. Click on "Save" to proceed to next step.



Step 2. AC Unison Configuration

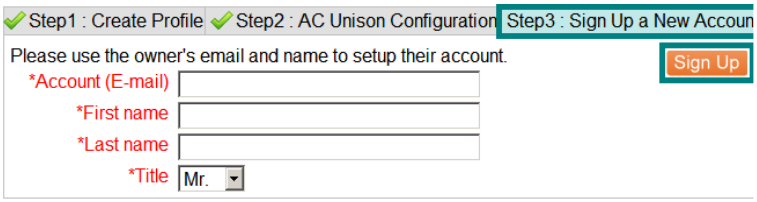
Under the AC Unison Configuration tab, create a layout model of the panels by dragging and dropping them into position. Use the panel serial numbers to position the panels as they are physically installed. Click on "Save" to proceed to next step.



Step 3. Sign Up a New Account

Under the Sign up a New Account tab, enter the email and name of the system owner to sign up his/her account. An email with the default password will be sent to the account email address.

The system registration process has been completed and the registered system is now listed on the All Systems page. However, this system will remain locked until the system owner logs in to the BenQ Solar Web Portal and activates his/her account.



3 Notice and safety instructions

This section contains important information and instructions to safely install an array of alternating current photo-voltaic solar modules (AC Unison module) and the Data Logger. Failure to follow these instructions can result in equipment damage or failure, or personal injury, and might void the system warranty, and/or property damage.

Important safety instructions for AC Unison modules

The nationally recognized testing lab (NRTL) performing the listing or certification on an AC Unison module assembly that includes this micro-inverter might require the following statements to be included in the AC Unison module installation instructions. There shall be no substitute for the words "CAUTION", "WARNING", or "DANGER" in the text of the following instructions. Exception: The words "WARNING" or "DANGER" may be used in lieu of "CAUTION". When used, these words shall be in upper case. Installation and field service is to be performed only by qualified, trained personnel with the necessary skills and knowledge to work on this type of electrical equipment.

Important

Perform all electrical installations in accordance with any local codes, the National Electrical Code (NEC) ANSI/NFPA 70 for US installations, or the Canadian Electrical Code Part I, CSA C22.1 for Canada.

This unit or system is provided with fixed trip limits and shall not be aggregated above 30 kW on a single Point of Common Connection.

Voltage and frequency limits for utility interaction [c]			
Condition	Simulated utility source		Maximum time (sec) (cycles) at 60 Hz[a] before cessation of current to the simulated utility
	Voltage (V)	Frequency (Hz)	
A	$< 0.50V_{nor}$ [b]	Rated	0.16
B	$0.50V_{nor}$ [b] $<V<0.88V_{nor}$	Rated	2
C	$1.10V_{nor}$ [b] $<V<1.20V_{nor}$	Rated	1
D	$1.20V_{nor} \leqq V$	Rated	0.16
E	Rated	f> Rated+0.5	0.16
F	Rated	F< Rated-0.7	0.16

a – Non-adjustable maximum clearing times

b – Nominal voltage equals 120V phase to neutral

c – Trip limit accuracy: Voltage-±2.5% based on 120V nominal, frequency-±2.5 Hz

- This AC Unison module is intended for operation in an environment having a maximum ambient temperature of 45°C.
- Work with the local electric company and authorities having jurisdiction (AHJ) before, during, and after the installation of the solar electric system. The following are examples of possible requirements the electric company might have regarding the installation:

  - An upgrade of the existing meter

- A readily accessible AC disconnect and a diagram showing its placement
- An inspection or approval before connecting the system to the utility grid
- Qualified personnel or electric company employee to connect the system to the utility grid

- WARNING: Shock Hazard. AC wiring is energized by both utility dedicated branch circuit(s) and AC Unison modules rated as "Utility Interactive". Opening the array's dedicated branch disconnect will also cause the AC Unison modules to stop producing power. Proper safety procedures must be followed when installing or accessing the dedicated branch circuit wiring, which includes unplugging the AC Unison modules from the dedicated branch circuit.
- The neutral within the AC Unison module is isolated from ground.
- The AC Unison module must be connected to a dedicated branch circuit from an AC supply system with the neutral referenced at the building or structure service entrance.
- The connector on the AC interconnecting cables is rated for disconnect under load and can be used as an NEC disconnect device. Some authorities having jurisdiction (AHJ) may require a separate disconnect next to the AC Unison module system as well as a readily accessible disconnect.
- The AC cables and connectors are listed for outdoor use with AC Unison module applications and are rated for 20A, and with insulation rated to a maximum temperature of 90°C.
- The AC Unison modules and all other metal structures, such as mounting systems, must be grounded per code.
- If a module is removed from within the string, it is recommended that you bridge the gap in the string using an AC extension cable. Inserting an extension cable maintains ground continuity to subsequent modules in the string. Other auxiliary grounding methods may be used.
- The metal components of the AC Unison module, including frame and micro-inverter, can reach temperatures of approximately 80°C or more under extreme environmental conditions. To reduce risk of burns, use appropriate safety procedures when handling.
- CAUTION: To reduce the risk of fire, connect only to a circuit provided with a dedicated 20 amperes maximum over current protection in accordance with the National Electrical Code, ANSI/NFPA 70.
- No more than 17 AC Unison modules can be connected to a single dedicated branch circuit.
- The AC Unison module output is Utility Interactive.
- To provide proper ventilation to the underside of the module, install modules with a minimum space of 1 inch between the bottom of module and the mounting surface. The 1 inch is the minimum for the inverter CSA certification. However, additional distance might be required to maintain a module back sheet temperature less than 85°C.
- During shipping, the mid-cable receptacle is securely fastened to prevent movement. Use caution when unpacking the module to ensure the mid-cable receptacle does not swing loose and cause damage to the module back sheet.
- The installer must ensure that the AC cables and mid-cable receptacles are supported (will not sag to the roof or module support structure) and are protected from excessive stress on the cord grip at the base of the mid-cable receptacle.

The AC Unison module is provided with an integral micro-inverter and is NRTL listed as an assembly for outdoor PV applications. There is no direct current (DC) field wiring required and the integral micro-inverter has no serviceable parts inside. The following caution is provided as part of the micro-inverter certification:

 CAUTION - Risk of Electric Shock!

- Do not remove micro-inverter's cover. No user serviceable parts inside. Refer servicing to qualified service personnel.
- Both AC and DC voltage sources are terminated inside this equipment. Each circuit must be individually disconnected before servicing the micro-inverter.
- When the photovoltaic module is exposed to light, it supplies a DC voltage to the micro-inverter.
- When managing AC Unison module cables within the array, the installer must ensure they do not bend the cables beyond their bend radius tolerances. For the AC Unison module cable, the installer must maintain a bend radius of 4 x cable O.D. or greater.

Miscellaneous instructions for AC Unison modules

- Do not install AC Unison modules in the rain, snow or windy conditions. Tools must be dry.
- Artificial sunlight should not be concentrated upon the AC Unison module. Do not expose AC Unison modules to sunlight concentrated with mirrors, lenses or other means.
- Use appropriate safety equipment (insulated tools, insulated gloves, etc) when working on any wiring.
- Do not use damaged or defective AC Unison modules. Place all damaged or defective modules in a carton to avoid exposure to light. Even damaged or defective modules can produce electricity.
- Roof mounted AC Unison modules are to be mounted over a fire resistant roof.
- Avoid uneven shade on the AC Unison module surface. Shaded cells may become hot ("hot spot" phenomenon) which may result in permanent damage to the module (e.g., solder joints may peel off).
- Do not clean the glass surface with chemicals or high pressure water spray.
- Do not cover the water drain holes of the frame. There is a risk of frost damage when the frame is filled with water.
- AC Unison modules are heavy. Handle with care. Keep children away from the system while installing.
- Do not expose the AC Unison module to excessive loads on the surface of the AC Unison module or twist the frame. The glass may break.
- Do not stand or step on the AC Unison module. The glass may be slippery, and there is a risk of injury or electric shock if glass is broken.
- Do not hit or put excessive load on the glass or back film. PV cells may break.
- To avoid damage to the back sheet, do not scratch or hit the back sheet.
- To avoid damage to the junction box, do not hit the junction box; do not pull the cables.
- Do not scratch the output cable or bend it with force. The insulation of the output cable may break which may result in electricity leakage or shock.
- Do not pull the output cable excessively. The output cable connection may become loose and cause electricity leakage or shock.
- Do not drill holes in the frame. It may compromise the frame strength and cause corrosion of the frame.
- Do not touch the AC Unison module with bare hands. The frame of the AC Unison module has sharp edges and may cause injury. Wear suitable gloves, such as leather gloves with padding in the palm and

finger areas.

- Do not drop the AC Unison module or allow objects to fall on the AC Unison module.
- Always wear protective head gear, insulating gloves and safety shoes (with rubber soles).
- Due to the risk of electrical shock, do not perform any work if the terminals of the AC Unison module are wet.
- Do not wear metallic jewelry which may conduct electricity and enable electric shock during installation.
- Do not touch the junction box and the end of the output cables (connectors) with bare hands during installation or under sunlight, regardless of whether the AC Unison module is connected to or disconnected from the system.
- Do not unplug a connector if the system circuit is connected to an operating load.
- Do not damage the back sheet of AC Unison modules when fastening the AC Unison modules to a support by bolts.
- Do not damage the surrounding AC Unison modules or mounting structure when replacing an AC Unison module.
- Use UV resistant materials, wire management hardware to secure cables. Drooping cables may cause various problems, such as electricity leakage.
- When AC Unison modules are installed on roofs or any other structures above ground, appropriate safety practices should be followed and appropriate safety equipment should be used in order to avoid possible safety hazards.
- Make sure flammable gases are not generated or present near the installation site.

FCC Compliance of AC Unison modules and Data Logger

The equipments have been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an output on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Safety Certification of Data Logger

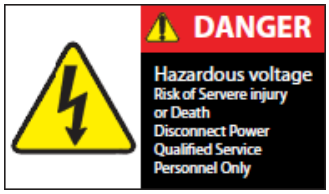
ETL listed to UL60950-1 ITE and UL60950-22 for outdoor use.
The Data Logger is not a utility meter, disconnect device, or power distribution device.

Safety instructions for Data Logger

Installation and field service is to be performed only by qualified, trained personnel with the necessary skills and knowledge to work on this type of electrical equipment. Field service is limited to the components contained in the lower compartment of the Data Logger.

- Perform all electrical installations in accordance with any local codes, the National Electrical Code (NEC) ANSI/NFPA 70 for US installations, or the Canadian Electrical Code Part I, CSA C22.1 for Canada.
- Suitable for use indoors or outdoors (Type 3R enclosure). Operating ambient from -20°C to 50°C.
- Identification label and power rating for this device are located behind the front access cover.
- Before connecting power, the Data Logger must be securely mounted to an inside or outside wall following the instructions in this document.
- For permanently connected equipment, a readily accessible disconnect device must be incorporated external to the equipment.
- The Data Logger can be connected to a branch circuit with any standard size breaker rating up to 20A. The input operating current is less than 0.1 amps.
- The Data Logger contains internal transient surge protection for connection to the load side of the service entrance AC panel. For installations in areas at risk of surges generated by high voltage utilities, industry or by lightning, it is recommended that an external TVSS also be installed.
- Do not attempt to repair the Data Logger. If the Data Logger fails, please return the unit to your distributor for servicing. Tampering with or opening the upper compartment of the Data Logger voids the product warranty.
- The Data Logger's internal circuits are provided with over-current fault protection on the line side only, not on neutral. It is important to ensure that neutral is connected to the correct terminal of the plug and to the Neutral location on the Data Logger's terminal block.

The following labels are used on the Data Logger housing:

	This label warns of hazardous voltages behind the AC terminal cover that can cause serious injury or death if the cover is removed. This area is to be accessed only by qualified, trained personnel with the necessary skills and knowledge to work on this type of electrical equipment. Disconnect power before opening.
	This label warns of immediate danger due to exposed hazardous voltages that can cause serious injury or death. This area is to be accessed only by qualified, trained personnel with the necessary skills and knowledge to work on this type of electrical equipment. Disconnect power before opening.
	IEC 60417-5172 symbol for double insulated equipment (CLASS II) which does not require a protective earthing (equipment grounding conductor) as a means of providing protection against electric shock.

