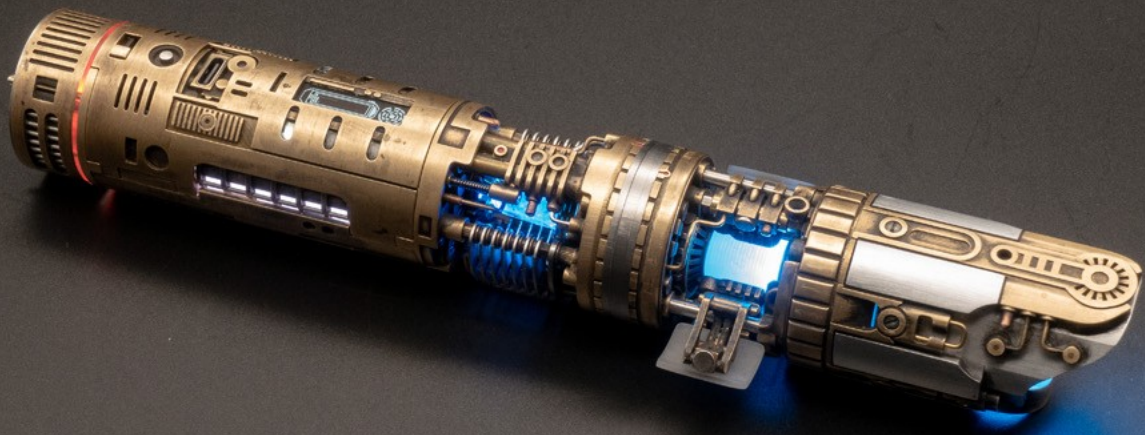


# METAL MASTER CHASSIS SYSTEM 3.1 INSTRUCTION MANUAL



This is the manual for the Saber-chassis only.  
It shows how to install the electronics and put together all chassis parts. This manual does not show how to convert a Graflex Flashgun or setup a soundboard.

This manual contains the instructions for Metal Master chassis version  
**3.1**

Metal Master Lightsaber chassis is only recommended for experienced model builders

**Manual Version 12.06.2024**



[mb-Sabers.com](http://mb-Sabers.com)

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# 1. Foreword

**Thank you for choosing my Graflex Lightsaber Chassis for your own Graflex based Lightsaber project.**

The mb-sabers Graflex chassis design has been continuously developed and improved since 2017. MB-sabers focused on this one chassis design to create the best possible chassis for Graflex based Lightsaber.

A lot of experience and passion has gone into this design. And of course mb-sabers will continue to work on improving this chassis and adapting it to customer needs in the future.

The Metal Master chassis design allows individual parts to be simply exchanged for the old version after further development. This often allows a complete chassis to be updated without having to re-buy all parts.

## **For creative design**

The metal Master chassis gives a lot room for individual custom designs.

Use the basic chassis parts and add self designed parts and elements to it. Especially the crystal chamber and the plasma gate can easily be modified.

## **For experienced hobbyists**

Editing and assembling the individual parts is not easy. 3D printed parts are not that accurate as CNC machined parts. Adjustments always have to be made. A proper workspace and professional tools are absolutely necessary. I only recommend building one of my chassis for experienced hobbyists.

## **Responsibility**

3D printed metal is conductive. The installation of all electronic parts must be done with care! MB-Sabers cannot be held responsible for improper use or assembly of the Metal Master Saber Chassis.

## **Print materials**

The Metal Master chassis is specially developed for metal 3D printing. Most parts are available as 3D prints. These parts are designed **for precious metal materials**. These materials have the best accuracy and usability. They can be drilled, cut and tapped very easy.

However, most parts are also available in steel or nylon plastic.

**Standard 3D-print STEEL materials  
will no longer be offered in the future!**

## 2. Tools

For assembling the printed chassis parts and installing the electronic parts you need different tools...

- sandpaper (240 grain and 600 grain)
- square sanding strips with 400 grid
- drill heads 1mm, 1.2mm 2mm, 3mm, 4mm
- small slot screwdriver
- double-sided adhesive tape (thin and foam)
- scalpel / small cutter
- tap M1.2 , M1.4 , M2
- glue (Pattex repair EXTREME, super glue, Epoxy)
- Loctite 648
- small files with diamond grid (small and medium)
- soldering-iron and solder
- tweezers
- liquid rubber
- insulating tape
- shrink tubing
- belt sanders small (for example Proxxon)
- power tool (Dremel or Proxxon)

## 5. Check the metal printed parts (especially standard steel)

After the printed parts arrive, they must first be inspected.

Most materials do not pose a major problem. However, parts printed from standard steel materials may have imperfections. **Nylon or precious metal parts shouldn't cause any problems.**

### Check all parts for:

**- closed / blocked holes** (try to push rods through each hole)

If there is a blocked hole make a picture (for Shapeways) before you do anything else.

If it is not possible to resolve this issue by drilling or other techniques please contact Shapeways and reclaim the part. They will reprint the part for you.



### **Use this text:**

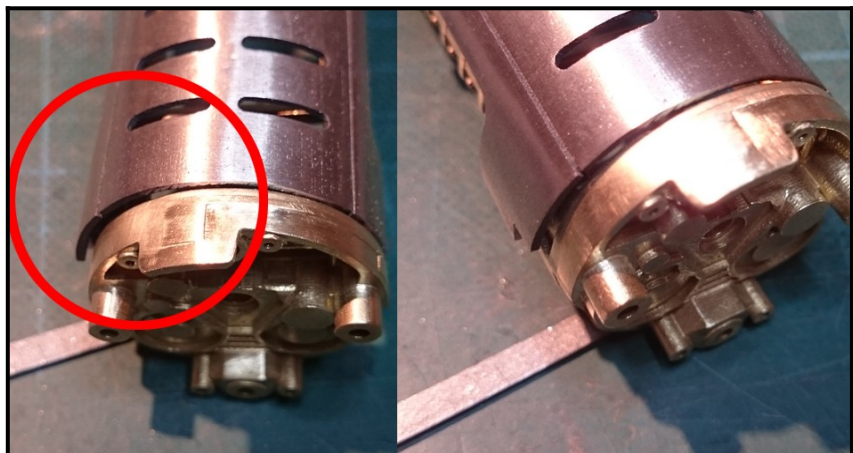
*I know the printing process. I know it is possible to get a perfect print result with this model.*

*It looks like the print was not checked and cleaned properly after the first step before the part goes through the infusion process.*

**- bent geometry**

If the object does not fit because of bent geometry try to reshape it. Steel material is brittle. So you have to be careful. **First take pictures of the non-fitting part (for Shapeways).** Then try to reshape it.

In most cases it is possible to make it fit again. If it is not possible then please contact Shapeways and reclaim this part. Send them the picture of the issue and ask for a reprint. They will reprint this part!

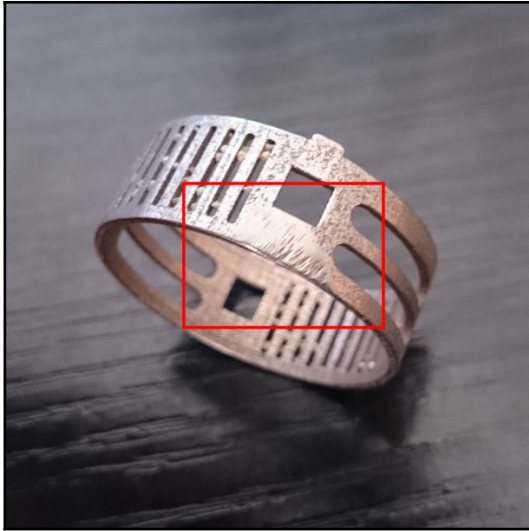


- **damaged surface** caused by removing sprue marks.

During the printing process sprues are added to the geometry. These sprues will be removed after the printing process. Sometimes Shapeways damages the part. Please contact Shapeways and reclaim the bad print. Send them the picture of the issue. They will reprint this part!

**Use this text:**

*I know the production process. These damages are caused by removing sprue marks carelessly. Please reprint this part.*



## 6. Preparing the surface

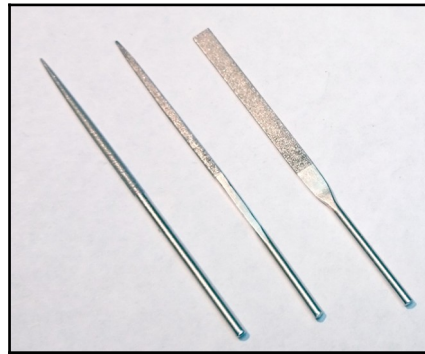
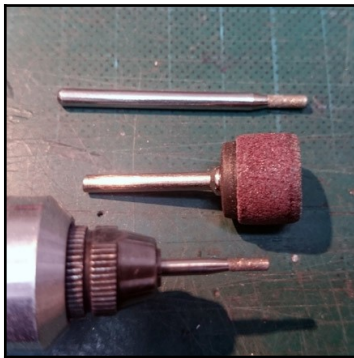
**IMPORTANT:** First adjust all parts till they fit perfectly before finally assembling them and installing the electronics.

3D printed metal parts are never perfect! They all need post processing to make them fit and look good. Depending on the material, the parts require more or less work.

Precious metals require the least amount of work. Standard steel needs the most amount of work.

### 6.1 Tools

- power tool and grinding heads
- diamond files (small)
- sandpaper (240 grit, 600 grit)
- belt sander (80 grit and 180 grit)



### 6.2 Precious Metal parts (Brass, Bronze, Silver) in general

Precious metal material can be ordered as polished or raw.

**Raw is recommended.** It is a lot cheaper. It is easy to sand or polish by yourself.

Also polished precious metal print lose detail and edges are rounded.

**For preparing precious metal parts, belt sander, sandpaper and small files are needed.**

## 6.3 Steel parts in general

### Steel parts do not fit without sanding

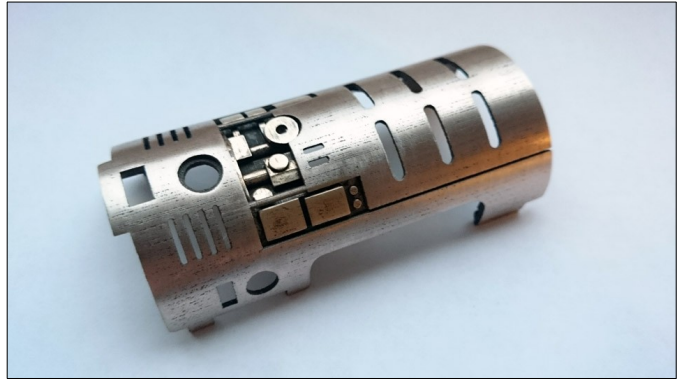
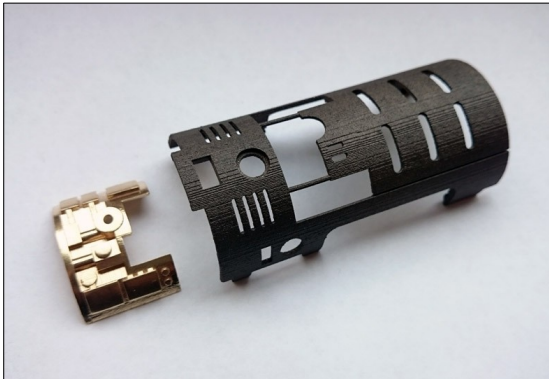
Each part has to be sanded. Take your time. For steel parts use your Dremel or Proxxon power tool with a grinding head.

For the finish use a belt sander (**80 grit and 180 grit**).

There are several areas which have to be sanded to make sure all parts fit together.

For the holes use small (2mm) grinding heads with your Dremel and small round hand files.

**Standard Steel material cannot be drilled.** Always use grinding heads, sand-paper or a diamond file.

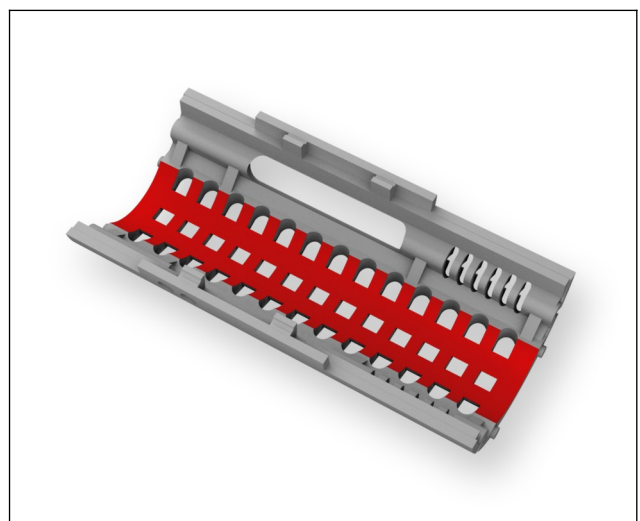


## 6.4 Steel parts which need more attention

### Battery cover Metal Master 07 (steel)

It is also necessary to sand down well the rough surface inside the battery section from part 07 (battery cover).

The battery has to have enough space to lay in the battery cover loosely. The battery cover must fit easily! This is very important.





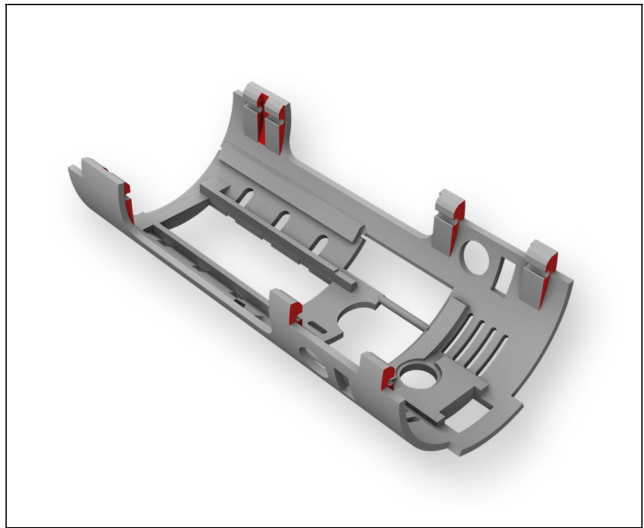
### Soundboard cover Metal Master 06 (steel)

Some areas of the soundboard cover **Metal Master 06** need special attention.

The area around the “light holes” inside the cover need to be sanded carefully to make sure the LED holder fits. This area has to be nice and smooth.

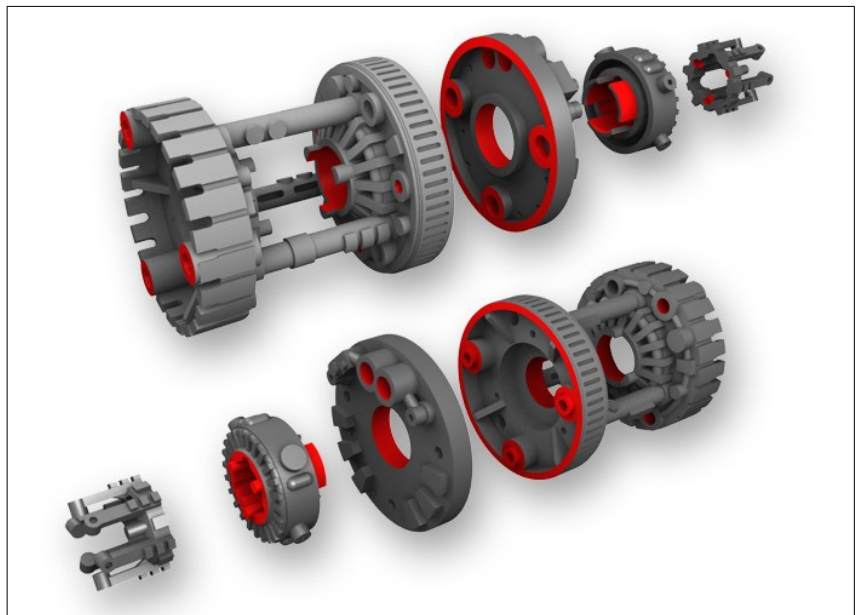
Other areas at the holders must be sanded to make the cover fit on the main part **Metal Master 05**.

**Check the fitting first. Then decide where and how much material has to be removed. Each steel print is different.**

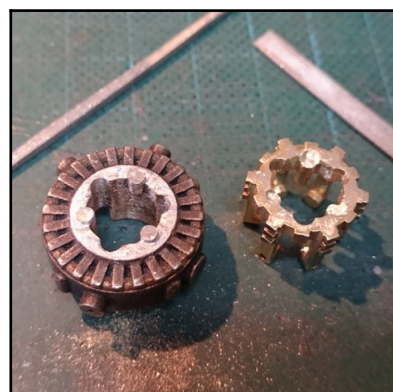


### Plasma Gate Part 01 and Part 02

All areas marked in **red** have to be sanded to make the steel parts fit.



