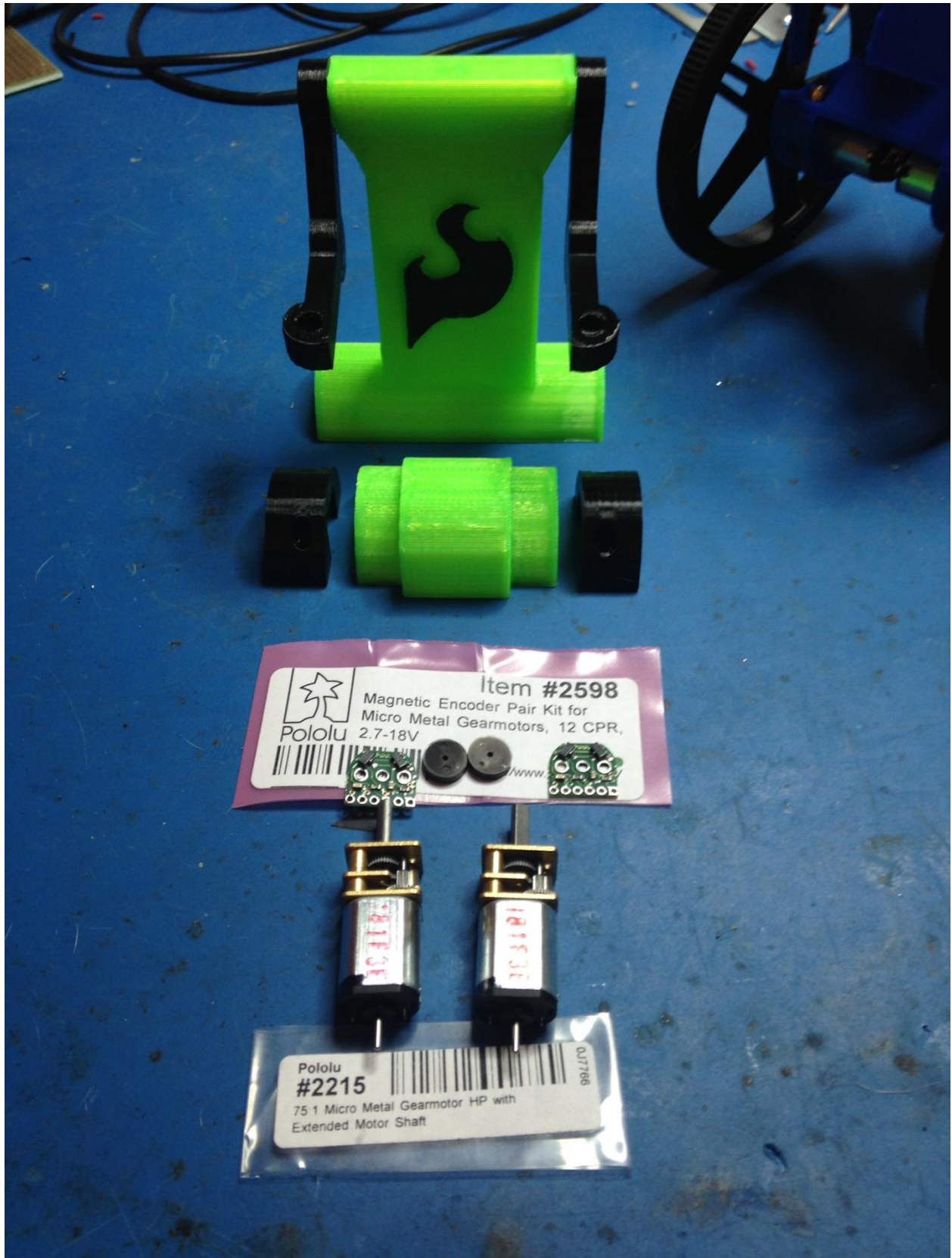


EddiePlus

Builder's Guide

Revision 0 (First Draft)



Items Required:

2x Pololu #2215 75:1 Micro Metal Gearmotor	https://www.pololu.com/product/2215
1x Pololu #2598 Magnetic Encoder Pair Kit	https://www.pololu.com/product/2598
1x Pololu #1425 70x8mm Wheels	https://www.pololu.com/product/1425
Intel Edison	https://www.sparkfun.com/products/13024
Dual H-Bridge	https://www.sparkfun.com/products/13043
9DOF IMU	https://www.sparkfun.com/products/13033
Battery Block	https://www.sparkfun.com/products/13037
USB and OTG Block	https://www.sparkfun.com/products/13045
GPIO Block	https://www.sparkfun.com/products/13038

Motor Mounts

4x M2x14 screws

Or

4x Self tapping screws (Minimum length 8mm)

SparkFun Edison Blocks

4x M2x5 standoff

20x M2x3 standoff

4x M2x3 screw

Arms

2x M3x14

Head

1x M3x5 standoff

Edison

2x M1.5x(length?) Screws

4x M1.5x3 Hex Spacers

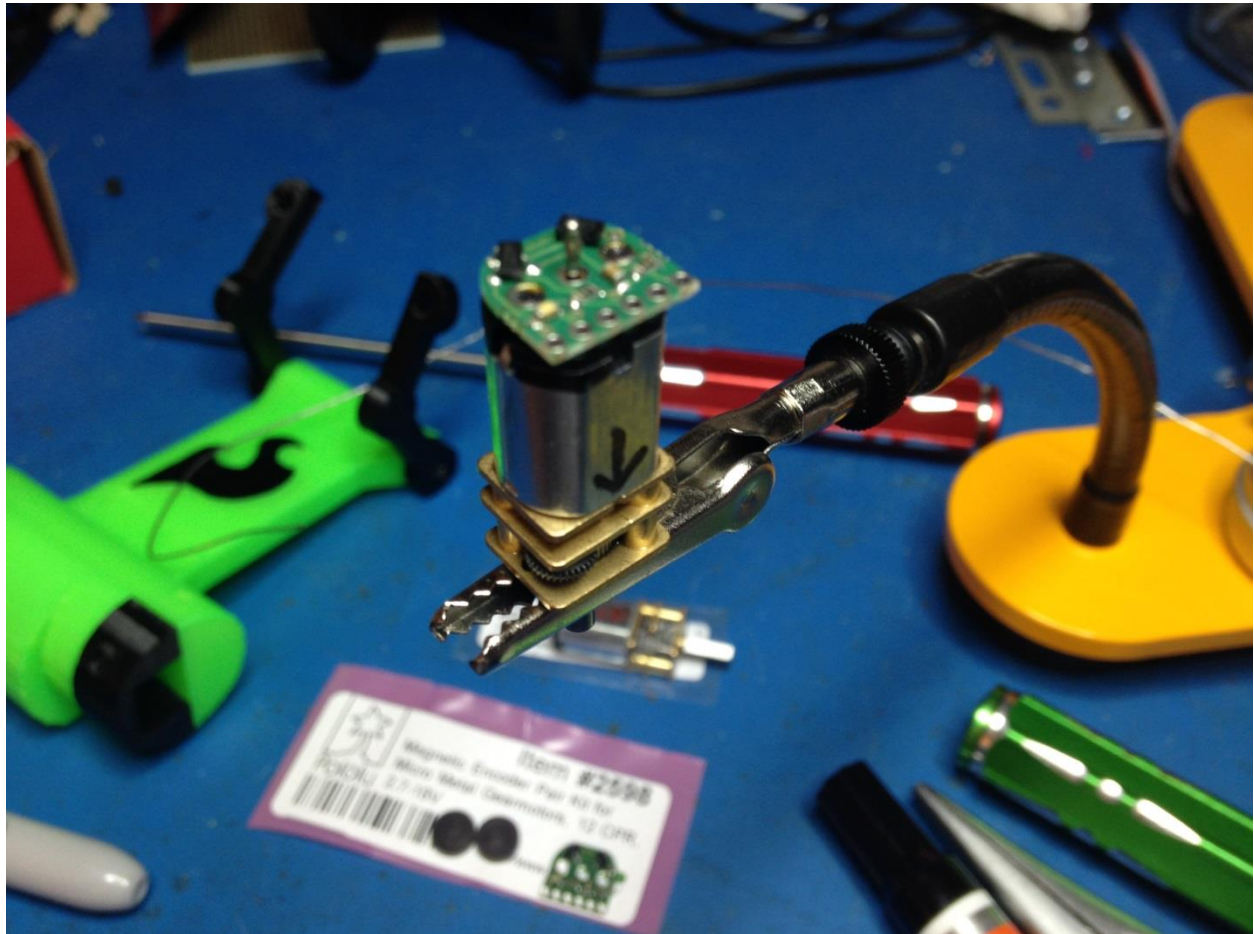
or

2x M2x3 Screws

4x M2x3 Standoff

Step 1 - Install Encoders

When installing the encoders you will notice they can be oriented two ways on the end of the motor but only one is correct for the purpose of this guide. Show below, notice the arrow I drew on the motor. This arrow is pointing towards the side of the gearbox that has no gears in the first half. Orient the encoder's six connectors towards this half of the motor as demonstrated.



