DROPLiT

Welcome to the Assembly Guide for the DropLit 3D printer.
Version 0.50, September 29th, 2014

Questions or corrections should be emailed to geneb@deltasoft.com

Disclaimer text provided by LulzBot

READ ME FIRST!

READ THIS MANUAL COMPLETELY BEFORE ASSEMBLING AND POWERING UP YOUR PRINTER!

Hazards and Warnings

The SeeMeCNC DropLit 3D printer has motorized parts. When the printer is in operation always be aware of possible hazards.

Electric Shock Hazard

Never open the electronics bay of the printer while the printer is powered on. Before removing the access door, always power down the printer and unplug the AC line cord.

Fire Hazard

Never place flammable materials or liquids on or near the printer when powered on or in operation.

Pinch Hazard

When the printer is in operation, take care to never put your fingers in the moving parts, including the belts, pulleys or gears. Also, tie back long hair or clothing that can get caught in the moving parts of the printer.

Static Charge

Make sure to ground yourself before touching the printer, especially the electronics. Electrostatic charges can damage electronic components. To ground yourself, touch a grounded source.

Age Warning

For users under the age of 18, adult supervision is recommended. Beware of choking hazards around small children.

Table of Contents

0 – Introduction and Acknowledgments

I’d like to welcome you to the DropLit assembly guide!

Please read this entire guide before you begin assembly of your new DropLit! It will help you avoid any unpleasant surprises and will ensure that you’ve got everything you need BEFORE you need it! Understand that the photographs in this assembly guide do NOT tell the whole story of each step! Make sure you read and understand the accompanying text for each step!

A quick note on the Arduino Uno and the gShield. These two devices work in combination to control the DropLit and are very static sensitive, so please don't take them out of the bags they ship in until you're ready to install them.

1 – Required and Optional Tools And Materials

Before you begin assembly of your DropLit, please make sure you've got everything on the following list of tools and additional materials.

- P1 & P2 sized Phillips screwdrivers
- Small flat tip jeweler's screwdriver
- Standard flat head screwdriver
- 5/32" Allen Wrench
- 5/16" Wrench
- 3/8" Wrench
- Wire strippers
- Wire cutters
- Battery powered screwdriver. If you ever needed an excuse to buy one of these, THIS IS IT.
- Soldering Iron
- Thin Super Glue.
- Waxed lacing cord. This is optional, but you can use this in place of wire ties in pretty much any application. You can find it here: http://www.skygeek.com/wht-string.html. While expensive, you'll never really need to buy a wire tie again and it'll likely last you the rest of your life. :)
- Q-Tips

2 – Visual Bill of Materials

Your DropLit kit should contain a wrapped pack of Melamine parts, three bags of parts (two bags of hardware, one bag of electronic parts) a short section of aluminum extrusion and a power supply.

Fig. 2-1: DropLit package contents.

The Melamine parts are covered with a special cutting mask that prevents the laser cutting operation from depositing laser cutting byproducts on the Melamine surface. You'll need to remove all of this material before beginning construction.

This process is called the Five Stages of Masking Tape.

1. Denial - Oh there's no way I need to scrape all this tape off those parts? Do I?
2. Anger - @#$%@#! This sucks! I've NEVER SEEN SO MUCH TAPE IN ONE PLACE IN MY LIFE!
3. Bargaining - “Well hi there, Significant Other! Would you PLEASE remove all this tape for me? PLEASE?”
4. Depression - This tape hates me. *sobs quietly*
5. Acceptance - Well I suppose if I'm ever going to get this thing built, I'd better get on with it and get all this tape removed...*sigh*

Ok, it's not THAT bad, it just seems like it. It beats having sticky residue all over your nice and

clean Melamine parts. :)

For those that aren't sure how to identify the various screw types, Bolt Depot has made available some *excellent* references. I would recommend Fastener Basics (http://www.boltdepot.com/fastener-information/Printable-Tools/Fastener-Basics.pdf) and their Fastener Type Chart (http://www.boltdepot.com/fastener-information/Type-Chart.aspx).

DropLit Hardware Bag #1

(___) (3) M5 Zinc Plated Nut

(___) (6) 1/4” ID x 5/8” OD x .196” Ball Bearing (R4ZZ)

(___) (57) #6-32 x 1” Phillips Pan Head Screw 18-8 SS

(___) (6) #6-32 x 2” Phillips Pan Head Screw 18-8 SS

(___) (10) #6-32 x 5/8” Socket Head Cap Screw 18-8 SS

(___) (75) #6-32 Nylon Lock Nut SS

Rubber foot pack containing

(___) (4) Leg for 44010 Foot

(___) (4) Rubber Foot (44010)

(___) (4) #10-32 x 5/8” Pan Head Screw (Nylon)

(___) (4) #10-32 Nylon Finish Nut

(___) (4) Plastic Bearing Roller 1/8” ID x 3/8” OD x 0.156” W

(___) (4) #6-32 x 1/2” Slotted Pan Head Screw (Nylon)

(___) (6) 1/4-20 T-Slot Nut

(___) (6) 1/4-20 x 1/2” Button Head Cap Screw (SS)

(___) (6) #2-56 x 5/8” Pan Head Screw

(___) (6) #2-56 Finish Nut

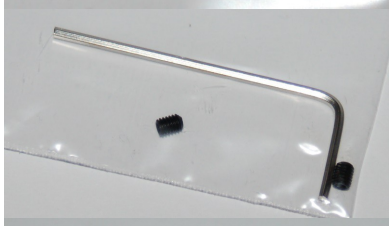
(___) (4) M3-.05 x 10mm Phillips Pan Head Screw (SS)

(___) (4) #4 SAE Flat Washer (SS)

(___) (8) #6 x 1/2” Phillips Pan Head Sheet Metal Screw (SS)

(___) (1) .300” OD x .030 wire x 1/2” SS Compression Spring

(___) (2) #10-32 T-Nut



(___) (2) M3-.5 x 6mm Allen Set Screw

(___) (1) 1.5mm Allen Wrench

(___) (4) #10-32 x 3/4” Knurled Thumb Screw (Black Nylon)

DropLit Hardware Bag #2

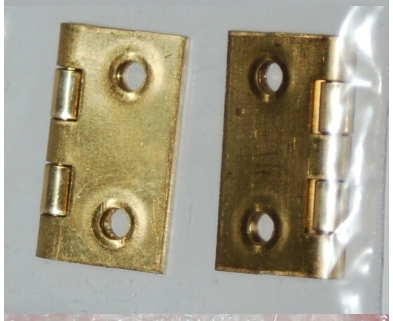
(___) (1) 12”, M5 Threaded Rod

(___) (1) 5mm Shaft Coupler

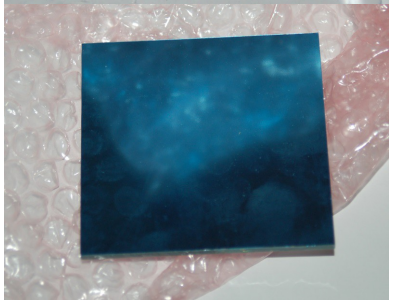
(___) (1) 15-1/4” T-Slot Extrusion

(___) (1) Build Platform Standoff

(___) (12) R4 Bearing Sleeve



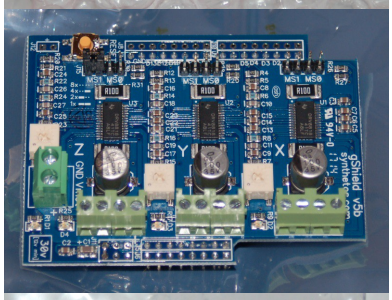
(___) (2) Hinge, 1x1



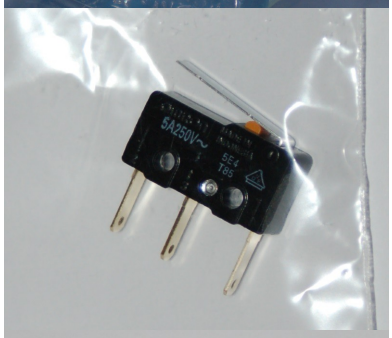
(___) (1) 75mm x 75mm First Surface Mirror

DropLit Electronics Pack

(___) (1) Arduino UNO R3



(___) (1) Gshield 3 Axis Stepper Motor Board



(___) (1) SW143-ND SPDT Micro Switch

(___) (2) Spade Terminal Crimp for Power Switch

(___) (1) NEMA 17 Stepper Motor (4800gcm holding torque)

(___) (1) Rocker Switch (Round)

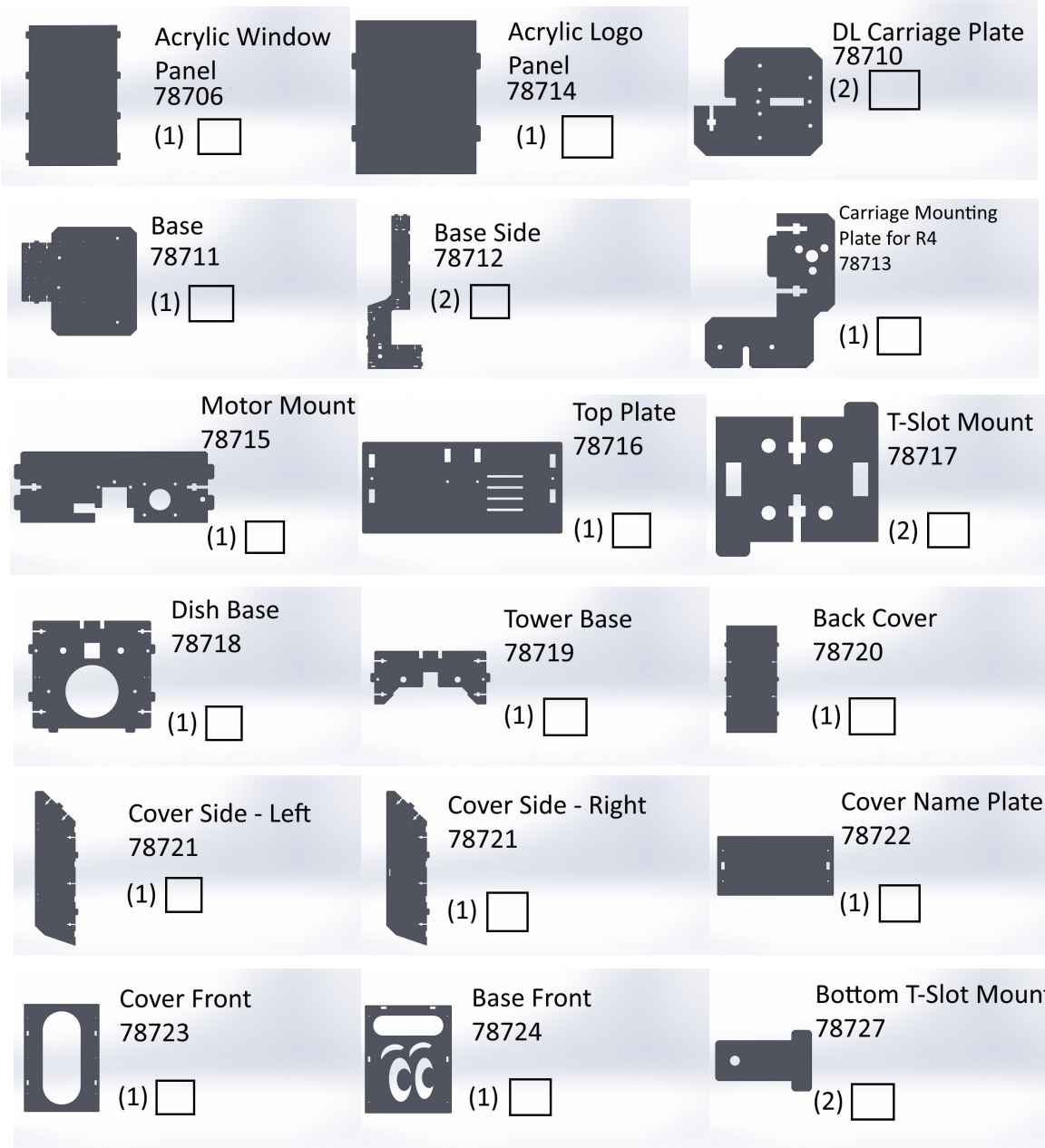
(___) (1) 550W ATX Power Supply (Viotek)

(___) (8) Small Wire Ties

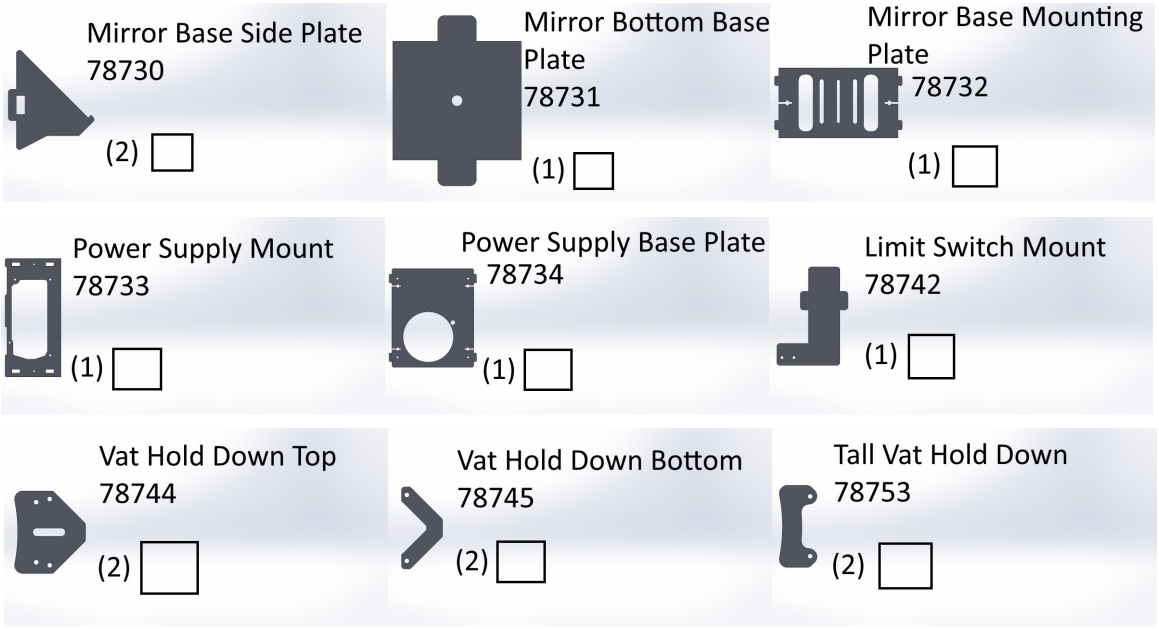
(___) (3ft) 26ga Black & White wire

DropLit Acrylic & Melamine Parts

The following parts will be found in the main laser cut parts package. Check off each item as you locate it. Please contact support@seemecnc.com if you're missing any of these parts.



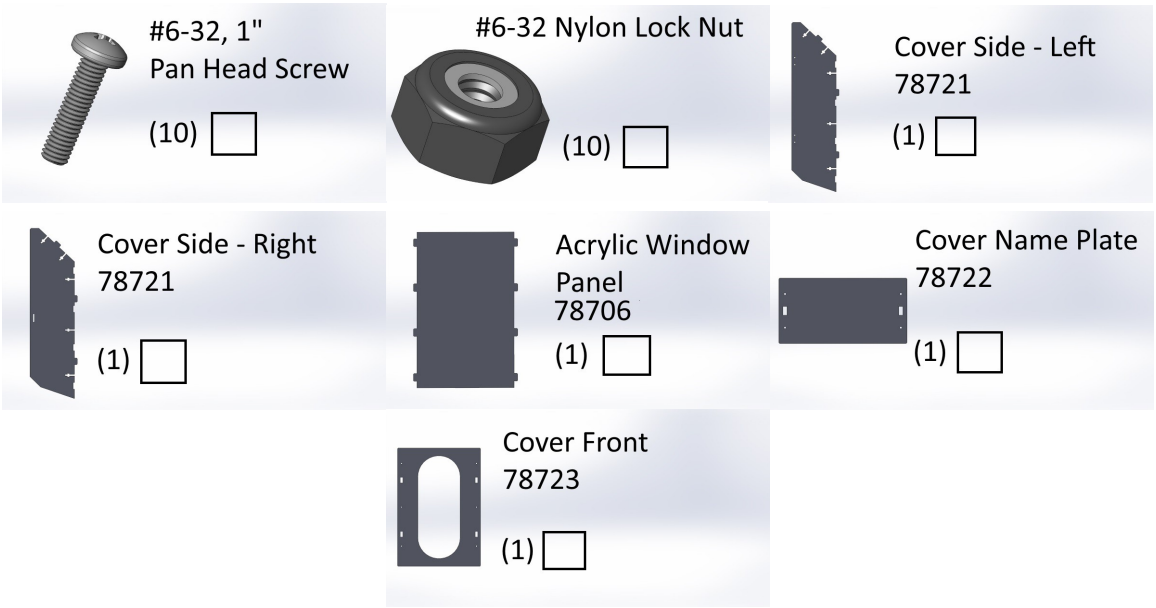
DropLit Acrylic & Melamine Parts – Continued



3 – Getting Started: Building the Front Cover

As discovered by the SeeMeCNC forum user “mhackney”, a good first step in building the DropLit is to start with the front cover. This is an excellent choice as it gives builders an easy introduction into the tab & slot construction that all SeeMeCNC 3D printers enjoy.

For this task, you'll need the following components:



The Cover Name Plate is identified by the laser-engraved SeeMeCNC logo as shown:

Fig. 3-1: Cover Name Plate

We're going to start the cover assembly by setting three #6-32 nylon lock nuts into the nut capture pockets on the left “side” of the cover. The left side is identified by the two pair of hinge holes along the edge of the side panel.

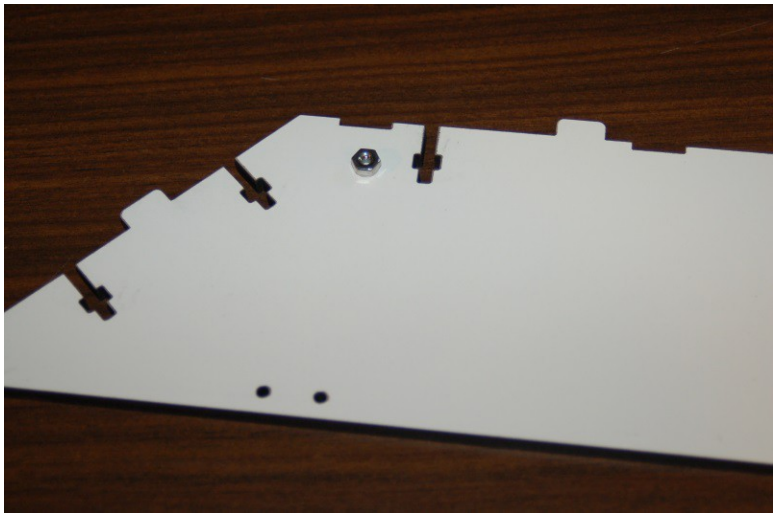


Fig 3-2: Nut & nut pockets

The laser cut nut pockets are designed to fit the nylon lock nuts snugly. If they're too difficult to press in from one side, try inserting the nut from the other side of the part. The laser leaves behind a bit of a beveled “kerf” that is wider at the top of the cut than at the bottom. This feature can help insert problematic nuts. If the nut REALLY won't fit, you can give it a bit of encouragement using a pair of needle nosed pliers. Just make sure that you're inserting the nut squarely as shown on the right.

Fig 3-3: Setting the nut.

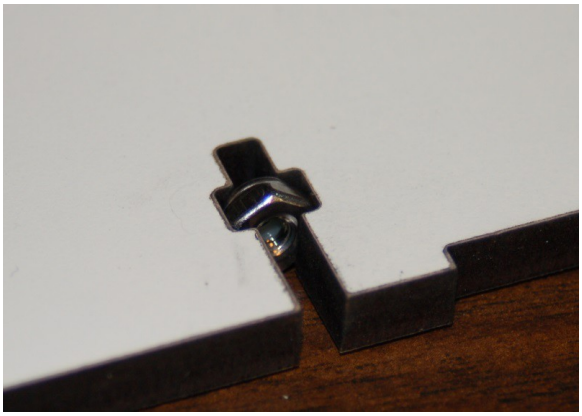


Fig 3-4: Nut fully seated.

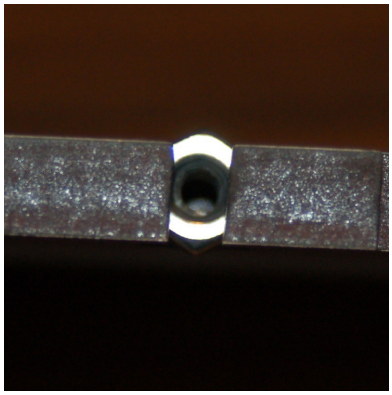


Fig. 3-5: Edge-on view.

The figures above show what a properly seated nut is going to look like.

Go ahead and insert two more of the nuts along the long edge of the cover side as shown below.

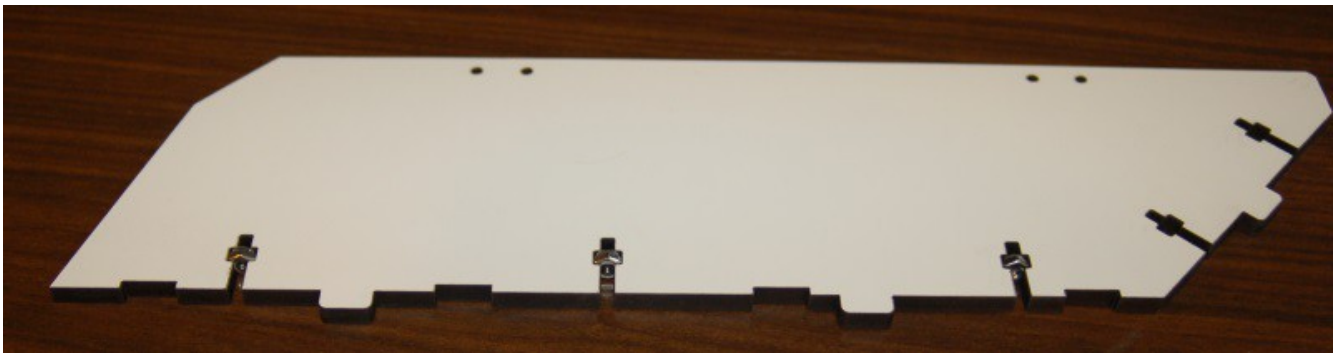


Fig. 3-6: First three nuts installed.

Lay the Cover Front flat on the table and align the cover side as shown – there's only one correct way, where all three screw holes align.

Fig. 3-7: Cover side alignment.

Press the tabs from the side into the slots on the Cover Front and then lay it over on the cover side so you can insert three #6-32 pan head screws in the mounting holes. Thread the screws finger tight.

Fig. 3-8: Setting the mounting screws.

Using your electric screwdriver (You DID buy one, didn't you? If not, you'd better have wrists of steel because that #2 Philips screwdriver is going to give you one heck of a workout...) carefully tighten the three screws you just threaded into the nuts.

Fig. 3-9: Properly tightened screw.

You want to take care to not over tighten the screws when installing them. If you apply too much force, the nut will start to collapse the base of the nut pocket.

The end result of that is the structural integrity of the joint is then compromised and the Melamine can no longer retain the nut properly.

Before we can install the right side of the cover, the acrylic window panel needs to be installed. Lay the cover down flat and slide the panel into the tabs provided, as shown below.

