

## **Installation and Assembly Instructions**

### **for Solar Modules**

#### **WARNING!**

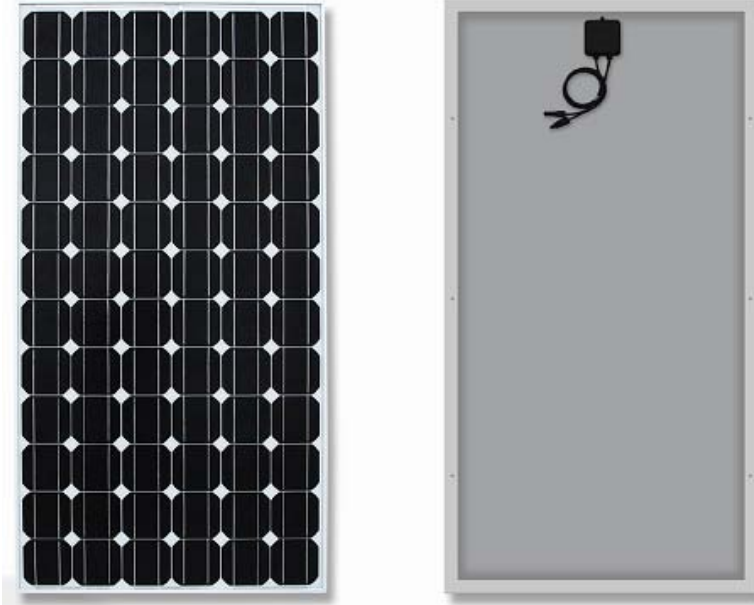
**The photovoltaic module produces electricity when exposed to the sun or other light sources. For your safety and the safety of others, please read the entire Installation and Assembly Instruction manual carefully prior to installation. Please carefully read the following installation and safety instructions. Non-compliance with these instructions may void the module warranty.**

#### **1. Company Introduction**

ET Solar Group is a vertically integrated solar energy equipment manufacturer and turnkey solutions provider. With local sales and marketing subsidiaries and offices throughout Asia, Europe, and North America, we provide high quality photovoltaic modules, world leading solar tracking systems and smart turnkey solutions to our customers in more than 50 countries and areas. Our products have been delivering strong operating performance in a large number of residential and utility scaled solar PV projects around the world.

#### **2. Structure of module**

ET modules are made by layering low-iron-tempered glass, an EVA sticky membrane, high conversion—efficient solar cells and a behind-the-membrane multi-layer backsheets. These elements are laminated into a plate by being heated in a vacuum. After installing the aluminum alloy frame and wiring compartment, a module is born (see Fig. 1)



**Fig.1: Front and back sides of ET-M572170 module**

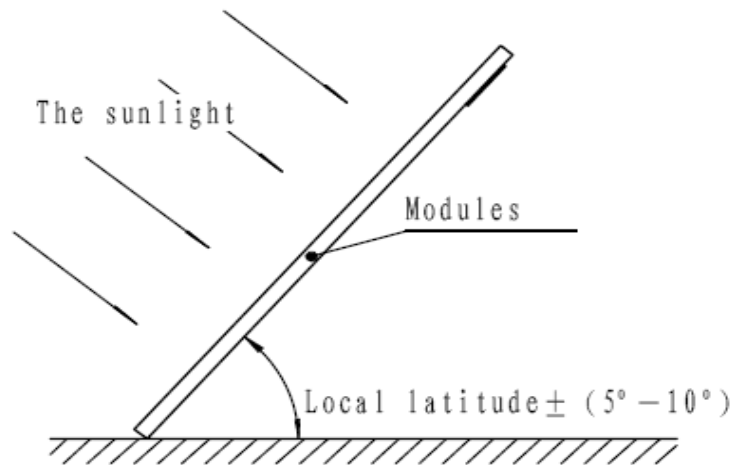
### **3. Installation of modules**

#### **WARNING!**

**Do not attempt to clean a module with a broken glass cover or a perforated backsheet. Such a module can present a serious shock hazard.**

#### **3.1 Installation**

When installing the modules, the face of the units should be placed where they are highly exposed to the sun. It is recommended that the modules usually face the equator; thus, in the Northern Hemisphere the surface should be oriented towards the south, and in the Southern Hemisphere, towards the north. Usually the angle between modules and the ground should be local latitude  $\pm (5^\circ \sim 10^\circ)$  as show in Fig.2.



**Fig.2 Assembly installation angle**

The recommended standoff height is 5 in. (127mm), if other mounting means are employed this may affect the UL Listing.

The specific angle depends on the sunlight condition, local climate and the actual application requirements. The appropriate angle of evaluation has a very important relationship to the output power of the modules and the cost of the construction. The surface of the modules should avoid shadows and be kept clean from foreign materials such as dirt.

