

Assembly: Rack & Pinion with Servo Motor (Vertical)

Step 1: Prepare Components

- Rack (straight gear strip)
- Pinion (circular gear)
- MG995 servo motor (for torque)
- Telescopic slide / drawer slide (for smooth vertical guidance)
- Mounting base (wood/acrylic board)
- Screws, nuts, and brackets

Step 2: Fix the Telescopic Slide

1. Mount the telescopic slide vertically on the base board.
2. Ensure the slide moves **up and down smoothly** without wobbling.
3. Attach a flat plate to the moving part of the slide – this will hold the **rack**.

Step 3: Mount the Rack

1. Attach the **rack gear** vertically to the moving plate of the slide.
2. Align the rack so its teeth face outward, ready to mesh with the pinion gear.
3. Make sure the rack can move **freely up and down** without tilting.

Step 4: Fix the Servo Motor with Pinion

1. Attach the **pinion gear** firmly to the horn of the MG995 servo motor.
2. Mount the servo motor **beside the rack** using an L-bracket or holder.
3. Adjust the position so the **pinion meshes smoothly with the rack teeth**.
4. Tighten screws to avoid slipping, but keep alignment free of extra friction.

Step 5: Wiring

1. Connect servo motor wires:
 - **Red** → +5V
 - **Brown/Black** → GND
 - **Orange/White** → Signal pin on Arduino/CPX
2. Provide external 5–6V, 2A power supply for MG995 (servo is high torque).
3. Connect ground of power supply and Arduino/CPX together (common ground).

Step 6: Test Movement

1. Upload simple code to move the servo from **0° to 180°** and back.
2. Observe:
 - Servo rotates pinion → rack moves **up**.
 - Servo rotates back → rack moves **down**.
3. If movement is jerky, check:
 - Gear alignment
 - Rack smoothness on slide
 - Servo power supply strength

Step 7: Add Safety Features (Optional)

- Install **limit switches** at **top and bottom** to stop motion.

This way you get a **working vertical lift model** using **rack, pinion, servo, and slide**.