The SunWorks Guide to Solar Energy for Caravans

SunWorks

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If you are interested in using a solar panel on your caravan, the following information will help you to decide what you need, where to buy it, and how to install it.

Contents

Section 1: What solar energy can do for a caravan.

1. Ensure that the battery is charged and ready when you start your journey.

Perhaps you leave your caravan unattended for long periods of time? A caravan left on the driveway or in winter storage will need some attention when used again. The last thing you need to find is that the battery is flat or even dead. No power available to light the interior, run the pumps, ignite the cooker etc..
Perhaps the alarm system has failed due to lack of battery support?

Fitting a small solar panel will help keep the batteries charged up when the caravan is unused.

2. Remove the need for a mains connection.

Using a campsite mains supply can be a significant expense and has several drawbacks:

- The cost will mount up over a period of time.
- You cannot always find a suitable connection, sometimes the adaptor needed is not in your spares box.
- The site power supply is broken.

A well proportioned solar panel system will overcome these difficulties and give you the freedom to park your caravan wherever you wish without consideration of a mains supply. Perfect for wild or off-site camping.

3. Keep your battery in good order.

Charging the battery correctly definitely makes it last longer. Batteries are expensive items and we rely on them constantly to provide power for all the electrical equipment on board. Looking after your battery will save you time and money and a solar panel is a great way to achieve this.

4. Peace of mind on holiday.

Life on holiday with a flat battery is not much fun! Your battery could be charged automatically from a solar panel, with no assistance from you.

5. Safety.

A solar panel can help keep your alarm system running and ensure that all the essential services on your caravan are ready when you need them, in any Circumstances.

Section 2: Typical solar panel systems for caravans.

There are two types of solar panel systems suitable for caravans.

1. Portable solar panel.

This type can be set up on the ground next to the caravan. They work very well when positioned directly facing the sun.

To use this type of system, you simply unfold the legs, prop it up outside, and connect it to the battery via the cable.

The best type has an adjustment to allow for the height of the sun.

The panel is stored away inside the caravan when not in use.

SunWorks portable solar panels are supplied complete with cable, charge controller, battery connections and an attractive and robust storage-bag.

2. Permanent roof-mounted solar panel.

These work whenever sunlight falls on the caravan roof. A typical roof-mounted solar panel system will comprise of:

- A semi-flexible solar panel
- Roof connection gland
- Solar Charge Controller
- Cables and fuses
- Connections for the battery
- Supports for the cables to protect them against vibration and movement

If you decide to fit a rooftop system yourself, you will also need clear and illustrated instructions to make the job as easy as possible. Please consider our solar panel kits which contain step-by-step, illustrated instructions.

Semi-flexible solar panels are glued onto the roof of the caravan and convert sunlight into electricity. The larger the solar panel the more electricity the panel can produce. You can use more than one panel to increase the power output, and generally it is possible to increase the size of an existing system in this way. This will be covered later.

Solar panels are made in several sizes and types. You will need help to decide what size and technology is best for you. We also deal with this later in this article.

The Solar Charge Controller. The Heart of the system

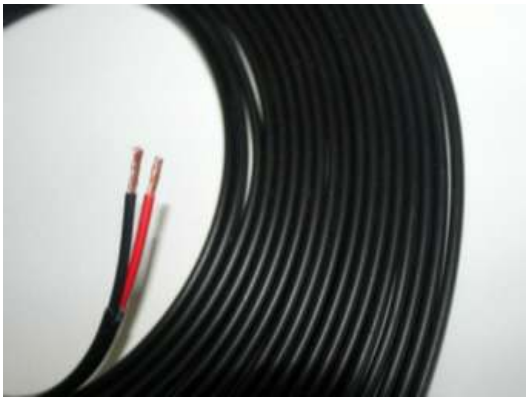
Your solar panel will send electrical power to your battery to charge it up. The panel is also easily capable of overcharging the battery, which could damage the battery permanently. To prevent this, a good quality charge controller MUST be fitted to your solar panel system.

