INSTALLATION MANUAL

IEC Version

THE VERTEX MODULE

SCREW&CLAMP INSTALLATION METHOD	*DE09 Series*

CONTENT

1. DISCLAIMER OF LIABILITY

The installation, handling and use of Trina Solar VERTEX crystalline series modules are beyond company control. Accordingly, Trina Solar does not assume responsibility for loss, damage, injury or expense resulting from improper installation, handling, use or maintenance.
Trina Solar assumes no responsibility for any infringement of patents or other rights of third parties that may result from use of the module. No license is granted by implication or under any patent or patent rights.
Specifications included in this manual are subject to change without prior notice.

2. SAFETY PRECAUTIONS

1. When designing the PV system, please always take into consideration the variation of the voltage under different temperatures (please check the respective temperature coefficient specifications of the modules, the V_{oc} of the modules will rise when the temperature drops);
2. Trina Solar requires that every VERTEX series PV module string should be fused prior to be connected with other strings. For the maximum fuse rate, please refer to the detailed SPEC in the last page.
3. Solar photovoltaic (PV) modules generate electricity when exposed to light. An array of many such modules can cause lethal shocks and/or burn hazards. Only authorized and trained personnel should have access to the modules.
4. Use properly insulated tools and appropriate protective equipment to reduce risk of electric shock.
5. Do not stand or step on the module.
6. Do not damage or scratch the front or backside surfaces of the module.
7. Never use a module with broken glass or top substrate. Broken modules should not be repaired and contact with any module surface can lead to electrical shock.
8. Do not disassemble the modules or remove any part of the module.
9. Protect plug contacts against soiling and do not make any plug connections using soiled plug contacts.
10. Do not install or handle modules when they are wet or during periods of high wind.
11. Do not connect cable from the positive terminal to the positive terminal of one single PV module.
12. Make sure connectors have no gap between insulators. A gap can cause fire hazard and/or danger of an electrical shock.
13. Make sure that the polarity of each module or a string is not reversed relative to the other the modules or strings
14. Artificially concentrated sunlight should not be used on the PV module.
15. In markets conforming to IEC standard, maximum system voltage must not exceed 1500V DC. In markets conforming to UL standard, maximum system voltage must not exceed 1000V(frameless)/1500V(full frame) . For roof use, the maximum system voltage must not exceed 600V according to National Electrical Code.
16. Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. The requirements of the National Electrical Code (NEC) in Article 690 shall be followed to address these increased outputs. In installations not under the requirements of the NEC, the values of I_{SC} and V_{OC} marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, over-current device ratings, and size of controls connected to the PV output.
17. Our module application class is class A, modules rated for use in this application class may be used in systems operating at greater than 50V DC or 320W, where general contact access is anticipated..
18. Installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1.
19. A 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.
20. The VERTEX modules have achieved fire rating Type 13 according UL1703 updated on 20th May 2014. The fire rating of this module is valid only when mounted as specified in the mechanical mounting instructions in this document.
21. The actual system fire rating should always be evaluated along with the roof cover and mounting.
22. Any module without a frame (laminate) 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.

23.  Meaning of crossed –out wheeled dustbin:Do not dispose of electrical appliances as unsorted municipal waste, use separate collection facilities.Contact your local government for information regarding the collection systems available.If electrical appliances are disposed of in landfills or dumps, hazardous substances can leak into the groundwater and get into the food chain, damaging your health and well-being.When replacing old appliances with new ones, the retailer is legally obligated to take back your old appliance for disposals at least free of charge.

3. UNPACKING AND STORAGE

1. Before installation, keep all modules and electrical contacts clean and dry.
2. If it is necessary to store modules temporarily, a dry, ventilated room should be used.
3. When unpacking, carry modules with both hands. Do not place modules on top of each other.
4. The double glass module should be handled carefully, so non-slip gloves are required for handling and installation.
5. Please use the appropriate removal tools when dismantling the plywood cases.

4. PRODUCT IDENTIFICATION

We recommend that you take note of the unique serial number on each module.

5. ENVIRONMENTAL CONDITIONS AND SITE SELECTION

5.1 CLIMATE CONDITION

Install Trina Solar Crystalline series modules in the following conditions:

- Operating temperature: -40°C to +85°C
- Storage temperature: -20°C to +50°C
- Humidity: below 85RH%
- Altitude: ≤2000m
- Mechanical Load Pressure: 5400Pa (245 Kg/m²) Max from the front side
  2400Pa from the rear.

