

TRUNSUN SOLAR PV MODULE INSTALLATION MANUAL

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1 Purpose of this manual

This manual applies exclusively to the solar photovoltaic module (hereinafter referred to as Module) of TRUNSUN SOLAR. The contents of this manual involve the installation methods, operation safety and maintenance information. Failure to follow these safety instructions could result in personal injury or property damage. Modules must be installed by professionals. Please read this manual carefully before installation. The installers must follow all the rules in this manual strictly as well as local requirements and regulations bylaw or authorized organizations.

2 Disclaimer

As the conditions or methods for the use of this manual and the installation, operation, use and maintenance of the modules are beyond the control of TRUNSUN, TRUNSUN shall not be responsible for any loss, damage or expense caused by any operation related to the installation, operation, use and maintenance. TRUNSUN shall not be liable for any infringement of third party patents or other rights that may result from the use of the modules.

The information in this manual is based on the knowledge and reliable experience of TRUNSUN modules. However, such information and recommendations, including product specifications, do not constitute any express or implied warranty. TRUNSUN reserves the right to modify the manual, modules, specifications or module information without prior notice.

Special modules shall be separately installed and used according to the module manual or the contract agreement.

3 Application products

This manual is applied to below TRUNSUN module series:

Poly module series:

TSP***-60 series, TSP***-72 series, TSHP***-60 series, TSHP***-72 series, TSHPxxx-120 series,
TSP***-60H series, TSP***-72H series, TSHP***-60H series, TSHP***-72H series,TSHPxxx-144 series,

Mono module series:

TSM***-60 series, TSM***-72 series, TSHM***-60/120 series, TSHM***-72/144 series,TSHM***-120L series,
TSM***-60H series, TSM***-72H series, TSHM***-60H series, TSHM***-72H series,TSHM***-144L series,

Shingling module series:

TSSM-60 series, TSSP-60 series

4 General safety precautions

4.1 Warning

Before installing, wiring, operating, or maintaining Trina modules, you should read and understand all safety precautions. Direct current (DC) is generated when the battery surface of the module is exposed to direct sunlight or other light sources, and direct contact with the live parts of the module, such as terminals, may result in death of personnel whether connected to the module or not.

4.2 General safety

- All installation work must comply with the local codes and the relevant international electrical standards.
- TRUNSUN recommends that PV module installation is conducted by personnel with experience in PV system

installation. Operation by personnel who are not familiar with the relevant safety procedures will be very dangerous.

- Do NOT allow unauthorized persons to access the installation area or module storage area.
- Do NOT install modules with damaged glass or damaged backsheet.
- Do NOT disassemble or move any part of the module.
- Do NOT artificially focus the light on the module.
- Do NOT connect or disconnect the module when it is energized or connected with the external power supply.
- Only special insulation tools for electrical installation can be used.
- If the circuit breaker and overcurrent protection circuit breaker cannot be opened or the inverter cannot be closed during module installation or wiring, an opaque material should be used to cover the array of module to stop the power output.
- Do not attempt to insert any conductive parts into the plug and junction box. Do not touch the plug or expose the terminal.

4.3 Handling safety

- Do NOT stand, walk on or step on the module directly.
- Do NOT damage or scratch the front or backside surfaces of the module.
- Do NOT scratch the output cable or bend it with force. The insulation of output cable can break and may result in electricity leakage or shock.
- Do NOT use water to extinguish fires of an electrical origin.
- Please do NOT loosen or unscrew the PV module bolts, which may lead to the module loading drop or even fall down.
- Do NOT drop PV modules or allow objects to fall down on the PV modules.
- Do NOT touch the terminal box or the ends of the output cables (connectors) with bare hands under sunlight, regardless of whether the PV module is connected to or disconnected from the system.

