

Operator's Manual: Solar Charging Station

Uses and Implementation

The items found in the box are designed to be configured into system that will charge small electronic devices. The devices approved to charge include cellphones, laptops, and other small electronics of similar voltage capacities. Provided are six solar panels that will act as a power source, transmitting energy into the different components explained below and creating a usable form of energy. The system as a whole has a capacity to charging between 20 and 35 devices a day and will operate in conjunction with the power grid. As well, the structural system will provide a housing for the system's elements and a covered location to provide outlets for charging.

Prototype

The system is designed to be used in the gable design shown in figure 1 on the right where the solar panels are going to be placed on the roof of the structure which is oriented at 30° and they are going to be bolted to the roof. Also, the combiner box and the DC disconnect are going to be attached to the structure as shown in figure 1 on the left colored blue and red.

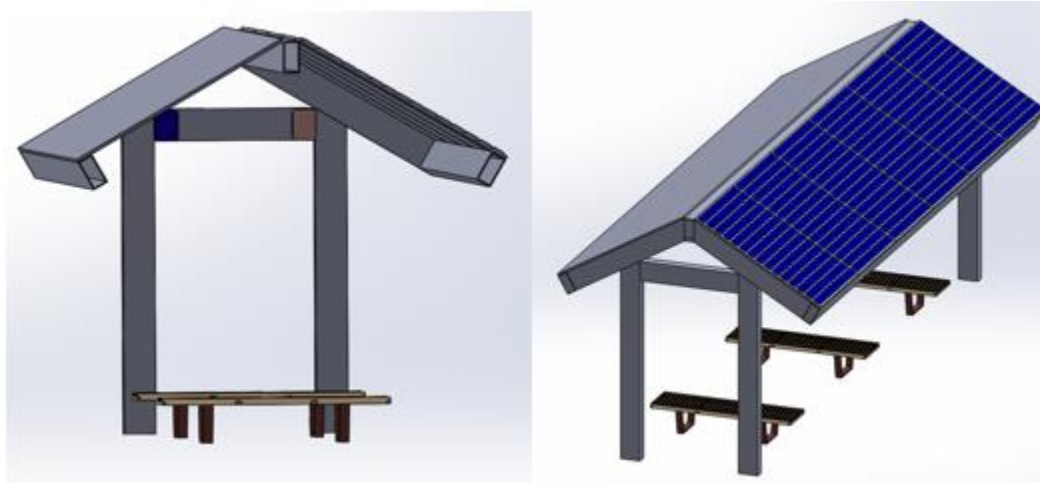


Figure 1- Gable Design Structure

Parts and Specifications

The solar system consists of eleven parts to complete. Each of the required items is listed below in the table in order of how the system will be connected.

Table 1: Parts

Item	Quantity	Specifications
ASE300-DG/50 Solar Panels	6	Produce DC power for the system. 300W, 50V, 12.4% efficiency
Combiner box	1	MidNite solar PV combiner box, protects the system from overcurrent
Fuse holder	1	Required by Arizona code, protects the system from having a power surge
Fuse	1	Required by Arizona code, protects the system from having a power surge, 600V, 30 amp
DC Disconnect	1	This pulls the solar panels off line in case of emergency
Sunny-Boy inverter	1	High frequency inverter, 240 VAC, 2000 Watts, 97% efficiency
Sunny-Beam Display	1	Wireless System monitor with Bluetooth. Displays consumption information for educational purposes.
AC disconnect	1	Square D disconnect switch. 240v ac, NEMA 3R, 2pole, 30 amp
Digital utility meter	1	Bidirectional meter for utility reasons, measures energy consumption in kWh
Square D meter socket	1	The main plug for the system, box for meter
Charging sockets	6	Where students can charge their electronic devices
12AWG double conducting wire	80	Wiring for electrical components of the system

Assembly

Six panels are wired in series, the black wire comes from the first panel is the negative terminal, the red wire comes from the last panel is the positive terminal.

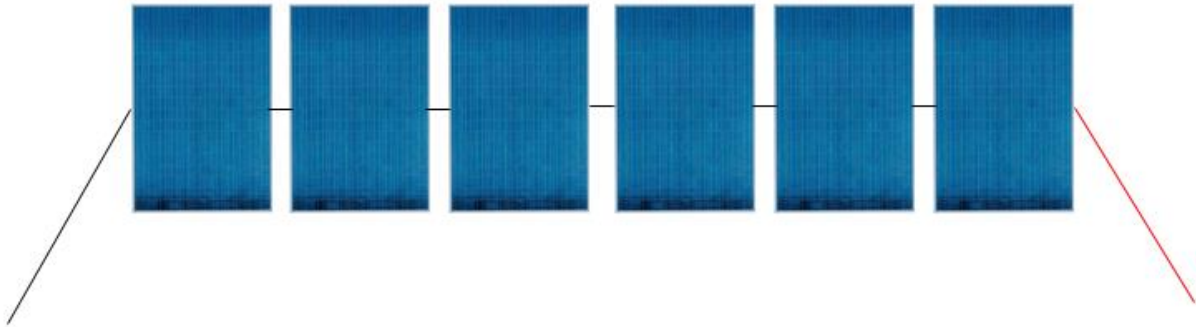


Figure 2: PV panels

The fuse holder and fuse have been preinstalled in the combiner box, the positive PV string goes into the top of the fuse hold and goes out from the bottom of the fuse hold. The negative PV string goes into the low-left corner as shown in Figure 2.



