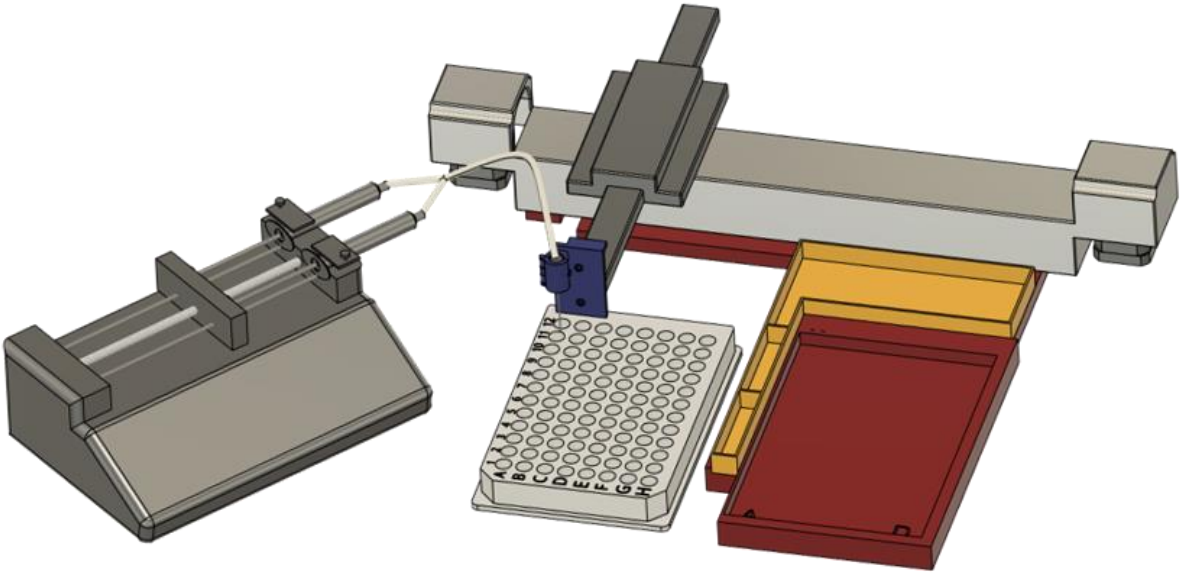


Pen Plotter Liquid Handler Build Guide

By: Apostolos Maroulis, Dylan Waynor

Parts List

AxiDraw Spacial System

Axidraw V3/B6 **get model number better specific specs**

3D Printed attachments (Files Included)

Fluidic Needle holder- PLA

Luer ‘straight line connector’ stabilizer - PLA

Stage/Platform - PLA

Fluidic System

40mm 20/22 gauge hypodermic needle

IDEX F-0.25-28/M-Luer (P-655)

IDEX Flngls Sys Short PEEK ⅛ 10pk (XP-335X)

38 in IDEX Tub FEP nat 1/8x.062 x 50ft (1521L)

(2X) IDEX F-Luer/F-Union (P-628)

(2X) BD 1ml syringe Luer-Lok tip

Plastic Tubing Cutter (A-327)

P-514 - PEEK Y Assembly 1/4-28 .060in thru hole

ChemyX Syringe pump Fusion 200x

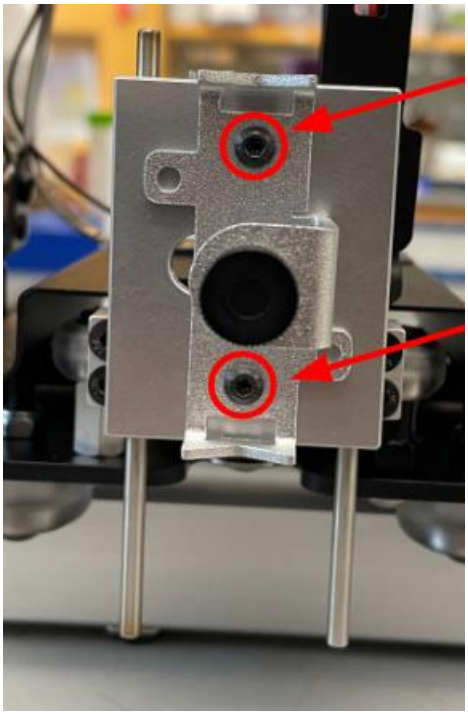
*Some disposable parts of the system will need replacement between experiments due to contamination

Spatial Movement: Axidraw System

The ‘out of the box’ Axidraw V3/B6 must be modified for our purposes. System differences in hardware may alter the appearance of some components of the guide, but the structure should be the same.

