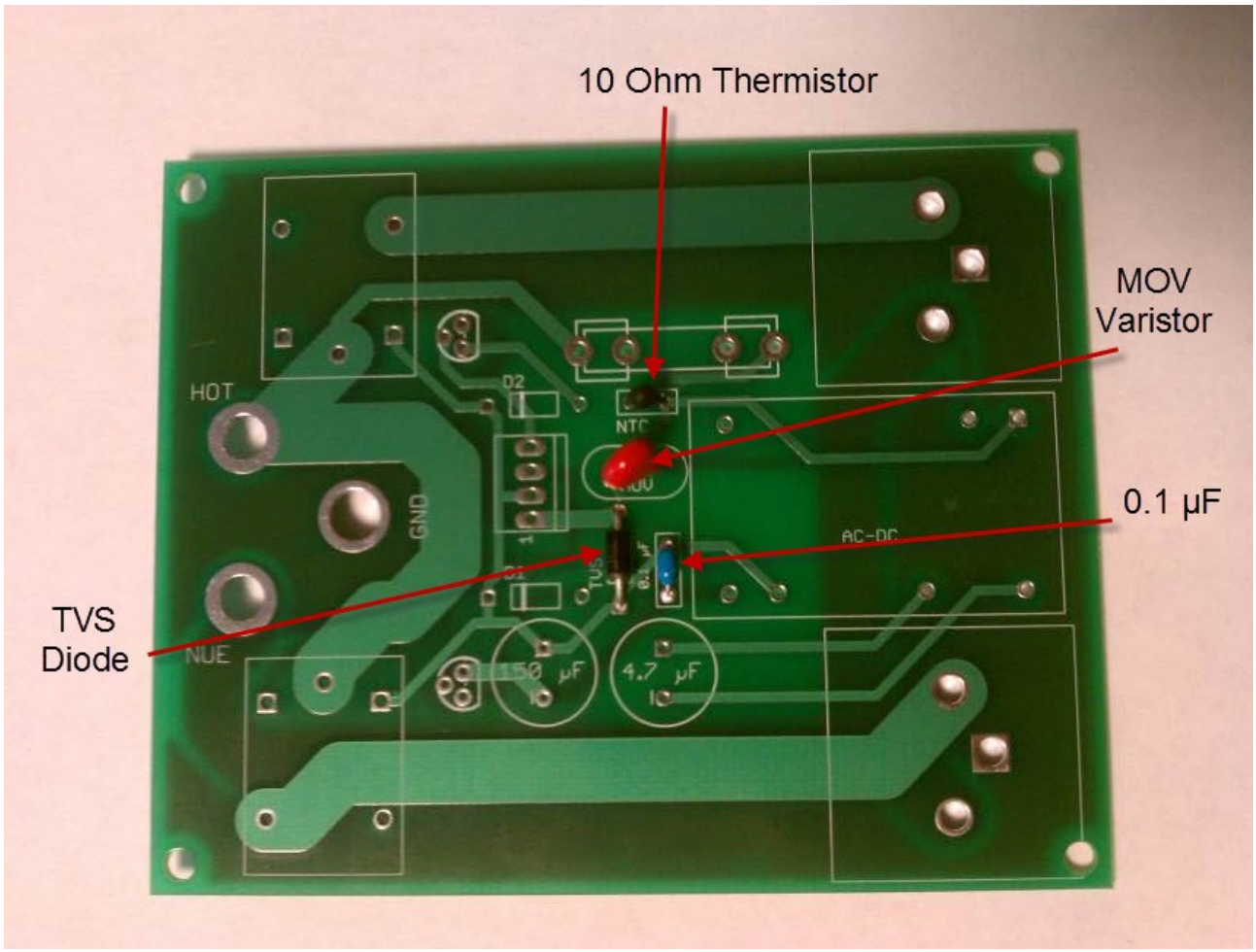
POWER BOARD

Step 1: Small parts

- 0.1uF cap
- TVS diode
- MOV Varistor
- 10 Ohm Thermistor

Make sure you have the TVS and not one of the Flywheel diodes. The TVS diode has a much smaller stripe than the Flywheel diodes (and there is only one TVS, while there are two Flywheels). Be careful of the orientation (line the stripe up with the stripe on the silkscreen)

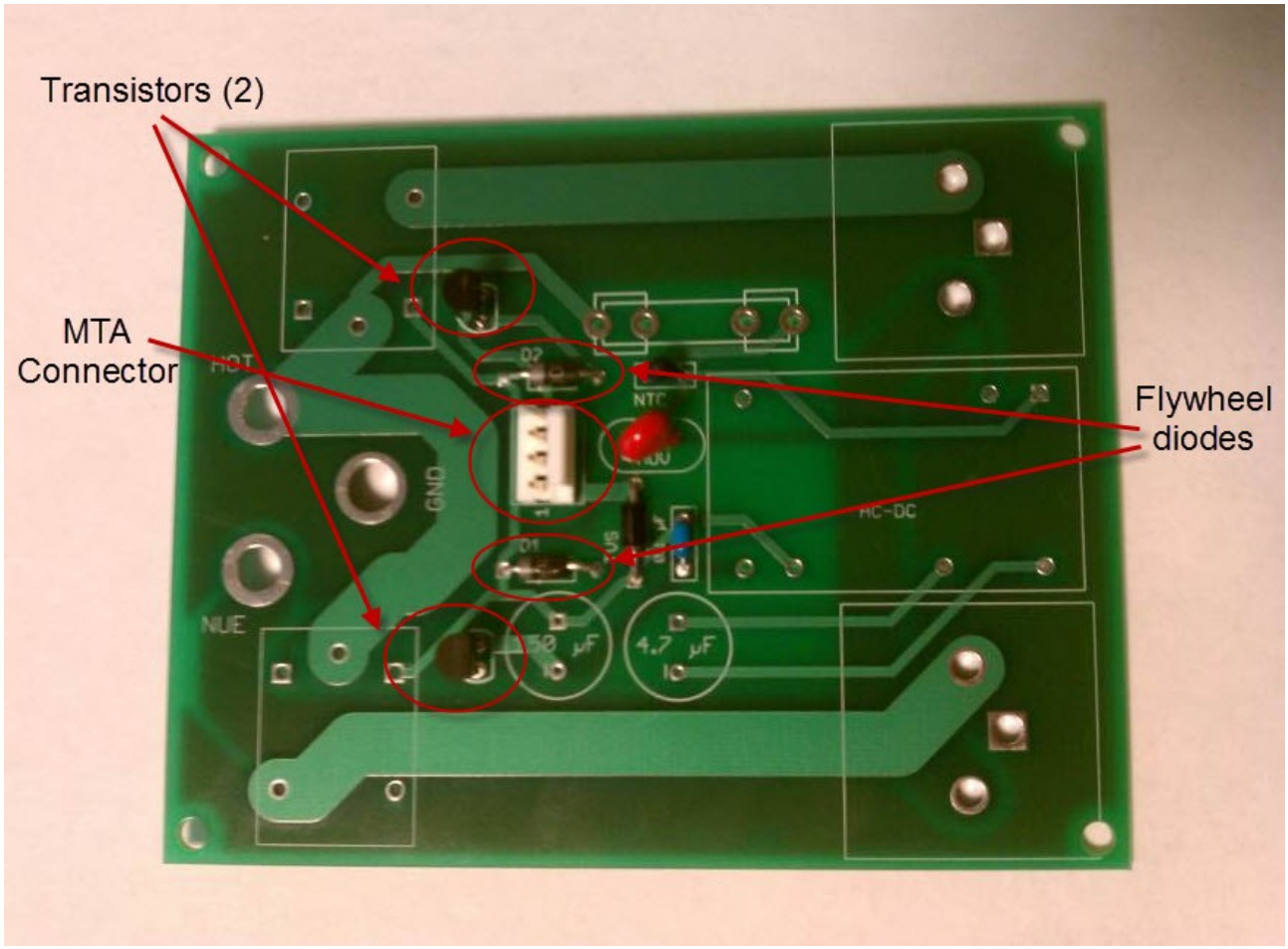
NOTE: Cut all the leads pretty close to the board. There is only about 0.080" of clearance between the bottom of the board and the casing.



Step 2: More small parts

- Flywheel diodes (2)
- MTA connector
- Transistors (2)

