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How to replace a Z-axis linear rail (XL)

help.prusa3d.com/g623886

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STEP 1 Introduction

- This guide will take you through the replacement of the **Z-axis linear rail** on the **Original Prusa XL**.

  The following instructions are compatible with all Original Prusa XL versions.

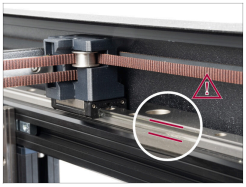
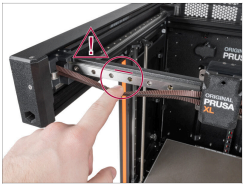
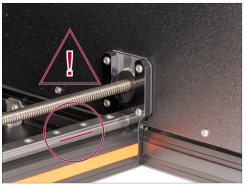
- All necessary parts are available in our eshop prusa3d.com.

  Note that you have to be logged in to have access to the spare parts section.

This guide is for both Z-axis linear rails on the XL printer.

This procedure requires printing the necessary tools. See the next step for more information.

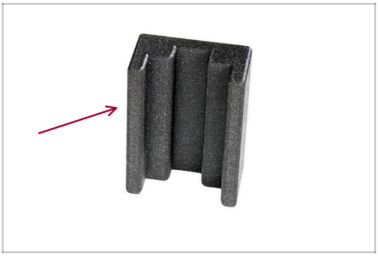
STEP 2 CAUTION: Lubricant Handling

⚠ **CAUTION: Avoid direct skin contact with the lubricant used for the linear rails** in this printer. If a contact occurs, **wash your hands immediately. Especially before eating, drinking, or touching your face.**

- Lubricant accumulates mainly in the linear rail channels on the linear sides.

STEP 3 Alignment Tool



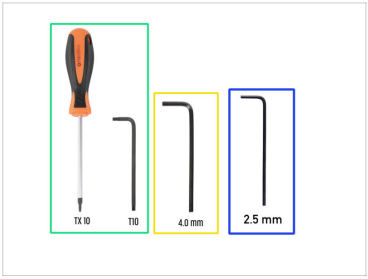
⚠ Before you begin the printer surgery, print out the **Alignment Tool** that is required for this procedure.

- Download the Alignment Tool from Printables.com.
  - It can be found in *Files -> Parts for maintenance*.
  - Read the Print instructions before printing.

⚠ **Do not proceed without this tool**. It is essential for this procedure.

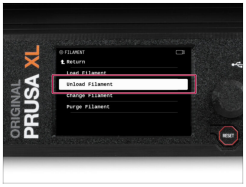
ⓘ If you are unable to print the part, please contact our customer support info@prusa3d.com.

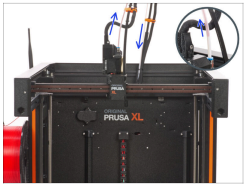
STEP 4 Necessary tools

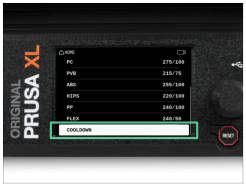


- **For this guide, please prepare:**
- T10 screwdriver or key
- 4mm Allen key
- 2.5mm Allen key
- Alignment Tool

STEP 5 Unloading filament





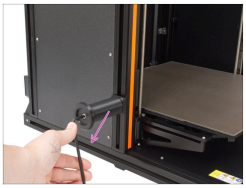


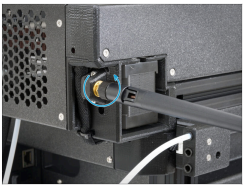
- If you have loaded the filament, unload it from the hotend. On the screen, navigate to *Filament -> Unload Filament*.

⚠ **WARNING: The hotend and heatbed are very HOT. Do not touch these parts!!!**

- Remove the filament from the hotend.
- Unwind the filament to the spool and remove the spool from the printer.
- Cooldown the printer, navigating to *Preheat > Cooldown*.

STEP 6 Preparing the printer - removing side accessories





See if the side of the Z-axis linear rail you will change has an antenna, spool holder, or filament sensor. In case any of those is present, follow the instructions below to remove it.

