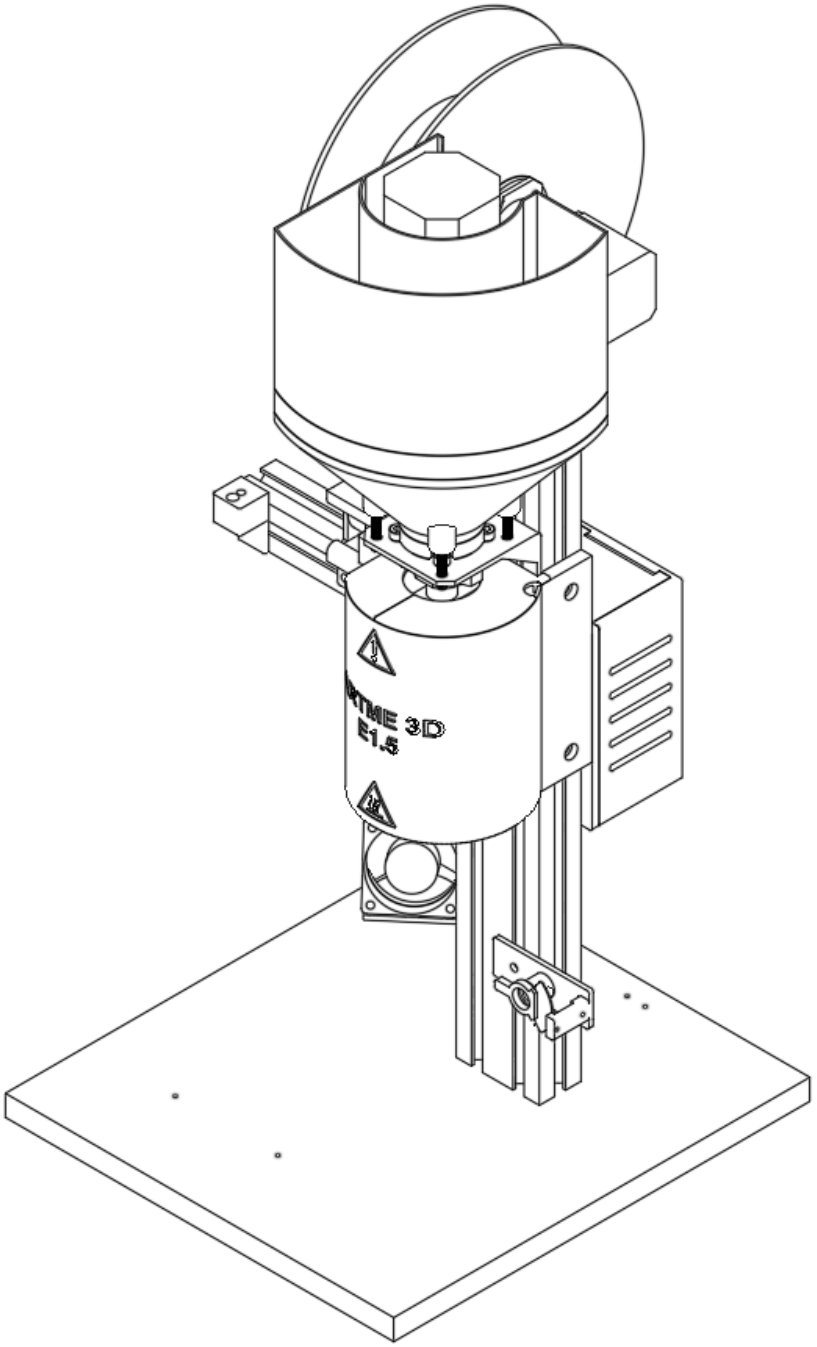
Assembly instructions

Original Desktop Filament Extruder E1.5 by ARTME 3D

Version 06.09.2021



Thank you for purchasing the kit for the original filament extruder E1.5 from ARTME 3D!

Your purchase supports us in the further development of this type of project and the quality assurance of the components.

The development and documentation of this project required hundreds of hours of work in 2.5 years, as well as high investments in materials and machines. If you would like to support me in the development of further projects, I am looking forward to a small donation via paypal to paypal@artme.de.

A big thank you goes to Filip Milier. He wrote the firmware “Marlin-Mackerel”, which made this project possible. You can find his original data at https://github.com/filipmu/Marlin-Mackerel. For the desktop filament extruder E1.5 the following has been edited:

- User interface changed
- Device parameters changed
- Integrated safety functions (thermal runaway)

I hope you enjoy setting up and operating the extruder,

David Thönnes from ARTME 3D

Important Information:

You purchase an assortment of hardware to make your own version of the extruder. There is no obligation to assemble the device according to my specifications, you can combine the components as you wish.
Your actions are necessary to operate the system as safely as possible. **It is therefore essential that you read Chapter 1 in the operating instructions.**

If you have any questions or problems, please read the FAQs in the documentation first or send an email to kontakt@artme-3d.de. Try to describe your problem in as much detail as possible.

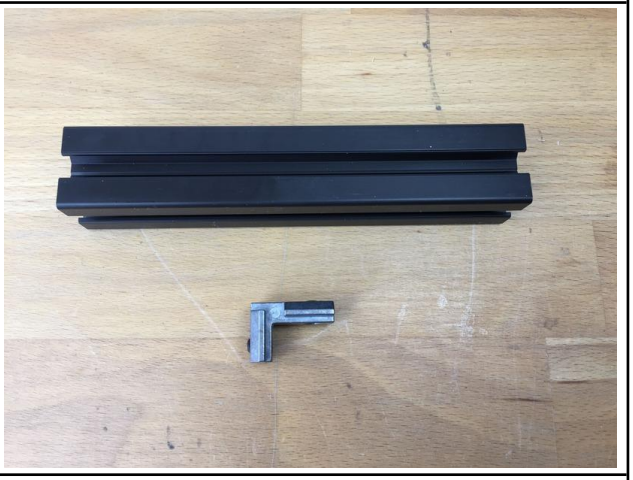
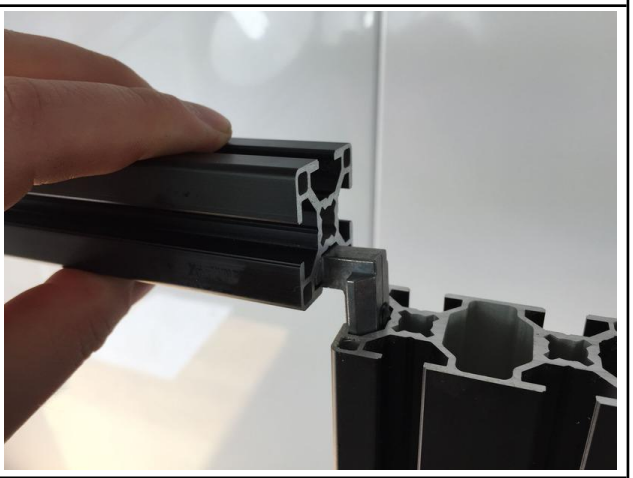
Contents:

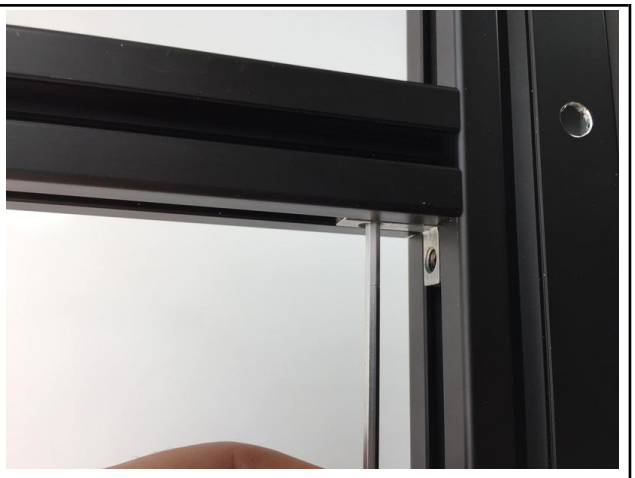
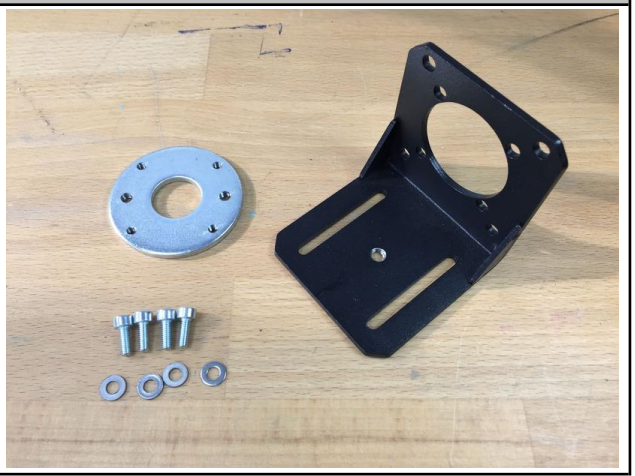
Overview of required tools:

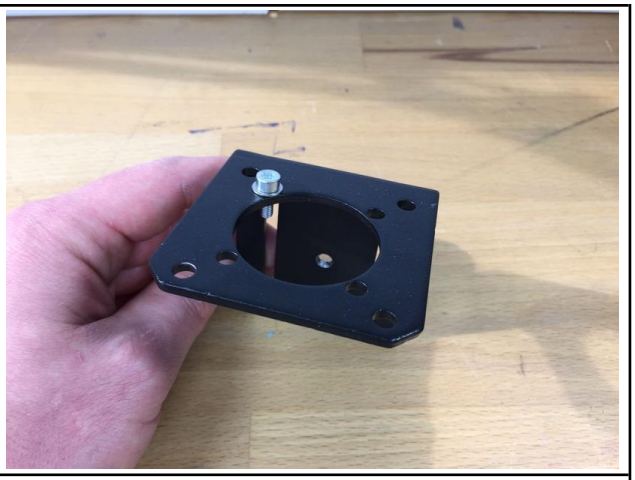
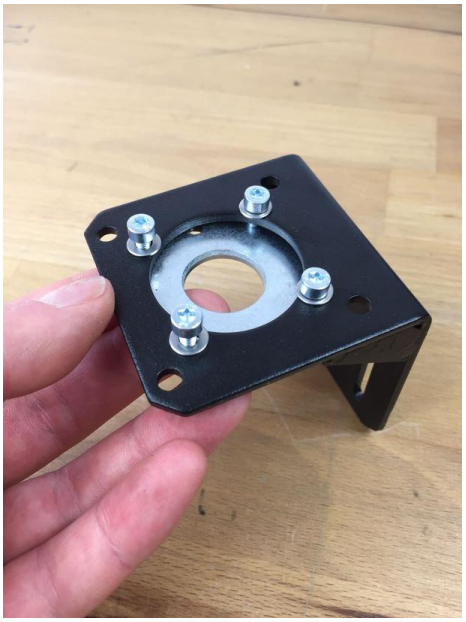
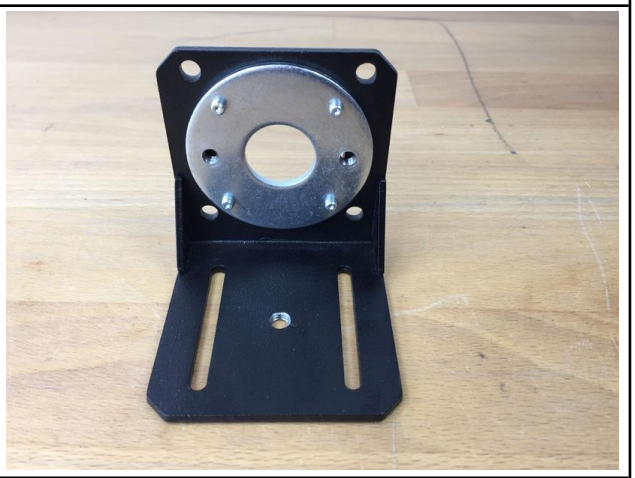
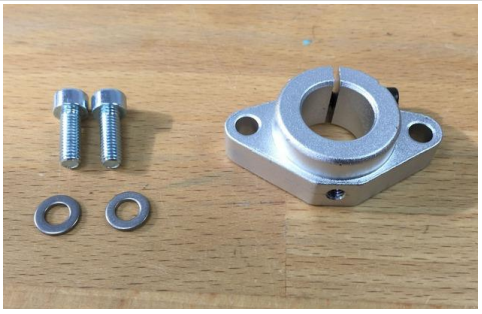
tool	size
Allen key	size 2 size 2.5 size 3 size 4
Torx key	TX 20 TX 25
Sockets and end wrench	size 8 size 13
cross recess screwdriver	PH1
slotted screwdriver	3mm
electric screwdriver	cross recess PH2
nose pliers / pliers	
round file	4mm diameter, long
half-round file	small
sandpaper	grit 120
marking pen	
superglue	
Diagonal cutters	
Scissors	
Tweezers	
Hammer	
Protective gloves / rubber glovesprotection	
Breathingmask	
Lighter	

1.0	Assembly of the main frame	
1.1	Take from package 0 (box supplied) 1x plate (FR01) 1x aluminum profile 30x60x500 (FR02)	
1.2	Take from package 2: Felt pads (SP07)	
1.3	Glue the felt pads on the back of the mounting plate in all four corners. The back has a rough surface.	

1.4	Take from package 1: 2x wood screws 5x60mm (SC18)	
1.5	Tool: Cordless screwdriver with cross recess PH2 Guide/turn the screws through the holes.	
1.6	The screws must go into the small holes in the corners of the aluminum profile. Alignment of the aluminum profile see next step.	

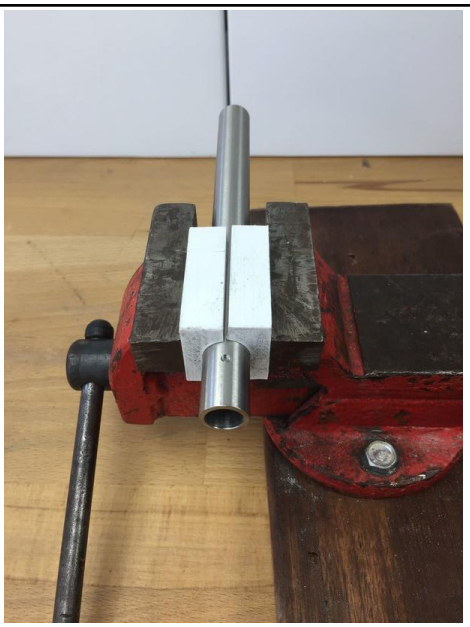
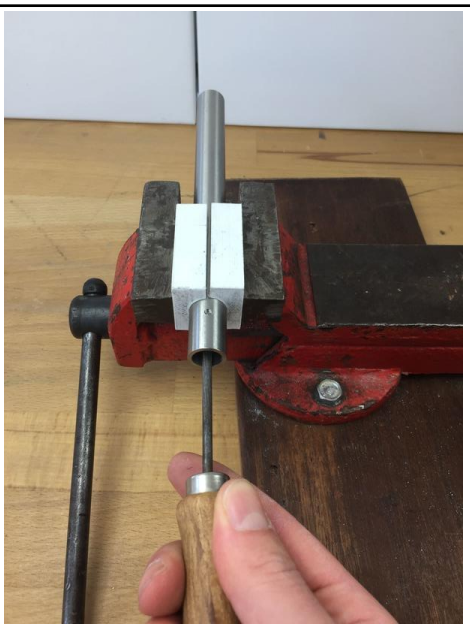
1.7	The holes in the aluminum profile must point upwards. If the aluminum profile has a nameplate, it must point to the rear in this view.	
1.8	Take from package 0: 1x aluminum profile 30x30x160mm (FR03) Take from package 2: 1x connector for profile (SP06)	
1.9	Insert the angle connector into the grooves of the aluminum profiles. See image.	

1.10	Tool: Allen key 3mm Slide the aluminum profile into the groove. Distance from the lower edge of the aluminum profile to the surface of the mounting plate approx. 300mm. The exact height will be set later.	
1.11	The small aluminum profile must be mounted on the left side.	
2.0	**Assembling the extruder pipe**	
2.1 Rem ove	Take from package 2: 1x mounting bracket (SP12) Take from package 3: 1x adapter disk 55x20x3mm (EB01) Take from package 1: 4x cylinder screw M4x10mm (SC04) 4x washer inside 4.2mm (SC13)	

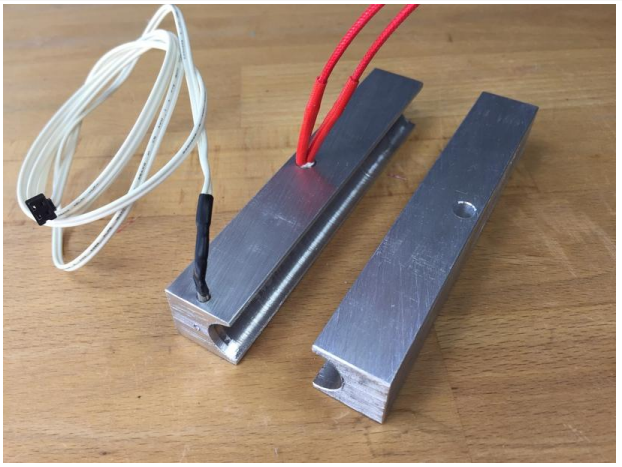
2.2	Insert the M4x10 cylinder screws with washers into the inner holes of the mounting bracket.	
2.3	Tool: Torx key TX20 Hold the adapter plate against it from below and screw in the screws. Alignment of adapter disc, see next step. Caution, just tighten the screws, do not tighten them.	
2.4	The free threads in the adapter disk must be horizontal.	
2.5	Take from package 3: 1x shaft holder SHF16 with thread M4 (EB02) Take from package 1: 2x cylinder screw M5x14mm (SC5) 2x washer inside 5.2mm (SC14)	

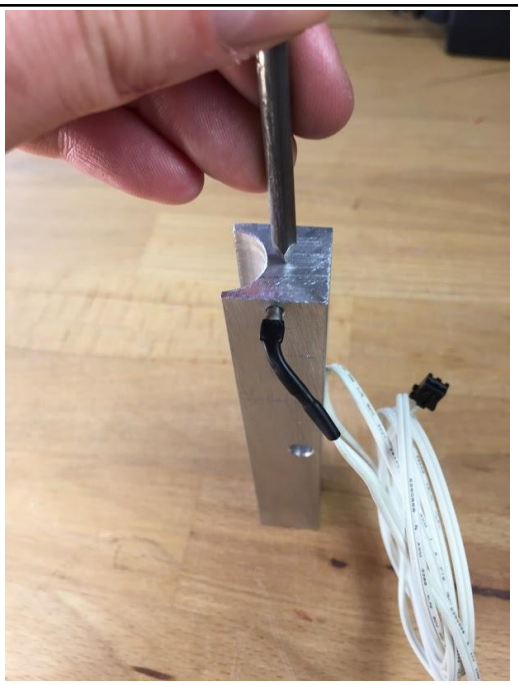
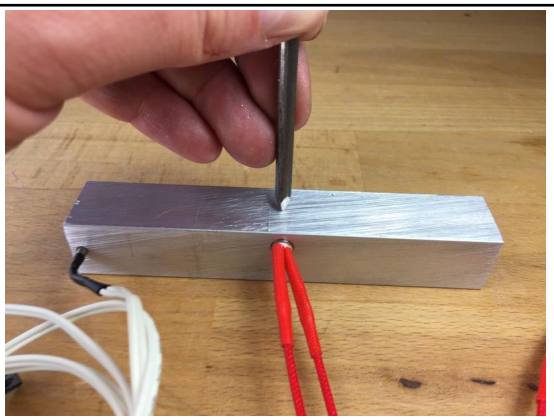
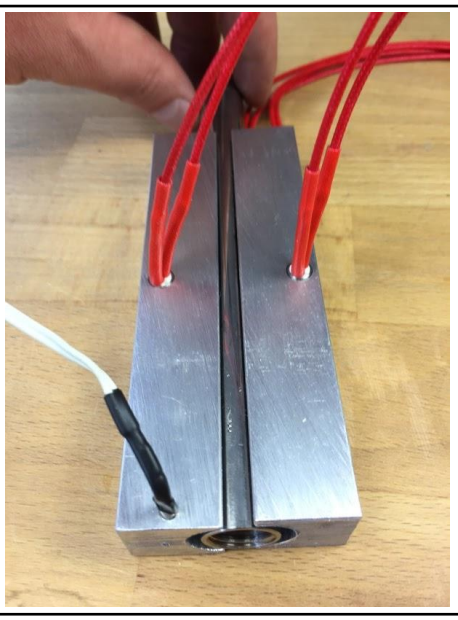
2.6	Tool: Torx key TX25 Insert the cylinder head screws with washers through the holes in the shaft holder and screw them into the thread. Do not tighten the screws yet.	
2.7	Take from package 0: 1x extruder barrel (CM01.1)	
2.8	The supplied extruder barrel is only suitable for processing industrial granulate. If you want to operate the extruder with it, continue with step 2.21. If you want to use your own (shredded) granules, the extruder tube must be modified, see the next steps.	
2.9	(1x extruder barrel CM01.2) The extruder barrel has grooves in the feed zone. The production is described below.	

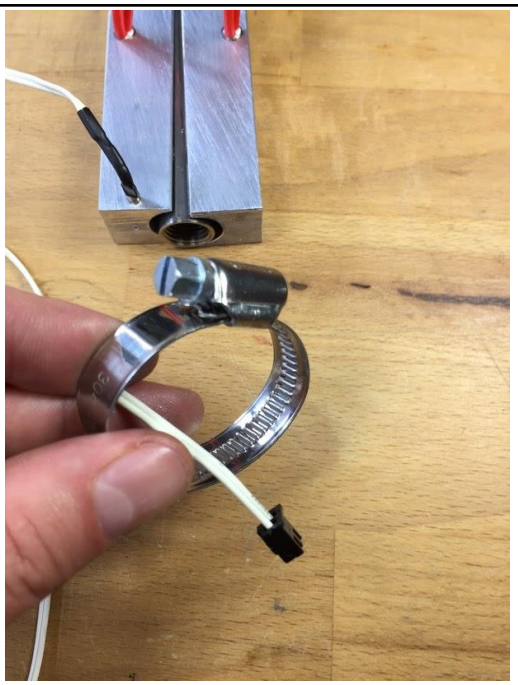
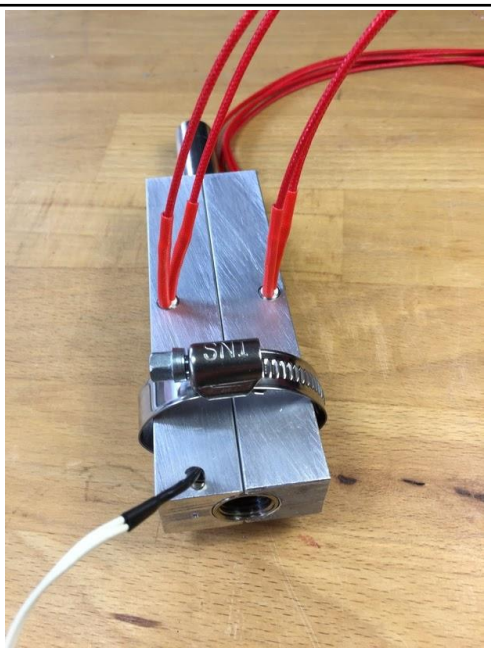
2.10	3D printing: sign template (EB10) The sign template is placed on the upper end of the tube. The thread of the pipe is at the bottom. The 3 points are arranged so that none is in line with the 3mm milling. See image.	
2.11	Tool: Marker pen Draw in the holes with the pen.	
2.12	This is how the resulting markings should look.	

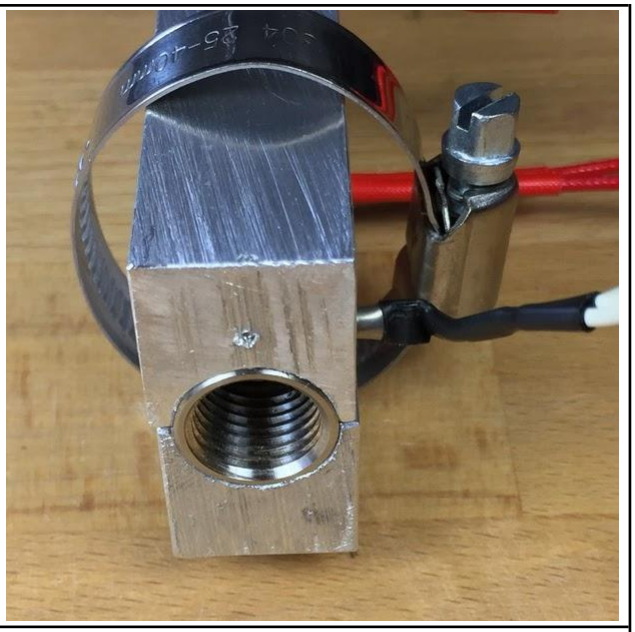
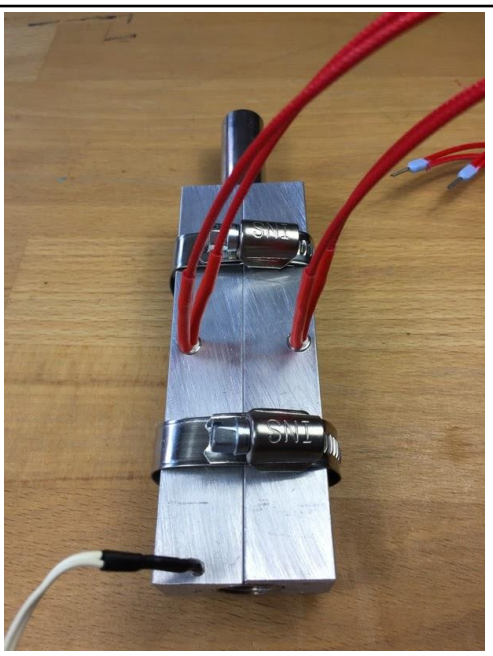
2.13	3D printing: Clamp vice (EB11) This can be used to clamp the pipe in a vice. The pipe is clamped in the position, that one of the marking points points downwards.	
2.14	Tools: Round file 4mm The round file should be long.	
2.15	The file is placed at the bottom above the marking point. File with slow, firm movements. Take your time. Important: keep the file very flat (almost vertical). This is the only way to make the groove long and deep enough. Keep turning the pipe when a groove is made. So that the area to be worked on always points downwards. For more details look next Step.	

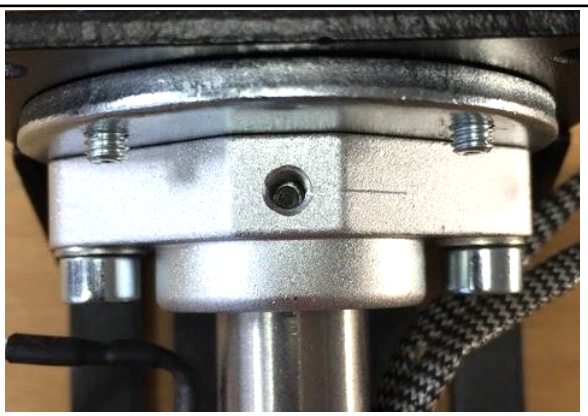
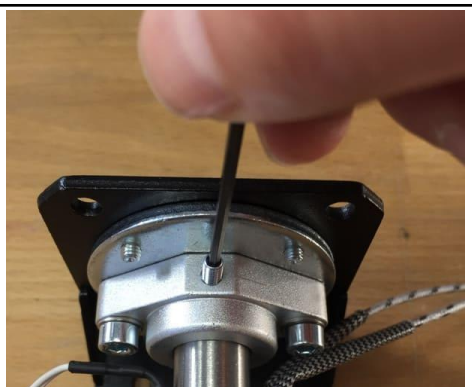
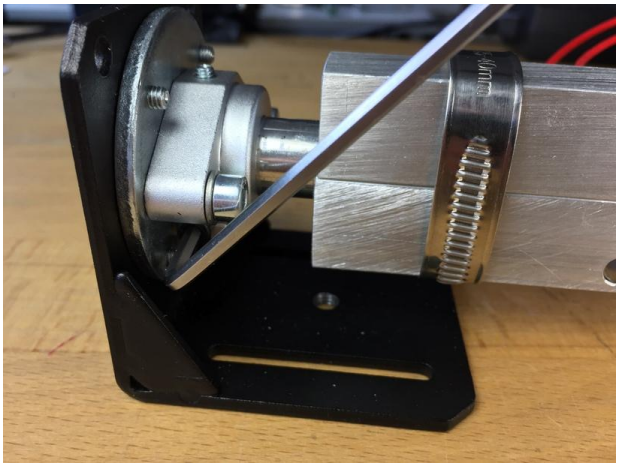
2.16	Here is a cut open tube for illustration. The inner wall is blackened so that you can see the groove better. The groove runs out to the rear.	
2.17	The groove should be approx. 25 to 30 mm long and taper inwards.	
2.18	Tool: Caliper At the beginning, the groove should be so deep that less than a millimeter of wall thickness remains.	
2.19	Tool: Half-round file, small By filing with the 4mm round file, the edges of the groove are angular and roughened. The groove is cleaned (deburred) with the small half-round file. Important: Make sure that the surfaces are very smooth! Unevenness can damage the extruder screw.	

