FLEXIBLE PHOTOVOLTAIC MODULES

Instruction Manual
THE PHOTOVOLTAIC MODULE

Introduction

A photovoltaic module is a device that converts solar energy into electrical energy, thanks to the presence of silicon cells within which the physical phenomenon known as the “photovoltaic effect” takes place. The greater the number of silicon cells in the photovoltaic module, the more electrical energy is produced.

The front surface of the photovoltaic module

The front surface of the module must be exposed to direct sunlight.

The junction box, at the request of the customer, can be placed on the back surface.
Warnings

Please read and follow these general instructions and warnings carefully; failure to comply with these instructions will void the warranty.

- Leave the photovoltaic module in the packaging until it is installed.
- Check the physical integrity of the module before installation.
- Contact with electrically active parts of the module can generate sparks and electrical discharges at low voltage: please use caution.
- The photovoltaic module produces electricity when the front part is exposed to sunlight; the voltage produced by a single module is not considered dangerous.
- When modules are connected “in series” the voltage is cumulative, whereas when connected “in parallel” the current is cumulative. For this reason, a system with multiple modules connected to each other can produce high voltages and currents that can be a source of danger and can cause serious injury or death. Use caution.
- The photovoltaic module must be handled with care without excessive bending (curvatures greater than 20% of its length can cause irreparable damage to the cells).
- Do not move the panel taking it by the connection cables.
- Do not put localized pressure on the cells.
- Avoid prolonged partial shade on the module.
- Do not use the photovoltaic module for purposes other than those for which it was designed and built.
- Do not place the module near sources of heat.
- Do not disassemble or modify the module components (junction box, cables and connectors).
- Do not pierce the module, even in areas that are far away from the cells.
- Do not use paint on the front or the back.
- Do not step on the module when it is not resting on a flat continuous surface.
- Do not concentrate sunlight or artificial light sources on the module.
- Do not short-circuit the module connectors (do not connect them together).

INSTALLATION

General rules for installation

For correct installation of the photovoltaic module, it is necessary to follow these guidelines.

- A photovoltaic module generates electricity when exposed to sunlight; it is advisable to fully cover the surface of the front side with a dark opaque material to block sunlight during installation or removal.
- During operation, the module tends to heat up (because of both the effect of solar radiation and the physical phenomenon of photovoltaic action). To
improve the performance of the module, it is therefore important to facilitate the dispersal of heat. One solution is to mount the module onto a metal surface which, because of its high thermal conductivity, facilitates the dispersal of heat. By the same token, fastening the module to thermally insulating materials is not recommended because it would impede the dispersal of heat.

- If the support chosen for the installation site is metallic (and therefore conducts electricity), when installing, be careful to avoid any contact between the metallic material and the electrical terminals of the module.
- During installation, be careful to comply with safety regulations and general instructions.
- Installation should only be undertaken in dry conditions, keeping the photovoltaic module and all tools dry and adequately insulated.
- Do not install the photovoltaic module in the vicinity of flammable gases or vapors.
- Choose an installation location which is exposed to direct sunlight as much as possible; avoid shaded areas.
- In the event that the cables need to be extended (e.g., to connect the module to a charge regulator), the electrical conductor section of the extension cord should be large enough to avoid excessive voltage drops with relative loss of power: in operational terms, for lengths of extension cables of more than 4 m, the relevant section of the conductor must be at least 4 mm².

**Orientation**

In general, for latitudes in Mediterranean Europe, the best energy performance of the module can be obtained by installing the module:

- facing south;
- at an inclination of about 30 ° from the horizontal.

Maximum energy yield cannot be guaranteed without the recommended orientation.

**Mounting**

The photovoltaic module can be mounted in the following ways:

- mechanically with eyelets
- bonding it using double sided tape
- pasting it with glue

**Mounting the panel by means of eyelets**

Mounting by means of eyelets is performed using plastic or metal bushing connectors, inserted into the eyelet as shown below:

1. insert the plastic or metal bushings into the holes of the module
2. apply the washer to the eyelet
3. tighten the screw inside the bushing until the washer is flush to the bushing

During mounting, avoid applying pressure on the cells or overbending the panel.

Eyelets are also suitable for mounting panels to non-rigid surfaces (house awnings, camper awnings, tents, etc.), even using elastic bands or ropes.

**Bonding the panel using double sided tape**

Bonding using double sided tape is indicated when the material of the module (PC) and that of the surface, on which the panel has to be fixed, have different thermal expansion coefficients (for example, PC and steel or PC and aluminum).