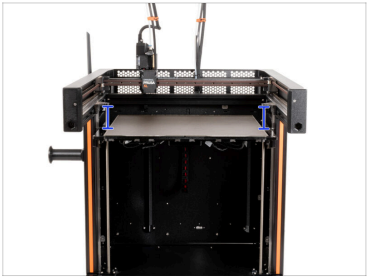
- Release the screw securing the spool holder and remove it from the printer.

  Note: The position of the screw may vary depending on the spool holder version you have.

- In case your printer has an antenna on the side where the linear rail will be replaced, unscrew the antenna by hand and remove it.

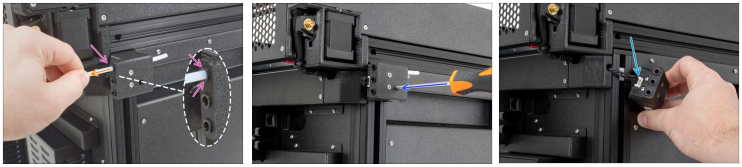
  If you have the version with the antenna on the back of the printer, you do not need to remove it.

STEP 7 Printer preparing



- Auto home your printer. Navigate to *Control* -> *Auto home*.
- Move the Z-axis 5 cm under the Nextruder. Navigate to *Control* -> *Move Axis* -> *Move Z.*
- From the rear side, turn the power switch OFF (symbol "O").
- Unlug the power cable.

STEP 8 Disassembling side filament sensor



The following step is necessary only if the filament sensor is on the same side as the Z-axis linear rail that is being replaced.

- With two fingers, push the black collet on the rear of the filament sensor assembly.
- At the same time, gently pull out the extruder PTFE tube from the filament sensor assembly.

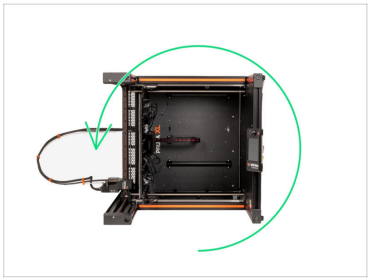
The connector has a safety latch. **It is necessary to press the latch before disconnecting**. Otherwise, the connector may get damaged.

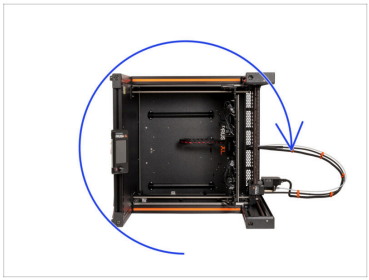
- Detach the filament sensor from the M3nEs nut using a T10 screwdriver.
- Press the latch to disconnect the filament sensor cable.

STEP 9 Removing the frame-rear-cover

- Using the 2.5mm key, loosen the screw holding the frame-rear-cover.
- Carefully slide out the frame-rear-cover.

STEP 10 Placing the printer



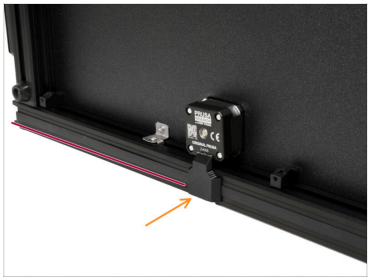


- Turn the printer to the left side if the Z-axis linear rail to replace is on the left side.
- If the Z-axis linear rail to replace is on the right side, turn the printer to the right side.

ⓘ The following steps will be the same for replacing the Z-axis linear rail on either side.

⚠ Do not move the printer before the replacement is finalized.

STEP 11 Uncovering the Z-axis motor cable - bottom



- Take a look at the bottom of the printer and locate:
  - Extrusion cover 243mm
  - Z-motor-cable-bottom-cover
- Remove both covers from the printer.

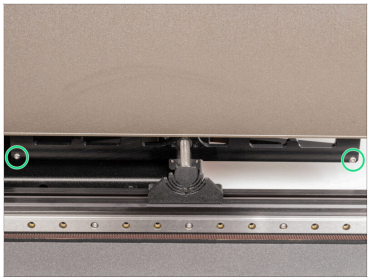
ⓘ The bottom of the printer is ready.

STEP 12 Uncovering the Z-axis motor cable - rear

- Locate the rear extrusion cover 354mm, and remove it.

