Telemetry Balkan doo Beograd

ORA-7

The Open Robotic Actuator Assembly Manual

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v 0.4.0

Beograd, Serbia
2026-02-17

Version History

Version	Date	Authors	Description
0.0.0	2026-02-17	Sergei Loshchilov	Original Document Started
0.1.0	2026-03-17	Sergei Loshchilov	Added BOM section. Partially populated it.
0.2.0	2026-03-18	Sergei Loshchilov	Added Electronics Schematics
0.2.1	2026-03-19	Sergei Loshchilov	Added the actuator control code example
0.2.2	2026-03-19	Sergei Loshchilov	Added the mechanics assembly plan
0.3.0	2026-03-30	Sergei Loshchilov	Added the description of the OSP controller, the OSP connection cable wiring and the ring topology overview
0.4.0	2026-04-17	Sergei Loshchilov	Added the mechanics assembly steps

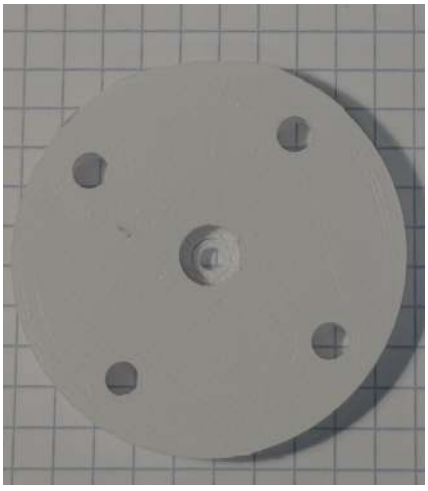
Contents

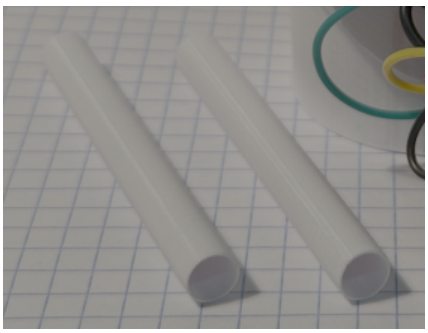
Overview

<TBD>

Bill of Materials

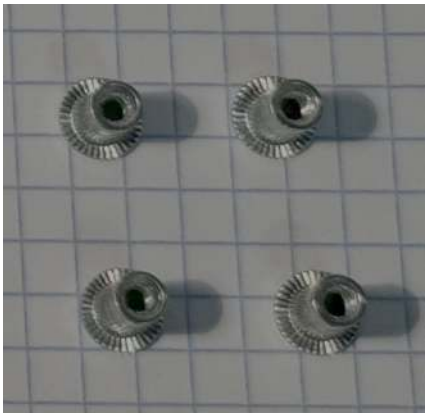
3D Printed Components

Type	Quantity	Image	Comments
ORA-7 Body	1		
ORA-7 Shaft Upper Half	1		

ORA-7 Shaft Lower Half	1		
ORA-7 Lid	1		
ORA-7 Schematics and Wires Protection Tube	2		

Mechanical Components

Type	Quantity	Image	Comments

6811 Bearing	1		
M4 Nut	4		
M4x10 Screw	4		
M3 Threaded Rivet	4		
DIN 7981 2.0x7.0 Self-Tapping Screw	4		To replace the original long screws of DS3240 servo
DIN 7981 3.0x12.0 Self-Tapping Screw	3		To mount the ORA-7 lid

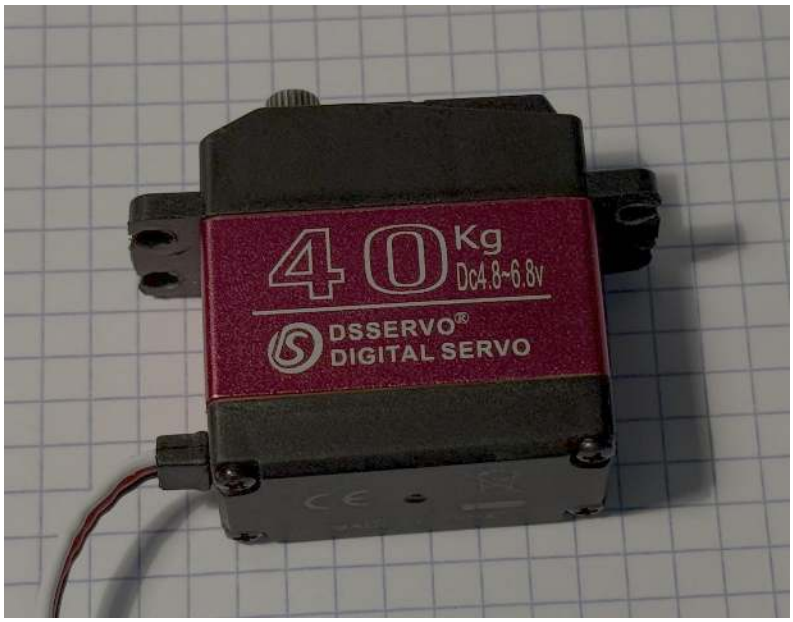
Electronic Components

Type	Quantity	Image	Comments
DS3240 Servo	1		Needs to be modified
Arduino Pro Mini 5V 16 MHz	1		Make sure it is not 3.3V 8 MHz version
DRV8871	1		
JST XH 6-Pin Female	2		
Wire AWG 22			To power up DRV8871 and connect DRV8871 to the motor
Wire AWG 28			To power up Arduino and connect the signal links