**Take your time to make everything fit together...**



## 7. Installation

### **! Safety first !**

**Please remember that metal materials are conductive! You have to make sure that the battery contacts are well insulated as well as all other electronic parts.**

**Do not mix up the electronic poles. Install the contacts like shown on the pictures.**

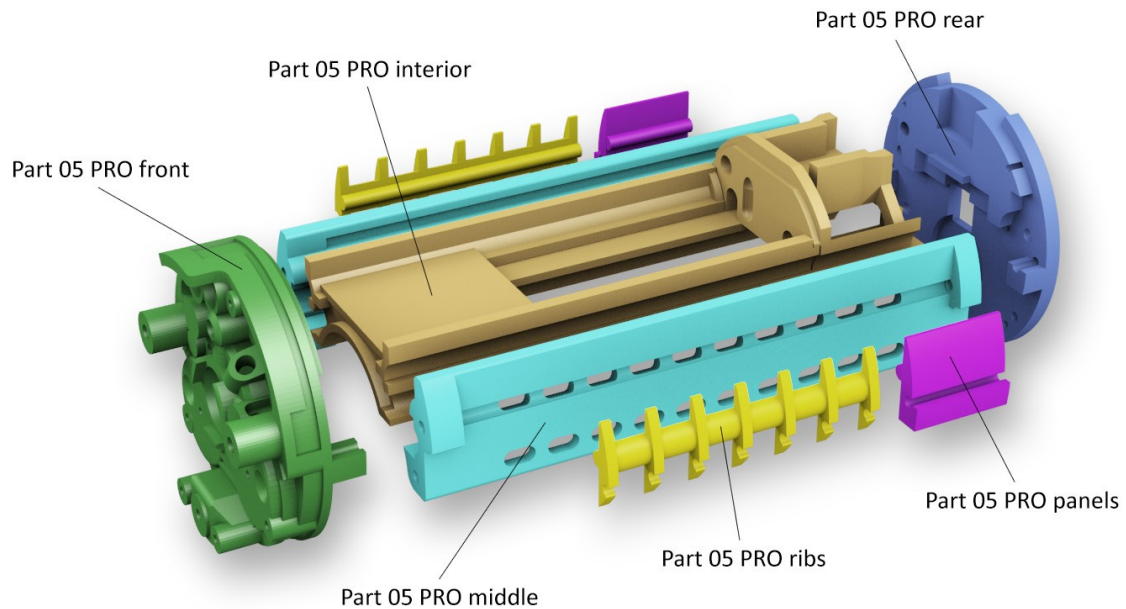
### 7.1 Electronic wire

Use **PTFE** wire. **PTFE** has the smallest profile.

function	AWG	mm <sup>2</sup>
speaker	26	0.14
single Pixel	30	0.05
Pixel data	30	0.05
<b>+ battery to + Soundboard</b>	<b>24</b>	<b>0.21</b>
<b>- battery to - Soundboard</b>	<b>22</b>	<b>0.32</b>
<b>+ battery to + pixel blade</b>	<b>22</b>	<b>0.32</b>
<b>- pixel blade to Soundboard</b>	<b>22</b>	<b>0.32</b>
motor	28	0.09
Plasma Gate Pixel PCB	26	0.14
USB port D+/D- to Soundboard	34	0.02
USB port <> charge PCB	28	0.09
Battery <> charge PCB	28	0.09
AUX/ACT switch	34	0.02
Accent smd LEDs	34	0.02

## 7.2 Part 05 v3.1 (Standard and PRO)

**Part 05 PRO** is more advanced and has more possibilities compared to the standard Part 05. With Accura middle parts, it is lighter and the side panels can be illuminated. It is also more accurate and can be perfectly adapted to Part 06 and Part 07.



### Part 05 v3.1 (Standard and PRO) thread positions

Part 05 v3.1 (PRO) must have additional threads for the M2 and M1.2 mounting rods.

**The rear** is the same on both versions. **Seven M1.2 threads** need to be cut.

**The front** has three M2 threads for the standard Part 05 and one M2 thread for the PRO version.

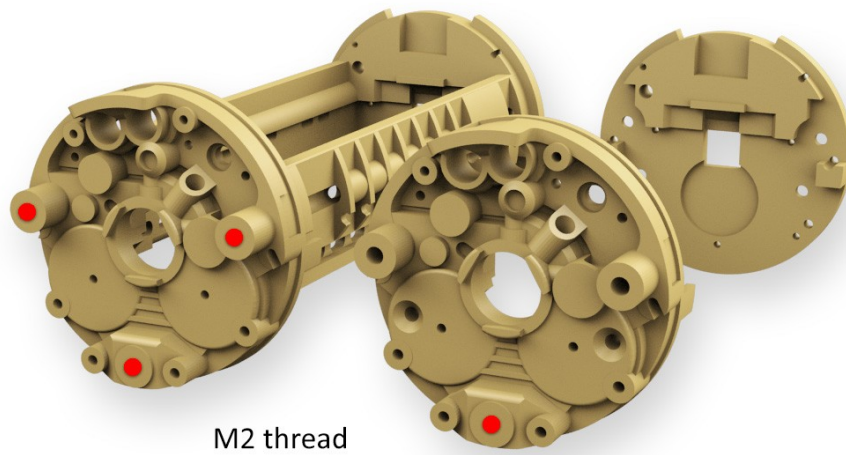
**Check the core holes before cutting the threads!**

**Use three-tap sets!**

**M2.0 thread** core hole: 1.7 mm

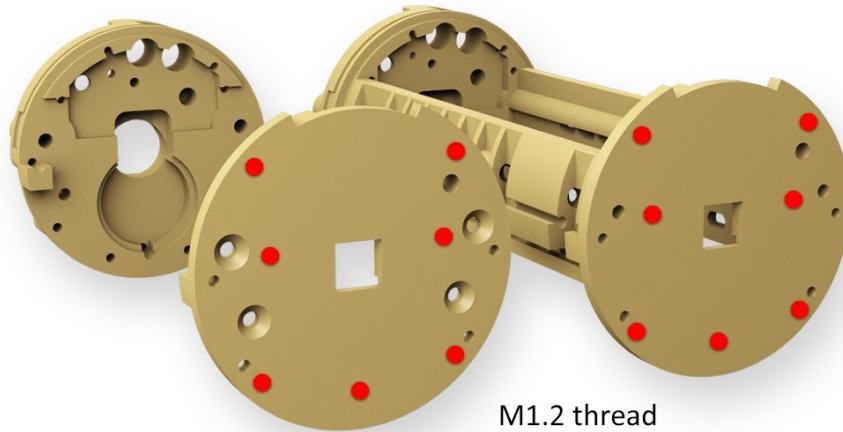
**M1.2 thread** core hole: 1 mm

**Front threads (M2)**



M2 thread

**Rear threads (M1.2)**



M1.2 thread

For the rear use the 3D printed **tap guide!**



## Part 05 PRO middle (side panels) preparation

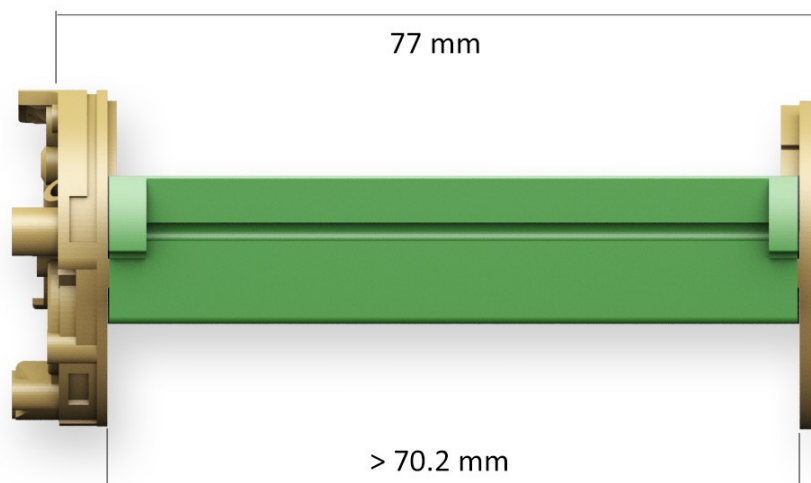
The middle section is available in precious Metal or SLA Plastic.

**TIP: Accura Xtreme 200** is best for illuminated side panels.

**The two panels for Part 05 PRO must be prepared carefully!**

Both ends have to be parallel. And the **length** of both panels must be **equal** and not under 70.2 mm! **70.5 mm are recommended.**

**IMPORTANT: Don't mix up the panel orientation! The wide bar is at the front, the narrow bar at the back.**



Use square sanding strips with 400 grid to smooth the surface.

Use a grinding machine (80-150 grid) with a 90° table to adjust the length and angle carefully!

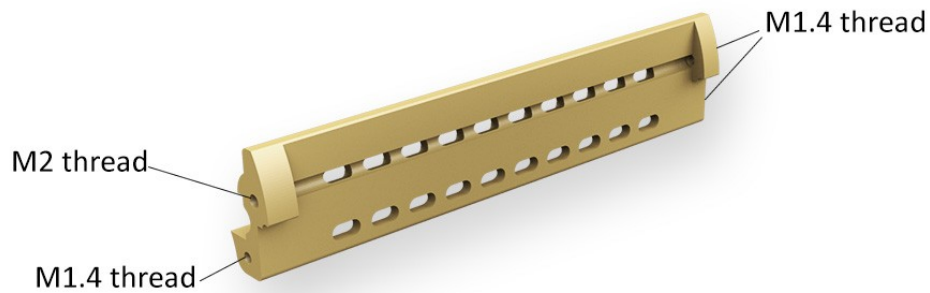


The threads and screw type for the middle section depend on the part material.

**Cast Metals** (brass, bronze, silver, gold) need M1.4 standard countersunk head screws:  
2x 5mm, 2x 6mm, 2x 10mm (core hole is 1.2 mm)

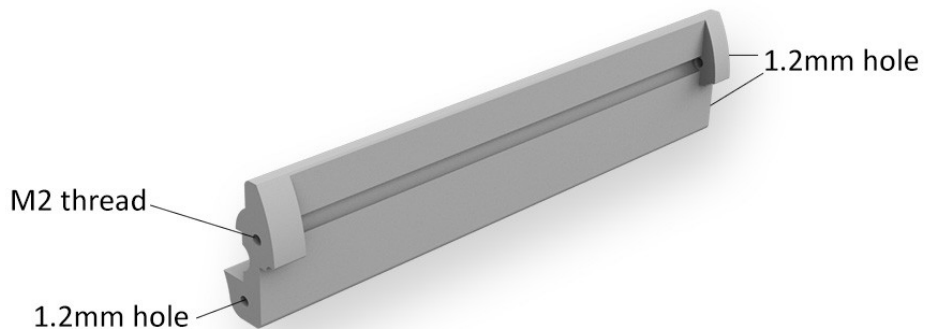
**M1.4 thread** core hole: 1.2mm

**M2 thread** core hole: 1.7mm

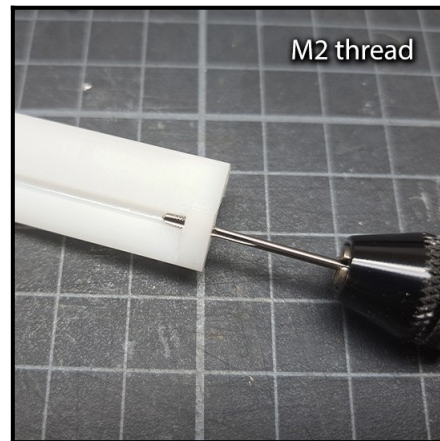


**SLA Plastic** (Accura) needs M1.4 countersunk head sheet metal screws:  
2x 6mm, 2x 8mm, 2x 12mm (core hole is 1.2 mm)

**M2 thread** core hole: 1.7mm



**Check the core holes before cutting the threads!**  
**Use three-tap sets!**



### Part 05 PRO assembling

**IMPORTANT:** Unlike the standard Part 05, the center plate must also be installed when assembling the PRO version!

That means all pixel and LEDs for illuminating the side panels must also be installed when assembling the Part 05 PRO!

**After all threads are cut, attach the side panels to the *Part\_05\_PRO\_front*.**

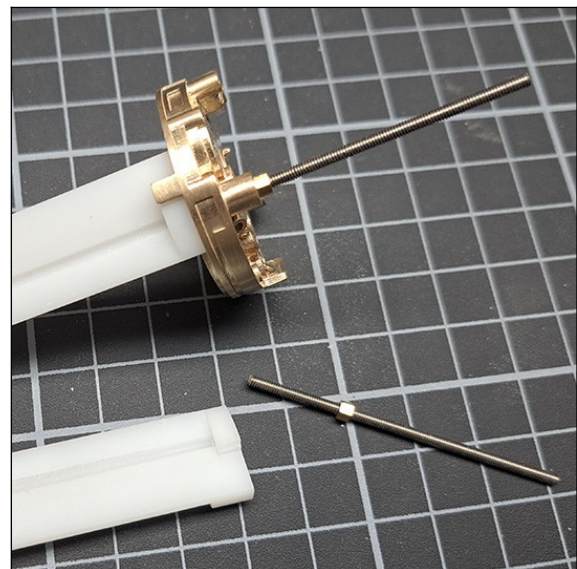
Use 60mm M2 threaded steel rods for the upper holes. Screw them into the side panels and then stick them into the *Part\_05\_front*. Add a M2 nut to each threaded rod and tighten them. Then attach the two lower screws.

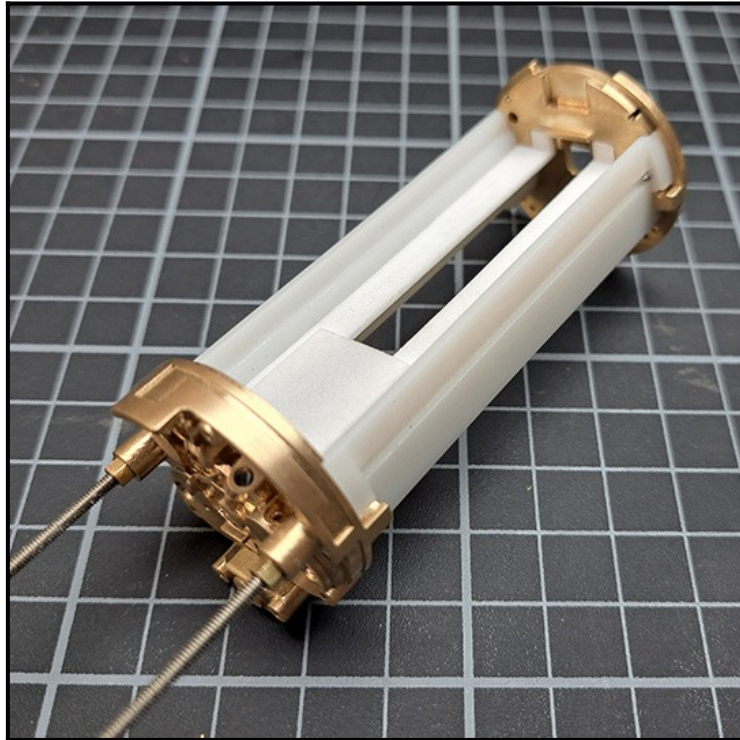
**Check the alignment of the two side panels.** Are they parallel and have a 90° angle to *Part\_05\_front*? Correct if necessary!

**Prepare the inner plate.** Sand down the grainy surface and temporary push it into the rails between the side panels. Check the length of the inner plate by temporary attaching the *Part\_05\_rear*. Correct the length if necessary!

Pull it out again. **Attach both wired pixel strips** or LEDs to the cut-outs of the inner plate. Test the function first! (See *Chapter: 7.8 accent pixel/LED*)

Push the plate back in between the side panels and **attach the Part 05 rear** with the four screws.

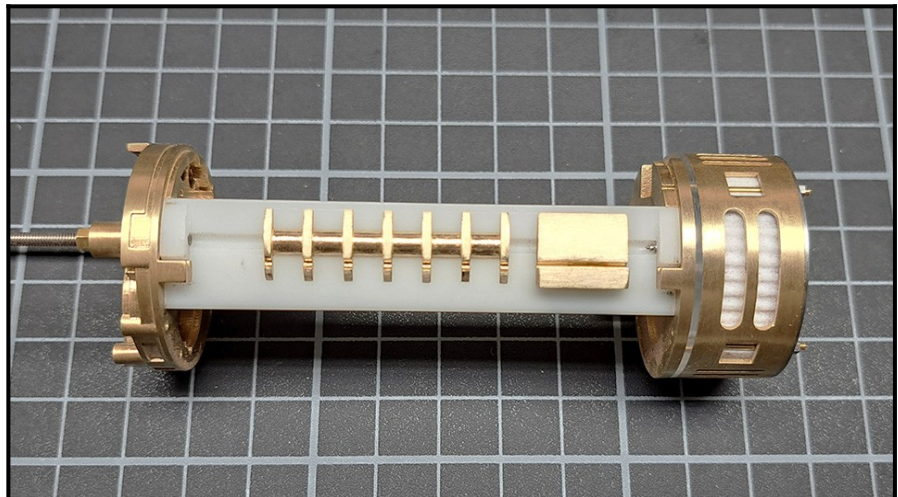




### Part 05 side panel add-on and ribs installation

**IMPORTANT:** The side panel ribs and add-on parts should be fitted to the side panels **after** part 06 has been adjusted! (See Chapter 7.5)

1. Add the ribs and panel add-on parts loose to the panel rail grooves and install Part 06 onto Part 05 PRO.
2. Mark the rib and add-on positions
3. Remove everything again and glue the ribs and add-on parts onto the panels. **Add glue only to the rail grooves.**





## 7.3 Speaker chamber

### Polishing the rear of part 05

Polish the rear end of Part 05 to a mirror finish. This effects the brightness of the speaker chamber accent LED.

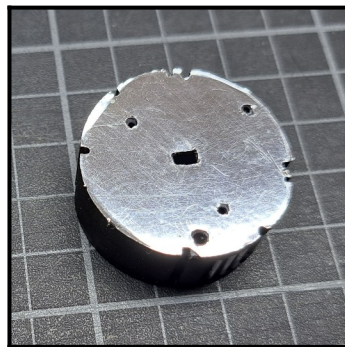
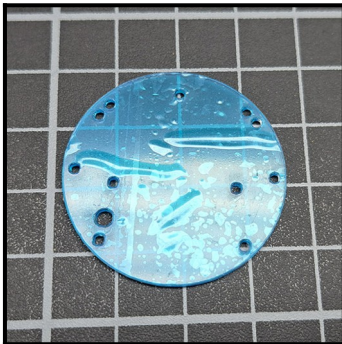
### Preparing the speaker chamber LED-SPACER

The spacer guides the speaker chamber's accent LED light.