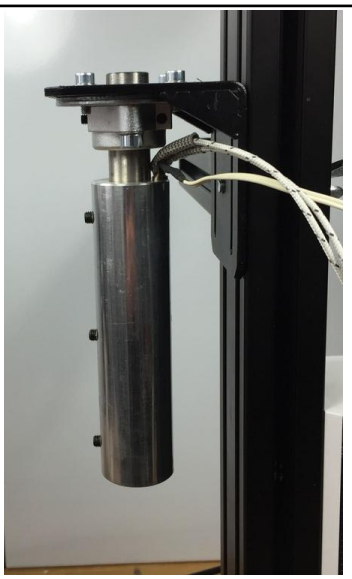
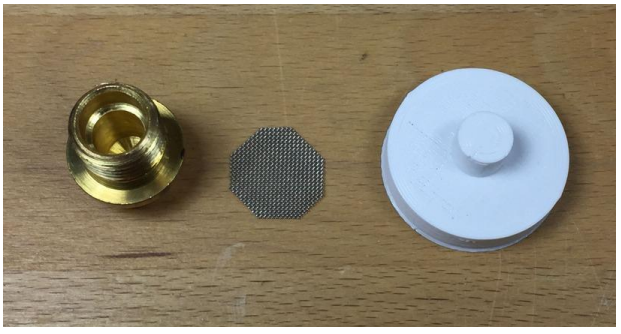
2.20	Tool: Spirit paper towel The markings can be removed with spirit and a cloth. All chips and debris inside the pipe must be thoroughly removed.	
2.21	Take from package 3: 2x heating cartridge (EB03, 53cm cable, ferrules) 1x thermistor (EB05) Take from package 0: 1x heating element (CM03.1) 1x heating element (CM03.2) Take from package 1: 1x nail (SP15) 2x hose clamp (SP15) Tools: Hammer Slotted screwdriver	
2.22	The heating elements are aligned as shown. The milled holes point inwards. The hole for the thermistor points downwards. The heating cartridges and the thermistor are inserted into the corresponding holes.	

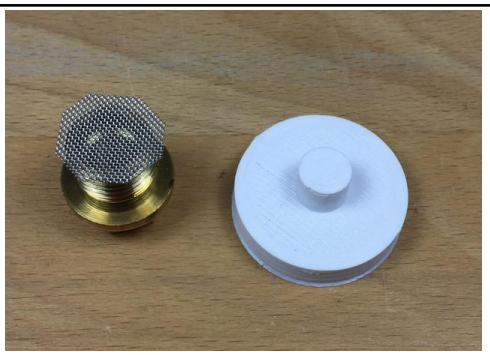
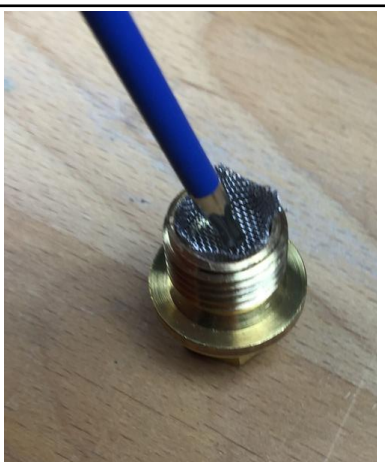
2.23	The thermistor is secured against slipping out. Place the nail on the face of the heating element and align it so that it sits over the thermistor. Now hit the nail with the hammer. The resulting indentation will hold the thermistor in place. Check that it is securely seated and repeat the process if necessary.	
2.24	The two heating cartridges are secured against slipping out. Place the nail on the side surface of the heating element and align it so that it sits above the heating cartridge. Now hit the nail with the hammer. The resulting indentation will hold the heating cartridge in place. Check that it is securely seated and repeat the process if necessary. Carry out this procedure for both heating cartridges. Translated with www.DeepL.com/Translator (free version)	
2.25	The extruder tube is pushed between the two heating elements in the following orientation: The thread in the tube faces the thermistor and is flush with the heating elements. The feed zone of the tube with the 3mm milling protrude on the other side.	

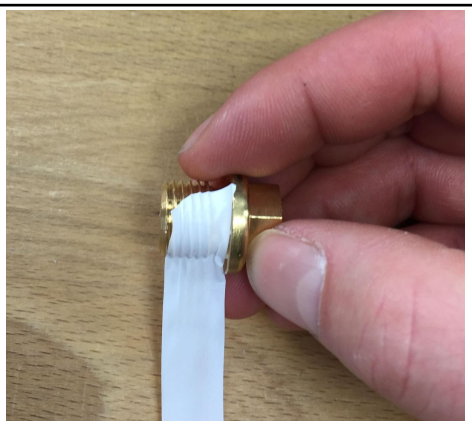
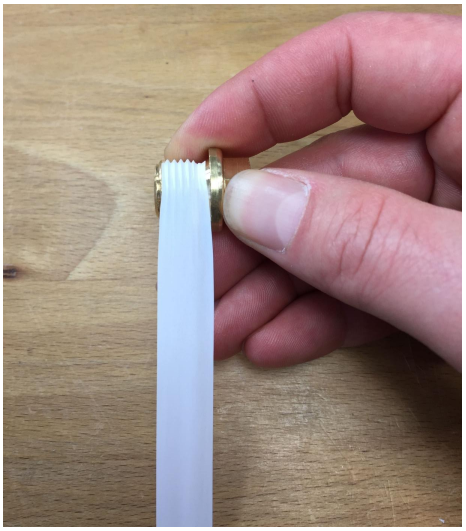
2.26	Align the first pipe clamp as shown in the figure. Pass the connecting line of the thermistor through the clamp and pull the whole line through.	
2.27	The clamp is attached as shown. If necessary, the clamp must be loosened slightly by turning the fastening screw counterclockwise with the slotted screwdriver. You can also bend the clamp slightly oval by squeezing it slightly.	
2.28	The second clamp is placed on the other side.	

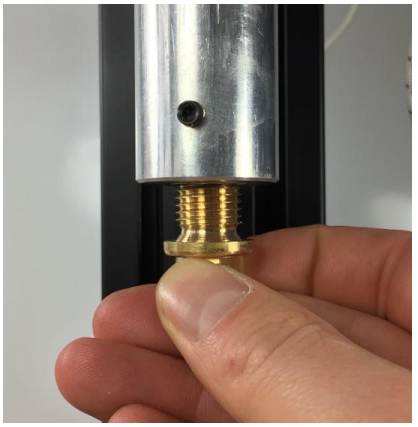
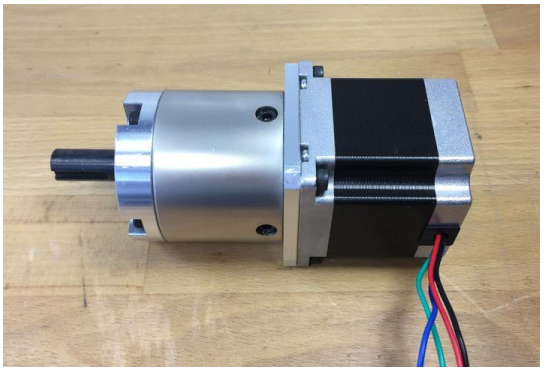
2.29	Turn the component so that it is upright.	
2.30	The tube must be rotated until the 3mm milling points upwards.	
2.31	Now the two hose clamps can be tightened. Make sure that the alignment of the tube does not slip. Now the tube must be cleaned inside. There must be absolutely no chips or impurities. Use a cloth with cleaning alcohol and pull it through the pipe.	

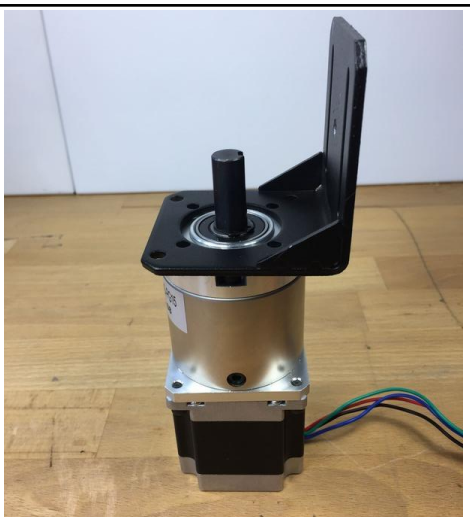
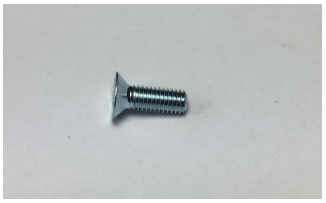
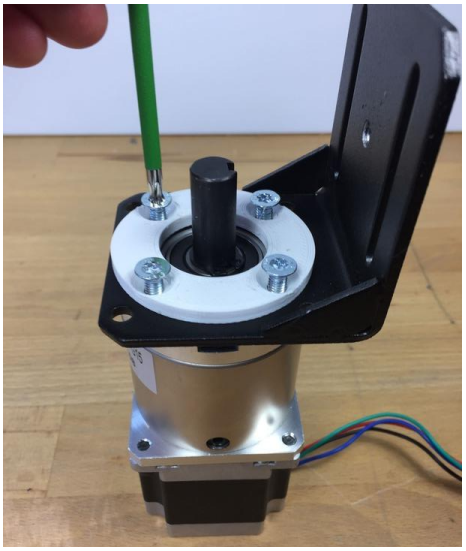
2.32	The extruder tube is pushed into the shaft holder on the mounting bracket. The 3mm milling points upwards.	
2.33	The tube is aligned so that the 3mm milling can be seen through the threaded hole in the shaft holder.	
2.34	Take from package 1: 1xMaden screw M4x10mm (SC15). Tool: Allen key 2mm Screw the grub screw into the thread in the shaft holder. Make sure that the grub screw hits the 3mm milling. Attention: tighten the grub screw only slightly.	
2.35	Tool: Allen key 3mm Tighten the clamping screw on the shaft holder firmly.	

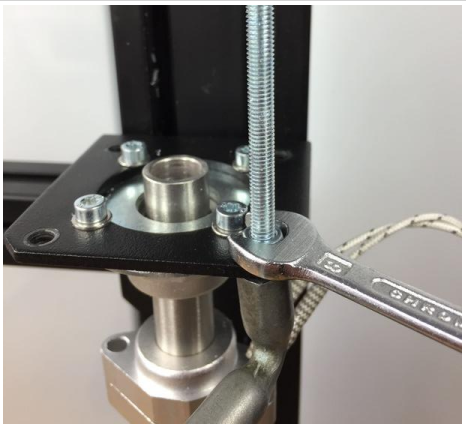
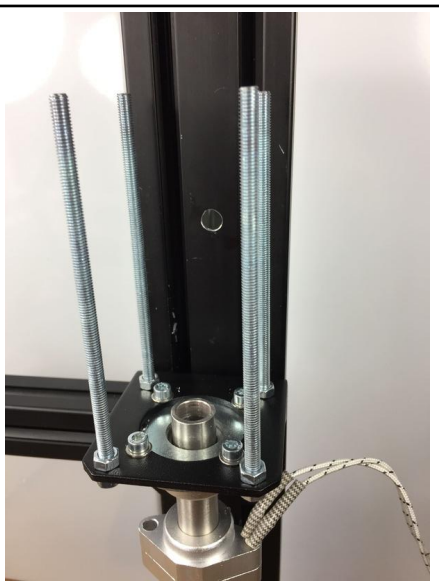
2.36	Take from package 1: Wing screw M6x35 (EB01)	
2.37	The wing screw is inserted from the rear through the lower hole in the aluminum profile.	
2.38	The mounting bracket is attached to the aluminum profile. To do this, screw the wing screw into the M6 thread in the mounting bracket. (Figure older version of the heating element)	
2.39	Take from package 3: Nozzle (EB06.2 - 06.4 depending on the filament diameter) Melt filter (EB07) Tool: Side cutters / scissors 3D printing: 1x bending aid melt filter (EB09) The melt filter is cut into a square piece with an edge length of 16 x 16 mm. The four corners are cut off, see picture.	

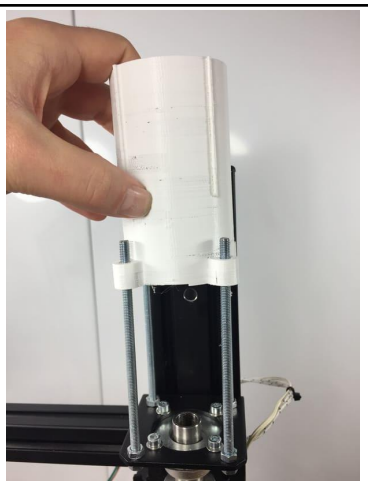
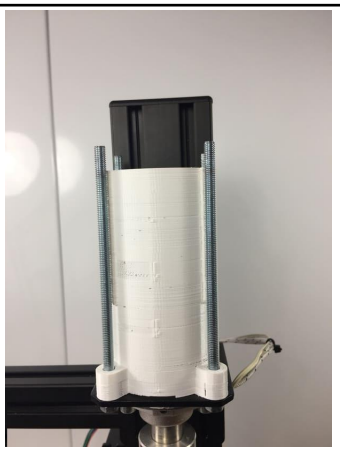
2.40	The melt filter is centered on the opening of the nozzle.	
2.41	The bending aid is also placed centrally on the melt filter. The 9 mm pin points downwards.	
2.42	The bending aid is pressed into the melt filter with a little pressure. This causes the melt filter to bend and slide into the opening of the nozzle. You can also use a vice.	
2.43	Pull the bending aid out again and remove the melt filter if it sticks to the bending aid.	
2.44	The hat-shaped melt filter is inserted into the opening of the nozzle. You can use a tool, see picture.	

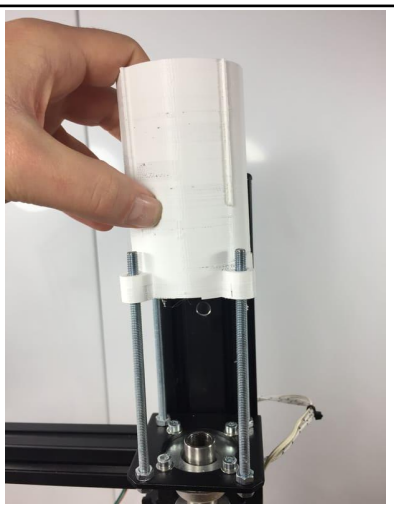
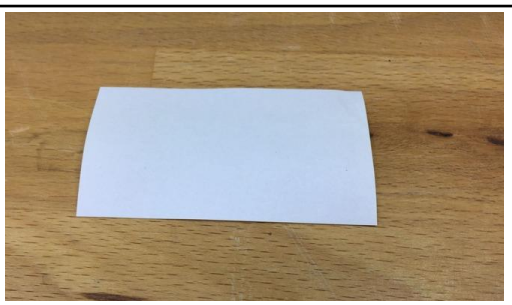
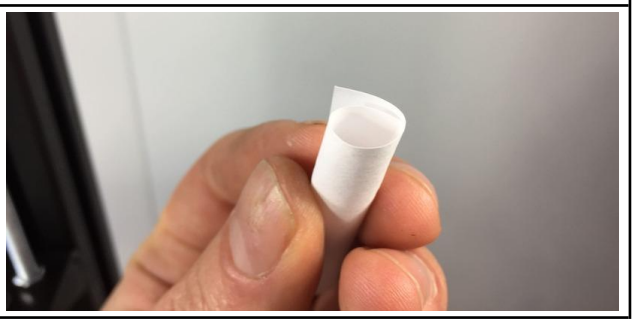
2.45	This is what the nozzle should look like with the melt filter inserted.	
2.46	Take from package 3: 1x Teflon tape (EB08) Depending on the plastics to be processed, it may be necessary to seal the thread of the nozzle. Teflon tape can be used for this. This is heat-resistant up to approx. 240 ° C. CAUTION: If you want to use higher temperatures, another suitable heat-resistant seal must be used. When Teflon burns, it produces toxic, noxious fumes. To wrap the Teflon tape around the thread, proceed as follows. Hold the nozzle in your right hand. The thread points to the left. Place the starting piece of the Teflon tape on the thread.	
2.47	Hold the tape with one finger as you twist the nozzle away from you. Pull lightly on the Teflon tape, then it fits well into the threads and does not protrude.	

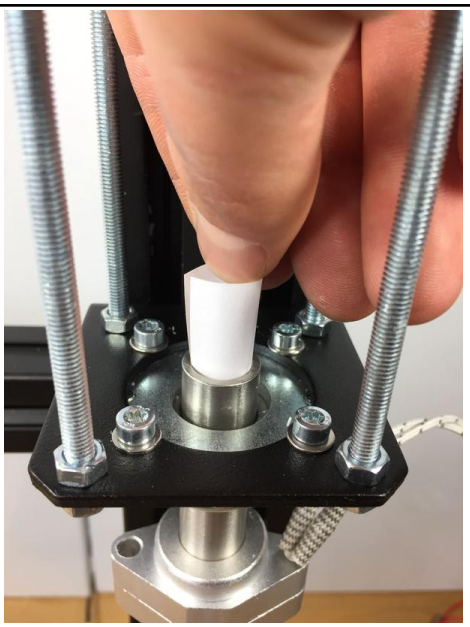
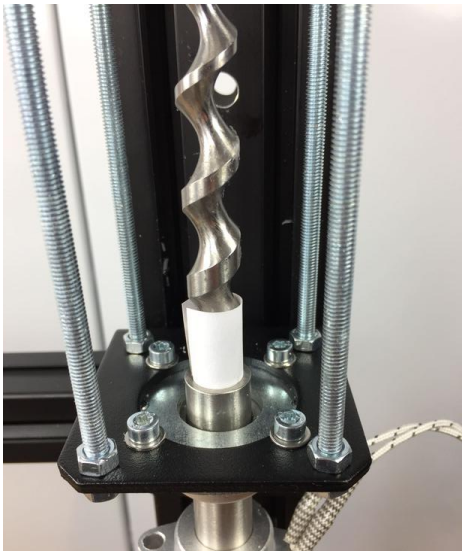
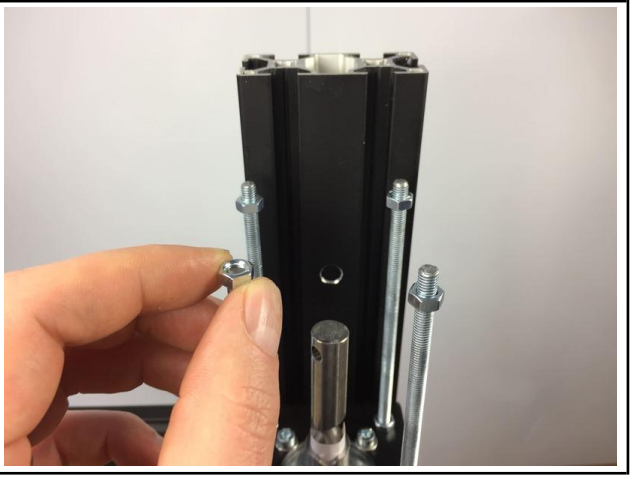
2.48	The end of the Teflon tape should stick if you press it down lightly as you wind it up.	
2.49	Now you can screw the nozzle into the extruder tube. (Figure older version of the heating element)	
2.50	Tools: Socket wrench 13mm or wrench 13mm A socket wrench is best suited for this. But it also works with a normal wrench.	
3.0	**Assembling the extruder drive**	
3.1	Take from package 0: 1x stepper motor Nema23 (MO01)	

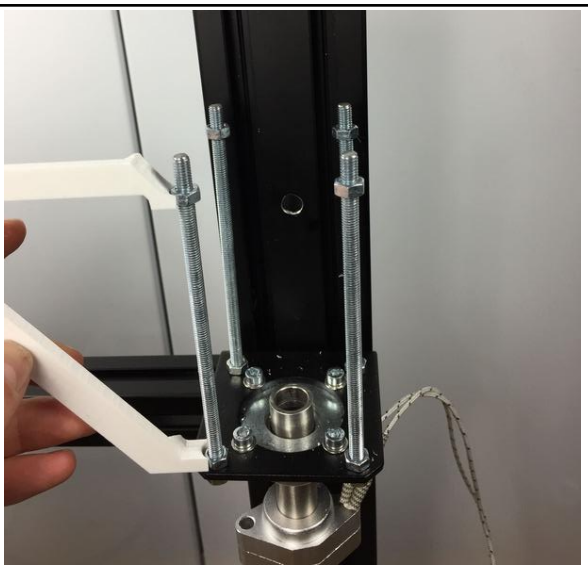
3.2	Take from package 2: 1x mounting bracket (Sp12) Place the mounting bracket on the stepper motor. Orientation see picture. The connection cable of the motor points in the same direction as the mounting bracket.	
3.3	Take from package 1: 4x countersunk head screw (SC06)	
3.4	3D printing: 1x coupling bearing surface (ED01) The storage area should be printed with 100% infill.	
3.5	Tool: Torx key TX25 Place the coupling bearing surface on the mounting bracket, see picture. The depressions point upwards. Tighten with the countersunk screws. Caution: Do not overtighten the screws. Otherwise the storage area will be damaged.	
3.6	Take from package 2: 4x threaded rod (SP04) Take from package 2: 4x nut M5 (SC11) Screw the nuts a little bit onto the threaded rod.	

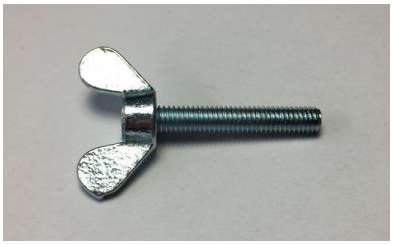
3.7	Take from package 1: 4x nut M5 (SC11) Insert the threaded rods into the holes in the mounting bracket on the extruder tube. Screw on further nuts from below. Make sure that the threaded rod is approximately flush with the lower nut.	
3.8	Tool: 8mm wrench Socket wrench 8mm To tighten, one nut must be held while the other is turned. This works best with a socket wrench and a wrench. In a pinch, you can hold one nut with pliers and tighten the other with a wrench. The nuts must be very tight.	
3.9	This is how it should look when all four threaded rods are mounted.	

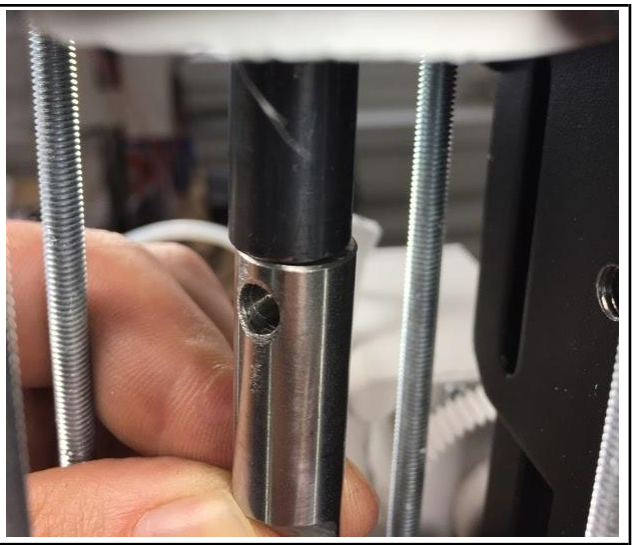
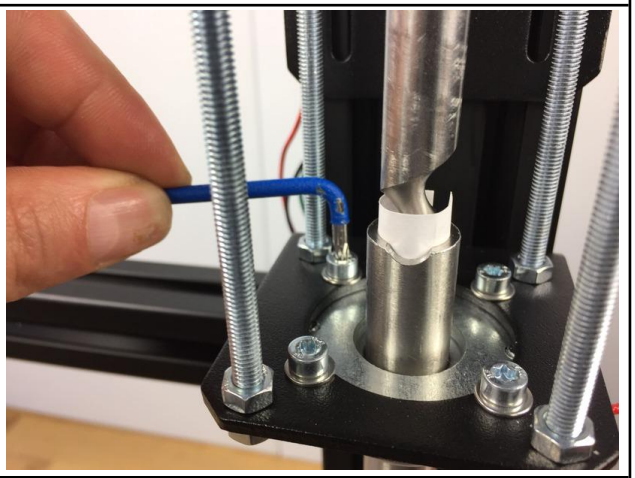
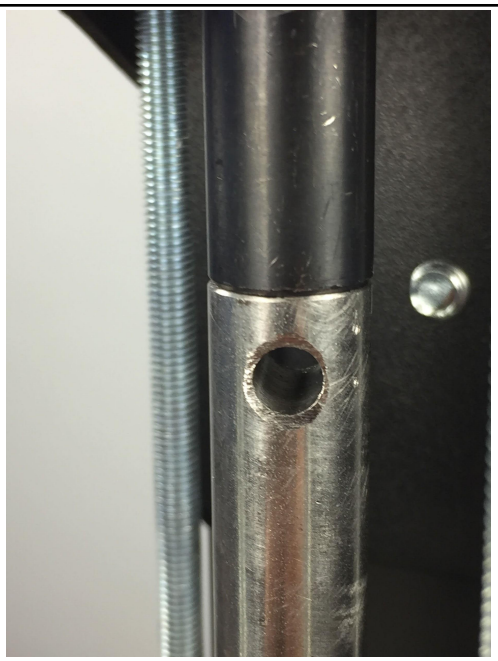
3.10	3D printing: Bending template for threaded rods (ED03) Place the bending template on the threaded rods and slide it down.	
3.11	The bending template must lie flat on the mounting bracket.	
3.12	Now check whether all threaded rods are parallel to the protruding edge on the bending template. If not, bend them by hand.	

3.13	If you look at the threaded rod from above, it must be in the middle of the protruding edge of the bending template. Bend the threaded rod by hand. Repeat these two steps until all threaded rods are parallel and centered to the protruding edges of the bending template. Make sure that the template lies flat on the mounting bracket at all times.	
3.14	Remove the bending template again.	
3.15	Tool: Paper strips approx. 70x36mm scissors Cut a piece of paper. (approx. 70x36mm)	
3.16	Roll the paper into a tube. (Roll the long edge so that the tube is approx. 70mm long)	

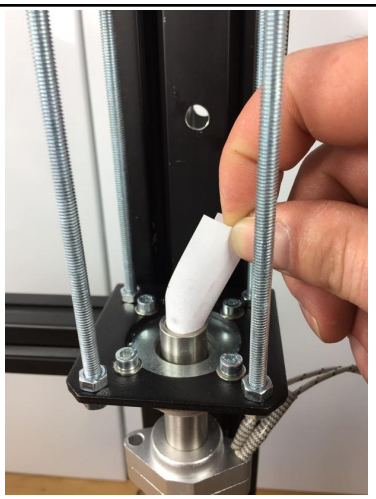
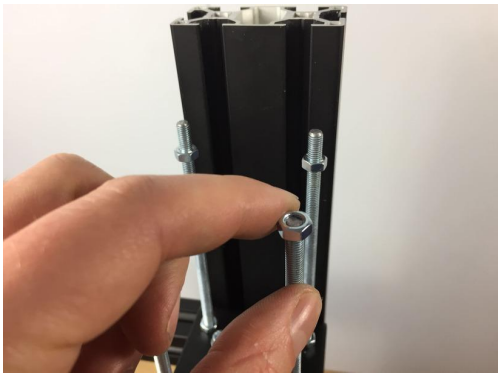
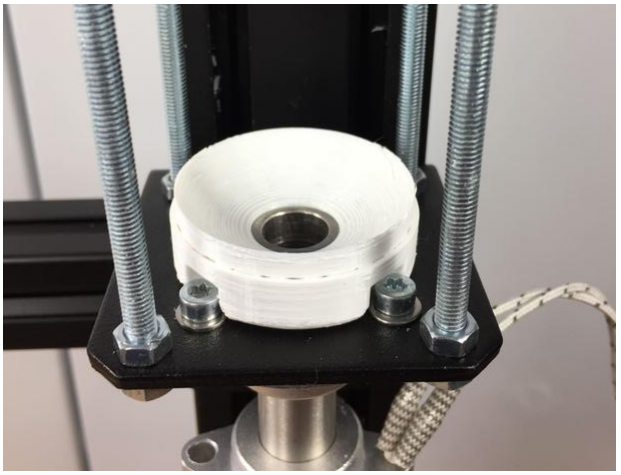
3.17	Push the paper tube into the extruder tube. Let it survive a bit.	
3.18	Take from package 0: 1x extruder screw (CM2.2)	
3.19	Push the extruder screw into the extruder tube. Be careful not to push the paper too far into the tube.	
3.20	Take from package 1: 4x M5(SC11) Screw another four nuts onto the threaded rods.	

