



BenQ
Solar

A division of AU Optronics

BenQ Solar Photovoltaic Modules Installation Guide (IEC, ETL)

Poly 60 cells series

[PM060PWX](#)

Mono 60 cells series

[PM060MWX/PM060MBX](#)

Mono 60 cells with light weight series

[PM060M0X](#)

Poly 72 cells series

[PM072PWX/PM072MWX](#)

Back contact 96 cells series

[PM096B0X](#)

Version 2.2

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BenQ Solar Photovoltaic Modules (IEC, ETL)

Installation Guide for Users

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Chapter I General Information

1.1 Introduction

The following is the product installation guide for the BenQ Solar photovoltaic modules. BenQ Solar modules should be installed by qualified professionals only. This guide is designed to be used in combination with industry recognized best practices and all applicable rules and regulations.

Please read these instructions in entirety before handling or using this product in any way.

IMPORTANT

BENQ SOLAR MODULES AND THIS GUIDE ARE DESIGNED FOR USE BY QUALIFIED PROFESSIONALS ONLY. FAILURE TO FOLLOW INSTRUCTIONS IN THIS GUIDE AND OBSERVE INDUSTRY BEST PRACTICES MAY RESULT IN DANGEROUS CONDITIONS AND COULD VOID THE PRODUCT WARRANTY.

1.2 Limited Warranty and Product Certifications

See BenQ Solar Limited Warranty document for full product warranty details and limitations. Product Warranty version is based on warranty note in effect at the time of product manufacturing date. Please download and save a copy of the Warranty Note for reference.

Some product certifications are detailed in chapter 6 of this document. See individual Module Specifications sheet for more information about product certifications of the desired BenQ Solar module model.

The most up to date version of both of these documents can be found in the BenQsolar.com Document Center.

<http://www.benqsolar.com/>

1.3 Disclaimer of Liability

It is each installer's responsibility to abide by all relevant rules and regulations when using this product. Always observe Industry Best Practices when handling, installing, and using this product. This guide is designed for use by trained and certified solar professionals only. BenQ Solar does not assume responsibility for loss, damage or expense resulting from installation, handling or use of this product. BenQ Solar further disclaims any responsibilities to those installers who did not follow the installation manual to install otherwise.

1.4 Guidelines for Safe Handling and Installation



IMPORTANT

THIS PRODUCT IS DESIGNED FOR INSTALLATION BY QUALIFIED PERSONNEL ONLY.

ALL HANDLING AND INSTALLATIONS MUST BE PERFORMED IN COMPLIANCE WITH ALL APPLICABLE CODES, RULES AND REGULATIONS.

In addition to the applicable rules and regulations, please follow all guidelines for safe handling and/or installation of BenQ Solar modules. In addition to the guidelines below, always observe industry best practices when handling and/or installing any BenQ Solar module. Save this Installation Guide for future reference.

LIFTING AND HANDLING

- Do not lift the module or carry module by junction box or PV cables.
- Do not drill holes in the frame. This will void warranty and may affect frame strength.
- Avoid scratching the frame. Scratches to the frame will compromise protective coating and can result in corrosion or weakened structure.
- Do not scratch or damage the module backsheet. Scratches to the backsheet could affect module performance.
- Do not stand on, drop, scratch or allow objects to hit modules (especially module glass).
- Do not install or handle the modules when wet or during periods of high wind.
- Do not install the modules where there may be flammable gases or vapors, since sparks may be produced.
- When storing the modules, take steps to cover the DC connectors and prevent dust from collecting on or in the connectors.
- Save these instructions for future reference.

ELECTRICAL HANDLING AND INSTALLATION

- Modules interconnect points conduct 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, torn or otherwise damaged.

- Please use caution when handling or connecting any module.
- Remove all metallic jewelry prior to installing this product to reduce the chance of accidental exposure to live circuits.
- Use properly insulated tools to reduce your risk of electric shock.
- Do not touch the terminals while the module is exposed to light.
- During installation use suitable protection prevent a discharge of at least 30 direct current volts to each person on crew.
- Do not connect or disconnect modules when current from the modules or an external source is present.
- Do not remove or misuse module connectors, this could void module warranty.
- Cover all modules in the PV array with an opaque material before making or breaking any connections.
- Use only the supplied locking connectors and safety clips in order to prevent untrained persons from disconnecting the modules once installed.
- There are no serviceable parts within the module. Do not attempt to change or repair any part of the module.
- Damaged modules (broken glass, torn back sheet, broken j-boxes, broken connectors, etc) can present 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 distributor for disposal instructions.
- **FIRE RATING: BenQ Solar Modules have been listed as Class C according to IEC 61730-2 standard. In case of roof installation, the PV module assemble is to be mounted on a fire resistant roof covering rated for the application. The PV module is comprised of a glass front surface and PET backsheet and has a Class C fire rating. For a non-integral module or panel, the assembly is to be mounted over a fire resistant roof-covering rated for the application. Modules may be mounted at any angle, from horizontal to vertical.**

NOTE: Shading a small/narrow portion of the module (e.g. narrow bands of shade caused by leafless branches or tall grass) can cause local cell temperature to rise, temporarily decreasing overall module output.

