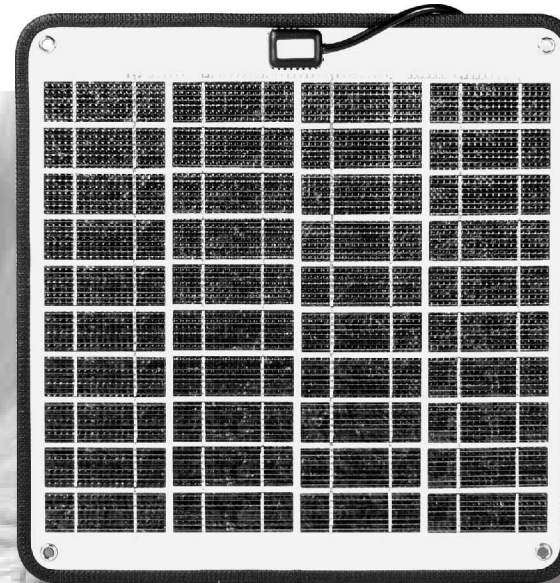


MARITIME SOLAR SYSTEMS



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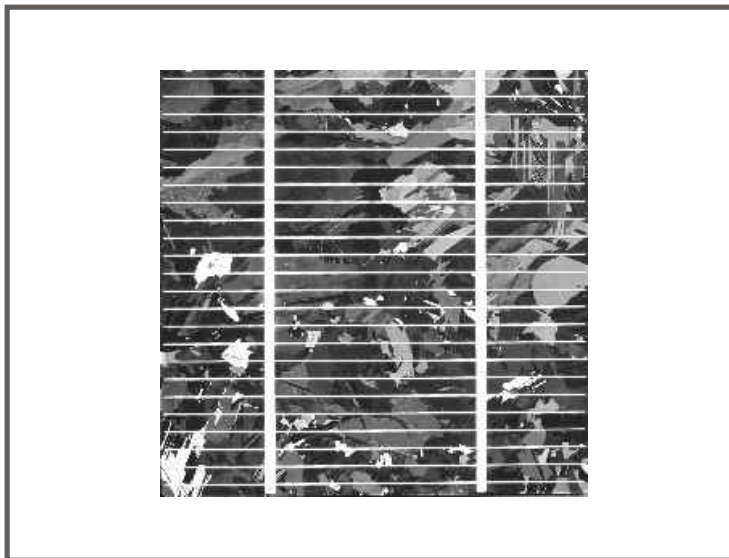
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Use of solar systems

For many years now solar modules have proven themselves in permanent use. Solar modules convert sunlight directly into electricity. The absorption of light in the solar cells builds up electric voltage (volts).

Photo of a crystalline solar cell



As solar cells do not store any electricity, the energy gained is fed through a charge regulator to the battery (lead/acid or gel battery) and stored there. That means, you can only take as much electricity from the battery as the solar energy system supplies.

Each of the many small electrical appliances on board consumes only a little bit of electricity. However, all together they are very taxing on the batteries. If the expensive batteries are to have a long service life, they should not be discharged completely. Early recharging is therefore necessary. A small solar energy system solves this problem in the simplest way!

Solar energy systems are ideal for use on sailing and motor boats. Even the use of small solar modules guarantees enough energy supply for the board electronics, which means that you are fully independent of the land mains supply!



Choose from our standard range for this, e.g. the SW 18/1 or the SW 25/1, which are easy to fit on the sliding hatch.

It is no longer necessary to run the ship's motor for hours to charge the battery. The solar energy system accomplishes that task reliably, quietly, without odour and without any activity on your part.

During the week the installed solar energy system can charge the battery completely so that you can comfortably use the electrical appliances on board at the week-end.

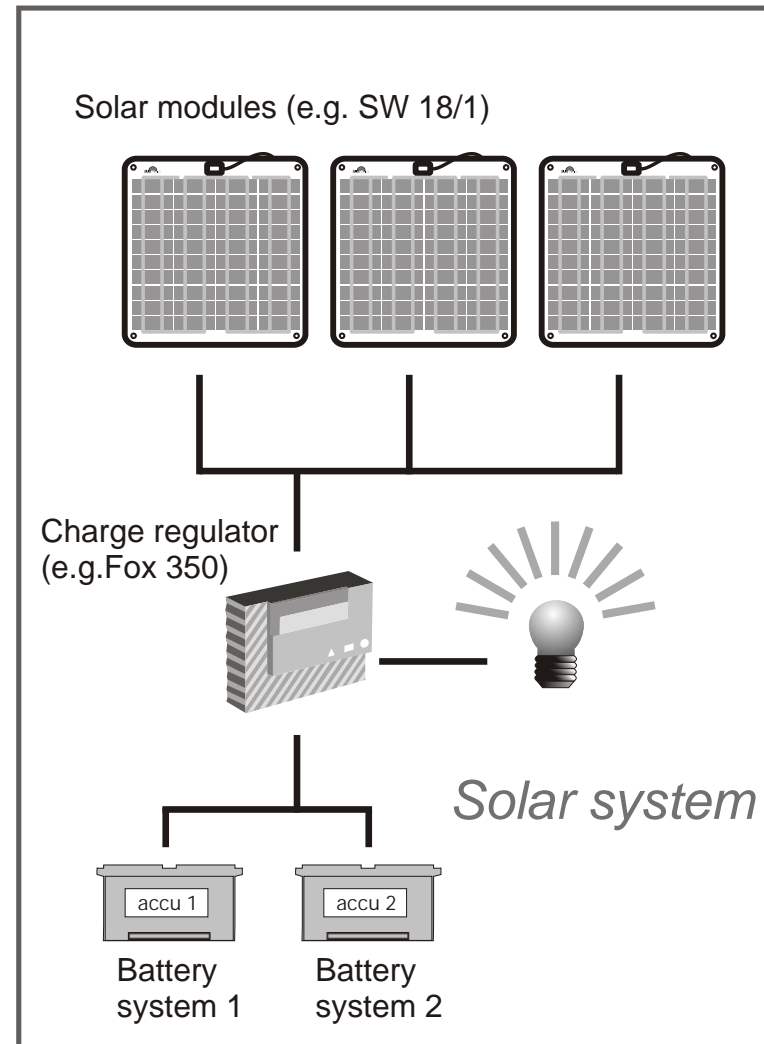
Use of solar systems

If more energy is needed during the time on board, additional modules can be connected, e.g. through plug-and-socket connections, and together with the solar modules already installed jointly charge the battery. This supplies all the electricity consumed by the radio and navigation system, automatic control system, laptop, light and even the fridge. Comfort as you've never experienced it before!

