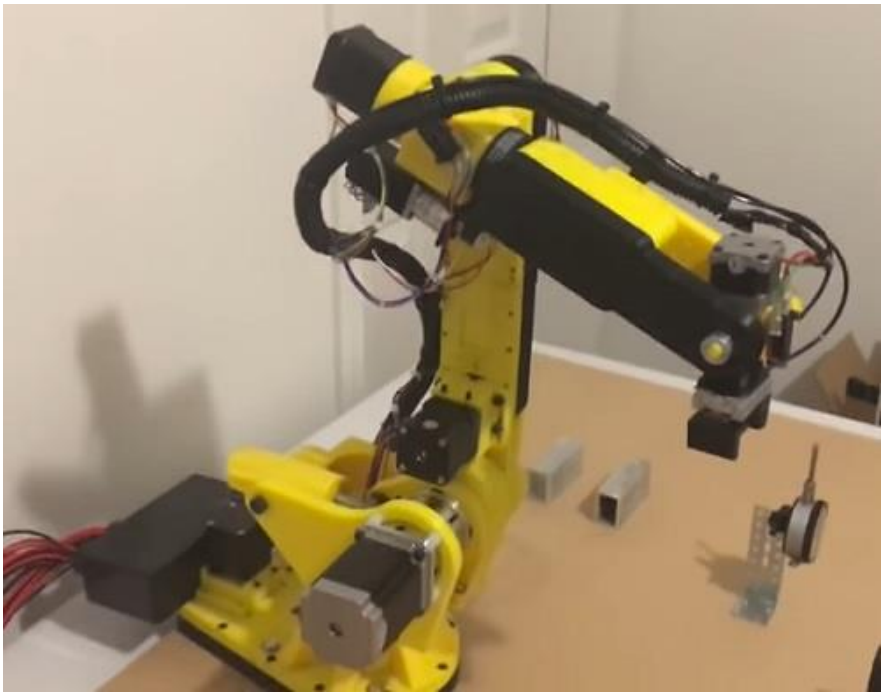
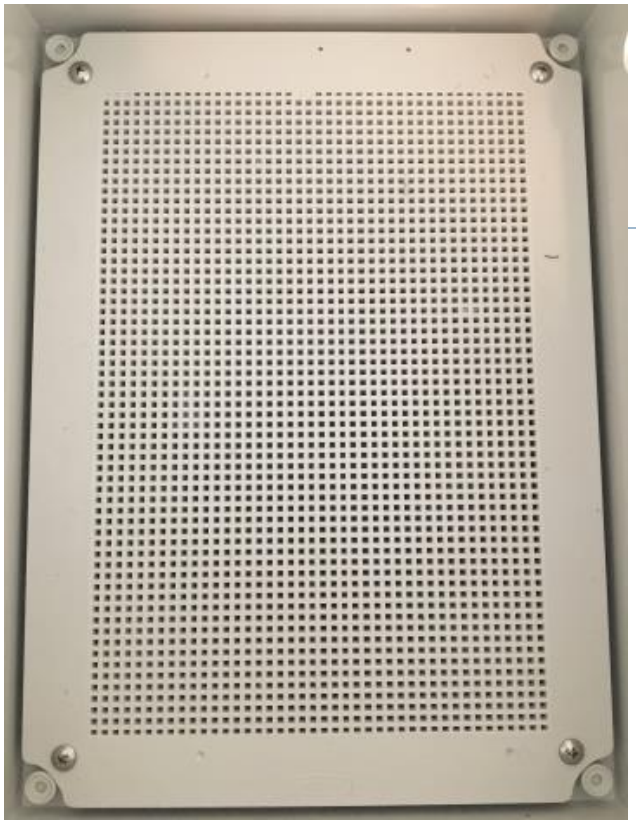


Model AR2 Electrical Enclosure

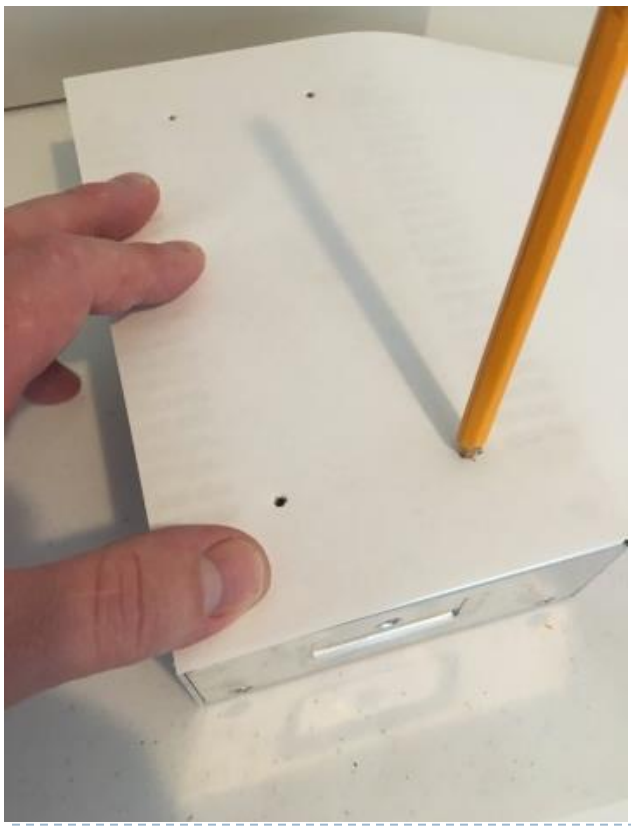
ELECTRICAL PANEL ASSEMBLY



Install backplane into bottom of enclosure using the supplied screws.

Cut 48mm x 30mm rectangular hole in right side of enclosure centered in panel with the top parallel to hasp as shown.

Install fused inlet socket, drill pilot holes and secure with (2) flat head screws.



Align sheet of paper on back of power supply and mark each of the 4 mounting holes.

Align sheet of paper even with backplane and then use marker to transfer the hole pattern.

Drill marked holes with 4mm drill bit then secure power supply with (4) 4mm x 10 button head screws to bottom of enclosure.

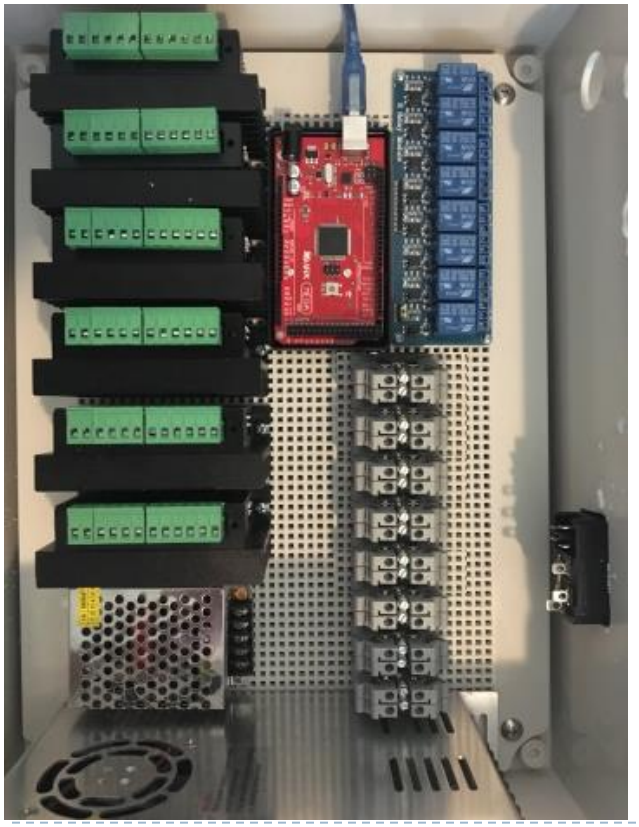
Cut length of DIN rail down to approx 6.5” long.

Use #6 and #4 sheet metal screws to secure

- (6) ST-6600 stepper drivers
- 5vdc power supply
- Arduino mega enclosure
- 8 channel relay board
- DIN rail

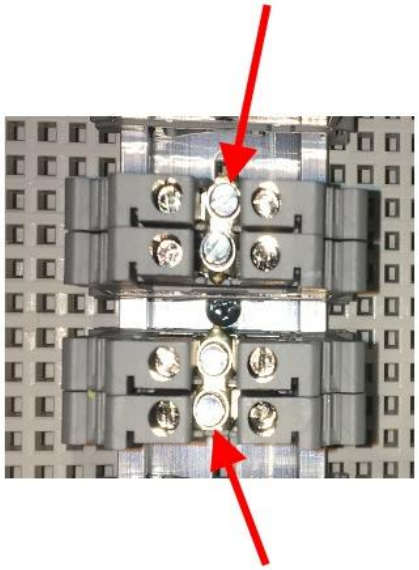
In the orientation shown.

Install Arduino 2560 mega control board with supplied USB cord inserted and secure board to enclosure base using #2 screws.



