5. E-axis assembly (spiral wrap)

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Step 1 — Textile sleeve vs spiral wrap

⚠️ Before you proceed further ensure again, you are in the correct chapter:

- **The longest and biggest sleeve is a spiral wrap.** If so, you can proceed according to this chapter.

- **If the longest and biggest sleeve is from textile,** please use this chapter instead: 5. E-axis assembly (textile sleeve)
Step 2 — Tools necessary for this chapter

- Needle-nose pliers for zip tie trimming.
- 2.5mm Allen key for M3 screws
- 2mm Allen key for nut alignment
- 1.5mm Allen key for tightening the pulley

Step 3 — Idler assembly (part 1)

- For the following steps, please prepare:
  - Extruder-idler (1x)
  - Bondtech pulley WITHOUT the lock screw (1x)
  - Pulley bearing (2x)
  - M3nS nut (2x)
  - Pulley shaft (1x)

Note there are two types of the Bondtech pulley in the package (one with and without lock screw). Make sure you are using the correct one.
Step 4 — Idler assembly (part 2)

- Press the nuts to the slots on both sides of the idler.

- **Insert both bearings** in the pulley. Be aware that bearings can slip out during assembly.

Layers might be visible in this printed part due to the geometry. The functionality and strength remain unaffected.
Step 5 — Idler assembly (part 3)

⚠️ Ensure both bearings are inside the pulley!

- Insert the pulley in idler as shown in the picture.
- Slide the shaft through the idler and pulley. Use reasonable force or you will **BREAK** the printed part.
- Place your finger on the bearing and ensure it can rotate freely.
Step 6 — New printed parts - extruder body

⚠️ **ATTENTION:** 3D printed extruder parts were improved in order to achieve better cooling. More information including direct comparison can be found on our [Prusa Research forum](https://forum.prusa3d.com/).

- The assembly of the printed parts is mostly the same. You will be informed in case extra attention is needed. Before you proceed to the next step, let’s learn how to recognize your parts:

  - **Previous design has a grill** on one side of the extruder body. This iteration has a label **B6** (printed by us) or **R2** (available on GitHub).

  - **The latest design has NO grill** to improve airflow. This iteration has a label **B7** (printed by us) or **R3** (available on GitHub).

ℹ️ In case you are using this guide to upgrade your MK2/S to MK3 and have already printed the B6/R2 design you can proceed or if possible reprint the latest parts B7/R3.
Step 7 — Assembling filament sensor (part 1)

⚠️ BE CAREFUL with the filament sensor, do not touch the black PCB nor the chips on it.

- For the following steps, please prepare:
  - Extruder-body (1x)
  - Filament sensor (1x)

ℹ️ The filament sensor is in the box labeled "2.3.4.5 SUP".
  - M3x10 screw (1x)
  - M3n nut (2x)
Step 8 — Assembling filament sensor (part 2)

⚠️ Before we continue with the assembly, we need to insert nuts in the Extruder-body. Take the extra time and effort to place them in properly. **You won't be able to reach them later.**

- Rotate the **front part** towards you and insert the M3 nut in the slot, all the way in.
- Rotate the **rear part** towards you and insert the M3 nut in the slot, all the way in.

ℹ️ If you can't push the nuts in, use a longer screw from the other side and tighten it until you "pull" the nut in.
Step 9 — Assembling filament sensor (part 3)

- **Carefully insert** the filament sensor in the slot, **do not use force** or you might damage the PCB!
Step 10 — Assembling filament sensor (part 4)

- Turn the extruder-body like in the picture. The pins of the filament sensor must be facing up.

- Locate the opening for the M3 screw.

- Take the M3x10 screw and tighten the sensor in place. No nut is needed, the screw will self-tap into the plastic.

⚠️ The sensor must be tightened completely to prevent its movement (screw head touching the board) BUT BE CAREFUL during tightening to avoid damage to the sensor.

ℹ️ Layers might be visible in this printed part due to the geometry. The functionality and strength remain unaffected.
Step 11 — Extruder assembly - idler (part 1)

- For the following steps, please prepare:
  - M3x30 screw (1x)
  - M3 translucent washer (2x)

ℹ️ Translucent washers are placed on the idler for better visibility. No need to place them as in the picture ;)

[Image of extruder assembly - idler (part 1)]
Step 12 — Extruder assembly - idler (part 2)

- Turn the Extruder-body like in the picture. The pins must be facing to the right.
- Insert M3x30 screw in the hole.
- Place a washer from the other side.
- Assemble the idler on the M3x30 screw.
- Finish the assembly with the second washer.