It is necessary to fit a solar-charge regulator in order to protect the battery both from overloading and also from excessive discharging. The charge regulator is connected in series between the solar module and the battery and monitors the battery's charging and discharging. If the battery is excessively discharged, the charge regulator, e.g. FOX 200, turns off the connected consumer, e.g. the radio, and in doing so extends the service life of the battery many times over.

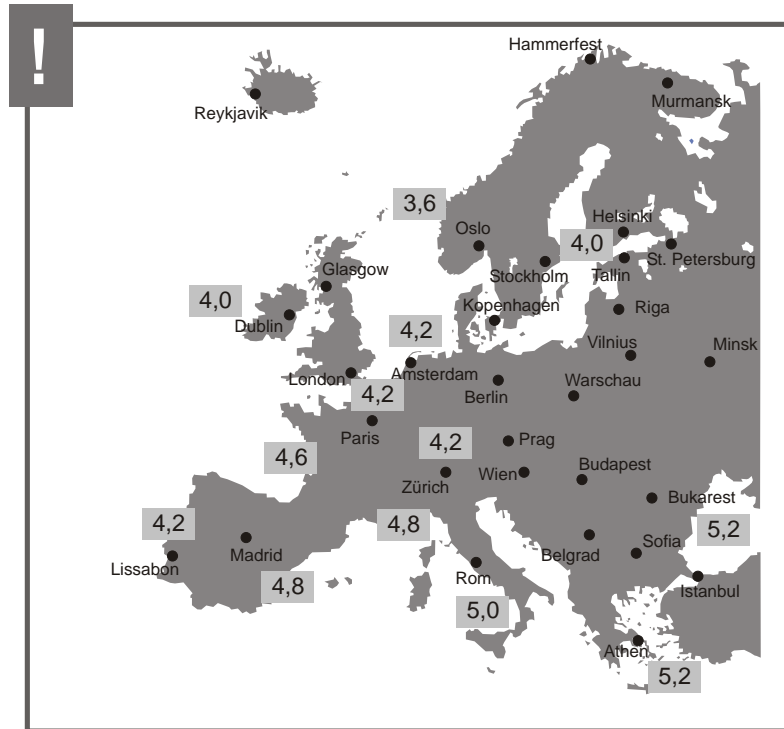
! Our comfort charge regulators, available in 12-volts and to some extent in 24-volts versions, can perform many other functions in addition. The FOX 350 charge regulator e.g. can charge two battery systems. A display shows the voltage of both systems and also the values of the consumer electricity.

As in the case with solar modules, using a charge regulator allows you to lie back and enjoy the peace of the bay while the sun recharges your battery!



Use of solar systems

The solar radiation conditions are decisive for the solar modules' energy efficiency. The sketch below will give you an impression of the regional distribution of the average radiation.

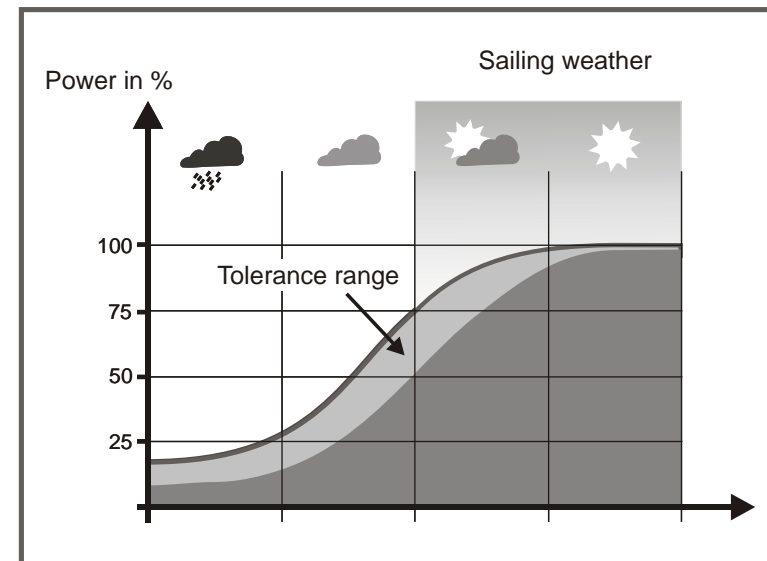


The numbers given correspond to the average sun hours over the period April - September.

To calculate the solar energy system's expected daily yield, the performance of the installed solar module is multiplied by the number of hours of sunshine in the respective region. For example, the following calculation applies to Barcelona: $1 \times 50 \text{ watts} \times 4.5 \text{ hours of sun} = 225 \text{ Wh/day}$

The values given are based on many years of measurements and represent the average yield, i.e. the values also take account of the average number of rainy days.

The following diagram illustrates the difference between the energy yield on a clear day and on a cloudy day:



Advantages

Absolute resistance to sea and salt water

SunWare solar modules were developed specially for marine applications in sea and salt water.

Thanks to the use of high-quality materials, which have been subjected to numerous stress tests, the modules are sturdy, durable and absolutely weatherproof.

The carrier plates and the fixing eyelets used are made of the best seawater-proof and acid-resistant V4A stainless steel (1.4571).

The cable outlet is totally potted and screwed tightly to the solar module. This rules out cable oxidation and the penetration of moisture into the module in applications in sea and salt water.

The cables attached to the modules are also made of weatherproof material which, as opposed to the conventional PVC-coated cables, does not become brittle when exposed e.g. to strong solar radiation, wind and water.

Reliability

SunWare solar modules are extremely efficient, function with absolute reliability and are maintenance-free.

Under the permanent quality control system, all SunWare solar modules are tested and measured individually before shipment.

SunWare gives 3 years' performance guarantee on all types of SunWare modules, above all in sea and salt water applications.



Flexibility and claim

Our range of services in the solar module area includes special custom-made models in addition to the production of the standard modules.

Individual customer requirements are met flexibly and reliably with the aid of our experienced Planning Team. Competence and specialised expertise are the distinguishing features of SunWare, from drawing up a cost estimate free of charge to the final production and including consultation etc.

Safety

In full-surface mounting, the SunWare solar modules can be walked on. The structured, Teflon-coated surface reduces the risk of slipping in wet conditions.

The edge-protection profile provided as standard prevents scratches or damage on the boat e.g. if portable solar modules are used. A risk of injury due to sharp edges is ruled out.

Assembly

SunWare solar modules offer numerous possibilities for extremely simple assembly.

The modules can be flexibly attached to all available eyelets with hooks, screws or rope ends.

In the case of portable use, care must be taken that the module is always attached securely to all eyelets. If only some of the available eyelets are used, the module will not be sufficiently stable!