Removing the source of any narrow bands of shade will prevent these “hot spots” from occurring, and ensure maximum module productivity. The module will resume normal performance once the source of shade is removed, with no impact to lifetime.

STORAGE

- When storing modules for any period of time, cover modules to ensure protection from the elements. Take special steps to cover/protect the module connectors.
- When storing the modules, turn so that the glass is face down. Do not allow water or dust to collect inside module, this can damage module connectors.
- When storing the modules, do not allow the anodized profiles (frames) to come into contact with contaminants such as cement or mortar, which will cause damage to the anodic oxide coatings.

Always contact your module supplier for additional instructions if maintenance is necessary.

Chapter 2 BenQ Solar Module Specifications

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 electrical characteristics depend on module Series and Wattage. Please refer to the tables below to learn more about the characteristics of your module(s).

2.1 Performance of PV Modules

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 I_{sc} and V_{oc} shown below 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 for sizing fuses and conductors as described in the NEC section 690.8.

While module current depends on solar irradiance, module voltage will vary depending on device temperature. This means overall production will vary depending on solar radiation, the temperature of the cells/module and the equipment to which they are connected.

2.2 PM060PW0 Series

Module Dimensions (L x W x H): 1639 x 983 x 40 mm (64.52 x 38.7 x 1.57 in)

Module Weight: 18.5 kg (41.1 lbs)

Power	250W	255W	260W	265W	270W
Efficiency	15.5%	15.8%	16.1%	16.4%	16.7%
V _{mp} (V)	30.6	30.8	31.2	31.6	32.0
I _{mp} (A)	8.17	8.28	8.34	8.39	8.44
V _{oc} (V)	37.4	37.7	37.7	37.9	38.1
I _{sc} (A)	8.69	8.76	8.83	8.87	8.93
Maximum Tolerance of Power	0 / +3%				

2.3 PM060MW0 / PM060MB0 Series

Module Dimensions (L x W x H): 1639 x 983 x 40 mm (64.52 x 38.7 x 1.57 in)

Module Weight: 18.5 kg (41.1 lbs)

Power	265W	270W	275W	280W	285W	290W
Efficiency	16.4%	16.8%	17.1%	17.4%	17.7%	18.0%
V _{mp} (V)	31.30	31.80	32.30	32.70	31.00	31.30
I _{mp} (A)	8.47	8.50	8.52	8.57	9.20	9.27
V _{oc} (V)	38.2	38.5	38.7	38.9	40.0	40.4
I _{sc} (A)	8.98	9.01	9.03	9.06	9.80	9.82
Maximum Tolerance of Power	0 / +3%					

2.4 PM060M0I Series

Module Dimensions (L x W x H): 1639 x 983 x 35 mm (64.52 x 38.7 x 1.38 in)

Module Weight: 10.5 kg (23.3 lbs)

Power	265W	270W	275W	280W	285W	290W
Efficiency	16.4%	16.8%	17.1%	17.4%	17.7%	18.0%
V _{mp} (V)	31.30	31.80	32.30	32.70	31.00	31.30
I _{mp} (A)	8.47	8.50	8.52	8.57	9.20	9.27
V _{oc} (V)	38.2	38.5	38.7	38.9	40.0	40.4
I _{sc} (A)	8.98	9.01	9.03	9.06	9.80	9.82
Maximum Tolerance of Power	0 / +3%					

2.5 PM072PW0 / PM072MW0 Series

Module Dimensions (L x W x H): 1956 x 992 x 40 mm (77.00 x 39.05 x 1.57 in)

Module Weight: 26 kg (57.33 lbs)

Power	300W	305W	310W
Efficiency	15.4%	15.7%	16.0%
V _{mp} (V)	36.7	36.9	37.1
I _{mp} (A)	8.17	8.25	8.33
V _{oc} (V)	45.5	45.6	45.7
I _{sc} (A)	8.62	8.68	8.77
Maximum Tolerance of Power	0 / +3%		

2.6 PM096B00 Series

Module Dimensions (L x W x H): 1559 x 1046 x 46 mm (61.38 x 41.18 x 1.81 in)

Module Weight: 18.6 kg (41.3 lbs)

Power	315W	320W	325W	327W	330W
Efficiency	19.3%	19.6%	19.9%	20.1%	20.3%
V _{mp} (V)	54.7	54.7	54.7	54.7	54.7
I _{mp} (A)	5.76	5.86	5.94	5.98	6.04
V _{oc} (V)	64.6	64.8	64.9	64.9	64.9
I _{sc} (A)	6.14	6.27	6.39	6.46	6.52
Maximum Tolerance of Power	0 / +3%				

Chapter 3 Mounting Guidelines

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

A gap between the module and system structure or ground is required to prevent wire damage and to allow air to circulate behind the module.

