



renkforce

Ⓒ Assembly Instructions/Conversion Instructions

RF2000 v2 Construction Kit Single Extruder

Order no. 1563100

RF2000 v2 Upgrade Kit to Dual Extruder

Order no. 1563101

CE

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1. Introduction

Dear Customer,

thank you for purchasing this product.

This product complies with the statutory national and European requirements. To maintain this status and to ensure safe operation, you as the user must observe these operating instructions!



These operating instructions are part of this product. They contain important notes on commissioning and handling. Also consider this if you pass on the product to any third party. Therefore, retain these operating instructions for reference!

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If there are any technical questions, contact:

International: www.conrad.com/contact

United Kingdom: www.conrad-electronic.co.uk/contact

2. Explanation of symbols



The symbol with a lightning bolt in a triangle is used where there is a health hazard, e.g. from electric shock. The device contains no parts that require servicing by the user. Therefore, never open the device.



The symbol with the exclamation mark points out particular dangers associated with handling, function and operation.



This symbol warns of hot surfaces the contact with which may cause injury.



Attention! Danger from moving parts - keep away fingers and other body parts.

This symbol warns of injury that may occur when reaching into the device in operation. Body parts may be crushed, pulled in or otherwise injured.



This symbol warns of hand injury from the belt drive.



The symbol with the arrow indicates special advice and notes.



Observe the operating instructions!

3. Intended use

The 3D printer produces two-coloured 3D-objects from suitable printing files. For this, suitable raw material (filament) is melted in the two print heads and attached in the required position for the object.

This product is only approved for connection to 230 V/AC, 50 Hz alternating voltage.

It is intended for indoor operation only. Do not use it outdoors. Contact with moisture, e.g. in bathrooms, must be avoided under all circumstances.

Using the product for any other purposes than those described above may damage the product. Improper use also may cause dangers such as short circuit, fire, electric shock, etc. Read the operating instructions precisely and keep them. Only pass the product on to any third parties together with the operating instructions.

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ATTENTION Mains voltage - the connection, installation and wiring of the electrical components must only be performed by an electrician who is familiar with the applicable safety provisions. Before commissioning, inspection according to the applicable safety provisions must be performed by an electrician. This also applies to repair work.

Observe all safety and assembly notes in these assembly instructions and in the operating instructions!

Current operating instructions

Download the current operating instructions via the link www.conrad.com/downloads or scan the displayed QR code. Follow the instructions on the website.



4. Scope of delivery

a) RF2000 v2 Construction Kit Single Extruder

- All necessary parts for installation of the printer (single extruder)
- Filament holder
- Mains cable
- SD card
- Spatula
- Notice sheet
- Operating and assembly instructions (digital as a download)

b) RF2000 v2 Upgrade Kit to Dual Extruder

- All necessary parts for the upgrade from single to dual extruder
- Operating and assembly instructions (digital as a download)

5. Important advice and notes - Please read!



ATTENTION Mains voltage - the connection, installation and wiring of the electrical components must only be performed by an electrician who is familiar with the applicable safety provisions. Before commissioning, inspection according to the applicable safety provisions must be performed by an electrician. This also applies to repair work.

Observe all safety and assembly notes in these assembly instructions and in the operating instructions!

Attention! Important note on shipping of the printer!

→ Please keep the original outer packaging and the inlay well! Only this permits safe transport, e.g. for guarantee/warranty!
Please observe the separate packaging instruction as well.

We assume no liability in case of transport damage to devices that were not sent out in their original packaging or that were packed improperly in it!

Important note for using the spatula

The enclosed spatula is meant for removal of the objects that are still stuck to the printing plate and that are difficult to remove without help.

→ Proceed with the utmost care when using the spatula!

The spatula should only be used if there is any printing film or adhesive tape on the printing plate. Also use the spatula only at a very flat angle.

Non-observation of the notes or wrong handling may damage the surface of the printing plate and thus influence the print quality! This may also cause loss of the warranty/guarantee!

6. Safety notes



In case of damage caused by non-compliance with these operating instructions, the warranty/guarantee will expire. We do not assume liability for any consequential damage.



We do not assume any liability for property damage and personal injury caused by improper use or non-compliance with the safety instructions. In such cases the warranty/guarantee is voided.

Dear Customer: The following safety information is intended not only for the protection of the device but also for the protection of your health. Please read the following items carefully.

a) General information

- For safety reasons, any unauthorized conversions and/or modifications to the product deviating from these operating instructions are not permitted. Components may be damaged and thus impair the function or safety of the device.
- The mains unit corresponds to the applicable CE provisions. Compliance with the applicable CE provisions for the finished construction kit, whoever, is subject to the constructor of the construction kit and also essentially depends on precise work during assembly.
- This device is a protection class I product. The voltage source must be a proper mains socket (230 V/AC, 50 Hz) of the public mains with a protective ground contact.
- The mains socket to which the 3D printer is connected must be close to the device and easily accessible to quickly separate the device from the mains voltage in case of an error.
- Attention, LED light:
Never look into the LED beam!
Never watch directly or with optical instruments!
- All persons who operate this product, mount, install, assemble it, put it into operation or service it must be trained and qualified accordingly and must observe these operating instructions.
- The 3D printer is not suitable for persons with physical, sensor or metal limitations or for inexperienced or uninformed persons.
- This product is not a toy, not to be used by children and not suitable for children. Children cannot judge the dangers involved when handling electrical devices.
- The mechanical parts of the product are produced highly precisely. Never apply any mechanical force here. The 3D printer may be rendered useless by this.
- Do not leave any packaging material unattended. It may become a dangerous toy for children.
- If you are not sure of the correct connection or if there are any questions that are not covered by the operating instructions, do not hesitate to contact our technical support or another specialist.
- Also observe the additional safety information in the individual chapters of these instructions.

b) Set-up, site of operation

- Set up the 3D printer only on a stable, horizontal, sufficiently sized surface.
- Choose the site of operation so that children cannot reach the product.
- When setting up the 3D printer, observe that the mains switch at the rear of the device must be easy to reach so that the device can be switched off quickly and easily in case of malfunction.
- The devices must not be exposed to any extreme temperatures, strong vibrations, high moisture, such as rain or steam or strong mechanical strain.
- Never place containers containing liquids, e.g. glasses, vases, etc. on the device or in its vicinity and do not pour any liquids out over the device. Liquids may get into the housing and impair electrical safety. This also poses great danger of fire or potentially fatal electric shock!

If this is the case, first power down the respective mains socket on all poles (e.g. switch off circuit breaker and FI switch) and then pull the mains cable from the socket. Disconnect all lines from the device. Do not operate any part of the product anymore afterwards, but take it to a specialist workshop.

- Never place any sources of open fire, such as lit candles, on or right next to the device.
- When setting up the product, make sure that the mains cable is not pinched or damaged by sharp edges.



c) Operation

- Push the emergency off switch at once if there is any electrical or mechanical problem! The printer will be powered down by this. Only reset the emergency off switch when the problem has been removed.
- Never reach into the 3D printer in operation. The mechanically moved parts within the printer pose a high risk of injury!
- The print head and the printing plate grow very hot in operation. Never touch these parts during or just after operation. Let them cool down sufficiently first (approx. 60 minutes).
- Disconnect the device from the mains before maintenance work or modifications (unplug the mains plug!) and let it cool down.
- In operation, there will be noise and, depending on the filament material used, smells. Observe this when selecting the site of setup and the filament material. Ensure sufficient ventilation or install an extraction system. Do not inhale arising vapours. When using any other than the recommended filament material, poisonous vapours or gases may develop.
- Do not touch the mains cable if it is damaged. First power down the respective mains socket on all poles (e.g. switch off circuit breaker and FI switch) and then pull the mains cable from the socket. Never operate the product with a damaged mains line.
- Never touch the mains line or the mains plug with wet or damp hands. There is a risk of potentially fatal electric shock!
- Never operate the device unattended.
- Only operate the device in moderate climates, never in tropical climates.

d) Socket

- The socket on the rear of the 3D printer serves to connect suitable devices. The socket is controlled separately by the 3D printer as required.

Never connect any other devices here that are not intended for operation in connection with the 3D printer.

- Do not overload the socket. The maximum permitted output power is indicated on the socket (also see chapter "19. Technical data").
- The mains cable must not be squeezed or damaged by sharp edges.
- Do not put any objects onto the mains cable and do not step on it. Place the mains cable so that no one can trip over it and that the mains lug is easily accessible.

Also place the mains cable so that there can be no damage when operating the 3D printer.

- Always pull a mains plug from the socket by the provided grip; never pull out a mains plug from the socket by the cable!
- Do not connect in series! Do not connect any socket strip to the socket of the 3D printer.
- Do not operate covered!
- Voltage-free only when the plug is pulled! The socket is controlled separately by the 3D printer. The mains voltage therefore may increase inadvertently.

For example, if you want to operate a device via the 3D printer socket, first pull the mains plug of the device from the 3D printer socket before performing any work on it.

7. Feature description

- Printing space (W x D x H) (X, Y, Z) single extruder approx. 200 x 290 x 185 mm; Dual extruder approx. 170 x 290 x 185 mm
- Play-free profile rail guides and ball-threaded drives for maximum precision
- Automatic printing plate measurement
- Heated printing plate of aluminium
- 1 high-precision extruder with replaceable printing nozzle and quick change function (RF2000 v2 single extruder)
- 2 high-precision extruder for 2-coloured printing with replaceable printing nozzle and quick change function (RF2000 v2 dual extruder)
- Extruder unit with quick-change function
- Integrated long-lived industrial mains unit
- Display and key pad for the device operation right at the device
- Control via a computer (USB) or stand-alone operation (with SD or SDHC card) possible
- Manual control of the printing parameters possible even during operation
- Extremely stable by aluminium/steel mechanics
- Suitable for all common standard roll filament types
- Breaking and abrasion-free cable guides across energy guide chains

8. Working principle of the 3D printer

For 3D print, first a file is needed that contains the three-dimensional data of the object to be printed (a common format of such a file is, e.g., a .stl-file).

This file can be produced with the corresponding software or with a 3D-scanner. There are also many printing files online that can be downloaded to print an object as quickly as possible.

The actual printer software has the task to render the above three-dimensional file into a file that the printer can print. This is a file in which the individual print layers, the temperature for the printing head or printing heads and printing plate, etc. are specified. The file has the extension ".gcode".

This G-CODE printing file is sent to the 3D printer either via the USB interface by the computer, or an SD card with the printing file is put into the card reader and the 3D printer is used in standalone operation.

The 3D printer prints the file layer for layer according to the FFF (Fused Filament Fabrication) / FDM (Fused Deposition Modelling) procedure.

At the actual print, the filament material is transported from a filament roll to the print head (extruder). For the dual extruder and two-coloured printing, this is done alternatingly with the two print heads.

In the extruder, the filament material is melted and then applied to the printing plate via a fine extruder nozzle layer by layer.

The heated printing plate moves in the Y and Z directions, the extruder unit moves in the X-direction. Thus, all prerequisites to produce a three-dimensional object by horizontal application of the present layers are created.



A 3D printer is a highly complex device in which many parameters must be set depending on the printer, printed object and filament material used.

Additionally, the adhesion of the printed object on the printing plate is influenced by printing plate temperature, filament material, shape of the printed object and surface properties of the printing plate.

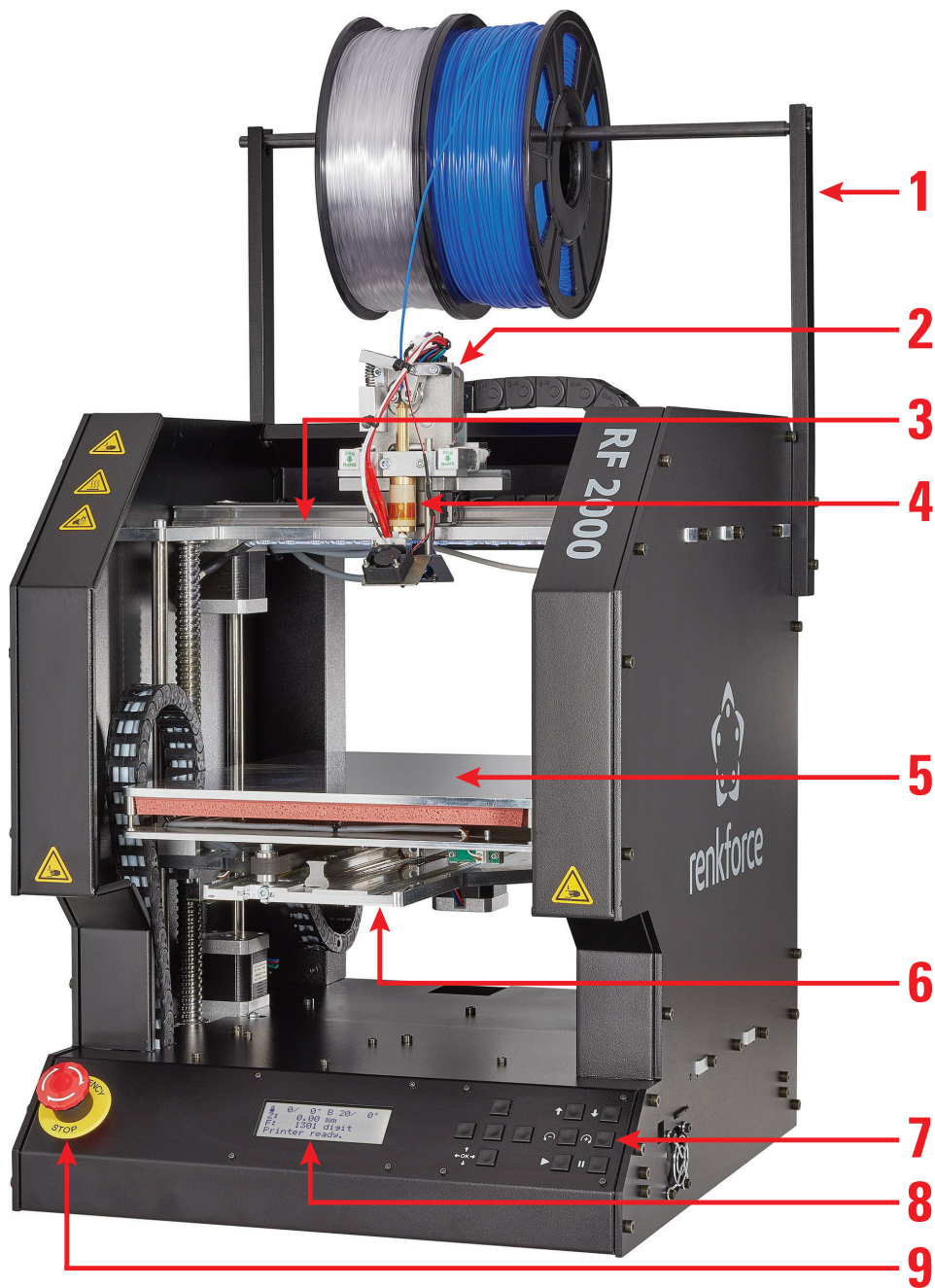
Ambience influences such as drafts, grease on the printing plate, etc. also play a role in the quality and adhesion of the printed object.

For the above reasons, it is not possible to achieve high-quality print results at once and without previous experiments.

Change the adjustable parameters in small steps to achieve the best printing results for your application. The printing examples enclosed on the SD-card provide references, but must be refined for perfect results depending on the above parameters.

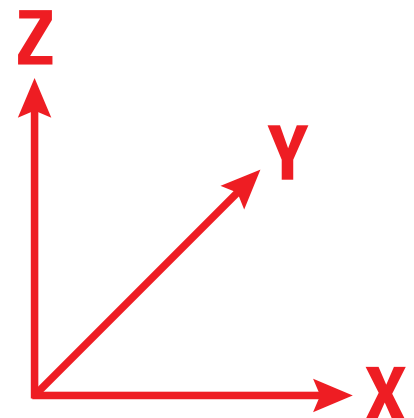
9. Overview of the most important parts

a) Single extruder

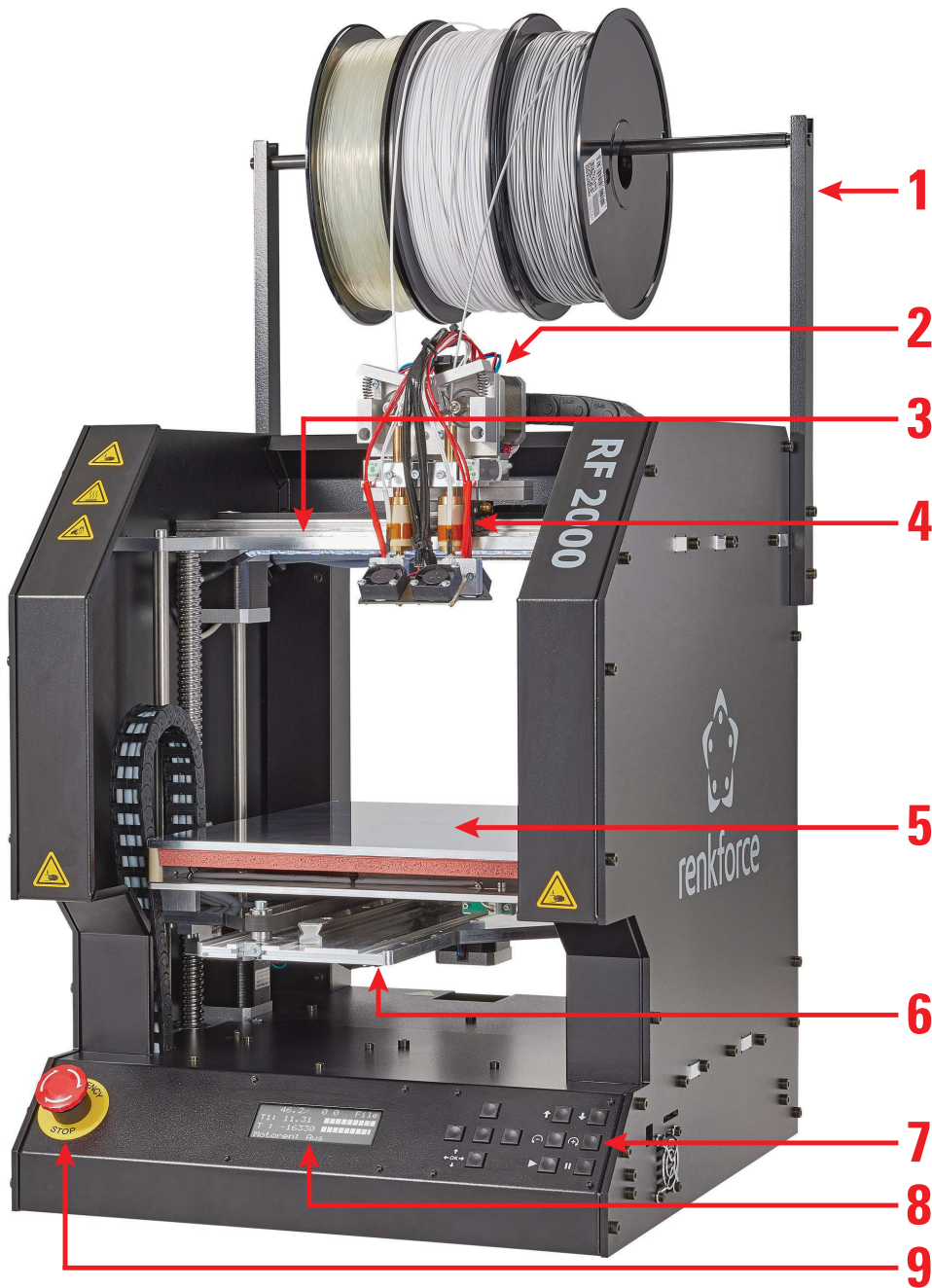


- (1) Filament holder
- (2) Extruder unit
- (3) X-plate
- (4) 1 extruder (single extruder)
- (5) Heating plate of glass ceramics
- (6) Y-plate
- (7) Operating button field
- (8) Display
- (9) Emergency off switch

→ In the small figure, the printing directions (x, y and z) are indicated.

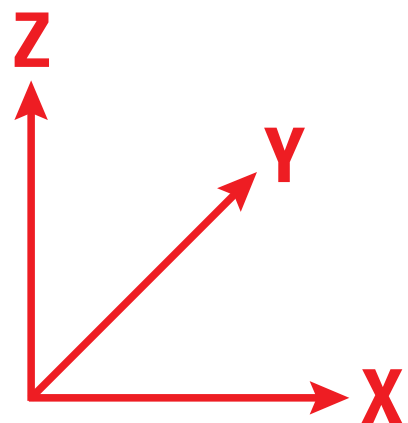


b) Dual extruder



- (1) Filament holder
- (2) Extruder unit
- (3) X-plate
- (4) 2 extruder (dual extruder)
- (5) Heating plate of glass ceramics
- (6) Y-plate
- (7) Operating button field
- (8) Display
- (9) Emergency off switch

→ In the small figure, the printing directions (x, y and z) are indicated.



10. Required tools and material

For use, calibration and maintenance

- Hex keys 2.5 mm / 3 mm / 4 mm
- External hex key socket wrenches 7 mm / 8 mm
- External hex key open-ended wrenches 5.5 mm / 7 mm / 8 mm / 11 mm
- Special adhesive tape in order to improve adhesion at certain filaments (e.g. PLA); our recommendation: blue adhesive tape, Conrad order no. 1093104

For the assembly of the kit and repair works

- Different screwdrivers (cross-head and slotted)
 - Hex key 1.5 mm / 2 mm / 2.5 mm / 3 mm / 4 mm
 - External hex key socket wrenches 4 mm / 5.5 mm / 7 mm / 8 mm
 - External hex key open-ended wrenches 5.5 mm / 7 mm / 8 mm / 11 mm
 - External hex key open-ended wrench (flat) 10 mm
- ➔ A hexagon socket wrench or a hexagon spanner may be used in some cases.
- Hammer
 - Stop angle
 - Calliper
 - Wire cutter
 - Combination pliers, small flat pliers and small long-nose pliers
 - Threadlocker varnish, medium strength
 - Feeler gauge 0.3 mm, 0.8 mm, 0.9 mm 1.0 mm (recommended up to 1.0 mm in 0.05 mm steps)
 - Hot-glue gun (optional)

11. General notes on installation



Take enough time for the assembly. Hurrying often leads to mistakes that may damage components or ruin the time benefit by elaborate rework.

The workplace should be sufficiently large and clean so that the various components and assemblies can be stored and assembled easily.

The aluminium parts of the construction kit are very sensitive to dirt. Wash your hands before installing these parts and use cotton gloves if necessary.

For the mounting locations and the correct alignment of the components, please observe the figures. For the dimensions of screws, nuts, etc., the information in the text is binding. In the figures these can deviate possibly.

All mechanical components of the construction kit are produced extremely precisely. Never apply any force during assembly. All parts can be assembled without any great application of force. If this is not the case, rethink the assembly step and reread the corresponding description in these instructions.

When tightening the screws, ensure that you do not tighten them too tightly. Many screws are turned into aluminium threads and therefore must not be tightened as far as it would be possible, e.g., in steel threads. A table with the recommended tightening torques of the screws can be found in the appendix (chapter 20. Annex: Recommended tightening torque of the screws) of these instructions.

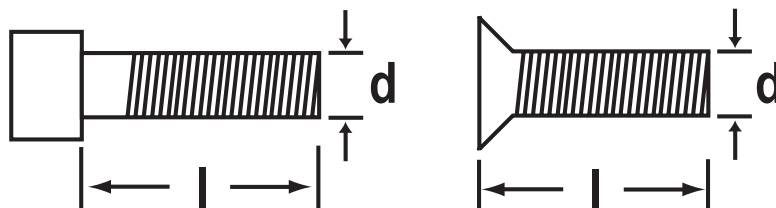


If you have also ordered the optional upgrade kit for dual extruders with the kit, please read chapter "16. Upgrade from single to dual extruder".

Sort the screws by size before assembly. This facilitates assembly, since you do not have to look for individual screws.

The delivery includes some screws, nuts and other small parts in larger numbers than necessary. They are meant as replacements in case a screw or similar material is lost in assembly.

For cylinder head screws, the length (l) is measured without the screw head; for countersunk-head screws, the length measurement takes place with the screw head. The diameter (d) is always measured by the thread.

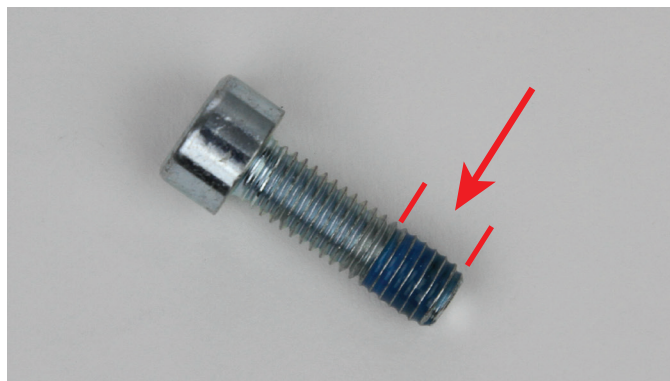


Application of the threadlocker varnish

In the following instruction, some screws must be secured with threadlocker varnish. This is indicated accordingly in the text.

Procedure:

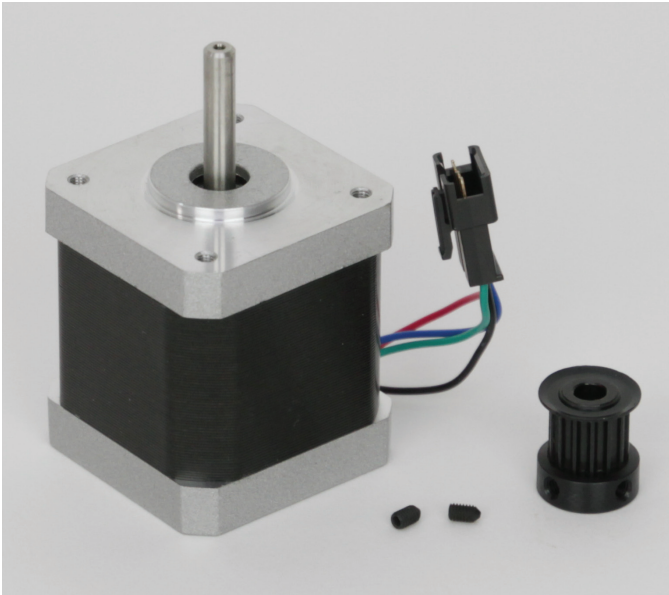
Put a small drop of threadlocker varnish medium-strength onto the thread start. Observe that you must only use a small drop as shown in the following screen.



12. Assembly of the mechanical parts

a) Preparation of various components

Attachment of the sprockets to the actuators

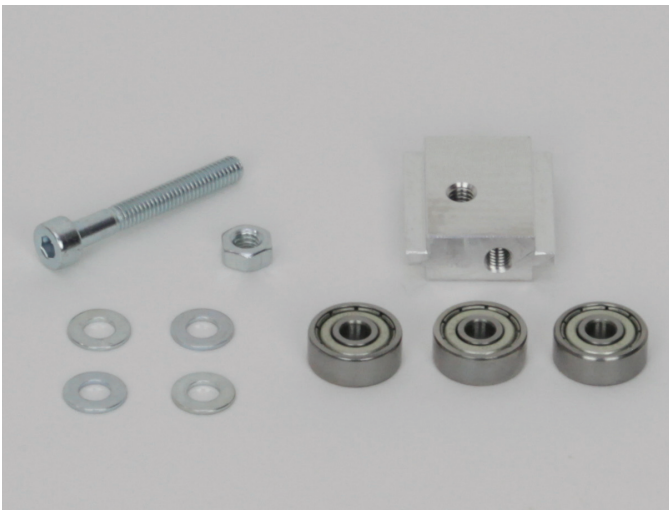


- 3 x actuator
- 3 x sprocket 14Z (small sprocket, outer diameter 16 mm)
- 6 x threaded pin M3x5



Push the sprocket onto the axis of the actuator. Fasten them with 2 threaded pins each. The threaded pins are provided with threadlocker varnish.
The motor axis must end flush with the upper edge of the sprocket.
Repeat the steps for the other two actuators.

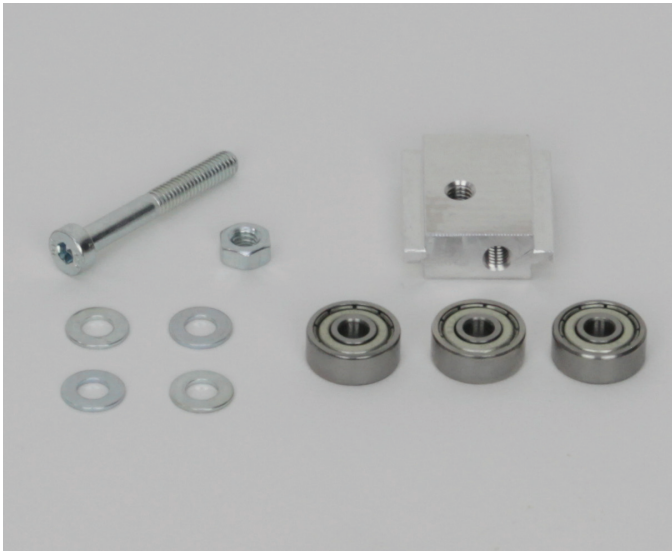
Installation of the belt tensioners



- 1 x cylinder head screw M4x30
- 1 x nut M4
- 1 x belt tensioner basic body
- 4 x washer (diameter inside/outside 4.3/8.8 mm)
- 3 x ball bearing 624ZZ (diameter inside/outside (3.8/13 mm))



Slide the 4 washers alternately with the 3 ball bearings onto the M4 cylinder head screw.
Turn the screw into the belt tensioner basic body as shown in the figure, tightening it well.
Finally, lock the screw with the nut.



- 1 x cylinder head screw M4x30 with flat head
- 1 x nut M4
- 1 x belt tensioner basic body
- 4 x washer (diameter inside/outside 4.3/8.8 mm)
- 3 x ball bearing 624ZZ (diameter inside/outside (3.8/13 mm))



Slide the 4 washers alternately with the 3 ball bearings onto the M4 cylinder head screw with the flat head.
Turn the screw into the belt tensioner basic body as shown in the figure, tightening it well.
Finally, lock the screw with the nut.

Glue connection of the printing plate

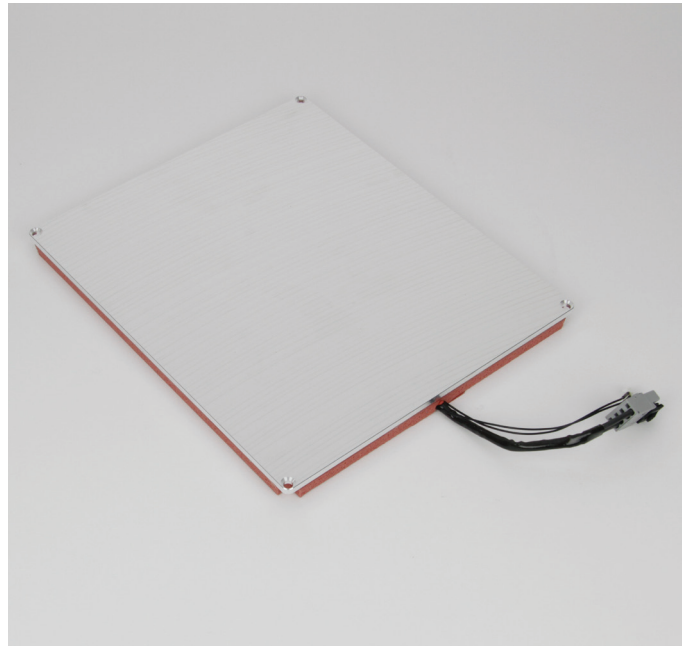


- 1 x aluminium printing plate
- 1 x heating mat (self-adhesive)



→ **The side of the printing plate where the holes are countersunk is the top side. The heating mat must be glued to the bottom side.**

First check the orientation of the heating mat on the printing plate.
Then clean the bottom side of the plate with a cloth and solvent. The printing plate must be free of dust and grease!
Now glue the heating mat with the side of the protective film on the bottom side of the plate without folds or bubbles. The heater must be fully supported and must not protrude at the edges.
The easiest way to do this is to glue the heating mat on piece by piece. Peel off the protective film a little (approx. 5 cm) and start at one side of the printing plate.
If the heating mat is correctly positioned, press it firmly with your fist. Then remove the protective film again and press the heating mat back in place.



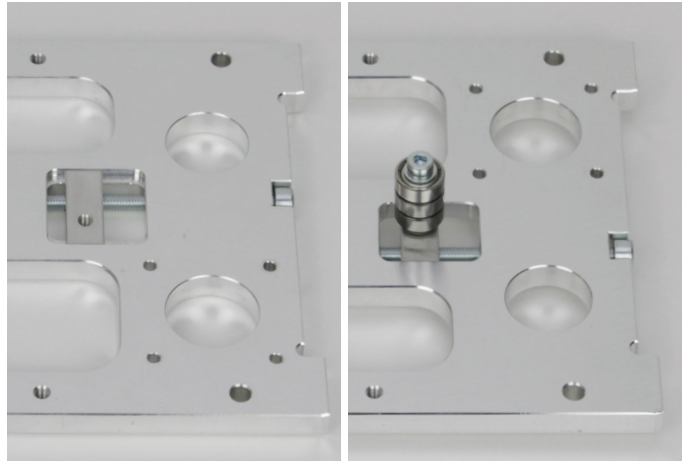
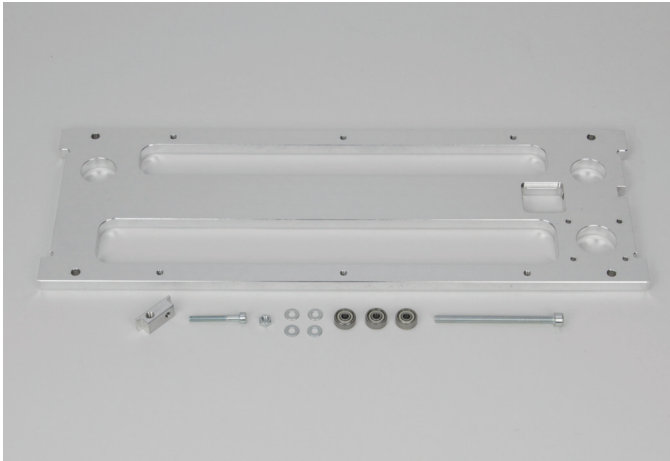
When the heating mat is completely glued on, press it down again completely with your fist.

The finished printing plate should now look like this.

→ **Attention! The adhesive surface of the heating mat is intended for single use only. If you remove the heating mat again, it will no longer stick securely to the printing plate, which of course affects the print quality.**

b) Assembly of the bottom plate

Installation of the belt tensioner



- 1 x bottom plate
- 1 x belt tensioner basic body
- 1 x cylinder head screw M4x30
- 1 x nut M4
- 4 x washer (diameter inside/outside 4.3/8.8 mm)
- 3 x ball bearing 624ZZ (diameter inside/outside (3.8/13 mm))
- 1 x cylinder head screw M5x70 (fully threaded)

Insert the belt tensioner basic body into the provided cut-out in the bottom plate. The cross-bore of the belt tensioner basic body and the bore in the bottom plate must align.

Slide the screw M5x70 from the right into the bottom plate and turn it into the basic body. The screw head is supported against the housing side part to be installed later so that the belt tensioner function is only present after assembly of the side part.

Turn the bottom plate over.

Slide the 4 washers alternately with the 3 ball bearings onto the M4 cylinder head screw.

Screw the screw fitted in this way into the belt tensioner basic body as shown in the figure on the right. Tighten the screw well.

Finally, lock the screw of the belt tensioner basic body with the nut (in the figure on the bottom side of the bottom plate).

Assembly of the spacers

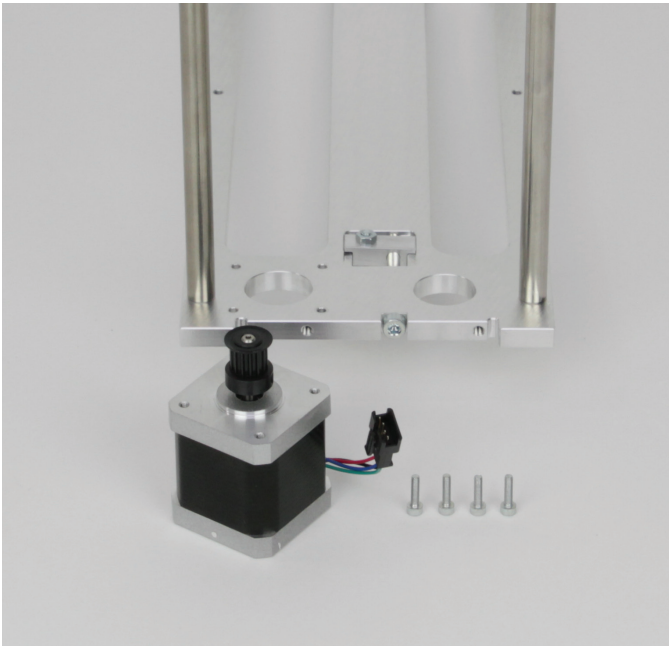


- 1 x bottom plate
- 4 x spacers
- 4 x cylinder head screw M5x16

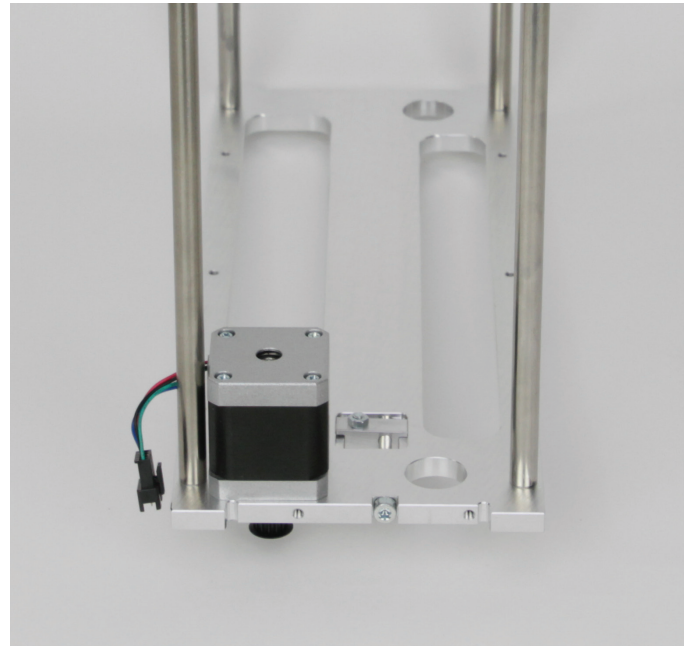
Attach the spacers to the top of the bottom plate with the 4 M5 cylinder head screws as shown in the figure (the belt tensioner is pointing downwards).

The screws are provided with threadlocker varnish.

Mounting the Z-motor

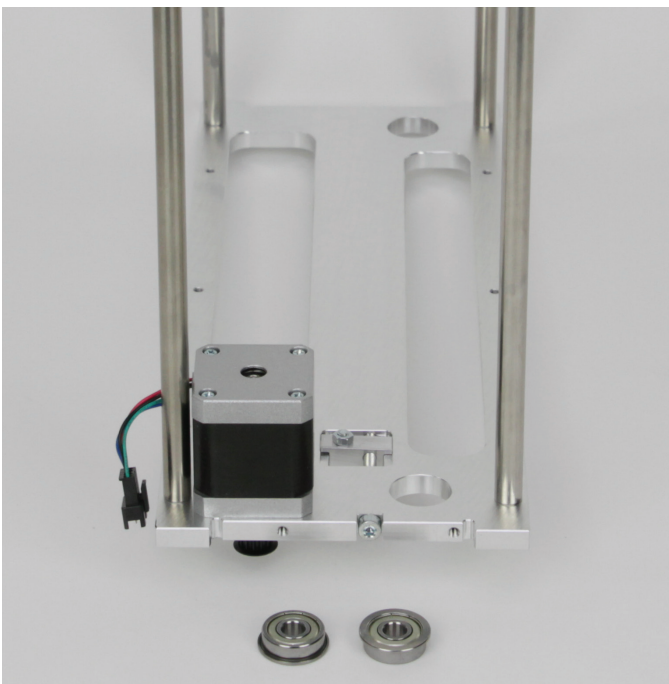


- 1 x bottom plate with mounted spacers
- 1 x actuator with installed sprocket
- 4 x Cylinder head screw M3 x 12

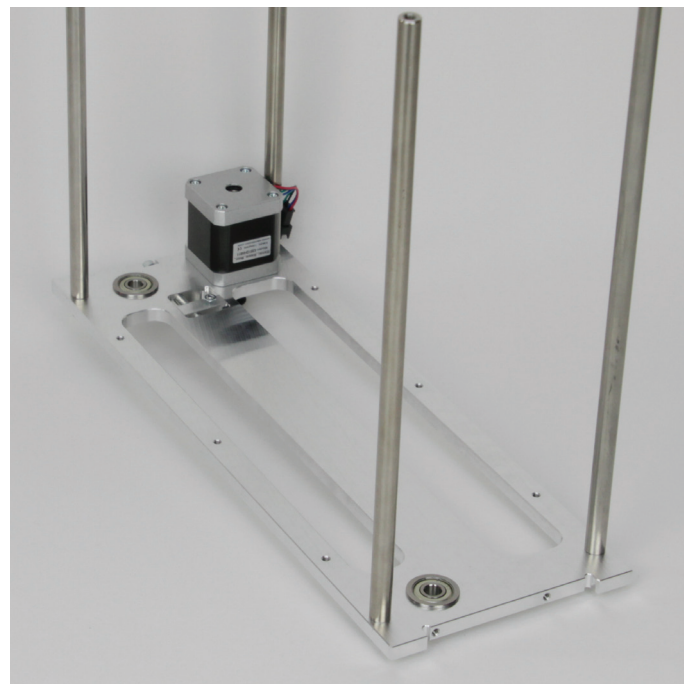


Attach the actuator to the bottom plate with the 4 M3 cylinder head screws as shown in the figure.
The screws are provided with threadlocker varnish.
The cable exit of the actuator must point in the opposite direction of the belt tensioner (see image).

Inserting the grooved ball bearings



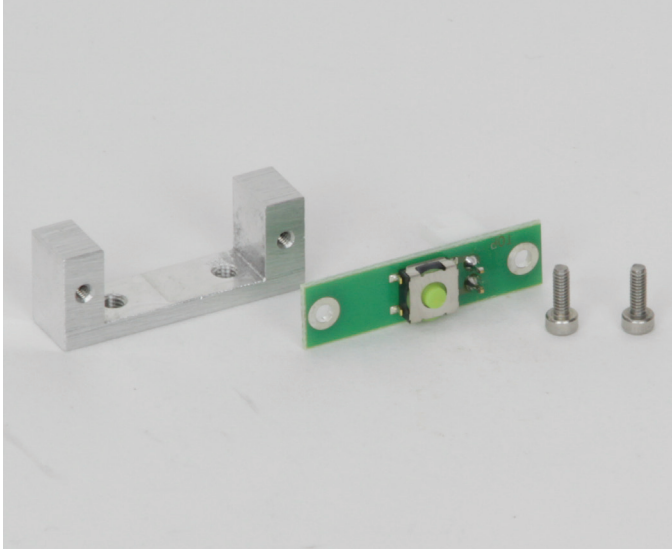
- 1 x bottom plate with mounted motor and spacers
- 2 x grooved ball bearings



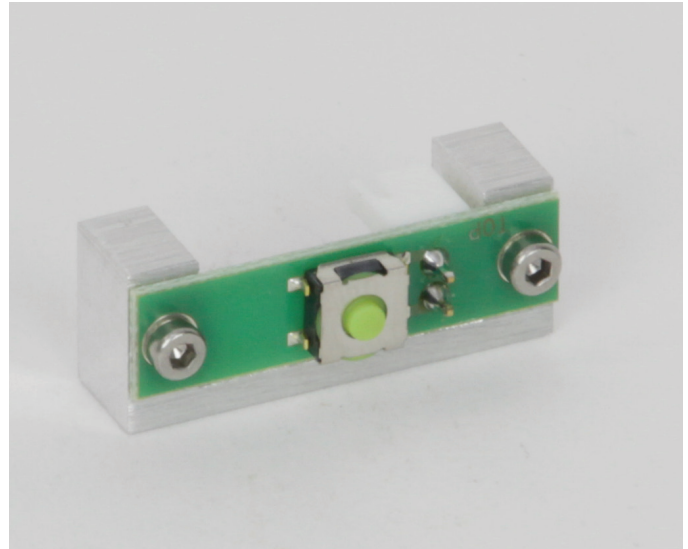
Insert the two grooved ball bearings from above into the corresponding holes in the bottom plate.
Turn the grooved ball bearings slightly when inserting them into the holes so that they slide more easily into the holes.
Do not use force at all.
The flanges of the grooved ball bearings must be cleanly aligned with the top of the bottom plate.

c) Assembly of the X-plate

Assembly of the limit switch on the holder

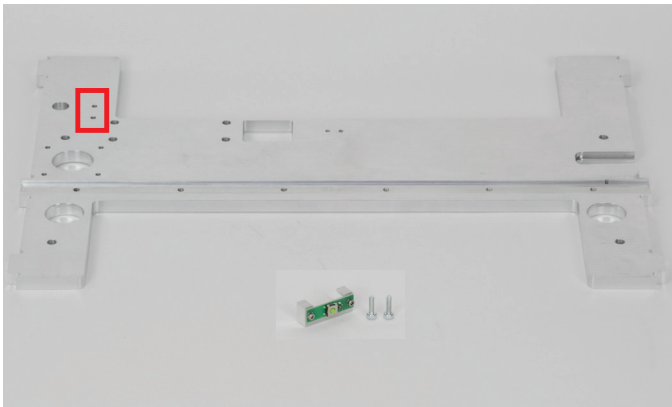


- 1 x holder for limit switch
- 1 x limit switch PCB
- 2 x cylinder head screw M2x6

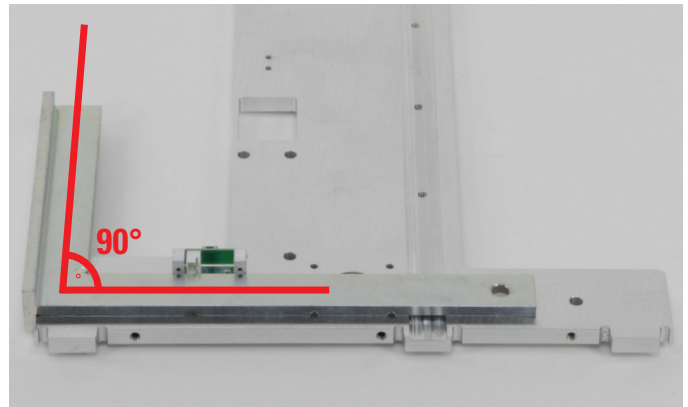


Mount the limit switch PCB to the holder using the two M2x6 screws as shown in the figure.
The PCB must be screwed onto the holder from the front so that the connector is in the holder (see figure).

Mounting the limit switch unit on the X-plate



- 1 x X-plate
- 1 x limit switch with holder
- 2 x cylinder head screw M3x10



Attach the limit switch with the holder to the X-plate with the two M3 cylinder head screws in the intended position (see red box in the left figure).

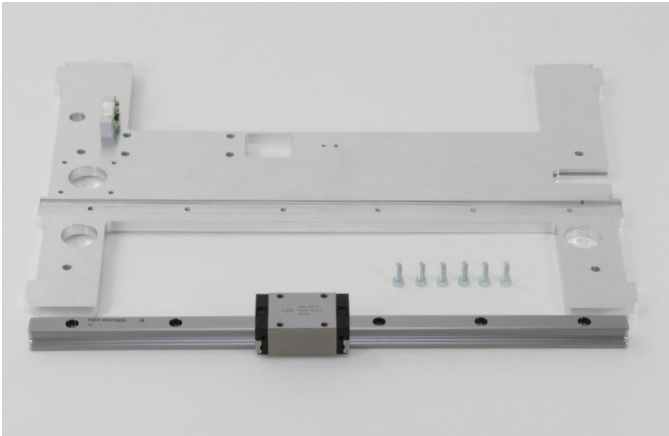
Align the limit switch with a stop angle at right angles to the X-plate. The screws are provided with threadlocker varnish.

→ **Attention! The X-plate must be aligned so that the groove points upwards! The limit switch must then also be mounted on this side!**

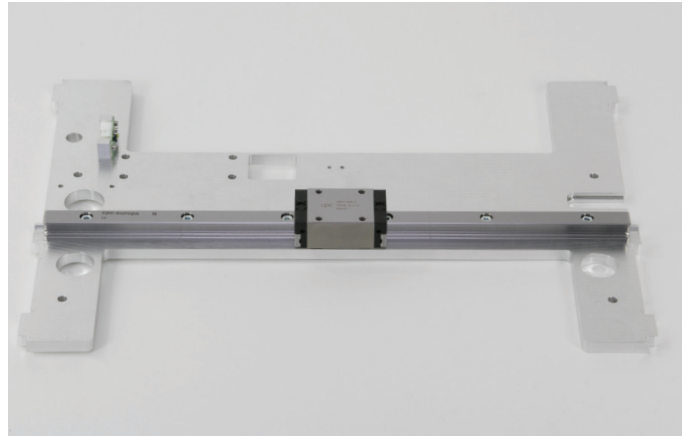
Mounting the guide rail



The guide carriage can generally be pushed off of the guide rail, since the bearing balls are combined in a chain. However, we recommend avoiding this if possible.



- 1 x X-plate with mounted X-limit switch
- 6 x cylinder head screws M4x14
- 1 x guide rail with guide carriage

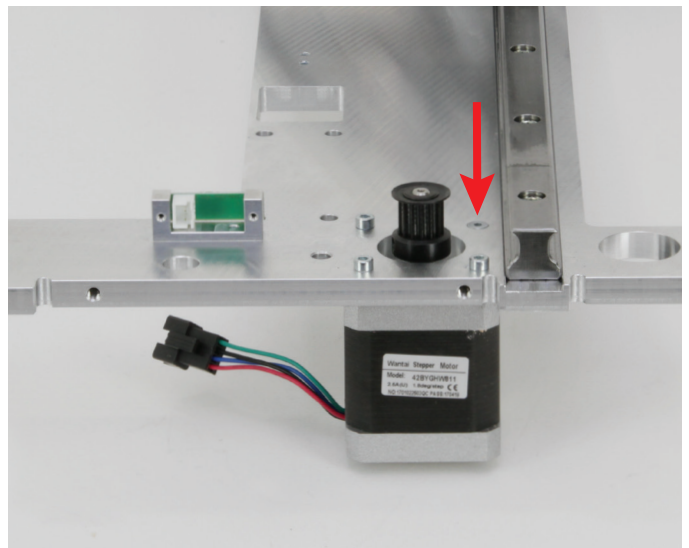


Insert the guide rail into the groove of the X-plate and fasten it with the 6 M4 cylinder head screws.
It does not matter how you align the guide rail.

Assembly of the actuator



- 1 x actuator with installed sprocket
- 3 x cylinder head screw M3x12
- 1 x countersunk screw M3x12
- 1 x X-plate with mounted X-limit switch and guide rail (not shown)



Attach the actuator to the X-plate with the 3 M3 cylinder head screws and one countersunk screw M3x12 as shown in the figure.
Position the countersunk screw at the inner position of the guide rail (see arrow).
The screws are provided with threadlocker varnish.
Align the actuator so that the cable exit points in the direction of the limit switch.

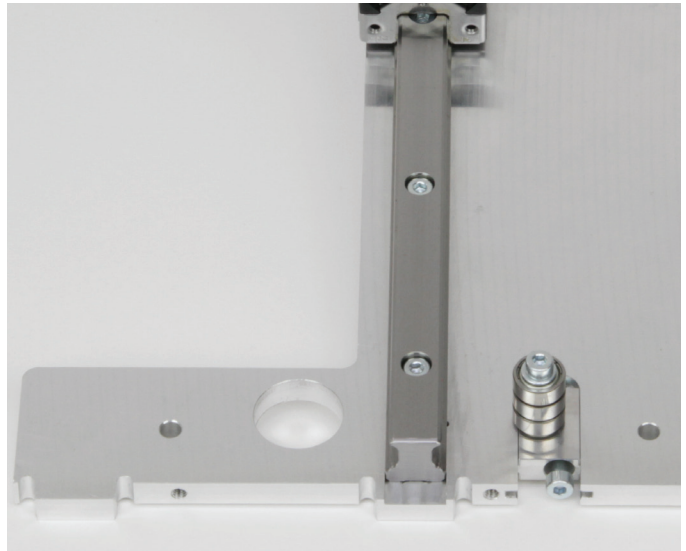


Please note! Since the countersunk screw was only changed during the production of the printer, a cylinder head screw is still installed in this position on a few following figures.

Installation of the belt tensioner



- 1 x belt tensioner assembly (with cylinder head screw **normal** head)
- 1 x cylinder head screw M4x30
- 1 x X-plate with mounted X-limit switch, guide rail and actuator (not in figure)

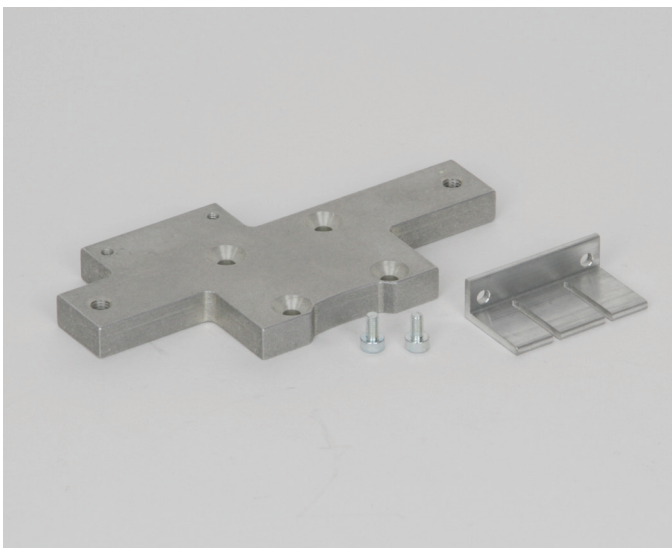


Push the belt tensioner into the cut-out of the X-plate as far as it will go.

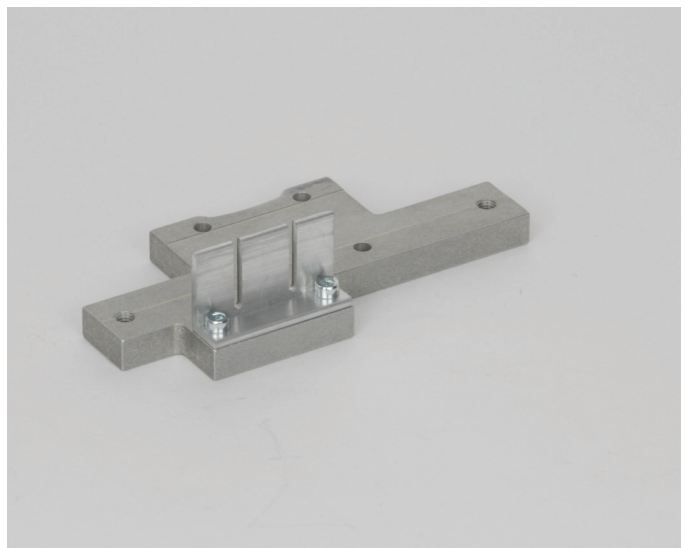
The belt tensioner must be aligned as shown in the figure. The hole in the belt tensioner basic body must be on the right and the ball bearings on the left in the direction of the guide rail.

Screw the M4 cylinder head screw into the basic body until it is in contact with the X-plate.

Mounting the belt holder on the guide carriage plate



- 1 x guide carriage plate
- 2 x cylinder head screw M3x6
- 1 x belt holder



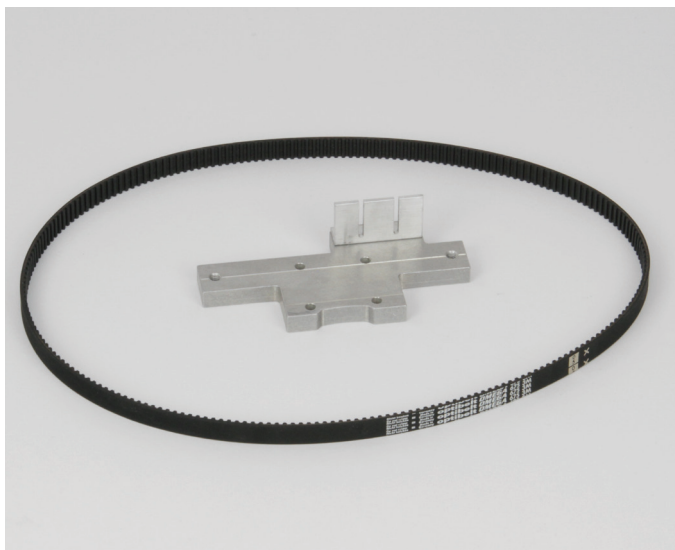
Place the guide carriage plate on your work surface so that the 4 countersinks are at the bottom.

Attach the belt holder to the bottom side of the guide carriage plate using the two M3 cylinder head screws.

Align the belt holder as shown in the figure.

The screws are provided with threadlocker varnish.

Application of the toothed belt

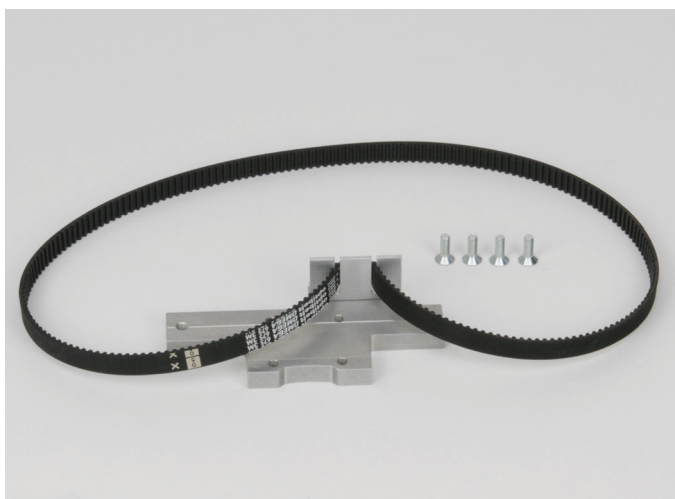


1 x guide carriage plate with mounted belt holder
1 x toothed belt 675 mm

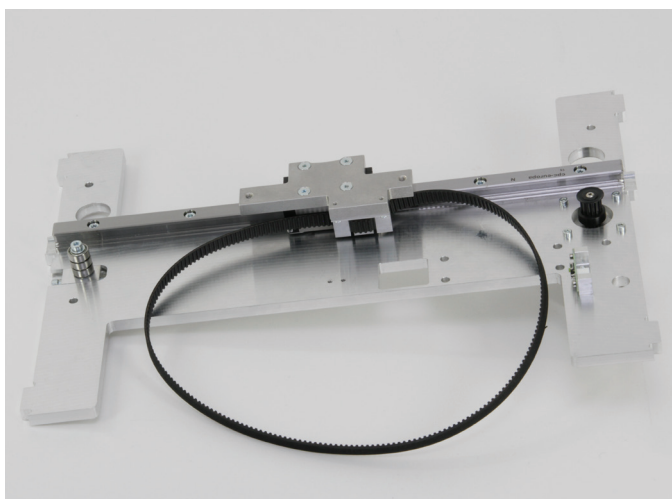


Insert the toothed belt into the belt holder as shown in the figure.
Press the toothed belt into the belt holder until the distance between the top and bottom of the belt is approximately the same.