Remove the blue foil from the **LED spacer**.

This part does not have to be glued. Just place it between part 05 rear and the speaker chamber.

Attach a thin self-adhesive mirror film to the back of the speaker chamber. Cut out the holes for LED, screws and rods.



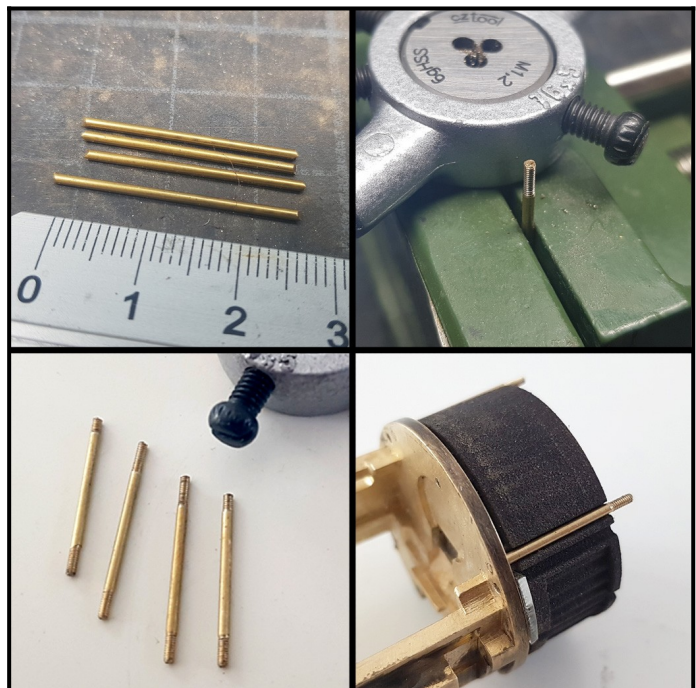
### Preparing the speaker chamber frame rods

The speaker chamber is framed by four 1.2mm rods.

Use four 1.2mm rods and cut M1.2 threads to each end.

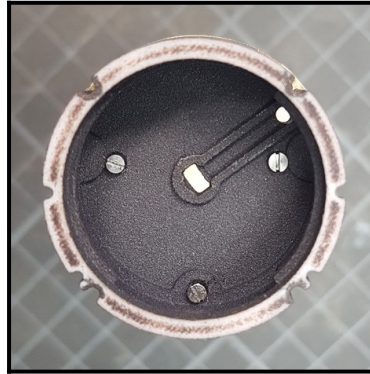
(Or use 1.2mm pre threaded rods [LINK](#))

1. Cut four 1.2mm rods to 2.5cm length.
2. Tap a thread **on one end** of each rod.
3. Screw them onto Part05, add the speaker chamber and speaker ring. Adjust the length of both ends of each rod.
4. Tap the other end of each rod.



### Assembling the speaker chamber

1. Add the four prepared 1.2 mm rods to Part05
2. Add the LED spacer and the chamber to Part05 and mount it with three M1.2 screws
3. Glue (12x) 8mm long 1mm rods into the indentations on the chamber side. Use **Loctite 648!**



### Preparing the Speaker rim cover

The speaker ring covers the speaker rim. It also holds the speaker and the Part\_08 in place. It consists of two metal rings. The first one is smaller. It is placed inside the Part\_08. It has to be adapted to the inner diameter of Part\_08. Sand the outside of the ring evenly till it fits into the cover.

Slide the Part 08 over the chamber. Add the first ring and push it in the cover onto the chamber. **Ring and Part\_08 should now have the same level!**

Make sure Part08 and the ring are rotated correctly. All holes line up.

Place the second ring onto the first. Make sure it is rotated correctly too.

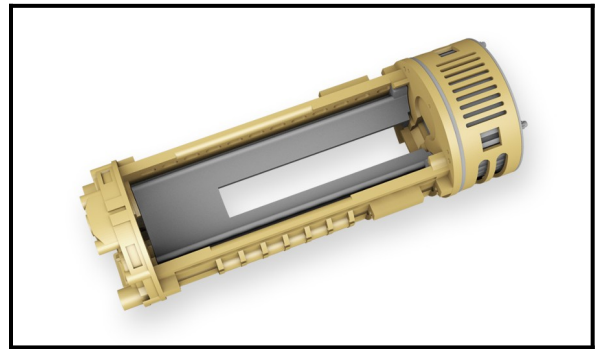
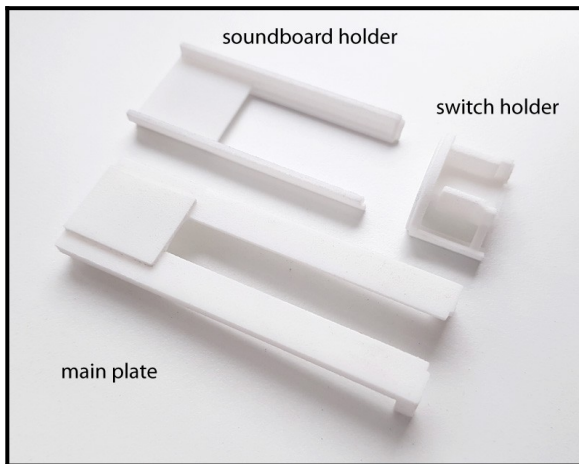
Add 4x M1.2 nuts to each chamber frame rod and screw them down.

**Now match the outer edge of the ring to the radius of Part\_08.** Use a rotary tool with grinding head and sandpaper.

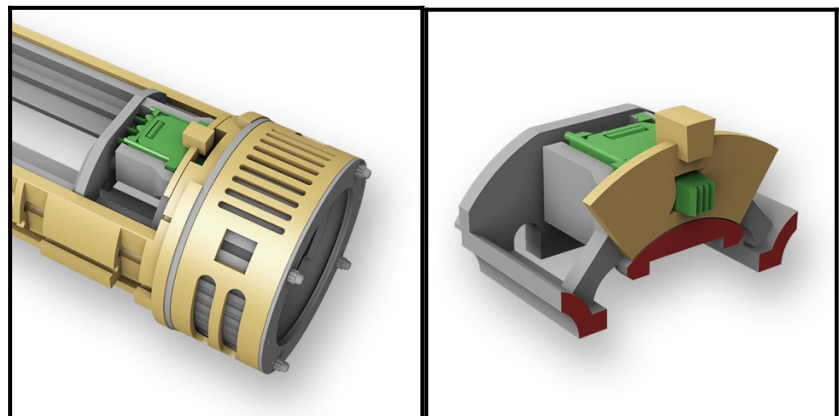


### Preparing interior parts (center plate, board holder, switch holder)

1. Separate all three parts and sand down the grainy surface.
2. Install the **center plate** into Part05. **NO glue needed!**  
**Part 05 PRO** should already have the center plate installed (with wired pixel strips)!

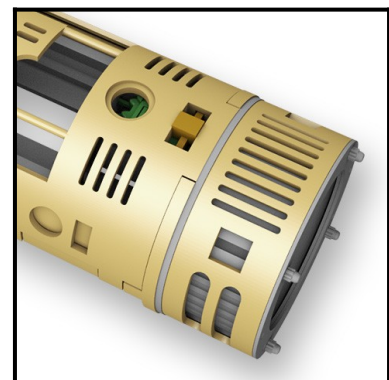


3. Add the **power switch (TS01CQE)** and the **slider** to the switch holder
4. Install the **soundboard holder** and the **switch holder** into Part05.
5. Test the **slider function**. It should fit nice and tight. If it is too loose, sand down the **red marked areas** on the switch holder and test again.



### Preparing the power switch slider cut-out

- Install the slider (together with the power switch, the switch holder and the soundboard holder) into Part05. Attach Part06 to Part05. Check how the slider knob fits into the **cut-out** of Part06. **Adjust the cut-out if necessary.**



## 7.4 Battery contacts

**Do not remove the shrinking foil/insulation from the Battery!  
Everything must be insulated well!**

### Battery

The Metal Master chassis is designed for **protected 18650 Lithium-Ion Batteries with raised top (plus pole)...**



**I recommend to use this battery brand:**

**protected 18650 Keppower 3.7V 3500 mAh / discharge rate 10A  
- NCR18650GA-**

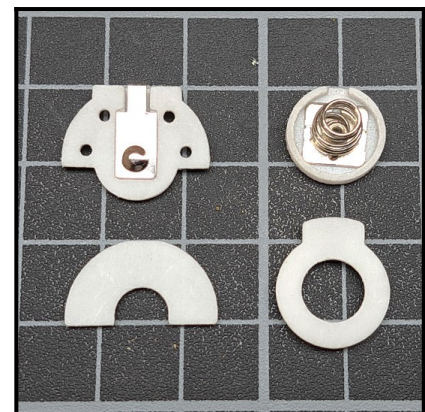
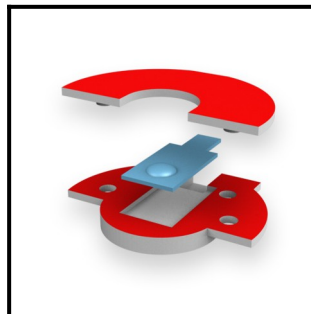
### Preparing nylon insulation parts

Separate all four nylon insulation parts and sand down the grainy surface.

**The insulation parts for the positive pole contact needs special attention!**

First sand down the red marked face of the **bottom part** till it lines up with the metal contact plate surface!

Then sand down the red marked face of the **top part**. Make it nice and thin.

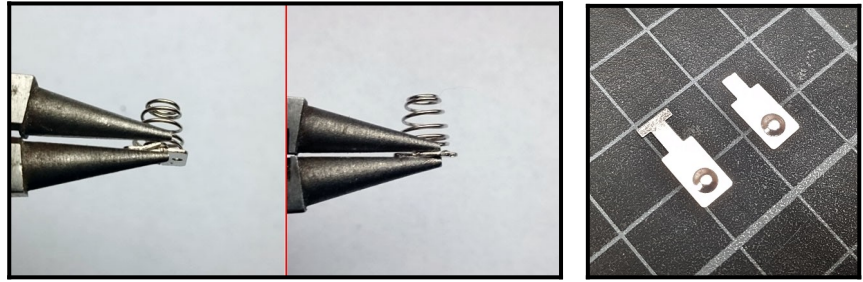


**IMPORTANT:** Before the final assembling and installation of the battery contacts, test them together with the Battery! Make sure the Battery fits easily into the chassis. If it is too tight, sand the **front of the negative** contact insulation and the **back of the positive** contact insulation!

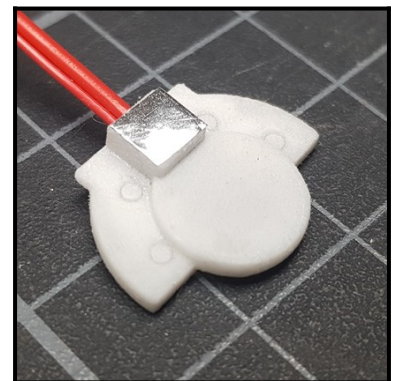
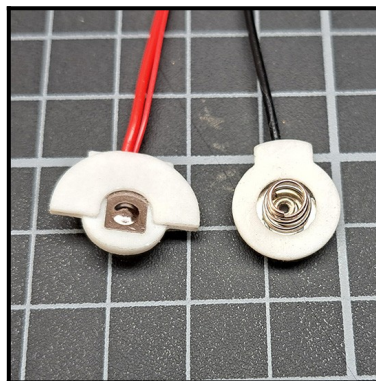
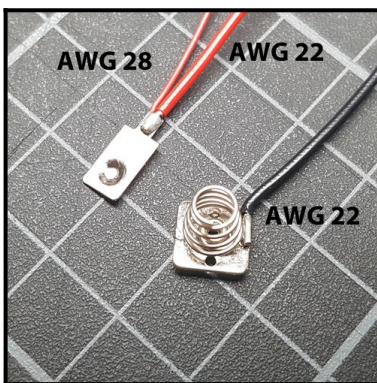
## Preparing and wiring the battery contacts

Both contacts are available at [www.mb-sabers.com](http://www.mb-sabers.com)

1. Flatten the hooks of the **spring-contact** with pliers.
2. Remove the T-bar of the **flat-contact**



3. Solder **PTFE wires** (AWG 28 and AWG 22) to the contacts as shown on the picture below. Solder the wires to the **bottom** of the **flat-contact** and to the **top** of the **spring-contact**.
4. Glue the metal contacts onto the nylon parts. Also glue on the cover. Use Pattex EXTREME or Epoxy
5. Attach a thin self-adhesive mirror film to the back of the flat-contact.

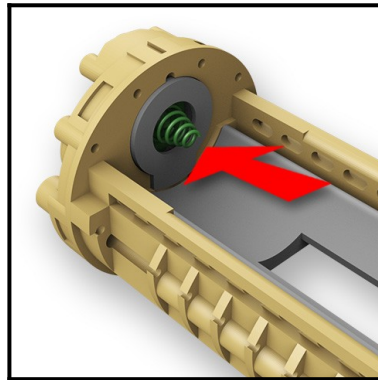


## Battery-contacts installation

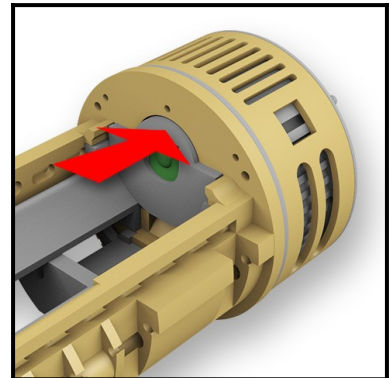
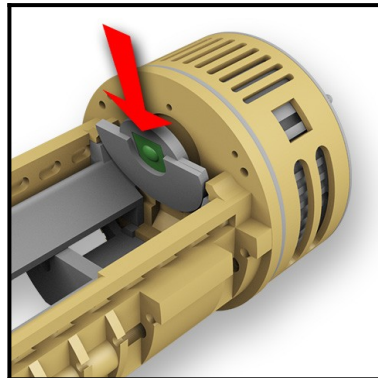
**IMPORTANT:** The battery-contacts will be installed after the center plate!

The **spring-contact** just has to be pushed into the slot.

**No glue needed!**



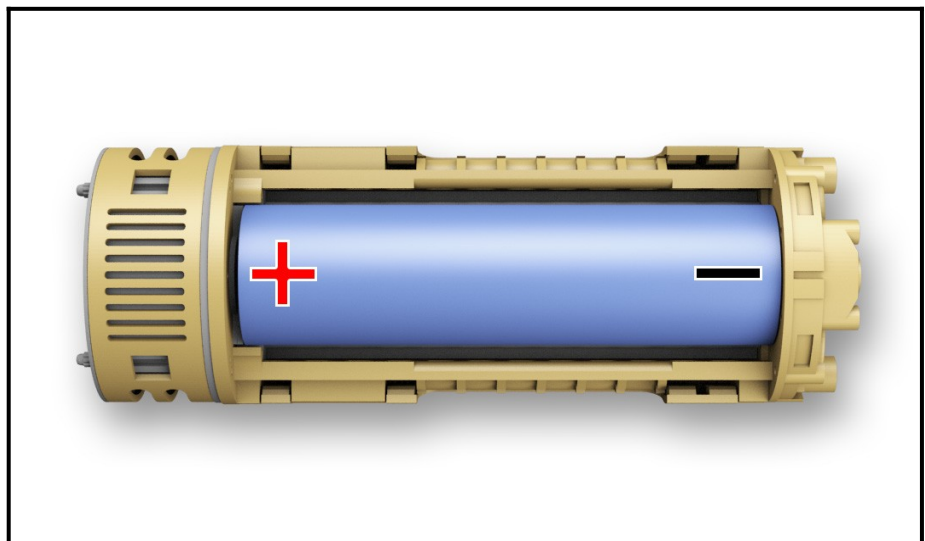
The **flat-contact** must be inserted at an angle of 40°. Then push it down to the final position. **No glue needed!**



## Electric pole orientation

**Front (spring-contact):**  
negative (-)

**Rear (flat-contact):**  
positive (+)



## 7.5 Soundboard cover (Part06)

### Soundboard cover Part 06 adjustments

Adjust the length by sanding the front and back of Part 06 till it fits perfectly into Part 05. If it fits too loose and can be moved sideways, then carefully bend the sides inwards.

Test the fit with installed center plate, switch and switch slider. Also add Part\_06\_Tech and install the 1mm mounting steel rods. Make adjustments if necessary.

**IMPORTANT:** Pay attention to the Part 06 "lip" behind the cut-out of the main switch. This has to line up with the Part 05 rear!



