INDEX

1 INTRODUCTION

1.1 PURPOSE OF THE MANUAL

The technical content of this guide applies to the installation, erection, connection and maintenance of photovoltaic modules of Suzhou Talesun Solar Technology Co., Ltd. (hereafter is referred to as "Talesun"). Any deviation from the contents of this manual will render the warranty and any guarantees thereunder null and void.

This manual is applicable to the following module types:
TP7F54M&TP7F54M(H)-XXX, TP7F60M & TP7F60M(H)-XXX, TP7F66M & TP7F66M(H)-XXX, TP7F72M & TP7F72M(H)-XXX, TP7F78M & TP7F78M(H)-XXX;
TD7G54M-XXX, TD7G60M-XXX, TD7G66M-XXX, TD7G72M-XXX, TD7G78M-XXX;
TP7G54M-XXX, TP7G60-XXX, TP7G72M-XXX;
TM7G54M-XXX, TM7G60-XXX, TM7G72M-XXX, TM7G78M-XXX;
TM3G48M-XXX, TM3G54M-XXX, TM3G66M-XXX;
TP8F54M & TP8F54M(H)-XXX, TP8F60M & TP8F60M(H)-XXX, TP8F66M & TP8F66M(H)-XXX;
TD8G54M-XXX, TD8G60M-XXX, TD8G66M-XXX;
TM8G60M-XXX, TM8G66M-XXX.
"XXX" represents the rated output power at STC

Information for installers

- ✧ Installers must read and understand this manual before installation.
- ✧ Please ensure that the installation, operation, and maintenance of the photovoltaic system described in the manual are performed by qualified personnel, such as personnel for system planning, installation and maintenance, whose operation must comply with all safety precautions in this manual and applicable local regulations; unqualified personnel can only carry out cleaning work.
- ✧ This manual is part of the product and should be retained during the service life of the photovoltaic system.

Information for operators

- ✧ Keep this manual during the service life of the photovoltaic system.
- ✧ Contact your equipment supplier for installation information concerning the photovoltaic systems. Be sure to learn about the guidelines and understand the needs of the persons who are in charge of local authorities, as well as the energy suppliers prior to the installation of photovoltaic power station.
- ✧ Make sure your PV system can withstand natural disasters (e.g. electricity, lightning strikes)

1.2 STATEMENT OF LIABILITY

- ✧ This statement is valid for Talesun products only.
- ✧ The information in this manual is based on Talesun's knowledge and experience and is considered to be reliable; but such information, including product specifications (without limitation) and suggestion, does not have any significance as a warranty or constitute an express or implied guarantee. Talesun reserves the right to change this manual, PV products, specifications, or product information sheets without prior notice.
- ✧ Talesun shall not bear any expenses arising from damage, loss or installation, operation, use or maintenance if the use

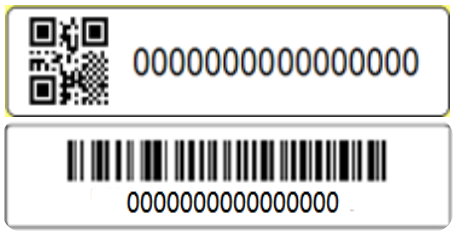
of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic products are beyond Talesun's control. Talesun does not cover any legal liability beyond the due function and safety performance. This manual is for reference only.

- ✧ No license is granted by implication or otherwise under any patent or patent rights.
- ✧ As for special modules, please install and use separately according to the module specifications or agreed terms in the contract.
- ✧ If your questions are not adequately addressed in this manual, please contact your system supplier. For more information, please visit Talesun website www.talesun.com.

1.3 PRODUCT IDENTIFICATION

Each module has three labels that provide the following information:

- ✧ Nameplate: describes the product type; rated power, rated current, rated voltage, open circuit voltage and short circuit current, all as measured under standard test conditions; as well as maximum system voltage fuse rating.
- ✧ Bar codes (One-dimensional Code or QR Code): The serial number has 16 digits. There are two bar codes on each module. One is permanently laminated inside the module which is obviously visible from the front of the module, and the other is pasted to the rear side of the module.
- ✧ Removing the nameplate will make the Talesun warranty void.



2 SAFETY GUIDELINES

2.1 GENERAL SAFETY GUIDELINES

DANGER! Danger due to electric shock!

All installations must be performed in compliance with all applicable regional and local codes, or other national or international electrical standards (if applicable) etc.

- ✧ A PV module can generate current and voltage even at low light intensity. Therefore, contact with live modules should be avoided and take care to isolate the live circuit before performing any connection or disconnection operation.
- ✧ Physically disconnecting a live circuit can cause an electric arc that will result in serious or fatal injury. The severity increases with the increase of the module number in series.
- ✧ Cover the PV modules with non-transparent material during the entire installation, so that can ensure reliable power-off of the modules.
- ✧ It is strictly prohibited to unplug the plug when there is a load. Be aware that even without light, there is still residual electrical energy in the power station. Make sure to disconnect the modules from the inverters first before disconnecting any contact switches for PV system installation.
- ✧ It is strictly prohibited to artificially concentrate sunlight on the modules. When the light shines on the front of the module, it is bound to produce electrical energy. The DC voltage may exceed 30V. Contact with a DC voltage of 30V or more is potentially hazardous.
- ✧ There is an extremely low voltage when the module or phase voltage exceeds 120V. Necessary protective and precautionary measures should be taken.
- ✧ Do not attempt to insert any conductive components into the plugs or junction boxes. Do not touch the plugs or exposed terminals.

