A day in the life of Project Fuso

One of my big design goofs on the rig was not preparing it for sub-freezing temperatures.

You can attribute this gaffe to living in San Diego, home of perfect weather, for six years, or simply to stupidity. But in either case, there I was.

It wasn't the whole rig that was the problem, or the camper. The camper is actually very well insulated and ready for cold weather, as you'd expect from something made in Canada.

The problem was I had designed a super trick raw water system to pull creek/pond/well water onto the truck, and process it with UV light and filters to make it safe to drink. But in all that design work: 45 gallon raw water tank, raw water pump, raw water filter, transfer tank, UV germ-killer filter, sub-micron filter, etc. one thing I forgot to include was the ability to drive, park, traverse, etc. anywhere that happened to be colder than 32F / 0C.

While it's nice to imagine a few years of exploring only areas that are warm and bucolic, that's exactly what it would be, a fantasy.

So there I was, deep into the construction of this rig and realized I needed to find a way to keep the raw water system from freezing up. And I needed to do it pronto.

I quickly located a heater mat that I could affix to the raw water tank itself, so I added a DC circuit, cable, connections, etc. for that. That was the easy part.

Next, I needed to keep the raw water compartment, with its pump, hoses, valves, filter, etc. from freezing up. This was much more challenging. But, I put it out there, and the universe provided the answers.

While brainstorming the problem with Jon one night in the shop I told him that what I needed was some way to circulate the water, so just like back home on the really hard, deep freeze spells of mid-winter when we'd keep the faucets dripping all night to keep the pipes from freezing, I could use the water itself to provide freeze protection. What I needed, I said, was some kind of timer that I could use to cycle the raw water pump on, to circulate the now-warmed-with-the-heater-water in the raw tank back through the pump & hoses, etc. Jon didn't know of anything, but said he'd keep his eyes open.

One day while I was running down parts I asked the guys at the electronics supply house if they had heard of any kind of timer that I could use to trigger a relay to drive a DC pump. "Just happen to have something like that," the guy replied. He walked me over to a corner of the store where a bunch of really interesting stuff for electronic cabinets was on display. The products were all designed for remote equipment cabinets such as cell tower relays and remote radio tower sites, etc.

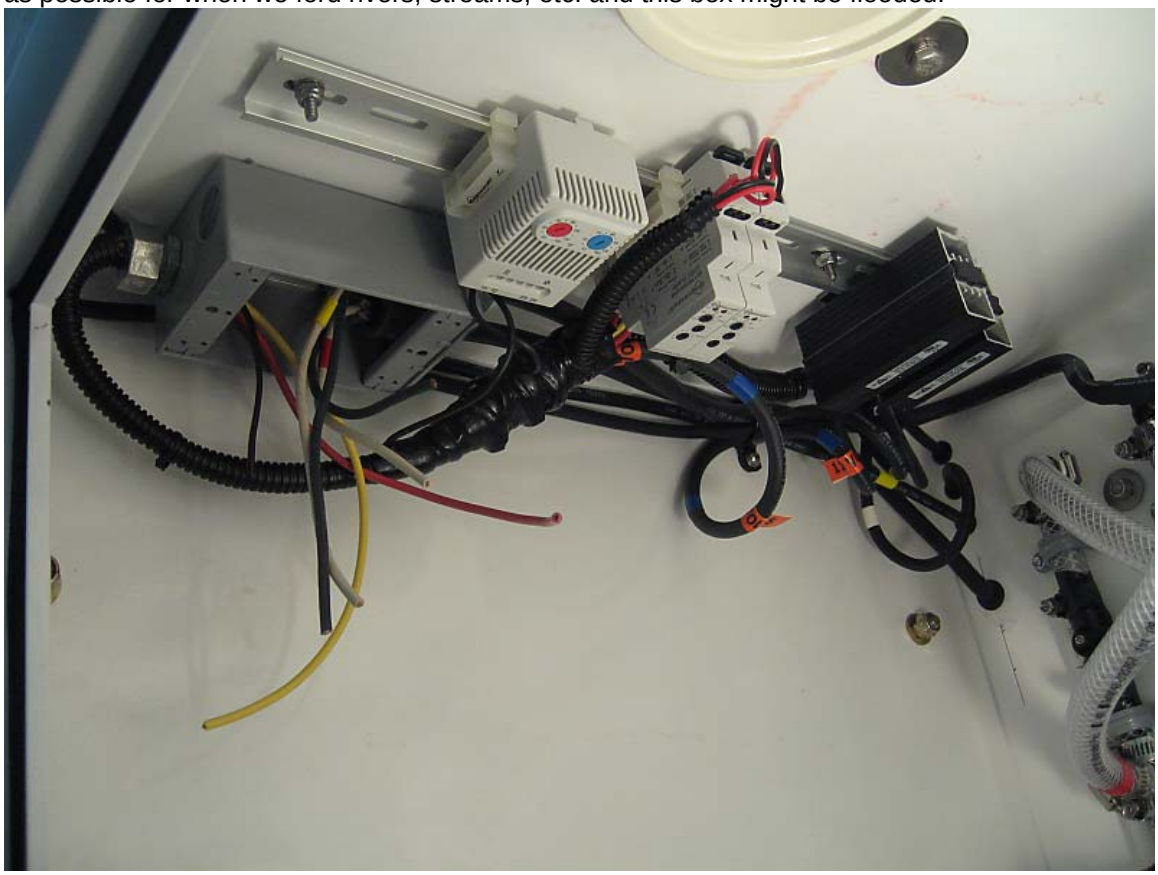
Among those parts I found what I was looking for, gathered it up and took it back to the shop.

