

Installation Manual

Opal Solar QSA Series

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1.Safety

The instructions related to safety and use indicated in this installation manual are intended for the prevention of unexpected danger, damage or failure.

- Only authorized and trained personnel should have access to or perform work on the modules or solar system.
- Personal protective equipment must be worn during the installation to reduce the risk of electric shock.
- Avoid contact with electrically active parts of the module, such as terminals, without appropriate safety gear and make sure to isolate live circuits before attempting to make or break any connections. Contact may result in lethal spark or electric shock.
- Do not use or install damaged or broken modules. Contact with any broken module surface or frame can lead to electrical shock.
- Perform all work in dry conditions. Installation of the modules during rain, heavy wind or snow may result in body injury or death.
- Heavy objects must be kept off the solar module.
- Do not stand or step on the module.
- Do not drop the module. Failure to comply may result in product damage, product failure or body injury.
- Do not scratch the coating surface of the frame. Scratches may decrease the total solar output due to corrosion of the frame.
- Do not disassemble the module or remove any part of the module. Do not drill holes in frame or glass. Any hole in the frame or glass of the module may decrease the strength of the frame or break the glass and lead to corrosion.
- Do not remove the labels attached to the module.
- Do not artificially concentrate sunlight on these solar modules.
- Use proper equipment, connectors and wires for the installation of the module. Ensure that all connections are securely made with no gap between the contacts. Failure to comply may result in fire, electrical shock, product damage, product failure, or body injury.
- Protect the electrical plug contacts against corrosion and soiling. Make sure that all connectors are corrosion free and clean before making the connection.

• Opal Solar modules are certified for operating in Class A installations at voltages below 1000Vdc. This maximum voltage should not be exceeded at any time.

• Use only insulated tools that are approved for working on electrical installations.



DO NOT INSTALL DURING RAIN, SNOW OR HEAVY WIND



DO NOT STAND OR STEP ON THE MODULE



WEAR PROTECTIVE GEAR DURING INSTALLATION



MAXIMUM VOLTAGE OF 1000Vdc DO NOT EXCEED



DO NOT DISASSEMBLE THE MODULES



AVOID CONTACT WITH ELECTRICALLY ACTIVE PARTS

2.Disclaimer of Liability

The installation, handling and use of Opal Solar modules are beyond company control. Opal Solar does not assume any responsibility for loss, damage, injury or expense resulting from the improper installation, handling, use or maintenance.

3.Transporting, Unpacking and Storing

- Do not stack on more than 2 packing boxes (maximum height of 2 pallets). See Figure 1.
- Do not loosen the banding when module is being transported. In case of loose banding, the module will be shaken and it can give stress to the module and may cause product damage.



Figure 1.No more than two boxes should be stacked

4. Mechanical Installation

4.1 Site Specification

Opal Solar Modules can be mounted in landscape and portrait orientation however the shading impact of dirt on the solar cells can be minimized by orienting the product in portrait. Position the modules to minimize the chances of shading at any time of the day. Mount modules in a way that the drainage holes in the module frame stay unblocked.

Opal Solar module's installation site should meet the following requirements as per module datasheet: Operation temperature: -40°C ~ +85°C

Mechanical load resistance: High wind loads (2400Pa), snow loads (5400Pa).

4.2 General Installation Guide

- The installer of Opal Solar module must at all time ensure that the installation complies with all local standards, codes, regulations and industry guidelines.

- Modules should be mounted or stored in a way that the front/top glass faces upward in order to prevent water from entering the junction box which could cause a safety hazard.

- Clearance between the solar module frames and structures such as roof or ground is required to prevent wiring damage and to allow enough ventilation behind the module. The recommended standoff height is a minimum 100mm.

- Modules should be mounted or stored in a way that the front/top glass faces upward in order to prevent water from entering the junction box which could cause a safety hazard.

- Clearance between the solar module frames and structures such as roof or ground is required to prevent wiring damage and to allow enough ventilation behind the module. The recommended standoff height is a minimum 100mm.

- A 10mm gap between module frames is recommended to avoid tension from thermal expansion.

