

## Solbian Solar Panel User's Manual

Thank you for purchasing a Solbian product. Our photovoltaic modules are built using innovative technology and superior quality materials. They will supply your energy needs in the harshest environmental conditions and with the versatility to suit many different applications. Please read these instructions carefully, to ensure correct utilization and a long life.

This manual is not an explicit or implicit warranty. Solbian accepts no responsibility for damage caused by the installation, use and maintenance of its products. Solbian reserves the right to modify its products, the technical specifications and this installation manual without notice.

THE FOLLOWING INSTRUCTIONS ARE EXCLUSIVELY GENERAL ADVICE. WE RECOMMEND THAT YOU HAVE THE MODULES INSTALLED BY QUALIFIED TECHNICIANS, RESPECTING STANDARDS IEC 62548 AND 62257 AND/OR ABYC ELECTRICAL RECOMMENDATIONS. WE RECOMMEND THAT YOU CONTACT YOUR SOLBIAN DEALER FOR DETAILS CONCERNING TECHNICAL ASSISTANCE.

### RECOMMENDATIONS

The following instructions must be read carefully and fully understood before proceeding with the installation, connection and use of SolbianFlex modules. Contact with electrical components, such as terminals, can cause burns and electric shock even when the module has not yet been connected to an electrical circuit. **A photovoltaic module generates electricity as soon as it is exposed to the sun or to a source of light.** Although the electrical output of one single SolbianFlex module is not dangerous, the connection of several modules in series or in parallel increases respectively the voltage and current. A photovoltaic system comprising of several modules can therefore generate voltages and currents which are dangerous and could be lethal.

SOLBAIN will not be held responsible in any way for accidents and damage to persons, including electric shock, caused by incorrect use or installation.

### IMPORTANT INFORMATION

This manual contains important information about safety, which must be read carefully and understood before proceeding with the installation and use of SolbianFlex photovoltaic modules and their accessories.

Please keep the receipt of purchase and the original packaging for the duration of the warranty.

### WARNINGS AND ELECTRICAL RISKS

Do not connect different models of photovoltaic modules in series or in parallel.

Check the compatibility of the charge regulator (if purchased separately) with SolbianFlex products.

Do not modify the electrical connections of the modules, in particular do not open or remove the sealed Junction Box which joins the internal structure of the module to the external electrical connections.

Do not cut or pierce the module, this could cause live components to be exposed and/or damage the module.

Do not bend or apply excessive force to the cables.

Do not expose the photovoltaic module to direct light during installation of the system and in any case take care when the module is exposed to light. It produces current and therefore its terminals are electrically live.

The maintenance, installation, and removal of the photovoltaic modules must take place on dry surfaces.

Use exclusively tools with insulated grips.

Do not use photovoltaic modules in the presence of flammable or explosive substances.

Keep the modules in their original packaging up to the moment of their installation.

Ensure that the position of the photovoltaic modules does not cause mechanical or electrical risks.

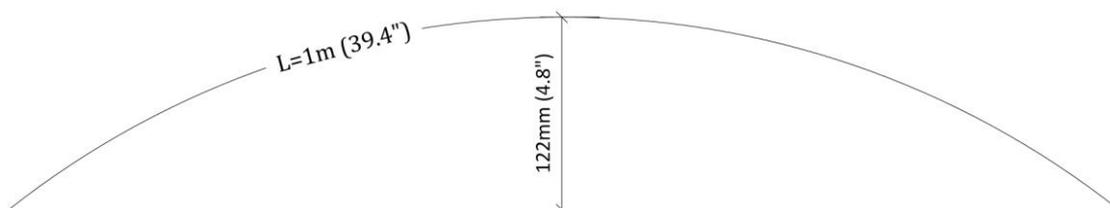
Do not use damaged photovoltaic modules (damaged during shipping, installation or in use).

Do not apply protections, paint or varnish to the module. Contact the manufacturer for information about cleaning and protection of SolbianFlex modules.

### **RISKS FROM MECHANICAL DAMAGE**

The photovoltaic cells contained in SolbianFlex modules are fragile. The manufacturing technology of the modules provides protection for the cells, provided that certain precautions are taken.