Today, after what seemed like a month building the electrical systems compartment, I finally got back to the raw water compartment to mount and hook up the nifty keep-the-box-warm stuff.

First, I test mounted the DIN rail that everything attaches to.

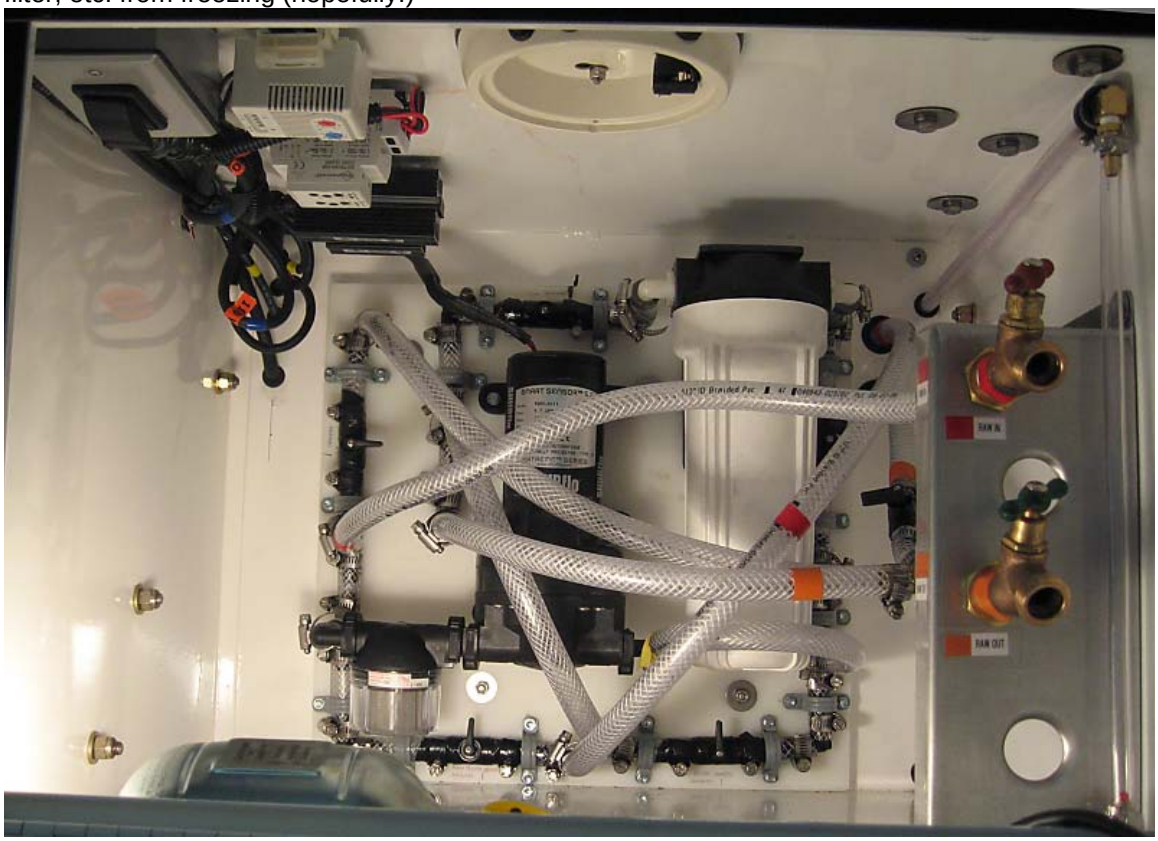
Then I bench built the system onto the DIN rail

Next, I mounted the system in the raw water box. I put it on the top of the box to keep it as high as possible for when we ford rivers, streams, etc. and this box might be flooded.



Finally, I wired up the system and installed the switch.

That yielded a raw water compartment that can keep itself warm and the water, hoses, pump, filter, etc. from freezing (hopefully!)