Take care to follow all applicable regulations, especially municipal and fire codes, when planning and executing your installation. 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 ONLY BE MOUNTED USING ONE OF THE FOLLOWING METHODS. DEVIATING FROM THE MOUNTING INSTRUCTIONS BELOW COULD AFFECT MAX WIND LOAD AND/OR PRODUCT WARRANTY.

3.1 Mounting with Screws

- Secure the module to the structure using only the factory drilled mounting holes.
- Do not drill any additional holes in module frame (doing so would void the warranty).
- Use corrosion-proof fastening materials.
- A torque wrench must be used for assembly. In the examples shown, the tightening torque of M6 size screw should be 8N · m and the tightening torque of M8 size screw should be 21N · m.
- Refer to product datasheet for the module dimensions and mounting hole locations.

PM060PW0 / PM060PW1 / PM060MW0 / PM060MW1 / PM060MW2 / PM060MW3 / PM060MB0 / PM060MB1 / PM060MB2 / PM060MB3

Secure each module to the structure using four stainless steel bolts, with nuts, washers, and lock washers. When using this mounting option, only the existing mounting holes (with the current diameter of **9mm**) can be used for module to meet 5400Pa design strength under IEC 61215/ IEC 61730 and UL 1703.

PM060MWR / PM060MBR

Secure each module to the structure using four stainless steel bolts, with nuts, washers, and lock washers. When using this mounting option, only the existing mounting holes (with the current diameter of **9mm**) can be used for module to meet 5400Pa design strength under UL 1703.

PM060M01

Secure each module to the structure using four stainless steel bolts, with nuts, washers, and lock washers. Only the existing mounting holes (Diameter: **6.6mm**) that can be used for module to meet 3600Pa design strength under IEC 61215/ IEC 61730 and to meet 2400Pa design strength under UL 1703.

PM072PW0 / PM072MW0

Secure each module to the structure using four stainless steel bolts, with nuts, washers, and lock washers. When using this mounting option, only the existing mounting holes (with the current diameter of **8mm**) can be used for module to meet 5400Pa design strength under UL 1703.

PM072PWA

Secure each module to the structure using four stainless steel bolts, with nuts, washers, and lock washers. When using this mounting option, only the existing mounting holes (with the current diameter of **8mm**) can be used for module to meet 5400Pa design strength under IEC 61215/ IEC 61730.

PM096B00

Secure each module to the structure using four **M6 (1/4")** stainless steel bolts, with nuts, washers, and lock washers per module. Only the mounting holes that are 322mm (12.6772 inches) from the short end of the module can be used for the module to meet 5400 Pa design strength.

3.2 Mounting with Clamps

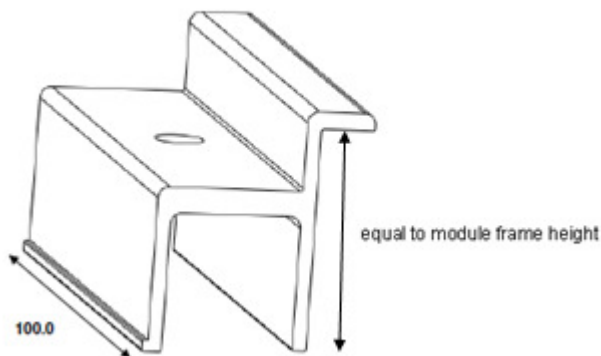
- Clips and clamps are not provided by BenQ Solar.
- The clamping clips on the side frame must be in parallel – equidistant from the closest module frame corner (see Figure 1).
- Ensure the clamps are of sufficient design strength to allow for the maximum design pressure of the module.

- Measurements of D1, D2, D3, and D4 below describe the centerline of the mounting clamp to the closest corner of the module frame.
- Clips and clamps are not provided by BenQ Solar.

