

# **a-Si/ $\mu$ cSi Tandem Module Installation Manual**



**Macsun Solar Energy Technology Co., Limited**  
**2014.1.20**  
**Applied to MS-SDXX**

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## **1. PURPOSE**

This procedure is to provide installation instructions for MS-SDXXX series thin film solar module with size of 1.1m\*1.3m for field installation.

## **2. WARNING**

Photovoltaic Modules produce electricity when exposed to the sun or other light sources. For your safety and the safety of others, please read the entire safety and installation instruction manual carefully prior to product installation. Also, carefully read the module data sheet provided with this product. Find out about any necessary local permits as well as installation and inspection requirements before installing module(s). The manufacturer assumes no liability for damages incurred due to non-compliance with these instructions. Please also observe the instructions for the other components which constitute the total PV system.

## **3. SCOPE**

This procedure establishes the key installation requirements to mount MS-SDXXX series thin film PV modules with size of 1.1m\*1.3m in the field which includes, but is not excluded to, roof tops, solar farms and commercial buildings.

## **4. RESPONSIBILITY**

Macsun Solar Energy Technology Co.,Limited shall maintain the engineering change control of this product.

End installer of the thin film PV modules is responsible for the design and integrity of the mounting system of the modules. The PV module manufacturer isn't responsible for the design and structural integrity of the PV modules. Installation of the PV modules must be performed by appropriately trained and equipped installers.

Supplier is responsible for maintaining and supporting the bill of materials on the supplier database.

## **5. INSTALLATION**

### **5.1 General instructions**

General instructions before installing the PV modules:

- Wear protection gloves, shoes and goggles for all kind of work you perform when handling glass
- Box cannot be placed in slope greater than 5 °the ground when unpacking and the long side on of box parallel to the ramp.



- People can not stand on logo printed side of box when unpacking.
- After unpacking, module must be unload within 1H.
- Only install modules which are not damaged.
- Ensure that the junction box, cable and connectors are undamaged prior to installation.
- Observe the grounding requirements depending on the installation location.
- Integrate the solar system in the existing lightning protection system in accordance with the local regulations.
- Do not install modules or perform maintenance of modules in strong wind or rain. It is recommended that mounting and installation only be performed in dry weather.
- During mounting on buildings, there is a danger that tools, mounting materials or solar modules can fall and injure people. Block off the danger area on the ground before beginning the assembly work.
- Warn people near the danger area or in the building. Keep children away from the installation site.
- Carry out wiring work in such a way that people are not endangered and that no damage can occur.
- Protect all parts of the module during transport and installation from mechanical stress (e.g. from pressure, tension, torsional stress). Ensure that the bend radius of the connection cables is greater than 60 mm at all times.
- The solar modules, especially the connectors and tools, must be dry during installation.

## 5.2 General mounting rules

- A. The mounting assembly and the undercarriage must be appropriately dimensioned and adapted to the in-situ environmental conditions so that the permissible maximum bending/deformation is not exceeded in relation to the edge length of the module if loading of  $L/400$  occurs. No buckling/twisting of more than 7.5 mm across the module diagonal is allowed!
- B. Modules must be steady-fastened and in a durable elastic bedding. All direct contact of the glass/solar module with metal parts of the substructure must be prevented.
- C. The solar module should be installed at stress-free and force-free conditions.
- D. Accumulation of water at the solar module must be prevented as it might cause corrosion on the panels and on the adhesive bonding (PVB or EVA foil between front and back glass) and can cause glass blinding and impairment to the adhesive bonding.
- E. When dimensioning the undercarriage, particular care should be taken of the various thermal coefficients for the used material
- F. Observe the specified fixation points at the approved mounting assemblies (maximum tightening torque for screws, positions of the drilled holes).

### 5.3 Module orientation

Always mount the modules in “portrait” orientation.

Do not mount the modules in “landscape” orientation.

