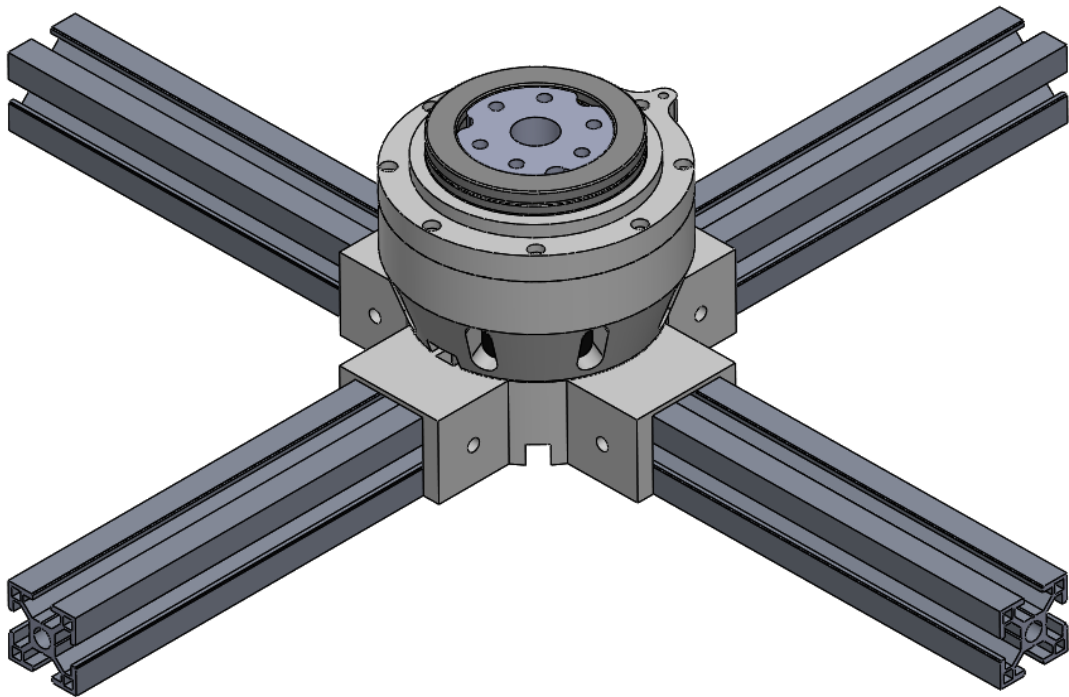


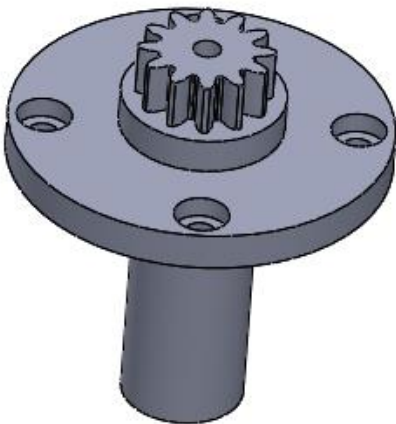
The goal of CM6 is to be a go-to robotic arm framework for people interested in robotics. CM6 uses 6 gimbal BLDC motors paired with small gear ratio gearboxes (from 5:1 to 9:1), by doing that it is passively compliant and safe. Each Joint is using an S-Drive BLDC driver that is mounted on modular actuator designs for specific gimbal motors. Design can be changed easily by using different size aluminum extrusions or changing the gear ratio of modular gearboxes.

The total price of this first version is around 1000 dollars in raw materials. But I believe that the future version could be pushed to around 700-800 dollars.

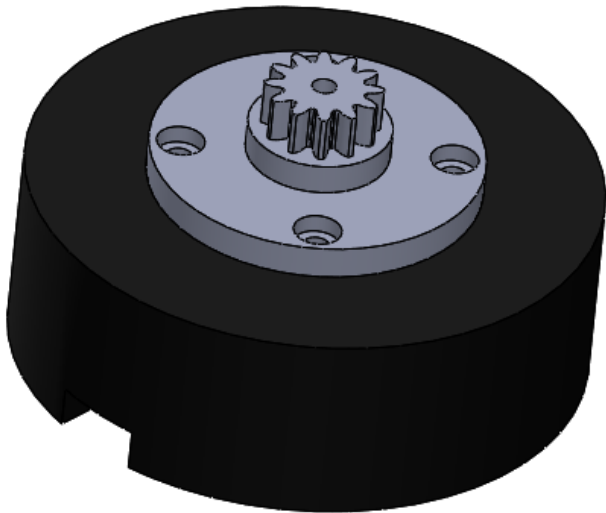
Note that if you are building V2 of this robot you will need to replace bottom lid parts of each joint and encoder shafts with the parts in the CM6_V2_PARTS folders! S-drives need to be replaced with spectral micro BLDC drivers!



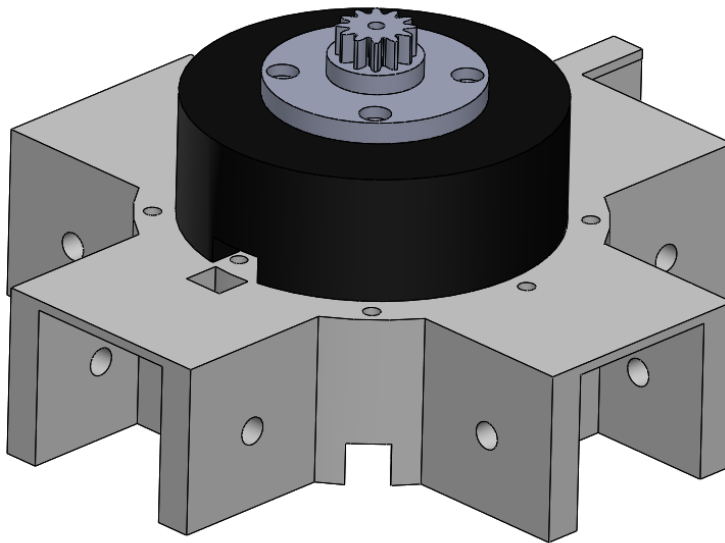
Part	Quantity	Position	Note: Joint 1 assembly



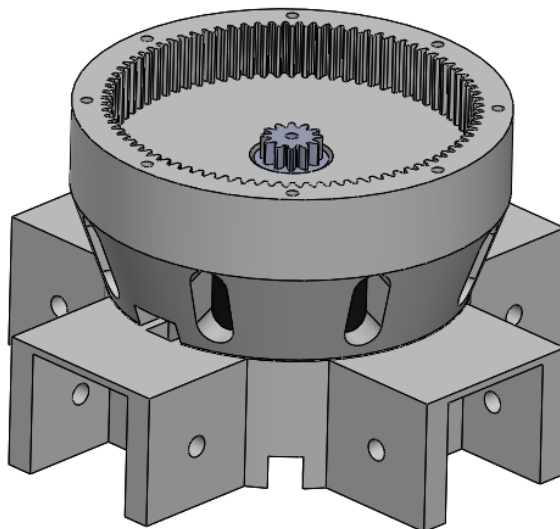
Part	Quantity	Position	Note: Screw in encoder shaft to sun with M3 20 mm screw. At the end of encoder shaft insert magnet for encoder.
Encoder shaft J1 Sun J1			



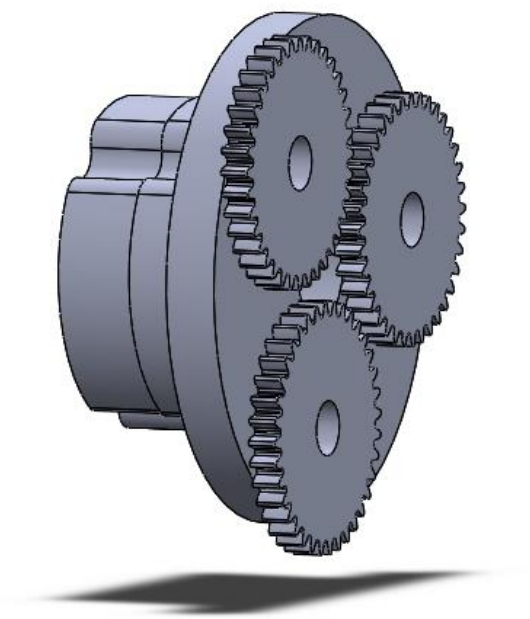
Part	Quantity	Position	Notes:
Gimbal Motor GM7008H	1	1	Connect gear to motor with 4 M3 5mm screws



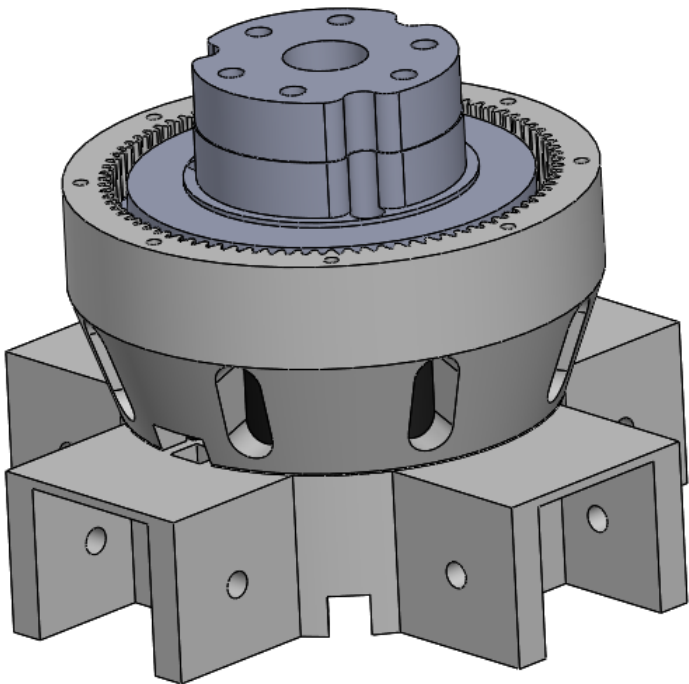
Part	Quantity	Position	Notes:
Bottom lid J1 BLDC driver	1	1	Connect lid to motor with 4 5-6 mm M3 screws. Make sure that hole for motor wires is on correct side. Attach BLDC driver with 4 M3 5mm screws.



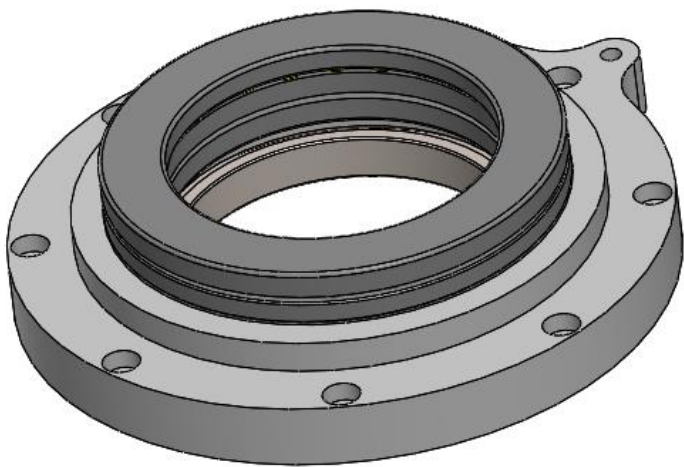
Part	Quantity	Position	Note: attach to bottom lid with 7 M3 30 mm screws.
J1 orbit			



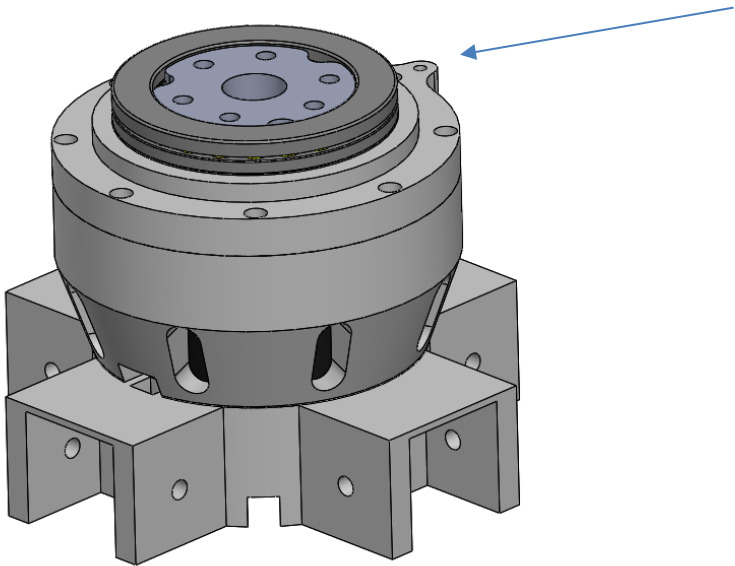
Part	Quantity	Position	Note: In every planet insert Radial ball bearing. Now screw in 3 M3 10 mm screws from the top side of the output shaft, so that planets can attach to the ends of the screws but still fall off.
J1 planets			
J1 output shaft			
Radial Ball bearing 3x8x4			