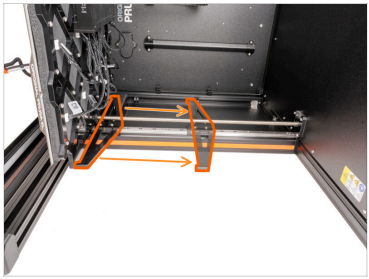
ⓘ The printer is now ready for releasing the motor.

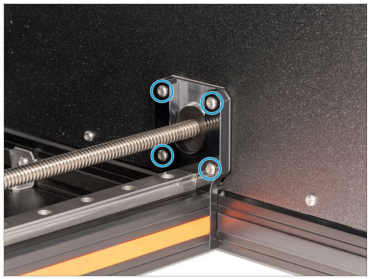
STEP 13 Releasing the Z-axis motor - part 1



- Using a T10 screwdriver, remove two M4x10rT screws and remove them. **Do not throw them away! We'll use them later.**
- Using a T10 screwdriver, remove the indicated two M3x12rT screws from the heatbed frame. **Do not throw them away! We'll use them later.**

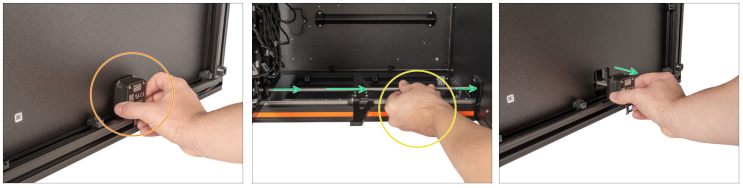
STEP 14 Releasing the Z-axis motor - part 2





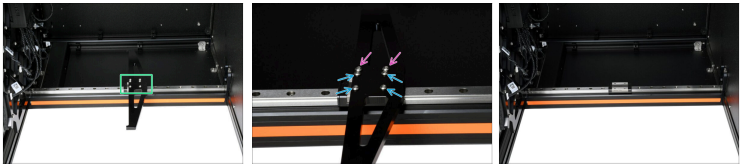
- Slide the bed-frame-mount to the middle of the linear rail.
- Using a T10 screwdriver, remove four M3x8rT screws to release the Z motor. Do not throw them away! We'll use them later.

STEP 15 Pulling out the Z-axis motor



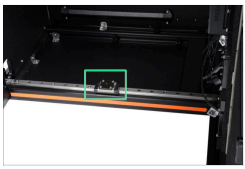
- Hold the Z-axis motor with your hand. **Don't pull out yet!**
- Grab the threaded rod with your other hand.
- Gently pull out the motor from the Bed-frame.

STEP 16 Removing the Z-axis arm (left)



- Follow this step if the Z-axis linear rail to replace is on the **LEFT side** of the printer.
- Locate the area indicated in green.
- Loosen 4x M3x8rT. Do not throw the screws away, we'll use them later!
- Leave the other 2x M3x8rT tightened.
- Remove the fixed arm from the rest of the linear rail.
- The linear rail is ready for final removal from the aluminum extrusion.

STEP 17 Removing the Z-axis arm (right)

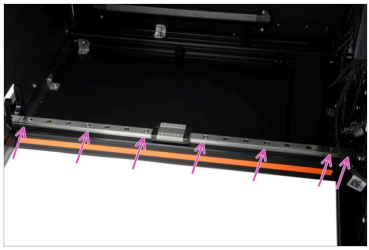



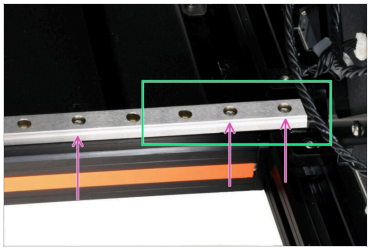

Follow this step if the Z-axis linear rail to replace is on the **RIGHT side** of the printer.

- Using the T10 screwdriver, loosen the M4x8rT and after that remove the rotary arm.
- Using the T10 screwdriver, loosen 4x M3x8rT to remove the square mount.

The linear rail is ready for final removal from the aluminum extrusion.

STEP 18 Removing the linear rail





The Z-axis linear rail is attached to the printer frame by 7x M3x8 screws.

Avoid damaging the modular bed tile cables during the procedure.