- Modules can be mounted on the sub-structure using corrosion-proof bolts through the mounting holes at the back of the module frame or purpose-designed certified clamps. Any other mounting method must be consulted and approved by Opal Solar in advance, otherwise may damage module and void the warranty.

4.2.1 Using Frame Mounting Holes

The frame of each module has 8 mounting holes (Length* Width: 14mm*9mm) used to secure the modules to support structure. Always use all the eight mounting holes to secure the modules. The module frame must be attached to a mounting rail using M8 corrosion-proof screws together with spring washers and flat washers in eight symmetrical locations on the PV module.

The applied torque value should be big enough to fix the modules steadily. The reference value for M8 screw is 20N*m. As to special support system or special installation requirement, please reconfirm with the support's supplier for the torque value

To maximize mounting longevity, Opal Solar strongly recommends the use of corrosion proof (stainless steel) fixings. Please find detailed mounting information in the below illustration as Figure 2.

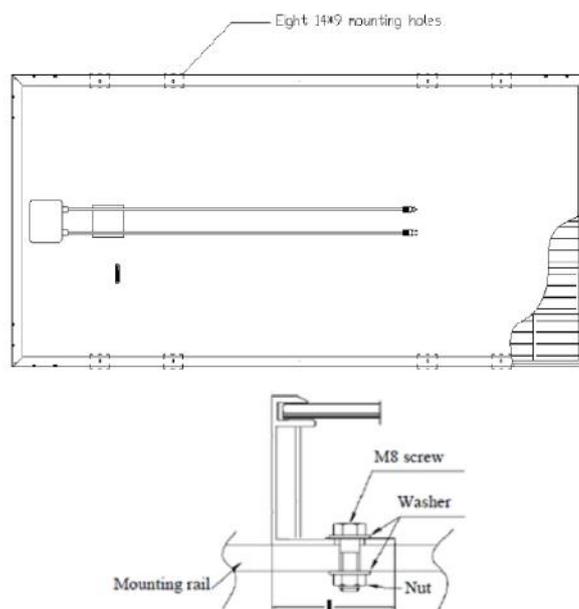


Figure 2. PV module installed using frame mounting holes

4.2.2 Using Clamps

- Modules should be mounted —using purpose-designed and certified clamps, and can be laid either across rails (Figure 3A), or parallel to the edge of frame (Figure 3B).

- Modules should be attached on a supporting structure (rail) by metal clamps. The length of rails must be longer than the length of module frame, otherwise please confirm with team to get approval.

- Use at least four clamps on each module; two on each side of the module. Depending on local wind and snow

loads, additional clamps may be required to ensure modules can bear the load.

- The clamping fixing attachment to the long sides of frames should be in the position between K and J, 2 clamps each side. Please find details in table 1.

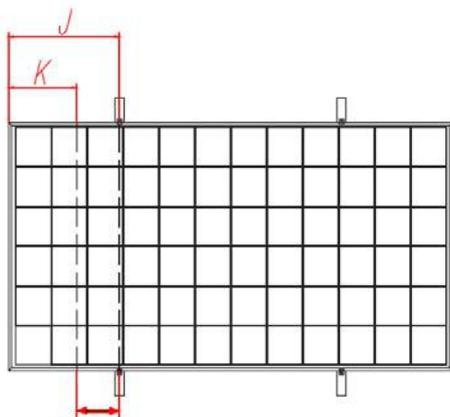


Figure 3A

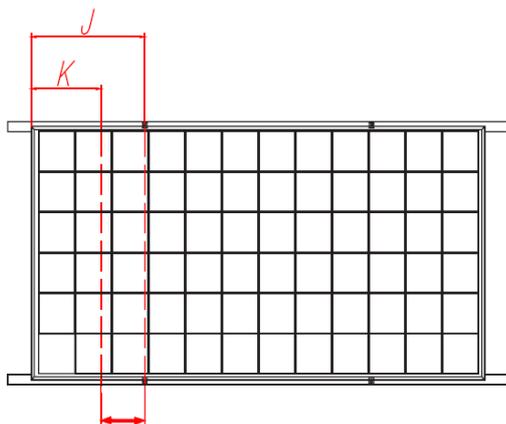


Figure 4B

Module Series	Dimensions LxW (mm)	J (mm)	K (mm)
QSAxxxP-60-S	1648 x 990	408	198
QSAxxxM-60-S	1648 x 990	408	198
QSAxxxP-72-S	1954 x 990	489	299
QSAxxxM-72-S	1954 x 990	489	299

