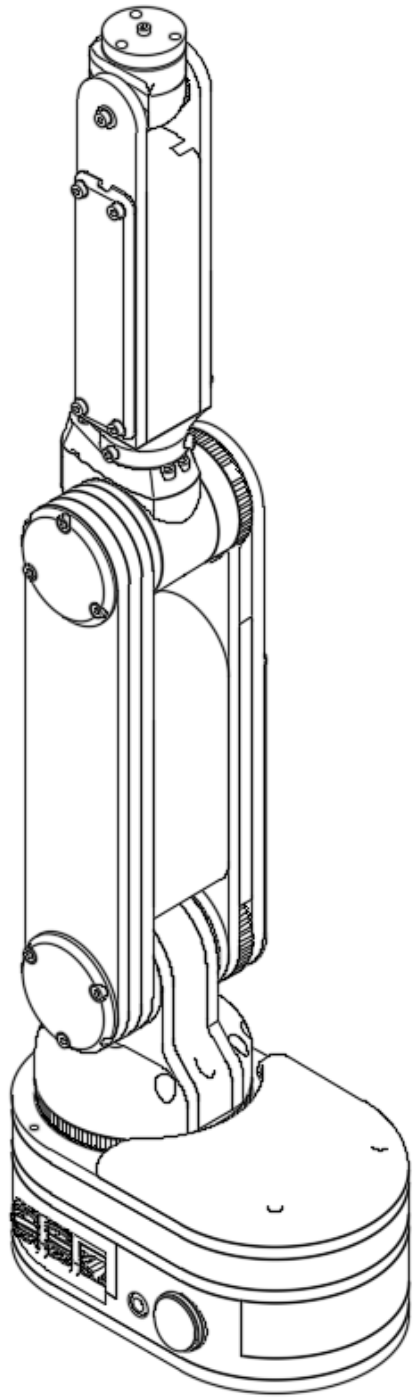
Assembly Manual

Version 1.0

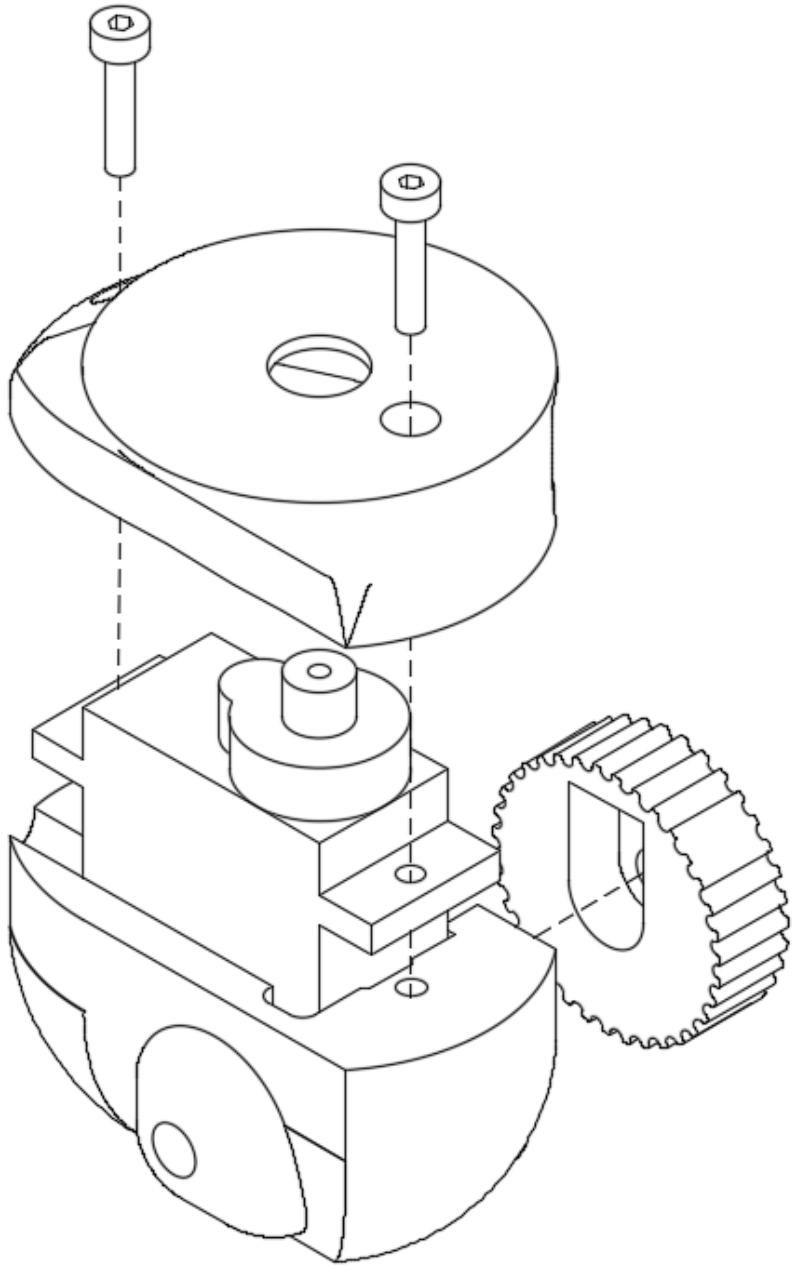
18.06.2025



Assembly 1: Step 1

- Custom: P101, P102, P103
- Ordered: MG90S
- Bolts: M2x10mm [x2]

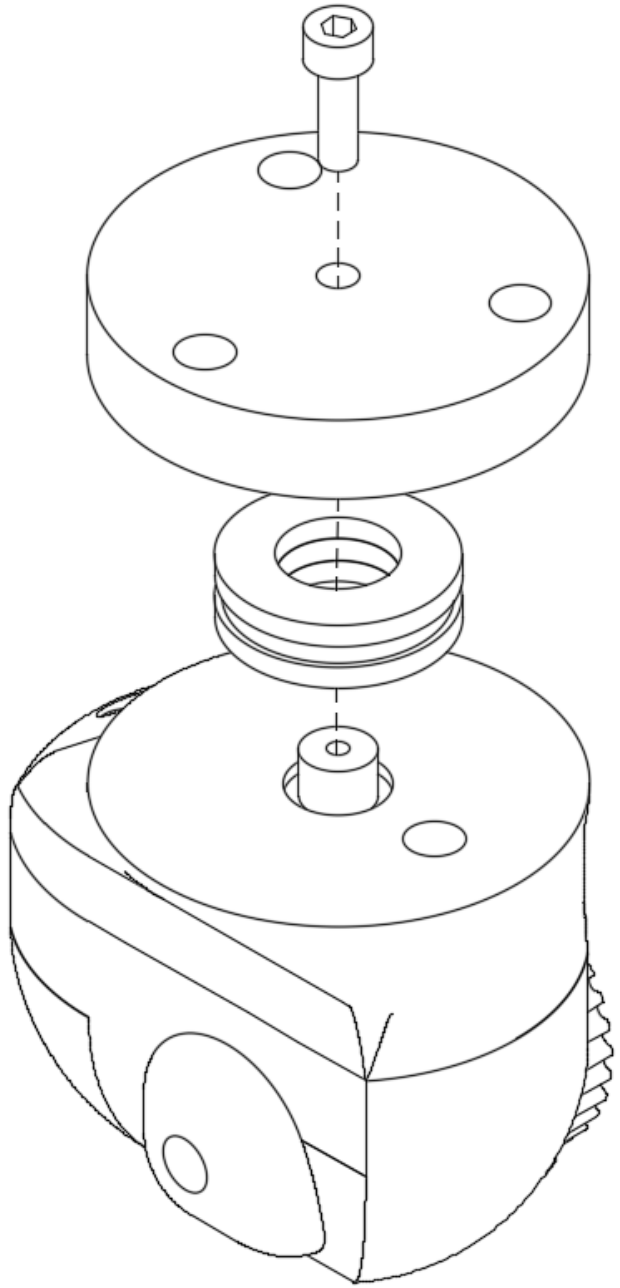
- Fasten the servo motor between P101 and P102 (screws directly into the plastic)
- Motor wires are channeled out an opening in the back P103 sits loose on P101

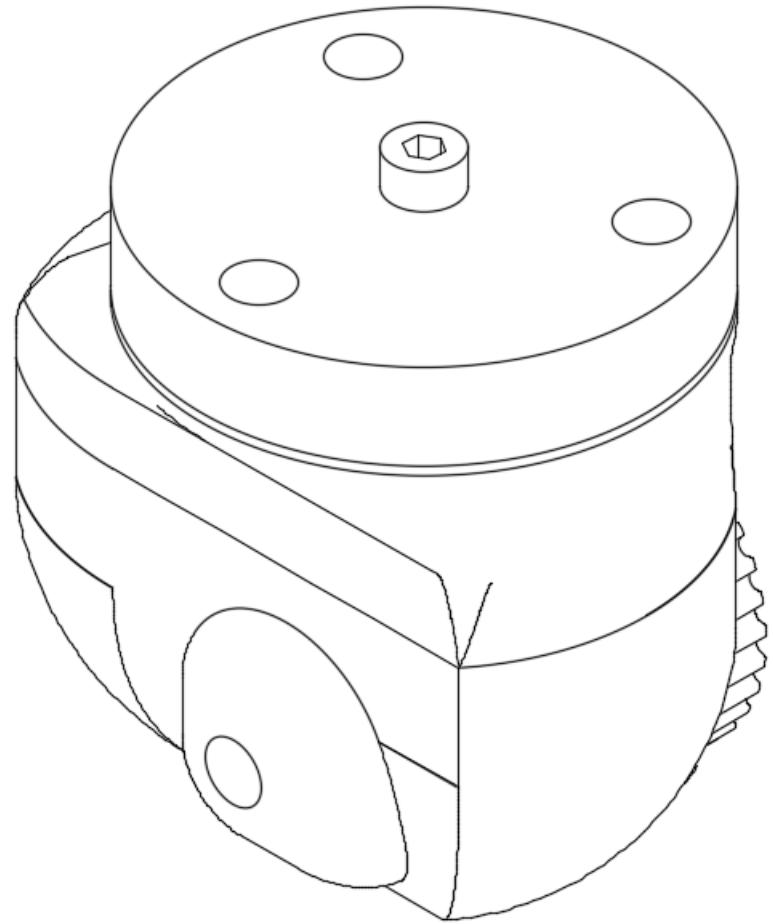


Assembly 1: Step 2

- Custom: P104
- Ordered: Thrust bearing (16x8x5)
- Bolts: M2.5x8mm

- Fasten P104 to the servo shaft, separated by the thrust bearing. Use thread-lock glue

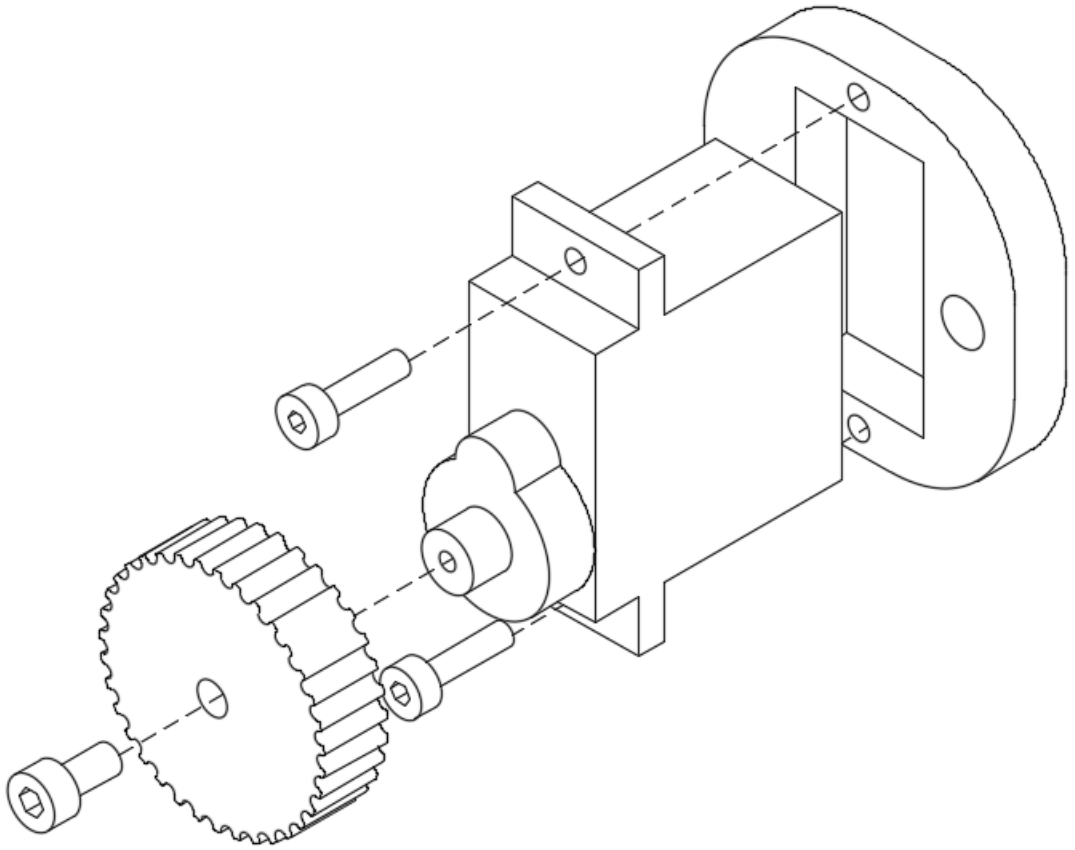




Assembly 2: Step 1

- Custom: P203, P204
- Ordered: MG90S
- Bolts: M2x8mm [x2], M2.5x5mm [x1]

