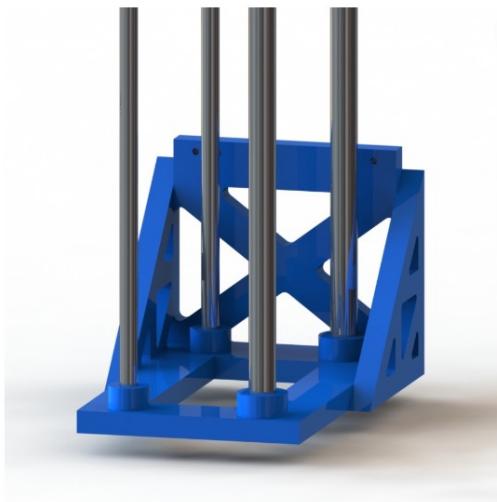


**Instruction Manual and
Hand-Book for TCA
Manufacturing Machine
Version 2.0**

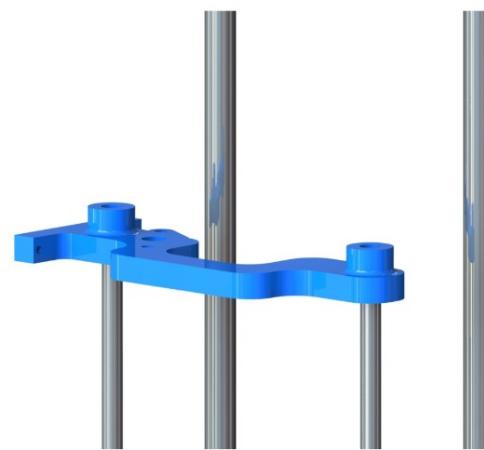
Mechanical Construction

Step 1: Download the SolidWorks file and 3D print the files from the folder Print files



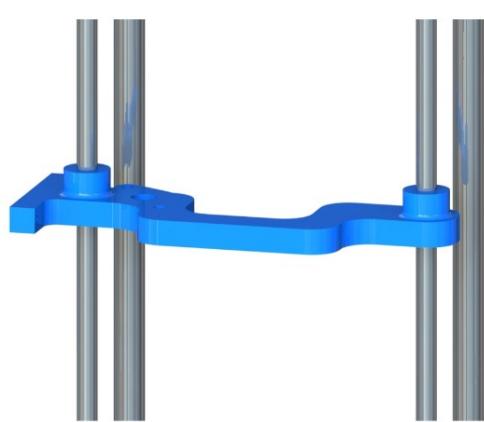
Step 2:

Now, Take the printed Bottom frame plate and insert the two 8mm dia, 1 meter guide rods and two 12mm dia, 2 meter guide rods into the slots provided



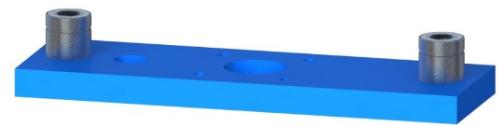
Step 3 :

Next, insert the connecteor plate onto the 8mm dia guide rods by aligning it.



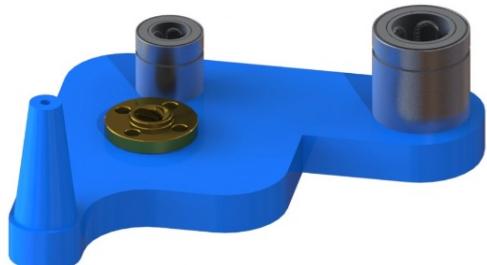
Step 4:

Align the remaining two 8mm guide rods to the holes in the connector plate and connect them above the guide rods that were fixed in Step-3



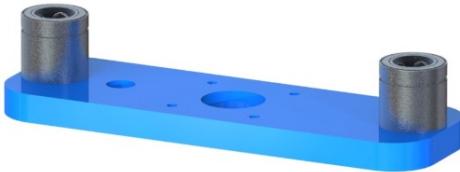
Step5:

Fit the 8mm LM8UU Ball Bearing into the 3D printed 8mm bottom motor plate as shown in the figure.



