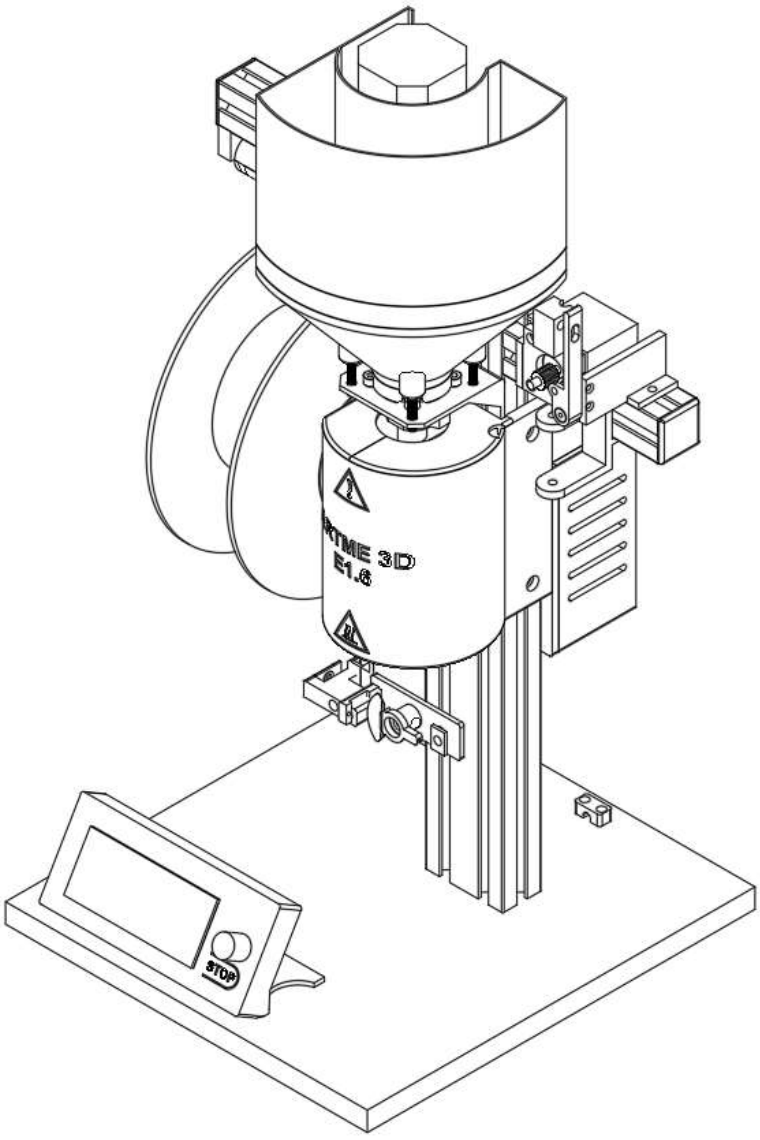
Operation manual

Original Desktop Filament Extruder E1.7 by ARTME 3D

Version 28.02.2022



Please read these operating instructions carefully and thoroughly to ensure safe and proper operation.

Thank you for purchasing the kit for my original Desktop Filament Extruder E1.7! Your purchase supports me in the further development of this type of projects and the quality assurance of the components.

If you would like to support me in developing and publishing projects of this kind, I would appreciate a small donation via paypal to paypal@artme.de.

If you have any questions or problems, please read the FAQ`s at www.artme-3d.de/support first or send an email to kontakt@artme-3d.de. Try to describe your problem as detailed as possible.

You buy a set of hardware to make your own version of the extruder. There is no obligation to build the device according to my specifications, you can combine the components as you like.
Your action is necessary to run the system as safe as possible. Therefore, please be sure to read chapter 1 in the operating instructions.

I wish you much pleasure in building and operating the extruder,

David from ARTME 3D

A big thank you goes to Filip Mulier. He wrote the firmware "Marlin-Mackerel" which made this project possible.

You can find his original data at https://github.com/filipmu/Marlin-Mackerel.

The following has been edited for the Desktop Filament Extruder E1.7:

- User interface changed
- Device parameters changed
- safety functions (thermal runaway and killswitch) integrated

Table of contents

1.Important notes for the user of the extruder

1.1 Disclaimer

Failure to follow the safety instructions, documentation and operating instructions may result in injury to users, inferior results or damage to components. Always make sure that everyone who operates the extruder knows and understands the contents of these operating instructions. Always make sure that you have the latest version of firmware installed on your extruder. We cannot control the conditions under which you assemble and operate the Original Desktop Filament Extruder E1.6. For this and other reasons, we assume no responsibility and expressly disclaim all liability for any loss, injury, damage or expense resulting from the assembly, handling, storage, use or disposal of the product. The information in this documentation is provided without any express or implied warranty as to its accuracy.

1.2 Safety instructions

1. please be very careful during any interaction with the extruder. This extruder is an electrical device with moving parts and high-temperature high temperature ranges.
2. The device is intended for indoor use only.
3. Do not expose the extruder to rain or snow.
4. always keep the extruder in a dry environment at a minimum distance of 30 cm from other objects.
5. During extrusion, plastic is melted, which causes odor. The inhaling these fumes is harmful to health. Always place the extruder in a well ventilated area. Do not use it in living rooms or bedrooms. Wear suitable respirators.
6. Some plastics can decompose thermally if heated for a long time or even if overheated. thermal decomposition, resulting in potentially toxic fumes.
7. it is recommended to install a carbon monoxide detector.
8. before processing a plastic material, always check its properties and processing temperatures.
and processing temperatures. Check the material safety data sheet. In case of questions contact the manufacturer of the material.
9. always switch off the extruder heating immediately when you are not extruding material.
10. If dangerous situations arise while the extruder is in operation, you can switch off all processes immediately by pressing the STOP button on the display.
11. Always place the extruder in a stable place where it will not fall or fall can tip over. Make sure you have a firm footing.
12. Never leave the extruder unattended while it is switched on and heated up.

13. Use surveillance systems for fire detection.
14. Protect the extruder from direct sunlight.
15. The extruder is powered by a 12VDC safety extra-low voltage with a maximum input current of 10A. An external power supply unit for operation on mains voltage is not included in the scope of delivery. Use safe, closed-type desktop power supplies for this. Never connect the device to a power source with different current or voltage values, as this can lead to malfunctions or damage to the extruder.
16. Lay the connection cable to the power source so that you cannot trip over, step on or be damaged in any other way. Make sure that the power cord is not damaged mechanically or in any other way. Do not use damaged cables and replace them.
17. Do not touch the heating element or heated tube when the extruder is in
Is operating or is warming up. Note that the temperature of the nozzle and the
Heating elements can be up to 300 ° C (572 ° F). Temperatures above 40 ° C (104 ° F) can damage the human body.
18. Beware of rotating parts and self-starting movements! Do not reach into the interior of the extruder while it is in operation. Injury can be caused by the rotating parts. Fingers can be crushed. Loose parts, clothing, long hair, jewelry or other objects can be pulled in by rotating parts.
19. Make sure that unattended children cannot access the extruder, even when the device is not in operation.

1.3 Intended use

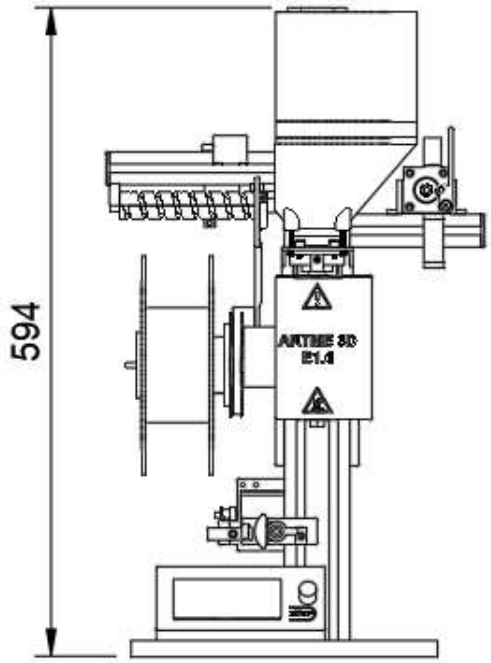
The device is only suitable for extruding thermoplastics with a melting temperature below 250°C. Any other use is not in accordance with the intended purpose.