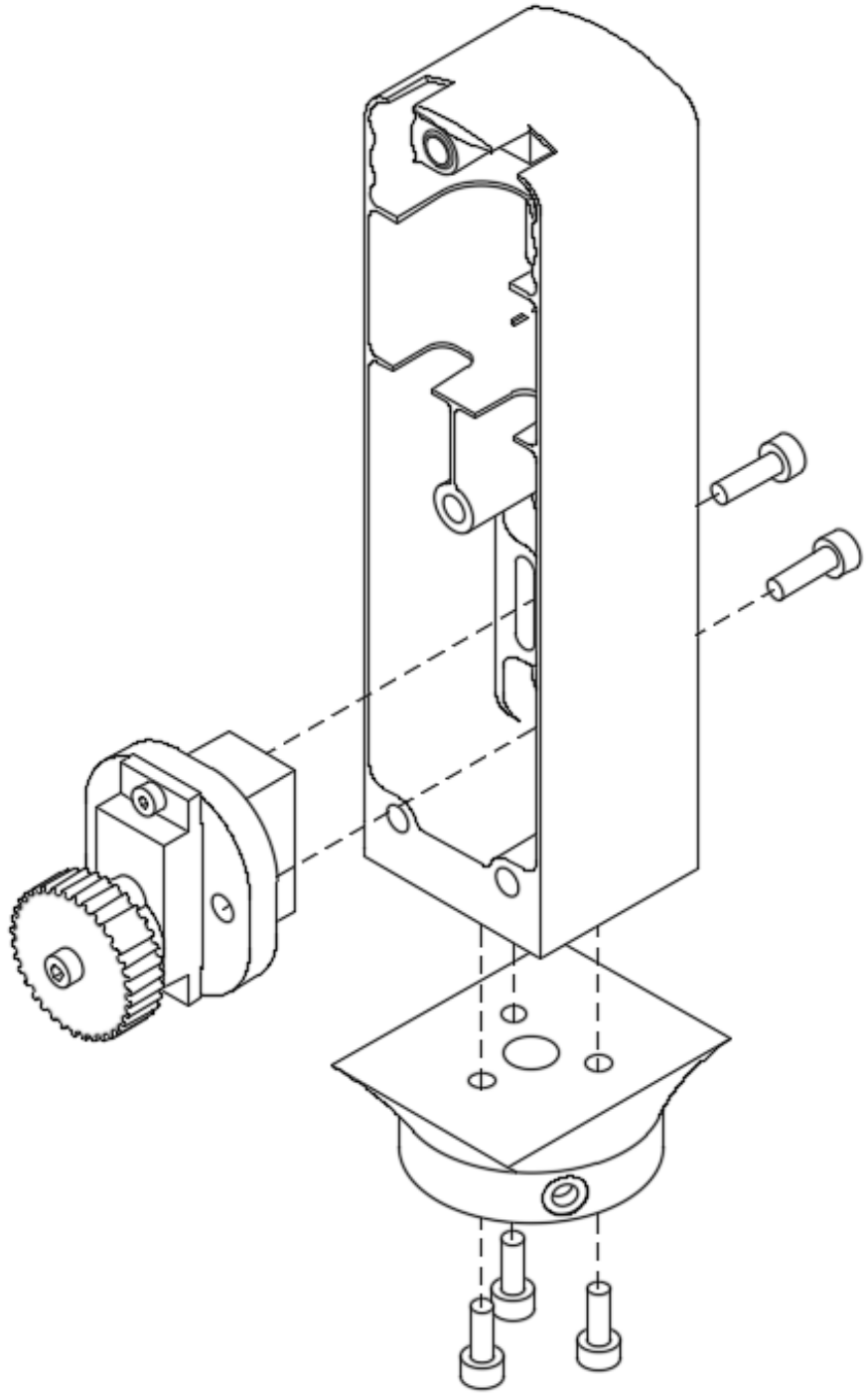
- Fastenthe servomotor to P203 with the M2 bolts.
- Fasten P204 to the servo-shaft with a M2.5 bolt, use threadlock glue.



Assembly 2: Step 2

- Custom: P201, P202
- Bolts: M3x8mm [x3], M3x10mm [x2]

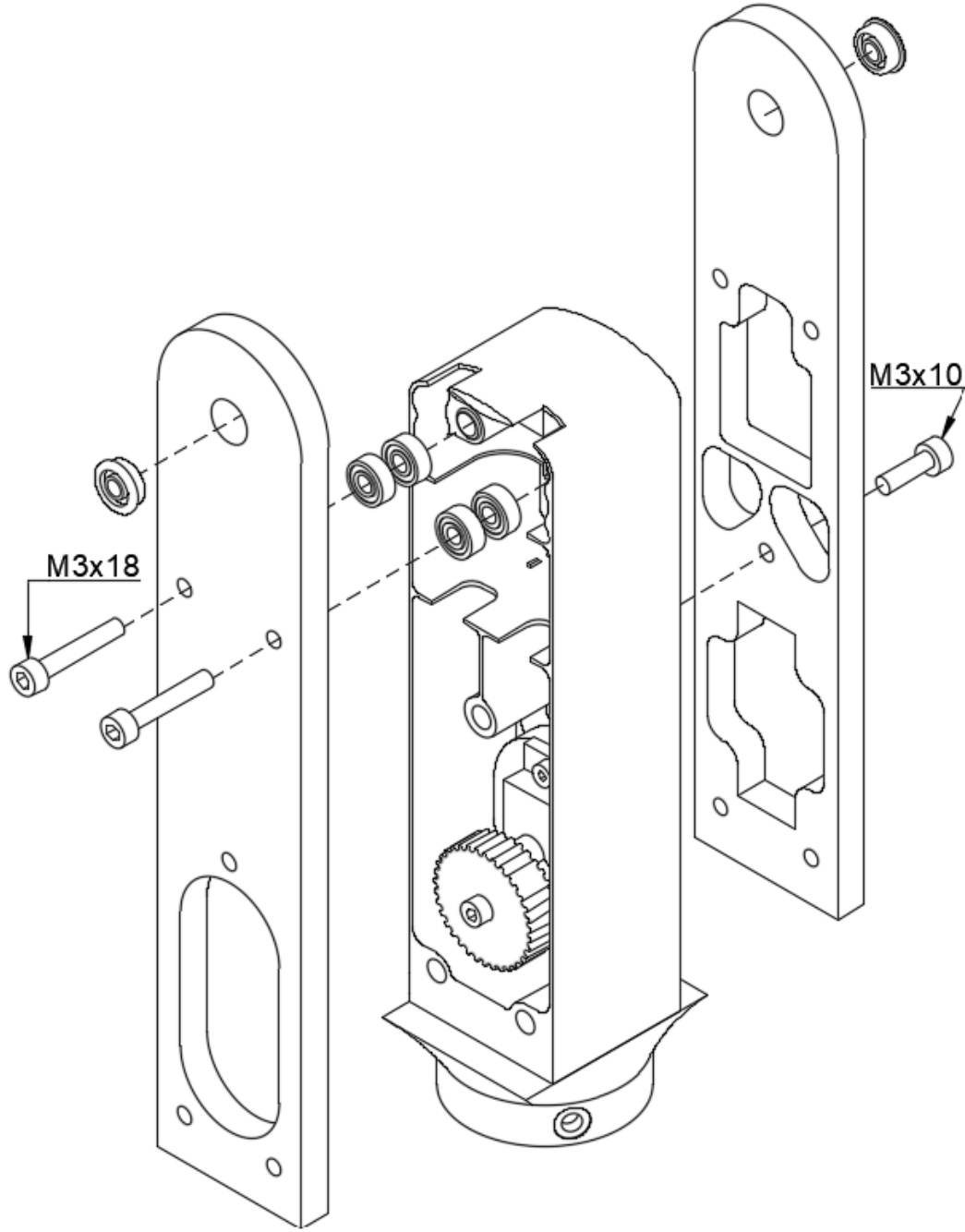
- Fasten P201 and P202 with three M3x8
- Connect the motor assembly to the slots so it can move up and down

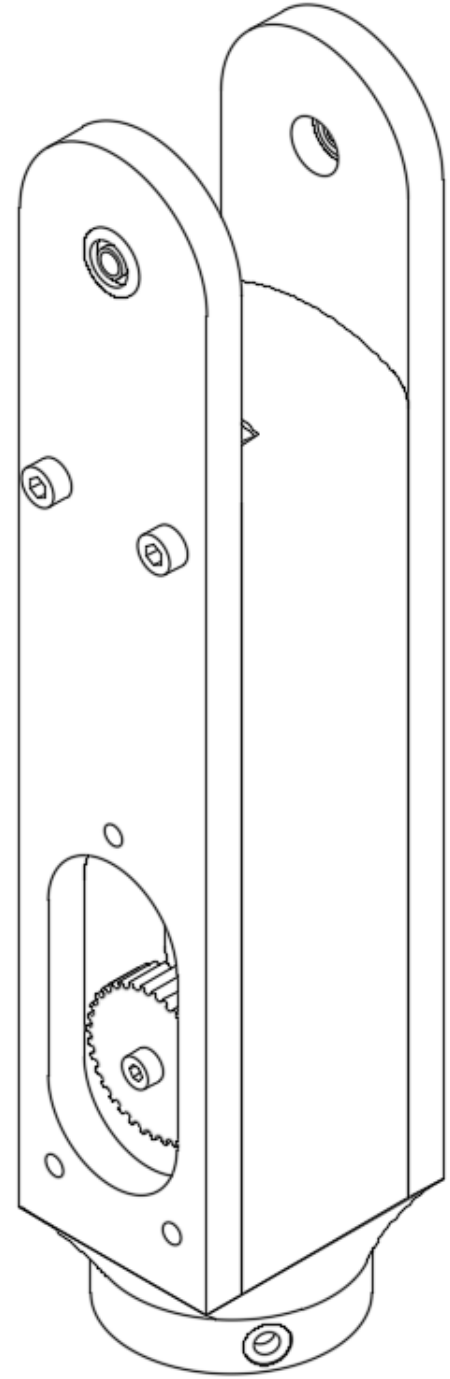


Assembly 2: Step 3

- Custom: W201, W202
- Ordered: MR83ZZ [x4], MF83ZZ [x2], GT2 Timing belt
- Bolts: M3x10mm [x1], M3x18mm [x2]

- Position the timing belt around P204 and between the MR83ZZ bearings
- Fasten W202 to P201 with two M3x18 bolts. NB: they go through the bearings placed above
- W201 is connected by a single M3x10
- Press the MF83ZZ into place

