

## RP9 Assembly Instructions



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## Specifications

5 ply Baltic birch frame  
Oil hardened drill rod linear rails  
Filament drive with high grip v-groove threaded coupler drives  
Remote extruder with 1.75 mm drive

Foot print  
Width 520 mm (20.5") - including spool holder  
Depth 550 mm (21.7") - with max travel  
Height 660 mm (26") - room for filament guide tube

Print Area  
X 200 mm (7.9")  
Y 200 mm (7.9")  
Z 200 mm (7.9")  
The complete printer part list can be found in the appendix.

## Getting Started

### ***Safety first***



**Safety is your responsibility. Always use the proper protective equipment and "safety sense" when building or operating a 3D printer.**

Printers have high voltage power supply, and extruder operating temperatures can be over 250 degrees Celsius (482 F). The operator should understand the hazards before operating a printer.

## Required tools



Please browse through the instructions and get familiar with the steps before you begin.

To put the kit together you will need:

- a Phillips screwdriver for the screws
- a pair of pliers to hold the nuts
- a sharp knife or a pair of side cutters to trim the zip ties and string
- sand paper to clean up the plywood parts and remove sharp edges.

Tools you may need for the electronic setup include:

- 25 to 40 watt soldering iron/solder
- Diagonal Cutters (dikes)
- multimeter to correctly set up the power supply and stepper motors and general trouble shooting.

For the printing you will want to have:

- computer with a USB to program and run the printer
- calipers to measure motion distance and extrusion width
- calibration block STP file that can be modeled or downloaded at [BobsCNC.com](http://BobsCNC.com)

## Building the Printer

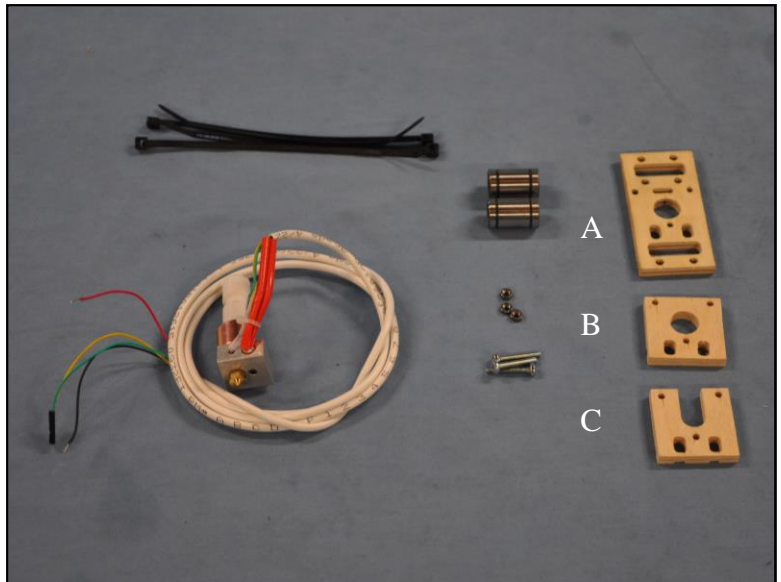


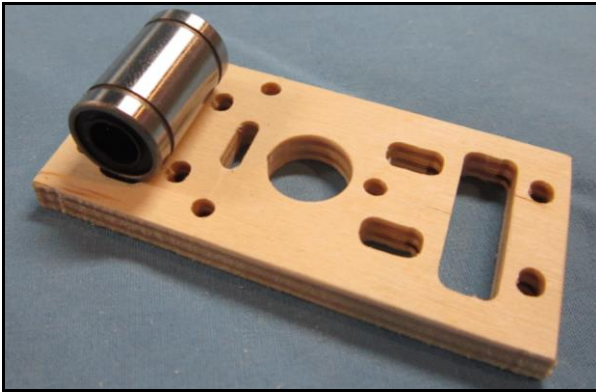
We recommend a large working surface for assembling the printer. The plywood may require some minor sanding and can be painted, stained or finished for a different look. A coat of sealer or lacquer on all surfaces of the plywood will add stability.

### ***Extruder Assembly***

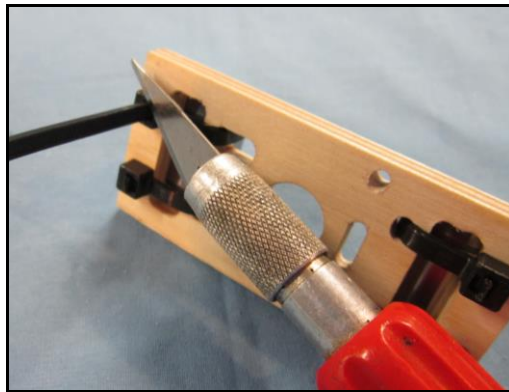
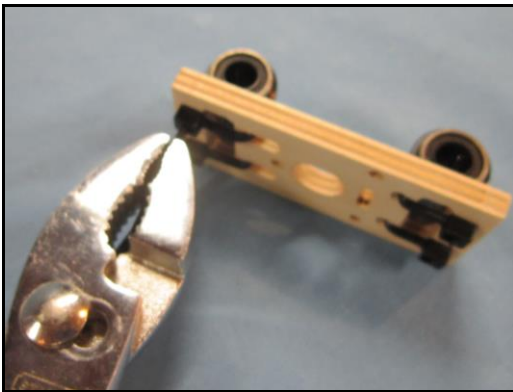
Parts for the extruder mount assembly include:

- A. 1 Extruder mount
- B. 1 Extruder top mount
- C. 1 Extruder lock
- D. 3 M3 x 20 machine screws
- E. 3 M3 nuts
- F. 2 LM8UU bearings
- G. 4 Large nylon ties
- H. 1 Extruder

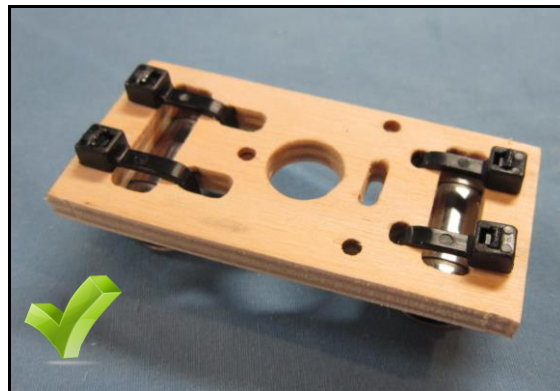
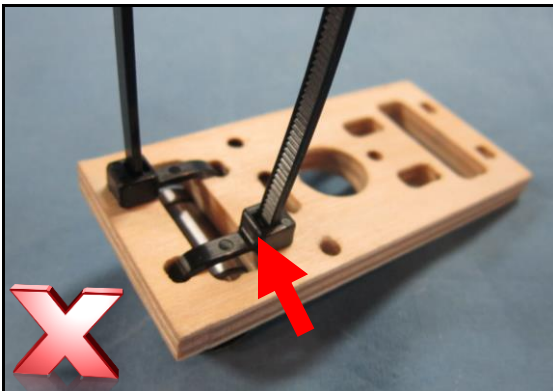




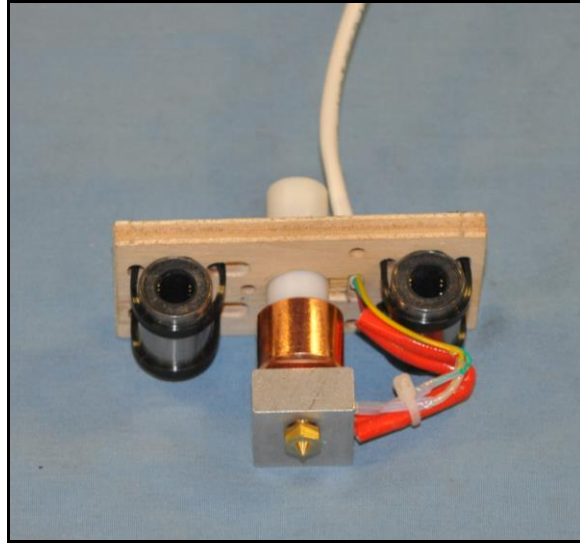
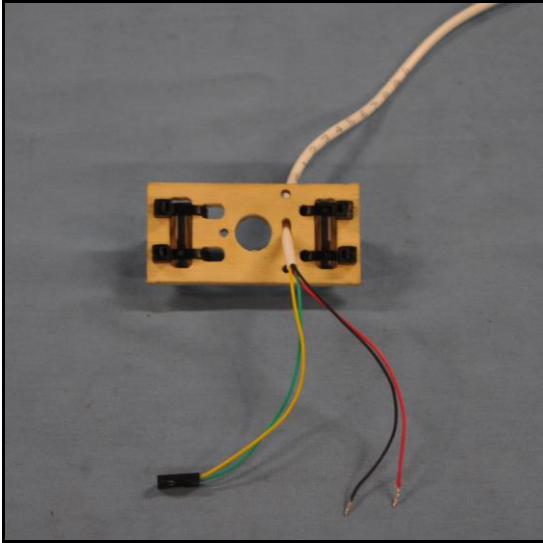
1. Place the bearings into the rectangular slots of the extruder mount.
2. Wrap the 2 bearings by inserting large nylon ties through the side opposite of the bearing into the slotted holes of the extruder mount. The slots on one side are larger to make room for nylon ties during a later step.



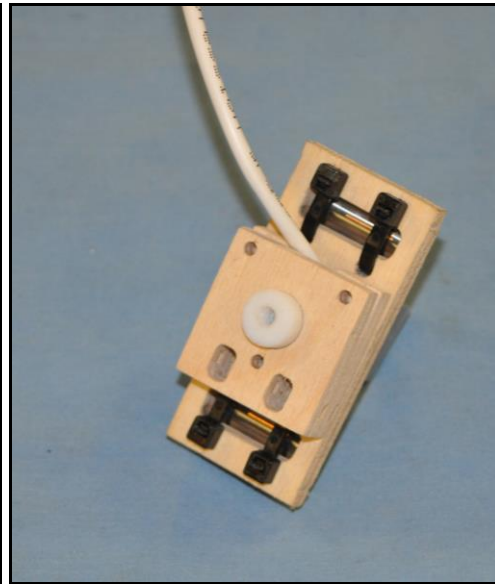
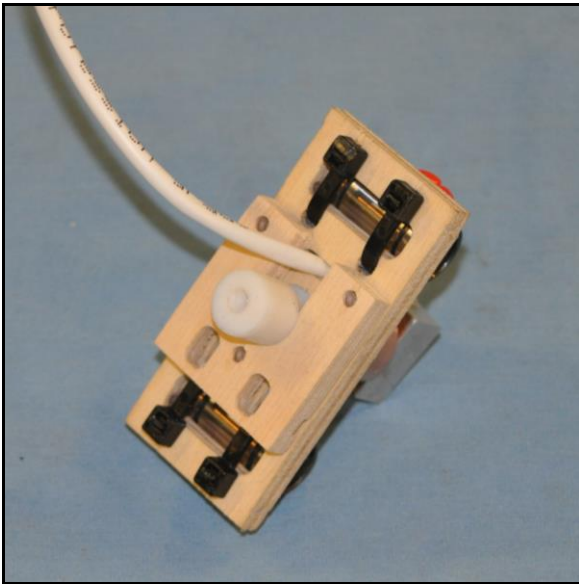
- 3 Pull the bearing snug against the extruder mount (use pliers if needed).
4. Cut off the excess of the nylon tie.



For a clean look and string clearance, insert the nylon straps first in the inboard holes.

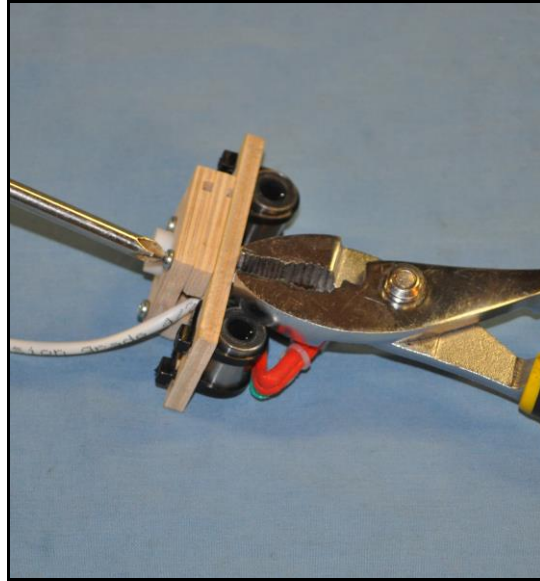
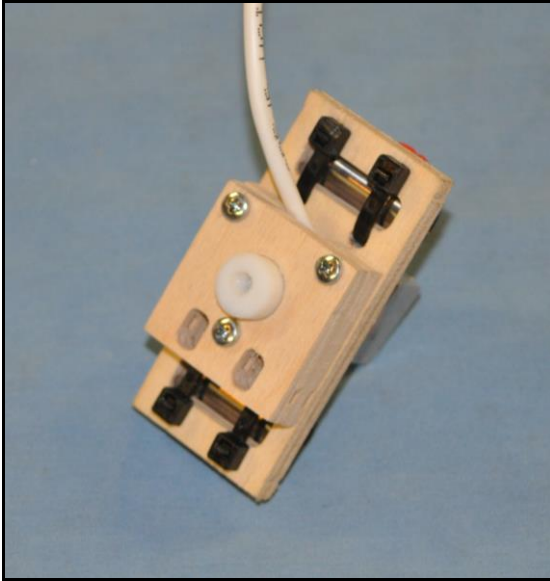


5. Insert the 4 extruder wires through the extruder mount from the same side as the bearings through the wire slot.
6. Place the extruder through the extruder plywood mount
7. Pull the wires through and re-coil them to keep them out of the way and undamaged.



8. Install the extruder lock.
9. Install the extruder top mount.



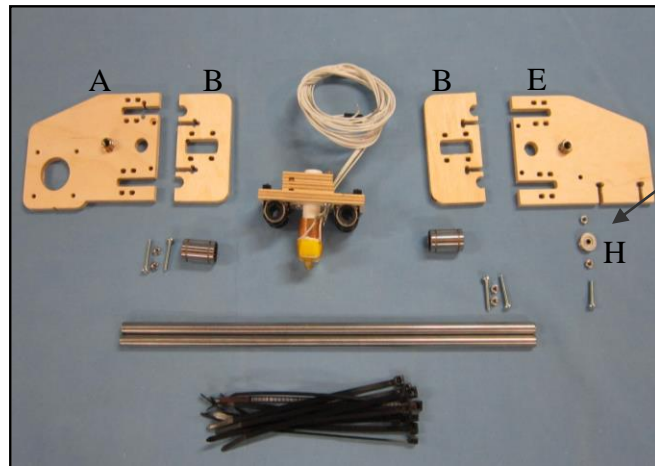


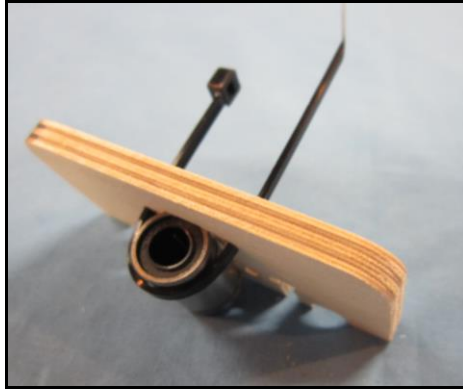
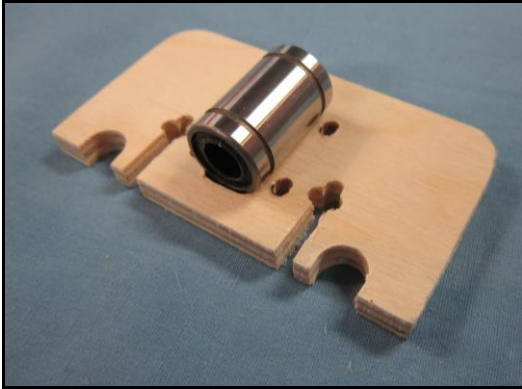
11. Insert the 3 M3 x 20 screws into the holes.
12. Install the 3 nuts and tighten.