- Using the short part of the 2.5mm Allen key, loosen 7x M3x8 screws. Do not throw them away, we'll use them later.
- The second picture shows a detail of the area marked in green with the rest of the printer, with the linear rail highlighted.
- Carefully remove the Z-axis linear rail.

STEP 19 Linear rail replacement - parts preparation



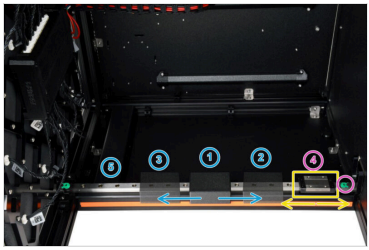
- For the following steps, please prepare:
- Linear rail (1x)

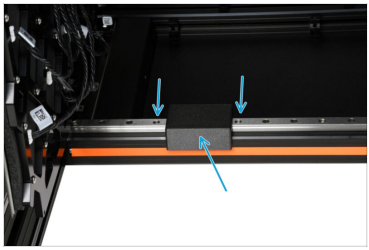
⚠ The Z-axis linear rail has two green protection pins. Do not remove them before this is instructed in this guide!

⚠ The Z-axis linear rail is composed of rail and carriage. Do not slide the carriage off the rail, this can cause irreversible damage!

- M3x8 screws (7x)
- Centering tool (1x)

STEP 20 Installing the linear rail part 1 (left)





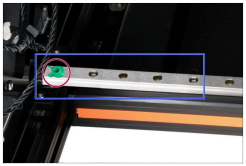
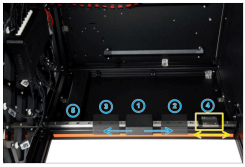
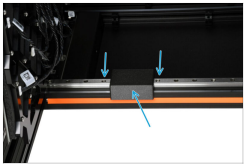
Follow this procedure if you are replacing the Z-axis linear rail on the left side of the printer.

Do not over-tighten the screws on this step, there is a risk of stripping them.

Avoid damaging the modular bed tile cables during the procedure.

- Insert the centering tool between a pair of M3x8 screws. Start with pair 1. Tighten the two screws next to the centering tool slightly, using the long side of the 2.5mm Allen key.
- Repeat this procedure for the other screws, apart from the one closest to the heatbed assembly.
  - If the carriage is in the way during either of these steps, carefully slide it to have enough space for the procedure.
  - Once you get to pair 4, remove the indicated green protection pin and continue with the procedure.

STEP 21 Installing the linear rail part 2 (left)

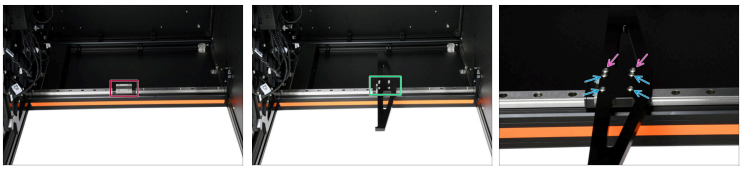
Follow this procedure if you are replacing the Z-axis linear rail on the left side of the printer.

Do not over-tighten the screws, there is a risk of stripping them.

Avoid damaging the modular bed tile cables during the procedure.

- The first picture shows a detail of the area closer to the heatbed. The screw closest to the heatbed assembly is tightened against a T-nut.
- Remove the green safety pin. Tighten the screw using the long side of the 2.5 Allen key.
- Repeat the full procedure with the centering tool for all pairs and for the screw closest to the heatbed in the indicated order. Tighten the screws fully but carefully, using the long part of the Allen key.
    - If the carriage is in the way during either of these steps, carefully slide it to have enough space for the procedure.

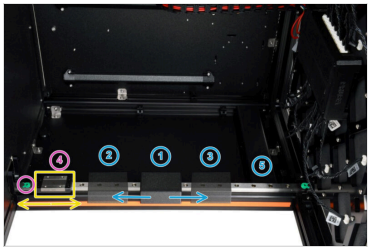
STEP 22 Installing the Z-axis arm (left)

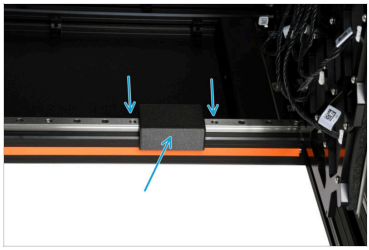


Follow this step if the replaced Z-axis linear rail is on the left side.