* Mechanical load bearing specifications of the module is based on Trina Solar mounting methods. A professional system installer must be responsible for the mechanical load calculations based on the specific system design.

*The modules have been evaluated by TUV according to IEC61215 for a maximum positive design loading of below 3600Pa, and negative design loading 1600Pa, with 1.5 times safety factor

5.2 SITE SELECTION

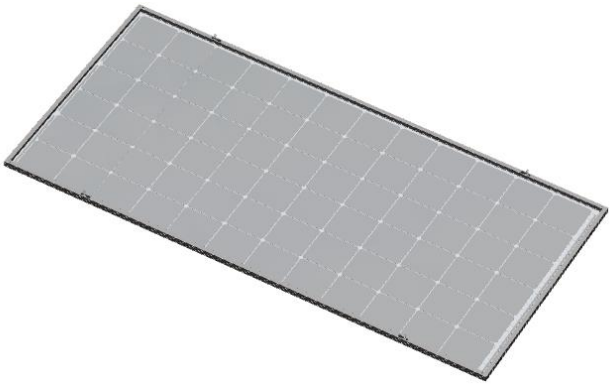
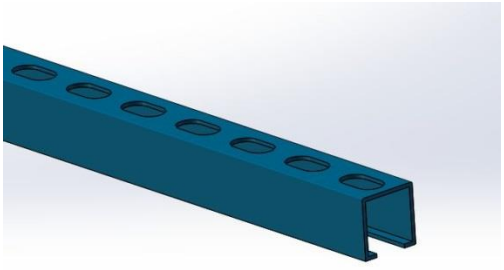
1. In most applications, Trina Solar PV modules should be installed in a location where they will receive maximum sunlight throughout the year.
2. Modules should not be shaded by buildings, trees, chimney, etc. at any time of the day.
3. Do not install in corrosive environments, such as beaches or landfill that can be easily flooded.
4. Do not install PV modules in a location where modules could be immersed in water or continually exposed to water from a sprinkler or fountain.
5. Do not install PV modules over naked flames or flammable materials.
6. Interspaces, the clearance between the module edge and surface of the wall or roof, of at least 115mm is required to prevent wiring damage and to allow air to circulate behind the module.

6. MOUNTING INSTRUCTIONS

The module is considered to be in compliance with IEC only when the module is mounted in the manner specified by the mounting instructions below. This mounting is using Trina Clamps or Screws, alternate mountings are available.

6.1 COMPONENTS OVERVIEW

6.1.1 SCREW

These components are only for use in the installation example in this section		
Components Name	**Overview**	**Description**
4 Set M8 Hexagon bolts, Nut, Spring Washer, Washer. Material: SUS 304		Used to connect modules and rails together
Grounding screw GB845-85-ST4.2*13-F-H+ , #5 star washer, 5#flat washer, 5# ground wire	 	Grounding Components
Frame Material: Aluminum 6005		Frame can protect the DG modules and easily for installation.
Racking Material: Q235B (Supply By EPC or Racking suppliers, suggested specification: overall dimensions is 41*62mm, thickness is 2.6mm)		Rails, support the PV modules.

6.2 MOUNTING METHODS

Please read this chapter in its entirety to familiarize with the process before beginning the installation. Also, be sure that the site has been completely prepared before beginning the installation.

6.2.1. Mounting with Bolts

- The frame of each module has 4-φ9*14mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to supporting structure.
- To maximize mounting longevity, Trina Solar strongly recommends the use of corrosion proof (stainless steel) fixings
- Secure the module in each fixing location with an M8 bolt and a flat washer, spring washer and nut as shown in Figure 1 and tighten to a torque of 16~20 N.m(140-180lbf.in.).
- All parts in contact with the frame should use flat stainless steel washers of minimum 1.5mm thickness with an outer diameter of 16-20mm(0.63-0.79in).