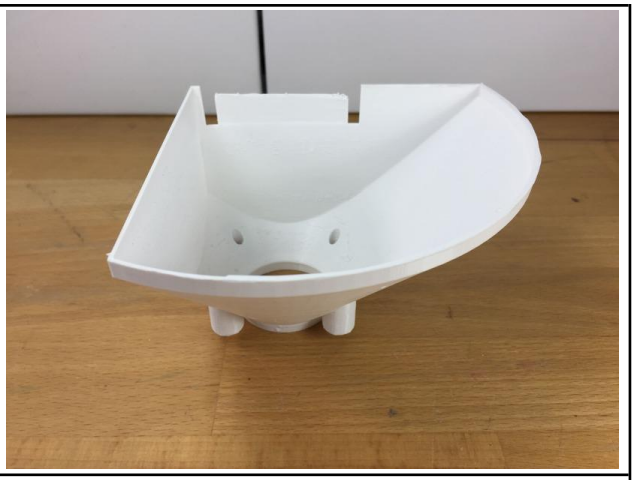
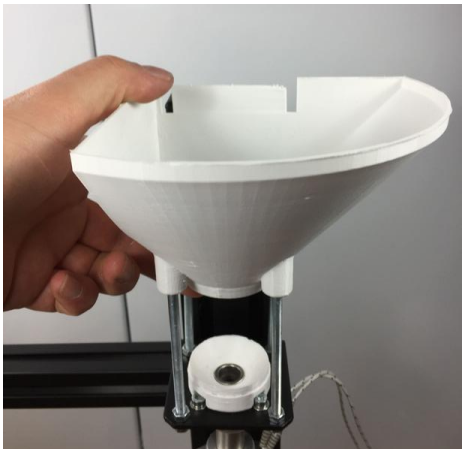
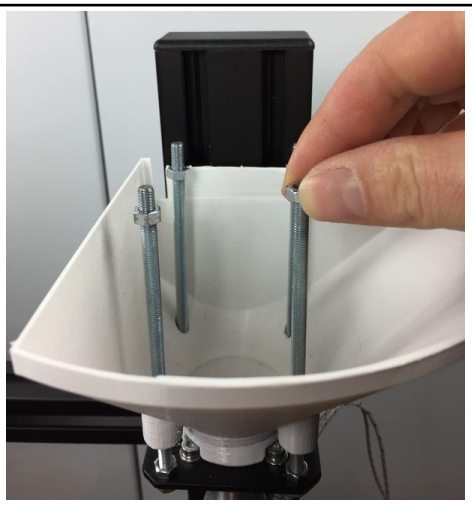
3.21	3D printing: 1x assembly aid (ED06) Apply the assembly aid as shown in the picture: -Bottom of the nut on the mounting bracket of the extruder pipe. -At the top of the loose mother.	
3.22	Turn the loose nut so that the upper edge is exactly flush with the assembly aid. This is done with all four mothers. Take your time and measure accurately. Here it is important that all nuts are the same distance from the mounting bracket of the extruder pipe. Otherwise the extruder screw may not be exactly parallel to the extruder tube and could produce abrasion.	
3.23	Place the stepper motor with the mounting bracket on the threaded rods. The angle points back to the aluminum profile. Attention, during the process it can happen that the nuts twist. If in doubt, use the assembly aid to measure again whether all nuts are at the same height.	

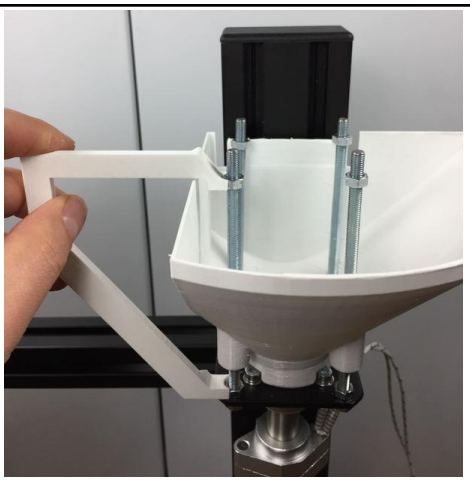
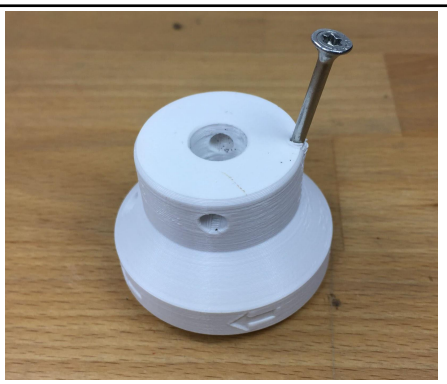
3.24	Take from package 1: 4x nut M5 (SC11) Screw four more nuts onto the ends of the threaded rods.	
3.25	Tool: 8mm wrench Tighten the nuts with a wrench.	
3.26	Take from package 1: 1x wing screw (SC19)	
3.27	Insert the wing screw from the rear into the upper hole in the aluminum profile and tighten the mounting bracket of the motor. If you do not hit the thread in the mounting bracket right away, it may be necessary to loosen the lower wing screw again and move the mounting bracket back and forth until they hit. Then tighten both wing screws again.	

3.28	Now check how the extruder screw and the shaft of the motor are aligned with each other. If these are not in alignment, this is set in the following steps.	
3.29	Tool: Torx key TX20 You can change the position of the extruder screw by moving the adapter disk and the extruder tube. The 4 cylinder screws at the top and the two cylinder screws on the shaft holder at the bottom must be loose.	
3.30	When the extruder screw and the shaft of the motor are in line, tighten the socket head screws of the adapter disk and the shaft holder. Check again whether the alignment is still correct. If in doubt, repeat the process until the alignment is good with the screws tightened, see picture.	

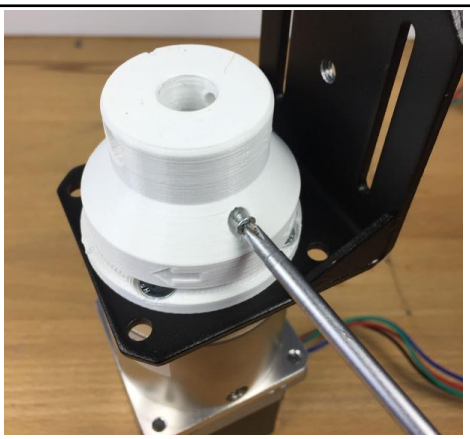
3.31	Tools: 8mm wrench Now the motor can be removed again. To do this, loosen and remove the upper nuts again.	
3.32	Loosen and remove the wing screw again.	
3.33	Remove the motor.	
3.34	Pull out the extruder screw.	

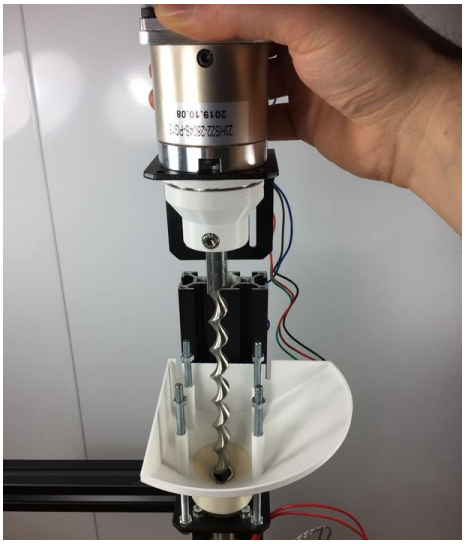
3.35	Remove the paper.	
3.36	Remove the four nuts on the threaded rods.	
3.37	3D printing: 1x feed zone (ED04) If possible, print this part in ABS or ASA. It lasts longer and enables higher extruder temperatures.	
3.38	Tool: 8 mm wrench Socket wrench 8 mm Place the feed zone on the extruder tube. See image.	

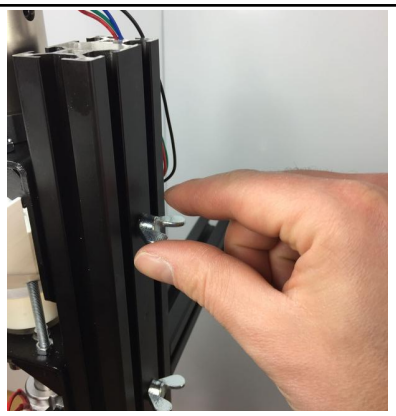
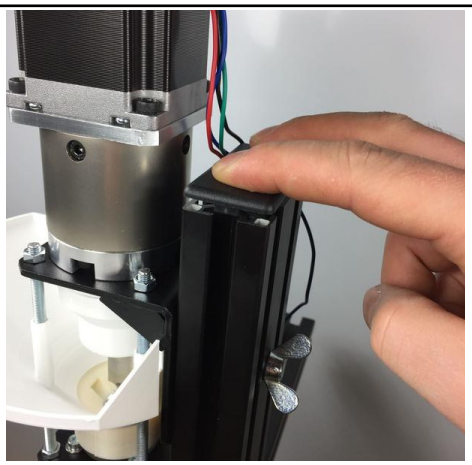
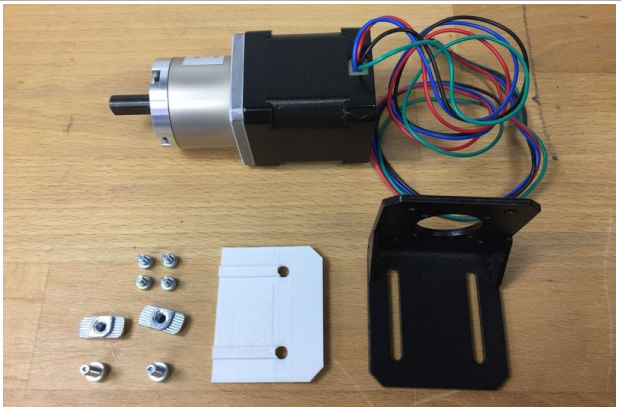
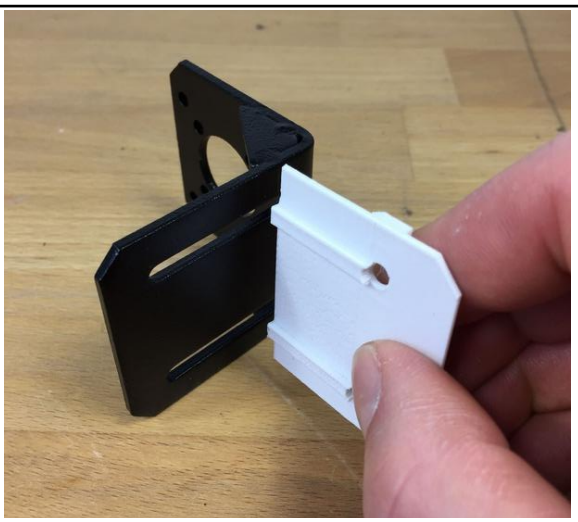
3.39	3D print: 1x hopper part 1 (ED05)	
3.40	Place the hopperl part 1 on the threaded rods. If the threaded rod does not fit well into the corresponding holes in the funnel, you can drill them open with the drill (5.5mm drill).	
3.41	Push the hopper part 1 all the way down.	
3.42	Screw four nuts back onto the threaded rods.	

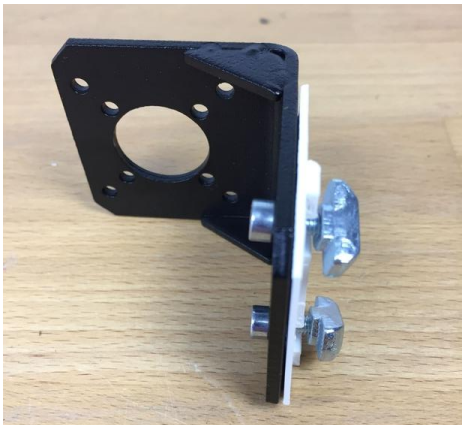
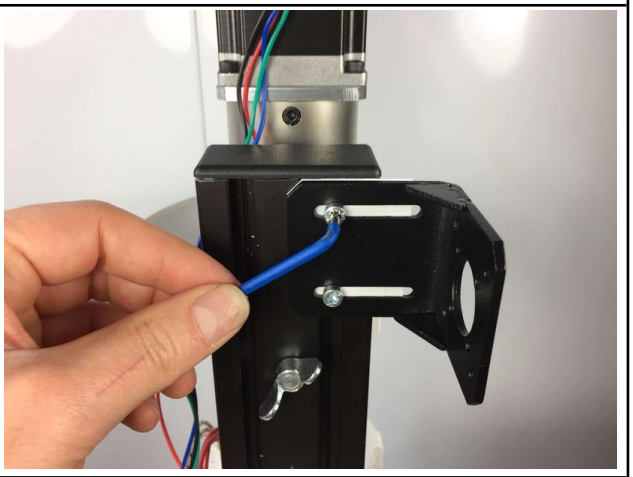
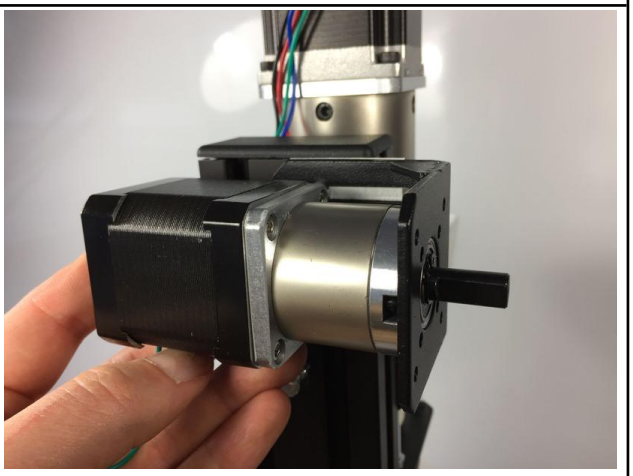
3.43	Align the height of the nuts again using the assembly aid.	
3.44	Again, be very careful this time.	
3.45	3D print: 1x coupling (ED02) Take from package 1: 1x wood screw 4x60 (SC17)your Tool: Torx key TX 25	
3.46	The screw is only required if you use self-made (shredded) granules. Screw the screw into the small hole in the clutch. The screw must protrude approx. 35 to 36 mm from the coupling.	
3.47	Take from package 2: 1x trust bearing (SP13)	

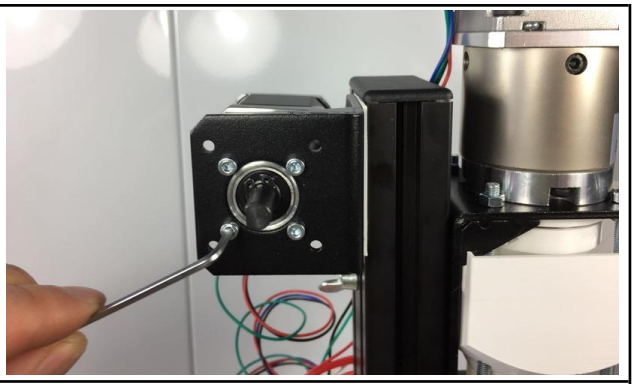
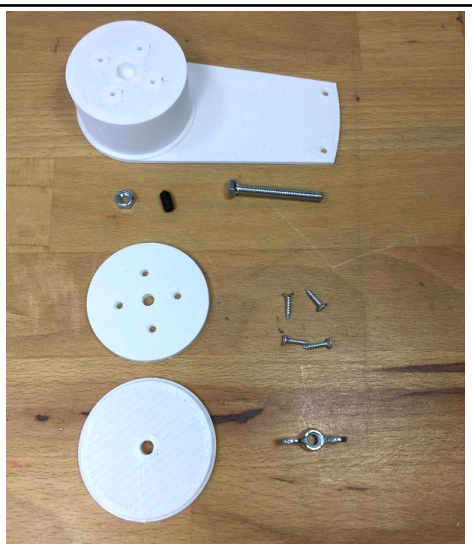
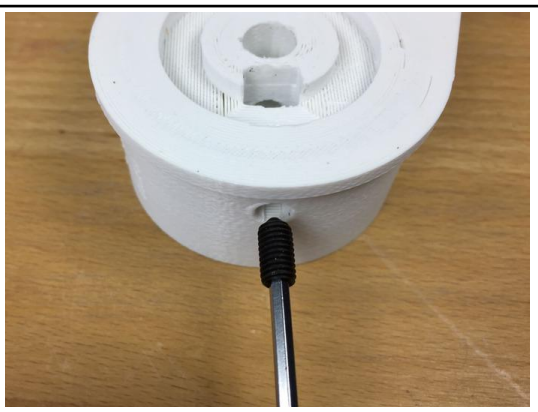
3.48	Remove the straps on the thrust bearing and insert the bearing into the recess in the coupling.	
3.49	Take from package 2: 1x parallel key (SP03)	
3.50	Place the key in the recess on the motor shaft. The motor shaft can be turned with the hands or a pair of pliers in the de-energized state if the alignment is unfavorable.	
3.51	Align the coupling so that the key and the groove in the coupling are opposite.	
3.52	Place the coupling on the motor shaft. If the bore of the coupling is too narrow, it can be drilled out with a 12mm drill or reworked with a file / sandpaper.	

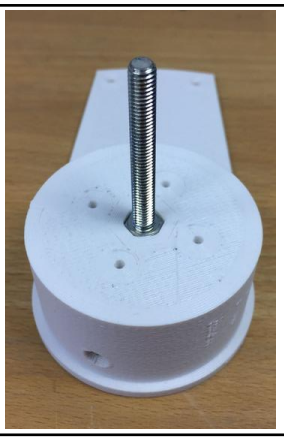
3.53	Take from package 1: 1x wood screw 2.5x12mm (SC01)	
3.54	Tool: cross-slotted screwdriver PH1 Screw the screw into the small side hole and tighten only slightly. This only serves to ensure that the coupling does not slip away during assembly. Make sure that the thrust bearing lies flat before the screw is tightened.	
3.55	Insert the shaft of the extruder screw into the coupling and align it so that the bore in the coupling and screw match. The shaft should slide in easily. If not, the hole has to be reworked with a 12mm drill or a file.	
3.56	Take from package 1: 1x cylinder screw M5x30 (SC07)	
3.57	Fasten the extruder screw with the cylinder screw. If the screw is a little loose, this is not a problem, it cannot fall out during operation.	

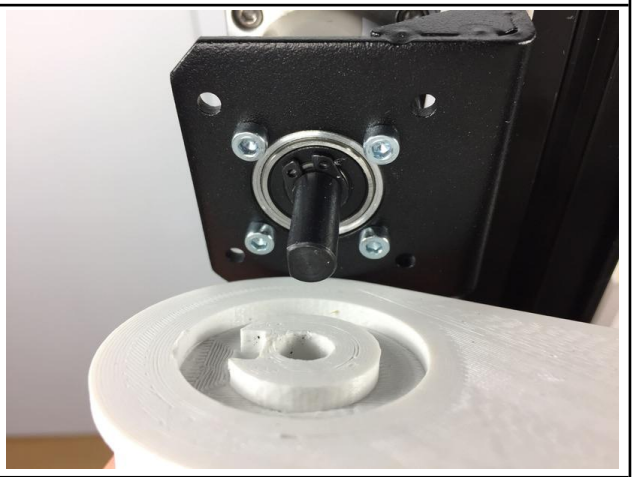
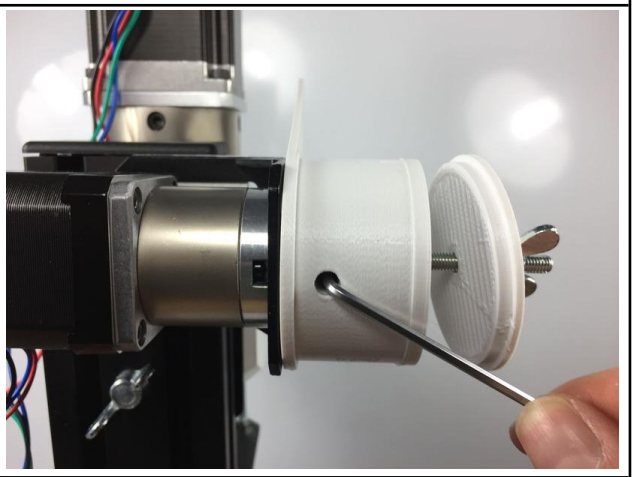
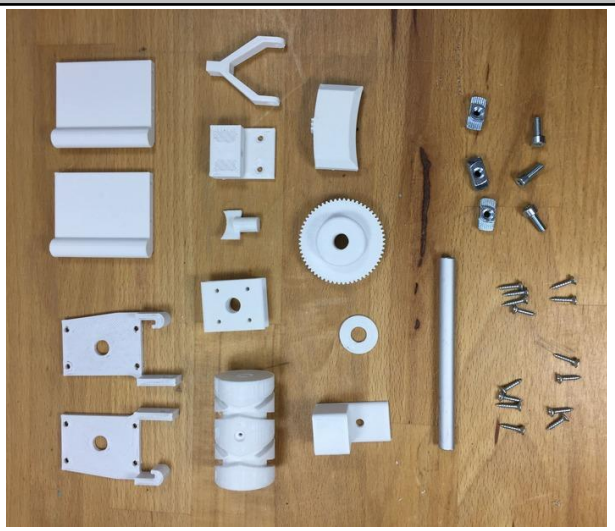
3.58	Check the height of the nuts again.	
3.59	Mount the motor with the extruder screw. To do this, push the extruder screw into the extruder tube and place the motor on the threaded rods.	
3.60	Put on four nuts again.	
3.61	Tools: Wrench 8mm Tighten the nuts.	

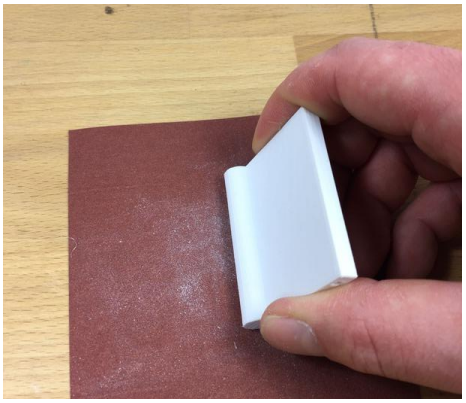
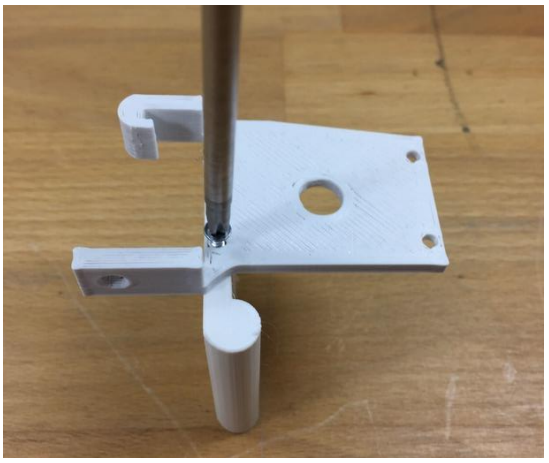
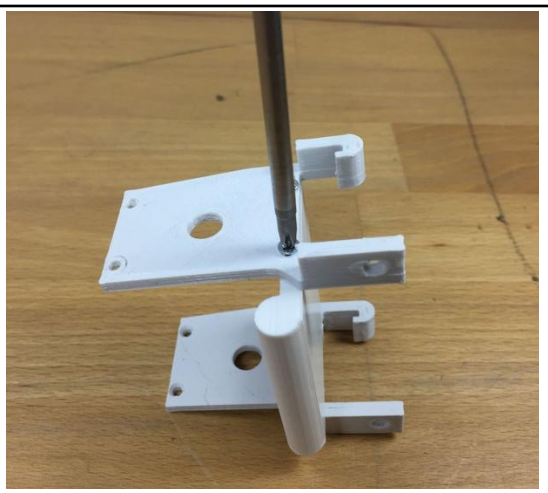
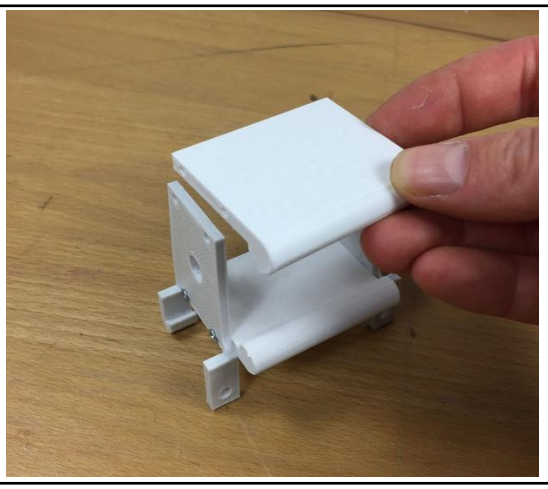
3.62i	Re-insert the wing screw from behind and tighten the mounting bracket of the motor. (If you use printed spacers, don't forget to do this).	
3.63	Take from package 2: 1x cover cap (SP02) Put the cap on the aluminum profile. Possibly a little pressure may be necessary. If in doubt, use light hammer blows.	
4.0	**Assembly of the winder unit**	
4.1	Take from package 0: 1x stepper motor Nema 17 (MO03) Take from package 2: 1x mounting bracket (SP14) 3D printing: 1x mounting rail (WI01) Take from package 1: 4x cylinder screw M3x6 (SC03) 2x hammer nut (SC10) 2x socket head screw M4x10 (SC04)	
4.2	Align the fitting rail with the mounting bracket, see picture.	

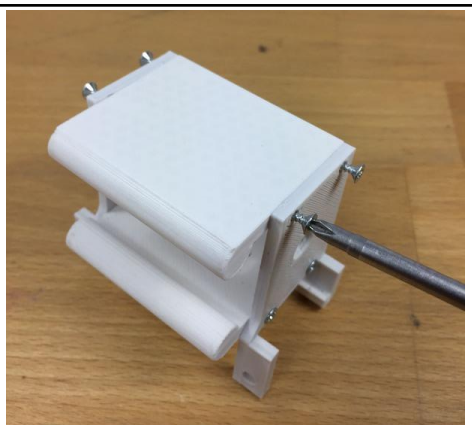
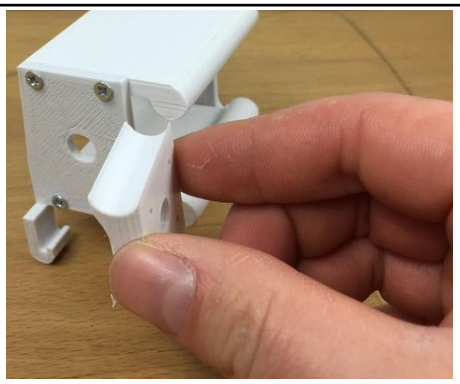
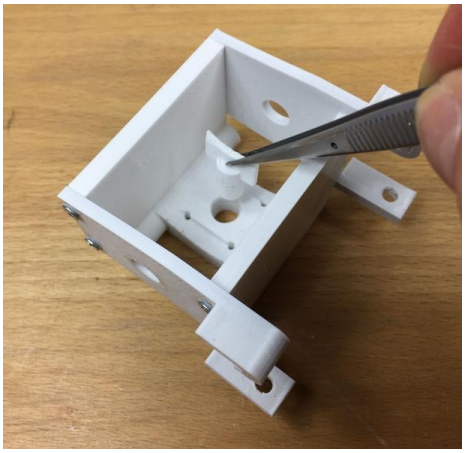
4.3	Attach the fitting rail.	
4.4	Insert the M4x10 cylinder screws through the mounting bracket and fitting rail and screw the hammer nuts a few turns onto the screws. The hammer nuts must still be loose.	
4.5	Tool: Torx key TX20 Fasten the mounting bracket with fitting rail from the rear of the aluminum profile. To do this, align the hammer nuts so that they slide into the groove. When tightening the screws, make sure that the hammer nuts turn 90° inside the groove and anchor.	
4.6	Place the stepper motor on the mounting bracket. The connection cable points downwards.	

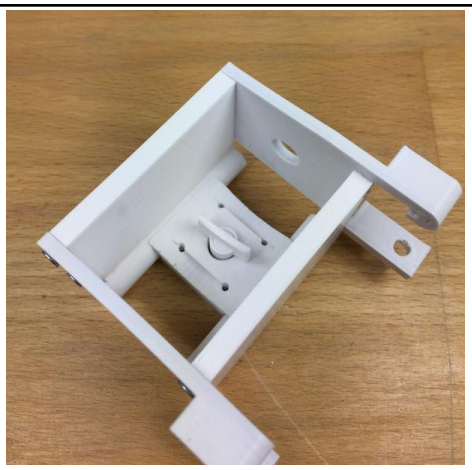
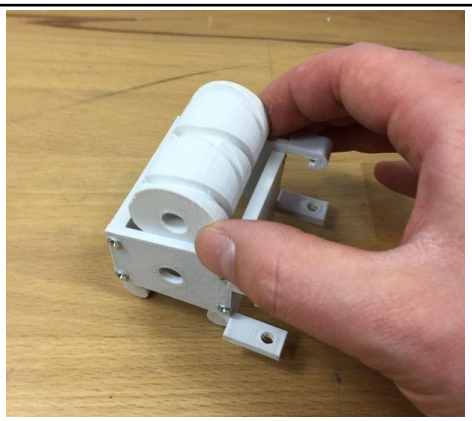
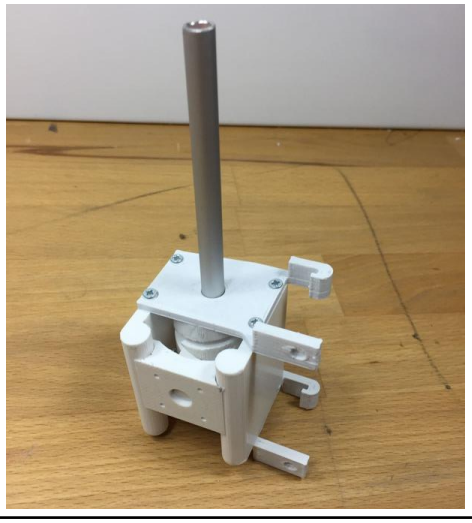
4.7	Tools: Allen key size 2.5 Screw the motor tight with the four small cylinder screws M3x6. Do not overtighten the thread.	
4.8	3D printing: 1x spool holder (WI2.1) 1x spool holder cover 1 (WI3.1) 1x spool holder cover2 (WI4.1) Take from package 1: 1x nut M5 (SC11) 1x grub screw M5x10 (SC16) 1x hexagon screw M5x40 (SC08) 1x wing nut M5 (SC09) 4x wood screw 2.5x12 (SC01)	
4.9	Insert the M5 nut into the groove in the bobbin holder from behind.	
4.10	Tool: Allen key size 2, slide the nut into the groove and screw in the M5 grub screw from the side. Do not screw it in too deep, otherwise the spool holder will not fit properly later.	