4 AC Unison Module

The **BenQ Solar AC Unison module** represents the latest advancements in PV system safety for both the installer and system owner. AC Unison modules are shipped to the installer with the micro-inverter factory-installed on a standard photo-voltaic solar module. The attached micro-inverter shields the installer, service provider, and module owner from exposure to the potentially lethal DC voltages produced when multiple DC modules are connected in series. AC Unison modules are quickly installed by plugging each module's fully insulated AC power cord into the insulated cord of the neighboring module. The reduced risk has the added benefit of reducing the overall installation and maintenance time. AC Unison modules also improve the energy production of the solar array. Each module has its own independently operating inverter, and therefore is controlled by its own Maximum Power Point Tracker (MPPT). Unlike PV arrays with a centralized inverter, the overall production of an AC array is not governed by the lowest producing module. This means that while one or more modules might have limited or no production due to shading, soiling, or malfunction, the remaining modules continue to produce at peak output levels.

4.1 Preparation

For the purpose of this document, a string is defined as one to seventeen AC Unison modules connected in parallel to a dedicated 20A branch circuit. An array refers to the entire installation of one or more strings connected to the structure's AC service equipment.

- The ideal installation path is to begin closest to the installed transition box and plug in each module as you move away from the box. Depending on the configuration of your array and the location of the transition box, this path may not be feasible. For example, in a 2-row configuration, we recommend installing the bottom row first and working up toward the transition box, which is likely mounted higher up the roof.

- BenQ Solar PV module may use anti-reflective coating (ARC) glass to enhance power output. Strongly recommend not to touch glass surface unless putting on clean gloves in order to prevent fingerprints left.

- Modules with ARC would cause color non-uniformity when viewing from certain angle, and it is not considered as defects.

- Before connecting AC Unison module system to any premises wiring, check the AC service panel where the AC Unison module System breaker will be located. Is there enough physical space in the Panel enclosure for the breaker? Is there enough electrical capacity remaining in the AC Service Panel to handle the AC Unison module system breaker?

- Where is the transition box located in relation to the module that will connect to it?

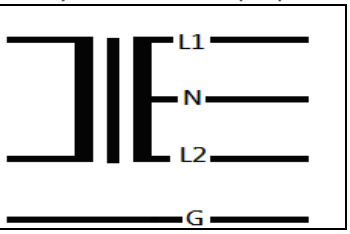
  Whether the box is located to the left or right of the array (as viewed from the ground facing the installed array) determines which transition cable you need (male or female) and what preparation is needed for the final module in the string. With the junction or transition box to the left, the transition cable will connect to the plug at the end of the AC cable. Therefore, a female transition cable is required. The final module in the string will require a protective cap be plugged into the mid-cable receptacle. With the junction or transition box to the right of the array, a male transition cable is needed, which will plug into the mid-cable receptacle, and the final module will require additional cable management to secure the end of the AC cable. Before connecting the transition cable, calculate the distance from the transition box to the module plus the distance under the module to reach the appropriate AC connector. This will determine the length of transition cable that you will need.

- Do you need any extension cables? Will the extension cable reach from connector to connector or is it necessary to modify the standard cable management of one or both modules to make the connection easier?

  If the extension cable is running across open roof, another cable management system might be needed to

keep the extension cable off of the roof and protected from the sun. If the distance to be crossed is longer than the length of the extension cable, you can use more extension cables. Use a transition cable to connect the module into a junction or transition box and wire according to local and NEC or CEC standards. The preparation and installation instructions included in this section are general instructions for installing AC Unison modules on most mounting systems. In some cases, it might be necessary to modify these instructions to accommodate specific installation requirements.

- Check the premises AC service conductors to ensure they are within the proper range.

240 Volt AC Single Phase **("split phase")**		
L1 to L2	211 to 264 VAC	
L1, L2 to Neutral	106 to 132 VAC	

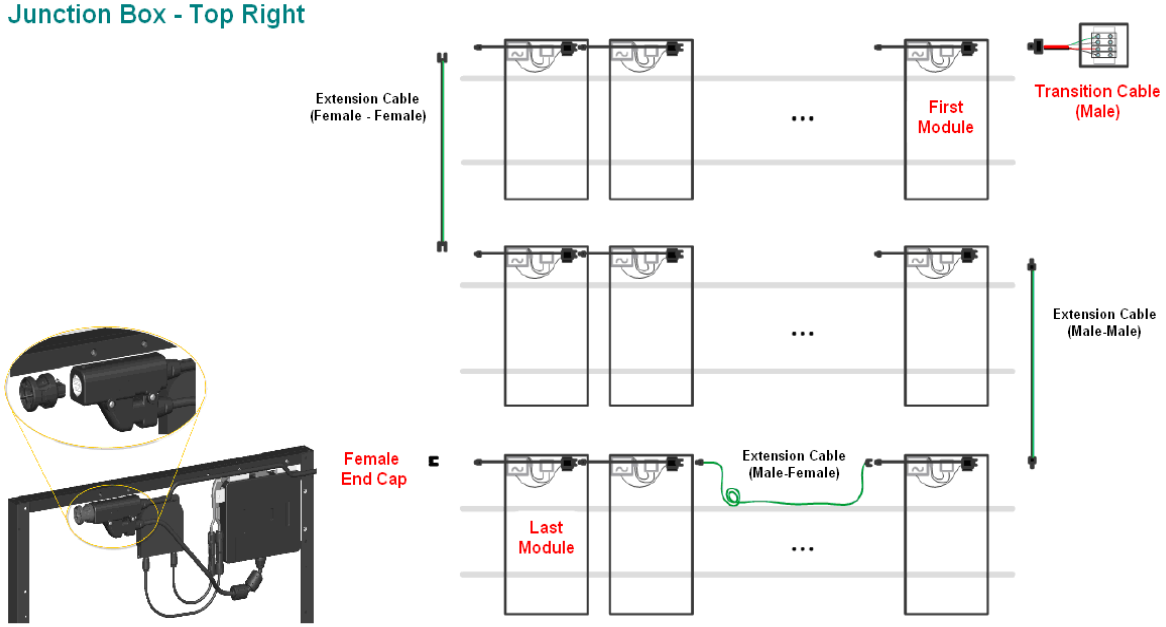
4.2 System layouts and accessories

The diagrams in this section provide examples of array configurations you might encounter and the types of cables necessary for various configurations. The following AC wiring accessories are available to assist in any system layouts that you will encounter.

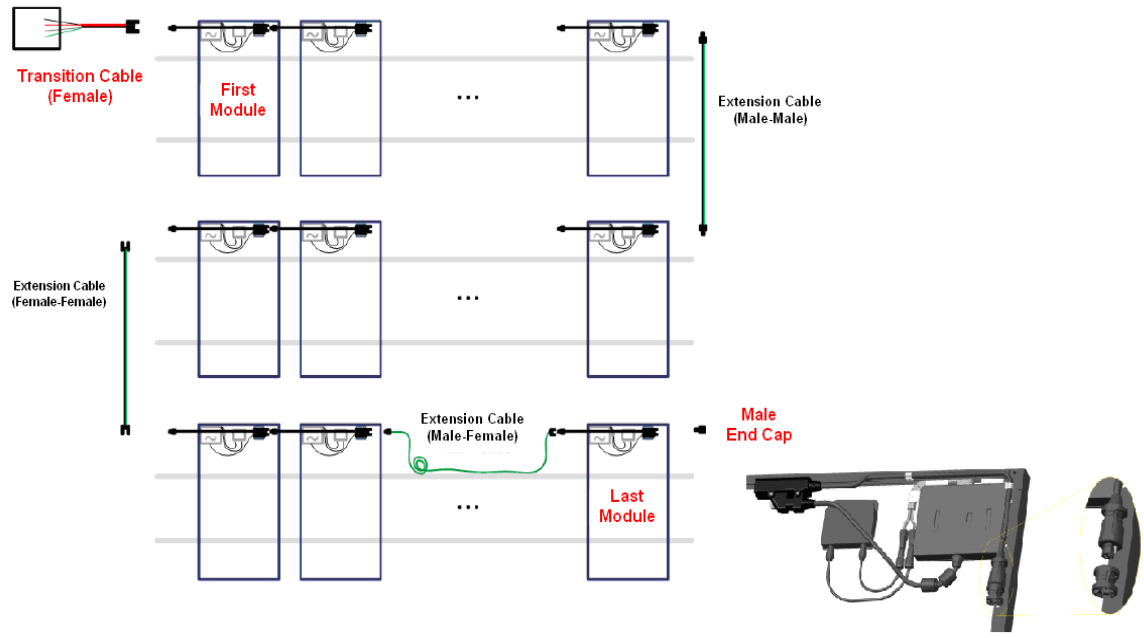
Part name	Description	
Male End Cap		- Plugs into the mid-cable receptacle at the end of a string to protect the cable from dirt and moisture.
Female End Cap		- Covers the interconnecting cable plug at the end of a string to protect the cable from dirt and moisture.
Transition Cable (Male)		- Interconnecting cable plug on one end and 100 mm of stripped wires on the other. - 20A, exterior-rated 4-wire (L1, L2, N, and Ground) cable. - Available in 5' and 10' lengths. - Each cable is shipped with one disconnect tool.
Transition Cable (Female)		- Interconnecting cable receptacle on one end and 100 mm of stripped wires on the other. - 20A, exterior-rated 4-wire (L1, L2, N, and Ground) cable. - Available in 5' and 10' lengths. - Each cable is shipped with one disconnect tool.

Extension Cable (Male-Female)		- Interconnecting cable plug on one end and interconnecting cable receptacle on the other. - 20A, exterior-rated 4-wire (L1, L2, N, and Ground) cable. - Available in 5' and 10' lengths.
Extension Cable (Male-Male)		- Interconnecting cable plugs on both ends. - 20A, exterior-rated 4-wire (L1, L2, N, and Ground) cable. - Available in 5' and 10' lengths.
Extension Cable (Female-Female)		- Interconnecting cable receptacle on both ends. - 20A, exterior-rated 4-wire (L1, L2, N, and Ground) cable. - Available in 5' and 10' lengths.
Disconnect Tool		- Center disconnect pin is inserted into interconnecting plugs, receptacles, and mid-cable receptacles to safely disconnect components.

