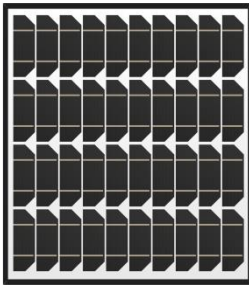


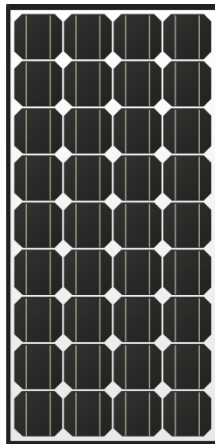
INSTALLATION MANUAL

MONOCRYSTALLINE MODELS

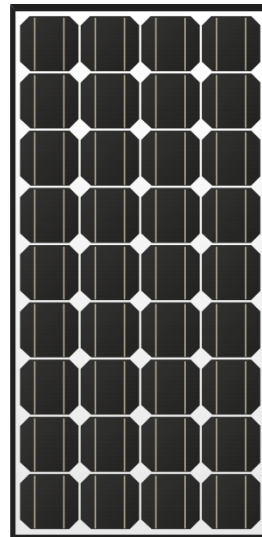
40 Watt



90 Watt



165 Watt



Thank you for purchasing the Battery Doctor® Monocrystalline Solar Panel. This manual contains safety and installation information for all Battery Doctor's® Monocrystalline Solar Panels.

Cautions

- Never touch the end of output cables with your bare hands when the modules are irradiated. Handle wires with rubber-gloves to avoid electric shock.
- Do not wear metallic jewelry when working on electrical equipment.
- Product should be installed and maintained by qualified personnel.
- Do not drop tools or other items on the glass of the solar module.
- Do not scratch the back film of the solar panel.
- Avoid exposing solar panels to partial sunlight or shadows. Partial sunlight can cause hot spots on the panel.
- Do not pour chemicals on module when cleaning. To clean use a damp cloth do not apply excessive pressure to the cells.
- Do not expose solar module to sunlight concentrated with mirrors, lenses or similar means.
- Keep module away from children.

Precautions when Working with Batteries

- Never smoke or allow a spark or flame near the batteries.
- Batteries generate hydrogen and oxygen during charging resulting in evolution of an explosive gas mixture. Care should be taken to ventilate the battery area and follow the battery manufacturer's recommendations.
- Batteries contain a very corrosive diluted acid as electrolyte. Precautions should be taken to prevent contact with skin, eyes or clothing.
- Use caution to reduce the risk of dropping a metal tool on the battery. It could spark or short circuit the battery or other electrical parts and could cause an explosion.
- Remove metal items like rings, bracelets and watches when working with batteries. The batteries can produce a short circuit current high enough to weld a ring or the like to metal and thus cause a severe burn
- If you need to remove a battery, always remove the ground terminal from the battery first. Make sure that all the accessories are off so that you do not cause a spark.
- Only use rechargeable 12 Volt batteries, ie. Sealed Lead Acid, Deep Cycle, Gel-Cell etc.
- Use properly insulated tools only when making battery connections.
- When working with batteries please follow the battery's manufacturer manual and precautions.

Precautions when Working with Solar Panels

With the incidence of sunlight or other light sources on all solar panels, a voltage appears at the output terminals of the solar panel turning it into a source of electricity. Do not make contact with the terminals when

the panel is exposed to sunlight or other light sources. To avoid shock hazard make sure the solar panel is either turned over so the cells are not exposed to light or cover the cells with an opaque (dark) material such as paper/cloth during the installation process.

Precautions when Working with Charge Controllers

If two or more solar panels are connected in series/parallel make sure that the sum of the short circuit current ratings of all panel strings does not exceed 80% of the charge controller's current rating i.e. 8 Amps or 28 Amps.

Package Contents:

- 1x Solar panel with EZ connect wiring
- 4x Mounting Z-brackets
- 4x Flange Bolts
- 4x Lock Nuts
- 4x Flat Washers
- 1x Battery Clamps



Required Tools (Not Included)

Wrench

Hand Drill

Pliers

Drill Bit

Installation Overview

Open the packaging and check to make sure that all parts have been received.

