

# Construction

## Electronics

### Pinouts

See JEOL 1200ex v2 Stage Electronics spreadsheet for definitive pinouts

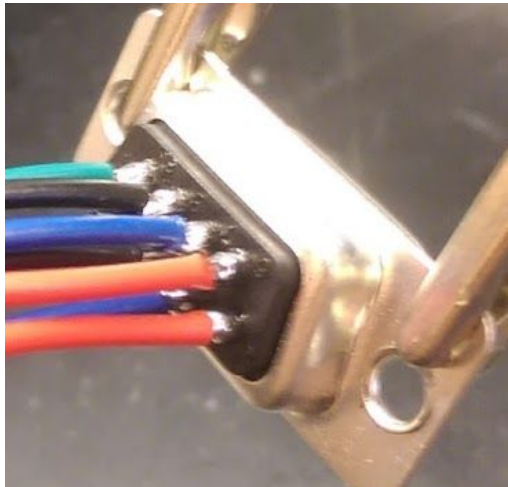
### Motor control boards

Modify jumpers to make this Arduino compatible

- Unsolder SB40, solder SB41
- Unsolder SB34, solder SB12
- One 1 board, Unsolder SB23, solder SB7 (this becomes the reel motor board)

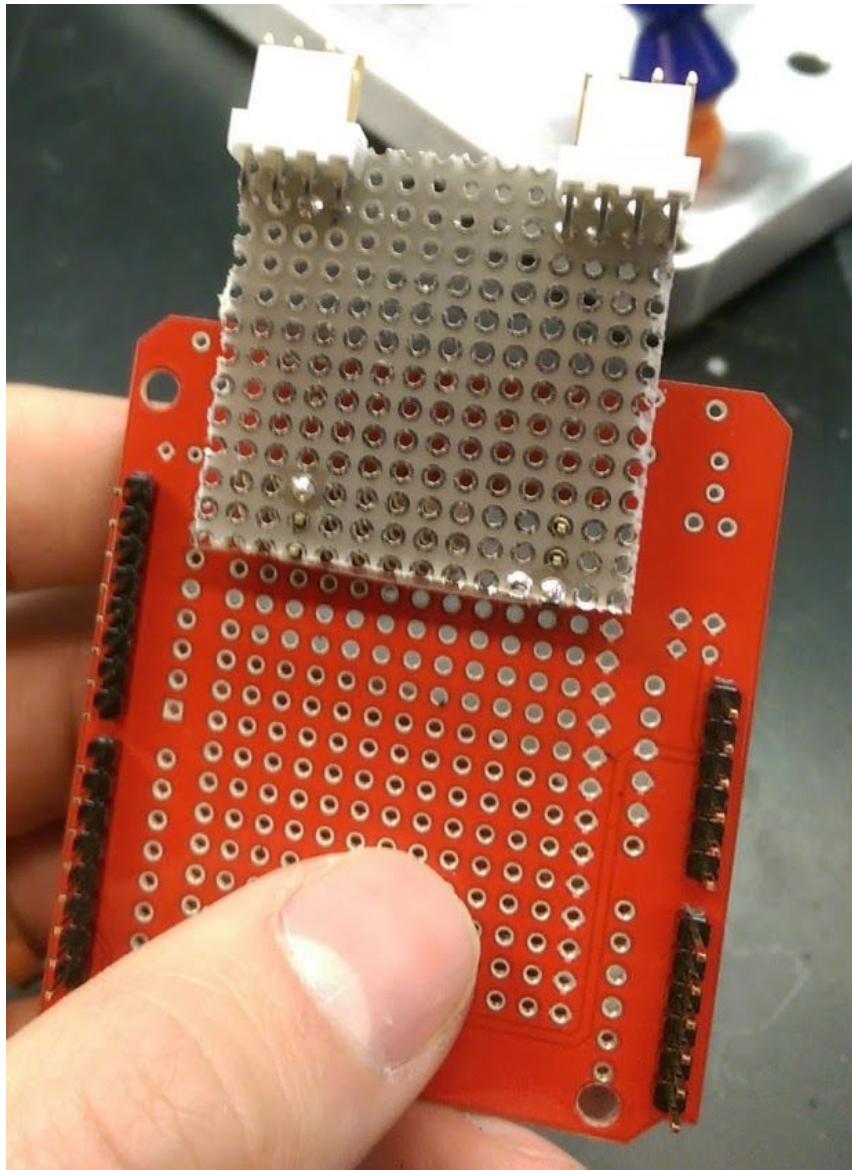
### Motors

Connect both feed steppers to 1 db-9 and both pickup steppers to a 2nd db-9 as follows:

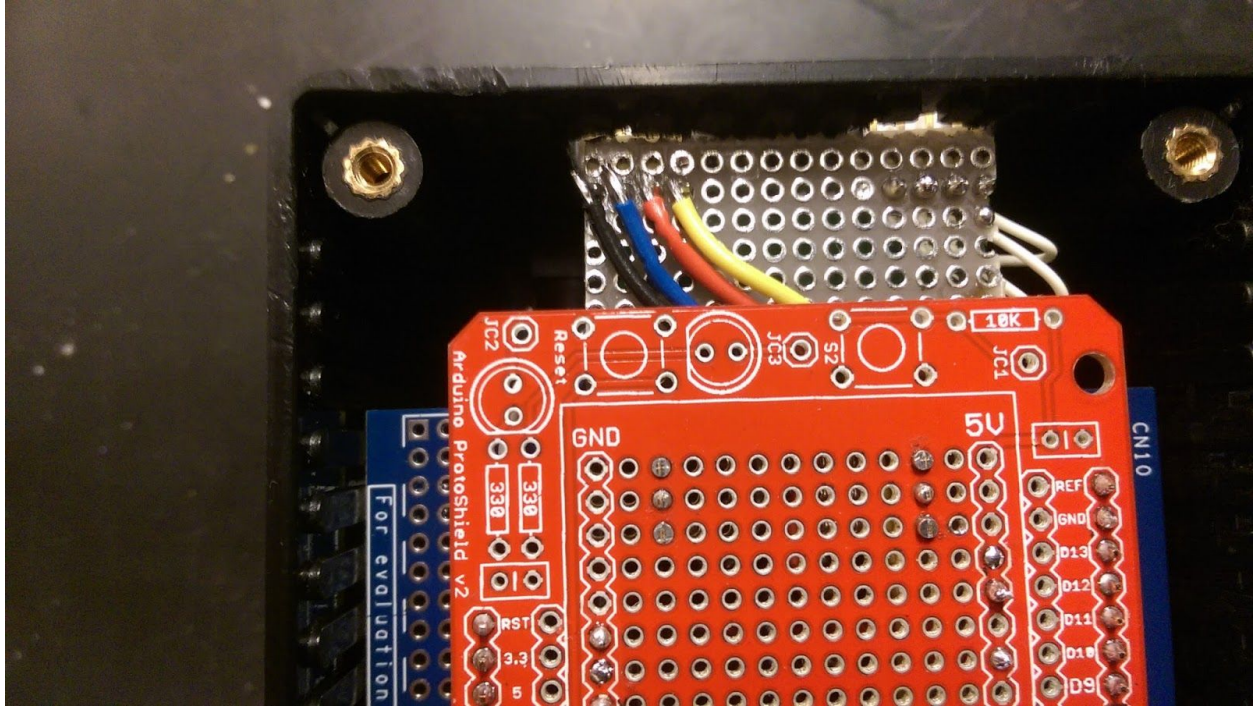


### Wheatstone bridge amplifier

Solder a protoboard piece to protoshield, so it extends beyond the shield and towards the edge of the enclosure:



14 x 14 holes



Connect 2 x 4 pin headers to this protoboard, connect up the wheatstone bridge amplifier output as follows:

- Scale DOUT : A0
- Scale SCK : A1
- Scale VCC : 5V
- Scale GND: GND

Solder the amplifier to the underside of the protoboard.

Connect the following to the 4 pin header (from left to right when looking at the connector from outside the enclosure)

1. E+ (Lemo: 9, Gray)
2. E- (Lemo: 7, Violet)
3. A- (Lemo: 8, Blue)
4. A+ (Lemo: 10, White)

The lemo color corresponds to the wire color of the 10 wire bundle (~1.5 feet) that runs from the lemo connector to the enclosure.

## Load Cell

With silver solder and kapton insulated wire, extend wires for tension sensor by ~6 inches. Connect extended wires to lemo feedthrough with pinout as above.