The assembly is to be mounted over a fire resistant roof covering material when roof mounting is intended for the modules, the fire resistance of roof covering or wall should be rated for the application.

**WARNING!**

**The local shadowing of modules may cause serious hot-spots and damage the modules.**

A torsion and corrosion-resistant anodized aluminum frame ensures dependable performance, even under harsh weather conditions. Eight pre-drilled mounting holes,

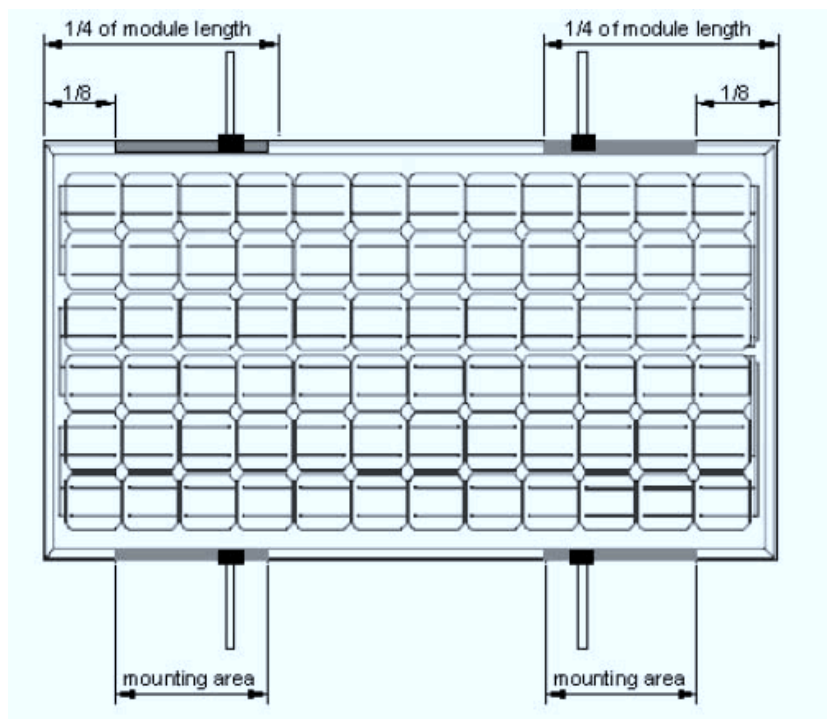
located on the aluminum alloy frame, are provided for ease of installation. They are designed to be used with metric M6×1(Torque 12 Lb-in) stainless steel screws.

### **Mounting with Bolts**

- 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.

### **Mounting with Clamps**

- If module clamps are used to secure the module, the torque on the clamp bolt should be around 8–10 Nm.
- A minimum of four module clamps should be used, two on each long 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.



**WARNING!**  
**The Fire Rating of this module series is Class “C”.**

**Grounding:** All permanently mounted modules have to be provided with appropriate grounding. The grounding lug should be suitable for outdoor use with aluminum. The grounding method of the frame of arrays shall comply with the NEC, article 250 and also meet UL 1703 standard. Lay-in-Lug ground part with 32 threads per inch (e.g., the lay-in-lug with UL file number E34440, part # GBL-4DB), with size #10-32 ½ inch stainless steel thread cutting screw, and using a 20 lb\*inch torque, should be mounted to one of the 4 mm diameter grounding holes marked as grounding hole on the frame. When the module system is used, it should be connected to the ground reliably. The ground wire should be a naked copper wire with surface coating only and with no insulation jacket. The area of cross-section of wire should be sized in accordance with the prime current carrying conductor. The area of cross-section of wire should meet the NEC, article 250. Installation in Canada shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part 1 (refer Figure 3)

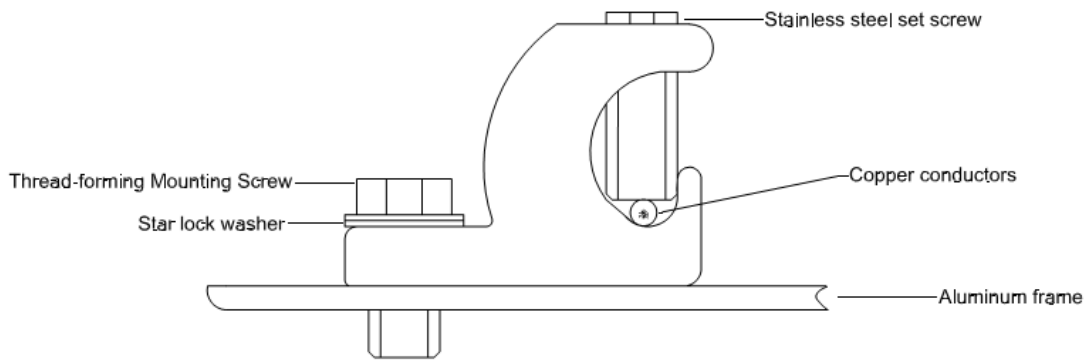


Fig 3. PV module grounding with lay in lug (  $\phi$  4mm grounding holes)

