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INSTALLATION MANUAL (IEC) ET SOLAR SERIES MODULE

Installation | Safety instructions | Maintenance

Please consult your dealer or the manufacturer concerning the warranty of your modules. If you have any further questions, your dealer and ET Solar will gladly assist you.

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1. PURPOSE OF THIS GUIDE


This guide contains information regarding the installation and safe handling of ET Solar photovoltaic modules (hereafter referred to as "modules"). All instructions should be read and understood before attempting installation. If there are any questions, please contact your dealer or ET Solar for further information. The installer should conform to all safety precautions in the guide when installing modules. Before installing a solar photovoltaic system, the installer should become familiar with the mechanical and electrical requirements for photovoltaic systems. Keep this guide in a safe place for future reference. If not otherwise specified, it is recommended that the requirements of the U.S. National Electrical Code (NEC) or respective European Code be followed.

Non-compliance with this installation instruction may result in property damage and/or physical injury. ET Solar will not be liable for compensation of any loss or injury caused by this type of non-compliance.

2. GENERAL

- Installing solar photovoltaic systems requires specialized skills and knowledge. The installer assumes all risk of injury, including risk of electric shock. Module installation should be performed only by qualified persons.
- All modules come with a permanently attached junction box and #12 AWG (4 mm²) wire terminated in Multi Contact PV connectors. Your dealer can provide additional extension cables to simplify module wiring.
- Each individual module can generate DC voltages greater than 30 volts (V) when exposed to direct sunlight. Contact with a DC voltage of 30 V or more is potentially hazardous. Exercise caution when wiring or handling modules exposed to sunlight.
- When disconnecting wires connected to a photovoltaic module that is exposed to sunlight, an electric arc may occur. Arcs can cause burns, start fires or otherwise create safety problems. Exercise caution when disconnecting wiring on modules exposed to sunlight.


- Photovoltaic solar modules convert light energy to direct-current electrical energy, and are designed for outdoor use. Proper design of support structures is the responsibility of the system designer and installer.
- Modules may be ground mounted, pole mounted, or mounted on rooftops.
- Do not apply paint or adhesive to the module.
- When installing modules, observe all applicable local, regional and national codes and regulations. Obtain a building and/or electrical permit where required.
- Storage Temperature: $-10^{\circ}\text{C} \sim 40^{\circ}\text{C}$, Storage Humidity: $\leq 70\%RH$;
- Modules should operate at environmental temperature of between -40 to $+85^{\circ}\text{C}$. If modules are to be installed in areas where the temperature may go outside the above range, please consult with ET Solar before installation.


 Do not attempt to disassemble the module, and do not remove any attached nameplates or components. Doing so will void the warranty.

 Do not use mirrors or other hardware to artificially concentrate sunlight on the module.

2.1 Safety precautions for installing a solar photovoltaic system

- Solar modules produce electrical energy when exposed to sunlight. DC voltages may exceed 30V on a single exposed module.
- Only connect modules with the same rated output current in series. If modules are connected in series, the total voltage is equal to the sum of the individual module voltages.
- Only connect modules or series combinations of modules with the same voltage in parallel. If modules are connected in parallel, the total current is equal to the sum of individual module or series combination currents.
- Bypass diodes are preassembled in each module. Do not remove these diodes.
- Keep children well away from the system while transporting and installing mechanical and electrical components.
- Completely cover all modules with an opaque material during installation to prevent electricity from being generated.

 Do not wear metallic rings, watchbands, ear, nose, or lip rings or other metallic devices while installing or troubleshooting photovoltaic systems.

 Use appropriate safety equipment (insulated tools, insulating gloves, etc) approved for use on electrical installations.

- Observe the instructions and safety precautions for all other components used in the system, including wiring and cables, connectors, DC-breakers, mounting hardware, inverters, etc.
- Use only equipment, connectors, wiring and mounting hardware suitable for use in a photovoltaic system.
- Always use the same type of module within a particular photovoltaic system.
- Under normal operating conditions, PV modules will produce currents and voltages that are different from those listed in the data sheets. The values in the module data sheets are collected under very specific circumstances known as Standard Test Conditions.
- Short-circuit current and open-circuit voltages should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacity, fuse sizes and size of controls connected to the module or system output. An additional multiplying factor of 125 percent (80 percent de-rating) may be applicable.

