

Assembly Manual

Documentation "Desafío 2"

Teacher: Harold Valenzuela

Auxiliaries: Fernando Navarrete, Francisco Cáceres

Helpers: Valentina Abarca, Fernanda Echeverría, Emilia Gutiérrez, Ignacio Nuñez

1. Introduction

Thank you for choosing the REPOS Sorting Conveyor Belt! Designed by Fernando Navarrete, this innovative solution transforms the way objects are sorted. With its advanced color detection system and precise integration of electromechanical actuators, you can automate sorting routines efficiently and reliably.

Figure 1 shows the fully assembled system, ready to optimize your sorting processes. Its design allows handling different sizes and types of objects by adjusting the speed and sequence of the actuators according to your specific needs. Additionally, its modular construction facilitates maintenance and future expansions, ensuring consistent performance and adaptability to various environments.

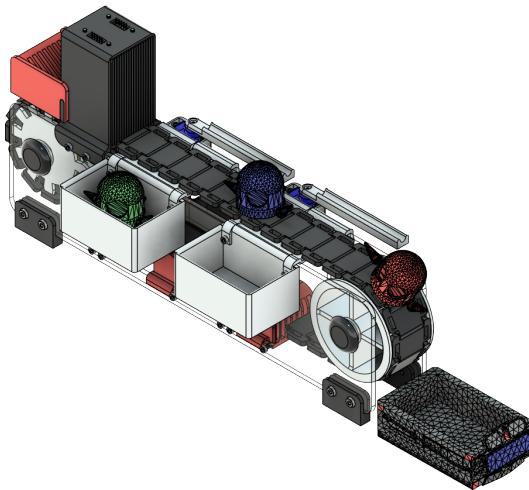


Figura 1: REPOS Sorting Conveyor Belt

In the following sections, the steps required to assemble your REPOS Sorting Conveyor Belt will be detailed.

2. Materials and Parts List

First, the following materials are required to assemble the conveyor belt, as detailed in Table 1.

Tabla 1: Materials list per conveyor belt

Name	Description	Quantity
M3x8 Bolts	ISO M3 cylindrical head bolts	40
M4x8 Bolts	ISO M4 cylindrical head bolts	8
M3x4 Bolts	ISO M3 flat head bolts	2
627zz Bearings	SKF radial bearings 7x22x7mm	4
DC Motor	Yellow 6V DC motor with gearbox	1
L298N Driver	Motor driver L298N	1
GY-31/TCS3200 Sensor	64-photodiode color sensor	1
SG90 Servo	SG90 servomotors with horns	2
18650 Battery	3.7V lithium-ion 18650 battery	2
2x18650 Battery Holder	18650 lithium-ion battery holder	1
SPST 2-pin Switch	20mm diameter SPST switch	1
Neodymium Magnets	12x4mm neodymium magnets for bearing covers	4

Next, the list of 3D-printed parts required to assemble the conveyor belt is shown in Table 2.

Tabla 2: 3D-printed parts list for each conveyor belt

Name	Description	Quantity
Track Chain	43-link track chain	1
Front Motor Gear	Gear of the left power unit	1
Rear Motor Gear	Gear of the right power unit	1
Motor Mount	DC motor support piece	1
Cylinder	Support unit cylinder	1
7mm Shaft	7mm shaft for the support unit	1
Acrylic Supports	Transparent acrylic side supports	2
Side Wall Supports	Support pieces for acrylic side supports	4
Lower Support	Component support pieces	2
Component Plate	Plate for L298N driver and batteries	1
Servo Mount	Mounts for SG90 servos	2
Servo Blades	Push blades for SG90 servos	2
Side Receiving Box	Boxes for sorted objects	2
Top Support	Piece connecting box and servos to keep belt level	2
Dark Chamber	Darkened chamber for color sensor	1
Slat Curtains	Curtains for dark chamber	2
Loading Hopper	Hopper to direct objects to dark chamber	1
Bearing Covers	Covers to protect bearings and prevent shafts from coming out	4

3. Assembly Process

First, place the 627zz bearings into the acrylic side supports in the 22mm holes, as shown in Figure ??.

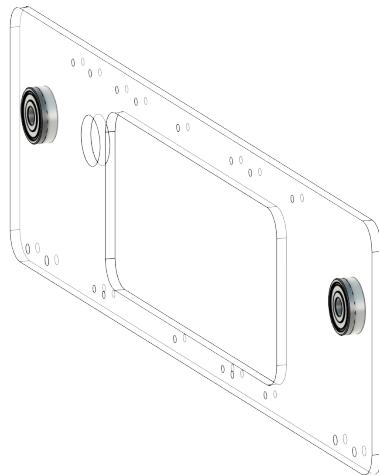


Figura 2: Rear acrylic support with embedded bearings. Glue is recommended for a press-fit.

The bearings should protrude toward the interior of the conveyor belt, according to Figure ??.

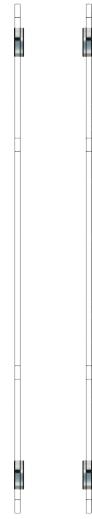


Figura 3: Acrylic supports with bearings positioned in the final conveyor belt assembly.