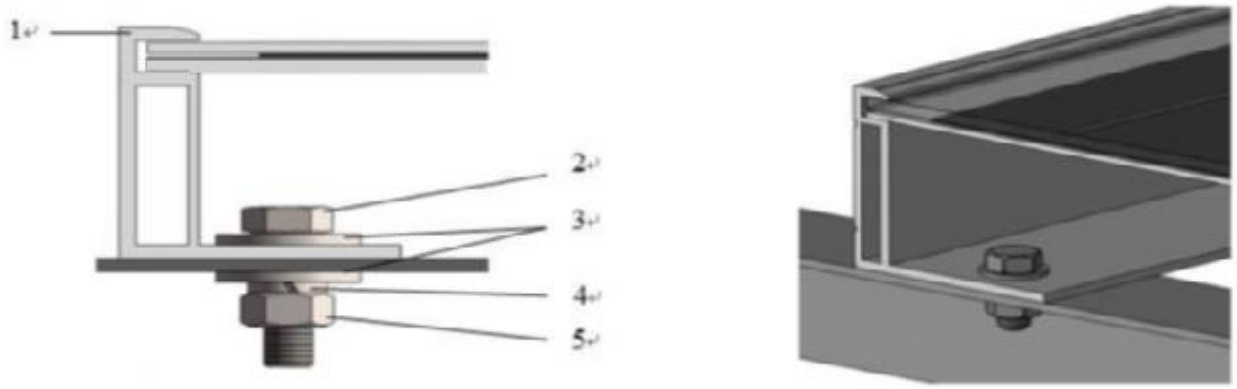
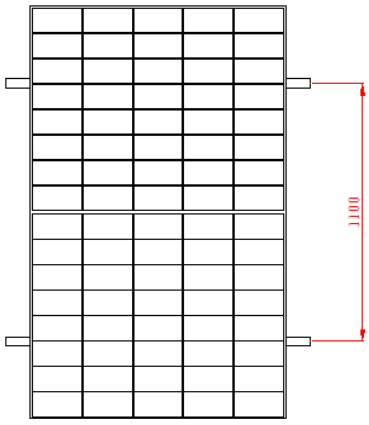
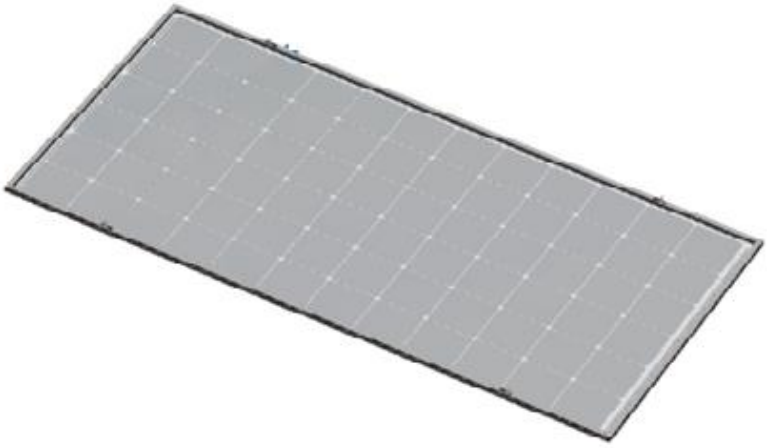
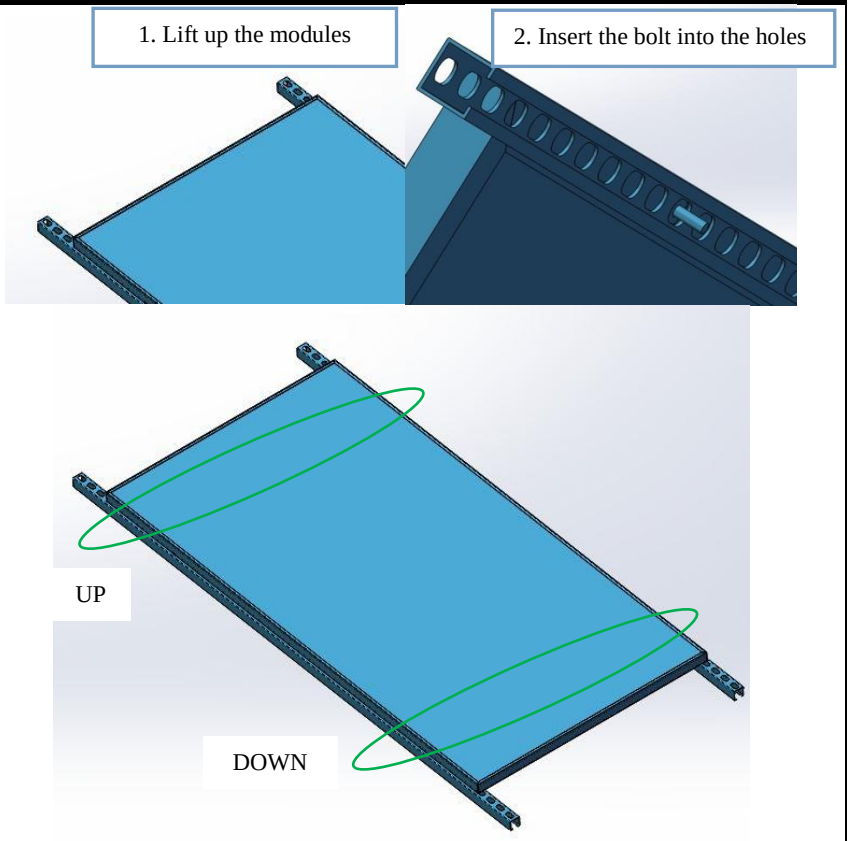