### ***Y Sub-assembly***

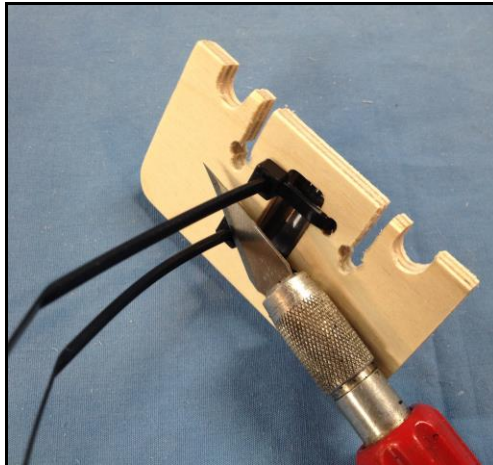
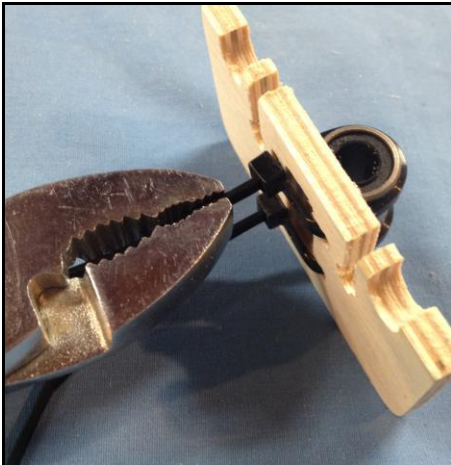
Parts for the Y sub-assembly include:

- A. 1 Left mount
- B. 2 Bearing holders
- C. 1 Extruder assembly
- D. 1 M3 x 16 machine screw
- E. 1 Right mount
- F. 4 M3 x 20 machine screws
- G. 6 M3 nuts
- H. V groove bearing 623VV
- I. 2 LM8UU bearings
- J. 12 Large nylon ties
- K. 2 8mm rods



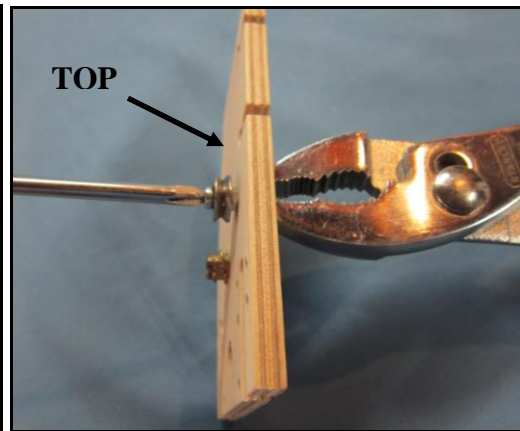
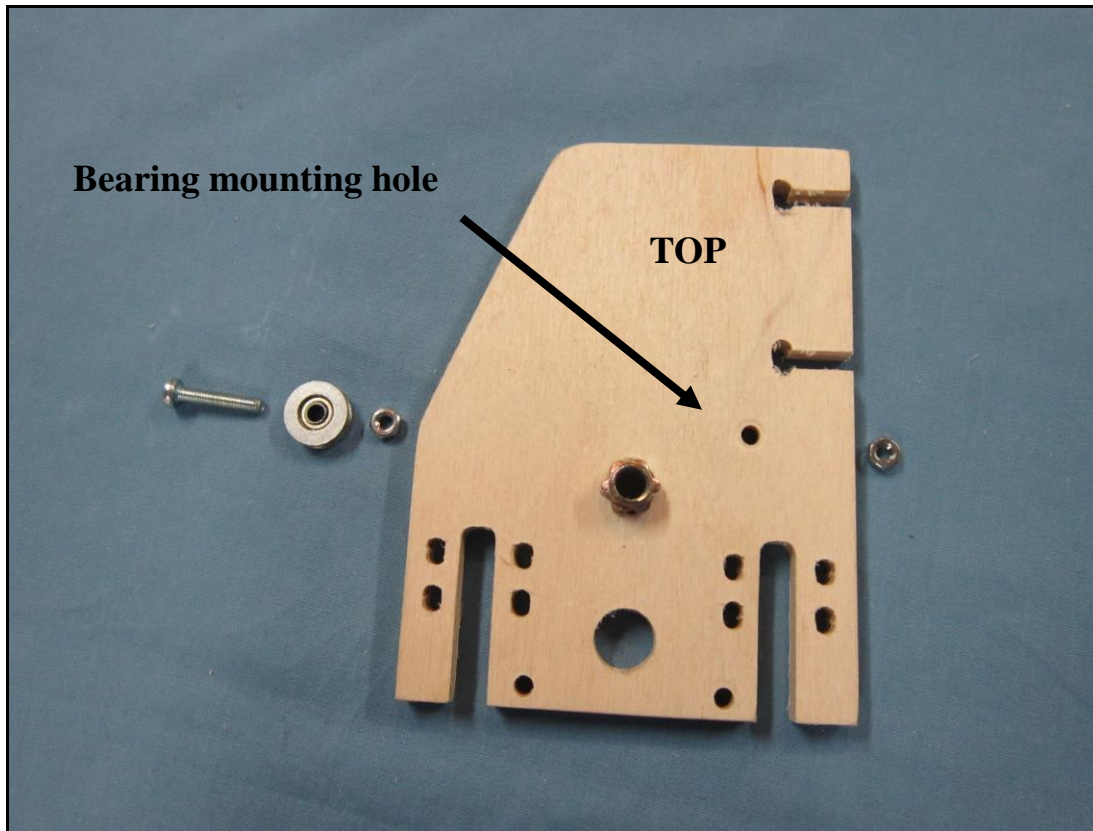


1. Place the bearings in the rectangular slots of the 2 plywood bearing holders.
2. Wrap the bearings by inserting large nylon ties through the side opposite of the bearing into the slotted holes of the bearing holders.



- 3 Pull the bearing snug against the 2 bearing holders (use pliers if needed).
4. Cut off the excess of the nylon tie.

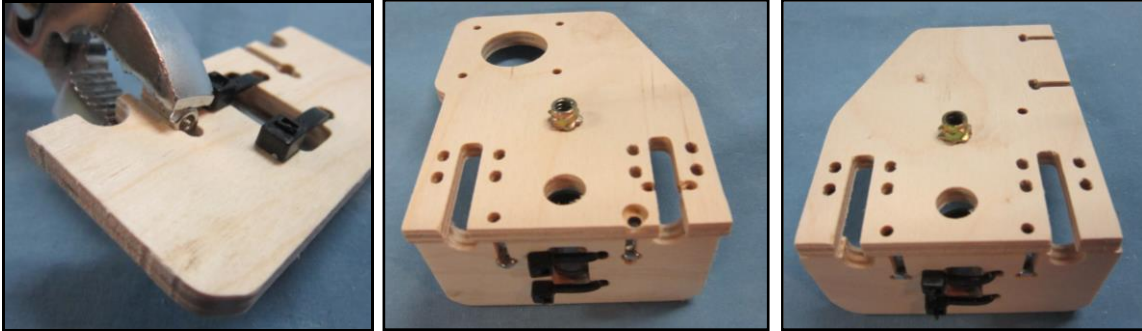




5. Insert the bearing and then the nut on the M3 x 16 machine screw.
6. Tighten the nut
7. Install the screw and bearing through the top of the right mount through the bearing mounting hole.
8. Install and tighten the nut.



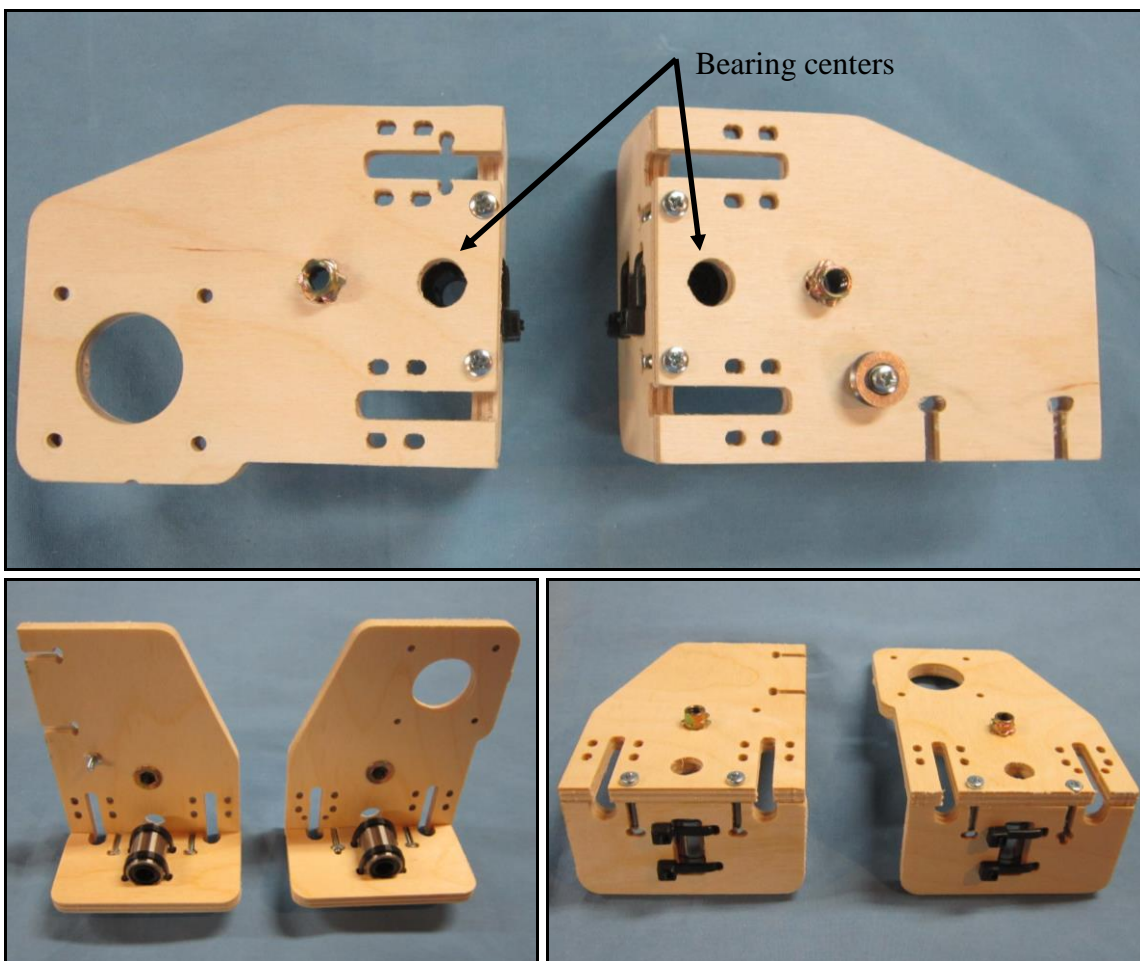
The bearing should rotate freely once installed.

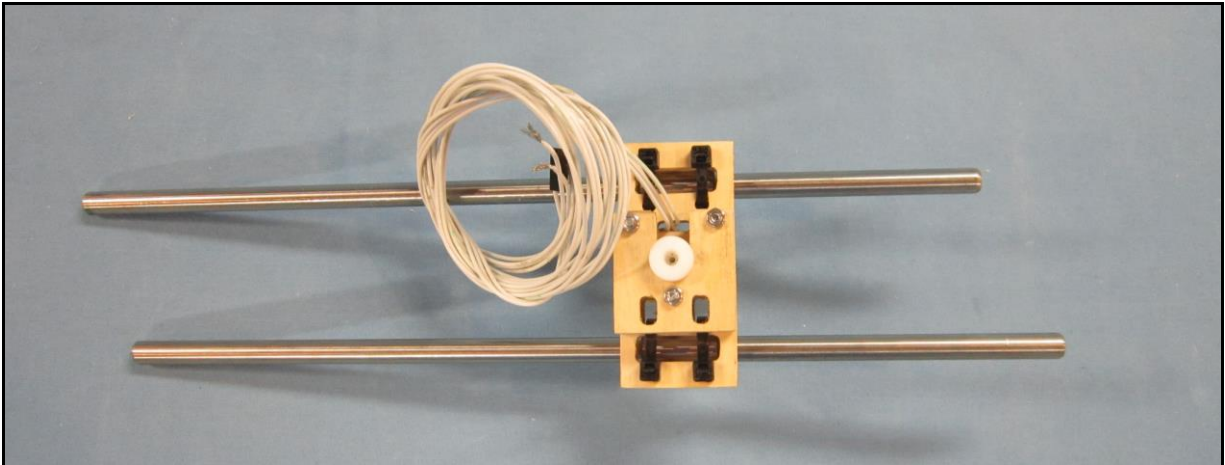


9. Press in the 2 M3 nuts into the slots on both of the 2 bearing holders.
10. Assemble the left and right mounts to the bearing holders with 2 M3 x20 machine screw.
11. tighten the screws.

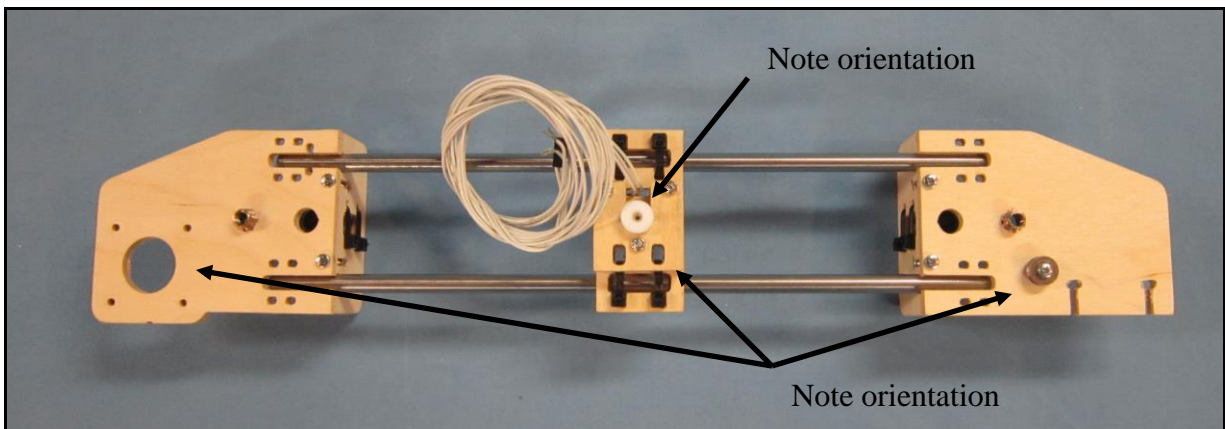


Note orientation is important. The bearing center should line up with the hole on the left and right mounts.





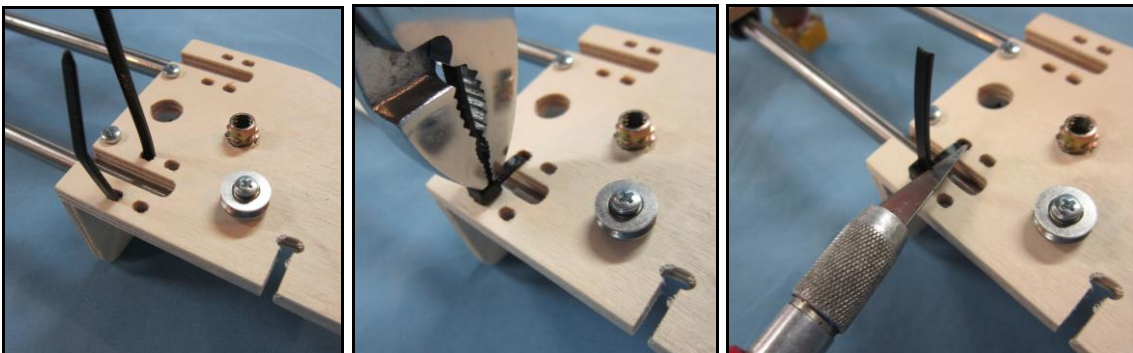
12. Slide both 8mm rods through the bearings on the extruder assembly.



13. Slide both rods into the left and right assemblies with the extruder nozzle facing down. The large slots in the extruder, bearing and large stepper motor hole are on the same side.



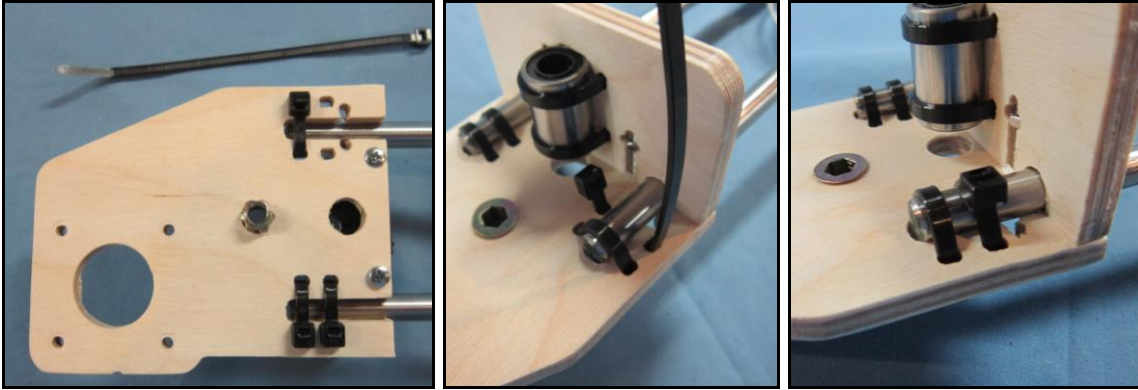
Note that the nylon tie under the Y limit (see page [25](#)) switch slots will be installed differently.



