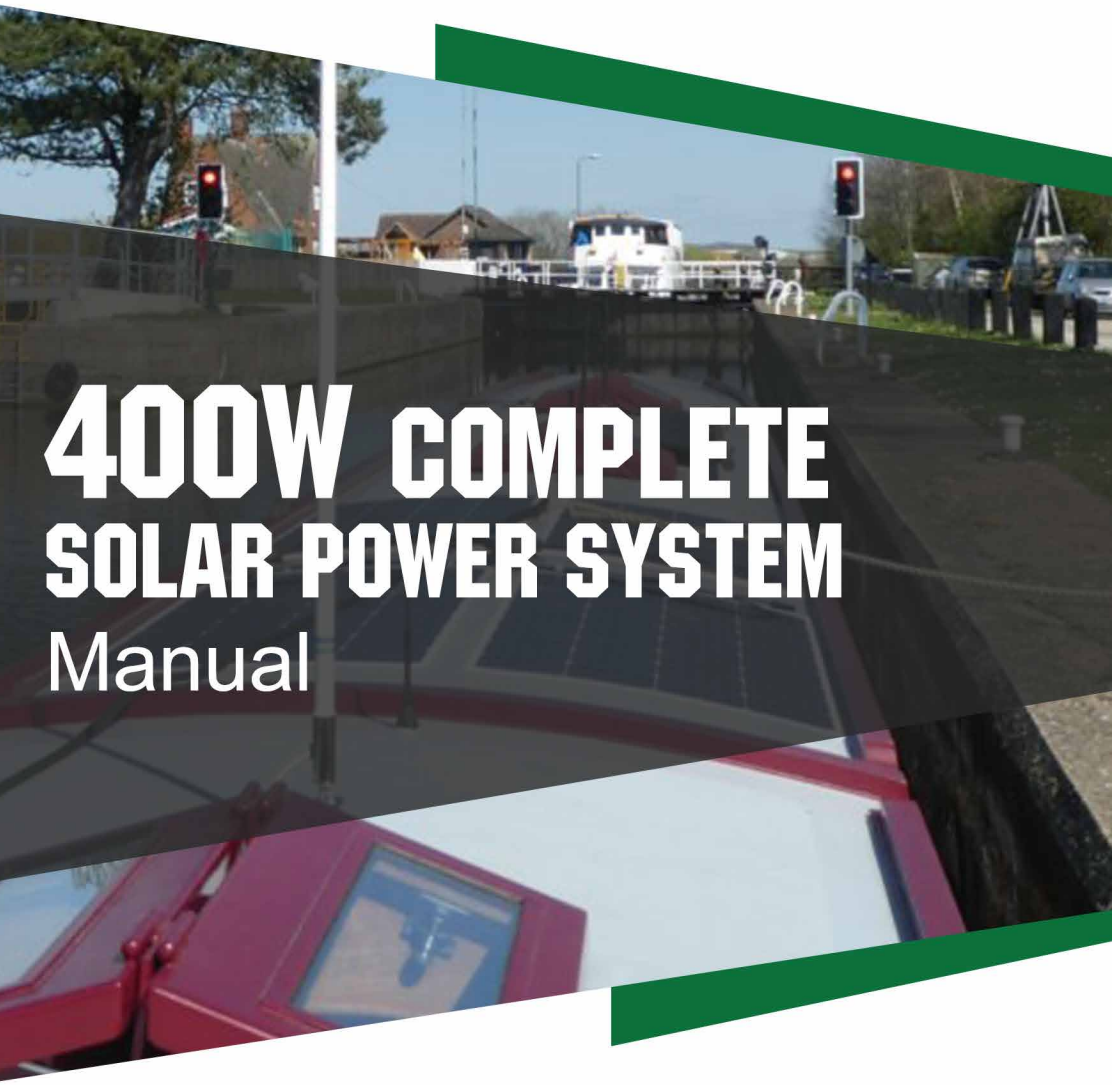
ECO-WORTHY



400W COMPLETE SOLAR POWER SYSTEM

Manual

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Contents

Safety Caution

Working with and installing electrical equipment is dangerous. Potential risks include hazards, electrocution and electrical fires.