Next, to facilitate assembly, bolt the components from the rear side and then join with the other

acrylic support. Attach the front and rear motor gears to the DC motor along with the motor mount, forming the **power unit** shown in Figure 4.

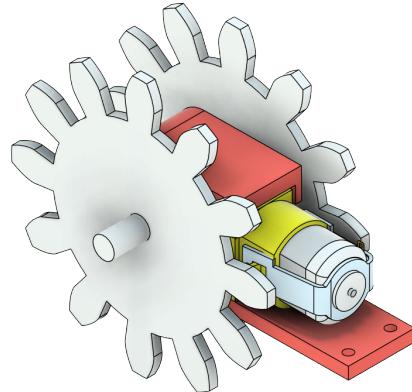


Figura 4: Assembled conveyor belt power unit, no additional fasteners required.

Then, insert the power unit into the left bearing of the rear side support using the shaft protruding from the gear, as shown in Figure 5.

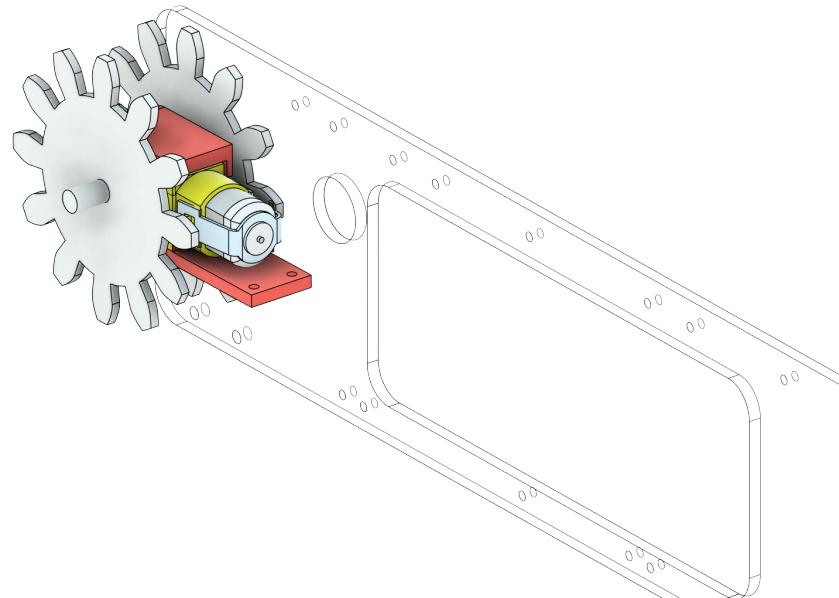


Figura 5: Power unit installed.

To secure the power unit, attach the lower support to the two lower 3mm holes near the unit, as shown in Figure 6.

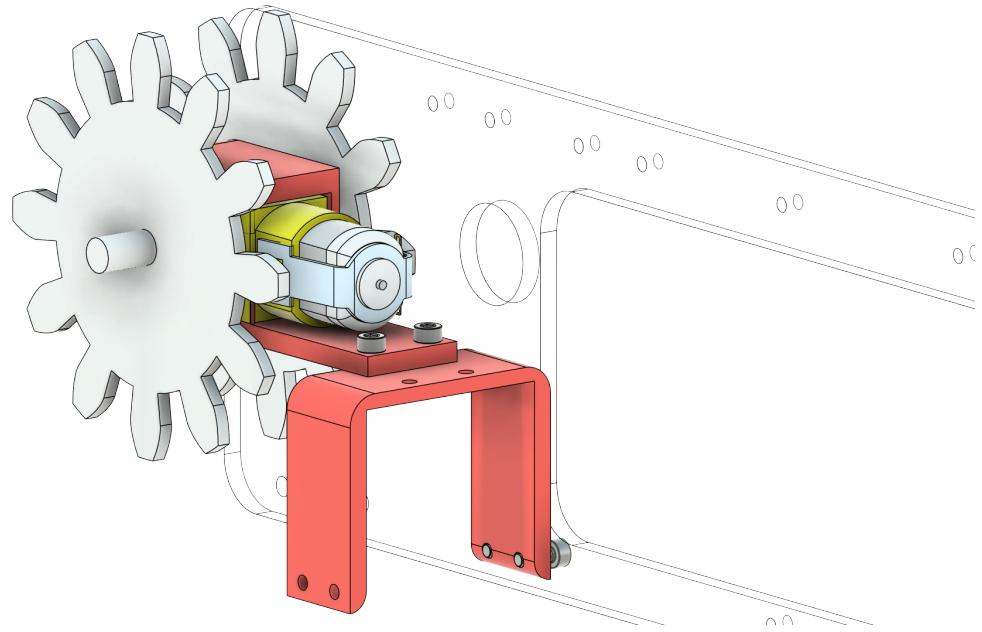


Figura 6: Power unit bolted with lower support.

Repeat this step for the lower support on the other side of the acrylic support, see Figure 7.