- Locate four threaded holes on the linear rail carriage.
- Place the arm-fixed in place.
- Using the TX 10 screwdriver, tighten the four M3x8rT screws.
- The other two M3x8rT screws are already tightened.

STEP 23 Installing the linear rail part 1 (right)





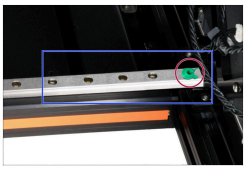
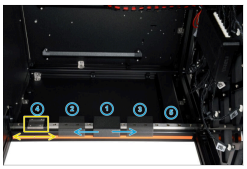
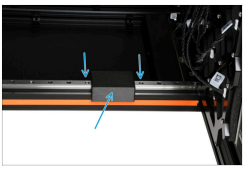
Follow this procedure if you are replacing the Z-axis linear rail on the right side of the printer.

Do not over-tighten the screws, there is a risk of stripping them.

Avoid damaging the modular bed tile cables during the procedure.

- Insert the centering tool between a pair of M3x8 screws. Start with pair 1. Tighten the two screws next to the centering tool slightly, using the long side of the 2.5mm Allen key.
- Repeat this procedure for the other screws, apart from the one closest to the heatbed assembly.
  - If the carriage is in the way during either of these steps, carefully slide it to have enough space for the procedure.
  - Once you get to pair 4, remove the indicated green protection pin and continue with the procedure.

STEP 24 Installing the linear rail part 2 (right)

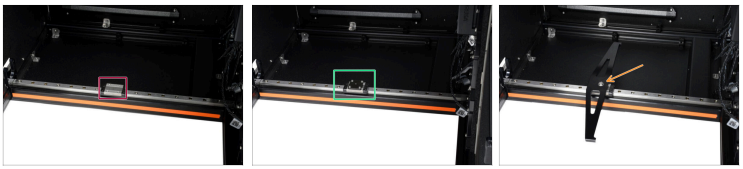
Follow this procedure if you are replacing the Z-axis linear rail on the right side of the printer.

Do not over-tighten the screws, there is a risk of stripping them.

Avoid damaging the modular bed tile cables during the procedure.

- The first picture shows a detail of the area closer to the heatbed. The screw closest to the heatbed assembly is tightened against a T-nut.
- Remove the green safety pin. Tighten the screw using the long side of the 2.5 Allen key.
- Repeat the full procedure with the centering tool for all pairs and for the screw closest to the heatbed in the indicated order. Tighten the screws fully but carefully, using the long part of the Allen key.
  - If the carriage is in the way during either of these steps, carefully slide it to have enough space for the procedure.

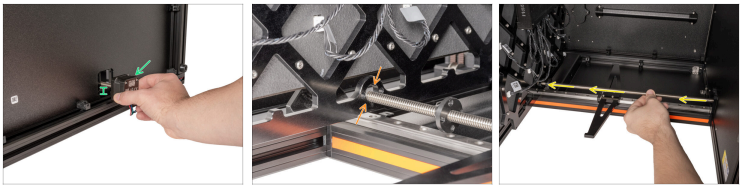
STEP 25 Installing the Z-axis arm (right)



Follow this step if the replaced Z-axis linear rail is on the right side.

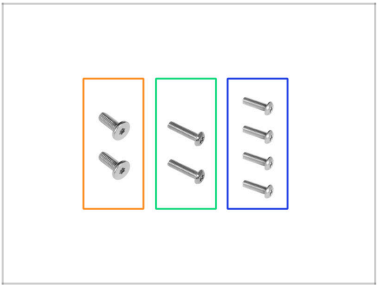
- Locate four threaded holes on the linear rail carriage.
- Place the square-mount in place. Using a TX 10 screwdriver, tighten 4x M3x8rT screws.
- Place the arm-rotary in place. Using a TX 10 screwdriver, tighten the M4x8rT screw.

STEP 26 Z-axis motor attaching



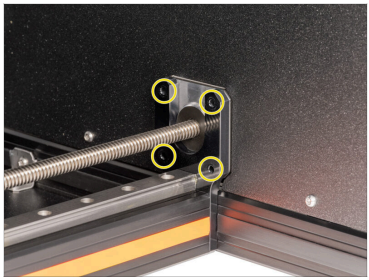
- Using one hand, take the Z-axis motor and keep it in a row.
- Using the second hand, insert gently the Z-axis motor back through the Bed-frame.
- Move the Z-axis motor to the side through the Bed-frame.