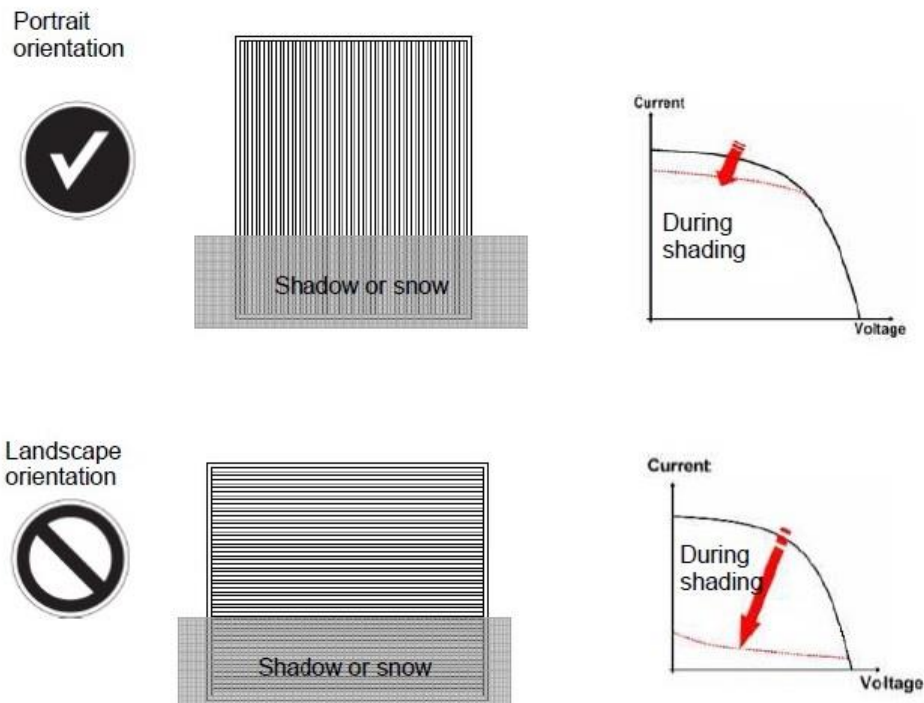


Fig.2 Position of the junction box

The junction box must be positioned at the top of the module. The junction box should be protected from water. If positioned at the bottom of the module, water can flow through the cable bushing and may cause the modules to malfunction.



Fig3. Right position of the junction box

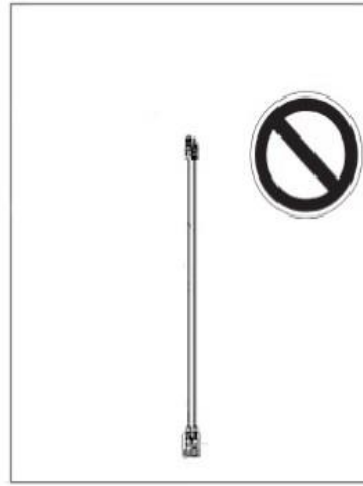


Fig.4 Wrong position of the junction box

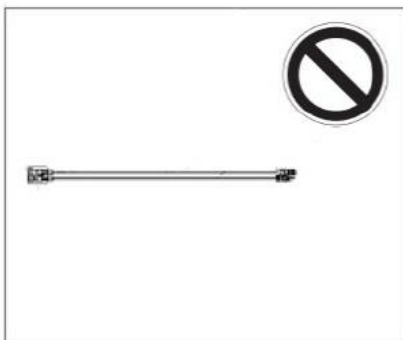


Fig5. Wrong position of the junction box

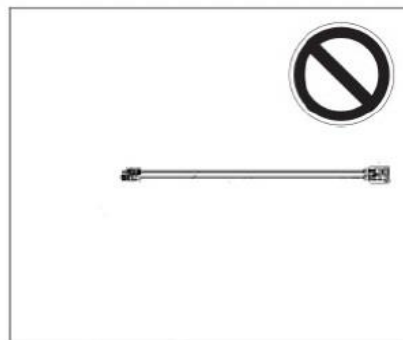


Fig6. Wrong position of the junction box

## 5.4 Mounting system

### 5.4.1 Parts of mounting system

For this configuration the maximum load is 2,400Pa/m<sup>2</sup>.

- The width of contact area must be a maximum of 14 mm and at least 12 mm. The clamp module surface contact length must be min. 1,300 mm on the long side and min. 80 mm on the short side. The clamps (including the elastic bedding) shall provide a nominal gap of 6.6 mm.
- Modules need to be set up on the lower edge and must be fastened linearly at both long sides in accordance with the support structure. A horizontal middle support is placed to enable center

fastening and to prevent non-admissible bending of the module. The horizontally positioned clamps guarantee that the module resists high wind suction loads.

The mounting system is described in Fig.7. In Fig.8 the shown clamps should be seen as examples. They should not be understood as standards, because other clamp dimensions are possible. All the other shown dimensions are mandatory to fulfill the Macsun Solar mounting requirements mentioned above.

All dimensions are shown in mm.