- ✧ Keep children and unauthorized persons away from the modules.
- ✧ In case of module damage or wrong operation of the PV array, please contact Talesun technical customer service.
- ✧ Do not wear metallic ornaments or hold any metallic devices while installing or troubleshooting photovoltaic systems. Please wear appropriate personal protective equipment.
- ✧ In case of fire, please do not use water to extinguish the fire at the power source.
- ✧ If the modules are wet or encounter a windy weather, do not install or handle the modules.

WARNING! Danger of injury due to broken glass! Risk of injury due to falling modules!

- ✧ The modules are primarily made of glass and therefore must be handled with special caution.
- ✧ In order to ensure safe mounting, make sure that you are familiar with all applicable national regulations for safe working and accident prevention.
- ✧ To prevent injury, wear appropriate protective clothing (e.g. safety shoes, protective gloves). The working voltage that the protective suit provided to the working staff can withstand shall not be lower than 1500V.
- ✧ If the module glass is broken or the backsheet is damaged, contact with any surface or frame of the module will result in electric shock!
- ✧ Under normal circumstances, the current and voltage values generated by the modules may be higher than those obtained under standard test conditions. Therefore, when determining the photovoltaic power generation system modules, such as the rated voltage, wire capacity, fuse capacity and the parameters associated with the module power output, the corresponding short circuit current and open circuit voltage should be multiplied by a factor of 1.25 before application.
- ✧ Modules in this application class can be used in systems with DC voltages greater than 50V or 240W. Modules that pass IEC61730 can be considered to meet the requirements of safety class II.

2.2 PRODUCT PROTECTION

- ✧ Do not attempt to disassemble the modules.
- ✧ Do not attempt to remove any nameplates or parts and components from the modules.
- ✧ Do not open the junction box under any circumstances.
- ✧ Do not connect blocked or contaminated plugs.
- ✧ Only after receiving the written confirmation from Talesun, can you carry out the modifications or other operations on the modules.

- ✧ Do not attempt to drill holes into the module (e.g., for installing the fasteners).
- ✧ Only use insulation tools dedicated for electrical installation.
- ✧ Do not use light concentrators (e.g. mirrors or lenses) to attempt to increase the power generation of the module. Otherwise the module may be damaged as a result, so that make the warranty to be void.
- ✧ It is strictly prohibited to squeeze or use sharp objects to knock, collide, scratch the tempered glass of the photovoltaic module.

2.3 TRANSPORT AND STORAGE SAFETY GUIDELINES

Inappropriate transportation and installation may damage the modules. To prevent damage to the modules:

- ✧ Transport the modules in their original packaging until installation.
- ✧ Store the modules securely in a ventilated and dry space. The outer packaging of the modules is non-weather resistant!
- ✧ Protect the modules against scratches and other damage, especially when the module edges are knocked or the modules are improperly stored.
- ✧ Ensure modules do not bend under their own weight.
- ✧ Do not place the modules without any protection. Otherwise the modules and frames are liable to be damaged.
- ✧ Do not lift or move the modules by using the cables or junction box under any circumstances!
- ✧ Do not place any hard objects on the upper or lower surfaces of the modules.
- ✧ Do not let the module surface bear the mechanical stress.
- ✧ Do not stand on the modules.
- ✧ Do not drop or place objects on the modules.

3 MECHANICAL INSTALLATION

3.1 SELECTING THE LOCATION

- ✧ The modules passed the certification according to IEC 61215 and other standards, and are suitable for safe operation in mild climatic conditions. When installing modules at high altitude area, the effect of high altitude on module operation needs to be considered.
- ✧ In general, modules should be installed in a position that receives the most light throughout the year. In the Northern Hemisphere, it is recommended that the modules face south. In the Southern Hemisphere, modules are recommended to face north. If the inclination angle of the module deviates from the due south (or due north) direction by 30 degrees, the power output of the module will be lost by approximately 10% to 15%. If the inclination angle of the module deviates from the due south (or due north) direction by 60 degrees, the power output of the module will be lost by approximately 20% to 30%. Determine the best azimuth angle for module installation by referring to the latitude and longitude of the installation site. The maximum altitude of the installation site is no more than 2000m.
- ✧ Do not install or use the modules in an environment with highly corrosive substances (such as salt, salt mist, salt water, active chemical vapor, acid rain, or any other substance that will corrode the modules, affect the safety or performance of the modules).
- ✧ Do not place the modules in water. The projection grade of the junction box is IP68.
- ✧ Do not install the modules near flammable gases and vapors (e.g. gas tanks) or near open flames or flammable materials. Solar modules are not explosion-proof items.
- ✧ Long-term exposure to salt mist (i.e., marine environments) and sulfur-containing (i.e., sulfur sources, volcanoes) environments will lead to a risk of module corrosion. It is not recommended to install modules within the range which is 0.1Km from the marine environment; and install the modules with salt mist resistant function, when the distance is between 0.1Km and 1Km.
- ✧ Modules should not be shaded throughout the year (e.g. by buildings, chimneys, trees). Even partial shading of the modules (e.g. by overhead lines, dirt, snow) should be avoided either.