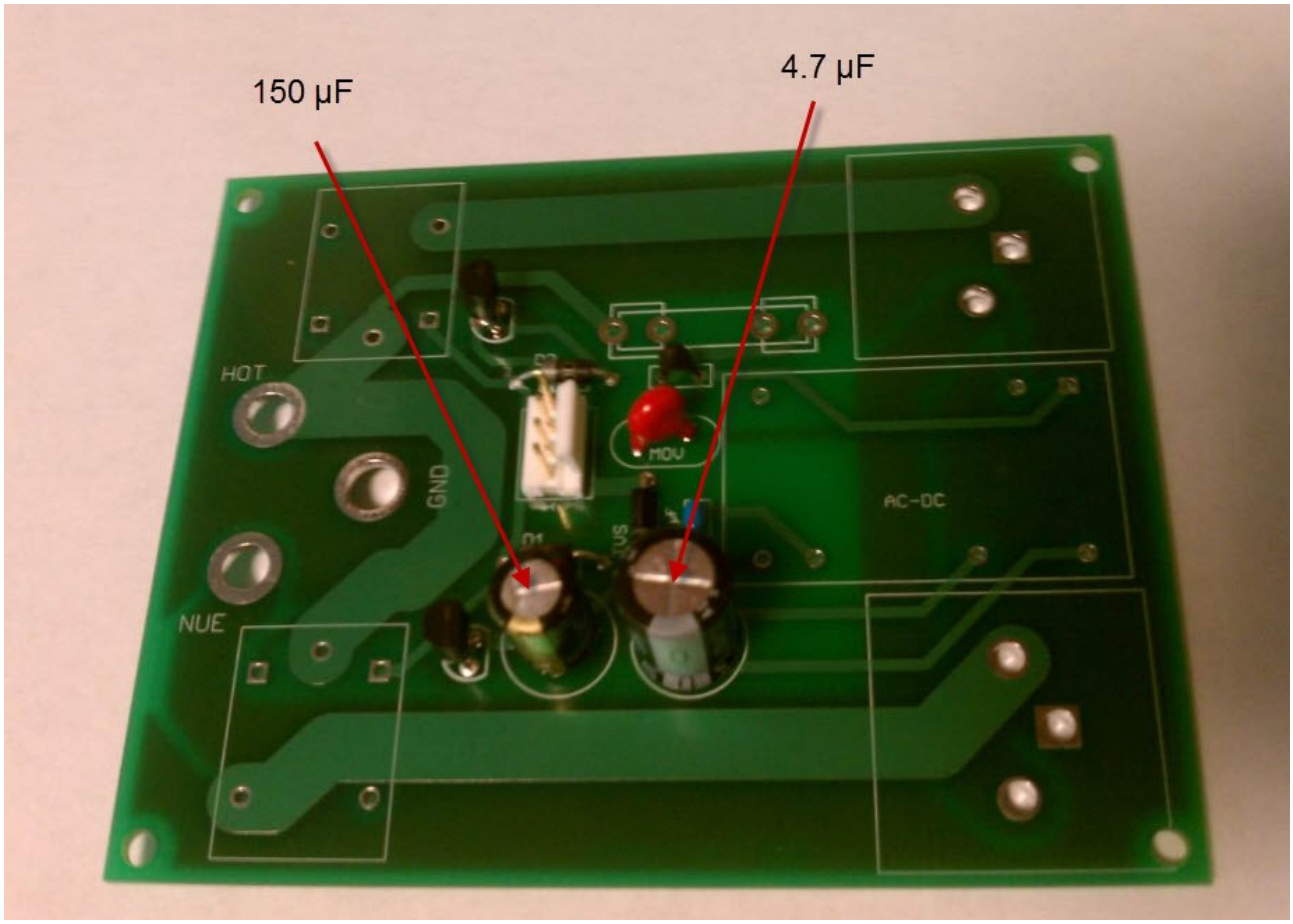
Make sure not to put too much heat on the MTA connector. Check that the pins are all lined up still. Orient the transistors with the flat lined up with the flats on their silkscreen footprints. Also make sure the diodes have the stripe on the part lined up with the stripe on the diode silkscreen footprint.



Step 3: Capacitors

- 150 uF Cap
- 4.7 uF Cap

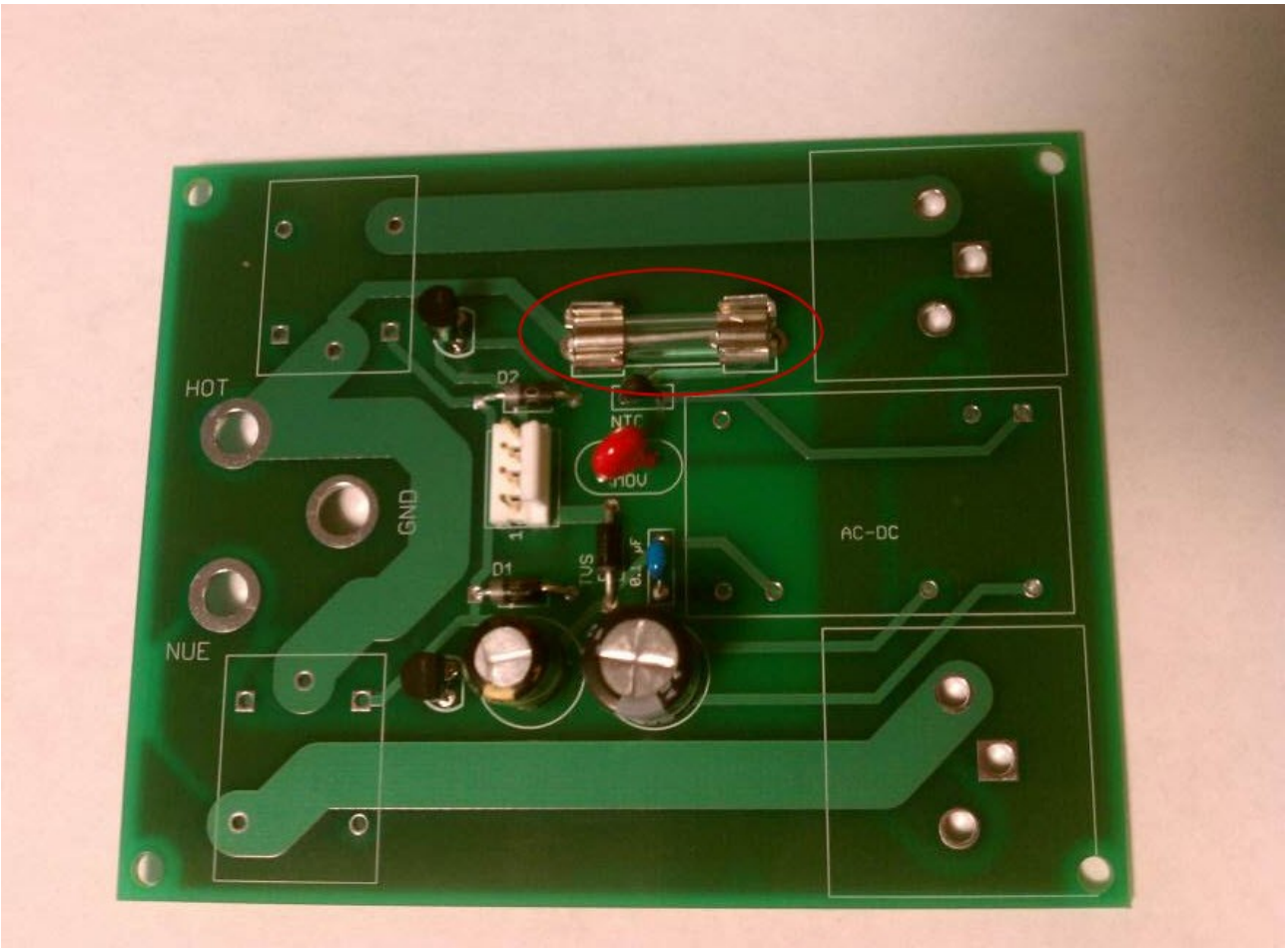
There is a small mark on the silkscreen for each cap noting which side is negative. Make sure both of these polarized caps are correctly oriented! (Incorrectly positioned caps risk exploding).



Step 4: Fuse

- Fuse Holders
- Fuse

An easy way to make sure the fuse holders line up is to insert the fuse holders onto the fuse before soldering this whole small assembly onto the board.