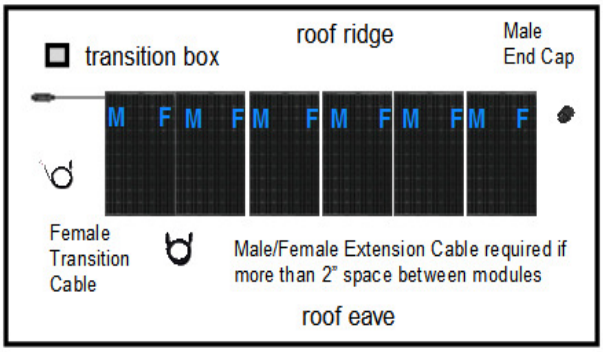
Junction Box - Top Right

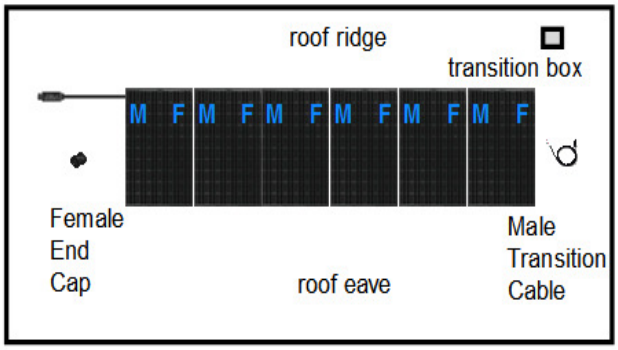


Junction Box - Top Left

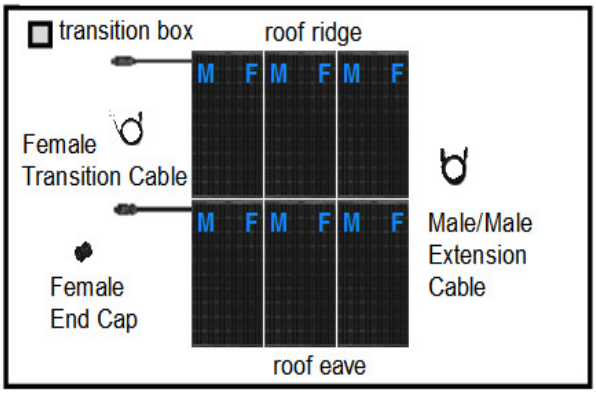


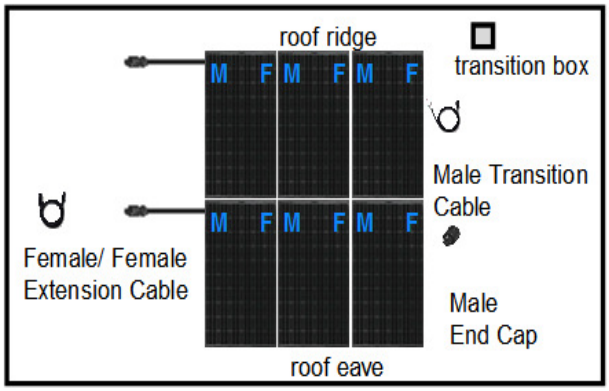
Single Row



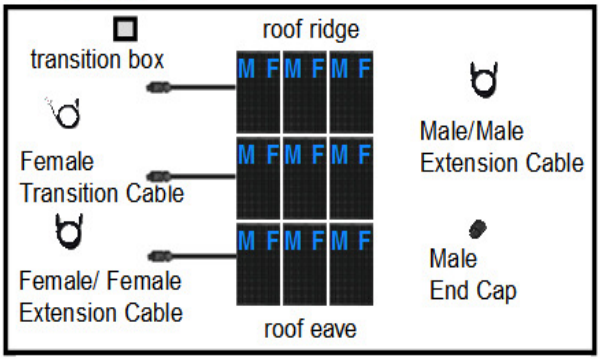


Two Rows

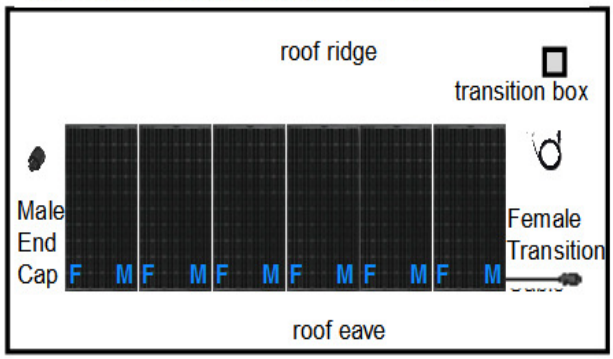




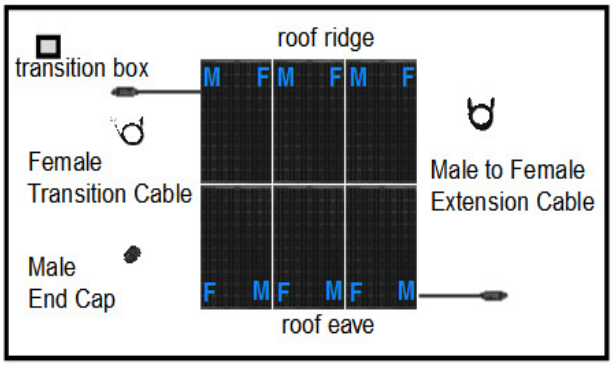
Three Rows



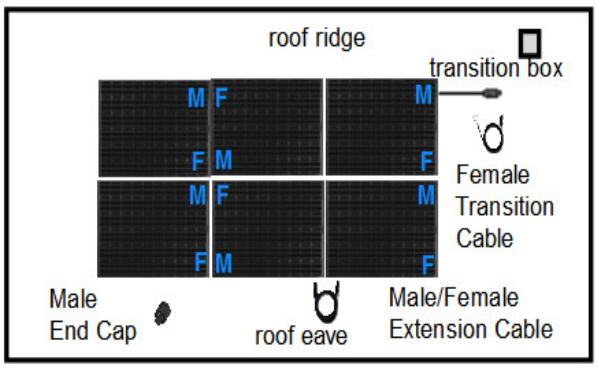
Single Row (modules rotated 180 degrees)



Two Rows (modules rotated 180 degrees)



Landscape



4.3 Mounting notes

PV modules should be installed in a location where there is no shading throughout the year. In the northern hemisphere, PV modules should typically face south, and in the southern hemisphere, PV modules should typically face north. Please make sure that there are no obstructions in the surroundings of the site of installation. Take proper steps in order to maintain reliability and safety in case the PV modules are installed in areas that have heavy snow / extreme cold / strong winds / installations over, or near, water and areas where installations are prone to salt water exposure or on small islands or in desert areas.

PV modules should be tilted so that the energy production from the PV modules will be maximized on an annual basis. The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface. BenQ Solar PV modules produce the most power when the sun's rays strike the module perpendicular to the module surface. To avoid performance losses in series circuits, ensure that all modules have the same tilt and orientation.

The following considerations might affect the placement of the mounting system or the alignment of the modules on the mounting system. However, no attempt is made to describe how to install the mounting system on the roof or how to use module clamps.

- Mounting rails must be positioned below the micro-inverter. Do not install modules with the micro-inverter resting on the mounting rail. The frame of the installed module must rest firmly on the mounting rail. Installing a module with the micro-inverter resting on the rail and uneven contact between the frame and the rail can cause damage to the micro-inverter and the module.
- When the mid-cable receptacle is attached to the AC Unison module with wire management components, the mid-cable receptacle extends beyond the edge of the module frame. Mounting rails must be positioned to not interfere with the mid-cable receptacle.

4.4 Equipment grounding

Solar modules and racking systems must be provided with appropriate equipment grounding. It's the installer's responsibility to ensure each module is secured to the racking system using certified equipment grounding hardware according to local codes. Proper equipment grounding of the AC Unison module system will ensure full warranty coverage. One tested and verified solution is to install AC Unison module with ProSolar aluminum rail and Burndy WEEB (Washer, Electrical Equipment Bond) devices. Please see Appendix A for detailed WEEB installation instructions.

Lightning protection for electronic equipment in the home is often accomplished using rapid response SOV's or MOV's. These devices are typically installed at a sub-panel or main service entrance panel where the AC Unison module system has been connected. Lightning arrestors handle large surges from nearby lightning strikes and surge capacitors control surges that are too fast or too light for a lightning arrestor to function. Although complete lightning protection systems from companies such as ABB, APC or Polyphaser can be designed to the practices in your area and installed in the home, more component level solutions can be purchased from companies like Dehn, Cital or Delta Lightning Arrestors (e.g. Delta LA 300 Series surge arrestors and CA 300 Series surge capacitors).

4.5 Micro-inverter specification

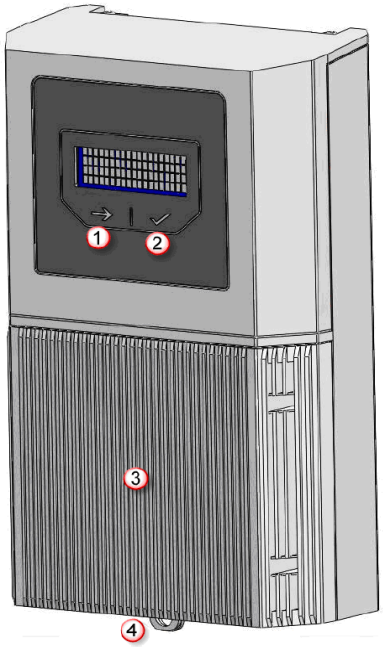
Parameter	Rating
OUTPUT DATA (AC)	
Maximum continuous output power (W)	225
Nominal output current (A)	0.9375
Nominal output voltage (V) (L-L)	240
Operating voltage range (V) (L-L)	211 – 264
Nominal frequency (Hz)	60
Operating frequency range (Hz)	59.3 – 60.5
Power factor rating	> 0.99
Total Harmonic Distortion (per IEEE 1547)	< 5 % (Passed up to 40th harmonic)
Number of phases	1 [a]
Maximum units per 20 amp dedicated branch circuit	17 [b]
Maximum output over-current protection (A)	20 [b]
Efficiency	
Peak inverter efficiency	95.5%
CEC weighted efficiency	94.5%
Nominal MPP tracking	99.6%
Mechanical Data	
Operating ambient temperature range	-40℃ to + 65℃
Cooling	Natural convention – No fans
Features	
Communication	Powerline Carrier
Compliance	FCC Part 15 Class B UL 1741 / CSA 107.1

[a] Single-phase requiring two of the phases (L1 and L2) for power production and a neutral for voltage sensing only, per IEEE 1547.

[b] This is the maximum number of micro-inverters that can be connected in parallel to a single dedicated branch circuit, which is protected by a circuit breaker rated at 20 A. This number is derived based on the requirements of the National Electrical Code (NEC) and the current rating of the micro-inverter. If more micro-inverters than this number need to be installed, additional 20-A branches shall be used, keeping the number of micro-inverters on each branch less or equal to this number.

5 Data logger

The **BenQ Solar Data Logger** is a gateway device that uses Power Line Communications (PLC) to collect status and performance data from AC Unison modules. Using broadband Internet, the Data Logger then forwards the collected data to the Solar Monitoring System at five minute intervals. When necessary, the Data Logger automatically downloads and installs enhancements, which can include defect fixes, to the software on the Data Logger or, on rare occasions, to the firmware on the micro-inverter. No manual intervention is required during the update process. The following diagrams illustrate the exterior and interior features of the Data Logger.



① NEXT button – Moves to the next item in the current menu

② SELECT button – Displays additional submenus or information

③ Removable access cover – Provides access to the field accessible components of the Data Logger

④ Location for security lock

① AC terminal block cover – Remove this cover to attach the wires that will connect the Data Logger to the site's electric service panel.

> Warning: This area is to be accessed only by qualified, trained personnel with the necessary skills and knowledge to work on this type of electrical equipment. Disconnect power before opening.

② 12-volt power port – For testing purposes, a suitable 12-volt battery can temporarily power the Data Logger and enable you to verify some functions of the Data Logger before the Data Logger is wired to a permanent power source.

③ USB port – Reserved for future use.

④ RJ45 port – An Ethernet cable can connect the Data Logger to a nearby network router or to a service provider's laptop for local access to the Data Logger's web interface.

5.1 Preparation

Choose a Mounting Location

- An important step in installing the Data Logger is choosing the location. Close proximity to the site's electric service panel or module aggregation panel ensures the best communications between the Data Logger and the AC Unison modules. The greater the distance between the Data Logger and the panel, the greater the risk of encountering limited or no communication with the modules.
- To ensure the best communications and to provide easy access by service providers, we recommend wiring the Data Logger's AC terminal block directly to a 20 A (max) circuit breaker in the service or aggregation panel used by the AC Unison modules. In many cases, this might be on an exterior wall, preferably away from direct sunlight, if possible.
- The Data Logger uses DHCP to acquire an IP address. To enable Internet communication between the Data Logger and the Solar Monitoring System, the Data Logger must be connected to a 10/100Base-T network router using an Ethernet cable. When connected to the Internet, the Data Logger periodically uploads site- and module-level data to the BenQ Solar Monitoring System. If a network or DHCP is not available, the Data Logger uses its default IP address, 192.168.100.1.