Figure 3: Combiner box

After the combiner box, PV strings are connected to the DC disconnect switch. There are three ports in the DC disconnect, which the PV strings can be connected into any one of them.

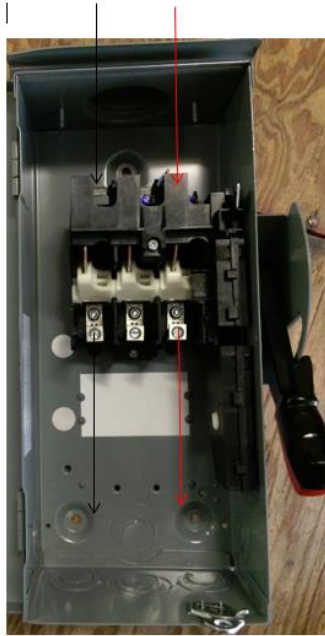


Figure 4: DC disconnect

The inverter has been set up for negative grounding. On the DC side, the negative inverter wire (black wire) of the Sunny Boy to the terminal (B). The positive inverter wire (red wire) of the Sunny Boy to the terminal (C). The negative DC wires of the PV strings will be connect to terminal (A). The positive DC wires of the PV strings will be connect to terminal (D).

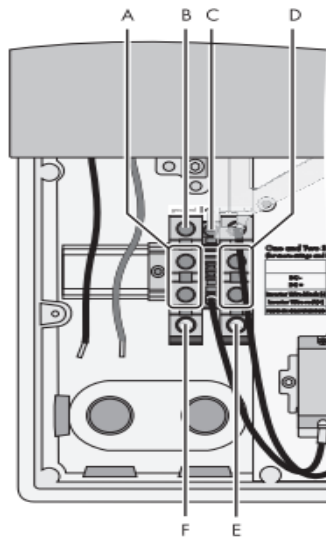


Figure 5: DC side of inverter

On the AC side, connect the N wire (white wire) of the Sunny Boy to the terminal (A). Connect the L1 wire (black wire) of the Sunny Boy to the terminal (B). Connect the L2 wire (red

wire) of the Sunny Boy to the terminal (C). Connect the L1 wire of the power distribution grid to the terminal (E). Connect the L2 wire of the power distribution grid to the terminal (F). Connect the AC equipment ground wire from the power distribution grid to terminals (G).

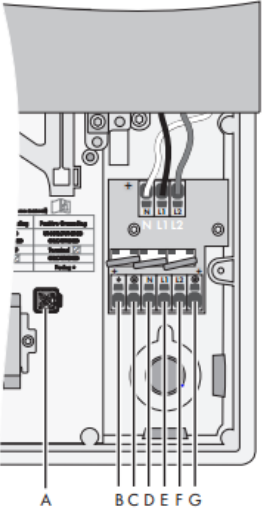


Figure 6: AC side of inverter

After the inverter, the system will be connected to an AC disconnect. The positive and negative go into the ports on top and come out from the bottom as shown in Figure 6.

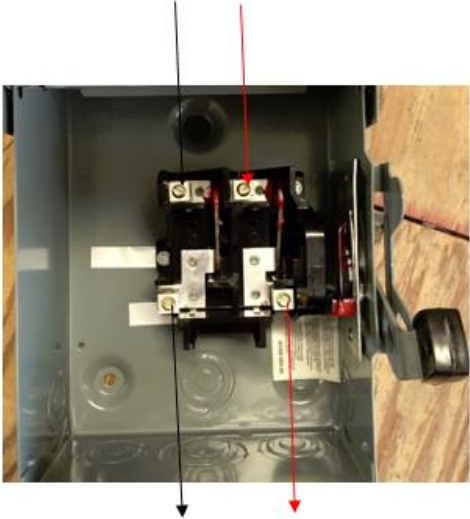


Figure 7: AC disconnect

The wires are then run through the digital monitoring system and into the grid. Next, wires come from the grid, pass through the digital utility meter and then to sockets to charge the electronic devices.

Operation and Safety

The charging station is used in order to charge small electronic devices. The use of the charging station is for any person who has a small electronic device. To use the charging station, plug the power cord for a small electronic into one of the power jacks attached to the charging station.

The charging station uses six solar panels to provide cost efficient power. The panels are wired in series in order to provide an optimal amount of power. It is recommended to have the solar panels covered before performing any kind of maintenance on the charging station. This will prevent the solar panels from producing any power. With the solar panels covered, they cannot produce any power, and this will keep a dangerous amount of electricity from reaching any person who performs maintenance on the solar panels themselves. It is also necessary to shut off the circuit with the dc disconnect switch and the ac disconnect switch before performing any maintenance on the interior system. The combination of these two safety measures help to keep dangerous amounts of electricity from being exposed to a person performing maintenance on the charging station. In the event that there are exposed wires within the system, it is necessary to inform each person around the charging station of the danger in the area. There are dangerous amounts of electricity moving through the wires, and a sign needs to be put up in order to help ensure the safety of every person in the vicinity of the charging station. Stay away from any exposed wires. This should happen until maintenance can be safely and successfully performed on the charging station. Any person using the charging station need to follow these simple rules:

1. Do not hang off of anything in the charging station
2. Do not touch the disconnect switches, inverter, solar panels, or any wires
3. Beware of hazardous weather conditions
4. Beware of falling snow and ice
5. Do not plug in anything other than small electronic devices