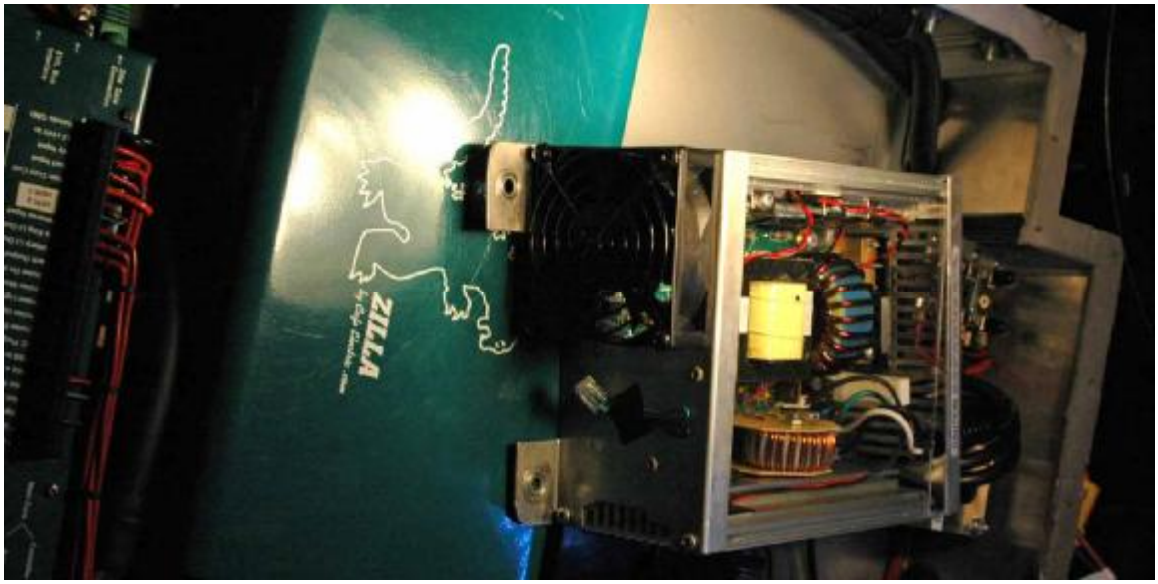
The Volt Vette Project

Chapter 41

Building a DC-DC Converter

I must say that when I started this project I never thought the DC to DC converter would be one of my biggest headaches!
But, as you have already learned from earlier chapters, a 45 amp converter could not hold up to the ever increasing loads I demanded of it.

A more normal conversion would not have power windows, power seats, power mirrors, power steering, and an electric air conditioner. If you don't have those things, then 45 amps worth of 12 volt power might see you through.



Lee and Dave put a lot of work into beefing up the Iota converter. But there was no way around it, I NEEDED more power!

Lee picked up a used American-made Vicor converter that could do the job if it was modified in just the right way.

The easy way would be to obtain 8 matching power modules. If they were all 10 amps at 14 volts and wired in parallel, I would have a nice 80 amp converter that could take in156 volts DC and output 14 volts. (I was told you need 14 volts to charge up a 12 volt battery.) (I learn new things every day.)

The engineers at Vicor think that the Volt Vette should use their newer, compact power modules. I look into it, and I like what I see, but the new design modules are too expensive for my budget.

I also learn that my modules are either “drivers” or “boosters”. If

you have nothing but boosters, you are screwed. The Vicor needs at least one driver or it won't work. Think of a train. A train made up of only boxcars is not going anywhere, whereas a train made up of locomotives...

