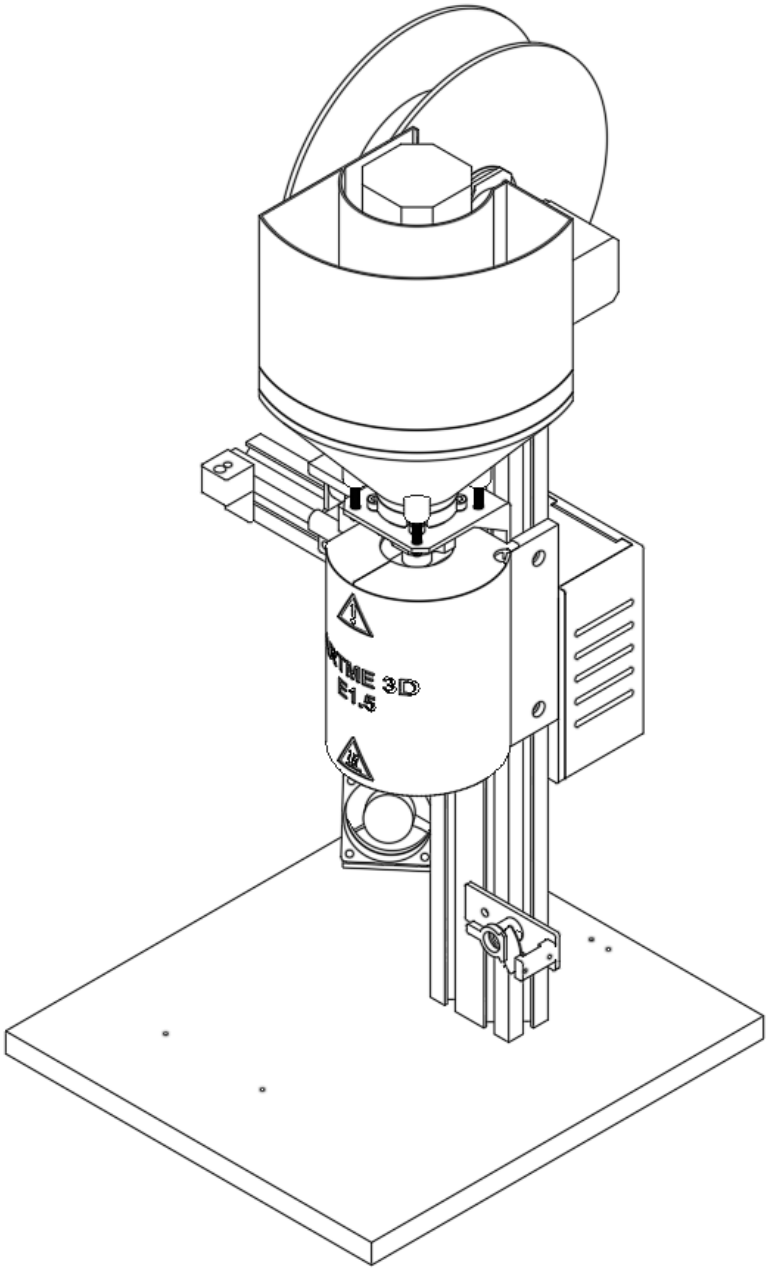
Operation manual

Original Desktop Filament Extruder E1.5 by ARTME 3D

version 06.09.2021



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

Thank you for purchasing the kit for our 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 at www.artme-3d.de/support first or send an email to kontakt@artme-3d.de. Try to describe your problem in as much detail as possible.

Contents

1.Important information for the user of the device

1.1 Disclaimer of liability

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 the Original Desktop Filament Extruder E1.5. 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 when interacting with the extruder. This extruder is an electrical device with moving parts and high temperature areas.
2. The device is only intended for indoor use.
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 to other objects.
5. Plastic is melted during extrusion, which leads to odor. The inhalation of these fumes is harmful. Always set up the extruder in a well-ventilated place. Do not use it in living rooms or bedrooms. Wear suitable respirators.
6. Some plastics canif they are heated for a long time or if they are overheated thermally decompose, which leads to potentially toxic fumes.
7. It is recommended to install a carbon monoxide detector.
8. Before you process a plastic, always find out about its properties and processing temperatures. Check the safety data sheet. If you have any questions, please contact the manufacturer of the material.
9. Always turn off the extruder heater immediately when you are not extruding any 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 location where it cannot fall or tip over. Pay attention to stability
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 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 the heated pipe 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

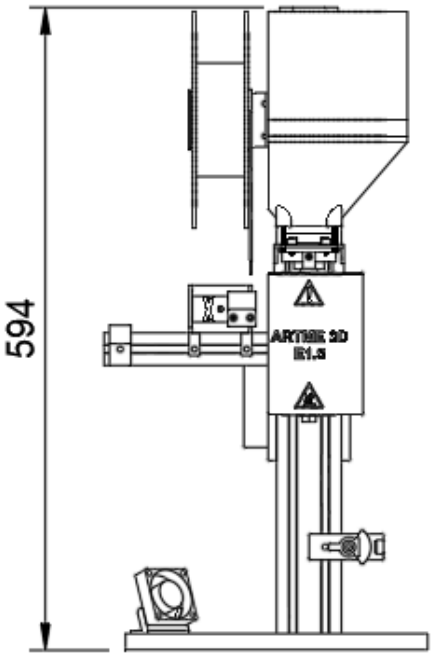
The device is only suitable for extruding thermoplastics with a melting temperature below 250° C. Processing of PVC is not permitted. Each other Use is not as intended.

