



BenQ
Solar

A division of AU Optronics

BenQ Solar Photovoltaic Modules (IEC, ETL)

PM220P00 / PM240P00
Installation Guide for Users

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Important

Please read this instruction sheet in its entirety before installing, wiring, or using this product in any way. Failure to comply with these instructions will invalidate the BenQ Solar Limited Warranty for PV Modules.

Limited Warranty

Module limited warranties are described in the BenQ Solar warranty certificates.

Warranties do not apply to any of the following:

PV modules which in BenQ Solar's absolute judgment have been subjected to: misuse, abuse, neglect or accident; alteration, improper installation, application or removal (including but not limited to installation, application or removal by any party other than a qualified personnel; non-observance of BenQ Solar's installation, users and/or maintenance instructions; repair or modifications by someone other than an approved service technician; power failure surges, lightning, flood, fire, accidental breakage or other events outside BenQ Solar's control.

Disclaimer of Liability

The installation techniques, handling and use of this product are beyond company control. Therefore, BenQ Solar does not assume responsibility for loss, damage or expense resulting from improper installation, handling or use.

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Safety Instructions

- Modules interconnect pass direct current (DC) and are sources of voltage when the module is under load and when it is exposed to light. **Direct current can arc across gaps and may cause injury or death if improper connection or disconnection is made, or if contact is made with module leads that are frayed or torn.** Do not connect or disconnect modules when current from the modules or an external source is present.
- Cover all modules in the PV array with an opaque material before making or breaking.
- It is imperative to use the supplied locking connectors and safety clips in order to defend against untrained personnel disconnecting the modules once they have been installed.
- All installations must be performed in compliance with all applicable regional and local codes.
- There are no user serviceable parts within the module. Do not attempt to repair any part of the module.
- Installation should be performed only by qualified personnel.
- Remove all metallic jewelry prior to installing this product to reduce the chance of accidental exposure to live circuits.
- Use insulated tools to reduce your risk of electric shock.
- Do not stand on, drop, scratch or allow objects to fall on modules.
- Damaged modules (broken glass, torn back sheet, broken j-boxes, broken connectors, etc) can be electrical hazards as well as laceration hazards. Contact with damaged module surfaces or module frame can cause electric shock. The dealer or installers should remove the module from array and contact the supplier for disposal instructions.
- Do not install or handle the modules when they are wet or during periods of high wind.
- Contact your module supplier if maintenance is necessary.
- Save these instructions.
- The electrical installation is in accordance with local electrical regulations.
- Do not open electrical connections or unplug connectors while the circuit is under load.



The module electrical ratings are measured under Standard Test Conditions (STC) of 1000W/m² irradiance with AM 1.5G spectrum and a cell temperature of 25°C. BenQ Solar modules deliver specific electrical characteristics in Table I.

Table I--Electrical Characteristics

Module Type	P _{max} (W)	V _{oc} (V)	I _{sa} (A)	V _{mp} (V)	I _{mp} (A)
PM220P00_220 PM240P00_220	220	36.37	8.36	27.73	7.78
PM220P00_225 PM240P00_225	225	36.79	8.46	28.91	7.91
PM220P00_230 PM240P00_230	230	37.01	8.49	29.23	7.94
PM220P00_235 PM240P00_235	235	37.21	8.55	29.44	8.02
PM220P00_240 PM240P00_240	240	37.42	8.62	29.65	8.1
PM220P00_245 PM240P00_245	245	37.63	8.68	29.87	8.18

PM220P00_250 PM240P00_250	250	37.83	8.75	30.08	8.26
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A PV module may produce more current and/or voltage than reported at STC. Sunny, cool weather and reflection from snow or water can increase current and power output. Therefore, the values of Isc and Voc marked on 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 PV output. An additional 1.25 multiplier may be required by the NEC (National Electric Code) for sizing fuses and conductors as described in the NEC section 690-8.

Performance of PV Modules

A PV module generates current which is proportional to the intensity of solar radiation, while the voltage varies with cell temperatures.

Note that the cell temperature is usually higher than the environmental temperature. The increase in the temperature of cell compared to the air temperature depends on the thermal characteristics of the module.