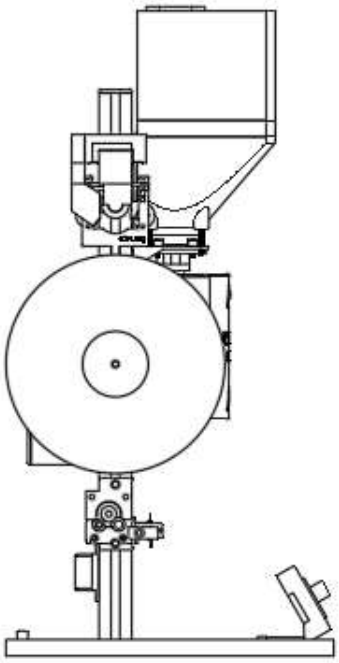
2. Technical data

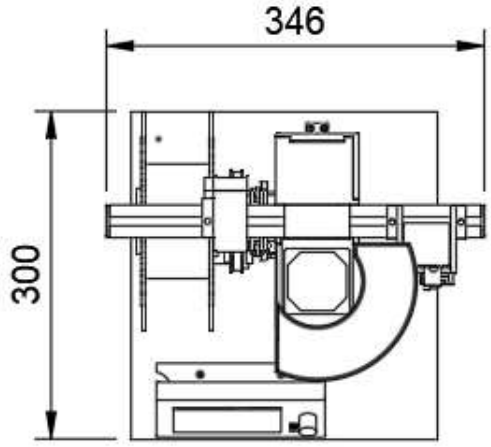
2.1 Technical data

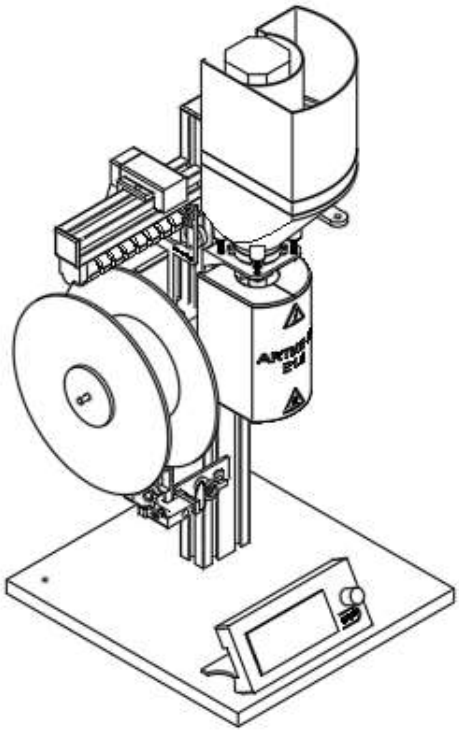
Name: Original Desktop Filament Extruder E1.6 by ARTME 3D (Kit)
Filament: 1,75 mm or 2,85mm
Manufacturer: Artme GmbH, Ludwigstraße 202, 67165 Waldsee, E-Mail: kontakt@artme-3d.de
Device usage: indoor use only
Power supply: 12V DC safety extra-low voltage at maximum 120W input power
Working temperature range: 18 °C to 30 °C
Humidity: 70% or less
Weight of the kit (gross / net): 8.2 kg / 6.7 kg
The serial number of the kit is located on the extruder frame (aluminum profile)

2.2 Dimensions and drawing









3. Instruction manual

3.1 Switch on, switch off

The extruder is switched on by connecting the supply voltage of 12V DC. It is recommended to use a safe table power supply in closed design (not included in the scope of delivery). The extruder is switched off by removing the supply voltage. Ensure that there is no voltage after switching off.

3.2 Display and operating elements

After the extruder is turned on, you will see the Info Screen. This shows the following data:

1: Temperature: Actual temperature / target temperature in degrees Celsius

2: E: Speed of the extruder motor in revolutions per minute (rpm) (only visible if the extruder is heated up and the extruder motor is started, otherwise COLD rpm)

3: S: measured value of the sensor

4: Av: average, Mx: maximum value, Mn: minimum value, of the sensor measured value

5: L: filament length in cm

6: Puller: speed of the puller motor in revolutions per minute (rpm).

7: Info line.

8: STOP: When this button is pressed, the extruder switches off all motors and heaters. To switch the device on again, it is necessary to switch the power supply off and on again.

9: Rotary button: The rotary button next to the display can be pressed and turned left and right. To get to the main menu, press the rotary knob. To scroll down in the main menu, turn the rotary knob to the right. To scroll up, rotate it to the left. To make a selection, the rotary knob is pressed in the corresponding position. In the main menu you will find some direct functions as well as further submenus with the following content:

3.3 Menu structure

Main menu (when extruder motor is off):
Info Screen: Back to Information Screen
START Extruder (Starts the extruder motor, attention the extruder temperature must be above 90°C to avoid damage).
Prepare (submenu for presetting the most important parameters, see below)
Preheat (preheat to 175°C)
Cooldown (switch off heating)
Control (submenu for setting controls, see below)
Clear Statistics (Sets the filament length counter reading and the min/max sensor reading to zero)
Enable Statistics (not yet needed in this operating state)

Main menu (when extruder motor is on):
Info Screen
Automatic pulling / Manual pulling (Starts or stops the automatic puller motor speed control)
STOP Extruder (Stops the extruder motor and the winder motor)
Tune (submenu to change current values, see below)
Preheat (Preheat to 175°C)
Cooldown (turn off heating)
Control (submenu to set controls, see below)
Clear Statistics (Sets counter reading of filament length and min/max sensor reading to zero)
Pause statistics (Pauses filament length counter reading and min/max sensor reading, then "Enable Statistics" to resume)

Prepare (Only to be seen when extruder motor is off):
Main (Return to main menu)
Extruder RPM (Set the extruder speed in revolutions per minute)
Extruder Temp (setting of extruder temperature in °C and heat up)
Fan speed (speed of the filament fan from 0 to 100 %)
L cutoff (setting of the filament length at which to cut off, here specified in millimeters)
Preheat (Preheat to 175°C)
Tune (Only visible when extruder motor is on):
Main (Return to main menu)
Extruder RPM (Setting the extruder speed in revolutions per minute)
Extruder Temp (setting of extruder temperature in °C)
Fan speed (speed of the filament fan from 0 to 100 %)
L cutoff (setting of filament length at which to cut off, here specified in millimeters).

Control submenu:
Main (Back to the main menu)
Temperature (submenu for setting the extruder temperature, see below)
Motion (submenu for controlling the motor settings)
Puller PID (submenu for setting the automatic rewinder)
Store memory (Stores the current speed values and settings)
Load memory (Loads the last stored speed values and setting values)
Restore failsafe (Loads the original firmware default settings)

Temperature:
Control (Return to Control menu)
Extruder Temp (Set extruder temperature in °C and heat up)
PID-P (Setting value P of the control behavior of the PID temperature control)
PID-I (Setting value I of the control behavior of the PID temperature control)
PID-D (Setting D of the PID temperature control behavior)
PID-C (Setting value C of the control behavior of the PID temperature control)
Preheat config (submenu for setting the preheat temperature)
PID Autotune (Starts several heating phases in order to determine the PID values for the heating so that
the control works accurately and consistently)

Preheat config:
Extruder Temp (Set target temperature to be heated to by the Preheat function.
Store memory (Stores the temperature setting)

Puller PID:
Control (Return to Control menu)
Sensor Pos (Factor for the height of the target sensor arm position)
L cutoff (Setting of the filament length at which to cut off, here specified in millimeters)
PID-P (Setting value P of the control behavior of the take-up)
PID-I (Setting value I of the control behavior of the rewind)
PID-D (Setting value D of the control behavior of the rewinding)
Faktor 1 (Factor for the sensor value display. When using a Hall sensor for diameter detection of the filament).
Faktor 2 (Factor for the sensor value display. When using a Hall sensor to measure the diameter of the filament).
P circ (circumference in mm of the puller wheel on the puller motor).

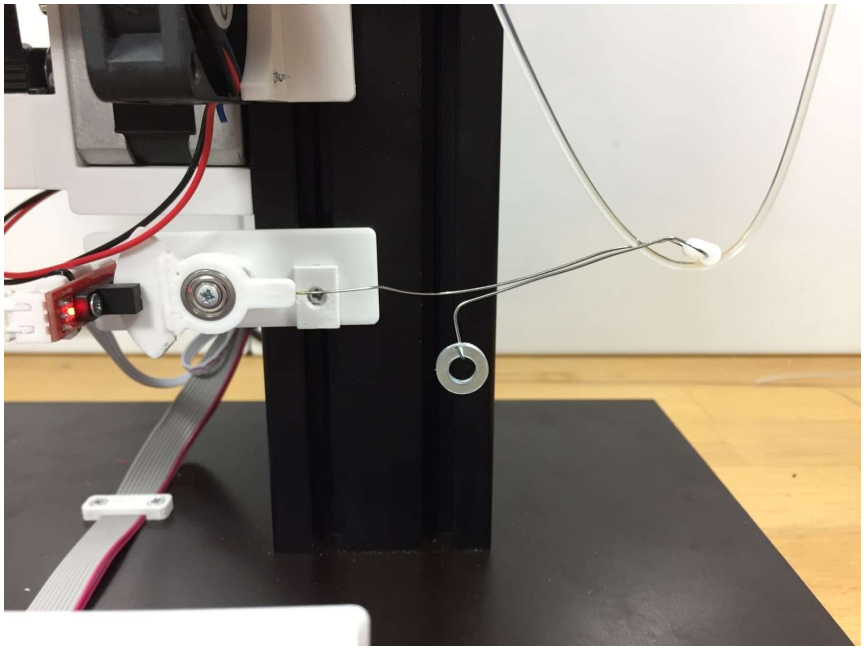
Motion:
Control (Back to Control menu)
Esteps/rev (number of steps per revolution of the extruder motor)
P steps/mm (number of steps per revolution of the winder motor)
Motor Acc (acceleration value)
Ve-jerk (Jerk setting)
Vmax e: (V setting)

3.4 Granules Prerequisites

Please read the material guide in Documentation (09-Material Guide). You can always find the documentation in current form for download at www.artme-3d.de/support.