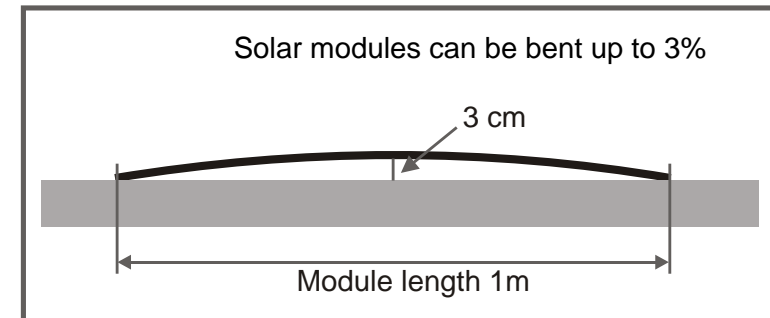
They can also be stuck over the entire surface without space-reducing rear ventilation. The 40-cell solar modules specially developed for this purpose are particularly suitable for these kind of assembly.

In contrast to the standard modules with 36 cells, the 4 additional cells completely absorb the voltage drop, caused by increased cell temperature during intensive solar radiation, and also guarantees absolute top performance during great heat in southern countries also.

SunWare solar modules can be bent up to 3% (= 3 cm to 1 m module length) and accordingly, when assembled on the deck, they can adapt ideally to the deck's curvature



The standard equipment with an extremely weatherproof cable of 3 m length offers flexible connection possibilities, e.g. under deck. An appropriate cable cross-section ensures sufficient energy exploitation for this cable length also, thereby preventing the drop in voltage which occurs with thinner cables.



Module equipment - Cell types

Only crystalline solar cells are used for SunWare solar modules.

The standard size of the solar cell is 100 x 100 mm, with a typical thickness of 0.32 mm. To produce smaller module sizes, the cells are cut, e.g. to 1/3, 1/2, 2/3 of the standard size. There is no change in the voltage in cut cells. However, the electricity produced by the solar cell depends on the size of the cell surface.

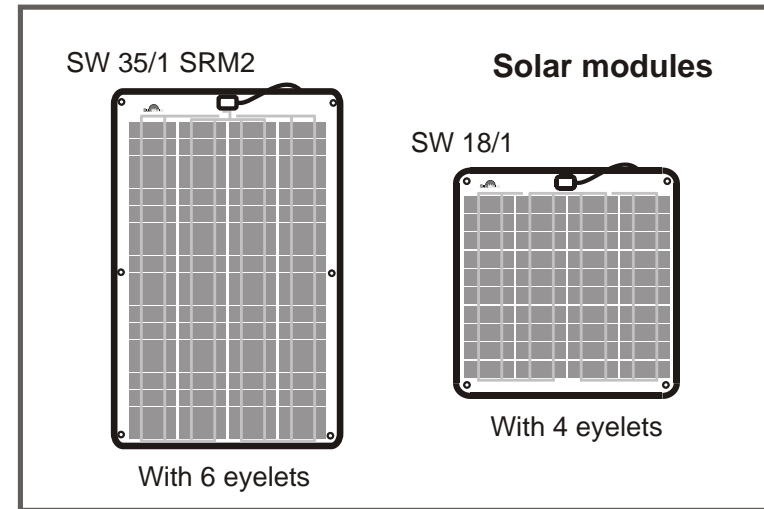
The maximum power of the solar cell in the standard format (100 x 100 mm) is 1.35 watts.

At this point of operation the cell supplies a voltage of 0.46 V and an electric current of 2.94 A.

Module equipment

Standard equipment of the SunWare solar modules without surcharge:

- cable outlet resistant to sea and saltwater
- 3-m connection cable
- all-round edge protection
- between 4 and 8 fixing eyelets depending on the type of module



Shipment

The modules are packed individually ready for shipment. The outside of the shipment box is marked with easily legible article number, module type, module designation and series number. The packaging is ideal for direct re-shipment, e.g. through the intermediary trade.

SunWare guarantees short delivery periods:
Due to export business payment in advance would be appreciated. Delivery immediately after receipt of payment.



SRM2 series


SunWare's SRM 2 series solves a frequent and well-known problem: power loss when parts of the solar module are in a shade.

For example, the sailing mast always casts a long shadow over the sailing boat. If this shadow falls on individual areas of the solar modules, the incidence of light on the solar cells is considerably reduced. Less light is absorbed and therefore less electricity generated. The modules output much less power.

Due to the interconnection of the solar cells in series, the solar modules' efficiency is therefore reduced to the value which it supplies at the weakest illuminated solar cell. If the battery is no longer sufficiently charged, temporary power shortages may occur.

This problem can be elegantly avoided with the SRM2-Solar modules (= **S**hadow **R**esistant **M**odules with **2** islands).

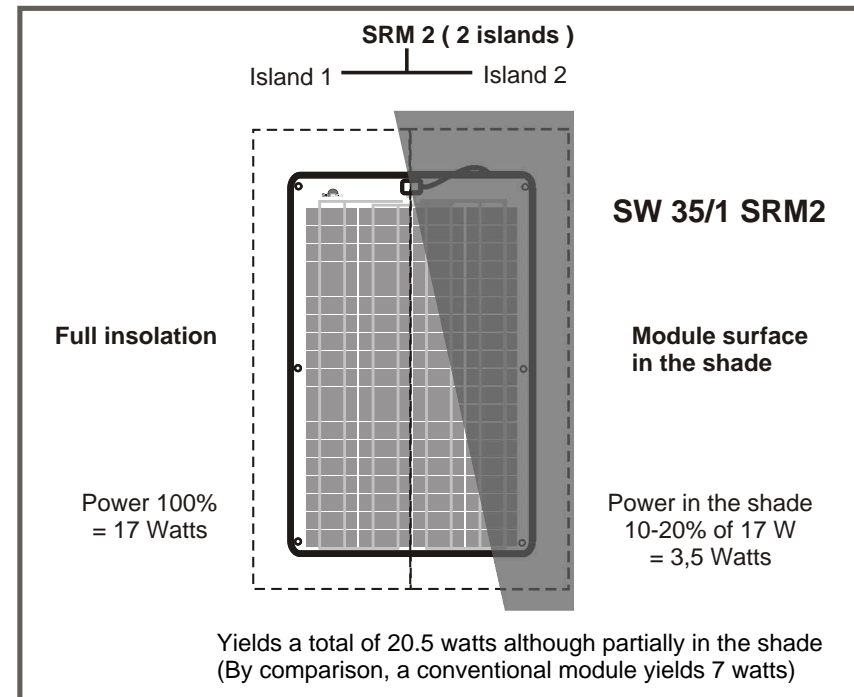
The cells are grouped in 2 islands which function in total isolation from each other and are wired separately. Therefore, if part of these solar modules are in the shade, the other area continues to deliver its usual power.

In this way the SRM 2 solar modules guarantee a constant supply to the electronic appliances and the battery on board, even when partially in the shade. 