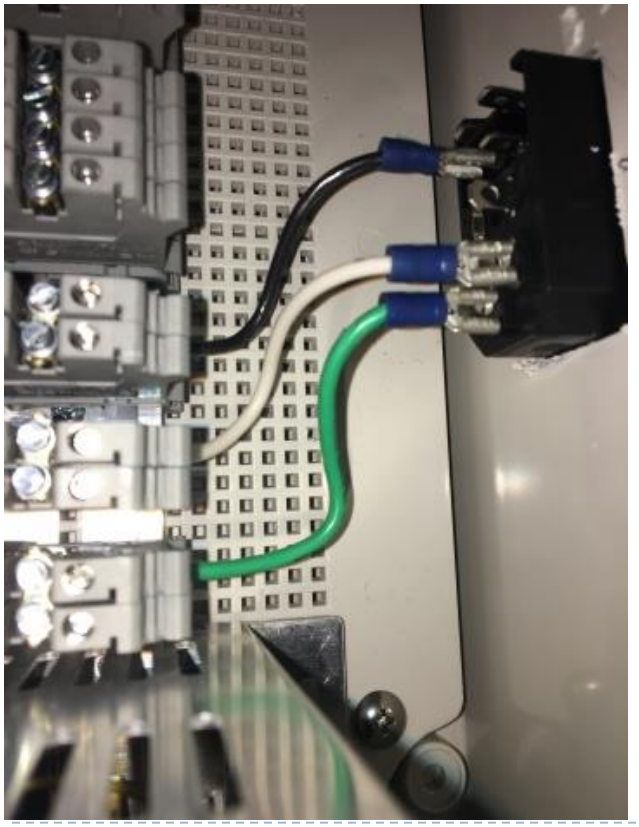
Install (16) terminal blocks onto DIN rail. Install in 8 groups of 2 as shown.

Install terminal jumpers across each set of 2 terminals so that each group of 2 becomes bridged together.

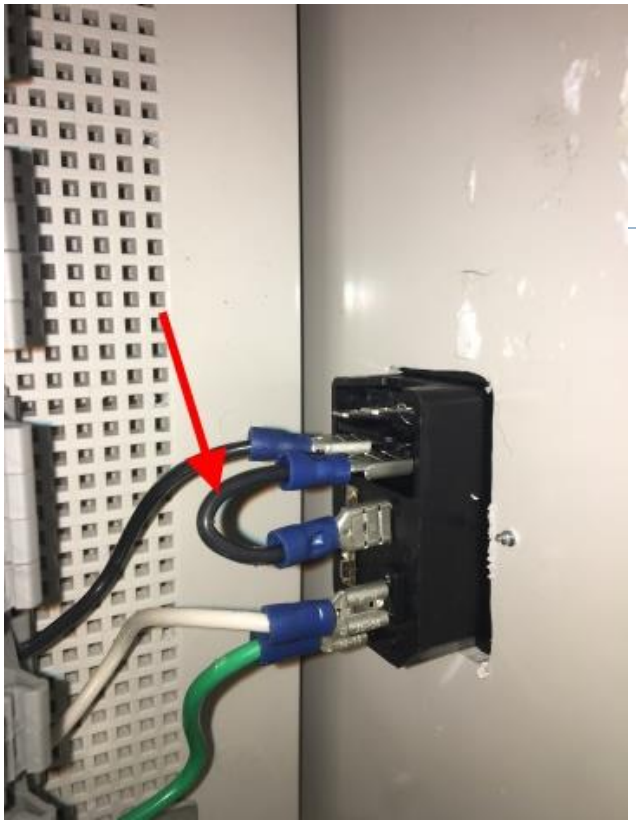


Install green16awg wire from bottom set of terminal blocks to terminal shown on fused inlet socket.

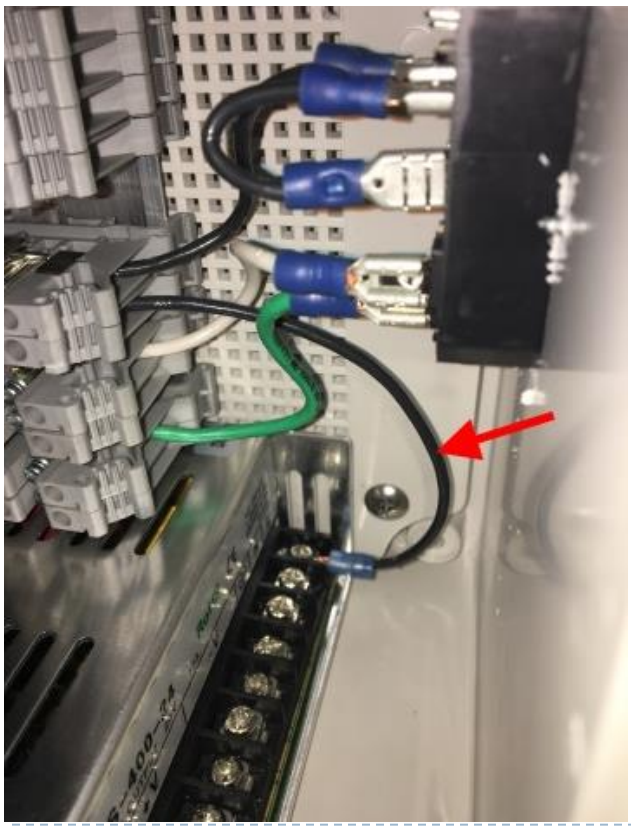
Install white16awg wire from 2nd set of terminal blocks to terminal shown on fused inlet socket.



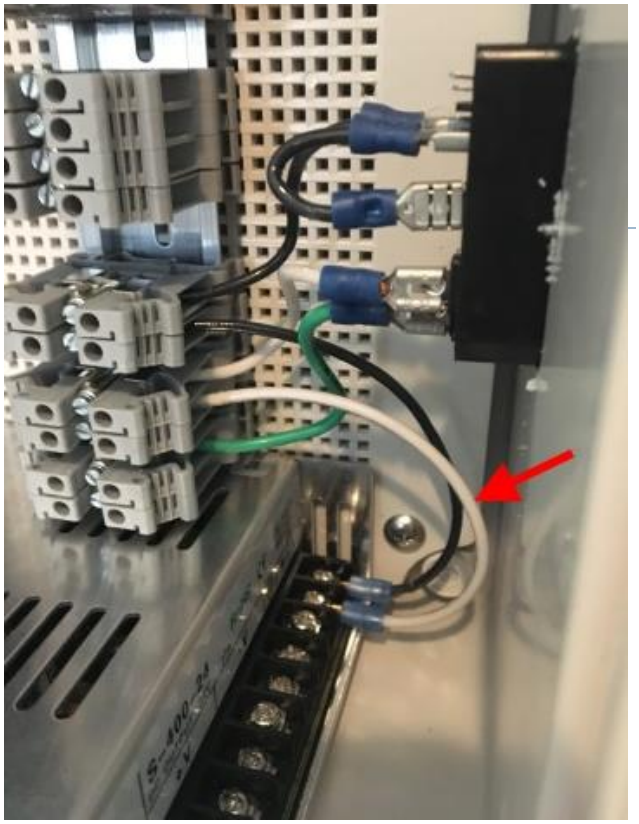
Install black16awg wire from 3rd set of terminal blocks to terminal shown on fused inlet socket.



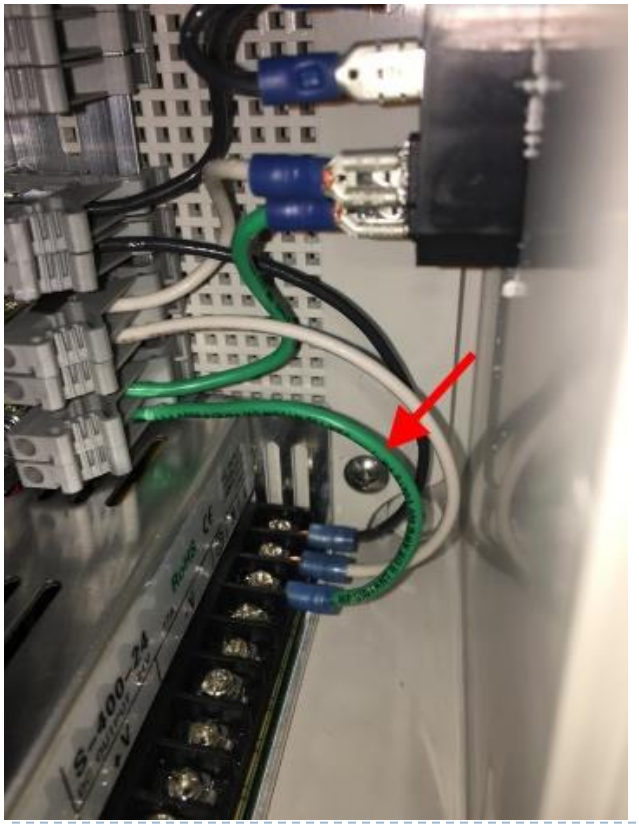
Install jumper as shown on inlet socket.