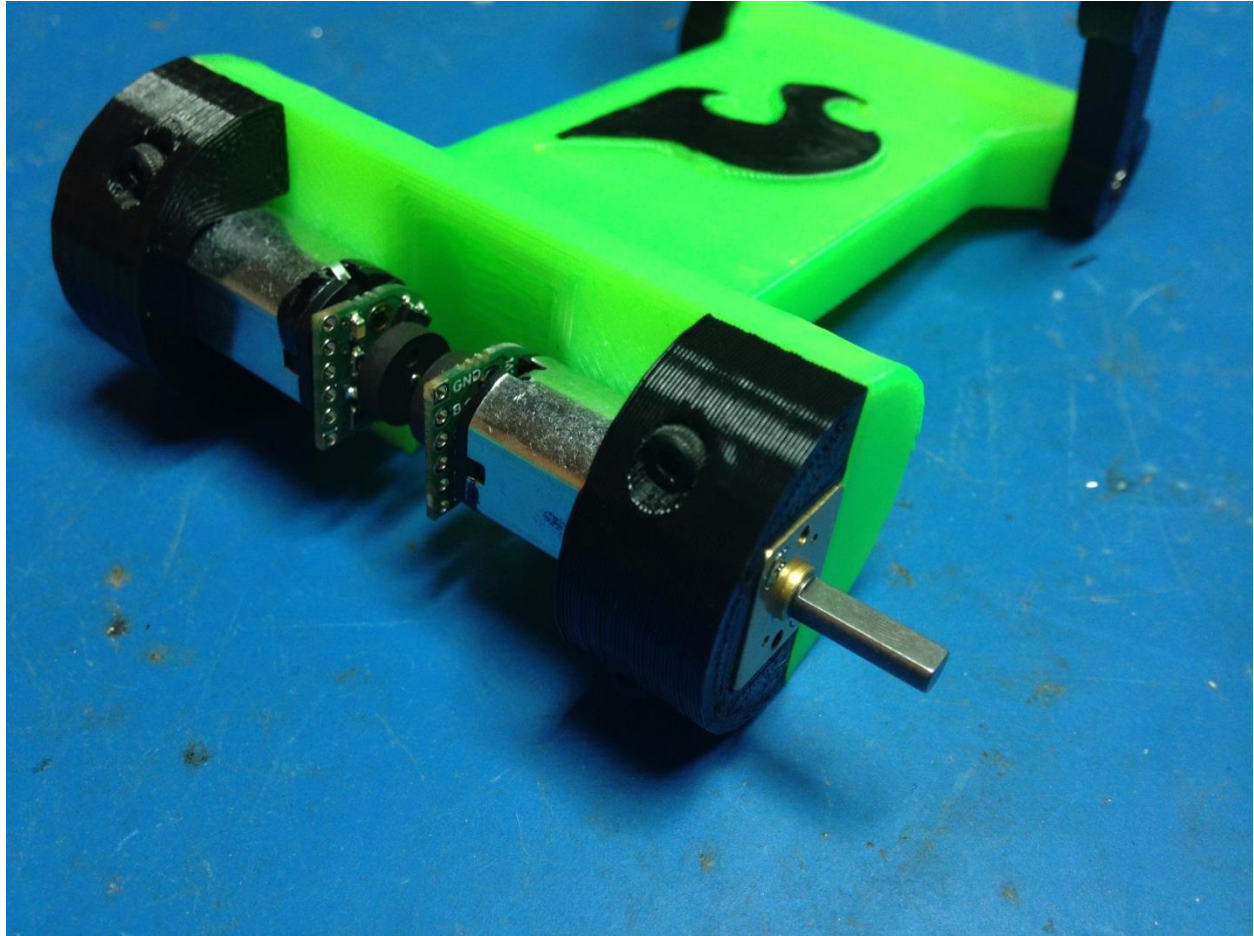
Note: Be sure to install the encoders nice and flush with the bottom of the motor.

Once soldered in place install the magnetic discs to finish the encoder installation on the motors.

Step 2 - Install Motors

Install the motors with encoders to the EddiePlus body using the printed motor mounts and M2x14 hex screws. Orient the motors with encoders as shown in the photo below.

Because of the thin threading take caution not to strip the plastic during installation. I recommend threading the screws into the body once before installing the motors.

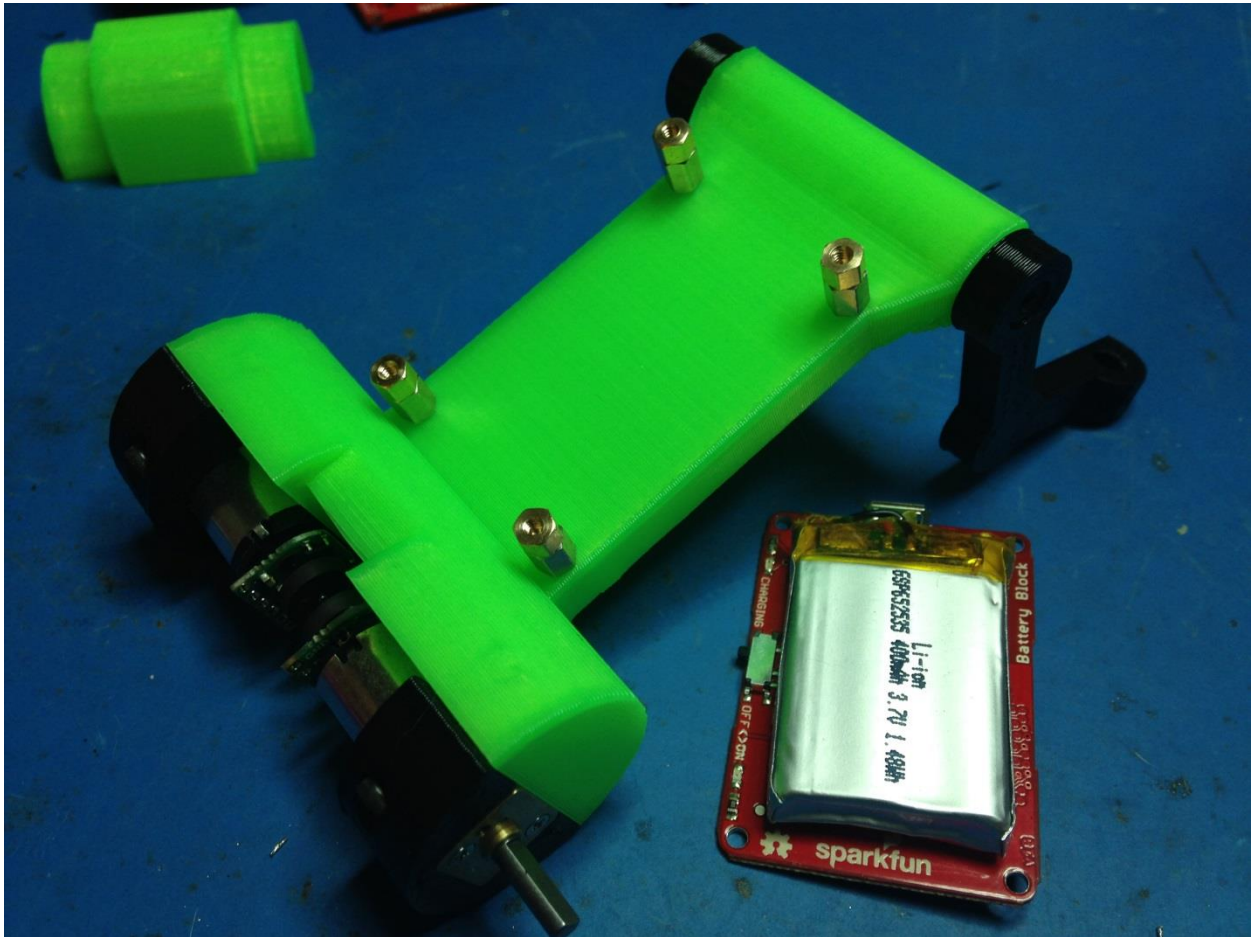


Note: The motors should be almost perfectly flush with the edge of the body and motor mount. Pressure and indentations inside the motor mount will hold the motor in place.

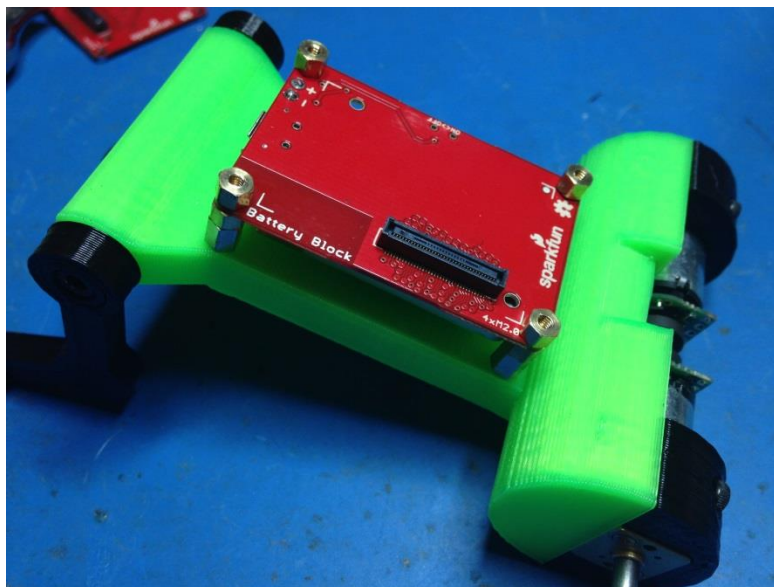
Also note: This photo was taken when I was using M2x14 screws to hold the motor mounts. After stripping out too many Eddie bodies I changed the motor mount design to accommodate more robust self-tapping screws. As a bonus the screw heads are completely hidden in the new motor mounts.

Step 3 - Install Battery Block

First attach the M2x5 standoffs to the back of the EddiePlus body; followed by a set of M2x3 standoffs to give the battery block enough clearance.



Note: Every Battery Block that I've received has had the battery pre-installed and required that I unstick the battery so it can be repositioned to fit within the four standoffs. Take caution not to bend the PCB if you have to re-stick your battery.