ℹ️ If the second washer keeps falling off. Use a M3n nut from the spare bag to fix it temporarily.
Step 13 — Assembling the Extruder motor pulley (part 1)

- For the following step, please prepare:
  - Extruder motor (1x)
  - Bondtech pulley WITH the lock screw (1x)

⚠ 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.

ℹ There is a second spare lock screw in the package.
Step 14 — Assembling the Extruder motor pulley (part 2)

- There is a flat part on the motor shaft, rotate it towards you.

⚠️ Slide the pulley on, note the **CORRECT** orientation.

- The screw must be facing directly against the pad (flat part) on the shaft. Slightly tighten the screw, the final adjustment will be done later.

- Don't press the pulley against the motor. Leave it on the very top of the shaft, see the picture.

- Before moving to the next step, rotate the pulley 90-degrees clockwise (the lock screw will be facing to the left).
Step 15 — Mounting the Extruder motor

- Find in the package two M3x30 screws and insert them into the holes.

Before mounting the motor, ensure the second translucent washer is still on the top M3x30 screw.

- Mount the motor on the extruder body as shown in the picture, double check the proper orientation of the motor cables.

- Tighten both screws firmly.

- Tighten the screw, but only slightly, keep in mind the idler must rotate freely.
Step 16 — Adjusting and tightening the pulley

- Open idler fully to have direct access to the pulley.
- Use a piece of 1.75 mm filament (from the spool) to align the pulley with the openings for the filament (see the picture). Arrows only indicate the direction. **Don't use the 3mm nylon filament!**
- Adjust the pulley and tighten it with 1.5mm Allen key. Use reasonable force as you might damage the thread.

ℹ️ When ready with the alignment, please remove the filament.
Step 17 — Securing the Extruder idler

For the following step, please prepare:

- M3x40 screw (2x)
- Extruder spring (2x)

Assemble springs on both screws, see the second picture.

Close the idler, so the screws can reach it.

Place both screws into the Extruder body and tighten them. The screw's head should be almost aligned with the printed surface.
Take two M3nS nuts from the package and insert them in the slots, all the way in.

Check proper alignment with the 1.5mm Allen key.
Step 19 — New printed parts - extruder cover

**ATTENTION:** 3D printed extruder parts were improved in order to achieve better cooling. More information including direct comparison can be found on our Prusa Research forum.

- The assembly of the printed parts is mostly the same. You will be informed in case extra attention is needed. Before you proceed to the next step, let's learn how to recognize your parts:

  - **Previous design has a grill** on one side of the extruder cover and **extra fan arm**. This iteration has a label **B6** (printed by us) or **R2** (available on GitHub).

  - **The latest design has NO grill** to improve airflow and also **the arm is not present**. This iteration has a label **B7** (printed by us) or **R3** (available on GitHub).

  - In case you are using this guide to upgrade your MK2/S to MK3 and have already printed the B6/R2 design you can proceed or if possible reprint the latest parts B7/R3.
Step 20 — Preparing the extruder cover

- For the following steps, please prepare:
  - Extruder-cover (1x)
  - M3nS nut (1x)
  - M3n nut (1x) - *skip for R3/B7*
  - M3x25 screw (2x)
  - B6/R2 - insert both nuts in the printed part. See the second picture.
  - B7/R3 - insert only M3nS nut. See the last picture.

ℹ️ In case you can't press the M3n nut 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 printed part during tightening.
Step 21 — Inserting the E3D hotend

- Take the E3D hotend and place it inclined into the Extruder body. Make sure the white PTFE tube fits in properly.

- Insert the hotend into the Extruder body, see the picture.

- Make sure the hotend is fully seated and the upper part aligned (almost in contact) with the surface of the printed part.

⚠️ Note the **CORRECT** orientation of the hotend.

⚠️ Be **VERY CAREFUL** with the hotend wires from now on, you can damage them.
Step 22 — Mounting the extruder-cover

- Rotate the extruder as shown in the picture.
- Take the extruder-cover and place it on the extruder body. Both printed parts must be in direct contact.
- Using M3x25 screws tighten both parts together.

