

MANA ENERGY
مانا انرژى 2024

Installation Manual for Mana Energy Modules

1-General Information

1.1-Overview

Thanks for choosing Mana Energy Modules. In order to ensure the PV modules are installed correctly, please read the following installation instructions carefully before modules are installed and used.

Please remember that these products generate electricity and certain safety measures need to be taken to avoid danger.

Make sure the module array is designed in such a way not to exceed the maximum system voltage of any system component such as connectors or inverters and only use compatible connectors of the same type.

The assembly is to be mounted over a fire resistant roof covering rated for the application. Before mounting the module, please consult your local building department to determine approved roofing materials.

Where general contact access is anticipated; When the modules are for rooftop application, it is necessary to take the overall fire rating of the finished structure as well as operation and maintenance into account. The roofing PV system shall be installed after being evaluated by construction experts or engineers and with official analysis results for the entire structure. It shall be proved capable of supporting extra system bricked pressure, including PV module weight.

1.2-Modules identification

Two labels on the module contain the information below (Figure1&2):

1. Nameplate: product type, rated power, rated current, rated voltage, open circuit voltage, short circuit current under testing conditions, certification indicator, maximum system voltage, etc.
2. Serial Number label: A unique serial number which is laminated inside the module permanently which can be found in the front of the module.

1.3- Warning

- PV modules generate DC electrical energy when exposed to sunlight or other light sources. Active parts of module such as terminals can result in burns, sparks, and lethal shock.
- Artificially concentrated sunlight shall not be directed on the module or panel.
- Front protective glass is utilized on the module. Broken solar module glass is an electrical safety hazard (may cause electric shock or fire). These modules cannot be repaired and should be replaced immediately.

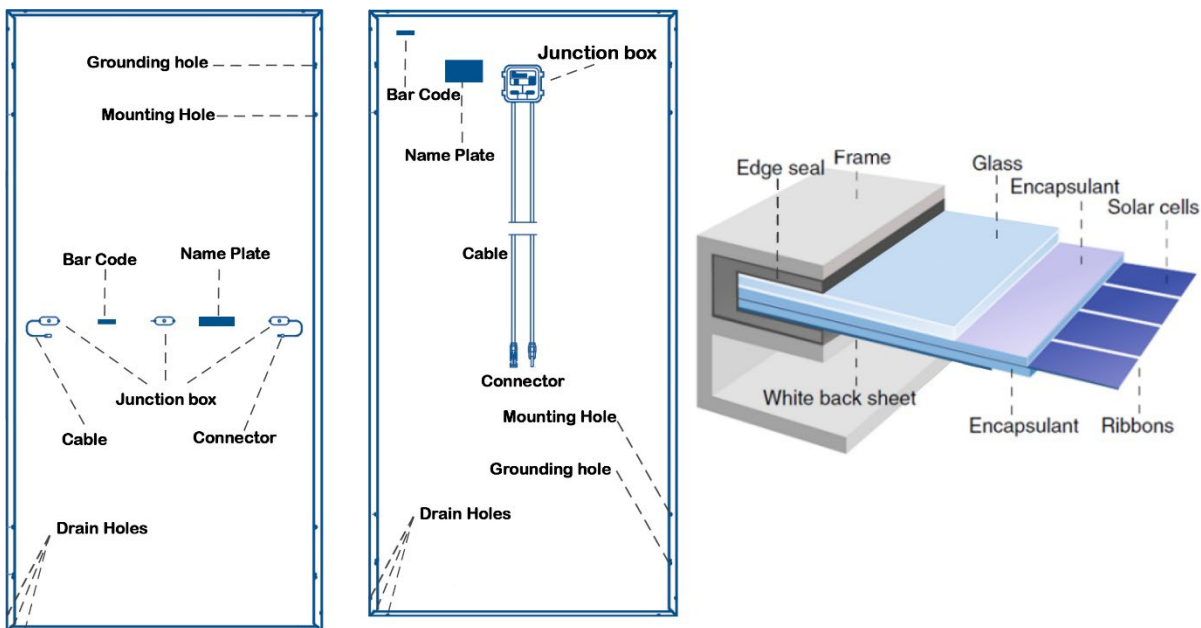


Figure1-Typical Mechanical Drawing of Mono-facial Modules

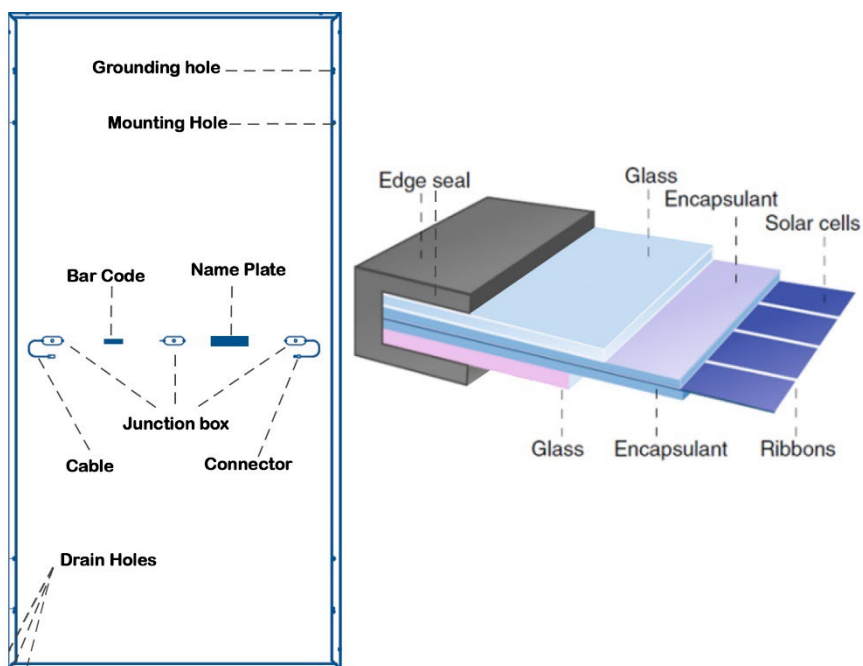


Figure2-Typical Mechanical Drawing of Bifacial Modules

- To reduce the risk of electrical shocks or burns, modules may be covered with an opaque material during installation to avoid injury.
- The installation work of the PV array can only be done under the protection of sun-sheltering covers or sunshades and only qualified person can install or perform maintenance work on this module.
- Follow the battery manufacture’s recommendations if batteries are used with modules.