In summary, depending on solar radiation, the temperature of the cells and the equipment to which they are connected, a PV module will generate a different current and voltage levels, which result in a different power output.

Grounding

BenQ Solar PV modules have a clearly marked grounding hole on each side of the frame for inserting the ground contact. The grounding screw and bolt are separately used from the mounting parts of the module.

The recommended assembly is shown in Figure 1. Note that the frame is fully insulated by anodizing. Please make sure the grounding screw removes the anodizing on the surface of the grounding holes, or scratch off the anodizing before the grounding connection is made. If the material of support structure is different with the material of frame (aluminum), the Insulation between them is required. Should the support structure be a non conductor, a cable must be connected by means of a suitable fastening system. The fastening system will be joined to a cable with a minimum 2.5mm² cross section, together with all the grounding conductors from each module. Please make sure that each module is grounding properly.

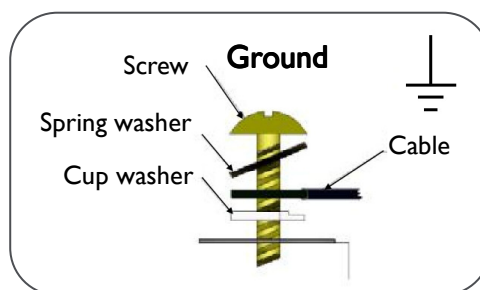


Figure 1 Recommended grounding connection

Devices listed and identified for grounding frames of PV modules are permitted to ground the exposed metallic frames of the module to grounded mounting structures. Per NEC 250.136, electrical equipment secured to and in electrical contact with a metal rack or structure provided for its support and grounded by one of the means indicated in 250.134 shall be considered effectively grounded.

Mounting

Modules may be mounted at any angle from horizontal to vertical. Select the appropriate orientation to maximize sunlight exposure.

The gap between the module and system structure or ground is required to prevent wiring damage and allows air to circulate behind the module.

Make sure that the module installation shall obey local fire-resistant regulations. Do not remove or alter the module frame. Additional mounting holes may damage the module and reduce the strength of the frame.



Important

Modules should be mounted using the following methods only:

1. Screwing:

Secure the module to the structure using the factory mounting holes. The torque wrench must be used for assembly. In the examples shown, the tightening torque must be $20\text{N} \cdot \text{m}$. Use the existing holes for securing the module; do not drill any additional holes (doing so would void the warranty). Use corrosion-proof fastening materials.

For PM220P00 and PM240P00 modules, four stainless steel bolts, with nuts, washers, and lock washers are recommended per module. Only the existing mounting holes (Diameter: 9mm) that can be used for module to meet 5400Pa design strength under IEC 61215/IEC 61730 and to meet 2400Pa design strength under UL 1703.

2. Clamping:

Note that the clamping clips on the side frame should be in parallel. Here are 2 clamping methods.

- Clamping on longer side frame: The side frames are attached to the longer sides of the module. Figure 3 shows effective mounting area.
The centerline of the clips should be between D1-375mm~D2-460mm from the short end of the module for 5400 Pa design strength under IEC 61215/IEC 61730 and for 2400Pa design strength under UL 1703.
- Clamping on shorter side frame: The side frames are attached to the shorter sides of the module. Figure 4 shows effective mounting area.
The centerline of the clips should be between D3-50mm~D4-150mm from the long end of the module for 2400 Pa design strength under IEC 61215/IEC 61730. Installers should ensure the clamps are of sufficient strength to allow for the maximum design pressure of the module. Clips and clamps are not provided by