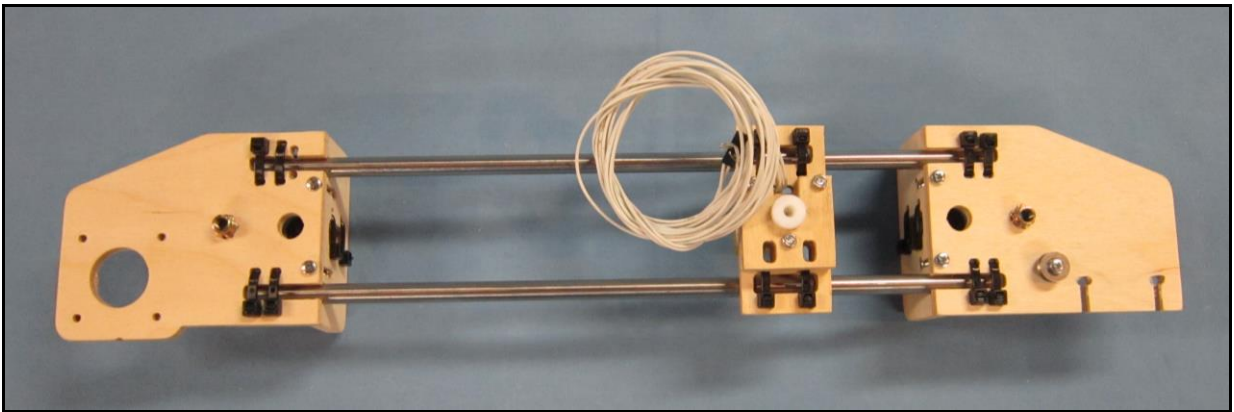
14. For 7 of the nylon ties, wrap the rods by inserting large nylon ties through the side opposite of the rods into the slotted holes of the left and right mounts.



15. Pull the rods snug against the left and right mounts (use pliers if needed).  
16. Cut off the excess of the nylon tie.



17. Wrap the rod by inserting the last large nylon tie through the same side as the rod into the remaining slotted holes of the left mount.  
18. Pull the rod snug against the left mount (use pliers if needed).  
19. Cut off the excess of the nylon tie.

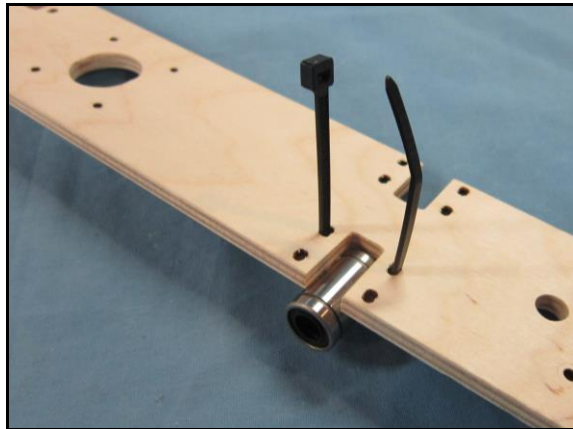
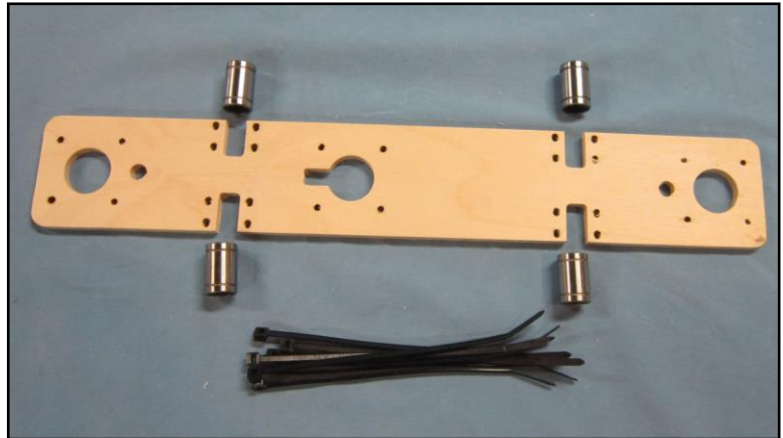


The extruder assembly should slide on the 8mm rods freely.

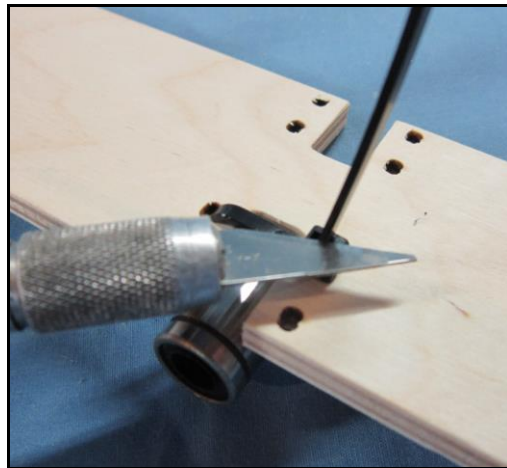
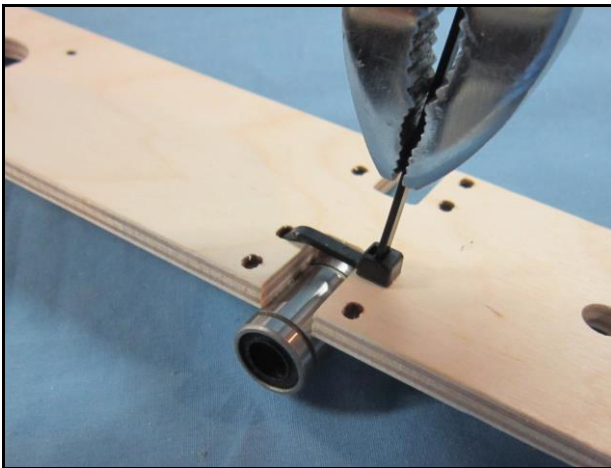
## ***X-Subassembly***

Parts for the x-subassembly include:

- 1 Plywood cross member
- 4 LM8UU bearings
- 8 Large nylon ties



1. Place the bearings in the u-shaped slots of the cross member.
2. Wrap the bearings by inserting large nylon ties through the side opposite of the bearing into the slotted holes of the bearing holders.



- 3 Pull the bearing snug against the extruder mount (use pliers if needed).
4. Cut off the excess of the nylon tie.



## Frame assembly

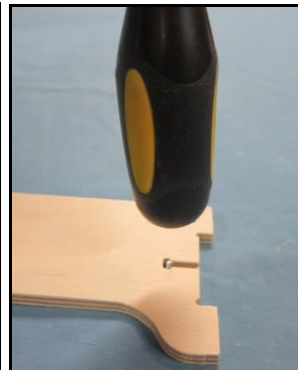
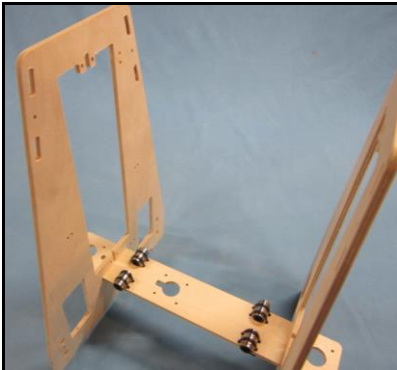
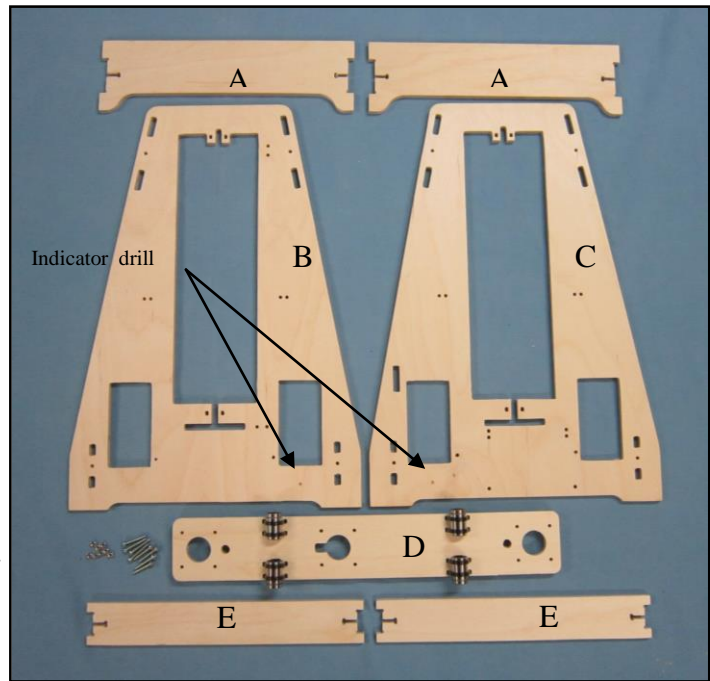
Parts for the frame assembly include:

- A. 2 Top braces
- B. 1 Left frame
- C. 1 Right frame
- D. 1 X sub-assembly
- E. 2 Bottom braces
- F. 8 M3 x 20 machine screws
- G. 8 M3 x 20 nuts

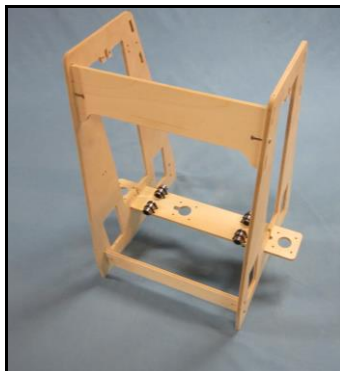


The orientation of B, C, and D is important.

- Indicator marks on the frame should be at the back facing inward.
- The middle stepper mount (key hole shaped hole) should be closer to the left frame



1. Properly orient and insert x sub-assembly into the left and right frame.
- 2 Press with pliers or tap the 8 M3 nuts into the 8 slots of the 4 braces. ( the handle of the screw drive works well)



3. Insert the top and bottom plywood braces into the slots.
4. Install and tighten the 8 M3 x20 machine screws.

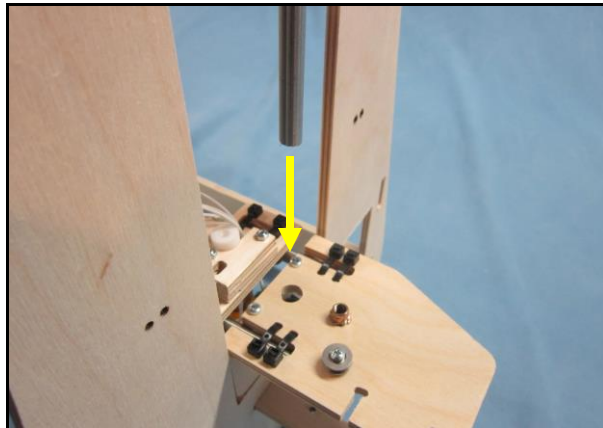
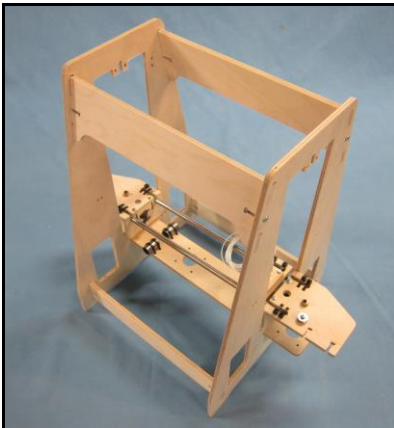
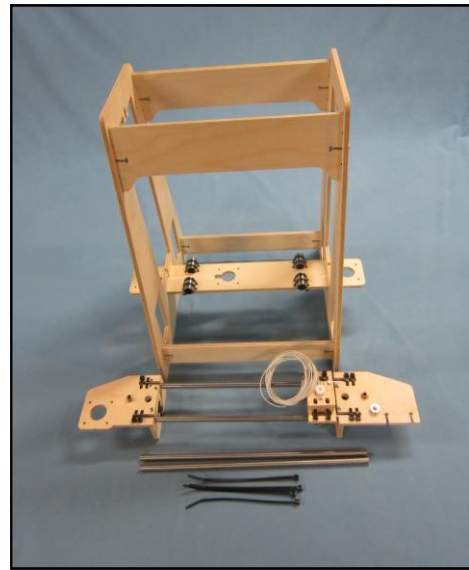
## Z Assembly

Parts for the z assembly include:

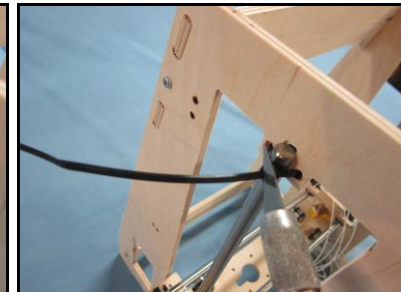
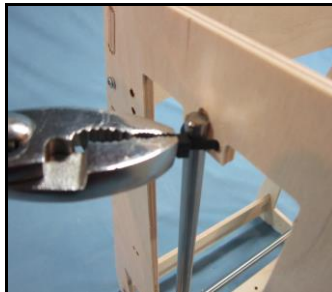
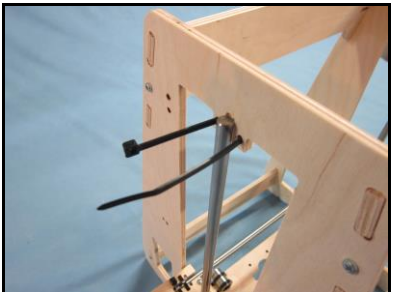
- 1 Frame assembly
- 1 Y assembly
- 2 8mm rods
- 4 Large nylon ties



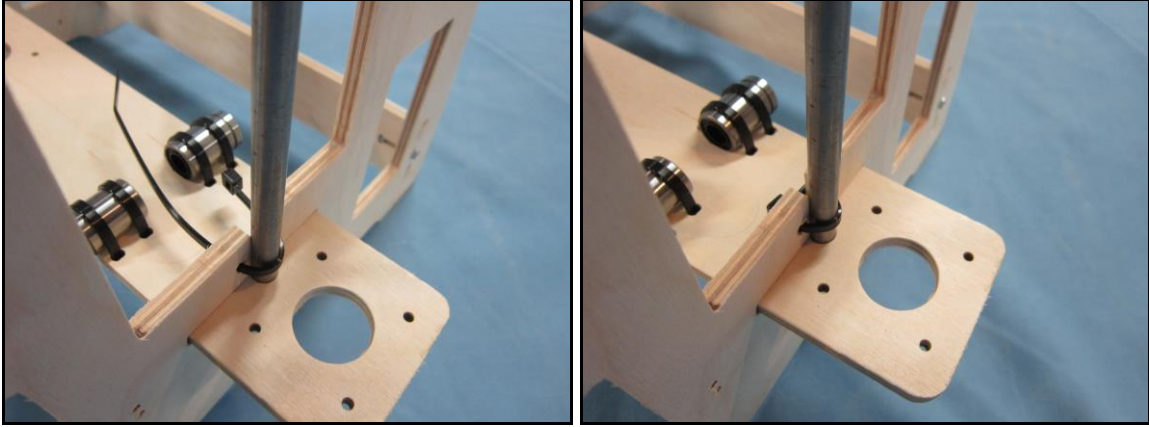
The orientation of top nylon ties is important. The nylon locking block needs to be on the outside to give maximum Y axis travel.



1. Place the Y assembly into the frame.
2. Insert the rods through the Y assembly and position them into the holes of the cross member at the bottom and u-shaped slots at the top of the frame



2. Wrap the top of the rods by inserting large nylon ties through same side as the rod into the slotted holes of the extruder mount.
3. Pull the rods snug against the frame (use pliers if needed).
4. Cut off the excess of the nylon ties.



5. Wrap the bottom of the rods by inserting large nylon ties through the side opposite as the rod into the slotted holes of the extruder mount.
6. Pull the rods snug against the frame (use pliers if needed).
7. Cut off the excess of the nylon ties.



The Y assembly should slide on the 8mm rods freely.

