

General Installation Manual for POWERCOM Photovoltaic Modules

Important!!

Please complete reading this instruction before installing, wiring, connecting, or using the product in any way. Failure to comply with these instructions will invalidate the POWERCOM Limited Warranty for PV Modules.

1.0 Introduction

Thank you for choosing POWERCOM photovoltaic modules. With proper operation and maintenance, POWERCOM PV modules will provide you with clean, renewable solar electricity for many years. This manual contains important installation, maintenance and safety information. The word “module” as used in this manual refers to one or more PV modules. Retain this manual for future reference.

1.1 Disclaimer of Liability

The installation techniques, handling and use of this product are beyond company control. Therefore, POWERCOM does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of, or in any way connected with installation, operation, use, or maintenance by using this manual. POWERCOM assumes no responsibility for any infringement of patents or other rights of third parties, which may result from use of modules. No license is granted by implication or under any patent or patent rights. The information in this manual is believed to be reliable, but does not constitute an expressed and/or implied warranty. POWERCOM reserves the right to make changes to the product, specifications, or manual without prior notice.

1.2 Limited of Warranty

The limited warranty set forth herein is expressly in lieu of and excludes all other express or implied warranties including, but not limited to, the warranties of merchantability and fitness for a particular purpose and all other obligations or liabilities on the part of POWERCOM, unless such other warranties, obligations or liabilities are expressly agreed to in writing by POWERCOM. PV modules which in POWERCOM's absolute judgment have been subjected to: misuse, abuse, neglect or accident; alteration, improper installation, application or removal by any party other than a POWERCOM authorized dealer; non-observance of the applicable POWERCOM installation, users and/or maintenance instructions; repair or modifications by someone other than an approved service technician of POWERCOM; power failure surges, lightning, flood, fire, accidental breakage or **other events outside POWERCOM's control**. POWERCOM shall have no responsibility or liability whatsoever for damages or injury to persons or property, or for other loss or injury resulting from any cause whatsoever arising out of relating to the PV modules(s) including, without limitation, any defects and/or failures in the PV module(s) or from use or installation.

2.0 Safety Precautions

Before installing this device, read all safety instructions in this document.

Danger!!

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Module interconnects 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.

- ◆ Before installing modules, contact the appropriate authorities to determine permissions, installation and inspection requirements, which should be followed.
- ◆ All installations must be performed in compliance with the National Electrical Code (NEC) and any applicable local codes and also be performed only by authorized personnel.
- ◆ To avoid the hazard of electric shock and injury, cover the entire front surface of the PV modules with a dense, opaque material such as a cardboard box, during installation and handling of the modules or making/breaking electrical connections.
- ◆ To avoid the hazard of electric shock, work only in dry conditions, with dry modules and adequate dry insulated tools.
- ◆ To avoid the hazard of electric shock and injury, be sure to completely ground all modules.
- ◆ Do not install or handle the modules when they are during periods of high wind.
- ◆ Do not touch the junction box terminals to avoid the hazard of electric shock and injury.
Remove all metallic jewelry prior to installing this product to reduce the chance of accidental exposure to live circuits.
- ◆ The shock hazard increases as modules with nominal open-circuit voltage (Voc) in excess of 50 V, and/or modules rated for maximum system voltage in excess of 50 V.
- ◆ The installer assumes the risk of all injury that might occur during installation, including, without limitation, the risk of electric shock.
- ◆ Since sparks may occur, do not install the module where flammable gases or vapors are present.

- ◆ Be sure that the construction or structure (roof, façade, etc.) has enough strength where the modules are being installed.
- ◆ For modules mounted on roofs, special construction or structures may be required to help provide proper installation support.
- ◆ Both roof construction and module installation design have an effect on the fire resistance of a building. Improper installation may contribute to fire hazards. Additional devices such as ground fault, fuses, and disconnects may be required.
- ◆ Do not treat the back sheet or front surface with paint or adhesives, to avoid reducing its' functionality, damage, inoperable conditions, and other unknown troubles.
- ◆ Do not stand on, drop, scratch, or allow objects to fall on modules.
- ◆ If the front glass is broken, or the back sheet is torn, contact with any module surface or module frame can cause

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electric shock.