Verify Required Supplies

- Depending on the mounting surface, use appropriate fasteners and anchors capable of supporting 15 lbs of weight. For Wood, use screws with 3/4" thread length. For outdoors, use galvanized or stainless steel.
- For outdoor wiring, use wet rated wire (e.g. THWN), outdoor-rated 1/2" conduit (metallic, non-metallic, or flexible), and appropriate conduit for Type 3R enclosures. Requirements in local codes and NEC or CEC standards take precedence over this list.
- For indoor wiring, use only listed/ certified wiring devices such as NEMA 1-14 polarized plug, SJO two-conductor power cord for 1/2" conduit hole on bottom of the Data Logger. If mounted on an interior wall, the Data Logger can be permanently connected by wiring directly to the service panel. The Data Logger can also be wired with a Polarized NEMA 1-15P style AC plug and plugged into a standard NEMA 5-15R AC outlet. Follow local codes and NEC or CEC guidelines for permanent connection to a wiring box or electric service panel.

5.2 Specifications

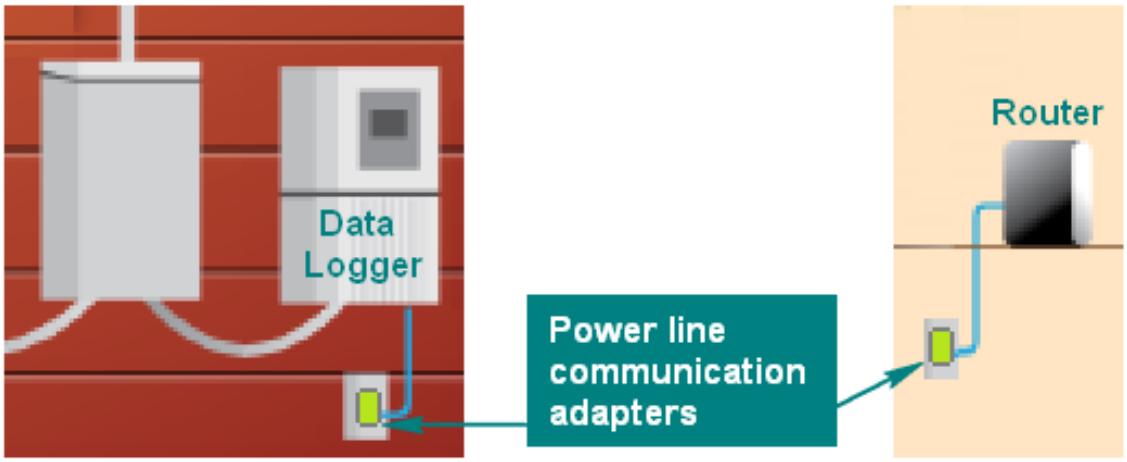
The Data Logger is suitable for use indoors or outdoors in temperatures between -20°C and 50°C (-4°F and 122°F). The exterior housing is rated Type 3R for protection against all weather conditions. The Data Logger can be connected to standard Type 3R service panels by using 1/2" outdoor conduit.

Communications	
With AC Unison modules	Power Line Communication
With monitoring system	Ethernet with 10/100Base-T router
Power Requirements	
Power Supply	Direct wire or AC outlet
Power Consumption	~0.1amp
Mechanical Specifications	
Dimensions	13.3"L X 7.9"W X 3.5"D

Weight	3.5 lbs
Ambient Temperature Range	-20°C and 50°C (-4°F and 122°F)
Enclosure Environmental Rating	Type 3R
Other	
Compliance	UL60950-1 ITE, UL60950-22 Outdoor Use, FCC Part 15 Class B,

5.3 Internet communication adaptors

For outdoor installation or when the Data Logger is far from the broadband router, it may not be practical to run a long Ethernet cable. Instead of connecting a long Ethernet cable between the Data Logger and broadband router, installers are suggested to use power line communication adapters or wireless communication adapters for internet connection as shown in the following diagram.



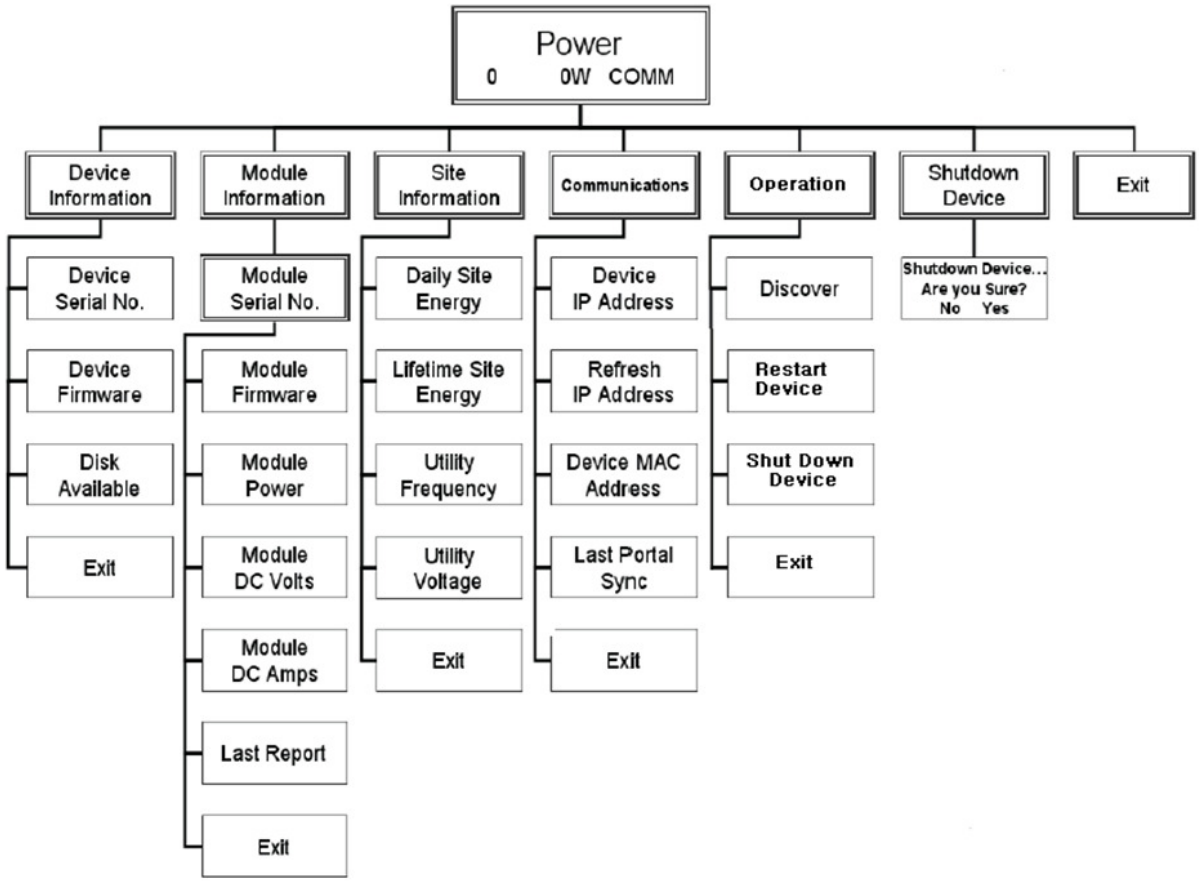
The following table lists the power line communication adapters and wireless communication adapters that are compatible with BenQ Solar Data Logger. The Data Logger may experience communication problems with other PLC communication adapters due to GFDI constraints. However, the Data Logger is compatible with most wireless communication adapters.

Power Line Communication	NETGEAR	Powerline 85 Adapter Kit	XETB1001	
	TP-LINK	AV200min Powerline Adapter Starter kit	TL-PA211KIT	
Wireless	PLANEX COMMUNICATIONS INC	無線LAN2ポートポケットルータ	MZK-MF-150W	
	NETGEAR	Universal Wireless Internet Adapter for TV & Blu-ray	WNCE2001	

5.4 LCD Menu

The following table defines the various screens available through the Data Logger's LCD interface. This interface is most commonly used by the installer to configure the site after modules have been installed or by a service provider performing maintenance at the site.

Use the two buttons below the LCD interface to navigate through a set of topic menus that provide access to information or setup controls. Press the arrow button (⇨) to move through the menus. Press the checkmark button (✓) to select a topic and begin viewing information. Press the arrow button (⇨) again to move through the information in the selected topic. Pressing the arrow button (⇨) on the EXIT screen returns you to the first menu item in the current topic menu. Pressing the checkmark button (✓) on the EXIT screen returns to the topic menu.


Power
0 0W COMM
Device Information
Module Information
Site Information
Communications
Operation
Shutdown Device
Exit
Device Serial No.
Device Firmware
Disk Available
Exit
Module Serial No.
Module Firmware
Module Power
Module DC Volts
Module DC Amps
Last Report
Exit
Daily Site Energy
Lifetime Site Energy
Utility Frequency
Utility Voltage
Exit
Device IP Address
Refresh IP Address
Device MAC Address
Last Portal Sync
Exit
Discover
Restart Device
Shut Down Device
Exit
Shutdown Device...
Are you Sure?
No Yes

Main Menu

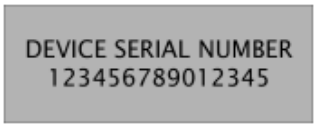
The table below describes the top-level menu items in the LCD interface. Use the arrow button (⇨) to scroll through the items in this table. Use the checkmark button (✓) to select the menu.

Menu	Description	Press ✓ to go to...
	Home screen appears when Data Logger is fully initialized. ① Number of discovered modules. ② Total amount of power generated by all modules at the time of the last data reading. ③ COMM = Connected to BenQ Solar Monitoring System, NOCOMM = Not connected to BenQ Solar Monitoring System.	
DEVICE INFORMATION	Information about the Data Logger.	"Device Information Menu"
MODULE INFORMATION	Information about each module that is monitored by this Data Logger.	"Module Information Menu"
SITE INFORMATION	Current performance statistics for the array.	"Site Information Menu"
COMMUNICATIONS	Information about communications with the Data Logger.	"Communications Menu"
OPERATION (or SETUP)	Menu for discovering the installed modules.	"Operation (or Setup) Menu"
SHUTDOWN DEVICE	Shuts down the Data Logger software before disconnecting from power supply.	"Shutdown Menu"

	Scrolls through the menus.	Exits the main menu and returns to the Home screen.

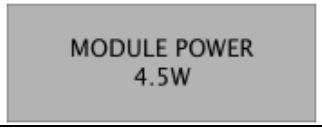
Device Information Menu

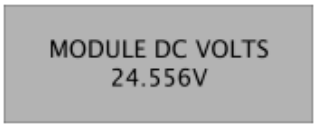
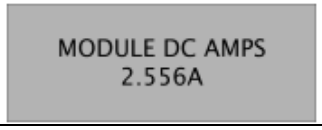
This menu provides basic information about the Data Logger. Press ⇨ to scroll through the menus.

Menu	Description
	Displays the serial number of the Data Logger.
	Displays the version number of the installed firmware.
	Displays the amount of memory still available on the SD card.
	⇨Scrolls through the menus. ✓Exits the information screens and returns to Device Information.

Module Information Menu

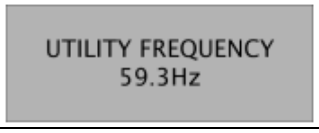
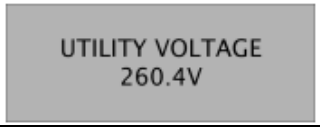
This menu provides information about each module in the installation.

Menu	Description
	Press ⇨ to scroll through the list of serial numbers. Press ✓ to view information about this module. The remainder of this table shows the information available for each module.
	Displays the version number of the firmware installed on the inverter attached to the module.
	Displays the current power output of the module.

	Displays the DC volts currently produced by the solar module.
	Displays the DC amps currently produced by the solar module.
	Displays the date and time the module last reported data to the Data Logger.
	Exits the information screens for the selected module and returns to Module Serial No.

Site Information Menu

This menu provides information about the overall performance of the site.