- The clamps must not contact the front glass of the module or deform the frame in any way. The contact area of clamp with the front of frame must be smooth, otherwise it may damage the frame and hence break the module. Avoid shading effects from the module's clamps. Drainage holes on the modules frame must not be blocked by the clamps. See Figure 4.

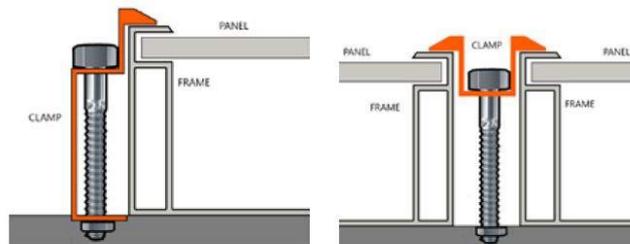


Figure 5. Clamp setup

5. Electrical Installation

5.1 Electrical Property

Rated electrical characteristics of module such as I_{sc} , V_{oc} and P_{max} are measured under Standard Test Conditions (STC). Standard Test Conditions: 1000 W/m² Irradiance, 25°C Cell Temperature and 1.5 Air Mass.

Under normal conditions, photovoltaic modules may produce higher current and/or voltage than reported at Standard Test Conditions. Hence, consider an additional safety factor of 1.25 on I_{sc} and V_{oc} values marked on modules, when determining component voltage ratings, conductor capacities, fusing sizes, and size of controls connected to the modules output.

Modules can be configured in series and/or parallel. See Figure 05.

- Series configuration: module voltages will add up when they are connected in series. The maximum quantity of modules in one string depends on the local temperature, maximum system voltage etc.

- Parallel configuration: module currents will add up when they are connected in parallel.

Modules with different electrical characteristics must not be connected directly in series.

The maximum system voltage for Opal Solar modules is 1000V DC. Make sure that system voltage and all other DC electrical components will not be exceeded in open-circuit operation at the lowest temperature expected at the PV system location.

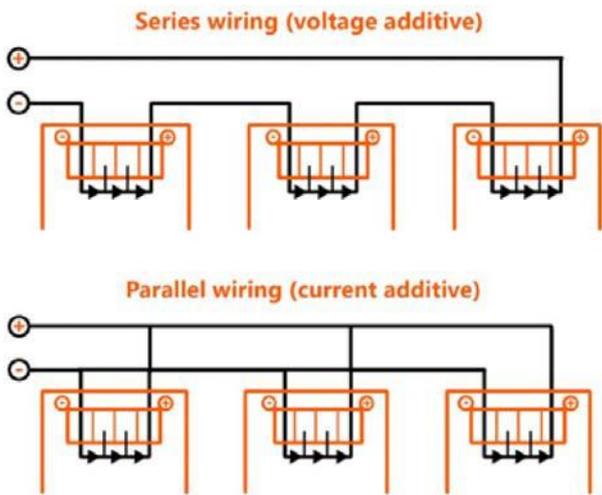


Figure 6. Series or parallel wiring

Always use a suitably rated DC isolator to interrupt the current flow before disconnecting the connectors.

5.2 Bypass Diodes

There are bypass diodes in the module junction box, wired in parallel with the PV cell strings. To limit modules heating and performance losses in the case of partial shading, the diodes bypass the current generated by the non-shaded cells. Be aware that bypass diodes are not over-current protection devices.

Do not attempt to open the junction box. In the event of a known or suspected diode failure, installers or maintenance providers should contact Opal Solar.