3.2 SELECTING THE APPLICABLE TRACKERS TO MOUNT

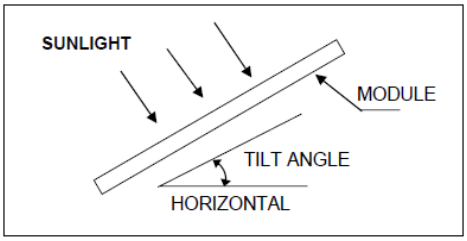
Guidelines and safety precautions should also be followed at all times when trackers and modules are installed and used. The mounting tracker structure of each module shall meet:

- ✧ Use durable, corrosion-resistant and UV-resistant material.
- ✧ The mechanical stress on the modules can be well transferred to the tracker structures.
- ✧ Ensure that no mechanical stress (e.g. caused by vibrations, twisting or expansion) is generated on the module.
- ✧ Ensure that it is well ventilated at the back of the modules.
- ✧ Ensure that the trackers have long term stability.
- ✧ Ensure that electrochemical corrosion is not caused by the use of metals in direct contact (i.e. ground wires, screws, washers, etc.).
- ✧ Allow for generating strain-free expansion and contraction due to natural ambient temperature variations.

3.3 GENERAL INSTALLATION

Modules installed in series should be ensured at the same orientation and angle. Difference in orientations or angles (different illumination) may cause a loss of power output.

- ✧ When developing the final layout of photovoltaic system, adequate staff passage should be ensured for subsequent repair and maintenance. Minimize the risk of indirect electric shock as much as possible, and avoid forming closed loops when designing the system.



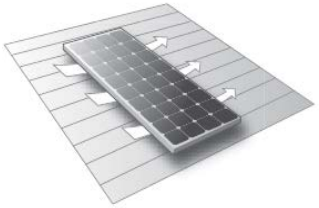
- ✧ During the installation of modules, it is recommended to keep the inclination angle above 10 degrees so that rain can wash the dust off the surface of the modules. If the inclination angle is too small, module cleaning need to be conducted more frequently, which affects the appearance and performance of the modules.
- ✧ Modules can be installed horizontally or vertically.
- ✧ The minimum spacing between two modules is 10mm.
- ✧ Select an installation mode, which should not block the drainage holes. Ensure that the drainage holes are unblocked during installation and use.
- ✧ Vertical installation is recommended. Only vertical installation is applicable to the areas where the ambient average humidity is greater than 70%.
- ✧ The optimal tilt angle of the module depends on the corresponding latitude. It is recommended to use professional PV system software to obtain this data.

Ground mounting

- ✧ Ensure that the lowest edges of the modules are not covered by snow for a long time, especially in areas with long periods of heavy snow in winter.
- ✧ Ensure that the lowest part of the module is placed highly enough so that it is not obscured by trees or plants, or covered by sand, dust or stones blown up by wind.

Roof mounting

- ✧ When installing modules on the roof of a building, please ensure in advance that the roof can be installed with modules. Make sure that the module is securely fastened and will not fall due to wind or snow loads. Reserve safe working areas at the edge of the roof and in the array of the modules.
- ✧ Make sure there is adequate ventilation space under the modules. At least 10 mm gap between the modules is required to allow thermal expansion of the bracket. If other installation methods are used, the UL certification or fire rating may be affected.



- ✧ The roof mounting shall be applied to the roof which has the corresponding fire rating. Talesun modules are identified as Class C fire rating according to UL790 standards.
- ✧ Any roof penetration required to mount the module must be properly sealed to prevent leaks.
- ✧ In some cases, additional support frames may be required.
- ✧ The roof installation of solar modules may affect the fireproofing of the building.
- ✧ In order to prevent accidents, do not install modules on the roof of a building during strong winds.
- ✧ Before installation, ensure that all support structures used to support the PV modules are at the correct tilt angle, which can withstand wind and snow loads as required by regional or local regulations.

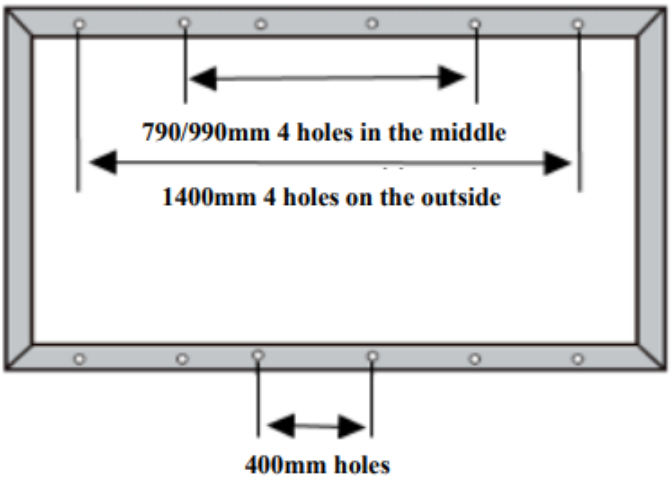
Pole mounting

- ✧ When installing modules on poles, choose poles and module mounting structure that can withstand the expected wind force.

3.4 INSTALLATION METHOD

- ✧ It is recommended that the modules be installed by using mounting holes or clamps. In order to meet the load requirements, we suggest to install the modules as per the methods shown in the diagram below.