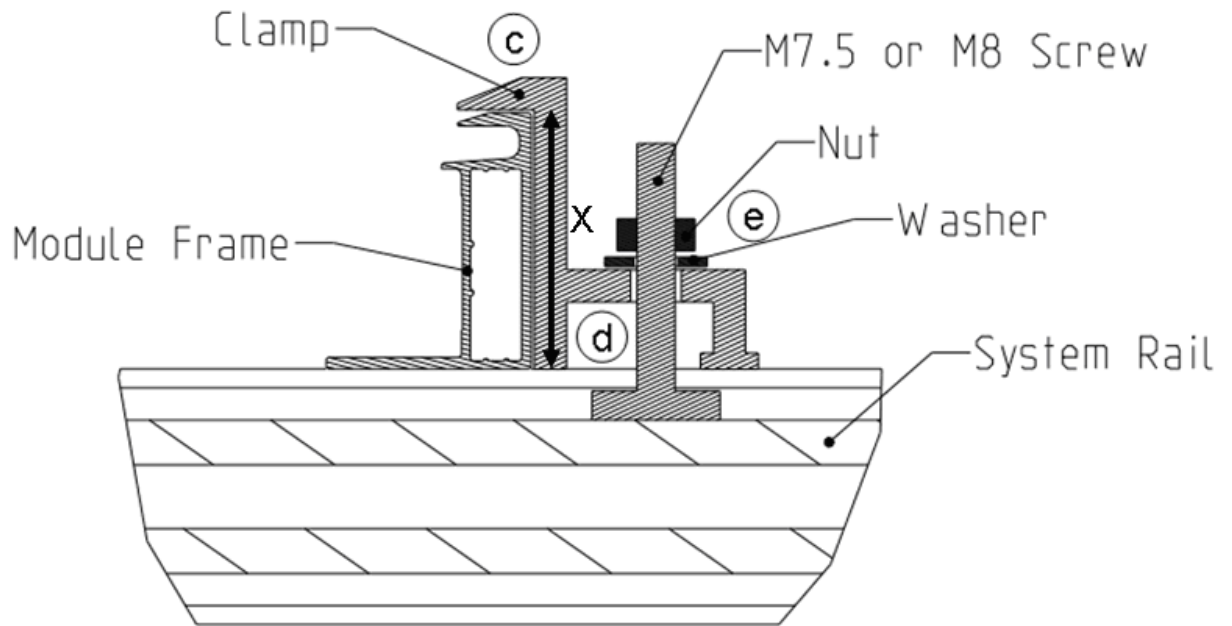
BenQ Solar suggests following conditions below for installation.

- a. Width of clip or clamp : 100mm
- b. Material : Aluminum
- c. Height of clip of clamp : equal to module frame height
- d. Recommended bolt torque : refer to item 3.1

Unit: mm



- Installation guide
 - a. Please check the center of the clamps alignment with mounting points.
 - b. The ranges of mounting places are illustrated in Figure 2 and Figure 3.
 - c. Clamp and frame should attached well without gap as picture ③ shown below.
 - d. Please fix clamps on system rails as the picture④ shown below.
 - e. Please tighten the screws in bolt torque of 20 N · m, then finish the installation as the picture⑤ shown below.



X : equal to module frame height

- There are two clamping methods available (see Clamp Location Details below for specific measurements):
 - Clamp on the long side of the frame (see Figure 2, measurements below)
 - Clamp on the short side of the frame (see Figure 3, measurements below)

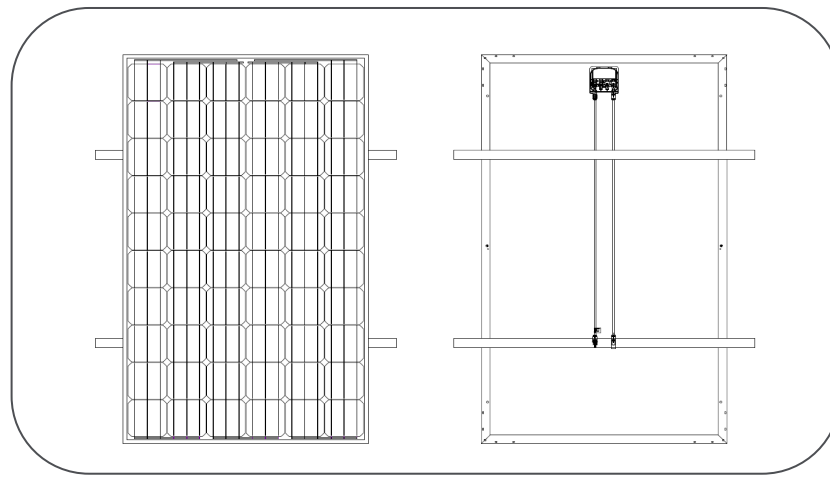


Figure 1 Top view and back view of module installed on a parallel mounting structure

