

## Design Decisions:

- Arduino Uno for microcontroller
  - Important constraints to consider include memory and I/O quantity
    - Memory must accommodate GRBL
    - I/O is 2 pins per motor minimum
  - At first an Arduino Mega was required to meet the I/O requirements of a 4-Axis machine, but an Uno will suffice for our 2-Axis Design
- Use of GRBL for Arduino
  - GRBL stuck out as an intuitive program which absolves the need to write any of the code to generate motor signals. Early testing confirmed that the Arduino was producing reliable output in the proper format for the stepper drivers.
- Use of Universal G Code Sender
  - There are many different options that GRBL supports for sending G code. This is the first one we tested and it conveniently logs command history + generates a visualized interpretation of the code.
- Use of 2 separate AC to DC power supplies
  - As the driver for the larger motor requires significantly more Voltage than the smaller driver we'd need a powerful buck DC-DC converter to run them off the same power supply. Hence we decided on using separate PSU's.
- Motor Selection
  - Motors were selected by ME's based off mechanical torque/rpm requirements
- Driver Selection for NEMA 34
  - Motor Specs:

|                 |       |
|-----------------|-------|
| Series Current  | 2.8 A |
| Bipolar Voltage | 4.7 V |
  - Driver: MA860H

|                |           |  |
|----------------|-----------|--|
| Current Range  | 2.4-7.2 A | (Can be fine tuned to 2.6 A with switches) |
| Supply Voltage | 36-80 VDC |  |
- Driver Selection for NEMA 14
  - Motor Specs:

|                 |       |
|-----------------|-------|
| Series Current  | 0.7 A |
| Bipolar Voltage | 4.2 V |
  - Driver: MBC25081TB

|                |           |  |
|----------------|-----------|--|
| Current Range  | 0.5-2.5 A | (Can be fine tuned with adjustment knob) |
| Supply Voltage | 12-24 VDC |  |
- PSU Selection
  - Calculations are inspired from geckodrive's power supply selection for stepper motors page. Great difficulty was experienced in finding a good vendor for the kind of power supplies we were looking for. Namely, most power supplies from vendors such as digikey and mouser were very expensive. Finally we found

circuit specialists which have two PSU's which fit well within our budget and more than meet the specifications.

- NEMA 34
  - Power:  $2.8 \times 4.7 \times 4 =$  53 W
  - Min Voltage Requirement: 36 V
  - Max Current Requirement: 2.8 A
    - Selection: 150W 36V PSU with +/-10% Voltage Control
- NEMA 14
  - Power:  $0.7 \times 4.2 \times 4 =$  6.7 W
  - Min Voltage Requirement: 12 V
  - Max Current Requirement: 0.7 A
    - Selection: 40W 15 V PSU with +/-10% Voltage Control