



Micromorph Thin-Film PV Panels

Rev. 13

INSTALLATION INSTRUCTION GUIDE

Frameless Thin Film Photovoltaic Panel



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1. Safety Information

1.1 Warnings

The PV panel produces electricity when exposed to the sun light or other light source. For your safety and the safety of others, ***please read the entire document carefully prior to the procedure of installing and wiring.*** Also, carefully read the panel data sheet provided with the product. Determine local permits, installation and inspection requirements before installing panels.

The manufacturer assumes no liability for damages incurred due to non-compliance of these instructions. Please also observe the instructions for the other components which make up the total PV system.

1.2 General

- DO NOT attempt to disassemble the panel.
- DO NOT remove any attached nameplates, serial number or components on the panels.



DOING SO WILL VOID THE WARRANTY!!

- DO NOT disconnect under load.
- DO NOT use mirror or other tool to artificially concentrate sunlight onto the Panel.

1.3 Working Safety Instruction

Be familiar with the basic principles of electricity and electrical equipment. Properly use insulated tools and appropriate protective equipment such as safety shoes and work gloves as well as protection goggles. Obtain and use a voltmeter for all systems where there is more than one panel in series.

The AURIA thin film panels are glass-glass panel (this means both the front and rear are made of glass) and must be treated as such.

- (1) Keep the panels in the delivered carton box until it is ready to be mounted, and do not place the panels under constant movements or vibrations.
- (2) **DO NOT** put strong pressure or stand on the panels surface and avoid bending forces.
- (3) Always ensure NO flammable gas near by the panels.
- (4) **DO NOT** pull at the connection cable, damage the connection cable by cutting, trapping it in the mounting frame, or bending severely. And the connection socket on

the rear of the panel must not be re-modified.

- (5) Ensure that the solar connector is not able to come into contact with water or moisture when storing or mounting the panel.
- (6) The panels must be mounted in such a way that they are not standing in water
- (7) Cover panel surface(s) completely with opaque material to halt the production of electricity when working on system installation.
- (8) **Disconnect** panel(s) from other sources of electricity, such as batteries or inverters, when working on system installation.
- (9) Exercise extreme caution when working on wiring up and including the inverter installation.
- (10) For safely and appropriately mounting the panels, please mount the panels with proper tool.
- (11) Avoid contact with terminals when panels are exposed to light. **DO NOT** remove any parts originally installed or disassemble the panel.
- (12) **NEVER** walk, sit, put anything or do any dangerous activity on the panel.
- (13) Please check the circuit arrangement before assembling the panel in order to ensure the max. power output.
- (14) **DO NOT** attempt to install or use a panel with broken or damaged glasses.
- (15) It is not permitted to use any tool to artificially concentrate sunlight onto the panel surface.

The panels are compliant for application *class A*: Hazardous voltage (*IEC 61730*: higher than 50Vdc; *EN 61730*: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated (Panel are compliant for safety through *EN IEC 61730-1* and *-2* within this application class are considered to meet the requirements for safety *class II*).

1.3.1 Unpacking the panels and storage:

External packaging of *AURIA* micromorph thin film solar panels is only considered complete with all the following packaging components.(see figure 1 of page 4) and a thorough examination before unpacking the carton box is necessary.

The packaging information of *Auria C series* panels are listed as below.

Auria Modules	Net Weight (kgs)	Gross Weight (kgs)	Carton Dimensions (mm)	Q'TY per Carton Box	Q'TY per 20 feet container	Q'TY per 40 feet container	Q'TY per 40 feet HQ container
M Series	690	775	1460 x 1150 x 1280	30pcs	240pcs	480pcs	900pcs

After unpacking the external packaging, each Auria panel can be found to be placed in each individual slot and fixed with partition from top as double protection.(see figure 2 of page 4)



Figure 1 : Outlook of complete packaging

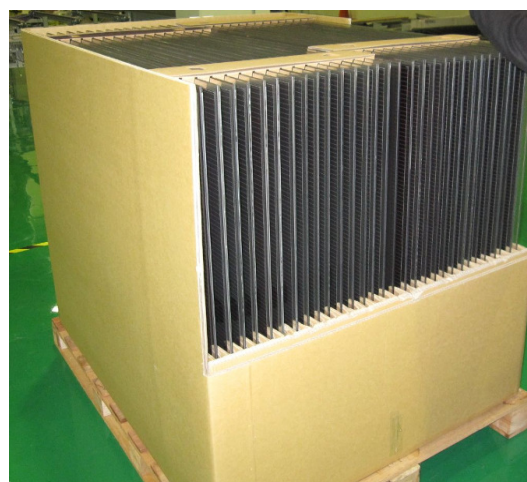


Figure 2 :Internal packaging

Extreme care is required when handling solar panels including unpacking, transporting and storing the panels :

- Transport panels in vertical position and carry panels with both hands **(DO NOT use the connection socket as a handle)**.
- Make sure panels are not bowing under their own weight and **DO NOT** place panels on the others.
- DO NOT** mark using sharp tools and keep all electrical contacts clean and dry.
- Auria panels should be stored in the carton box in indoor space with room temperature of $20 \pm 2^{\circ}\text{C}$ and humidity of $65 \pm 2\%$.

1.3.2 Eliminating Electrostatic Discharge (ESD)

Purpose

The process of Eliminating Electrostatic Discharge (ESD) based on the following procedures in order to ensure *optimized* performance of Auria panels.

Procedure

Methods and steps to ground each of Auria panels after unpacking can be seen below.