Mechanics Assembly

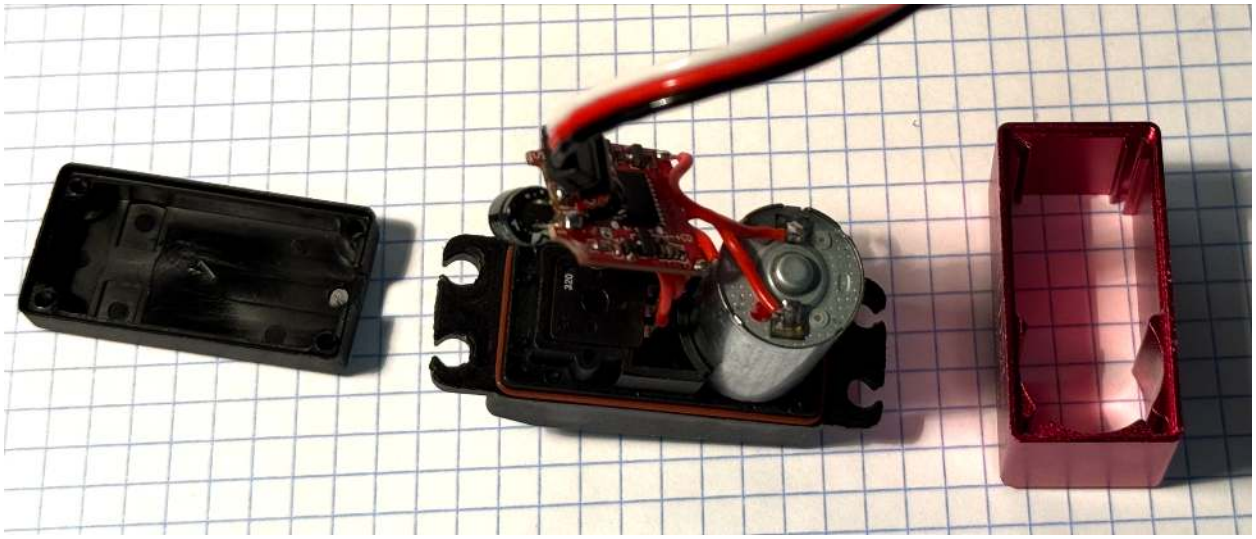
Print the 3D Printed Components

Partially Disassemble DS3240



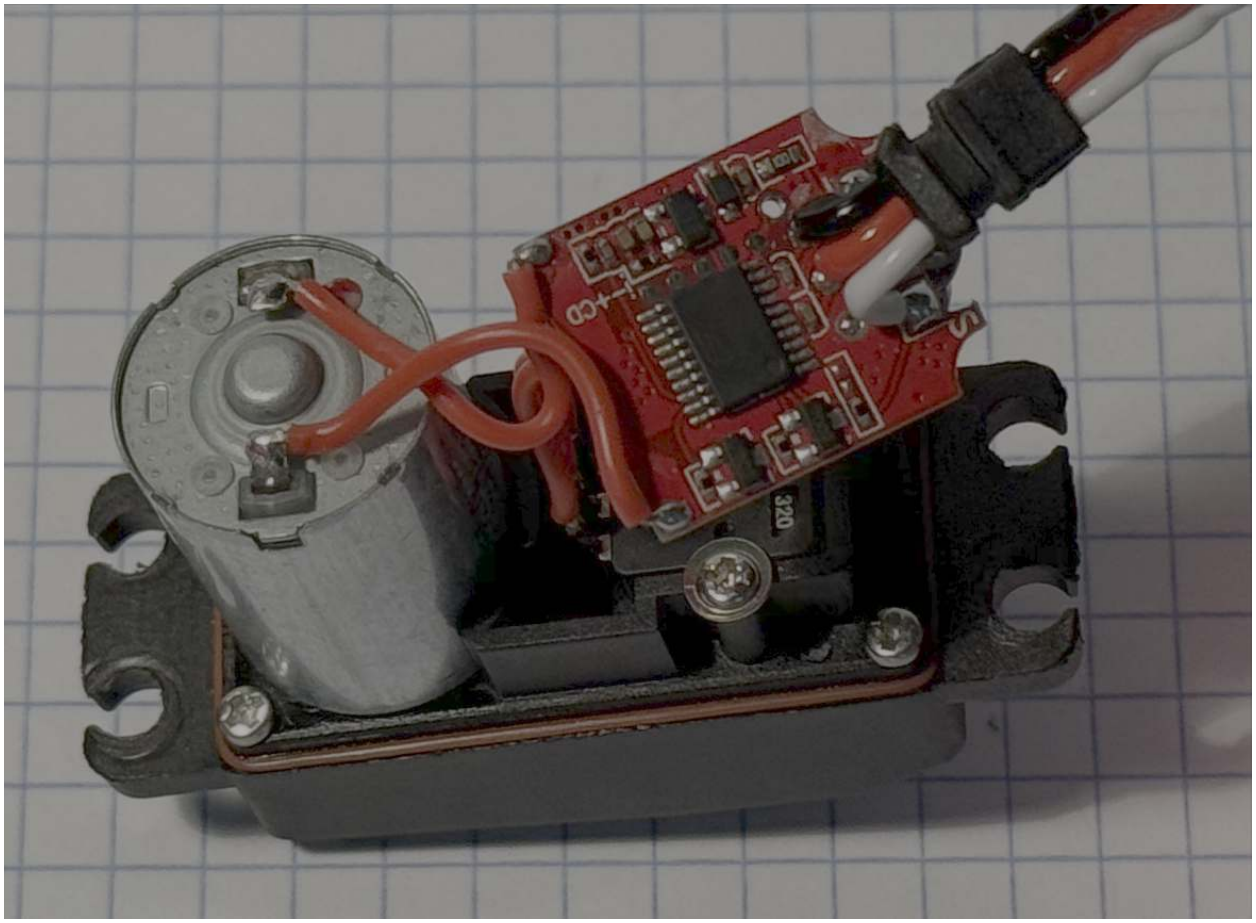
Remove the back lid

Remove the aluminium body

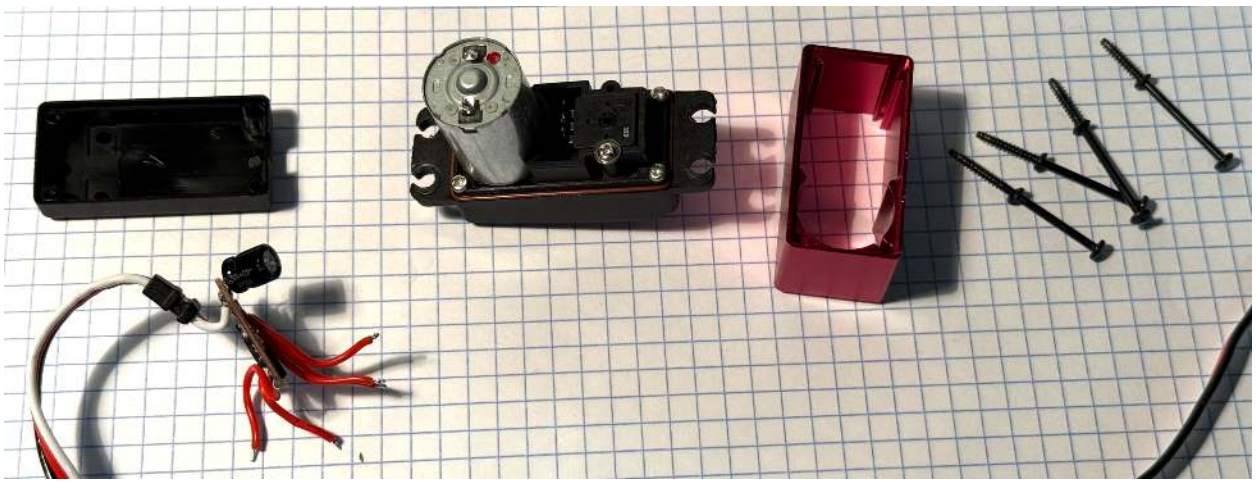


Note: be careful here. Try to remove it without opening the gearbox, as once the screws are unscrewed the gearbox is no longer fixed.