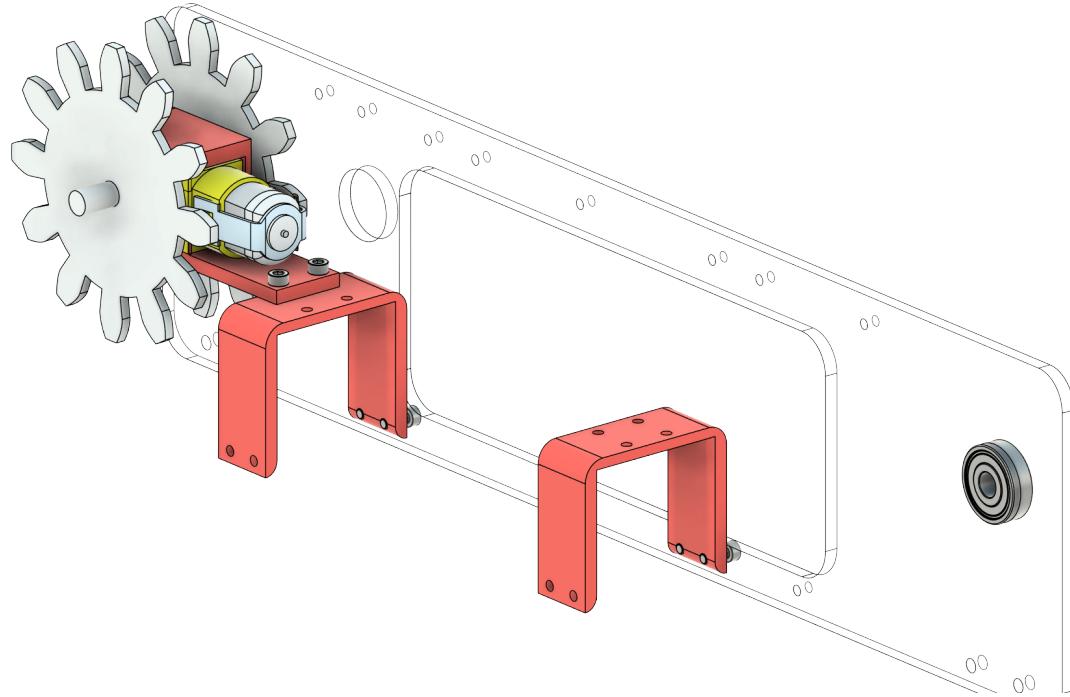


Figura 7: Lower supports bolted to acrylic support.

The component plate should be bolted together with the L298N driver using M3x8mm bolts and the 2x18650 battery holder using M3x4mm flat head bolts to allow battery placement, see Figure 8.

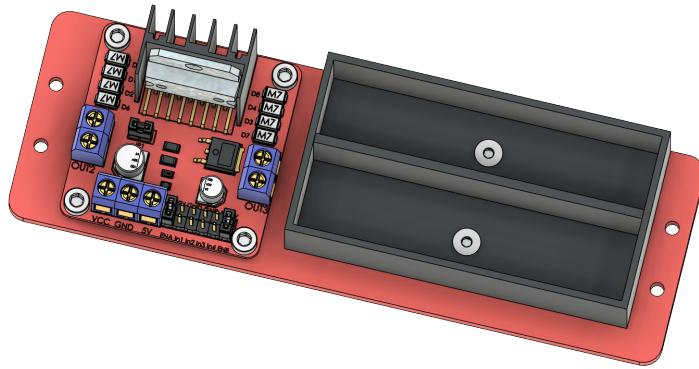


Figura 8: Assembled component plate.

Next, attach the component plate to the assembly by bolting it to both lower supports, as shown in Figure 9.

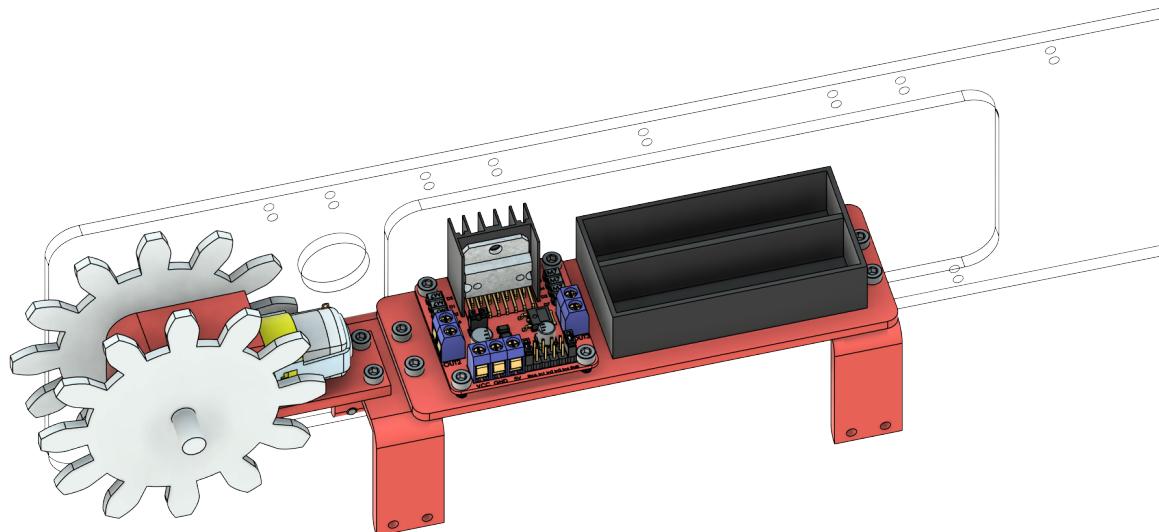


Figura 9: Component plate incorporated into the conveyor belt assembly.

