Quick Guide for Users SolarWorld® solar modules

Last revised: November 2008

Carefully read through these installation instructions before installing, operating or servicing the photovoltaic (PV) system. Failure to follow these instructions may result in bodily injury or damage to property. Keep these instructions! Working on a PV system requires specialized knowledge and must therefore be carried out only by appropriately qualified and authorized personnel. Keep children away!

Warning notices

Danger of death from electric shock!

Solar modules generate electricity as soon as they are exposed to light. The voltage of a single module is less than 50VDC. When several modules are connected in series, the summed voltage can be dangerously high. When the modules are connected in parallel the currents are summed together. Although touch protection is provided in the form of the fully insulated plug contacts, the following points must be observed when handling the solar modules to avoid the risk of fire, arcing and fatal electric shock:

- **The installation of higher voltage systems should be done by qualified, licensed professionals.**
- **Do not insert electrically conducting parts into the plugs or sockets!**
- **Do not wear metallic jewelry while performing mechanical or electrical Installation.**
- **Do not fit solar modules and wiring with wet plugs and sockets! Tools and working conditions must be dry.**
- **Exercise extreme caution when carrying out work on wiring and use the appropriate safety equipment (insulated tools, insulated gloves, etc.)!**
- **Do not use damaged modules! Do not dismantle modules! Do not remove any part or label fitted by the manufacturer! Do not treat the rear of the laminate with paint, adhesives or mark it using sharp objects!**

Danger of death from electric shock!

The inverter can produce dangerous, high voltages, even when not connected:

- **Exercise extreme caution when working on wiring and the inverter.**
- **After switching off the inverter, it is essential to wait for the time interval specified by the manufacturer before beginning any further work. This allows the high voltage components time to discharge.**
- **Be sure carefully to follow the inverter manufacturer's installation instructions.**

Danger of death from arcing!

Modules generate direct current (DC) when any amount of light shines on them. When breaking a connected string of modules (e.g. when disconnecting the DC line from the inverter under load), a lethally strong arc can occur:

- **Never remove the solar generator from the inverter while it is still connected to the main grid!**
- **Ensure that the cable connections are in perfect condition (no cracking, soiling or other contamination)!**

Unpacking the modules and storage

• Observe the warnings on the packaging!
The utmost care is required when handling the modules. Take care when unpacking, transporting, and storing them. Leave modules in packaging until they are to be installed. Carry modules with both hands. Do not use the connection socket as a handle. Do not stand modules on hard or rough ground. Do not stand modules on their corners. Ensure modules do not bow. Do not place modules on top of each other. Do not subject to load, do not stand on them, do not drop. Do not mark or work on them with sharp objects. Keep all electrical contacts clean and dry. In order to keep a record of your system, we recommend that you make a note of the serial numbers. If it is necessary to store the modules temporarily, a dry, ventilated room should be used.

General safety information

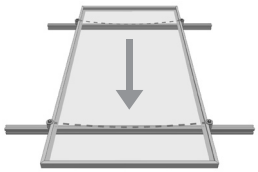
Ensure that the module is used for its intended purpose only. Pay attention to the local ordinances, building standards and accident- prevention regulations during installation. The safety information for other system components must also be followed.

Installation

When installing the modules, please pay attention to:

• Safety during installation
Do not carry out installation work when there are strong winds. Secure yourself and other workers to avoid falling. Secure work materials to prevent articles from falling. Create a work zone to avoid accidents with other people.

• Keeping within the maximum permitted load
Make sure the support structure adheres to maximum permissible load requirements as prescribed by local ordinances, particularly in regions of high snow accumulations and high wind velocities. Take notice to possible bowing of the modules under high loads. Avoid installing fasteners, cable ties, etc. between the module backside and support structure (i.e. on mounting rails) as any sharp edges can damage module.