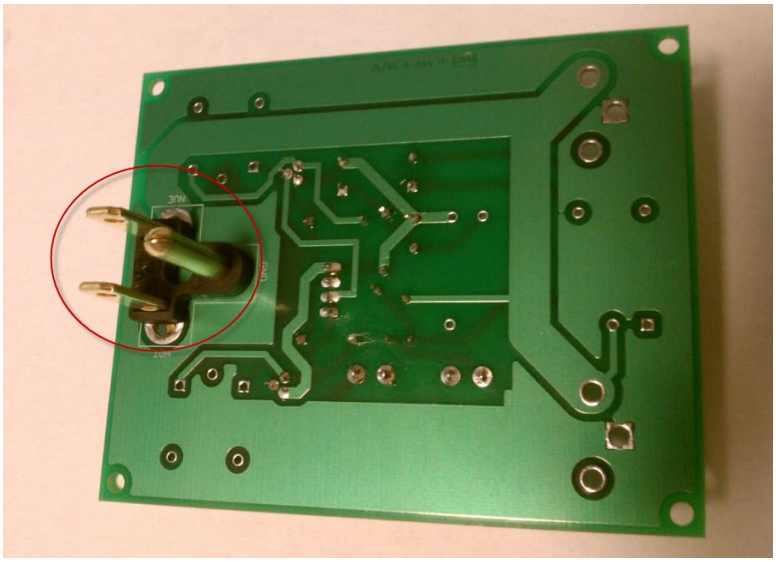


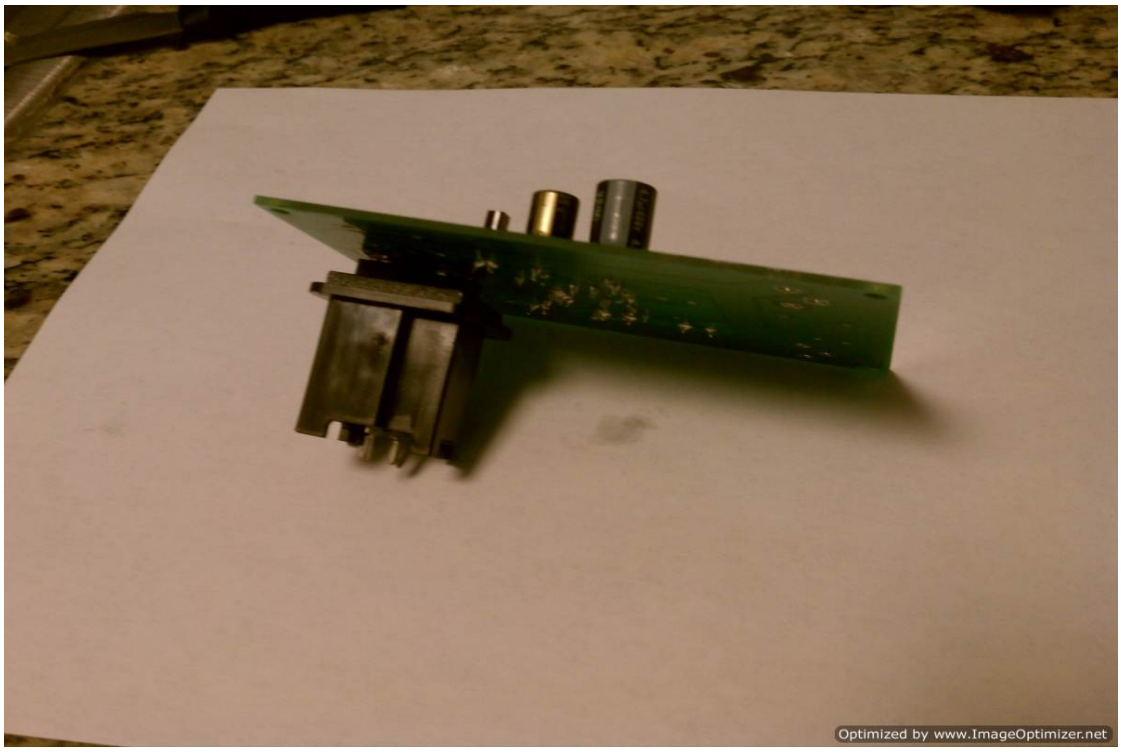
Step 5: Outlet plug

- Male outlet plug

This is the hardest piece because it takes so much heat to get the solder to stick to the plug. But give it lots of solder for a good connection.

Because there is so much heat, the plastic melts a little and the prongs of the outlet tend to skew. To keep them straight, use one of the female plugs to hold the prongs in the correct position while you solder.

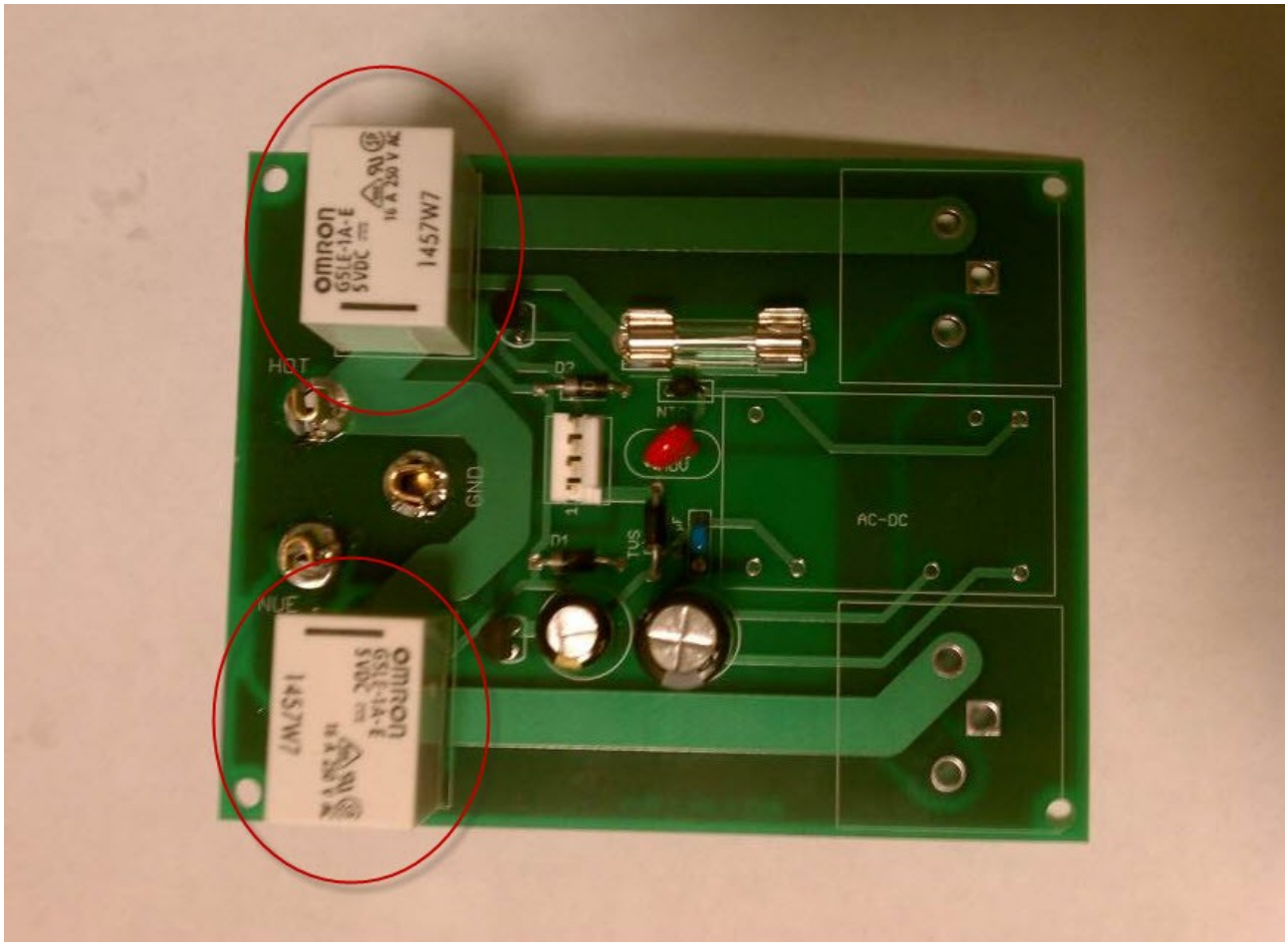




Step 6: Relays

- Relays (2)

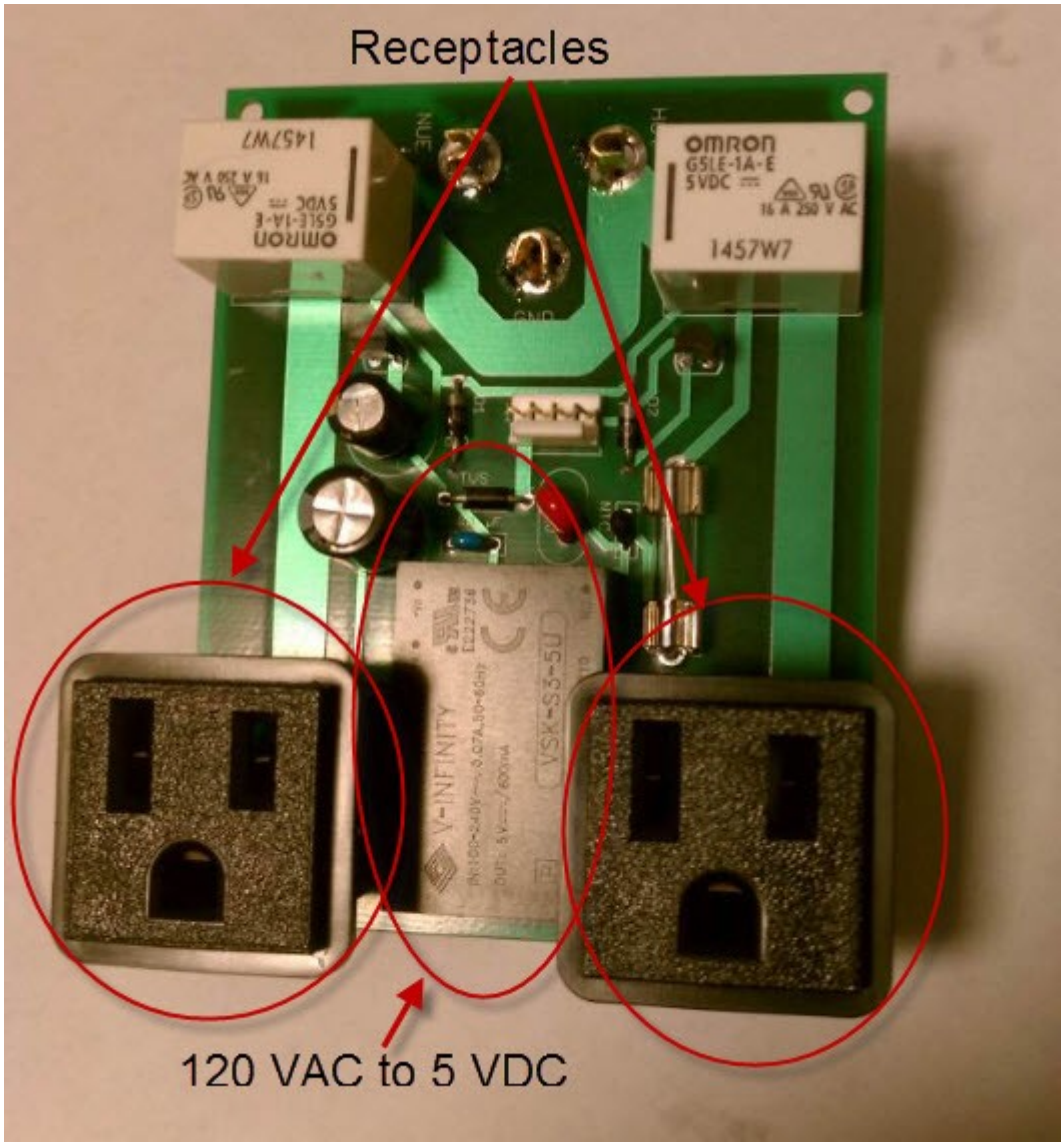
Note that with some types of relay there is one hole with no pin.



Step 7: Receptacles and Converter

- Outlet receptacles
- 120VAC to 5VDC

Try to keep the receptacles pretty squared up with their silkscreens. Later on the cover will be difficult to put on if these are too far skewed. Be generous with the solder.