Replace the original long screws with 2.0x7.0 self tapping screws, to fixate the gearbox again

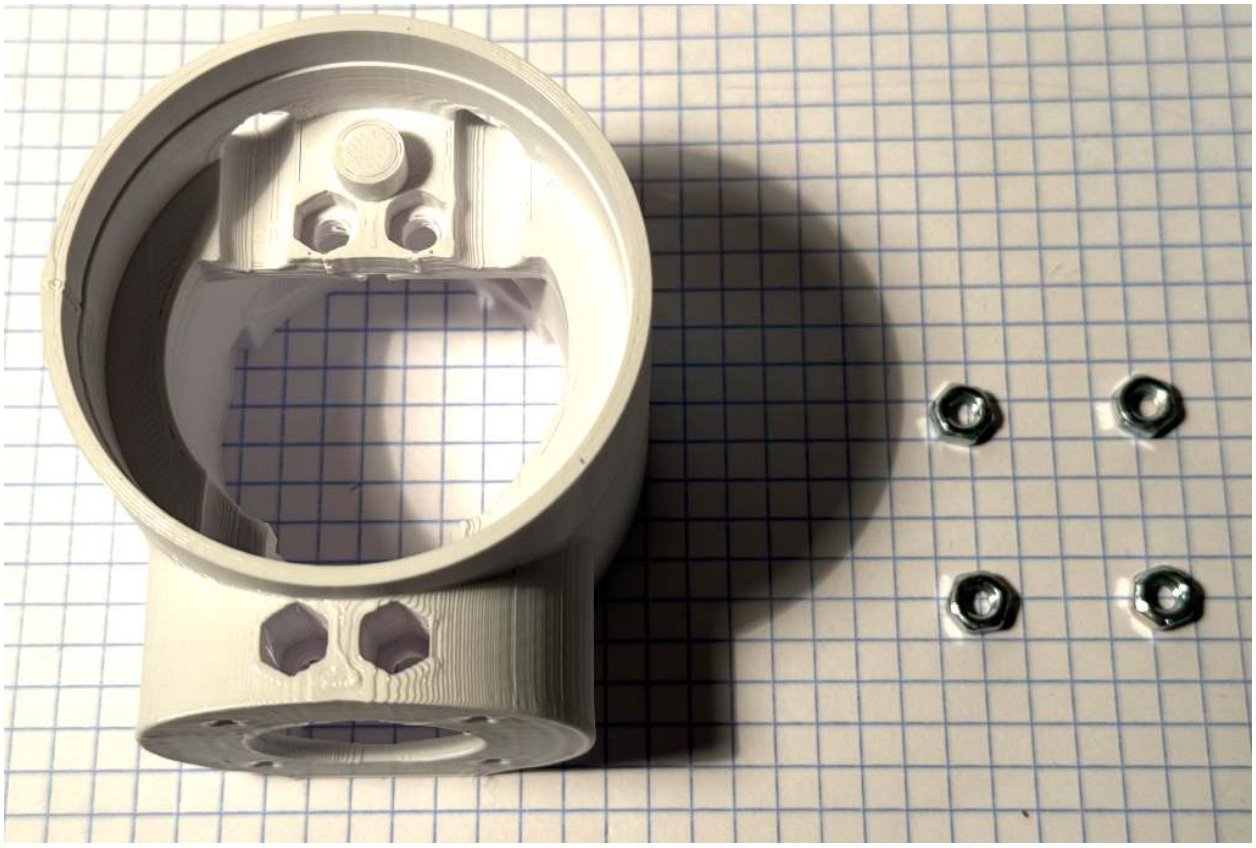


Unsolder the schematics



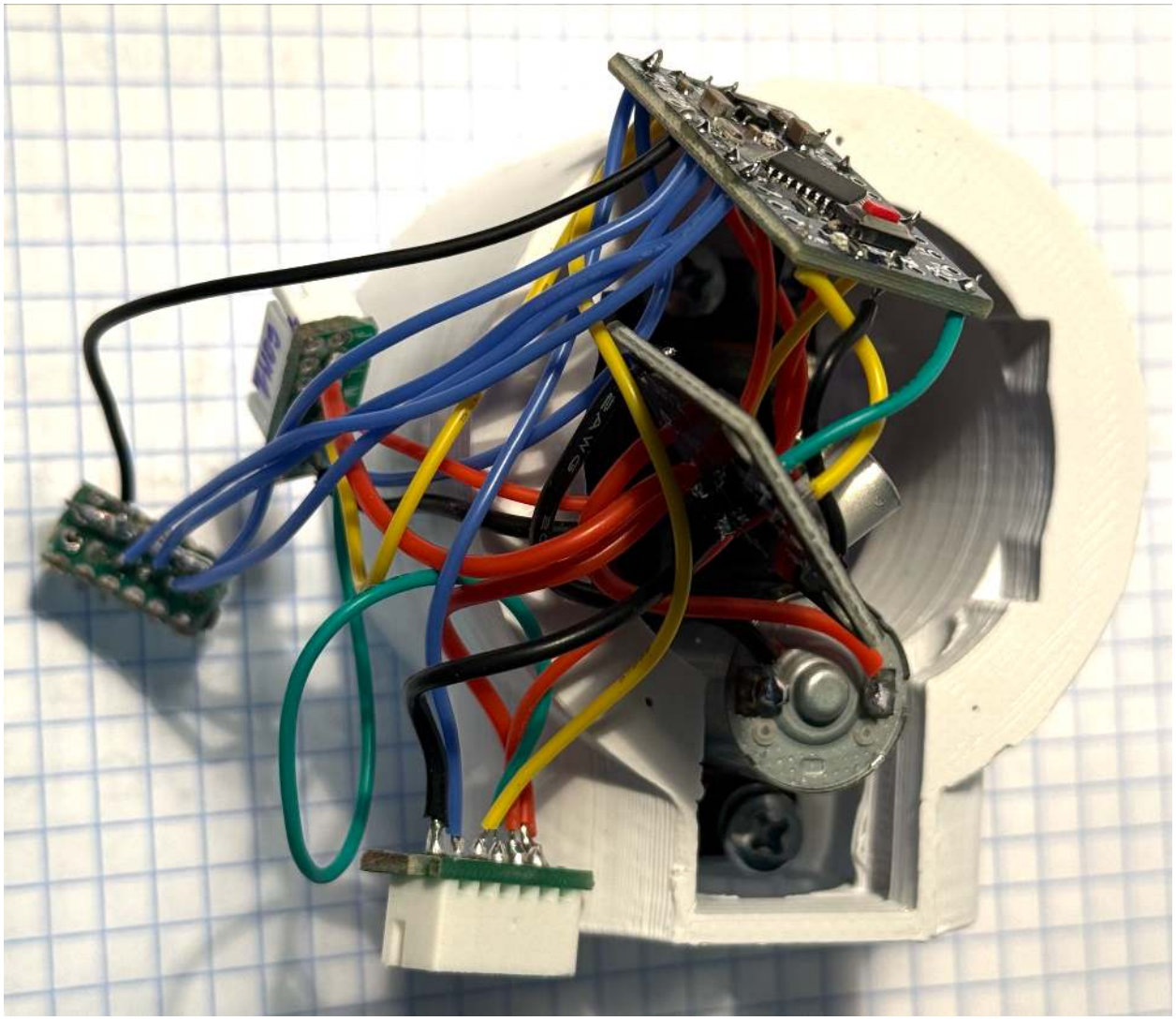
Note: Do not dismount the resistive encoder. Just unsolder the wires from it.

