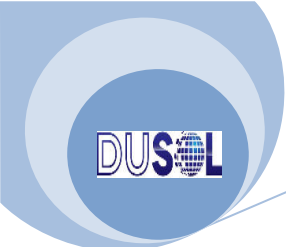


User Manual



Mono & Multi
Solar PV module DS36 series
Solar PV module DS60 series
Solar PV module DS72 series



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1. General Information

1.1 Over view

Thanks for choosing DUSOL Solar PV modules. In order to ensure the PV modules to be installed correctly, please read the following operation instructions carefully before installing and using the modules.

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

1.2 Introduction

This User Manual refers to the installation, wiring, handling, maintenance and general administration of our PV-modules. Please read this manual accurately and completely before configuration and installation of the PV-module. All advices given in this document are to be handled by a qualified person. Attention should also be paid to the live threatening risk, which may occur because of the tension in conjunction with a grid-feeding PV-plant. In case of an improper installation of the module there is a danger of fire risk.

In case of divergence towards this user manual DUSOL does not incur liability for personal damages or property damages, which arise because of improper utilization, maintenance or incorrect assembly of the photovoltaic module.

1.3 Applicable Products

This document is applicable to the series of solar module as listed below:

DS36M (150=40-170, in increment of 5)

DS60M (250=250-280, in increment of 5)

DS72M (300=170-350, in increment of 5)

DS36W (150=40-170, in increment of 5)

DS60W (250=250-280, in increment of 5)

DS72W (300=300-350, in increment of 5)

Make sure the array of modules installed within the Maximum permitted system voltage and the rating current and voltage of the sub-equipments such as regulators and inverters. The maximum permitted system voltage (DC) of the modules is 1000V. This module has a Class C Fire Rating and must be installed over a roof which is with appropriate fire resistance.

The modules are qualified for application class A, and modules qualified for safety through EN IEC 61730 within this application class are considered to meet the requirements of Safety Class II

2. Basic safety instructions

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 module. Broken solar module glass is an electrical safety hazard (may cause electric shock and fire). These modules cannot be repaired and should be replaced immediately.



Electric Shock and Burn Hazard

This photovoltaic module produces electricity when exposed to the sun

- To reduce the risk of electrical shocks or burns, modules can be covered by opaque materials during installation to avoid shocks or burns.
- Solar modules create electricity and are even energized under a slight illumination level. A series connection of modules leads to an accumulation of voltage. A parallel connection in addition leads to an accumulation of current. The wiring of several modules to a generator control panel is only to be handled by authorized specialized staff.
- Following the battery manufacturer's instructions if batteries applied.
- Do not install modules where flammable gas may be present.
- Do not touch live terminals with bare hands. Use insulated tools for electrical connections
- Do not remove any part of the module installed or disassemble the module.
- All instructions should be read and understood before attempting to install, wire, operate and maintain the module.
- Please do not lift up PV modules by lifting up the connected cables or the junction box.
- All PV systems must be earthed.
- Never open the junction box of the photovoltaic module.
- 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 this module should be multiplied by 1.25 when determining 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.
- Do not stand or step on the PV module, this is prohibited and there is a risk of damage the module and cause injury for you.
- Only PV modules with the same cell size should be connected in series.
- During all transportation situations, please make sure no huge shock for the vehicle or the modules, as this may damage the module or lead the cell to be crack.
- During all transportation situation, never let the module fall down from the vehicle, house or hands. This will break the cells of the module.
- Do not clean the glass with chemicals.
- Do not disconnect any of the module when it is under load.

3. Installation

3.1 Installation safety

- Always wear protective head gear, insulating gloves and safety shoes (with rubber soles).
- Keep the PV module packed in the carton or on the pallet until installation.
- 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 modules are wet.
- Use insulated tools and do not use wet tools.
- When installing PV modules, do not drop any objects (e.g., PV modules or tools).
- Make sure flammable gasses are not generated or present near the installation site.
- Insert interconnect connectors fully and correctly. Check all connections.
- The interconnect cable should be securely fastened to the module frame, Cable support should be done in a way to avoid the connector from scratching or impacting the back sheet of the module.
- Do not touch the terminal box and the end of the interconnect cables (connectors) with bare hands during installation or under sunlight, regardless of whether the PV module is connected to or disconnect from the system.
- Do not expose the PV module to excessive loads on the surface of the PV module or twist the frame.

- Do not hit or put excessive load on the glass or back sheet, this may broken the Cells or cause micro crack.
- During the operation, don't use sharp tools to wipe the backsheet and glass, it would leave scratch on the module. Do not drill holes on the frame; it may cause corrosion of the frame.

3.2 Installation Condition

3.2.1 Climate condition

Please install the modules in the following conditions:

- a) Relative humidity: within 45% to 95%.
- b) The operating temperature: within $-40^{\circ}\text{C}(-4^{\circ}\text{F})$ to $85^{\circ}\text{C} (185^{\circ}\text{F})$
- c) The wind/snow pressure load of the installation site should be less than $5,400\text{N/m}^2$ (50PSF).