Solar panels generate electricity as soon as being exposed in sunlight. To avoid a shock hazard, it's better to keep the panel covered with something during installation and avoid direct contact with the output terminals.

·Observe correct polarity with all interconnections between the solar-panel, charge controller, and the battery. Reverse polarity may causedamage

·Make sure all wire connections are tight and secure, loose connections may cause sparks and intermittent behavior

·Do not perform installation in the presence of any flammable materials

·Make sure you work in a well-ventilated area

·Use properly insulated tools: adjustable wrench, wire stripper, screw-driver, wire crimping tool, insulation gloves

·Remove metal items such as rings, bracelets, and watches

Product Overview

ECO-WORTHY 400W Off-Grid Solar Power System, an electricity supply project, which is clean, quiet, and compatible with RV, trailer, shed and house roof.

The complete kit contains:

·4 PCs 100 Watts Monocrystalline Solar Panel

·1 PC 1500W 24V DC-110V AC Pure-sine-wave Inverter

·1 PC 60A PWM Solar Charge Controller

·2 PCs 12V 50AH Lithium Battery

·1 Pair of 16ft 11AWG Solar-Controller Cable

·1 Pair of Y Branch Connector

·1 Pair of 1ft 10AWG Lithium Battery Cable

·1 Pair of 2.6ft 7AWG Battery-Inverter Cable

·1 Pair of 16.4ft 12AWG Solar Extension Cable

·1 Pair of 4.92ft 11AWG Battery-Controller Cable

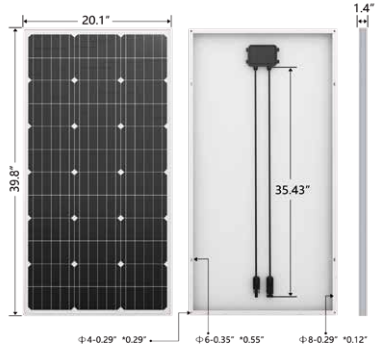
·4 Sets of Z Bracket

·Necessary bolts and nuts designed for plane installation.

Components Description

Solar Panel

The solar panel is a set of solar photovoltaic modules that generate electricity based on sunlight. This system contains 4 pieces of 100W panels with monocrystalline solar cells.



Electrical Data	
Maximum Power at STC*	100W
Optimum Operating Voltage (Vmp)	18V
Optimum Operating Current (Imp)	5.55A
Open Circuit Voltage (Voc)	21.6V
Short Circuit Voltage (Isc)	6.11A
Module Efficiency	19.41%
Weight	13.14 lbs(5.96 kg)
Size	1010×510×35mm (39.8 x 20.1 x1.4 in)

Solar Cable Connectors	
Rated Current	30A
Maximum Voltage	1000V
Maximum AWG Size Range	10AWG ～ 14AWG
Temperature Range	−40℃～+85℃
IP Rating	IP67

Junction Box	
IP Rating	IP68
Diode Type	blocking bypass diodes
Output Cables	12AWG（2.9 ft long）

Solar Charge Controller

The 60A PWM solar charge controller turn the wavy current from solar panel into stable 24V DC current for battery bank, make the charging process safe and effctive.

Model	ECO-SC60A	Remarks
Rated current	60A	
System voltage	Automatic recognition of 12V/24V	Default automatic identification
	Manual setup	
Rated power	12V/900W 24V/1800W	
Operating temperature	-25℃to+55℃ ;	
IP protection degree	IP30	
Net weight	1.4lbs/650g	
Protection functions	Battery plate reverse connection protection , a battery reverse connection protection, charging battery board short circuit protection, charging the battery open circuit protection, charging over current protection, overload protection, load short-circuit protection controller and over temperature protection.	
Dimensions	7.4*5.0*2.1in/189.3*128*53.1mm	

Pure-sine-wave Inverter

The inverter transforms 24V battery DC power into 110/120V AC power, and directly supply for home appliances with the socket on bottom. It's able to run devices with total power of 1500W.