Install M4 Nuts into ORA-7 Body

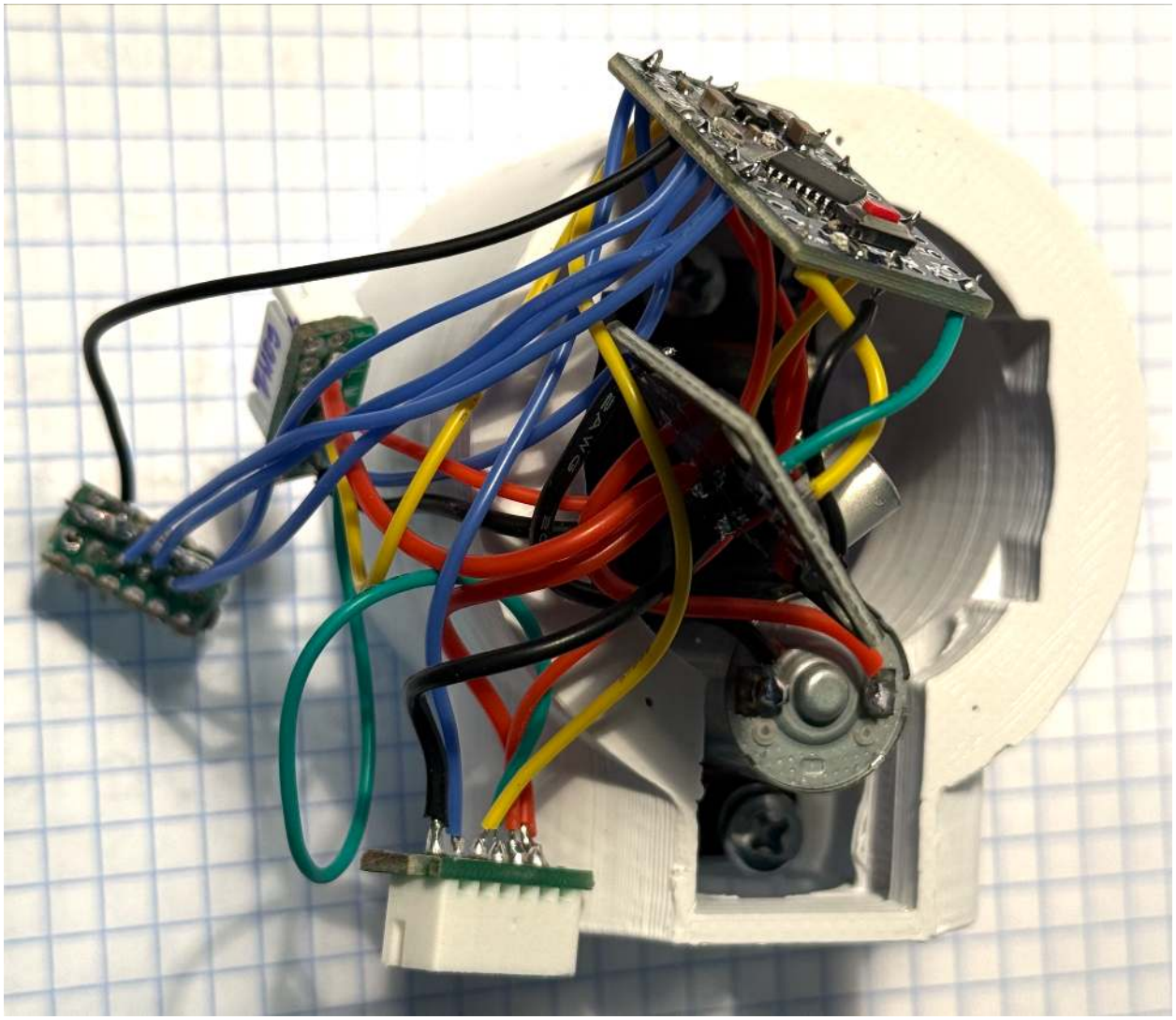


Setup the Electronics

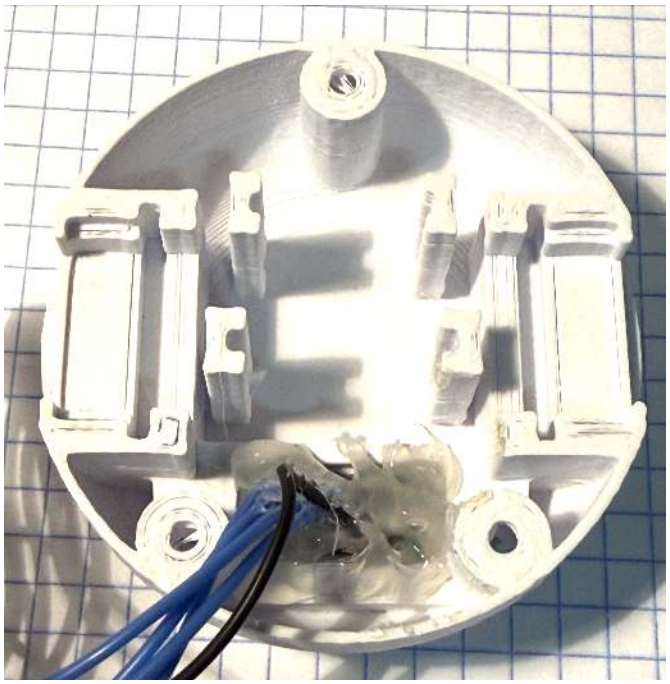
Follow the Electronics Assembly to setup the electronics properly.



Mount DS3240 into ORA-7 Body



Glue the Address Selector into ORA-7 Lid



Assemble ORA-7 Shaft

Set the DS3240 into a middle position

Connect ORA-7 to the computer

See Connecting to the Computer section for more details.

Connect to ORA-7 via Python

```
from osp import OSP
ora = OSP("/dev/cu.usbserial-AI20M8EA")
```

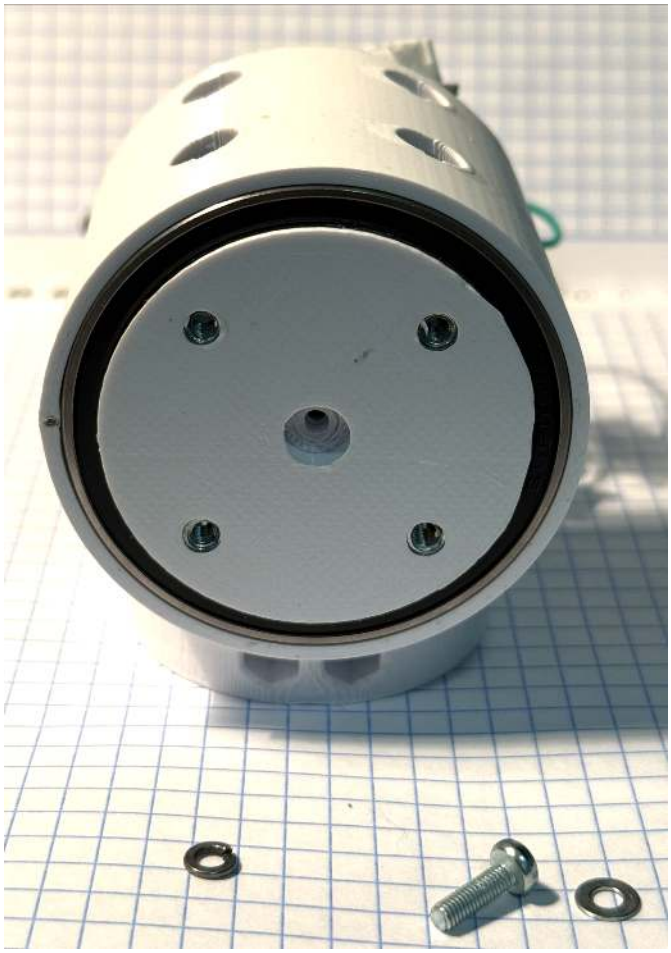
Set the actuator position to the middle

```
ora.ora_set_angle(0,8192)
```

