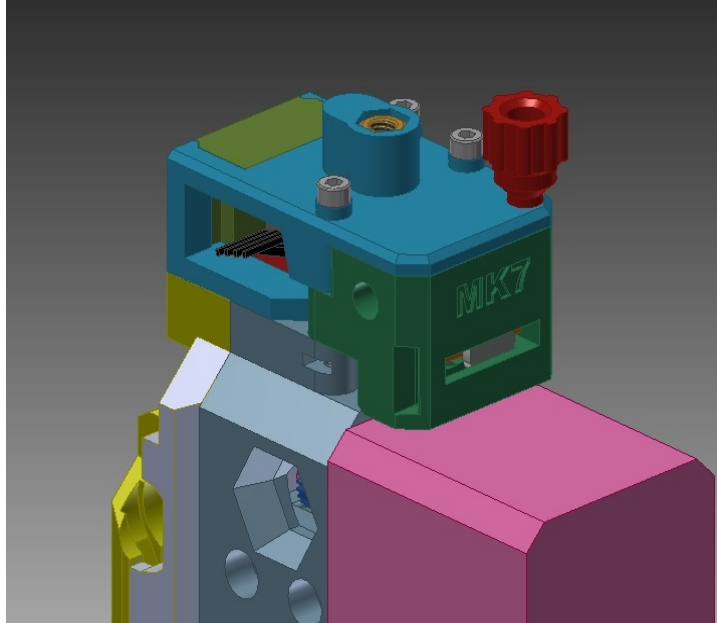


# THE FROG

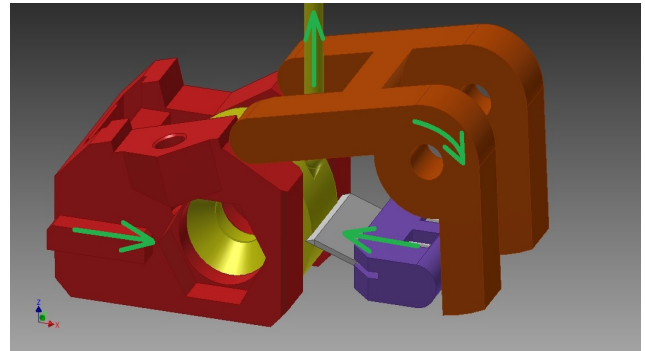
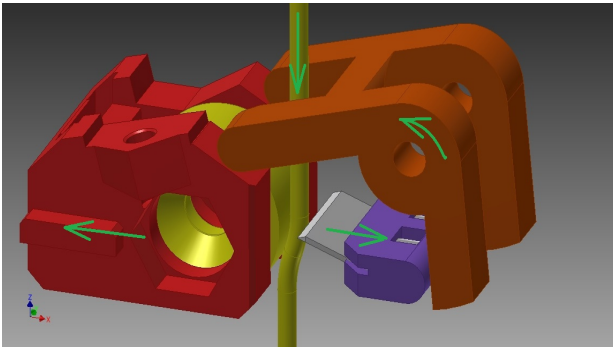
## What is The Frog

The frog is the first extruder body designed specially to work with the PRUSA's MMU2. Its design simplify filament tip settings quite a lot, adding reliability to the machine.



## How does the frog work?

The Frog features a blade that does not cut the tips, but gets in the middle of the way when the filament retracts thus preventing the filament from pulling any long string from the hot end.



## Where is the Frog?

The Frog can be downloaded from [CGTrader](#).

Also, there's a Github repository with the following documentation::

- Parts List
- Bill of materials
- Instructions for printing and preparation of the parts
- Assembly guide
- Printing with The Frog

## **Does installing the frog will end completely with the strings?**

No, it will not. The frog is a mechanism with moving parts and must be built and assembled with care and love to perform properly. A small detail like a not lubricated bearing, an angled or tilted blade or a hidden ball of fluff might cause The Frog not to perform correctly..

Also, the material you are printing in, and your settings have a say on what you get, but even if the material is very stringy, cleaning and resetting the machine with The Frog is fast and easy. It can usually be done with no tools and it doesn't mean a lost print but only a pause in the printing.

## **Does The Frog alone solve the MK3 + MMU2 issue?**

No, it does not. With the PRUSA firmware as it is now (3,5,1) you can still get skipped layers with The Frog. Therefore I recommend using The Frog with [TheZeroBeast firmware](#) that recognizes jams through the clever use of the optical filament sensor. The Frog features an indirect reading sensor mod which improves the reliability in the sensor's readings and works well with filaments of all colors, even transparent.

## **Will The Frog improve?**

I have run and pressed hard to upload the design as soon as I have been reasonably confident with it because I know that many people want some solution for their MMU2, so The Frog's design is very young. Tests take so long that testing has been limited, but results have been spectacular though. This is the reason I am not waiting six months to go public, I would like to test my device six more months before doing so, but you also have probably waited long enough since you ordered your MMU2 to get it going too.

The device has been designed so that the replacement of a few small parts can modify its performance (forces exerted, distances travelled, etc.), so yes, The Frog might improve, but I don't expect it to need a mayor overhaul.

## **So if it says MK7 on top, why is it The Frog?**

The project was created with one aim in mind: no hairs.

## **How was The Frog born?**

The Frog has been crafted after some months of intense testing and prototyping ,and many hours of work by one very disgusted PRUSA customer who wanted the machine he had bought to work.

The Frog could not be true without some other people. Special thanks for helping me make my machine finally work (that was the only objective) to TheZeroBeast for his fantastic firmware.

## NO PAYMENT POLICY

Before you read about the no payment policy, let me to tell you a little story in just one paragraph.

I was once in one of those scandinavian countries where you can leave an unlocked bicycle in the street in the city all day long and nobody will touch it. In the subway, I noticed that apart from the normal turnstile where you cancel your ticket, there was another gate for handicapped people and also another gate more with no cancelling machine.

I asked my native host what was this third gate for, and he told me that it was meant for people with no money, so they could also get on the subway and go home. So I asked him what was stopping the people that in fact had the money, from using this gate and not paying. He looked at me completely puzzled and said:

-So if they have the money to pay, and the deal is fair, why wouldn't they want to do it?

And the lesson I learnt that day is that justice is not about giving or asking everybody the same thing, but giving everyone what they need and asking everyone for a fair deal.

Now about the **NO PAYMENT POLICY**:

The Frog can be [downloaded from CGTrader](#) for 10€. Additionally, you'll have to spend about 7€ more in parts. You can make an offer for less money though. Minimum payment in CGTrader is two dollars.

If you want The Frog and you have any reason that makes you think that you should not pay me for my work, you can still get it and not pay me. Just make an offer for the design and mail me ([gcon114@gmail.com](mailto:gcon114@gmail.com)) a very brief note (SUBJECT: I AM NOT PAYING THE FROG) with the reason that you have not to pay for it. Nearly every motive will be accepted without questioning (please also state where you are from. I am just curious).

Whatever your offer for the design was, it will be accepted and (Grabcad commission discounted) it will be donated to the charity of your election (Greenpeace, UNICEF, etc.) please provide a URL for your donation in the mail)

If you do not have a preferred charity, it will be donated to Paul Watson's Sea Shepherd (just because that's the one I like, now more than ever, as the Japanese fleet have started hunting whales again).