Input Voltage	24V DC
Output Voltage	110V AC
Continuous Power	1500W
Surge Power	3000W
Frequency	60Hz
Effienvy	>90%
Working Temperature	-10℃~+50℃
Size	13.8*5.9*3.14 inch

Batteries

The complete system includes 2 pieces of 12V 50Ah rechargeable lithium batteries. For this is a 24V system, the batteries should be wired as a 24V battery bank. The total capacity of the battery bank is about 1280Wh.

12V 50Ah LiFePO4 Battery	
Battery Capacity	50Ah
Battery Power	640Wh
Battery Voltage	12.8V
Maximum Charge/ Discharge Current	40A/60A
Charge Temperature Range	32°F~131°F / 0°C~55°C
Disharge Temperature Range	-4°F~131°F / -20°C~55°C
Maximum Charge Voltage	14.5V
Discharge Cut-Off Voltage	10V
Screw size	M6
Battery Weight	4.9kg/10.8lb
Battery Size	8.8*5.3*7inch/ 22*13.5*17.8cm

16.4ft Extension Cable

16.4ft 12AWG MC4-copper head cable for solar panel array - controller connection

Battery Cable

1ft 10AWG ring-head cable for batteries connection

Battery-Inverter Cable

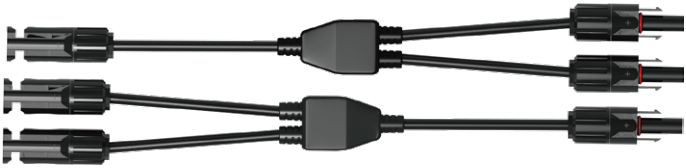
2.6ft 7AWG ring-head cable for battery bank - inverter connection

Battery-Controller Cable

4.92ft 11AWG cable for battery-controller connection

Y-Branch Connecotr

Split Y-shape cable for parallel connection of solar panels



Z Mounting Brackets

Mounting brackets for fixing panel to a flat surface. There are 4 brackets for each solar panel

Installation Guide

-Setup the battery bank

The inverter in this system requires a 24V battery bank for running.

With 2 pieces of batteries, the connection should be:

Connect 2 batteries in series to form a 24V battery bank. Method: hook up each battery's positive terminal to the other's negative terminal.

The diagram as below:

-Connect solar charge controller with battery

The solar charge controller should be put indoor. After the battery bank setup accomplished, wire the controller with battery bank. The controller has 3 parts of ports, middle ports are for connecting with battery.

Wiring method: Use the controller-battery cable for connection, battery + port to one battery's positive terminal, battery - port to the other's negative terminal

-Mount the solar panels

Determine a location for the solar panel that is exposed in direct sunlight and clear of any shading such as trees, roof overhangs, etc. Ideally, the panels should be positioned to minimize the wiring distance between the solar panel and the combiner box.

For Northern Hemisphere installations, the solar panels should be mounted at an angle facing true south (true north for Southern Hemisphere installations). The mounting angle should be equal to the latitude location of where you are installing the solar panels. For example, the latitude of Miami, Florida, USA is 25 degrees. Therefore, solar panels installed in this area should ideally be facing true south at a tilt angle of 25 degrees.