Assembly of the guide carriage plate on the guide carriage

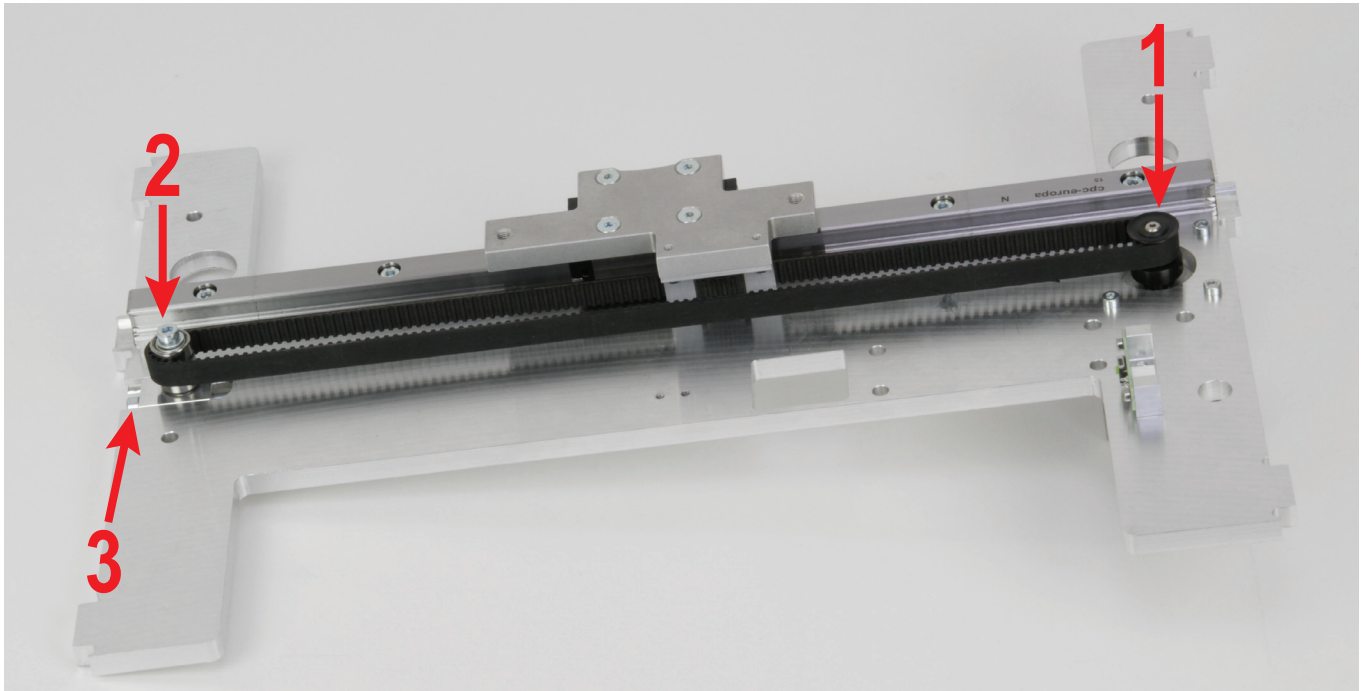


1 x guide carriage plate with mounted toothed belt
4 x countersunk head screw M4x10
1 x X-plate with mounted X-limit switch, guide rail, actuator and belt tensioner (not in figure)



Attach the guide carriage plate to the guide carriage with the 4 countersunk screws.
First loosely screw in all 4 screws and then tighten them crosswise.
The screws are provided with threadlocker varnish.
The guide carriage plate shall be aligned so that the toothed belt is on the side of the motor and belt tensioner.

Positioning and tensioning the toothed belt

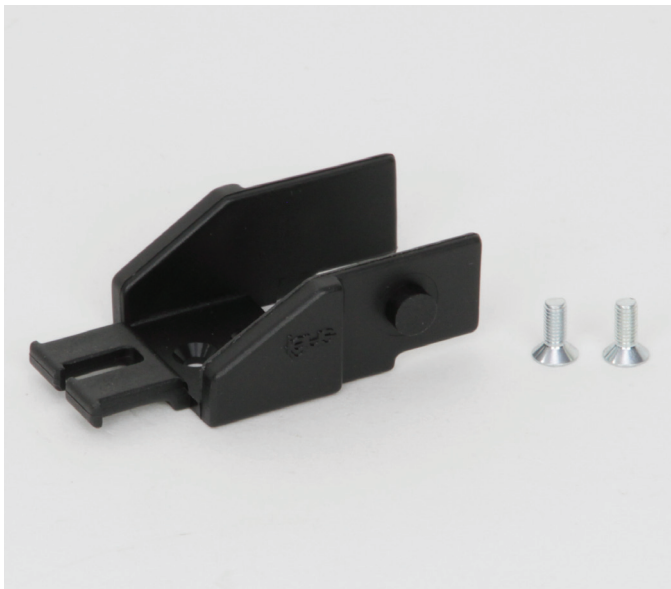


The belt tensioner must be completely relaxed!
Place the toothed belt first over the sprocket of the motor (1) and then over the ball bearings of the belt tensioner (2).
Tension the toothed belt by turning the M4 cylinder head screw in the belt tensioner basic body (3) until it can be easily turned by 180° with two fingers.

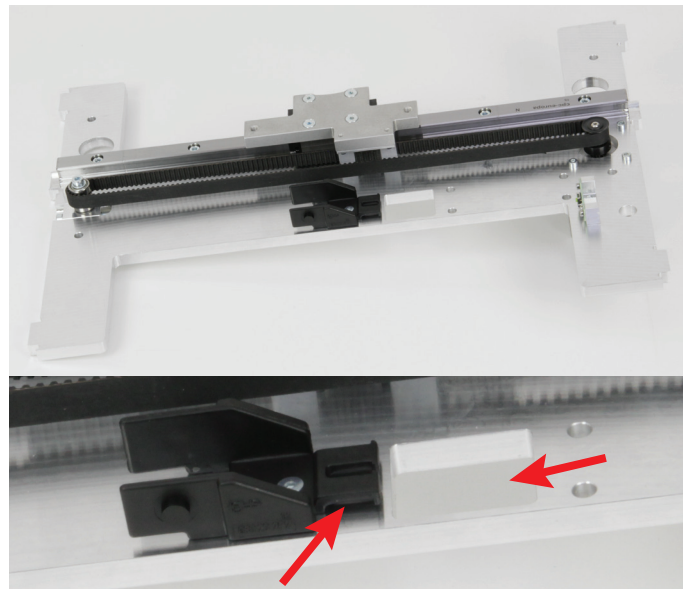
→ **Attention!** The toothed belt must not be tensioned too strongly. If the belt tensioner bends, the belt tension must be reduced under all circumstances.

A method for more precise adjustment of the belt tension can be found in the operating instructions (separate PDF) in chapter "21. Maintenance".

Assembly of the drag chain end piece



- 1 x large drag chain end piece with nipple
- 2 x countersunk screw M3x8
- 1 x X-plate with mounted X-limit switch, guide rail and guide carriage plate (not shown)



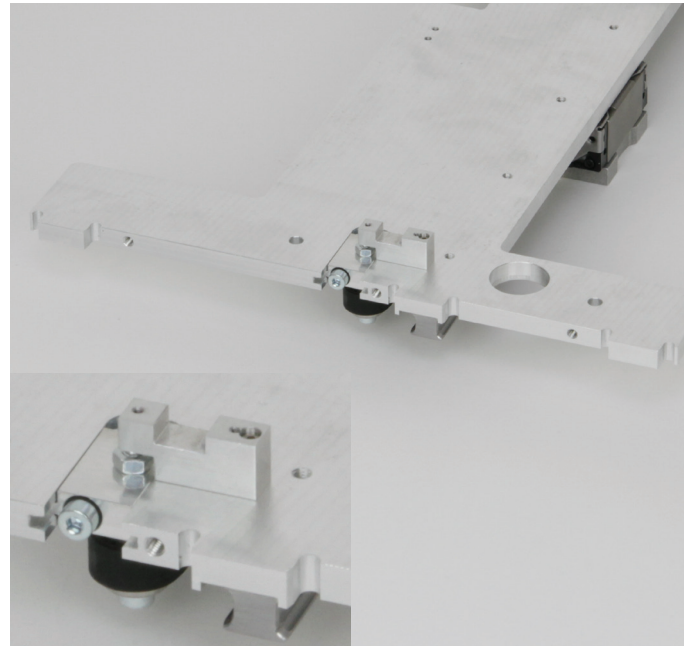
Attach the drag chain end piece to the X-plate as shown in the figure. The drag chain end piece must be aligned so that the attachment for the tension relief cable ties is immediately to the left of the square recess in the X-plate.

The screws are provided with threadlocker varnish.

Installation of the light barrier holding block

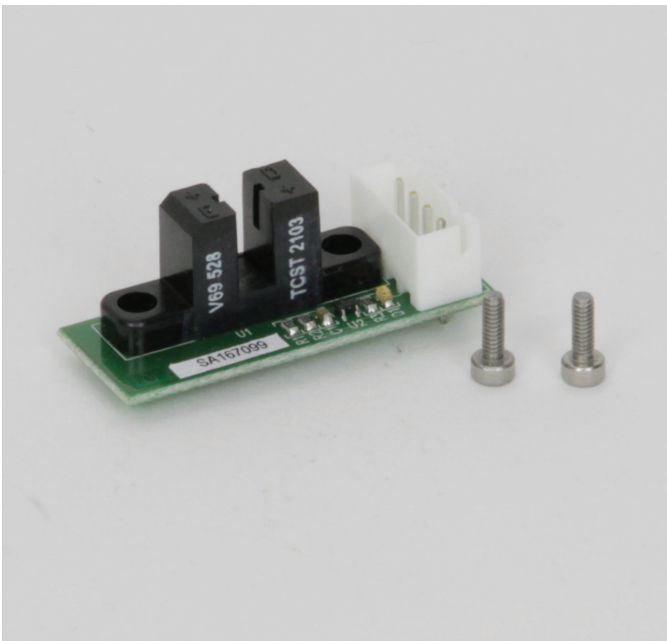


- 1 x light barrier holding block
- 1 x cylinder head screw M2x14
- 1 x X-plate with mounted X-limit switch, guide rail, guide carriage plate and drag chain end piece (not shown)

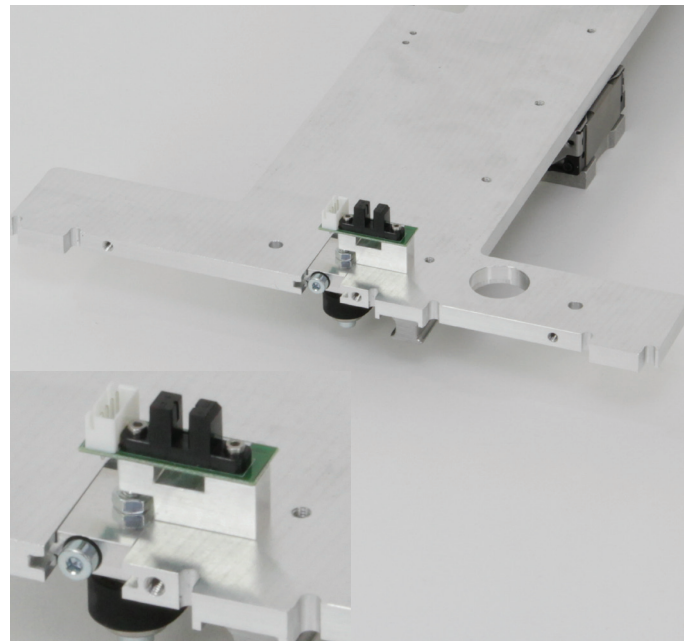


Turn the X-plate.
Attach the light barrier holding block to the bottom side of the X-plate with the M2 cylinder head screw as shown in the figure.
Make sure that the holding block is straight.
The recess at one end of the retaining block should be above the nut of the belt tensioner.
Apply a threadlocker varnish to the screw.

Mounting the light barrier



- 1 x light barrier
- 2 x cylinder head screw M2x6
- 1 x X-plate with mounted X-limit switch, guide rail, guide carriage plate and drag chain end piece (not shown)

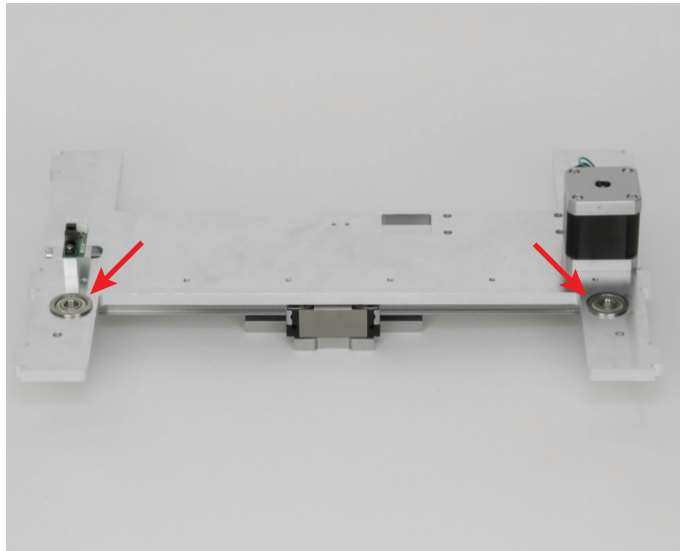


Attach the light barrier to the previously mounted light barrier holding block with the two M2 cylinder head screws as shown in the figure.
The connection socket must be on the side of the belt tensioner.

Inserting the grooved ball bearings



- 2 x grooved ball bearings
- 1 x X-plate with mounted X-limit switch, guide carriage plate and light barrier (not in figure)



Insert the grooved ball bearings on the bottom side into the corresponding holes in the X-plate.
Turn the grooved ball bearings slightly when inserting them into the bores and do not use force under any circumstances.
The flanges of the grooved ball bearings must be cleanly aligned with the bottom of the X-plate.

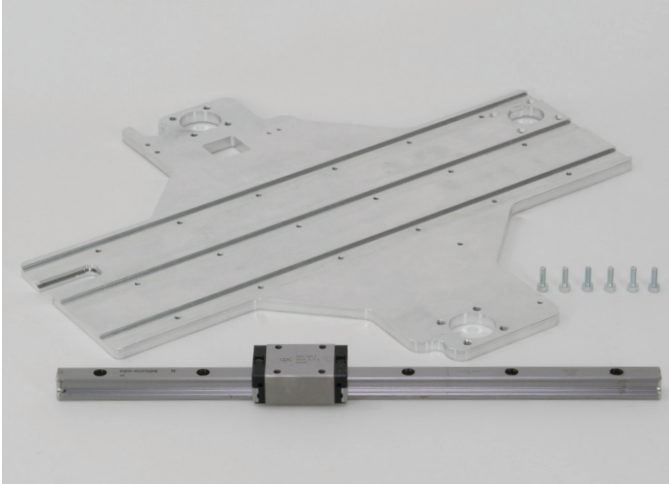
→ Since the two grooved ball bearings are only inserted into the X-plate from below, they may not be properly fixed in the bores due to the tolerances. If this is the case, you can also carry out this work step only during the assembly of the X-plate.

d) Assembly of the Y-plate

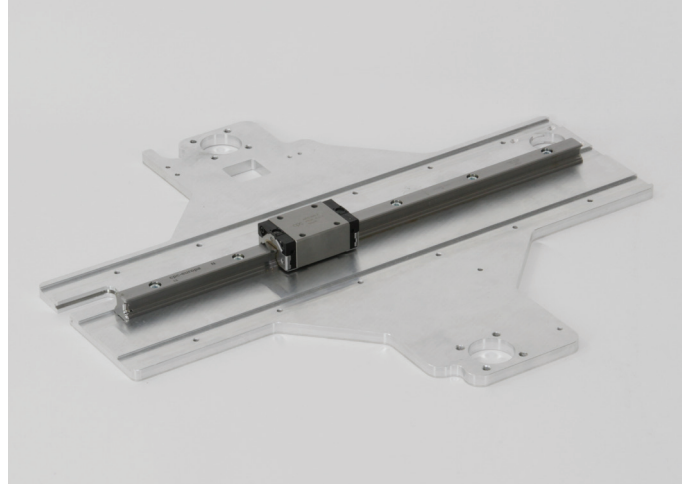
Mounting the guide rail



The guide carriage can generally be pushed off of the guide rail, since the bearing balls are combined in a chain. However, we recommend avoiding this if possible.



- 1 x Y-plate
- 1 x guide rail with guide carriage
- 6 x cylinder head screws M4x14

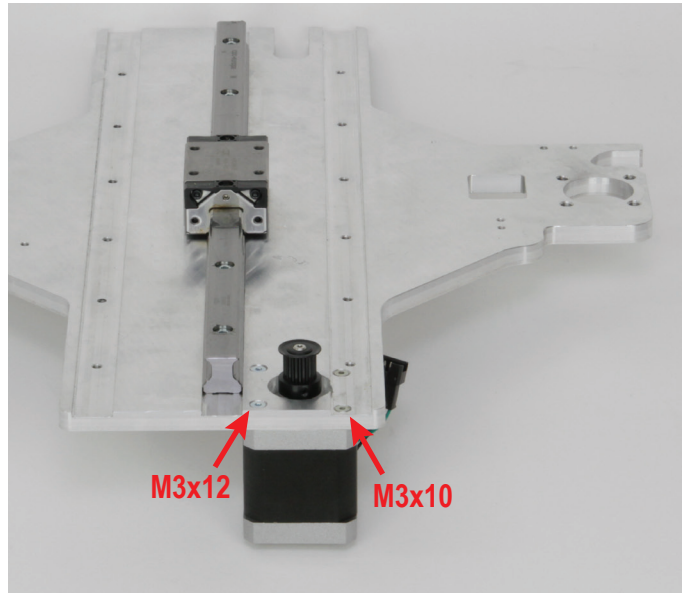


Insert the guide rail into the middle groove of the Y-plate and fasten it with the 6 M4 cylinder head screws. It does not matter how you align the guide rail.

Assembly of the actuator



- 1 x actuator with installed sprocket
- 2 x countersunk screw M3x10
- 2 x countersunk screw M3x12
- 1 x Y-plate with mounted guide rail (not shown)



Attach the actuator to the Y-plate with the 4 countersunk screws as shown in the figure.

The two countersunk screws M3x12 belong to the left side (from the figure view) at the guide rail and the two M3x10 belong to the right side in the groove.

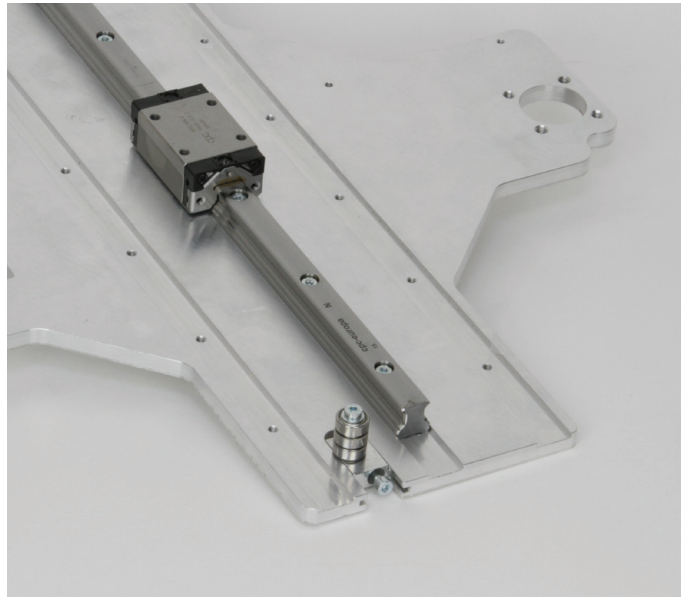
The screws are provided with threadlocker varnish.

Align the actuator so that the cable exit points to the middle of the Y-plate (i.e. backwards in the figure).

Installation of the belt tensioner



- 1 x belt tensioner assembly (with cylinder head screw **flat** head)
- 1 x cylinder head screw M4x30
- 1 x Y-plate with mounted guide rail and actuator (not shown)

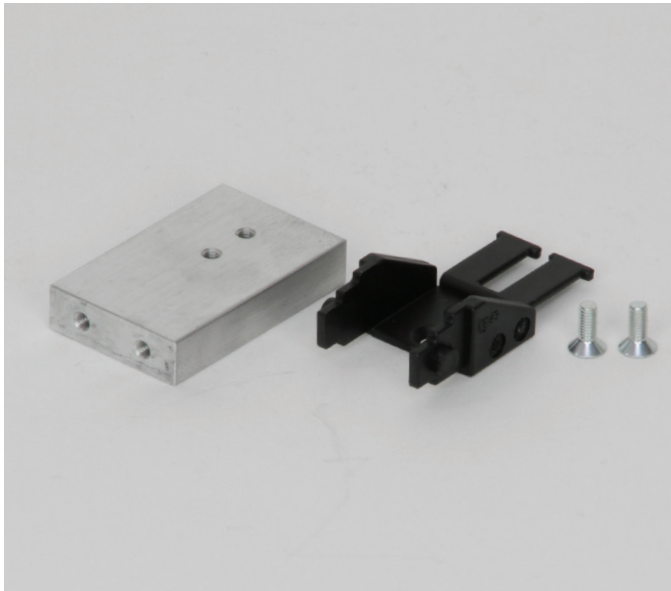


Push the belt tensioner into the cut-out of the Y-plate as far as it will go.

The belt tensioner must be aligned as shown in the figure. The hole in the belt tensioner basic body must be on the right and the ball bearings on the left in the direction of the guide rail.

Screw the M4 cylinder head screw into the basic body until it is in contact with the Y-plate.

Assembling the drag chain holding block



- 1 x drag chain holding block
- 1 x drag chain end piece with nipple
- 2 x countersunk screw M3x8

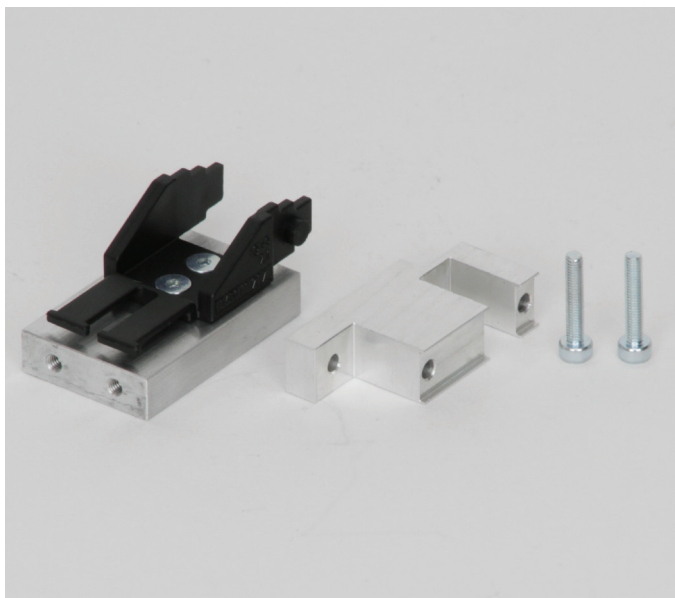


Attach the drag chain end piece to the holding block as shown in the figure.

The drag chain end piece must be aligned on the holding block so that the attachment for the tension relief cable ties points in the direction of the two holes on the bottom side.

The screws are provided with threadlocker varnish.

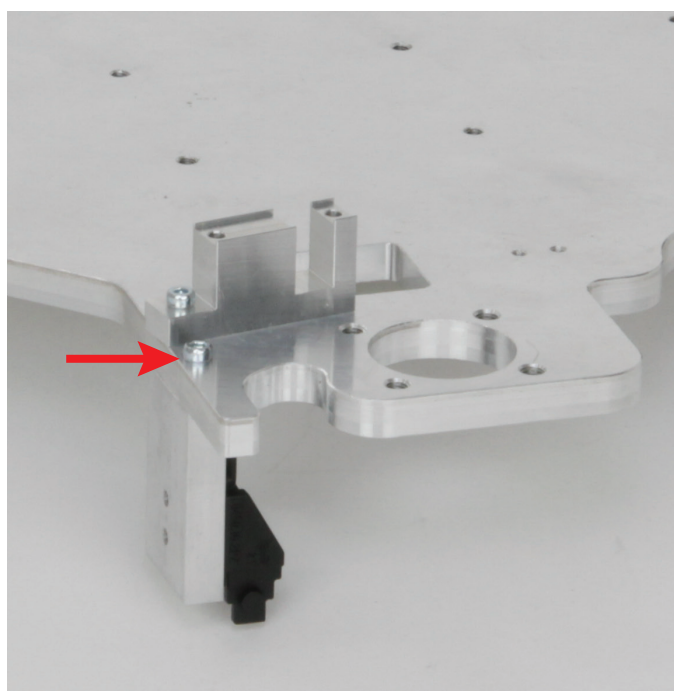
Assembly of the drag chain and limit switch holding block



- 1 x assembled drag chain holding block
- 1 x limit switch holding block
- 2 x cylinder head screw M3x16



Attach the drag chain holding block to the top of the Y-plate (on the side where the guide rail is mounted) using one of the two M3 cylinder head screws.
Turn the screw loosely into the hole on the outside (red arrow in the right figure).
Apply a threadlocker varnish to the screw.

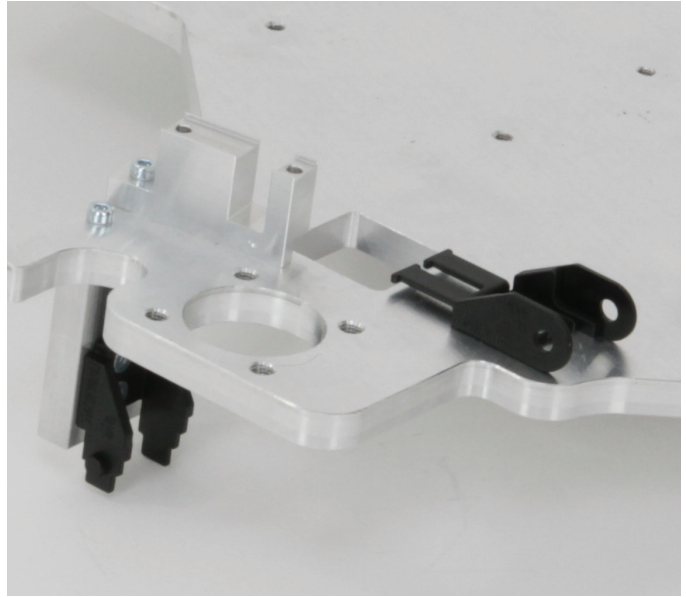


Now fasten the limit switch holding block at a slight angle (so that the nut of the ball-threaded drive still has space next to it) with the second M3 cylinder head screw on the bottom side of the Y-plate.
Turn the screw loosely into the second hole of the drag chain holding block.
Apply a threadlocker varnish to the screw.
Align the drag chain holding block straight with the Y-plate and tighten both screws.

Mounting the drag chain end piece on the bottom side



- 1 x drag chain end piece with hole
- 2 x countersunk screw M3x8

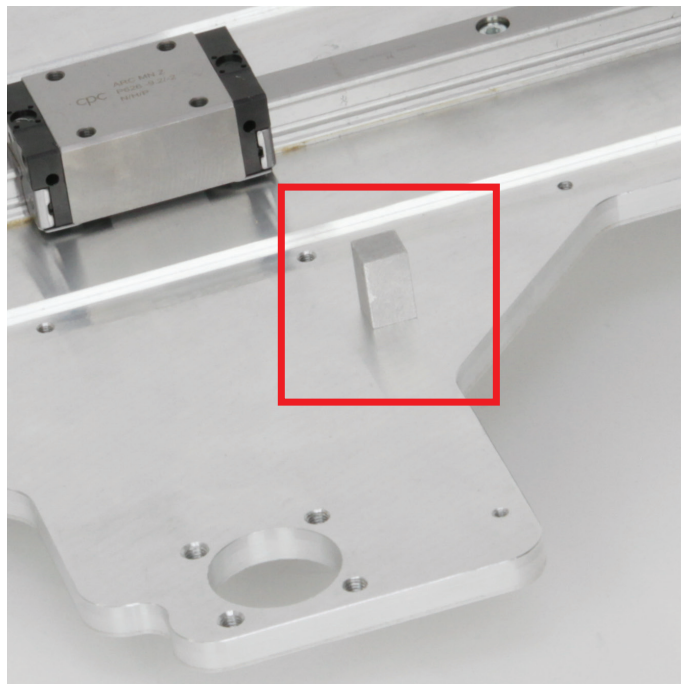


Attach the drag chain end piece to the bottom side of the Y-plate using the two M3 countersunk head screws as shown in the figure. The screws are provided with threadlocker varnish.

Mounting the actuator for the Y-limit switch



- 1 x actuation for limit switch
- 1 x cylinder head screw M3x12

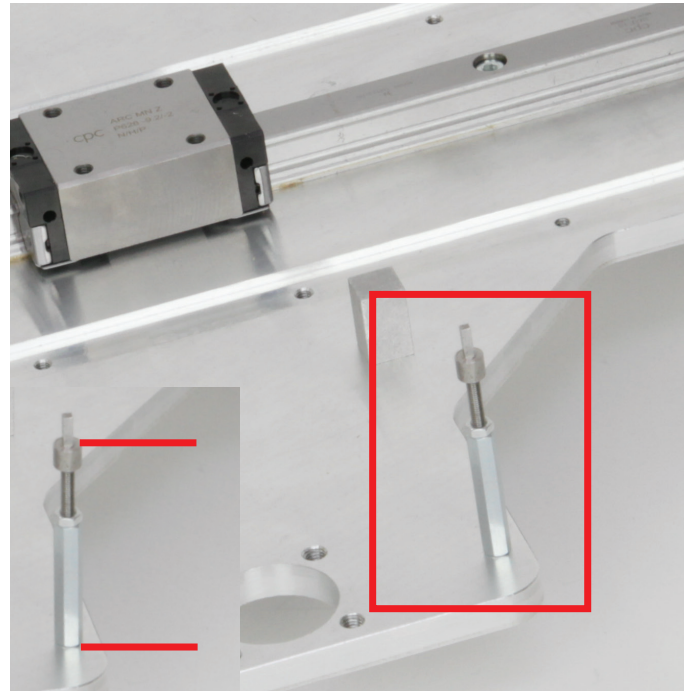


Attach the actuator for the Y-limit switch to the top of the Y-plate as shown in the figure. Apply a threadlocker varnish to the screw. The actuator must be aligned straight to the Y-plate. As soon as you have mounted the table, please check whether the actuator hits the limit switch correctly and readjust it if necessary.

Mounting the actuator for the Z-limit switch



- 1 x hexagon threaded bolt M3, length 36 mm
- 1 x actuation for Z-stop M3
- 1 x nut M3

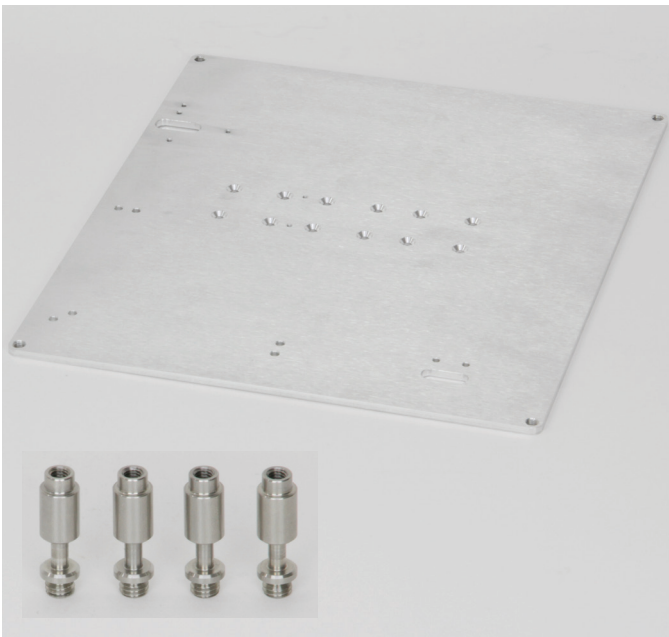


Turn the hexagon threaded bolt M3 into the Y-plate from above as shown in the figure.

Then turn the actuation for the Z-limit switch into the hexagon threaded bolt and counter it lightly with the nut.

The total length of the hexagon threaded bolt with the actuation screwed in should be 55 mm between the upper edge of the Y-plate and the actuation (upper edge of the round part, without square) (see small figure).

Mounting the spacer bolts on the undertable



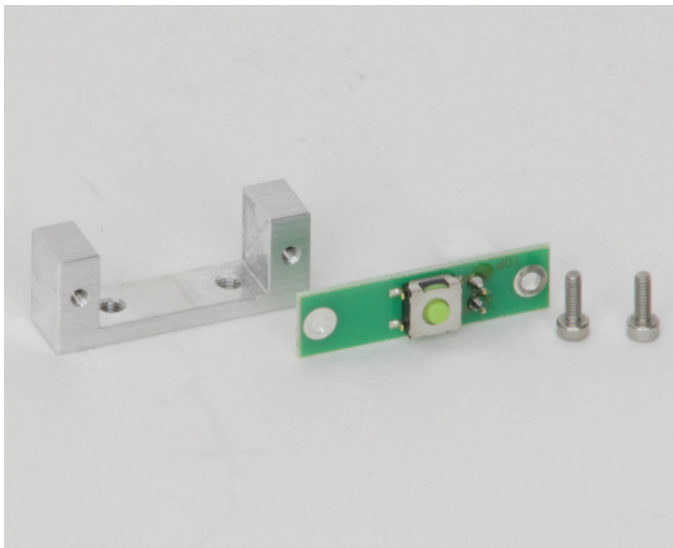
- 1 x undertable
- 4 x spacer bolts stainless steel (Attention! These are proportional to the undertable slightly larger)



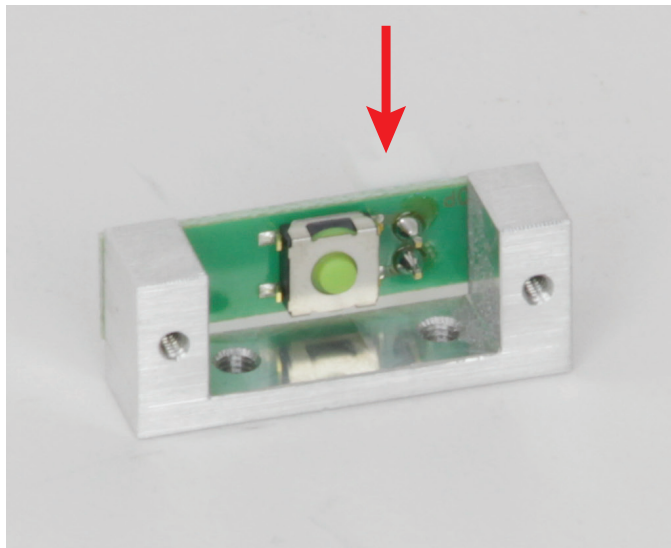
Screw the 4 spacer bolts into the upper side of the undertable (side with the countersunk holes) as shown in the figure.

Tighten them carefully with pliers and a cloth (to protect the spacer bolts).

Assembly of the Y-limit switch



- 1 x holder for limit switch
- 1 x limit switch PCB
- 2 x cylinder head screw M2x6



Mount the limit switch PCB to the holder using the two M2x6 screws as shown in the figure.
The PCB must be screwed onto the holder from behind. Align the PCB so that the connector is on the right as shown in the figure (see arrow in the figure).

Mounting the Y-limit switch on the undertable

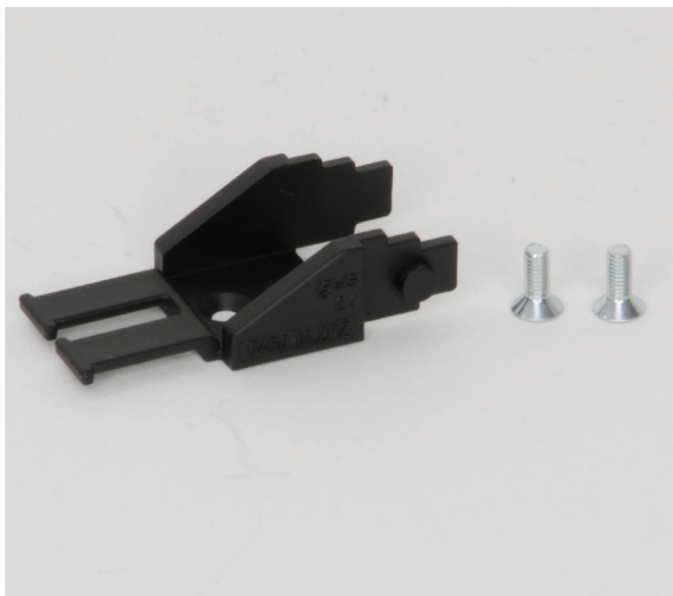


- 1 x limit switch with holder
- 2 x cylinder head screw M3x8
- 1 x undertable with mounted spacer bolts (not in figure)

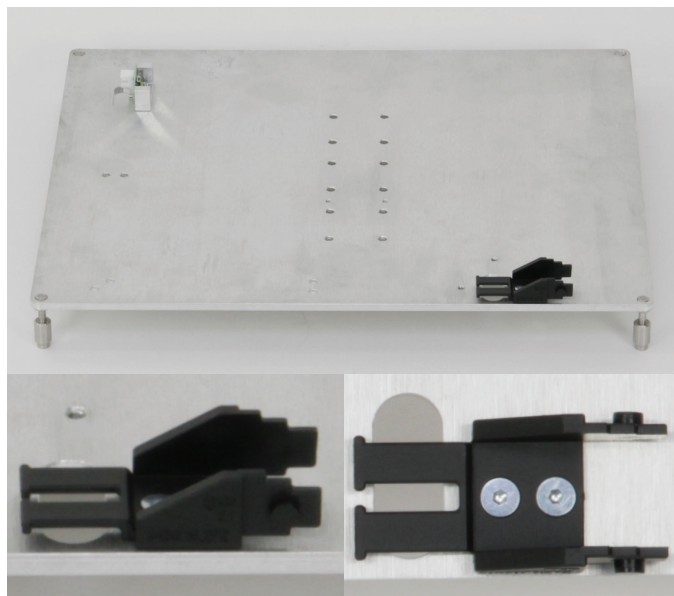


Turn the undertable over so that it rests on the 4 spacer bolts.
Fix the limit switch with the two M3 cylinder head screws to the bottom side of the undertable (in the figure the upper side).
Align the limit switch as shown in the figures.
The small figure on the left shows an enlargement, the small figure on the right the top view.
The screws are provided with threadlocker varnish.

Assembly of the drag chain end piece on the undertable

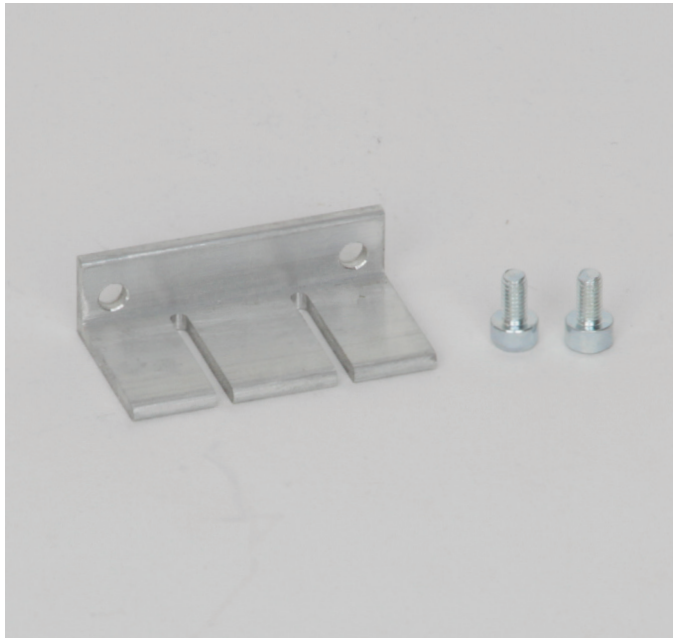


- 1 x drag chain end piece with nipple
- 2 x countersunk screw M3x8
- 1 x undertable with mounted spacer bolts and limit switch (not shown)

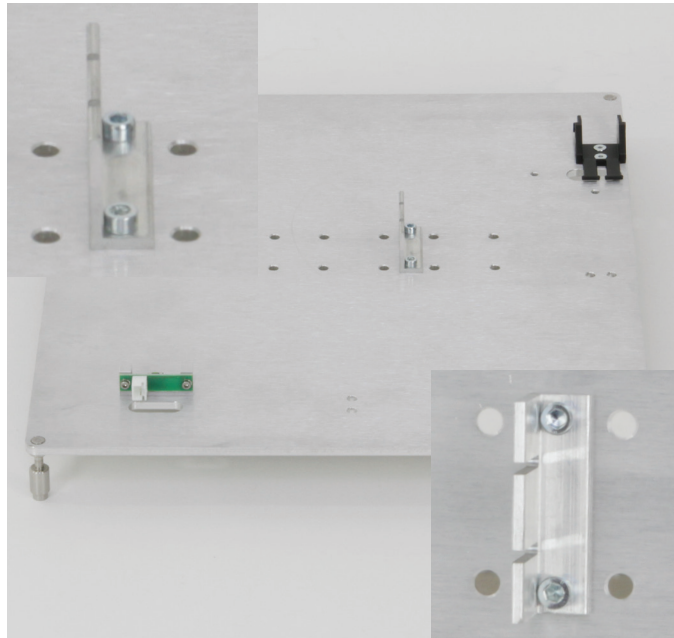


Attach the drag chain end piece to the bottom side of the undertable with the two M3 countersunk head screws as shown in the figure (the upper side in the figure).
Align the drag chain end piece as shown in the figures.
The small figure on the left shows an enlargement, the small figure on the right the top view.
The screws are provided with threadlocker varnish.

Mounting the belt holder on the undertable



- 1 x belt holder
- 2 x cylinder head screw M3x6
- 1 x undertable with mounted spacer bolts, limit switches and drag chain end piece (not in figure)

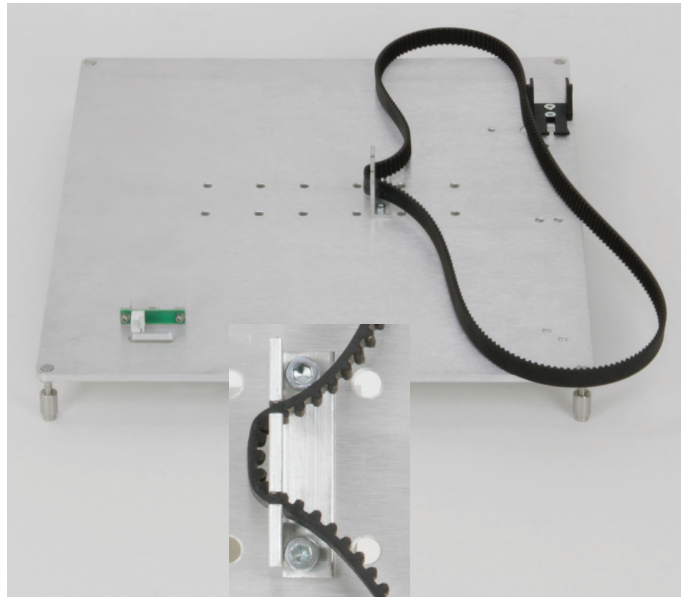


Attach the belt holder with the two M3 cylinder head screws, as shown in the figure, to the bottom side of the undertable (upper side in the figure).
Align the belt holder so that the comb points in the direction of the limit switch.
The small figure on the upper left shows an enlargement, the small figure on the lower right the top view.
The screws are provided with threadlocker varnish.

Application of the toothed belt

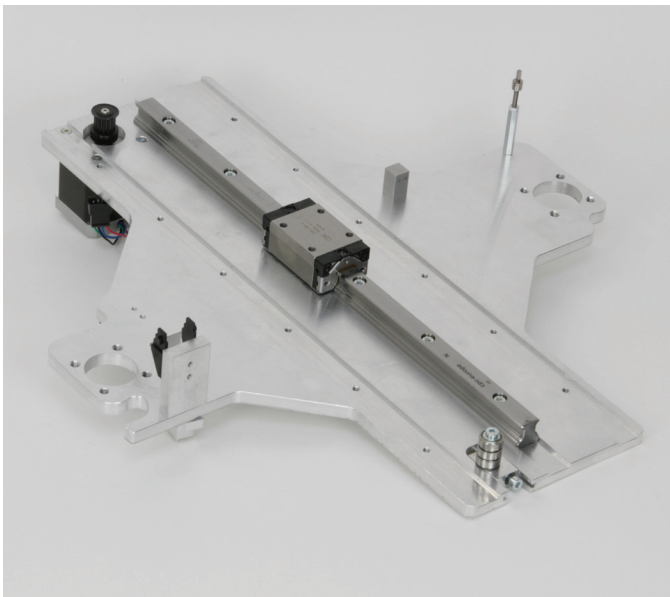


- 1 x toothed belt 753 mm
- 1 x undertable with mounted spacer bolts, limit switch, drag chain end piece and belt holder (not in figure)

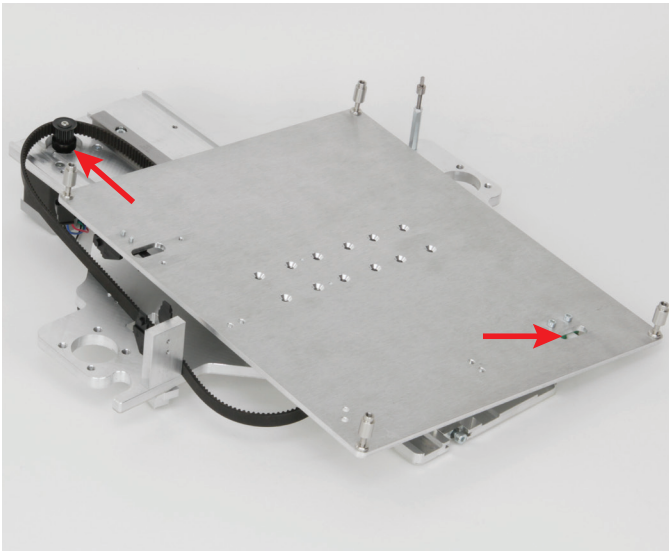


Insert the toothed belt into the belt holder as shown in the figure. Press the toothed belt into the belt holder until the distance between the top and bottom of the belt is approximately the same. The small figure shows the top view.

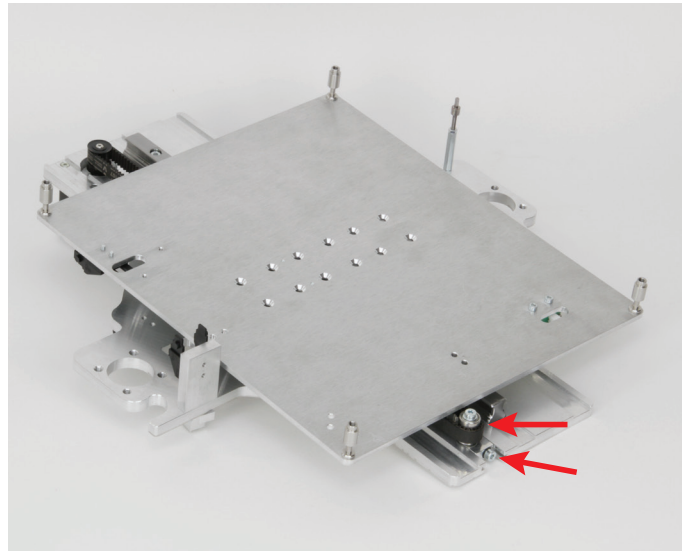
Mounting the undertable on the Y-plate



- 1 x Y-plate mounted
- 1 x undertable mounted
- 4 x countersunk screw M4x8 (Attention! These are shown somewhat larger in relation to Y-plate resp. undertable)

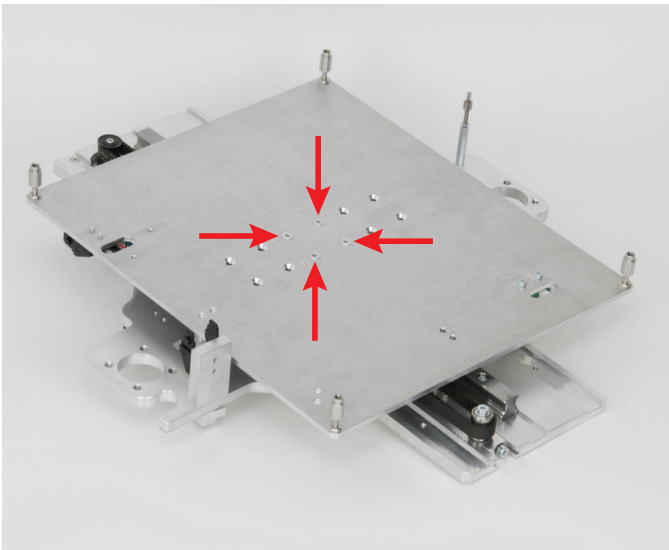


First slide the guide carriage approx. into the middle of the guide rail. Place the undertable on the Y-plate and attach the toothed belt to the top of the motor knurl.



Now place the toothed belt below over the ball bearings of the belt tensioner (upper arrow in the figure). This must be completely relaxed.

Tension the toothed belt slightly by turning the M4 cylinder head screw in the belt tensioner basic body (lower arrow in the figure).



Attach the undertable to the guide carriage of the Y-plate using the 4 countersunk screws in the 4 centre holes.

Make sure that you really get all 4 holes on the guide carriage.

Apply a threadlocker varnish to the screws.

Tighten the screws slightly.

To check whether the undertable is mounted straight, set the complete Y-plate upright and hold the undertable in place.

The edge on which the belt tensioner is located must be at the bottom and supported on a straight surface.

Carefully lower the undertable. If it is not completely in contact with the surface such as the Y-plate, loosen the 4 countersunk screws and readjust the undertable.

Then tighten the screws crosswise.

Finally tighten the toothed belt correctly.

To do this, turn the M4 cylinder head screw in the belt tensioner basic body again until it can be easily turned by 180° with two fingers.

➔ **Attention! The toothed belt must not be tensioned too strongly. If the belt tensioner bends, the belt tension must be reduced under all circumstances.**

A method for more precise adjustment of the belt tension can be found in the operating instructions (separate PDF) in chapter "21. Maintenance".

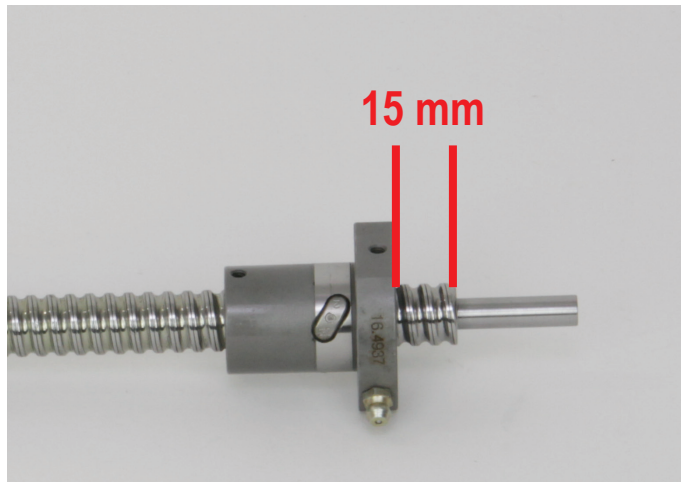
Installing the ball-threaded drives



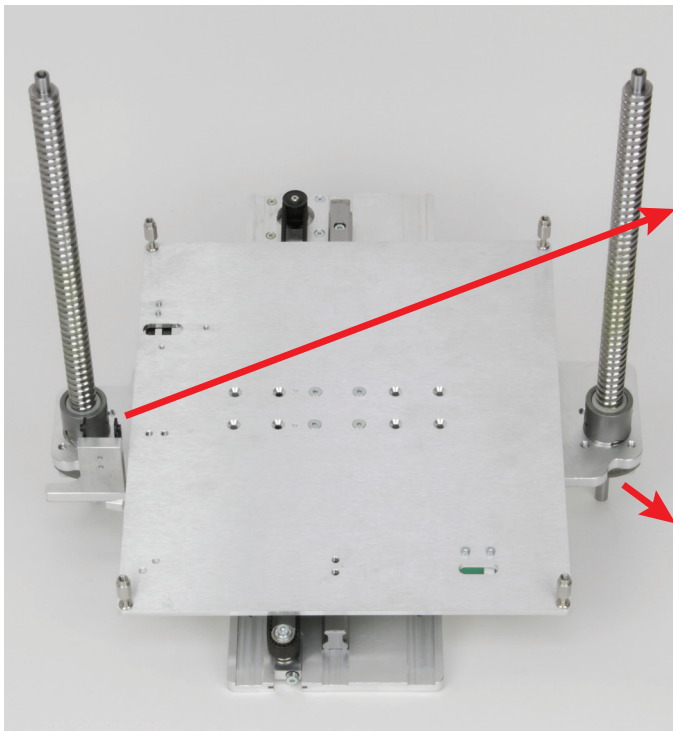
The nuts must never be removed from the ball-threaded drives, since the bearing balls would fall out otherwise. This would be irreparable. Loss of guarantee/warranty!



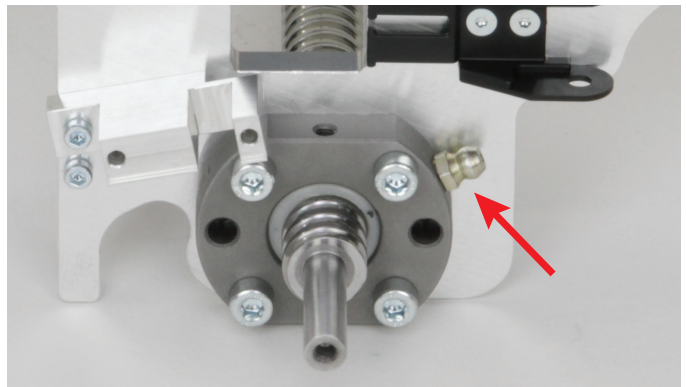
2 x ball-threaded drive
8 x cylinder head screw M5x16
1 x Y-plate mounted (not in figure)



First turn both nuts of the ball-threaded drives downwards until approx. 15 mm of residual thread remains (see figure).



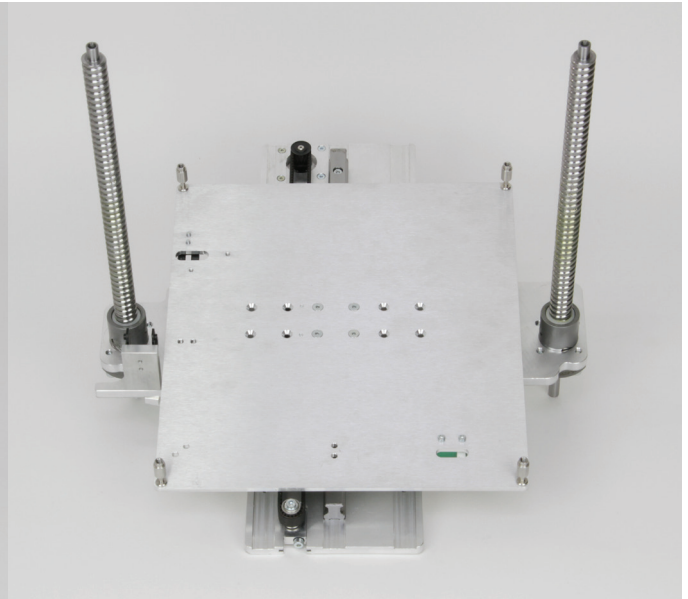
Insert both ball-threaded drives into the corresponding holes of the Y-plate **from below**, as shown in the figure. Fasten them to the Y-plate from below using 4 M5 cylinder head screws each. Only turn on the screws loosely by hand here, however.



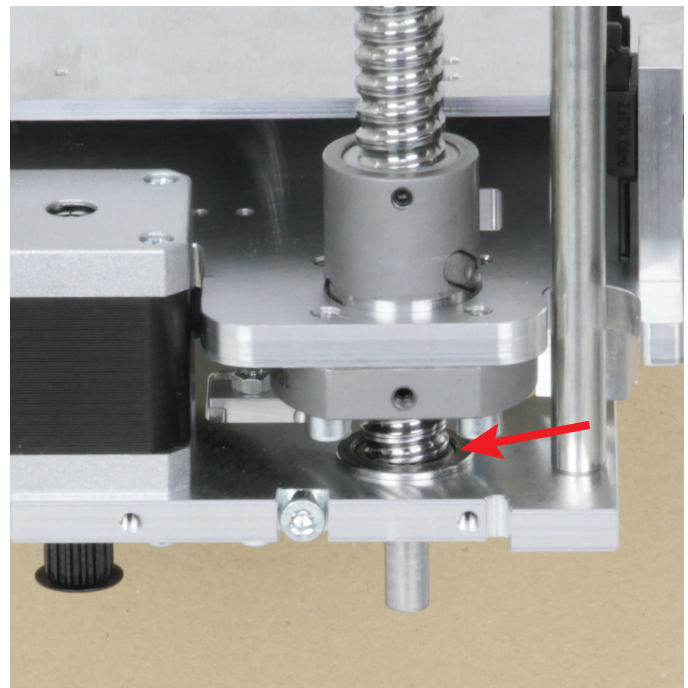
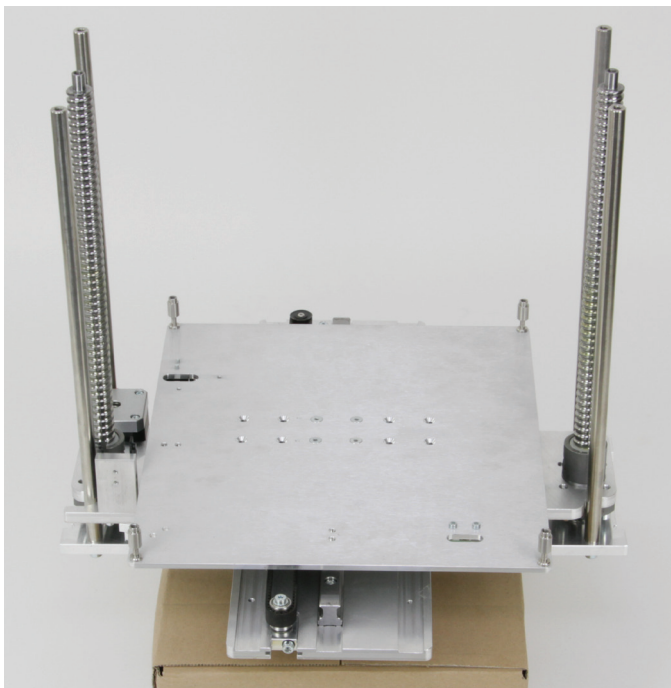
Observe the position of the lubrication nipples. They must both point to the inside of the device. The flattened sides of the attachments must end flush with the outer edge of the Y-plate.

e) Assembly of the mechanical basic construction

Connection of the bottom plate to the Y-plate



1 x bottom plate mounted
1 x Y-plate mounted



When inserting the ball-threaded drives into the ball bearings of the bottom plate, make sure that the spindles are screwed out exactly the same distance and are not displaced against each other. If this is not the case, check the previously set 15 mm and, if necessary, readjust by turning the ball-threaded drives. Thread the cut-out on the left side of the Y-plate into the spacer of the bottom plate. Then carefully insert the two ball-threaded drives into the two bearings of the bottom plate.

The ball-threaded drives must be cleanly flush against the grooved ball bearings in the bottom plate after assembly (see small figure).