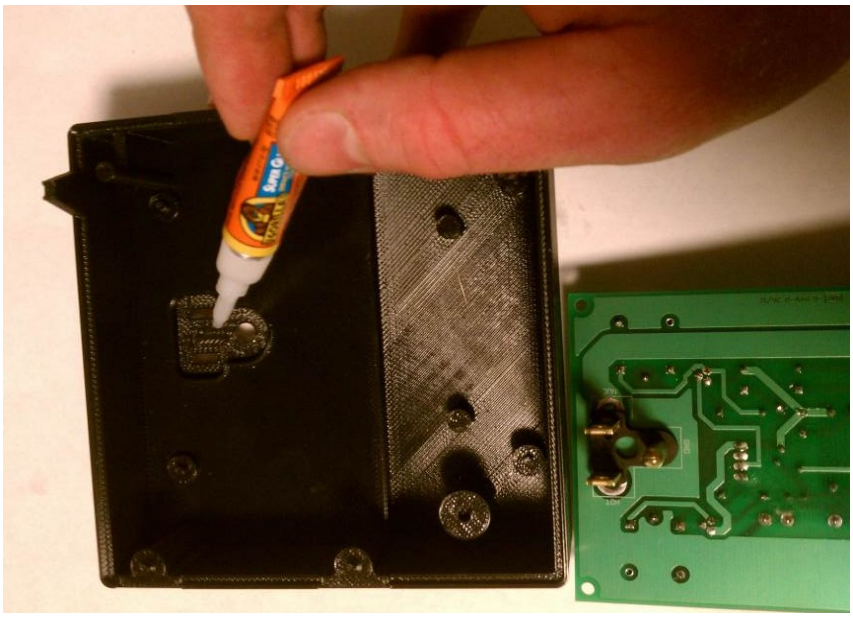


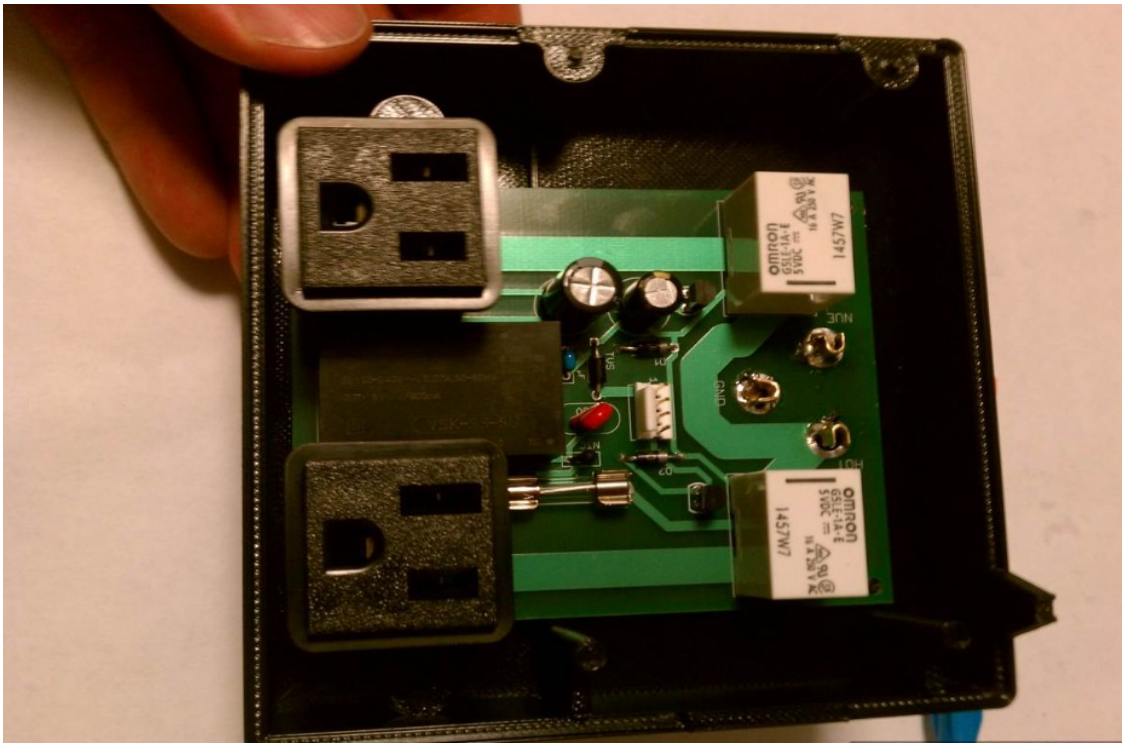
Step 8: Gluing

- Glue

NOTE: You can assemble it fully without gluing if you'd like to test the Power Board. Testing is always a good idea because if you discover a mistake, glue is hard to undo. But eventually it's a good idea to glue it because it puts a lot of stress on the board to get the plug into an outlet.

Apply some glue to the recessed area of the bottom cover that will house the male outlet plug. Then insert the Power Board into the bottom cover fitting the outlet prongs into the holes. Make sure all the alignment features line up and the board is properly seated before you set it aside to allow the glue to dry.





LOGIC BOARD

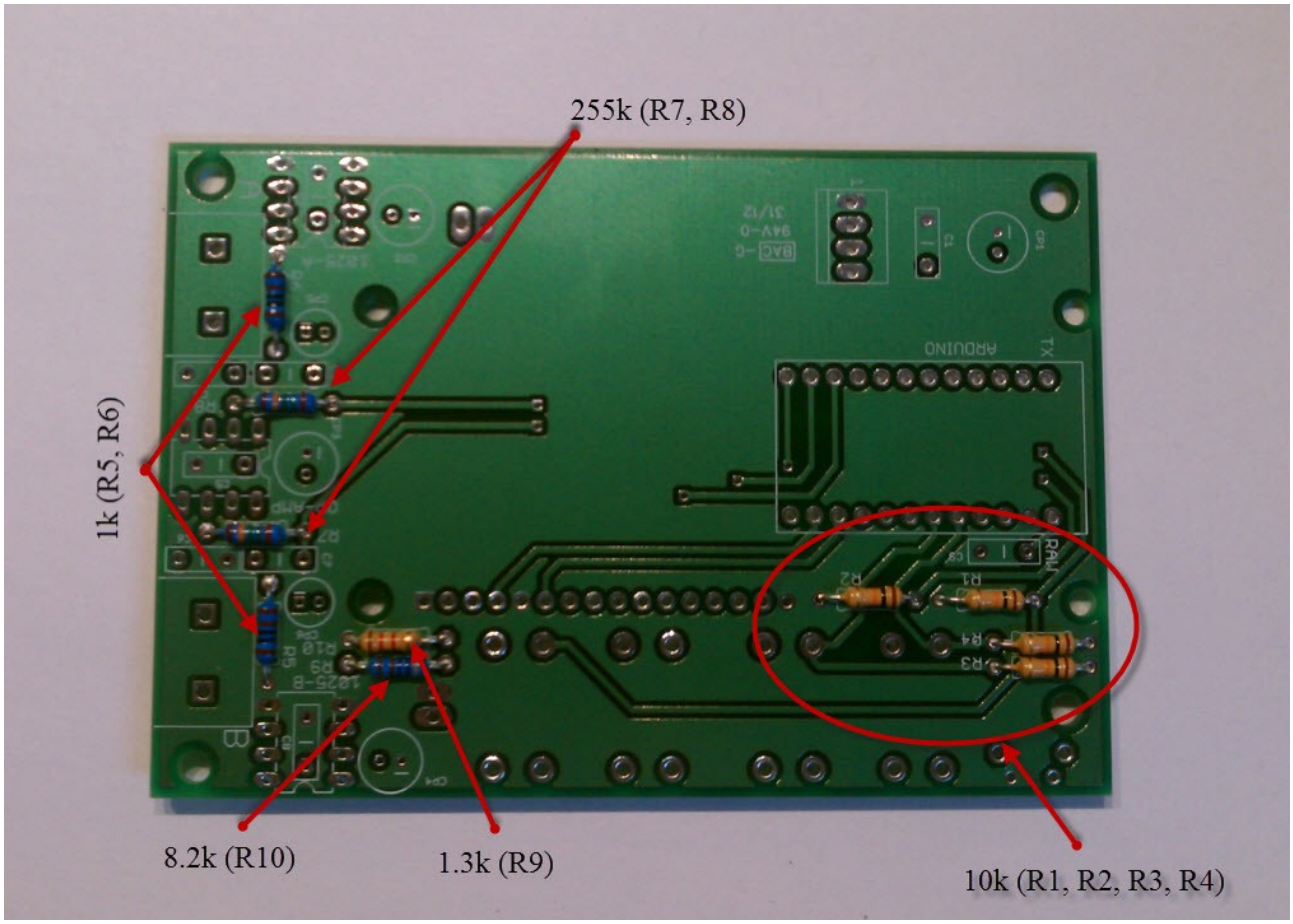
Step 1: Resistors

- 255k resistors (2: R7, R8)
- 1k resistors (2: R5, R6)
- 10k resistors (4: R1, R2, R3, R4)
- 1.3k resistor (R9)
- 8.2k resistor (R10)

The 1.3K and 8.7k resistor provide the voltage divider that sets the contrast of the LCD screen. These are the resistors to change if you want to adjust that.

Double check the resistors with an ohmeter to make sure you have the correct ones in the correct places. The silkscreen on the board has the values labelled to help know which resistors go where.

Trim the leads and proceed!