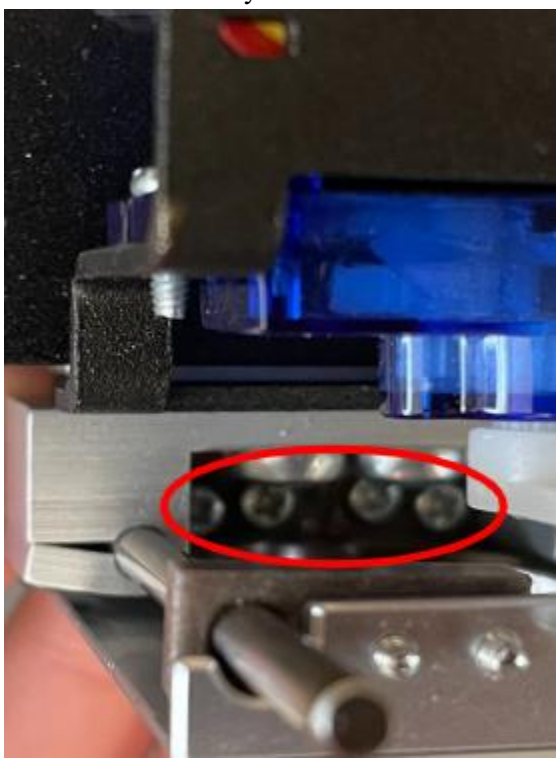
Step 1. Remove Pen Holder

1.1. Remove the two screws holding the outwards facing pen holder. This should expose the flat carriage. (hold onto the button head screws, they will be used in a later step)