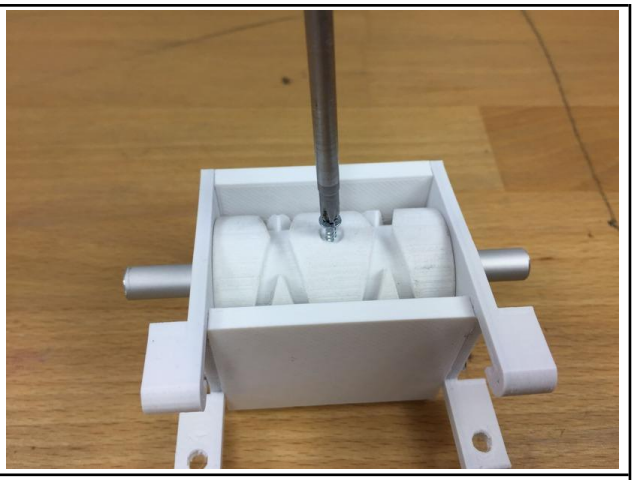
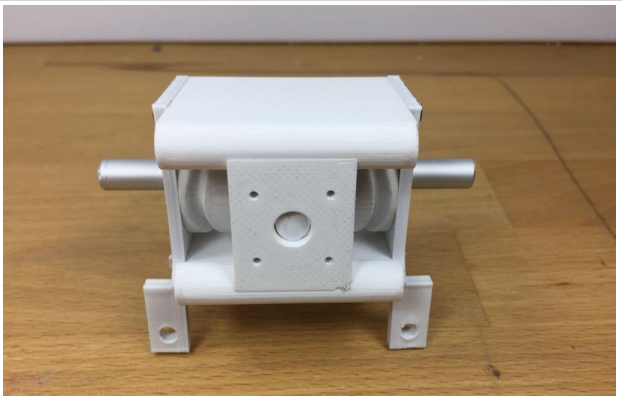
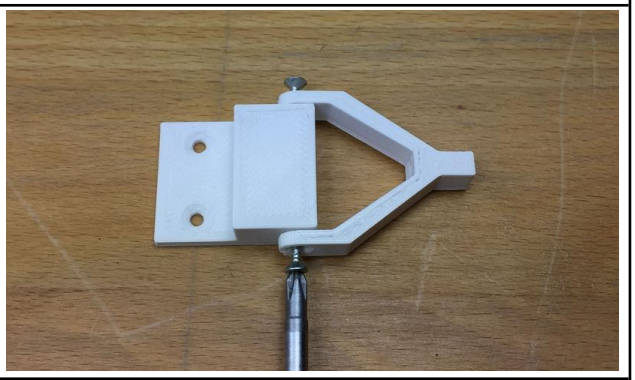
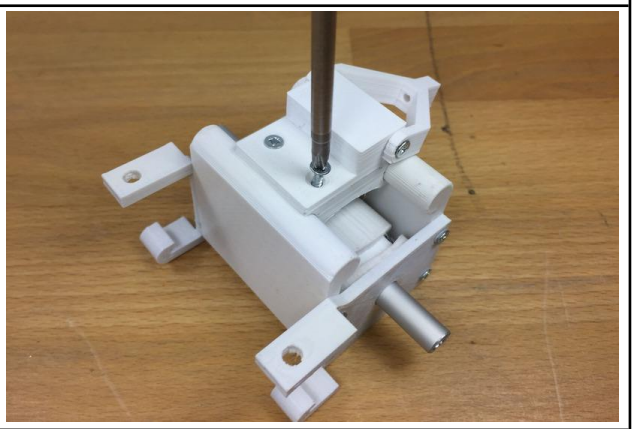
4.11	Insert the hexagon head screw into the opening provided in the spool holder.	
4.12	Push the spool holder cover 1 onto the screw. Make sure that the countersinks in the four small holes point upwards.	
4.13	Tool: cross-slotted screwdriver PH1 Screw in the screws 2.5x12, see picture.	
4.14	Place the spool holder cover 2 on the screw.	

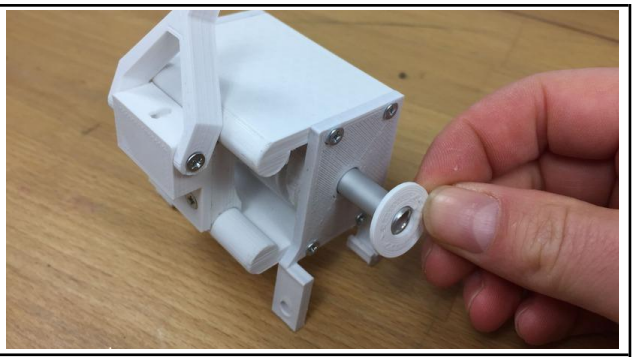
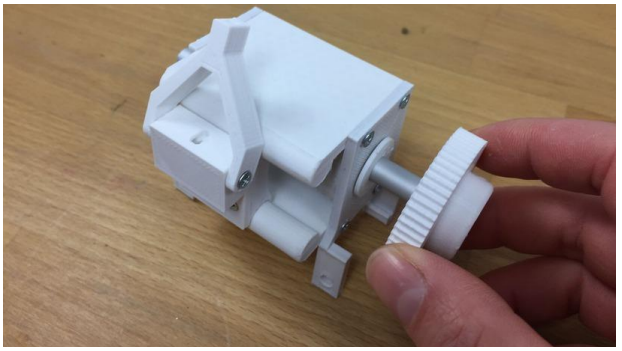
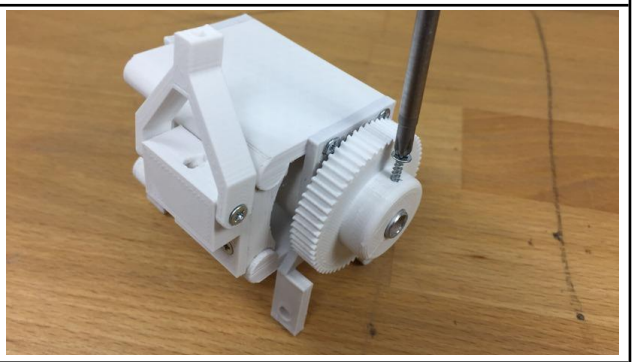
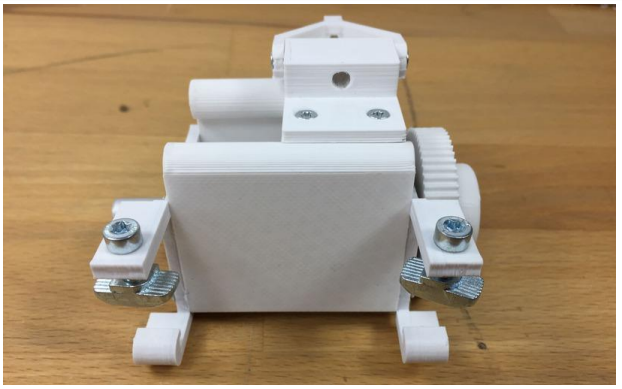
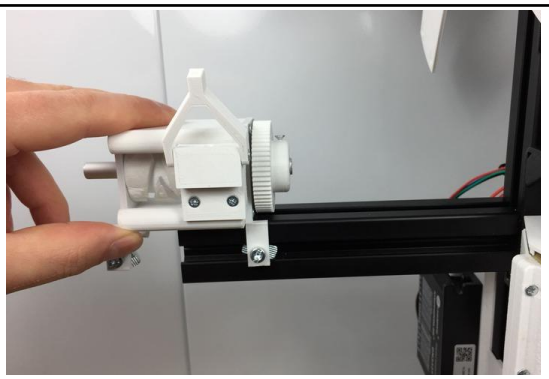
4.15	Turn the wing nut onto the screw.	
4.16	Put the spool holder on the shaft of the small stepper motor. Make sure the grub screw in the spool holder is aligned with the flat surface on the motor shaft.	
4.17	Tool: Allen key size 2.5 Tighten the grub screw. Do not overtighten the thread	
5.0	**Filament guide assembly**	
5.1	3D printing: 1x frame socket left (FG01) 1x frame socket right (FG02) 2x frame guide (FG03.1) 1x screw roller (FG4.1) 1x carriage (FG05) 1x plow (FG06) 1x filament brake part 1 (FG7.1 or 7.2) 1x lever guide (FG8.1 or 8.2) 1x filament brake part 2 (FG09) 1x washer (FG10) 1x gear (FG11) 1x pusher (FG12.1 or FG12.2) Take from package 2: 1x round rod (SP05) Take from package 1:	

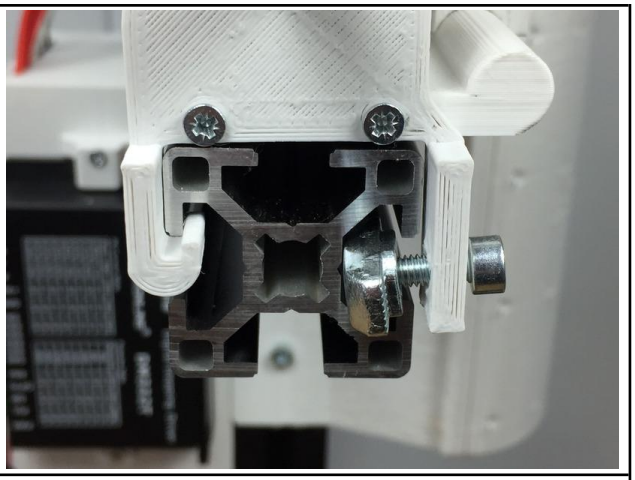
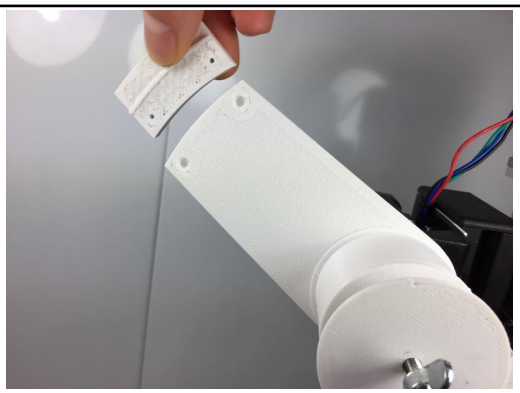
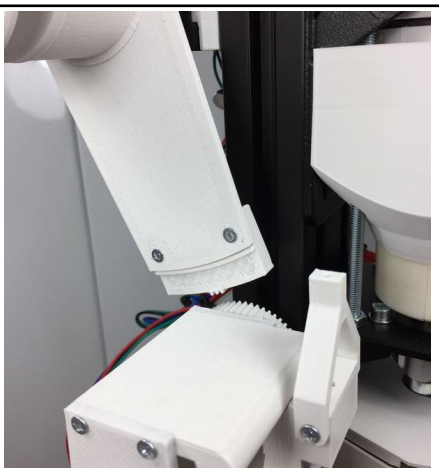
	3x hammer nuts M4 (SC10) 3x socket head screw M4x10 (SC04) 14x wood screws 2.5x12mm	
5.2	Tool: Sandpaper / file Sand the round surface of the two frame guides FG03.1 smooth with sandpaper or a file.	
5.3	Tool: cross-slotted screwdriver PH1 Screw the frame socket left FG01 onto the frame guide. Orientation see picture.	
5.4	Screw the frame socket right FG02 to the frame guide. Orientation see picture.	
5.5	Insert the second frame guide FG03.1.	

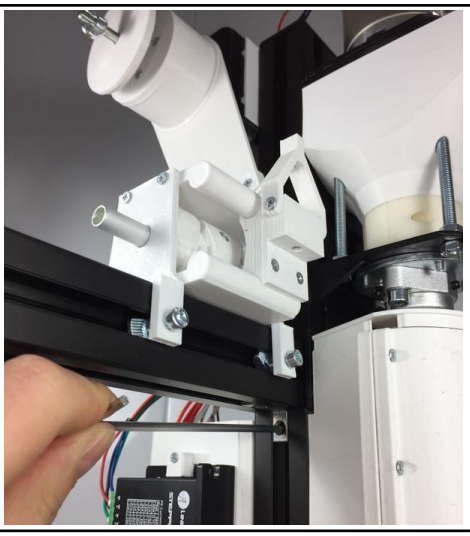
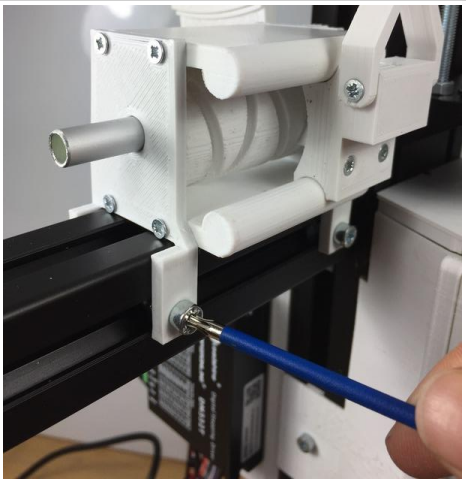
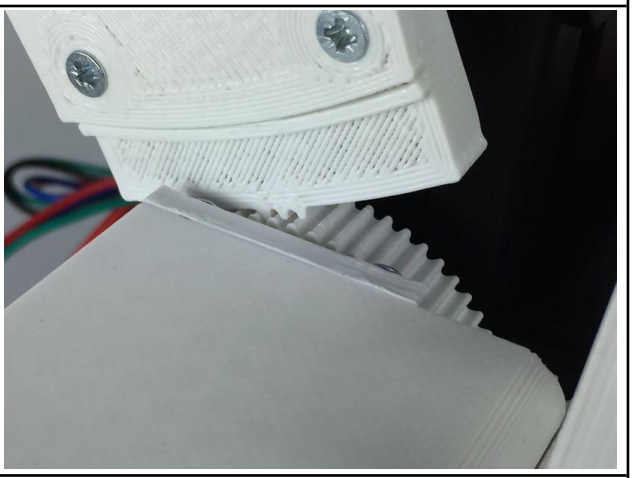
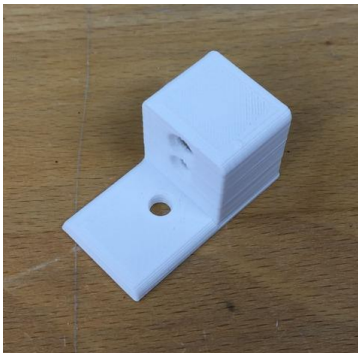
5.6	Screw the frame guide tight.	
5.7	Insert the carriage FG05. Orientation see picture.	
5.8	It must be possible to move the slide fairly easily over the entire length of the guide.	
5.9	The FG06 plow is used from behind.	

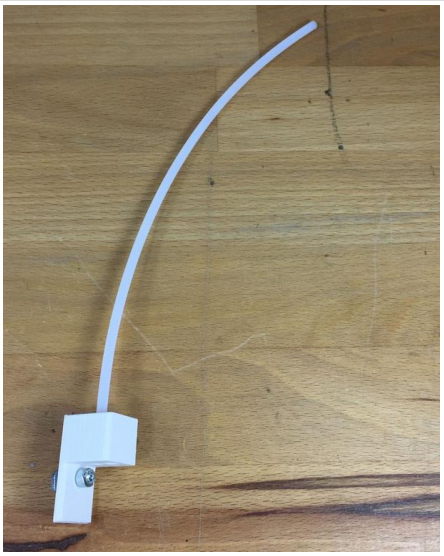
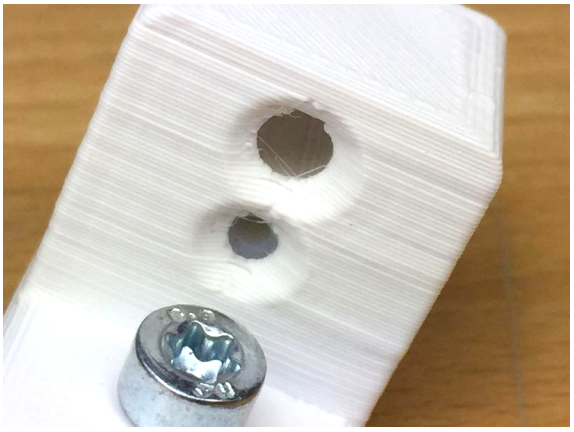
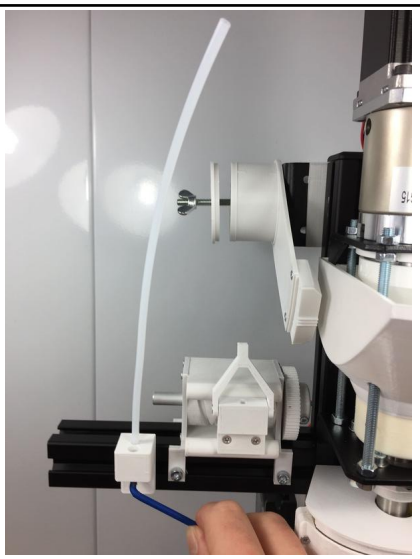
5.10	If the plow does not turn easily, rework the printed parts with sandpaper or a file.	
5.11	Insert the screw roller FG4.1 from behind. If it doesn't fit right away, sand off the side surfaces a little.	
5.12	Make sure that the plow hits in the groove of the screw roller.	
5.13	Push the round rod (SP05) sideways through the frame and screw roller. If it is difficult, drill out the holes with an 8mm drill or rework with a file.	

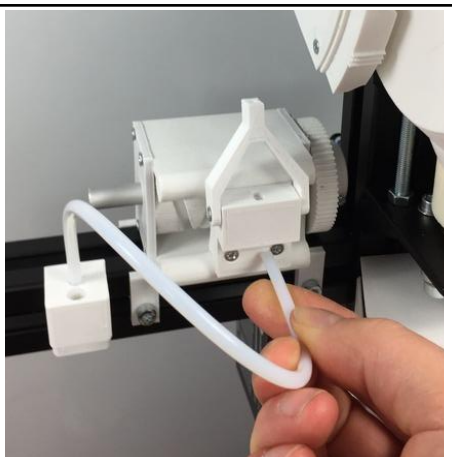
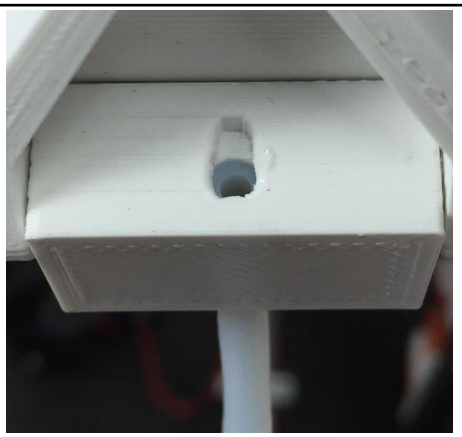
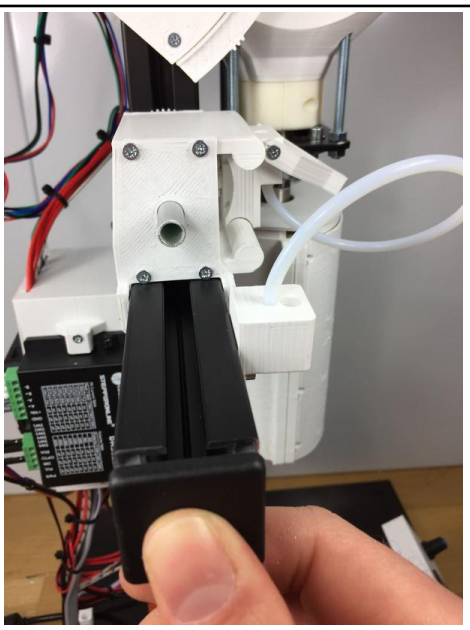
5.14	Secure with a screw 2.5x12.	
5.15	Turn the round rod, now the screw roller should turn smoothly and move the carriage back and forth. If parts are stiff, dismantle and regrind surfaces.	
5.16	Screw the lever guide FG8.1 or 8.2 onto the filament brake FG 7.1 or 7.2.	
5.17	Screw the filament brake onto the carriage. Orientation see picture.	

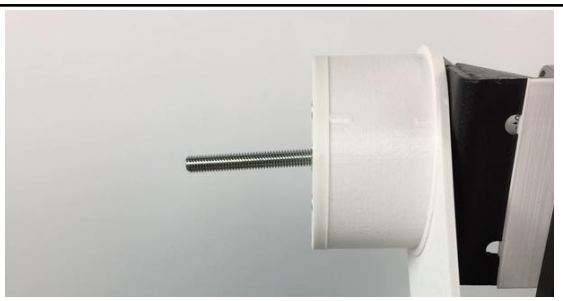
5.18	Slide the washer FG10 on the right side onto the round rod.	
5.19	Push the gearl FG11 onto the round rod from the right as well.	
5.20	Push it and press so hard that the gear can be turned with slight resistance. Then secure with a screw.	
5.21	Insert the cylinder screws through the holes in the frame socket and screw the hammer nut onto them from below.	
5.22	Slide the filament guide onto the aluminum profile on the side. See next step	

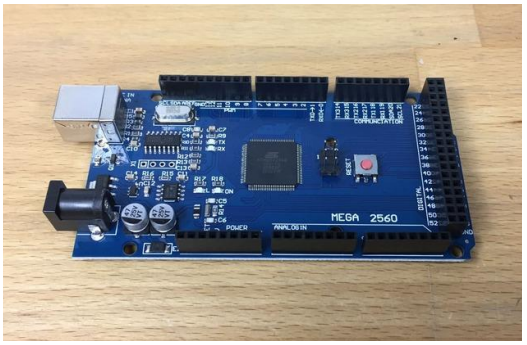
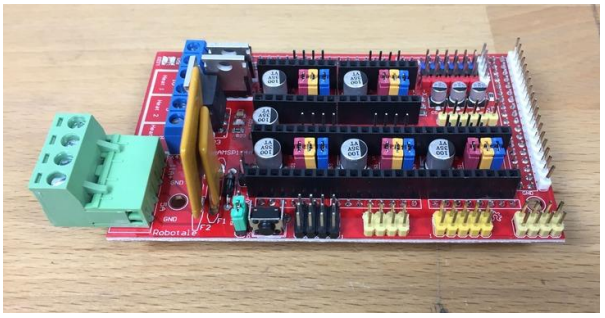
5.23	The hooks must engage in the groove of the profile and the hammer nut must be loose. It will be screwed tight later.	
5.24	Take the pucher FG 12.1 or 12.2 in hand.	
5.25	Screw the pusher onto the spool holder. To do this, align as shown.	
5.26	Tool: cross-slotted screwdriver PH1 And fasten with two screws.	
5.27	The motor for the rewind can be turned by hand when the power is off. Orient it so that it is facing the filament guide gear.	

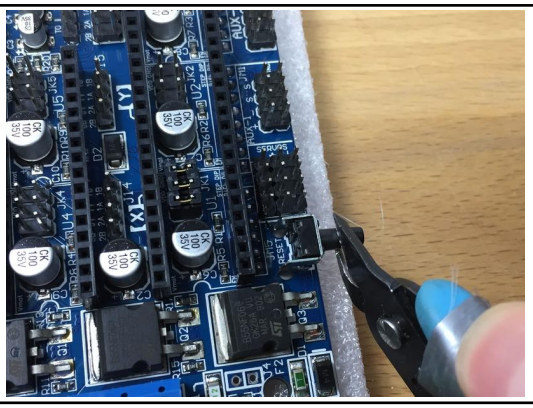
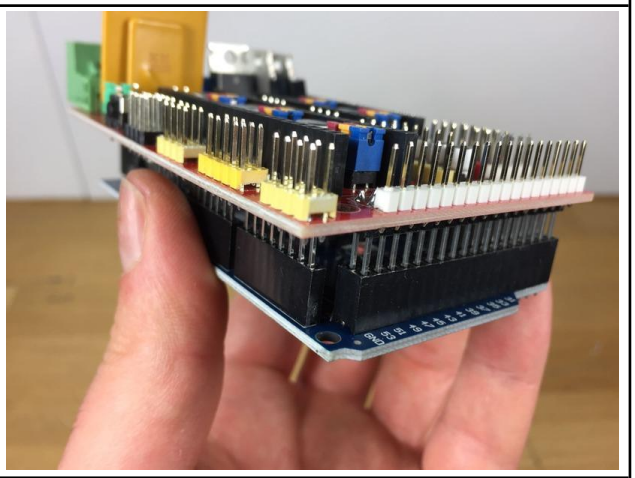
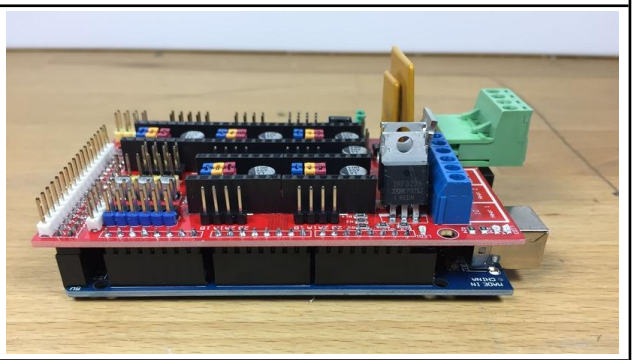
5.28	Tool: Allen key size 3 Loosen the angle connector of the side aluminum profile and align it in height so that the gear wheel and the slide are in contact.	
5.29	Tool: Torx key TX20 Align the filament guide so that the gear and the slide allow you to move well and mesh with each other. See next step. When tightening the screws, make sure that the hammer nuts twist in the groove.	
5.30	The gear wheel and the slide must move smoothly into one another without hitting anything. Repeat steps 5.28 and 5.29 until this is the case.	
5.31	Take the filament brake part 2 FG09 in hand and check the bores for roundness and dimensional accuracy. If necessary, re-drill with a 4 and 6mm drill.	

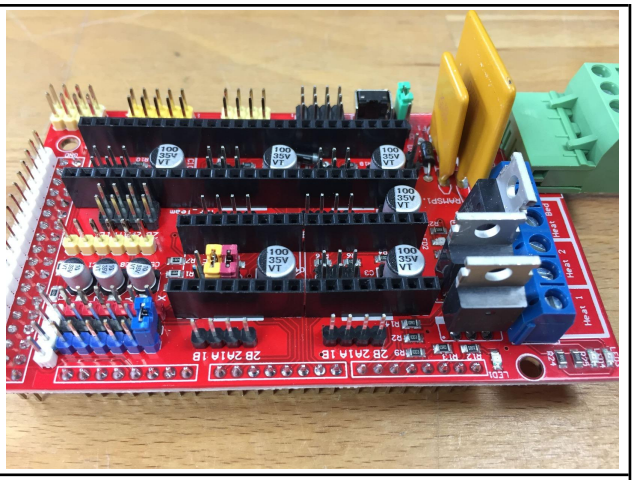
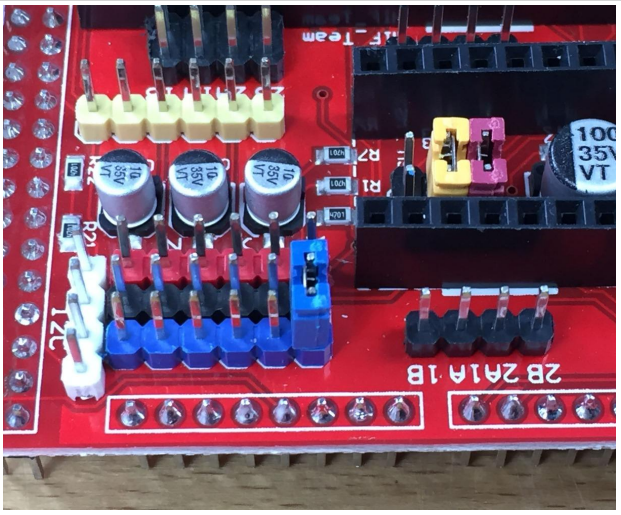
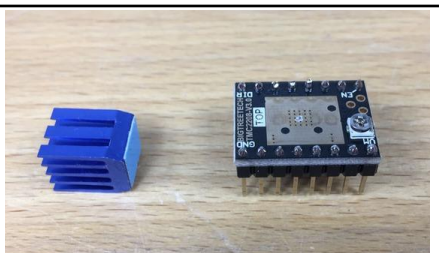
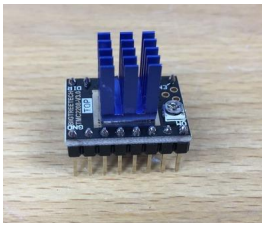
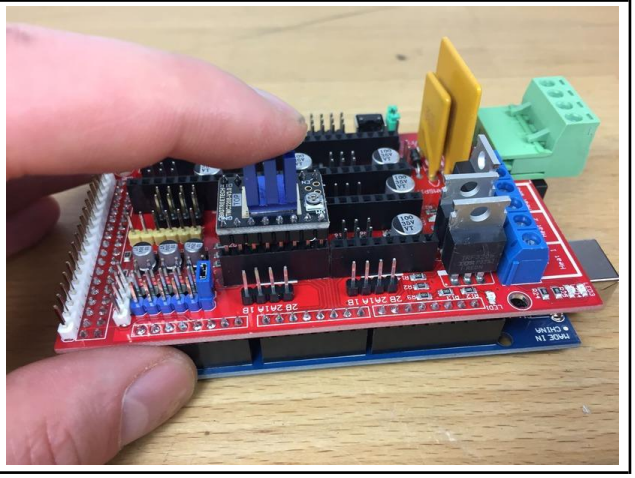
5.32	Push a cylinder screw through the hole and screw a hammer nut onto it.	
5.33	Take from package 2: PTFE tube (SP08.1 or SP08.2) Push the PTFE tube into the corresponding hole.	
5.34	The tube must be inserted to the end of the hole. If that doesn't work, rework the hole.	
5.35	Tool: Torx key TX20 Screw the filament brake part 2 to the aluminum profile on the side. When tightening the screws, make sure that the hammer nut turns in the groove.	

