

ASSEMBLY MANUAL

Product: Zor Deca Mechanical Mug Holder

Target Group: Grades 6–12 | Ages 11+

Estimated Build Time: 40 - 60 Minutes

NAME YOUR ZOR

Zor means **Strength** and Deca means the **10th iteration**.

Now, it's your turn to build it and bring it to life. Every machine needs an identity.

What will you name your Zor? (*Example: Freddy's Zor*)

My Zor's Name: _____

Pre-Assembly Component Checklist

Before starting, clear your workspace and verify you have all components from your kit.

Part ID	Name	Qty
B1	Base	1
TC	Top Cover	1
FPB	Finger Palm Block	1
TPB	Thumb Palm Block	1
F1	Finger	2
T1	Thumb	1
G1	Spur Gear	1
G2	Spur Gear	1
IG	Idler Gear	1
SP	Spacer	1
FMB	Finger Moving Block	1
TMB	Thumb Moving Block	1
10mm	10mm Screws	4
12mm	12mm Screws	3
25mm	25mm Screws	2
Grease	Grease Tube	1

STEP-BY-STEP ASSEMBLY INSTRUCTIONS

CRITICAL DECISION: To Grease or Not to Grease?

The included lubricant packet is **only for permanent or long-term builds**. Please check with your instructor or determine your project's goal before opening the packet:

1. **SKIP GREASE IF:** This kit will be disassembled and rebuilt by multiple student groups. Leaving the parts dry prevents a messy cleanup and preserves the components for the next class. **Skip Step 1 entirely and proceed to Step 2.**
2. **USE GREASE IF:** This is a permanent engineering build for a display, a single dedicated project or an advanced long-term testing environment. **Proceed to Step 1 below.**

Step 1: Component Lubrication

Required Parts: TPB, G1, G2, IG, FMB, TMB, Grease Tube

Required Tools: None

Est. Time: 5 mins

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
1.1	Open your included grease tube.	
1.2	Lubricate Gears: Using the provided toothpick, apply a small dab of grease to the underside of all gears (G1, G2, IG). Space the dabs evenly in three spots to form a triangle.	

1.3	Lubricate Moving Blocks: Locate the teeth on the Moving Blocks (FMB, TMB) that come into contact with the gears (typically just the middle section). Apply a small dab of grease directly to these teeth.	
1.4	Lubricate Palm Blocks: Apply a small dab of grease along the sliding ribs of the Thumb Palm Block (TPB).	

Step 2: Finger Module Sub-Assembly

Required Parts: FMB, FPB, F1 (x2), SP (x1), 12mm Screws (x2), 25mm Screws (x2), *Washers (x4)

**Note: Washers may already be pre-threaded onto your screws.*

Required Tools: Screwdriver

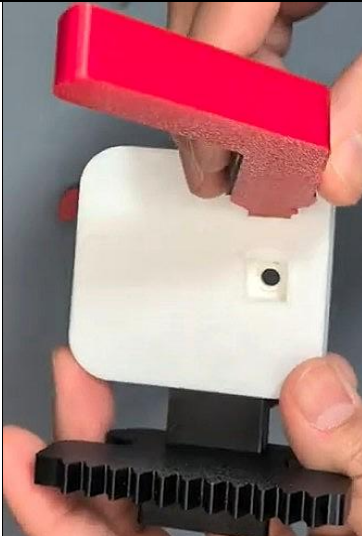
Est. Time: 15 mins

Part A: Joining The Blocks

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
2.1	Position the FMB: Lay the Finger Moving Block (FMB) on your workspace with the back side (the side with the track walls) facing up.	
2.2	Prepare the Screws: Slide a washer onto each of the two 25mm screws. Insert these screws from the back side through the lower holes of the FMB.	

2.3	Align the Spacer: Slide the spacer (SP) over the exposed screw threads resting on the top side of the FMB.	
2.4	Attach the Palm Block: Align the two holes on the bottom edge of the Finger Palm Block (FPB) with the screws and spacers. Tighten the screws to secure the FPB and FMB together. Ensure the two square pocket holes on the FPB are facing outward.	
2.5	Position the FPB so the two square pocket holes face the same side as the teeth on FMB.	