The charge controller should:

- Prevent overcharging of the battery
- Maximise the charge in the battery
- Prolong battery life
- Operate completely automatically

All SunWorks solar charge controllers meet these criteria.

Cables:



If installing a permanent, rooftop system, use only good quality automotive cables, preferably approved to ISO6722-01. The cable must be double insulated and should use red and black cores for easy identification.

For most caravans a cable size of 2.5 mm sq is needed for solar panels of up to 300 watts. This assumes that the total cable length does not exceed 10 meters.

If you are using two or more solar panels, the total solar panel power should not exceed 300 watts, for this size of cable.

SunWorks can supply the cable you need. Please see our website or contact us if you need cable for a higher power system or for a longer length of cable.

Fuses and battery connections:

For permanent installations, the connection between the controller and the battery must be fused. For systems up to 200 watts a 15 amp fuse is suitable. For systems up to 300 watts a 20 amp fuse should be used.

The fuse should be mounted in it's own in-line fuse holder, close to the battery. Use a high quality fuse holder for security and safety, and make sure that it is accessible in case you need to change it.

Do not try to use one of the spare fuses in the caravan fuse panel.

SunWorks can provide a battery harness which includes the fuse holder, making the battery connection and fuse of your system easy to install.

Roof Connection:

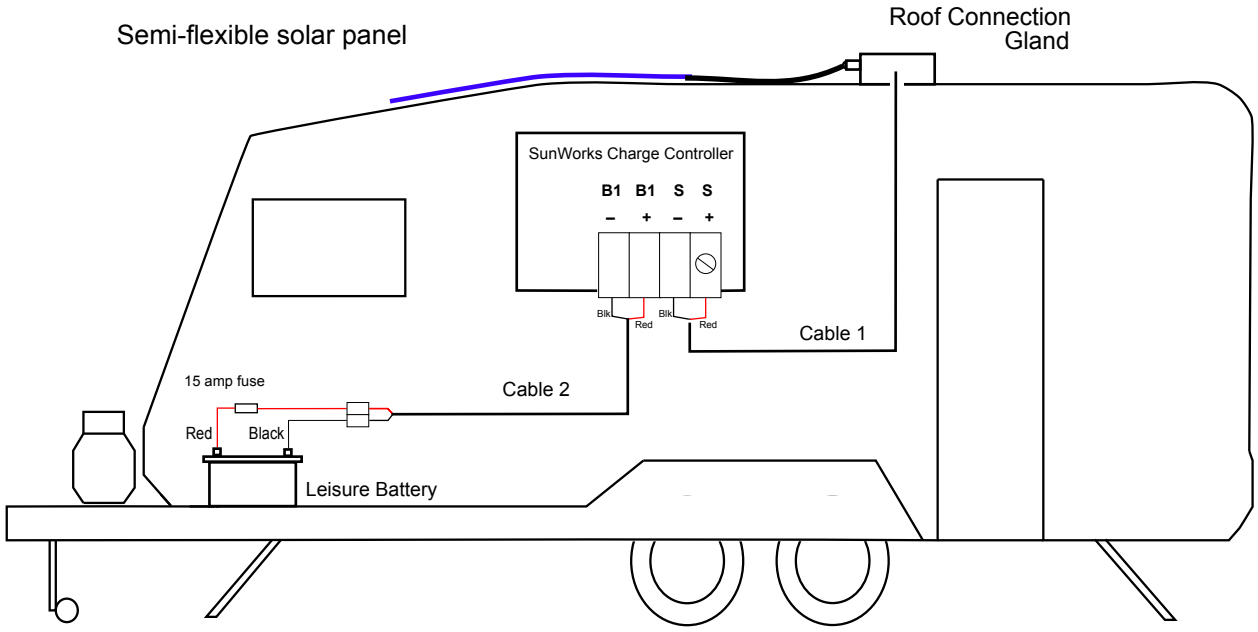
If the solar panel is mounted on the roof of the caravan you will need to install a roof connection gland to allow the cable to pass through the roof in a secure and watertight manner.

