



# HF PHOTOVOLTAIC MODULES

Instruction Manual

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## INTRODUCTION

This manual provides an overview of Enecom HF photovoltaic modules and their use. It covers the following Enecom modules:

Module Code	Description
HF20-5-16	Flexible m-si module: 620 mm × 292 mm
HFp20-5-16	Pliable flexible m-Si module: 320 mm × 280 mm (closed)
HF40-5-16	Flexible m-Si module: 604 mm × 536 mm
HFp40-5-16	Pliable flexible m-Si module: 560 mm × 280 mm (closed)
HF <sub>s</sub> 40-5-16	Flexible m-Si module: 1120 mm × 282 mm
HF65-6-16	Flexible m-Si module: 728 mm × 660 mm
HF <sub>s</sub> 65-6-16	Flexible m-Si module: 1370 mm × 344 mm
HF80-5-16	Flexible m-Si module: 1104 mm × 536 mm
HF90-5-18	Flexible m-Si module: 1230 mm × 536 mm
HF135-6-16	Flexible m-Si module: 1350 mm × 660 mm
HFpy120-6-16	Flexible p-Si module: 1350 mm × 660 mm
HFsp 90-5-16	Flexible m-Si module: 970mm × 536 mm
HFsp120-5-21	Flexible m-Si module: 1250mm × 536 mm

This manual also applies to modules which have been custom designed to the customer's specifications.

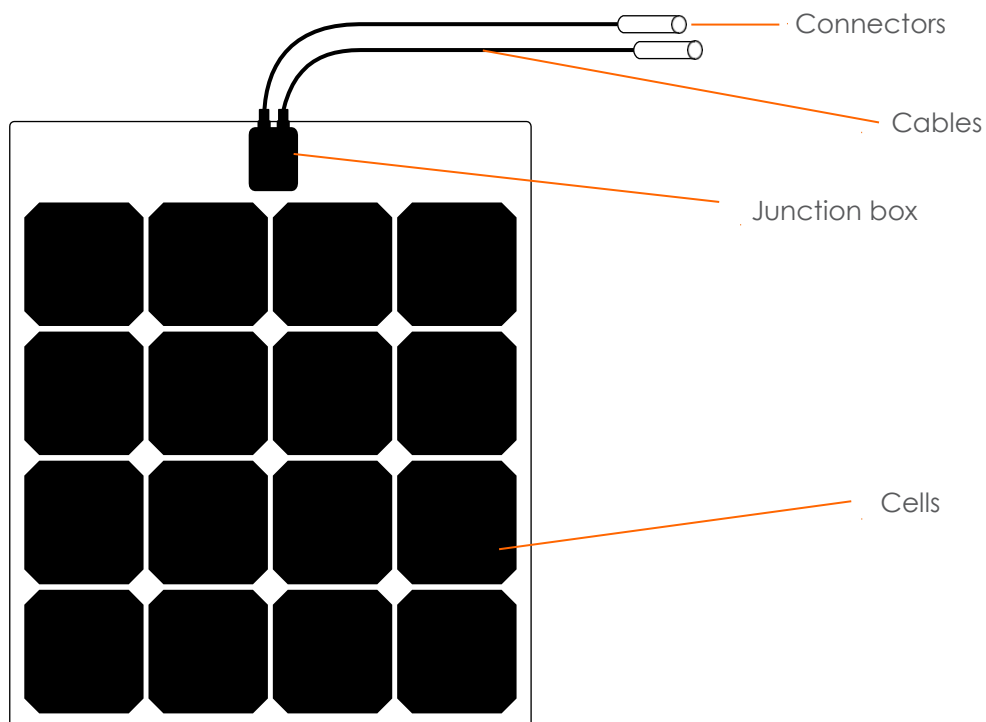
# THE HF PHOTOVOLTAIC MODULE

## 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 is the number of silicon cells in the photovoltaic module, the more electrical energy is produced.

