



MSR

MALAYSIAN SOLAR RESOURCES

Product documentation

MSR solar Standard Photovoltaic Modules (type designation “MSR Standard”)

Please read carefully the following product documentation and safety instructions.

Non-compliance with these instructions may void the module warranty.

1. Purpose of this documentation

This guide contains basic information regarding Malaysian Solar Resources Sdn. Bhd. standard photovoltaic modules, their installation and safe handling. All instructions should be read and understood before attempting installation. If there are any questions, please contact your dealer or MSR for further information.

This documentation refers to the PV-modules themselves and is not the complete installation. It serves as a general reference.

Generally, the installer must understand to all safety precautions in this documentation, as well as the applicable national codes and standards when installing MSR PV-modules. Before installing a solar photovoltaic system, the installer should become familiar with the mechanical and electrical requirements for photovoltaic systems. Keep this documentation in a safe place for future reference.

2. System components (modules and mounting system; standard scope of delivery)

- MSR solar standard photovoltaic modules ((MYS-zzM/By/ww-xxx, MYS-zzP/By/ww-xxx type designation MSR Standard module which is where (M = monocrystalline cells; P = polycrystalline cells), “y” = busbar number either it is a 2 busbar or 3 busbar, “ww” = is either CF = glass-foil-module (framed) or CL= glass-foil-module (frameless) and the “xxx” stands for nominal power values up to 420 W_p), certified framed glass/foil laminates with crystalline solar cells, permanently attached junction box, and double insulated 4mm² wires terminated in touch safe specific PV DC-connectors.
- The mounting system does not form part of Malaysian Solar Resources supply.

3. General safety relevant aspects

Do not attempt to disassemble the module, and do not remove any attached nameplates or components. Doing so will void the warranty.

- The modules are qualified for application class A: Hazardous voltage (IEC 61730: higher than 50V DC; EN 61730: higher than 120V), hazardous power applications (higher than 240W) where general contact access is anticipated.
- Installing solar photovoltaic systems requires specialized skills and knowledge. It should be performed only by

- qualified and specially instructed personnel. The installer assumes all risk of injury, including risk of electric shock.
- Use only equipment, connectors, wiring and mounting hardware specifically designed for use in a photovoltaic system.

3.1. Precautions for mechanical installation

- MSR Standard modules are designed for installation with specific photovoltaic mounting systems. Otherwise it will be fully responsible by the installer.
- The mounting system must be capable of securely fixing MSR Standard modules exposed to uplift or load pressures of more than 30 lb_s/ft².
- The mounting structure and hardware must be made of durable, corrosion- and UV-resistant material.
- Observe all instructions and safety precautions included with the mounting system (e.g. “Alutec”) to be used with the module.
- If modules are installed on roofs (non-integral modules or panels), a fireproof underlay is needed. If modules are installed in roofs, all applicable local, regional and national codes and regulations have to be observed.
- The correct order to orient the module is vertical with the junction box on the higher side of it. The reason is the breather port in the junction box, that must be mounted facing downward and not be exposed to the rain.

3.2 Wiring

- The Modules use Ningbo Shihe New Energy Technology SH0820T3 type junction box with same type cable Photovoltaic wire, size 12 AWG with 90° sunlight resistant rating. This box, on the back side of the module, is weather proof and is designated to be used with standard wiring or conduit connections. Wiring methods should be in accordance with the NEC (National Electrical Code). Bypass diodes and cable clamps are included with each module shipped from the factory. The modules have been tested with Ningbo Shihe new Energy Technology junction box SH0820T3 type and cable photovoltaic wire, type PV wire, 12 AWG with 90° sunlight resistant rating. Junction box should be kept in the upper most position in order to avoid the ingress of water.
- CORRECT WIRING SCHEME:** When designing the system, avoid forming loops to minimize risk in the event of an indirect lightning strike. Check that wiring is correct before starting up the generator. If the measured open circuit voltage (Voc) and short-circuit current (Isc) differ from the specifications, then there is a wiring fault.
- Correct connection of contact plug connectors. The plug connector has its own polarity. Make sure that the connection is safe and tight. The plug connector should not receive outer stress. Otherwise, it is only used to connect the circuit!
- Use of suitable material



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Use cable extensions and plugs that are designed for outdoor application. Ensure that they are in perfect electrical and mechanical condition. Use only cables having one conductor. Select the appropriate cable diameter to minimize voltage drop (to calculate the minimum cable diameter and the fuse, and to calculate controls, multiply the I_{sc} and U_{oc} by a factor of 1.25). The recommended cable size is 12AWG.