Arrange to have on hand the proper tools to carry out the mounting installation.

Determine the mounting location of the solar panel(s).

Mount the charge controller within 5 feet of battery or loss of current may occur.

Wire the battery to the charge controller and then the solar panel to the charge controller to ensure that the correct polarity is observed.

Secure the solar panel to the desired location, solar panel must be within 20 feet of the battery, or loss of current may occur.

Selecting the Correct Charge Controller

Charge Controllers may be sold separately and are required for installations of solar systems arrays that are rated 9 Watts and higher. Charge Controllers help to protect the battery(s) and solar panel(s) from harmful reverse currents, battery over charging and high wattage surges. Additional protections are found on larger charge controllers.

10 Amp Charge Controller (#23122)

An easy to connect and easy to read charge controller with LED light indicators for battery charging **cut-in voltage 13V** and battery full **cut out voltage 14.2V**. The 10 Amp Charge Controller is compatible with solar system arrays rated up to 120 Watts.

Protections:

Reverse Current
Over Charge

Low Voltage
High Voltage surges

30 Amp Digital PWM Charge Controller (#23125)

With Pulse Width Modulation (PWM) technology this charge controller helps to maintain a higher charging efficiency, thus maintaining a higher battery reserve and capacity than the standard on-off 10 Amp charge controller. The 30 Amp Digital PWM Charge Controller features a digital LCD display and adjustable voltage settings.

Protections:

Short Circuit
Low Voltage
Overloading

Discharging
Reverse Current
Discharging

Selecting the Correct Battery

We do not offer batteries. However, please choose a 12 Volt rechargeable battery. Do not attempt to recharge non-rechargeable batteries. 6 Volt battery configurations may also be used if connected in series (Negative to Positive). You may choose a Sealed Lead Acid battery, a Gel-Cell or a Deep Cycle 12 Volt battery. Batteries come in all different sizes, Please converse with your battery dealer for more information on which type of

battery you should use for your system. Note your solar panel amperage rating when selecting your battery size.

Easy Electrical Installation

Please confirm that you have all parts to your system before starting installation.

Figure 1 shows how to connect the solar panel to the 12 Volt batteries

Step 1

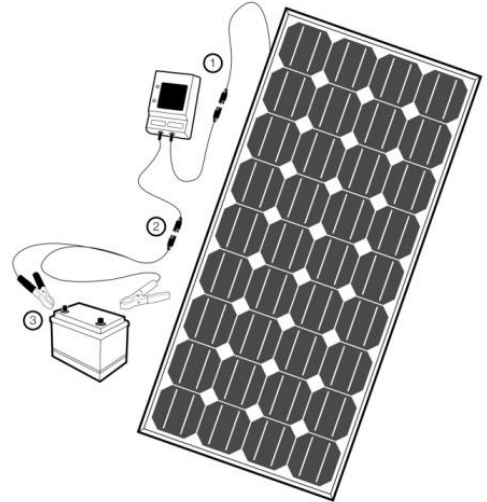
Connect the charge controller to the solar panel.

Step 2

Connect the battery clamps to the charge controller.

Step 3

Connect the battery clamps to the battery in parallel. (Parallel connections = Positive to Positive and Negative to Negative).



When installing solar panels configuration and systems, please carefully observe correct cable connections and polarity. The solar panels can be damaged by not observing the correct electrical installation and polarity; in addition, this will void the warranty of your solar panel(s). Having a multi-meter handy will help to confirm correct polarities.

Extending the Wiring

If you choose to mount your solar panel further away from the charge controller by extending the wiring we recommend the following gauges at each specified distance. Use stranded wire instead of solid wire. Stranded wire does not fatigue or loose connections over time.

Appropriate wire gauge should be used for distance and total amperage, for further information please consult with a licensed electrician or through an online wiring chart calculator

To prevent loss of current we suggest mounting the solar panel within 20 feet of the charge controller and the charge controller should be installed within 5 feet of the battery.