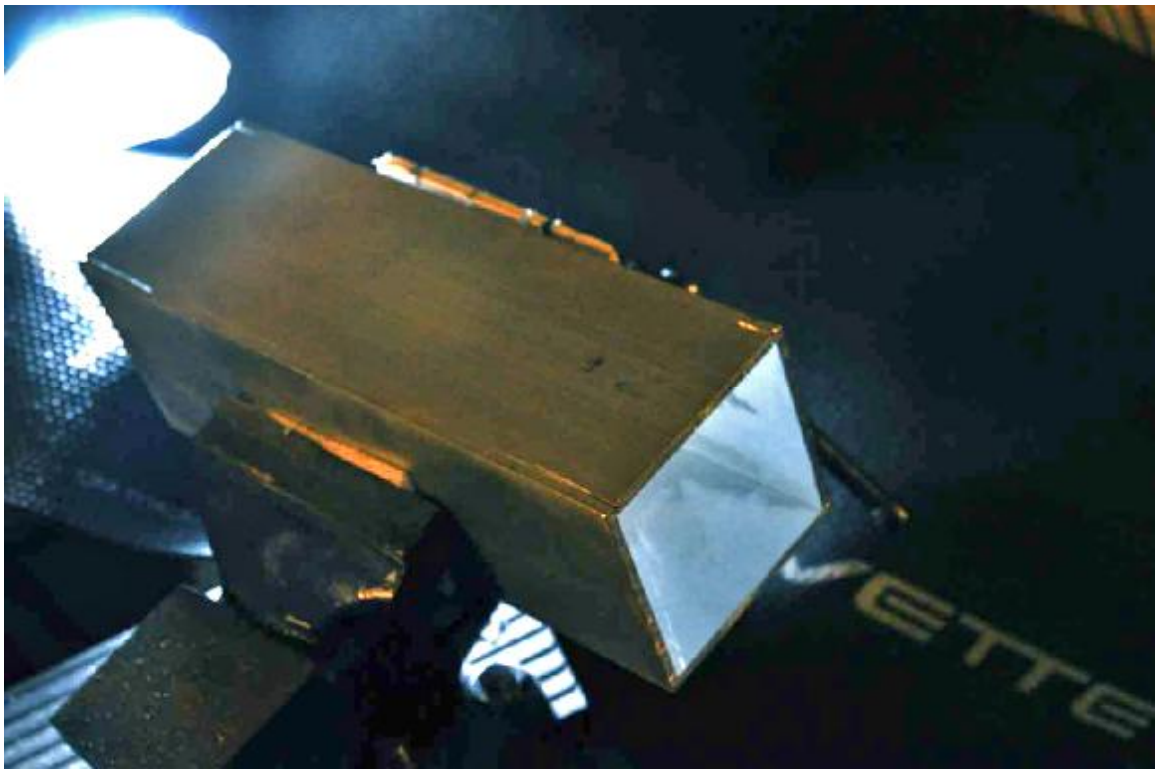
I discover I have nothing but driver modules.

Chris Simon, who holds the title of Conversion Specialist in the club, goes to the Vicor website and finds a page that tells how to turn a driver into a booster. This is very good news. Chris now knows how to make do with the modules we have.

But first, I need to find a way to mount, and a place to mount, the converter. Not Easy—there is no room in the electronics box!

After thinking it over for about 6 weeks, I come up with a not quite wonderful plan.

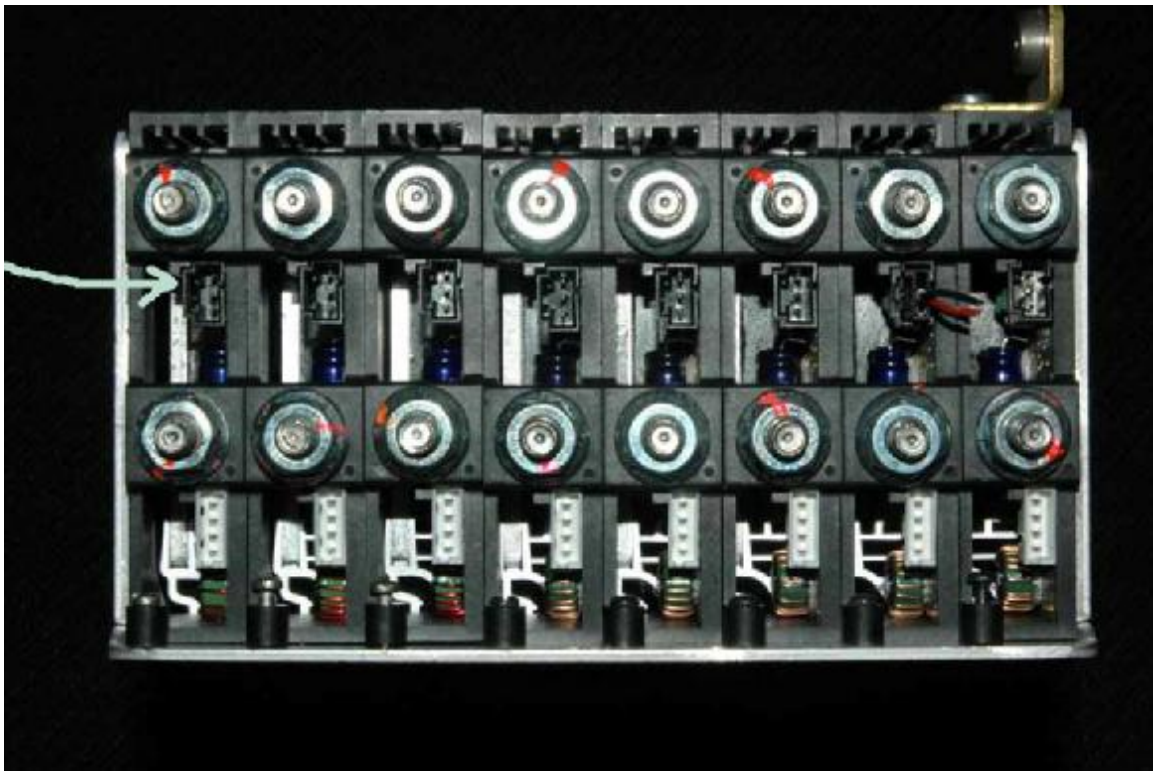
At the local steel yard, I find a piece of box channel aluminum.