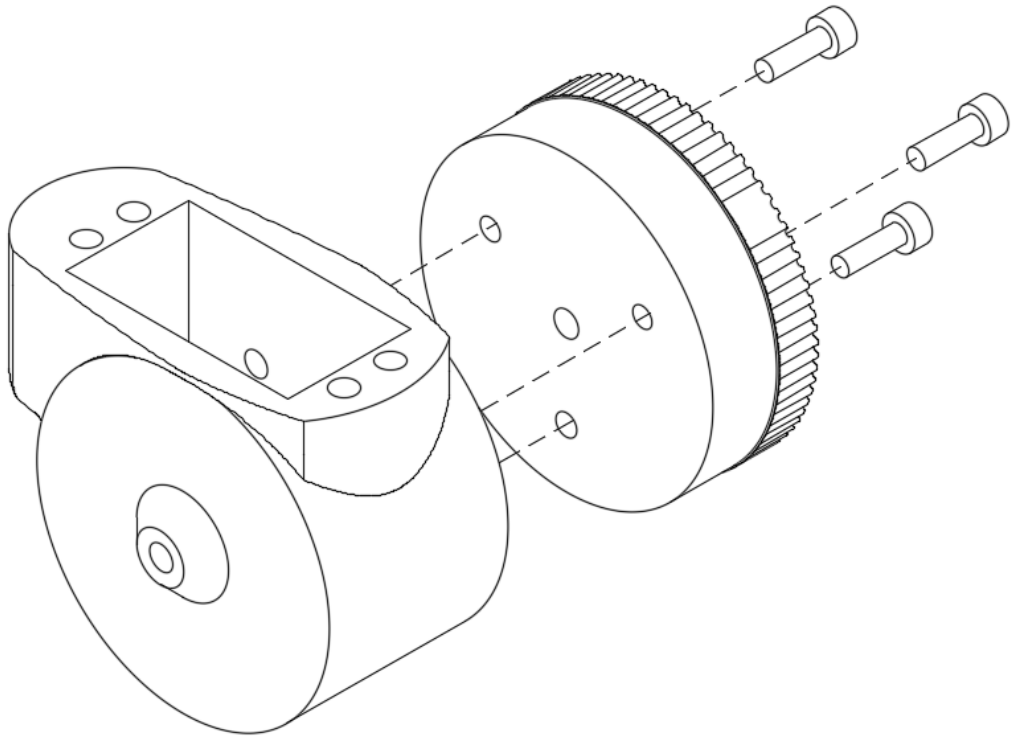




Assembly 3: Step 1

- Custom: P301, P303
- Bolts: M3x10 [x3]

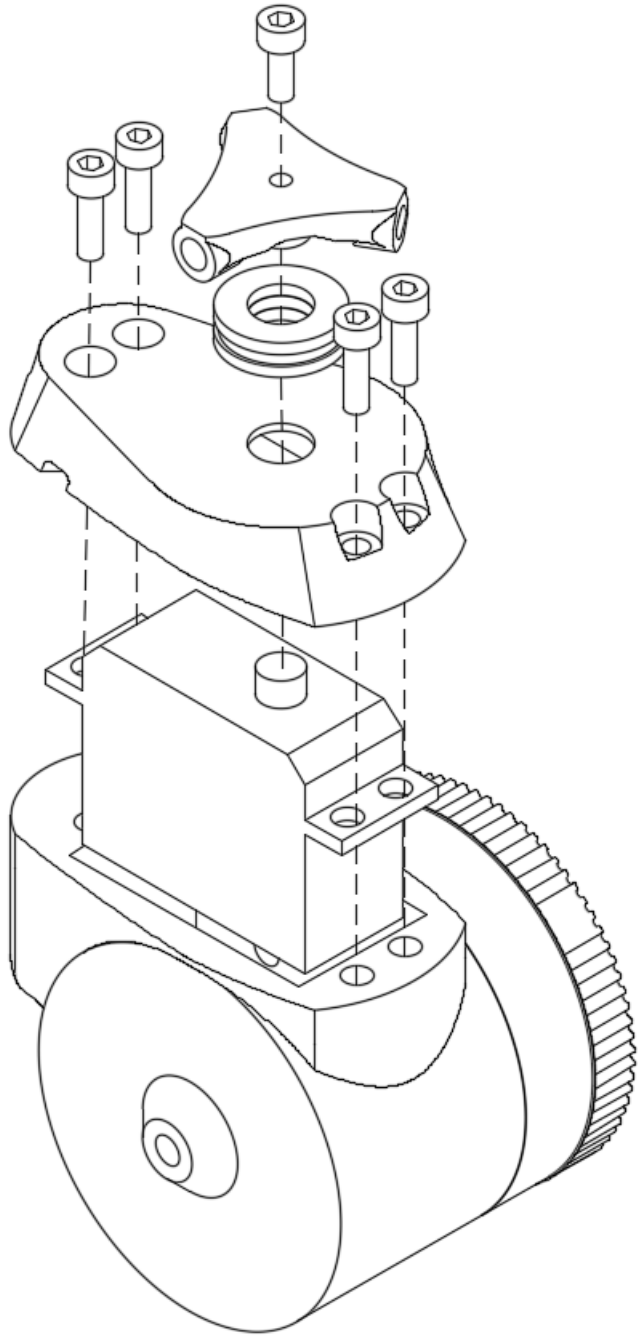
- Connect P301 and P302 with three M3x10 bolts

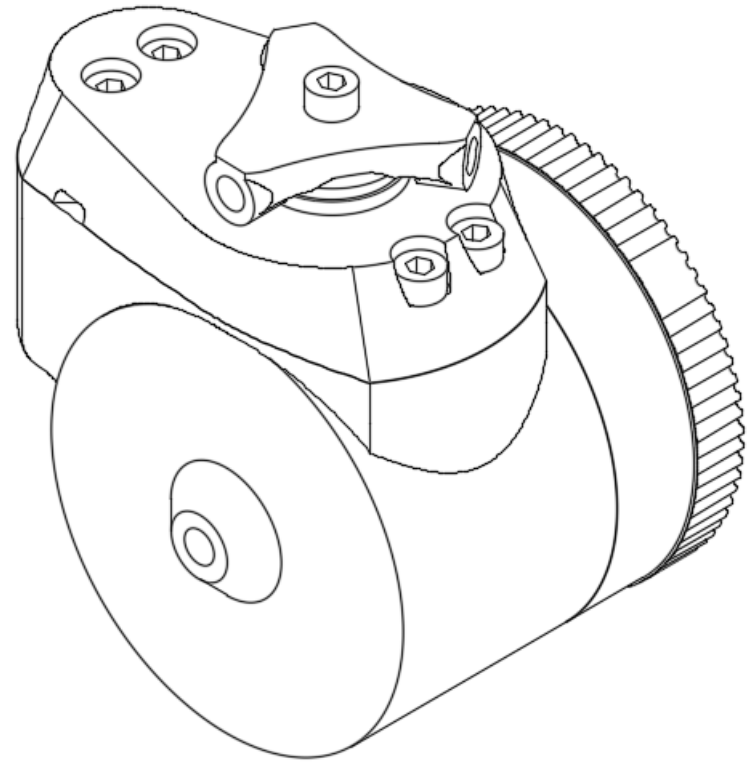


Assembly 3: Step 2

- Custom: P302, P304
- Ordered: TD-9225MG, Thrust bearing (16x8x5)
- Bolts: M3x8 [x1], M3x10 [x4]

- Mount the servo motor in between P301 and P302 with four M3x10 bolts. Motor cables are led out a channel in the back
- Fasten P304 to the servo shaft with a M3x8 with a thrust-bearing in between. Use threadlock glue

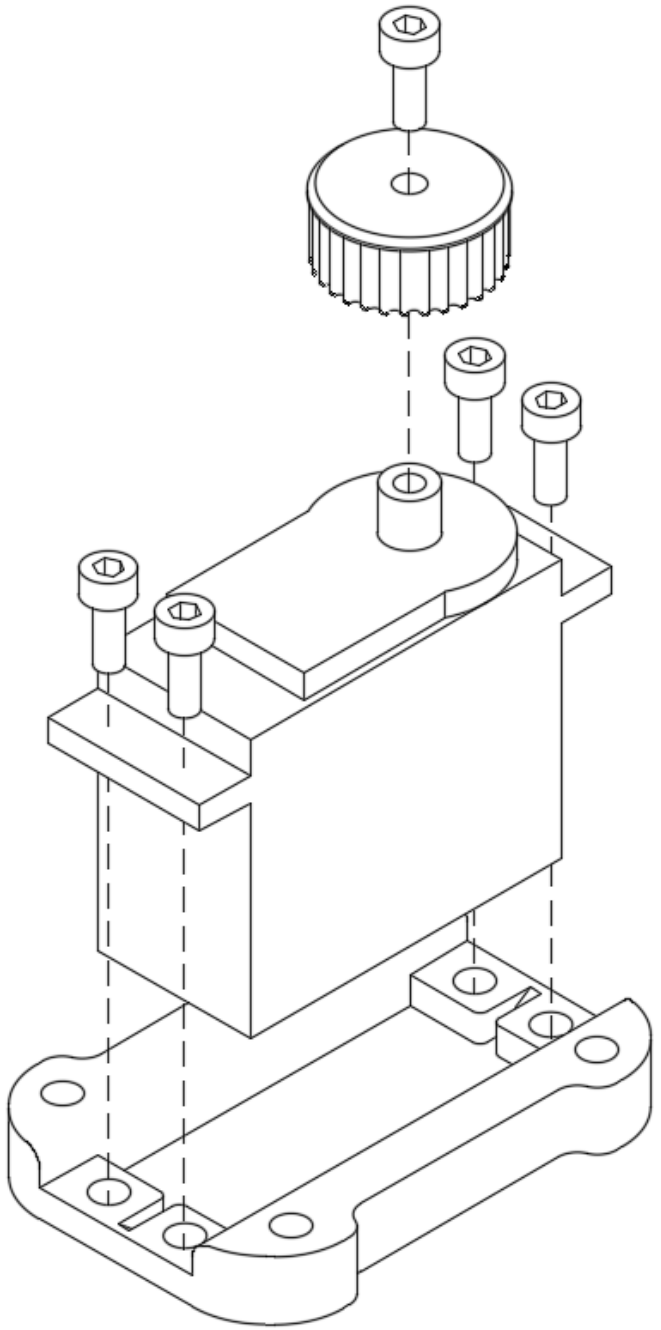




Assembly 4: Step 1

- Custom: P406, P410
- Ordered: MG996R
- Bolts: M3x8 [x5]

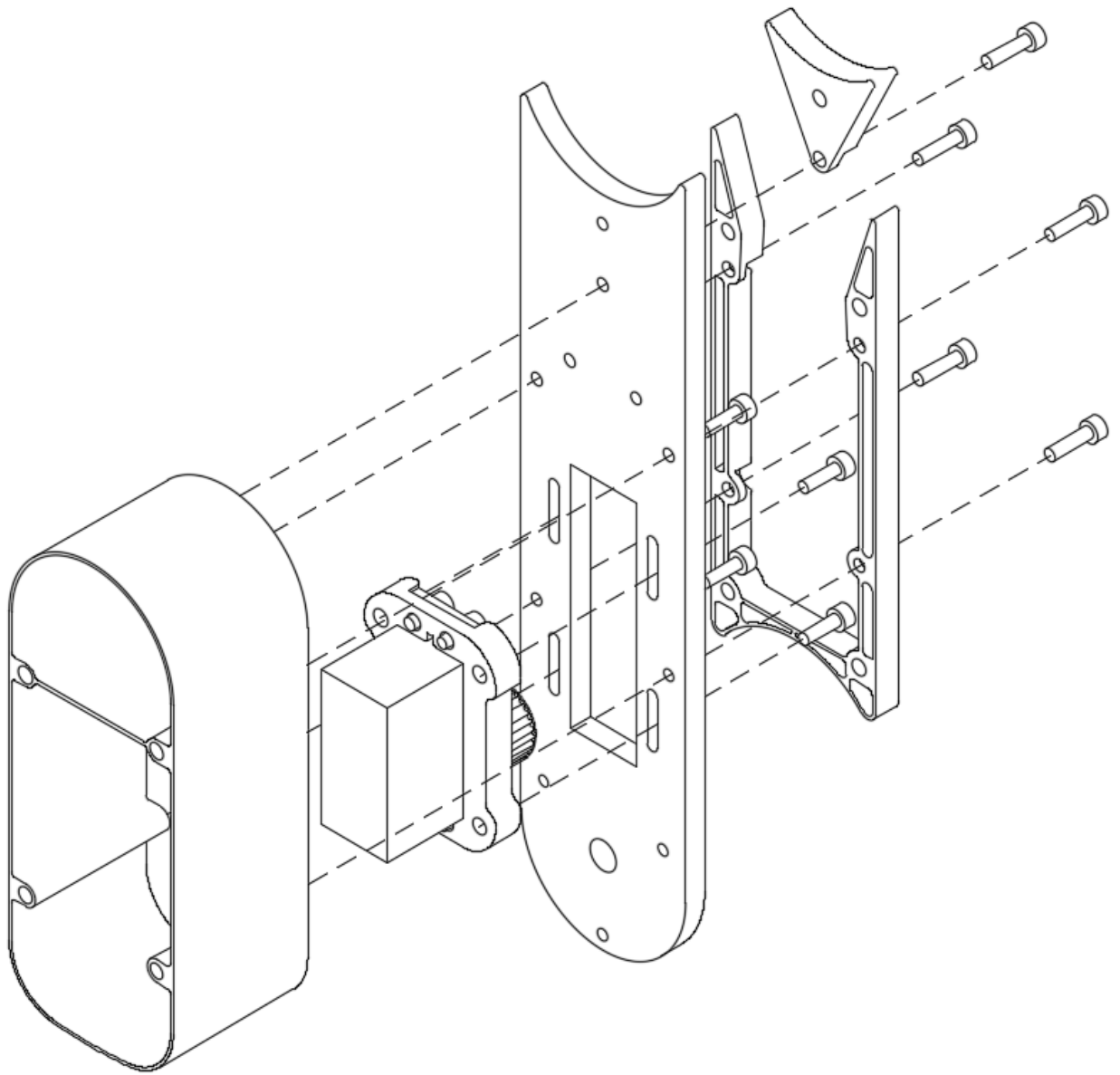
- Mount the servo motor to P406 with four bolts
- Fasten P410 to the servo shaft with a M3x8. Use threadlock glue