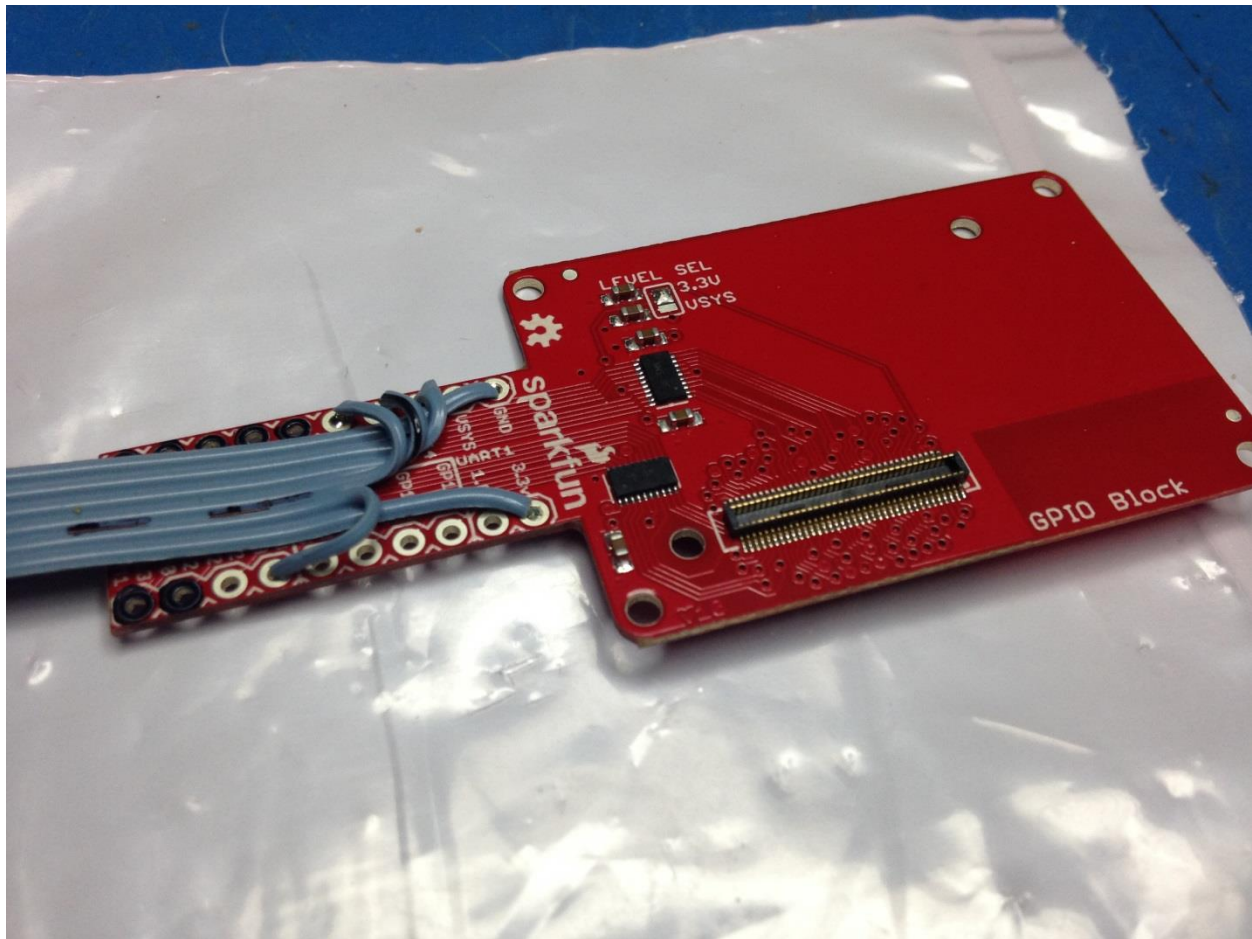


Step 4 - Install GPIO Block

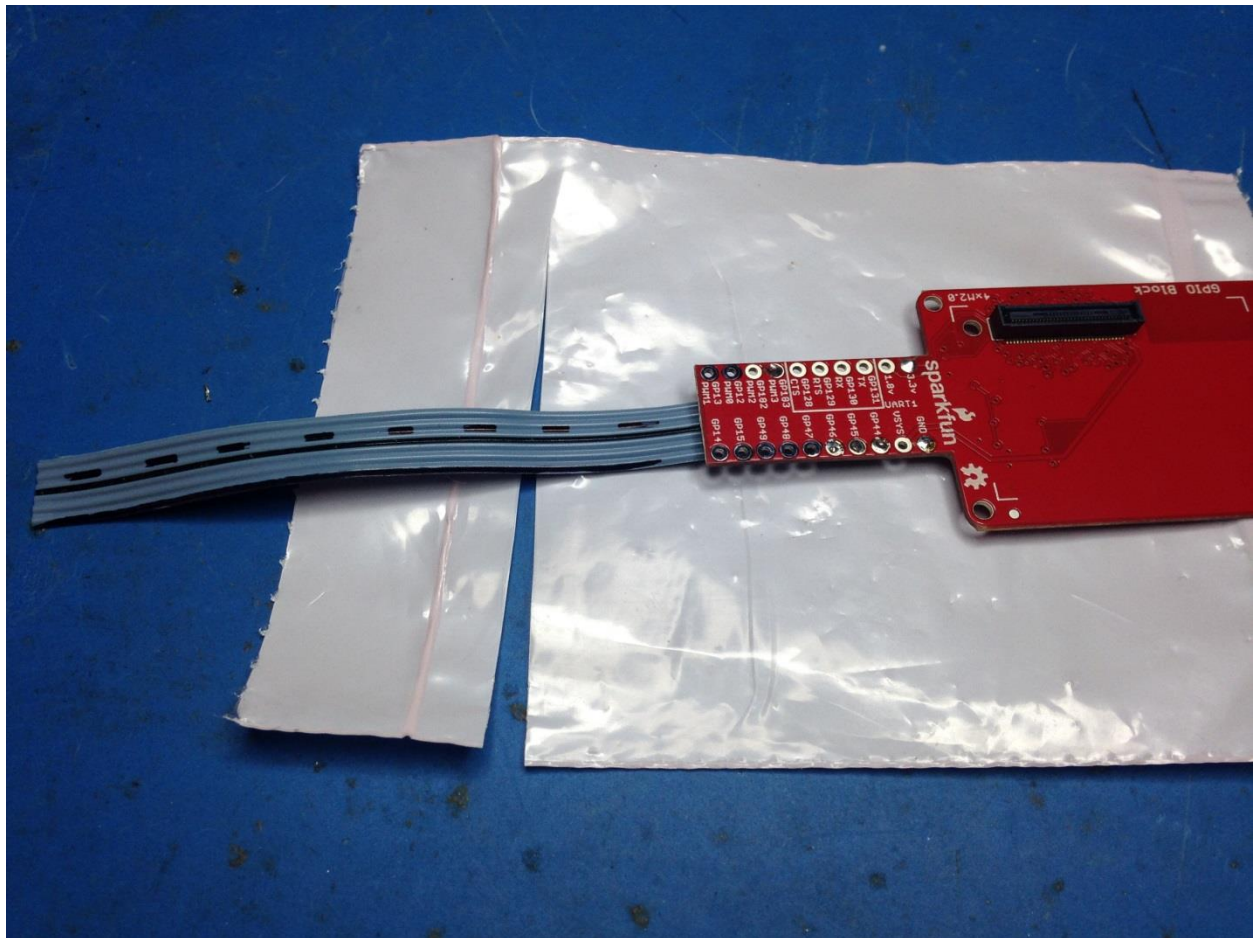
This is where the fun begins! You will need a short section (about 100mm) of ribbon cable 6 wires wide. Prepare one end of the ribbon cable by stripping the shielding on all six wires and apply solder to keep them from fraying apart.

I started by attaching power to one of the end wires on the ribbon cable then GND on the opposite side.

Using a razor I carefully separated enough wire to reach each of the four GPIO breakouts and soldered them in place.

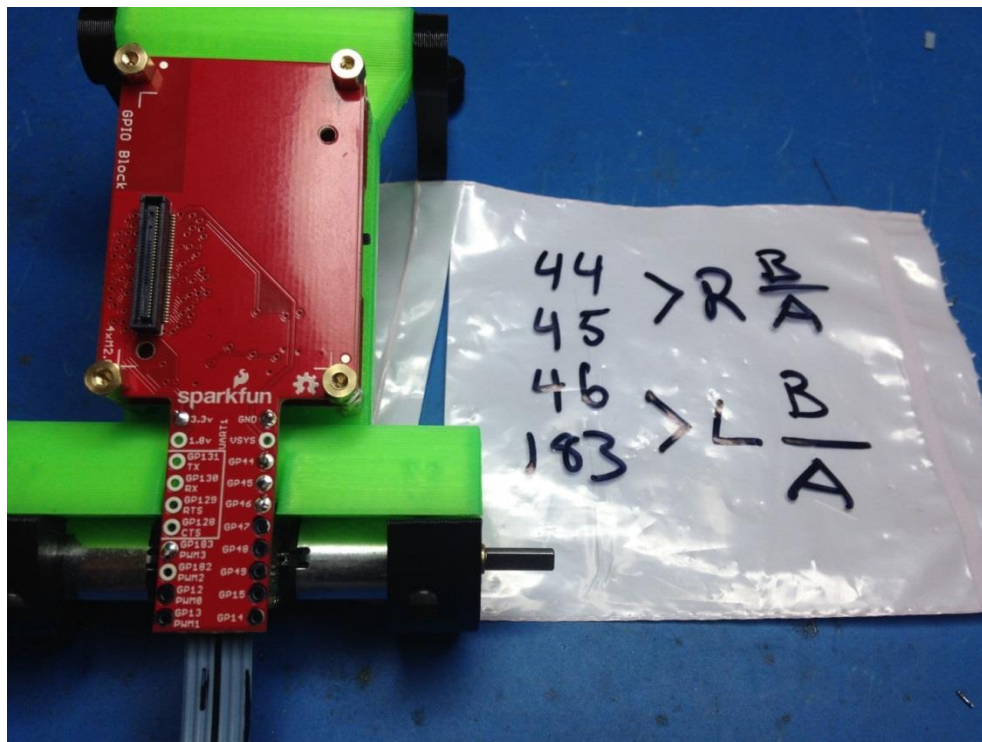


Note: I'm using 3.3V levels but if you were so inclined you could use VSYS (~4VDC).



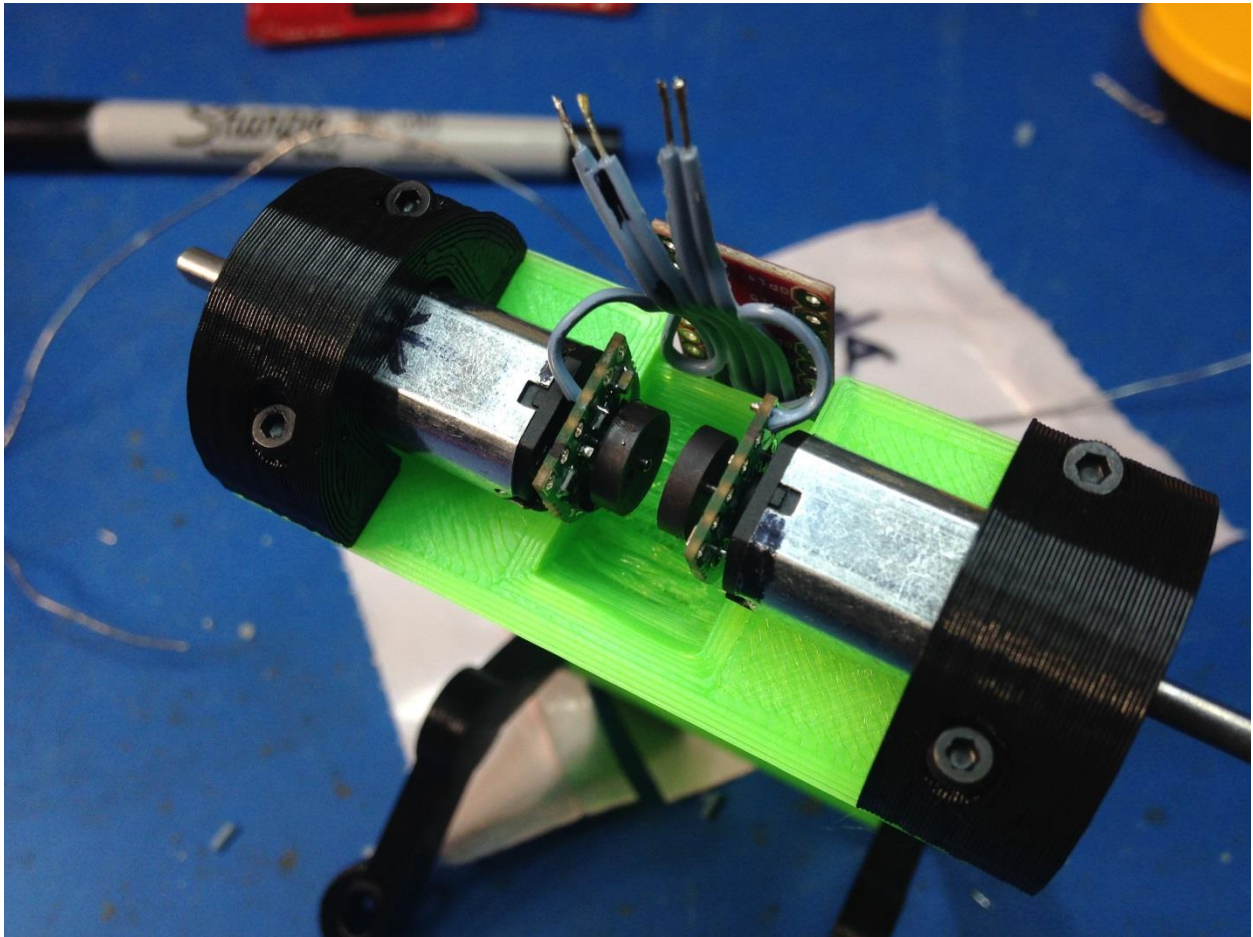
Note: Using a sharpie I marked the edge wire for GND and added dashes to the two wires used on the left encoder.