Back in my garage, I cut away one side. The Vicor fits smoothly into the now-U-shaped bracket.

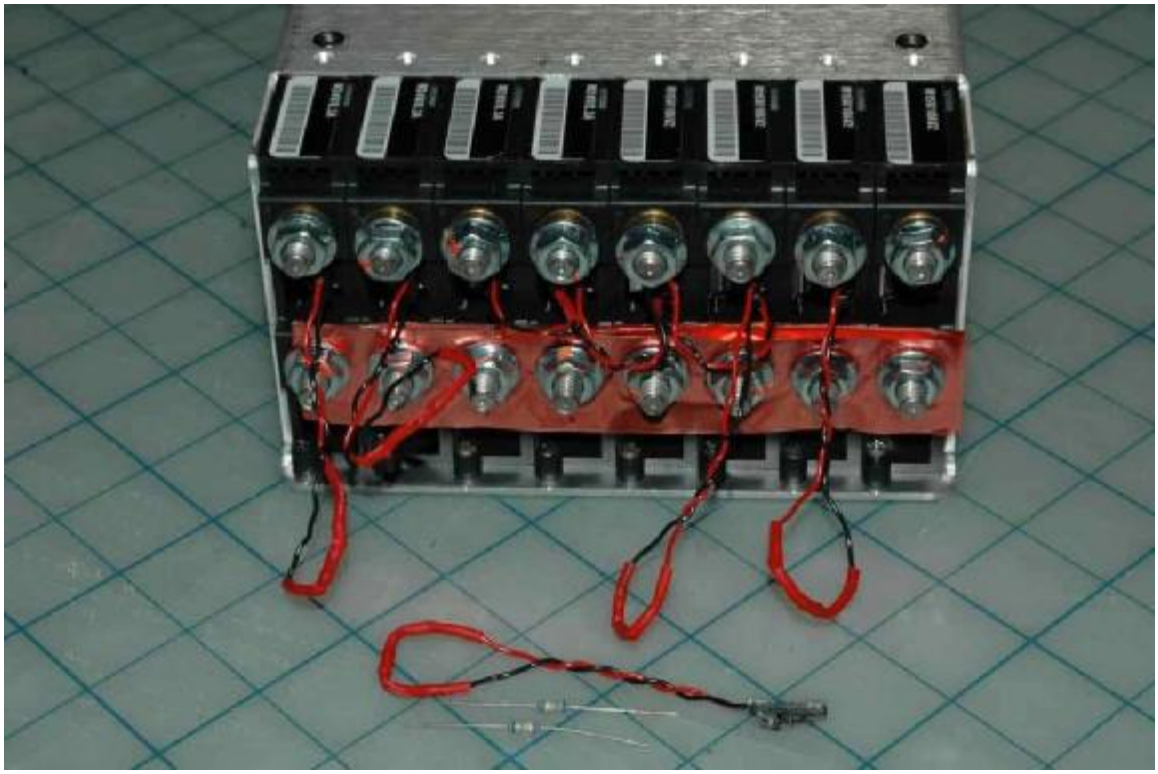
This bracket is then bolted to the top of the passenger side rear wheel well.

I buy the parts Chris tells me we will need to modify the converter.