Mount 25T Arm on DS3240

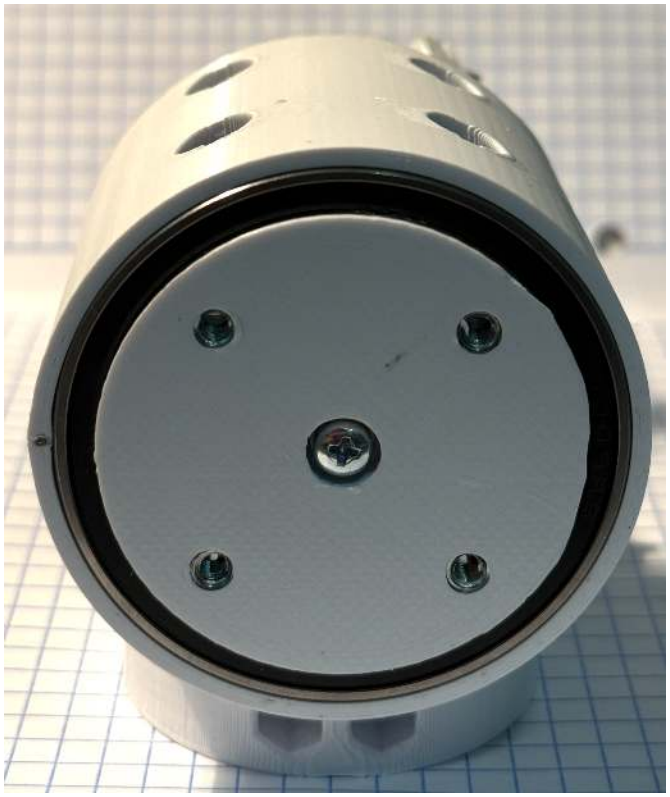
Install ORA-7 Shaft into ORA-7 Body

Push the shaft with the bearing into the body

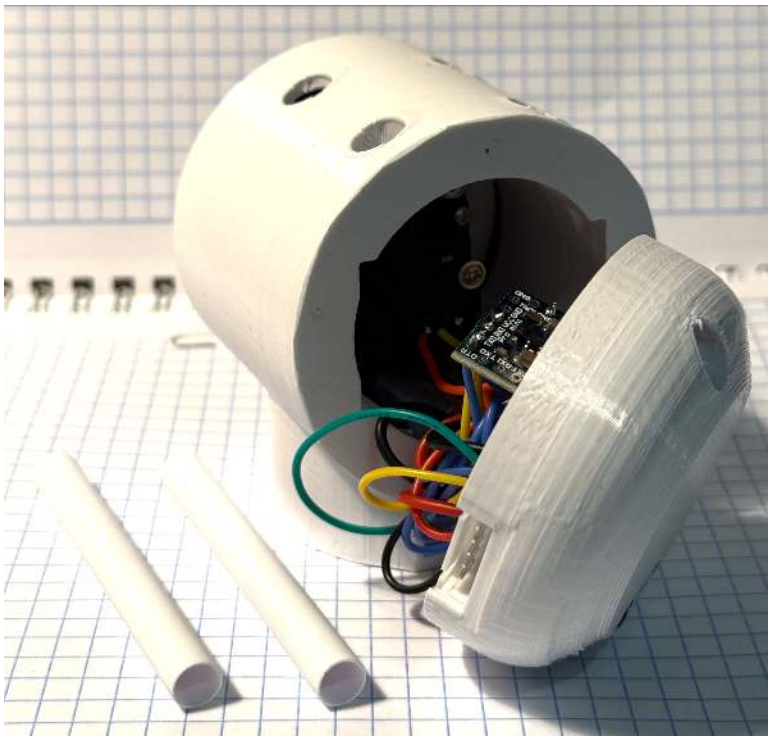


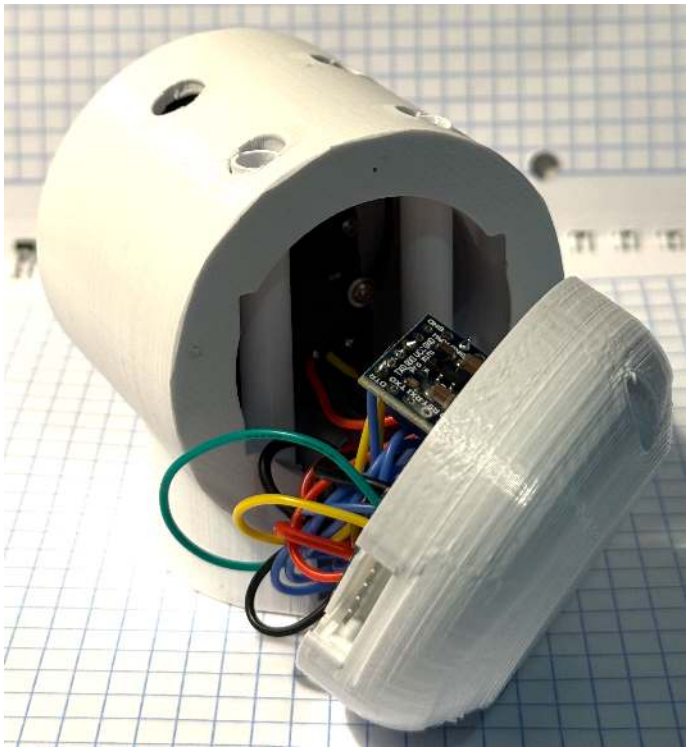
Advise: Optionally apply the adhesive sealant to the body where it is touching the bearing.