SolbianFlex modules are semi-flexible, but they cannot be rolled-up or folded. The maximum curvature allowed is 1 m radius. For a 1 m (39.4") long module (L), the maximum arc height is 122 mm (4.8").



Excessive bending must be avoided when handling the modules. The module may be handled by the edge, but only if it is held vertically and without exerting excessive pressure to the edges of the cells.

SolbianFlex modules may be walked on, but only when they are firmly mounted on a flat, smooth, rigid surface, with no bumps, hollows or irregularities. Be cautious when walking on them. You should be barefoot or wearing soft-soled shoes. Avoid heels or shoes with a rigid sole.

### **Uninstalled modules or modules in removable installations must not be walked on.**

If sharp or heavy objects are allowed to fall onto the modules, they can cause fractures in the cells.

If, during installation or maintenance, it is necessary to kneel on the module, it is advised to use adequate protection, to avoid damaging the cells.

## HOT-SPOTS

A module containing damaged cells, or even a module in good condition in which one or a small number of cells are completely shaded, can suffer from a HOT-SPOT, i.e. local overheating, even up to the point of causing the protective material to smoke and reach temperatures over 200°C (392 °F) on small areas.

In principle, this phenomenon could cause a fire, a danger which is always present where electrical apparatus is used. However, normally the damage is limited to small local burning.

**In the event of HOT-SPOTS forming, the module must be disconnected immediately.** In this way, the flow of current is stopped and further temperature rises are avoided. As an alternative, it is possible to cover the module, to avoid exposure to light. In the case of several modules connected in series, the only solution is to disconnect the module.

## MECHANICAL INSTALLATION

Do not bend the modules with a radius of bending less than 1m, otherwise the photovoltaic cells could be permanently damaged.

SolbianFlex modules alone cannot withstand the loads caused by high winds or snow. The installation must bear in mind the structural resistance of the modules' support. The panel's structure must not be continually subjected to stress. Improper use of SolbianFlex modules can cause irreversible damage, thereby compromising the efficiency and usage of the system.

The position of the installation should take advantage of the maximum exposure to the sunlight and the minimum shading. Remember that even partial shading of the module can cause a substantial reduction in the amount of energy produced. Do not place objects on the modules exposed to the light.

The position of SolbianFlex modules must allow adequate circulation of air on the surfaces exposed to sunlight. This is necessary to lower the temperature and ensure high efficiency.

## INSTALLATION WITH SCREWS

Solbian panels may be attached to a rigid surface using fasteners. The fasteners should be at least ¼" from the edge of the panel and any part of the cell or wiring. **In this case, the modules cannot be walked on.**

## INSTALLATION ON A CANVAS BIMINI OR DODGER USING VELCRO OR ZIPPERS

Although Solbian Flex solar panels are ideal for canvas installation, they must be fully supported for their entire area. The canvas bimini or dodger surface must be firm and sturdy, some older structures may need to be updated or re-tensioned. It is necessary to prevent any "flogging" in the wind or any excessive movement. One should be able to pull firmly on any corner of the structure and not produce much movement.

Solbian Flex panels are "semi-flexible", not folding or rollable. They can be mounted on curved surfaces as long as they do not exceed a bend with radius of 1m. Nor may they be installed in such a manner that may bend locally or have any kink, such as over a middle support bar in a bimini.

If a Solbian panel must be installed over a crossbar, and if there is any bend in the canvas surface over the bar, then a stiffening backing should be used under the panel. Typically a lightweight twin-wall polycarbonate may be used; however you should contact your distributor for information on backing material.

Zippers or Velcro may be used to attach the panels, with the Velcro option recently becoming more popular. Here is an example of a Velcro installation:



Note that the Velcro is both sewn and glued to the panel. Also note that in this case a bit more clearance could have been left between the Velcro and the cells to avoid shading the cells.

Regarding sewing, do NOT sew into the cells, stay 8-10mm (.4") away from them. Stitching should have wide spacing. If holes are too close together, it can weaken the edge of the panel.

#### INSTALLATION USING DOUBLE-SIDED ADHESIVE, GLUE OR DUAL-LOCK TAPE

Before installation, the surface onto which the modules are to be installed must be perfectly clean and dry. The installation of SolbianFlex modules using peel and stick adhesive supplied by the manufacturer must be carried out carefully and with precision, as this permanent method does not allow repositioning. The surface on which the modules are installed does not necessarily need to be regular, but if it is not, the modules cannot be walked on. Similar results can be obtained with silicon or polyurethane glue. In this case, Solbian is not responsible for the results, but may be consulted about the adhesive to use.