To get higher current or higher voltage or both, the modules typically shall be connected into an array by field wiring. There are two methods of wiring: series wiring and parallel wiring.

The series wiring:



The parallel wiring:



Wiring the array to final junction box/inverter/charge controller:

According to the above picture to make field wiring to final junction box/inverter/charge controller. When additional connectors and cables used, connector shall be Type PV-KBT4/6II-UR (female)/ Type PV-KST4/6II-UR (male) by MULTI-CONTACT USA and cable shall be type PV Wire by Ningbo Followray Solartech Co Ltd.

Bypass diodes

Partial shading of an individual module can cause a reverse voltage across the shaded module. Current is then forced through the shaded area by the other modules.

When a bypass diode is wired in parallel with the series string, the forced current will flow through the diode and bypass the shaded module, thereby minimizing module heating and array current losses.

Diodes that are used as bypass diodes must:

Have a Rated Average Forward Current 15A of Schottky Barrier Rectifier or above and have a Rated Repetitive Peak Reverse Voltage 45V or Above.

Maximum Series fuse Rating:

Maximum Series Fuse Rating to be used will be 15 Amps.

3.3 Precautions for electrical installation

- When disconnecting wires connected to a photovoltaic module that is exposed to light, an electric arc may occur. Arcs can cause burns, start fires or otherwise create safety (up to lethal electric shock) problems.
- Before any manipulation at an installed PV plant, switch it off first on AC-side after on DC-side of the inverter or the charge controller.
- Check for remaining voltage before starting, and observe the local safety relevant regulations for such working conditions.
- Under normal conditions, a photovoltaic module can produce more current and/or voltage (here: 30V DC) than reported at standard test conditions.
- Accordingly, the values of I_{SC} and V_{OC} 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. In the USA, refer to Section 690-8 of the National Electrical Code (NEC) for an additional multiplying factor of 125 percent (80 percent de-rating) which may be applicable.
- Contact with a DC voltage of 30 V or more is potentially hazardous. Exercise caution when wiring or handling modules exposed to sunlight.
- Only connect modules with the same rated output current in series. If modules are connected in series, the total voltage is equal to the sum of the individual module voltages.
- Only connect modules or series combinations of modules with the same voltage in parallel. If modules are connected in parallel, the total current is equal to the sum of individual module or series combination currents.
- Always use the same type of module within a particular photovoltaic system.
- With a serial interconnection of the modules, the sum of the open circuit voltage at Standard Test Conditions (V_{oc} @ STC) must not pass over the maximal system voltage indicated, both indicated in the modules datasheet.
- If the sum of short circuit currents of the parallel connected modules passes over the reverse current (indicated in the table of chapter 8), string diodes or fuses have to be used in each string of modules connected in parallel. These string diodes or fuses have to be qualified for the maximum expected current and voltage.
- 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. The battery 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 is 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.
- Observe the instructions and safety precautions for all other components used in the system, including wiring and cables, connectors, DC-breakers, inverters, etc.



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- Use appropriate safety equipment (insulated tools, insulating gloves, etc) approved for use on electrical installations.

3.4 General prescriptions for installation

- Do not install the modules near equipment or in locations where flammable gases can be generated or collected.
- Do not use mirrors or other hardware to artificially concentrate sunlight on the module.
- When installing modules, observe all applicable local, regional and national codes and regulations. Obtain a building and/or electrical permit where required.
- Keep children well away from the system while transporting and installing mechanical and electrical components.
- Do not wear metallic rings, watchbands, ear, nose, or lip rings or other metallic devices while installing or troubleshooting photovoltaic systems.
- Do not drill holes in the glass surface of the module. Doing so will destroy the module and void the warranty.
- Do not drill additional mounting holes in the module frame. Doing so will void the warranty.
- Do not lift the module by grasping the module's junction box or electrical leads.
- Do not apply paint or adhesive to the module.
- ❖ **Do not stand or step on module. Danger of breaking the glass or slipping off with possibility of severe injury or death!**
- Do not drop the module or allow objects to fall on the module.
- Do not place any heavy objects on the module.
- Inappropriate transport and installation may damage the module glass or the solar cells inside the module.

4. Mechanical Installation

4.1. Robustness of modules and mounting system

Malaysian Solar Resources Sdn. Bhd. standard photovoltaic modules have been tested to withstand snow loads and wind pull upto 30 lbs/ft².