1. Frame Holes Mounting



- ✧ The module is installed with the beam vertical to the frame long side; the module is installed with the beam parallel to

the frame long side; and the mounting methods of tracking bracket (see the installation legend below for details), safety factor γm=1.5 (test load = design value *1.5 times safety factor).

- ✧ Modules should be bolted to support structures through mounting holes located on the back side of the frame. Do not drill additional holes, otherwise will void the warranty.
- ✧ Use M8 coarse thread bolts for the 4 mounting holes on the outside and the 4 holes in the middle (990mm); use M6 coarse thread bolts for the 4 mounting holes in the middle (790mm) / 400mm holes.
- ✧ Each module must be securely fastened by using at least 4 mounting holes. Emergency mounting holes shall be also used if there is additional wind or snow load. System designer and installer should calculate the load in advance to make proper design of support structure.
- ✧ Recommended bolt accessories are as follows:

Types & Materials of Accessories	Bolts Q325B / SUS304	Washers Q325B / SUS304	Spring Washers Q325B / SUS304	Nuts Q325B / SUS304	Torque
M8	M8 (full thread recommended)	2pcs, Thickness >1.5mm; External Diameter =16mm	8	M8	16~20N•m
M6	M6 (full thread recommended)	2pcs, Thickness >1.5mm; External Diameter =12~16mm	6	M6	10~16N•m

- ✧ Follow mounting guidelines recommended by the PV mounting supplier. The mounting design must be certified by a registered professional engineer.
- ✧ The mounting design and procedures shall comply with local codes and all authorities having jurisdiction.
- ✧ Ensure that the drain holes of the frame are open to make the water flow drain out smoothly, so that may prevent frost damage.
- ✧ Modules shall be installed in such a way so as to ensure that rainwater and snowmelt can slide down freely, thereby avoiding water accumulation or freezing.

2. Clamp Installation

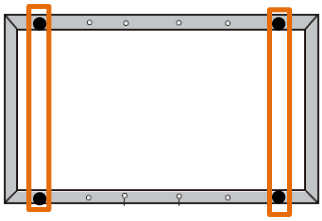
- ✧ Clamps can be applied to the module installation. Modules must be firmly secured to the mounting bracket by pressing at least 4 clamps on the frame.
- ✧ The modules must be firmly secured to their support. It's the installer's responsibility to ensure the clamps itself is of sufficient strength for installation.
- ✧ The modules cannot be installed in the environment that the wind loads or snow loads exceed their maximum allowable loads.
- ✧ The module clamps shall not be in contact with the front glass or deform the frame. Clamps must not have shadowing effects on the module. Drain holes in the module frames must not be obscured by the clamps.
- ✧ The module is installed with the beam vertical to the frame long side; the module is installed with the beam parallel to

the frame long side. Safety factor γm=1.5 (test load = design value *1.5 times safety factor).

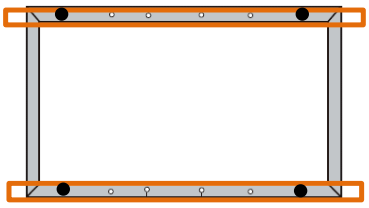
- ✧ The installation structure of modules must be made of corrosion-resistant and UV resistant materials. It is recommended to use clamps that can at least fix M8 bolts. For example, the tightening torque of M8 bolts should range from 16 to 20 N•m. Make sure that the clamps will not fail due to deformation or corrosion during the whole module is loaded.
- ✧ The recommended length for clamp is ⩾ 50mm. The overlap length between the clamp and the module frame is at least 8mm, but not more than 12mm. The height of the clamp is matched with the size of frame B side.

Mounting Method / Accessory Legend

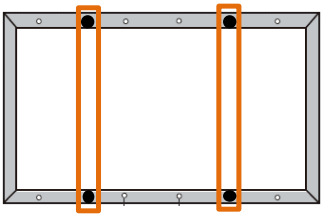
a：Outer 4 holes bolt mounting
(with beam vertical to frame long side)



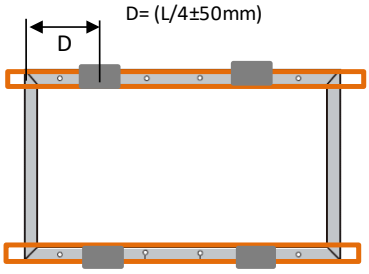
b：Outer 4 holes bolt mounting
(with beam parallel to frame long side)



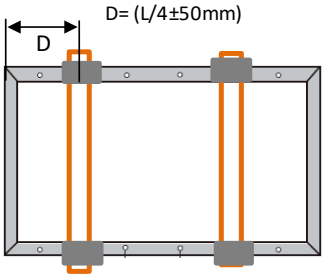
c：Middle 4 holes bolt mounting
(with beam vertical to frame long side)



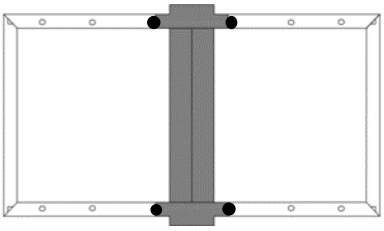
d：Clamp mounting with beam parallel to frame long side
D= (L/4±50mm)



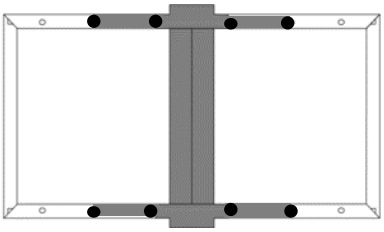
e：Clamp mounting with beam vertical to frame long side
D= (L/4±50mm)



