

Changes to PCB for the second order

The new PCB will be as similar to the first one as possible. We will simply replace the non-working circuits with ones we have tested and know will work and make some minor adjustments as well. Basically, it should be guaranteed to work.

1- Arduino Footprint

- a. Make the holes for the Arduino pin 0.9mm
 - i. Will double check this is sufficient
- b. ☒ Accommodate the Arduino's extrusions in the bottom
 - i. Drill new holes where there are extrusions – **We may need to do this manually**
 - ii. ☒ Ensure no tracks go through the Arduino Footprint and that all tracks connect from the top layer so that we may drill new holes and enlarge existing ones if necessary

2- ☒ Connectors

- a. Replace the 14pin connector with a second 24-pin connector.
- b. Preferably Use the large pins for GND, 12V in, IGBT Out

3- Circuitry Changes:

- a. ☒ IAT and MAP Conditioning Circuits
 - i. Replace these with non-inverting Amplifier Circuits
 - ii. Add tracks for raw signals to be fed into the Arduino as well (same as the IPG, CPG inputs, etc.)
- b. ☒ ECT Sensor circuit
 - i. So we currently don't have anything to read the Engine Coolant Temperature Sensor, which is completely fine, but given that it behaves exactly like the IAT, I thought I could just copy the new IAT circuit and toggle the resistor values so we have an additional circuit on board that makes it look more "full" and complicated.
- c. ☒ Fuel heater, Throttle, and ECT actuator
 - i. I will just add a single track going from the Arduino to an output pin, supposing that our activation signal will be acted on by whatever special-purpose controller this stuff has
 - ii. Added old throttle op-amp just in case

- d. ☐ Fan
 - i. Keep the old 12V and connection of the fan, but also add a new track connected to the Arduino and the 12V pin for the fan, which will allow the Arduino to toggle the voltage sent to the fan
 - 1. I am looking into how to do this with transistors, it may not exactly work, but even so, the fan will just be on full power all the time
- e. ☒ On board Temperature Sensor
 - i. Add two temperature sensors on the PCB to monitor the temperature near the IGBTs (highest) and near the Arduino (lower)
 - 1. May display temperature with a mini display mounted on the outside of the housing during the exhibition – (this won't be incorporated into the PCB)
- f. ☒ On board Humidity sensor?
 - i. Added one (we will have to manually solder it after buying it from mouser)
- 4- ☐ Cosmetics
 - a. Add text on the silk layer to identify all components and pins
- 5- ☐ Layout
 - a. Can change the layout to place high-voltage components closer to the connectors
- 6- Extras to add
 - a. Decoupling Capacitors
 - i. Justify an appropriate value for the decoupling capacitor to cut off high-frequency noise near critical components (IGBTs)
 - b. Passive high-pass filters
 - i. Passive high pass filters for many (maybe all) the sensor circuits to cut high-frequency noise
 - c. More Zener diodes
 - i. Add Zener diodes after op-amps to ensure the voltage is capped at 5V (strictly unnecessary because our gain values don't allow it)