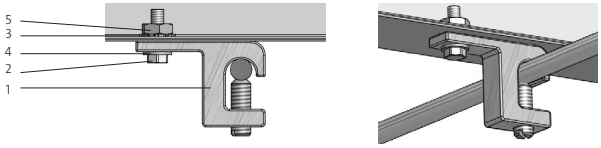
Drawing:
Bowing of the module under high mechanical front loads.

• Grounding of the module and frame
The company installing the PV module frame is also responsible for the professional grounding. If the building is already equipped with an exterior lightning protection system the PV-installation must be integrated in the protection system against direct effects of lightning. Country specific standards must be adhered to.

A grounding method authorized by UL is mandatory in the US and Canada.

Example UL:
The modules can be connected to the grounding holes using a lay-in lug and a screw with serrated washer, washer and nut.

Drawings:
Ground connection using a cable lug, a bolt, a serrated washer, a washer and a nut.



1) Lay-in lug
2) Bolt
3) Serrated washer
4) Washer
5) Nut

We recommend using the components as listed below. Any UL approved PV grounding method and components are also acceptable in the US and Canada.

Table: Recommended components

Item	Description	Manufacturer/ Distributor	Manufacturer Part Number
Grounding Lug	Lay-In Lug	Ilsco	GBL-4
Bolt	#6-32, SS	McMaster Carr	92314A148
Serrated washer	M5, SS	McMaster Carr	91120A140
Washer	ID 9/64", OD 3/8", SS	McMaster Carr	92141A007
Nut	#6-32, SS	McMaster Carr	91841A007

See: www.ilsco.com; www.mcmaster.com

• Fire safety
The roof construction and installation may affect the fire safety of a building; improper installation may contribute to hazards in the event of fire. For roof application, the modules should be mounted over a fire resistant covering rated for the application. The module is "non-explosion-protected equipment". Hence it must not be installed in the proximity of highly flammable gases and vapors (e.g. filling stations, gas containers, paint spraying equipment). The module must not be installed near open flames or flammable materials.

• Suitable environmental conditions
The module is intended for use in temperate climatic conditions.
The module must not be subjected to concentrated light. It must not be immersed in water or constantly exposed to water spray (e.g. from fountains). There is risk of corrosion with exposure to salt (it is recommended that modules are installed at least 500 m or 1700 ft from the sea) and sulfur (sulfur sources, volcanoes). The module may not be exposed to extremely corrosive chemicals (e.g. emissions from manufacturing plants).

• Suitable installation
Make sure the module meets the technical requirements of the system as a whole. Ensure that other system components do not exert damaging mechanical or electrical influences on the modules. When connected in series, modules must all have the same amperage. When connected in parallel, the modules must all have the same voltage. The modules must not be connected together to create a voltage higher than the permitted system voltage. Modules must not be fitted as overhead glazing or vertical glazing (façade). Ensure that the mounting system can also withstand the anticipated wind and snow loads. There are openings at the base of the module frame to allow water from precipitation to drain. Ensure that these openings are not blocked nor partially blocked by the module installation method.

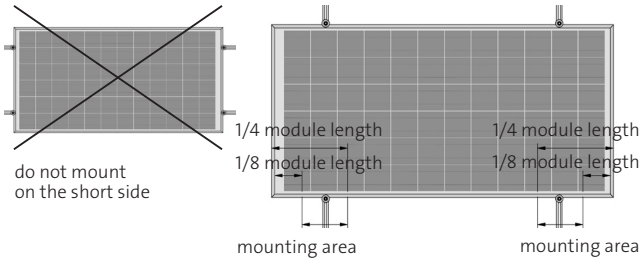
• Optimum orientation and tilt
To obtain maximum yield from the system, we recommend that you determine the best direction and tilt angle for the modules. Conditions for generating electricity are considered ideal when the sun's rays strike the module perpendicular to its surface. To avoid performance drops in series circuits, ensure that all modules have the same orientation and tilt.

• Avoidance of shading
Even partial shading will cause a yield reduction. A module is "shade free" when the entire surface is shade free all year round and, even on the most unfavorable days of the year, receives unobstructed sunlight.