Step 2: Capacitors

- 0.1 µF caps (9: C1, C2, C3, C4, C5, C6, C7, C8, C9)
- 100 µF Capacitors (4: CP1, CP2, CP3, CP4)
- 1 µF Capacitors (2: CP5, CP6)

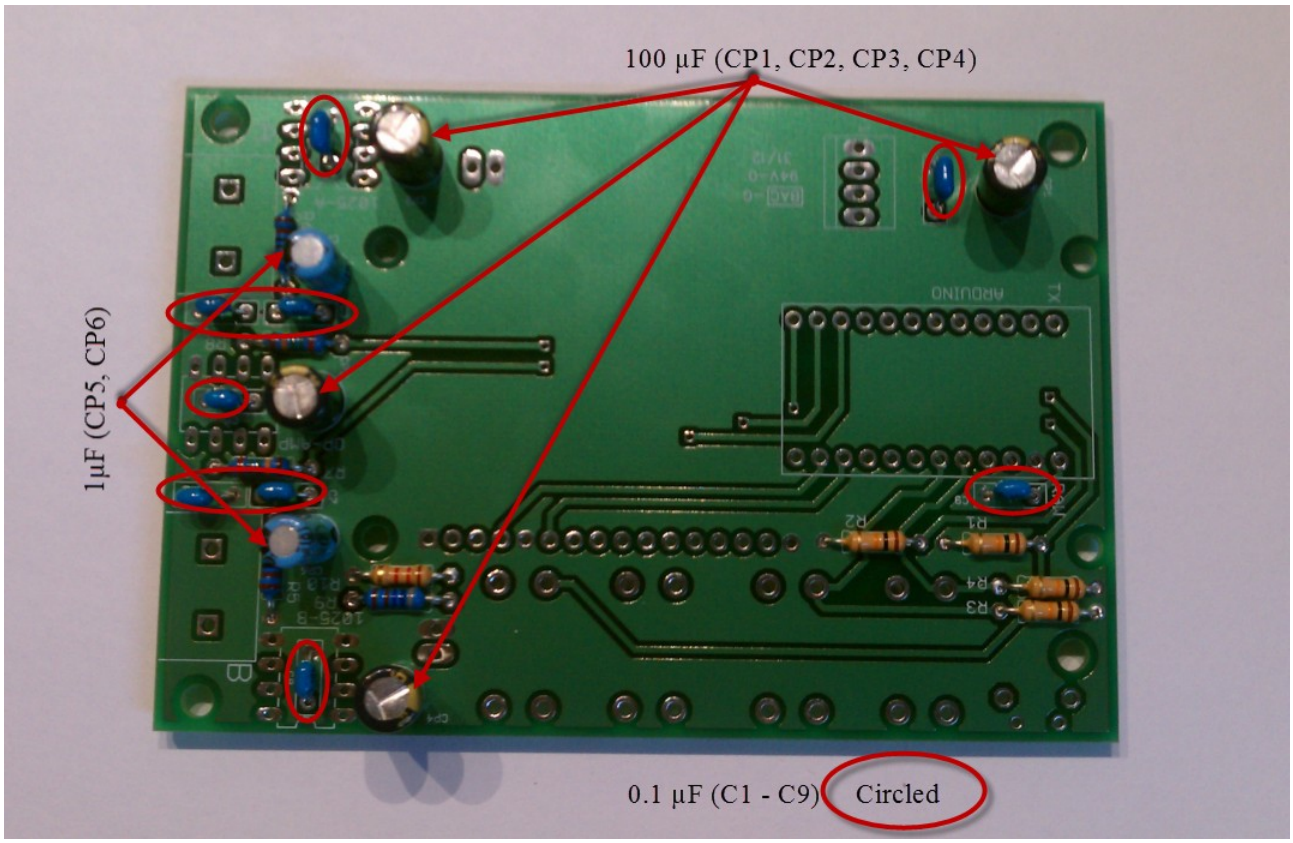
(CP stands for Capacitor Polarized!)

Some of the 0.1 uF caps will be nested inside the DIP-8 sockets so make sure they are perpendicular to the board and seated all the way down.

Also make sure the negative side of the polarized cap is correctly aligned; there is a small negative symbol on the silkscreen.

The symbol for the 0.1uF caps on the board is a small rectangle with a dash in the middle (-). These caps do not have a +/- side so orientation is not important The board marking for the 180 uF and 10 uF caps is a small circle with a dash (-) to indicate the negative side and thus orientation IS important!

Remember to keep all the leads nice and trimmed after every step. It gets cluttered quick if you don't!

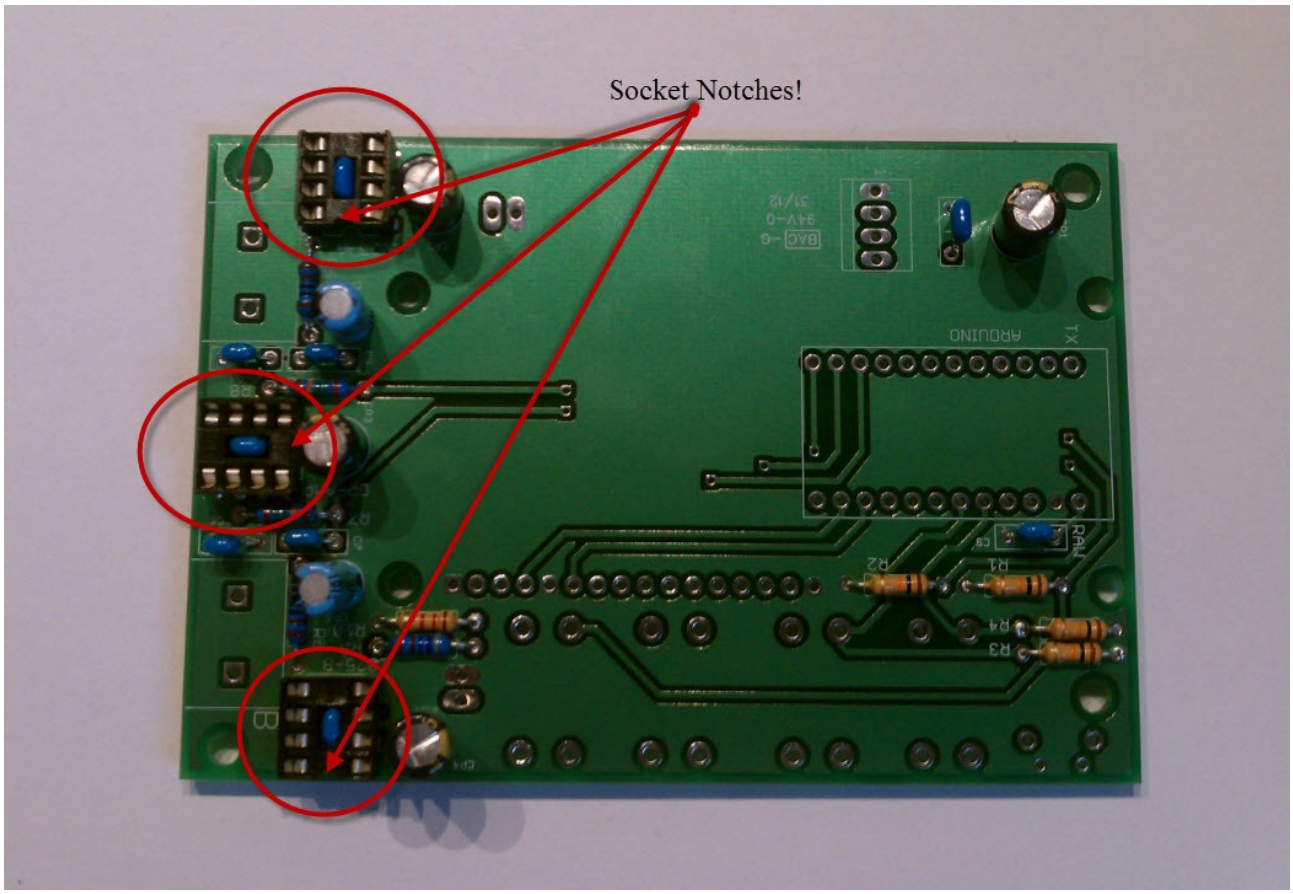


Step 3: DIP Sockets

- DIP-8 sockets (3)

Make sure the little 0.1 uF caps fit inside of the sockets where applicable.

Also note the orientation of the notch as laid out in the silkscreen. If you get this backwards, you can always rectify it when you actually install the IC. But getting it right now could prevent you from accidentally installing an IC backwards later on.



Step 4: Cleaning

Clean the board!

This is a good opportunity to clean all the flux and goop off of the board. Both sides if you can access it. Most of the sensitive components for the thermocouple circuits have now been installed and these circuits are sensitive enough that poor solder joints and excessive flux can make a significant difference in the performance. So double check all your solder joints so far and make the board as clean as possible.

If you have flux remover and wire brushes then excellent. Otherwise rubbing alcohol and an old toothbrush work pretty well.