1. Use metal wire (or conductor, A point) connected to a ground point (see blue dash square in Figure 1).
2. Use another metal wire (or conductor, B point) to connect each panel after unpacking as shown in Figure 2.

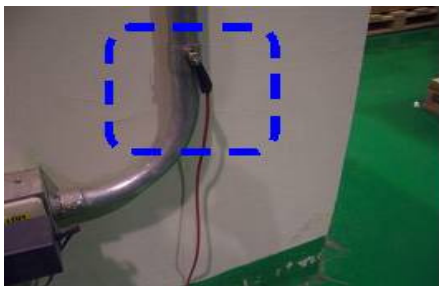


Figure 1

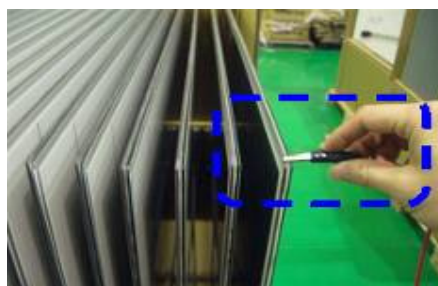


Figure 2

1.3.3 Idle Voltage

Working on uncovered solar panels is working under current. As light meets the solar panel, you can expect full idle voltage at the cable ends of the panel or the cable ends of the switched strings. The more panels switched in series the greater the idle voltage.

Number of panels x Panel idle voltage = **Overall voltage**

The maximum permitted system voltage of the solar generator and the maximum permitted *DC* voltage of the inverter may not be exceeded by overall voltage.

CAUTION!!!

The cabling, connections and implementation must only be carried out by electronic specialists.

For the alternating current connection to the public supply network (cabling between the inverter and the house connection and the mounting of the supply meter in a *NEC* suitable meter requires the electrician to be authorized by the appropriate power supplier/mains operator.

2. Panel Introduction

Appearance of Panel (All dimensions refer to the frameless panel)

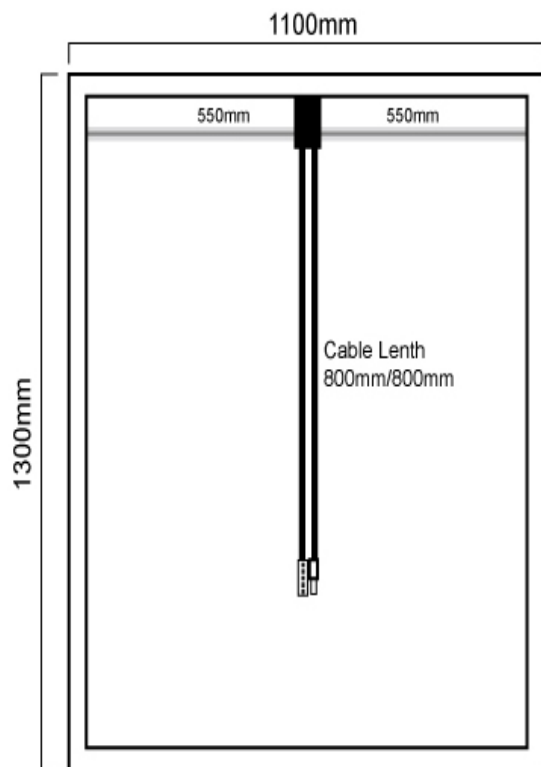
2.1 Micromorph Thin Film Panels

Dimension (W xL): 1,100 *mm* x 1,300 *mm*

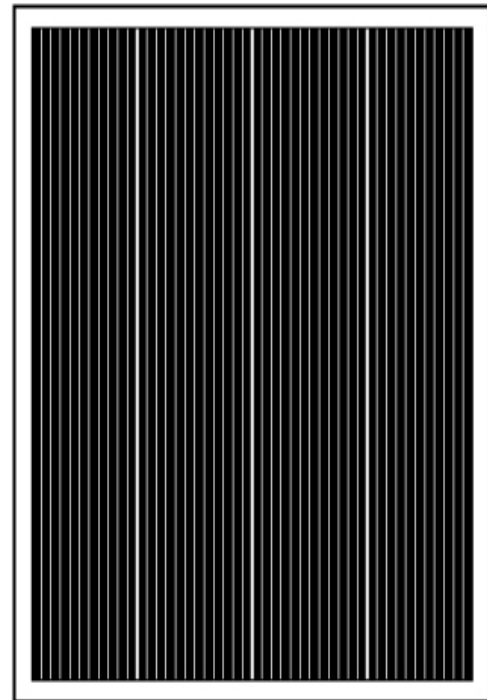
Surface Area 1.43 *m*²

Net Thickness 6.8 *mm* (without junction box)

