2. Y-axis assembly

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Step 1 — Tools necessary for this chapter

- Needle-nose pliers for zip tie trimming.
- 3mm Allen key for M5 screws
- 2.5mm Allen key for M3 screws
- 2mm Allen key for nut alignment
Step 2 — YZ frame - preparing the components

- Prepare following parts to build the YZ frame:
  - Aluminum extrusions (4x)
  - Aluminum frame (1x)
  - M5x16r screw (16x)

⚠ Before you proceed further, please place the frame on a **FLAT SURFACE** (this is crucial).
Step 3 — YZ frame - mounting the longer extrusions

- Take the **LONGER** aluminum extrusions and place them next to the frame.

⚠️ Make sure the engraved **PRUSA logo** on the frame (top left) **IS VISIBLE**!

ℹ️ Note: screws are inserted from the opposite side of the frame. If you need to manipulate with the frame, make sure the extrusions are on the correct side.

- Ensure you are using the correct holes, see the second picture. Use the M5 screws to connect extrusions to the frame. Tighten the screws with the Allen key just slightly!

- Now, tighten the screws fully, but **ON A DIAGONAL**, see the last picture. As soon as you finish the first, tighten the second pair. Then proceed to the second long extrusion.
Step 4 — YZ frame - mounting the shorter extrusions

- Take the **SHORTER** aluminum extrusions and place them next to the frame.

**⚠️** Short extrusions must be placed on the side, where engraved **PRUSA logo** on the frame (top left) **IS NOT VISIBLE**.

**ℹ️** Note: screws are inserted from the opposite side of the frame. If you need to manipulate with the frame, make sure the extrusions are on the correct side.

- Ensure you are using the correct holes, see the second picture. Use the M5x16 screws to connect extrusions to the frame. Tighten the screws just slightly!

- Now, tighten the screws fully, but **ON A DIAGONAL**, see the last picture. As soon as you finish the first, tighten the second pair. Then proceed to the second short extrusion.
Before we proceed further, let's make a final check. **IT IS VERY IMPORTANT** to have extrusions on the correct side of the frame.

- **Long extrusions** - must be on the side of the frame with the Prusa logo, also ensure longer extrusions are **closer together**.

- **Short extrusions** - must be on the side of the frame without the Prusa logo, also ensure shorter extrusions are **further away from each other**.
Step 6 — Y-axis: front and rear plate preparation

- For the following steps, please prepare:
  - Front plate (1x)
  - Rear plate (1x)
  - M5x16r screw (16x)
  - PSU holders M3nE (2x)
Step 7 — Y-axis: front plate assembly

- Rotate the frame with longer extrusions towards you.
- Place the front plate on the extrusions and secure it with M5x16r screws, **DON'T TIGHTEN** them yet!
- Now, tighten the screws fully, but **ON A DIAGONAL**, see the second picture. As soon as you finish the first, tighten the second pair. Then proceed to the second long extrusion.
Step 8 — Different PSU types

There are two types of the PSU with different mounting points. Make sure you are following the correct instructions!!!

- **New PSU with black casing** *(PSU holders are on the side of the extrusion)*
- **Old PSU with silver casing** *(PSU holders are on the top of the extrusion)*

Find your PSU in the package.

Step 9 — Y-axis: preparation for the Black PSU

**THIS IS A VERY IMPORTANT STEP!** Incorrect placement of PSU holders will lead to issues later.

This step is valid only for the **BLACK PSU**!!

- Take the YZ frame and rotate it with the shorter extrusions towards you.
- Place the PSU holders (M3nE) in the extrusion, **use the side section**, ensure it is the correct extrusion. See the picture.

The exact spacing of the PSU holders doesn't matter, we will adjust them later.
Step 10 — Y-axis: preparation for the Silver PSU

⚠️ THIS IS A VERY IMPORTANT STEP! Incorrect placement of PSU holders will lead to issues later.

⚠️ This step is valid only for the **SILVER PSU**!!

- Take the YZ frame and rotate it with the shorter extrusions towards you.

- Place the PSU holders (M3nE) in the extrusion, **use the top section**, ensure it is the correct extrusion. See the picture.

ℹ️ The exact spacing of the PSU holders doesn't matter, we will adjust them later.
Step 11 — Y-axis: rear plate assembly

- Ensure the frame with shorter extrusions is rotated towards you.
- Place the rear plate on the extrusions and secure it with M5x16r screws, **DON'T TIGHTEN** them yet!
- Now, tighten the screws fully, but **ON A DIAGONAL**, see the second picture. As soon as you finish the first, tighten the second pair. Then proceed to the second short extrusion.
Step 12 — Y-axis: geometry check

⚠️ Before you proceed further, please place the frame on a **FLAT SURFACE** (this is crucial).