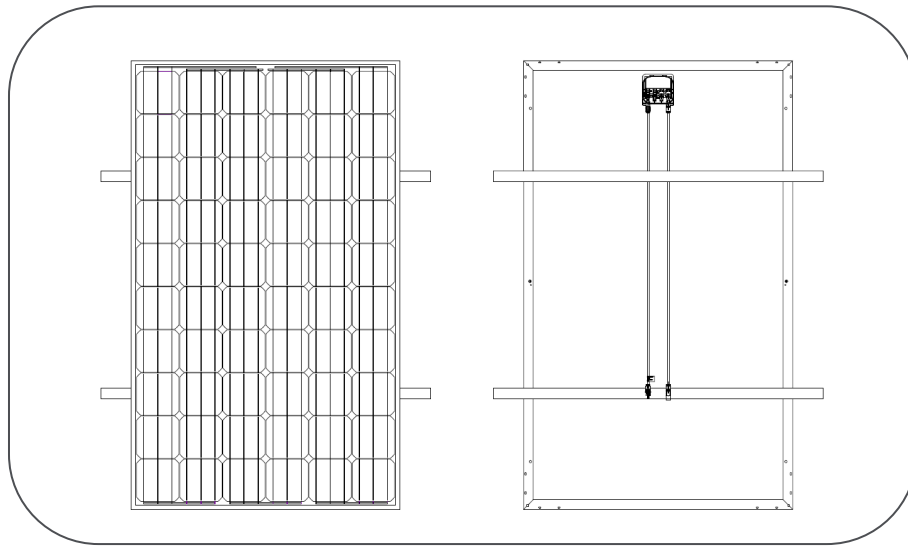


Figure 2 Installation of module

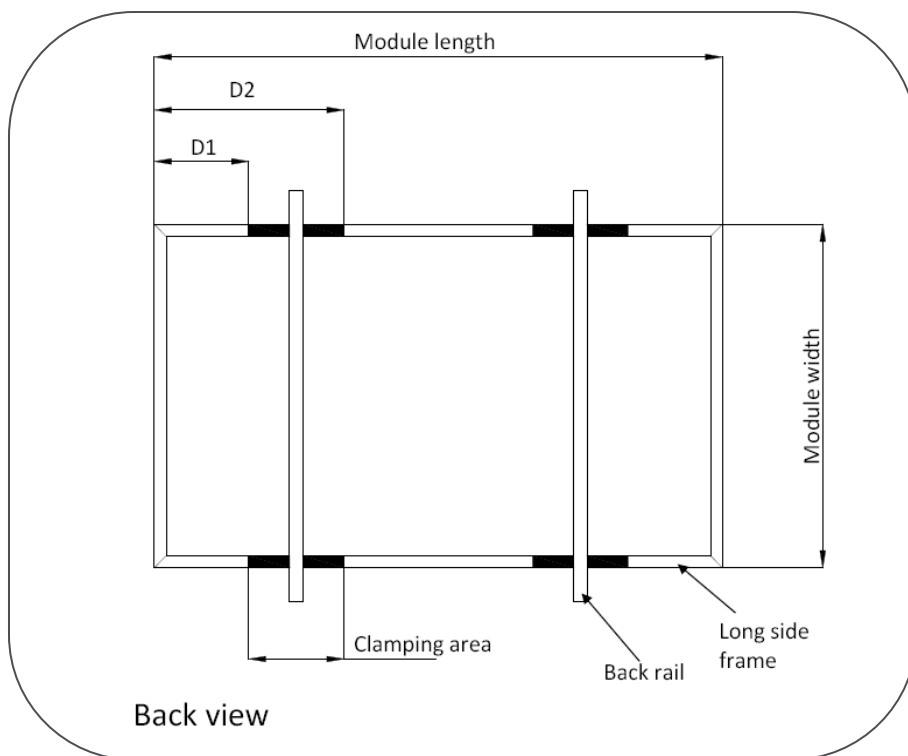


Figure 3 Effective mounting area (clamping)

