

USER MANUAL

BushPower's Solar68 Portable Solar Panel is a great solution for any leisure or outdoor activity where energy is required and battery charging via 230V AC is not possible. The Solar68 is available as a complete kit allowing the user to set up and start charging a battery within a couple of minutes.

The Solar68 is not imported. Except for the laminate all materials are made in South Africa, and the Solar68 is hand made supporting South African small businesses. The laminate used is the well-known 68W triple-junction thin film laminate from US manufacturer Uni-Solar. These laminates are normally bonded onto large flat surfaces to generate power for anything from telecoms sites to large buildings such as warehouses and museums. They are difficult to use in the outdoors because the adhesive becomes extremely messy, can be damaged easily, and the lack of features makes them hard to use, connect, store and transport.

These thin film laminates offer high temperature and low light performance, are more receptive to blue light (prevalent earlier in the morning and later in the afternoon) and therefore generate power over a longer part of daylight hours - independent tests have shown that these laminates can yield up to 30% more power than similar output glass/crystalline solar panels. Therefore, when comparing these panels to others for both output and cost, they should be compared to higher wattage panels.

Possible Solar68 uses include:

- Traveling with a 4x4, with or without a trailer or caravan
- Camping, even with a normal car
- Fieldwork or research stations
- NGOs
- Any situation where a permanent solar system is not feasible

A single Solar68 can supply energy for a 12V DC fridge/freezer, low energy lights, and other low power appliances – its real capabilities depend on actual power consumption and, of course, the weather (no sunshine means little or no power). But even a little power is better than nothing so your battery life will be extended.



FEATURES

- The Solar68 can be placed on the ground, on a flat surface, pegged down on one side and hung on the other side, or in any way that allows the Solar68 to face sunlight.
- There is no glass so it is almost unbreakable (but don't drive over it or fold/bend the laminate).
- It is waterproof so it can even be left out in the rain.
- With its strengthened PVC bag, it can be stored anywhere, even strapped down on a roofrack.
- A protective sheet is supplied with the Solar68 to prevent stones and mud from scratching the teflon coated surface.
- The strengthened PVC bag is large and strong enough to store a second Solar68 laminate.
- The components that make up the Solar68 kit are also available individually, making it easy to replace items when necessary, or upgrade the solar regulator or cables.

SETTING UP THE Solar68 (and double laminate 136W kit)

If the Solar68 Portable Solar Panel is bought as a complete kit it includes:

1. The Solar68 laminate.
2. A solar regulator.
3. The cables and connectors needed to connect the solar panel to the regulator and the regulator to the battery.
4. An extension cord so you can camp in the shade and place the panel in the sun.
5. A canvas bag to store the cables.
6. A strengthened PVC carry bag to store the kit.
7. **For the 136W kit**, there is a second 68W laminate, a junction cable and a protective cylinder.

First time installation:

For any solar system to work and charge a battery or batteries, a solar regulator is required. Solar panels generally output between 16V and 18V DC so connecting one directly to a battery will damage the battery after a short while. The solar regulator must be connected as close as possible to the battery to prevent voltage drop between the regulator's battery connection and the battery terminals. Look at the solar regulator's installation instructions for its maximum cable length but this is usually less than 2 metres, preferably as short as possible.

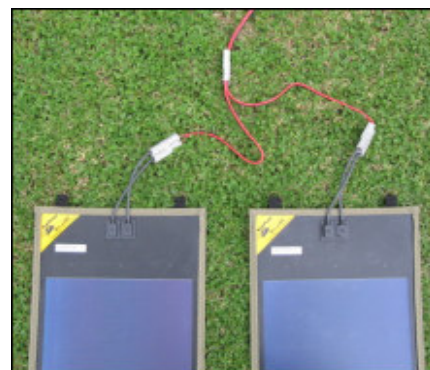
1. Choose a suitable place where the **solar regulator** will be mounted as close as possible to the battery (regulator must be kept clean and dry, i.e. not in an engine bay or somewhere outside a vehicle). Use screws, rivets, double-sided tape, etc to mount the regulator.
2. The **regulator-to-battery cable** supplied with the Solar68 is 2.5 metres long – after measuring the actual length of cable required cut off the cable to the required length (cut off from the labeled regulator side and not the battery lugs side). Then firstly connect the red wire to the positive “+” and the black wire to the negative “-” connection on the regulator's battery connection, secondly connect the red cable lug to the battery “+” and the black cable lug to the battery “-”. Always ensure correct polarity to prevent damage to electrical equipment. NOTE: the cable used may differ from time to time, the positive “+” may be fully red or have a red trace, the negative “-” may be fully black or have a black trace in it.
3. Depending on the solar regulator used the regulator will now switch on (sometimes a switch-on self-test is performed).
4. The **short cable (+/- 30cm)** can now be connected to the regulator's solar input connection and left in place ready to plug in the solar panel at any time.
5. Most solar regulators also have a load output connection: for more information about using this take a look in the NOTES section of this document.

