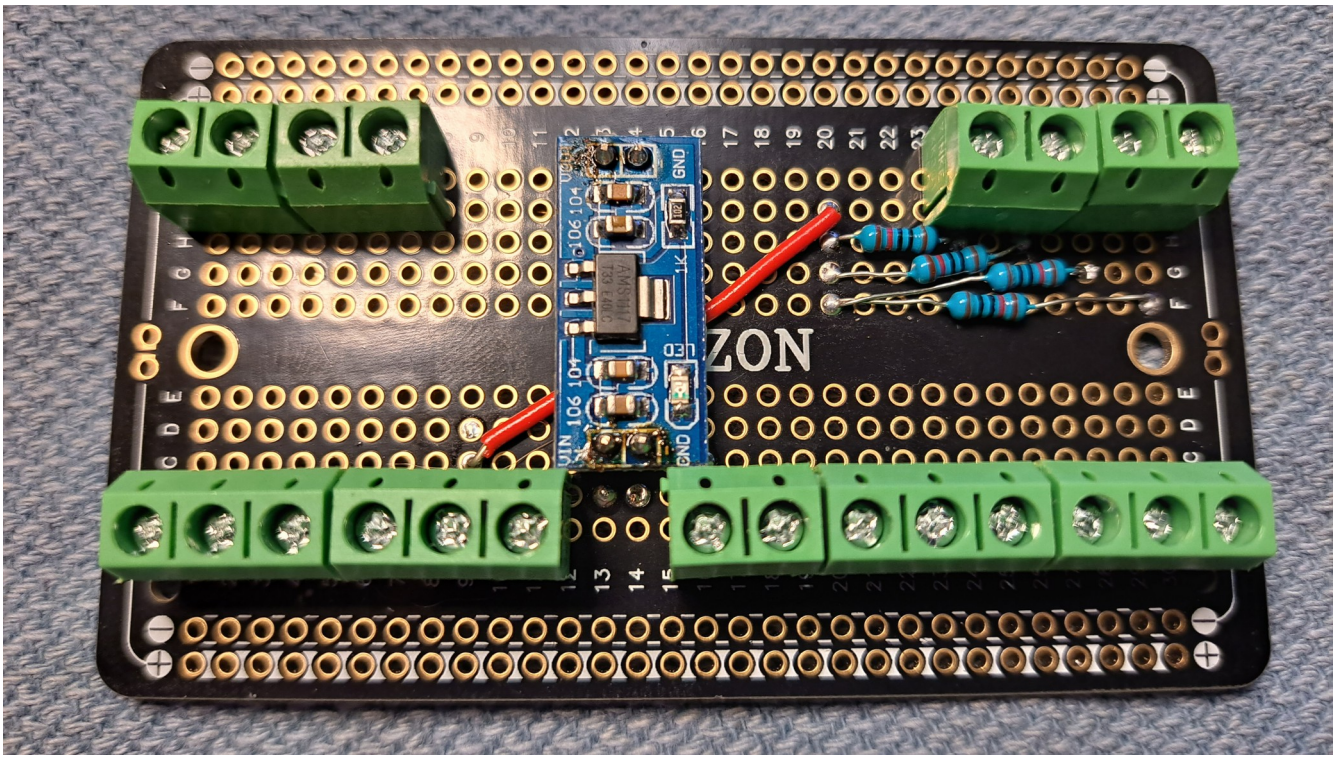
I almost always base my projects on PCB clones of breadboards to make planning easier. In rare cases, I will use plain old point-to-point boards if it doesn't involve a lot of jumper connections. Here's a link to the boards I used in the photos.

https://www.amazon.com/gp/product/B0BP28GYTV/

There are four PCBs that require soldering and that's the power break out board (pictured above), the valve control board, the heating stepper control board, and the interface board. Luckily, none of them involve anything real complicated.

Power Break Out Board



The power break out board receives 5 volts from the buck regulator provides a set of power distribution terminals. Six for 5 volts, four for 3.3 volts, eight grounds, and set of four pull up resistors for the GPIO pins to the servo valve limit switches.