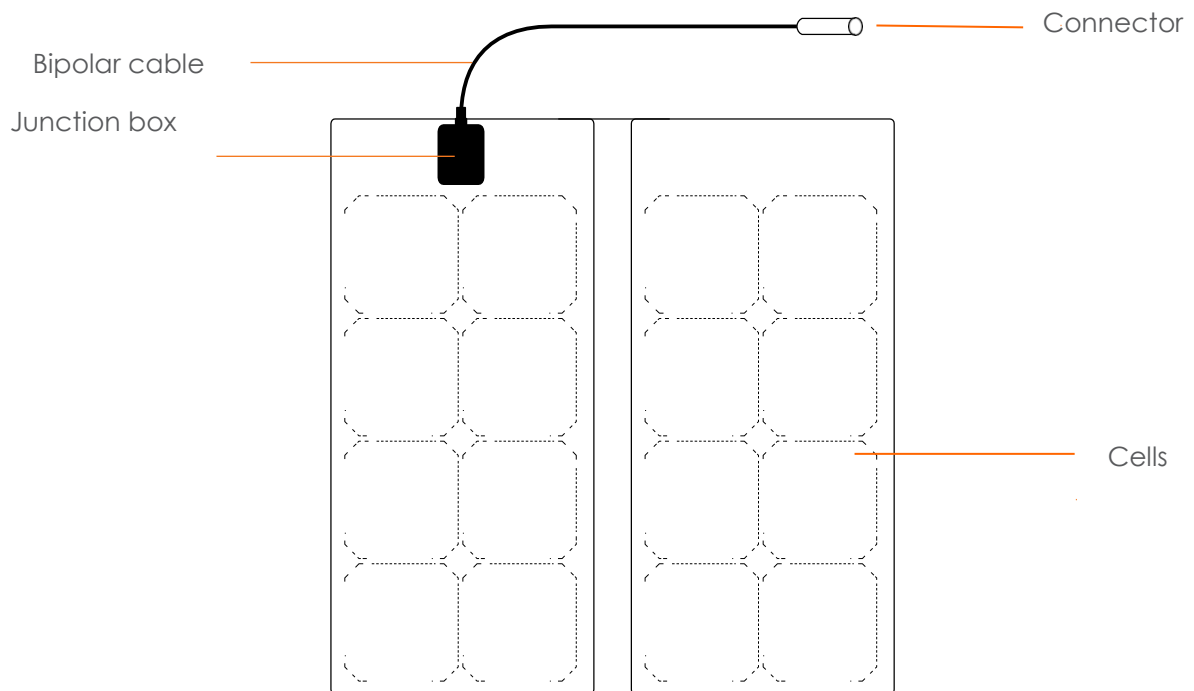
## The front surface of the photovoltaic module

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



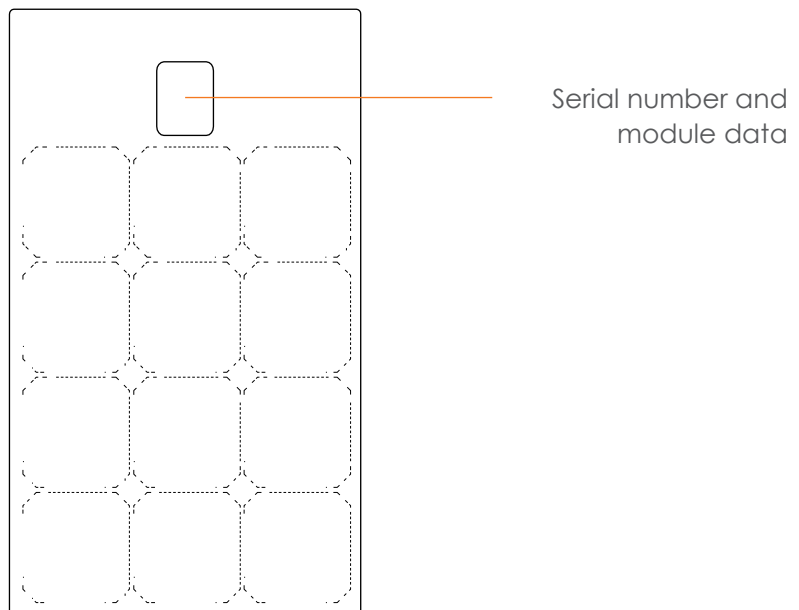
The junction box, at the request of the customer, can be placed on the back surface.

## Back surface of the photovoltaic module



In HFp modules the junction box is positioned on the back surface.

In HF and HFp modules the back surface of the module has no components; it provides only the identification label bearing the serial number of the module and the electrical data plate (unless the junction box has been positioned on the back surface, in which case the junction box will also be present).







## Identification

Every Enecom module is identified by a label on the back surface with the following information.