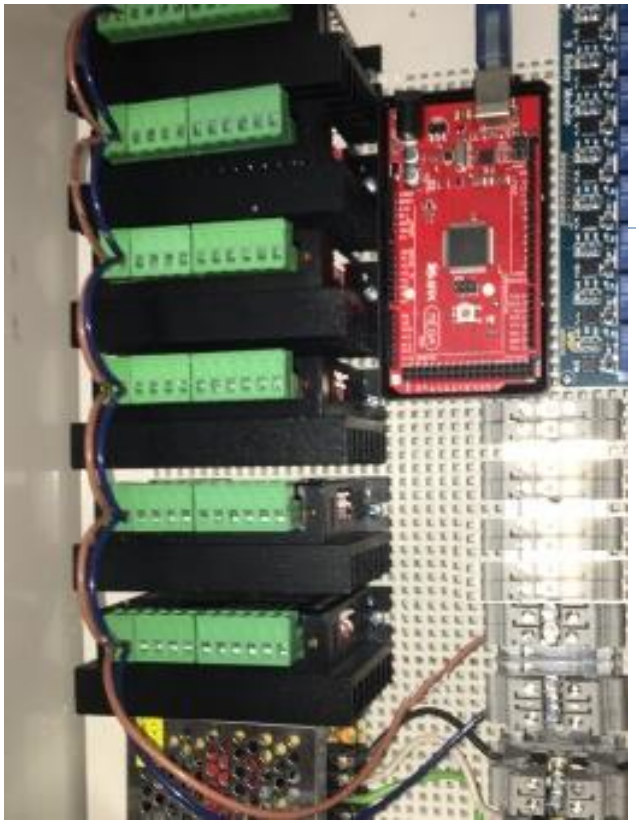
Install black 16awg wire from 3rd terminal block from bottom to the Line terminal on power supply.



Install white 16awg wire from 2nd terminal block from bottom to the Neutral terminal on power supply.

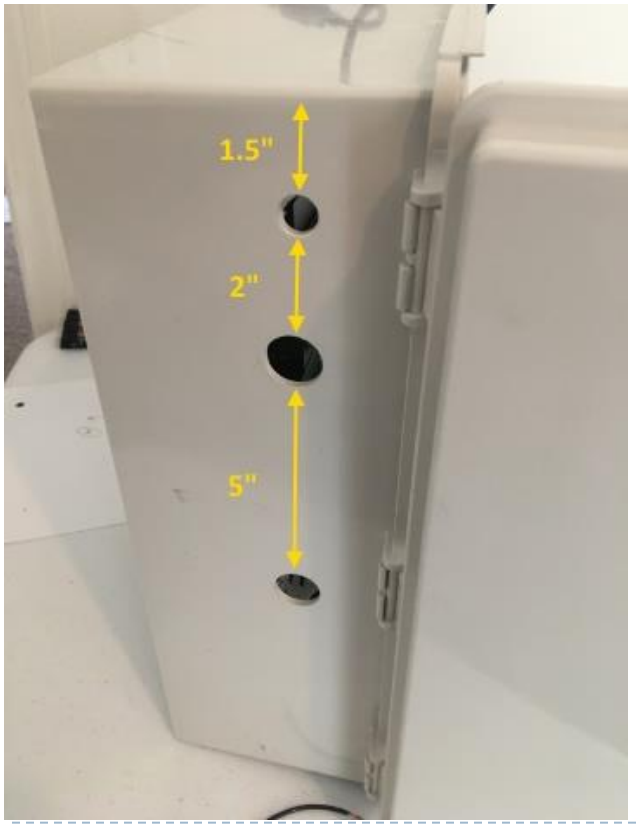


Install green16awg wire from terminal block from bottom to the Ground terminal on power supply.



Install blue 16 awg wire from the 4th from the bottom terminal block to the DC- terminal on bottom stepper driver and then install jumpers all the way up across all 6 drivers.

Install brown 16 awg wire from the 5th from the bottom terminal block to the DC+ terminal on bottom stepper driver and then install jumpers all the way up across all 6 drivers.

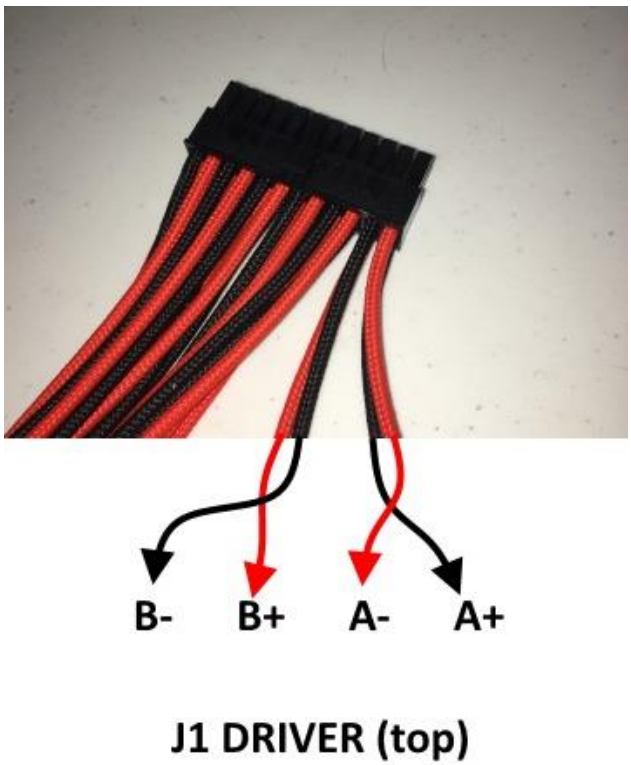


Use stepped drill bit to drill ½" diameter hole on left side of enclosure 1.5" from top. Drill 7/8" hole 2" down from ½" hole and then another 7/8" hole 5" down from the first 7/8" hole.

Install (1) ½” gland nut and (2) 7/8” gland nuts as shown.

Cut female end off of ATX 24 pin extension cable as shown and then strip back ¼” of sheathing from the end of each wire.

With ATX male end clip facing out toward you as shown insert the top 12 wires into the top gland nut and then insert the bottom 12 wires into the bottom gland nut.

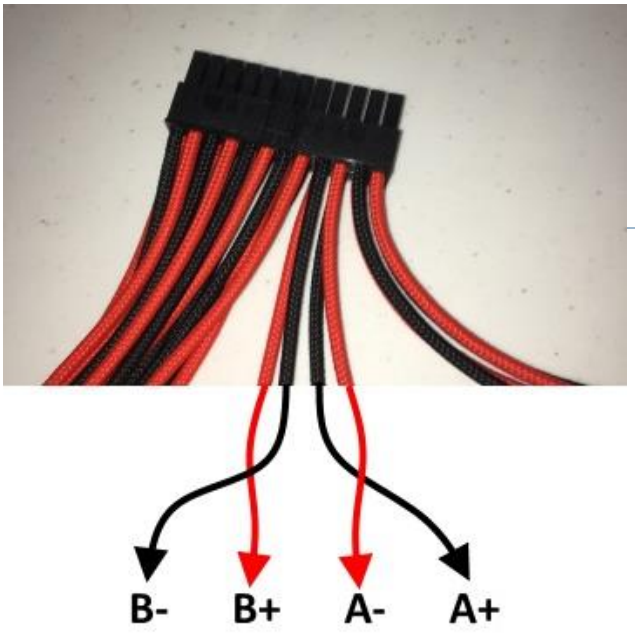


J1 DRIVER (top)

The next step is to land the ATX extension wires to the correct terminal on all 6 drivers. This and the following 5 slides will illustrate which wires go to the correct driver terminals. You will need to trace each wire inside the enclosure and connect as shown. The top driver in the enclosure is for J1 the second down is for J2 and down on. Also refer to the full wiring diagram at the end of this manual as well as the ATX pinout diagram.

