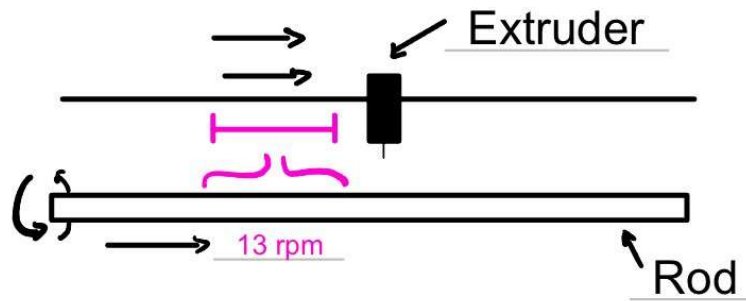# Coil Printer Spacing Calculation / Arduino Device Use

Main Spacing Calculation: $Spacing = \frac{V_{extruder}}{rpm_{rod}}$

2 Main Factors to Consider for Spacing:
- Linear velocity of the extruder ($V_{extruder}$)
- Rotational speed of the vascular graft rod (rpm_{rod})

For Rotational Speed of the Vascular Rod…
$y = 1.0715x + 2.6653$ (trendline made in excel)
$y = Resistance\ Setting$
$x = Actual\ RPM$

For a 13 Resistance Setting:
$13 = 1.0715x + 2.6653$
$x = 9.64507699\ rev/min$

For Linear Velocity of the Extruder…
$V_{extruder} = \pi \times diameter_{extruder} \times r\frac{rev}{min}$
$V_{extruder} = \pi \times 12\ mm \times r\frac{rev}{min} \approx 37.699 \times r\frac{rev \times mm}{min}$
$r = rpm_{extruder}$
$V_{extruder} = 37.699 \times r\frac{rev \times mm}{min}$

Calculating a <u>3 mm</u> Spacing w/ ~9.645 rev/min:
$Spacing = \frac{37.699 \times r\frac{rev \times mm}{min}}{9.64507699\frac{rev}{min}}$
$Spacing = 3.90862614 \times r\ mm$
$3\ mm = \frac{37.699 \times r\frac{rev \times mm}{min}}{9.64507699\frac{rev}{min}}$
$r = 0.767533117\ rpm$

To Use the Current Iteration of the Device:
- Button 1: Increase Rotational Extruder Speed (r)
- Button 2: Decrease Rotational Extruder Speed (r)
- Button 3: Change Direction of Extruder
- Button 4: Move Printer
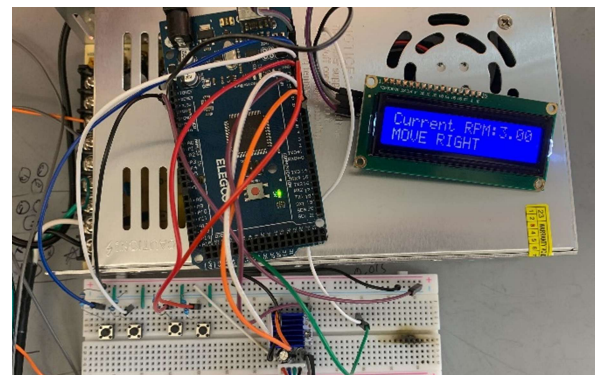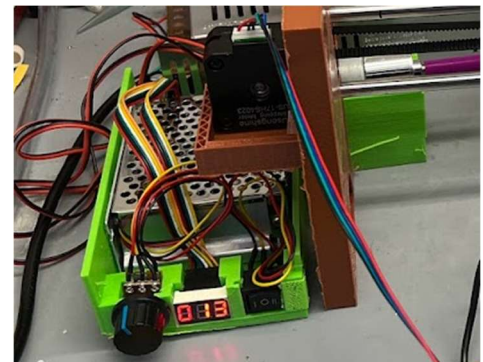
Notes*

- Spacings will stay the same as long as the linear velocity and rotational speed of the vascular rod are the same (only coil thickness will change based on uptake speed)
- Needle gauges/pump speed will also determine coil thickness – this should be investigated more thoroughly
- Arduino code is also uploaded in Jonathan's Folder