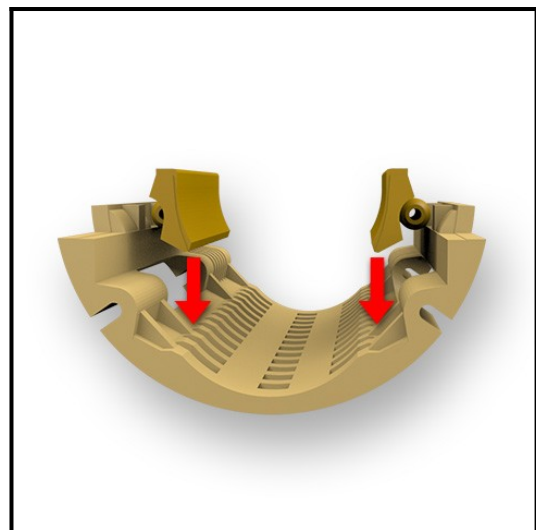
## 7.6 Battery cover (Part07)

### Battery cover Part 07 adjustments

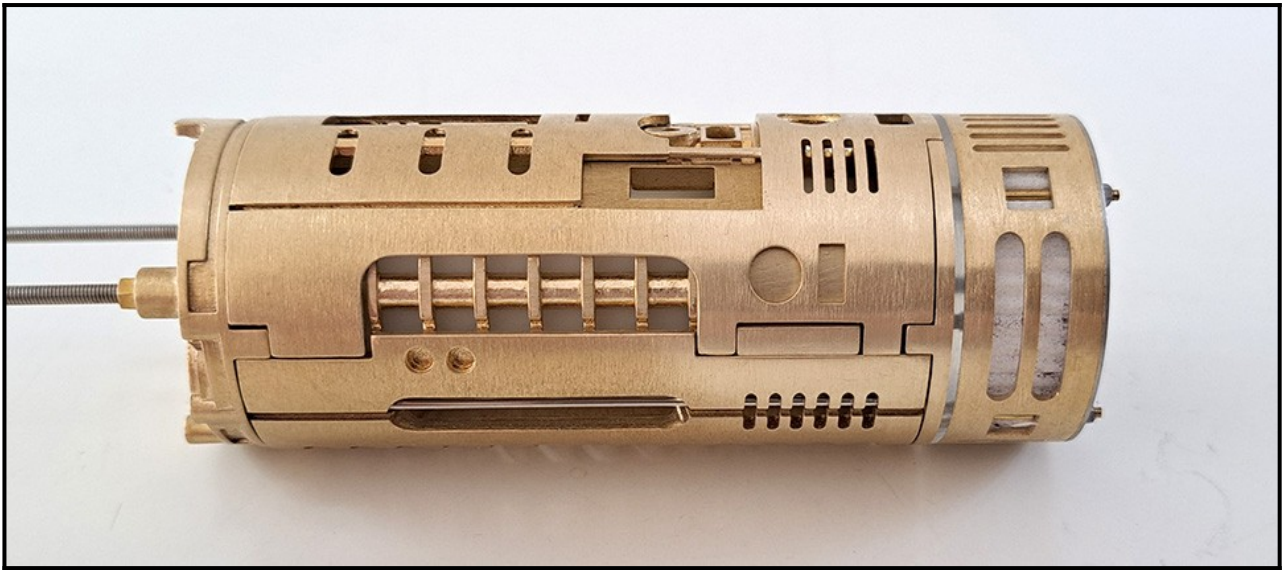
Adjust the length by sanding the front and back of Part 07 till it fits perfectly into Part 05. If it fits too loose and can be moved sideways, then carefully bend the sides inwards.

### Battery side cover installation

1. Check the holes and the fitting of the side cover
2. Glue the two side cover into position
3. Check that the Battery fits in loosely! Make adjustments if necessary!



**IMPORTANT:** First adjust all parts till they fit perfectly before finally assembling them and installing the electronics.



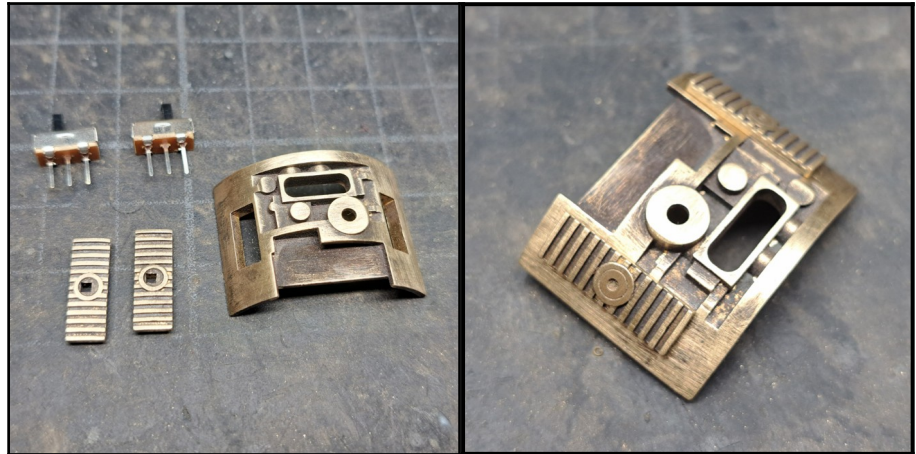
Make adjustments by sanding and bending. Assemble all parts and sand the surface for nice transitions between each part. This takes time and should be done carefully to get a perfect result.

**Assemble the whole chassis without electronics. When everything fit and look perfect, take everything apart again and start installing the electronics.**

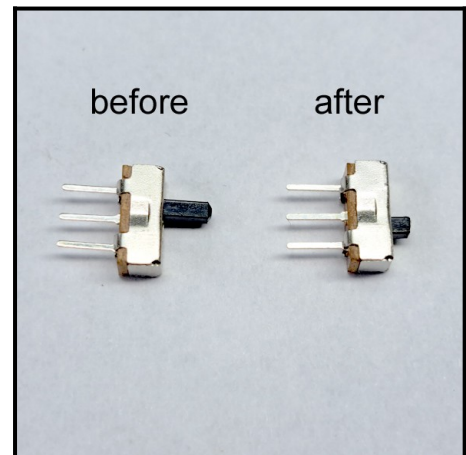
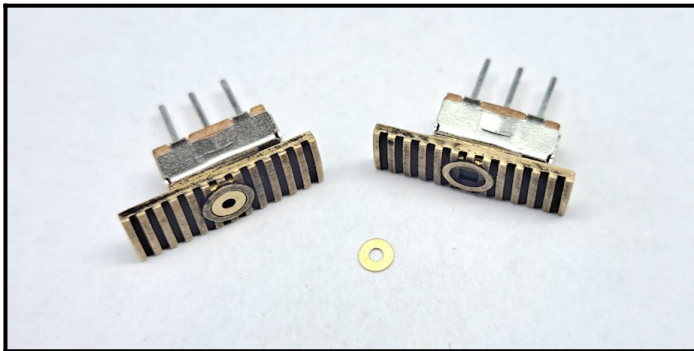


## 7.7 Slide switches (Part 06 Tech)

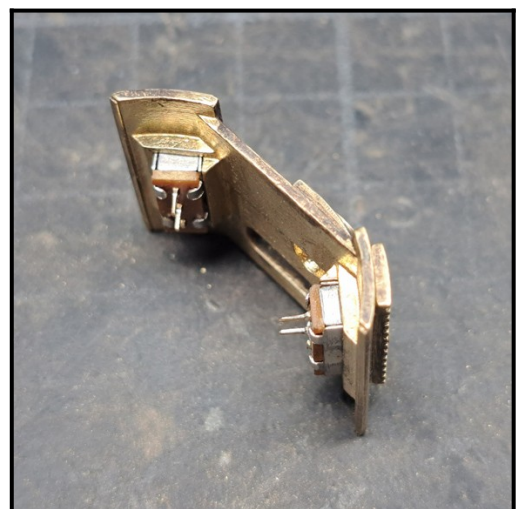
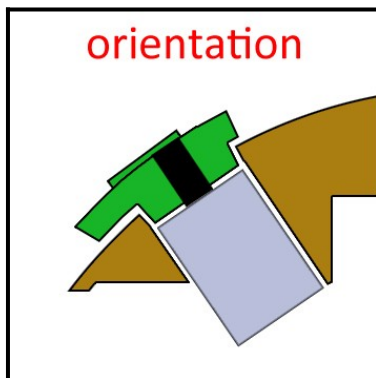
There are two different **Part\_06\_Tech** versions available. One has two installed slide switches. These switches can be used for the motor or illuminated side bars example.



1. Prepare the 3D printed parts. Make them nice and smooth. So the switches can slide easily.
2. Cut two switches to length.
3. Attach the switches to the slider.
4. Attach two washers to the round deepenings (**Loctite 648**).



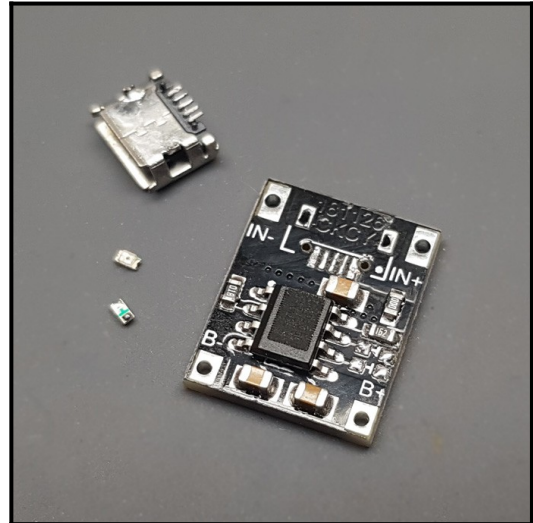
5. Install the two switches into the TECH part.  
**Pay attention to the orientation!**  
**Carefully** use **Loctite 648** or **superglue** to attach them.



## 7.8 Charge PCB

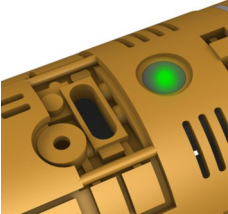

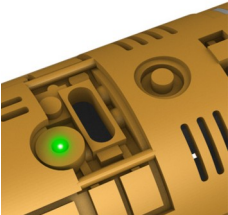

### Preparing the Charge board PCB

1. Remove the USB port
2. Solder a 4cm AWG 28 wire to the **B-** pad
3. If you like to have the two **indicator LEDs** on a different position, remove them.



### External charging indicator LED position

You can add charging indicator LEDs to the chassis cover Part06.  
There are **two different positions** possible:

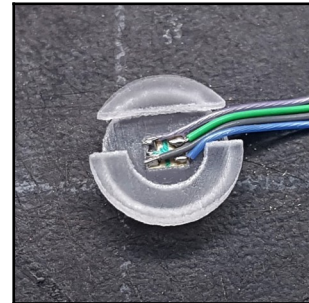
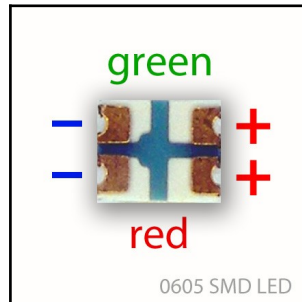
	LED position	Part needed	Link to print part
1			<a href="#">Metal Master 3.0 part 06 LED holder</a>
2			<a href="#">Metal Master 3.0 part 06 detail</a>

### Preparing the SMD charge LED

You need a **0605 Bi-color SMD LED** (usually green/red).

Add 5cm **AWG 34 wires** to the four solder pads.

Depending on where the LED will be placed, glue it into the **Part 06 LED holder** or not.

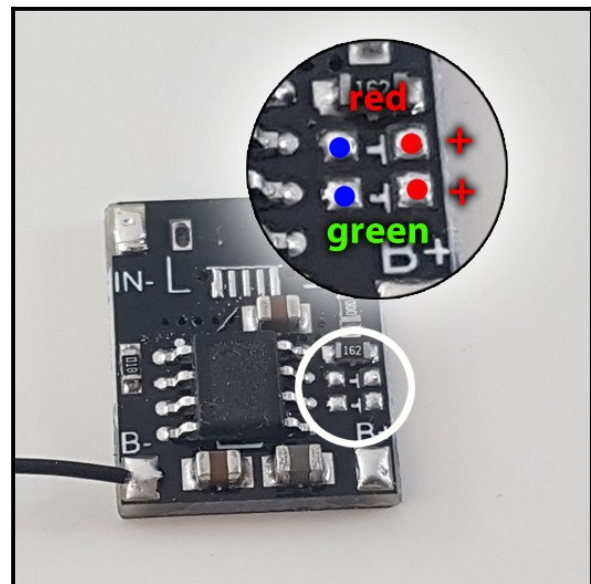


### Wiring the indicator LED to the charge PCB

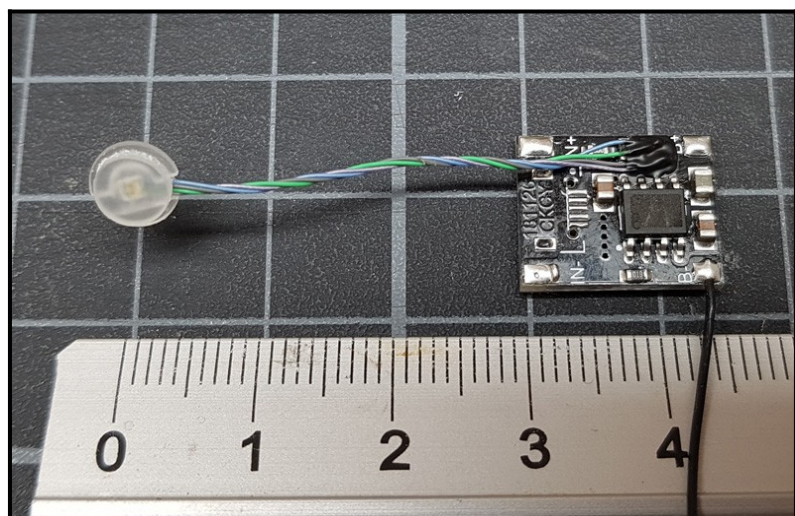
Solder the four AWG 34 LED wires to the pads on the charge-PCB as shown on the picture.

**The wires should be twisted and be at least 4cm long!**

Apply liquid rubber to the solder joints on the LED and PCB for more stabilization.

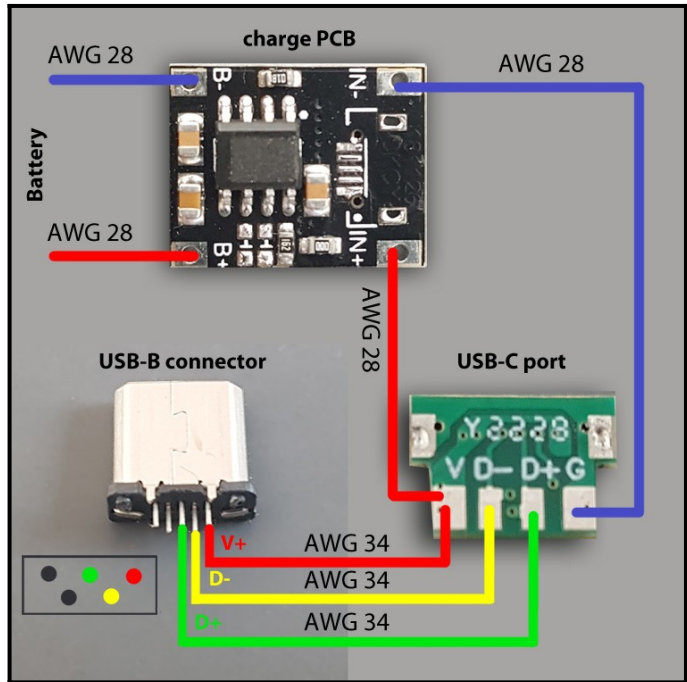
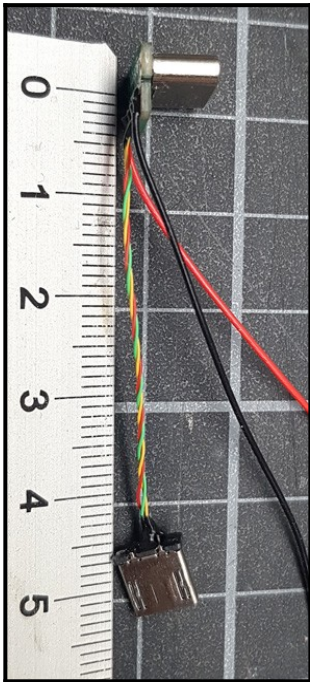


The PCB should now look like this:



### Wiring the USB-C port

The AWG 34 wires should be twisted. For the USB-C port the wire bridge should be at least 4cm long. Add liquid rubber to the solder joints for protection.



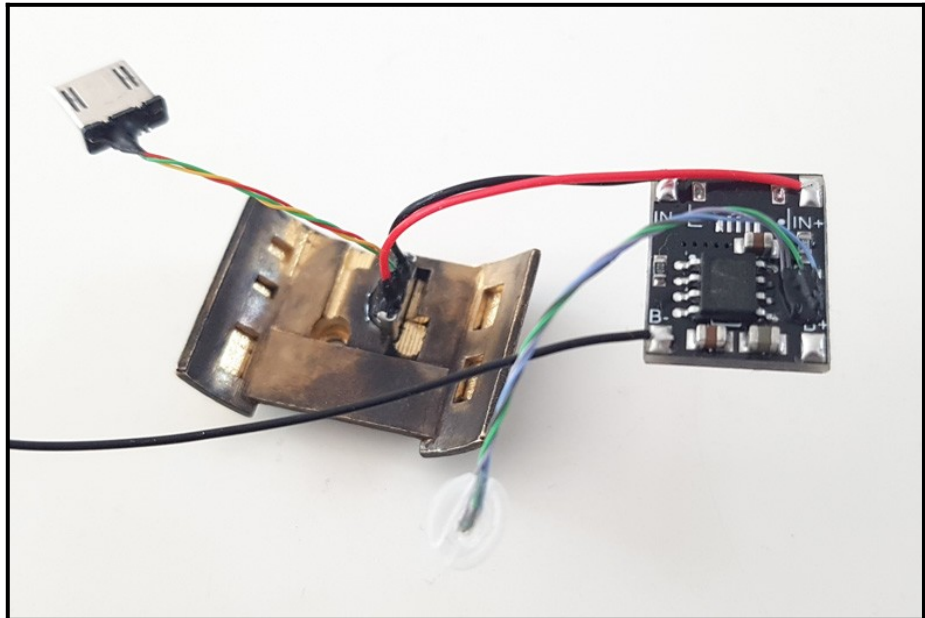
### Attaching the USB port to the chassis Part 06 Tech

Solder the AWG 28 wires to the charge PCB (IN-/IN+).