ENECOM s.r.l. gruppo EN-ECO S.p.A.  
Via Emilia, 6 10099 San Mauro Torinese (TO) - ITALY

MODULE TYPE:	1)	
Serial Number	2)	
Data produzione	3)	gg/mm/aa
Maximum power (Pmax)	4)	Wp
Open circuit voltage (Vca)	5)	V
Short circuit current (Isc)	6)	A
Voltage at max power (Vmp)	7)	V
Current at max power (Imp)	8)	A
Maximum system voltage	9)	V
10) Nominal power misured at standard test condition (STC): I = 1000 W/m <sup>2</sup> Tamb = 25°C AM = 1.5		
    <p>Tested in according to EN IEC 61215 and EN IEC 61730</p>		

1. Panel type
2. Serial number of the module, year and place of production (SMT = San Mauro Torinese, MM = Montemurlo)
3. Date of production
4. Maximum power
5. Open circuit voltage
6. Short circuit current
7. Voltage at maximum power
8. Current at maximum power
9. Maximum system voltage
10. Nominal power measured at Standard Test Conditions (STC)



Do not remove or tamper with the label.

## Technical specifications

### Technical specifications of the HF line

	HF20-5-16	HF40-6-16	HF80-5-16	HF90-5-18	HF65-6-16	HF 135-6-16
Max power Pmax(Wp) ± 3%	20	40	80	90	65	135
Open circuit voltage Voc (V)	19,63	19,63	19,63	22,42	20,2	20,2
Short circuit current Isc (A)	1,40	2,80	5,61	5,61	4,36	8,61
Voltage at Pmax Vmp (V)	16,23	16,23	16,23	18,54	16,4	16,4
Current at Pmax Imp (A)	1,33	2,65	5,31	5,15	4,07	8,14
Number of cells	32	32	32	36	32	32
Size (w x h) in mm	620 x 292	604 x 536	1104 x 536	1230 x 536	660x728	1351 x 660
Thickness in mm	1,8-2 mm					
Weight (kg)	0,5	0,8	1,3	1,5	1,3	2,2
Cell efficiency	18,6%				18,6%	
Output terminals	MC4 connectors					
Maximum system voltage	600 V					

### Technical specifications of the HFfs-HFsp-HFpy line

	HFfs40-5-16	HFfs65-5-16	HFsp90-5-16	HFsp120-5-21	HFpy120-6-16
Maximum power Pmax(Wp)	40	65	90	120	120
Open circuit voltage Voc (V)	19,63	20,2	19,9	25,66	19,68
Short circuit current Isc (A)	2,80	4,36	6,01	6,01	8,56
Voltage at Pmax Vmp (V)	16,23	16,4	17,1	22,1	16,3
Current at Pmax Imp (A)	2,65	4,07	5,65	5,65	8,05
Number of cells	32	32	28	36	32
Size (w x h) in mm	1120 x 282	1370 x 344	977x536	1230x536	1350x660
Thickness in mm	1,8-2 mm				
Weight (kg)	0,8	1,2	1,5	1,8	2,2
Cell efficiency	18,6%	18,6%	22,3 %	22,3%	17,8%
Output terminals	MC4 connectors				
Maximum system voltage	600 V				



### Technical specifications of the HFp line

	HFp20-5-16	HFp40-6-16
Maximum power $P_{max}(W_p) \pm 3\%$	20	40
Open circuit voltage $V_{oc}$ (V)	19,63	19,63
Short circuit current $I_{sc}$ (A)	1,40	2,80
Voltage at $P_{max}$ $V_{mp}$ (V)	16,23	16,23
Current at $P_{max}$ $I_{mp}$ (A)	1,33	2,65
Number of cells	32	32
Size (w x h) in mm	320 x 280 (closed)	560 x 280 (closed)
Thickness in mm	1,8-2 mm	
Weight (kg)	0,6	0,9
Cell efficiency	18,6%	
Output terminals	Cigarette lighter style socket / MC4 connectors	
Maximum system voltage	600V	

### Technical specifications of the wired junction box

Junction Box Size	82 x 64 x 13 mm
Diode	one-two bypass diodes
$I_F$	12 A
$V_{DC}$	45V
Temperature range	-40 ÷ 80 °C
Protection class	IP67

### Technical characteristics of the connectors

	HF20-5-16 HFp20-5-16 HFp40-5-16	HF40-5-16 HF40-5-16 HF65-6-16 HF80-5-16 HF90-5-18 HF130-6-16 HF20-5-16 HFp20-5-16 HFp40-5-16
Connector type	Standard cigarette lighter style socket	Standard MC4
Protection class	IP22	IP67

## 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. Please use caution.
- 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. The minimum suggested curvature radius is 1 meter, if lesser curvature radius is needed contact the technical support that will provide you a response about the feasibility of the installation.
- 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 walk on the module.
- 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. 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.