When using commercial glue, be careful not to create an irregular surface, if the modules are to be walked upon. The glue should be applied uniformly with a thickness not exceeding 2mm.

Before proceeding with a permanent installation using glue or double-sided tape, we recommend that you check the performance of the module by measuring Voc and Isc and comparing with the datasheet.

ATTENTION: The double-sided adhesive backing tape makes a very strong bond with the support material and does not allow repositioning. Trying to remove a module, even if it is only partially attached, can seriously damage the cells.

When using Dual-Lock tape, we recommend using 3M dual-lock MP3560 tape (or similar product, meant for outside use and resistant to higher temperatures) mounted with no more than 8" between each strip of tape to ensure secure attachment.

### INSTALLATION OF MODULES WITH RIBBON CONTACTS ON REAR SIDE

The metal ribbons (wiring strips) on the back of the module are electrical contacts and are therefore live when the module is exposed to light. Although the voltage is low, avoid short-circuiting the contacts which could lead to arcing and overheating.

For this type of installation, we recommend that you have the modules installed by qualified marine technicians, respecting standards IEC 62548 and 62257 and/or ABYC electrical recommendations.

### PROTECTIVE FILM ON FRONT OF MODULE

The modules are shipped with a protective film on the front surface. We recommend that you remove this after the installation has been completed. In any case, the protective film **must be removed before using the module for the first time.**

### ELECTRICAL INSTALLATION

A photovoltaic module behaves like a current generator (such as a battery) and therefore has a positive contact and a negative contact.

Normally, the module cannot supply an electrical device directly, due to the variability of the current which depends on the intensity of the sunlight. It is therefore standard practice to use the module to charge a battery, which then supplies current to the devices.

A battery may only be charged directly by the photovoltaic module if the voltage is exactly right for the chosen battery (e.g. 14V charge voltage for a 12V lead-acid battery). However, this set-up is at risk of overcharging and is inefficient. We therefore recommend the use of electronic charge controllers, which optimize the charging process. Solbian strongly recommends using charge controllers with MPPT (Maximum Power Point Tracking), in order to exploit the maximum amount of energy possible.

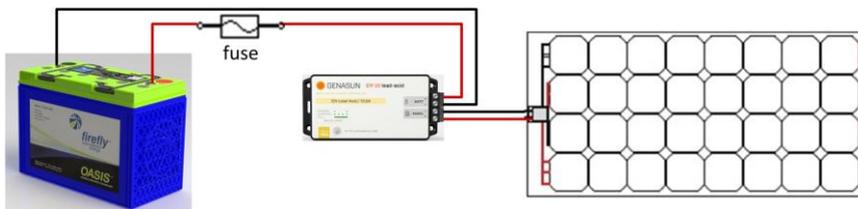
The cables must be of sufficient cross-section to avoid significant voltage-drop. Always use specific cable for photovoltaic installations, resistant to atmospheric agents. The cross-section (wire size) must be chosen taking into account the cable length (distance of run X 2 because it is a loop), 3% Voltage drop, and max current. The following is what is recommended:

Length	Current (Amps)												
	5	10	15	20	25	30	40	50	60	70	80	90	100
10' 3m	18	14	12	10	10	8	6	6	6	6	6	4	4
15' 5m	16	12	10	10	8	8	6	6	4	4	4	2	2
20' 6m	14	10	10	8	6	6	6	4	4	2	2	2	2
25' 8m	12	10	8	6	6	6	4	4	2	2	2	1	1
30' 9m	12	10	8	6	4	4	4	2	2	2	2	1	1
40' 12m	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
50' 15m	10	6	6	4	4	2	2	1	1/0	2/0	3/0	4/0	4/0
60' 18m	10	6	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
70' 21m	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	4/0
80' 24m	8	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0
90' 27m	8	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0
100' 30m	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0
110' 33m	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0
120' 36m	6	4	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0	4/0
130' 40m	6	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0	4/0
140' 43m	6	2	2	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0
150' 46m	6	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0
160' 49m	6	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0
170' 52m	6	2	1	2/0	3/0	3/0	4/0	4/0	4/0	4/0	4/0	4/0	4/0