The solar modules available as SRM 2 modules are

SW 35/1 SRM 2 (34 Watts)

SW 54/1 SRM 2 (52 Watts)



40-cell solar modules

40-cell solar modules

Depending on the strength and degree of the direct exposure to the sun's rays, the cells of a solar module can heat up very intensively.

If the solar module is installed without rear ventilation spacing, the development of heat can cause a drop in voltage so that the battery can no longer be charged completely. A lower energy yield must be expected then.



40-cell solar modules on the other hand offer the clear advantage that they can be stuck firmly all over the base. The 4 additional cells absorb the voltage drop which occurs with 36-cell solar modules. The charging current of the solar module is not influenced by the build-up of heat in the solar cells then.

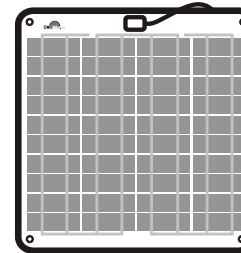
Advantages for you: you can dispense entirely with any space-consuming rear ventilation and e.g. if you assemble on deck you can walk over the solar module with boat shoes.

We have included the following 40-cell solar modules in our standard range:

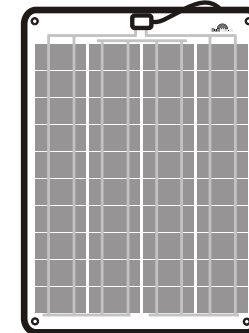
- SW 18/1 (18 Watts)
- SW 27/1 (27 Watts)
- SW 35/1 (36 Watts)
- SW 54/1 (54 Watts)

40 cell solar modules

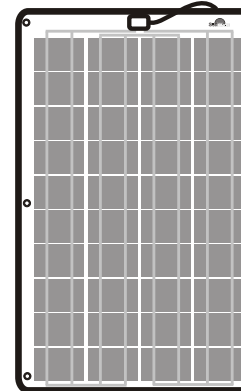
SW 18/1



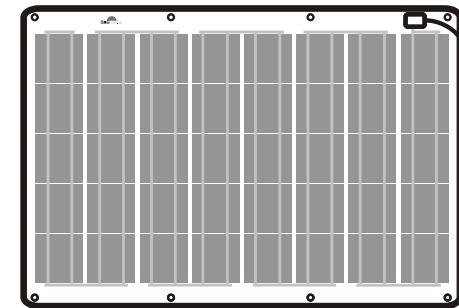
SW 27/1



SW 35/1



SW 54/1



Module components

Module components

The carrier plate of all SunWare solar module types consists of 1-mm-thick V4A stainless steel sheeting.

In a thermal vacuum process EVA lamination is welded inseparably on the pre-treated carrier. The solar cells are now thermally sealed and embedded and in this way protected e.g. against the penetration of moisture.

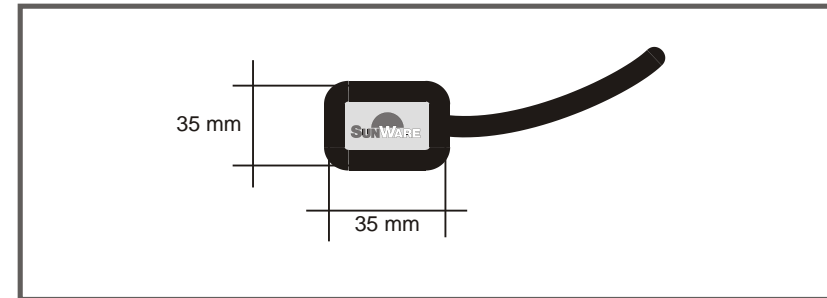


The following illustrated cable outlet is attached firmly to the front of the SunWare solar modules so that this point is also completely waterproof.

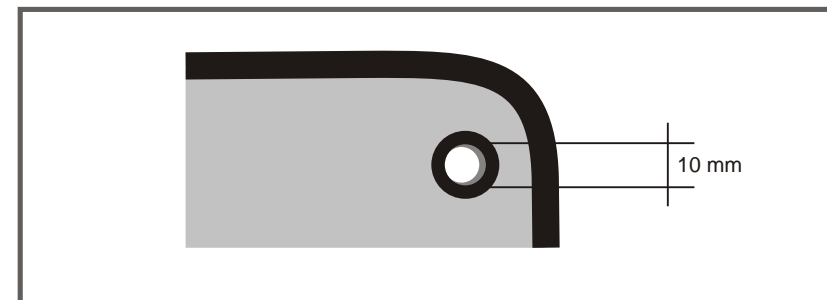
To conclude, a black rubberised edge protection profile with stainless-steel clamping profile inside is put onto the module edges.

The eyelets pressed into the module corners and sides are also made of stainless steel and have an internal diameter of 10 mm (see illustration).

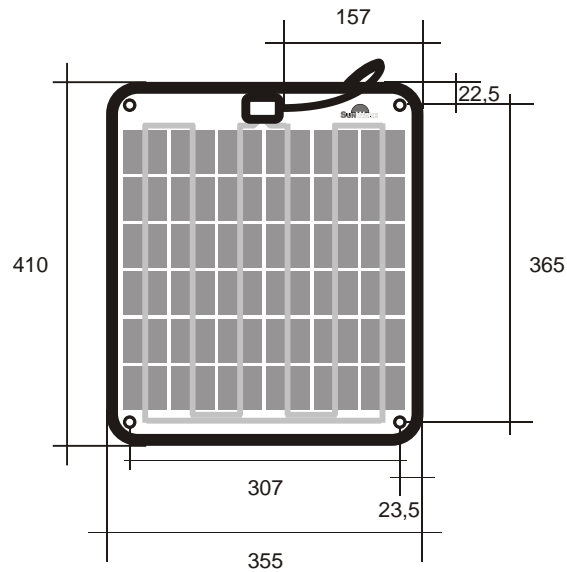
Cable outlet



Fixing eyelets



Module type: SW 12/1

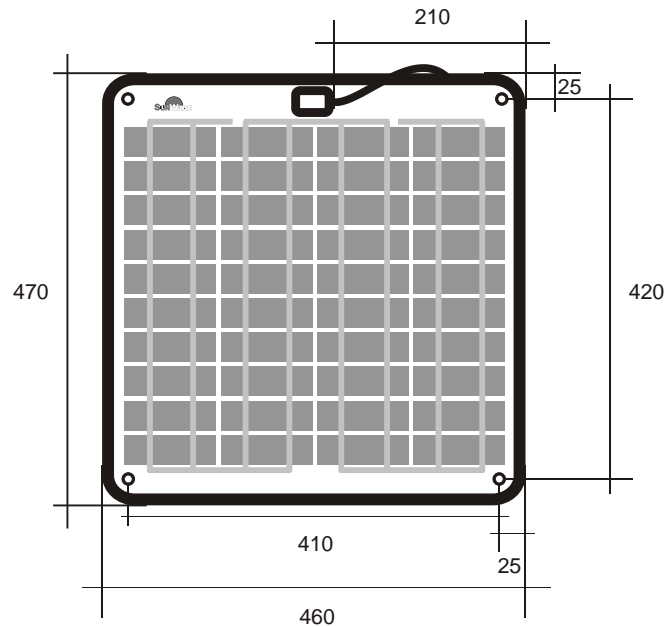


Technical features

		Unit
P max	12	W (Watts)
U max	16,5	V (Volt)
I max	0,8	A (Ampère)
U oc	23,2	V (Volt)
I sc	0,9	A (Ampère)
Number of cells	36	pcs.
Cell size	50 x 50	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	410	mm
Width	355	mm
Eyelets	4 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	1,5 kg	
Shipment weight	2,7 kg	

Technical changes reserved

Module type: SW 18/1

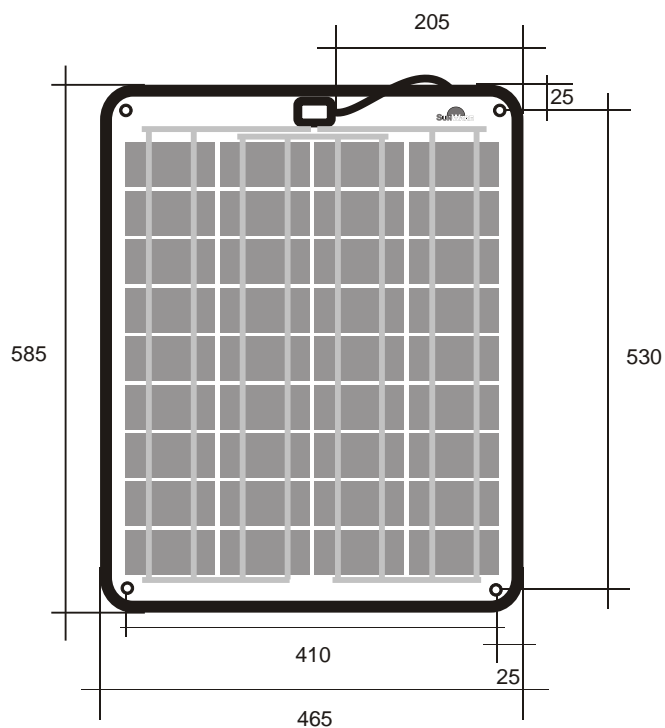


Technical features

		Unit
P max	18	W (Watts)
U max	18,2	V (Volt)
I max	1,1	A (Ampère)
U oc	23,2	V (Volt)
I sc	1,2	A (Ampère)
Number of cells	40	pcs.
Cell size	34 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	475	mm
Width	465	mm
Eyelets	4 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	3,0 kg	
Shipment weight	3,7 kg	

Technical changes reserved

Module type: SW 25/1

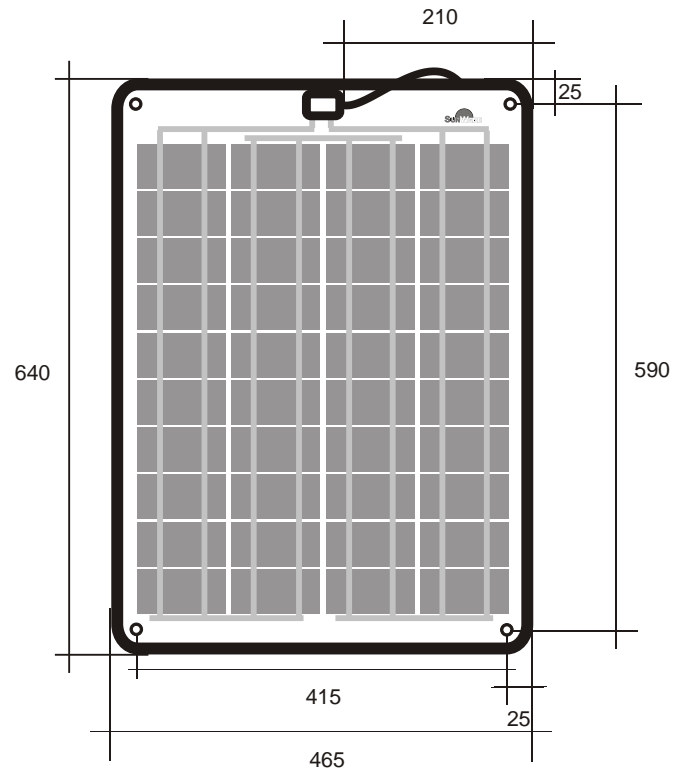


Technical features

		Unit
P max	25	W (Watts)
U max	16,5	V (Volt)
I max	1,4	A (Ampère)
U oc	20,9	V (Volt)
I sc	1,6	A (Ampère)
Number of cells	36	pcs.
Cell size	50 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	585	mm
Width	465	mm
Eyelets	4 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	3,2 kg	
Shipment weight	4,2 kg	

Technical changes reserved

Module type: SW 27/1

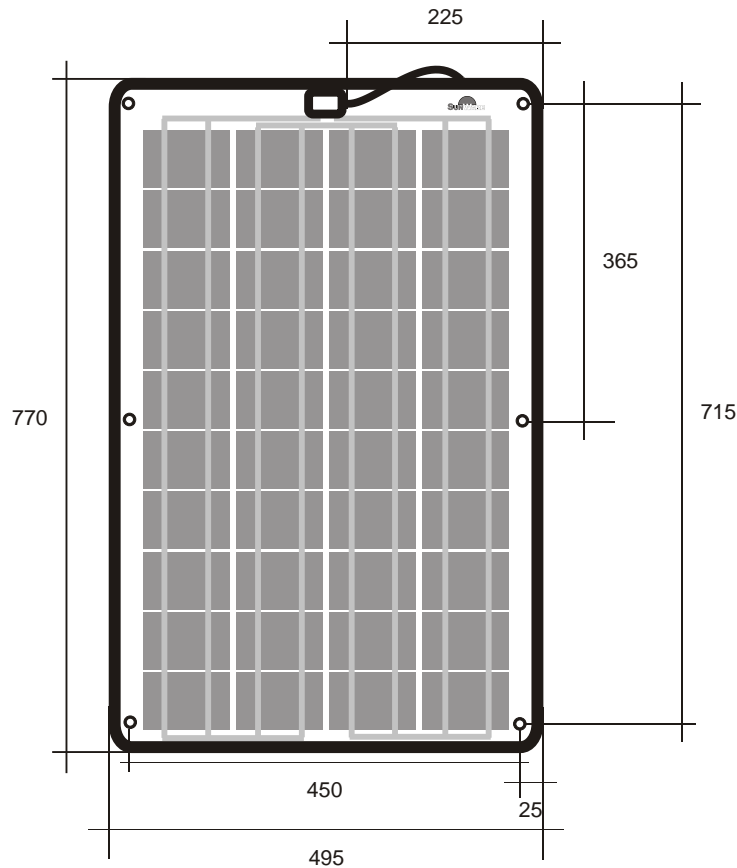


Technical features

		Unit
P max	27	W (Watts)
U max	18,2	V (Volt)
I max	1,4	A (Ampère)
U oc	23,2	V (Volt)
I sc	1,6	A (Ampère)
Number of cells	40	pcs.
Cell size	50 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	640	mm
Width	465	mm
Eyelets	4 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	3,2 kg	
Shipment weight	4,5 kg	