**Wire length:** red 5.5cm / black 4.5cm

Install the USB-C port into **Part\_06\_Tech**. Make it fit first. Maybe some sanding is needed. Then place it into the slot.

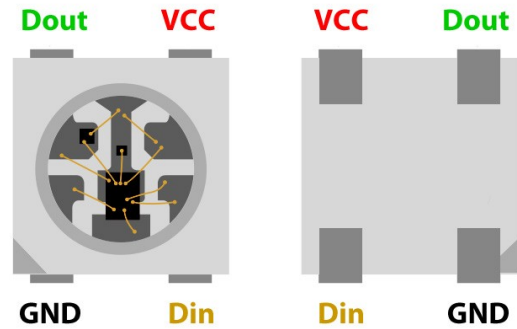
Add some (a needle tip) **Loctite 648**. Let it flow between the port and slot. **Do not let it drip into the port!**



## 7.9 Accent LED/Pixel

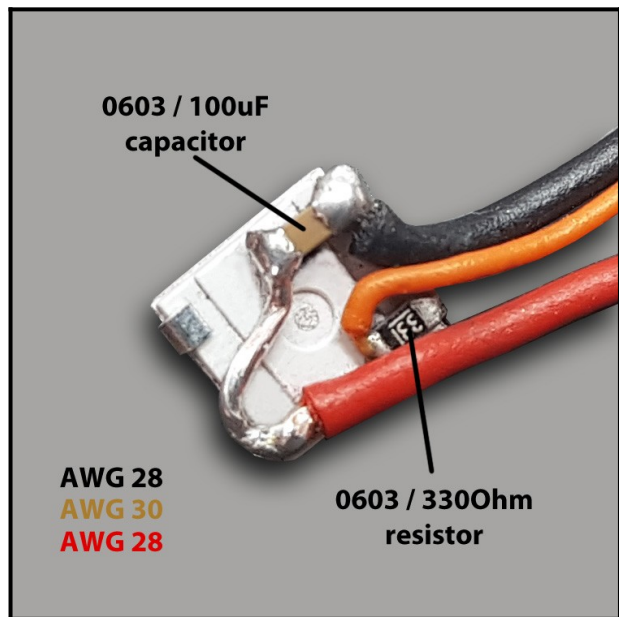
### Preparing 5050 RGB Pixel LED

Because there is not much space for accent LED/Pixel, **single pixel without PCB** have to be used. In this case a common LED SMD 5050 RGB **WS2812B** is used.



Solder the wires as shown in the picture

**Din:** AWG 30  
**VCC:** AWG 28 – AWG 30  
**GND:** AWG 28 – AWG 30  
**capacitor:** 100uF  
**resistor:** 330 Ohm



### Crystal chamber 5050 RGB Pixel installation

Add the wired pixel to both crystal holder.  
The picture shows the position of the 5050 pixels...  
Glue them in.

The wires pointing up! (Not shown in the pictures)

**Make sure the solder pads do not touch the metal parts!**  
**Insulate them with liquid rubber!**

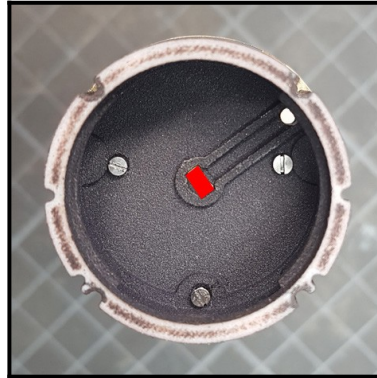
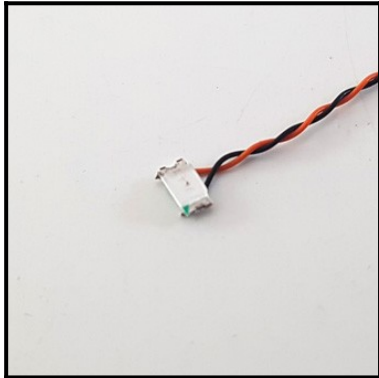
You can glue a 10mm washer onto Part02D for a nicer look.



### Speaker chamber accent LED installation

The speaker chamber has got a slot for one **1206 smd LED** or one **small pixel LED**.

Glue the smd LED into this slot directly onto the spacer. Lead the wires to and through the through hole.

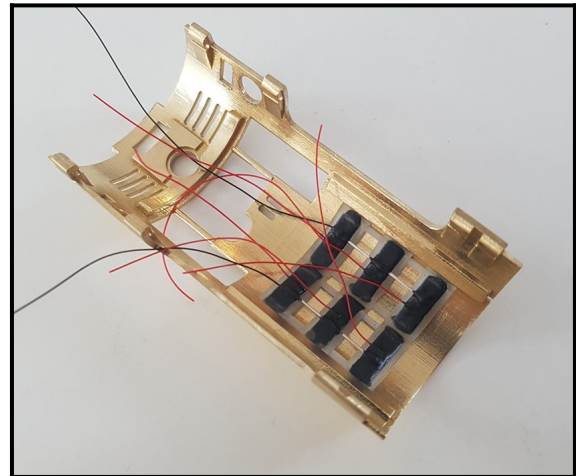
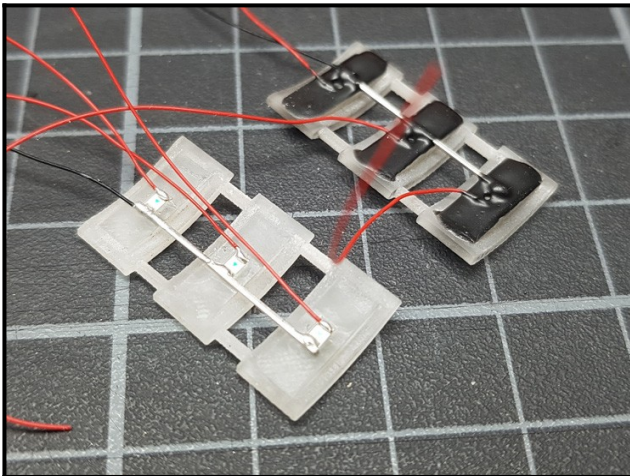


### Top cover (Part 06) accent LED installation

Most Part06 LED holder are designed for **0805 SMD LEDs**.

Glue the LEDs into the indentations and solder AWE 34 wires to the solder pads. Insulate everything with liquid rubber. Then push the holder into the guide rail. (Maybe some tape or glue is necessary to hold it in position).

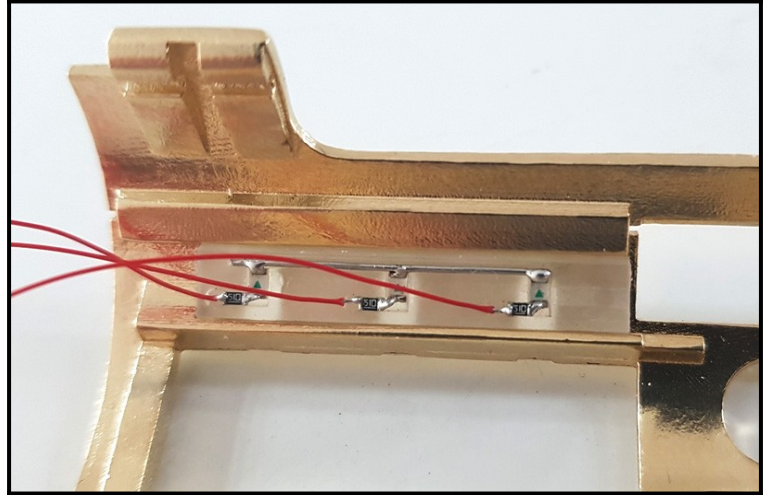
It can also look good to add translucent white adhesive film onto the holder.



### Part 06 Oled accent LEDs

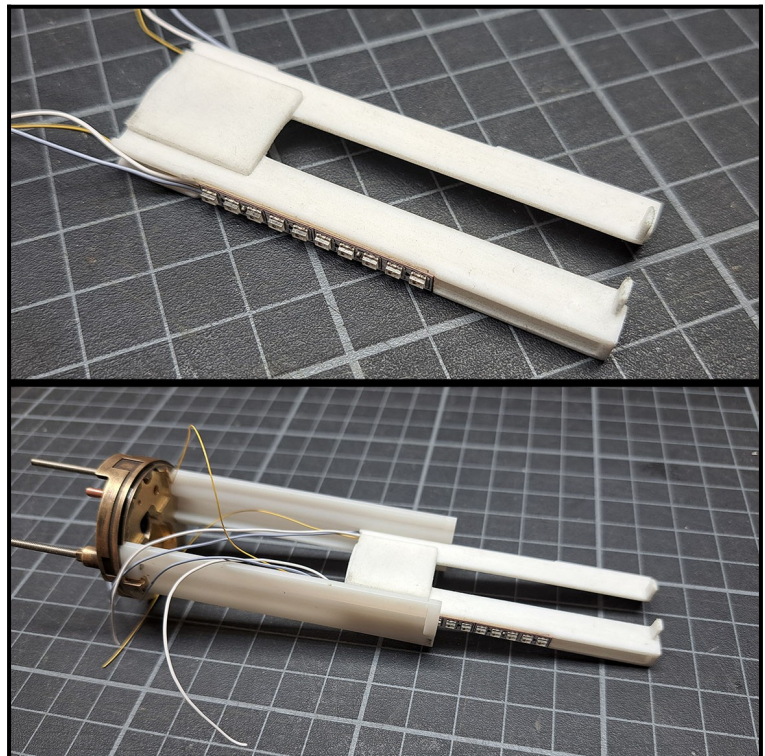
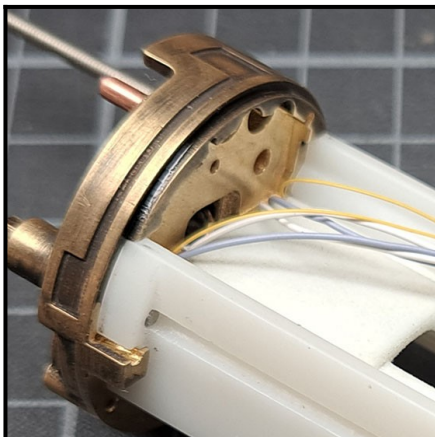
The **Part06 Oled** has his own accent LED holder design. It's designed for **0805 SMD** LEDs. It also has slots for 0603 smd resistors for each LED.

1. Glue the smd LEDs into the slots. Pay attention to the orientation.
2. Add the resistors and solder them to the LEDs.
3. Add a long pin to connect all negative poles. Solder it to each LED.
4. Solder AWG 34 wires to each resistor and one to the pin.
5. Cover everything with liquid rubber.



### Part 05 PRO side panel pixel strip

Use two thin and small high quality pixel strips. Solder AWG 30 wires and install the pixel strips on the center plate of part 05. Then push the center plate between the Part 05 side panels. Lead the wires to the front.



## 7.10 Oled Display

The top cover **Metal Master 06 Oled** is designed to integrate a standard Oled display with **128×32 pixel resolution**.



### Oled display modifications

Before the Oled display can be installed into the chassis cover, it has to be modified. Otherwise it would not fit. The modification is simple...

**1.** Remove the display carefully from the board. It is held by a double-sided adhesive film. Remove this film and replace it with a thin double-sided adhesive film.

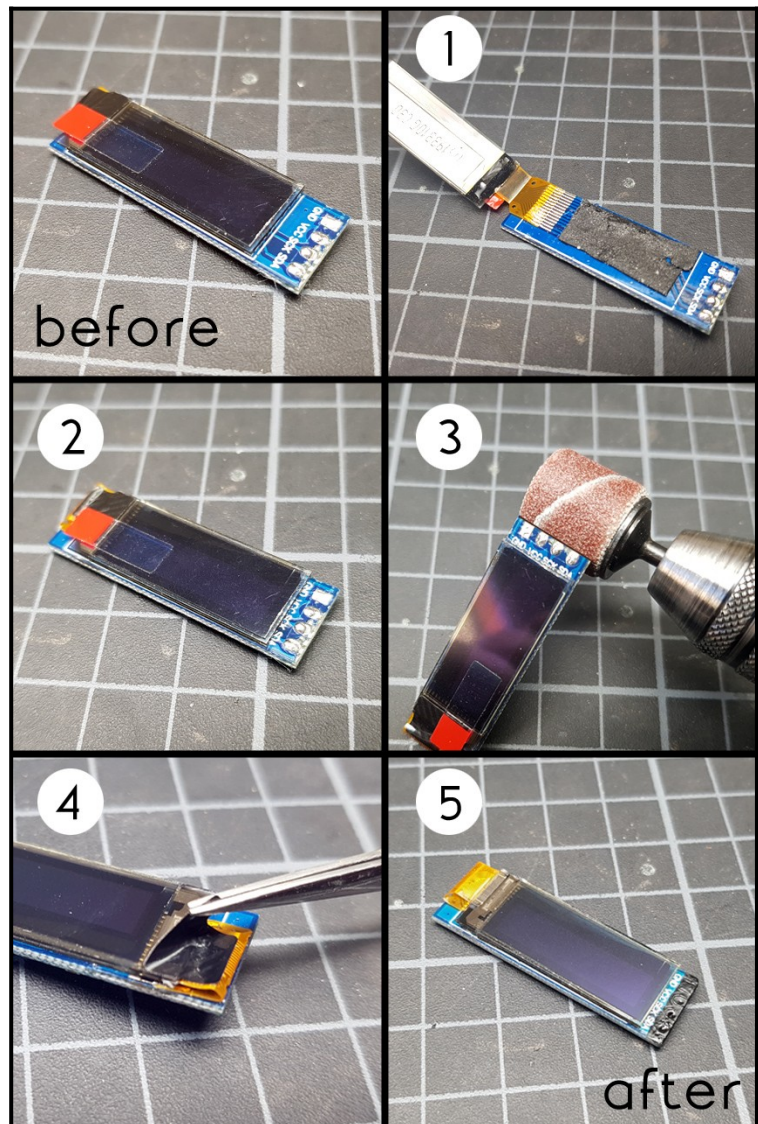
**Be careful with the flat flexible wire.**

**2.** Place the display back onto the board. But change the position 2mm to the front.

**3.** Reduce the length of the board. Remove 1-2mm material up to the solder joints.

**4.** Remove the black protection foil from the flat wire behind the display.

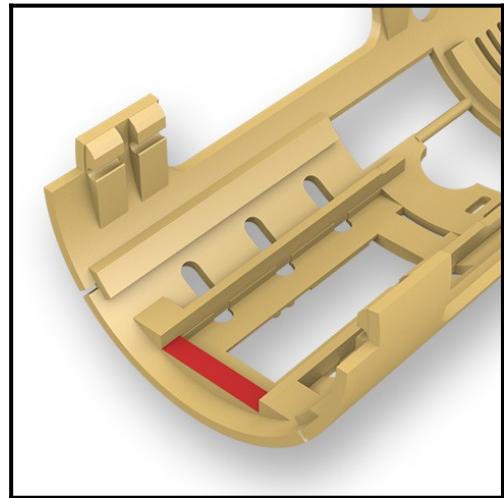
**5.** Cover and insulate the solder joints with liquid rubber and tape.



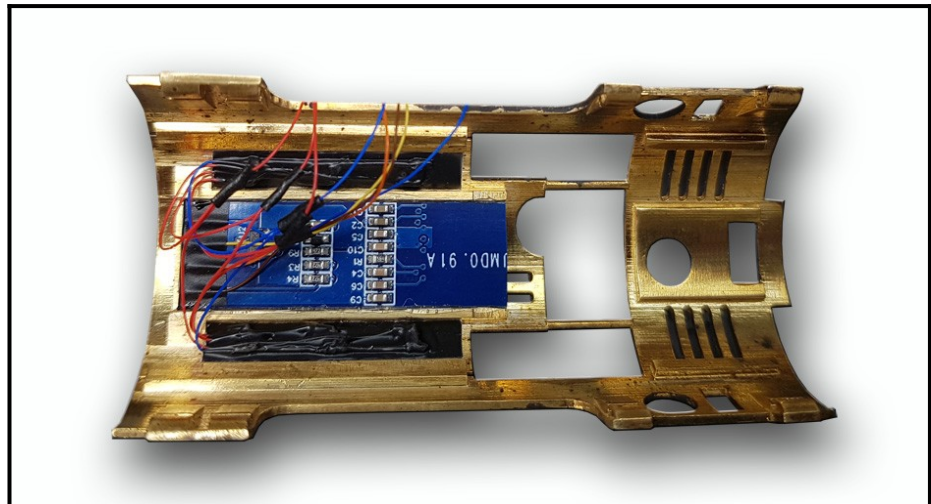


## Oled display installation

1. Solder AWG 34 wires to the four pads in **PCB direction**.
2. Insulate the solder pads with liquid rubber and adhesive film.
3. Apply thin **adhesive film** to the top end of the Oled window as marked in red in the picture on the right.
4. Apply Pattex extreme repair glue (or similar) to the **long sides** of the Oled PCB.
5. Push the Oled display into the frame



This is how the attached Oled display and accent LEDs should look like...