All donations (identified by the email address) will be listed in an open spreadsheet in the repository, and the records of these donations will be kept open for public inspection.

All the NON PRUSA firmware and hardware developers, unfortunate PRUSA customers like me, that have become unwillingly unpaid beta testers and have tried doing something (other than complaining and wasting filament and time) just because they wanted their machines to work, are invited to download my device for free (same email, same method, SUBJECT: DEVELOPER WANTS THE FROG FREE, please provide also a charity webpage for your donation).

You can also buy a kit with all the relevant parts: (bearing, blade, magnets and bolts for 50 € here. There is another kit that includes also the plastic parts with the all subassemblies already prepared for 150 € here, If you want my arabian sheik bonus service, I will personally travel to your house and install The Frog in your printer. The fee for this service is 4.000 € anywhere in the world except the Faroe Islands.

## FIRMWARE

The frog will work with all PRUSA's firmware, because it does not condition anyhow the works of the machine. However, in my experience the best results and higher reliability were obtained using [TheZeroBeast firmware](#).

TheZeroBeast firmare is, in my opinion, just great. Not only loads and unloads are much faster, but it also, making use of the crash detection, recovers well from jams and problems like grinded filament, a thick tip (in or out) or balls of fluff cheating the PINDA.

# PARTS LIST AND BILL OF MATERIALS

## 1 Plastic printed parts

Part Number	Name	Material	Weight (infill 60%)
1	RollerMK7	TPU	1,22 g
2	X-CarriageMK7	PETG	43,34 g
3	ExtruderBodyMK7	PETG	54,76 g
4	TopCoverMK7	PETG	17,51 g
5	FrontTrapMK7	PETG	14,29 g
6	BackTrapMK7	PETG	5,21 g
7	SliderCartMK7	PETG	3,46 g
8	BearingFixAMK7	PETG	0,31 g
9	BearingFixBMK7	PETG	0,39 g
10	Blade HolderMK7	PETG	0,64 g
11	Cutter LeverMK7	PETG	2,04 g
12	PlugMK7	PETG	1,38 g

The ExtruderBody and the X-Carriage were designed starting from step files of the original PRUSA parts published by jzkmath that can be found [here](#).

As this is a mechanism with moving parts, all printed parts must have certain quality. Tolerances have been set so printing and assembly are simple enough but you must make sure that the relevant surfaces (sliding or rotating parts) are clean enough to perform properly.

## 2 Bill of Materials

You will need all the usual MK3 hardware and...

A- 3 M3 x 30 bolts (Better Allen head but not compulsory)

B- 3 square M3 nuts

C- 1 M3 x 12 mm normal slotted or philips bolt (NOT Allen, neither Hex) (i.e. ISO 1207 and many others)

D- 1 M3 x 18 Bolt (Better Allen head but not compulsory. M3 x 20 will do too)

E- 1 M5 nut (better brass)

F- 1 M3 x 12 bolt (Better Allen head but not compulsory)

G- 1 M3 x 4 bolt (Better Nylon6, but not compulsory)

H- 1 [Bearing OD 6 mm ID 3 mm thickness 2 mm](#)

I- 3 [Neodymium magnets diameter 10 mm x thickness 2 mm](#)

J- 3 [Neodymium magnets diameter 3 mm x thickness 2 mm](#)

K- 1 Blade 8 mm x 8 mm aprox

Regarding the blade.

The blade is not meant to cut the filament, but only the hairs, therefore it has to be very sharp, just like new. If it has been already working cutting filament it is better to use a new one.

The size of the blade is the same as the one that PRUSA provides with the MMU2.

Incidentally, this is the same size as all the small cutters you will find for school kids, so if you lost your PRUSA's useless blade, don't worry. They are easy to replace without contacting them.

Just for fun about PRUSA's shop prices, have a look at these two links of basically the same product: the pulley gears.

<https://shop.prusa3d.com/es/mk3-printer-parts/210-bondtech-drivegear.html>

<https://www.aliexpress.com/item/Funssor-stainless-steel-hobbed-pulley-driver-gear-Prusa-i3-MK3-Extrusion-Wheel-Cloned-Btech-Dual-Gears/32904909191.html?spm=a2g0s.9042311.0.0.ed404c4dPPPC8C>

## PRINTING, PREPARATION OF THE PARTS AND ASSEMBLY

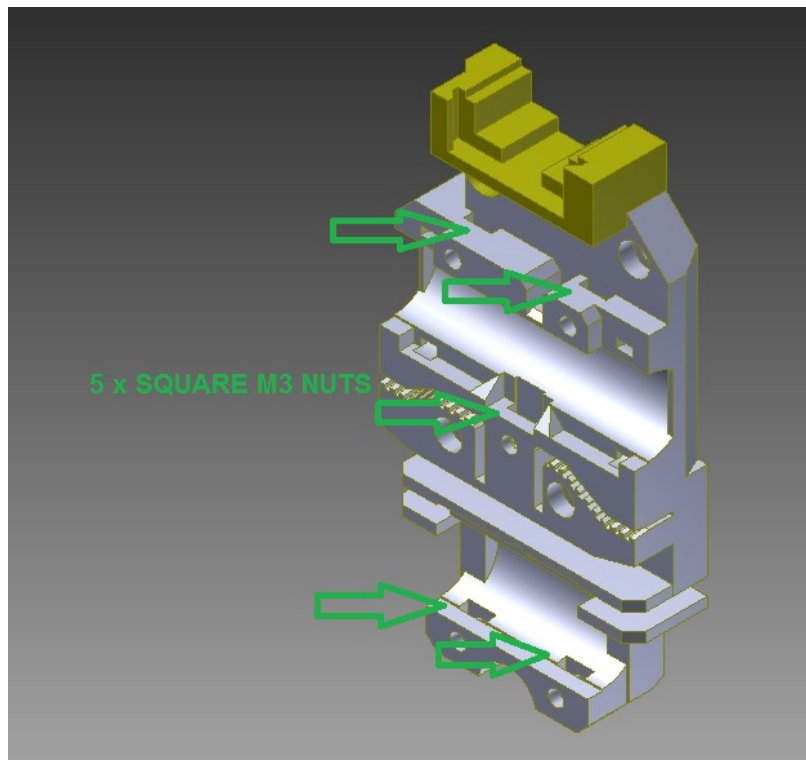
All the STL files feature the part in the position it was printed by me with best results. Some of the parts demanded support, others asked for rafts. Some needed both, many of them none. I even used a support blocker in one part. Proceed according to your skill and experience.

Please follow all steps in the exact order for an easy assembly.