3.5 Prepare sensor

The sensor of the extruder is responsible for automatically controlling the pulling speed of the filament so that the pulling force on the filament always remains the same. In order for the sensor arm to properly sense the height of the filament, the wire on the sensor arm must be bent to shape and fitted with a PTFE roller. (See Assembly Instructions 08-Sensor and Fan Assembly) It may also be necessary to attach a tension weight to the sensor.



3.6 Calibrate sensor

The sensor consists of an optical photoelectric sensor (optical limit switch) and a 3D printed sensor arm with an aperture. This aperture is illuminated by the light barrier and should be printed in a white material. The material thickness of the aperture may need to be changed after printing so that the sensor functions properly. To do this, proceed as follows:

1. On the information view of the display you see under "S" the sensor value which changes when the sensor is moved. Hold the sensor arm horizontally and read the value. Now set this value under Main menu-Control-Puller PID-Sensor Pos. Save the entry under Main menu-Control-Store memory. If the value is outside the adjustable range or fluctuates when the sensor arm is moved instead of rising or falling evenly, the sensor orifice must be mechanically reworked. To do this, remove the sensor arm by loosening the small screw on the ball bearing. The surface of the sensor aperture, which is located between the light barrier, can now be ground a little thinner with a file. Sand the aperture from both sides so that the transilluminated surfaces are clean and matte. Make sure that the surface is thinned evenly and that there are no dents. The wedge shape of the transilluminated surface must be maintained. Then reinstall the sensor arm and read the value again. Repeat the process if necessary.
2. Adjust the distance of the sensor to the extruder nozzle by loosening the small screw on the sensor holder, sliding the sensor up or down, and reattaching it. The distance to the nozzle is measured at the point where the filament touches the sensor when

the sensor is horizontal. The distance can be between 40 and 120mm depending on the material.

3.7 Calibrate puller wheel

The toothed wheel on the puller can have a different diameter than specified in the data sheet or order text of the wheel due to production reasons. To obtain a correct display of the filament length, the circumference of the puller wheel must therefore be adjusted in the control unit. To do this, measure the diameter of the wheel with a caliper gauge. Now the circumference must be calculated. You can use an online circle calculator for this and enter the diameter there and get the value of the circumference.

Or you can calculate it with the following equation:
$U=2*\pi*r$
So you calculate 2 * 3,14 * half of the measured diameter. (The sign * means multiply).

Example:
If you measure a diameter of 12mm on the puller wheel, calculate 2 * 3.14 * 6. This gives a circumference of 37.68mm.

Enter this value under Main Menu - Control-Puller PID - P circ. The value must be entered in millimeters. Then save the setting (Main menu - Control - Store memory).

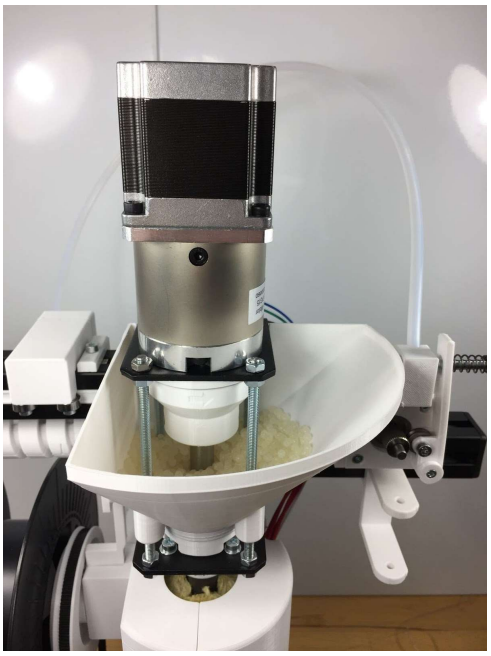
3.8 Calibrate temperature control

It is necessary that the temperature remains very uniform during operation and does not fluctuate. Even a temperature change of 1 - 2°C can have an influence on the quality of the extrusion. Calibration has already been performed when testing the components before shipping the kit. Therefore, you should not need to perform this step. However, if you still notice excessive fluctuations in your temperature control during operation, you can calibrate the temperature controller. To do this, run the Autotune function. This can be found under Main Menu - Control - Temperature - Autotune PID. Start the function in cold condition. Once you have started the function, the process will take a few minutes. Do not operate the unit during this time. When the process is complete, the control will begin to beep. Press the rotary knob to turn off the signal. Now the values for the PID control are determined and must still be stored (Main menu - Control - Store memory). The extruder cools down again automatically.

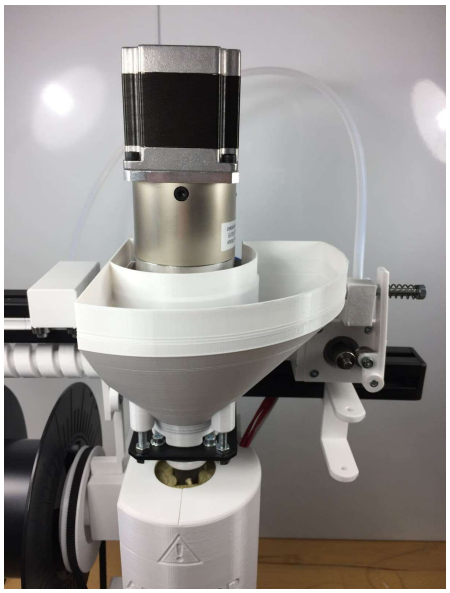
3.9 Extrude plastic

CAUTION Danger of burns! The nozzle and the metal parts on the extruder become very hot. When the filament (in the form of a hot, soft plastic filament) comes out of the nozzle, it is very hot (150°C to 250°C). To get the take-up going, you must handle the filament while it is soft. Therefore, use protective gloves or tools such as tweezers to touch the filament in this area. The filament cools down considerably after a few centimeters on the surface, but inside it still remains very hot for a longer distance. Therefore, be very careful when handling the filament.

1. Heat up the extruder.(Main Menu - Preheat) The extruder will now heat up to 175°C. This temperature is an approximate starting value for PLA. If you want to set a different preheat temperature, you can do so under Main Menu - Control - Temperature - prehet config. Regardless, you can change the temperature at any time under Main Menu - Prepare/Tune - Temperature. For a list of empirical values for different types of plastic, see the "empirical values" at www.artme-3d.de/support. When the extruder is heated, the controller will beep twice. This is to ensure that you do not forget that the unit is operating.
2. Fill the hopper with plastic pellets. The hopper part 1 is permanently installed on the extruder and should always be at least filled to get consistent extrusion results:



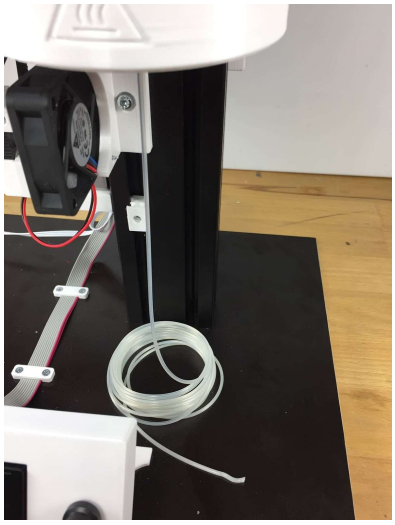
3. The hopper part 2 has a kind of orifice plate so that the granulate flows to the feed zone in a controlled manner when processing resin pellets (industrial granulate). When processing shredded 3D printing waste, the hopper part 2 should be removed to prevent bridging in the material.



4. The hopper part 3 enlarges the hopper and allow a longer runtime. This part is stackable, so you can put another hopper part 3 on it.

5. Start the extruder motor (Main Menu - START Extruder). On factory setting, the motor starts with 5 revolutions per minute (RPM). This is an empirical value for industrial plastic granulate. If you are processing shredded waste, the RPM is usually somewhat higher. The puller motor and the spool motor will also start, so the filament spool will also rotate. You can change the extruder speed at any time (Main Menu - Prepare/Tune - Extruder RPM). When the extruder is running for the first time, or when the extruder screw is free of plastic, it may take a few minutes for material to come out of the die.

