

Checking the Charged State of a Leisure Battery

The approximate charge state of a leisure battery can be obtained with the use of a voltage meter (preferably one with a digital readout which can indicate fractions of volts). The measurement should be taken with no charging and no current drain on the battery, if in doubt disconnect the battery (always turn off the charger or remove hook-up first before disconnecting). Also it should not be checked until at least 4 hours after any charging taking place.

Battery voltage indications

| | |
|--------------------|----------------|
| 12.7 Volts or more | = 100% charged |
| 12.5 Volts | = 75% |
| 12.4 Volts | = 50% |
| 12.2 Volts | = 25% |
| 12 Volts or less | = Discharged |



SOLAR POWER GUIDE

An Introduction

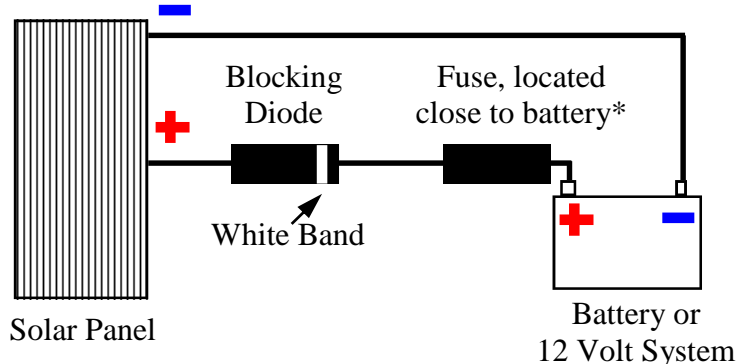
Solar panels or modules convert sunlight directly into D.C. electricity. This is a semiconductor process within the silicon cells where the light energy is transferred to electrons where it is available as electricity, from this you will see that the output is dependent on the amount of light energy falling on the panel. Temperature has an effect but is negligible in comparison. Panels are designed to charge a battery of 12volts, during charging a higher voltage of about 14volts is required to force a charge back into the battery. A panel will have a voltage of about 20volts with no load. When the panel is connected to the battery a charging current will flow in to the battery causing the panel voltage to drop to the battery voltage of 12-14volts. Panels can also be connected in parallel, this increases the power output by adding the panels together.

The power output depends on the weather, siting of panels and many other variables - therefore exact figures are very difficult. From experience in clear sunny weather an output peak of about 80-100% of the panels rated output power can be expected. An average of 50% over the day can be improved upon by moving the panel to track the sun. As it is difficult to define light levels without expensive equipment, a guide to when panels begin to charge the battery system is that dark and grey clouds remove the direct light that the panels require to give a useful output, white clouds allow enough direct light to pass through. Overcast days will usually produce sufficient to overcome battery self discharge.

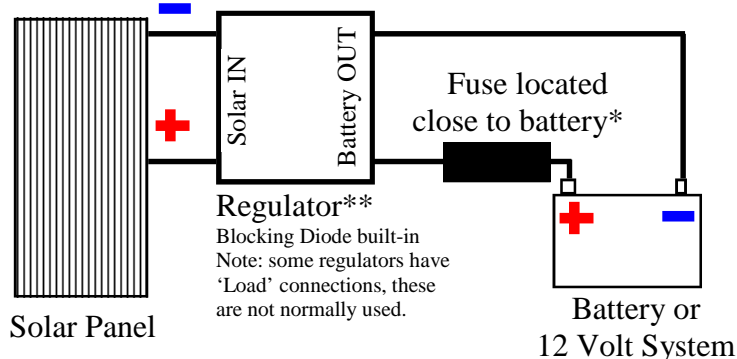
(Continued on page 2)

Connecting Solar Panels

Connecting panels 20 Watts or less without a regulator



Connecting panels more than 20 Watts with a regulator



Important

The fuse protects the cable and should be fitted close to the battery or 12 Volt connection.