Connect the J1 driver to the wires shown

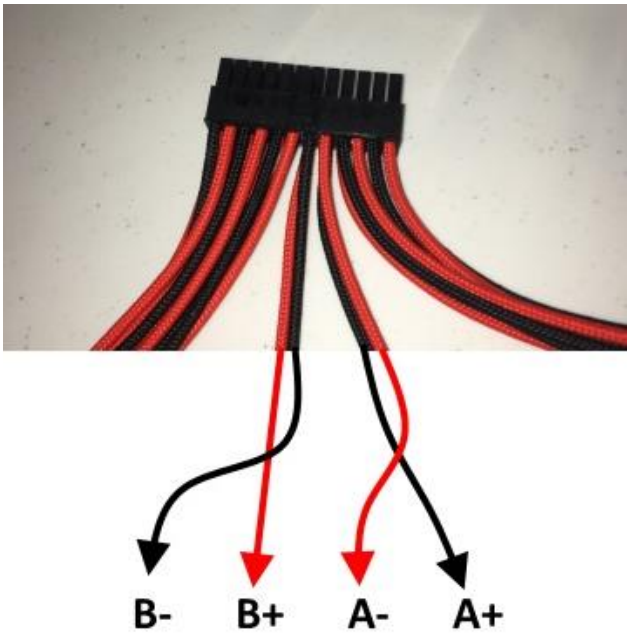
(note the male connector tab is on top in the picuture)



J2 DRIVER (2nd down)

Connect the J2 driver to the wires shown

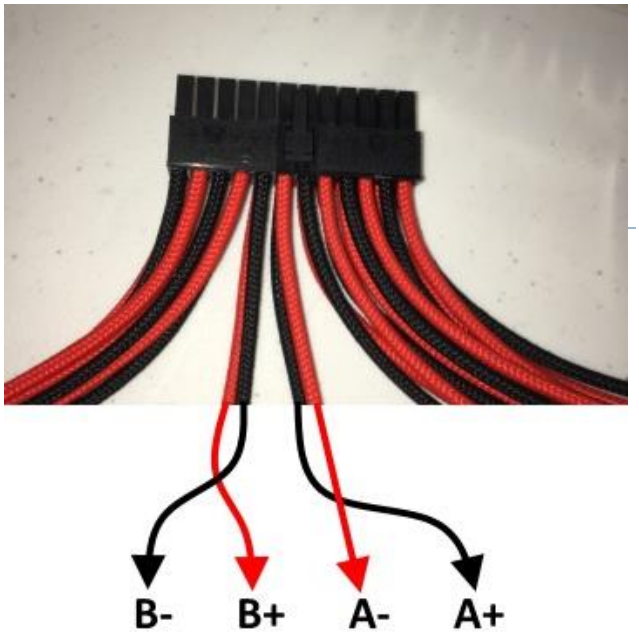
(note the male connector tab is on top in the picuture)



J3 DRIVER (3rd down)

Connect the J3 driver to the wires shown

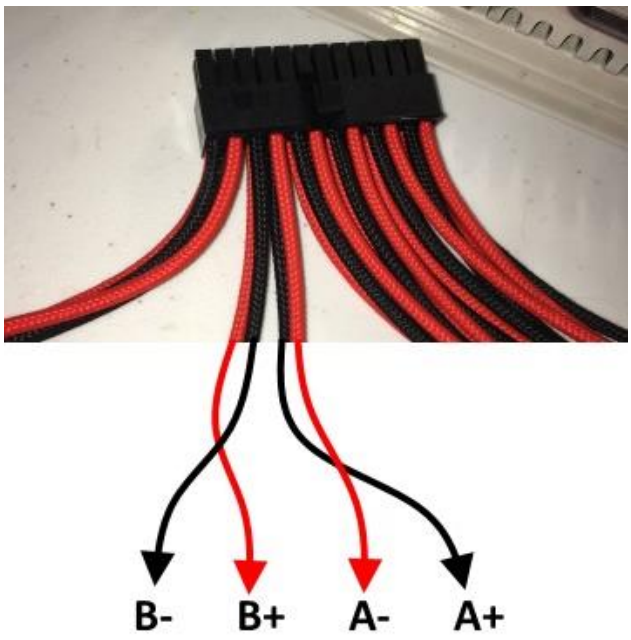
(note the male connector tab is on top in the picuture)



J4 DRIVER (4th down)

Connect the J4 driver to the wires shown

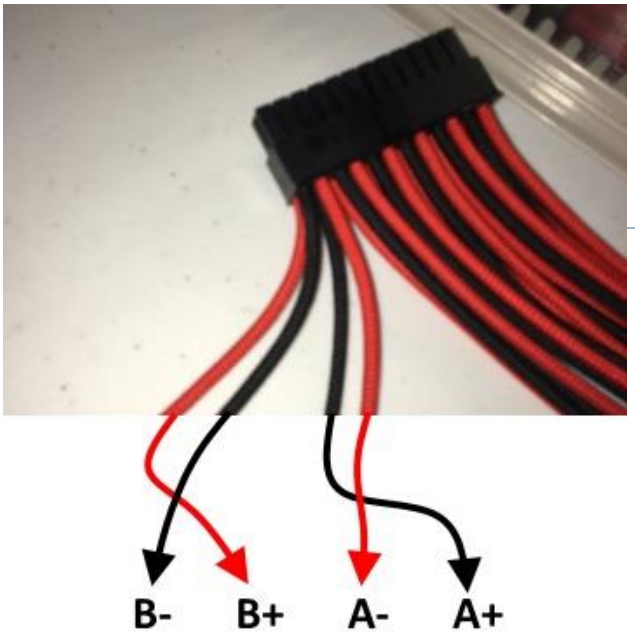
(note the male connector tab is on top in the picuture)



J5 DRIVER (5th down)

Connect the J5 driver to the wires shown

(note the male connector tab is on top in the picuture)

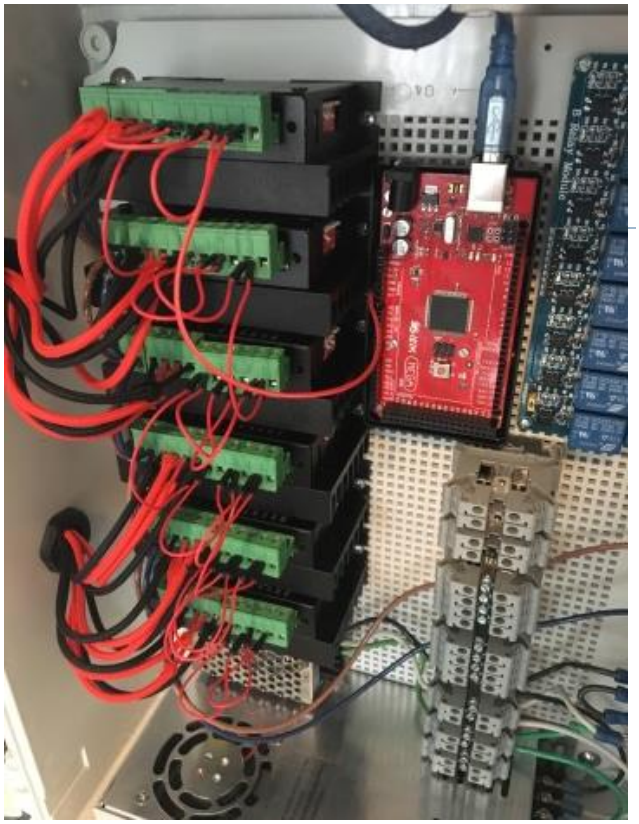


J6 DRIVER(6th down)

Connect the J6 driver to the wires shown

(note the male connector tab is on top in the picuture)

From inside the enclosure with all the ATX extension wires landed to the 6 drivers it should look like this.

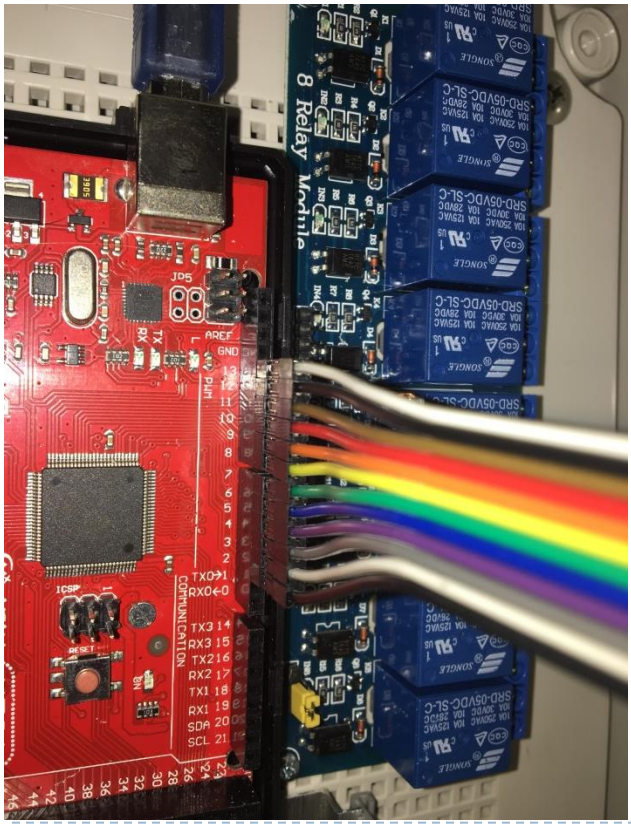


The next step is to run 5vdc from the arduino to all the (+5v) terminals across all of the stepper drivers. The drivers are NPN or negative switching which means the step and direction pulses will be made by the negative wire and the positive is high or on all the time on all the (+5v) terminals. Each driver has (3) positive terminals that require a constant +5v signal:

- PUL+(+5)
- DIR+(+5)
- ENA+(+5)