Part B: Installing the Fingers

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
2.6	Align the Fingers: Insert the fingers into the square pocket holes on the front of the FPB. Make sure the raised geometric boss (the protrusion) on each finger nests perfectly into the square pocket hole of the FPB.	
2.7	Insert Back Screws: Locate the dovetail feature on the back side of the FMB. Ensure each 12mm screw has a washer on it. <i>(If not already threaded, slide a washer onto each screw now)</i>. Push the prepped screws through the holes next to the dovetail.	
2.8	Verify Orientation: Before final tightening, ensure the fingers are facing the correct direction. The fingers must curve inward toward the side where the dovetail sits on the edge (opposite of the pocket holes).	
2.9	Secure: Tighten the back screws completely to lock the fingers into place.	

Step 3: Thumb Module Assembly

Required Parts: TPB, Thumb (T1) with pre-attached pin, 12mm Screws (x2), *Washers (x2)

**Note: Washers may already be pre-threaded onto your screws.*

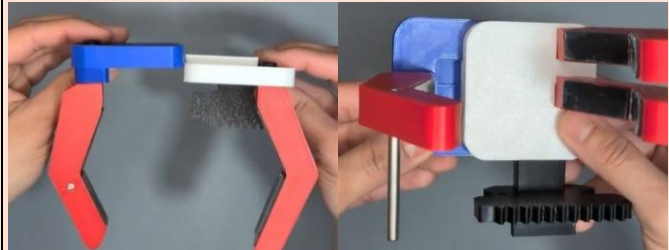
Required Tools: Screwdriver

Est. Time: 5 mins

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
3.1	Identify Component Orientation: Hold the Thumb Palm Block (TPB) and inspect its features: the front square pocket hole, the back mating dovetail track and the open slot at the edge of the dovetail which must face outward.	
3.2	Align the Thumb: Insert the Thumb (T1) boss into the square pocket hole on the front of the TPB. Ensure the thumb curves in the same direction that the back dovetail track is facing.	
3.3	Screw loosely from Behind: Turn the assembly over to the flat back surface. Slide washers onto the two 12mm screws, insert them through the back of the TPB and screw them loosely into the thumb. Leave enough play so the thumb can be lifted and wiggled slightly; this clearance is required to align the pin into the base later.	
3.4	Floating Pin Check: Notice the metal pin protruding from the thumb. This pin is already permanently glued into place and doesn't need any adjustment. Leave it as-is for now so that when you lift and position the thumb later, the pin can slide smoothly into its designated slot on the Thumb Moving Block (TMB).	

FIT & FUNCTION CHECK: DOVETAIL ALIGNMENT

Slide Test: Take the completed Thumb Module and slide its back dovetail track onto the matching rail of the Finger Module. The blocks should glide smoothly along the track.



Orientation Check: Verify that the fingers and the thumb curve toward each other, facing the correct way to form a closed grip.



Wiggle Room: Ensure the thumb still has a tiny bit of play from the loose screws. If it feels completely rigid, back the screws out a quarter-turn so you can lift the pin into the base in the next section.



Step 4: Base Assembly

Required Parts: B1, FMB, TMB, G1, G2, IG, Finger Module (*Assembled in Step 2*)

Required Tools: None

Est. Time: 10 mins

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
4.1	Place the main base chassis (B1) on your workspace. Note that the push button, spring and pawl mechanism come pre-assembled from the factory. Position the base so this pre-assembled button mechanism faces toward you.  DO NOT DISASSEMBLE THESE PARTS.	
4.2	Position the TMB: Hold the Thumb Moving Block (TMB) so the pin slot is on the left side when looking down at it.	
4.3	Place the TMB: Place TMB onto the guide wall in the base so that the two walls on the underside of TMB straddle the wall in the base.	
4.4	Mount the Finger Module: Hold the Finger Module assembly with its gear teeth facing inward toward the central gear. Lower it onto the base, ensuring the two bottom walls of the Finger Moving Block (FMB) cleanly straddle the single guide wall on the base.	