Assembly 4: Step 2

- Custom: P404, P407, P408, W404
- Bolts: M3x10 [x4], M3x12 [x5]

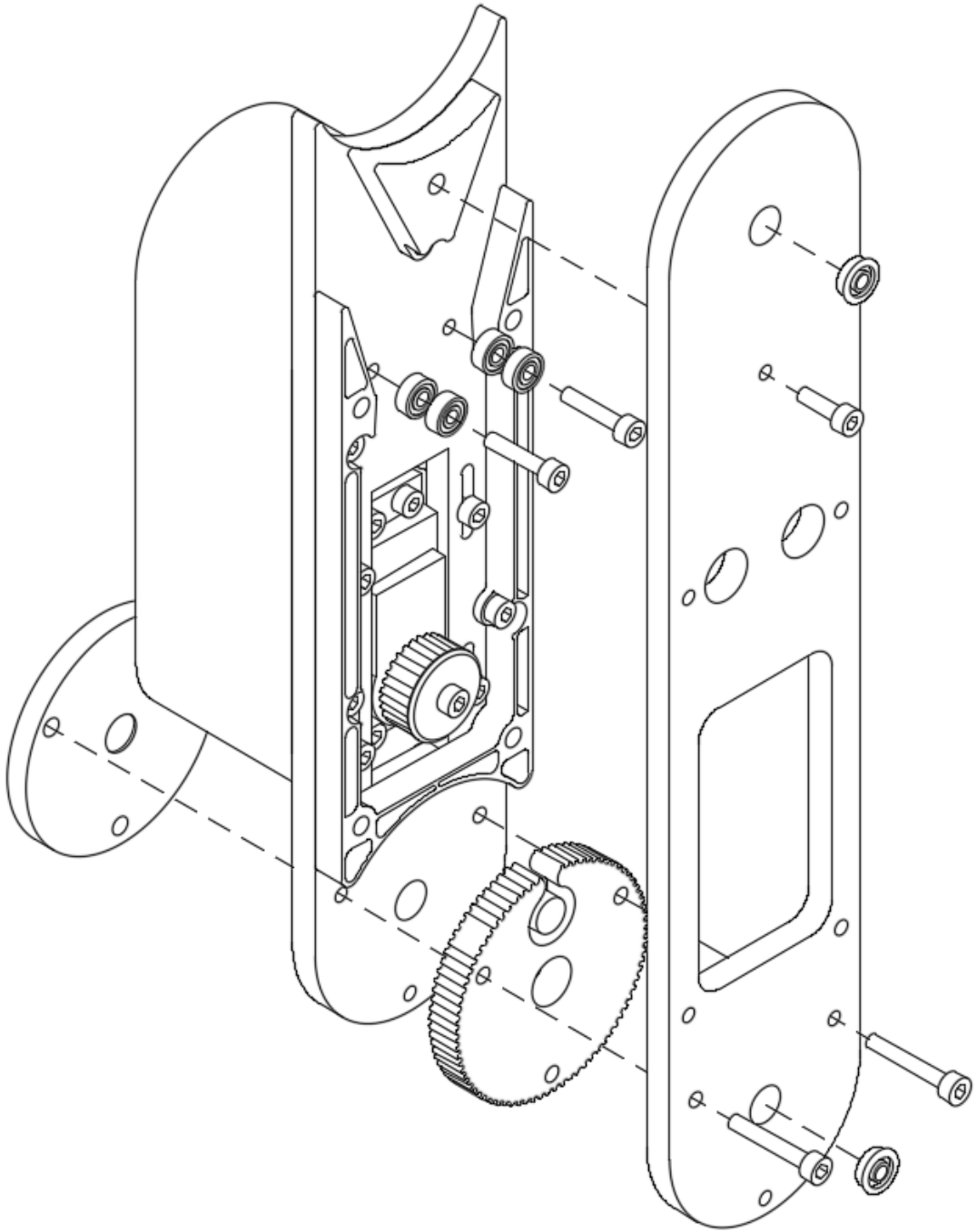
- Mount the motor assembly to W404
- Fasten P404, P407 and P408 with 5 M3x12



Assembly 4: Step 3

- Custom: P403, P409, W403
- Ordered: MR83ZZ [x4], MF83ZZ [x2], GT2 Timing belt, GT2 Timing belt
- Bolts: M3x10 [x1], M3x15 [x2], M3x22 [x2]

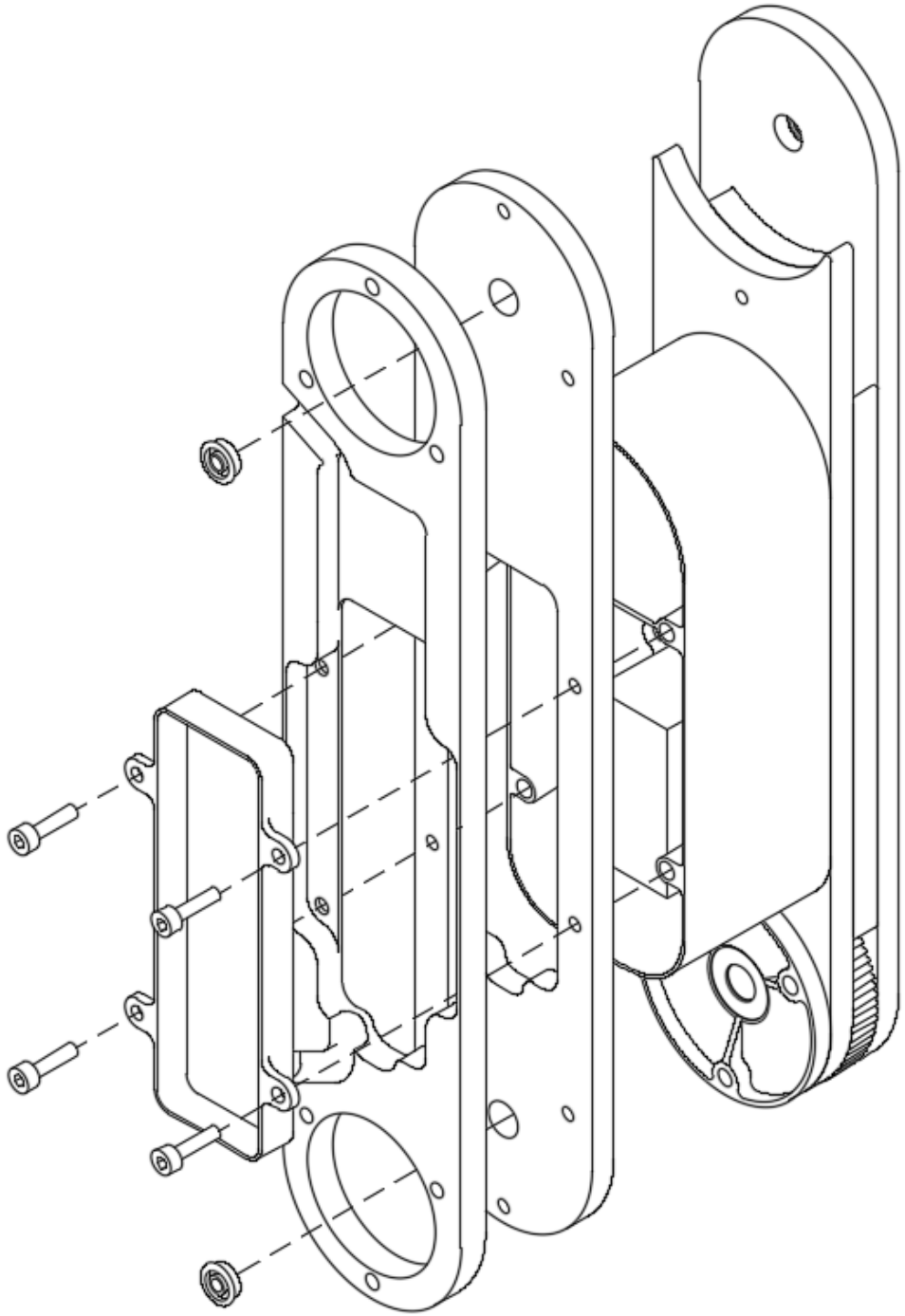
- Fasten the MR83ZZ with M3x15
- Place the timing belts in position
- Fasten W403, P403 and P409. NB a ziptie can be used around the belt in the gap
- Press in the MF83ZZ. The lower goes to W404

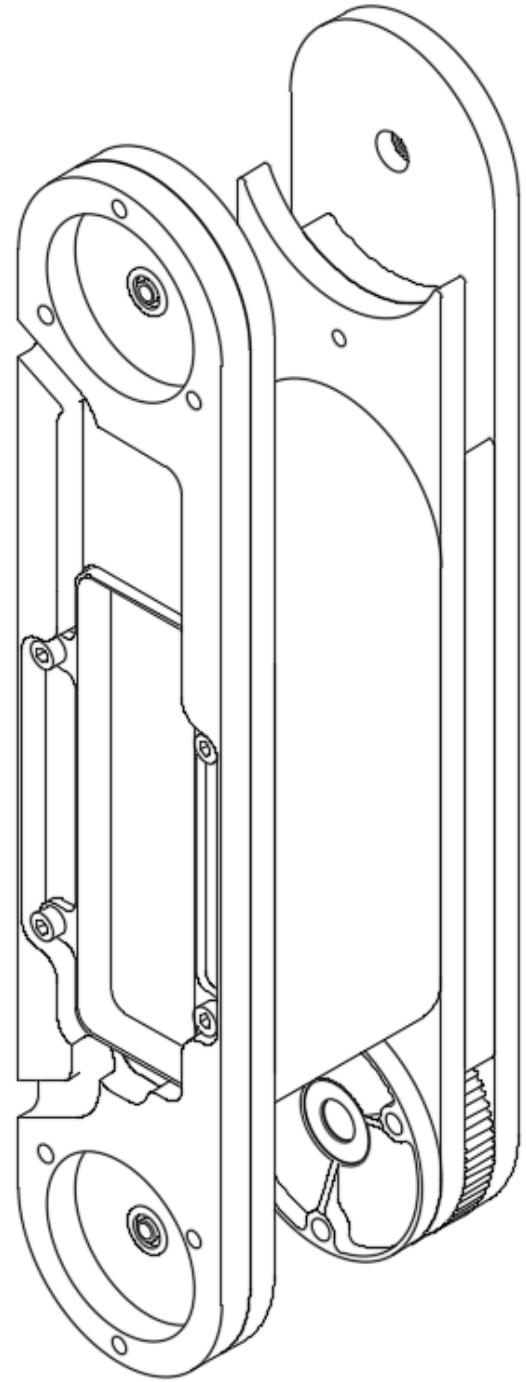


Assembly 4: Step 4

- Custom: P401, P402, W401
- Ordered: MF83ZZ [x2]
- Bolts: M3x12 [x4]

- Fasten P401, P402 and W401 to P404 with M3x12
- The motor cables are routed out underneeth P402
- Press in the MF83ZZ