Menu	Description
	Displays the amount of energy produced today.
	Displays the total energy produced over the lifetime of the array.
	Displays the frequency of the electric grid at the time of the last data reading.
	Displays the voltage of the electric grid at the time of the last data reading.
	⇨Scrolls through the menus. ✓Exits the information screens and returns to Site Information.

Communications Menu

This menu provides the IP address and MAC address of the Data Logger as well as the date and time that the Data Logger last communicated with the monitoring system.

Menu	Description
DEVICE IP ADDRESS 12.34.56.789	Displays the IP address of the Data Logger.
REFRESH IP ADDRESS	Press ✓ to acquire a new IP address or to renew the current IP address. An interim screen displays the progress of the refresh and returns the Device IP Address Screen.
DEVICE MAC ADDRESS 01:23:45:67:89:AB	Displays the MAC address of the Data Logger.
LAST PORTAL SYNC 01/01/2011 12:10	Displays the date and time that data from the modules was last transmitted to the monitoring system.
EXIT	⇨Scrolls through the menus. ✓Exits the communication information screens and returns to Communications.

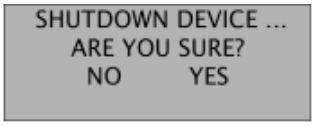
Setup Menu

The submenu in this menu enables you to discover newly installed AC Unison modules.

Menu	Description
DISCOVER	Press ✓ to begin discovering modules. An interim screen displays the discovery progress and returns the next screen.
DISCOVERY COMPLETE 5 MODULES FOUND	Press ⇨ to move to the EXIT screen.
EXIT	⇨Scrolls through the menus. ✓Exits the information screens and returns to Setup.

Shutdown Menu

This menu shuts down the Data Logger device. To restart the device, cycle the power supply by unplugging the Data Logger and then plugging it back in or by flipping the circuit breaker.

Menu	Description
	Press ⇨ to begin the shutdown process.
	Press ⇨ to choose the correct response to the confirmation question, then press ✓. Selecting "Yes" continues the shutdown.
	The screen goes blank when the Data Logger is off.

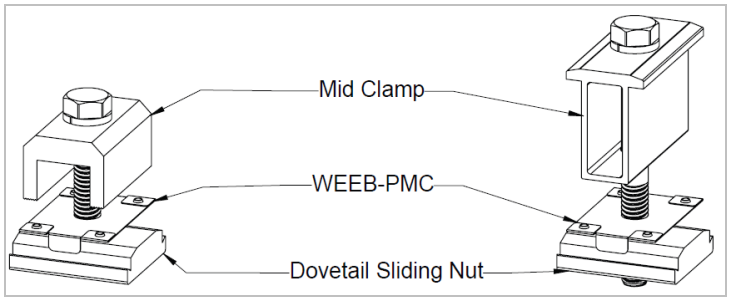
Appendix A. Burndy WEEB installation manual

- Listed WEEB devices intended for use in bonding BenQ Solar AC Unison modules to mounting structures may be used for grounding as described in the NEC or CEC accordingly. Prior to installation, all bolts that employ bonding and grounding hardware shall have general purpose anti-seize applied onto the bolt threads.

Cat. No.	Racking System	Torque
WEEB-PMC	Professional Solar – RoofTrac, GroundTrac, SolarWedge	15 ft-lbs / 20.5 Nm

- Install the WEEB onto the midclamp of racking hardware to bond module frames to mounting rail in accordance with the layout specified in the Burndy installation manual for the pertinent racking system.

- Pre-assemble WEEB-PMC onto ProSolar midclamp assembly as shown:



- Ensure both sides of the modules are positioned against midclamp and WEEB teeth are underneath module frames. Hand tighten fasteners to keep modules in place since WEEBs are intended for one time use only and cannot be reused. When position is finalized, tighten hardware to specified torque.

- Using the approved hardware, install the WEEB Lug at the end of each rail to connect the equipment ground conductor to the system. Each nut/bolt combination that installs a Lug and Bonding Jumper shall be tightened to 10 ft-lbs. / 13.5 Nm of torque as specified in the Burndy manual.

- Lug is capable of securing one 6AWG or two 10AWG or two 12 AWG copper conductors. Tighten bolt securing copper conductor to 7 ft-lbs / 10 Nm torque.

Advancing Renewable Technology

Washer, Electrical Equipment Bond

WEEB

Patent Pending

INSTALLATION INSTRUCTIONS

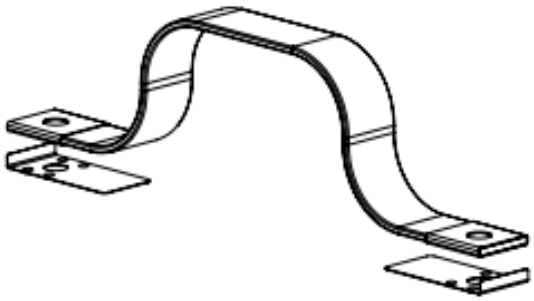
For Professional Solar only

Please read carefully before installing.

Burndy LLC. recommends that the sufficient details of the installation be submitted to the AHJ for approval before any work is started.

WEEB-PMC

WEEBLug-6.7 assembly



WEEB Bonding Jumper-6.7

Products are tested to UL 467, CAN/CSA-C22.2 No. 41
US/Canadian standards for safety grounding and bonding equipment

Intertek

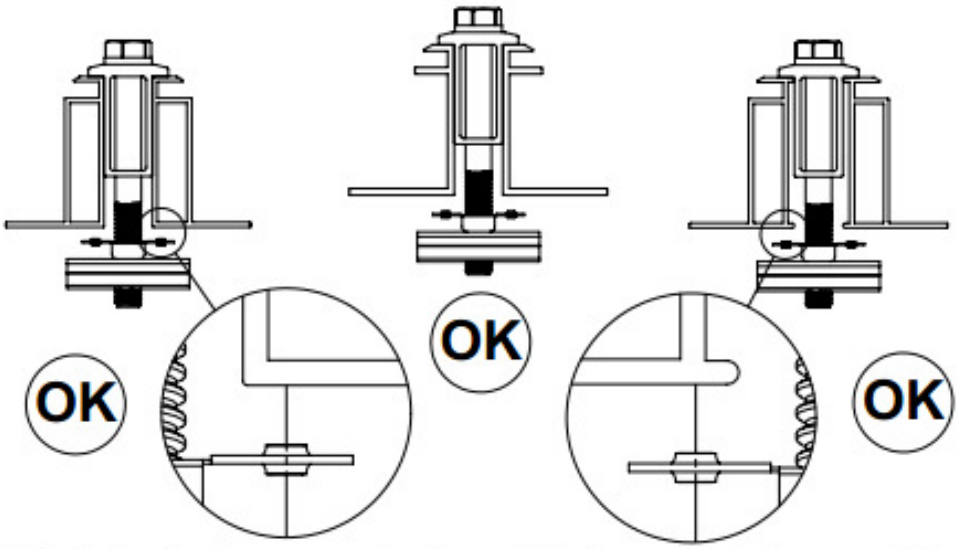
3098177

WEEB COMPATIBILITY

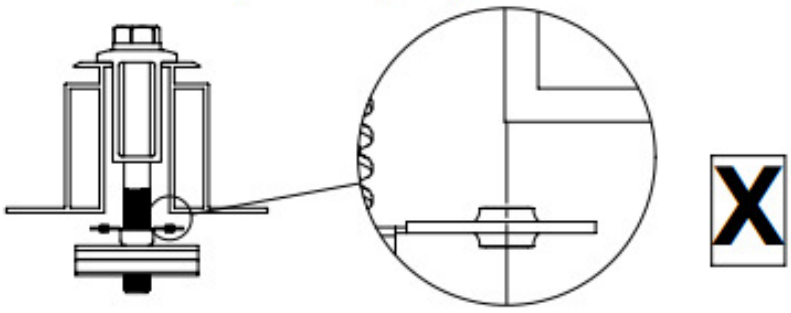
The WEEB family of products can be used to bond anodized aluminum, galvanized steel, steel and other electrically conductive metal structures. All installations shall be in accordance with NEC requirements in the USA and with CSA C22.1 in Canada. The WEEBs are for use with modules that have a maximum series fuse rating of less than 25A.

Standard Top Down Clamps

The WEEBs used for bonding the PV modules to the mounting rails are compatible with various cross-sections of module frames. The following are examples of module frames that are compatible. Notice that the WEEB teeth are positioned completely under the edge of the module frame.

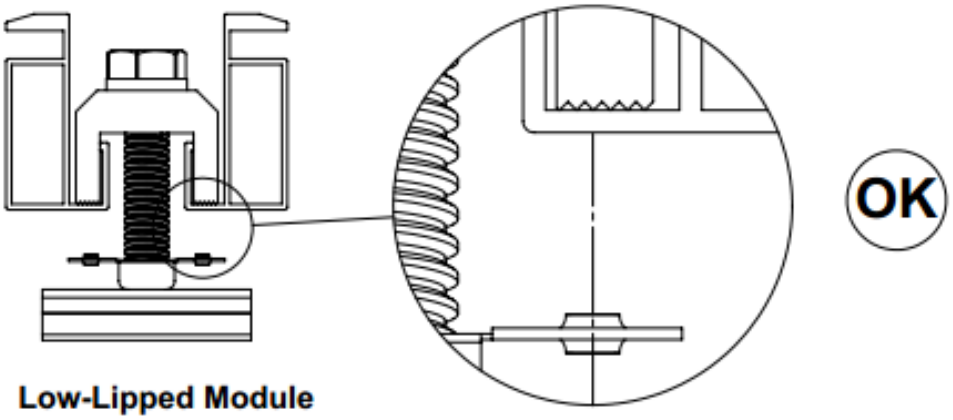


The following is an example of a module frame that is incompatible with the WEEB. The WEEB teeth are positioned only partially under the edge of the module due to the lip on the top edge of the module.



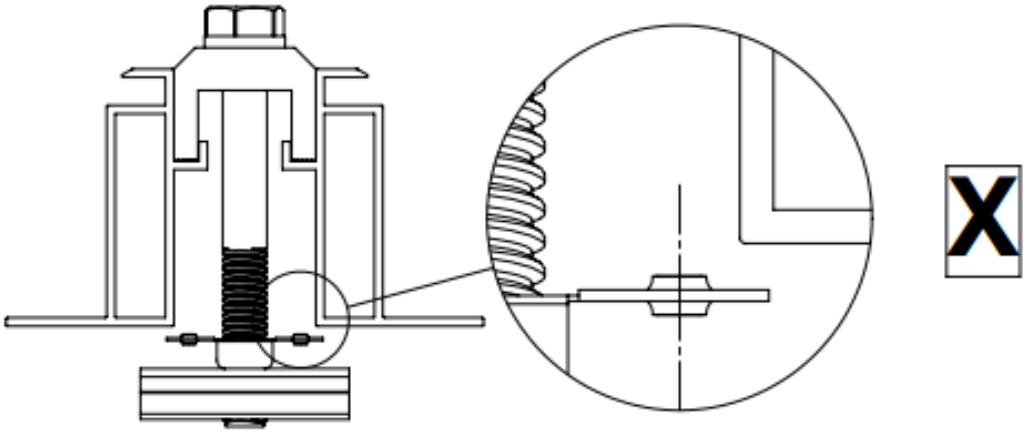
Top Down Clamps for Lipped Modules

The following are a few variations of lipped solar modules mounted with inverted U-shaped clamps. Notice that the force which the inverted U-shaped clamp exerts is in line with the WEEB teeth.