6. When plastic comes out of the die, the extruder still needs a moment until the pressure and temperature curve along the extruder screw are even. Therefore, let it run for another 3 to 10 minutes. When processing shredded 3D printing waste, it may be necessary to initially increase the extruder temperature by about 20°C and then lower it again to the processing temperature until the system runs stably. This increases the temperature in the feed zone and allows the pellets to be conveyed more evenly. The sensor can be removed and set aside to avoid being damaged by the soft, hot plastic. The soft plastic filament should produce fairly uniform rings on the mounting plate. If you have problems with the extrusion, see www.artme-3d.de/support for the FAQ (regularly asked questions) and advice on what may be causing the problems.



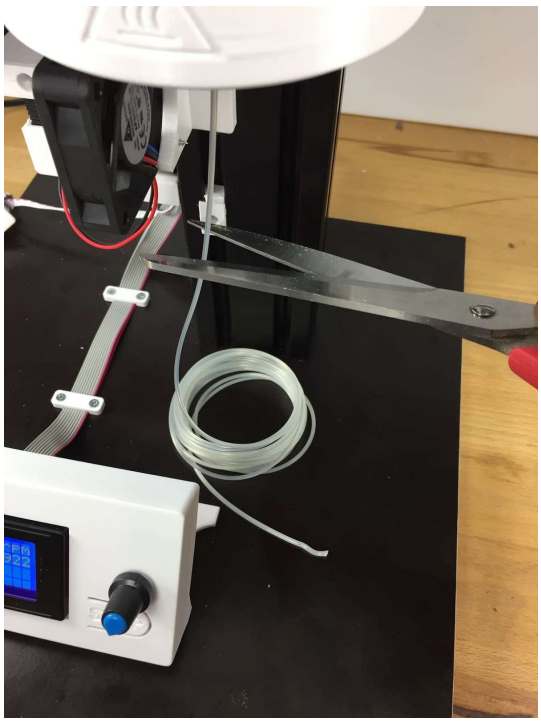
7. The presetting of the motor current is set so that the power of the motor is sufficient for processing common materials and little heat is generated in the motor. It may be necessary to increase the motor current if you are processing tough or semi-flexible materials such as PETG, PVA or harder types of TPU. If the motor current is not sufficient, the stepper motor will lose steps. This manifests itself in a disturbing noise and stalling of the extruder screw. The setting of the motor current can be adjusted at the dip switches on the external stepper motor driver. The setting position is printed on the stepper motor driver. If you set the motor current above 2.5 A(peak), it may be necessary to cool the motor.

3.10 Prepare filament calibration

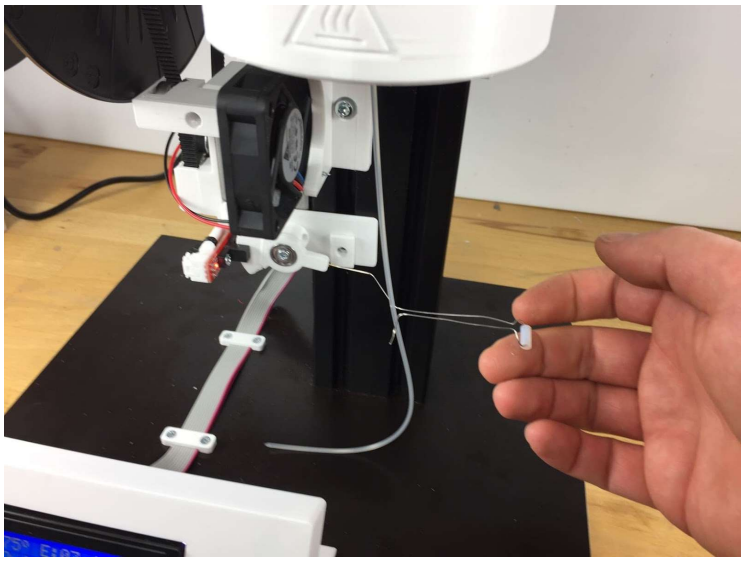
1. Roughly set the speed of the puller motor by turning the knob on the display while the information view is shown. A list of empirical values depending on the type of plastic can be found in the "empirical values" at www.artme-3d.de/support. The extruder speed must be adapted to the rewind speed. If the extrusion speed is too slow, there is a risk that the take-up process will not work because the filament solidifies too early.

2. Roughly set the fan speed. Main menu - Prepare/Tune - Fan speed. A list of empirical values depending on the type of plastic can be found in the "empirical values" at www.artme-3d.de/support. Cooling the filament on its way to the rewinder has two reasons. First, it generally cools the filament so that it is cold enough to be wound well. Secondly, it cools the surface of the filament in the area of the sensor so that the sensor arm does not stick to the soft filament. In this case, increase the speed of the fan. If cooling takes place too quickly, the filament will twist. In this case, reduce the speed.

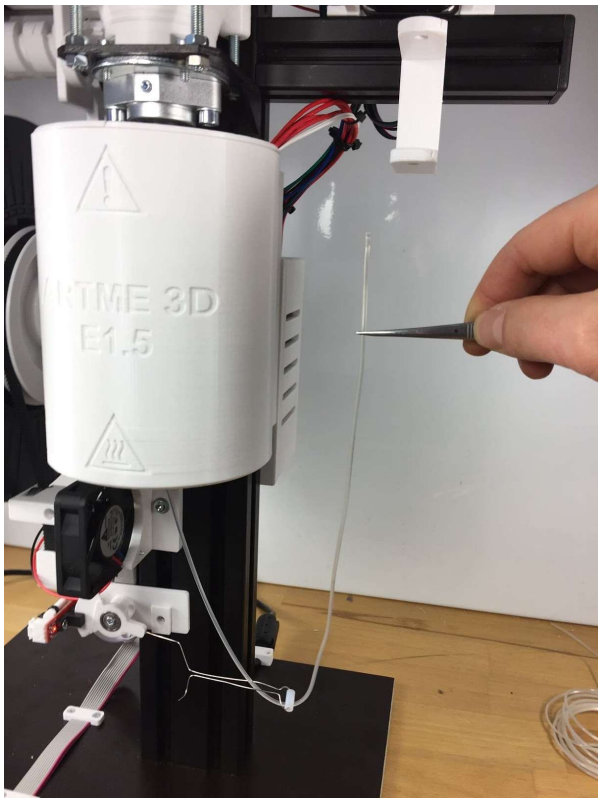
3. Cut the still soft filament about 7 to 10 centimeters after the nozzle with scissors.



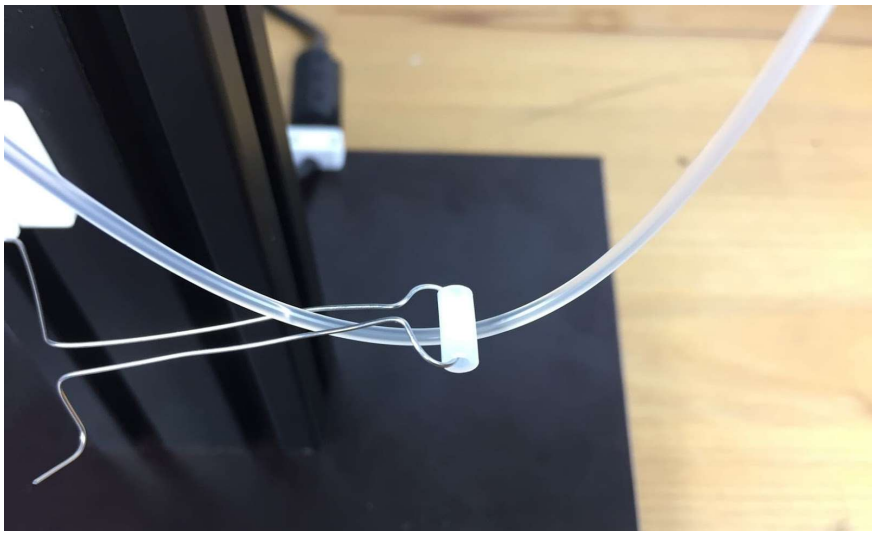
4. Place the sensor back on the holder.