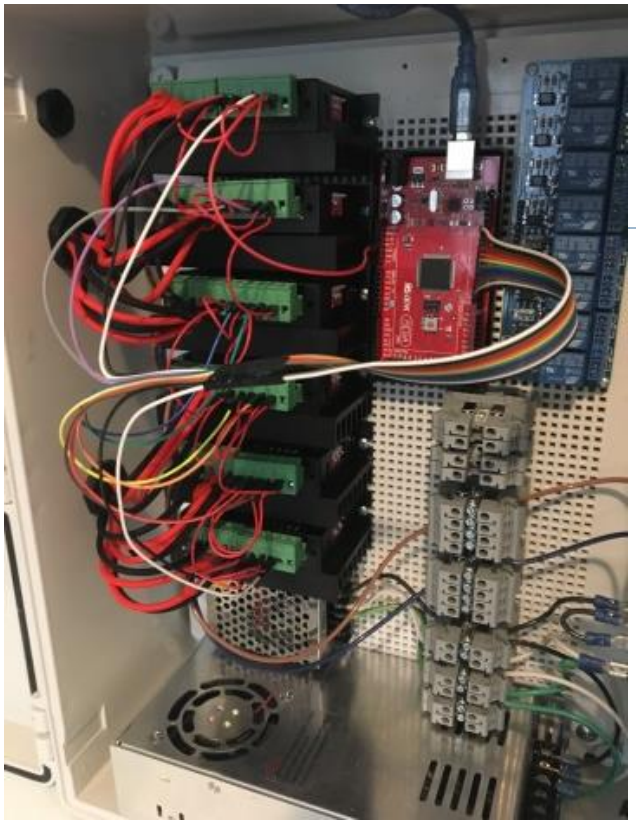
Run a long jumper from the arduino +5v to the J1 stepper drivers ENA+(+5v) terminal, then jumper that over to the DIR+(+5) and jumper that over to the PUL+(+5), then jumper to the next driver and across its (3) (+5) terminals and continue down and across all drivers – you will need a total of (17) short jumper wires.

(Also refer to the full wiring diagram at the end of this manual)



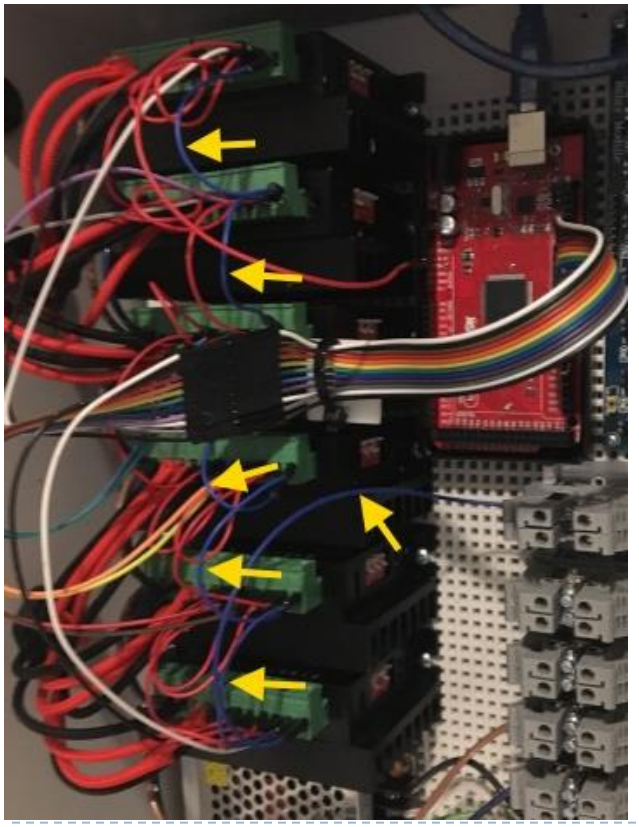
Connect a ribbon of (12) jumper wires to pins 2 through 13 on the arduino board as follows:

- Pin 2 to black to J1 PUL(-5)
- Pin 3 to white to J1 DIR(-5)
- Pin 4 to grey to J2 PUL(-5)
- Pin 5 to purple to J2 DIR(-5)
- Pin 6 to blue to J3 PUL(-5)
- Pin 7 to green to J3 DIR(-5)
- Pin 8 to yellow to J4 PUL(-5)
- Pin 9 to orange to J4 DIR(-5)
- Pin 10 to red to J5 PUL(-5)
- Pin 11 to brown to J5 DIR(-5)
- Pin 12 to black to J6 PUL(-5)
- Pin 13 to white to J6 DIR(-5)



Extend the jumper wires with matching color wires and connect to the stepper drivers negative pulse and direction terminals as outlined in the previous step.

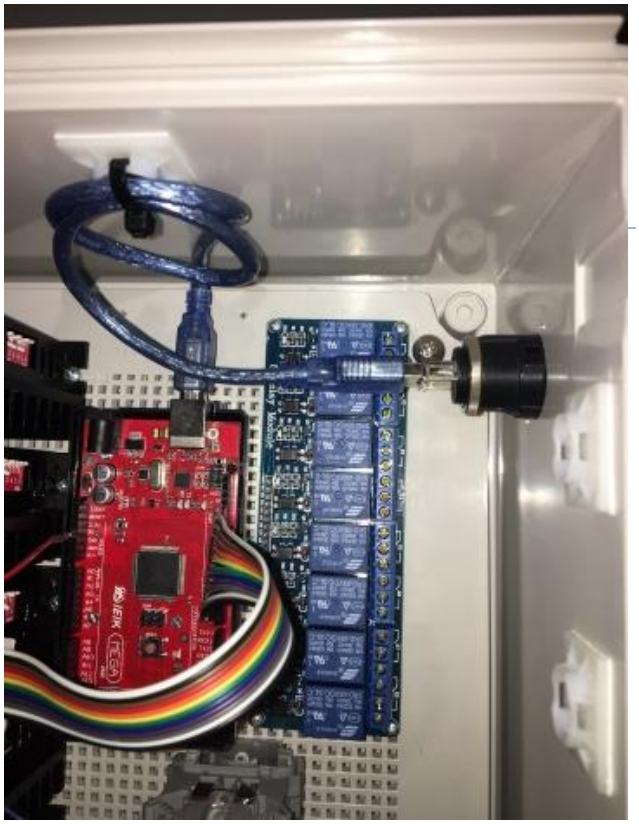
(Also refer to the full wiring diagram at the end of this manual)



Connect a long blue jumper from the top set of terminal blocks over to the ENA-(ENA) on the J6 driver and then use 5 short blue jumpers to jump across the ENA-(ENA) on all stepper drivers. The purpose of these wires is to disable all the stepper drivers. If you were to provide a negative input to any of the other 3 inputs on the top set of terminal blocks this would disable all drivers. This circuit will not be used any further in this manual but its purpose would be if you had a safety switch or gate protecting your robot you would wire your safety gate to these terminals to provide -5v when the gate is open and this will disable any motors while the gate or safety circuit is open.

Use stepped drill bit to drill a 7/8” hole in right side of enclosure centered in panel toward the top of enclosure as shown.

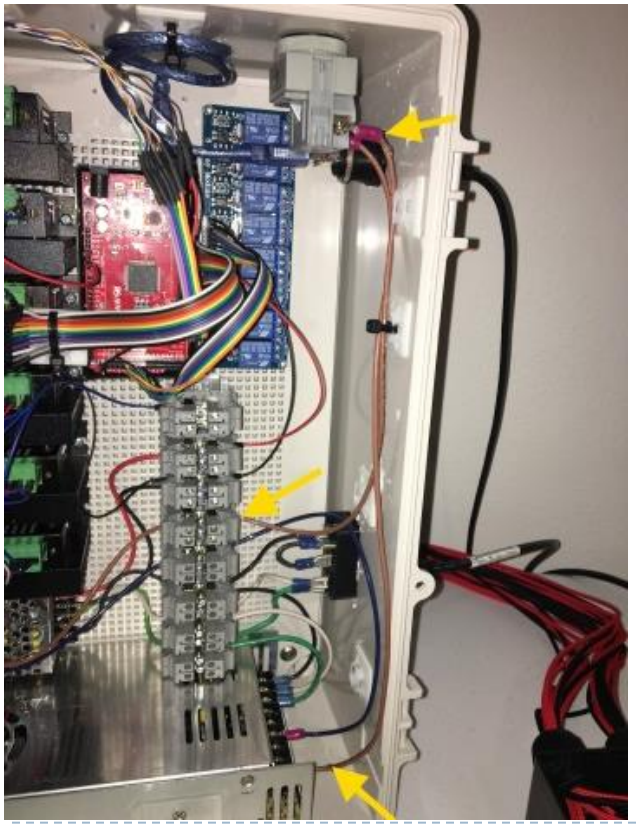
Install USB (B) to (A) panel jack as shown.



On inside of enclosure connect USB cable from arduino to USB panel jack. Secure cable with adhesive cable tie mount.

