

INSTALLATION INSTRUCTION AND MAINTENANCE MANUAL FOR CRYSTALLINE SOLAR PV MODULE

REVISIONS					Risen Energy Co.,Ltd	
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Safety and Installation Instructions

Last Revised: July 2015

1. INTRODUCTION

This installation instruction manual provides information about Risen Energy crystalline Silicon solar photovoltaic modules, provides recommendations for the installation of RISEN PV (photovoltaic) modules, and identifies hazards associated with the handling and installation of these modules.

Please read this document in its entirety before installing, wiring, or using your PV module(s). For information on mounting types other than the ones described in this document, please contact your installers or RISEN main offices. Failure to comply with these instructions will invalidate the RISEN Limited Warranty for PV Module.

1.1. Disclaimer of Liabilities

RISEN products are designed and manufactured in accordance with relevant international standards. However, as the conditions or methods of installation, operation, use and maintenance are beyond RISEN's control, RISEN does not assume responsibility and expressly disclaims liability for loss, damage or expense arising out of, or in any way connected with, such installation, operation, use or maintenance.

Full details of our Limited Warranty are provided in our Warranty Certificate; however, a warranty claim will be invalidated if there is evidence that the product:

- Has either been tampered with, damaged, or something has been adhered/attached to the backsheet
- Has not been installed in accordance with these instructions.

2. SAFETY

2.1. General Information

These products are intended to operate under normal sunlight conditions, DO NOT attempt to increase module output by concentrating light on its surface. Prior to installation, seek guidance from a certified engineer to verify that the mounting arrangement is proper for the conditions of the location.

Furthermore, if the PV modules are to be installed on a roof, ensure that a full structural evaluation covering the effects of module and mounting system on the roof is carried out by a competent person.

2.1.1. The system has to be in compliance with all applicable building and electrical codes or regulations.

2.1.2. PV systems have the ability to form high temperature arcs if the module, cabling or electrical devices are damaged.

2.1.3. To minimize fire hazards:

- For rooftop installations, mount the modules over a fire resistant roof covering rated for the application.
- For ground mounted installation the design should take into account the growth of vegetation in order to minimize consequent fire risks.

- System should be designed to allow all means of electrical disconnection to be readily accessible to fire fighters and responders to safety incidents.

- These modules have not been certified for building integration (directly into the roof or wall), marine or vehicle applications. These applications may have additional requirements for which our products have not been certified.

2.2. Handling Safety

Before performing any operation involving the module or system electrical connections, perform a risk assessment paying particular attention to the environmental conditions and personal protection equipment required.

Use appropriate protective safety equipment as recommended by local safety codes and practices (e.g. hard hat, scaffolding, steel toe capped shoes, gloves and restraining harness) and exercise caution, particularly when installing modules at height.

PV modules are heavy and should always be handled by two people, preferably supporting the module by its long sides; furthermore, they contain glass, which can be easily broken if mistreated.

DO NOT

- Use the junction box cables to handle the module
- Walk on, bend or drop the PV module similarly
- Place heavy loads or drop objects on the module
- Keep sharp objects on the module front and back surface
- Install the module if the back sheet or glass is damaged because there is an electrical and fire risk

Modules can get very high temperatures when they are in operation and especially if they are partially shaded, be careful not to touch them without proper personal protection equipment.

2.3. Electrical Safety

PV modules generate DC electricity whenever they are exposed to light and potentially lethal voltages can be present when more than two modules are connected in series. The installation and wiring of the PV modules should always be performed by an electrical installer who is qualified in accordance with ALL local standards and codes.

When working with PV modules, the following precautions shall be taken:

- Ensure that appropriate barriers (fences etc.) are installed to prevent interference or accidental contact with live circuit elements by unauthorized personnel or animals.
- Disconnect the electrical circuit (inverter or DC load switch) before disconnecting module cables.

DO NOT

- Scratch or mishandle the product
- Damage, pull, bend or place heavy loads on the cables.
- Connect modules together when the terminals are wet.
- Attempt any installation in adverse weather conditions (high winds, rain or when ice or snow is present).

2.4. Fire Rating

RISEN modules have been certified to comply with UL790 Class C fire rating. For rooftop installations, the fire rating of a roof

covering below the modules must be the same or better than the module rating.

2.5. Module Safety Application Class

“RISEN modules have been certified and qualified for application class A: Hazardous voltage (IEC61730: higher than 50V DC; EN61730: higher than 120V), hazardous power applications (higher than 240W) where general contract access is anticipated (modules, qualified for safety through EN IEC61730-1 and EN IEC61730-2 and within this application class, are considered to meet the requirements for Safety class II)”.