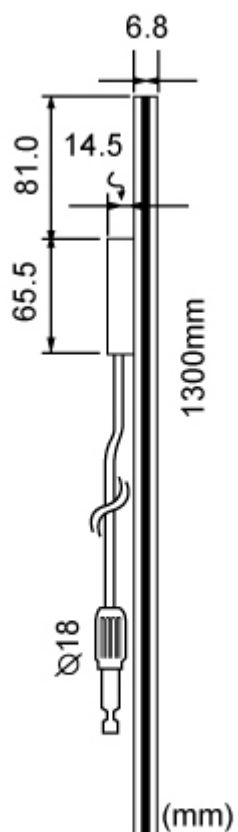
Net Weight 23 *kg*



Rear view

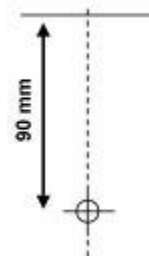


Front view

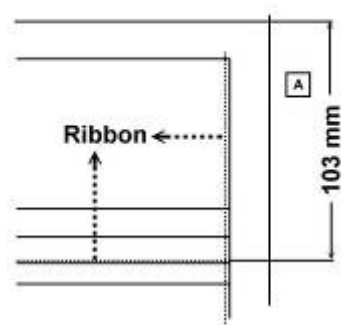


Side view

Detail A



Detail B

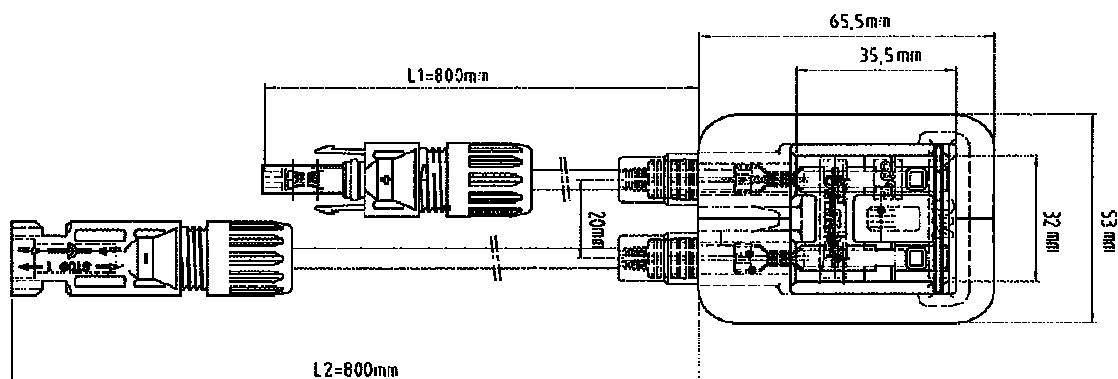


2.2 Appearance of Junction Box

Junction Box : MC4 Compatible, with Bypass Diode

Maximum System Voltage : 1000 V (Pole to Ground)

600 V (Pole to Pole)



Plug MC4 (4Φ) Compatible



FEMALE(MINUS)



MALE(PLUS)



WARNING!! NEVER disconnect or connect the pin-and-socket connections under electrical load!!



WARNING!! NEVER connect the MALE and FEMALE (short circuit) of single panel or multiple panels in series!!



WARNING!! When the wires from junction box needed to be settled in the cable tray, Never pull the wires straightly or exert a extension force to fix them, which might cause the peeling of junction box.

3. Planning Notes

3.1 Place of Installation

Environmental influences at the place of installation may have a negative effect on the performance of the unit or cause damages to the panels. This includes, for example, aggressive fumes as can be found in the vicinity of chemical plants, but also in agriculture near, pig sties, chicken runs and in the vicinity of open liquid manure storage. For safety reasons the panels may also **NOT** be used in the vicinity of easily flammable gases.

3.2 Mains Feed

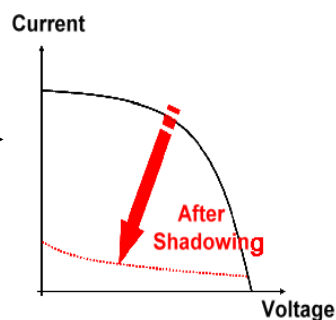
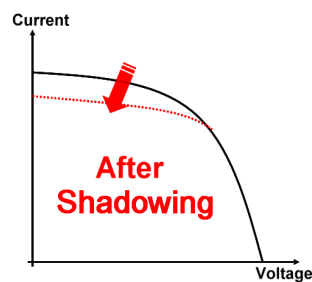
The feeding from the inverter into the public network must be carried out by an authorized specialist. The connection conditions of the relevant supply company must be observed.

3.3 Solar Panel

All panels to a given inverter should have the same orientation and the same angle otherwise this may lead to loss of performance. The entire generator field should be free of shadows and thus take into account the lowest height of the sun in winter. Even minor partial shadows can have a considerable effect on performance.

3.4 Panel install Orientation

Case A



Case B

1. The best way for user to get the maximum power output is to install the panels in the

location without any shadowing.

2. The above two cases (*A and B*) show that if the panels cannot avoid the shadowing effect, what can be done for having a better power output is putting the panel in the position shown as in Case A, that means when install the panels, their laser scribed line must run vertically with respect to the ground, i.e. solar panels need to be set up on lower edge
3. **DO NOT** put panels close to any dangerous place with flammable gas.
4. Inclination angle of the panels should be **> 10 degrees** for the purpose of self-clean by raining. A reference for inclination angle is shown in following table.

Site Latitude	0°~ 15°	15°~ 25°	25°~ 30°	>30°
Fixed tilt Angle	10°~ 15°	The same as Latitude	Latitude + 3°	30°~ 35°

5. Artificially concentrated sunlight shall not be directed on the panel.

3.5 Electrical Connections

Panels 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 parallel connected panels depends on the plant topology (inverter sizing according to known practice, protection means, etc.).


⚠ NOTE! Under normal conditions, a photovoltaic panel is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions, i.e. sunny, cool weather and reflection from snow and water can increase current and power output. Accordingly, the values of I_{sc} and V_{oc} marked on this panel should be multiplied by a factor of **1.25** when determining component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output.

⚠ Important!!! Blocking diodes or fuses at the head of the strings shall be used for reverse current protection when more than 2 strings are connected in parallel. If no particular protection is foreseen not more than 2 strings respectively should be connected in parallel. NEVER exceed the limit of 1000 V on connected panels (maximum reverse-current protection of 9 Amps!), but do not exceed maximum DC input voltage of inverter.