There are various types of roof connection glands. These are glued to the roof of the caravan. The cables pass through the roof, underneath the gland.

The diagram below shows the simple connections for a typical installation.

The semi-flexible solar panel (shown in blue) is connected to the solar charge controller via cable 1. Cable 2 connects the charge controller to the battery via a 15 amp fuse.

These cables are both 2-core cables with red and black conductors.



Section 3: What size and type of solar panel do you need for your caravan.

The caravan's battery supplies the lights, pumps, television, computer and many other items. The size of solar panel you will need depends on how much power all of these items consume.

If you intend to use a portable solar panel, the size will be limited by the weight of the panel you can manage, and the available space to store it. We recommend using a 50 watt portable system as a good compromise between size and power output.

Given the time involved and the initial outlay of a permanent rooftop solar panel installation, it is best to install a semi-flexible panel of at least 50 watts. For the average caravan owner this will provide a good maintenance charge to the battery. During the summer months in the UK this size of panel will also provide a little extra power and so reduce the need for mains power.

If your interest is simply to ‘trickle’ charge a battery during the long periods when the caravan is not in use, then a 35 watt solar panel will usually suffice. But keep in mind that a small panel like this may struggle to maintain the battery at the optimal condition for prolonged life.

Smaller panels should not be considered for caravans.

If your interest is to increase your independence of external power sources then a panel of 100 watts is recommended for a caravan.

Total independence in the average caravan requires a solar panel of at least 200 watts, usually arranged as two 100 watt semi-flexible panels. Using two or more panels will usually make the installation easier since a 200 watt panel is a very large item to locate on a caravan roof. Two 100 watt panels will also reduce the effects of part-shading. Panels should be connected ‘in-parallel’ and you should use panels of the same technology type.

It is possible to fit a system with future expansion in mind. If it is anticipated that a larger solar array might be needed in the future, additional panels can be added later as long as all the other components of the system have been chosen with this in mind. Items like the charge controller, wiring and fusing must be considered during the initial installation. Please contact us if you need more information on this.

<u>Solar panel types.</u>

Solar panels come in many different shapes and sizes, and in several technology types. The following should clear up any confusion.

For caravans it is definitely not recommended to use rigid aluminium framed solar panels on the roof. The roof of a caravan is generally NOT strong enough to withstand the wind loading force when travelling at speed. These panels panels are too heavy and create too much drag for a caravan roof.

The best solution for a caravan roof is to use a semi-flexible solar panel. Semi-flexible solar panels have been popular for some time on caravans because they are very thin and can be glued directly to a curved surface, such as a caravan roof. They are assembled between layers of clear flexible plastic allowing the panel to be bent slightly to follow the roof contours.

The total thickness of a SunWorks semi-flexible solar panel is only 3 mm.

Flexible solar panels offer a very aerodynamic installation, helping to reduce noise when travelling.

Solar panel technologies.

Solar panels are made in three different technologies.

Polycrystalline and monocrystalline types are by far the most efficient and cost effective solar panel technologies in common use for caravans. These can be identified easily because the panels are assembled using 36 crystalline cells connected by thin metallic strips.

Of the two types, we strongly recommend the use of monocrystalline panels as these give the best output for the size and price.

The latest and most efficient SunWorks monocrystalline panels have the connections hidden behind the individual solar cells, exposing more of the cell for sunlight conversion. These are called ‘back-contact’ solar cells.

The third solar panel technology, amorphous silicon, is far less efficient and should generally be avoided for caravan applications. These panels have the appearance of a uniform coating of a dark powdery material. The efficiency is about a third of a good monocrystalline panel, so comparing power output, they are three times larger.