I also used a sharpie to blacken the seven GPIOs that are not available due to the Dual H-Bridge Block.

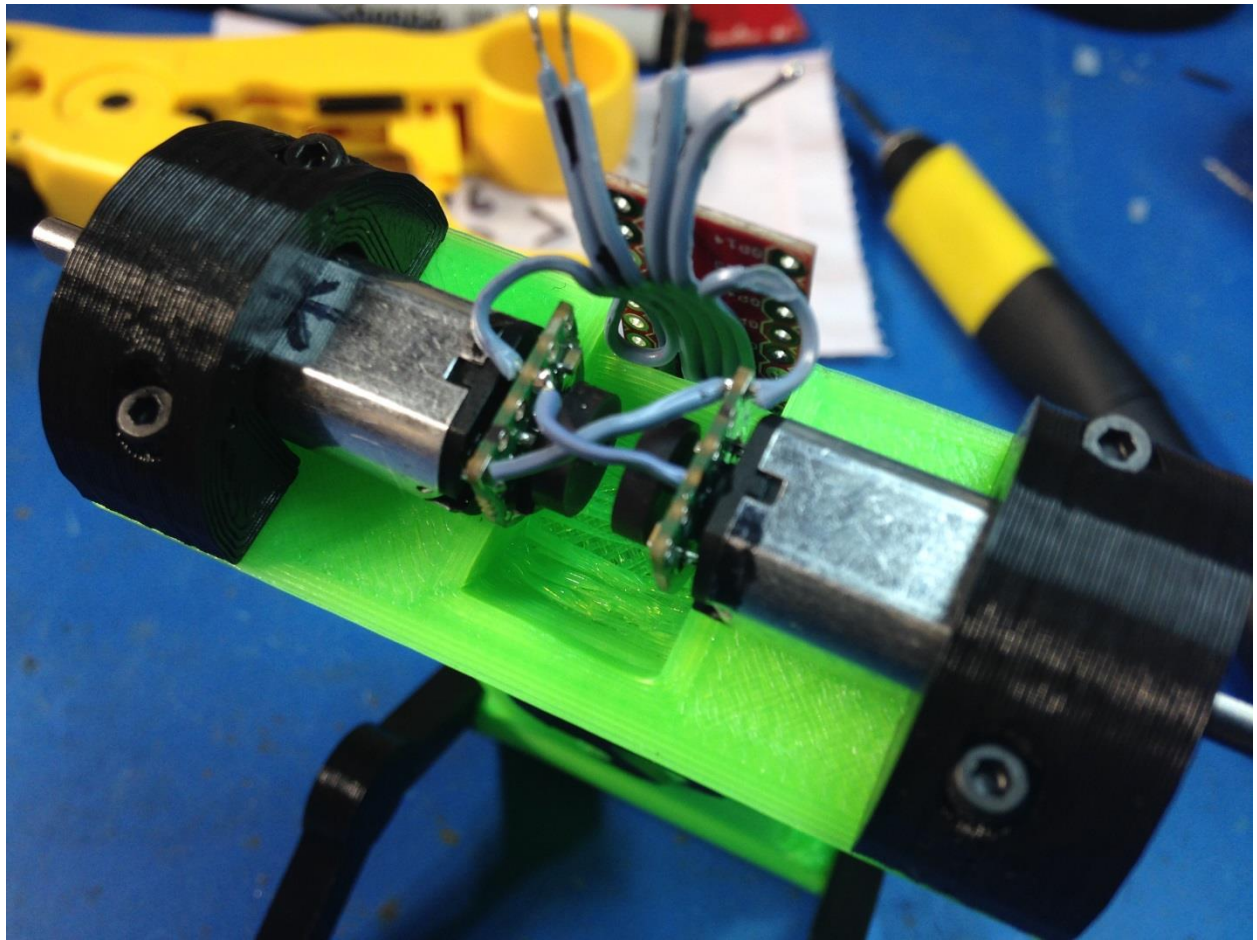


Step 5 - Wire GPIO Block to Encoders

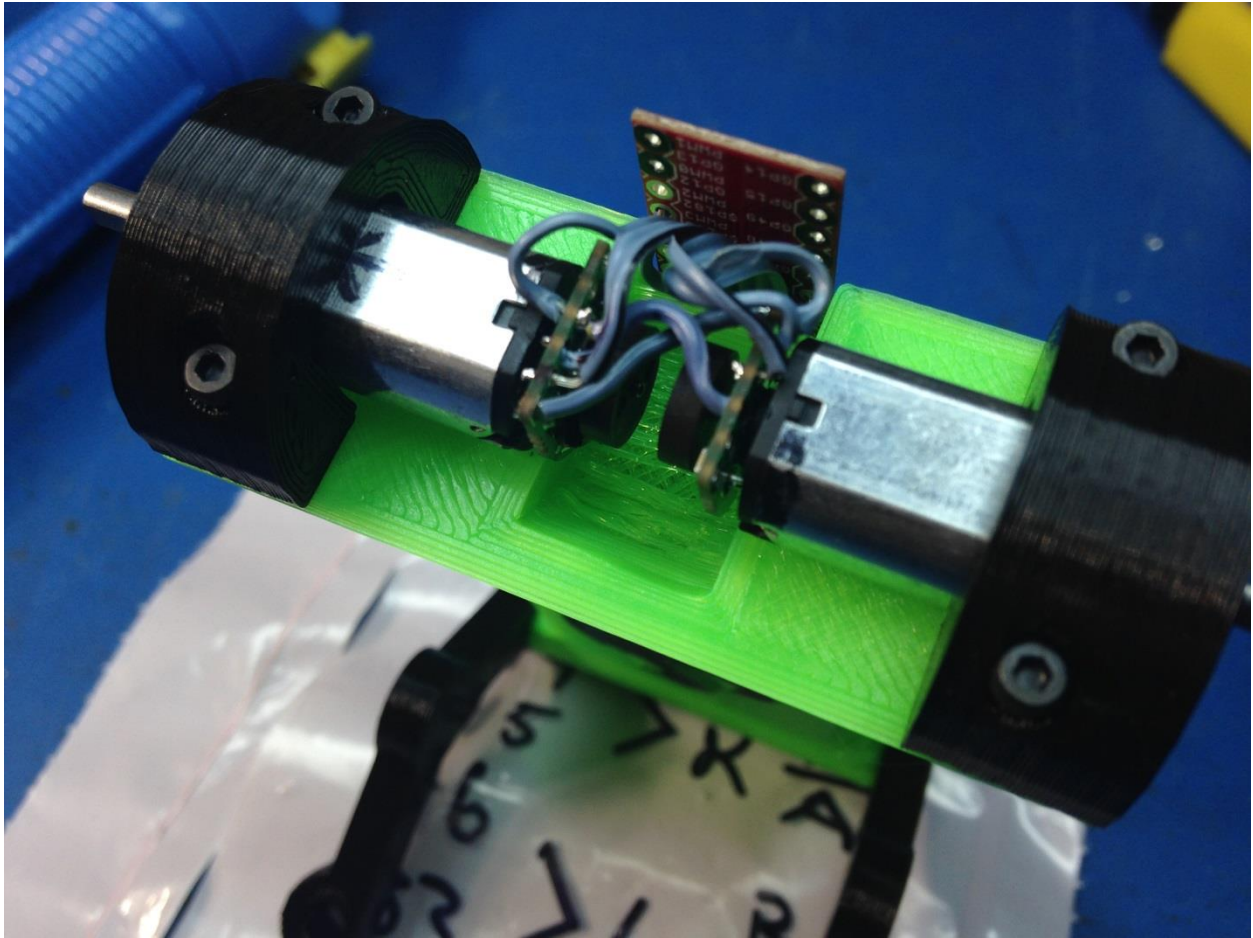
Yes the fun continues here. I started this section by soldering the 3.3V wire to one encoder and GND to the other.



Then using a couple of small sections of wire I bridge power and ground to the adjacent motor.



Next I soldered the encoder A and encoder B wires to A and B on both the left and right motors.