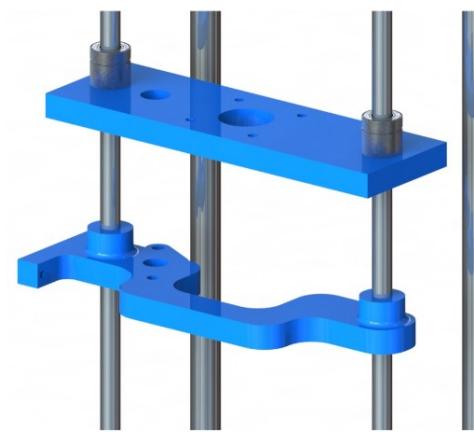
Step 6:

Insert the lead screw nut into the hole provided in the bottom motor traveller plate and fix it with M3 nuts and bolts. Now also insert the LM8UU Ball Bearing into the hole beside the lead screw nut and the LM12UU Ball Bearing into the remaining hole.



Step 7:

Insert the 12mm LM12UU Ball Bearing into the 3D printed 12mm bottom motor plate as shown in the figure.



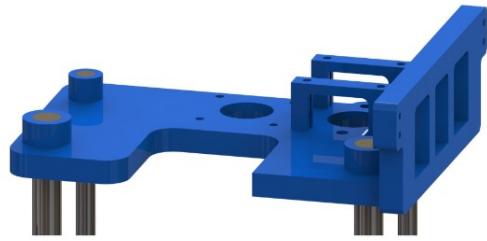
Step 8:

Now slide the bottom motor plate along with ball bearings onto the 8mm guide rods from above.



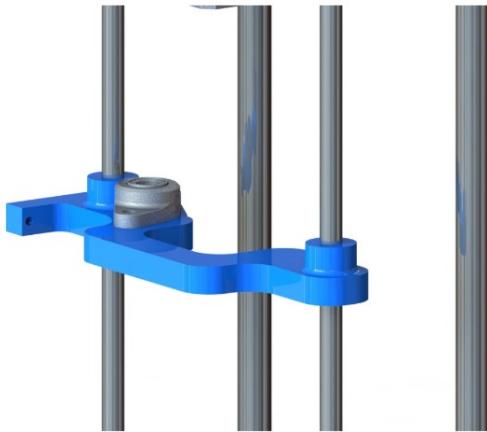
Step 9:

Similar to the Step 7, slide the bottom motor traveller plate onto the back 8mm and 12mm guide rods. And slide the 12mm bottom motor plate on to the two 12mm guide rods.



Step 10:

Take the top motor plate and insert the 8mm guide rods and 12 mm guide rods into the holes provided on it.



Step 11:

Install the KFL08 Pillow Block Bearing onto the connector plate to smoothen the lead screw rotation.



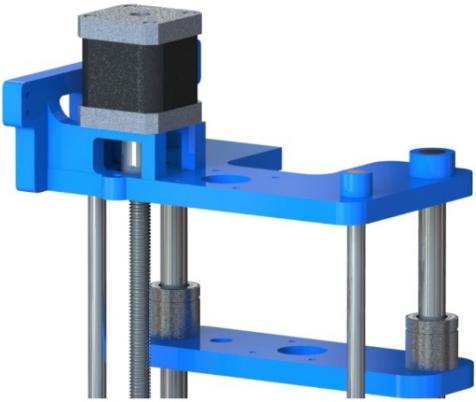
Step 12:

Fix a NEMA 17 stepper motor to the bottom motor plate using the M3 Button Head Screws and also connect the shaft with the belt pulley.



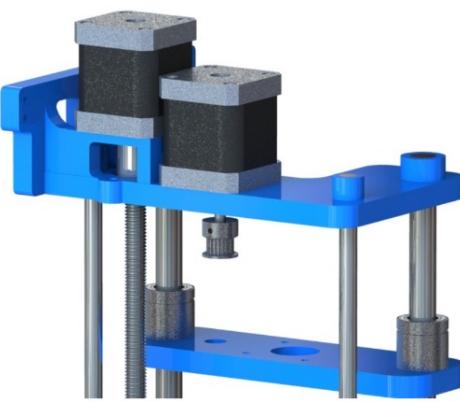
Step 13:

Take the shaft connector from the lead screw set and connect one end with the shaft of the stepper motor and the other end with lead screw