3. MODULE INSTALLATION

The module should be mounted in locations that meet the following requirements.

3.1. Operating Temperature

RISEN modules are to be installed in environments at which RISEN modules operates in the recommended operating temperatures range of -40°C to +85°C. Adequate ventilation beneath the modules prevents heat build-up affecting module performance.

3.2. Installation Sites and Conditions

- Ensure that there are no objects behind the module that can damage the back sheet when it deflects under normal operating conditions.
- Install the modules at an angle of at least 10° from the horizontal to aid self-cleaning and reduce dirt collection.
- Shading causes loss of output. Ensure that the modules are not shaded at any time of the day. Avoid trees, buildings or obstructions, which could cast shadows on the module especially during the winter months when the arc of the sun is lowest over the horizon.
- The modules shall not be exposed to continuous wetting, e.g. by fountains.
- The module shall not be exposed to salt or sulfur which can cause corrosion.

3.3. Mounting Options

PV modules can be mounted to the substructure using either corrosion-proof M8 bolts placed through the mounting holes on the rear of the module or specially designed module clamps.

Regardless of the fixing method the final installation of the modules must ensure that:

A clearance of at least 115mm is provided between modules frame and the surface of the wall or roof.

The minimum distance between two modules is 10 mm.

The mounting method does not block the module drainage holes.

Panels are not subjected to wind or snow loads exceeding the maximum permissible loads, and are not subject to excessive forces due to the thermal expansion of the support structures.

A. Mounting with Bolts

The frame of each module has 4 x φ9mm mounting holes, ideally placed to optimize the load handling capability, to secure the modules to supporting structure.

- To maximize mounting longevity, RISEN strongly recommends the use of corrosion proof (stainless steel) fixings
- Secure the module in each fixing location with an M8mm bolt and a flat washer, spring washer and nut as shown in Figure 1 and tighten to a torque of 16 N.m.

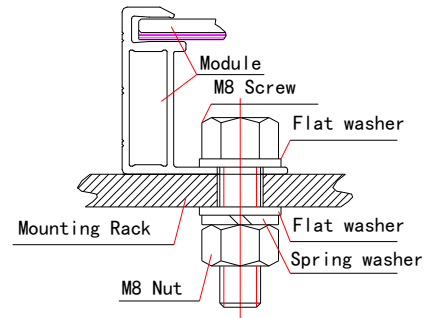


Fig. 1. SPV module installed with Bolt fitting method

B. Mounting with Clamps:

- RISEN has tested its modules with a number of clamps from different manufacturers and recommends the use of clamps which have an EPDM or similar insulating washer, fixing bolt of at least M6. The clamp must overlap the module frame by at least 7mm but no more than 10 mm.
- Use at minimum 4 clamps to fix modules on the mounting rails.
- Modules clamps should not come into contact with the front glass and must not deform the frame.
- Be sure to avoid shadowing effects from the module clamps.
- The module frame is not to be modified under any circumstances.
- When choosing this type of clamp-mounting method, use at least four clamps on each module, two clamps should be attached on each long sides of the module (for portrait orientation) and each short sides of the module (for landscape orientation). Depending on local wind and snow loads, additional clamps may be required to ensure that modules can bear the load.
- Applied torque should refer to mechanical design standard according to the bolt customer is using, ex:

M6 ---- 8N • M

M8 ---- 16N • M

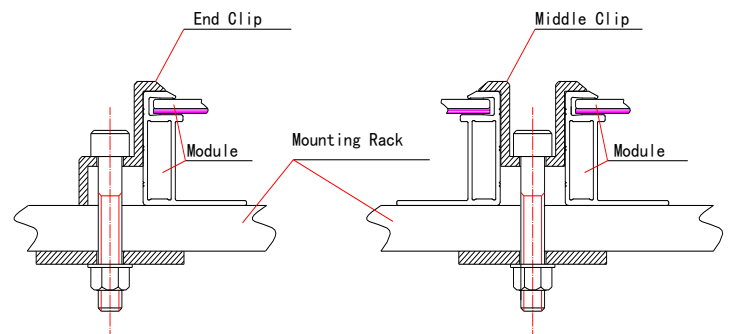
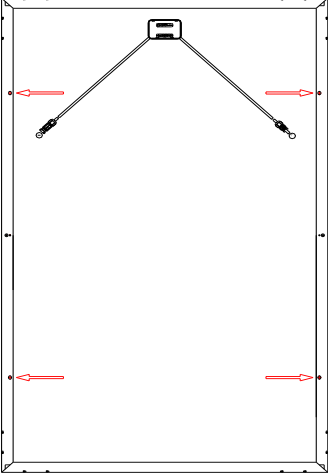
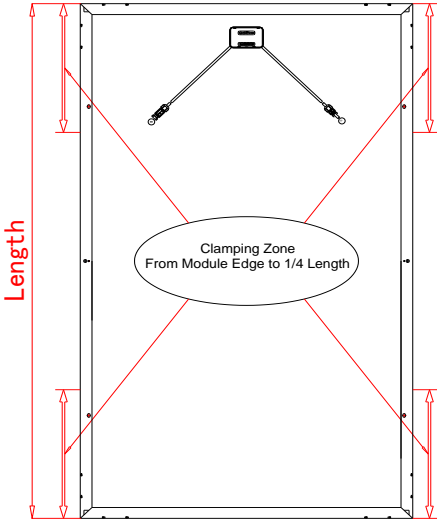
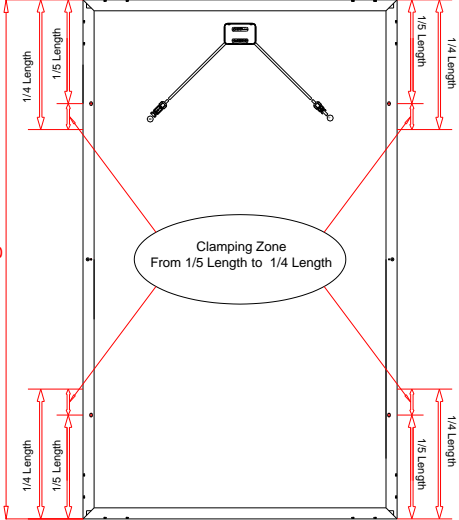
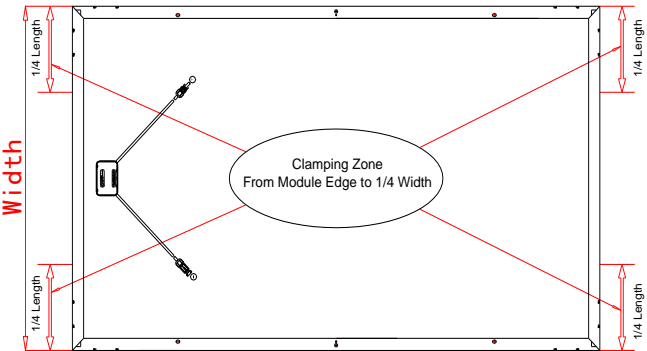
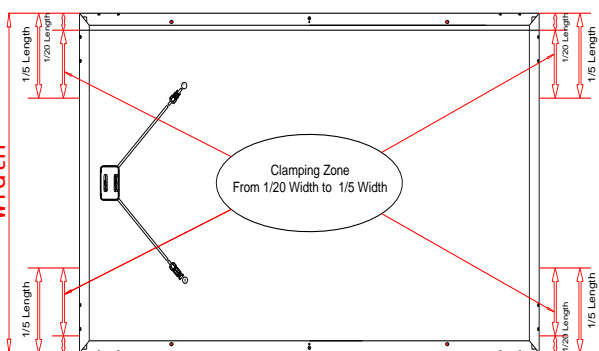


Fig. 2. SPV module installed with clamp fitting method

	2400 Pa Load	5400 Pa Load
Mounting system	 <p style="text-align: center;">Use four mounting holes</p>	
Clamping system Attachment to the long frame	 <p style="text-align: center;">Use four clamps</p>	 <p style="text-align: center;">Use four clamps</p>
Clamping system Attachment to the short frame	 <p style="text-align: center;">Use four clamps</p>	 <p style="text-align: center;">Use four clamps</p>

4. ELECTRICAL CONNECTION

RISEN modules can be used in single or multiple-module systems to meet the current / voltage requirements of different application. Use only the same type of modules in the same electrical circuit. Refer to local regulations to determine which applicable standard should be used for your installation.

The electrical ratings at Standard Test Conditions (1000W/m² irradiance, AM 1.5 spectrum, cell temperature 25°C) can be found on each module label.

Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly,

the values of I_{sc} and V_{oc} marked on this module 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.

Please refer to table C-1 “Module Characteristics Table” for the application class of the product according to IEC 61730 standard.

4.1. Series Connection

RISEN modules are provided with assembled cables and connectors. Modules cables are connected in series by connecting the positive (+) connector of one module to the negative (-) connector of the adjacent module. To determine the maximum number of modules that may be connected in series, divide the maximum system voltage as stated on the label (or the maximum allowed by local standards or codes, whichever is less) by the module open-circuit voltage (V_{oc}) after correcting for temperature as required by local codes or standards.