Low-Lipped Module

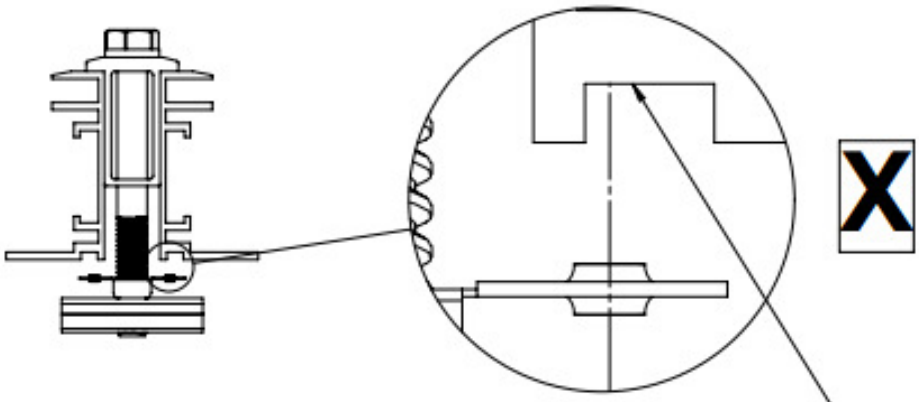
The WEEB-PMC is not compatible with high lipped modules. The WEEB teeth do not intersect with the solar module frame.



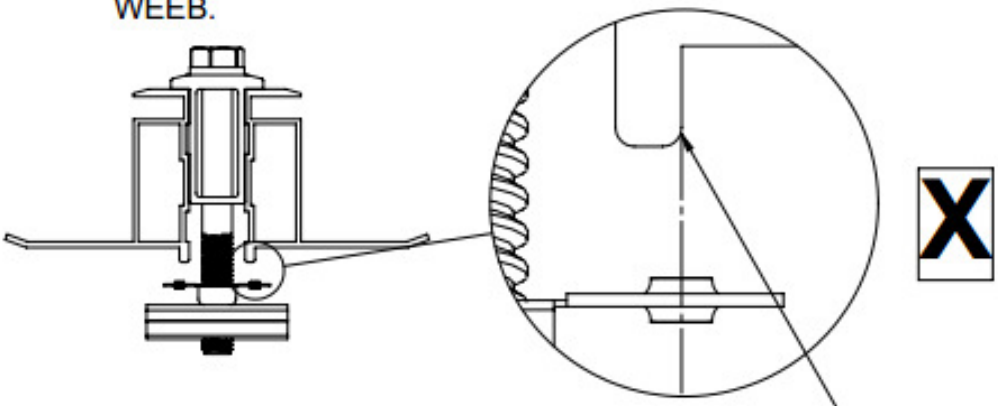
High-Lipped Module

WEEB COMPATIBILITY

Module frames like those shown here may have a ridge or lip on the bottom edge of the frame that would prevent the WEEB teeth from fully embedding.



Shown here is an example of a groove that will prevent the WEEB teeth from properly penetrating the module frame. This type of frame is not compatible with the WEEB.



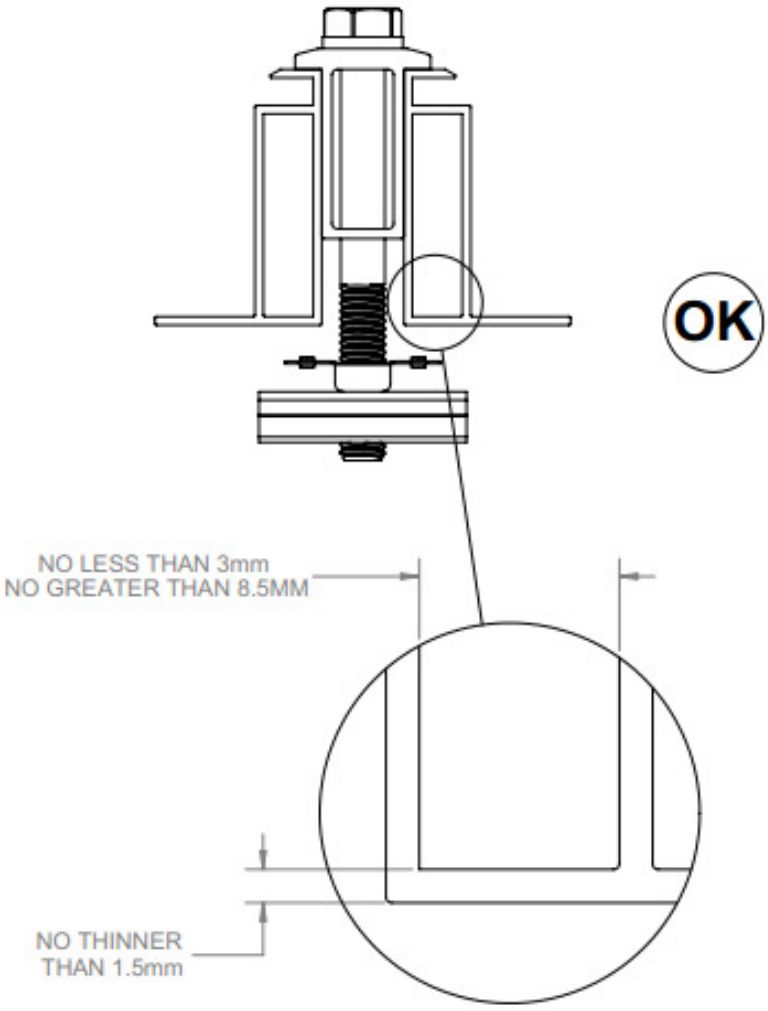
Shown here is an example of a lip that will prevent the WEEB teeth from properly penetrating the module frame. This type of frame is not compatible with the WEEB.

Important Note:

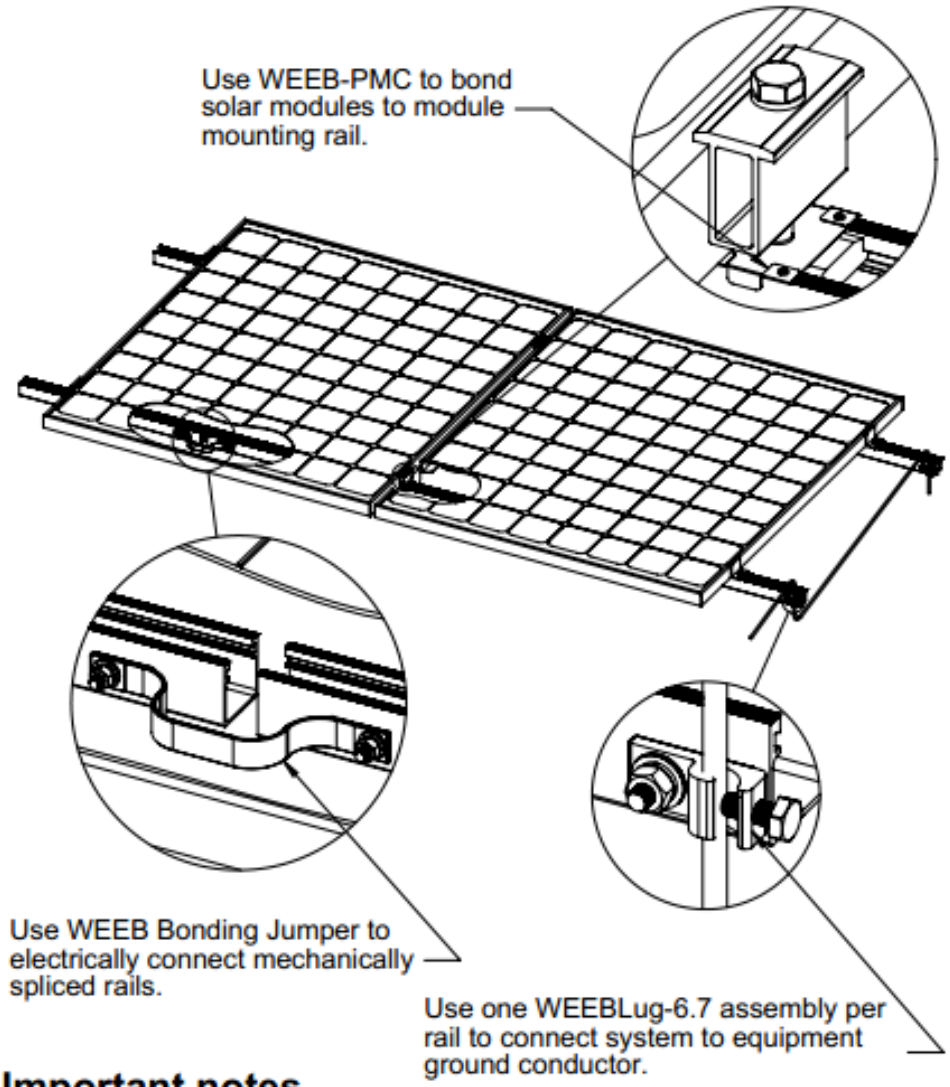
Inspect each module frame used with a WEEB to ensure that the bottom mounting face of the frame is flat, and that there are no hinderances to embedding WEEB teeth. Do not use a module with a frame that prevents the WEEB teeth from embedding fully.

WEEB-PMC on Boxed Module Frames

Certain module frames do not have enough structural strength to withstand the force required to embed a WEEB. These frames will deform and therefore not allow sufficient penetration of the WEEB teeth. The general requirements for minimum module frame thickness of "boxed" type module frames are illustrated below.



SYSTEM OVERVIEW

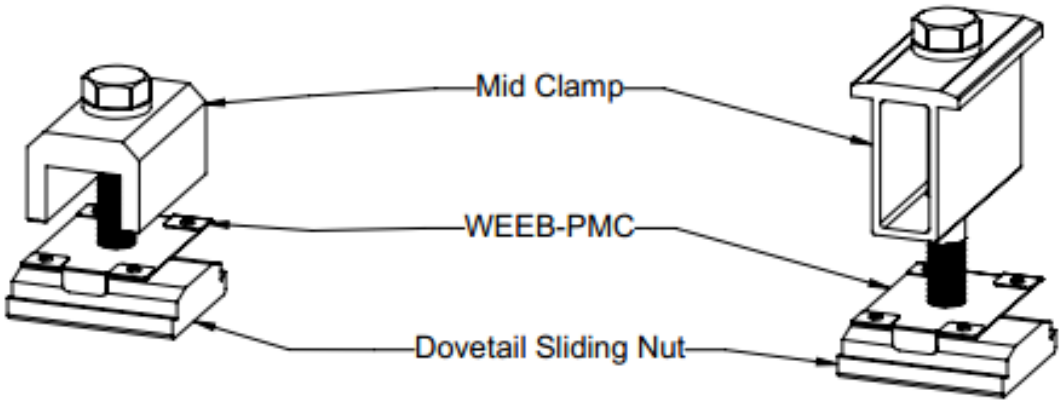


Important notes

1. **Use general purpose anti-seize compound on fastener threads when installing WEEBs.**
2. **The NEC section 690.43 states, "Exposed non-current carrying metal parts of module frames, equipment, and conductor enclosures shall be grounded in accordance with 250.134 or 250.136(A) regardless of voltage."**
3. **WEEBs are intended for SINGLE USE ONLY. Functionality will not be guaranteed if reused.**