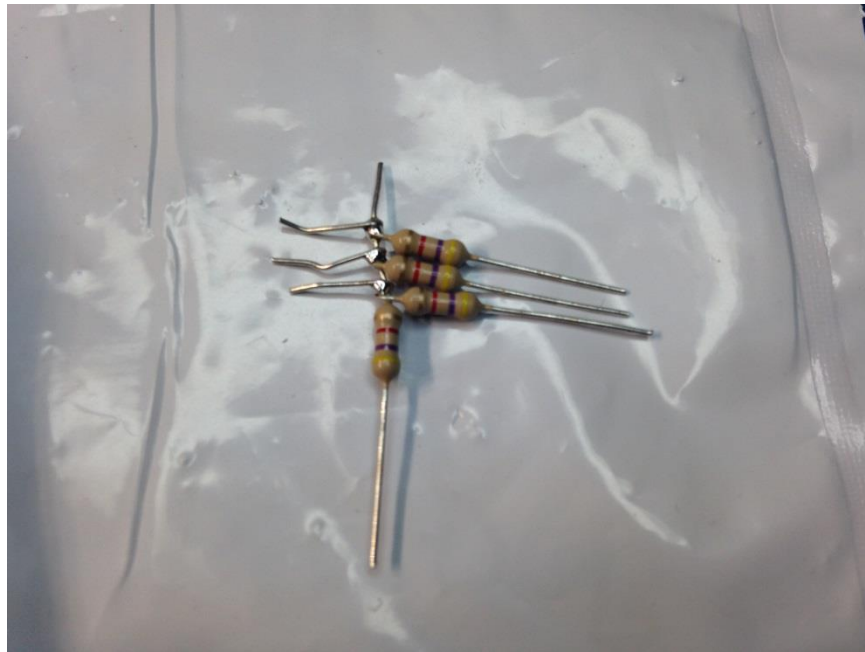


Once you've made it this far go ahead and give yourself a pat on the back. Be sure none of the wires are touching the encoder magnets and you should be in good shape.

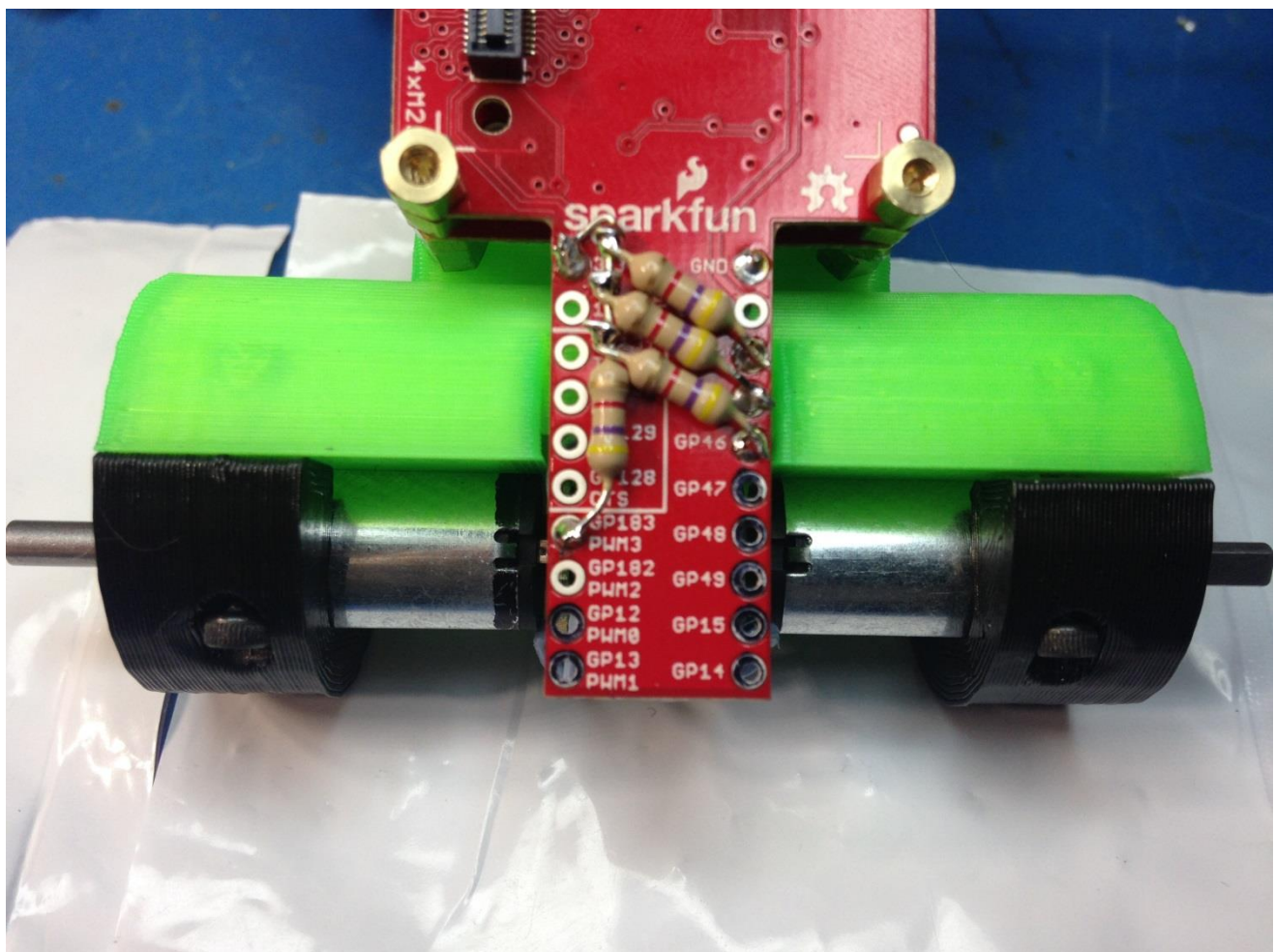
This is the encoder to GPIO connection table.

GPIO 44	Right Encoder	B connection
GPIO 45	Right Encoder	A connection
GPIO 46	Left Encoder	B connection
GPIO 183	Left Encoder	A connection

Now because the GPIO Block uses the TXB0108 for level shifting we are going to need to add some 5k ohm pull up resistors to each of the four encoder signals. Without these resistors the auto-direction sensing in the TXB0108 will not allow the encoder signals to reach the Edison.



NOTE: These are the smallest 5k resistors I had on hand. They work but are a little bulky.



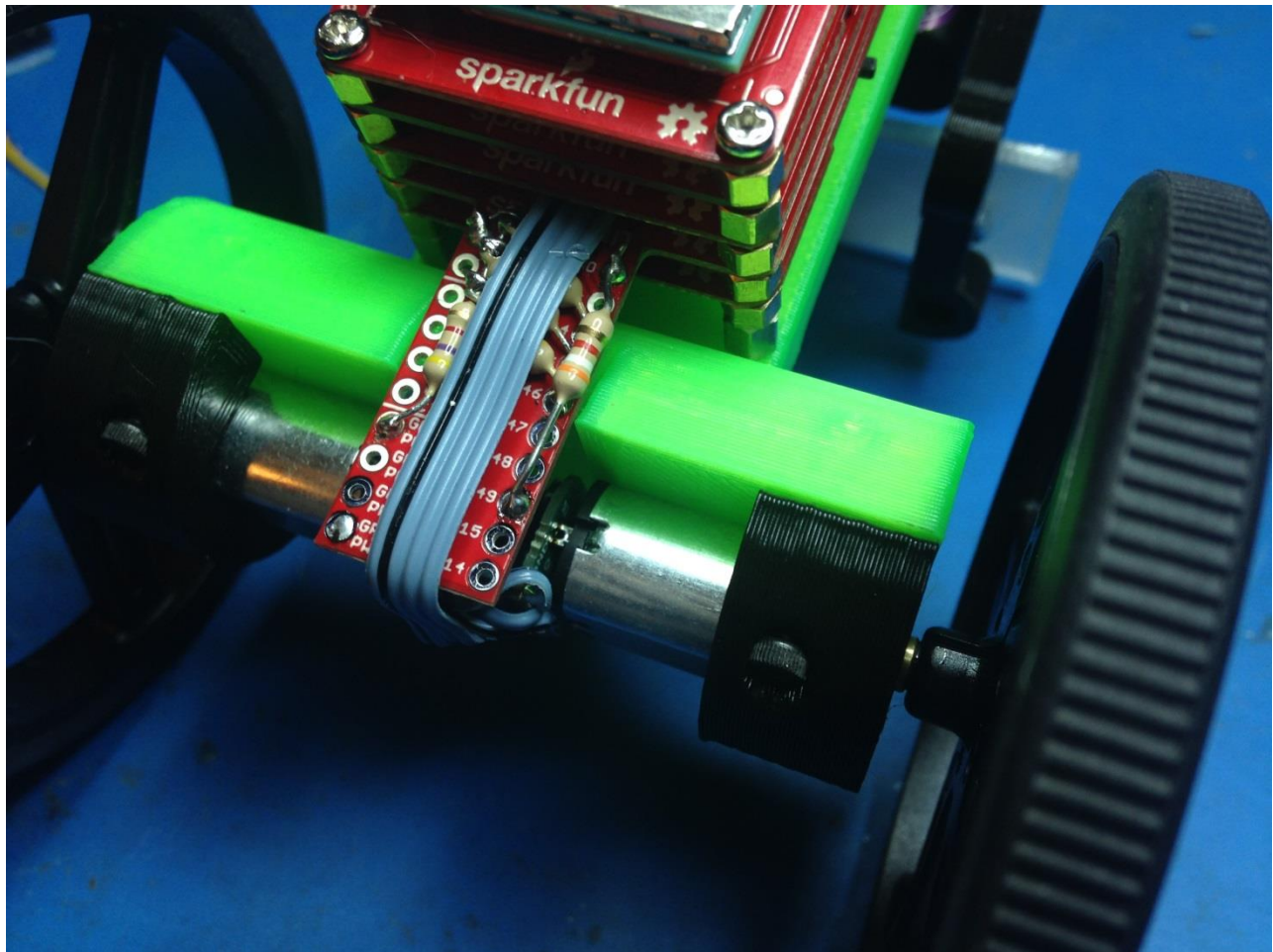
To prevent motors from running during boot a pull down resistor is used on GPIO 49. This prevents the TXB0108's default high-impedance state from bringing the dual H-bridge out of standby mode while the system is booting.