4.2. Parallel Connection

If the array has 1 or 2 parallel strings, no overcurrent protection device is required. In arrays with 3 or more strings in parallel, each string must be protected by a fuse or circuit-breaker. The type of overcurrent protection device shall be suitable for photovoltaic applications and the manufacturer’s sizing guidelines shall be followed to select the minimum current rating. Refer to Table 1 for the maximum series fuse size allowed for the module.

4.3. System Components Selection

The minimum voltage rating for system components is determined by multiplying the open-circuit voltage V_{oc} (stated on the module label) by the number of modules connected series and by the temperature correction factor for V_{oc} (determined by the temperature coefficient for V_{oc} from the module specification).

$$\text{Component Minimum Voltage Rating} = V_{oc} \cdot N_s \cdot [1 + \beta (T - 25)]$$

where :

- V_{oc} : Module open-circuit voltage (V)
- N_s : Number of modules connected in series
- β : Temperature coefficient of V_{oc} (%/°C)
- T : Lowest expected ambient temperature (°C)

4.4. System Wiring Selection

Use cables with certified for PV applications, 1000V and 90°C sunlight resistant (UV). System cables must always have a cross sectional area greater than 3mm² (AWG 12). When selecting the minimum current carrying capacity of the cables, multiply the short-circuit current (I_{sc}) stated on the module label by 1.25 and by the number of parallel connected solar modules or strings of modules.

$$\text{Cable Minimum Current Rating} = 1.25 I_{sc} \cdot N_p$$

where :

- I_{sc} : Module short-circuit current (A)
- N_p : Number of modules or strings of modules connected in parallel

4.5. System Earth(Grounding)

The frame of each module is grounded by fixing an appropriate earth (grounding) cable (solid copper wire with a minimum

14AWG-2.5mm² to max 10AWG-6mm²) to one of the earthing points of the module (refer to figure 3) using a M4 x 12 mm long, type F self tapping (thread cutting) screw and M4 serrated washer.

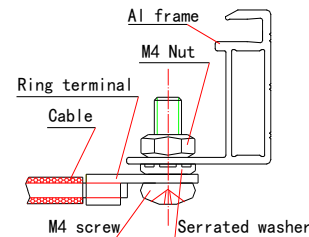


Fig. 3. Recommended grounding connection method

For optimal performance, it is recommended to use the **system negative grounding** where the negative polarity of the PV modules array is connected to the ground. Failure to comply with this recommendation will reduce the module performance and may invalidate the limited power warranty of the module.

4.6. Ground Fault Detection

After system installation and before start up, perform (R_{iso}) initial ground fault detection if ground fault(s) are identified and not corrected then disconnect modules from each other to prevent the array arcing to ground and to reduce voltage levels.

5. MODULE CLEANING

Solar modules are generally self-cleaning, but in particularly dry areas or where module tilt is minimal, dust and other substances such as bird droppings can build up over time and impact on the amount electricity generated by a module. Cleaning the modules periodically will ensure maximum energy output.

- Only clean modules when there is low solar radiation and modules are producing low energy.
- Clean the module surface with a soft cloth or sponge using clean and neutral water base or pH<7.5 cleaners (neither non-ammonia nor basic pH>7.5 solutions).
- **DO NOT** use high-pressurized water, steam cleaners or any kind of hard abrasive materials that could scratch the surface coating on the glass.

6. MAINTENANCE

In order to maximize system performance and ensure long lifetime and minimize risks, periodic maintenance must be carried out by qualified personnel. This maintenance must include but it is not limited to:

- If the installation is in open field, clear periodically the vegetation or any other flammable material in the area;
- Verification of system isolation (R_{iso} tests);
- Verification of the integrity of electrical and mechanical connections;
- Wiring is securely connected and free of corrosion;
- Cleaning of the PV modules (if required)

7. SPECIFICATIONS

Notes

1. Standard Test Condition(STC) of Irradiance of $1000\text{W}/\text{m}^2$, AM1.5 Solar Spectrum & 25°C cell temperature
2. Nominal Operating Cell Temperature (NOCT): $45\pm 2^\circ\text{C}$
3. The tolerance of Voltage and Current within $\pm 10\%$
4. Temperature coefficient of Current is $0.05\%/^\circ\text{C}$
5. Temperature coefficient of Voltage is $-0.32\%/^\circ\text{C}$
6. Temperature coefficient of Power is $-0.39\%/^\circ\text{C}$
7. See PV Module Datasheets for mounting and grounding holes locations, other electrical and mechanical details.