- Do not use this module to replace or partly replace roofs and walls of living buildings.
- Do not install modules where flammable gas may be present.
- Do not remove any part installed by “Mana Energy” or disassemble the module.
- All instructions should be read and understood before attempting to install, wire, operate and maintain the module.
- Don’t lift up PV modules using the attached cables or the junction box.
- Carry the module by at least two persons.
- Do not touch live terminals with bare hands. Use insulated tools for electrical connections.
- All PV systems must be grounded to earth. If there is no special regulation, please follow the National Electrical Code or other national code.
- 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 value of I_{sc} and V_{oc} marked on the module should be multiplied by 1.25 when determining PV system component voltage ratings, conductor current ratings, fuse sizes, and size of controls connected to the PV output.
- Once the PV module has been shipped to the installation site, all of the parts should be unpacked properly with care.
- Only the modules with the same type and the capacity should be connected in series inside the string.
- During transporting modules, please attempt to minimize shock or vibration to the module, as this may damage the module or lead to cell micro cracks.
- During all transportation situations, never drop the module from a vehicle, house or hands. This will damage module.
- Do not stand or step on the PV module. This is prohibited and there is a risk of damage to the module and cause injury for you.
- Do not disconnect modules from the circuit, when they are operating in the system and deriving electrical load.
- Connector of junction box cannot be contacted with oily substances, for example, lubricant, rust inhibitor etc.
- Do not carry a module on your head, with the backsheet facing towards to your helmet, if it is not avoidable, please make sure that, the module is facing with the glass side to your helmet.
- Keep the junction box cover closed at all times.
- Do not expose junction box and connectors directly to sunlight and protect them from water immersion.

2- Installation

2.1- Installation safety

- Follow unpacking instructions when opening packaging carton.
- Always wear protective head gear, insulating gloves and safety shoes (with rubber soles).
- Keep the PV module packed in the carton until installation.
- In case of no connected load or external circuits, modules can still produce voltage. Please use insulation tools and wear rubber gloves when operating modules in the sunlight.
- No switch is on the PV modules. Operating of PV modules can only be stopped when they are kept from sunlight or covered by hard board or UV-proof materials.
- To avoid electric arc or electric shock hazards, please do not break down electric connection in loaded conditions. Incorrect connections will also lead to electric arc or shock. Keep connectors dry and clean and make sure that they are in good operating condition. Do not insert other metals into the connectors or carry out electric connection by whatever means.
- Do not touch the PV module unnecessarily during installation. The glass surface and the frame may be hot. There is a risk of burns and electric shock.
- Do not work in rain, snow or windy conditions.
- Due to the risk of electrical shock, do not perform any work if the terminals of the PV module are wet.
- Do not try to dismantle the module or remove nameplate or parts of modules.
- Do not paint or apply any other adhesive on modules.
- Do not damage or scratch backsheet of modules.
- Do not drill holes on the frame of module which may reduce frame loading capacity and lead to corrosion and invalidation of the limited warranty for customers.
- Do not scratch anodic coating of aluminum alloy frame except for grounding connection. Scratch may lead to frame corrosion and reduce frame loading capacity and long-term reliability.
- Do not repair problematic modules on your own.
- When installing PV modules in deserts or windy and sandy areas, “Mana Energy” recommends the use of connector dust caps before installation, or other measures to prevent sand and dust from entering the connectors. This is important to prevent potential insertion problems or electrical safety hazards.



Figure 3- connector dust caps

- Modules (glass, junction boxes, connectors, etc.) must be protected from long-term exposure to any environments containing sulfur, strong acid/alkaline conditions etc., which may pose a risk of corrosion to the product.
- If module glass or other sealing materials are damaged, please wear PPE (personal protective equipment) and then isolate modules from the circuit.
- Make sure flammable gasses are not generated or present near the installation site.
- Insert module connectors fully and correctly. An audible "click" sound should be heard. This sounds confirms the connectors are fully seated. Check all connections.
- The module leads should be securely fastened to the module frame, Wire Management should be done in a way to avoid the connector from scratching or impacting the back sheet of the module.
- Do not touch the junction box and the end of the interconnect cables (connectors) with bare hands during installation or under sunlight, regardless if the PV module is connected to or disconnected from the system.
- Do not expose the PV module to excessive loads on the surface of the PV module or twist the frame, this may break the cells or cause micro cracks.
- During the installation or operation, don't use sharp tools to wipe the back sheet and glass. Scratches can appear on the module.
- When installing modules on roof mounted structures, please try to follow the "from top to bottom" and/or "from left to right" principle, and don't step on the module.

2.1.1- Fire safety

Please refer to local laws and regulations before installing modules and abide by requirements on building fire protection. According to the corresponding certification standards, the fire rating of "Mana Energy" Mono-facial modules is IEC Class C.