## LED

Make a 4 pin wound bundle, of ~1.5 ft length, for the LED with the following pinout (left to right looking at the connector from outside the enclosure):

- Yellow 12V (12V)
- Red 5V (Don't connect this to the arduino)
- Blue Control (D3)
- Black Gnd (GND)

Connect these to the buck-puck. Also, connect the LED- and GND on the buckpuck and the LED+ and LED- to the correct pins on the LED.

After soldering the LED, tap the holes (4-40) on the heatsink, use some thermal tape and adhere the LED. Tape over the contacts after screwing in the LED with socket head cap screws. Now double sided tape the buck-puck to the heat sink clean up the wiring and zip tie the heat sink to the LED mount.

## Enclosure

Cut holes for the following in the enclosure:

- One end
  - Arduino USB
  - 2x 4 pin connectors
- Other side
  - Power plug (not the one on the Arduino)
  - 2x db-9 connectors (for steppers)

Something like the following template (scaled to fit the ends of the enclosure)



## Hardware

Deburr parts and make final modifications

1. Channel (top/bottom):
  - a. Deburr and polish channel surfaces

- b. Round off channel entrance and exit
2. Make sure piezo plates are flat and burr free
3. Check all oring sealing surfaces

## Chamber cleaning

Clean all parts that will go into vacuum with the following:

1. Wipe off any visible dirt
2. Wash in hot water and alconox
3. If possible, place in ultrasonic cleaner for 5 minutes with alconox and water
4. Rinse thoroughly with hot water
5. Rinse with DI water
6. Rinse with Acetone
7. Rinse with 100% ethanol

## Custom hardware

Machine the following (per stage):

- 2x pinch drive pulleys (remove set screw portion, re-glue)
- Modify 2x KF-25 feedthroughs
  - Tension: ? OD hole
  - Smaract: ? OD hole
- Tape roller screws (SS, 4-40 x 1/8 x 5/8 shoulder screw) cut threads with dremel to vent
- Drill out bore to 5mm for 2x 1/8 MXL 15 tooth 3/16 bore

Waterjet cut the following (per stage):

- 2x pinch\_drive\_clamp\_short (1/8" stock)
- 2x reel\_drive\_clamp (1/8" stock)
- Glue orings to drive rollers (after cleaning the rollers)
- Clean the bearings and reoil them with vacuum pump oil or vacuum grease

## Assembly

1. Piezo chamber
  - a. Assemble piezo stack
    - i. Affix baseplate to XY piezo stack (alignment!)
    - ii. Affix topplate to XY stack (alignment!)
  - b. Assemble channel (tape together)
    - i. Preload??
  - c. Affix piezo stack to piezo chamber
  - d. Affix KF-25 tee to piezo chamber
  - e. Feed loadcell through kf-25 tee and into piezo chamber
  - f. Assemble and mount loadcell
  - g. Affix smaract feedrough to kf-25 flange
  - h. Affix kf-16 viewport to piezo chamber lid

2. Reel housing (feed + pickup) [some of this might be best done AT the installation site]
  - a. Insert ferrotec feedthroughs
  - b. Mount idle roller & pinch drive roller at same time
  - c. Mount reel hub (if needed use a precision spacer behind the hub to get the spacing right)
  - d. Affix reel flange (right for fee, left for pickup) (must be done BEFORE steppers)
  - e. Affix reel to kf-16 flange one 1 side (left for feed, right for pickup)
  - f. Affix kf-16 viewport to kf-16 flange
  - g. For pickup only, affix reel flange to takeup reel flange
  - h. Affix pinch and reel plates
  - i. Insert 1x screw for reel flange, then affix ferrotec clamps
  - j. Mount pulleys + slip clutch
  - k. Mount belts and steppers
  - l. Run wiring

## Testing

### Vacuum testing

Vacuum test the following:

- Reel housings (feed and pickup)
  - With no extra flanges
  - With all extra flanges
- Piezo chamber (on column?)
  - By itself
  - With KF-25 Tee
  - With reel housings

### Movement testing

Test that piezos move with no reported errors

Test pinch drive movements and note directions

Test tape movement

## Installation

1. Remove front left and back right plugs + plates
2. Insert pickup rest
3. Insert front\_left\_xy\_flange
4. Affix piezo chamber
5. Mount channel
6. Align channel

7. Mount pickup housing
8. Mount feed housing