5.3 Wiring

All wiring should be performed, by qualified installers, in accordance with the local codes and regulations, including fire, building and electrical.

Junction boxes have been designed to be easily interconnected in series. Each module has two single-conductor wires, one positive and one negative, which are pre-wired inside the junction box.

To connect modules in series, plug the positive socket of one module into the negative socket of the next until you hear a "click". Before connecting modules always ensure that the contacts are corrosion free, clean and dry.

Product can be irreparably damaged if an array string is connected in reverse polarity to another. Always verify the voltage and polarity of each individual string before making a parallel connection. If you measure a reversed

polarity or a difference of more than 10V between strings, check the string configuration before making the connection.

Cables should be fixed to the mounting structure in such a way that mechanical damage of the cable and/or the modules is avoided. Do not apply stress to the cables. For fixing, use appropriate means, such as sunlight resistant cable ties and/ or wire management clips specifically designed to attach to the modules frame. While the cables are sunlight resistant and waterproof, where possible, avoid direct sunlight exposure and water immersion of the cables.

6. Grounding

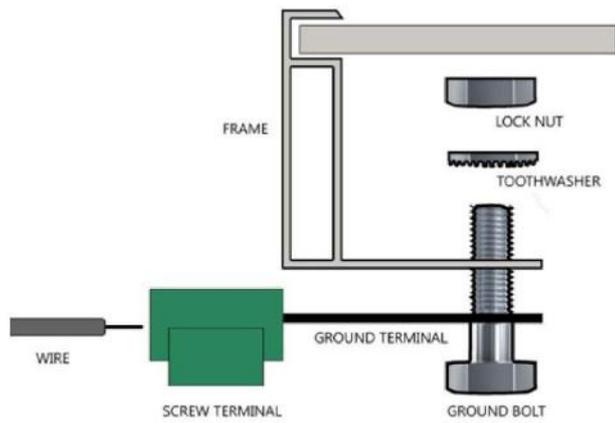
All conductive parts of the solar array (e.g. module frames, mounting racks) must be grounded in accordance with the appropriate national and local regulation at the site of installation.

To achieve proper grounding, the module frames and all conductive structural members must be connected together continuously using a suitable grounding conductor. Please be careful in arranging the system ground so that the removal of one module from the circuit will not interrupt the grounding of any other modules.

Pre-drilled holes marked with a grounding sign at the back of the module frame can be used for this purpose. These holes should be used for grounding purposes only and must not be used for mounting the modules. See Figure 06.

Third party grounding devices can be installed on Opal Solar modules for grounding the conductive parts of the modules. The devices have to be installed in accordance with the grounding device manufacturer's specified instructions.

Opal Solar modules use an anodic oxidized aluminum frame to resist corrosion. The grounding device must fully contact with the inside of the aluminum alloy, and must penetrate the surface of the frame oxidation film.



7. Maintenance and Care

Under normal circumstances, a well-designed PV system should operate trouble free over its entire operational life, and it requires minimal maintenance. However, system performance and reliability can be improved by taking some simple steps.

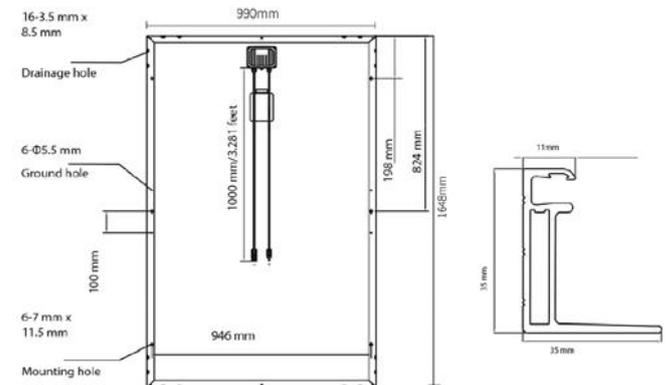
It is the user's responsibility to report to the supplier regarding the damages found within 2 weeks.

We encourage you to periodically inspect the PV array, just as you might do for a typical roof inspection.