The roof should be coated by a layer of fireproof materials with suitable fire protection rating for roofing installation and make sure that the back sheet and the mounting surface are fully ventilated.

Different roof structures and installation modes will affect fireproof performance of buildings. Improper installation may lead to the risk of fire. To guarantee roof fire rating, the distance between module frame and roof surface must be $\geq 10\text{cm}$ (0.39 inch) Adopt proper module accessories such as fuse, circuit breaker and grounding connector according to local regulations.

Do not use water to extinguish fires when the module is connected to any powered system.

Please do not apply modules in where exposed inflammable gases are nearby.

2.2- Installation Condition

2.2.1- Climate condition

“Mana Energy” recommends that the module should be installed in a working environment with an ambient temperature of -20°C to 50°C, but not exceed the temperature limit of -40°C to 85°C and Humidity > 85RH%

The mechanical load bearing (include wind and snow loads) of the module is based on the approved mounting methods. The professional system installer must be responsible for mechanical load calculation according to the system design.

Make sure that installed modules do not suffer wind or snow pressure that exceeds the permissible maximum load limit.

2.2.2- Site Selection

In most applications, “Mana Energy” modules should be installed in a location where they will receive maximum sunlight throughout the year. In the Northern Hemisphere, the module should typically face south, and in the Southern Hemisphere, the modules should typically face north.

When choosing a site, avoid trees, buildings or obstructions, which could cast shadows on the solar photovoltaic modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though the factory fitted bypass diodes of the PV module will minimize any such loss.

“Mana Energy” modules shall be installed on proper buildings or other appropriate places (such as ground, garage, building outer wall, roof, PV tracking system) but shall not be installed on any vehicles.

When stacking module on the rooftop, the rooftop should be tested for such loading and the installation plan must be developed in accordance with the specification requirements.

Modules cannot be used in environments with too much hails, snows, flue gas, air pollution and soot or in places with strong corrosive substances such as salt, salt mist, saline, active chemical steam, acid rain, or other substances corroding modules, affecting modules’ safety or performance.

Please take protective measures to ensure reliable and safe installation of modules in severe environments such as heavy snow, cold and strong wind or islands close to water and salt mist or deserts.

Do not install modules at places that are possible to be flooded.

Do not install the PV module near open flame or flammable materials.

When solar modules are used to charge batteries, the battery must be installed in a manner, which will protect the performance of the system and the safety of its users. Follow the

battery manufacturer’s guidelines concerning installation, operation and maintenance recommendations. In general, the battery (or battery bank) should be away from the main flow of people and animal traffic. Select a battery site that is protected from sunlight, rain, snow, debris, and is well ventilated. Most batteries generate hydrogen gas when charging, which can be explosive. Do not light matches or create sparks near the battery bank. When a battery is installed outdoors, it should be placed in an insulated and ventilated battery case specifically designed for the purpose.

Do not install the PV module in a location where it would be immersed in water or continually exposed to water from a sprinkler or fountain etc.

Modules are designed to operate up to 2000 m above sea level.

2.2.3- Tilt Angle Selection

The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface. The PV module generates maximum output power when it faces the sun directly.

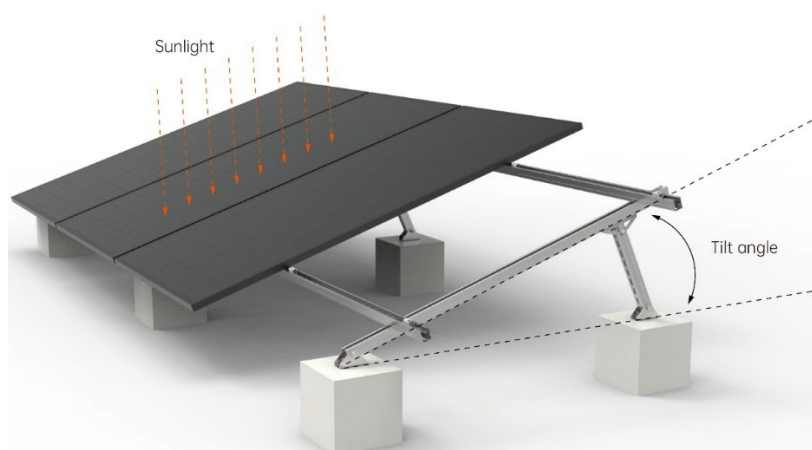


Figure 4- Modules tilt angle

“Mana Energy” suggests that tilt angle of module installation be no less than 10°, so module surface dust can be washed away easily by rainfall and frequency of cleaning can be reduced. And it is easy for accumulated water to flow away physically and avoid water mark on the glass surface which may further affect module appearance and performance.

Please take in note, that the limitation of Tilt angle / slope is maximum 60 °.

“Mana Energy” modules connected in string should be installed with the same orientation and tilt angle. Different module orientation and tilt angle may result in different levels of solar irradiation and also power generation. In order to achieve the maximum annual generating capacity, the optimal orientation and inclination of PV modules in the installed

area should be selected to ensure that sunlight can still reach to modules even on the shortest day of the year.

For standalone systems with batteries where the PV modules are attached to a permanent structure, the tilt angle of the PV modules should be selected to optimize the performance based on seasonal load and sunlight. In general, if the PV output is adequate when irradiance is low (e.g., winter), then the angle chosen should be adequate during the rest of the year. For grid-connected installations where the PV modules are attached to a permanent structure, PV modules should be tilted so that the energy production from the PV modules will be maximized on an annual basis.

2.3- Mechanical Installation Introduction

Solar PV modules usually can be mounted by using the following methods:

bolts and clamps.