• Adequate ventilation
Ventilation of the module backside is necessary to avoid the build-up of heat that can reduce performance.

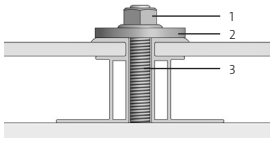
Mounting

Each module must be securely fastened at a minimum of 4 points. The frame has been stress tested for mounting by the long sides. The module should not be secured by its short sides.

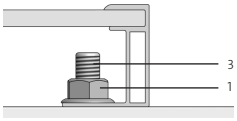


PV modules can be mounted to the substructure by clamping on (Example A) at the front side or by screwing (Example B) at the back side.

Example A: Clamping



Example B: Bolting



1) Stainless steel serrated lock nut
2) Stainless steel washer
3) Stainless steel M8 (5/16 inch) T-head bolt

The clamping area (Example A) of the washer must cover at least 135 mm^2 or 0.21 in^2. A torque wrench must be used for assembly. In the examples shown, the tightening torque (using stainless steel M8 or 5/16 inch bolts) must be 20 Nm or 11.8 ft-lbf. Use the existing holes for securing the module; do not drill any additional holes (doing so would void the warranty). Use appropriate corrosion-proof fastening materials.

Wiring

The module is provided from the factory with pre-connectorized cables. Under no circumstances should the junction box be opened.

For the wiring, pay attention to:

• Correct wiring scheme
In order to decrease voltage caused by indirect lightning strikes, all connecting cables should be as short as possible. 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.

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

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

• Cable protection
We recommend securing the cables to the mounting system using UV-resistant cable ties. Protect exposed cables from damage using suitable precautions (e.g. laying them in plastic pipes). Avoid direct exposure to sunlight.

Underwriters Laboratories Information (U.S. and Canada)

- The solar module electrical characteristics are within +/-10% of the module label indicated values of Isc ,Voc,and Pmpp under Standard Test Conditions (irradiance of 100 mW/cm^2, AM 1.5 spectrum, and a cell temperature of 25°C/77°F)
- Under normal conditions, a photovoltaic module is likely to experience conditions that produce more current and/or voltage than reported at standard test conditions. Accordingly, the values of Isc and Voc marked on this module should be multiplied by a factor of 1.25 when determining component voltage ratings, conductor capacities, fuse sizes, and size of controls connected to the PV output.
- Refer to section 690-8 of the National Electric Code (NEC) for an additional multiplying factor of 125% (80% de-rating) which may be applicable
- Over-current protection shall be in accordance with the requirements of Article 240 of the NEC
- Conductor recommendations: 8-14 AWG (1.5-10 mm^2) USE-2 (nonconduit)/ THWN-2 (conduit), 90°C wet rated
- Cable conduits should be used in locations where the wiring is accessible to children or small animals
- Modification or tampering of diodes by unqualified personnel is not permitted. Please consult a SolarWorld Service Center for additional information regarding diode replacement/repair.

Maintenance and cleaning

Given a sufficient tilt (at least 15°), it is generally not necessary to clean the modules (rainfall will have a self-cleaning effect). In case of heavy soiling, we recommend cleaning the modules using plenty of water (from a hose) without any cleaning agents and using a gentle cleaning implement (a sponge). Dirt must never be scraped or rubbed away when dry, as this may cause micro-scratches.

We recommend that the system be inspected at regular intervals to ensure:
1. All mounting points are tight and secure and free of corrosion.
2. All cable connections are secure, tight, clean and free of corrosion.
3. Cables are not damaged in any way.
4. The conductivity of module frame to earth ground.

Disclaimer of liability

Since compliance with this guide and the conditions and methods of installation, operation, use and maintenance of the modules are not checked or monitored by SolarWorld AG, SolarWorld AG accepts no liability for damage arising through improper use or incorrect installation, operation, use or maintenance.

Furthermore, liability for infringements of patent law or of other third party rights arising from the use of the modules is excluded unless we are automatically liable by law.

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