* Fuse Rating

| | |
|--------------|-----------|
| 1 x 36 Watt | = 3 Amp |
| 1 x 65 Watt | = 5 Amp |
| 1 x 85 Watt | = 7.5 Amp |
| 1 x 130 Watt | = 10 Amp |

** If the regulator will be exposed to damp conditions, the periodic use of a water repellent spray (i.e. WD40) on the terminals is recommended.

A regulator/charge controller is only required if the maximum current in to the battery exceeds 10% of battery capacity in Amp hours, assuming battery is in use. A regulator/charge controller will prevent over-charging of the battery, this will only occur with large panels or when using small capacity batteries. Diodes should be fitted to all panels, these act as one way valves. When the panel is able to supply power to the battery, the diode lets it through, when the panel cannot supply power (at night or in bad weather) the diode prevents the battery discharging back through the panel. Fuses should be used as a safety measure, and fitted as close to the battery as possible.

Panels can also power equipment directly, these should be loads such as fans and pumps, not voltage sensitive equipment like televisions, radios etc. When using solar power to charge a battery, equipment can be connected and used at the same time, the battery will stabilise the voltage.

Types of Solar Cells

Essentially four solar cell technologies are available commercially:

Single Crystal Silicon (Mono-Crystalline)

Cells are sliced from a pure crystalline silicon ingot. The most efficient available commercially (~15% conversion efficiency).

CIS (Copper Indium Diselenide)

Representing the latest development in Thin film technology solar cells. Approximately 11% efficient.

Poly-Crystalline Silicon

Molten silicon is poured into a mould and then sliced into cells. The second most efficient technology (~13% conversion efficiency).

Amorphous Silicon

Commonly used in toys, calculators and consumer electronics. Thin film technology, inexpensive but least efficient alternative (~8% efficient).

Determining Solar Panel Size

Required for 12 Volt Battery Charging (ideal conditions).

The maximum current available from a solar panel is given by dividing the panel Wattage by 17.

e.g. A 75 Watt solar panel will give a maximum charging current of: 75 divided by 17 = 4.4 Amps

AMP Hours and WATT Hours...

In power systems we describe the total amount of energy consumed over a certain period in either amp hours or watt hours. A one amp draw for 4 hours has used a total of 4 amp hours (Ahr) of current. A 100 watt light bulb over 24 hours uses 2400 watt hours (WHr) or 2.4 kilowatt hours (kWHr) of energy. Note: a kilowatt equals 1000 watts, and a kilowatt hour equals 1000 watt hours.

AC versus DC Current...

Just to make things interesting, electrical energy is moved from place to place in two ways. Alternating current (AC) is the most common form; utility power arrives to us at high voltage AC current. Alternating current is like water sloshing back and forth in a bath, the same electrons doing the work in one spot. Solar panels and batteries produce direct current (DC), which is easier to store. DC current is usually used at lower voltages, i.e. 12 or 24 volts.

Advantages of Higher Voltages...

In all power systems we have to move the electricity from one place to another. The transfer is not 100% efficient, and we must take care to minimise the power losses en route. In wire, the loss of electrical power is a factor of the resistance of the wire, and the amount of current going through it. If we use higher voltages, our current is less, so power losses will be lower.

The Difference Between Volts, Amps and Watts...

The common units used in the measurement of electricity are:

Volts: Electrical force of pressure behind the electrons in a circuit. Analogous to water pressure or PSI, it tells us the system voltage (12, 24).

Amps: The number of electrons flowing past in a second. Like litres per second in a pipe, it defines the electrical current in a wire.

Watts: Total amount of electrical energy, per second.

The formulae to convert from one to another are:

Watts = Volts times Amps

Volts = Watts divided by Amps

Amps = Watts divided by Volts

Take an example of a 60 Watt light bulb...

At 12 Volts: 60 Watts divided by 12 Volts = 5 Amps

At 220 Volts: 60 Watts divided by 220 Volts = 0.27 Amps

This demonstrates that at a low voltages (i.e. 12 Volts) more current is required to do the same work and therefore the wire carrying this current must be of a larger capacity (i.e. thicker) than at higher voltages.