Tested pull down resistor on GPIO 49

4.7k NO – Stays high at boot

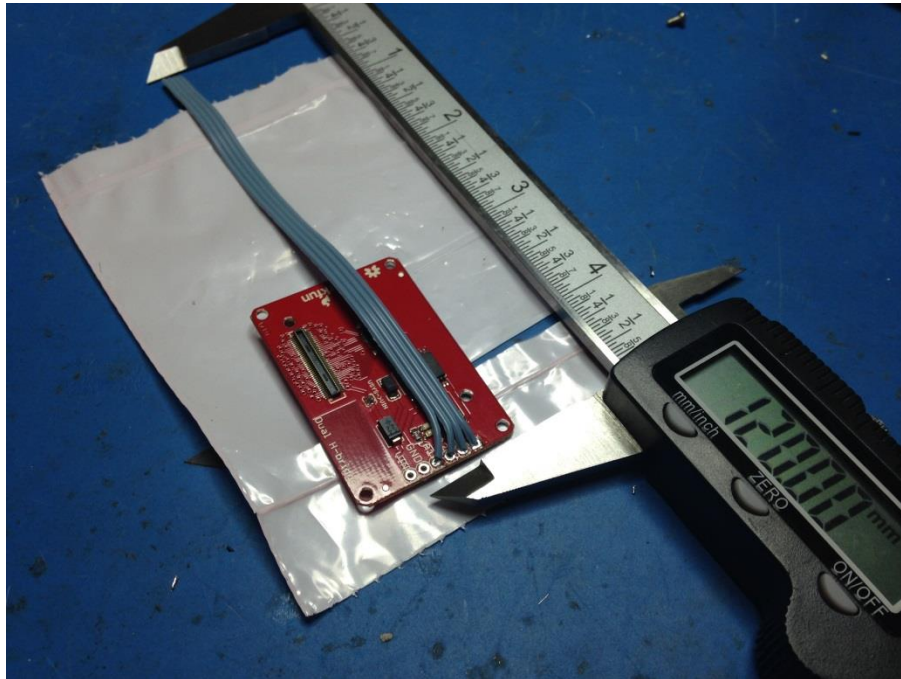
3.9k YES - Works

1.8k YES - Works

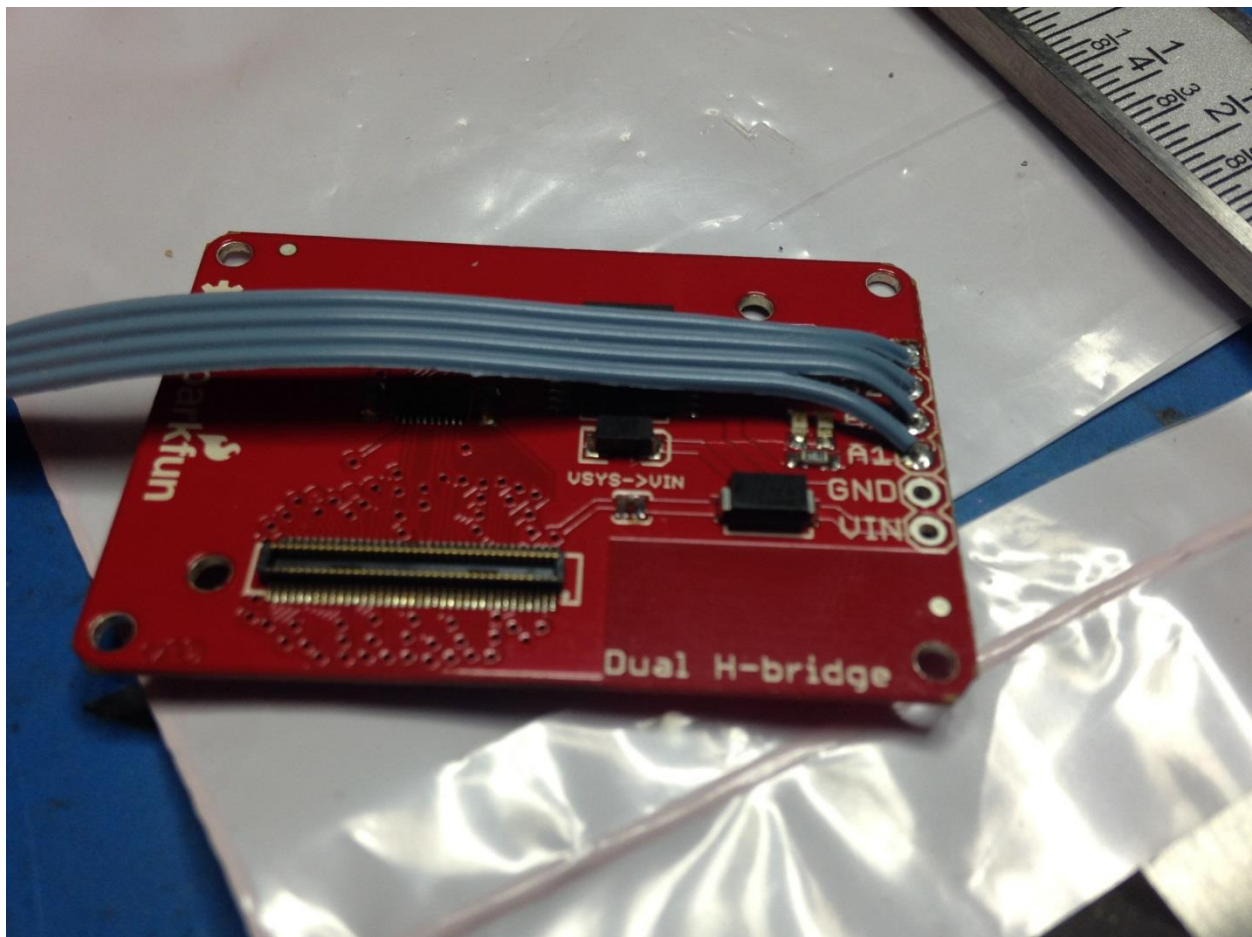


Step 6 - Wire and Install Dual H-bridge

For this step I started with about 120mm of ribbon cable that was 4 wires wide. Solder these to A1,A2,B1,B2 on the Dual H-bridge Block.

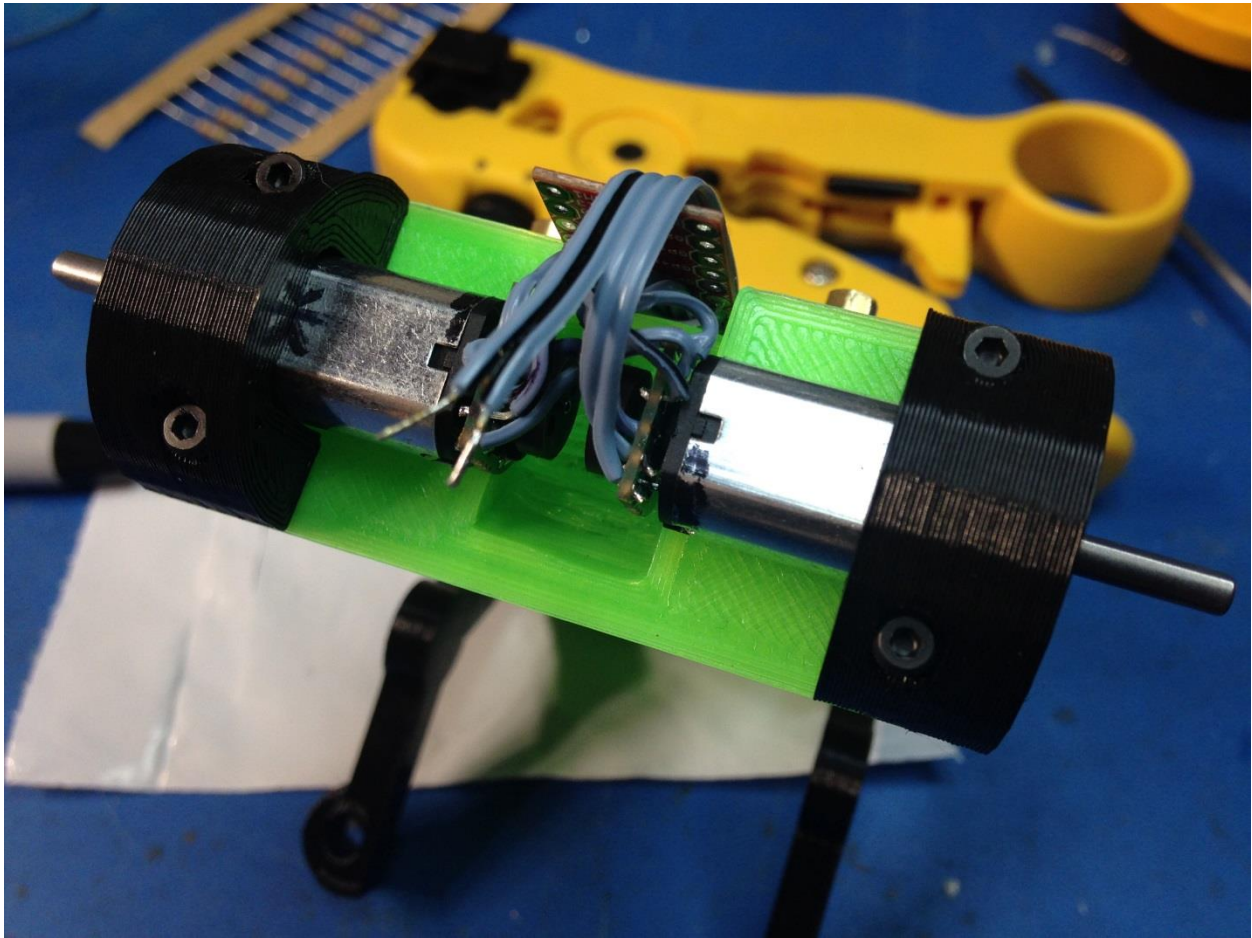


Next add a solder bridge to the VSYS->VIN pads. This will allow the battery power to drive the motors.