IMPORTANT: After this step, check the initial connections of the DC motor, L298N driver, and power supply. Leave an extra wire available for the future connection of the SPST switch. Immediately connect the three control pins of the DC motor (ENA, IN1, and IN2). Also, reserve a wire for the 5V and GND return to power the servomotors.

Next, incorporate the **support unit** of the conveyor belt, consisting of the 7mm shaft and cylinder. Press-fit the 7mm shaft into the bearing opposite the power unit and place the cylinder inside the shaft, as shown in Figure 10.

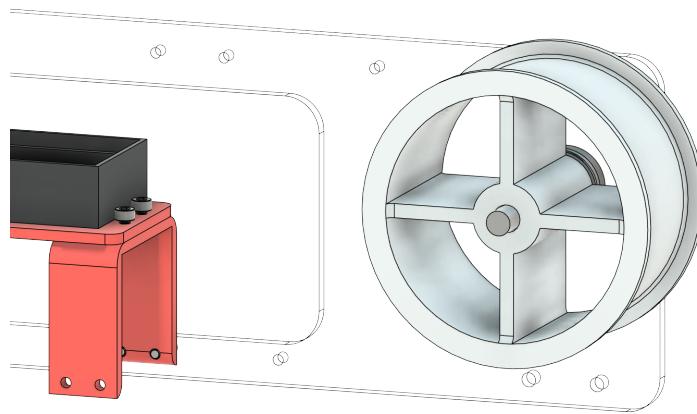


Figura 10: Support unit installed into the conveyor belt.

To complete the rear side acrylic support, place the servomotors into the upper holes of the acrylic supports. First, attach the servos without horns to the supports using M3 bolts, see Figure 11. Pass the cables through the cutout in the support before positioning.

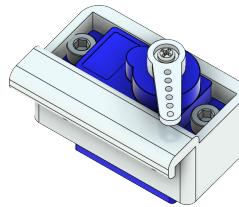


Figura 11: Servo mount with SG90 servo bolted.

Then, attach both servomotors to the current assembly, as illustrated in Figure 12.

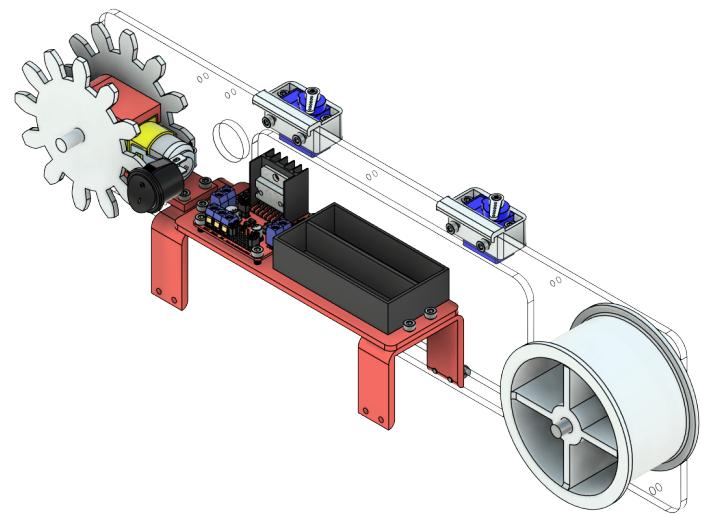


Figura 12: Servomotors installed in the conveyor belt assembly.

Finally, add the side wall supports to both acrylic supports using M4x8mm bolts, see Figure 13.

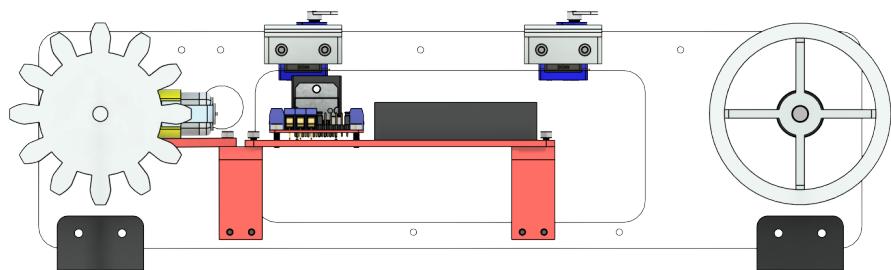


Figura 13: Side wall supports attached to the acrylic support.

Next, carefully place the track chain between the teeth of the power unit gears and over the cylinder of the support unit, according to Figure 14.