2.2 General installation notes

- Drainage holes must not be covered with parts of the mounting system. The junction box has a breather port which must be mounted facing downward and cannot be exposed to the rain. The junction box should be on the higher side of the module when it is mounted in order to orient the breather port correctly.
- Do not lift the module by grasping the module's junction box or electrical leads.
- Do not stand or step on module.
- Do not drop the module or allow objects to fall on the module.
- Do not place any heavy objects on the module.
- Do not scratch the anodized coating of the frame (except for grounding connection).
- Do not scratch the glass surface.
- Prior to installation, do not store modules outdoors or in a damp environment.
- Inappropriate transport and installation may damage the module glass or frame.

3. MECHANICAL INSTALLATION

3.1 Selecting the location

- Select a suitable location for installation of the module.
- For optimum performance, the module must be facing true south in northern latitudes and true north in southern latitudes.
- For detailed information on optimal module orientation, refer to standard solar photovoltaic installation guides or a reputable solar installer or systems integrator.
- Shading on the module will reduce electricity production.
- Do not install the module near equipment or in locations where flammable gases can be generated or collected.

3.2 Selecting the proper mounting structure and hardware

- Observe all instructions and safety precautions included with the mounting system to be used with the module.
- Do not drill holes in the glass surface of the module. Doing so will void the warranty.
- Do not drill additional mounting holes in the module frame. Doing so will void the warranty.
- Modules must be securely attached to the mounting structure using four mounting points for normal installation. If heavy wind or snow loads are anticipated, additional mounting points should also be used. Please see the drawing below. Load calculations are the responsibility of the system designer or installer.
- The mounting structure and hardware must be made of durable, anti-corrosion and UV-resistant material.

4. MOUNTING METHODS

4.1 Mounting with bolts

- Four or Eight pre-drilled mounting holes, located on the aluminum alloy frame, are provided for ease of installation. They are designed to be used with metric M8 stainless steel screws. We recommend to use a tighten torque of 16~20 N.m

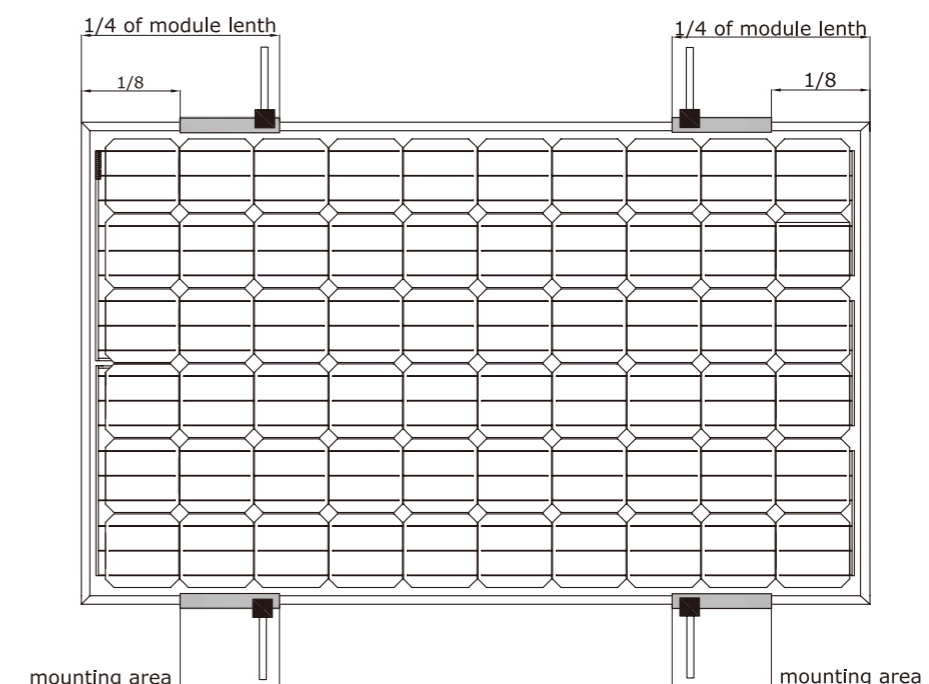
- The module must be attached and supported by at least four bolts through the indicated mounting holes.
- Most installations will use the four inner mounting holes on the module frame.
- Depending on the local wind and snow loads, additional mounting points may be required.