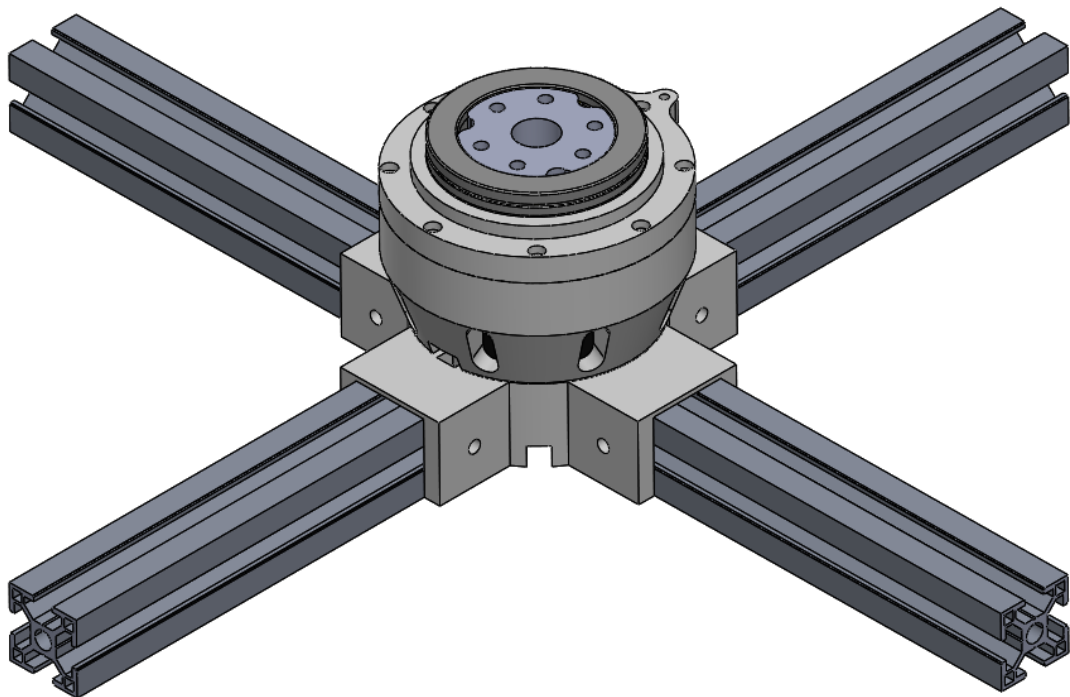
Part	Quantity	Position	Note: Insert output shaft assembly. You should be able to spin the output shaft and motor should turn also.



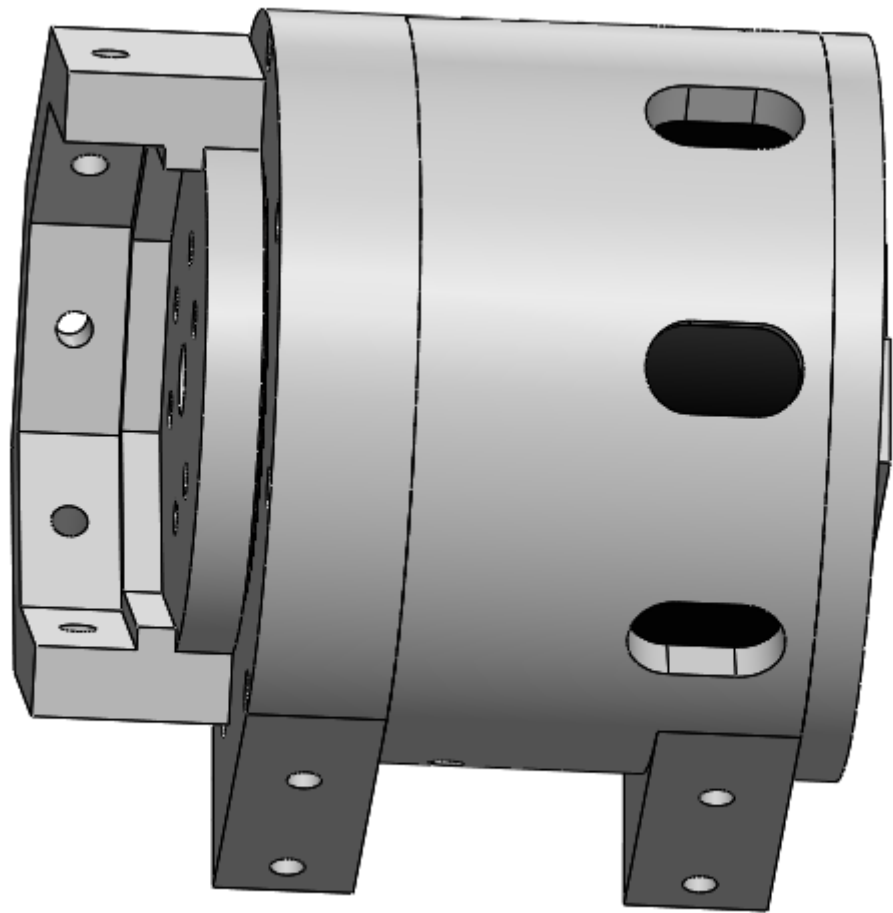
Part	Quantity	Position	Note:
Thrust Ball Bearing 50x70x14			
Radial Ball bearing 50x67x7			
J1 top lid			



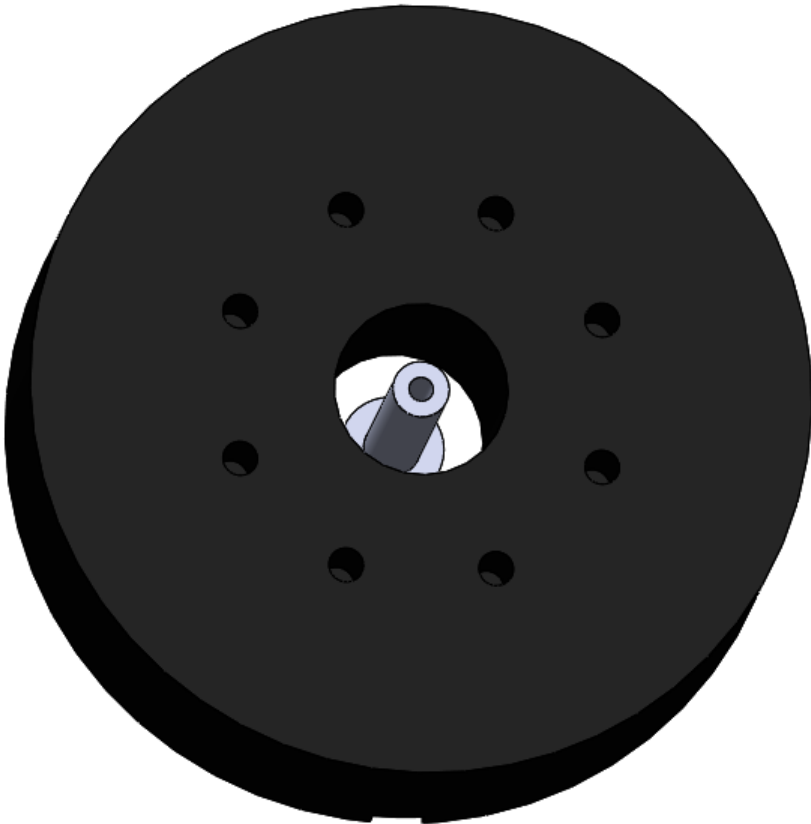
Part	Quantity	Position	Note: Screw in top lid with 8 15mm M3 screws. Part market with arrow is used for homing and can be placed on any side but I recommend this side.



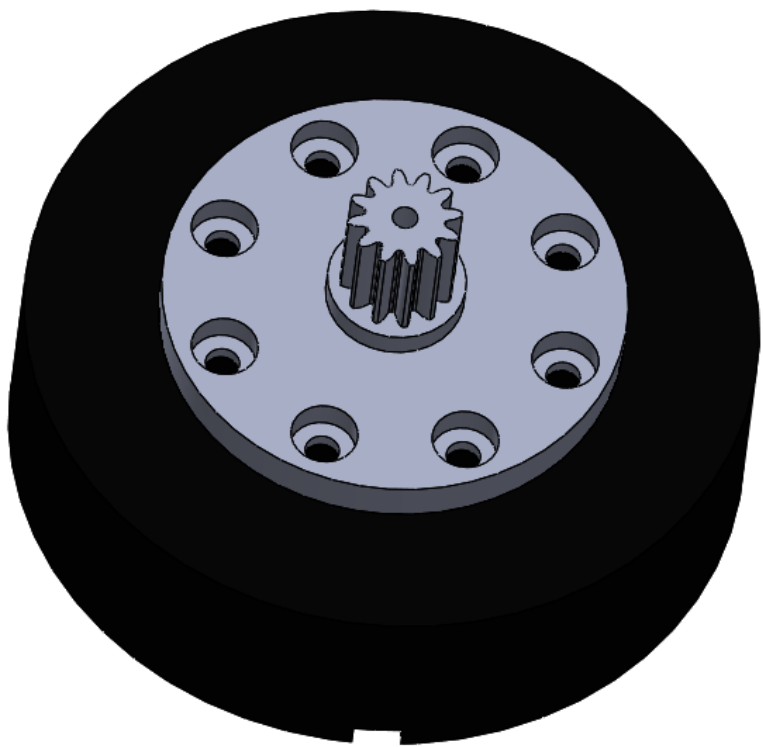
Part	Quantity	Position	Note:
Hammer nut U8 M5 M5 15 mm screw 30x30 180mm T slotted aluminum extrusion			



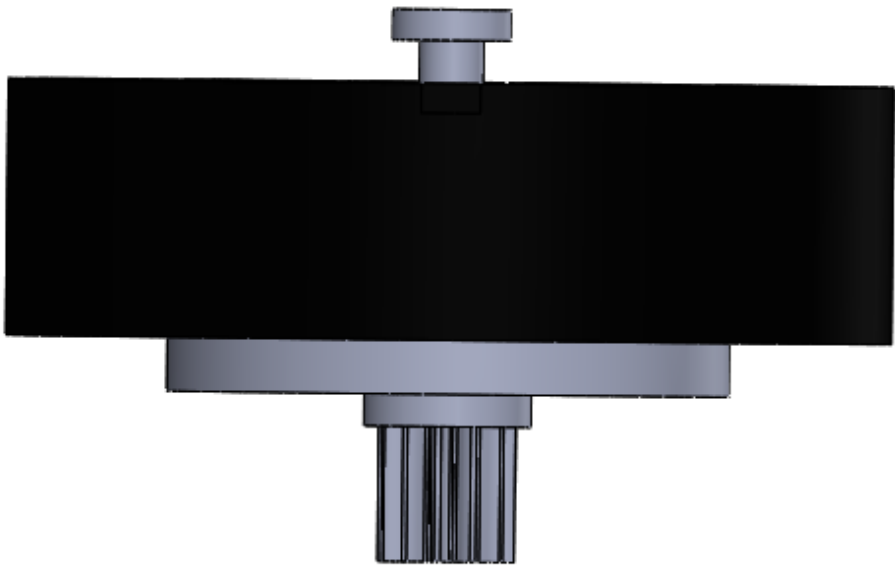
Part	Quantity	Position	Note: Joint 2 assembly. All of the joints have similar assembly steps just different screws sizes and parts. So some steps might be skipped

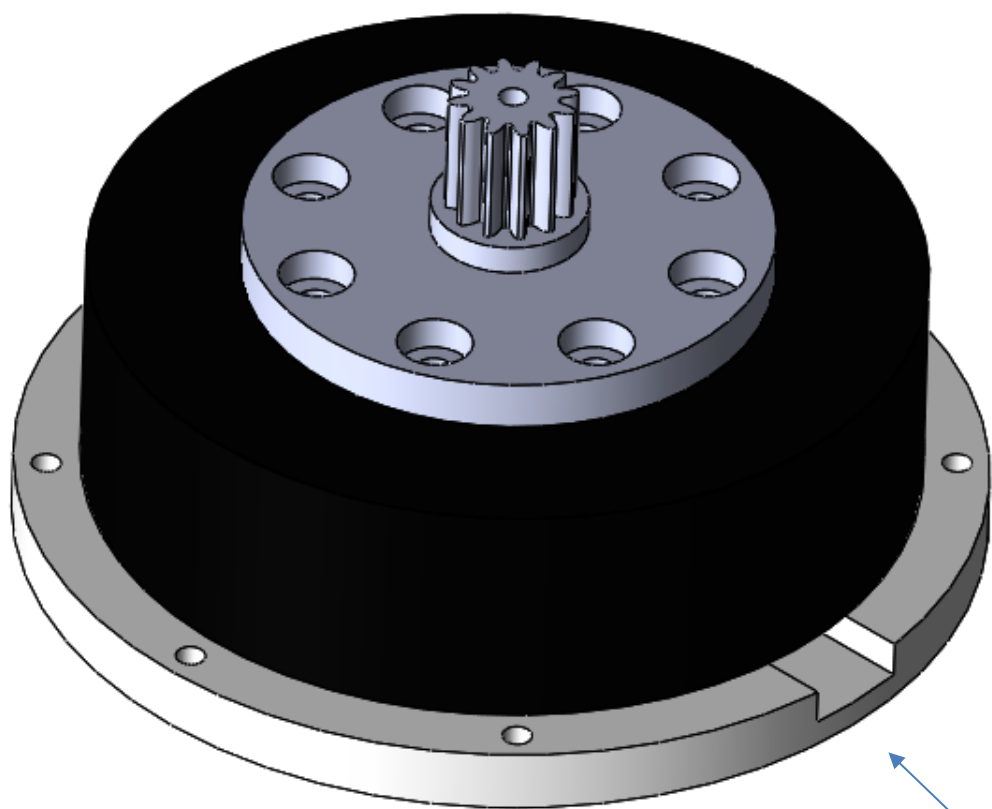


Part	Quantity	Position	Note: This part is different from other motor assemblies. Encoder shaft cant go thru the motor hole so first you need to position it like in the picture.
Iflight Ipower GM8112			
Brushless Motor			
J2 encoder shaft			