**0 - Disassemble** the stock extruder body as [PRUSA's guide for extruder B6 to B7 upgrades](#) says. Disassemble also the x-Carriage

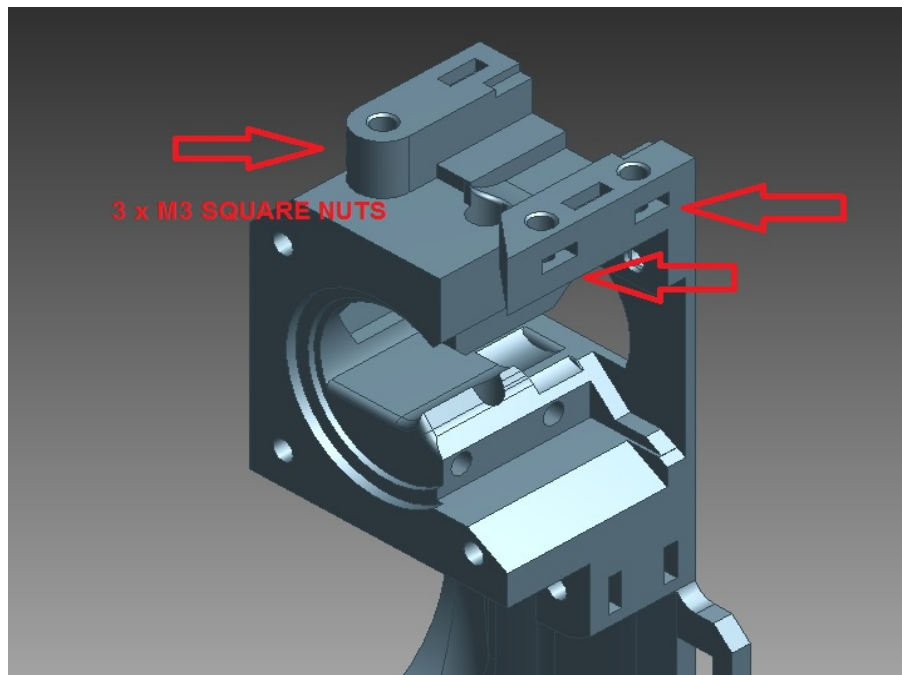
### 1 – x-CarriageMK7 (Part #2)

**Printing:** No support needed to print this part.



**Assembly:** It uses the same five square M3 nuts as the PRUSA MK3 part, and it must be assembled identically

## 2 – ExtruderBody (Part #3)



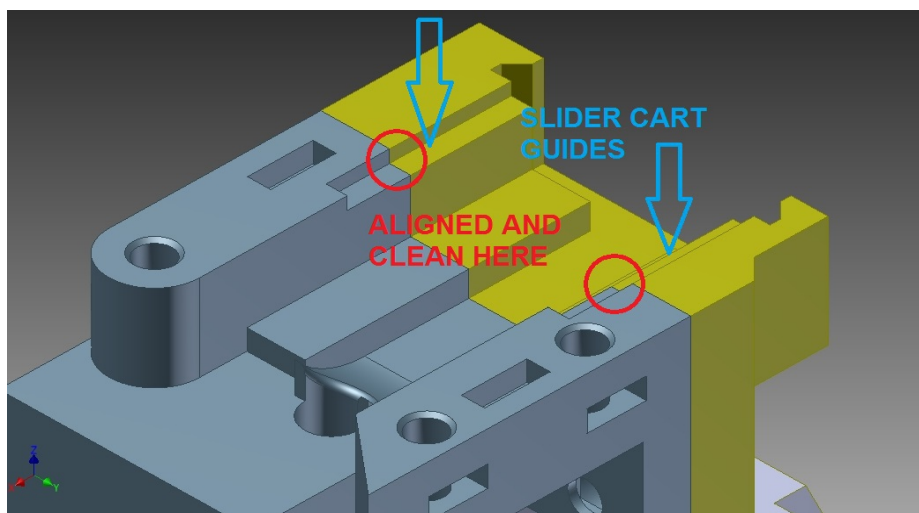
**Printing:** No support needed to print this part.

**Preparation:** Clean well the filament passage with a 2 mm drill bit.

**Assembly:** Identical assembly as the stock prusa part, with the same hardware: bolts, nuts, hotend, fans, stepper, PINDA probe, etc. all the same. Additionally place three square nuts in the slots in the upper part of the body to secure the sensor cover (two at the right, one at the left). (Part #B)

### **IMPORTANT**

When assembling the ExtruderBody in place against the X-Carriage, make sure that the guides for the SliderCart on top both parts are well aligned, both horizontally and vertically. A small edge might be present in both parts where they were in contact with the printing bed. Remove it so that the SliderCart can move well along the guides.





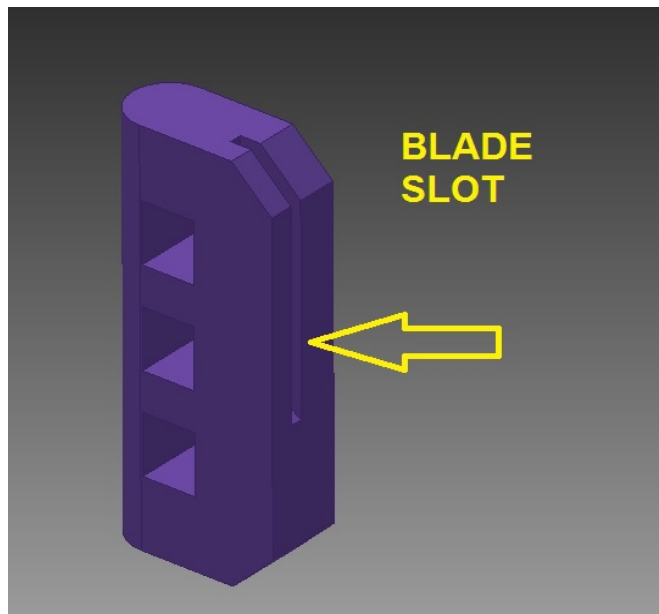
### 3 – CutterAssembly

**Printing:** Print the BladeHolder (Part #10) in vertical position. Open end of the blade slot upwards. Better if you use raft. No support needed.

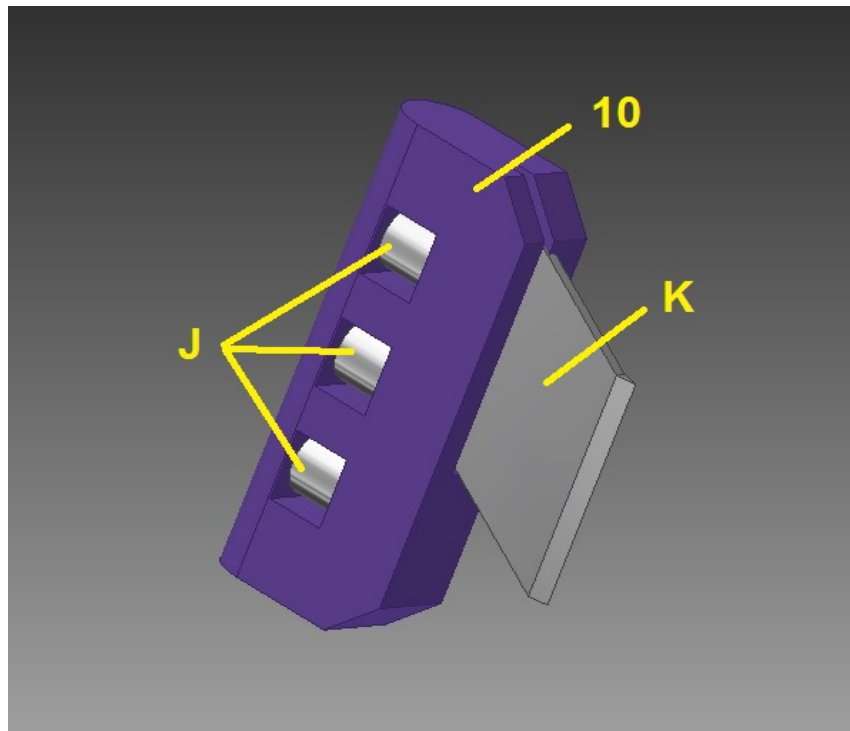
**Preparation:** Once printed, prepare meticulously the printed plastic part: First use the Blade (Part #K) to clean very well the blade slot. Run dry tests to check that the Blade sits well along all along the bottom. Do not glue the Blade yet.