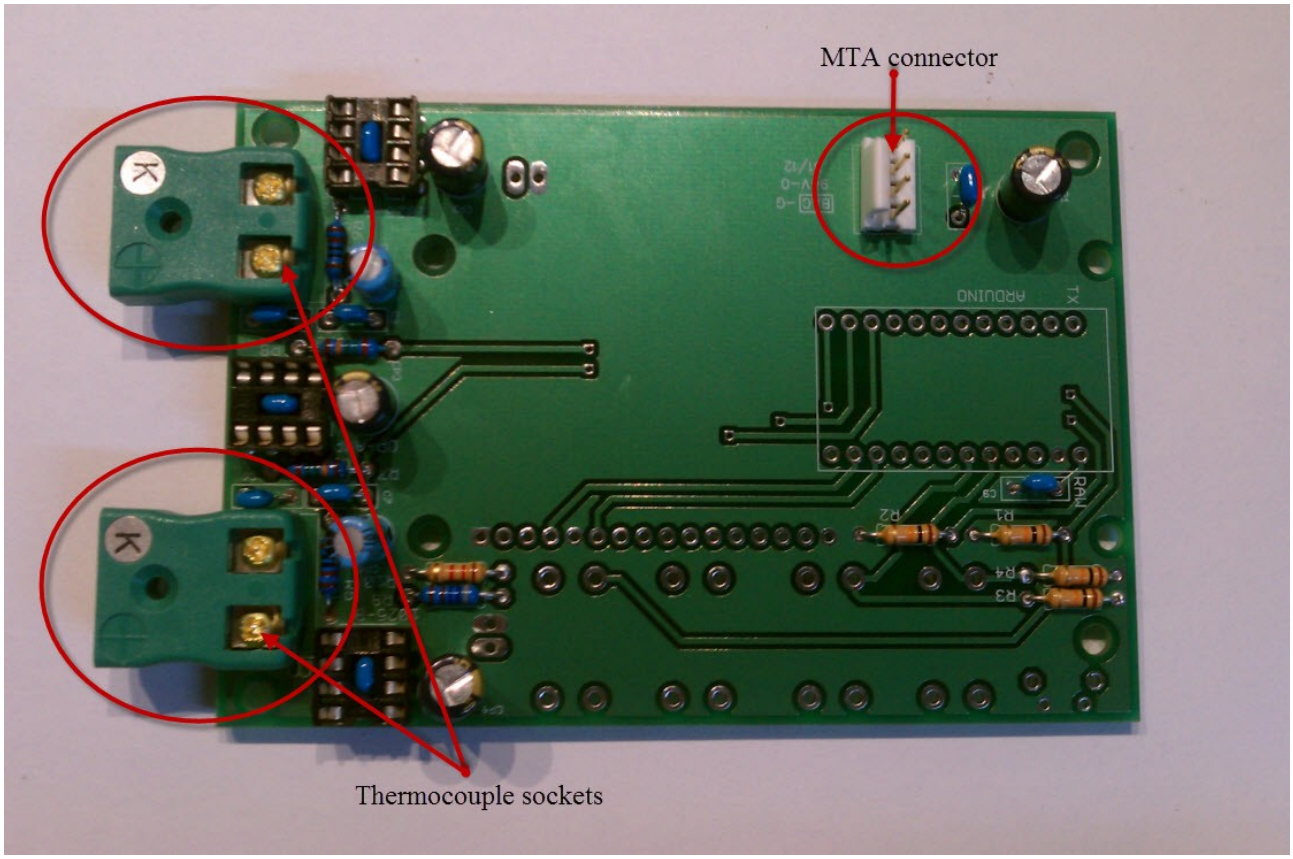
Really this should be done often. But this is a good point to do it if you'll only do it once.

Step 5: Connectors

- Thermocouple sockets (2)
- MTA Connector

Note the orientation of the MTA connector (match the retaining clip to the marked area on the silkscreen).

Make sure the thermocouple sockets are nicely pushed flat against the board. If they aren't sitting flush to the board, it could affect how the cover fits later on.

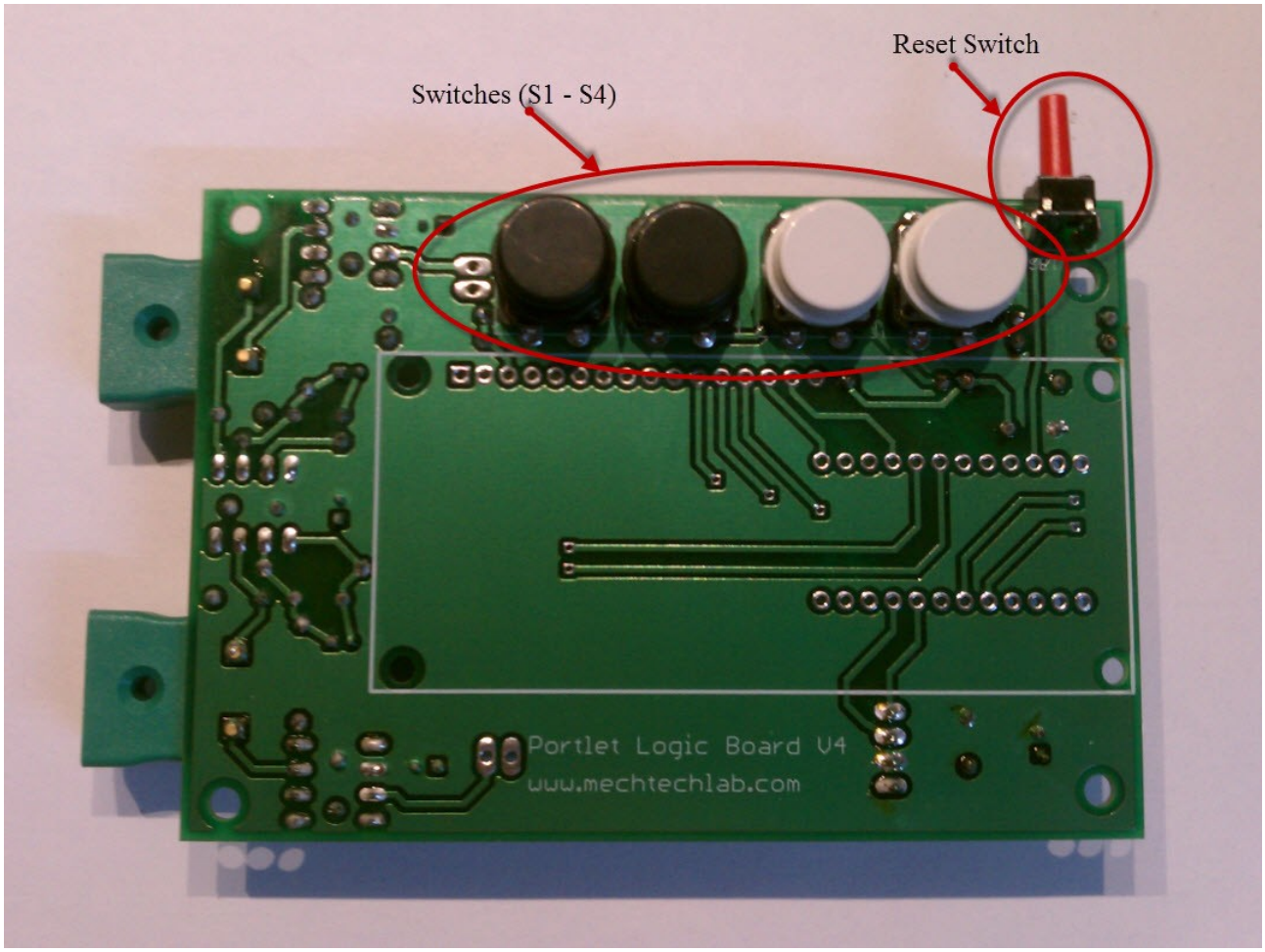


Step 6: Switches

- Tactile switches (4: S1, S2, S3, S4)
- Reset side switch

Note that the colored caps on the tactile switches can be switched around if you don't like the colors.

Also note which side of the board the switches go on! The silkscreen outline indicates the side of the board the switches should be mounted on.



Step 7: Attaching the Arduino

- Bent header (1x6)
- Straight header (2 pieces of 1x12)
- Arduino Pro Mini

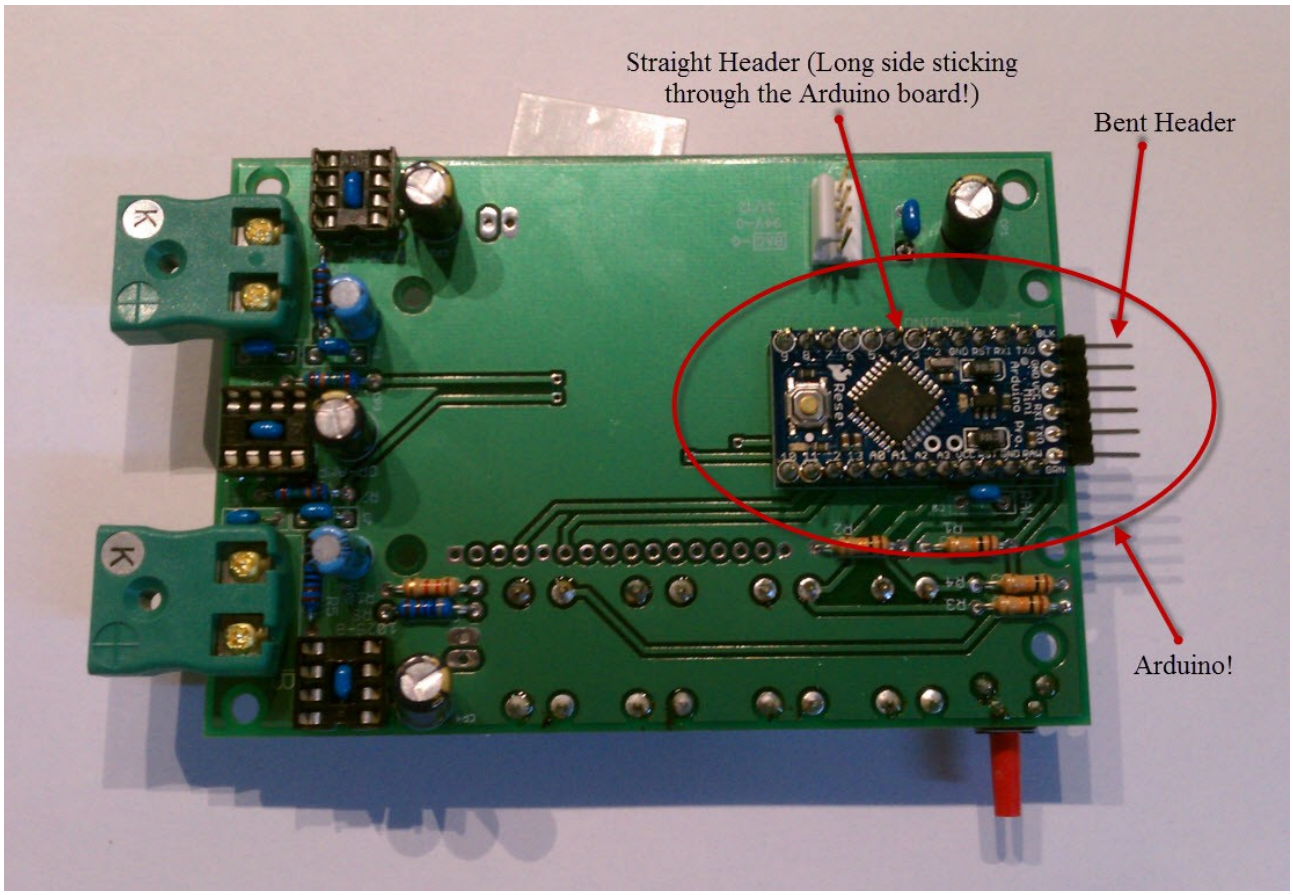
The orientation is important so there are no interferences. Make sure when the Arduino is assembled that you can still read the silkscreens labeling the pins (on the Arduino board itself) and that the reset button of the Arduino is towards the center of the board.