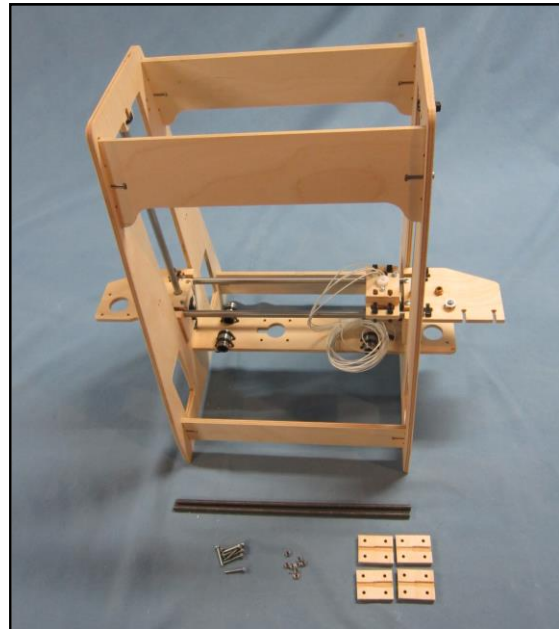
### ***Z - Rod Assembly***

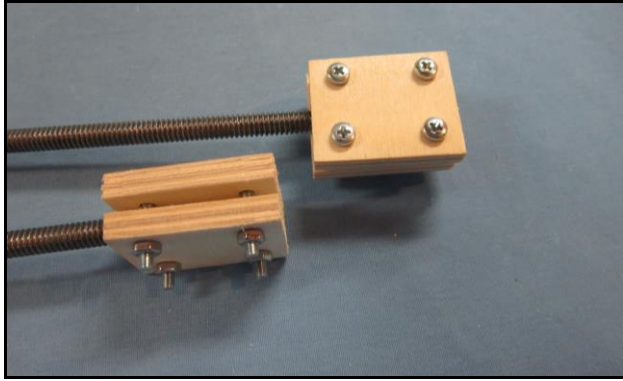
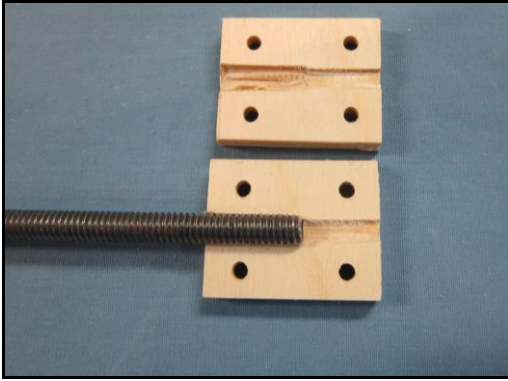
Parts for the Z rod assembly include:

- 1 Frame assembly
- 2 1/4-20 threaded rods
- 4 Coupler halves
- 8 M3 x 20 machine screws
- 8 M3 nuts

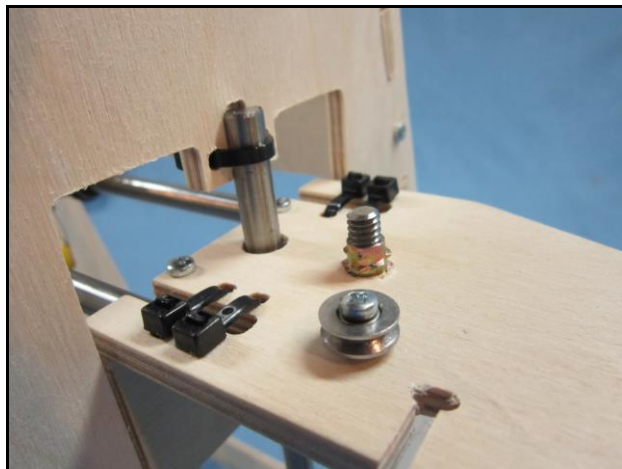


The orientation of the coupler is important. The larger slots are paired and connected to the threaded rod.





1. Assemble each of the threaded rods into the larger coupler slots.
2. Connect the coupler halves with 4 M3 x20 screws and nuts.
3. Only snug up the screws, they will be tightened in a later step.



6. Thread both of the coupler assemblies into the threaded inserts on the Y assembly. The coupler halves may need to be removed to get the threads started through the inserts on the Y assembly.



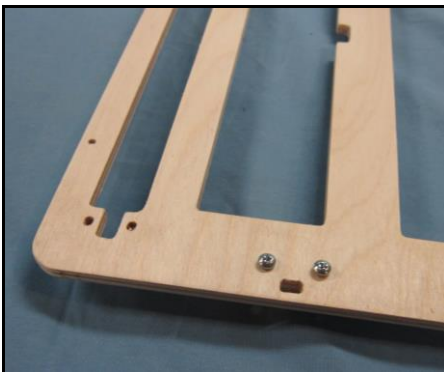
## X Assembly

Parts for the x assembly include:

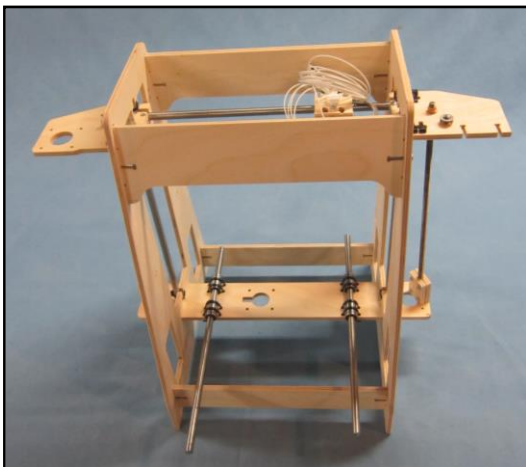
- A. 2 X string holders
- B. 1 X bed mount
- C. 1 Frame assembly
- D. 2 8mm rods
- E. 4 Large nylon ties
- F. 4 M3 x16 machine screws
- G. 4 M3 nuts



Note orientation. The string holder is mounted on bottom on the front and it is mounted on top in the rear. The cut groove in the string holder mates with the bed mount.

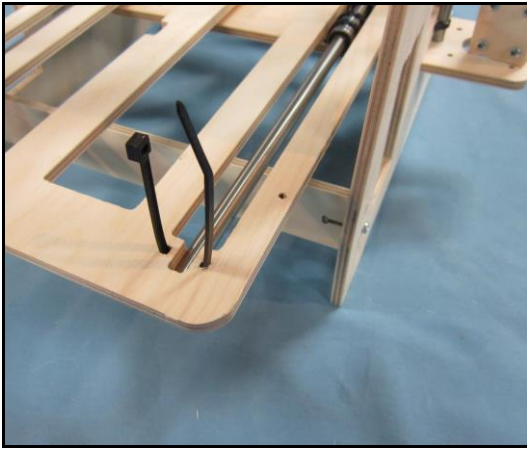


1. Install the string holders into the bed mount using 2 M3 x 16 machine screws.
2. Install the M3 nuts and tighten



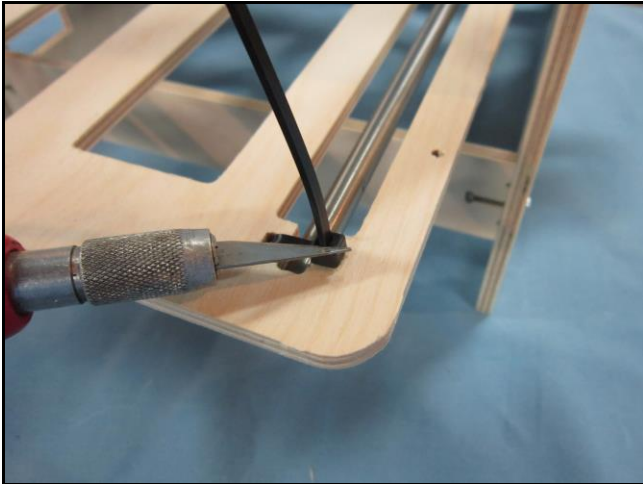
2. Insert the rods into the bearings on the cross member and install the bed.





5. Wrap the bottom of the rods by inserting large nylon ties through the side opposite of the rod into the slotted holes of the extruder mount.

6. Pull the rods snug against the frame (use pliers if needed).

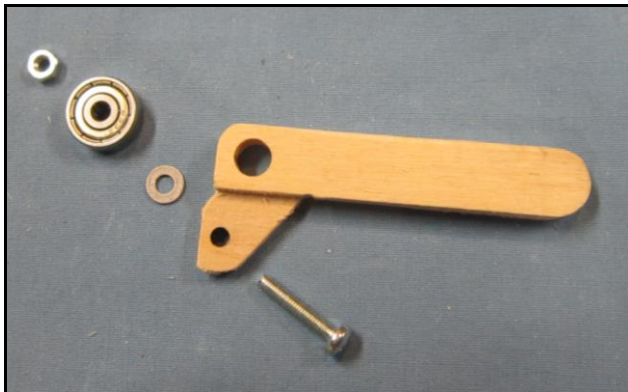
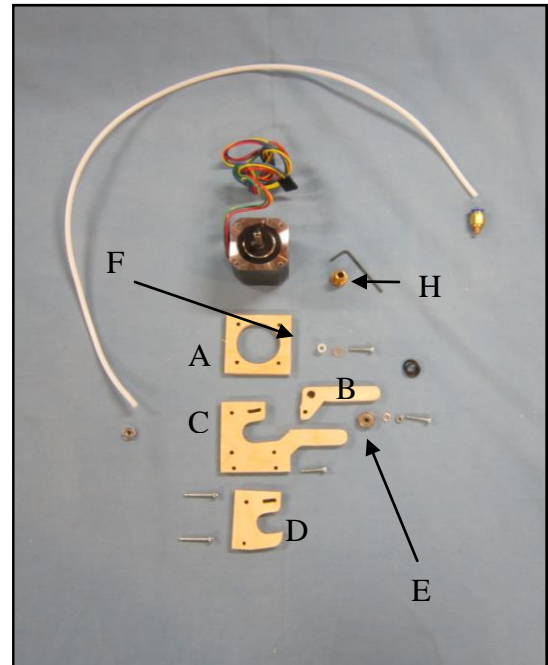


7. Cut off the excess of the nylon ties.

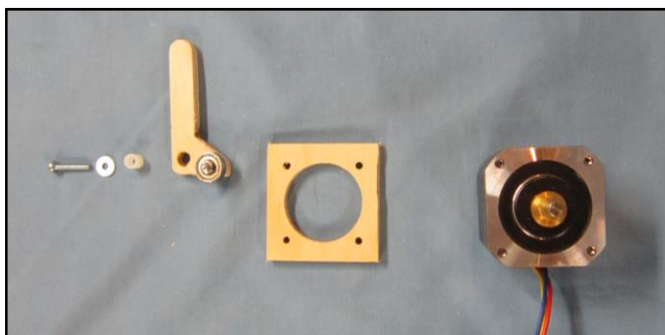
## ***Extruder (cold end) Assembly***

Parts for the cold end include:

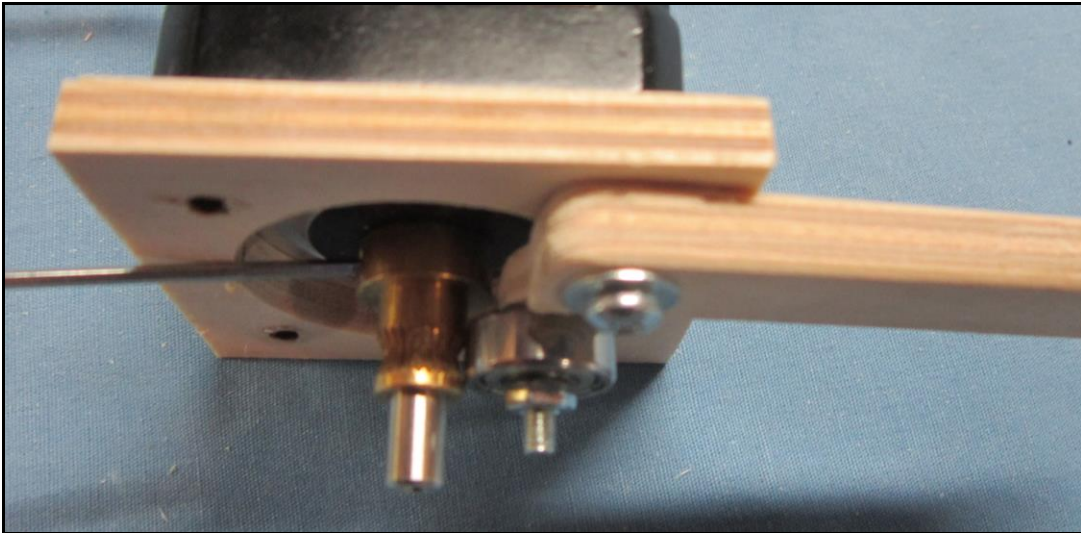
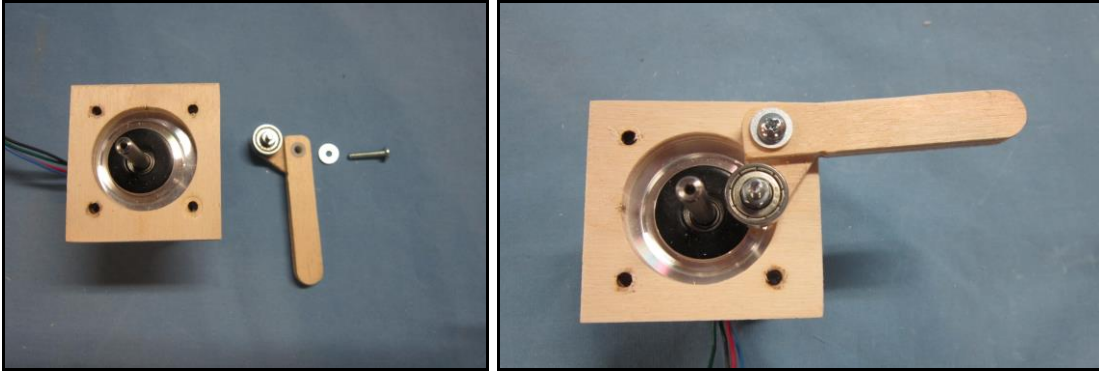
- A. 1 Backing plate
- B. 1 Bearing arm
- C. 1 Mid plate
- D. 1 Front plate
- E. 1 Drive bearing
- F. 1 Nylon bushing
- G. 1 Stepper motor
- H. 1 Extruder drive gear
- I. 1 Filament guide tube
- J. 1 Filament guide tube nut
- K. 1 Large washer
- L. 2 M3 x16 machine screws
- M. 1 Small washer
- N. 1 M3 nut
- O. 2 M3 x 20 machine screws
- P. 2 O-rings



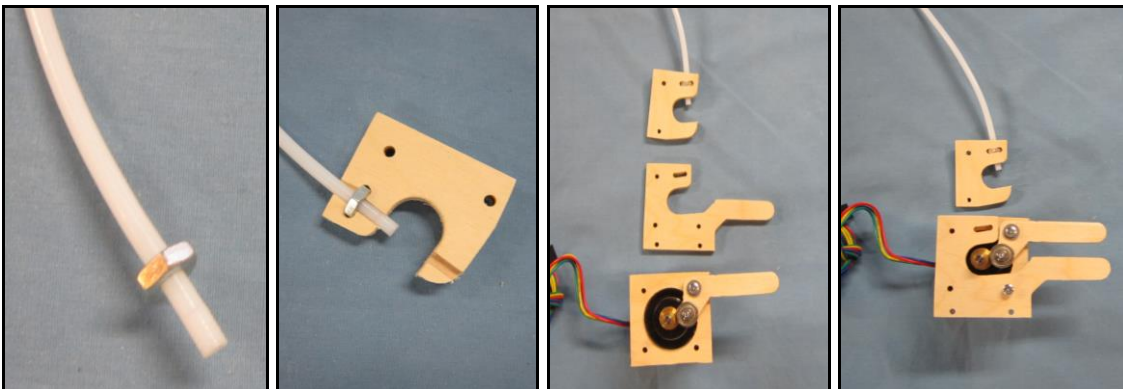
1. Insert the M3 x 16 through the extruder arm.
2. Install the small washer on the screw.
3. Install the bearing on the screw.
4. Install the nut on the screw and tighten



5. Press the nylon bushing into the extruder arm.
6. Insert the big washer onto the M3 x 16 machine screw.

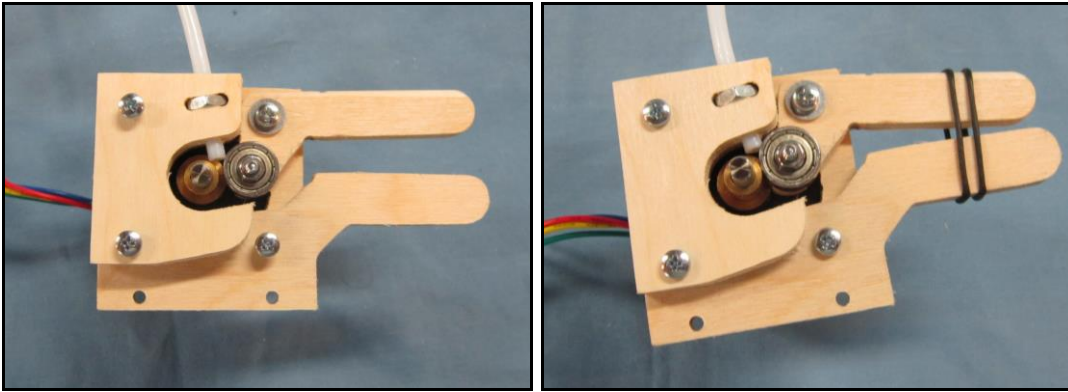


7. Insert the screw and washer thru the nylon bushing on the extruder arm.
8. Insert the screw through the backing plate and screw into the stepper mounting hole.
9. Insert the extruder drive gear and adjust the height so that the bearing is centered on the knurled part of the wheel. Tighten the extruder drive wheel with the Allen wrench.



10. Thread the filament guide nut onto the filament guide tube so that 10 to 12 mm (0.4 - 0.5") is through
11. Insert the tube and nut into the front plate groove.
12. Stack the mid plate on the backing plate and insert the M3 x16 into the lower right mounting hole.