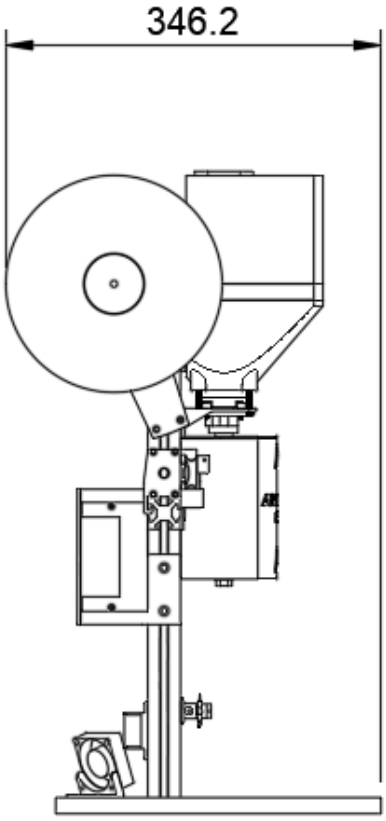
2. Technical data

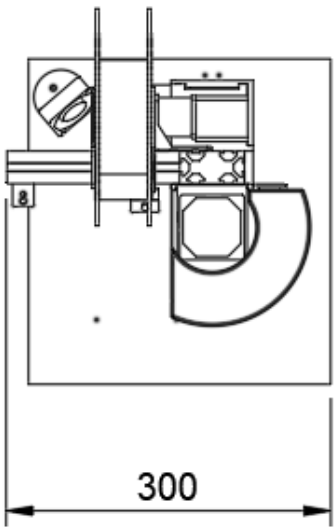
2.1 Technical data

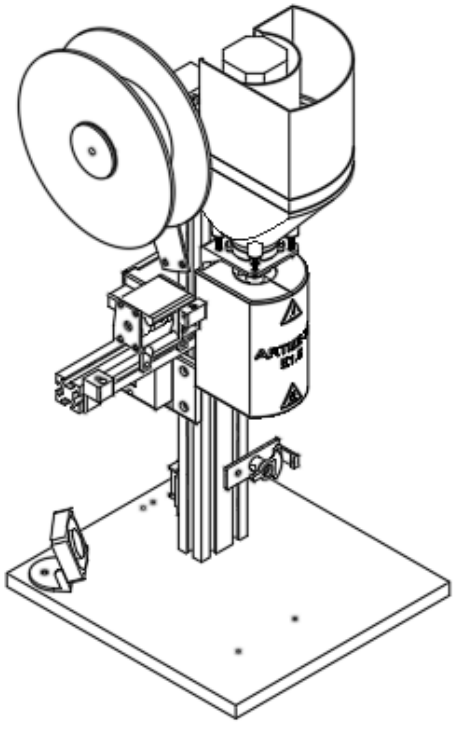
Name: Original Desktop Filament Extruder E1.5 by ARTME 3D (kit)
Filament: 1.75 mm or 2.85 mm
Manufacturer: Artme GmbH, Ludwigstrasse 202, 67165 Waldsee, Germany,
E-Mail: info@artme .de
Device use: only indoors
Power supply: 12V DC safety extra-low voltage with a maximum input Power of 90W
Working temperature 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 on the extruder frame (aluminum profile)

2.2 Dimensions and drawing









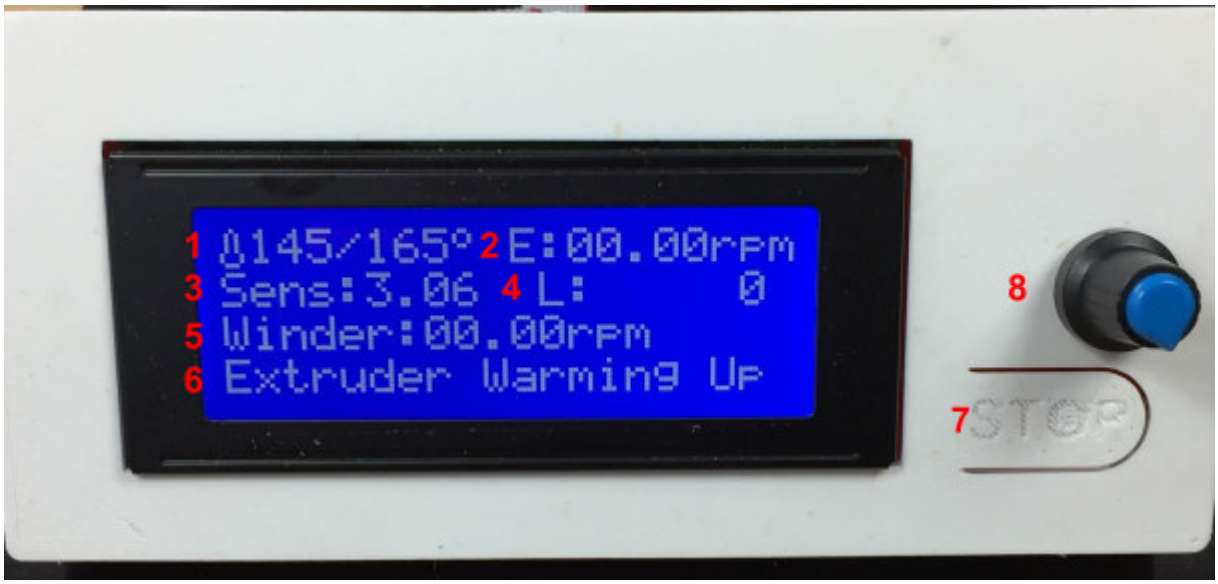
3. Operating instructions

3.1 Switching on, switching off

The extruder is switched on by connecting the supply voltage of 12V DC. It is advisable to use a safe table power supply (12V, 90W) in a 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 Operation and menu structure

After the extruder has been switched on, you will see the information view (info screen). These Displays the following data:



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

2: E: Extruder Speed in revolutions per minute (rpm)

3: Sens: Factor of the sensor position

4: L: Filament length (Attention: The value is determined by the revolutions of the Filament spool calculated. The diameter of the spool changes as the filament is wound. Therefore, the value of the filament length is not very accurate.)

5: Winder: Winder speed of the winding motor in revolutions per minute (rpm).

6: Info line.