- ◆ There are no user serviceable parts within the module. Do not attempt to repair any part of the module.
- ◆ Do not artificially concentrate sunlight on a module to avoid the hazard of fire or damage.
- ◆ Do not use modules of different specifications in the same system.
- ◆ Do not disconnect terminals while PV modules generate electricity and connect electrical load to avoid the hazard of electrical shock.
- ◆ Follow all safety precautions of other system components used.
- ◆ Use a module for its intended purpose only.
- ◆ Contact your module supplier if maintenance is necessary.

3.0 Electrical Characteristics

The module electrical ratings are measured under Standard Test Conditions (STC) of 1 kW/m² irradiance with AM 1.5G spectrum and a cell temperature of 25° C. POWERCOM modules deliver specific electrical characteristics (Table 1.).

A photovoltaic 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 the module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor ampacities, 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.

Electrical Characteristic	Model Name					
	PPV-140M6	PPV-190M6	PPV-220M6	PPV-245M6	PPV-255M6	PPV-300M6
Rated Power, [W] ¹	140	190	220	245	255	300
Power Tol, [%]	+/- 3	+/- 3	+/- 3	+/- 3	+/- 3	+/- 3
Open-circuit voltage - Voc, [V]	22.21	29.74	33.72	37.47	37.61	45.06
Short-circuit current - Isc, [A]	8.55	8.59	8.63	8.64	8.78	8.72
Maximum power - Pmax, [W]	140	190	220	245	255	300
Max. Power Voltage - Vpm, [V]	17.54	23.83	27.03	30.06	30.46	36.31
Max. Power Current - Ipm, [A]	7.98	7.97	8.14	8.15	8.37	8.26
Module weight, [kg]	11	15.3	17.2	18.2	18.2	22.3
Dimensions / (mm x mm x mm)	995*995*40	1316*995*40	1474*995*40	1632*995*40	1632*995*40	1948*995*40
Max. System Voltage, [V] ⁶	1000	1000	1000	1000	1000	1000
Maximum fuse rating, [A]	12	12	12	12	12	12
Total number of cells	36	48	54	60	60	72

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Notes :
1. Values at Standard Test Conditions(STC) of Irradiance 1000 W/m ² , Air Mass AM1.5, Cell Temperature 25°C
2. Nominal Operating Cell Temperature(NOCT) is 44.8°C±2°C
3. Temperature Coefficient of Current is 3.214(mA/°C)
4. Temperature Coefficient of Voltage is -149(mV/°C)
5. Temperature Coefficient of Power is -0.37(%/°C)
6. Maximum System Voltage is 1000V

Table 1. Electrical Characteristics at STC

3.1 Fire Rating

The module is Class C fire rated.

3.2 Bypass Diode Rating

The bypass diode of Junction Box is Tyco-SL1110, 40V, 15A rated.

4.0 Installation

- ◆Modules should be firmly fixed in place in a manner suitable to withstand all expected loads, including wind and snow loads.
- ◆We recommend installation methods shown in Figure 1. In some areas, local electrical codes may govern the installation and use of PV modules.

5.0 Electrical Connections

- ◆Modules may be connected in series and/or parallel to achieve the desired electrical output as long as certain conditions are met. Please use only the same type of modules in a combined source circuit.
- ◆All connections should be secure, tight and electrically and mechanically sound.
- ◆UV-resistant cables and connectors approved for outside use should be used. Ensure that they are electrically and mechanically sound.
- ◆Conductor gauge should be chosen so as to ensure that DC power losses (voltage drop) are kept to a minimum (less than 1% is preferred).