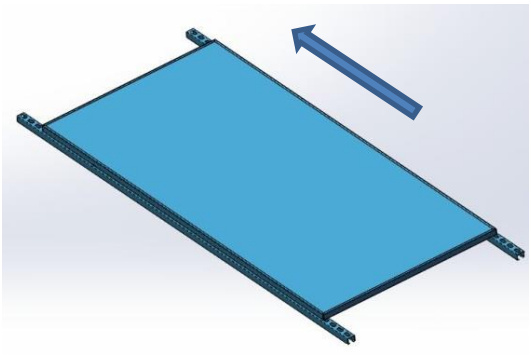
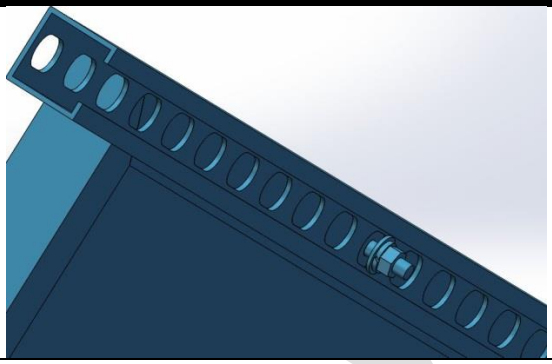
Figure 1. PV module installed with Bolt fitting method

1) Aluminum Frame 2) M8 Stainless Bolt
3) Flat Stainless Washer 4) Spring Stainless Washer
5) HEX Stainless Nut

Mechanical Load Pressure	Safety Factor	Mounting Direction (The crossbeam is perpendicular to the long side.)
+4000 Pa / -2650 Pa	**1.5**	 ***NOTE: The above-described distance is from the middle of the** bolts **to the middle of the** bolts ***NOTE: Need two support rails below the PV module to make sure the Mechanical load. *NOTE: The actual load is + 6000Pa/-4000Pa**

Installation steps

Step 1: insert bolts	
Setting the specified bolts into the 4 holds of frame.	
Step 2: Insert the bolt into the holes	
1. Lift up the module; ensure the bolt over the racking. 2. Aim the bolt to racking. 3. Insert the bolt into the holes；	
Step 3: Push the modules to the right position	

Push the PV modules to the right position, so that the bottom two screws are in the middle of the border screw slot.	
Step 4: Fixed the bolts (Torque requirement of M8 bolts: 16~20Nm;)	
flat washer, spring washer and the Nuts are placed in turn, and then tighten the nut. Repeat this step and finish the 4 holes. (16N·m~20N·m)	

*Note: Don't place the screws in the slot

6.2.2. Mounting with Clamps

- Trina Solar has tested its modules with a number of clamps from different manufacturers, fixing bolt of at least M8. The length of clamp ≥50mm(1.97in) .（During the loading process, the clamp does not deform）
- The clamp must overlap the module frame by at least 7mm (0.28in) but no more than 10mm (0.39in).
- Use at minimum 4 clamps to fix modules on the mounting rails.
- Modules clamps should not come into contact with the front glass and must not deform the frame.
- Be sure to avoid shadowing effects from the module clamps.
- The module frame is not to be modified under any circumstances.
- When choosing this type of clamp-mounting method, use at least four clamps on each module, two clamps should be attached on each long sides of the module (for portrait orientation). Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.
- Applied torque should refer to mechanical design standard according to the bolt customer is using, ex:
- M8 ---- 16-20N.m(140-180lbf.in)