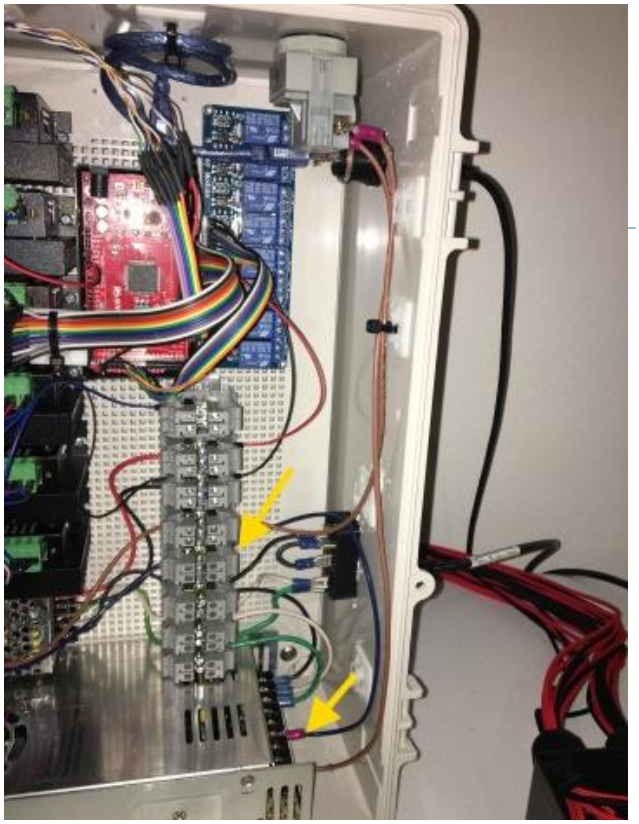
Use stepped drill bit to drill a 7/8” hole in top of enclosure where shown.

Install E-Stop button as shown.

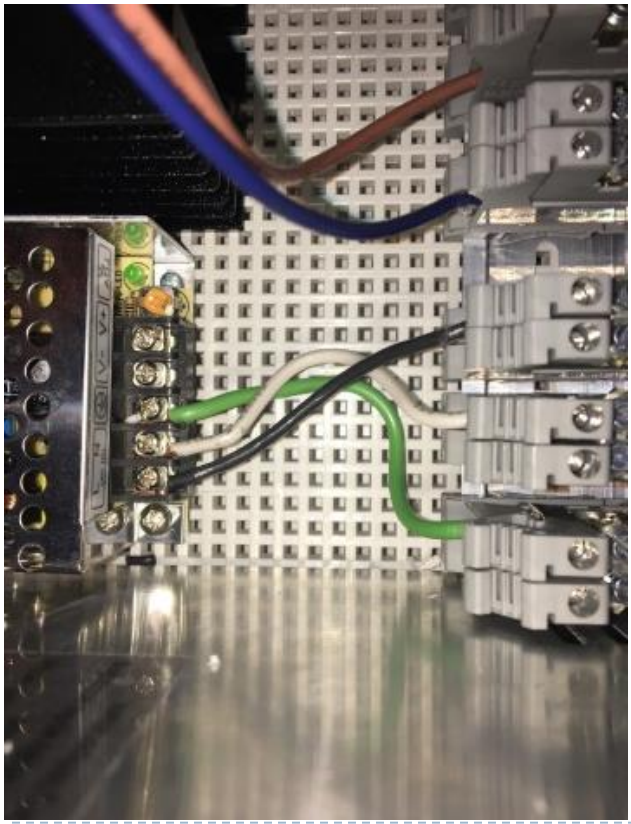


Connect brown 16awg wire from +V terminal on 24vdc power supply up to terminal on E-Stop switch – then from opposite terminal on E-Stop switch down to the 5th from the bottom terminal block group on DIN rail.

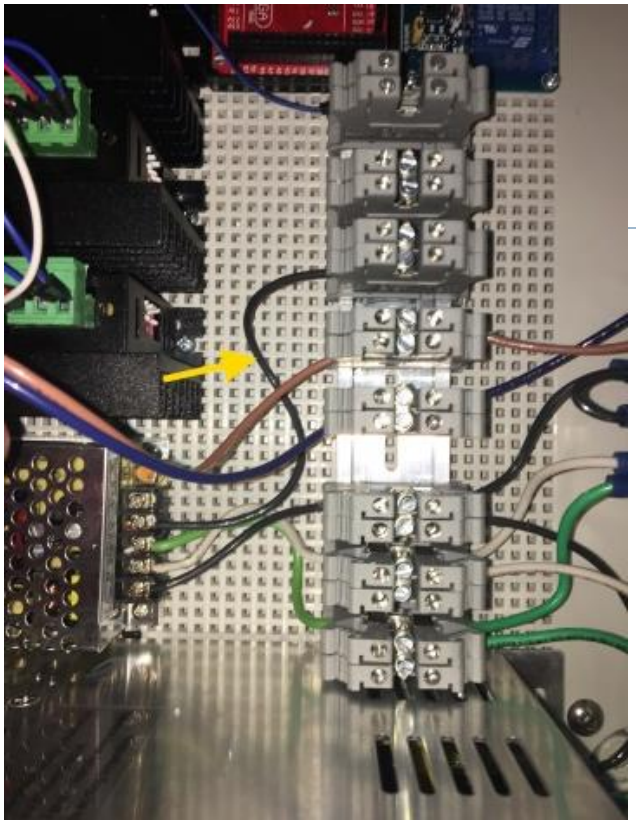
The E-Stop button will cut off the 24vdc power to the stepper drivers.



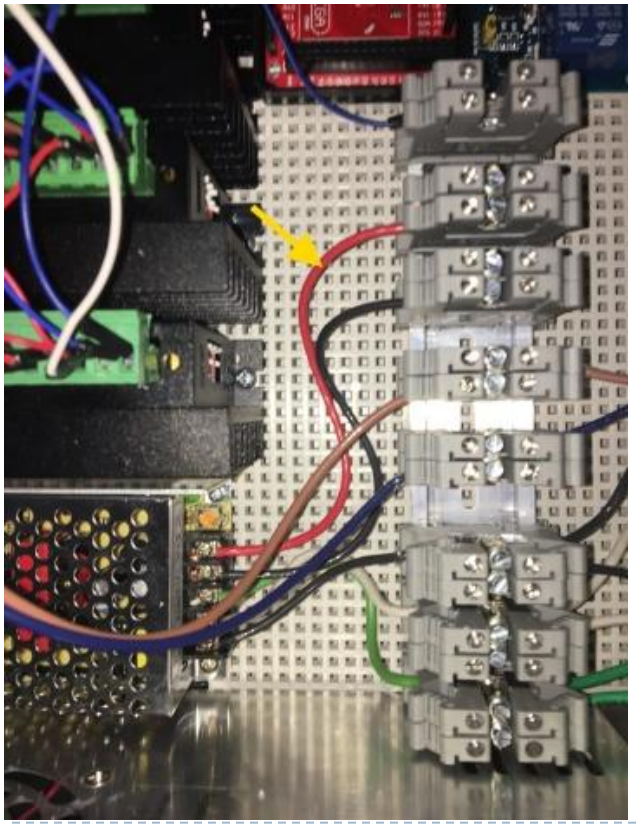
Connect blue 16awg wire from –V terminal on 24vdc power supply to 4th from the bottom terminal block group on DIN rail.



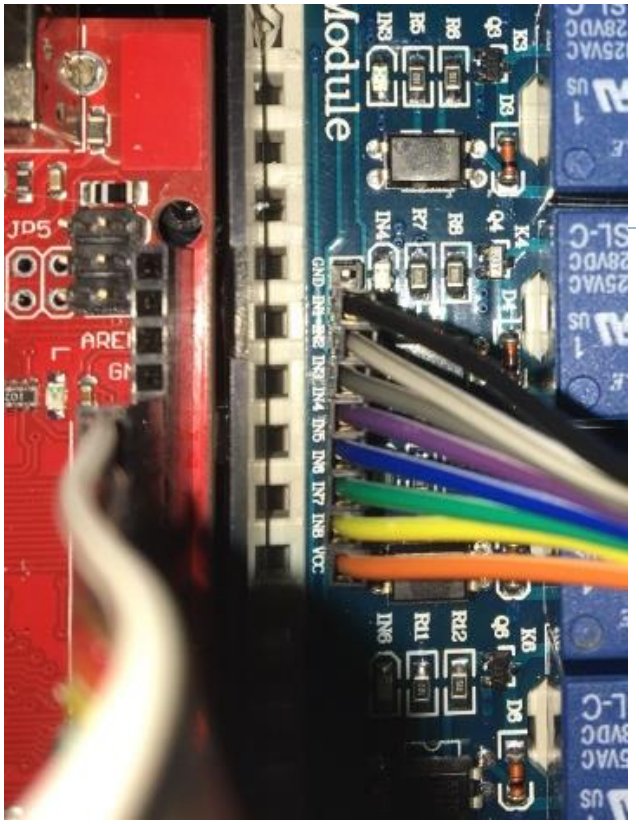
Connect black, white and green wires from the 3 bottom terminal blocks over to the corresponding terminals on the 5vdc power supply as shown.