4.4 Storage and unpacking

- Modules should be stored in a dry and ventilated environment to avoid direct sunlight and moisture. If the module is stored in an uncontrolled environment, the storage time shall not be more than 3 months and additional measures shall be taken to protect the connector from moisture or the module from sun exposure such as using the connector cover.
- Please protect the packing from damage. Follow the recommended unpacking steps to open the module wrapper. Opening package, transportation and storage procedures should be handled with care.
- It is forbidden to carry the modules through the wire and junction box. It is recommended to hold the frame to carry the modules.
- The unpacking process must be operated by two people at the same time, and modules need to be carried by both hands.
- **Package label description**



The Modules in the carton box are fragile.
Handle with care.



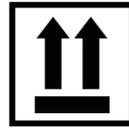
DO NOT expose the module to rain
or moisture.



It is prohibited to tramp on the packing
box and module.



During the stacking of the Modules
the outer packing box can be stacked not exceed 2



The package shall never be upside down
during the transportation.



Cartons can be recycled

5 Mechanical installation

5.1 Installation site

- Modules can be installed in land area in addition to the salt water, acid and alkali corrosion.
- For the modules installed near the coastline, the location of the modules should greater than 1000m away from the coastline at high tide.
- Do not store, install, or use modules in places where flammable gases are likely to be generated or collected.
- Modules should be installed away from trees, buildings and other obstacles, so that the modules could get the maximum light area to reduce the shadow. Even partial occlusion of a module can result in a significant reduction in output power. The shading on the module increases the temperature of the shaded area, resulting in a decrease in output power and a decrease in lifetime.
- Customers need to be informed in advance if modules need to be installed at unconventional areas.

5.2 Installation tilt

- The tilt angle of the PV module refers to the angle between the module and the horizontal ground surface. TRUNSUN recommends that the mounting tilt angle range should be between 0 ~ 90 °. An appropriate installation angle can realize the maximum light area on the modules.
- Improper installation Angle will lead to the reduction of output power. If the modules are installed in series, please ensure that all modules are installed in the same orientation and Angle. Different installation orientation and Angle will lead to different lighting area on the modules, which will lead to the reduction of output power.
- In the northern hemisphere, the module is suggested facing south; In the southern hemisphere, it is suggested to face north.
- The optimum inclination Angle of the module depends on the corresponding latitude. It is recommended to use professional photovoltaic system software to obtain this data.

5.3 Installation

5.3.1 Installation principles

- Ensure the module installation means and support system sufficiently robust, so that the Modules can undertake the preset loading conditions, the support installer or supplier shall provide necessary guarantee and other related certifications. The installation support system shall pass the inspection and test by the third-party test institution with the static mechanic analysis capability, and use the local national or international standards, such as DIN1055 or equivalent.
- The support structure shall be made of the durable, corrosion resistant and ultraviolet resistant materials.
- Always wear dry insulation protection equipment: insulated tools, head gear, insulated gloves, safety belt and safety shoes (with rubber soles).

- Ensure the correct connection between male and female connector, check the connection status, all of the cable shall not be separated from modules in case of the connectors scratch or squeeze the back sheet.
- When the module is installed on the roof or the building, it is necessary to ensure that the roof structure is fixed firmly and will not be damaged by heavy wind or heavy snow, and the back of the module shall be well-ventilated to facilitate the cooling of the module (the minimum gap between the module and installation surface is 10cm).
- Considering the influence of linear thermal expansion of the module frame, the minimum distance between two Modules should not be less than 20mm.
- Ensure that the module backside will not contact the support or architectural structure even if there is the module surface is under the external pressure.
- It is required to follow the instruction guide and safety rules attached on the support.
- It is not allowed to drill the hole in the glass surface or frame of the module. Otherwise, the guarantee will be invalidated.
- When to install the Modules on the roof, it is necessary to guarantee the roof structure is suitable for the module installation. And the installed modules should not be beyond the roof zone. Additionally, The roof area where it is penetrated by module installation shall be properly sealed to prevent the roof from water leakage.
- When the module is installed on the supporting column, it is necessary to ensure the supporting column and module installation structure is capable of withstanding the expected local wind.
- The maximum mechanical load that the module can pass is 2400Pa on the back side (equivalent to wind pressure) and 5400Pa on the front side (equivalent to snow pressure), depending on the type of installation of the modules (see installation method below).
- Modules can be mounted in landscape or portrait orientation.

5.3.2 Installation method

- The Modules may be installed and fixed with the following methods:

1. Mounting hole installation: (see figure1)

1) Use the corrosion-resistant M8 bolt, a flat washer and a spring washer for fixing with the installation support through the installation hole in the frame of the module, and tighten to a torque of 14~20 N.m.

2) The frame of each module has 8- $\phi 9 \times 12$ mm mounting holes. The number of mounting holes shall be used according to the load demand.

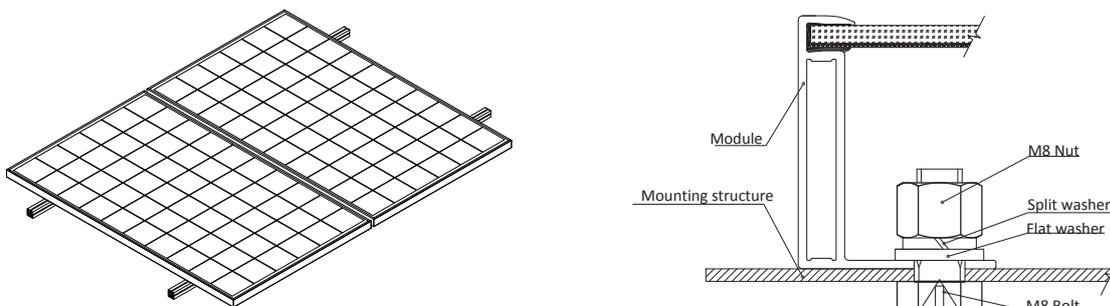


Figure1 Mounting hole installation

2、Clamping installation: (see figure 2)

1) The module must be secured to the supporting rail by the metal clamps which must meet the following conditions or relevant installation system standards.

2) It is recommended to use torque of 18~24 N.m.

3) Under no circumstances shall the metal clamp touch the front glass of the module or deform the frame in order to avoid the hot spot effect caused by the clamp. The drain holes on the frame shall not be blocked or blocked by clamps.

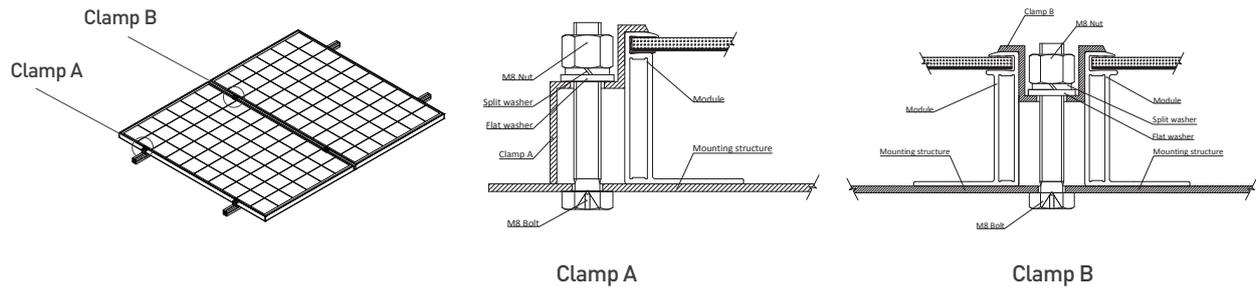


Figure2 Clamp installation

- Select the appropriate installation method according to the required mechanical load, as shown in figure 3

	Mounting hole installation	Clamping installation
2400Pa/2400Pa load	<p>1/1 Use four mounting holes</p>	<p>2/1 Use four mounting clips</p> <p>Permissible position of clamps</p>
5400Pa/2400Pa load	<p>1/2 Use Four or eight mounting holes</p>	<p>2/2 Use four mounting clips</p> <p>Permissible position of clamps</p>

Figure3 Installation method

6 Electrical installation

6.1 Electrical wiring

- All wiring should be performed, by qualified installers, in accordance with the local codes and regulations.
- Under normal conditions, a Module may produce more current and/or voltage than reported at standard test

conditions. Accordingly, the values of ISC and VOC marked on the Module should be multiplied by a factor of 1.25 when determining component voltage ratings, current ratings, fuse sizes, and size of controls connected to the PV output.