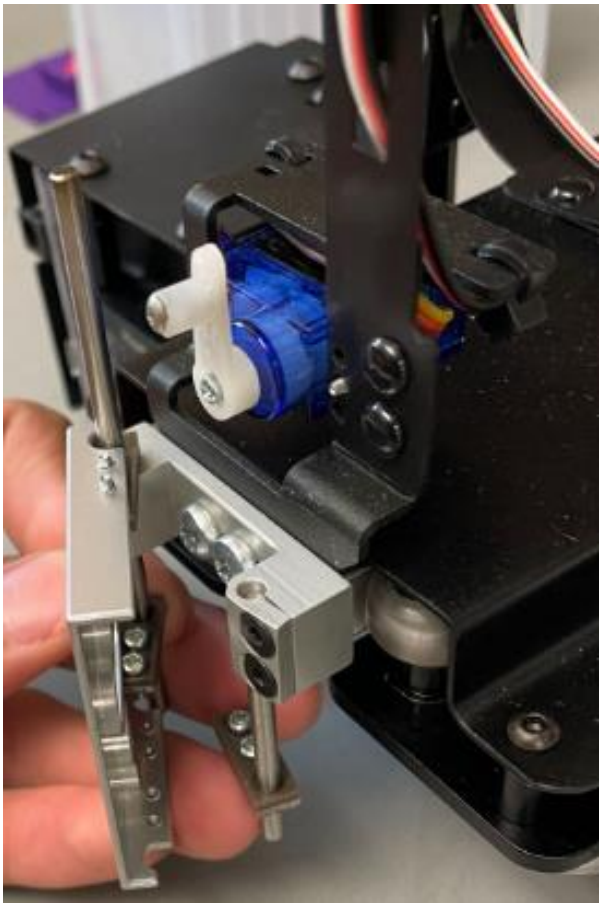


Step 2. Lowering the guide pins

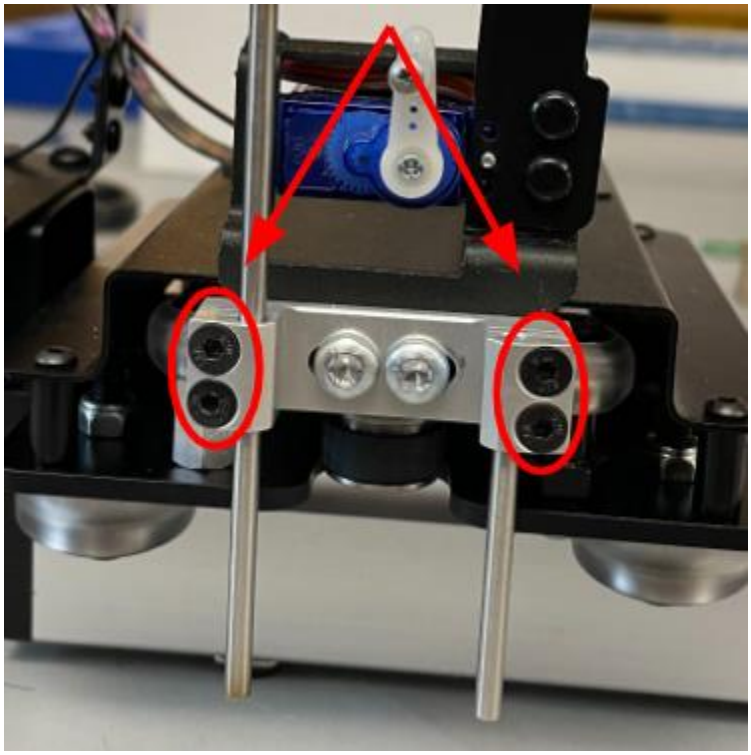
2.1. (looking down from the top of the carriage) Remove the bottom four screws holding the carriage. Take into consideration which screw goes on each side. The screws are ‘side dependent’ and will produce resistance when reattached incorrectly.



2.2. Once the screws are out, rotate the carriage piece outwards to clear the servo lever. If there is resistance, then slightly loosen the screws holding the top (brown) guide pieces (The guide pieces may fall, remember to keep track of side specific screws). To fully remove the carriage, tilt it up and slide it off from the top.

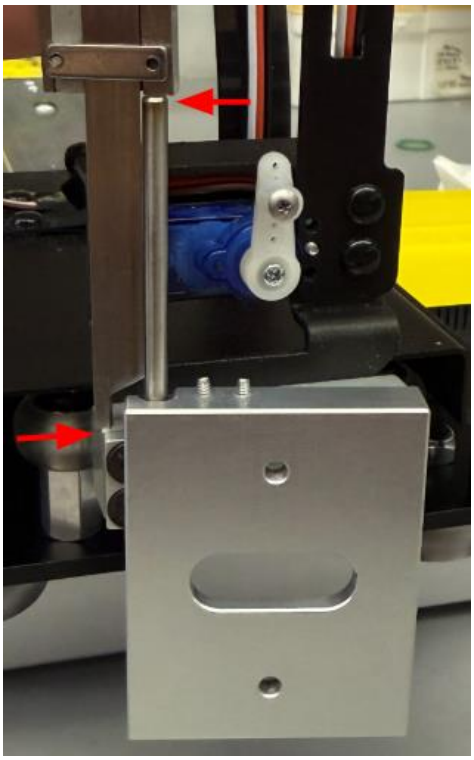


2.3. Loosen the four screws that clamp down on the guide pins. (Make sure to fully insert your allen key as to not strip the screws)



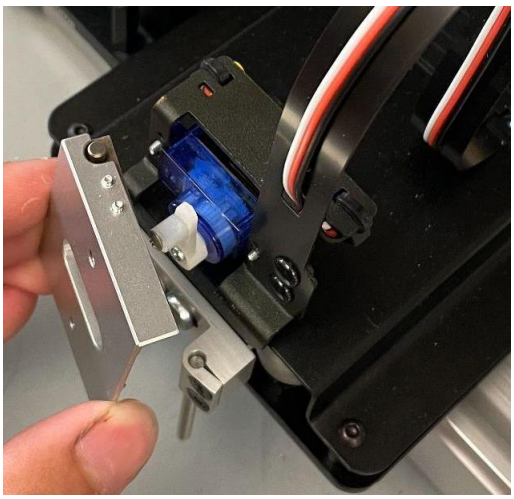
2.4. Adjust guide pin height

Set the top height of the longer bar to a length of 1.7in from the top of the guide pin clamp. (In the image below the carriage piece is on for reference height) To secure the guide pin's height tighten the screws.