The modules must not be mounted in regions, where higher wind- and snow loads are expected than 30 lbs/ft². The whole support structure needs to be strong enough to cope with above loads.

Load calculations to check for the applicability for the actual installation are within the responsibility of the system planner or installer.

4.2. Selecting the location

- Select only suitable locations for installation of the modules.
- In most cases, optimum performance is achieved if the modules face true south in northern latitudes and true north in southern latitudes.
- For detailed information on optimal module orientation, refer to standard solar photovoltaic installation guides or a reputable solar installer or systems integrator.
- The module should not be shaded at any time of the day.
- Do not install the module near equipment or in locations where flammable gases can be generated or collected.

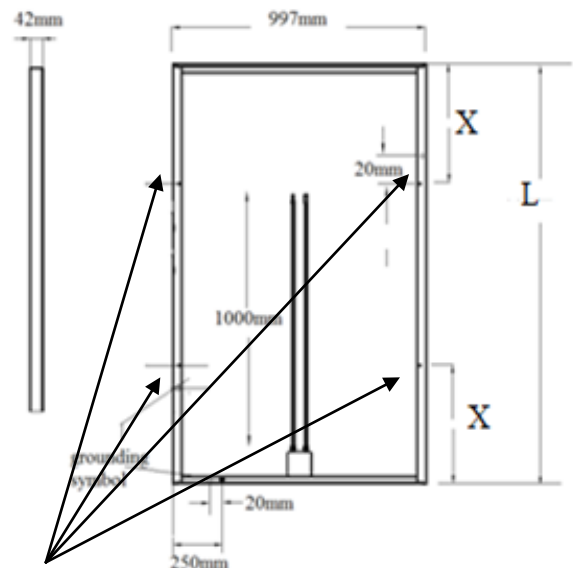
4.3. Mounting methods

4.3.1. Mounting with bolts

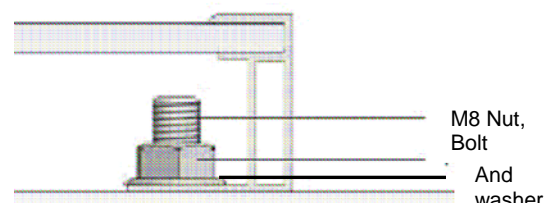
- The module must be attached and supported by at least four bolts M8 (depending on the situation) through the indicated mounting holes.
- Most installations will use the four mounting holes on the module frame. We recommend using a torque wrench for installation. The tightening torque (using stainless steel M8 bolts. Stainless steel washer and Stainless steel M8 nut) should be around 16 Nm. Use the existing holes to secure the module and do not drill additional holes (doing so would void the warranty). Use appropriate corrosion-proof fastening material.
- Clearance between the module frame and mounting surface may be required to prevent the junction box from touching the surface and to circulate cooling air around the back of the module. The clearance required between module frame and mounting surface is 6 inches.
- The module assembly installed on the roof top should have fire resistant covering of suitable rating.
- Modules installed on roof top with slope less than 5 in / ft (127/305 mm) requires to maintain a fire class C rating.

4.3.2. Mounting with Bolting Hardware

- Other specific photovoltaic mounting methods are acceptable as long as the minimum requirements as described in chapter 48.1 are met.



4 x Module mounting holes





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Type	Cell Number	L Length	X Length
MYS-60P/B3/CF-245	60	1666mm	281mm

- In any case the grounding screws, bolts or other parts have to be used separately from mounting parts of the module.

The ground point on the frame must be screw only at this symbol below



5. Electrical Installation

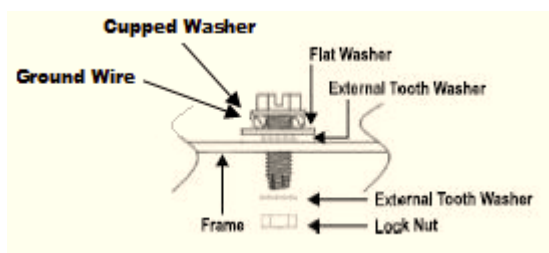
5.1. Grounding

Type	Cell Number	L Length	X length
MYS-60P/B3/CF-245	60	1666mm	281mm

All module frames must be properly grounded in countries, where grounding of modules is mandatory. The installer of a PV system is responsible for grounding each module frame. It is recommended to ground each module frame at the provided grounding holes. The installer of a PV system is responsible for grounding each module frame. The ground connections between modules must be approved by a qualified electrician. The main earth ground must only be connected by a qualified electrician. UL approved grounding method is mandatory in the USA and Canada. Installation shall be in accordance with CSA C22.1, Safety Standard for Electrical Installations, Canadian Electrical Code, Part I.