1) All installation methods herein are only for reference, and “Mana Energy” will not provide related mounting components, the system installer or trained professional personnel must be responsible for the PV system’s design, installation, and mechanical load calculation and security of the system.

2) Before installation, the following items should be addressed:

a) Visually check the module for any damage. Clean the module if any dirt or residue remains from shipping.

b) Check if module serial number stickers match.

3) “Mana Energy” modules are designed to meet a maximum positive (or downward) pressure of 5400Pa (Only referring to the mentioned module type in this manual) and negative (or upward) pressure of 2400Pa. This design load was then tested with a safety factor of 1.5 times. When mounting modules in snow-prone or high-wind environments, special care should be taken to mount the modules in a manner that provides sufficient design strength while meeting local code requirements.

Mounting structure shall be made from durable, corrosion resistant, UV-proof materials.

In regions with heavy snowfall in winter, adjust the height of the mounting system so that the lower edge of the module is not covered by snow. Also, in order to reduce the risk of hot spots caused by flying sand and rocks damaging the module and shading, the lowest point of the module should be at a certain height to avoid the module being blocked by weeds and shrubs growing on the ground.

According to IEC 61215, solar modules are rated as a class C Flame-Spread Ratings product.

4) If modules are installed on brackets parallel to the roof, the minimum gap between the module frame and the roof/wall shall be 10cm which is good for air circulation to achieve

better performance of module. Make sure the building is suitable for installation before installing modules on roof. Moreover, seal properly to prevent leakage.

5) The module frames can encounter thermal expansion and cold contraction. So, the minimum distance between two adjoining modules shall be no less than 10 mm (0.39 inch). The specific space interval can be calculated according to the actual installation tolerance and deformation of the mounting bracket.

6) Ensure that the backsheet, the front and rear glass of the module will not directly touch the mounting bracket, building structure, and environmental foreign objects (such as stones), especially under the action of external force, which will cause damage to the packaging backsheet and glass, and therefore the product warranty is invalid.

7) The modules can be installed in either landscape or portrait orientation. When installing the modules, be cautious not to block the drain hole of the frame.

8) All parts in contact with the frame should use flat stainless-steel washers of at least 1.8 mm thickness.

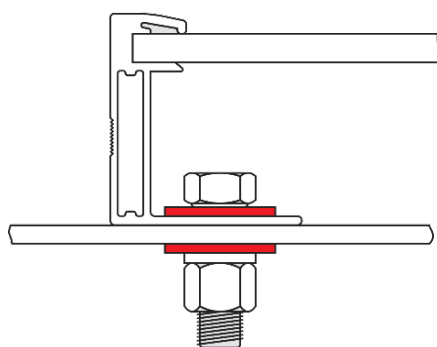


Figure 5- Flat stainless-steel washers

9) The laminate of the PV modules will sink downward to varying degrees due to gravity, with the center of module being the maximum deflection position. While using bolting or clamping mounting method, the maximum allowable deflection (ΔL shown in the picture below) is 20 mm (in the absence of external forces caused by, for example, wind and snow). Note that applying pressure to the module surface during storage, transportation and installation will lead to more severe deflection.

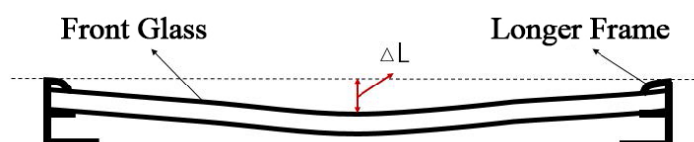


Figure 6- PV module deflection

2.3.1- Mounting with Bolts

The frame of each module has 4 mounting holes (12mm*9mm) used to secure the modules to support structure. Always use all the four mounting holes to secure the modules. The module frame must be attached to a mounting rail using M₈ corrosion-proof bolts together with spring washers and flat washers in four symmetrical locations on the PV module. The applied torque value should be big enough to fix the modules steadily. The reference value for M₈ bolt is 16~20N*m. As to special support system or special installation requirement, please reconfirm with the support's supplier for the torque value. Please find detailed mounting information in the below illustration:

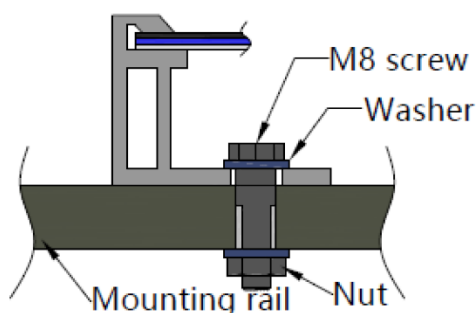


Figure 7-Mounting with bolt

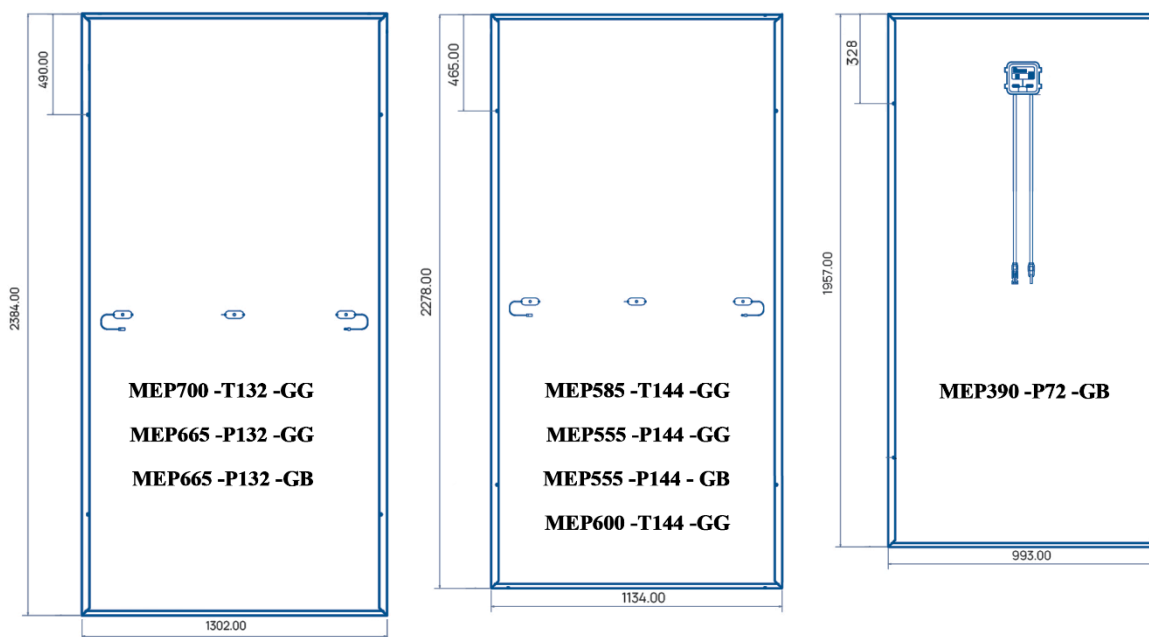


Figure 8- Mounting Holes on modules frames

2.3.2- Mounting with Clamps

The module 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, please be sure to use at least four clamps on each module, two clamps should be attached on each long side of the module.

Depending on the local wind and snow loads, if excessive pressure load is expected, additional clamps or support would be required to ensure the module can bear the load. The applied torque value should be big enough to fix the modules steadily (Please consult with the clamp or support's supplier for the specific torque value, Such as M8 Screw torque reference value is 16~20N*M).

For installation where mounting rails run parallel to the frame, the frame must overlap the rails completely or the overlapping distance must $\geq 20\text{mm}$.

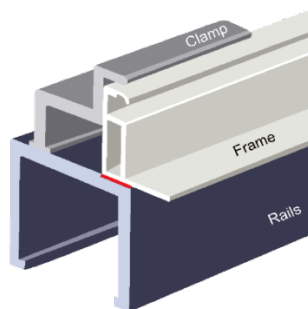


Figure 9- Overlapping frame and clamp

The clamps must be between M and N points. The installation diagram of clamp is shown as:

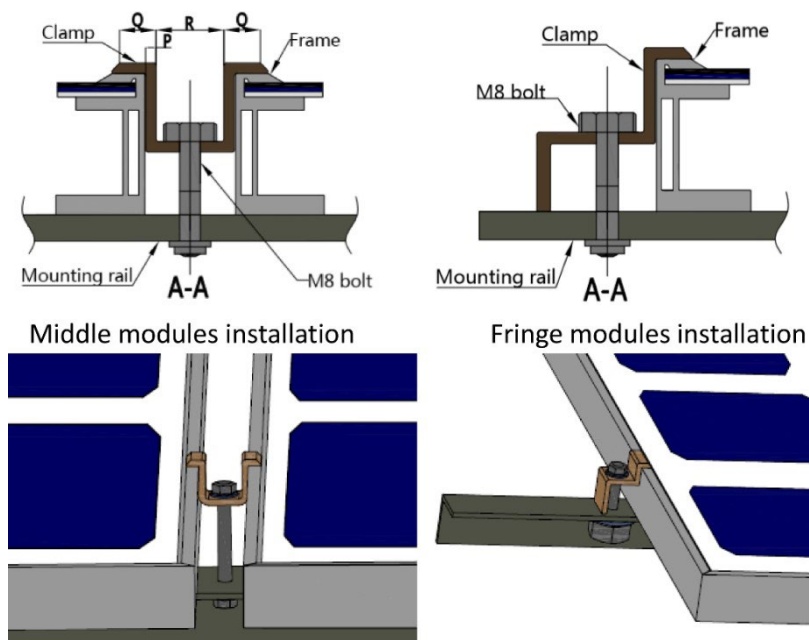


Figure 10- Mounting by clamps

As shown in the figure below, the minimum length L of the clamps is 50mm.