- To ensure proper system operation the correct cable connection polarity (Figures 4 & 5) should be observed when connecting the modules to each other or to a load, such as inverter, a battery etc. If modules were not connected correctly, the bypass diode could be destroyed. PV modules can be wired in series to increase voltage. A series connection is made when the wire from the positive terminal of one module is connected to the negative terminal of the next module. Figure 4 shows modules connected in series. PV modules can be connected in parallel to increase current (Figure 5). A parallel connection is made when the wire from the positive terminal of one module is connected to the positive terminal on the next module.

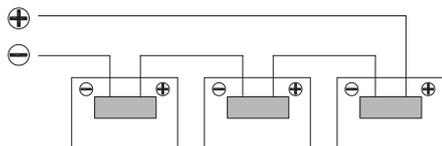


Figure 4 connection in series

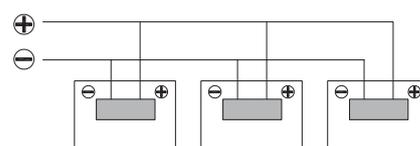


Figure 5 connection in parallels

- The number of modules in series shall be calculated reasonably according to the system configuration and corresponding rules. The open circuit voltage under the condition of local minimum temperatures expected value cannot exceed the maximum module system voltage (according to IEC61730, the maximum system voltage of TRUNSUN's module are 1000 V and 1500 V, the client may calculate according to the actual voltage of module) and the required value of the other DC electrical components.

The maximum number of the modules can be installed in a string can be calculated based on below formula:

$$N = \frac{V_{max}}{V_{oc}(1 - \beta(25 - X))}$$

V_{oc}: Open circuit voltage of each module (refer to product label or data sheet)

V_{max}; Maximum system voltage

β; Thermal coefficient of open circuit voltage for the module (refer to data sheet)

X; The lowest expected ambient temperature for the installation location

N; The maximum number of modules in series

6.2 Grounding

- The modules are designed with anodized corrosion-resistant aluminum alloy frames as rigid supports. In order to use safely and avoid modules from lightning or static damage, the module frame must be grounded. When grounding, the grounding device must be fully in contact with the aluminum alloy to penetrate the oxide film on the surface of the frame.
- It is forbidden to drill any additional grounding hole on the module frame, otherwise the warranty will be invalid
- ⚠ The grounding of the module shall be performed by qualified electricians. The module frame shall be connected to each other with appropriate grounding wires. 4-14mm² copper wire is recommended as the grounding wire. Is recommended to be used as the grounding mark. All conductive connections must be securely connected.
- Stainless steel shall be used for bolts, nuts, plain washers, plain washers and other relevant parts unless otherwise specified. TRUNSUN does not provide grounding parts.
- The two grounding methods recommended by TRUNSUN are shown below.