Observe all local electric codes and regulations.

The modules can be connected at the grounding holes using stainless steel nut, bolt, star washer, cup washer and flat washer of size M5. The torque rating provided for grounding means is 2.3 to 2.8 Nm [20 and 25 in.-lbs]. The grounding method of the frame of arrays shall comply with the NEC, article 250.



- The grounding screw, bolt or other parts are separately used from the mounting parts of the module. The grounding is achieved through securement to the array frame. The array frame shall be grounded in accordance with NEC Article 250.
- Devices listed and identified for grounding metallic frames of PV modules are permitted to ground the exposed metallic frames of the module to grounded mounting structures.
- Functional grounding is not foreseen for the Malaysian Solar Resources Sdn. Bhd. standard photovoltaic modules. If it is performed, local electric codes and regulations have to be observed, and used grounding means have to be isolated from live parts by reinforced insulation.

5.2. General electrical installation

WARNING! Electrical shock hazard! Do not touch bare conductors or other potentially energized parts.

- Photovoltaic modules convert light energy to direct-current electrical energy. They are designed for outdoor use.
- Do not use modules of different configurations in the same system.
- MSR-Standard modules are supplied with IEC certified cables and connectors for serial electrical connections.
- Use only additional cables which are qualified for the expected maximum current, maximum voltage and environmental conditions. Minimum cross section 4mm² (#12 AWG).
- For additional extension cables use only suitable cables.
- The PV-DC-connectors must never be disconnected under load! Stick to the first rule of chapter 3.2.
- Refer to the relevant standards in your country to determine overcurrent, conductor ampacity and size requirements.
- For best performance, ensure that positive and negative DC wires run closely together avoiding loops, which will also reduce the strength of inductive impacts of nearby lightning strikes.
- Following the installation of a module string, its performance is checked to ensure proper functioning. At least, Isc and Voc need to be checked with appropriate equipment and circuit breakers.

6. Maintenance

MSR recommends the following maintenance items to ensure optimum performance of the module:

- Clean the glass surface of the module as necessary. Use water and a soft sponge or cloth for cleaning. A mild, non-abrasive cleaning agent can be used if necessary. Do not use dishwasher detergent.
- Electrical and mechanical connections and the general condition of an installed PV-system should be checked periodically by qualified personnel to verify that they are clean, secure and undamaged.
- Eventually occurring problems must only be investigated by qualified personnel.
- Observe also the maintenance instructions for all other components used in the system.

7. Shutting down the system

- Disconnect system from all power sources in accordance with instructions for all other components used in the system.



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- The PV-DC-connectors must never be disconnected under load! Use switches designed for being disconnected under the prevailing DC-load or stick to the first rule of chapter 3.2.
- The system should now be out of operation and can be dismantled. In doing so, observe all safety instructions as applicable to installation.

Malaysian Solar Resources Sdn. Bhd.
Lot74369,Lebuhraya Tun Razak,
26300 Gambang, Kuantan,
Pahang, Malaysia.
www.malaysiansolar.com
info@malaysiansolar.com

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8. Electrical ratings after preconditioning >20kWh/m² of the concerned modules:

Model (MYS-60P/B3/CF-XXX)	245
Maximum Power (P_{MPP})	245 W
Rated Voltage (V_{MPP})	30.692V
Rated Current (I_{MPP})	8.007A
Open Circuit Voltage (V_{OC})	37.902V
Short Circuit Current (I_{SC})	8.574A
Maximum System Voltage	600 V
Fire Class (UL 790)	C
NOCT	45 °C

The electrical characteristics are within $\pm 10\%$ of the indicated values of I_{sc} , V_{oc} , and P_{mpp} under Standard Test Conditions (irradiance of 1000 W/m², AM 1.5 spectrum, and a cell temperature of 25°C/77°F)

9. Disclaimer of liability

Because the use of this documentation and the conditions or methods of installation, operation, use and maintenance of photovoltaic products are beyond MSR 's control, MSR 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 MSR 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.

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Information about manufacturer:

Please consult your dealer or the manufacturer concerning the warranty of your modules. If you have any further questions, your dealer will gladly assist you.