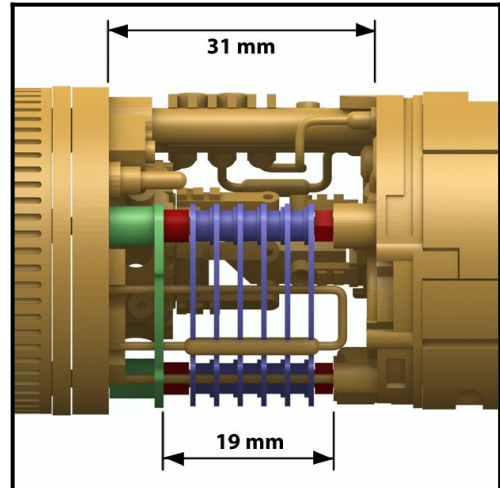


## 7.11 Fins installation (3D printed or laser cut)

### Fin variations

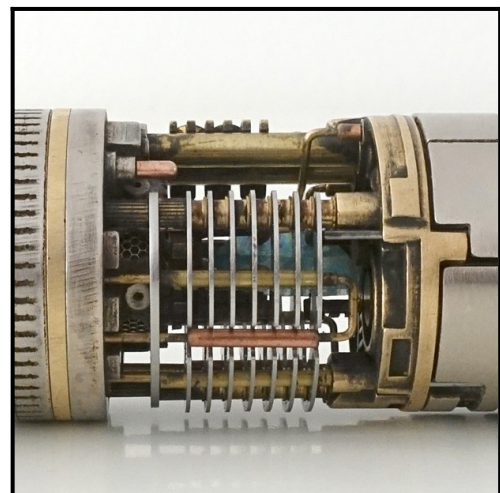
It is possible to use either 3D printed **Part04 fins** or **laser cut fins** (from [www.mb-sabers.com](http://www.mb-sabers.com)) with M2 spacer. It doesn't matter what kind of spacer are used or how many fins. Important is only to keep the chamber length equal or smaller than 31mm.

So, if six **0.5mm laser cut fins** are used, **2.2mm spacer** are necessary to make sure the chamber is not longer than 31mm.



This is the steel **fin setup** with the laser cut fins from **mb-sabers.com**.

It contains seven 0.5mm brass fins, 6 threaded spacer and one 1mm steel fin (replacing Shapeways Part 02 C).

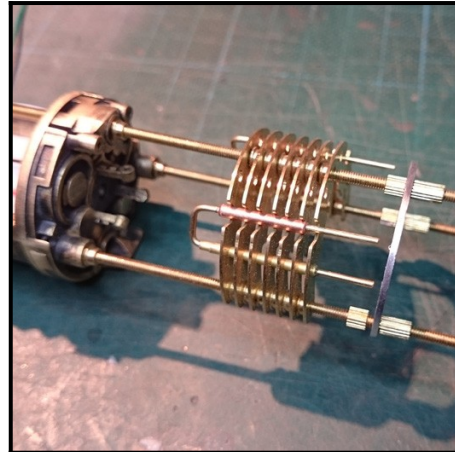
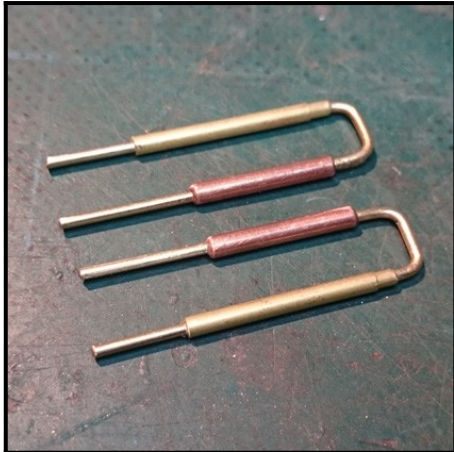


## Preparing the U-rods

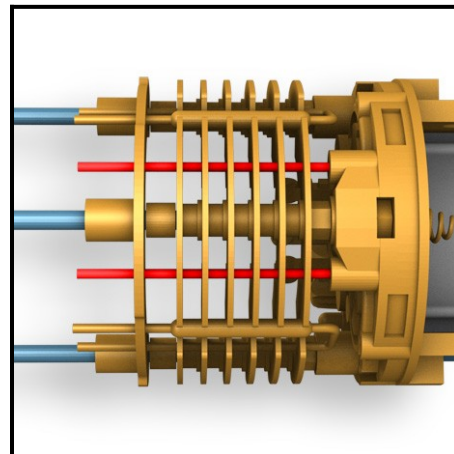
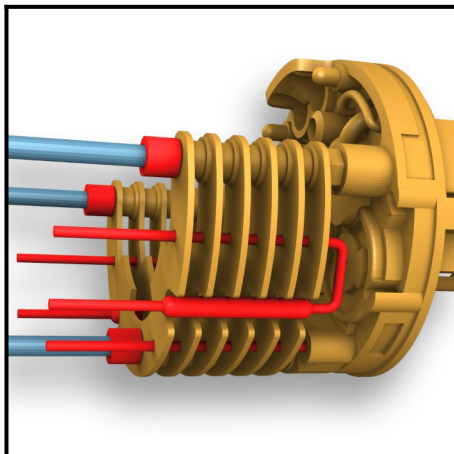
The **U-rods** for the fins are a design element, which can also be modified. You need at least two 70mm rods with 1mm diameter.

Bend them with **round nose pliers** to the U-shape you can see on the pictures. The distance between both ends is 5.5mm.

The next pictures show **advanced U-rod designs**. Some 2mm diameter tubes were added. These U-rods can be combined with the **fin**s from the mb-sabers.com shop.



1. Install the U-rods together with the fins.
2. Add a **M2 nut** or a 3mm long **threaded spacer** to each threaded rod to hold the fins in place. **Hand-tighten each nut.**
3. Install the **short rods** into the lower fin holes. The rods should be 35-37mm long.
4. Add the **3D printed Part03** or the 1mm steel fin with the 5mm threaded spacer.



## 7.12 Crystal chamber (Part 02)

**1. Stick two brass tubes** (35mm long / 4mm diameter) into the two holes from Part\_02\_A.

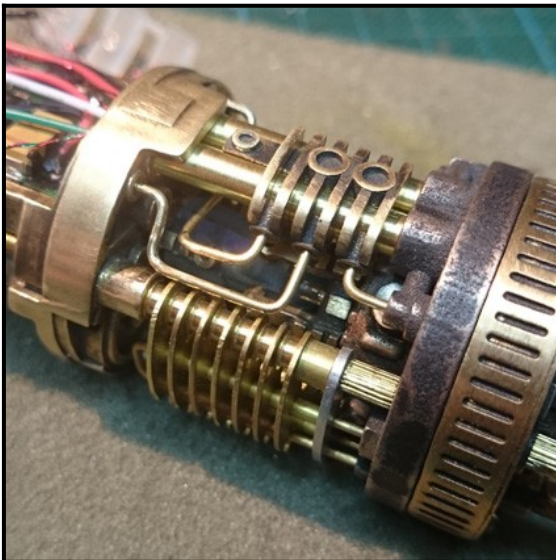
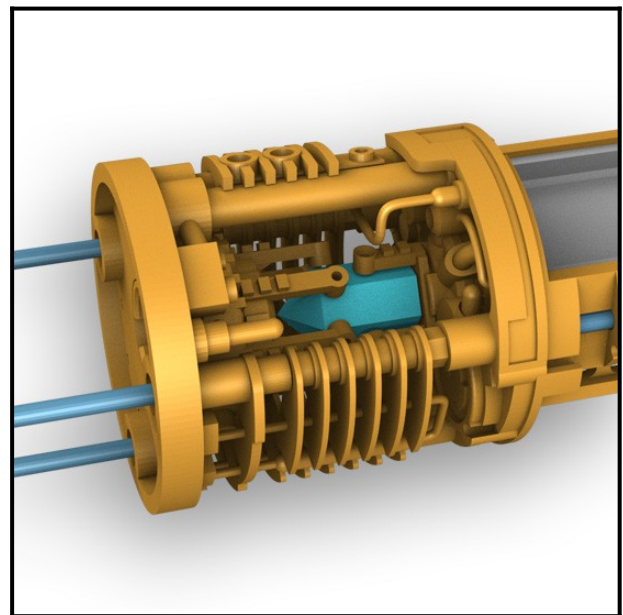
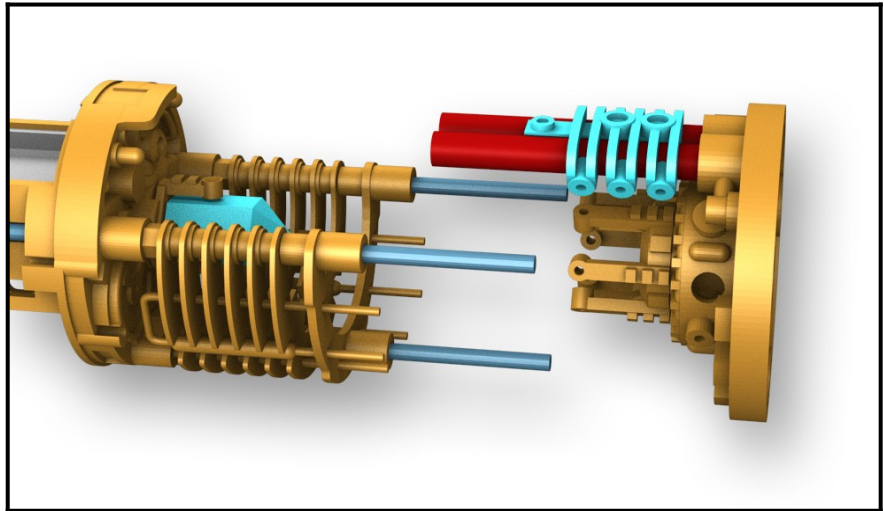
**2. Slide the 3D printed tubes-add-on** loose over the tubes. **Don't glue it on.**

**3. Install the crystal**

**4. Place Part\_02 with installed brass tubes** over the three threaded main threaded rods

**5. Install crystal-chamber metal wire details.** This step is up to you. You can add details to the crystal-chamber the way you like.

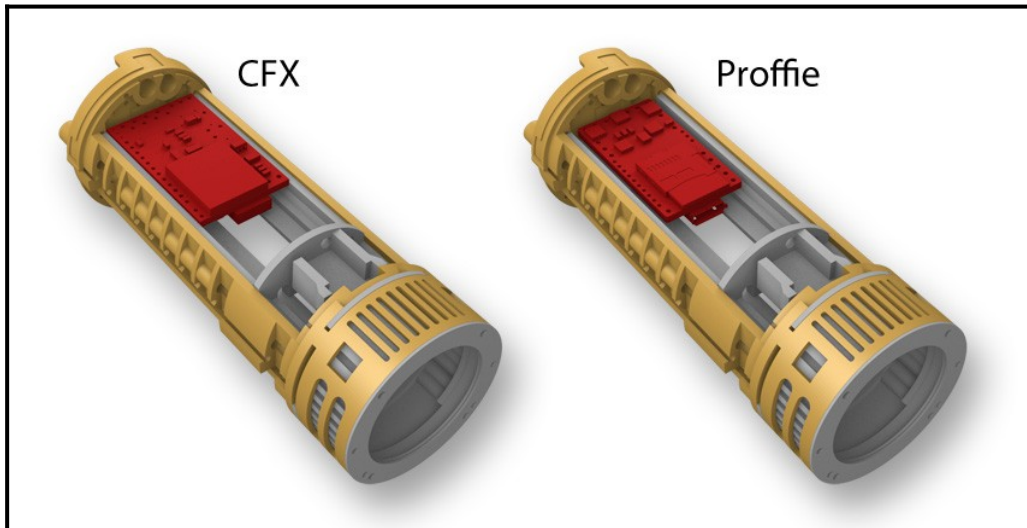
**This is an example:**



## 7.13 Electronics installation

Now it's time to install The Soundboard, Main Power-Switch and Speaker.

### Soundboard position

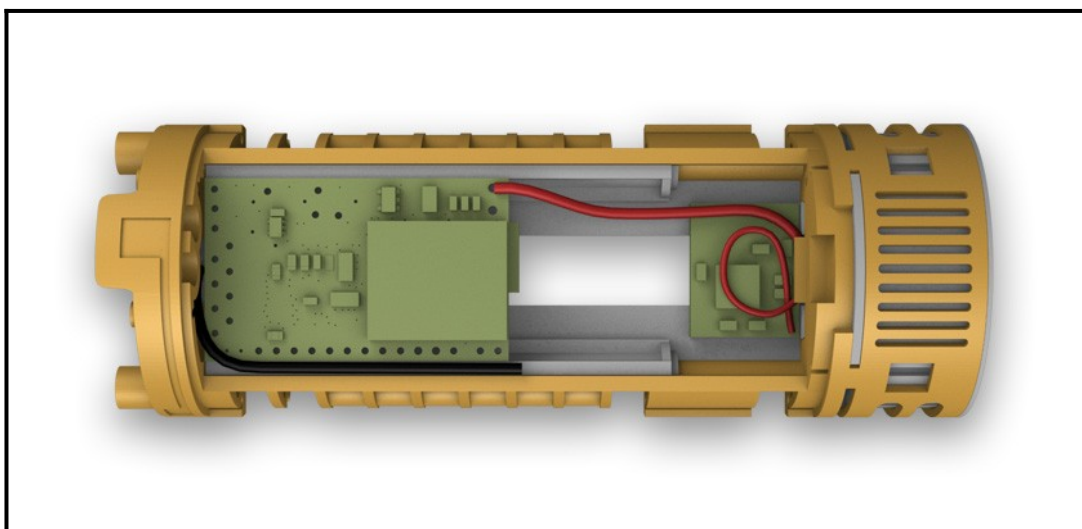


#### **Attach the Soundboard.**

**The soundboard is clamped into the soundboard-holder.** In addition, a double-sided adhesive tape should be attached under the soundboard.

### Battery contact wire positions

This picture shows the position for the **Soundboard**, **charge-PCB** and the **wires** from both battery contacts.

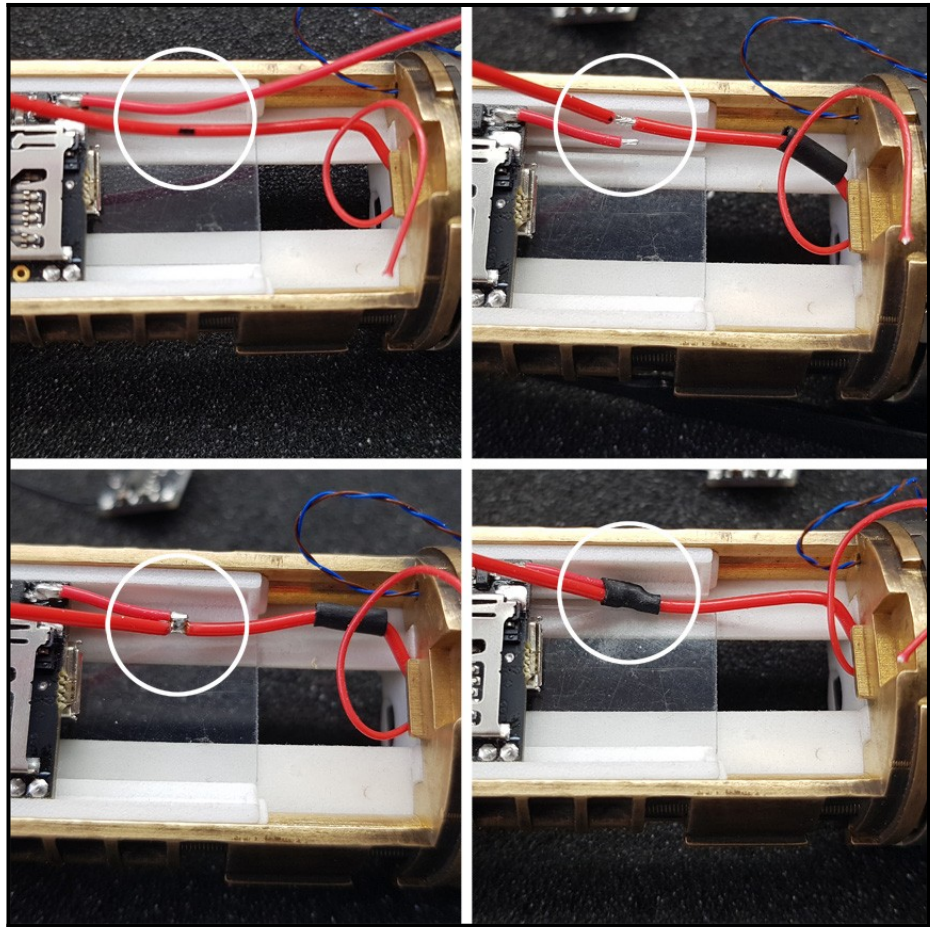


## Soundboard - Blade power junction

The **NeoPixel blade** will be powered directly from battery +. So, the wire from battery needs a junction as shown in the pictures.