**Assembly:** Set the three small Magnets (Part #J) in the slots with the same polarity facing the Blade. The easy way to check if all three Magnets in the BladeHolder have the same polarity is putting another magnet against the back of the part. It will seat straight and centered if the assembly is correct.

Now you can glue the Blade (Part #K) with a drop of CA glue in each side. Make sure it sits well in the bottom. If it doesn't, just clean the slot of the dried glue and redo again. It is very important that the Blade sits well all along the bottom of the groove. It cannot be angled or tilted.



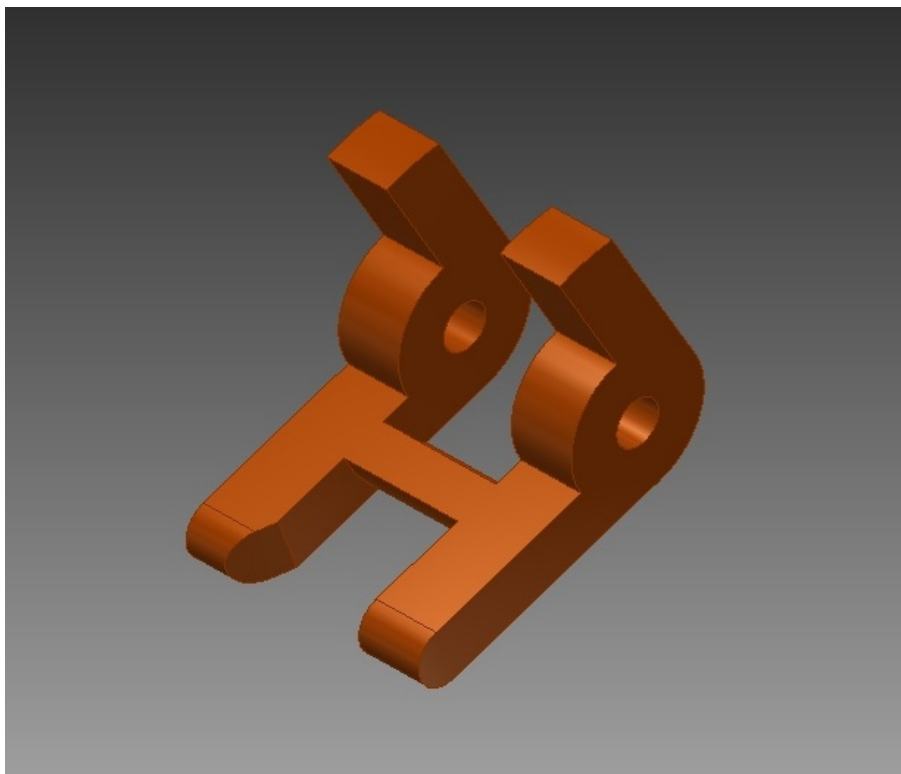
Note that the Blade slot is not centered in the BladeHolder, and when assembled the Magnets (Part #J) must be placed facing upwards.



The CutterAssembly is ready

#### 4- CutterLever. (Part #11)

**Printing:** I printed this part with raft and support.

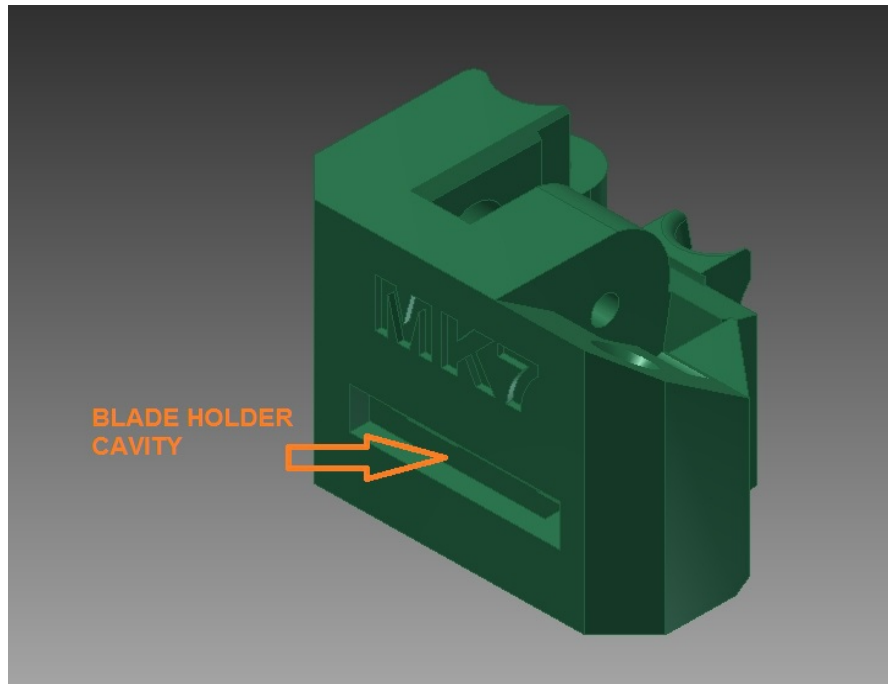


**Preparation:** The M3 bolt must not screw in the holes, it should be a tight fit but the part must be able to rotate freely with an M3 bolt as a shaft.

## 5- FrontTrap (Part #5)

**Printing:** Print this part with the MK7 embossment facing down. No support needed.

**Preparation: IMPORTANT** Clean well all cavities. Clean specially well the blade slot. It is very important that you clean thoroughly specially the bottom part of the slot where the BladeHolder moves. Use a magnifying glass to check if necessary. You might have to sand a bit one end of the BladeHolder (Part #10), the one you printed in contact with the bed. The CutterAssembly must move really smooth inside the part. If your print oozed inside the cavity too much you might need to sand the BladeHolder.