There are two kinds of clamps:

- End clamps (used at the end of the PV system field)
- Middle clamps (used between two modules)

Both clamps are shown in Fig.8. The dimensions of the final positions are shown in Fig.7. It is important to note that the dimensions of both clamps are mandatory in order to maintain Macsun Solar mounting recommendations.

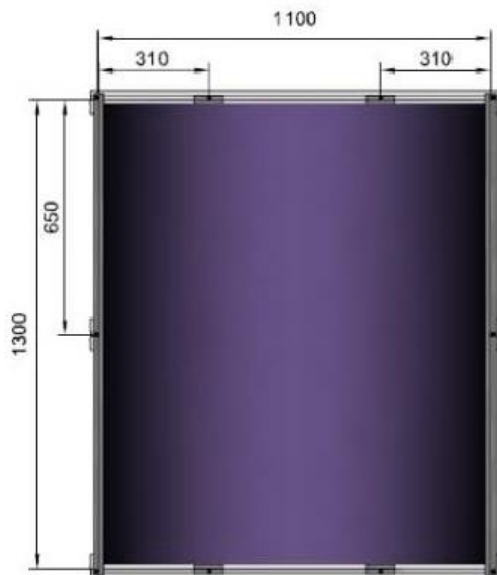


Fig.7 Assembled mounting

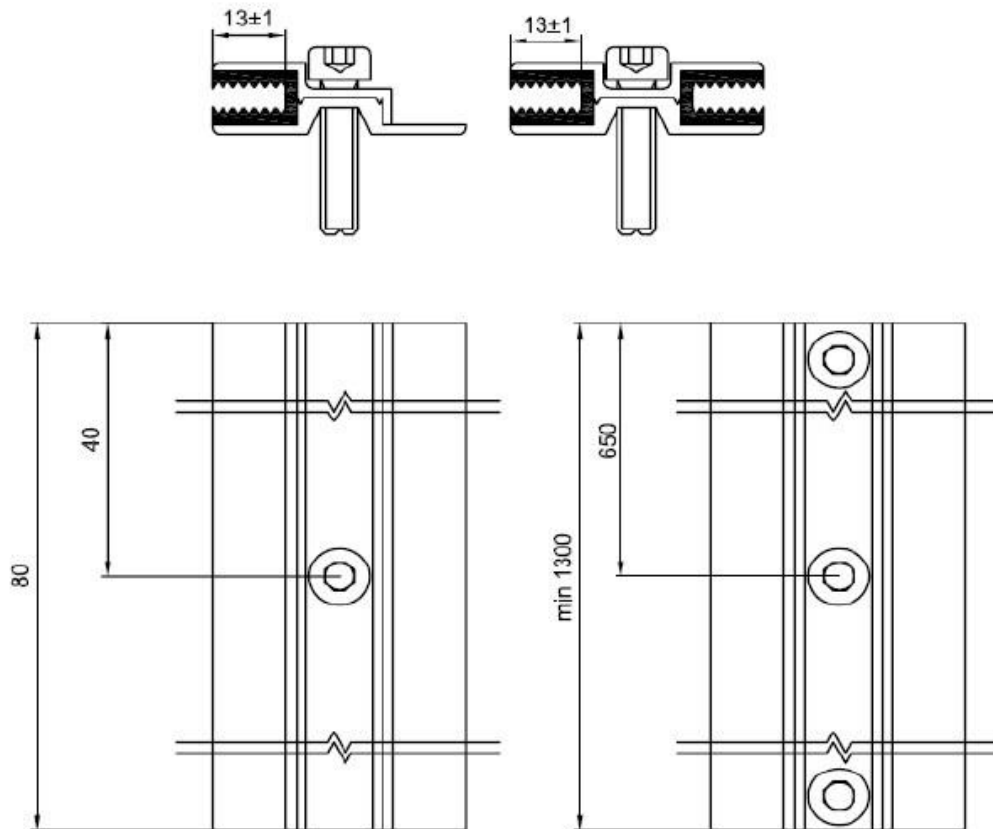


Fig.8 Clamp design configuration

#### 5.4.2 Tool for mounting system

Permitted tools:

- Cordless screw driver without impact feature.
- Warning: You have to limit the maximum torque.
- Short cranked wrench key.
- Screw driver.

Prohibited tools:

- Impact screw driver.
- Long cranked wrench key.
- Ratchet wrench.

#### 5.5 Procedure

A. Determining the necessary distance between the support rails of the substructure or framework.

The distance between the support rails is about 660mm (measured from middle to middle). The exact dimension will depend on the specific clamp design. The middle rail is called “middle support”. All rails are horizontally aligned.