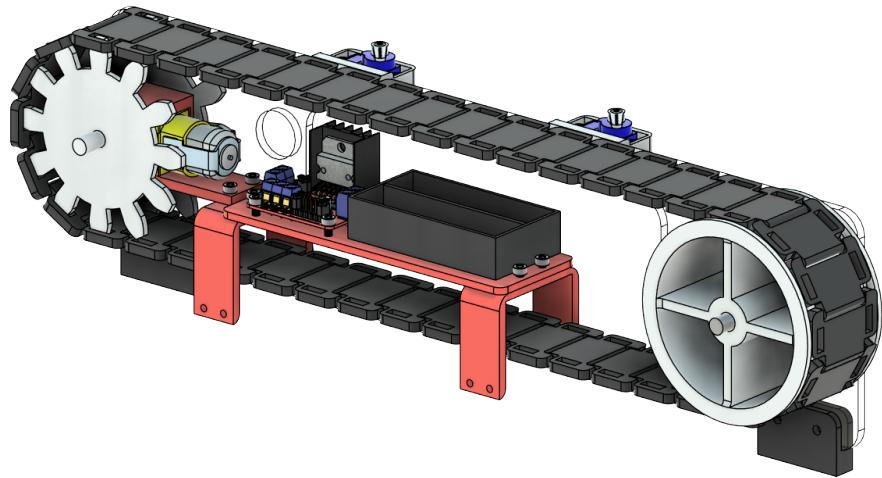


Figura 14: Track chain installed in the assembly.

Then, place the remaining side acrylic support over the shafts of the power unit and support unit, and bolt the lower supports to the acrylic support, as shown in Figure 15.

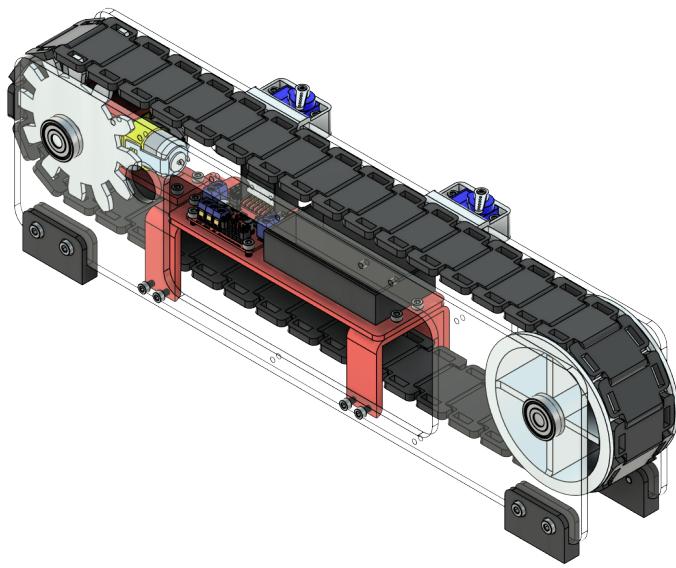


Figura 15: Remaining side acrylic support installed.

IMPORTANT: At this stage, connect the 2-pin SPST switch using the previously reserved wire, attaching it to the positive terminal of the batteries to control the conveyor belt power. Route the servomotor connections through the opposite hole of the switch support, ensuring all wires face the front of the conveyor for future connections. The switch installed in the 20mm hole is shown in Figure 16.

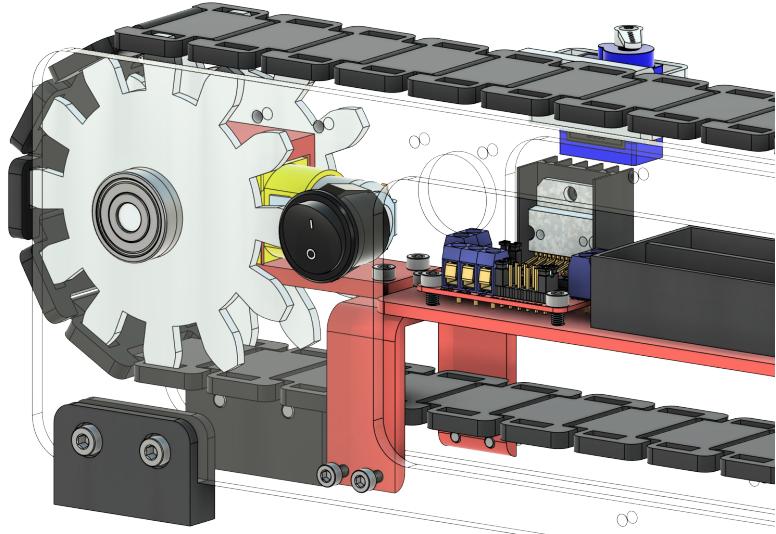


Figura 16: 2-pin SPST switch installed in the assembly.

Next, place the bearing covers over the 4 bearings. These covers include pre-attached 12x4mm neodymium magnets with glue, as shown in Figure 17.