## Orientation

In general the best energy performance of the module can be approximately obtained by installing the device:

- facing south;
- at an inclination equal to the latitude from the horizontal.

Installing the module at non-optimal inclination and orientation lead to reduce the module's power output.

## Mounting

The photovoltaic module can be mounted in the following ways:

- mechanically with eyelets
- bonding it using double sided adhesive

### Mounting the panel by means of eyelets

Mounting by means of eyelets is performed using screw or bushing that leave space between the eyelet and the screw or spacer used for the installation.

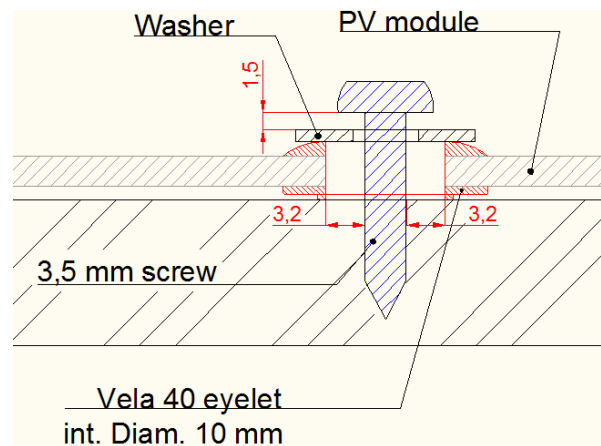
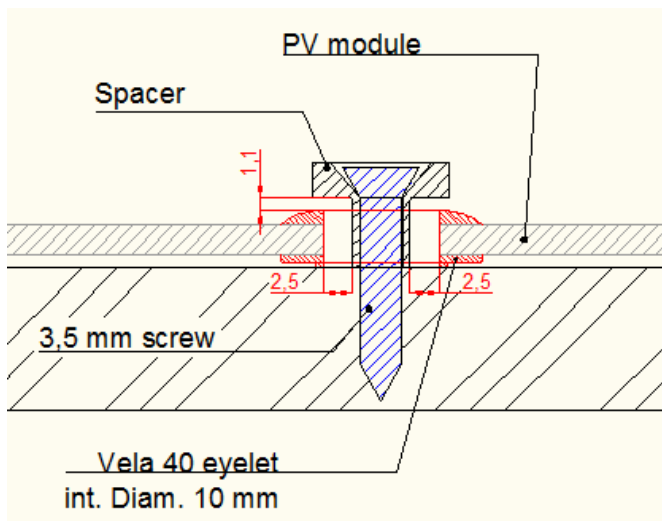
The space allows thermal dilation between the module and the fixing system and for a correct installation this space has to be at least:

- 1 mm from the top of the eyelet and the fixing system.
- 2 mm from the internal diameter of the eyelet and the screw



Block the module without leave space for thermal dilation void the guarantee

See below an example of a mechanical fixing system using a washer or a spacer and a screw:



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

Eyebrow fixing is also suitable for support on non-rigid surfaces (awnings, camper verandas, camping tents, etc.) using elastic or corded joints for example.

## Bonding the panel using double sided adhesive

Bonding using double sided adhesive is indicated when the material of the module and that of the surface, on which the panel has to be fixed, have similar thermal expansion coefficients.

Enecom can provide the module with already attached to the back double sided adhesive stripes or send to you the quantity you need for the installation.

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
- do not subject the cells of the module to localized pressure during mounting: this can cause serious damage to the solar cells

Fastening with double-sided adhesive makes it difficult to remove the module from the surface on which it is glued without damaging it due to the high adhesion strength that is created between the surfaces. It is therefore advisable to use this installation method if you do not want to move the module later and if the installation is final while you are advised to fasten with dual lock when you need to move the module after installation.