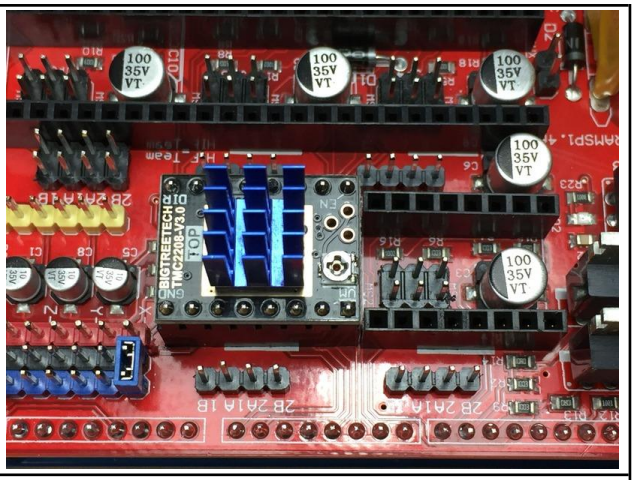
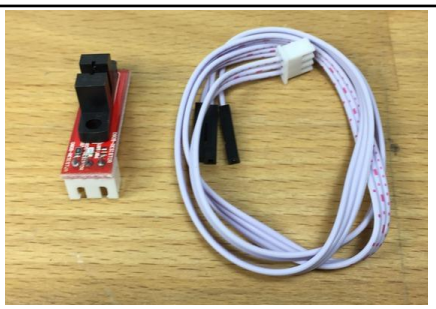
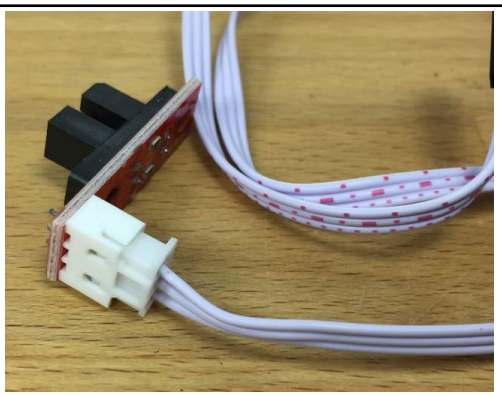
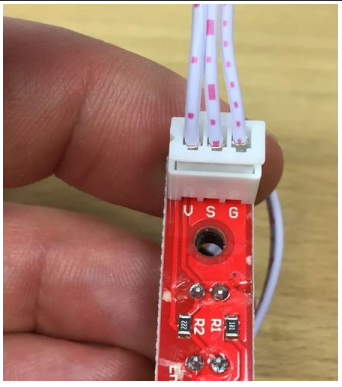
5.36	Bend the PTFE tube and insert it into the filament brake part 1 from below.	
5.37i	Here, too, the tube should be inserted to the end of the hole.	
5.38	Take from package 2: 1x cover cap 30x30 (SP01) Place the cover cap on the side of the aluminum profile.	
5.39	Remove the wing nut on the spool holder	

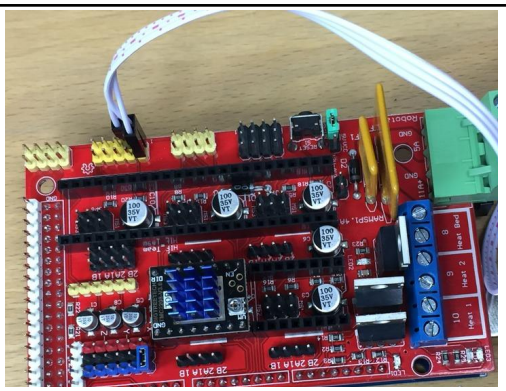
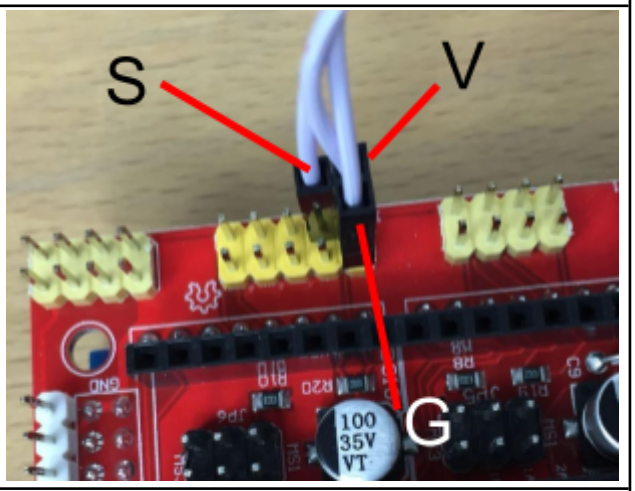
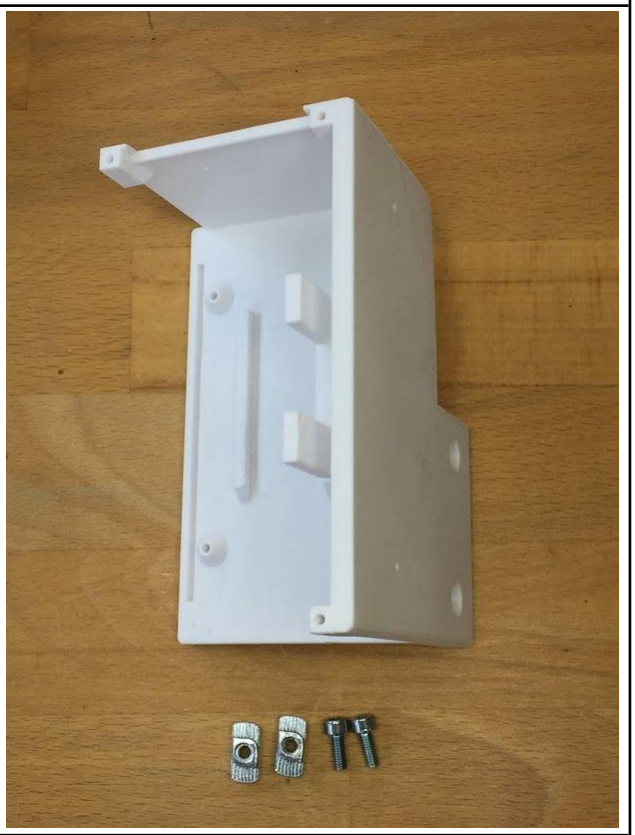
5.40	Remove the lid.	
5.41	Take from package 0: 1x filament spool (WI05.1) Push the filament spool onto the holder.	
5.42	Put on the lid.	
5.43	Tighten the wing nut slightly.	

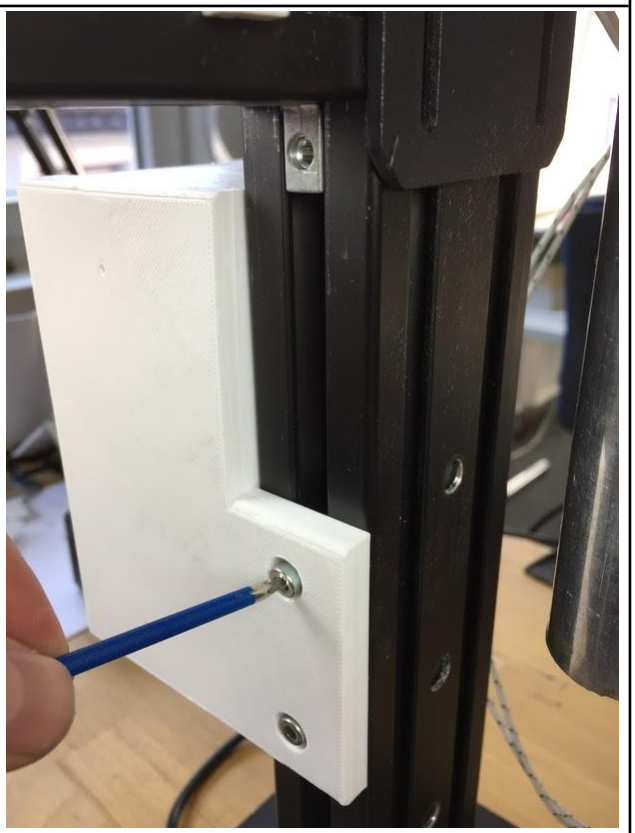
6.0	Electronics assembly	
6.1	ATTENTION: Please be extremely careful when handling electronic components: Avoid electrostatic charging! (Touch grounded metal parts, such as a radiator, to discharge yourself) Do not bend circuit boards! Never pull or insert plugs or components during operation! Handle electronics only when it is switched off! Always pay attention to the correct polarity of the connections! Failure to follow these rules can damage or destroy the electronics. If you bought an original ARTME 3D extruder kit, you can start at step 6.15, as the electronics are pre-assembled.	
6.2	Take from package 4: 1x Arduino (EL01)	
6.3	Take from package 4: 1x Ramps 1.4 or 1.5 (EL02) This is what a Ramps 1.4 board can look like. The system works with Ramps 1.4 or 1.5. Depending on availability, one of the two boards is included in the kit. They look different in color. But all pins and connections are identical.	
6.4	Ramps 1.5 This is what a Ramps 1.5 board can look like.	

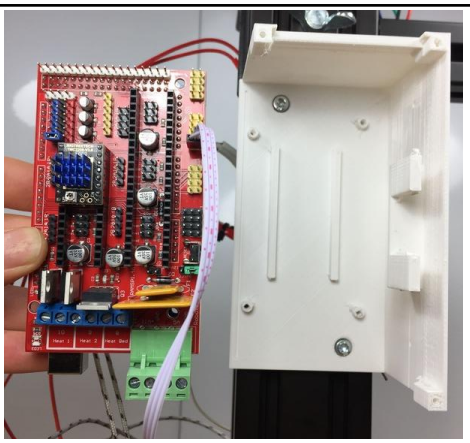
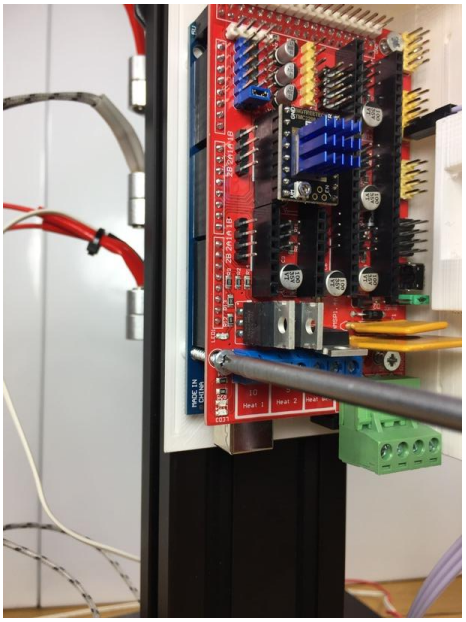
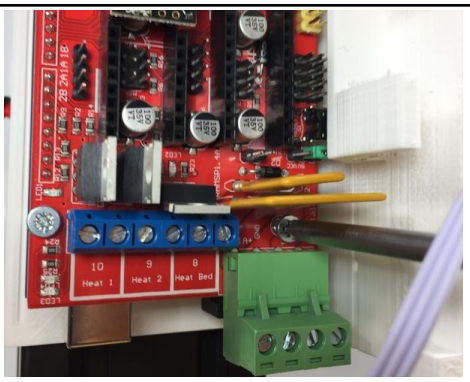
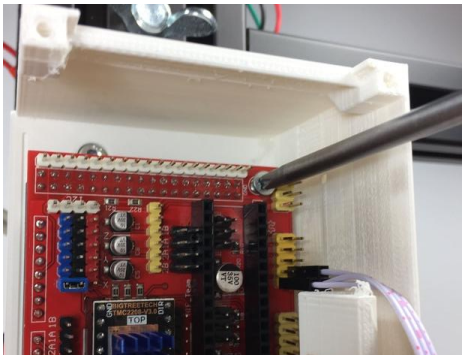
6.5	The Ramps Board has a small button on the side. This reboots the Arduino. If the button is long, as shown in the picture, it must be shortened, otherwise the board will not fit into the housing. This can be done with a side cutter.	
6.6	The button of the push button should not be longer than 3 mm.	
6.7	The Ramps Board is plugged onto the Arduino. Warning: it is very important here that all pins are aligned straight and meet in the correct slot. Only then do you press the boards together to connect them.	
6.8	Check that all pins are correctly inserted.	

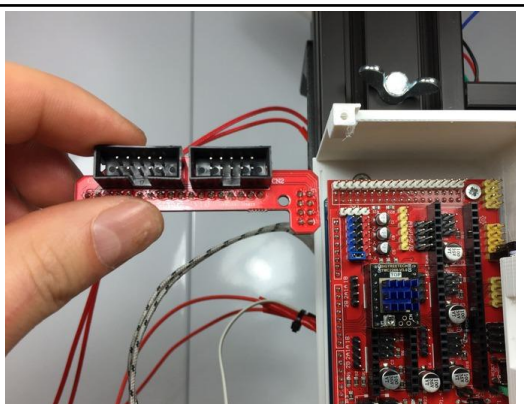
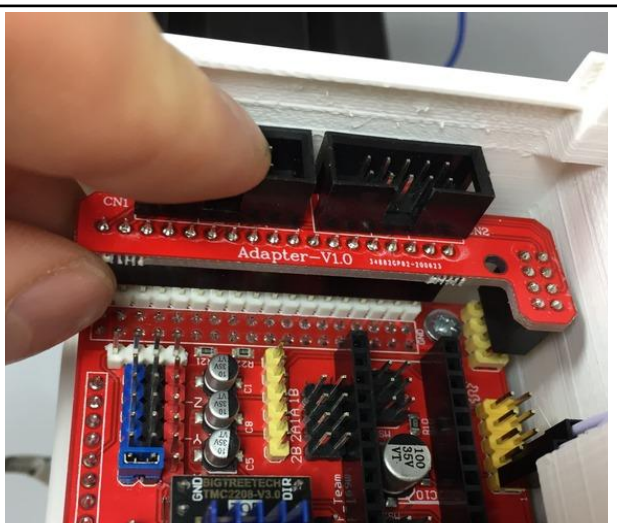
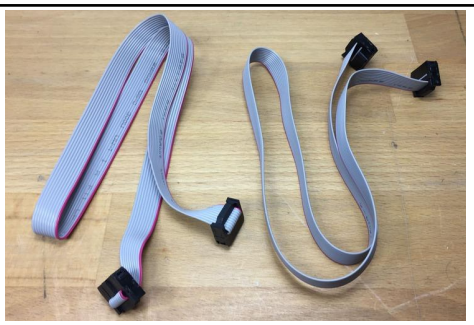
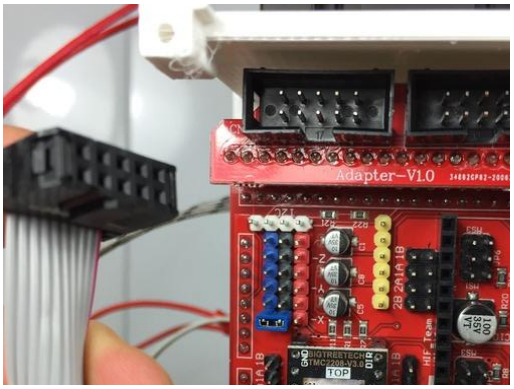
6.9	Take from package 4: 3x jumpers (EL03) The 3 jumpers (in the picture with the colors red, yellow and blue) must be inserted. See exact location next step.	
6.10	The position of the 3 jumpers can also be found in the electronics plan. This is stored in the “07_electronics” folder.	
9.11	Take from package 4: 1x stepper motor driver (EL04) The stepper motor driver is usually supplied with a separate heat sink, which must be glued on. To do this, remove the foil on the adhesive strip on the heat sink.	
6.12	The heat sink is glued in the middle of the area provided for it. Make sure that the heat sink does not touch the soldering points.	
6.13	The stepper motor driver is plugged into slot E1 of the ramp board. Make sure to use the correct orientation. The TMC 2208 is plugged in as shown in the picture. The small potentiometer next to the heat sink shows how the driver is aligned. In the electronics plan in the “07_electronics” folder, it is marked where the corresponding pins of the motor driver must be if you use a different one.	

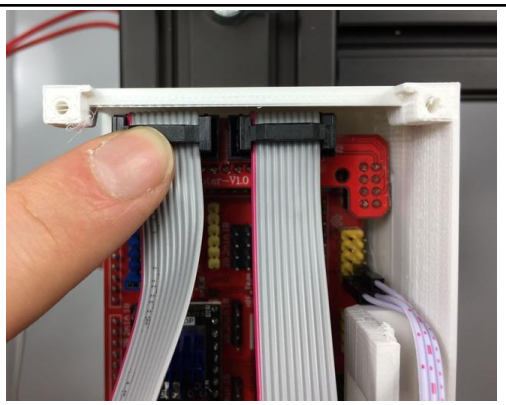
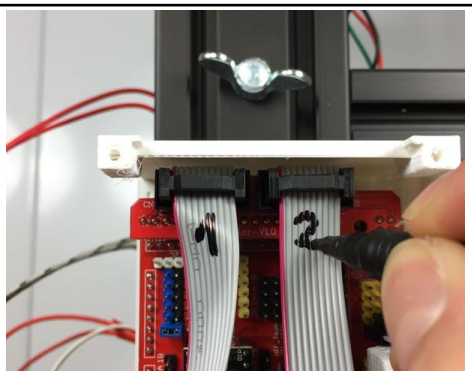
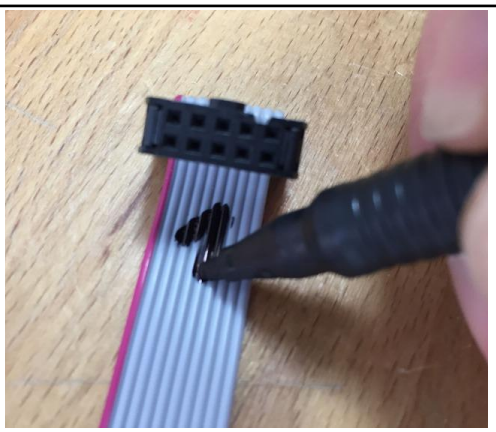
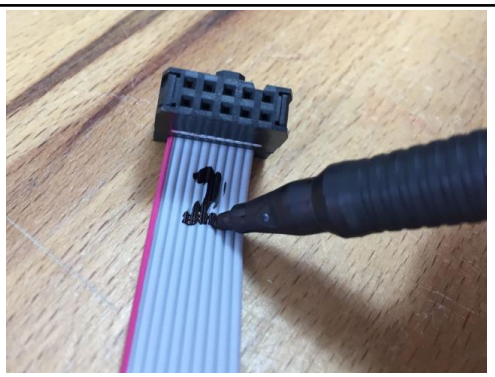
6.14	Check the alignment of the motor driver and whether all pins are correctly connected.	
6.15	Take from package 4: 1x optical limit switch (EL05)	
6.16	Take limit switch and connection cable to hand.	
6.17	Connect the connection cable to the sensor. The connector is coded by pins so that it can only be plugged in one direction.	
6.18	Make a note of which letter belongs to which wire. The wires can be distinguished by dots and lines.	

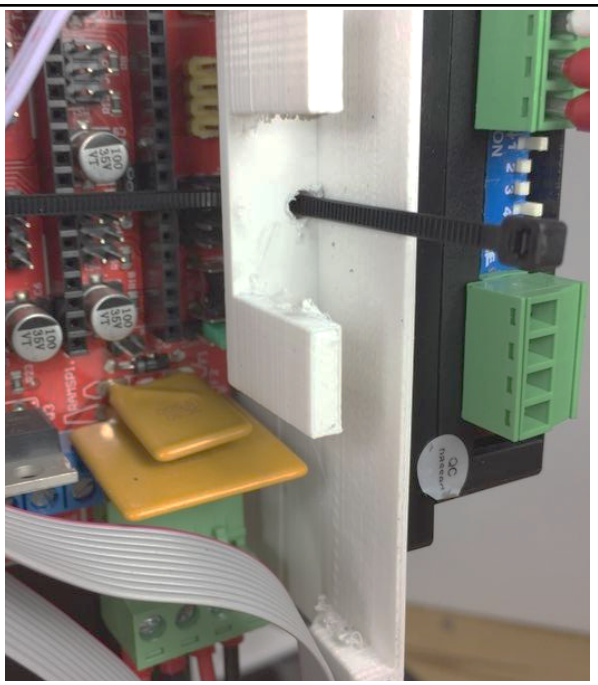
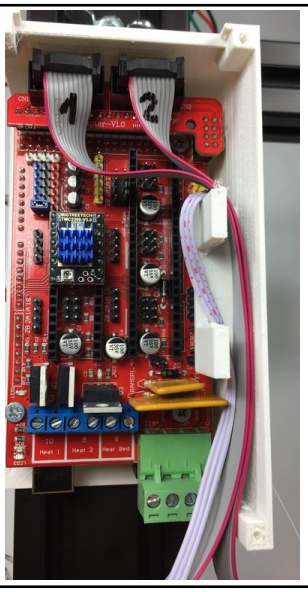
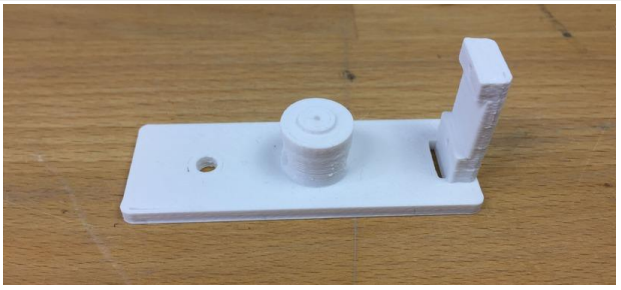
6.19	The other end of the connection cable is now plugged onto the board. Make a note of the patch panel. For the orientation of the individual plugs, see the next step.	
6.20	Connector orientation, see picture. If the designations on the sensor differ, you can find more details in the electronics plan in the “07_electronics” folder.	
6.21	3D printing: 1x Arduino housing (EL06) Remove from package 1: 2x cheese head screw M4x10 (SC04) 2x hammer nut M4 (SC10)	

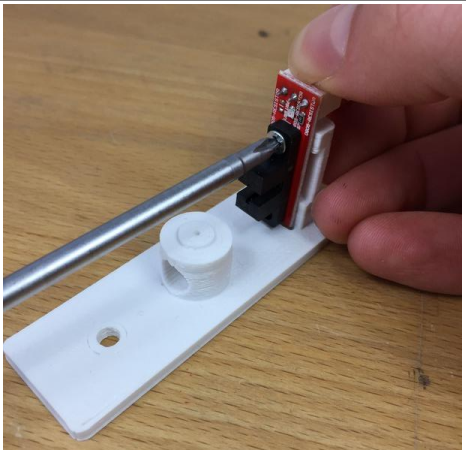
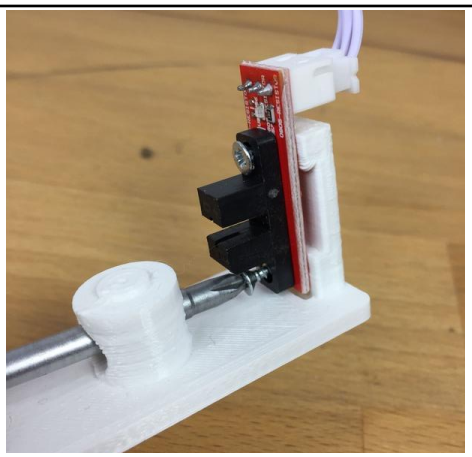
6.22	Insert the cap screws through the holes and screw the hammer nuts onto the screws.	
6.23		
6.24	Tool: Torx key TX20 The housing faces backwards and is screwed to the aluminum profile from the side. The lower edge of the Arduino housing has a distance of approx. 16cm to the mounting plate. Again, make sure that the hammer nuts twist in the groove when tightening the screws.	
6.15	Take from package 1: 3x wood screws 3x25 (SC02)	

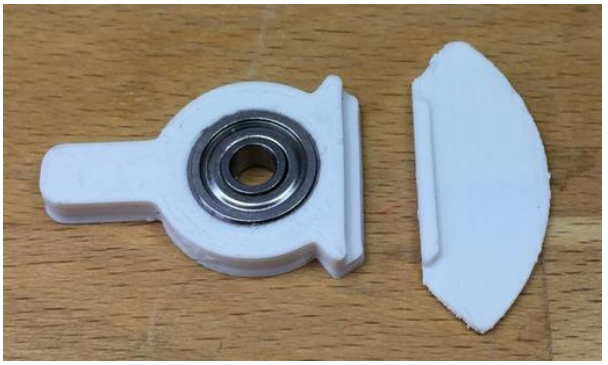
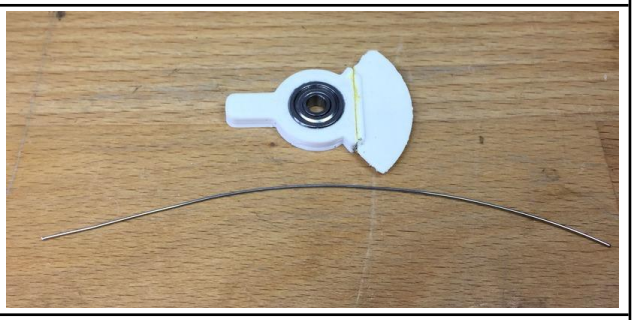
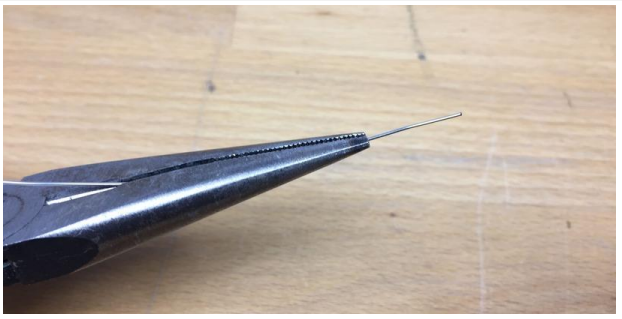
6.26	Alignment of the board for installation in the housing.	
6.27	Tool: cross-slotted screwdriver PH1 Hold the board in the case. Guide a 3x25 screw at the bottom left through the corresponding holes in the circuit board, screw it into the housing and tighten it only slightly. If you don't hit the holes for the screw correctly, it can help to turn the device over and screw in the screws from above rather than from the side.	
6.28	Insert a screw at the bottom right through the corresponding holes in the circuit boards, screw into the housing and tighten only slightly.	
6.29	Insert a screw at the top right through the corresponding holes in the circuit board, screw it into the housing and tighten only slightly.	