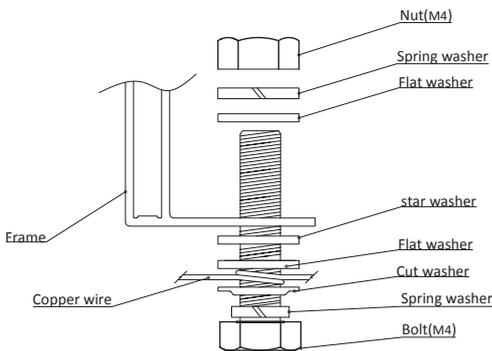


Figure 6 Grounding by cable

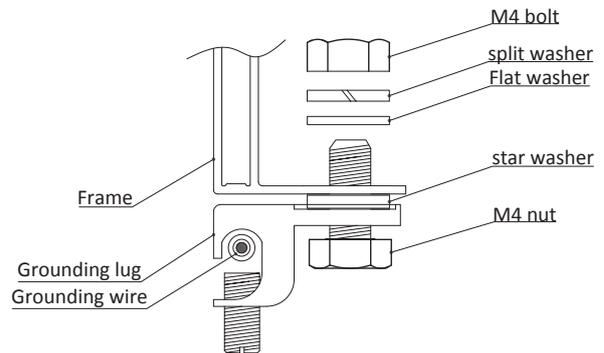


Figure 7 Grounding by lugs

Proper size grounding wire should be selected and fixed under the connection cable or grounding lugs. Torque wrench may be used during installation. Tightening torque of nut is 3 ~ 7N.m.

7 Bypass diodes and current protection

7.1 Bypass diodes

- In a system with two or more Modules connected in series, if part of a Module is shaded while the other part is exposed to the sun, a very high reverse current will go through the cells which have been partly or entirely covered and it will cause overheat on the cells, which may damage the Module. Using bypass diodes can protect modules from this kind of risk.
- Only professionals are allowed to install the bypass diodes. Open the junction box cover and install the same type diodes in the appropriate holes in the module.

7.2 Current protection

- Always install a fuse or circuit breaker for the module that matches its maximum fuse current and system voltage in accordance with local regulations. To ensure the protection of the fuse, refer to the fuse range recommended on the module nameplate, and refer to the local power installation safety manual.
- When the modules are installed in parallel, each piece of module or a string of cells must have a fuse that meets the maximum fuse current specified in the power specification.
- The nominal rating of all electrical components shall not be less than the nominal rating of the system and shall not exceed the maximum system voltage indicated on the module nameplate.

8 Maintenance

8.1 Visual and electrical inspection

The modules in a PV array should be regularly checked for damage. Factors such as glass breakage, cable breakage, and junction box damage may lead to function and safety problems.

- It is recommended to perform a preventive inspection every six months without changing the components of the module. If electrical or mechanical properties are required for inspection or maintenance, qualified professionals should be advised to avoid any electric shock or loss of life.
- Inspect for loose or corroded electrical interfaces, loose connections between supports and components, connections between cables, connectors, and grounding.
- Replacement modules 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.

- Trim any vegetation which may shade the solar array, thus impacting performance.

8.2 Cleaning

The amount of electricity generated by a solar module is proportional to the amount of light falling on it. A module with shaded cells will produce less energy and therefore it is important to keep modules clean. Appropriate maintenance measures shall be taken to keep the assembly free of snow, guano, seeds, pollen, leaves, branches, dust and stains, etc.

- In most conditions, the normal rainwater can keep the module glass clean. Clean the glass surfaces with wet soft sponge or cloth if necessary. Use mild non-abrasive cleaning agent to remove stubborn dirt. If the module installation Angle with the ground is 0° , it required relatively frequent cleaning frequency. In general, if installation Angle is 15° , the module's self cleaning ability is better than 0° .
- When cleaning PV modules, do NOT step on the modules; do NOT spray water on the backside of the module or the cables; do NOT clean the backside of the modules; keep the connectors clean and dry; prevent fire and electrical shock from occurring; do NOT use as steam cleaner.
- Modules can work effectively without cleaning, but removing dust from the glass surface can increase output power. Use a wet sponge or cloth to clean the surface of the glass. Wear rubber gloves for maintenance.
- The back surface of the module normally does not need to be cleaned but, in the event this is deemed necessary, avoid the use of any sharp projects that might damage the penetrating the substrate material.

9 Note

The output power value described in the manual is the value of the module tested under standard conditions. Daily operation environment and standard test conditions are often different.