Important!!! For optimal performance, *AURIA SOLAR* panels must only be used in configurations where the negative polarity of the PV panel is connected to ground (***use of inverter with transformers with negative grounding***).

Failure to comply with this requirement will reduce the performance of the system and invalidate *AURIA SOLAR* warranty for the panels.

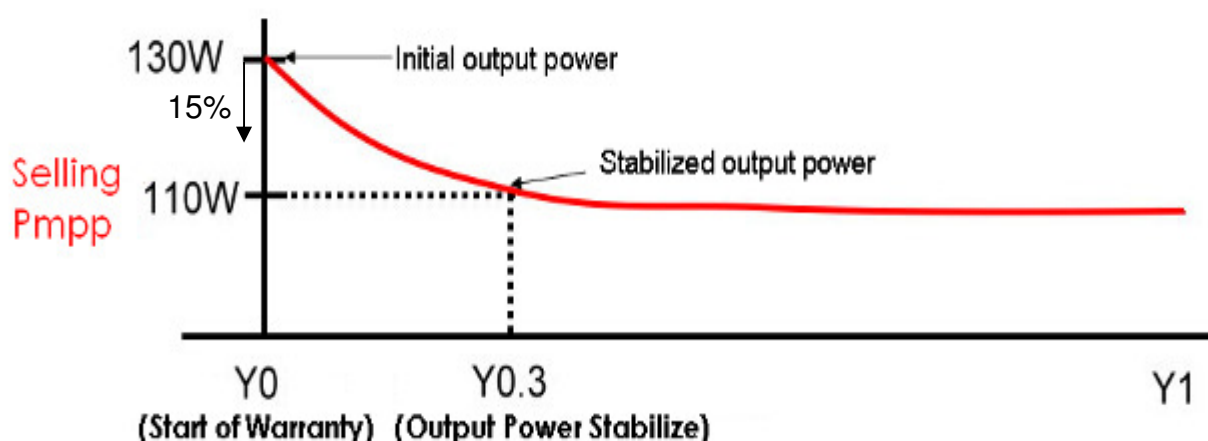
- a) **ONLY** connect series solar power panels of the same type and power category.
- b) The solar cables are equipped with the *MultiContact* solar-look pin-and-socket connector system for *PV*.
- c) Be absolutely sure to observe the panels' polarity. Reverse polarity might cause destruction of the protective diodes.
- d)  **Warning** According to the provisions of the *National Electrical Code*, grounding work and wiring connections to the inverter should be performed by a qualified electrician.

Notice 1 : Max System Voltage: 1000 V (Pole to Ground)
600 V (Pole to Pole)

Notice 2 : The initial value for the output power of panels is higher than the nominal values. Please take it into account when you choose inverter.

Light Induced Degradation (*LID*) factor : 15%

Stabilized output power = Initial output power * (1-*LID* factor)



Notice 3 : The number for series or parallel connecting of panels should be under the limited numbers with safety capacity of electrical power.

And please make the design based on stabilized parameters.

4. Handling the panel

4.1 Mounting/Fixing

AURIA thin film panels are designed for roof, façade and open space systems. AURIA Solar bears NO responsibility for any damage caused by the use of unsuitable or inappropriate mounting/fixing systems. Before starting with the mounting process, the strength of mounting/fixing structure on the panel field must meet the local loading condition. *i.e.* wind, snow, earthquake, and so on.

The frameless panels must not be clamped directly using metal clamps, **ONLY** laminated clamps which hold both sides of the panel in water-proof uv-resistant rubber can be used. (a rubber material named “**EPDM**” *Ethylene Propylene Diene Monomer* is recommended)

The stainless bolts and nuts used to fix the clamps or plates onto solar panel should not be less than **M8** size.

The tightening torque pressed on clamps should be in between **5.9~6.6 lbf-ft (8~9 N-m)** as suggestion, never exceed **7.37 lbf-ft (10 N-m)** to avoid breakage of panel surface.

Variable I: An example structure of mounting system, which has passed TÜV test under 2,400 Pa is shown below:

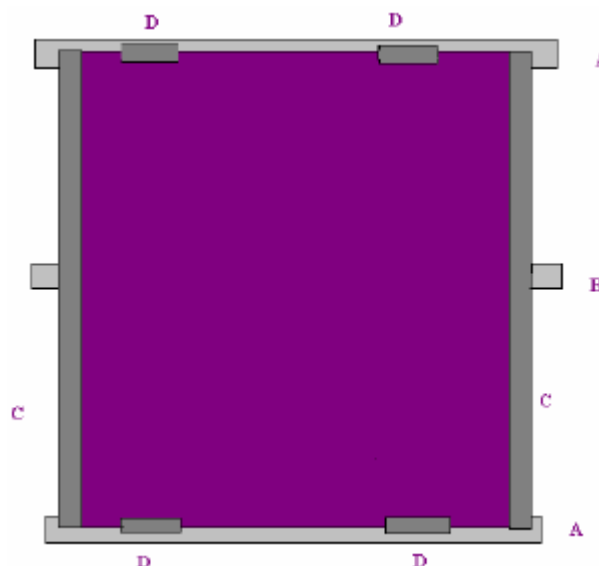


Fig. View on the two-sided linear fixation set-up

(a) Support frame of the substructure (b) Middle support of the substructure (horizontal) (c) Linear fixing element (vertical) (d) Horizontal holding clamps