5.1.1 Use Z-Brackets on an rv roof: “Flat Mount”

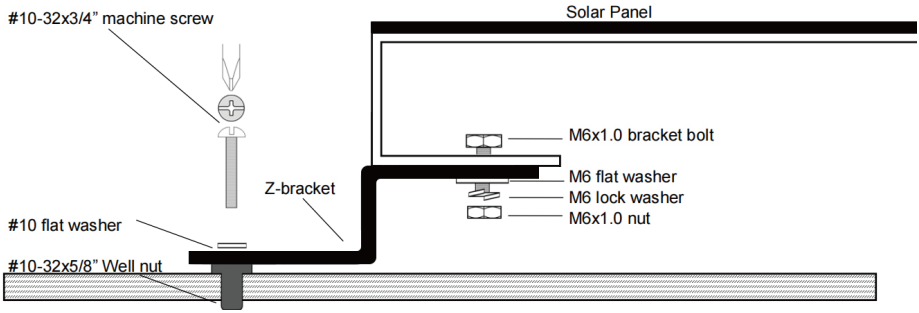
When mounting a panel using Z-Brackets, a well-nut (also known as “expansion nut”) is often used on a pre-drilled hole. This procedure safely secures the panel on thin cabin roofs or RV roofs. Using a well-nut is recommended, as the rubber expansion prevents water leakage.(The Z-Bracket set does not include well nuts)

Step1： Attaching the Z-Bracket to a solar panel
Locate the mounting holes on the solar panel.Solar Panels have four mounting holes on each side.

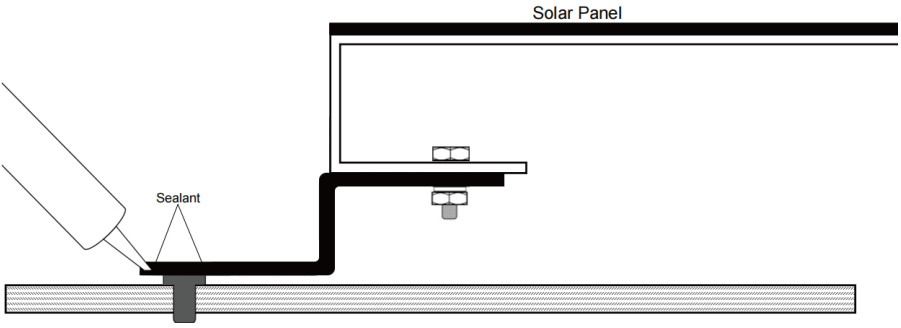
Step2： Mark and drill holes
With the Z-Brackets attached to the frame, the panel can be laid on a mounting surface, making it easier to mark the holes for the well-nut.

Step 3: Attaching the panel to the roof

Figure picture below illustrates the correct way to use the well-nut. The rubber flange has to be flushed on the roofline. The Z-Bracket,along with the flat washer and lock washer, hold the well-nut in place when the screw is fastened.



Gently insert the well nut into the drill hole . Be careful not to push the well nut flange completely into the holes. Make sure the flange is flushed on the roofline.Before attaching the panel to the roof, a film of caulk can be laid between the RV roof and the Z-Bracket. Even though the well-nut provides a watertight bond, this provides additional sealant.



-Setup the panels array

The battery bank and inverter require 24V input from the solar panels array. So 4*panels should be wired into a 24V array.

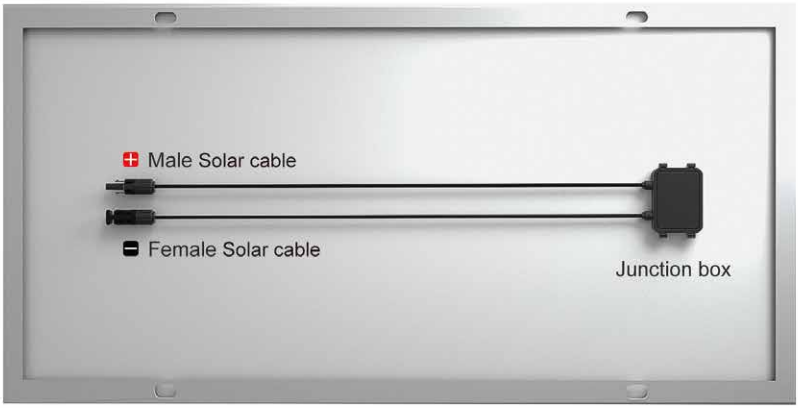
Wiring method:

1.Connect each 2 panels in series to make 2 strings of 24V

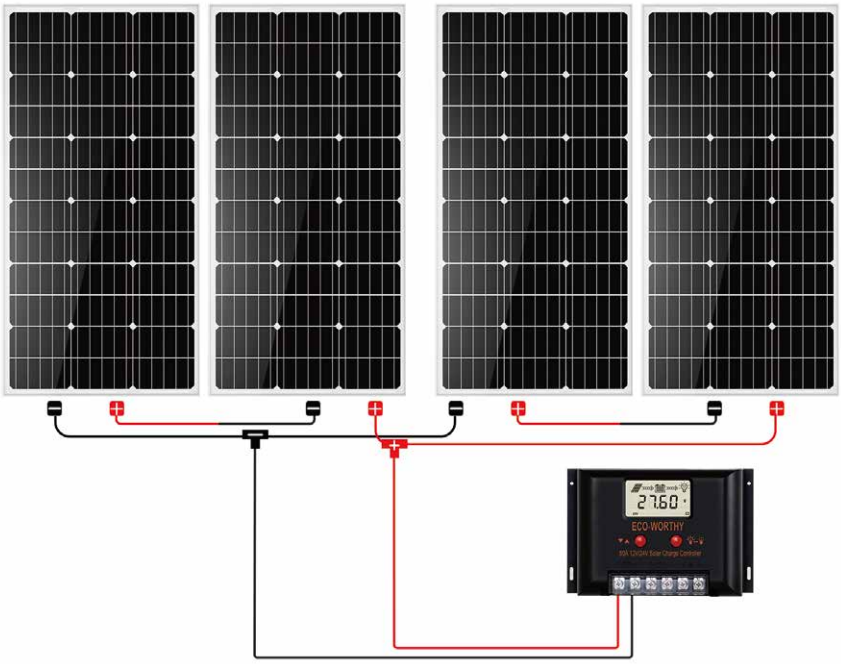
Each ECO-WORTHY Solar Panel has a pair of MC4 solar cable at the back of panel that consists of male and female connectors. This type of connector uses a “snap-in” type of safety locking clips to lock the two mating connectors, making it easy to install.

For series connections, just plug one panel’s male and the other’s female MC4 connectors together.

Solar cable Connectors and mating contacts



2.Use 1 pair of Y-branch connector to wire 2 strings together in parallel. Diagram as below:



-PV output to solar charge controller

After all panels get wired by Y-branch connector, use the 16.4ft 8AWG solar-controller cable to connect the solar panel array output wire with the controller.

MC4 terminals to plug the Y-branch connector terminals, and the copper-head terminals to the controller PV input port, + for positive cable, - for negative one.

-Place the inverter

The inverter should be put indoor to avoid raindrop or any other weather issue that may causes electrical fault. Here some notice should be followed:

·Please do not install the inverter in a humid, greasy, flam mable, explosive, dusty or other severe environments.

·During cabinet installation, sufficient space shall be reserved around the hybrid inverter for heat dissipation.

·The polarity of the battery input end of this product shall not be reversed, otherwise the device may be damaged easily or there may be some unpredictable dangers.

It can be mounted on wall with proper screws, there are reserved mounting holes on the edge of the unit.

Connect battery with inverter

Use the cable inside the inverter package to wire the battery bank to the inverter. There is one battery port on the bottom of hybrid inverter.
Wiring method: one battery's positive terminal to DC input +, the other's negative terminal to DC input -.

-Inverter to appliances

Before booting the inverter, the AC OUT ports should be wired with the home socket or appliances first.

-Turn on the inverter

When all wirings are done, check if the battery type switcher is at Li-ion, since it's connected with lithium battery bank. The final step is to boot the hybrid inverter by pressing the switch on its bottom.

LCD display screen info： battery present voltage
(Note: the inverter only works when 24V battery bank connected)

Fusing and Setting

-Fusing position

The requirement to protect photovoltaic systems from overcurrent conditions is defined in Article 690.9(A) of the NEC. Fuses are required to protect cables and PV modules from line-line, line-ground and mismatch faults. The sole purpose is to prevent fire and safely open a faulted circuit if an overcurrent event were to occur. However, there are some situations where fusing is not required and is defined by the following:

Two Strings in Parallel (fusing not required)

So no need to fuse the PV array you built, or the connection between it and controller.