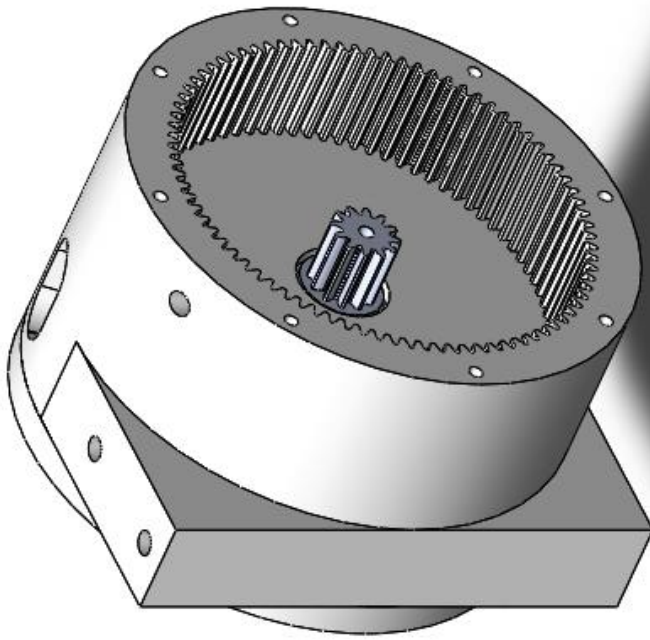


Part	Quantity	Position	Note: Use 25 mm screw to attach sun to encoder shaft. Use 8 M5 5mm screws to attach sun to the motor.
J2 sun			

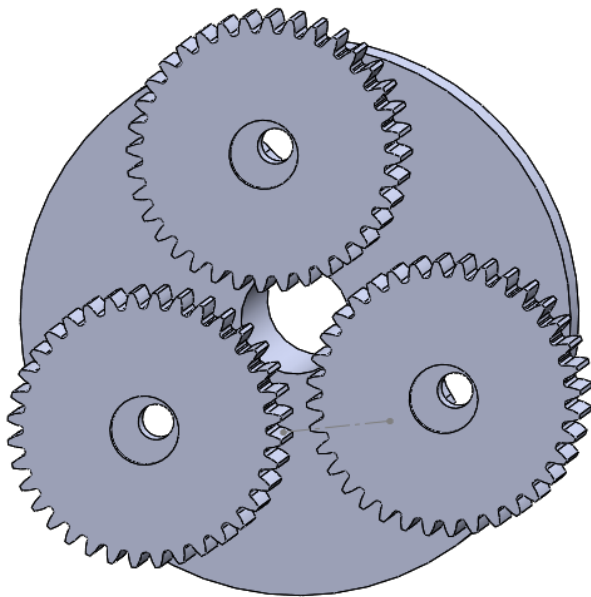




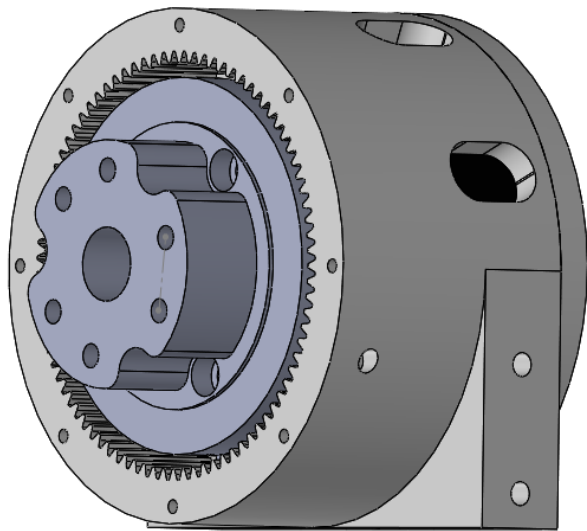
Part	Quantity	Position	Note: Use M5 8mm screws to attach bottom lid to motor. Attach Encoder board to bottom lid with 4 M3 5mm screws. Make shure that part where motor wires are are on the notch on bottom lid
J2 bottom lid			



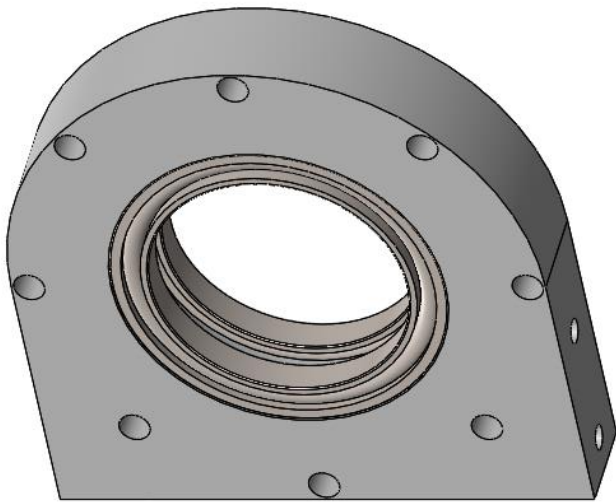
Part	Quantity	Position	Note: Attach orbit to bottom lid with 8 M3 15mm screws.
J2 Orbit			



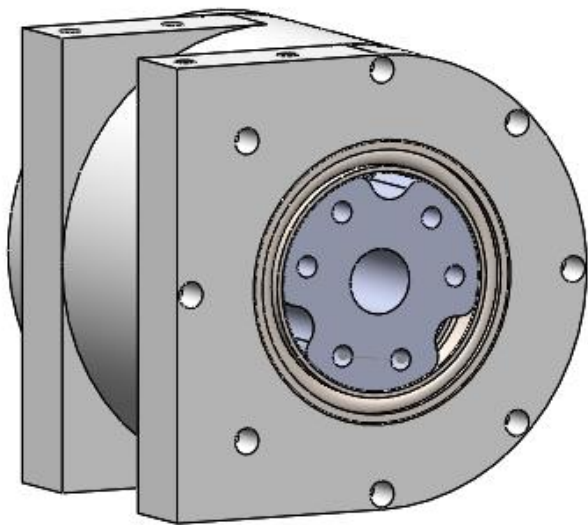
Part	Quantity	Position	Note: Insert 2 ball bearing in each planet. Same like in step for J1 insert 3 M5 15 mm screws to hold bearings.
J2 Output shaft			
J2 planets			
Radial Ball bearing 5x16x5			



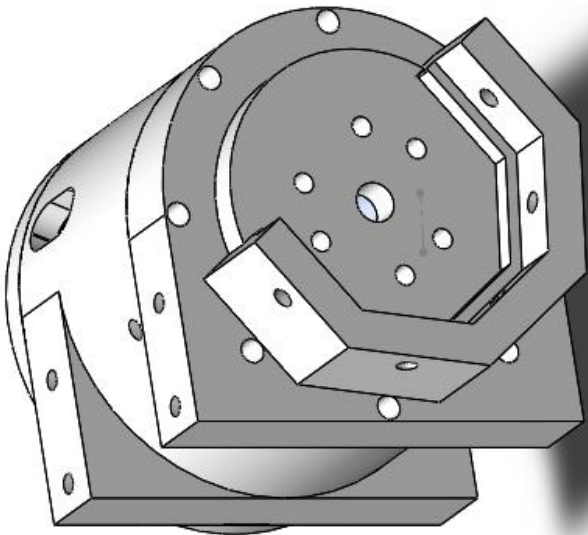
Part	Quantity	Position	Note: Insert output shaft in the orbit.



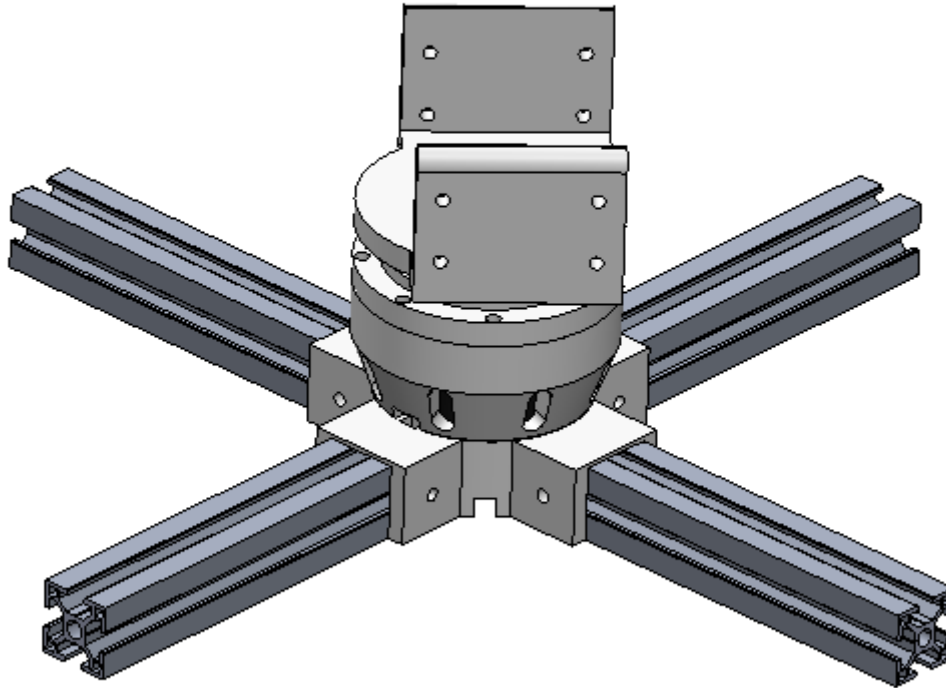
Part	Quantity	Position	Note: Insert 2 Radial Ball bearing 50x67x7 in the holes on top lid.
Top lid			
Radial Ball bearing 50x67x7			



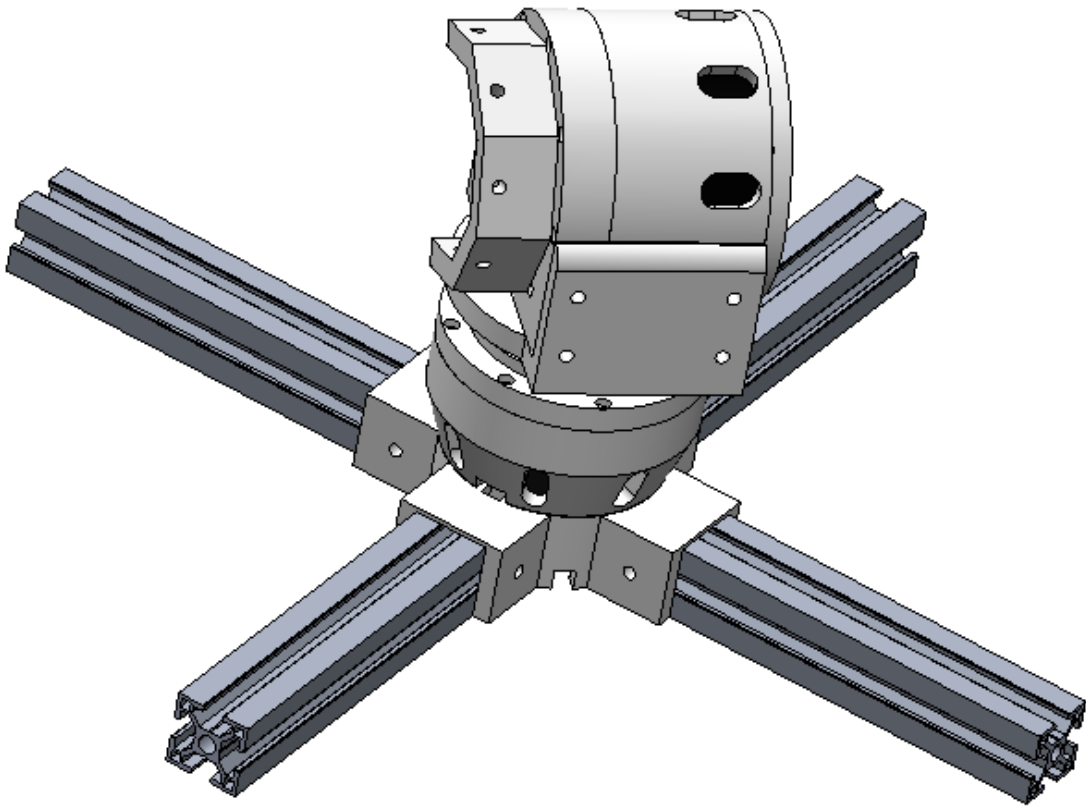
Part	Quantity	Position	Note: Attach top lid to orbit with 8 15-20 mm M3 screws.