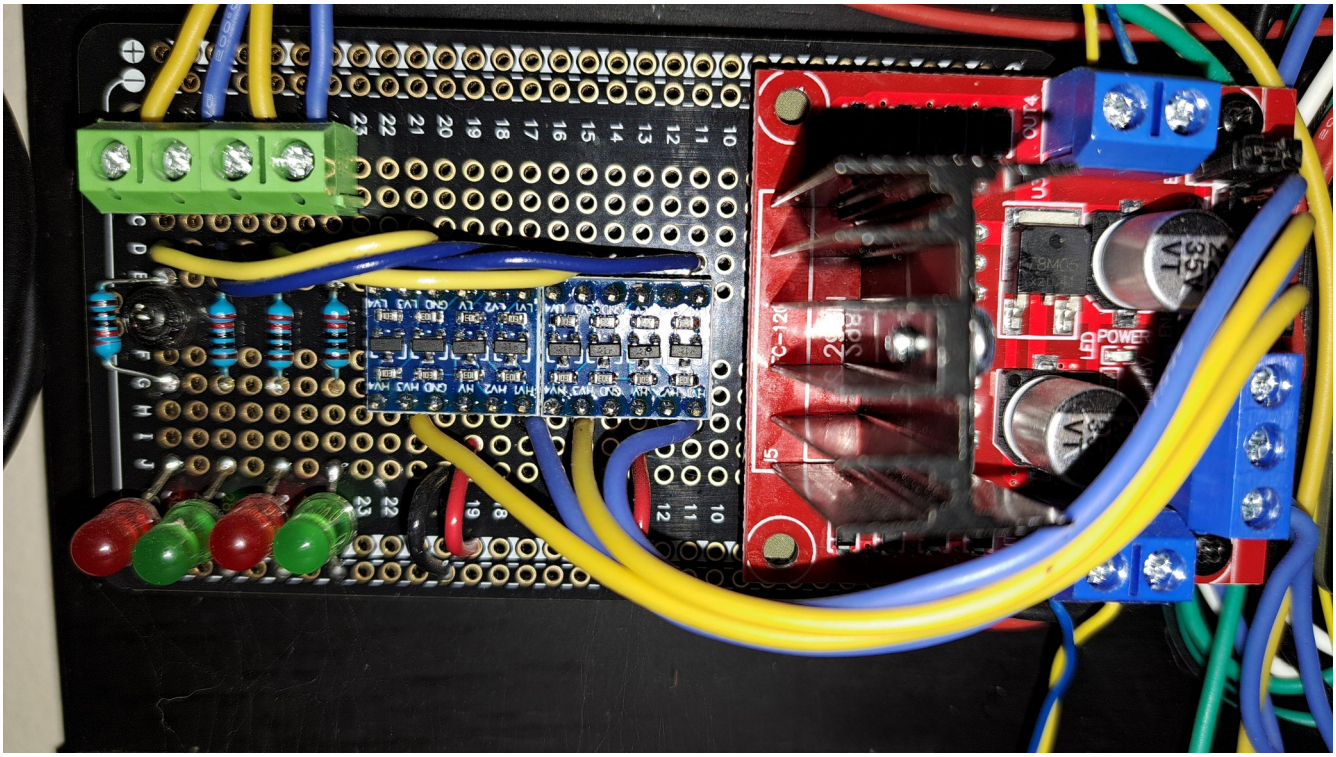
The pull up resistors are 10K and feed from the 5 volt supply. The 3.3 volt supply was an after thought, or I would have fed 4.7K resistors from there.

The little blue board in the middle is an AMS1117 3.3 volt 800 mA regulator that feeds from the 5 volt supply and outputs to the four terminals in the upper left. Below is a link to these regulators.

https://www.amazon.com/gp/product/B074FDLCLB/

Thus far, I am only using the 3.3 volt supply to power the heating stepper motor control board and a small speaker that I use for the Raspberry PI audio output.