The solar regulator can now be left permanently wired up like this and ready for use.

Using the Solar68 (and double laminate 136W kit):

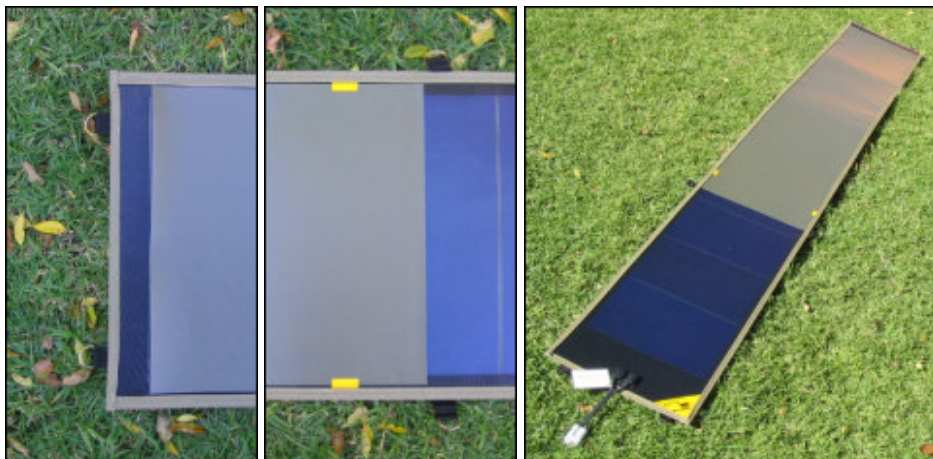
Once the solar regulator is installed and connected to the battery, the Solar68 laminate/s can be connected:

1. Remove the Solar68 laminate from the PVC carry bag, undo the two plastic buckles, and unroll the Solar68 making sure that it is in direct sunlight.
2. Remove the protective PVC sheet.
3. For a double laminate 136W kit, connect the two output cables using the supplied junction cable (see image alongside).
4. The extension cord must be unwound and **first** one side connected to the solar regulator's solar panel input short cable and **second** the other side to the Solar68 laminate output or junction cable as applicable.
5. Move the Solar68 laminate when necessary to keep it in the sun, peg it down if the wind is blowing, hang it onto something suitable to keep the sunshine on it.



STORING THE Solar68

1. The protective PVC sheet must be used to prevent the teflon coating being scratched by mud, stone chips, etc.
2. Place the protective PVC sheet over the cell surface of the Solar68 so that the bottom is about 5cm away from the bottom edge of the Solar68, and the top is slipped underneath the yellow markers to keep it in place.



3. Hold the top (cable) end of the Solar68 on both sides, roll it and align the top of the laminate with the yellow markers on the sides.
4. Continue rolling the Solar68 until the end. If the laminate is aligned and rolled correctly the end will line up with the buckles at the end.
5. Do the buckles and place the Solar68 into the strengthened PVC carry bag.



6. For the double laminate 136W kit, fit the smaller laminate inside the larger laminate using the supplied protective cylinder.