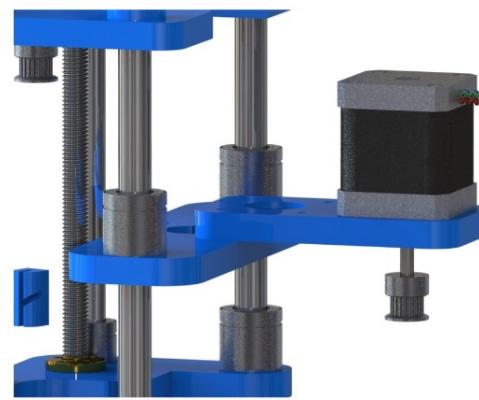
Step 14:

Now take the entire assembly from Step 12 and fix the motor in the assemble to the top motor plate using the M3 Button Head Screws



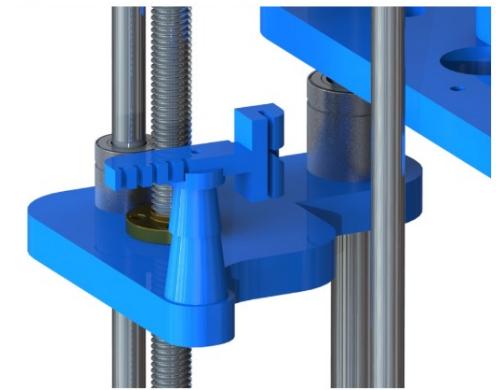
Step 15:

Now take another stepper motor and fix it on the top motor plate using M3 Button Head Screws and also connect its shaft to the belt pulley.



Step 16:

Add the extension plate to the 12mm bottom motor plate and fix the stepper motor along with the belt pulley to it using the screws.

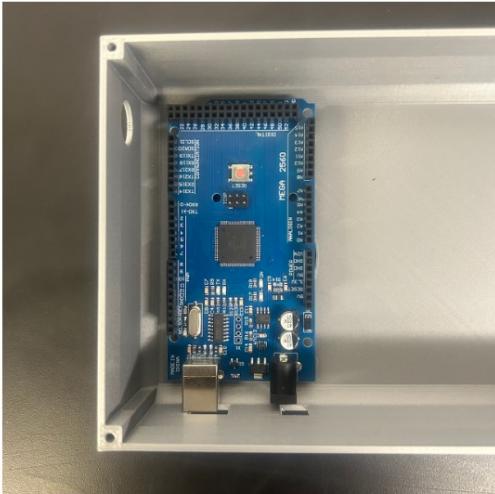


Step 17:

Align the follower mount and the follower guide on the bottom motor traveller plate as shown in the figure and fix them using a M3 Button Head Screw.

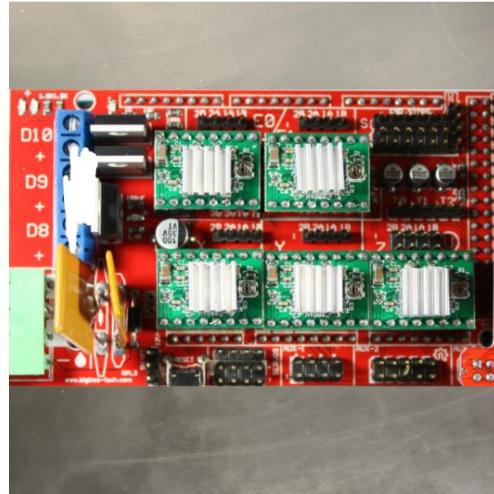
Electrical Construction

Step 1: Print the control box top and bottom.



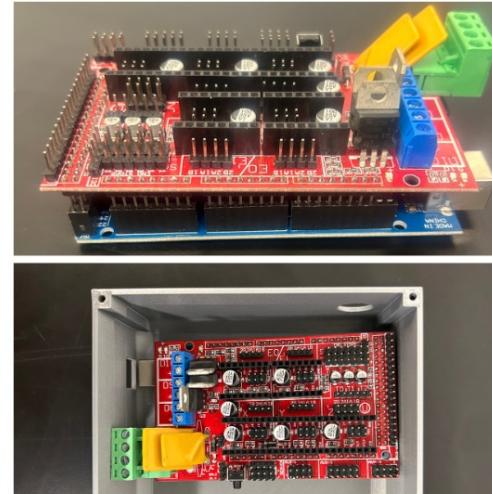
Step 2:

Fix the Arduino Mega 2560 onto the holes provided on the control box bottom using screws.