Solar Panel Output Power

The power output of a solar panel is usually given in Watts. This is a universal measurement of power and is a good way to compare panels. However, when choosing the other parts of the system such as the charge controller, the cable, and the fuse, you will often find that the unit of measurement is the Amp. This can be confusing but it is easy to change between the two measurements:

- FOR 12V SYSTEMS ONLY (i.e. most modern caravans) To find the approximate output of the solar panel in Amps, divide the Watts figure by 17.6. So a 100 watt panel will produce about 5.7 amps. This is a reasonable approximation. If you have reason to find the exact rating for your panel in amps, you will have to ask the manufacturer.

Note also that it is possible for a brand new solar panel to initially produce a little more than the stated output, especially for the first few months. One reason for this is because the factory measurement is made in controlled artificial conditions and not in normal sunlight.

In summary:

1. Choose a monocrystalline, semi-flexible panel with 36 cells.
2. For the average caravan user, select a 35 watt solar panel as a minimum to trickle-charge the battery.

3. An 50 to 100 watt solar panel should ensure good battery maintenance and provide extra power in the summer months.
4. A solar panel array of 200 watts or more should remove the need for an external mains supply on a caravan site for example.

Section 4: How to select a Solar Charge Controller.

Having chosen the solar panel, you now need to select a suitable charge controller, and there are a few aspects to consider:

1. The charge controller must be rated higher than the solar panel. At least 15% higher, preferably more, is recommended. So a 100 watt panel will need a controller rated at 115 watts or more.

To make it easier for you, SunWorks solar charge controllers are specified using both Amps and Watts. As an example, if you select a solar panel with an output of 100 watts, you could use a SunWorks SB1Z or SB1C. All of these controllers are specified at 170 watts, comfortably higher than the 100 watt rating of the panel.

2. The charge controller should be capable of these three essential charge modes:
   - Boost charge (sometimes called Bulk mode)
   - Absorption mode
   - Float mode

3. The controller should operate using PWM technology. This gives better control of the charge levels and helps prolong battery life.

4. Efficiency. If a charge controller has a metal heatsink attached to it, it is because it is not particularly efficient and it will warm up significantly. This applies to controllers of up to about 15 amps. For larger systems it is normal to see heatsinks on controllers but the heat loss at this power level is not important.

All SunWorks charge controllers meet the above criteria.

5. Display. Solar panels have no moving parts and so it is impossible to see how well the system is working. An LCD display is a useful option and should show the output current of the panel in Amps and the battery voltage in Volts. You will then see how well the panel is working and how the battery is charging up.

The SunWorks SB1C is an example of this type of controller.

Other controller types have flashing LED's to indicate the battery charge level and the solar current. The SunWorks SB1Z is an example of this type of controller.

6. Appearance. Will you want to mount the controller within view so that you can see the LCD display, or would you prefer it tucked away out of sight? If the controller is mounted within view, what colour should it be? SunWorks controllers offer a choice of Black or Light Grey.

In summary, the SunWorks range includes solar charge controllers with or without an LCD display. Those with displays are available in black or light grey. Those without displays are designed to be mounted out of sight, close to the battery.

The SunWorks Z-series controllers are designed to fit close to the battery but do have have an additional output so that the SunWorks Remote Display Unit can be added at a later time.

Battery charging should be carried out carefully. A fully automatic controller with no user controls will provide the best charging system, and peace of mind.

Section 5: How to choose a complete installation kit.

An easy way to gather together the essential parts needed for an efficient and secure solar panel installation is to choose a SunWorks Solar Panel Kit. All of the electrical parts have been chosen to work correctly together, and the panels, controllers and cables have been carefully selected for use on caravan installations.

SunWorks has a range of kits for caravan owners ranging from 50 watts to 200 watts. These are designed specifically for caravan owners and contain the best quality components we can find.

They offer exceptional value for money.

Each kit also contains full and illustrated instructions. The instructions take you through every step of the installation, and describe the best way to fit each part including how to safely make the connection through the roof of your caravan.

SunWorks also offer support via email, free of charge, to all our customers.

Section 6: Installation of a solar panel system on a caravan.

