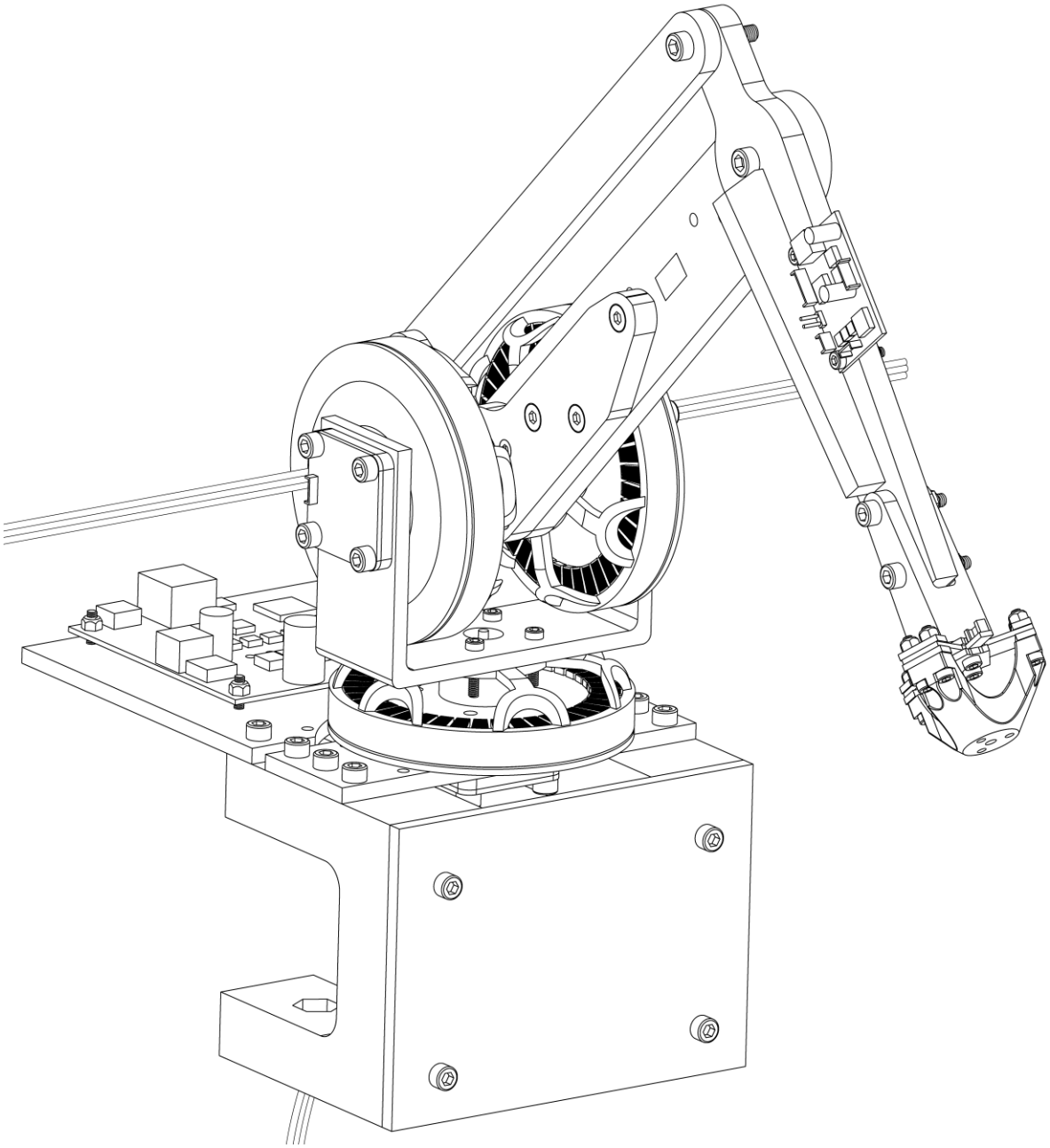
Mantis Desktop Assembly Guide



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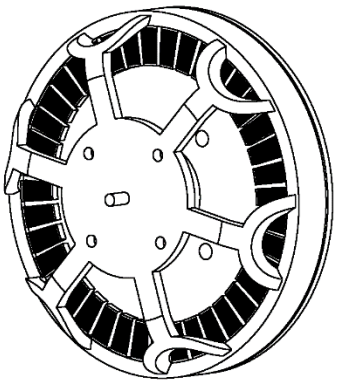
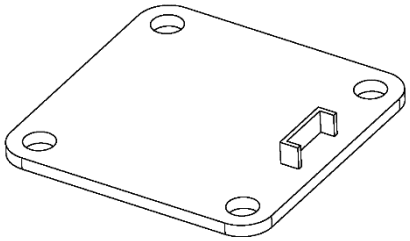
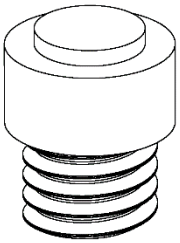
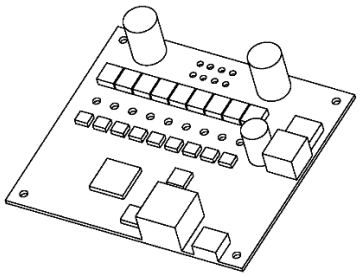
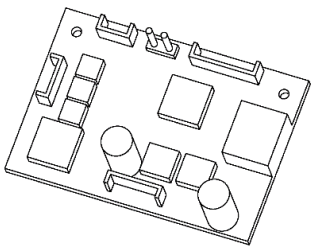
Introduction:

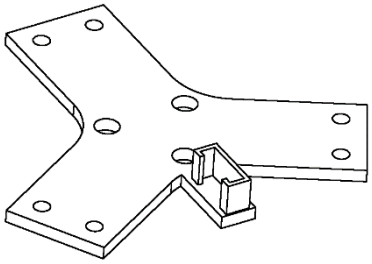
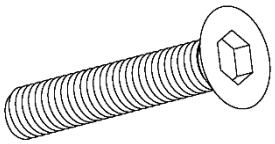
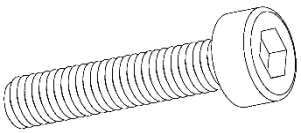
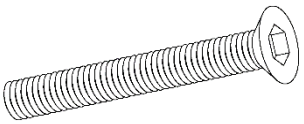
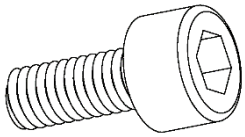
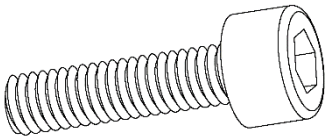
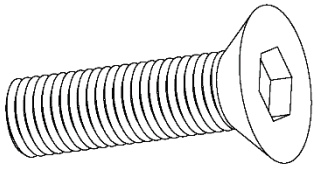
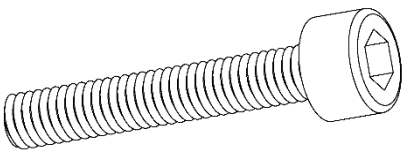
This document contains instructions for assembling the open source Mantis desktop haptic robot. The most recent version of this document along with the source materials can be found on our GitHub. (https://github.com/senmag-robotics/Mantis-Desktop/)

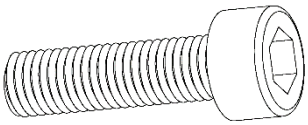
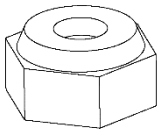
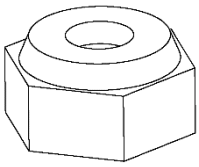
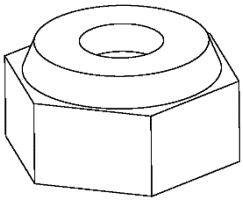
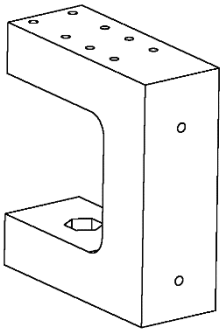
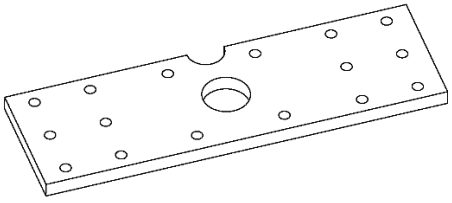
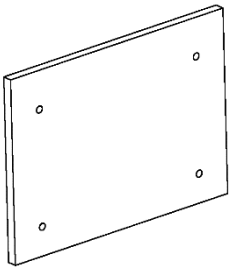
This document contains visual instructions for assembling a Mantis desktop from pre-fabricated parts. General information on fabricating / purchasing the parts can be found in the "PartFabrication.ods" file in the GitHub, and more detailed information including CAD files can be found in the Source/CAD folder.

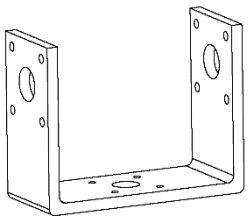
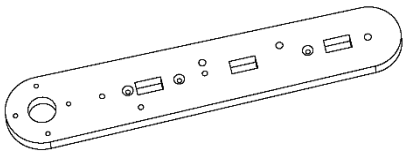
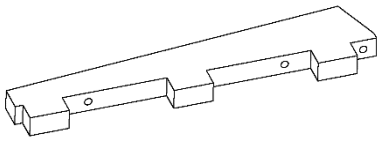
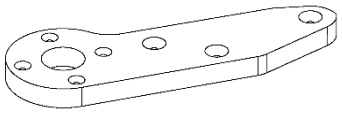
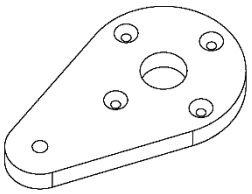
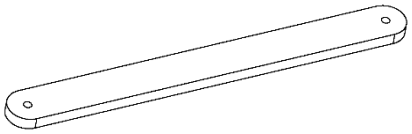
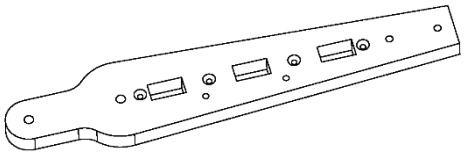
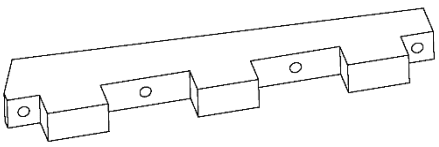
The next section in this document is the part index. This lists all of the major components needed to assemble the mechanics of the Mantis-mini. This section is followed with step-by-step instructions to assemble the parts. Connecting the electronics and uploading firmware will be covered by a separate document.