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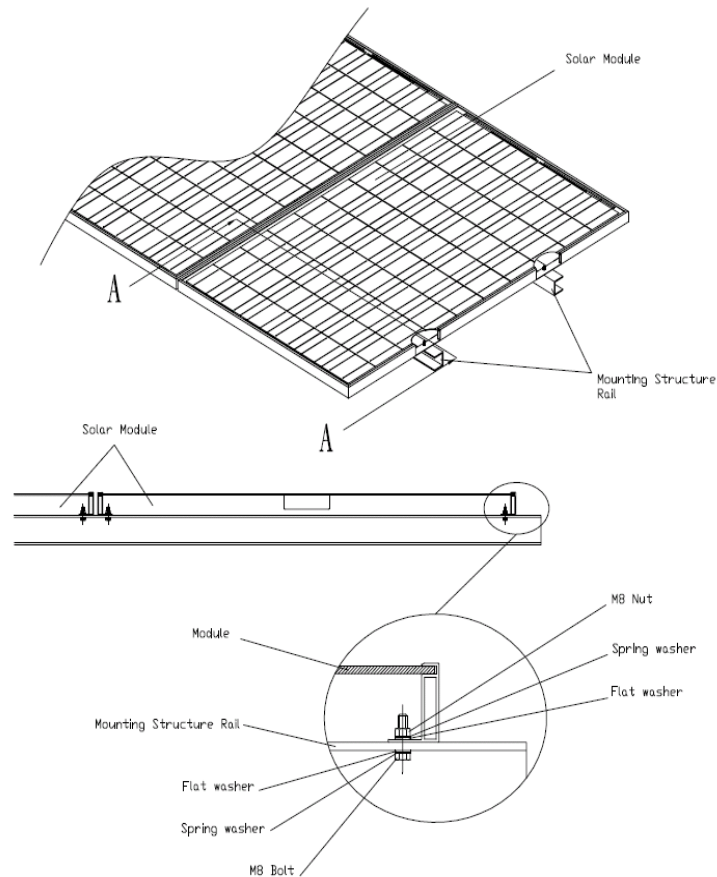


Figure 1. Installation

5.1 Equipment Grounding

To avoid electrical shock, ground the frame of the module or array before wiring the circuit using a grounding method that meets NEC requirements for grounding solar electrical systems. POWERCOM recommends the following two methods of grounding the module frame. Figure 2. is for customer reference.

- (1) Using an equipment ground conductor with stainless steel hardware at one of the two designated $\Phi 3.8$ grounding holes on the module frame. If a equipment ground conductor larger in diameter than #10 AWG is necessary, a grounding lay-in lug is required. A thread-forming 8-18 stainless steel screw is required when using a self-drilling type screw to make the frame ground connection. Please refer to NEC Article 690 on grounding PV arrays for specific requirements.
- (2) POWERCOM modules can be grounded using third-party grounding washer or clip systems provided they have been tested and certified to meet UL 467 and UL 1703 requirement for bonding/grounding systems and are installed according to the manufacturer's specified instructions.

5.2 System Grounding

- ◆ A wiring terminal or bonding location of module intended to accommodate a field installed equipment-grounding conductor shall be identified with the appropriate symbol (IEC 60417- 5019(DB:2002-10)) or shall have a

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green-colored part.

- ♦To avoid galvanic corrosion, use of stainless steel fastening materials are the preferred choice, but galvanized or hot-dipped zinc plated fasteners are acceptable.

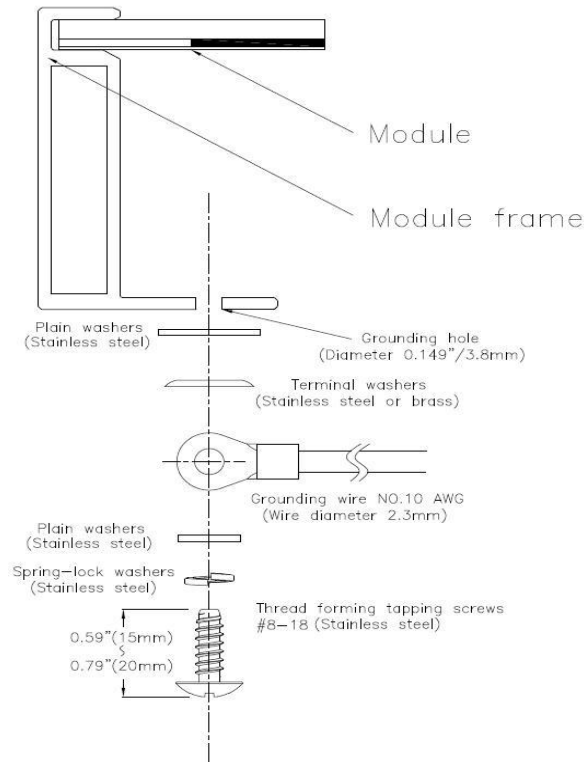


Figure 2. Panel Grounding

5.3 Module Wiring

- ♦The modules may be wired in series to produce the desired voltage output. Do not exceed the maximum system voltage indicated in Table 1.
- ♦The modules may be combined in parallel to produce the desired current output. Each series string or module may be required to be fused prior to combining with other strings. Table 1 describes the maximum fuse size allowed. Please refer to the NEC Article 690 for additional fusing requirements.
- ♦Modules shall not be wired in parallel without maximum over current protection.
- ♦These modules contain factory installed bypass diodes. If these modules are incorrectly connected to each other, the bypass diodes, cable, or junction box may be damaged.
- ♦In order to minimize voltage surges which could be induced by indirect lightning strikes, DC cables of the same string should be bundled together so that loops are kept as small as possible. String configurations should be checked before system commissioning. If the open circuit voltage (Voc) and the short circuit current (Isc) deviates from the specifications, this could indicate a configuration fault. Correct DC polarity should be observed at all times.