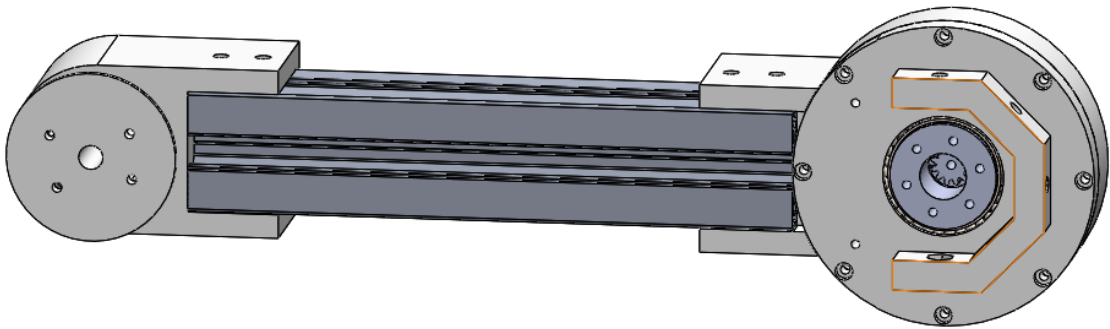
Part	Quantity	Position	Note: Attach arm holder to output shaft with 6 25mm M5 screw.
Arm holder			



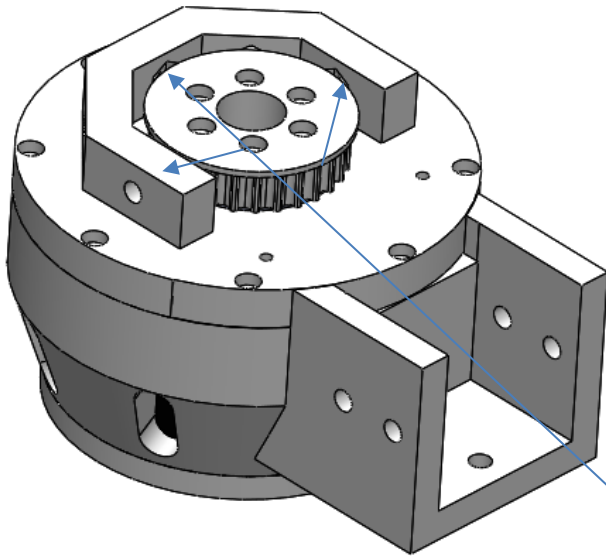
Part	Quantity	Position	Note: Attach Rotating base to output shaft of J1 with 6 M5 25mm screws. Be carefull with pressure on the bearing. Dont screw screw one by one but try to screw all at once.
Rotating base			



Part	Quantity	Position	Note: Secure rotating base to J2 with 8 M5 15mm screws.



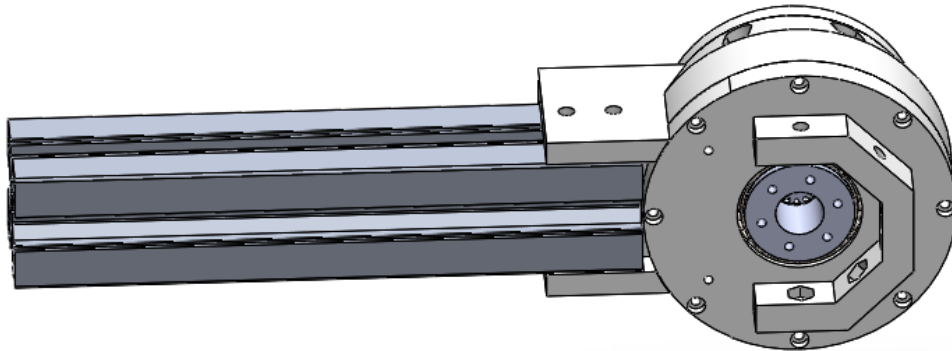
Part	Quantity	Position	Note: Upper arm assembly. First part is Joint 3 assembly.



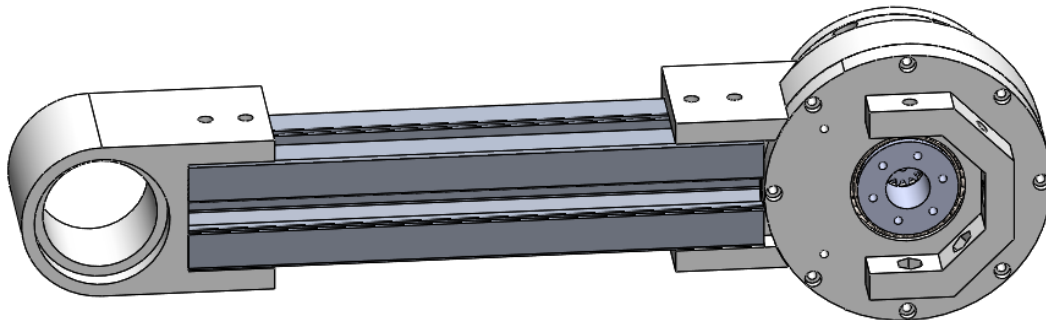
Part	Quantity	Position	Note: Joint 3 assembly is basically same as joint 1 assembly. Only difference is that bottom lid is attached to orbit with 10 – 15mm screws. Note2: Make shure that direction of top lid is as shown in the picture. Note3: Attach pulley to output shaft with 15-20 mm M3 screws. Note4: Dont attach the pulley at this step. In the holes indicated with this arrow place M5 nuts.
Pulley 28 teeth			

CM6 Assembly

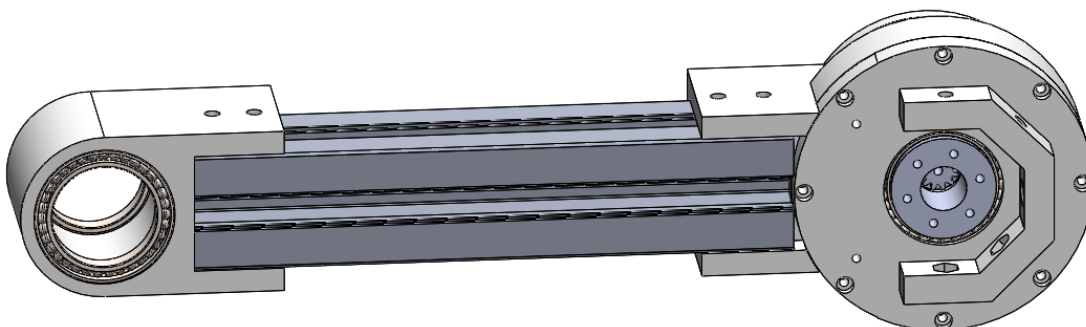
V1



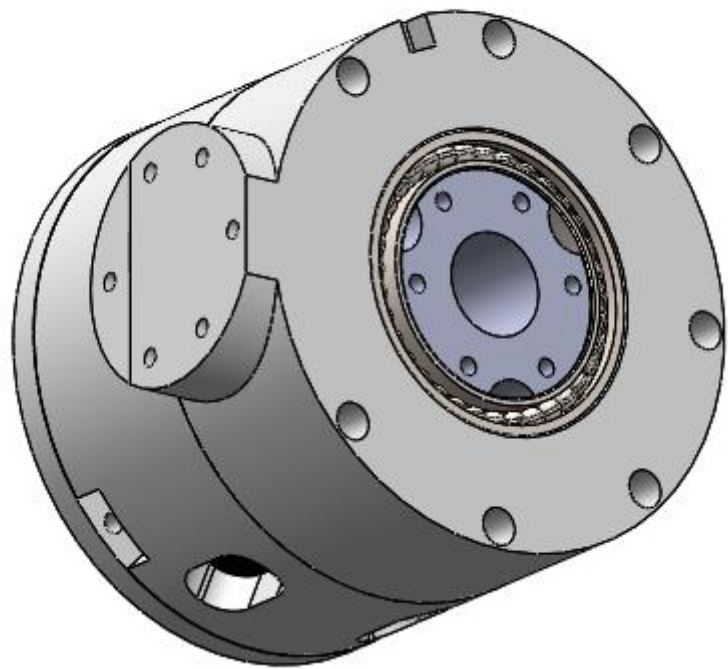
Part	Quantity	Position	Note: Attach aluminum extrusion with M5 15 mm screws.
40x40 200mm T slotted aluminum extrusion Hammer nut U10 M5 x 6			



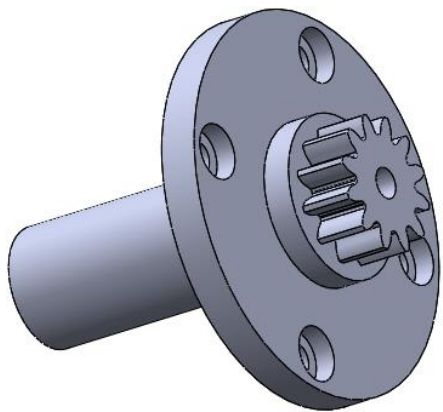
Part	Quantity	Position	Note: Attach holder with 6 M5 15mm screws.
Joint 3 holder Hammer nut U10 M5 x 6			



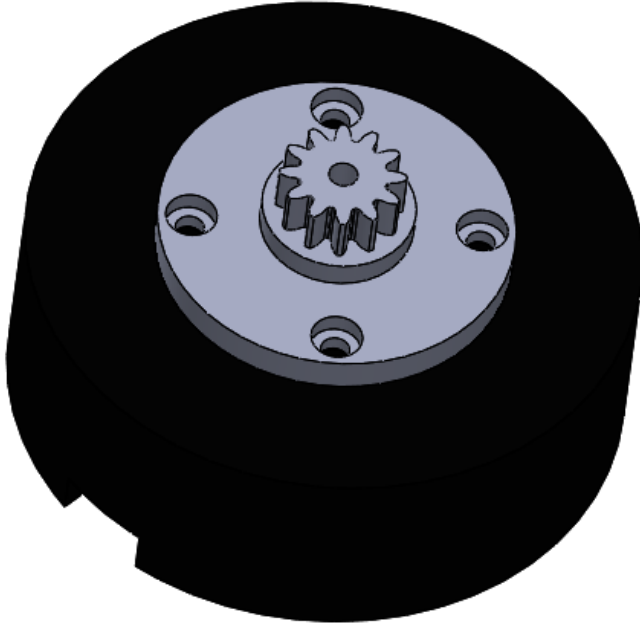
Part	Quantity	Position	Note: Attach 2 ball bearings in Joint 3 holder.
Radial Ball bearing 35x47x7			



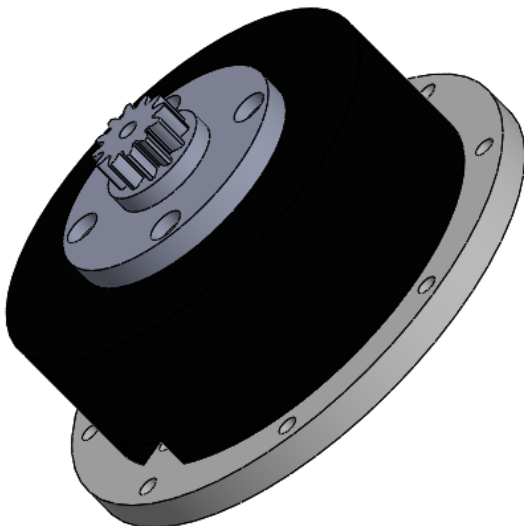
Part	Quantity	Position	Note: Joint 4 assembly.



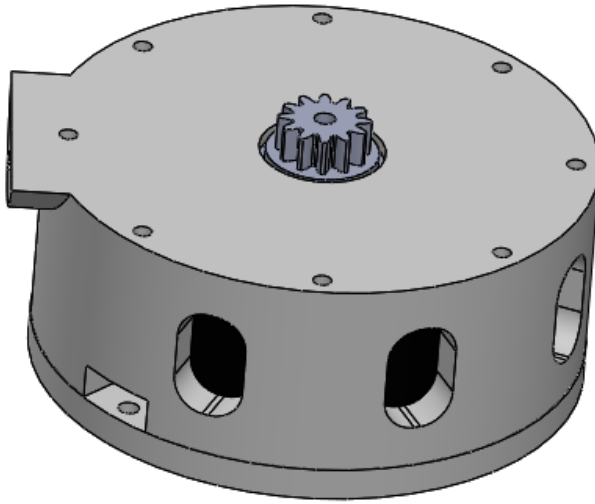
Part	Quantity	Position	Note: Attach gear to encoder shaft with 15-20 mm screw.
Sun joint 4			
Encoder shaft joint 4			



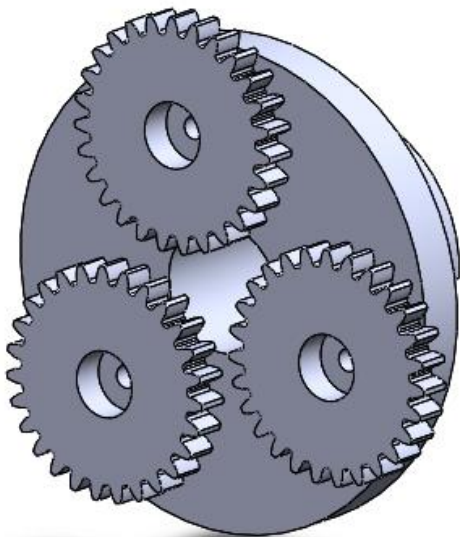
Part	Quantity	Position	Note: Attach sun gear to the motor with 4 M3 5mm screws.
Gimbal Motor GM7008H			



Part	Quantity	Position	Note: Attach motor to the bottom lid with 4 M3 5mm screws. Also attach BLDC driver to bottom plate with 4 5mm screws.
Bottom lid J4			