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

3.2.2 Site selection

In most applications, DuSol solar PV 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. Modules facing 30 degrees away from true South (or North) will lose approximately 10 to 15 percent of their power output. If the module faces 60 degrees away from true South (or North), the power loss will be 20 to 30 percent.

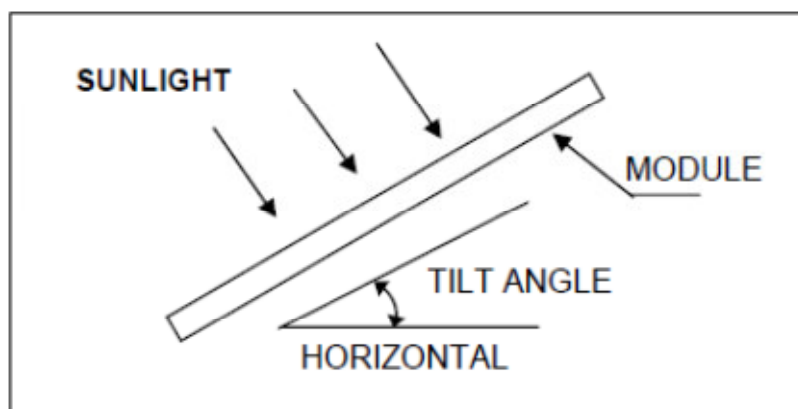
When choosing a site, avoid trees, buildings or obstructions, which could cast shadows on the solar photovoltaic modules especially during the winter months when the arc of the sun is lowest over the horizon. Shading causes loss of output, even though the factory fitted bypass diodes of the PV module will minimize any such loss. Do not install the PV module near naked 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.

3.2.3 Tilt angle selection

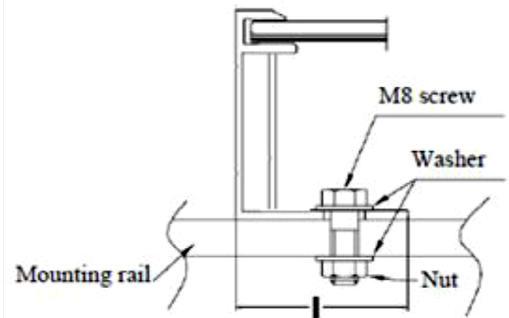
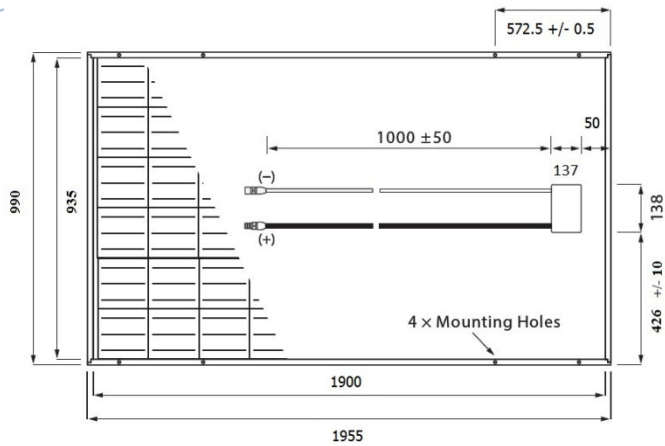
The tilt angle of the PV module is measured between the surface of the PV module and a horizontal ground surface. The PV module generates maximum output power when it faces the sun directly.



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.

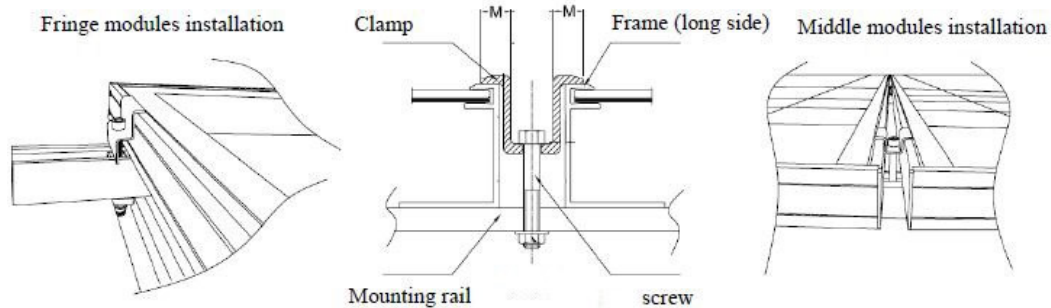
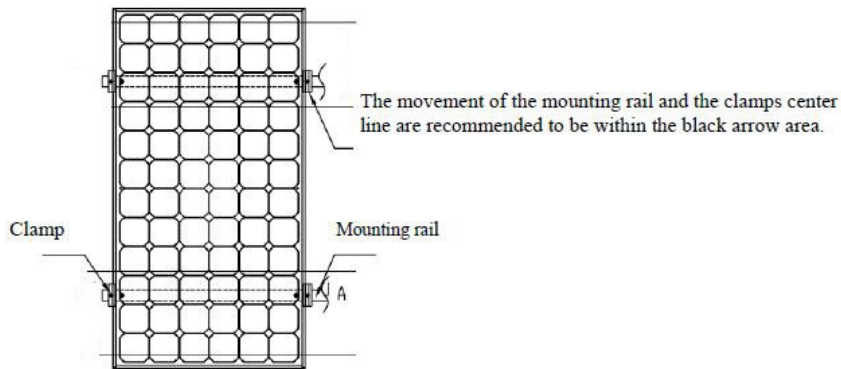
4. Mechanical Installation introduction