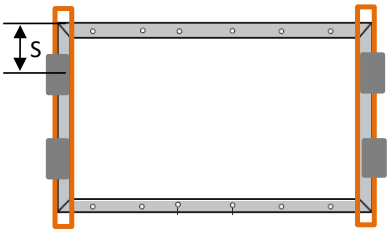
f：Tracking bracket bolt mounting



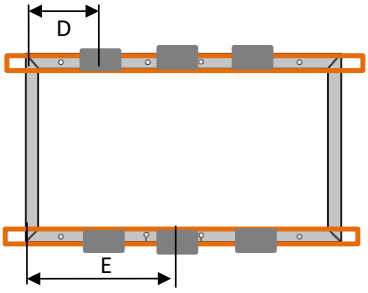
g：Tracking bracket + support bar bolt mounting



h：Clamp mounting with beam parallel to frame short side
S= (W/4±50mm)

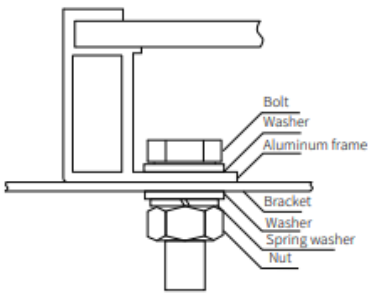


i： With beam parallel to frame long side both ends clamp mounting D= (L/4±50mm) middle clamp mounting E= (L/2±50mm)

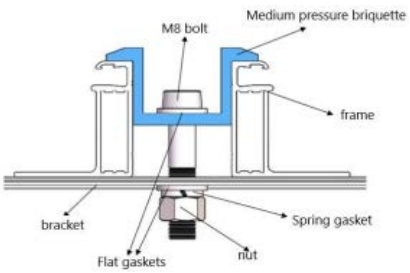


Remarks: "L" is module length; "W" is module width.

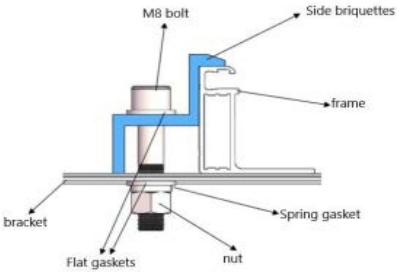
Bolt Legend



Clamp Legend



Medium Clamp Mounting

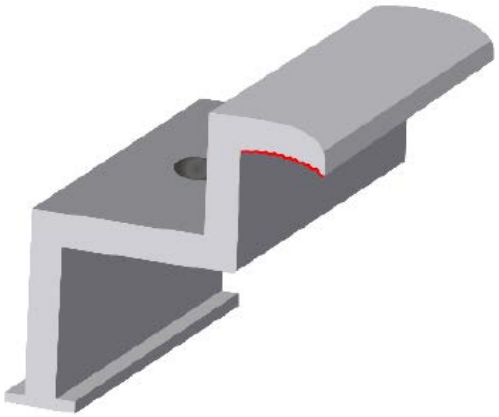
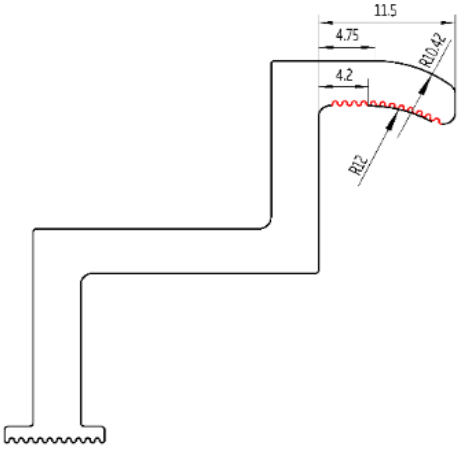


Side Clamp Mounting

Module Type	Mounting Method / Load Design Value					
	a: Outer 4 holes bolt mounting (with beam vertical to frame long side) e：Clamp mounting with beam vertical to frame long side (L/4±50mm)	**c：Middle 4 holes bolt mounting (with beam vertical to frame long side)**	**b：Outer 4 holes bolt mounting (with beam parallel to frame long side) d：Clamp mounting with beam parallel to frame long side (L/4±50mm)**	**f：Tracking bracket bolt mounting g：Tracking bracket + support bar bolt mounting**	**h：Clamp mounting with beam parallel to frame short side (W/4±50mm)**	**i：With beam parallel to frame long side both ends clamp mounting (L/4±50mm), middle clamp mounting (L/2±50mm)**
☆TP7F**	+ 3600Pa -1600Pa	+ 2400Pa -1600Pa	+ 2400Pa -1600Pa	+ 1600Pa -1600Pa (g)	/	/
☆TD7G**						
☆TP7G**						
☆TM7G**						
☆TM3G**						
TP8F**		/	/	/		
TD8G**						
TM8G**						
TP7F54M	/	/	/	/	+ 1600Pa -1067Pa	
TP7G54M						
TM7G54						
TD7G54						
TD7G72M (B Side 35mm)					/	+ 3600Pa -2400Pa