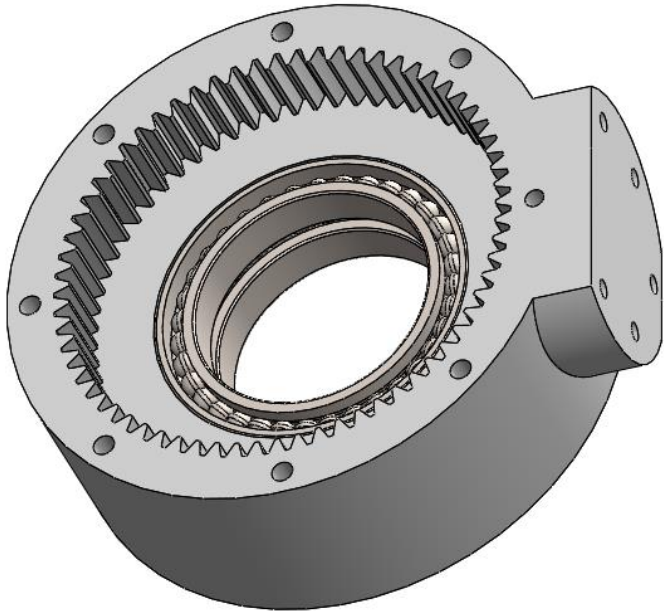


Part	Quantity	Position	Note: Attach motor part to bottom lid with 7 15 mm M3 screws.
motor part (very original thank you)			

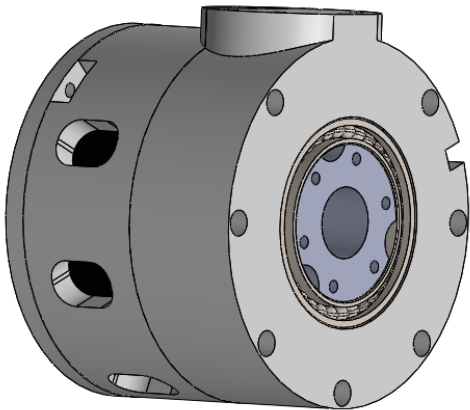


Part	Quantity	Position	Note: In every planet insert Radial ball bearing.
Output shaft joint 4 Planets joint 4			

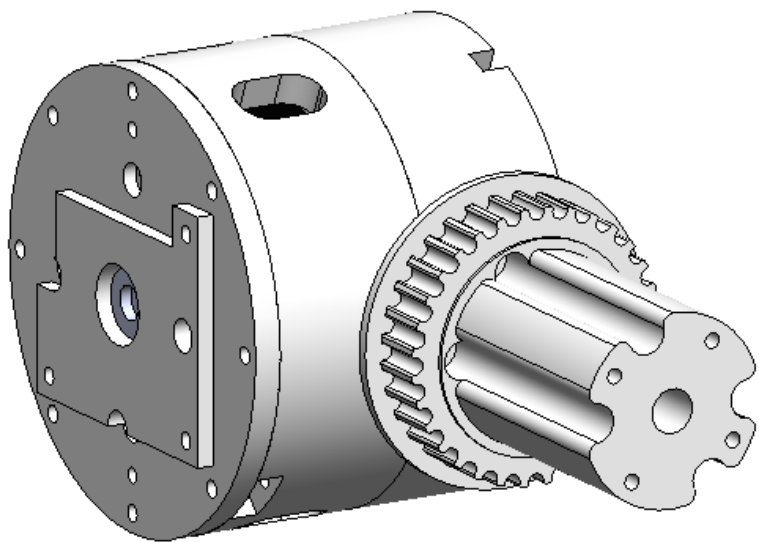
			Now screw in 3 M3 8 mm screws from the top side of the output shaft, so that planets can attach to the ends of the screws but still fall off.
--	--	--	---



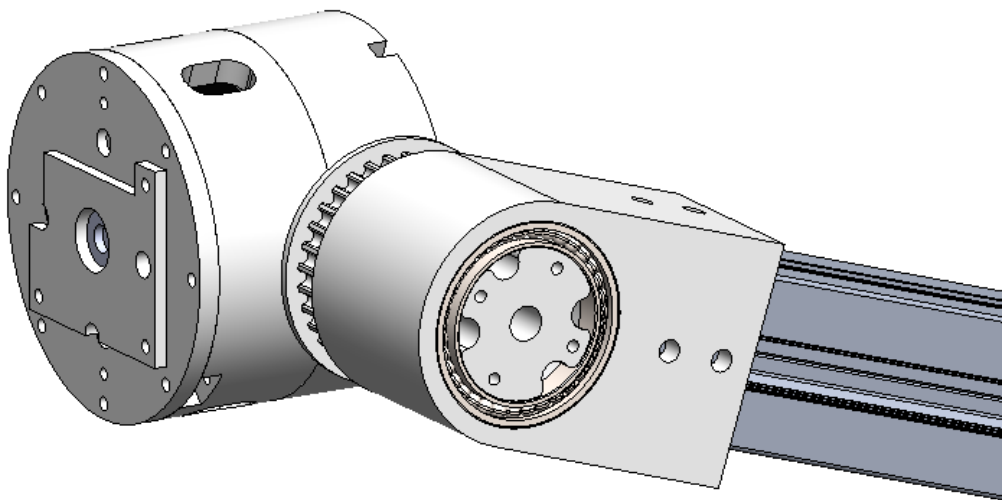
Part	Quantity	Position	Note: Attach 2 radial ball bearings to top lid.
New top lid gear Radial Ball bearing 35x47x7			



Part	Quantity	Position	Note: Attach lid to motor part with 7 25 mm M3 screws.

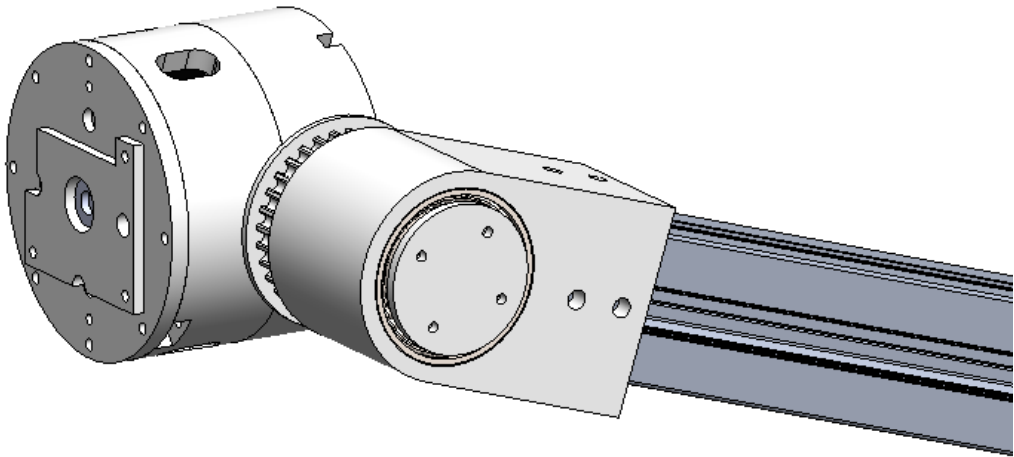


Part	Quantity	Position	Note: Attach 32 teeth pulley to J4 assembly with 4 M3 10-15 mm screws.
32 teeth pulley J4 assembly			

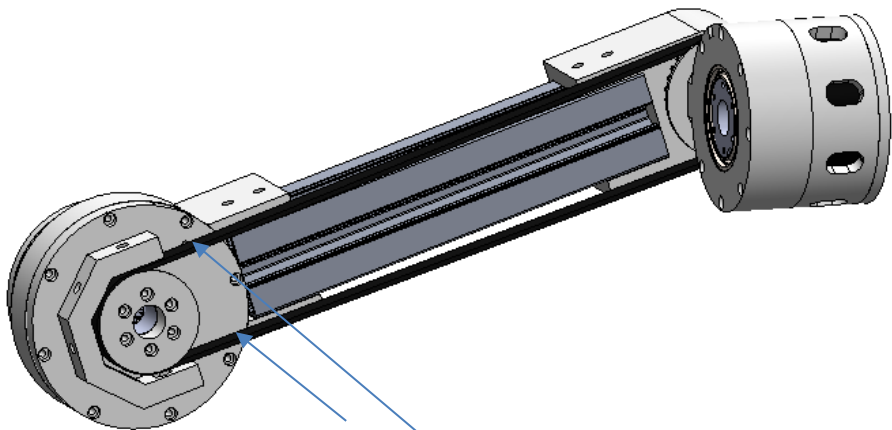


CM6 Assembly	V1
---------------------	-----------

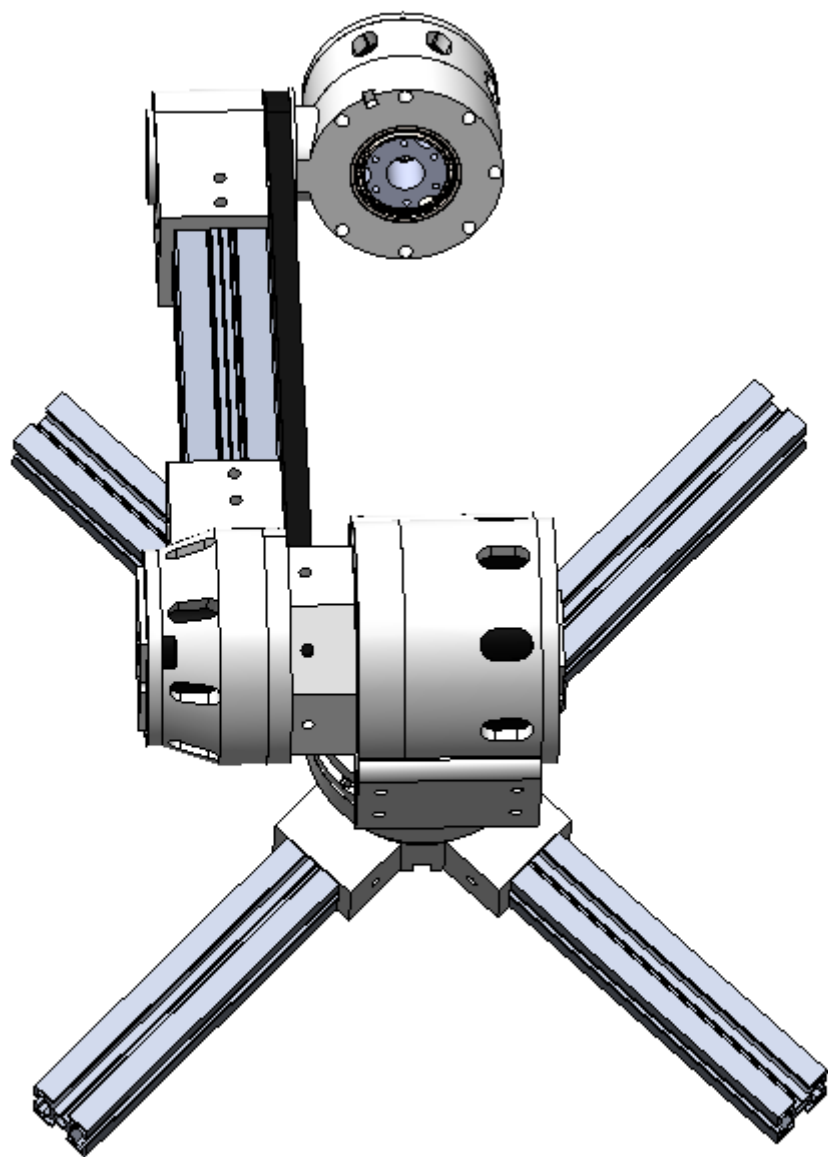
Part	Quantity	Position	Note: Attach previous assembly to upper arm assembly.



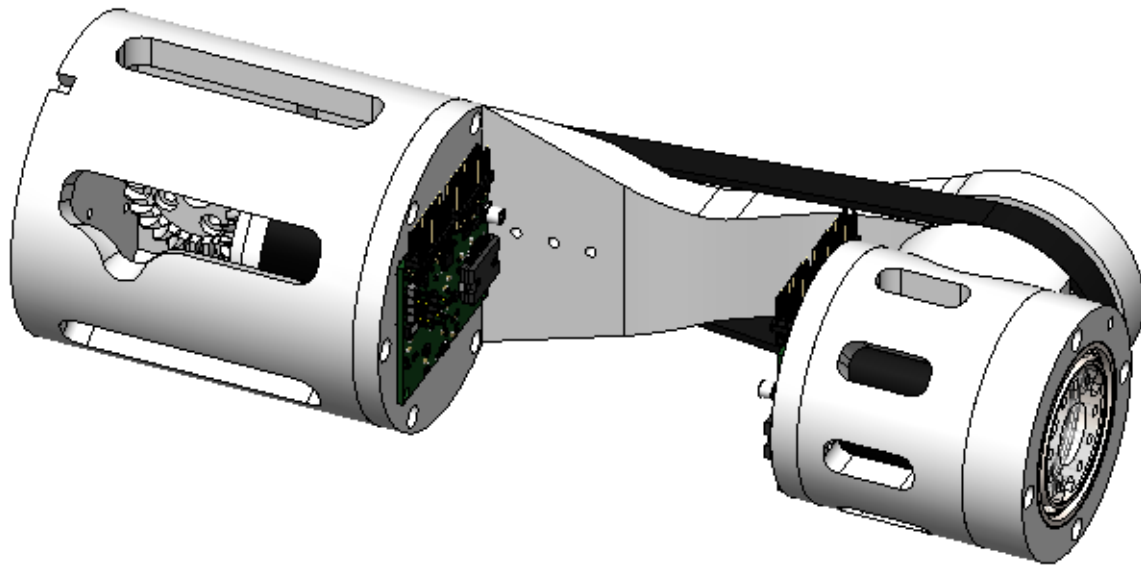
Part	Quantity	Position	Note: Secure the 32 teeth pulley with 4 M3 15mm screws.