End Clamp installation **Middle Clamp installation**

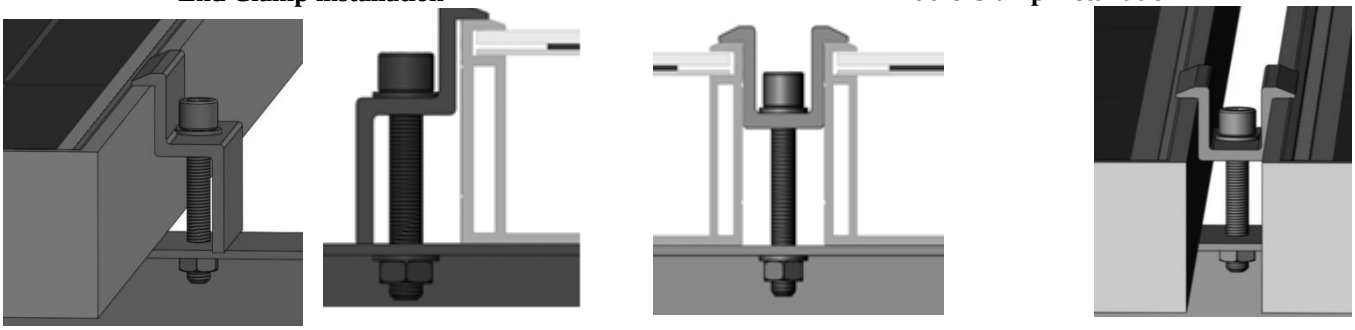
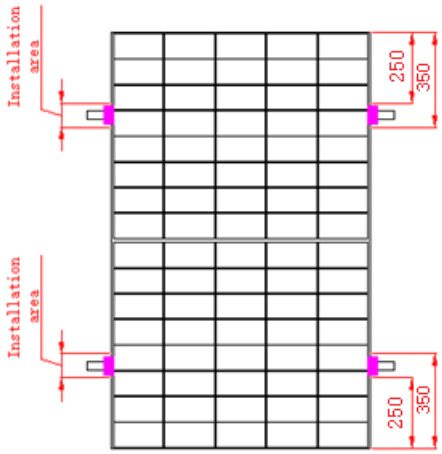


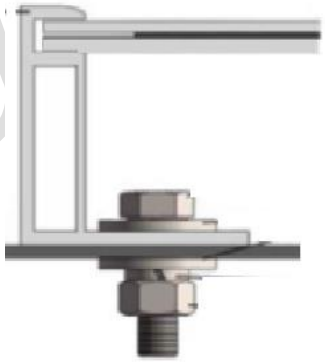
Figure 2. PV module installed with clamp fitting method

Mechanical Load Pressure	Safety Factor	Mounting Direction (The crossbeam is perpendicular to the long side.)
+4000 Pa / -2650 Pa	**1.5**	 ***NOTE: The above-described distance is from the module edge to the middle of the clamp.** ***NOTE: Need two support rails below the PV module to make sure the Mechanical load.** ***NOTE: The actual load is + 6000Pa/-4000Pa**

AME COMPATIBILITY WITH VARIOUS RACKING SYSTEMS.

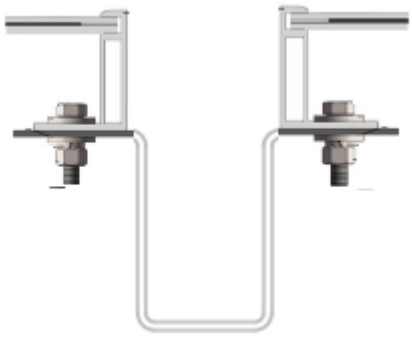
The following examples illustrate how to evaluate Trina Frame compatibility with various racking systems.

- Please pay attention to the size from component battery to the edge of the frame, and the bracket or pad shall not obscured the battery
- Please note that the connection location should be reserved for bracket under the grounding hole.



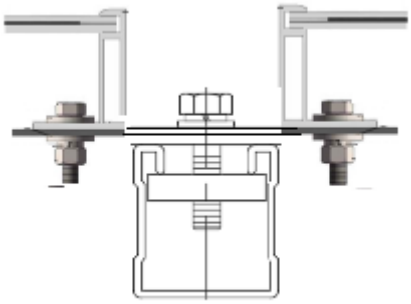
Example A: zigzag racking installation

- When selecting zigzag steel, please confirm the structural strength of profiles.
- When selecting zigzag steel, please confirm the size and the hole position of it so that the gaskets, washers and screws can be installed.
- Please press the waist type wind hole at the bottom of zigzag steel.



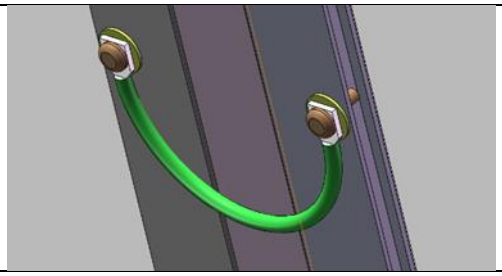
Example C: C structure steel type 1 racking installation

- When selecting C structure steel, please confirm the structural strength of pads.
- When selecting C structure steel, please confirm the size and hole position of pads so that the gaskets, washers and screws can be installed.
- For C structure steel type 1 racking, due to the amount of space inside the racking section, many choices are available including T-shape nuts.