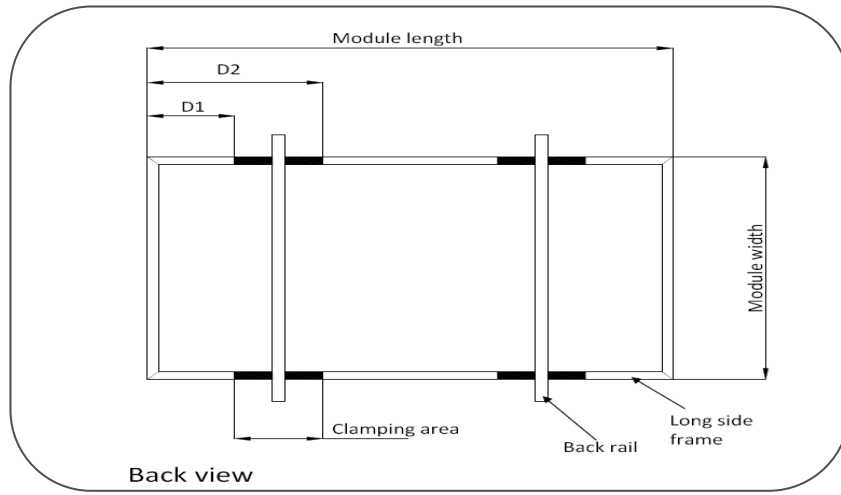


Figure 2 Long rail mounting clamp range (D1 and D2)

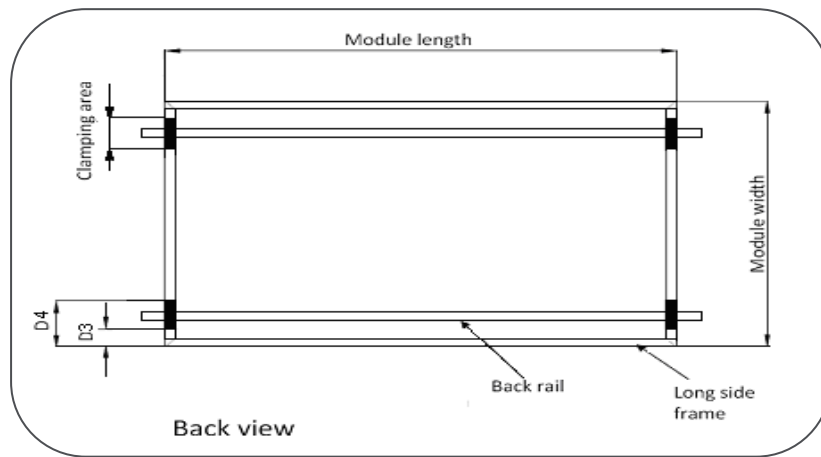


Figure 3 Short rail mounting clamp range (D3 and D4)

	<u>Long Rail (5400 Pa)</u>		<u>Short Rail (2400 Pa)</u>	
<u>Model Name</u>	<u>D1</u>	<u>D2</u>	<u>D3</u>	<u>D4</u>
PM060PW0	165 mm (6.49 in)	245mm (9.64 in)	158 mm (6.22 in)	238 mm (9.36 in)
PM060PWI	165 mm (6.49 in)	245mm (9.64 in)	158 mm (6.22 in)	238 mm (9.36 in)
PM060PWA	165 mm (6.49 in)	245mm (9.64 in)		
PM060PWB	165 mm (6.49 in)	245mm (9.64 in)		
PM060M0I*	281 mm (11.06 in) *	375 mm (14.76 in) *		
PM060MW0	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MW1	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MW2	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MW3	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MWR	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MB0	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MB1	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MB2	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MB3	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM060MBR	205mm (8.07in)	271mm (10.67in)	124 mm (4.88 in)	198 mm (7.80 in)
PM072PW0	130mm (5.11 in)	490 mm (19.29 in)		
PM072PWA	130mm (5.11 in)	490 mm (19.29 in)		
PM072MW0	130mm (5.11 in)	490 mm (19.29 in)		
PM096B00	250 mm (9.84 in)	400 mm (15.75 in)	215 mm (8.46 in)	315 mm (12.4 in)
* <u>PM060M0I has a max design strength of 3600 Pa.</u>				

PM060PW0 / PM060PWI Module Clamp Location Details

- **Long rail** clamping for 5400 Pa design strength: clamp between **D1 – 165 mm (6.49 in)** and **D2 – 245 mm (9.64 in)** from the closest short side of the module.
- **Short rail** clamping for 2400 Pa design strength: clamp between **D3 –158 mm (6.22 in)** and **D4 – 238 mm (9.36 in)** from the closest long side of the module.

PM060PWA / PM060PWB Module Clamp Location Details

- Long rail clamping for 5400 Pa design strength: clamp between **D1 – 165 mm (6.49 in)** and **D2 – 245 mm (9.64 in)** from the closest short side of the module.

PM060MW0 / PM060MW1 / PM060MW2 / PM060MW3 / PM060MWR / PM060MB0 /

PM060MB1 / PM060MB2 / PM060MB3 / PM060MBR Module Clamp Location Details

- Long rail clamping for 5400 Pa design strength: clamp between **D1 – 205 mm (8.07 in)** and **D2 – 271 mm (10.67 in)** from the closest short side of the module.
- Short rail clamping for 2400 Pa design strength: clamp between **D3 – 124 mm (4.88 in)** and **D4 – 198 mm (7.80 in)** from the closest long side of the module.