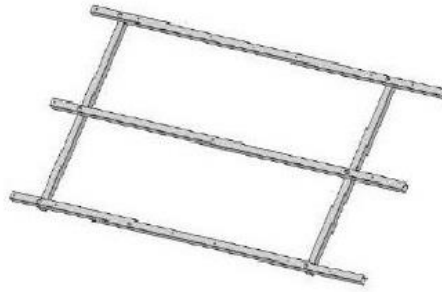


Fig.9 Support rail position

#### B. Positioning the bottom parts of the clamps.

Position the bottom parts of the clamps. The long side of the module will be completely supported by the clamps. You have to position the short clamps on the support rail. The dimensions are shown in Fig.7. The middle support requires additional rubber strips to protect the module under load. Use tape to fix the position of the clamps because they will not be finally tightened until you complete the last mounting step. Insert the nuts in the groove of the profile. They are required to tighten the clamps later.

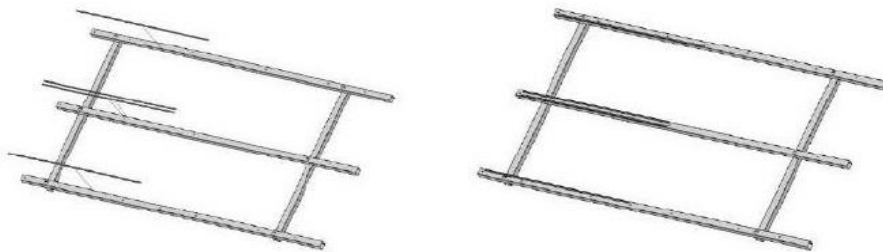


Fig.10 Rubber positions



Fig.11 Horizontal lower supporting clamps

#### C. Positioning the solar module

Place the module on the bottom clamp parts. Check that there is no contact between the module and the metal parts. All contacting surfaces have to be protected by the rubber. Two workers are always required to carry the module. Carry the module with extreme care.

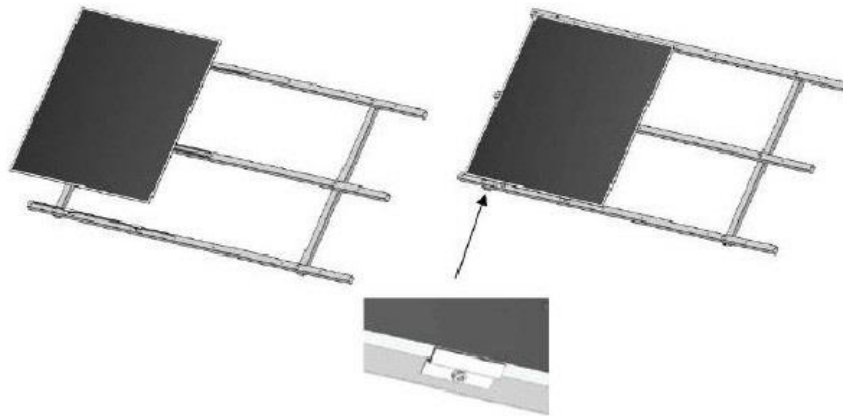


Fig.12 Module mounting

#### D. Mounting the top parts of the clamps

Mount the top parts of the clamps as shown in Fig.13. Then secure these parts with cylinder head screws. Tighten the screws to a torque of 12-14 N m.

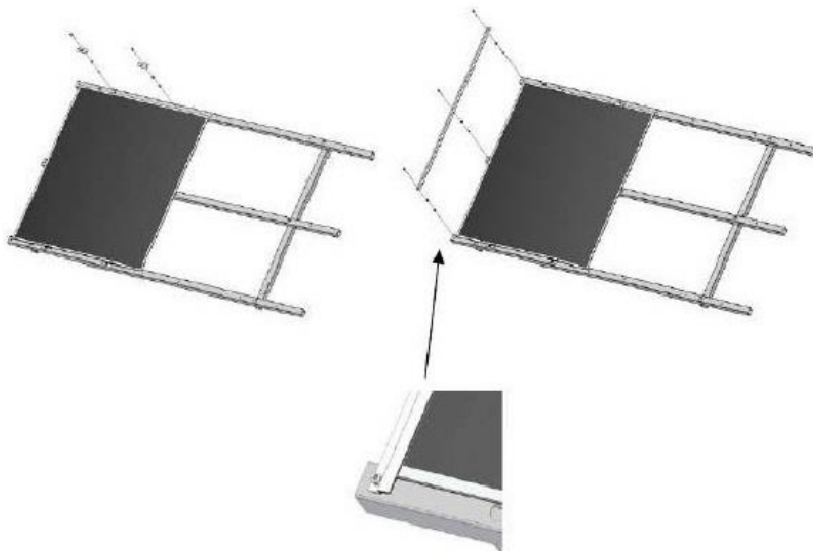


Fig.13 Securing the clamps

E. Repeat the same procedure for the next modules. For middle panels, use the middle clamps. They will secure two modules at the same time.