- All the components are cut or drilled by machine for highest precision, but with uneven tightening, it is possible to warp the frame.

- Using your hand, try to wiggle with the frame sides and check, whether some corners are lifting up or not.

- In case you find some imperfections, release the screws, press the extrusions against the FLAT SURFACE and tighten them again.

**IMPORTANT INFO:** the printer is capable of self-correcting a certain amount of the frame skew. Try getting the geometry as best as possible, however, if one of the corner still keeps lifting up with values up to 2 mm (0.08 inch) you can proceed.
Step 13 — Mounting antivibration feet (optional)

Note this step is optional for now. **We recommend mounting the feet now to protect the surface on your table** (workbench). However, you need to lift the frame up before each turn.

There will be extra step at the end of the assembly to remind you of the antivibration feet.

Note there are two designs of the feet, your package will have either the new version (marked orange) or the old version (marked red).

- **For this step, please prepare:**
  - New antivibration foot (4x)
  - Old antivibration foot (4x)

- Turn the YZ frame on the side and insert the antivibration foot. **For the new design**, insert and turn 90 degrees to lock it in place. **For the old design** insert inclined, then rotate the foot until you squish the rim inside the extrusion.

- Repeat this process on all 4 feet. Place them 2-3 cm from the end of each extrusion.
Step 14 — Y-axis: smooth rods holders

For the following steps, please prepare:

- Y-rod-holder (4x)
- M3x10 screw (8x)
- M3nS nut (8x)
Step 15 — Preparing Y-rod-holder

- Take one Y-rod-holder and insert two M3nS nuts.

- Make sure you've pressed the nuts all the way in. You can use pliers, **BUT** be careful, you can damage the printed part.

  - In case you can't press the nuts in, don't use excessive force. First, check if there isn't any obstacle in the nut trap.

- Ensure and adjust the alignment of each nut with the 2mm Allen key.

- Repeat this step for the remaining Y-rod-holders.
Step 16 — Mounting the Y-rod-holder parts

- Take the first pair of Y-rod-holders and place them on the longer extrusions, openings for screws must be facing up.

- Rotate the 3D printed parts towards the front plate.

- Secure each front holder with two M3x10 screws. **Tighten both screws equally, but not completely.** We will tighten them fully later on.

- Take the second pair of the Y-rod-holders and secure them with M3x10 screws on the rear plate (with shorter extrusions). **Tighten both screws equally, but not completely.** We will tighten them fully later on.

- In case the M3nS nuts keep falling out, please flip the frame upside down. Tighten both printed parts and then return the frame to the previous position.
Step 17 — Preparing Y-belt-idler (part 1)

For the following steps, please prepare:

- Y-belt-idler (1x)
- M3x18 screw (1x)
- M3x10 screw (2x)
- M3nN nyloc nut (1x)
- M3n (2x)
- 623h bearing housing (1x)
Step 18 — Preparing Y-belt-idler (part 2)

- Take the Y-belt-idler and insert two M3n nuts from the top.

- Turn the idler to the other side and insert the M3nN nyloc nut. The rubber inside the nut must be facing towards you. **BE CAREFUL**, don't over tighten the screw, you can break the part!

- Make sure all three nuts are all the way in.

**In case you can't press the nuts in, don't use excessive force. Take M3 screw thread it from the opposite side of the printed part, as you tighten the screw, it will pull the nut in. Be careful not to break the idler during tightening.**
Step 19 — Preparing Y-belt-idler (part 3)

- Insert the prepared bearing in the Y-belt-idler.

* Bearing housing orientation doesn't matter.

- Secure the bearing with the M3x18 screw. Don't fully tighten the screw.

- Place your finger on the bearing and ensure it can rotate freely. If needed adjust the screw.
Step 20 — Mounting the Y-belt-idler

- Rotate the frame with longer extrusions towards you.
- Take the Y-belt-idler and place it on the front plate. Note there is a mark (circle) on the printed part facing up.
- Secure the Y-belt-idler with two M3x10 screws. Tighten the screws until the printed part reaches the surface of the plate.

This approach is different compared to the previous model MK3, follow the instructions in this step.
Step 21 — Y-axis: motor and motor holder

- For the following steps, please prepare:
  - Y-axis motor (1x)
  - Y-motor-holder (1x)
  - M3x10 screw (4x)
  - M3n nut (2x)

⚠️ **Ensure you are using the correct motor**, there is a label on the bottom of the casing. The reason is, each motor has different cable length.
Step 22 — Preparing Y-motor-holder

- Take the Y-motor-holder and insert two M3n nuts.