NOTES

1. Most solar regulators also have a load output connection – this is a very useful feature because the regulator is able to monitor the battery's state of charge. If appliances such as a 12V fridge and/or lights are powered through the regulator, these will all be switched off automatically when the battery reaches a preset low voltage disconnection point. This is a great feature to ensure that the battery is not overdischarged. Only low power appliances can be connected in such a way (up to the regulator's current rating) but generally these are the appliances that are powered by deep cycle batteries anyway – high current appliances such as compressors, inverters, spotlights, etc should be powered by the vehicle's starting battery. Not using the regulator's load output connection will not affect the regulator's solar charging capabilities.
2. If the canvas appears to be lifting from the laminate, especially when the Solar68 is new or little used, simply press it down again to remove these bubbles. The canvas may lift off the adhesive-sealant on the back of the laminate initially but with use and solar heating of the adhesive-sealant this will stop with use.
3. Always refer to the solar regulator manufacturer's installation instructions.
4. During the first 8-10 weeks of operation, the laminate's electrical output exceeds specified ratings. Power output may be higher by 15%, operating voltage may be higher by 11% and operating current may be higher by 4%.
5. The laminate's electrical specifications are based on measurements performed at standard test conditions of 1000 W/m² irradiance, Air Mass 1.5, and Cell Temperature of 25 °C after stabilization. Actual performance may vary up to 10% from rated power due to low temperature operation, spectral and other related effects.
6. The laminate's and Solar68's specifications are subject to change without notice.

WARRANTY

1. The Solar68 Portable Solar Panel is covered by a two year manufacturing defect warranty.
2. All laminates are tested prior to sale/shipment.
3. The Solar68 can only be rolled - do not fold or kink the Solar68, or flatten after it is rolled. Also do not roll the Solar68 tighter than specified. This may damage the wires within the laminate.
4. Do not walk, drive, etc on the Solar68. This may damage the solar cells or the internal wires.
5. Do not drag the Solar68 on the ground unnecessarily, especially for long distances or rough surfaces, as this will wear out the stitching.
6. Do not drag or pull the Solar68 from the output cable. It may not be possible to repair damaged output cables, rendering the laminate unusable.
7. When rolling the Solar68 use the protective sheet to prevent scratches on the cell surface. Mud, sand, stone chips, etc stuck to the ground side of the Solar68 laminate will scratch the Teflon coating.
8. The D rings are useful for pegging the Solar68 laminate on the ground or for hanging from a roofrack, tent poles, etc. Do not use them with undue force or high winds as the D rings or webbing may be damaged.
9. When not using the Solar68 for extended periods, make sure it is stored dry. If it is wet while on holiday is fine but make sure it is dried thereafter.
10. The Solar68 Portable Solar Panel is manufactured and intended for leisure and general use. For permanent or commercial use please contact BushPower for advice.
11. If you have issues or ideas please contact BushPower so that design changes can be evaluated to make the Solar68 suitable for the required use or for future improvements.
12. Disassembling or modifying the Solar68 will invalidate the warranty.

Solar68 PHYSICAL CHARACTERISTICS

Dimensions: length: 2850mm, width: 395mm, thickness: 6mm (18mm including cable covers).
Weight: Solar68 laminate 5.4 kg, Solar68 complete kit 7.8kg, Solar68 136W complete kit 13.2kg.
Output cables: 2.5mm² cable with two pole grey connector rated to 50 amps.
Bypass diodes: connected across every solar cell for shadow tolerance.
Laminate encapsulation: durable ETFE (e.g. Tefzel®) high light-transmissive polymer.
Laminate covering: waterproof, rip-stop canvas.
Adhesive: ethylene propylene copolymer adhesive-sealant with microbial inhibitor.
Cell type: 11 triple junction amorphous silicon solar cells 356 x 239mm connected in series.
Tolerances: length: ± 5mm, width: ± 3mm.
Rated power (P_{max}): 68 W per laminate, production tolerance ± 5%.

LAMINATE ELECTRICAL SPECIFICATIONS

STC (1000 W/m², AM 1.5, 25° C cell temperature)

Maximum Power (P_{max}): 68 W
Voltage at P_{max} (V_{mp}): 16.5 V
Current at P_{max} (I_{mp}): 4.1 A
Short-circuit Current (I_{sc}): 5.1 A
Open-circuit Voltage (V_{oc}): 23.1 V
Maximum Series Fuse Rating: 8 A

NOCT (800 W/m², AM 1.5, 1 m/sec. wind)

Maximum Power (P_{max}): 53 W
Voltage at P_{max} (V_{mp}): 15.4 V
Current at P_{max} (I_{mp}): 3.42 A
Short-circuit Current (I_{sc}): 4.1 A
Open-circuit Voltage (V_{oc}): 21.1 V
NOCT: 46° C