PM060M01 Module Clamp Location Details

- Long rail clamping for 3600 Pa design strength: clamp between **D1 – 281 mm (11.06 in)** and **D2 – 375 mm (14.76 in)** from the closest short side of the module.

PM072PW0 / PM072PWA / PM072MW0 Module Clamp Location Details

- Long rail clamping for 5400 Pa design strength: clamp between **D1 – 130 mm (5.11 in)** and **D2 – 490 mm (19.29 in)** from the closest short side of the module.

PM096B00 Module Clamp Location Details

- Long rail clamping for 5400 Pa design strength: clamp between **D1 – 250 mm (9.84 in)** and **D2 – 400 mm (15.75 in)** from the closest short side of the module.
- Short rail clamping for 2400 Pa design strength: clamp between **D3 – 215 mm (8.46 in)** and **D4 – 315 mm (12.4 in)** from the closest long side of the module.

Chapter 4 Wiring, Connecting and Grounding BenQ Modules

4.1 Wiring & Connecting

DO NOT do any change or adjustment on the cable of Junction Box.

DO NOT disconnect DC Cables alone, someone should always be nearby!

DO NOT disconnect/connect modules while they are under load!

DO NOT assemble the connector with wet or dirty hands.

Always make sure that all locking connectors are fully engaged and locked. Otherwise faulty connections can result in arcs, electrical shock, and equipment damage.



IMPORTANT

Do not bend the cable directly behind the contact point. A minimum bending radius of $r \geq 4x$ (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 connection(s) is avoided.

PV Cable		
Standard	2pfg1169.08.2007	UL4703
Type	PV1-F with 4mm ² conductor size	PV wire with 12AWG conductor size
Rated Temperature	-40 ~ 90C	-40 ~ 90C

Table I PV Cable Feature

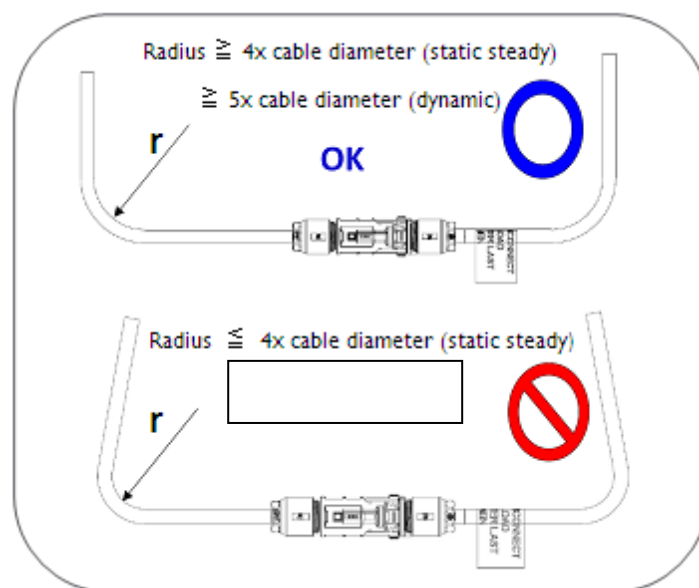


Figure 4 The minimum bending radius of cable

Pay attention to the following when wiring:

I. 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 DC plug connection method

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

3. Use correctly rated materials

Use PV rated solar cable for wiring 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

Secure the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage using suitable precautions. Avoid leaving DC cables in direct and extended exposure to sunlight.

WIRING AND INSTALLATION GUIDELINES

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. Keeping the cells' operating temperature low will allow for the best possible performance. The module's performance will be enhanced.
- Do not install modules in systemic and ongoing shade; this can cause the temperature of exposed cells to rise, reducing output, and may stress conductive bonds in module.
- The DC conductors must be properly gauged so that the voltage drop does not exceed 2% of the nominal voltage.
- BenQ Solar PV modules are supplied with or without cables, according to where they are ordered. If supplied without cables, it is recommended that cables with cross sections between 4 and 10 mm² be used.
- The cables, which allow easy handling while providing high protection against overloads and short-circuits. They are made of flexible Cu conductors, cross linked insulated polyethylene and coated with polyvinyl chloride or similar insulation. The insulation is flame, acid and alkali resistant and should be stored in an area free of any corrosive gases.

DC CONNECTION WIRING/ INSTALLATION WARNINGS

- The modules should be handled and installed by qualified persons only.
- Keep all panel connectors dry and clean at all times. Do not attempt to establish an electrical connection with wet, soiled, dusty/dirty, or otherwise faulty connectors.
- Unconnected connectors must be covered/protected at all times to prevent dust, foreign particles, etc. from accumulating within prior to connection.
- Do not allow unprotected connectors to rest on the ground or roof surface.