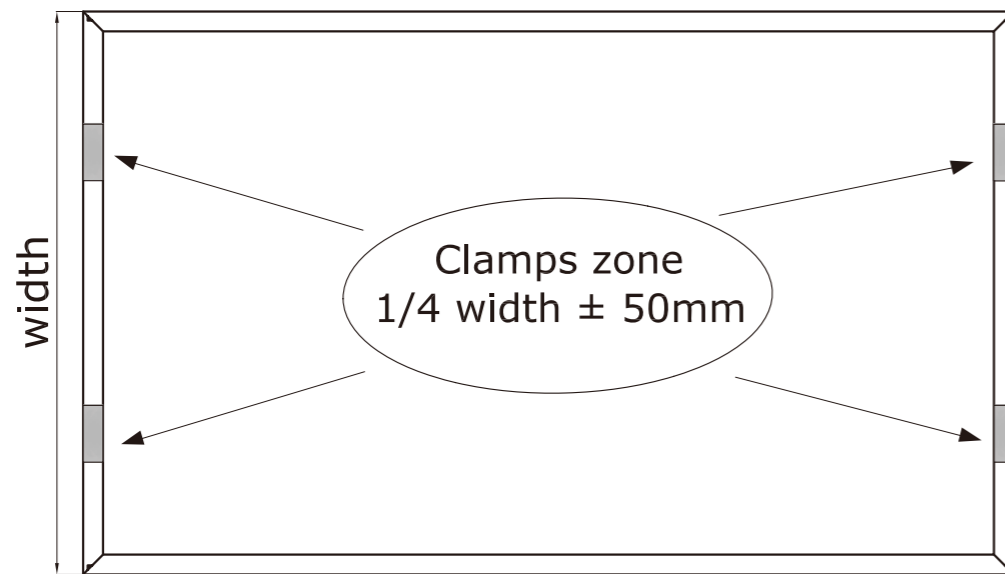
4.2 Mounting with clamping hardware

- A minimum of four module clamps should be used, two on each long/short frame side, in the general clamping areas denoted by the wide arrows on the drawing.
- Depending on the local wind and snow loads, additional module clamps may be required. (e.g. if the snow load is as high as 5400pa, please use eight clamps on the long frame)
- Other mounting methods are acceptable as long as the minimum requirements as described under term 4.2 mounting with clamping hardware are met.
- If module clamps are used to secure the module, The torque should refer to mechanical design standard, we recommend the following torque for bolt:

M6-----9 N.m

M8-----16~20 N.m



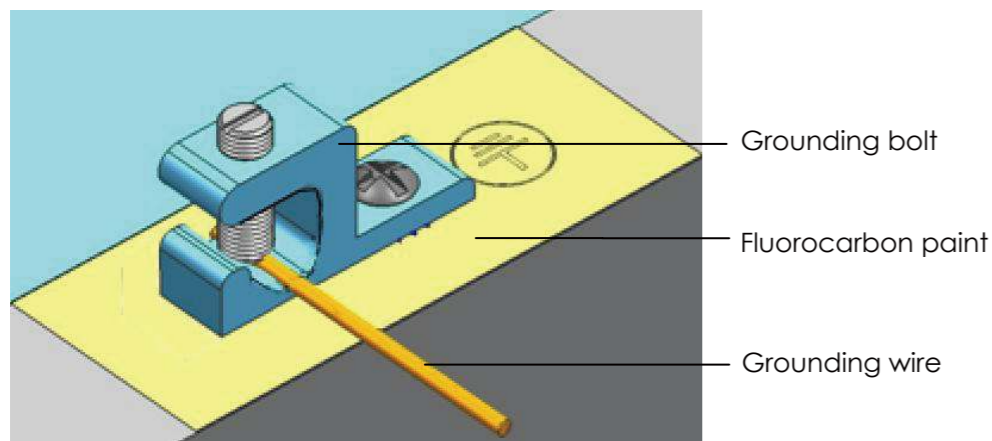


Use four clamps on short frame

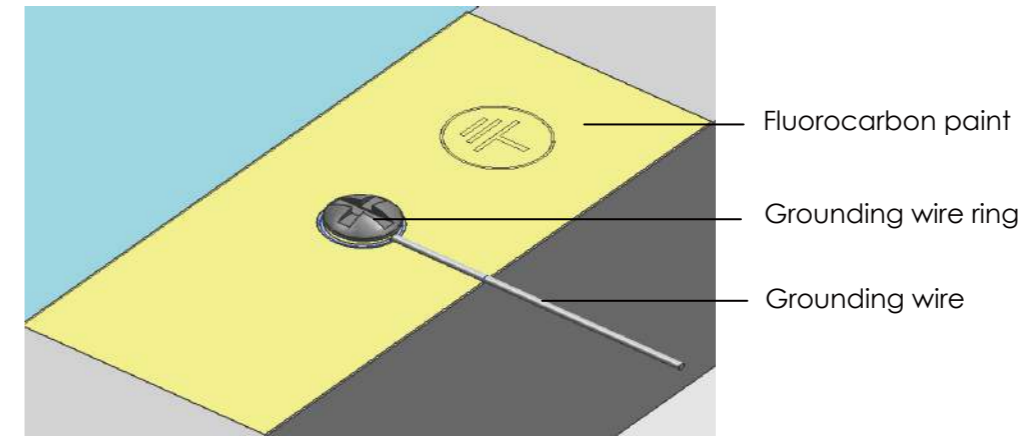
4.3 Anti-salt module mounting procedure

For photovoltaic systems to be installed near the coastline, we recommend using ET SOLAR Anti-salt modules with the following installation action items.

Mainstream Grounding Methods:



Option 1



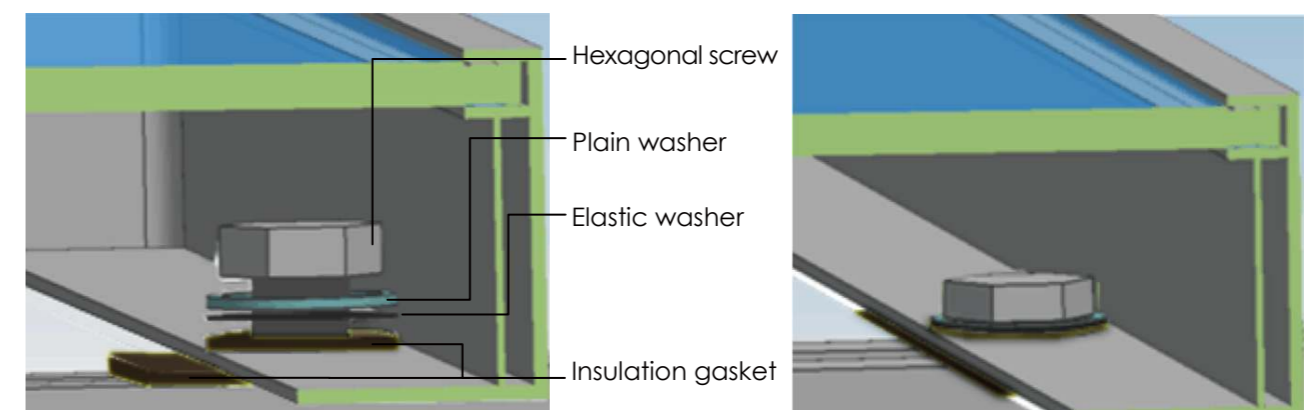
Option 2

Grounding System Installation Steps:

- 1) Before the installation of each module, clean the frame installation area (35mm by 100mm surrounding the grounding hole) and keep it dry.
- 2) Choose either one of the two options described in the diagrams above to properly ground the module.
- 3) Spray varnish on the yellow portion of the diagram covering the entire grounding area. We recommend fluorocarbon varnish.

