

## Solar Power Install for 25' Airstream CCD

My wife and I enjoy boondocking and camping in our Airstream at local, state and national parks that don't typically have hookups. The Group 27 battery in our old motor home would last 4 full days with intermittent use of the furnace in the evenings, however, we found out what most of you know. Modern appliances in our Airstreams have a lot of parasitic electrical demand. We can squeak out 3 days with the two Group 24 batteries and careful use of power but not with frequent use of the furnace. We decided to install a solar charging system so that we could extend our stays somewhat indefinitely.

I chose the 260 watt DC3 RV solar power kit from Solartron Technologies in Victorville, CA. which included:

- Two Kyocera 130 watt photovoltaic (PV) solar panels rated 7.39 amps at 17.6 volts with a 25 year warranty;
- Two US made flat solar module mounting kits with stainless steel mounting hardware;
- A US made BZ Products MPPT250 250 Watt high efficiency Maximum Power Point Tracking charge controller with a 5 year warranty;
- 25 ft of sunlight resistant wiring;
- 25 amp inline photovoltaic fuse and instructions;
- Electrical box with 15 and 30 amp DC circuit breakers (optional).

After confirming the kit was complete located the yellow and green wires pre-installed by Airstream for solar power. The photovoltaic end was terminated in the lower part of the refrigerator space accessed from the outside hatch on the side of the trailer. The battery end was a coil of wire near the 12 volt power bus under and behind the sofa against the front wall of the trailer. The next step was to locate where the charge controller will be installed, in our case on the street side of the shelf between the sofa and the front of the

trailer. Lastly I made detailed measurements to locate where the PV panels will be installed on the roof, between the air conditioner and the rear roof vent.

The width of the PV panels required that I carefully measure and layout where they would be located. I loose fitted one panel on the roof in both planned locations to make sure they would fit between the refrigerator vent on the street side and the awning rail on the curb side. Loose fitting the panel identified several issues that needed to be addressed. The curved roof of the Airstream had to be considered in the installation. The electrical junction box on the back of each panel would almost touch the roof. Secondly the bottom of the mounting brackets did not sit flat on the roof. Lastly the mounting holes in the panel frame didn't line up with the spacing of the ribs or spars in the Airstream roof.

My examination identified one more issue to address. Airstream pre-wires the trailers for about 100 watts of solar power. I was installing two 130 watt panels. The instructions recommended that 6 gauge wire be used for distances of 11 to 20 ft. The existing 10 gauge wire would create some voltage loss at higher current levels and reduce the efficiency of my system, however the equipment in the kit I chose offered a solution.

The BZ Products Charge Controller incorporates "maximum power point tracking" technology or MPPT to maximize power output from the PV panels. The LC130 PV panels produce the most current, 7.4 amps, at 17.6 volts. If the panel were connected directly to the batteries being charged it would operate at the battery voltage, typically 12 to 14 volts depending upon its state of charge. Panel output at battery voltage would be would be higher, 7.8 amps, but total power, volts times amps or watts, would be lower;  $14 \times 7.8 = 109$  vs.  $17.6 \times 7.39 = 130$ . The MPPT uses digital technology to maintain the PV voltage to optimize

total power output. The controller also includes a high speed switching network and inductor to transform the voltage and current to the that of the connected load, typically 12 to 14 volts. In our example charge controller output to the battery would be 9.2 amps at 14 volts and 10.8 amps at 12 volts, both higher than the 7.8 amps that would have been delivered if the battery was connected directly to the PV panel. The most recent MPPT designs can transform even higher mismatches in voltage with little loss of efficiency, 24, 50 and even 100 volts to 12 or 24 volts! This feature is very useful in large fixed solar installations such as a business or home. I decided to use it to my advantage in dealing with the 10 gauge wire in the Airstream.

I wired my PV panels in series as a nominal 24 volt system; current flow or amps at 24 volts would be reduced 50% compared to a 12 volt system, resulting in less voltage drop through the 10 gauge wiring. The higher voltage of the PV panels operating in series would also help in low light conditions where output of a parallel system might be too low to charge the batteries.

With the basic design concept complete I installed the brackets, electrical wiring, both PV panels and charge controller. The last task was to allow the panels to fully charge the batteries, check the temperature and set the float voltage to the battery manufacturers specifications.

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For an unabridged version please see the Sierra Nevada Unit web site, <http://sierranevadaairstreams.org/owners-guide/maintaining/energy-power/solar-kd6uvt/>

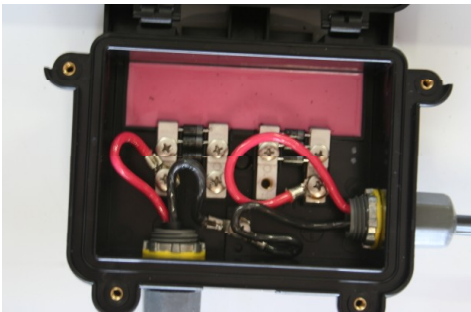
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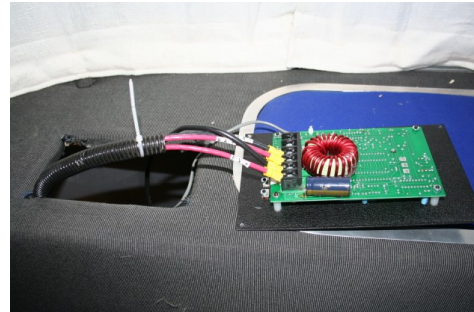
1: PV Panel with Wiring (Note Relocated Lower Mounts)



2: PV Panel Wire Through Refrigerator Roof Vent



3: Street Side Junction Box & Series Wiring



4: Wiring Harness at MPPT Charge Controller



5: Lower Refrigerator Access Opening (Note Wiring Tag Labeled 24 Volts)



6: System Installed and Float Voltage Set (Note Wiring Tag Labeled 24 Volts)



7: Street Side Installation



8: Completed Installation