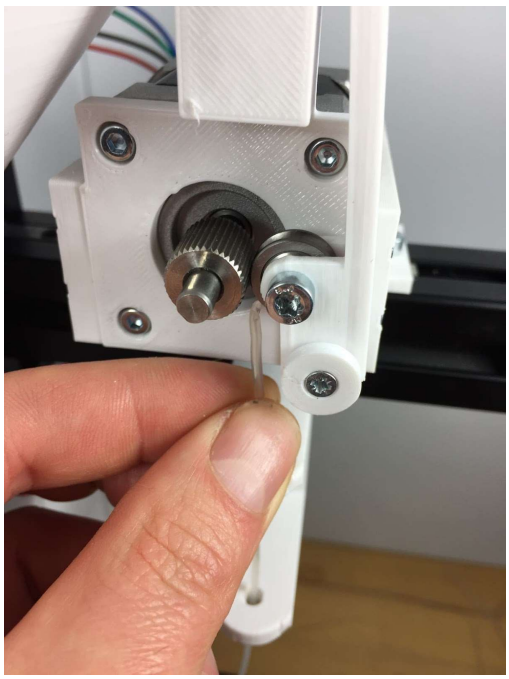
5. Guide the filament in an arc towards the puller motor and place the sensor on the filament (details next step). Pull it at about the same speed as it comes out of the nozzle and keep the sensor horizontal. If the cooling by the fan is too fast or the extrusion speed is too low, the filament may twist. In this case, reduce the fan speed or increase the extruder motor speed. If it doesn't work the first time, just try again by depositing the filament. After a bit of practice, you will be able to do this very quickly.



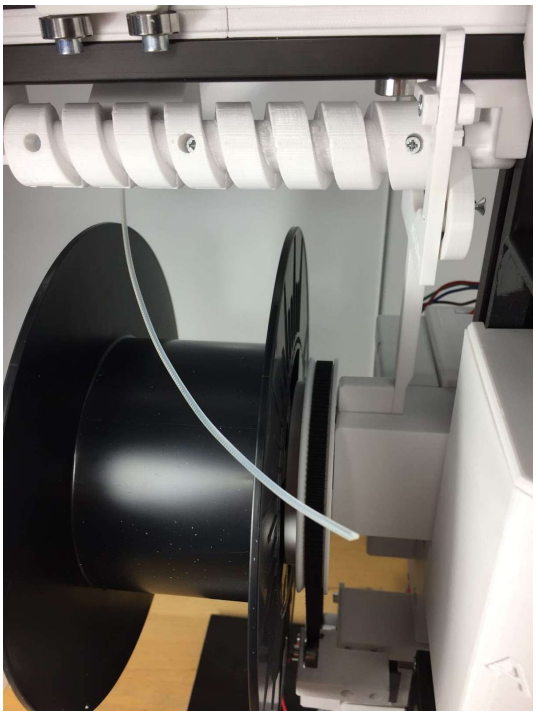
6. Make sure that the filament on the sensor is guided between the two wires and that the PTFE roller can be rotated slightly. The position of the sensor can be changed by bending the wire construction so that the filament runs in a line from the nozzle to the puller motor without being pulled to the side. For sticky or very soft materials, it may be necessary to position the filament fan to cool the material so that it does not stick to the sensor and form an arc.



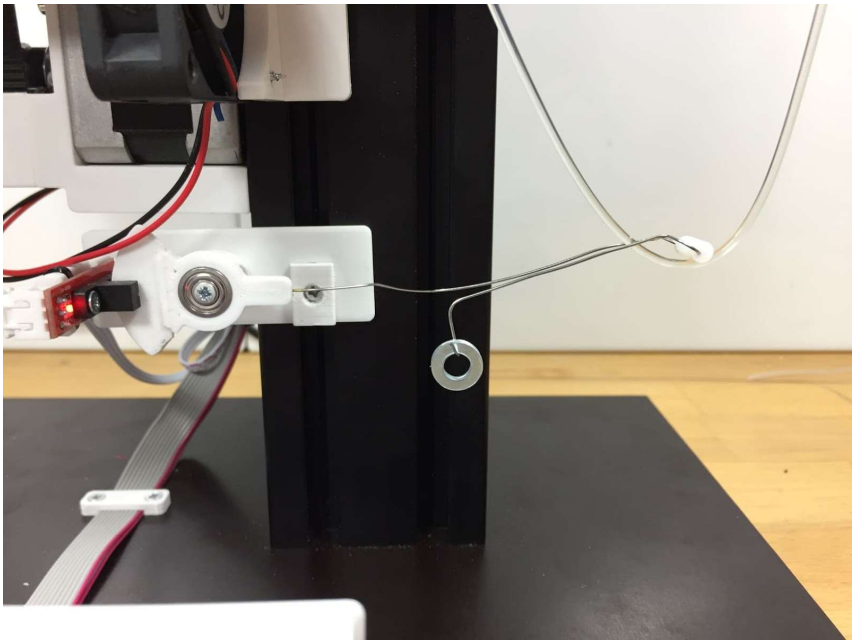
7. Push the filament through the guide under the puller motor. Then push the filament into the puller motor and between the toothed wheel and the pinch wheel. Once the motor pulls the filament by itself, make sure that it hits the guide to the PTFE tube. If the filament arrives at this point still too soft, it may twist, causing the sensor to malfunction. Or the filament will be pressed oval. To prevent this, you can increase the speed of the filament fan, reduce the production speed or position an additional fan (not included) on the filament guide under the puller motor. This can be connected to D9 on the Ramps Board. Observe polarity.



8. Now the filament runs through the PTFE tube and comes out above the spool. Let it run to the bottom first to have time to make the next adjustments.



9. The speed of the puller motor can now be changed by turning the rotary knob on the display. (Info view must be visible). Set the speed so that the sensor is approximately horizontal.



10. Then start the automatic (main menu - automatic pulling) Now the speed of the puller motor is controlled depending on the height of the sensor. If the sensor lowers, the speed is increased and vice versa. This ensures that the soft filament, which runs in an arc to the puller motor, always hangs at the same height. This keeps the diameter uniform. It may be necessary to change all values until the system runs stably. However, with a little practice and the empirical values, this can be done quite quickly.

However, it is important to change only one value at a time and wait a moment for the effect to settle in the system before changing the next value.

11. You can interrupt the automatic puller motor speed control at any time (Main menus -/ Manually pulling) and control it again via the rotary knob in the Information view. This is especially advantageous if you have to change many setting values. Do not start the automatic speed control again until the sensor is approximately horizontal.

3.11 Perform filament calibration

It is best to check the diameter with a digital caliper gauge. Measure just before the puller motor between the guides.

When setting the diameter, it is important to know the following: A digital caliper can measure in hundredths, but the measurement result is highly dependent on the quality of the caliper, the application, and the roundness and temperature of the filament. Do not let this mislead you. If, for example, you set a diameter of the filament that is between 1.6 and 1.8mm (for 1.75mm filament system), it can be processed well with common 3D printers. If in doubt, you can adjust the flow rate of the printer or enter the diameter of the filament in the slicer. However, if the diameter of the filament fluctuates strongly, even though the rewind is running automatically, something is wrong in the system (granulate quality, speed too high, melt filter dirty, material unsuitable, etc.). See the FAQ`s and material guide at www.artme-3d.de/support). If you process a new material without any experience, this process can take some time, because you have to keep an eye on many parameters and the

system reacts quite sluggishly. So, for example, if you change the temperature to optimize the filament diameter, wait a moment for the temperature to equalize throughout the system. The same applies to changing the extruder speed.

Important to know: Plastics expand to different degrees when leaving the nozzle. Therefore, the hole in the nozzle only roughly defines the filament diameter:

PLA and PETG: 1.7mm bore (empirical value, may vary)
ABS: 1.5mm hole (experience value, may vary)
PP: 1mm bore (experience value, may vary)

The following things also have an influence on the filament diameter:

1. The size of the hole in the nozzle
2. The pressure in the system depending on the speed, material and temperature.
3. The filling level of the hopper. (At least hopper part 1 should always be filled to ensure uniform pressure in the system).
4. The distance between the nozzle and the sensor. (greater distance increases the dead weight of the filament).
5. The property of the material depending on the temperature (tough or soft).
6. The weight of the sensor.
7. The distance from the fan to the nozzle. The closer the fan to the nozzle the cooler the nozzle will be and the filament will cool down sooner.
8. Plastic is damaged during each melting process (degradation due to the frequency and duration of the melting processes). This can change the properties of the plastic. PLA, for example, appears to become thinner and does not expand as much as it leaves the nozzle the more times it is melted. This reduces the diameter of the filament and requires new adjustments.
9. Even plastics of the same grade can have different properties. This depends, for example, on the manufacturer's formula or the age of the material.
10. Avoid drafts in the room.
11. Always dry the material before processing. (See material guide at www.artme-3d.de/support).

Therefore, it is recommended to use the empirical values (download www.artme-3d.de/support) and then proceed as follows for fine adjustment:

1. The bore of the nozzle can be different depending on the material to be processed. Only change the nozzle diameter with the aim of changing the diameter of the filament if you do NOT achieve your goal with the help of the following setting options:

2. If the filament diameter is too large, you can:
    a. Increase the distance of the sensor to the nozzle. Increase the filament's own weight so that the filament draws slightly thinner.
    b. Slightly increase the temperature. This softens the plastic and causes it to draw thinner. If the plastic still arrives at the sensor too hot, the sensor arm may brake or bounce. In this case, increase the speed of the filament fan.
    c. Attach an additional small weight (e.g. washer M5) to the sensor, this will pull the filament a bit.
    d. Slow down the speed of the extruder motor. This will lower the pressure in the system and the filament will expand less when it leaves the nozzle.
    e. Reduce the fan speed. Then the filament cools down a little later and has more time to be pulled by its own weight.
    f. Increase the distance from the fan to the nozzle slightly. This way the filament is softer shortly after the nozzle and stretches a bit more.