Recommended mounting methods

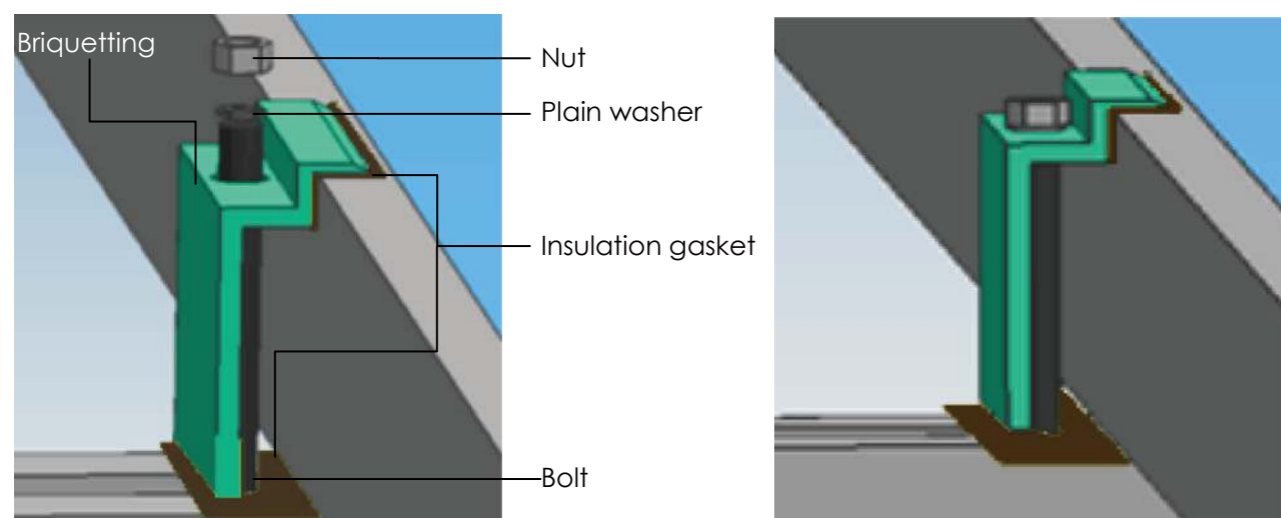
For mounting system with bolts, refer to picture 1 and 2.



Picture 1

Picture 2

For mounting system with clamps, refer to picture 3 and 4.



Picture 3

Picture 4

Maintenance

To ensure optimum modules performance at project sites near the coastline, we recommend the following maintenance services once every 3 months:

- 1) Inspect the frames, mounting systems, grounding holes and other easily corrodible areas.
- 2) Clean the frames, mounting systems, grounding holes and other areas subject to dust and salt accumulations.

To maintain and repair installation sites that are rusty and corroded:

- 1) Clean up the dust and salt accumulations around the rusty areas.
- 2) Spray fluorocarbon varnish on all installations and rusty areas. Make sure that no area is missed.
- 3) For other operation and maintenance guidance, please refer to near-coast installation standard.

Attentions

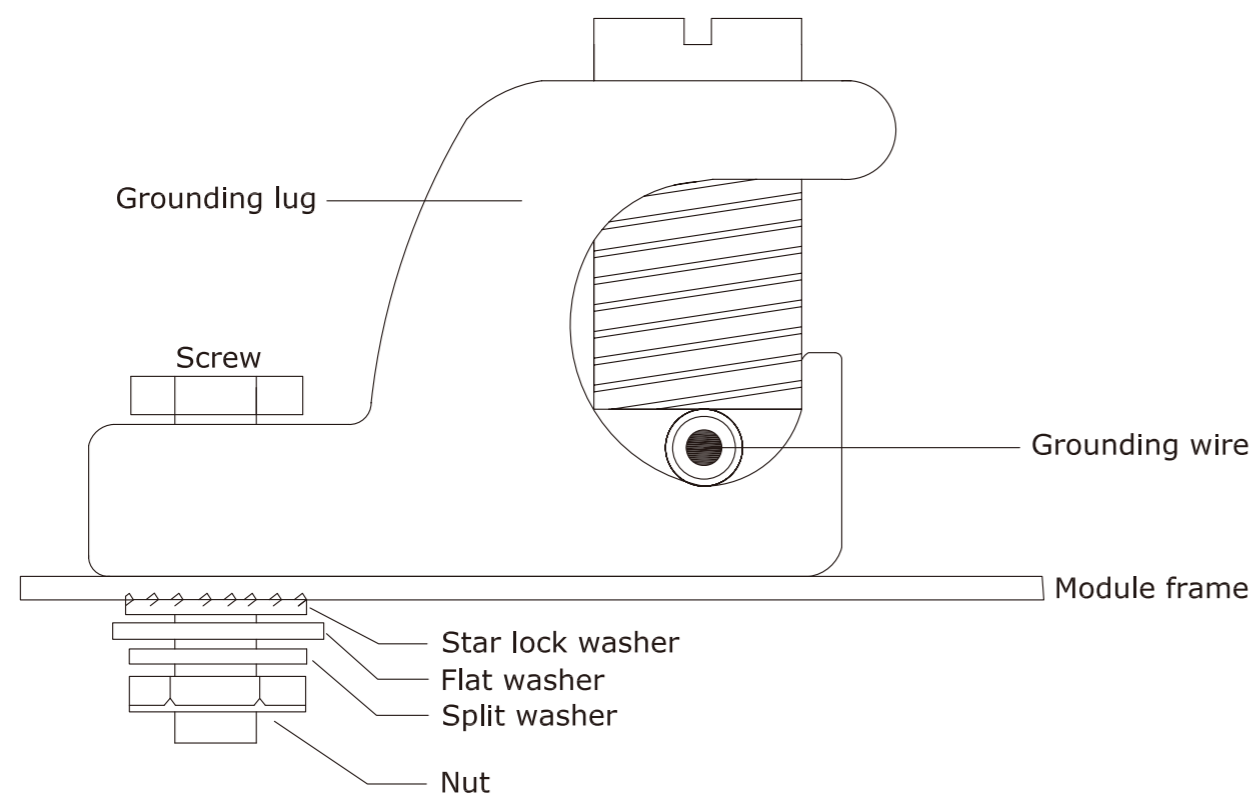
- Aside from components that are parts of the grounding circuit, all other components should be insulated from the module frames using non-conductive gaskets.
- For fluorocarbon varnish or other chemicals, please follow the instructions strictly, personal protective equipment (such as goggles, mask, gloves etc) may be needed during the operation.
- No photovoltaic module should be installed within 50 meters from the edge of the coastline.
- In areas between 50 meters and 500 meters from the edge of the nearest coastline, we recommend ET SOLAR Anti-salt Modules to be used in photovoltaic energy systems installations.
- In areas greater than 500 meters from the edge of the nearest coastline, we recommend conventional modules to be used in photovoltaic energy systems installations.