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

8: Rotary knob: The rotary knob next to the display can be pressed and turned left and right. To get into the main menu, press the rotary knob. To go 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 but also further submenus with following content:

Main menu when extruder motor OFF:
Info screen: Back to the information view
START Extruder Starts the extruder motor. Attention, the extruder temperature must be above 90 ° C to avoid a cold start.)
Prepare (submenu for presetting the most important parameters, see below)
Preheat (preheating to 175 ° C)
Cooldown (switch off heating)
Control (submenu for setting controls, see below)
Clear Statistics (sets the count of the filament length to zero)
Enable Statistics (currently not required)

Main menu when extruder motor ON:
Info Screen
Automatic winding / Manually winding (starts or stops the automatic winding control)
STOP Extruder (stops the extruder motor and winding motor)
Tune (submenu to change current values, see further below)
Preheat (preheating to 175 ° C)
Cooldown (switch off heating)
Control (submenu for setting controls, see below)
Clear Statistics (sets the count of the filament length to zero)
Pause statistics (stops the count of the filament length)

Prepare (only visible when the extruder motor is OFF):
Main (back to the main menu)
Extruder RPM (setting the extruder speed in revolutions per minute)
Extruder Temp (setting the extruder temperature in ° C and heating up)
Fan speed (speed of the filament fan from 0 to 100%)
L cutoff (setting of the filament length at which the shutdown is, specified in millimeters)
Preheat (preheating to 175 ° C)

Tune (only visible when the extruder motor is ON):
Main (back to the main menu)
Extruder RPM (setting the extruder speed in revolutions per minute)
Extruder Temp (setting the extruder temperature in ° C)
Fan speed (speed of the filament fan from 0 to 100%)
L cutoff (setting of the filament length at which the shutdown is, specified in millimeters)

Control submenu:
Main (Back to main menu)
Temperature (submenu for setting the extruder temperature, see below)
Motion (submenu for regulating the motor settings)
Winder PID (submenu for setting the automatic winding)
Store memory (saves the current speed and setting values)
Load memory (loads the last saved Speed and setting values)
Restore failsafe (loads the original default settings of the firmware)

Temperature:
Control (back to the control menu)
Extruder Temp (setting the extruder temperature in ° C and heating 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 (settingD of the control behavior of the PID temperature control)

PID-C (setting C of the control behavior the PID temperature control)
Preheat config (submenu for setting the preheating temperature)
PID Autotune (Starts several heating phases to determine the PID values for the heating so that the regulation works exactly and constantly)

Preheat config:
Extruder Temp (set the target temperature to which the “Preheat” function is used to heat up)
Store memory (saves the temperature)

Winder PID:
Control (back to the control menu)
Sensor Pos (factor for the height of the desired sensor arm position)
L cutoff (setting of the filament length at which it should be switched off, specified in millimeters)
PID -P (setting value P of the control behavior of the winding)
PID-I (setting value I of the control behavior of the winding)
PID-D (setting value D of the control behavior of the winding)

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

3.3 Granulate requirements

The extruder is designed for plastics in granulate form. The following requirements apply to the grain size:

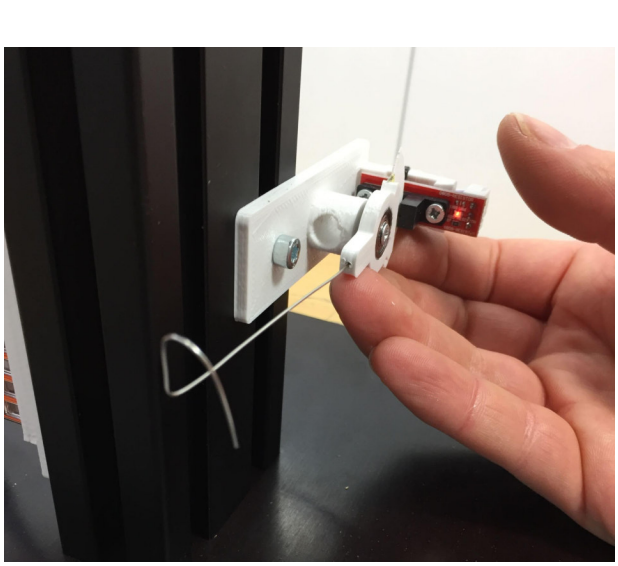
1. In the case of ready-to-use (industrial) granules: Each grain may be a maximum of 5mm long on the longest side. All other sides must be smaller than 4mm.

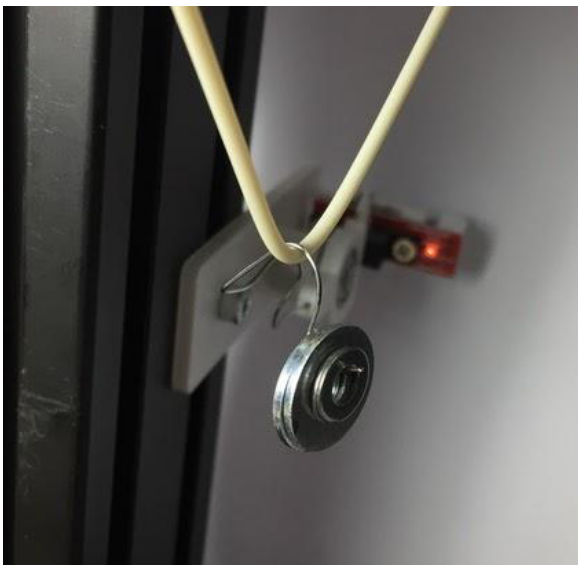
2. DIY Granules by shredding: Each grain should not be longer than 4.5mm on all sides. This can be ensured by sieving the material before use. The sieve must have a mesh size of 4.5x4.5mm. Homemade granulates have to be mixed well homogeneously. Another criterion for self-made granules is their pourability. Compared to brand-new granules, self-made granules from plastic waste usually trickle much worse. It also tends to form bridges. This means that cavities are formed in the granulate because it is wedged at narrow points in the funnel and therefore no material may reach the extruder screw, even though the funnel is apparently full. The design of this extruder is designed to prevent this from happening. On the one hand the shape of the funnel is designed for this and on the other hand a kind of agitator is attached to the coupling between the extruder screw and the drive motor. This prevents bridging in the catchment area. When using self-made granules, the funnel part 2 should be removed.

3. Protect any type of granulate from dust and contamination. Use containers with lids. The melt filter in the nozzle only ensures that the filament is processed on 3D printers with a 0.4mm nozzle. Many other types of contamination cannot be stopped by the filter or they can clog the filter prematurely. Keep granules dry. Some plastics absorb moisture and should be dried before they are processed.