Connecting additional Solar Panels

Connecting Solar Panels

Assembly:

1. To connect 2 Solar Panels together simply remove the J-plugs at the end of each Solar Panel to reveal at least 2 inches of bare wiring.

2. Once the two wires are exposed they can be connected together by either twisting the wires together or by using solder. When connecting the wires always ensure the correct polarity is observed, Negative (- Black) to Negative and Positive (+ Red) to positive.
3. Once the wires are connected they can be placed in/on the correct terminals of your charge controller.
4. Once the wires have been placed on their terminals correctly ensure the connection is safe and secure and that the bare wires cannot come into contact with each other. This can be done by using insulation tape or electrical tape that can be wrapped around the wires to stop them from coming into contact with one another.

Note: If the Solar Panel wires short while being connected to the Charge Controller it may cause irreparable damage. Removing the J-Plug will not affect the warranty on Solar Panels.

Tools Needed:

Crimping Tool/ Wire strippers
Solder and Soldering Iron (optional)
Electrical Tape

Additional 12V DC Batteries

Addition batteries may be desired for extra electrical storage.

For 12 Volt battery bank configurations; make sure your batteries are connected in parallel (Positive to Positive and Negative to Negative)

1. From the charge controller attach the red battery clamp to the red terminal of the first battery in the bank, matching the polarities, positive to positive.
2. Then connect the black alligator clamp to the black terminal of the second or last battery in the bank, again matching polarities, negative to negative. This will ensure an equal charging across both or all batteries.

Connecting an Inverter

An inverter can be used to convert the 12 Volt energy created to 120 Volt Electricity.

Inverter sizes and types vary depending on your power consumption needs. Please discuss which inverter to purchase with your Inverter dealer.

Monitoring your Solar System

To confirm that your solar panels are generating power we suggest purchasing a multi-meter. Annual testing and inspections are recommended to confirm all connections are secure and panels are functioning properly.

Open voltage testing of solar panels may range from 11 Volts up to 21.6 Volts depending on the intensity of the sun, this is within normal range.

Upon annual inspections it is recommended to wipe all solar panels with a damp towel to remove dust and debris covering the panels, as layers of dust can affect the solar panel voltage.

Routine Maintenance Check List

- ✓ Check and replace damaged components if necessary.
- ✓ Clean with a damp towel or cloth remove all debris.
- ✓ Check and maintain the battery electrolyte levels are at regular intervals as per the battery manufacturer's recommendations if flooded wet cell lead acid batteries are used.
- ✓ Check solar panel open voltage range.
- ✓ Check solar panel close circuit range.
- ✓ Confirm all wiring connections are secure and tight.
- ✓ Confirm all mounting connections are secure and tight.

Mounting

Recommendations

Choose a site for mounting the solar panels that is free from shade and located in an area that receives maximum sunlight daily. For maximum solar power absorption throughout the day, a tilt-mounting kit is recommended.

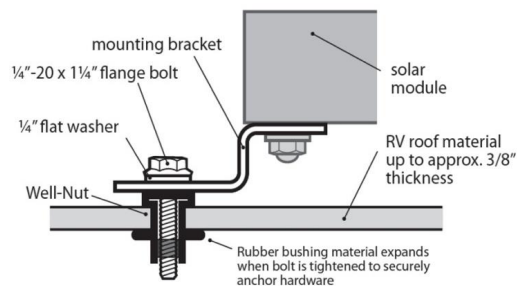
The solar panels can be permanently installed level using the hardware included. If you choose not to use the included Z-brackets ensure that you create a ½ inch space between the mounting surface and the solar panel to allow for proper airflow under the solar panel.

When making connections ensure polarity is maintained, reverse polarity may cause damage and will void the warranty.