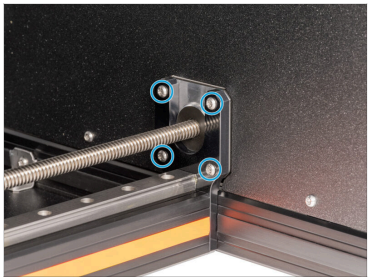
STEP 27 Securing the Z-axis motor: parts preparation



- For the following steps, please prepare:
  - M4x12rT screw (2x)
  - M4x10rT screw (2x)
  - M3x10rT screw (4x)

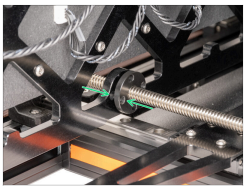
STEP 28 Securing the Z-axis motor





- Insert four M3x10rT screws into the four holes in Z-motor-mount.
- Tighten the screws with a T10 screwdriver.

STEP 29 Securing the trapezoid nut



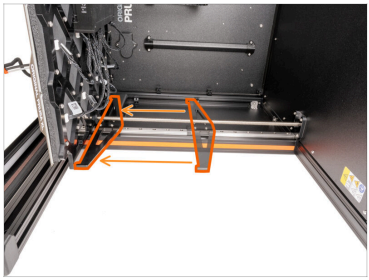
⚠ **Do not move the Bed-frame! Move only the trapezoid nut.**

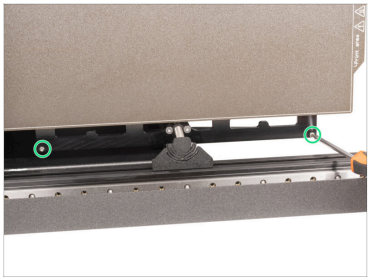
- From the bottom side of the heatbed:
  - **Line up the threaded hole in the trapezoid nut with the hole in the Bed-frame** by turning it clockwise.
- From the upper side of the heatbed:
  - Locate two holes next to the threaded rod.

⚠ Be really careful, you can easily turn the screw and damage the thread in the trapezoid nut.

  - Insert two M4x10rT screws and **gently** tighten them using a T10 screwdriver.

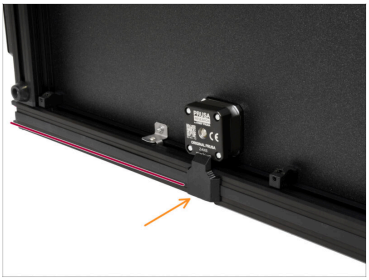
STEP 30 Securing the Bed-frame





- Manually slide the bed-frame-mount towards the heatbed.
- Secure the Bed-frame-mount to the Bed-frame with two M3x12rT screws using a T10 screwdriver.

STEP 31 Covering the Z-axis motor - bottom



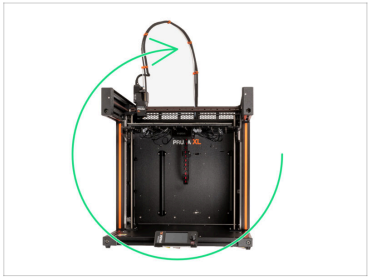
- Take a look at the bottom of the printer.
- ⚠ Be careful, don't pinch any cables!
- Insert the motor cable in the extrusion. Make sure it goes perpendicular from the motor to the extrusion first.
- Insert the Extrusion cover 243mm. Push it and slide it through its length.
- Push the Z-motor-cable-bottom-cover into the frame.

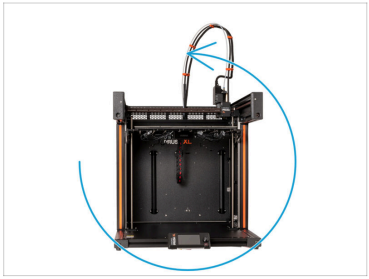
STEP 32 Covering the Z-axis motor - rear

⚠ Be careful, don't pinch any cables!