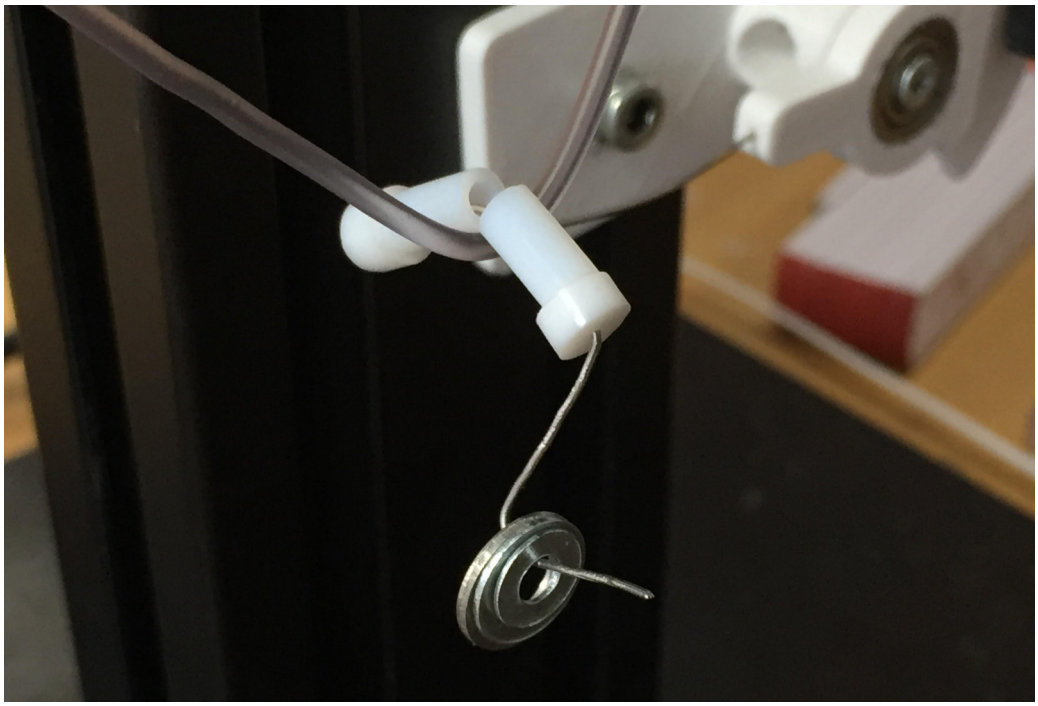
3.4 Preparing the Sensor

The extruder sensor is responsible for ensuring that the winding speed can be regulated automatically so that the tensile force on the filament always remains the same. The wire on the sensor arm must be bent so that the sensor arm can detect the height of the filament well. See image. It may also be necessary to hang a pull weight on the sensor. Bend the wire with needle-nose pliers or your hands:





With relatively "sticky" materials such as PP, the sensor may brake or jump. This can negatively influence the diameter of the filament. To prevent this, the wire of the sensor can be modified with PTFE tubing:

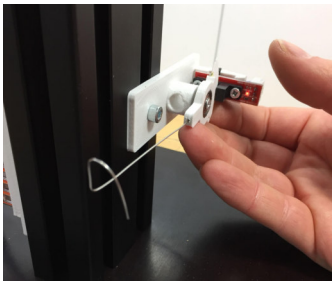


The PTFE tube is cut into small "rolls" which act like a "bearing" as they can rotate. The bend keeps the filament centered and prevents the filament from drifting to the side. These parts are not included in the kit.

3.5 Calibrating the Sensor

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

1. On the information view of the display you can see under “Sensor” 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-Sensor PID-Sensor Pos. Save the entry under Main Menu-Control-Store memory. If the value is outside the adjustable range or fluctuates when moving the sensor arm instead of rising or falling uniformly, the sensor panel 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 cover, which stands between the light barrier, can now be sanded a little thinner with a file. Sand the cover on both sides so that the illuminated surfaces are clean and matt. Make sure that the surface is evenly thinner and that there are no dents. The wedge shape of the illuminated area must be retained. Then reinstall the sensor arm and read the value again. Repeat the process if necessary.



2. Set the distance between the sensor and the extruder nozzle by loosening the cylinder screw on the sensor holder, pushing the sensor up or down and fastening it again. Make sure that the hammer nut turns inside the groove of the aluminum profile when you tighten the screw again. The distance to the nozzle is measured at the point where the filament touches the sensor when it is horizontal. The distance can be between 40 and 120mm, depending on the material.

3.6 Calibrating the temperature control:

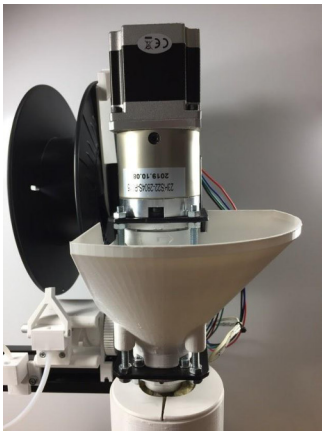
It is necessary that the temperature remains very even during operation and does not fluctuate. Even a temperature change of 1 - 2 ° C can affect the quality of the extrusion. So if you notice excessive fluctuations in your temperature control, you can calibrate the temperature controller. To do this, run the autotune function. You can find this under Main Menu - Control - Temperature - Autotune PID. Start the function in the cold state. Once you have started the function, the process will take a few minutes. Do not operate the device during this time. When the process is complete, the controller will start beeping. By pressing the rotary knob you switch off the signal. The values for the PID control have now been determined and still need to be saved (main menu - Control - Store memory). The extruder cools down again automatically.

3.7 Extrude plastic

ATTENTION Risk of burns! The nozzle and the metal parts on the extruder get very hot. When the filament (in the form of a hot, soft plastic thread) comes out of the nozzle, it is very hot (150 ° C to 260 ° C). To get the winding going, you need to touch the filament while it is soft. Use protective gloves or aids such as tweezers to grip the thread in this area. After a few centimeters, the filament cools down significantly on the surface, while the inside remains very hot for a longer distance. So be very careful when handling the filament.

1. Preheat 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. Independently, you can change the temperature at any time under Main Menu - Prepare/Tune - Temperature. A list of empirical values can be found in the "empirical values" at www.artme-3d.de/support. When the extruder is heated up, the controller will beep twice. This is to ensure that you do not forget that the unit is in operation.