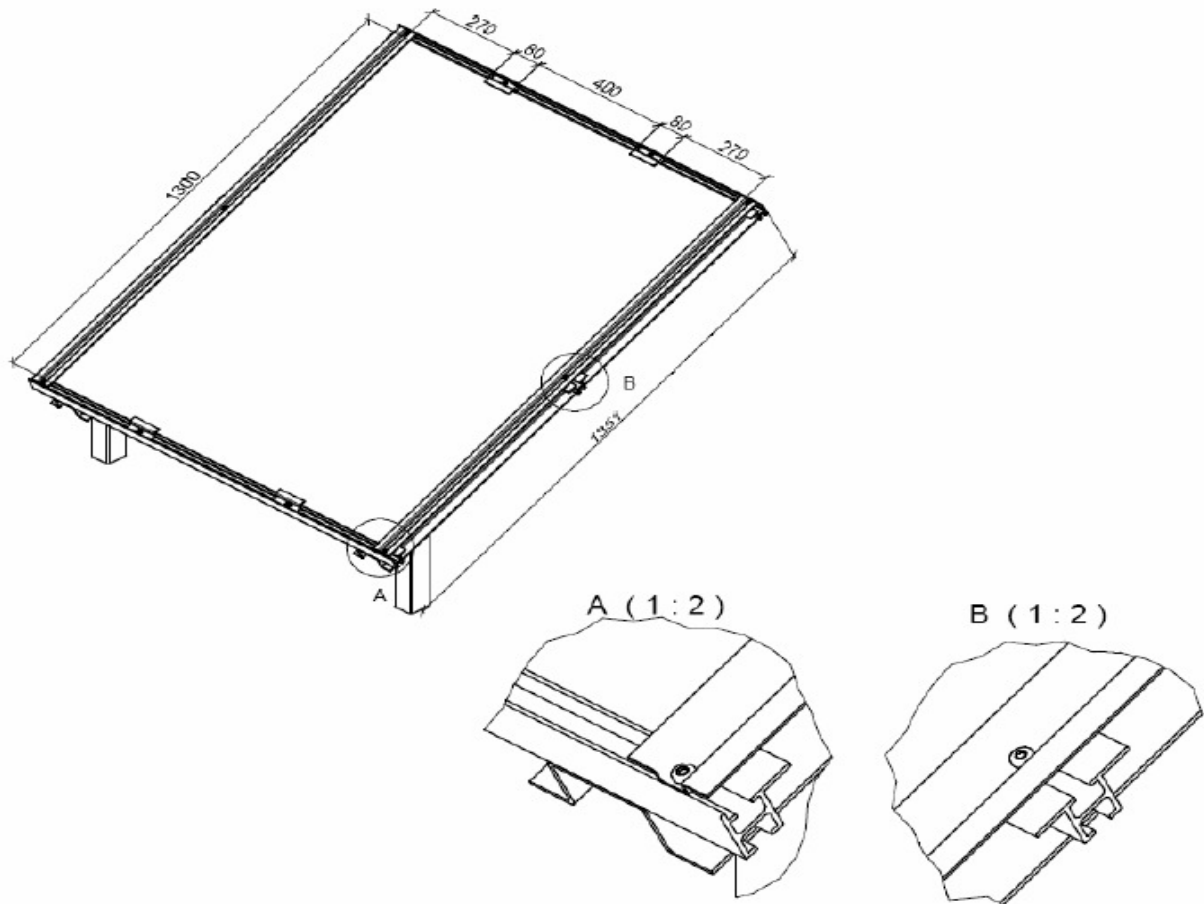


Fig. Mounting Configuration

1. 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 the center fastening and to prevent non-admissible bending of the module. The horizontally positioned clamps guarantee that the module resists high wind suction loads.
2. The mounting assembly and the undercarriage must be appropriately dimensioned and adapted to the in-situ environmental conditions so that the admitted maximum bending/deformation is not exceeded in relation to the edge length of the module, if loading of $L/100$ (13 mm, respectively 11 mm) occurs. No buckling/twisting of more than 30 mm across the module diagonal!
3. Modules must be stead-fastened and in a durable elastic bedding. All direct contact of the glass/solar module with metal parts of the substructure must be prevented.
4. The clamps/width of contact must have a maximum of 12 mm and at least 10 mm.
5. The solar module should be run at stress- and force-free conditions, so make sure if the structure underneath is in a plane.
6. Accumulation of water at the solar module must be prevented; might cause corrosion on the panels and on the adhesive bonding (PVB foil between front and back glass)

and can cause glass blinding and impairment to the adhesive bonding.

7. Dimensioning the undercarriage, particular care should be taken of the various thermal coefficients for the used material.
8. Observe the specified fixation points at the approved mounting assemblies (tightening torque for screws, positions of the drilled holes).

Variable II:

Another solution to mount frameless solar modules is shown below:

1. The long side of panels will be supported by extrusion aluminium (gray parts).
2. The margin of panel (light blue part) will be enveloped by C-shaped EPDM.
3. Two 1-meter long aluminium clamps (orange parts) will be fixed upon the panel and screwed with 5 screws (min. *M8 size*) on each side.

With such fixing configuration, the panel can stand for 2,400 *Pa* loading test in one hour.