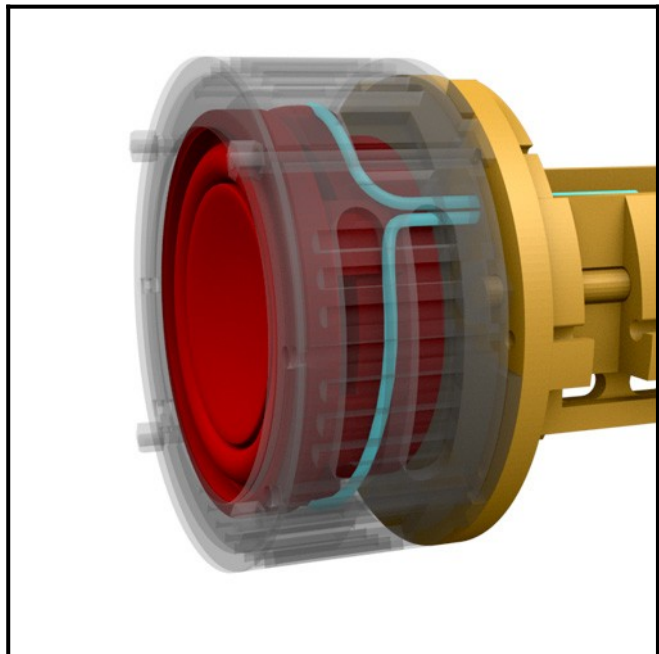
### Other option:

Most Soundboards have two Vin(+) solder pads. One on each side. Use one for Vin(+). And the other one for the Pixel Blade power wire.



## Speaker installation

1. Solder **AWG 26 wire** to a 28mm speaker.
2. Rout the wires through the hole inside the speaker chamber.
3. Push the speaker carefully into the chamber. Make sure it's rotated correctly!  
**Solder joints pointing up and down.** As shown in the picture.
4. Install the inner and outer speaker cover ring.



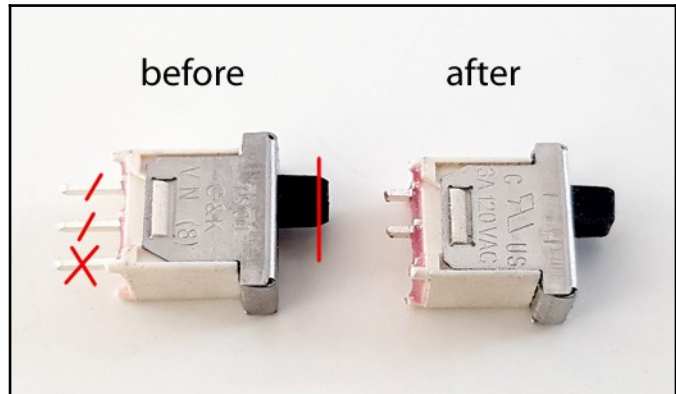
### Main Power-Switch TS01CQE

Buy it at [DigiKey](#)

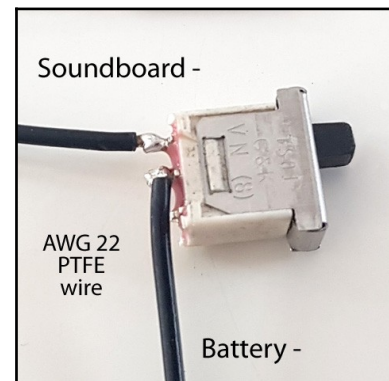
Metal Master 3.0 is designed for [TS01CQE 3A](#) switch. This switch can handle high current and is best for Pixel blade sabers.

The switch has to be modified first. As shown on the pictures.

1. Remove one pin.
2. Shorten the other two pins.
3. Shorten the slider.

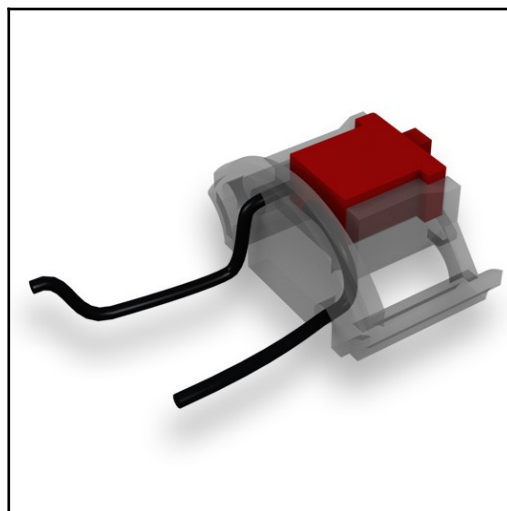


Add 5cm AWG 22 PTFE wire to the two pins as shown in the picture.



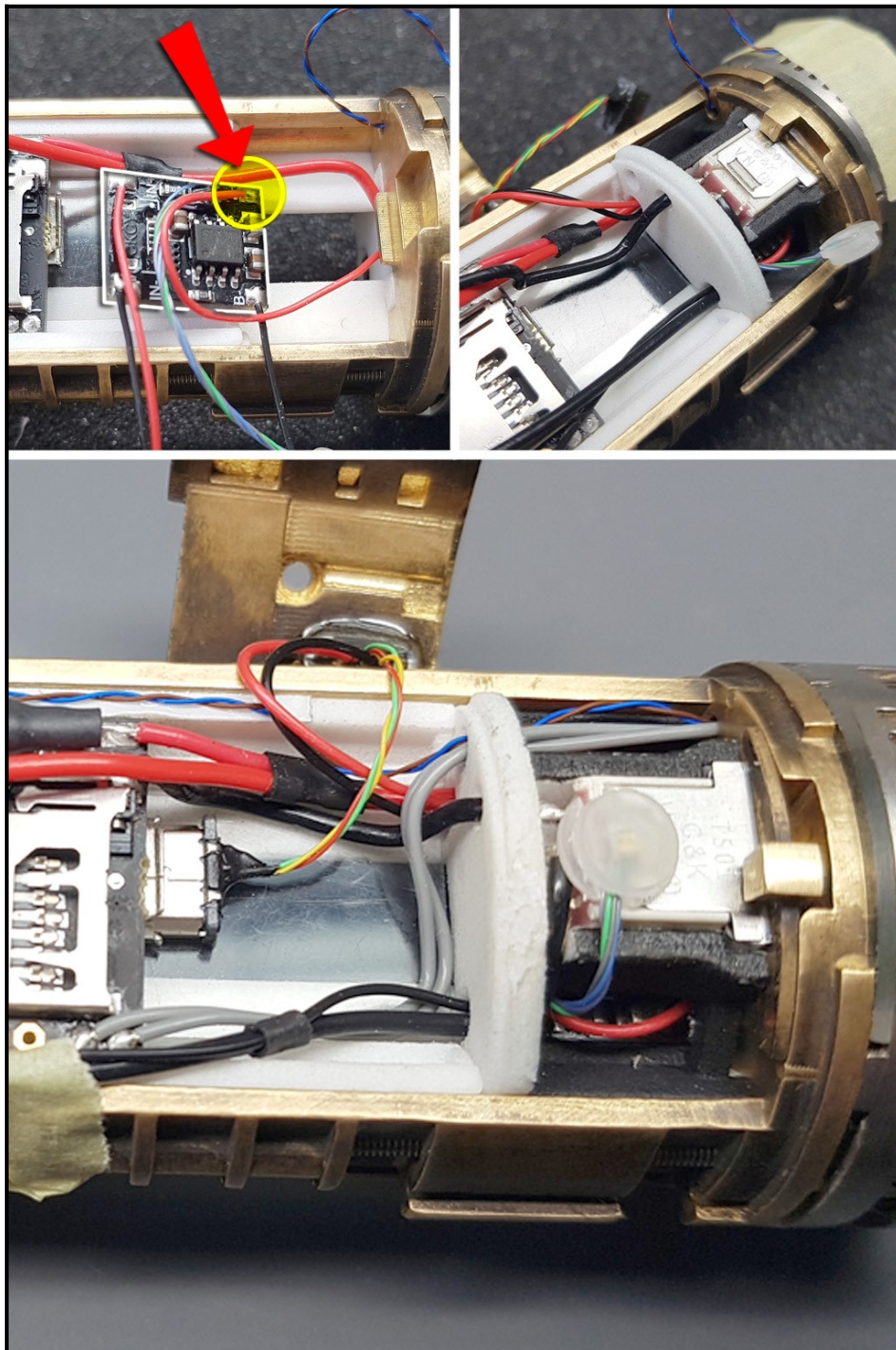
### Power-Switch holder wire routing

Place the switch into the holder and rout the wires as shown in the picture. **No glue needed!**



### Adding the Power-Switch and charge-PCB / USB port

1. Install the main power switch into the switch holder.
2. Solder the AWG 30 wire from battery positive to the prepared charge-PCB **B+ pad**.
3. Place the **charge PCB** in position **below the switch holder**. **No glue needed**.
4. Install the switch holder. Guide the wires as shown on the pictures.
5. Solder the wires coming from the switch to the Soundboard negative pad and to the wire which leads to the battery negative.
6. Solder the **speaker wires** (gray) to the Soundboard. Rout the wires as shown in the picture.
7. Place the **charge indicator LED** above the main power switch



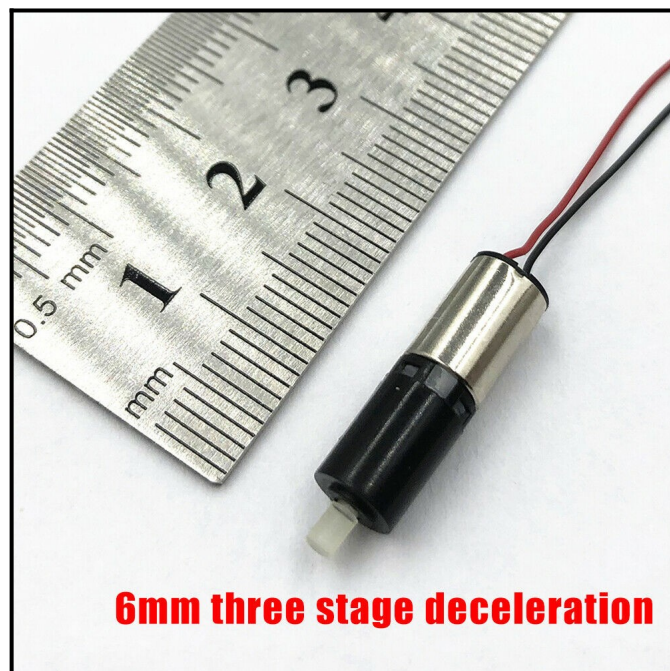


## 7.14 Spinning Plasma Gate (Part 01) + hatches

The **Spinning Plasma Gate (SPG)** is only available for **mb-Sabers' EMITTER Blade holder**. It is compatible with all mb-Sabers Graflex chassis. Old Part\_01 versions can easily be replaced. It includes a spinning object called the spinner.

### Required additional parts for the SPG

- 3x 28.5 mm **steel tubes** with 3mm outer diameter and thin wall [Link to shop](#)
- 3x 15mm **brass tubes** with **4mm outer** and **2mm inner** diameter [Link to shop](#)
- 3x 40mm steel **threaded rods** M2
- 2x **bearing** (dimensions are listed in the description below) [Link to shop](#)
- 9x M2 **model-nuts (steel)** [Link to shop](#)
- 3x 3mm M2 spacer
- 3mm **LED**, 5mm LED or pixel LED [Link to shop](#)
- LED holder [Link to shop](#)
- electronic **motor with gear installed (200 rpm) 6mm diameter!** [Link to shop](#)



## Part 01 front setup

### **Smooth contact surfaces**

Use a flat and even ground to sand the surfaces nice and even.  
Use 240 grid.  
This ensures that the Emitter can be attached perfectly aligned.

### **Smooth the outer shape**

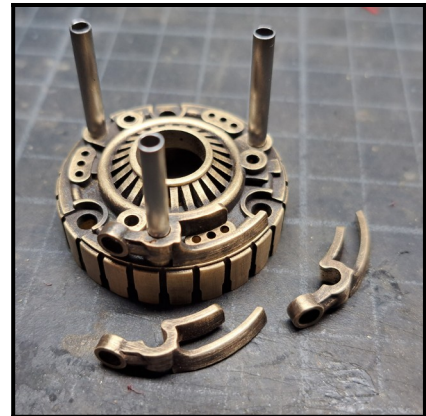
Use a grinding machine (80-150 grid) with a 90° table to smooth the outer shape of Part 01 front.



Add three **thin walled steel tubes** (3mm diameter 28,5mm length) to **Part\_01\_back**. Make sure they are aligned well!  
Then glue them in with **Loctite 648**.

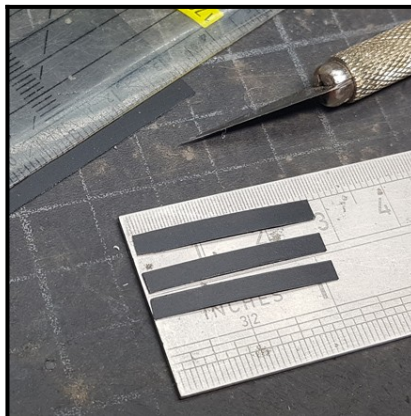
**Make sure the ends are smooth without sharp edges.**  
**Otherwise electric wires could get damaged!**

Remove the sprues from the three 3D printed detail parts.  
Place them over the three steel tubes and glue them on with **Loctite 648**.



### **Add vent cover**

Use black or black covered plastic sheets to cover the part 01 vents. It's not necessary to glue them in.



## Threaded rod setup

### Required additional parts

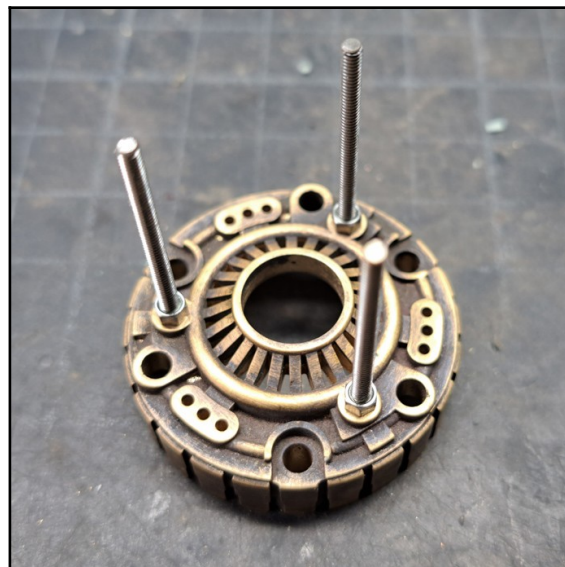
- 3x 33.7mm steel **threaded rods** M2 [Link to shop](#)
- 3x 15mm **brass tubes** with 4mm outer and 2mm inner diameter [Link to shop](#)
- 12x M2 **model-nuts** (steel) [Link to shop](#)

**Part\_01\_front** and **Part\_01\_back** are connected by three **33.7mm** threaded **M2** steel rods. Each rod gets a **15mm brass tube** as spacer (4mm outside/2mm inside). These tubes **MUST** have the same **exact length (+/- 0.05mm)** AND both ends should be **parallel**. Together with **two 3mm M2 spacer**, holding the tube in position, the length should be 21mm (+0.0mm/- 1mm). **These additional spacer are necessary!**

**The first spacer nut (marked in red) should be glued onto the threaded rod. Use Loctite 648.**



Attache the threaded rods to **Part01 front**. Add a washer and a nut to each and fasten the nuts.



## Plasma Gate hatches

### Required additional parts for the SPG hatches

- steel rods 1mm (hard steel) [Link to shop](#)
- brass tube 1.5mm/1.1mm [Link to shop](#)
- 6x round magnets 1mm x 4mm [Link to shop](#)

#### **1. Preparing the 3D printed parts**

Remove the sprues from the **3D printed hatch parts**.

Cut M1.2 threads into the mounting holes for the covers.

Check all hinge holes. Clean them. The steel rod must slide in easily!

#### **2. Drilling the pin notches**

The Gate Hatches are actually a loose construction which adjusts the position by itself.

The hinge holders (*Part\_01\_hatch\_A*) are not glued or screwed to the plasma gate tubes.

The three hinge holders are placed loose over the three wire tube and the **three 15mm brass spacer tubes**.

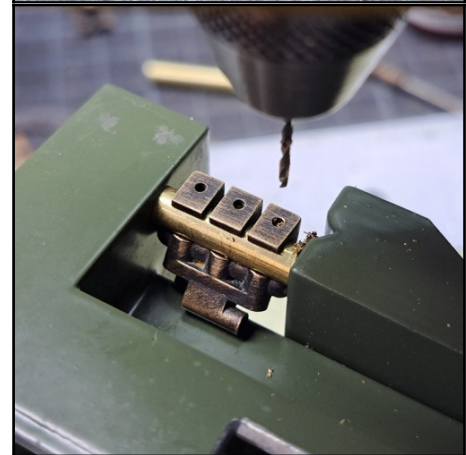
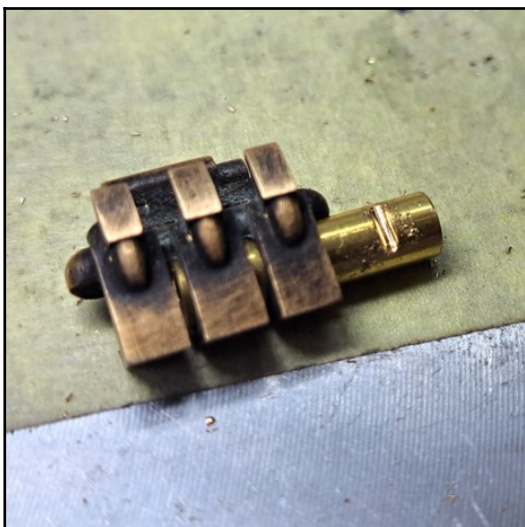
The hinge holders will be hold in position **by three pins**.

For these pins each of the three brass spacer tubes need a **pin notch**.