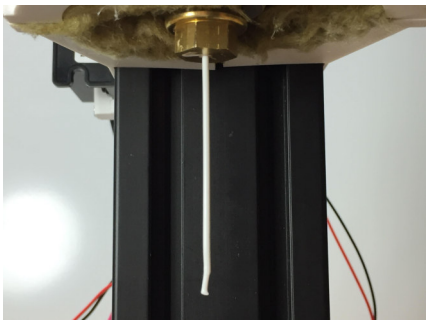
2. Fill the hopper with plastic granules. The funnel part 1 is permanently installed on the extruder and is sufficient for test quantities:



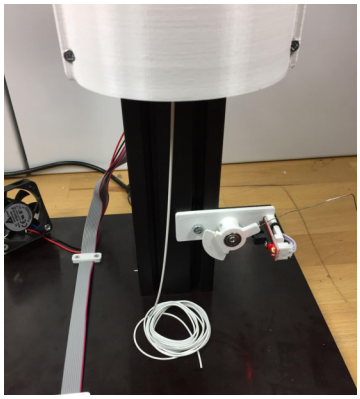
The hopper part 2 has a kind of aperture so that the granulate flows in a controlled manner to the feed zone when larger quantities of granulate are processed.

The hopper part 3 enlarges the funnel and enables a longer running time. You can put another funnel part 3 on it.

3. Start the extruder motor (Main Menu - START Extruder). In the 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 winding 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.



4. If plastic comes out of the nozzle, you can decrease the temperature from the initial elevated temperature for start-up to the temperature required for operation. The extruder then needs a moment until the pressure and temperature profiles are uniform along the extruder screw. So let him run for another 2 to 5 minutes. One reason for e.g. uneven and rough material can be incorrect settings. Take a look at the FAQs. You can find this at www.artme-3d.de/support.



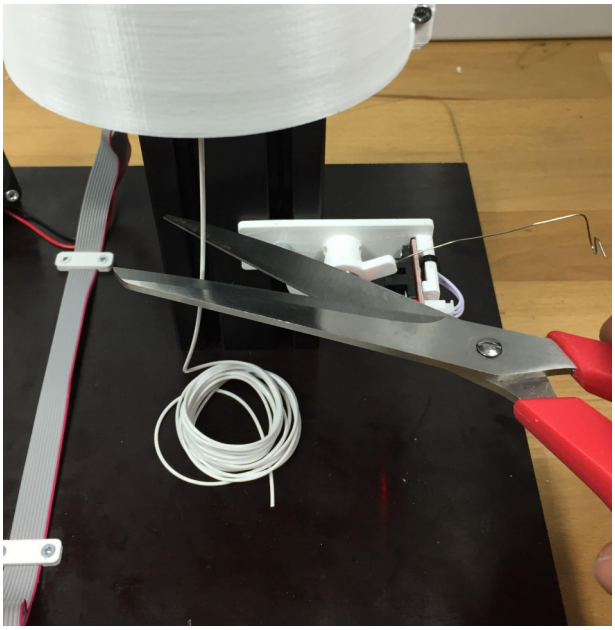
3.8.1 Wind up 1.75mm filament:

1. Roughly set the speed of the winding motor by turning the rotary knob on the display while the information view is visible. The speed should initially be between 1.5 and 2.5 rpm. The extruder speed must be adapted to the winding speed. If the extrusion is too slow, there is a risk that the winding process will not work due to the filament solidifying too early. A list of empirical values depending on the type of plastic can be found at www.artme-3d.de/support.

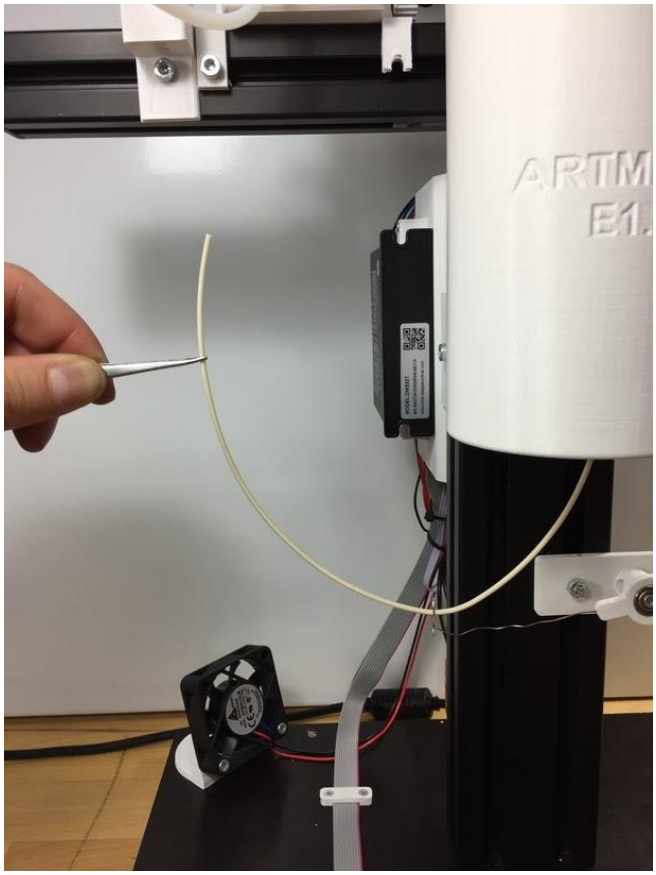
2. Set the fan speed roughly. Main menu - Prepare / Tune - Fan speed. There are two reasons for the filament being cooled on the way to take-up. On the one hand, it generally cools the filament so that it is cold enough to be wound up properly. On the other hand, it cools the surface of the filament 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 the cooling takes place too quickly, the filament becomes twisted. In this case, reduce the speed.

3. Loosen the wing nut on the filament spool. This means that it can later be easily rotated into a suitable position to thread the filament.

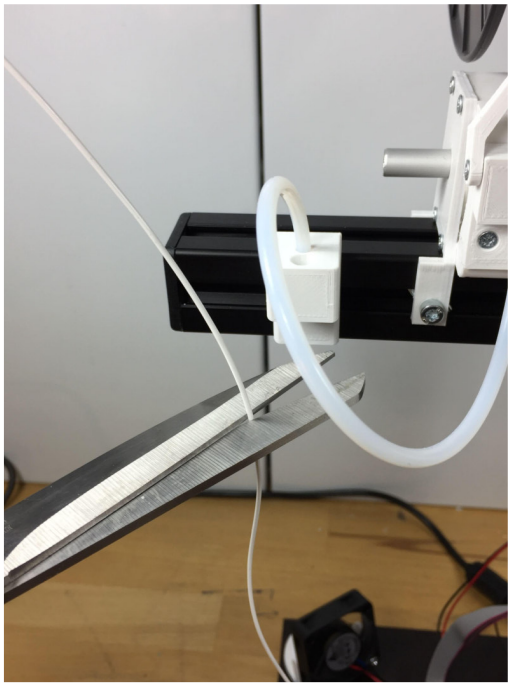
4. Now start the winding process: Cut the still soft filament approx. 7 to 10 centimeters after the nozzle with scissors.