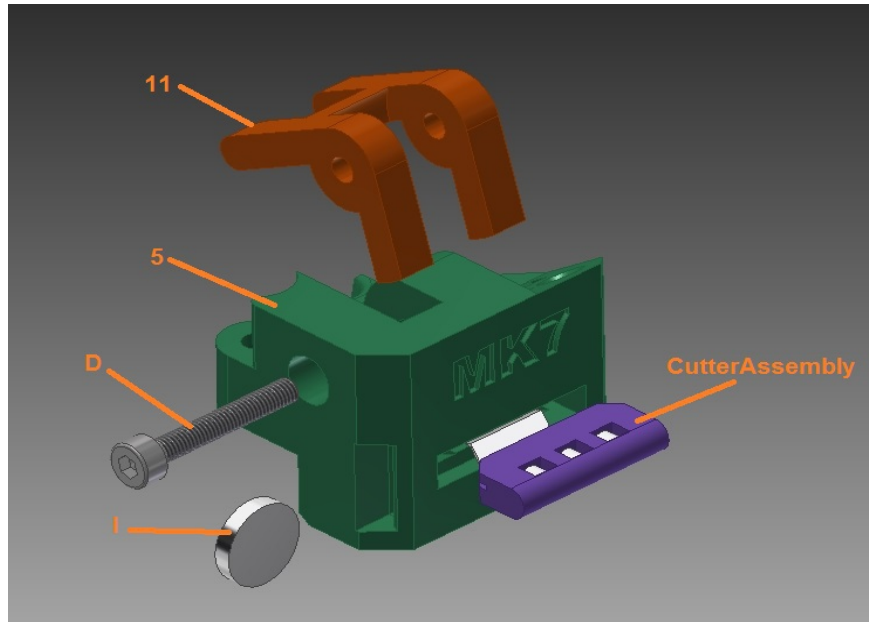
There is only one M3 screw to be cut in the part. This bolt will be the CutterLever hinge shaft. I recommend using a tap male because I do not like fighting, but I guess forcing a bolt through it (PRUSA's way) should also do. The one vertical blind hole does not need a screw.

FrontTrap is ready

## 6 – FrontTrapAssembly

**Assembly:** Slide the CutterAssembly in the front slot of the FrontTrap with the Magnets facing upwards. Place the CutterLever (Part #11) from the top and fit the M3 x 18 bolt.(Part #D) The bolt must be loose enough so the lever moves easily. Slide the back Magnet ((Part #I) in its slot. Polarity of the magnet must be set so that the magnets are attracted. Start checking that the Blade is centered vertically in its slot. It means that you assembled it right and not angled.

Now check that the movement of the CutterAssembly is really smooth, and that when you pull the lever the blade shows about 2 mm. When retracted, the blade should not show AT ALL in the filament's path. The retraction of the blade must be smooth and perfect. ALWAYS. If it isn't then disassemble and clean the blade holder slot again. When retracted, the blade should not show at all in the filament's path. If it does, it means that the blade does not sit in the bottom of its slot in the blade holder (but at least the blade holder slot seems to be clean, because the blade holder went all the way to the bottom).



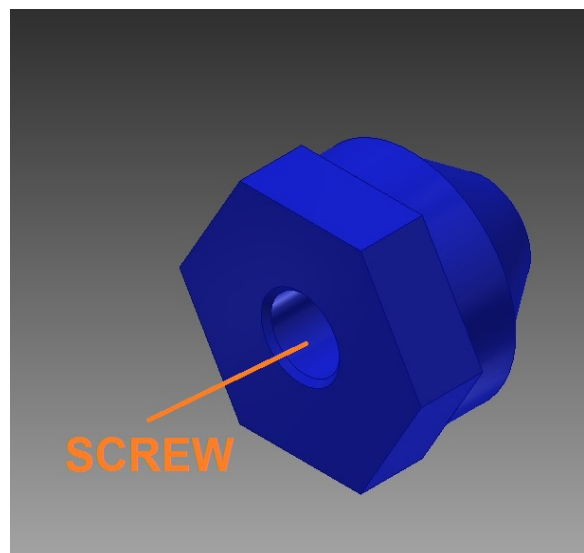
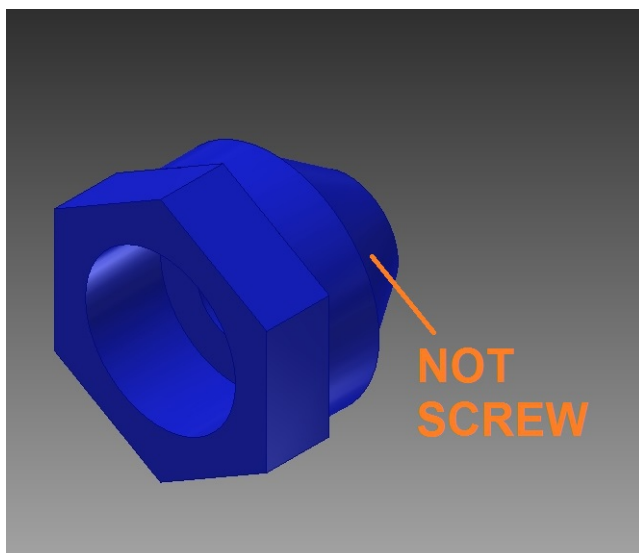
FrontTrapAssembly is ready

## 7-BearingFix A/B (Part #8 and Part #9)

**Printing:** I usually employ rafts when printing very small parts like these.

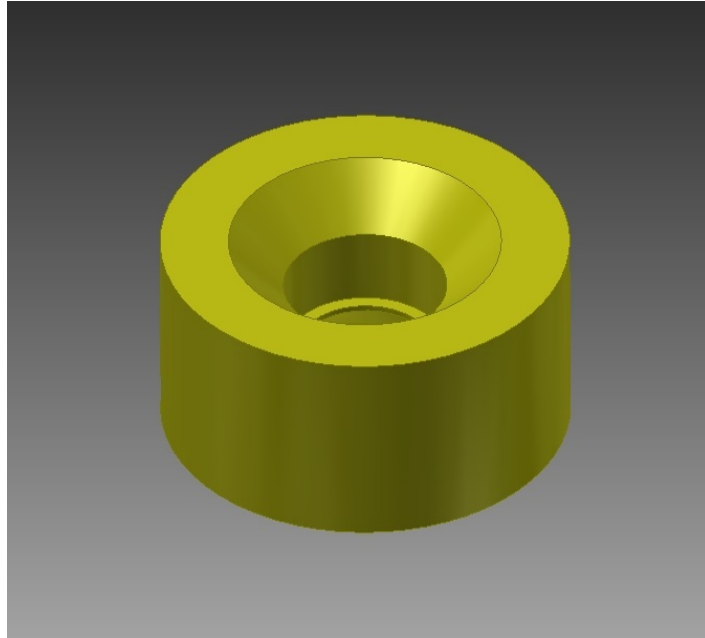
**Preparation:** One of the parts holds the bolt head, and must not be thread. Use the tap male or a bolt to enlarge the hole if necessary.

The other part holds the tip of the bolt and must be screwed. Use a tap male or a bolt to cut the screw in the plastic part before proceeding with the assembly.