- 4.5 Sync the Starting Positions:
Push both the Finger Module and the Thumb Module fully outward. Both moving blocks must be pushed out all the way so they align and stop at the same starting point; this synchronization is crucial for the gear teeth to mesh properly and for the adjustment clicks to work.



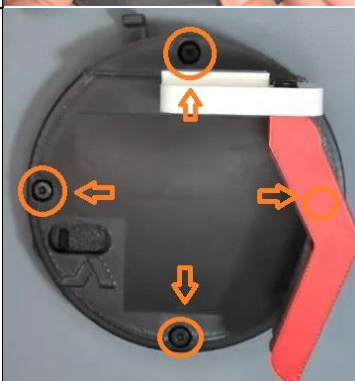
Step 5: Attaching the Top Cover

Required Parts: Base Assembly (*From Step 4*), Top Cover, 10mm Screws (x4), Washers (x4)

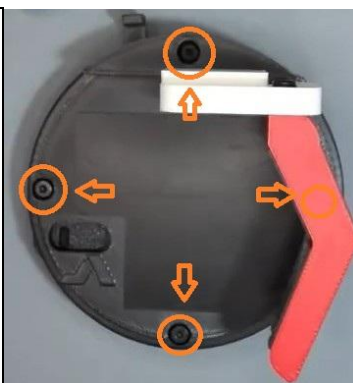
**Note: Washers may already be pre-threaded onto your screws.*

Required Tools: Screwdriver

Est. Time: 5 mins

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
5.1	Align the Top Cover: Pick up the top cover and orient it so the cutout on the top right matches the shape of the finger module's palm block. Lower the cover onto the base, making sure the FMB and TMB stay properly seated inside their tracks.	
5.2	Match the Screw Holes: Press the top cover down flat and align its four corner holes with the corresponding screw holes in the base.	
5.3	Prep & Insert Hardware: Drop a washer into each of the four corner holes on the top cover and then insert a 10mm screw into each. (<i>If your screws already have washers threaded onto them, just drop them into the holes</i>).	

5.4	Fasten the Cover: Tighten all four screws firmly to lock the moving blocks inside the base assembly.
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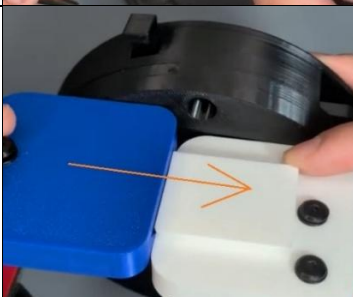
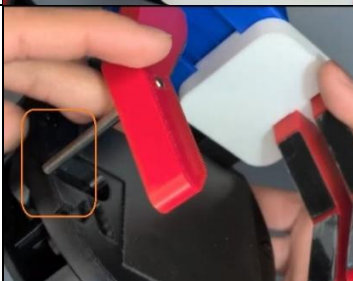


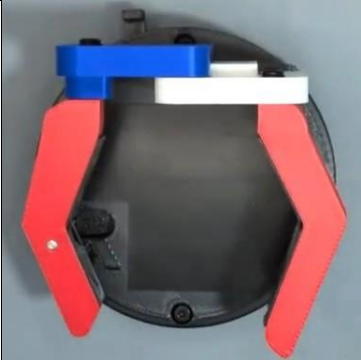
Step 6: Attaching the Thumb Module to the Base

Required Parts: Current Assembly (*what we have so far*), Thumb Module

Required Tools: Screwdriver

Est. Time: 5 mins

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
	Quick Check: Ensure the thumb screws are still loose. The thumb needs to wiggle slightly so the pin can align in the next step.	
6.1	Begin with the Dovetail Slide: Hold the entire thumb module together with your fingers. Begin sliding the dovetail track onto the base rail, moving the thumb block and the pin forward as a single unit to avoid applying too much force.	
6.2	As the module slides about halfway down the track, use the wiggle room from the loose screws to gently lift the pin up and over the edge of the top cover.	