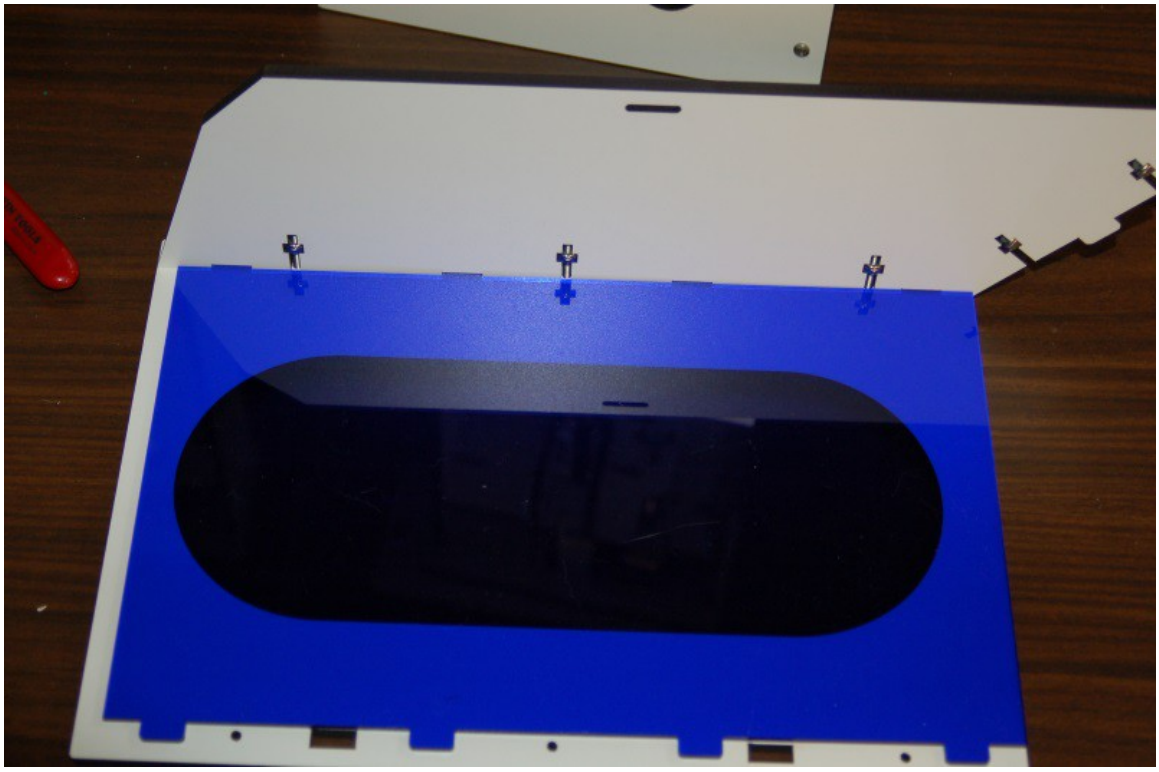


Fig. 3-10: Window panel installation.

Now insert three #6-32 nuts into the right cover side and install it using three screws, just as you did the left side.

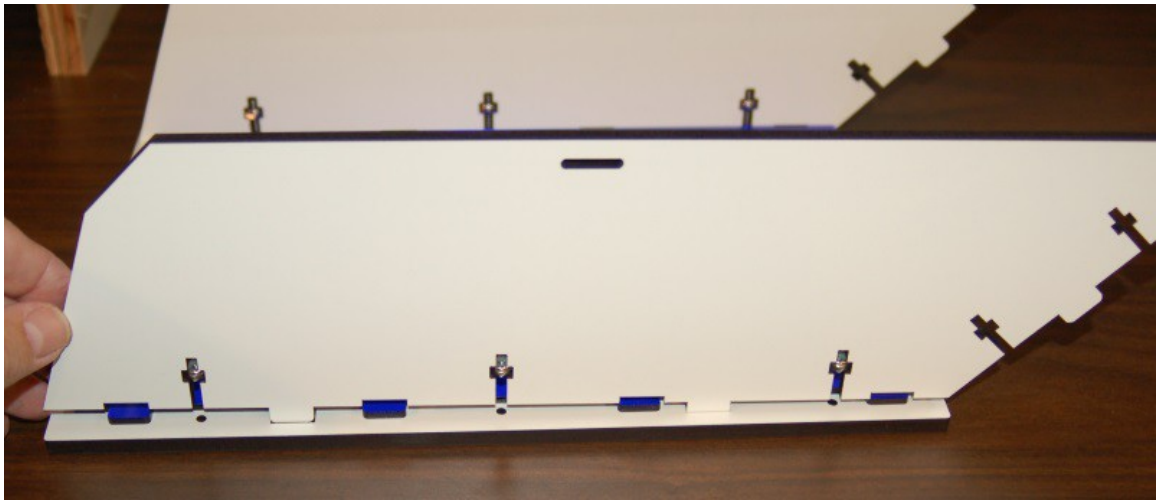


Fig. 3-11: Installing the right cover side.

Now you're ready to install the Cover Name Plate.

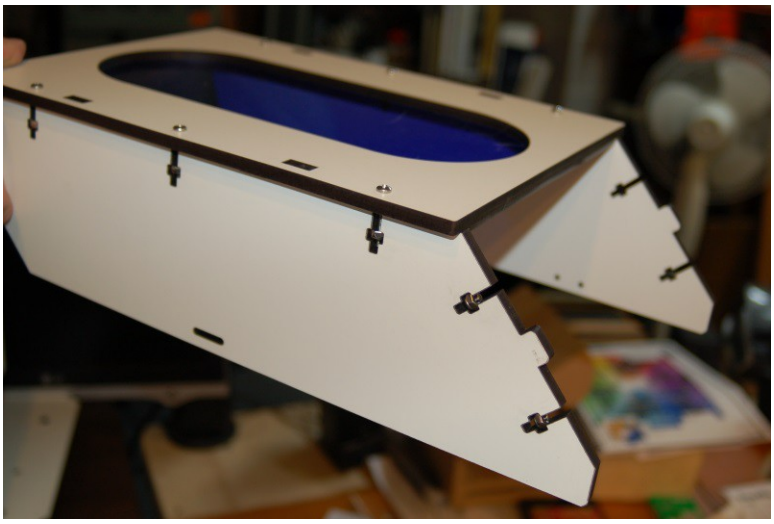


Fig. 3-12: Nearly done!

Now you'll need to insert two nuts into each cover side in order to attach the Cover Name Plate.

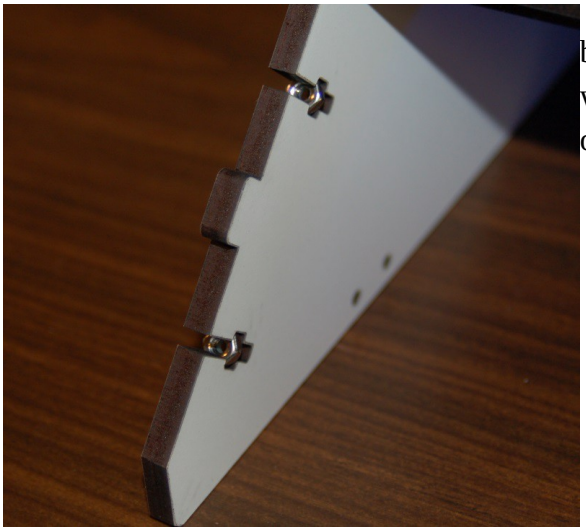


Fig. 3-13: Cover Name Plate nuts.

Now set the Cover Name Plate into place as shown below – with the SeeMeCNC logo upside down. Attach with four #6-32, 1” pan head screws. (You'll find there's an ongoing pattern with this whole screw/nut thing...)

Fig. 3-14: Cover Name Plate in place.

The DropLit cover is now completed! Set it aside and we'll get back to it when it's time to install it on the main DropLit chassis.

Fig. 3-15: Completed DropLit door!

Note that from now on, if I mention inserting nuts or screws without a qualifier, I'm referring to the #6-32 nylon lock nuts and #6-32, 1” long pan head screws respectively.

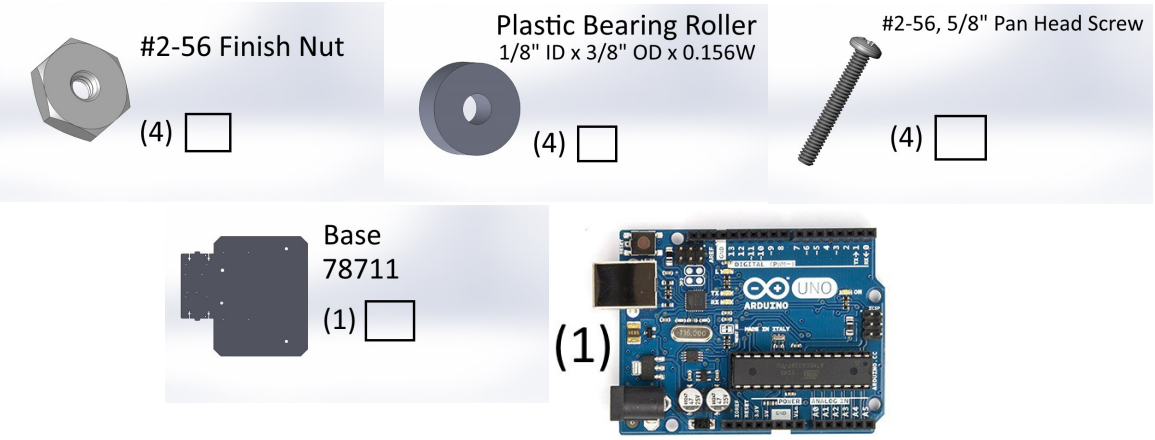
4 – Building the DropLit Chassis

Now that you're familiar with the basic assembly tasks for the DropLit, let's get started on the main chassis! I'm going to break the chassis assembly down into a series of sub-tasks that will make it easier to document the build. Each task will contain its own component list so you won't see one huge list at the beginning of this chapter.

Mounting the Arduino Uno

First, we're going to install the Arduino Uno into the DropLit base plate. The reason for this is that the screws used to mount the Arduino Uno will be nearly impossible to reach later on in the build.

Here's the components you'll need for this task:



You're going to mount the Arduino Uno to the base plate using the holes marked in green.

The Arduino Uno mounts to the bottom face of the base plate, so make sure you've got the base plate oriented the same as shown in Fig. 4-1.

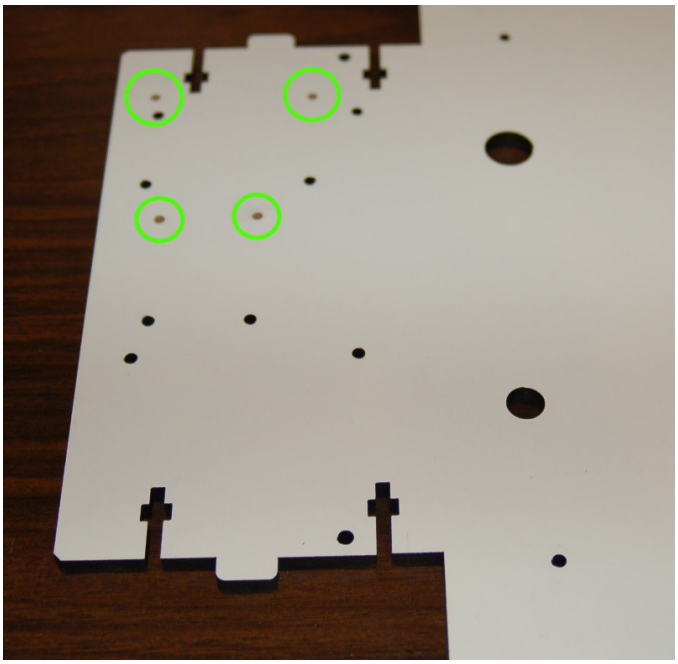


Fig. 4-1: Arduino Uno mounting holes.

The four plastic bearing rollers specified are being used as spacers to stand the Arduino Uno off the base plate a small amount. Go ahead and set them down over the mounting holes as shown on the right.

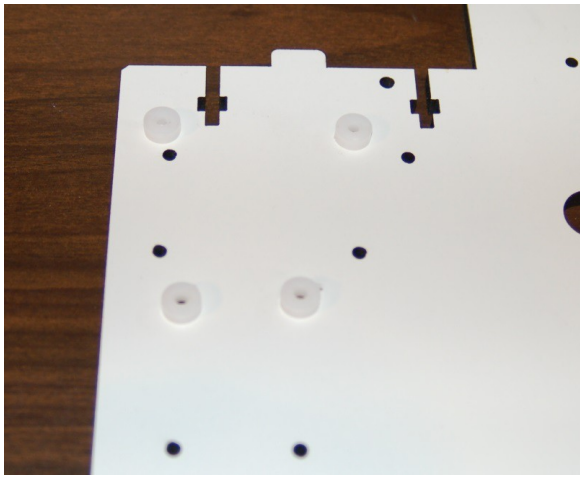


Fig. 4-2: Spacers in place.

Slide the base plate off the edge of your work table so the portion the Arduino Uno mounts to overhangs a small amount. Insert the four #2-56, 5/8” pan head screws into the mounting holes.

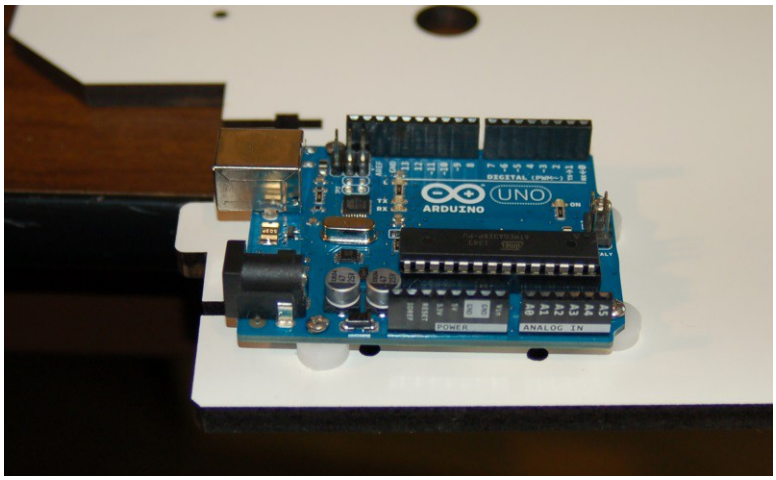


Fig. 4-3: Arduino Uno in position.

Thread a #2-56 finish nut on to each screw and gently tighten with a P1 Philips screwdriver. Take care to not crank it down too hard – you'll crack the Arduino Uno's circuit board!

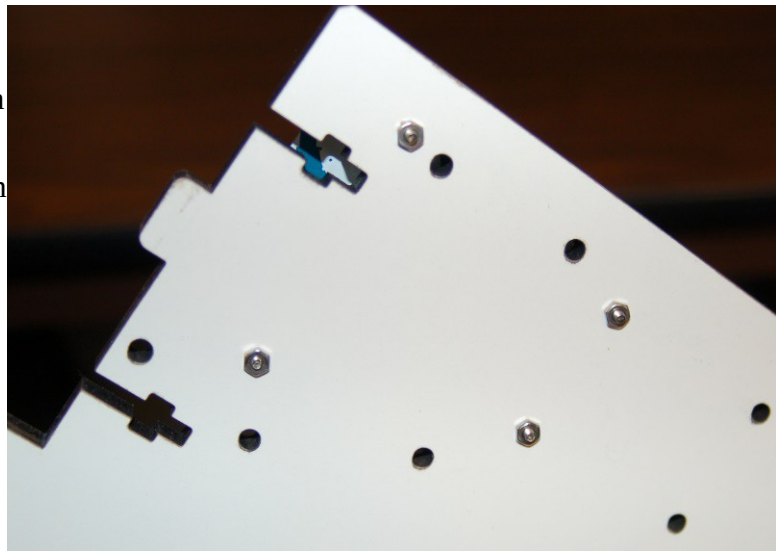


Fig. 4-4: Nuts in place.

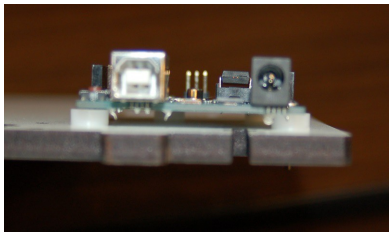
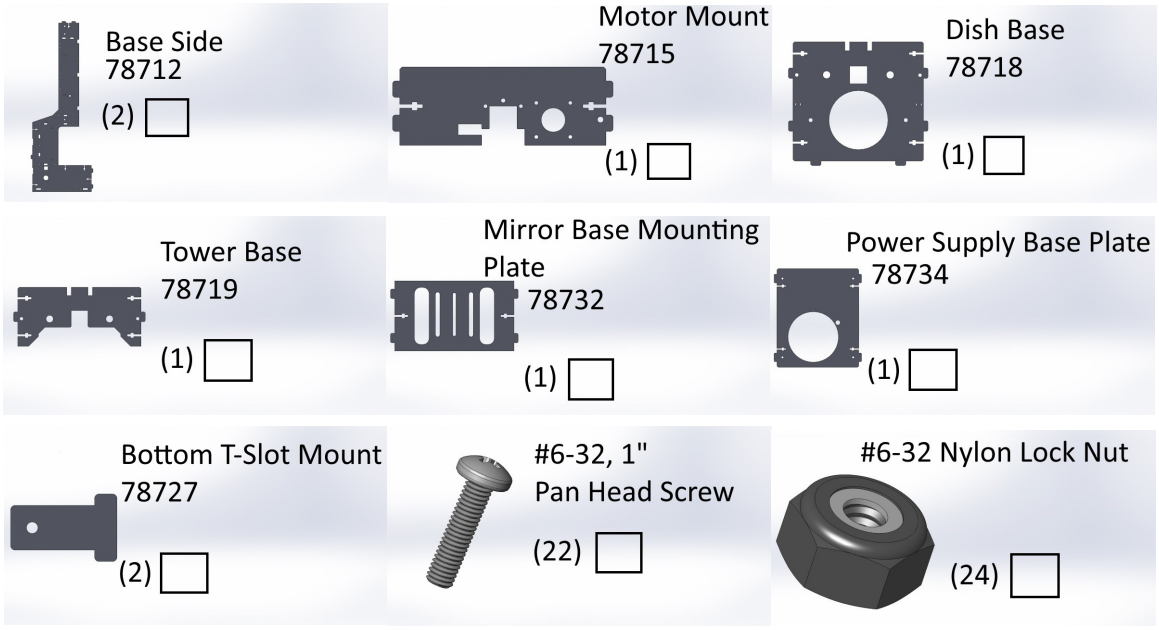


Fig. 4-5: Arduino Uno mounted!

Assembling the Chassis

Now that the Arduino Uno is installed, we're going to get the main chassis assembly started. For this task, you'll need the base you just installed the Arduino Uno on as well as the following components:



The first step is to install the feet on the power supply base plate. Because the rubber “shoes” for the feet are very “grippy”, set those aside until you're done with the whole assembly. By leaving them off, it's a lot easier to move the DropLit around as you work on it.

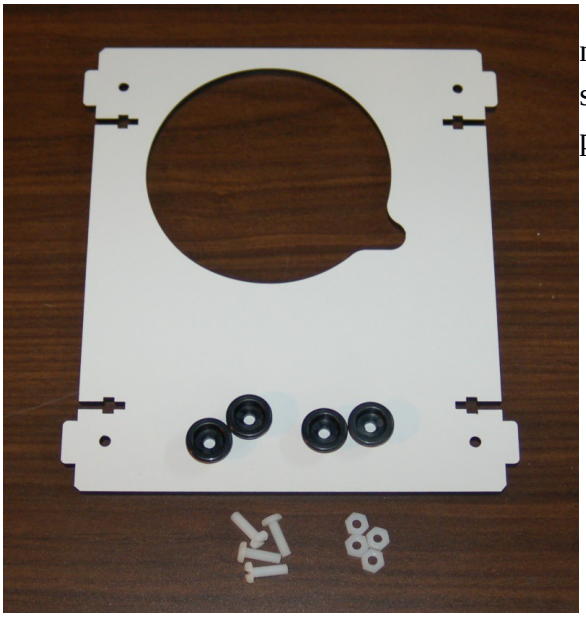


Fig. 4-6: PS base and foot parts.

The feet for the DropLit are installed by inserting a nylon screw through the foot cup and then putting the screw through the mounting hole on the under side of the power supply base plate.

Fig. 4-7: Foot cup & screw.

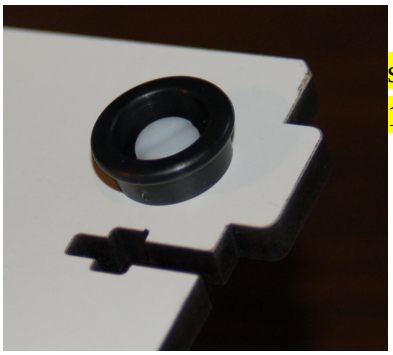


Fig. 4-8: Ready for nut!

Please make sure that you've got the power supply base plate oriented as I show in Fig. 4-10, otherwise you're going to have a bad time.

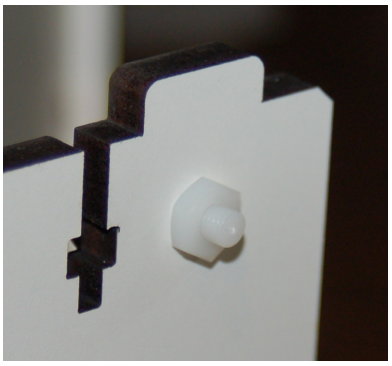


Fig. 4-9: Nut installed!

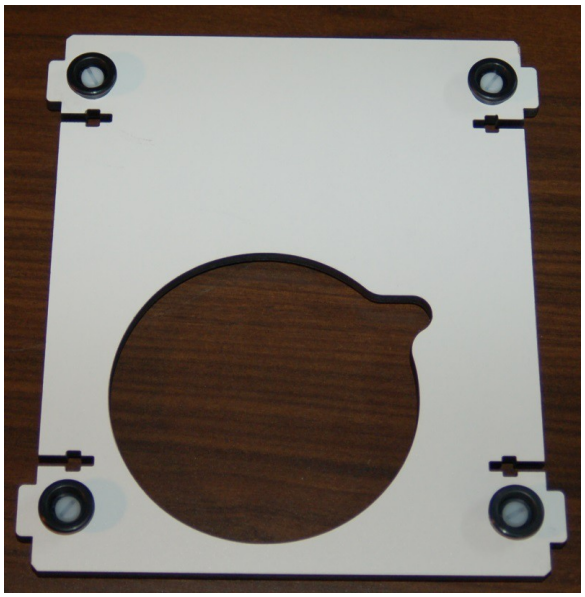


Fig. 4-10: All four foot cups installed.

The sides of the DropLit come in a left & right part. We're going to start the assembly using the right side as the starting point. The right side has the power switch and USB holes cut in it.

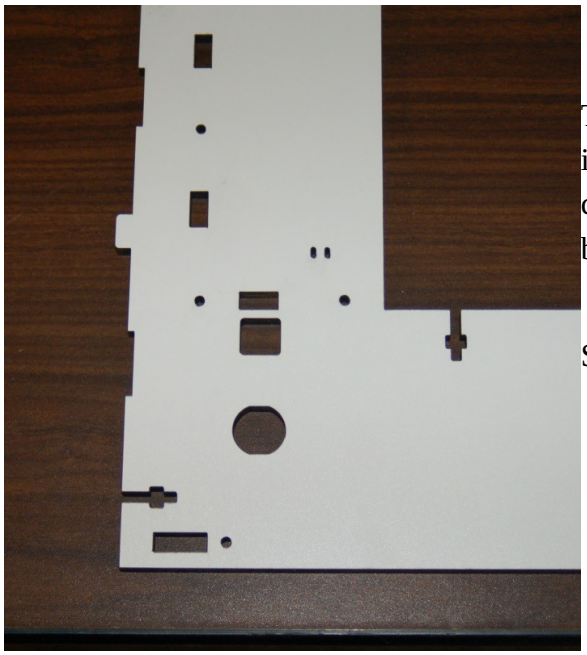


Fig. 4-11: Right chassis side.