## 8 – Roller.(Part #1)

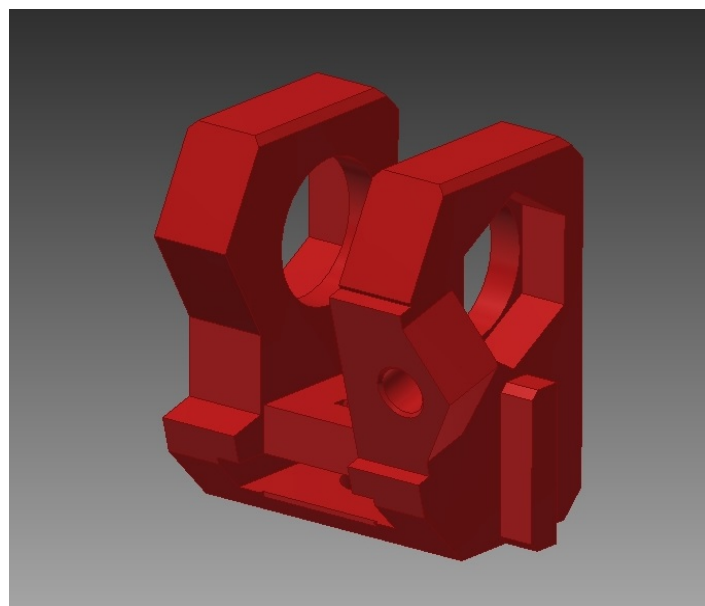
**Printing:** Print it in TPU. The softer the better. The blade will fight against the rugosity of this part (layer upon layer), so make it a good print. No support necessary. There's one good way to print this part and another wrong one. Make sure you position it properly or the bearing won't sit right centered.



## 9- SliderCart. (Part #7)

**Printing:** A small but difficult part to print. Print it with the magnet side against the printing bed. My best prints have been using raft, supports and a support blocker in the magnet cavity.

**Preparation:** Once printed and clean, make a screw for the filament sensor bolt (Part #G) in the hole. Again I recommend using a tap male but you can force the screw with an M3 bolt.



## 10 – SliderCartAssembly.

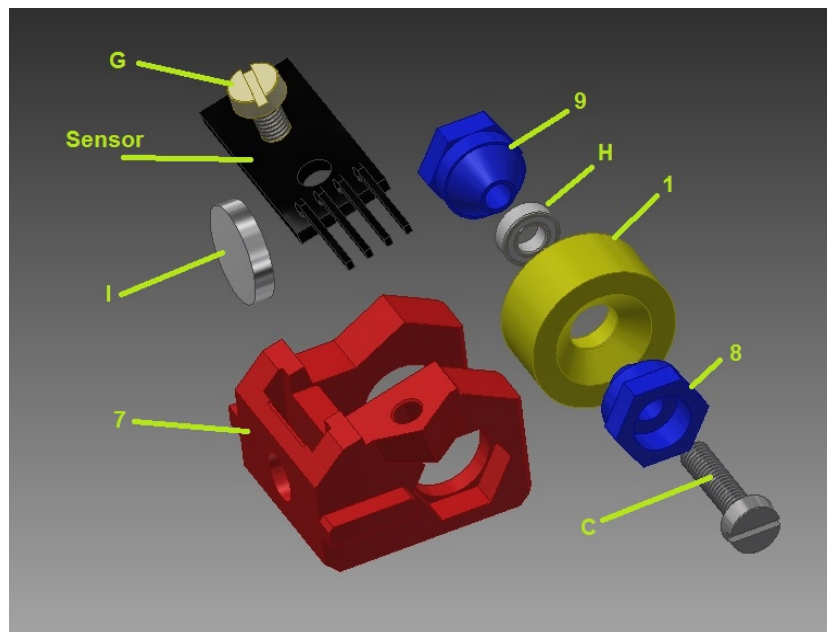
**Assembly:** Place the Bearing (Part #H) in the TPU roller (Part #1). Use a slotted 16 mm bolt (Part #C) as the shaft for the bearing. Drive the Bearing's fixes A and B (Parts #8 and #9) to the bottom of their cases tightening the shaft bolt. Once they are in place, loose the bolt (Part #C). Make sure you do not tighten the bolt too much. The roller must rotate with barely any friction. Place the magnet (Part #I) in the slot. Polarity must be set so when in position (the roller in contact with the blade), the BladeHolder magnets and the SliderCartAssembly magnet should repel each other (though they are pretty far away)

**Polarity of all the magnets of the device**, starting from the front and going to the back of the extruder must be set like this:

(+/-)(+/-)(-/+)(+/-)

(+FrontTrap 10 x 2 magnet- )(+BladeHolder 3 units x 3 x 2 magnets-) (-SliderCart 10 x 2 magnet+) (+BackTrap 10 x 2 magnet-)

Now you should test that you can assemble easily the filament sensor. Use the M3 x 4 Nylon6 bolt (Part #G). Remember that the mirror must be facing the roller, but do not assemble it just yet.

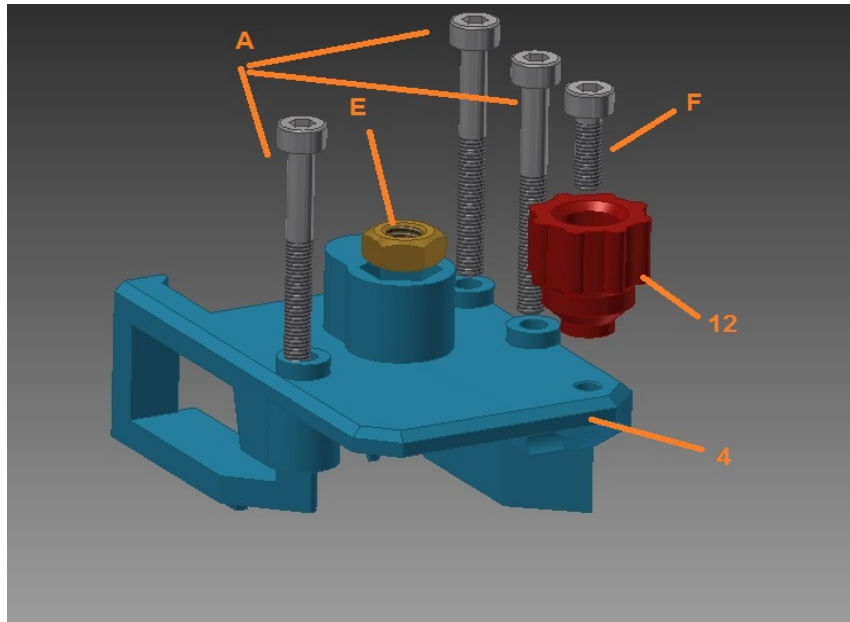


The SliderCartAssembly is ready.

## 11 – TopCover (Part #4)

**Printing:** Print it upside down with support.

**Preparation:** Make sure you clean well the filament passage and the four holes for the bolts. One of the holes (the flat one) must have a screw. It is best to use a Tap male for it because this hole is going to be the FrontTrapLock (Parts #F and #12) that keeps the FrontTrap shut, so you want it to run really smoothly. The other three holes must let the M3 x 30 bolts (Part #A) through and cannot be threaded.