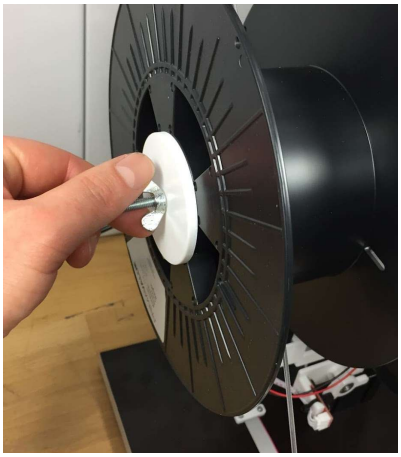
3. Accordingly, if the filament diameter is too small, you can:
    a. Reduce the distance to the nozzle
    b. Reduce the temperature slightly
    c. Reduce the weight on the sensor
    d. Increase the speed if necessary.
    e. Increase fan speed.
    f. Reduce distance between fan and nozzle.

4. Remember to give the system time after each change until the effect is stable.

5. Make a note of the setting values and store the settings if necessary. (Main menu - Control - Store memory)

3.12 Filament spooling

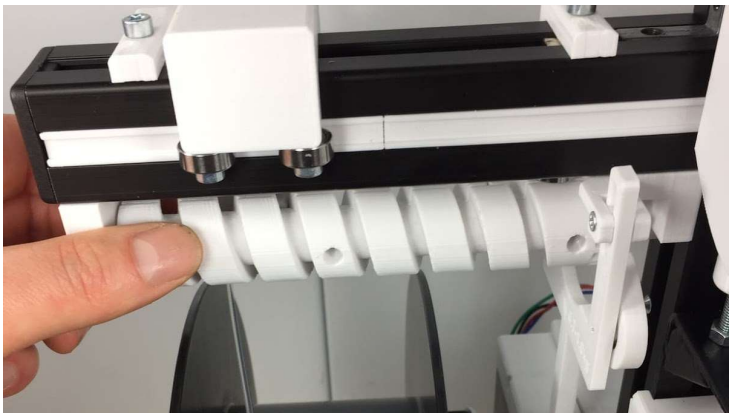
1. Loosely turn the wing nut on the filament spool. This will allow you to quickly rotate the spool to the desired position.



2. Cut the filament above the spool. The beginning of the filament is threaded into the opening at the bottom of the spool. To do this, turn the empty spool by hand to a position where you can see the opening.push the filament through it.

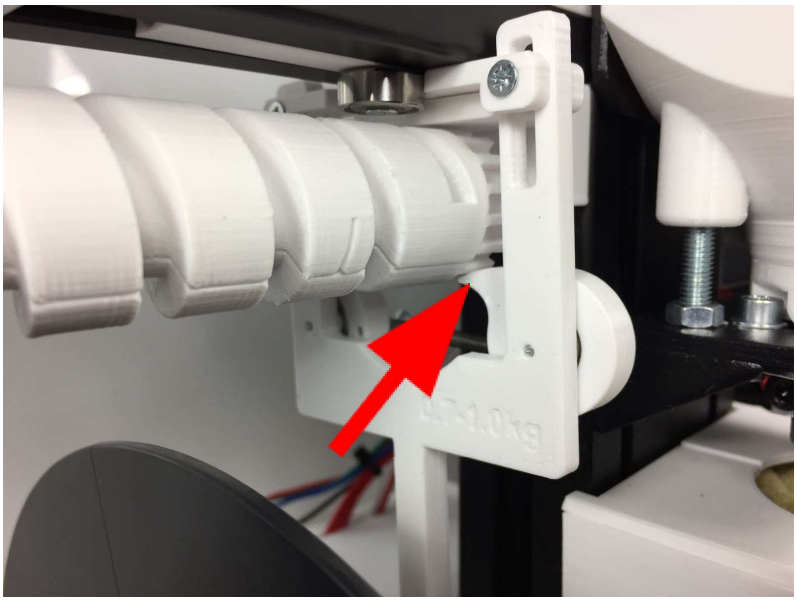
3. The filament start is bent around the outside of the spool and fastened with an adhesive strip. Then directly tighten the thumbscrew again so that the spool is rotated by the spool motor. It must be turned quite tightly so that it does not open during operation.

4. Bring the carriage on the filament guide also to the left side by turning the spiral axis.

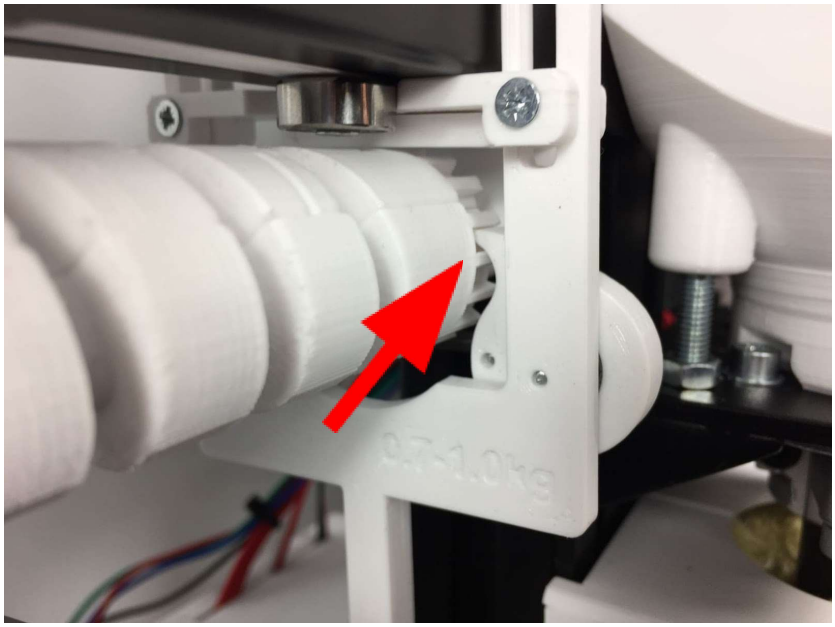


5. Slide the first windings to the left side.

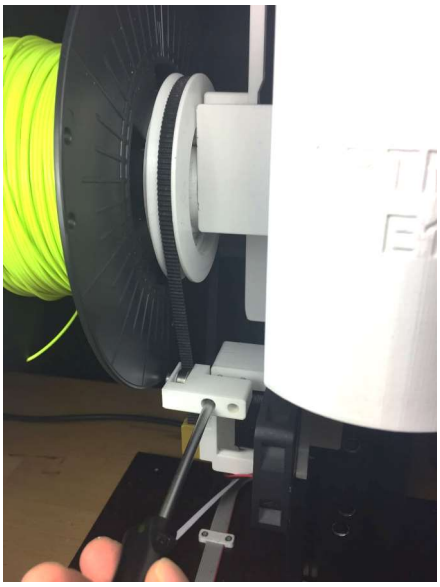
6. It may happen that one or both serrated drivers on the swing arm are twisted downwards.



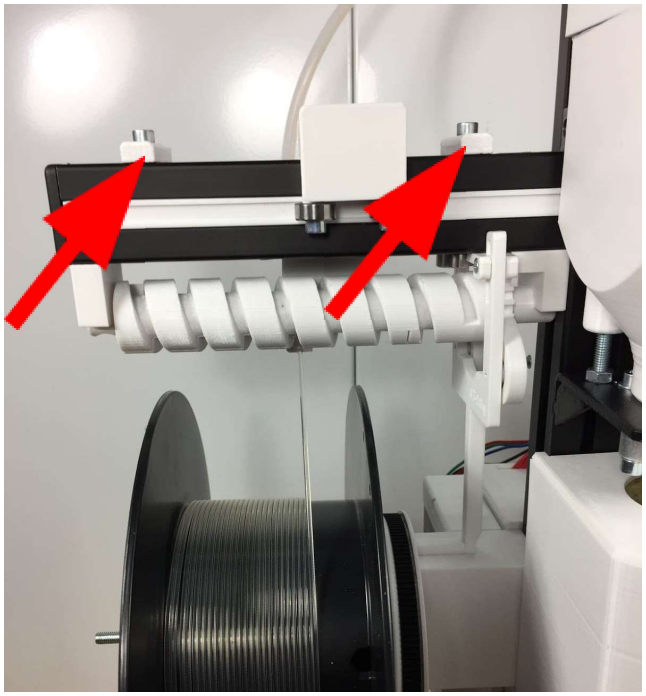
7. It is important that the serrated drivers straighten up again. To do this, you can press the rocker arm into both detent positions and/or turn the spiral axis slightly. When the rocker raises and lowers once, the serrated drivers should engage the teeth on the spiral axis and rotate it two teeth further. This corresponds approximately to a slide movement of the filament guide of 1.7mm. So if the winding on the spool is too tight or too loose, you can change this value by loosening the aluminum profile (to which the filament guide is attached) and fixing it a few millimeters higher or lower. This will affect the rotation of the spiral axis. However, this should only be done once you are somewhat familiar with the device and have produced the first filament spools.