Step 3:

Mount the A4988 Motor Drivers after attaching the heatsinks onto the RAMPS 1.4 controller.



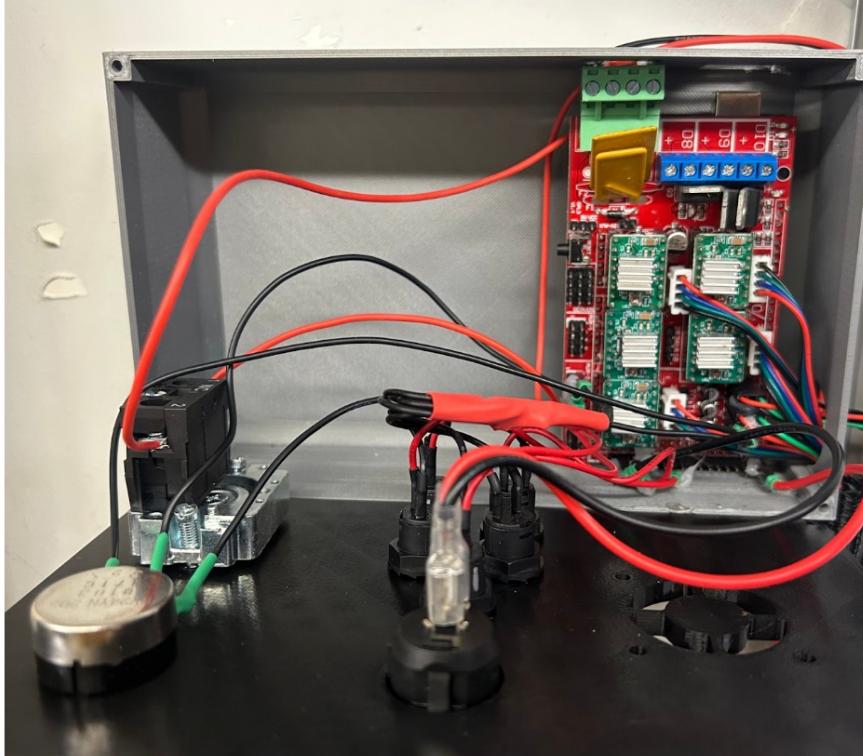
Step 4:

Connect the RAMPS 1.4 with the arduino in the control box bottom.



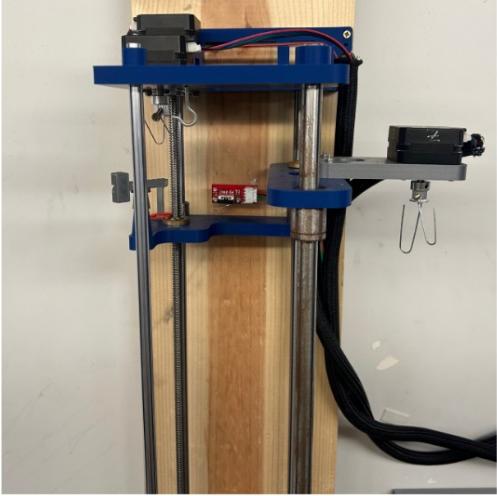
Step 5:

Fix momentary push buttons, latch button, potentiometer and the emergency stop button on the control box top.



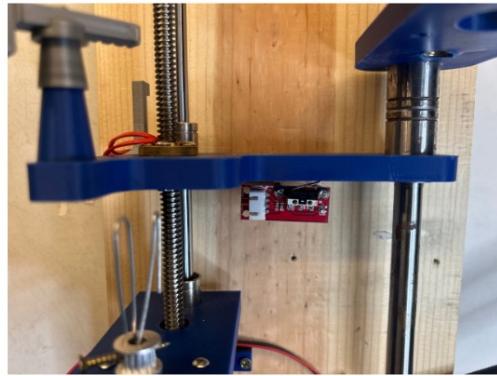
Step 6:

Connect one end of all of the 5 momentary push buttons and the negative of latch switch to GND(Ground) in RAMPS1.4. And connect the other end of the 1st push button to pin 40, 2nd button to pin 42, 3rd button to pin 44, 4rd button to pin 39, 5th button to pin 47. Now connect the positive of the latch button to the pin 16. Also connect the negative of the 12V power supply to negative of RAMPS 1.4. And the positive of power supply to input of emergency stop switch. Next connect the output of the emergency stop to RAMPS 1.4 positive. Finally connect the pin 1(VCC) to any positive of endstop pins which are connected to 5V internally, pin 2(output) to A9 pin in AUX2 of the RAMPS1.4 and pin 3(ground) to any GND in the RAMPS1.4.