## Other installation option

If it is not possible to fix the module as in the two previously-mentioned cases, please contact Enecom Technical Support who will provide you support giving instructions on how to proceed with the installation.



Install the panel in a different way than the two described without contacting the technical office and having its permission void the warranty

## Electrical connections

### Connecting several modules together



This option is not applicable to modules HF20-5-16, HFp20-5-16, HFp40-5-16 with cigarette lighter style socket

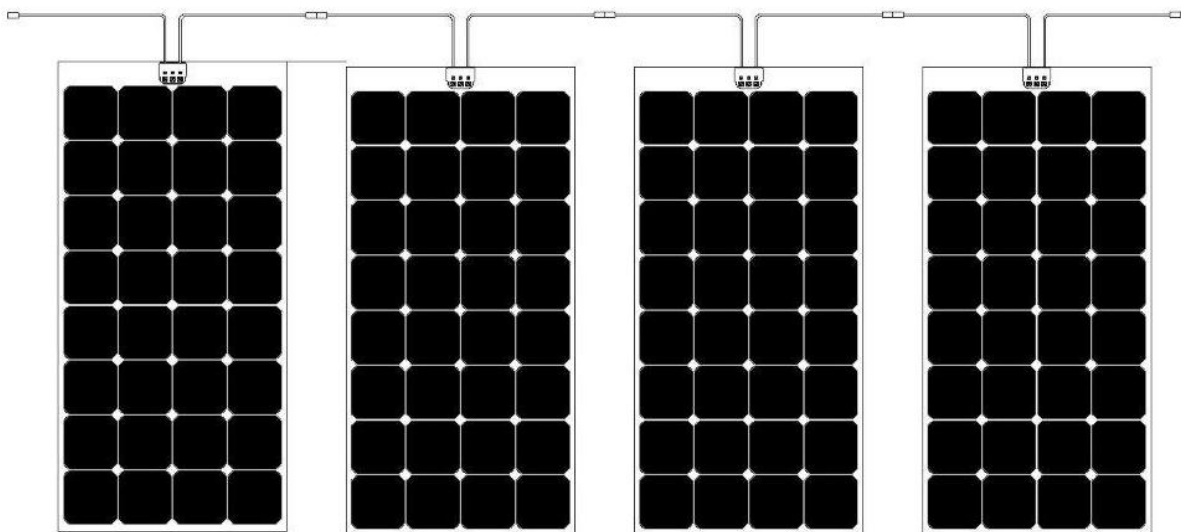
Several PV modules can be connected to each other in the following ways:

- 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.

$\Sigma$  VOLTAGE  
= CURRENT



Modules of the same type can be always connected in series. The connection in series between different types of modules can be done only after Enecom technician's authorization.



Warning! Wrong connections between the modules void the guarantee.