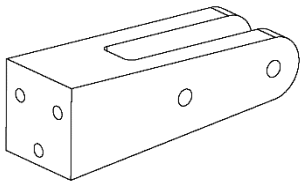
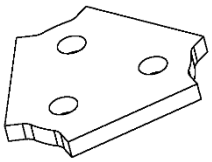
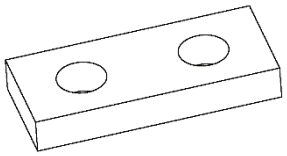
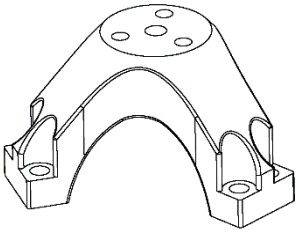
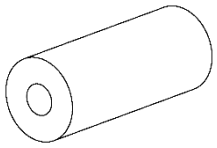
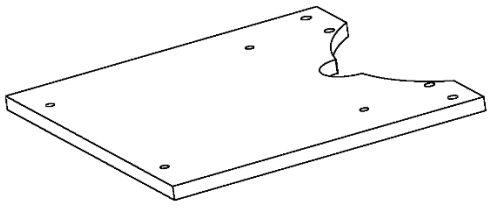
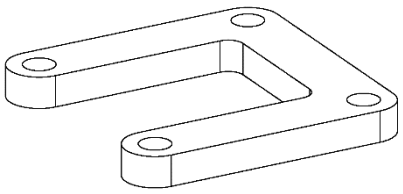
Part index:

Part reference	Quantity in kit	Description	Image
Motor	3	Brushless DC Motor. Produces Torque	
Encoder	3	Measures the angle of a magnet	
Encoder Magnet	3	Attached to motor, allows encoder to measure angle of motor.	
Main Controller	1	Main electronic controller	
Sensor Controller	1	Electronic controller for the force sensor	

Force Sensor	1	Force sensor – measures force output in 3D	
Bolt (M3 15mm countersunk)	15		
Bolt (M3 15mm Cap)	20		
Bolt (M3 22mm countersunk)	4		
Bolt (M4 10mm Cap)	6		
Bolt (M4 16mm Cap)	18		
Bolt (M4 12mm countersunk)	3		
Bolt (M4 25mm Cap)	2		

Bolt (M5 18mm Cap)	3		
Nut M3 Nyloc	12		
Nut M4 Nyloc	2		
Nut M5 Nyloc	3		
Part A	2	The base sections of the robot, designed to clamp onto a table edge.	
Part B	1	The top panel for the base	
Part C	1	The front panel for the base	

Part D	1	The shoulder pivot bracket	
Part E	1	The shoulder section of the arm	
Part F	1	The first stiffening brace for part E	
Part G	1	The second stiffening brace for pare E	
Part H	1	The elbow section of the arm	
Part I	1	The parallel link section of the arm	
Part J	1	The end section of the arm	
Part K	1	Stiffening brace for part J	

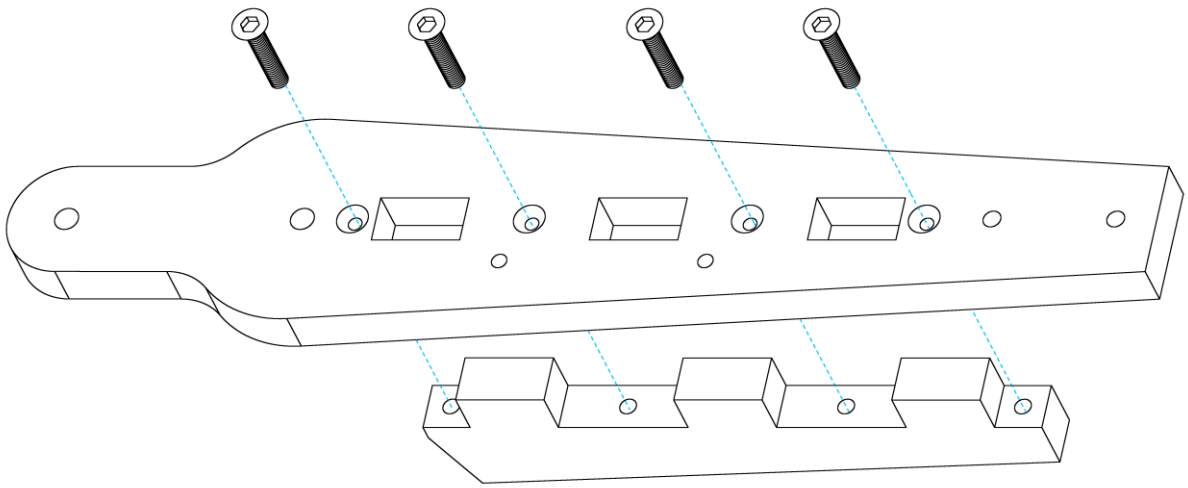
Part L	1	Attachment for the force sensor	
Part M	2	Washer plate for the force sensor	
Part N	6	Washer plate for the force sensor	
Part O	1	End cap of the force sensor	
Part P	1	Centre pin to make axle between motors	
Part Q	1	The panel that the main controller is attached to	
Part R	3	Spacer for the encoders	

Assembly Guide:

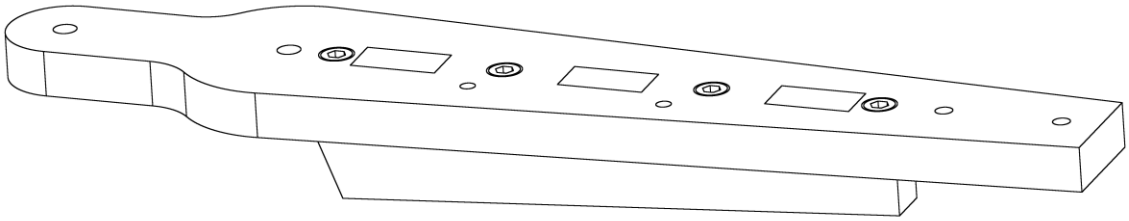
Step 1 – Attach the arm end brace part:

- M3 15mm countersunk (x4)
- Part J
- Part K

Directions:



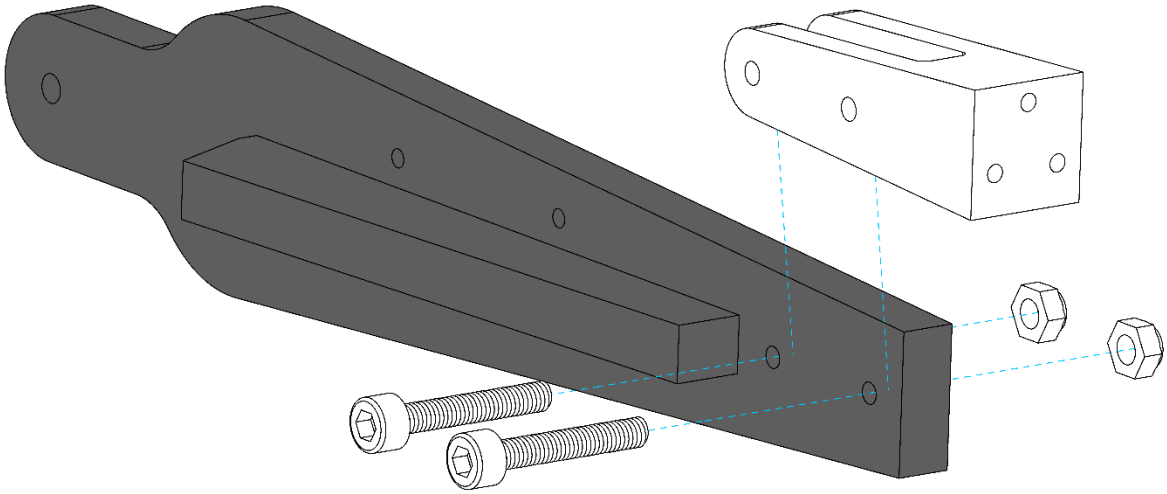
Finished:



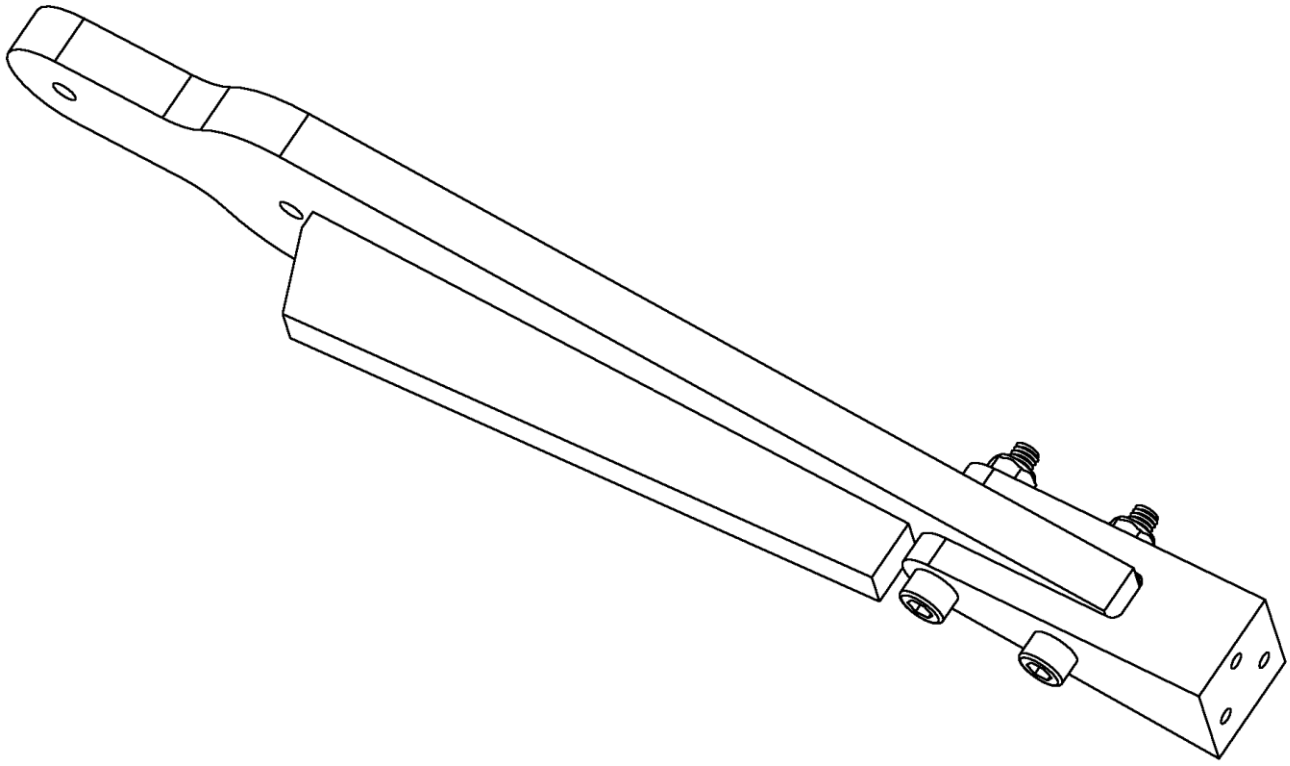
Step2, attach the force sensor mount:

- M4 25mm Cap (x2)
- M4 Nyloc nut (x2)
- part L

Directions



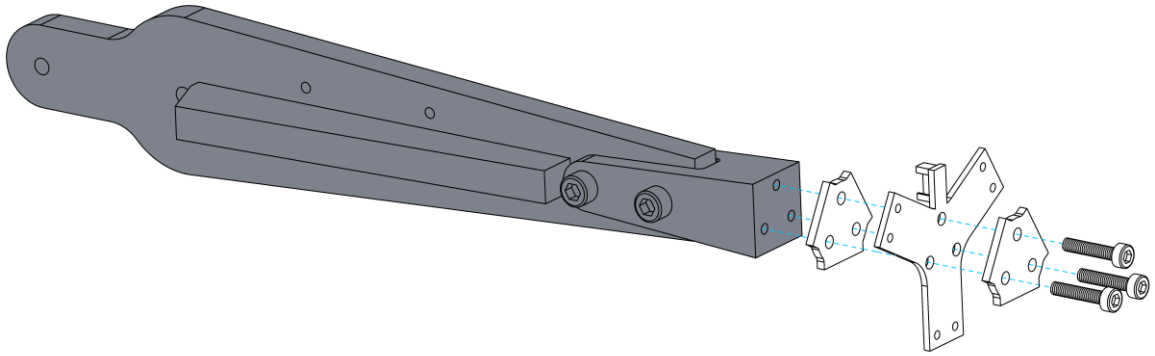
Finished:



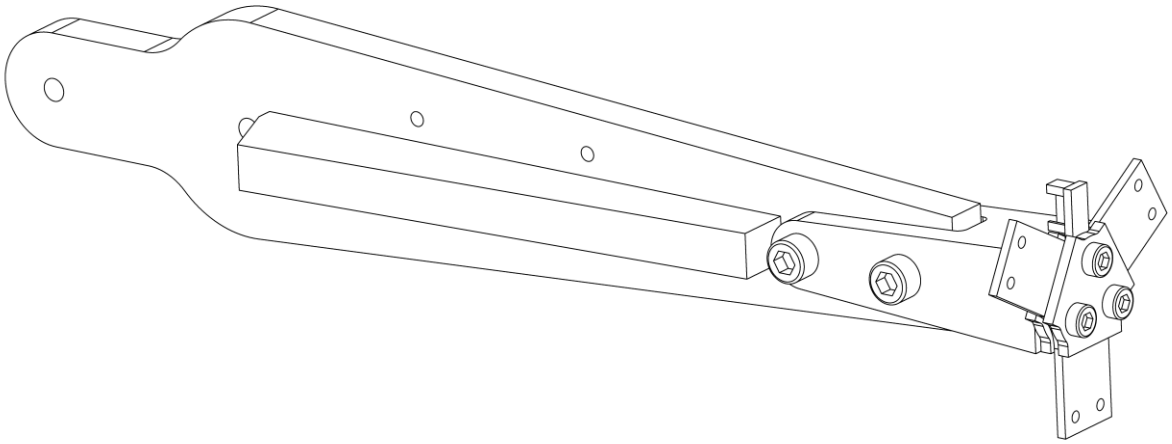
Step3, attach the force sensor:

- M3 15mm Cap (x3)
- Part M (x2)
- Force sensor

Directions:



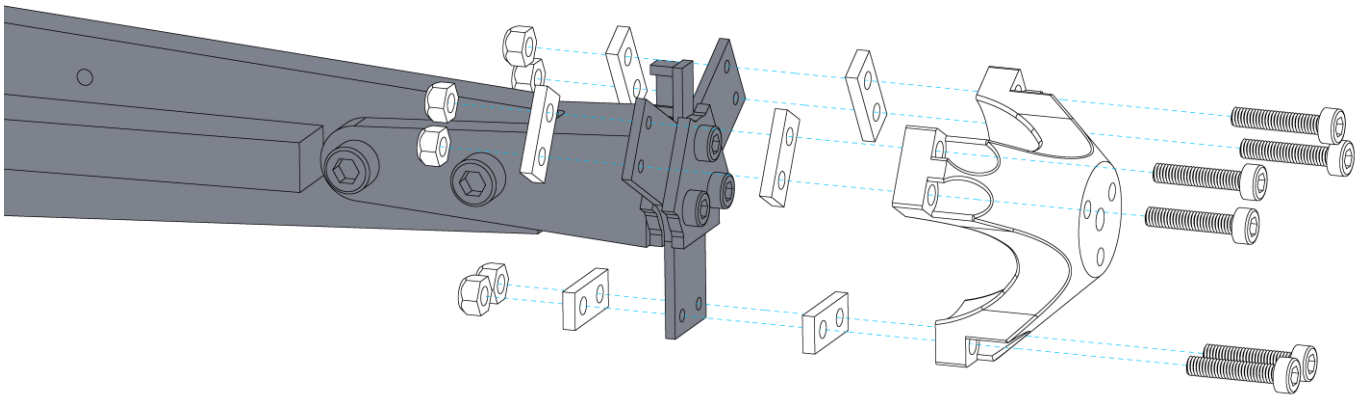
Finished:



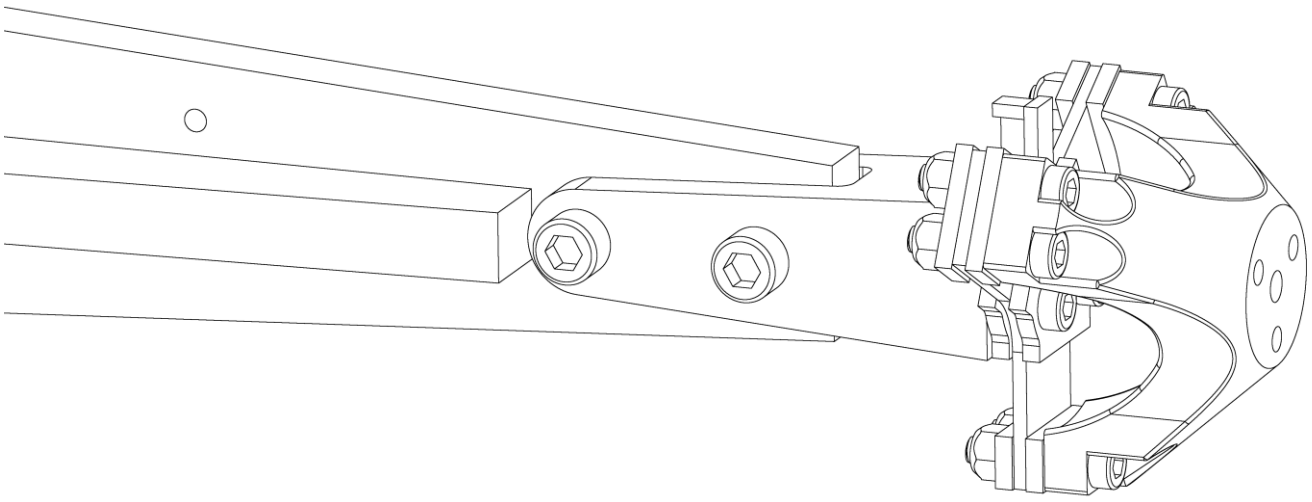
Step4, attach the end effector mount:

- M3 15mm Cap (x6)
- M3 Nyloc Nut (x6)
- Part N (x6)
- Part O

Directions:



Finished:



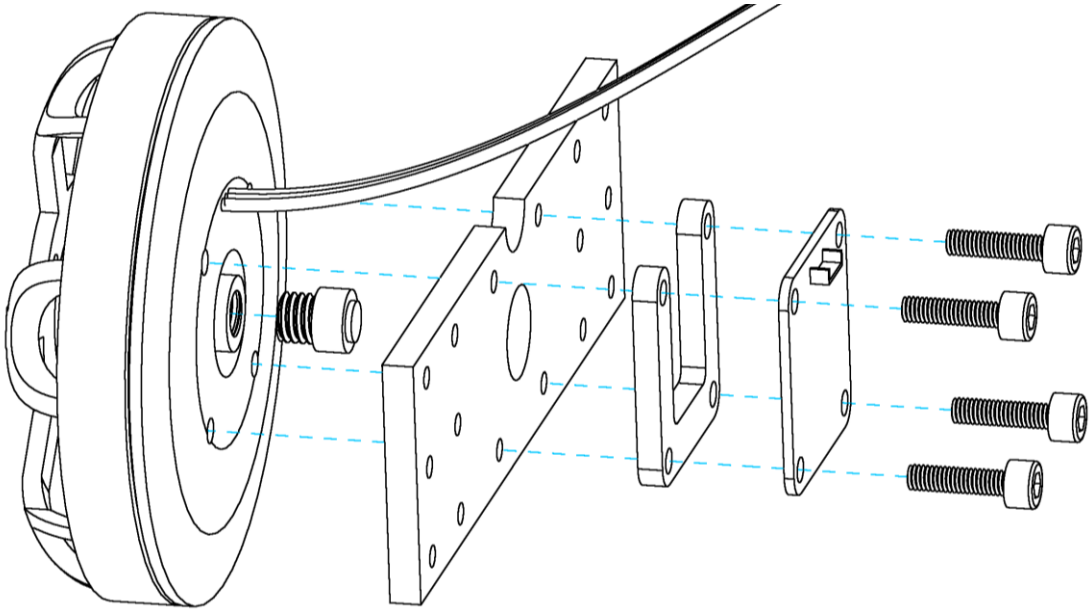
Step5, attach a motor and encoder to the baseplate:

- M4 16mm Cap (x4)

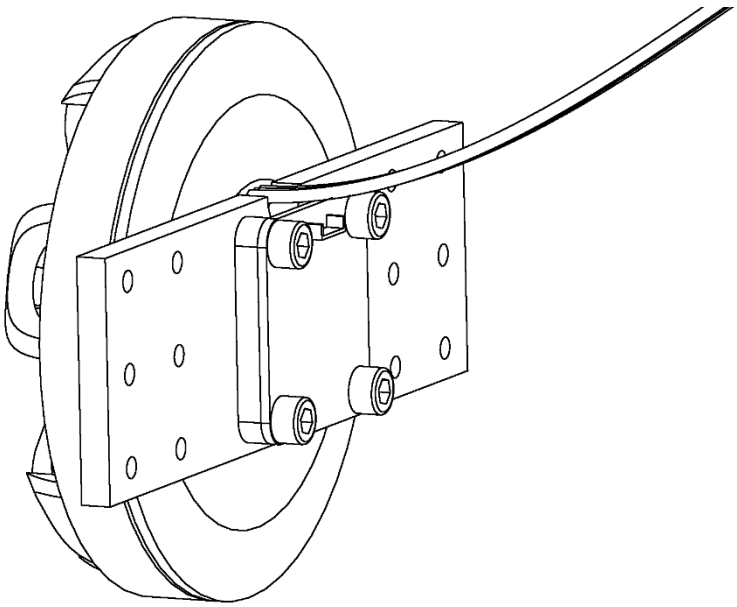
- Part C
- Part R
- Motor
- Encoder Magnet
- Encoder

Directions:

- Screw encoder magnet into motor first



Finished:

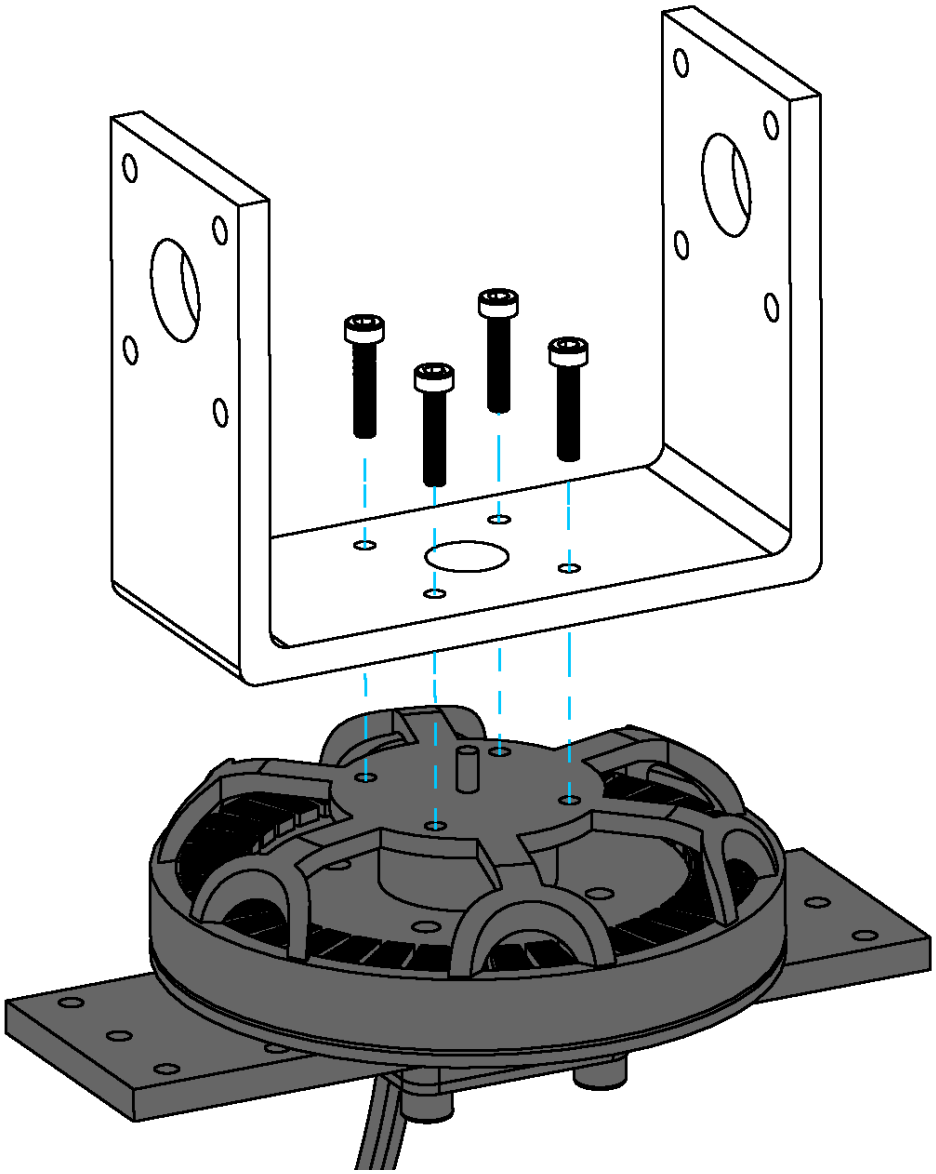


Step6, attach the shoulder bracket to the previous step:

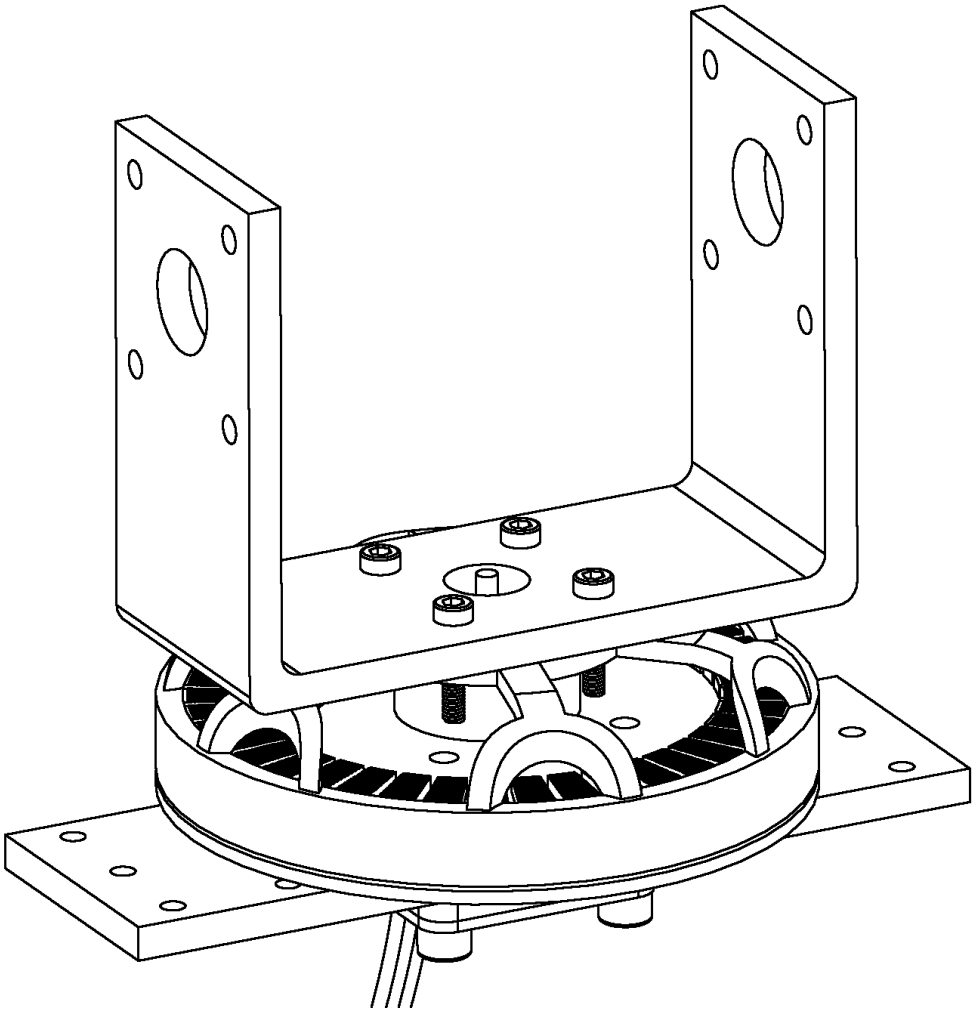
- M3 15mm Cap (x4)

- Part D

Directions:



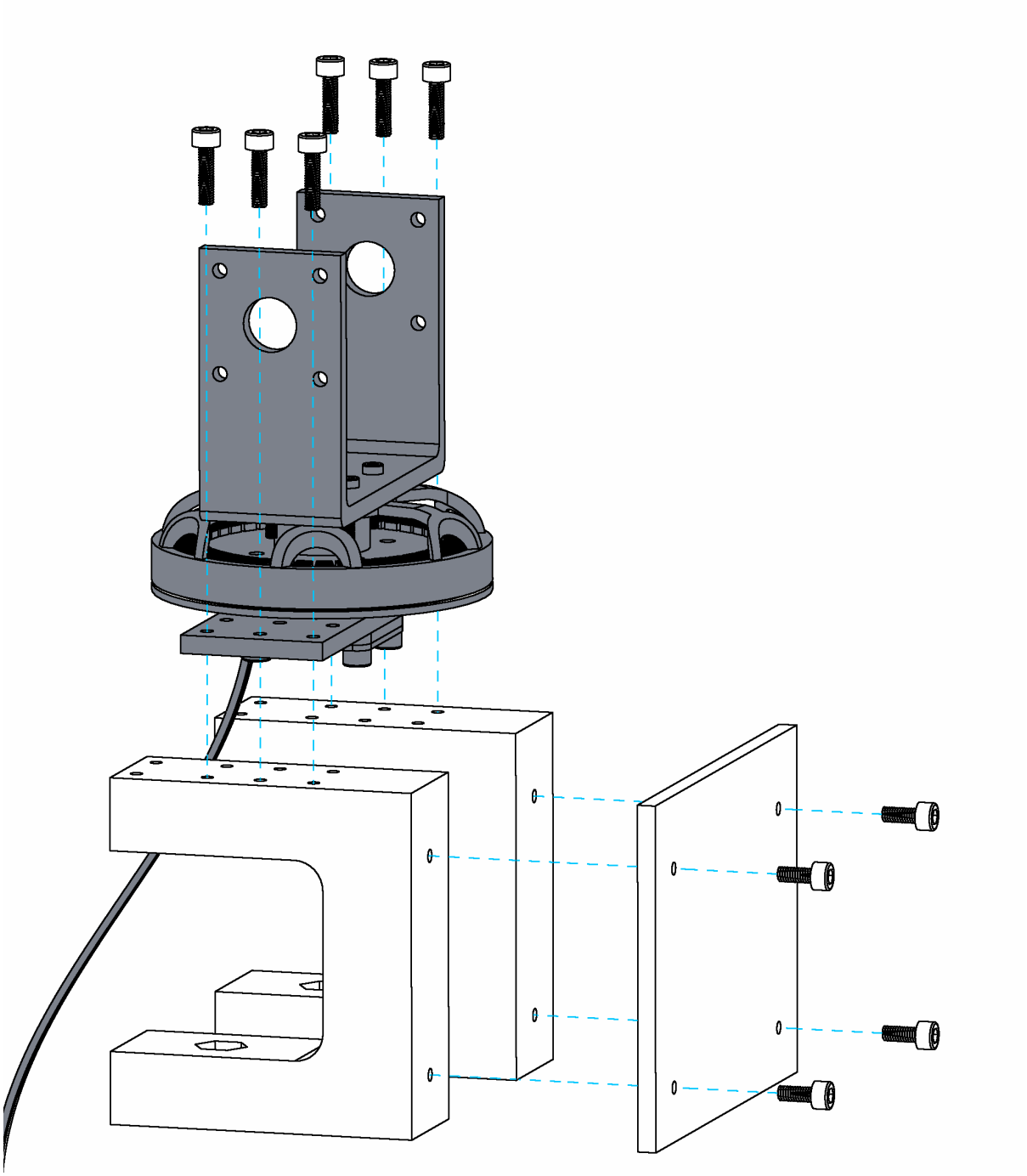
(Step6) Finished:



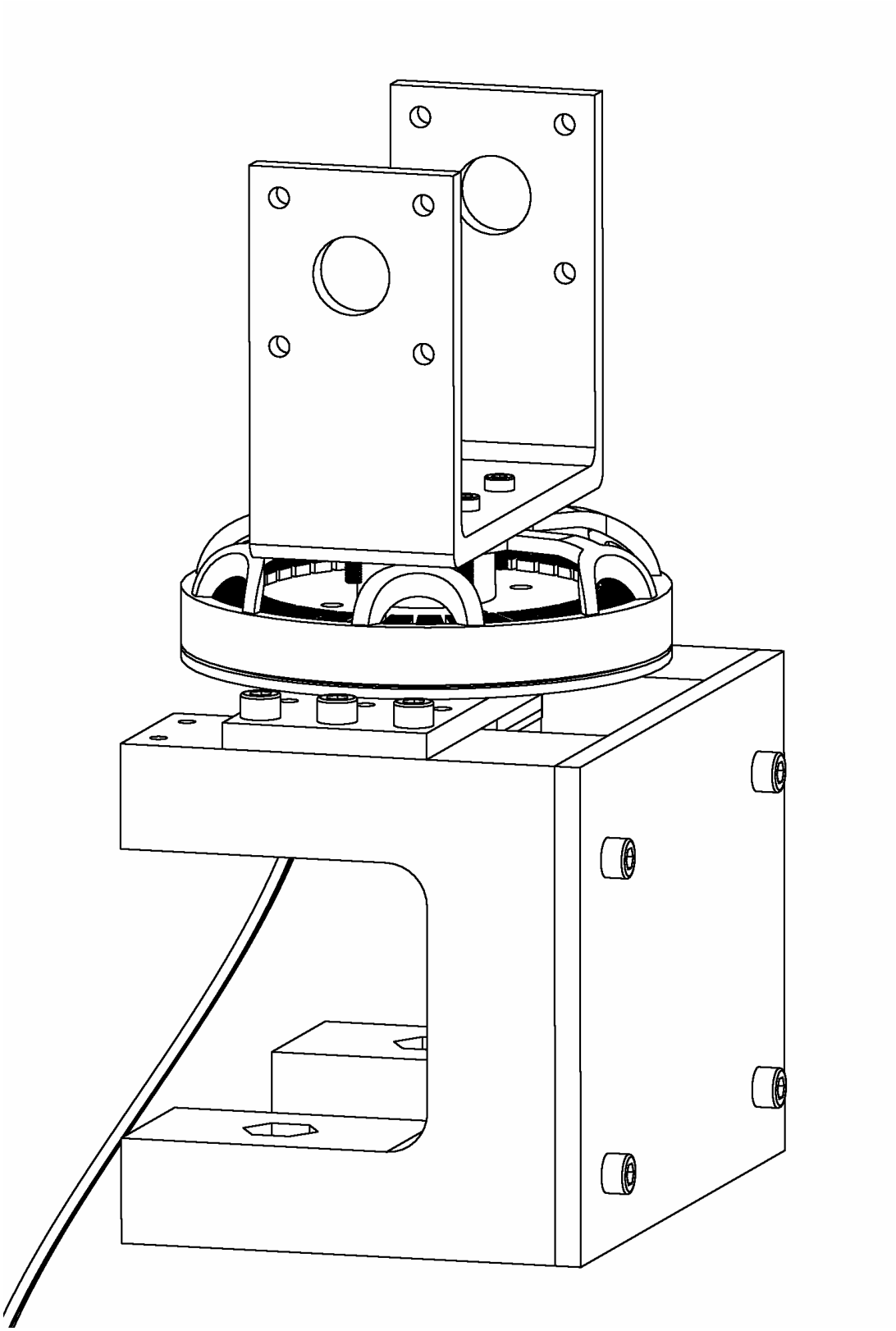
Step7, assemble the base of the robot:

- M4 16mm Cap (x6)
- M4 10mm Cap (x4)
- Part A (x2)
- Part B

Directions:



(Step7) Finished:



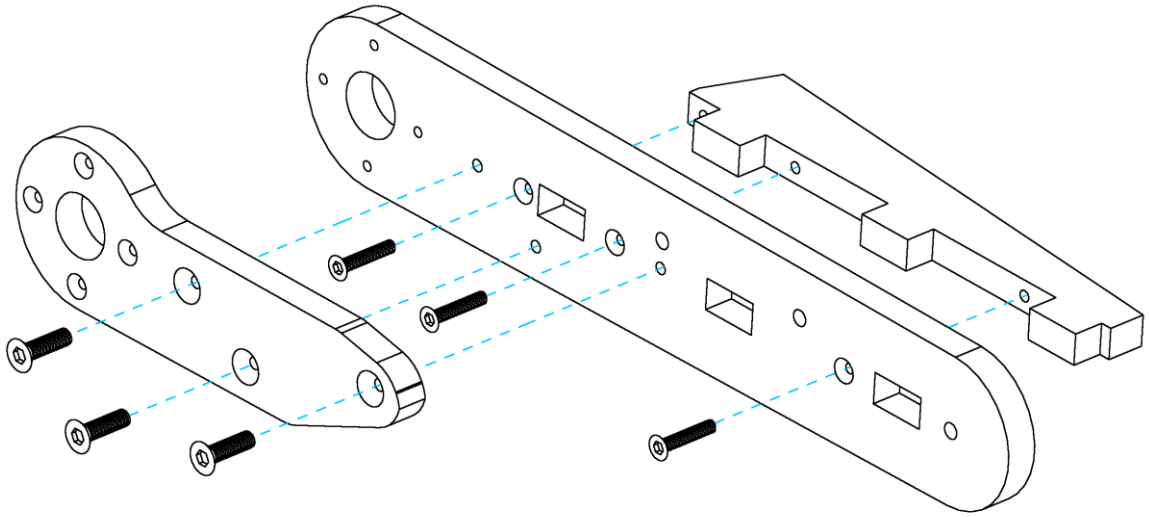
Step8, assemble the main arm section:

- M3 15mm Countersunk (x3)

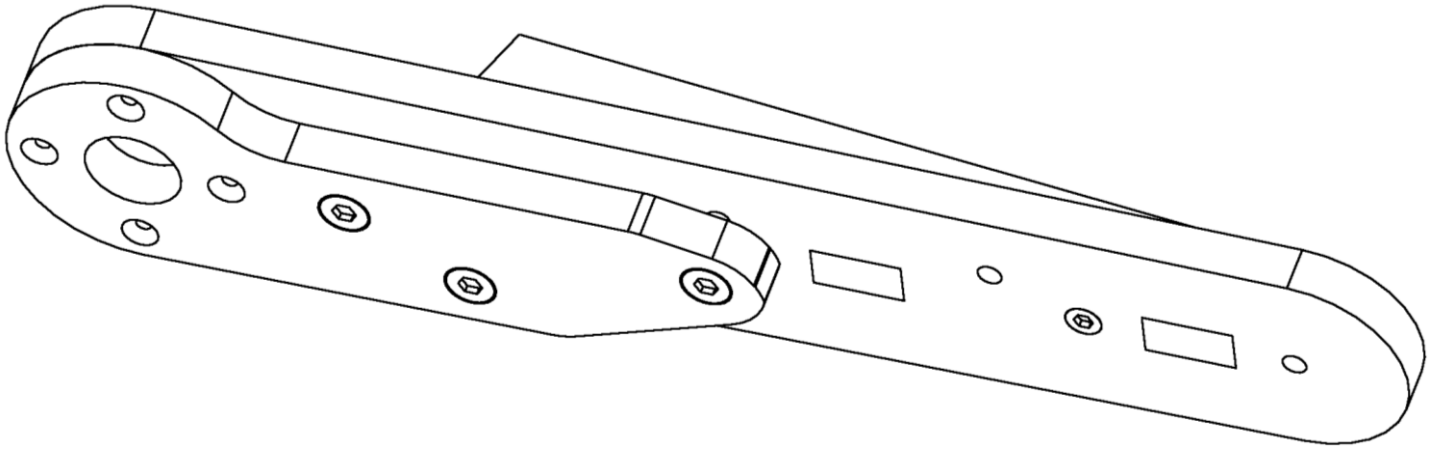
- M4 12mm Countersunk (x3)
- Part E
- Part F
- Part G

Directions:

- Attach parts D and E first (with M3 bolts)



Finished:

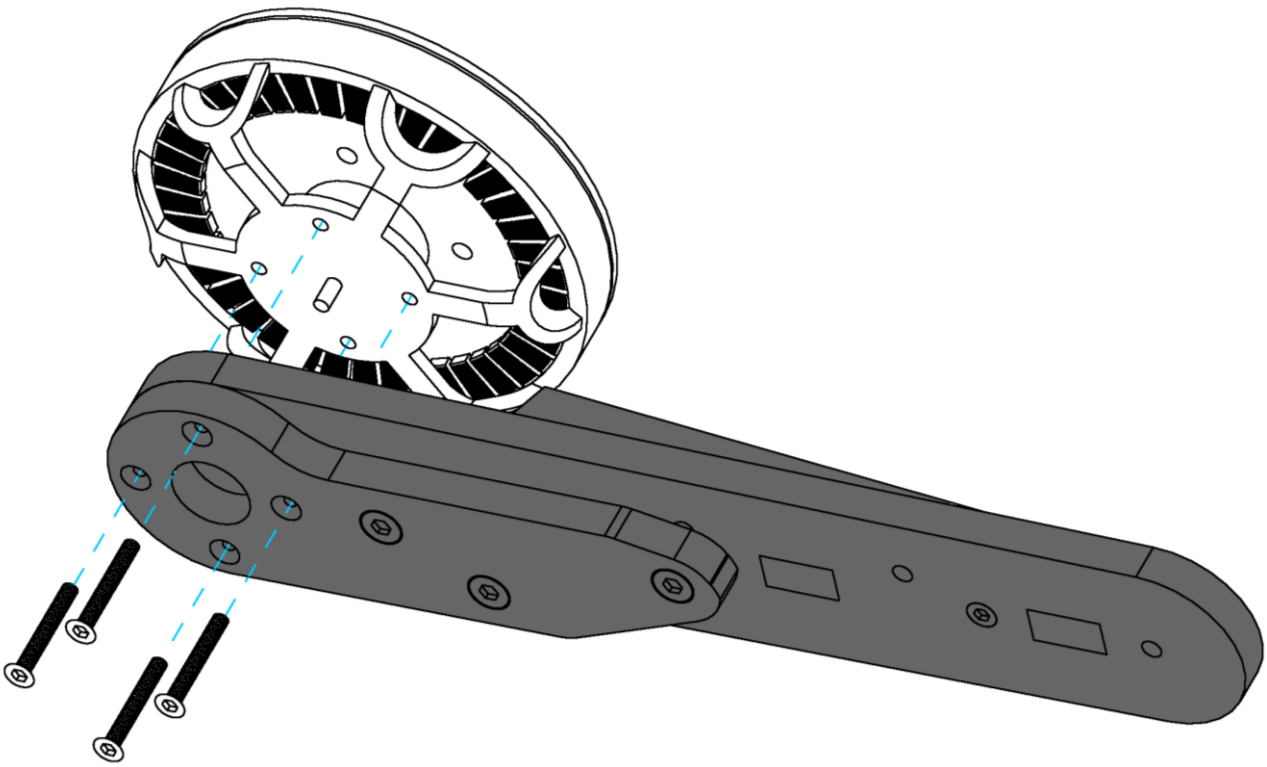


Step9, attach the main arm section to a motor:

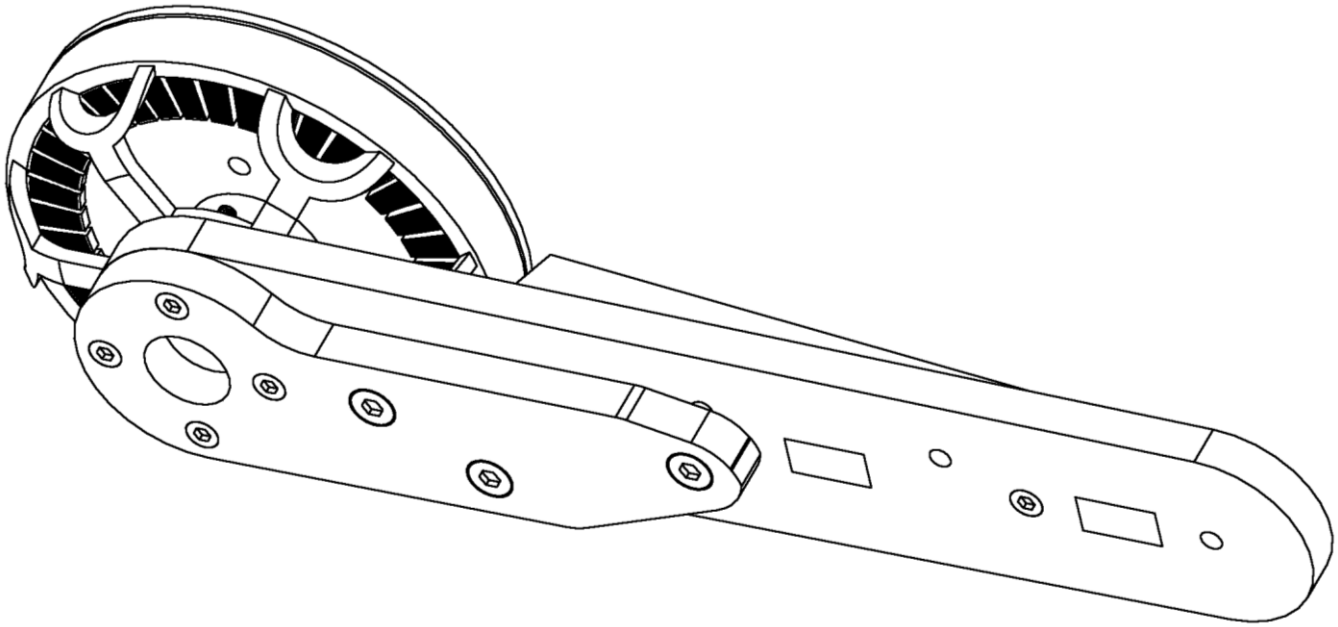
- M3 22mm Countersunk (x4)

- Motor

Directions:



Finished:

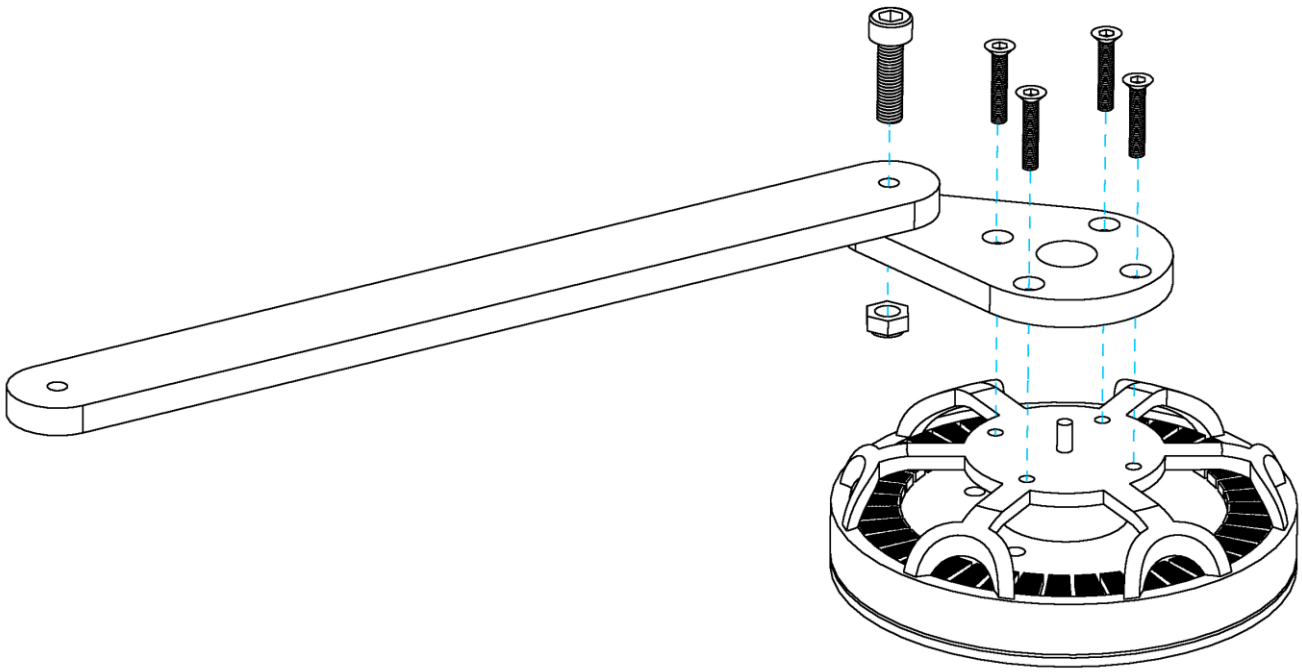


Step10, assemble and attach the parallel link to a motor:

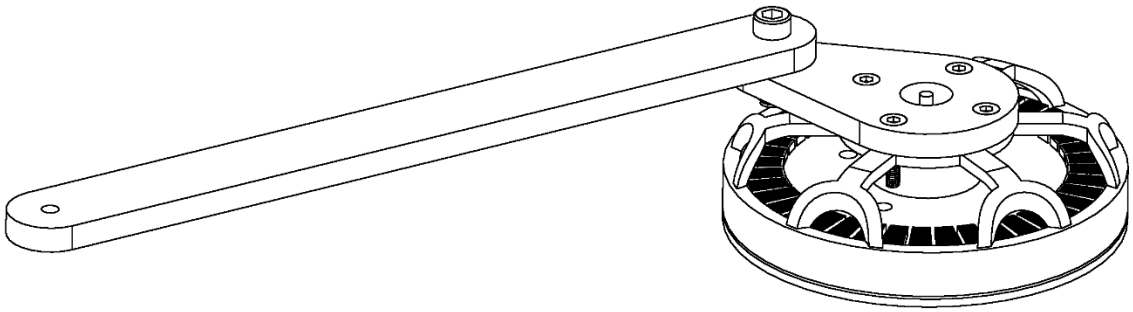
- M3 15mm Countersunk (x4)
- M5 18mm Cap
- M5 Nyloc Nut
- Part H
- Part I
- Motor

Directions:

- Attach parts G and H first. Do not over-tighten M5 Bolt + Nut – there should be little friction



Finished:

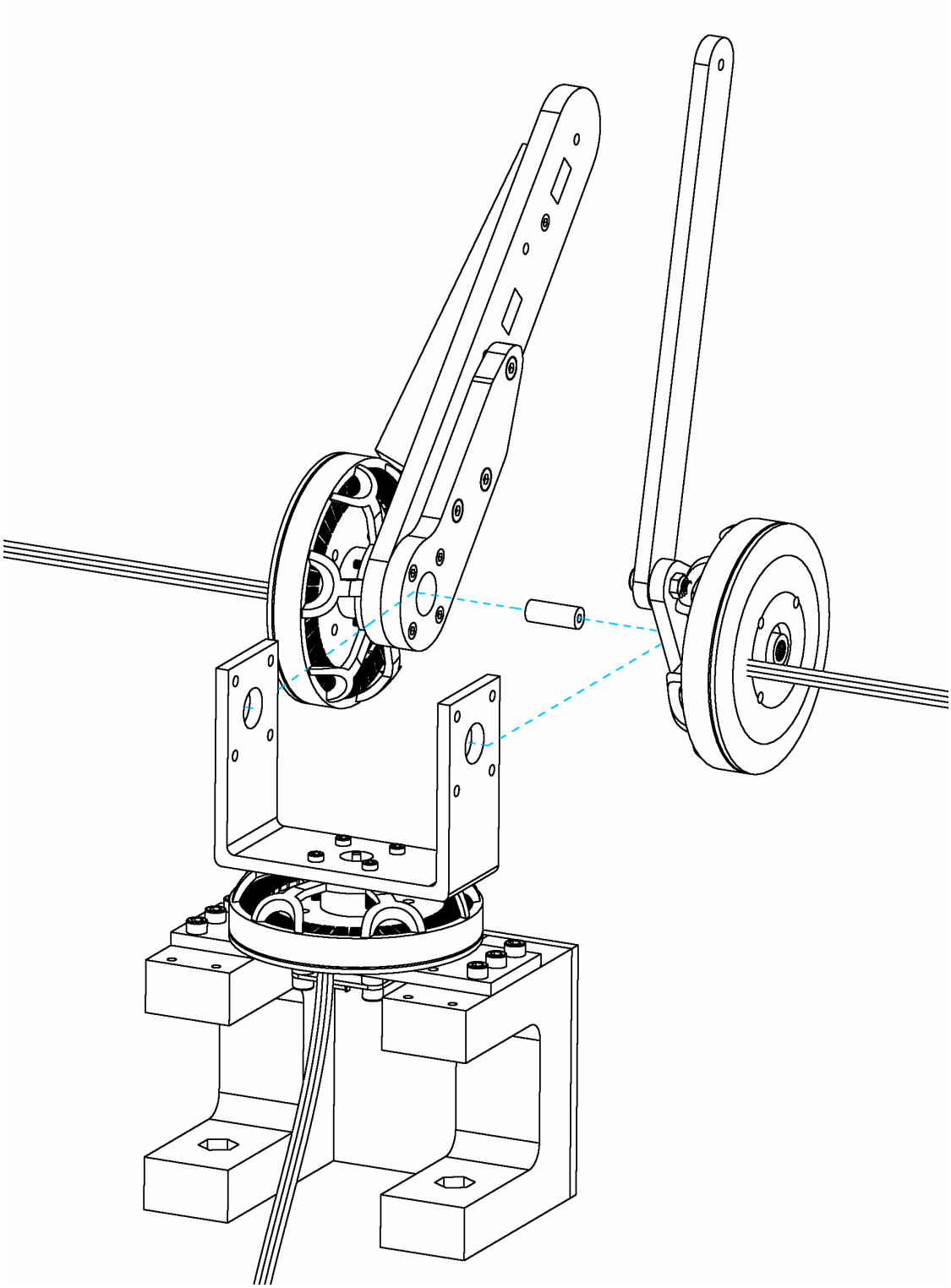


Step11, align both motors within the shoulder bracket:

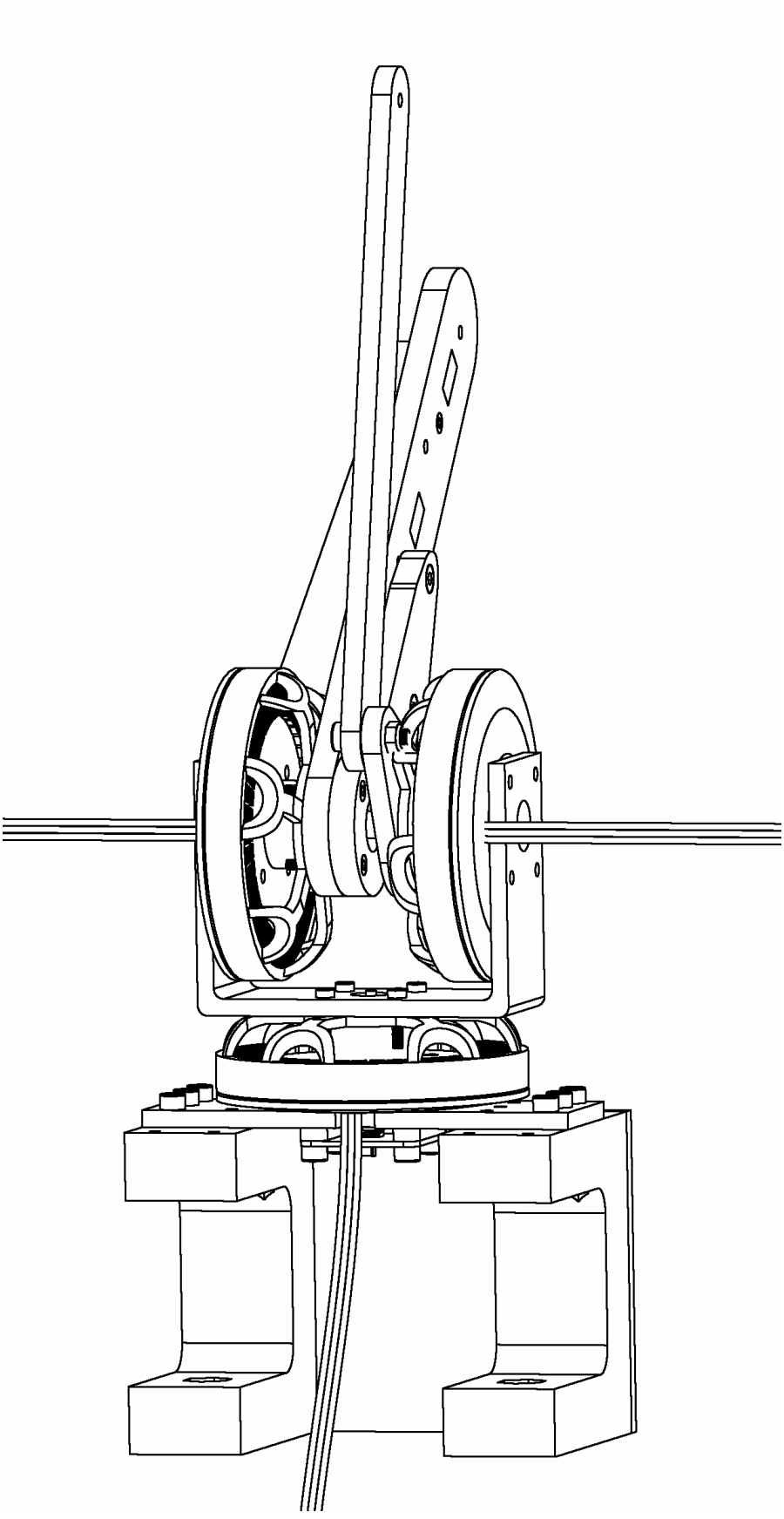
- Part P

Directions:

- Part P should fit over the shaft of each motor. The Motors should then fit snugly into Part D ready to be fastened in step 12.