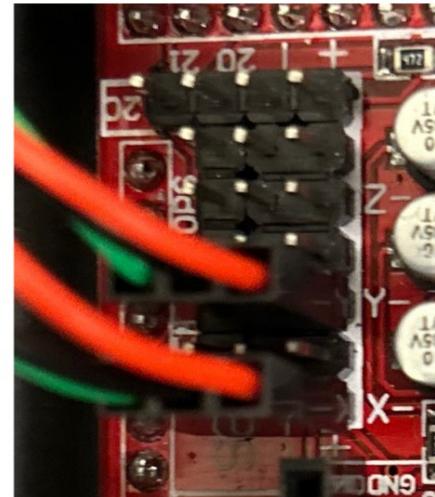
Step 7:

Take the bottom traveller plate to the maximum height and attach and endstop sensor as shown in the figure.



Step 8:

Take the bottom traveller plate to the minimum height and attach and endstop sensor as shown in the figure.



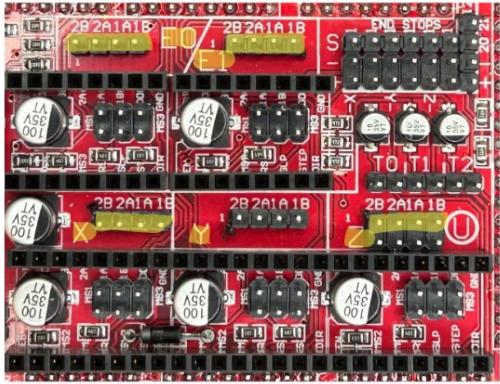
Step 9:

Connect the top endstop sensor to Xmin pin D3, and the bottom endstop to Ymin pin D14.



Step 10:

Label the motors as Top backside which is connected to lead screw as X, the one on the right side as Z, top front as E0, and left bottom fixed as E1.



Select Board

```
TCA_Letscode8_21_2024.ino
1 #include <AccelStepper.h>
2 // Define pin numbers //
3
4 // X motor definitions
5 #define X_STEP_PIN 54
6 #define X_DIR_PIN 55
7 #define X_ENABLE_PIN 38
8
9 // Y motor definitions
10 #define Y_STEP_PIN 68
11 #define Y_DIR_PIN 61
12 #define Y_ENABLE_PIN 56
13
14 // Z motor definitions
15 #define Z_STEP_PIN 46
16 #define Z_DIR_PIN 48
17 #define Z_ENABLE_PIN 40
18
19 // E0 motor definitions
20 #define E0_STEP_PIN 26
21 #define E0_DIR_PIN 28
22 #define E0_ENABLE_PIN 24
23
24 // E1 motor definitions
25 #define E1_STEP_PIN 36
26 #define E1_DIR_PIN 34
27 #define E1_ENABLE_PIN 38
28
29 #define X_MIN_PIN 3
30 #define Y_MIN_PIN 14
31
32 // Button Definitions
33 #define BUTTON_PIN1 48
34 #define BUTTON_PIN2 42
35 #define BUTTON_PIN3 44
36 #define BUTTON_PIN4 39
37 #define BUTTON_PIN5 47
38 #define REVERSE_BUTTON_PIN 15
39 #define RESET_BUTTON_PIN 23
40
```

Screenshot

Step 11:

Connect the motors according to the labels to the RAMPS 1.4.