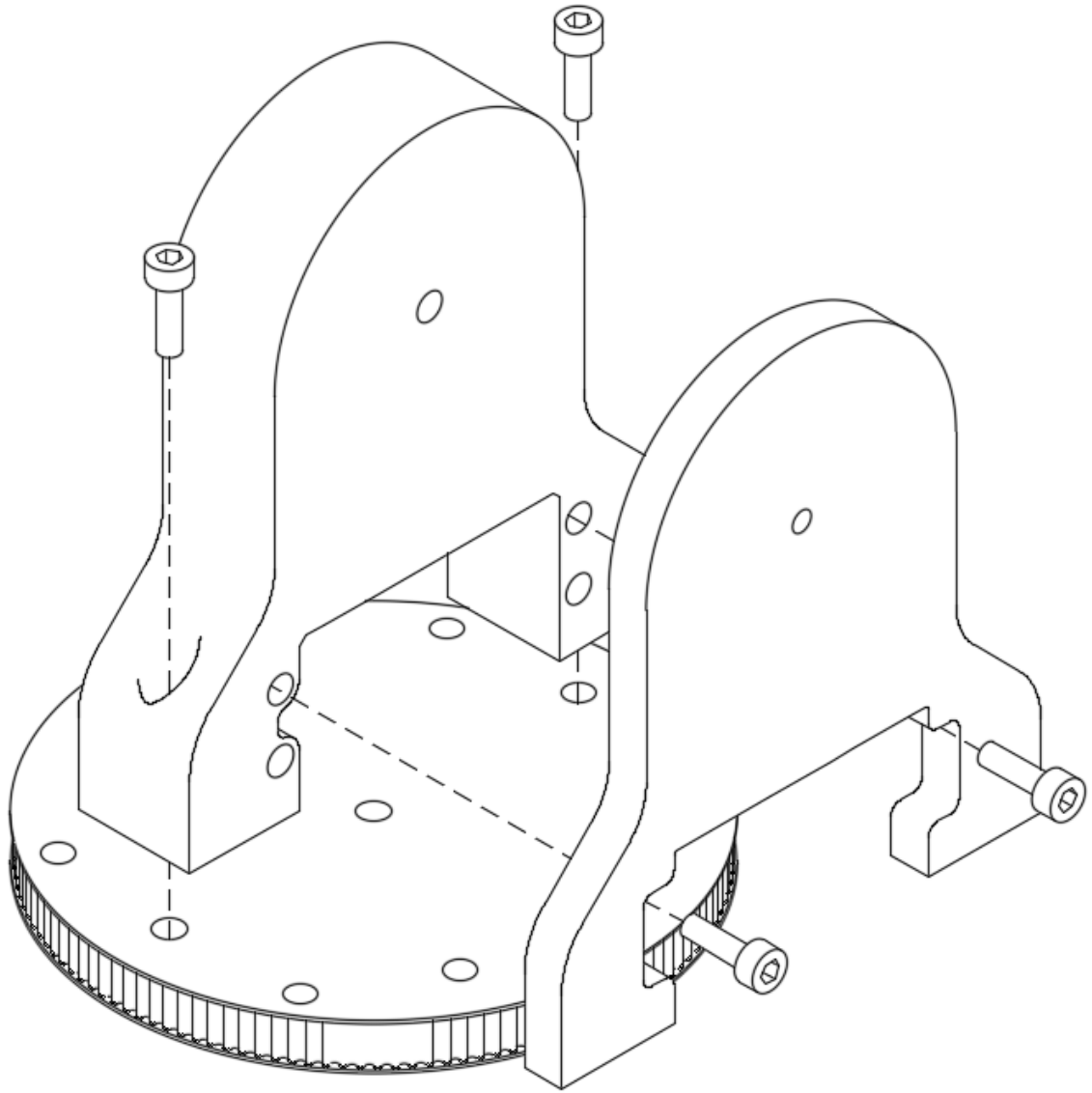




Assembly 5: Step 1

- Custom: P501, P502, W502
- Bolts: M3x10 [x4]

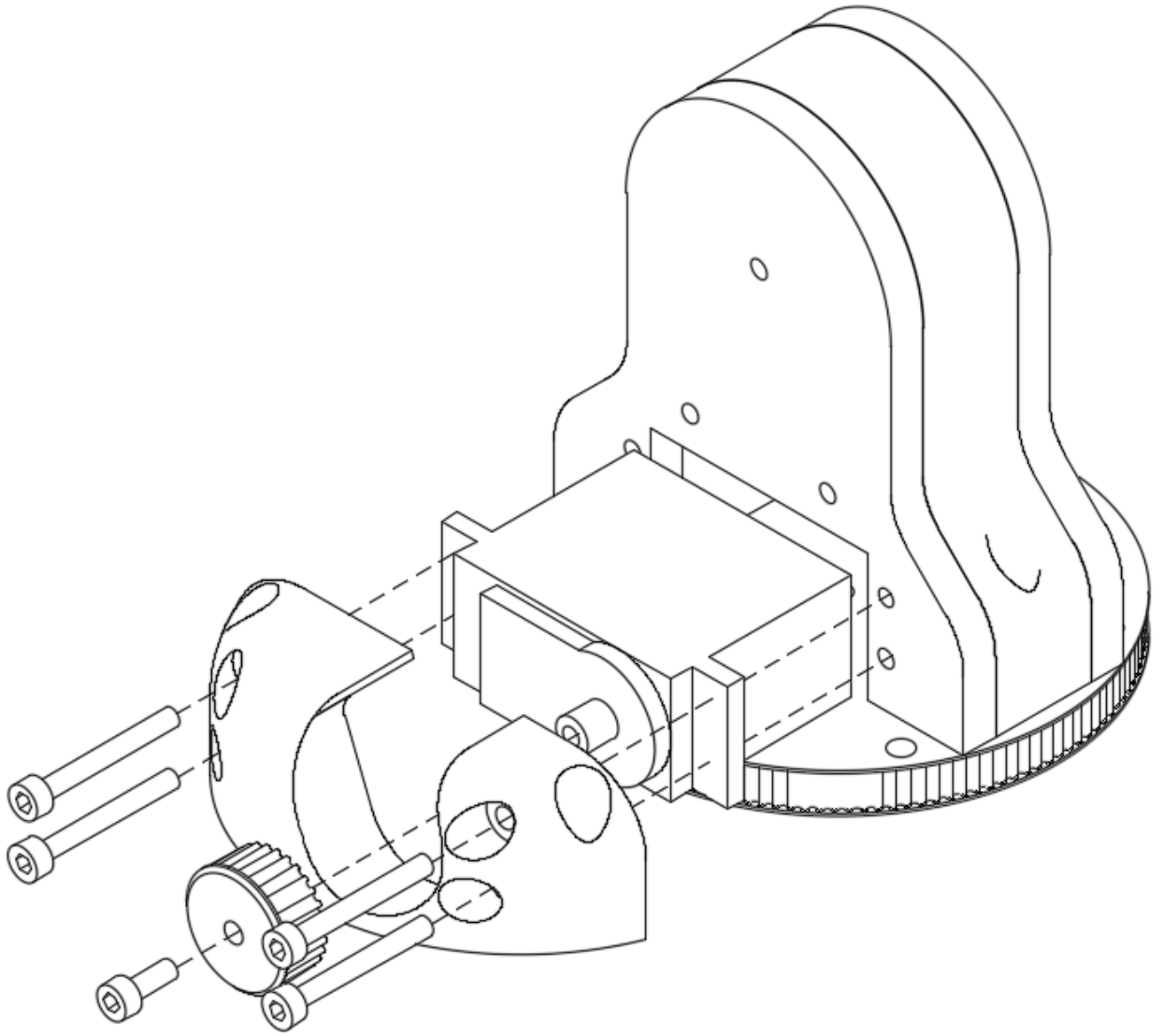
- Fasten P501 and P502
- Fasten W502 to P501



Assembly 5: Step 2

- Custom: P503, P505, W501
- Ordered: MG996R
- Bolts: M3x8 [x1], M3x25 [x4]

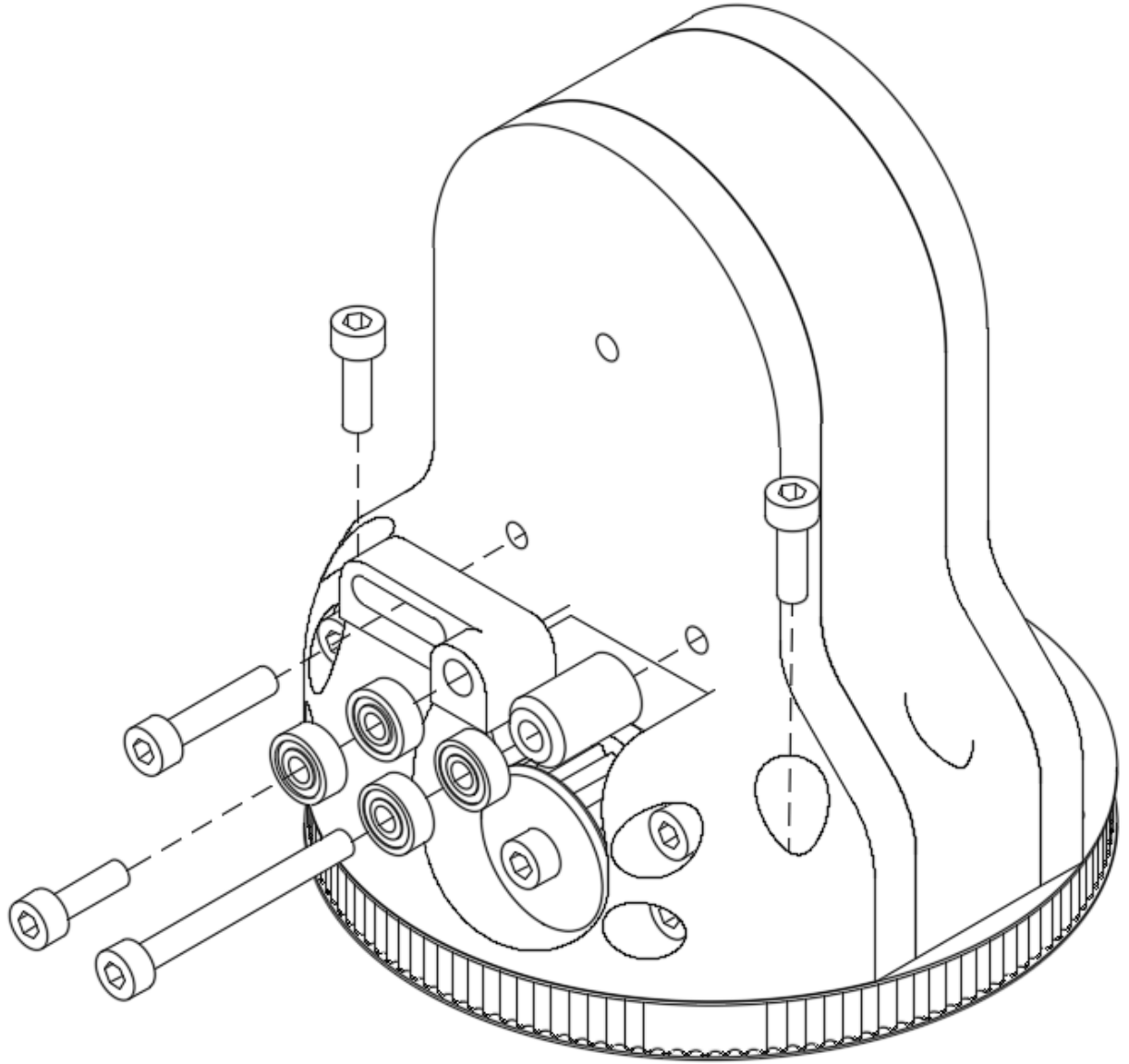
- Mount the servo, W501 and P503 to P501 with 4 M3x25
- Fasten P505 to the servo shaft with a M3x8, use threadlock glue