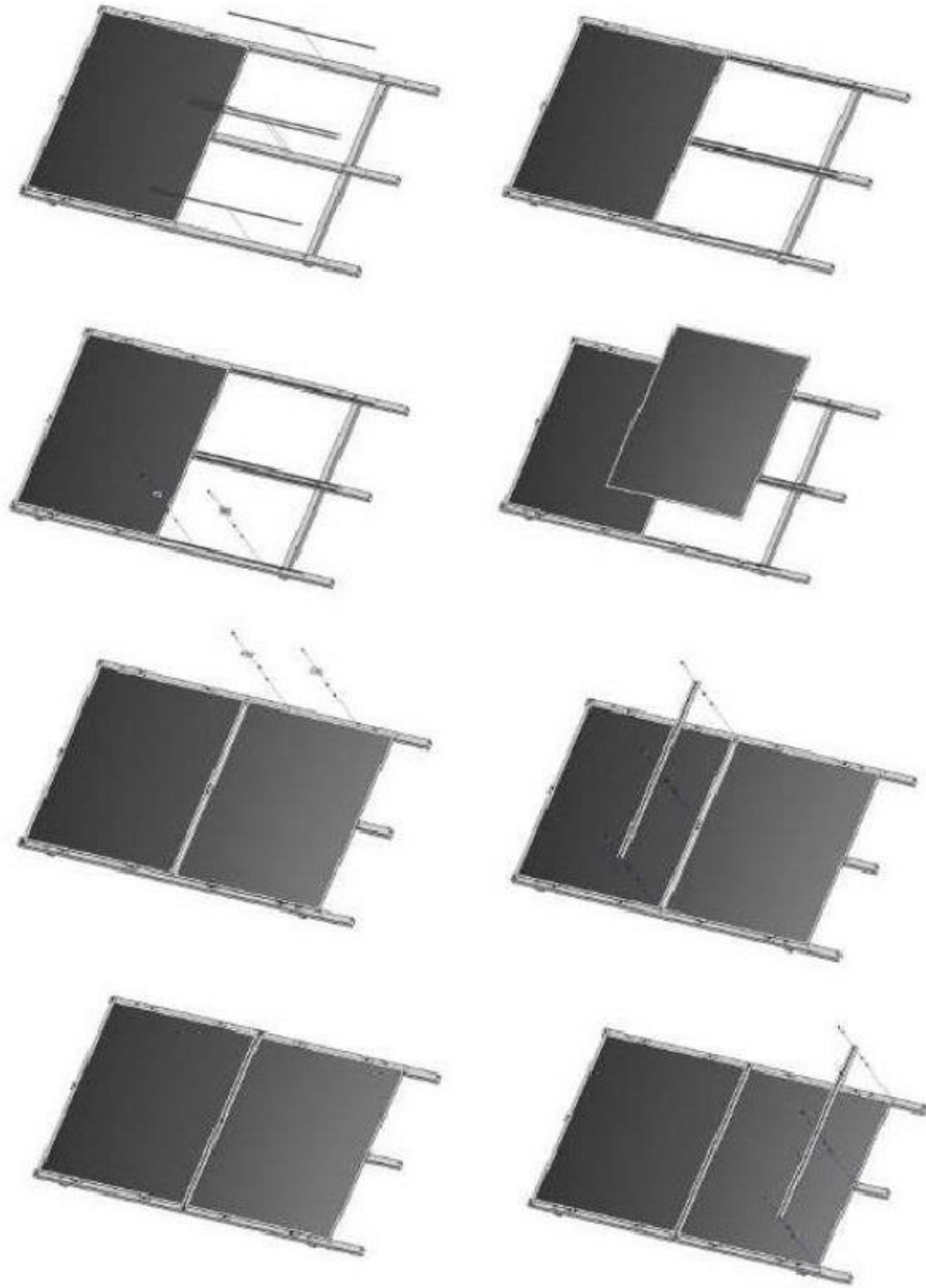


Fig.14 Repeating step1-4

### 5.6 Example

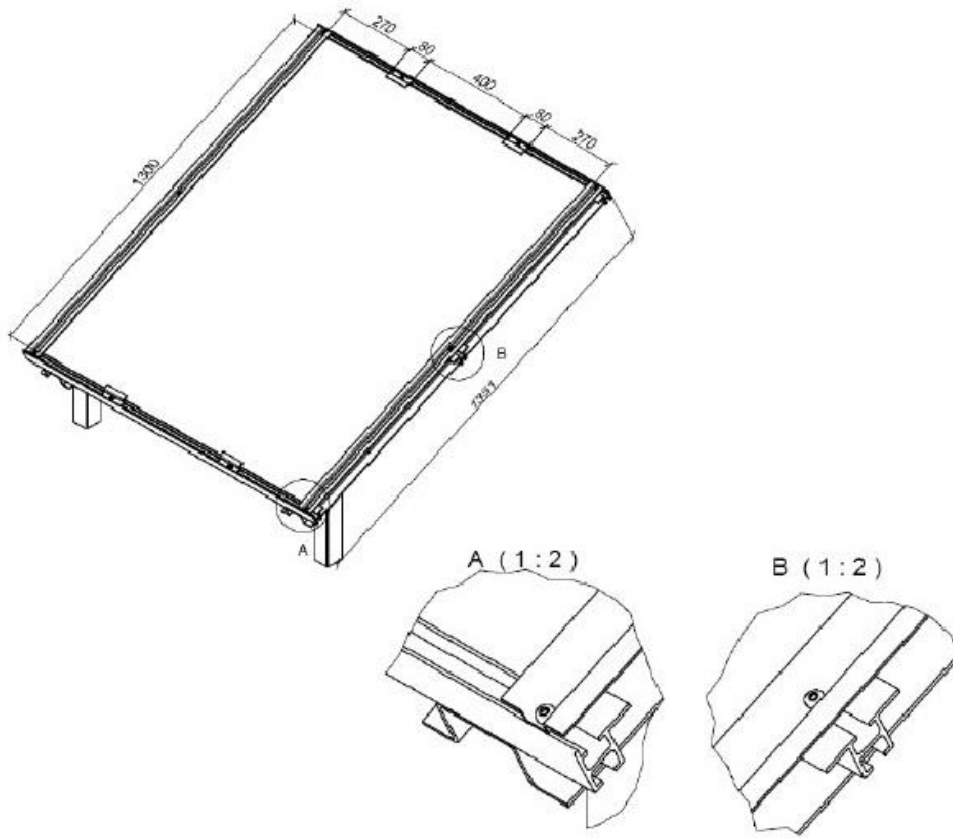


Fig.15 Example

Examples of a mounting system without and with a solar module



Fig.16 Mounting system without solar panel



Fig.17 Mounting system with solar panel

## 6. ELECTRICAL RATINGS

### 6.1 Electrical Characteristics at STC (1000W/m<sup>2</sup>, 25°C, AM1.5)

Module Type <sup>+</sup>		MS-SD120 <sup>+</sup>	MS-SD125 <sup>+</sup>	MS-SD130 <sup>+</sup>	MS-SD135 <sup>+</sup>	MS-SD140 <sup>+</sup>
Initial <sup>+</sup> Values <sup>+</sup>	$P_m(W)^{+}$	134.83 <sup>+</sup>	140.45 <sup>+</sup>	146.07 <sup>+</sup>	151.69 <sup>+</sup>	157.30 <sup>+</sup>
	$V_{oc}(V)^{+}$	73.18 <sup>+</sup>	73.70 <sup>+</sup>	74.16 <sup>+</sup>	74.72 <sup>+</sup>	75.16 <sup>+</sup>
	$I_{sc}(A)^{+}$	2.76 <sup>+</sup>	2.80 <sup>+</sup>	2.85 <sup>+</sup>	2.89 <sup>+</sup>	2.93 <sup>+</sup>