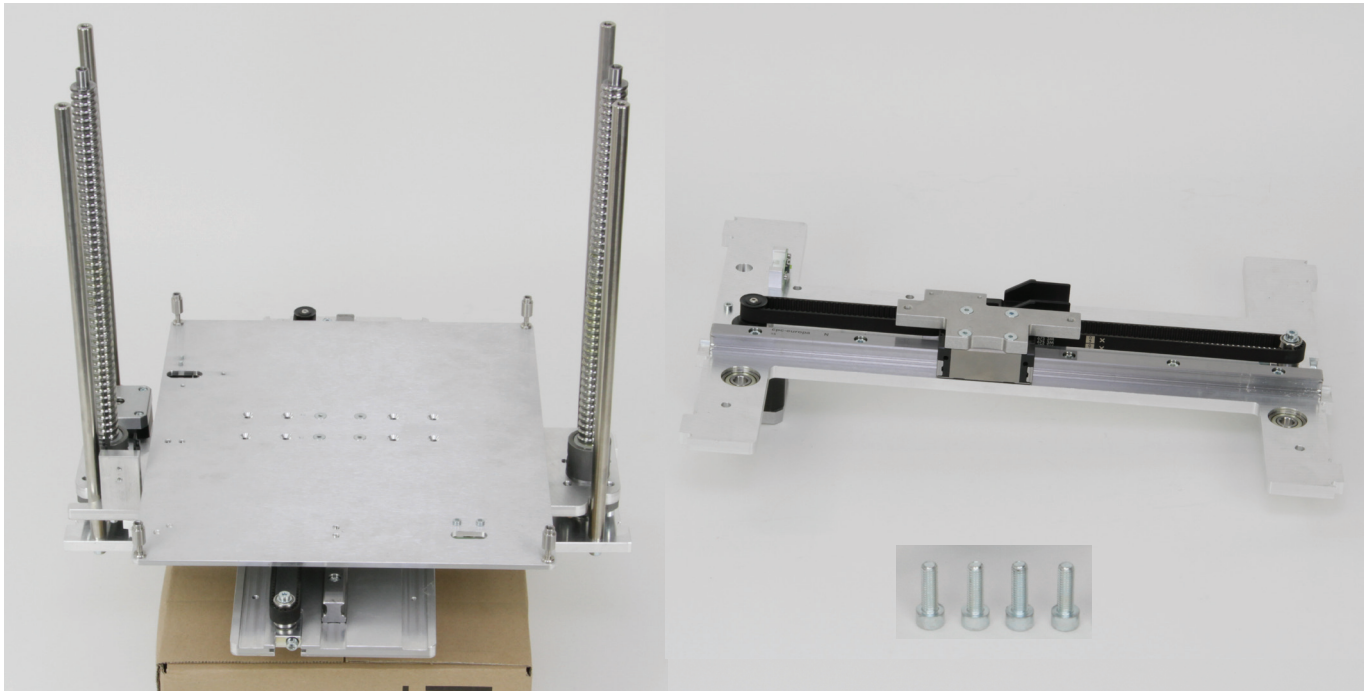
→ **Attention! If the ball-threaded drives do not slide into the bearings without force, please refer to the next figure. If the assembly has worked, you can skip the next figure.**



If the ball-threaded drives do not slide into the bearings without force, remove the two ball-threaded drives and the two bearings from the bottom plate and slide the bearings onto the ball-threaded drives first. The flange of the ball bearing must be aligned with the nut of the respective ball-threaded drives.

After assembly, the grooved ball bearings must cling neatly at the beginning of the thread of the ball-threaded drives (see left figure).

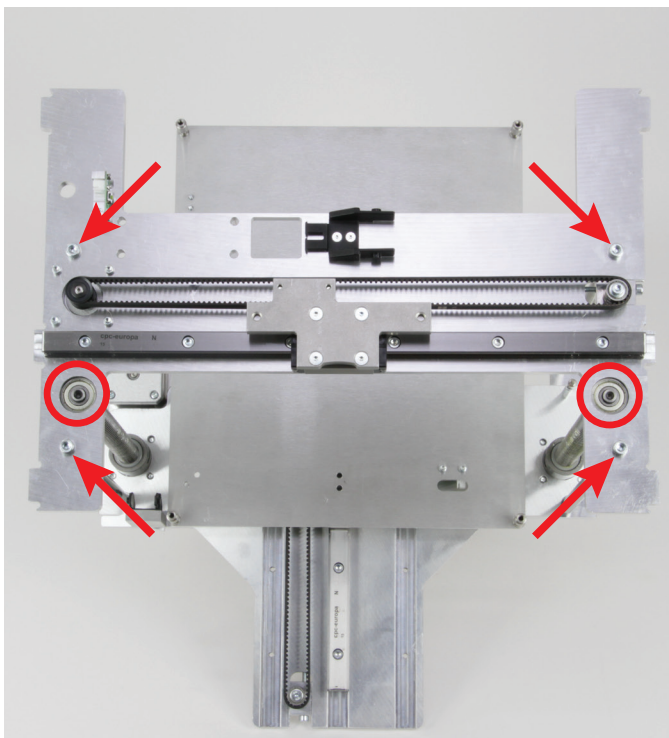
Assembly of the X-plate



1 x basic frame (bottom plate with Y-plate)

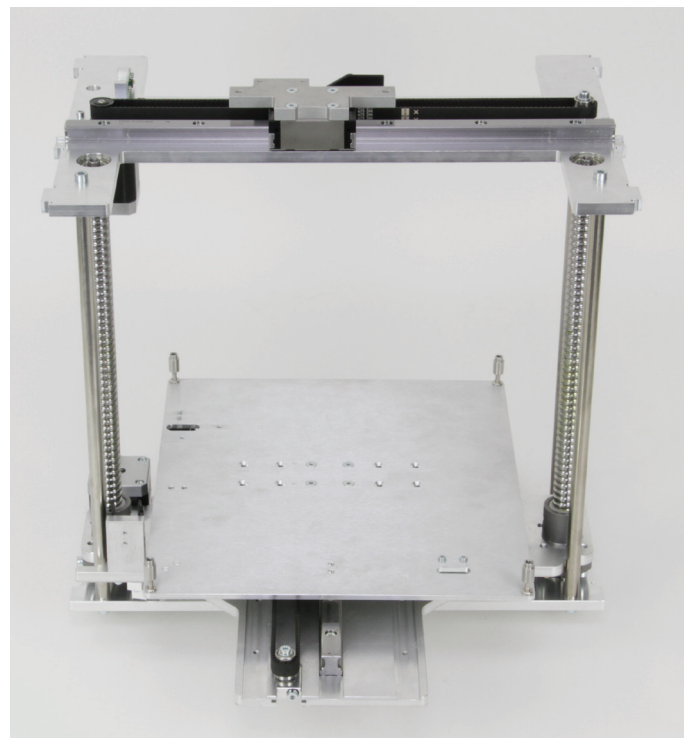
1 x X-plate

4 x cylinder head screw M5x16 (Attention! These are shown slightly larger in proportion)



Slide the X-plate onto the basic frame consisting of bottom plate and Y-plate and fasten it to the 4 spacers using the 4 cylinder head screws (see arrows in the figure).

Apply a threadlocker varnish to the screws.

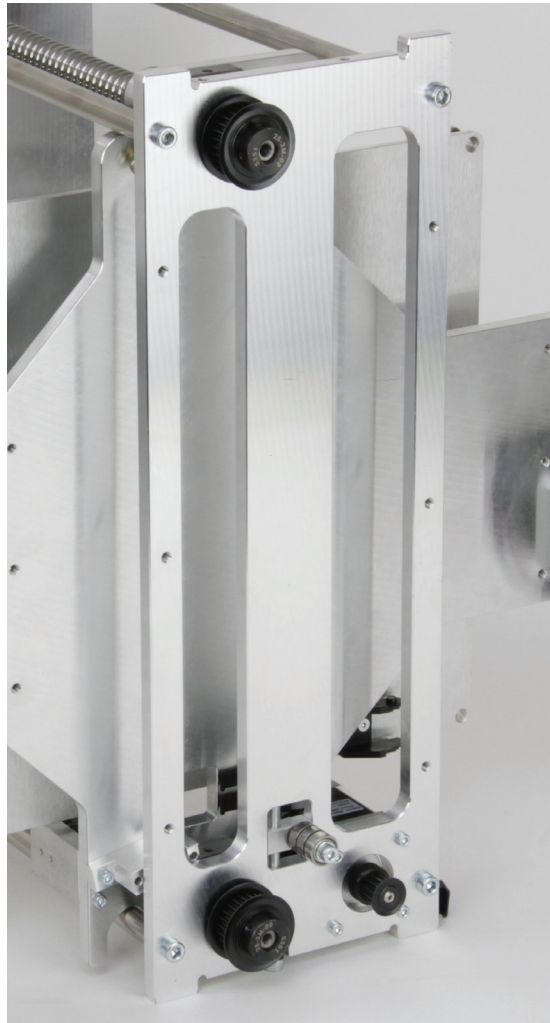


The ball-threaded drives should cling neatly at the grooved ball bearings in the X-plate after assembly.

Assembly of sprockets on ball-threaded drives



- 1 x basic frame
- 2 x sprocket 28Z (outer diameter 32 mm)
- 4 x threaded pins M3x5



Slide the sprockets onto the ends of the ball-threaded drives and secure them with the threaded pins.

Align the sprockets so that the tooth surfaces run in a plane with the tooth surface of the motor pinion.

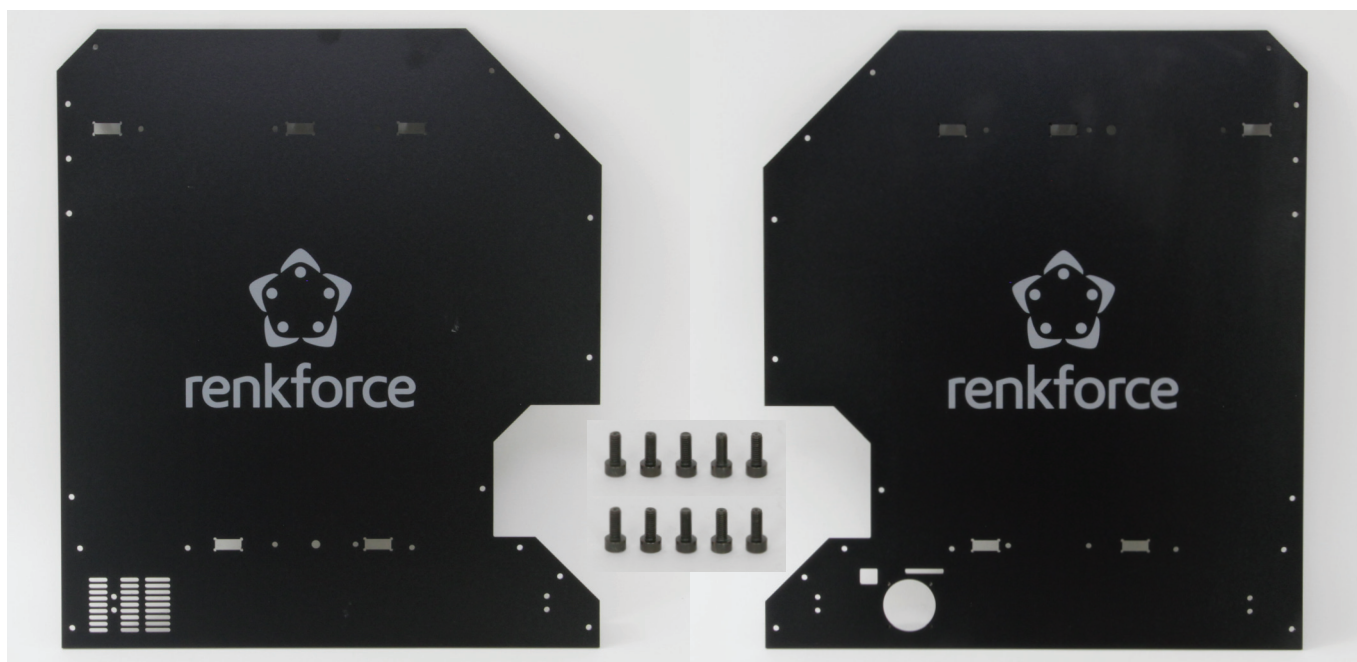
→ **Attention!** It is irrelevant how you mount the two large sprockets. However, it is important that you mount both of them the same way and that the tooth surfaces of the two sprockets are aligned with the sprocket of the motor. If necessary, simply correct the position of the sprocket on the Z motor.

If you point the side with the threaded pins towards the bottom plate, remember that you will have to tighten the threaded pins later when the side parts are mounted. If you mount the sprockets the other way round, the threaded pins must still hit the shaft!

Important! Attach the sprocket that is **not** at the motor (the upper one in the figure) only slightly with a threaded pin to keep it from falling out. Otherwise, a burr would be created by the tip of the threaded pin, so that the sprocket can no longer be moved. Screw in the second threaded pin loosely.

The threaded pins of the sprocket on the motor are to be coated immediately with thread-locker varnish, the threaded pins of the other sprocket only later when tightening.

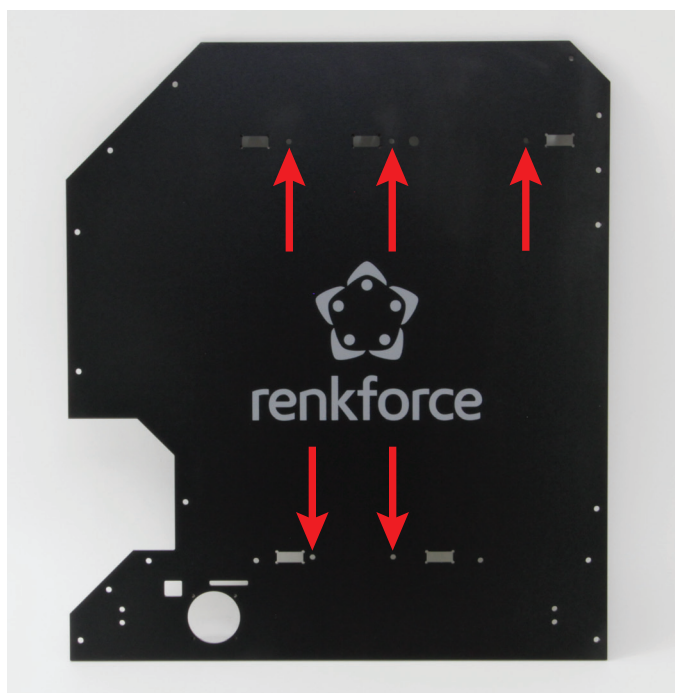
Assembly of the side parts



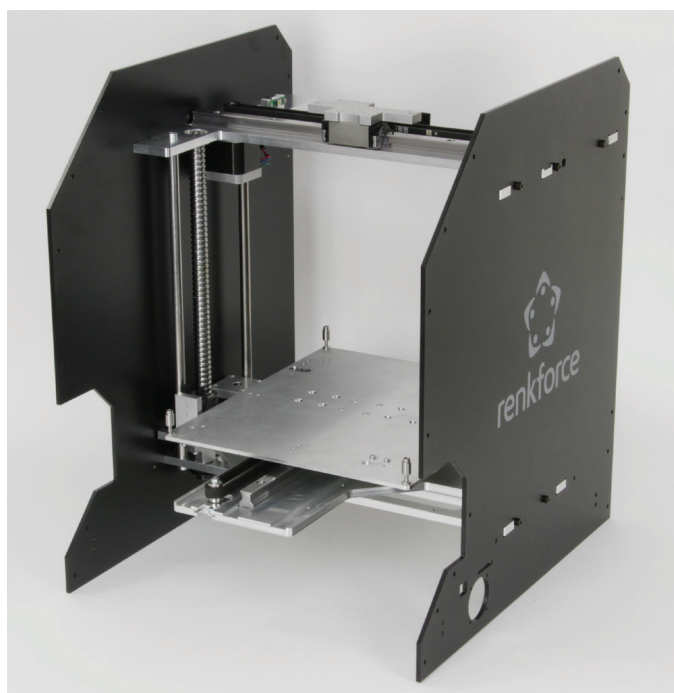
1 x side part left

1 x side part right

10 x cylinder head screw M4x10 black (Attention! These are shown slightly larger in relation to the side parts)



The side parts must be fastened to the basic frame with the 5 marked holes (see arrows in the figure).



Attach the side parts to the left and right of the basic frame and fasten them with 5 cylinder head screws each.

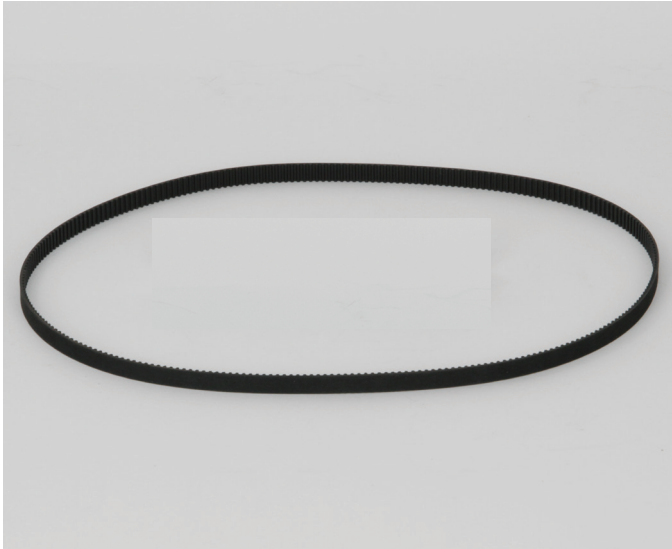
Mount the side part with the opening for the fan on the right side.

The lugs on the bottom plate and X-plate must be inserted into the openings in the side parts.

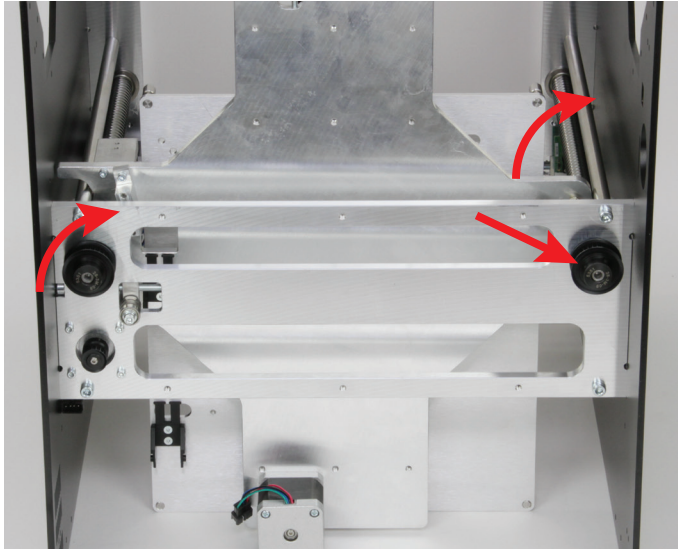
If this is not possible without force, loosen the 4 M5 cylinder head screws with which the X-plate is screwed to the 4 spacers.

Note: The side parts are sensitive to scratching!

Application of the toothed belt



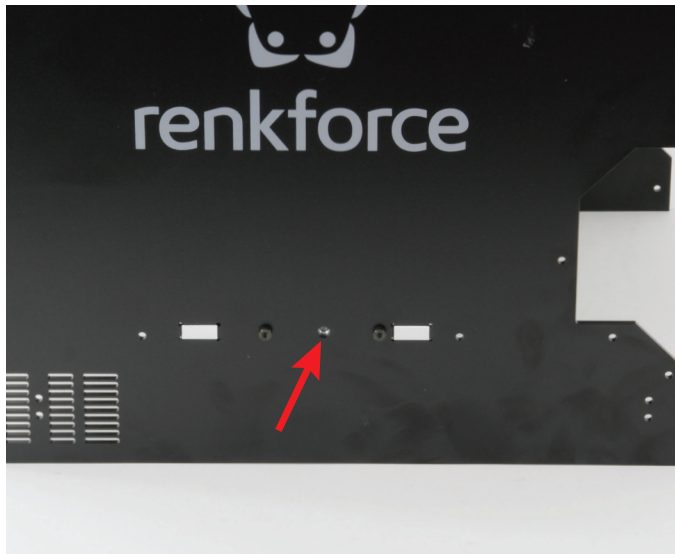
1 x toothed belt 816 mm



Tilt the basic frame backwards (do not turn it upside down). By turning the left sprocket and the right ball-threaded drive, align the Y-plate so that it is reasonably straight.

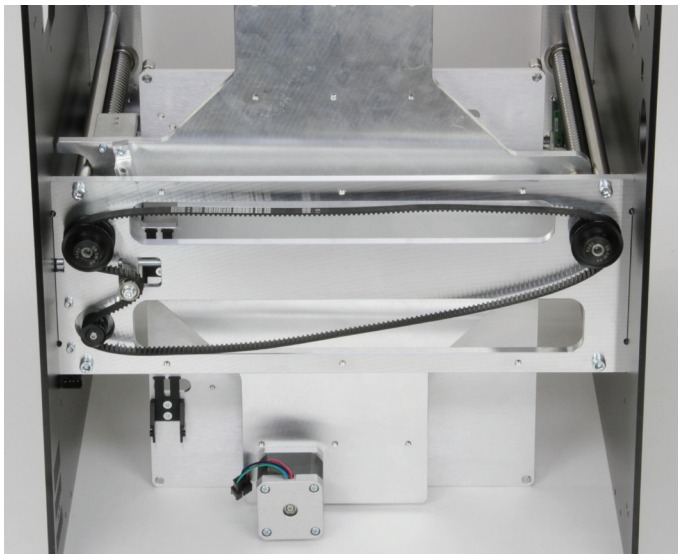
In addition, the threaded pin that you have lightly tacked on beforehand (straight arrow in the figure) must be accessible.

Loosen this threaded pin so that the sprocket can be turned again.



Before continuing, the belt tensioner must be fully released. To do this, turn the adjusting screw of the belt tensioner (outside on the left-hand side) to the right until the belt tensioner is at the far left (on the side of the motor knurl).

The toothed belt is also tensioned again later using this screw. For this you have to turn the screw to the left.



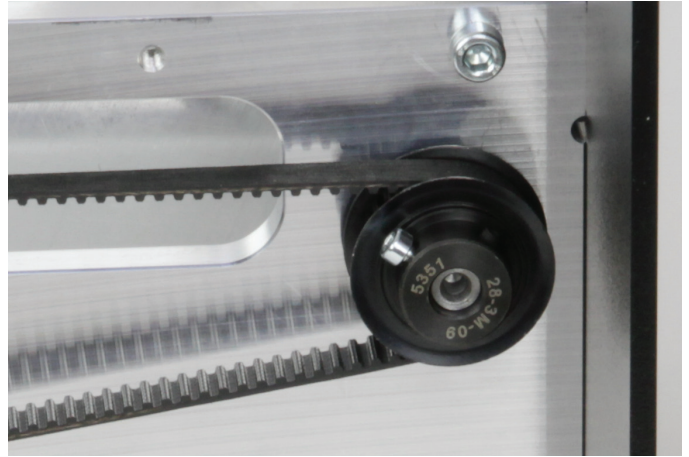
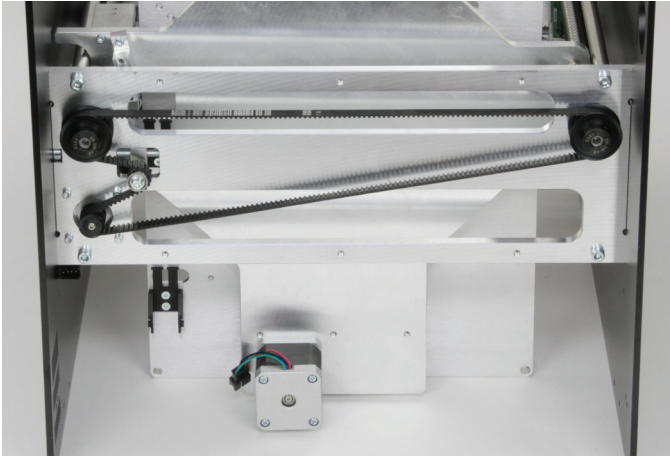
Mount the toothed belt as shown in the figure.

First attach the belt to the left sprocket and hold it tight.

Then attach it to the right sprocket and tighten it clockwise (the piece between the two sprockets should be tightened as much as possible).

Now attach the belt to the motor pinion and pull it over the belt tensioner. You still keep the toothed belt tensioned.

Tensioning the toothed belt



Now tighten the toothed belt by turning the adjusting screw (see penultimate figure) until it can be easily turned by 180° with two fingers.

Caution:

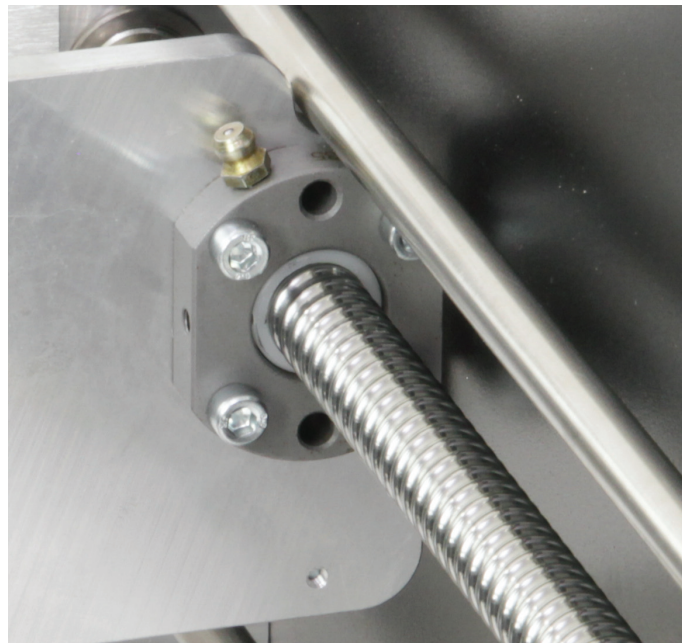
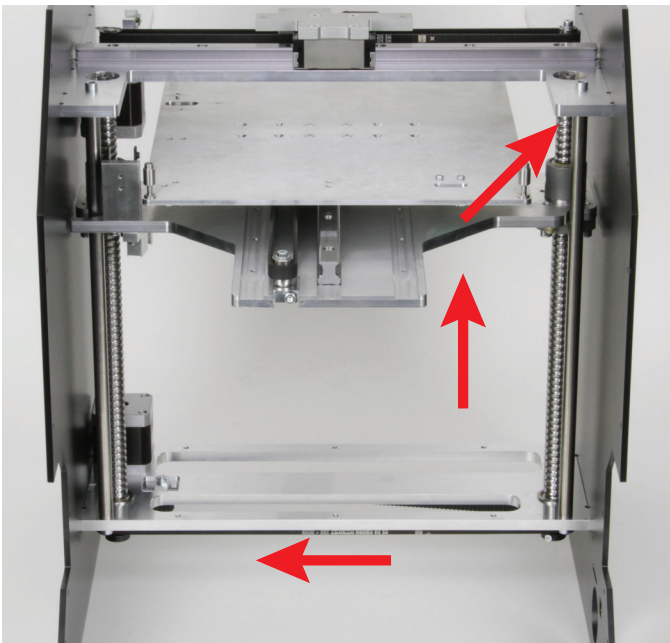
The toothed belt must not be tensioned too strongly. If the belt tensioner bends, the belt tension must be reduced under all circumstances.

A method for more precise adjustment of the belt tension can be found in the operating instructions (separate PDF) in chapter "21. Maintenance".

→ Note! The next step is to move the Y-plate almost all the way up. Therefore it is recommended to temporarily replace the one threaded pin, with which you had previously only lightly attached one sprocket, with a conventional M3 cylinder head screw (e.g. M3x6). This can then be tightened **slightly** more so that you can move the Y-plate upwards over the belt.

If you choose this option, remove one of the two loose threaded pins now and check again that the Y-plate is reasonably straight. Then insert a conventional M3 cylinder head screw and tighten it slightly so that the sprocket does not run through empty.

Tighten the ball-threaded drives



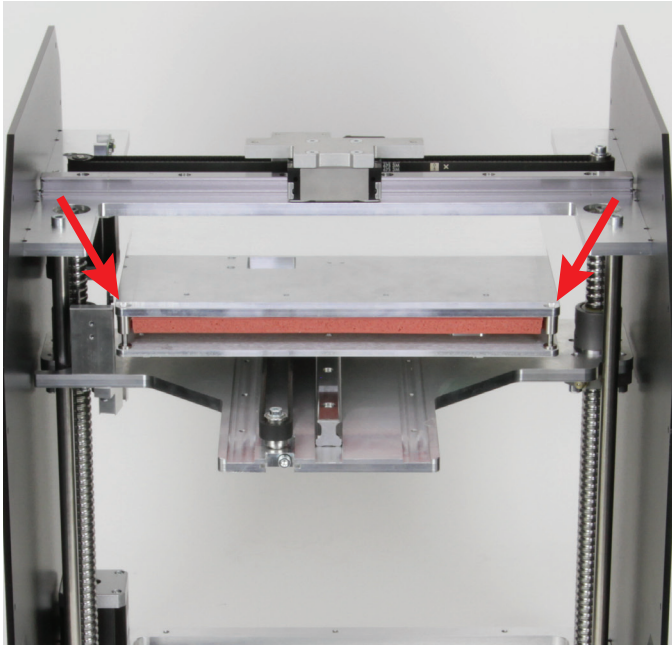
Put the basic frame on its bottom side again.

Move the Y-plate almost all the way up until the actuator for the Z-limit switch is near the light barrier.

If you have replaced the threaded pin, it is sufficient to move the toothed belt (the side facing the front) to the left. Otherwise move the toothed belt and the right-hand screw drive to the left at the same time.

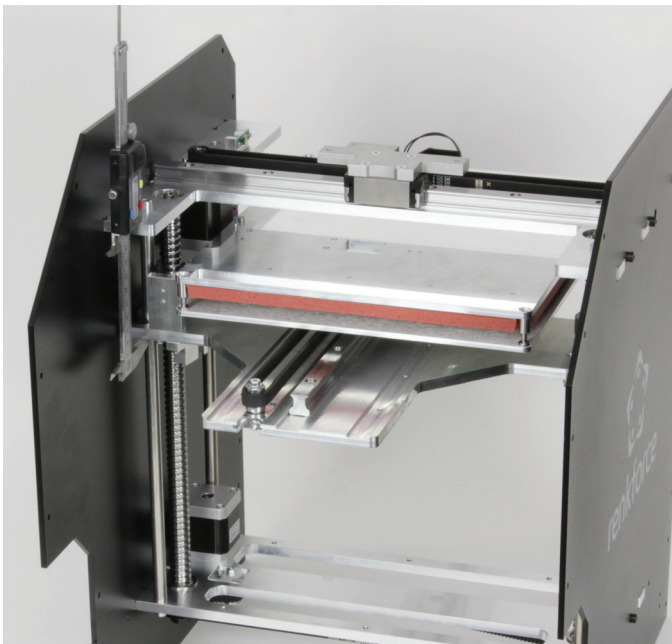
Loosen the 4 fixing screws on each ball-threaded drive to release any tension. Then tighten all screws crosswise.

Precise alignment of the ball-threaded drives

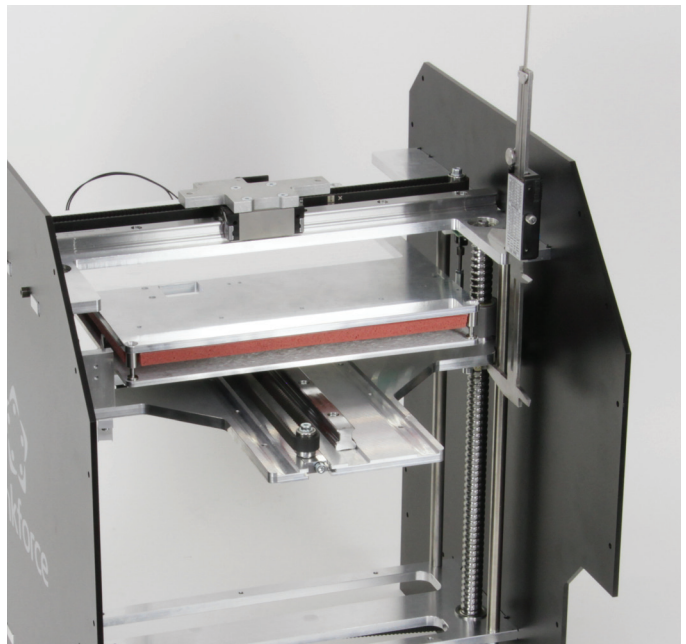


Take the printing plate and place it on the 4 spacers of the undertable. Make sure that the 4 spacers engage correctly in the holes of the printing plate.

If necessary, loosen the M3 cylinder head screw of the right sprocket so that it can move freely again.



Use a calliper on the left side to measure the distance between the Y and X plates.

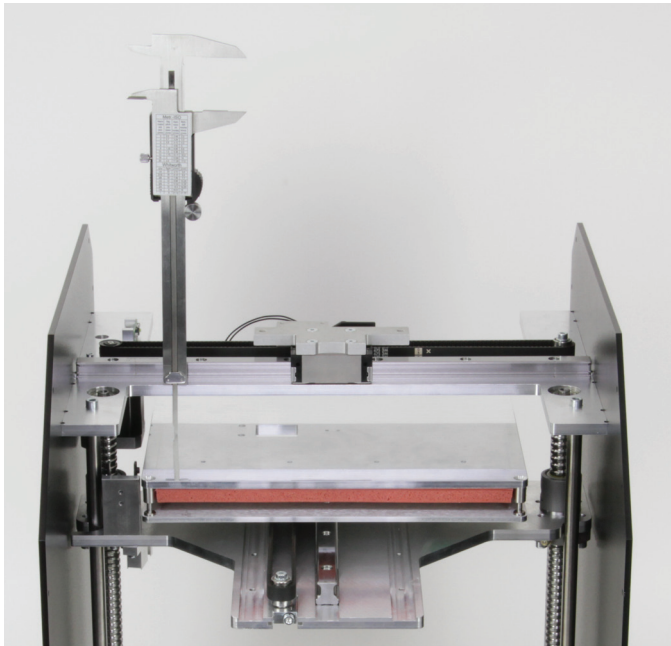


Now measure the distance on the right side between the Y and X plates. The distance must be precisely the same on both sides.

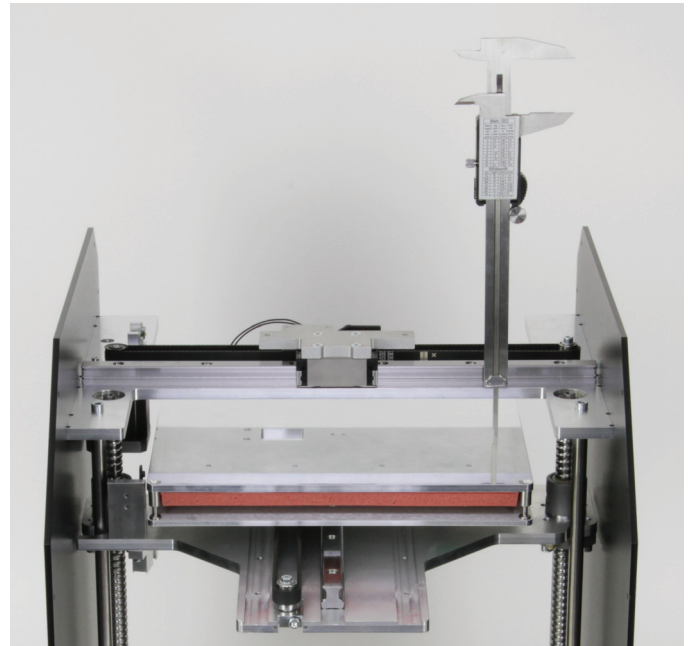
If necessary, you can adjust the distance by turning the right-hand ball-threaded drive. Rotate this only in very small steps!

The difference between the two values should in any case be less than 0.1 mm, even better less than 0.05 mm.

When the distance fits, lightly tighten the M3 screw or threaded pin.

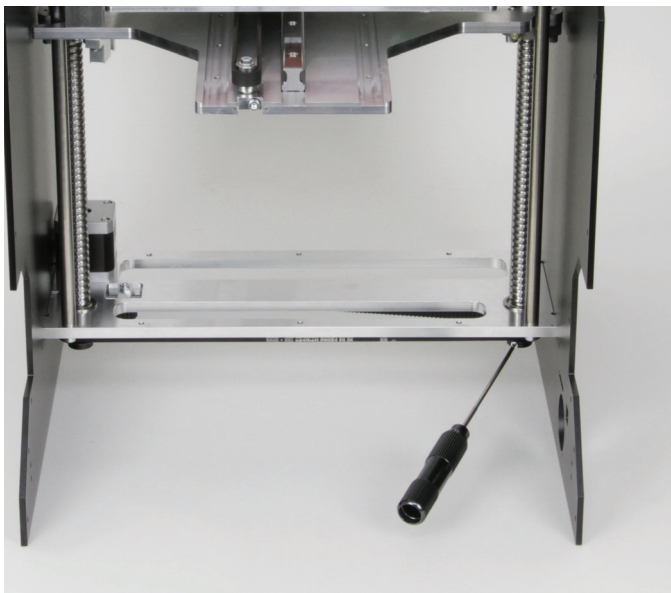


Now check the alignment of the printing plate.
The guide carriage on which the undertable is mounted should be in line with the two measuring points.
First measure again on the left side. Here, however, you now take the distance between the X-plate and the upper side of the printing plate.



Then measure the distance between the X-plate and the upper side of the printing plate on the right side.
The distance must now be exactly the same on both sides.
The difference between the highest and lowest position on the printing plate shall not exceed 0.2 mm. Otherwise, the automatic printing plate correction cannot compensate for the difference during printing.
This of course also applies to this measurement (left and right).
The difference should be as small as possible. It should be less than 0.1 mm, or better still less than 0.05 mm, as with the Y-plate.

Tightening the sprocket



When the distance fits, carefully remove the M3 cylinder head screw (if present) or threaded pin. Apply threadlocker varnish to the threaded pin and tighten it finally.

Move the toothed belt to the right (the Y-plate should move downwards) until the second threaded pin is accessible.
Proceed with this as with the first one.
Finally remove the printing plate.

Installing the foot holders



- 4 x rubber foot
- 4 x foot holder
- 10 x cylinder head screw M4x10 black



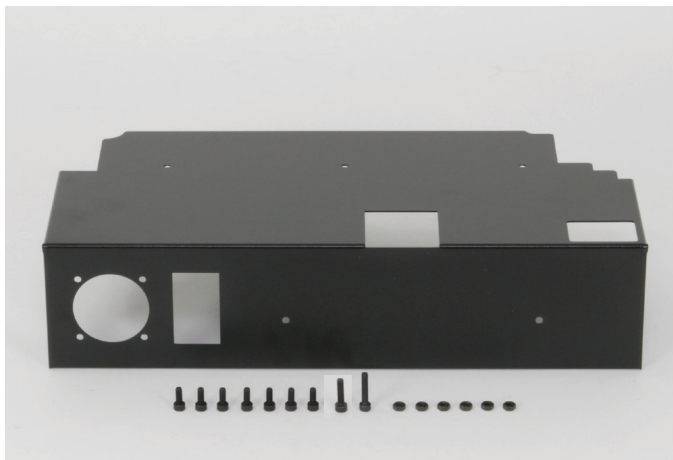
Fasten the foot holders as shown in the figures, with the wider side pointing downwards, each with 2 M4x10 screws on the side parts. Tighten the screws M4x10 by hand. Tightening is only carried out here after the bottom sheet has been fitted. Finally, turn a rubber foot into each of the 4 holders from below (see figure on the right).

f) Assembly of the covers

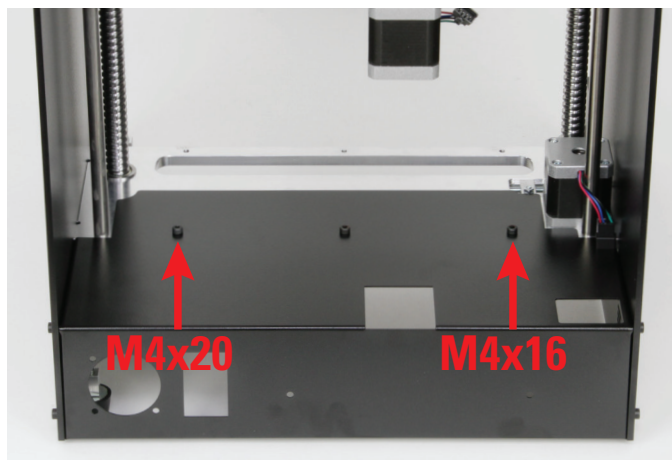


Observe sharp edges in these parts. There is a danger of injury at careless handling.

Installation of the rear cover



- 1 x rear cover
- 7 x cylinder head screw M4x10 black
- 1 x cylinder head screw M4x16 black
- 1 x cylinder head screw M4x20 black
- 6 x nut M4 black

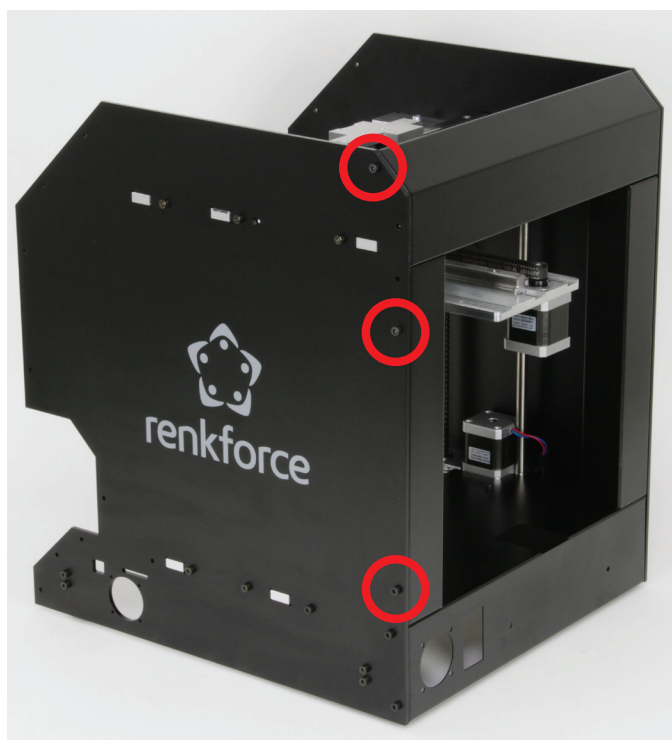


Fasten the rear panel to the basic frame with the screws and nuts as shown in the figure. Use 6 cylinder head screws with nuts for side mounting (3 on each side) and 3 cylinder head screws from above on the bottom plate. The cylinder head screw M4x20 must be screwed in at the left position and the cylinder head screw M4x16 at the right position from above (see red arrows in the figure).

Attachment of the rear cover parts

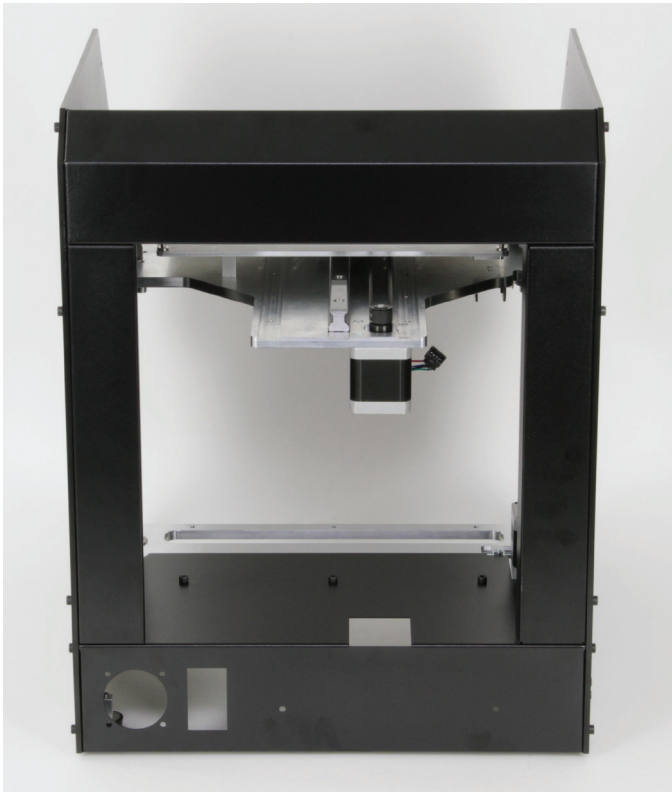


- 1 x rear head cover
- 1 x rear side panel right (from rear view)
- 1 x rear side panel left (from rear view)
- 6 x cylinder head screw M4x10 black
- 6 x nut M4 black



Fasten the rear cover parts to the basic frame using only the 3 holes marked in the figure on each side. The other bores remain clear for now.

The side panel on the left (the larger of the two) is mounted on the right (from the rear view) above the cable feedthrough.

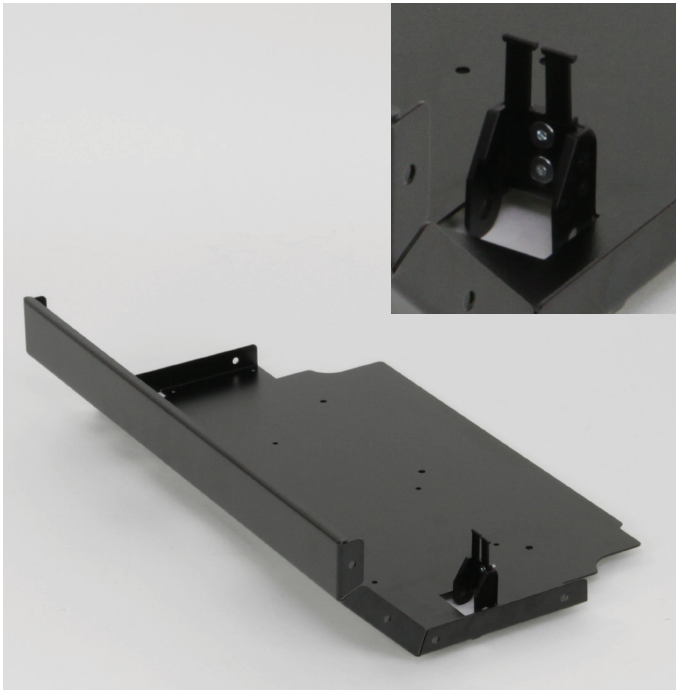


Insert the rear panels into the basic mechanics and fasten them to the side parts with the screws as shown in the figure above.

Preparation of the operating cover

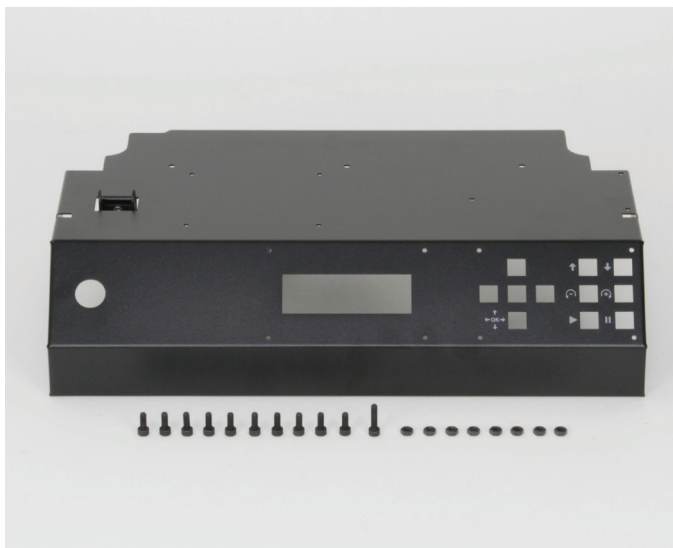


- 1 x operating cover
- 1 x drag chain end piece with hole
- 2 x countersunk screw M3x8
- 2 x nut M3

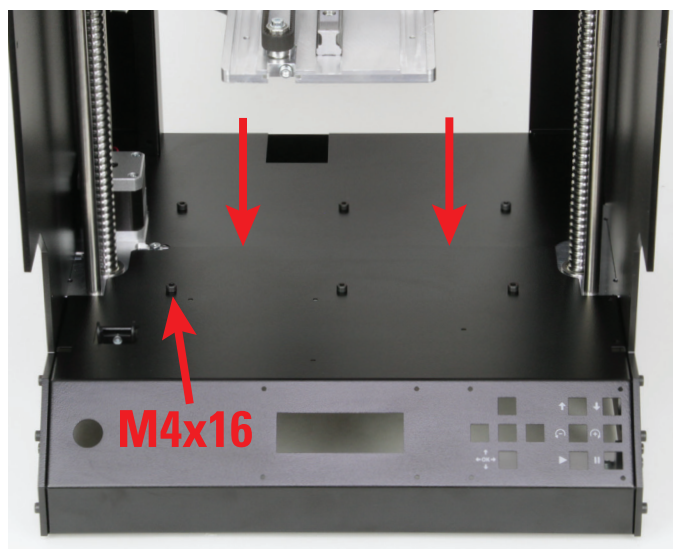


Mount the drag chain end piece with the M3 countersunk screws and nuts in the cut-out of the operating cover as shown in the figure.

Installation of the operating cover



- 1 x operating cover with drag chain end piece
- 10 x cylinder head screw M4x10 black
- 1 x cylinder head screw M4x16 black
- 8 x nut M4 black



Insert the operating cover into the basic mechanics and fasten it with the screws as shown in the figure.
Use 8 cylinder head screws with nuts for side mounting (4 per side) and 3 screws from the top on the bottom plate. Use the cylinder head screw M4x16 in the left position (see arrow from below).
During installation, make sure that the operating cover and rear panel are in contact with each other in the middle of the unit (see arrows above) and do not overlap or form a gap.

Installation of the privacy screens



- 1 x privacy screen left
- 1 x privacy screen right
- 10 x cylinder head screw M4x10 black
- 10 x nut M4 black

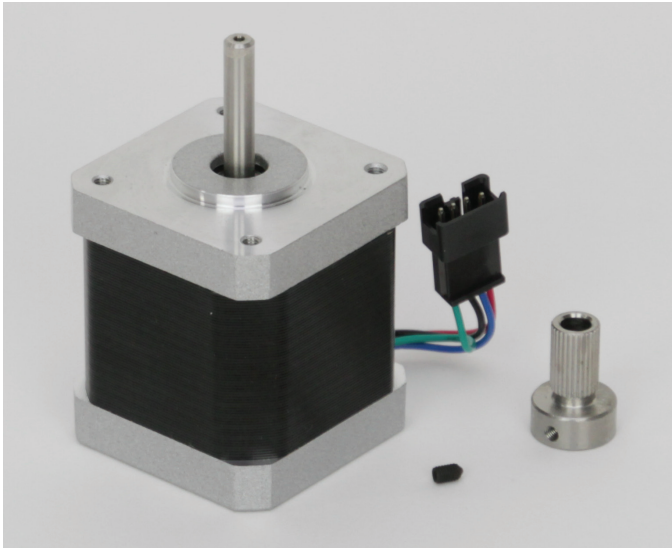


Fasten the privacy screens to the two side parts with 5 cylinder head screws and 5 nuts on each side.

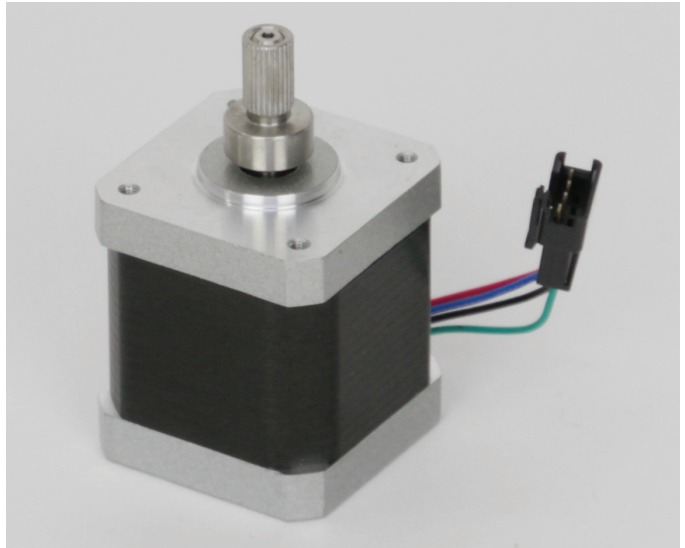
13. Assembly and mounting of the extruder unit

a) Preparation of various components

Mounting the knurl on the feed motor



- 1 x actuator
- 1 x feed knurl
- 1 x threaded pin M3x5



Place the feed knurl on the axis of the actuator and fasten it with the threaded pin. Apply threadlocker varnish to the threaded pin. The feed knurl must be flush with the upper edge of the motor shaft.

Assembly of the ball bearing holder

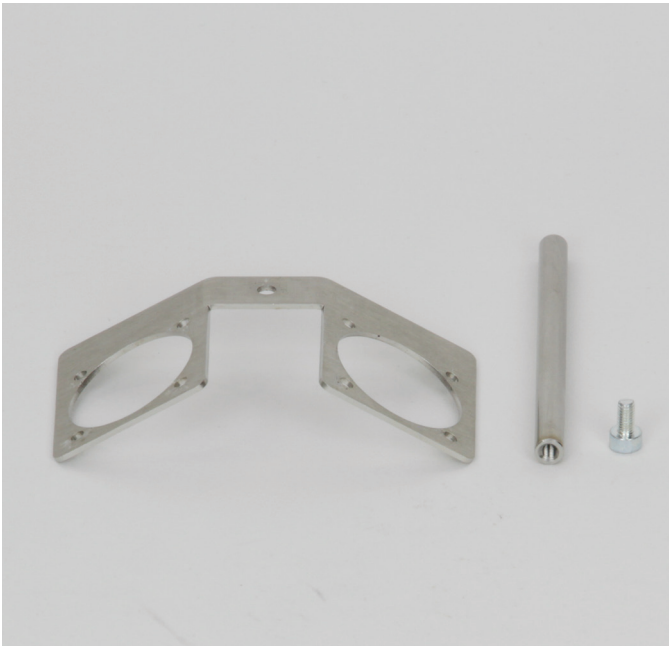


- 1 x ball bearing holder (left)
- 1 x grooved ball bearing (diameter inside/outside 3.8/13 mm)
- 1 x cylinder pin 4x14 mm



Place the ball bearing holder on a straight and firm surface. Then insert the ball bearing into the recess of the holder and carefully drive the cylinder pin with a hammer into the holder and the ball bearing. The cylinder pin must be flush with the bearing side of the ball bearing holder. So it has to be sunk a little into the hole at the top. For the last piece, make use of a mounting mandrel or a punch. Then turn the holder and turn the cylinder pin back a little until the ball bearing is centred in the ball bearing holder. The ball bearing must not touch the side!

Assembly of the fan sheet

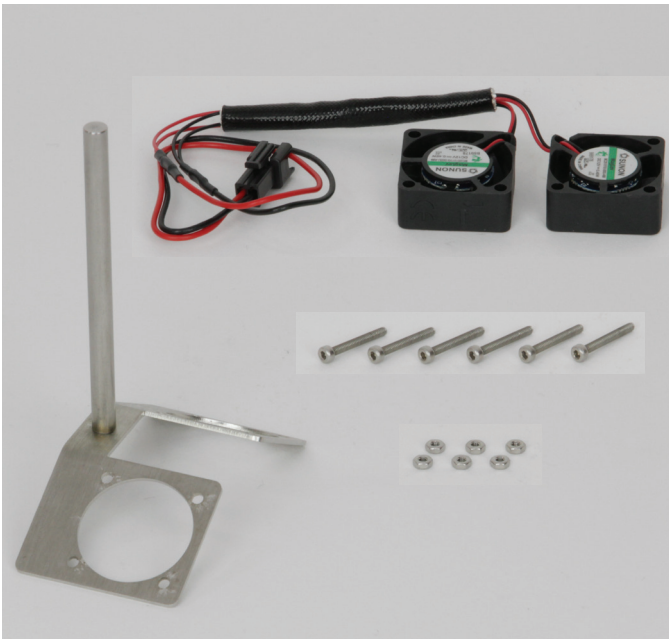


- 1 x fan sheet for 2 fans
- 1 x rod
- 1 x cylinder head screw M3x6

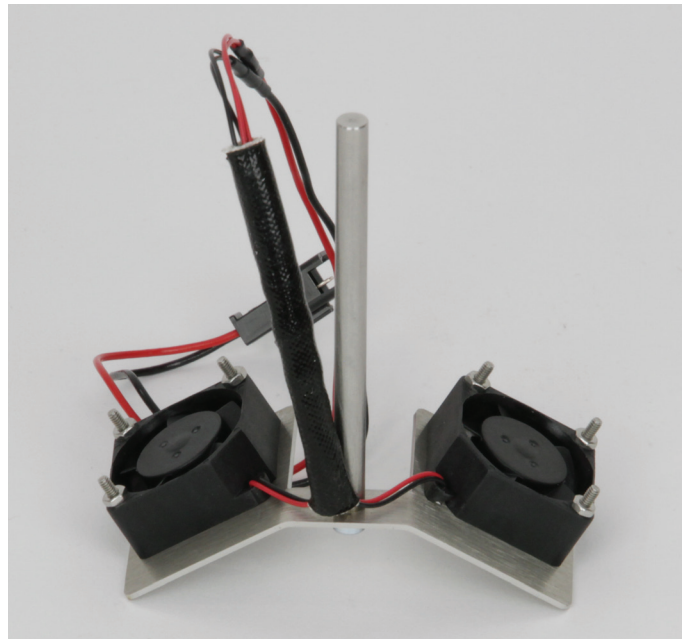


Fasten the fan sheet to the rod with the cylinder head screw.
Apply a threadlocker varnish to the screw.

Mounting the fans



- 1 x fan sheet with rod for 2 fans
- 1 x double fan
- 6 x cylinder head screw M2x16
- 6 x nut M2



Attach both fans to the fan sheet with 3 screws and nuts each, as shown in the figure.
The fans must be aligned so that the blowing direction (indicated by an arrow on the fan) goes downwards through the fan sheet.
Place the fan cable around the outside of the rod.
All screws must be provided with threadlocker varnish.

b) Assembly of the extruder

Assembly of the heating block



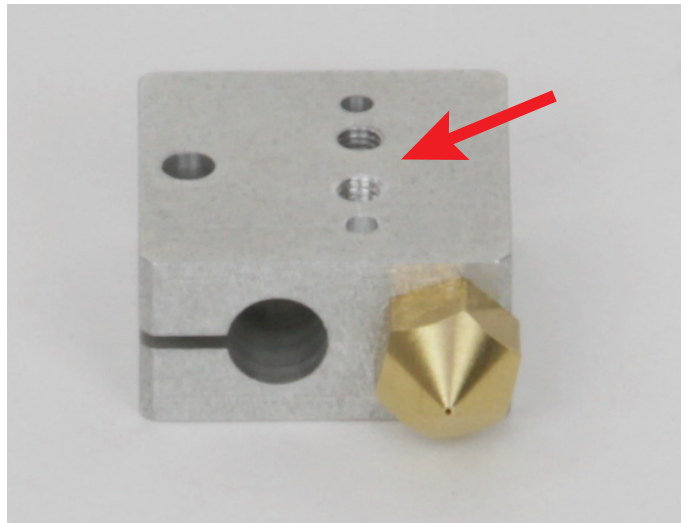
- 1 x heating block
- 1 x nozzle 0.4 mm
- 1 x PTFE thread sealing tape



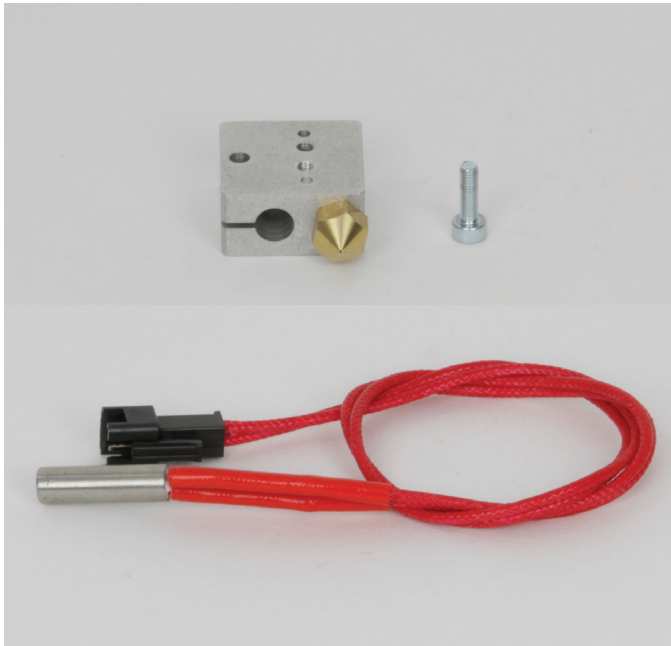
Cut about 25 to 30 mm of thread sealing tape from the roll and wrap it around the thread of the nozzle, as shown in the figure. Observe the winding direction in any case! The sealing tape must run with the thread! This means that the end of the sealing tape on the outside must not oppose the turn-in direction. Otherwise, it might happen that the sealing tape is shifted when screwed in and does not seal properly.



The sealing tape must never protrude beyond the thread. Cut off the sealing tape that protrudes over the thread with a sharp knife, e.g. by running the knife along the upper-most groove of the thread. Smooth the sealing tape well with your fingers. The ridges of the thread may be slightly visible. This way, the nozzle can be turned in more easily without the sealing tape becoming bunched up in the thread.



Turn the nozzle into the heating block. The heating block must be aligned so that the opening without thread is on the left and the 4 holes (the 2 in the middle with thread) are at the top (see arrow in the figure). The nozzle must then be turned in as shown in the figure. Screw in the nozzle all the way and tighten it with an 8 mm open-faced spanner. Check from the other side of the nozzle that no sealing tape is visible.



- 1 x heating block with mounted nozzle
- 1 x cylinder head screw M3x10
- 1 x heating cartridge



Insert the heating cartridge into the corresponding opening from above (opposite of the nozzle). Secure the heating cartridge with the cylinder-head screw as illustrated. The cartridge should be flush with the heating block at the bottom of the nozzle.

Assembly of the extruder upper part



- 1 x nozzle holder
- 1 x PEEK part
- 1 x PTFE thread sealing tape



Cut about 25 to 30 mm of thread sealing tape from the roll and wrap it around the thread of the nozzle holder, as shown in the figure. Observe the winding direction in any case! The sealing tape must run with the thread! This means that the end of the sealing tape on the outside must not oppose the turn-in direction. Otherwise, it might happen that the sealing tape is shifted when screwed in and does not seal properly.



The sealing tape must never protrude beyond the thread. Cut off the sealing tape that protrudes over the thread with a sharp knife, e.g. by running the knife along the upper-most groove of the thread. Smooth the sealing tape well with your fingers. The ridges of the thread may be slightly visible. This makes it easier to screw the nozzle holder into the PEEK part without the sealing tape jerking in the thread.



Turn the nozzle holder into the PEEK part carefully. It will only fit in one side because the opening is larger on the other side. Tighten the nozzle holder hand-tight with a 13 mm spanner. Hold the PEEK part with your hand.



1 x PEEK part with mounted nozzle holder
1 x PTFE insert
1 x extruder infeed



Push the PTFE insert into the PEEK part. Take a hexagon socket wrench with at least 3 mm and push the PTFE insert entirely into the PEEK part.



Carefully turn the extruder inlet into the PEEK part and tighten it manually as far as possible.



1 x extruder upper part
1 x nut M6 (flat ISO 4035)
1 x PTFE thread sealing tape



Screw the M6-nut onto the long thread of the nozzle holder to the stop.



Cut about 30 to 35 mm of thread sealing tape from the roll and wrap it around the thread of the nozzle holder, as shown in the figure. Observe the winding direction in any case! The sealing tape must run with the thread! This means that the end of the sealing tape on the outside must not oppose the turn-in direction. Otherwise, it might happen that the sealing tape is shifted when screwed in and does not seal properly.



The sealing tape must never protrude beyond the thread. If necessary, cut it off with a sharp knife, e.g. by moving the knife along the top groove of the thread. Smooth the sealing tape well with your fingers. The ridges of the thread may be slightly visible. This way, the nozzle holder can be turned in more easily without the sealing tape becoming bunched up in the thread.

Assembly of the extruder lower and upper part



1 x extruder lower part
1 x extruder upper part



Turn the extruder top into the extruder bottom to the stop. Counter the extruder top with the nut against the extruder bottom (open-faced spanner 10 mm, flat).



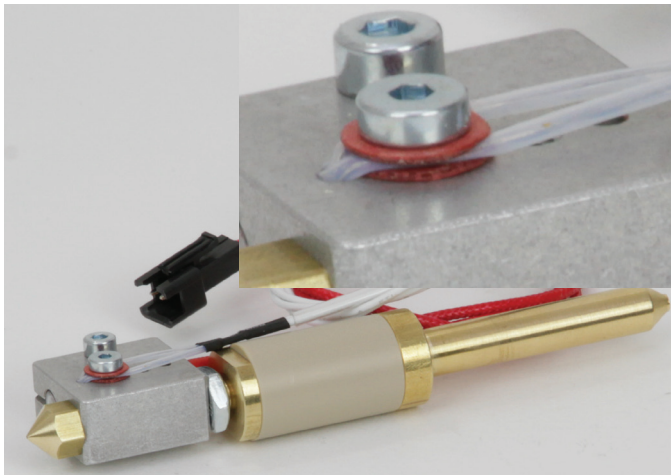
- 1 x extruder
- 1 x temperature sensor
- 1 x cylinder head screw M3x8 (flat head)
- 2 x paper disc M3

Attention! The temperature sensor is very sensitive! Installation therefore must be performed with the utmost care!



First check the two PTFE tubes on the temperature sensor. These must both be present at the temperature sensor (see small figure above left). If this is not the case, push them towards the temperature sensor until they are present.

Insert the temperature sensor as far as it will go into the small hole (without thread) closest to the nozzle (see small figure above right).



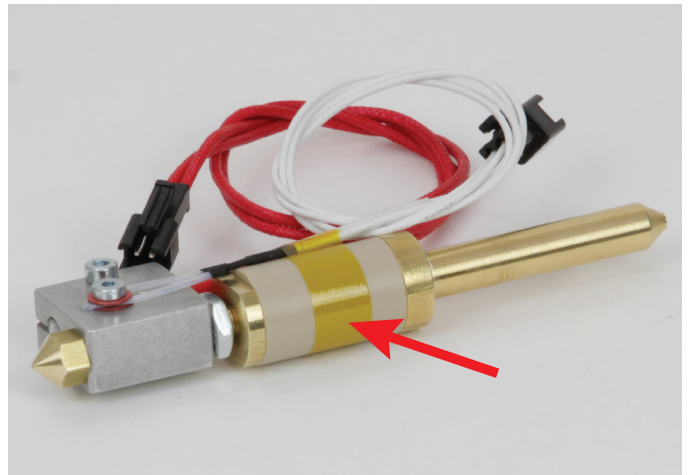
First push a paper disc onto the cylinder head screw (flat head). Hold the lines of the temperature sensor in the area of the black shrink hose and push the lines slightly towards the nozzle. This ensures that the sensor remains in the bore up to the stop.

Place the second paper disc directly on the hole (with thread) of the heating block.

Thread the cylinder head screw with the first paper disc between the two lines of the sensor.

Screw the cylinder head screw through the second paper disc into the thread of the heating block.

Only tighten the screw slightly so that the connection lines are not damaged. It is best to insert the screw only by hand and check it at the end with a hex key so that it is not too loose.



Now glue a strip of Kapton adhesive tape around the PEEK part and attach the two white wires of the temperature sensor (arrow). The two heat shrink hoses should not touch the brass of the nozzle holder. The extruder is now fully assembled.

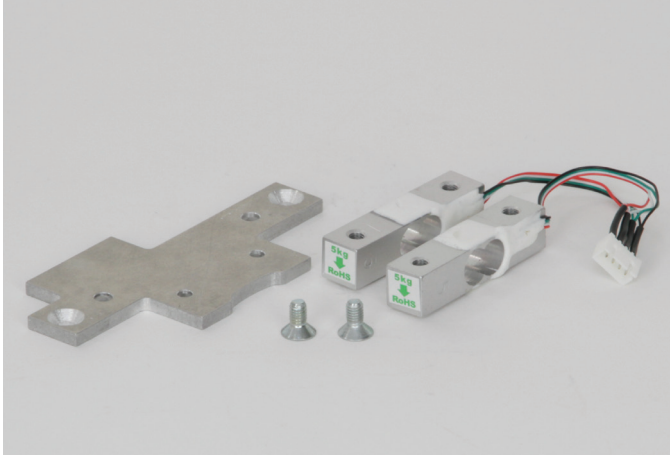
→ **Please note!**

The cylinder head screw with which the lines of the temperature sensor are fixed should be checked regularly. If the screw loosens and the sensor slips out of the hole, this can damage the extruder!

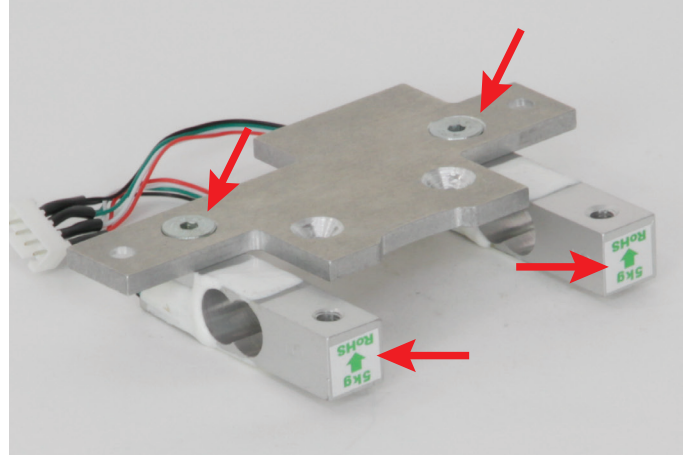
On the following figures the cylinder head screw M3x8 with the flat head is partly still designed as a normal cylinder head screw. The following figures also show the normal version of the extruder inlet.

c) Assembly of the extruder unit

Mounting the strain gauges



- 1 x adapter plate
- 2 x strain gauges
- 2 x countersunk screw M5x10

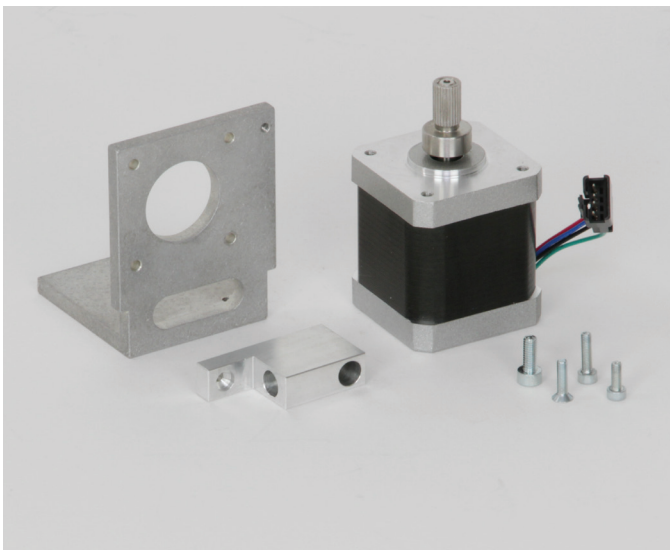


Attach the adapter plate loosely to the bottom side of the two strain gauges using the two countersunk screws. The assembly takes place in the two holes at the cable outlet.

The screws are provided with threadlocker varnish.

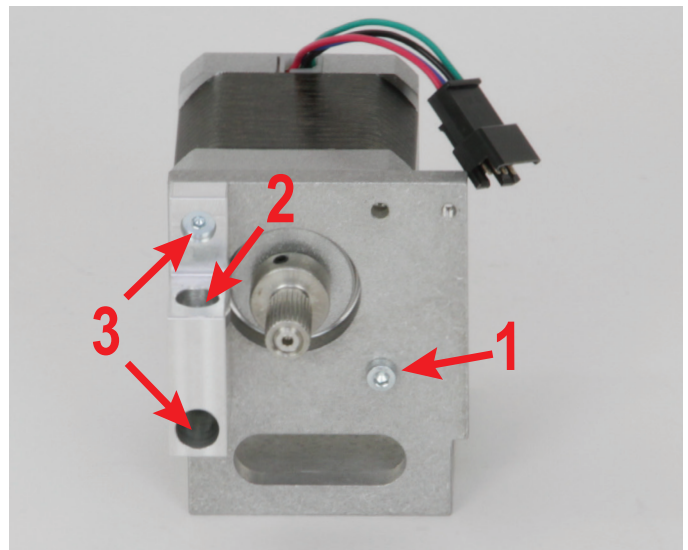
→ Important! The bottom side of the strain gauges is the side to which the two green arrows (on the front) point. The two arrows must point accordingly to the adapter plate.

Mounting the feed motor and the spring holder



- 1 x motor holder
- 1 x motor with mounted feed knurl
- 1 x spring holder
- 1 x cylinder head screw M4x8
- 1 x cylinder head screw M3x12
- 1 x countersunk screw M3x12
- 1 x cylinder head screw M3x8

→ If you have also purchased the upgrade kit for dual extruders as part of the kit, you can integrate the upgrade kit from this step onwards. For this, observe chapter "16. Upgrade from single to dual extruder".



Push the feed motor from behind through the motor holder. The cable outlet must point upwards.

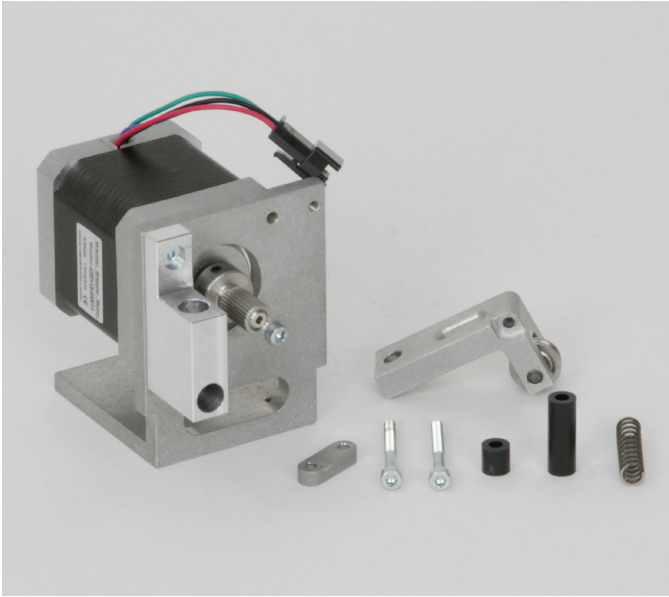
First fix the motor at the bottom right with the cylinder head screw M3x8 (1).

Then fasten the spring holder on the left side, through the motor holder, also in the motor. The opening of the hole must point upwards (2). Use the countersunk screw at the top of the spring holder and the cylinder head screw M3x12 at the bottom (3).

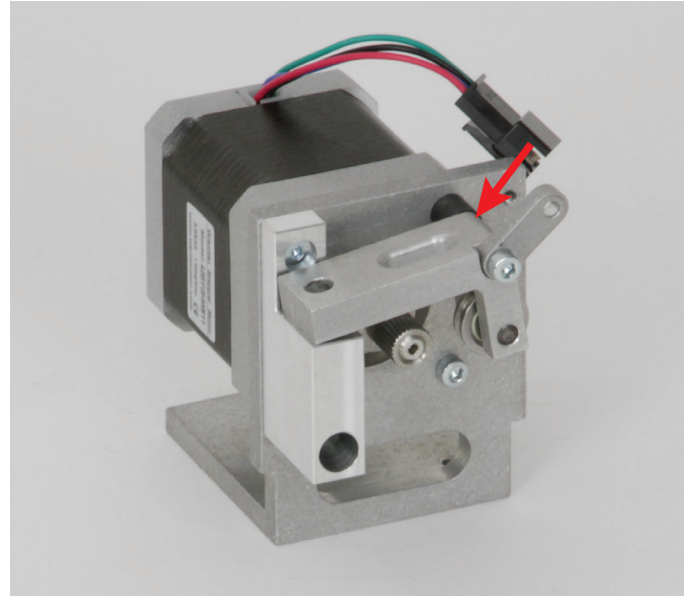
The screws are provided with threadlocker varnish.

Screw the cylinder head screw M4x8 into the vertical hole of the spring holder (2) as far as it will go, without using any threadlocker varnish.

Assembly of the ball bearing holder



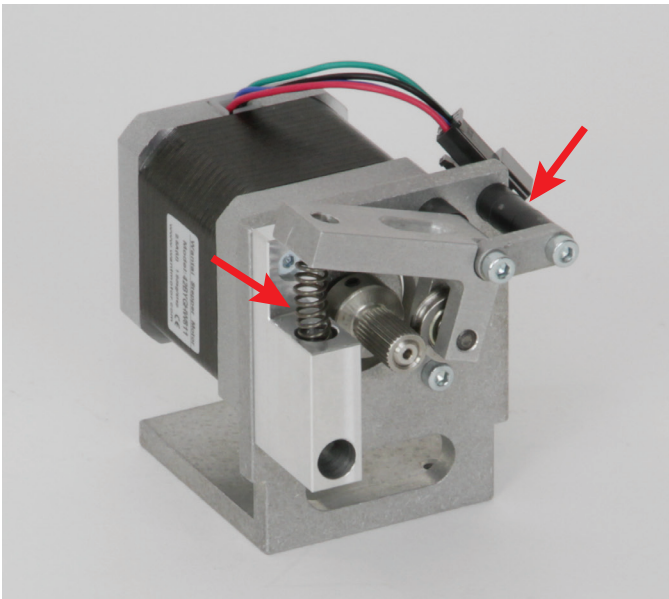
- 1 x motor holder with mounted motor
- 1 x ball bearing holder (assembled)
- 1 x counter-bearing
- 2 x cylinder head screw M3x30
- 1 x spacer 7 mm
- 1 x spacer 19 mm
- 1 x spring



Attach the ball bearing holder, as shown in the figure, top right through the motor holder in the motor. The counter-bearing must be placed in the cut-out of the ball bearing holder.

Apply a threadlocker varnish to the screw.

Order: Cylinder head screw M3x30 - counter-bearing - ball bearing holder - spacer 7 mm - motor holder - motor



Attach the counter-bearing to the motor holder, as shown in the figure, at the top right of the motor.

Apply a threadlocker varnish to the screw.

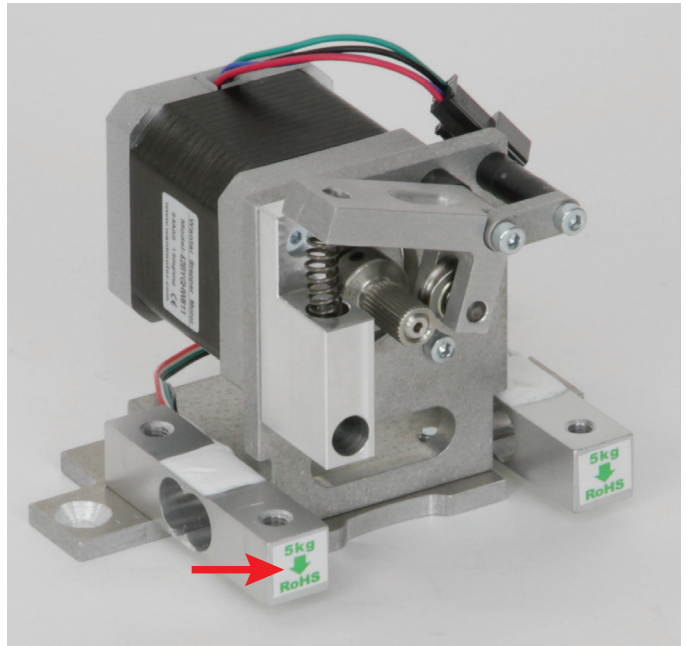
Order: Cylinder head screw M3x30 - counter-bearing - spacer 19 mm - motor holder

Push the spring on the left side first into the vertical hole of the spring holder and then under the ball bearing holder so that the spring engages.

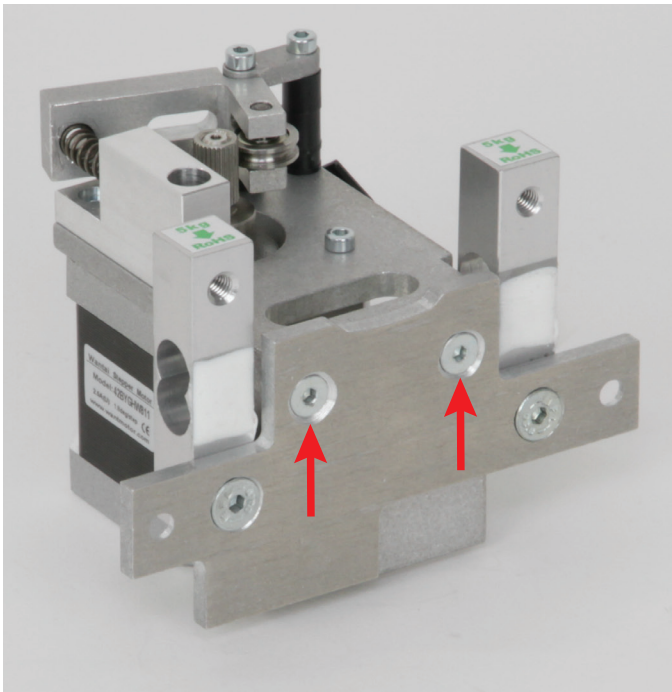
Mounting the motor holder



- 1 x strain gauge with mounted adapter plate
- 1 x motor holder with motor
- 2 x countersunk screw M4x10



The unit with the strain gauges must be positioned so that the two green arrows on the front face downwards.
Place the motor holder on the adapter plate.
The cables of the strain gauges must run over it.

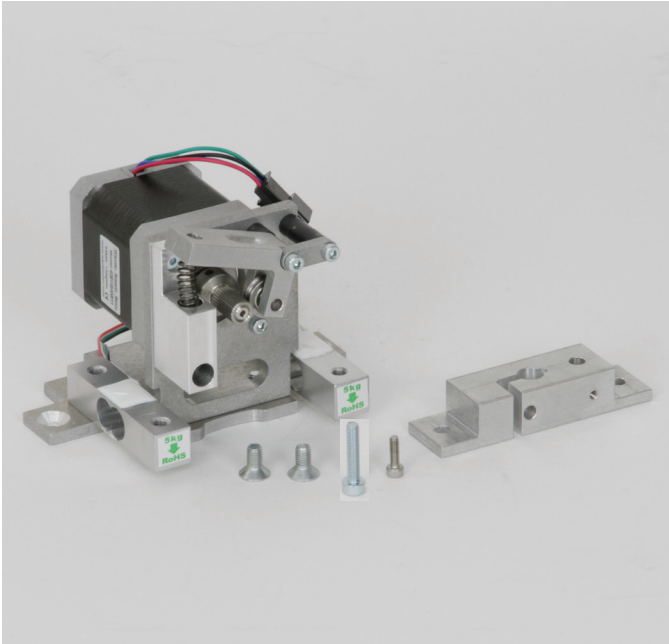


Attach the motor holder to the adapter plate using the two countersunk screws and tighten the screws.
The screws are provided with threadlocker varnish.

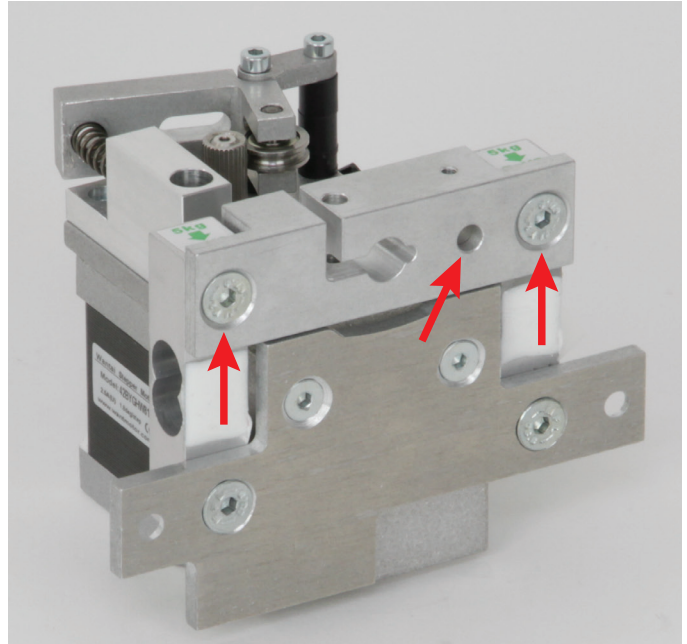


Attention! Before you continue, please check that the two strain gauges are installed correctly.
The two green arrows must point away from the motor holder!

Mounting the extruder holder



- 1 x previously mounted extruder unit
- 1 x extruder holder
- 2 x countersunk screw M5x10
- 1 x cylinder head screw M4x20
- 1 x cylinder head screw M3x10



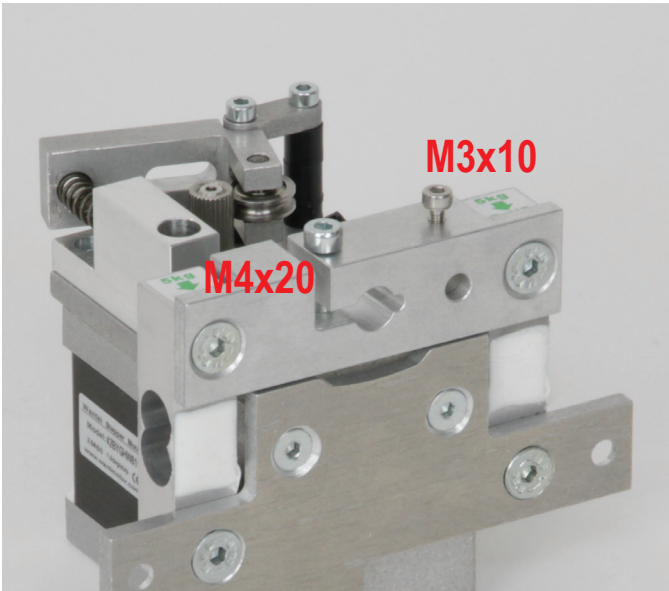
Attach the extruder holder loosely to the bottom side of the two strain gauges using the two countersunk screws. The mounting takes place in the two holes opposite the adapter plate. The smaller hole must be, as shown in the figure, from the view from below, on the right. The screws are provided with threadlocker varnish.

Align the strain gauges at 90° to the adapter plate and extruder holder.

The adapter plate must not touch the extruder holder!

Tighten all 4 countersunk screws.

Assembly of spring and retaining screws for extruder and fan sheet



Screw the cylinder head screw M4x20 into the middle hole of the extruder holder.

Screw the cylinder head screw M3x10 into the right hole of the extruder holder.

Both screws may only be screwed in to such an extent that the two holes in the extruder holder are still freely accessible.

Do **not** use locking varnish on both screws!

Assembly of the drag chain end piece



- 1 x holding plate
- 2 x countersunk screw M3x30
- 1 x adapter for drag chain X (aluminium block)
- 1 x large drag chain end piece with hole



Attach the drag chain end piece to the holding plate as shown in the figure.

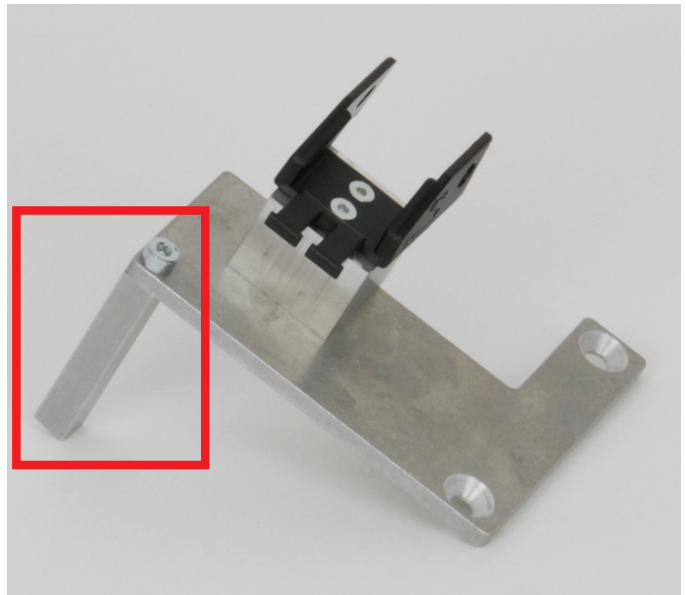
The screws are provided with threadlocker varnish.

Order: Countersunk screws M3x30 - drag chain end piece - adapter for drag chain X - holding plate

Mounting the actuator for the X-limit switch



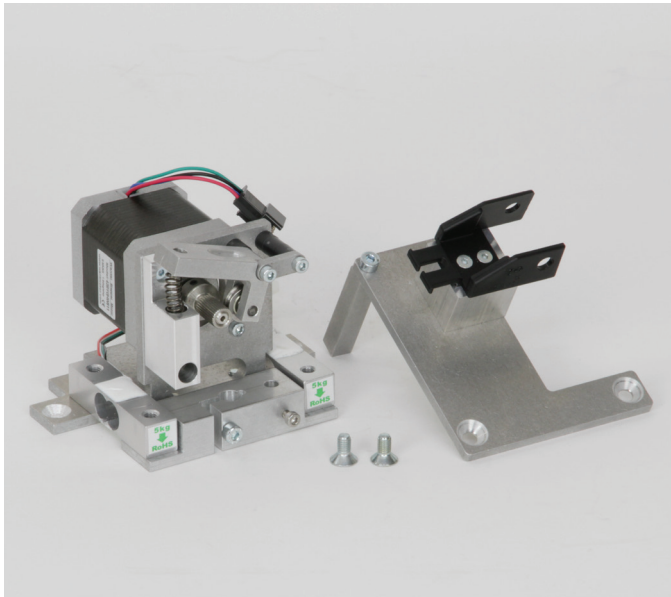
- 1 x holding plate with mounted drag chain end piece
- 1 x actuator
- 1 x cylinder head screw M4x10



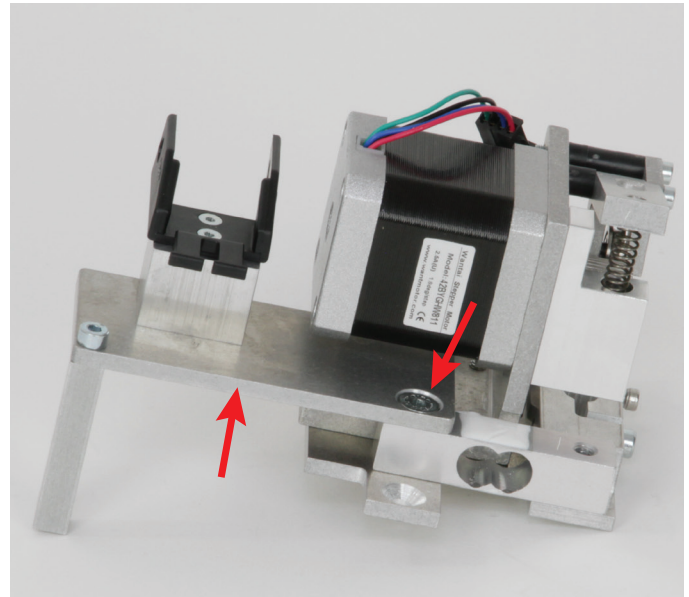
Mount the actuator straight on the holding plate with the cylinder head screw as shown in the figure.

Apply a threadlocker varnish to the screw.

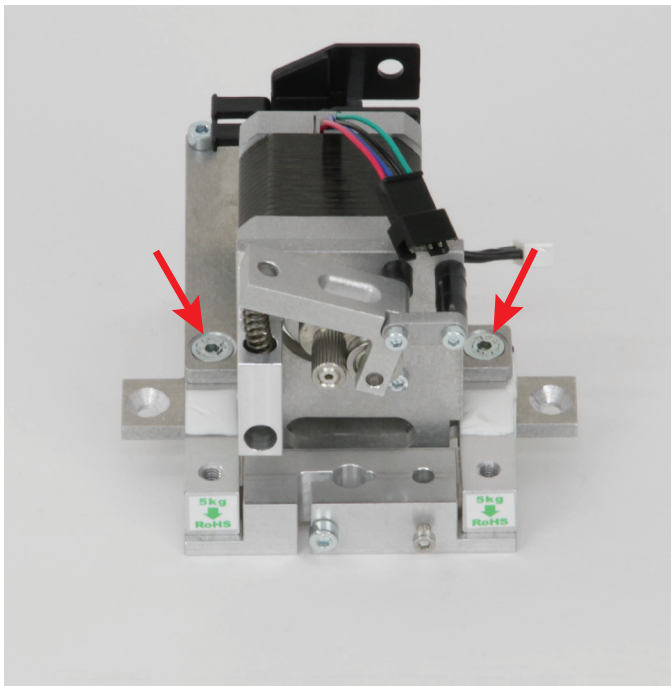
Mounting the holding plate



- 1 x previously mounted extruder unit
- 1 x assembled holding plate
- 2 x countersunk screw M5x10



Mount the holding plate to the extruder unit as shown in this and the next figure.
The screws must be screwed into the respective rear bore of the strain gauges (at the cable outlet).

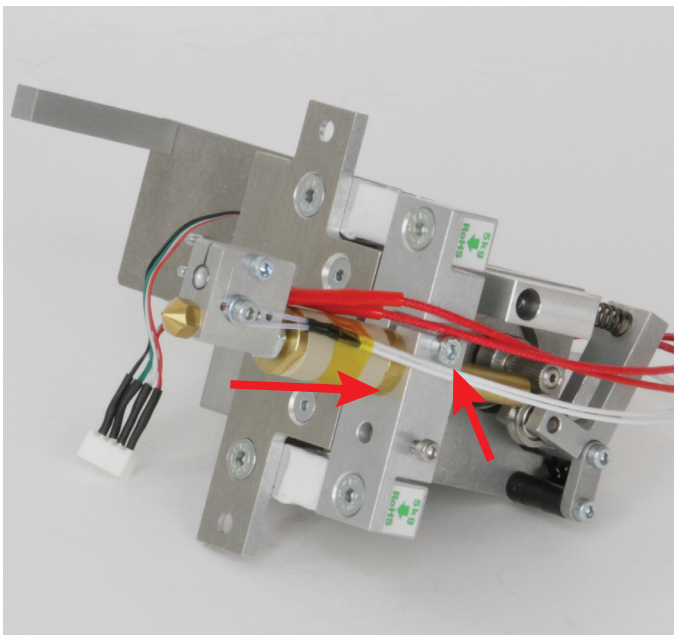


The screws are provided with threadlocker varnish.

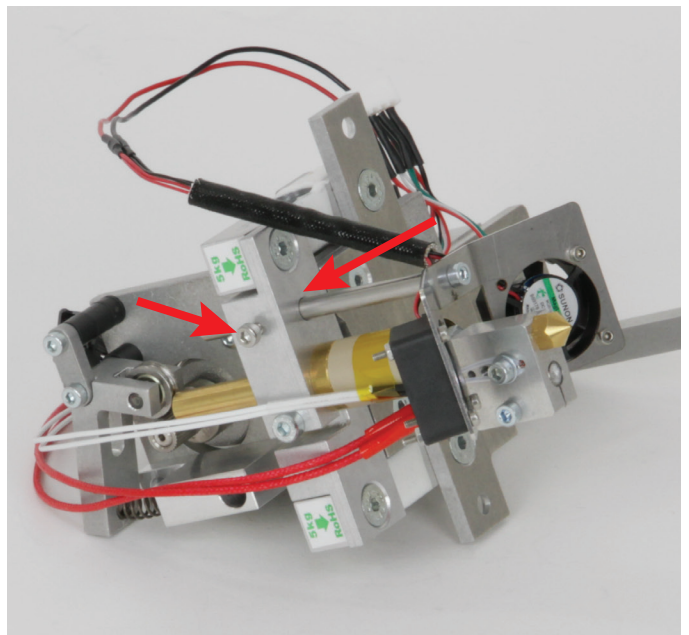
Mounting the extruder and fan



- 1 x previously mounted extruder unit
- 1 x extruder
- 1 x fan sheet with installed fans

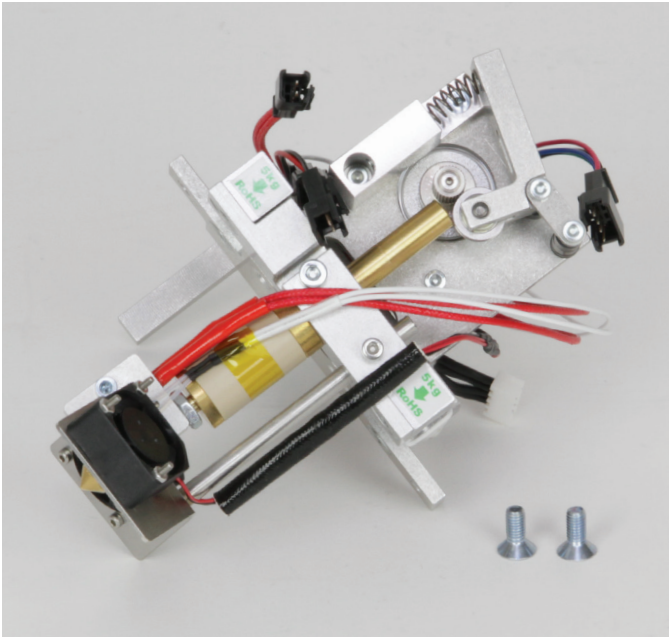


Place the extruder unit on its side.
From below, slide the extruder into the centre hole of the extruder holder.
Align the extruder so that the screws on the heating block are facing forward. In addition, the heating block must be parallel to the extruder holder.
Tighten the extruder retaining screw. The extruder must no longer move.

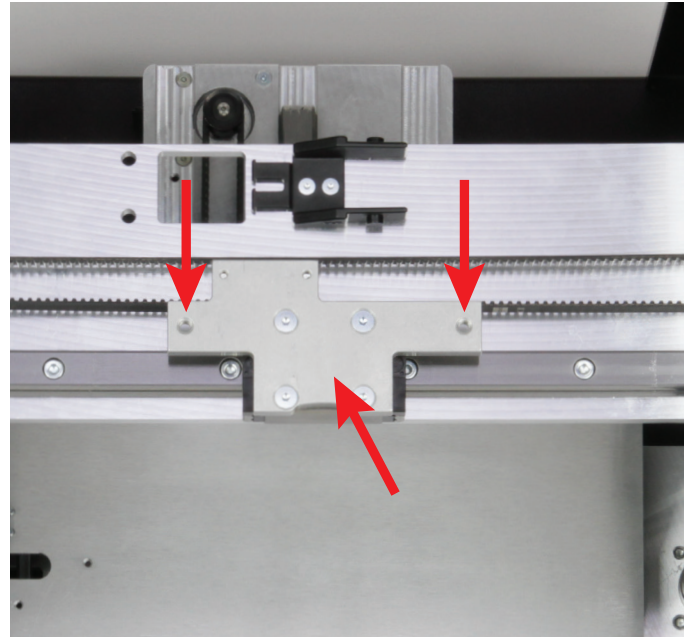


Insert the fan sheet into the small hole to the right of the extruder.
The fans must enclose the extruder, but must not touch it.
Align the fan sheet straight and tighten the retaining screw slightly.
The fan sheet must no longer move.
(For the figure we put the unit on the other side)

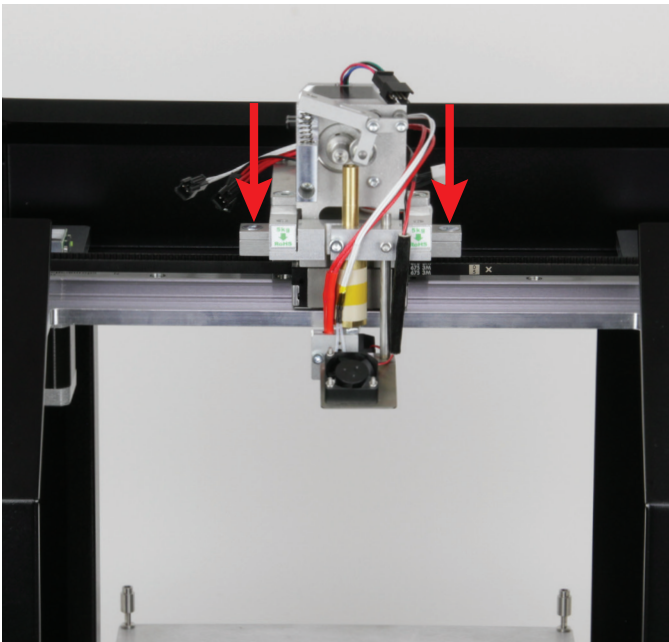
d) Mounting of the extruder unit



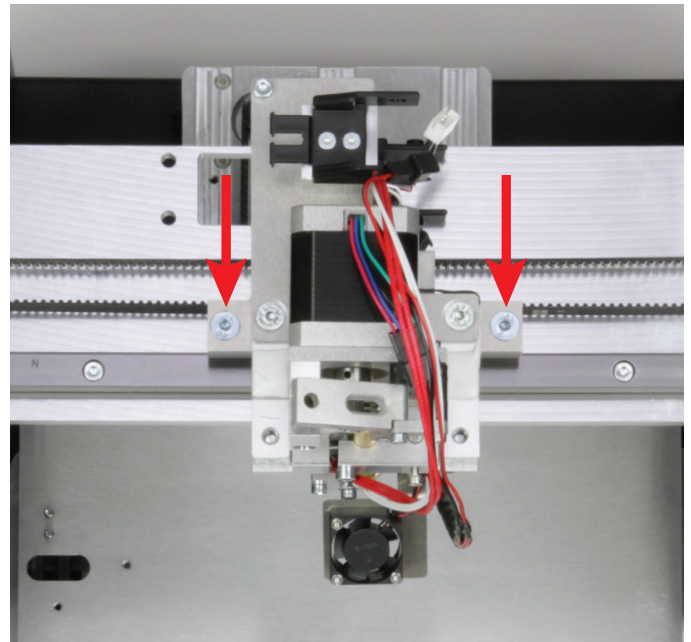
1 x extruder unit (completely assembled)
2 x countersunk screw M5x12



The extruder unit is mounted on the guide carriage plate (arrow from below) with two screws (see arrows from above).



Place the extruder unit on the guide carriage plate and secure with the two M5 countersunk screws.
Do **not** apply threadlocker varnish to the two screws!



Here still the view from above.

→ It may be necessary to loosen the fan sheet so that you can insert the extruder unit. When you reattach it, make sure that the fan screw located under the X-plate does not touch it. In addition, the sheet should be above the nozzle tip.
The extruder and fan cables are only attached later when the remaining cables are laid.

14. Wiring of the electrical components

a) General information



ATTENTION Mains voltage - the connection, installation and wiring of the electrical components must only be performed by an electrician who is familiar with the applicable safety provisions. Before commissioning, inspection according to the applicable safety provisions must be performed by an electrician.

During the connection work, the mains line must never be connected to the mains.

Drag chains



The energy drag chains have tabs on one side of the links through which the lines are pushed into the chains.

When pushing in the lines, always push in the stronger lines first and then the thinner ones. If the tabs of the drag chains do not return to their initial position when pushed in, the tabs can be pulled back carefully with long-nosed pliers.

The lines must be cleanly placed next to each other in the energy drag chain and must not be twisted.

When clipping in the drag chain ends into already-installed drag chain end pieces, small flat pliers with which the end links of the energy drag chains are latched in the nipples or holes of the end pieces are helpful. Observe that the drag chain ends latch neatly with the end pieces. Do not apply any great force, since the plastic material would be damaged otherwise and the drag chain or end piece would be rendered useless (loss of warranty/guarantee!).

There are 3 energy drag chains in the delivery. One large energy drag chain with 11 links and two smaller energy drag chains with 22 and 25 links. The description of the individual work steps shows which energy drag chains are to be used where.

Lines



Lines that may be swapped are marked with numbers.

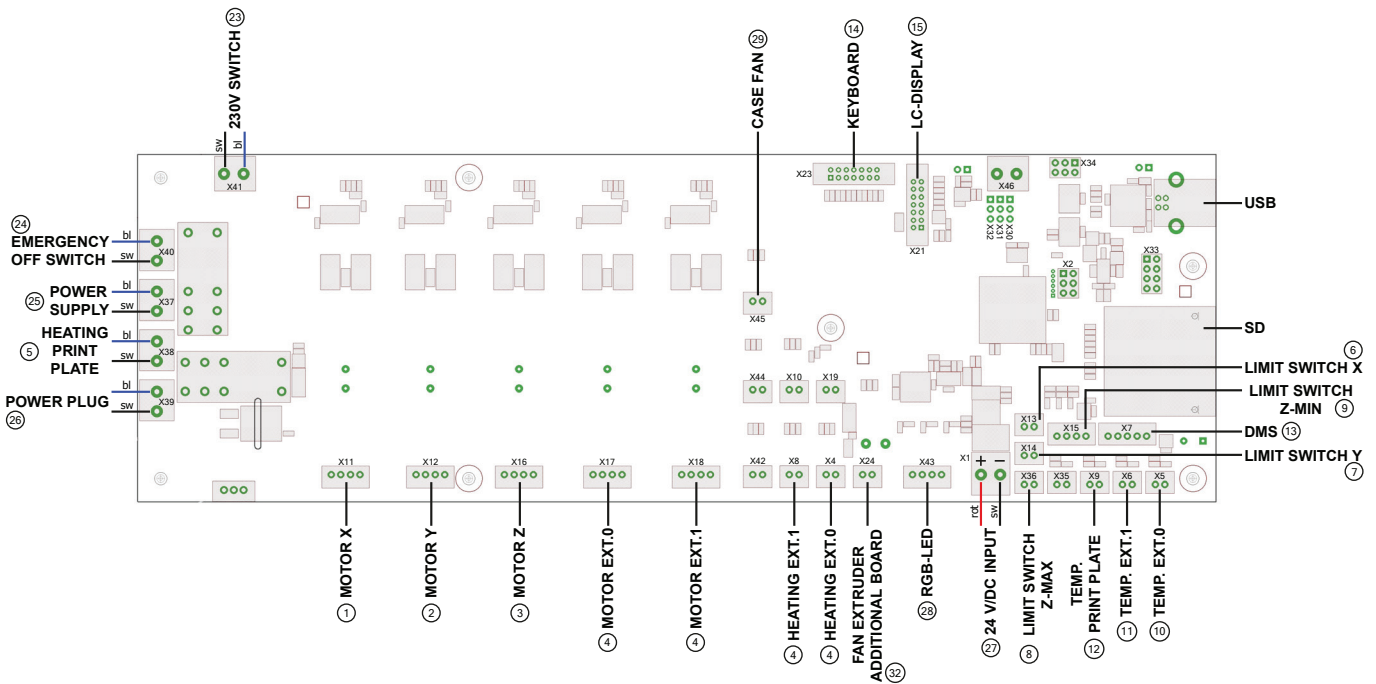
These numbers are placed on labels and line ends that are connected to the PCBs in the device socket. Therefore, observe that the marked line ends must be placed in the device socket when placing the lines.

In chapter "14. b) Wiring plan" you will find the wiring plan for the main PCB, in which the required line connections are shown and the complete table with all used lines or connections.

In addition, in the two chapters "14. c) Installation and connection of the PCBs and components" and "14. d) Wiring of the components" you will find a table at the end with the cables and connections used in the respective chapter.

b) Wiring plan

Connection plan of the main PCB



Abbreviations used:

230 V SWITCH = This is where the cable from the low-power device combination socket is connected.

bl = The respective blue line is connected here

sw = The respective black line is connected here

EXT. = extruder

DMS = elongation measuring strip

LIMIT SWITCH Z-MAX = Limit switch installed at the bottom of the Y-plate

LIMIT SWITCH Z-MIN = Limit switch installed at the bottom of the X-plate (light barrier)

The number designations at the lines correspond to the cable marks at the individual cables.

Overview of all lines and connections

Line	Length	Connection main PCB	Pin number plug/main PCB (all pins on white plugs; colour based on pin1)	Component	Pin number plug/component (all pins on plugs; colour based on pin1)
1	735 mm	X11	4pin green/yellow/white/brown	Motor X	4pin yellow/green/brown/white
2	840 mm	X12	4pin green/yellow/white/brown	Motor Y	4pin yellow/green/brown/white
3	380 mm	X16	4pin green/yellow/white/brown	Motor Z	4pin yellow/green/brown/white
4	1440 mm	X17	4pin green/yellow/white/brown	Motor extruder 0 (1st extruder)	4pin yellow/green/brown/white
		X18	4pin yellow-brown/white-yellow/ brown-green/white-green	Motor extruder 1 (2nd extruder)	4pin white-yellow/yellow-brown/ white-green/brown-green
		Fan additional PCB	4pin red/blue/grey-pink/red-blue	Fan 1/2 (single extruder)	2pin red/blue (+ = red)
				Fan 3/4 (dual extruder only)	2pin grey-pink/red-blue (+ = grey-pink)
		X4	2pin grey/pink	Heating extruder 0 (1st extruder)	2pin grey/pink
		X8	2pin black/violet	Heating extruder 1 (2nd extruder)	2pin black/violet

5	1000 mm	X38	3pin, open ends	Heating printing plate	2-pole black + 1-pole green-yellow Ring cable lug
6	975 mm	X13	2pin brown/white	Limit switch X	2pin brown/white
7	1630 mm	X14	2pin brown/white	Limit switch Y	2pin brown/white
8	830 mm	X36	2pin brown/white	Limit switch Z-max	2pin brown/white
9	1300 mm	X15	4pin green/yellow/white/brown	Limit switch Z-min	4pin green/yellow/white/brown
10	1500 mm	X5	2pin brown/white	External temperature sensor 0 (1st extruder)	2pin brown/white
11	1500 mm	X6	2pin brown/white	External temperature sensor 1 (2nd extruder)	2pin brown/white
12	1230 mm	X9	2pin brown/white	Temperature sensor printing plate	2pin brown/white
13	1420 mm	X7	5pin yellow/brown/green/white/shield	DMS (elongation measuring strip)	4pin yellow/brown/green/white
14	150 mm	X23	14pin flat-band cable	Keyboard (twisted plug)	14pin flat-band cable
15	175 mm	X21	14pin flat-band cable	Display	14pin flat-band cable
28	1000 mm	X43	4pin	LED strip	
29	140 mm	X45	2pin red/black (+ = red)	Housing fan	
32	140 mm	X24	2pin brown/white	Fan control	3pin white/empty/brown

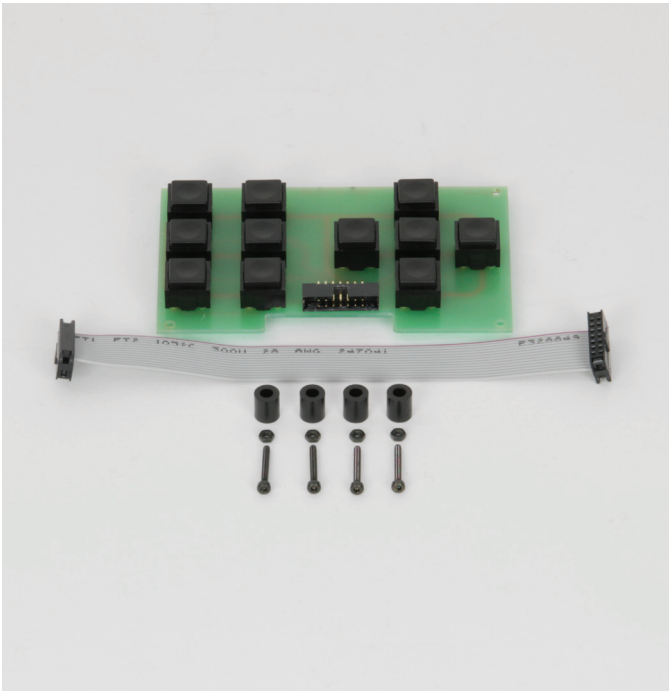
Line	Length	Cross-section	Connection	Pin number plug/main PCB (all pins on white plugs; colour based on pin1)	Connection	Pin number plug/component (all pins on white plugs; colour based on pin1)
22	150 mm	0.75 mm ²	Casing	1pin green-yellow ring cable lug	Low-voltage device combination socket	1pin green-yellow flat cable lug
			Mains adapter protective earth	1pin green-yellow open end		
23	640 mm	0.75 mm ²	Main PCB X41	1pin black open end	Low-voltage device combination socket	1pin black flat cable lug
				1pin blue open end		1pin blue flat cable lug
24	150 mm	0.75 mm ²	Main PCB X40	1pin black open end	Emergency off	1pin black flat cable lug
				1pin blue open end		1pin blue flat cable lug
25	550 mm	0.75 mm ²	Main PCB X37	1pin black open end	Mains unit L	1pin black open end
				1pin blue open end	Mains unit N	1pin blue open end
26	600 mm	0.75 mm ²	Main PCB X39	1pin black open end	Power plug	1pin black open end
				1pin blue open end		1pin blue open end
27	370 mm	2.5 mm ²	Main PCB X1	1pin red, open end (+)	Mains unit +V	1pin red, open end (+)
				1pin black open end	Mains unit -V	1pin black open end
30	170 mm	0.75 mm ²	Casing	1pin green-yellow ring cable lug	Power plug Protective ground	1pin green-yellow open end
31	180 mm	2.5 mm ²	Casing	1pin green-yellow ring cable lug	Mains unit -V	1pin green-yellow open end

c) Installation and connection of the PCBs and components

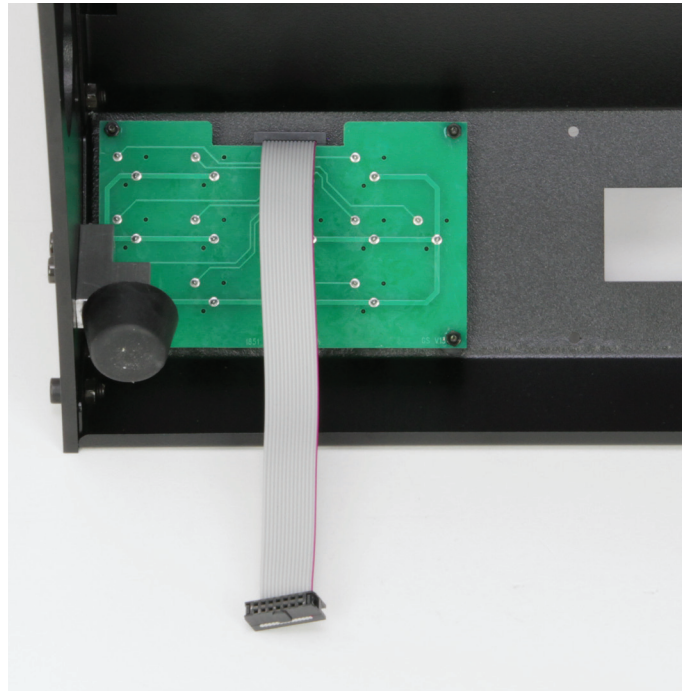


The components on the PCBs can be damaged by electrostatic discharge. Therefore, touch an earthed radiator, for example, before picking up the PCBs or use an earthing strap.

Installing the keyboard PCB



- 1 x keyboard PCB
- 1 x flat band line with **twisted** plugs (line 14) (150 mm)
- 4 x spacer roller 8 mm for keyboard PCB
- 4 x nut M2 (black)
- 8 x cylinder head screw M2x16 (black)



For easier mounting, you can fix the spacer rollers to the top of the PCB beforehand, e.g. with a drop of hot glue. If necessary, it may also be advisable to unscrew the foot holder in the area of the keyboard PCB for mounting.

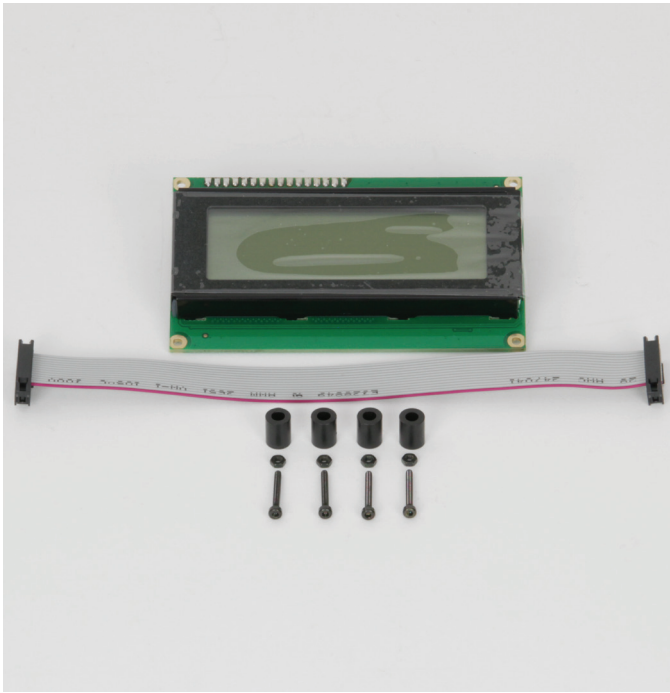
First connect the flat band line to the keyboard PCB and make sure that the lugs on the plugs are in the correct position. Mount the keyboard PCB with the spacer rollers 8 mm as shown in the figure.

The 4 screws have to be lacquered with threadlocker varnish in the area of the nuts!

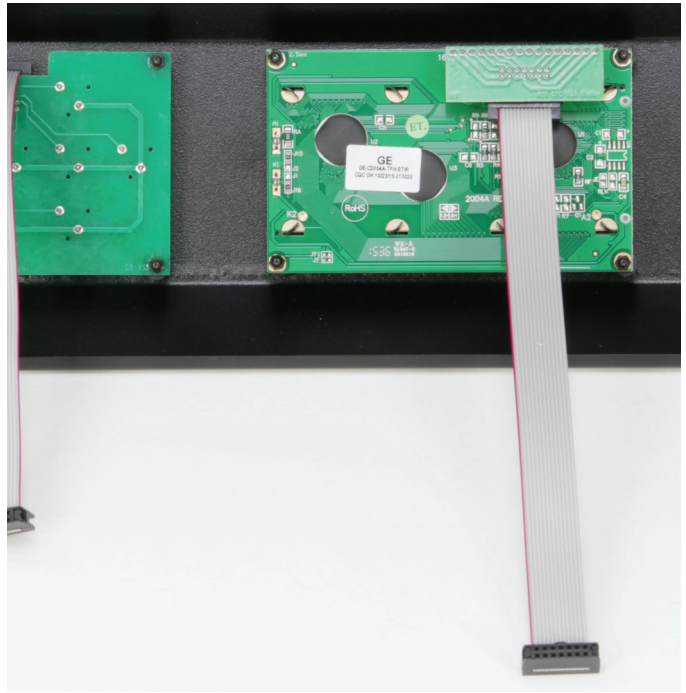
During assembly, align the PCB so that the connector with the flat band line points to the top of the device.

First loosely fasten the PCB so that it can still be moved slightly. Then check all buttons so that they move smoothly and do not jam in the housing cut-outs. Finally tighten all 4 nuts.

Installation of the display PCB



- 1 x display PCB
- 1 x flat band line with plugs (cable 15) (175 mm)
- 4 x spacer roller 9 mm for display PCB
- 4 x nut M2 (black)
- 8 x cylinder head screw M2x16 (black)



For easier mounting, you can fix the spacer rollers to the top of the PCB beforehand, e.g. with a drop of hot glue.

Remove the protective film from the display first.

Mount the display PCB with the spacer rollers 9 mm as shown in the figure.

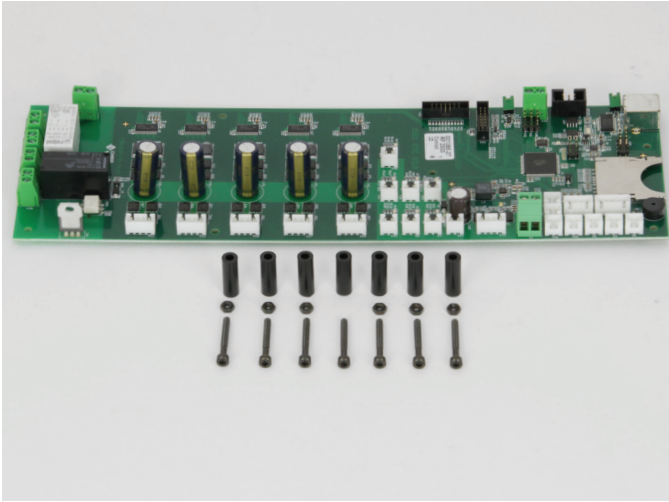
The 4 screws have to be lacquered with threadlocker varnish in the area of the nuts!

When mounting the PCB, align it so that the small additional PCB with the plug connector points to the top of the device.

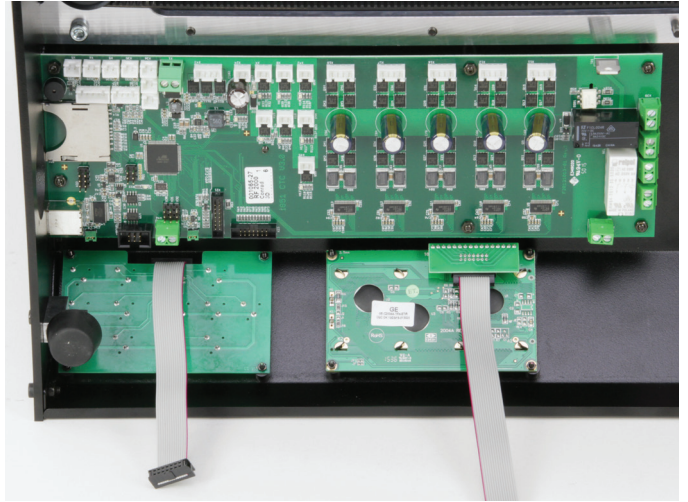
First loosely fasten the PCB so that it can still be moved slightly. Then align them in such a way that the display is exactly right-angled in the housing cut-out. Then tighten all four nuts.

Finally, connect the flat band line to the display PCB and make sure that the lugs on the plugs are in the correct position.

Installation of the main PCB



- 1 x main PCB
- 7 x spacer roller 20 mm
- 6 x nut M3 (black)
- 7 x cylinder head screw M3x25 (black)



For easier mounting, you can fix the spacer rollers to the bottom of the PCB beforehand, e.g. with a drop of hot glue.

Mount the main PCB with the spacer rollers 20 mm as shown in the figure.

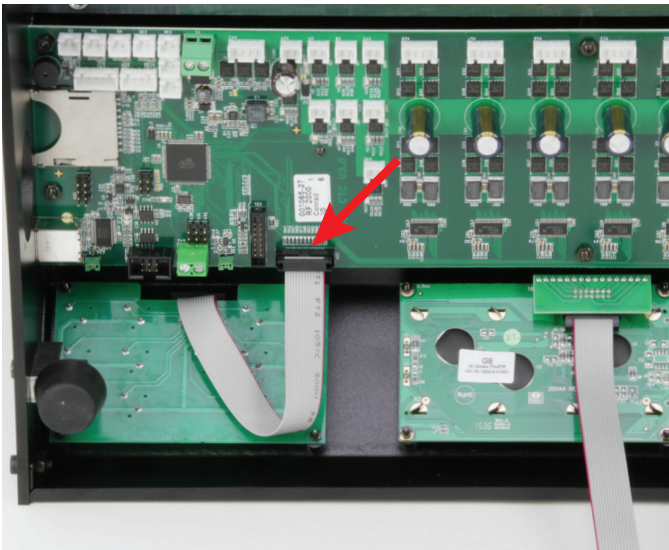
Insert the cylinder head screw in the middle only through the hole and the spacer roller. This is not yet fastened with a nut.

The 6 screws on the outside of the PCB must be coated with thread-locker varnish in the area of the nuts!

During assembly, align the PCB so that the USB connection and the memory card reader lie neatly behind the respective housing cut-outs.

Then tighten the 6 nuts on the outside of the PCB.

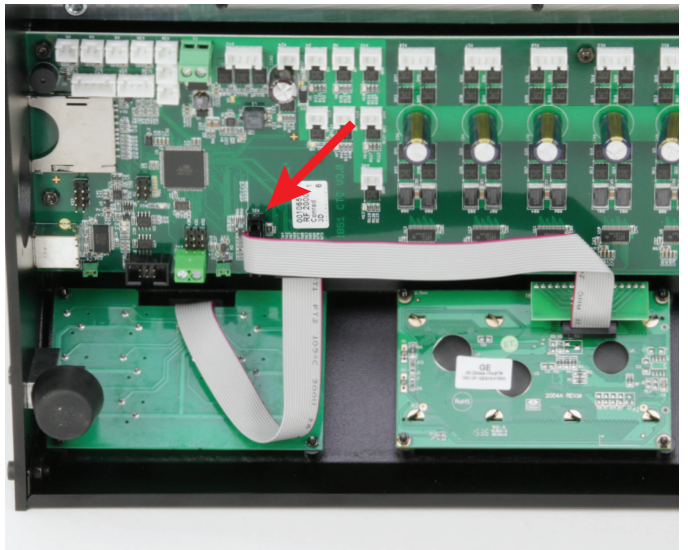
Connection of display and keyboard PCB



Connect the flat band line (line 14) connected to the keyboard PCB to plug strip X23 of the main PCB.

Again, observe correct position of the lugs at the plugs again.

Optionally, you can secure the plug connections with a drop of hot glue.

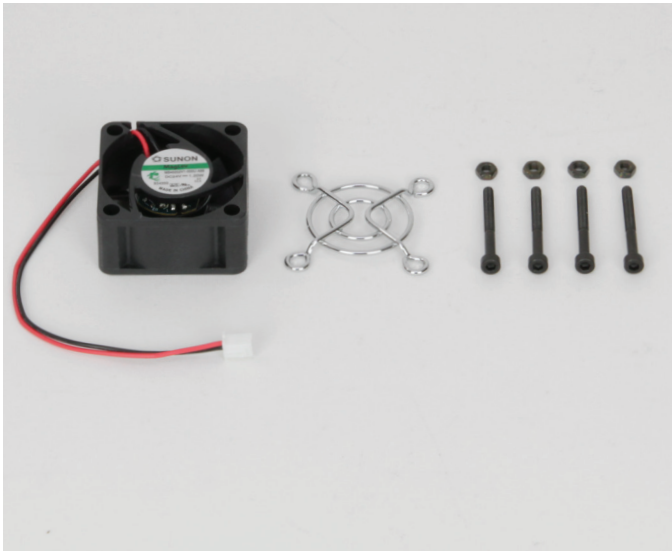


Connect the flat band line (cable 15) plugged into the display PCB to the plug strip X21 of the main PCB.

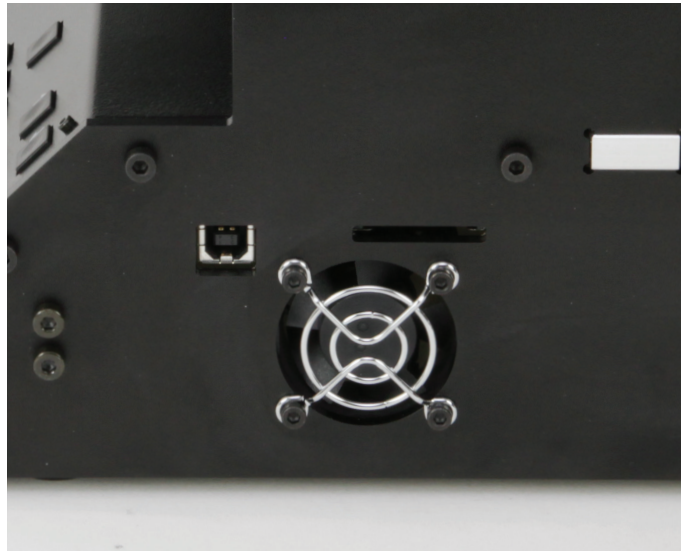
Again, observe correct position of the lugs at the plugs again.

Optionally, you can secure the plug connections with a drop of hot glue.

Installation of the fan for the main PCB



- 1 x fan 40x40
- 1 x fan grille
- 4 x cylinder head screw M3x30 (black)
- 4 x nut M3 (black)



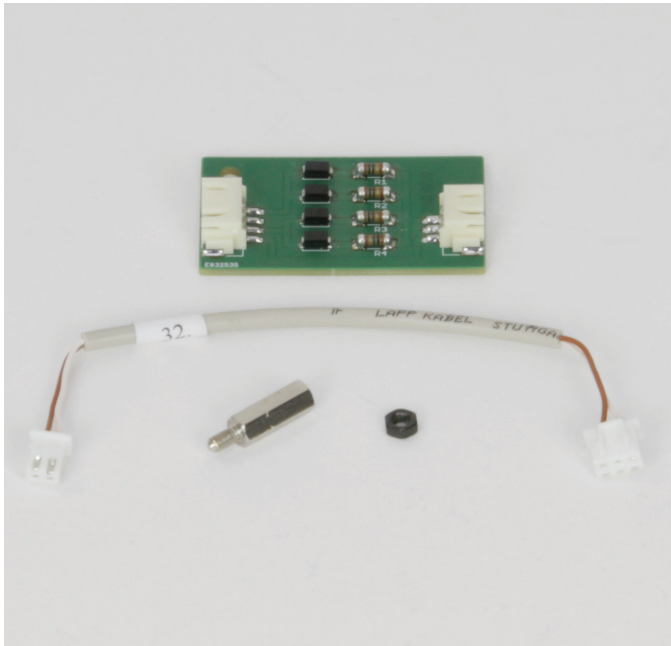
Mount the fan grille and the fan with the 4 cylinder head screws and the 4 nuts on the recess on the right side part. The fan sheet should be mounted from the outside and the fan from the inside. Pay attention to the blowing direction of the fan. This is marked by an arrow on the fan and should be directed inwards. The fan also should be installed so that the connection cable points to the main PCB and the connection X1 (also see next figure).

Connection of the fan

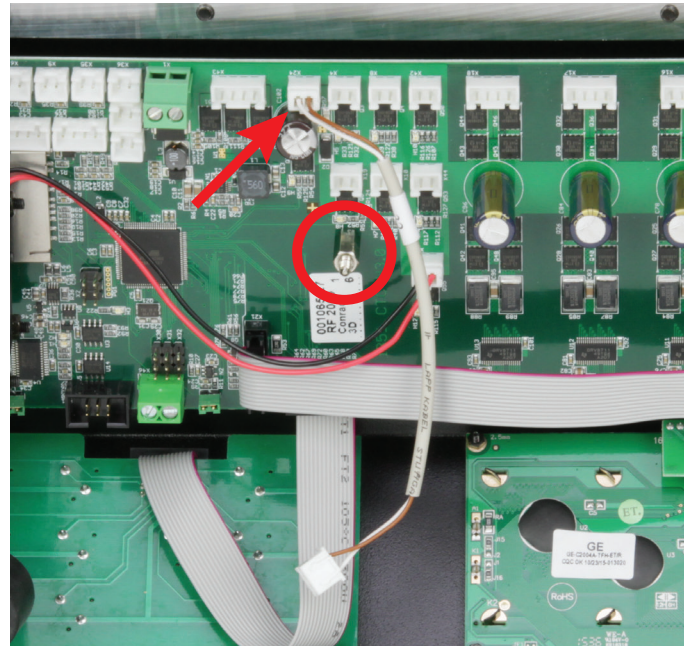


Connect the fan to the X45 connector on the main PCB as shown in the figure.

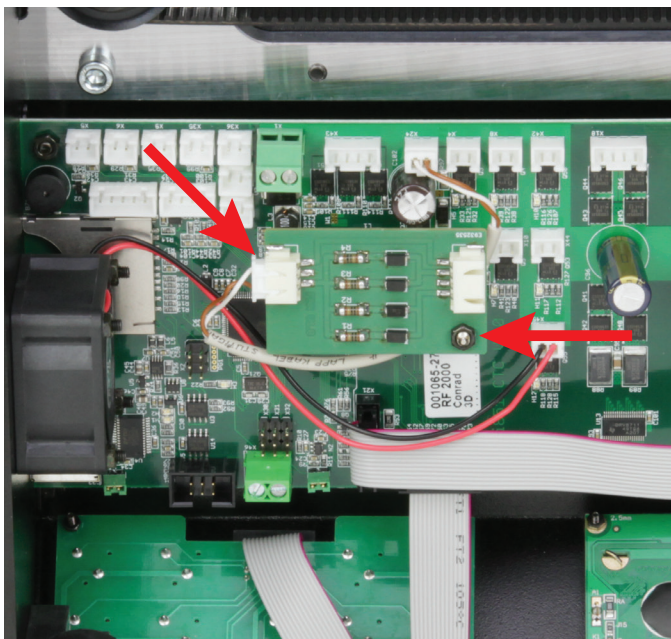
Installation of the additional PCB for the fan controller



- 1 x additional PCB
- 1 x cable 32 (140 mm)
- 1 x hexagon threaded bolt M3, length 15 mm
- 1 x nut M3 black



Mount the hexagon threaded bolt M3 to the remaining cylinder head screw in the middle of the main PCB.
The screw has to be lacquered with threadlocker varnish in the area of the threaded bolt!
Connect the 2-pole plug of cable 2 to connection X24.

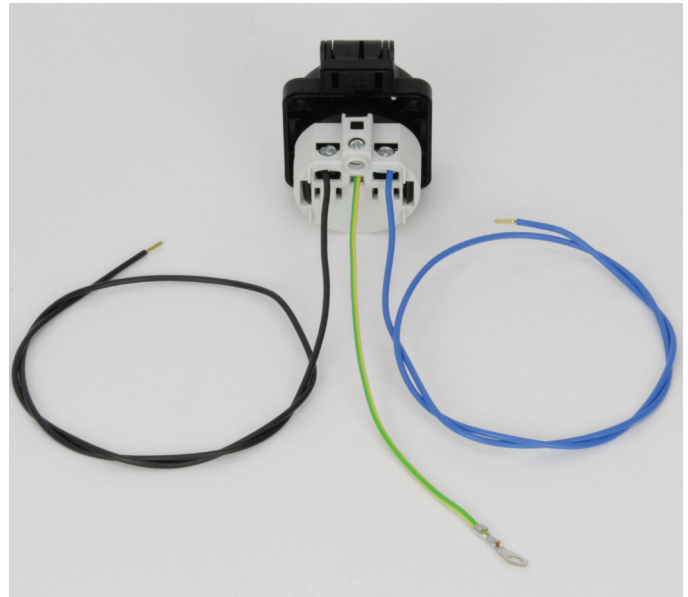


Fasten the additional PCB with the nut M3 to the hexagon threaded bolt previously fitted.
The hexagon threaded bolts have to be lacquered with threadlocker varnish in the area of the nut!
Align the PCB in the direction of the fan.
Now connect the 3-pole plug of cable 2 to the 3-pole socket of the additional PCB.

Connection of the lines to the socket



- 1 x power plug
- 4 x cylinder head screw M4x10 black
- 4x nut M4 black
- 1 x line with ring eyelet green/yellow (170 mm) (line 30)
- 1 x line black (600 mm) (line 26)
- 1 x line blue (600 mm) (line 26)

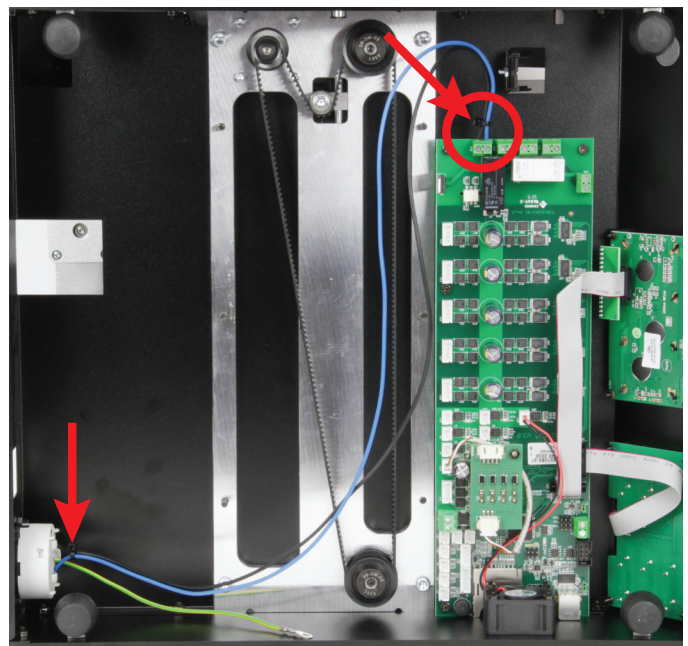


Connect the black line as illustrated (from the rear view of the socket) to the left terminal.
Connect the blue wire to the right-hand terminal.
Connect the line with the ring eyelet green/yellow to the middle terminal.

Installation and connection of the power plug



Push the socket with the cables from behind into the corresponding opening and fasten it with the 4 cylinder head screws and nuts. The socket must be aligned so that the cover opens upwards.

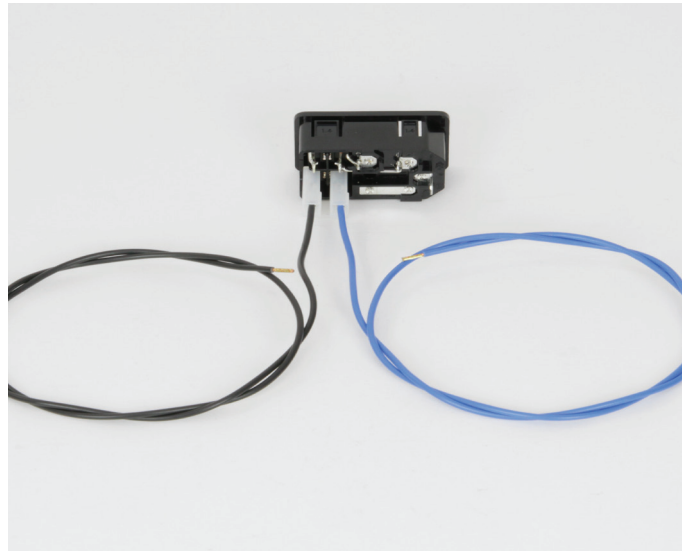


Connect the black and blue lines of the socket to the terminals X39 (see circle in the figure) of the main PCB. Viewed as in the figure, the black line must be connected on the left and the blue one on the right in the terminal.
Tie both lines together with a small cable tie (99 mm) close to the connection terminal and socket (see arrows in the figure).
The line with the ring eyelet (green/yellow) is only connected later.

Connection of the lines to the low-power device combination socket



1 x low-power device combination socket
1 x line black (640 mm) (line 23)
1 x line blue (640 mm) (line 23)

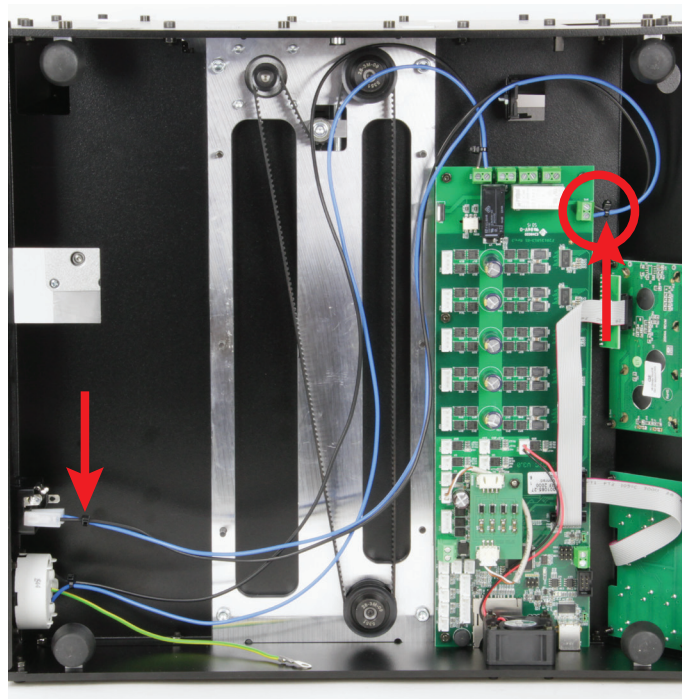


When the low-power device combination socket is in the position shown in the figure, connect the black wire to the terminal on the far left and the blue wire to the terminal (N) next to it on the right.

Installation and connection of the low-power device combination socket

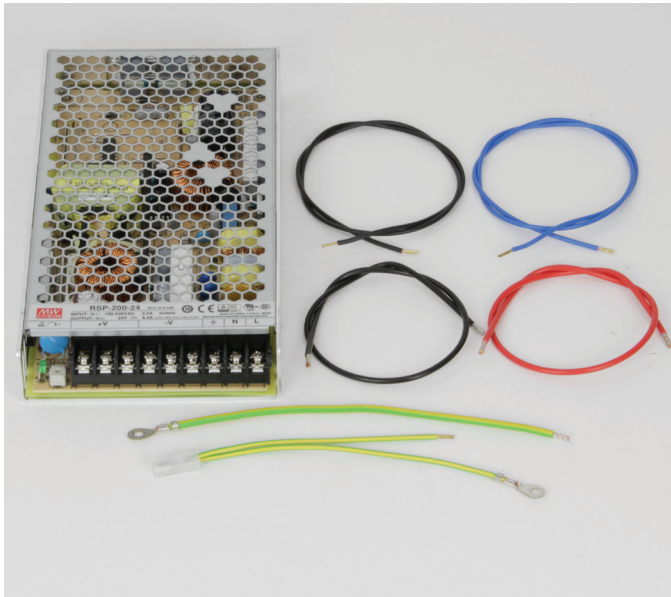


Clip the low-power device combination socket into the corresponding cut-out in the rear panel. The socket must be inserted so that the switch points down.

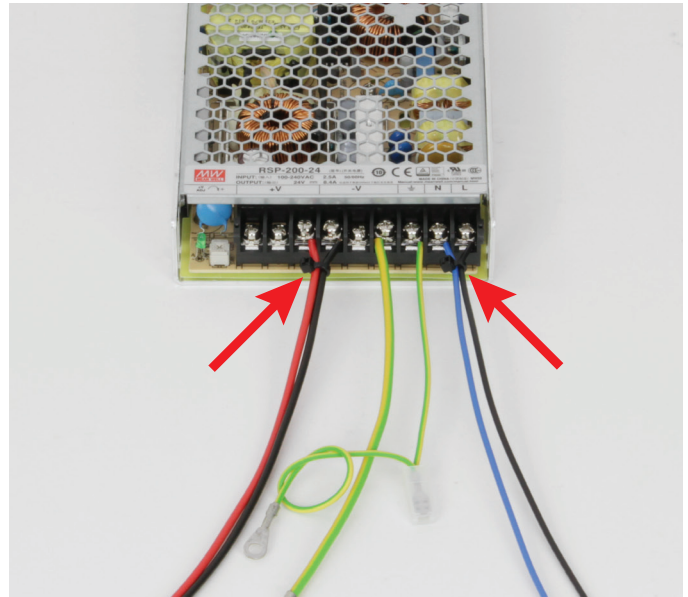


Connect the black and blue lines of the low-power device combination socket to the terminals X41 (see circle in the figure) of the main PCB. Viewed as in the figure, the black line must be connected at the top and the blue one at the bottom in the terminal. Tie both lines together with a small cable tie (99 mm) close to the connection terminal and low-power device combination socket (see arrows in the figure).

Connection of the lines at the mains unit

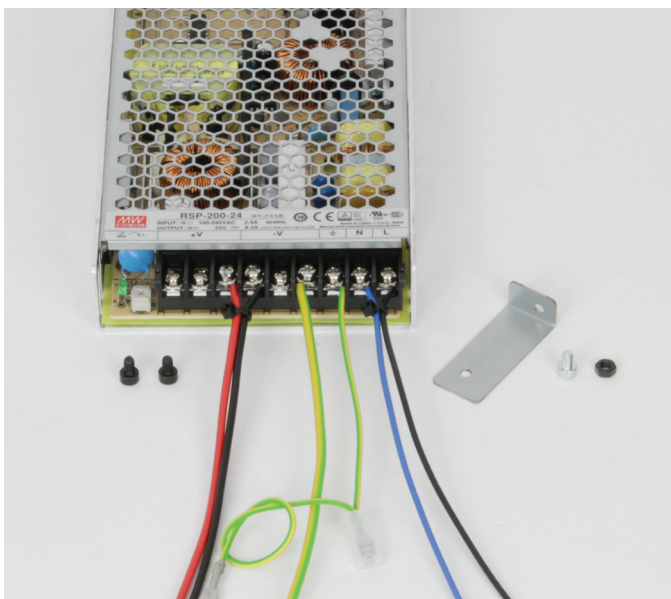


- 1 x mains unit
- 1 x line black (550 mm) (line 25)
- 1 x line blue (550 mm) (line 25)
- 1 x cable black (370 mm, 2.5 mm²) (cable 27)
- 1 x cable red (370 mm, 2.5 mm²) (cable 27)
- 1 x line with ring eyelet green/yellow (180 mm, 2.5 mm²) (line 31)
- 1 x line with flat plug connector and ring eyelet green/yellow (150 mm) (line 22)



Connect the black wire (550 mm) to terminal **L** and the blue wire (550 mm) to terminal **N** of the mains unit.
 Connect the line with the flat plug connector and the ring eyelet (green/yellow) to the protective ground terminal (⊕) at the mains unit.
 Connect the cable with the ring eyelet (green/yellow) (180 mm, 2.5 mm²) to one of the terminals **-V** on the mains unit.
 Connect the black cable (370 mm, 2.5 mm²) to one of the **-V** terminals.
 Connect the red cable (370 mm, 2.5 mm²) to one of the **+V** terminals.
 Tie together the lines at the terminals **L** and **N**, as well as **+V** and **-V** with a small cable tie (99 mm) each close to the connection terminal (see arrow in the figure).

Installation of the mains unit

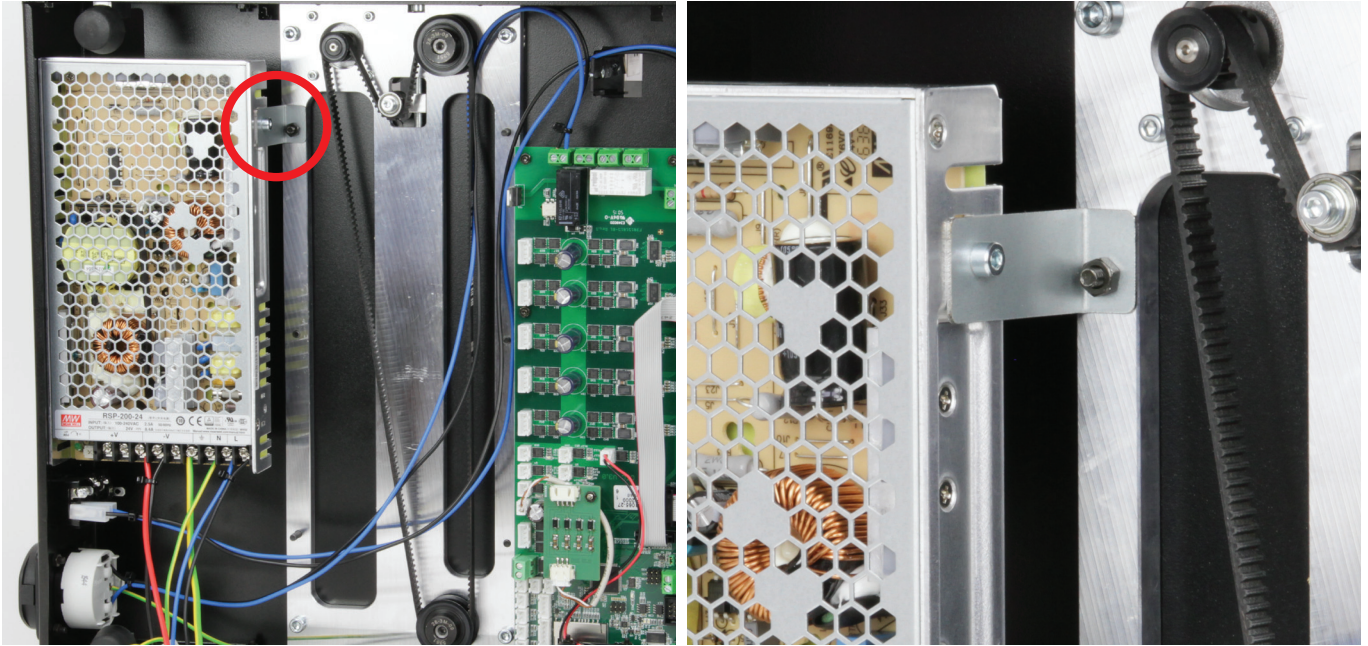


- 1 x mains unit with already-connected lines
- 2 x cylinder head screw M4x6 (black)
- 1 x retaining bracket for mains unit
- 1 x cylinder head screw M4x6
- 1 x nut M4 (black)



Attach the mains unit to the rear panel with the 2 black M4 cylinder head screws so that the connections of the mains unit to the socket and the screw terminals face downwards.
 Please also note the next figure.
 Tighten the two screws not entirely yet.

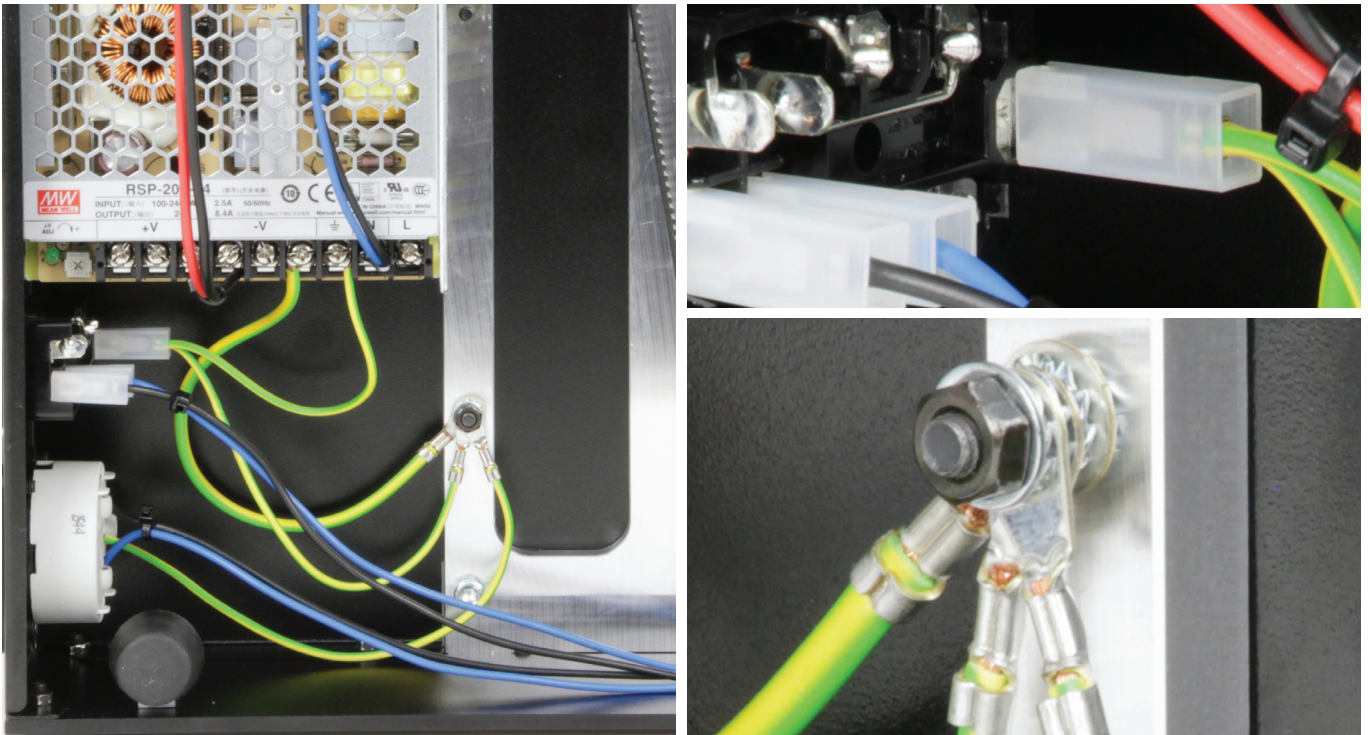
Installing the retaining bracket



Loosely fasten the retaining bracket with the nut M4 to the upper fixing screw of the rear panel (M4x16) (as shown in the figure). Then fasten it to the mains unit with the M4x6 cylinder head screw (see figure).

Finally, tighten the nut, the screw from the retaining bracket on the mains unit and the two screws on the outside of the housing.

Connecting the protective conductors



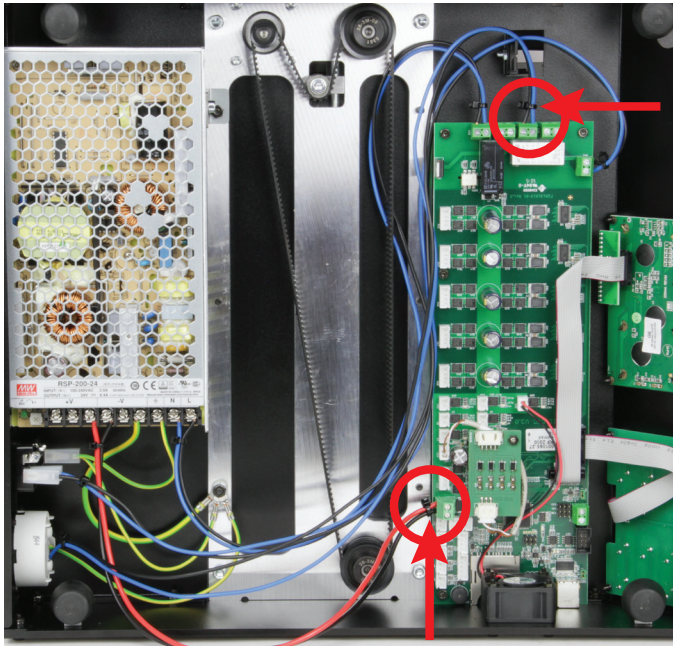
Connect the line with flat plug connector (green/yellow) to the protective ground contact tab of the low-power device combination socket (see small figure at the upper left).

Connect the ring eyelet of the green/yellow cables (-V mains unit, protective conductor mains unit, protective conductor socket) to the long fixing screw M4x20 of the rear panel as shown in the left figure.

Caution: This connection creates the safety-technically important contact between the housing parts and the protective ground. Always observe the position of the washers and sprockets:

Housing > sprocket M4 > ring eyelet > sprocket M4 > ring eyelet > sprocket M4 > ring eyelet > sprocket M4 > washer M4 > nut M4 black (see figure below right)

Connection of the mains unit



Connect the black and blue lines to the terminals X37 (see upper circle in the figure) of the main PCB. Viewed as in the figure, the black line must be connected on the left and the blue one on the right in the terminal.

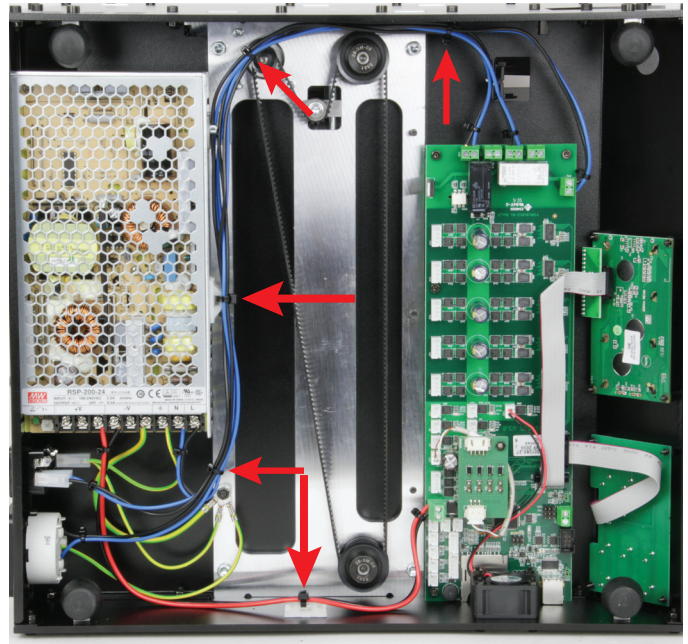
Tie both lines together with a small cable tie (99 mm) close to the connection terminal (see arrows in the figure).

Connect the red and black lines (370 mm each) to the terminals X1 of the main PCB.

Tie both lines together with a small cable tie (99 mm) close to the connection terminal (see arrows in the figure).

Attention! Pay attention to the polarity:
red = + (in the figure upper terminal of X1)
black = - (in the figure lower terminal of X1)

Placing the lines



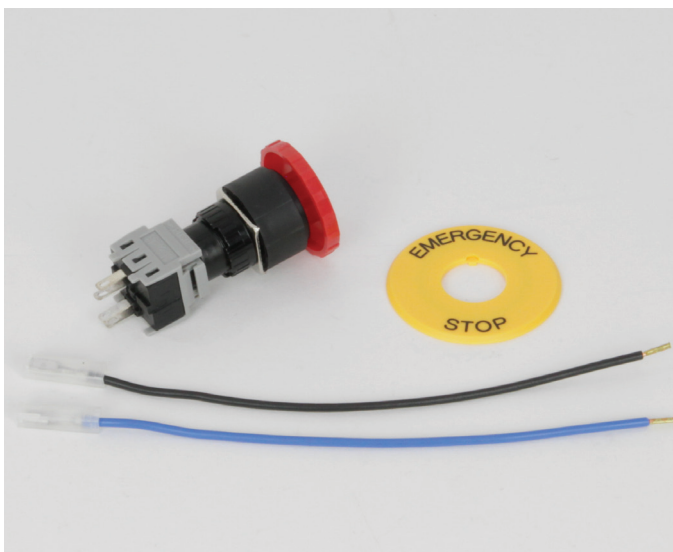
Tie all black and blue wires together with 3 small cable ties (99 mm) (see the 3 small arrows in the figure).

Then attach this strand to the mains unit using a self-adhesive cable tie holder and a large cable tie (142 mm) (see large horizontal arrow in figure).

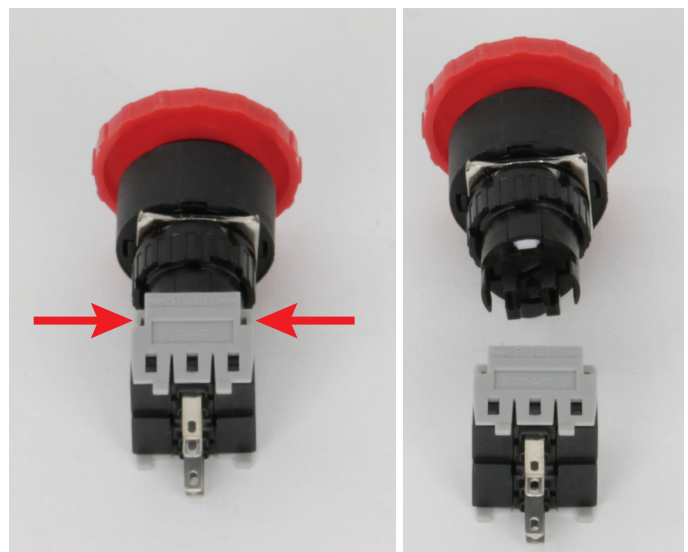
The black and red wires are also attached to the housing with a self-adhesive cable tie holder and a large cable tie (142 mm) (see large vertical arrow in the figure). Make sure that there is at least as much distance between the lower edge of the side part and the adhesive socket as between the lower edge and the housing fan.

The lines must not get into the rotating toothed belts in operation.

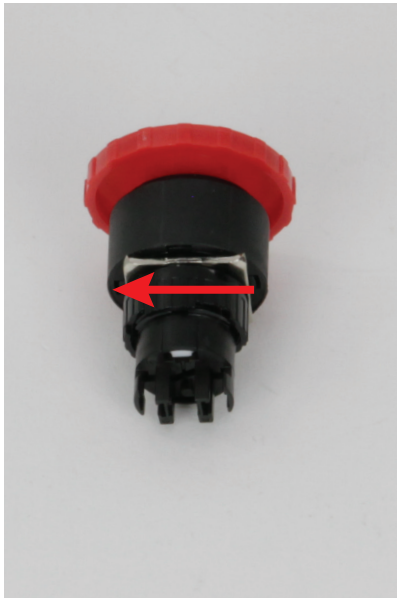
Preparing the emergency off switch



- 1 x emergency off switch
- 1 x name plate "EMERGENCY STOP"
- 1 x line black (150 mm) (line 24)
- 1 x line blue (150 mm) (line 24)



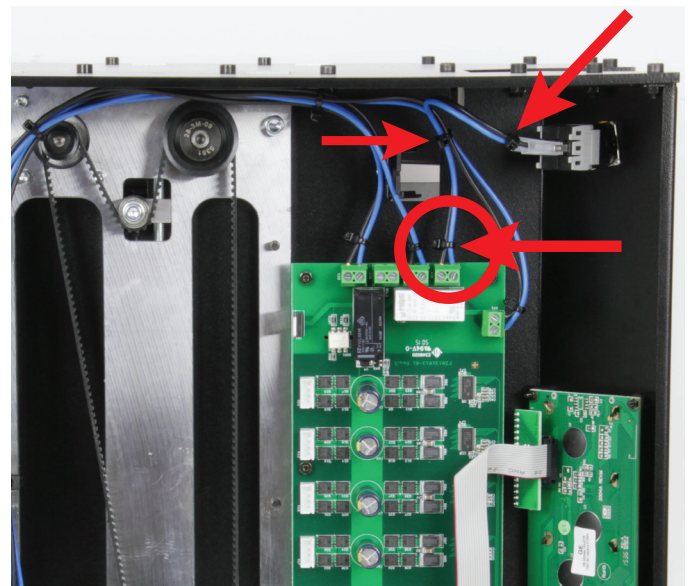
To disassemble the emergency off switch, press the release button on both sides simultaneously and pull the switch apart.



Unscrew the plastic fixing nut counter-clockwise and then remove the metal washer.

The emergency off switch must be installed in this sequence. The parts on the left in the figure are mounted from the outside (from bottom to top), the parts on the right in the figure are mounted from the inside (from top to bottom).

Installation and connection of the emergency off switch



First attach the name plate to the switch. It must be pushed onto the switch in the guide.

Then insert the switch into the opening.

From the inside, first push the metal washer onto the switch with the curved corners towards the housing. Then tighten the switch with the plastic nut (the flat side towards the housing).

Make sure that the name plate is aligned straight.

Reconnect the electrical part of the switch.

Connect the two wires to the two middle contacts "NC" (the two outer contacts must stay free). The polarity is irrelevant for this.

Connect the black and blue wires to the terminals X40 (see circle in the figure) of the main PCB. Viewed as in the figure, the black line must be connected on the left and the blue one on the right in the terminal.

Tie both lines together with a small cable tie (99 mm) close to the connection terminal and switch (see big arrows in the figure).

Lay the cables neatly and fix them with a small cable tie (99 mm) (see small arrow in the figure).

Overview of all cables and connections used in this chapter

Line	Length	Connection main PCB	Pin number plug/main PCB (all pins on white plugs; colour based on pin1)	Component	Pin number plug/component (all pins on plugs; colour based on pin1)
14	150 mm	X23	14pin flat-band cable	Keyboard (twisted plug)	14pin flat-band cable
15	175 mm	X21	14pin flat-band cable	Display	14pin flat-band cable
28	1000 mm	X43	4pin	LED strip	
29	140 mm	X45	2pin red/black (+ = red)	Housing fan	
32	140 mm	X24	2pin brown/white	Fan control	3pin white/empty/brown

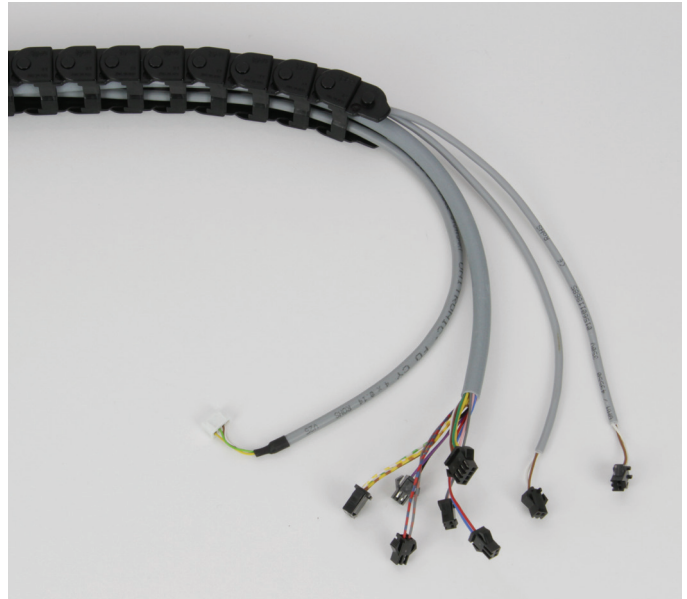
Line	Length	Cross-section	Connection	Pin number plug/main PCB (all pins on white plugs; colour based on pin1)	Connection	Pin number plug/component (all pins on white plugs; colour based on pin1)
22	150 mm	0.75 mm ²	Casing	1pin green-yellow ring cable lug	Low-voltage device combination socket	1pin green-yellow flat cable lug
			Mains adapter protective earth	1pin green-yellow open end		
23	640 mm	0.75 mm ²	Main PCB X41	1pin black open end	Low-voltage device combination socket	1pin black flat cable lug
				1pin blue open end		1pin blue flat cable lug
24	150 mm	0.75 mm ²	Main PCB X40	1pin black open end	Emergency off	1pin black flat cable lug
				1pin blue open end		1pin blue flat cable lug
25	550 mm	0.75 mm ²	Main PCB X37	1pin black open end	Mains unit L	1pin black open end
				1pin blue open end	Mains unit N	1pin blue open end
26	600 mm	0.75 mm ²	Main PCB X39	1pin black open end	Power plug	1pin black open end
				1pin blue open end		1pin blue open end
27	370 mm	2.5 mm ²	Main PCB X1	1pin red, open end (+)	Mains unit +V	1pin red, open end (+)
				1pin black open end	Mains unit -V	1pin black open end
30	170 mm	0.75 mm ²	Casing	1pin green-yellow ring cable lug	Power plug Protective ground	1pin green-yellow open end
31	180 mm	2.5 mm ²	Casing	1pin green-yellow ring cable lug	Mains unit -V	1pin green-yellow open end

d) Wiring of the components

Preparation of cables for the extruder unit

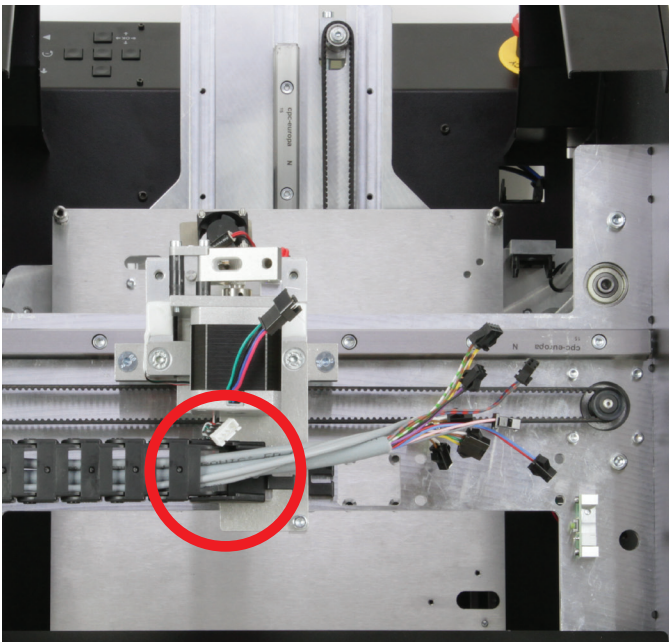


- 1 x energy drag chain large, 11 links
- 1 x cables 04 (heating, fan, motor extruder 0 and 1)
- 1 x cables 10 (temperature sensor extruder 0)
- 1 x cables 11 (temperature sensor extruder 1; only with dual)
- 1 x cables 13 (elongation measuring strip)



Push the cables into the energy drag chain so that the end link with the nipples is directed towards the black plugs of cables 04, 10 and 11 and towards the 4-pin plug of cable 13.

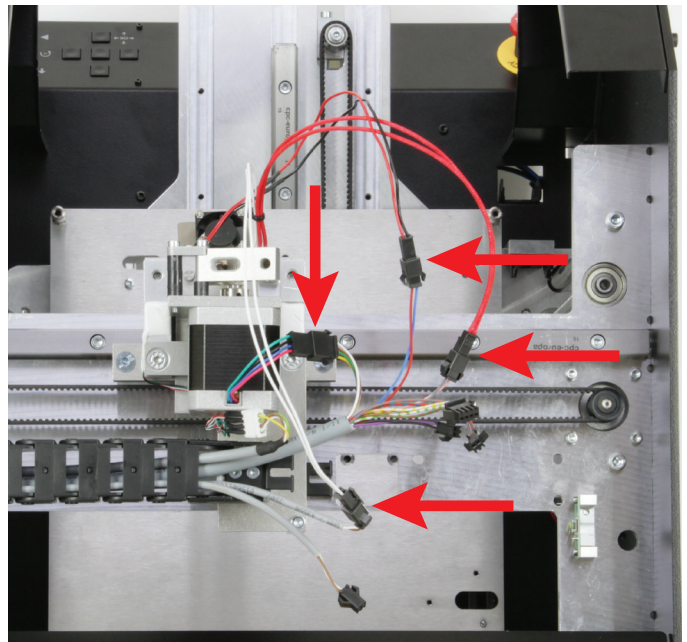
Assembly of the energy drag chain and connection of the extruder unit



Engage the energy drag chain in the drag chain end piece of the extruder unit.

Pull all cables slightly out of the drag chain.

→ All connections of line 04, except the ones described on the right and line 11 are only required for the dual extruder.



Connect the cables to the respective plugs.

Line 04:

4-pole yellow/green/brown/white - motor

2-pole red/blue - extruder fan

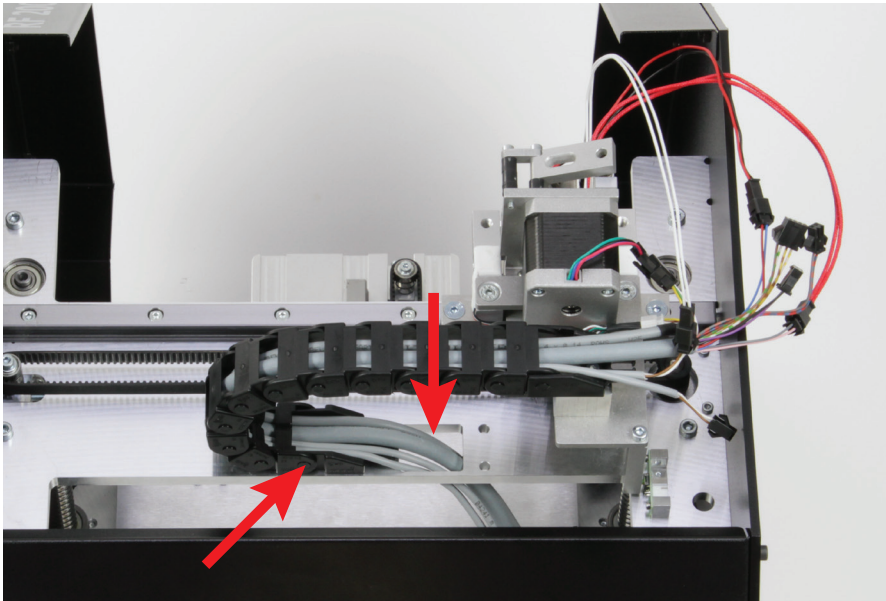
2-pole grey/pink - heating extruder (red cable from extruder)

Line 10:

Temperature sensor extruder (white cable from extruder)

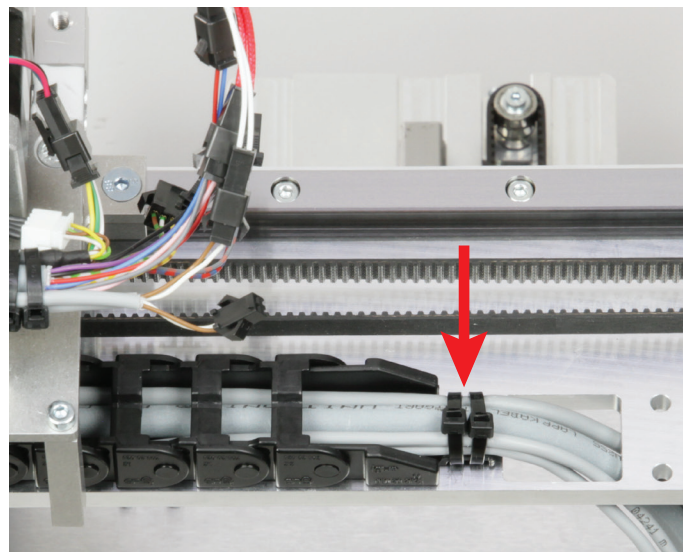
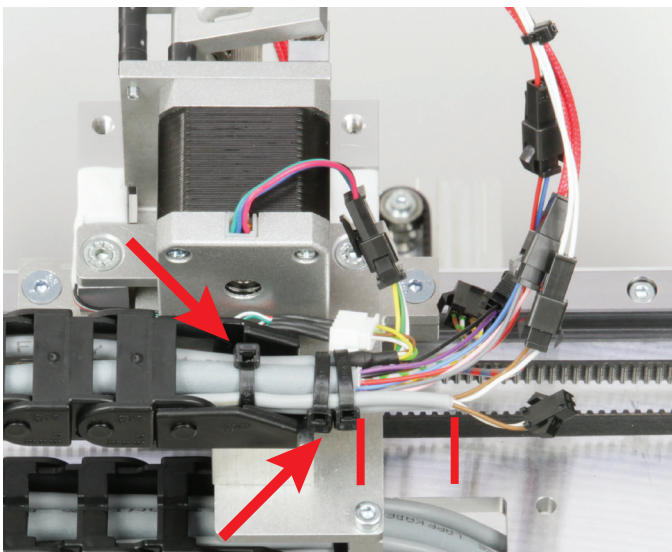
Line 13:

Elongation measuring strip



Move the extruder carriage all the way to the right (from the rear view as shown in the figure). Carefully thread all cables through the opening of the X-plate in the direction of the Y-plate. Then engage the energy drag chain at the free end piece.

Fastening the lines



First, use four small cable ties (99 mm) to lay the lines from the extruder (heating, temperature sensor and fan) neatly to the plugs. Position the first cable tie at the height of the upper edge of the extruder holder (heating and sensor only). The fourth one at the plugs. Please note the last two figures on the next page.

Push all cables back into the drag chain until cable 04 and 13 terminate with the tension relief. The two cables 10 and 11 must protrude 22 mm further than the cables 04 and 13 (see the two vertical lines in the figure).

Tie all cables together in the drag chain with a large cable tie (142 mm) about 10 to 20 mm from the tension relief. The lock of the cable tie should point upwards.

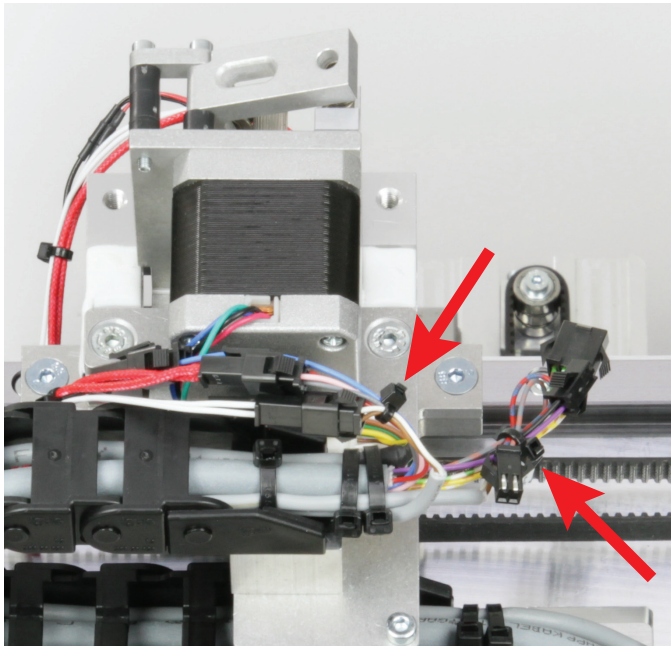
Then fix the cables with two large cable ties (142 mm) to the tension relief of the upper drag chain end piece.

Move the extruder carriage several times from left to right.

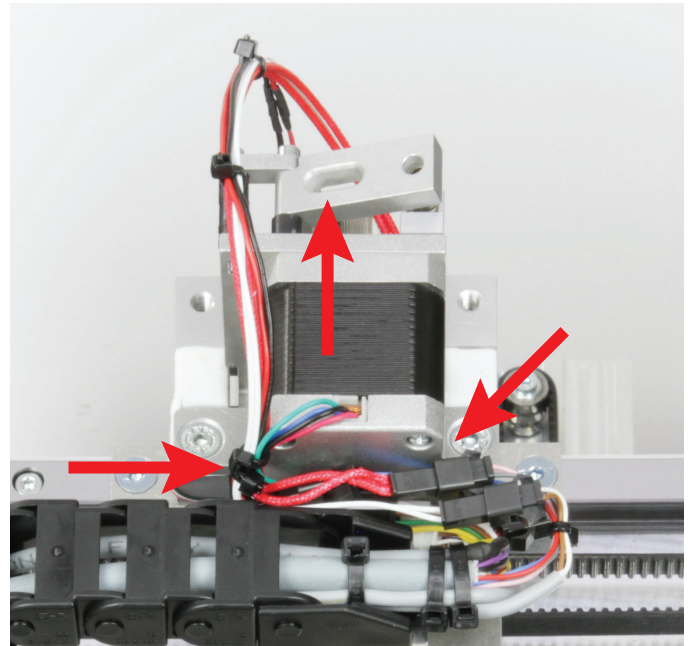
Then fix all cables with two large cable ties (142 mm) to the tension relief of the lower drag chain end piece.



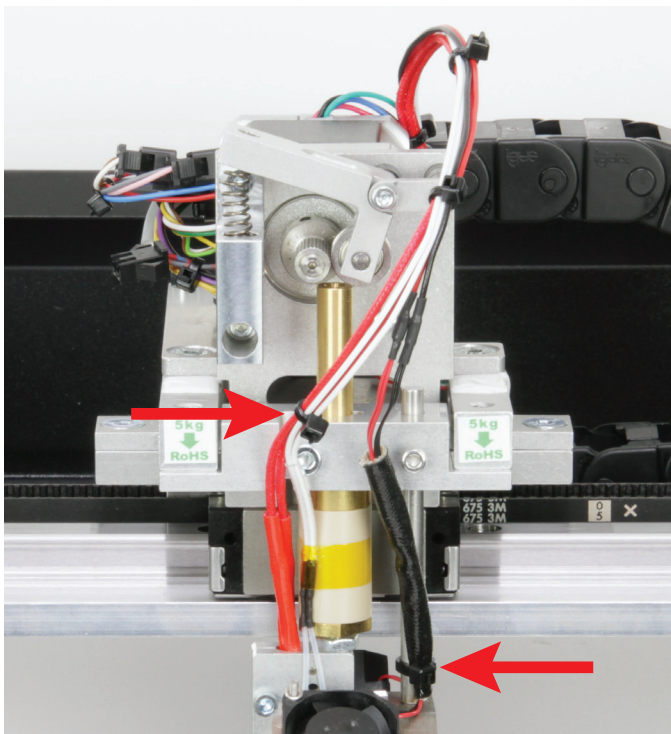
When subsequently tying the lines together, it should be the case that if the extruder unit is to be removed, as few cable ties as possible must be opened. Therefore the cables should only be tied together before or after the plug.



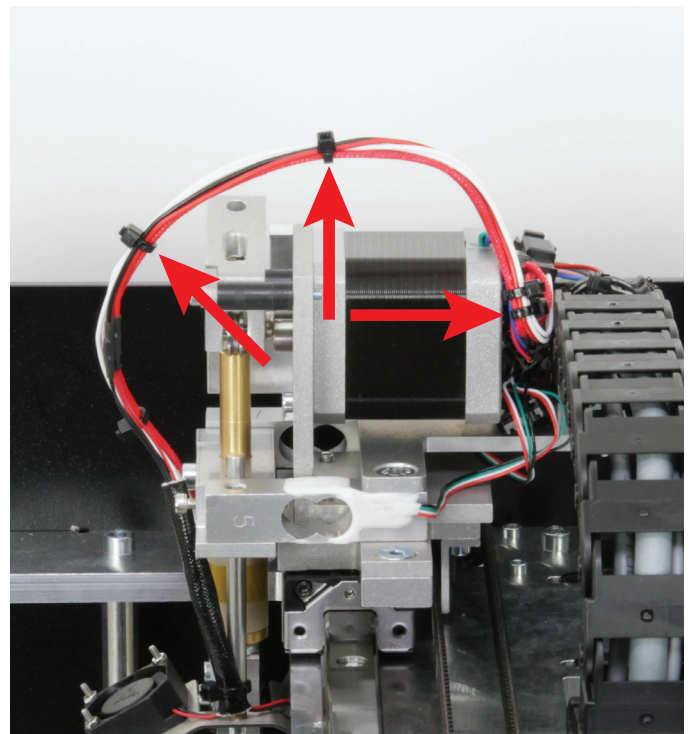
Tie all unused cables together with a small cable tie (99 mm). The cables for the extruder heating, the temperature sensor and the fan are also tied together with a small cable tie. Make sure, however, that the cable tie is behind the plug, i.e. in the direction of the drag chain.



Push all cables behind the motor. The lines to the extruder should be at the top. Fix them to the motor cable with a small cable tie. The lines to the extruder must not be routed over the inlet for the filament. This must remain free.



So the 4 small cable ties should be approximately positioned (see upper arrow in this figure and the arrows in the right figure). The lines should also be routed slightly to the right on the side of the fan. So that the filament inlet remains free. In addition, position a small cable tie at the bottom of the fan sheet and fix the fan cable with it (see lower arrow).

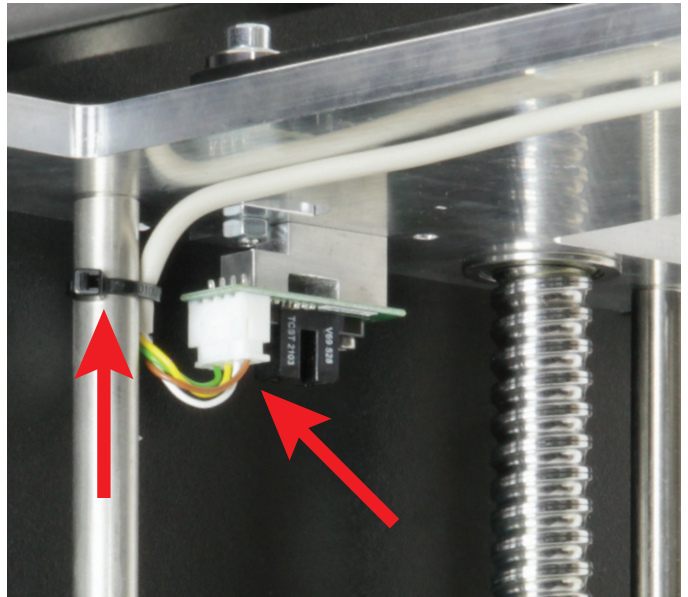


The side view should look roughly as in the figure above. Important! The extruder and fan cables must never be tensioned! They must be routed loosely. Never lay the cables behind the counter-bearing or attach them to it. Otherwise, there may be problems at calibration!

Connection of the limit switch for the Z-direction (Z-min limit switch at the X-plate)

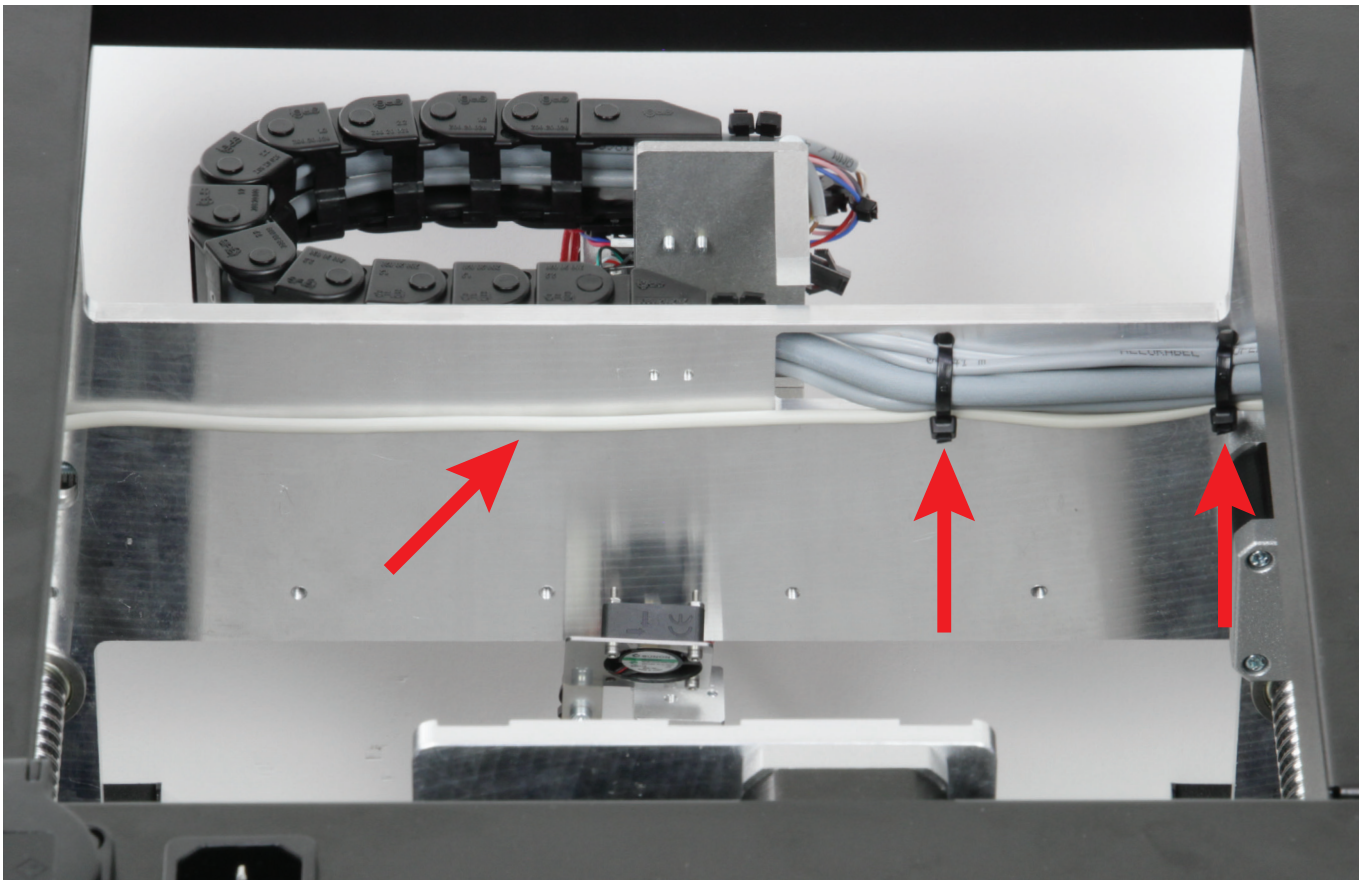


1 x cable 09 (Z-min limit switch)



Connect the cable 09 with the side without numbering to the connection plug of the light barrier.
Fasten the cable to the spacer with a small cable tie (99 mm). The cables between cable tie and connector plug must not be tensioned.

Placing the line of the Z-stop

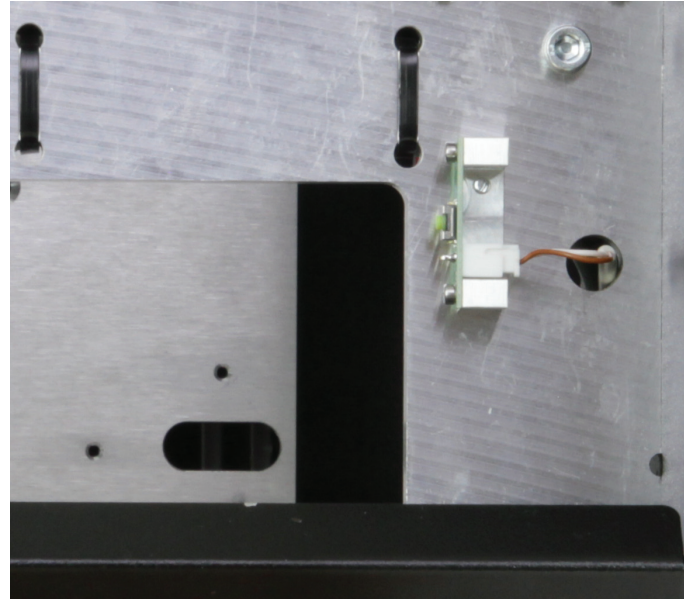


Lay the cable of the upper limit switch for the Z-direction to the remaining cables of the extruder unit.
Fix all cables together with a large cable tie (142 mm) in the holes provided.
The lock of the cable tie should be on the bottom side.

Connection of the limit switch for the X-direction



1 x line 06 (X-limit switch)

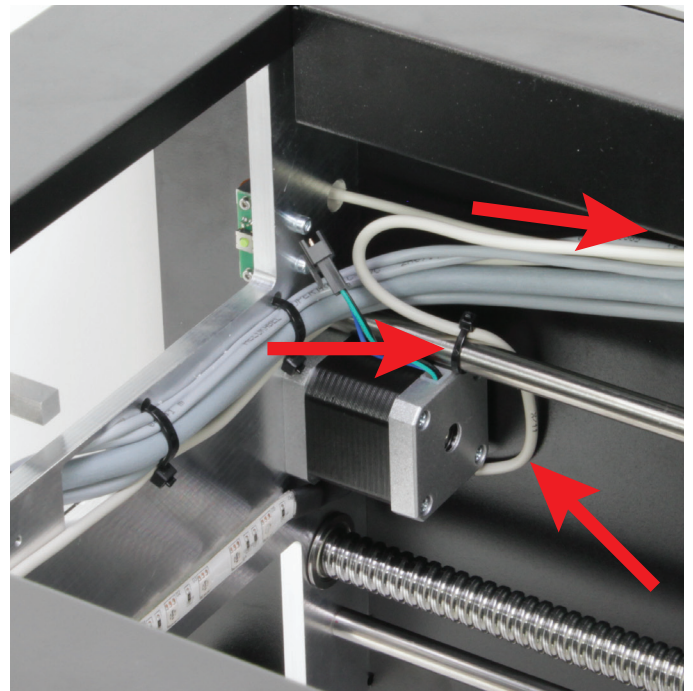


Thread the cable 06 downwards through the round bore hole in the X-plate and connect it (again the side without numbering) to the connector plug of the X-limit switch.

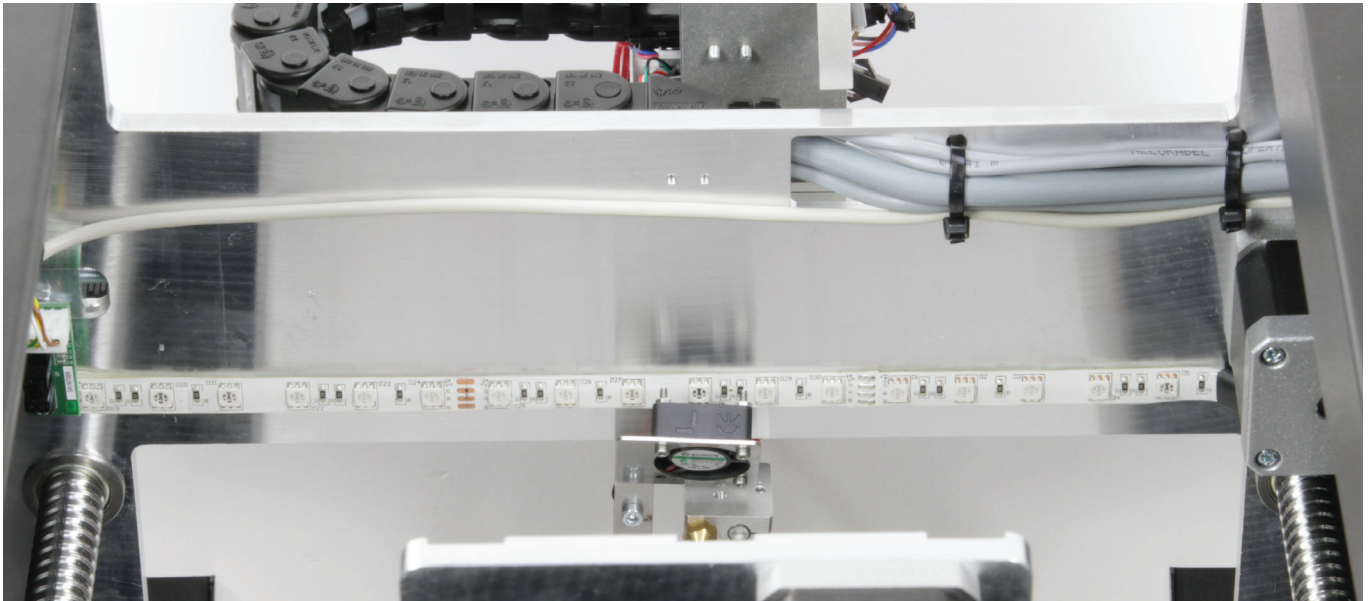
Installation of the LED strip



1 x cable 28 (LED strips with connection cable)



Attention! Please note the following figure first.
Then lay the connection cable of the LED strip on the side wall at the bottom around the motor and run it past the metal spacer.
Fix the cable to the spacer with a small cable tie.
Then lead the cable with the other cables in the strand downwards.

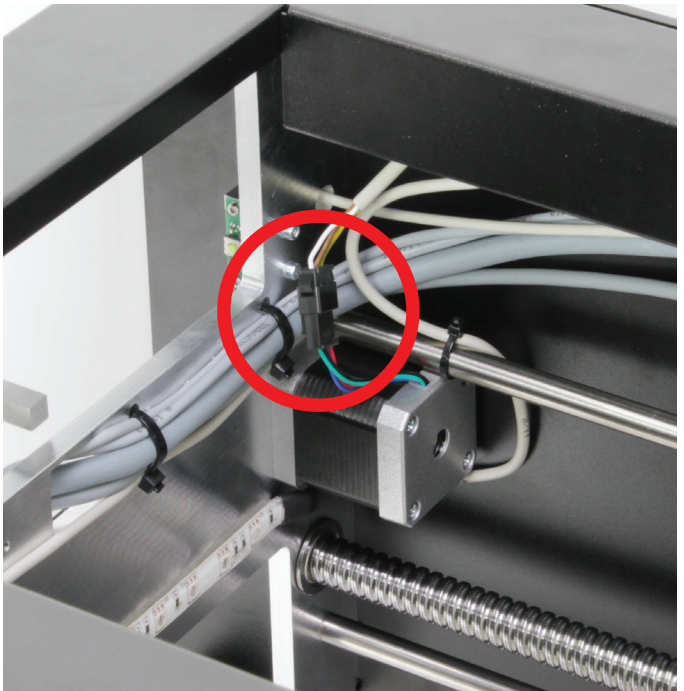


Stick the LED strip, as shown in the figure, from below to the X-plate, just below the guide rail.
 The adhesive surfaces must be degreased beforehand.
 Align the LED strip so that the connection cable ends at the front of the X-plate motor.
Caution: The LED strip must not touch the light barrier holding block.
 Now continue with the previous figure.

Connection of the X-motor

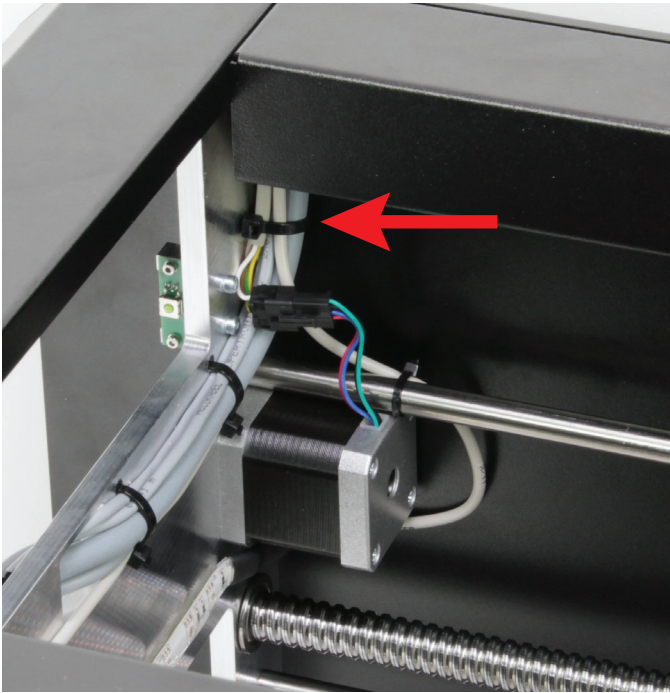


1 x line 01 (X-motor)

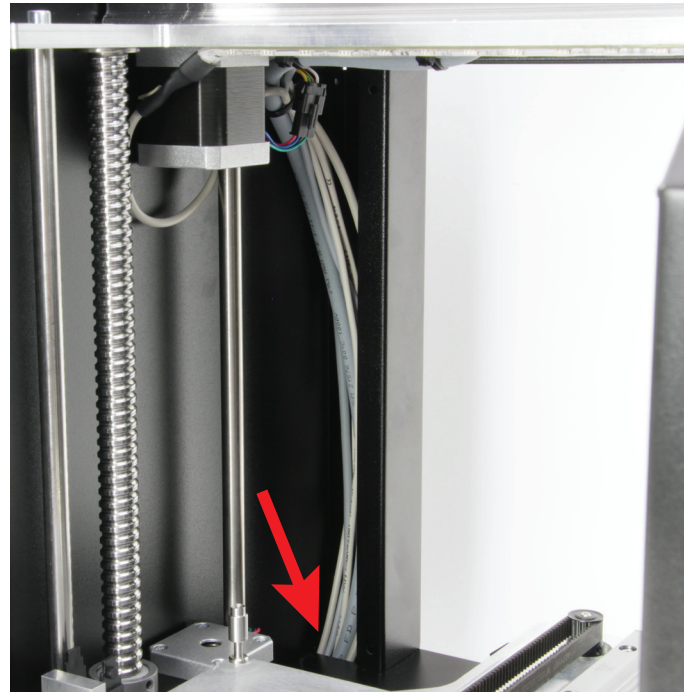


Connect cable 01 to the X-motor and lay it together with the cables from the extruder unit, the cables from the X- and Z-direction limit switches and the LED strip cable downwards.

Placing and fastening the lines



Push the wiring harness all the way up towards the X-plate and tie it together with a large cable tie (142 mm).

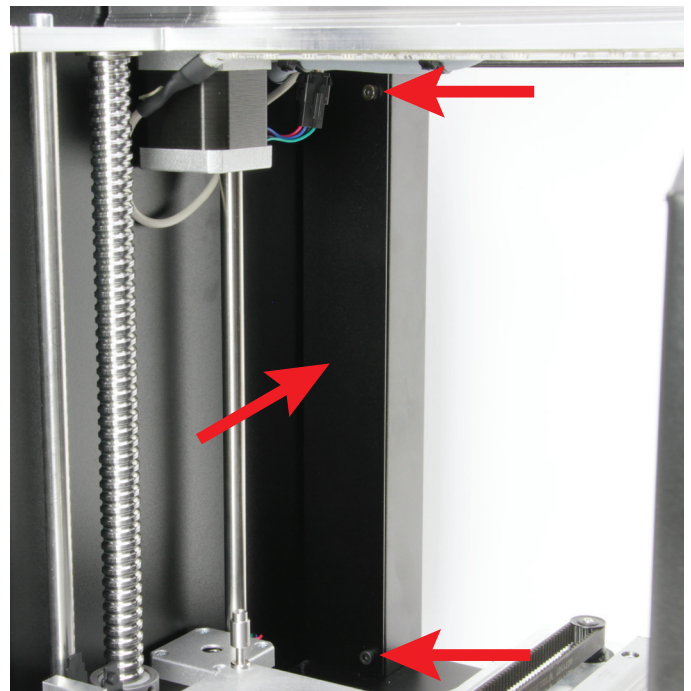


If not already done, route all cables through the opening in the rear panel and down into the base of the device.

Mounting the cover for the cable duct



1 x cover for cable duct
2 x cylinder head screw M4x10 black
4 x nut M4 black



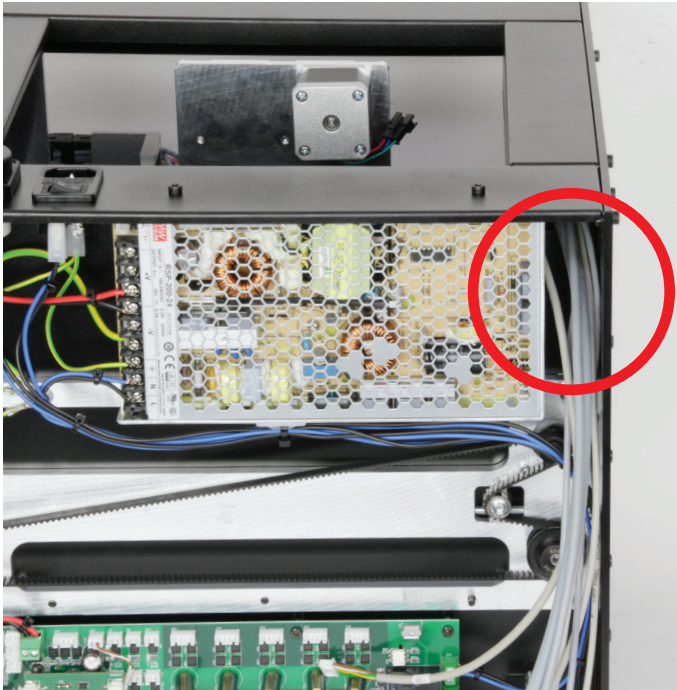
Place the cover on the cable duct and insert one M4 cylinder head screw into each of the two holes. The cover must be aligned in such a way that the holes face inwards and lie one above the other with the holes in the cable duct. During insertion, you must push the wiring harness upwards.



Flip up the rear head cover to gain access to the upper fixing screw of the cable duct cover.



Fasten the upper cylinder head screw with a nut M4. It is best to use a small pointed pliers or tweezers first and an external hexagon socket wrench to tighten it.



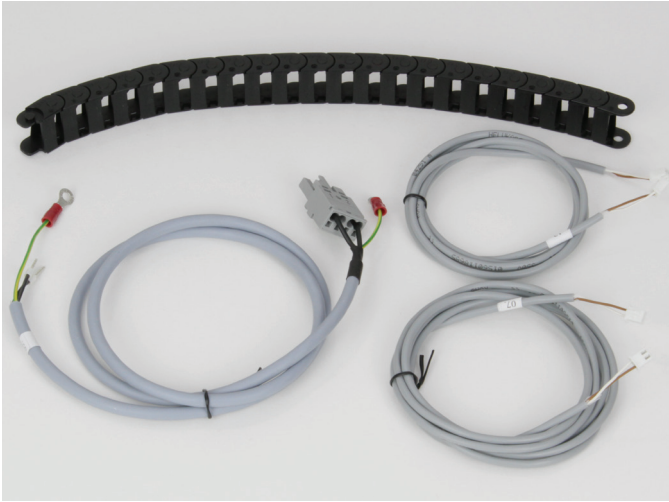
Carefully place the printer on the front panel. You should hold the previously inserted lower screw tight. Dismantle the foot together with the holder in the upper right corner (from the figure view).



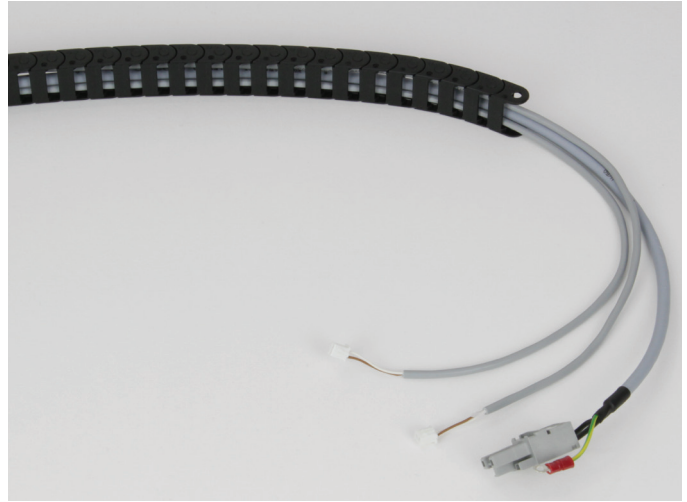
Fasten the cylinder head screw with the nut M4. If you do not have a suitable special tool, use a ring or fork wrench and tape one side with adhesive tape. You can then insert the nut from the other side and guide it to the screw. See figures below. Finally, reassemble the foot and holder.



Preparation of the cables for the heated printing plate and the Y-limit switch

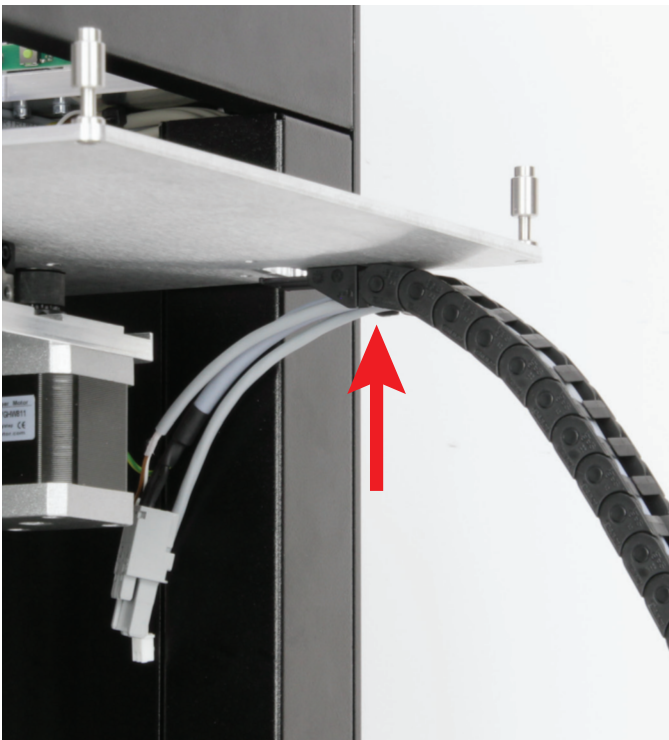


- 1 x energy drag chain small, 22 links
- 1 x lines 05 (heating printing plate)
- 1 x lines 07 (limit switch Y)
- 1 x lines 12 (temperature sensor printing plate)
- Also required: 1 x cylinder head screw M3x10; 1 x washer M3;
2 x sprocket M3; 1 x cylinder head screw M3x16



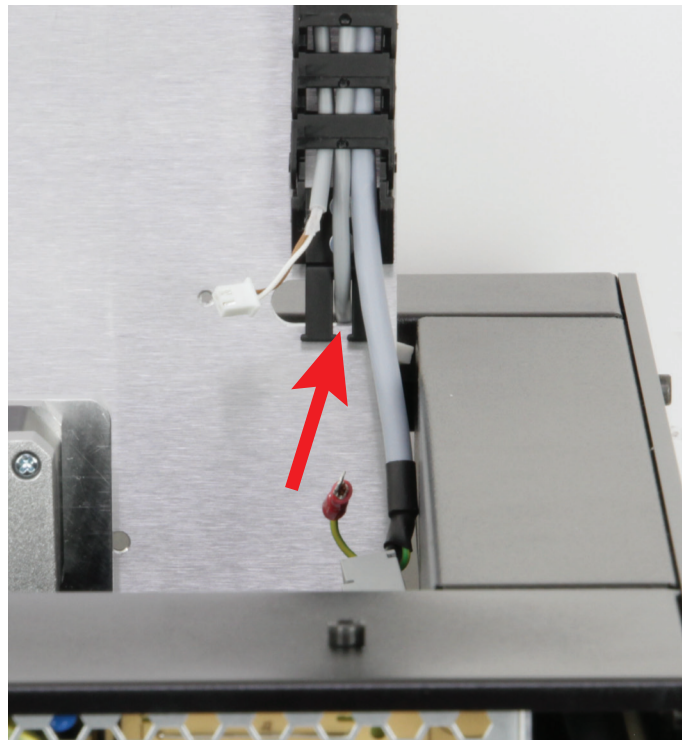
Push the cables into the energy drag chain in such a way that the end link with the holes is directed towards the cable ends without label.

Assembly of the energy drag chain and the cables for the printing plate



Engage the energy drag chain in the drag chain end piece of the undertable.

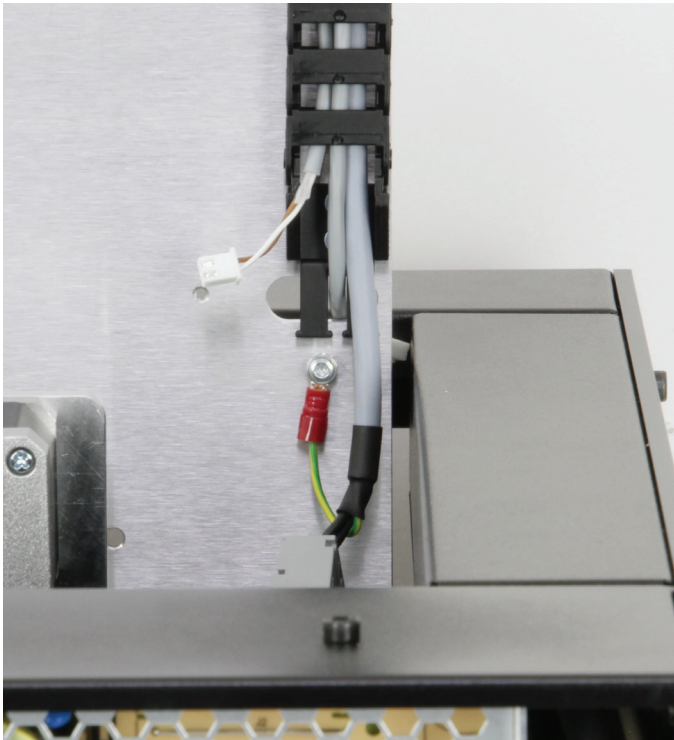
In order to display the following figures better, we have placed the printer on the front side.



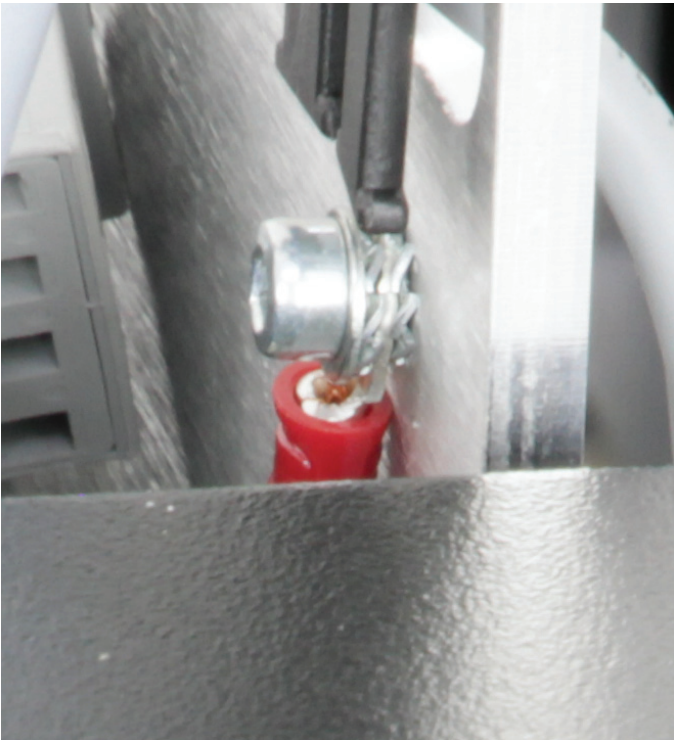
From the point of view shown in the figure, the cables in the drag chain should be arranged as follows.

On the far left the line 12 (temperature sensor printing plate), in the middle the line 07 (limit switch Y) and on the right the line 05 (heating printing plate).

Thread the cable 07 (limit switch Y) centrally through the tension relief. First insert the plug of the cable into the left side of the tension relief. Then carefully guide the two individual wires of the cable between the table and the tension relief into the middle (see arrow in the figure).



Fasten the protective conductor (green/yellow cable with ring eyelet) with the cylinder head screw M3x10, the washer M3 and the two sprockets M3 to the bottom side of the undertable.



Caution: This connection creates the safety-technically important contact between the housing parts and the protective ground. Always observe the position of the washers and sprockets:

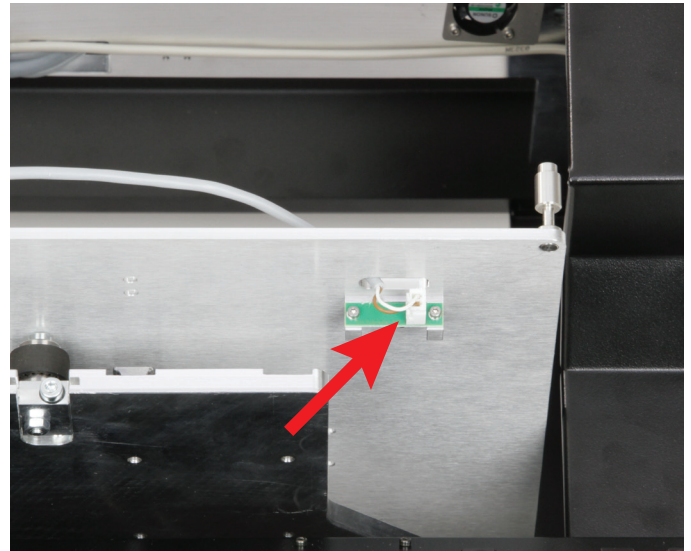
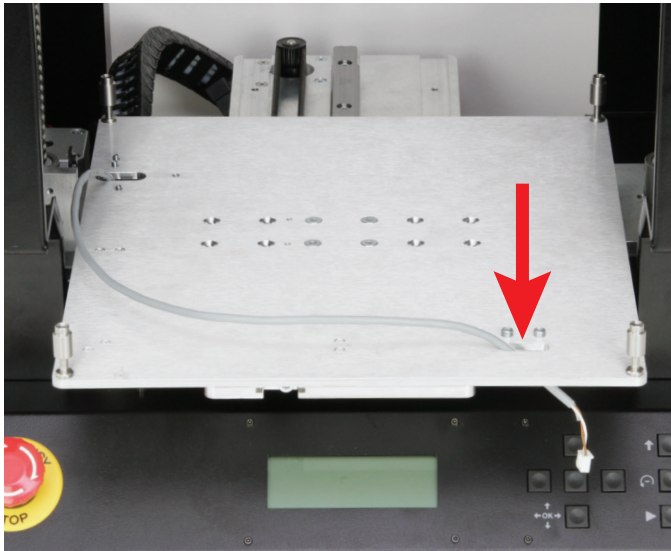
Screw head > washer > sprocket > ring eyelet > sprocket > undertable (see image section)



Mount the connector for the power supply of the heating with the cylinder head screw M3x16 on the bottom side of the undertable. Tighten the screw only slightly for the time being.

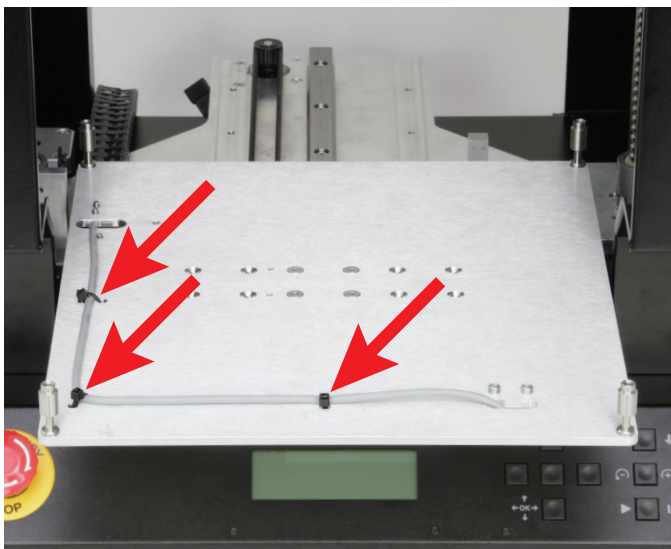
Now put the printer back on its feet and move the Y-plate downwards so that you can lay the cable for the limit switch neatly.

Connection of the Y-limit switch



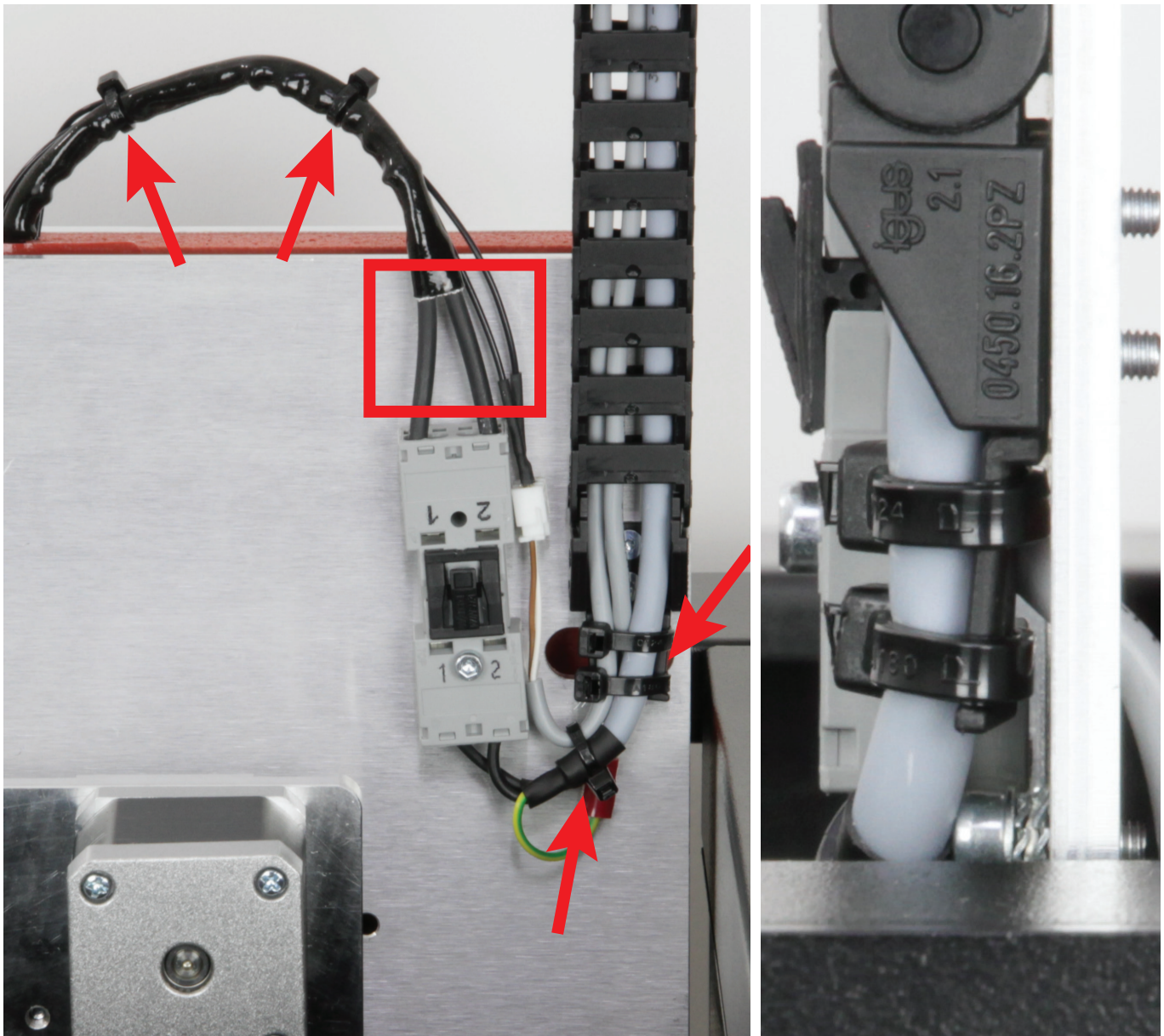
Pull out the cable 07 until it reaches the limit switch and then insert it through the opening of the undertable.

Connect cable 07 to the limit switch mounted on the undertable.



Fix the cable to the undertable with three small cable ties (99 mm). In order to lay the cable as tensioned and neatly as possible, start with the cable tie, which is closest to the limit switch, and work your way towards the drag chain. Push the remaining cable back into the drag chain.

Laying and fixing the cables on the undertable



Take the printing plate and place it on the 4 spacers. If, like us, you have put the printer back on the front side, fasten the printing plate cross-wise with at least 2 countersunk screws M4x10.

Tie the power cable and the line for the temperature sensor of the printing plate together with two small cable ties (99 mm) (see the two upper arrows in the left figure). The cable tie closures should point upwards.

Connect both plugs from the printing plate to the corresponding counterpart.

Now fasten the connector for the power supply of the heating and make sure that the line from the printing plate does not touch the Y-motor. If this is the case, turn the connector of the power supply of the heating to the right to tighten the cable more.

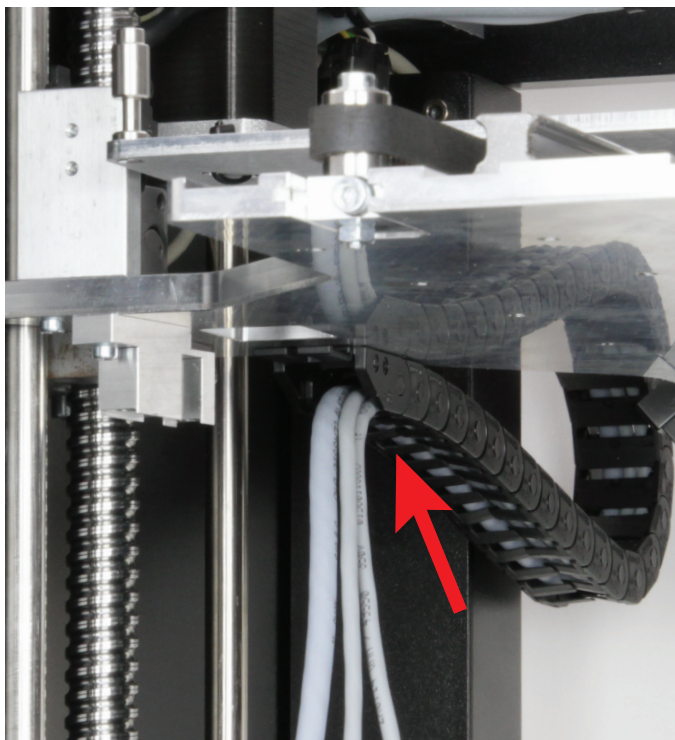
Now connect the line of the temperature sensor with the line for the power supply (see arrow at the bottom of the left figure). The cable should already be laid in the direction of the heating as shown in the figure. In addition, the cable should form a nice loop at the cable tie.

Finally, fasten the cable harness to the tension relief of the drag chain using two large cable ties (142 mm). One cable tie should be attached before the cable for the limit switch and the other after the cable for the limit switch (see right figure). Before tightening the cable ties, push the cables back into the drag chain.

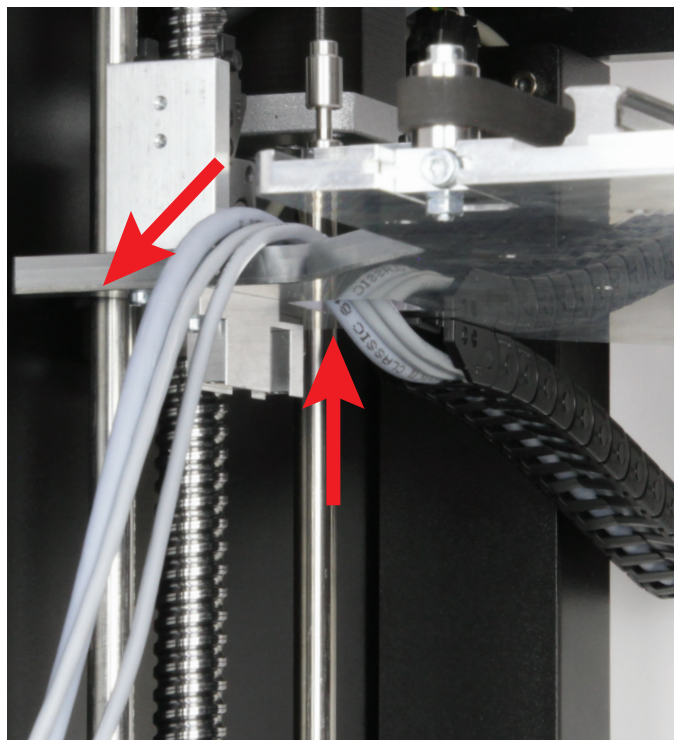
→ If the cable from the plug to the heating mat of your printer sinks downwards and there is a danger that it will get stuck to the Y-motor during operation, glue an adhesive socket in the area of the cable (see red square in the figure) from below to the undertable. The adhesive surface must be degreased beforehand.

Later, during the final assembly of the printing plate, you attach the voltage supply cable and the cable for the temperature sensor to this adhesive socket with a cable tie (99 mm).

Mounting the energy drag chain on the Y-plate



Snap the other end of the energy drag chain from the undertable into the end piece of the Y-plate.

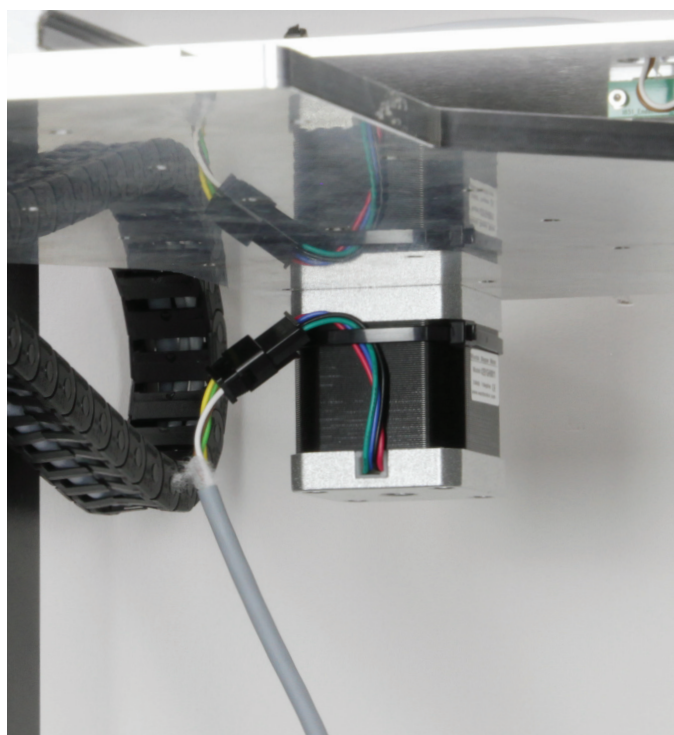


Then lay the cables of the energy drag chain upwards through the opening in the Y-plate.

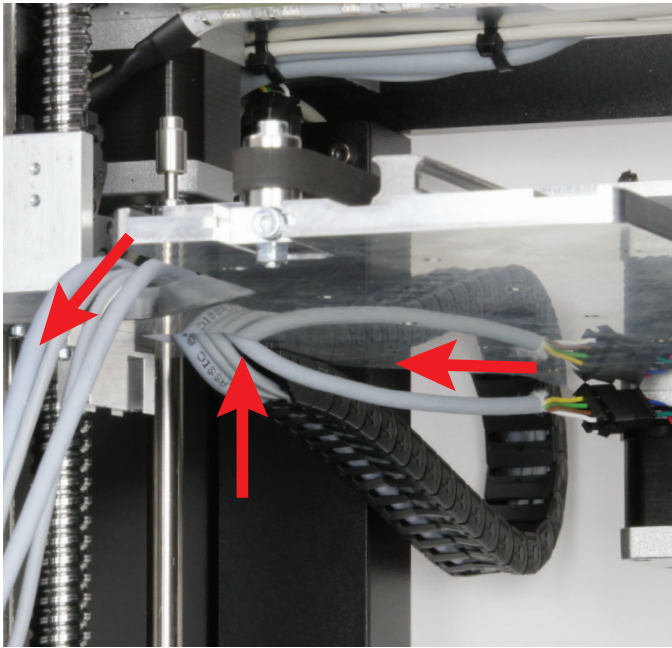
Connection of the Y-motor



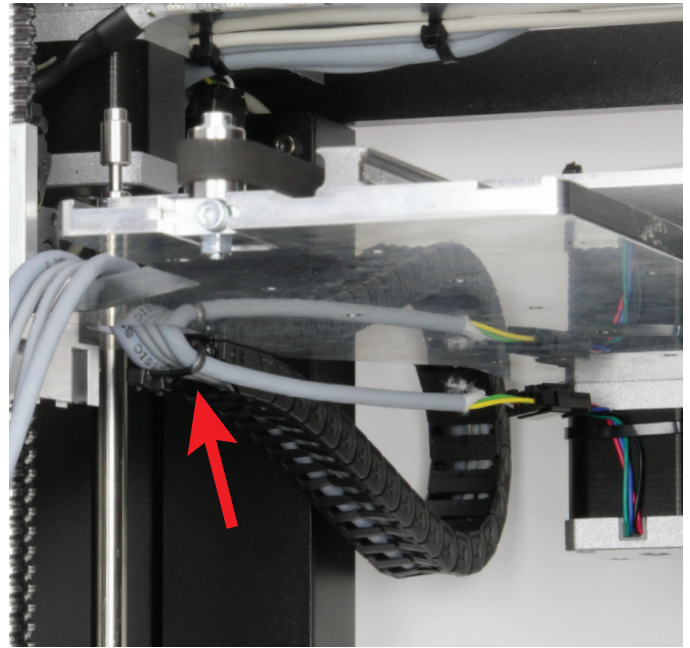
1 x cables 02 (Y-motor)



Connect cable 02 (Y-motor) to the connector of the Y-motor. Fasten the cable to the motor using 2 large cable ties (142 mm) that have been joined together (see figure).



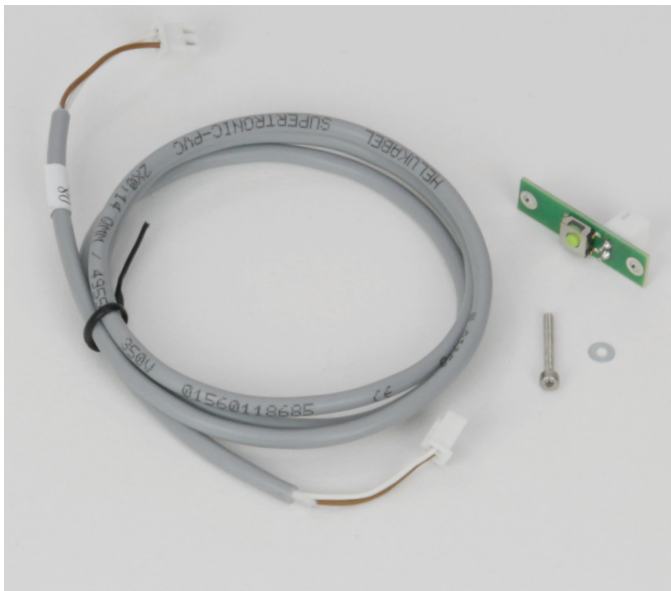
Route line 02 through the opening in the Y-plate upwards as well.



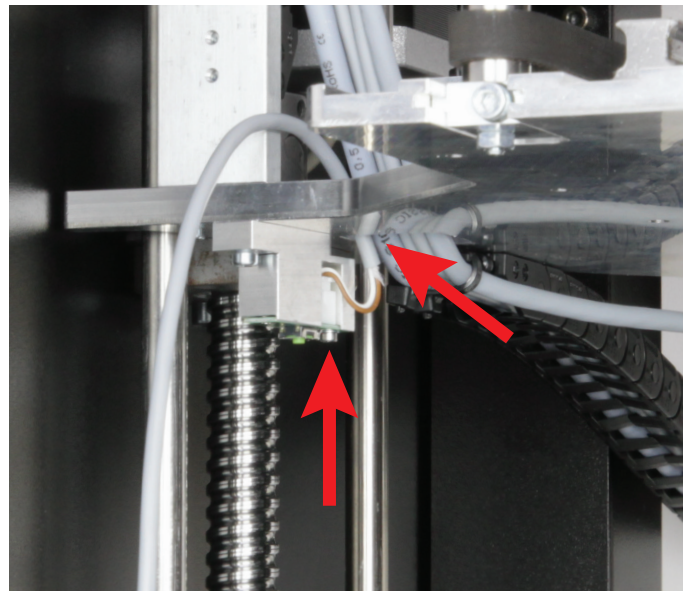
Move the undertable back and forth several times. Then reattach the cable harness to the tension relief of the drag chain using two large cable ties (142 mm).

With the cable tie, which is closer to the drag chain, you only attach the cables in the drag chain to the tension relief. Use the other cable tie to additionally fasten the cable of the Y-motor. Make sure that the cable is slightly tensioned.

Installation and connection of the limit switch for the Z-direction (Z-max limit switch at the Y-plate)



- 1 x cable 08 (limit switch Z-max)
- 1 x limit switch PCB
- 1 x cylinder head screw M2x16
- 1 x washer M2



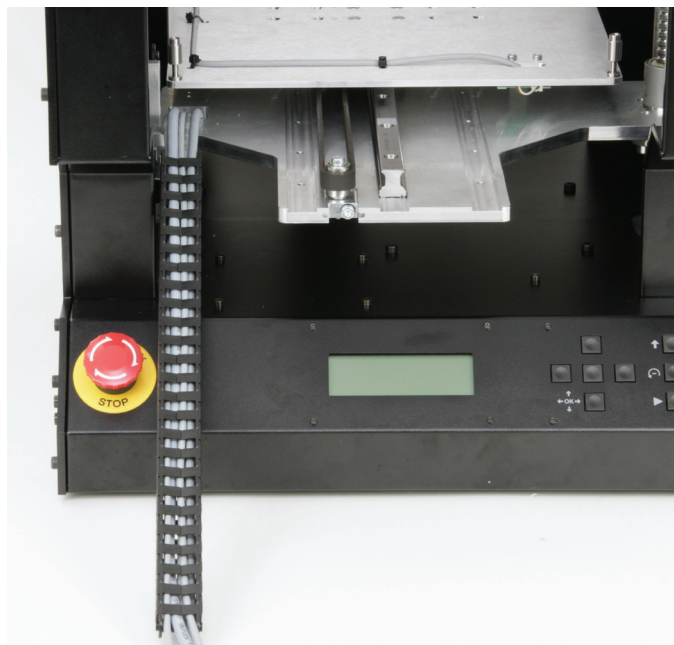
Connect the plug of cable 08 (without label) to the limit switch PCB. Mount the PCB with the cylinder head screw and the washer from below on the limit switch holding block of the Y-plate, as shown in the figure.

The screw must be turned into the rear hole for this. As shown in the figure, lead the connection cable out on the right side. Then route it upwards through the opening in the Y-plate to the other lines.

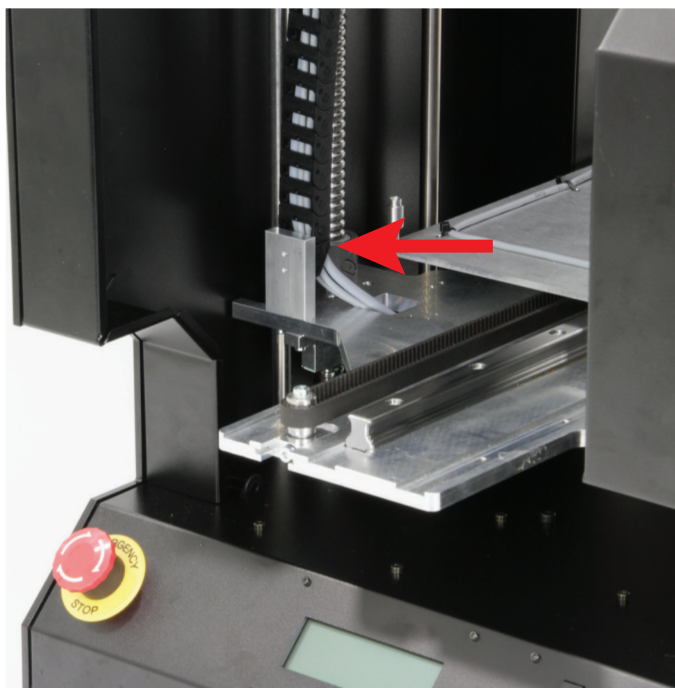
Placing the energy drag chain from the Y-plate to the operating cover



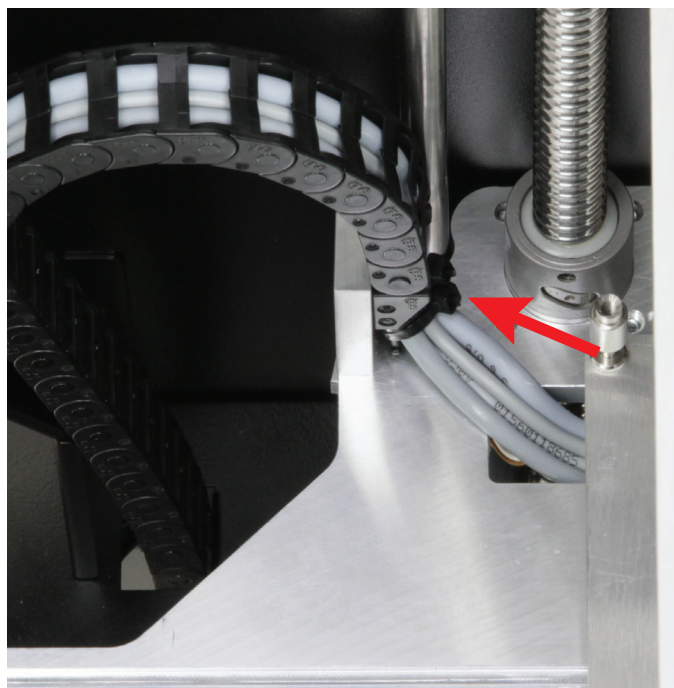
1 x energy drag chain small, 25 links



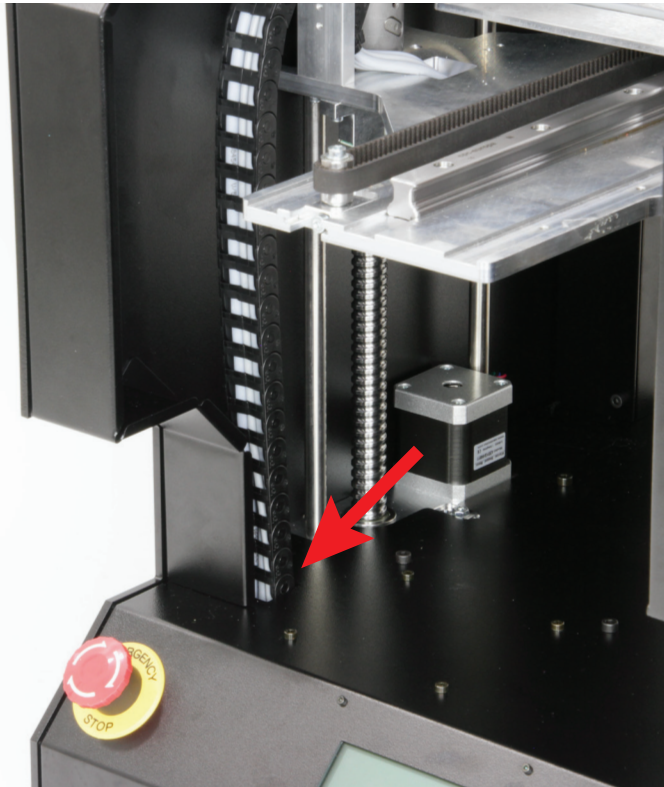
Push the lines coming from the opening in the Y-plate into the last remaining energy drag chain (small, 25 links) so that the end link with the nipples points at the line ends with the label.



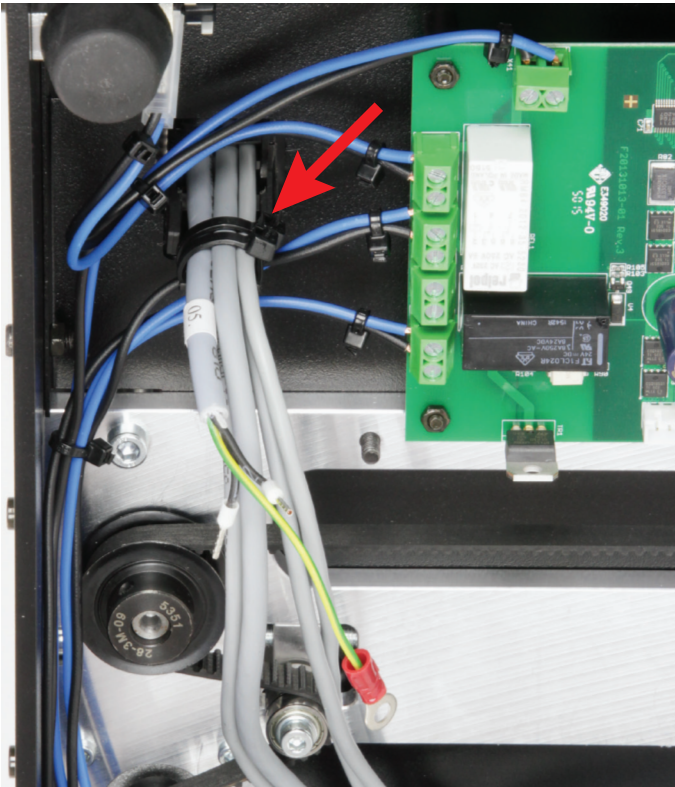
Snap the energy drag chain into the end piece on the Y-plate.



Attach the cable harness to the tension relief of the drag chain end piece using two large cable ties (142 mm). Make sure that the cable 08 for the lower Z-limit switch with the insulation lies on the edge of the opening.

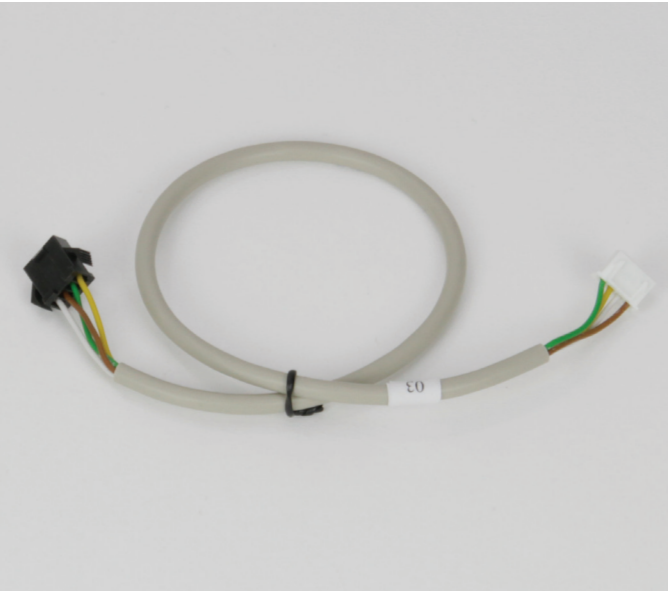


Feed the cables down through the opening in the operating cover and snap the still open end of the energy drag chain into the end piece on the operating cover.

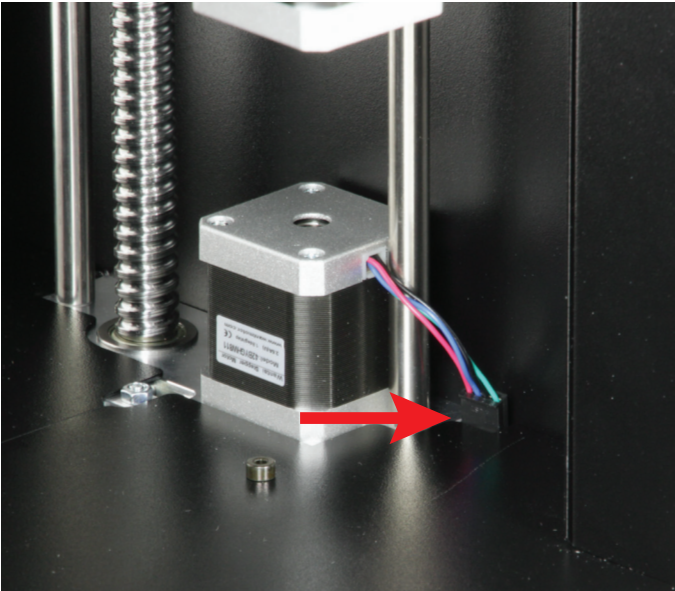


Attach the cable harness to the tension relief of the drag chain end piece using two large cable ties (142 mm).

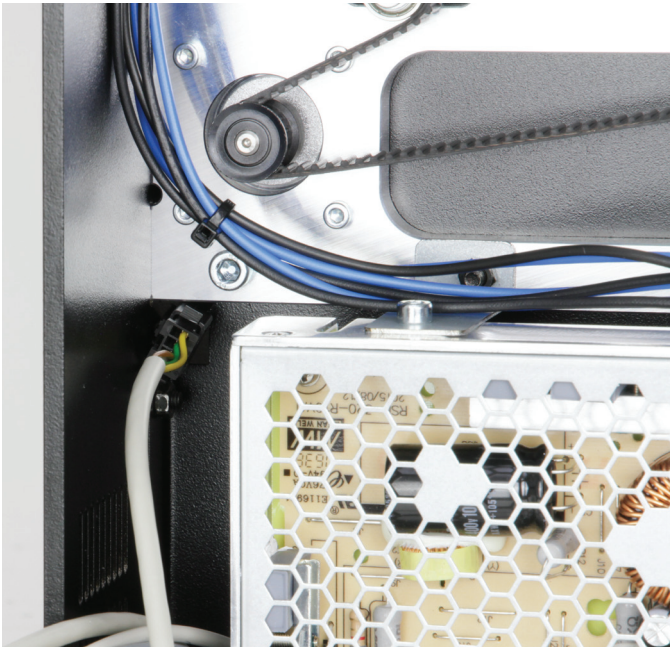
Connection of the Z-motor



1 x line 03 (Z-motor)

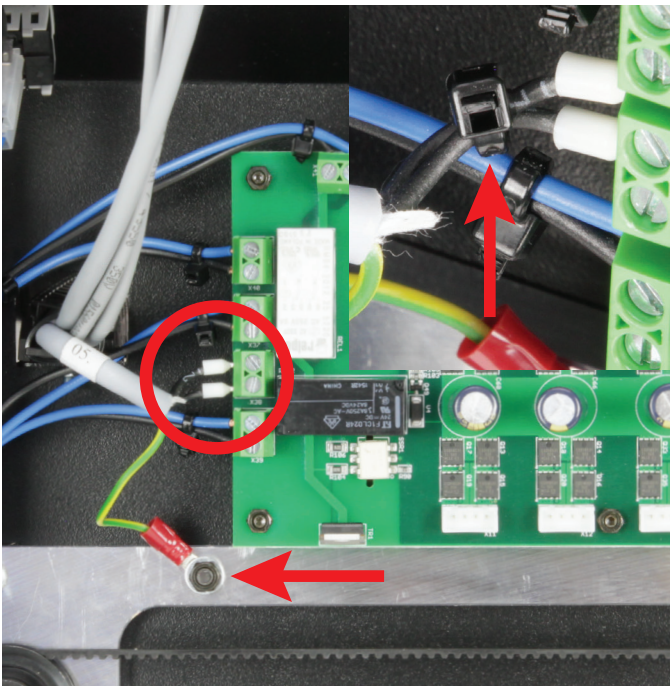


Push the Z-motor connector through the opening in the rear panel so that it is accessible from below.



Connect the cable 03 (Z-motor) to the connector of the Z-motor.

Connection of the heating for the printing plate



Now connect the heating of the printing plate (line 05) first.

Connect the two black wires to terminal X38 (see circle in the figure) of the main PCB. Tie both lines together with a small cable tie (99 mm) close to the connection terminal (see vertical arrow in the small figure).



Fix the ring eyelet of the protective conductor of the cable 05 to the left fixing screw of the operating unit cover using sprockets and an additional nut (see arrow in left figure).

Caution: This connection creates the safety-technically important contact between the housing parts and the protective ground. Always observe the position of the washers and sprockets:

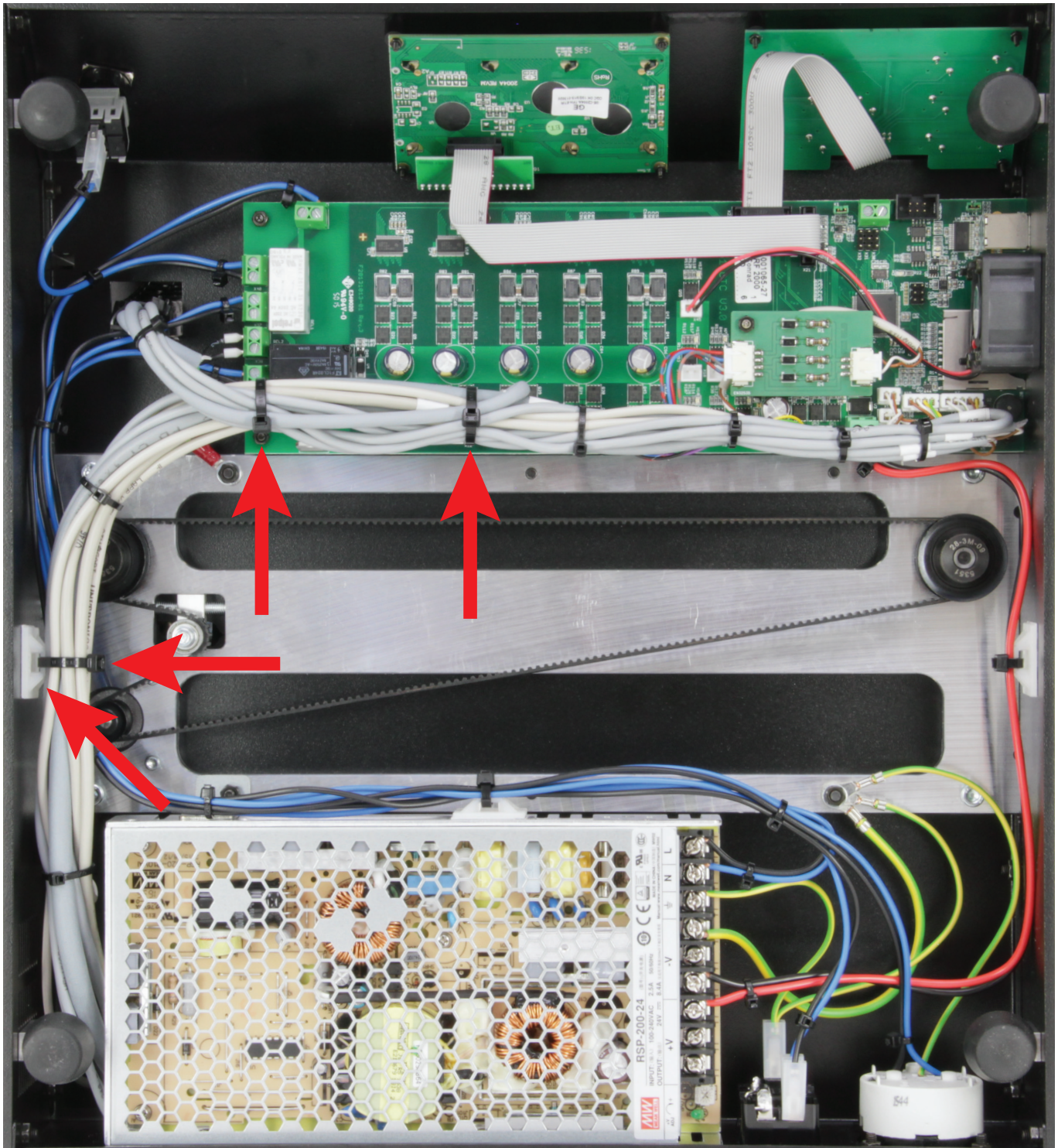
Cylinder head screw > housing > sprocket > ring eyelet > sprocket > washer > nut M4 (see right figure)

Connection of the remaining device cables

Now connect all other device lines to the main PCB according to the table on the next page. The figure shows how the cables should be laid. Lay all cables neatly and secure them with small (99 mm) and large (142 mm) cable ties and a self-adhesive cable tie holder. Use large cable ties (142 mm) for the cable tie holder and at the points where all control cables are combined (see arrows in figure). Fasten the black and blue cables to the adhesive socket with the other cables.



During operation, the cables must not touch the sprockets or get caught in the rotating toothed belt!



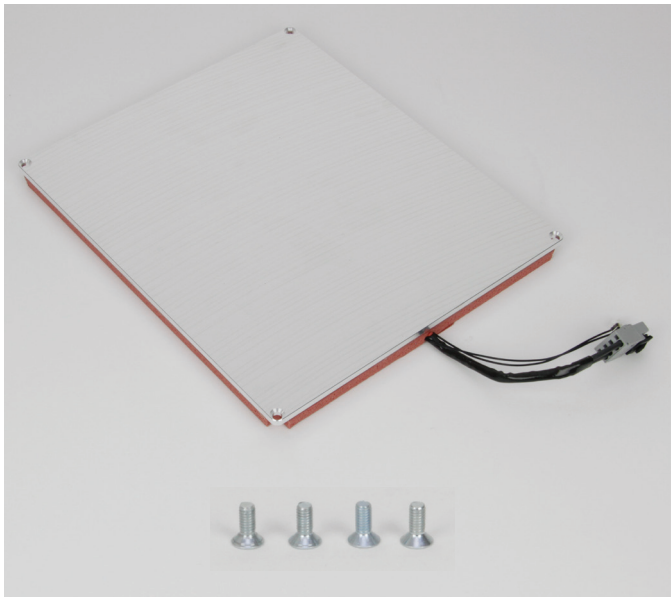
Overview of all cables and connections used in this chapter

Line	Length	Connection main PCB	Pin number plug/main PCB (all pins on white plugs; colour based on pin1)	Component	Pin number plug/component (all pins on plugs; colour based on pin1)
1	735 mm	X11	4pin green/yellow/white/brown	Motor X	4pin yellow/green/brown/white
2	840 mm	X12	4pin green/yellow/white/brown	Motor Y	4pin yellow/green/brown/white
3	380 mm	X16	4pin green/yellow/white/brown	Motor Z	4pin yellow/green/brown/white
4	1440 mm	X17	4pin green/yellow/white/brown	Motor extruder 0 (1st extruder)	4pin yellow/green/brown/white
		X18	4pin yellow-brown/white-yellow/ brown-green/white-green	Motor extruder 1 (2nd extruder)	4pin white-yellow/yellow-brown/ white-green/brown-green
		Fan additional PCB	4pin red/blue/grey-pink/ red-blue	Fan 1/2 (single extruder)	2pin red/blue (+ = red)
				Fan 3/4 (dual extruder only)	2pin grey-pink/red-blue (+ = grey-pink)
		X4	2pin grey/pink	Heating extruder 0 (1st extruder)	2pin grey/pink
		X8	2pin black/violet	Heating extruder 1 (2nd extruder)	2pin black/violet
5	1000 mm	X38	3pin, open ends	Heating printing plate	2-pole black + 1-pole green-yellow Ring cable lug
6	975 mm	X13	2pin brown/white	Limit switch X	2pin brown/white
7	1630 mm	X14	2pin brown/white	Limit switch Y	2pin brown/white
8	830 mm	X36	2pin brown/white	Limit switch Z-max	2pin brown/white
9	1300 mm	X15	4pin green/yellow/white/brown	Limit switch Z-min	4pin green/yellow/white/brown
10	1500 mm	X5	2pin brown/white	External temperature sensor 0 (1st extruder)	2pin brown/white
11	1500 mm	X6	2pin brown/white	External temperature sensor 1 (2nd extruder)	2pin brown/white
12	1230 mm	X9	2pin brown/white	Temperature sensor printing plate	2pin brown/white
13	1420 mm	X7	5pin yellow/brown/green/white/ shield	DMS (elongation measuring strip)	4pin yellow/brown/green/white
28	1000 mm	X43	4pin	LED strip	

15. Final work

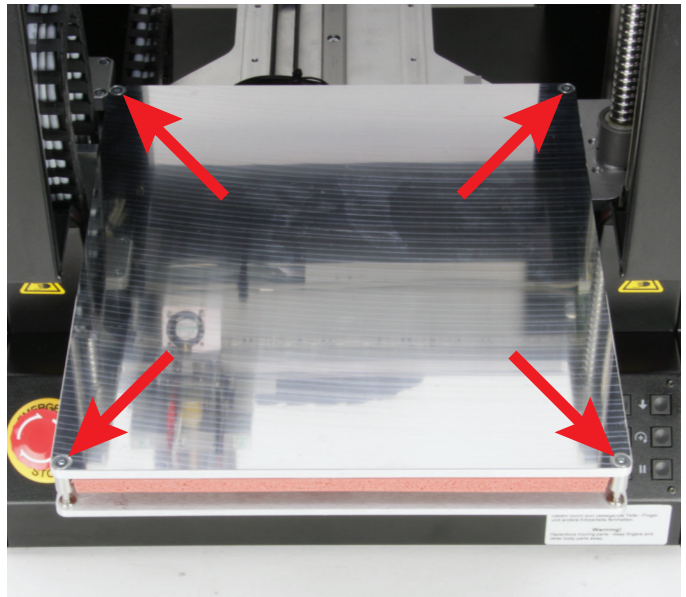
→ If the motors are moved manually, the display may light up. This is not a malfunction. A voltage induced by the movement in the motors causes the display to light up.

Mounting and connection of the heating plate



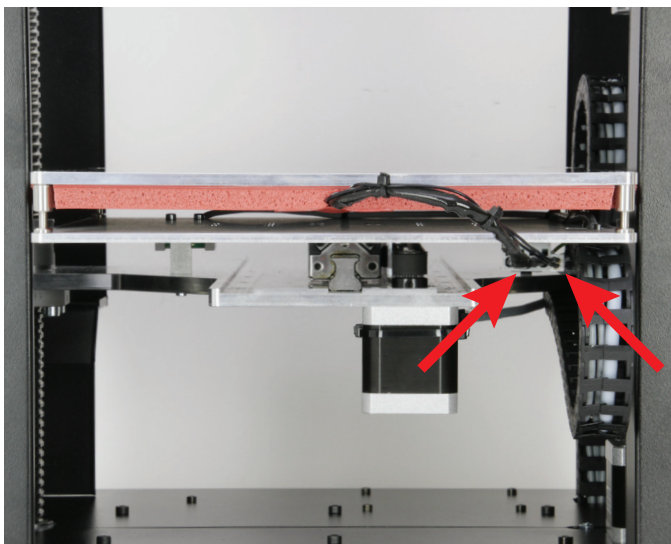
1 x printing plate

4 x countersunk screw M4x10 (Attention! These are shown slightly larger in relation to the printing plate)



Place the printing plate on the spacer bolts of the undertable and screw a countersunk screw into each of the bolts for fastening.

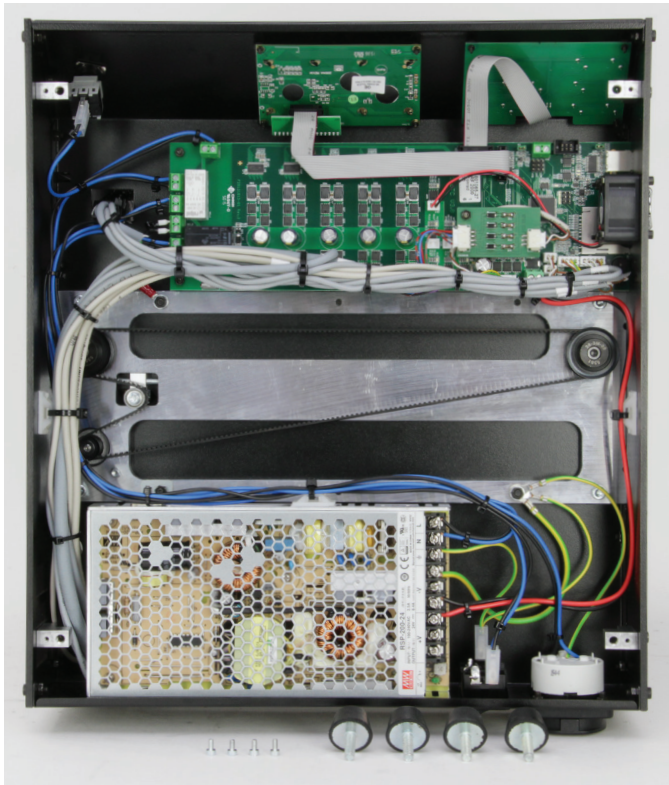
Important! Tighten the 4 countersunk screws well. The printing plate must not have any play upwards!



Connect the two connectors of cable 05 and 12.

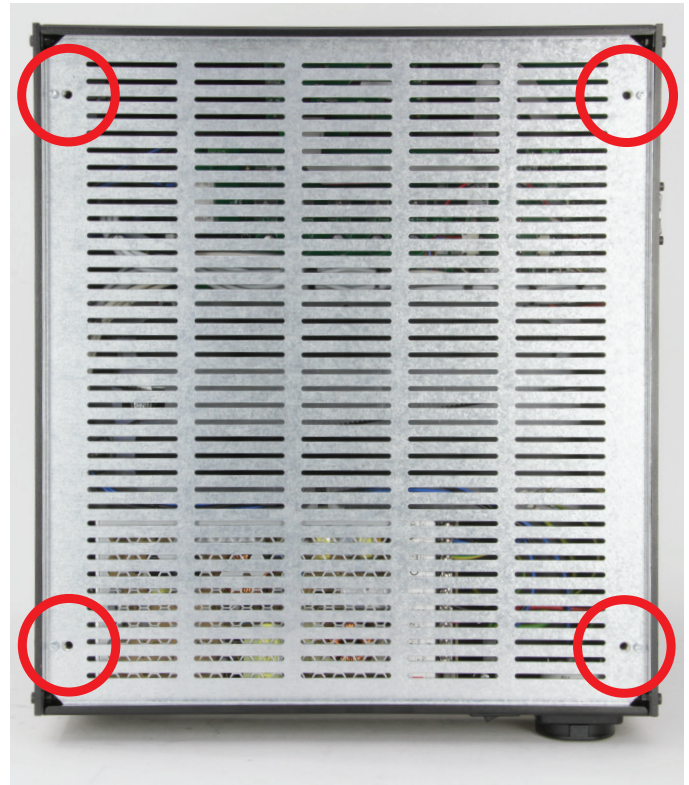
Important! When inserting the printing plate, make sure that the aluminium printing plate really rests on the spacer bolts and not the silicone heating mat!

Attachment of the bottom cover



- 4 x cylinder head screw M3x6
- 4 x rubber foot
- 1 x bottom sheet (see right figure)

→ If the holes are not properly aligned when subsequently screwing in the M3 cylinder head screws or rubber feet and can be screwed in without resistance, you must loosen the fixing screws of the foot supports again slightly.



First turn the 4 rubber feet out of the foot holders. Then insert the bottom sheet with the folds towards the outside of the housing. First insert the edge at the back of the housing and then fold the bottom sheet into the housing. Attach the bottom sheet to the foot holders with the four cylinder head screws M3x6. Finally, turn the 4 rubber feet back into the foot holders. After screwing in the rubber feet, finally tighten the fastening screws of the foot holders.

Inserting the mains fuse



Carefully lever the fuse holder with a suitable screwdriver out of the low-power device combination socket.



Insert the fuse into the fuse holder as shown in the illustration and push it back into the low-power device combination socket. The nipple must point upwards when it is pushed in.

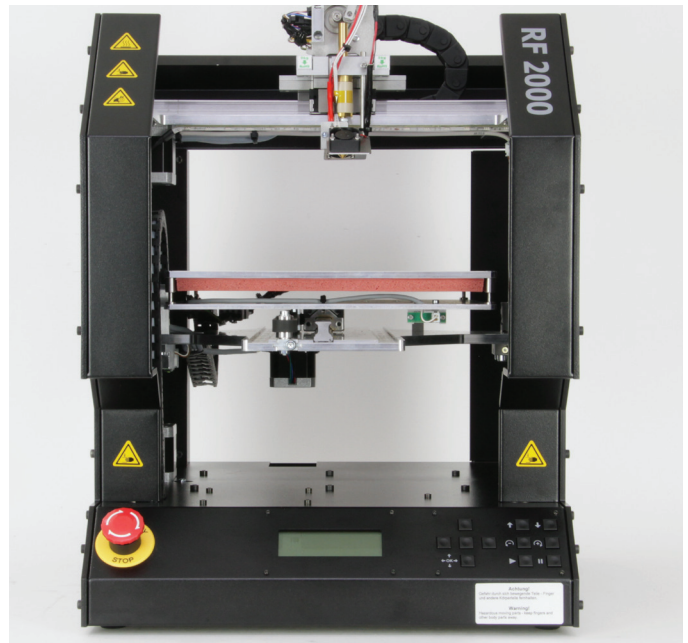
Sticking on the rating plate and the warning signs



Glue the rating plate to the housing between the screws of the mains unit.

Glue the sticker "Max. 800 W" to the socket cover.

Degrease the glue areas beforehand.

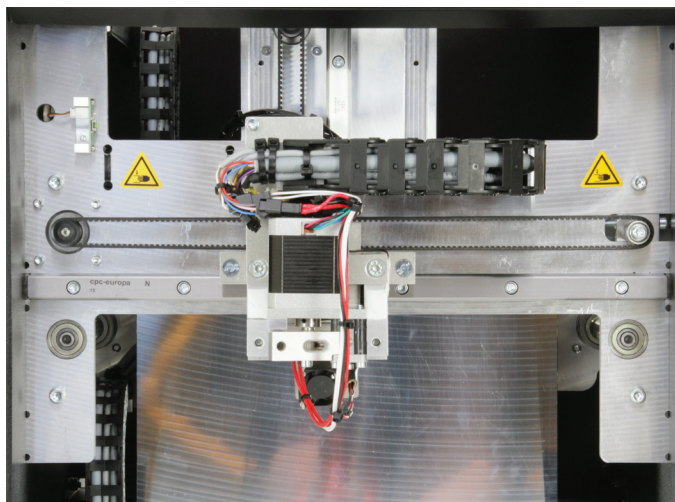


Attach the silver warning text sign to the front of the printer below the keyboard as shown in the figure.

Attach one of the 3 yellow warning sign stickers "Hot Surface", "Danger of Crushing" and "Risk of Injury to Hand" to the sloping part of the left privacy screen in a clearly visible position.

Attach two additional warning sign stickers "Danger of Crushing" to the lower, straight part of the left and right privacy screens (above the emergency stop and keyboard).

Degrease the glue areas beforehand.



On the upper side of the X-plate, on the left and right side of the extruder carriage, at the height of the energy chain, attach a warning sign sticker "Danger of Crushing".

Degrease the glue areas beforehand.



Attach the last warning sign sticker "Danger of Crushing" to the rear panel next to the opening for the Y-motor.

Degrease the glue area beforehand.

→ The single extruder printer is now fully assembled. For commissioning, operation, calibration, etc., please continue with our separate operating instructions. All further steps are described here.

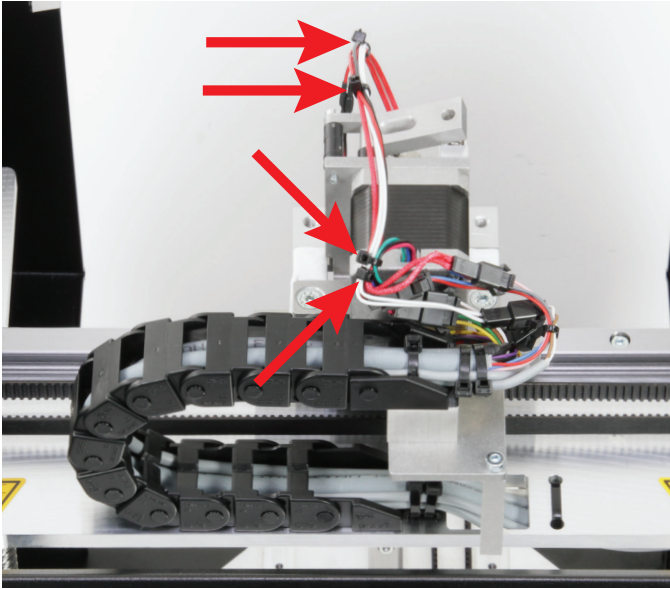
You can find the instructions on the product page of the printer or in the download area on our website (see item "Current Operating Instructions" in chapter "3. Intended use").

16. Upgrade from single to dual extruder

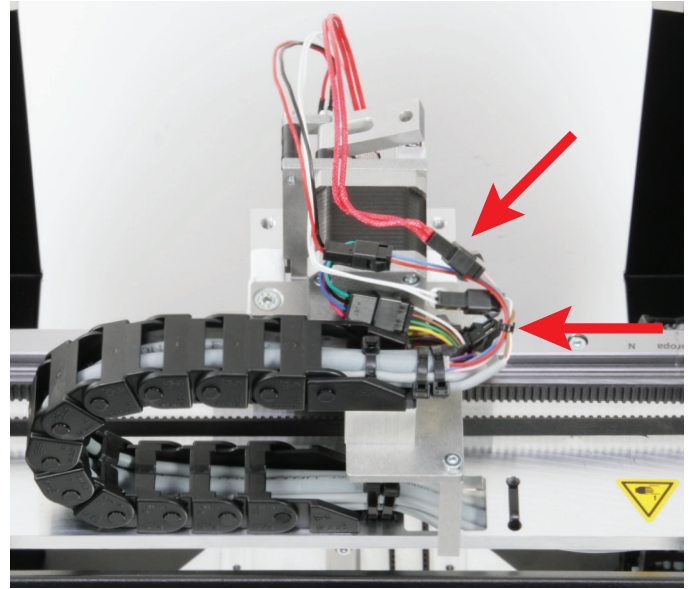
→ This chapter only applies to buyers of the RF2000 v2 single extruder kit and finished device who want to upgrade their printer to 2 extruders. Accordingly, the RF2000 v2 upgrade kit for dual extruders must also be purchased.

If you have purchased the kit and would like to upgrade to dual when assembling it, it makes sense to consider this chapter directly when assembling it.

a) Disassembly of the single extruder unit

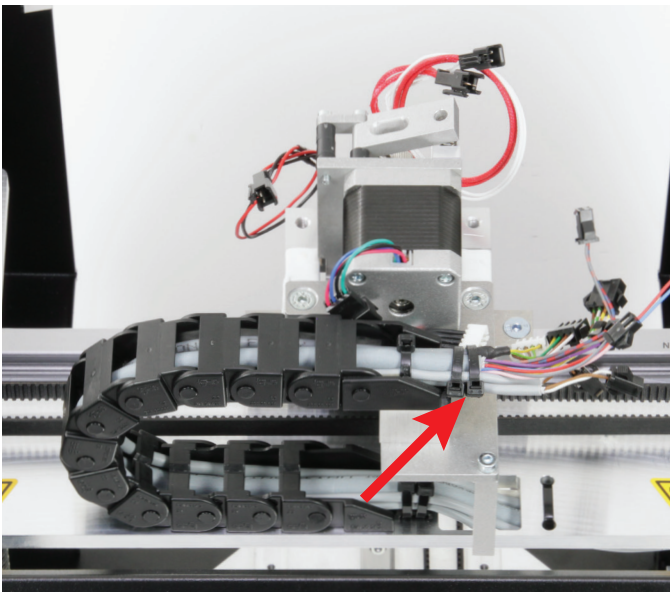


First remove the 3 small cable ties that hold the heating and temperature sensor cables from the extruder and the fan cable together. In addition, remove the small cable tie that attaches the extruder wiring harness to the motor cable.

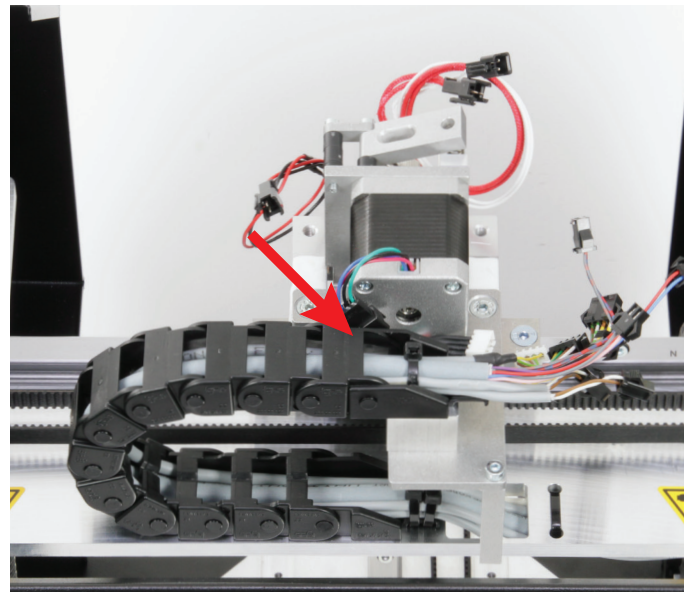


Now disconnect all connectors and remove the two small cable ties that hold the unused and used cables together in front of the connectors on the energy chain side.

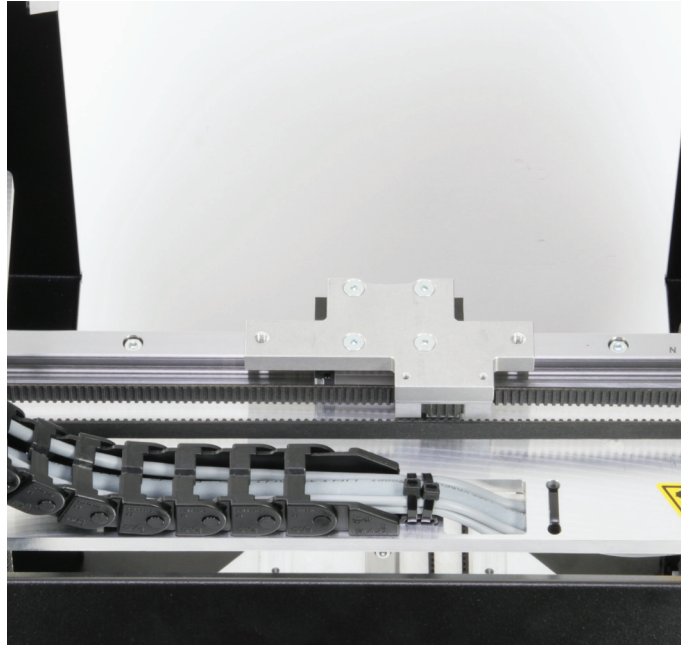
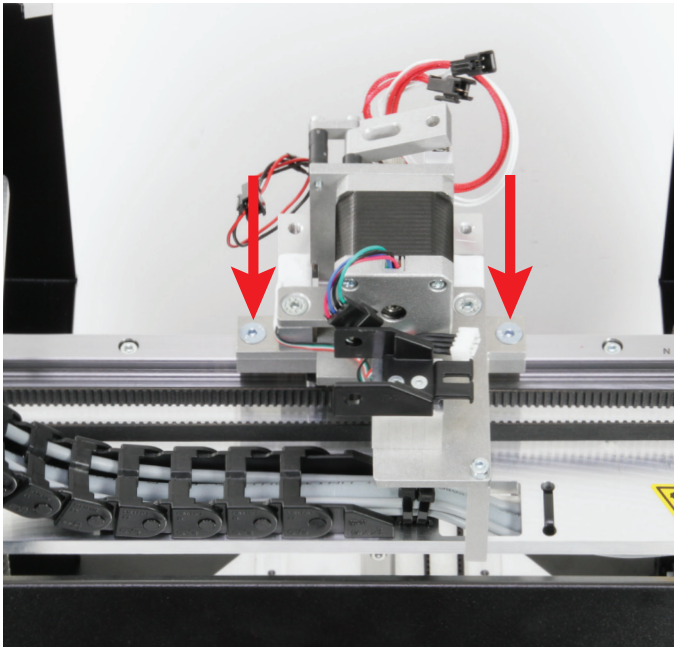
→ Important! Note or mark line 10 (extruder temperature sensor) so that you can later distinguish it from line 11.



Remove the two large cable ties that fix the cable harness to the tension relief of the drag chain end piece.



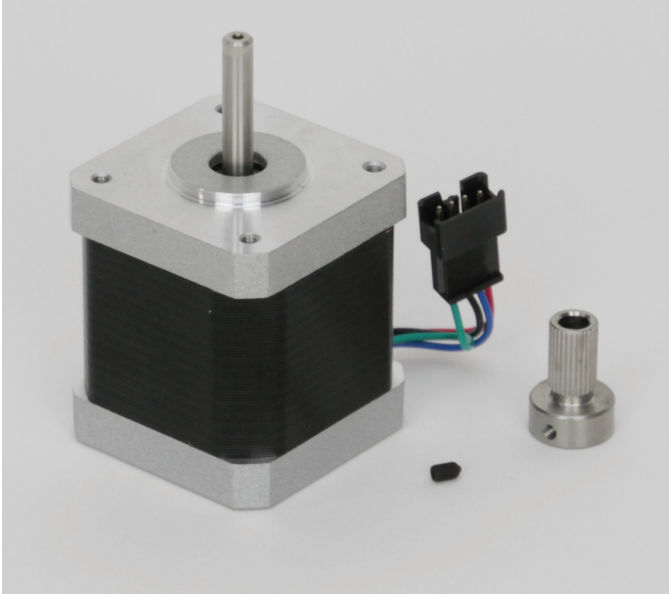
Release the drag chain from the drag chain end piece. The easiest way to do this is to insert a flat screwdriver between the end piece and the last link.



Loosen and remove the two countersunk screws securing the extruder unit to the printer.

b) Preparation of various components

Mounting the knurl on the 2nd feed motor



- 1 x actuator
- 1 x feed knurl
- 1 x threaded pin M3x5



Place the feed knurl on the axis of the actuator and fasten it with the threaded pin. Apply threadlocker varnish to the threaded pin. The feed knurl must be flush with the upper edge of the motor shaft.

Assembly of the 2nd ball bearing holder

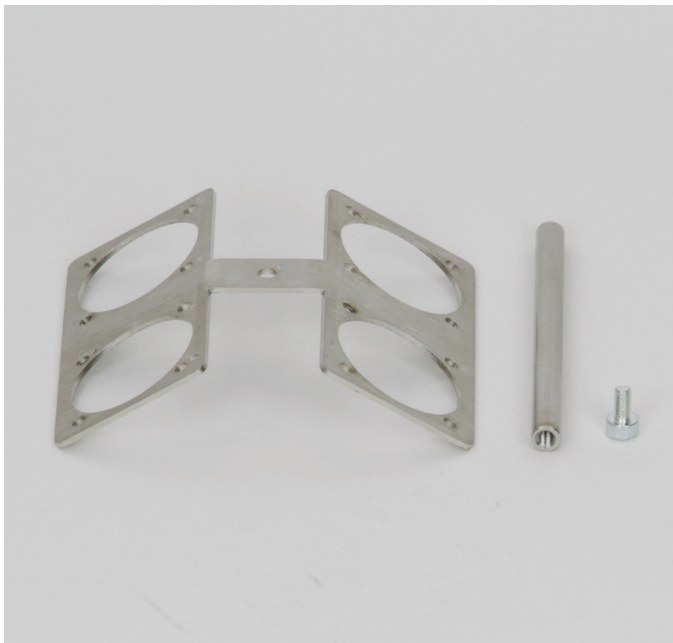


- 1 x ball bearing holder (right)
- 1 x grooved ball bearing (diameter inside/outside 3.8/13 mm)
- 1 x cylinder pin 4x14 mm



Place the ball bearing holder on a straight and firm surface. Then insert the ball bearing into the recess of the holder and carefully drive the cylinder pin with a hammer into the holder and the ball bearing. The cylinder pin must be flush with the bearing side of the ball bearing holder. So he must be a little sunk in the hole at the top. For the last piece, make use of a mounting mandrel or a punch. Then turn the holder and turn the cylinder pin back a little until the ball bearing is centred in the ball bearing holder. The ball bearing must not touch the side!

Assembly of the fan sheet for 4 fans



- 1 x fan sheet for 4 fans
- 1 x rod
- 1 x cylinder head screw M3x6

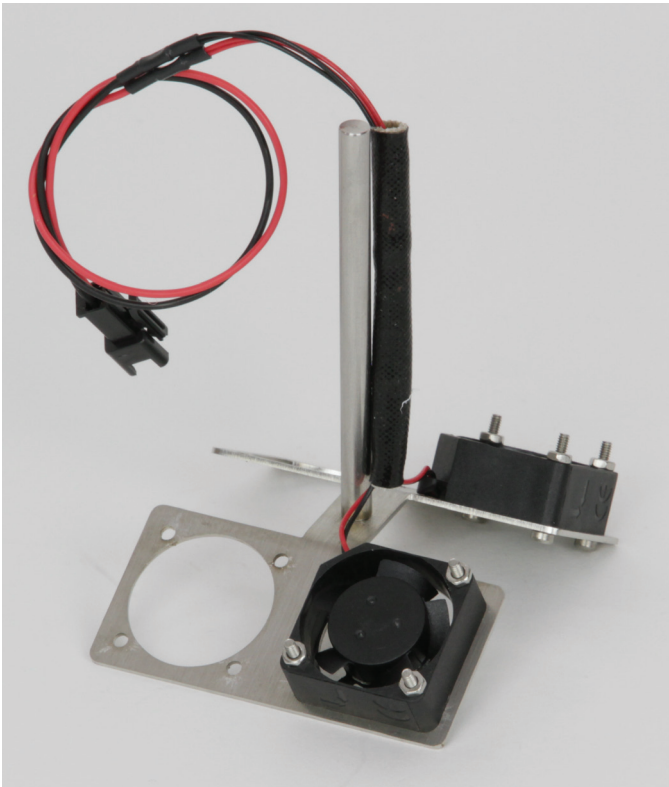


Fasten the fan sheet to the rod with the cylinder head screw.
Apply a threadlocker varnish to the screw.

Mounting the fans



- 1 x fan sheet with rod for 4 fans
- 2 x double fan
- 12 x cylinder head screw M2x16
- 12 x nut M2

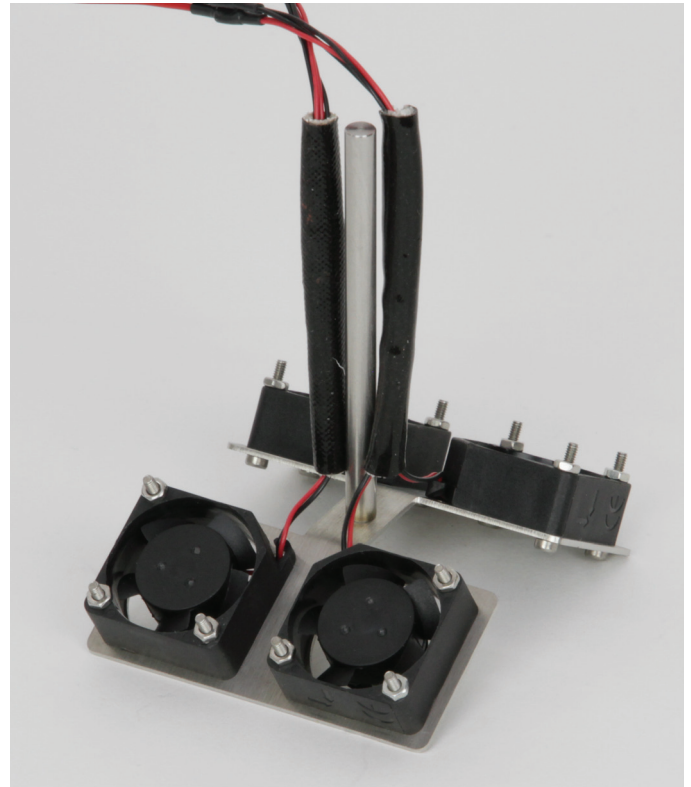


First attach a double fan with 6 screws and nuts on one side of the fan sheet, as shown in the figure.

Leave the fan cable on the side where the fan is.

The fans must be aligned so that the blowing direction (indicated by an arrow on the fan) goes downwards through the fan sheet.

All screws must be provided with threadlocker varnish.



Now attach the 2nd double fan with 6 screws and nuts, as shown in the figure, on the other side of the fan sheet.

Leave the cable of the 2nd fan also on the side where the fan is.

Again, the fans must be aligned so that the blowing direction (indicated by an arrow on the fan) goes downwards through the fan sheet.

All screws must be provided with threadlocker varnish.

c) Assembly of the 2nd extruder

Assembly of the heating block



- 1 x heating block
- 1 x nozzle 0.4 mm
- 1 x PTFE thread sealing tape

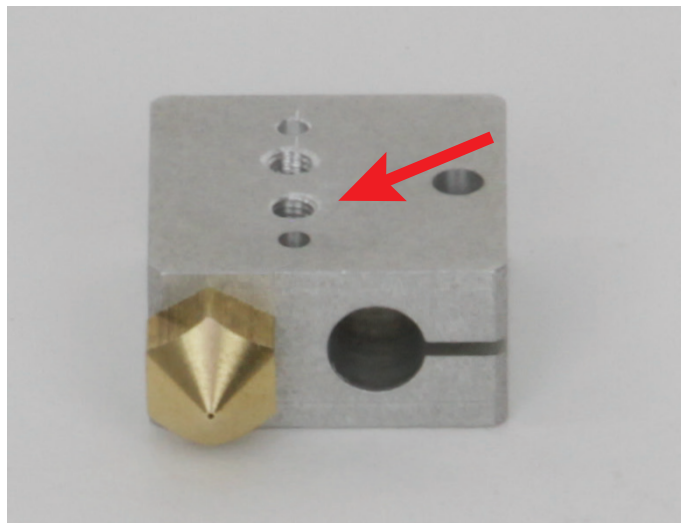
→ The heating blocks for the two extruders are identical. The difference can only be found in the assembly. For the right-hand extruder, the heating block is rotated 180°.



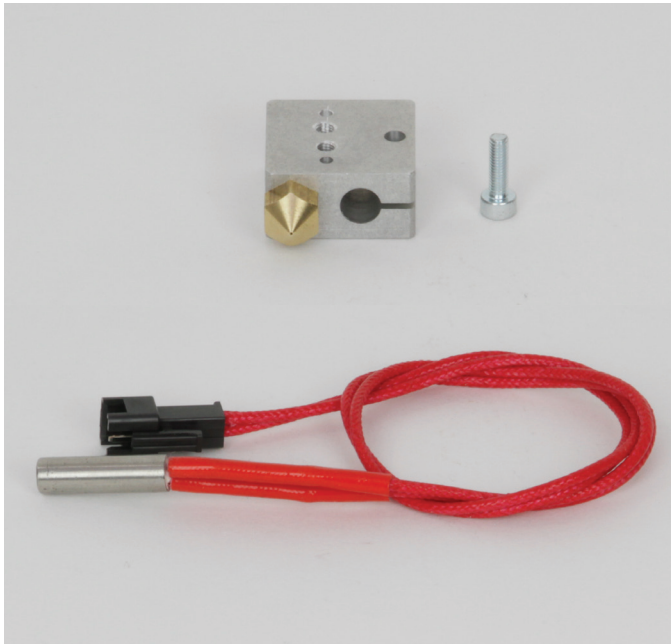
Cut about 25 to 30 mm of thread sealing tape from the roll and wrap it around the thread of the nozzle, as shown in the figure. Observe the winding direction in any case! The sealing tape must run with the thread! This means that the end of the sealing tape on the outside must not oppose the turn-in direction. Otherwise, it might happen that the sealing tape is shifted when screwed in and does not seal properly.



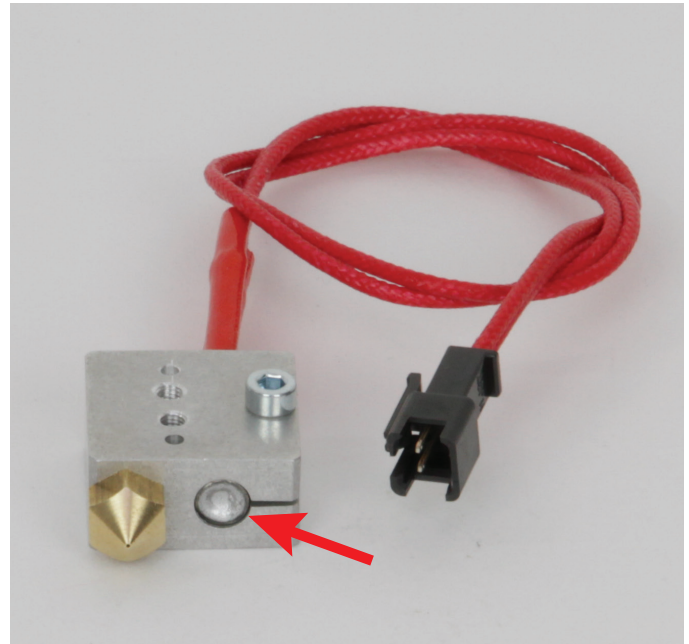
The sealing tape must never protrude beyond the thread. Cut off the sealing tape that protrudes over the thread with a sharp knife, e.g. by running the knife along the upper-most groove of the thread. Smooth the sealing tape well with your fingers. The ridges of the thread may be slightly visible. This way, the nozzle can be turned in more easily without the sealing tape becoming bunched up in the thread.



Turn the nozzle into the heating block. The heating block must be aligned so that the opening without thread is on the left and the 4 holes (the 2 in the middle with thread) are at the top (see arrow in the figure). The nozzle must then be turned in as shown in the figure. The hole for the heating cartridge must be on the right. Screw in the nozzle all the way and tighten it with an 8 mm open-faced spanner. Check from the other side of the nozzle that no sealing tape is visible.



1 x heating block with mounted nozzle
1 x cylinder head screw M3x10
1 x heating cartridge



Insert the heating cartridge into the corresponding opening from above (opposite of the nozzle).
Secure the heating cartridge with the cylinder-head screw as illustrated. The cartridge should be flush with the heating block at the bottom of the nozzle.

Assembly of the extruder upper part



1 x nozzle holder
1 x PEEK part
1 x PTFE thread sealing tape



Cut about 25 to 30 mm of thread sealing tape from the roll and wrap it around the thread of the nozzle holder, as shown in the figure.
Observe the winding direction in any case! The sealing tape must run with the thread! This means that the end of the sealing tape on the outside must not oppose the turn-in direction. Otherwise, it might happen that the sealing tape is shifted when screwed in and does not seal properly.



The sealing tape must never protrude beyond the thread. Cut off the sealing tape that protrudes over the thread with a sharp knife, e.g. by running the knife along the upper-most groove of the thread. Smooth the sealing tape well with your fingers. The ridges of the thread may be slightly visible. This makes it easier to screw the nozzle holder into the PEEK part without the sealing tape jerking in the thread.



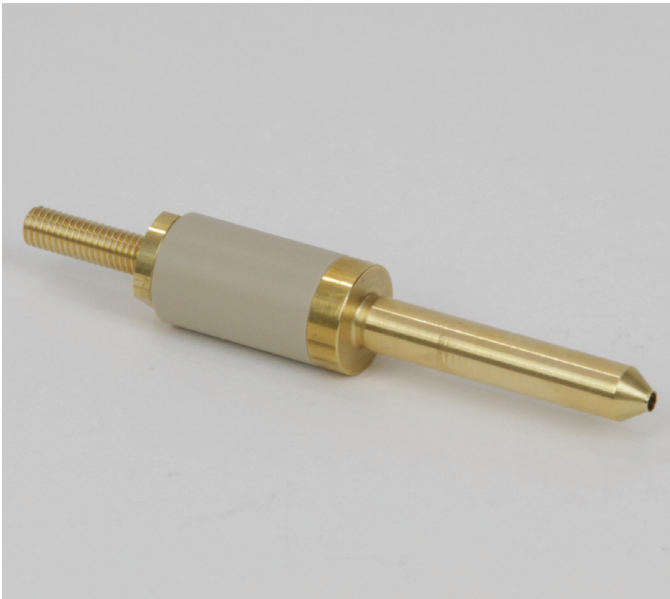
Turn the nozzle holder into the PEEK part carefully. It will only fit in one side because the opening is larger on the other side. Tighten the nozzle holder hand-tight with a 13 mm spanner. Hold the PEEK part with your hand.



1 x PEEK part with mounted nozzle holder
1 x PTFE insert
1 x extruder infeed



Push the PTFE insert into the PEEK part. Take a hexagon socket wrench with at least 3 mm and push the PTFE insert entirely into the PEEK part.



Carefully turn the extruder inlet into the PEEK part and tighten it manually as far as possible.



1 x extruder upper part
1 x nut M6 (flat ISO 4035)
1 x PTFE thread sealing tape



Screw the M6-nut onto the long thread of the nozzle holder to the stop.

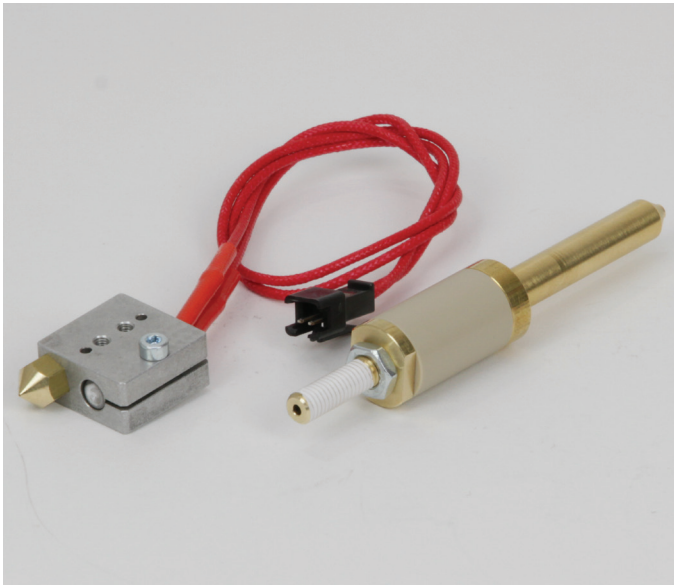


Cut about 30 to 35 mm of thread sealing tape from the roll and wrap it around the thread of the nozzle holder, as shown in the figure. Observe the winding direction in any case! The sealing tape must run with the thread! This means that the end of the sealing tape on the outside must not oppose the turn-in direction. Otherwise, it might happen that the sealing tape is shifted when screwed in and does not seal properly.

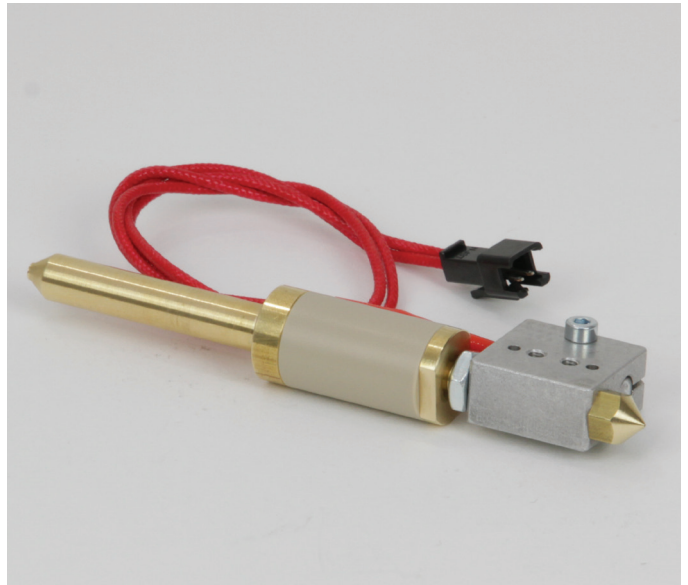


The sealing tape must never protrude beyond the thread. If necessary, cut it off with a sharp knife, e.g. by moving the knife along the top groove of the thread. Smooth the sealing tape well with your fingers. The ridges of the thread may be slightly visible. This way, the nozzle holder can be turned in more easily without the sealing tape becoming bunched up in the thread.

Assembly of the extruder lower and upper part



1 x extruder lower part
1 x extruder upper part

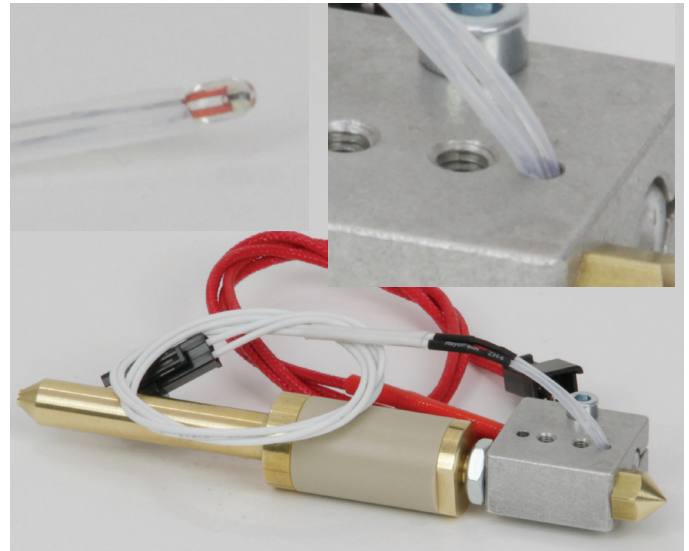


Turn the extruder top into the extruder bottom to the stop. Counter the extruder top with the nut against the extruder bottom (open-faced spanner 10 mm, flat).



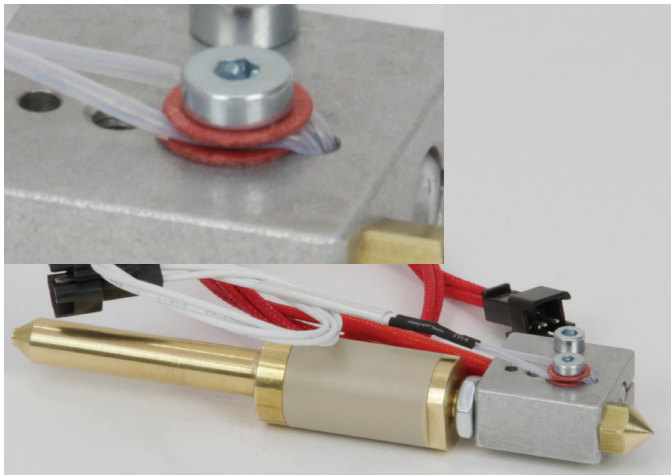
- 1 x extruder
- 1 x temperature sensor
- 1 x cylinder head screw M3x8 (flat head)
- 2 x paper disc M3

Attention! The temperature sensor is very sensitive! Installation therefore must be performed with the utmost care!



First check the two PTFE tubes on the temperature sensor. These must both be present at the temperature sensor (see small figure above left). If this is not the case, push them towards the temperature sensor until they are present.

Insert the temperature sensor as far as it will go into the small hole (without thread) closest to the nozzle (see small figure above right).



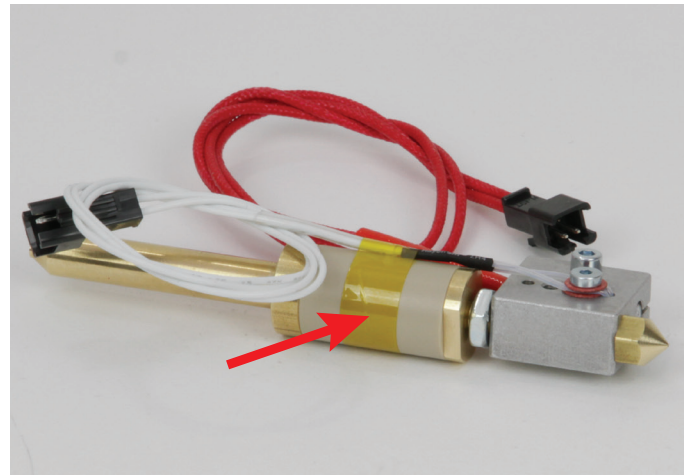
First push a paper disc onto the cylinder head screw (flat head). Hold the lines of the temperature sensor in the area of the black shrink hose and push the lines slightly towards the nozzle. This ensures that the sensor remains in the bore up to the stop.

Place the second paper disc directly on the hole (with thread) of the heating block.

Thread the cylinder head screw with the first paper disc between the two lines of the sensor.

Screw the cylinder head screw through the second paper disc into the thread of the heating block.

Only tighten the screw slightly so that the connection lines are not damaged. It is best to insert the screw only by hand and check it at the end with a hex key so that it is not too loose.



Now glue a strip of Kapton adhesive tape around the PEEK part and attach the two white wires of the temperature sensor (arrow). The two heat shrink hoses should not touch the brass of the nozzle holder.

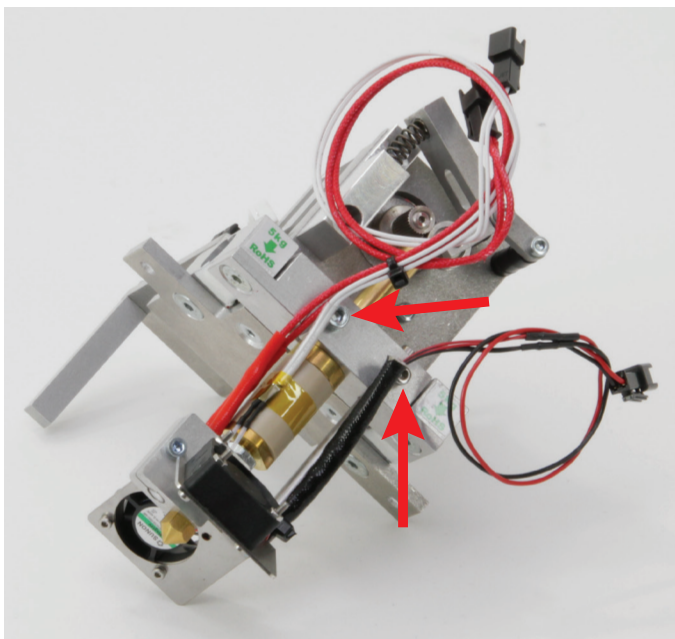
The 2nd extruder is now fully assembled.

→ **Please note!**

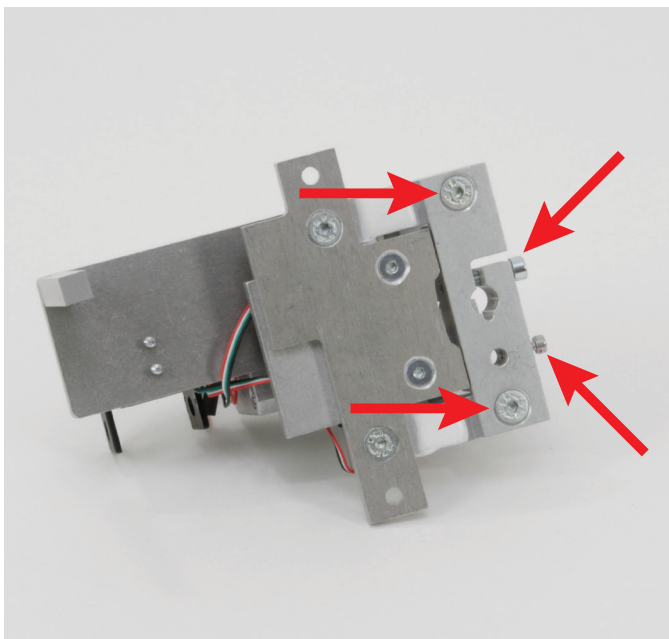
The cylinder head screw with which the lines of the temperature sensor are fixed should be checked regularly. If the screw loosens and the sensor slips out of the hole, this can damage the extruder!

On the following figures the cylinder head screw M3x8 with the flat head is partly still designed as a normal cylinder head screw. The following figures also show the normal version of the extruder inlet.

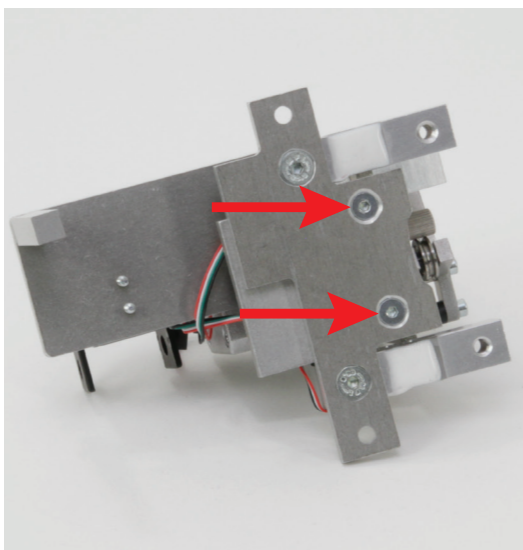
d) Disassembly of the extruder unit (single extruder)



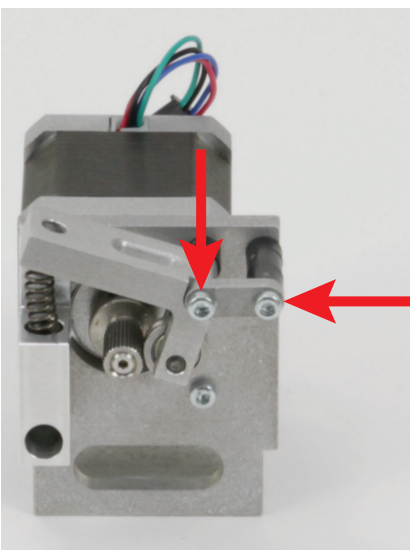
Loosen the two retaining screws in the extruder holder and remove the extruder and fan sheet.



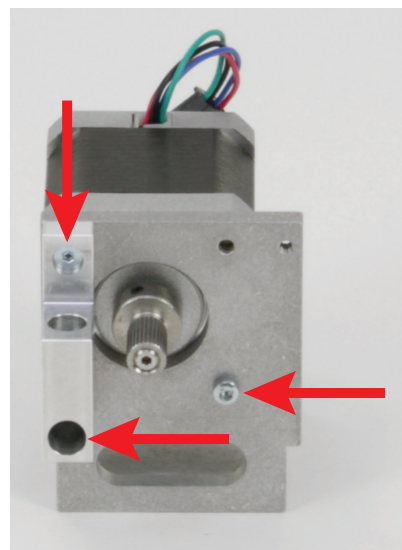
Remove the previously loosened retaining screws. Loosen and remove the two countersunk screws securing the extruder holder.



Loosen and remove the two countersunk screws securing the motor holder. Hold the motor holder firmly and remove it.



Loosen and remove the two M3 cylinder head screws that secure the ball bearing holder and counter-bearing. Remove the ball bearing holder and the counter-bearing.



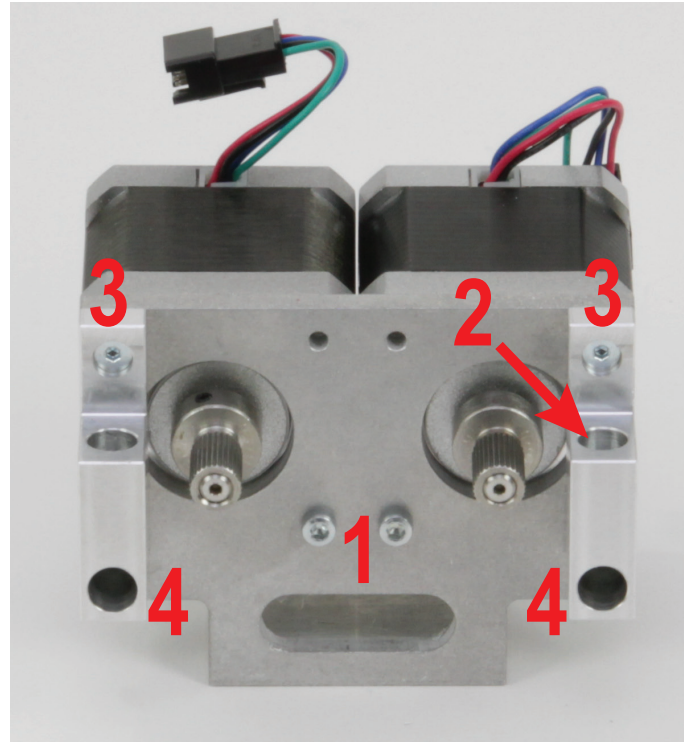
First loosen and remove the countersunk screw and the cylinder head screw with which the spring holder is fixed and then remove them. Then loosen the last motor screw and remove the motor.

e) Assembly of the extruder unit (Dual Extruder)

Assembly of the feed motors and spring holders



- 1 x motor holder (dual)
- 2 x motor with mounted feed knurl
- 2 x spring holder
- 1 x cylinder head screw M4x8
- 1 x cylinder head screw M4x8 (mounted in the spring holder)
- 2 x cylinder head screw M3x12
- 2 x countersunk screw M3x12
- 2 x cylinder head screw M3x8



Push the feed motors from behind through the motor holder. The cable outlet must point upwards.

First fix both motors in the middle of the motor holder at the bottom with one cylinder head screw M3x8 each (1).

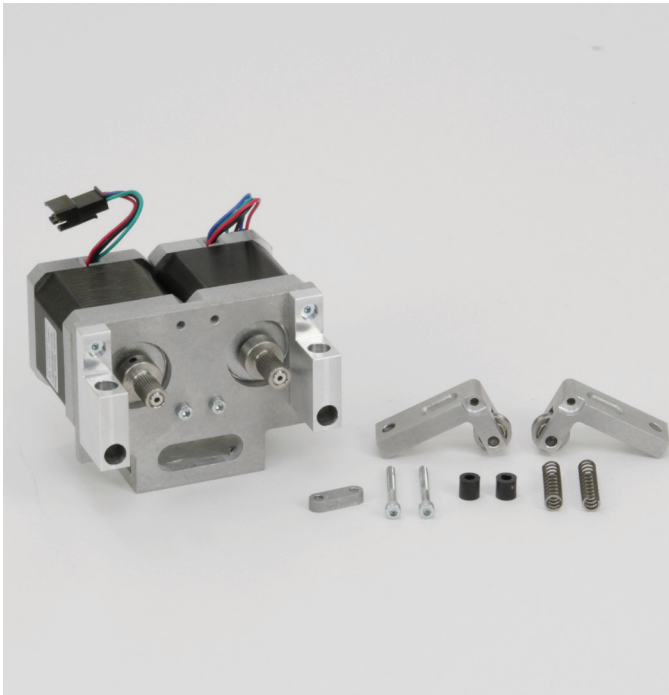
Then fasten one spring holder each on the left and right side through the motor holder, also in the motor. The opening of the hole must point upwards.

Use the countersunk screw M3x12 (3) at the top of both spring holders and the cylinder head screw M3x12 (4) at the bottom.

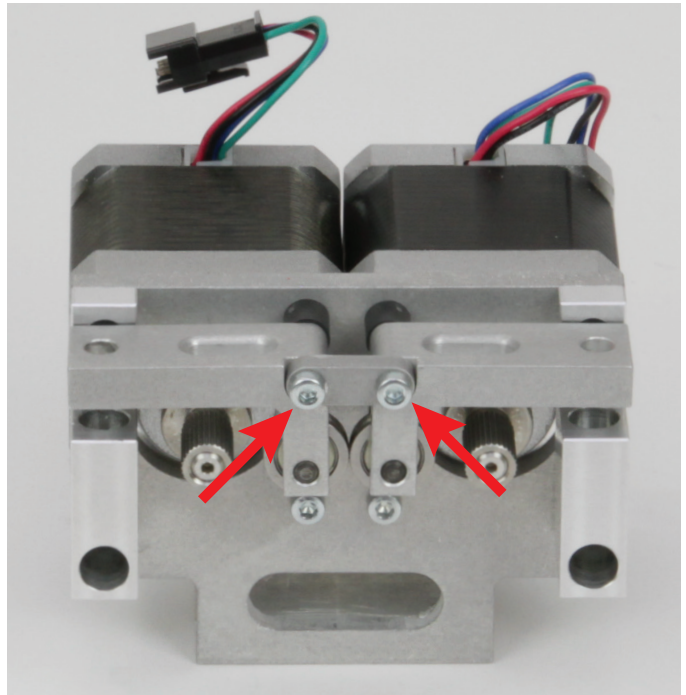
The screws that you screw into the motor must be provided with threadlocker varnish.

Screw the cylinder head screw M4x8 into the vertical hole of the new spring holder (2) as far as it will go, without using any threadlocker varnish.

Assembly of the ball bearing holders



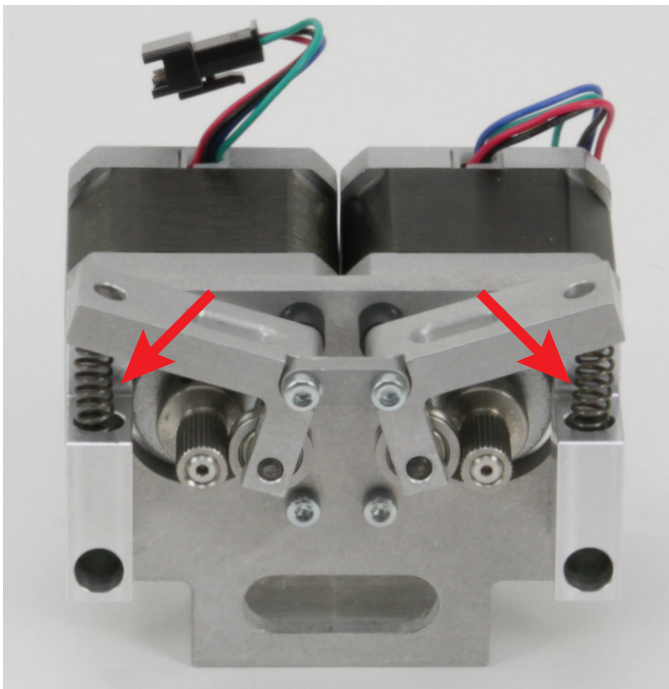
- 1 x motor holder (dual) with mounted motors
- 1 x ball bearing holder left (assembled)
- 1 x ball bearing holder right (assembled)
- 1 x counter-bearing
- 2 x cylinder head screw M3x30
- 2 x spacer 7 mm
- 2 x spring



Attach the ball bearing holders, as shown in the figure, through the motor holder in the motor. The counter-bearing must be placed in the cut-outs of the ball bearing holders.

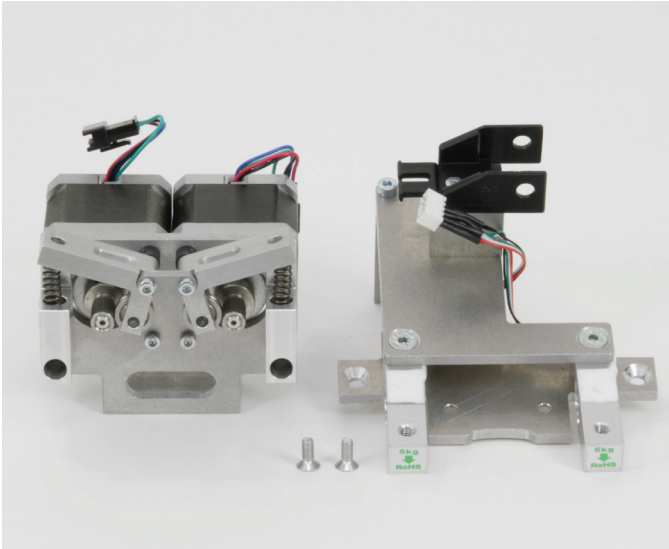
The screws are provided with threadlocker varnish.

Order: Cylinder head screw M3x30 - counter-bearing - ball bearing holder - spacer 7 mm - motor holder - motor

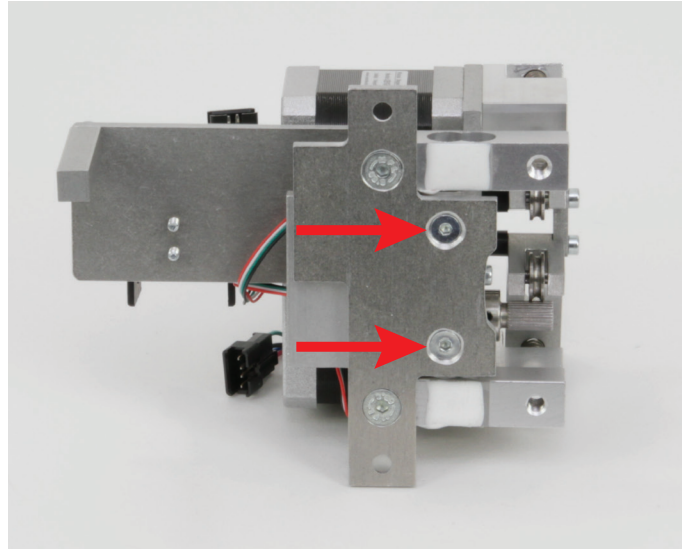


Slide the springs first into the vertical hole of the respective spring holder and then under the ball bearing holder so that the spring engages.

Mounting the motor holder

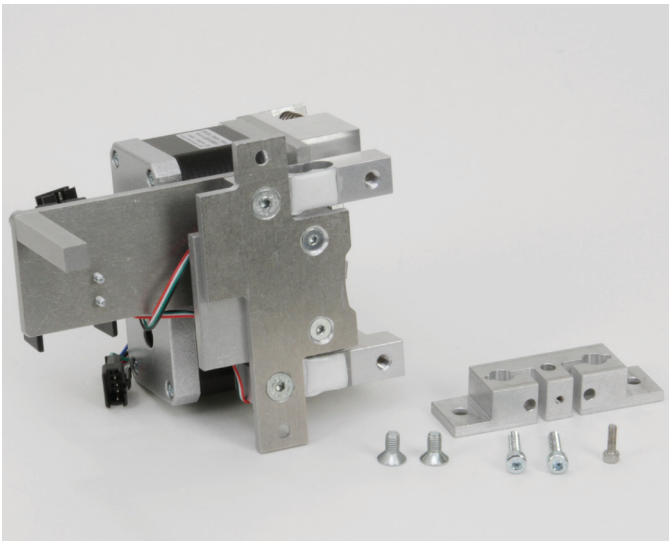


- 1 x motor holder with motor
- 1 x strain gauge with mounted adapter plate
- 2 x countersunk screw M4x10

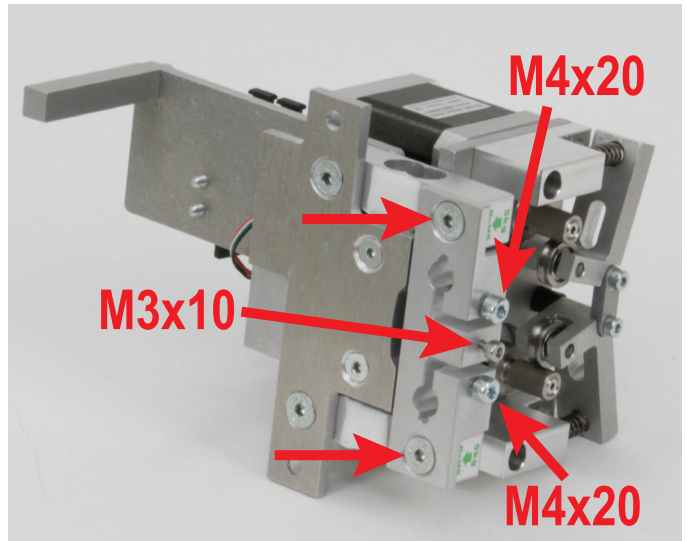


Slide the motor holder into the strain gauge unit, between the holding plate and the adapter plate.
Take care not to damage or squeeze the strain gauge cable.
Attach the motor holder to the adapter plate using the two countersunk screws and tighten the screws.
The screws are provided with threadlocker varnish.

Mounting the extruder holder



- 1 x previously mounted extruder unit
- 1 x extruder holder (dual)
- 2 x countersunk screw M5x10
- 2 x cylinder head screw M4x20
- 1 x cylinder head screw M3x10



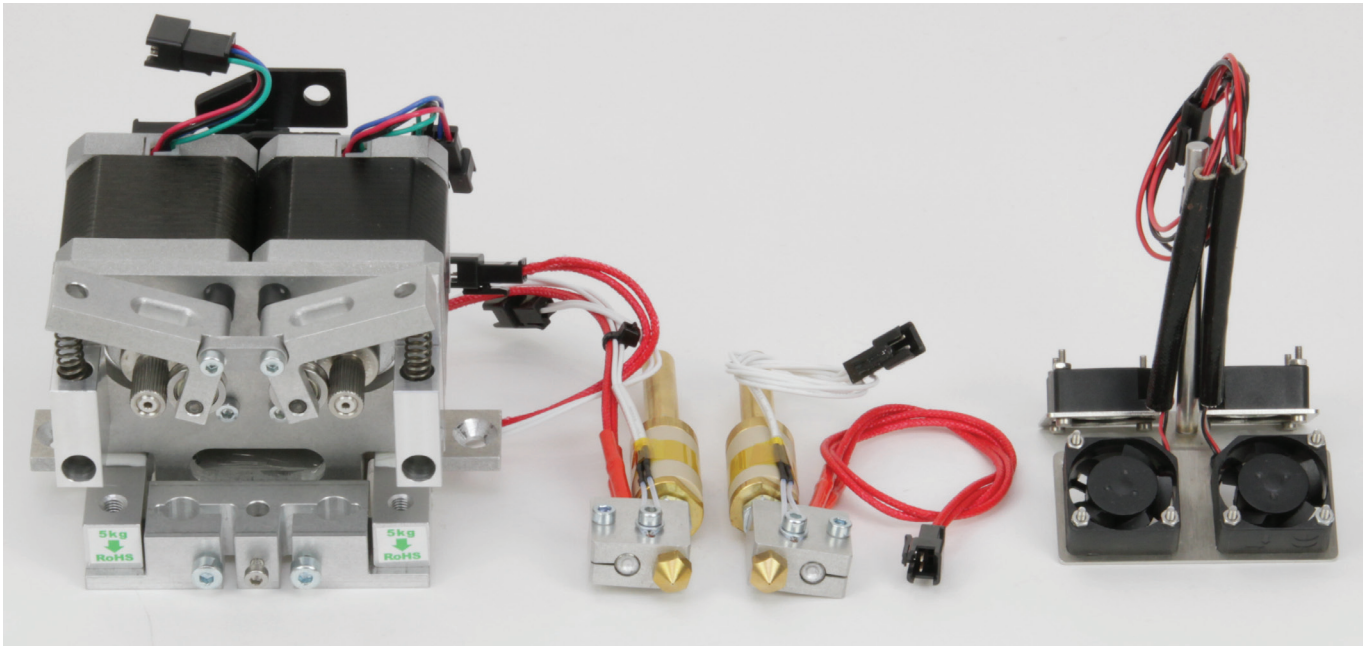
Attach the extruder holder to the bottom side of the two strain gauges using the two countersunk screws. The mounting takes place in the two holes on the same side of the adapter plate. The hole in the middle of the extruder holder must be directed away from the extruder unit.

The screws are provided with threadlocker varnish.

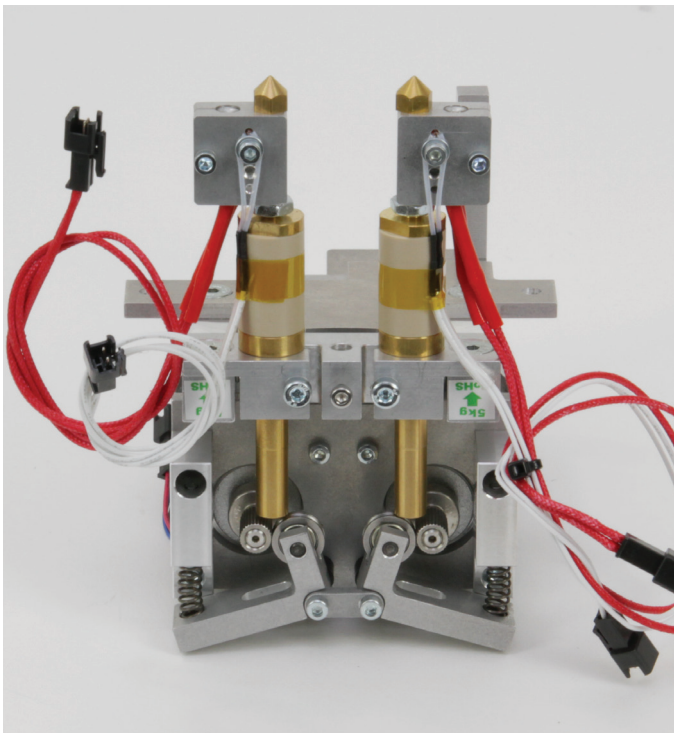
Turn the cylinder head screw M3x10 into the middle bore of the extruder holder until the vertical bore is still freely accessible.
Loosely screw the cylinder head screws M4x20 into the two outer holes of the extruder holder.

Do **not** use locking varnish on both screws!

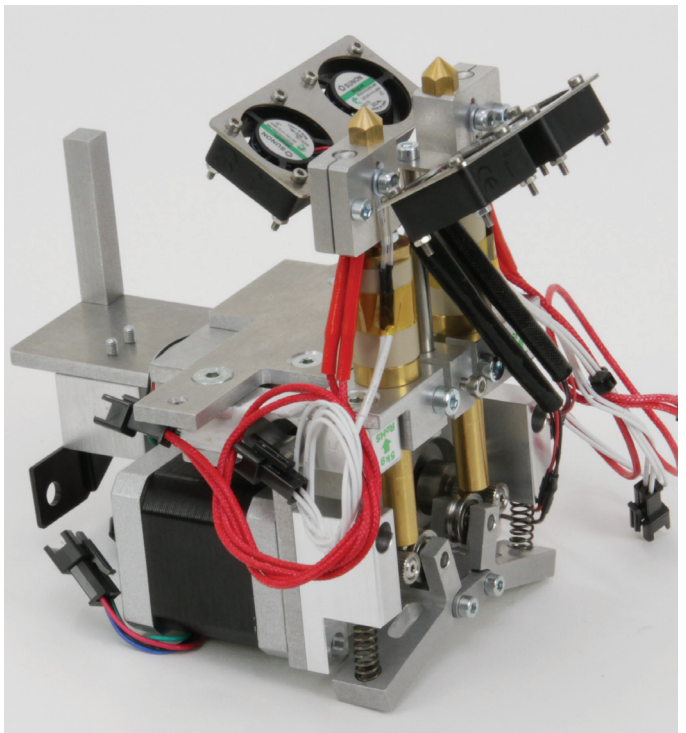
Mounting the extruder and fan



- 1 x previously mounted extruder unit
- 1 x extruder left
- 1 x extruder right
- 1 x fan sheet with installed fans



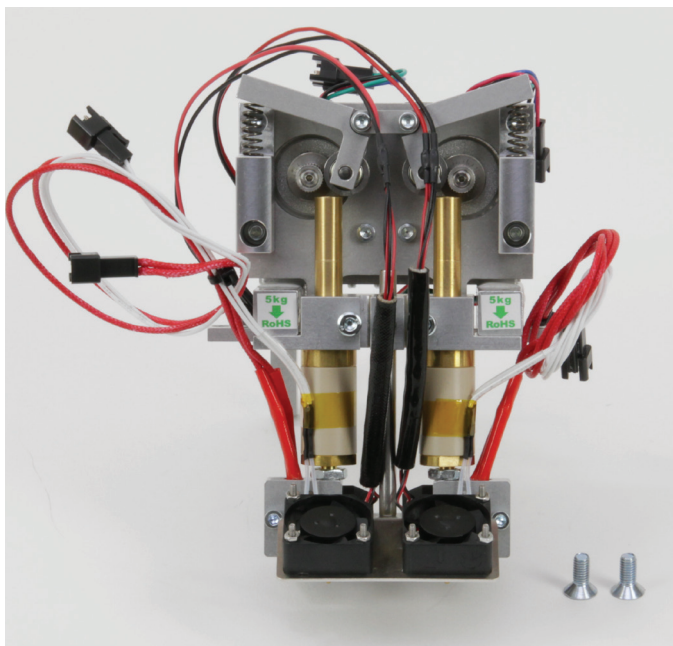
Turn the extruder unit upside down.
Slide the extruders one after the other into each hole of the extruder holder. Align the extruders so that the screws on the heating block are facing forward. In addition, the heating blocks must be parallel to the extruder holder.
Tighten the retaining screws on both extruders. The extruders must no longer move.



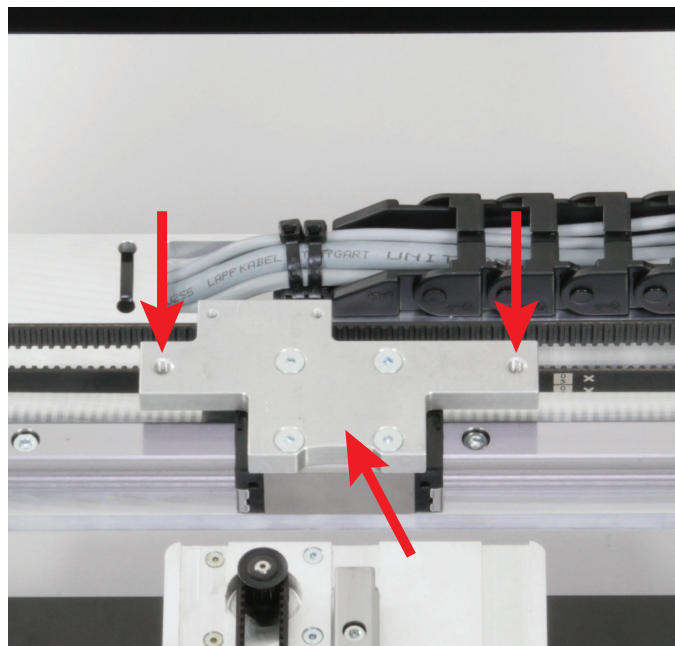
Insert the fan sheet into the small hole in the middle of the extruder.
The fans must enclose the extruder, but must not touch it.
Align the fan sheet straight and tighten the retaining screw slightly.
The fan sheet must no longer move.

f) Assembly and connection of the extruder unit (dual extruder)

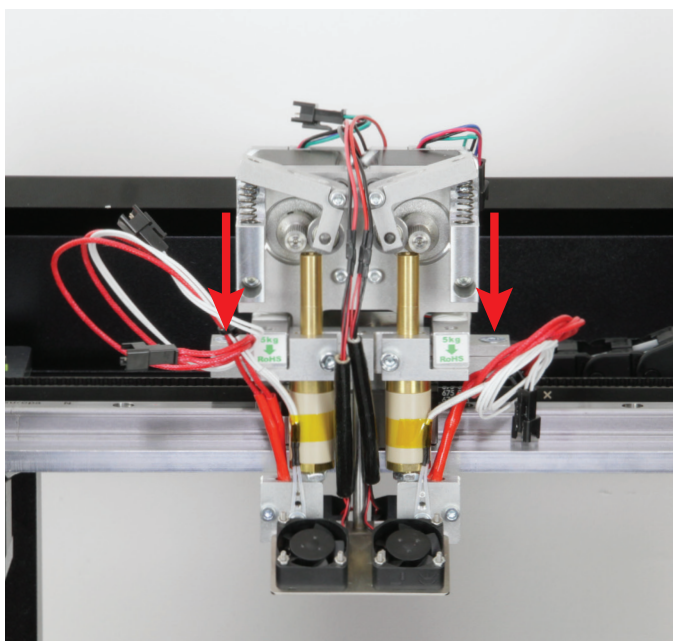
Mounting of the extruder unit



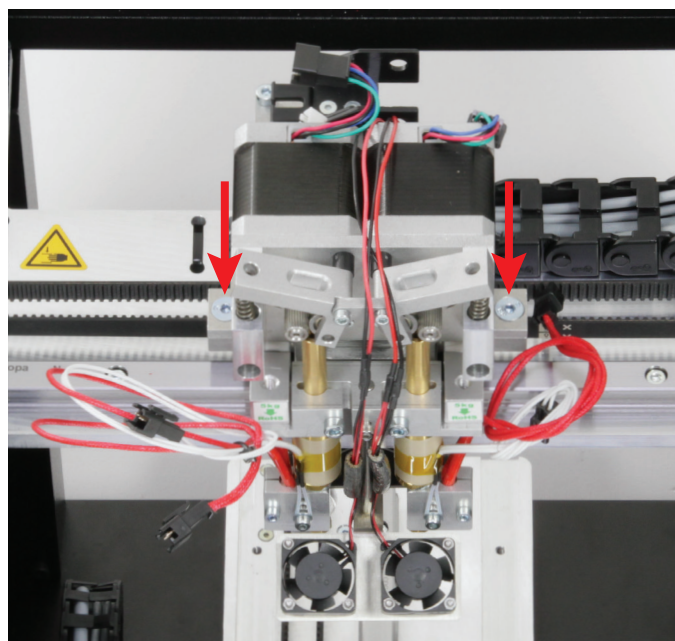
1 x extruder unit (completely assembled)
2 x countersunk screw M5x12



The extruder unit is mounted on the guide carriage plate (arrow from below) with two screws (see arrows from above).



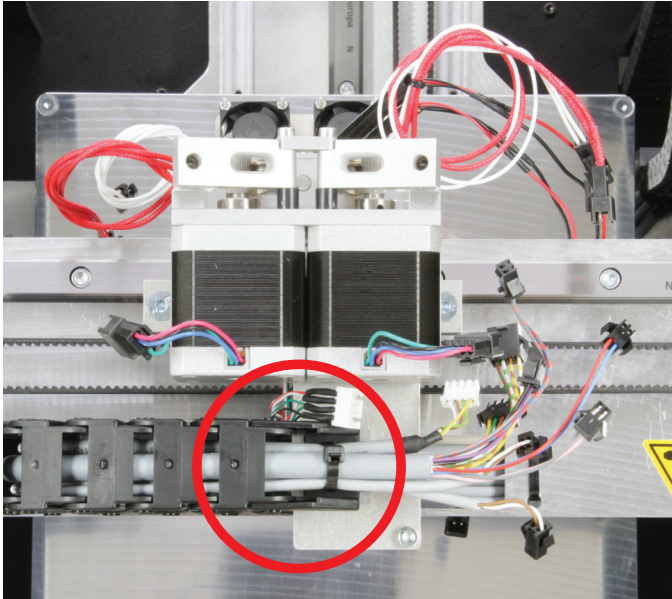
Place the extruder unit on the guide carriage plate and secure with the two M5 countersunk screws.
Do **not** apply threadlocker varnish to the two screws!



Here still the view from above.

→ It may be necessary to loosen the fan sheet so that you can insert the extruder unit. When you reattach it, make sure that the fan screw located under the X-plate does not touch it. In addition, the sheet should be above the nozzle tip.
The extruder and fan cables are then attached when the remaining cables are laid.

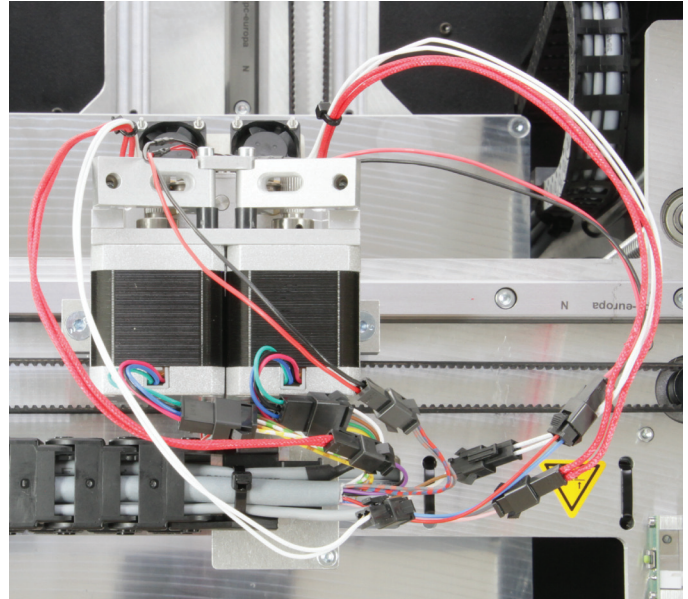
Connection of the extruder unit



Engage the energy drag chain in the drag chain end piece of the extruder unit.

Pull the cable strand slightly out of the drag chain.

→ Attention! In the following description "Extruder 0" means the left extruder from the front view. This is the first extruder. Since the following figures were taken from the back view except one, the first extruder, i.e. the extruder 0, is the right one in the respective figure.



Connect the cables to the respective plugs.

Line 04:

4-pole yellow/green/brown/white - motor extruder 0

4-pole white-yellow/yellow-brown/white-green/brown-green - motor extruder 1

2-pole red/blue - extruder fan extruder 0

2-pole grey-pink/red-blue - extruder fan extruder 1

2-pole grey/pink - heating extruder 0 (red cable extruder 0)

2-pole black/violet - heating extruder 1 (red cable extruder 1)

Line 10:

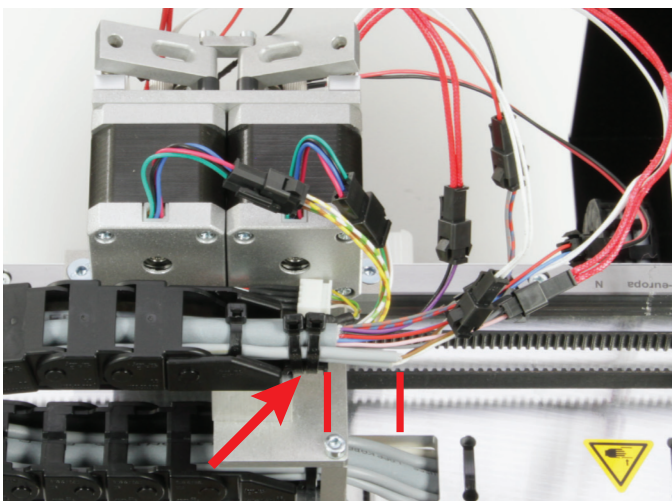
Temperature sensor extruder 0 (white cable from extruder 0)

Line 11:

Temperature sensor extruder 1 (white cable from extruder 1)

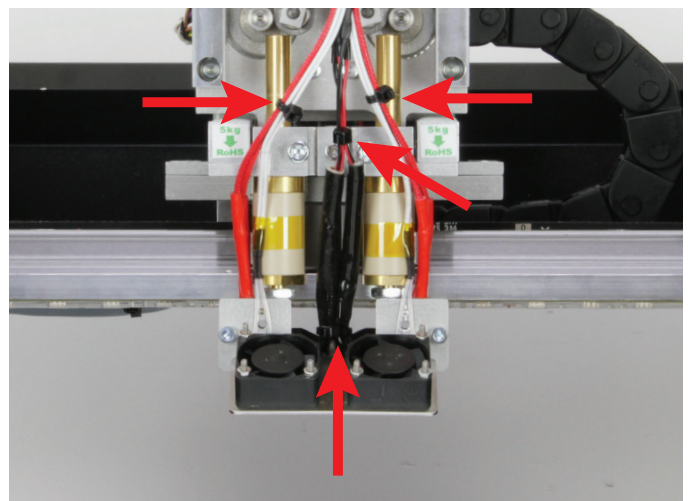
Line 13:

Elongation measuring strip

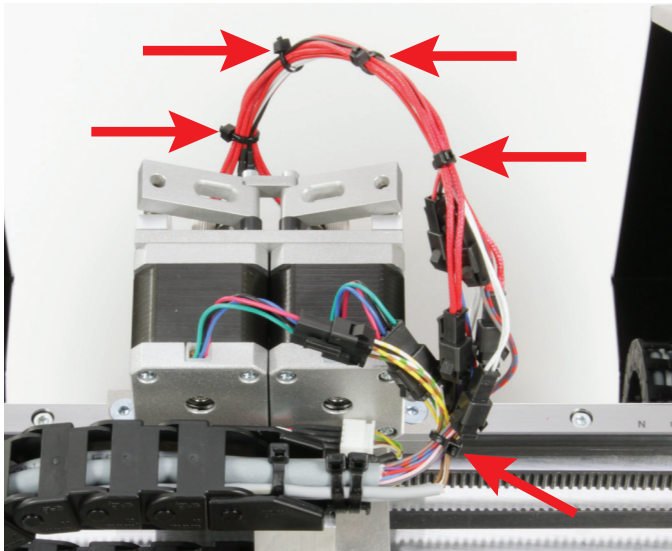


Push all cables back into the drag chain until cable 04 and 13 terminate with the tension relief. The two cables 10 and 11 must protrude 22 mm further than the cables 04 and 13 (see the two vertical lines in the figure).

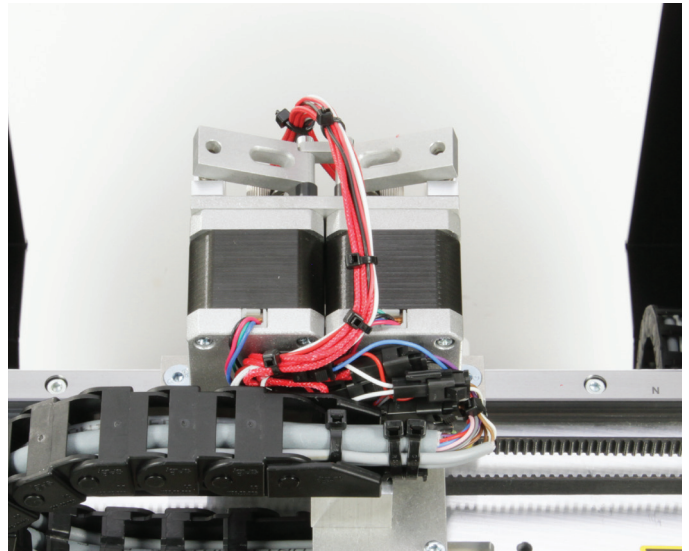
Then fix the cable harness with two large cable ties (142 mm) to the tension relief of the drag chain end piece.



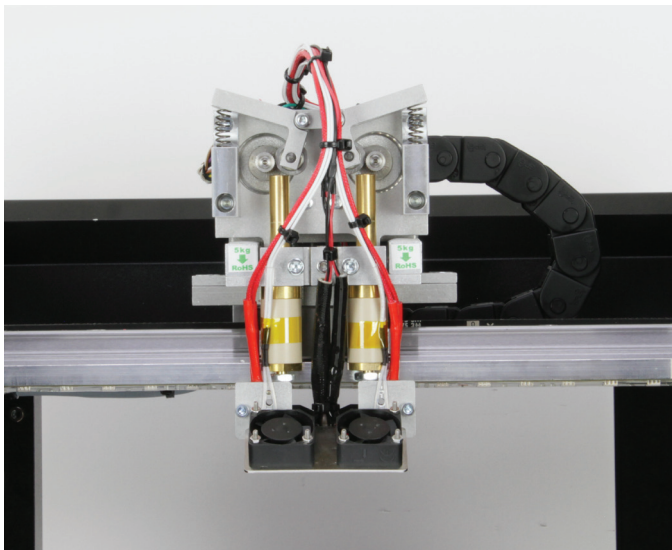
Tie the lines (heating and temperature sensor) from the right extruder together at about the same height as those from the left extruder. Position a small cable tie at the bottom of the fan sheet and fix the fan cable including heat protection with it (see arrow from below). In addition, tie the two fan cables together at the level of the extruder holder.



Use four small cable ties (99 mm) to lay the lines from the extruder (heating, temperature sensor and fan) neatly to the plugs. Position the first cable tie at the level of the ball bearing holders. The fourth one at the plugs. Please note the last two figures on this page. Additionally fix the cables between the connectors and the drag chain end piece with a small cable tie (99 mm).

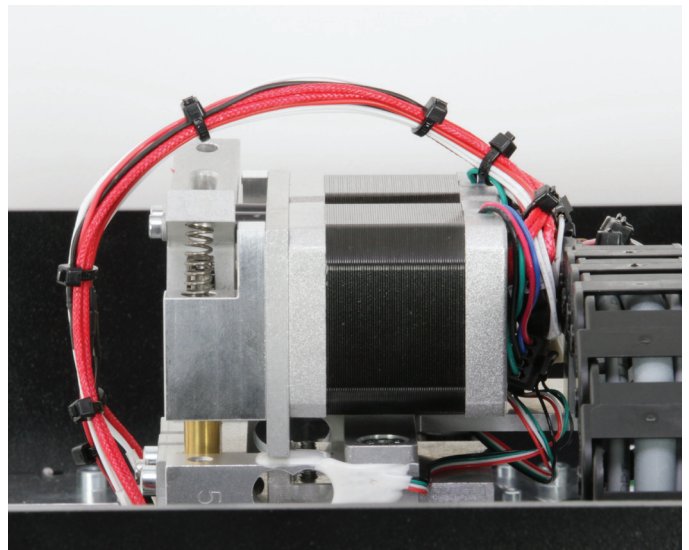


Push all cables behind the motor. The lines to the extruder should be at the top. Fix them to the motor cable with a small cable tie. The lines to the extruder must not be routed over the inlets for the filament. If possible, they should run in the middle and should not be too tight.



The whole thing should look like this from the front view.

→ When attaching the cable ties, please note that they should only be positioned before or after the entire connectors. It should be the case that if the extruder unit is to be removed, as few cable ties as possible must be opened.



The side view should look roughly as in the figure above. **Important! The cables of the two extruders and the fan must never be tensed! They must be routed loosely. Never lay the cables behind the counter-bearing or attach them to it. Otherwise, there may be problems at calibration!**

Overview of all cables and connections used in this chapter

Line	Length	Connection main PCB	Pin number plug/main PCB (all pins on white plugs; colour based on pin1)	Component	Pin number plug/component (all pins on plugs; colour based on pin1)
4	1440 mm	X17	4pin green/yellow/white/brown	Motor extruder 0 (1st extruder)	4pin yellow/green/brown/white
		X18	4pin yellow-brown/white-yellow/ brown-green/white-green	Motor extruder 1 (2nd extruder)	4pin white-yellow/yellow-brown/ white-green/brown-green
		Fan additional PCB	4pin red/blue/grey-pink/red-blue	Fan 1/2 (single extruder)	2pin red/blue (+ = red)
				Fan 3/4 (dual extruder only)	2pin grey-pink/red-blue (+ = grey-pink)
		X4	2pin grey/pink	Heating extruder 0 (1st extruder)	2pin grey/pink
		X8	2pin black/violet	Heating extruder 1 (2nd extruder)	2pin black/violet
10	1500 mm	X5	2pin brown/white	External temperature sensor 0 (1st extruder)	2pin brown/white
11	1500 mm	X6	2pin brown/white	External temperature sensor 1 (2nd extruder)	2pin brown/white
13	1420 mm	X7	5pin yellow/brown/green/white/ shield	DMS (elongation measuring strip)	4pin yellow/brown/green/white

→ The printer is now fully assembled and converted to a dual extruder. For commissioning, operation, calibration, etc., please continue with our separate operating instructions. All further steps are described here.

You can find the instructions on the product page of the printer or in the download area on our website (see item "Current operating instructions" in chapter "3. Intended use").

17. Handling

- Never connect the mains plug to a mains socket immediately after the device has been taken from a cold to a warm environment. The resulting condensation may destroy the device. Allow the device to reach room temperature before connecting it. Wait until the condensation has evaporated.
- Never pull the mains plug from the mains socket by the cable. Only pull it from the mains socket by the intended grip areas.
- Disconnect the 3D printer from the mains voltage if you are not going to use it for an extended period of time.
- Disconnect the mains plug from the mains socket during thunderstorms for reasons of safety.
- The heating plate and the extruders may heat up strongly in operation. Do not touch these parts during or just after operation. Let these parts cool off first.

18. Disposal



The product does not belong in the household waste!

Dispose of the product according to the relevant statutory regulations at the end of its service life.

19. Technical data

Operating voltage	230 V/AC, 50 Hz
Power intake 3D printer	max. 760 W
Connection output socket	max. 800 W
Total power intake	max. 1560 W
Fuse	T6.3AL/250 V (5 x 20 mm, slow-acting trigger)
Production process	FFF (Fused Filament Fabrication) / FDM (Fused Deposition Modelling)
Printing space (W x D x H)	Single extruder approx. 200 x 290 x 185 mm (X, Y, Z)
.....	Dual extruder approx. 170 x 290 x 185 mm (X, Y, Z)
Printing layer thickness	0.05 - 0.3 mm
Nozzle diameter	0.4 mm
Suitable filament material	ABS, PLA, PVA, EcoPLA™, PET, Taulman, Layrick, Bendlay, Laywood-D3, HIPS and smartABS
Filament diameter	Standard, max. 1.75 mm
Power of the heating plate	560 W
Extruder temperature	120 – 270 °C
Heating plate temperature	55 – 160 °C
Interfaces	USB 2.0 and SD/SDHC card reader
Dimensions (W x H x D)	390 x 665 x 420 mm
Weight	19.7 kg

20. Annex: Recommended tightening torque of the screws

Description of the fastening	Thread size	Type	Torque
Threaded pin on motor pinion	M3	Threaded pin	0.7 Nm
Ball bearing for belt tensioner on basic body	M4	Cylinder head screw	3.0 Nm
Ball bearing for belt tensioner on basic body	M4	Cylinder head screw	3.0 Nm
Spacer on bottom plate	M5	Cylinder head screw	5.4 Nm
Actuator on bottom plate	M3	Cylinder head screw	1.7 Nm
Limit switch on limit switch holder	M2	Cylinder head screw	0.3Nm
Limit switch on X-plate	M3	Cylinder head screw	1.0 Nm
Guide rail on X-plate	M4	Cylinder head screw	3.5 Nm
Actuator on X-plate	M3	Cylinder head screw	1.7 Nm
Actuator on X-plate	M3	Countersunk screw	1.7 Nm
Ball bearing for belt tensioner on basic body	M4	Cylinder head screw	3.0 Nm
Belt holder on guide carriage plate	M3	Cylinder head screw	1.1Nm
Guide carriage plate on guide carriage	M4	Countersunk screw	4.0 Nm
Drag chain end piece on X-plate	M3	Countersunk screw	1.2 Nm
Light barrier holding block on X-plate	M2	Cylinder head screw	0.3 Nm
Light barrier on light barrier holding block	M2	Cylinder head screw	0.3 Nm
Guide rail on Y-plate	M4	Cylinder head screw	3.5 Nm
Actuator on Y-plate	M3	Cylinder head screw	1.7 Nm
Actuator on Y-plate	M3	Countersunk screw	1.7 Nm
Ball bearing for belt tensioner on basic body	M4	Cylinder head screw	3.0 Nm
Drag chain end piece on holding block for guide rail	M3	Countersunk screw	1.2 Nm
Holding block for guide rail with limit switch holding block on Y-plate	M3	Cylinder head screw	1.9 Nm
Drag chain end piece on Y-plate	M3	Countersunk screw	1.2 Nm
Actuation for the end stop on Y-plate	M3	Cylinder head screw	1.7 Nm
Hexagon threaded bolt for limit switch actuation on Y-plate	M3	Hexagon threaded bolt	1.1 Nm
Limit switch on limit switch holder	M2	Cylinder head screw	0.3Nm
Undertable holder on limit switch holder	M3	Cylinder head screw	1.1 Nm
Drag chain end piece on undertable	M3	Countersunk screw	1.2 Nm
Undertable holder on belt tappet angle	M3	Cylinder head screw	1.1 Nm
Undertable with guide carriage	M4	Countersunk screw	4.0 Nm
Threaded circulation spindle on Y-plate	M5	Cylinder head screw	5.4 Nm
Spacer on X-plate	M5	Cylinder head screw	5.4 Nm
Pinion on ball circulation spindle	M3	Threaded pin	0.7 Nm
Side parts left and right	M4	Cylinder head screw	4.0 Nm
Foot holder on side parts	M4	Cylinder head screw	4.0 Nm
Back panel on side parts and bottom plate	M4	Cylinder head screw	2.9 Nm
Rear side parts and rear head cover with side parts	M4	Cylinder head screw	2.9 Nm
Drag chain end piece on operating cover	M3	Countersunk screw	1.1 Nm
Operating cover with side parts and bottom plate	M4	Cylinder head screw	2.9 Nm
Privacy screen right and left on side parts	M4	Cylinder head screw	2.9 Nm

Description of the fastening	Thread size	Type	Torque
Threaded pin on extruder feed knurl on actuator	M3	Threaded pin	0.7 Nm
Rod on fan sheet	M3	Cylinder head screw	1.7 Nm
Fan on fan sheet	M2	Cylinder head screw	0.3 Nm
Heating cartridge in heating block	M3	Cylinder head screw	1.0 Nm
Temperature sensor in heating block	M3	Cylinder head screw	Hand-tight, with a lot of feeling
Adapter plate on strain gauge	M5	Countersunk screw	5.4 Nm
Motor on motor holder and spring holding block	M3	Cylinder head screw	1.7 Nm
Motor on motor holder and spring holding block	M3	Countersunk screw	1.5 Nm
Motor on motor holder	M3	Cylinder head screw	1.7 Nm
Ball bearing holder on motor	M3	Cylinder head screw	1.7 Nm
Motor holder on adapter plate	M4	Countersunk screw	4.0 Nm
Extruder holder on strain gauges	M5	Countersunk screw	5.0 Nm
Drag chain end piece on holding plate for end stop	M3	Countersunk screw	1.2 Nm
End stop actuation on holding plate	M4	Cylinder head screw	3.0 Nm
Extruder holder on strain gauges	M5	Countersunk screw	5.0 Nm
Holding plate on strain gauge	M5	Countersunk screw	5.0 Nm
Extruder unit on guide carriage plate	M5	Countersunk screw	5.0 Nm
Keyboard PCB on operating cover	M2	Cylinder head screw	0.3 Nm
Display PCB on operating cover	M2	Cylinder head screw	0.3 Nm
Main PCB on operating cover	M3	Cylinder head screw	1.1 Nm
Fan on right side part	M3	Cylinder head screw	1.0 Nm
Fan PCB on hexagon bolt	M3	Cylinder head screw	1.1 Nm
Socket on rear panel	M4	Cylinder head screw	1.0 Nm
Mains unit at the rear panel	M4	Cylinder head screw	2.5 Nm
Angle on mains unit	M4	Cylinder head screw	1.0 Nm
Angle on rear panel	M4	Cylinder head screw	2.5 Nm
Earthing cable from the low-power device combination socket, socket and mains unit to the bottom plate	M4	Cylinder head screw	2.5 Nm
Cable duct on rear side panel	M4	Cylinder head screw	2.5 Nm
Earthing cable to undertable	M3	Cylinder head screw	1.0 Nm
Wago plug to undertable	M3	Cylinder head screw	1.0 Nm
Limit switch PCB for Z-max	M2	Cylinder head screw	0.3 Nm
Earthing cable on bottom plate	M4	Cylinder head screw	2.5 Nm
Printing table on spacer bolt	M4	Countersunk screw	2.0 Nm
Bottom sheet on foot holder	M3	Cylinder head screw	1.2 Nm

Description of the fastening	Thread size	Type	Torque
Threaded pin on extruder feed knurl on actuator	M3	Threaded pin	0.7 Nm
Rod on fan sheet	M3	Cylinder head screw	1.7 Nm
Fan on fan sheet	M2	Cylinder head screw	0.3 Nm
Heating cartridge in heating block	M3	Cylinder head screw	1.0 Nm
Temperature sensor in heating block	M3	Cylinder head screw	Hand-tight, with a lot of feeling
Adapter plate on strain gauge	M5	Countersunk screw	5.4 Nm
Motor on motor holder and spring holding block	M3	Cylinder head screw	1.7 Nm
Motor on motor holder and spring holding block	M3	Countersunk screw	1.5 Nm
Motor on motor holder	M3	Cylinder head screw	1.7 Nm
Ball bearing holder on motor	M3	Cylinder head screw	1.7 Nm
Motor holder on adapter plate	M4	Countersunk screw	4.0 Nm
Extruder holder on strain gauges	M5	Countersunk screw	5.0 Nm
Drag chain end piece on holding plate for end stop	M3	Countersunk screw	1.2 Nm
End stop actuation on holding plate	M4	Cylinder head screw	3.0 Nm
Extruder holder on strain gauges	M5	Countersunk screw	5.0 Nm
Holding plate on strain gauge	M5	Countersunk screw	5.0 Nm
Extruder unit on guide carriage plate	M5	Countersunk screw	5.0 Nm
Filament holder on side part	M4	Cylinder head screw	2.5 Nm

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