Remarks:
1. The "**" in the module type indicates the cell quantity of different types;
2. "L" is module length; "W" is module width.
3. "☆" Module type: 54/60/48, a and b: outer 4 holes bolt mounting method is not applicable to these module types.
4. Module Type TP7F** includes TP7F54M&TP7F54M(H)-XXX, TP7F60M & TP7F60M(H)-XXX, TP7F66M & TP7F66M(H)-XXX, TP7F72M & TP7F72M(H)-XXX, TP7F78M & TP7F78M(H)-XXX; TD7G** includes TD7G54M-XXX, TD7G60M-XXX, TD7G66M-XXX, TD7G72M-XXX, TD7G78M-XXX; TP7G** includes TP7G54M-XXX, TP7G60-XXX, TP7G72M-XXX; TM7G** includes TM7G54M-XXX, TM7G60-XXX, TM7G72M-XXX, TM7G78M-XXX; TM3G** includes TM3G48M-XXX, TM3G54M-XXX, TM3G66M-XXX; TP8F** includes TP8F54M & TP8F54M(H)-XXX, TP8F60M & TP8F60M(H)-XXX, TP8F66M & TP8F66M(H)-XXX; TD8G** includes TD8G54M-XXX, TD8G60M-XXX, TD8G66M-XXX; TM8G** includes TM8G60M-XXX, TM8G66M-XXX.

- ✧ If the modules are not installed according to the above diagram, the actual load bearing value may be reduced.
- ✧ This manual is for reference only. Customers need to select the corresponding installation method base on purchased modules.

Clamp Legend （Matches A Side）	
	
Note: The clamp that matches A-side has a hook structure at the contact surface with the module frame, increasing the friction force. It is recommended that TM8G series customers choose this type of clamp, which specific dimension is illustrated above (only applicable to TM8G series).	

4 ELECTRICAL INSTALLATION

4.1 MODULE SELECTION

- ✧ Select and use the modules of same type, same configurations and same power in the same system. This is the only way to achieve optimal yields.

4.2 SAFTY FACTOR

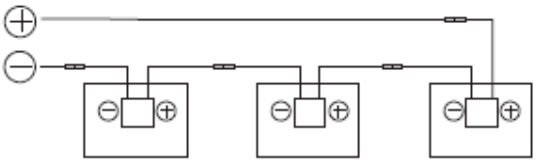
- ✧ Photovoltaic modules may withstand greater current and/or voltage under normal circumstances than those under Standard Test Conditions. Therefore, the values of Isc and Voc should be multiplied by 1.25 times when determining the module nominal voltage, nominal current, fuse current and controller size. Alternatively, a valid national installation guide of electrical systems can be used. Pay attention to avoid the PID phenomenon at the system installation side during installation.

4.3 Wiring and cables

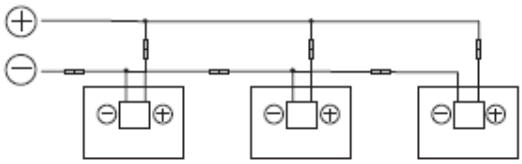
- ✧ The wiring and cable management should be designed, reviewed and approved by the EPC contractor, especially for assemblies using tracking brackets. The required cable lengths should be checked in advance, to ensure good functionality and proper installation.
- ✧ The wiring should be checked for correctness before starting the system. lf the measured open-circuit voltage (Voc) and short-circuit current (lsc) do not match the specifications provided, there may be a wiring fault
- ✧ Each string should be left open-circuit until the system is connected to the grid after the modules have been installed. Appropriate protection is required to avoid the ingress of water vapour and dust.

✧ Talesun recommends the following wiring methods.

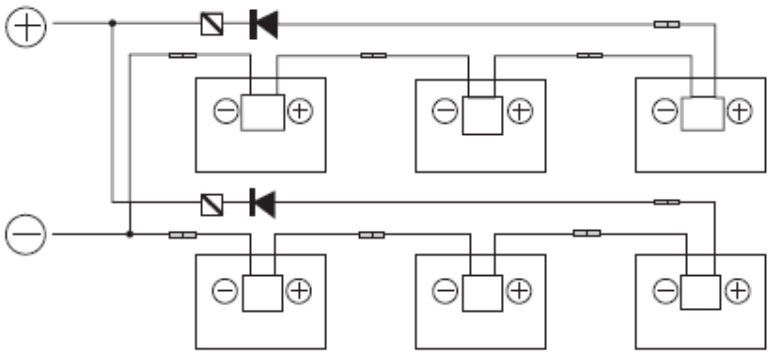
Series Connection



Parallel Connection



Series Connection and then Parallel Connection



Electrical Diagrams of Series and Parallel Circuits

4.4 GENERAL INSTALLATION

✧ Before installing modules, contact the appropriate authorities to determine permissions, installation and inspection requirements applicable to your site selection and installation.

✧ Check applicable building codes to ensure that the support structures (roofs, exterior walls, supports, etc.) are strong enough to support the weight of the modules and all other system components.

✧ When a high current needs to be obtained, several photovoltaic modules can be connected in parallel. The total current is equal to the sum of the respective currents, and each module (or a series of modules in series) must be configured with a specified maximum current fuse. The recommended number of parallel modules is one.