	$V_{mp}(V)^{+}$	56.41 <sup>+</sup>	57.56 <sup>+</sup>	58.90 <sup>+</sup>	59.72 <sup>+</sup>	60.73 <sup>+</sup>
	$I_{mp}(A)^{+}$	2.39 <sup>+</sup>	2.44 <sup>+</sup>	2.48 <sup>+</sup>	2.54 <sup>+</sup>	2.59 <sup>+</sup>
Stable <sup>+</sup> Value <sup>+</sup>	$P_m(W)^{+}$	120 <sup>+</sup>	125 <sup>+</sup>	130 <sup>+</sup>	135 <sup>+</sup>	140 <sup>+</sup>
	$V_{oc}(V)^{+}$	72.45 <sup>+</sup>	72.96 <sup>+</sup>	73.42 <sup>+</sup>	73.97 <sup>+</sup>	74.41 <sup>+</sup>
	$I_{sc}(A)^{+}$	2.68 <sup>+</sup>	2.72 <sup>+</sup>	2.76 <sup>+</sup>	2.81 <sup>+</sup>	2.86 <sup>+</sup>
	$V_{mp}(V)^{+}$	51.50 <sup>+</sup>	52.74 <sup>+</sup>	53.94 <sup>+</sup>	55.56 <sup>+</sup>	56.91 <sup>+</sup>
	$I_{mp}(A)^{+}$	2.33 <sup>+</sup>	2.37 <sup>+</sup>	2.41 <sup>+</sup>	2.43 <sup>+</sup>	2.46 <sup>+</sup>
<b>Over-current protection rating :6A<sup>+</sup></b>						