If you are a competent DIY enthusiast it is entirely possible to successfully install a solar panel system on your caravan. This will save on the cost of the installation.

Do be aware that a good professional installer will take full responsibility for the system and will complete the job in much less time than you.

If you decide to fit the system yourself, it is best to set aside approximately seven hours for the work, spread over two days as you will need to allow time for the adhesive to cure.

Go through all the instructions carefully and make sure you are familiar with every component of the system.

Persuade a friend to help, especially with the work on the caravan roof.

Section 7: List of tasks.

1. Measuring up the area available for the solar panel. Keep the panel away from other items such as roof vents and remember to include space for the connection gland.

2. Routing the cables.

The solar panel cables will pass from the panel, through the roof, to the controller. Make sure that the roof gland is situated above a cupboard or locker. That way the cable will be hidden from view.

A second cable passes from the controller pass through cupboards and lockers to the battery.

With a bit of planning, cables can usually be hidden from view. Make use of cupboards and lockers for the cable runs. Plastic conduit is also a good way to hide unsightly cables. This can be found in good DIY shops, often in a range of colours.

If you want a charge controller with a LCD display, choose one that allows cables to enter discretely from the back. This will make a more attractive installation as the cables will be hidden from view. See the SunWorks SB1C as an example of this type of controller.

Alternatively, a controller without an LCD display will cost a little less. This type of

controller is best fitted in the same locker as the battery where it will be out of sight. Please see the SunWorks SB1Z as an example of this controller type. These Z-Series controllers can use the SunWorks Remote Display Unit which can be optionally fitted at a later date.

3. Fitting the roof connection gland. Special care must be taken during this part of the installation because a hole has to be made in the roof of the caravan to allow the cables from the solar panel to pass through the roof. The roof connection gland will cover and seal the hole.

Make the hole just large enough for the cable to pass through the roof. It is best to make the hole above an overhead locker if possible so that the cable is always hidden from view. Use a good quality roof gland. See the SunWorks range of roof connection glands for good examples.

Take care when drilling the hole not to interfere with any cables that are already installed in the caravan roof-space. The manufacturer of the caravan will often run cables through the roof-space.

IF IN ANY DOUBT PLEASE CONSULT THE MANUFACTURER OF YOUR CARAVAN.

There are methods to avoid damage to the roof-space cables. We can provide details of these on request.

4. Fitting the solar panels.

To attach a semi-flexible solar panel to the roof of your caravan it is very important to use an adhesive suitable for this purpose. It has to be a high grade weather resistant glue such as Sikaflex 252i. SunWorks can provide you with the correct adhesive for this purpose. Please see our website for more details.

The panel should be positioned on the roof together with the connection gland. The flexible panel can be held in place with soft weights such as bags of sugar. Do not use hard weights as these can damage the panel.

The panel should make contact with the roof over its entire surface. If this is not possible, try moving it to a different position on the roof where there is less curvature.

Be very careful not to over-bend the panel. We recommended a maximum curvature of 20%.

When you are happy with the position, draw around the panel and the gland with a soft pencil.

Do not glue the panel to the roof yet. It is best to fit all the other components first and ensure that the system is working correctly before you finally glue the panel in place.

5. Fitting the charge controller.

A good quality charge controller will have complete installation instructions included. Follow these instructions carefully paying special attention to fusing requirements.

Please contact us for help with fusing requirements.

Section 8: List of materials.

- Solar panel.
- Charge controller to suit the panel.
- Glue (Sikaflex 252i)
- Cable. Use automotive grade only.
- Terminal blocks, non corrosive.
- Battery wiring harness with fuse holder for simple connection to the battery.
- Roof connection gland, aerodynamic type with watertight cable entry.

List of tools (minimum).

- Tape measure
- Screwdrivers, flat and posidrive.
- Wire cutters.
- Wire strippers.
- Pliers.
- Bradawl or other sharp pointed tool.
- Electric drill and drill bits.
- Fine sandpaper.
- Marker pen or pencil.

Section 9: Conclusions.