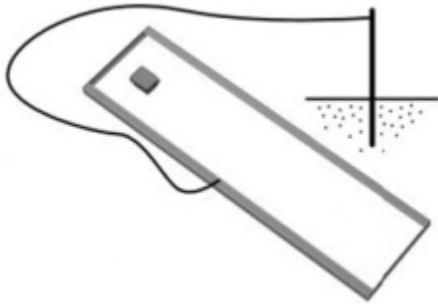


Fig 4. Module to grounding rod

### 3.2 Junction box

The junction box should be fixed on the top end of the module during assembly so as to prevent the seepage of rain.

ET Solar provides a wiring type box. When the integrated J-box is adopted, no tool is necessary for wiring. Just connect the modules in series according to “+” or “-”. You can complete complex series and parallel connection easily and quickly using different electric connectors provided by your supplier.

Connectors provided by different suppliers will not mutually match up. Different connectors provided by one supplier will not match up either. Only one type of the same connector from one supplier should be used to ensure the reliability of the electrical connection.

Module	Male connector	Female connector	Manufacturer	Notes
ETP672series ETP654 series ETP660 series	1394461-2	1394462-4	Tyco Electronics Amp GMBH	12AWG wire
ETM572 series ETM53680 Series	PV-KBT3	PV-KST3	Multi-Contact USA	12AWG wire

There are other options in addition to using a wiring type junction box only consisting of two terminals marked with "+" and "-" to represent the positive and negative terminals of the power supply. Some junction boxes include three or more terminals. Only those terminals indicated with "+" and "-" should be connected to the load. The others are designed for the bypass diodes to reduce the damage to modules caused by hot spots and

to ensure uninterrupted electrical energy output from the array. The hex nut in the exit position on the junction box is used to hold a rubber ring to seal the box.

When disconnecting the connectors of a photovoltaic module in a module array that is exposed to sunlight, electric arcs may result. Such arcs may cause burns and fires. Therefore, PV system commissioning and maintenance must be performed by a qualified electrician in accordance with the NEC. Before disconnecting a module in a solar array, disconnect the string of module from the DC Disconnect at the inverter side, and then fully cover the module with an opaque material. Do not short the positive and the negative connectors of a module exposed to sunlight.

**WARNING!**

**Wiring must only be completed by a qualified engineer with suitable tools.**

The specification of wire for the electric coupler that ET Solar provided is  $1 \times 4.0\text{mm}^2$ . Equivalent wire should be used if the user prefers to use his own wire. When the module's rated current is lower, 12AWG wire is recommended for use, and the strength of the wire should be taken into consideration. ET Solar does not provide any output wiring for module installation.

ET Solar modules are designed to use copper wire only. The working temperature of wire and J-box is  $-40^{\circ}\text{C}$ -  $90^{\circ}\text{C}$ . The wiring box interior is not intended for field access, and no serviceable parts are inside.

The installation in Canada shall be in accordance with CSA C22.1, Safety standard for electrical installations, Canadian Electrical Code, Part 1.

### **3.3 Output Voltage, Current and Maximum Power**

The open-circuit voltage ( $V_{oc}$ ), short-circuit current ( $I_{sc}$ ) and maximal power ( $P_{max}$ ) are printed on the PET label on the backside of the module. The electrical characteristics are within  $\pm 10$  percent of the indicated values of  $I_{sc}$ ,  $V_{oc}$  and  $P_{max}$  under standard test

conditions (irradiance of 100 mW/cm<sup>2</sup>, AM1.5 spectrum, and a cell temperature of 25°C (77°F)).

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 Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes, and size of controls connected to the PV output. If modules are to be installed in parallel (electrically), each module (or series string of modules so connected) shall be provided with the maximum series fuse as specified.

**WARNING!**

In order to avoid electric shock and scalding, it is necessary to cover the surface of the module with a suitable material to prevent incidental light contacting the modules during the connection process.

The modules will generate electrical energy under sunlight and other light sources.

Refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 125 percent (80 percent derating) which may be applicable.

#### 4. Characteristics of Modules

**WARNING!**

**The product is designed as a plain plate type that should not be irradiated directly under concentrated light.**

The array consists of modules in series and parallel and has a similar electrical curve to that of a single module. In order to output maximum electrical power to the load, try to make the impedance of the load match the electric performance of the module or array. In order to maintain the stability of the system, also pay attention to the changes in the



electric curve of modules, especially under weak light. In more complex control circuits, the controller supplier may have already adopted microprocessors for the tracking of maximum power output. For the best impedance matching and the best tracking of maximum power output, please refer to other relevant documents regarding these issues.