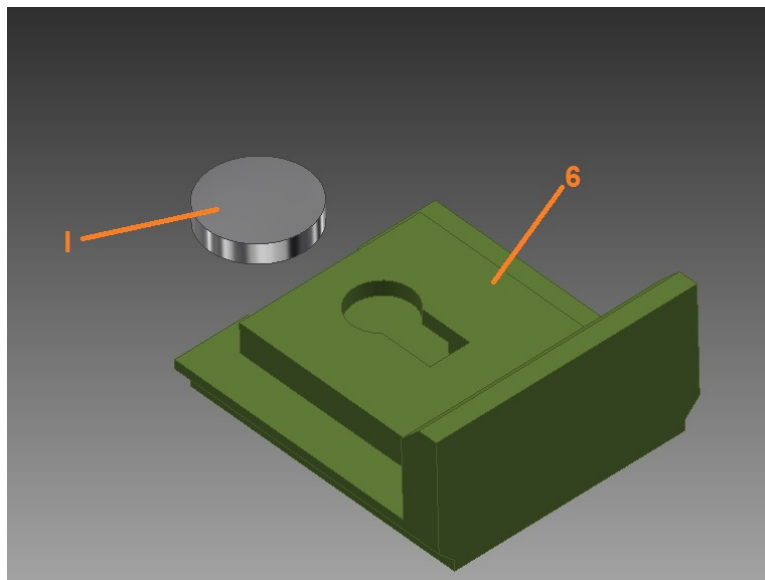
Use a hot soldering Iron tip to place the M5 nut (Part #E) for the Festo connector in place. Make sure it sits straight.

TopCover is ready

## 12 – BackTrap (Part #6).

**Printing:** Print this part with no support.

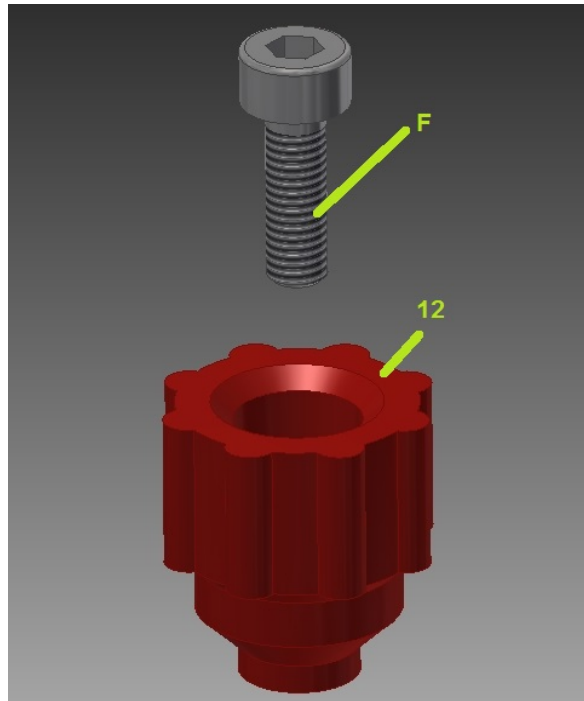
**Assembly:** Place the 10x2 mm magnet (Part #1). Polarity of the magnet must be so that the slider cart pulls away from the back trap and pushes towards the filament



BackTrapAssembly is ready.

### 13 – FrontTrapLock

For the FrontTrapLock, the best is to use a bolt (Part #F) and a Plug (Part #12) for easy inspection with no need of tools. Fit the bolt (Part #F) into the Plug's hole (Part #12) with a nut and a washer from the other side until the bolt's head gets to the bottom. It will stay there. Remove nut and washer.

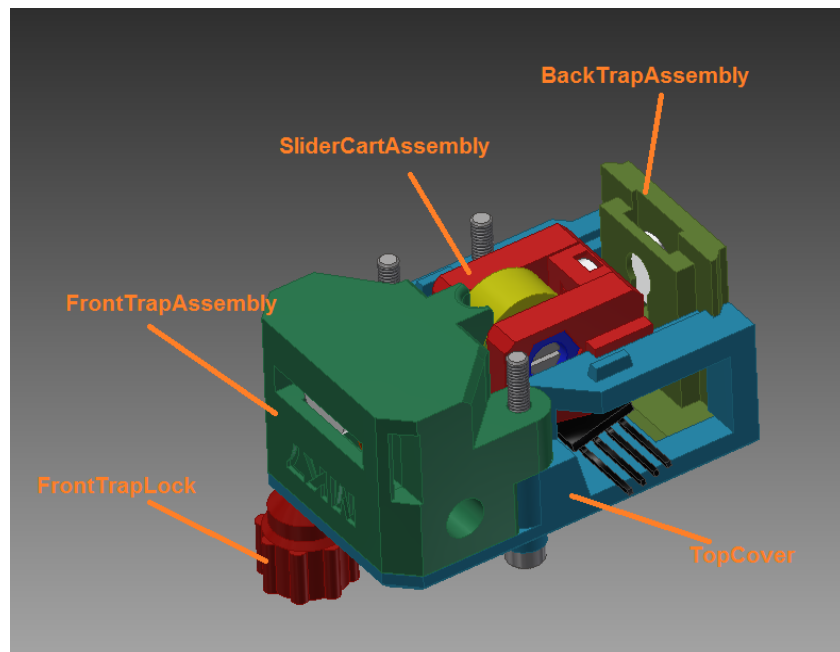


### 14- Top Assembly

Follow these steps in order:

- 1- Install the FrontTrapAssembly on the TopCover. Use both bolts (Part # A and #F) to set it correctly in place, but do not tighten them. The bolt on the left (M3x30) (Part #A) is the shaft for the hinge of the FrontTrapAssembly. The one on the right is the FrontTrapLock
- 2- Slide the SliderCartAssembly FROM THE BACK into the TopCover.
- 3- Place the nylon bolt (Part # G) in the filament sensor hole.
- 4- Put the filament sensor with the bolt (Part #G) through the side window of the TopCover (Part #4)
- 5- TILTING the SliderCartAssembly you will easily be able to screw the filament sensor bolt into its hole in the SliderCart. Remember that the mirror must be facing the roller. The filament sensor could be bolted also into the SliderCartAssembly with the TopCover in place in the extruder, but I find that it is more difficult, uncomfortable and the procedure is finally much slower.
- 5- Slide the BackTrapAssembly into the TopCover FROM DE TOP, until it is flush.





TopAssembly is ready

15- In the assembled ExtruderBody, **put in place with care** the TopAssembly . First the BackTrap guides, then the bolts. Do not do it hastily. Take care that the filament sensor does not move while assembling.

16- Set the three M3 x 30 bolts (Part #A) but **do not tighten them**. Tolerances are tight, and the sensor cover has not been designed too strong so it would be light. If you tighten these bolts too much, plastic parts will bend ever so slightly, and the SliderCart might not move.

17- First **check** that the TopAssembly is correctly in place and everything looks nice and neat. Now open the FrontTrap and **check** with your finger that the Slider cart can move with ease. **Check** that it comes back to the front right away. Tighten the three bolts slowly and jumping from one bolt to the other. Stop and ease the moment you detect that the slider cart does not move as easily as before. There are no big forces there, those three bolts don't need to be that tight. Just **check** that nothing moves loose and that the FrontTrapAssembly can be opened when you free the FrontTrapLock.