We'll install all of the “small” horizontal parts first. The base plate with the Arduino Uno on it will be installed last as it extends beyond the plane defined by the chassis side and would make mounting the other parts a bit more difficult.

Grab four nuts and install them into the Power Supply Base Plate as shown below.

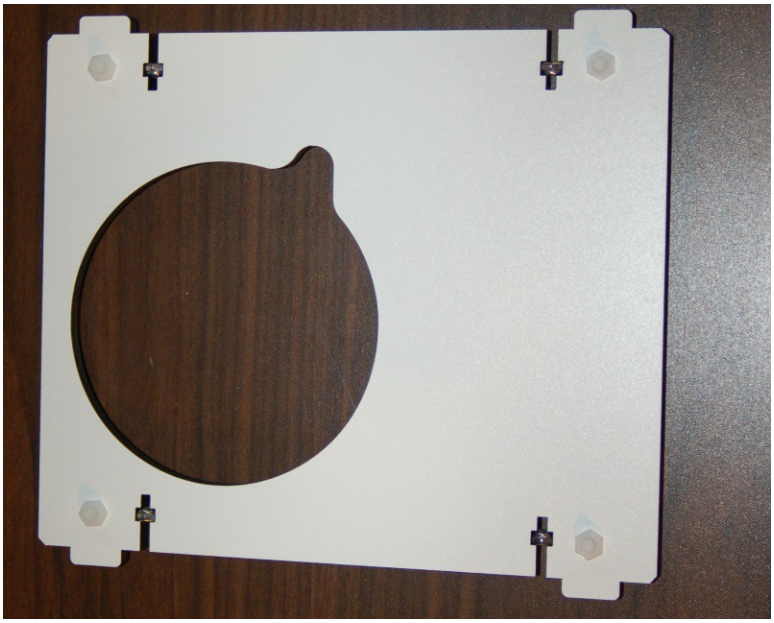


Fig. 4-12: PS Base with nuts installed.

Insert the tabs into the bottom slots on the chassis side and fix in place using two screws. Don't tighten the screws fully – you want the vertical parts slightly loose when it comes time to install the left side of the chassis. Having the vertical parts a bit loose will make getting the tabs aligned on the other side a lot easier.

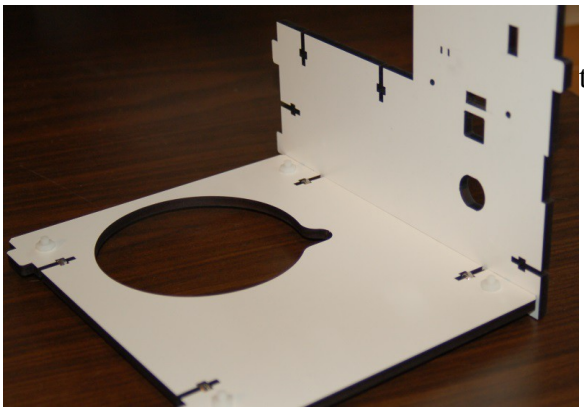


Fig. 4-13: Power supply base plate installed.

Next up is the Mirror Base Mounting Plate. Unlike the other parts, this oriented vertically.

Install two nuts as shown.

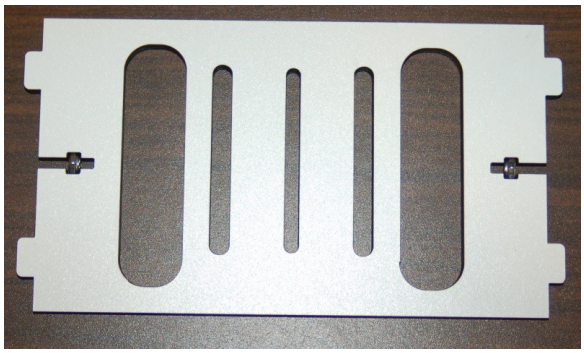


Fig. 4-14: Mirror Base with nuts installed.

Now install the Mirror Base as shown – fix in place with one screw.

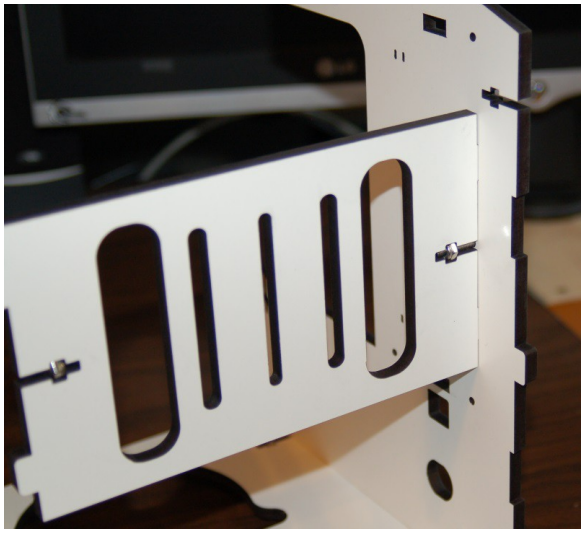


Fig. 4-15: Mirror Base installed.

Now grab the Dish Base and install four nuts on it.

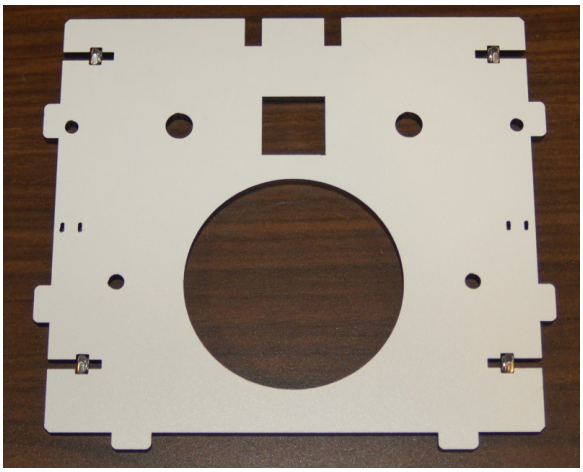


Fig. 4-16: Dish Base with nuts installed.

You'll need to insert two #10 T-Nuts in to the holes on either side of the dish opening as shown below. Gently tap the T-Nuts into the holes and then put a dab of super glue along the perimeter of the T-Nut in order to help keep it from popping out.

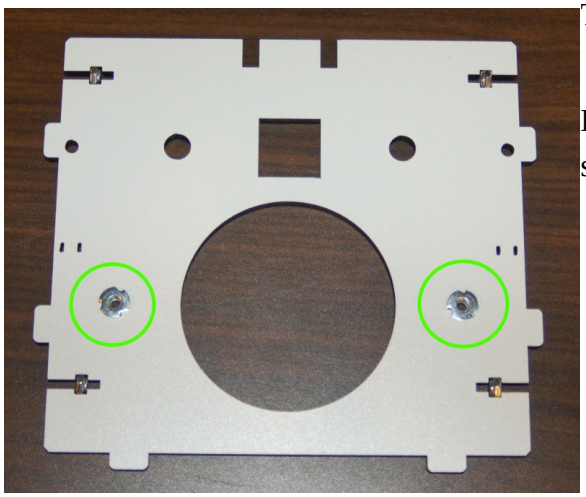


Fig. 4-17: T-Nuts installed.

Once the glue has dried, go ahead and install the Dish Base into the chassis side and fix in place with two screws. Make sure that the T-Nuts face DOWN!

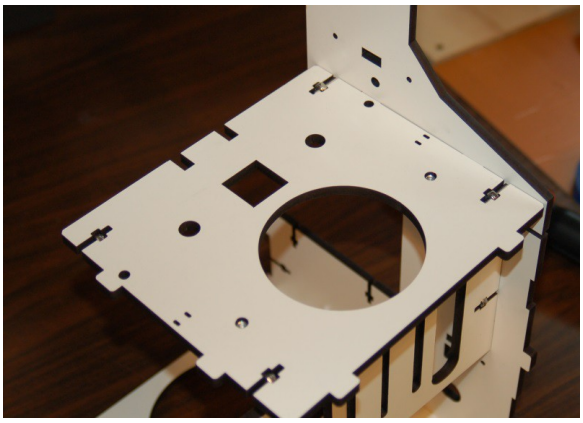


Fig. 4-18: Dish Base installed.

At this point you can slide the two Bottom T-Slot mounts into place in the slots provided in the Dish Base. I did that with this documentation build, but they're really not useful until it's time to install the aluminum extrusion.

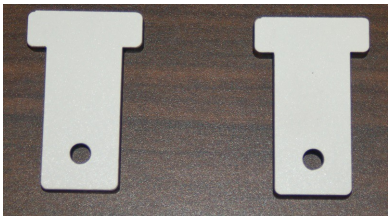


Fig. 4-19: Bottom T-Slot Mounts

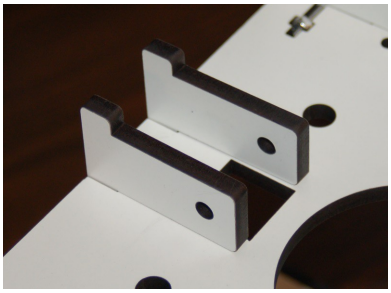


Fig. 4-20: ...mounted in place.

Install four nuts into the Tower Base as shown below.

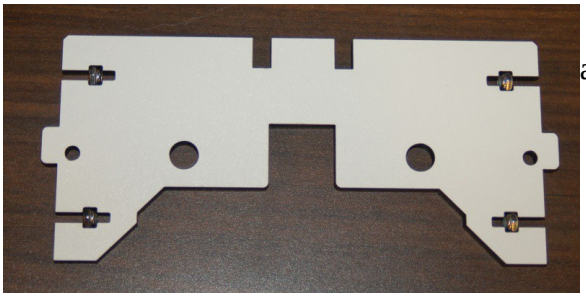


Fig. 4-21: Tower Base nuts installed.

Next, install two nuts into the Motor Mount.

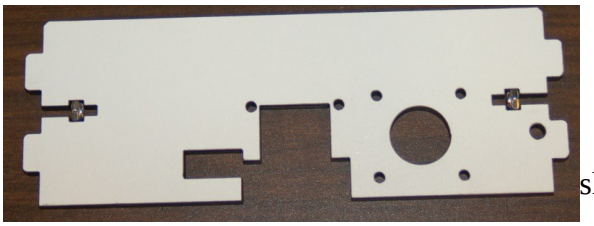


Fig. 4-23: Motor Mount nuts installed.

Next, install the Tower Base into the chassis side and fix in place with two screws.

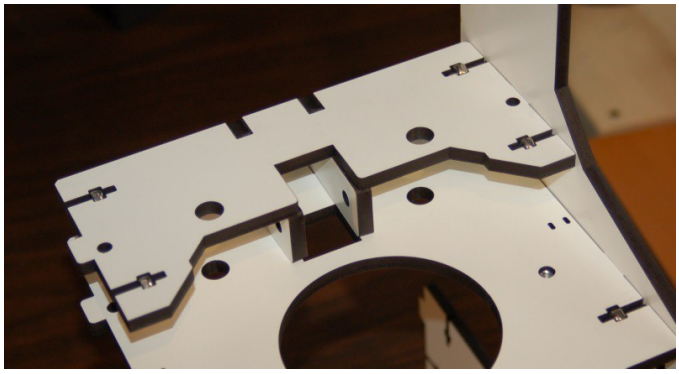


Fig. 4-22: Tower Base installed.

Install it to the upper slot in the chassis side as shown and fix in place with one screw.

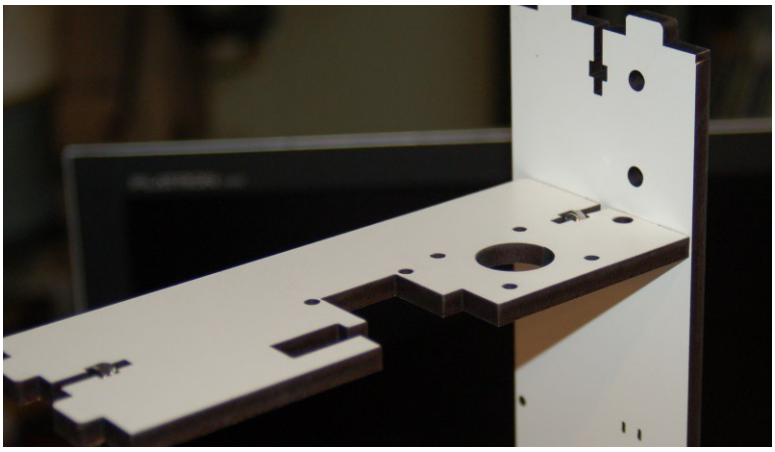


Fig. 4-24: Motor Mount installed.

With the Motor Mount installed, it's now time to get the big base installed!

Insert four nuts into the Base as shown below.

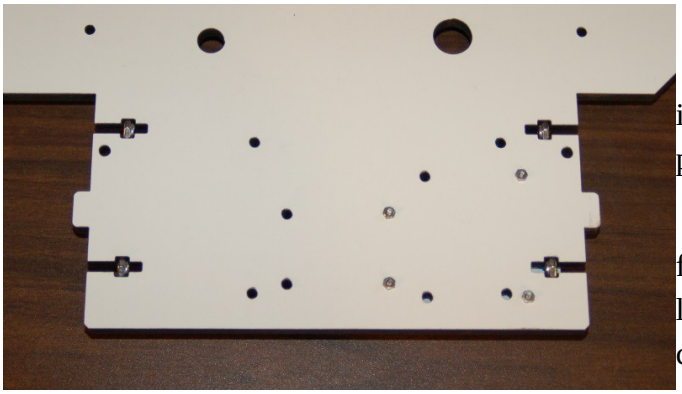


Fig. 4-25: Base nuts installed.

You'll want to lay the DropLit on its “face” in order to make the base installation as painless as possible.

Make sure that you've got the Arduino Uno facing DOWN and that the USB port on the Uno lines up with the square opening for it on the right chassis side. Fix in place with two screws.

Fig. 4-26: Base installed.

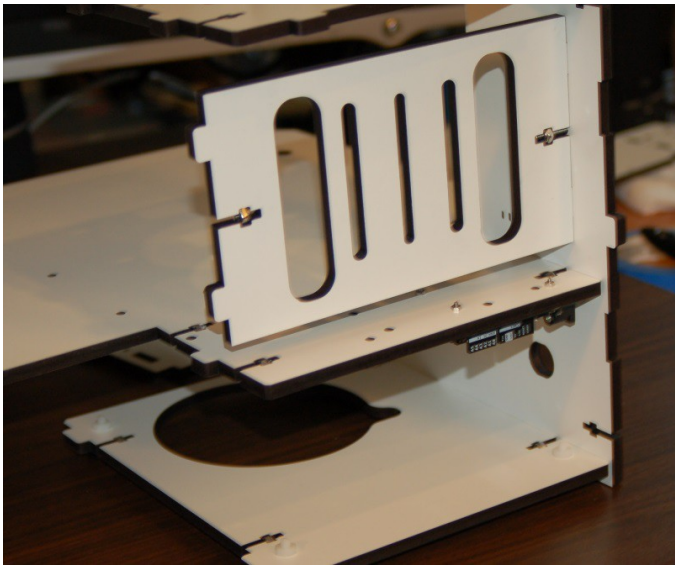


Fig. 4-27: Base installed.

Now comes the “fun” part. (Yes, I'm being sarcastic.)

In order to install the left side on to the DropLit, you get to perform a magic trick that involves aligning ten tabs with ten slots while simultaneously not breaking anything or throwing the machine across the room. It CAN be done. I've done it. Nobody got hurt either! (The cat DID give me a funny look though.)

Start at the bottom and work your way up. As you work your way up, you'll want to throw screws in a bit more than finger tight to keep things from popping loose as you work your way up. Please take your time and if it becomes necessary to apply a little mechanical encouragement to make the parts fit, make sure you've got the chassis laid flat and fully supported.

Fig. 4-29: Start at the bottom and work your way up!

I really wish I could regale you with tales of derring-do as I fit this thing together, but the process was actually pretty straightforward and really didn't require any photographic clarification.

After you're done, your DropLit should look like this:

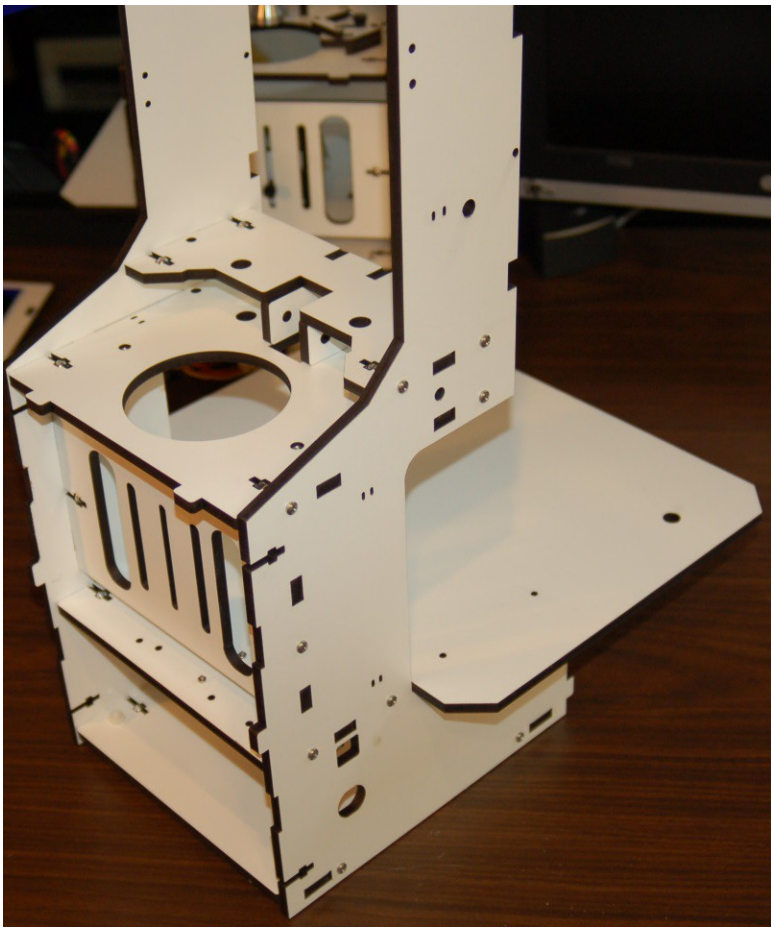


Fig. 4-29: Almost done!

The last task for this section will be to install the last four nuts & screws required to fix the base to the main chassis. Insert two nuts on each side as shown and fix in place with four screws.

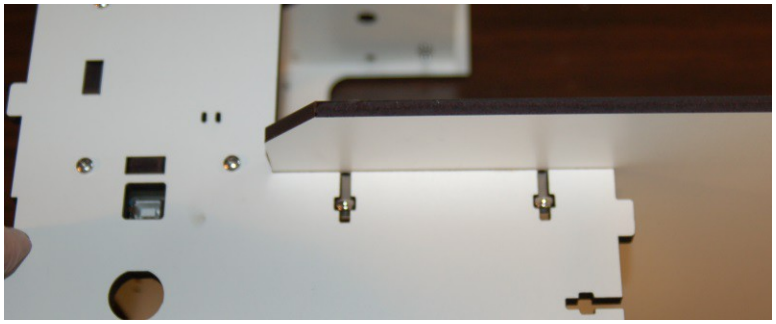


Fig. 4-30: Base nuts installed.

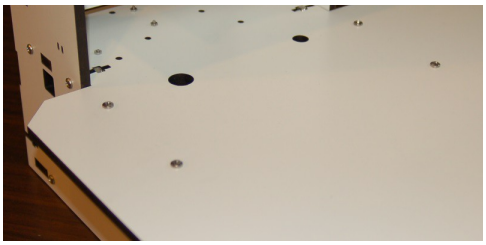
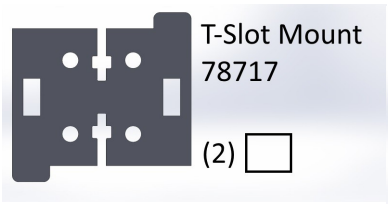
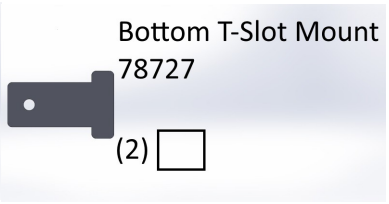


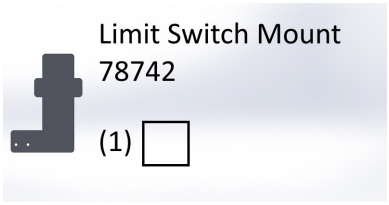
Fig. 4-31: Screws in place.

Installing the T-Slot Extrusion

Now we're going to install the aluminum T-Slot extrusion into the core of the DropLit. You'll need the following components for this task:







If you installed the Bottom T-Slot Mounts from the prior step, pull them from the chassis as we'll be adding nuts & screws to them shortly.

The aluminum extrusion will have an M5 threaded rod in the center of it – remove the tape from the ends of the extrusion and slide the M5 rod out of the center and set it aside. Take care to not bend it!

We'll start with getting the T-Slot mount parts ready – install four nuts into the T-Slot Mount as shown below.

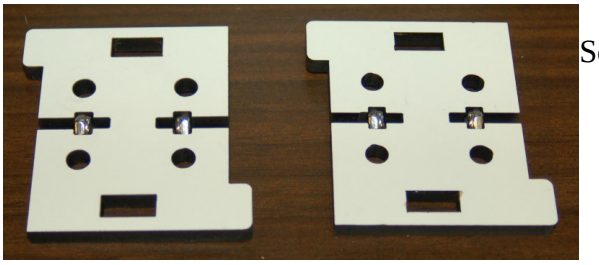


Fig. 4-32: T-Slot Mount nuts installed.

Next, install a T-Slot Nut & ¼-20 Button Head Cap Screw into the bottom and upper T-Slot Mounts as shown.

Fig. 4-33: Bottom T-Slot Mount.

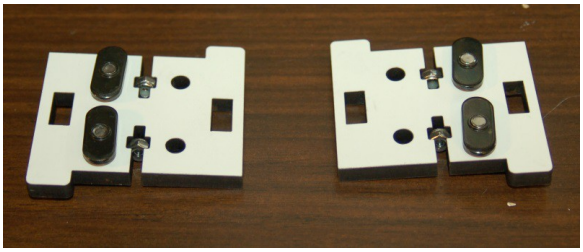


Fig. 4-34: Upper T-Slot Mount.

Next, insert the Bottom T-Slot Mounts into the tabs provided by the Dish Mount & Tower Base.

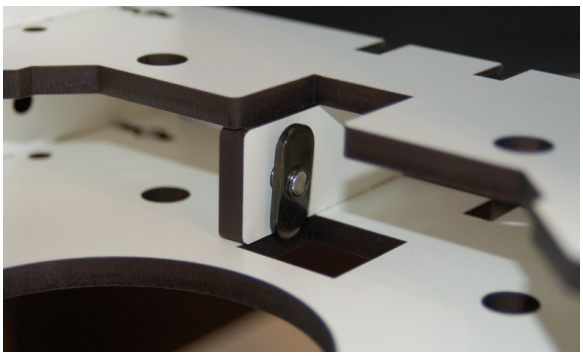


Fig. 4-35: First one side...