(Step11) Finished:

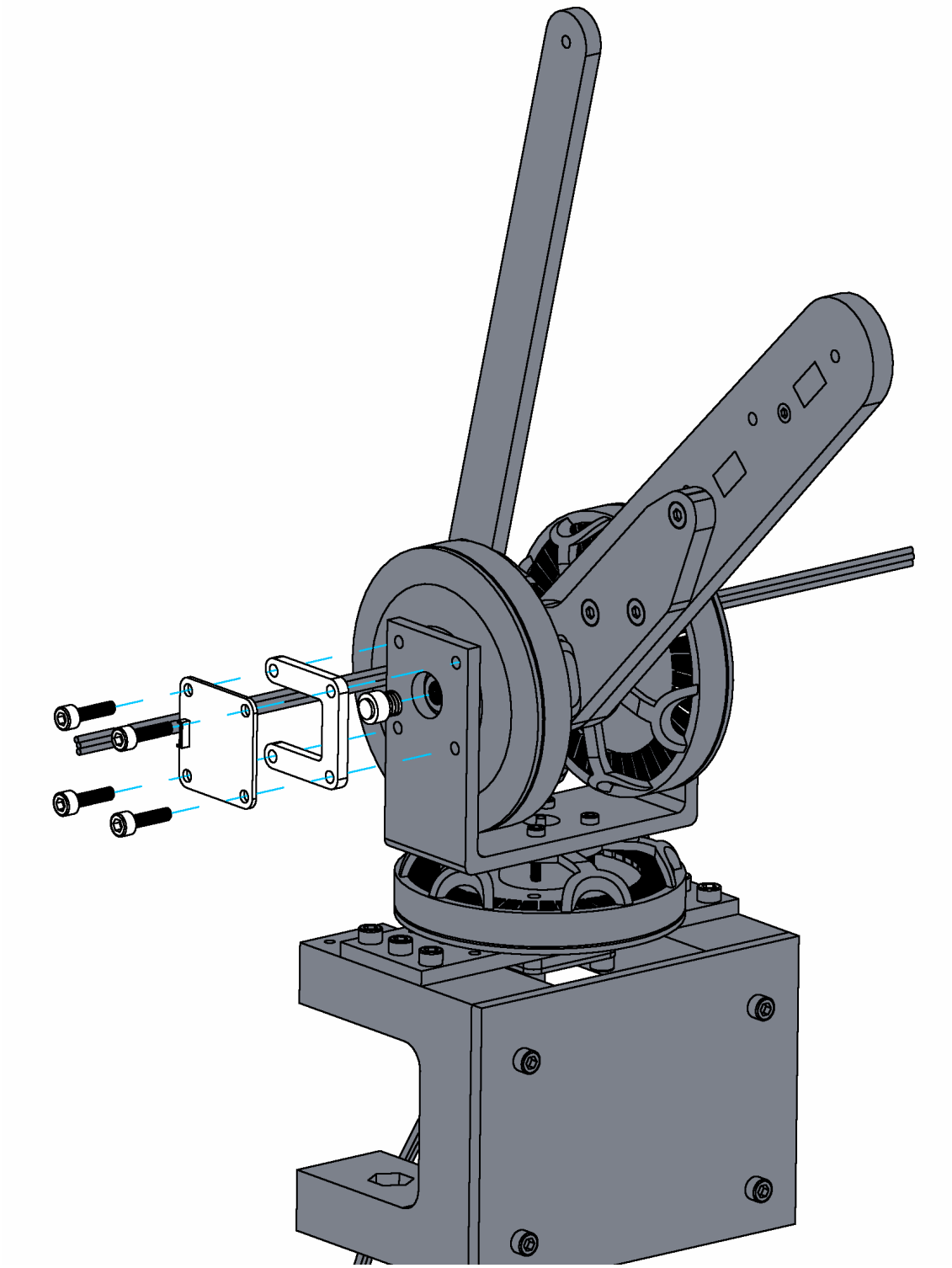


Step 12, attach the encoders and motors to the shoulder bracket:

- M4 16mm Cap (x8)
- Part R (x2)
- Encoder Magnet (x2)
- Encoder (x2)

Directions (part 1):

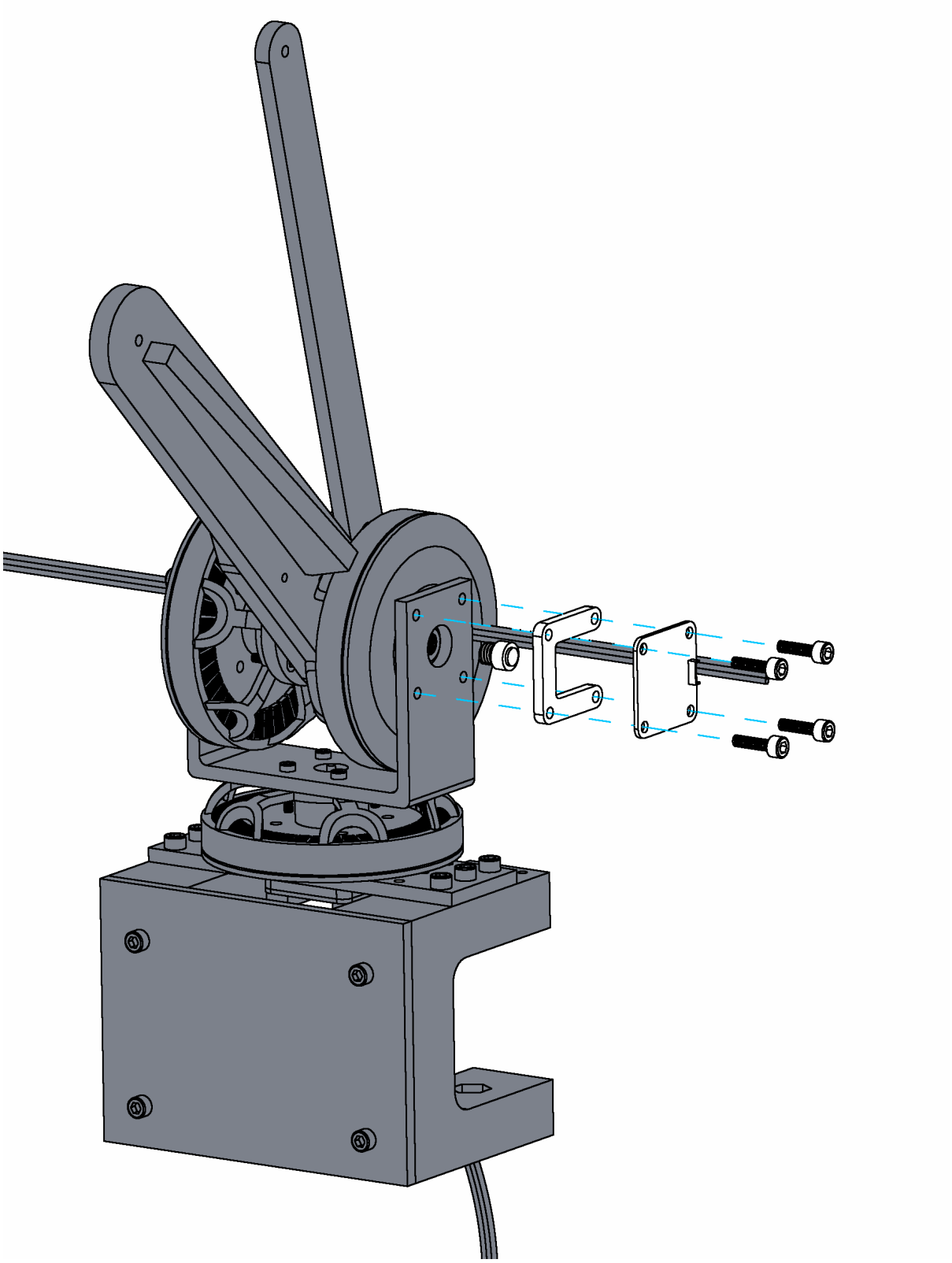
- Screw encoder magnet into motor first

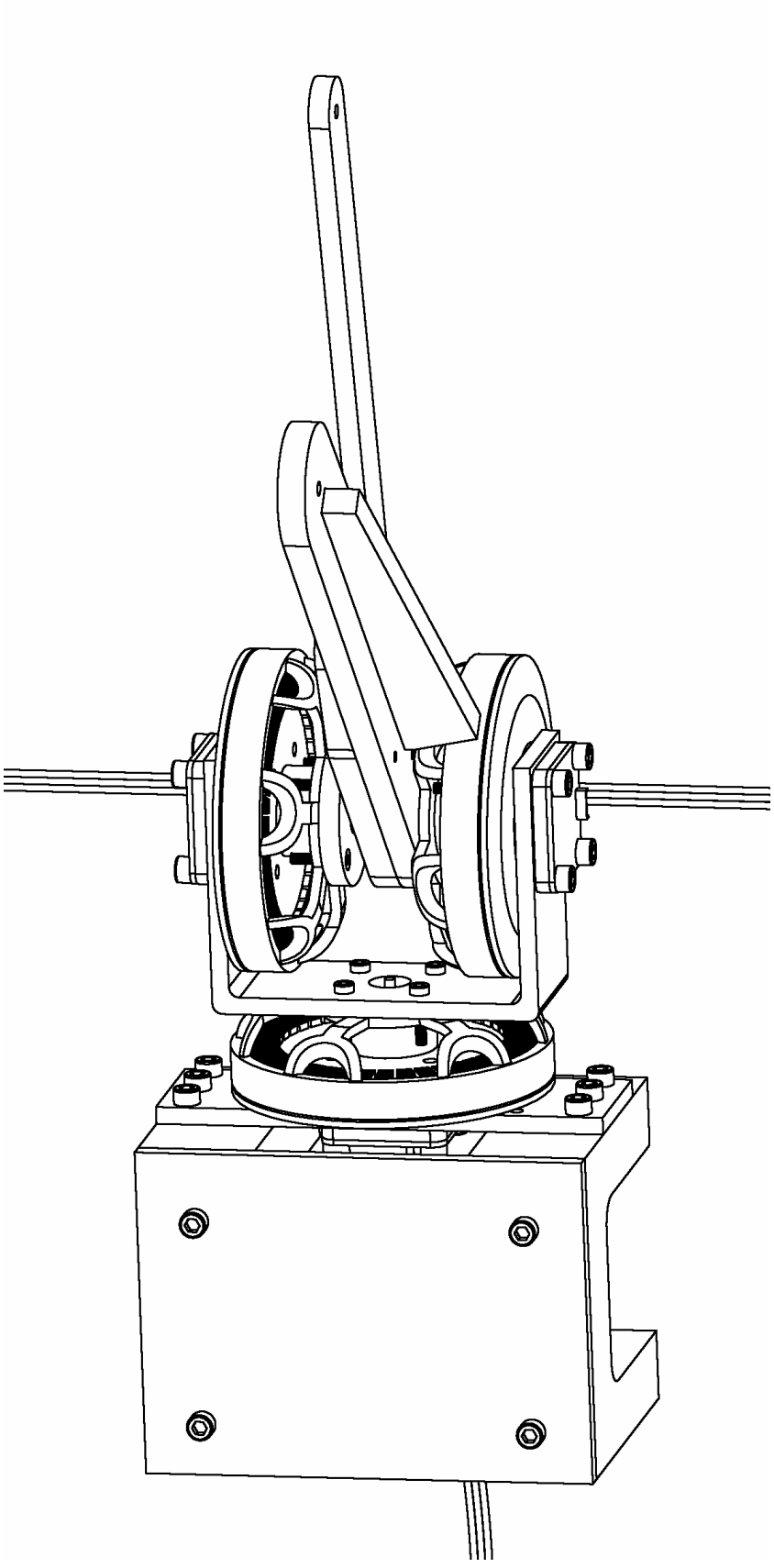


(Step 12) Directions (Part 2):

- Screw encoder magnet into motor first

(Step 12) Finished:



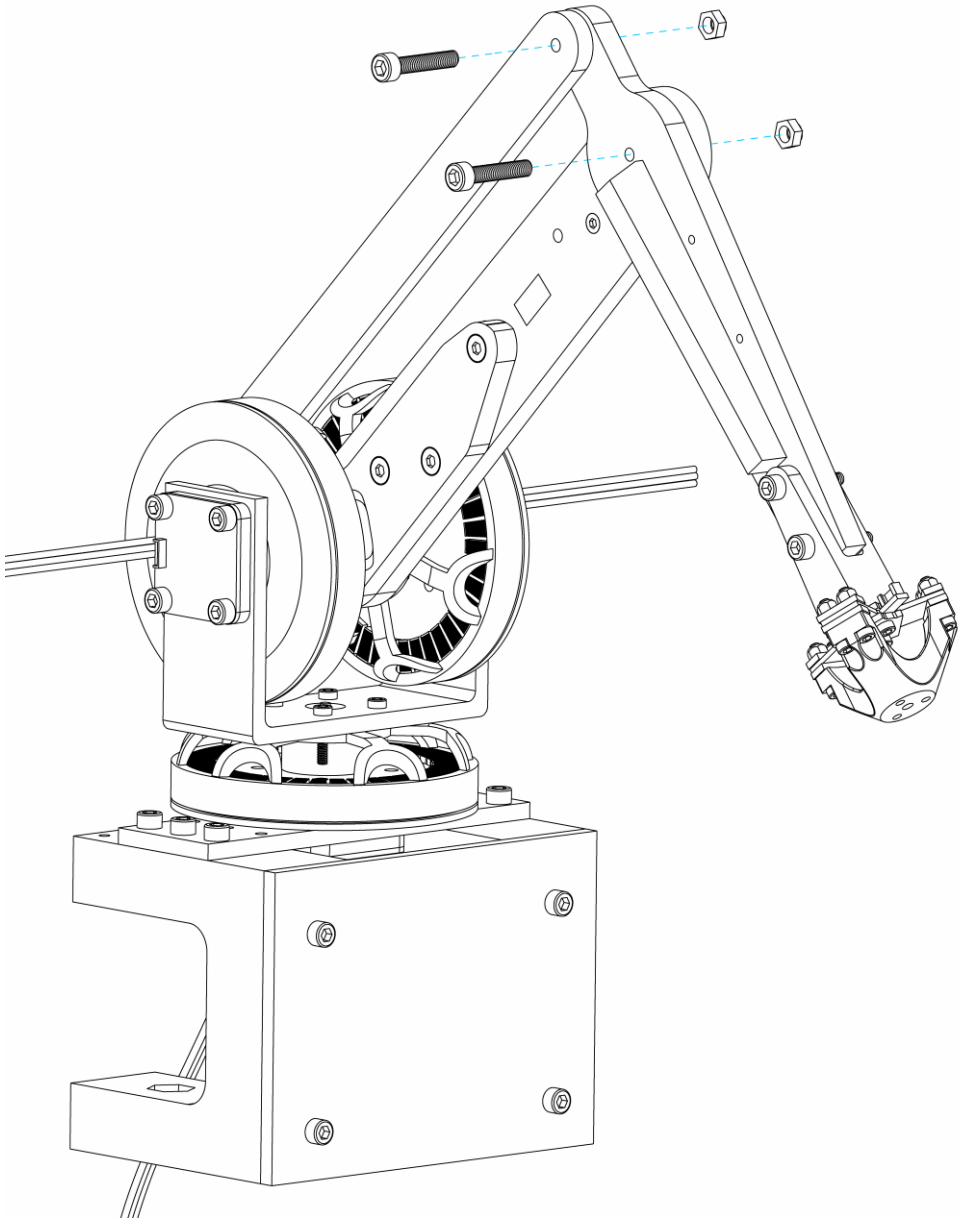


Step 13, attach the arm end onto the main and parallel arm sections:

- M5 18mm Cap (x2)
- M5 Nyloc Nut (x2)

Directions:

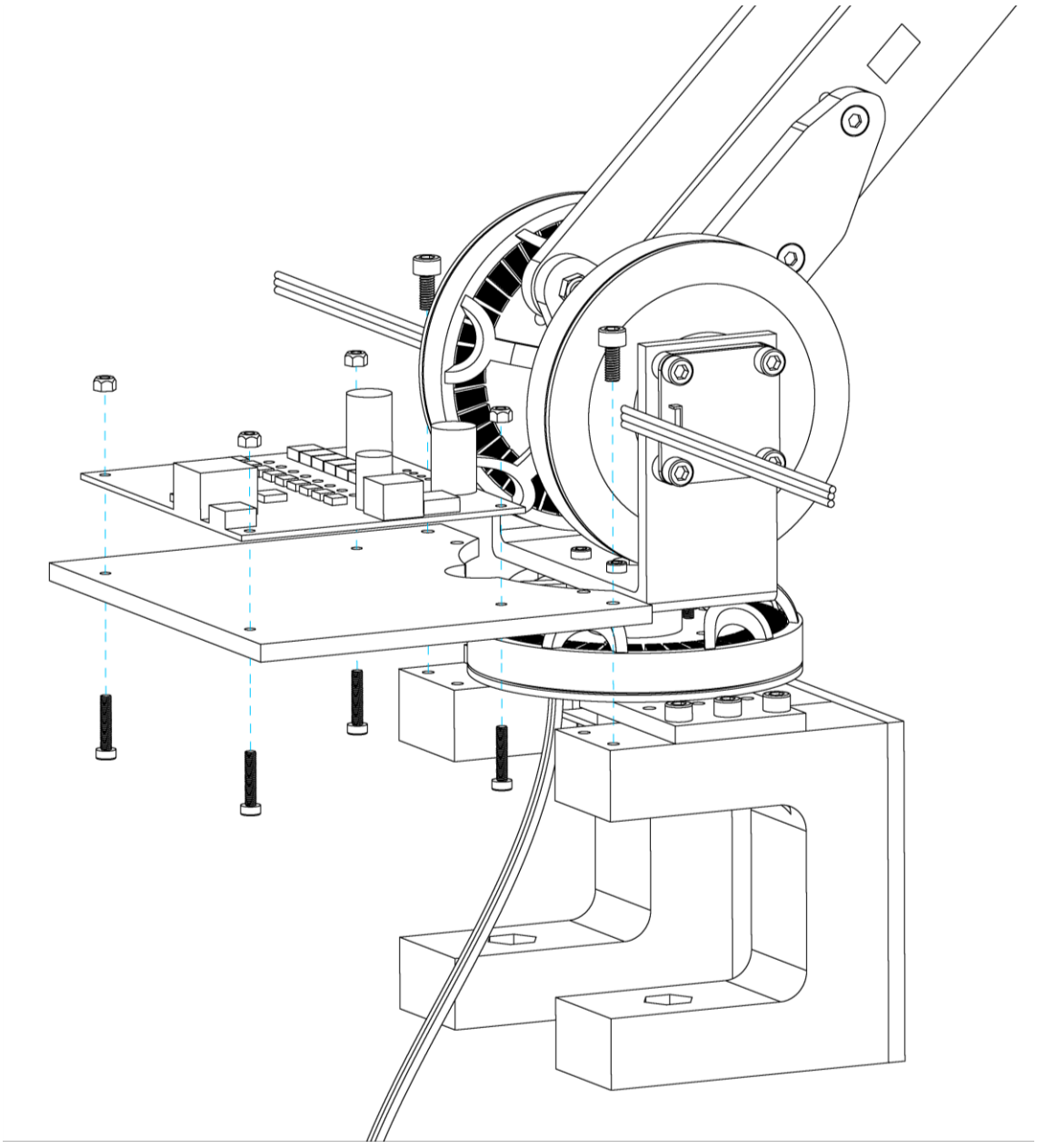
The bolts should be as tight as possible without causing friction



Step 14, attach the main controller:

- Main controller
- Part Q
- Bolt M3 15mm Cap (x4)
- Nut M3 Nyloc (x4)
- Bolt M4 10mm Cap (x2)

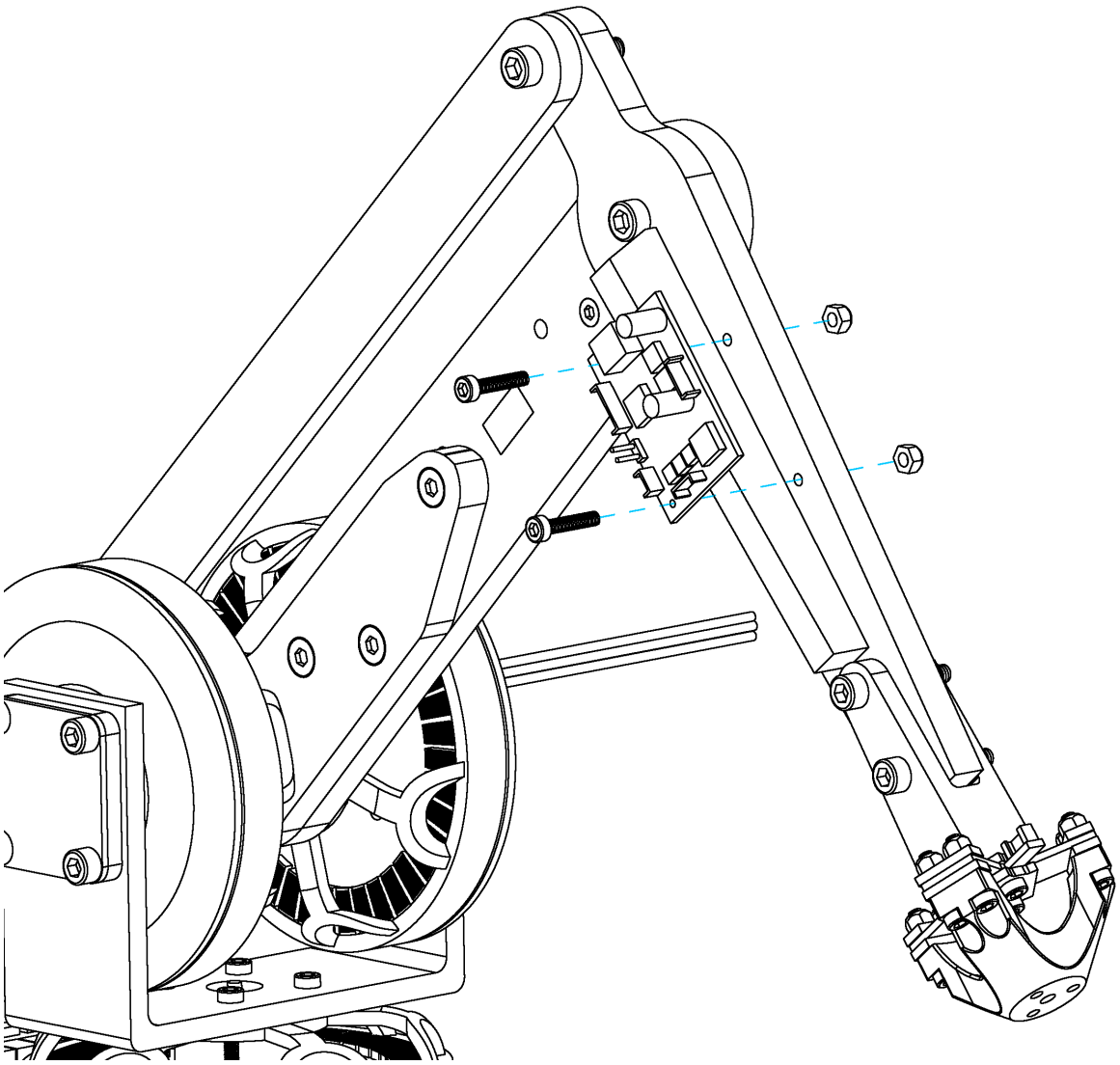
Directions:



Step 15, attach the force sensor controller:

- Sensor controller
- Bolt M3 15mm Cap (x2)
- Nut M3 Nyloc (x2)

Directions:



Finished!