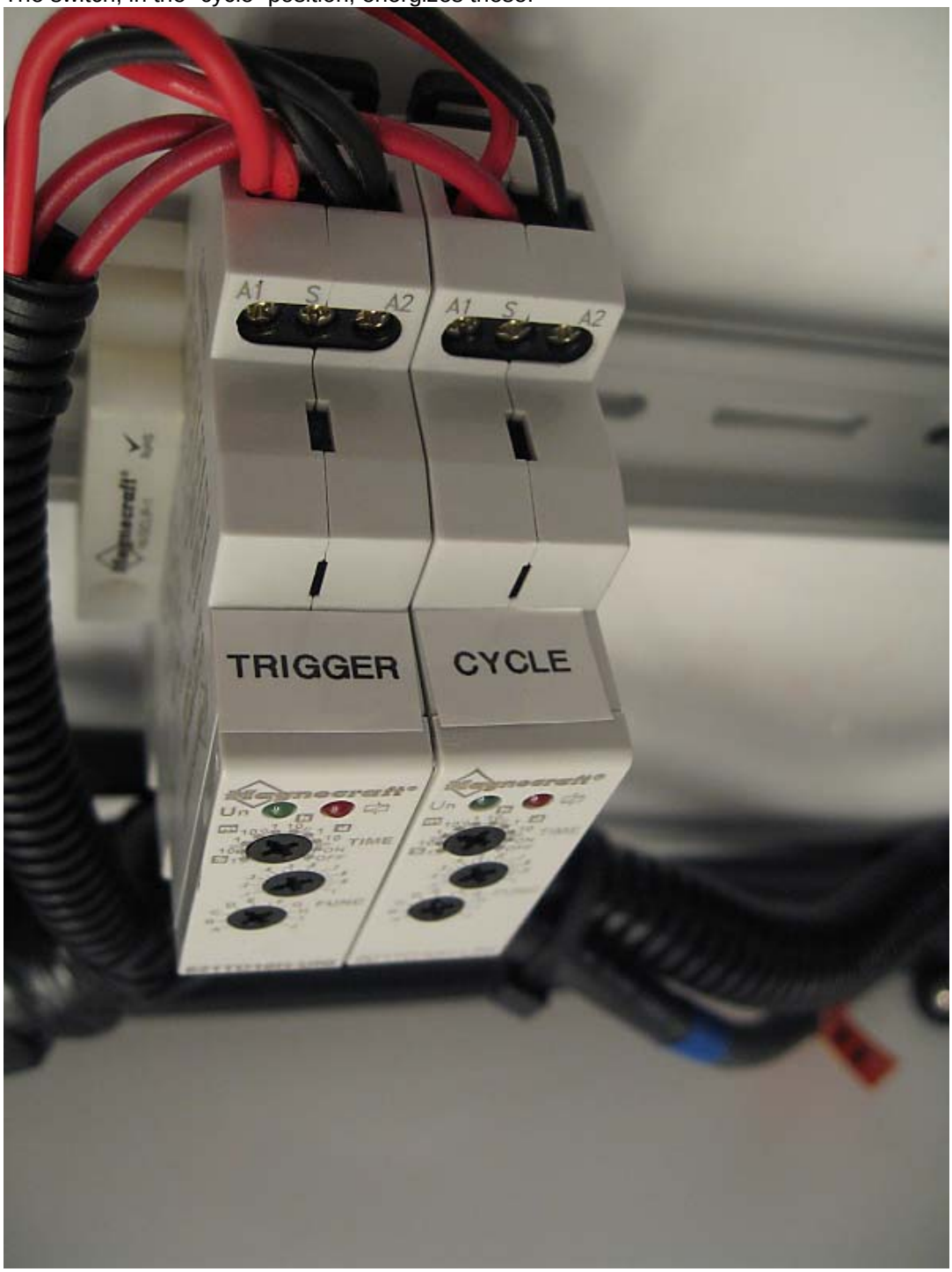


So, what are these components, you might ask.

First, the switch that controls the raw water pump in a weatherproof box with a waterproof switch.

But that certainly isn't very sexy. Not even really techie.

The switch, in the "cycle" position, energizes these.



They are two Magnecraft timer-relays. The left one is the trigger. Every time its trigger timer runs out, it generates a latch pulse that starts the timer on the cycle timer. When the cycle timer sees the trigger pulse voltage, its relay closes and runs the raw water pump for its selected time.

