Bob's Tech Tip

Random electronic failures plagued the jet boat. No amount of wire fault tracing disclosed the culprit. So work-a-rounds employing relays and new wiring made instruments, lights and pumps function.

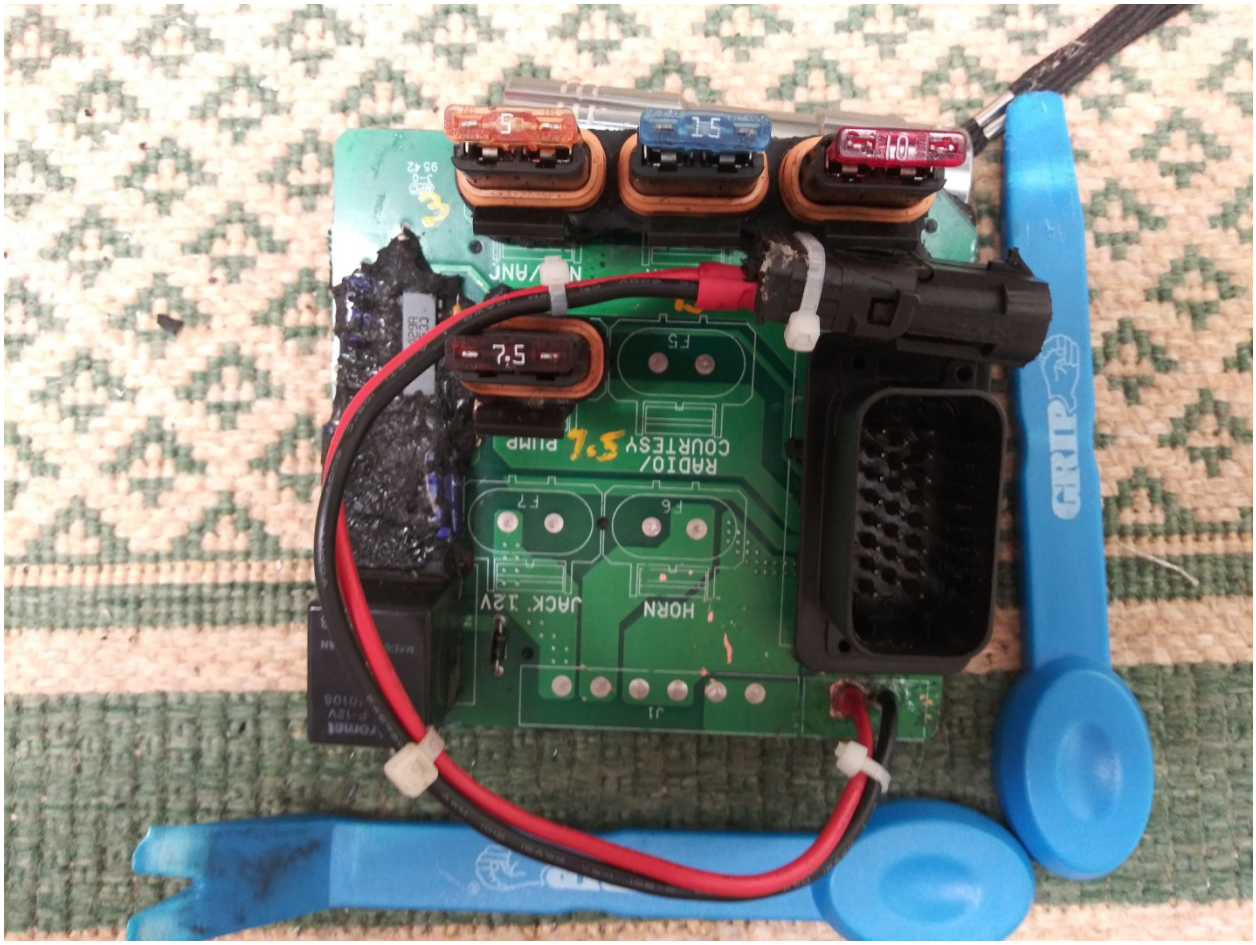
Last week, out on the lake, all electronics quit. Fortunately, the ignition is powered by a separate magneto which enabled me to return safely to the dock. At the shop, I began to wiggle wires and smoke scented burning circuit board wafted from the hatch. I cut the master power switch and found the source, a control circuit board in a tray covered with a thick coat of epoxy to protect against moisture. The technical term is "potting"; a process of filling an electronic assembly with epoxy to protect against moisture and corrosive agents. See the example below.

Potted assemblies are common in cars and tend to be located beneath the hood or in the trunk. Mechanics will replace a failed potted board, but if you are working on a restoration or vintage daily driver or flood damaged vehicle, your only choice may be to find a good used board, repair the board or junk the vehicle.