**Ensure again the hotend is properly assembled.** The surface of the heatsink (part of the hotend with cooling ribs) must be aligned with the surface of the printed parts. See the last picture.

**Note** the B7/R3 extruder cover is missing the "arm". Otherwise the assembly is the same.
Step 23 — Preparing cooling fans

- For the following steps, please prepare:
  - M3x18 screw (6x)
  - Left hotend fan (1x)
  - Front print fan (1x)

⚠️ The left hotend fan has two sides, but the side with sticker must be always facing the hotend (not visible when the fan is mounted). Otherwise, the cooling won't work properly.

ℹ️ The left hotend fan (Noctua) can be also in a black colour without the rubber corners, other hardware parameters are the same.

ℹ️ **Note for B7/R3** design only five M3x18 screws are needed, at the end of this chapter you might have one M3x18 left, which is OK ;)

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Step 24 — Mounting the left hotend fan

- Place the Extruder on the side and guide the wires from the motor in the slot.
- Place the Left hotend fan on the Extruder. The cable must be placed in the top left corner, see the picture.

⚠️ Note the correct orientation of the fan. The sticker has to face towards the hotend!

- Insert M3x18 screws and tighten them slightly.
- Now, tighten ALL screws, alternating diagonals. After tightening, check that the fan can still rotate freely.

⚠️ **DON'T** tighten the screws too hard, all parts are made of plastic and you can break them.
Step 25 — Mounting the front print fan - parts B6/R2

⚠️ This step is valid only for the design B6/R2 if you have new parts B7/R3 without the grill please skip to the Step 26

- Rotate the Extruder as in the first picture.
- Mount the Front print fan using two M3x18 screws.

⚠️ DON'T tighten the screws too hard, all parts are made of plastic and you can break them.
Step 26 — Mounting the front print fan - parts B7/R3

Following steps are valid only for the latest design B7/R3, if your Front print fan is already mounted, then skip to the Step 29.

- For the following steps, please prepare:
  - nozzle-fan-45deg-support (1x)
  - nozzle-fan-45deg (1x)
  - M3x18 screw (1x) - already prepared in step 22
  - M3x10 screw (2x)
  - M3n nut (1x)

In case you are missing one M3x10 screw please use the spare bag.
Step 27 — Mounting the front print fan - parts B7/R3

- Press the M3n nut in the support, all the way in. It will be barely visible. If needed use a screw from the other side to pull the nut in, then remove the screw.

**WARNING:** there are pins of the filament sensor on the other side of the extruder. Be careful as you might bend them during the following steps!!!

- Connect the support to the extruder using the M3x10 screw. Note the correct orientation in the picture.

- The inclined part of the support must be facing to the extruder cover.

- Place the nozzle-fan on the extruder and secure it using M3x10 screw.
Step 28 — Mounting the front print fan - parts B7/R3

- Slide the Front print fan in the nozzle-fan.
- Secure the fan using a M3x18 screw.
- **In case you are upgrading already assembled printer**, it might happen the fan cable is too short and you can't incline the fan. First, try gently pull the cable from the spiral wrap. If this doesn't help unhook the cable (see the picture), **but be extremely careful as you might disconnect the wires from the fan!**
Step 29 — Preparing the P.I.N.D.A. probe

For the following steps, please prepare:

- P.I.N.D.A. probe (1x)
- M3x10 screw (1x)
- M3nS nut (1x)

⚠️ The probe is a sensitive device, please handle it with care during the assembly!

ℹ️ The P.I.N.D.A. cable can be either black or grey, both probes are the same.

⚠️ Make sure there are **FOUR wires** in the connector, if not, please **stop the assembly** and contact our support asap.
### Step 30 — Mounting the P.I.N.D.A. probe

- Start with the front print fan wire and place it under the cable clip.
- Gently push the P.I.N.D.A. probe through the mount.
- Create a loop on the probe wire, then place the wire under the cable clip.
- Slide the M3nS nut in the slot and tighten the probe SLIGHTLY with the M3x10 screw.