We recommend the use of butyl double-sided adhesive when the two materials have very different thermal expansion. It is preferable to use the polyurethane adhesive when the difference of expansion coefficients is not very relevant. You can fix the panel also with a kind of Velcro called Dual Lock. This system allows you to remove the panel if necessary, but it is not recommended where high adherence is required.

The following instructions should be followed when using this method:
• clean the installation surface thoroughly with isopropyl alcohol
• make sure the surfaces are completely dry after cleaning
• attach the modules, making sure there are no air bubbles between the adhesive and the surfaces (if necessary, use a piece of wood or metal to distribute pressure evenly)
• do not subject the cells of the module to localized pressure during mounting: this can cause serious damage to the solar cells
• if sealant is used, follow the instructions on the product card provided by the supplier carefully, and distribute the sealant evenly on the surface to be bonded

**Pasting the panel with glue**

The use of glue is indicated when the module and the surface on which you paste it have the same coefficient of expansion (for example if you join PC and plastic or PC and rubber).

If you install the modules using glue Sikaflex 222UV, it is necessary to follow the instructions below:
• clean all surfaces (module and support) thoroughly and dry them very well
• use the Primer recommended by Sika specific for the surfaces to be bonded
• apply the product on the surface at a temperature between 10 and 35° C
• spread the product evenly over the entire surface with a spatula
• make sure there are no air bubbles between the panel and the surface to be bonded (if necessary, use a plate of wood or metal to distribute pressure evenly).
• do not subject the cells of the module to localized pressure during mounting: local pressure on the surface of the modules can cause serious damage to solar cells
• don’t use glue when the surface on which the panel goes has a coefficient of expansion too different from polycarbonate

For more complex applications, installation by a qualified technician is strongly recommended.

**Electrical connections**

**Connecting several modules together**

Several PV modules can be connected to each other in the following ways:
• in-series connection
• parallel connection
Connection of several modules in series

For in-series connection, the positive connector (+) of one module must be connected to the negative connector (−) of the one next to it: in this way, a voltage corresponding to the sum of the electrical voltages of each individual module will be present between the free connector of the first module and the free connector of the last module.

\[ \Sigma \text{VOLTAGE} = \text{CURRENT} \]

For in-series connection, only identical modules can be used and the number of modules to be connected is based on the electrical voltage you wish to obtain.

⚠️ Warning! This type of connection is indicated when all modules are exposed to the sun in the same way. If more than 4 modules are to be connected, only a qualified technician should perform the installation.
Connection of several modules in parallel

In parallel connection, an electrical current is obtained which is the sum of the electrical currents generated by the individual modules. Establishing a parallel connection requires the use of additional connectors (parallel connectors) which can be ordered separately from our accessory range.

\[
\text{VOLTAGE} = \sum \text{CURRENT}
\]

Warning! All the modules connected in parallel must be identical and have the same current and voltage. It is also necessary to protect the panels by using blocking diodes placed on the positive cable of each panel group.
Connecting to an accumulator (battery)

The connection of one or more modules to an accumulator must always be performed by means of a charge regulator. The module (or the string of modules) must be connected to the charge regulator and the accumulator by means of two extension cables.
Direct connection to usage devices

Direct connection is possible only with usage devices that have a built-in battery and charge regulator.

Connecting to the electrical network

The connection of one or more modules to the electrical network is not described in this manual, as it must be performed by a qualified technician because small electrical systems are subject to specific regulatory constraints and safety regulations.

MAINTENANCE

Photovoltaic modules require very little maintenance because of the absence of moving parts. Maintenance includes the following:

- regular cleaning of the module;
- periodic inspection;
- electrical performance checks.

Cleaning the module

Dirt accumulated on the upper surface reduces performance and can cause adverse effects similar to those caused by shade. The problem is more pronounced in areas with high smog levels or the presence of birds or trees.

The intensity of the effect depends on the opacity of the accumulations (grime, soot, leaves, bird droppings, etc.). In many cases, rain may reduce or eliminate the accumulation of impurities on the modules.

Cleaning involves simply washing the module with fresh water and non-abrasive sponges. Do not use pressurized water jets.

Inspection

It is a good rule to inspect the photovoltaic system periodically in order to check the condition of the mechanical and electrical connections between the devices.

Electrical performance checks

Periodic electrical performance checks help to ensure the proper functioning of the photovoltaic module: for example, a reduction of the electrical power generated may indicate an isolated shady area on one or more cells, which can then be rectified to obtain optimal performance.
CONTACT DETAILS