On the other hand, even though the inverter has built-in fuse, it's better to add one fuse in between it and the battery bank. For a 24V 1500W inverter, the current it receives from battery should be about 62A, so a 75A fuse is recommended.

Testing and Troubleshooting

Testing

Test all electrical and electronic components of your system before commissioning it. Follow the instructions in the guides supplied with the components and equipment.

·Test modules connected in series before they are connected to the system.

·To determine Voc and Isc in the following tests, the module(s) must be exposed to the sun and not connected to a load. Observe personal safety when making these measurements.

·Check the open-circuit voltage (Voc) of every series module using a digital multimeter. The measured system Voc should correspond to the sum of the Vocs of the individual module. You will find the rated voltage in the technical specifications of the specific module. If the measured value is significantly lower than the expected value, proceed as described under “Troubleshooting an low voltage”.

·Determine the short-circuit current (Isc) of every series circuit. It can be measured directly by connecting the digital multimeter to the two terminals of the series circuit or module. Attention, the rated scale of the ammeter or the rated current of load should be more than 1.25 times of the rated short-circuit current of the series module. You will find the rated current data in the technical specifications sheet. The measured value can vary significantly, depending on weather conditions, the time of day, and the shading of the module.

Troubleshooting a low voltage

To identify the commonly low voltage and excessively low voltage, the commonly low voltage mentioned here is the decrease of open-circuit voltage of the module, which is caused by the temperature rising of solar cells or lower irradiance. Excessively low voltage is typically caused by improper connections of the terminals or defective bypass diodes.

·First, check all wiring connections to see if it is not open-circuit or is not connected well.

·Check the open-circuit voltage of each module

·Disconnect the wiring at both terminals of the modules.

·If the measured voltage is only half of the rate, this indicates a defective bypass diode. By replacing or remove the diode, the issue may be sorted. Removing the bypass diodes should only be done by a competent PV technician and the module has to be disconnected from the system.

In the case of fine irradiance, if the voltage across the terminals differs from the rated value by more than 15%, this indicates a bad electrical connection.

FAQ

A1:The hybrid inverter is not working. The screen is not showing anything.

Q1:For this situation, there are 3 things to check:

(1)Check for loose, broken or corroded connections in the cables between the inverter and battery bank.

(2)Check the fuses/breakers in the combiner box.

(3)Verify battery voltage is sufficient to power up the inverter

A2:Everything is hooked up correctly. The sun is shining directly onto the solar panels but no charge is going to the batteries.

Q2:Check the voltage of the battery bank. The battery bank is most likely fully charged and the solar charge controller inside the hybrid inverter has disconnected the solar panels from the battery. The solar charge controller will reconnect the solar panels to the battery bank when it requires charging.

Maintenance

The following maintenance is recommended to ensure optimum performance and longevity of the solar panel:

•Clean the glass surface of the solar panel when necessary. Always use water and a soft sponge or cloth for cleaning. A mild, non-abrasive cleaning agent can be used to remove dirt.

•Check the electrical and mechanical connections every six months to verify that they are clean, secure and undamaged.

•Inspect the solar panels and make sure the surfaces are free from dust, dirt, and other debris; clean with a wet cloth or glass cleaner if necessary.

•Check to make sure all structural components, mechanical fasteners, and electrical connections are secure, clean, and corrosion-free.

•Check and replace damaged components if necessary

Support

For the use of this manual and the conditions or methods of installation, operation, use, and maintenance of photovoltaic (PV) product are beyond ECO-WORTHY's control, ECO-WORTHY does not accept responsibility and expressly disclaims liability for any loss, damage, or expense arising out of or in any way connected with such installation, operation, use or maintenance.

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This product is covered by a 1 year warranty provided by ECO-WORTHY Ltd. We will refund or partial refund or replace any products with defects due to our imprudence.

If you are experiencing technical problems and cannot find a solution in this manual, please contact ECO-WORTHY for further assistance.

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