

Unimen Solar Co., Ltd

Solar module installation manual

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1. Purpose of the guide

The guide provides the Information for installation and use of modules from Unimen Solar Co., Ltd (Hereinafter abbreviate Unimen).

Please read and understand the guidebook before the installation. If there are any questions, please contact us. During the installation, please comply with safety measures and local law. Before installation, the installer should be familiar with the system for mechanical and electrical requirements. Please keep the guide for future reference.

1.1 In General

Installation needs professional skills and knowledge. It must be completed by professionally qualified engineers. Each module has a junction box, and Unimen can provide the cables as the customers require. Installers should understand the danger that may occur during the installation in advance, including electric shock, etc. In case of direct sunlight, each module can generate more than 30V voltage. It's dangerous to contact with the voltage above 30V.



Do not disconnect the cable in case of load.

Modules can change the solar energy to DC. Modules are used in ground, roof or other outdoor environments. Rational design and use of mounting system is the responsibility of designer or installer. Please use the recommended installation hole in subsequent paragraphs.



Don't decompose modules, nor remove any brands of modules.



Don't paint nor put adhesive on the surface of modules.



Don't use mirror nor lens focusing sunlight to the modules. When making the installation, please comply with the local, regional or national laws and regulations.

1.2 Precaution

When sunlight irradiates the modules, the modules will exceed 30V DC voltage. If the modules are in series connection, the total voltage is the added voltage of each connected modules; if the modules are in parallel connection, the total current is the added current of each connected module.



During transportation and installation, keep children away from the modules. the installation process, use opaque material which covers the surface of modules to avoid current.



During installation and maintenance, do not wear metal rings, bracelet, earrings, nose rings, lip rings or other metal goods. Apply the to installation manuals for all components, such as wires and cables, connectors, controller, inverter, batteries, etc.

Only use types of connector, cable, mounting system etc that match the system. In a particular system, please use same type modules. In standard test conditions (1000W/m² of irradiance, AM1.5 spectrum, 25 °C ambient temperature), there's 10% tolerance for I_{sc}, V_{oc} and P_{max} of modules compare to the standard value.

In original outdoor conditions, the current and voltage of modules is a little bit different from parameters listed. Parameters are measured under standard test conditions, so when designing the system, please design according to 125% of parameter specification.

2 Product ID

Each module has two ID possibilities of identification

Label: describes type, rated power, rated voltage, rated current value in standard test conditions; weight, size, etc.; maximum fuse capacity and maximum system voltage, and company information.

Bar code: each module has a unique serial number, it is permanently fixed in the inside of module during laminating, in the back of the modules, there's a serial number same with the bar code for

scanning.

3 Machinery Installation

3.1 Select Location

Select the appropriate location to installation.

In the northern hemisphere, it's better to install the modules facing south; in the southern hemisphere, it's better to install the modules facing north. To find the best installation place, please refer to the installation guide or consult a reliable solar energy system installation company.

Modules should be installed in the location where there is irradiation and it is ensured not to be dodged at any time.

Don't install modules where flammable gases are gathering.

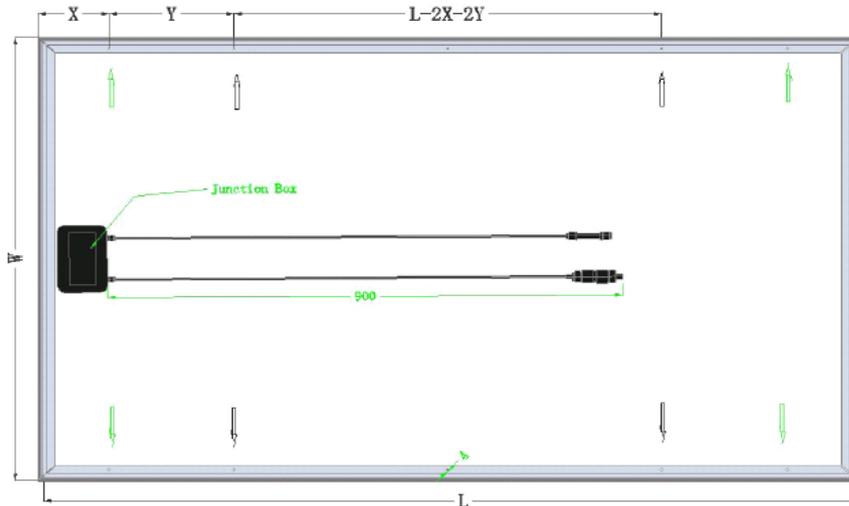
3.2 Select the appropriate mounting system.

It should be complied with the instructions attached to the mounting system.