Valve Control Board

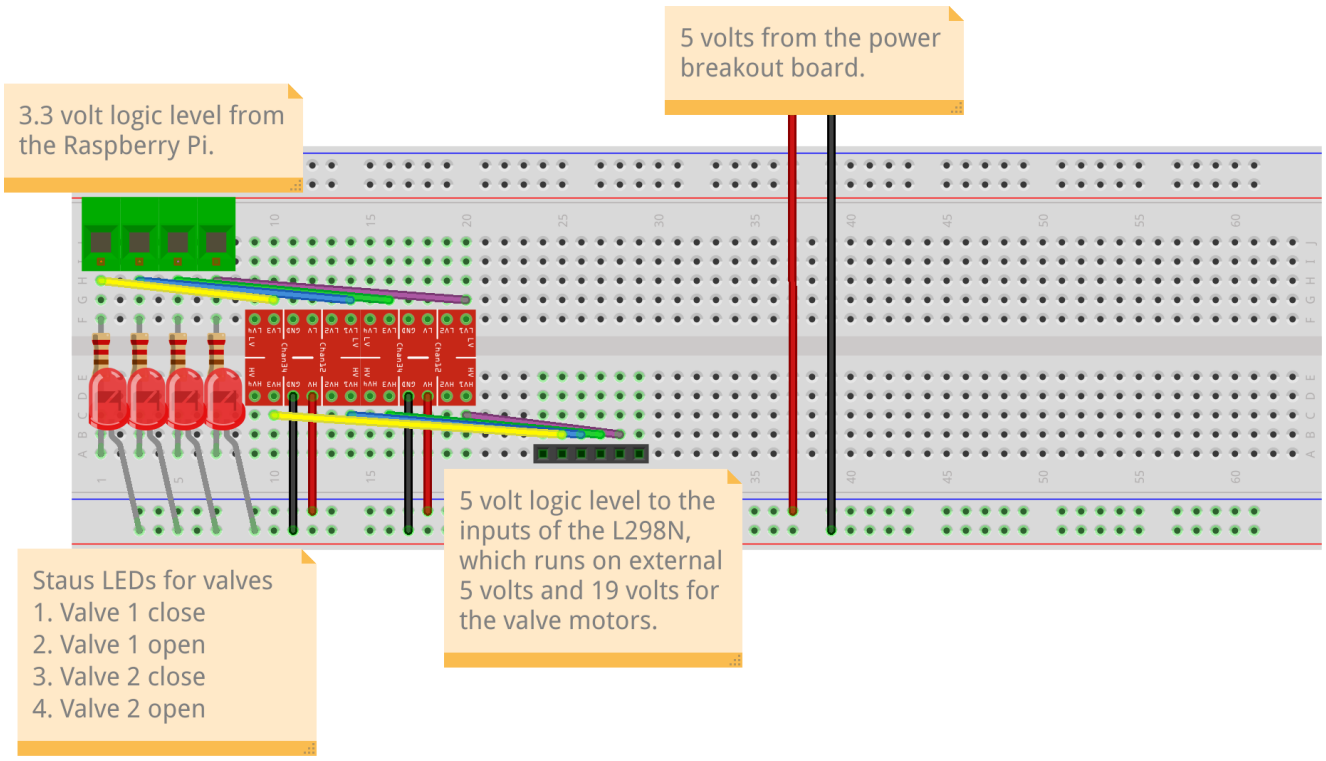


The condenser and dephlegmator valves don’t use stepper motors, but they have upper and lower limit switches. These use plain old DC motors and their position is merely tracked by how many milliseconds that they get power in either direction. This is the reason for the “Calibrate Valves” function of the smart still controller.

The motors are controlled by an L298N “H-Bridge” driver which is commonly used in robotics and RC cars. These drivers use 5 volt logic, so I2C logic level shifters are used in order for the 3.3 volt logic from the Raspberry PI GPIO pins to control them. This could also be done with a diode/resistor pair per pin, but I like simple.

If you look at the source code in valve.c you will see the GPIO pin assignments for the valve motors. Looking at the diagram below, the green header connects to the GPIO pins 25, 24, 21, and 20 from left to right.

The 4 pull-up resistors on the power break out board in the above connect to GPIO pins 23, 22, 19, and 18 which are for the limit switches in the valves. When these pins are pulled low by the limit switches, it tells the code in valve.c that the valve is at its full-open or full-closed position. I will cover the valve connections later.


5 volts from the power breakout board.
3.3 volt logic level from the Raspberry Pi.
5 volt logic level to the inputs of the L298N, which runs on external 5 volts and 19 volts for the valve motors.
Staus LEDs for valves
1. Valve 1 close
2. Valve 1 open
3. Valve 2 close
4. Valve 2 open
fritzing