ℹ️ The exact position of the P.I.N.D.A. probe will be adjusted later (in Chapter 9, Preflight check), so there is no need to adjust the probe or tighten the screw fully at this point.
Step 31 — Extruder cables preparation

- Place the Extruder on the Y-carriage as in the first picture. Ensure the correct orientation of the printer, shorter extrusions must be facing towards you.

- If needed, lower the X-axis so you can see the entire X-carriage. It is needed for the next step.

- Take the cables from P.I.N.D.A. probe and front print fan, slide it between the lower smooth rod and belt.

- Take the cables from Extruder motor and left hotend fan, slide it between the lower smooth rod and belt.

⚠️ **IT IS VERY IMPORTANT** to place the cables as shown in the pictures. Please double check your steps.

ℹ️ Cables from hotend will be placed under the lowest smooth rod. We will arrange them later.
Step 32 — Mounting the Extruder

- For the following step, please prepare:
  - M3x40 screw (1x)
  - M3x30 screw (1x)
  - M3x18 screw (1x)

- Place the Extruder near the X-carriage and check no wire is pinched. There is a slot in the X-carriage for the motor wires, see the picture. Bend the motor cable in it and leave the fan wires straight.

- Mount the Extruder on the X-carriage using the screws above. Tighten all screws, but not fully. We need to arrange the cables again, this time in the back.

- Guide the cables through slots (channels) on both sides of the Extruder. On the left side, it is Front Print fan and P.I.N.D.A. probe, on the right side Extruder motor and Left Hotend fan.

- Ensure again the cables are in the channels and not pinched between printed parts. Now, tighten all screws, equally to prevent issues.
Step 33 — Cable for the filament sensor

- Locate the cable for filament sensor in the package.
- There are two types of the connectors on the cable:
  - The 4-pin connector for the sensor (used now)
  - The 5-pin connector for the EINSY board (used later)
Step 34 — Connecting the Filament sensor

- Use the cable from the previous step and connect it carefully to the filament sensor.

⚠️ Note the connector has two different sides. The side with safety pin must be on the left (white wire is facing up and red down).

- Gently rotate the cable (clockwise) to create a small loop, see the second picture.

- Push the cable through the opening on the X-carriage.

Step 35 — Preparing the NYLON filament

⚠️ Starting mid of February 2018, there will be only one 50cm NYLON filament included.

- There are two NYLON filaments included in the kit with lengths 50 and 30 cm. Both have Ø 3 mm. For this step please use the longer one and DON'T TRIM any of them!

- Using the pliers cut one end of the filament to create a tip.

- Check the tip is similar to the third picture.
Step 36 — Inserting the NYLON filament

- Locate the hole for the NYLON filament. Using the smallest Allen key ensure there are no obstacles inside.

- Using the pliers insert the NYLON filament in the slot. Hold the extruder with your second hand.

⚠️ BE EXTREMELY CAREFUL as the pliers tend to slide and you can easily damage the wires!!!

- To check if the filament is seated properly, gently pull it with your hand. The X-axis should bend a little, but the filament must remain in the slot.

ℹ️ If you have issues, try to adjust the tip on the filament.
Step 37 — Preparing the X-carriage-back (part 1)

- For the following steps, please prepare:
  - X-carriage-back (1x)
  - Cable-holder (1x)
  - M3n nut (1x)
  - M3x10 screw (1x)

  The M3x10 screw will be used temporarily, use one from the spare bag.

- M3x40 screw (1x)

Step 38 — Preparing the X-carriage-back (part 2)

- Insert the M3x10 screw in the X-carriage-back. Tighten it completely.

- Rotate the printed part and insert the M3n nut.

- Tighten the M3x10 screw until the nut slides in the printed part. Note the shape of the cutout for the nut, you might need to adjust (rotate) the nut.

- Remove the M3x10 screw and place it back in the spare bag.
Step 39 — Preparing the X-carriage-back (part 3)

- Prepare the M3x40 screw and cable-holder from the previous step.
- Tighten the screw all the way through the printed part.

⚠️ Note there is a recess (slot) for the screw's head on one side of the printed part.

Step 40 — Preparing the X-carriage-back (part 4)

- Place the X-carriage-back as in the picture. You must see the MK3 sign.
- Tighten the X-carriage-back and the cable-holder together.
- Check the "u-shaped" slot is aligned properly on both parts.
Step 41 — Assembling the X-carriage-back

- Push the cables from the Extruder **THROUGH** the X-carriage-back. Start with Extruder motor and the Left hotend fan.