- Do not climb up or walk on the module.
- Do not drop the module or throw objects on the module.
- Use the module only for the purpose to which it is designed.
- Do not dismantle the module or remove any part, label, or piece assembled by the manufacturer 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.
- Do not install the modules where there may be flammable gases or vapors, since sparks may be produced.
- Take care to 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 exposed to light.
- Install with suitable protection to redirect a discharge of 30 or more direct current volts to if delivered any person on the installation team.
- Please prevent adherent of oil such as paraffin liquid, animal oil and vegetable oil from molding parts. It may be cracked or broken and loose the performance of Junction Box and connectors.

4.2 Module 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 usually sold separately from the mounting equipment.

Please make sure the grounding screw breaks the anodized surface of the module frame around the holes. Another option is to scratch off the anodizing before the grounding connection is made. The frame is fully insulated by the anodization process, so this step is essential for proper ground contact.

An anti-oxidation compound should be applied to the bare aluminum surface for protection. Use a layer of insulation if the support structure material is different than the frame material (aluminum) to prevent galvanic corrosion.

If the support structure is a non conductor, a dedicated ground cable must be connected to each module frame by means of a suitable fastening system. The fastening system must be spliced with a cable that has a minimum diameter of 2.5mm². Please make sure that each module is grounded properly per local municipal requirements. The recommended assembly of grounding screw is shown below in Figure 5.

Note: When using a Tapping Screw for grounding, the cap washer is used for buffer only and can be substituted by any M4-M4.5 washer.

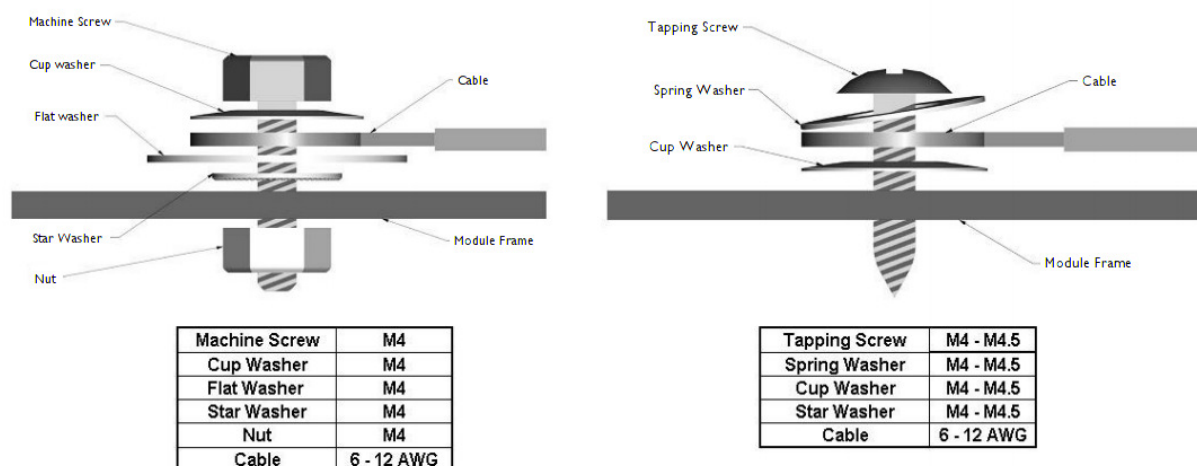


Figure 5 Recommended grounding connection

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.

Failure to properly ground each module will reduce the performance of the system and invalidate BenQ Solar's Limited Power Warranty for PV Modules.

Grounding of the module frame can be achieved through use of clamps that penetrate the anodization in conjunction with grounding of the mounting system or through direct grounding of the frames by attaching a copper wire to a grounding hole of each module (bolt size, M6 × 1.0 × 50).

4.3 System Grounding (Negative)

PM060PW0 / PM060PW1 / PM060PWA / PM060PWB / PM060M01 / PM060MW0 / PM060MW1 / PM060MW2 / PM060MW3 / PM060MWR / PM060MB0 / PM060MB1 / PM060MB2 / PM060MB3 / PM060MBR / PM072PW0 / PM072PWA / PM072MW0

For optimal performance, AUO photovoltaic modules should only be used in conjunction with galvanically insulated inverters where the negative (-) polarity of the PV array is connected to ground protected by a fuse.

4.4 System Grounding (Transformerless or Positive)

PM096B00

Comply with the local regulations for earthing the modules and the PV array.

Grounding of the module frame can be achieved through use of clamps that penetrate the anodization in conjunction with grounding of the mounting system or through direct grounding of the frames by attaching a copper wire to a grounding hole of each module.

4.5 Limitation in Connection

IEC

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

ETL

The UL 1703 certificate of these modules guarantees their insulation up to a DC voltage of 1000V. (UL 1703 Standard).

Both standards apply to all module series described in this manual, 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 wired in parallel.

BenQ Solar recommends the PV conductor, which cross section is 4 mm². External connection boxes can 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.

Recommended maximum series/parallel module configurations for 1000V inverter.