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5.4 Array Wiring

- ♦The term “array” is used to describe the assembly of several modules on a support structure with associated wiring.
- ♦National electrical codes and regulations need to be followed when selecting cables. For field connections, recommend using minimum 4 mm² or #12 AWG copper wires insulated for a minimum of 90°C.
- ♦Cables should use UV-resistant cable ties, or other sunlight-resistant device and are insulated to withstand the maximum possible system open circuit voltage. Loose and unsecured cables should be protected from mechanical damage. Avoid, as far as possible, exposing the cables to direct sunlight.
- ♦Check your local codes for requirements.

5.5 Module Terminations

- ♦A junction box as a terminal enclosure is equipped for electrical connections on POWERCOM modules.
- ♦If two or more separable connectors are provided, they shall be configured or arranged so that the other and vice-versa will not accept the mating connector for one, if it will result in an improper connection.

5.6 Conduit

- ♦For applications where wire conduits are used, follow the applicable codes for outdoor installation of wires in conduits. Minimum diameter of wire conduit is 4.0 mm².
- ♦Verify that all fittings are properly installed to protect wires against damage and prevent moisture intrusion.

6.0 Module Mounting

The POWERCOM Limited Warranty for PV Modules is contingent upon modules being mounted in accordance with the requirements described in this section.

6.1 Site Considerations

POWERCOM modules should be mounted in locations that meet the following requirements:

Operating Temperature:

All POWERCOM modules must be mounted in environments that ensure POWERCOM modules will operate within the following maximum and minimum operating temperatures:

Max. Operating Temp.	+85°C , +185°F
Min. Operating Temp.	-40°C , -40°F

Care should be taken to provide adequate ventilation behind the modules, especially in hot environments.

Design Strength:

POWERCOM modules are designed to meet a maximum positive (or upward, e.g. wind) design pressure of 2400 Pa and negative (or downward, e.g. static load) design pressure of 5400 Pa when mounted in one of the mounting configurations specified in Section 6.2. A design strength of 2400 Pa corresponds approximately to a wind speed of 125 mph.

When mounting modules in snow-prone or high-wind environments, special care should be taken to mount the modules in a manner that provides sufficient design strength while meeting local code requirements.

Excluded Operating Environments:

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Certain operating environments are not recommended for POWERCOM modules and are excluded from the POWERCOM Limited Warranty for these modules.

- ◆ No POWERCOM module should be mounted at a site where it may be subject to direct contact with salt water. Recommended distance from the sea: 1600 feet.
- ◆ POWERCOM modules with an anti-reflective coating on the glass should not be mounted in basic environments (those which have a PH balance equal to or greater than 7). Basic environments degrade the coating, reduce module energy gain and may cause a non-uniform appearance. This is not a concern in most areas because most outdoor environments are acidic and therefore do not pose a problem, but POWERCOM recommends that the site be checked before mounting the modules, especially in coastal settings.
- ◆ Where POWERCOM module could be exposed to sulfur or other corrosive chemicals, such as near sulfur springs or volcanoes because of the danger of corrosion.

6.2 Mounting Configurations

Modules may be mounted at any angle, from horizontal to vertical. Select the appropriate orientation to maximize sunlight exposure. Specific information on module dimensions and the location of mounting and grounding holes is provided below (Table 2 and Figure 3).

In order to prevent water from entering the junction box, which could present a safety hazard, modules should not be mounted such that the front/top glass faces downward (e.g., on a tracking structure that positions the modules with the junction box facing skyward during sleep mode).

Clearance between the module frames and structure or ground is required to prevent wiring damage and allows air to circulate behind the module.

The module is only UL Listed for use when its factory frame is fully intact. Do not remove or alter the module frame. Creating additional mounting holes may damage the module and reduce the strength of the frame.

For roof mounting, the assembly is to be mounted over a fire resistant roof covering rate for the application, and any slope less than 5 in/ft(127/305 mm) required to maintain a fire class rating.