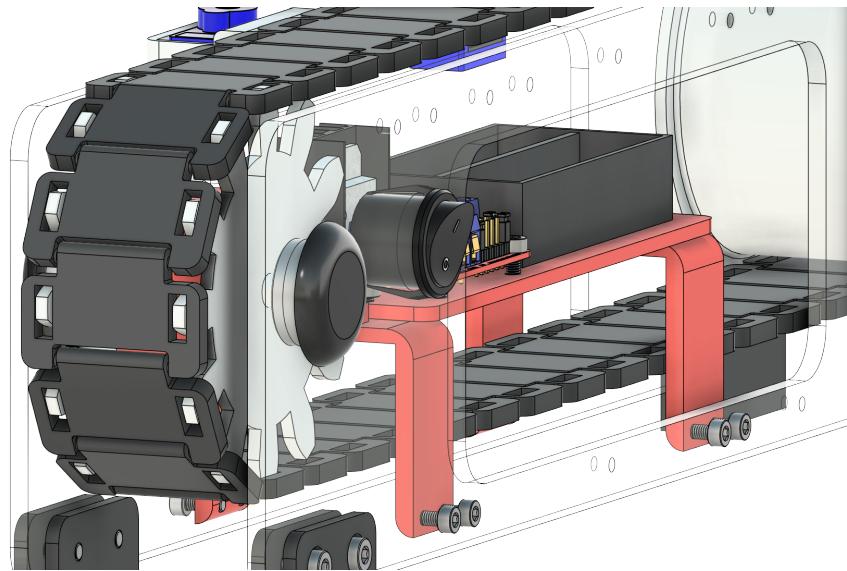


Figura 17: Bearing covers installed.

Then, attach the servo blades (remember to calibrate the zero position of the servos before installation to ensure correct operation range), see Figure 18.

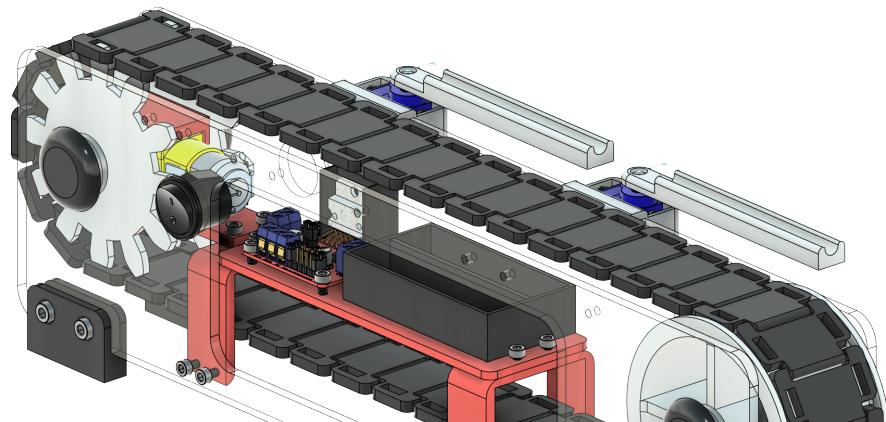


Figura 18: Servo blades installed.

Next, assemble the dark chamber with the color sensor and the slat curtains before installing it on the conveyor belt. First, position the slat curtains into the upper holes of the chamber, as shown in Figure 19.



Figura 19: Slat curtains positioned in the dark chamber.

Then, bolt the GY-31/TCS3200 color sensor into the chamber using M3 bolts through the slat curtains, as shown in Figure 20. Note the cutouts for the sensor connection pins at the top of the chamber.

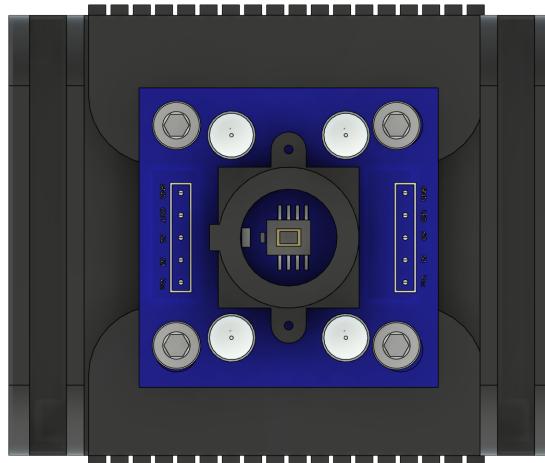


Figura 20: Color sensor GY-31/TCS3200 installed in the dark chamber.

After securing the sensor, bolt the dark chamber to the conveyor belt on the side holes, as illustrated in Figure 21. M3x10mm bolts with nuts are recommended for better adjustment, but M3x8mm bolts also work.