Step 12:

Download the arduino code and upload it onto the arduunio Mega

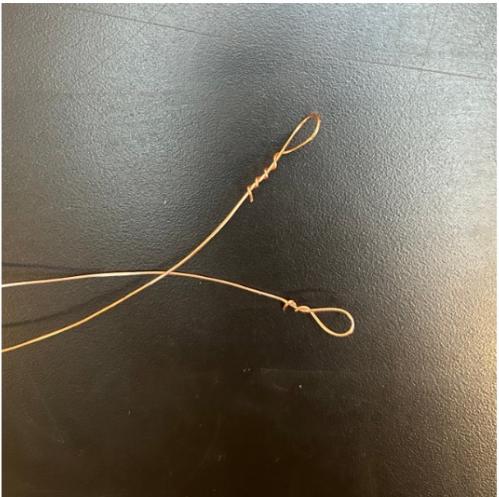
Step 13:

Test the code by powering the machine and making sure all the motors are working when you press push button 1 and stop when button 5 is pressed.

Step 14:

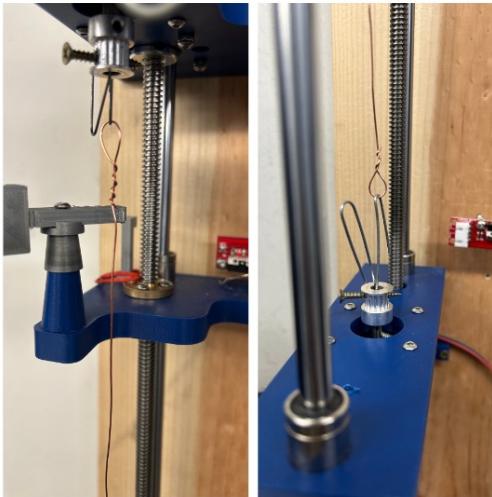
Make sure that all the buttons, endstops, emergengy button are working. And the direction of all the motors is clockwise when the latch switch is off and anti clockwise when it is on.

Instructions



Step 1:

Take a 26 Ga bare copper wire of length 0.9 meters and create a loop on both ends.



Step 2:

Hook both the ends to motors as shown in figure to motor E0 and E1.



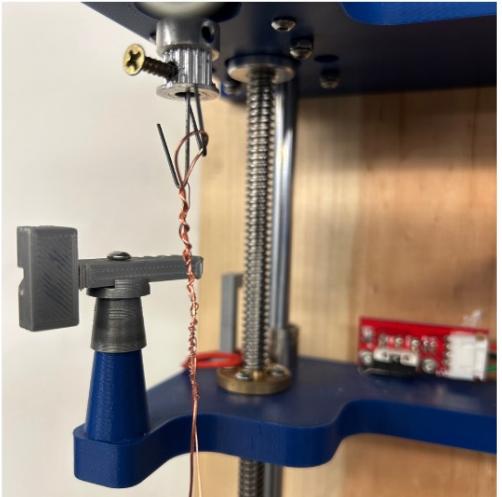
Step 3:

Now take the 30 Ga bare copper wire and cut it at 3.6 meters and create loops on both ends.



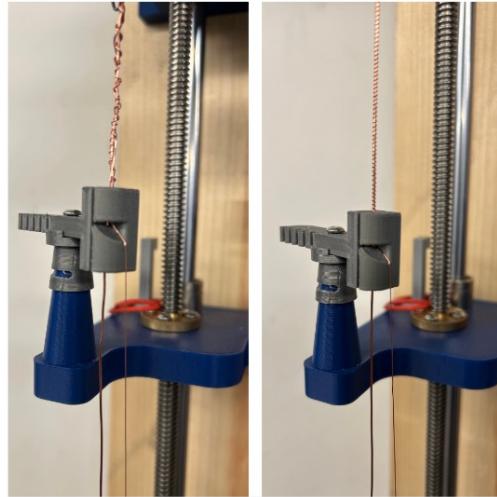
Step 4:

Now hook one end of the wire to the motor E0 and run the wire along the pulley with weight and connect it to motor Z



Step 5:

Now press the button 3 (Mandrel only) and coil the 30 Ga wire around the 26 Ga as shown.