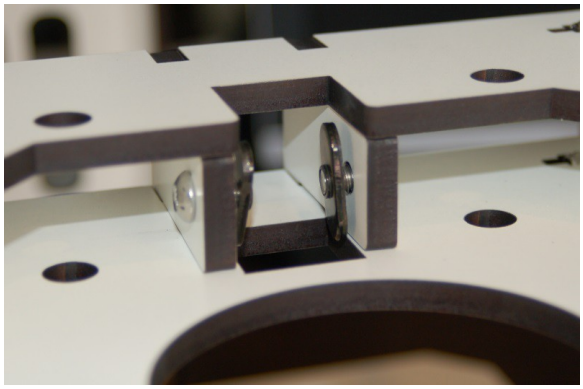


Fig. 4-36: ...and the other!

Make sure you keep the T-Slot nuts oriented vertically as I show in the two figures above. They'll need to be in that orientation in order to fit into the t-slot in the extrusion.

Now install the Limit Switch Mount into the Upper T-Slot Mount.

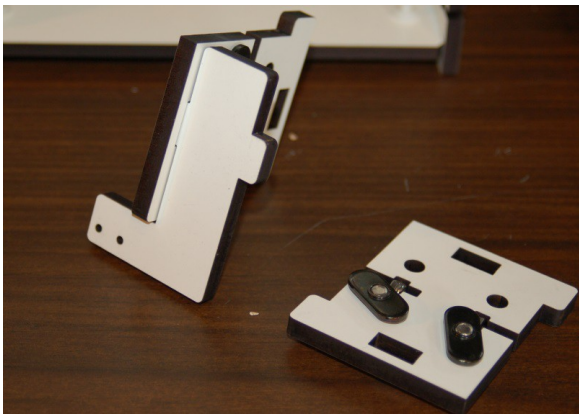


Fig. 4-37: Left side first..

Take special care to make sure that you've got the parts oriented as I show here in Figs 4-37 and 4-38.

Fig. 4-38: ..then the right.

Using two screws, fix the Upper T-Slot Mount to the motor mount as shown.

Now it's time to get the aluminum t-slot extrusion installed into the DropLit chassis. It's a very straightforward task, but you need to be careful as to not damage the lower tower mount as it passes through it.

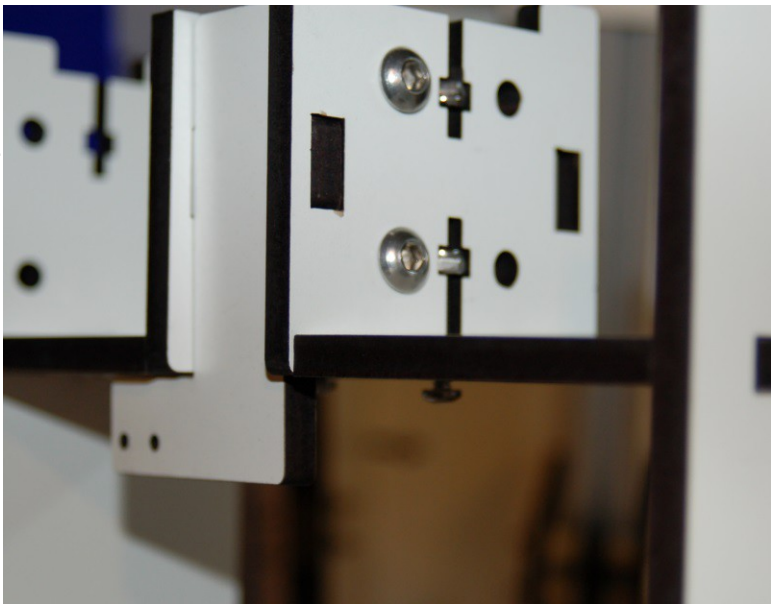


Fig. 4-39: Attaching the T-Slot Mount.

Slide the extrusion in from the top as shown below – note that the T-Slot Nuts need to be oriented vertically so they fit easily in the slots in the extrusion.

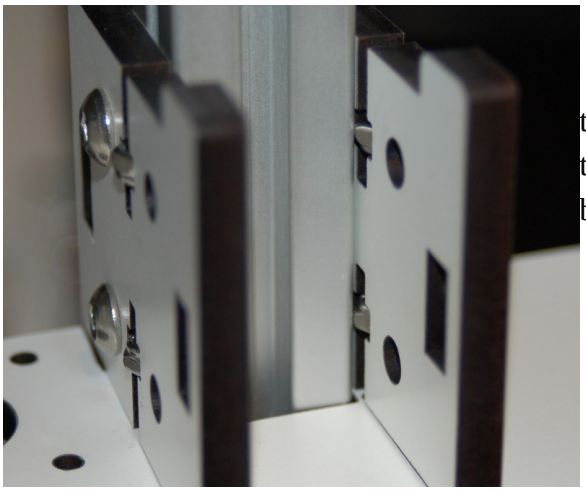


Fig. 4-40: Installing the extrusion.

Slide the extrusion all the way down until it catches the T-Slot Nuts at the bottom. Once it does, carefully tap the extrusion down until it's flush or nearly flush with the bottom surface of the Tower Base.

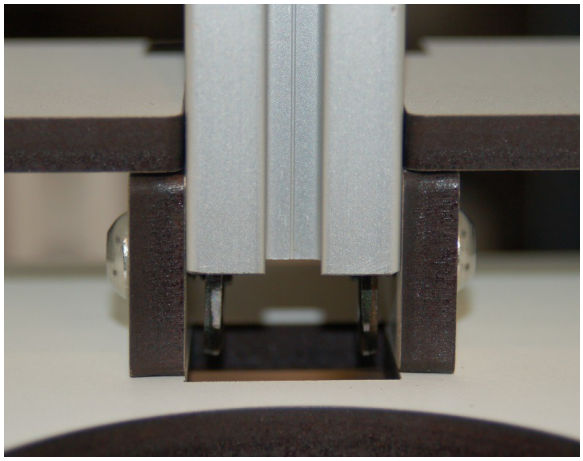


Fig. 4-41: Bottom extrusion mount.

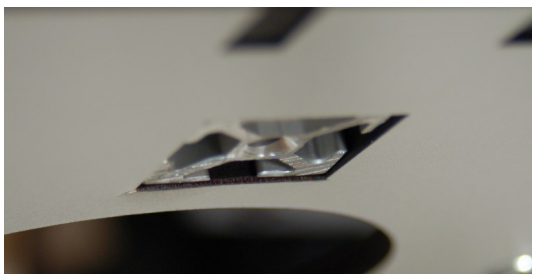


Fig. 4-42: Proper T-Slot Extrusion Depth.

Using your 5/32” Allen Wrench, tighten up the six screws that hold the extrusion into the mounts.

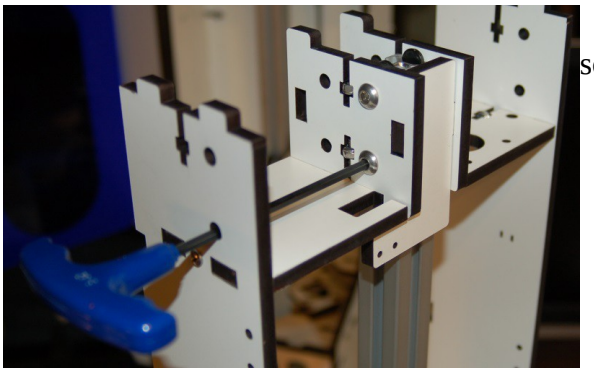


Fig. 4-43: Tightening the upper mount...

When tightening the upper mount, do the two lower screws followed by the two uppers.

Make sure that you don't tighten the screws too much. You want the cap of the screw to *just* start to dimple the Melamine, but no tighter.

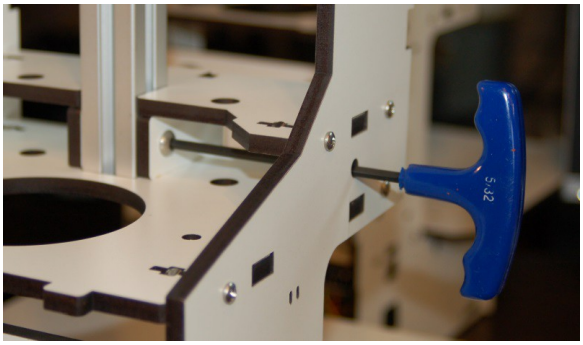


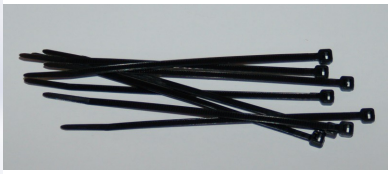
Fig. 4-44: ...and the lower!

5 – Assembling the Drive System & Carriage

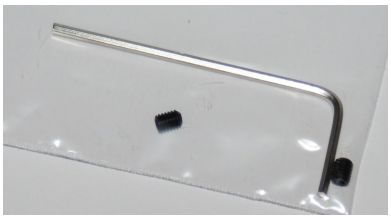
Like I did in the previous section, I'm going to break up the build tasks in order to avoid a huge materials list at the beginning. The first task is going to be attaching the stepper motor to the Motor Mount and routing the wiring to the electronics compartment.

Installing the Stepper Motor

You'll need the following components for this task:



5 Wire Ties



The first thing that we need to do is remove the connector shell from the stepper motor wiring. The gShield uses screw terminals and not four pin connectors like the stepper is supplied with.

We do want to preserve the little metal crimp sockets as they will fit easily into the gShield's terminal block. Removing the pins is very simple – insert a small pin or needle into the hole above each position and that will release the crimp socket. Press down and pull at the same time and it comes right out.

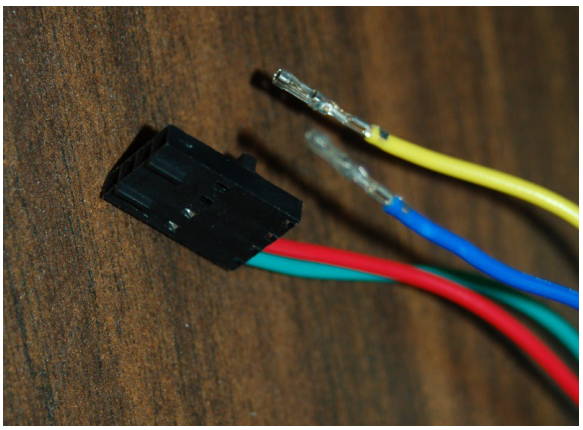


Fig. 5-1: Two wires down, two to go!

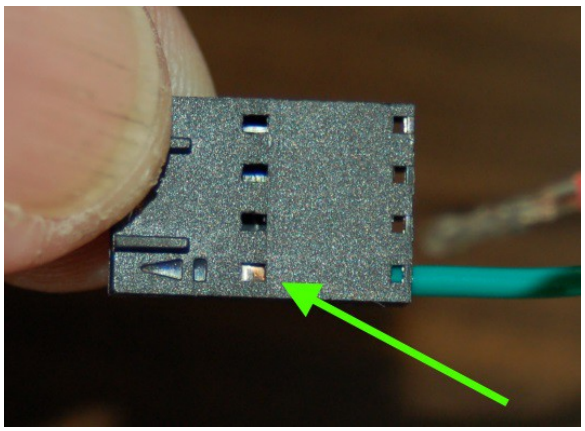


Fig. 5-2: Release tab location.

Now you need to install the two M3 grub screws into the 5mm shaft coupler before you can install it on to the stepper motor.

Using the included Allen wrench, thread one of the grub screws into the side of the shaft coupler as shown. The stepper motor included with the DropLit has a “flatted” shaft. You want to slide the shaft coupler on to the stepper motor's output shaft such that the grub screw you just installed will grip on that flatted portion when it's tightened down.

Fig. 5-3: Shaft coupler prep.

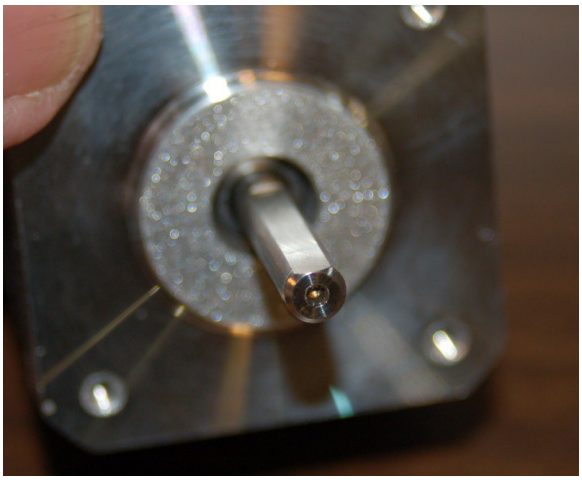
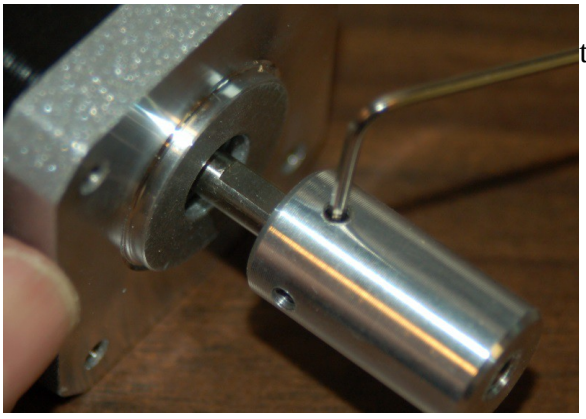


Fig. 5-4: Flatted Shaft.

When the shaft coupler has an internal feature that will limit how far down the shaft it will travel. Once you reach that spot, tighten down the grub screw.



Rotate the shaft coupler a bit and install & tighten the second grub screw as shown below.

Fig. 5-5: First grub screw tightened.

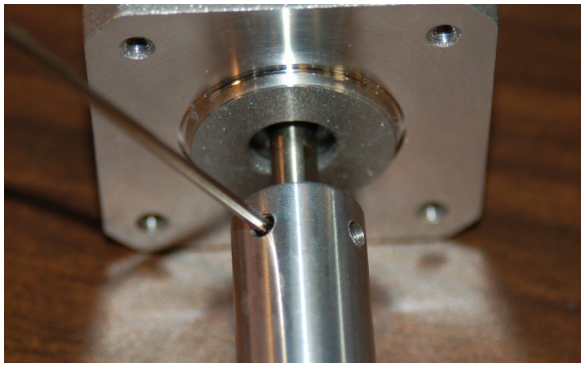


Fig. 5-6: Last grub screw in.

Next, you'll want to route the stepper motor wires through the guide hole at the outside edge of the motor mount. You'll notice in the photos that I've added waxed lacing cord to the wires to neaten it up a bit. I don't recommend you do this unless SeeMeCNC increases the guide hole diameter. It's just too tight to accommodate the stepper wires AND the lacing cord.

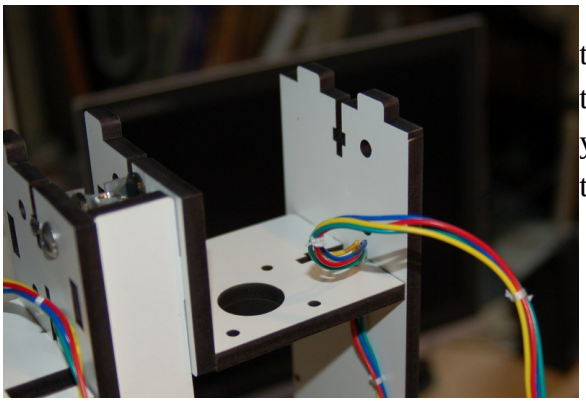


Fig. 5-7: Top wiring guide hole...

Now you can set the stepper motor in to position on the motor mount as shown below. Make sure you've got the mounting holes lined up! (It'll happen by default if you match the position of your motor to the one shown in the photo.)

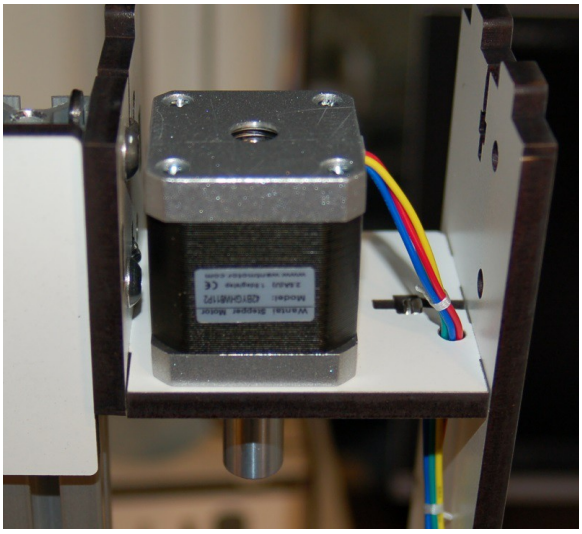


Fig. 5-8: Stepper motor ready for screws!

Four M3 x 10mm screws & four #4 flat washers are required to fix the stepper motor into place. You'll need a P1 Philips screwdriver for these small screws.

Fig. 5-9: Stepper mounting hardware.

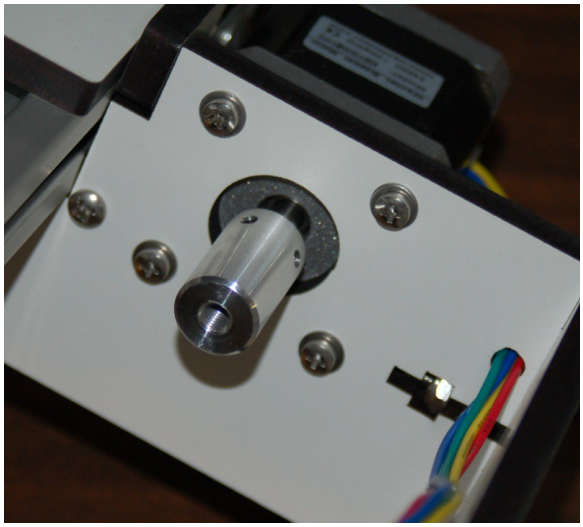


Fig. 5-10: Stepper installed!

Now you need to route the stepper motor wires down through the other guide holes along the inside right side of the DropLit chassis. I'd recommend “spindling” the end of the wires a bit to make them a bit easier to get through the holes – it's a tight fit.

Fig. 5-11: Spindled wires.

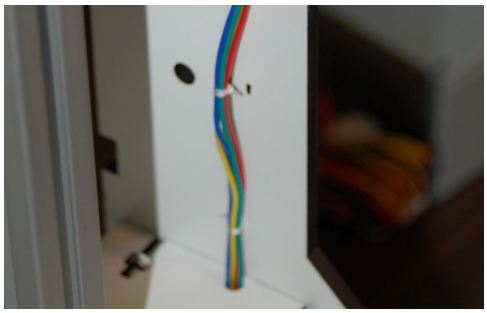


Fig. 5-12: Tower Base hole.

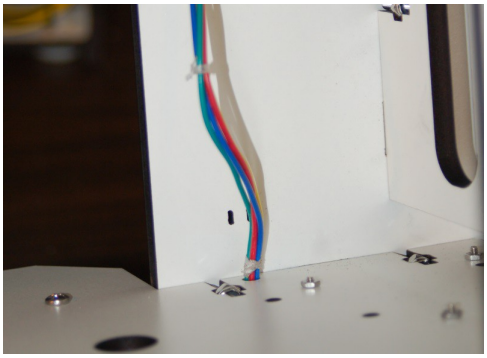


Fig. 5-14: Base hole.

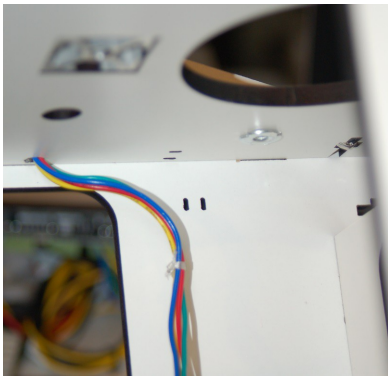


Fig. 5-13: Dish Base hole.

Once you've got the wires routed, start at the top and fix them in place using the include wire ties.

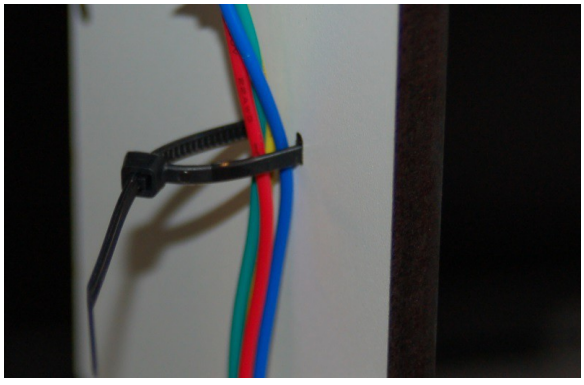


Fig. 5-15: Top wire tie started.

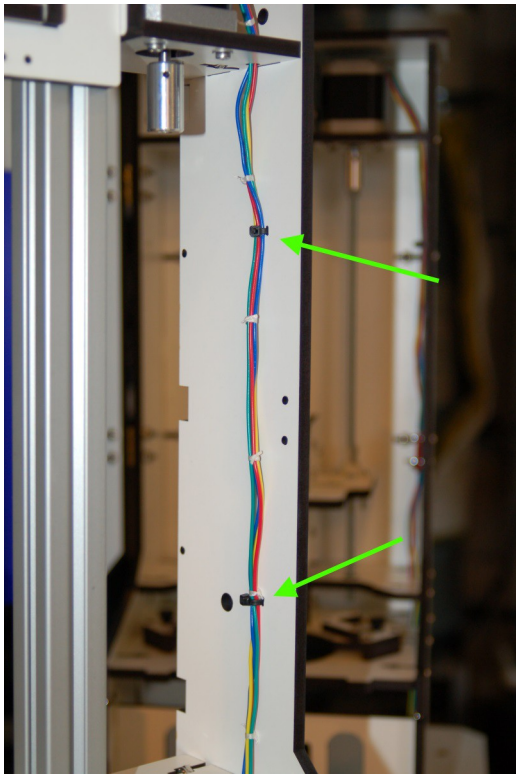


Fig. 5-16: Upper two tie locations.

Tie the two upper first and the lower three last.

Clip off the “tail” of the wire ties when you're done.

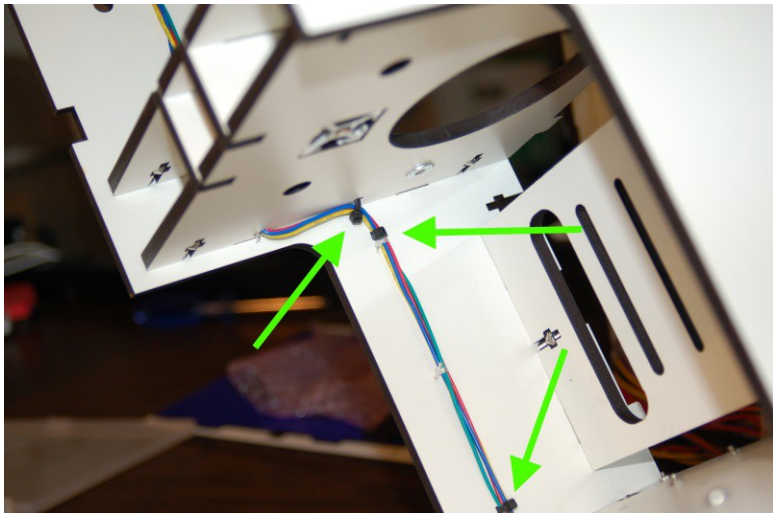
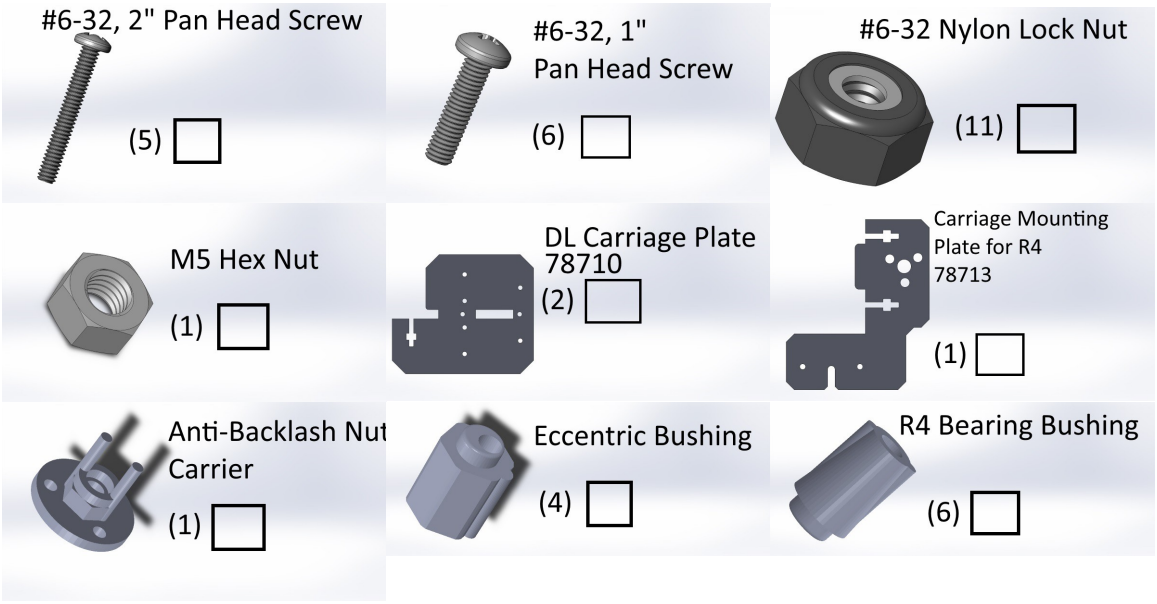


Fig. 5-17: Lower three tie locations.