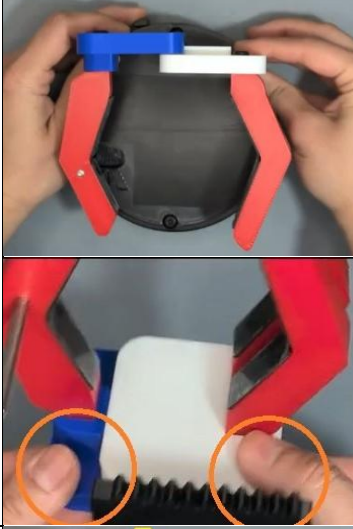
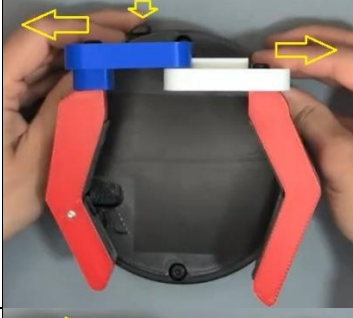
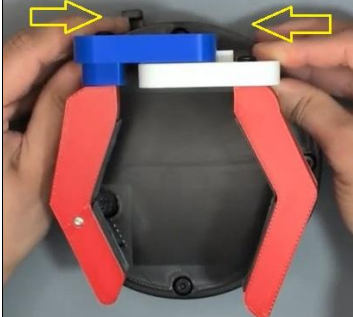
6.3	Guide the pin over the top cover and through the cover's cutout.	
6.4	Lower the pin directly into the slot of the TMB inside the base until it sits neatly inside.	
6.5	Final Tightening: Once the pin is properly seated deep inside the slot and the module moves smoothly, tighten the thumb assembly screws completely to lock everything securely in place.	

Step 7: The Grand Finale: Functional Click Test

Required Parts: Completed Assembly

Required Tools: None

Est. Time: 2 mins

STEP #	STEP DESCRIPTION	CORRESPONDING FIGURE
7.1	Proper Hand Placement: Place your hands on the bottom edges of the palm blocks (your left hand on the bottom-left edge and your right hand on the bottom-right edge).	
7.2	Reset to the Starting Position: Press and hold the pre-assembled release button on the base and pull the modules completely outward to their maximum limit.	
7.3	Test the 3 Inward Clicks: Push the blocks directly inward toward the center to hear 3 clicks (one for each adjustment level). The modules will click automatically as they slide, so there is no need to press the release button.	

Complete Assembly

Take a look at the finished Zor Deca from multiple angles to verify your build.





Care & Maintenance

1. **Cleaning:** Wipe components with a damp cloth. Use a lint roller to quickly clean dust or fuzz off the rubber grip pads.
2. **Washing:** Hand-wipe only. Not dishwasher safe. Avoid submerging the base to protect internal mechanics and lubrication.
3. **Environment:** Avoid prolonged exposure to direct heat sources or open flames.



Reset & Disassembly Instructions

Classroom Reset:

Disassemble all components **except for the internal mechanics inside the Base Chassis (B1)** to reset the kit for the next student.



Do NOT Touch:

Do not attempt to remove the push button, compression spring or locking pawl from the base. These internal components must remain assembled at all times.

TROUBLESHOOTING GUIDE

If your Zor Deca isn't moving smoothly or feels bound up, check these common fixes:

1. Stiff or Jammed Movement | Over-Tightened Screws

- **Fix:** If the blocks won't slide or feel too stiff, loosen the top cover screws by a quarter-turn. The internal components need a tiny amount of clearance fit to move freely.

2. Binding Mechanism | Misaligned Gear Teeth

- **Fix:** If the mechanism is binding or sticking, unscrew and remove the top cover to inspect the gears inside. Make sure the teeth on both moving blocks (FMB/TMB) are fully engaged with the gear train (G1/G2/IG) and pushed outward all the way before screwing the top cover back on.

3. Missing Clicks (Block Positioning)

- **Fix:** If you aren't getting all 3 clicks, the moving blocks (FMB/TMB) were likely misaligned during Step 4.5.
- **Try this first:** Press the release button and slide the blocks all the way out and back in 2 or 3 times to see if the teeth settle into place.
- **If it still binds:** Remove the top cover, push both modules fully outward to their stop points so the teeth mesh perfectly and screw the cover back on.