Technical changes reserved

Module type: SW 35/1

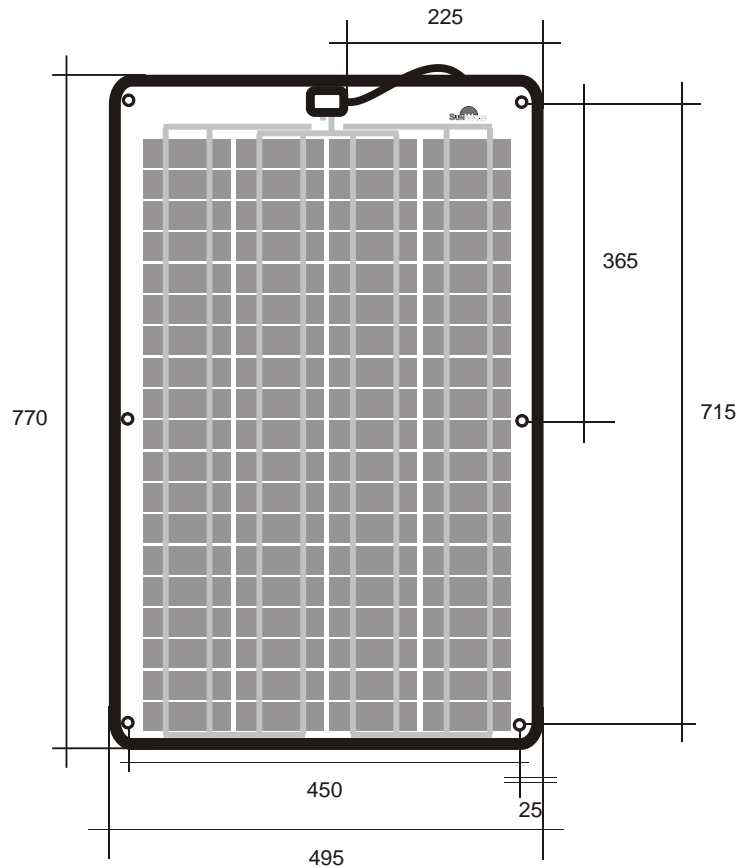


Technical features

		Unit
P max	36	W (Watts)
U max	18,2	V (Volt)
I max	2,0	A (Ampère)
U oc	23,2	V (Volt)
I sc	2,2	A (Ampère)
Number of cells	40	pcs.
Cell size	66 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	770	mm
Width	495	mm
Eyelets	6 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	4,5 kg	
Shipment weight	5,8 kg	

Technical changes reserved

Module type: SW 35/1 SRM2

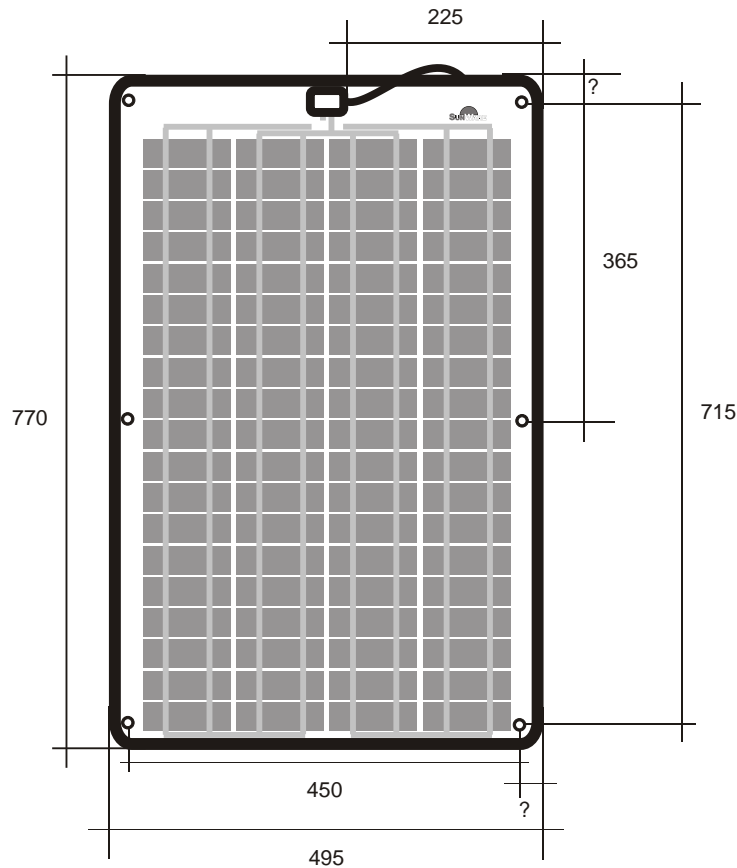


Technical features

		Unit
P max	34	W (Watts)
U max	17,2	V (Volt)
I max	2,0	A (Ampère)
U oc	22,0	V (Volt)
I sc	2,2	A (Ampère)
Number of cells	2 x 38	pcs.
Cell size	34 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	770	mm
Width	495	mm
Eyelets	6 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	4,4 kg	
Shipment weight	5,7 kg	