5. ELECTRICAL INSTALLATION

5.1 Grounding

- All module frames must be properly grounded.
- Observe all local electric codes and regulations.
- A bonding or toothed washer is required to make proper and reliable electrical grounding connection with the anodized aluminum frame.
- Devices listed and identified for grounding metallic frames of PV modules are permitted to ground the exposed metallic frames of the module to grounded mounting structures.
- Consider using a lay-in lug, rated for outdoor use, if the module grounding conductor is to be larger than #10 AWG.
- When using lay-in lugs, the grounding conductor should be inserted into the opening indicated in the figure, and secured using the set screw.

- Expect for equipment grounding, ET Solar recommends the negative pole of PV module array is connected to earth during all PV system installations. That will keep optimal performance of PV Power Plants, which are located in a hot, high humidity climate and high Maximum System Voltage.



PV module grounding with lay in lug ($\phi 4\text{mm}$ grounding holes)

5.2 Wire

- The junction box on each PV module has two wires that terminate in a male and a female connector. When the modules are to be connected in series, the male connector should be plugged into the female connector of the neighboring module while the female connector should be plugged into the male connector of the other neighboring module.

- When connecting parallel modules strings to the distribution box, use proper third-party PV system connectors with suitable length PVF type cable which are qualified for EN50521 and 2PFG1169. All field wiring cables must have large enough cross-sectional areas approved for use at the maximum short-circuit current of the PV module. ET Solar recommends that installers use only sunlight resistant cables (PVF1 type) for direct current (DC) wiring in PV systems. The recommended minimum wire size should be 4 mm^2 and must be subject to the local national codes and regulations.
- The connecting cables must not cross each other and must be kept away from direct sunlight, heat source and any static pool of water. The cables should be secured by the modules mounting structure and should maintain a distance of at least 25 mm from one another with no possibility of coming into contact.
- The connectors should be kept dry and clean. Do not attempt to make electrical connections between wet, soiled, or otherwise faulty connectors. Faulty connections can result in electrical shocks and arcs.

5.3 General electrical installation

- Do not use modules of different configurations in the same system.
- This module is supplied with Multi Contact connectors for electrical connections.
- Refer to local code to determine appropriate types and temperature ratings of conductors. Wiring should be #12 AWG, 4 mm^2 (minimum) and must be temperature rated at $90\text{ }^\circ\text{C}$ (minimum).
- Completely cover system modules with an opaque material to prevent electricity from being generated while disconnecting conductors.
- Refer to local code to determine over current, conductor ampacity and size requirements.
- Installation shall be in accordance with local code.