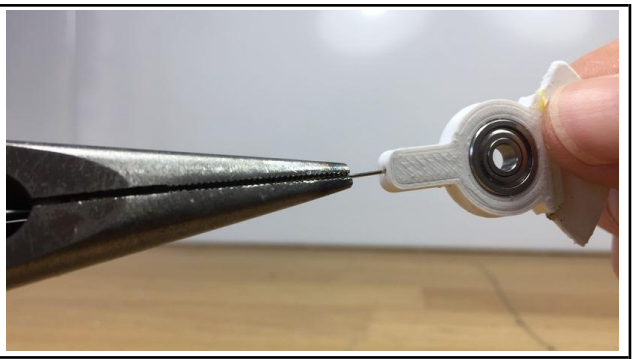
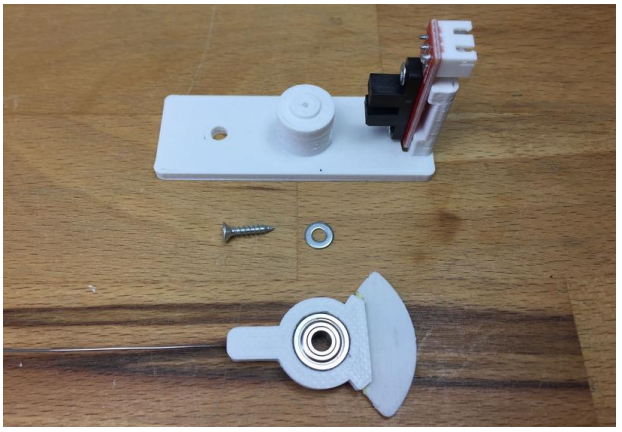
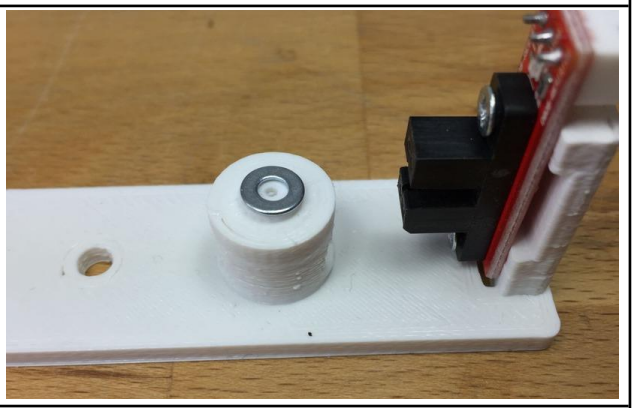
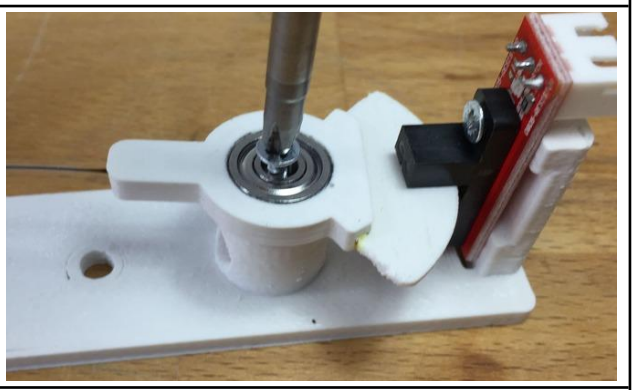
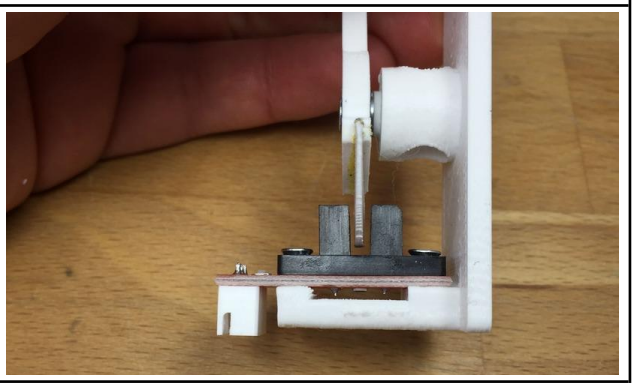
6.30	Take from package 4: 1x LCD Adapter (EL07)	
6.31	Alignment of the LCD adapter for installation.	
6.32	Hold the adapter on the upper rows of pins and align so that all pins meet in the corresponding slots. Double check. Then attach by pressing.	
6.33	Take from package 4: 2x LCD wire (EL08)	
6.34	Align the LCD cables before installation. The two connector ends of an LCD cable are designed differently. Select the connector that has the coding groove in the appropriate place so that it can be plugged in as in the next step.	

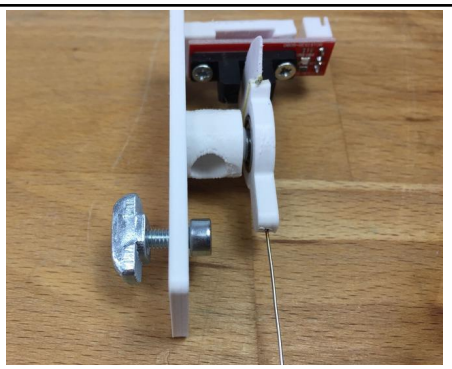
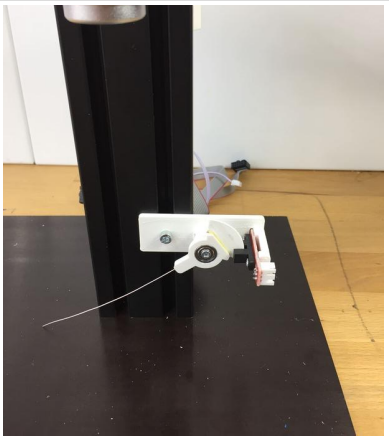
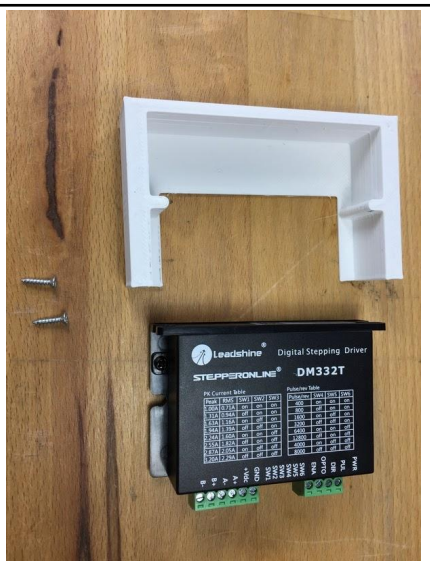
6.35	Then attach by pressing.	
6.36	Tool: Marker pen Label the cable as shown in the picture.	
6.37	The corresponding cable counterparts are given the same number. The cable, which was labeled with a 1 in step 6.36, also gets a 1 at the other end of the cable.	
6.38	The cable, which was labeled with a 2 in step 6.36, also gets a 2 at the other end of the cable.	

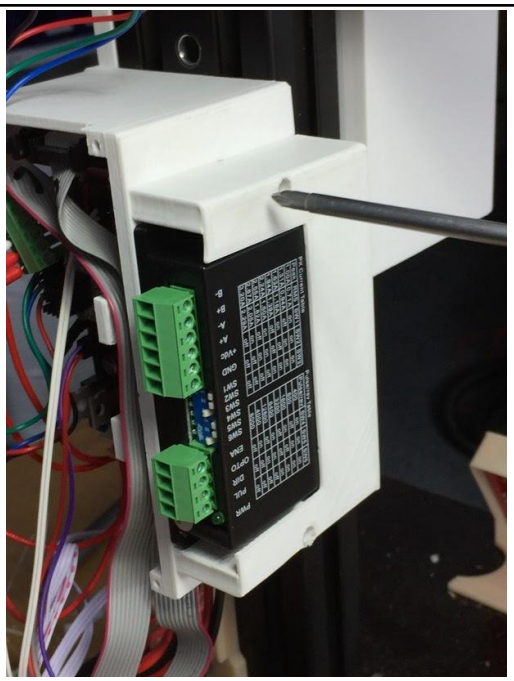
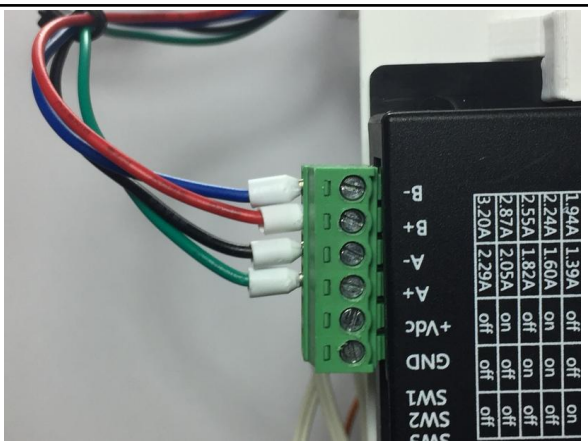
6.39	Take from package 2: 1x zip tie (SP11) The side arm in the housing is used to organize the cables later. Insert a cable tie through the corresponding opening beforehand. Pull the bottom end to the left with tweezers.	
6.40	Place the LCD cable and the connection cable of the sensor in the holding arm.	
6.41	3D printing: 1x sensor holder (EL11)	

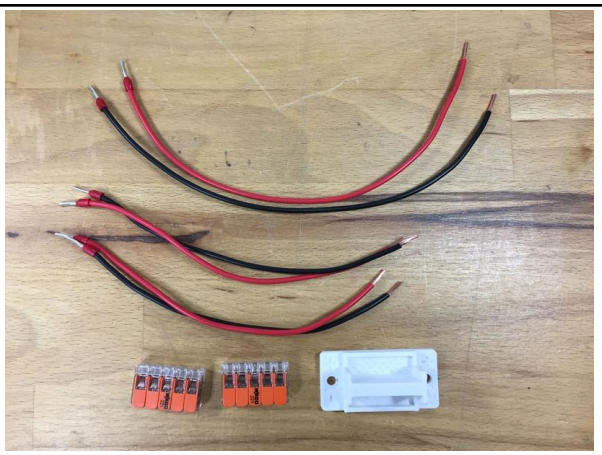
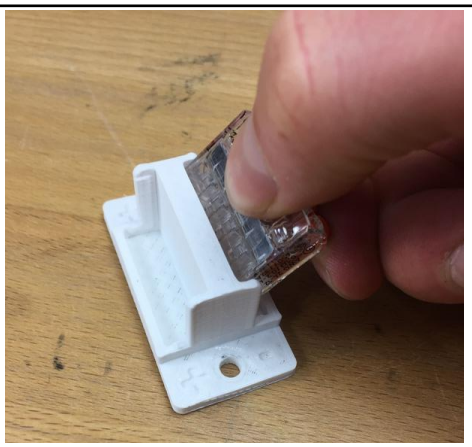
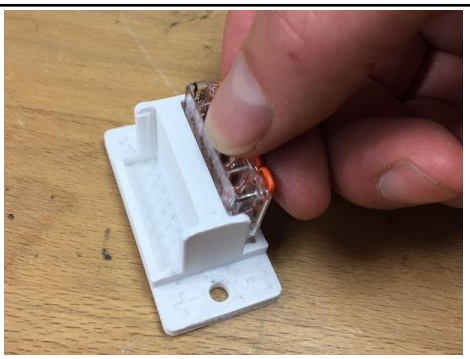
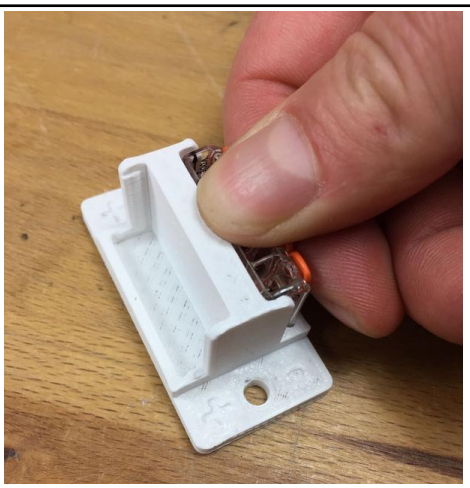
6.42	Hold the sensor against the sensor holder. See image. remove plug if necessary.	
6.43	Take from package 1: 2x wood screw 2.5x12 (SC01) Tool: cross-slotted screwdriver PH1 Tighten with a screw 2.5x12. See image.	
6.44	Tighten with the second screw.	
6.45	3D printing: 1x sensor arm (EL12) 1x sensor cover (EL13) Take from package 2: 1x ball bearing (SP10)	

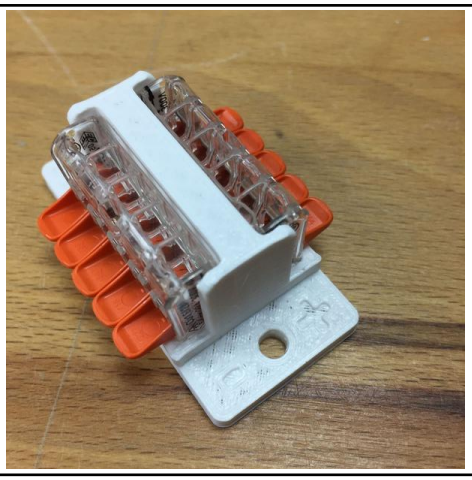
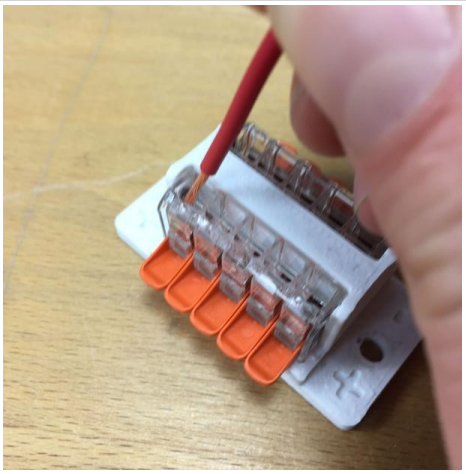
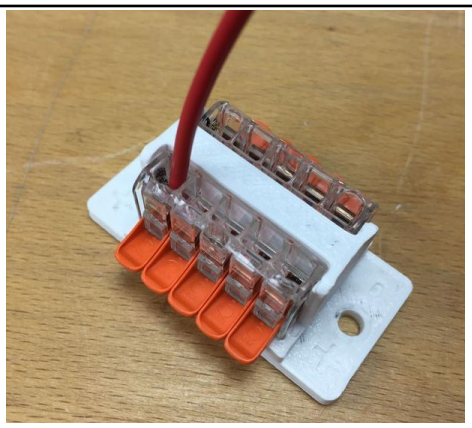
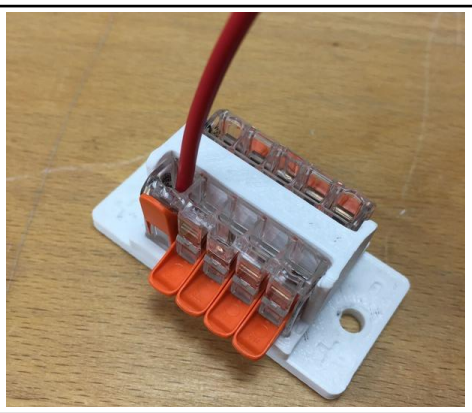
6.46	Tool: if necessary, vice Press the ball bearing into the sensor arm. This may take some strength. If necessary, rework the hole or press in the bearing with a vice.	
6.47	The ball bearing must be flush with the surface of the sensor arm.	
6.48	Align the panel before assembly. Important: The bezel must be aligned as shown in the picture.	
6.49	Tool: Superglue / power glue Take from package 2: 1x wire 0.6x110mm (SP09) The cover is glued in place with superglue or power glue.	
6.50	Take from package 2: 1x wire 0.6x110mm Tool: Needle nose pliers Hold the wire with pliers. Leave only a little wire protruding.	
6.51	Tool: Lighter Heat the wire with a lighter.	

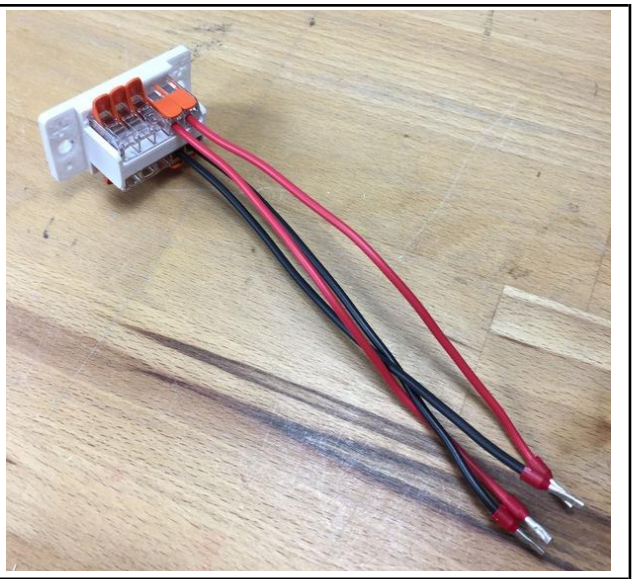
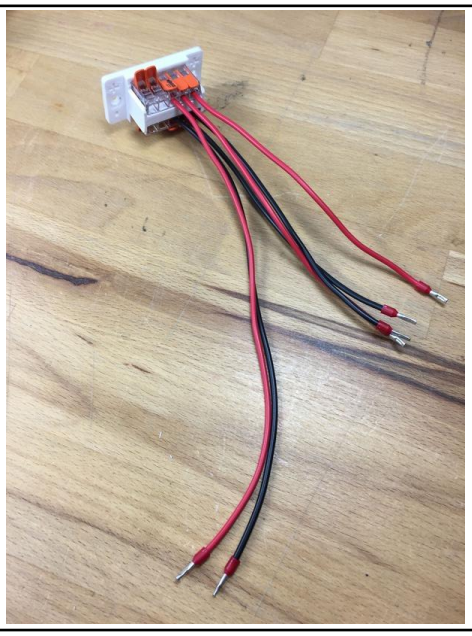
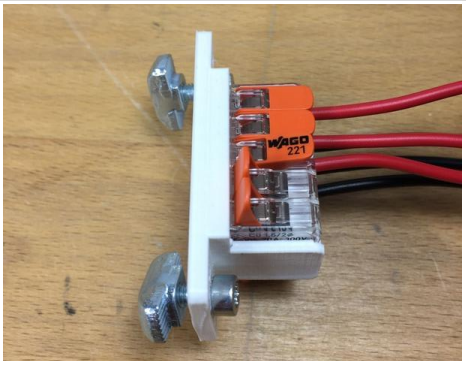
6.52	Press the hot wire into the small hole in the sensor arm and hold it until it has cooled down. The wire should now be firmly glued.	
6.53	Take from package 1: 1x washer M3 (SC12) 1x wood screw 2.5x12 (SC01)	
6.54	Place the washer on the sensor arm.	
6.55	Tool: cross-slotted screwdriver PH1 Tighten the sensor arm in the correct position.	
6.56	Check that the sensor can move freely.	

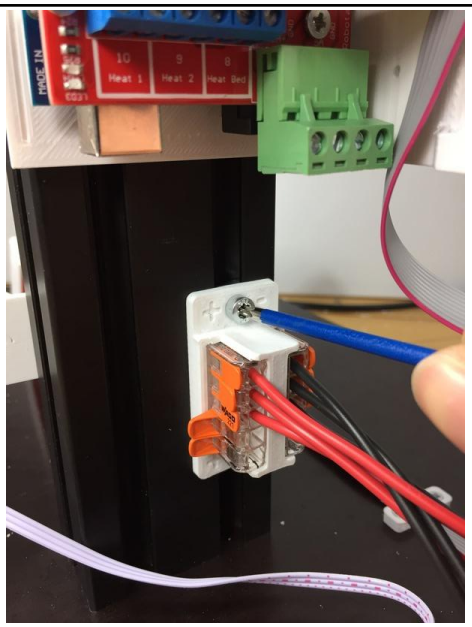
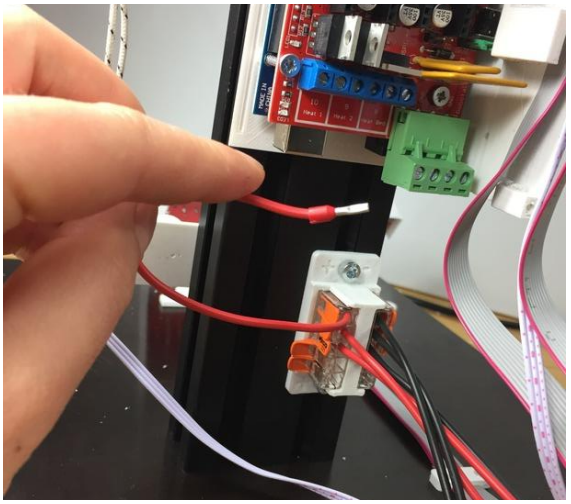
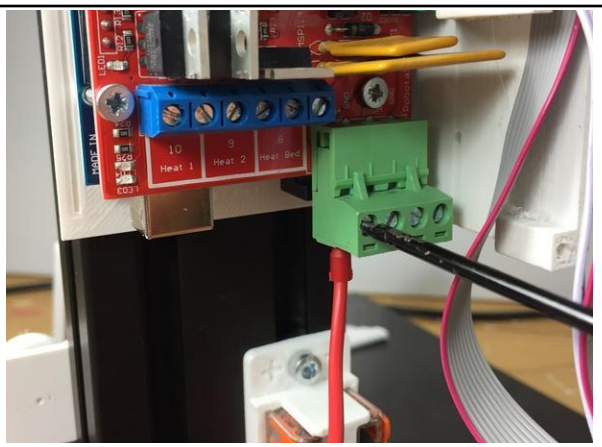
6.57	Take from package 1: 1x hammer nut (SC10) 1x cylinder screw M4x10 (SC04) Mount the cylinder screw and hammer nut on the sensor holder.	
6.58	Tool: Torx key TX20) Mount the sensor holder on the aluminum profile. approx. 5cm above the mounting plate. Again, make sure that the hammer nut turns when you tighten the screw in the groove.	
6.59	Take from package 0: 1x stepper motor driver DMT322T (MO06) 3D printing: 1x driver mounting (EL14) Take from package 1: 2x wood screw 2.5x12 (SC01)	
6.60	Turn the stepper motor driver upside down and insert it into the mounting. See picture.	

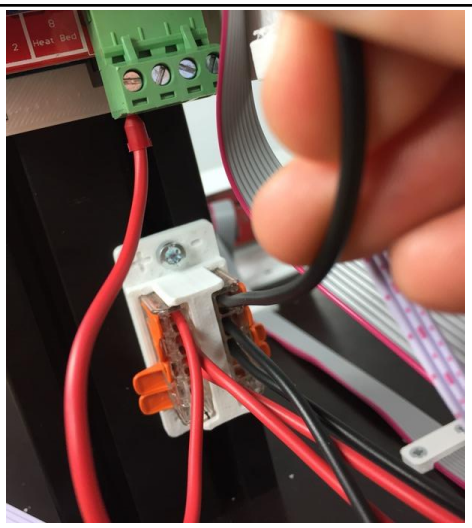
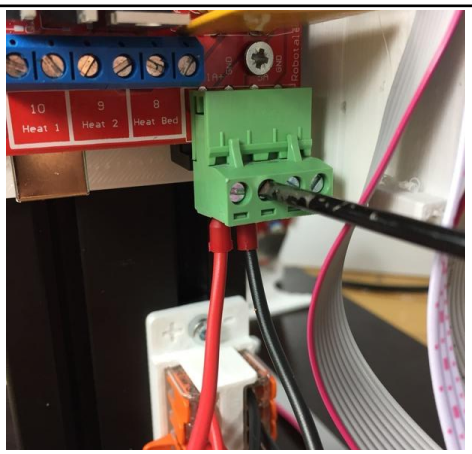
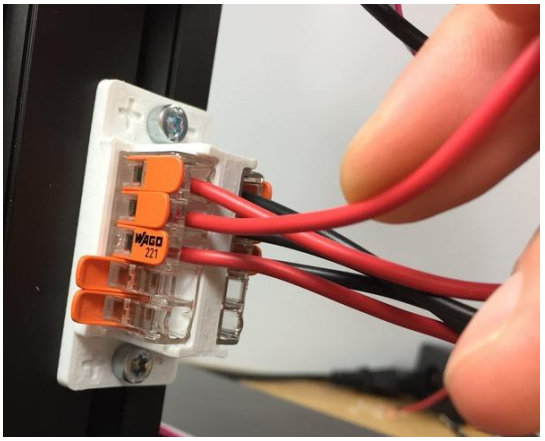
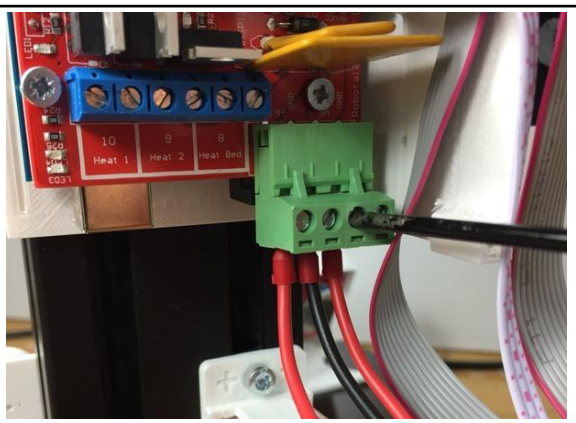
6.61	Tool: cross-slotted screwdriver PH1 Insert the two screws through the holes provided and screw the bracket to the side of the Arduino housing. Holes are provided in the Arduino housing for this purpose.	
6.62	Set the dip switches on the motor driver. (See photo) The setting means: 3200 steps per revolution 1.9 A maximum phase current In a few cases (depending on the material) it may be necessary to increase the motor current a little later.	
6.63	Tool: Slotted screwdriver 3mm Connect the connecting cable of the large stepper motor (MO01) to the stepper motor driver. See picture for colors. If you are using a different motor with a different color coding, you will find more details in the electronic diagram in the “07_electronics” folder. After tightening the screws, check whether all contacts are tight.	

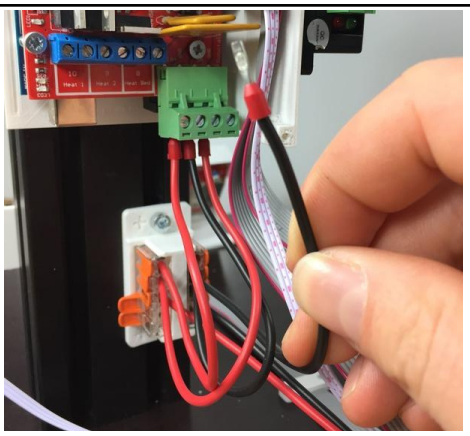
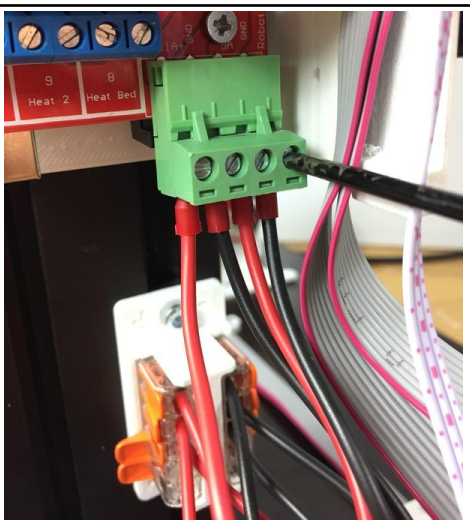
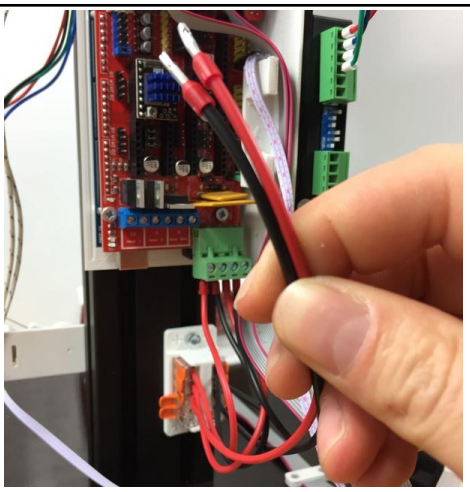
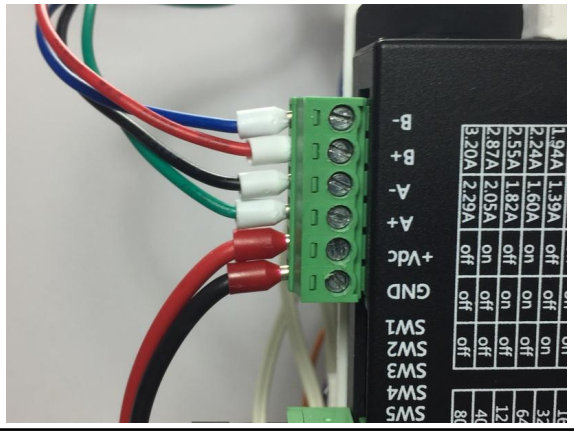
6.64	Take from package 4: 2x terminal Wago 221 (EL09) 2x black wire 150mm (EL16) 2x red wire 150mm (EL17) 1x black wire 260mm (EL18) 1x red wire 260mm (EL19) 3D printing: 1x terminal holder (EL10) A ferrule must be pressed onto one end of each wire.	
6.65	Press the Wago clamp into the holder. To do this, place it on the side and press down.	
6.66	Stand up straight.	
6.67	And push it in completely. The balance clamp locks into place.	