**Over-current protection rating :6A**

## 7. MECHANICAL CHARACTERISTICS

Size <sup>+</sup>	L1300mm x W1100mm x T6.8mm (Without Junction Box) <sup>+</sup>
Weight <sup>+</sup>	25kg <sup>+</sup>
Encapsulation Material <sup>+</sup>	White EVA <sup>+</sup>
Front Panel <sup>+</sup>	Float Glass, extra white, 3.2mm <sup>+</sup>
Rear Panel <sup>+</sup>	Float Glass Annealed, 3.2mm <sup>+</sup>
Snow / Wind Load <sup>+</sup>	2400Pa <sup>+</sup>
Cell Type <sup>+</sup>	Tandem Junction Cell (a-Si / uc-Si) <sup>+</sup>

Cross contact feedthrough	1 hole D=15mm (position: 550mm,103mm)
Cross contacting wire	4mm ×0.08mm core, Tin coated
Longitudinal contacting wire	2mm ×0.08mm core, Tin coated
Isolation line short side	14mm
Isolation line long side	13.6mm
Dead zone P1-P3	250um
Number of active cells	165
Cell width	6.446mm
Module storage temperature	-40°C up to 85°C

## 8. ELECTRICAL INSTALLATION

### 8.1 Installation layout: Series/Parallel connection

#### 8.1.1 Series connections

If the modules are connected in series, the overall voltage may reach high values. When this type of layout is used, the equivalent voltage is the sum of the voltages of each individual panel. Modules which are connected in series must have identical current characteristics.

Do not connect different types of modules directly in the same string.

Do not exceed the maximum inverter voltage. The overall voltage must always and, in any case, be less than the maximum system voltage and lower than the inverter maximum input voltage.

#### 8.1.2 Parallel connections

For applications which require high levels of current, modules can be connected in parallel and the overall current will be equal to the sum of the currents of each panel.

Parallel connections can only be set if module voltage characteristics are identical. A parallel connection is allowed for a maximum 3 strings. If the installation requires a greater amount of strings connected in parallel, then a protective device (e.g. blocking diode or fuse) is required every 3 strings.

### 8.2 Connectors and cables

Modules may be connected in series and/or parallel to achieve the desired electrical output as long as certain conditions are met. The definitive number of modules connected in parallel depends on the plant topology (inverter sizing according to best known practice, protection means, etc.). If no particular protection is foreseen, no more than three modules or strings respectively should be connected in parallel. Never exceed the limit of 1,000V on connected modules (see also maximum reverse-current protection of 2 times  $I_{sc}$ !). Use blocking diodes or fuses at the head of the strings to reverse current protection when more than 3 strings are connected in parallel.

- Wiring and the grounding method for array frames must be in accordance with the local electrical code.
- Installation must be in accordance with local safety standard for electrical Installations.

Important! For optimal performance, the modules must only be used in configurations where the negative polarity of the PV module is connected to ground (use of inverters with transformers with negative grounding). Failure to comply with this requirement will reduce the performance of the system and void Macsun Solar warranty for the modules.