- Insert the motor cable in the extrusion.
- Insert the Extrusion cover 354 mm.

STEP 33 Turning the printer





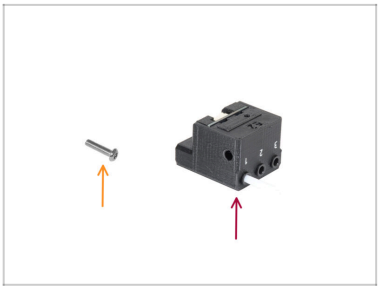
- Turn the printer to the right side on its feet.
- If the replaced Z-axis motor was on the other side, turn the printer to the left side on its feet.

STEP 34 Tightening the frame-rear-cover

⚠ Do not pinch the cables!

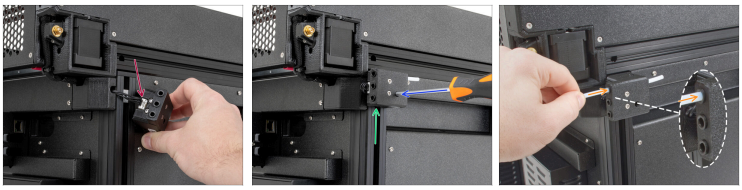
- Carefully slide in the frame-rear-cover.
- Tighten the M3x12 screw using the 2.5mm key.

STEP 35 Preparing the Filament sensor



- **For the following steps, please prepare:**
  - M3x12rT screw (1x)
  - Filament sensor assembly

STEP 36 Attaching the filament sensor



- Connect the filament sensor cable to the filament sensor assembly.
- Move the filament sensor assembly to the top of the extrusion and align the M3nEs nut so that it aligns with the opening on the filament sensor assembly.
- Attach the filament sensor to the M3nEs nut using the M3x12rT screw and T10 screwdriver.
- Insert the PTFE tube from the extruder into to the first collet on the rear of the filament sensor assembly.

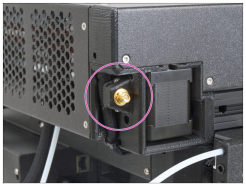
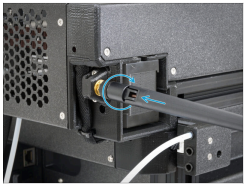
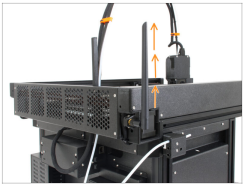
STEP 37 Installing the Wi-Fi antenna: parts preparation

For the following steps, please prepare:

- Wi-Fi antenna (1x)

The Original Prusa XL is shipped with two versions of the Wi-Fi antenna, each with a different shape. The functionality is the same.

STEP 38 Installing the Wi-Fi antenna

This step is necessary only if you have the antenna on the side of the printer where you replaced the Z-axis linear rail.

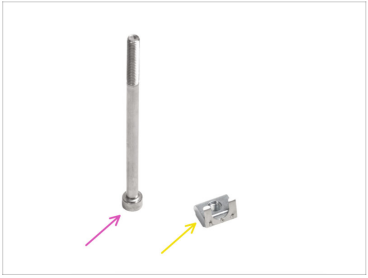
- Locate the Wi-Fi antenna connector on the right rear corner of the printer.
- The antenna can be rotated around and bent in two directions.
- We recommend pointing the antenna straight upwards.

STEP 39 Spool holder assembly versions

Original Prusa XL comes with two versions of the spoolholder. Each version has a slightly different parts and different procedure.

- **Refer to the pictures to compare which parts you have, and then choose the instructions that match:**
  - **Printed spool holder** (Version A): Set of three printed parts. If you have this version, continue to the **Version A: Spool holder: parts preparation**.
  - **Injection molded spool holder** (Version B): Set of two injection molded parts. If you have this version, continue to **Version B: Assembling the spool holder: parts preparation.**.