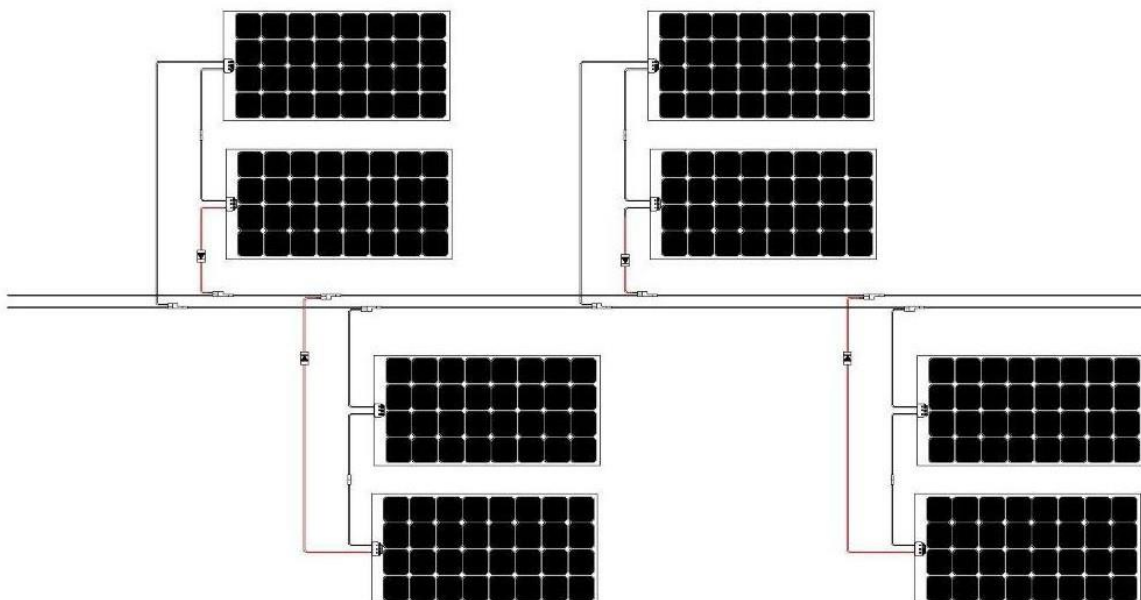


Warning! This type of connection is indicated when all modules are exposed to the sun in the same way. We suggest that the installation of more than two modules should be performed by a qualified technician.

### 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.

**VOLTAGE =**  
**Σ CURRENT**



Warning! All the modules connected in parallel must be identical. It is also necessary to protect the panels by using blocking diodes placed on the positive cable of each panel group.

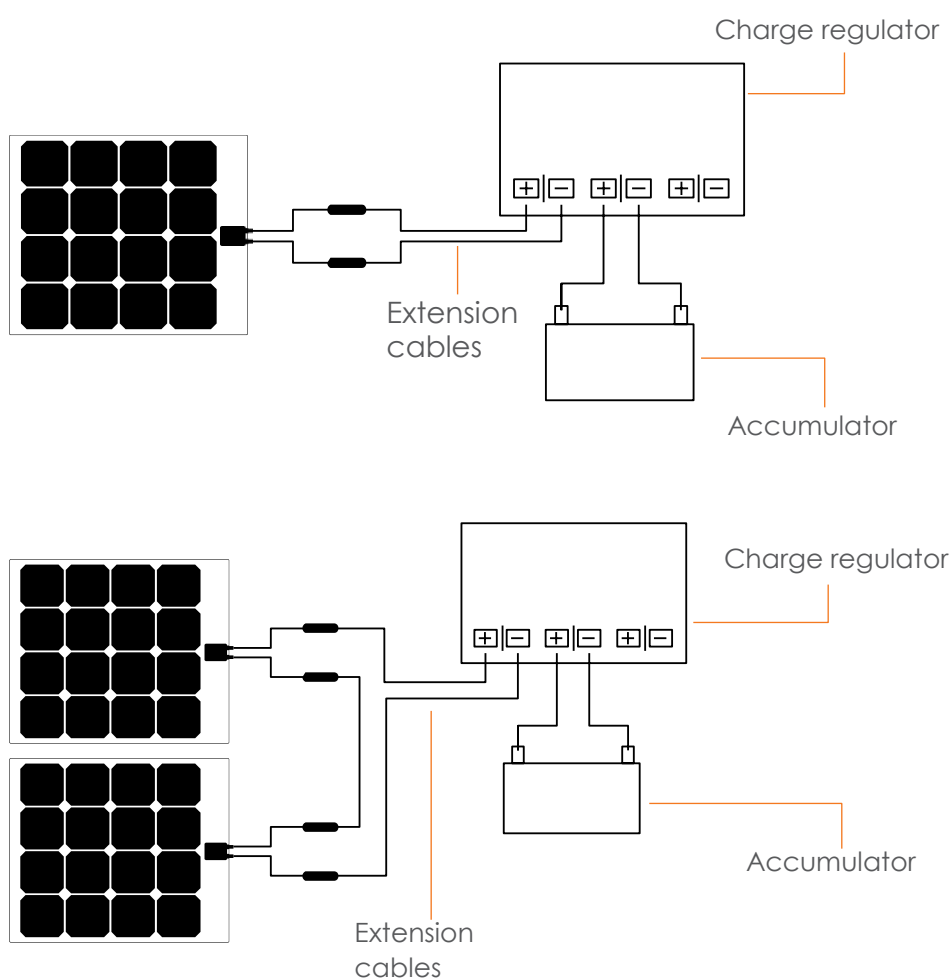
## Connecting to an accumulator (battery)

**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.

The charge controller must be chosen according to the instruction of its user manual; if the compatibility is not certain contact Enecom's technical office. Any erroneous connections to the solar charger will cause the void of the guarantee and may be a source of malfunction of the system.

See below some example of connection to an accumulator.