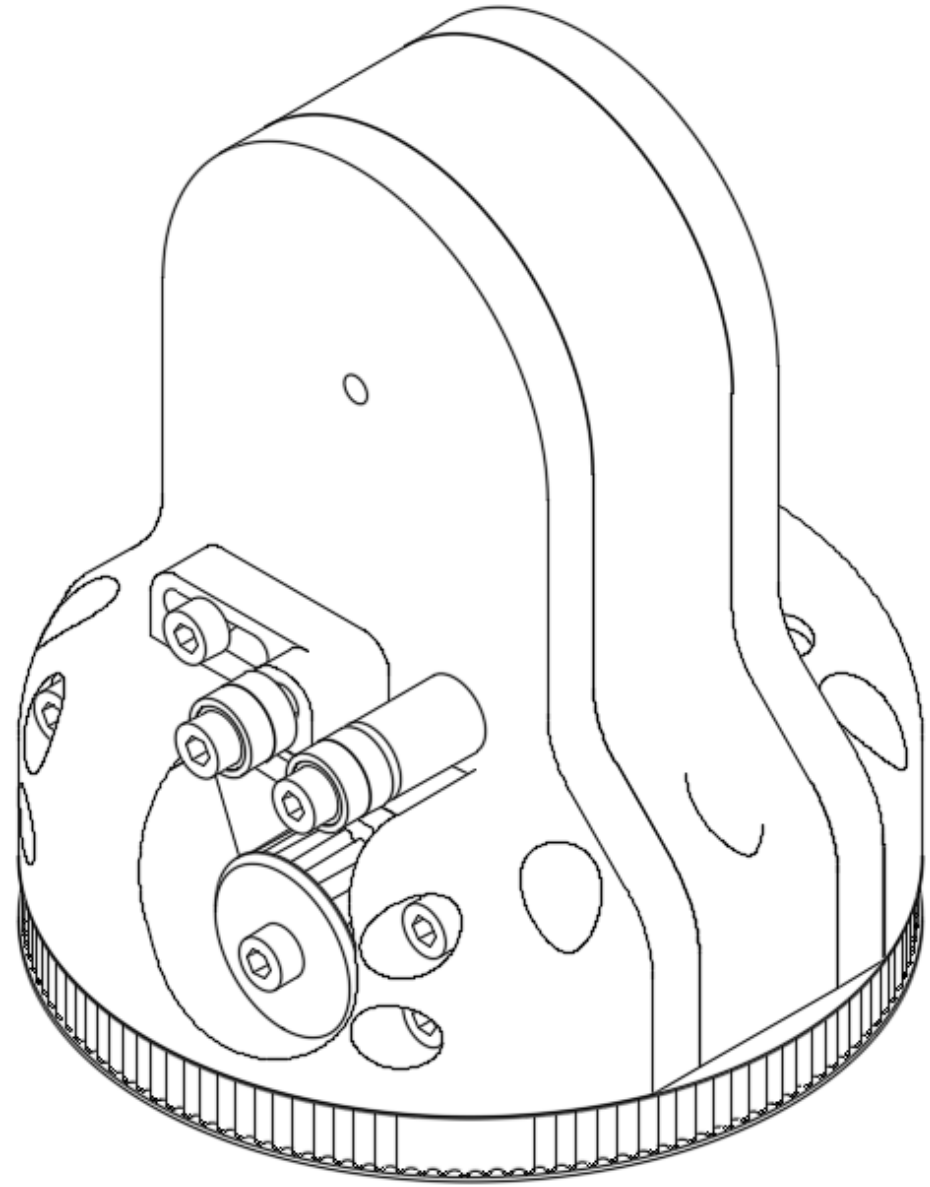


Assembly 5: Step 3

- Custom: P506, P507
- Ordered: MR83ZZ [x4]
- Bolts: M3x10 [x3], M3x15 [x1], M3x25 [x1]

- Fasten P503 to P502 with two M3x10
- Mount P506 to W501/P501 with M3x15
- Fasten 2 bearings in P506 with a M3x10
- Fasten 2 bearings through P507 to P501 with a M3x25

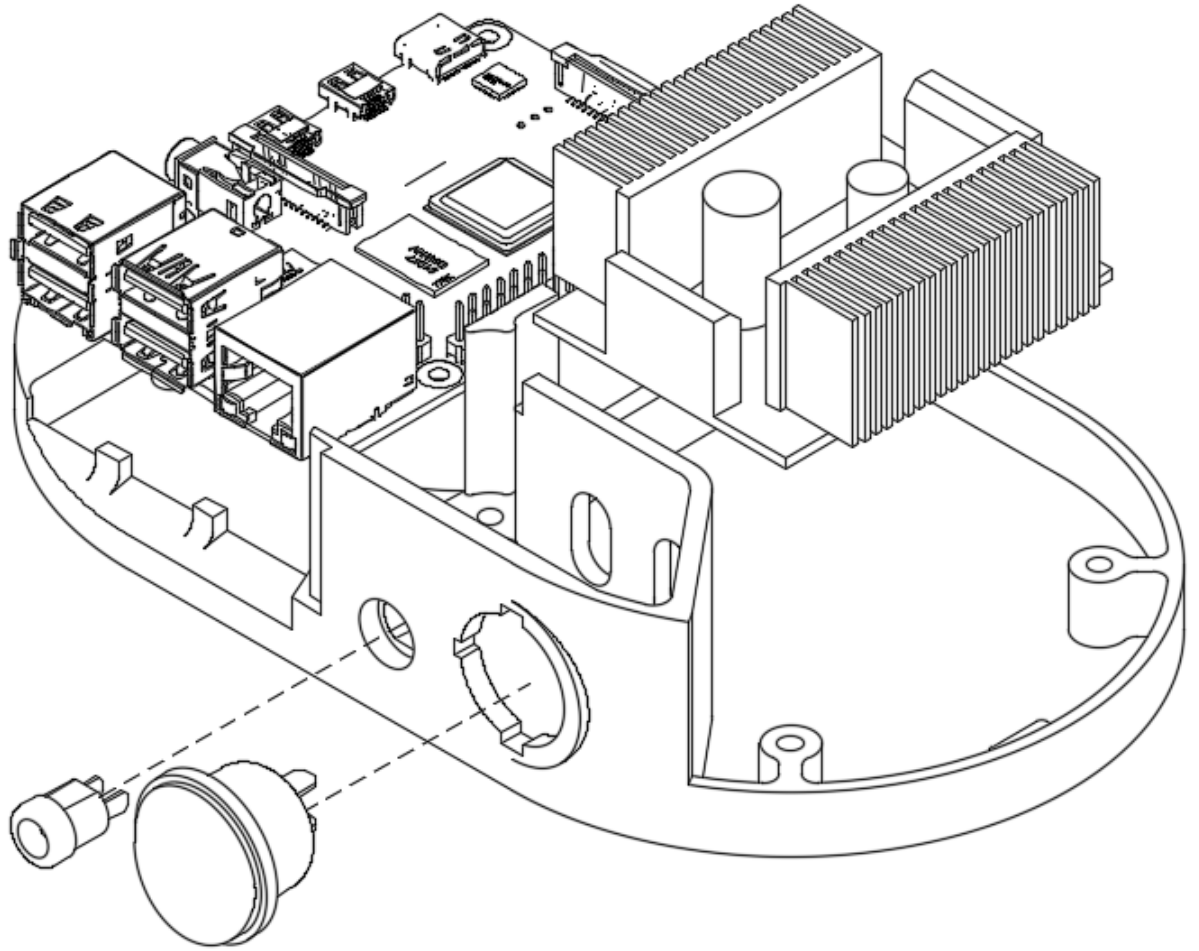




Assembly 6: Step 1

- Custom: P601
- Ordered: DC/DC Converter, Switch, Barrel Jack, Raspberry Pi

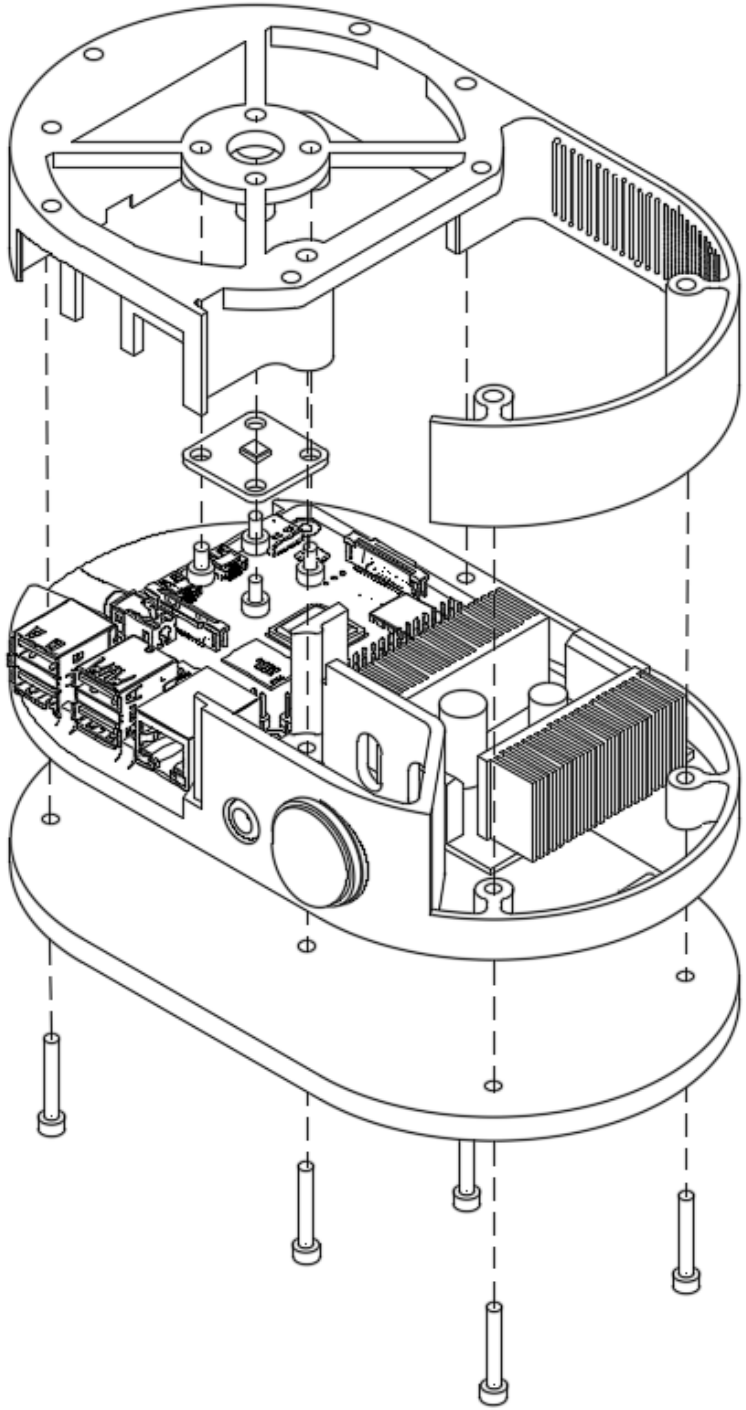
- Press the Raspberry into position in P601
- Fit the barrel jack and switch
- Place the DC/DC converter
- Make the connections between switch, jack and converter



Assembly 6: Step 2

- Custom: P602, W601
- Ordered: AS5600
- Bolts: M3x5 [x4], M3x20 [x5]

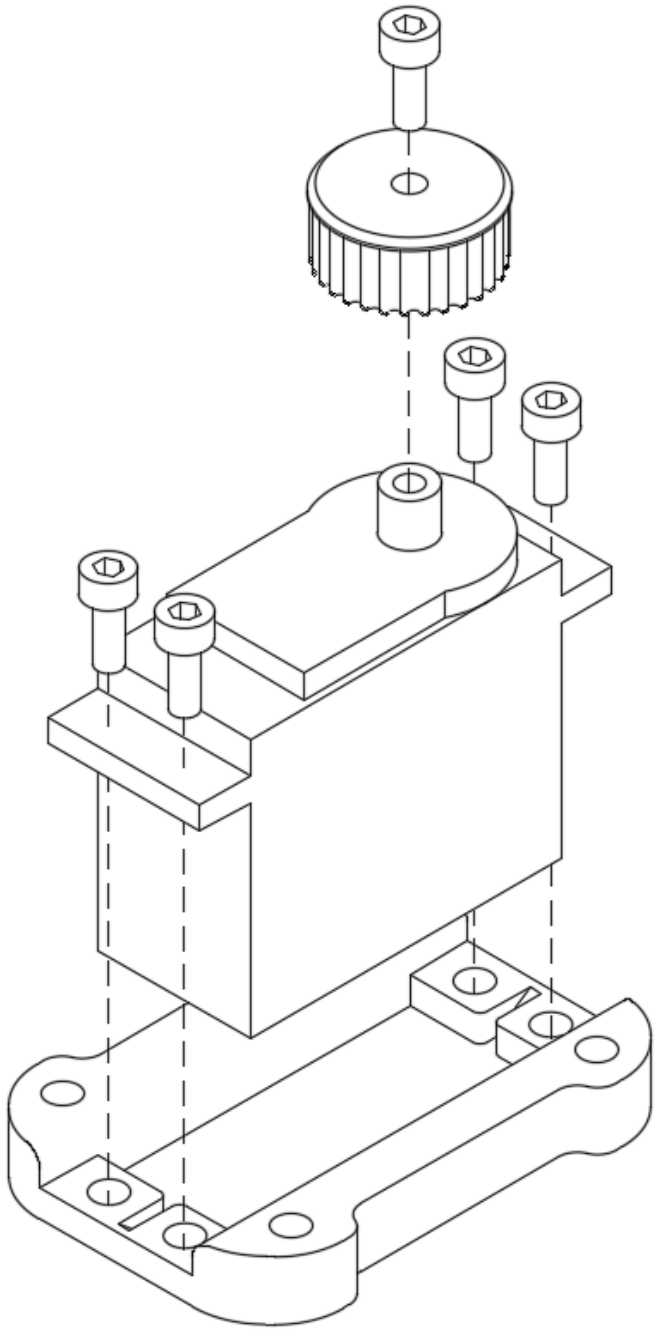
- Fasten the AS5600 with 4 M3x5
- Fit P602 to P601
- Fasten W601 with 5 M3x20