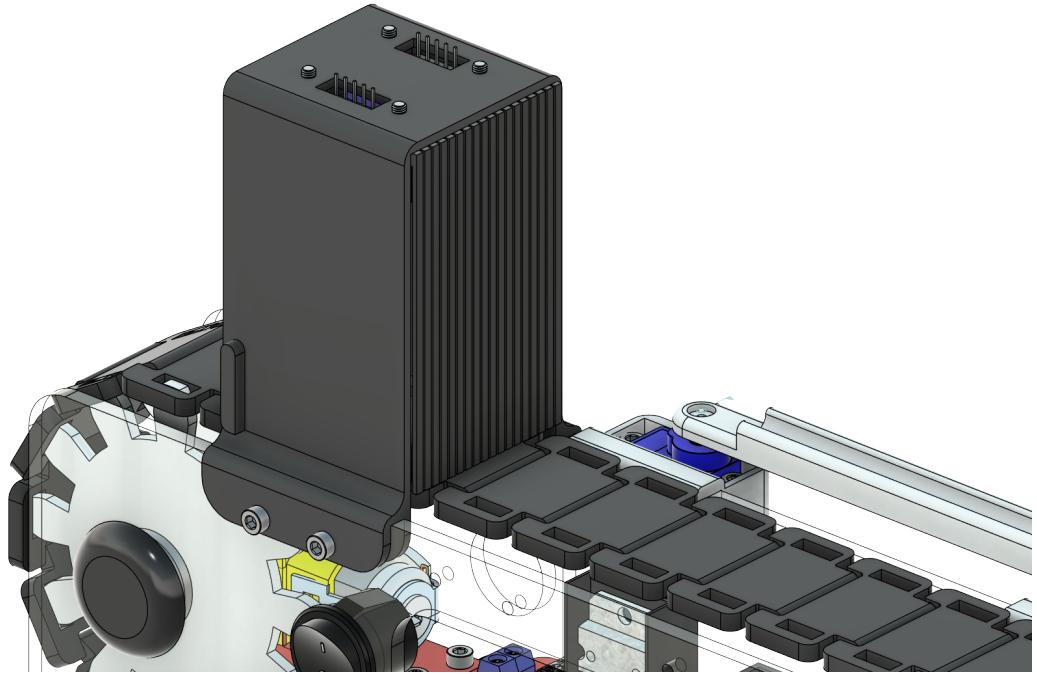


Figura 21: Dark chamber installed on the conveyor belt.

Next, attach the loading hopper to the protrusions on the sides of the dark chamber, as shown in Figure 22.

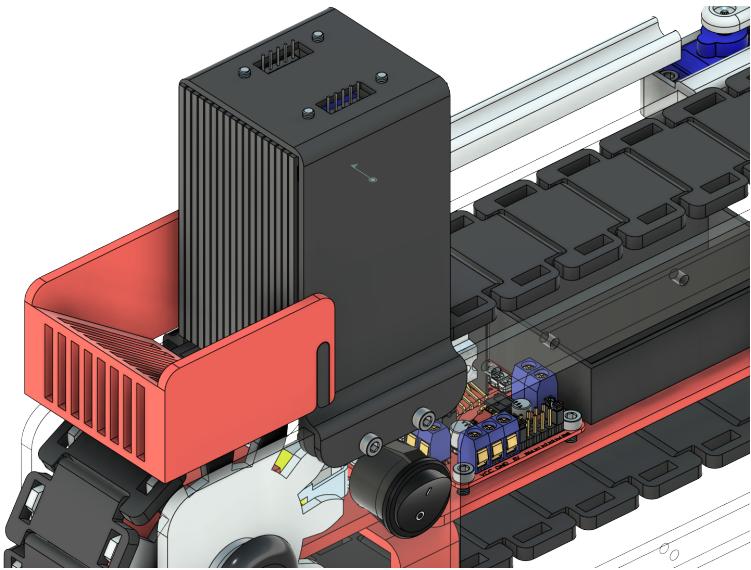


Figura 22: Loading hopper attached to the dark chamber.

Finally, attach the side receiving boxes along with the top support. First, pre-fix the receiving boxes with the top support for stability, as shown in Figure 23.

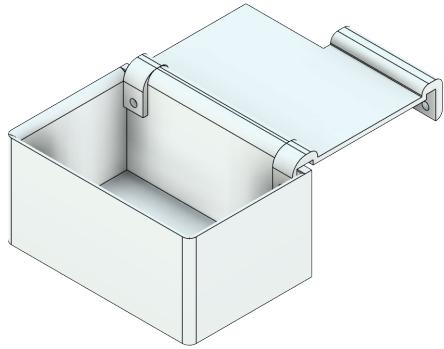


Figura 23: Side receiving box pre-fixed with top support.

Then, slightly lift the track chain and slide both receiving boxes onto the pre-fixed top support. Ensure they do not interfere with the servomotors. Attach M3 bolts to the three holes on the top support (2 front, 1 back), as shown in Figures 24 and 25.