Maximum series = $1000V / \text{Product Voc} / 1.25$ (safety factor)

Example : The Voc of PM200M00_200 is 30.4V, then the maximum series/parallel module configurations for 1000V inverter is 26.

Formula

$$1000V / 30.4V / 1.25 = 26$$

Chapter 5 Maintenance

- Inspect all modules annually for safe electrical connections, sound mechanical connection, and corrosion.
- BenQ Solar PV module may use Anti-Reflective Coating (ARC) glass technology to enhance power output.
- Do not touch glass surface unless wearing clean gloves in order to prevent fingerprints or smudges on the ARC. Fingerprints may be removed with standard glass cleaner.
- Periodically clean glass and the module surface only with a soft cloth or sponge using mild detergent and water.
- 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 void the product warranty.

5.1 Module Cleaning Guidelines

Dirt piled up on the module's transparent surface reduces its performance and may cause the module hot spot effect. This problem may become serious in the case of industrial waste and bird droppings collecting on the module surface.

Thin layers of dust (normal soiling) that reduce the sun's intensity evenly are not dangerous and the power reduction is not as significant as other debris.

Clean the module array regularly to address reduced production due to soiling. The frequency of cleaning depends on how quickly material accumulates. Mounting the module at or above a 15 degree angle will help prevent dust and debris from collecting on the module.

In many cases, rainfall may reduce or remove the need to clean the modules. It is best to clean the module during early morning, late afternoon or cloudy day. Do not clean module during high temperature, temperature lower than zero degrees Celsius, or any time when there is a large temperature difference between module and cleanser.

If it is necessary to clean back side of module, do not damage any components. Avoid allowing any oily liquids such as paraffin liquid, animal oil, or vegetable oil contacting with junction box, cable and connector. BenQ Solar PV modules can withstand snow pressure of 2400 Pa.(UL 1703) Please use soft brush lightly removing snow pileup. Do not try to remove frozen snow and solid ice on the module (it will eventually melt off).

5.2 Module Cleaning Instructions

Solution Mixture: clean water with low mineral amount, non-abrasive/ non-caustic detergent, weak acid/weak alkalescent solution, or solution of $\text{PH} < 10$.

Cleaning Tool: soft brush, non-conductive brush, non-abrasive sponge, non-abrasive cloth, seamless cloth. Do not use high pressure spray.

1. Clean module and glass surface with solution and tools fitting the above descriptions.
2. If dirty area on glass surface which is hard to be cleaned such as oily substances or sap, try to use commercial glass detergent, alcohol, isopropanol (IPA), or sodium bicarbonate solution.
3. Use clean water to rinse glass clean of all cleaning solution. Dry wet modules using a clean and dry cloth. Do not leave stagnant water on glass surface.

5.3 Cleaning the Frame

BenQ Solar module frames include an anodic oxide coating to increase produce life. The cleaning cycle for regular anodic oxide coatings is generally every six months. When cleaning, be sure not to damage or scratch this coating. Dirt on the frame can generally be cleaned off using warm, mildly soapy water and a fiber brush. Do not use abrasive cleaning tools like steel wool or acidic/ alkaline chemicals to clean.

(Reference : GB 5237.2, Wrought aluminum alloy extruded profiles for architecture)

5.4 Visual inspection of the module

During regular cleaning cycles, be sure to visually inspect each module. The purpose of visual inspection is to detect possible faults or damage. Specifically:

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

5.5 Inspecting connections and cabling

While performing semi annual maintenance, carry 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. Contact BenQ Solar for additional information about resolving faults in module seal.

Chapter 6 Certifications

6.1 IEC Certification

- The PV modules provided by BenQ Solar all pass the design qualification and type approval standard IEC 61215 edition 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 EN IEC61730.2 within this application class are considered to meet the requirements for Safety Class II.

6.2 ETL Certification

- This product meets or exceeds the requirements set forth by UL1703 for PV Modules.
- This UL1703 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.
- If the module is intended to be used on the roof in America, it must be used in combination with a rack that meets the below conditions:
 1. This rack has been tested in accordance with UL1703 system fire test and has a system fire class rating.
 2. During system fire test, the rack must use same “Type I/2” of module.

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版本 Rev.	修訂日期 Rev. Date	修訂內容 Update contents
1.0	2013/7/23	New issue
1.1	2013/7/25	Add section 4.4 transformer less of PM096
1.2	2014/04/23	1. Add new model : PM096B01, PM245P03 2. Modify the typo of PM096 clamping area
1.3	2014/06/30	Add new model : PM060P00
1.4	2014/07/01	Add new model : PM048M00/PM060M01/PM060M02
2.0	2014/12/11	Add new model : PM072P00, Modify electrical characteristic of modules.
2.1	2015/05/06	Add warning of legal
2.2	2015/12/01	Update model name and clamp position