Don't drill holes in the glass surface.

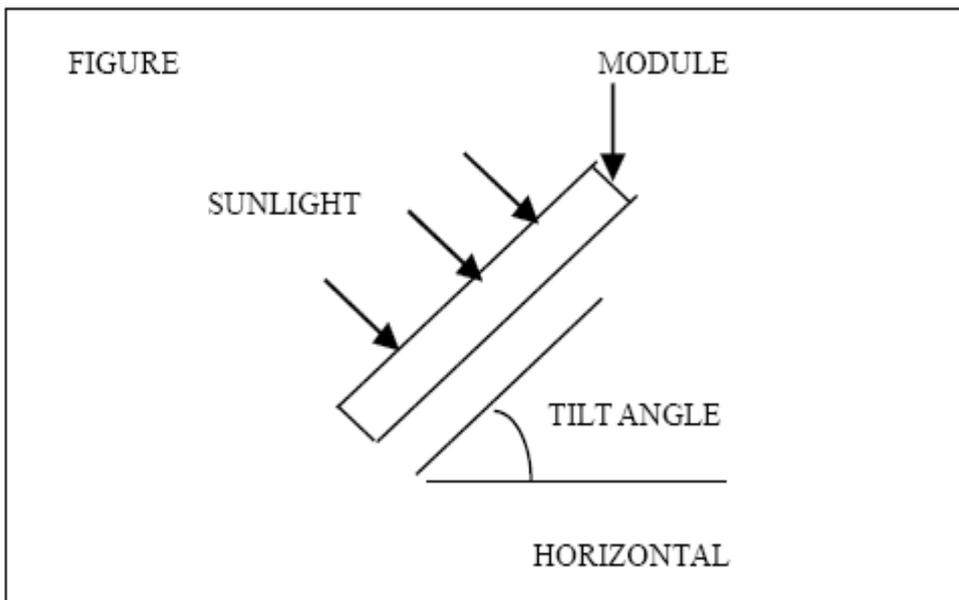
Don't drill holes in the frames.

During installation, use the four mounting holes inside of the frame to fix to the mounting system. Please also use the mounting holes outside of the frame for strengthen the fixing when there's strong wind or heavy snow. Details please refer to the figure below. Meanwhile, please make load calculation by designer.



The mounting system must be durable, corrosion resistant, anti- UV aging materials. The module tilt angle is measured between the solar modules and the ground (Figure 1)

Figure 1



3.3 Ground installation

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Select the appropriate height for PV system installation, it's easy to clean up the snow, dust etc of the surface of modules. While also ensuring that the lowest part of the module should be high enough to avoid the damage of plants or trees.

3.4 Roof installation

When modules are installed on the roof or other buildings, make sure that it is securely fixed and will not be damaged by the strong winds or heavy snow. The backside of the modules should be ventilated to cool the modules (the minimum distance for modules and the surface of installation is 10cm). During roof installation, ensure that the construction of roof is appropriate. In addition, the roof must be sealed where the modules are installed, in case of leak. In some cases, some special mounting system may be used, please consult a reliable company for installation. Install solar modules on the roof may affect the fireproof of housing. The fireproof rating of the modules is C-class, please install and refer to the actual situation of the local roof. When there are strong winds, do not work on the roof.

3.5 Pillar Installation

When installing the modules in pillars, select pillar and mounting system.

3.6 Machinery Installation

When installing the modules, the prefabricated mounting holes in the frames should be used. In standard conditions, use the 4 mounting holes inside of the frame to install modules. If there are strong winds or heavy snow, please also use the 4 mounting holes outside of the frame.

Don't move modules by the junction box or cable.

Don't stand or step on the modules.

Don't fall down nor allow objects fall down to modules.

To avoid broken glasses of modules, don't put heavy objects on the modules.

4 Electrical Installation

4.1 ON-Grid system

DC produced by the system can be converted to AC and connected to the public grid. The on-grid connecting-system is different in each region. Please consult engineers for designing the system. Typically, the installation of this system needs to be recognized by the public utilities sector, it needs the formal acceptance and approval.

4.2 Grounding

The mounting system must be grounded correctly. Use the recommended connectors and connect-cables correctly. Fix them to the modules' frame.

Use a electroplating treated mounting system to ensure good circuit conduction.

It is recommended to use grounding wire accessories to connect the grounding cable. Firstly, peel off the cable about 16mm, don't damage the core wire and insert the socket of the connector, then fix the screw. Next, use M3 or M5 stainless steel screws and connectors for connecting to the aluminum frame. Note: There are two different sizes of grounding holes, the smaller is gradually discontinued. Besides, the way of grounding installation is the same. Fix the radial washer directly to the bottom of the wires; pierce the oxide film in the aluminium frame to conduct the circuit. Followed by a flat washer, then a spring washer, and finally a nut, so as to ensure reliable grounding. M3 or M5 screw recommended tightening torque is 0.8Nm or 1.5Nm.