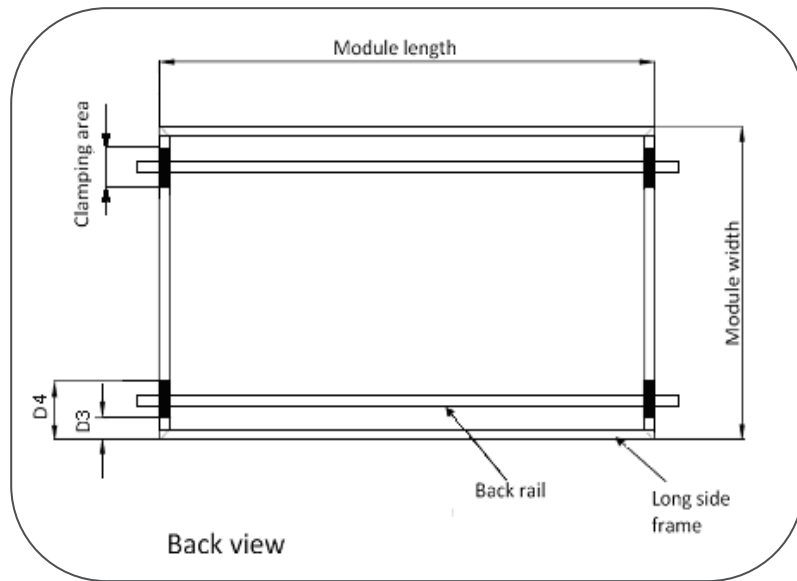


Figure 4 Effective mounting area (clamping)

Wiring

DO NOT do any change or adjustment on the cable of Junction Box.
DO NOT disconnect cable by yourself!



Important

The cable must not be bent or crushed on the direct exit of the cable screw joint. A minimum bending radius $r \geq 4x$ (static steady), $r \geq 5x$ (dynamic) cable diameter must be maintained. The cable must be routed in a way that tensile stress on the conductor or connections is prevented.

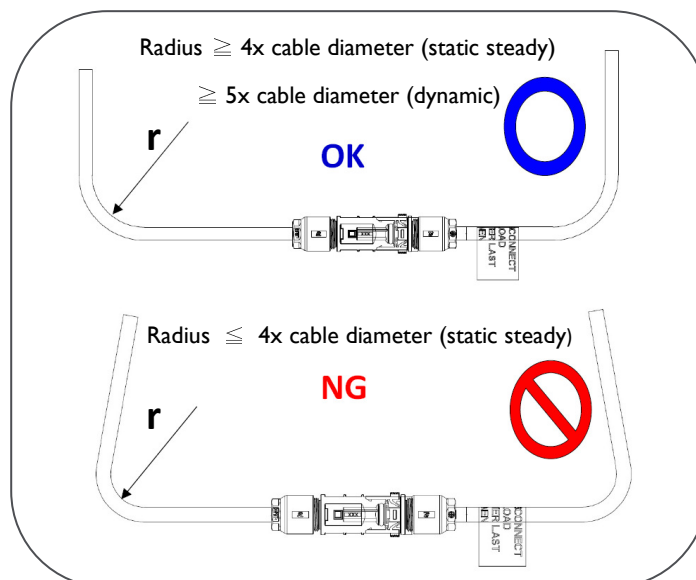


Fig. 5 Minimum bending radius of cable

For the wiring, please pay attention to:

1. Correct wiring scheme

Check that the wiring is correct before commissioning the system. If the measured open circuit voltage differs from the specifications, then there is a wiring fault. Ensure that the polarity is correct.

2. Correct plug connections

Make connections only in dry conditions. Ensure that connections are secure and tight.

3. Use of suitable materials

Use special solar cable and suitable connectors only. Ensure that they are in perfect electrical and mechanical condition. Use only single wire cables. Select a suitable conductor diameter to minimize voltage drop.

4. Cable protection

We recommend securing the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage using suitable precautions. Avoid direct exposure to sunlight.

Installation

Please note the following instructions:

- To ensure the correct orientation of the module, the module should face southwards in the northern hemisphere and northwards in the southern hemisphere.
- The module must be installed so that air can freely circulate around it. The cells' working temperature will thus be reduced and, consequently, the module's performance will be enhanced.
- The cross section for the conductors must be ensured that the voltage drop during the installation does not exceed 2% of its nominal voltage.
- BenQ Solar PV modules are supplied with or without cables, according to where they are ordered. Should they be supplied without cables, it is recommended that cables with cross sections between 4 and 10 mm² be used. The cables, which allowed easy handling while providing high protection against overloads and short-circuits, are formed by flexible Cu conductors, cross linked insulated polyethylene and coated with polyvinyl chloride or similar. They must be kept with low corrosive gas surrounded and with acid and alkali resistance and must not be flamed nor fire propagated during operating.
- The back of the module avoid direct exposure to sunlight.