Screw the M3x12 screw with the washer and the grover washer into it

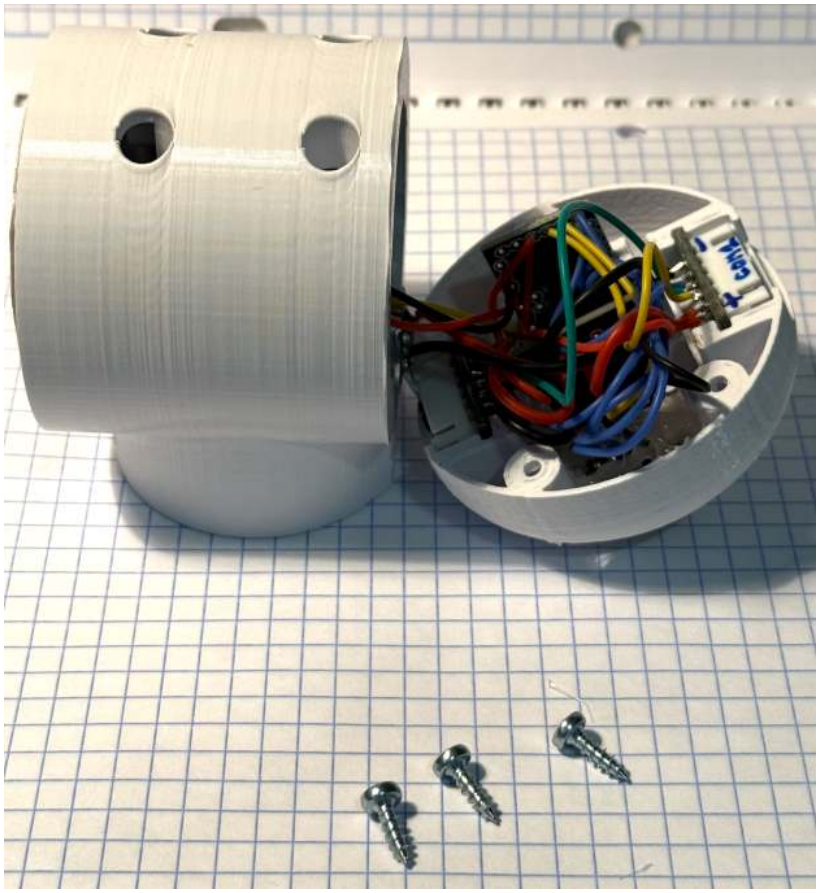


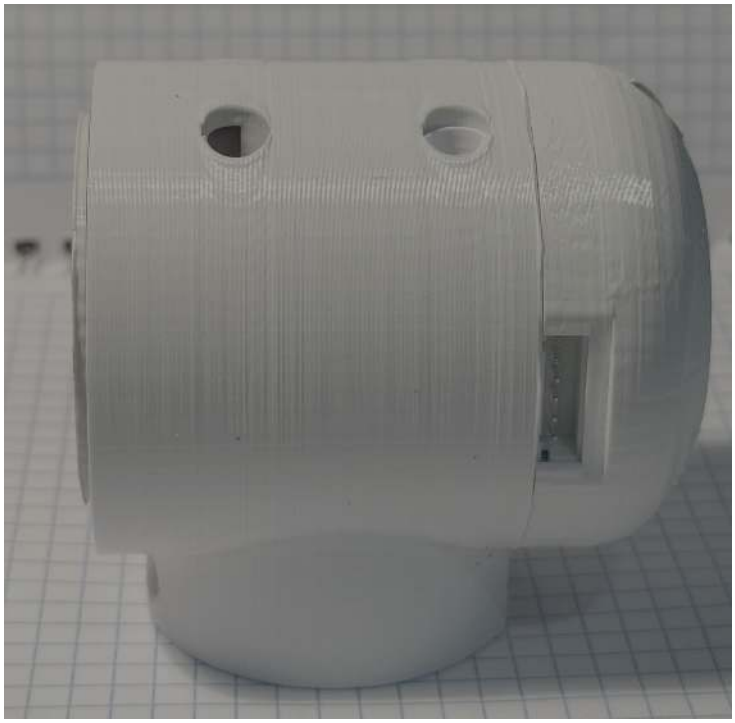
Install the wires protection tubes





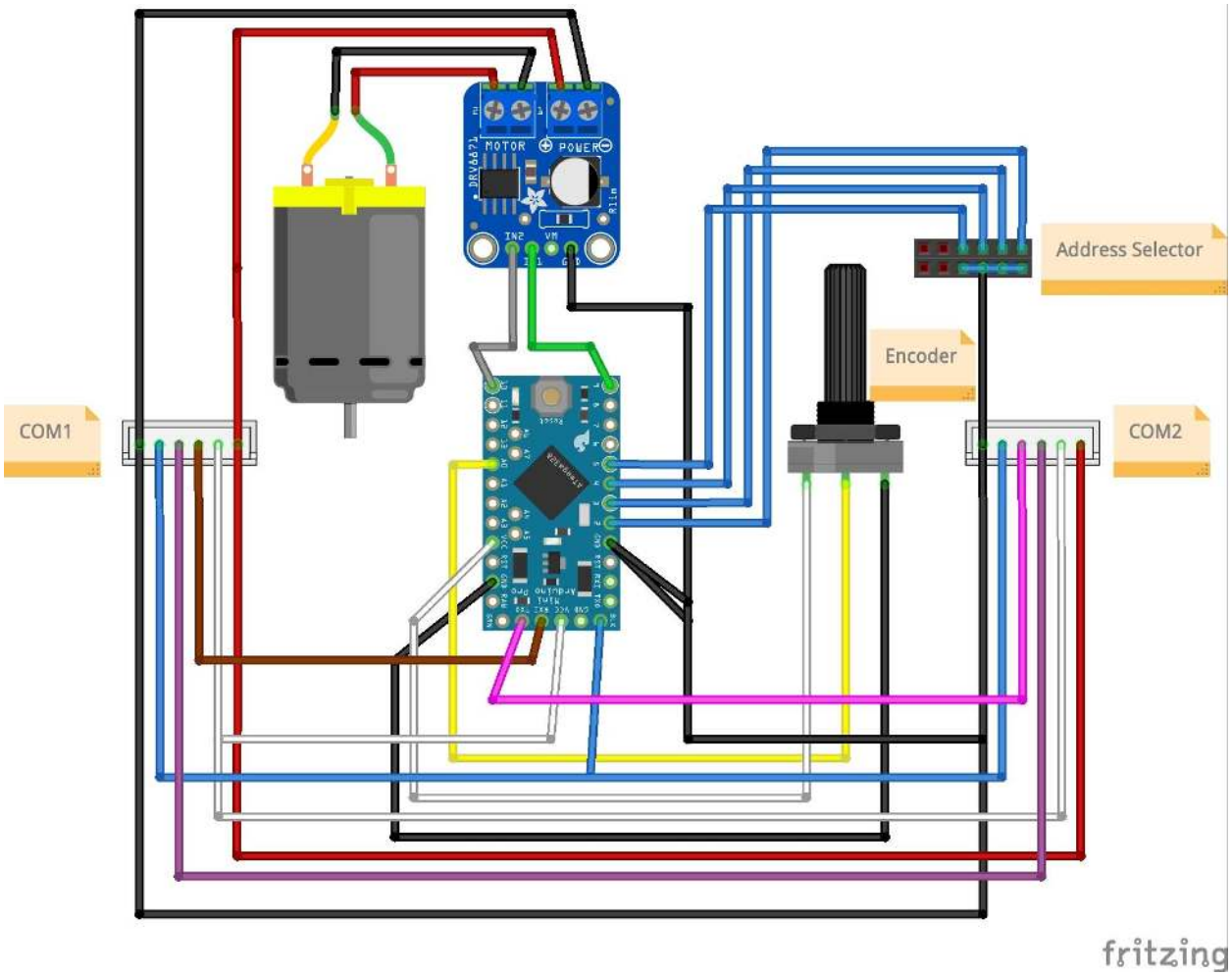
Install ORA-7 Lid on ORA-7 Body





Electronics Assembly

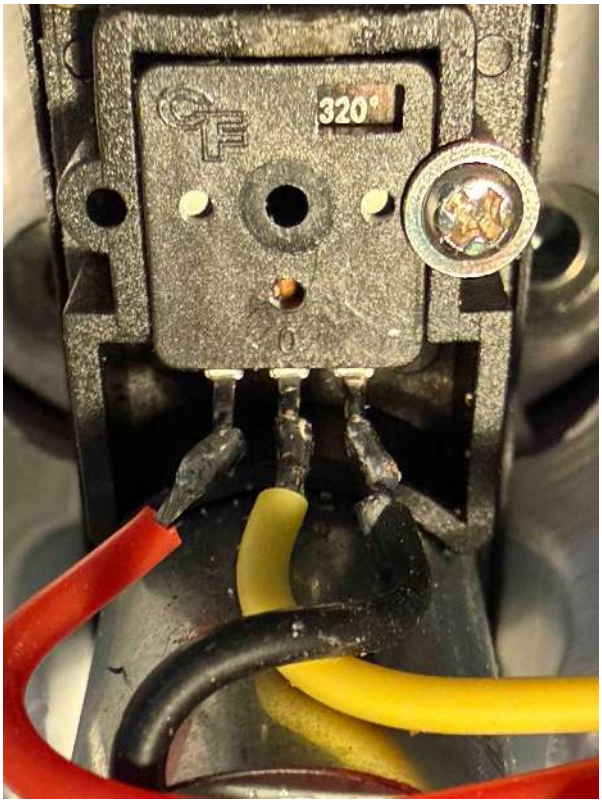
Schematics