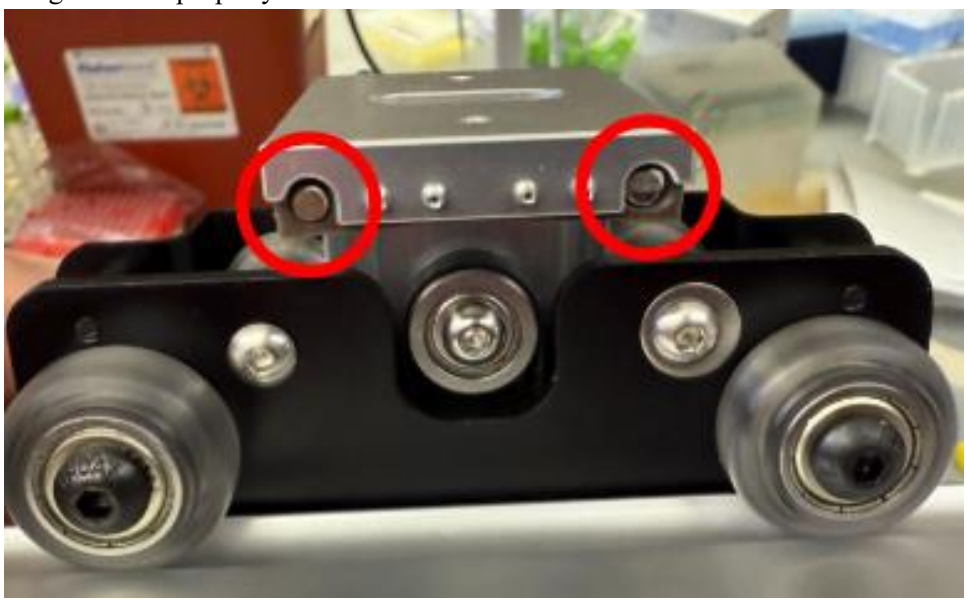
2.5. Re-install Carriage

Insert the top of the carriage at an angle making sure that the top lip of the carriage goes **BELOW** the servo lever.



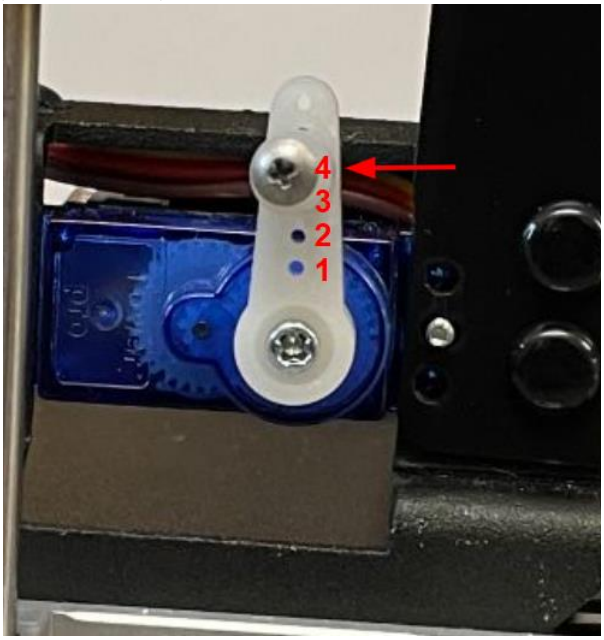
Re-attach the (brown) guide pins into the carriage by fastening the four screws. (To ensure smooth movement slight adjustments of the guide pins may be done by loosening and tightening)

2.6. Double check this last step by ensuring that the bottom end of the two pins do not protrude below the carriage and are properly stabilized.



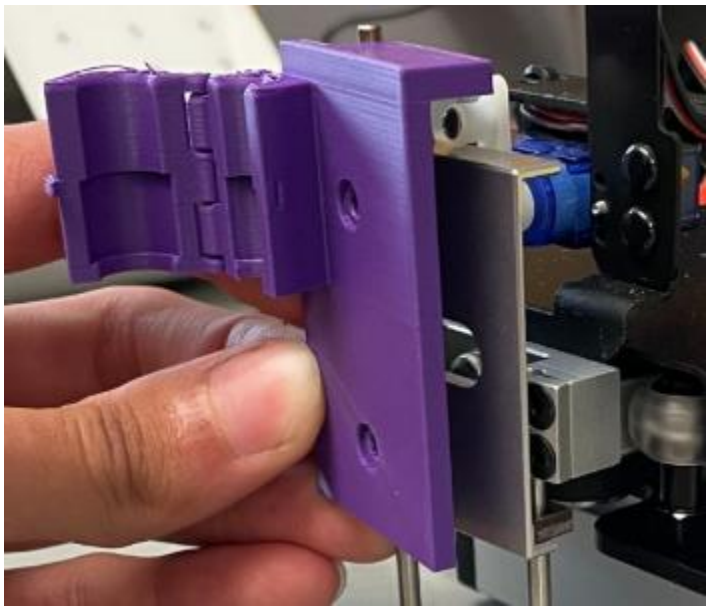
Step 3: Adjust the servo Lever position

The ‘out of the box’ servo lever position is adjusted by moving the placed screw. For our build we adjust the to the ‘fourth’ position (shown below).