- See Chapter 8.4 Inverters for other configurations such as transformerless inverters.
- Only connect solar power modules in series when they are of the same type and power category.
- It is not necessary to open the connector box with cables connected at the factory for electrical switching of the solar power modules!
- The solar cables are equipped with the Multi-Contact compatible (MC4) solar-lock pin-and-socket connector system for PV. When mounting modules, to minimize the ingress of water, make sure the junction box is installed at the top of the module.
- The plugs are marked with the respective polarity as shown in Fig. 18. The MINUS pole is minus-coded; the PLUS pole is neutrally coded.



Fig.18 Electrical connectors

- If additional cables are needed, only use appropriate cables.

Be absolutely sure to observe the polarity of the module. Reverse polarity might cause destruction of the protective devices!

### 8.3 Grounding and potential equalization

To avoid electrical shock, ground the substructure of the module before wiring the circuit using a grounding method that meets the appropriate standards (IEC 61730 or UL1703) or directive requirements for grounding solar electrical systems. Correct grounding means the substructure has the same voltage potential as earth ground and the substructure must be electrically isolated from any live, current conducting parts by reinforced insulation.

**Warning:** Incorrect grounding may cause risk of fire hazard!

For transformer inverters, the current through this ground connection must be limited to 20mA in order to protect the system from ground leakage current in the case of isolation failures (e.g. in case of module glass breakage).

One possibility to achieve this current limitation is by installing a  $\geq 50\text{k}\Omega$  resistor (considering 1,000

VDC max system voltage) between the negative pole and ground. Make sure to use a resistor for which the manufacturer provides a ground kit complying with above provisions.

Direct grounding with a direct connection of pole and earth is prohibited.

See Chapter 8.4 for information about transformerless inverters.

## 8.4 Inverters

Inverters convert direct current into alternating current. Inverters of the latest generation, with MPPT (Maximum Power Point Tracker), optimize the production, even in situations of weather changes or variable sunlight.

Suitable inverter configurations:

- Central inverters
- String inverters
- Multi-string inverters
- Inverters on single module level

Not all inverters without transformers can be used. Please contact the manufacturer of the inverter for further information.

This document does not provide performance comparisons between inverters or a recommendation of a specific inverter manufacturer. This document provides a general overview of the key characteristics that should be considered when evaluating inverter options as follows:

### **Attention:**

Inverters with a transformer can be used in the conjunction with clamps.

## 9. MAINTENANCE

### 9.1 Shutting down the PV power plant

For shutting down your PV power plant or PV array, refer to manual provided by your inverter manufacturer.

### 9.2 Checking the solar modules

The following must be checked once a year.

Check for glass cracks and chip outs. If the solar module has a crack, replace it.

Check for damages. If the solar module is damaged, replace it.

Check the connection between the junction box and the back glass of the module. The box must be completely bonded to the surface of the back glass.

The following measures may be required.

Check for dust and dirt. If necessary, clean the module.

In winter, if necessary, you must clear snow from the solar modules. If there is a large amount of snow,



remove the snow from the solar modules. The maximum allowed load is 2400Pa/m<sup>2</sup> (ca. 245kg/m<sup>2</sup>).

This will protect your modules from damage. Use a brush to remove the snow.

### **9.3 Cleaning the solar modules**

Use only water and a clean cloth to clean the modules. Do not use any chemicals or sharp tools to remove dirt.

Clean the modules during the coolest hours of the day to avoid thermal stress and consequent mechanical stress with risk of breakage.

### **9.4 Checking the mounting system**

Check that all connections are tight

Check all polymer parts for cracks. If they have cracks, replace them.

### **9.5 Checking the wiring and cable connection**

The following must be checked once a year. This check has to be done by a qualified technician.

Check all cable connections for correct fit. If the connectors do not fit properly, switch off the PV field and connect the connectors correctly. If the connector is damaged, replace it.

Check all wires for damage. If the wire is damaged, switch off the PV field and replace the defective wires.

## **10. DISPOSAL**

If the product or any of its components require disposal at the end of their service life, please comply with the specific disposal criteria defined by local regulations.

Disposal Options are:

Dumping

Incineration

Recycling (e.g. PV Cycle)

Reuse as fiber glass

The manufacturer operates in conformity with the local directives.

For example, the directive adopted by European Community member states: Directive 2002/96/EC, regarding the management and recycling of waste of electrical and electronic equipment (RAEE).

The product is marked with the following symbol, indicating the need for separate waste:



Fig.19 Separate waste symbol

The product may not be disposed as normal urban waste. The module components must be appropriately classified and accordingly collected for disposal in proper collection sites as provided by local authorities. Failure to comply with these regulations may result in administrative and legal sanctions.

## **Macsun Solar Energy Technology Co.,Limited**

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