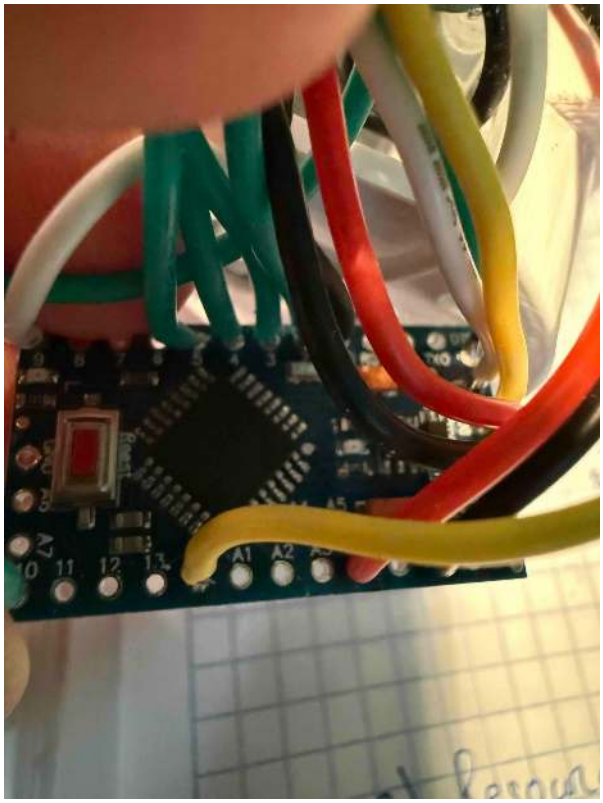


DS3240 Servo Upgrade

Encoder <-> Arduino

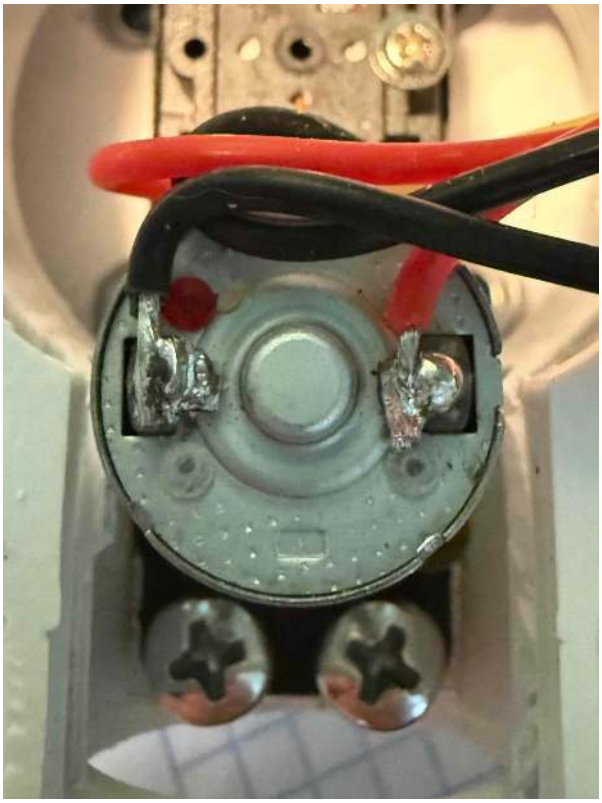
Encoder PIN	**Arduino PIN**
Right	GND
Middle	A0
Left	VCC

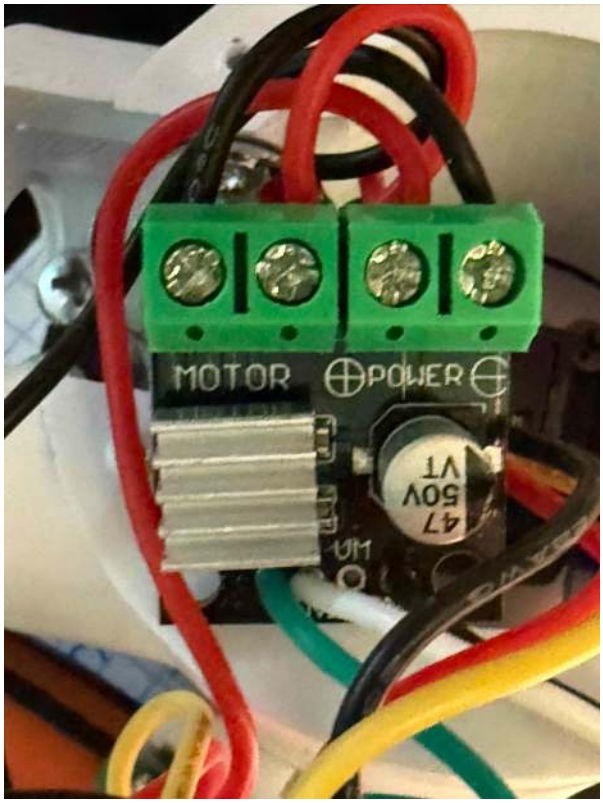




Motor <-> DRV8871

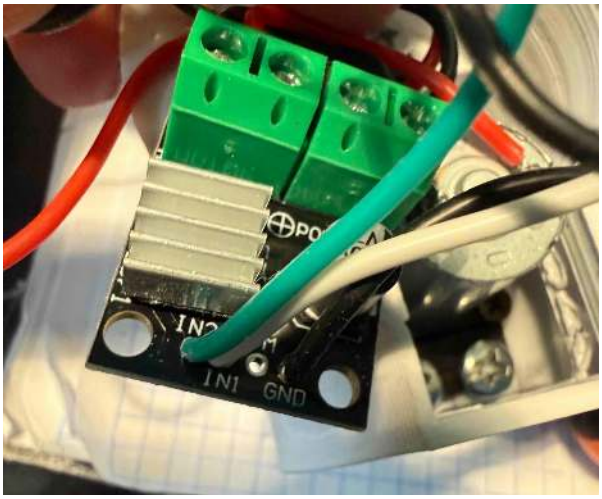
Motor PIN	**DRV8871 PIN**
RIGHT	OUT1
LEFT (With RED Mark)	OUT2