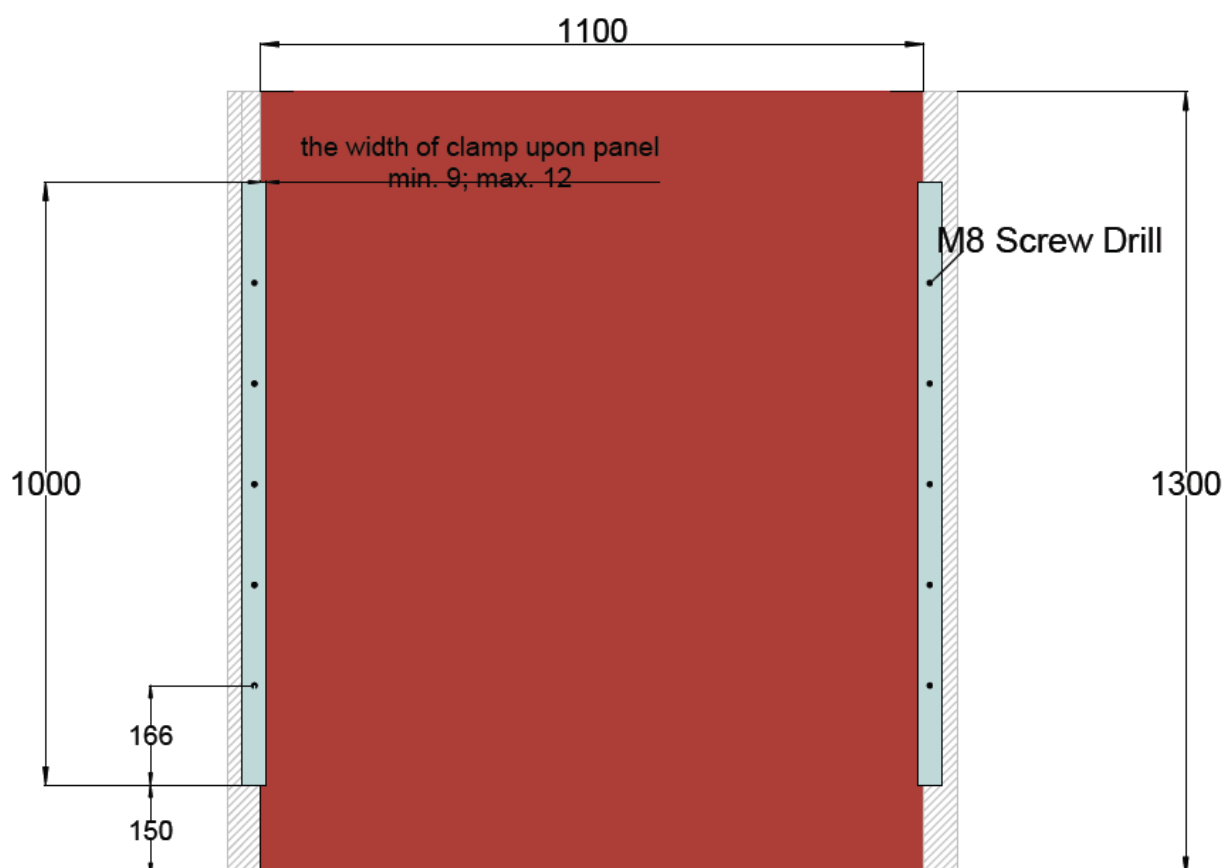


Fig. Configuration of the mounting method-variableII

⚠ Important!!!

- A. When selecting the clamps of the mounting system, thickness of the panel/glass should be taken into account.
- B. If the frameless glass-glass panel is compressed too much, the glass may break.
- C. ONLY use rust-free materials like **anodized** aluminum or stainless steel to mount or fix the panels.
- D. Beware of the working tools DONOT hit on the surface or edge of panels during installation.
- E. Slide the panels **gently towards** previously panel in horizontal direction.
- F. DO make sure the clamps are not mounted on **active area of solar panel**; otherwise, it may cause loss to the panel performance and energy yield. **9~12 mm** is recommended.
- G. An improper mounting of panels caused breakage of panel (red circled).

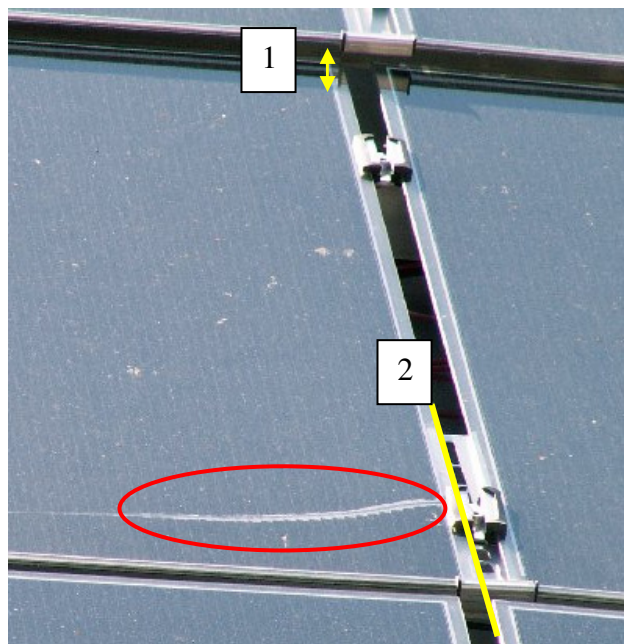
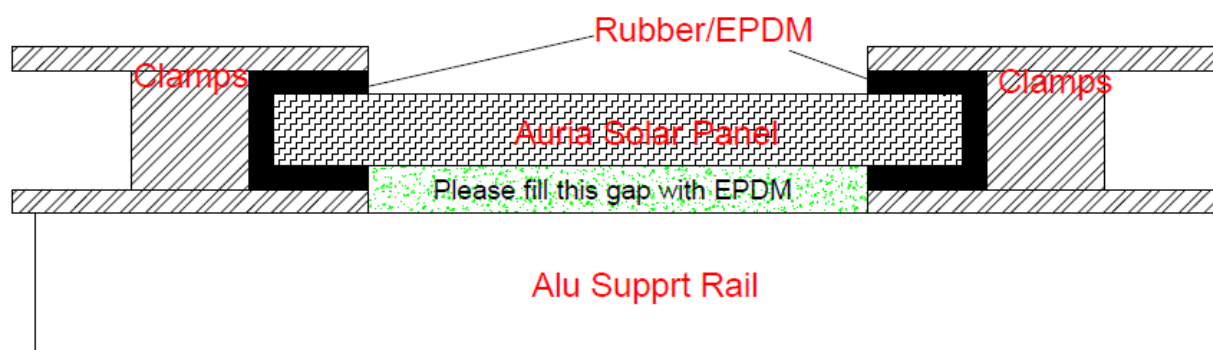