- A suitable solar panel system can enhance any caravan, making it more reliable and comfortable to use.
- A solar panel can be portable, or permanently mounted to the roof of the caravan.
- Portable panels are of the rigid aluminium framed type, whereas permanently mounted solar panel must be of the semi-flexible type.
- Solar panel systems for the average caravan range in size from 35 watts to 200 watts.

Section 10: FAQ's

In this section we have tried to answer some of the questions you may have about SunWorks solar charge controllers and also about solar energy in general. If you need further information please contact us.

How do SunWorks solar charge controllers work?

A SunWorks charge controller will control the electrical current from your solar panels to your battery. The controller will decide when the battery needs charging, allowing the current to pass as necessary and then disconnecting once it is fully charged. The charge controller will always put the maximum charge possible into your battery. The battery charge is constantly monitored and the appropriate electrical current is applied to the battery. Battery life will be maximised and the performance of your solar panel system will be enhanced.

Why do I need a solar charge controller?

The amount of electricity produced by a solar panel depends on the amount of sunlight falling on the panel. During low sunlight periods the panels will only produce small amounts of electricity, in high sunlight situations a great deal of electricity can be produced. A flat battery can absorb a high current from a solar panel but a charged battery will be damaged by too much current. A charge controller will gradually reduce the current from the solar panel as the battery charges up.

Which controller will suit my 100 watt panel?

Depending on the manufacturer, a 100 watt panel will produce about 5.6 amps of electrical current in direct sunlight. So you should choose a controller that will handle at least 15% more than this. A 11 amp controller would be most suitable.

Which charge controller is best for my caravan?

Our most popular controller for caravans is the SB1C. This handles solar panels up to 11 amps. If your solar panels produce more than 11 amps then we suggest you consider our SB2C which handles up to 15 amps.

I have more than one solar panel. How do I choose a controller?

If you intend to connect your solar panels together to make one large panel, then you simply add together the Watts rating of each panel. For example, two 100 watt panels wired in parallel will perform as a 200 watt panel. Choose a controller that can handle at least 15% more than this total, i.e. a 15 amp controller such as the SunWorks SB2C or SB2Z.

Is it easy to install a SunWorks controller?

SunWorks charge controllers are straightforward to install by a competent DIY enthusiast. Essentially there are two wires for the battery and two for the solar panel. Details of wire type and fuses to be used are included in the comprehensive instructions.

Is it easy to use a SunWorks charge controller?

All our controllers are fully automatic and need no user operation.

Do I need to use isolating diodes with my solar panel?

For the average caravan it is not necessary to use isolating diodes. These are only required where three or more solar panels are used in parallel.

Can I wire several solar panels together?

Panels for caravans can be connected together, in parallel to effectively make a larger panel. We recommend that you do not exceed two panels in a normal caravan system without taking special precautions.

What is a MPPT charge controller?

This type of controller was developed for use on large solar panel systems such as those found on building roof-tops. In these situations they are essential and work well.

We do not recommend these controllers for use on caravans because:

- The long cables found on caravans create a ‘voltage overhead’, making it difficult for the MPPT controller to work efficiently.
- The additional complexity means they have an inherent loss of up to 10%.
- It is less expensive to add a little more power to your system by using a slightly larger solar panel or adding an extra panel to an existing system. This solution is also more reliable than a complex MPPT controller.

MPPT charge controllers can often be successfully used on:

24 volt battery systems.

12 volt battery systems where the cables are short and are of large cross-section

Section 11: Disclaimer.

The information provided in this document is intended for caravans using a standard 12 volt electrical system with negative earth connections. It is not intended for 24 volt systems and should not be used with regard to these systems.

The information is given in good faith and is the result of many years of experience in this field. However, there are situations where this information is NOT applicable.

If the reader is in any doubt he/she should take further advice, or contact us directly.

SunWorks and it’s directors and employees do not accept any responsibility for any harm or damage incurred as a result of using this article, either to the user, or to the caravan or equipment involved.