- In the next step add the Front print fan and P.I.N.D.A. probe cables.

⚠️ Cables from hotend and filament sensor are **NOT GOING** through the X-carriage-back!

- Carefully insert the nylon filament and then slide the X-carriage-back towards the X-axis.
Step 42 — Adjusting the filament sensor cable

- Before pressing the X-carriage-back against the X-axis, place the filament sensor cable through the slot. See both pictures.

⚠️ Check the cables are not pinched between the X-carriage-back and the X-axis!!!
Step 43 — Mounting the X-carriage-back

- Using five M3x10 screws tighten the parts together in following order:
  - Start in the middle and ensure proper alignment.
  - Continue in the corners, tighten all screws equally.
  - After the tightening is done, push the filament sensor cable in the slot along X-carriage-back, join the remaining cables.
Step 44 — Cable management using spiral wrap

- Wrap the spiral wrap (the largest and the longest one) around the cables and the nylon filament.

- Start with cables from the upper part, after 3-4 turns (not more!) slide the wrap on the cable-holder. If possible, press the wrap slightly in the X-carriage-back.

⚠ Don't wrap the entire cable bundle now, we will get to it later.
Step 45 — Tightening the spiral wrap (Part 1)

- Use three zip ties and push them through the lower slots on the cable-holder.
- Check for the last time both the wrap and cables are seated properly.

⚠️ **PAY GREAT ATTENTION** to the final position of the zip ties. If you don't follow the manual, you will have issues during prints!

- Tighten first zip tie on the side of the cable-holder and cut the zip tie as close as possible to the printed part.
- Tighten second and third zip tie on the top, but note they both must be slightly **to the left**. Cut the zip ties as close as possible to the spiral wrap.

ℹ️ Don't wrap the entire cable bundle now, we will get to it later.
Step 46 — Tightening the spiral wrap (Part 2)

- Use two zip ties and push them through the upper slots on the cable-holder.
- **ATTENTION!** Before tightening the zip ties add the cables from the hotend.
- Once the hotend cables are included, tighten the zip ties and cut remaining parts.
  
  🔄 Don't wrap the entire cable bundle now, we will get to it later.

Step 47 — Finalizing the spiral wrap

- Make one more turn of the spiral wrap, then add the cables from the hotend.
- Wrap the whole cable bundle.
Step 48 — Mounting the Filament-sensor-cover (part 1)

For the following steps, please prepare:

- Idler-plug (1x)
- Filament-sensor-cover (1x)
- PTFE tube (1x)
- M3x10 screw (2x)

In case you are missing one M3x10 screw please use the spare bag.
Step 49 — Mounting the Filament-sensor-cover (part 2)

- Locate the largest circular opening for the PTFE tube on the top of the Extruder.
- Push the PTFE tube in. Most of the tube's length will stick out.

In case the PTFE does not hold properly in the hole, you can assemble it to the cover first, BUT MAKE SURE there is no obstacle in the hole as you can easily deform the tube while placing as a part of the cover.
Step 50 — Mounting the Filament-sensor-cover (part 3)

- Carefully slide the filament cover on the PTFE tube.
- Using two M3x10 screws mount the cover.

Step 51 — Assembling the idler-plug

- Locate the part, where the idler is cut out (M3 screw is visible).
- Assemble the idler-plug and ensure it fits properly. Otherwise, it might fall down during the print.
Step 52 — Mounting the fan-nozzle

⚠️ In case of parts B7/R3 your fan-nozzle is already mounted, skip this step.

- For the following step, please prepare:
  - Fan-nozzle (1x)
  - M3x10 screw (1x)
  - Carefully slide the X-axis up so you have access to the lower part of the Extruder.
  - Release slightly both screws on the front print fan.
  - Assemble the fan-nozzle and tighten all three screws.

ℹ️ In case you are missing M3x10 screw, please use one from the spare bag.
Step 53 — E-axis is finished!

- **Are we there yet? Almost!** You've just finished the hardest part of the assembly. Awesome job!

- Check the final look, compare it to the picture. Note with B7/R3 parts the extruder looks different.

- Checked everything? Let's move to: [6. LCD assembly](#)