Installing the Carriage

Next up, we'll get the Carriage assembled and attached to the t-slot extrusion. For this task, you'll need the following components:



Insert the M5 nut into the bottom of the Anti-Backlash Nut Carrier as shown. The nut may not be a tight fit, so you'll need to hold it in place until the carrier is installed.

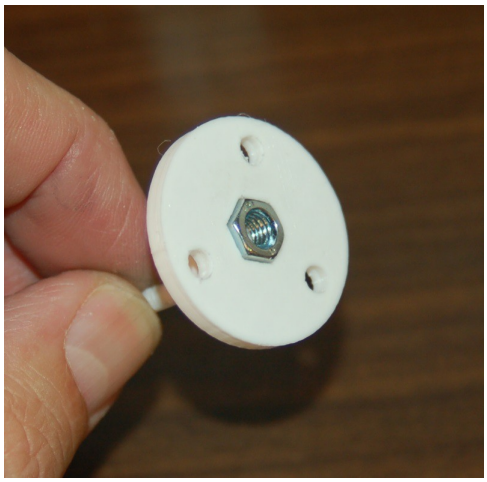


Fig. 5-18: Anti-Backlash nut installed.

Before you mount the Anti-Backlash Nut Carrier to the Carriage plate, you need to install two nuts in the pockets on the Carriage plate.

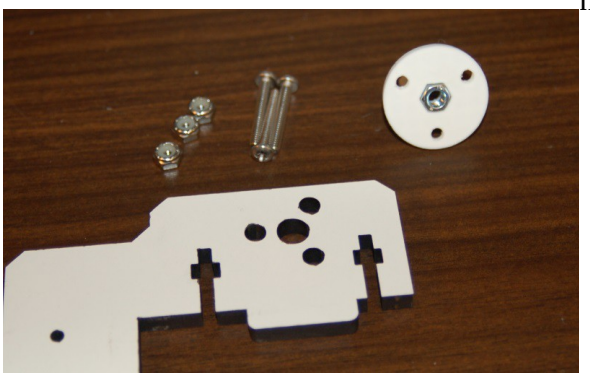


Fig. 5-19: ABN Installation parts.

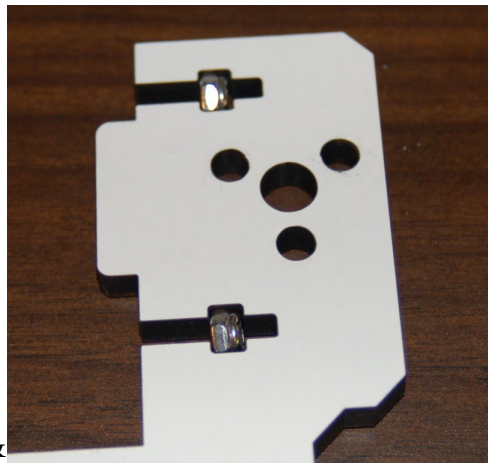


Fig. 5-20: Nuts in Carriage plate.

Set the Anti-Backlash Nut Carrier on top of the Carriage plate as shown and fix in place with one screw & nut. Make sure you keep the center of the M5 nut aligned with the center hole in the mount. You also want to ensure that your installation matches the photos *EXACTLY.* You don't want to install the part on the wrong side of the Carriage.

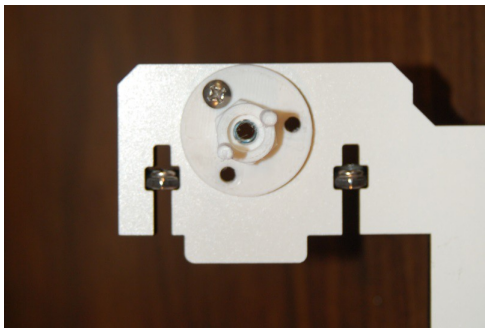


Fig. 5-21: Installation of the ABN carrier.

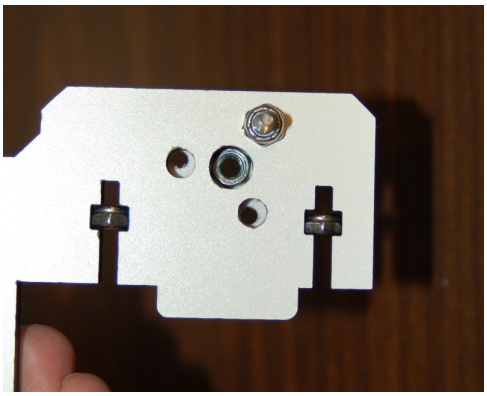


Fig. 5-22: Back side...

Note that the center alignment of the M5 nut is more important that the center alignment of the mounting hardware in the Carriage. The holes in the Carriage are large enough to allow some offset.

Fig. 5-23: Finished installation.

The next step involves installing the R4 bearings, but first you'll need to attach the Acetal “tires” to each of the 5 bearings as shown.

Fig. 5-24: Bearings and "tires".

Start the assembly by pressing an R4 bearing into the tire half as shown below.

Fig. 5-25: One side installed.

Next, press the other half on to the R4 bearing. The fit will be tight, but it should go on without too much hassle.

Fig. 5-26: Tire installed!

Go ahead and repeat this for the remaining four R4 bearings.

Once you're done with that, you need to insert two R4 Bearing Bushings into three of the R4 bearing assemblies you just finished.

Fig. 5-27: First one side...

Fig. 5-28: ..and the other!

Now you need to insert two of the Eccentric Bushings into both of the remaining R4 bearing assemblies as shown below. Please make sure that you've got the bushings aligned with each other – use the raised line on each as an alignment guide. Set those aside – you'll be coming back to them in a moment.

Fig. 5-29: Bushings aligned.

Now take three of the 2” pan head screws and slide a R4 bearing bushing assembly, through a DL Carriage Plate on to each one.

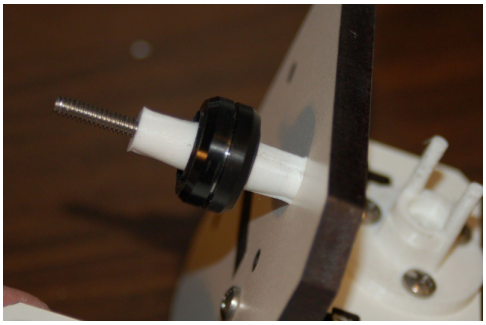


Fig. 5-30: R4 bearing installed.

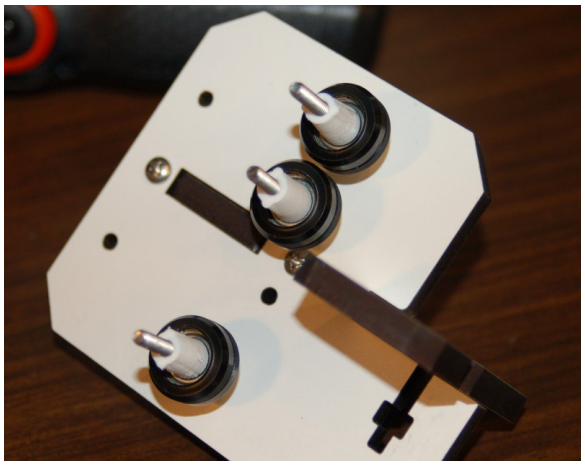
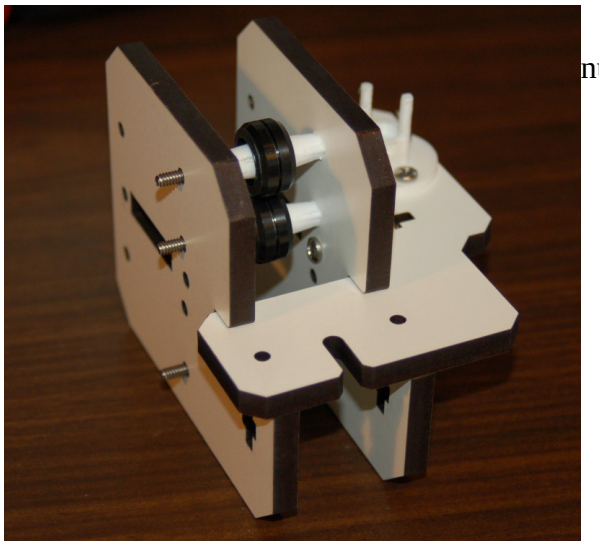


Fig. 5-31: All three done.

Now grab the other DL Carriage Plate and slide over the screws you just installed.



Fix the DL Carriage Plate into place using three nuts and a 5/16” wrench. Take care to not over-tighten!

Fig. 5-32: DL Carriage Plate installed.

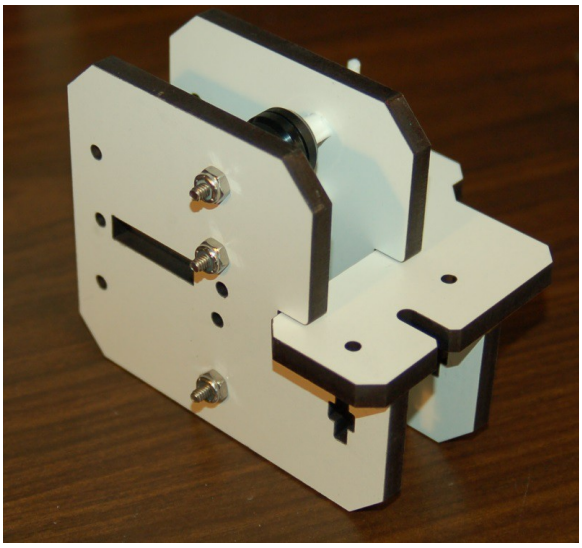


Fig. 5-33: Carriage nearly completed!

Now it's time to attach the carriage to the aluminum extrusion. Set the carriage in place as shown and use a 2” screw as shown to temporarily hold the carriage in place.

Grab one of the R4 Eccentric equipped bearings and slide it into place between the two DL Carriage Plates. Keep the alignment bump facing the extrusion – that will give you the most leeway for installation. I found that using a cut-down Q-Tip a very handy alignment tool.

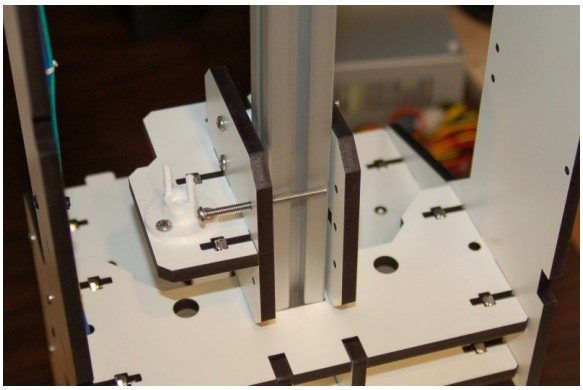


Fig. 5-34: Ready for the first eccentric bearing.

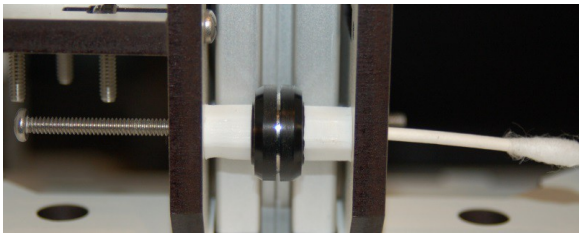
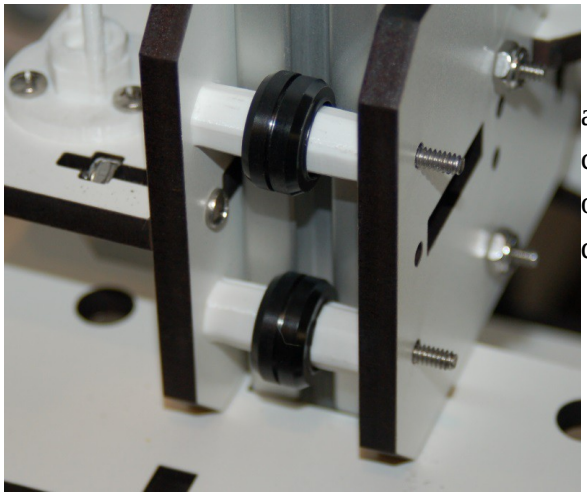


Fig. 5-35: Eccentric Bearing installation.

Slide in a 2” screw from the other side and drive out the Q-Tip and then install the upper eccentric.



Now thread on a nut to each screw on the eccentrics and tighten using a screwdriver and a 5/16” wrench. You can reach each screw head via an access hole in the side of the DropLit as shown. When you've got the top one done, just lift the carriage a bit to reach the lower one.

Fig. 5-36: Eccentrics installed.

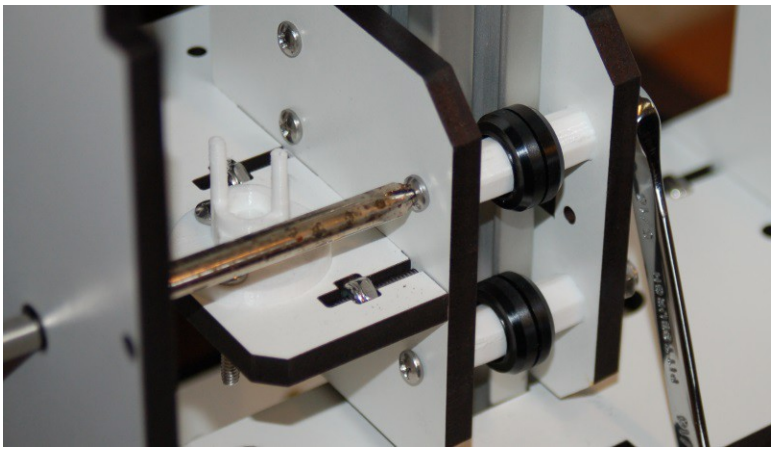


Fig. 5-37: Bolting down the eccentrics.

You now need to install the last two nuts & screws to the front section of the carriage assembly. We'll then move on to adjusting the eccentrics!

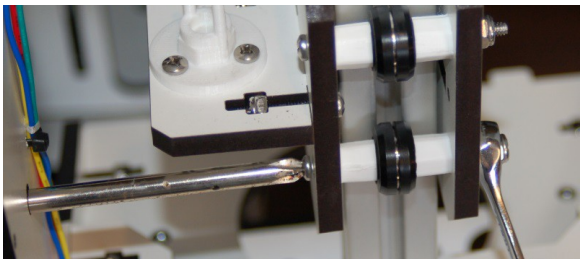


Fig. 5-37A: Tightening down the lower eccentric.

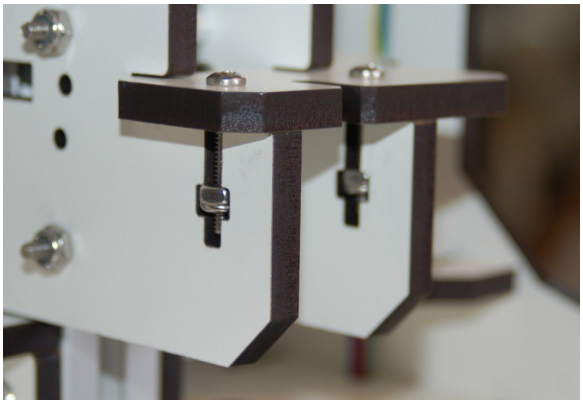


Fig. 5-38: Finishing the carriage assembly.

The two eccentric bearings you just installed need to be adjusted in order to allow them to grip the extrusion properly. Using one or two 3/8” wrenches, turn the eccentric clockwise to bring the bearings closer to the extrusion. Adjust both eccentrics equally.

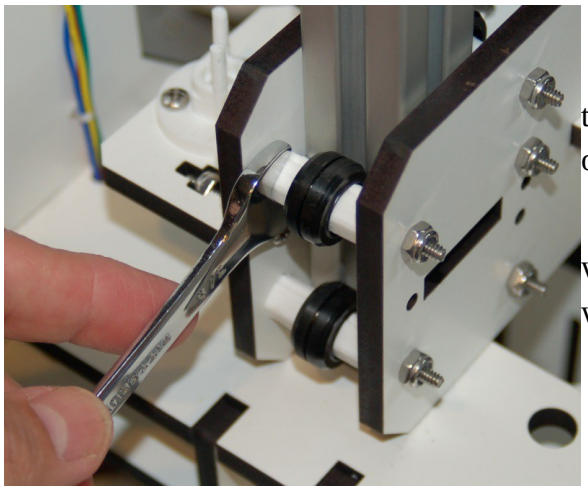


Fig. 5-39: Adjusting the Eccentric bearings.

You want to make sure that you've got the bearings tight enough that they constrain the carriage such that the only movement it has is straight up and down the tower.

A properly adjusted carriage will fall to the bottom when lifted, with all five bearing moving and in contact with the tower extrusion.

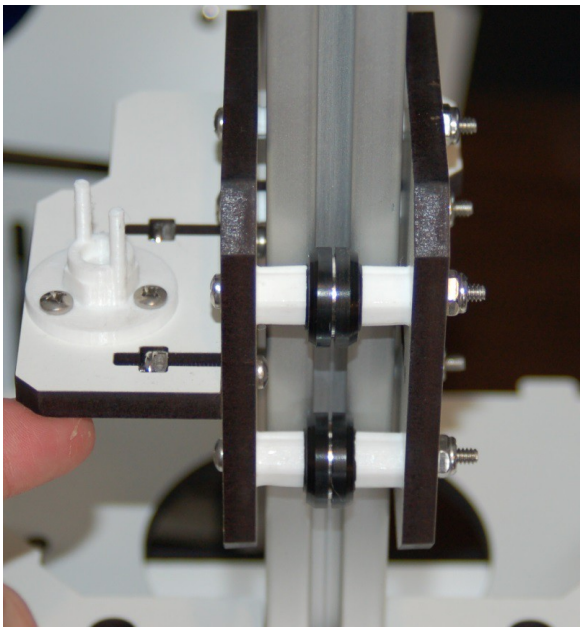
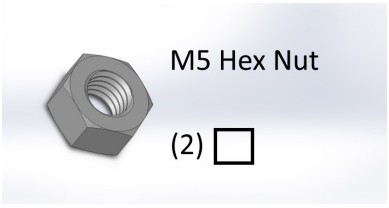


Fig. 5-40: Adjusted carriage!

Installing the Z Axis Drive Rod

Now we need to get the carriage attached to the stepper motor by installing the Z Axis Drive Rod. That's just a fancy name for the M5 threaded rod that hooks the stepper motor to the uppy/downy thingy. :)

For this task, you'll need the following components:



Installing the Z-Axis rod is really simple and straightforward. First, slide the rod into the chassis using the hole in the Dish Plate. The hole is lined up with the stepper motor. You'll need to support the carriage with the back of your hand as you do this.

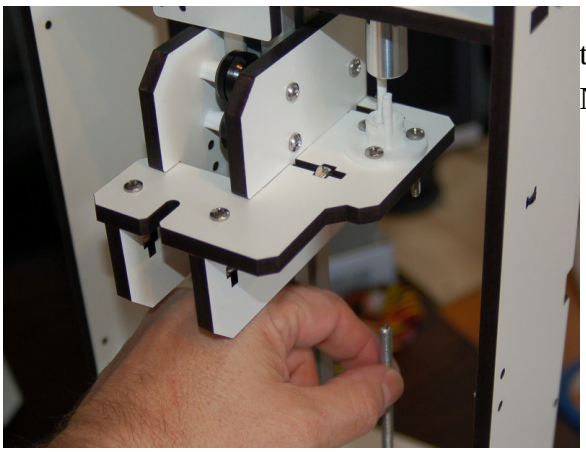


Fig. 5-41: Threading the rod...

Slide the rod up through the carriage plate and thread it into the M5 nut that's under the Anti-Backlash Nut Carrier.

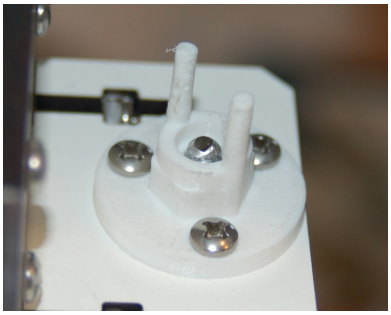


Fig. 5-42: Threaded!

You want to only thread the rod in a short amount – it should only be slightly above the nut inside the Anti-Backlash Nut Carrier as shown in Fig. 5-42.

Insert the small compression spring between the two uprights in the Anti-Backlash Nut Carrier.

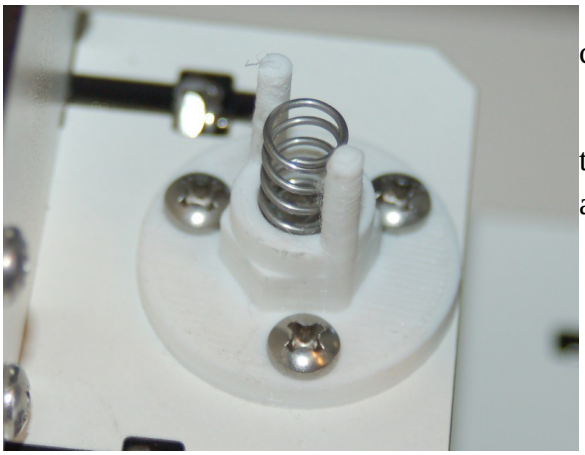


Fig. 5-43: Spring installed.

Now insert an M5 nut between the uprights and use it to compress the spring about 3/16” of an inch.

Thread the M5 rod up until it engages the M5 nut above the spring and then continue to thread it until you've got about 2” of rod above the Anti-Backlash Nut Carrier.

