

# INSTALLATION MANUAL

UL VERSION

## 1. DISCLAIMER OF LIABILITY

The installation, handling and use of Trina Solar 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

- When designing the SPV system, please always take into consideration the variation of the voltage under different temperatures (please check the respective temp. coefficients of the modules, the Voc of the modules will be rise when the temperature drops);  
For example: with TSM-190DC01 modules (Max. System voltage is 600V) the maximum series modules configuration number should NEVER can exceed  $N = 10 (600V/56.22V = 10.7)$ , taking into consideration the possible variation of the voltage due to the lowest temperature in winter at specified location can reach  $-40^{\circ}\text{C}$ .
- We require that every series SPV 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.
- Solar photovoltaic (SPV) modules generate electricity when exposed to light. An array of many modules can cause lethal shocks and/or burn hazards. Only authorized and trained personnel should have access to the modules.
- Use properly insulated tools and appropriate protective equipment to reduce risk of electric shock.
- Do not stand or step on the module.
- Do not damage or scratch the front or backside surfaces of the module.
- Never use a module with broken glass or torn substrate. Broken modules cannot be repaired and contact with any module surface or frame can lead to electrical shock.
- Do not disassemble the modules or remove any part of the module.
- Protect plug contacts against soiling; do not make any plug connections using soiled plug contacts.
- Do not install or handle modules when they are wet or during periods of high wind.
- Do not short the positive and the negative of a single SPV module.
- Do not disconnect under load.
- Make sure connectors have no gap between insulators. A gap can cause fire hazard and/or danger of an electrical shock.
- Make sure that the polarity of each module or a string is not reversed considering the rest of the modules or strings.
- Artificially concentrated sunlight should not be used on the SPV module.
- Maximum system voltage must not exceed 600V DC.
- Under normal conditions, a solar photovoltaic module is likely to produce more current and /or voltage than reported under standard test conditions. Accordingly, the value of Isc marked on this module should be multiplied by a factor of 1.25 when determining the conductor current ratings, fuse sizes and size of controls connected to the SPV output. Refer to Section 690-8 of the National Electric Code for an additional multiplying factor of 1.25 which maybe applicable.
- Installation in Canada shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code Part 1.

## 3. UNPACKING AND STORAGE

- Before installation, keep all modules and electrical contacts clean and dry.
- If it is necessary to store modules temporarily, a dry, ventilated room should be used.
- When unpacking, carry modules with both hands. Do not place modules on top of each other.

## 4. PRODUCT IDENTIFICATION

We recommend that you take note of the serial number, each individual module has a unique serial number. It is permanently attached to the backsheet of the module on the product sticker.

## 5. ENVIRONMENTAL CONDITIONS AND SITE SELECTION

### 5.1 CLIMATE CONDITION

Install Trina Solar Crystalline series modules in the following conditions:

Ambient Temperature:	-40°C to +40°C
Operating Temperature:	-40°C to +85°C
Storage Temperature:	-20°C to +40°C
Humidity:	below 85RH%
Mechanical Load Pressure:	below positive or negative design loading of 30lbs/ ft <sup>2</sup> (it has a maximum 5400Pa according to TUV evaluation)

\* Note: Mechanical load bearing (include wind and



snow loads) of the module is based on mounting methods. Professional system installer must be responsible for mechanical load calculation according to system design.

## 5.2 SITE SELECTION

- In most applications, Trina Solar SPV modules should be installed in a location where they will receive maximum sunlight throughout the year.
- Modules should not be shaded at any time of the day because of buildings, trees, chimney, etc.
- Do not install SPV modules in corrosive environment, such as corrosive salt areas within proximity of the ocean or sulfurous area, etc.
- Do not install SPV modules in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain, etc.
- Modules should be mounted over a fire resistant covering, with adequate ventilation between the module backsheet and the mounting surface. Clearance between the module frames and surface of the wall or roof is required to prevent wiring damage and to allow air to circulate behind the module. The required minimal stand-off height is 115mm. Any slope less than 5in/ft (127mm/305mm) is required to maintain a fire class rating.
- Do not mount SPV module in such way that the drain holes of SPV module are intended to block up.