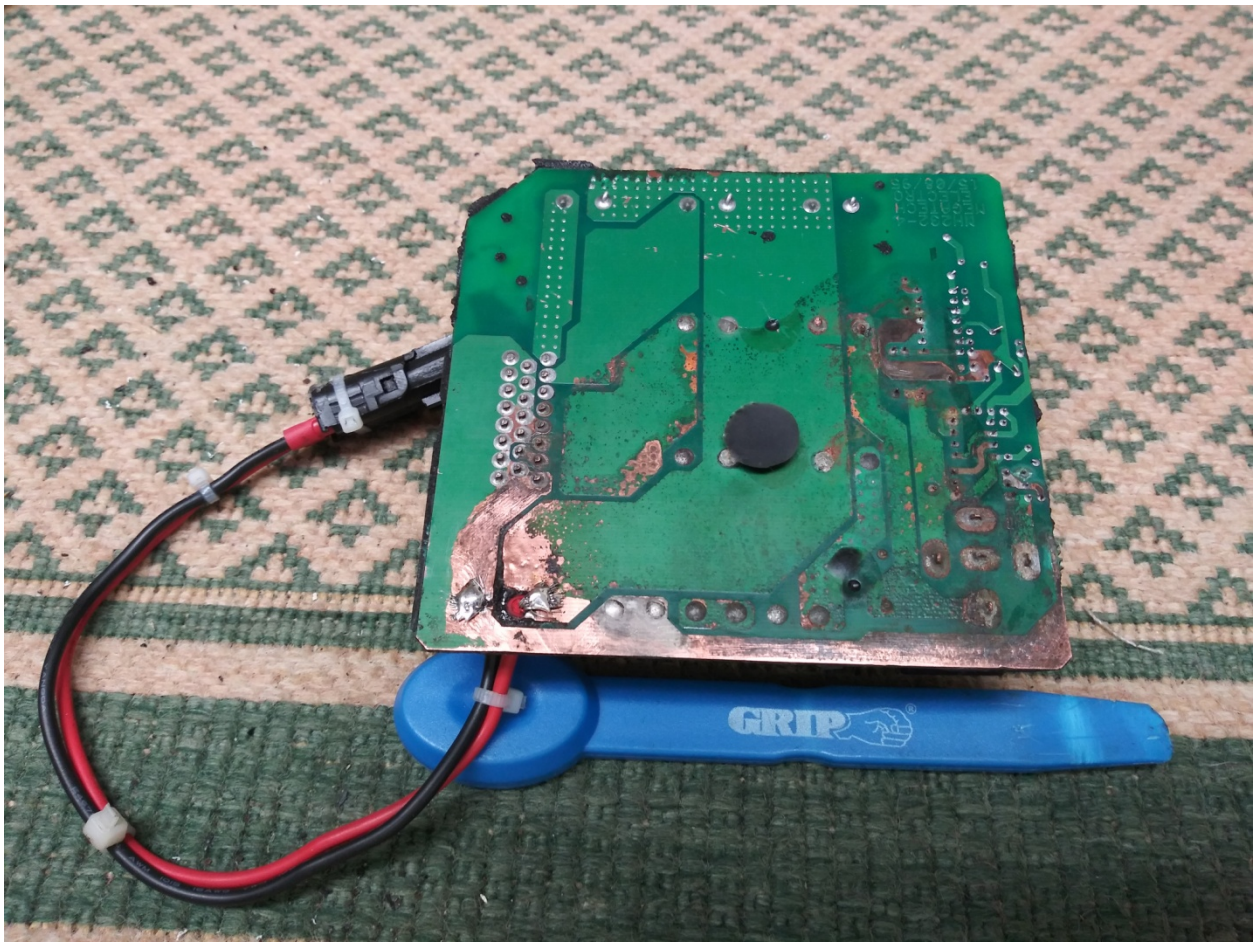
In this situation, I thought I'd order another board. I pulled the part number from the unit and performed a quick Internet search. New replacements were unavailable; Mr. EBay could provide a used board for $895 from a vendor who did not accept returns. Hum!

Options: (1) pay the $895, (2) junk the boat (c) build a control board with a bunch of relays, or (d) fix it. I chose "d", because anyone can throw money at a problem and doing so violates my principals.

Previous experience with potted circuit boards taught that epoxy covering a hot board becomes soft. To soften the epoxy, I could use a heat gun; but controlling the heat to prevent solder melt is difficult. I opted to place the board in a water filled pan which was brought to a boil. Then, I lifted the circuit board out and used plastic trim tools to gingerly separate the epoxy from the board. Hard metal pry tools will cut traces and create "real" problems. The board was immersed several times for reheating because the epoxy hardens as it cools. Work quickly and carefully. Why immersing in boiling water, because boiling point of water is below the melt point of solder. I did not want to create more problems by making a difficult task impossible.



The board separated from the tray easily. I observed water infiltrated the potting tray along the vertical edges in cracks between the tray and the epoxy. Moisture worked its way beneath the board and corroded solder joints, compromised traces, breaking circuits and the resulting corrosion caused a short, which burned the board.



In above picture, the microprocessor controller is on right side and power is inserted at the lower left corner. I cleaned the traces, repaired damage, installed a power pigtail and tested all solder joints for continuity. I was fortunate the microprocessor was not compromised. If it had been, another could be ordered by placing its part number, located on the upper surface, on the Internet. I did this, and found them available along with a schematic showing the companion components.

It was not necessary to remove the epoxy covering the microprocessor and companion components to repair the circuit board, choosing to leave well enough alone.

My proofreader inquired, "How does one repair a trace?" I replied, "Not with solder, but with conductive copper paint applied directly to the clean exposed ends of the copper trace. Use any low resistance conductive paint. I apply conductive paint with a toothpick.

The repaired circuit board awaits installation. I plan to seal the bottom with a clear spray urethane; then, place the board in the tray and seal it by placing a bead of silicone along the edge of the circuit board and the tray.

The tray must be prepared to receive the circuit board. It is imperative to have an air gap between the bottom of the circuit board and the tray to prevent any intruded moisture from touching the board and shorting out any circuits. I placed a retired Volvo "O-ring" oil filter gasket on the tray and set the circuit board on top.

It took two hours to de-pot and repair the circuit board; time well spent and money saved.

Bob lives in Cary, NC and is co-chairman of the Blue Ridge Chapter of VCOA. Contact him at rfsepe@gmail.com or 919-417-5019. He'll respond to questions about Volvo concerns.