Connect black 16awg wire from –V terminal on 5vdc power supply to the 6th from the bottom terminal block group.

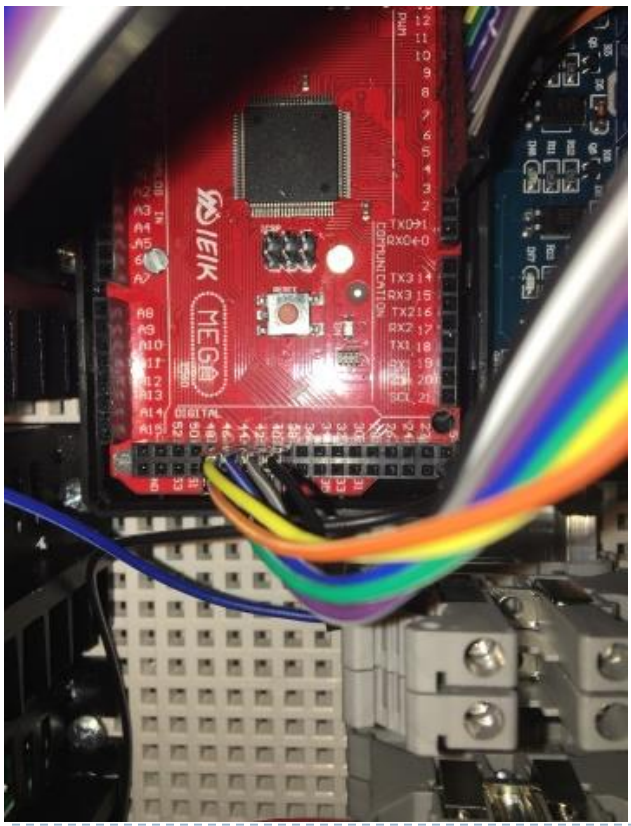


Connect red 16awg wire from +V terminal on 5vdc power supply to the 7th from the bottom terminal block group.



Connect a ribbon of (8) wires from the 8 channel relay board to the arduino as follows:

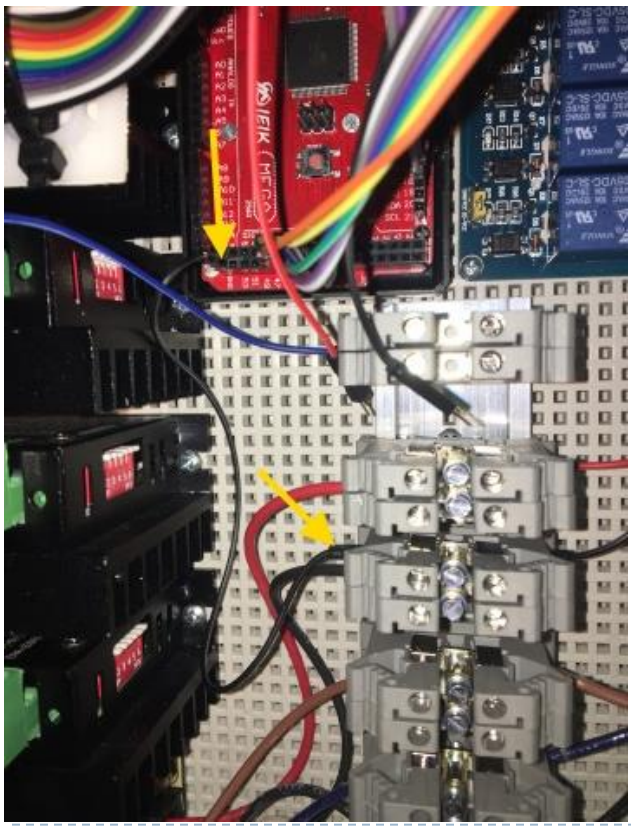
- IN1 to black to arduino pin 38
- IN2 to white to arduino pin 39
- IN3 to grey to arduino pin 40
- IN4 to purple to arduino pin 41
- IN5 to blue to arduino pin 42
- IN6 to green to arduino pin 43
- IN7 to yellow to arduino pin 44
- IN8 to orange to arduino pin 45



This photo shown the other end of the ribbon connected to pins 38 through 45 on the arduino.

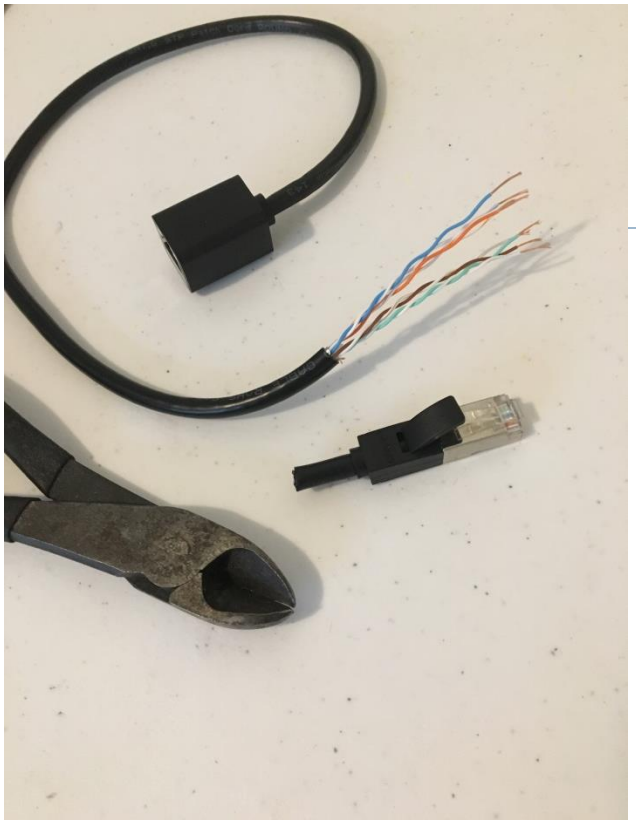
Connect a long red jumper from the VCC terminal on the relay board to the +5vdc terminal blocks on the DIN rail (7th from the bottom)

Connect a long black jumper from the GND terminal on the relay board to the -5vdc terminal blocks on the DIN rail (6th from the bottom)

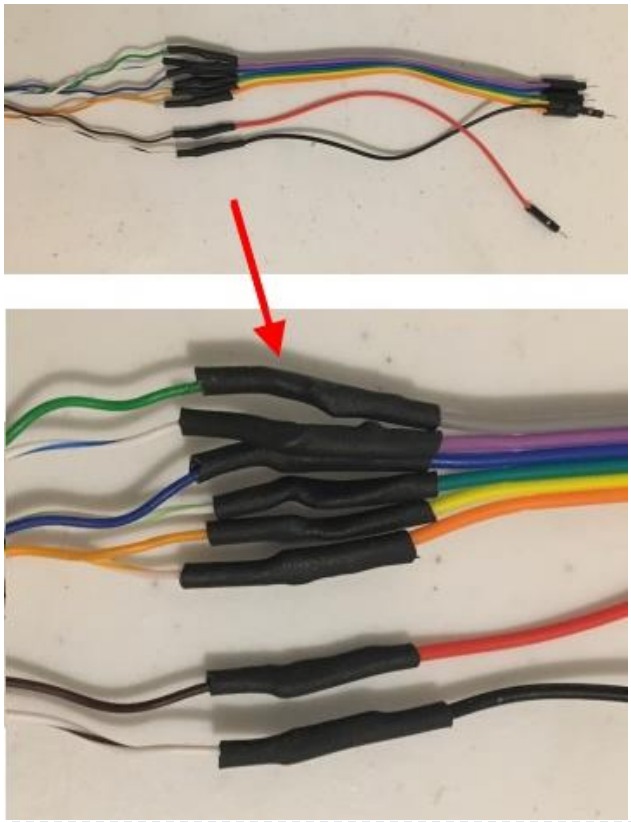


Connect a long black jumper from the far bottom left GND terminal on the arduino to the -5vdc terminal group on the DIN rail (6th from the bottom)

The arduino and the 5vdc power supply must share ground connection – the 5vdc supply powers the relays as the arduino tends to run short on power.



Cut off the male end of an RJ45 extension cable, remove 2” of outer sheathing then strip ¼” sheathing off each individual wire.