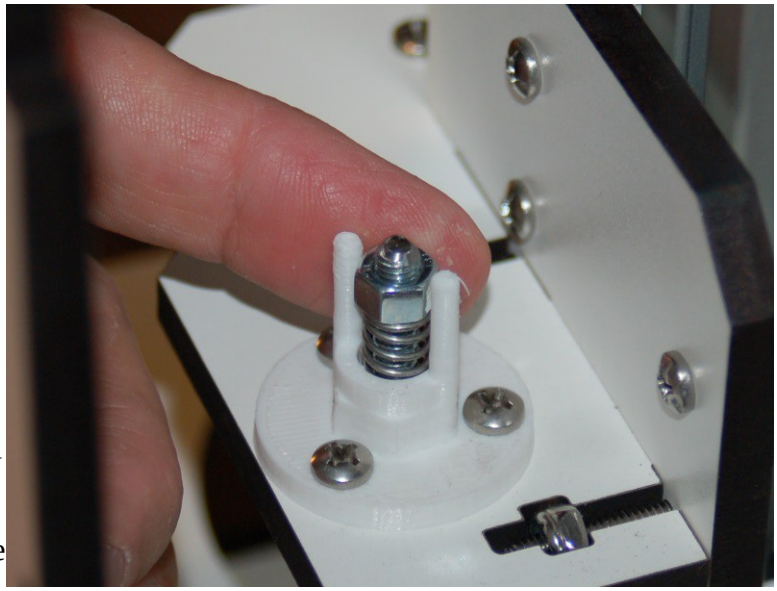


Fig. 5-44: Rod captured in Anti-Backlash Nut.

I'd like to take just a second and explain what this whole Anti-Backlash thing is all about. We're essentially capturing the M5 rod between two fixed points and using a spring to keep tension on those fixed points. See a nut will have a little “give” to it in order to allow it to easily thread on to a screw or rod. This is a great feature in a fastener, but an absolutely rotten thing to have if you're using these things to precisely move a platform or carriage. What happens is that when the threaded rod changes direction, no motion will result for some small percentage of the rotation because the rod is going to take up the “slack” in the nut. If the rotation is small enough, the carriage won't move at all because the motion did nothing but take up that extra room. By having the Anti-Backlash nut installed, that slack is removed by the spring. The nuts capturing the rod are ALWAYS in contact with the threads because the upper nut is pressing against the upper face of the thread and the lower nut is pressing against the lower face of the thread, so a direction change will result in instant motion of the attached carriage. Ok, now that you understand why that's being done, let's get the Z-Axis rod connected to the stepper motor!

Take the last M5 nut and thread it on to the Z-Axis rod till it's about an inch from the end. This nut is going to act as a “jam” nut – it will prevent the Z-Axis rod from backing out of the shaft coupler once it's installed.

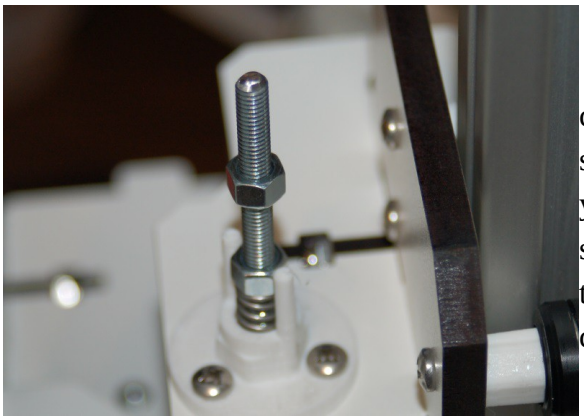


Fig. 5-45: Jam nut threaded on.

Now raise up the carriage until the Z-Axis rod comes into contact with the threaded coupler on the stepper motor. Hold the carriage in place with one hand as you rotate the threaded coupler, clockwise. After a turn or so, the threads in the coupler should pick up the rod. Keep turning until the rod has gone into the coupler as far as it can.

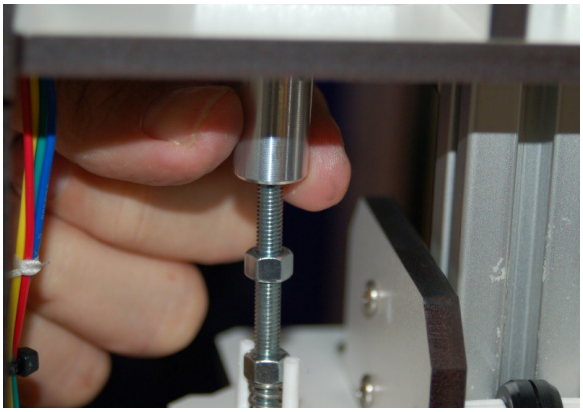


Fig. 5-46: Mating to the threaded coupler.

Once you've done that, spin the M5 nut up until it comes in contact with the bottom face of the threaded coupler. Using a pair of slip joint pliers and a 5/16” wrench, tighten the M5 nut against the face of the threaded coupler as shown below.

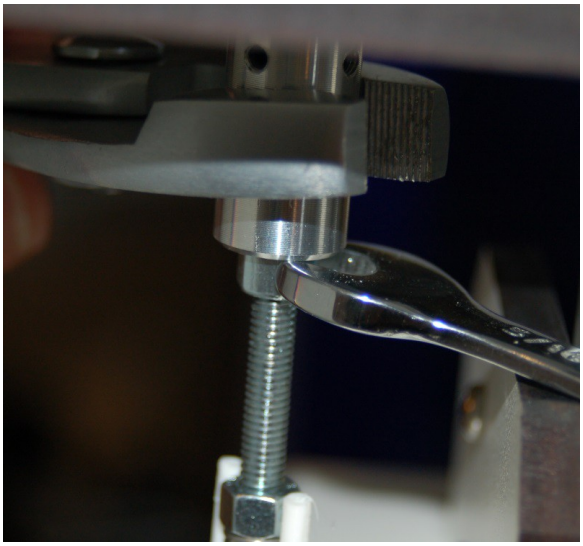


Fig. 5-47: Tightening the Jam nut.

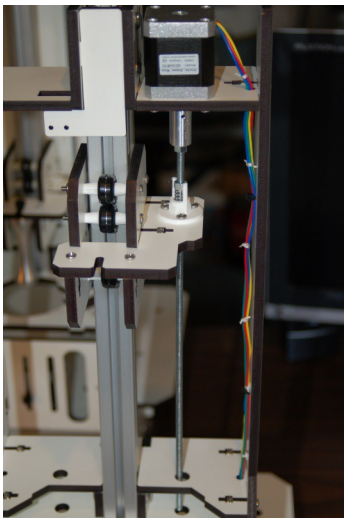


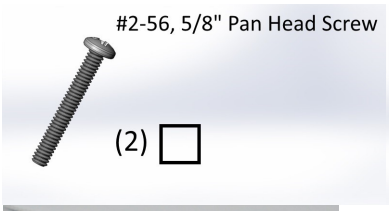
Fig. 5-48: DONE!

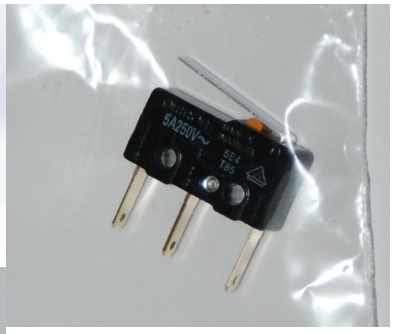
6 – Things Electronic!

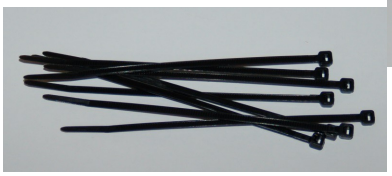
This chapter will cover the remaining electronic components of the DropLit.

Installing the Limit Switch

First, let's get the limit switch installed. For this task, you'll need the following components:







Three Wire Ties

We need to start by soldering a pair of wires to the limit switch as shown below.

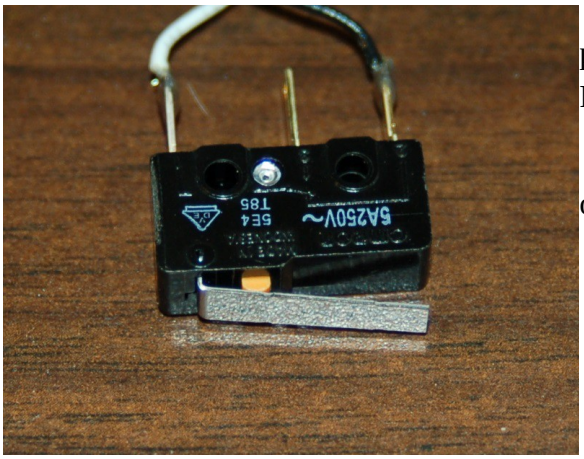


Fig. 6-1: Leads attached.

It doesn't really matter what color goes to what post, but make sure you're using the outer posts as shown in Fig. 6-1.

Now thread the leads up through the rectangular opening on the motor mount.

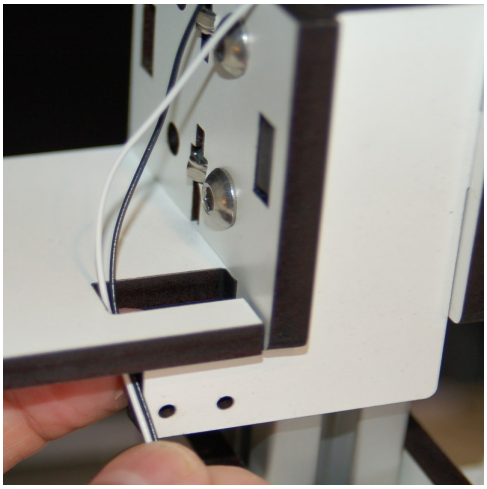


Fig. 6-2: Route through the motor mount...

Next, run the wires through the lower hole in the upper tower mount...

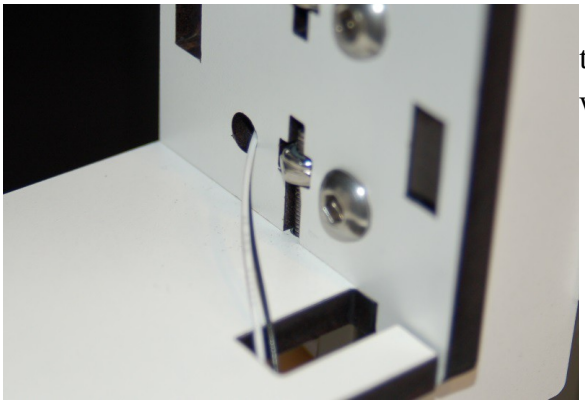


Fig. 6-3: ...and through the tower mount.

And finally, spindle the wires together a bit and run them down the center hole in the extrusion. Pull all the wire through, but not too tight.

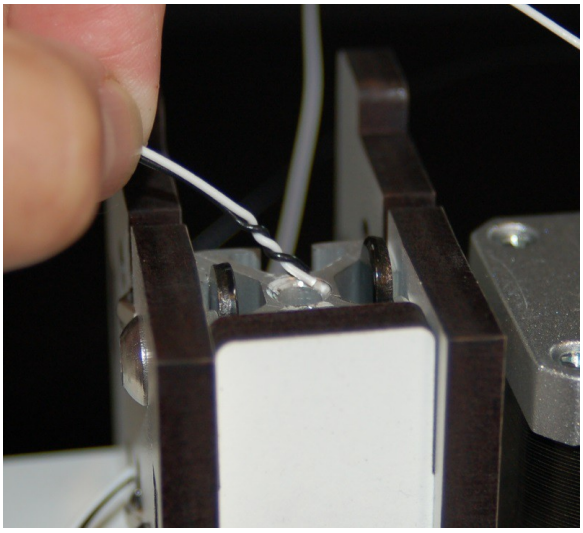


Fig. 6-4: Through the tower center.

Next, use the two 2-56 screws & nuts to fix the limit switch in place. Make sure your switch is oriented identically to that shown in Fig. 6.5.

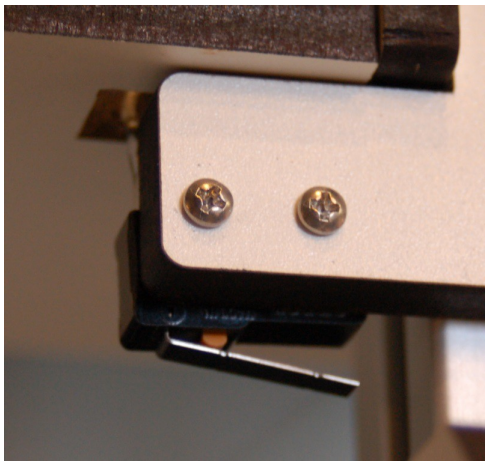


Fig. 6-5: Limit switch, front side.

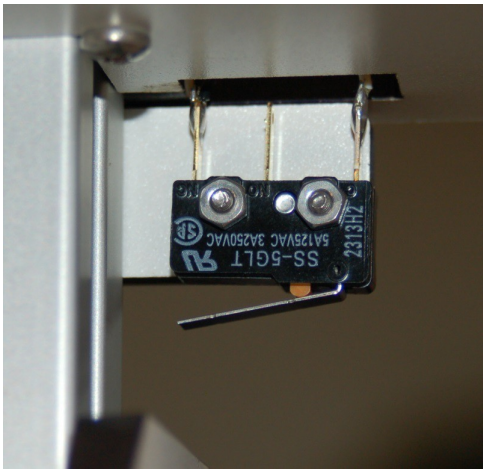
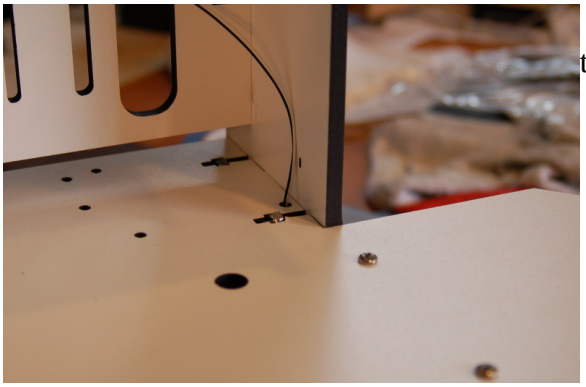


Fig. 6-6: Limit switch, back side.

Now move to the bottom of the DropLit and route the limit switch wires through the small hole on the side of the base, opposite the hole where the stepper motors were routed.



Finally, tie the limit switch wiring in place using the three wire ties at the locations shown.

Fig. 6-7: Limit switch wire routing.

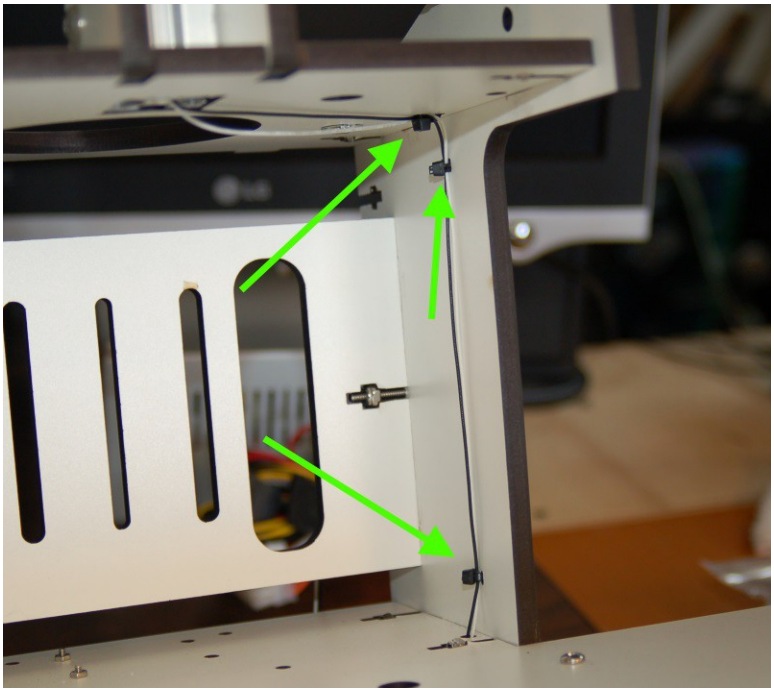
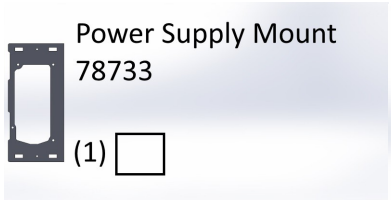
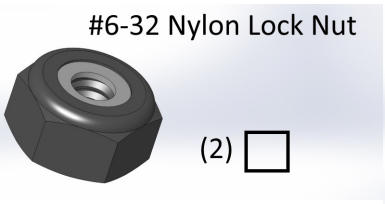


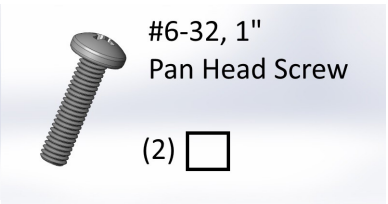
Fig. 6-8: Wire tie locations.

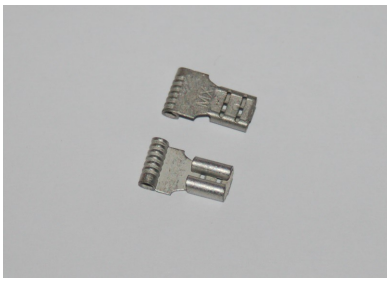
Installing the Power Supply & Power Switch

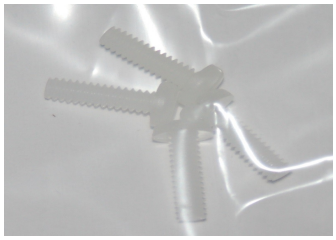
You'll need the following components for the next task:











The first thing you'll need to do is cut some wires free of the power supply for use with the DropLit. The first two go to the power switch. One is black and one is green. They're found on the large connector on the power supply You'll see them highlighted below.

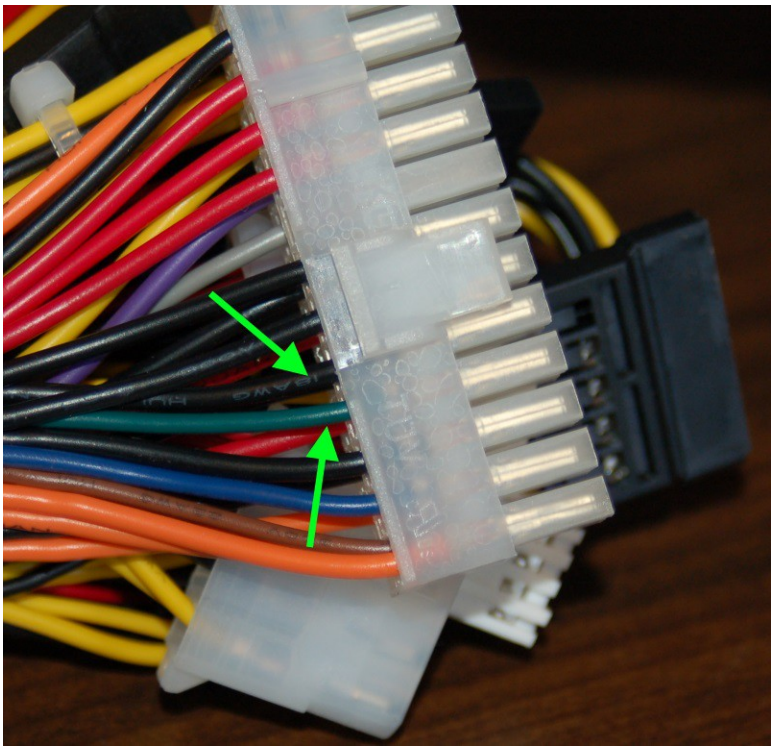


Fig. 6-9: Power Switch wires.

Cut those two wires flush with the back of the connector and “un-route” them from the harness and pull them free so you can work with them. The idea here is to leave the unused wiring wrapped up as it is in order to make it stay compact and all one bundle once the power supply is installed.

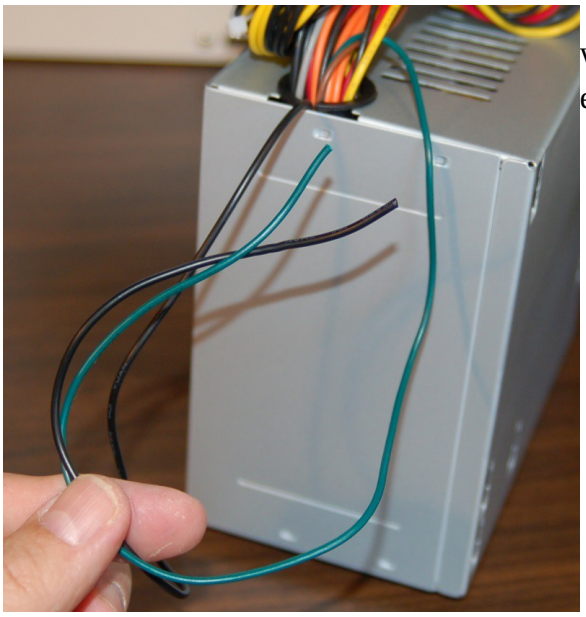


Fig. 6-10: Power switch wires extracted.

Next, strip about 1/4” of insulation from those two wires and crimp on the spade lug connectors that will eventually attach to the power switch.

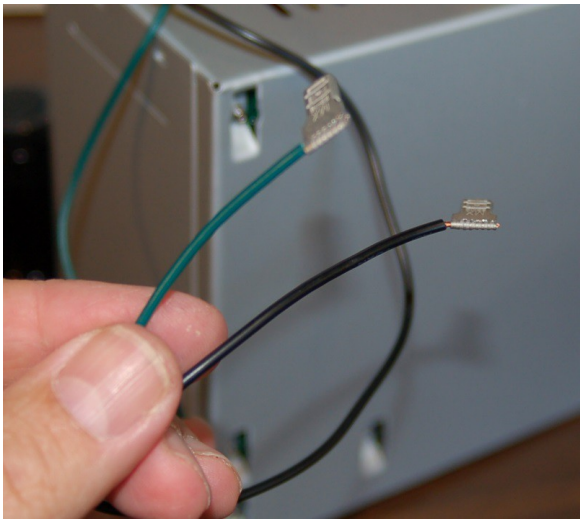


Fig. 6-11: Spade connectors crimped in place.

Now locate one of the square connectors that's got two black & two yellow wires connected to it. They may be clipped together – it doesn't matter as you'll just clip them flush and extract them the same way you did with the power switch wires.

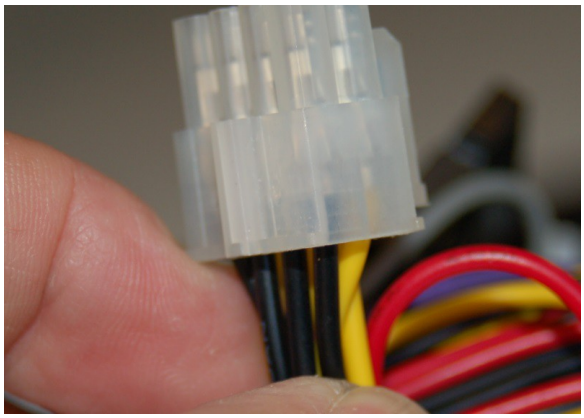


Fig. 6-12: Handy source of 2 black & 2 yellow.

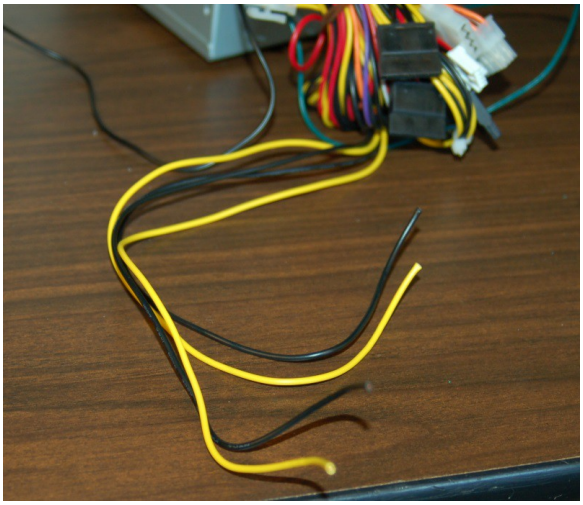


Fig. 6-13: Wires freed up for use.