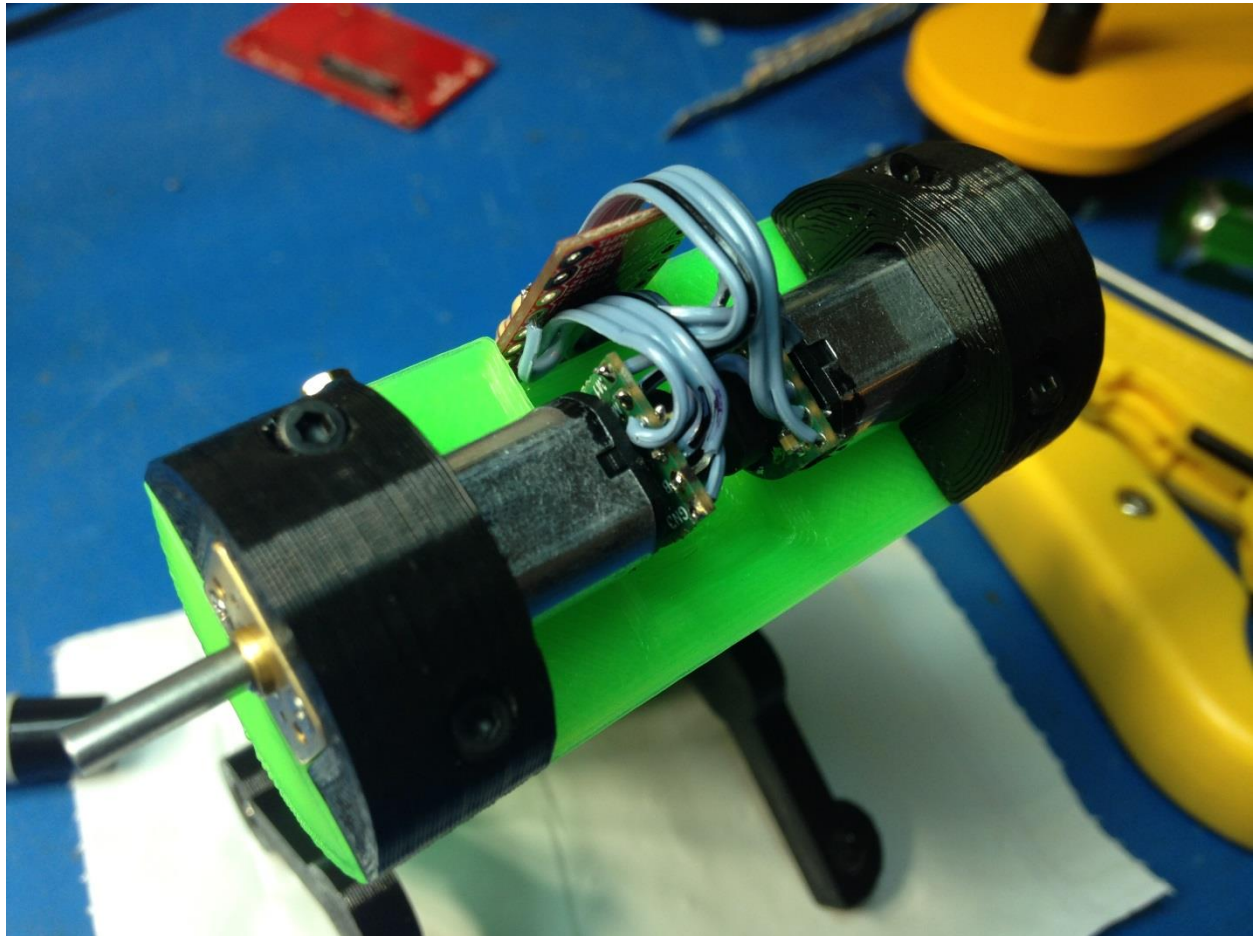


Install the PCB and wrap the wires around to the bottom side. Be sure not to pinch or put a kink anywhere in the ribbon cable as this will diminish the motor's drive power.

Use the image below as a guide. The wires on the right side go to the right motor. The rightmost wire is B1 on the H-bridge and connects to M1 on the encoder. The adjacent wire connects to M2 on the right encoder.

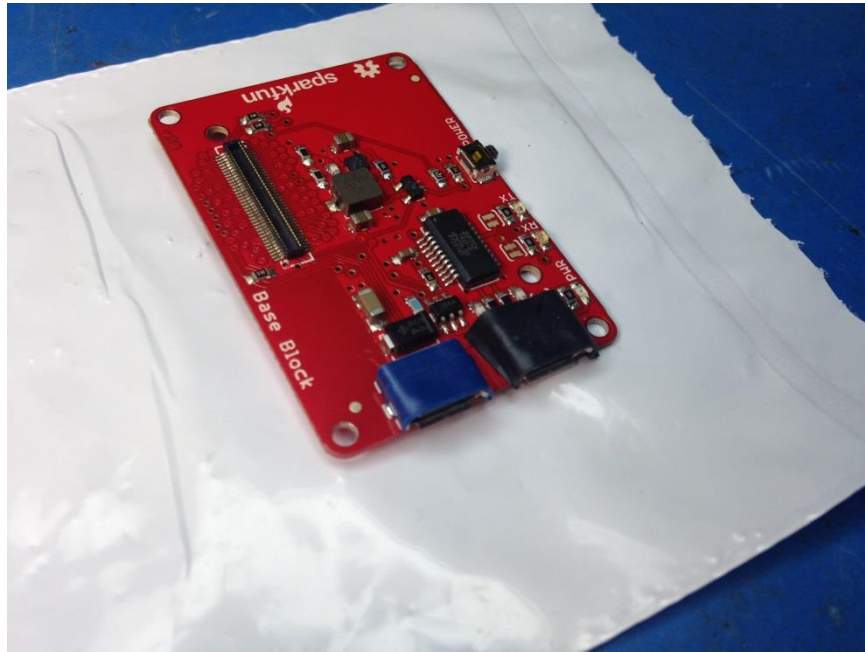


Use the image below as a guide. The remaining wires on the left side go to the left motor. The leftmost wire is A1 on the H-bridge and connects to M1 on the encoder. The adjacent wire connects to M2 on the left encoder.

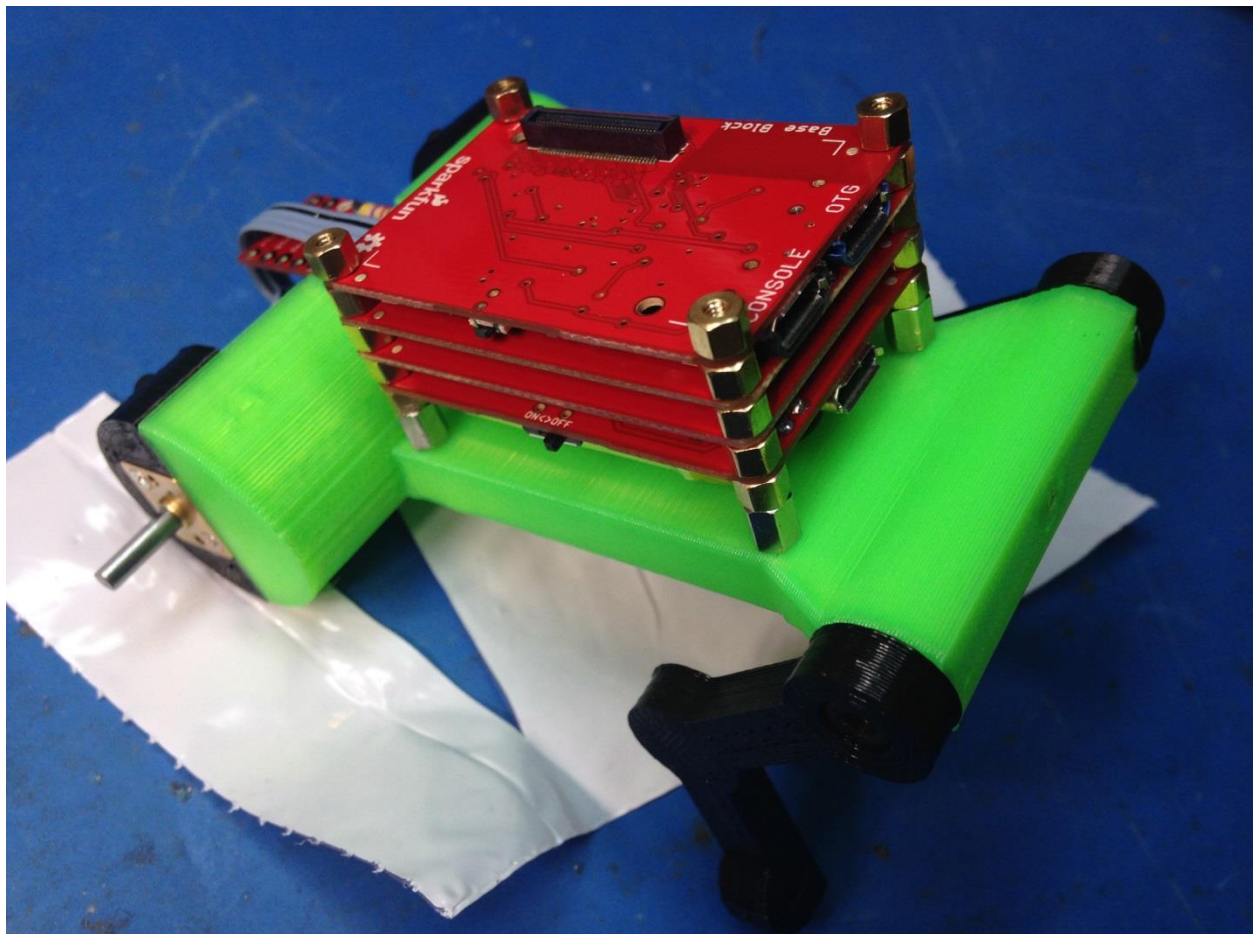


Step 7 - Install Base Block

Before you install the Base Block I recommend putting about 3 layers of electrical tape over the USB connectors so no conductive metal is exposed.