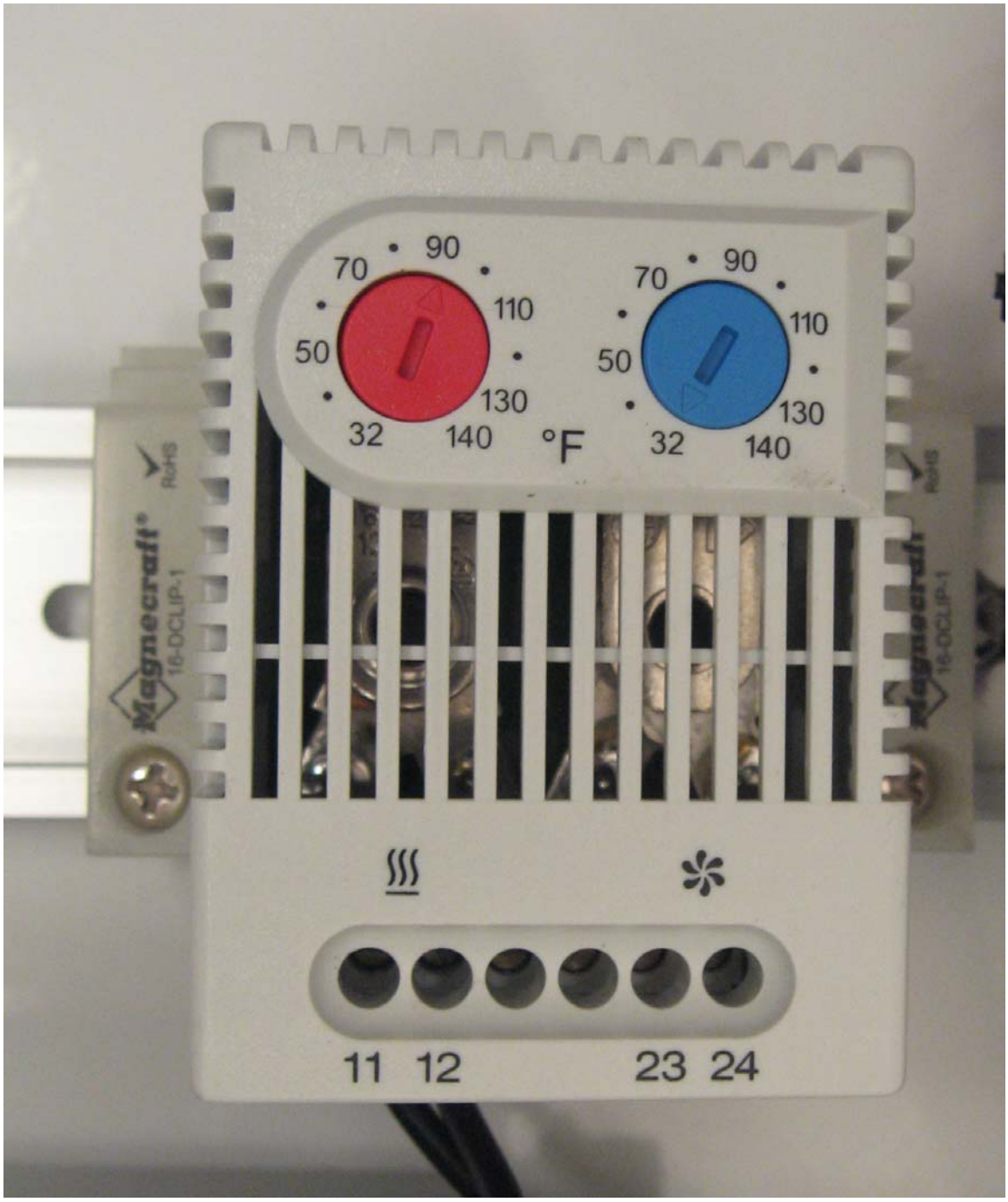
The timer-relays are programmed with this interface.

Just to keep things interesting, Magnecraft changed the function program definitions between the time the one on the left was built and the one on the right was delivered, so I had to interpret two different sets of functions and profiles to get this set up.

I've currently got it set for one minute of pump operation every ten minutes. We'll have to wait until we get into freezing weather to see if that will be adequate.

That system all runs on 12VDC. Everything else runs on 120VAC.

Starting with the thermostat, which doesn't really run on any voltage, it just latches closed a contact if the temp exceeds or drops below the relevant setting.



When it does, it energizes these two heaters.

The bigger one uses 30 watts at 120VAC, the smaller one 20 watts.

You're probably thinking the same thing I was, "50 watts! How can you heat a box that big with only 50 watts?" That's how I ended up with 50. I started with the 20 watt unit and ordered the additional 30 when I couldn't sleep at night.

Resistive, radiant heat is an interesting thing. In a small enclosure, a small amount of radiant heat can make a huge difference. That's why one survival tactic in cold is to keep your dome light turned on when you periodically run your engine. Even the tiny 20 watt or smaller bulb in your dome light can make a difference in a space the size of your car interior.

Don't believe it?

Then check this out.

221 degrees Fahrenheit is pretty darn hot. And that temp reading is not of a kiln or a blast furnace.

It’s of those two little heaters.

I think once I add the insulation to the box, we’ll be OK.

Isn’t technology wonderful?