6.3 GROUNDING

- All module frames and mounting racks must be properly grounded in accordance with appropriate respective National Electrical Code.
- Proper grounding is achieved by bonding the module frame(s) and all metallic structural members together continuously using a suitable grounding conductor. The grounding conductor or strap may be copper, copper alloy, or any other material acceptable for use as an electrical conductor per respective National Electrical Codes. The grounding conductor must then make a connection to earth using a suitable earth ground electrode.
- Trina Solar modules can be installed with the use of third party listed grounding devices for grounding the metallic frames of PV modules. The devices have to be installed in accordance with the grounding device manufacturer's specified instructions.
- Please refer to the "Product Catalogue" link for detailed grounding hole locations and size at http://www.trinasolar.com/
- Grounding hardware comes in a package that includes the grounding screw, flat washer、star washer and wire
- Electrical contact is made by penetrating the anodized coating of the aluminum frame, and tightening the mounting screw (come with the star washer) to the proper torque of 25lbf.in.
- Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.

Star washer, flat washer, grounding wire are placed in turn, then screwed into the grounding hole to bond the adjacent modules	

- We also recommend using the following methods to ground installation properly under UL investigation,

- **Method 1: Tyco grounding bolt # 2058729-1:**

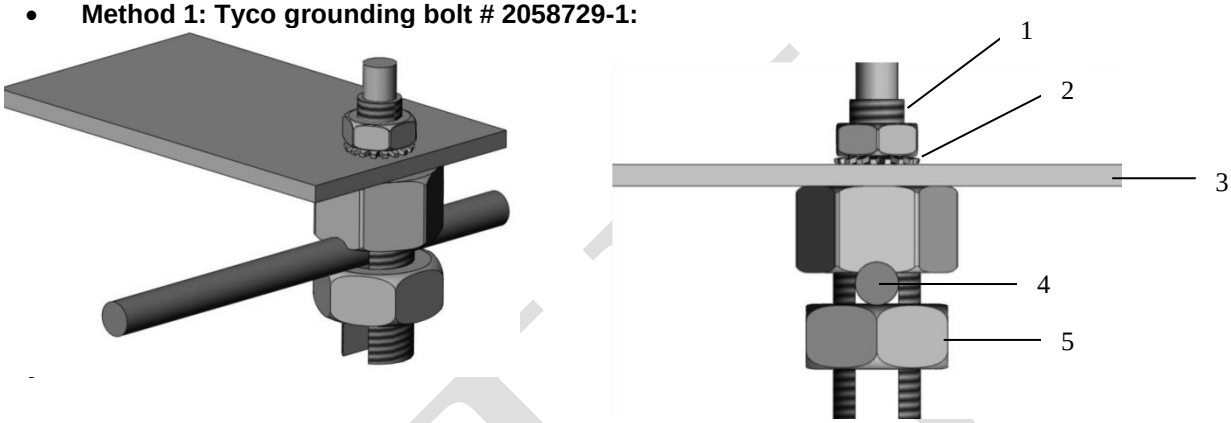


Figure 4. Tyco grounding bolt # 2058729-1

1) Wire bolt and slot 2) Mounting wash hex nut
3) Aluminum frame 4) 0.006 to 0.025in^2 cable
5) Hex Nut

- Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut.
- Electrical contact is made by penetrating the anodized coating of the aluminum frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25lbf.in.
- Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.
- The wire binding bolt should be tightened to the proper torque of 45lbf.in.