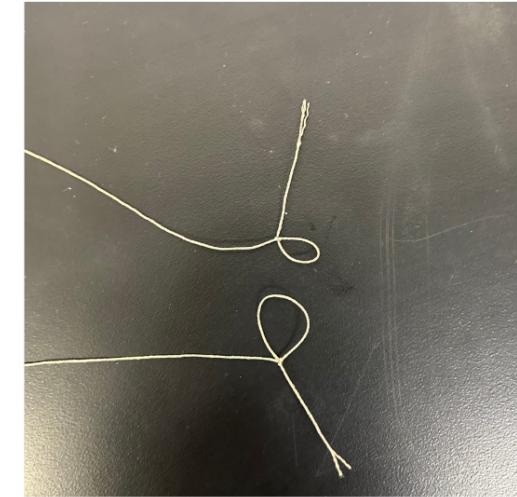
Step 6:

Next run the 30 Ga wire through the follower guide as shown and press button 2(Coil around mandrel).



Step 7:

Wait till the traveller plate reaches the minimum point and then move the follower guide out of the way and press mandrel only button and coil the wire around the mandrel.



Step 8:

Remove the wires from the top motor and take a 3.6 m Nylon 6,6 tread and create loops on both ends.



Step 9:

Now hook one end of the thread to the motor Eo and run the wire along the pulley with weight and connect it to motor Z



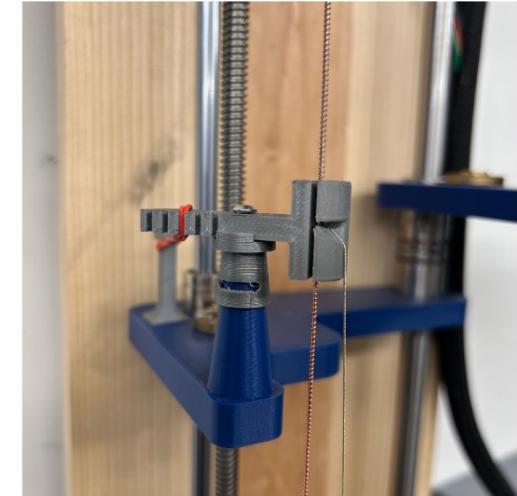
Step 10:

Press the button 1(Twisting) which will help with the twisting of the thread.



Step 11:

Now add the copper wires to the top motor and press the button 3(Mandrel only) and coil the thread around the copper wires.



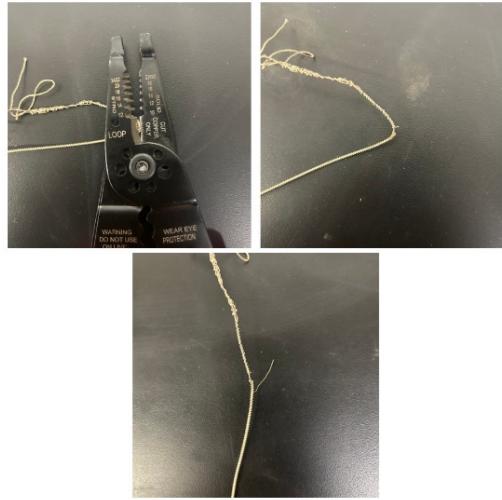
Step 12:

Next run the thread through the follower guide as shown and press button 2(Coil around mandrel).



Step 13:

Remove the entire setup from the machine and anneal the setup at 195K for 45 mins



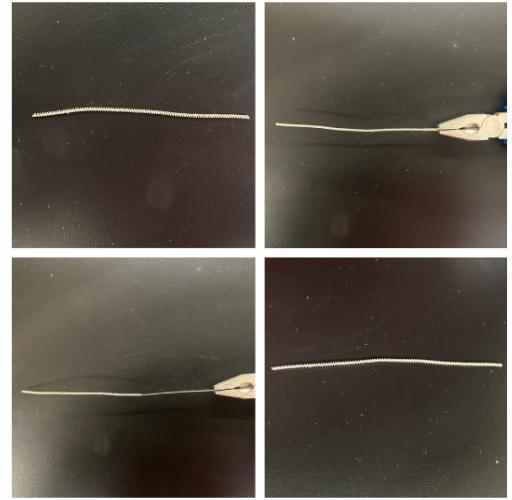
Step 14:

Now make a small cut on the coiled 30 Ga wire and again fix the setup to the E0 motor and E1 motor.



Step 15:

Hold the cut 30 Ga wire and press the button 3 (Mandrel only) so that the wire will be uncoiled.



Step 16:

Now cut the wire with coiled thread into your desired length. Hold the 26 Ga wire with a plier and pull it out.