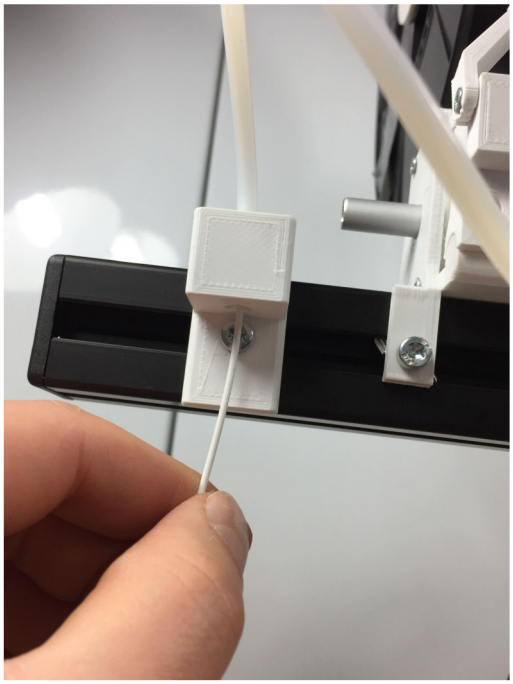


5. Guide the filament in an arc in the direction of the filament guide and place the sensor on the filament. Pull it at about the same speed as it comes out of the nozzle and hold the sensor horizontally. So the diameter of the filament is uniform right from the start.



6. Push the filament through the filament brake and the PTFE tube. If necessary, cut the filament beforehand. Also make sure that the filament sensor remains roughly level.

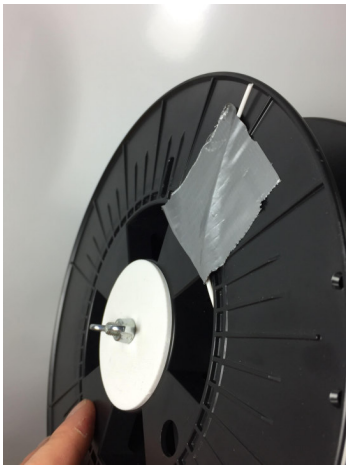




7. When the filament arrives at the end of the PTFE tube, thread it through the lever guide.

8. 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 and push the filament through. Also make sure that the filament sensor remains

roughly level. The beginning of the filament is bent over on the outside of the spool and attached with an adhesive strip. Some filaments hold by bending even without adhesive tape.



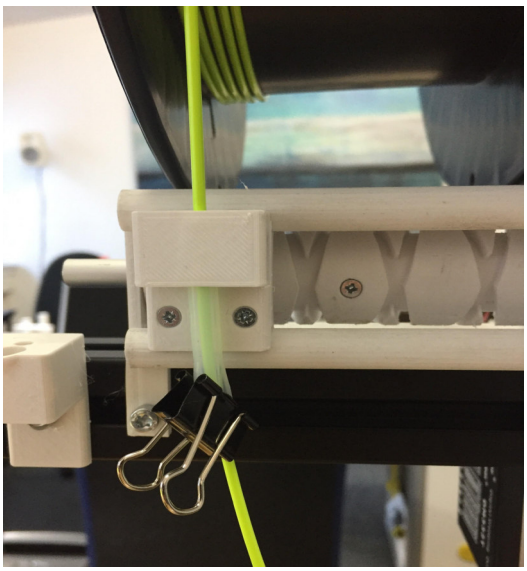
9. Tighten the wing screw again so that the spool is rotated by the winding motor. Now check how the height of the sensor behaves and adjust the speed of the winding motor. When the sensor lowers, increase the speed. When the sensor rises, reduce the speed (turn the rotary button on the display while the information view is visible). Warning, the system is sluggish. When you make an adjustment, it will take a few seconds for the motor to adopt the new speed. Therefore do not change the speed in too large steps and wait for the effect. If the sensor arm remains largely stable in the horizontal position, you can start the automatic winding (main menu - Automatic winding). You can interrupt the automatic winding at any time (main menu - / Manually winding) and control it again using the rotary knob in the information view. If you get into the situation where you have to react quickly and the speed setting reacts too slowly, you can simply loosen the wing nut on the spool and turn it by hand.

10. Now you can push the first turns of the filament on the spool to the left and align the filament guide carriage by turning the gear or the round rod so that the filament is straight towards the spool. So the winding can start cleanly. Check that the teeth of the gear and the teeth of the slide on the spool holder mesh properly when the spool holder is in the appropriate position. If the reversal of the filament guide starts too late or too early at both ends of the spool, you can move the entire winding guide a little bit to the left or right (loosen the screws for this). Make sure that the slider continues to grip the teeth of the gear wheel properly.

11. The extruder switches off automatically after reaching a preset filament length. The default setting is 200000 mm (200m), which corresponds to approximately 500g 1.75mm filament when using a 750g spool. You can set the default setting for shutdown. (Main menu - Prepare / Tune - L cutoff) You can read off the current length on the information view under “L:”. You can reset or pause the display (main menu - Clear Statistics or Pause statistics). The length value is displayed and set in millimeters. The actual length of the filament on the spool is slightly different because the diameter of the spool changes as it is wound (and then more and more filament is wound per revolution). To do this, note the value displayed when the roller has reached your desired filling quantity and adjust it as the switch-off length in the menu if necessary.