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

Modules HF20-5-16, HFp20-5-16 and HFp40-5-16 are suitable for this type of connection by means of an automobile transformer specific to its device. The transformer is equipped with a cigarette lighter style plug which is inserted into the module's socket.



### 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 or isopropyl alcohol using 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 solar panels and the 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.

## WARRANTY

The warranty against defects in material and workmanship and the warranty of proper functioning of the product are given in the document "Enecom Warranty" provided together with this manual.

## CONTACTS

### Headquarters

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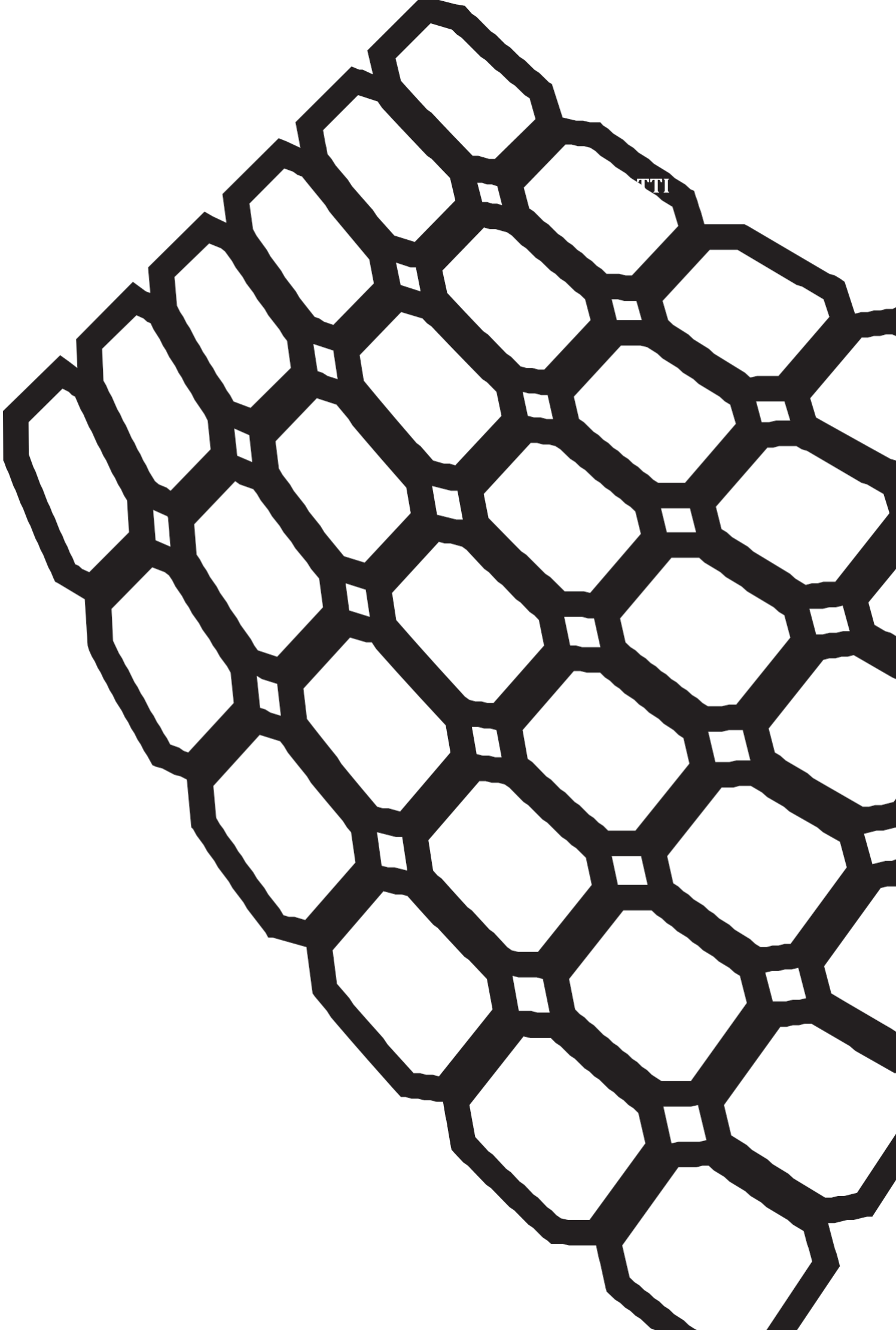
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