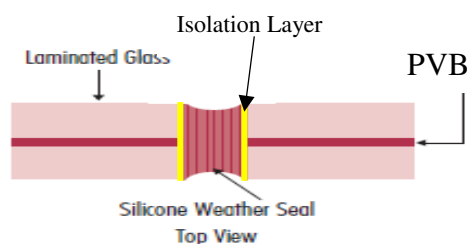
Fig. Improper Mounting System might cause damage of panels

- 1. Make sure that the fix structure under panels is built in a plane, so that the panels will not be bended or twisted.
- 2. Make sure the panels and clamps are seat exactly on fix structure.

Note!! If *other clamp solutions* are applied on the mounting, please fill the gap between support rail and panels to enhance the supporting for panel. As shown below:



Note!! If *silicone sealants* are used to seal the gap between panels and metal parts, please make sure that the *PVB* layers of panels will not contact directly with silicone, which might form small bubble at the contacted edge.



Other qualified mounting method as reference:

OptiBond Filed for patent at the German patent office, No. 10 2008 027 857

4.1.1 Grounding the mounting system

The mounting system must be incorporated into the main equipotential bonding. For this purpose, all of the metal components are connected in a way that conducts electricity and connected to the equipotential bonding rail using a grounding cable of 4~14 AWG (2.5~22 mm²) The minimum requirement is for the equipment grounding conductor for PV source and output circuits to be sized to carry 1.25 times the short-circuit currents at that point.

4.2 Inverter

For the sake of safety and performance, ensure the apparatus meet following industrial standard: **VDE 0126-1-1, UL 1741, JET, IEC 62109** or other local recognized standard.

Inverters without transformers are **NOT** permitted to use with *AURIA* thin film panels.

Pay attention to the planning notes in the installation instructions for the inverter.

When setting up the inverter, note the initial values of the panel (in particular, the P_{mpp} , power at max. power point) are approximately 15% higher than the nominal values (stabilized values). The inverters must be compatible with stabilized values of panels to avoid over design and ensure the optimal performance of inverters.

Command: To avoid overvoltage of inverters in the beginning of installation, the brand new panels are suggested to be exposed under sunlight for 1~3 weeks¹ after fixing and wiring. The whole system can only be connected to grid **Not** until the power decay to stabilized values.

¹: Actual exposure time depends on the weather on site. The exact requirement for the power decay is exposed under sunlight with insolation of $1,000 \text{ W/m}^2$ for 45 hours.

4.3 Cabling

For the string cabling, pay attention to the following instructions.

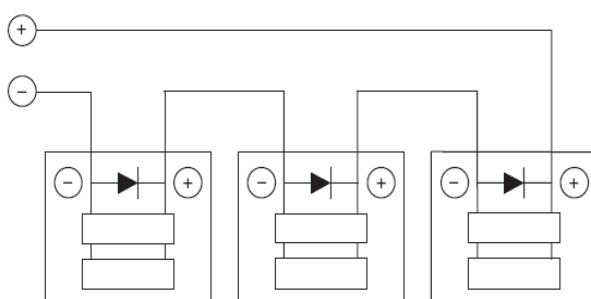
- ONLY use **UV** and **water-resistant** solar cable with a cross-section of at least 12 AWG (4 mm^2).
- With longer cable length, a greater cable cross-section may be necessary.
- To prevent loss of performance caused by cable losses, the cable cross-section must be precisely calculated.

All *AURIA* thin film panels are fitted with MC4 compatible solar connectors and its polarity is shown on the connectors.

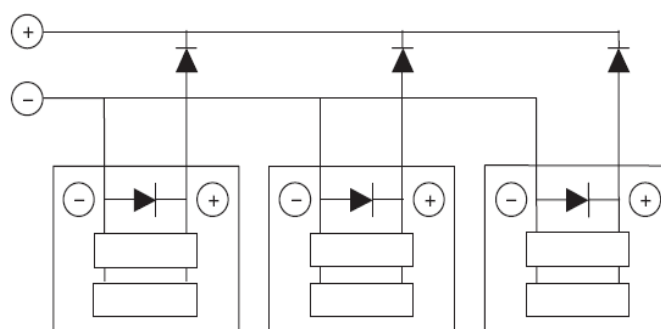


- When fixing the solar connectors and couplings to the string cabling, only original crimping tools may be used.