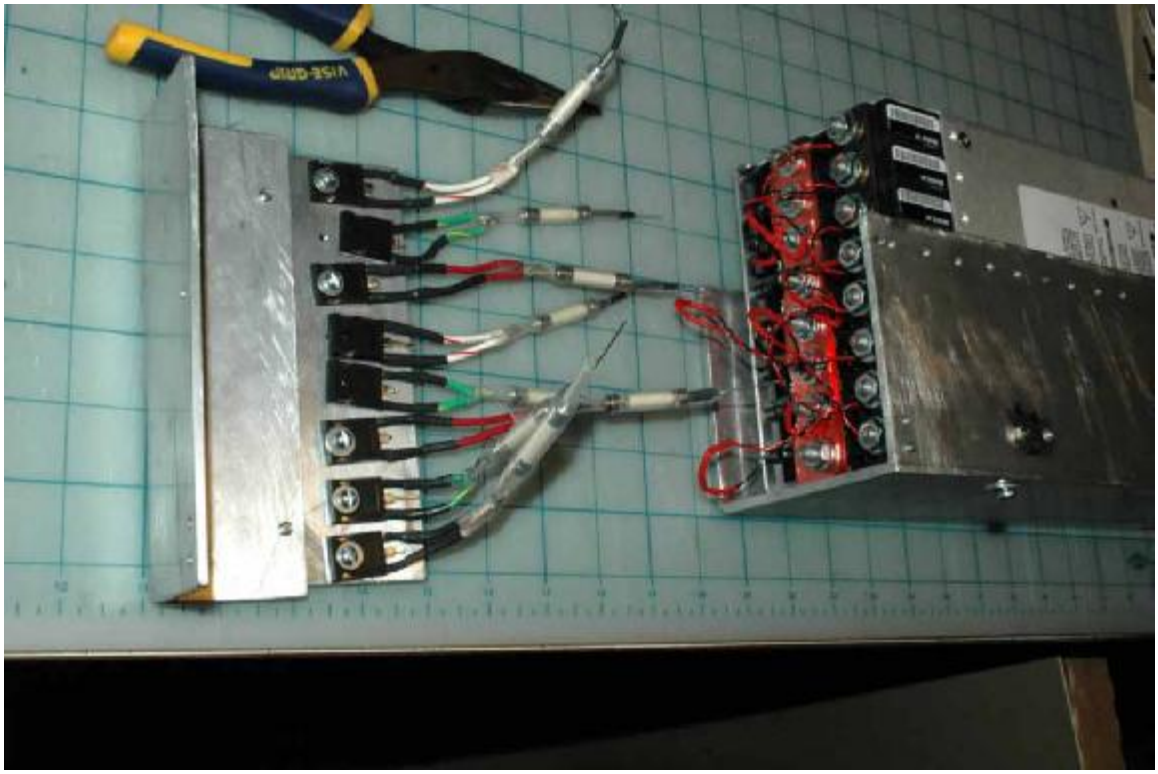


Each power module will need a tiny resistor plugged into a tiny socket, found at the output end of the Vicor. (see photo above)

In this photo you can see just how small the resistors are. The color bands form a code that tells an electrical engineer what kind of resistor he or she is dealing with.



Chris puts together all the plugs and resistors and covers the resistors with heat shrink tubing.
I take some copper foil, cut it into strips, and make holes in them with a paper punch. Next, I stack the 6 strips to form a buss bar and bolt them to the modules. This will make the power modules run in parallel to each other.



Chris has me add diodes and fuses. I also use heat shrink tubing to keep bare wires from shorting out. The diodes are all bolted to a metal plate, which acts as a heat sink, keeping the diodes from getting too hot.

The trimmed down converter tested well while sitting on the workbench. The Vicor put out a steady 14 volts, just what we wanted to power the many 12 volt systems!

But, when I wired the Vicor into the vette electrical system the converter produced zero volts.
I couldn't find anything amiss, so I turned everything off, disconnected the wires to the accessory battery, and called it a night. Just before going to bed, I looked in on the car.

What a shock! The heater fan was going full blast, the air conditioning fans were running, and on the dash, both turn indicator lights were on! Despair! And more despair!

I look under the hood. The wires from the 12 volt battery were touching some bare metal. From what little I know about electricity, the battery should have shorted out in a display of bright fireworks.
There should be a big bad black mark where the wires touched the metal. The battery should be door-nail dead and nothing should be running.

I lift the wires from the bare metal, the 3 motors switch off, and the lights slowly grow dim. Looking carefully at the metal, I can find no burn marks and the battery looks OK.

My head hurts and I do not sleep well.

I fear I have killed the Volt Vette. After putting everything back the way it was before I installed the Vicor, I discover the car is still acting crazy.

I need help, really bad!

Chris Simon comes by. He thinks the first thing to do is to make certain everything is well grounded.
I thought I had the Vicor grounded to the car frame, but Chris discovers it is not. Chris also thought I had mounted the diodes incorrectly.

I had mounted the metal diode plate to the Vicor metal bracket. Chris told me to rebuild the converter in such a way that the diode plate would be properly grounded, but without any metal to metal contact with the Vicor.

I cut a piece of clear plastic and attach the diode plate to it. Then I made certain that the plate was well grounded.

The Volt Vette acts a little less crazy, but is still undriveable.

The next day, Rolf takes a crack at it. He agrees with Chris that everything should be grounded before digging any deeper.

Rolf starts by taking the old DC-DC back out of the car, and wiring the Vicor back in. Then, he discovers the electronics box is no longer grounded. Once Rolf has the box grounded, the Volt Vette springs back to life. It must be magic because I can see no logical reason why a ground wire would cure so many problems!

But it's not ours to reason why.

After driving a hundred miles, the Vicor converter is still keeping the accessory battery fully charged and all the 12 volt systems happy.

Finally!

I replace the carpeting around the wheel well and add a finger guard to the Vicor for extra safety.

Now I can get back to building the digital dash.