4.3 Electrical Installation

In one PV system, please use the same modules. The maximum number of modules (N) = $V_{max\ system} / [V_{oc} \text{ (at STC)}]$. Several modules are connected in series, and then paralleled to form a photovoltaic array, which is particularly applicable to high voltage situations. If the modules are in series, the total voltage is equal to the sum of the voltage of each module. If high current is needed, please connect the modules in parallel. The total current is equal to the sum of the current of each module. Unimen can provide prefabricated module-connectors for connecting the system. Regarding cable size, type and temperature parameters please refer to the relevant regulations.

The cross sectional area of the selected cable and connectors must meet the maximum system capacity of short-circuit current (for a single module the cable cross-sectional area is recommended as

4mm², the rated current of connectors is above 10A), otherwise cable and connector will overheat because of the large current. Please note the maximum cable temperature is $\geq 85\text{ }^{\circ}\text{C}$, the connector maximum temperature is $\geq 105\text{ }^{\circ}\text{C}$.

When making the installation, face up the surface with the junction box, and try to avoid rain shower.

5. Debugging and maintenance

5.1 Blocking diode and bypass diode

The blocking diode can prevent the current to flow from the battery to the modules when there's no current generate by modules. If you do not use the controller, we recommend to use the blocking diode. For the using of the controller, please consult the professional dealer.

In a system of two or more modules connected in series, when a part of the module is occluded and the other part exposed to the sun, the high reverse current will flow through and partially or completely block the cell, causing the cell to overheat and even to damage the modules. In all modules above 55 watt there have been integrated bypass diodes in the junction box. The diodes are not broken easily, and can be replaced easily. During debugging or maintenance of solar systems, protect yourself to avoid electrical shocks.

5.2 Testing, debugging and troubleshooting

Test all the components before using the system, and comply with the guide book.

5.2.1 Testing the modules connected in series before integrating the series in the system. When using a digital multimeter to check the open circuit voltage of the modules connected in series, the measurements should be equal to the sum of the individual modules' open circuit voltage. You will find the rated voltage in the technical specification. If the measurement value is much lower than expected, please follow the "low voltage troubleshooting" in the instructions for processing.

A digital multimeter can be used to connect the two ends of the modules in series to check short

circuit current of each series circuit, or use PV lights as load for testing. Note that the ammeter rated load current scale should be rated 1.25 times higher than the short-circuit current of the series modules. You can find the rated current in the technical specifications. Measured value will be changed with the climatic conditions, time and modules shading conditions.

5.2.2 Troubleshooting for fault low voltage.

Identification of the normal low voltage and fault low voltage. The so called normal low-voltage is the reduction of the open circuit voltage, which is caused by the rise of temperature of the cells or the reduction of irradiance. Low voltage fault is usually due to wrong connections or a damage caused by bypass diodes. First, check all wiring connections to be well-connected, to ensure that there is no open circuit.

Check the open circuit voltage of each module. Cover the modules completely with a piece of opaque material. Disconnect both ends of the wire of the module. Remove the opaque material on the module, inspect and measure the terminal open circuit voltage.

If the measured voltage is only half of the rated value, it shows the bypass diode has been broken, please refer to 'test and replacement of bypass diodes'.

In the case that irradiance is not so low, if the difference between the terminal voltage and the rated voltage is more than 5%, it indicates that there's problem in module connection.

5.3 Maintain

Unimen recommends the following maintenance measures to ensure the best performance components:

When necessary, clean the glass surface of the module with a soft sponge or cleaning cloth. Using mild, non-abrasive cleaning agent added to remove stubborn dirt. Ensure, on a regular basis of mechanical and electrical checking in every 6 months, that the connectors of the modules have a clean and reliable connection.

If you have any questions, please check with qualified personnel. Note that all the requirements of components in the system, such as mounting system, charging rectifiers, inverters, batteries etc. comply with each other.

6 Disclaimer

If the installation, operation, maintenance are beyond the scope of Unimen's control, Unimen will not be responsible for the loss, damage or expense caused by it. The use of PV products may lead to the infringement of third party's patents or other rights, Unimen will not be responsible for it. Customers do not get the use of Unimen product patent or patent rights of any use of authority.

The information in this manual based on the knowledge and reliable experience from Unimen. However, the information including product specifications and recommendations do not constitute any guarantee.

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