- Check the polarity of the string cables before you connect to the inverter. Continue to check the plausibility of the string voltages before taking the system into operation.
- ONLY panels of the same type may be switched together.
- ◆ **Series switching:** In order to increase the voltage, several panels can be switched in a row to form a string. The maximum DC voltage of the inverter and the maximum system voltage of the panels **CAN NOT** be exceeded. Connect the cables with the positive connector of one panel to the negative connector of another. The string cables to the inverter are then connected to the first and the last panels.



- ◆ **Parallel switching:** To ensure optimum use of the inverter, it may be necessary to switch several strings in parallel to increase the current level. If more than two strings are switched in parallel, blocking diodes must be switched in the individual strings to protect against too high back current.



Plan the entire cabling carefully. If the cable cross-sections are not properly chosen, this will lead to cable loss which have a direct effect on the performance of the unit. The permitted current carrying capacity of the cable may not be exceeded as this would lead to excessive heating and possibly even to cable fire. Observe the relevant guidelines and regulations.

A Cabling example for 4 panels in series, the positive and negative cables will go through the cable dust (the green part) to *DC* combined box.

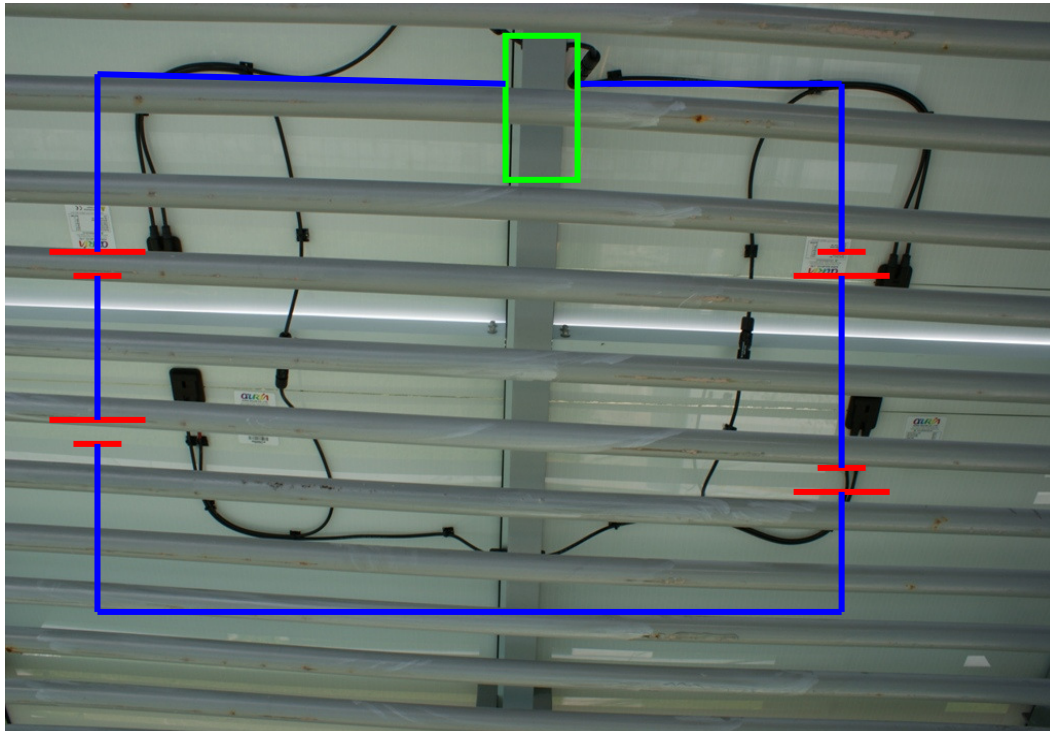


Fig. Electrical connection of panels

4.4 Disconnecter

Direct current string cables may only be connected via permitted disconnectors to the inverter. In so far as the planned inverters do not have these disconnectors, the string lines must be switched via external permitted disconnectors.

4.5 Lightning Protection Unit

Make sure that you consult a specialist for lightning technology in order to find out the optimal installation of lightning protection equipments on site. If the photovoltaic unit cannot be incorporated into a lightning protection unit, all metallic components of the photovoltaic unit and the frame should be incorporated into the main equipotential bonding.

The surge protection devices are strongly recommended to be installed in the *DC* combined box for each sub-area of panel field to prevent the panels and inverters from damage of surge.

5. Maintenance

Pay attention to the following notes for maintenance task in order to make sure that the system is operated with its maximum performance.

- ◆ Keeping the panel surface clean is the most important to get the maximum power output.
- ◆ Regularly checking the system for functionality, signs of damages and broken parts of glass.
- ◆ The panels can be cleaned with water and a soft cleaning cloth.
- ◆ **DO NOT** use harden or abrasive cleaning agents that might scratch the surface of the panel. The glass of the panel **must not** be scratched.
- ◆ For cleaning purpose. use water that is low on lime and ensure that no limescale build up on the glass surface.

6. Customer Service & Technical Support

Limited Warranty

- Material and Workmanship Warranty: 5 Years
- 90% of the minimal rated Power Output: 10 Years
- 80% of the minimal rated Power Output: 25 Years

Normally, the panel under valid condition and general terms can work regularly. All warranty and liability have to follow with **Auria Solar Warranty Policy**. Any of the following with verification will void **Auria Solar Warranty Policy**.

1. Failure to comply with the installation or handling procedures and precautions described in caution labels, installation instructions or other written information provided by *Auria Solar*.
2. Mounting incorrectly or with no functional safety and protective mechanisms; unprofessional assembling or handling of the panels.
3. Application for unusual purposes.
4. Ignore the relevant valid regulations and the general application rules of technology.

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