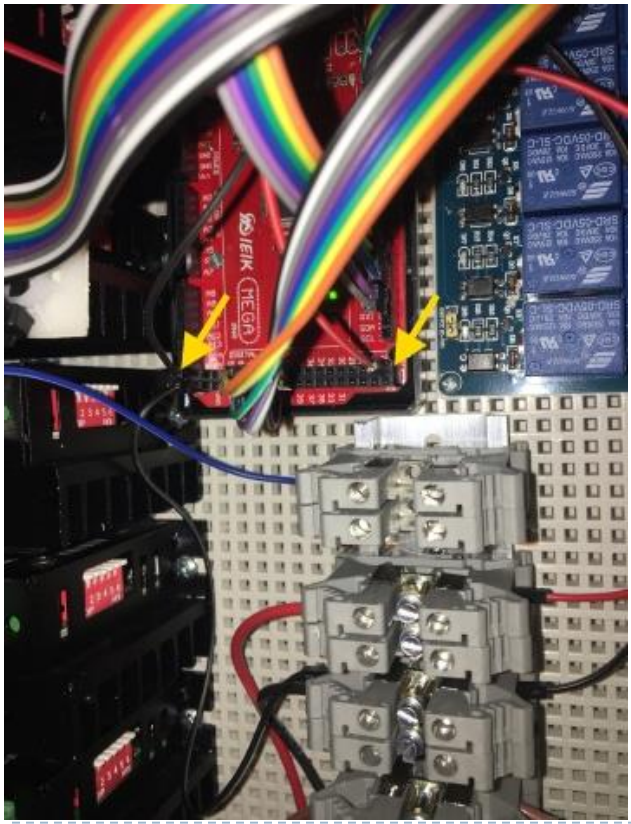
Solder and heat shrink tube a (6) ribbon set of jumpers as follows:

- RJ45 white/or stripe to orange to arduino pin 14
- RJ45 or/white stripe to yellow to arduino pin 15
- RJ45 white/gr stripe to green to arduino pin 16
- RJ45 blue/white stripe to blue to arduino pin 17
- RJ45 white/blue stripe to purple to arduino pin 18
- RJ45 green/white stripe to grey to arduino pin 19

Then connect:

- RJ45 brown/wh stripe to red jumper to arduino +5v
- RJ45 white/brown stripe to black jumper to arduino GND

Feed RJ45 cable assembly through ½" gland nut on left side of enclosure and plug (6) wire ribbon into arduino pins 14 through 19 as shown.



Connect red wire from RJ45 cable assembly to the +5v pin on far bottom right of board.

Connect black wire from RJ45 cable assembly to the other unoccupied GND pin on far bottom left of board.

Set the dip switches for J1 stepper driver:

J1=
- Switch 1 – down
- Switch 2 – up
- Switch 3 – up
- Switch 4 – up
- Switch 5 – down
- Switch 6 – up

Set the dip switches for J2 stepper driver:

J2=
- Switch 1 – down
- Switch 2 – up
- Switch 3 – up
- Switch 4 – down
- Switch 5 – up
- Switch 6 – down

Set the dip switches for J3 stepper driver:

J3=

Switch 1 – down
Switch 2 – up
Switch 3 – down
Switch 4 – down
Switch 5 – down
Switch 6 – up

Set the dip switches for J4 stepper driver:

J4=

Switch 1 – up
Switch 2 – down
Switch 3 – up
Switch 4 – down
Switch 5 – up
Switch 6 – up

Set the dip switches for J5 stepper driver:

J5=
- Switch 1 – down
- Switch 2 – up
- Switch 3 – up
- Switch 4 – up
- Switch 5 – down
- Switch 6 – up

Set the dip switches for J6 stepper driver:

J6=
- Switch 1 – down
- Switch 2 – up
- Switch 3 – up
- Switch 4 – down
- Switch 5 – up
- Switch 6 – up

This table outlines stepper driver switch settings.

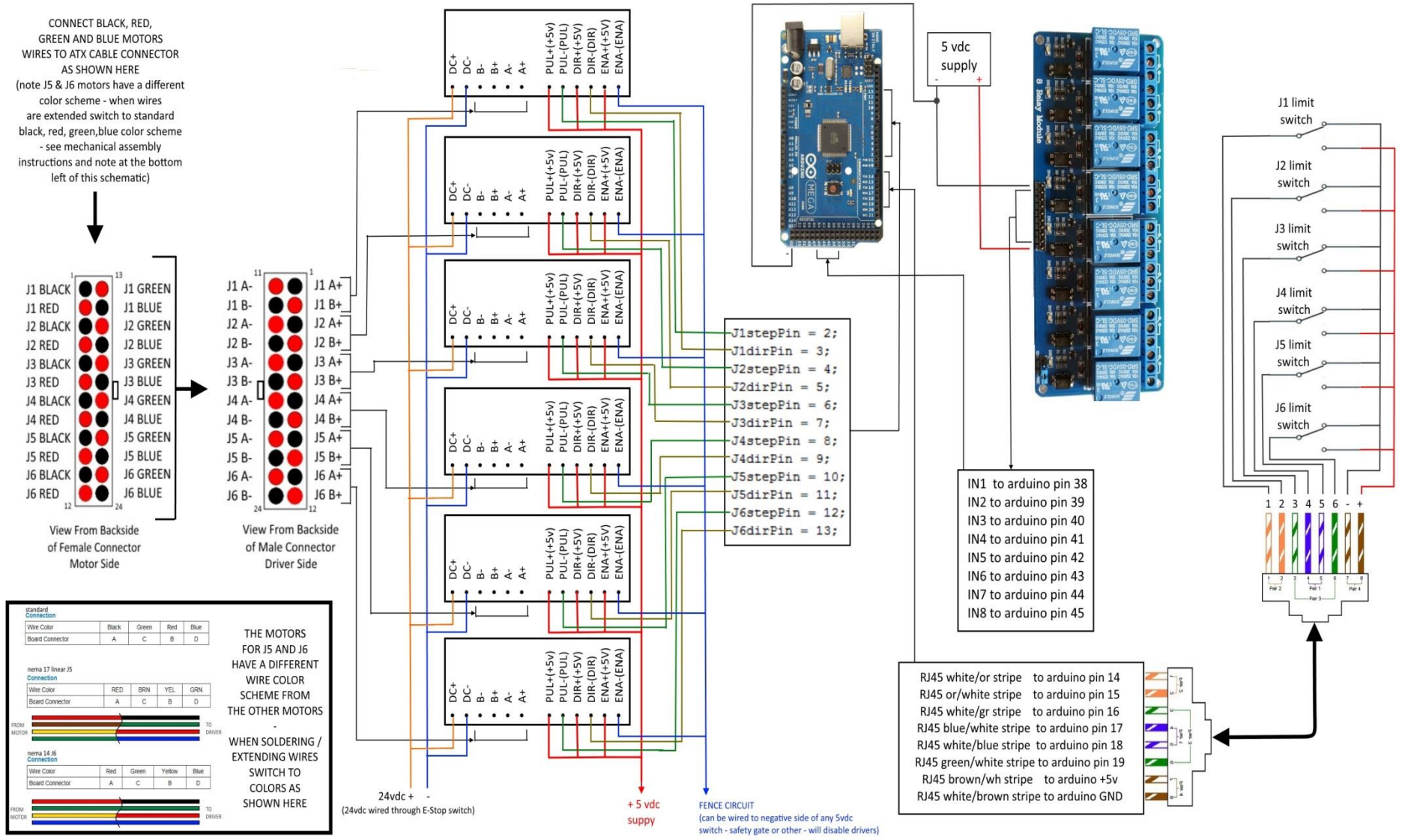
Microstep Selection

Microstep	S1	S2	S3
OFF	0	0	0
1	0	0	1
1/2A	0	1	0
1/2B	0	1	1
1/4	1	0	0
1/8	1	0	1
1/16	1	1	0
OFF	1	1	1

Current Setting

Current(A)	S4	S5	S6
0.5	0	0	0
1.0	1	0	0
1.5	0	1	0
2.0	1	1	0
2.5	0	0	1
3.0	1	0	1
3.5	0	1	1
4.0	1	1	1

AR2 - 6 AXIS STEPPER MOTOR ROBOT WIRING SCHEMATIC



Startup

- I would recommend waiting to loom all the wires on the robot until after you have started up the robot so you can make sure all axis fully articulate and you have plenty of slack on the wires.
- Load the "sketch_Annin_Robot.ino" to the arduino and take note which COM port your arduino is connected to.
- Before opening the AR2 software and establishing a serial connection toggle each limit switch on the robot and make the the LED on the arduino lights up. Every switch should make the LED come on its imperative these all work otherwise you cannon calibrate the robot.
- Open the AR2 software and set the COM port (you should only have to do this the first time)
- Carefully test each axis – jog J1 through J6 a couple degrees *(be careful – robot is not calibrated yet and you can drive an axis too far and bend one of your switches)* in each direction to make sure you can jog in each direction. If you find an axis not moving or if the + and – jog buttons make the axis go in the same direction then you very likely have an issue with the step or direction wires to the stepper drivers or an issue with one of the many jumpers. I have found every problem I have encountered has been due to a jumper not making connection or coming loose. I cant stress enough the need to secure each wire and check with a meter.
- Press the manual calibrate button – the robot should move to each limit switch and calibrate each axis to its limit.
- J1 should go to its full negative limit @ -166°
- J2 should go to its full negative limit @ -128°
- J3 should go to its full positive limit @ +140°
- J4 should go to its full positive limit @ +167°
- J5 should go to its full negative limit @ -105°
- J6 should go to its full negative limit @ -116°

- You should now be able to use your robot.