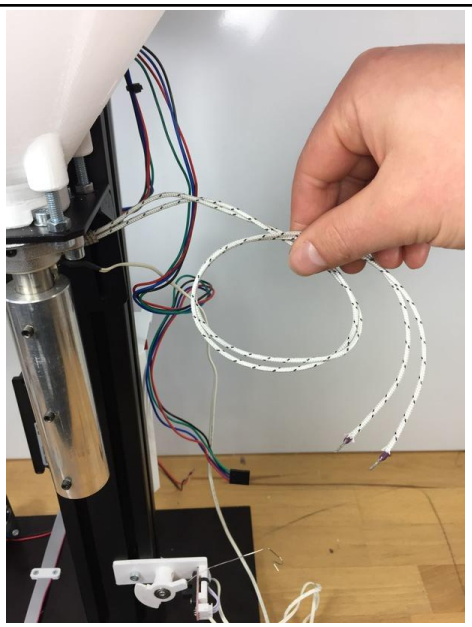
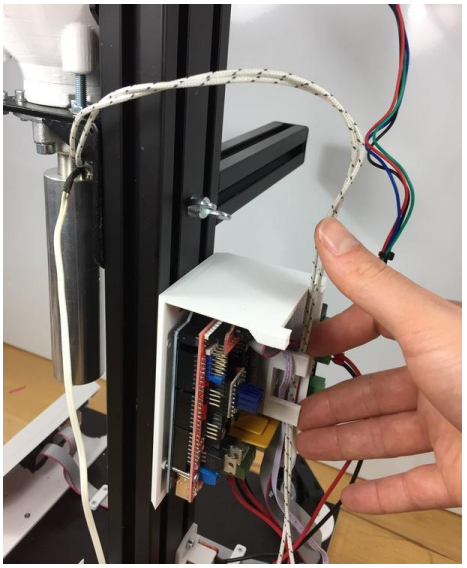
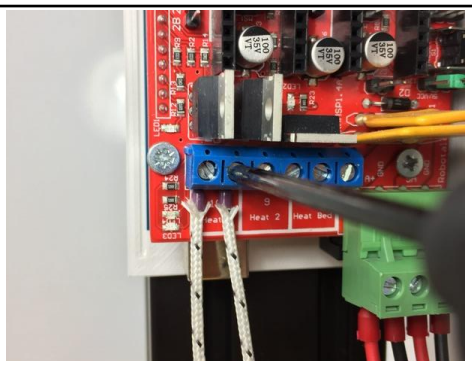
6.68	Open the small clamping levers.	
6.69	make sure that the “+” mark on the clamp holder points to the left. Then insert a 150mm red wire (EL17) into the top terminal.	
6.70	The wire must be fully inserted.	
6.71	Then close the clamping lever. This creates a safe electrical connection.	

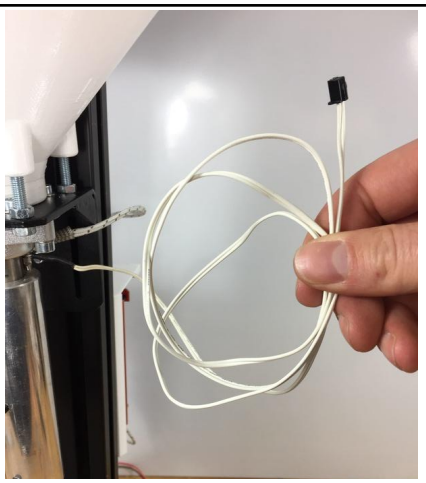
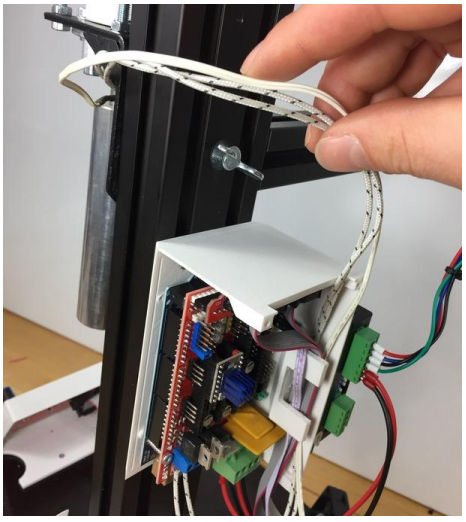
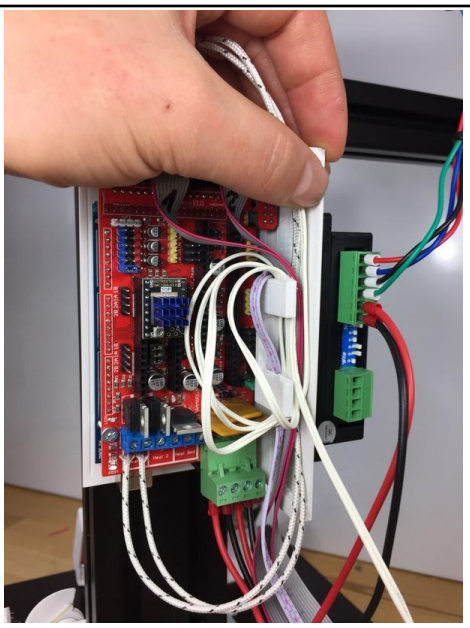
6.72	Now install the remaining 150 mm long lines. The black lines are plugged into the Wago terminal, which is on the side marked with a '-'. See image.	
6.73	Now clamp the 260 mm long cables. Red back to the “+” side and black back to the “-” side.	
6.74	Take from package 1: 2x hammer nuts M4 (SC10) 2x cylinder screw M4x10 (SC04)	
6.75	Mount the cylinder screw and hammer nut on the terminal holder.	

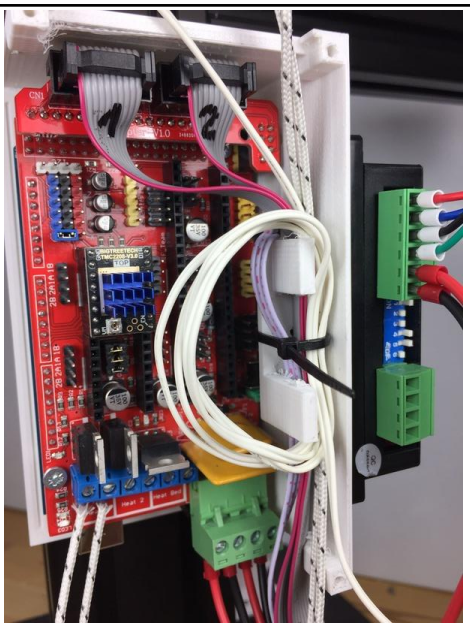
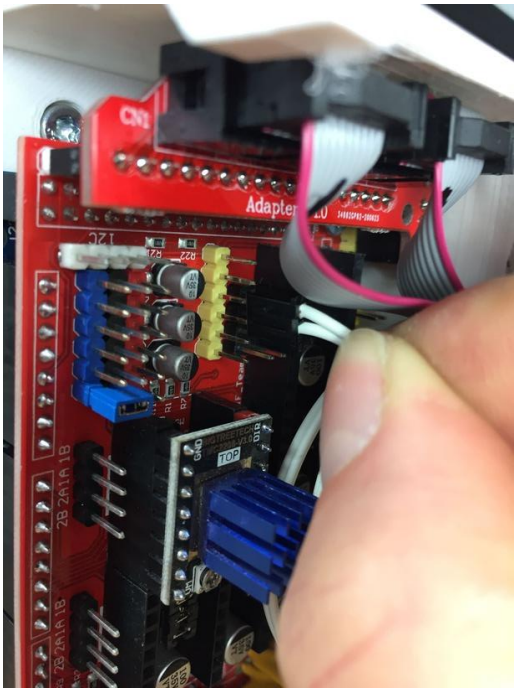
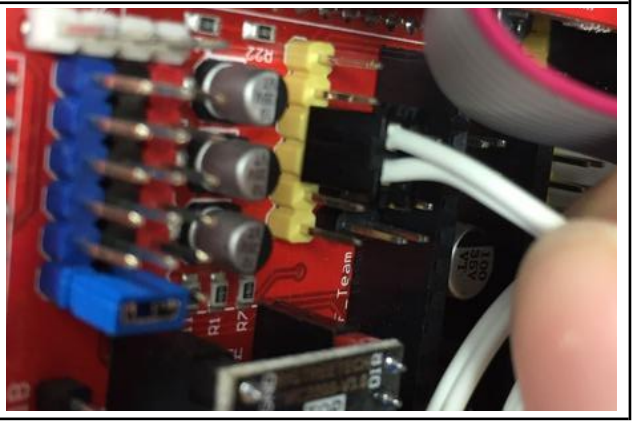
6.76	Tool: Torx key TX20 Mount the terminal holder on the aluminum profile from the rear. About 3cm above the mounting plate. Again, make sure that the hammer nuts twist when tightening the screws in the groove.	
6.77	Take the red 150 mm long cable which is plugged into the left Wago terminal at the top.	
6.78	Tool: Slotted screwdriver 3mm Connect this to the ramps board. Important slot exactly as in the picture.	

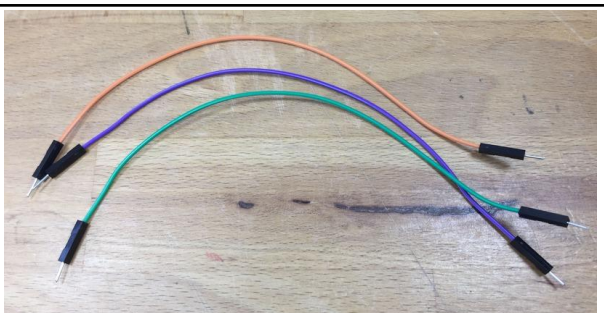
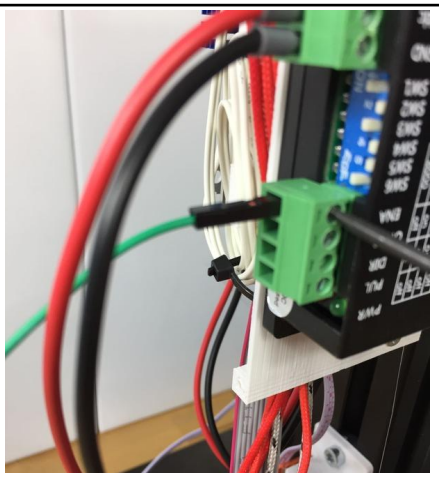
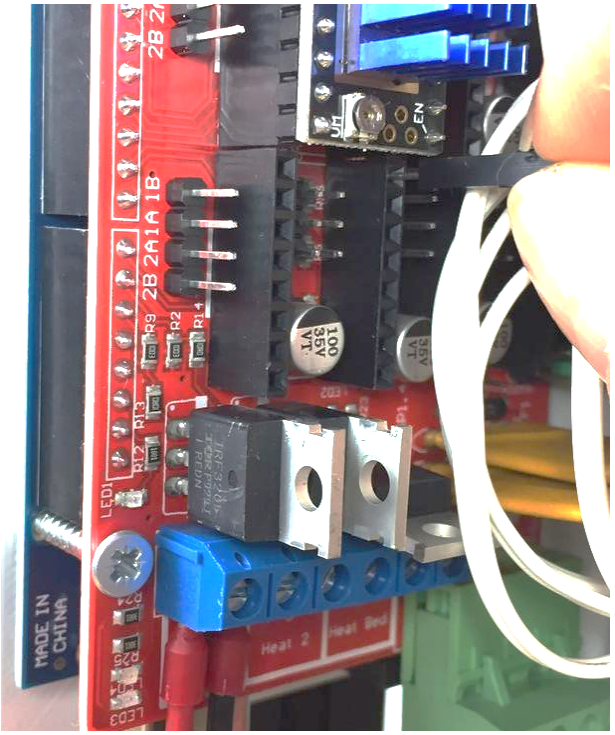
6.79	Take the black 150 mm long cable which is plugged into the right Wago terminal at the top.	
6.80	Tool: Slotted screwdriver 3mm Connect this to the ramps board. Important slot exactly as in the picture.	
6.81	Take the second red 150 mm long cable which is plugged into the left Wago terminal at the top.	
6.82	Tool: Slotted screwdriver 3mm Connect this to the ramps board. Important slot exactly as in the picture.	

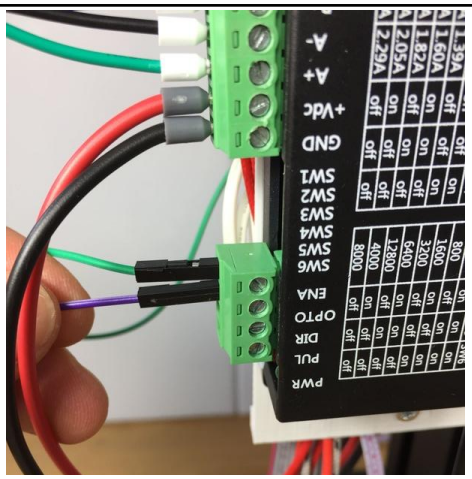
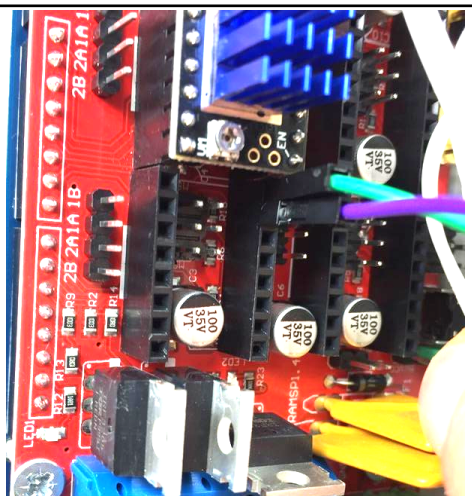
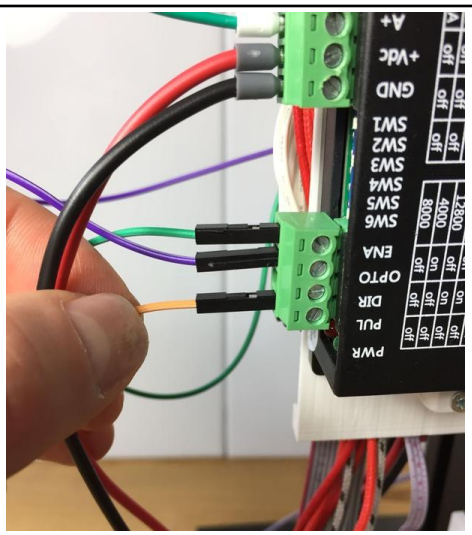
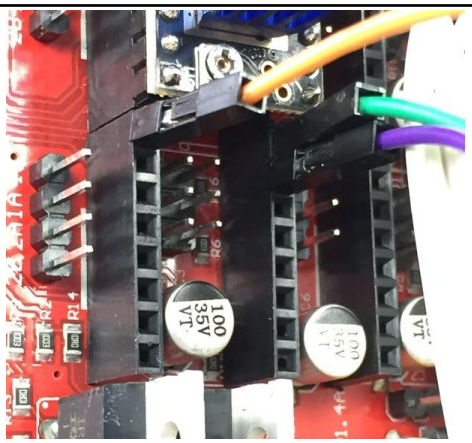
6.83	Take the second black 150 mm long cable which is plugged into the right Wago terminal at the top.	
6.84	Tool: Slotted screwdriver 3mm Connect this to the ramps board. Important slot exactly as in the picture.	
6.85	Take the remaining two 260 mm cables.	
6.86	Tool: Slotted screwdriver 3mm Connect this to the motor driver. Important: Connect red to Vdc + and black to GND. Check that all connections to the ramps and motor driver are tight.	

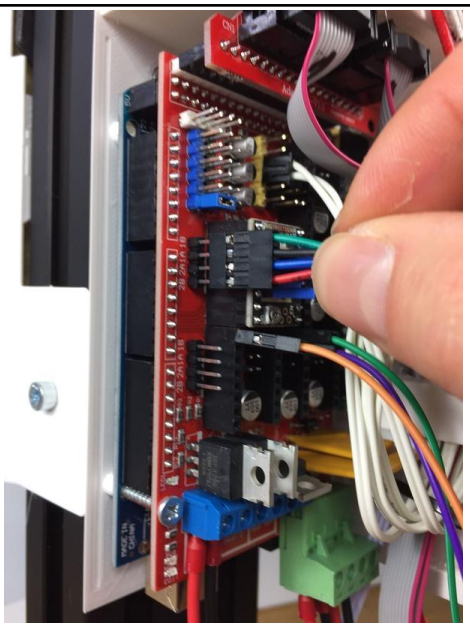
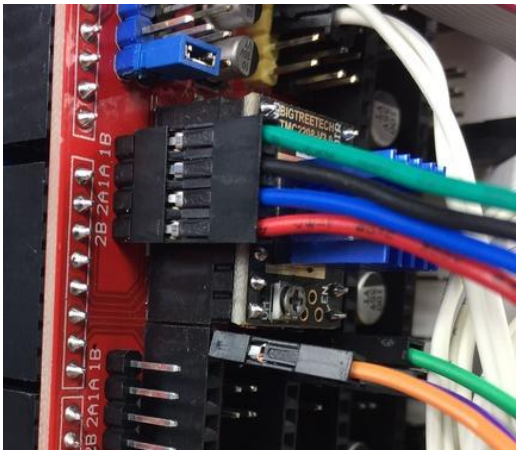
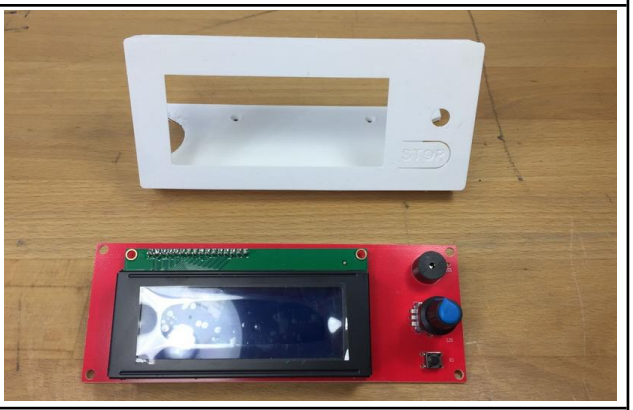
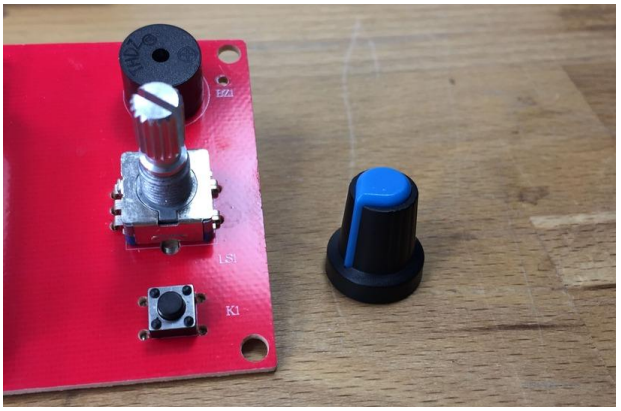
6.87	Take the connection cable of the heating cartridge to hand. (older version in the picture, in the current version there are 2 heating cartridges)	
6.88	Lead the cables to the back. In the Arduino housing there is a fixing point where the wires will be locked later.	
6.89	Tool: Slotted screwdriver 3mm Connect the cable to terminal D10 on the ramp. The polarity does not matter. The picture shows an older version. In the current version there are 2 pairs of wires, which are joined together with a wire end sleeve.	

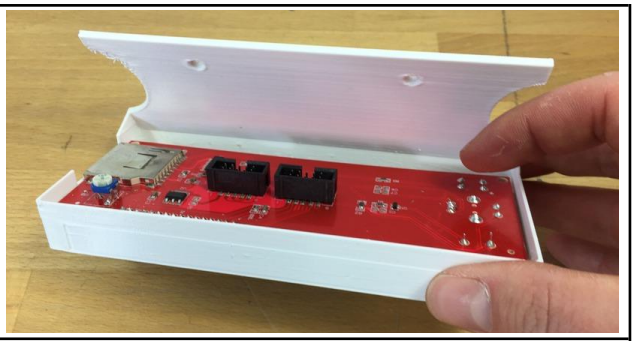
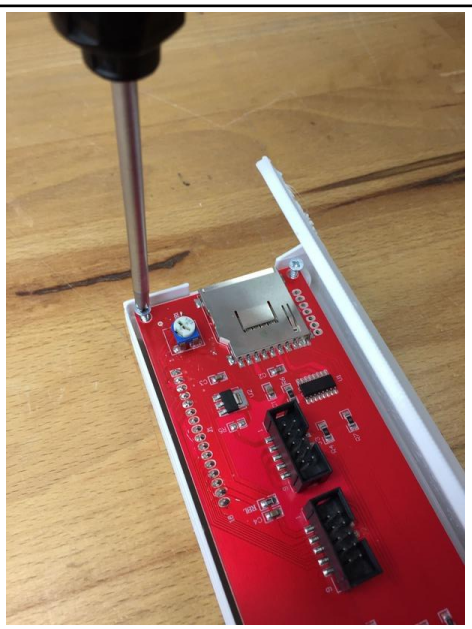
6.90	Take the connection lead of the thermistor to hand.	
6.91	Lead the line to the rear.	
6.92	Fix the cables on the holding arm. The lead from the thermistor can be wrapped around the holder as it is a little too long.	

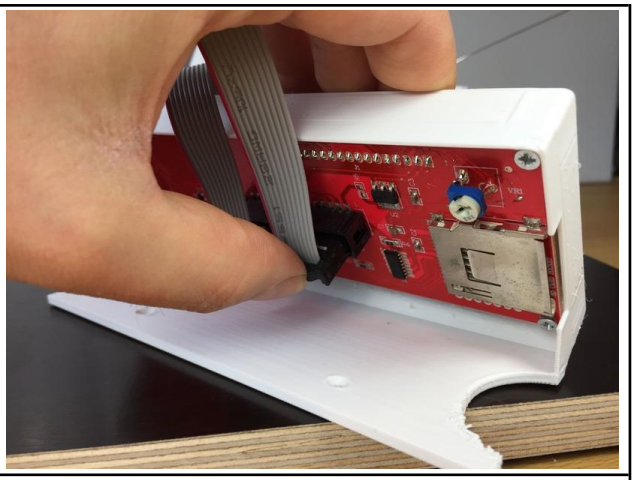
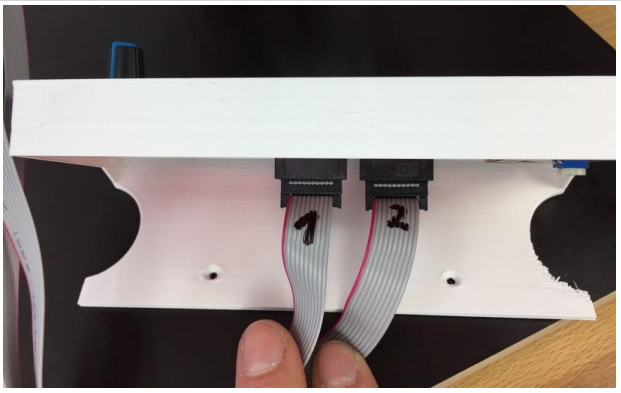
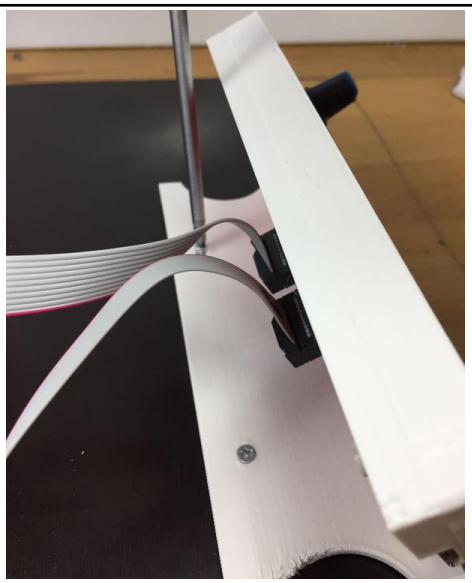
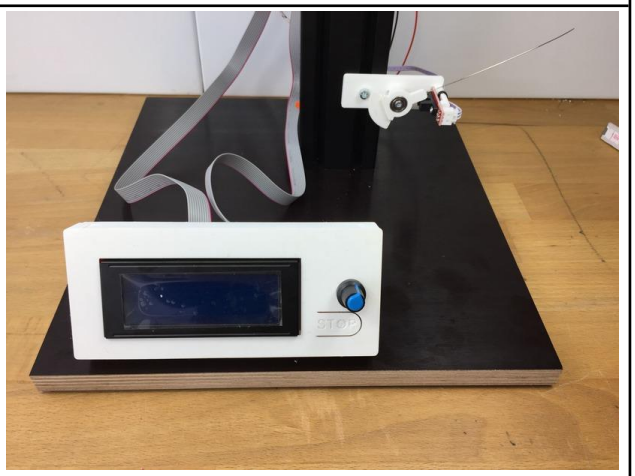
6.93	Pull the prepared cable tie to the holding arm and cut off the protruding piece.	
6.94	Plug the plug of the thermistor into the following slot on the ramp. (Yellow slot in the picture). See next step for details.	
6.95	Put the connector on the middle two pins. Polarity doesn't matter.	

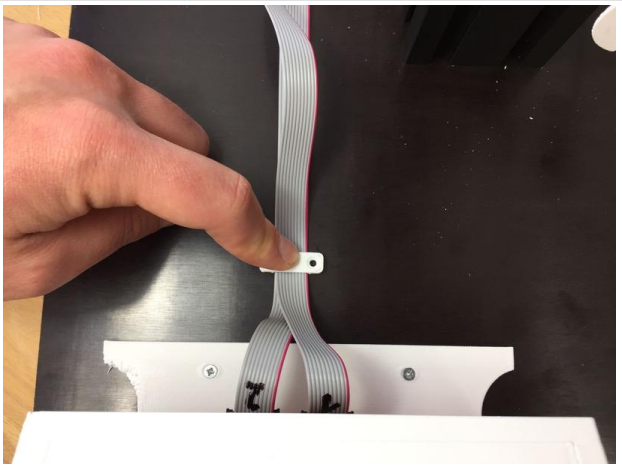
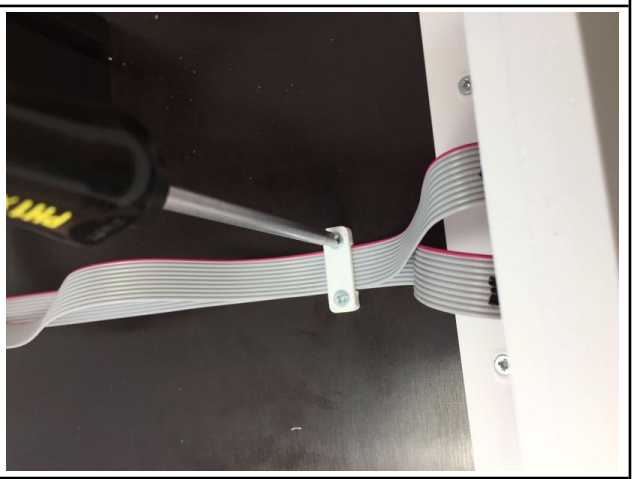
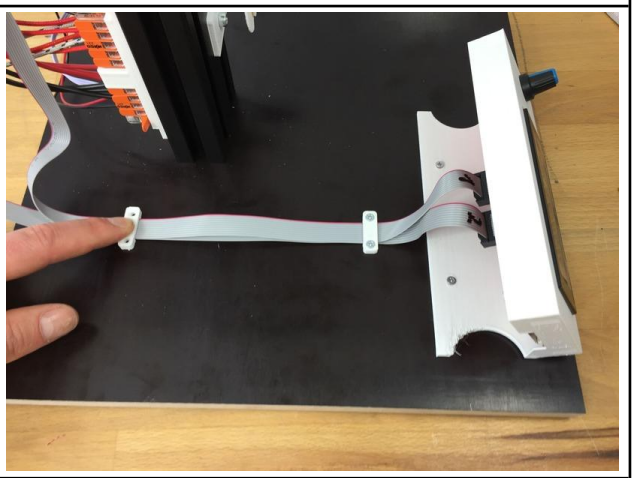
9.96	Take from package 4: 3x connecting cable Dupont (EL15)	
6.97	Tool: Slotted screwdriver 3mm Connect a connection line to the motor driver at ENA. The color of the line does not matter.	
6.98	Plug the other end of the connection cable into slot E0 (under the stepper motor driver that is already inserted): The slot consists of two rows of black plugs. Plug the other end of the connecting cable into the top slot in the right-hand row. For details, see the electronics plan in the “07_electronics” folder.	

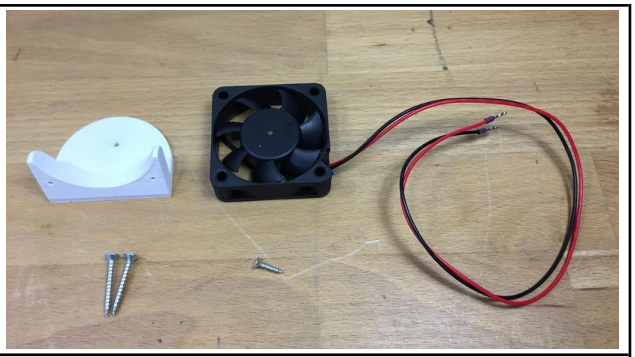
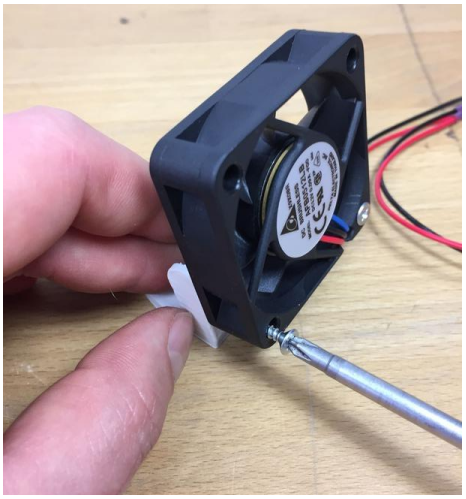
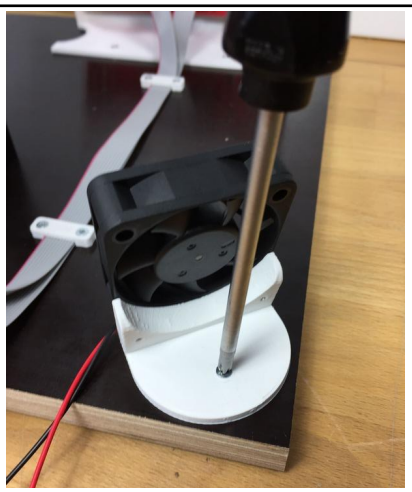
6.99	Tool: Slotted screwdriver 3mm Connect another connection line on the motor driver to OPTO. The color of the line does not matter.	
6.100	Insert the other end of the connection cable in the right-hand row directly under the cable that has already been inserted. For details, see the electronics plan in the “07_electronics” folder.	
6.101	Tool: Slotted screwdriver 3mm Connect the last connection line on the motor driver to PUL. The color of the line does not matter.	
6.102	Plug the other end of the connecting cable into the top slot in the row on the left.	