✧ When a high voltage needs to be obtained, several photovoltaic modules can be connected in series. The total voltage

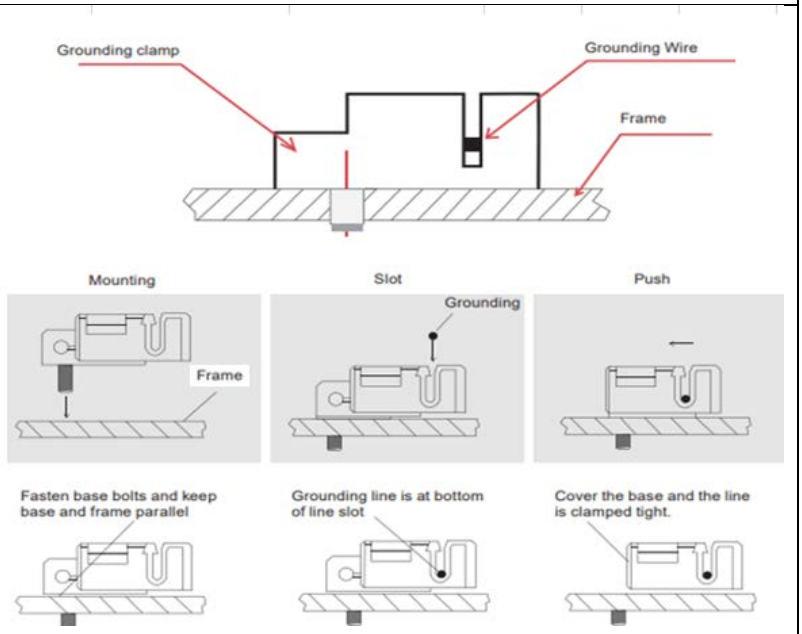
is equal to the sum of the respective voltages. However, the maximum system voltage must be lower than the maximum certified voltage and the maximum input voltage for inverters and other electrical equipment in the installation system.
The maximum number of modules in series is (N) ≤ System Vmax / {Voc (at STC) × [1+ (t- 25) * Kv]}, where:
System Vmax: The smaller of the maximum certified voltage, the maximum output voltage of the system inverter or other electrical equipment
Voc: Open circuit voltage of PV module (v)
t: The lowest ambient temperature (℃)
Kv: Temperature coefficient of open circuit voltage for PV module (/℃) -- refer to product technical data sheet

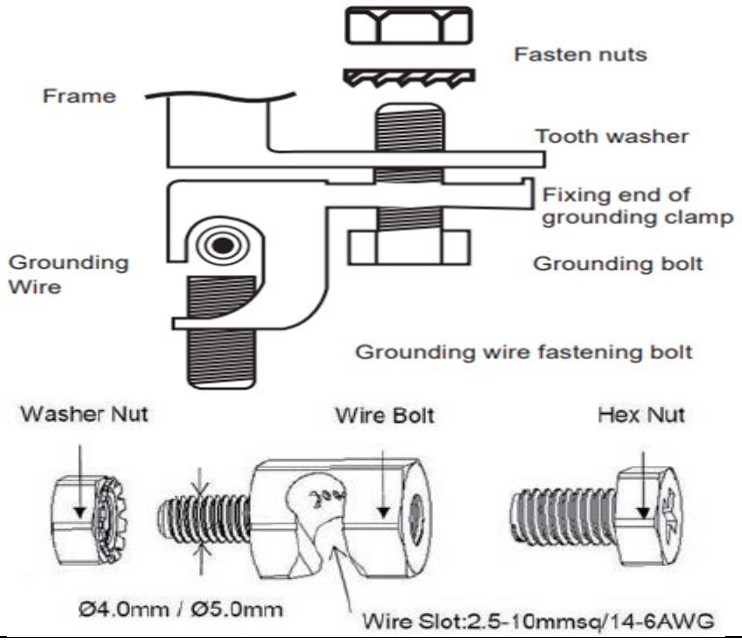
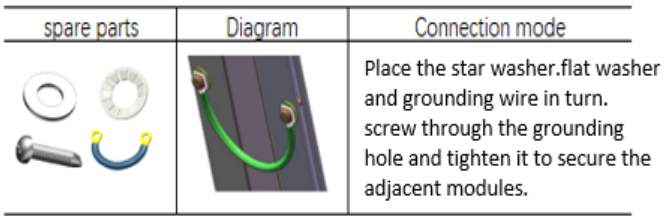
- ✧ Connect the appropriate number of modules according to the voltage specification of the inverter used by the system. Even under the worst local temperature conditions, the voltage generated by the connected modules shall not be higher than the voltage allowed by the system.
- ✧ It is recommended to connect modules with similar electrical properties on the same string to reduce array mismatch effects.
- ✧ Use dedicated photovoltaic cables and matching plug specified by local fire, building and electrical codes (wiring should be placed in light-resistant conduits or light-resistant materials if cables are exposed to air). Ensure that they are placed under optimum electrical and mechanical conditions.
- ✧ Only photovoltaic cables can be used as connecting cables. A PV system must use the same type of connectors from the same manufacturer and the connectors linked to the inverters should be the same type from same manufacturer as well. During installation, disassembly, maintenance, and any other related process, the applied force between the cable and the connector shall not be greater than 90N to avoid improper connection or damage of the connector and the cable caused by human factors, which may affect the electrical safety or service life of the product.
- ✧ Ensure that all electrical components are placed in a proper, dry and safe condition. In this way may avoid electrical short-circuits or dangerous contact voltages due to defective or damaged cables.
- ✧ Always avoid mechanical stress on the connecting cables.
- ✧ Ensure the tight connection and correct connection between individual connectors (especially for inverters).
- ✧ The minimum bend radius of the cable is 43mm.