8. The toothed belt is used to keep the filament under tension. It therefore spins easily. If the tensile force is too small, the belt can be tensioned by the belt tensioner. if the tensile force is too large, the spool motor can be blocked. In this case, loosen the belt tensioner slightly. The left screw on the belt tensioner determines the position of the tensioner, the right screw sets the belt tensioner straight. In a few cases (e.g. when winding 3mm filament) it may be necessary to increase the motor current. This can be adjusted by the small potentiometer on the stepper motor driver TMC 2208. For this purpose please contact ARTME 3D.

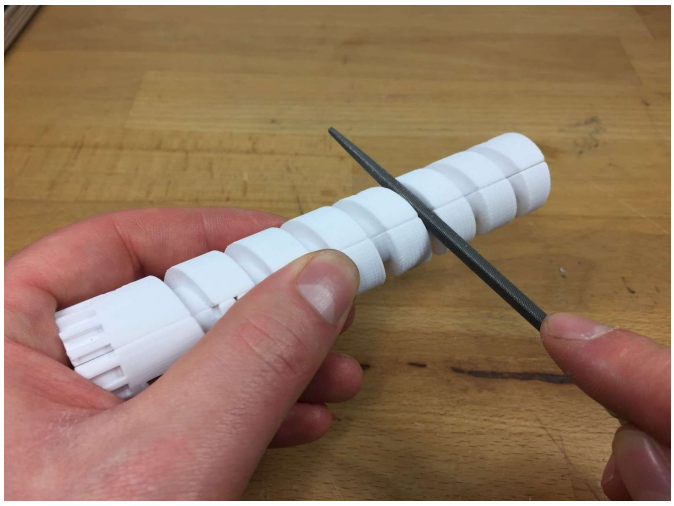


9. Depending on the spool width, it is necessary to adjust the stops for the carriage of the filament guide to the correct position in order to obtain a clean take-up. The position of the stops can be changed by loosening the cap screw. When the carriage presses against a stop, the swing arm will snap to the other position, reversing the direction of rotation of the spiral axis. Adjust the stops so that the direction changes when the filament arrives at the outer sides of the spool.

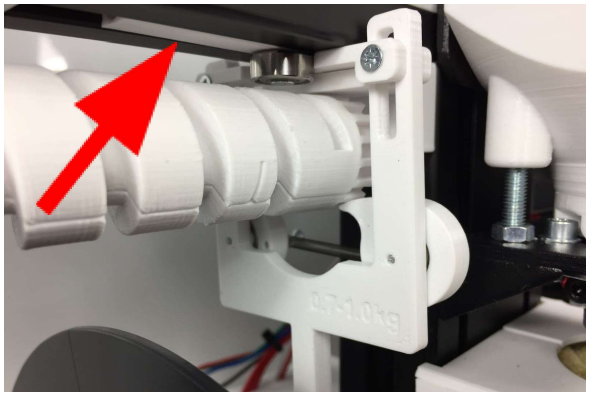


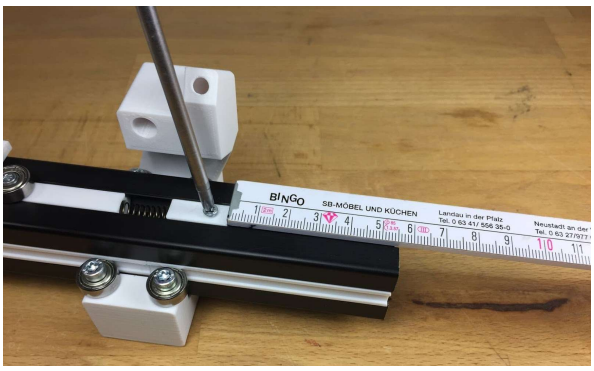
10. If the guidance direction switches too early, there are the following things to consider:

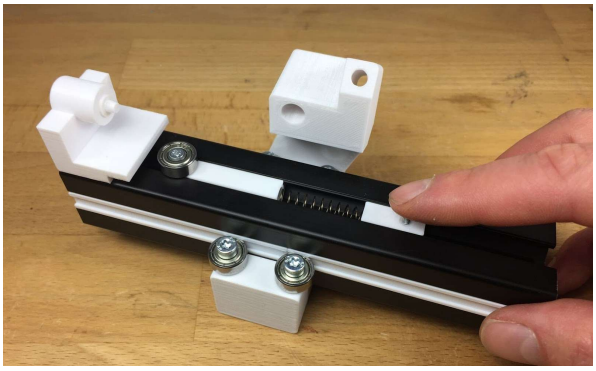
1. If the spiral axis rotates out of round or sluggishly or hooks at one point or another, it may need to be removed and reground slightly. (See also assembly instructions 06 Filament guide assembly).



2. The spring tension of the detent mechanism is too weak. To do this, the spriral axle must be removed and the coil removed. Then you can loosen the small screw on the spring tensioner and increase the spring tension by pushing it together. Then fasten the small screw again. (See also assembly instructions 06 Filament guide assembly).







11. When the winding has started successfully, you can reset the filament length counter. (Main menu-Clear statistics) The extruder switches off automatically after reaching a preset filament length. Before it can be started again, the device should be switched off once and switched on again. The default setting is 200000 mm (200m), which corresponds to approximately 570g (for 1.75mm filament). You can set the preset for shutdown. (Main menu - Prepare/Tune - L cutoff). The cutoff length value is displayed in millimeters (mm). You can read the produced filament length on the information view of the display under "L:". This value is displayed in centimeters (cm). (e.g. 20000cm = 200m) You can reset or pause the display (Main menu - Clear Statistics or Pause statistics).

3.13 Switch off and cool down

Stop the extruder motor (Main menu - STOP Extruder).
Switch off the heating (Main menu - Cooldown).
Cooling down will take some time, because quite little heat is lost due to the insulation of the extruder and no more cold pellets are heated up.
Disconnect the extruder from the power supply. Make sure that no one can burn themselves on the hot parts of the extruder.

3.14 Recommissioning

Heat the extruder to the desired temperature. After reaching the temperature, you can start the extruder motor. The system does not run stably yet, because the heat distribution in the system is not even yet. Let the extruder run until the extruder screw is filled with new plastic and the extrusion is uniform. This may take 3 to 10 minutes. The old plastic, may have changed its properties (degradation) due to the slow cooling process after shutdown and may be slightly thinner or burnt than the new plastic that then flows in.

When processing shredded 3D printing waste, it may be necessary to initially raise the extruder temperature by about 20°C and then lower it back to the processing temperature until the system is running stably. This increases the temperature in the feed zone and allows the pellets to be conveyed more evenly.

3.15 Material change

There are several options for changing the type of plastic to be processed:

1. While the extruder is running, add new material and run the extruder until the screw, extruder barrel, and die have cleaned themselves. This can take 10 to 40 minutes depending on the material and the temperature requirements of the material.

2. When changing from a high melting temperature plastic to a low melting temperature plastic, it may be necessary to clean the nozzle area and change the filter. (See next chapter) Also clean the area of the thread in the extruder tube. To do this, you can, for example, insert a small screwdriver into the hot pipe and rub along the thread in circular motions, pulling out the plastic inside. The temperature should not be too high

when doing this. The plastic should be tough, rather than liquid. Do this while the extruder is running slowly until the new plastic arrives at this point without contamination. Caution, when the extruder screw is rotating, a tool inserted into the tube can become jammed and damage the extruder screw and tube. Therefore, do not push the tool too deep into the tube, only stay in the area of the thread. Insert a new filter (see next chapter). Stop the extrusion before screwing the nozzle back in. After the nozzle is hot again (after approx. 1 minute), you can start the extrusion again.