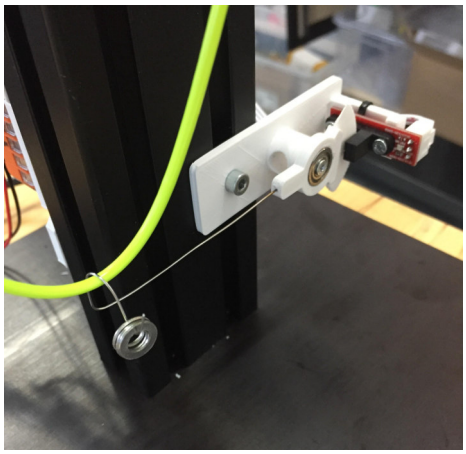
3.8.2 Wind up 2.85mm filament:

Basically, proceed as under 3.8.1. The difference is that 2.85mm thick filament is much more rigid than 1.75mm filament. Therefore, winding it up is a bit more difficult. The filament must be braked in front of the spool so that it is under tension and winds up neatly. To do this, the filament brake on the filament guide must be modified:



A short piece of PTFE tube with an outer diameter of 6mm and an inner diameter of 4mm is inserted into the filament brake (printed part FG07.2_filament brake 2.85mm). The PTFE tube is slit at the lower end with a knife and the filament is passed through. A clamp or clothespin clamps the hose together so that the filament is braked. The cooling or production speed may have to be optimized so that the filament has cooled down at this point and cannot be compressed.

Furthermore you should use a weight on the sensor at 2.85mm in order to increase the weight of the filament and to get a smooth surface:



3.9 Set filament diameter

The best way to check the diameter is with a digital caliper. Measure just before the filament spool. When setting the diameter, the following is important to know: A digital caliper can measure in the hundredths of a range, but the measurement result is heavily dependent on the quality of the caliper, the application and the roundness of the filament. Don't let this fool you. For example, if you set a filament diameter between 1.6 and 1.8mm (with a 1.75mm filament system), this can be processed well with common 3D printers. If in doubt, you can adjust the flow rate of the printer or enter the diameter in the slicer. However, if the diameter of the filament fluctuates significantly, although the winding is running automatically, something is wrong in the system (granulate quality, speed too high, melt filter dirty, material unsuitable, etc. see the FAQs 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 rather slowly. So if you change the temperature, for example, in order to optimize the filament diameter, wait a moment until the temperature in the entire system has equalized. The same applies to changing the extruder speed.

Important to know: Many plastics expand to different degrees when they leave the nozzle. Therefore, the hole in the nozzle only roughly indicates the filament diameter. The following things have an influence on the filament diameter:

1. The size of the hole in the nozzle
2. The pressure in the system as a function of speed, material and temperature.
3. The filling level of the funnel. (There should always be at least hopper part 1 filled to ensure uniform pressure in the system).
4. The distance between the nozzle and the sensor.
5. The property of the material depending on the temperature (tough or soft)
6. The weight of the sensor.

7. The "stickiness" of materials such as PP can influence the function of the sensor. See chapter 3.4.
8. Plastic is damaged with every 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 be thinner and does not expand as much when it leaves the nozzle, the more often it is melted. This reduces the diameter of the filament and requires new settings.
9. Even plastics of the same type can have different properties. This depends, for example, on the manufacturer's recipe or the age of the material.
10. Avoid drafts in the room

It is therefore advisable to try out the empirical values first. Proceed as follows to set the filament diameter:

1. The bore of the nozzle roughly defines the diameter of the filament and can be different depending on the material to be processed. Do not change the nozzle diameter with the aim of changing the diameter of the filament until you have checked the following points.

2. If the filament diameter is too large, you can:
    a. Increase the distance between the sensor and the nozzle. The weight of the filament is increased so that the filament is a little thinner.
    b. Slightly increase the temperature. This makes the plastic softer and thinner. If the plastic reaches the sensor too hot, the sensor arm can brake or bounce. In doing so, increase the speed of the filament fan.
    c. Attaching an additional small weight to the sensor will stretch the filament.
    d. Slow down the speed. This reduces the pressure in the system and the filament expands less when it leaves the nozzle.
    e. Decrease the fan speed. Then the filament cools down a little later and has more time to be pulled by its own weight.

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

4. Remember to give the system time after every change until the effects are stable.

3.10 Switching off and cooling down

Stop the extruder motor (main menu - STOP extruder)
Switch off the heating (main menu - Cooldown)
It will take some time to cool down, as the insulation of the extruder means that very little heat is lost and cold granulate is no longer heated.
Disconnect the extruder from the power supply. Make sure that nobody can get burned on the hot parts of the extruder.

3.11 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. Let the extruder run until the extruder screw is filled with new plastic and the extrusion is uniform. This may take 2 to 5 minutes. The old plastic may have changed its properties (degradation) due to the slow cooling process after switching off and may be somewhat thinner or burnt than the new plastic that is then flowing in.

3.12 Material Change:

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

1. Fill in new material during operation and let the extruder run until the screw, the extruder tube and the nozzle have cleaned themselves. This can take 10 to 30 minutes, depending on the material and the temperature requirements of the material.

2. If you switch from a plastic with a high melting temperature to a plastic with a low melting temperature, it may be necessary to clean the area of the nozzle and to change the filter. To do this, the nozzle must be removed while it is hot. Caution: there is a risk of burns when removing. Please use protective gloves and tools to grip. After unscrewing the nozzle, remove the filter, e.g. with tweezers or a thick needle, and then let the nozzle cool down briefly until the plastic inside becomes tough. Then you can pull out the plastic with needle-nose pliers or tweezers, for example. If the plastic is at the right temperature, you can get almost everything out in one piece. Also clean the area of the thread in the extruder tube. To do this, you can, for example, insert a small screwdriver into the pipe and rub it in circular movements along the thread and pull out the plastic inside. (Do not damage the extruder legs in the process). The temperature must not be too high. The plastic should be tough rather than liquid. Do this while the extruder is running slowly until the new plastic arrives at this point with no contamination. Insert a new filter (see next chapter). To install the nozzle, stop the extrusion. Then reinstall the nozzle. After the nozzle is hot again (after approx. 1-2 minutes) you can start the extrusion again.

3. If there are deposits on the extruder screw, it may be necessary to dismantle and clean the extruder screw while it is hot. First, let the extruder run idle as much as possible in the heated state so that as little plastic as possible remains in the extruder screw. Then loosen and remove the nuts on the threaded rods on the mounting bracket of the extruder motor. Open and remove the thumb screw on the back of the main frame that holds the extruder motor mounting bracket. Now you can loosen the motor from the coupling and pull it upwards by inserting a slotted screwdriver into the area of the axial bearing and levering / turning it. Lay the engine on its side. Make sure that you do not lose the feather key and do not get pulled on the motor cable. Now the extruder screw can be gripped at the coupling and pulled out upwards. In the event of a problem, some strength may be required. If in doubt, continue heating the extruder so that the plastic becomes softer. Be careful with the whole process, there is a great risk of burns. Wear protective gloves. After pulling out, you can clean the extruder screw. Also wait a short time until the snail cools down a little so that the plastic becomes tough, then you can pull the plastic off. Start on the cold shaft. At the tip of the screw, this cools down last. If there are charred spots or other buildup, it may be necessary to grind and polish the worm again. The extruder screw is installed in the reverse order. (If in doubt, see assembly instructions, Chapter 3.56). Under no circumstances should you forget to realign the nuts on the threaded rods using the assembly aid.