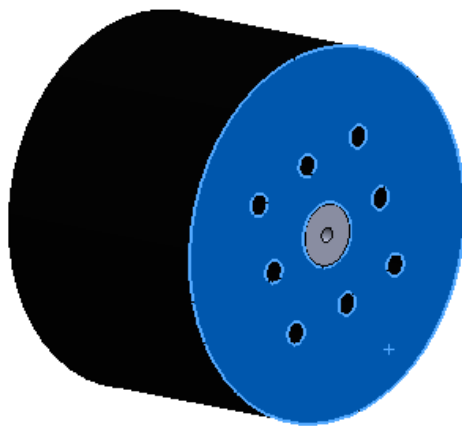
Part	Quantity	Position	Note: Belt can be placed easily by removing pulley from joint 3 and then placing it back. That will automatically tighten the belt. You can additionally tighten the belt by using small bearings in these holes.
HTD 710-5M belt			



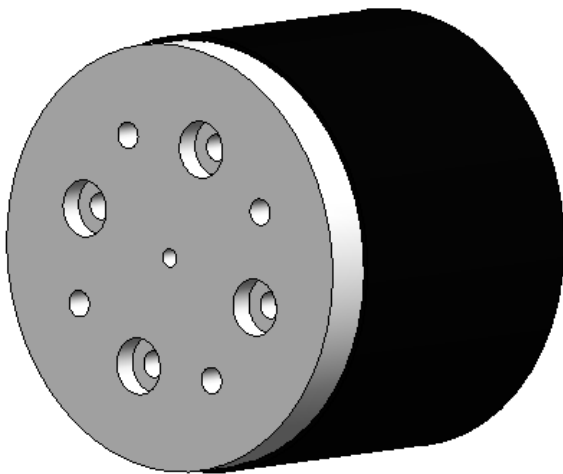
Part	Quantity	Position	Note: Attach upper arm to rotating base with 5 M5 20mm screws.



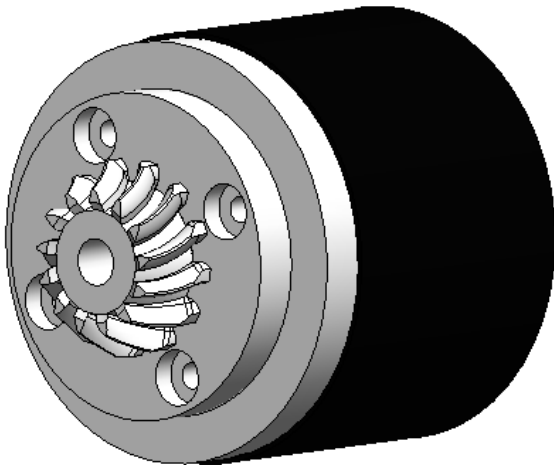
Part	Quantity	Position	Note: Lower arm assembly



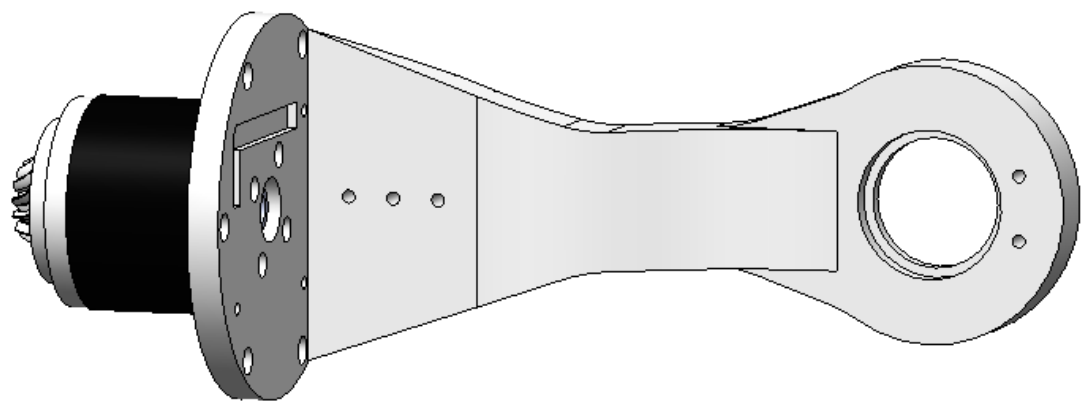
Part	Quantity	Position	Note: Insert encoder shaft in motor.
Emax Brushless Motor GB4114 Small gimbal encoder shaft			



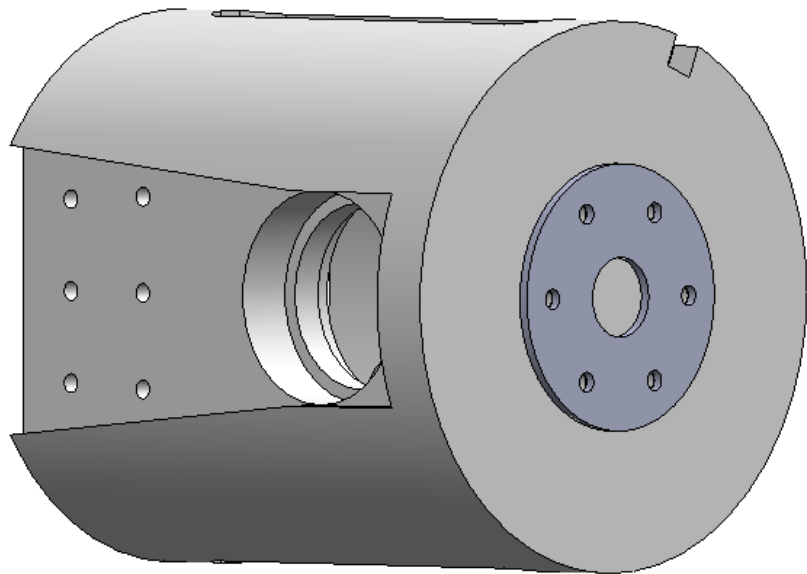
Part	Quantity	Position	Note: Secure motor extension with 4 M3 5mm screws.
Motor extension			



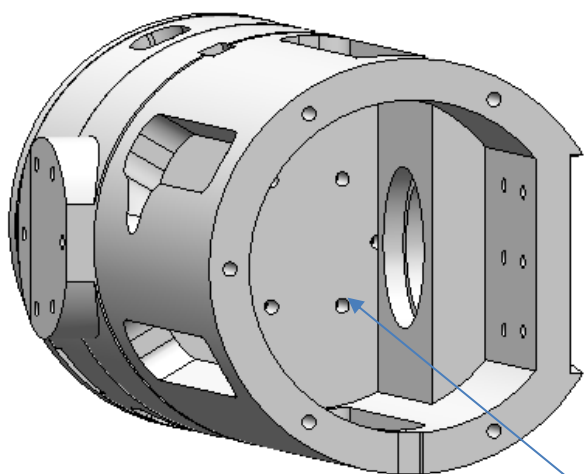
Part	Quantity	Position	Note: Secure gear with 4 M3 5mm screws to Motor extension part. Secure encoder shaft with 10-15mm M2 screw.
Gear 13 right			



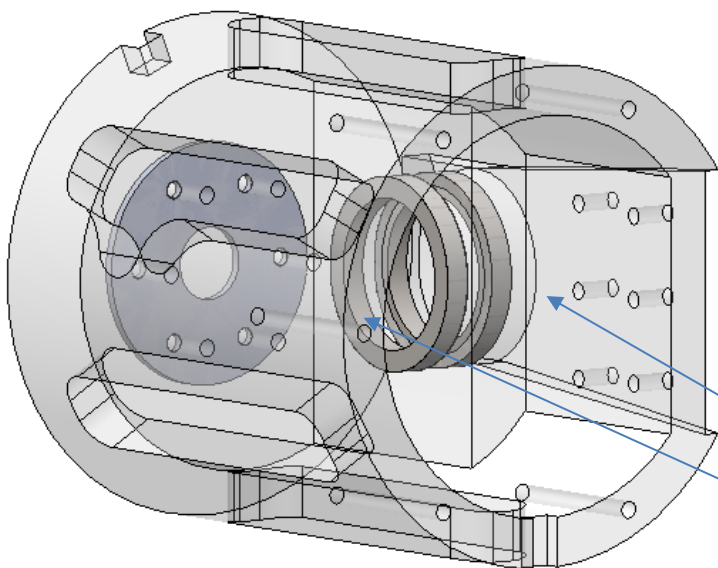
Part	Quantity	Position	Note: Secure motor to bottom lid with 4 M3 5mm screws.
Bottom lid J5			



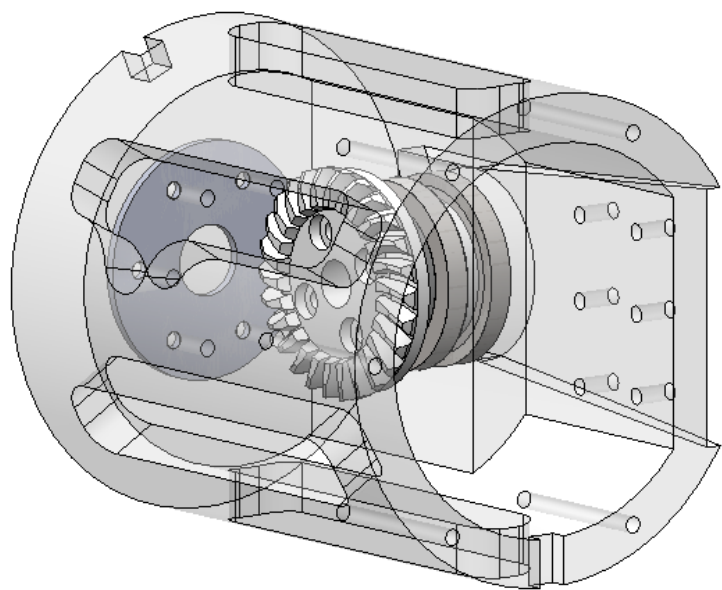
Part	Quantity	Position	Note:
2mm extender			
Lower arm main body			



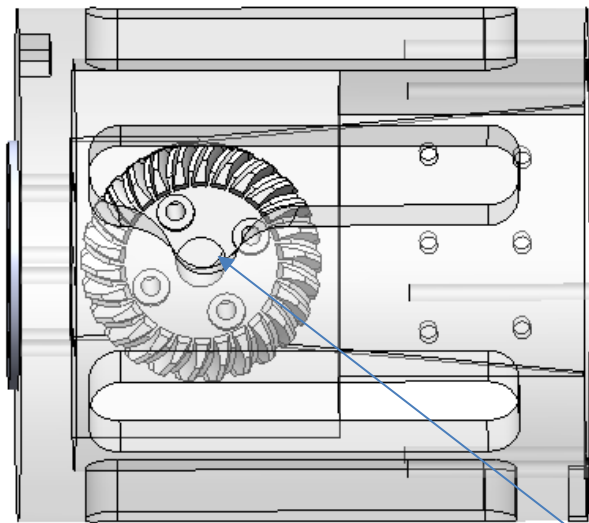
Part	Quantity	Position	Note: Secure main body to output shaft of Joint 4 with 5 20mm M3 screws. Make shure you have 2mm extender in between output shaft and main body. J4 will be hidden in next pictures for clarity.
2mm extender Lower arm main body			



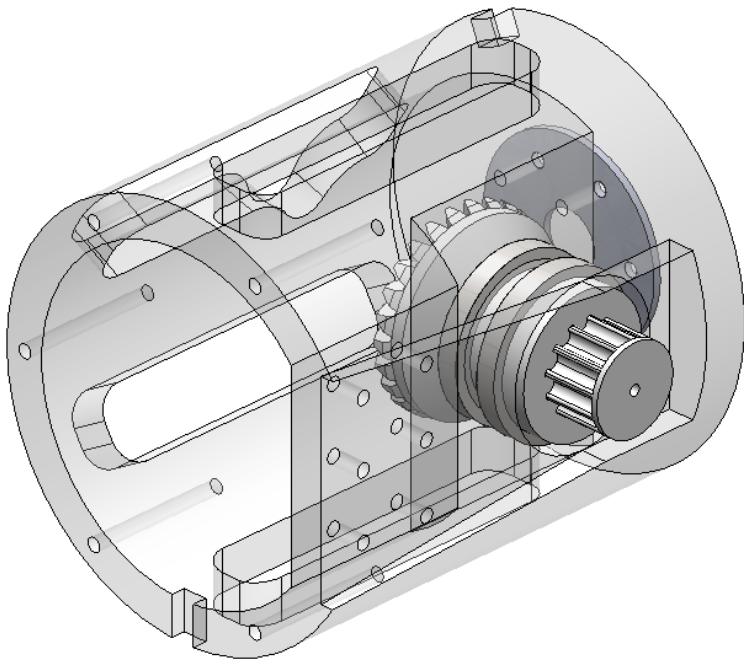
Part	Quantity	Position	Note: Place 2 ball bearings in indicated holes.
Radial Ball bearing 25x32x4			