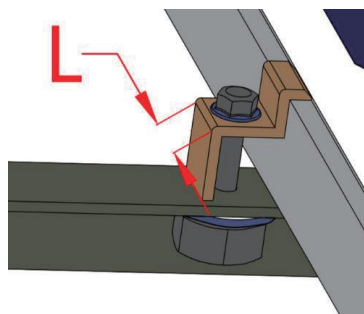


Figure 11- length of the clamps

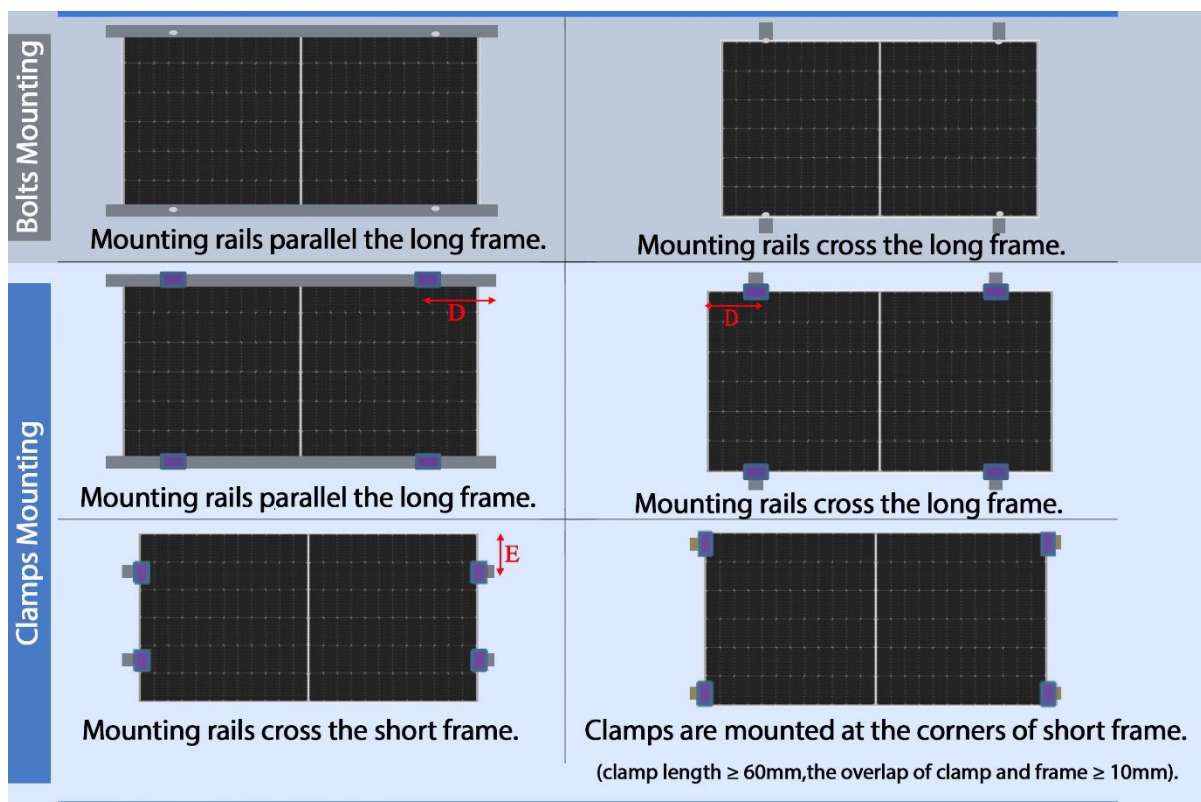


Figure 12- Installation modes

Table 1- Installation and Mechanical Load of Mana Energy PV Modules

Model		Cell Type	Bolt Mounting	Clamp Mounting				
			Mounting rails cross the long frame	Mounting rails cross the long frame			Mounting rails cross the short frame	Clamps are mounted at the corners of short frame
				$300 \leq D \leq 580$	$450 \leq D \leq 570$	$480 \leq D \leq 580$		
Monofacial	MEP390-P72-GB	M2	+5400, -2400	+5400, -2400	/	/	± 2400	+2400, -1800
	MEP555-P144-GB	M10	+5400, -2400	/	+5400, -2400	/	± 2400	± 1800
	MEP665-P132-GB	G12	+5400, -2400	/	/	+5400, -2400	± 2400	/
Bifacial	MEP555-T144-GG	M10	+5400, -2400	/	+5400, -2400	/	± 2400	± 1800
	MEP585-T144-GG		+5400, -2400	/	+5400, -2400	/	± 2400	± 1800
	MEP600-T144-GG		+5400, -2400	/	+5400, -2400	/	± 2400	± 1800
	MEP665-P132-GG	G12	+5400, -2400	/	/	+5400, -2400	± 2400	/
	MEP700-T132-GG		+5400, -2400	/	/	+5400, -2400	± 2400	/

3- Wiring and Connection

- a) Before this procedure, please read the operation instructions of the PV system carefully. Make wiring by multi-connecting cables between the PV modules in series or parallel connection, which is determined by user's configuration requirement for system power, current and voltage.
- b) PV modules connected in series should have similar connectors of identical type current, and modules must not be connected together to create a voltage higher than the permitted system voltage. The maximum number of modules in series depends on system design, the type of inverter used and environmental conditions.
- c) The maximum fuse rating value in an array string can be found on the product label or in the product datasheet. The fuse rating value is also corresponding to the maximum reverse current that a module can withstand, i.e., when one string is in shade then the other parallel strings of modules will be loaded by the shaded string and the current will pass through to create a current circuit. Based on the maximum series fuse rating of module and local electrical codes and standards, make sure the modules strings in parallel are protected with the appropriate in-line string fusing.
- d) Open the combiner box of the control system and connect the conductor from the PV arrays to the combiner box in accordance with the design and local codes and standards. The cross-sectional area and cable connector capacity must satisfy the maximum short-circuit of the PV system, otherwise cables and connectors will become overheating for large current. Please pay attention to the temperature limit of cables is 85°C.
- e) Make sure that the cables do not run between the modules and the mounting rail or structure (risk of pinching).

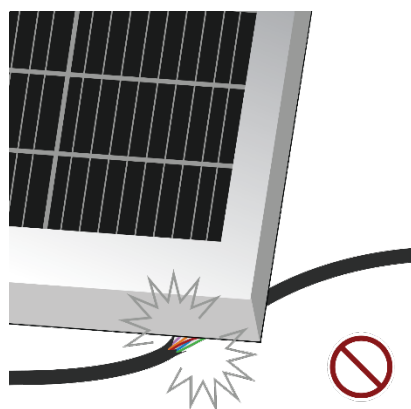


Figure 13-Cable pinching

When modules are in series connection, the string voltage is sum of every individual module in one string. When modules are in parallel connection, the current is sum of the individual module. Modules with different electric performance models cannot be connected in one string.