STEP 40 Version A: Assembling the spool holder: parts preparation



- **For the following steps, please prepare:**
- Spool-holder-slider (1x)
- Spool-holder-base (1x)
- Spool-holder-mount (1x)
- M5x85 screw (1x)
- M5nEs nut (1x)

STEP 41 Version A: Assembling the spool holder: adjusting the nut

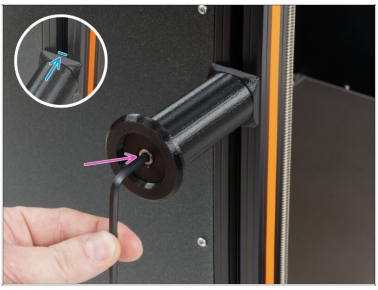
- Carefully turn the printer so that the side with the Wi-Fi antenna and side filament sensor faces you.
- Insert the M5nEs nut into the front support extrusion (with the orange plastic cover). Insert the side with the spring (metal plate) first, then push the nut inside.
- The M5nEs nut is free to move, you can adjust the position as you want. But remember, the nut must be slightly pushed in to smoothly move. Anyway, we recommend approximately the same position as you can see in the picture.

STEP 42 Version A: Assembling the spool holder



- Insert the spool-holder-base into the spool-holder-slider and push it through a little through the part.
- Attach the spool-holder to the spool-holder-mount.
- Insert the M5x85 screw into the spool-holder-assembly.

STEP 43 Version A: Mounting the spool holder assembly



- Attach the spool holder assembly to the M5nEs nut in the extrusion. Note that there is a protrusion on the spool-holder-mount, which must fit into the groove in the extrusion.
- Tighten the spool holder assembly.

⚠ **Do not use the spool holder as a handle!**

- **Now, go to XYZ calibration**

STEP 44 Version B: Assembling the spool holder: parts preparation

- For the following steps, please prepare:
- Spool-holder-slider (1x)
- Spool-holder-base (1x)
- M4x12 screw (1x)
- M4nEs nut (1x)

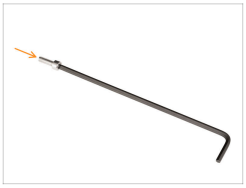
STEP 45 Version B: Assembling the spool holder: adjusting the nut

- Carefully turn the printer so that the side with the side filament sensor is facing you.
- Insert the M4nEs nut into the front support extrusion (with the orange plastic cover). Insert the side with the spring (metal plate) first, then push the nut inside.
- The M4nEs nut is free to move, you can adjust the position as you want. But remember, the nut must be slightly pushed in to smoothly move. Anyway, we recommend approximately the same position as you can see in the picture.

STEP 46 Version B: Assembling the spool holder

- Locate pins two pins on the spool-holder-base and line them with the rails in the spool-holder-slider.
- Insert the spool-holder-base into the spool-holder-slider and push it through a little through the part.

STEP 47 Version B: Preparing the spool holder



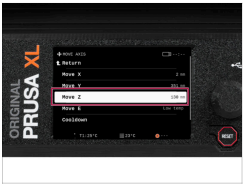
- Insert the M4x12 screw on the longer side of the 3mm Allen key.
- Insert the 3mm Allen key with the M4x12 screw through the assembled spool holder to the prepared hole in the spool-holder-base.
- The M4x12 screw has to protrude through the spool-holder-base.

STEP 48 Version B: Mounting the spool holder assembly

- Attach the spool holder assembly to the M4nEs nut in the extrusion. Note that there is a protrusion on the spool-holder-mount, which must fit into the groove in the extrusion.
- Tighten the spool holder assembly.

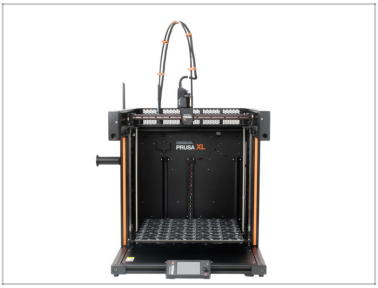
⚠ **Do not use the spool holder as a handle!**

STEP 49 Z alignment calibration



- From the rear side, plug in the power cable.
- Turn the power switch ON (symbol "I").
- Turn the printer's front side facing you.
- On the screen, navigate to *Control -> Move Axis -> Move Z.* Rotate the LCD encoder to move the Z-axis to the bottom, until the end of the range, and observe if the movement is smooth.
- On the screen, navigate to *Control -> Calibrations & Tests -> 4 Z Alignment Calibration* and let the printer calibrate.

STEP 50 Good job!



- Well done, you successfully replaced the Z-axis linear rail on your Original Prusa XL!

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