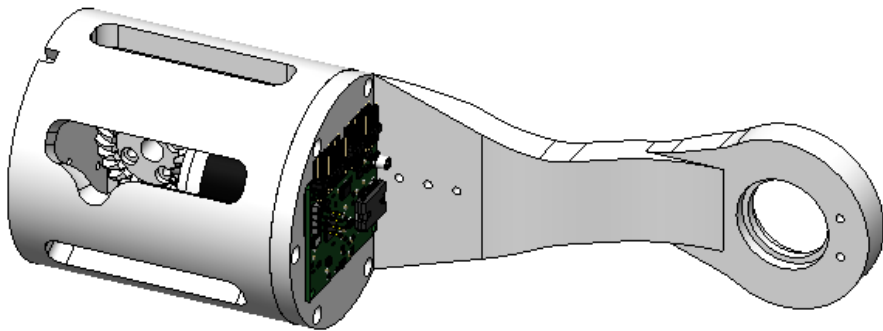
Part	Quantity	Position	Note:
Gear 26 print			



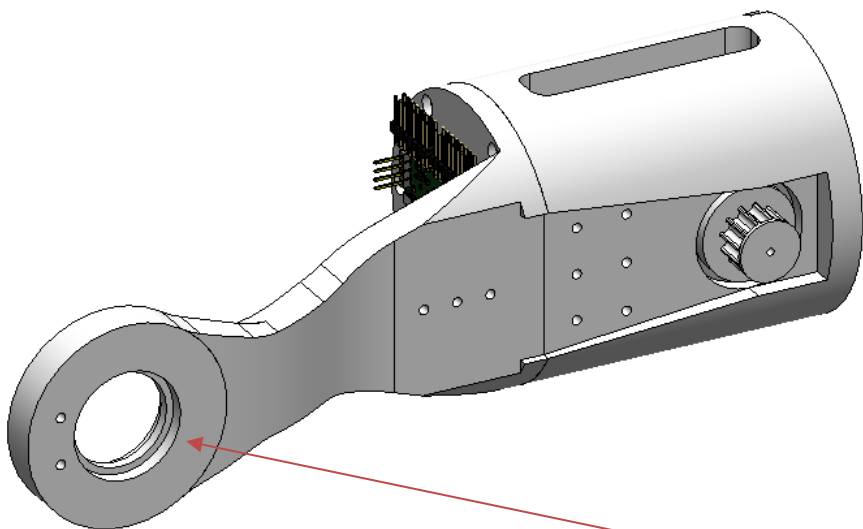
Part	Quantity	Position	Note: Thru indicated notch place 4 25mm M3 screws thru Gear 26.



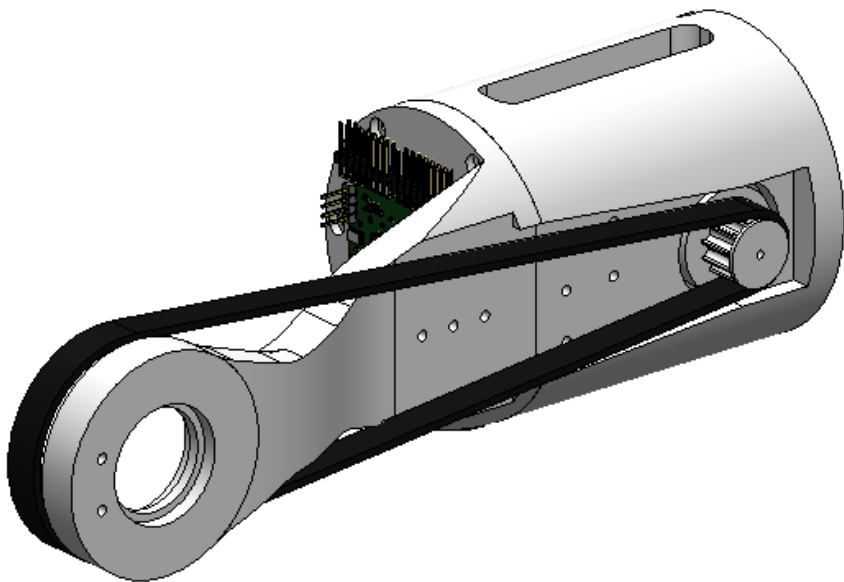
Part	Quantity	Position	Note: Thru same notch screw in pulley 12.
Pulley 12			



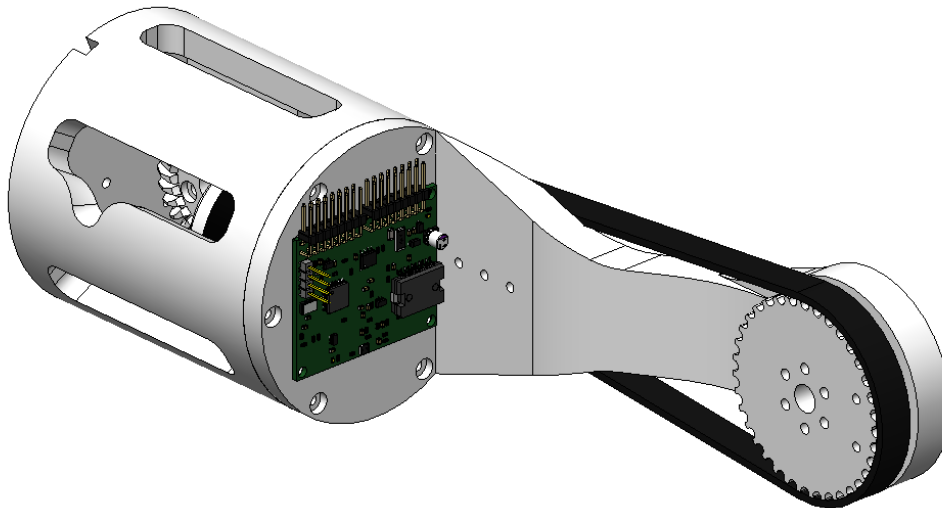
Part	Quantity	Position	Note: Use 5 M3 15-20 mm screws to secure bottom lid to main motor body.



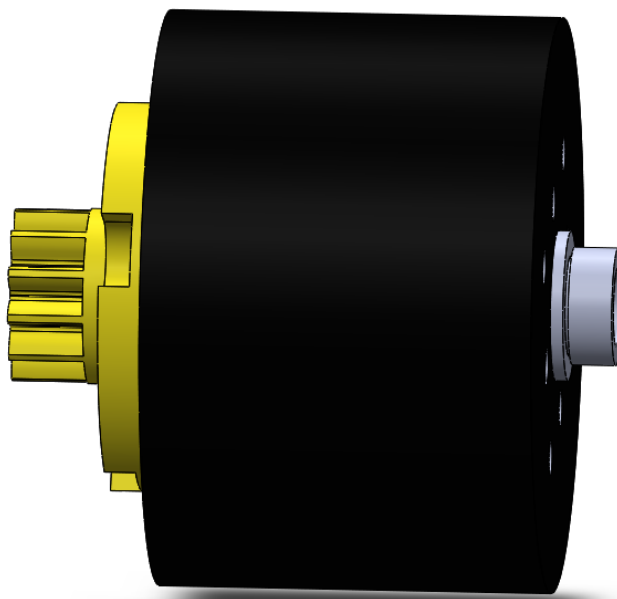
Part	Quantity	Position	Note: Insert 2 25x32x4 mm ball bearings to these holes.
2 25x32x4 mm ball bearings			



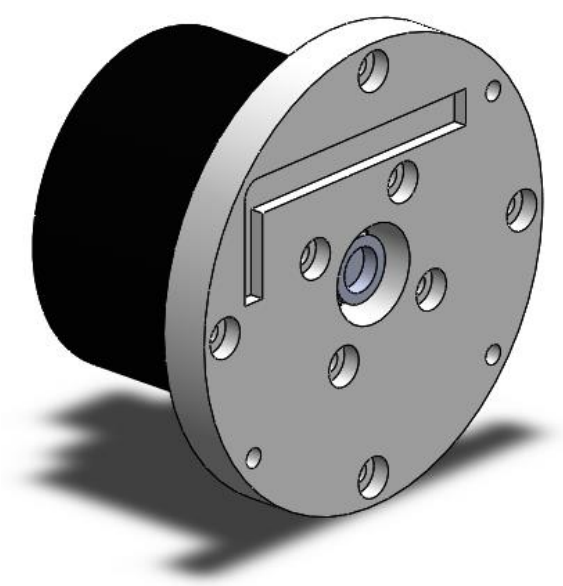
Part	Quantity	Position	Note: Position the belt.
HTD 520-5M belt			



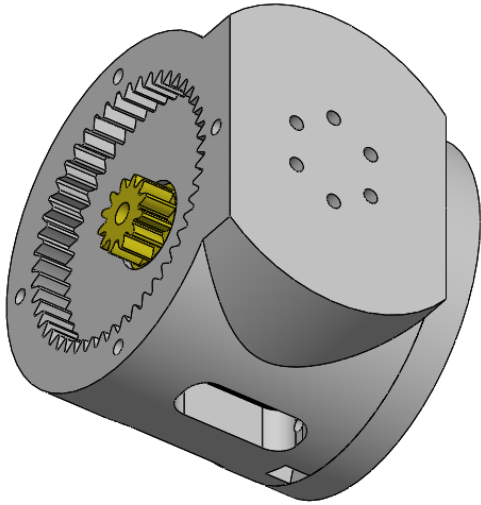
Part	Quantity	Position	Note: Insert the pulley thru the bearings.
36 pulley			



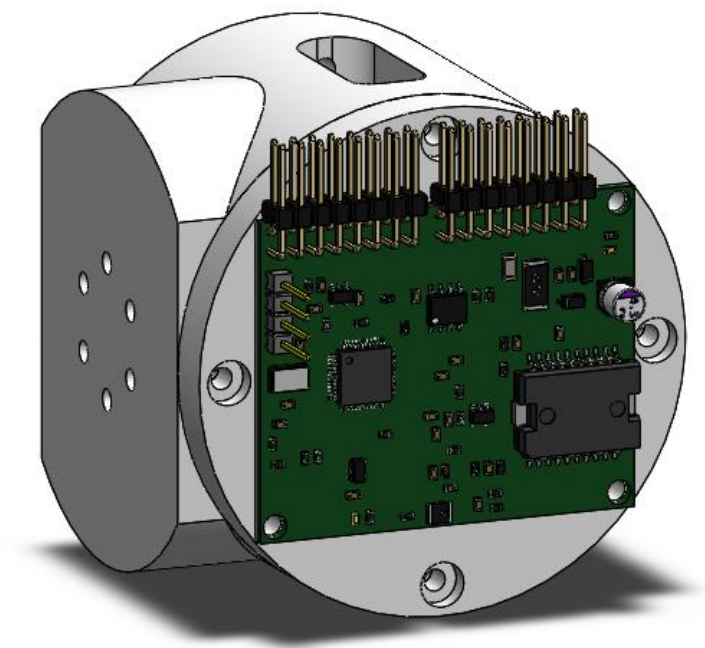
Part	Quantity	Position	Note: Secure sun gear with 4 M3 5mm screws and secure encoder shaft with 10 mm M2 screw.
Emax Brushless Motor GB4114 Small gimbal encoder shaft Sun gear			



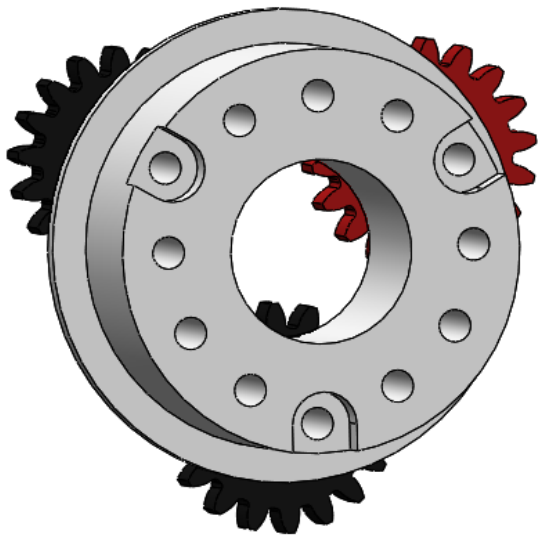
Part	Quantity	Position	Note: Secure bottom lid to motor with 4 M3 5mm screws.
Bottom lid J6			



Part	Quantity	Position	Note: Secure orbit with 4 10mm M3 screws.
Orbit 48			



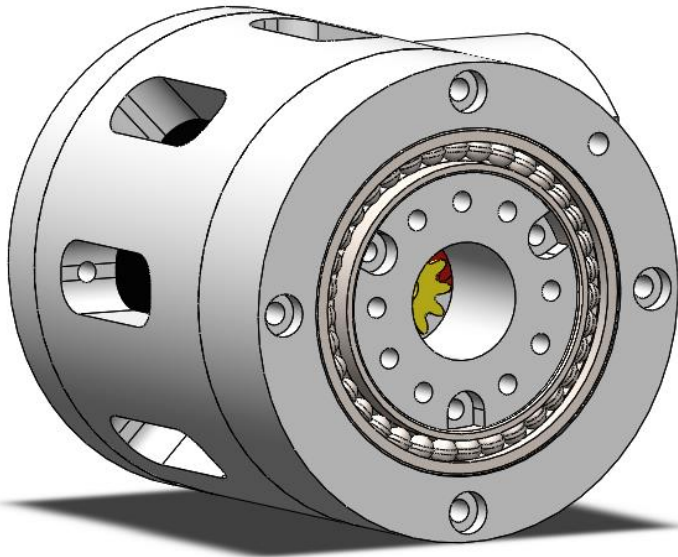
Part	Quantity	Position	Note: Now you can secure BLDC driver with 4 M3 5mm screws.