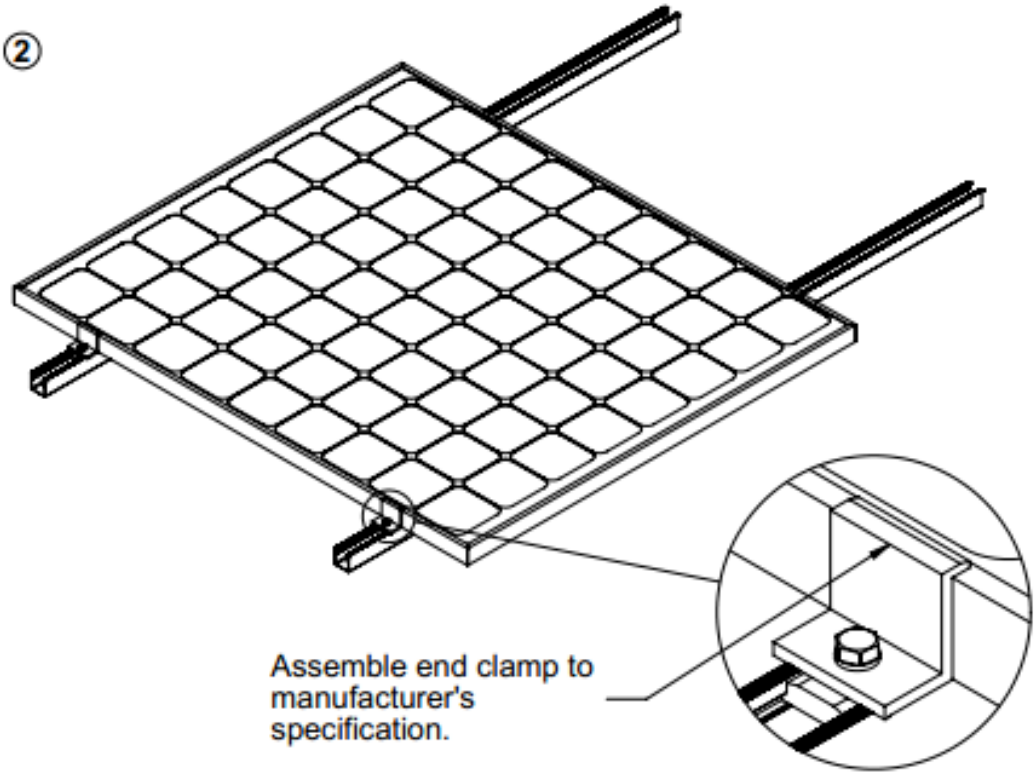
WEEB-PMC ASSEMBLY

①

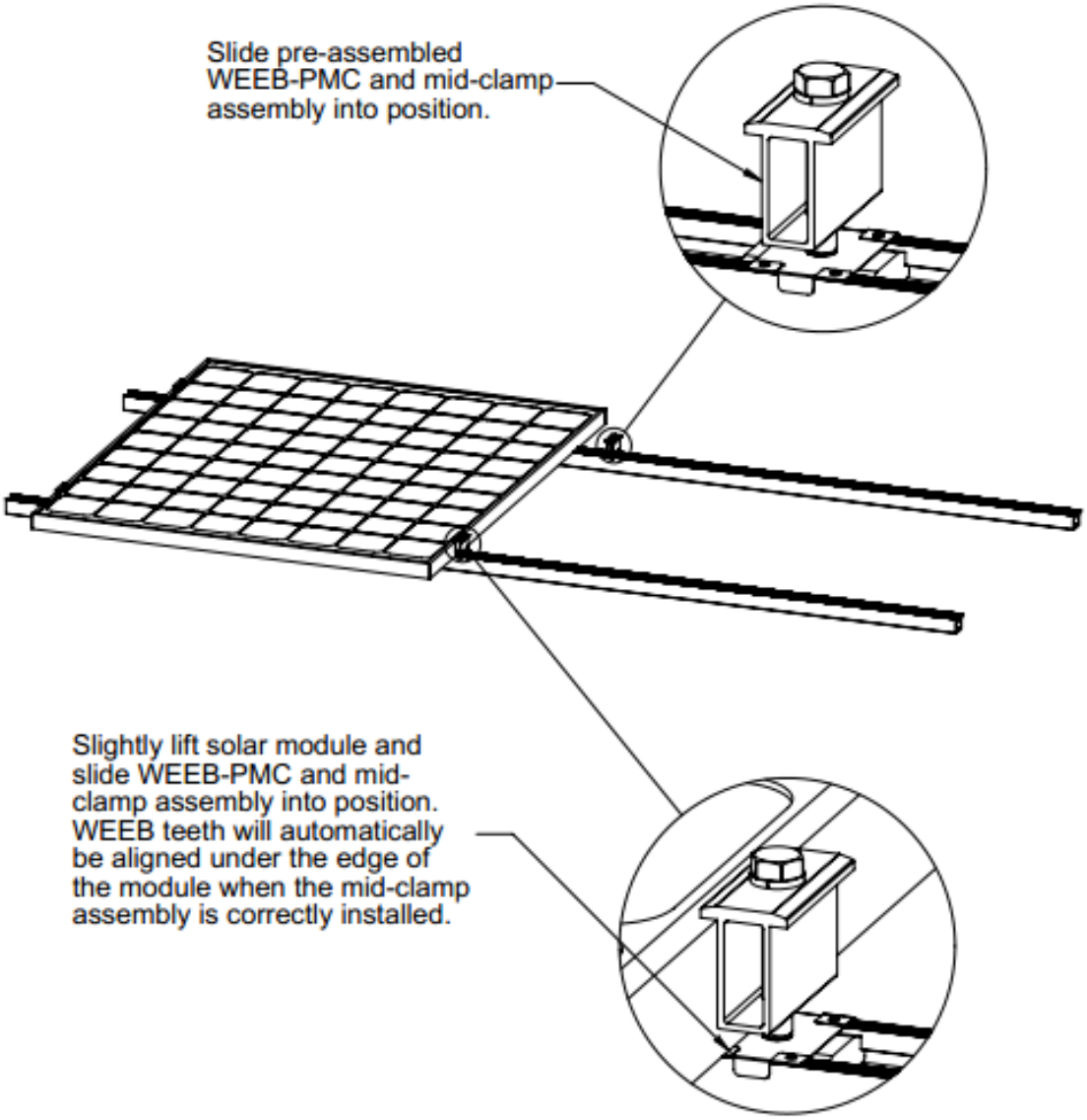


Pre-assemble WEEB-PMC to mid-clamp assembly as shown. Pre-assembling WEEB-PMC to mid-clamp assembly will contain the small individual parts, reducing the possibility of losing parts during installation.

②



③



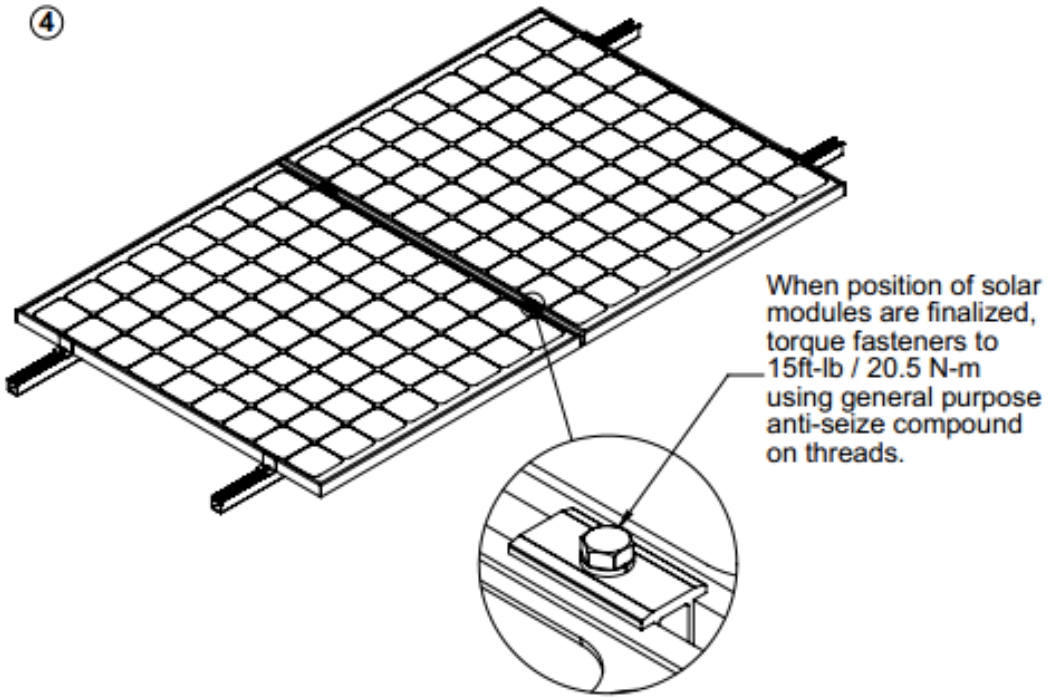
Important note:

To correctly install WEEB-PMC, ensure that both sides of the solar modules are completely positioned against the mid-clamp. Refer to WEEB compatibility page for illustrations. Visually check that WEEBs are properly positioned.

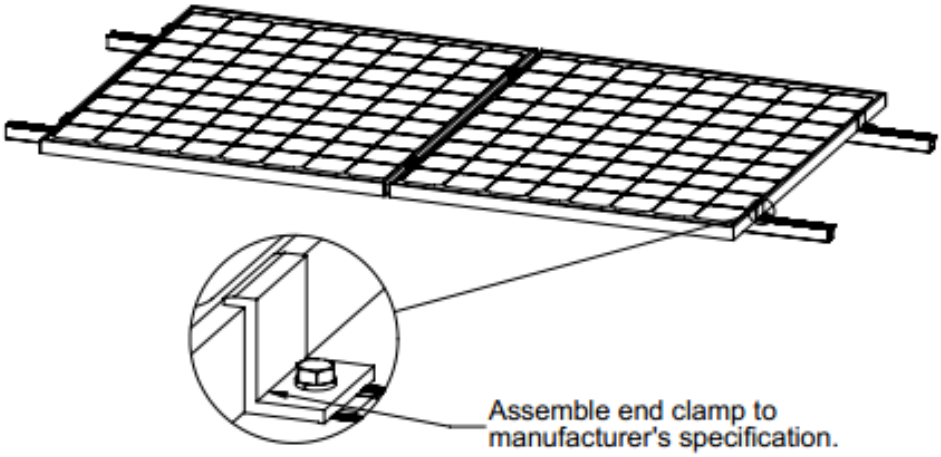
Important note:

WEEBs are for SINGLE USE ONLY! Do not torque fasteners down if position of solar modules is not finalized. Only slightly tighten fasteners to keep modules in place.