Use the 6 pin bent header for the programming interface to the Arduino board. **Look at the orientation in the picture below** (if it's backwards, the cap won't fit in the hole of the box to protect the pins). The two straight headers will connect the Arduino to the board. **Make sure the long side of the headers goes through the Arduino board** (otherwise they will stick too far through the board and interfere with the LCD on the other side).

WARNING: You do want to make sure the Arduino is fully seated, but make sure that the six pins from the bent header are not gouging into the copper mask below it. You don't want there to be any shorts there.

TIP: Go ahead and solder all six of the bent header pins while the board is lying on the table. This helps keep them straight. Then, only solder one pin of each straight header to the Arduino to hold them in place. Then place the Arduino assembly in position on the board to ensure all of the header pins are lined up before continuing to solder everything.

Make sure everything gets soldered. Almost all of the Arduino pins are used.



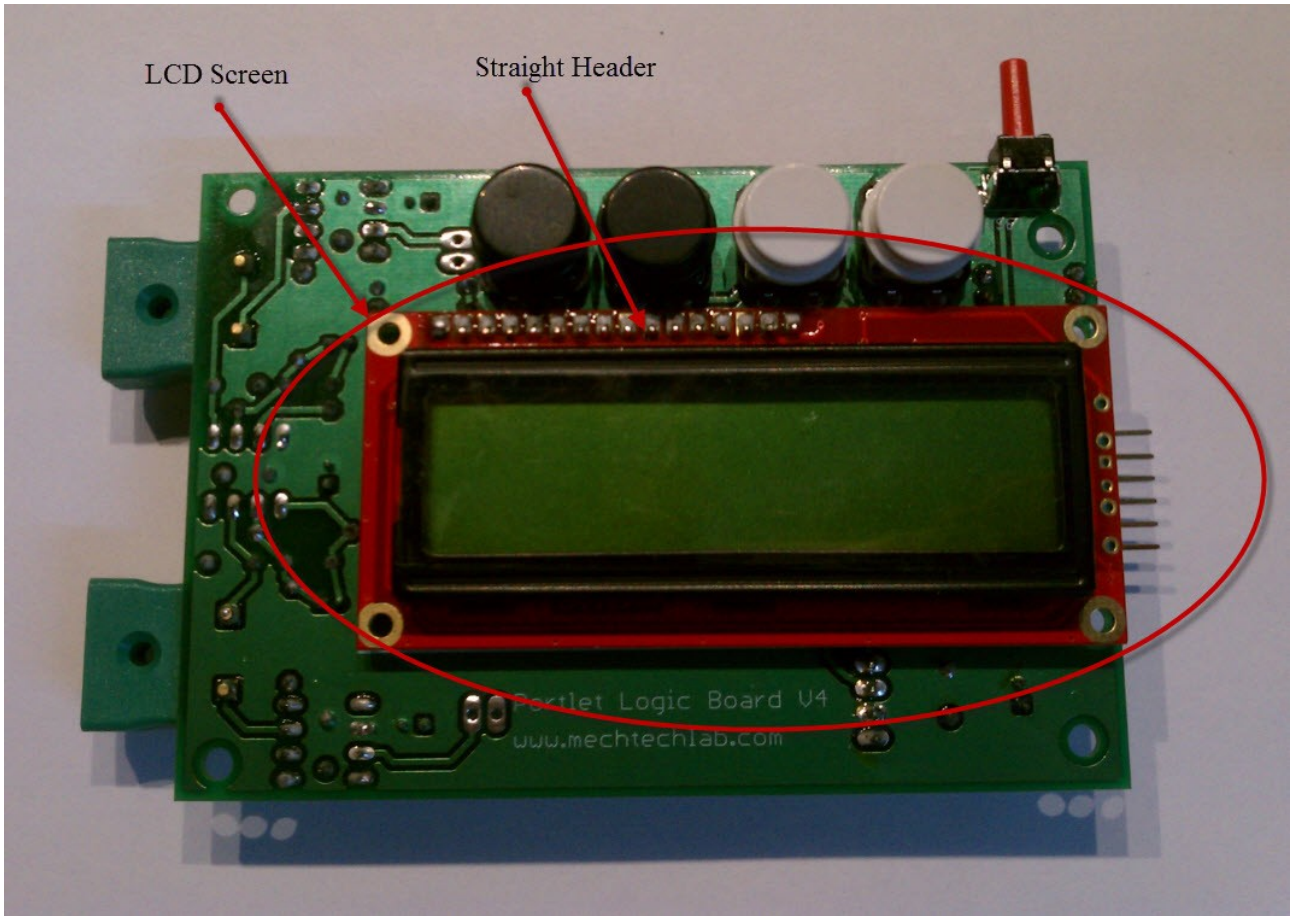
Step 8: LCD

- Straight header (1x16)
- LCD screen

Alignment is easier with this header than it was on the Arduino. It usually works well to solder all of the pins to the LCD before putting the LCD on the main board.

This time put the long side of the headers through the logic board (short side through the LCD board) so that the long pins do not interfere with the cover. So when you look at the LCD, as in the picture below, you are seeing the short side of the header pins sticking through.

TIP: If you solder the header to the LCD screen after positioning everything, it's a lot easier to reach the pins if you remove the caps from the switches. Otherwise the soldering iron could melt a bit of your buttons.



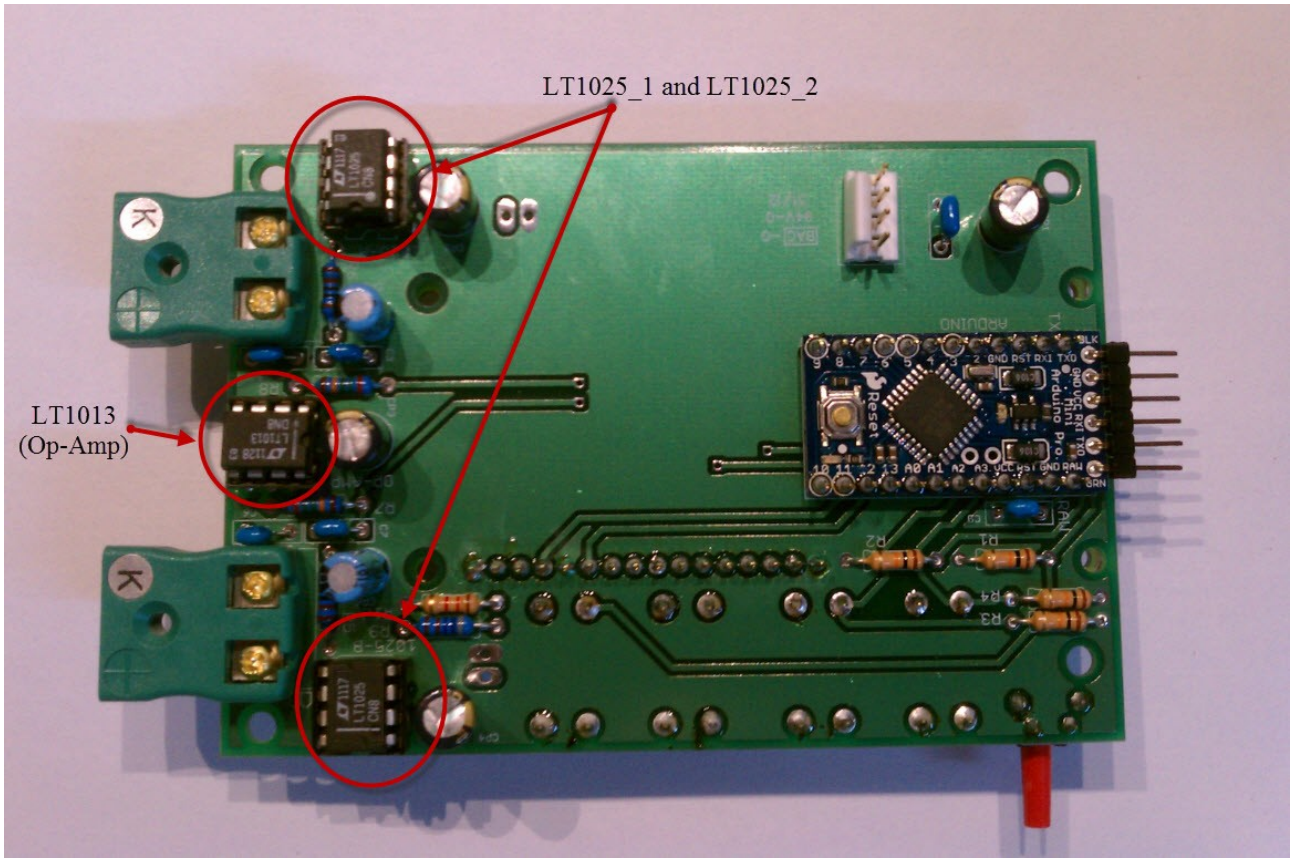
Step 9: Chip insertion

- LT1025 (2)
- LT1013

Make sure the orientation is correct; match the notch on the IC with the notch on the socket (which should match the notch on the silkscreen).