Electrical ratings of ET Solar modules are as follows. The detailed specs should refer to module datasheet.

Model	Open circuit voltage at STC(Vdc)	Rated Voltage at STC(Vdc)	Maximum system voltage(Vdc)	Rated current at STC(A dc)	Short circuit current at STC(Adc)	Rated maximum power at STC(watts)	Maximum series fuse(A)
ETM53670	21.45	16.9	600	4.14	4.45	70	7
ETM53675	21.73	17.4	600	4.31	4.72	75	
ETM53680	21.88	17.64	600	4.54	4.98	80	
ETM53685	21.94	18.05	600	4.71	5.29	85	
ETM572155	43.30	35.20	600	4.40	4.98	155	12
ETM572160	43.90	35.26	600	4.49	5.07	160	15
ETM572165	44.12	35.68	600	4.60	5.19	165	
ETM572170	44.16	36.13	600	4.71	5.3	170	
ETM572175	44.25	36.24	600	4.83	5.50	175	
ETM572180	44.60	36.30	600	4.95	5.61	180	
ETM572185	44.60	36.30	600	5.09	5.80	185	
ET-P654180	32.35	26.45	600	6.81	7.6	180	
ET-P654185	32.3	26.45	600	6.99	7.7	185	
ET-P654190	32.5	26.78	600	7.1	7.72	190	
ET-P654195	32.75	27	600	7.22	7.98	195	
ET-P654200	33.2	25.8	600	7.75	8.26	200	
ET-P654205	32.8	27.3	600	7.5	8.1	205	
ET-P654210	32.83	27.54	600	7.63	8.3	210	
ET-P654215	33.2	27.54	600	7.81	8.5	215	
ET-P654220	33.2	27.54	600	7.81	8.5	215	
ET-P672230	43.56	34.2	600	6.75	7.32	230	
ET-P672235	43.56	34.2	600	6.87	7.45	235	
ET-P672240	43.85	34.95	600	6.88	7.63	240	
ET-P672245	43.85	34.95	600	7.01	7.7	245	
ET-P672250	43.88	35.2	600	7.12	7.81	250	
ET-P672255	43.88	35.2	600	7.24	7.85	255	
ET-P672260	43.49	34.8	600	7.47	8.18	260	
ET-P672265	43.63	36.4	600	7.28	7.9	265	
ET-P672270	43.63	36.4	600	7.43	7.9	270	

ET-P672275	43.78	36.72	600	7.49	7.96	275	
ET-P672280	43.78	36.72	600	7.63	7.98	280	

ET-P660200	36	28.75	600	7.7	7.71	200	15
ET-P660205	36	28.75	600	7.13	7.8	205	
ET-P660210	36	28.75	600	7.3	7.99	210	
ET-P660215	36	29	600	7.41	8.1	215	
ET-P660220	36.3	29	600	7.58	8.1	220	
ET-P660225	36.3	29	600	7.75	8.1	225	
ET-P660230	36.5	29.4	600	7.82	8.3	230	
ET-P660235	36.5	29.4	600	7.99	8.3	235	

Usually the load of the modules is a group of batteries. To prevent the modules from being charged by batteries under the circumstance of no sunlight, it is important to add a shut-off diode in series. Also, please consider the voltage decrease of PN junction of about 0.7V when connecting the shut-off diode. The modules can withstand for a maximum positive or negative design loading of 45 lbs / ft<sup>2</sup>.

The environmental temperature may also affect the modules' output power. If the environmental temperature goes up, the short-circuit current will increase a little, while open-circuit voltage will decrease, which will result in a decrease in the module's output power. Therefore, a lower environmental temperature is most appropriate for the module.

### 5. Operation and Maintenance

ET Solar module users should rinse the array seasonally or as needed in dry, dirty areas to improve the performance of their solar electrical systems. Heavily soiled modules will have a decrease in performance due to reduced light on the photovoltaic cells. Studies by the PVUSA in Davis, CA estimate that during a dry year module soiling may affect performance by as much as 7% annually with no cleaning. Seasonal rains often clean the modules, however, during the long dry summer, it is helpful to rinse the modules as needed.

ET solar modules may be rinsed with clean water to remove dirt. Normal pressure from a standard residential hose and nozzle is recommended. Early morning and late afternoons are favorable times to clean to avoid a sudden change in temperature. Care must be taken since modules produce energy any time light is present. Modules are not to be touched or walked on except by a licensed professional.

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**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 out of or in any way connected with such installation, operation, use or maintenance. No responsibility is assumed by ET Solar 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.

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