Technical changes reserved

Module type: SW 35/1 24 V



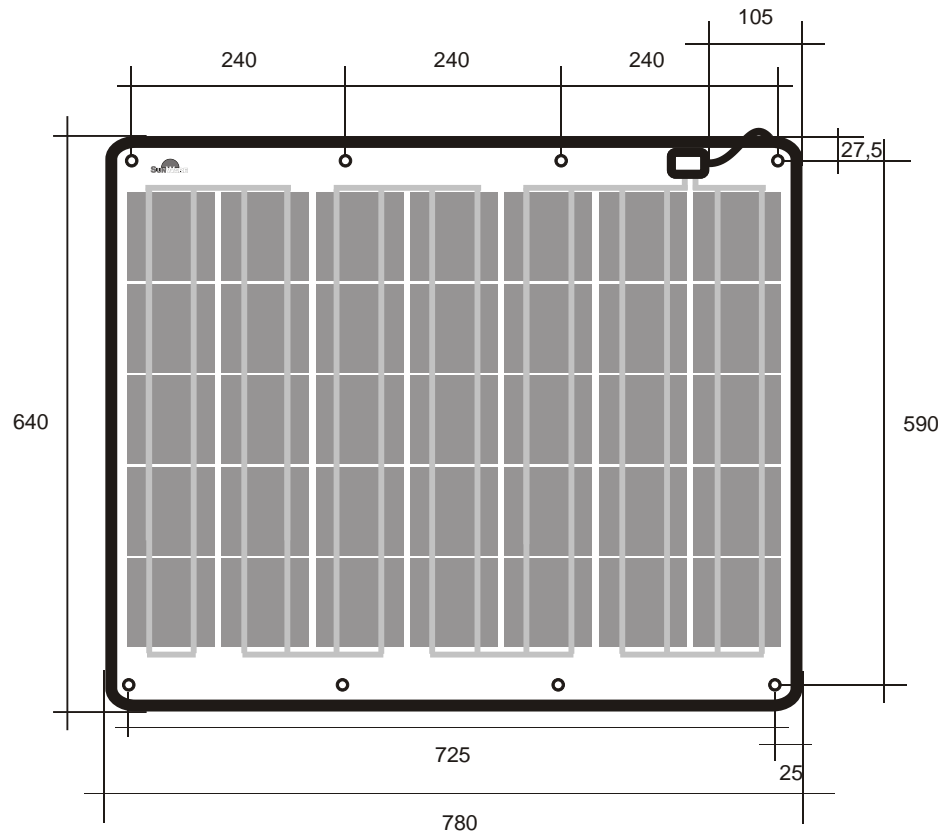
Technical features

		Unit
P max	34	W (Watts)
U max	35,01	V (Volt)
I max	1,0	A (Ampère)
U oc	44,1	V (Volt)
I sc	1,1	A (Ampère)
Number of cells	76	pcs.
Cell size	34 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	770	mm
Width	495	mm
Eyelets	6 pcs.stainl. steel, inside diam.10mm	
System voltage	24	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	4,4 kg	
Shipment weight	5,7 kg	

Technical changes reserved

Specification sheets

Module type: SW 50/1



Technical features

		Unit
P max	52	W (Watts)
U max	16,5	V (Volt)
I max	3,0	A (Ampère)
U oc	20,3	V (Volt)
I sc	3,3	A (Ampère)
Number of cells	36	pcs.
Cell size	100 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	780	mm
Width	640	mm
Eyelets	8 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	5,6 kg	
Shipment weight	7,7 kg	