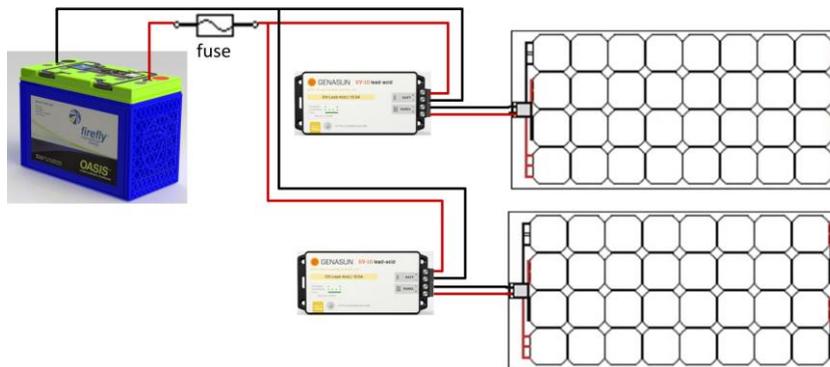
Length	Current (Amps)												
	5	10	15	20	25	30	40	50	60	70	80	90	100
10' 3m	18	18	16	14	12	12	10	10	8	8	8	6	6
15' 5m	18	16	14	12	12	10	10	8	8	6	6	6	6
20' 6m	18	14	12	10	10	10	8	6	6	6	6	4	4
25' 8m	16	12	12	10	10	8	6	6	6	4	4	4	4
30' 9m	16	12	10	10	8	6	6	6	4	4	4	2	2
40' 12m	14	10	10	8	6	6	6	4	4	2	2	2	2
50' 15m	12	10	8	6	6	6	4	4	2	2	2	1	1
60' 18m	12	10	8	6	6	4	4	2	2	1	1	1/0	1/0
70' 21m	12	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
80' 24m	10	8	6	6	4	4	2	2	1	1/0	1/0	2/0	2/0
90' 27m	10	8	6	4	4	2	2	1	1/0	1/0	2/0	2/0	3/0
100' 30m	10	6	6	4	4	2	2	1	1/0	2/0	2/0	3/0	3/0
110' 33m	10	6	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
120' 36m	10	6	4	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
130' 40m	8	6	4	2	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0
140' 43m	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	4/0
150' 46m	8	6	4	2	2	1	1/0	2/0	3/0	3/0	4/0	4/0	4/0
160' 49m	8	6	4	2	2	1	1/0	2/0	3/0	4/0	4/0	4/0	4/0
170' 52m	8	6	2	2	1	1	2/0	3/0	3/0	4/0	4/0	4/0	4/0

## EXAMPLES OF INSTALLATIONS

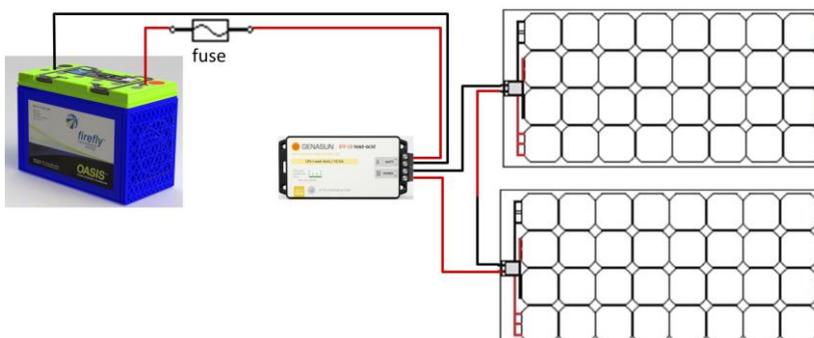
- a) One single module with a charge controller, battery and load. The load can be supplied directly by the controller (when the model of controller allows) or by the battery. In this arrangement, the controller needs to be able to handle the full rated current and voltage of the panel. The cable to the battery needs to be able to handle the maximum current of the controller. The fuse needs to be sized for 1.5 X the max current of the controller.