Assembly 6: Step 3

- Custom: P604, P605, W603
- Ordered: MG996R
- Bolts: M3x8 [x5], M3x10 [x4]

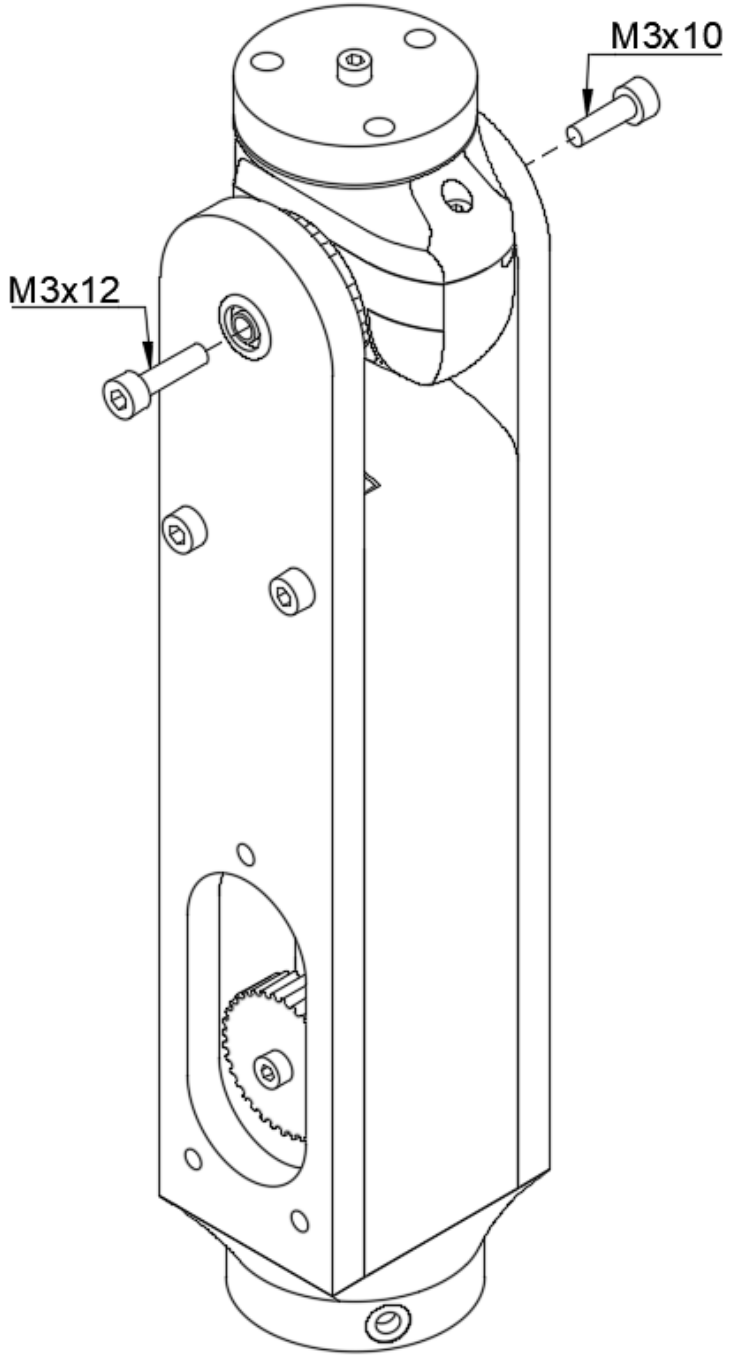
- Mount the servo motor to P604 with 4 M3x8
- Fasten P605 to the servo shaft with a M3x8. Use threadlock glue
- Fasten P604 to W601 with 4 M3x10



General assembly: Step 1

- Assemblies: A1, A2
- Bolts: M3x10 [x1], M3x12 [x1]

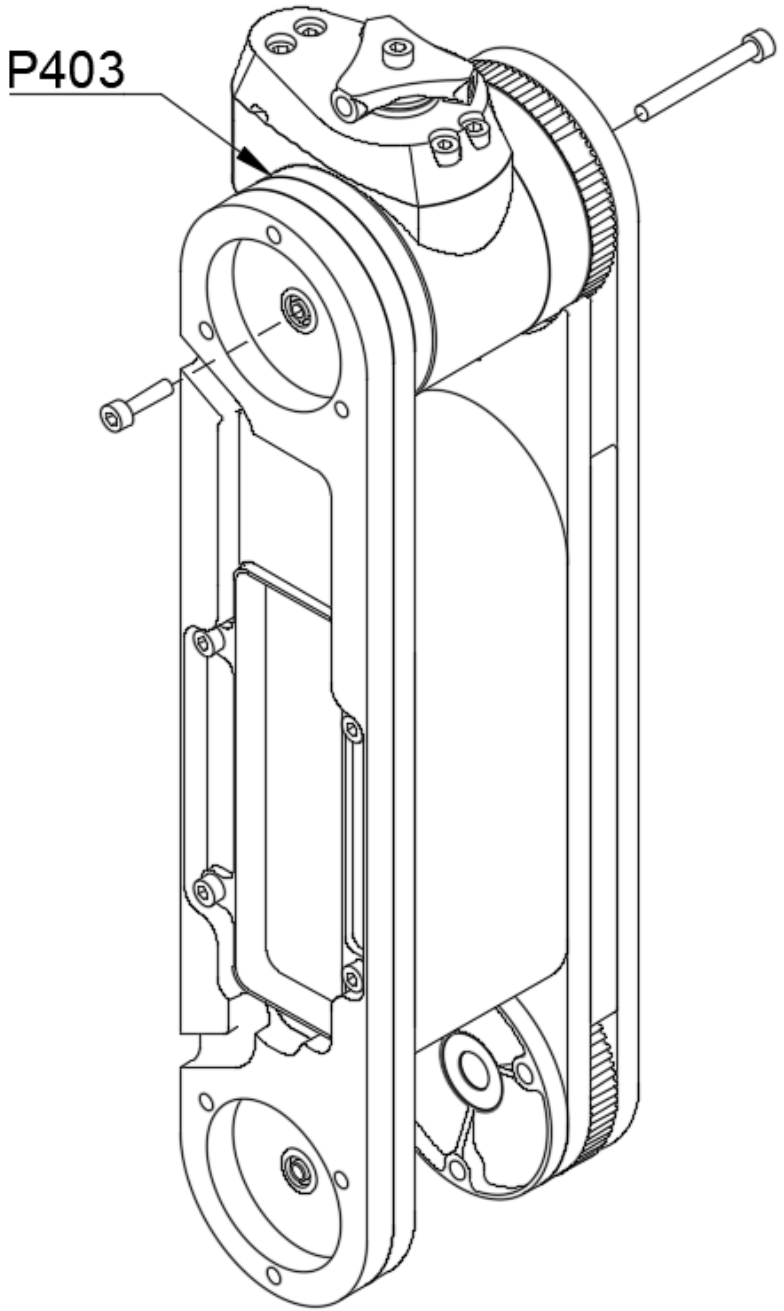
- Fit the A1 in A2, make sure the timing belt goes around A1 pulley
- Fasten with bolts, use threadlock glue. NB: not tight, ensure free rotation



General assembly: Step 2

- Assemblies: A3, A4
- Components: P403
- Bolts: M3x12 [x1], M3x30 [x1], M3 standoff (5mm)

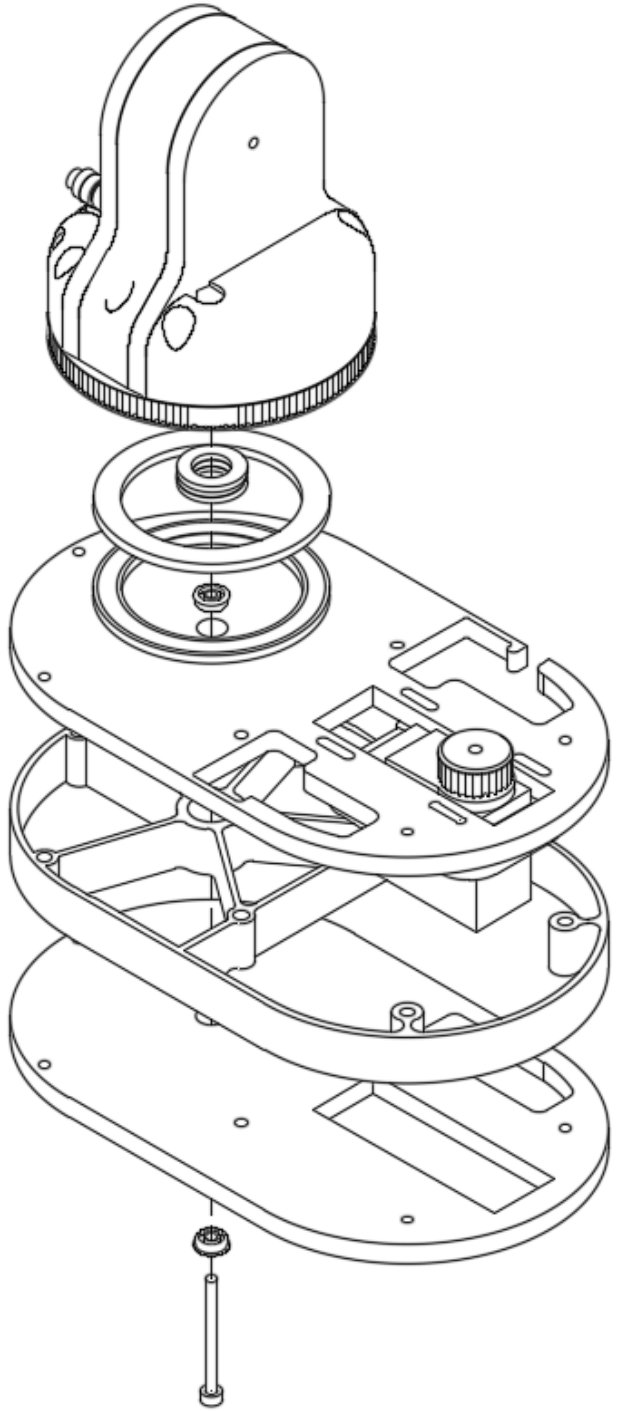
- Place P403 in position, this will be fastened later
- Fasten the M3x12 to the standoff, through the bearing (cable side)
- Fasten A3 to the two bolts, use threadlock glue
- The belt can be tensioned



General assembly: Step 3

- Assemblies: A5
- Components: P603, W602, W603, Thrust-bearing duct
- Ordered: MF83ZZ [x2], Thrust bearing(18x10x5.5), 4.5mm steel balls
- Bolts: M3x35 [x1]