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

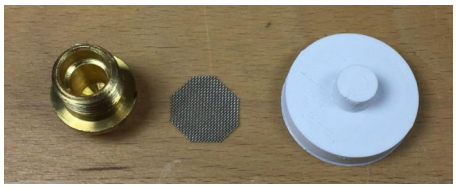
3.13 Replacing the melt filter:

The melt filter consists of a wire mesh made of stainless steel with a mesh size of 0.3 mm (mesh 50). You can buy this on the Internet if necessary. If the filter is contaminated or is removed when changing material, it may be necessary to replace it. There are two ways of removing the old melt filter from the nozzle:

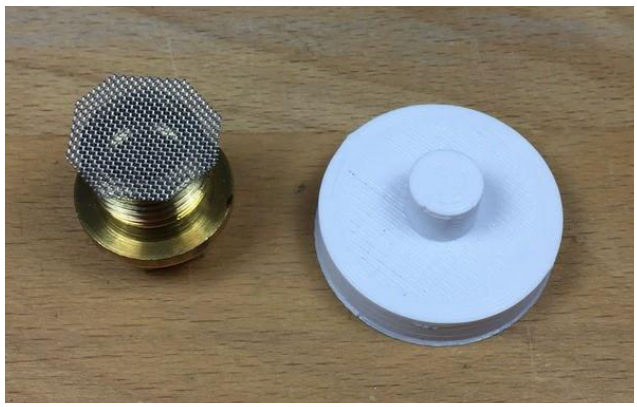
1. Remove the nozzle when it is hot. Caution: risk of burns, use gloves and tools. Use a needle or tweezers and pry out the wire mesh.
2. Heat the extruder to a low temperature so that the plastic in the nozzle starts to soften but not become liquid (for PLA e.g. approx. 120 ° C). Then unscrew the nozzle. A plug of still solid plastic, which encloses the wire mesh, remains on the extruder and the nozzle should be clean and empty. Heat the extruder to the set temperature and pull out the plug.

The installation of a new wire mesh works as follows:

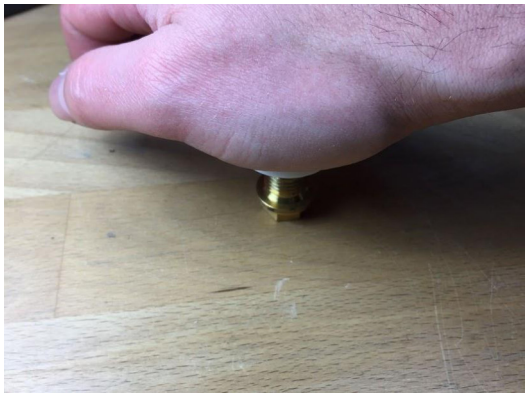
1. Cut an approx. 16x16mm piece of wire mesh and cut off the corners (approx. 3mm). Diagonal cutters or sturdy scissors can be used for this. (Attention, the scissors can wear out prematurely.)



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

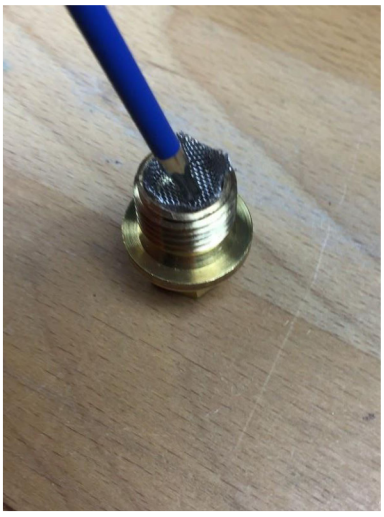


3. Press the bending aid centrally into the wire mesh so that it is pressed into the opening. If in doubt, you can use a vice.

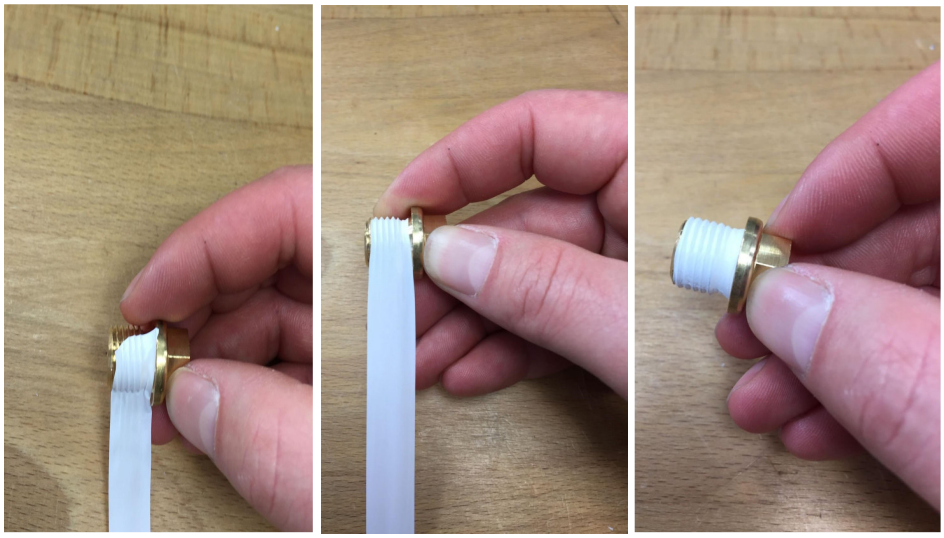


4. Pull the bending aid out again.

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

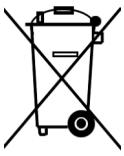


6. If necessary, replace the Teflon tape on the thread of the nozzle.



7. Screw the nozzle back into the hot barrel.

4. 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 disposed of free of charge at suitable collection points in your region. Furthermore, all components of the extruder are suitable for other different tasks and can be installed in other projects or devices.