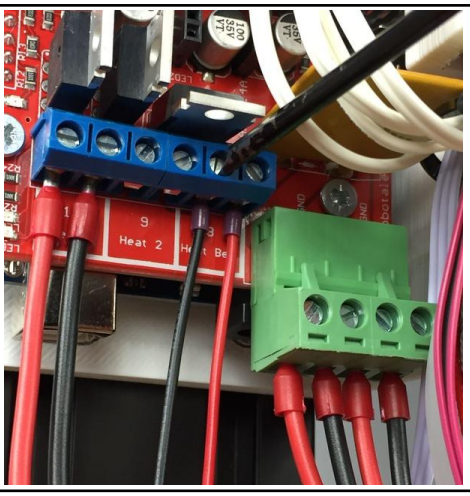
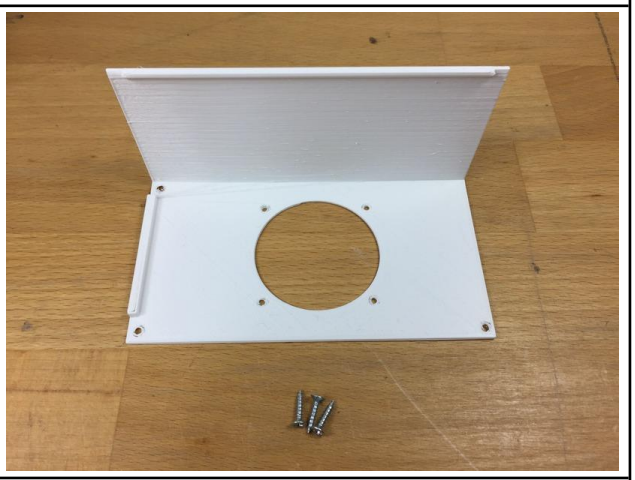
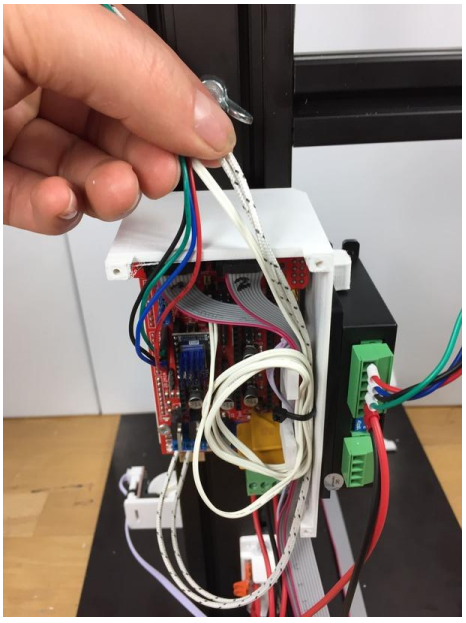
6.103	Connect the connecting cable of the small stepper motor of the winding to the ramp board.	
6.104	The red wire on the plug must point downwards. Make sure that the plug is pushed open all the way.	
6.105	3D printing: 1x LCD holder (EL25) Take from package 4: 1x LCD 2004 display (EL26)	
6.106	Remove the rotary knob by pulling it.	

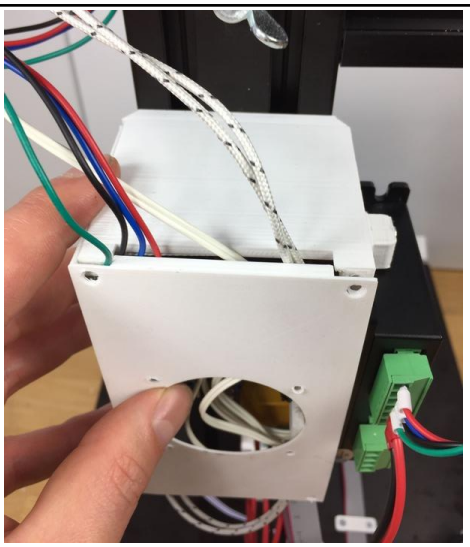
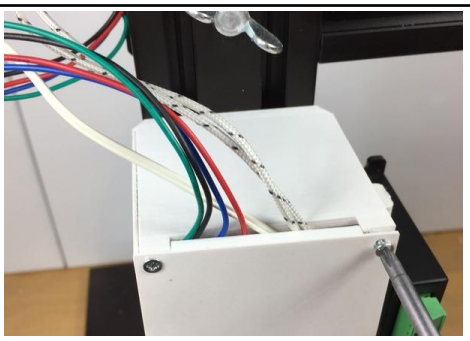
6.107	Insert the display into the display holder from behind.	
6.108	Display and rotary knob in the right place.	
6.109	Take from package 1: 4x wood screw 2.5x12 (SC01) Tool: cross-slotted screwdriver PH1 Screw the display tight in all four corners from behind.	
6.110	Put the rotary knob back on. If the rotary knob can no longer be pressed properly, remove it again by pulling it and insert something like a ball of paper into the rotary knob as a spacer and attach the rotary knob again.	

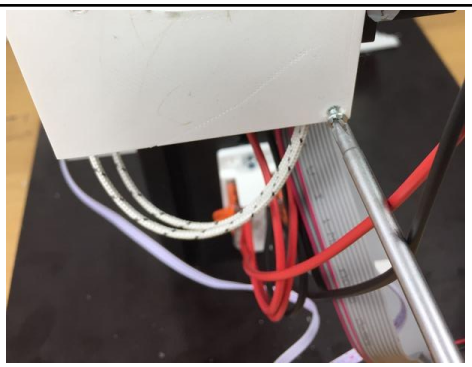
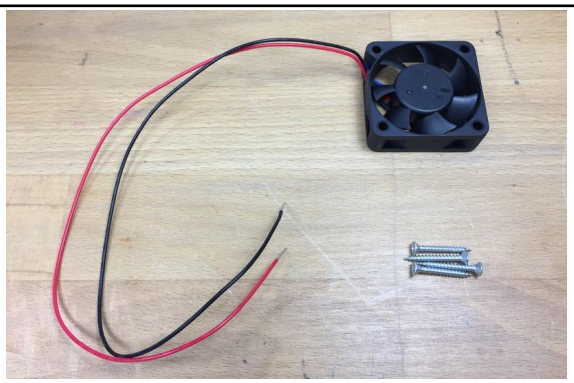
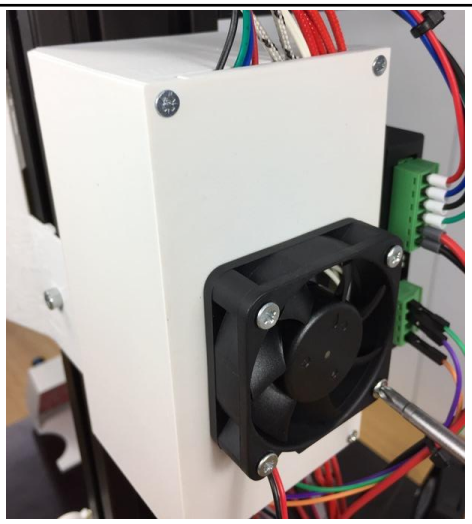
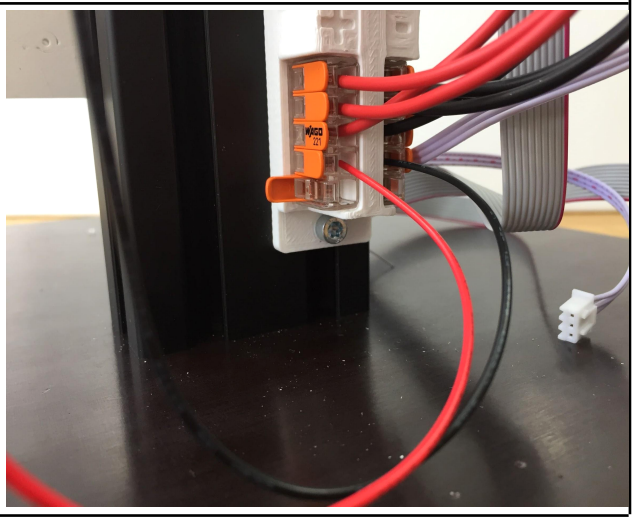
6.111	Connect the LCD cable. For alignment of the cables, see next step.	
6.112	The cable with the number 1 is on the left, the cable with the number 2 on the right.	
6.113	Take from package 1: 2x wood screw 2.5x12 (SC01) Tool: cross-slotted screwdriver PH1 Tighten the display holder. For the position, see the next step or the technical drawing of the base plate (FR01) in the “06-mechanical parts” folder.	
6.114	This is what the display should look like now.	

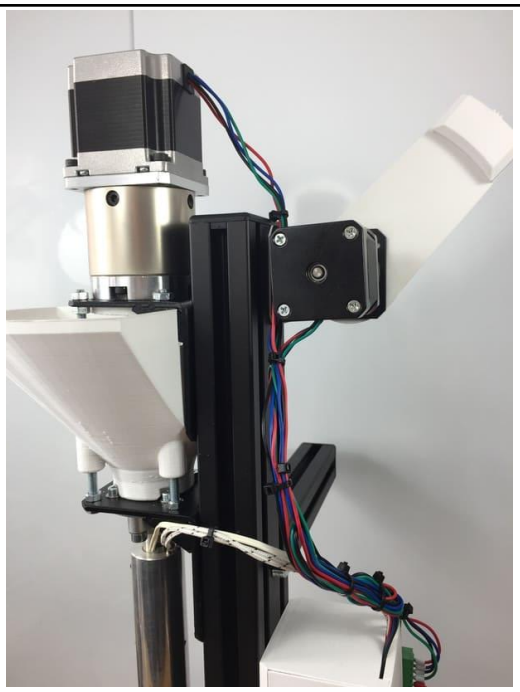
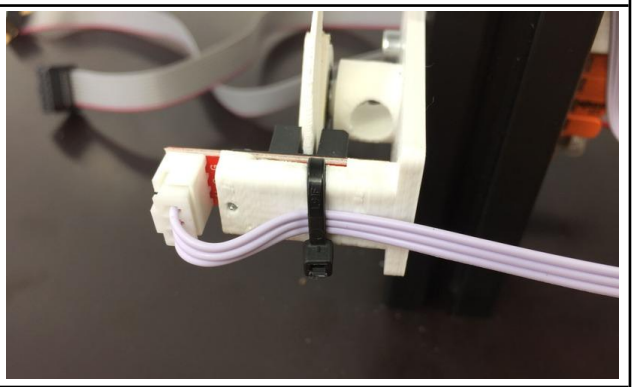
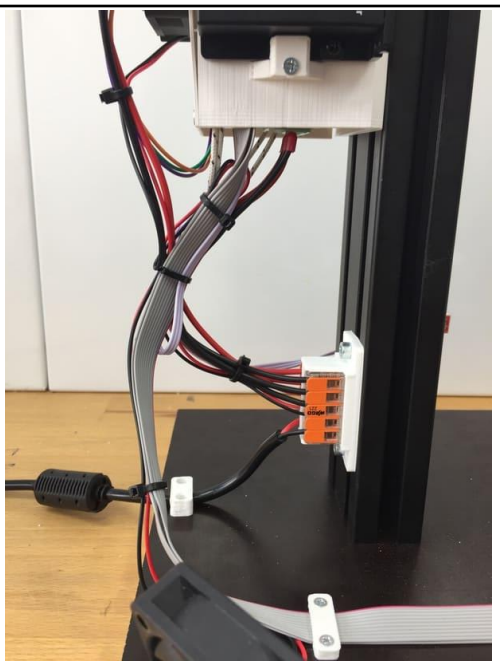
6.115	3D printing: 2x ribbon cable holder (EL27)	
6.116	Lay the LCD cables on top of each other and attach the holder.	
6.117	Take from package 1: 2x wood screw 2.5x12 (SC01) Tool: cross-slotted screwdriver PH1 Tighten the holder.	
6.118	Take from package 1: 2x wood screw 2.5x12 (SC01) Tool: cross-slotted screwdriver PH1 Align the LCD cable straight, attach the second clamp and screw it tight.	

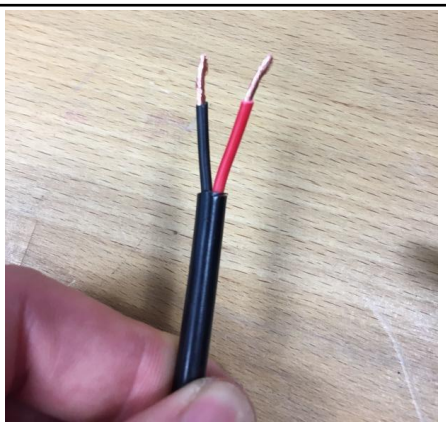
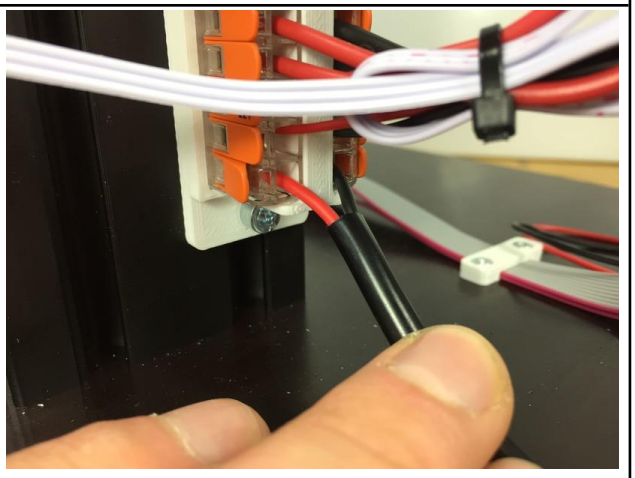
6.119	3D printing 1x fan bracket (EL28) Take from package 4: 1x fan 12V (EL29) with wire end sleeves (EL30) Take from package 1: 2x wood screw 3x25 (SC02) 1x wood screw 2.5x12 (SC01)	
6.120	Tool: cross-slotted screwdriver PH1 Tighten the fan to the fan holder. Orientation see picture.	
6.121	Position the fan holder on the base plate. For the position, see the picture or technical drawing of the base plate (FR01) in the “06-mechanical parts” folder.	
6.122	Tool: cross-slotted screwdriver PH1 Tighten the fan bracket. Tighten the screw just enough so that the bracket can still be turned.	

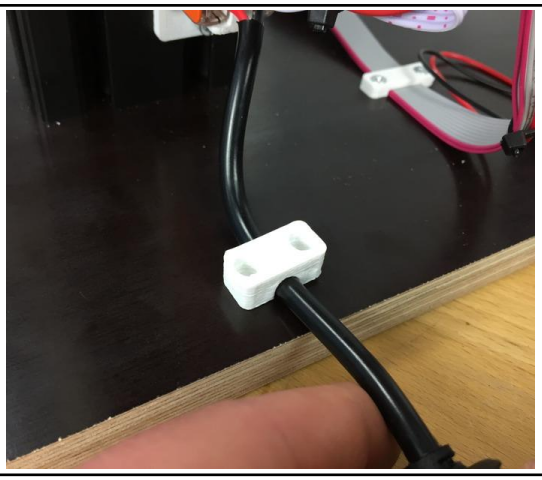
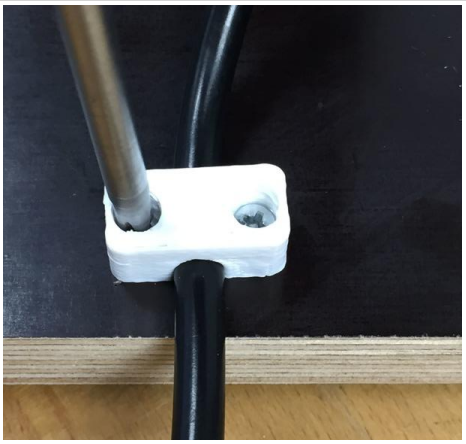
6.123	Tool: Slotted screwdriver 3mm Connect the connection cable of the fan on the Ramps Board to connection D8. Attention: pay attention to polarity. Red wire in right terminal, black wire in left terminal. See image.	
6.124	3D printing: 1x cover Arduino top (EL21) (Older version can be seen in picture) Take from package 1: 3x wood screw 2.5x12 (SC01)	
6.125	The wires that lead up out of the housing hold together.	

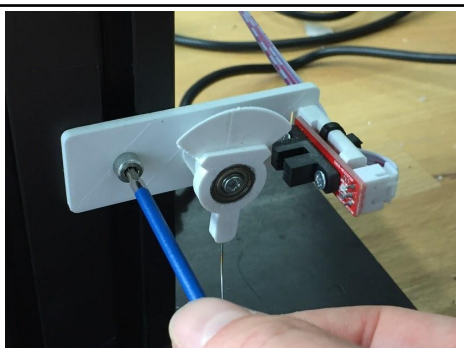
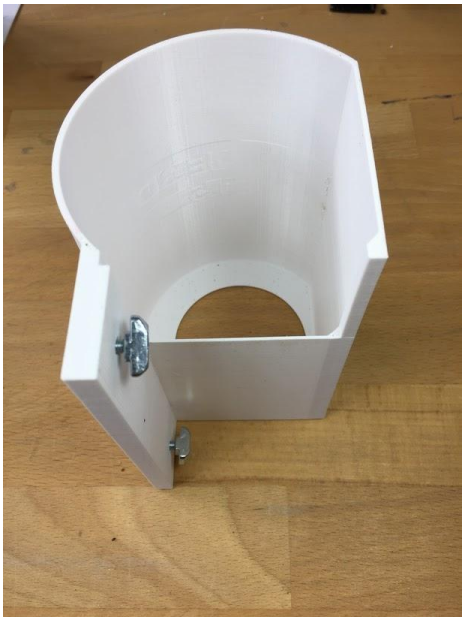
6.126	Put on the cover. Align the lines so that they are in the resulting slot.	
6.127	Tool: Phillips screwdriver PH1 Tighten the two upper screws in the cover.	
6.128	Align the cover so that the side wall meets the slot and closes.	
6.129	Closed side wall.	

6.130	Tighten the lower screw in the cover.	
6.131	Take from package 4: 1x fan 24V or 12V (EL22) (Without ferrules) (24V fans often run quieter) Take from package 1: 4x wood screw 3x25 (SC02)	
6.132	Tool: Phillips screwdriver PH1 Screw the fan to the cover. Caution Do not tighten the screws very firmly, otherwise they will spin.	
6.133	Connect the fan to the Wago terminals. Attention red wire to “+”, black wire to “-”.	

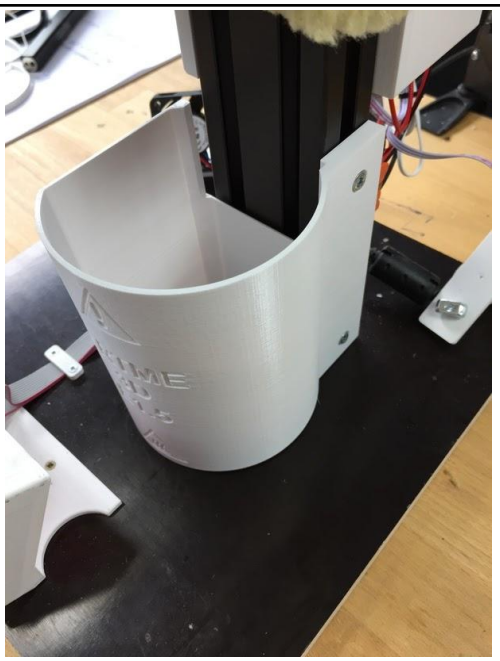
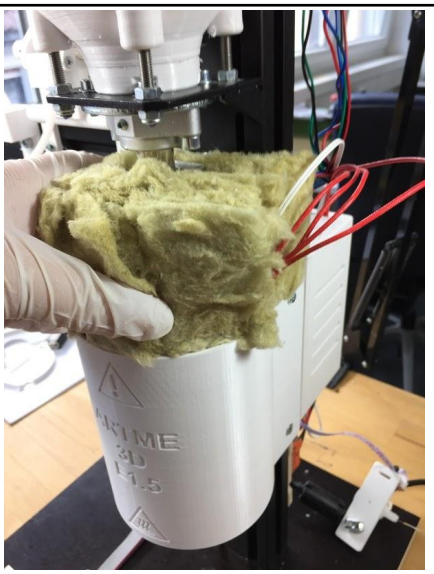
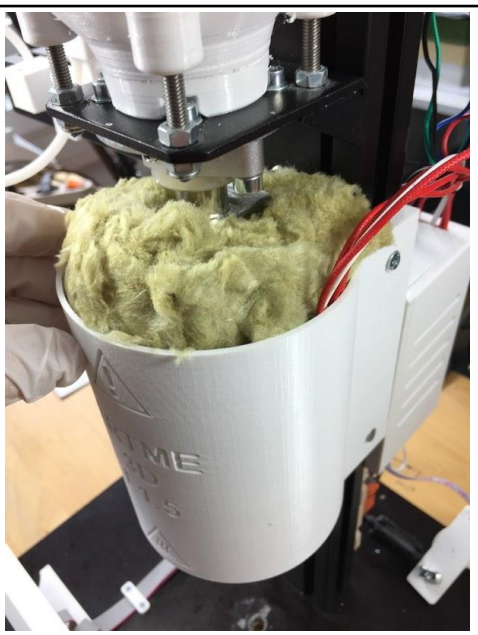
6.134	Take from package 2: 11 cable ties Arrange the cables in the upper area and fix them with the cable ties.	
6.135	Fasten the sensor cable so that it is secured against pulling.	
6.136	Arrange the cables in the lower area and fix them with the cable ties.	

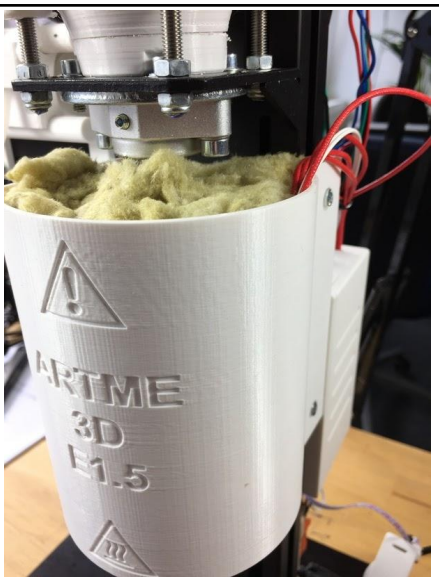
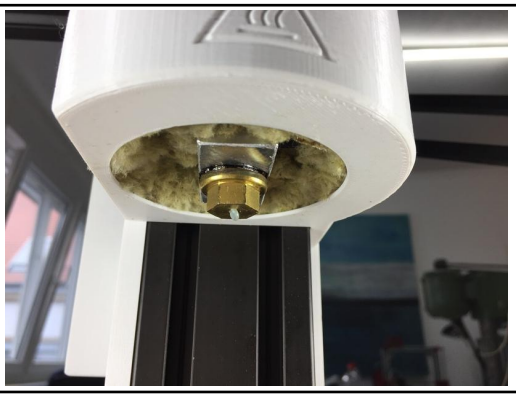
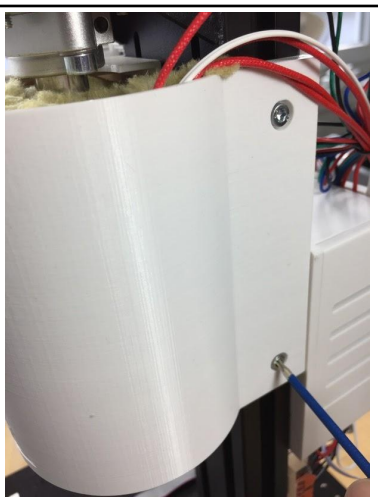
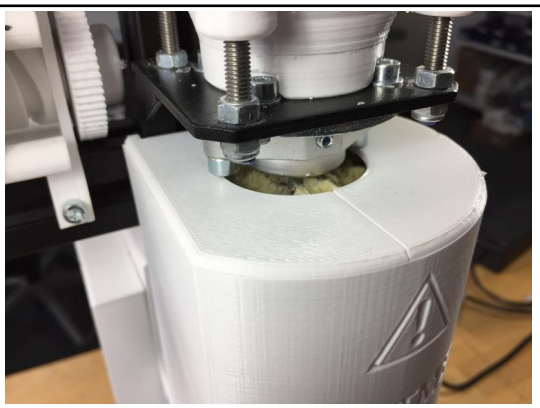
6.137	Required component: 1x power supply 12VDC 8-10A (not included) Please use a closed, safe power supply as shown. 3D printing: 1x strain relief (EL24) Take from package 1: 2x wood screw 2.5x12 (SC01)	
6.138	Cut the plug at the 12v output of the power supply unit and strip the insulation from the cables (with a knife / wire stripper / scissors). Be careful not to damage the copper strands.	
6.139	Connect the 12V line of the power supply unit to the Wago terminals: Pay attention to polarity again! Connect the positive pole (+) of the power pack to the Wago terminal on the left side (marked with “+”). Connect the negative pole (-) of the power pack to the right Wago terminal (marked with “-”). The colors red and black are not always given for every power supply unit. Reverse polarity can damage the components. If in doubt, measure with a measuring device to determine the correct polarity.	

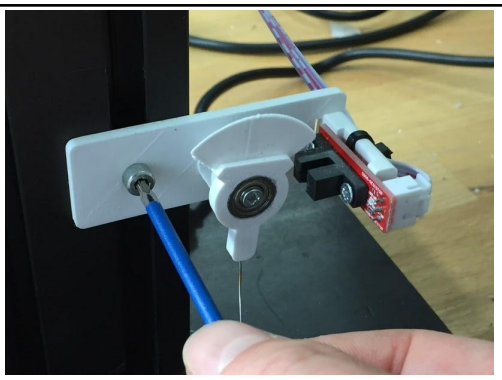
6.140	Put on strain relief.	
6.141	Tool: cross-slotted screwdriver PH1 Tighten the strain relief.	
6.142	Connect the power cord to the power pack. But don't plug it in a socket yet.	
7.0	**Insulation**	
7.1	If you print the printed parts of the insulation in PLA and use the rock wool properly, operation up to 190 ° C is no problem. In addition, the cover can become soft and deform after long periods of use, but it is strongly recommended that the insulation be applied. The insulation protects you from burns on the hot parts. The insulation greatly reduces the energy consumption of the extruder. The insulation ensures better heat distribution and better extrusion. The fibers of the rock wool can irritate the skin and make it itchy. Use gloves or rubber gloves when handling. Avoid creating dust by working slowly. Use a dust mask.	

7.2	3D printing: 1x cover (IN01) 1x cover left (IN03) 1x cover right (IN04) Take from package 1: 2x hammer nut M4 (SC10) 2x cylinder screw M4x12 (SC04) TakeRemove from package 0: 1x rock wool 135x230x40mm (IN02)	
7.3	Unscrew the sensor and set it aside.	
7.4	Insert the cylinder screws through the mounting holes and screw the hammer nuts onto the screws.	
7.5	Flatten the rock wool over the entire surface several times by hand. This makes it more pliable.	

7.6	Clamp rock wool behind the heating element. The long side is transverse.	
7.7	Carefully bend the rock wool around the heating element. Be careful not to break through the wool. The wires stick out to the side.	

7.8	Align the cover with the aluminum profile. Insert the hammer nuts into the lateral groove of the profile. (do not screw tight yet)	
7.9	Push the cover over the rock wool from below. Press the wool together again and again with your hand..	
7.10	Push the cover further up. Guide the lines between the rock wool and the cover upwards.	

7.11	Press the remaining rock wool into the cover. Push the lines to the rear.	
7.12	The correct height is reached when the nozzle can be seen at the bottom. Distribute the wool from below around the heating element and push it into place.	
7.13	Tighten the cap screws. (not too tight, otherwise the pressure part may break).	
7.14	Place the two cover parts on the cover from the left and right. If the cover touches the shaft holder, loosen the cover again if necessary and briefly push it a little deeper. Then fasten again.	

7.15	Reattach the sensor.	
7.16	Congratulations! Construction is complete! The required firmware is already on the Arduino if you have bought an original kit from ARTME 3D. If not, you can find the firmware in the documentation and install it using the Arduino IDE. It is essential that you read the operating instructions and the safety instructions in Chapter 1 before commissioning.