The 1025's go on the outside and the op-amp is in the middle.

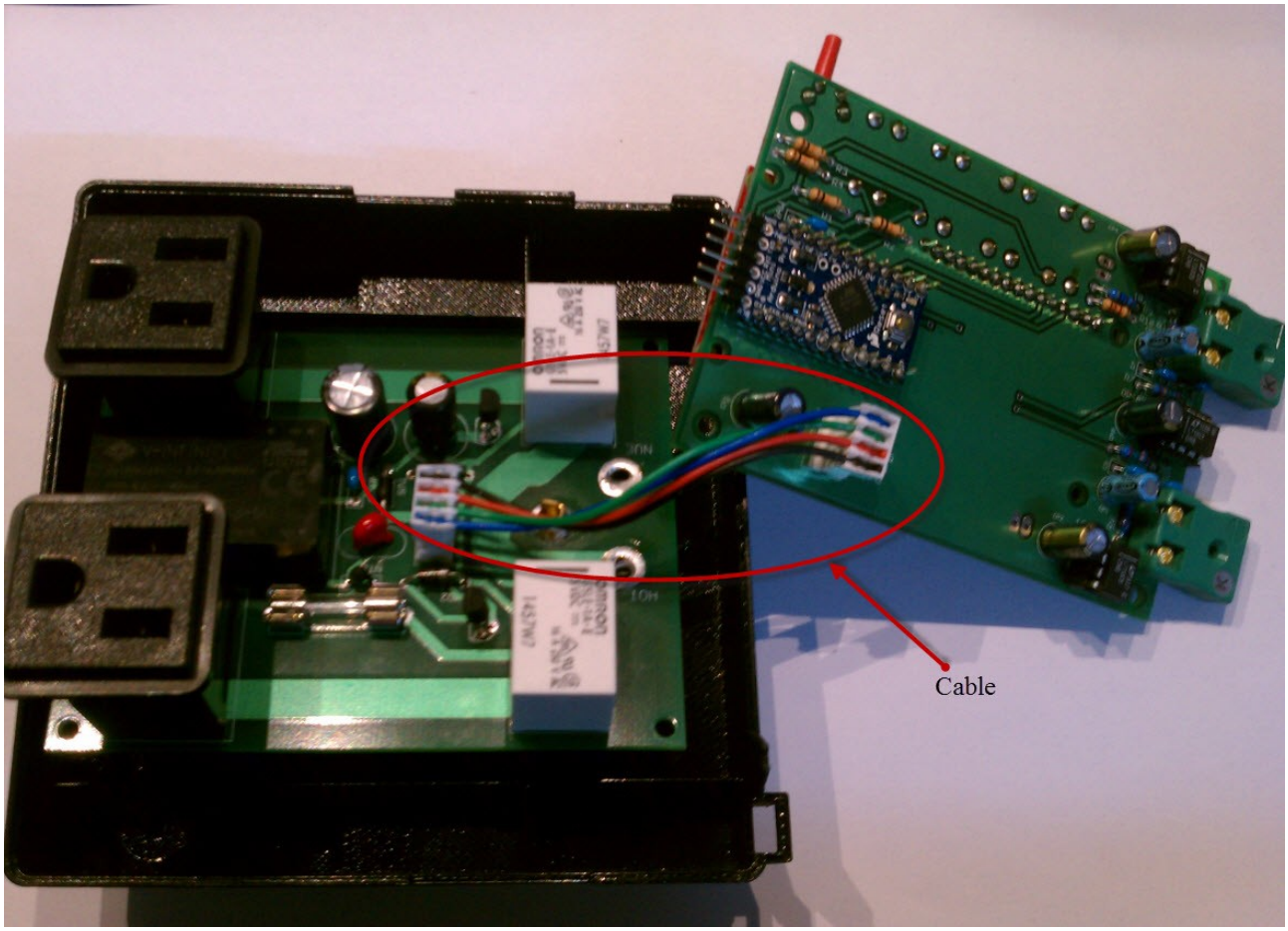
TIP: Using the table top to bend the pins in just a little makes it fit into the socket a little easier.



Step 10:

- Cable

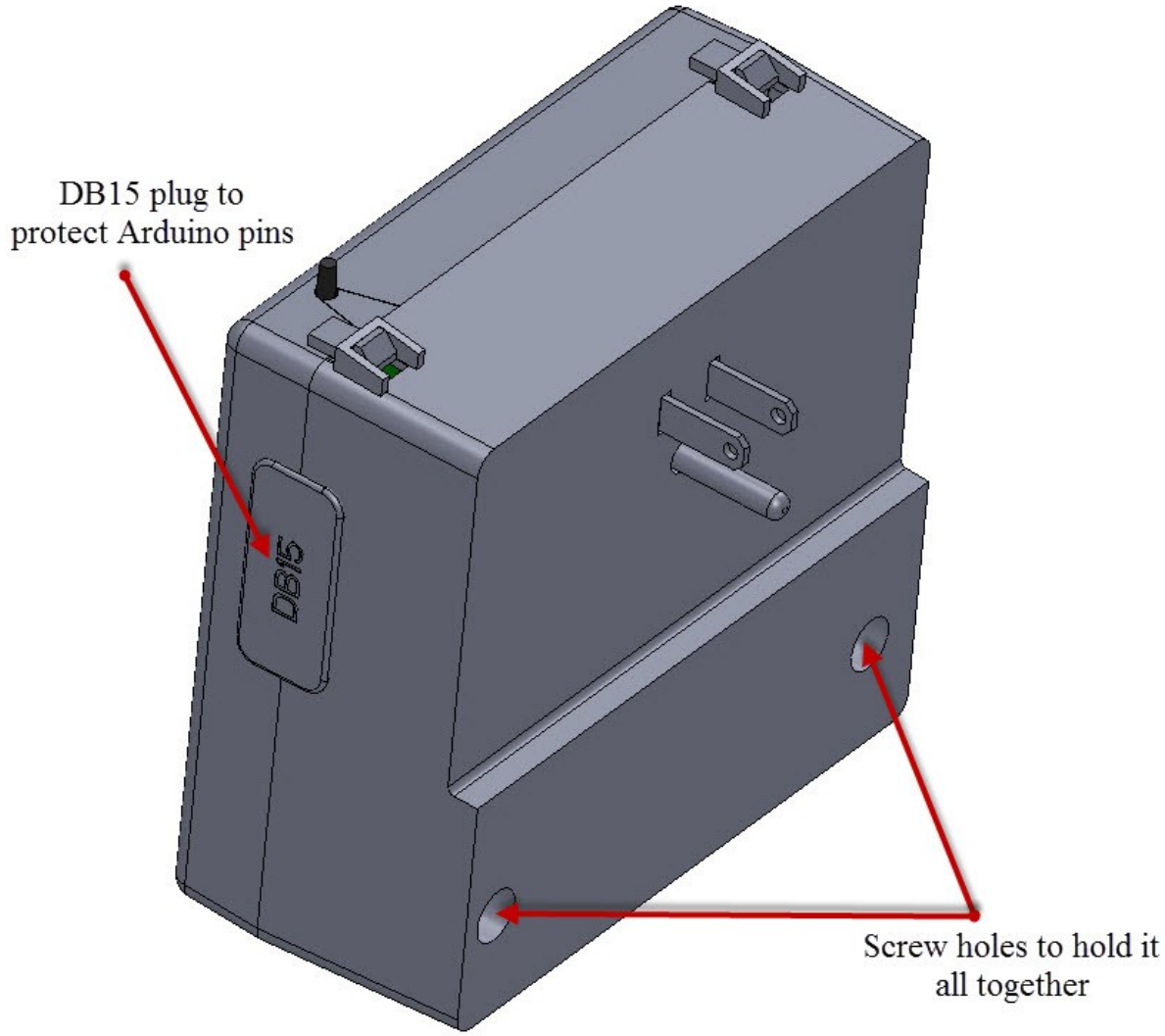
Attach the two boards with the provided cable



Step 11:

- Enclosure top and bottom
- Screws (2)
- DB15 plug

Attach the two halves of the casing with the two screws and then use the DB15 plug to protect the Arduino programming pins.



Step 12: Wrapping it all up

Start testing that things work!

Please be safe.

Lots of effort was put into making this a safe project, but because it does involve 120VAC, there cannot be enough emphasis on safety. Especially when plugging your device into the wall for the first time.

If possible use a GFCI outlet that can be turned on with a remote switch. This way your hands will be no where near the device when you power it on for the first time and there is little risk of blowing a fuse in your house. If there is no switch controlled outlet, a power strip with a switch works well to keep your hands away from the device when turning the power on.

Wear safety glasses when turning on the unit for the first time. Because there are some large capacitors in the assembly, if something is wired incorrectly these capacitors can explode. It is protected by the case, but there would still be a startling pop sound and some very acrid smoke. Do NOT breath in the smoke and make sure there is plenty of ventilation.

If you can successfully power on the device without anything appearing to be wrong, you are ready to start testing the functionality!