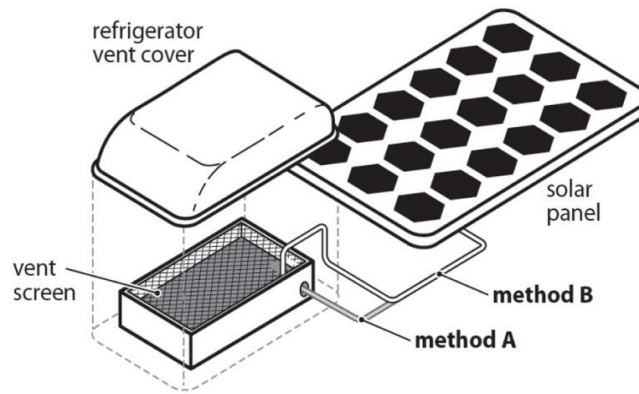
Measure the distance between the mounting site and the battery location. The charge controller should be mounted in close proximity to the battery bank (within 5 feet). Refer to the DC electrical wire guide to choose an appropriate gauge wire for the length of the wire.

If you choose to mount your Solar Panel to your RV, be sure you solidly mount your panels to the roof. If you have a rubber roof over thin plywood you may want to use molly fasteners to get a better grip. If you have a fiberglass roof, drill some pilot holes through the fiberglass to reach plywood below. This will prevent cracking or damaging the fiberglass. If your RV is equipped with a metal roof you must mount the solar panel to the joists supporting the roof.

Figure 3 shows an example of how the panel can be mounted with the z-brackets included.



The wire from the solar panel can be routed to the interior of the RV through the roof-top refrigerator vent. In this kind of installation attempt to mount the panel near the refrigerator vent. See Figure 4.



Run Times

Please refer to the runtimes chart to choose how much solar power your desired system requires. Note that all runtimes and ratings are approximate and may vary depending on your location and time of day and are based on 7 Hours of full sunlight a day.

Rated Hourly (Maximum output)	40 Watt	90 Watt	165 Watt
		2.29 Amp	5.14 Amp
Weekly Output	1960 Watts / 112.2 Amps	4410 Watts / 251.86 Amps	8085 Watts / 462 Amps
Weekly Run Times			
Laptop (20-50 watts)	39 Hours	88 Hours	160 Hours
PC (80-150 watts)	13 Hours	29 Hours	50 Hours
Television 19" Color (70 watts)	28 Hours	63 Hours	110 Hours
CD Player - Radio (35 watts)	56 Hours	126 Hours	230 Hours
Fan (10-50 watts)	39 Hours	83Hours	165 Hours
Halogen Light (100 watts)	19 Hours	44 Hours	80 Hours
Fluorescent Light (40 watts)	49 Hours	110 Hours	200 Hours
Coffee Maker (800 watts)	2 Hours	6 Hours	10 Hours
Portable Heater (1500 watts)	1 Hour	3 Hours	5 Hours

Electrical Ratings

Rated electrical characteristics are within +10 percent of the indicated values of Isc, Voc, Pmax under Standard Test Conditions (irradiance of 100 mW/cm², AM 1.5 spectrum, and a cell temperature of 25°C {77°F}).

Pmax	40W	90W	165W
Voltage at Pmax (Vmp)	17.5V	17.5V	17.5V
Current at Pmax (Imp)	2.29A	5.14A	9.43A
Open-Circuit Voltage (Voc)	21.6V	21.6V	21.0V
Short-Circuit Current (Isc)	2.47A	5.49A	9.95A
Dimension	24x20x2.1"	32.6x26.5x1.2"	57.8x26.5x1.4"
Efficiency	18.4%	18.2%	17.20%
Cell technology	Monocrystalline	Monocrystalline	Monocrystalline
Class	A	A	A
Weight	8.81lbs	21.1lbs	25.3lbs

The electrical characteristics are based on the results of outgoing test.

Under normal conditions, a photovoltaic module may experience conditions that produce more current and/or voltage than reported at Standard Test Conditions. Modules should be multiplied by a factor of 1.25 when determining **component voltage ratings, conductor** capacities, fuse sizes and size of controls connected to the module output. Refer to Sec. 6908 of the National Electric Code for an additional multiplying factor of 125 percent (80 percent of rating) which may be applicable.

Please refer to Section 690-8 of the National Electrical Code for an additional multiplying factor of 1.25 which may be applicable.