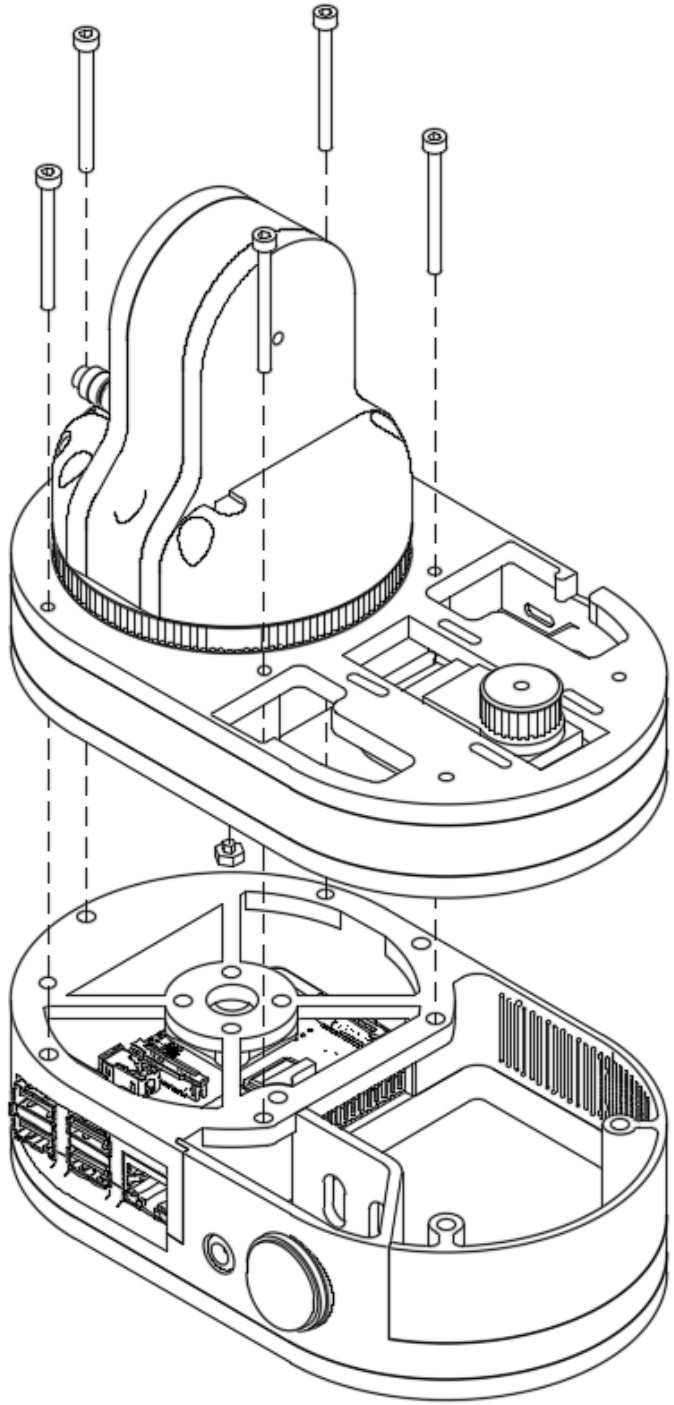
- Fill the printed thrust bearing with metal balls, use lubrication
- Press MF83ZZ to W602 and W603
- Fasten A5 to the A6 assembly with a M3x35



General assembly: Step 4

- Assemblies: A5, A6
- Components: Magnetholder
- Bolts: M3x35 [x5]

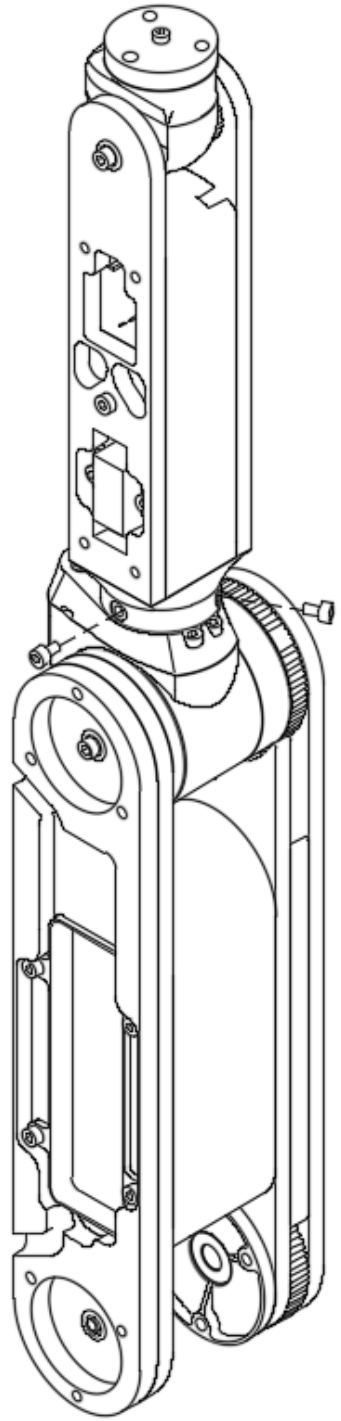
- Pressfit the magnetholder with magnet to the M3x35 connecting A5 to A6
- Connect with 5 M3x35



General assembly: Step 5

- Assemblies: A1-A4
- Bolts: M3x5 [x3]

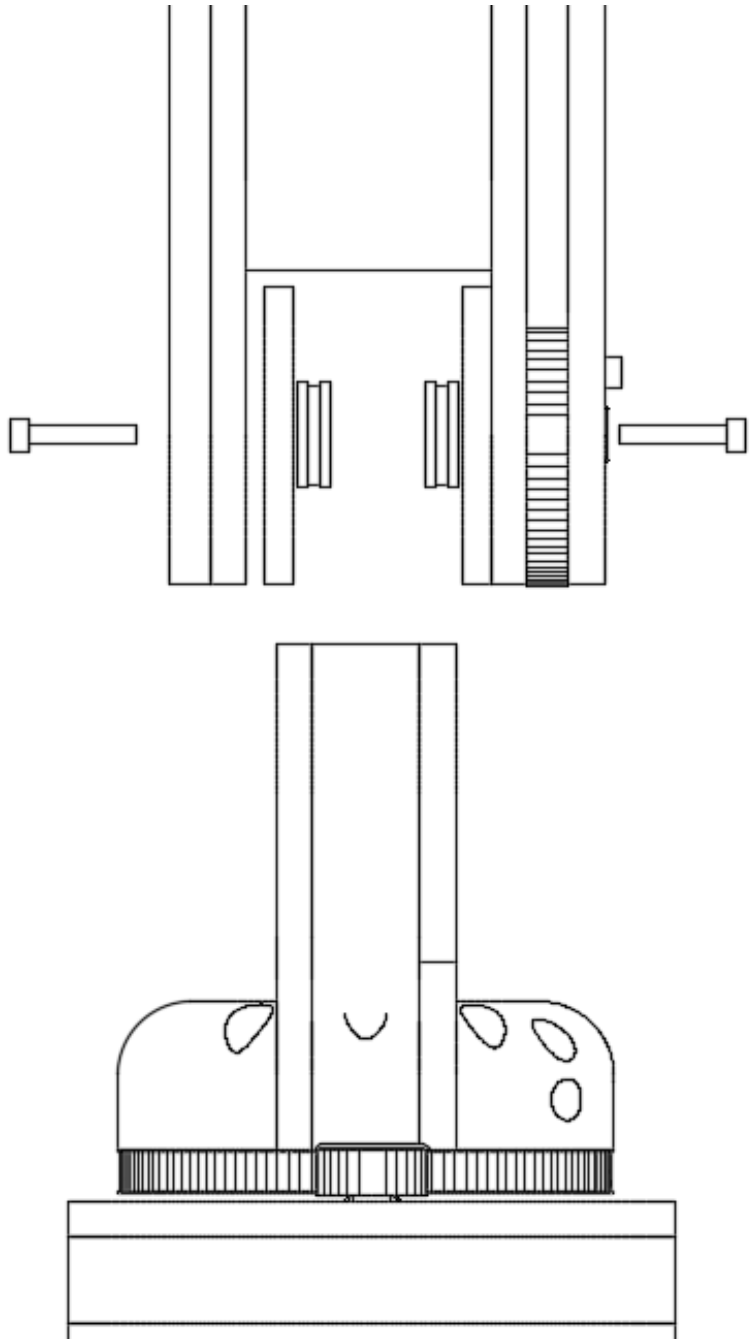
- Connect A2 to A3 with 3 M3x5



General assembly: Step 6

- Assemblies: All
- Components: P403
- Ordered: Thrust bearing (18x10x5.5)
- Bolts: M3x18 [x2]

- Place P403 and bearings
- Slide onto A5 and fasten with bolts



Cabeling

- Ordered: ESP32-C3 supermini [x2], wires, I2C multiplexer
- Bolts: M3x5 [x4]

- Use the schematics figure from chapter 9
- One ESP32 is going in A2, the other in A6
- The power cables are connected in DC/DC-converter for A6, two M3x5 and inserts in A5 and A2
- I2C lines are connected with JST connectors
- I2C on AS5600 goes through the I2C multiplexer

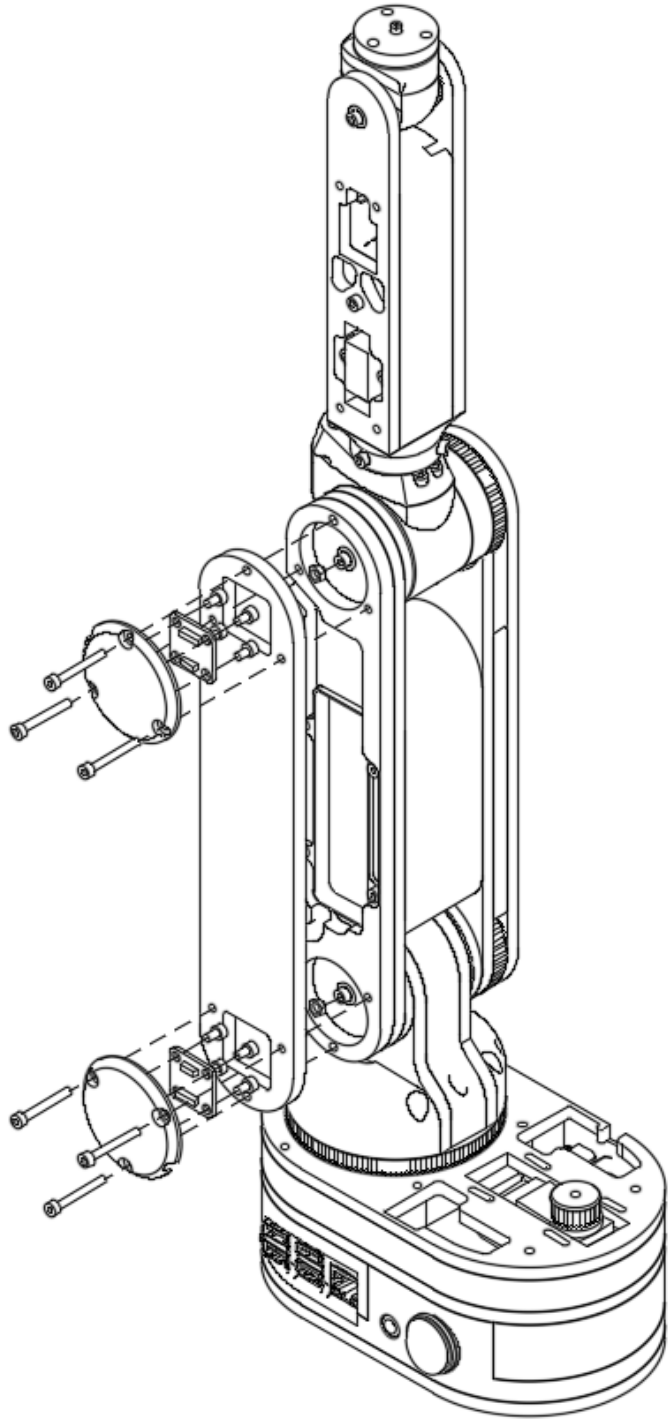
  (NB: Cables are soldered directly to board)
- It is recommended to use cable-sleeves in A6-A5, A5-A4 and A4-A3
- Set 5v output on converter

  (wago-terminals can be used in A4)

Cover assembly: Step 1

- Components: P405 [x2], W402, Magnetholder [x2]
- Ordered: AS5600 [x2]
- Bolts: M3x5 [x8], M3x25 [x25]

- Fit magnetholders w. magnets to bolts in joints
- Fasten the encoders to P405 with M3x5
- Fit all wires in cable gate in A4 and place W402 over
- Fasten P405 to A4 with M3x25



Cover assembly: Step 2

- Components: P205, P206, P411, P504, P606
- Bolts: M3x10 [x4] M3x15 [x7], M3x25 [x1], M3x35 [x2]

- Fasten P205 and P206 with M3x15
- Fasten P411 with 2 M3x10 and 1 M3x25
- Fasten P504 with 2 M3x10
- Fasten P606 with 2 M3x35