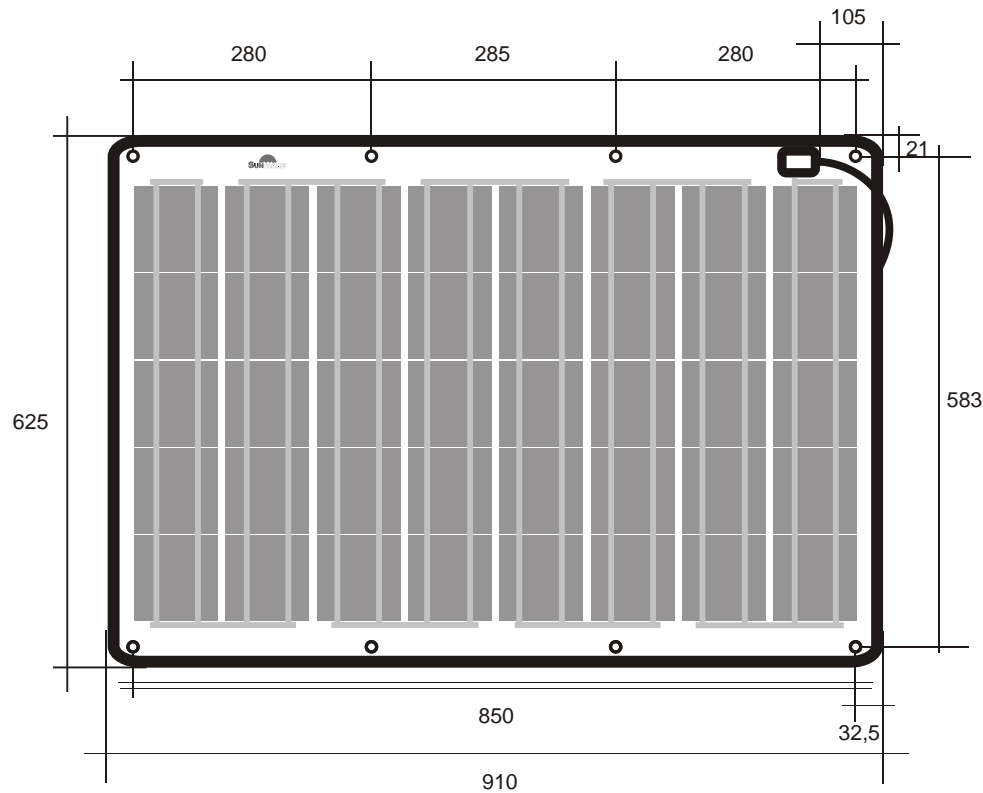
Technical changes reserved

Specification sheets

Product information - Solar modules



Module type: SW 54/1



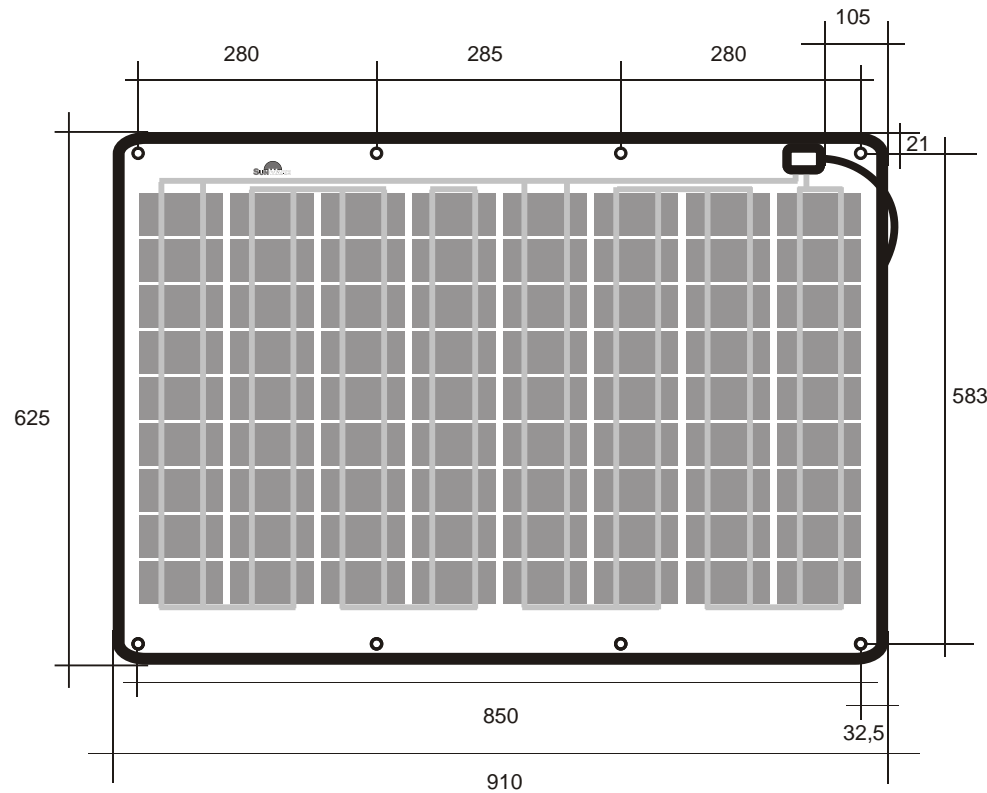
Technical features

		Unit
P max	54	W (Watts)
U max	18,2	V (Volt)
I max	3,0	A (Ampère)
U oc	23,2	V (Volt)
I sc	3,3	A (Ampère)
Number of cells	40	pcs.
Cell size	100 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	910	mm
Width	625	mm
Eyelets	8 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	6,7 kg	
Shipment weight	8,1 kg	

Technical changes reserved

Specification sheets

Module type: SW 54/1 SRM2



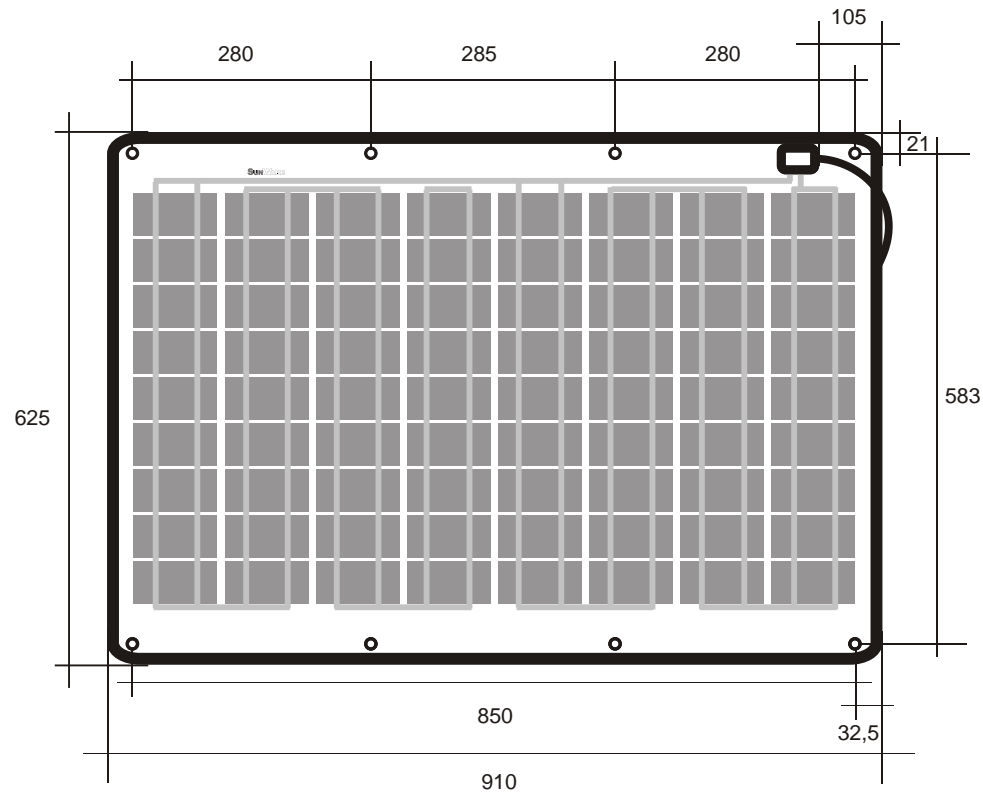
Technical features

		Unit
P max	52	W (Watts)
U max	16,5	V (Volt)
I max	3,0	A (Ampère)
U oc	20,9	V (Volt)
I sc	3,3	A (Ampère)
Number of cells	2 x 36	pcs.
Cell size	50 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	910	mm
Width	625	mm
Eyelets	8 pcs.stainl. steel, inside diam.10mm	
System voltage	12	V (Volt)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	6,7 kg	
Shipment weight	8,1 kg	

Technical changes reserved

Specification sheets

Module-type: SW 54/1 24 V



Technical features

		Unit
P max	52	W (Watts)
U max	33,9	V (Volts)
I max	1.5	A (Ampère)
U oc	41,7	V (Volts)
I sc	3,3	A (Ampère)
Number of cells	72	pcs.
Cell size	50 x 100	mm
Type of laminate	ETFE/EVA/stainl. steel	1 mm
Length	910	mm
Width	625	mm
Eyelets	8 pcs.stainl. steel, inside diam.10mm	
System Voltsage	24	V (Volts)
Rounding	edge protection with stainl. steel clamping profile	
Cable outlet	completely sealed	
Cable type	2 x 1,5 qmm, wire "+" = red, "-" = blue	
Background colour	white	
Packaging	individually packed, ready for shipment	
Weight net	6,7 kg	
Shipment weight	8,1 kg	

Technical changes reserved

General warranty conditions

SunWare Solartechnik GmbH & Co. KG warrants for a period of 3 (three) years from the date of sale to the original purchaser against power output degradation in excess of 10 (ten) per cent of the rated power under the standard conditions of 1,000 W/sqm, 25°C, 1,5 AM.

SunWare warrants to replace this lost power provided such degradation is found to be due to faulty workmanship or materials.

For the frameless solar modules, **a maximum bending of 3 cm per 1 m is allowed**. The frameless modules must be fixed in a way which prevents the module swinging.

Not included is damage which is caused by faulty handling and modifications, e.g. strong bending.

All other products manufactured by SunWare, in particular charge controllers and digital displays, will be warranted for a period of 1 (one) year from the date of sale to the original purchaser against defects resulting from faulty workmanship and/or materials when such equipment is installed and used under normal conditions.

Faulty materials are to be returned, freight prepaid and accompanied by a copy of the original invoice and the guarantee card. The serial number must be clearly legible on the warranty card or invoice.

Further warranties as a result of reduced power output or consequential damage in particular repair or compensation are explicitly excluded.