## 6. MOUNTING INSTRUCTIONS

### 6.1 MOUNTING METHODS

PV modules can be mounted to the substructure using the following methods:

(1) Screw fitting: Using corrosion-proof screws (M8) in the existing installing holes in the module frame..

- The frame of each module has 4 mounting holes used to secure the modules to supporting structure.
- Module frame must be attached to a mounting rail using M8 corrosion-proof screws together with spring washers and flat washers in four symmetrical locations on the SPV module.
- The modules have been evaluated by for mounting using the 4 provided mounting holes in the frame.
- Applied torque should be 8 Newton-meters. Please find detailed mounting information in the below illustration:

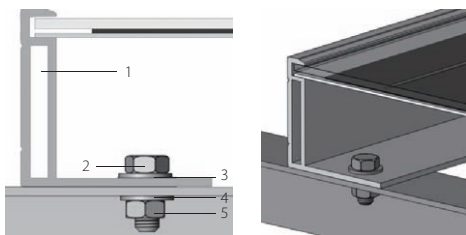


Figure1. SPV module installed with Screw fitting method

- 1) A Aluminum Frame
- 2) M8 Stainless screw
- 3) 8mm Flat Stainless Washer
- 4) 8mm Spring Stainless Washer
- 5) M8 HEX Stainless Nut

### 6.2 GROUNDING

- Proper grounding is achieved by bonding the module frame(s) and all metallic structural members together continuously using a suitable grounding conductor. Grounding conductor or strap may be copper, copper alloy, or 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.
- The grounding is achieved through securement to the array frame. The array frame shall be grounded in accordance with NEC Article 250
- The following method has been UL tested and approved for module grounding:

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

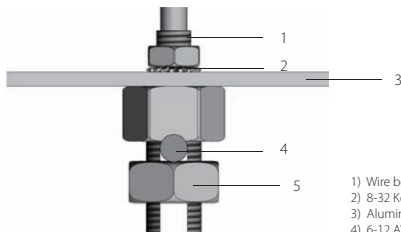
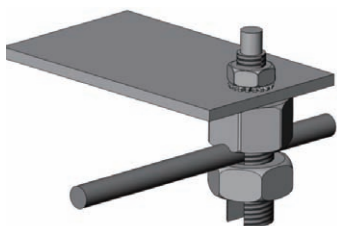


Figure2. Tyco grounding bolt # 2058729-1

- 1) Wire bolt and slot
- 2) 8-32 Keps Mounting wash hex nut
- 3) Aluminum frame
- 4) 6-12 AWG cable
- 5) 3/8\"/>

- Tyco Grounding hardware is UL Listed as a package that includes the grounding bolt, mounting and grounding hex nut.
- Make electrical contact by penetrating the anodized coating of the aluminum frame, by tightening the mounting wash hex nut (come with the star washer) to the proper torque (25 in lb).
- Select grounding wire size: (6 to 12 AWG solid bare copper) and install underneath wire binding bolt.
- Tighten wire binding bolt to proper torque (45 in lb).
- The Tyco grounding bolt is only UL listed for use with 6-12 AWG bare solid copper wire.

### 6.3 MODULE WIRING

Each module has two standard 90°C sunlight resistant output cables each terminated with plug & play connectors. The wire type and gauge of the output cables are 600V rated PV Wire cable and are 12AWG in size. This cable is suitable for applications where wiring is exposed to the direct sunlight. We required that all wiring and electrical connections comply with the appropriate national electrical code.

For field connections, use the minimum 12AWG copper wires insulated for a minimum of 90°C and Sunlight resistance with insulation designated as PV Wire.

- The minimum and maximum outer diameters of the cable are 5 to 7mm<sup>2</sup>.

## 7. MODULE TILT ANGLE

Trina Solar SPV modules connected in series should be installed at same orientation and angle. Different orientation or angle may cause loss of output power due to difference of amount of sunlight exposed to the module.