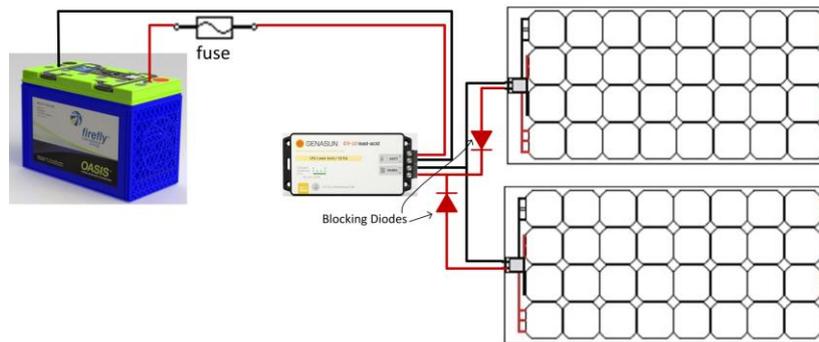
- b) With several modules, the best solution is to connect each one independently to a separate controller. The controllers can then be connected in parallel to the battery, as they are protected against reverse current. Each controller should be sized for the individual panel ratings. When the controllers are connected in parallel, the total current to the battery is the sum of each controller's max current. The size of the cable to the battery must be calculated by adding together the max currents of each controller and the fuse must be sized 50% higher than that.



- c) Multiple modules may be connected in series to a single controller. Only modules with the same current (i.e. same cell type) can be connected in series. The controller needs to be sized for the total of all panel voltages and the current rating of an individual panel. The cabling to the battery needs to be able to handle the rated current of the controller and the fuse should be sized for 1.5 X the max current of the controller. This arrangement should only be used when shading or partial shading is NOT an issue. If any portion of either panel is shaded, it will affect the performance of the entire array.

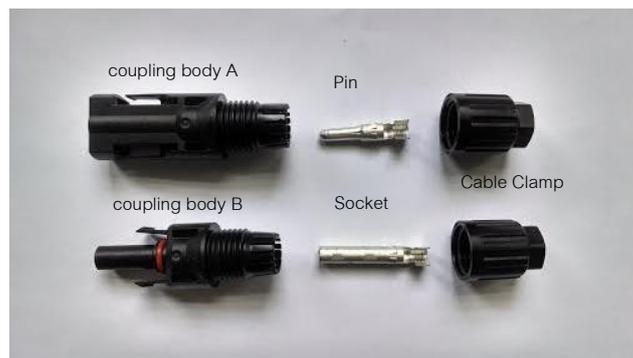


- d) Multiple panels can be wired in parallel to a single controller. This should be done when shading is anticipated and where installing one controller per panel is not possible. Only panels of the same voltage may be wired in parallel. In order to avoid wasted energy, overheating and even fires, **it is essential to use blocking diodes with parallel connections (see circuit diagram)**. Expect .7 V drop across the diodes. In this case, the controller should be sized for the voltage of the panel and the max current of all panels combined. The cabling should be sized for the max current of the controller and the fuse should be rated for 1.5 X the max current of the controller.



The choice of charge controller depends on the configuration of the installation, the type of modules and the battery. If you purchase your charge controller together with SolbianFlex modules, you will receive the necessary assistance in choosing. In any case, Solbian will not be held responsible for damage or malfunctioning caused by incorrect use of charge controller, whether purchased from Solbian or not. Make sure that you read the controller's instructions very carefully.

#### ASSEMBLY OF MC4 CONNECTORS



Note: The couplings supplied on Solbian solar panels are high quality industry standard MC 4 connectors. See above photo to properly match up the aluminium fitting with the appropriate coupling body. When making your connections, make sure that the positive side of the panel is connected to the positive side of the controller. (You will be installing the "opposite" coupling body to the positive cable on the controller side than is attached to the positive cable on the panel). In order to confirm the + and – cables from the panel, use a voltmeter. If the voltage reads positive, then the red side of your voltmeter is on the positive cable. If your voltmeter reads negative, then the red side of your voltmeter is on the negative cable.

1. Unscrew cable clamp from Coupling body. Inside the “teeth” on the cable side of the coupling body you should see a black rubber gland. In most cases this will be set into the teeth when you receive it. If it is separate, as shown below, set it into the coupling body inside the teeth.