- In case you can't press the nuts in, don't use excessive force. Use an M3 screw from the other side and tighten it.

- Place the Y-motor-holder on the motor, ensure the correct orientation as in the picture (use the motor cable).

- Using two M3x10 screws tighten holder and motor together.
Step 23 — Mounting Y-motor-holder

- Take the Y-motor-holder and place it on the rear plate (short extrusions).

- Ensure the correct orientation, the motor shaft must be facing towards the aluminium extrusion with the PSU holders. **Note that their position differs based on the Black or Silver PSU.**

- Secure Y-motor-holder with two screws M3x10.
Step 24 — Y-axis: Y-carriage

- For the following steps, please prepare:
  - Y-carriage (1x)
  - U-bolt (3x)
  - Linear bearing (3x)
  - M3nN nyloc nut (6x)

- The printer's package contains a lubricant, which is intended for maintenance. No need to use it now the bearings are lubricated. There is a dedicated online manual on how to clean the printer and apply the lubricant. See Printer maintenance tips

- For MK2/S owners, the Y-carriage is now symmetrical in one direction, therefore the dot (countersink, marker) orientation for bearing insertion doesn't matter.
Step 25 — Correct bearing orientation

- When placing bearings onto the Y-carriage, make sure that they are oriented as shown in the picture. One of the tracks (row of balls) has to be in line with the cutout for the bearing!

⚠️ This orientation has to be followed in all 3 bearings on the Y-carriage!
Step 26 — Installing bearings on the Y-carriage (part 1)

⚠️ This is VERY IMPORTANT part of the assembly, which can significantly influence printer's behaviour. PLEASE read following lines carefully!

- Place the Y-carriage on a flat surface. Orientation doesn't matter.
- Insert linear bearing in the cutout and secure it by U-bolt.
- Hold thumb on the U-bolt and turn the carriage. Place nyloc nuts on both ends of the U-bolt.
- Start tightening the nuts, BUT ENSURE you are tightening both nuts equally and AS SOON AS EACH NUT REACHES THE SURFACE OF THE Y-CARRIAGE STOP TIGHTENING!!! We will finish tightening the nuts in the next step.

- Repeat these steps for the remaining two linear bearings.

⚠️ Over tightening nuts leads to deformation of the bearing and all the issues connected with it. Please follow the instructions.
Step 27 — Installing bearings on the Y-carriage (part 2)

⚠️ Ensure again the nuts are tightened just to the surface and equally.

- Check if the bearing is centered in both directions, if not slightly release the nuts and adjust its position. Then retighten the nuts to the previous state.

- When you are ready, using pliers rotate each nut, but only 90°. This is enough to fix the bearing without deforming it.

- Repeat these steps for remaining two linear bearings.
Step 28 — Inserting smooth rods into Y-carriage

- Take all the smooth rods and compare their lengths. For Y-carriage you need mid-sized rods (330 mm).

⚠️ NOW, PLEASE BE VERY CAREFUL! Gently insert the rod straight into the bearings, do not apply too much force and do not tilt the rod!

- If you can't slide the smooth rod easily, check the two bearings are aligned properly.

ℹ️ In case you manage to push out balls from the bearings, please count them. One or two balls are ok, if there are more of them, please consider ordering new bearings.
Step 29 — Mounting the Y-carriage

- Take the Y-carriage including smooth rods and place them in YZ-frame. Make sure, that two bearings are on the left side (see the picture).

- Using your thumb, press the smooth rods inside all four holders. Don't use excessive force.

⚠️ Check again the correct bearing orientation!!!
Step 30 — Securing the Y-carriage

- Find the package with zip ties and take out 4 pieces.
- Slide the zip tie through the holder, there is a slot.
- Connect the zip tie and tighten it. The "head" should be inside the frame.
- Using pliers cut the remaining part.
- Repeat this step in all four corners.
Step 31 — Aligning the smooth rods

**IMPORTANT:** proper alignment of the smooth rods is crucial to reduce noise and overall friction.

- Ensure all M3x10 screws on Y-holders are released, so the printed parts are able to move.
- Move the Y-carriage back and forth across the entire length of the smooth rods to align them.
- Then move the carriage to the front plate and tighten all screws in the front-Y-holders.
- Move the Y-carriage to the rear plate and tighten all screws in the back-Y-holders.
Step 32 — Assembling the Y-motor pulley

- There is a flat part on the motor shaft, rotate it similarly to the first picture. See the direction of the arrows.