4.5 GROUNDING

- ✧ Module frames must be properly grounded. The ground wire must be properly secured to the frame of the module to ensure good electrical contact. Use the recommended type or equivalent connecting cable.
- ✧ In addition, from the system side, the negative grounding of the inverter can effectively reduce the PID effect of the modules. However, professional personnel are required to operate the matching negative grounding of the inverter.
- ✧ If the frame is made of metal, the surface of the frame must be electroplated with a protective layer and have good continuous conductivity.
- ✧ The grounding device must penetrate the anodic oxide film on the module frame and be in full contact with the interior of aluminum alloy. The grounding conductor must be connected to the earth through a suitable grounding electrode.

- ✧ There are grounding holes with diameter of 4mm near the edge of the back frame long side of the module. According to IEC61730-1:2023, the grounding holes on the frame are marked with typical grounding symbols (⏥). These holes can only be used for grounding and therefore cannot be used for module installation. This method includes bolts, flat washers, start washers, washers and nuts, as shown in the diagram below. The bolts should be tightened when grounding is installed. Do not drill extra holes in the module frame.
- ✧ The following are three grounding methods for reference:

Grounding Type	Requirements	Legend
Using grounding clamp	1. Grounding clamp: Tyco 1954381-1 (recommended). 2. There is a grounding hole with a diameter of 4.2mm at the middle edge of the frame on the back of the module. The median line of the grounding mark coincides with the median line of the hole and is consistent with the length direction of the frame. 3. The grounding between modules must be confirmed by a qualified electrician, and the grounding device must be manufactured by a qualified electrical manufacturer. The recommended torque value is 2.3 N•m. The grounding clamp uses 12 AWG copper core wire. The copper wire shall not be damaged by pressure during installation.	

Use unused mounting holes for grounding	1. The existing but unused mounting holes on the modules can be used to install the grounding device. Align the grounding clamp with the frame mounting hole. Use the grounding bolt to pass through the grounding clamp and frame. Put the tooth washer on the other side and tighten the fasten nut. Pass the grounding wire through the grounding clamp. The material and size of the grounding wire shall meet the requirements of relevant local national, regional or international regulations, laws and standards. 2. Place the serrated washer on the other side and tighten the lock nut. The recommended tightening torque for the nut is 2 Nm to 2.2 Nm. 3. Tighten the grounding wire fastening bolt, and then the installation is completed.	
Use grounding holes for grounding	1. The grounding hardware includes: grounding screw, flat washer, star washer and grounding wire. Other related hardware shall be stainless steel. The ground wire shall adopt copper core wire of 4-14mm² and 90 ° C (AWG 6-12), and shall comply with the relevant local national, regional or international regulations, laws and standards. Please do not drill holes on the module frames or modify the frames, otherwise Talesun limited warranty will be invalid. 2. Talesun recommends that the grounding resistance < 1 Ω. The electrical contact point is formed by penetrating the anodized coating of the aluminum frame and tightening the mounting screw (together with the star washer) to an appropriate torque of 3-7 N•m.	

5 MAINTENANCE

5.1 ANTI-REVERSE DIODES AND BYPASS DIODES

- ✧ Anti-reverse diode prevents current from flowing from the cells to the module when the module does not generate electricity. It is recommended to use anti-reverse diodes when there is no charging regulator. Your specialist dealer can recommend suitable types.
- ✧ In systems with two or more modules in series, high reverse current will flow through the cells when one part of the

module is obscured and the other parts are exposed to the sunlight. These reverse currents can cause the affected cells to heat up and may even damage the module. The by-pass diode is used in the module to protect it from being subjected to such a large reverse current. All modules with power ratings greater than 55 watts have the junction boxes integrated with bypass diodes. In case of diode failure, it can also be easily replaced; however, only qualified personnel can perform this operation, otherwise it will violate the warranty.

- ✧ Protect yourself from electric shocks while commissioning or maintaining the photovoltaic system.

5.2 TROUBLESHOOTING

DANGER! Life danger due to electric shock!

- ✧ Please do not attempt to solve the problem by yourself!
- ✧ In case of problems or damaged modules (for example, glass breakage, damaged cables), please contact your installer or the Talesun Technical Customer Service.

5.3 MAINTENANCE

- ✧ Talesun modules shall be inspected and maintained regularly after installation. Rain can wash away dirt. However, rain may not adequately remove more stubborn dirt (i.e. pollen, vegetation, bird droppings, etc.). Such dirt will obscure the power generation part of the module and may lead to a reduction in the system performance. Talesun recommends the following maintenance in order to ensure optimum performance of the module:
- ✧ Clean the glass surface if necessary. Make sure to use clean water and soft sponge or cloth, and use mild and non-abrasive cleaning agent to remove stubborn stains. Talesun limited warranty will be invalid due to damage caused by improper cleaning methods.
- ✧ Check the electrical and mechanical connections every six months to verify that they are clean, secure and undamaged.
- ✧ If any problem arises, have them investigated by a module specialist. Note: read the maintenance instructions for all components used in the system (such as support frames, charging regulators, inverters, batteries etc.).
- ✧ The right of final interpretation belongs to Suzhou Talesun Photovoltaic Technology Co., Ltd.

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