The frame of each module has 4 mounting holes (Length* Width: 10mm*5mm) used to secure the modules to support structure. If the wind or snow loads is less than 2400Pa , you can use the four symmetry holes close to the inner side on module frame. ,if the wind or snow load is bigger than 2400Pa, you must use all the 4 mounting holes. The module frame must be attached to a mounting rail using corrosion-proof screws together with spring washers and flat washers in eight symmetrical locations on the PV module. The applied torque should be big enough to fix it steadily, for safety, you'd better follow the clamps manufacture's recommendation. Please find detailed mounting information in the below illustration,



4.1 Fixation with clamps (at long side or short side)

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 or short sides of the module. Depending on the local wind and snow loads, if the pressure load is more than 2400Pa, additional clamps or support would be required to ensure the module can bear the load. The applied torque should be big enough to fix it steady, Please find detailed mounting information in the below illustration, the mounting place distance is



5. Wiring and connection

- a) 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 module connected in series should have similar current. Modules must not be connected together to create a voltage higher than the permitted system voltage(1000VDC), as reference the maximum number of modules in series (N) can be easily calculated by dividing the Maximum System Voltage of the modules by the respective Voc value of the module. Any more please always take into consideration the variation of the voltage under different temperatures, the Voc of the modules will be rise when the temperature drops.
For example: with DS72300M-72 modules (Max. System voltage is 1000V) the maximum series modules configuration number should NEVER can exceed $N= 22$ ($1000V/45.2V = 22.1$)
- c) PV module connect in parallel should have similar voltage. As reference the maximum number of modules in parallel can be easily calculated by dividing the maximum rated current (indicated in the electrical specification) by Isc value of the module, and then plus 1. Any more please always take into consideration the variation of the current under different temperatures, the Isc of the modules will be rise when the temperature goes up.
- d) Open the connection box of the control system and connect the cabled from the PV arrays to the connection box in accordance with the installation indication of the PV control systems. The cross-sectional area and cable connector capacity must satisfy the maximum short-circuit of PV system (For a single component, we recommended the cross-sectional area of cables is 4mm² and the rated current of connectors is more than 10A), otherwise cables and connectors will become overheating for large current. Please pay attention: the temperature limit of cables is 85°C and the temperature limit of connector 105°C)
- e) All module frames and mounting racks must be properly grounded in accordance with local and national electrical codes. Attach the equipment grounding conductor to the module frame using the hole and hardware provided. Note that a stainless steel star washer is used between the ground wire and the module frame. This washer is used to avoid corrosion due to dissimilar metals. Tighten the screw securely.
- f) These modules contain factory installed bypass diode .if these modules are incorrectly connected to each other, the bypass diodes, cable or junction box may be damaged.

6. Maintenance and care

In general it is not necessary to clean the modules if the inclination is $>10^\circ$. In case of persistent dirt use only classic glass cleaner or cleaning alcohol. Do not use galling or chemical cleaners, do not scrape the module.

All modules are maintenance free, but it could be useful to verify the PV-installation regularly against following criteria's:

- Integrity of the cables
- Fastening elements against e.g. loose brackets
- Cleanness, stainlessness and safe connection of all cables connections

In some cases:-

- a) A built up 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.
- b) Never use abrasive material under any circumstances.
- c) 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.
- d) Check fixing screws and mounting brackets are tight, adjust and tighten as necessary.
- e) When clean the modules, it is not allowed to stand on the module this it prohibited.

7. Electrical specification

The module electrical rating are measured under Standard Test Conditions, which are $1000\text{W}/\text{m}^2$, irradiance with AM 1.5 spectrum and 25°C (77°F) ambient temperature. The module might produce more or less voltage or current than rating value in uncertainty condition. 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 current ratings, fuse sizes, and size of controls connected to the PV output. Please refer DuSol catalogue for more electrical characteristics of PV products at STC and the tolerance of I_{sc} , V_{oc} , V_{mp} and I_{mp} is $+15\%$ & -5% .

8. 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 DuSol control, DuSol 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 DuSol 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 DuSol 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 .DuSol reserve the right to change the manual, the PV produce, the specifications, or product information sheets without prior notice.

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