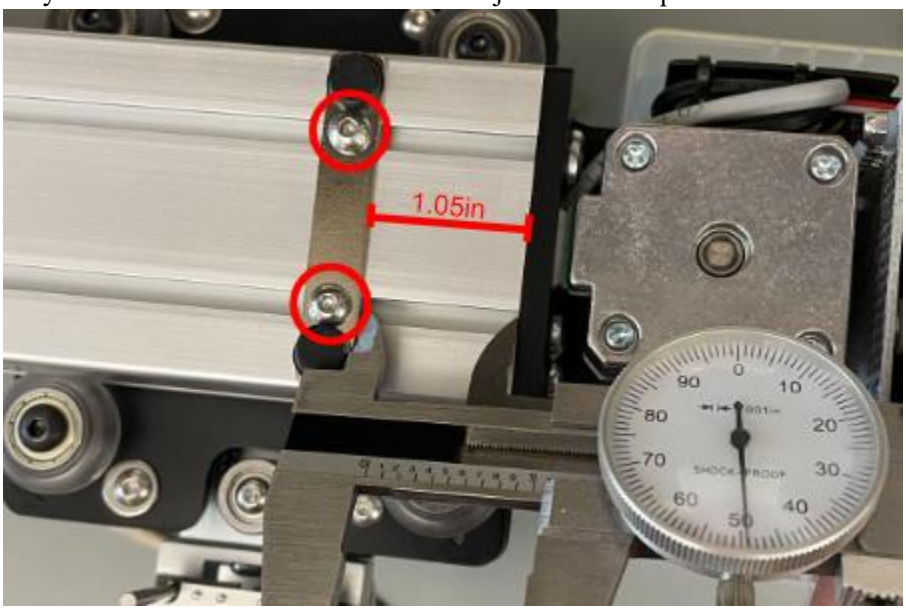


Step 4: Install 3D printed Needle holder

Lift the Carriage upwards below the servo lever. Place the printed needle holder above the servo lever. This should allow the servo lever to be sandwiched between the aluminum and printed lips.
Using The two screws taken off in Step 1, fasten the needle holder to the carriage.

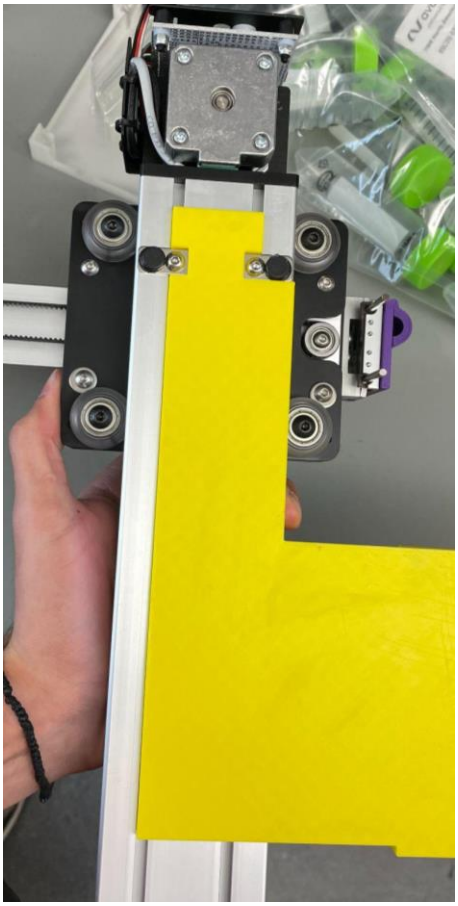


Step 5: Adjust the rubber feet of the AxiDraw
Carefully flip the device over. Unscrew the two button head screws, and move the rubber feet plate to 1.05 inches (26.67mm) from the black endplate. This introduces a standard base point of contact that will be used in the next step.
(for this step it may be beneficial to find two box-like objects to hold up the device at its motors)



Step 6: Install 3D printed platform

Press the printed platform in so the notch lines up with the rubber feet plate, and ensure the two ridges fit in the slots on the underside of the device, as shown in the picture.