④



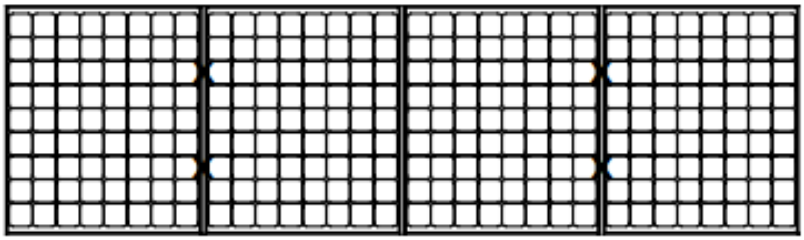
⑤



WEEB-PMC LAYOUT

⑥

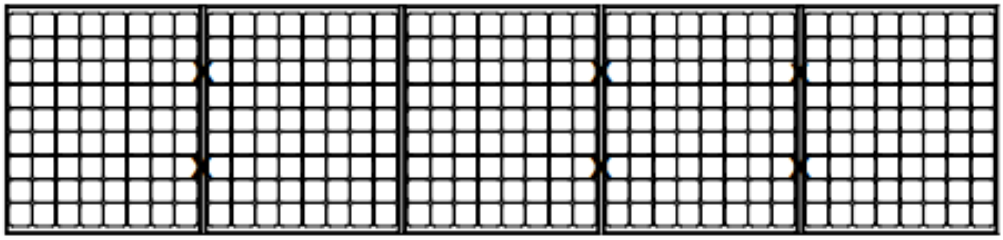
EVEN NUMBER OF MODULES IN ROW



X DENOTES PLACES TO INSTALL WEEB-PMC

C X R = 4 X 1
WEEB-PMC NEEDED = C X R = 4 X 1 = 4

ODD NUMBER OF MODULES IN ROW



X DENOTES PLACES TO INSTALL WEEB-PMC

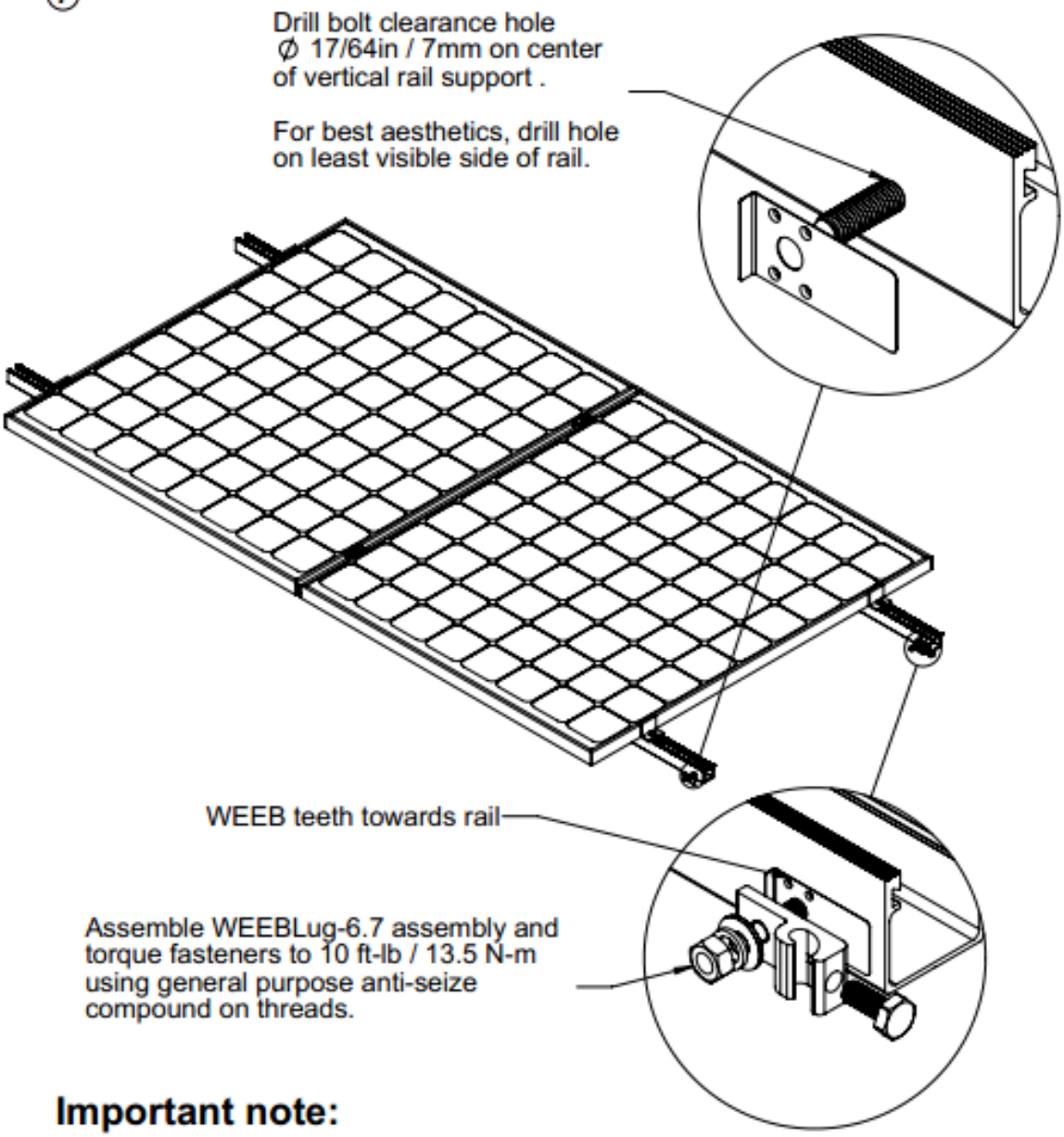
C X R = 5 X 1
WEEB-PMC NEEDED = [C+1] X R = [5+1] X 1 = 6

Note:

When replacing a single faulty module, also remove the adjacent module which contacts the same WEEBs as the faulty module. This will ensure that there are never ungrounded modules in the array.

WEEBLUG ASSEMBLY

⑦

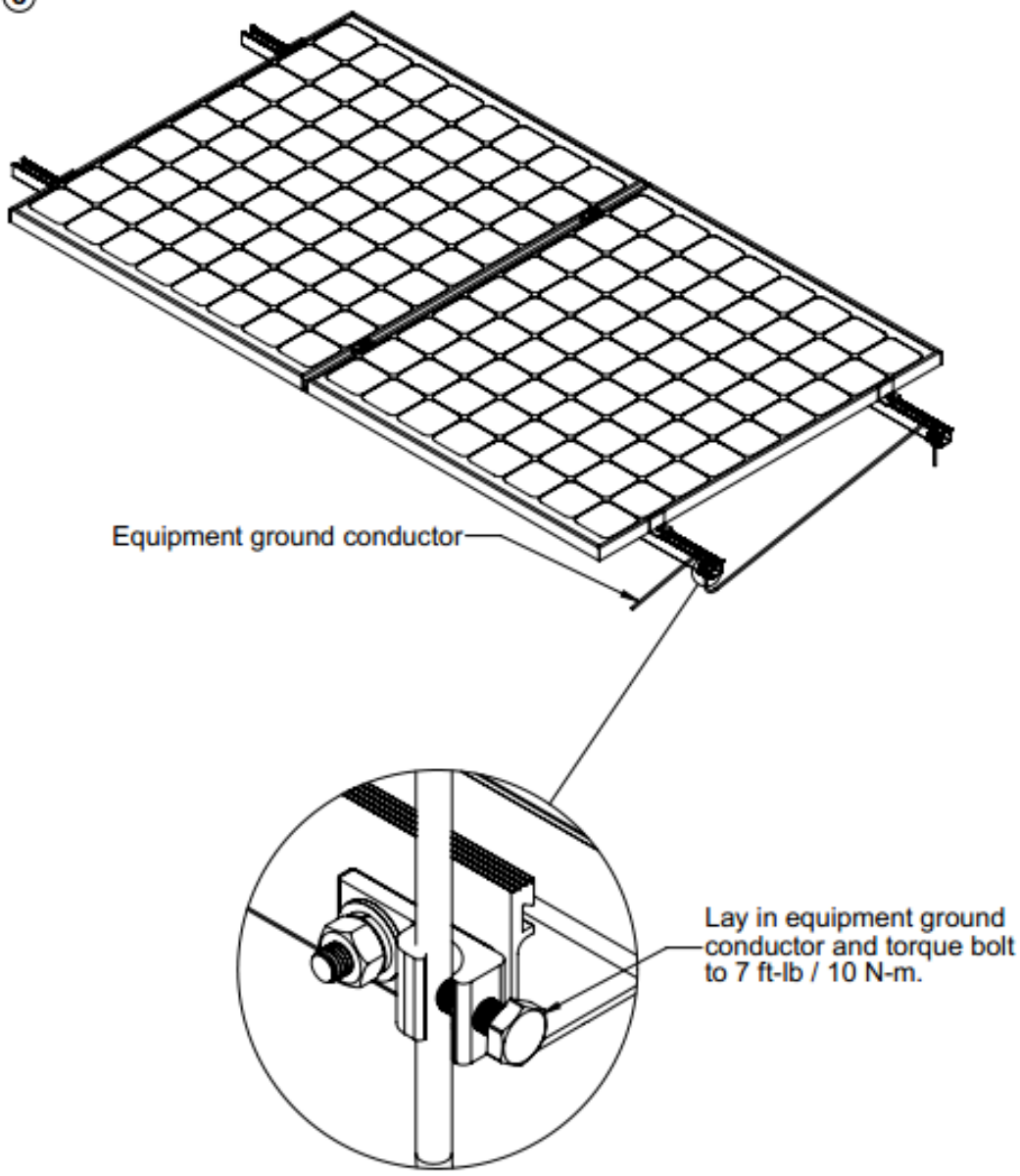


Important note:

1. **WEEB-6.7 that sits under the WEEBLug is for SINGLE USE ONLY! Ensure position is correct before tightening.**
2. **The WEEBLug-6.7 may be used with a maximum equipment ground wire of 6 AWG.**

GROUND CONDUCTOR ASSEMBLY

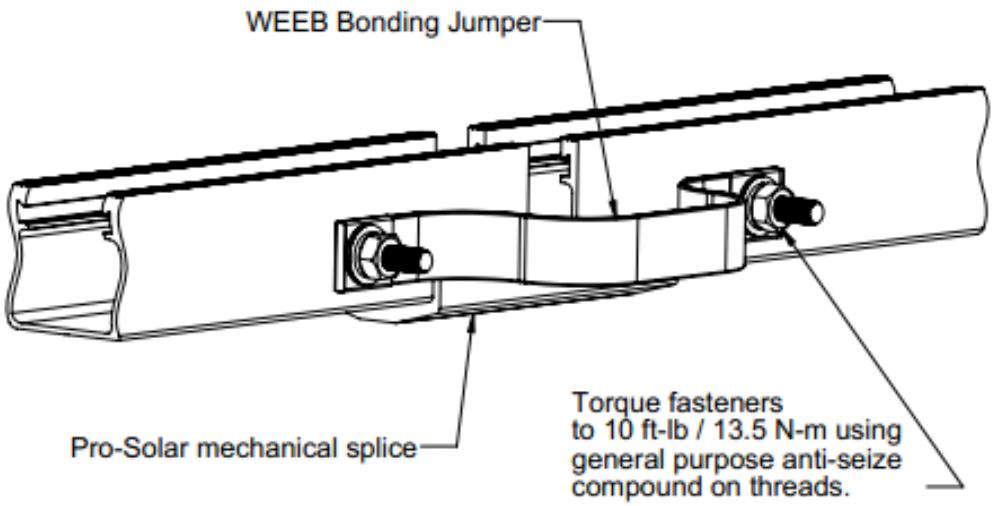
⑧



PMC SPLICE KIT ASSEMBLY

⑨

WEEB Bonding Jumper can be used for all rail splices including expansion joints.



Appendix B. Recommendation for cleaning of the module

Glass of module

Dirt piled up on the module's transparent surface reduces its performance and may cause reverse hot spot effects. The problem may become serious in the case of industrial waste and bird droppings. The intensity of the effect depends on the waste's opacity. The layers of dust that reduce the sun's intensity evenly are not dangerous and the power reduction is not usually significant. The frequency of cleaning depends, of course, on how quickly dirt accumulates. When the module is mounted over angle of fifteen degree, the module has efficacy of self-cleaning. In many cases, rainfall may reduce or remove the need to clean the modules.

BenQ Solar recommends cleaning module during early morning, late afternoon or cloudy day. Do not clean module during high temperature, temperature lower than zero degrees Celsius, or when large temperature difference between module and cleanser.

If necessary to clean back side of module, do not damage any components. Please prevent any oily liquids such as paraffinum liquidum, animal oil, or vegetable oil contacting with junction box, cable and connector.

Some BenQ Solar PV module can withstand snow pressure of 5400 Pa. Please use soft brush lightly removing snow pileup. Do not try to remove frozen snow and solid ice on the module.

The cleaning operation must be performed, in general, by the user. It simply consists of washing the modules with solution and tools. The cleaning step as follows：

Solution：clean water, water with low mineral amount, non high-pressure water, non-abrasive/ non-caustic detergent, weak acid/weak alkalescent solution.

Tool：soft brush, non-conductive brush, non-abrasive sponge, non-abrasive cloth, seamless cloth。

Clean module and glass surface with solution and tool described as above.

If dirty area on glass surface which is hard to be cleaned such as oily substances, try to use commercial glass detergent, alcohol, isopropanol(IPA), or sodium bicarbonate solution.

Use clean water to clean glass again and weeding out water by dry cloth. Do not leave stagnant water on glass surface.

Anodic oxide coatings of module frame

The cleaning cycle for regular anodic oxide coatings is generally every six months. When cleaning, attention should be paid not only to cleaning surface dirt, but also not to damage the anodic oxide coatings.

Dirt can generally be cleaned off using a suitable lubricant or warm, mild soapy water, and a fibre brush may be used to clean any dust that may also stick to the surface. Sandpaper, steel wire brushes or other friction articles, or acid and alkali may not be used to clean anodic oxide coatings, as they may damage the coatings.

To prevent the anodic oxide coatings of the anodized profiles from being damaged, special attention should be paid during transportation. When storing the anodised profiles, do not allow the profiles to come into contact with contaminants such as cement or mortar, which will cause damage to the anodic oxide coatings.