Now cut 1/4” of insulation from each black & yellow wire and spindle them together as shown in Fig. 6-14.

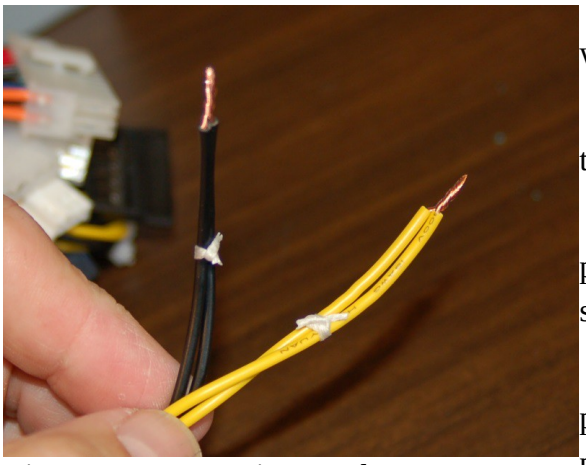


Fig. 6-14: Power wires ready!

You'll see that there's lacing cord present on the wires – I do this to keep the wiring neat and manageable.

Waxed lacing cord is a LOT better than wire ties for this kind of thing!

Now you need to get the power supply mounting plate and attach it to the power supply using four nylon screws. Leave the screws loose for the moment.

Make sure you keep the orientation of the mounting plate the same as you see in the photos, otherwise the power supply won't fit into the base properly.

Fig. 6-15: Power supply mounting plate orientation.

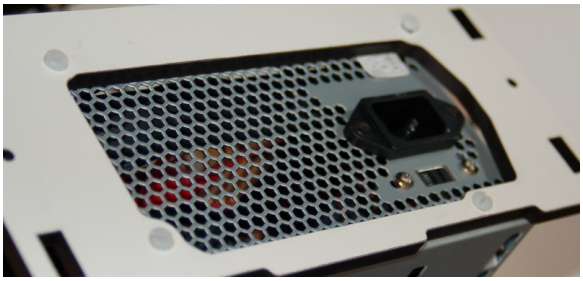


Fig. 6-16: Nylon screws installed.

Lay the DropLit over so the back of the machine is exposed and install one nut in each side as shown below.

Fig. 6-17: Nut installed.

Now you can insert the power supply into the back of the DropLit. Take care that the wiring harness doesn't strike the Arduino Uno!

Fig. 6-18: Installing...

Fig. 6-19: Ready for screws.

Fix the power supply mounting plate in place with two screws.

Now it's time to get the power switch installed! Grab the power switch and remove the retaining nut that's on the back.

Fig. 6-20: Power switch and nut.

Slide the retaining nut over the green & black power switch wires as shown below.

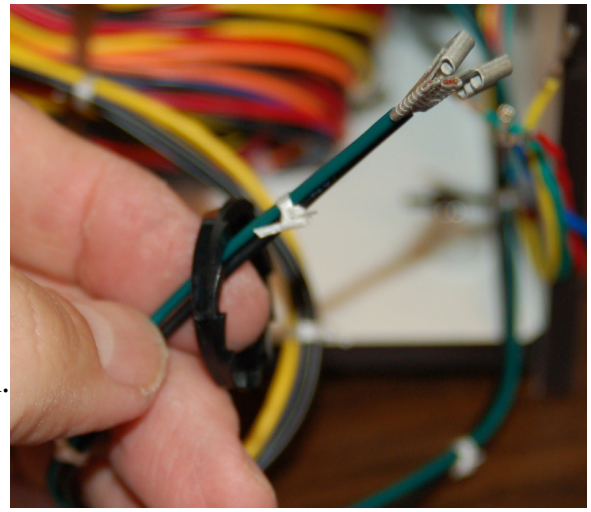


Fig. 6-21: Nut over wires...

Now route the wires out through the hole in the side of the DropLit and attach the power switch.

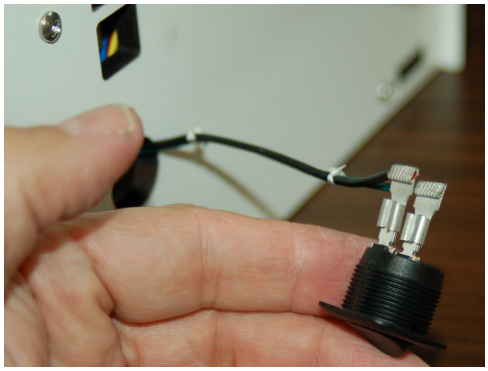


Fig. 6-22: Switch wired.

Rotate the switch as shown below and insert it into the DropLit chassis, then thread on the retaining nut.

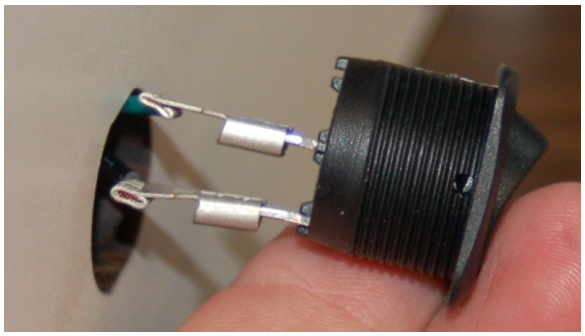


Fig. 6-23: Switch orientation.

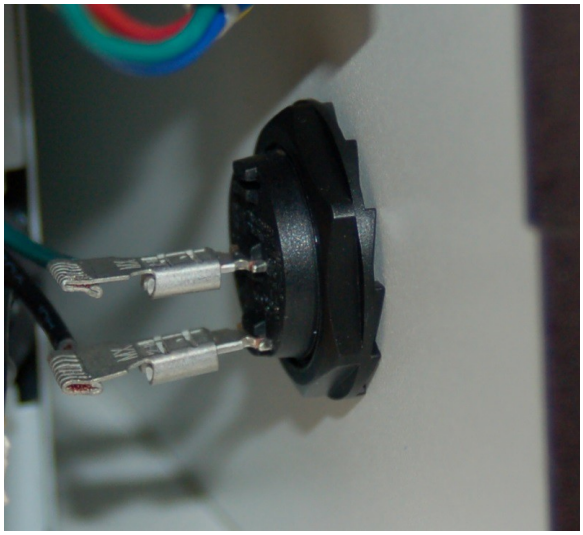


Fig. 6-24: Switch installation complete!

Wiring & Installing the gShield

For this task the only component you'll need is the gShield itself:

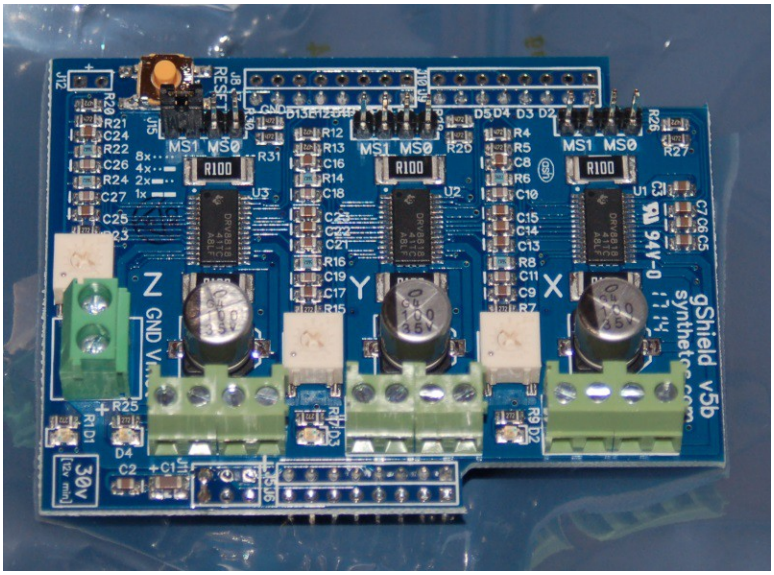


Fig. 6-27: The gShield

Warm up your soldering iron! The first step is to solder the limit switch wires to the gShield. The black wire is soldered to the hole marked “GND” and the white wire is soldered into the hole marked “D11”.

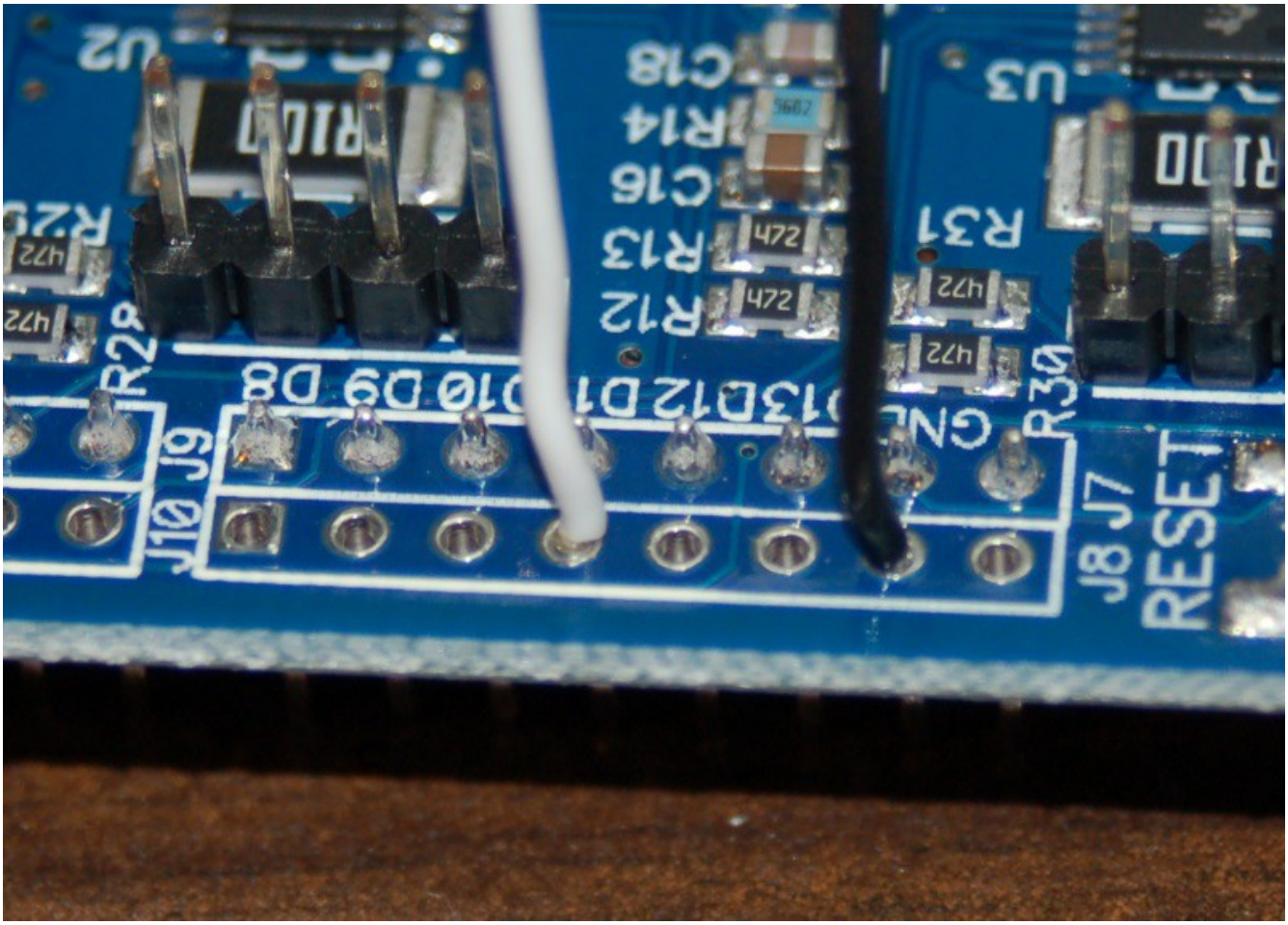


Fig. 6-25: Limit switch wires soldered into place.

Now you need to install the black & yellow power wires into the two position terminal block along the edge of the gShield. The black wires go into the position marked “GND” and the yellow wires go into the position marked “Vmot”. Please trim your wire a bit so that little or no wire is visible outside the face of the terminal block. (In other words, DO IT BETTER THAN I DID!)

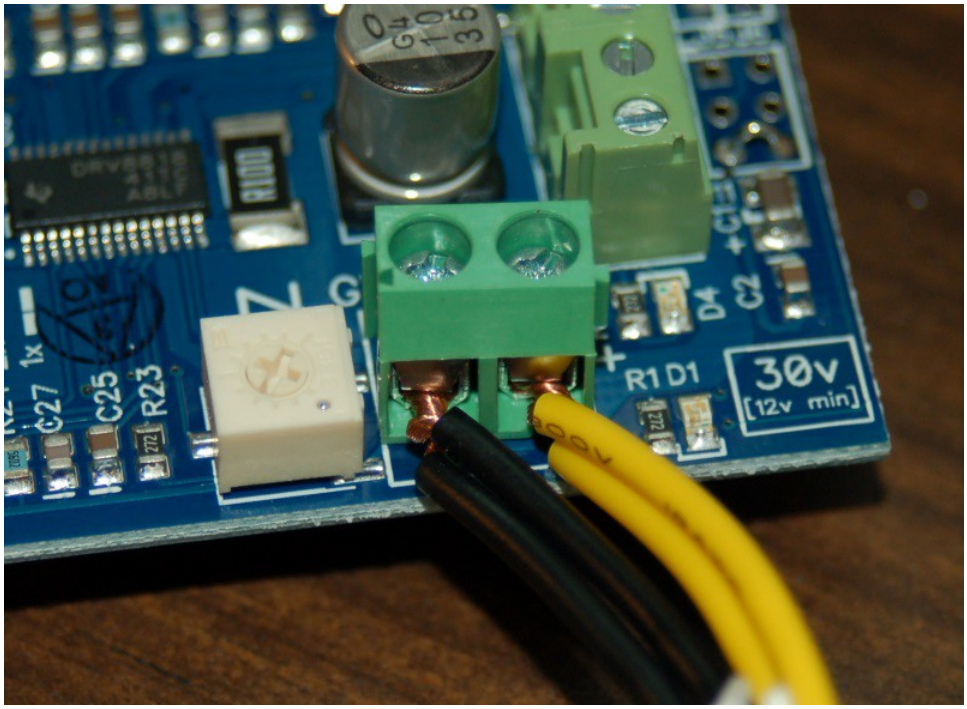


Fig. 6-26: Power wires installed.

Now insert the four stepper wires into the “Z” position on the gShield, just as you see them on the right. Note that this terminal block uses a very small flat tip screwdriver!

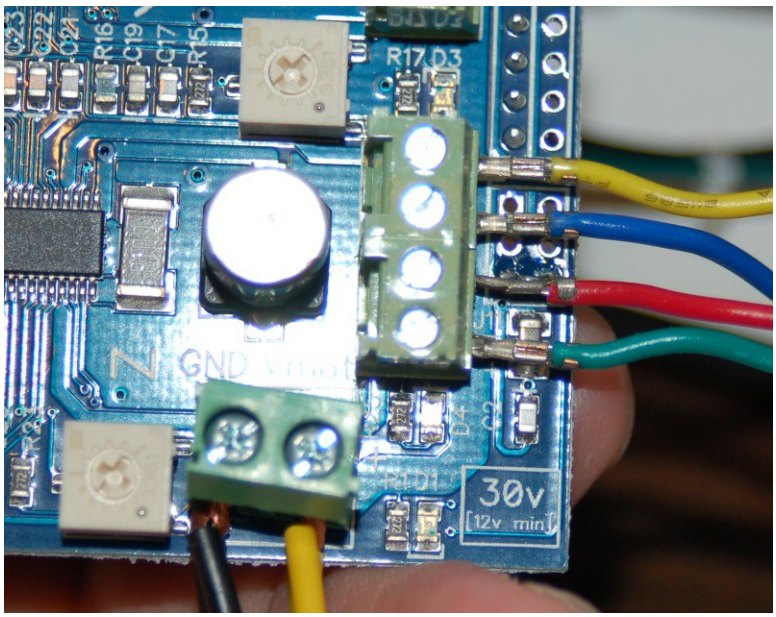


Fig. 6-27: Stepper wires installed.

Finally, it's time to install the gShield on to the Arduino Uno! The pins on the “bottom” of the gShield fit exactly into the two rows of sockets on the Arduino Uno as shown below.

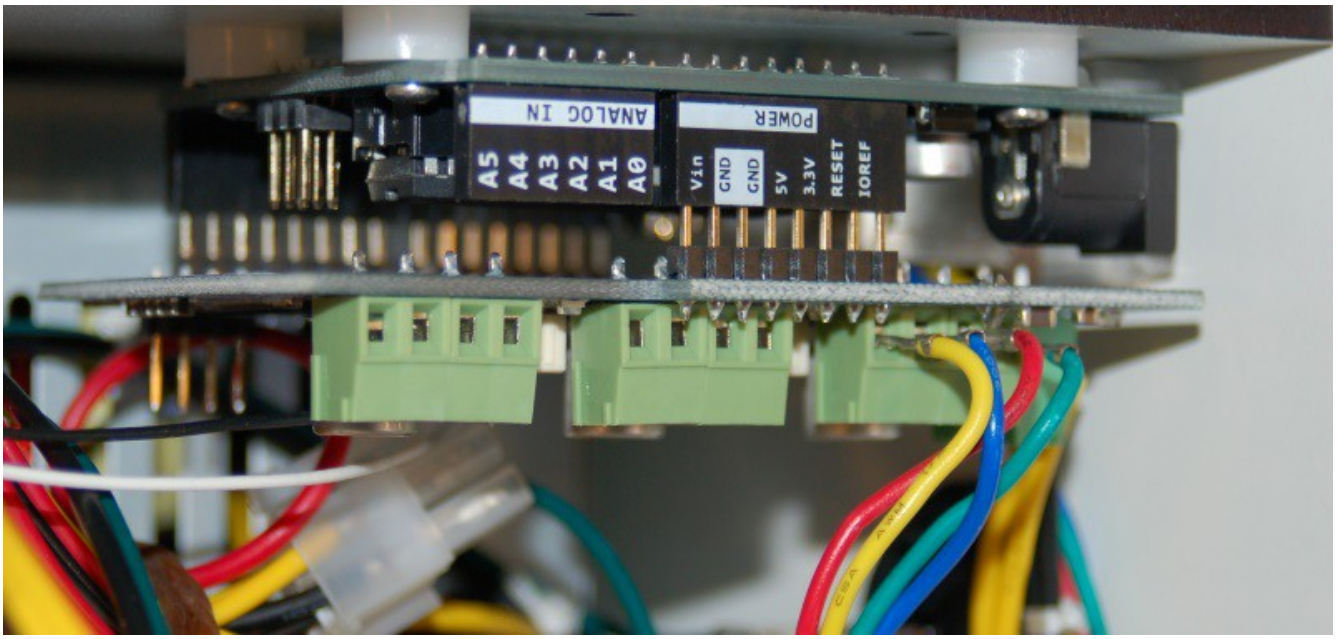


Fig. 6-28: Installing the gShield.

Once you've got the three sets of pins started, gently press on the center of the gShield to seat both sides evenly.

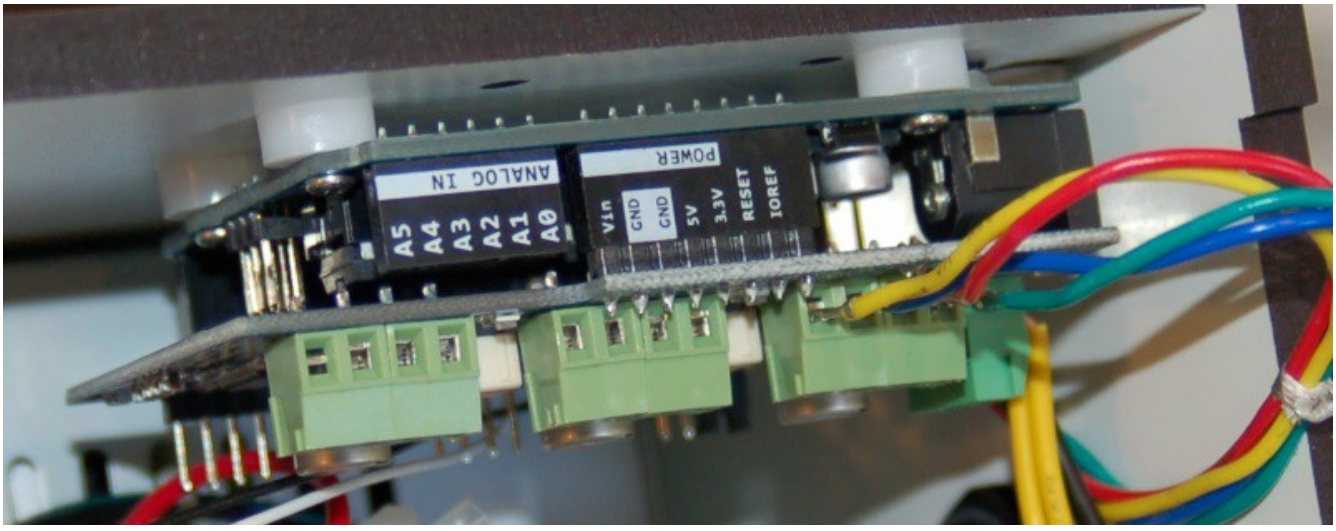


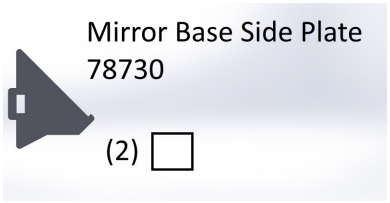
Fig. 6-29: gShield installation complete.

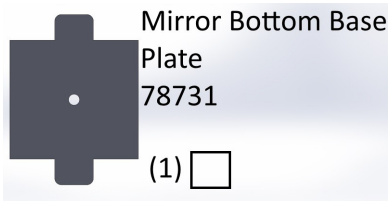
You're almost done! Next up, we'll get the last parts installed!

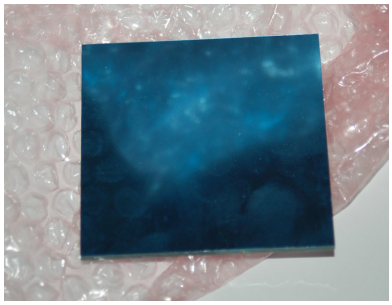
7 – Final Assembly

Assembly & Installation of the Mirror Support

First up, let's get the mirror support framework assembled. For this task, you'll need the following components:







1 Knurled Thumbscrew

The first thing you'll need to do is use the knurled thumbscrew to create threads in the Mirror Bottom Base Plate as shown:

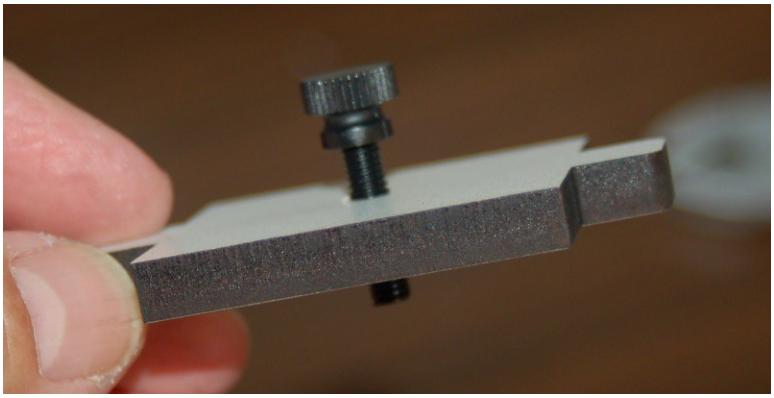


Fig. 7-1: Threaded base.