Fluidic System construction

Step 1. Preparation of materials

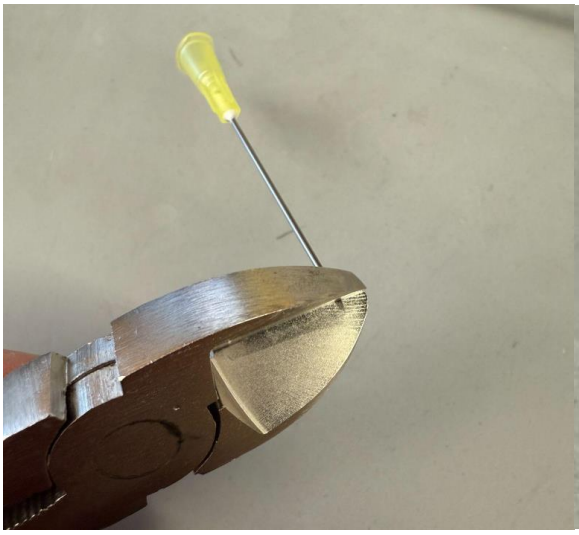
1.1. Tubing Preparation

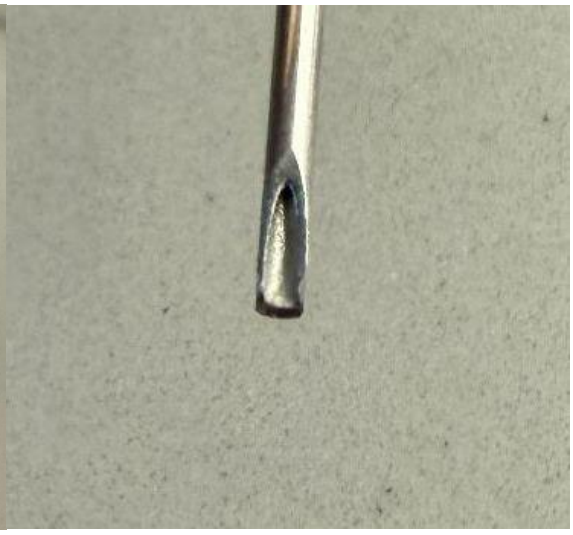
Cut the 1/8th OD tubing to 36 in (91.4 cm) long using a tubing cutter, or a utility knife, making sure to have a flat and perpendicular cut with no burrs

Also cut 2 short pieces of 1/8th OD tubing at 1 inch in length

1.2. Needle Preparation

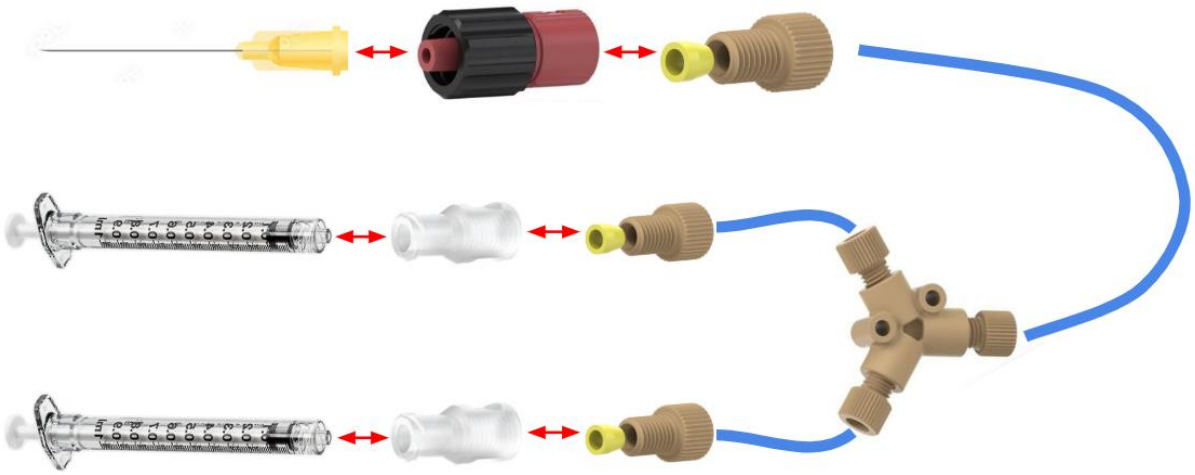
Snip the end of the hypodermic needle with a pair of side cutters, or other cutting tool. Make sure that you do not cave in the needle causing fluid transfer issues.





Step 2: Fluidic system assembly

The diagram below shows system assembly parameters. Tighten the Luer connectors to prevent leakage.



Step 3: Attach fluidic system assembly to Chemyx syringe pump and Needle holder This closes the loop between Spatial system and fluidic system.