- Place a GT2-16 pulley on the Y-motor shaft as shown in the picture.

- Don't press the pulley against the motor. Leave a gap so the pulley can rotate freely.

- One of the screws must be facing directly against the pad (flat part) on the shaft. Slightly tighten the first screw.

- Turn the shaft and slightly tighten the second screw.

- Don't tighten the pulley firmly yet, we'll get to that later.
Step 33 — Y-axis: Assembling the belt

- For the following steps, please prepare:
  - Y-belt-holder (1x) *smaller of two*
  - Y-belt-tensioner (1x) *bigger of two*
  - Y-axis belt 650 mm (1x)
  - M3x30 screw (1x)
  - M3x10 screw (4x)
  - M3nN nyloc nut (1x)
  - M3n nut (2x)
Step 34 — Y-axis: Assembling the belt

- Take the Y-belt-holder (smaller of the two printed parts).
- Insert M3n nut, all the way in.
- Insert M3nN nyloc nut, all the way in.

ℹ️ Use the screw pulling technique.
Step 35 — Y-axis: Assembling the belt

- Bend one end of the belt around M3x10 screw.
- Push it in the holder as in the picture. Use an Allen key to push the belt in.
- Make sure the bent part and the end are within the width of the printed part.
- Teeth on the belt must be facing up!
- Tighten the screw until you reach the nut, don't over tighten the screw, you will deform the belt.
- Hold the nut from the other side until the screw reaches its thread.
Step 36 — Y-axis: Assembling the belt

- Using M3x10 screw fix the Y-belt-holder to the Y-carriage. Tighten the screw and ensure the printed part is parallel with the "axis" between the Y-motor and Y-belt-idler.

- Use the hole on the left, see the picture.

- Guide the belt along the Y-axis, around the pulley on the Y-motor and back.

- Make sure the belt is inside the frame, not under!

- Push the belt through the Y-belt-idler and back to the "center" of the Y-carriage.
Step 37 — Y-axis: Assembling the belt

- Take the Y-belt-tensioner (bigger of the two printed parts).
- Insert M3n nut, all the way in.

**Use the screw pulling technique.**

- Bend second end of the belt around the screw and push it in the holder as in the picture. Use an Allen key to push the belt in.
- Make sure the bent part and the end are within the width of the printed part.
- Teeth on the belt must be facing up!
- Tighten the screw until you reach the nut, don't over tighten the screw, you will deform the belt.
- Hold the nut from the other side until the screw reaches its thread.
Step 38 — Y-axis: Assembling the belt

- Using M3x10 screw fix the Y-belt-tensioner to the Y-carriage. **Don't tighten the screw completely**, we need to adjust the position of the printed part.

- Use the hole on the right, see the picture.

- Insert the M3x30 screw through both printed parts. Start tightening until you reach the M3nN nyloc nut.
Step 39 — Aligning the Y-axis belt

- Make sure the belt is placed in the "axis" of the printer. Both top and bottom part of the belt should be parallel (above each other).

- To adjust the belt position, release screws on the pulley and slightly move with it, until you reach the best position.

- Tighten both screws on the pulley.
Step 40 — Tensioning the Y-axis belt

- Using a finger on your left hand push the belt down. Some force should be needed for bending the belt, BUT don't try to overstretch the belt as you might damage the printer.

- You can change the tension in the belt by adjusting the M3x30 screw below the Y-carriage.
  - **Tighten the screw**, bring the parts closer and thus increase the overall tension.
  - **Release the screw**, parts will move apart, the overall tension will decrease.
Step 41 — Testing the Y-axis belt

- Use the technique described below to test if the belt is properly stretched.
- Use pliers to hold the Y-axis motor shaft.
- Move the Y-carriage with your hand towards the Y-axis motor. Don't use excessive force.
- If the belt is stretched properly, you should feel a resistance and the Y-carriage won't move at all. If the belt is too loose, it will deform (create a "wave") and jump over the teeth on the pulley.
- After the proper tension is set, tighten the M3x10 screw.
Step 42 — Haribo time!

Carefully and quietly open the bag with the Haribo sweets. High level of noise might attract nearby predators!

- You need to split the bears into 8 groups according to the upcoming chapters.
- Each chapter requires specific amount of bears, see the picture.
- For Y-axis you must eat 15% of all the bears.

Step 43 — Y-axis is finished!

- **Y-axis is done**, great job!
- Check the final look, compare it to the picture.

Note that you should feel some resistance while moving with the Y-carriage. It is due to the tightened belt and also the motor has some resistance.

- Ready for more? Lets move to 3. X-axis assembly