3. If there are deposits on the extruder screw, it may be necessary to remove and clean the extruder screw while it is hot. First allow the extruder to run empty as far as possible in the heated state so that as little plastic as possible remains in the extruder screw. Then loosen and remove the nuts of the threaded rods on the mounting bracket of the extruder motor. Open and remove the thumbscrew on the back of the main frame that holds the extruder motor mounting bracket. Now you can disengage the motor from the coupling and pull it away upward by inserting a flathead screwdriver into the thrust bearing area and levering/turning. Lay the motor on its side. Be careful not to lose the key or pull on the motor cable. Now the extruder screw can be grasped at the coupling and pulled / turned out upwards. In case of problems, some force may be necessary to do this. If in doubt, heat up the extruder further so that the plastic becomes softer. Caution: There is a great risk of burns during the entire process. Wear protective gloves. After extraction, you can clean the extruder screw. Wait a short time until the screw cools down so that the plastic becomes tough and then you can remove the plastic. Start at the cold shaft. The tip of the auger is where it cools last. If there are charred areas or other buildup, it may be necessary to grind down the screw (180, 240, 400 grit) and re-polish. Installation of the extruder screw is done in reverse order. (If in doubt, see the assembly instructions). Do not forget to realign the nuts on the threaded rods with the mounting aid (3D printed part ED06-mounting tool).

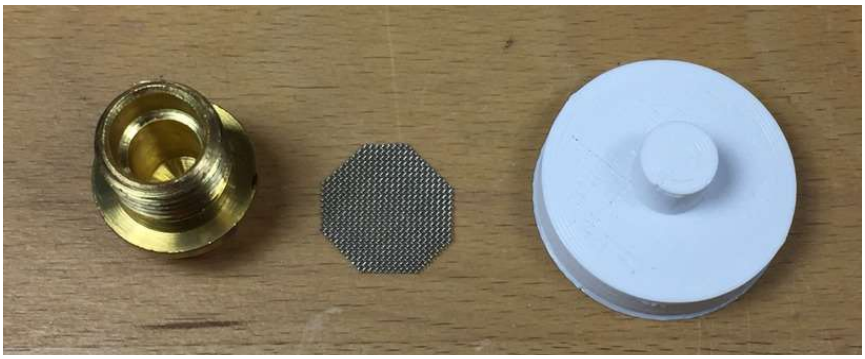
4. There are plastic combinations that require a cleaning material (intermediate rinsing with cleaning granules) in order to achieve a clean material change. Especially if the melting points or processing temperatures of the plastics to be changed are far apart.

3.16 Install melt filter

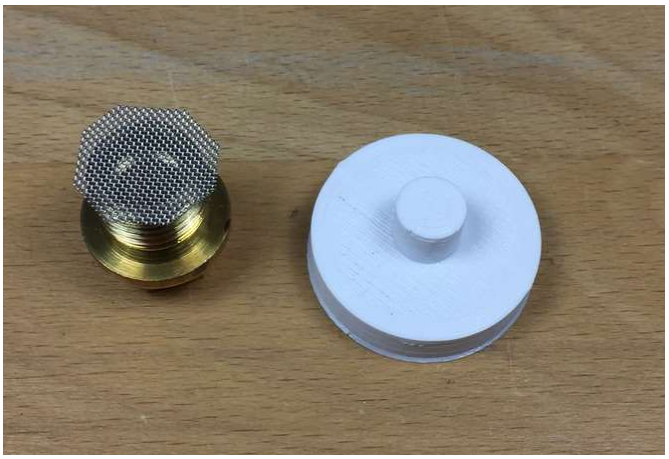
The melt filter consists of a stainless steel wire mesh with a mesh size of 0.3mm (Mesh 50). This can be purchased on the Internet if required.

The installation of a new wire mesh works as follows:

1. Cut an approx. 16x16mm piece of wire mesh and trim the corners (approx. 3mm). Side cutters or sturdy scissors can be used for this. (Caution the scissors may wear out early in the process).



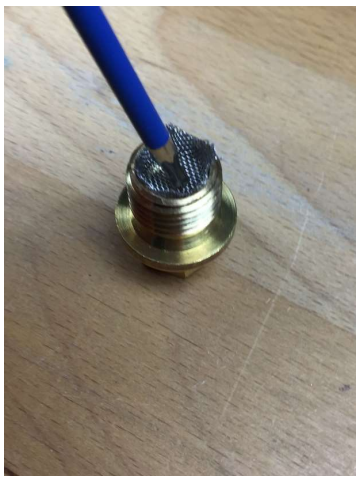
2. Place the wire mesh on the nozzle opening. Make sure that it is centered.



3. Press the bending aid into the center of the wire mesh so that it is pressed into the opening. If in doubt, you can use a vice to help you.

4. Pull out the bending aid again.

5. If the wire mesh gets stuck on the bending aid, remove it and push it into the nozzle opening again.



3.17 Seal and install nozzle

With low viscosity plastics, some melt may press through the thread of the nozzle and stick to the filament after some time. To prevent this, the nozzle can be sealed with Teflon tape. You can get this sealing tape in any hardware store. The extruder must not be heated above 250°C with this sealing. If you use a system with higher temperatures you need other high temperature sealants.

To seal with Teflon tape, proceed as follows:

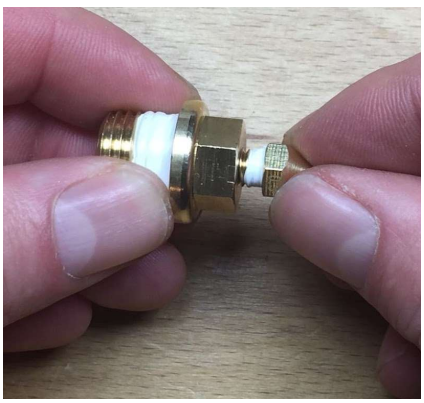
1. Align the nozzle as shown in the picture and place the Teflon tape on the thread. Hold it with a finger until you have made the first wraps, then the tape will hold itself. It is enough if you seal the bottom part of the thread. If the

Teflon tape seems too wide, just pull it a little bit in length or fold it, then it will be narrower.

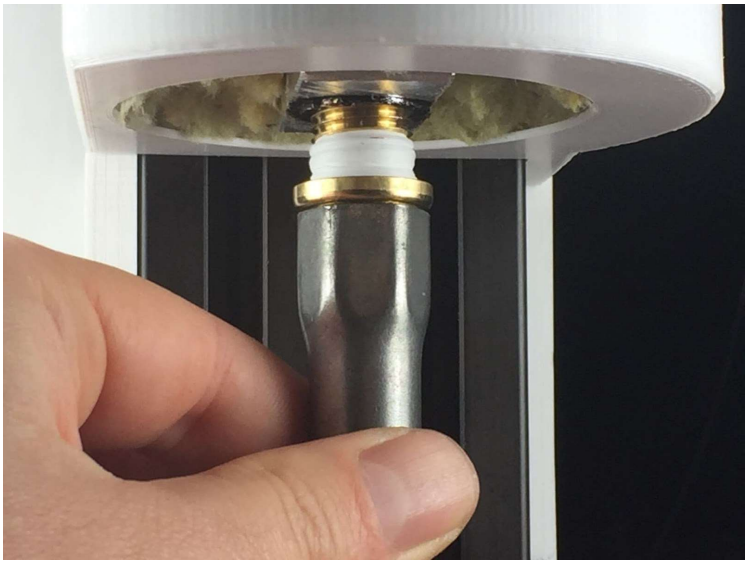
2. After 5 to 7 turns, you can tear off the Teflon tape and press it on.

3. The small nozzle can also be sealed in the same way. The small nozzle is a standard V6 (E3D style) 3D printer nozzle, which can be purchased cheaply on the Internet and drilled out.

4. Now screw both nozzles into each other. do not tighten the small nozzle too much, otherwise it may break off.




5. The nozzle is now screwed back into the tube. The tube should be hot so that residual plastic in the thread of the tube is soft. This works easiest with a socket wrench.



3.18 Replacing the melt filter:

If the filter is contaminated or removed during a material change, it may be necessary to replace it. To remove the old melt filter from the nozzle, remove the nozzle while hot. Caution risk of burns, use gloves and/or tools. Now the filter insert can be removed. To do this, use a thicker needle or tweezers and pry out the wire mesh. Then allow the nozzle to cool for a few seconds until the plastic inside becomes tough. Then you can use, for example, needle nose pliers or tweezers to pull out the plastic. When the plastic is at the right temperature, you will get almost all of it out in one piece. You can then continue with items 3.15 and 3.16.

4. Maintenance

4.1 Check components:

Check the components for proper function at regular intervals. 3D printed components can warp over time due to aging or heat exposure and may impair function.

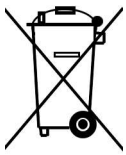
4.2 Retighten screws:

Check at regular intervals whether screws are loosening and retighten them if necessary.

4.3 Lubricate ball bearings:

The small ball bearings on the unit are maintenance-free. The open axial bearing on the coupling of the extruder screw should be checked for sufficient lubrication at regular intervals. If you use grease, it should not be too firm in consistency, rather soft. If you use oil, it should not be too thin, rather thick.

5. Disposal of the device



You can return defective devices or electronic parts to us. You can find the current address at www.artme.de. Never throw defective devices in the trash. Electronic waste can also be handed in free of charge at suitable collection points in your region. Furthermore, all components of the extruder are suitable for other various tasks and can be installed in other projects or devices.