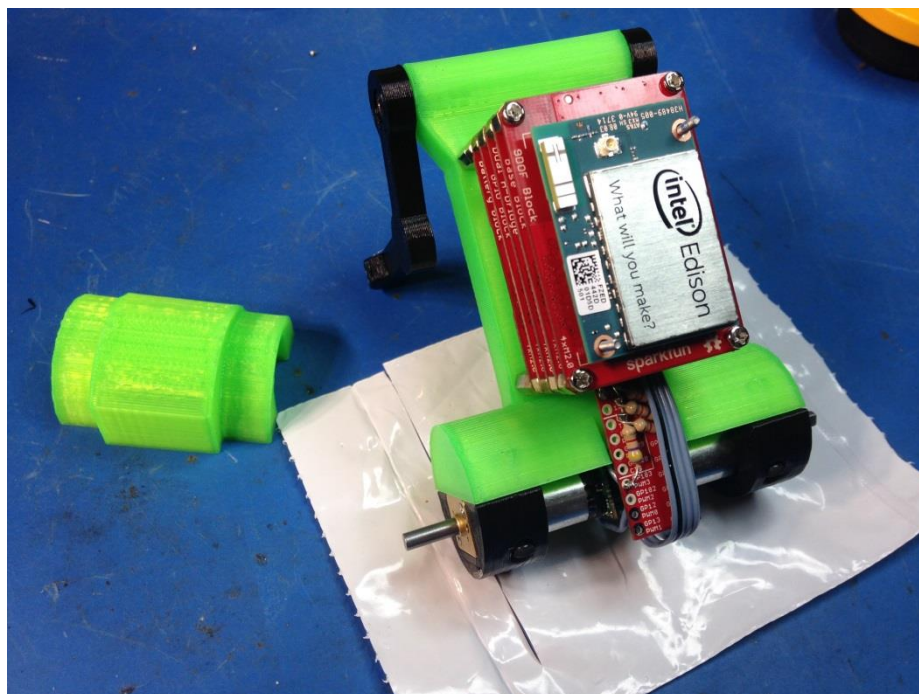
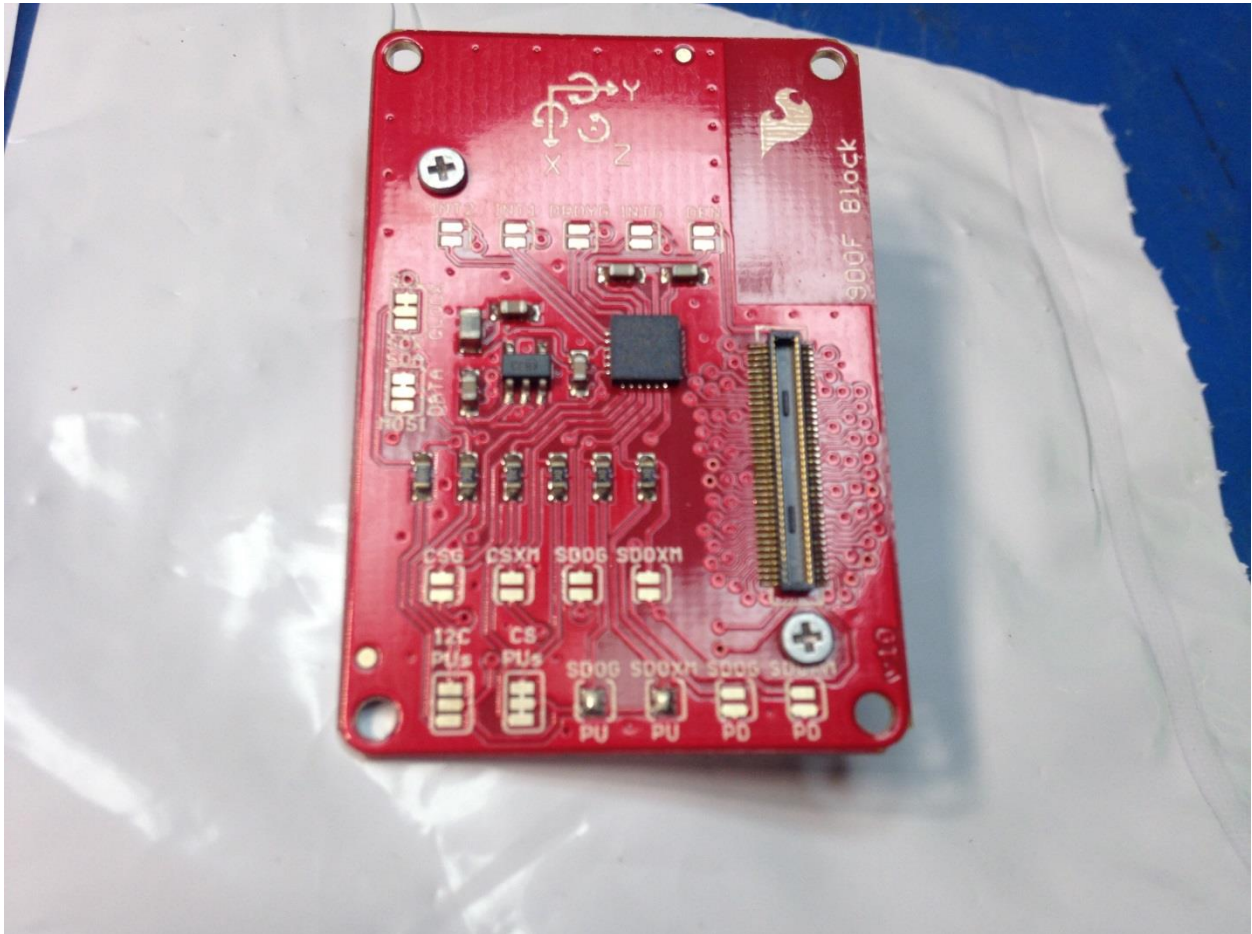


If you try to install the Base Block without protection you will see the USB connectors are dangerously close to contacting the H-bridge output.



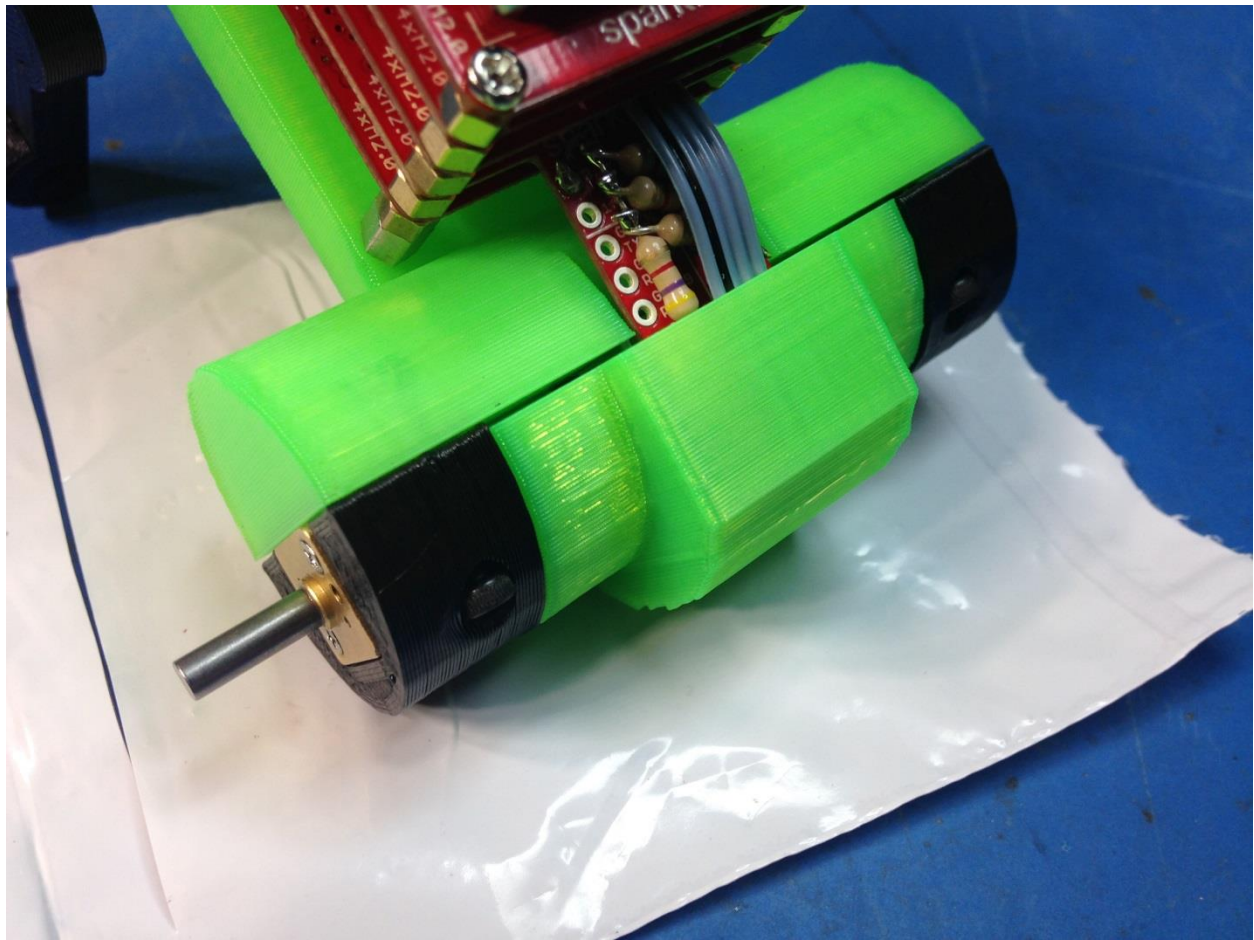
Step 8 - Install 9DoF Block

This is the last block in the EddiePlus stack and you will most likely want to secure your Edison. I used the M1.5 screws and M1.5x3mm spacers provided with the mini Edison breakout on this build. I've also had success with M2x3 screws and standoffs but watch out for the tiny traces next to the holes. You don't want to cause any trouble.

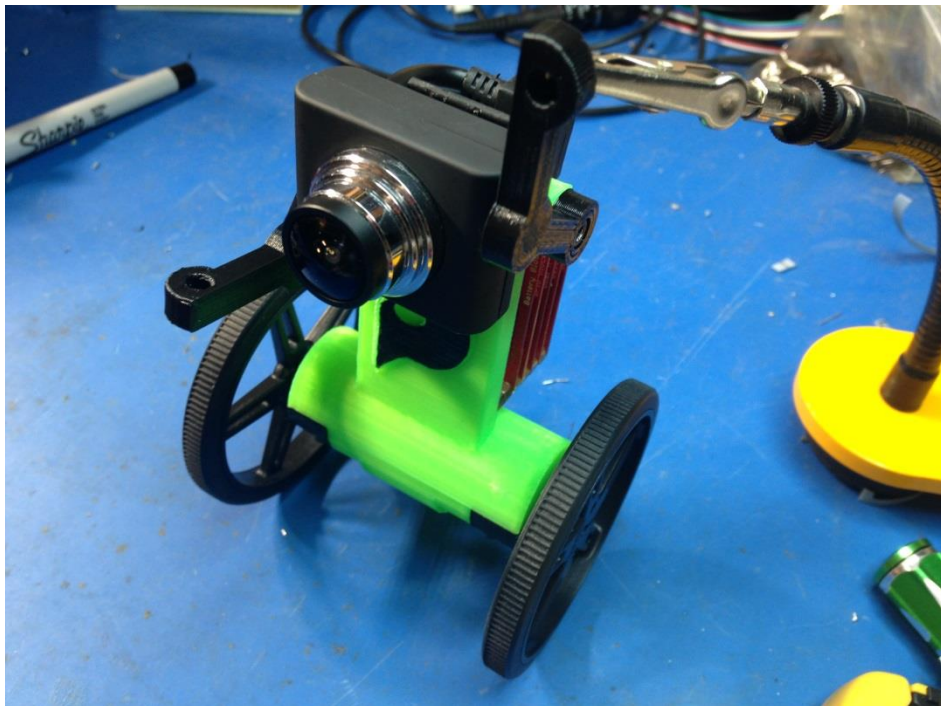


Step 9 - Install Motor Cover and Wheels

The motor cover should press fit with a minimal amount of pressure and stay in place without screws. There is enough clearance for the ribbon cable to wrap around the underside of the GPIO Block and not be pinched by the cover.



When installing the wheels I recommend using your index finger and thumb to apply pressure to the motor mount and body while pushing the wheel in place. The motors do lock in place when installed properly but I'd hate for something to go wrong when pushing the wheel onto the output shaft.



Congratulations! You have made it and are ready to download the EddiePlus source code. I hope you enjoy your Eddie.