

cTOPconsult, July 2013, blog-post

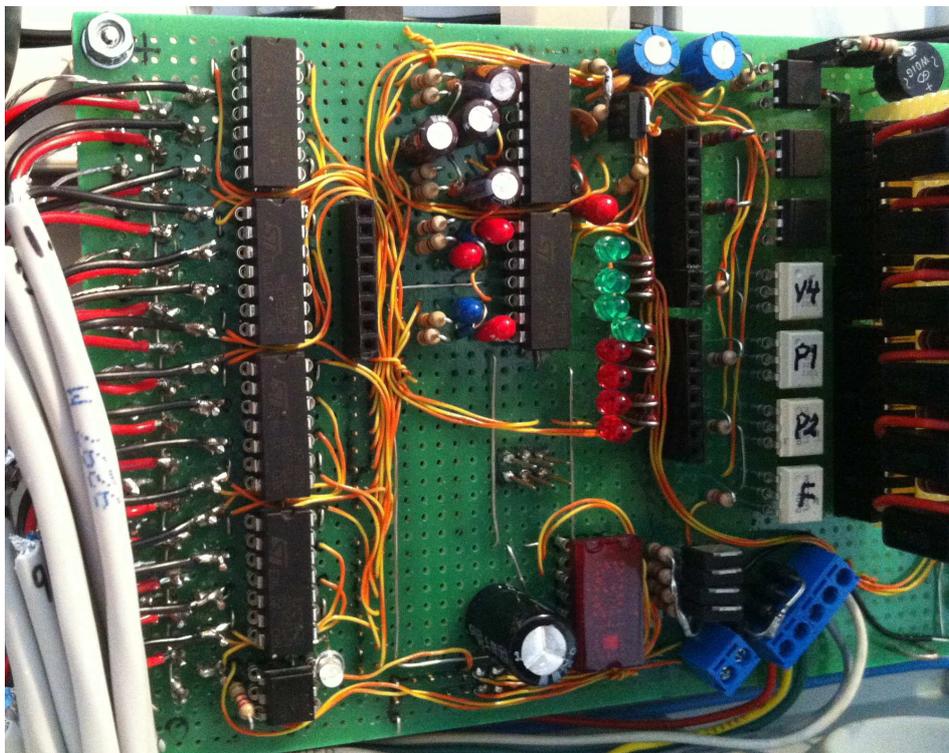
The Purix Controller, Prototype 2

The second prototype controller I made for Purix was finished in March 2013. One of the main goals for Purix is to keep costs down on ALL components, which also include pumps, valves and fan. In february, march we still did not see a clear picture of what components would be available, so we decided for a design with high flexibility especially on the types of outputs: On/off, direct PWM, Phase, 24 VDC, 230 VAC, 0-10 V analog or PWM. The main hardware design was basically the same as for the first prototype, but with these extra new features:

- Four more temperature inputs, now 16 in total.
- A set of four MOS outputs for stepper motor controlled expansion valve.
- Two galvanic isolated TRIAC outputs for direct on-off control of 230 VAC valve coils.
- Single digit program step display.
- Four galvanic isolated TRIAC outputs for analog phase control of 230 VAC pumps and fan.
- One galvanic isolated input for synchronization of the phase control outputs with the 50 Hz mains.
- Analog circuitry for phase synchronization that does not involve Arduino interrupts

All six TRIACs with snubber circuits were placed on a separate board, and this time the Arduino was placed below the shield. The on-board 8 VDC regulator used on the first prototype was omitted, but the high current MOS drivers for direct PWM drive of 24 VDC pumps were kept (4 instead of 6).

Here is a picture of the second prototype, where the Arduino Mega is (not visible) under the shield. The output TRIAC-board is to the right in the picture, and the 16 temperature inputs to the left:



On the software side the following were added:

- A specially designed stepper motor control routine, which will turn off coil current when position is reached (to reduce power consumption). Auto calibration at start-up and a smart interface to PID regulators included.
- Routine for automatic calibration of the analog phase synchronization.
- Small display routine for program step identification. Only indented for testing.
- Routine for scaling, inverting an offsetting any output.
- Several new process control commands for the serial communication.
- One decimal added to temperature logging values.

We installed the second prototype on the Purix in Bari in March. Most things worked according to plan, except for the phase control of the fan. We had a lot of noise problems, and the EMF-filter between the mains input and the TRIAC was burned off. We never came to any conclusions to what the problems were really about because the lack of time. Instead we bought at separate module for PWM-to-TRIAC-phase control. This did not work very well either, and will in the long run be a too expensive solution. Instead we have come up with a better and completely different idea that I will explain in my next blog post about the development of the Purix controller.

I have not given up on my idea about analog circuitry for phase synchronization not involving Arduino interrupts, and I will try to develop this further for other purposes.

Here is the installation box, with additional power supplies and noise filter:

