

# renkforce

Ⓒ Manual

## **3D-Printer Construction Kit RF1000**

Item No. 1007507

## **3D-Printer RF1000**

Item No. 1007508

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	Page
1. Introduction.....	3
2. Explanation of Symbols.....	4
3. Intended Use.....	4
4. Safety Information.....	4
5. Features .....	6
6. Working Principle of the 3D Printer .....	6
7. Overview of the Most Important Parts .....	7
8. Required Tools and Material .....	8
9. Assembly of the Mechanical Parts .....	8
a) General .....	8
b) Assembly of the Components .....	9
10. Wiring of the Electrical Components .....	40
a) General .....	40
b) Wiring of the Components.....	41
c) Installation of the PCBs .....	49
11. Final Work.....	54
12. Initial Commissioning.....	57
a) Assembly of the Filament Holder and the Filament Hose .....	57
b) Insertion of the Filament.....	58
c) Setup and Transport.....	59
d) Mains Connection and First Activation .....	59
e) Calibration.....	60
f) First Print of an Example Object from the SD Card .....	63
13. Operation at the Printer.....	65
a) Menu Overview.....	65
b) Functions of the Individual Menu Items.....	67
14. General Notes on 3D Printing.....	69
15. Software “Repetier Host” .....	70
a) General Notes on Software .....	70
b) Installation .....	70
c) Connection of the Connected Printer.....	71
d) Manual Operation via the Software .....	73
e) Placement of a printing Object in the Software .....	74
f) Preparation for Print.....	76
g) Printing .....	78
h) More Detailed Description of the Slicer Functions.....	80
16. Software “Cura” .....	86
a) General Notes on Software .....	86
b) Installation .....	86
c) Setup of the Software .....	87
d) Use of the Software in the Quickprint Mode.....	91
e) Use of the Software in the Expert Mode.....	92
17. Filament Change.....	94
18. Firmware Update.....	95



	<b>Page</b>
19. Maintenance.....	97
a) General .....	97
b) Cleaning.....	98
c) Fuse Replacement.....	98
d) Checking the Belt Tension.....	98
e) Nozzle Change.....	101
20. Handling.....	101
21. Troubleshooting.....	102
22. Disposal .....	104
23. Technical Data.....	104
24. Annex .....	105
a) Wiring Plan of the Main PCB .....	105
b) Notes on the Print Files (GCODE Files) on the Enclosed SD Card .....	106
c) Setting up the Printer Settings .....	106
d) Explanation on the Configuration Files on the Enclosed SD Card .....	109
e) Setting up the Slicer.....	109
f) Recommended Tightening Torque of the Screws .....	112

# 1. Introduction

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Dear Customer,

thank you for purchasing this product.

This product complies with the statutory national and European specifications. 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!

If there are any technical questions, please contact:

International:        [www.conrad.com/contact](http://www.conrad.com/contact)

United Kingdom:    [www.conrad-electronic.co.uk/contact](http://www.conrad-electronic.co.uk/contact)

## 2. Explanation of Symbols

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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 exclamation mark symbol indicates that the user must read these operating instructions before commissioning of the device, and observe them during operation.



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



This symbol warns of hand injury that may occur when reaching into the device in operation.



The symbol with the arrow indicates special advice and notes.

## 3. Intended Use

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

This product is only approved for connection to 100-240 V/50/60 Hz alternating current and only for use in the private area.

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.

Any use other than that described above will damage this product and involves the risk of short circuit, fire, electric shock, etc.

This product complies with the statutory national and European requirements. All company names and product names are trademarks of their respective owners. All rights reserved.



**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.**

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

## 4. Safety Information

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**The guarantee/warranty will expire if damage is incurred resulting from non-compliance with these operating instructions. We do not assume liability for any consequential damage.**



**Nor do we assume any liability for damage to property or personal injury caused by improper use or failure to observe the safety information. 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 through the following attentively:

- 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.
- 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.



- 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 heating plate grow very hot in operation. Never touch these parts during or just after operation. Let them cool down sufficiently first (approx. 60 minutes).
- 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.
- 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.
- 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.
- 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 and not suitable for children. Children cannot judge the dangers involved when handling electrical devices.
- This device is a safety class 1 product. The only permissible voltage source is a properly grounded mains socket (100-240 V/50/60 Hz) of the public mains.
- 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.
- 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.
- When setting up the product, make sure that the mains cable is not pinched or damaged by sharp edges.
- Never touch the mains line or the mains plug with wet or damp hands. There is a risk of potentially fatal electric shock!
- 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.
- Never operate the device unattended.
- Only operate the device in moderate climates, never in tropical climates.
- 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.

## 5. Features

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- Large printing space of approx. 245 x 230 x 200 mm
- Play-free profile rail guides and ball-threaded drives for maximum precision
- Automatic printing plate measurement
- Ceramics heating plate with structural surface
- Highly precise extruder with replaceable printing nozzle
- 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
- Future-proof with optional accessories

## 6. Working Principle of the 3D Printer

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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 already 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 print temperatures for printing head and heating bed, etc. are specified. The file has the extension “.gcode”.

This GCODE 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 then prints the print 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 the filament roll to the print head (extruder).

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

The heating plate moves in the Y and Z directions, the extruder 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.**

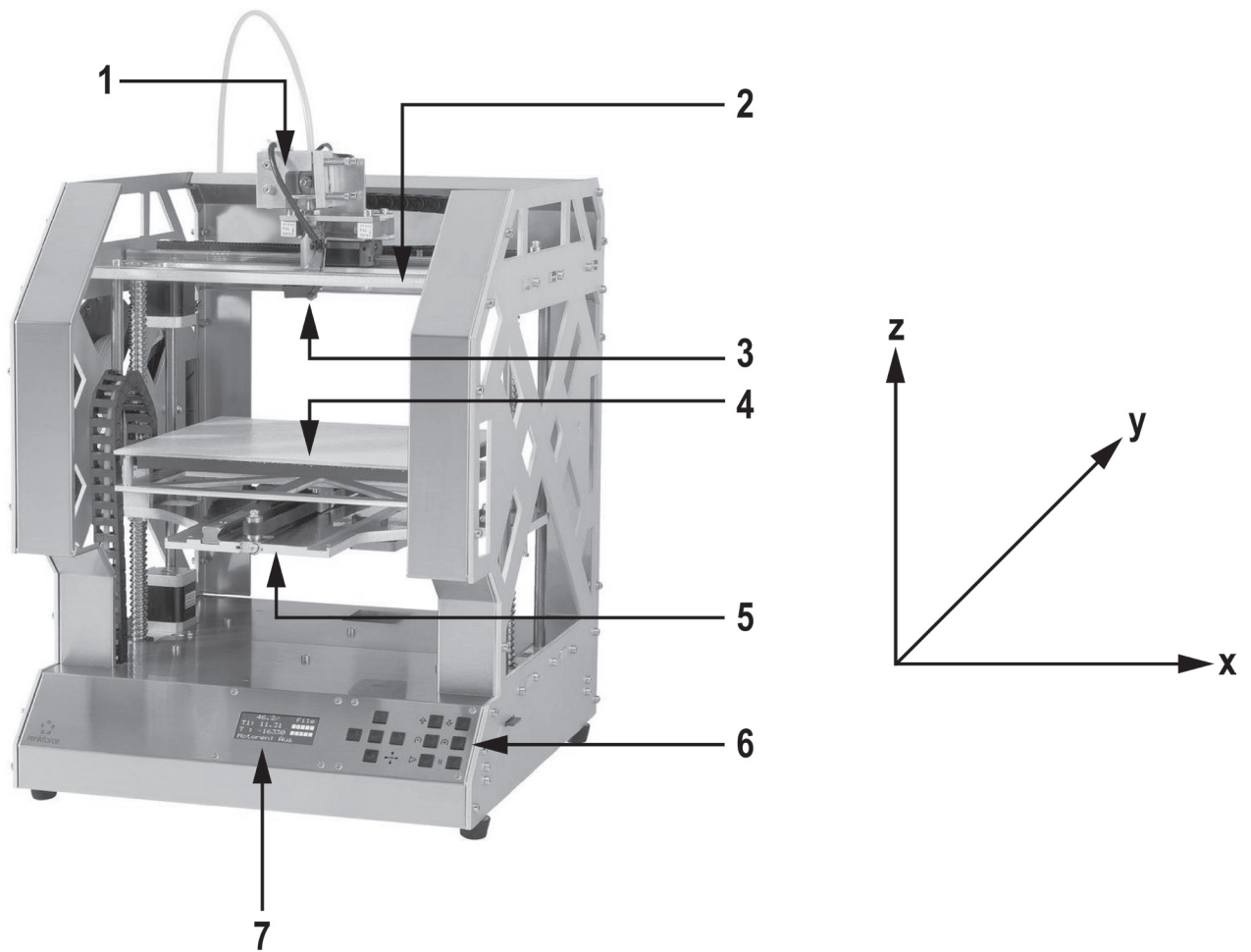
**Ambience influences such as drafts, grease on the printing plate, etc. also play a role in the quality and adhesion of the printed object.**

**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.**

## 7. Overview of the Most Important Parts

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- (1) Extruder carriage
- (2) X-plate
- (3) Extruder
- (4) Heating plate
- (5) Y-plate
- (6) Operating button field
- (7) Display

→ To the right of the figure, the printing directions (x, y and z) are indicated.

## 8. Required Tools and Material

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- Different screwdrivers (cross-head and slotted)
- Hexagon socket wrench 1.5 mm / 2 mm / 2.5 mm / 3 mm / 4 mm
- Hexagon wrench 4 mm / 5 mm / 5.5 mm / 7 mm / 13 mm (2x)
- Stop angle
- Calliper
- Wire cutter
- Small flat pliers and small long-nose pliers
- Threadlocker varnish, medium strength
- Hot-glue gun (optional)

## 9. Assembly of the Mechanical Parts

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The following chapters refer to the assembly of the 3D printing construction kit, but are also interesting for owners of the ready-made device as information for later accessory assembly.

If you have purchased the finished device, you can skip the following chapters and continue directly with the chapter "Initial commissioning".

### a) General Information



**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 different components and assemblies can be put down and installed easily.**

**The stainless steel parts of the construction kit are very sensitive to dirt. Wash your hands before installing these parts and use cotton gloves if necessary. Remove the protective film only directly before assembly.**

**Always observe the images during assembly. Here, the assembly locations and correct alignment of the components are shown.**

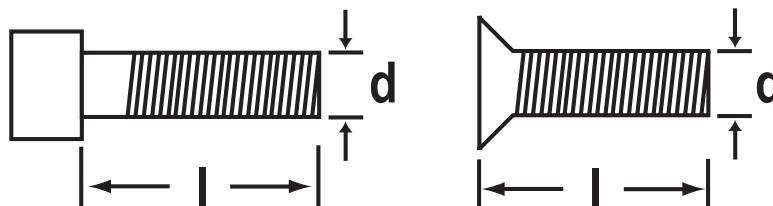
**All mechanical components of the construction kit are produced extremely precisely. Never apply any force during assembly. All parts can be assembled without any great application of force. If this is not the case, rethink the assembly step and reread the corresponding description in these instructions.**

**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 of these instructions.**



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

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

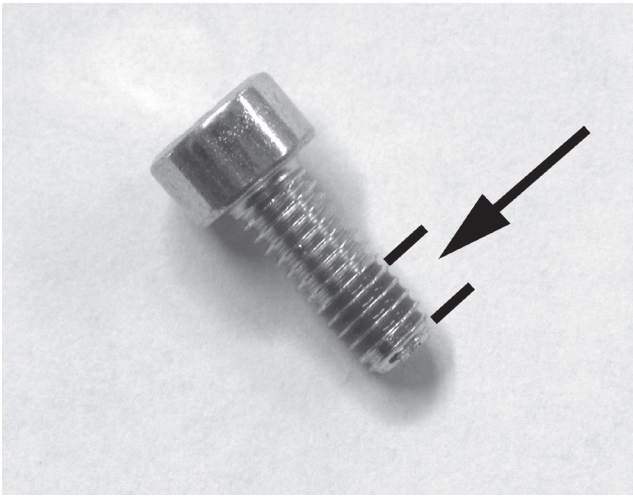


## Application of the threadlocker varnish

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

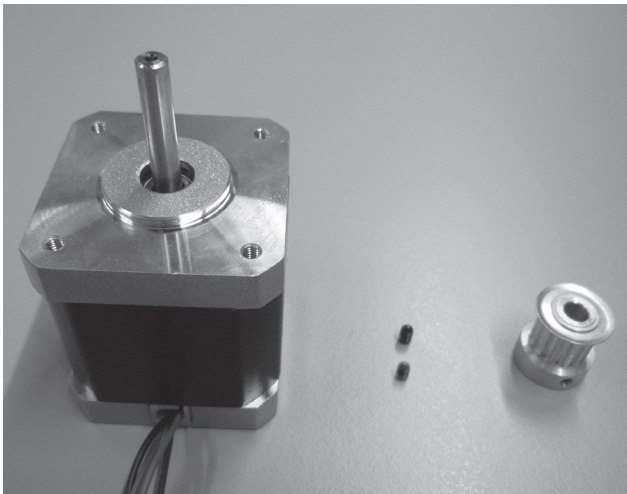
Procedure:

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.

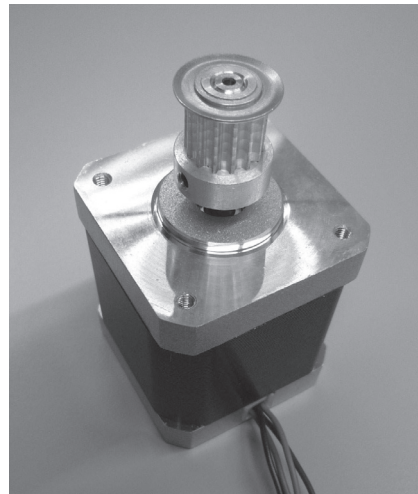


## b) Assembly of the Components

### Attachment of the motor pinion to the actuators



3x actuator  
3x sprocket 14Z (small pinion, outer dia. 16 mm)  
6x threaded pin M3 x 5



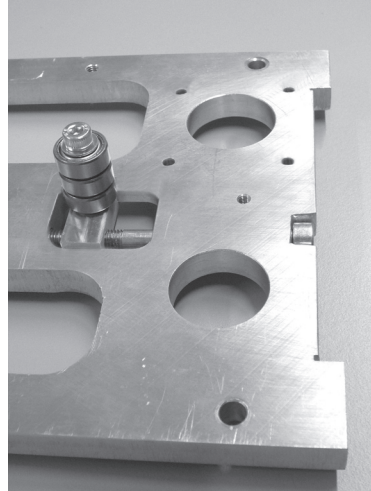
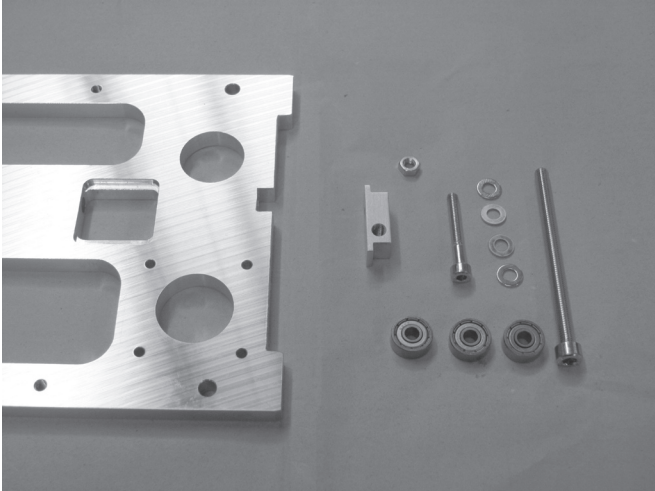
Push sprockets onto axes of the actuators and attach them with 2 threaded pins each. Apply threaded pins with threadlocker varnish.

The motor axes must end flush with the upper edges of the sprockets.



## Assembly of the bottom plate

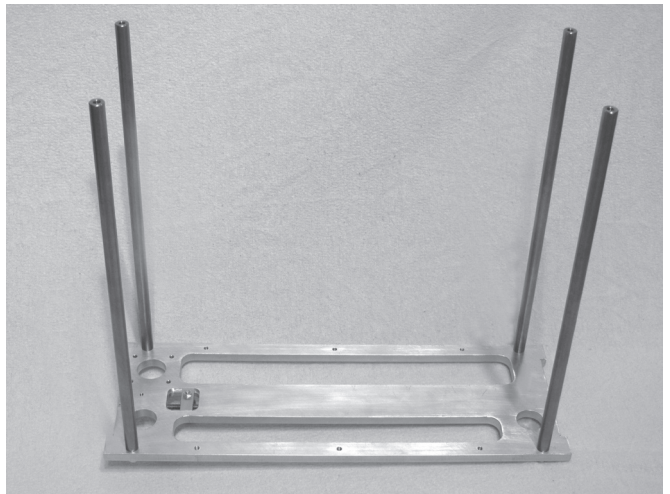
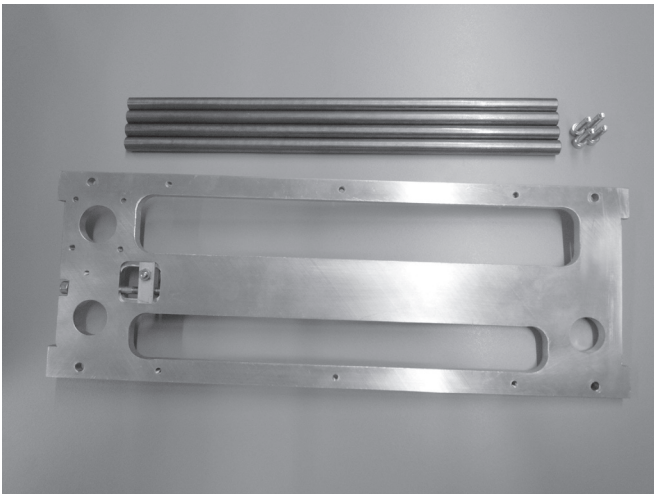
### Assembly of the belt tensioner



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

Insert belt tensioner basic body into the intended breakout of the bottom plate. The cross-bore of the belt tensioner basic body and the bore in the bottom plate must align. Push washers onto the M4x30 screw alternately with the ball bearings. Screw the screw equipped in this manner, as shown in the figure, into the belt tensioner basic body and tighten it well. Counter the screw with the nut at the belt tensioner basic body (in the figure on the bottom of the bottom plate). The screw head of the belt tensioner (on the right in the figure) 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

### Assembly of the Spacers

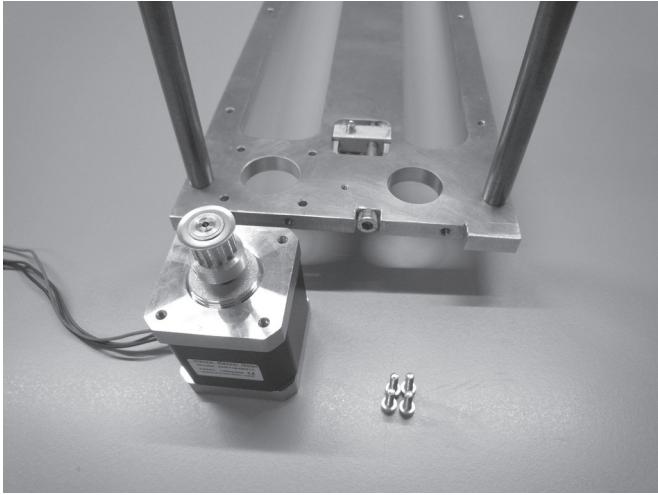


- 4x spacers
- 1x bottom plate
- 4x cylinder head screw M5x16

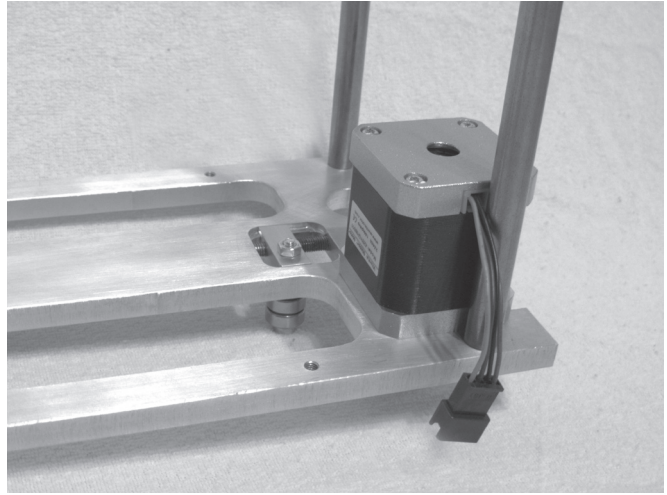
Turn the bottom plate and attach the spacers to the top of the bottom plate with the screws as shown.



## Assembly of the drive motor

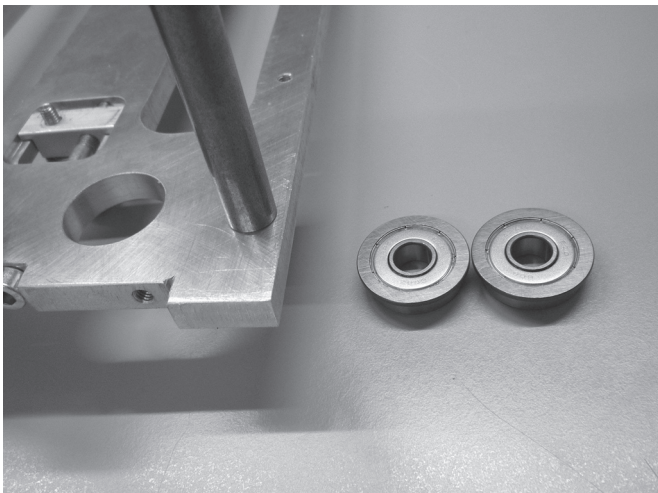


1x actuator  
1x bottom plate  
4x cylinder head screw M3x12



Attach the actuator to the bottom plate with the 4 screws as shown in the figure.  
Apply screws with threadlocker varnish.  
The cable exit of the actuator must point at the long side of the plate as shown.

## Inserting the grooved ball bearings



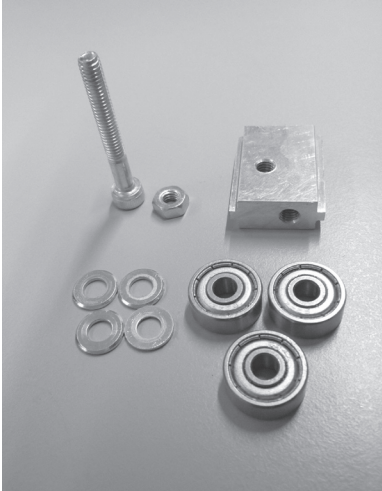
2x grooved ball bearings  
1x bottom plate



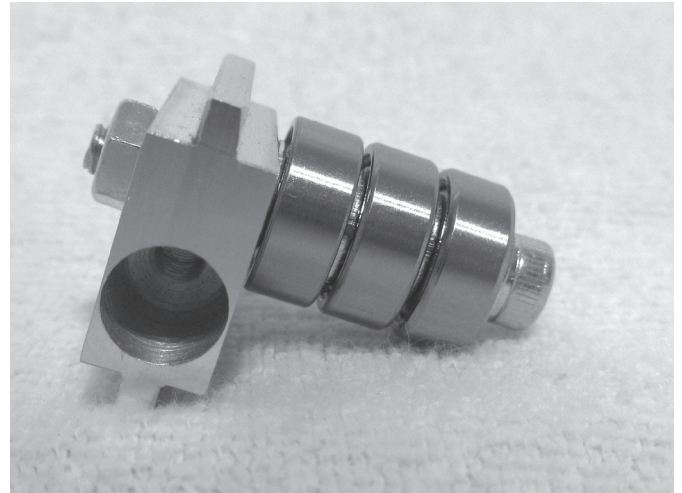
Insert the grooved ball bearings into the corresponding bores of the bottom plate from above.  
Turn the grooved ball bearings slightly, when inserting them into the bores. Do not apply any force. The flanges of the grooved ball bearings must be cleanly aligned with the top of the bottom plate.

## Assembly of the X plate

### Assembly of belt tensioner

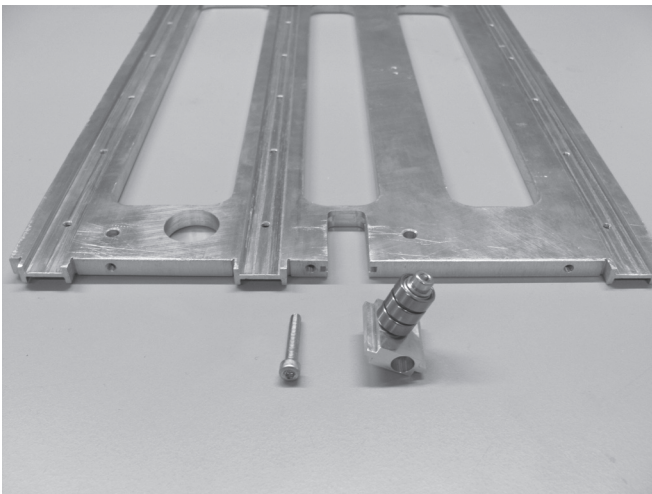


- 1x belt tensioner basic body
- 3x ball bearing 624ZZ (diameter inside/outside (8.8/13 mm)
- 4x washer (diameter inside/outside 4.3/8.8 mm)
- 1x cylinder head screw M4x30
- 1x nut M4

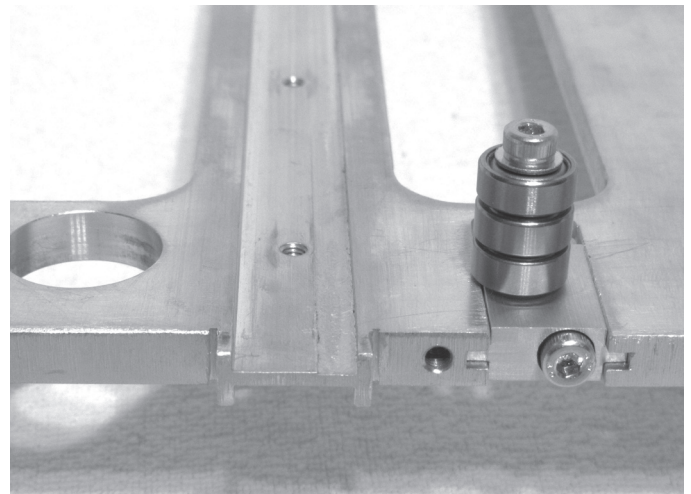


- Push washers onto the screw with the ball bearings alternately.
- Screw the screw into the belt tensioner basic body as shown in the figure and tighten it well.
- Counter the screw with a nut.

### Attachment of belt tensioner to the X-plate



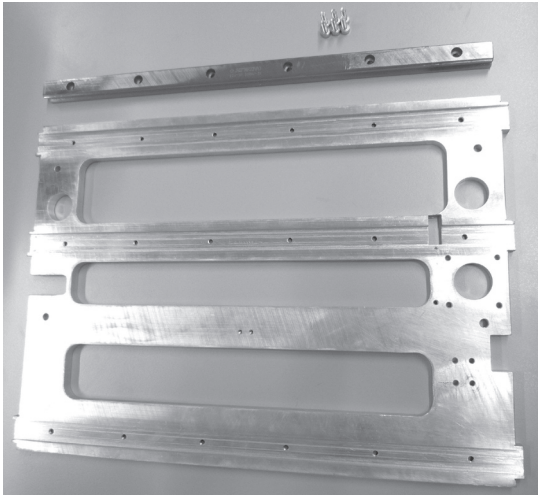
- 1x X-plate
- 1x assembly belt tensioner (see above)
- 1x cylinder head screw M4x30



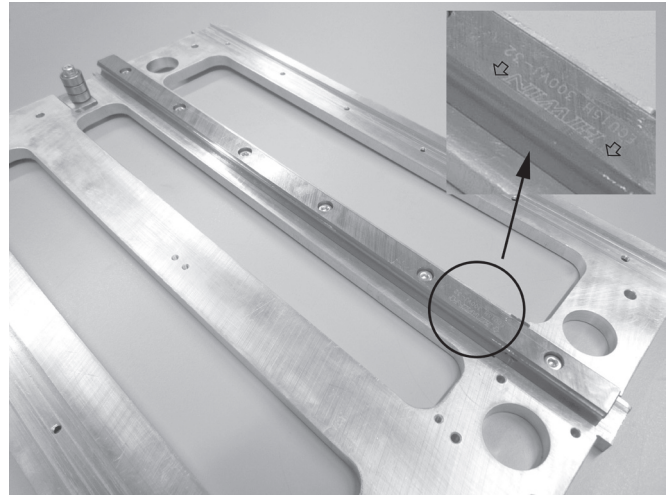
- Push the belt tensioner assembly into the intended section of the X-plate and turn the screw into the belt tensioner.
- Observe the position of the bore in the belt tensioner (must be on the right as shown in the figure). The ball bearings must be on the grooved side of the X-plate.



## Attachment of the guide rail



1x X-plate  
1x guide rails  
6x cylinder head screws M4x12



Insert the guide rail into the middle groove of the X-plate and attach with the screws.  
The imprinted arrows on the guide rail must point to the side of the belt tensioner.

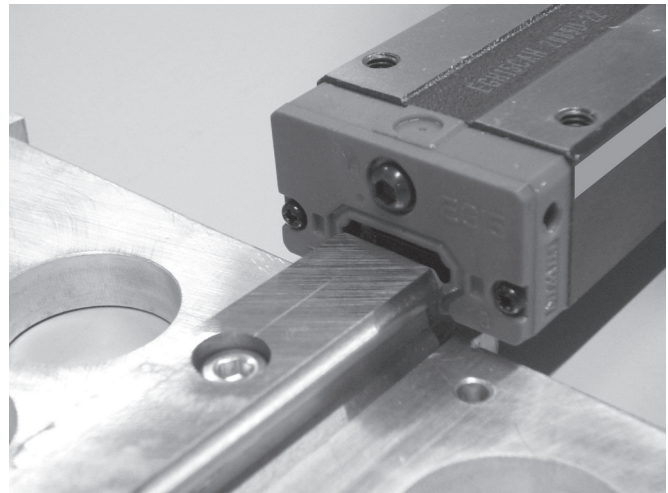
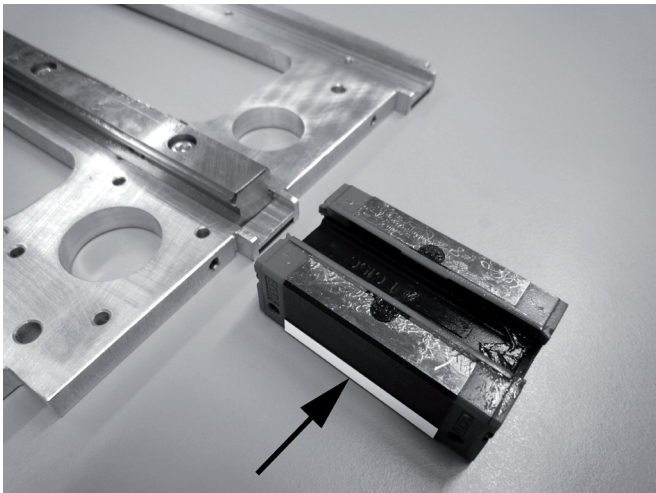
## Push the guide carriage onto the guide rail

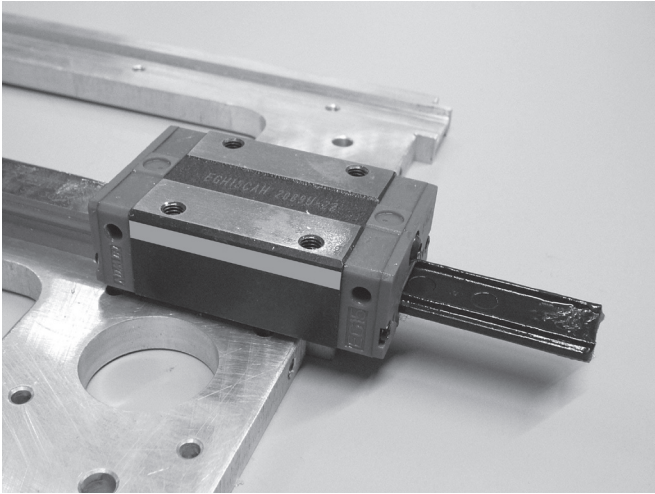


**The assembly aid (plastic part in the guide of the guide carriage) must never be removed before pushing on the guide carriage, since the gearing balls will fall out of the carriage otherwise. This would be irreparable.**

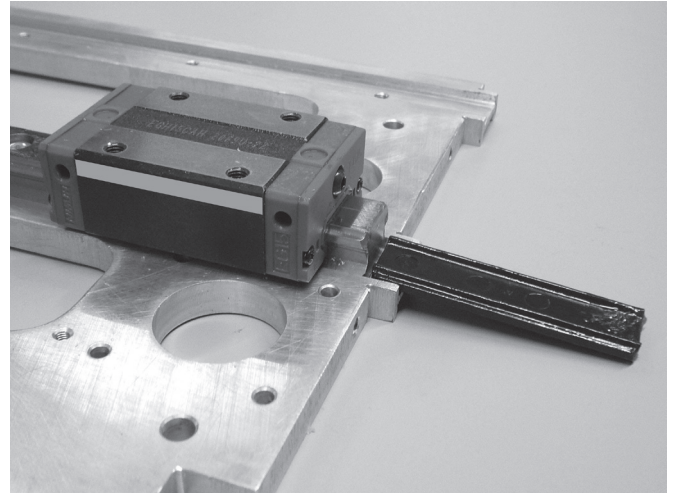
**This also applies when the guide carriage is pushed from the guide rail after assembly. For reasons of safety, the guide carriage should be secured, e.g. with adhesive tape before further installation.**

**The guide carriage has a polished area on one side (see arrow in the figure on the lower left). Turn the guide carriage so that the arrows on the guide rails point towards the ground area of the guide carriage before pushing it on.**



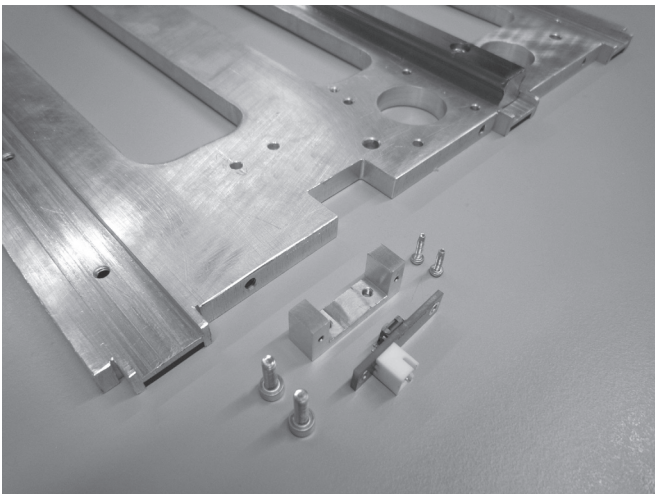


1x X-plate  
1x guide carriage complete with assembly aid

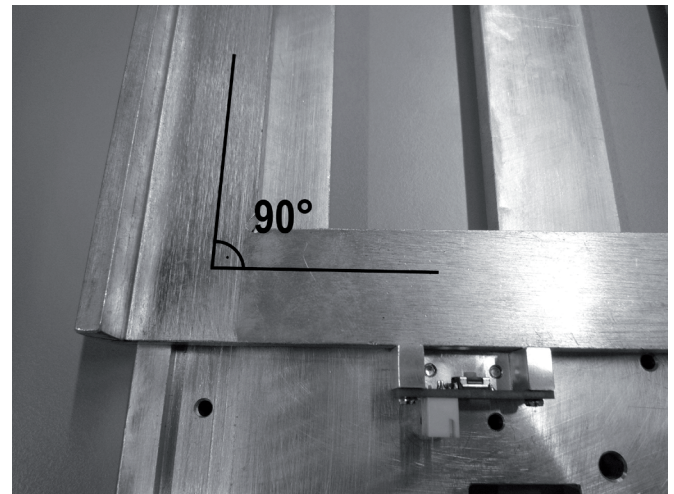


Carefully push the guide carriage onto the guide rail and push the assembly aid (plastic part) from the guide carriage while doing so.

#### Attaching the limit switch for the X-direction



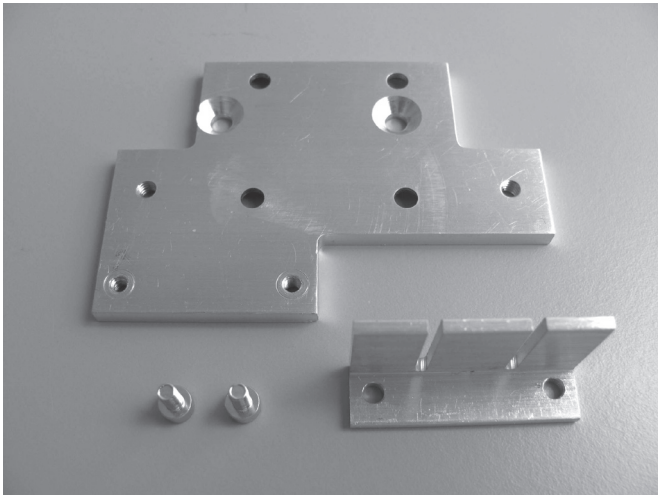
1x X-plate  
1x limit switch  
1x holder for limit switch  
2x cylinder head screw M2x6  
2x cylinder head screw M3x10



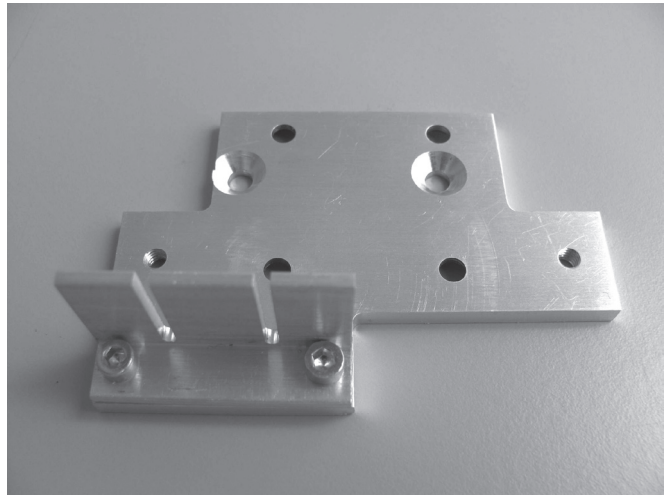
Install the limit switch PCB with the M2x6-screws to its holder so that the plug connector points away from the holder (see figure). Then align the limit switch with the holder with a stop angle at a right angle to the X-plate and screw it onto the X-plate with the M3x10 screws.



### Attachment of the belt holder to the guide carriage plate

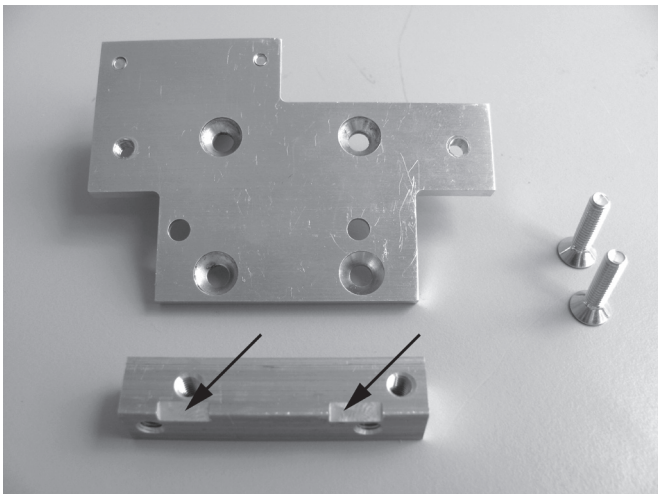


- 1x guide carriage plate
- 1x belt holder
- 2x cylinder head screw M3x6

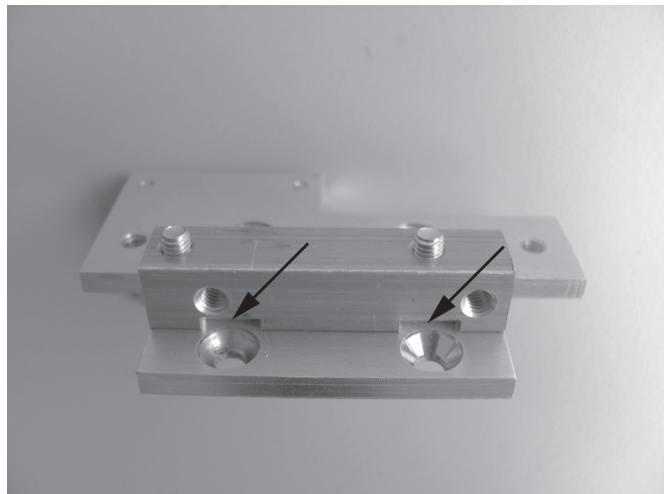


Attach the belt holder at the bottom of the guide carriage plate with the two screws as shown.  
Apply screws with threadlocker varnish.

### Assembly of the infeed holder

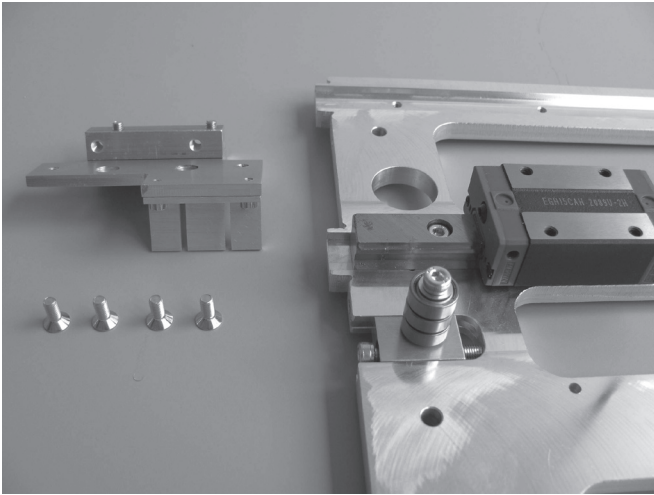


- 1x guide carriage plate
- 1x infeed holding block
- 4x countersunk head screw M4x10
- 2x countersunk head screw M4x16

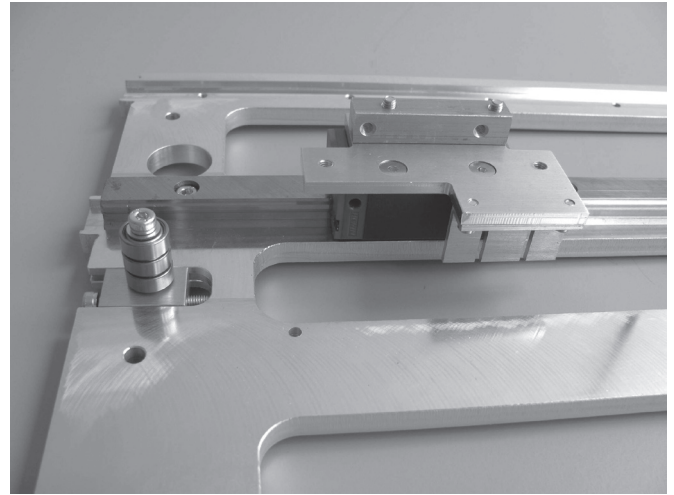


Infeed holding block attached under the plate with the two countersunk head screws M4x16. The two disconnections at the infeed holding block must point to the recessed bores as shown (see arrows). Tighten screws well, since the extruder will acquire play later otherwise.

### Assembly of the guide carriage plate on the guide carriage

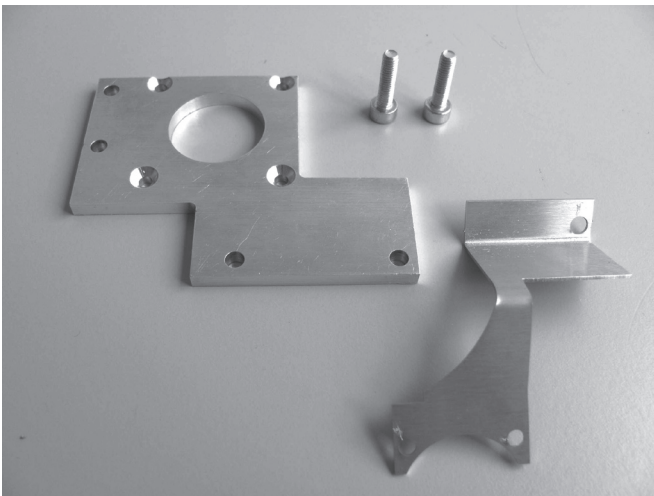


- 1x guide carriage plate
- 1x X-plate
- 4x countersunk head screw M4x10

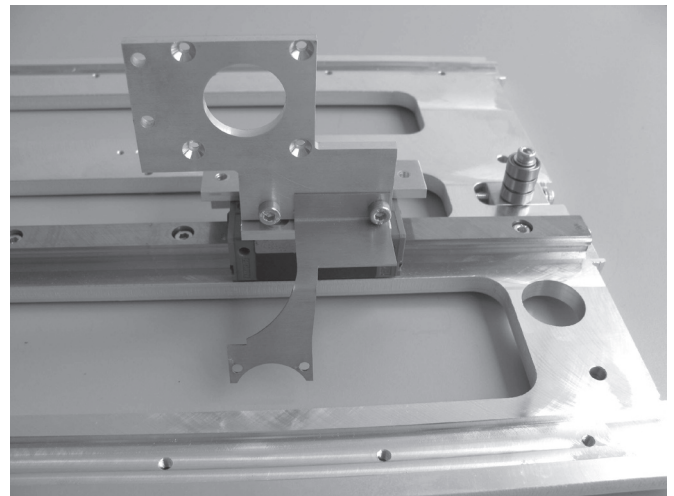


Attach the guide carriage plate to the guide carriage with the 4 countersunk head screws. First screw in the two screws at the disconnections. Apply screws with threadlocker varnish. The belt holders must be on the side with the previously installed belt tensioner.

### Attachment of motor holder and fan sheet

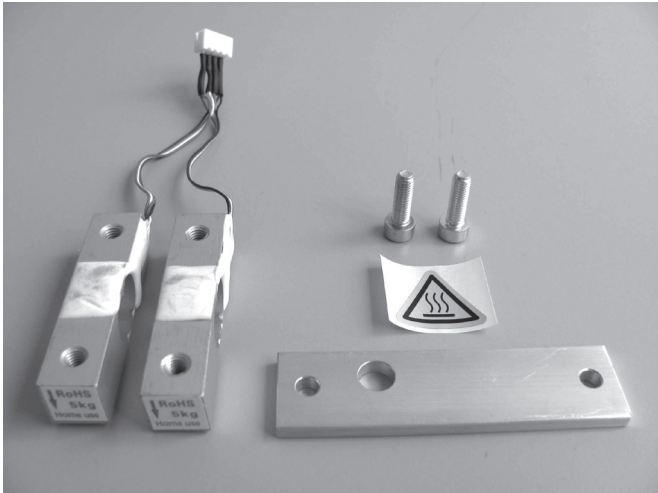


- 1x fan sheet
- 1x motor holder
- 2x cylinder head screw M4x16

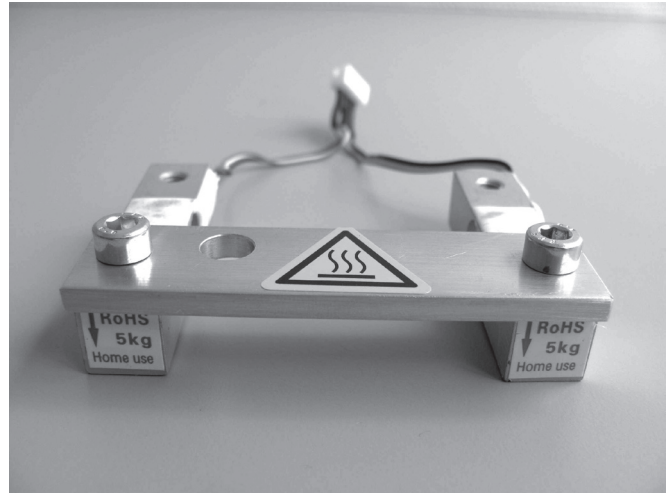


Attach the motor holder to the guide carriage as shown together with the fan sheet.

## Assembly of the elongation measuring strips and the extruder holder

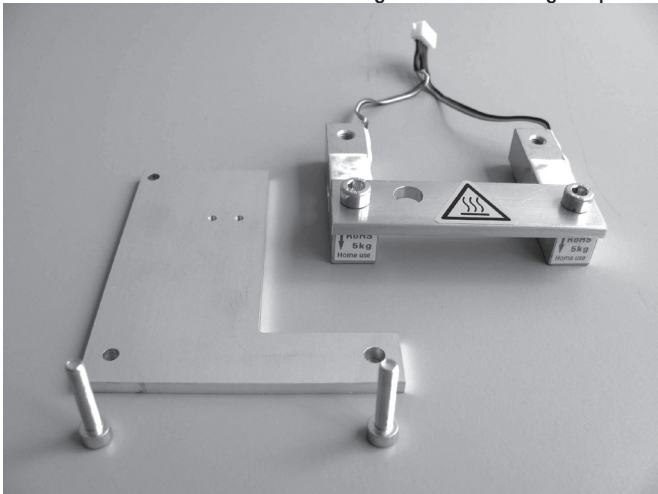


- 1x extruder holder
- 2x elongation measuring strips
- 2x cylinder head screw M5x16
- 1x sticker „Attention, hot surface“

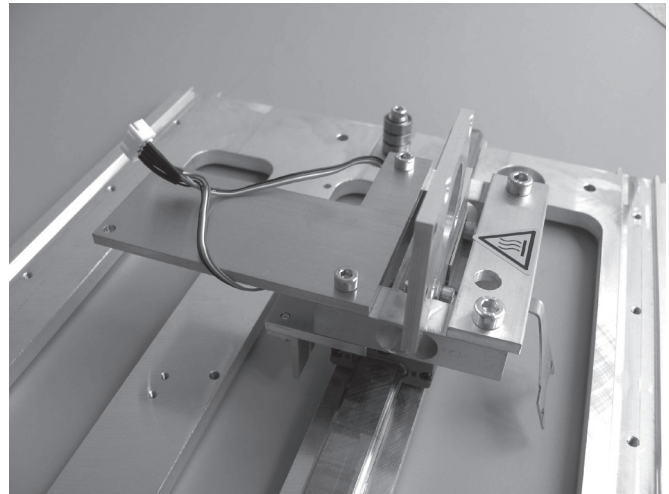


- Attach extruder holder to the elongation measuring strips with the two screws. For this, observe the position of the bores in the extruder holder (see screen).
- Apply screws with threadlocker varnish.
- Do not tighten the screws yet though.
- The arrows at the head sides of the elongation measuring strips must point down.
- Attach sticker to the extruder holder as shown.

## Attach the extruder holder and elongation measuring strips



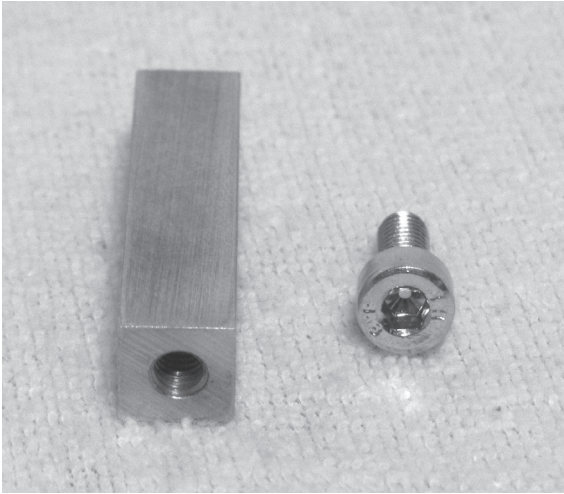
- 1x assembly extruder holder with elongation measuring strips
- 1x holding plate for end stop actuation
- 2x cylinder head screw M4x20



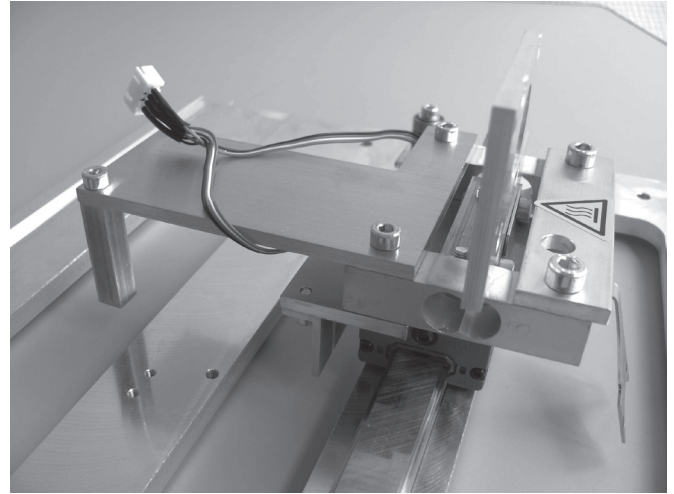
- Attach the assembly from the previous construction section together with the holding plate of the end stop actuation to the guide carriage as shown.
- Apply screws with threadlocker varnish.
- Attention, the connection lines of the elongation measuring strips must be placed above the holding plate (see figure).
- Now tighten the two screws of the extruder holder as well.



## Install the end stop actuation

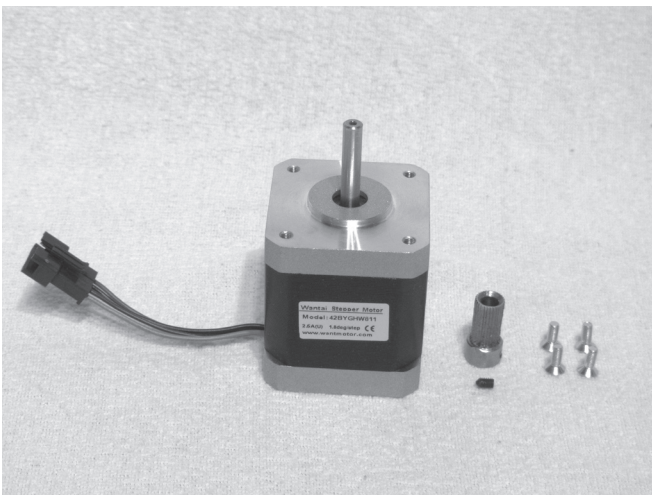


- 1x end stop actuation
- 1x cylinder head screw M4x10

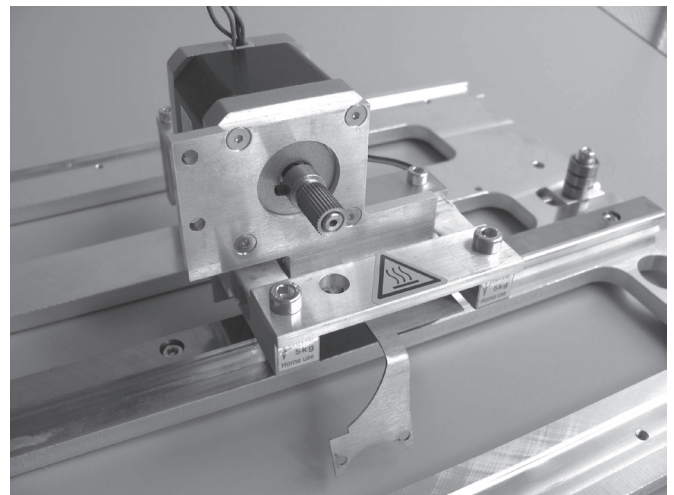


Install the unit with the cylinder head screw as shown.

## Assembly of the feed motor



- 1x actuator
- 1x feed knurl
- 1x threaded pin M3x5
- 4x countersunk head screw M3x8



Push the feed knurl onto the axis of the actuator and attach it with the threaded pin. Apply threaded pin with threadlocker varnish.

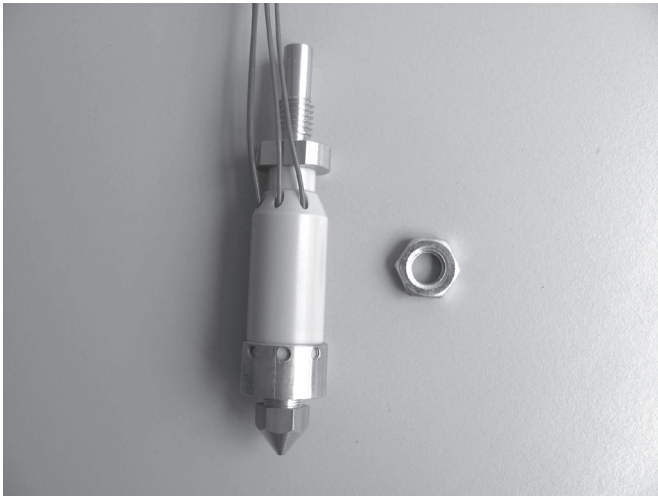
The motor axis must end flush with the upper edge of the feed knurl.

Push the motor through the motor holder from behind and attach it with the countersunk head screws. Apply screws with threadlocker varnish.

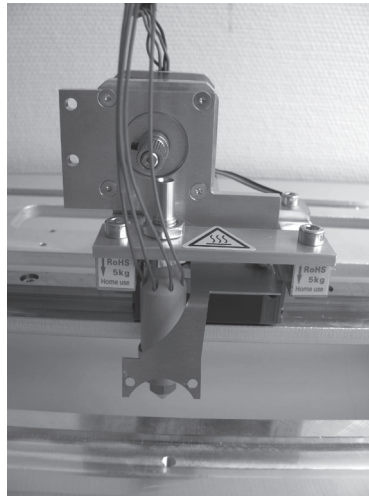
The cable exit at the motor must point up as shown.



## Install extruder.



1x extruder  
1x flat nut M8

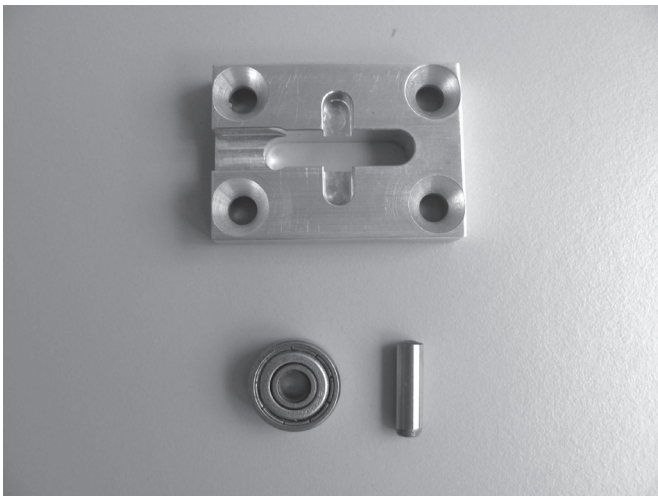


Push extruder through the extruder holder from below and attach it with the flat nut.

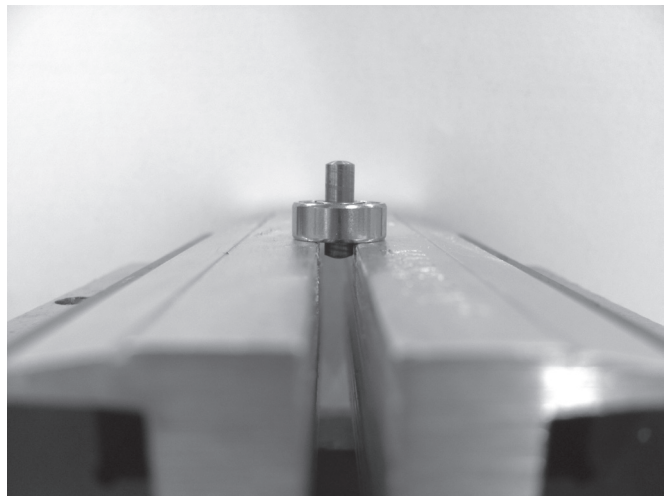
Align the extruder so that the filament material can be inserted into the extruder bore straight from the top past the pinion of the actuator.

During assembly, observe that the connection lines of the extruder are not caught or damaged.

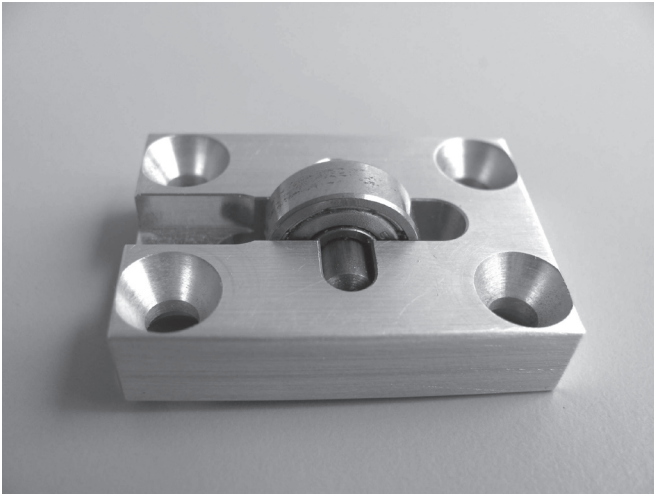
## Assembly of the ball bearing holder



1x ball bearing 624ZZ (diameter outside 13 mm)  
1x cylinder pin 4x14 mm  
1x ball bearing holder

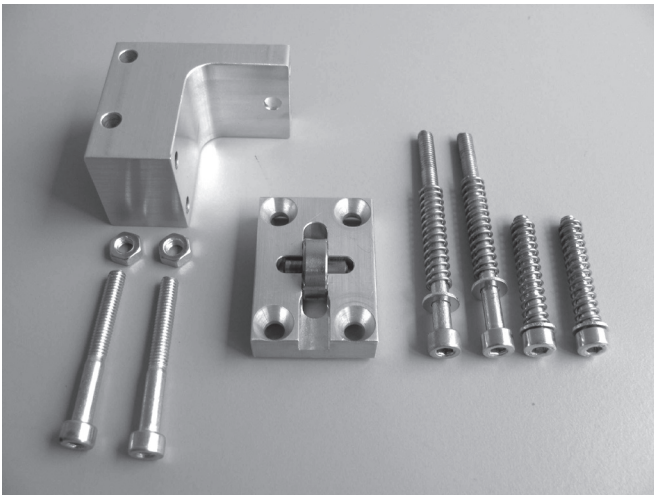


Carefully drive the cylinder pin into the ball bearing with a hammer until it is centred in the ball bearing. For this, support the ball bearing, e.g. on a vice and open the vice slightly so that the cylinder pin can be driven through the ball bearing.

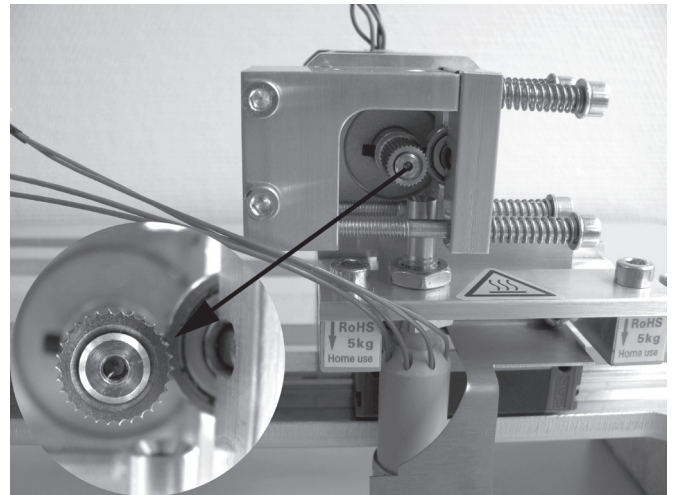


Insert the ball bearing with cylinder pin into the groove of the ball bearing after assembly.

#### Assembly of the filament infeed unit

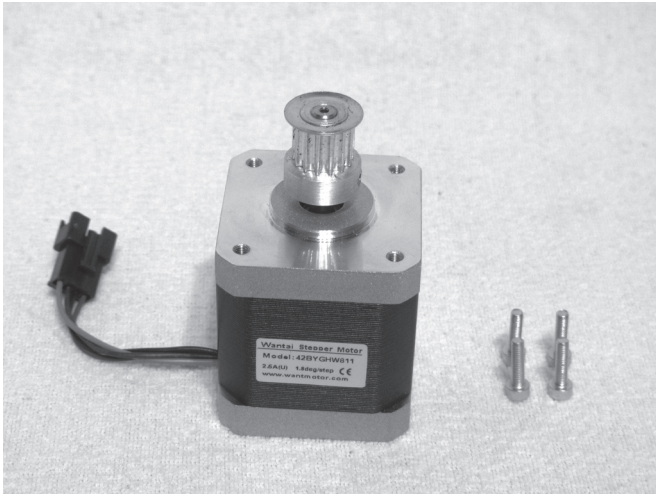


- 1x ball bearing holder with ball bearing unit
- 4x springs
- 1x feed basic part
- 2x cylinder head screw M4x25
- 2x cylinder head screw M4x35
- 2x cylinder head screw M4x45
- 2x nut M4
- 4x fitted discs 4/8 (diameter inside/outside 4/8 mm)

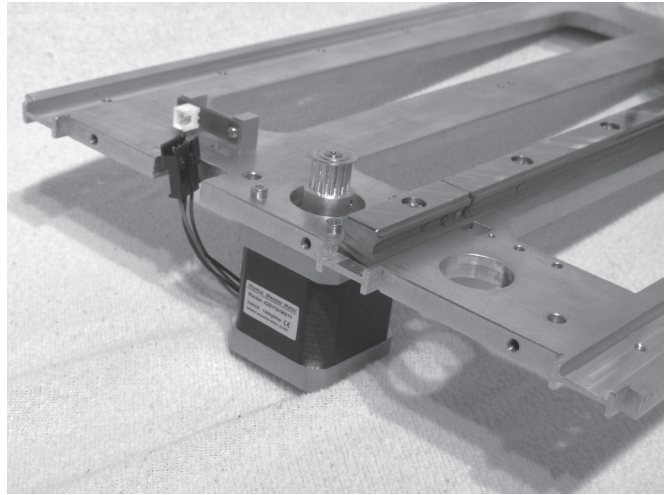


Attach feed basic part to the motor holder from the front with 2 cylinder head screws M4x35 and 2 nuts M4.  
 Push one spring each onto 2 cylinder head screws M4x25 and 2 cylinder head screws M4x45. Enclose the fitted discs 4/8 at the screwheads.  
 Attach the ball bearing holder to the feed basic part with the screws equipped with springs and washers from the right (top M4x25, bottom M4x45). Observe that the ball bearing does not fall from the holder or cant.  
 The ball bearing must be supported on the feed knurl of the feed motor after assembly.

## Install motor

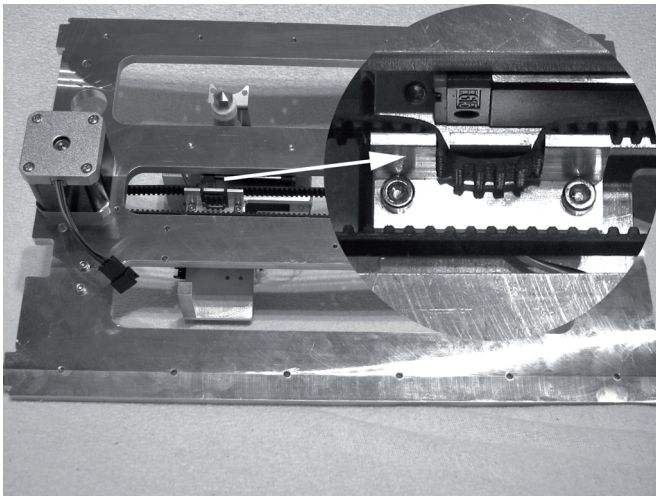


1x actuator  
4x cylinder head screw M3x12

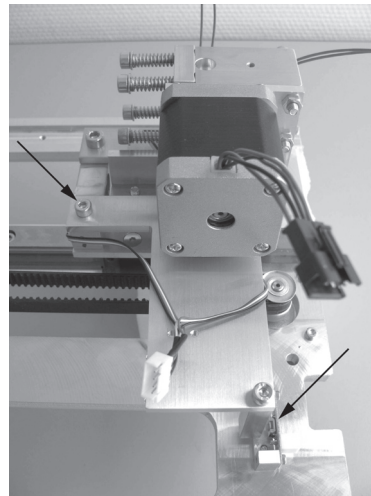


Attach the actuator to the X-plate with the 4 screws as shown in the figure.  
Apply screws with threadlocker varnish.  
The cable exit of the actuator must point at the rear of the plate as shown.

## Attach toothed belt



1x toothed belt 675 mm



Relieve belt tensioners entirely.  
Insert the toothed belt on the motor pinion and then into the belt holders as shown in the first figure.  
Then put the toothed belt across the belt tensioner.  
**Caution: For the above steps, always observe that the guide carriage does not leave the guide rail.**

Tension toothed belt by turning the belt tensioner screw until it can still easily be turned by 180° with two fingers.  
After the belt has been installed, move the extruder carriage to check whether the limit switch (arrow in the right of the figure) is tripped by slight pressure from the end stop actuation (triggering leads to a slight click).  
If the limit switch is not actuated, loosen the screw again (arrow to the left on the screen) and twist the holding plate for the end stop actuation a little until the limit switch can be actuated.

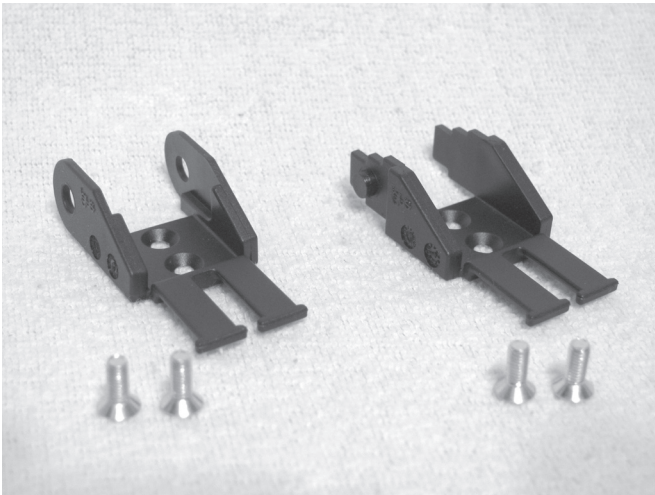
### Caution:

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

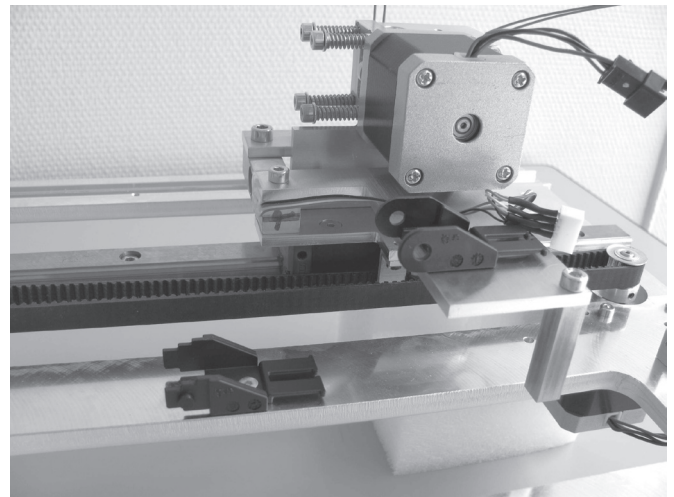
**A method for more precise setting of the belt tension is found in the chapter „Maintenance“.**



## Assembly of the drag chain end pieces

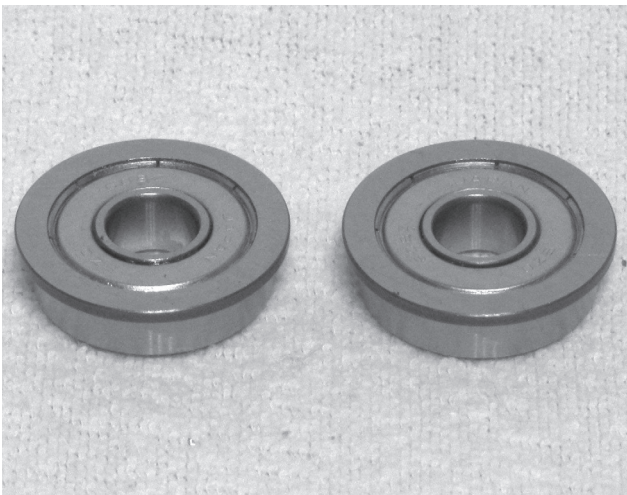


- 1x drag chain end piece with hole
- 1x drag chain end piece with nipple
- 4x countersunk head screw M3x8

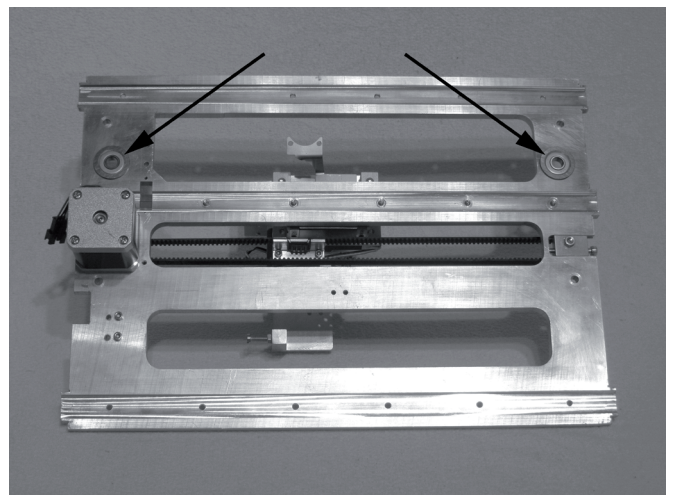


Install the drag chain end pieces as shown in the figure.  
Drag chain end piece with hole = extruder carriage  
Drag chain end piece with nipple = X-plate

## Inserting the grooved ball bearings

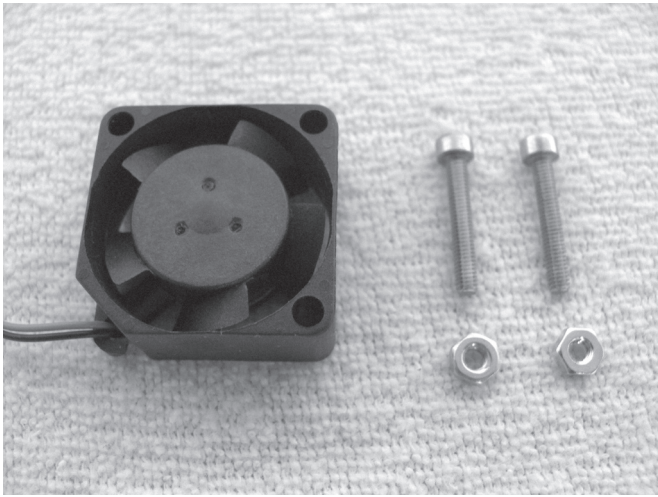


2x grooved ball bearings

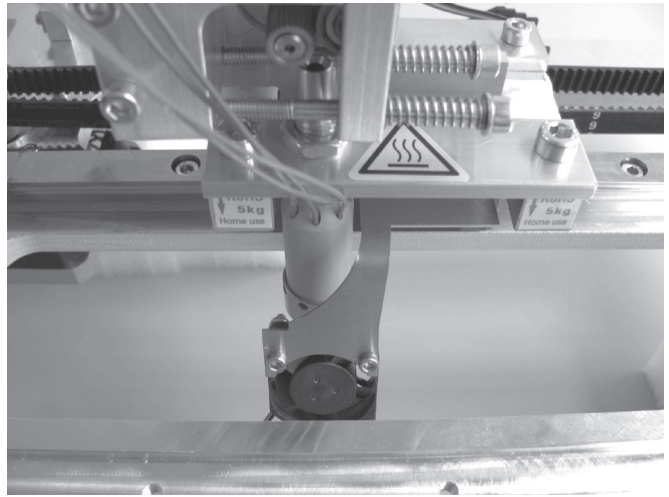


Insert the grooved ball bearings into the corresponding bores of the X-plate from below.  
Turn the grooved ball bearings slightly, when inserting them into the bores. Do not apply any force. The flanges of the grooved ball bearings must be cleanly aligned with the bottom of the X-plate.

## Assembly of the fan



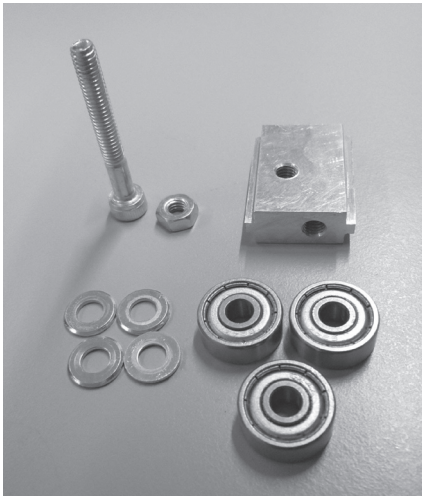
- 1x fan
- 2x cylinder head screw M2.5x16
- 2x nut M2.5



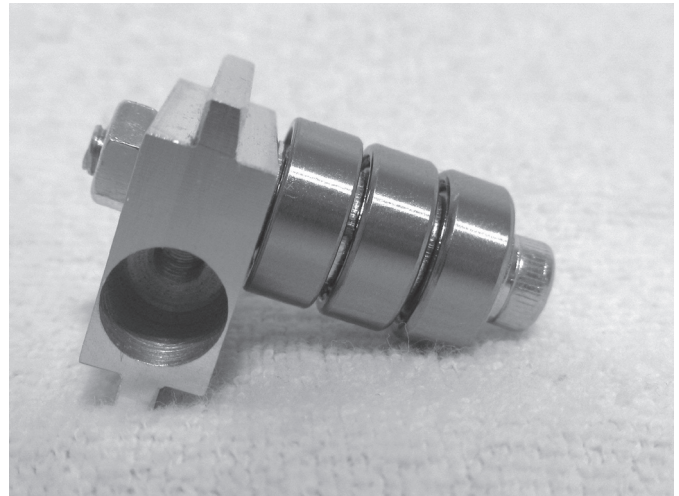
Install the fan at the fan sheet as shown with both screws. Apply screws with threadlocker varnish. Observe that the blowing direction (marked by an arrow on the fan) points towards the extruder.

## Assembly of the Y-plate

### Assembly of belt tensioner



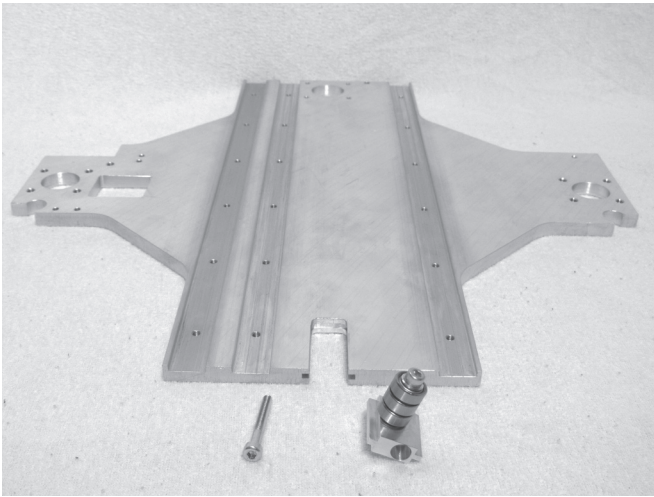
- 1x belt tensioner basic body
- 3x ball bearing 624ZZ (diameter inside/outside (8.8/13 mm)
- 4x washer (diameter inside/outside 4.3/8.8 mm)
- 1x cylinder head screw M4x30
- 1x nut M4



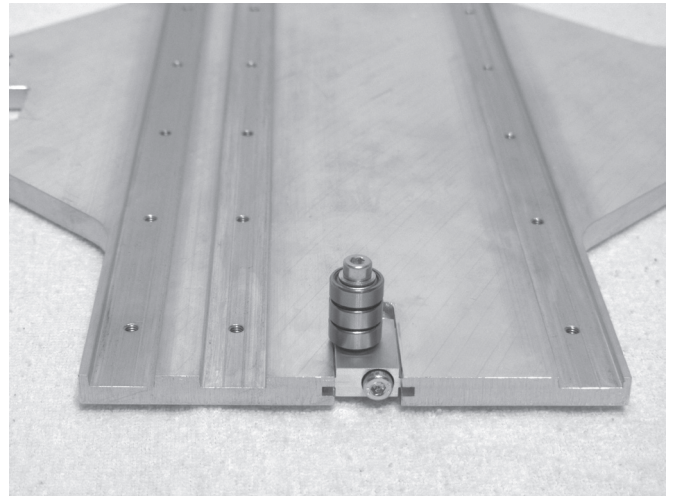
Push washers onto the screw with the ball bearings alternately. Screw the screw into the belt tensioner basic body as shown in the figure and tighten it well. Counter the screw with a nut.



### Attachment of belt tensioner to the Y-plate

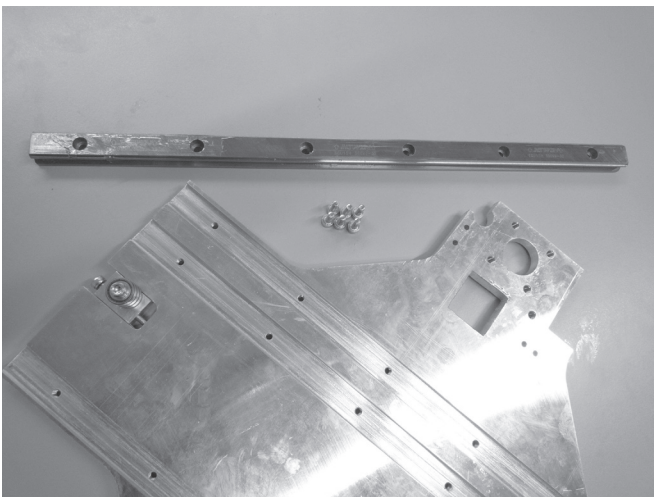


- 1x Y-plate
- 1x assembly belt tensioner (previous construction step)
- 1x cylinder head screw M4x30

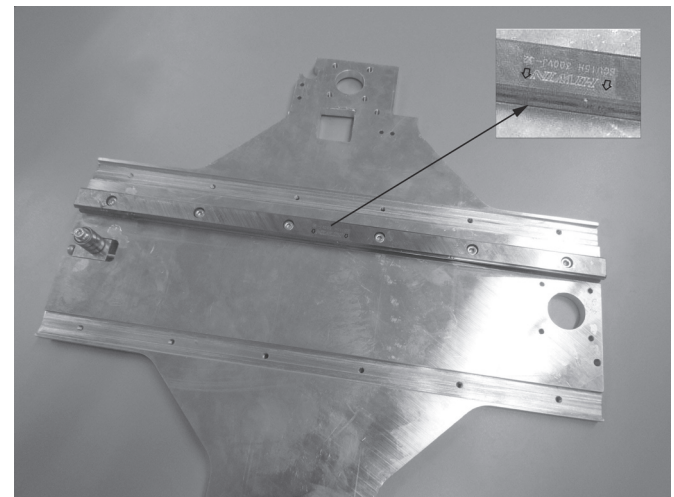


Push the belt tensioner assembly into the intended section of the Y-plate and turn the screw into the belt tensioner. The ball bearings must point to the grooved side of the Y-plate and the bore in the belt tensioner must be on the right (see figure).

### Attachment of the guide rail



- 1x Y-plate
- 1x guide rails
- 6x cylinder head screws M4x12



Insert the guide rail into the middle groove of the Y-plate and attach it with the screws. The imprinted arrows on the guide rail must point to the plate centre.

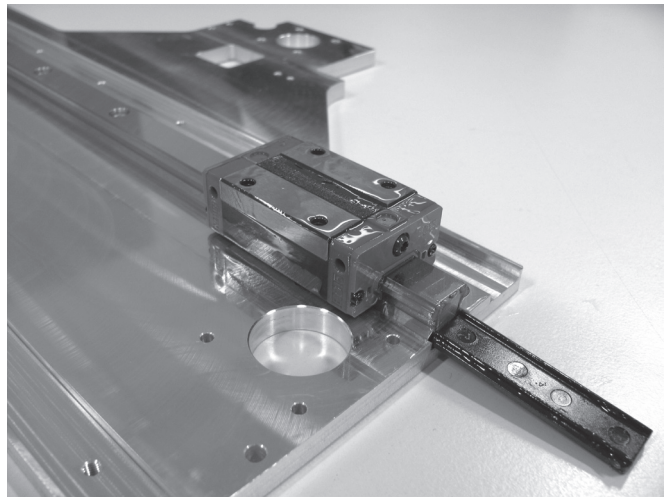
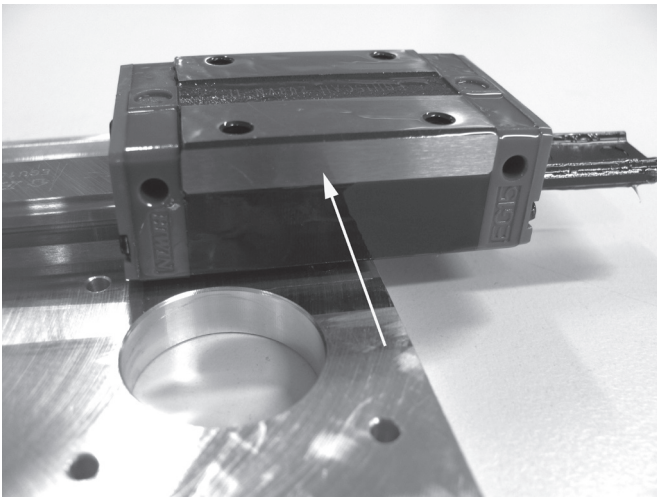
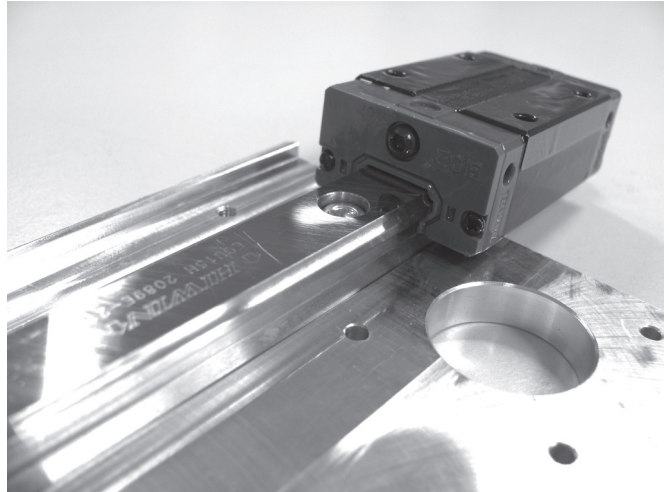
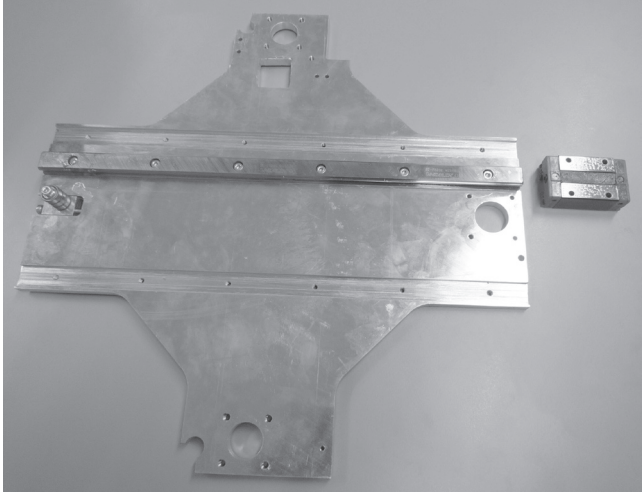
Push the guide carriage onto the guide rail



**The assembly aid (plastic part in the guide of the guide carriage) must never be removed before pushing on the guide carriage, since the gearing balls will fall out of the carriage otherwise. This would be irreparable.**

**This also applies when the guide carriage is pushed from the guide rail after assembly. For reasons of safety, the guide carriage should be secured, e.g. with adhesive tape before further installation.**

**The guide carriage has a polished area on one side (see arrow in the figure on the lower left). Turn the guide carriage so that the arrows on the guide rails point towards the ground area of the guide carriage before pushing it on.**

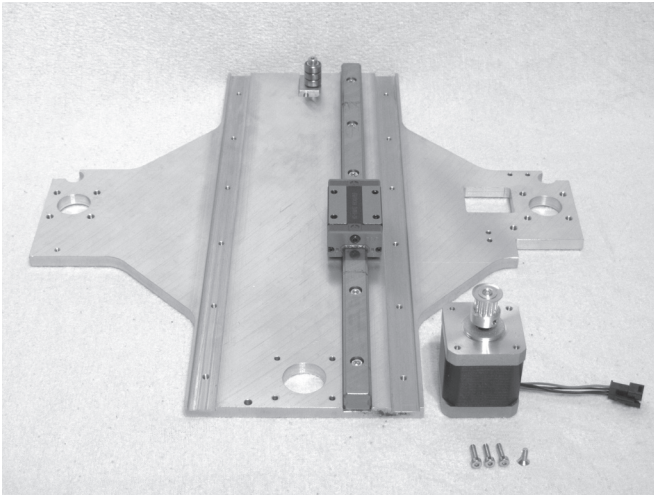


1x Y-plate  
1x guide carriage complete with assembly aid

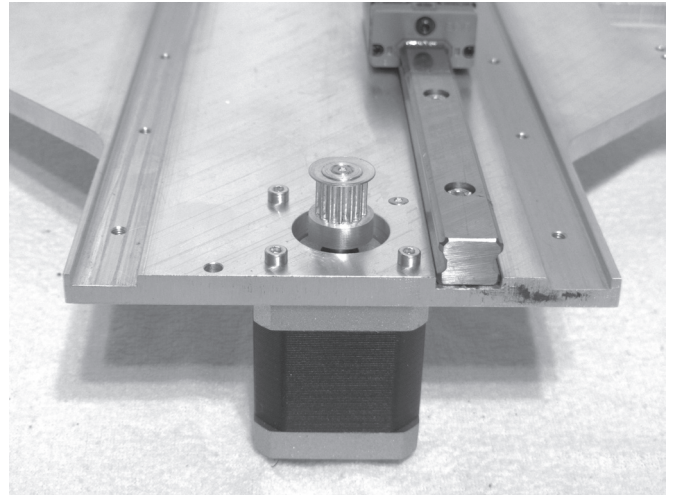
Carefully push the guide carriage onto the guide rail and push the assembly aid (plastic part) from the guide carriage while doing so.



### Assembly of the drive motor

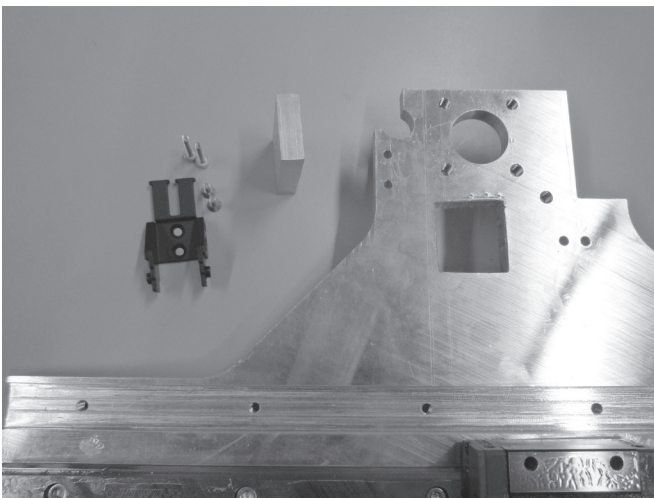


- 1x actuator
- 1x Y-plate
- 3x cylinder head screw M3x12
- 1x countersunk screw M3x12

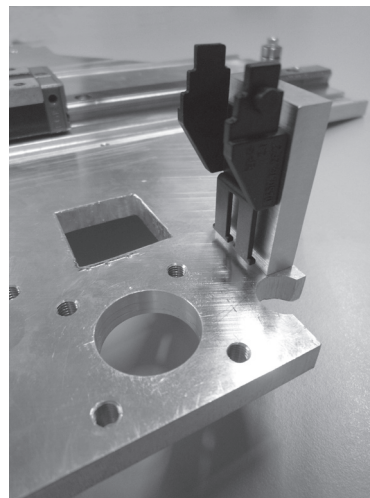


Attach the actuator to the Y-plate with the 3 cylinder head screws and the countersunk screw as shown in the figure. Use the countersunk screw for the countersunk bore. Apply screws with threadlocker varnish. The cable exit at the motor must point to the middle of the Y-plate (i.e. in the figure backwards).

### Assembly of the drag chain end piece top



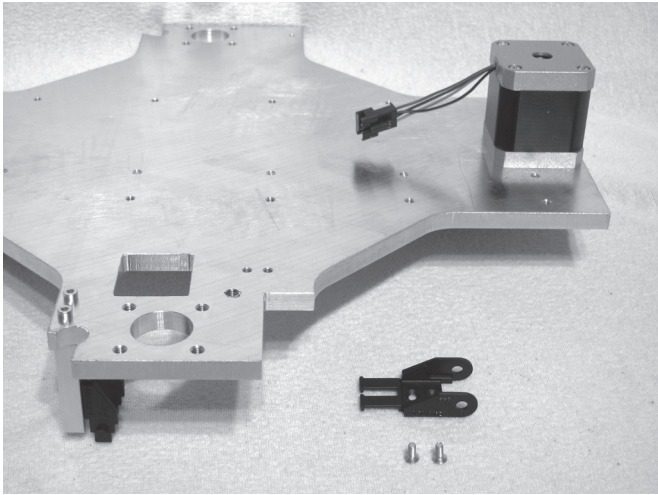
- 1x drag chain end piece with nipple
- 1x holding block for guide rail
- 2x cylinder head screw M3x16
- 2x countersunk screw M3x8



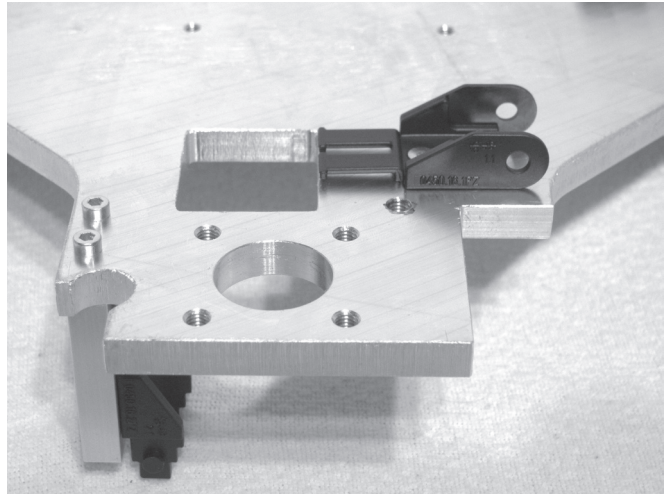
Attach the drag chain end piece with the countersunk screws at the holding block. Attach the holding block with the cylinder head screws as shown in the figure on the grooved side of the Y-plate.



## Assembly of the drag chain end piece bottom

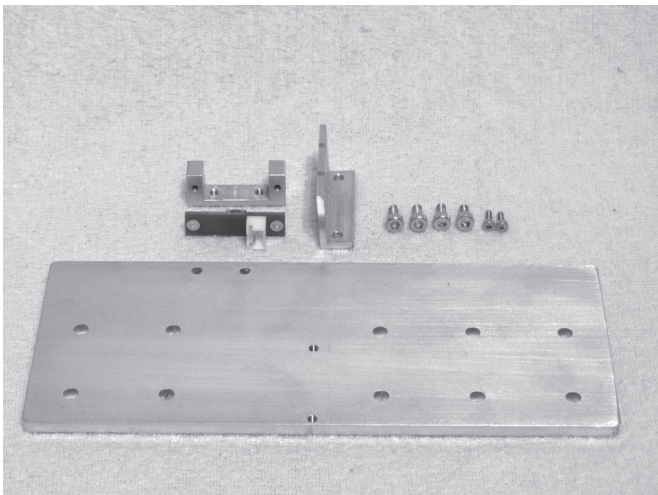


1x drag chain end piece with hole  
2x countersunk screw M3x8

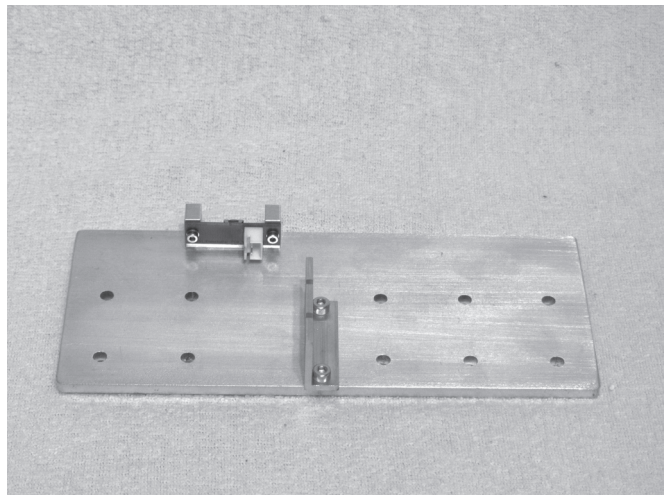


Attach the drag chain end piece with the countersunk screws as shown in the figure on the ungrooved side of the Y-plate.

## Install the holder of the under-table plate



1x undertable holder  
1x limit switch holder  
1x limit switch PCB  
1x belt tappet angle  
2x cylinder head screw M3x6  
2x cylinder head screw M3x8  
2x cylinder head screw M2x6

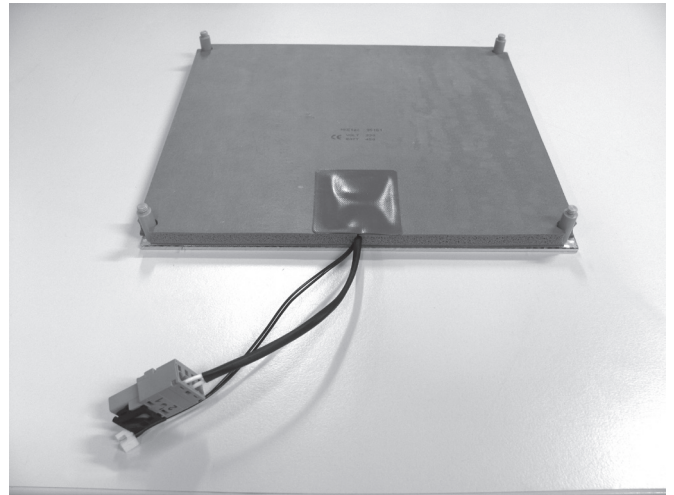


Attach limit switch holder to the undertable plate with screws M3x8.  
Attach the limit switch PCB to the limit switch holder with screws M2x6.  
Install the belt tappet angles with screws M3x6 as shown in the figure.  
Apply screws of the belt tappet angle with threadlocker varnish.

Glue connection of the heating plate.



- 1x ceramics plate
- 1x heating
- 4x spacer bolts



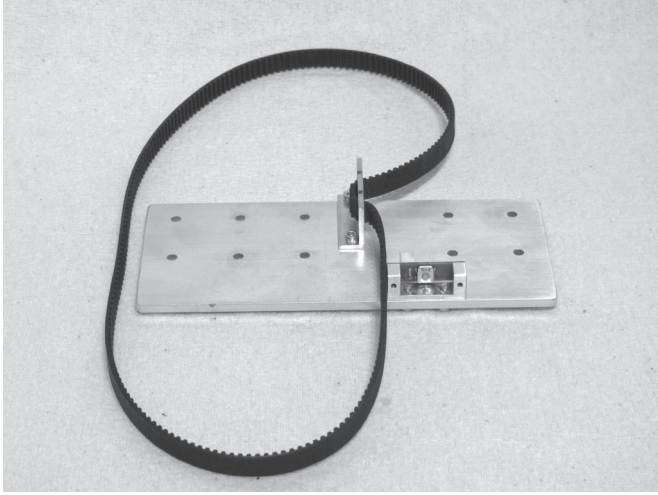
Plug the spacer bolts with the thread bores to the bottom of the ceramics plate (side with tissue structure) and provisionally fasten with 4 screws.

**Caution: Only tighten the screws slightly since there is the danger that the ceramics plate will break otherwise.**

Check the alignment of the heating by pushing the heating across the spacer bolts. The heating must then be supported fold-free with the side with the protection foil against the bottom of the ceramics plate and must not protrude at the edges. Clear the bottom of the ceramics plate of dust and grease with a rag and solvent.

Then remove the protective foil from the heating and finally glue the heating to the bottom of the ceramics plate without blisters.

## Application of the toothed belt

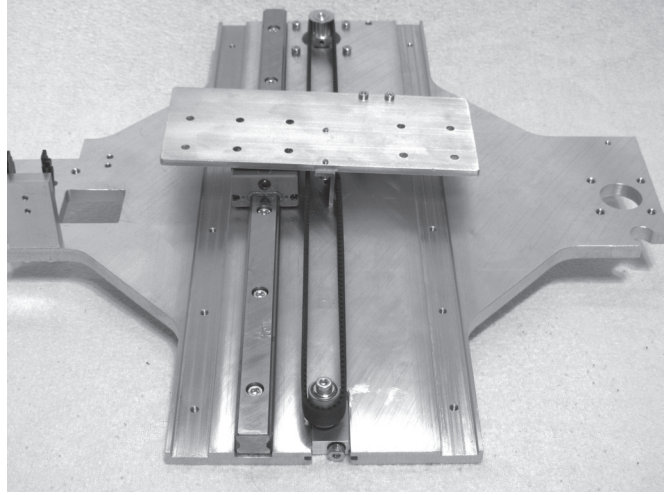


1x undertable holder from the previous step  
1x toothed belt 675 mm

### 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 setting of the belt tension is found in the chapter „Maintenance“.**



Insert toothed belt into the belt tappet angle as shown on the left.

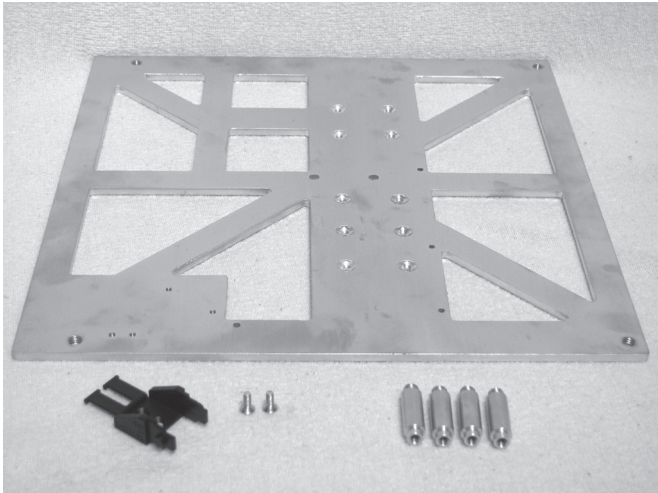
Relieve belt tensioners entirely.

Turn the undertable holder and put the toothed belt onto pinion and belt tensioner as shown.

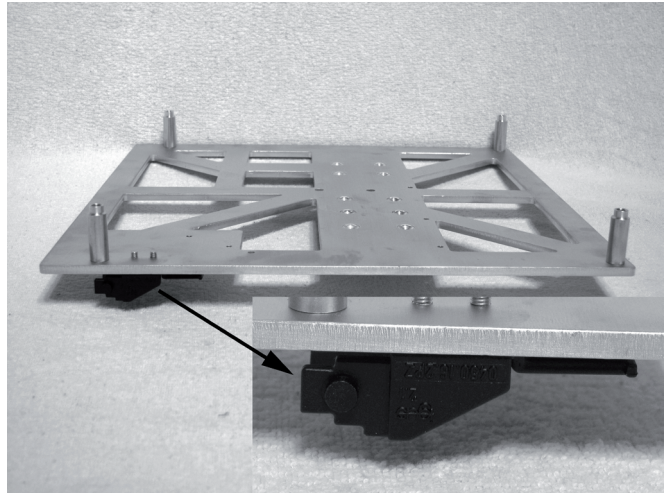
The undertable holder is only placed on the guide carriage here (do not screw on yet).

Tension toothed belt by turning the belt tensioner screw until it can still easily be turned by 180° with two fingers.

## Assembly of the undertable



1x undertable  
1x drag chain end piece with nipple  
4x spacer bolts  
2x countersunk screw M3x8

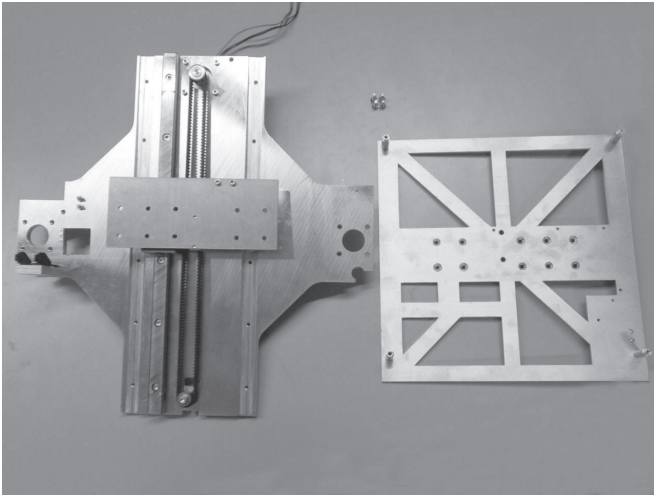


Screw in spacer bolts into the top of the undertable (side with recessed bores).

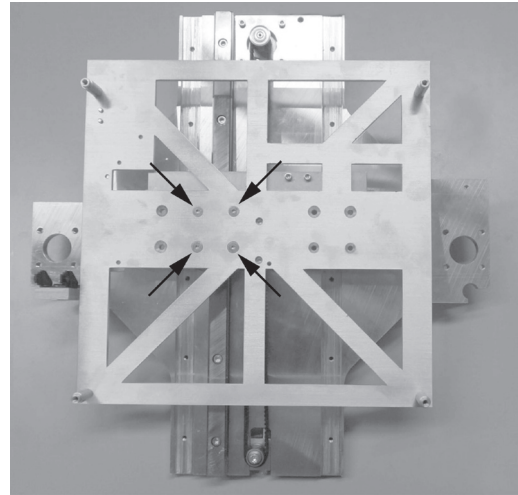
Install the drag chain end piece on the underside of the undertable.



### Assembly of the undertable



- 1x undertable
- 1x Y-plate
- 4x countersunk head screw M4x12

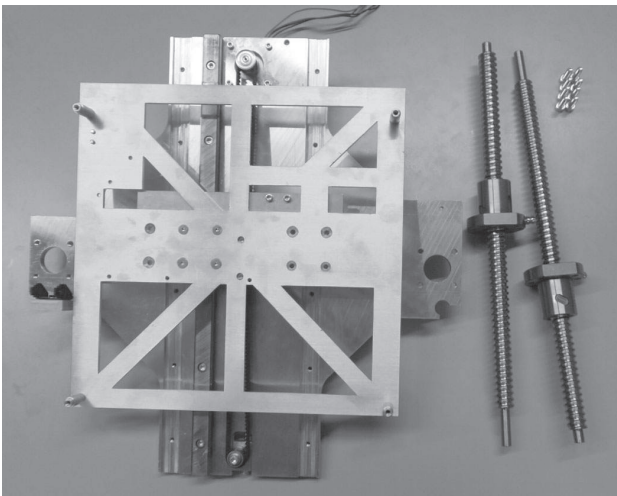


Attach the undertable with the 4 countersunk head screws to the undertable holder as shown.  
Apply screws with threadlocker varnish.

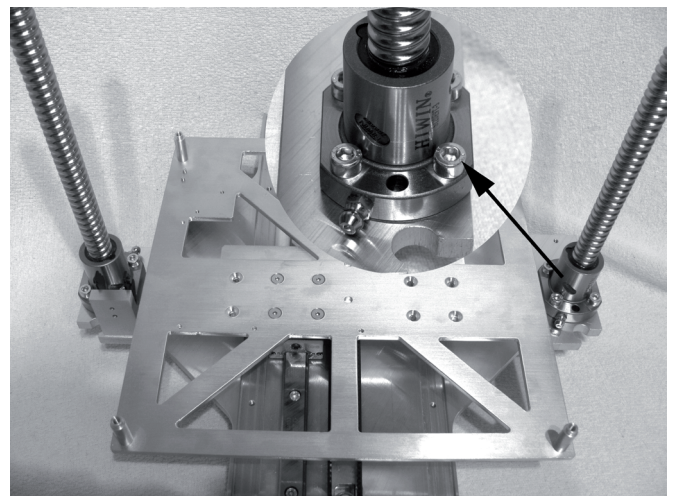
### Assembly of the thread circulation spindles



**The nuts on the threaded circulation spindles must never be removed from the threaded circulation spindles, since the bearing balls would fall out otherwise. This would be irreparable.**

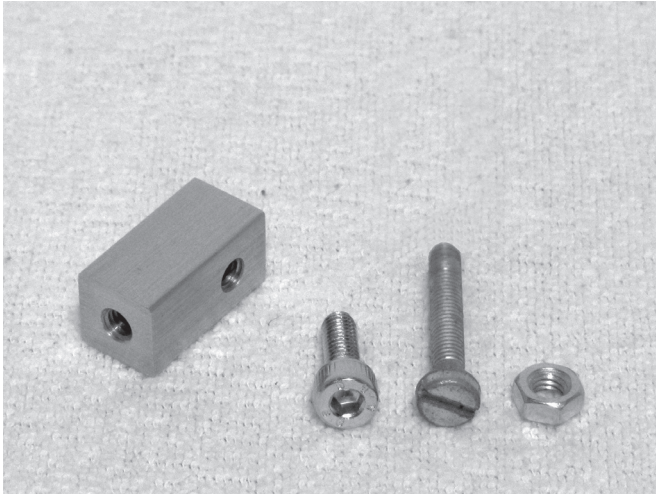


- 2x threaded circulation spindle
- 1x Y-plate
- 8x cylinder head screw M5x16

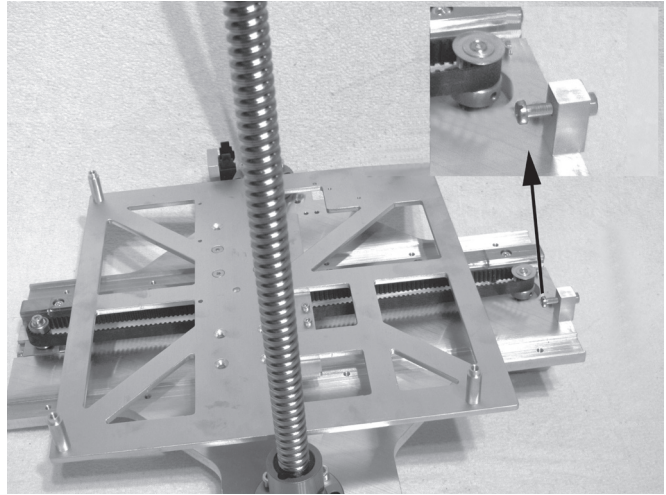


Attach threaded circulation spindles to the Y plate as shown with 4 screws each.  
Observe the position of the lubrication nipples. They must both point to the inside of the device.  
The flattened sides of the attachments must end flush with the outer edge of the Y-plate.

## Installing the limit switch actuation

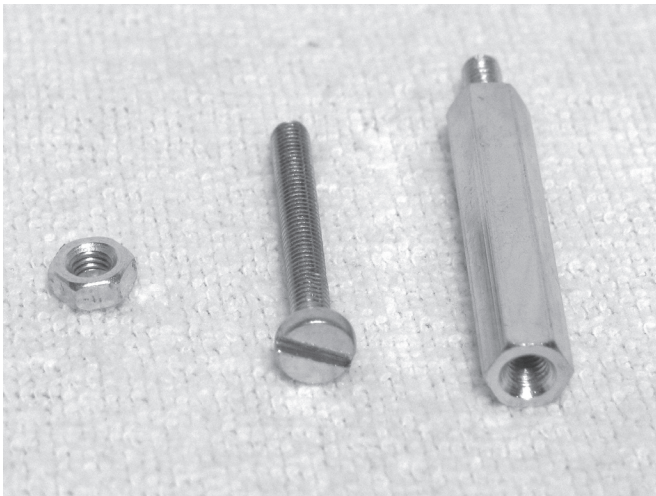


1x actuation for limit switch  
1x cylinder head screw M4x12  
1x cylinder head screw M4x20  
1x nut M4

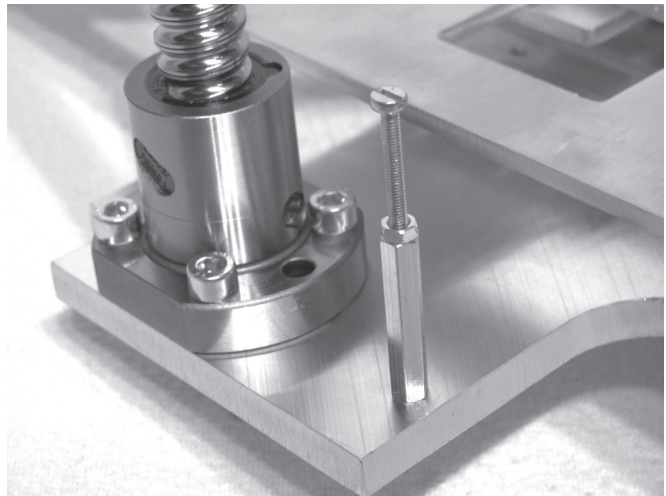


Turn the cylinder head screw into the aluminium block and counter it with the nut on the opposite side. The screw thread must end with the nut.  
Install the actuation of the limit switch as shown at the Y-plate. The actuation must be aligned so that the screw head can actuate the limit switch at the undertable.

## Install end actuation for the Z-axis



Hexagon threaded bolt M3  
1x slotted screw M3x25  
1x nut M3

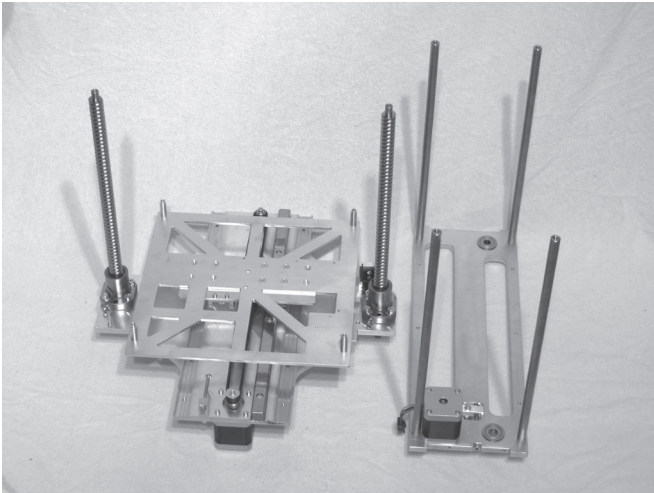


Turn the hexagon thread bolt into the Y-plate from above as shown.  
Turn the slotted screw into the hexagon threaded bolt and counter slightly with nut.

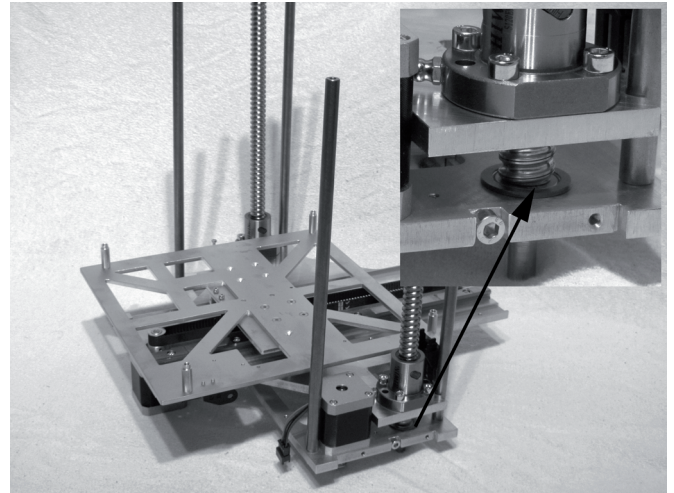


## Assembly of the Mechanical Basic Construction

### Connection of the bottom plate to the Y-plate

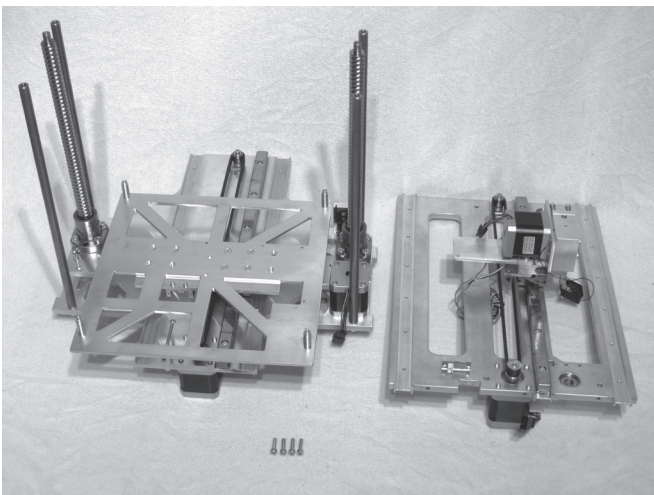


1x bottom plate  
1x Y-plate

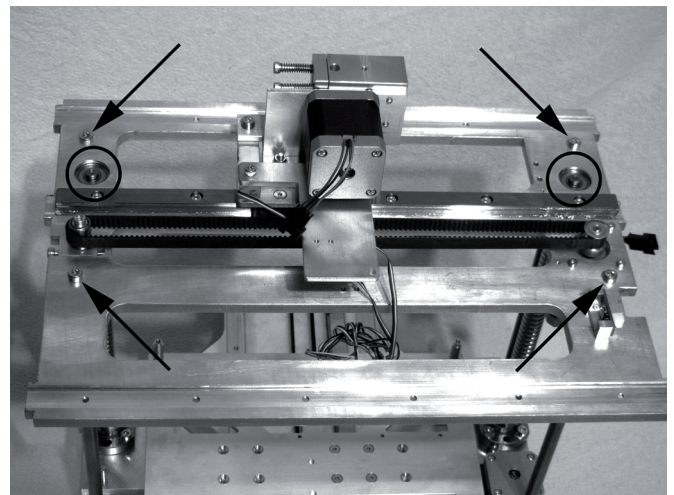


When inserting the thread circulation spindles into the bottom plate, always observe that the spindles are turned out precisely the same length and are not offset against each other. If this is not the case, the thread circulation spindles must be adjusted to each other by turning. Thread the Y-plate into the spacers of the bottom plate with the two mill-outs from above. The thread circulation spindles must be cleanly flush against the grooved ball bearings in the bottom plate after assembly.

### Assembly of the X-plate

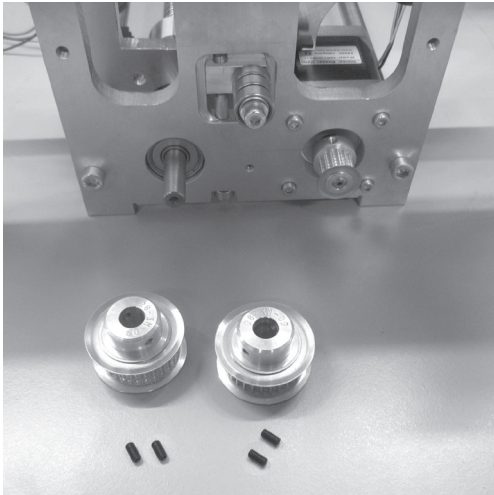


1x basic frame  
1x X-plate  
4x cylinder head screw M5x16

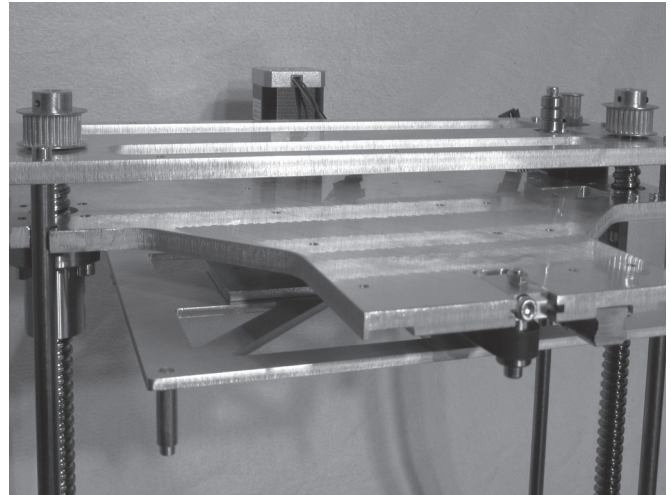


Push the X-plate onto the basic frame of the bottom plate and Y-plate (see previous construction step) and attach it to the spacer bolts with the screws. Apply screws with threadlocker varnish. The thread circulation spindles must be cleanly flush against the grooved ball bearings in the X-plate after assembly.

## Assembly of the pinions at the thread circulation spindles

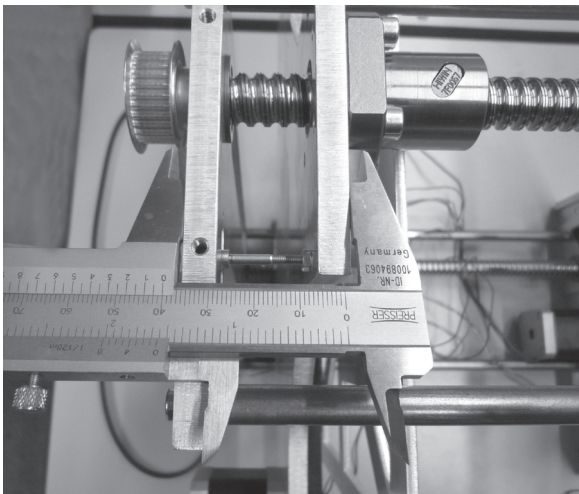


2x sprocket 28Z (large pinion, outer dia. 32 mm)  
1x basic frame  
4x threaded pins M3x5



Push sprockets onto the ends of the thread circulation spindles and attach with the threaded pins.  
Then align the position of the pinions so that the toothed areas are at a level with the toothed area of the motor pinion.

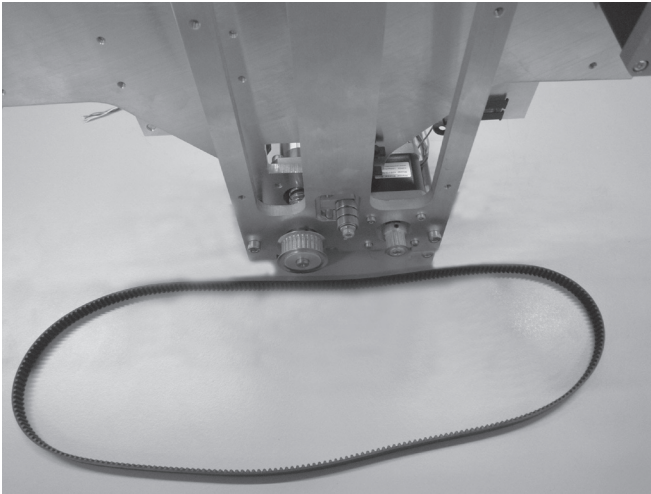
## Aligning the thread circulation spindles



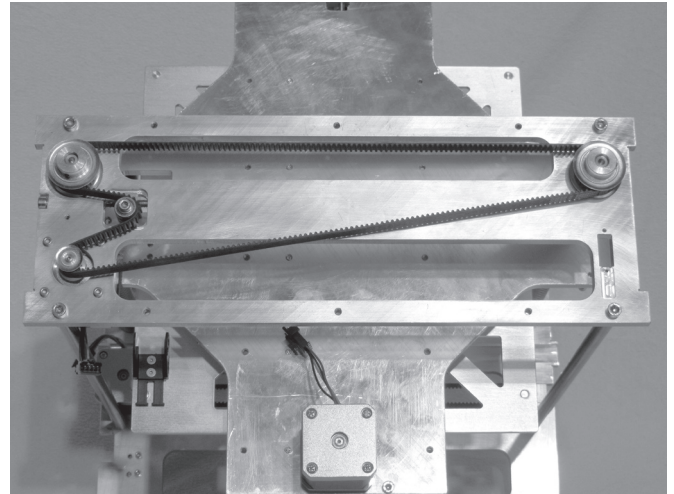
Measure the distance between the bottom plate and the Y-plate with a calliper.  
The distance must be precisely the same on both sides.  
If required, the distance can also be adjusted by turning the spindles.



### Assembly of the toothed belt

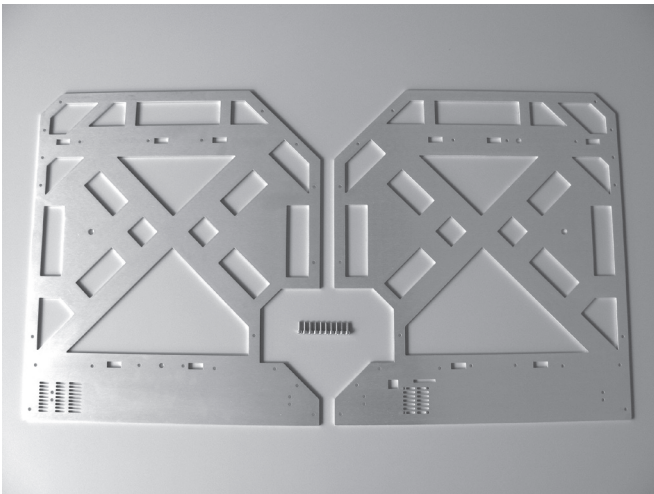


- 1x basic frame
- 1x toothed belt 822 mm

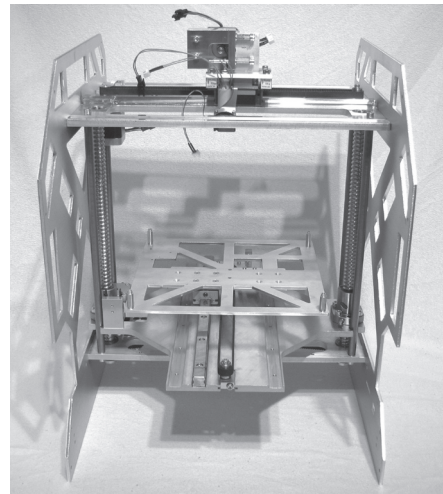


Tip the basic frame back (do not put it on its head).  
Relieve belt tensioners entirely.  
Install the toothed belt as shown.  
Observe that the distances set in the previous step are not changed. The bottom plate and Y-plate still need to be precisely in parallel.

### Assembly of the side parts



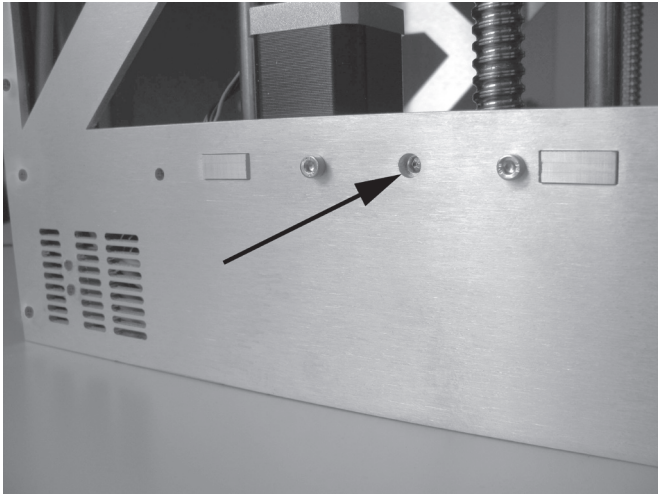
- 1x side part left
- 1x side part right
- 10x cylinder head screw M4x10



Push the side parts onto the basic frame on the sides and attach them with the screws.  
The side part with the openings for USB connection and memory card is installed on the right side.  
The openings of the side parts must be cleanly inserted into the tabs at the bottom and X plate.  
**Note: The side parts are sensitive to scratching!**



Tension the belts of the bottom plate



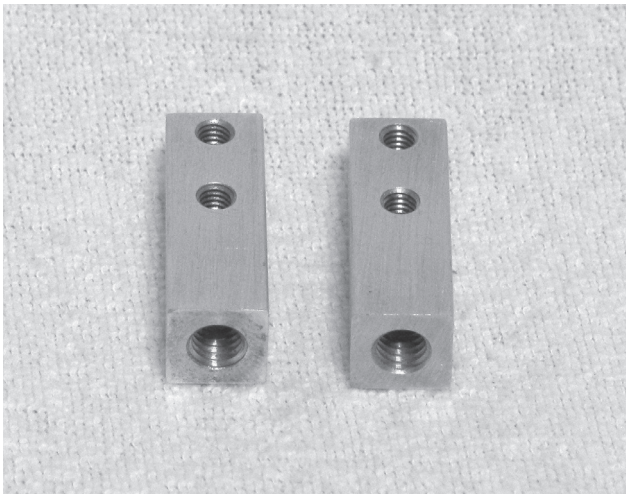
Tension the toothed belt of the bottom plate by turning the belt tensioner screw (see arrow) until it can still be easily turned by 180° with two fingers.

**Caution:**

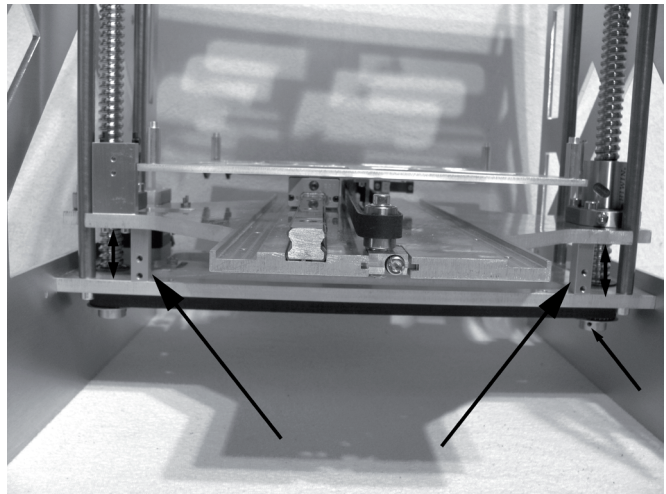
**The toothed belt must not be tensioned too strongly. If the belt tensioner bends, the belt tension must be reduced under all circumstances.**

**A method for more precise setting of the belt tension is found in the chapter „Maintenance“.**

Final inspection of the parallelism of the bottom plate and Y-plate



2x foot holder small (B)



Insert the right and left foot holder between the bottom plate and the Y-plate.

Turn the toothed belt of the bottom plate to adjust the height of the Y-plate until the foot holders touch the Y-plate.

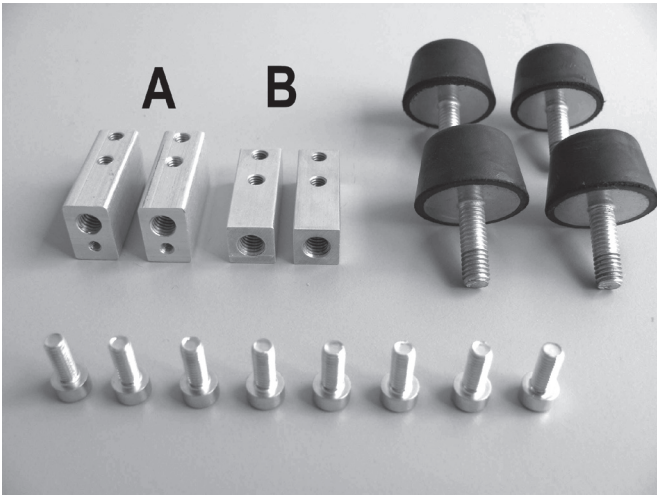
Both sides now have to have the same distances between the foot holders and the Y-plate.

If this is not the case, the threaded pin at the pinion of **one** threaded spindle must be loosened again.

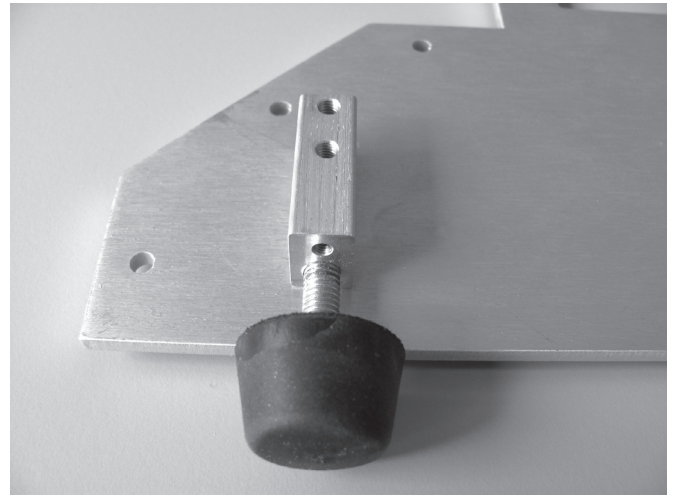
Then turn the threaded spindle until both foot holders are flush with the Y-plate.

Then tighten the threaded pin again and remove the foot holders.

## Assembly of the foot holders



- 2x foot holder large (A)
- 2x foot holder small (B)
- 4x rubber feet
- 8x cylinder head screw M4x10



The foot holders large (A) are installed in the area without ventilation slits in the side parts, the foot holders small (B) are installed in the area of the ventilation slits.

Attach foot holders to the side parts with the threads pointing down with 2 screws M4x10 each. For this, install the foot holders large (A) with the smaller threads facing the housing centre.

Do not tighten the screws M4x10 yet. This is done after the bottom sheet is installed.

Turn the rubber feet into the foot holders from the bottom.

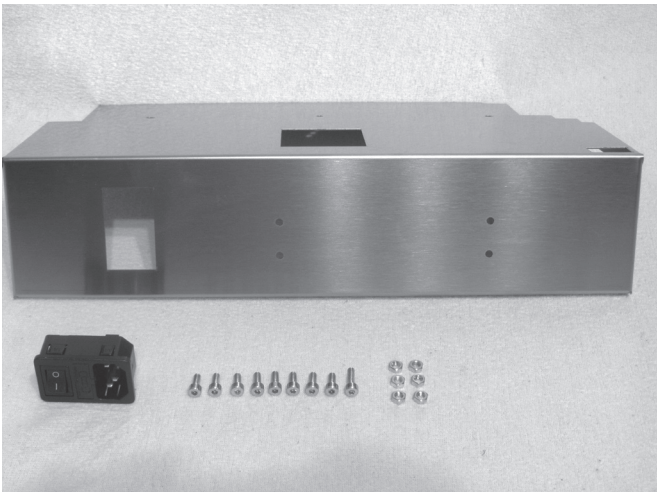
## Assembly of the covers



**If necessary remove the protective foil from the stainless steel covers only just before assembly. The adhesive residue particularly in the area of the edges and embossing can be removed with a rag soaked with alcohol.**

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

## Installation of the rear cover



- 1x rear cover
- 1x low-power device combination socket
- 8x cylinder head screw M4x10
- 1x cylinder head screw M4x20
- 6x nut M4



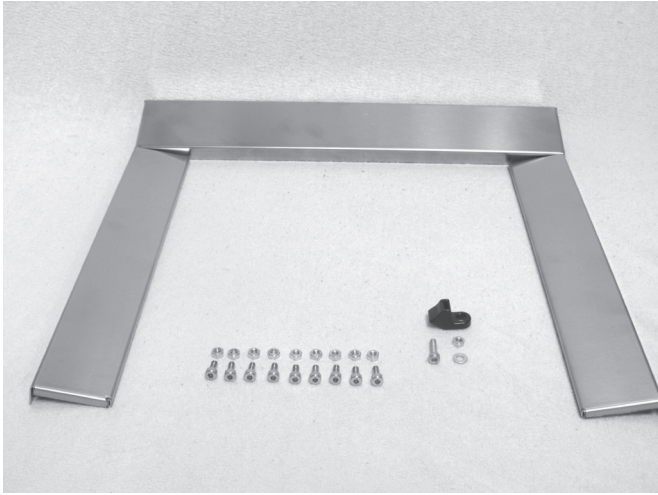
Clip the low-power combination socket into the corresponding cut-out of the rear cover.

Attach the rear cover to the basic frame with the screws and nuts as shown:

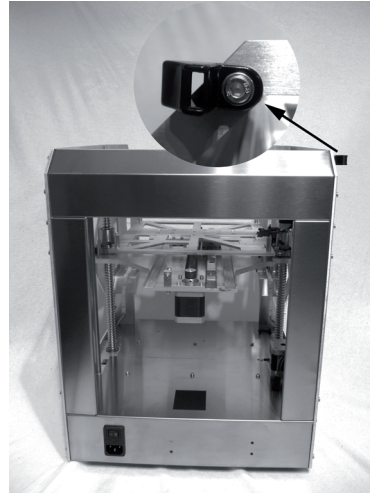
Use 6 screws with nuts at the side parts and 3 screws centrally at the bottom plate. Screw the screw M4x20 into the left position as shown in the figure.



## Attachment of the rear cover parts



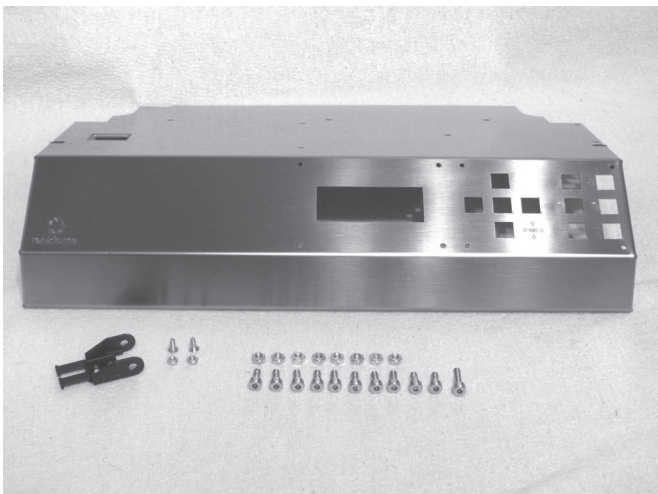
- 2x rear side covers
- 1x rear head cover
- 1x holder for the filament hose
- 9x cylinder head screw M4x10
- 1x cylinder head screw M4x16
- 1x washer (diameter inside/outside 4.3/8.8 mm)
- 10x nut M4



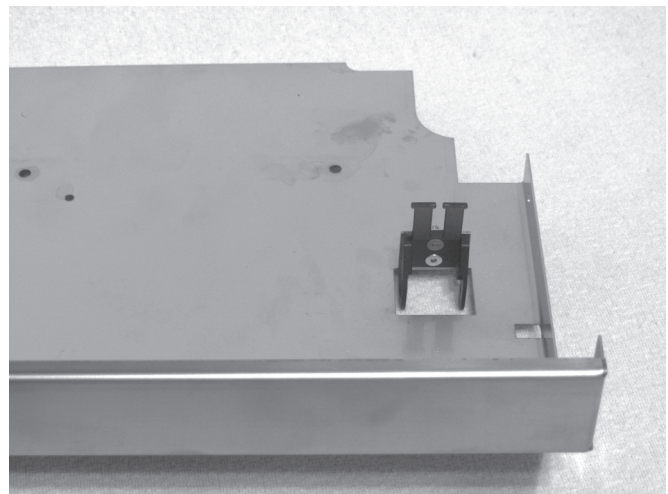
Insert rear covers into the basic mechanics and attach them to the side parts with the screws as shown.

The holder for the filament hose is attached with the upper attachment screw (M4x16 + washer 4.3 mm) of the head cover (in the upper right of the figure).

## Preparation of the operating cover

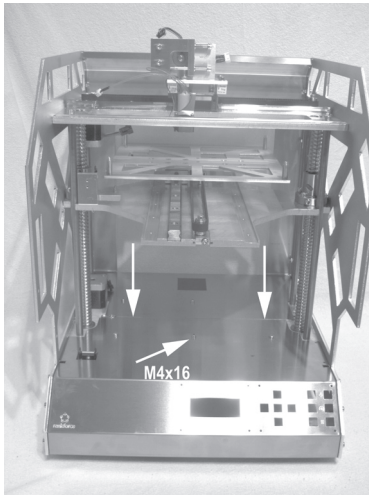


- 1x operating cover
- 1x drag chain end piece with hole
- 2x countersunk screw M3x8
- 2x nut M3
- 10x cylinder head screw M4x10
- 1x cylinder head screw M4x16
- 8x nut M4



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

## Installation of the operating cover



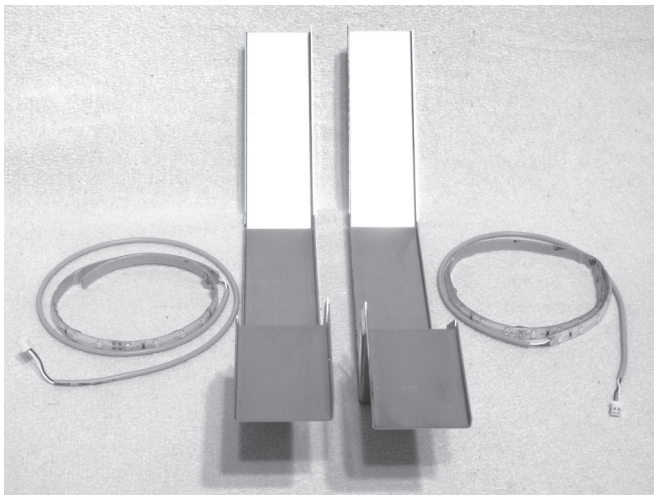
Insert the operating cover into the basic mechanics as shown and attach it with the screws as shown.

8 screws with nuts at the side parts

Use 3 screws centrally at the bottom plate, including screw M4x16 in the middle position as shown on the screen.

Observe that the operating cover and rear cover meet in the middle of the device (see arrows) and do not overlap or form a gap.

## Preparation of the sight protection blinds

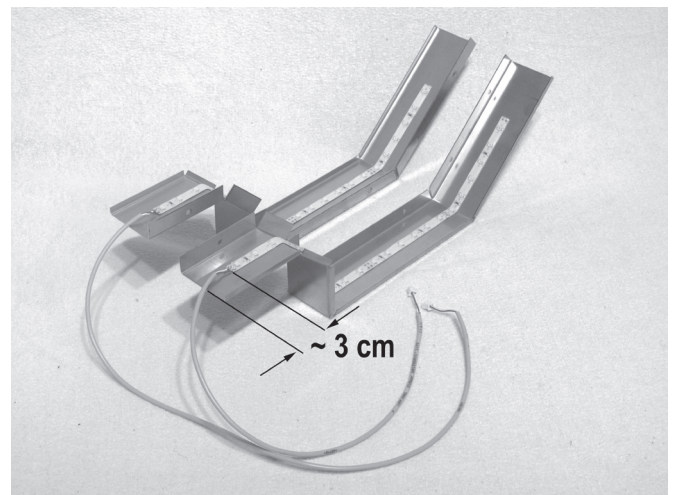


1x sight protection blind right

1x sight protection blind left

1x LED strip with long connection line

1x LED strip with short connection line



Glue LED strip into the sight protection blinds as shown. Degrease the adhesive areas first. Distance of the LED strips from the lower edge of the sight protection blinds, approx. 3 cm.

LED strips with long connection line > left sight protection blind

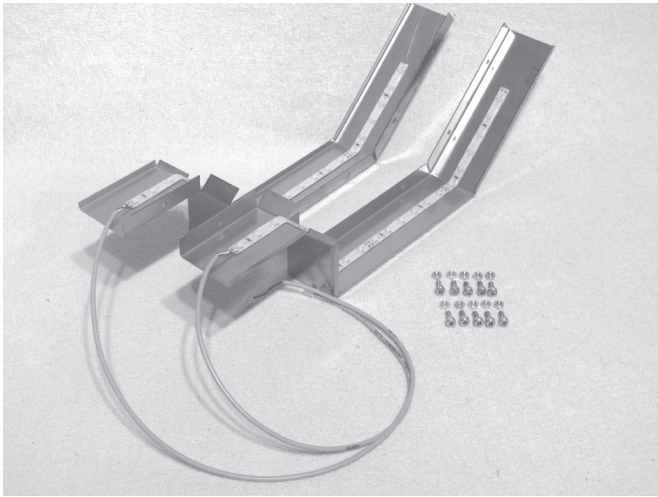
LED strips with short connection line > right sight protection blind

### Caution:

**Observe the position of the connection lines (see figure).**

**The solder points must not come into contact with the housing sheet since there may be irreparable damage to the main and display PCB otherwise. If required, glue a piece of insulating tape between the soldering points and the housing sheet.**

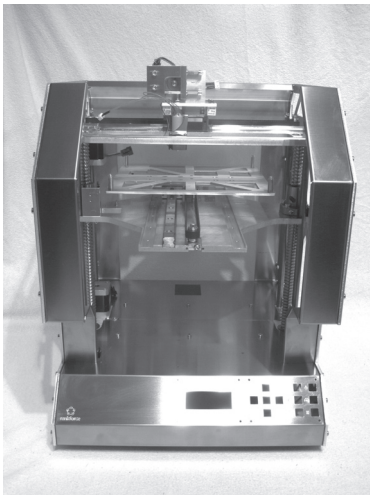
## Installation of the sight protection blinds



1x sight protection blind right  
1x sight protection blind left  
10x cylinder head screw M4x10  
10x nut M4



Guide the connection lines into the socket through the intended openings (see arrow).  
Attach the sight protection blinds on the side of the side parts with the screws and nuts.



Attach the sight protection blinds to the side parts with the screws and nuts.



# 10. 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.**

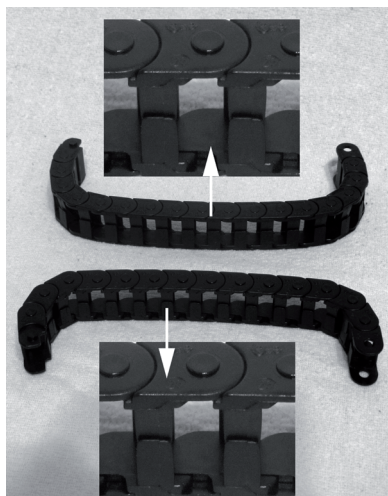
### Drag chains

→ The drag chains have tabs on one side of the links through which the lines are pushed into the chains. Since the drag chains can only be bent in one direction, the tab position must be observed (open on the inside > bottom in the following figure and open on the outside > top in the following figure). This is indicated when describing the individual work steps.

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 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 drag chains are latched in the nipples or holes of the end pieces are helpful. Observe that the drag chain ends latch cleanly 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!).



### Lines

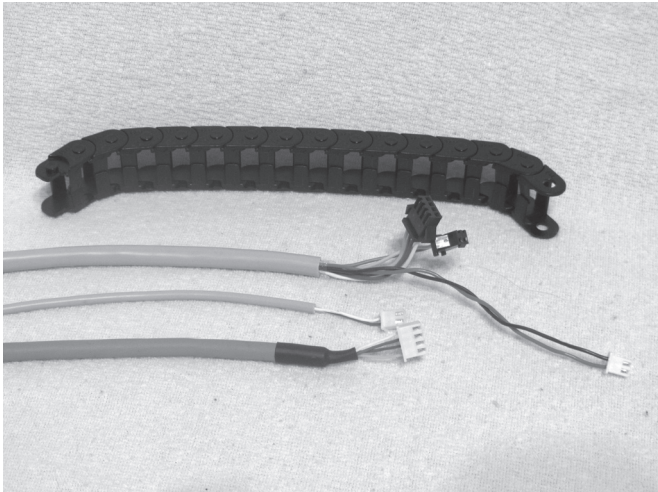
→ Lines that may be swapped are marked with numbers.

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.

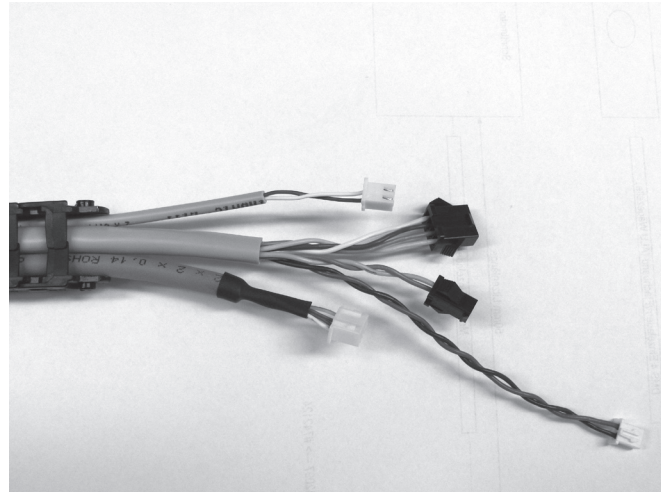
In the Annex, you will find a wiring plan for the main PCB in which the required line connections are marked.

## b) Wiring of the Components

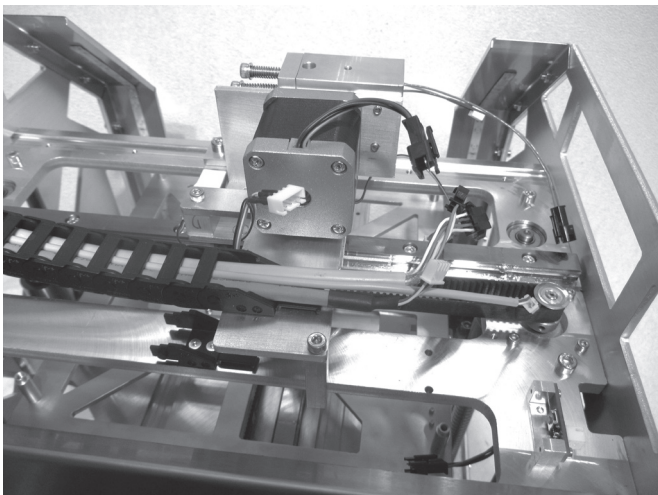
### Extruder



Drag chain 15 links open on the inside  
Lines 14, 15 and 19



Push the lines into the drag chain so that the end link points to the line ends without label with the nipples.

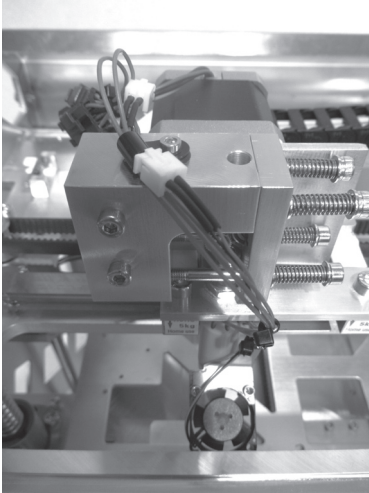


Latch the drag chain at the extruder carriage and pull the lines from the drag chain until they can be plugged into the connections of the extruder carriage cleanly placed.

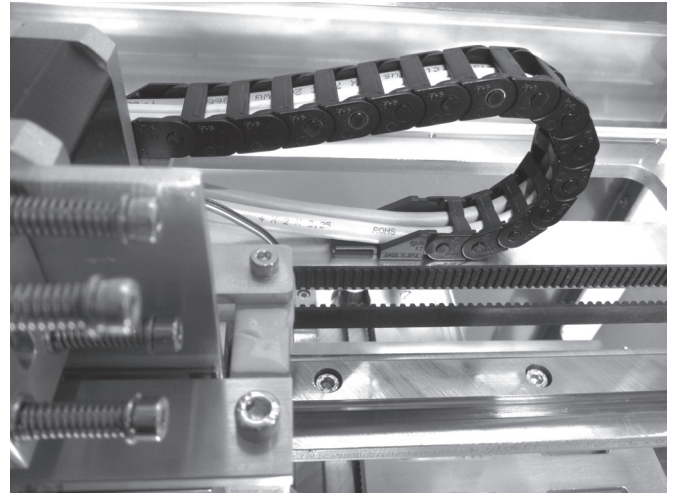


Connect the lines to the respective matching plugs.  
**Caution: the line with the blue/red wires is connected to the fan. This is the only line that can be swapped due to its plug.**

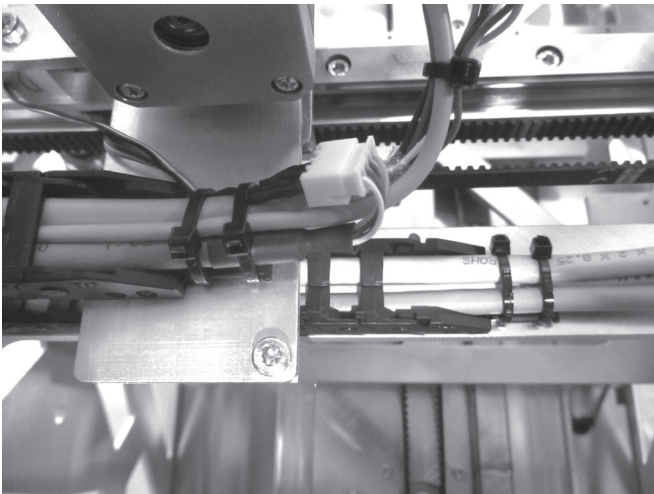




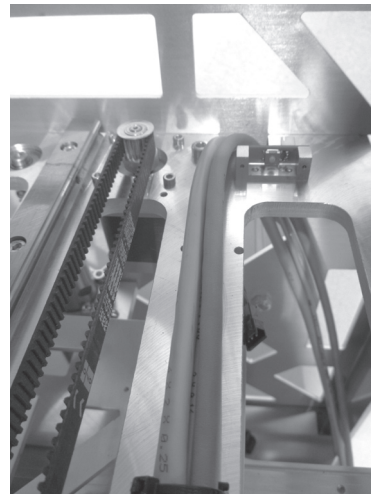
Place lines cleanly with small cable ties (99 mm). Guide the lines to the extruder and the fan through the illustrated line eyelet and attach the eyelet to the feed basic part with a screw M3x6.



Latch the drag chain on the free end piece.

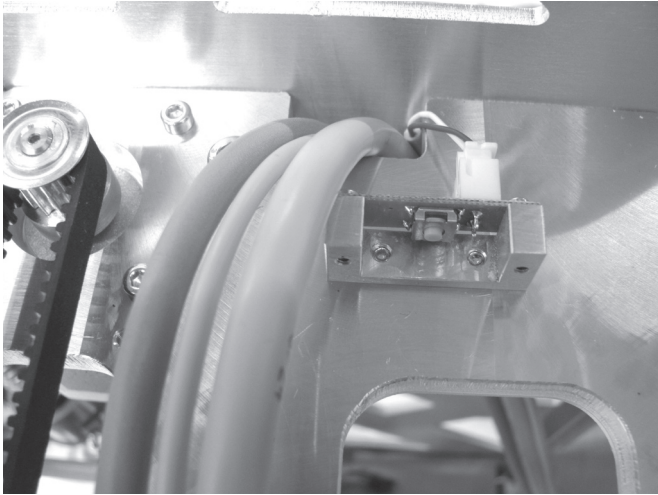


Apply two large cable ties (142 mm) for tension relief each at the two drag chain end pieces.



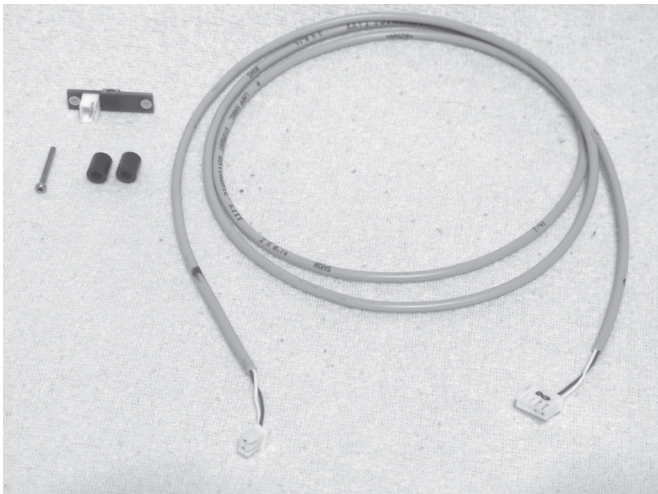
Place the free line ends through the opening in the X-plate past the limit switch and down.

### Limit switch for the X-direction

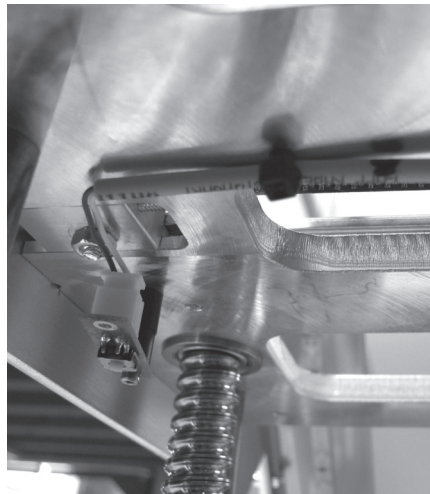


Plug line 11 into the plug connector of the limit switch on the X-plate and also route the line down through the opening tin in the X-plate.

### Limit switch for the Z-direction



- 1x limit switch PCB
- Line 8
- 2x spacer sleeves 8 mm (or 1x spacer sleeve 16 mm)
- 1x cylinder head screw M2x20

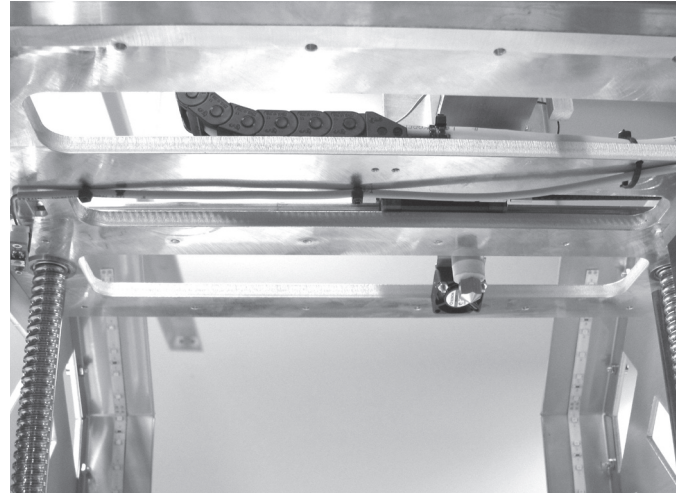


Push line 8 into the plug connector of the limit switch PCB. Install the limit switch with the spacer sleeve(s) to the X-plate from below as illustrated. Do not tighten the screw entirely yet.



Turn the toothed belt at the base plate manually so that the Y-plate moves up. Keep turning until the alignment of the limit switch just installed can be adjusted. The limit switch must be aligned so that it can be actuated by the slotted screw in the Y-plate.

**Caution:** When making this setting, observe that the extruder does not impact anywhere, which would damage it.



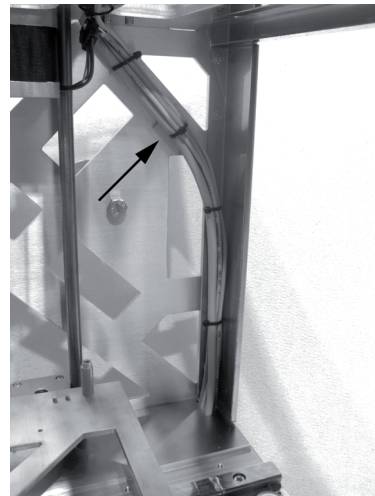
Place the line of the limit switch for the Z direction along the bore below the X plate and secure it with two small cable ties (99 mm).

Attach a third small cable tie (99 mm) that additionally connects the lines to the extruder carriage at the top of the X-plate.

#### Connection of the X motor



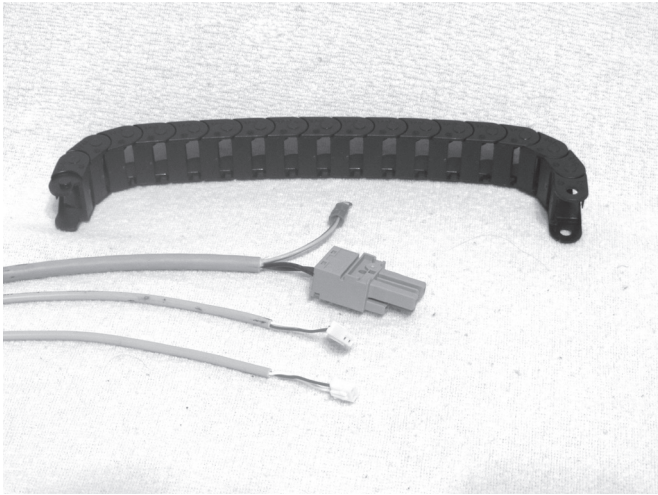
Connect line 17 to the X-motor and place it downwards together with the lines from the extruder carriage and the lines from the limit switches for the X- and Z-directions.



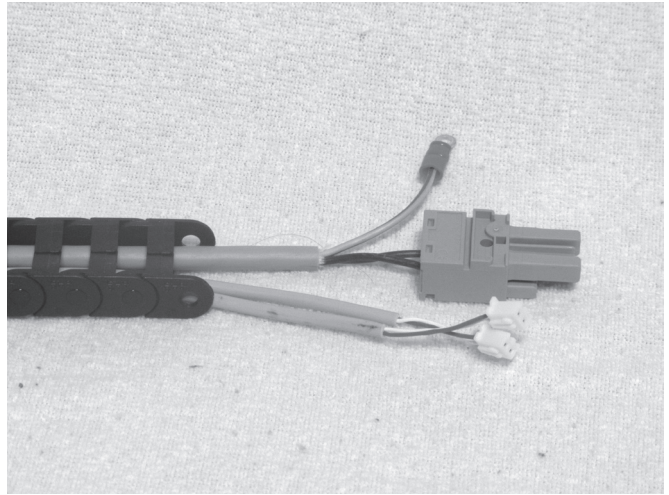
Route the line strand into the device socket through the opening in the rear cover and secure it with small cable ties (99 mm) and a self-adhesive cable tie holder (arrow).



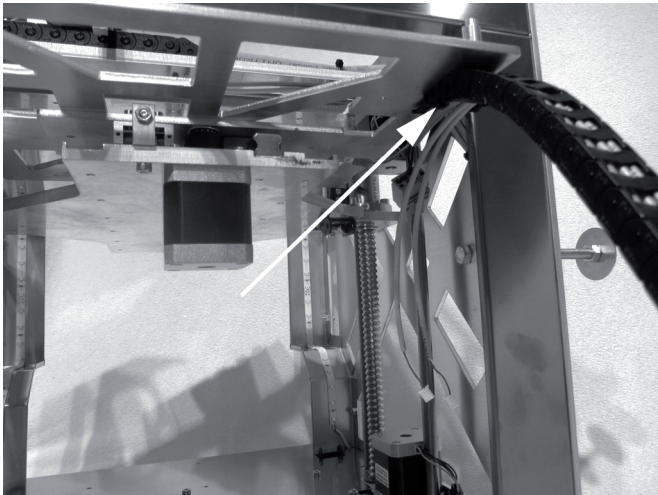
Heating bed, limit switch for the Y-direction and Y-motor



Drag chain 20 links open on the outside  
Lines 12, 13 and 20



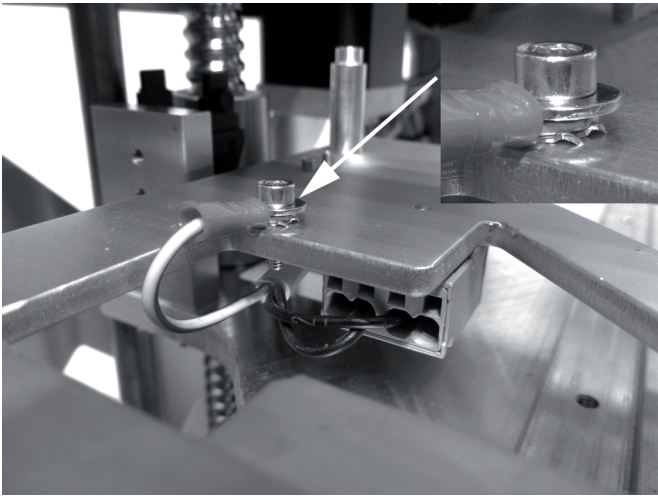
Push the lines into the drag chain so that the end link points to the line ends without label with the holes.



Latch the drag chain at the end piece of the undertable and pull the lines out of the drag chain far enough to be placed cleanly.



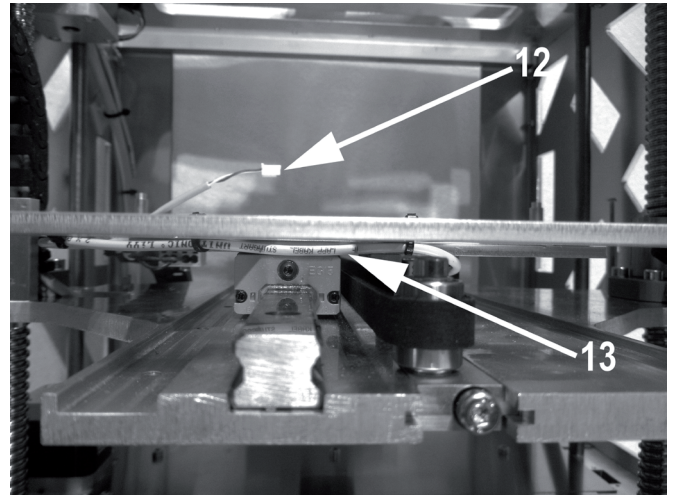
Install the plug connectors for the power supply of the heating plate with a cylinder head screw M3x16 at the bottom of the undertable.



Connect the protective ground (green/yellow line with ring eyelet) with a cylinder head screw M3x10, a washer and two sprockets at the top 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)**

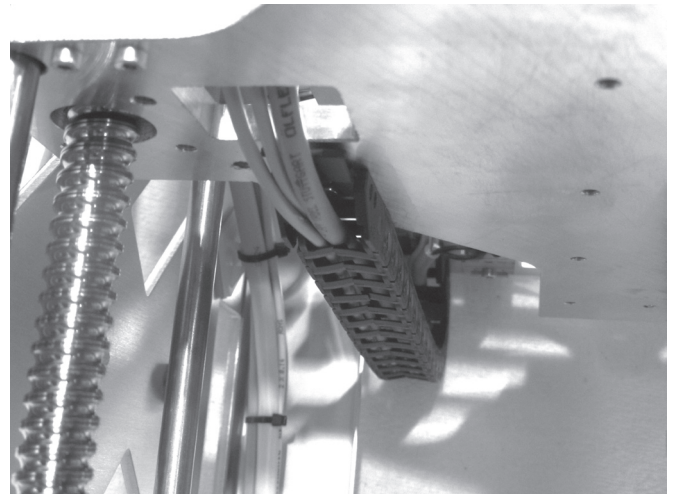


Connect line 13 with the plug connector of the limit switch for the Y-direction and place the line.

Let line 12 protrude from the drag chain by about 8 cm and attach it to the bore in the undertable with a small cable tie (99 mm). The thermal sensor of the heating plate is attached here later.

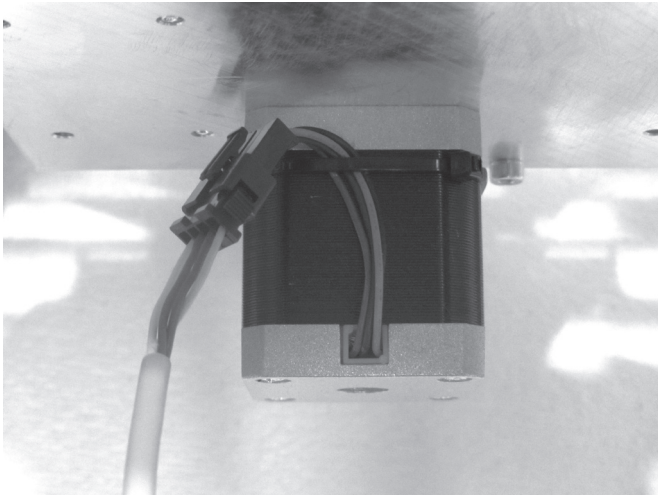


Latch the other end of the drag chain at the end piece of the Y-plate.



Route the lines of the drag chain upwards through the opening in the Y-plate.





Connect line 18 to the plug connector of the Y-motor and fasten the line to the motor with 2 small cable ties (99 mm) that are combined as shown.



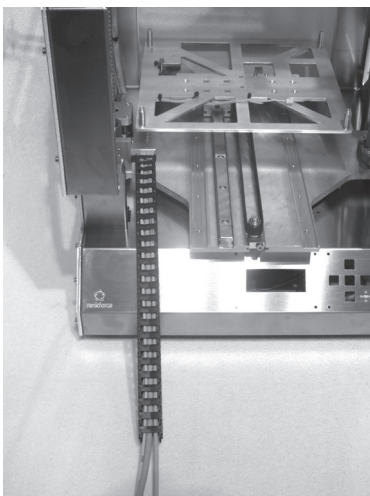
Route line 18 through the opening in the Y-plate upwards as well.



Apply two large cable ties (142 mm) for tension relief each at the two drag chain end pieces.



For the lower drag chain end piece at the Y-plate, include the line to the Y-motor in the tension relief.



Push the lines into the last remaining drag chain (25 links, open on the outside) so that the end link points to the line ends with the label with the nipples.

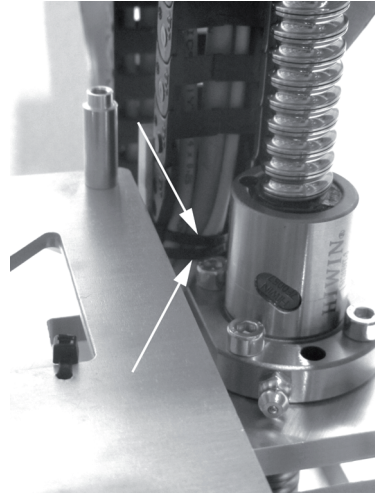


Latch the drag chain in the end piece at the Y-plate.





Latch the other side of the drag chains in the end piece of the operating cover.

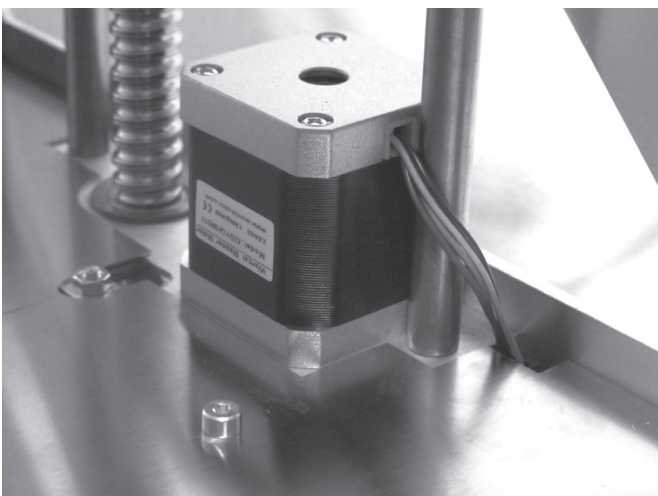


Apply two large cable ties (142 mm) at the drag chain end piece at the Y-plate for tension relief.

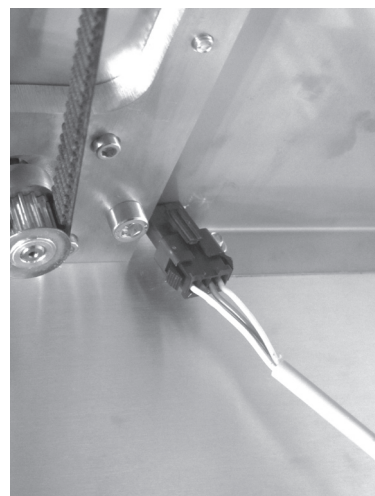


Apply two large cable ties (142 mm) at the drag chain end piece at the operating cover for tension relief.

#### Connection of the Z motor



Push the plug connector at the Z-motor through the opening in the rear cover.



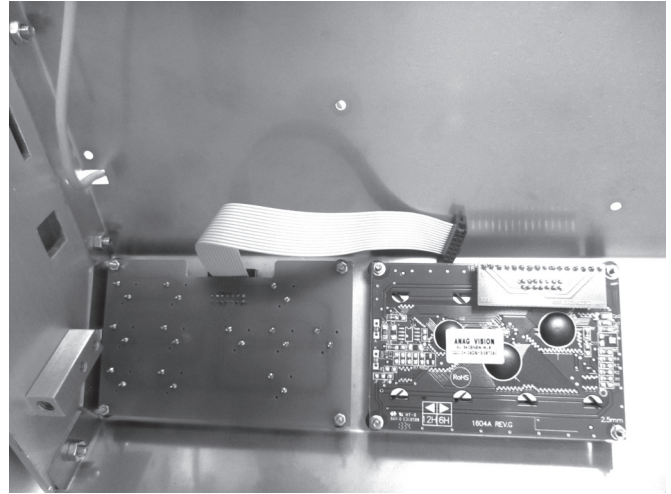
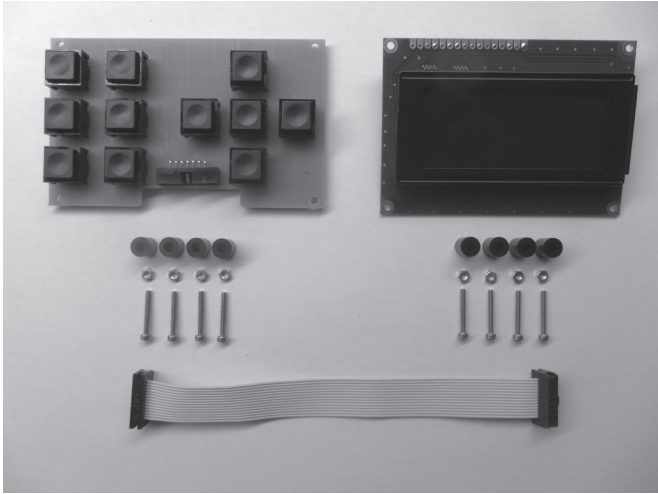
Connect line 16 to the plug connector of the Z-motor.

## c) Installation of the PCBs



The components on the PCBs can be damaged by electrostatic discharge. Therefore, touch, e.g. an earthed radiator before taking any PCBs into your hand.

Installation of the display and keyboard PCB



- 1x keyboard PCB
- 1x display PCB
- 4x spacer roller 8 mm for keyboard PCB
- 4x spacer roller 9 mm for display PCB
- 8x cylinder head screw M2x16
- 8x nut M2
- 1x flat band line with twisted plugs

Connect the flat band line to the keyboard PCB. Observe correct position of the latching tabs at the plugs.

Install the keyboard PCB as shown with the spacer rollers 8 mm. The spacer rollers may be fastened at the PCB with a drop of hot glue for easier assembly first.

Apply all screws in the area of the nuts with threadlocker varnish.

The plug connector with the flat band line must point to the top of the device.

Align the PCB so that the keys are not caught in the housing cut-outs.

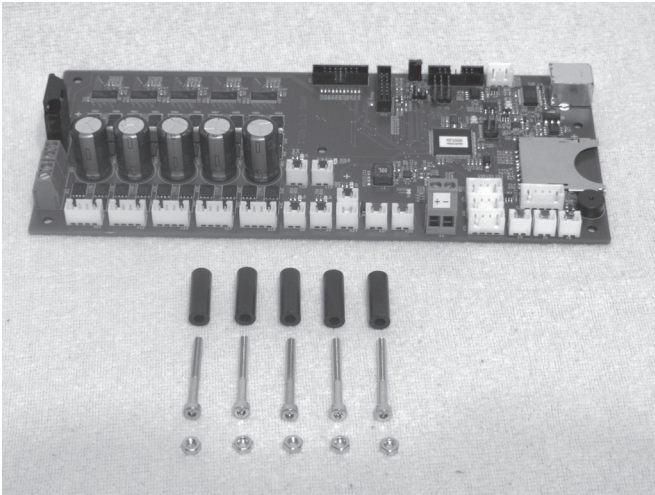
Remove the protective foil from the display.

Install the display PCB with the spacer rollers 9 mm as shown. Apply all screws in the area of the nuts with threadlocker varnish.

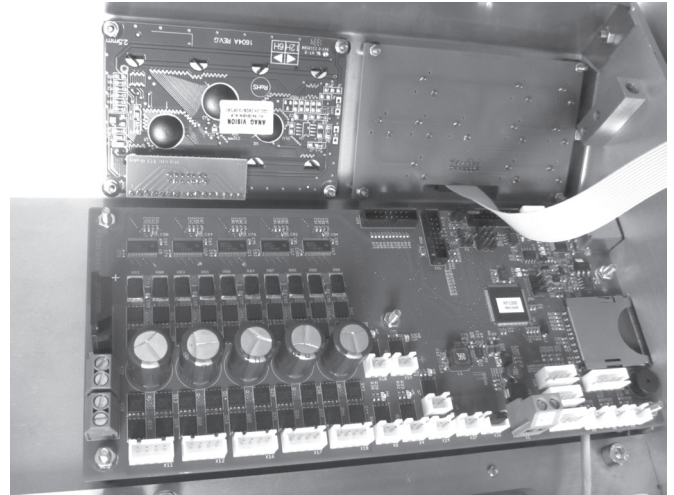
The small additional PCB with the plug connector point to the top of the device.

Align the PCB so that the display is at a right angle to the housing cut-out.

## Installation of the main PCB

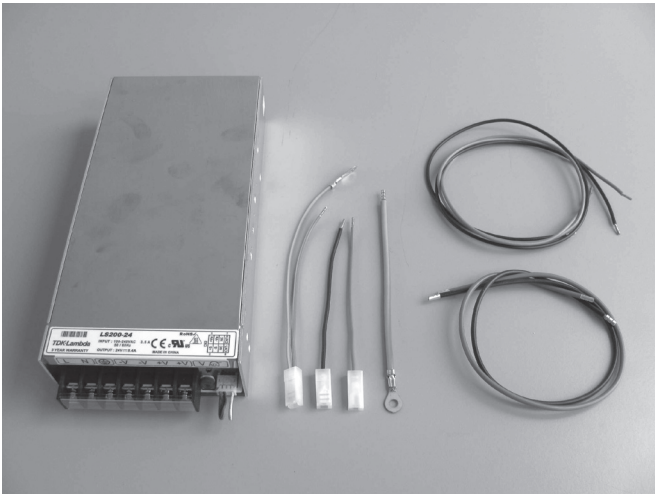


- 1x main PCB
- 5x spacer roller 20 mm
- 5x cylinder head screw M3x25
- 5x nut M3

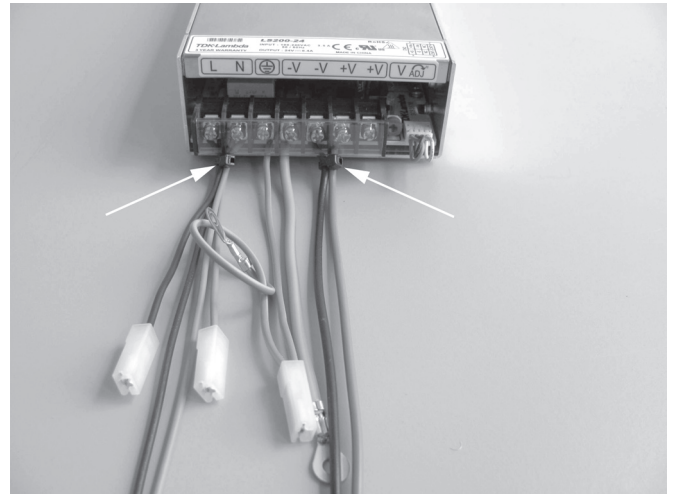


Install the main PCB with the spacer rollers 20 mm as shown. The spacer rollers may be fastened to the PCB with a drop of hot glue for easier assembly first. Apply all screws in the area of the nuts with threadlocker varnish. Align the PCB so that the USB connection and the memory card reader are placed cleanly behind the respective housing cut-outs.

## Connection of the lines at the mains unit



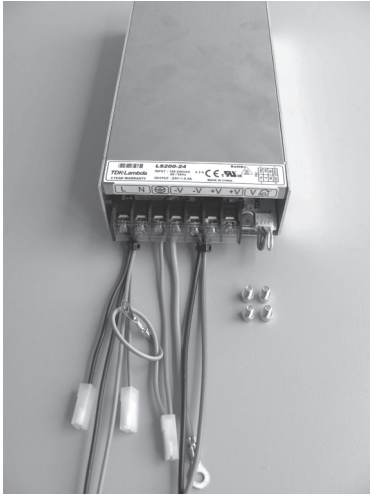
- 1x mains unit
- 1x line with flat plug connector black (short)
- 1x line with flat plug connector blue (short)
- 1x line with flat plug connector green/yellow (short)
- 1x line with ring eyelet green/yellow (14 cm)
- 1x line black (61 cm)
- 1x line blue (61 cm)
- 1x line red (37 cm)
- 1x line black (37 cm)



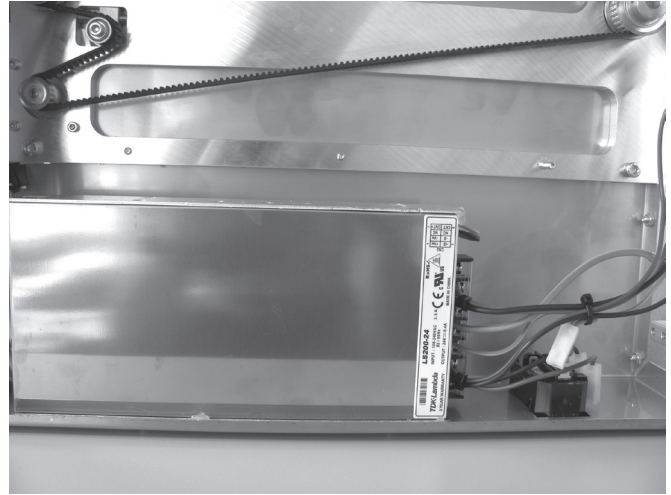
Remove the transparent protective cover from the clamping strip of the mains unit. Connect the line with the flat plug connector black (short) and line black (61 cm) to the terminal L at the mains unit. Connect the line with the flat plug connector blue (short) and line blue (61 cm) to the terminal N at the mains unit. Connect the line with the flat plug connector green/yellow (short) to the protective ground terminal  $\oplus$  at the mains unit. Connect the line red (37 cm) to the terminal +V at the mains unit. Connect the black line (37 cm) and the line with ring eyelet green/yellow (14 cm) with the terminal -V at the mains unit. Put on the transparent protective cover at the clamping strip of the mains unit again. 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 arrows in the figure).



## Installation of the mains unit

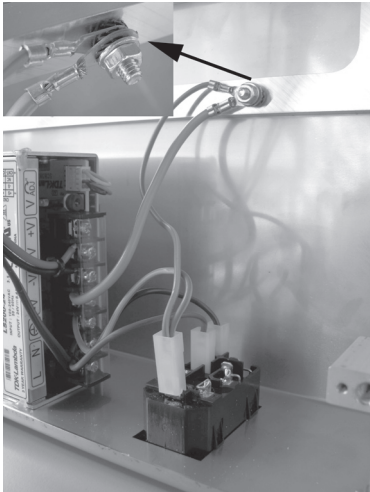


1x mains unit with already-connected lines  
4x cylinder head screw M4x6



Attach mains unit with the 4 screws at the rear cover.

## Connection of the mains unit



Plug the line with the flat-plug connector black (short) to the upper switching contact tab of the low power device combination socket.

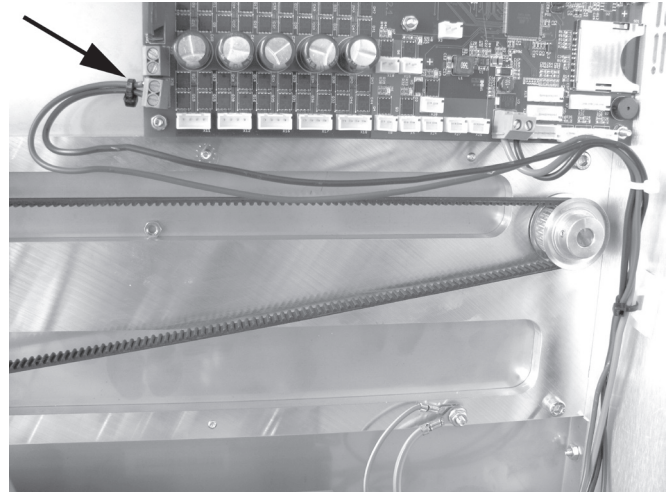
Plug the line with the flat-plug connector blue (short) to the contact of the low power device combination socket tab below it.

Plug the line with the flat-plug connector green/yellow (short) to the protective ground contact tab of the low power device combination socket tab.

Connect the ring eyelets of the green/yellow lines as indicated to the long attachment screw of the rear cover.

**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 > ring eyelet > sprocket > ring eyelet > sprocket > washer > nut M4 (see figure section)**



Connect the line black (61 cm) and line blue (61 cm) to the terminals X28 of the main PCB. Tie both lines together with a small cable tie (99 mm) close to the connection terminal (see arrow in the figure).

Connect the line red (37 cm) and line black (37 cm) to the terminals X1 of the main PCB.

**Attention, observe polarity of the lines:**

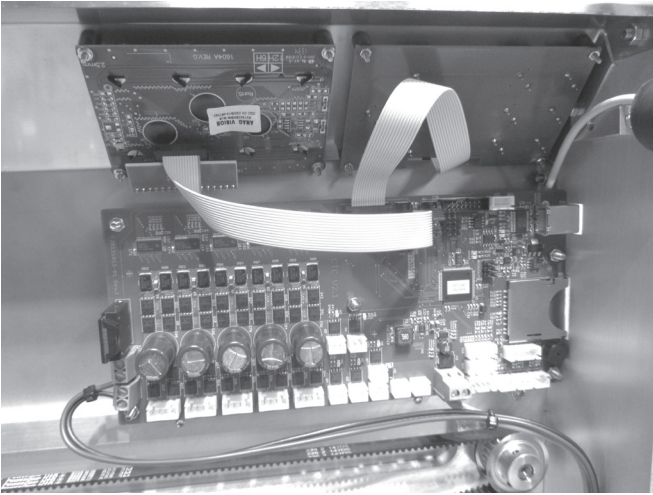
**red = + (left terminal in the figure)**

**black = - (right terminal in the figure)**

Route the lines cleanly with cable ties and a self-adhesive cable tie holder and secure them.

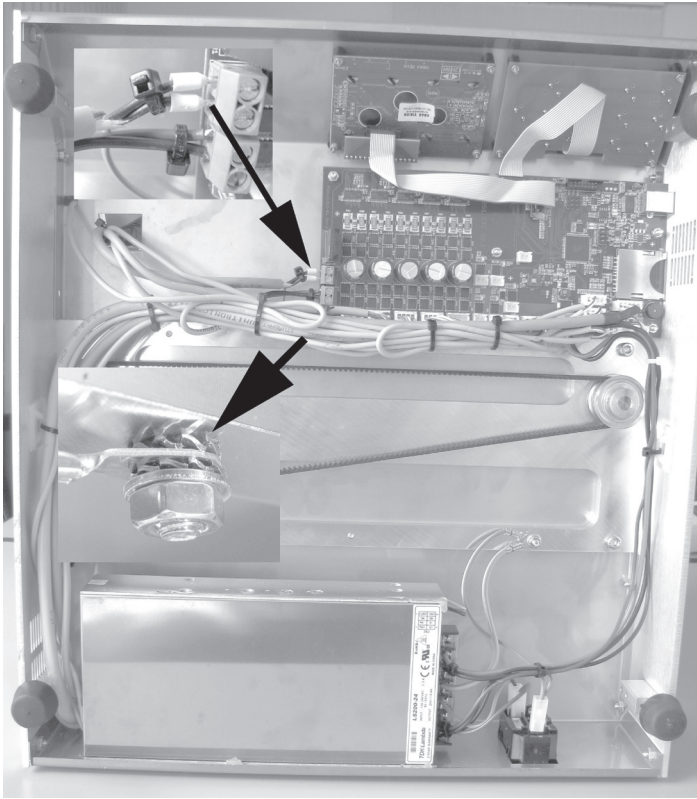
The lines must not get into the rotating toothed belts in operation.

## Connection of display and keyboard PCB



Connect the flat-band line already connected to the keyboard PCB to plug strip X23 of the main PCB.  
Connect the remaining flat band line to the untwisted plugs at the display PCB and the plug strip X21 of the main PCB. Observe correct position of the latching tabs at the plugs again. Optionally, the plug connections can be secured with a drop of hot-glue.

## Connection of the device lines



Connect the device lines to the main PCB as follows:

Line	Terminal main PCB	Connected components
8	X15	Limit switch Z-direction
9	X26	LED lighting right
10	X27	LED lighting left
11	X13	Limit switch X direction
12	X9	Thermal sensor heating plate
13	X14	Limit switch Y-direction
14	X5	Thermal sensor extruder
15	X7	Elongation measuring strip
16	X16	Motor Z-direction
17	X11	Motor X-direction
18	X12	Motor Y-direction
19 (4-pin)	X17	Motor extruder
19 (2-pin red/blue)	X24	Fan
19 (2-pin pink/grey)	X4	Heating extruder
20	X29 + protective ground at middle screw operating unit cover	Heating plate



**The ring eyelet of the protective ground at line 20 is attached with sprockets and an additional nut at the middle attachment screw of the operating unit cover.**

**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 > ring eyelet > sprocket > washer > nut M4 (see image section)**

**Tie both lines of the heating plate together at terminal X29 with a small cable tie (99 mm) close to the connection terminal (see arrow in the figure).**

Route all other lines cleanly with small cable ties (99 mm) and a self-adhesive cable tie holder and secure them.

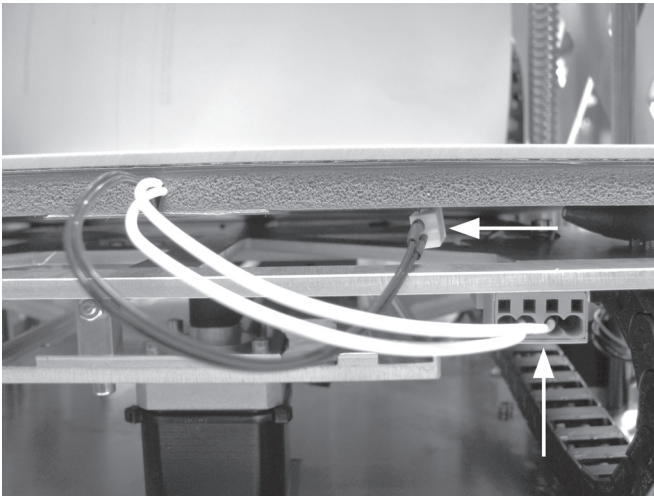
The lines must not get into the rotating toothed belts in operation.



# 11. Final Work

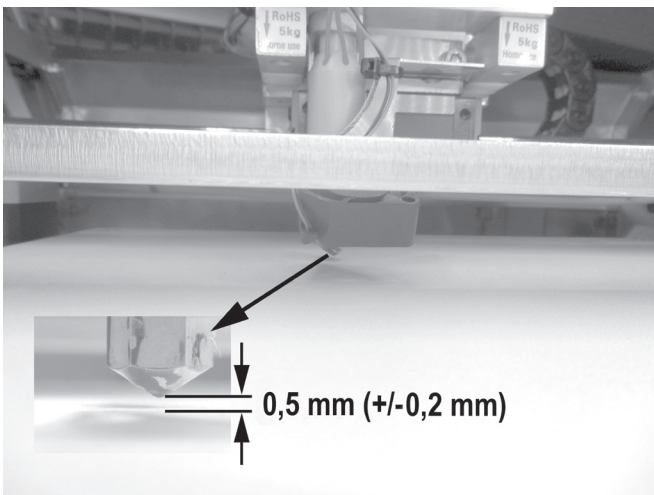
→ If the motors are moved manually, the display may light up. This is not a malfunction. A voltage induced by the movement causes the display to light up.

## Connection of the earthing plate



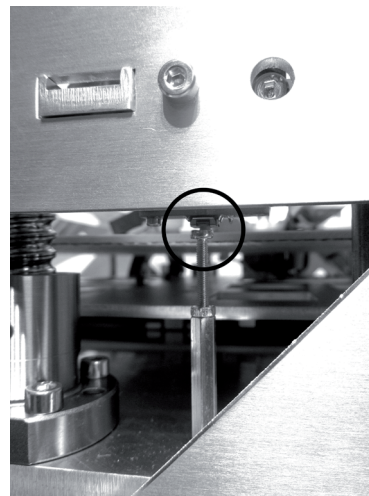
Place the heating plate onto the spacer bolts of the undertable and connect the two plug connectors from line 12 and 20.

## Basic setting limit switch Z-direction



Loosen the actuation screw in the Y-plate for the limit switch in the Z-direction and turn it all the way into the hexagon bolt. Carefully turn the toothed belt of the bottom plate until there is a gap of 0.5 mm (+/-0.2 mm) set between the heating plate and extruder. 0.5 mm correspond roughly to the thickness of 5 layers of printer paper (80 g/m<sup>2</sup>).

**Caution: No force must be applied to the heating plates, since the ceramics material would break otherwise (loss of warranty/guarantee).**



Set the adjustment screw so that the limit switch of the Z-direction is tripped in this position (a slight click is audible).

Move the extruder and Y-plate manually and ensure that the extruder cannot touch the heating plate anywhere in the working area and that the same distance is complied with everywhere.

If this is not the case, the undertable plate must be aligned carefully. However, the heating plate must be taken off first (danger of breaking!).

After this setting, counter the setting screw with the nut again.

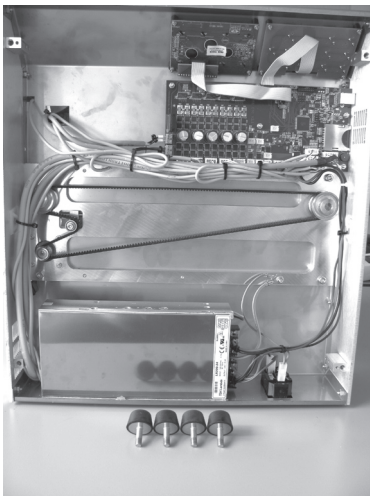
## Discharge tensions of the threaded circulation spindles



Slightly loosen the attachment screws of the threaded circulation spindles on both sides of the printer (4 screws each) again and then tighten them again.

This avoids tensions that may cause stiff movement when moving the Z-axis in operation.

## Attachment of the bottom cover



Turn the rubber feet off the foot holders.

4x rubber feet

2x hexagon socket screw M3x6



Insert the bottom sheet with the folds towards the housing outside.

First insert the edge at the housing rear and then fold the bottom sheet against the housing.

Attach the bottom sheet to the large foot holders with the two hexagon socket screws M3x6.

Turn 4 rubber feet into the foot holders.

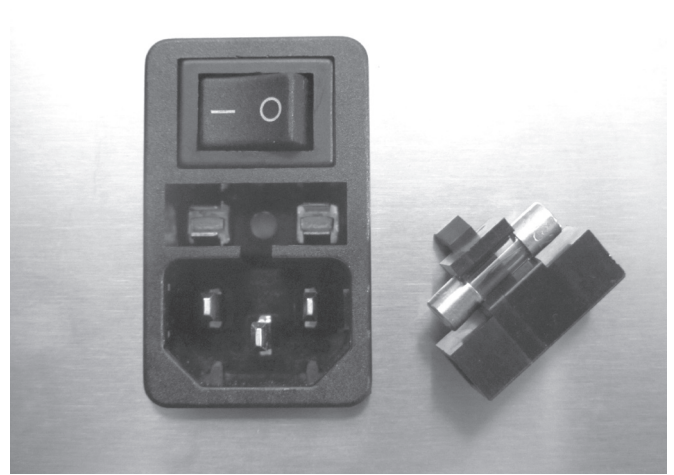
If the bores do not align cleanly and the rubber feet cannot be turned in without resistance, the attachment screws of the foot holders must be loosened again slightly.

After turning in the rubber feet, finally tighten the foot holder attachment screws.

### Inserting the mains fuse



Lever the fuse holder off the low power device combination socket with a suitable screwdriver.



Insert the fuse as shown and push the fuse holder back into the low power device combination socket.

### Glue on the rating plate and warning signs



Stick the rating plate onto the housing next to the power socket.  
Degrease the adhesive areas first.



Glue the two other yellow warning signs to the front of one of the two sight protection blinds well visibly.  
Degrease the adhesive areas first.



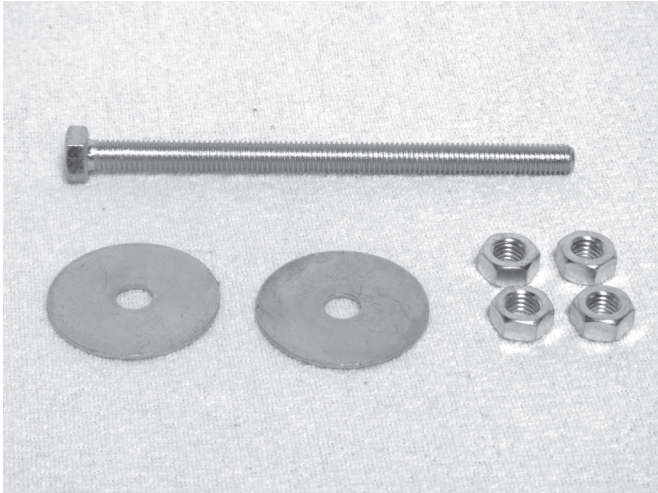
## 12. Initial Commissioning



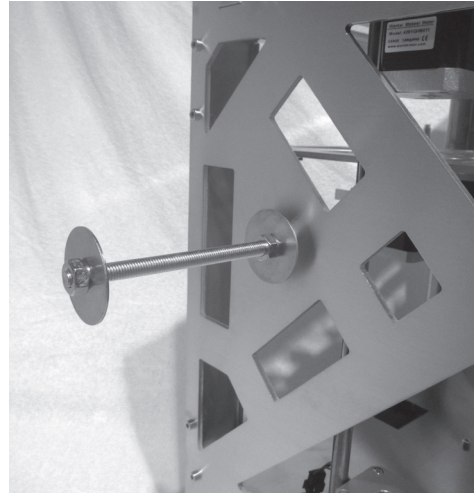
Before initial commissioning, all transport protections or fuses that have been installed during installation must be removed.

### a) Assembly of the Filament Holder and the Filament Hose

Assembly of the filament holder



1x hexagon screw M8x120  
2x car body washer M8  
4x nut M8

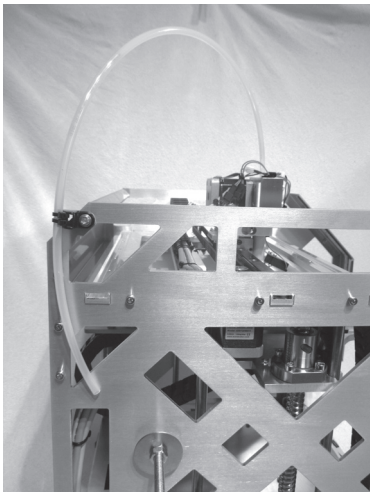


Push the hexagon screw from the inside outwards through the corresponding bore in the left side part and attach it from the outside with a nut.

Put on car body washer and counter with another nut.

At the end of the hexagon screw, turn on a nut, enclose the car body washer and counter with another nut.

**Note: Printable adapters for different filament rollers can be downloaded from the product page of the 3D printer online.**



Push filament hose into the feed basic part and fasten it at the filament hose holder with a small cable tie (99 mm).

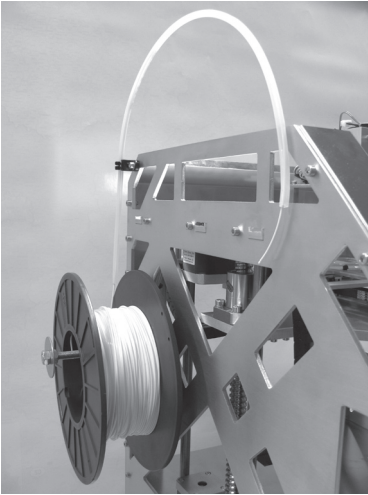
**Caution: do not contract the table tie too far. The filament hose must not be crushed.**

Align the filament hose so that it has enough play for movements of the extruder carriage.

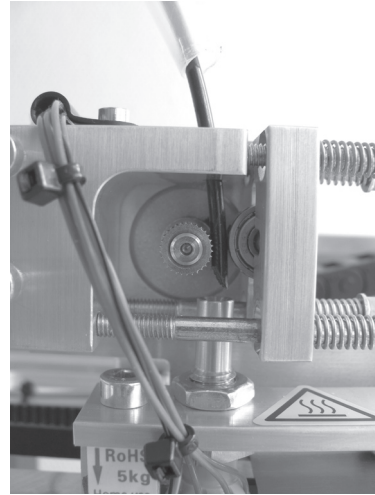
**Note:**

**Filaments from various manufacturers cause a high friction resistance in the hose. Therefore, please check that the filament can be moved freely before use. If friction is too high, the alternative filament holder (see „First Print of an Example Object from the SD Card“) can be used.**

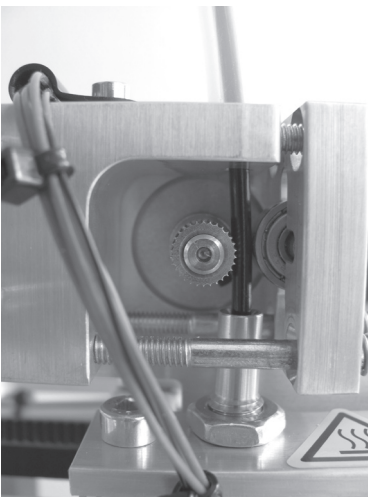
## b) Insertion of the Filament



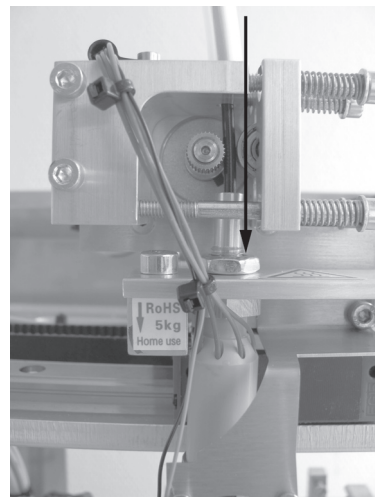
Pull the filament hose end from the infeed basic part.  
Push the filament roller onto the filament holder and guide the filament through the filament hose until it escapes on the other side.  
The filament roller must move freely.



Cut into the filament end at a 45°-angle. Insert the filament through the bore and past the feed motor into the extruder to the stop.



Push the filament hose end into the infeed basic part.  
Tighten all spring screws so that the filament is cleanly guided but also is not deformed badly by the filament feed.  
It must be possible for the feed motor to turn without slippage or catching when pulling or pushing at the filament.



The filament must be guided in a straight line from the top between the feed motor and the ball bearing into the bore at the extruder. It must not catch at the bore edge of the extruder.

## c) Setup and Transport



When setting up the 3D printer, observe that the mains switch at the low power device combination socket must be easy to reach so that the device can be switched off quickly and easily in case of malfunction.

Ensure proper ventilation when setting up the device. Do not put the device down on soft supports such as a carpet or bed, etc. the air circulation also must not be impaired by other objects. This prevents heat dissipation from the product and may lead to overheating (danger of fire).

When setting up the device, make sure that it has a stable footing and place it on a stable underground. Persons may be injured if the 3D printer drops.

When setting up the device, make sure that the connection cables are neither pinched nor damaged by sharp edges.

Always place cables so that no one can trip over them or be caught in them. There is a danger of injury.

→ Never place the device on any valuable or sensitive furniture surfaces without sufficient protection.

- Put up the 3D printer on a level, stable and non-vibration-sensitive surface.
- If you want to transport the 3D printer, secure the moving parts and the heating bed with adhesive tape or cable ties.

## d) Mains Connection and First Activation



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.

Do not let the mains cable come into contact with other cables.

Be careful when handling mains cables and mains connections. Mains voltage may cause potentially fatal electric shock.

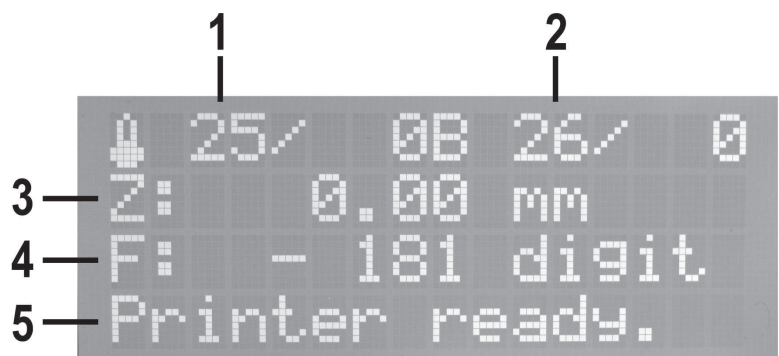
Make sure that no cables lie around openly. Install cables professionally to prevent accidents.

Before plugging in the mains plug, ensure that the device voltage indicated at the 3D printer corresponds to the available mains voltage. Do not connect the device if the indication does not correspond to the available mains voltage. Incorrect supply voltage may lead to irreparable damage to the device and danger to the user.

- Plug the low power device plug of the mains line into the low power device combination socket at the rear of the device.
- Plug the mains plug of the mains line into a protective contact socket.
- Switch on the printer with the mains switch at the low power device combination socket (put the switch in position I).
- The lighting now lights up and the display shows the welcome screen briefly.

Then the main menu appears:

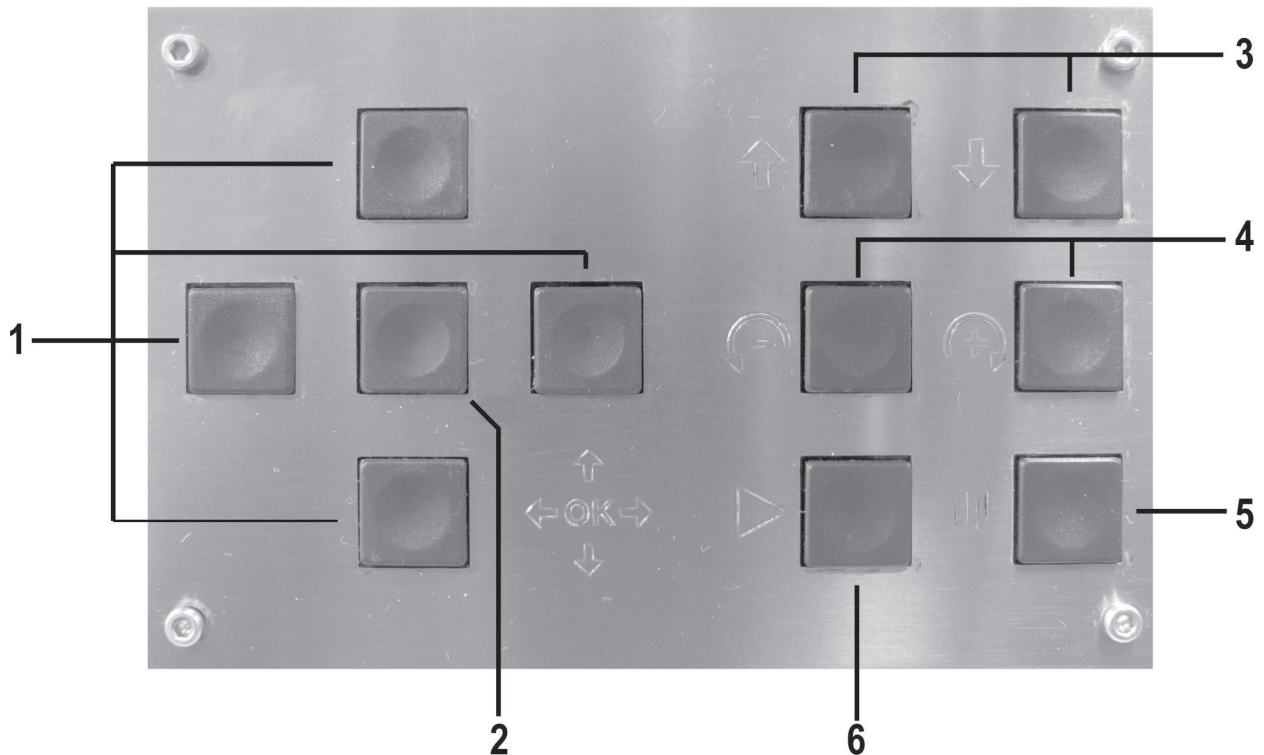
- (1) Extruder temperature (actual/target)
- (2) Temperature heating bed (actual/target)
- (3) Print plate offset in mm from the home position
- (4) Measured value of the print sensors at the extruder
- (5) Status information



→ The target temperatures are not displayed here yet, since the extruder and heating bed are not heated yet.



Function description of the operating buttons:



- (1) Direction buttons for navigation in the menu structure (left / right / top / bottom)
- (2) OK button for confirmation of a selection in the menu
- (3) Heating plate movement up / down
- (4) Filament infeed + = forward / - = back
- (5) Printing pause  
1x push: Print stops  
2x pushes: Printing head moves away from printed object (the previous position remains saved)
- (6) Continuation of print after a printing pause

## e) Calibration



**Before calibration, filament must be inserted (see "Insertion of the Filament"), since the measured values are falsified otherwise. The filament must not be introduced into the extruder in this case, however. It only needs to be clamped between the ball bearing and infeed knurl. If there is already some filament in the extruder, move it out with the manual filament infeed first. Caution: If the extruder has already been used, it must be heated first.**

**Calibration should be performed now and then. It is a prerequisite for high printing quality. Perform the calibration after a transport of the 3D printer or any changes to the heating plate in any case.**

**This calibration does not replace the correct basic setting of the limit switch for the Z-direction. It serves to balance out slight irregularities of the heating plate while printing.**



Ensure that the heating plate is supported levelly on the spacer bolts.

Ensure that the extruder nozzle is clean on the outside. If it is contaminated, clean it as described in chapter "Maintenance and Care".

The figures on the display screens may vary a little depending on firmware version.

```
>Quick Settings→
  Position      →
  Extruder      →
  Fan speed     →
```

Push OK

```
Quick Settings→
  Position      →
  >Extruder     →
  Fan speed     →
```

Select „Extruder“ with the direction buttons.

```
>Bed Temp.: 0°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→
```

Push OK and select „Bed Temp“ with the direction buttons.

```
*Bed Temp.: 0°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→
```

Push OK

```
*Bed Temp.:100°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→
```

Set „100 °C“ with the direction buttons.

```
>Bed Temp.:100°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→
```

Push OK



```
↓ 21/ 0B 56/100
Z: 0.00 mm
F: -8362 digit
Printer ready.
```

Push the direction button „left“ 2x to return to the main menu. Wait until the actual temperature of the heating plate in the display indicates 100 °C and then let heating continue for approx. 5 more minutes until the temperature of the heating plate has stabilised.

```
Extruder      →
Fan Speed     →
SD Card       →
>Configuration →
```

Push OK and select „Configuration“ with the direction buttons.

```
General       →
Acceleration  →
Feedrate      →
>Heat Bed Scan
```

Push OK and select „Heat Bed Scan“ with the direction buttons.

```

# 22/ 0B100/100
Z: 0.00 mm
F: -8151 digit
Heat Bed Scan

```

Push the direction button „left“ 2x to return to the main menu. The status display of the main menu shows „Heat Bed Scan“. The geometry of the heating plate is now measured automatically. This process will take a while.

After measurement, the heating plate returns to the home position and the display shows „Scan completed“.

If the display shows „Scan aborted“, this means that measurement has been aborted. In this case, repeat the basic setting of the limit switch for the Z-direction (see chapter „Final Work“ earlier in these instructions).

```

>Quick Settings→
  Position      →
  Extruder      →
  Fan speed     →

```

Push OK

```

Quick Settings→
  Position      →
>Extruder      →
  Fan speed     →

```

Select „Extruder“ with the direction buttons.

```

>Bed Temp.: 100°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→

```

Push OK and select „Bed Temp“ with the direction buttons.

```

*Bed Temp.: 100°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→

```

Push OK

```

*Bed Temp.: 0°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→

```

Set „0 °C“ with the direction buttons.

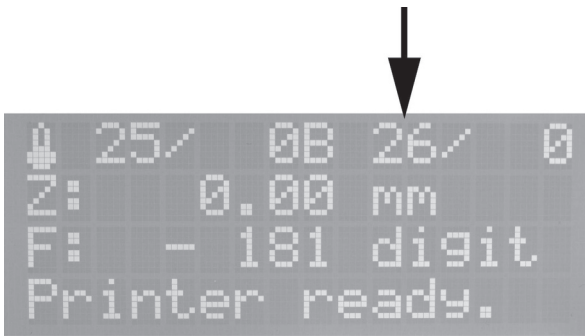
```

>Bed Temp.: 0°C
  Temp. 0 : 0°C
  Extruder 0 Off
  Extr. position→

```

Push OK





Push the direction button „left“ 2x to return to the main menu.  
Wait until the actual temperature of the heating plate in the display shows room temperature again.

### f) First Print of an Example Object from the SD Card



**When heating, there may be slight development of smoke or steam. This is normal. Please ensure the corresponding ventilation.**

**If you are printing with PLA filament, cover the heating plate with cleaning tape or a slightly structured crepe tape.**

**You can find the print files on the enclosed SD card in the folder GCODE. The printing files are saved in the two folders „ABS“ and „PLA“ depending on the filament type used.**

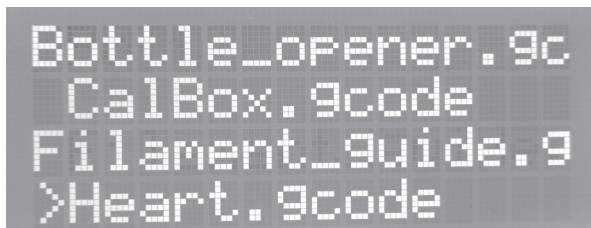
Push the enclosed SD card into the SD card reader at the right of the 3D printer.



Push OK and select „SD-Card“ with the direction buttons. If the printer was already switched on before insertion of the SD card, the option „Mount Card“ must be performed.



Push OK and select „Print file“ with the direction buttons.



Push OK and mark the desired file in the corresponding folder „ABS“ or „PLA“ with the direction buttons.



Confirm with OK.

The display returns to the main menu and the heating plate is heated.  
Then the axes move to the home position and the extruder is heated.  
Once the extruder has reached its operating temperature, printing starts.

→ The progress of heating of the heating plate and extruder can be tracked based on the temperature displays in the upper display line.

The printing progress can be tracked in the lower status display.

During the first centimetres of printing, the distance between the heating plate and extruder can be fine-adjusted manually with the buttons for heating plate movement (3).

It should be approx. 0.2 mm (corresponds to about twice the paper thickness of regular 80g/m<sup>2</sup> printer paper).



**For this setting, observe that the extruder must not touch the heating plate since it may be damaged otherwise (loss of warranty/guarantee).**

→ The distance between the extruder and heating plate is set precisely with the software later (Z-compensation), but the manual setting is sufficient for the first prints.

If no filament escapes from the extruder at first, the filament infeed button (4) must be pushed until filament escapes.

Let the printed object cool off for a few minutes after printing. When the temperature of the heating plate is below 40 °C (see display), the printed object comes free from the heating plate and you can remove it.

### Removing the SD card



Push OK and select „SD-Card“ with the direction buttons.



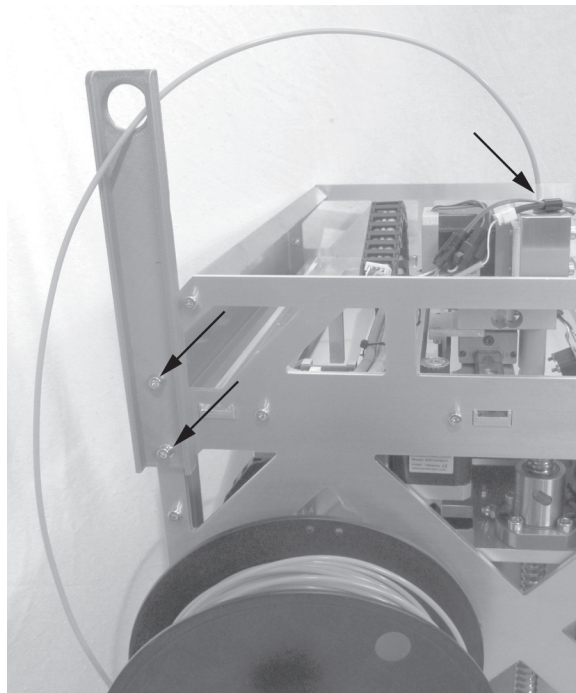
Push OK and select „Unmount Card“ with the direction buttons.

Push OK again and then remove the SD card.

Push the direction button „left“ 2x to return to the main menu.

→ The enclosed SD card holds, among others, a printing file for an alternative filament holder (file name „Filament\_guide.gcode“, also see description enclosed with these instructions).

You can install this filament holder instead of the filament hose at the 3D-printer. For this, cut a short piece (approx. 3 cm) from the filament hose and plug it into the filament introduction at the extruder as a centring piece.



# 13. Operation at the Printer

---

## a) Menu Overview

Operation takes place via the left key block at the printer:

- The direction buttons are used for navigation in the menu structure (left / right / top / bottom)
- The OK button is used to confirm a selection in the menu and to call the menu structure from the main menu (description above under "Mains Connection and First Activation").

→ The menu structure may deviate slightly depending on firmware.

<b>Quick Settings</b>	Home All Output Object Speed Mul.:100% Flow Mul.:100% Preheat PLA Preheat ABS Cooldown Disable Stepper Restart
<b>Print file</b>	
<b>Position</b>	Home All Home X Home Y Home Z Position X X: 0.00 mm Endstop min:Off Endstop max: N/A Position Y Y: 0.00 mm Endstop min:Off Endstop max: N/A Position Z Z: 0.00 mm Endstop min:Off Endstop max: N/A Position Extruder E: 0.00 mm 1 click = 1 mm
<b>Extruder</b>	Bed Temp.: 0°C Temp. 0 : 0°C Extruder 0 Off Position Extruder E: 0.00 mm 1 click = 1 mm
<b>Fan speed</b>	Set Origin Fan Speed: 100% Set Fan 25% Set Fan 50% Set Fan 75% Set Fan 100%



<b>SD Card</b>	Mount Card		
	Print file		
	Unmount Card		
	Delete file		
<b>Configuration</b>	General	Baudrate:250000	
		Stepper Inactive	[s]: 360
			0=Off
		Max. Inactive	[s]: 0
			0=Off
	Acceleration	Print X: 1000	
		Print Y: 1000	
		Print Z: 1000	
		Move X: 1000	
		Move Y: 1000	
		Move Z: 1000	
		X/Y-Jerk : 10.0	
		Z-Jerk : 20.0	
	Feedrate	Max X: 500	
		Max Y: 500	
		Max Z: 50	
		Home X: 200	
		Home Y: 200	
		Home Z: 20	
	Heat Bed Scan		

## b) Functions of the Individual Menu Items

### Quick Settings

Output Object	Moving heating plate to removal position
Home All	Move all axes into the home position
Speed Mul.:100%	Setting of the printing speed
Flow Mul.:100%	Setting of the material flow speed
Preheat PLA	Preheating of the heating plate and extruder to PLA temperature
Preheat ABS	Preheating of the heating plate and extruder to ABS temperature
Cooldown	Cooling down (all heatings off)
Disable Stepper	Switching off all motors
Restart	Restart firmware reset

**Print File** Print from SD card (only visible if SD card is inserted)

### Position

Home All	Move all axes into the home position
Home X	Move X-axis into the home position
Home Y	Move Y-axis into the home position
Home Z	Move Z-axis into the home position
Position X	Move X-axis into a settable position / display of the limit switch condition
Position Y	Move Y-axis into a settable position / display of the limit switch condition
Position Z	Move Z-axis into a settable position / display of the limit switch condition
Position Extr.	Manually operating extruder infeed / 1mm per click / <b>ATTENTION: only use in the heated condition</b>

### Extruder

Bed Temp.: 0°C	Setting the heating bed temperature manually
Temp. 0 : 0°C	Manually set the extruder temperature (e.g. for filament change)
Extruder 0 Off	Switch off the extruder heating
Position Extruder	Manually operating extruder infeed / 1mm per click / <b>ATTENTION: only use in the heated condition</b>
Set Origin	Set the new zero point

### Fan Speed

Fan Speed: 100%	Display of fan speed
Set Fan 25%	Set the fan speed to 25%
Set Fan 50%	Set the fan speed to 50%
Set Fan 75%	Set the fan speed to 75%
Set Fan 100%	Set the fan speed to 100%

### SD Card

Mount Card	Initialise SD card (after insertion)
Print File	Start print from SD card
Unmount Card	Deactivate SD-card for removal
Delete File	Delete file from SD card (then the file to be deleted is selected)

## Configuration

General	Baud rate:250000	Setting of the transfer speed from the computer
	Stepper Inactive	Time setting until the motors are switched off in standby
	Max. Inactive	Time setting until the display is switched off in standby
Acceleration	Print X: 1000	Setting of the printing acceleration of the X-axis
	Print Y: 1000	Setting of the printing acceleration of the Y-axis
	Print Z: 1000	Setting of the printing acceleration of the Z-axis
	Move X:1000	Setting of the travel speed of the X-axis
	Move Y:1000	Setting of the travel speed of the Y-axis
	Move Z:1000	Setting of the travel speed of the Z-axis
	X/Y-Jerk :10.0	Acceleration of X and Y axis at small steps
Z-Jerk : 20.0	Acceleration of Z-axis in small steps	
Feed rate	Max X: 500	Max. speed of the X-axis
	Max Y: 500	Max. speed of the Y-axis
	Max Z: 50	Max. speed of the Z-axis
	Home X: 200	Max. speed of the X-axis when moving to the home position
	Home Y: 200	Max. speed of the Y-axis when moving to the home position
	Home Z: 20	Max. speed of the Z-axis when moving to the home position
Heat Bed Scan	Heating bed calibration	



## 14. General Notes on 3D Printing

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The print quality of 3D printers depends on a great many factors.

It is not always possible to achieve a satisfactory print result at the first attempt.

### Extruder temperature

The best extruder temperature depends on the filament material and the printer layer thickness. The manufacturer information for the printing temperature can vary very strongly here.

Perform the first test prints at a temperature in the middle range of the manufacturer's information.

To optimise the print quality, print the same object with the same printing layer thickness and different extruder temperatures in 5 °C steps and then compare the results.

This way you can approach the best extruder temperature for different filaments and printing layer thicknesses most easily.

If the extruder temperature is set too hot, the material cannot cool off fast enough and will melt the layer below again.

If the extruder temperature is too low, the filament will not become liquid enough and the filament flow is not homogeneous. The individual filament layers also cannot combine sufficiently.

### Heating bed temperature

The best heating bed temperature also depends on the filament material. It permits perfect adhesion of the printed object to the heating plate.

PLA can also be printed without a heating bed, but a temperature of approx. 60 °C has turned out to be ideal.

When printing PLA (particularly at small objects with a small footprint), the heating bed should additionally be applied with cleaning tape or a slightly structured crepe tape to increase surface adhesion.

ABS needs a heating bed for printing. Otherwise it will not adhere at all or only insufficiently. Here, a temperature of approx. 160 °C should be tried out.

If the heating bed temperature is too high, the printed object may distort or the lower layers will cool off too slowly.

If the heating bed temperature is too low, the printed object will not adhere sufficiently or the corners will come free of the heating plate while printing.

### Print layer thickness

The print layer thickness determines the height of the individual print layers and thus the resolution and quality of the printed object.

The thinner the printed layers, the better the print quality and the longer the print duration.

The thinner the printed layers, the lower the print quality and the shorter the print duration.

→ Experiment with the above parameters to find the best printer results for you depending on the material used.

The first print attempts should be done with PLA filament, since it is a material that can be mastered relatively easily and that is subject to fewer problems with shrinkage, accuracy and adhesion on the heating plate.

# 15. Software “Repetier Host”

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## a) General Notes on Software

It is unfortunately not possible to explain the complete function of the enclosed software in the scope of this instruction. For this, we refer to the integrated online help function and the information on [www.repetier.com](http://www.repetier.com).

The basic operation and the path to the first printout are, however, described below so that you can get a result quickly and easily.



**The enclosed SD card holds a custom version of the software that contains the printer settings and configuration files for the RF1000 in the folder “Repetier-Host”. We urgently recommend to install the custom version of the software since then you do not need to configure the software and the required drives are already installed as well.**

**Configuration of the software and driver installation are explained below in the Annex to these instructions for the sake of completeness. However, the software only needs to be configured if you install the basic version of the software from [www.repetier.com](http://www.repetier.com). The configuration files required for this are enclosed on the included SD card in the folder “Slic3r Settings”.**

**If you have already installed a previous basic version of the software, the old version can be uninstalled and the custom version can be newly installed. The slicer settings of the previous version are not deleted and reappear in the custom version.**

The software Repetier-Host performs the following tasks:

- Placement of the 3D-object to be printed on the printing plate.
- Slicing of the object to be printed into thin layers that the 3D printer can print out layer for layer. The result of this process is a G-Code file.
- Review of the G-Code files for error and printability.
- Sending the G-Code files to the printer or saving on an SD card for standalone print.
- Monitoring the 3D printer in operation.
- Setting and storage of printer and filament-specific data.

## b) Installation

- Install the file “setupRepetierHost\_RF1000\_3D\_x\_xx.exe” from the directory “Repetier-Host” from the SD-card (x\_xx designates the software version here).

→ For the installation of the custom version of the software the user has to be registered as an administrator. Otherwise the necessary configuration files and printer settings won't be installed.

- Alternatively, the installation file for the basic version of the software can also be downloaded from [www.repetier.com](http://www.repetier.com). There, MacOS X- and LINUX versions of this software are offered as well.

→ Prerequisites for installing under Windows:

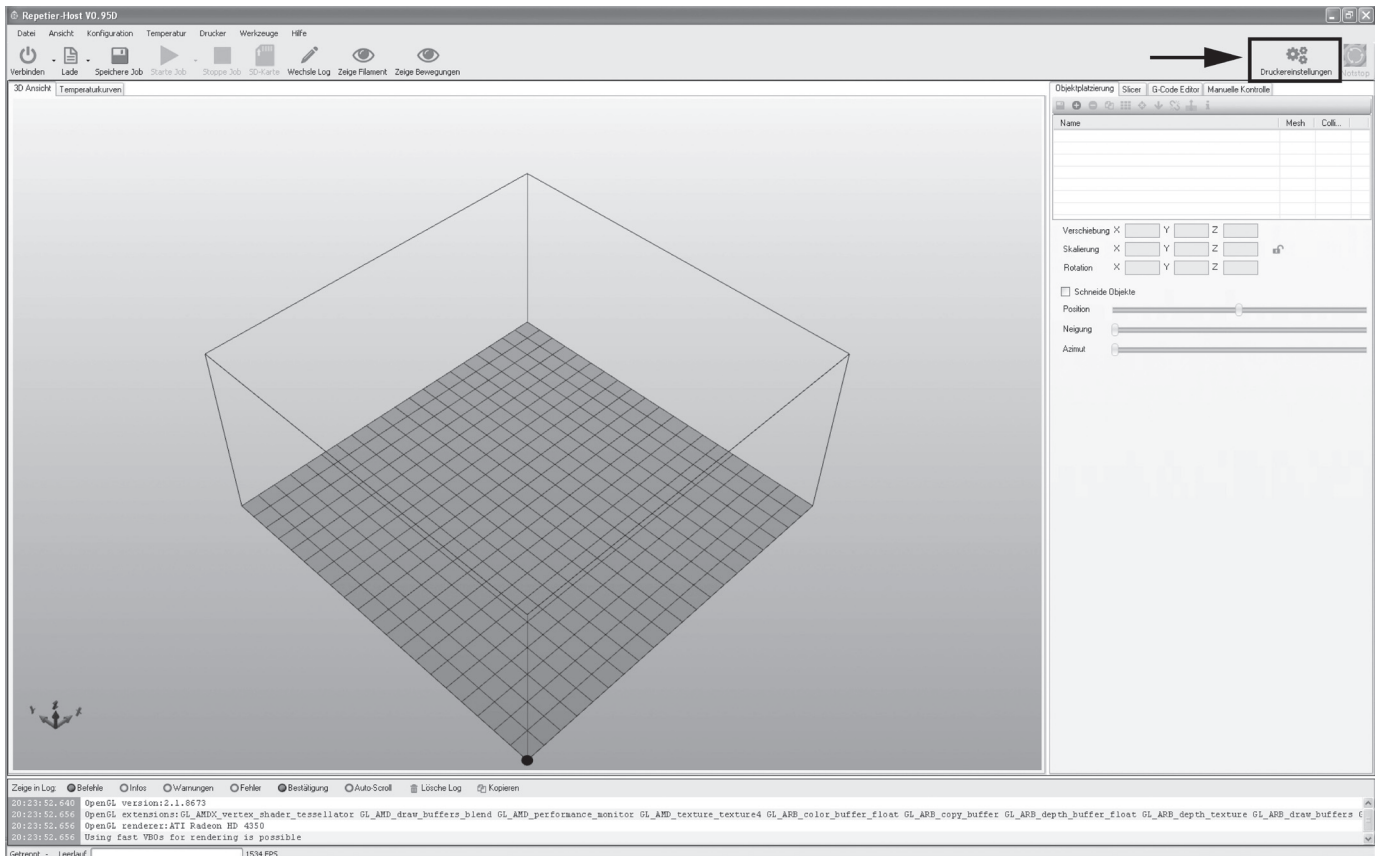
Microsoft .Net Framework 4 must be installed on the computer. This software can be downloaded free of charge from [www.microsoft.com](http://www.microsoft.com).

The further system requirements for installation of Repetier-Host (also for other operating systems) are found on [www.repetier.com](http://www.repetier.com).

Updates for Repetier-Host are regularly published under [www.repetier.com](http://www.repetier.com). Updates of the custom version can be found on [www.conrad.com](http://www.conrad.com) in the download area on the product page of the 3D-printer.

## c) Connection of the Connected Printer

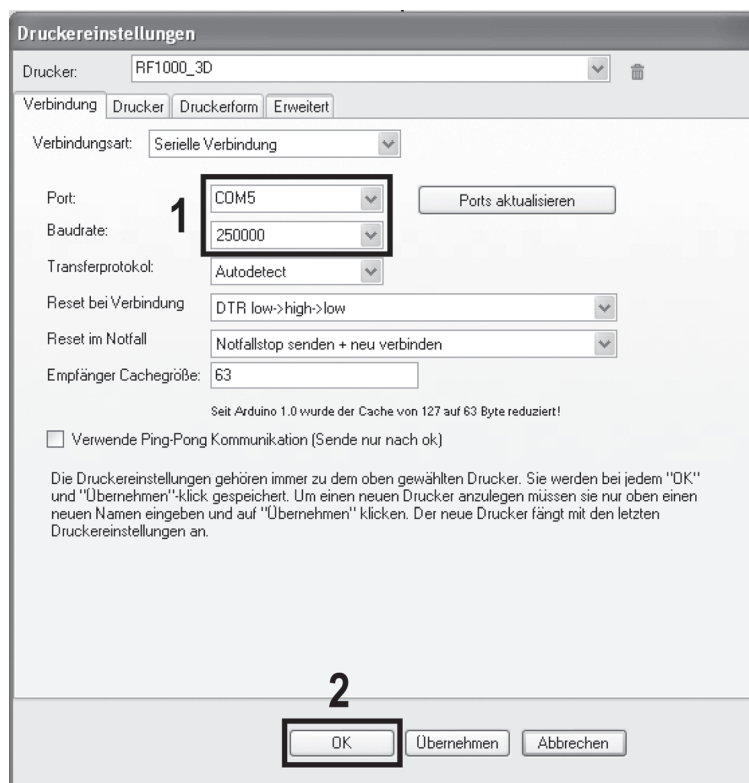
Start the programme Repetier-Host and select printer settings at the upper right in the window.



(1) Set the port and baud rate as displayed.

→ The port number is system-dependent. You can find it in the device manager of the control panel, under connections (COM and LPT).

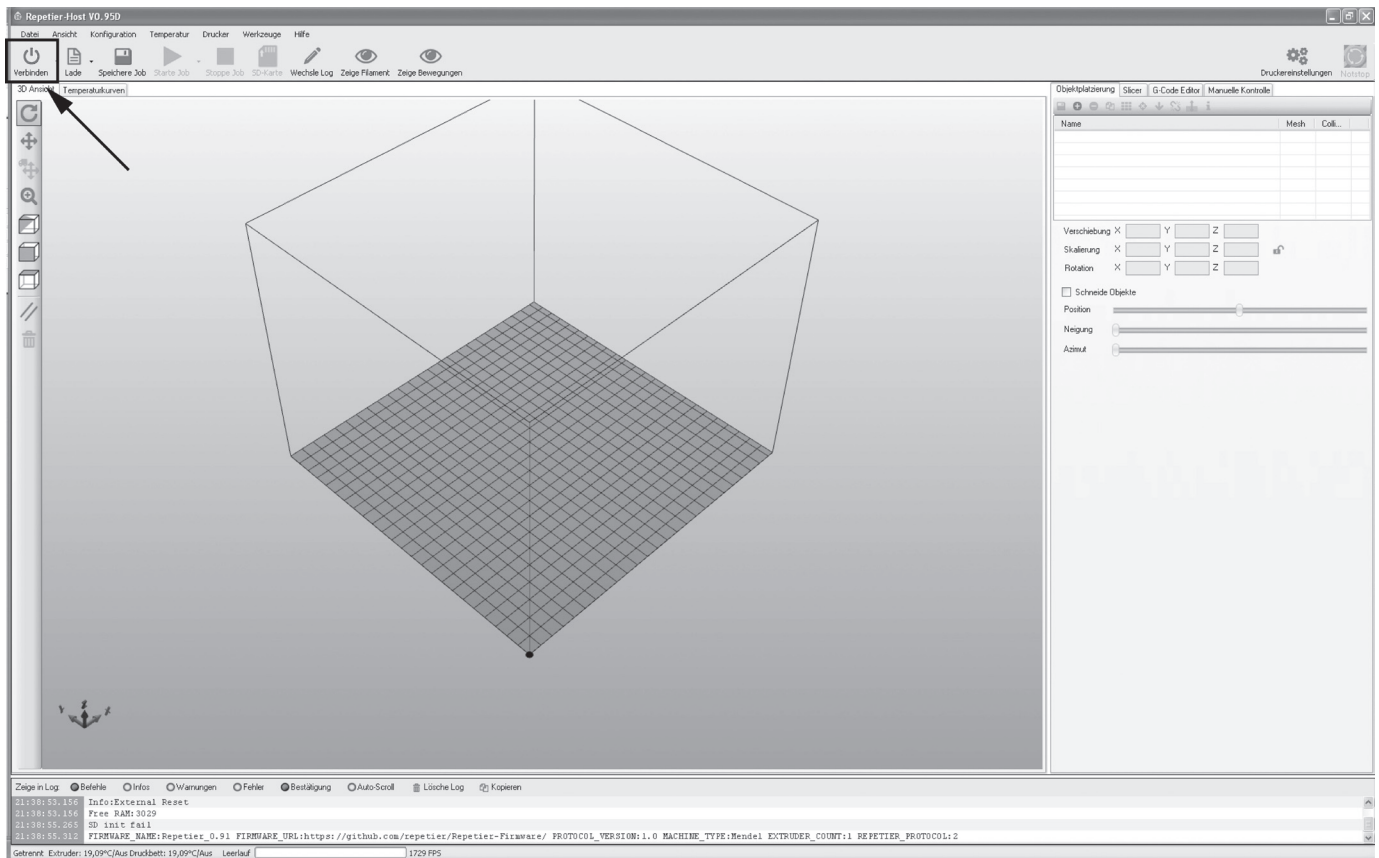
(2) Click "OK".





Click "Connect" in the upper left of the main screen of the software.

After a few seconds, the symbol appears in green and the label turns to "Disconnect".



The printer has successfully been connected to the software and only some manual settings can be tested.

## d) Manual Operation via the Software

Click the tab "Manual Control" on the main screen of the software.



**Before trying out manual printer control, the settings for the limit switches for the Z and Y axes must have been performed (see pages 31 and 54). In the finished device, this has already been performed at production but should be inspected again for reasons of safety.**

**If this is not observed, there may be damage to the 3D printer (loss of warranty/guarantee).**



- (1) Printer moves into the home position
- (2) X-axis moves into the home position
- (3) Y-axis moves into the home position
- (4) Z-axis moves into the home position
- (5) The arrow icons can be used to operate the corresponding axes manually. Depending on where the arrow is clicked, differently long routes are run. The route length is displayed when the mouse pointer is moved across the corresponding button of the arrow.
- (6) Switch off motors to move them manually.
- (7) Printer moves into the parking position.
- (8) Switching the extruder heating on/off, e.g. to heat the extruder before filament change. Below this, the temperature and filament infeed can be operated.
- (9) Switching the heating bed on/off. Below this, the temperature can be set.

## e) Placement of a Printing Object in the Software

Click the “+” symbol on the main screen of the software in the object placement tab.

Select the desired file and click “OK”.

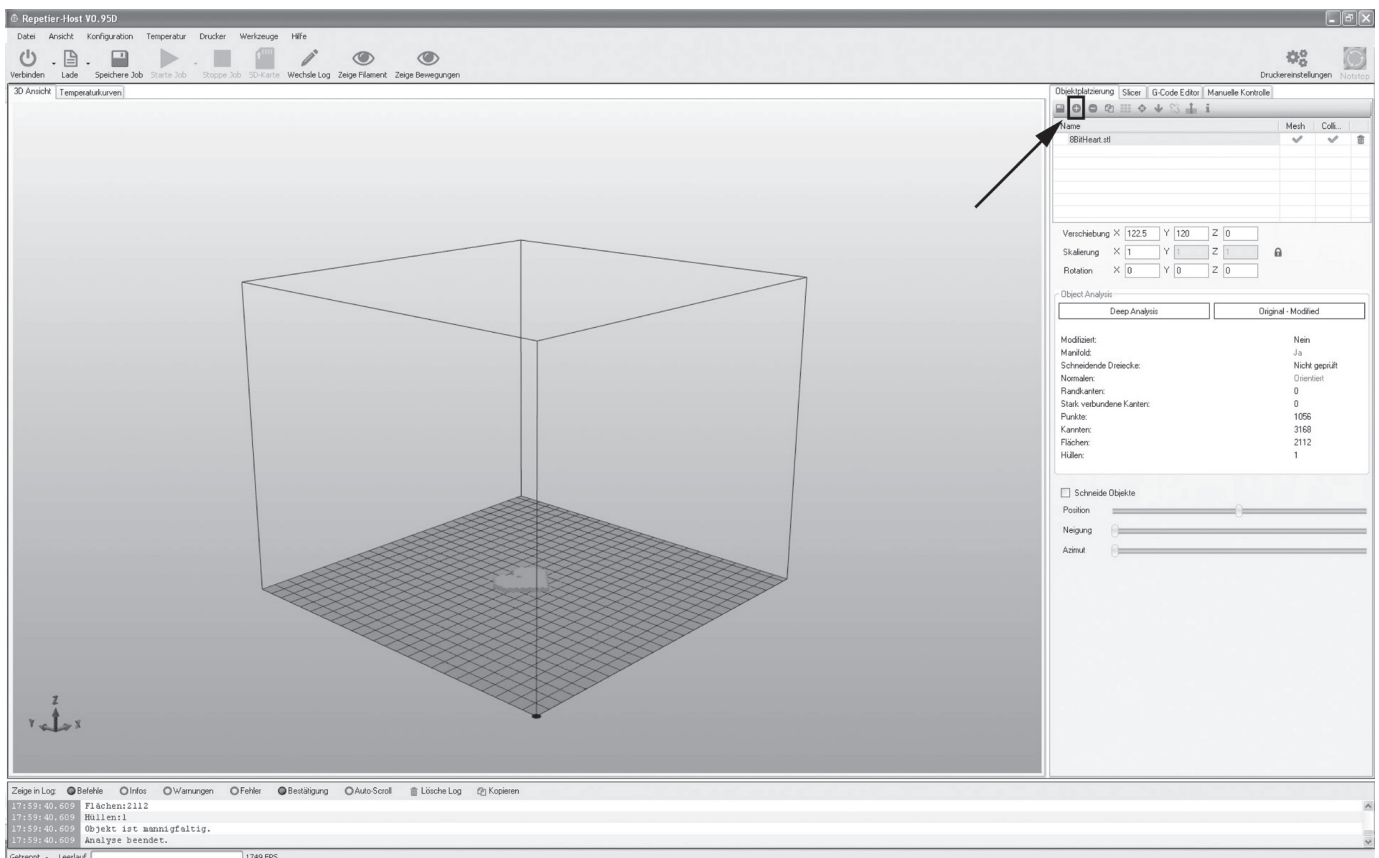
The 3D object “drops” onto the printing plate in the main window.

→ The following file types can be opened with this software:

- \*.stl (STL-files)
- \*.obj (OBJ-files)
- \*.3ds (3D-Studio-files)

In the folder «STL» on the enclosed SD card, you will find a few examples for the first printing attempts. However, there are already many places online where you can download 3D files (e.g. [www.thingiverse.com](http://www.thingiverse.com)).

Alternatively, you can, of course, also use a 3D programme to make your own.

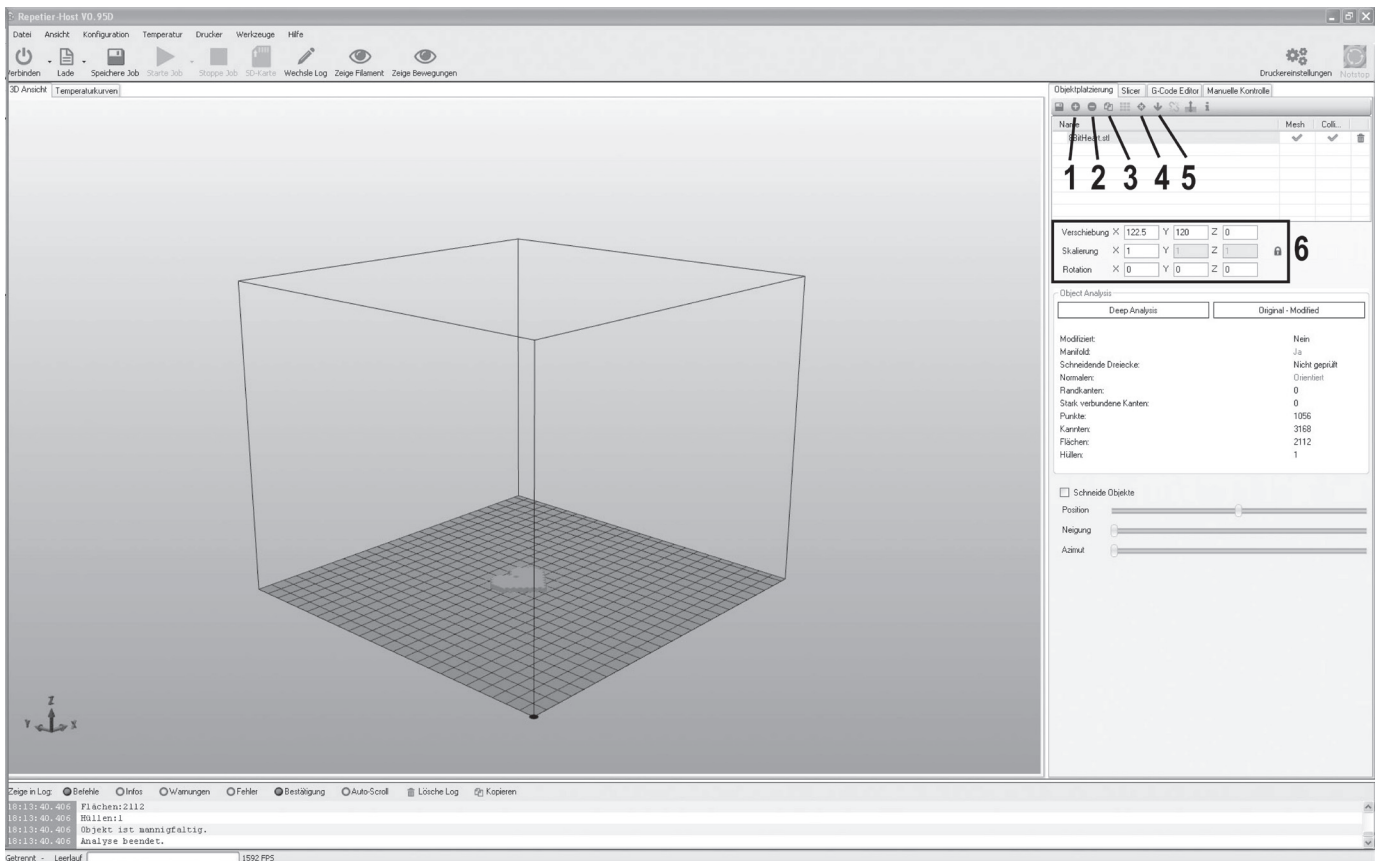




Short description of the most important buttons in the object placement tab:

- (1) Adding objects (as described above)
- (2) Deleting the objects from the printing plate
- (3) Copying objects for multiple printing (in another window, the number of copies can be chosen)
- (4) Centring the object on the printing plate
- (5) "Dropping" again (this button should be pushed again before the further steps to ensure that the object is supported cleanly on the printing plate)
- (6) In the fields below, the object can still be moved, scaled and rotated.

→ Use the scaling function to compensate the size retention of the printed object here as well. If it is known, e.g., that the filament material used shrinks by 2 %, set the scaling to the value 1.02 (this is an approximate reference value). After printout, you can measure the object and adjust scaling again if required.



## f) Preparation for Print

To be able to print the object, it first needs to be sliced into individual printing layers. This process is referred to as “slicing”.

### Slicing of the placed printing object

- (1) Select suitable slicer settings for your print.

The settings are always marked with the following routine:

Printer\_Filament material\_Layer thickness\_Nozzle diameter

Example: RF1000\_ABS300\_100\_05 = RF1000\_3mm ABS\_layer thickness 100 µm (= 0.1 mm)\_nozzle diameter 0.5 mm



**Always use the same settings in the input fields “Print settings”, “Printer settings” and “Filament settings”.**

- (2) Further settings can be made optionally here. However, this should only be done by experienced users. For functions, see the online help function of the software.
- (3) Click “Slice with Slic3r”, to slice the 3D file.

The screenshot shows the Slicer software interface with the following elements:

- Navigation tabs: Objektplatzierung, Slicer, G-Code Editor, Manuelle Kontrolle.
- Large button: **3** ▶ Slice mit Slic3r
- Button: Beende Slicing
- Slicer selection: Slicer: Slic3r (dropdown), Manager (gear icon)
- Configure button (gear icon)
- Print settings (highlighted with a large '1'):
  - Druckeinstellung: RF1000\_ABS300\_100\_05 (dropdown)
  - Druckereinstellung: RF1000\_ABS300\_100\_05 (dropdown)
  - Filament settings:**
  - Extruder 1: RF1000\_ABS300\_100\_05 (dropdown)
  - Extruder 2: RF1000\_ABS (dropdown)
  - Extruder 3: RF1000\_ABS (dropdown)
- Advanced settings (highlighted with a large '2'):
  - Überschreibe Slic3r Einstellungen
  - Kopiere zu überschreibende Druckereinstellungen (button)
  - Aktiviere Support
  - Aktiviere Kühlung
  - Layer Höhe: 0.3 mm (input field)
  - Füllichte: 50% (slider)
  - Winkel Füllung: 45° (slider)
  - Füllmuster: rectilinear (dropdown)
  - Ausgefülltes Füllmuster: rectilinear (dropdown)
- Footer text: Slic3r ist ein eigenständiges, externes Programm, welches auch unabhängig gestartet werden kann. Für weitere Informationen zu diesem Programm besuchen Sie folgende Webseite: <http://www.slic3r.org>

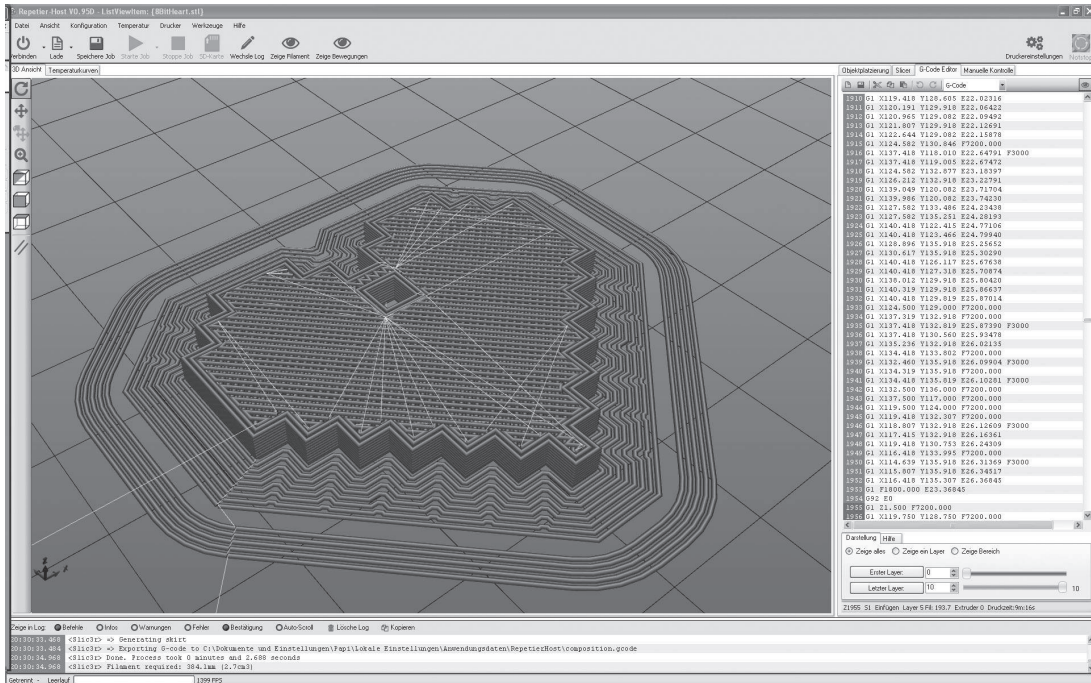
The finished printing file appears in the graphics window after calculation.

To the right of it, the G-code (layer description) appears, and below a control with which the layer view can be influenced.

This layer view serves to check for errors before printing.

In the very left of the screen, there is a tool bar that serves view control.

→ For more detailed descriptions of the functions, see the online help function of the software.

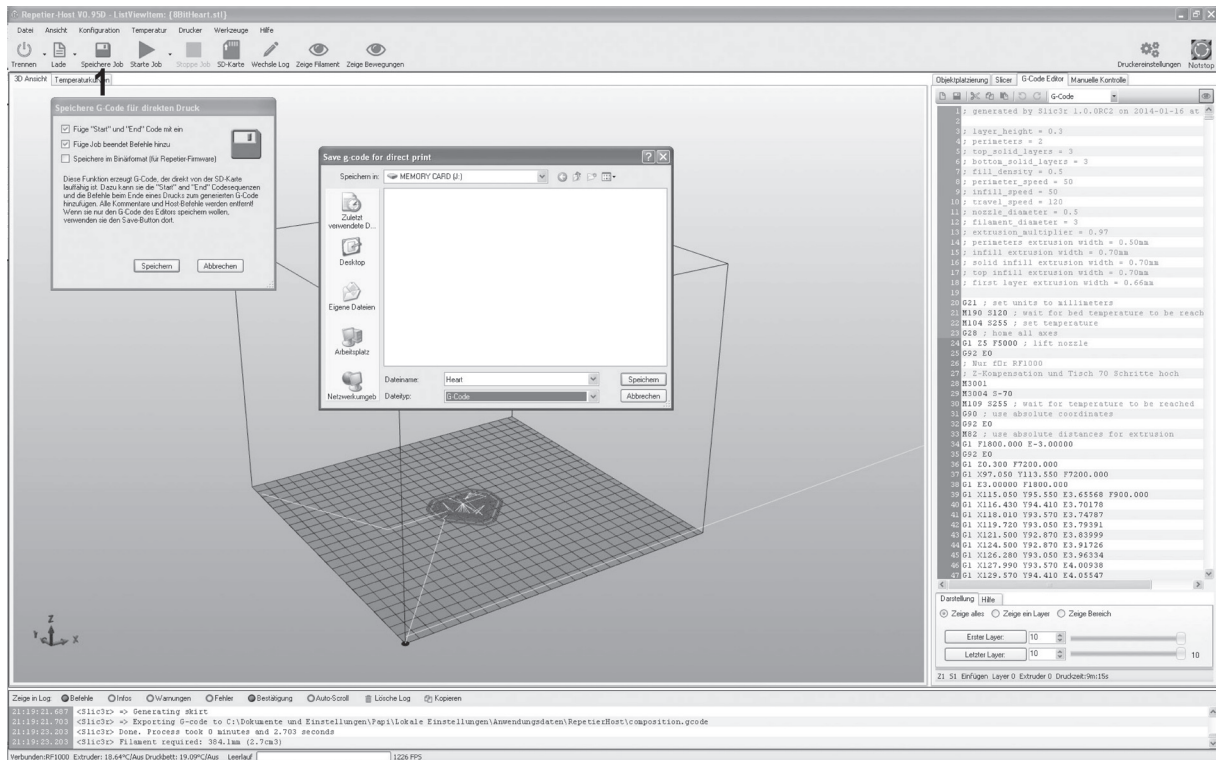




## g) Printing

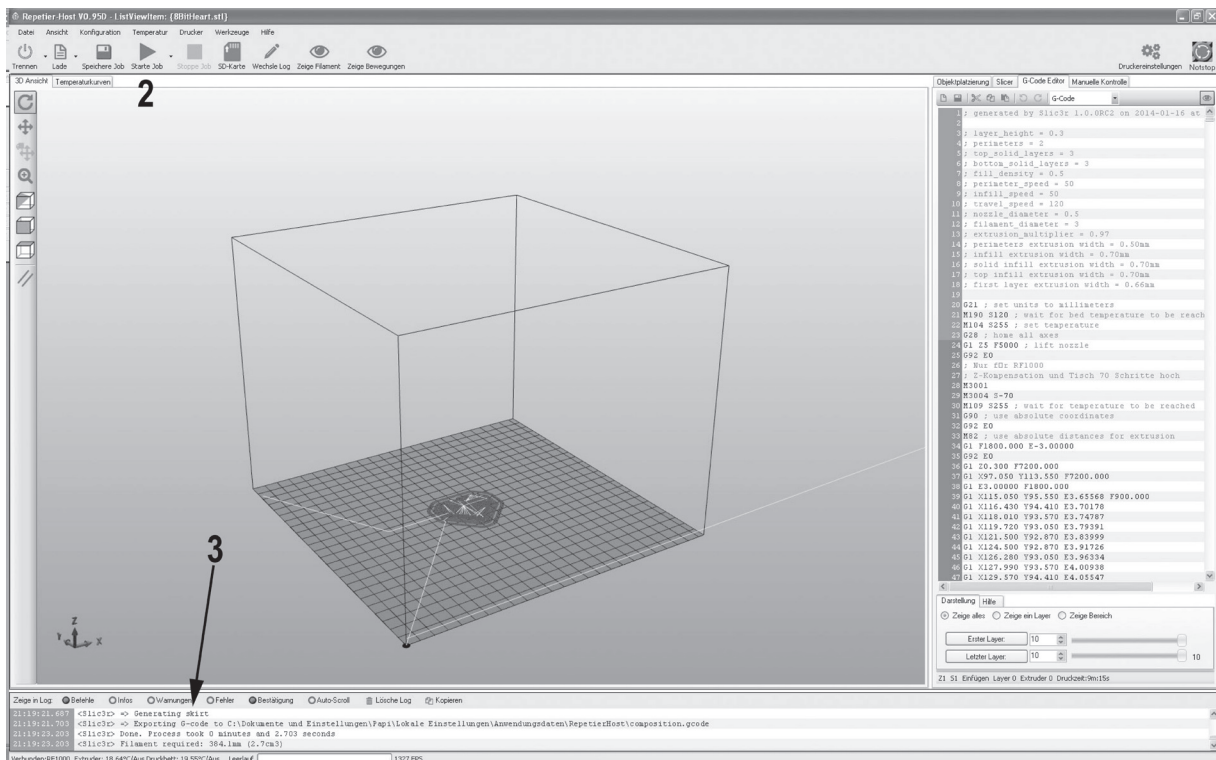
The printing file produced in this manner can be printed now. There are two options for this:

- (1) Click "Save Job" to save the print file on an SD card and then print it out stand-alone.

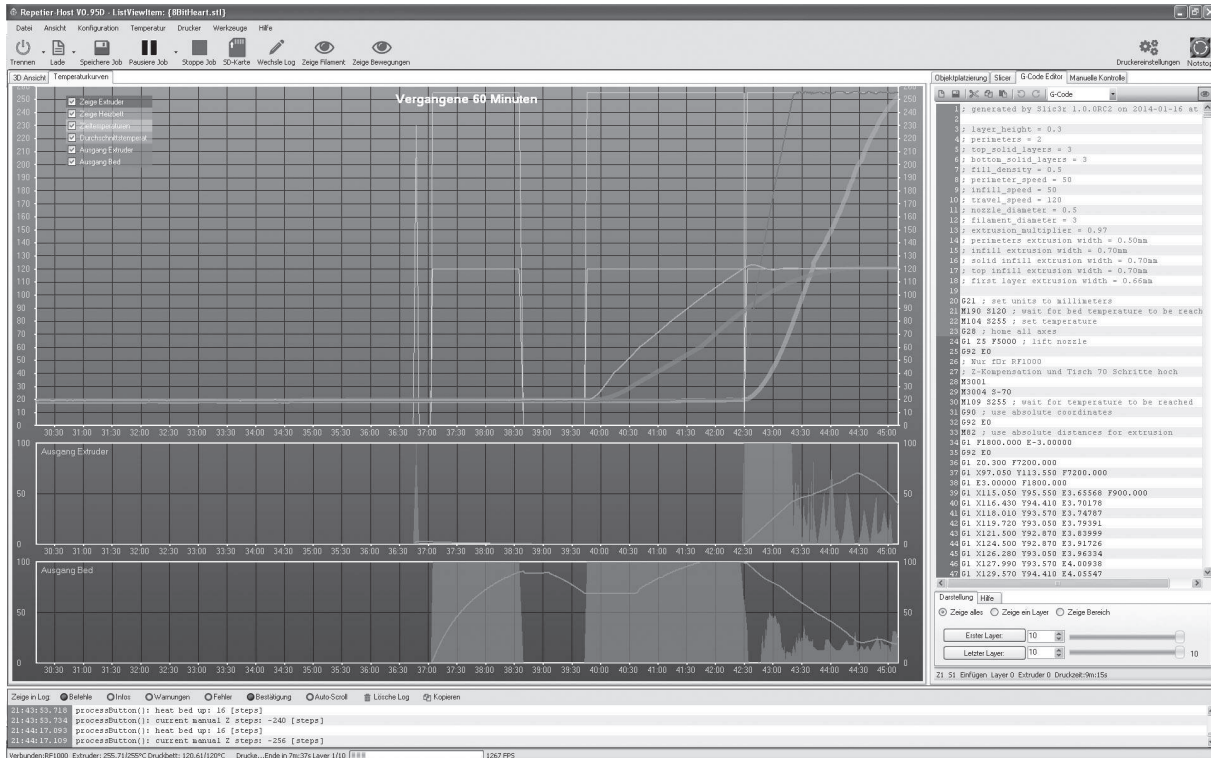


- (2) You can also click "Start job" to send the file directly to the connected 3D printer via the USB interface of the computer and print it.

Here, the log window (3) below the image shows current information on software, slicer and printer during printing.



The graphics window may be switched to display temperature curves. There, the temperatures and their course are graphically displayed in a chart.



During the first centimetres of printing, the distance between the heating plate and extruder can be manually adjusted with the buttons for heating plate movement (3).

It should be approx. 0.2 mm (corresponds to about twice the paper thickness of regular 80g/m<sup>2</sup> printer paper).



**For this setting, observe that the extruder must not touch the heating plate since it may be damaged otherwise.**



The distance between the extruder and heating plate is later set precisely with the software but the manual setting is sufficient for the first print.

If no filament escapes from the extruder at first, the filament infeed button (4) must be pushed until filament escapes.



At PLA printing of small objects with a small footprint, it is recommended to apply the heating plate with cleaning tape or a slightly structured crepe tape before printing. Spraying the heating plate with hair spray can be helpful here as well. These measures increase adhesion of the printed object on the heating plate.

Let the printed object cool off for a few minutes after printing. When the temperature of the heating plate is below 40 °C (see display), the printed object comes free from the heating plate and you can remove it.

If the printed object does not come loose easily, you can loosen it carefully with a painter's spatula, knife, etc.



**Do not apply any mechanical force on the heating plate. Danger of heating plate breakage!**

## h) More Detailed Description of the Slicer Functions



Below some settings of the slicer are explained that are only to be changed by experienced users. The use of wrong settings can result in damage to the 3D printer or defective printouts.

Beginners should first work with the basic settings that are integrated in the custom version in any case.



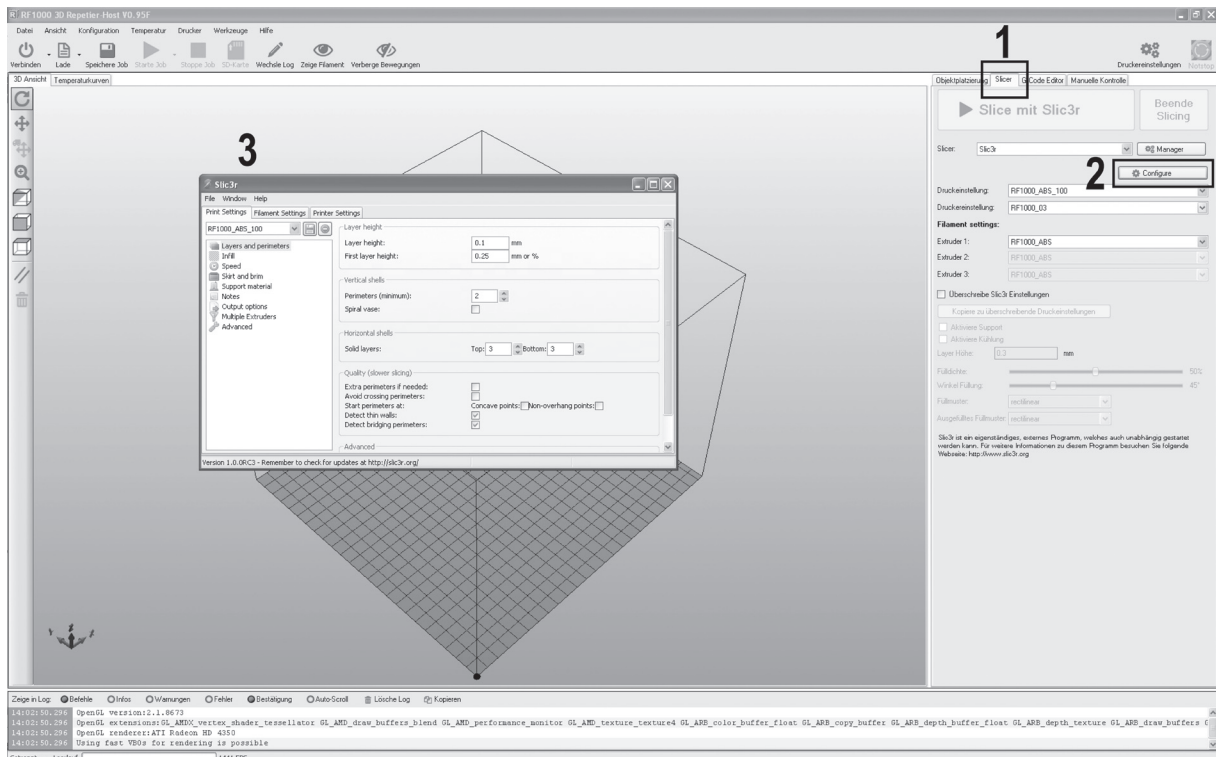
If you make any changes to the settings, these must be saved in the configuration settings by clicking the disc icon.

Save the different settings as a configuration setting. Assign unique names for the different configuration settings so that you can assign them uniquely to the different filament types, print resolutions, etc. later.

For more information, read the integrated online help function.

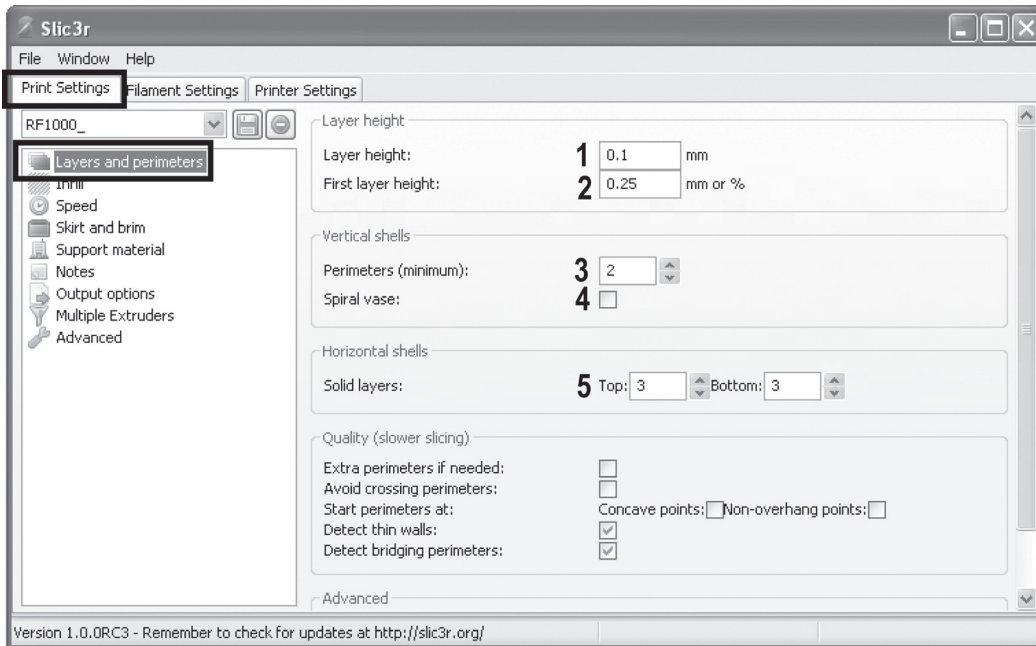
Click the software in the tab "Slicer" (1) to Configure (2) in the right window.

The window of the slicer (3) is opened.

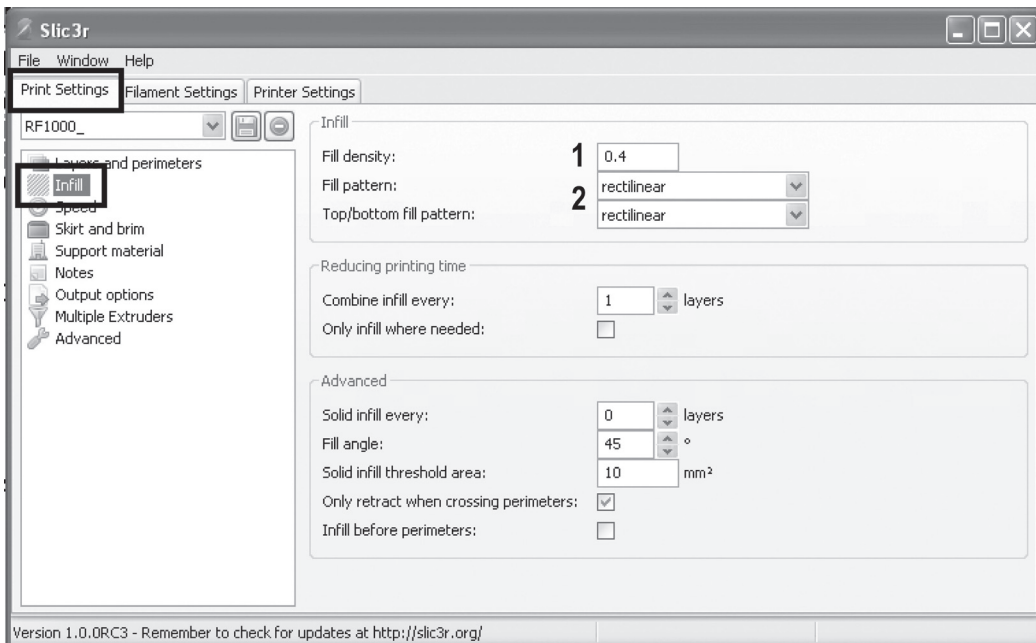




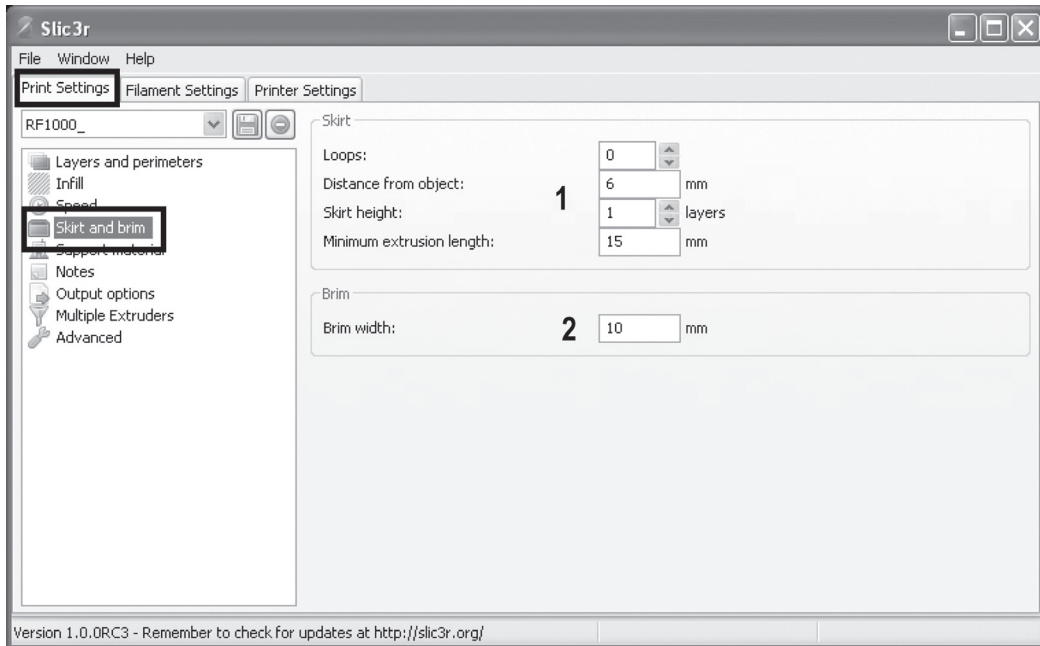
## Print Settings



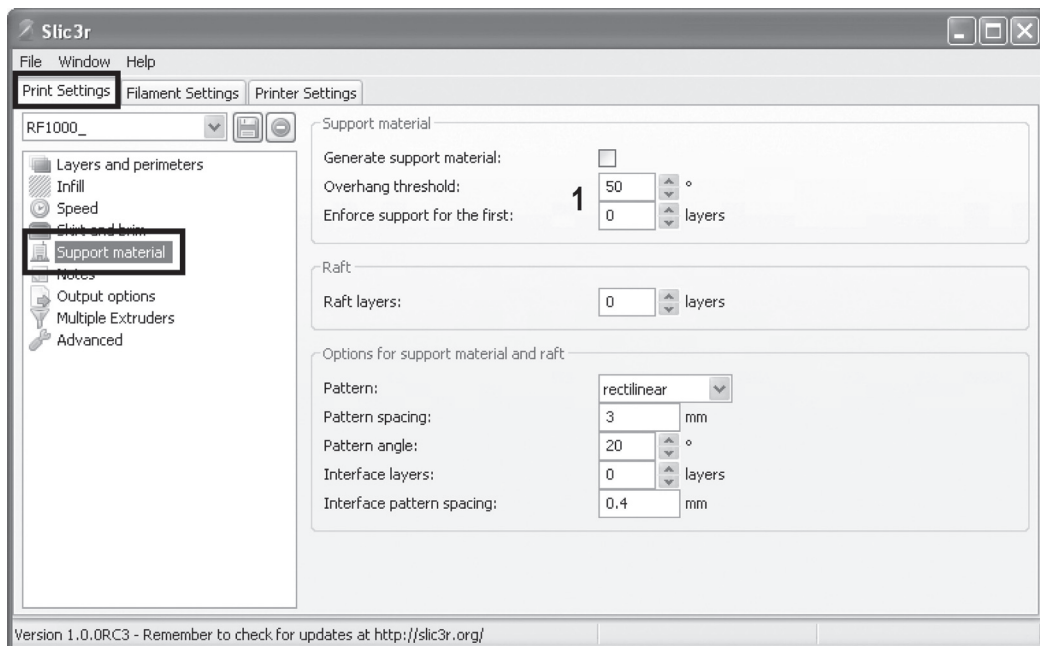
- (1) Layer height (accuracy/resolution of the print object)
- (2) Layer height of the first layer (influences the adjustment and adhesion on the printing plate; set the first layer a little thicker than the following layers)
- (3) Number of outer wall layers
- (4) Activate for hollow bodies (e.g. vases)
- (5) Filled layer number top/bottom



- (1) Object filling (0-1 = 0-100%)
- (2) Filling pattern of the object and the first and last layer

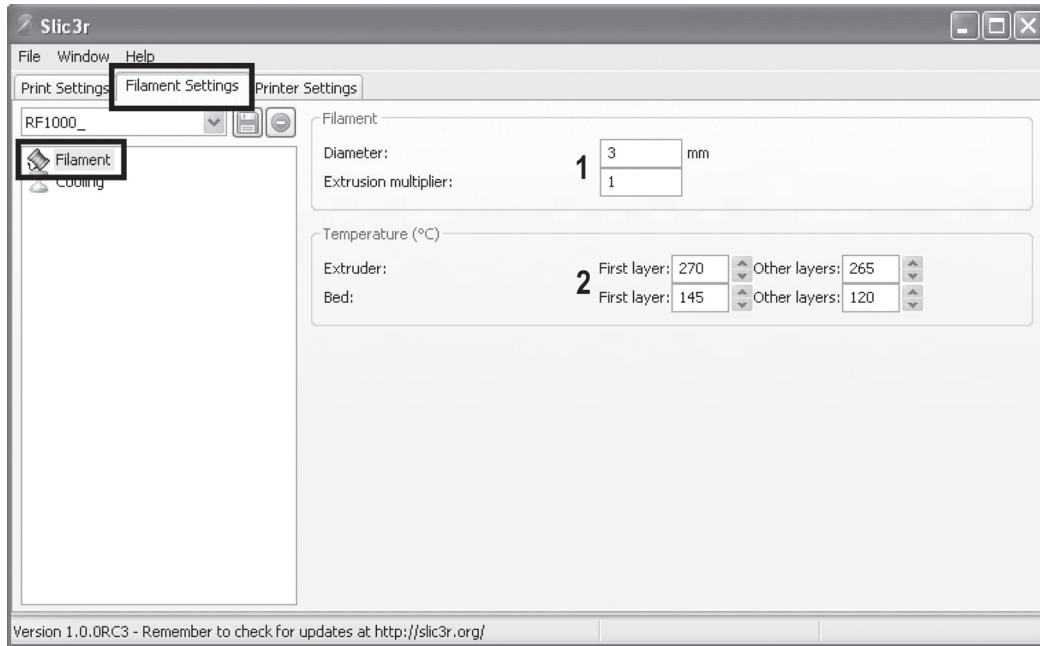


- (1) Loops are circles, that are drawn around the object when printing starts, stabilise the filament flow before the actual object is printed. Here, number, distance from the object, height and minimum length are specified.
- (2) Brim is a thin edge that is placed right around the object to increase the footprint and thus adhesion to the printing plate. Here, the width of the brim is specified.



- (1) Selection and adjustment of the supporting material that is needed when printing complex objects such as bridges or hollow spaces (poss. required for printing object with overhangs  $> 45^\circ$ ).
- The first printing attempts should be without a supporting brim since the result here is usually better again.

## Filament Settings

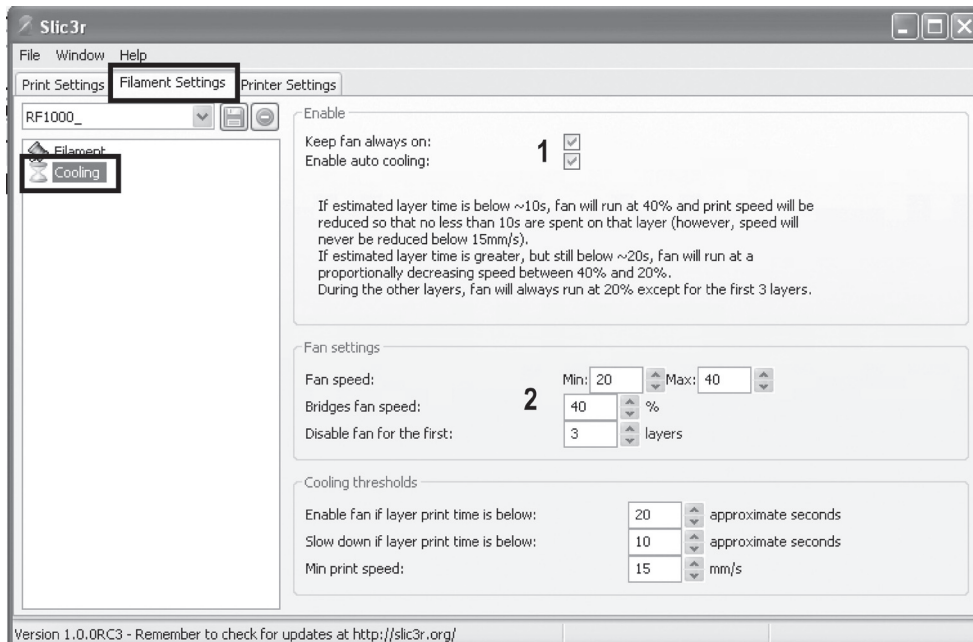


(1) Filament diameter and filament diameter tolerances according to the manufacturer specification are set here. If no manufacturer's specification is present, these values can also be measured with a calliper (measure 1 m of filament material in 10 different points and then set the average here).

(2) Temperature settings for extruder and heating bed separated by first and all other layers.

→ Observe the settings recommended by the filament manufacturer!

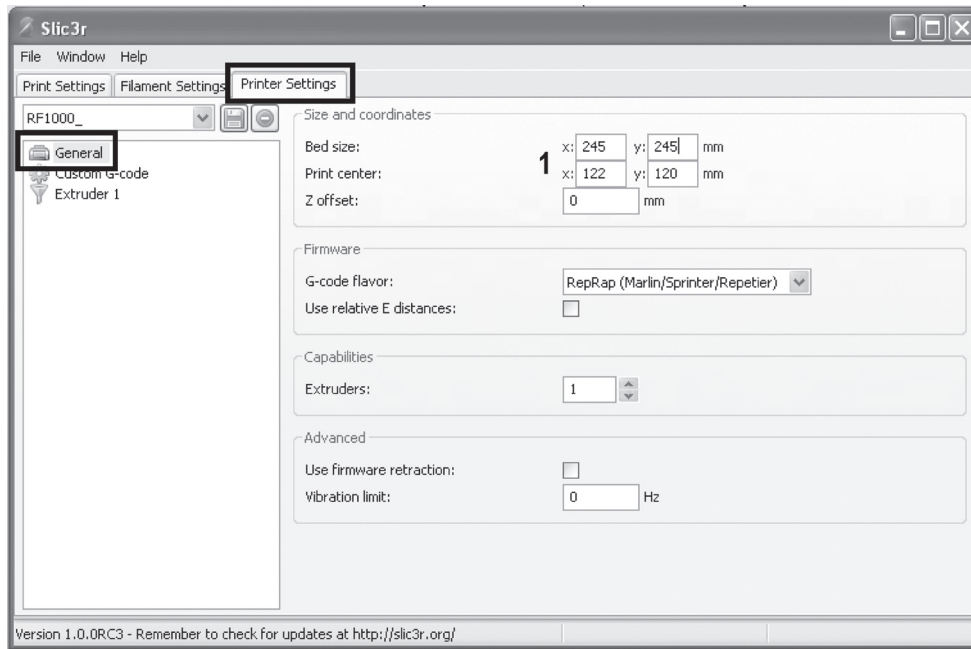
Since the best values may fluctuate extremely depending on the filament manufacturer, perform your own tests based on the pre-settings to achieve the best printing quality. When performing the tests, proceed in 5 °C steps and compare the results during or after printing with other settings. The first layer should always be printed a little more hotly for better adhesion on the heating plate.



(1) Here you can choose between automatic cooling and permanent operation of the fan at the extruder.

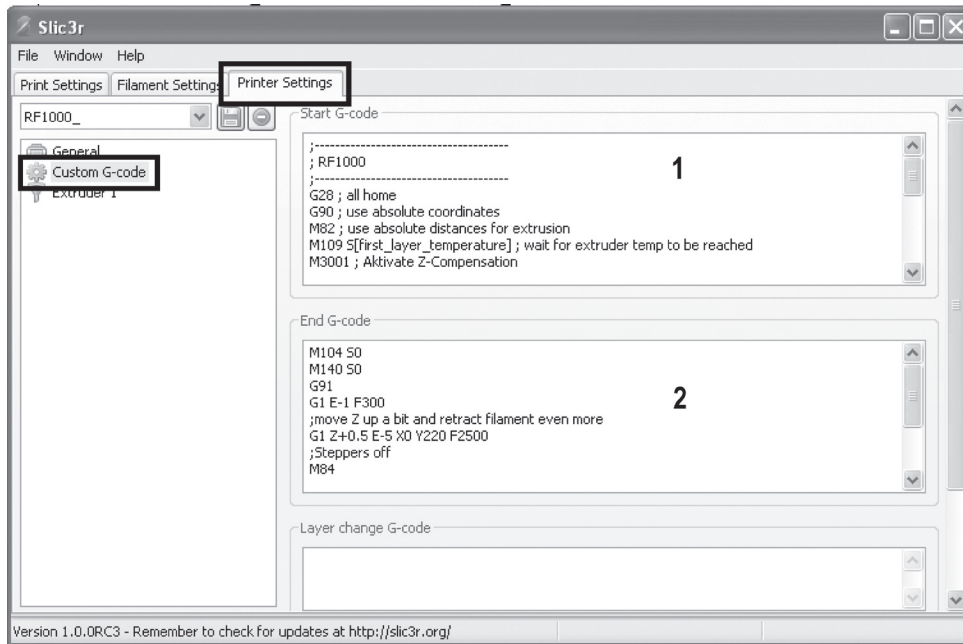
(2) Setting of the fan speed.

## Printer Settings



(1) Geometric data of the heating plate





- (1) The starting code contains the first commands that the 3D printer performs. Here, e.g. a Z-compensation can be started.

The Z compensation is unnecessary if the distance between the extruder nozzle and heating plate is set manually with the buttons of the operating fields (as described before when starting a printing process).

Procedure for determination of the correct command:

Move the printer to the home position.

Switch off the motors and return to the main menu display.

Move the extruder and the heating plate so that the extruder is placed centrally above the heating plate.

Place a normal, singly folded printer paper (80 g/m<sup>2</sup>) between the extruder and heating plate.

Move the heating plate with the buttons for the heating plate movement up until the paper can just be moved. A distance of approx. 0.2 mm is set here.



**Do not move the heating plate up too far. Danger of breaking the heating plate!**

Read the printing plate offset from the home position in the display (Z value in the second display line).

Convert the offset read to motor steps according to the following formula:

$642 \times \text{distance value} = \text{number of steps to be set}$

Example: Your measured -0.27 mm  $\gg 642 \times (-0.27) = -173.34$  steps (also about -173 steps)

This means that the starting code must be moved up by 173 steps (- => up / + => down)

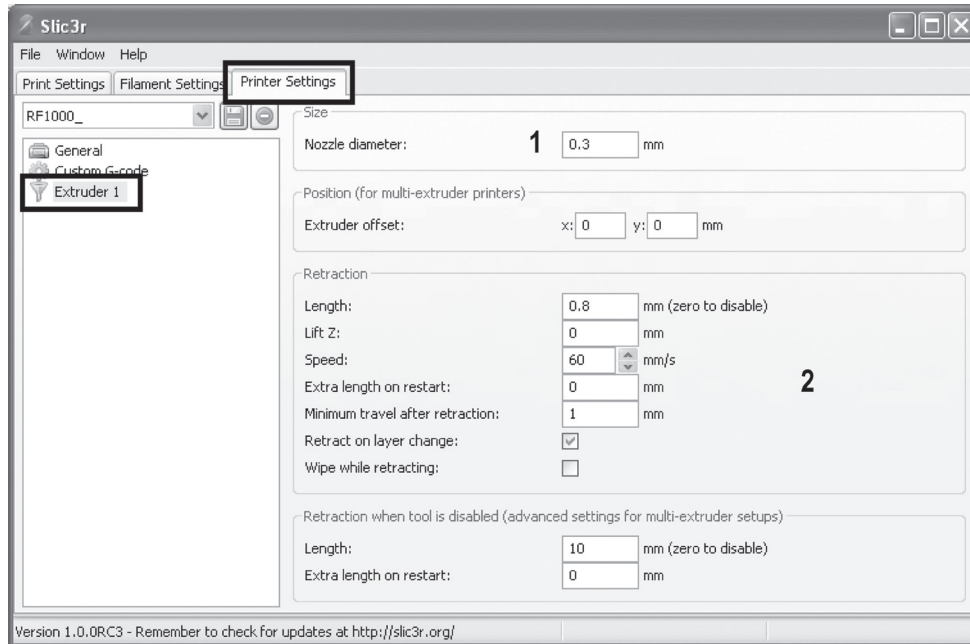
The Z-compensation command then would be:

M3000

M3004 S-173 (-173 is the number of the determined steps for the Z-motor)

- (2) The end code will be performed at the end of the print and could contain, e.g. the run into a removal position for the printed object.

→ Detailed information on the G-Codes can be found, e.g., in <http://reprap.org/wiki/G-code>



- (1) Setting of the nozzle diameter
- (2) Settings for the filament withdrawal if the extruder moves to another position of the printed object during printing. If the filament was not withdrawn here, there would be drop or string formation that would negatively influence printing quality.

## 16. Software "Cura"

### a) General Notes on Software

It is unfortunately not possible to explain the complete function of the "Cura" software in the scope of this instruction. We refer to the instructions and the forum under [www.ultimaker.com](http://www.ultimaker.com).

The basic operation and the path to the first printout are, however, described below to that you can get a result quickly and easily.

To further facilitate this, we have collected some printer and material-specific configuration files for the software that are enclosed on the included SD card.

Cura is another high-performance software solution for 3D printing that is easy to operate even for beginners.

### b) Installation

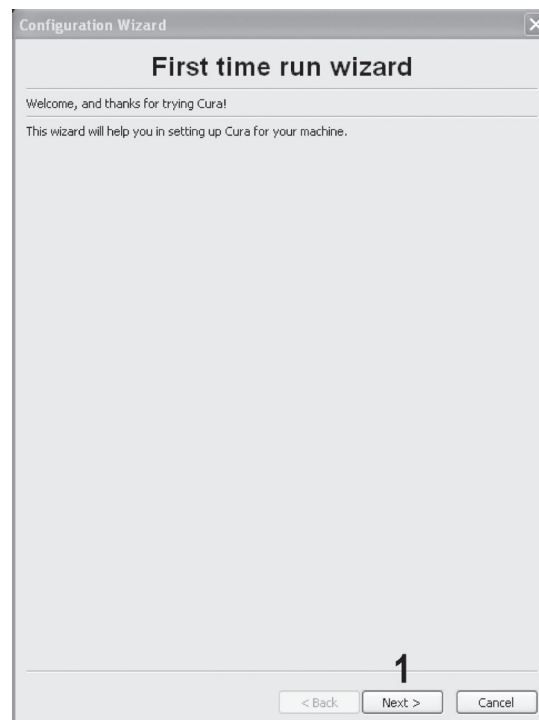
- Download the software from [www.ultimaker.com](http://www.ultimaker.com).
- Install the setup file that you have downloaded.
- If during installation the operating system shows a message according to which the driver has not passed the Windows logo test, choose "Continue installation".

## c) Setup of the Software

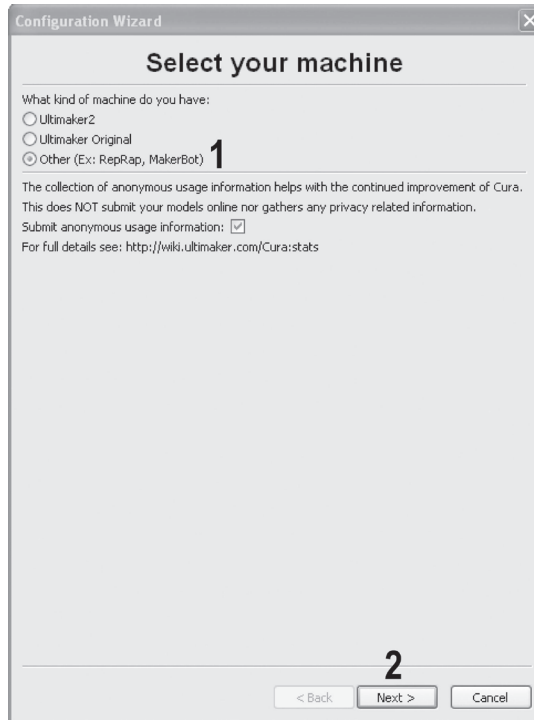
- Connect the 3D printer to a free USB interface of the computer and switch it on.
- If the printer has not been connected to the computer before, the operating system recognises new hardware and is looking for the corresponding driver.
- Select manual driver selection and enter the directory.  
→ The printer driver is in a subdirectory of the directory “Arduino” on the enclosed SD card (just open the folders and subfolders in the “Arduino” directory until the directory “drivers” is displayed).
- If during installation the operating system shows a message according to which the driver has not passed the Windows logo test, choose “Continue installation”.
- Start the software.

The “Configuration Wizard”, which will guide you through the setup process of the 3D printer, appears:

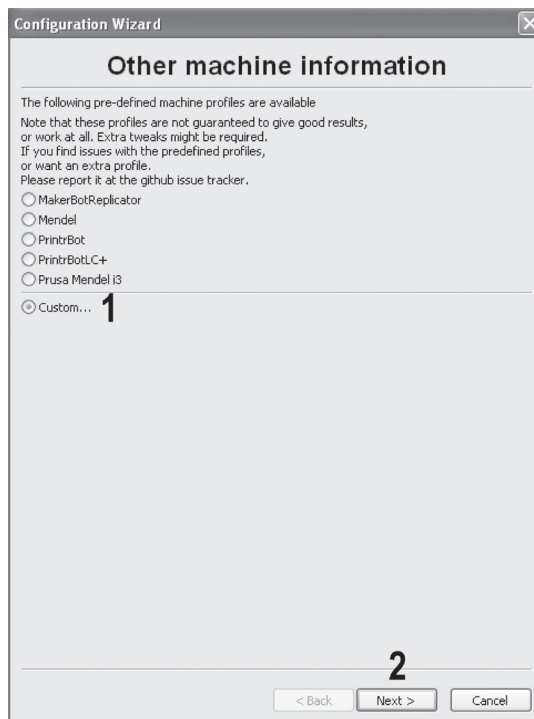
(1) Click “Next”.



- (1) Select "Other" in the next window.
- (2) Confirm the selection with "Next"

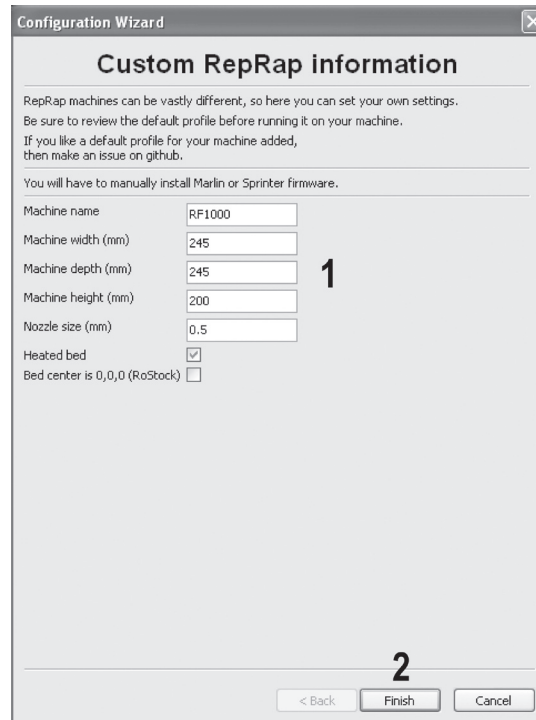


- (1) Select "Custom..." in the next window.
- (2) Confirm the selection with "Next"



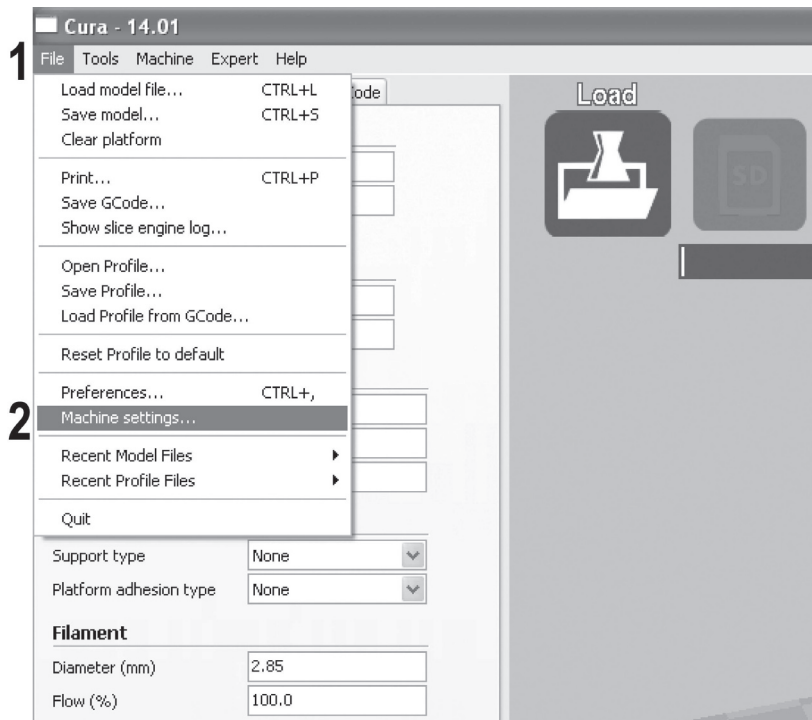


- (1) Enter the values shown in the figure in the field on the following screen.
- (2) Click "Finish" to complete the wizard.



The software starts and there is already an object on the printing area.

- (1) Click "File"
- (2) Select "Machine settings"

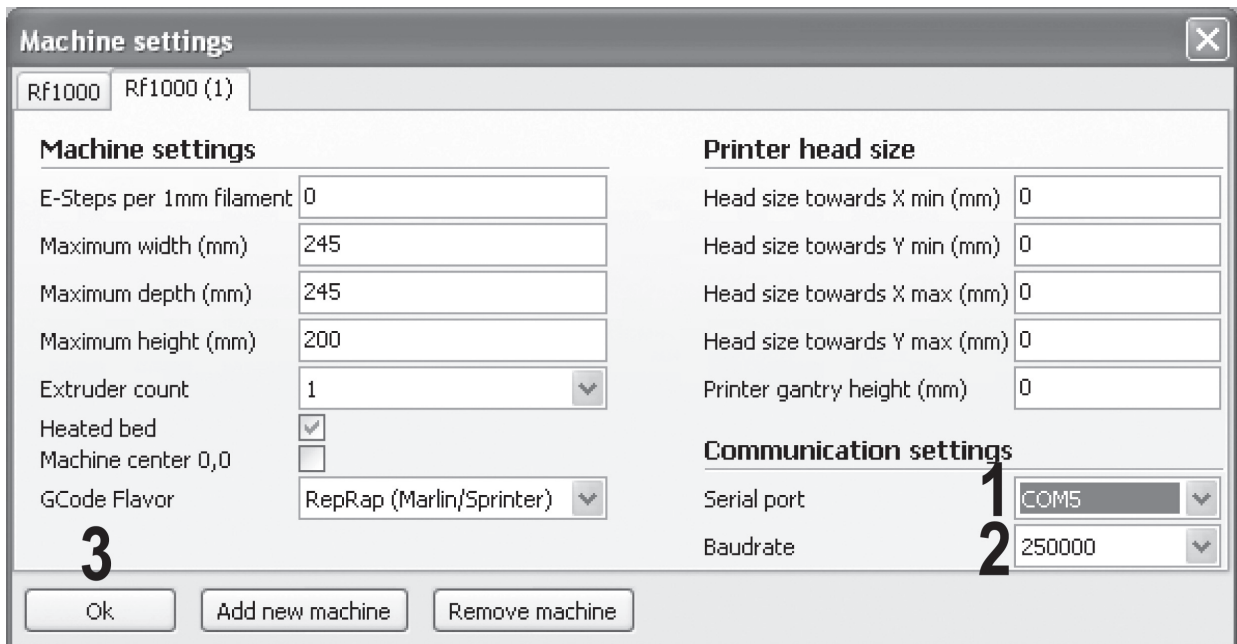


(1) Select the serial port to which your printer is connected.

→ The port number is system-dependent. You can find it in the device manager of the control panel, under connections (COM and LPT).

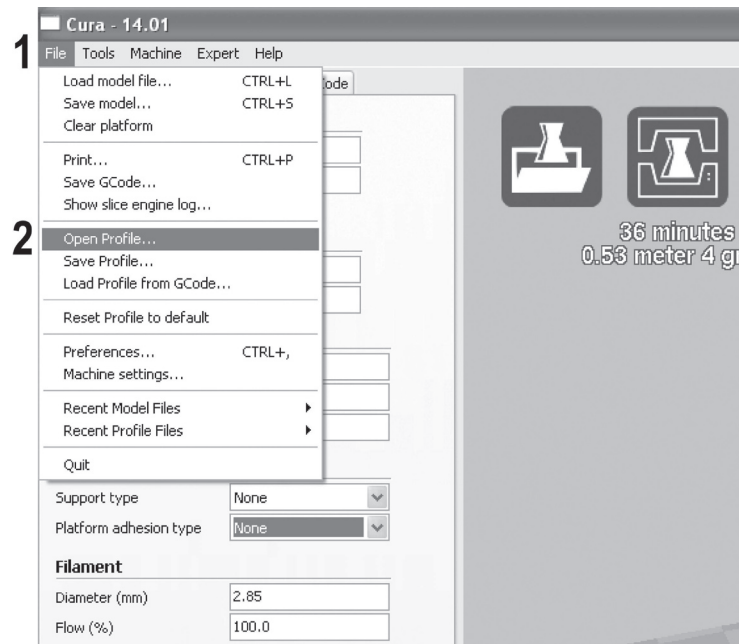
(2) Set the baud rate as shown.

(3) Click "OK" to save the changes.



(1) Click "File".

(2) Select "Open Profile".

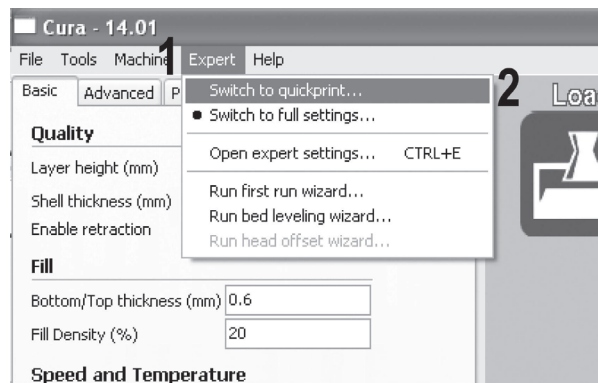


Select a filament configuration file for the filament used by you in the selection window and confirm your selection.

→ You can find the configuration file "Settings.ini" on the enclosed SD card in the folder "Cura". Alternatively, you can skip this step. The software then uses its own basic settings that are sufficient for the first print.

## d) Use of the Software in the Quickprint Mode

- (1) Click "Expert".
- (2) Select "Switch to quick print..."



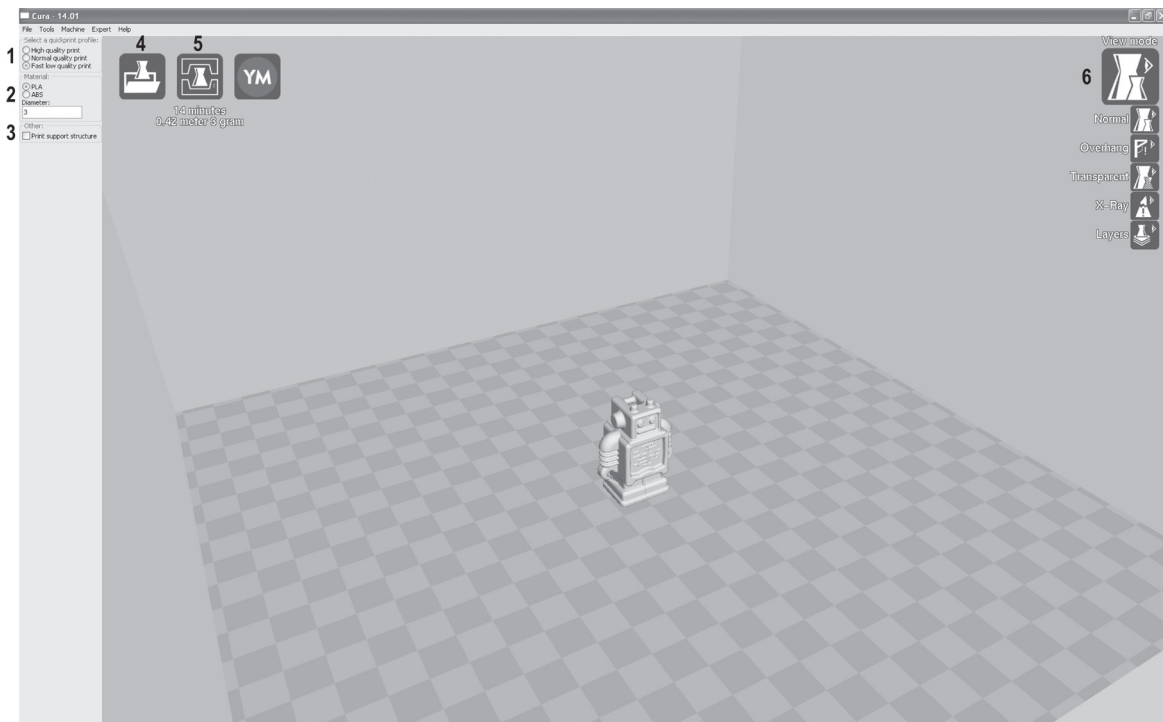
The software interface is now simplified and only very few settings need to be made before printing.

This surface is ideal for producing the first test prints and familiarising yourself with the software settings and the resulting changes.

→ In Quickprint mode, start and end G-Codes or Z-calibration are not supported. These settings are, however available in expert mode (for more information, see the instructions and the forum under [www.ultimaker.com](http://www.ultimaker.com)).

Try printing the object already on the software printing plate with different settings and inspect the different results.

Find some information on the possible settings enclosed:

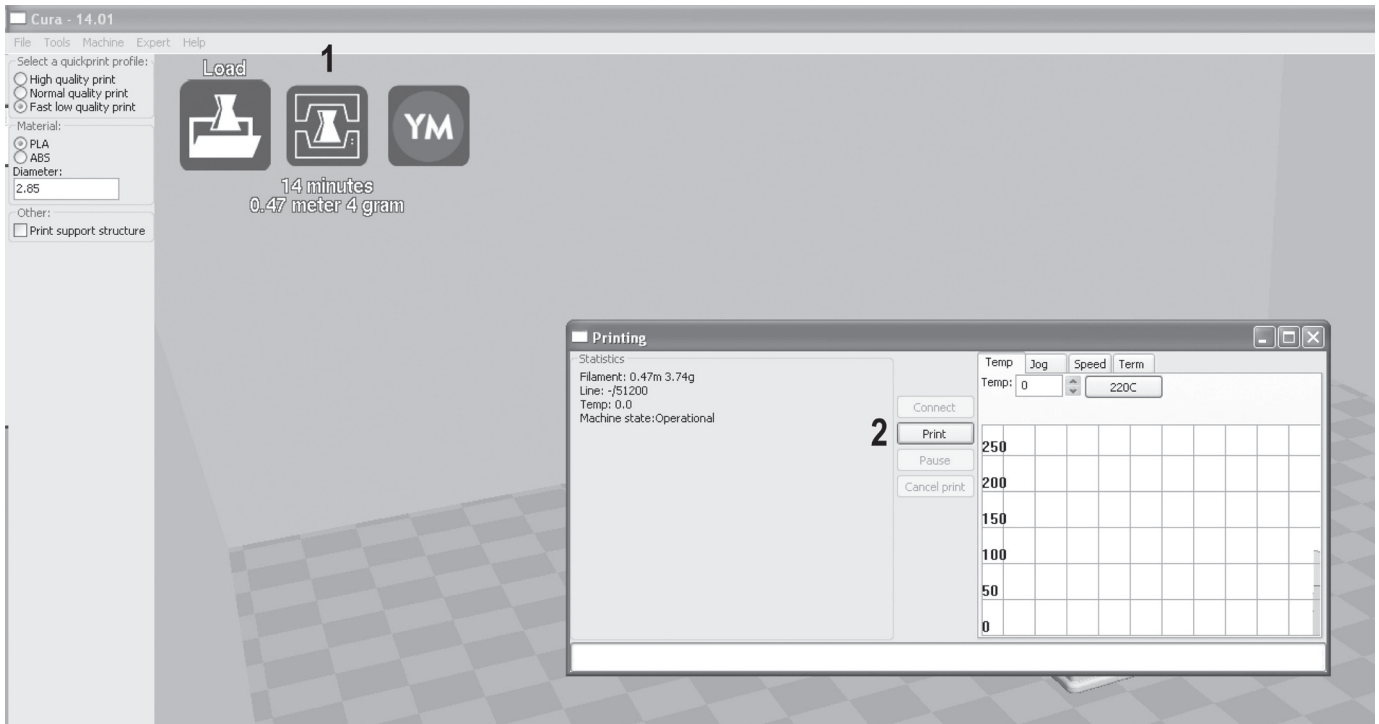


- (1) Selection of the printing quality (the higher, the slower the print)
- (2) Selection of the filament material and filament diameter
- (3) With the field activated, supporting structures are printed as well (required when printing out with overhangs, e.g. for bridges)
- (4) Loading 3D files to be printed
- (5) Start the printing process
- (6) Selection of view options

## Starting print

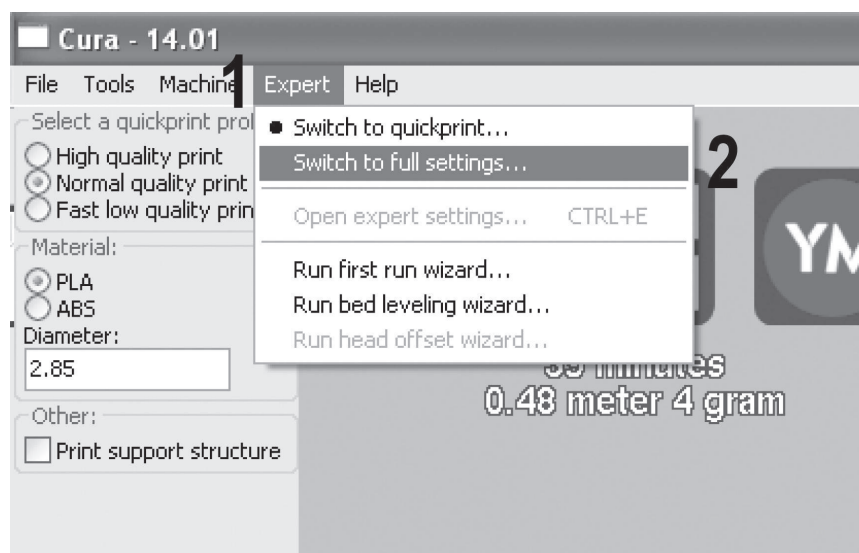
→ At PLA printing of small objects with a small footprint, it is recommended to apply the heating plate with cleaning tape or a slightly structured crepe tape before printing. This increases adhesion of the printed object on the base plate.

- (1) Click the symbol for "Print".
- (2) In the next window, click "Print".



## e) Use of the Software in Expert Mode

- (1) Click "Expert".
- (2) Select "Switch to full settings..."



The software interface now has a lot more setting options.

→ This mode should only be used by users with experience or advanced knowledge of 3D printing.



Find some information on the possible settings enclosed:

The image shows the Cura 14.01 software interface. On the left, the 'Basic' settings panel is visible, with various settings grouped into sections: Quality, Fill, Speed and Temperature, Support, and Filament. Each setting is accompanied by a numerical label from 1 to 11. On the right, a summary panel displays three icons (a printer, a printer with a part, and a 'YM' logo) and the following statistics: 36 minutes, 0.53 meter, and 4 gram.

Section	Setting	Value	Label
Quality	Layer height (mm)	0.1	1
	Shell thickness (mm)	1.0	2
	Enable retraction	<input checked="" type="checkbox"/>	
Fill	Bottom/Top thickness (mm)	0.6	3
	Fill Density (%)	20	4
Speed and Temperature	Print speed (mm/s)	50	5
	Printing temperature (C)	220	6
	Bed temperature (C)	70	7
Support	Support type	None	8
	Platform adhesion type	None	9
Filament	Diameter (mm)	2.85	10
	Flow (%)	100.0	11

Summary Panel:  
36 minutes  
0.53 meter 4 gram

- (1) Thickness of the printing layers
- (2) Strength of the outer hull of the printing object
- (3) Thickness of the bottom and lid filling of the print object
- (4) Density of the filling
- (5) Printing speed
- (6) Extruder temperature
- (7) Heating bed temperature
- (8) Selection of different supporting structures when printing bridges, etc.
- (9) Selection of additionally printed structures around the object to prevent coming loose from the heating bed, raising of edges, etc.
- (10) Filament diameter
- (11) Material flow quantity

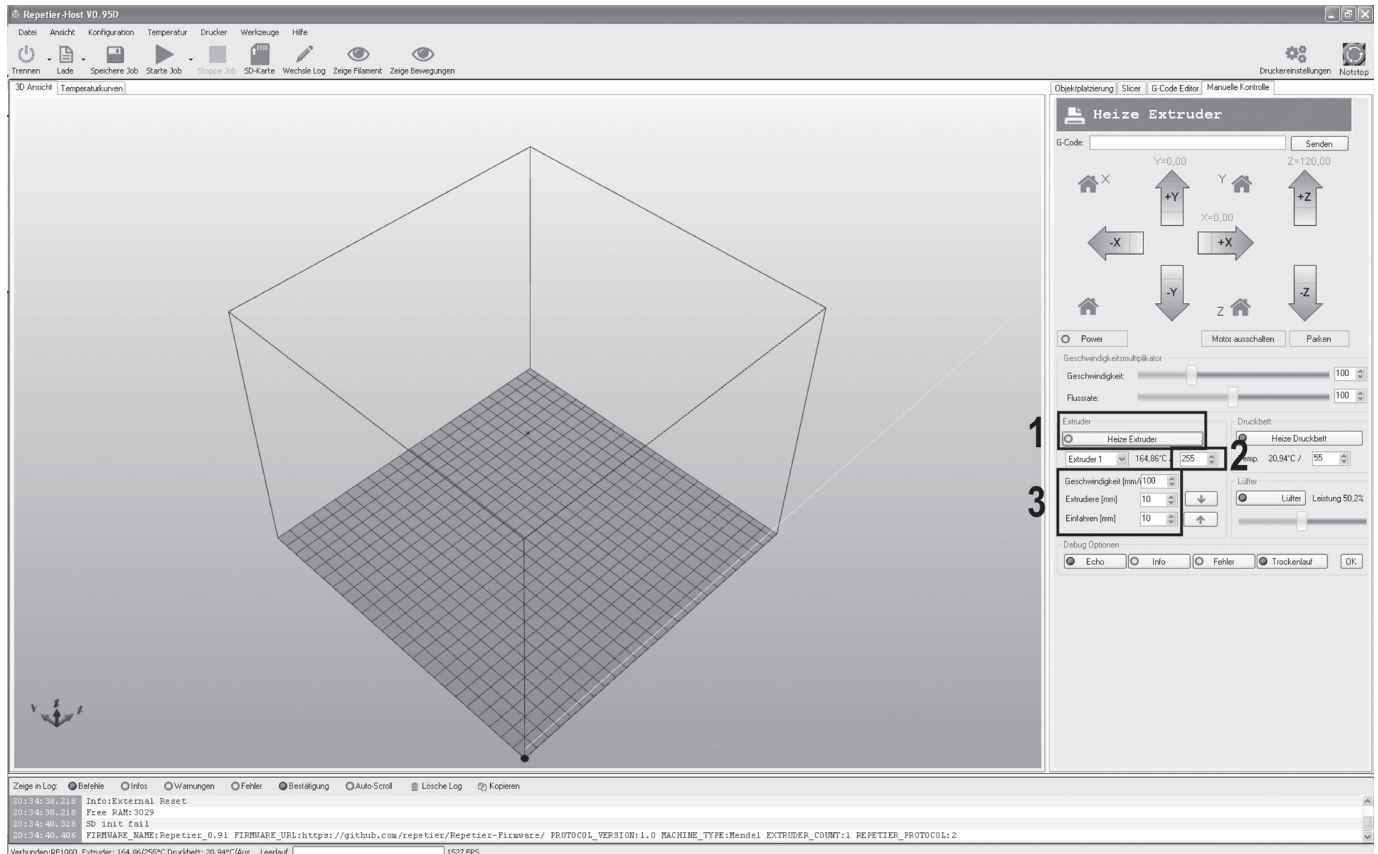
# 17. Filament Change

Before filament change, the extruder must be heated so that the old filament can be cleanly replaced from the extruder.



**Do not touch the hot extruder nozzle when replacing the filament, danger of burns!**

**Always wait for the extruder temperature to be reached at filament change and let the extruder heat for approx. another minute, since the extruder may break otherwise.**



- (1) Switch on the extruder heating.
- (2) Set a temperature suitable for the inserted filament material (ABS: 270 °C / PLA 230 °C).
- (3) When the temperature is reached, let the extruder heat for approx. another minute and then move the filament material out of the extruder with the manual control:

“Extrude” moves material into the extruder, “Move in” pulls the filament from the extruder.

Here, speed and length of the material that is being conveyed per mouse click can be set.

After the old filament has been removed from the extruder, you can pull it out of the filament hose and insert the new filament.

Then proceed as described for “Initial Commissioning”, in “Inserting the Filament” to insert the new filament.

Use the manual control of the software again and let enough material extrude until the residue of the old material has completely escaped from the extruder (can be recognised by the colour change).

Switch off the extruder heating again and have the extruder cool off.

# 18. Firmware Update

The firmware is updated frequently to optimise the properties of the 3D printer.

The currently installed firmware version of your printer is briefly displayed in the upper display line after switching on the printer.

→ For firmware updates, see <https://github.com/RF1000/Repetier-Firmware>. Here, the most recent firmware updates are provided. You can choose between two “branches”:

“Master” is the final version of the firmware.

“Development” is the version of the firmware that is currently subject to development.

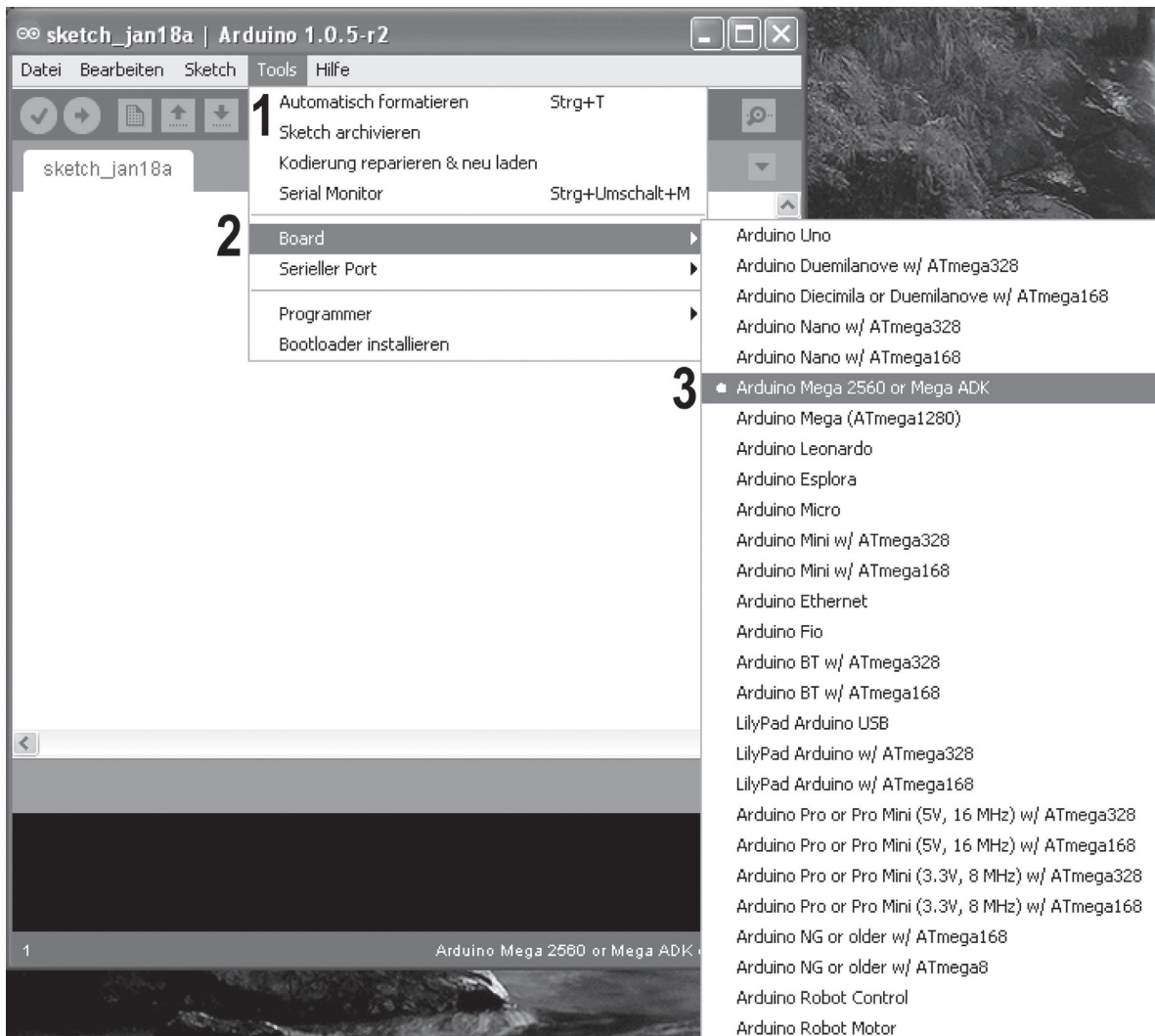
The firmware link can also be reached in the custom software Repetier-Host under “Help” > “RF1000 Firmware”.

## Update process

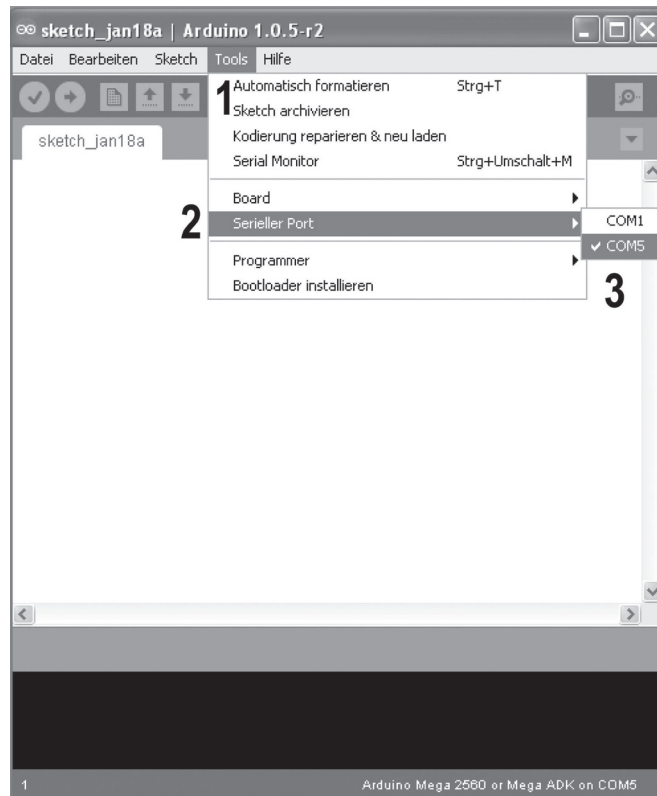


**The printer must be connected to the USB interface of the computer and must not be connected to any other software (for Repetier-Host, e.g. click “Separate”).**

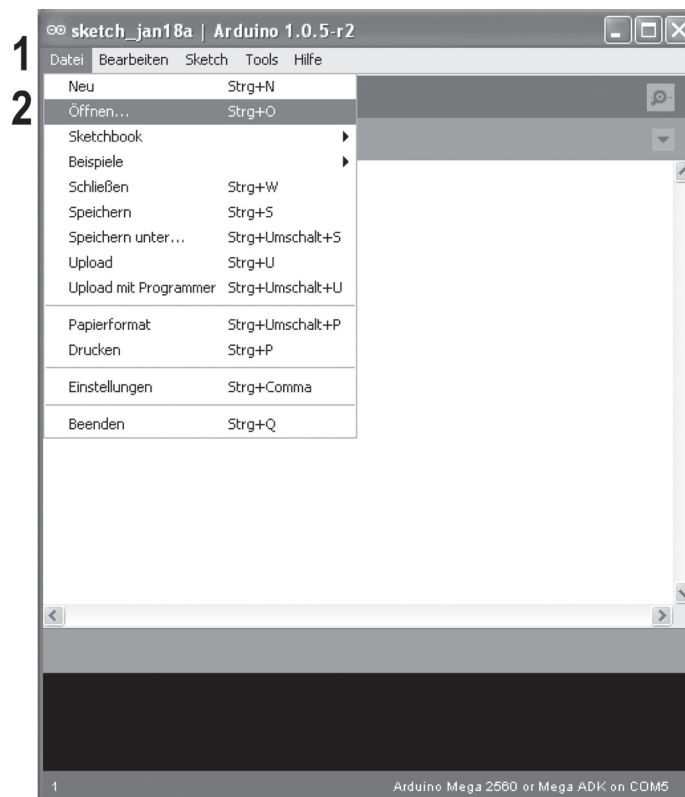
- Download the corresponding update file and save it on your computer.
- Execute the file arduino.exe, which is on the enclosed SD-card (folder “Arduino” and its version subfolders until you find the file “arduino.exe”).
- A window opens



- In the menu “Tools”, select the option “Board” and set the type “Arduino Mega 2560 or Mega ADK”.



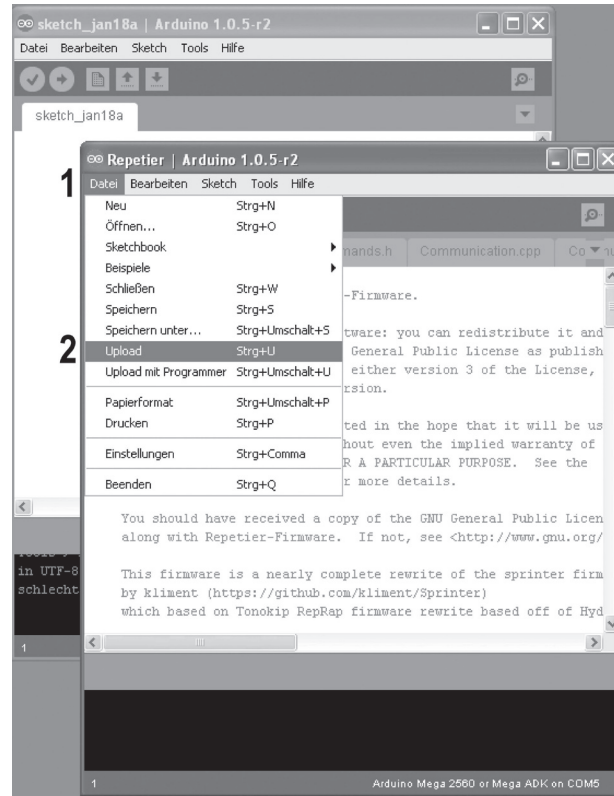
- In the menu "Tools", select the option "Serial port" and set the correct port.
- The port number is system-dependent. You can find it in the device manager of the control panel, under connections (COM and LPT).



- In the menu "File", choose the option "Open..." and select the file "repetier.ino" from the downloaded firmware folder.
- The file "repetier.ino" can be found via the following file path: "Repetier-Firmware-master\src\ArduinoAVR\Repetier"



- A new window opens.
- Click "Upload" in the menu "File" here to transfer to the new firmware to the 3D printer.



- After a successful firmware update, the 3D-printer will start again and briefly display the new firmware version in the first display line after the start.

## 19. Maintenance

### a) General Information

Periodically verify the technical safety of the 3D printer, e.g. check for damage to the mains cable and the casing.

If you have reason to believe that the device can no longer be operated safely, disconnect it immediately and make sure it is not operated unintentionally. Pull the mains plug from the mains socket!

It can be assumed that safe operation is no longer possible if:

- the device is visibly damaged
- the device no longer works
- the device has been stored under unfavourable conditions for an extended period of time or
- after exposure to extraordinary stress caused by transport

Always observe the following safety information before cleaning or servicing the 3D printer:



**Live components may be exposed if covers are opened or components are removed.**

**The device must be disconnected from all power sources before any servicing or repair work is carried out.**

**Capacitors inside the device may still carry voltage even though they have been disconnected from all power sources.**

**Only qualified experts familiar with the hazards involved and the relevant regulations must perform repairs.**

## b) Cleaning

### Device

The outside of the 3D printer should only be cleaned with a soft, dry cloth or brush.

→ Never use any aggressive cleaning agents or chemical solutions on plastic parts, stickers or the display since these parts would be damaged otherwise.

### Nozzle cleaning



**Caution: Danger of burns. Do not touch the hot nozzle directly.**

Outside cleaning of the nozzle:

Carefully wipe off the extruder nozzle after each print using tissue paper or similar.

The nozzle still has to be hot for this. If this is not the case, heat up the extruder nozzle first.

Inner cleaning of the nozzle:

Heat up the extruder and actuate the manual feed forward and backward several times until enough filament is extruded.

If the extruder continues not to extrude enough material after this procedure, let the extruder cool off to the lower melt temperature of the filament as indicated by the manufacturer (filament material must only be viscous anymore) and carefully confirm manual infeed backwards until the filament has been transported out of the extruder, including contamination. Cut off the contaminated part of the filament and reinsert it after heating up the extruder again.

### Cleaning the heating plate



**Caution: Danger of burns. Let the heating plate cool off before cleaning.**

Clean and degrease the heating plate thoroughly with a soft rag and some acetone after each print.

## c) Fuse Replacement

If you have to replace the fuse, ensure that you only use fuses of the specified type and rated current (see "Technical Data") as a replacement.



**Never repair fuses or bridge the fuse holder.**

- Unplug the mains plug from the mains socket and disconnect the low-voltage line from the low power device combination socket at the rear of the device.
- Using a suitable screwdriver to push the fuse holder out of the low power device combination socket carefully.
- Remove the defective fuse and replace it with a new fuse of the indicated type.
- Carefully push the fuse holder with the new fuse back into the low power device combination socket at the device.
- After this, you can reconnect the device to the mains voltage and take it into operation.

## d) Checking the Belt Tension

- Check the tension of the drive belts now and then.
- If required, retention them by setting the belt tensioner with the setting screws so that the toothed belts can still be twisted by 180° easily with two fingers.



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

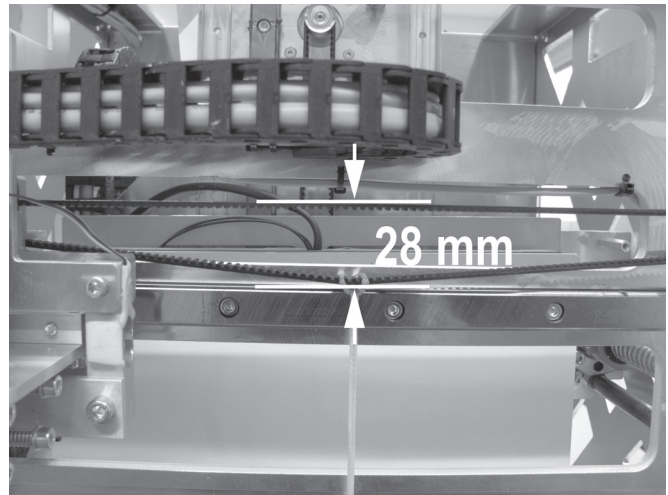
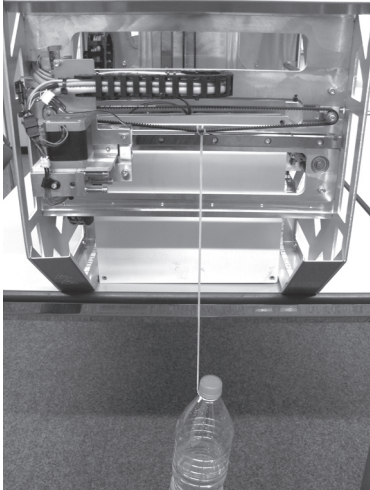
### Method for precise setting of the belt tension

For this, you need a weight of 1 kg, such as a water bottle filled with water to reach the specified weight of 1 kg. You also need a cord for attachment.



**Fasten the heating plate with adhesive tape or similar first to keep it from falling out and being damaged if the printer tips.**

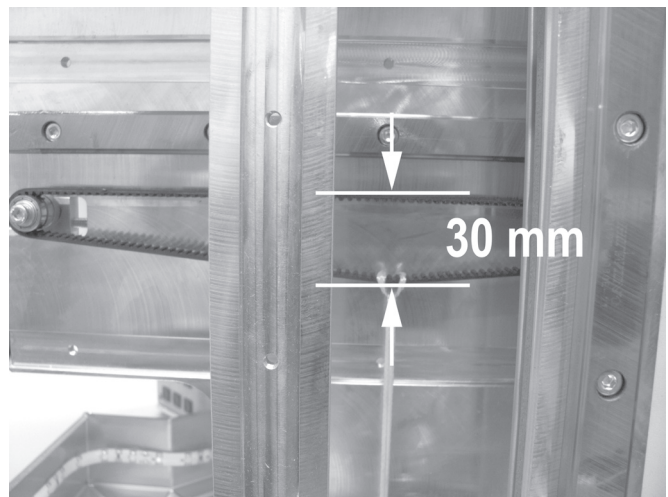
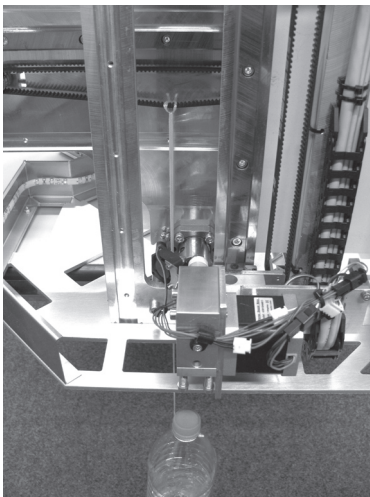
**Place a soft support under the printer so that it is not scratched when tipping and so that it cannot damage the table top.**



Now tip the printer to its front near the edge of the table and attach the weight to the part of the toothed belt for the X-direction that is now at the bottom using the cord.

Measure the distance between the two toothed belt halves as shown in the figure. Set a distance of 28 mm with the belt tensioner.

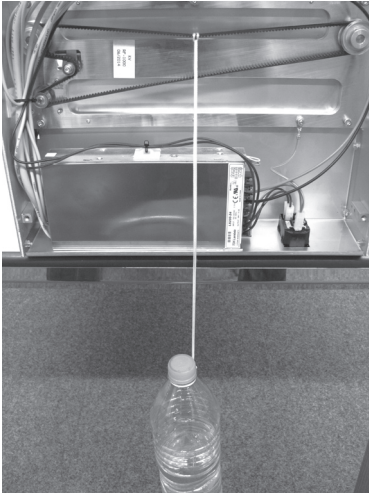
The weight must be suspended so that it can move freely.



Now tip the printer to the right side near the edge of the table and attach the weight to the part of the toothed belt for the Y-direction that is now at the bottom using the cord.

Measure the distance between the two toothed belt halves as shown in the figure. Set a distance of 30 mm with the belt tensioner.

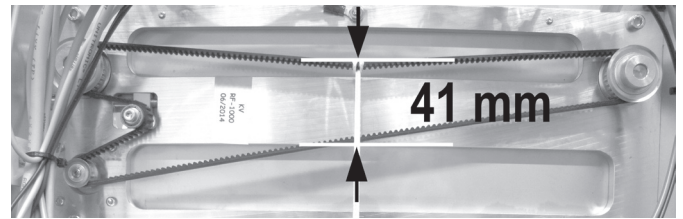
The weight must be suspended so that it can move freely. For this, it must be threaded through an opening in the side part near the right threaded circulation spindle.



Tip the printer onto its back close to the edge of the table and remove the bottom sheet.

Attach the weight to the part of the toothed belt for the Z-direction that is now at the top with the cord.

The weight must be suspended to be freely movable but may touch the mains unit housing. This is not a problem.



Measure the distance between the two toothed belt halves as shown in the figure. Set a distance of 41 mm with the belt tensioner.

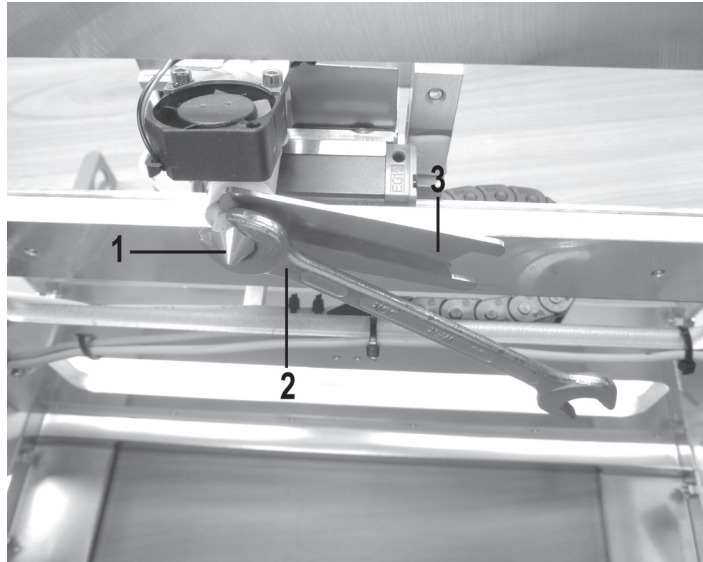


## e) Nozzle Change



**Caution: Danger of burns. Do not touch the hot nozzle or the extruder directly.**

- To replace the extruder nozzle, the extruder must first be heated to a temperature suitable for the inserted filament material.
- When the temperature is reached, remove the inserted filament material as described in “Filament Change”.
- Screw off the extruder nozzle (1) from the extruder with a 10 mm hexagon wrench (2). Always secure the extruder against twisting at the flattened area of the nozzle thread above the nozzle with the enclosed nozzle wrench (3).



**The extruder must not twist during nozzle change and the nozzle must never be turned when cold since the cement layer above the nozzle may break otherwise. This will render the extruder useless.**

- Clean the thread at the extruder of filament residue (e.g. with a brass brush).
- Coil a piece of sealing tape of about 5 cm around the nozzle thread at the extruder and carefully screw the new nozzle onto the extruder. Secure the extruder against twisting again with the enclosed nozzle wrench.



**Do not wrap the sealing tape beyond the nozzle thread since the nozzle will clog otherwise. We recommend our PTFE high-temperature tape from the accessory programme of the 3D printer.**

- Carefully screw in the new extruder nozzle. Never apply any strong forces for this.
- Then insert the filament again as described in “Filament Change”.
- Switch off the extruder heating again and have the extruder cool off.

## 20. 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 extruder may heat up strongly in operation. Do not touch these parts during or just after operation. Let these parts cool off first.

# 21. Troubleshooting

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With this 3D printer, you have purchased a product that is built to the state of the art and operationally safe. Nevertheless, problems or errors may occur. Therefore, we would like to describe how to eliminate possible errors here:



**Always observe the safety information!**

## **The 3D printer does not work after switching on. The display and print space lighting remain dark:**

- Check the connection of the mains line.
- Check the mains socket. Is it properly supplied with current?
- Check the mains fuse (also see “Fuse change” in chapter “Maintenance”).

## **No USB connection to the 3D printer is possible:**

- Check the USB line connection.
- Is the right USB port selected in the software?
- Are the required drivers installed?
- Unplug the USB line and then plug it in again.
- Start the software again.
- Switch the 3D printer off and on again.
- Start the computer again.
- Use another USB port.
- Connect the 3D printer directly to a USB port of the computer. Do not use any USB hub.

## **Calibration of the heating plate stops. The display shows the message “Scan aborted”:**

- Heat the extruder to melting temperature of the inserted filament and transport the filament a few steps backwards out of the extruder. The filament must not cause any forces to be exerted on the extruder but the ball bearing holder still must be loaded by the filament.
- The extruder nozzle must be clean from the outside (if required, heat and wipe off first – caution: hot nozzle!)
- Perform the basic settings of the limit switch for the Z-direction again. The plate distance must not be too large.
- The pressure sensors may have been installed under tension. In this case, loosen the screws of the print sensors and then retighten them evenly.

## **The print has defects:**

- Check the extruder and heating bed temperature settings. They must match the filament material and print object. Experiment with the temperature settings in steps of 5 °C for a perfect print result.
- Only start the print when the extruder and the heating bed have reached the specified temperature.
- The distance between the heating plate and extruder is set incorrectly. Perform Z calibration or set the distance more precisely when starting the print using the buttons at the 3D printer.
- When printing from the PC, do not use any other programmes requiring high computing power. Virus scanners and downloads may also impair signal transfer to the 3D printer. Try performing the same print from the SD card to ensure that the USB connection is not the cause of the problems.

**The filament supply breaks off or there is not enough filament material supplied:**

- Check the filament unroller. It must turn easily.
- Check whether the filament material has caught on the filament unroller. The filament hose at the filament roller may have caught.
- Some filament types do not slide through the filament hose properly. If required, use the alternative filament holder that you can print from the SD card (file name "Filament\_guide.gcode").
- The set extruder temperature is too low for the filament material used. The feed knurl slips at the filament material.
- Check whether the feed knurl slips on the motor axis of the extruder motor. The grub screw may have come loose. If the feed knurl slips in spite of the grub screw being tightened, use a grub screw with a point or slightly file down the motor axis in the area of the grub screw to reduce slippage.
- The clamping spring screws at the filament feed are not tightened well enough. Therefore, the drive slips.
- Check that the filament material runs into the extruder from above cleanly. It must be able to run past the extruder motor from above and into the bore of the extruder without scraping or clamping anywhere. If this is not the case, loosen the nut at the extruder and the screws at the feed basic part and align the parts so that the filament is cleanly inserted into the extruder.
- The extruder nozzle is clogged. Heat up the extruder and actuate the manual feed forward and backward several times until enough filament is extruded.
- Let the extruder cool down to just below the melt temperature specified by the manufacturer for the filament (filament material must only be viscous anymore) and carefully actuate the manual feed backwards until the filament with contamination has been removed from the extruder. Cut off the contaminated part of the filament and reinsert it after heating up the extruder again.

**Printing stops during the process:**

- Check the settings of your computer. It must not switch to standby mode while printing (energy option settings) or simply shut down (installation of software or software updates during printing).
- If the value measured by the printing sensors at the extruder exceeds a threshold, the printer will automatically switch to pause mode for reasons of safety. Printing can be started again by pushing the button for continuing printing (play button). If this happens frequently, the print sensors are installed under tension. In this case, loosen the screws of the print sensors and then retighten them evenly.

**The printed object does not adhere to the heating plate:**

- The temperature of the heating plate is set incorrectly. Experiment with the temperature settings in steps of 5 °C for a perfect print result.
- When printing problematic objects, it is beneficial to let the heating plate heat up for approx. 15 minutes before printing.
- Check whether the heating (red foam material) adheres cleanly to the ceramics printing plate. It must not come loose (even partially). If this is the case, the temperature distribution of the heating plate is insufficient and the printed objects cannot adhere well.
- There are residues on the heating plate that prevent adhesion of the object. Rub the heating plate with a soft cloth that is soaked with a solvent (e.g. acetone).
- The heating plate has not reached the set temperature yet.
- At PLA printing of small objects with a small footprint, it is recommended to apply the heating plate with cleaning tape or a slightly structured crepe tape before printing. This increases adhesion of the printed object on the base plate.

**The printed object cannot be removed from the heating plate:**

- Wait until the heating plate has cooled down to less than 40 °C.
- Use a painter's spatula or a knife to remove the object.



**Repairs other than those described above should only be carried out by an authorised specialist.**

## 22. Disposal

---



Electronic devices are recyclable waste and must not be disposed of in the household waste!

Dispose of the product according to the applicable statutory provisions at the end of its service life.

## 23. Technical Data

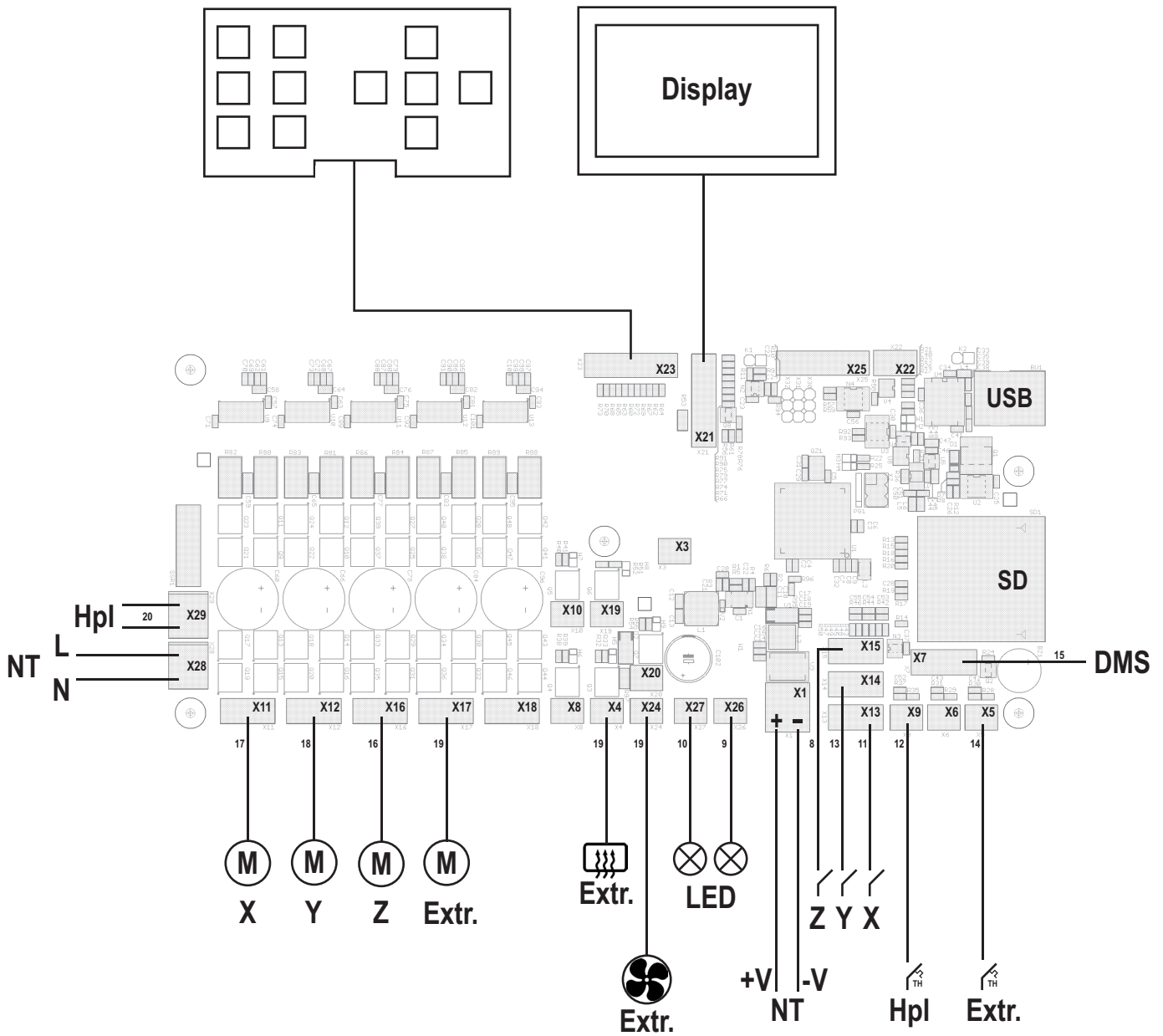
---

Operating voltage.....	100 - 240 V/AC, 50/60 Hz
Power consumption.....	620 W
Fuse .....	T4AL/250 V (5 x 20 mm, slow-acting trigger)
Production process .....	FFF (Fused Filament Fabrication) / FDM (Fused Deposition Modelling)
Model size (W x H x D) .....	max. 245 x 200 x 230 mm
Printing layer thickness .....	0.05 - 0.3 mm
Nozzle diameter.....	0.5 mm
Suitable filament material.....	ABS, PLA, PVA, EcoPLA™, PET, Taulman, Layrick, Bendlay, Laywood-D3, HIPS und smartABS
Power of the heating plate .....	450 W
Extruder temperature .....	160 - 270 °C
Heating plate temperature .....	55 - 120 °C
Interfaces .....	USB 2.0 and SD card reader
Dimensions (W x H x D).....	375 x 500 x 410 mm
Weight.....	16.5 kg



# 24. Annex

## a) Wiring Plan of the Main PCB



### Abbreviations used

Hpl = heating plate

NT = mains unit

Extr. = extruder

DMS = elongation measuring strip

M = motor

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

## b) Notes on the Print Files (GCODE Files) on the Enclosed SD Card

The folder "GCODE" on the enclosed SD card holds various finished printing files.

These files do not need to be sliced with a software like the Repetier-Host first. They can be printed right from the SD card (also see "First Print of an Example Object from the SD Card").

The files are saved in the folder "ABS" and "PLA", depending on the filament type used.

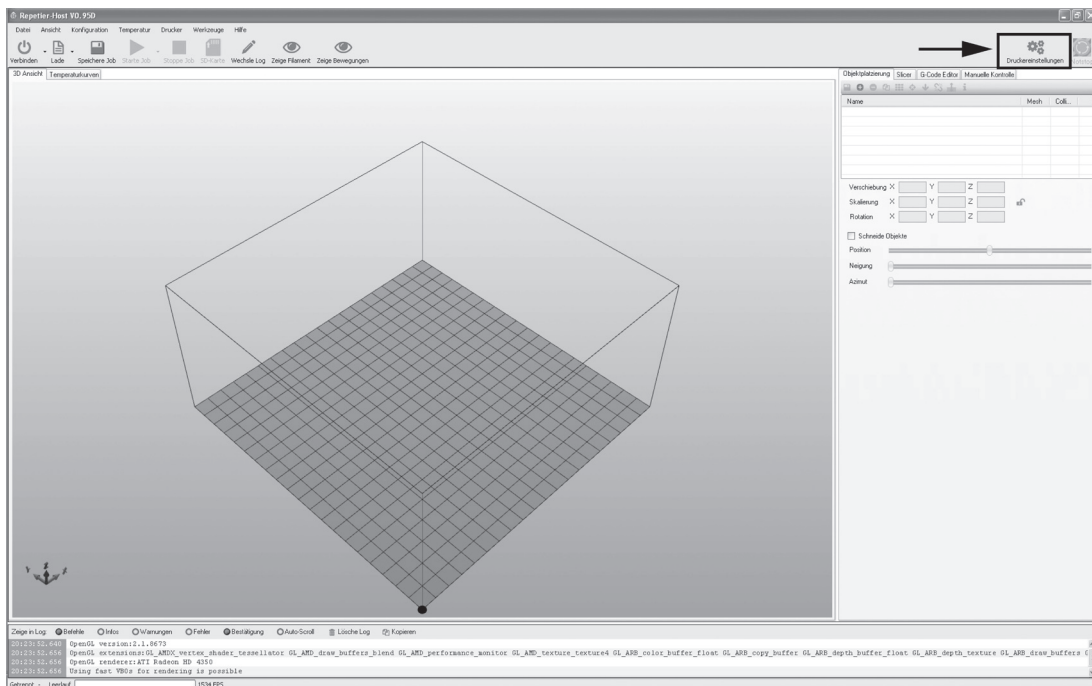
Example: Heart.gcode in the folder ABS = small heart for printing with ABS filament

## c) Setup of the Printer Settings



**This chapter is only targeted at users who do not have the custom version of the software installed. If you have installed the custom version (can be recognised by the image of the RF1000 3D-printer when the programme starts), you may skip this chapter. It only serves information purposes then.**

Start the programme Repetier-Host and select printer settings at the upper right in the window.



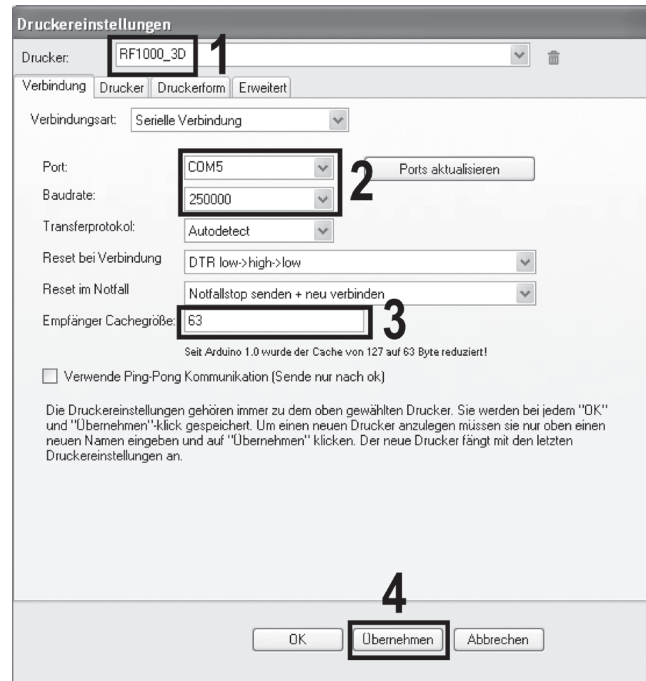
(1) Name your printer RF1000\_3D in the following window in tab "Connection" or assign a name of your own.

(2) Set the port and baud rate as displayed.

→ The port number is system-dependent. You can find it in the device manager of the control panel, under connections (COM and LPT).

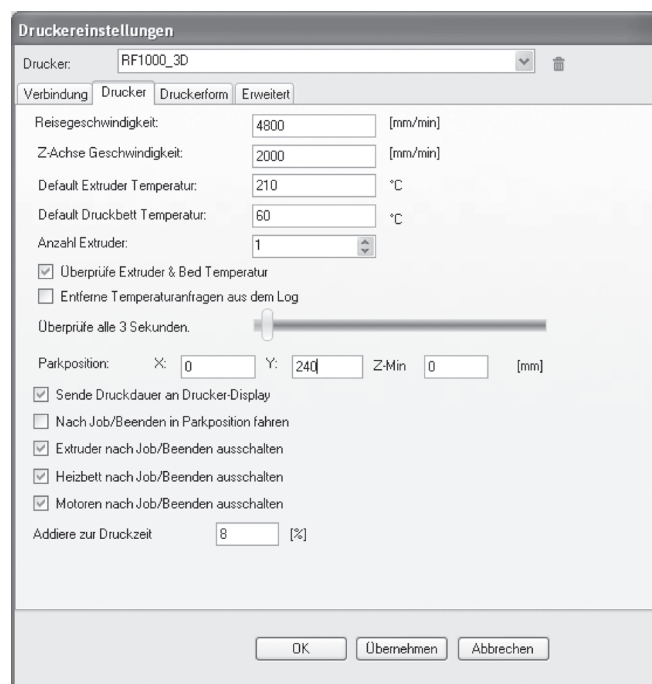
(3) Set the receiver cache size as shown.

(4) Click "Accept".



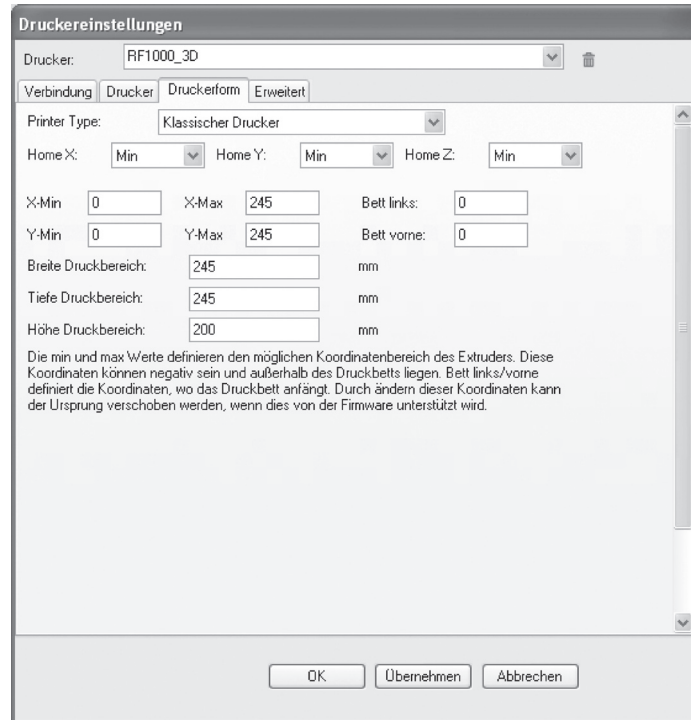
Click the tab "Printer".

Transfer the settings 1:1 as shown in the following figure and click "Accept".



Click the tab "Printer form".

Transfer the settings 1:1 as shown in the following figure and click "Accept".



No settings are necessary in the tab "Advanced".

Click "OK".



## d) Explanation on the Configuration Files on the Enclosed SD Card



This chapter is only targeted at users who do not have the custom version of the software installed. If you have installed the custom version (can be recognised by the image of the RF1000 3D-printer when the programme starts), you may skip this chapter. It only serves information purposes then.

The folder "Slic3r Settings" on the enclosed SD-card contains different configuration files (.ini-files) for the basic version of the software Repetier-Host.

If you have installed the custom version adjusted for the RF1000 of the Repetier-Host software, configuration files are already integrated into the software.

The files are designated as follows:

Printer name\_Filament material\_Layer thickness\_Nozzle diameter.ini

Example:

RF1000\_ABS300\_100\_05.ini = Printer RF1000\_Filament 3mm ABS\_Layer thickness 100 µm (=0.1 mm)\_Nozzle Diameter 0.5 mm

→ The option VASE permits printing of objects with filling (e.g. cylinder) as hollow bodies without having to produce the corresponding 3D file for it.

If a cylinder-shaped body is printed with the option VASE, the resulting object has a bottom plate and a thin outer wall (like a vase).

## e) Setting up the Slicer

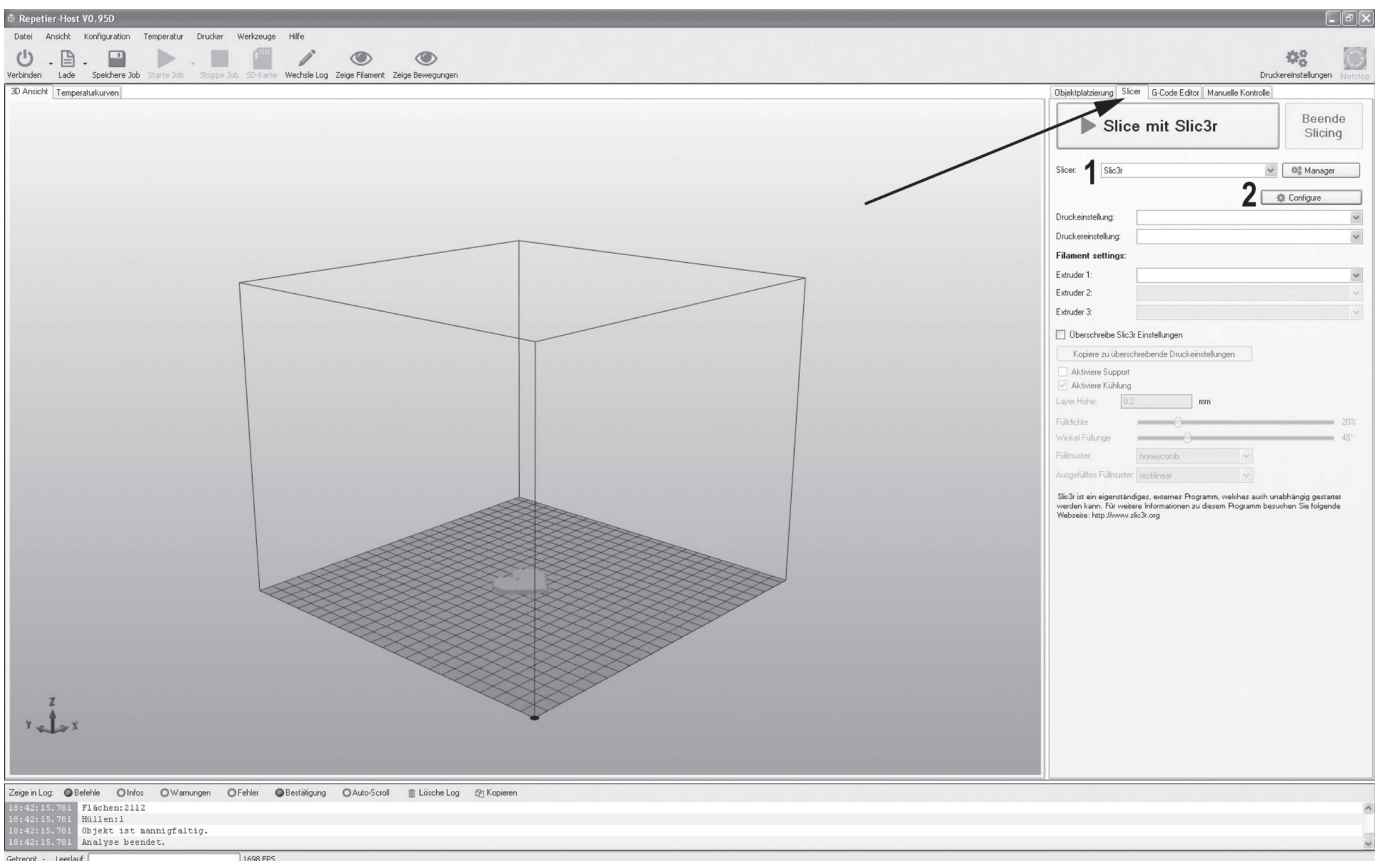


This chapter is only targeted at users who do not have the custom version of the software installed. If you have installed the custom version (can be recognised by the image of the RF1000 3D-printer when the programme starts), you can ignore this chapter. It only serves information purposes then.

Click the tab "Slicer".

(1) In "Slicer", select the programme "Slic3r".

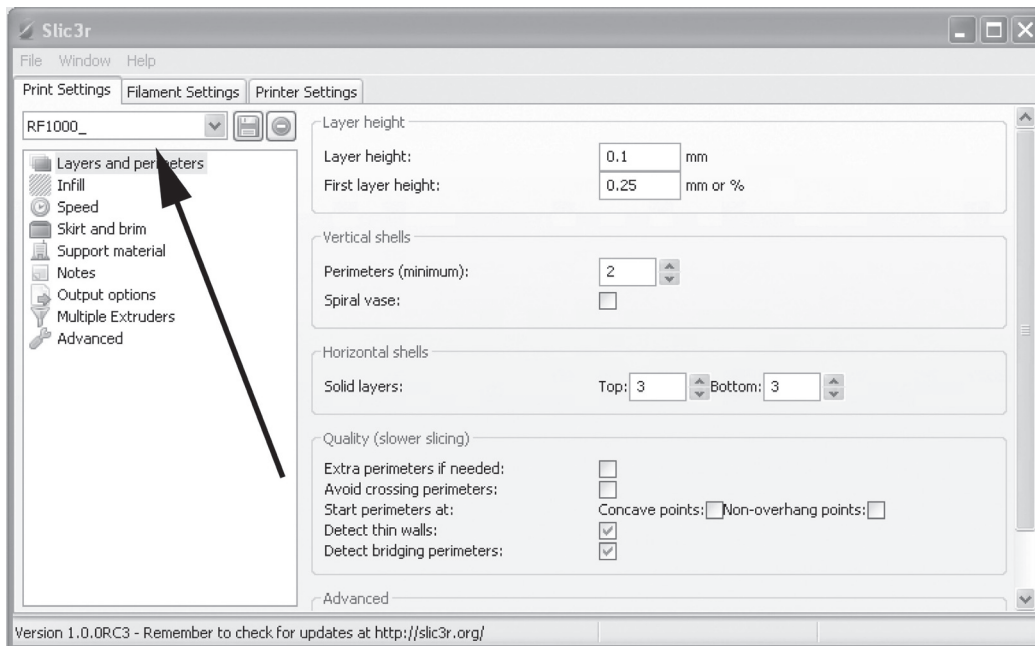
(2) Click "Configure" to set up the programme on the 3D-printer.



Select the tab "Print Settings" and click "Load Config..." in the menu.

Select the folder "Slic3r Settings" on the enclosed SD card in the following dialogue field. Select the first configuration file in this folder and confirm selection with the button "Open".

The selected file appears in the window.



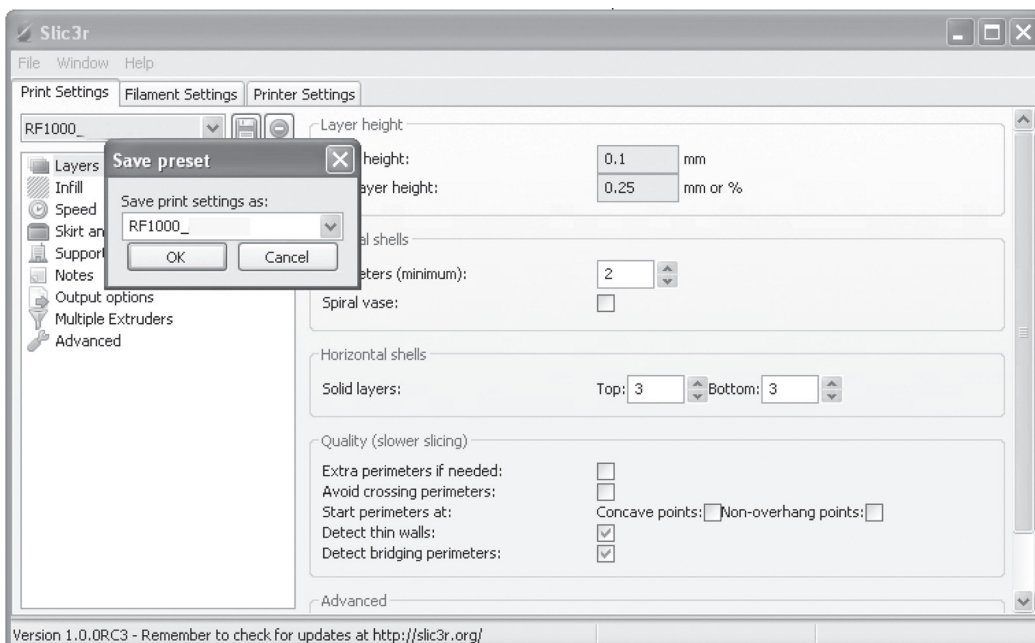
Save the configuration file by clicking the disc symbol.

Leave the suggested name or assign one of your own for this configuration setting and click "OK".

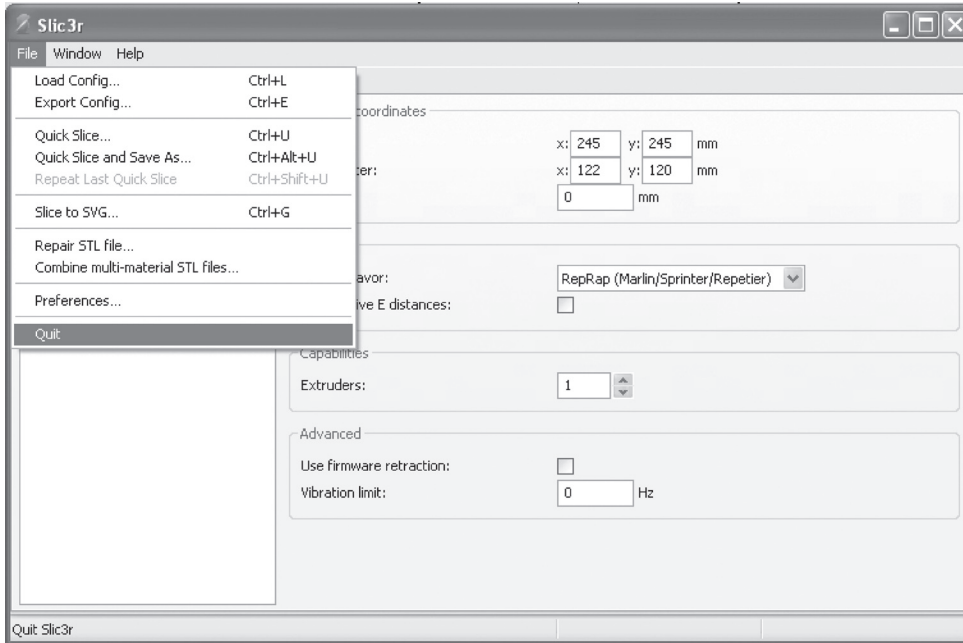
Open the tabs "Filament Settings" and "Printer Settings" in the same manner and save the above file in these tabs as well.

Then save all other configuration files on the SD card as described above in the tabs "Print Settings", "Filament Settings" and "Printer Settings".

→ For a more detailed description of the different files on the SD-card, see this Annex, "Explanation on the Configuration Files on the Enclosed SD Card".



In the menu "File", click "Quit" to close the configuration window again.



The new configuration settings now appear in the tab "Slicer" in the main view of the software and can be used.

## f) Recommended Tightening Torque of the Screws

Description	Thread size	Torque
Attachment of the threaded pin to the motor pinion	M3	0.7 Nm
Attachment of the ball bearing for belt tensioner to the basic body	M4	3 Nm
Attachment of the spacer to the bottom plate	M5	5.4 Nm
Attachment of the actuator to the bottom plate	M3	1.9 Nm
Attachment of the ball bearing to the belt tensioner basic body	M4	3 Nm
Attachment of the guide rail to the X-plate	M4	4 Nm
Attachment of the limit switch to the limit switch holder	M2	0.3 Nm
Attachment of the limit switchholder to the X-plate	M3	1 Nm
Attachment of the belt holder to the guide carriage plate	M3	1.1 Nm
Attachment of the feed holder block to the guide carriage plate	M4	4 Nm
Attachment of the guide carriage plate to the guide carriage	M4	4 Nm
Attachment of the motor holder and fan sheet to the feed holder block	M4	4 Nm
Attachment of the extruder holder to the elongation measuring strip	M5	5.4 Nm
Attachment of the holding plate for the end stop with elongation measuring strips to the guide carriage plate	M4	3 Nm
Attachment of the end stop to the holder plate for end stop actuation	M4	3 Nm
Attachment of the threaded pin to the small pinion on the actuator motor	M3	0.7 Nm
Attachment of the motor to the motor holder	M3	1.5 Nm
Attachment of the extruder to the extruder holder	M8	1.4 Nm
Attachment of the feed basic part to the motor holder	M4	3 Nm
Attachment of the actuator to the X-plate	M3	1.9 Nm
Attachment of the drag chain end piece to the holder for the end stop	M3	1.2 Nm
Attachment of the fan to the fan sheet	M2.5	0.7 Nm
Attachment of the ball bearing to the belt tensioner basic body	M4	3 Nm
Attachment of the guide rail to the Y-plate	M4	4 Nm
Attachment of the actuator to the Y-plate	M3	1.9 Nm
Attachment of the drag chain end piece to the holding block for the guide rail	M3	1.2 Nm
Attachment of the holding block for the guide rail to the Y-plate	M3	1.9 Nm
Attachment of the drag chain end piece to the Y-plate	M3	1.2 Nm
Attachment of the holder for the limit switch to the limit switch	M2	0.3 Nm
Attachment of the undertable holder to the limit switch holder	M3	1.1 Nm
Attachment of the undertable holder to the belt tappet angle	M3	1.1 Nm
Attachment of the drag chain end piece to the undertable	M3	1.2 Nm
Attachment of the undertable to the Y-plate with the guide carriage	M4	4 Nm
Attachment of the threaded circulation spindles to the Y-plate	M5	5.4 Nm
Attachment of the actuation for the end stop to the Y-plate	M4	3.4 Nm
Attachment of the hexagon threaded bolts for the limit switch actuation to the Y-plate	M3	1.1 Nm
Attachment of the installed bottom plate to the installed X-plate	M5	5.4 Nm
Attachment of the pinion to the ball circulation spindle	M3	0.7 Nm
Attachment of the left and right side parts	M4	4 Nm



<b>Description</b>	<b>Thread size</b>	<b>Torque</b>
Attachment of the small/large foot holder to the side parts	M4	4 Nm
Attachment of the rear cover to the side parts and bottom plate	M4	2.9 Nm
Attachment of the rear side covers and rear head cover to the side parts	M4	2.9 Nm
Attachment of the drag chain end piece to the operating cover	M3	1.1 Nm
Attachment of the operating cover to the side parts and bottom plate	M4	2.9 Nm
Attachment of the right and left sight protection cover to the side parts	M4	2.9 Nm
Attachment of the limit switch PCB to the X-plate	M2	0.3 Nm
Attachment of the earthing cable of line 20 to the undertable	M3	1.1 Nm
Attachment of the display PCB and keyboard PCB to the operating cover	M2	0.3 Nm
Attachment of the main PCB to the operating cover	M3	1.1 Nm
Attachment of the mains unit to the rear cover	M4	2.5 Nm
Attachment of the earthing cable to the bottom plate	M4	2.5 Nm
Attachment of the earthing cable of line 20 to the bottom plate	M4	2.5 Nm
Attachment of the bottom sheet to the foot holders	M3	1.1 Nm

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