- **Method 2: Tyco grounding bolt #1954381-2:**

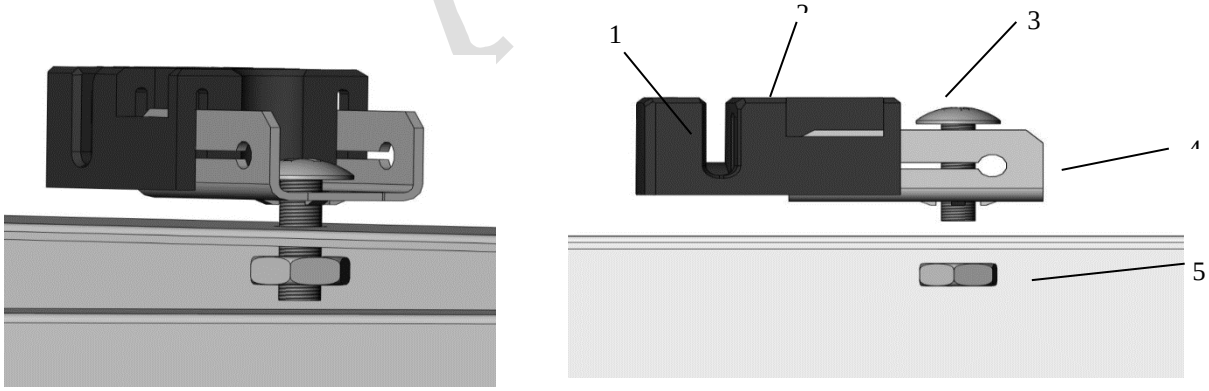


Figure 5. Tyco grounding bolt # 1954381-2
(Not applicable for TRINAMOUNT module series)

1) Wire slot (available for 0.006 to 0.025in^2 cable) 2) Slider
3) Bolt 4) Base
5) Nut

- Tyco grounding hardware comes in a package that includes the grounding bolt, mounting and grounding hex nut.
- Electrical contact is made by penetrating the anodized coating of the aluminum frame, and tightening the mounting hex nut (come with the star washer) to the proper torque of 25lbf.in.
- Grounding wire size (6 to 12 AWG solid bare copper) should be selected and installed underneath the wire binding bolt.
- The wire binding bolt should be tightened to the proper torque of 45lbf.in.
- The Tyco grounding bolt is only listed for use with 6 to 12 AWG bare solid copper wire.
- **Method 3: ERICO grounding bolt # EL6CS14-6**

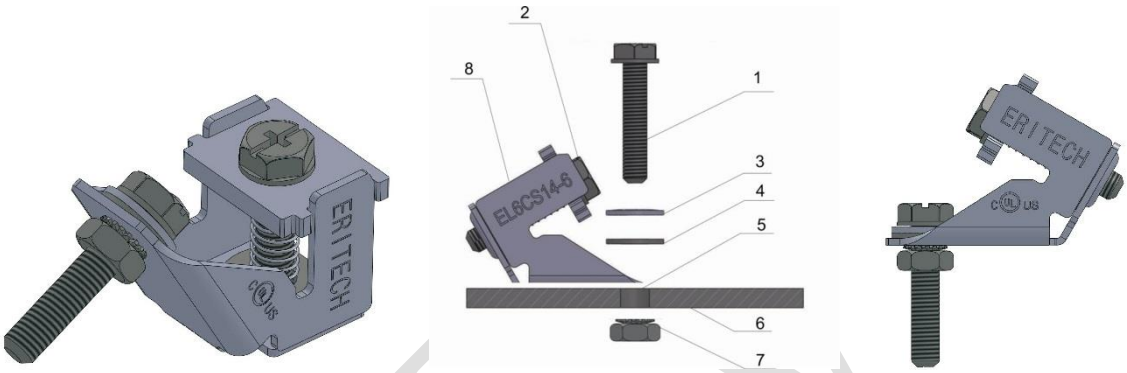


Figure 6. ERICO grounding bolt # EL6CS14-6
(Not applicable for the TRINAMOUNT module series)

1) Machine Bolt A 2) Machine Bolt B
3) Belleville washer 4) Flat Washer
5) Clearance hole for #10[M5] machine bolt 6) Aluminum frame
7) Machine box hex nut with lock washer 8) Grounding bolt

- The lug should be installed on a surface that is larger than the bottom surface of the lug.
- The lug should be installed in the grounding holes provided on the PV module.
- Machine bolt A should be torqued to 35lbf.in, to secure the grounding bolt to module frame.
- The grounding bolt is only listed for use with 6-12 AWG bare solid copper wire.
- For proper wire binding, machine bolt B should be torqued to 35lbf.in.

7. MODULE WIRING

Each module has two 4mm^2 diameter type standard 90°C sunlight resistant output cables each terminated with plug & play connectors. This cable is suitable for applications where wiring is exposed to the direct rays of the sun. We recommend that all wiring and electrical connections comply with the appropriate national electrical code(s).

For field connections, use the minimum 4mm^2 diameter copper wires insulated for a minimum of 90°C and sunlight resistant as well.

The minimum and maximum outer diameters of the cable are 5mm to 7mm. Refer to Datasheet Specifications for the maximum electrical rating of series fuse.