13. Stack the top plate onto the mid plate and insert 2 M3 x 20 machine screws.
14. Tighten all 4 of the screws.
15. Add 2 o-rings
16. Adjust the guide tube so that it is close to the drive wheel without touching it.

## Adding the Electronics

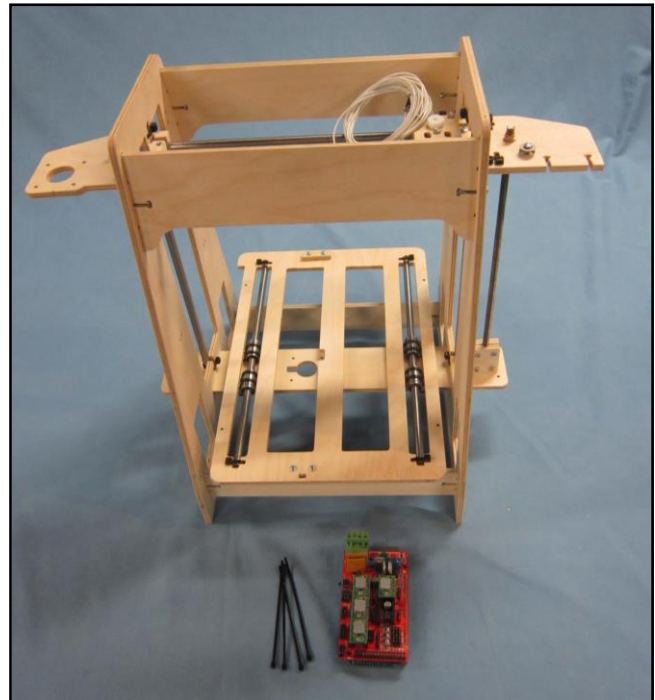
### *Controller Assembly*

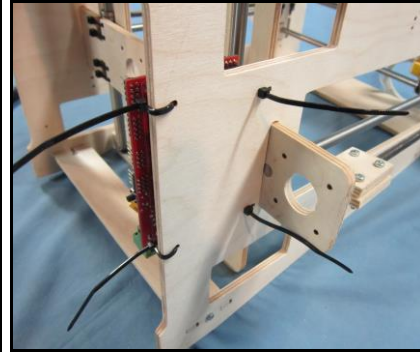
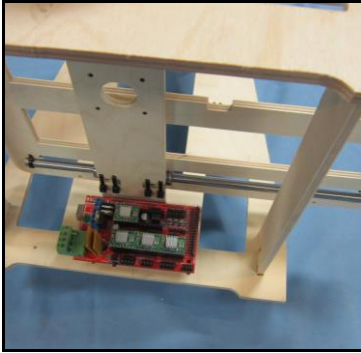
Parts for the Ramps:

- A. 1 Frame assembly
- B. 1 Controller assembly
  - 1 Arduino
  - 1 Ramps1.4
  - 4 Stepper drivers
- C. 4 Small nylon ties

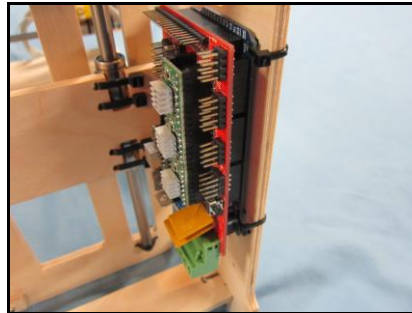
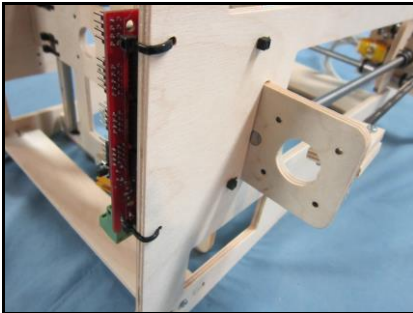


Snug up board against the frame until it is firm. Do not over tighten the ties as this will damage the control board





- 1 Install the controller board underneath the bed on the right hand frame.
2. Insert and loosely tie the top two small nylon ties through the frame and Arduino mounting holes.
3. Insert the 2 bottom small nylon ties.



4. Gently snug the control board up against the frame.
5. Cut off the excess of the nylon tie.

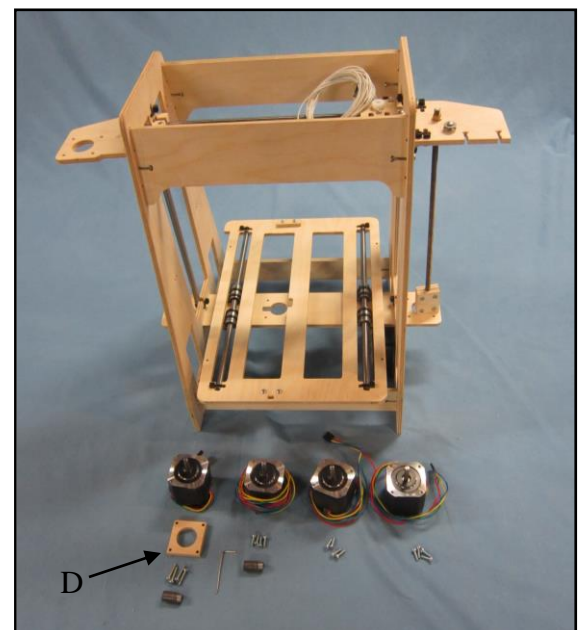
## ***Motion Stepper motors***

The minimum lengths of wire for the stepper motors are:

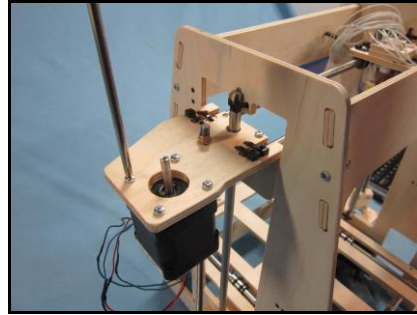
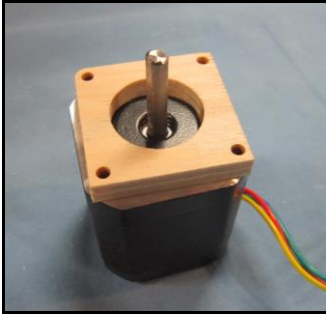
X	Stepper	125 mm
Y	Stepper	584 mm
Z <sub>Right</sub>	Stepper	305 mm
Z <sub>Left</sub>	Stepper	330 mm
E	Stepper	520 mm

Parts for the motion stepper motors:

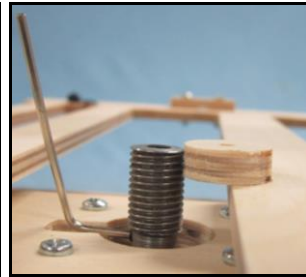
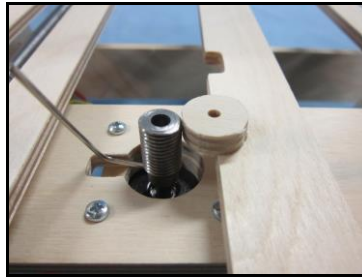
- A. 1 Frame assembly
- B. 4 Stepper motors
- C. 2 threaded couplers (x & y stepper motors)
- D. 1 X stepper spacer
- E. 4 M3 x 15 (x-stepper motor)
- F. 12 M3 x 10 machine screws



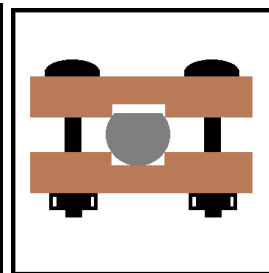
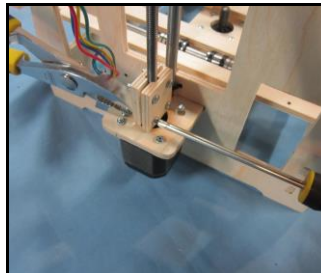
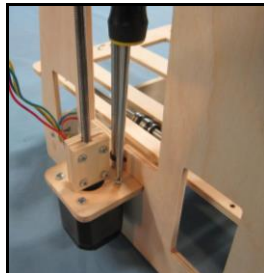
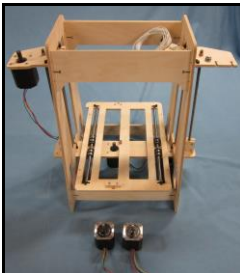




1. Place the spacer on the X stepper motor and install the assembly onto the middle mount of the cross member.
2. Install and tighten the 4 M3 x16 machine screws.
3. Install the Y stepper motor to the Y assembly with 4 M3 x 10 machine screws.
- 4 Tighten the machine screws.



5. Set the height on the Y threaded coupler so that the Allen key is flat against the top of the Y assembly.
6. Set the height of the X threaded coupler so that it is approximately 1 mm less than the round spacer thickness. (This will give the build platform clearance)



4. Install and tighten both of the Z stepper motors 4 M3 x10 mm machine screws.
5. Tighten the 8 coupler machine screws so that the gap is even and parallel on both sides.

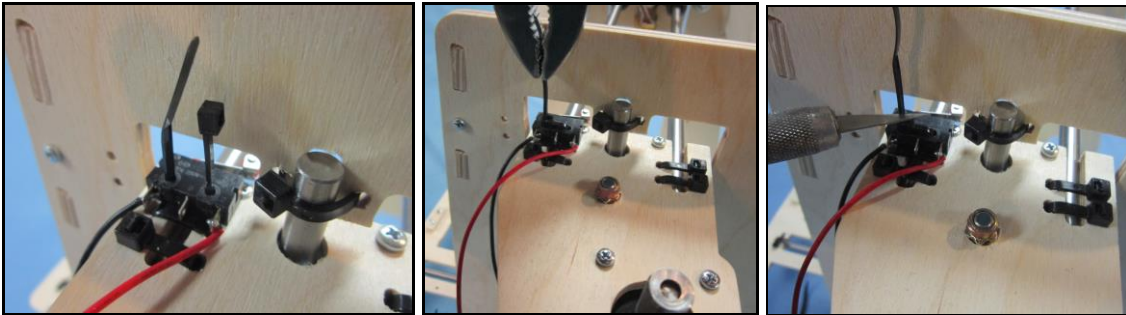
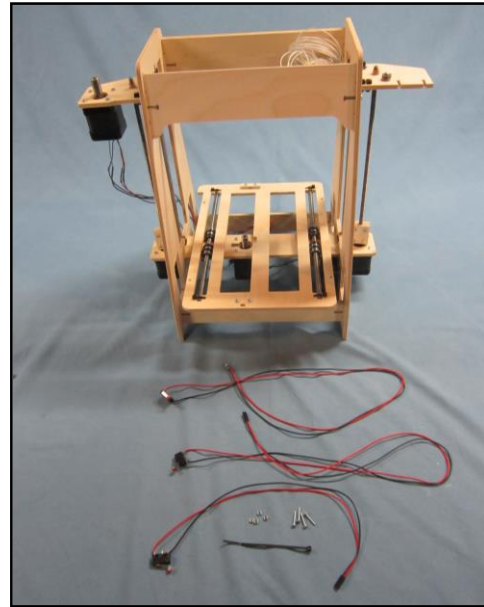


If the Z stepper motors have flats, then align the flats on the motor shafts as seen in the diagram.

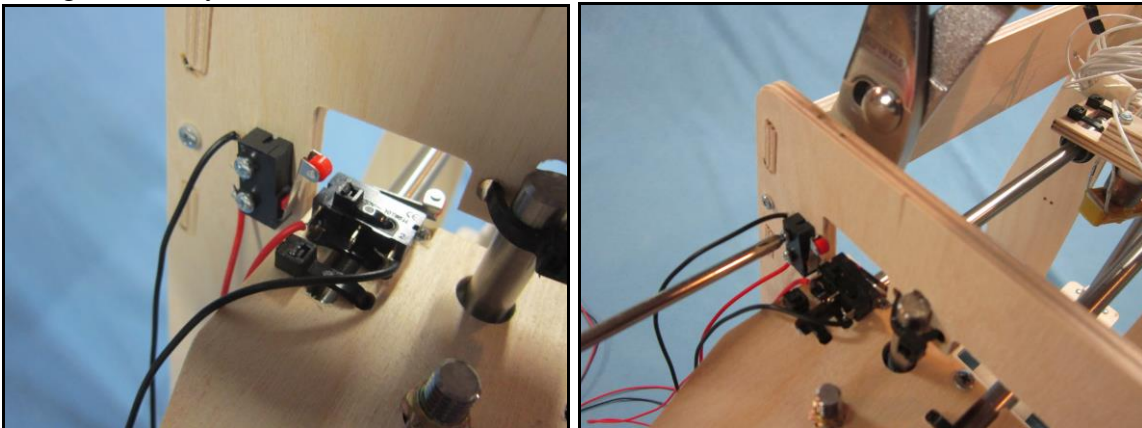
## Limit Switches

Parts for the motion stepper motors:

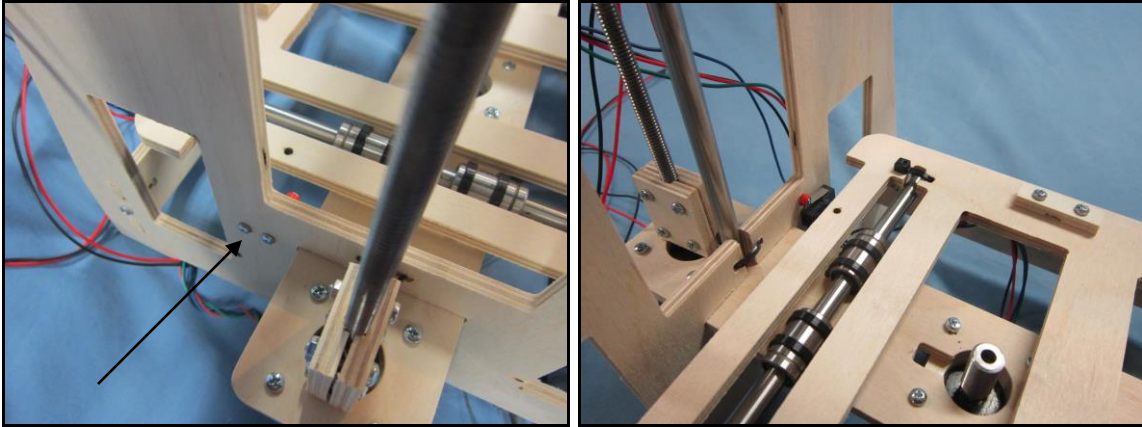
- A. 1 Frame assembly
- B. 2 Limit switches (long wires)
- C. 1 Limit switch (short wire)
- D. 4 M2.5 x16 machine screws
- E. 4 M2.5 nuts
- F. 1 small nylon tie



1. Insert the small nylon tie through the Y limit switch ( long wires) hole, loop around the rod and back up through the second limit switch hole. (Left side)
2. Tighten the nylon tie and cut off the excess.



3. Place the Z Limit switch (long wires) on the left frame near the top with 2 M2.5 x16 screws and nuts.
5. Tighten the nuts.



4. Install the X limit switch (short wires) on the inside of the lower left frame. 2 M2.5 x 16 screws and nuts.
5. Tighten the nuts

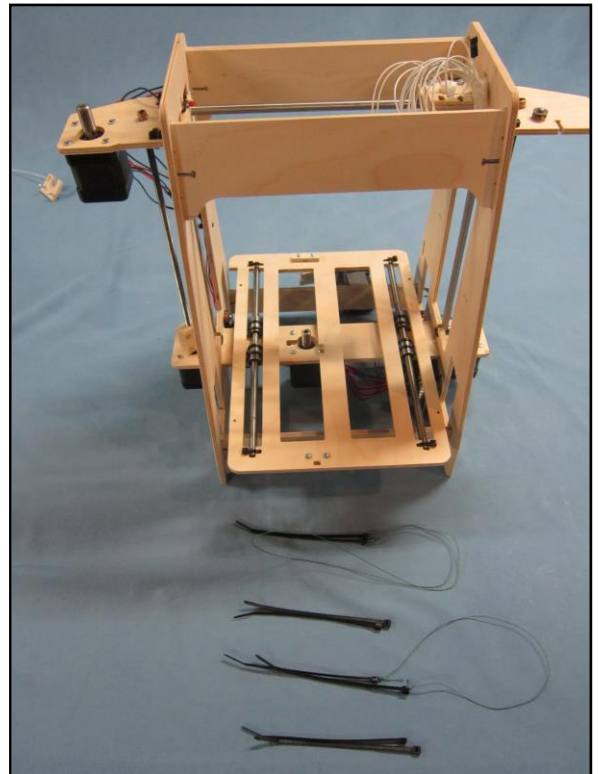
## Adding The String Drive

Parts for the string drive assembly include:

- A. 1 X drive string assembly (shorter)
- B. 1 Y drive string assembly (longer)
- C. 4 large nylon ties



The kit includes 2 sets of tied string. The instruction for tying the knot has been added for reference.