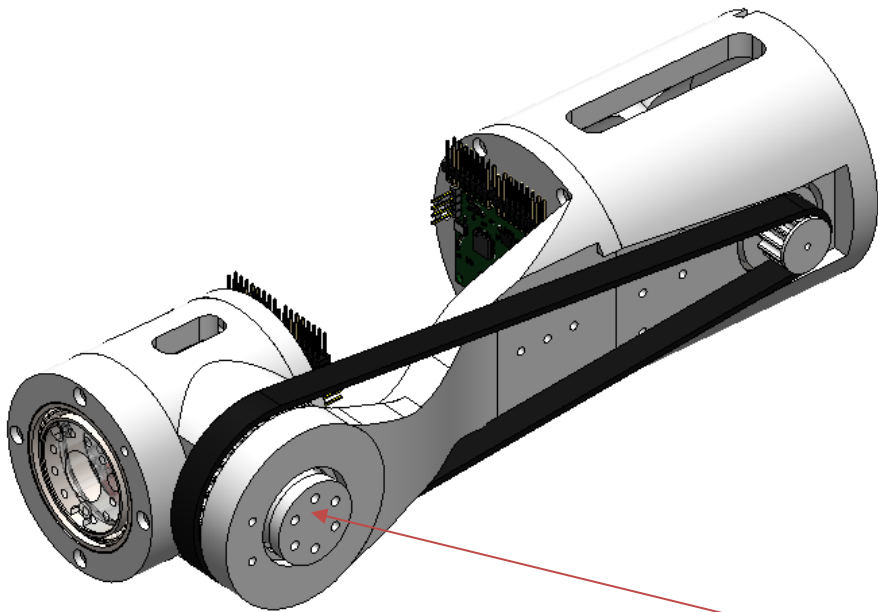
Part	Quantity	Position	Note: Same as previous steps for other joints. Use 3 M3 20 mm screws.
Planet 18 Output shaft J6			



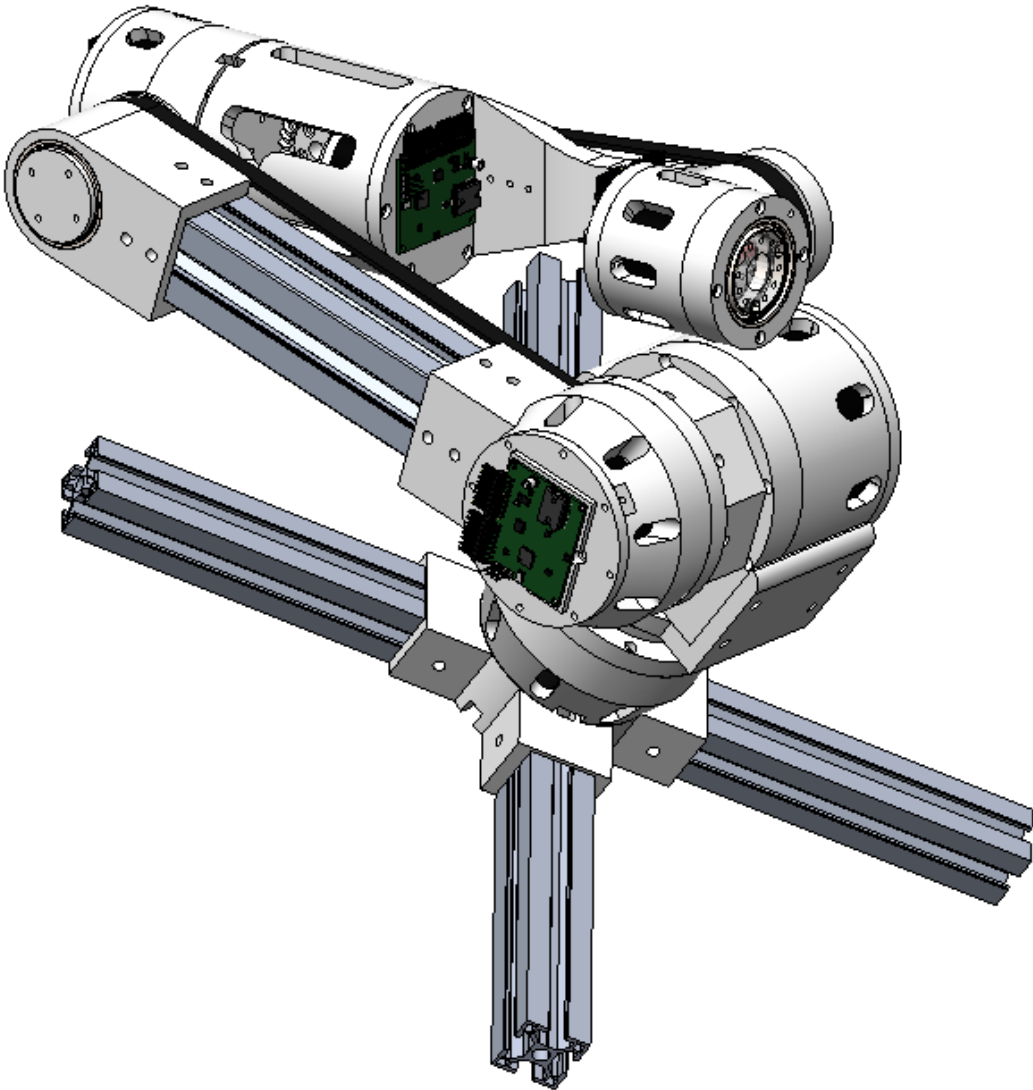
Part	Quantity	Position	Note:
Top lid J6			
Radial Ball bearing 35x47x7			



Part	Quantity	Position	Note: Secure top lid with 4 M3 20 mm screws.



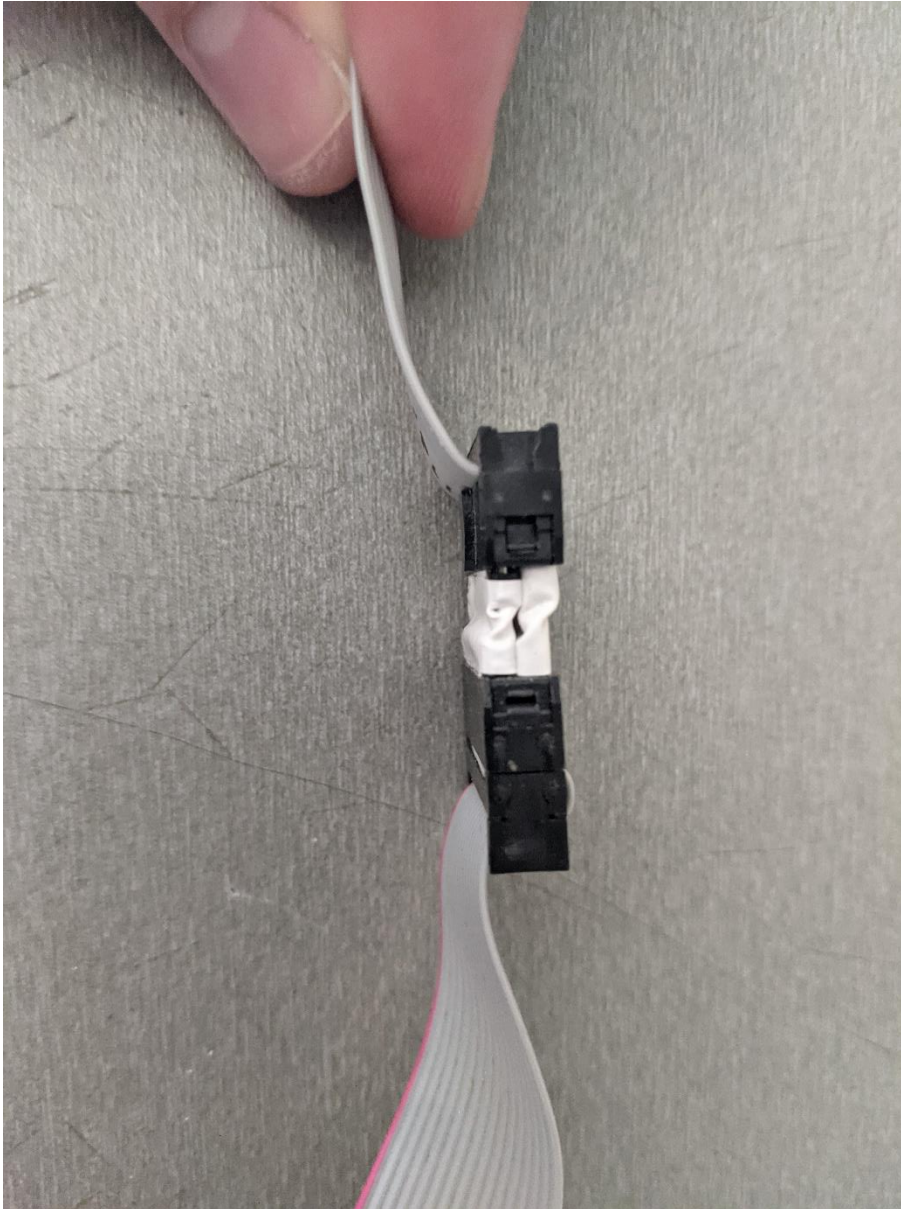
Part	Quantity	Position	Note: Secure joint 6 with 6 M3 35 mm screws.
Axis 5 bearing lid			



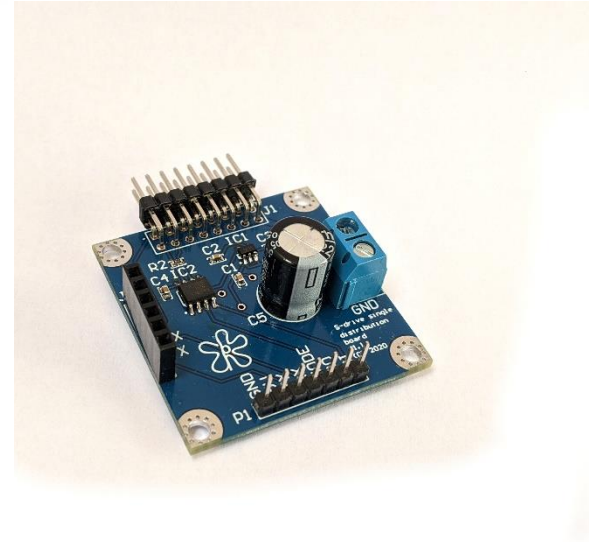
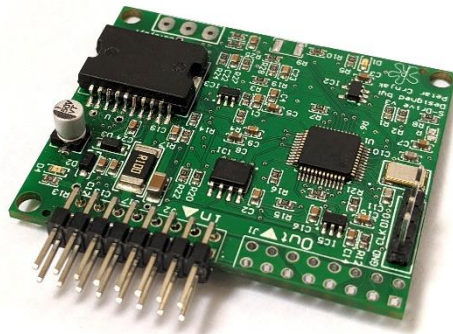
Part	Quantity	Position	Note: Basic assembly is done.

Cables for robot

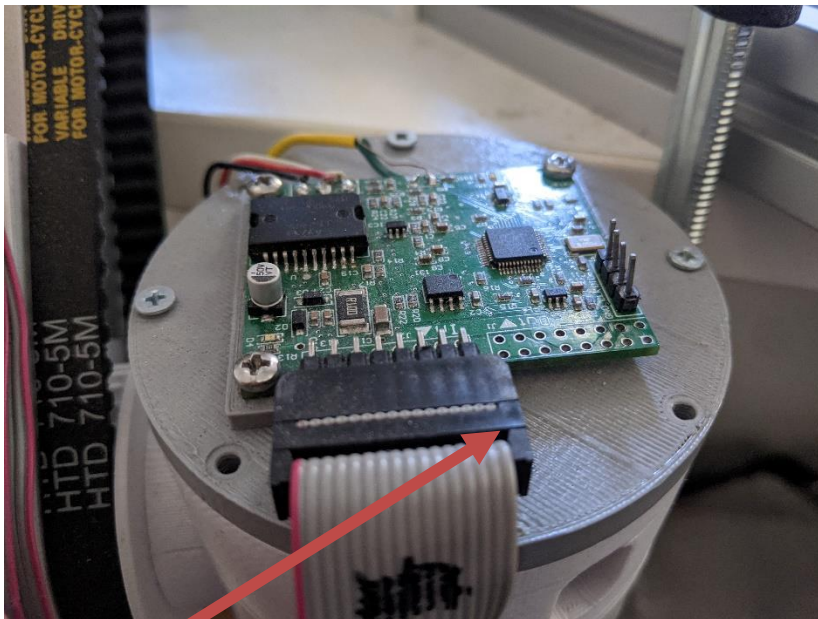
Cables used for power and signals are ribbon cables with IDC connectors. Cables need to be connected in this configuration:



To connect them use 4 8 pin male pin headers. Each motor and distribution board need to be connected with this type of cable configuration.



Connections need to be made like this. Only connect sides that are marked with IN on boards. Connect them so that direction of the ribbon cable is same as on distribution board and driver board. (Note use the cables that are made in previous step from 2 cables. Dont use single ribbon cable to connect distribution board and driver board. **If you do that will destroy your driver board**)



Connection on distribution board needs to be the same.