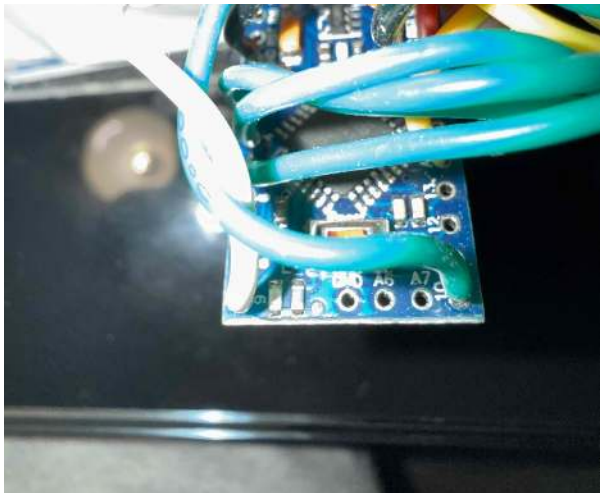




DRV8871 <-> Arduino

DRV8871 PIN	**Arduino PIN**
IN1	D9
IN2	D10
GND	GND





Interfaces

COM1 (Left)

Pinout

PIN0	PIN1	PIN2	PIN3	PIN4	PIN5
GND	DTR Connected to Arduino DTR	TX Connected to COM2 RX	RX Connected To Arduino RX	Ctrl Power +5V	Motor Power +8.4 V or +12.0 V
JST LOCK HERE					

PCB

Size: 20x8

COM2 (Right)

PIN0	PIN1	PIN2	PIN3	PIN4	PIN5
GND	DTR Connected to Arduino DTR	TX Connected to Arduino TX	RX Connected to COM1 TX	Ctrl Power +5V	Motor Power +8.4 V +12.0 V
JST LOCK HERE					

Address Selector

Pinout

PIN 0	PIN 2	PIN4	PIN6	PIN8	PIN10
reserved	reserved	ADR3 (Ard D5)	ADR2 (Ard D4)	ADR1 (Ard D3)	ADR0 (Ard D2)
reserved	reserved	GND	GND	GND	GND
PIN1	**PIN3**	**PIN5**	**PIN7**	**PIN9**	**PIN11**

PCB

Size: 18x8

Connecting to the Computer

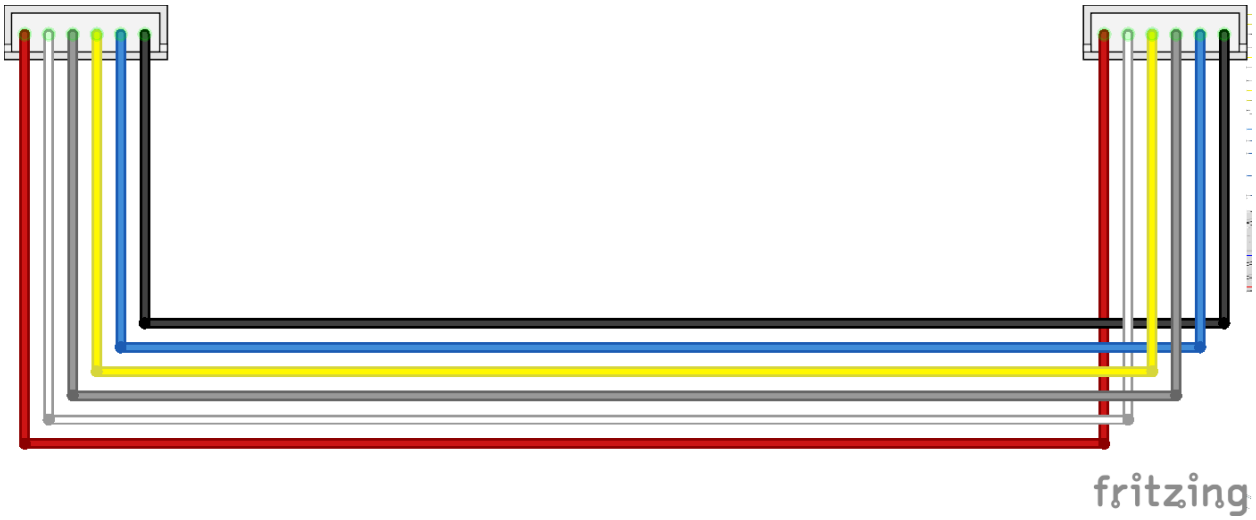
OSP Controller

OSP Controller allows to connect the OSP-enabled devices like ORA-series actuators to the computer via USB port and to supply the power to those devices. The detailed information about the controller specs and the assembly instructions are available in OSP-Controller Assembly Manua available on ThingVerse:

https://www.thingiverse.com/thing:7339429/files

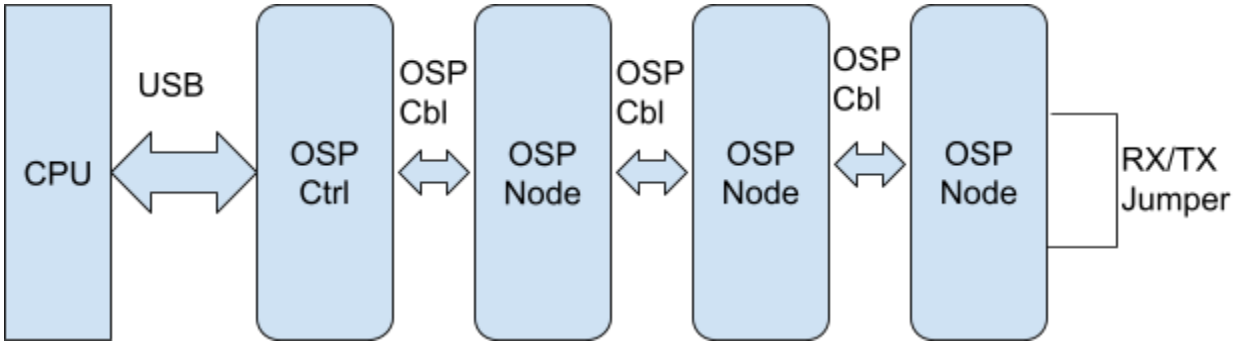
Connection Cable

The OSP connection cable is JST XH Male <-> JST XH Male 6 wires cable.

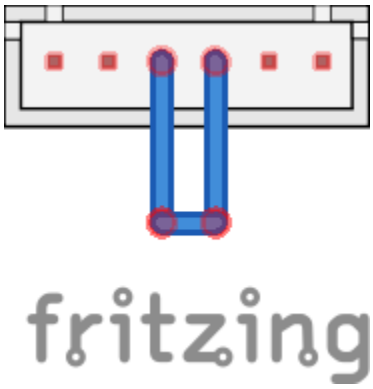


Ring Topology

OSP protocol supports ring topology, allowing to connect multiple OSP-enabled devices to a single controller.



The last device must have the communication pins TX and RX connected with each other closing the loop and allowing the signal to run back to the controller.



Software

Communication Protocol

To control the ORA series actuators the OSP protocol is used. The documentation on this protocol is available at Telemetry Balkan doo website: https://www.telemetrybalkan.com/content/files/2023/02/Open-Serial-Peripheral.-Communication-Protocol.pdf

Arduino Firmware

Python SDK

TODO: Push the ORA-7 Related Changes to a separate repository

Programming Example

Control the actuator angle

```
from osp import OSP

ora = OSP("/dev/cu.usbserial-A50285BI")
ora.ora_set_angle(0, 5000) # params (address, angle)
```

Conclusion