18 – **Last pre-flight check:** Loose the FrontTrapLock and open the FrontTrapAssembly

- Does the Roller rolls easily?
- Does the SliderCartAssembly moves backward easily when pressed with a finger?
- Does it come to the front right away once it is left alone?
- And in the FrontTrapAssembly:
- Does the blade gets out easily when the lever is actioned?
- Does the blade retract swiftly when the lever is no more actioned?
- Is the blade completely hidden from the filament's path when retracted?
- Close the FrontTrapAssembly again and secure the FrontTrapLock. If you didn't close it well, the TopCover would raise and bend, and a creek would appear between the parts.

19- Place the **electrical connector** in the filament sensor's pins. Red cable at the front, white cable to the back of the machine. If the sensor cable is just a bit too short I recommend redoing the textil seath work on the cables again. Ten minutes job but it's worth it. There's enough filament sensor cable (the one that is red, blue,white & black) in the MK3 to do a nice and neat job.

20 – Connect the **Festo**, and here we are ready to go.

The frog is assembled. Happy printing.

## PRINTING WITH THE FROG

OK, the frog does not make miracles and you will probably get a few jams, but it is easy and fast to get over them and continue with the print.

What follows only applies if you print with TheZeroBeast firmware.

### 1. Jams from a bad sensor reading.

Caused by the buildup of hairs or fluff in the roller cavity that do not let the roller roll. Yes, the FrontTrap does really work well as a trap for hairs and bits. If you are getting repeated sensor misreadings and you see nothing to clean, there might be a ball of fluff behind the roller or hairs rolled in its shaft. Hairs could be very difficult to see sometimes. Open the BackTrap to check and clean. In the worst cases you might have to open the TopCover (3 bolts) to clean well, or even check the bearing's shaft.

Machine behaviour: Pauses, retracts filament all the way to the MMU2, shows tip (usually perfect) and waits.

Solution: Fix the tip if necessary, pull back the filament. Open front trap and clean well all the fluff and hairs in the cavity. Make sure that the roller can roll easily. Hairs could be difficult to see. Check also the blade's movement. There could be debris blocking the slot under the blade. Close the front trap. Press the button in the MK3. The machine will load and you'll have to press the button again to start printing. Watch out for whatever gets stuck in the tip after reloading. Better clean it before the extruder gets to the wipe tower.

### 2. Any jam that causes a MMU2 halt, recognized by a flashing led in the device, can usually be solved by first: fixing the root of the problem, second: putting the filaments ready in the load position and third pressing the middle button of the MMU2..

Some example of these jams are:

#### - Jams from a false PINDA reading

Occurs when unloading. Caused by the buildup of hairs or fluff in the PINDA ball area, dragged by the filament tip from the extruder when retracting.

Machine behaviour: Filament retracts too much. Machine pauses. Led flashes in the MMU2

Solution: Free the Festo connector in the MMU2. Push the filament through. If it doesn't go straight through the selector you might have to open the MMU2 and put the filament tip through the hole. The tip of the filament should clean all the rubbish of the PINDA in the selector on its way out. Check the PINDA light. Pull the filament back to the load position. Fit the Festo again and push the middle button in the MMU2.

#### - Jams from a grinded filament.

Usually occurs when loading but also when unloading. Caused by a grinded filament for whatever reason ( a bad sensor reading, a tangled filament in the spool rollers, a tip too thick to get out of the extruder, etc.)

Machine behaviour. The machine behaves exactly like in the case of a false PINDA reading, except that you'll find no fluff in the PINDA ball and the filament could be anywhere in the machine.

Solution: Check if the filament is grinded. If it is, just cut the damaged part, place the filament in the load position, secure the Festo and push the middle button of the MMU2.

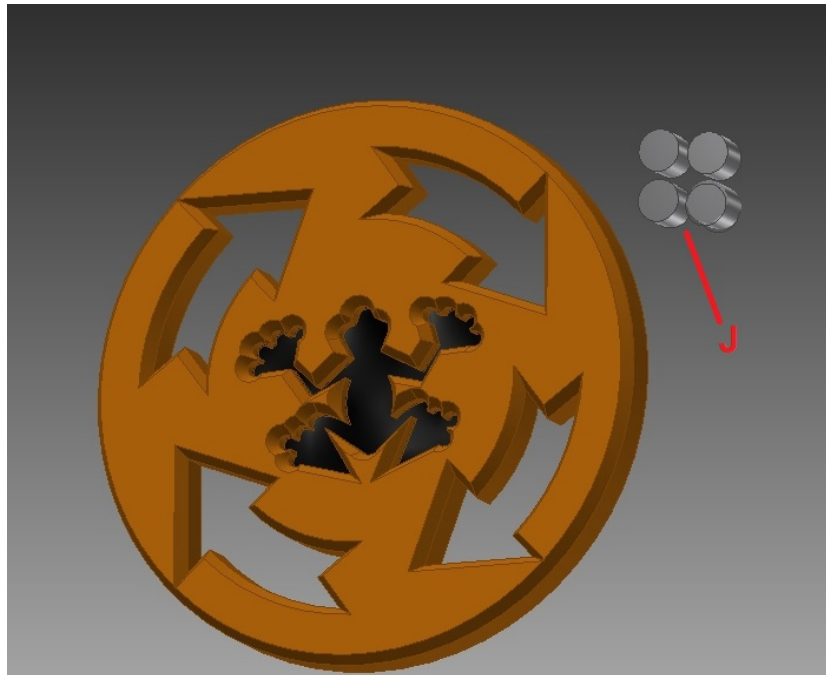
When you are printing with The Frog, if the machine pauses, you fix whatever you think it was, restart again and then the machine stops again (could be the next load or the next time the machine uses the same filament), this means that whatever it was the reason that

caused the first pause (a “dirty” roller, a grinded filament,...), it was not correctly fixed the first time you tried.

However, with The Frog you should have very few jams, and you should be able to recover swiftly from all of them.

## BONUS

### TheFrogSpinner



Ready to tackle your first unassisted (hopefully) multicolor print? Just a few filament changes so you can see that The Frog really works. And now that the spools are loaded, why not PETG? Are you afraid or what? Don't bother about settings. Just use PETG defaults with TheZeroBeast touch.

I usually slow the printing speed to maybe 50% on the first layer when printing a small and intricate part like this.

Once you print it, you'll need to glue four of those little magnets to the back of the spinner to attach it to the stepper.. No, my psychiatrist says there's nothing wrong with me liking magnets...

And now that you are getting maybe a little more confident, and although it is completely unnecessary, you can print that FrontTrap part with the MK7 logo in other color, just for the show off!! STL files are BONUS2A and 2B. It's just a few more filament changes, only to get warm. Take a look while it's working?. How do you like those tips? Open the FrontTrap. Any debris accumulating? If there's debris there, that may give you an idea of how much are you going to need to tend the machine (open the FrontTrap and clean) with that particular material.

There you are. Your MMU2 is finally working.