2. Strip end of cable approx. ¼” and mate it with the winged end of the pin or socket. Squeeze wings of Pin or Socket down to restrain wire, then solder.
3. Slide Cable Clamp over cable then push Pin or Socket into respective Coupling until it clicks into place. Pull on wire to confirm correct engagement.
4. Tighten Cable Clamp on to Connector body.

## MAINTENANCE OF THE PHOTOVOLTAIC SYSTEM

Due to the absence of moving parts, the required maintenance is minimal. The following instructions are important:

Keep the modules clean. Ensure there is nothing on the panel that could cause any shading on any of the cells as this can cause loss of output and excess heat that can damage the panel if extreme. Wash with fresh water, especially in a marine environment, to avoid damage caused by saltwater. The surface of the modules may be cleaned using neutral soap and water, wiping carefully and without using abrasive material. Denatured alcohol (methylated spirit) can be used to remove grease etc. When panel is clean and dry, apply a coating of a plastic protectant such as “Plexus” or Novus plastic cleaner #1- available at your marine chandlery or online. If contaminants build up or oxidation occurs over time, it may be necessary to polish the panel. The recommended polisher is Novus brand polish, #2 (Fine scratch remover). It is recommended that you hand polish the panels as a power polisher could burn the surface with too much friction. Follow the instructions on the product label.

Check the structural integrity of the installation and the electrical connections periodically.

Check the efficiency of the system using the monitoring functions in the charge regulators (LEDs or displays).

## POSSIBLE FAILURE MODES

Fractured cells- Fracturing can be caused by excessive bending of the module during installation or use, or by impact or mechanical stress. Fractured photovoltaic cells do not normally cause a total loss of performance in a module, but more usually a drop in efficiency. A module with fractured or malfunctioning cells can be detected by measuring the current using a 10A ammeter. In full sunlight, the current should be the same order of magnitude as the **I<sub>sc</sub>** of the module (see datasheet), e.g. above 5A for the SP series modules. The voltage is barely affected by cell fracture.

Water inside the junction box- Although the junction boxes are waterproof, infiltrations are possible due to manufacturing defects or impact. If this occurs, remove the cover of the junction box and proceed to dry the inside.

Defects with the charge controller- Charge controllers, like all electronic devices, can fail. The display, if there is one, may indicate failure. In any case, the first step is to check the state of the electrical connections between modules, controllers and batteries.

#### **EXCERPT FROM WARRANTY TERMS**

SolbianFlex modules are covered by a warranty for manufacturing defects and performance. Here are some of the warranty conditions. The text of the full warranty (the sole applicable warranty) is available on request and is published on the website [www.solbian.eu](http://www.solbian.eu)

#### **TWO YEAR WARRANTY ON PRODUCT INTEGRITY**

SolbianFlex serie SP, SX, CP and CUSTOM modules are guaranteed for two years from date of purchase. If they fail to perform correctly during 24 months from the date of purchase, Solbian undertakes to repair or replace them at its discretion, or to offer a refund. Repair, replacement or refund are the sole conditions offered by the warranty and cannot be extended beyond 24 months.

#### **5 YEAR PERFORMANCE WARRANTY**

The performance of SolbianFlex photovoltaic modules is measured under standard conditions at the end of the production line. The power, expressed in W, reduces gradually over time, due to various factors, such as the cell encapsulation material becoming more opaque, deterioration of the electrical contacts etc.

Solbian guarantees that, if the modules are used in the appropriate manner, the power will not fall below 90% of the declared value within 5 years from purchase. If the customer has proof of a greater fall in power than warranted, the application of this clause can be requested. Solbian will, at its discretion, repair or replace the module, or may replace the lost generating power with similar new modules, or reimburse the lost generating power beyond the 90% limit, at market price for similar modules. Repair, replacement, or reimbursement are the sole conditions offered by the warranty and cannot be extended beyond 60 months.

#### **RECYCLING AND DISPOSAL**

Solbian is part of the European consortium PV-CYCLE, for the recycling of damaged or end-of-life modules, available in many European countries. SolbianFlex photovoltaic modules are electrical apparatus and must be disposed of accordingly, according to the laws of the country. In case of disposal requirements, please contact our sales department.