

Assembly Instructions

Motor Mounts Assembly

1. Take both 3.5x4.5-inch compression board and drill a 1-inch hole centered 2.25 inches from the sides and 2.25 inches from the bottom for the X-axis toothed gear.
2. On the same pieces, drill two 3/16-inch holes 0.5 inches from the bottom and 1-inch from both sides for the tension pulley bolts.
3. On all four tension pulley bolt holes, insert the bolt and pulley, with washers on either side of the pulley, and tighten the nut on the backside until the pulley just rotates freely.
4. On both 4x6-inch compression board pieces drill 3/16-inch holes as indicated on the drawing for the stepper motor braces.
5. Take all four 1-inch cubes and drill a 0.5-inch hole through the center.
6. Apply a small amount of glue to the outside of the brass slide bearings and insert them fully into the holes in the cubes, ensuring the bearings are flush on each end.
7. Take both 5/8x5/8x2.5-inch wood blocks and drill a 1/4-inch hole fully through 0.5 inches from the top and bottom of each block.
8. Take the 1.5x2.5-inch board and drill one 3/16-inch hole 1.5-inches from the bottom and 0.5 inches from a side. Attach tension pulley, bolt, nut, and washers as above.
9. Screw each stepper motor to their bracket with the M2 bolts, ensure the wires are facing upwards.
10. On all three motors, attach the toothed pulleys such that the end of the pulleys is flush with the end of the pulley mount. Screw the pulleys on with supplied allen wrench firmly.
11. Put two bolts through each slot of the motor brackets with the bolt head up.
12. Align each bolt on the motor bracket with the holes in the 4x6-inch board. Ensure each motor is aligned in the correct position. Push the bolts through the board and loosely secure them with nuts underneath.
13. Glue two 1-inch cubes to the bottom of each 4x6-inch board, aligning them with the front corners of the board and ensuring the slide bearings are parallel with the front of the board and perpendicular with the X-axis motor. Wait until the glue sets before moving forward.
14. Glue both 3.5x4.5-inch boards to the front of each 4x6-inch board with the 1-inch hole centered on the X-axis pulley and the two tension pulleys to the bottom. Wait until the glue sets before moving forward.
15. Glue both 5/8x5/8x2.5-inch wood blocks to the backside of the 3.5x4.5 boards. Ensure the drilled holes are facing inward and flush with the x-axis motor brackets. Wait until the glue sets before moving forward.
16. Glue the 1.5x2.5-inch board to the 5/8x5/8x2.5-inch wood block on the motor mount with just an x-axis motor. Ensure the pulley is aligned between two drilled holes in the block. Wait until the glue sets before moving forward.
17. Securely tighten the nuts holding the motor brackets to the motor mounts ensuring the pulleys are aligned properly.

Wooden Frame

1. On each 2x4x48-inch wooden board drill a 3/8-inch hole, one inch deep, 1.5-inches from the outer side and 1.5-inches from the bottom of the board. Do this for a total of 4 times for each lower corner of the board. These are to insert the linear rails into.
2. From each of the previous holes, drill a 1/4 -inch hole, 1/2-inch deep, 1-inch up and 3/4-inch from the outside of the board.
3. Glue a pulley belt bracket into each of the previous holes with the window of the brackets facing upwards. Ensure the glue is dry before attaching the GT2 pulley in further steps.

Slide Rails

1. On each of the 3/8-inch and 1/4-inch slide rails remove any oil and dirt from the surface with a solvent and rag.
2. Inspect each rail for any manufacturing marks that may impede movement on them. If any detected carefully machine or sand the defects to provide a smooth surface.

3D Printed Writing Mount Assembly

1. Take the two pieces of the clamp and insert the pin such that the 'teeth' of the clamp are facing each other.
2. Place the bolt through the hole in the clamp and the hole in the front mount. Tighten with nut securely.
3. Place the large spring between the backside of the clamp over the two support mounts.
4. Insert the servomotor into its hole on the back mount. Screw the two M2 screws into the two holes on the servomotor into the back mount.
5. Screw the servomotor lever into the servomotor at the 9 o'clock position.
6. Insert the two 1/8-inch rods into the top holes of the front mount. Align the front mount and the back mount rod holes, with the front mount pin holes on top of the back holes.
7. Insert the 1/8-inch rod through the top holes of the back mount.
8. Adjust the rods so that there is room to slide the smaller springs over each rod without inserting into the next holes.
9. With the springs in place, insert the rods through the holes in the front mount and then the bottom mount.
10. Ensure that the front mount and clamp can freely move along the rods and springs with the back mount not moving.
11. Insert the two GT2 belt supports into the back of the back plate and glue in place.
12. Insert the three rail support blocks into the back of the back plate. Align the holes so they are parallel with each other, and the holes are on the outside of the mount assembly.

CNC Shield Assembly

1. Take each of the heat shields, remove the film protecting the adhesive, and attach to the large chip on each of the stepper motor drivers.
2. Insert a jumper on the center pins of each of the X, Y, and A driver mounts on the V3 CNC shield. This will put the stepper motors in quarter step.
3. Insert a driver into each of the X, Y, and A mounts. Ensure the 'EN' pin on the driver is aligned with the 'EN' pin on each mount. Not doing so will ruin the drivers.
4. Insert jumpers on the 'X' and 'A' pins above the CNC shield's DC power input. This will clone the X drive to the A drive to run both motors simultaneously.
5. Flash the Arduino board with GRBL.
 - a. Download and install the latest version of Arduino IDE.
 - b. Download the [GRBL code](#) and install it as an Arduino library in one of two ways:
 - c. Extract the folder from the zip file into the Arduino library's location on your hard drive or use the "Add .ZIP Library" tool in Arduino IDE.
 - d. Connect your Arduino board to your computer.
 - e. Open the example file "grblUpload" from Arduino IDE. It will have only one line of code: `#include <grbl.h>`
 - f. Hit the "Upload" button.
6. Connect the CNC shield to the Arduino board.
7. Attach DC power supply cables to the CNC shield. Ensure the positive and negative cables are in the correct spots, failure to do so damage the CNC shield and possibly the Arduino.

Graffiti Bot Assembly

1. Take the assembled writing mount and slide the two 1/4-inch rods through the holes in the block supports.
2. With the writing mount upright, insert the ends of the 1/4-inch rods into the holes of the block mounts on each of the motor mounts. Ensure the rods are fully inserted.
3. Take the 3/8-inch rods and insert them through the slide bearings at the bottom of each motor mount.
4. Align the wooden frame pieces to the ends 3/8-inch rods and insert them fully into the holes on the boards.
5. Attach one end of a GT2 belt to one of the X-axis pulley brackets, teeth down, with two zip ties. Pull the other end of the belt to the opposite side while threading through the tension pulleys and geared tooth pulley on the motor bracket. Tension the belt until it is taut in the bracket and zip tie it down. Repeat for the other side.
6. For the Y-axis, start at one of the brackets on the backside of the mount. Zip tie the belt to one and loop the belt around the smooth pulley and back around the toothed pulley on

the motor. Loop the pulley around the remaining bracket, get the belt taut and zip tie the belt together.

7. Attach the Arduino and CNC Shield to the motor mount with one only one motor, ensuring the power cables and USB connector are facing outwards.
8. Connect the wires from the motors to their appropriate pins on the CNC shield.
9. Connect the pins from the servomotor to the CNC Shield: Orange on +Z pin, red on 5V, and brown on GRD.
10. Manage the cables from the different motors with zip ties so that they don't interfere with the drawing device or get interlaced with the belt and pulleys.

Finished