Model No.	A Length	B Width	C Installation location	D Installation location	E Installation location	F Thickness
PPV-140M6	995	995	595	945	945	40
PPV-190M6	1316	995	383	1236	945	40
PPV-220M6	1474	995	541	1394	945	40
PPV-245M6	1632	995	699	1552	945	40
PPV-255M6	1632	995	699	1552	945	40
PPV-300M6	1948	995	1015	1868	945	40

Table 2. Structure configuration

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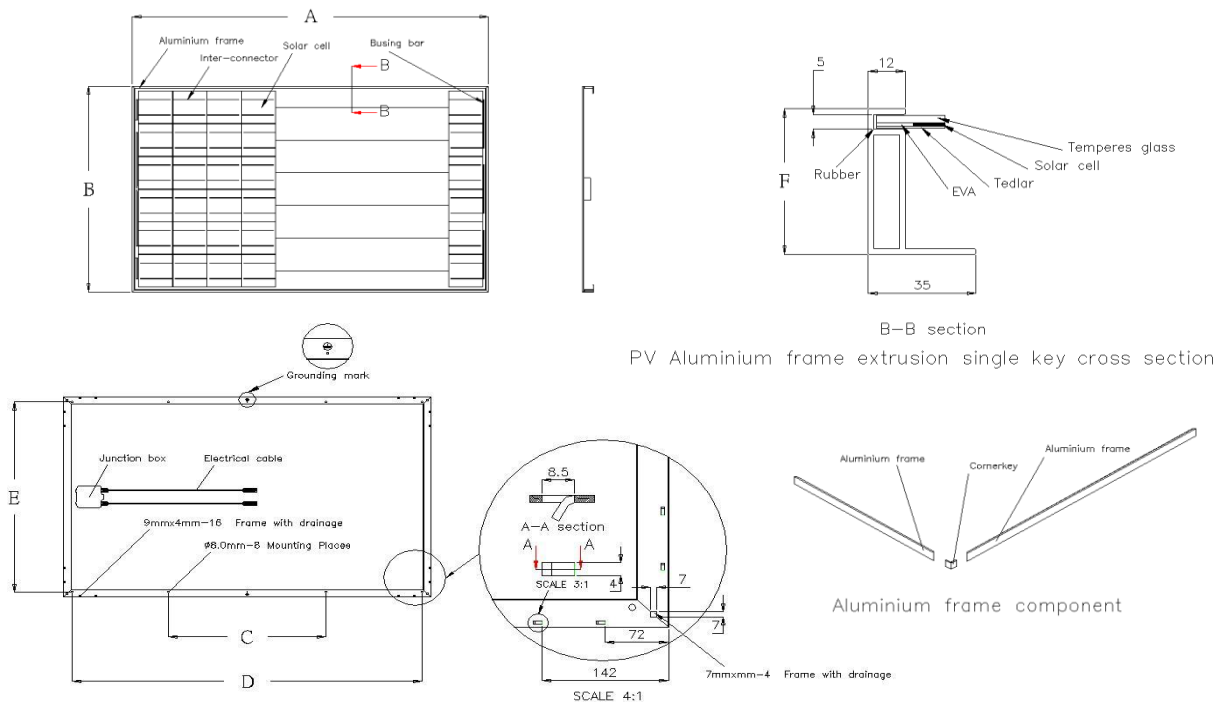


Figure 3. Structure Design

Modules may be mounted using the following methods only:

- (1) **Frame Holes:** Secure the module to the structure using the factory mounting holes. Four 8mm stainless steel bolts, with nuts, washers, and lock washers are recommended per module. Refer to Table 2 for the module dimensions and hole locations. This method has been certified by a third-party organization according to UL 1703
- (2) **Pressure Clamps or Clips:** Mount the module with the clips on the side frame of the module. The side frames are attached to the longer sides of the module. The centerline of the clips should be 6-15 from the end of the side frame. 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 POWERCOM.
- (3) **End Mount:** End mounting is the capture mounting of the length of the module's end frame to a supporting rail. The end frames are on the shorter dimensions of the module. The end-mounting rail and clips or clamps must be of sufficient strength to allow for the maximum design pressure of the module. Verify this capacity with the mounting system vendor before installation.

7.0 Maintenance

Inspect all modules annually for safe electrical connections, sound mechanical connection, and freedom from corrosion. Periodically clean the module surface with water and a soft cloth or sponge. 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.

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