- The maximum voltage of the system must be less than the maximum certified voltage 1500V typically and the maximum input voltage of the inverter and of the other electrical devices installed in the system. To ensure that this is the case, the open circuit voltage of the array string needs to be calculated at the lowest expected ambient temperature for the location. This can be done using the following formula.

$$\text{Max System voltage} \geq N * Voc * [1 + TCvoc \times (Tmin-25)]$$

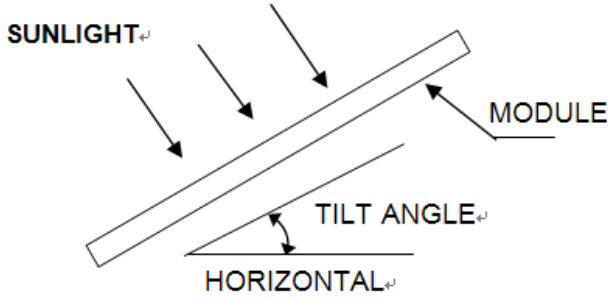
Where

N	No. modules in series
Voc	Open circuit voltage of each module (refer to product label or data sheet)
TCvoc	Thermal coefficient of open circuit voltage for the module (refer to data sheet)
Tmin	The lowest ambient temperature

- Recommended maximum series is [1000 V/(1.25*Voc)], parallel module configurations is [fuse rating/Isc+1]
- When the modules connect in parallel, the output current will be equal to the sum of each branch current. We suggest that every series SPV module string should be fused prior to be connected with other strings. Please refer to the applicable regional and local codes for additional fuse requirements.

8. MODULE TILT ANGLE

Trina Solar PV modules connected in series should be installed at the same orientation and angle. Different orientation or angle may cause loss of output power because each module may be exposed to different amounts of solar irradiation.
Trina Solar PV modules produce the most power when they are perpendicular to incoming sunlight. For installations where the PV modules are attached to a permanent structure, the PV modules should be tilted for optimum winter performance. The module tilt angle is measured between the solar modules and the ground. Optimal tilting of PV module is almost the same as the latitude of installation location.



SPV module Tilt angle

9. MAINTENANCE AND CARE

- Under most weather conditions, normal rainfall is sufficient to keep the PV module glass surface clean. If dust or dirt build-up becomes excessive, clean the glass only with a soft cloth using mild detergent and water.
- Do not clean the modules with cold water during the warmer hours of the day in order to avoid creating any thermal shock that may damage the module.
- At least once a year, it is recommended to check the torque of terminal screws and the general condition of wiring. Also, check that mounting hardware is properly torqued. Loose connections will result in damage of the array.
- Modules that are replaced must be the same type. Do not touch live parts of cables and connectors. Use appropriate safety equipment (insulated tools, insulating gloves, etc.) when handling modules.
- Cover the front surface of modules by an opaque material when repairing. Modules when exposed to sunlight generate high voltage and are dangerous.
- Trina Solar PV modules are equipped with bypass diodes in the junction box. This minimizes module heating and current losses.
  - Do not try to open the junction box to change the diodes even if they malfunction.
  - In a system using a battery, blocking diodes are typically placed between the battery and the PV module output to prevent battery discharge at night.

Trina Solar is a member of the European PV Cycle Association. Through the pre-financed PV Cycle program, Trina Solar PV modules will be taken back and treated in an environmentally sustainable manner.*Applicable only to participating countries within the Europe Union.
WARNING: For any electrical maintenance, the PV system must first be shut down. Improper maintenance can cause lethal electric shock and/or burns.

10. SPECIFICATIONS

For module specifications, please see the Datasheet included in the shipment carton and visit Trina Solar website www.trinasolar.com to get the datasheet of each product or the comprehensive product catalogue.

11. CONTACTS

These solar modules do not contain any user serviceable parts.
If you suspect that your installation is not working properly, then contact your installer immediately.

1. Contact your installer
2. Contact Trina Solar after-sales service team at: http://customerservice.trinasolar.com
3. Submit the Customer Feedback form at: www.trinasolar.com; one of our technical service representatives will contact you as quickly as possible. A username and password is required to send feedback from the customer service link

WARNING: For any electrical maintenance, the PV system must first be shut down. Improper maintenance can cause lethal electric shock and/or burns.

12. HISTORY

Edition	Revision Date	Revised Item	Revised Content
New Edition	2020.12.01	Installation Manual of Module_210 Series(400W)	
2nd Edition	2020.12.31	Update the cross beam clamp load, cross beam screw hole load.Modify gasket size	Update the cross beam clamp load, cross beam screw hole load.Modify gasket size