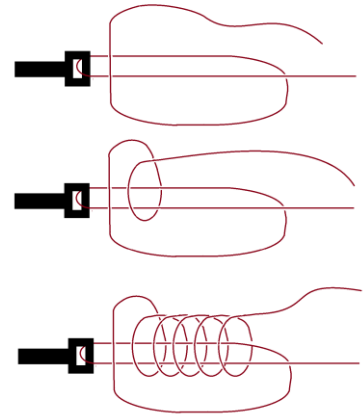




## Tying the knots (Uni-knot)

This knot is called the Uni-knot and has "how to" videos on You-Tube.

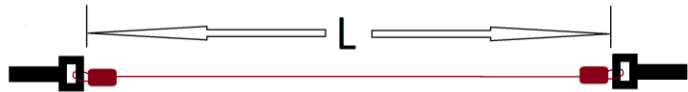
1. Loop the string through the locking block of the nylon tie.
2. Loop the same string behind the horizontal stationary string, bring it up over both horizontal strings
3. Repeat step 2 for a total of 5 loops.
4. pull the knot tag end and tighten the knot.



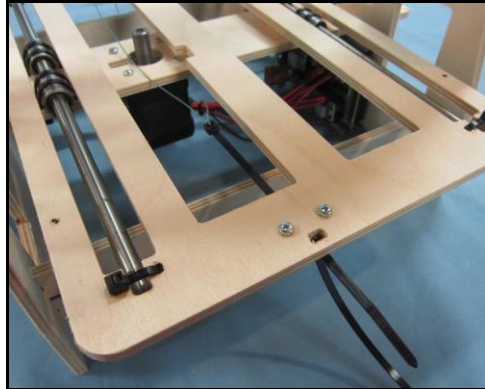
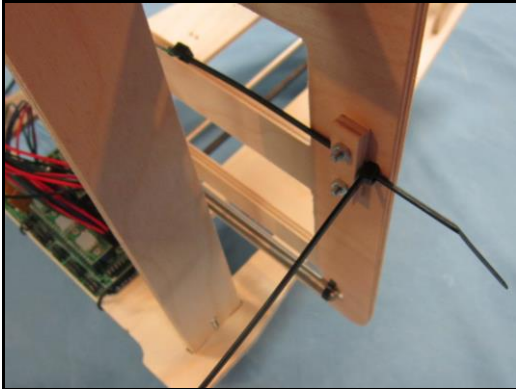
The tied length of the string from one nylon tie to the other is:

X-string       $L = 330 - 350 \text{ mm}$

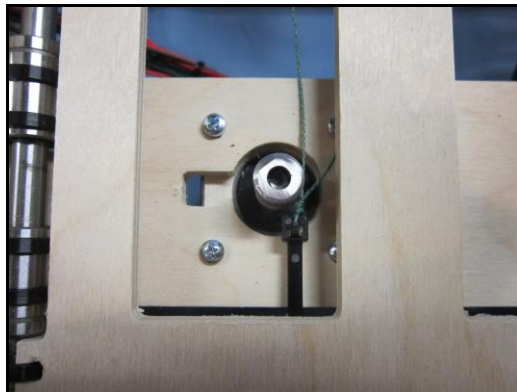
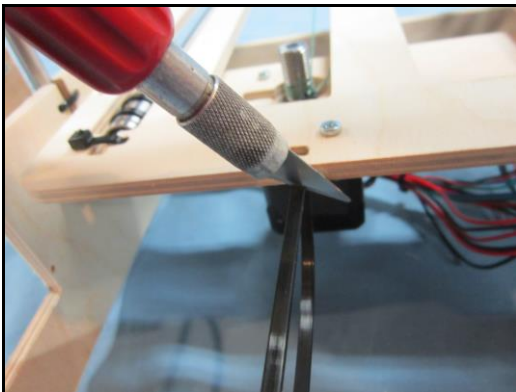
Y-string       $L = 690 - 710 \text{ mm}$



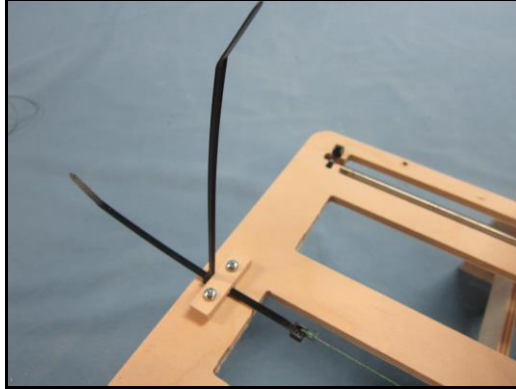
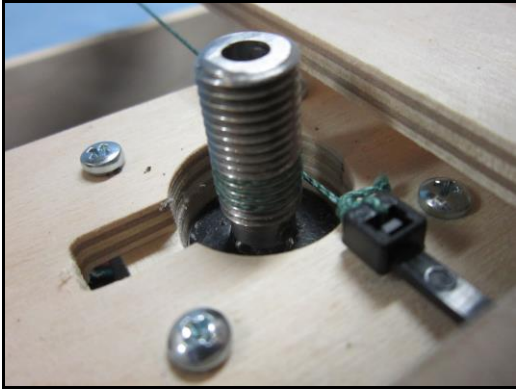
## X string Drive



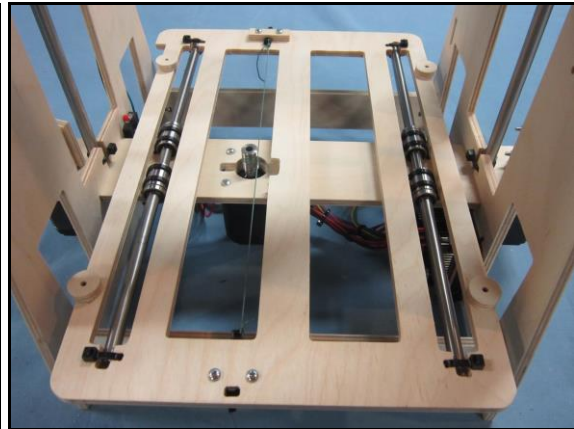
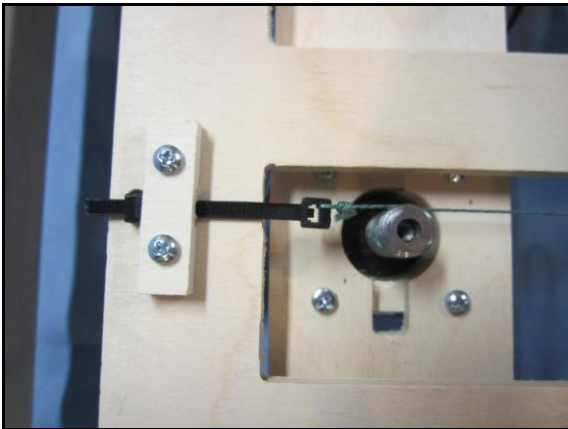
1. Place a large nylon tie into behind the string holder, then thread the large tie connected to the string through the string holder into the loose nylon tie



2. Push the bed to the rear stop making the coupler closer to the nylon tie.
3. Push the nylon tie connected to the sting into the string holder until the nylon tie is close but is no longer touching the X threaded coupler.



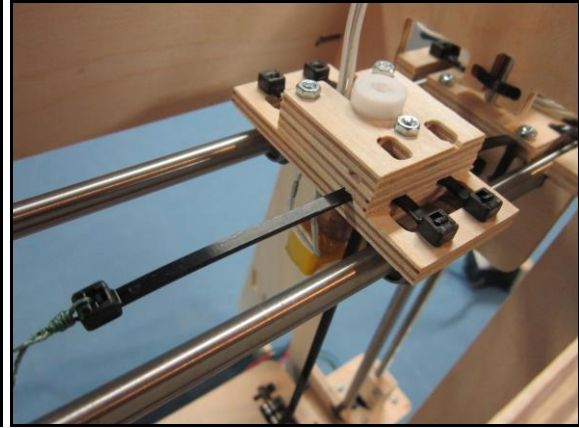
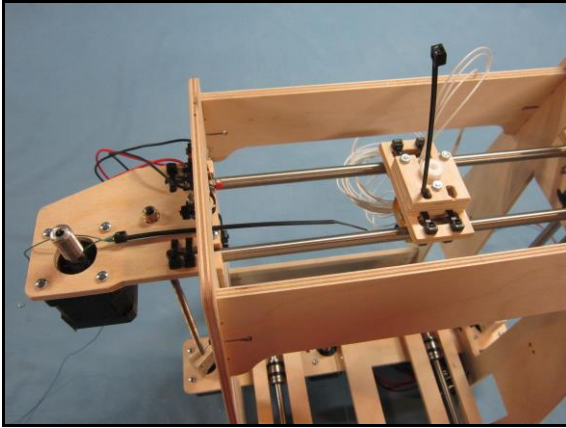
4. Wrap the string around the threaded coupler 3 to 4 times close to the bottom of the threaded coupler.
5. Insert the large nylon tie with the string attached through the rear string holder and the loose nylon tie.



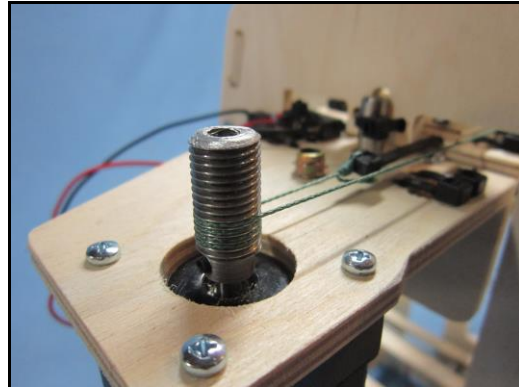
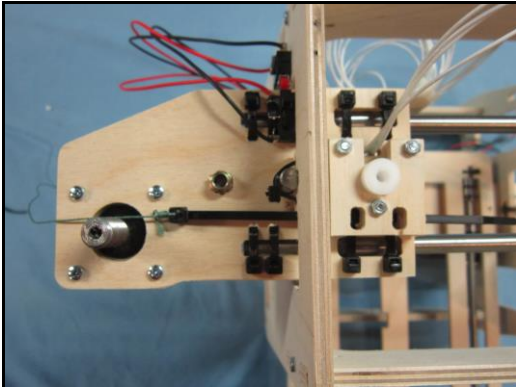
6. Snug up the string and slide the bed back and forth to ensure that the sting rides in the threads of the coupler with full travel ( threads will move up as the bed moves rearward)
7. If needed, adjust the string moving it up or down the threaded coupler.
8. Tighten the sting by pushing the nylon tie into the string holder.
9. Cut off the excess of the nylon ties.



## Y String Drive



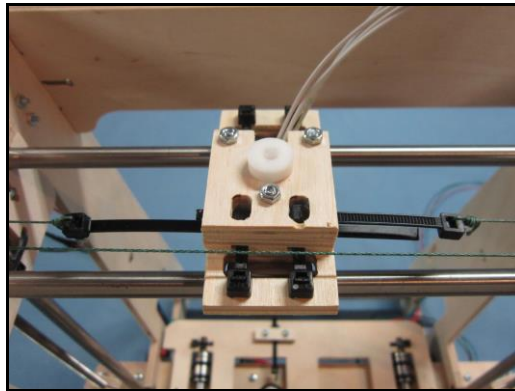
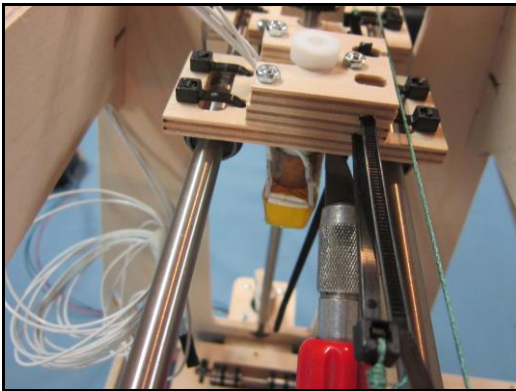
1. Insert the large loose nylon tie into the top of the left hole and align the box end to the bottom hole of the extruder mount.
2. Insert the large nylon tie with the string attached into the bottom slot on the left side of the extruder.



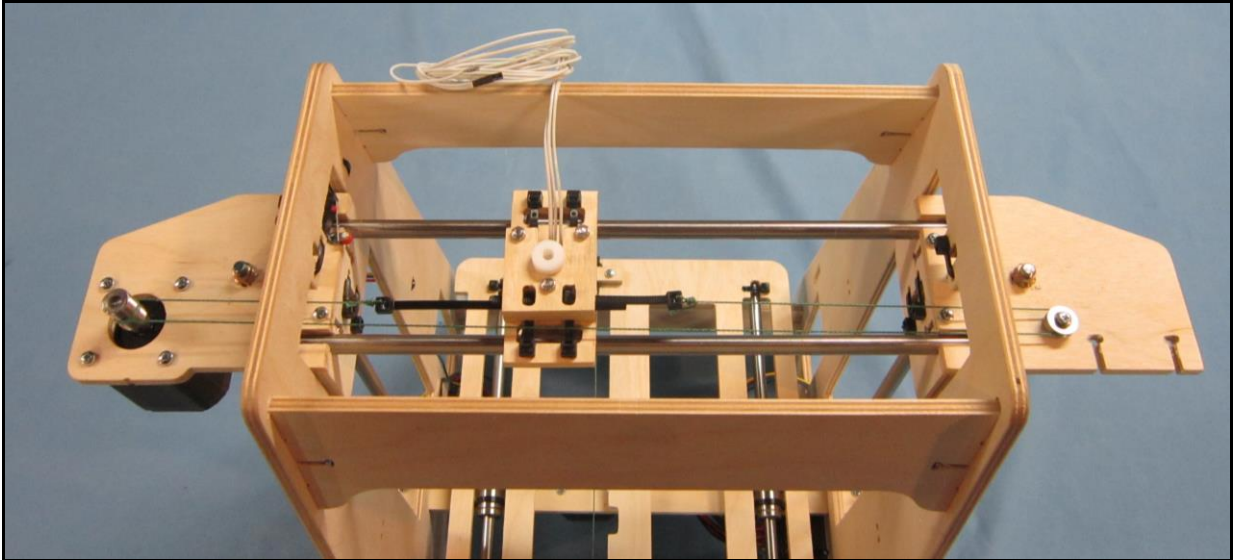
3. Move the extruder to the left stop and push the nylon tie connected to the string into the string holder until the nylon tie is no longer touching the threaded coupler.
4. Wrap the string around the threaded coupler 3 to 4 times close to the bottom of the threaded coupler.



5. Route the string across the printer to the right hand mount around the pulley then back to the extruder.
6. Insert the large loose nylon tie into the right hole and align it with the top slot on the right side of the extruder.



7. Snug up the string and slide the extruder back and forth to ensure that the string rides in the threads of the coupler with full travel with nylon tie clearance.
8. If needed, adjust the string moving it up or down the threaded coupler.
9. Tighten the string by pushing the nylon tie into the extruder slots.
10. Cut off the excess of the nylon ties.



The extruder should move from left to right without contacting any parts of the frame or Y assembly parts. The string on the nylon ties may need to be adjusted if there nylon tie hits the frame.