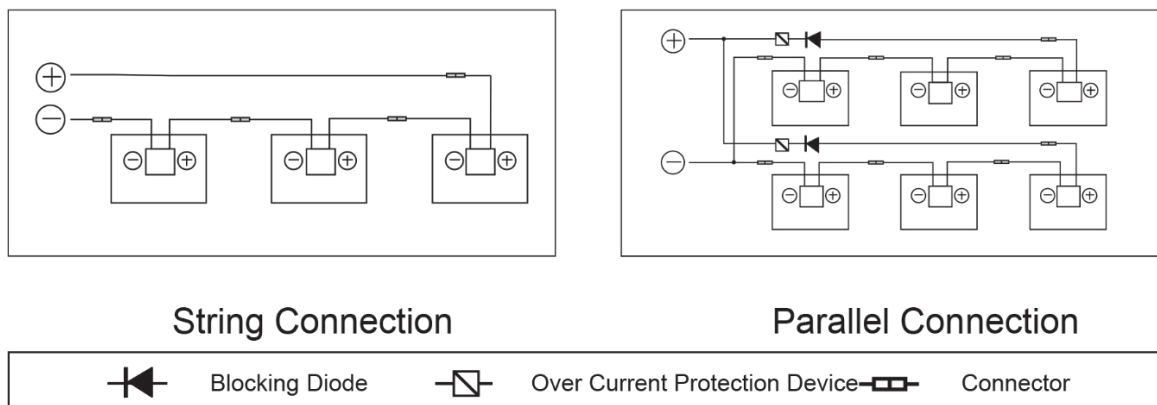


Figure 14- Serie and Parallel connections

The maximum allowed quantity of modules in string connection shall be calculated according to relative regulations. The open circuit voltage value under the expected lowest temperature shall not exceed the maximum system voltage value allowed by modules and other values required by DC electric parts (maximum system voltage is DC1500V— actually system voltage is designed based on the selected module and inverter model.)

The V_{OC} factor can be calculated by the following formula.

$$V_{oc} = 1 - \beta V_{oc} * (25 - T)$$

T: The expected lowest temperature of the installation site,

β ; V_{OC} temperature coefficient (%/C) (refer to modules data sheet for further detail)

If there is reverse current exceeding the maximum fuse current flowing through the module, use overcurrent protection device with the same specifications to protect the module; if the parallel connection is more than 2, there must be an overcurrent protection device on each string of module.

- f) Follow the requirements of applicable local and national electrical codes.
- g) These modules contain factory installed by pass diodes. If these modules are incorrectly connected to each other, the bypass diodes, cable or junction box may be damaged.
- h) The cable of the junction box is defined as L_1 , as showed below:

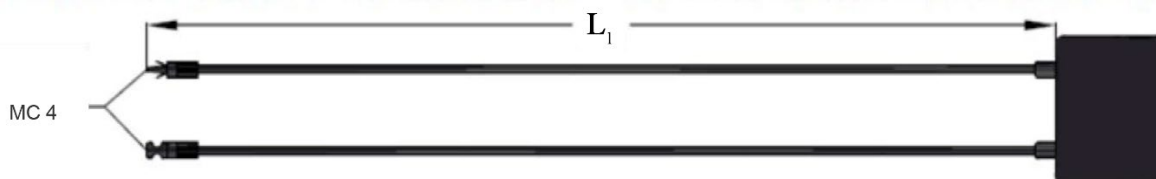


Figure 15-Cable of junction box

For “Mana Energy” MEP-390-P72-GB module, L is 1000 mm and for half-cut modules it’s 300 mm (It can be 120 cm at the customer's request). Please take the cable length into consideration before designing the wiring layout.

i) It is recommended to use negatively grounded inverters to avoid the PID effect for non-PID free modules.

j) If modules are connected in series, the total voltage is equal to the sum of individual voltages. The recommended as below,

$$\text{System voltage} \geq N * V_{oc} [1 + TC V_{oc} * (T_{min} - 25)] \text{ Where}$$

N: Module numbers in series

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

TC V_{oc} : Temperature coefficient of open circuit voltage (refer to product label or datasheet)

T_{min} : Minimum ambient temperature

e) For wiring connections, please use standard PV copper wires with a cross-section area of at least 4mm² (12 AWG), and should be light-resistant and temperature-resistant at a minimum of 90 °C.

f) Do not bend the cables less than 43 mm (1.69 inch) radius. PV cables will be damaged if bending radius less than 43 mm.

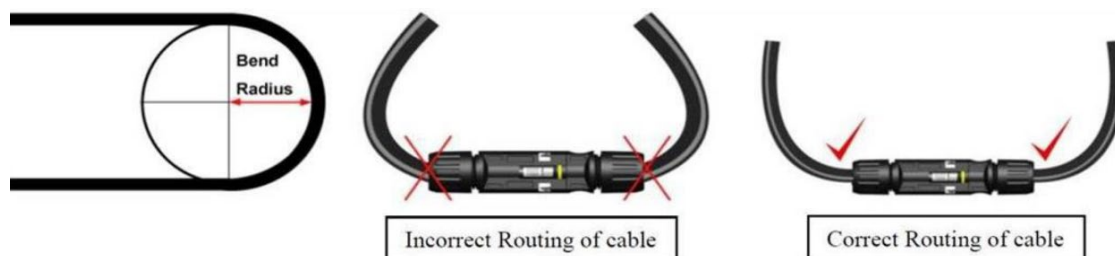


Figure 16-Routing of cables

4- Grounding

Equipment equipotential bonded conductor to the hole and hardware provided. Note that a stainless-steel star washer is used between the ground wire and module frame. This washer is used to avoid corrosion due to dissimilar metals. Tighten the screw securely.