Next, attach the two Mirror Base Side Plates to the bottom base plate.

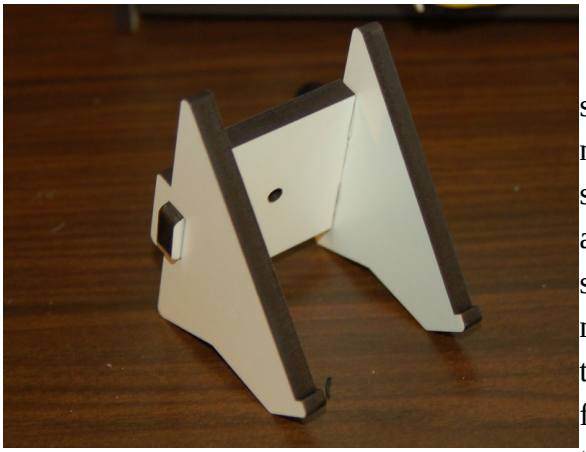


Fig. 7-2: Ready for the mirror!

The mirror that comes with your DropLit is a first surface mirror. This means that the silvering on the mirror isn't covered and is directly exposed, thus “first” surface. A normal mirror has this silvering protected with a coat of paint – this makes a standard mirror a “second” surface mirror. The reason the DropLit uses this special mirror is that the light will have to pass through the glass twice before it reaches the bottom of the resin vat. The first pass is when the light from the projector goes through the glass on its way to the silver layer and then when it passed back out through the glass after being reflected. This will cause an image “ghost” that would ruin your print. If you're curious, here's a nice description of the effect: http://en.wikipedia.org/wiki/First_surface_mirror

The mirror that SeeMeCNC ships has had protective film applied to the primary surface, making it easy to identify how to orient the mirror. Using your Super Glue, attach the mirror to the mirror frame – please make sure that the side plates are as square as possible to the base plate before gluing the mirror in. The reason for this is that the tabs on the side plates fit into slots on the DropLit, under the Dish Base.

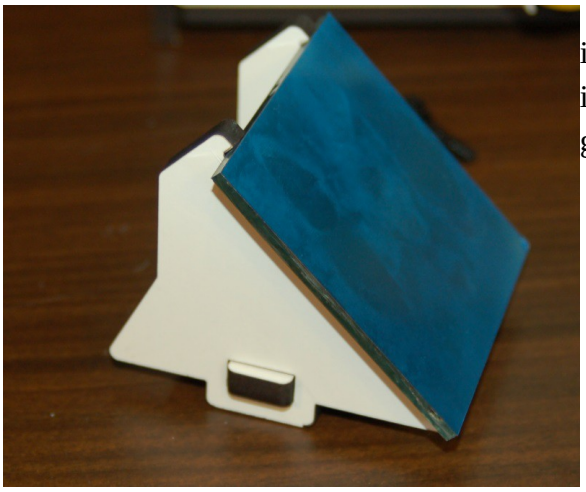


Fig. 7-3: Mirror glued into place.

You'll want to clean the back of the mirror with isopropyl alcohol in order to remove any finger oils from it. This will help the Super Glue get a better grip on the glass.

Once the glue has dried, carefully remove the protective film from the mirror. Do NOT touch the surface of the mirror!

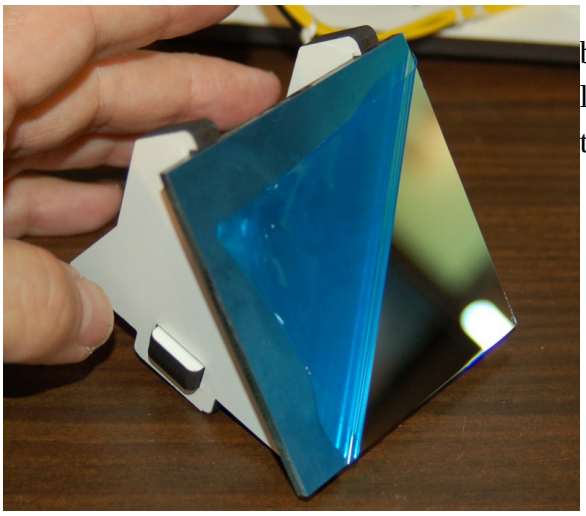


Fig. 7-4: Removing protective film.

Now you can install the mirror assembly into the base of the DropLit. We'll worry about setting the height later, so for now just set it into place and thread the thumbscrew in.

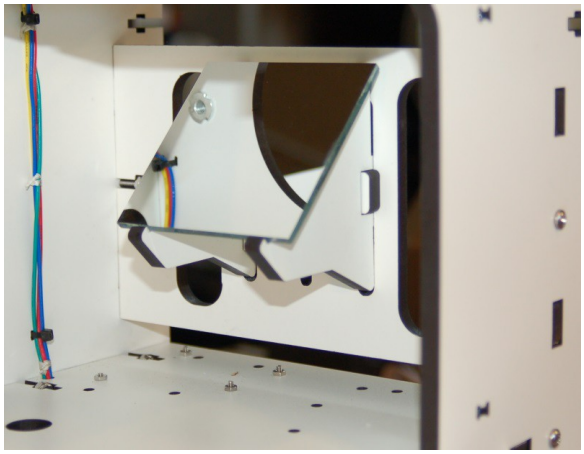
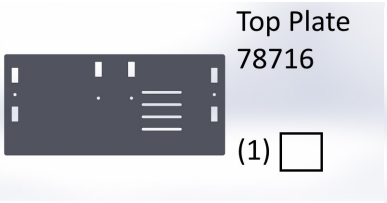


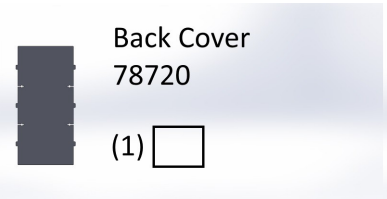
Fig. 7-5: Mirror installed.

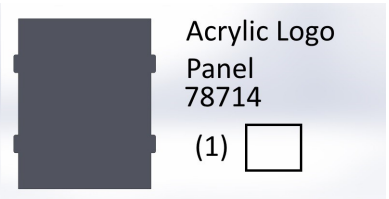
Fig. 7-6: Adjustment thumbscrew installed.

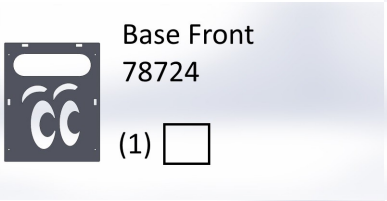
Final Assembly

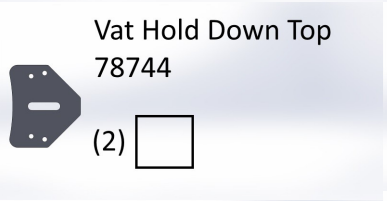
For the next tasks, you'll need the following components:

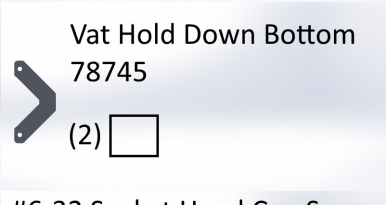


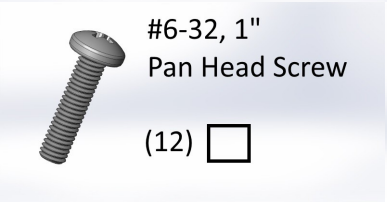


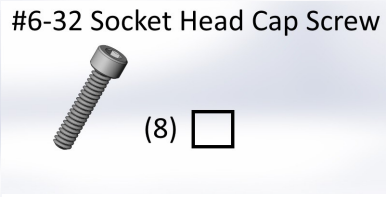


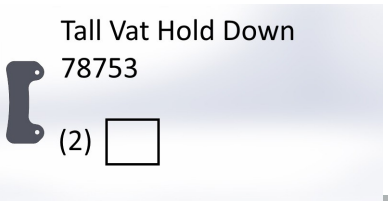




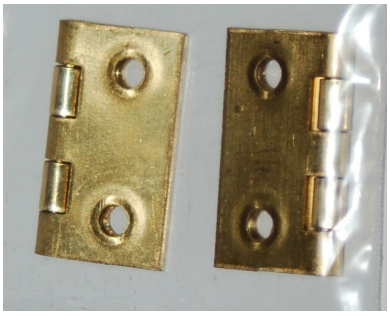








3 Knurled Thumbscrews



First, let's get the Top Plate installed. Insert a nut into the DropLit sides – there should be two more installed in the upper tower mount from a prior step.

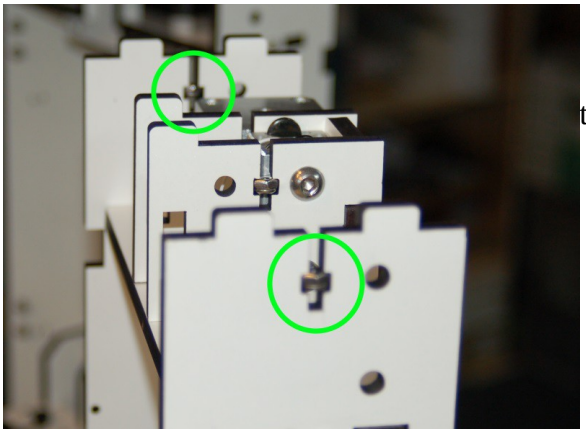


Fig. 7-7: Top Plate nuts.

Next, install the top plate by aligning the six tabs on the DropLit chassis with the six slots on the top plate.

Fix it in place with six screws.

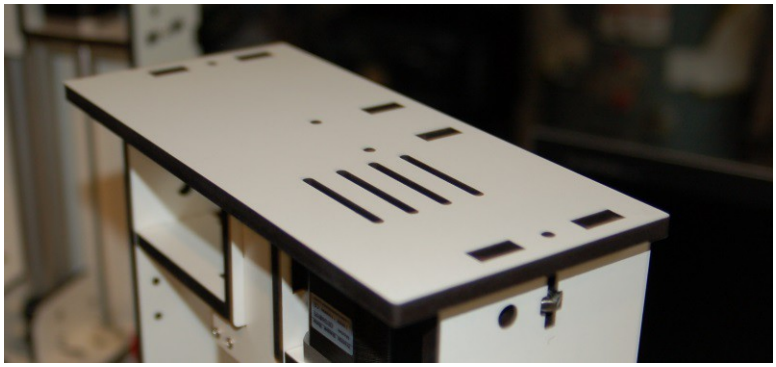


Fig. 7-8: Top Plate installed.

Get the Back Cover and install four nuts into the pockets as shown below.

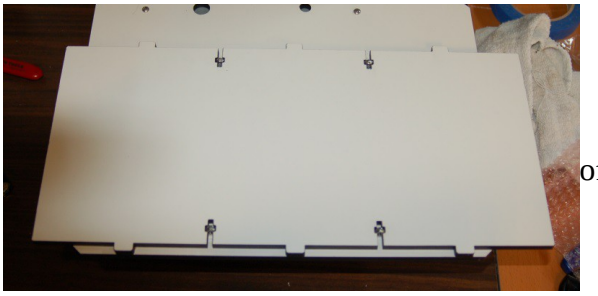


Fig. 7-9: Back Cover with nuts.

Carefully tap the back cover into place on the back of the DropLit and fix in place with four screws.

Fig. 7-10: Ready for screws.

Next, we're going to install the Logo Cover on the front of the machine. Insert two nuts on each side in the locations shown.

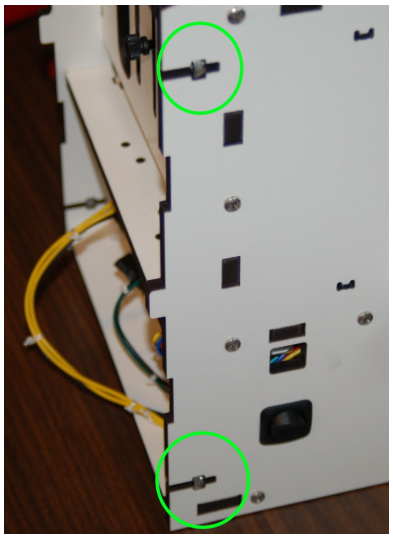


Fig. 7-11: Logo panel nuts.

Now you'll want to set the Acrylic Logo Panel in to place, fitting the tabs into the shallow notches on either side of the DropLit. You may want to lay the machine on its back to make the panel stay in place without having to tape it.

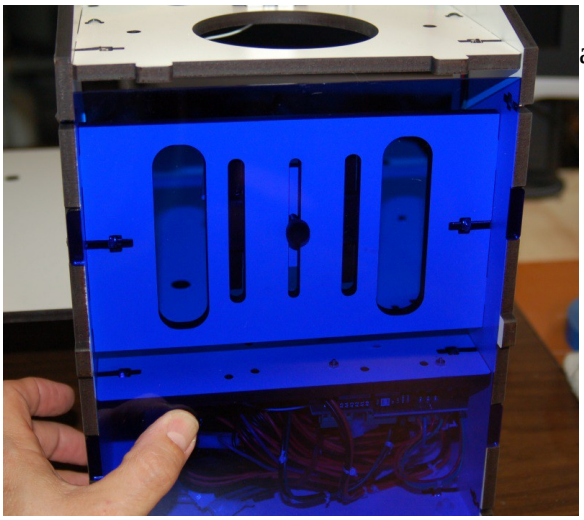


Fig. 7-12: Acrylic Logo Panel in place.

Now you can set the Logo Panel into place and attach it using four screws.

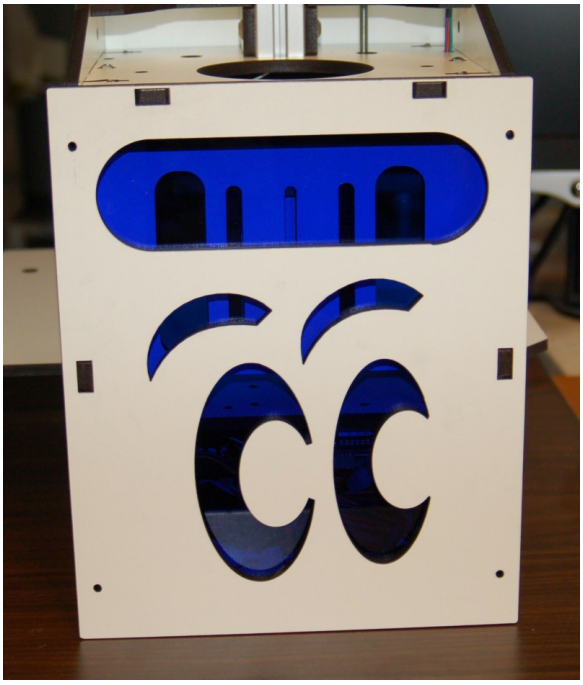


Fig. 7-13: Logo Panel in place.

Now let's get the door mounted!

Install a brass hinge at the two hing locations on the left side of the door. You'll need two Socket Head Cap Screws and two #6-32 nylon lock nuts for each hinge.

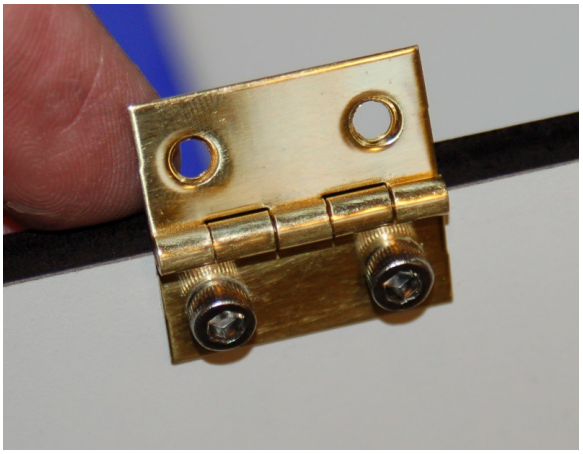


Fig. 7-14: Hinge, front side.

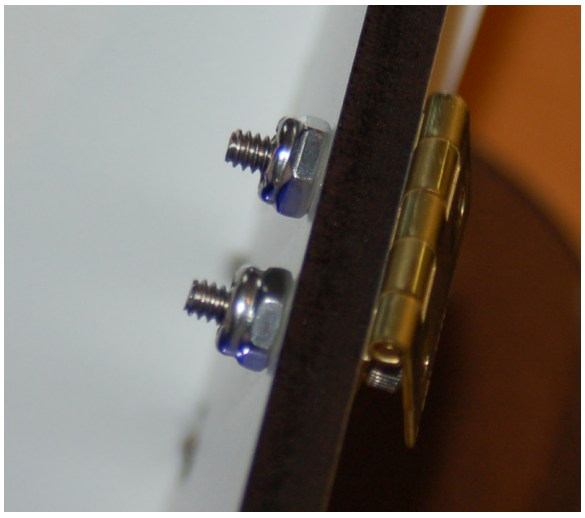


Fig. 7-15: Hinge, back side.

Fig. 7-16: Both hinges installed on the door.

Now you can hang the door in place by using one cap screw at the top and one at the bottom. This will hold the door in place long enough for you to easily thread on and tighten the nuts used on the back side.

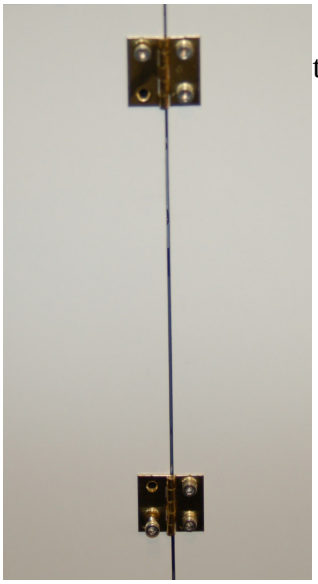


Fig. 7-17: Holding the door.

Now insert the other two screws and nuts – tighten all the way around and the door installation is complete!

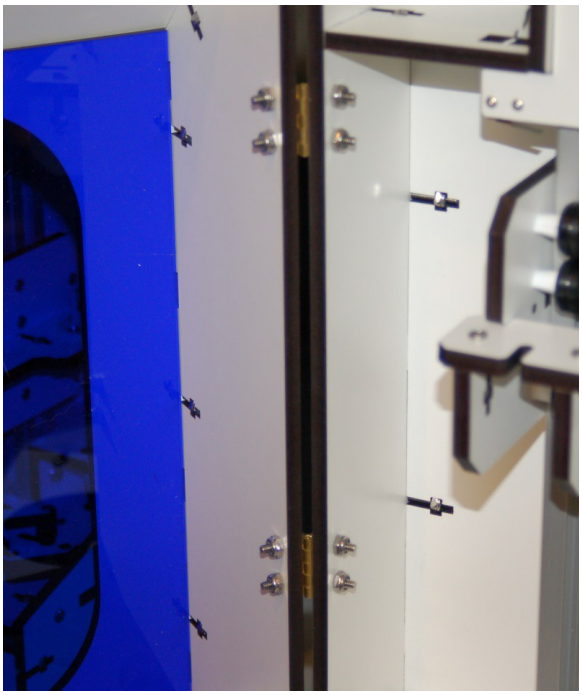


Fig. 7-18: Door installed!

Now let's get the vat clamps assembled! You'll need the following parts for each one:

Fig. 7-19: Vat clamp parts.

The vat clamp is really simple to assemble. First, attach a Tall Vat Holddown using two of the #6, 1/2” Pan Head Machine screws to the Vat Holddown Top part.

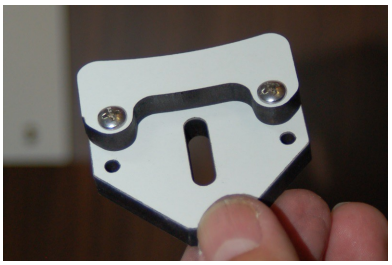


Fig. 7-20: Step 1

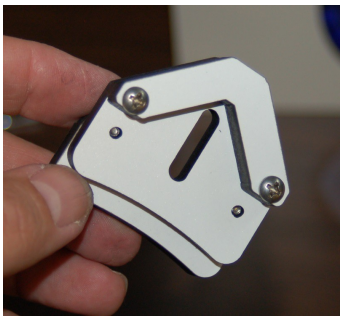


Fig. 7-21: Step 2.

Next, flip that assembly over and install a Vat Holddown Bottom using another pair of the #6 screws. When you've assembled both of the vat clamps, you can install them on the Dish Plate using two of the knurled thumbscrews as shown below.

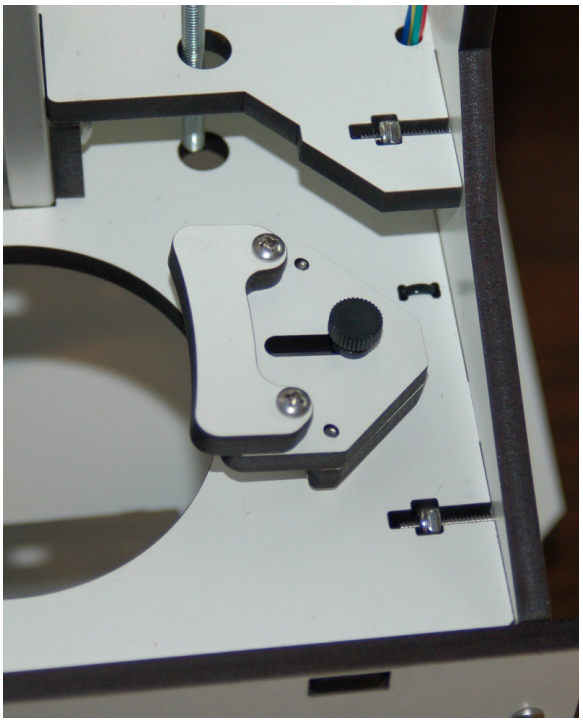


Fig. 7-22: Vat clamp installed.

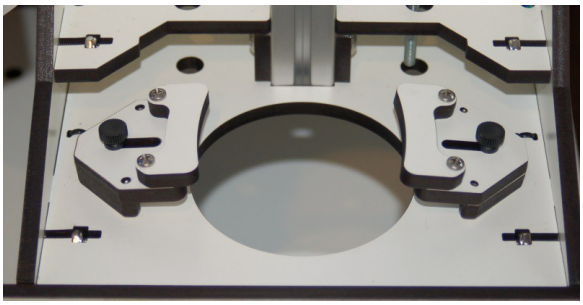


Fig. 7-23: Both clamps in place.

Now grab the four rubber “shoes” that you set aside in Chapter 4 and get them installed on the plastic feet on the bottom of the DropLit. They just slide on. Kind of like Slippers Of Awesome. :)

Fig. 7-24: Shoes on, ready to dance!

Next, let's get the Build Platform Installed. Simply insert a knurled thumbscrew into the threaded end and then install it in the Carriage as shown.

Fig. 7-25: Build Platform ready to install.

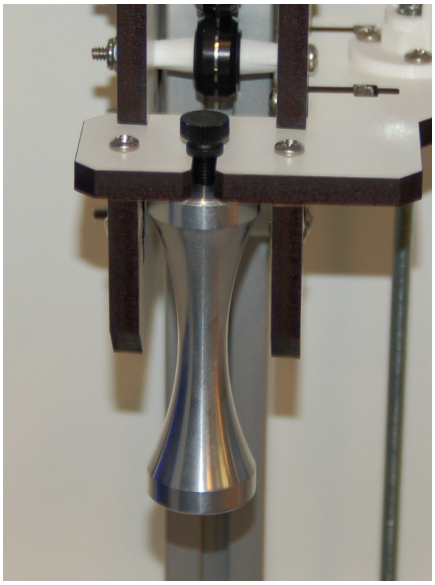


Fig. 7-26: Platform installed!

Congrats! Your DropLit 3D printer build is now complete!