Trina Solar SPV modules produce the most power when they are pointed directly at the sun. For installations where the SPV modules are attached to a permanent structure, the SPV modules should be tilted for optimum winter performance. As a rule, if the system power production is adequate in winter, it will be satisfactory during the rest of the year. The module tilt angle is measured between the solar modules and the ground (Figure 1). Optimal tilting of SPV module is almost the same as the latitude of installation location.

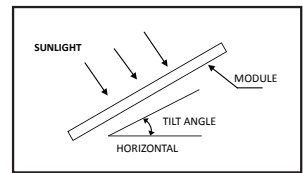


Figure3. SPV Module Tilt Angle

## 8. MAINTENANCE AND CARE

- Trina Solar modules have received a Class C Fire Rating as per UL 1703
- 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.
- Be cautious when cleaning the back surface of the module to avoid penetrating the substrate material. Modules that are mounted flat (0° tilt angle) should be cleaned more often, as they will not "self clean" as effectively as modules mounted at a 15° tilt or greater.
- 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 for the array.
- Modules that have been replaced must be of 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 SPV 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 it malfunctions.
- In a system that uses a battery, blocking diodes are typically placed between the battery and the SPV 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 SPV modules will be taken back and treated in an environmentally sustainable manner.

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



**SPECIFICATIONS:**

Module Series	Model	Dimensions (mm)	Weight (kg)	Electrical Performance @ STC					Max-System Voltage (VDC)	Max-Series Fuse (A)
				Max-Power $P_m$ (W)	Max-Power Voltage $V_{pm}$ (V)	Max-Power Current $I_{pm}$ (A)	Open-Circuit Voltage $V_{oc}$ (V)	Short-Circuit Current $I_{sc}$ (A)		
72pcs 125x125mm Monocrystalline Silicon SPV Module	TSM-185DA80	1581x809x40	1.56	185	36.2	5.12	44.6	5.58	600 v	100
	TSM-190DA80			190	36.8	5.17	45.0	5.61		
	TSM-195DA80			195	37.3	5.24	45.4	5.64		
	TSM-200DA80			200	37.8	5.30	45.8	5.68		
	TSM-205DA80			205	38.4	5.36	46.2	5.73		
	TSM-210DA80			210	38.8	5.42	46.4	5.78		

Table 5: Electrical and Mechanical Specifications

**Notes:**

- D represents mono-crystalline silicon.
- Rated electrical characteristics are within 10 percent of measured values at Standard Test Condition(STC) of Irradiance of 1000W/m<sup>2</sup>, AM1.5 Solar Spectrum & 25°C cell temperature.
- Nominal Operating Cell Temperature (NOCT):47±2°C
- Temperature coefficient of Current is 0.05%/°K, Temperature coefficient of Voltage is -0.35%/°K.

**BYPASS DIODES AND BLOCKING DIODES**

Partial shading of an individual module can cause a reverse voltage across the shaded SPV module. Current is then forced go through the shaded area by the other modules.

When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded SPV module, thereby minimizing module heating and array current losses.

Currently, Trina Solar SPV modules are equipped with bypass diodes in the junction box. The diode type is 10SQ050(for RenHe junction box, nominal current is 10A, peak reverse voltage is 50V)or F1200D (for Tyco junction box 2-1394723-1& 1-1394723-8, nominal current is 12A, peak reverse voltage is 200V) or SL1010 (for Tyco junction box 1740699-6, nominal current is 11A, peak reverse voltage is 40V) or SL1515 (for Tyco junction box 1740971-1, nominal current is 16A, peak reverse voltage is 40V). Do not try to open the junction box to change the diodes even if it malfunctions.

In a system that uses a battery, blocking diodes are typically placed between the battery and the SPV module output to prevent battery discharge at night.

Diodes that are used as blocking diodes must have a:

- Rated Average Forward Current [IF(AV)] above the maximum system current at the highest module operating temperature.
- Rated Repetitive Peak Reverse Voltage [VRRM] above the maximum system voltage at the lowest module operating temperature.

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