Warnings

- The modules should be installed and handled by qualified persons only.
- Do not climb up or walk on the module. Do not drop the module or throw objects onto it.
- Use the module only for the purpose to which it is designed for. Do not dismantle the module or remove any part, label, or piece installed by the manufacturer and protection diodes without the manufacturer's authorization.
- Do not concentrate sunlight or other artificial light sources onto the module.
- Use tools duly coated with insulating material while working with the modules.

- Always work under dry conditions, both for the modules and tools.
- Do not install the modules where there may be flammable gases or vapors, since sparks may be produced.
- Avoid electric discharges when installing, wiring, starting up or carrying out maintenance work on the modules.
- Do not touch the terminals while the module is exposing to light. Provide the installation with suitable protection devices to prevent a discharge of 30 or more direct current volts from any person.

Limitation in Connection

IEC

The IEC 61730 certificate of these modules guarantees their insulation up to a DC voltage of 1000 V. (IEC 61730 Standard).

UL

The UL 1703 certificate of these modules guarantees their insulation up to a DC voltage of 600 V. (UL 1703 Standard).

However, a cable with a suitable cross section must be used for conducting the sum of the currents as generated by the modules. A series protection fuse of 15A is recommended for each string when module strings are parallel connected.

In any event, BenQ Solar recommend the PV conductor, which cross section is 4 mm². External connection boxes will be used to enable greater cable cross section area for long distance transmission.

The modules are qualified for the application class A: Hazardous voltage (IEC 61730: higher than 50V; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated.

Shadow effect

The shadow or hot spot effect is caused by an isolated shadow on one or several module cells while the rest are receiving high radiation. This situation must be solved by removing the cause of the shadows. The three protection diodes described in the junction box are provided to prevent damage to the cells.

Maintenance

Inspect all modules annually for safe electrical connections, sound mechanical connection, and freedom from corrosion. Periodically clean glass and the module surface only with a soft cloth or sponge using mild detergent and water. Fingerprints may be removed with standard glass cleaner. Do not use harsh cleaning materials such as scouring powder, steel wool, scrapers, blades, or other sharp instruments to clean the glass surface of the module. Use of such materials will invalidate the product warranty.

Regular cleaning of the module

Dirt piled up on the module's transparent surface reduces its performance and may cause reverse hot spot effects. The problem may become serious in the case of industrial waste and bird droppings. The intensity of the effect depends on the waste's opacity. The layers of dust that reduce the sun's intensity evenly are not dangerous and the power reduction is not usually significant. The frequency of cleaning depends, of course, on how quickly dirt accumulates. In many cases, rainfall may reduce or remove the need to clean the modules.

The cleaning operation must be performed, in general, by the user. It simply consists of washing the modules with water and non-abrasive detergent.

Visual inspection of the module

The purpose of visual inspection of the module is to detect possible faults, specifically:

- Possible broken glass.
- Rust on the circuits and soldering of the PV cells: this is normally due to moisture entering the module through a breakage in the encapsulating layer during installation or transport.

Inspection of connections and cabling

Perform preventive maintenance every 6 months, carrying out the following operations:

- Check the tightness and condition of the connection cable junctions.
- Check the junction box sealing. Should sealing faults be observed, the items which have been affected should be replaced and cleaned. It is important to monitor the junction box sealing by using new sealing methods such as silicon sealing according to the case.

Certifications

- **IEC**
 - The PV modules provided by BenQ Solar all pass the design qualification and type approval standard IEC 61215 editions 2.
 - The PV modules provided by BenQ Solar all pass the safety qualification standard **IEC 61730** certified for application class A.
 - Modules qualified for safety through EN IEC61730-1 and -2 within this application class are considered to meet the requirements for Safety Class II.

- **ETL**

This product meets or exceeds the requirements set forth by ULI 703 for PV Modules. This ULI 703 Standard covers flat-plate PV modules intended for installation on buildings and those intended to be freestanding. To satisfy the listing for this product the modules must be mounted with a rack or standoff structure. It does not include integration into a building surface because additional requirements may apply. This product is not intended for use where artificially concentrated sunlight is applied to the module.

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