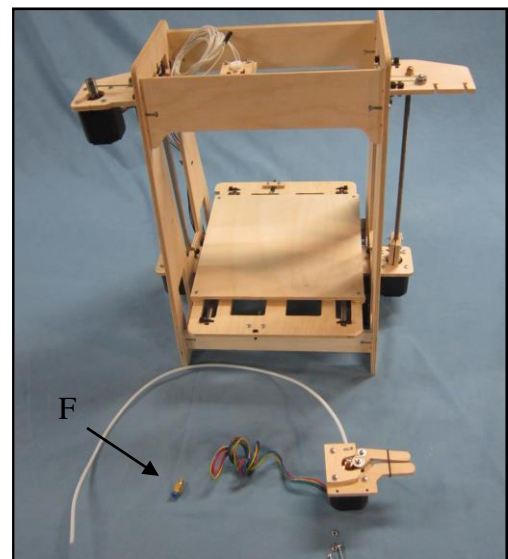
## ***Adding the Extruder Driver***

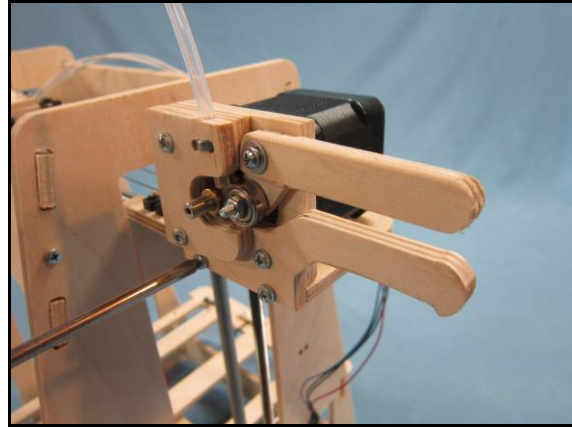
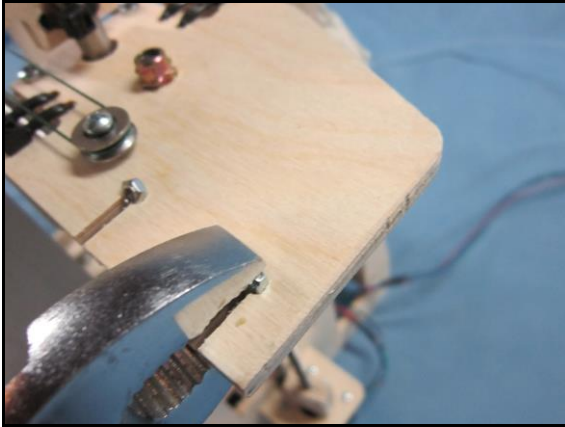
Parts for adding the extruder driver include:

- D. 1 Frame assembly
- E. 1 Extruder assembly
- F. 1 SMC connector
- G. 2 M3 X 20 machine screws
- H. 2 M3 Nuts

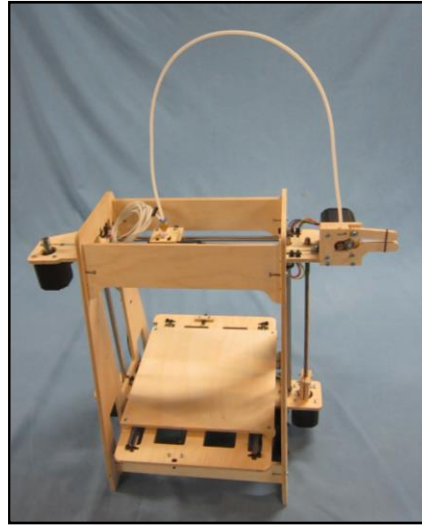
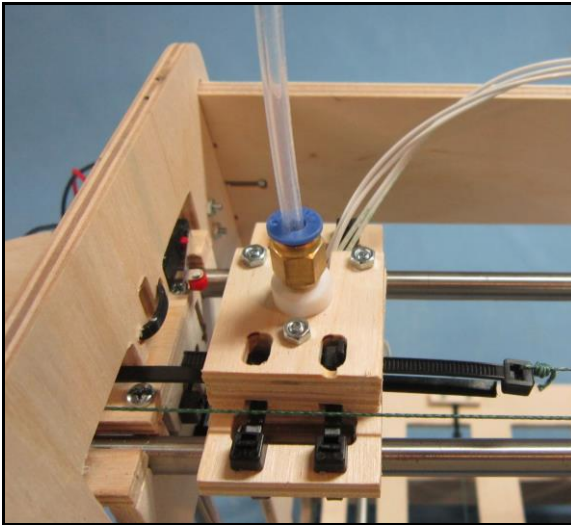


The SMC fitting will release the tube if the blue ring is push into the fitting as the tube is gently pulled. This allows for quick filament changes.





1. Press the 2 M3 nuts into the right mounts.
2. Insert and tighten 2 M3 X20 machine screws.



3. Insert the SMC into the top of the extruder.
4. Insert the tube into the SMC



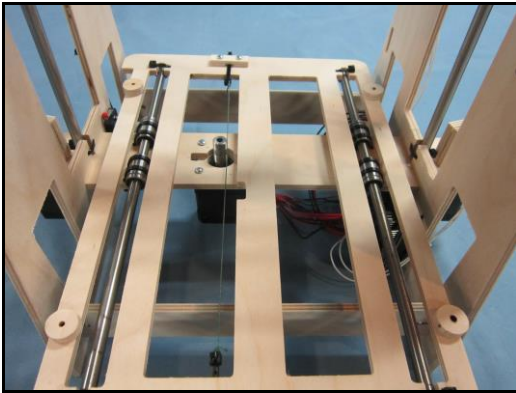
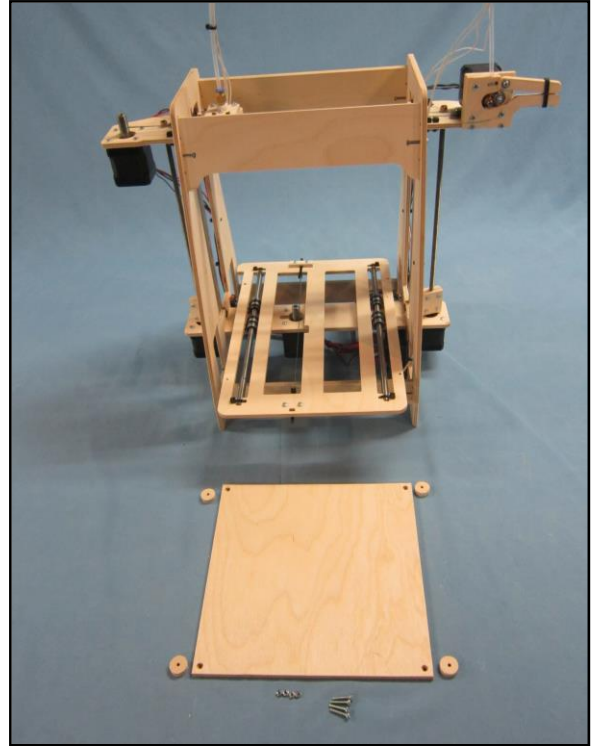
## Build Platform Assembly

Parts for adding the build platform include:

- A. 1 Build Platform
- B. 4 Round Spacers
- C. 4 M3 X 20 machine screws
- D. 4 M3 Nuts



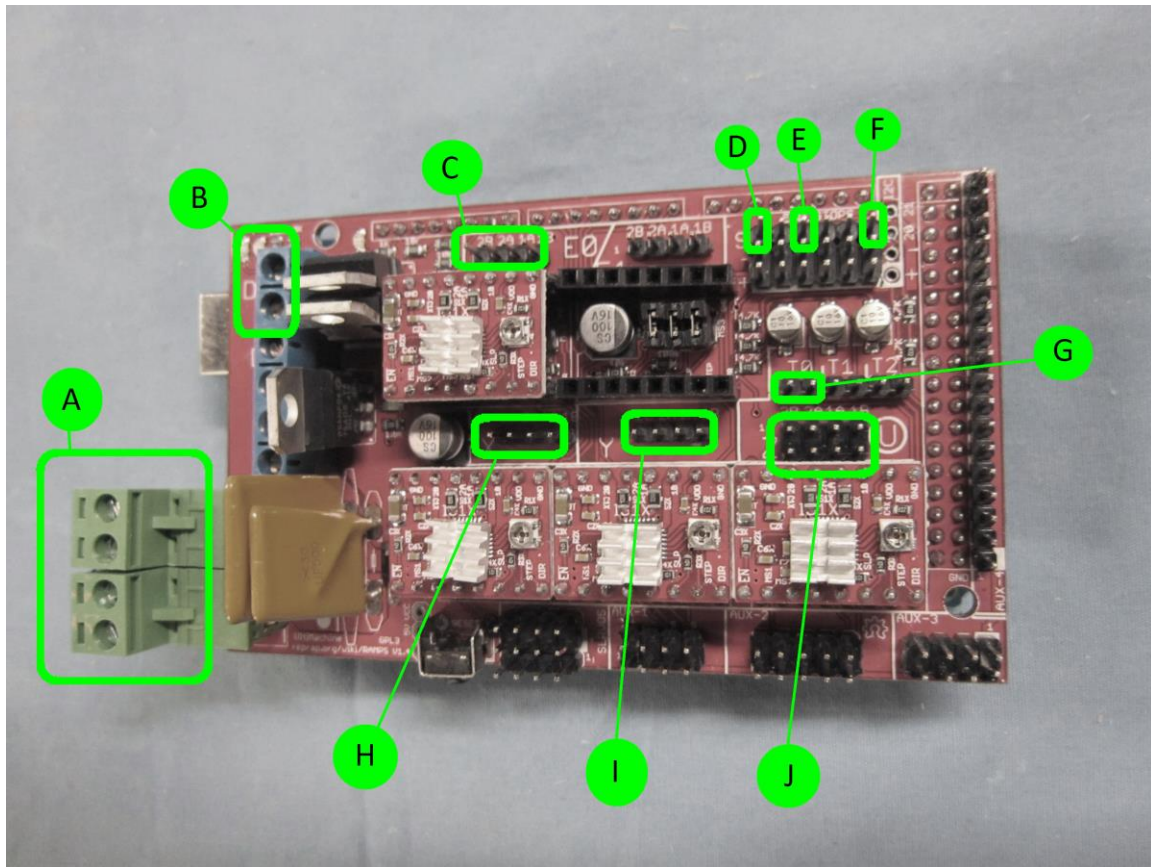
The Build platform has counter bored holes. These holes should be facing up.



1. Place the 4 spacers over the holes in the bed mount.
2. Insert 4 M3 X 20 machine screws through the build platform, spacers, then bed mount.
3. Install and tighten the 4 M3 Nuts

# Connecting the Controller

## Ramps1.4 Connections

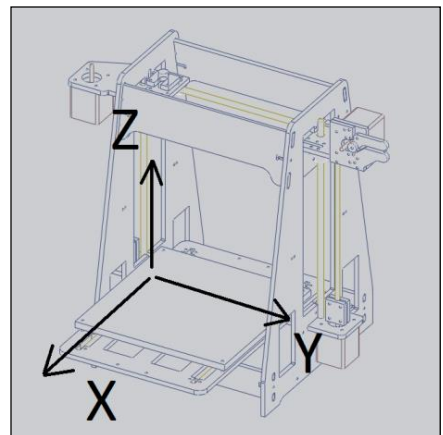


The main power (A) and the stepper motors (C,H,I, and J) have to be connected correctly. Improper connection can permanently damage the board. If you are unsure about the connection, the internet is a good resource and has a great deal of information on the Ramps1.4.

The connections are:

- A. Main Power supply
- B. Extruder power
- C. Extruder stepper motor
- D. X-min limit switch
- E. Y-min limit switch

- F. Z-max limit switch
- G. Extruder sensor
- H. X stepper motor
- I. Y stepper motor
- J. Z stepper motors



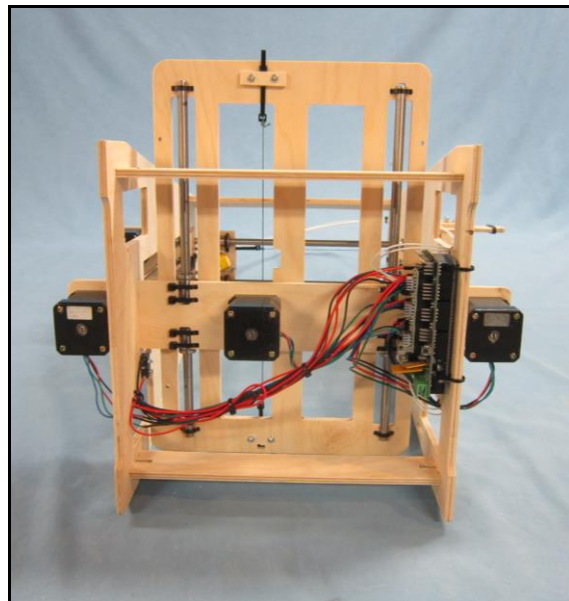
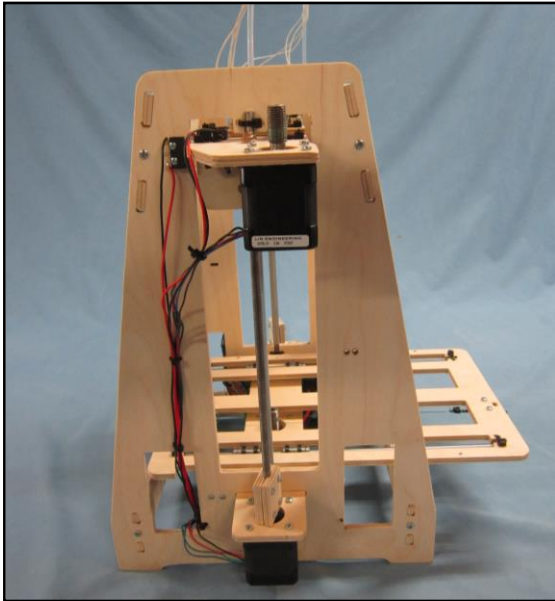
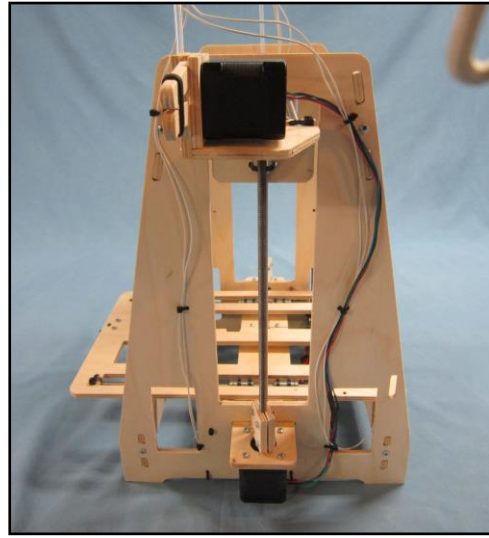
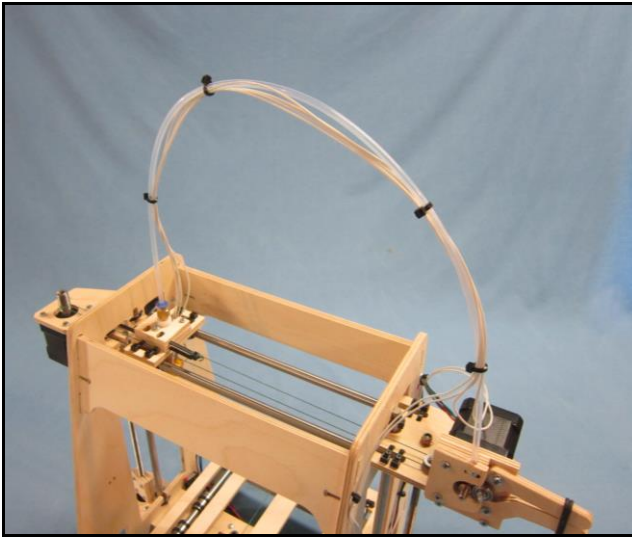
## Wire Routing With Nylon Ties



There are drilled holes in the frame and small extra small nylon ties included in the kit to secure the wires. Several sets of wires will need clearance to move with the Y-assembly. They included the:

- Extruder and Y stepper motor wires.
- Y and Z limit switch wires.
- The Extruder heater and sensor wires.

The 2 extruder sensor wire routes to the front. Below are pictures of typical wire routing.





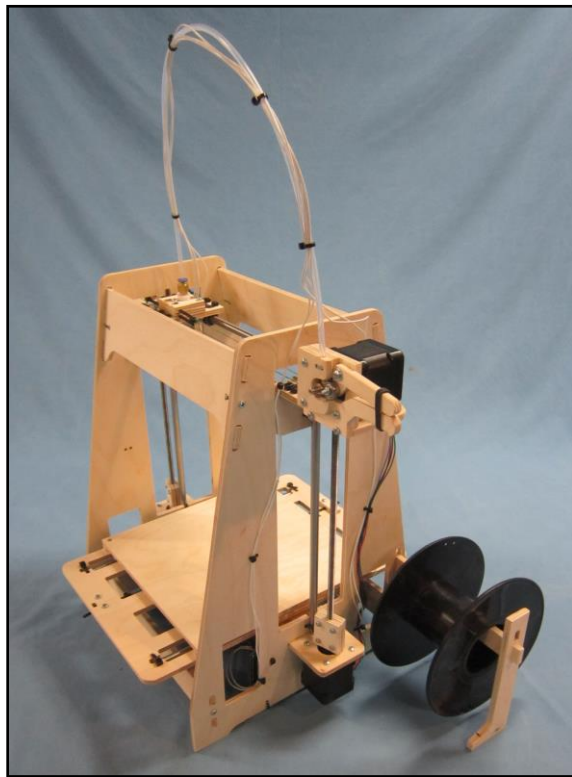
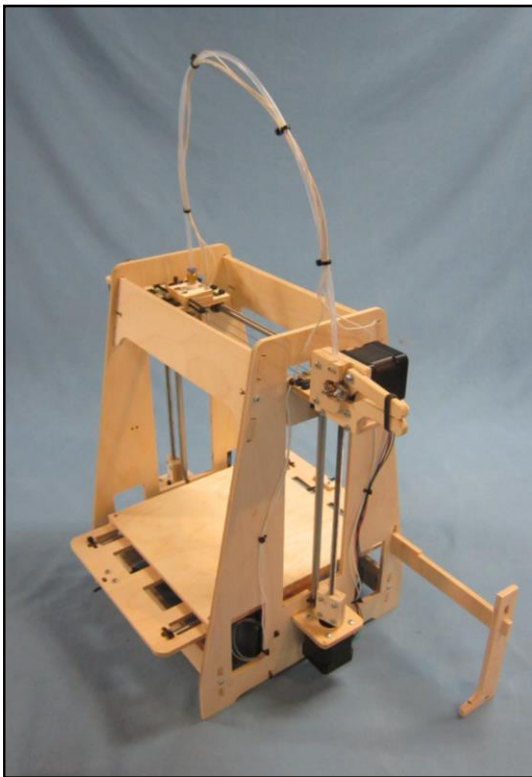
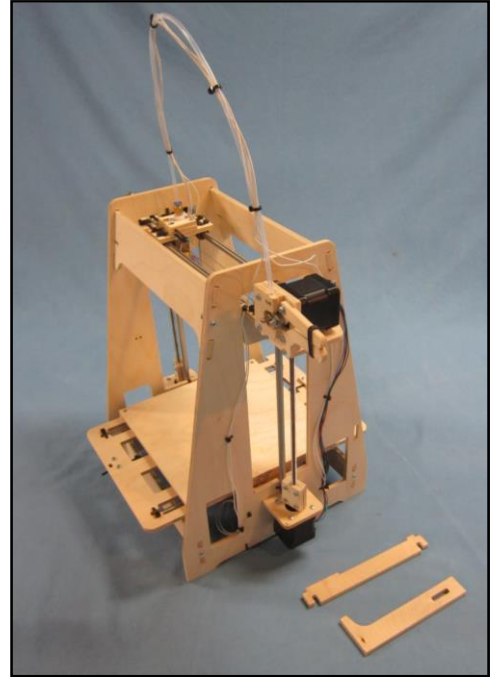
## Filament Spool Holder

Parts for adding the filament spool holder include:

- A. 1 Printer
- B. 1 Spool leg
- C. 1 Spool support



The reel holder is designed to quickly change spools of filament. The groove in the top of the spool support should be oriented to the outside for to ensure spool clearance with the frame.