- For best performance, ensure that positive and negative DC wires run closely together to avoid loops.

WARNING!

Electrical shock hazard!

Do not touch bare conductors or other potentially energized parts.

5.4 Electrical ratings of the concerned modules

Please refer to ET module datasheets. Datasheets can be downloaded from website: www.etsolar.com

6. TESTING, DEBUGGING AND TROUBLESHOOTING

- Blocking diode can be used in PV system to prevent reverse current from the battery if there is no photovoltaic current in the module. If charge controllers are not used, then it is recommended to use blocking diodes. For more details on charge controllers, please consult with professionals.
- In cases where two or more modules are connected serially in a system, if part of the modules are occluded and the other part are exposed to the sun, the high reverse current will flow partially or completely through the module, causing the modules to overheat and even damaging the modules. Bypass diode used in modules can protect modules from such impact of excessive reverse current..The bypass diodes have been integrated in the junction box.
- Operators should protect themselves from electrical shock during debugging or maintenance of solar systems.

Test procedure for modules serial connected before connect them to the PV system.

- Use digital multimeter to check the total open circuit voltage of the serially connected modules. The results should be equal to the sum of the open circuit voltage of individual modules, which can be found from the label on the modules. If the total open circuit voltage is much lower than expected, please follow the following procedure in this instruction.

Troubleshooting for low voltage

- There are two causes of low open circuit voltage, environmental change or circuit fault. The drop of irradiance or increase of environmental temperature reduces the open circuit voltage, which is normal. The troubleshooting here refers to the low voltage caused by circuit faults, which is usually due to incorrect connection of terminals or damage of bypass diodes.
- First, check all wiring connections, and ensure they are well-connected into the PV system. Then check the modules one by one as below:
- Measure the open circuit voltage of a module.
- Cover the module completely with opaque material.
- Disconnect the module from the system.
- Remove the opaque material from the module, and measure its open circuit voltage.
- If the measured voltage is one third or two thirds of the rated value, it indicates that bypass diodes don't work well, and should be replaced.

7. MAINTENANCE

ET Solar recommends the following maintenance items to ensure optimal performance of the module:

- Clean the glass surface of the module as necessary. It is recommended to clean the glass surface with pressured running water compliance with local drinking standards, e.g. low mineral content, near neutral PH value. The maximum water pressure recommended is 1 MPa and the water jet is at least 50cm away from the glass surface. Do not use dishwasher detergent. Do not have water staying on the glass surfaces of PV modules for a long time.
- If a module power decreases abnormally, and its glass surface is found covered by dust, please contact your module installer, retailer or ET solar immediately for technical support.
- Do not attempt to clean a module if the front glass is broken or the backsheet is perforated.

- Electrical and mechanical connections should be checked periodically by qualified personnel to verify that they are clean, secure and undamaged.
- Check the electrical and mechanical connections periodically to verify that they are clean, secure and undamaged.
- Problems should only be investigated by qualified personnel.
- Observe the maintenance instructions for all other components used in the system.

Shutting down the system

- Completely cover system modules with an opaque material to prevent electricity from being generated while disconnecting conductors.
- Disconnect system from all power sources in accordance with instructions for all other components used in the system.
- The system should now be out of operation and can be dismantled. In doing so, observe the all safety instructions as applicable to installation.

8. DISCLAIMER OF LIABILITY

Because the use of this manual and the conditions or methods of installation, operation, use and maintenance of photovoltaic products are beyond ET Solar's control, ET Solar does not accept responsibility and expressly disclaims liability for loss, damage, or expense arising from or in any way connected with improper installation, operation, use or maintenance . Improper installation, operation, use or maintenance means that installation, operation, use or maintenance does not strictly follow this manual and/or the local, regional and national codes and regulations.

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ET Solar shall not be in any way responsible or liable for the end user Customer or any third-party arising out of any non-performance or delay in performance of any terms and conditions of sale, including this manual, due to fire, flood, blizzard, hurricane, thunder, acts of God, changes of public policies, terrorism, war, riots, strikes, unavailability of suitable and sufficient labor or materials and other events which are out of control of ET Solar.

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