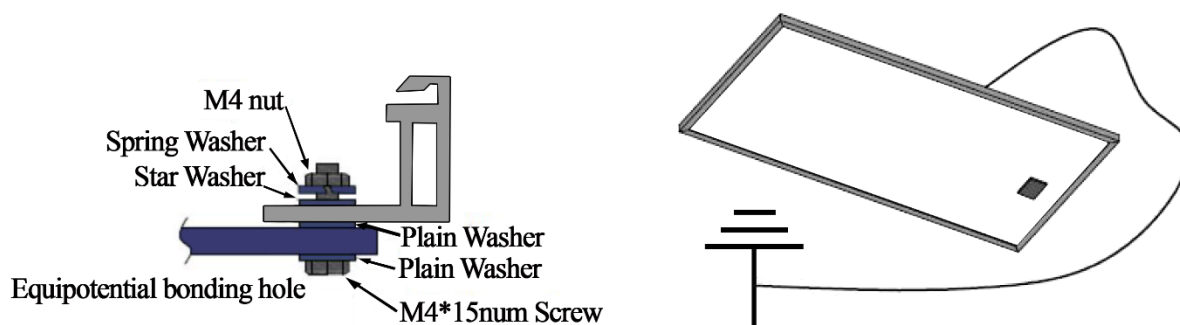


Figure 17-Modules grounding

5- Fuse

The fuse should be connected to each non-grounded pole of the array (in other words, if system is not grounded, the fuse should be connected to both positive and negative terminals).

- a) The maximum rating of the fuse connected in series is 30A (M10 module), and the module-specific ratings are available on the product label and product data sheet.
- b) The fuse rating also corresponds to the maximum reverse current that the module could withstand (when an array is shading, the array is loaded into another parallel module array to generate power), thus the number of parallel connected arrays is affected.
- c) It is forbidden to connect two or more strings in parallel and then share the fuses.

6- Storage

Modules should always be stored in a dry and ventilated environment with relative humidity below 85% and ambient temperatures between -20°C and 50°C . In an uncontrolled environment, the storage time for modules should be no longer than 3 months. In this case, extra precautions should be taken to prevent connectors from being exposed to moisture or sunlight.

7- Maintenance and care

It is required to perform regular inspection and maintenance of the modules, especially during the warranty period. To ensure optimum module performance, “Mana Energy” recommends the following maintenance measures:

7.1- Visual Inspection

Inspect the modules visually to find if there are any visual defects, if there are, the following items should be evaluated:

- a) If modules are observed having slight cell color differences at different angles, this is a normal phenomenon of modules with anti-reflection coating technology.
- b) Whether the glass is broken.
- c) No sharp objects are in contact with the PV module surfaces.
- d) PV modules are not shaded by unwanted obstacles and; or foreign material.
- e) Corrosion along the cells' bus-bar. The corrosion is caused by moisture intrusion through the module back sheet. Check the back sheet for damage.
- f) Check whether the back sheet is burnt out.
- g) Check if screws and mounting brackets are tight, adjust and tighten as necessary.

7.2- Cleaning

- a) A buildup of dust or dirt on the module(s) front face will result in a decreased energy output. Clean the panel(s) preferably once per annum, if possible (depend on site conditions), using a soft cloth dry or damp, as necessary. Water with high mineral content may leave deposits on the glass surface and is not recommended.
- b) If you are not sure whether the array needs to be cleaned, first select a column of particularly dirty array to begin cleaning. If the power generated increased less than 5%, cleaning is usually not required. The above verification should be carried out only under a stable sunshine rate (sunny, strong sunshine, no cloud).
- b) Never use abrasive material under any circumstances.
- c) In order to reduce the potential for electrical and thermal shock, Mana Energy recommends cleaning PV modules during early morning or late afternoon hours when solar radiation is low (less than 200W/m^2) and the modules are cooler, especially in regions with hotter temperatures.
- d) Never attempt to clean a PV module with broken glass or other signs of exposed wiring, as this presents a shock hazard.
- e) Never use chemicals when cleaning modules as this may affect the module warranty and energy output.
- f) It is strictly forbidden to clean PV modules under special weather: wind level greater than four, heavy rain or heavy snow.
- g) During cleaning, the water pressure on the surface of module glass shall not exceed 4MPa and the module is not allowed to withstand additional external force.
- h) The back of the PV module usually does not need to be cleaned; If you need to clean the back of the PV module, ensure that the cleaning liquid does not penetrate into the bottom layer of the material.

i) Do not clean the glass with chemicals. Only use tap water. Make sure the module surface temperature is cool to the touch. Cleaning modules with cool water when module surface temp is high may result in glass breakage.

7.3- Inspection of Connector and Cable

It's recommended to implement the following preventive maintenance every 6 months:

- a) Check the sealing gels of the junction box for any damage.
- b) Examine the PV module(s) for signs of deterioration. Check all wiring for possible rodent damage, weathering and that all connections are tight and corrosion free. Check electrical leakage to ground.

8- Electrical Specification

The module electrical ratings are measured under Standard Test Conditions, which are $1000\text{W}/\text{m}^2$, irradiance with AM 1.5 spectrum and 25 deg (77F°) ambient temperature. The module might produce more or less voltage or current than rated value in uncertainty condition.

9- Disclaimer of Liability

Because the use of the manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic (PV) product are beyond Mana Energy's control, Mana Energy does not accept 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.

No responsibility is assumed by Mana Energy for any infringement of patents or other rights of third parties, which may result from use of the PV product. NO license is granted by implication or otherwise under any patent or patent rights.

The information in this manual is based on Mana Energy's knowledge and experience and is believed to be reliable, but such information including product specification (without limitations) and suggestions do not constitute a warranty, expresses or implied. Mana Energy reserve the right to change the manual, the PV produce, the specifications, or product information sheets without prior notice.