1. Insert the spool support into the right frame and spool leg rectangular slots.



# Congratulations your Printer is assembled!

If you are new to 3D printers, there is a lot of learning ahead. The good news is that there are many resources online to help you with questions. You will need to choose software and firmware that suits your needs.

## Initial Controller Setup

1. Download Arduino Software
2. Use the Arduino software to configure the firmware
2. Connect the controller to the computer via the USB and download the firmware to the computer

## ***Arduino 2560 Firmware settings***

The firmware will need to be up loaded to the Arduino board using the Arduino software that can be downloaded at: <http://arduino.cc/en/main/software>

There are several good choices in firmware. Repetier is a good choice and can be located at: <http://www.repetier.com/> It includes the software and firmware for a complete package.

The firmware will need to be configured. Good starting values are:

X Velocity	100 mm/s
Y Velocity	100 mm/s
Z Velocity	4.5 mm/s
E Velocity	100 mm/s

X Homing Velocity	100 mm/s
Y Homing Velocity	100 mm/s
Z Homing Velocity	4.5 mm/5

X Acceleration	2000 mm/s <sup>2</sup>
Y Acceleration	2000 mm/s <sup>2</sup>
Z Acceleration	100 mm/s <sup>2</sup>
E Acceleration	100 mm/s <sup>2</sup>

With micro stepping set to 16

X stepper motor	98.5 steps/mm
Y stepper motor	98.5 steps/mm
Z stepper motors	2519.685 steps/mm
E stepper motor	164.7 steps/mm

Starting PID control settings for the extruder are:

Integral drive max	255
Integral drive max	40
PID P gain	8.5
PID I gain	0.35
PID D gain	51.5
Temperature sensor type	9

The firmware offers an auto tune (command M303) to set the PID values.

## ***Power supply***



The Power supply will need to be connected correctly to avoid possible damage to the controller board. Check polarity with a multimeter and follow the controllers recommendations. The power supply should be rated at 6 to 8 Amps at 12VDC.



1. Correctly connect the 4 terminals to the Ramps 1.4 Connector terminal.

## First print (quick guide)



Initial setup and calibration of the printer will take some time but once you understand the parameters you will be able to diagnose printing issues quickly. We have included some basic steps to get you started.

### Connecting the printer

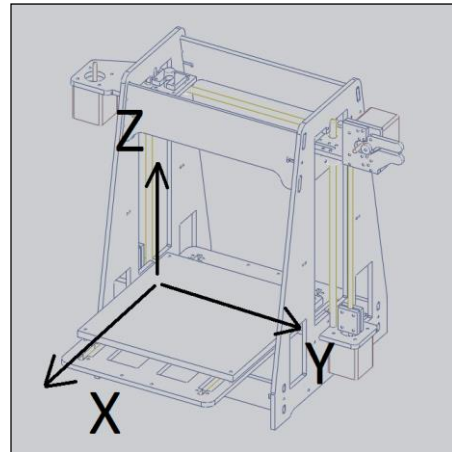
1. Connect the power supply
2. Connect the controller to the computer via USB
3. Open the controller software and connect the printer

### Moving the X, Y, and Z axis

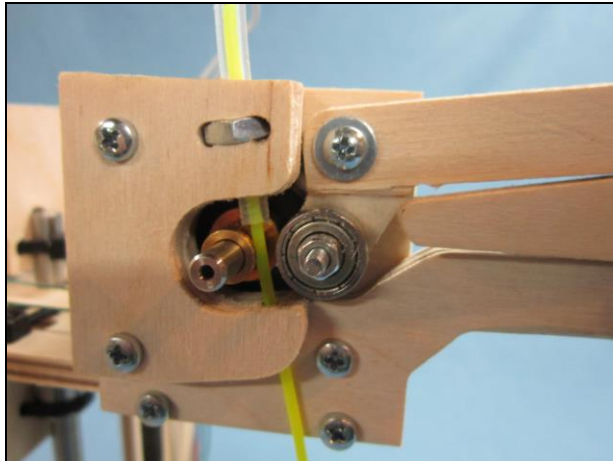
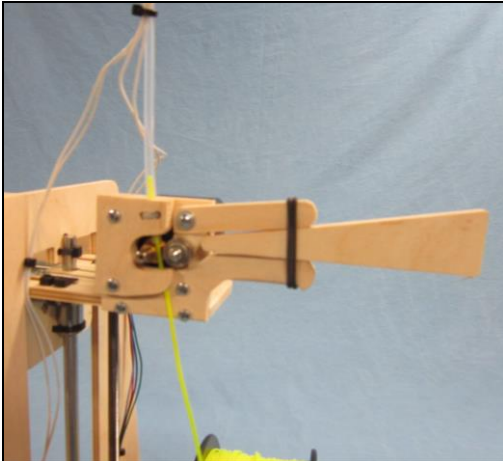
1. Use the software controls to move the X,Y and Z steppers. make sure the move in the correct direction. The diagram has arrows showing the positive axis directions.



If the motors move in the incorrect direction, it can be changed with a firmware setting or turning the stepper motor connectors 180 degrees. The power must be removed before stepper motor connectors can be removed to avoid damage to the controller board.



### Loading the 1.75 mm filament



1. Insert the wedge tool (included in the kit) into the extruder driver releasing the force of the drive bearing onto the extruder drive as shown.
2. Insert the 1.75 mm filament into the bottom hole of the top mount through the filament extruder drive tube until it reaches the extruder.

3. Use the software controls to turn on the extruder to the correct working temperature of the filament. Once the extruder reaches the set temperature, use the software control to feed the filament into the nozzle. Check to make sure the extruder stepper motor rotates in the correct direction.

### Homing and Z Height Adjustment

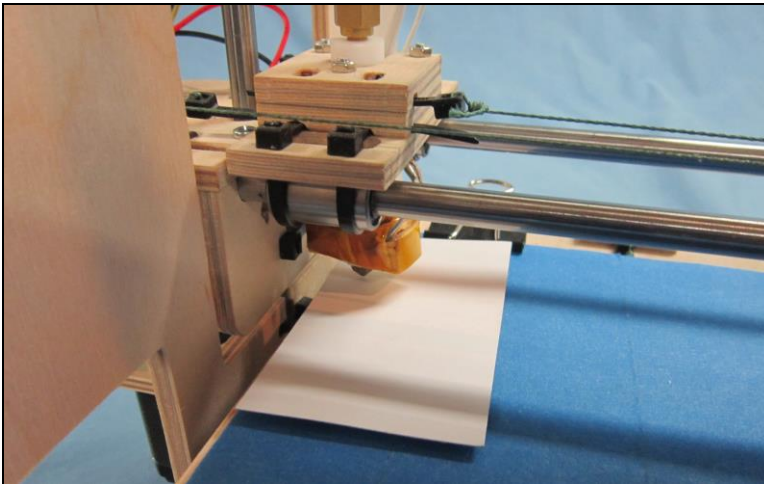
1. Home the axes to ensure that the limit switches are connected correctly



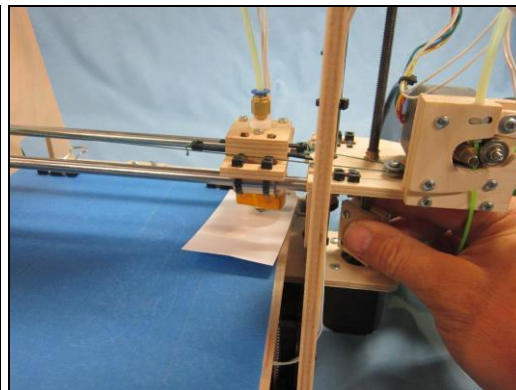
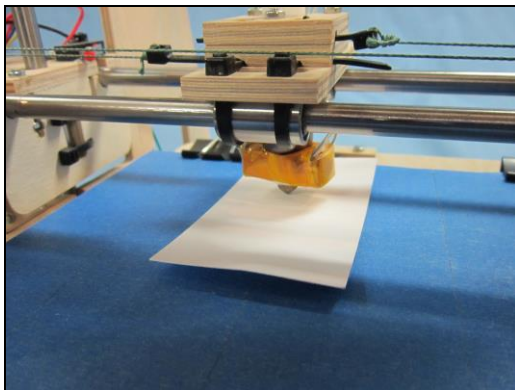
Note that the switches are wired normally closed. If the limit switches do not function troubleshoot the switches using the `M119` code.

2. Set the firmware for Z max length to 210 mm.

3. Use the `G0 Z20` command to move the printer close to the bed.



4. Slowly move the Z axis close to the bed. Use a gage or business card to get the right side of the bed the set distance to the nozzle. (business card is around 0.35 mm thick)



5. Once you get the set height for the left side, move the Y axis to the right a little at a time while adjusting the height of the nozzle from the bed to the set height by manually adjusting the right Z stepper motor.

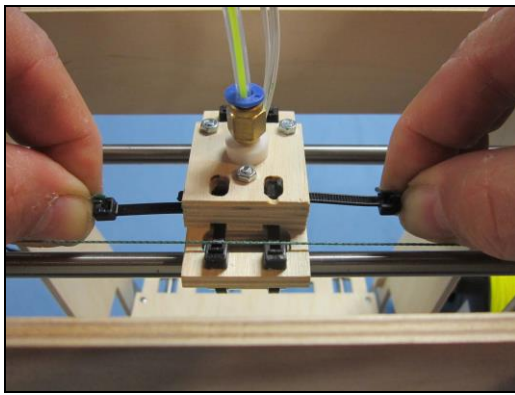
6. Repeat steps 4 and 5 until the nozzle is the same distance from the bed for Y travel.



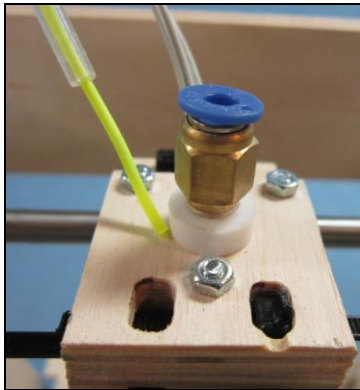
7. Note the Z position displayed in the software. If the number is positive, then subtract this number and add the gauge thickness from the Z max length. For example. If the Z max length was set to 210 and once moved to the set position the software position reads 7.1 mm. then the Z max length would need to be set to  $210 - 7.1 + 0.35 = 203.25$
8. Set this value in the firmware for the Z max length.
9. Home the Z axis and use the `G0 Z0.35` command to verify.
10. Download a file and print a part.

### Tips and tricks

- Isopropyl alcohol to clean blue painters tape to ensure first layer sticking
- First layer is key. Experiment to learn what is the best layer height.
- Different colors will have different printing characteristics



- The string drive may loosen as the knots pull tight. Simply tighten them by pushing the nylon ties to the next click.



- Push to connect (SMC) will quickly release the filament guide tube and allows for quick filament changes.

# Appendix

## Warranty and Return Policy

### 30 Day Warranty

BobsCNC will guarantee all supplied parts for 30 days after the delivery date. If there are missing or defective parts, the buyer must contact Bobs CNC during this 30 day time frame using the "Contact Us" form located at [BobsCNC.com](http://BobsCNC.com). After 30 days, no warranty is given nor will any refund be given. In order to receive a refund, the kit must not have been assembled or attempted to have been assembled. Bobs CNC will have the sole discretion to determine if a kit or any part of the kit is eligible for a refund.

### Technical Assembly

BobsCNC cannot guarantee the buyer's ability to assemble the kit or calibrate the printer. The quality of the prints are dependent on proper set up and understanding of the printing parameters, and therefore results may vary. The assembly, calibration, and understanding of these parameters requires technical and mechanical proficiency. Please review the instruction manual and this return policy prior to purchase as there can be no refund for a kit that has been attempted to be assembled or assembled fully.

### Return Shipping Damage

Bobs CNC will not be liable for any damage incurred during shipping for a return. It is suggested that in case of a return that the buyer purchase shipping insurance.

### Parts included in the basic kit

	Quantity	Extruder assembly	Y - Sub Assembly	X - Sub Assembly	Frame Assembly	Z - Assembly	Z - Rod Assembly	X - Assembly	Extruder Assembly	Controller Assembly	Motion Stepper Motors	Limit Switches	Braided String Drive	Extruder Driver Mount	Build Plate	Extra Stuff
Extruder Mount	1	1														
Extruder Lock	1	1														
Extruder Spacer	1	1														
Left Mount	1		1													
Right Mount	1		1													
Bearing Holders	2		2													
Cross-member	1			1												
Top Braces	2				2											

Bottom Braces	2				2												
Left Frame	1				1												
Right Frame	1				1												
Coupler Halves	4						4										
Bed Mount	1							1									
String Holders	2							2									
Backing plate	1								1								
Bearing Arm	1								1								
Mid Plate	1								1								
Front Plate	1								1								
X Stepper Motor Spacer	1										1						
Build Plate	1															1	
Round Spacers	4															4	
Spool support	1																1
Spool leg	1																1
Wedge tool	1																1

M2.5 X 16 Machine Screws	4											4					
M2.5 Nuts	4											4					
M3 X10 Machine Screws	12										1	2					
M3 X16 Machine Screws	11		1					4	2			4					
M3 X20 Machine Screws	31	3	4		8		8		2					2	4		
M3 Nuts	36	3	6		8		8	4	1					2	4		
1/4-20 Inserts	2		2														
1/4-20 Threaded Rods	2						2										
LM8UU Bearings	8	2	2	4													
V groove Bearing	1		1														
Drive Bearing	1								1								
Large Nylon Ties	55	4	2	8		4		4					8				1
Small Nylon Ties	25									4		1					5
8 mm Drill Rod	6		2			2		2									2
Extruder Guide Tube	1								1								
Nylon Bushing	1								1								
O-rings	4								2								2
Large Washer	1								1								
Small Washer	1								1								
Extruder Tube Nut (10-24)	1								1								
Threaded Couplers (7/16-20)	2										2						
1.5 mm Allen Wrench	1																1
Limit switches (long wires)	2											2					
Limit switch (short wire)	1											1					
Braided String	4												2				2
SMC	1													1			

## Added parts included in the deluxe kit

	Quantity	Extruder assembly	Y - Sub Assembly	X - Sub Assembly	Frame Assembly	Z - Assembly	Z - Rod Assembly	X - Assembly	Extruder Assembly	Controller Assembly	Motion Stepper Motors	Limit Switches	Braided String Drive	Extruder Mount	Build Plate	Extra Stuff
Extruder	1	1														
Stepper Motor	5								1		4					
Extruder Drive Gear	1								1							
Ramps 1.4	1									1						
Arduino 2560	1									1						
Stepper Drivers	4									4						
Power Supply	1														1	



The parts in the deluxe kit can be purchased separately.

- The extruder for the RP9 printer can be found at: [BobsCNC.com](http://BobsCNC.com)
- The NEMA17 stepper motors can be found in many online stores. The extruder stepper should rated holding torque of 5.5Kg.cm (76 oz-in). Other stepper motors can be less but could reduce performance. Search for "*printer stepper motors*"
- The feedstock drive wheel needs to fit a 5 mm shaft and knurling bottom diameter of 6 mm. Search online for "*feedstock drive wheel*".
- The Arduino, Ramps1.4, and A4988 stepper drives (with heat sinks) are common in online stores.
- The power supply should be 12 VDC an rated at 6 to 8 amps. Search online for "*12 VDC 8 amp power supply*".



Other supplies that you will need are:

- Build plate can be hardboard, glass, aluminum, etc.
  - Size is 200 to 215 mm square
- Blue painters tape ( or a glue stick) and build plate clips
- 1.75 mm PLA with 0.05 mm tolerance