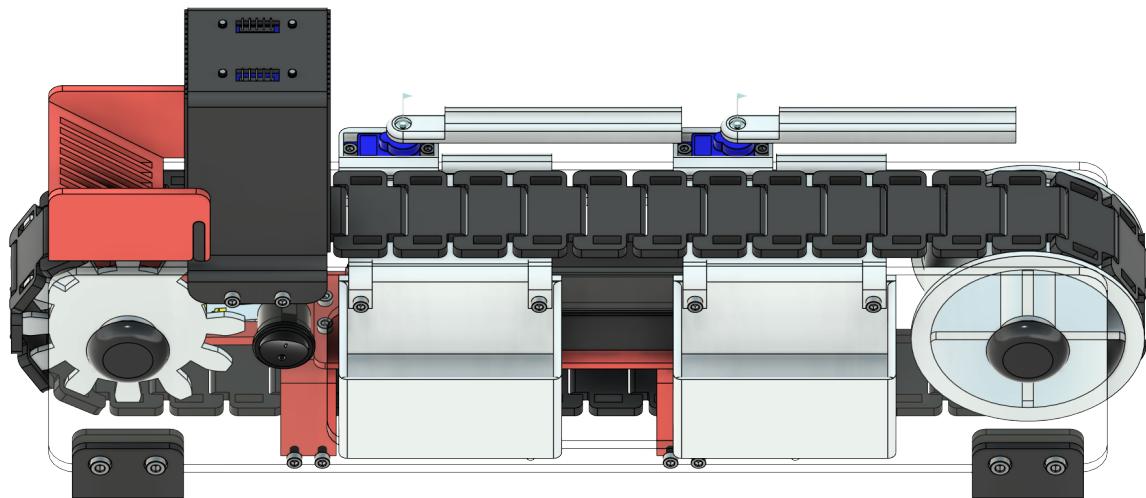


Figura 24: Receiving boxes and top support assembly, front view.

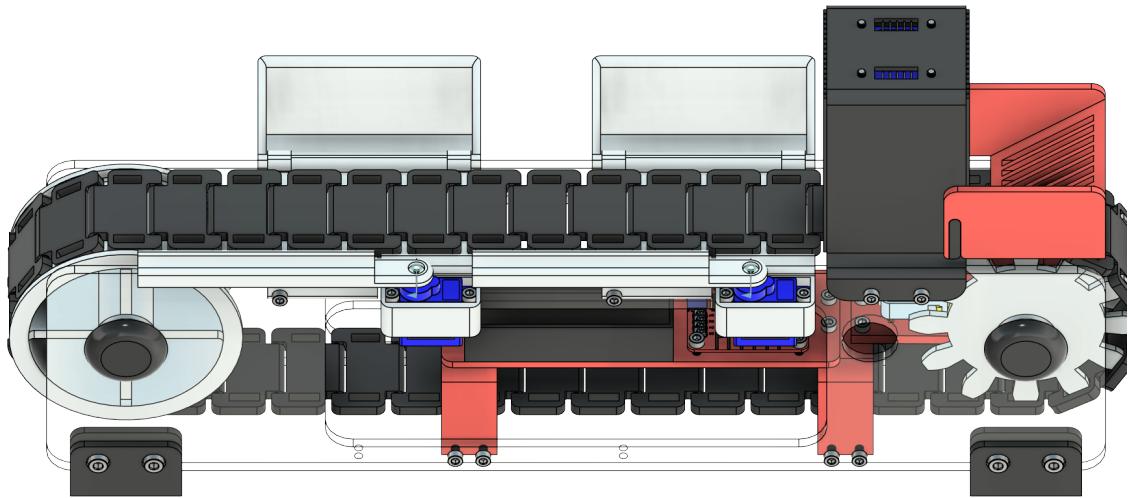


Figura 25: Receiving boxes and top support assembly, rear view.

Optionally, tensioners can be installed on the lower part of the conveyor belt next to each lower support. This ensures proper tension so the track chain engages with the power unit gears and moves correctly. To install the tensioners, lift the return section of the chain, place the tensioners, and bolt them at their single attachment point, as shown in Figure 26.

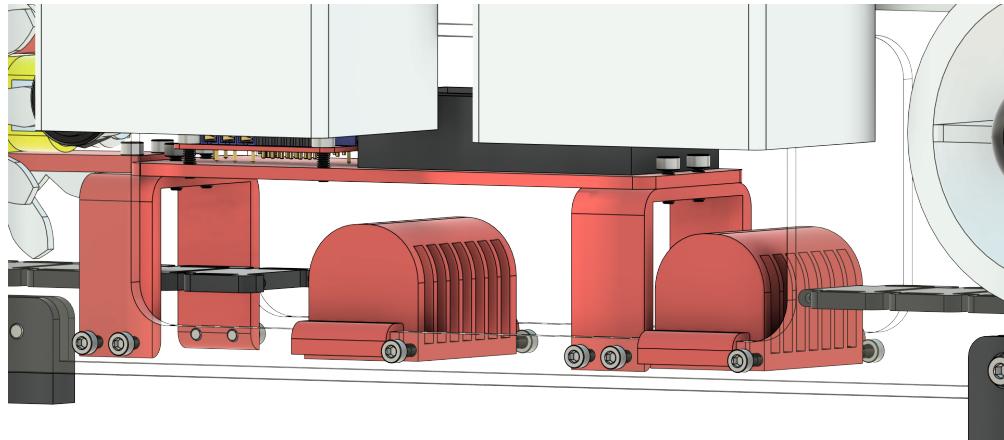


Figura 26: Tensioners bolted to the conveyor belt. The track chain is hidden in the CAD model as its bending occurs only in reality.

Additionally, the final receiving box at the end of the conveyor is optional, as shown at the beginning of this manual in Figure 1.