- Periodically inspect the solar modules for damage, such as cracked glass.
- Clean the solar panels glass using fresh water, not organic cleaners or solvents. Beware that abrasive cloth or paper can damage the panel's anti-reflective glass coating.
- If possible, undertake the inspection at a time of day when close proximity objects cast their longest shadows.
- After a major weather event, e.g. hail storm, or if unrelated work has been done on the roof, e.g. roof cleaning, check that no collateral damage has been done to the solar array.
- Never walk on, sit on, or place objects on the surface of the solar panel.
- Trim any vegetation which may shade the solar array thus impacting performance.
- Check that mounting hardware is properly tightened.
- Inspect all cables to verify that connections are tight; the cables are protected from direct sunlight and sited away from areas of water collection.

8. Product Specification

8.1 Measurements



The drawing above is for QSAxxx60P-S. For other models and more details of the module, please refer to the datasheet or the label at the back of the module.

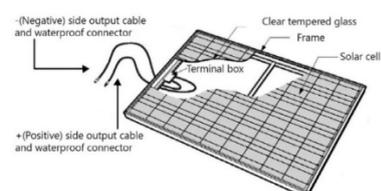
8.2 Product Identification

Each module has three labels on its rear side providing the following information:

- Nameplate - describes the product type, rated power, rated current, rated voltage, open circuit voltage, and short circuit current. They are all measured under standard test conditions (such as weight and dimension). The maximum system voltage of 1000 VDC and maximum fuse rating are also shown on the nameplate.
- "Pass": describe inspection date and security class.
- Barcode: each individual module has a unique serial number. Do not remove any label. If the label is removed, the product warranty will no longer be honored by Opal Solar.

8.3 Components

- Solar cell
- Frame
- Tempered glass
- Junction box
- Negative side output cable and waterproof connector
- Positive side output cable and waterproof connector



8.4 Specifications

Please refer to datasheet to get more detailed specification for module.

Model	QSA265P	QSA270P	QSA275P	QSA280P
Rated Power in Watts-Pmax (Wp)	265	270	275	280
Open Circuit Voltage-Voc (V)	37.87	38.00	38.45	38.69
Short Circuit Current-Isc (A)	9.18	9.45	9.52	9.59
Max Power Voltage-Vmpp (V)	30.92	31.08	31.12	31.20
Max Power Current-Impp (A)	8.58	8.70	8.85	8.99
Module Efficiency (%)	16.2%	16.5%	16.9%	17.2%

Model	QSA285M	QSA290M	QSA295M	QSA300M
Rated Power in Watts-Pmax (Wp)	285	290	295	300
Open Circuit Voltage-Voc (V)	39.15	39.45	39.81	39.90
Short Circuit Current-Isc (A)	9.46	9.54	9.59	9.68
Max Power Voltage-Vmpp (V)	31.80	32.15	32.38	32.59
Max Power Current-Impp (A)	8.97	9.03	9.12	9.21
Module Efficiency (%)	17.5%	17.8%	18.1%	18.4%

Model	OSY320P	OSY325P	OSY330P	OSY335P
Rated Power in Watts-Pmax (Wp)	320	325	330	335
Open Circuit Voltage-Voc (V)	45.45	45.67	45.86	45.98
Short Circuit Current-Isc (A)	9.25	9.48	9.52	9.57
Max Power Voltage-Vmpp (V)	37.02	37.11	37.15	37.26
Max Power Current-Impp (A)	8.65	8.77	8.89	9.00
Module Efficiency (%)	16.5%	16.8%	17.1%	17.3%

Model	OSY350M	OSY355M	OSY360M	OSY365M
Rated Power in Watts-Pmax (Wp)	350	355	360	365
Open Circuit Voltage-Voc (V)	47.01	47.31	47.62	47.82
Short Circuit Current-Isc (A)	9.53	9.60	9.66	9.75
Max Power Voltage-Vmpp (V)	38.58	38.82	39.14	39.38
Max Power Current-Impp (A)	9.08	9.15	9.20	9.27
Module Efficiency (%)	18.1%	18.4%	18.6%	18.9%