**2.1** Stick the brass spacer tube into the hinge holder and clamp both in a small vice as shown on the picture.

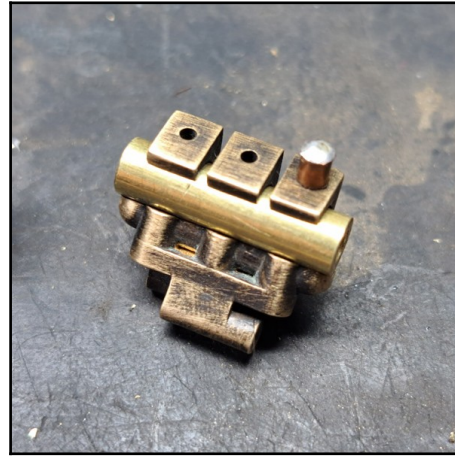
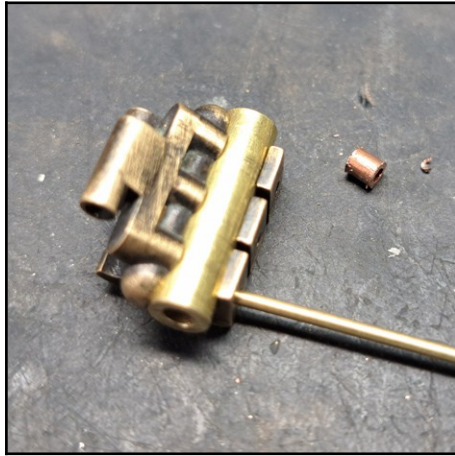
**2.2** Use a drill stand with a 1mm drill head to drill through the first hole from the right into the the brass tube.

**It should now look like this:**



### 3. Preparing the pins

Use a 2mm/1mm brass or bronze tube for the pin-head. Cut it to 2mm length. Solder a 1mm brass rod into the pin-head. Adjust the length of the pin for perfect fit.

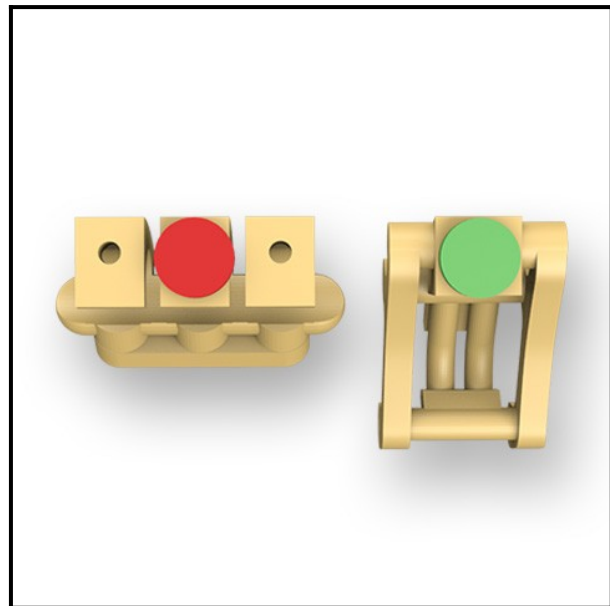


### 4. Adding the hatch magnets

Use six round **magnets (4mm x 1mm)** and place them onto the center of each 3D printed hatch part (as shown in the picture).

First place a magnet onto the part and adjust the position. Then carefully add Loctite 648 and let it flow under the magnet. Let it dry.

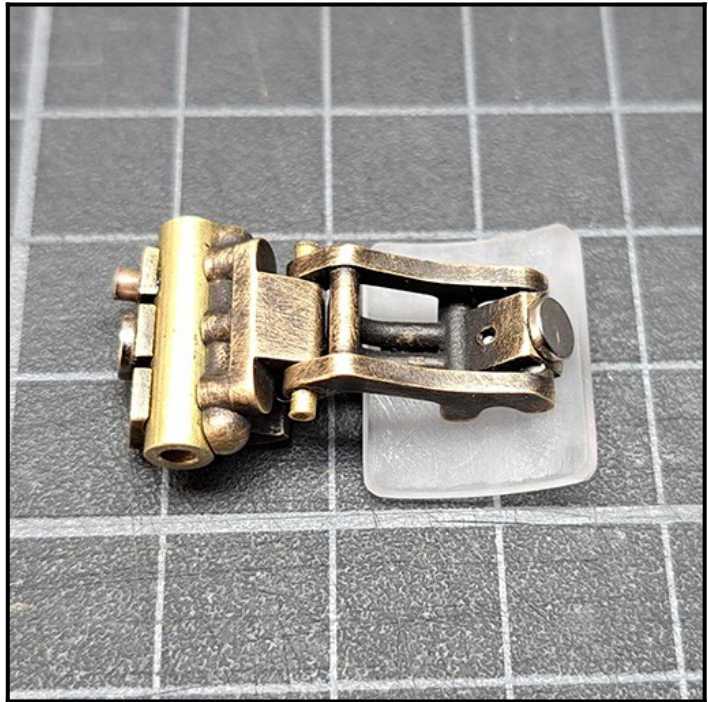
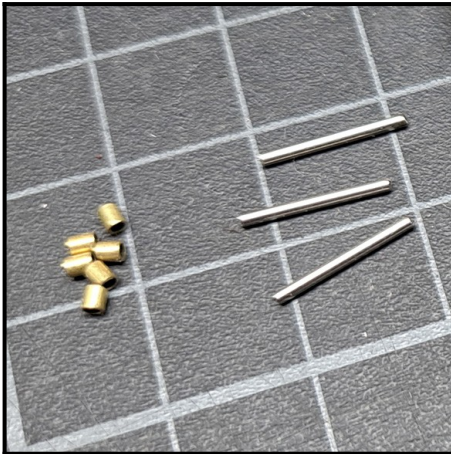
**IMPORTANT: Don't mix up the poles!**



## 5. Installing the hinge-rods

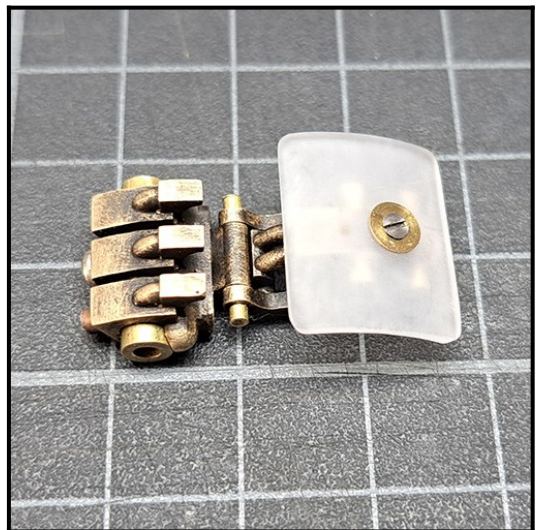
The hatches are attached by three 12 mm long steel rods.  
The rods are installed with small sleeves at each end.  
Cut a 1.5 mm/1.1 mm diameter brass tube into 2 mm long sleeves.  
Two for each hinge. Altogether 6 sleeves

The small 2mm tubes are fixed to the hinge-rods with **Loctite 648**.



## 6. Installing the hatch cover

The 3D printed hatch part has a 1mm hole for a M1.2 thread. You can attach whatever you want to it. Usually three 3D printed covers are attached by a M1.2 screw and a M2 washer.



## 7. Adding the hatches to the Plasma Gate

Place the assembled hatches with the attached tubes over the Plasma Gate M2 rods and add the second 3mm long M2 spacer to hold the hatches in position.



## Spinner and motor installation

Use a small 6mm diameter electric motor with attached gear.

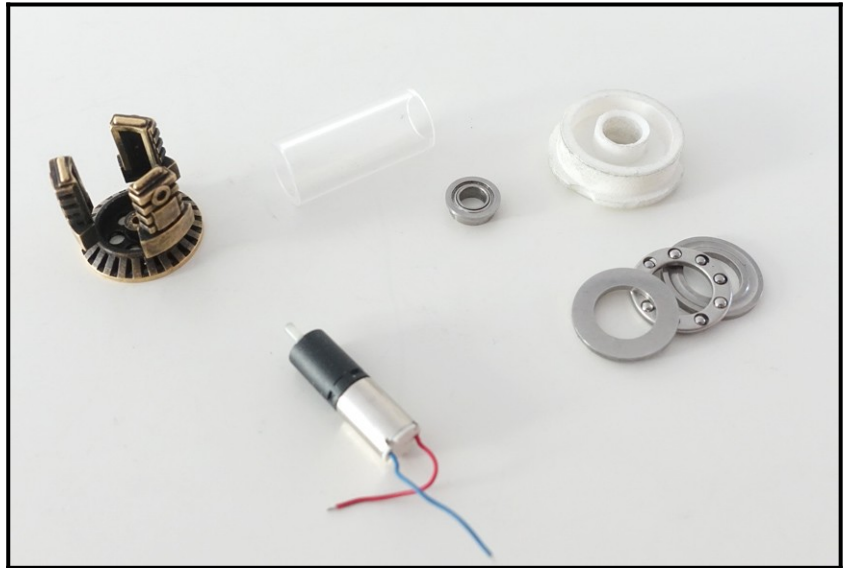
**Depending on the manufacturer, the motors have different shaft diameter.** Some have 2mm others have 1.5mm or less.

The "Spinner" has a 1mm hole.

**Adjust the hole size to the shaft size.**

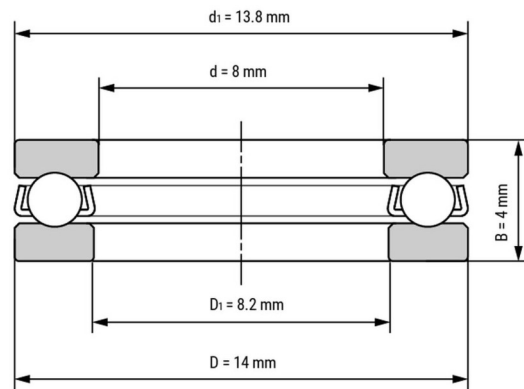
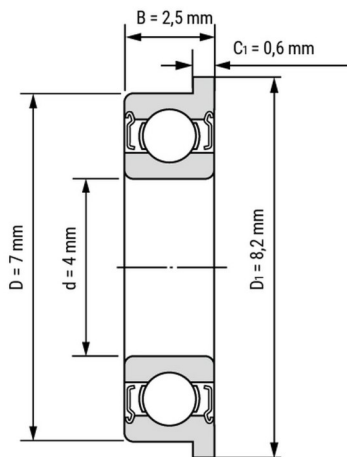
The shaft should slip in with medium pressure. But do not make it fit loose! The shaft will not be glued into the "Spinner"!

**If the shaft fits loose, use small round pliers to press the Nylon-shaft slightly flat. This makes the shaft fit tighter.**



## **Bearings**

These are the two bearings for the SPG.





## Assembling the motor section

The motor-holder holds the small electric motor in position.

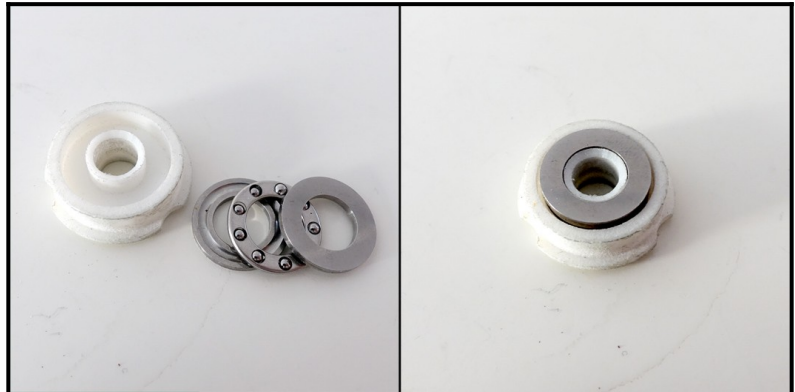
It also houses one of the two bearings. **This bearing is not absolutely necessary.** The SPG works also without it. **All parts will be assembled without glue!**

**It is important to (carefully) sand off the grain on the printed Motor-holder surface!**

Check the fitting of the motor and the motor-holder itself. **The motor should slip in with medium pressure as well as the holder. But do not make both parts fit loose!**

1. Place the first bearing into the motor-holder.

**Important: The motor-guide in the middle of the motor-holder must not protrude beyond the ball bearing! Cut it a little until it is slightly lower the bearing level (picture).**



2. Push the “Spinner” onto the motor shaft.

It should now look like this...

**The motor wires can be protected by shrinking foil and liquid rubber.**

Push the holder (with installed motor and “Spinner”) into **Part01 SPG back.**



## Install the Plasma tube and motor

The 21 mm 3D printed Plasma tube is a very important part for the spinning function.

The tube holds one of the bearings (bearing\_1).

**The tube needs a planar and smooth right-angled end to make sure the rotation axis is straight!**

**Install the bearing\_1 and push the Plasma tube through Part\_01\_front down to the bearing\_1.**

Check the length of the tube and make adjustments if necessary.

**The tube should touch the bearing without pressure!**

**Run the motor and test it.** When everything works and fits nicely, **remove motor-holder and PC-tube again (push out the motor-holder by pushing the PC-tube in motor direction).**

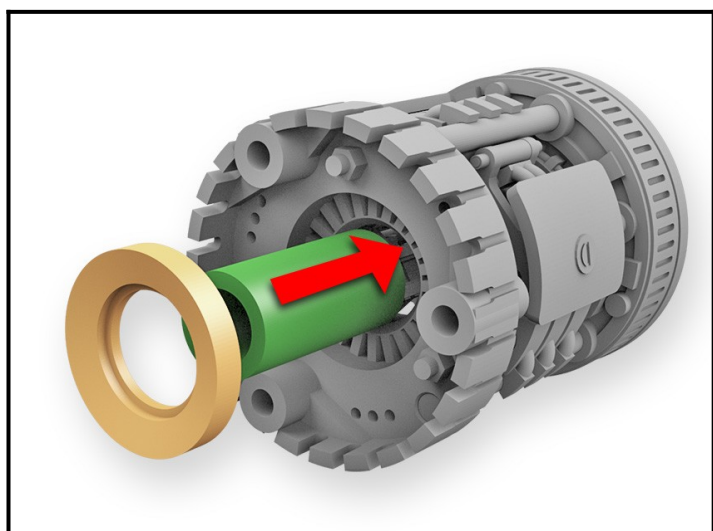
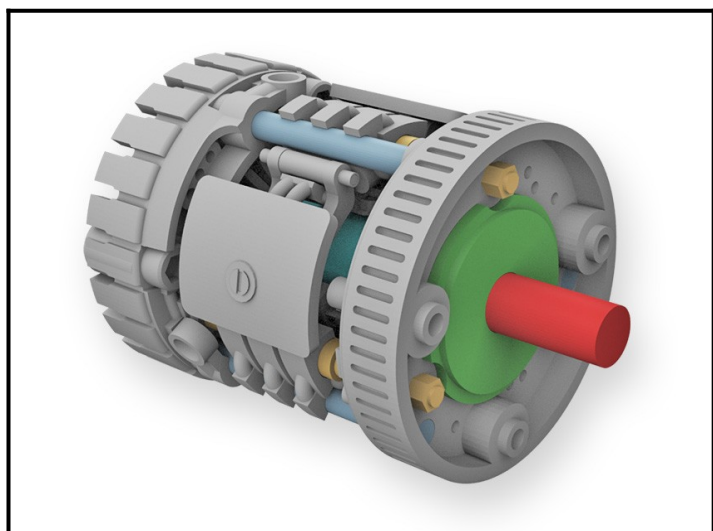
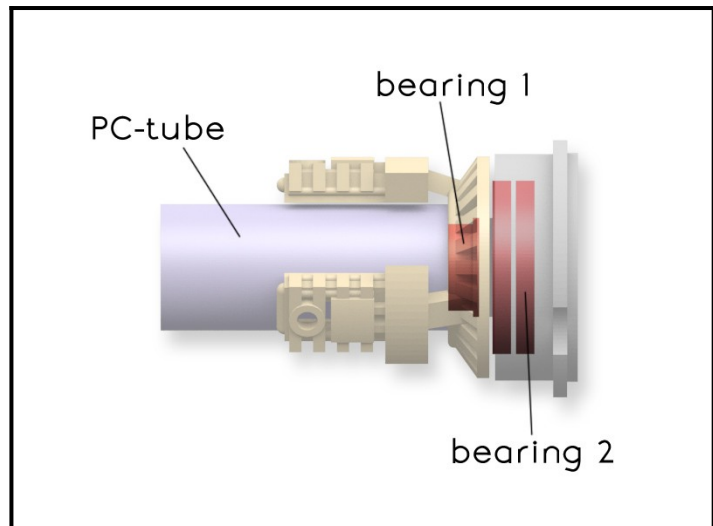
Install the motor-holder again and use 1-2 Epoxy drops to just fix the position.

Add some flexible glue to the Plasma-tube and push it through the **Part\_01\_front** down to the bearing\_1.

Again... **The tube should touch the bearing without pressure!**

**Run the motor for a moment and let everything dry well!**

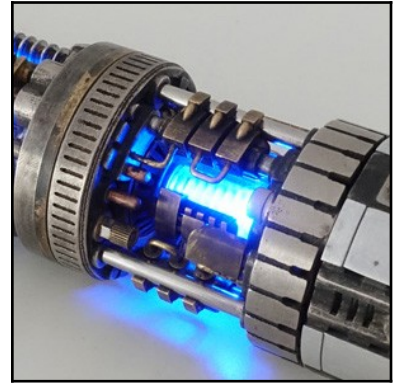
Then add the NeoPixel-ring holder.



## Plasma Tube filling

Fill the Plasma Tube with something **to scatter the light**. For example **plastic wrap**. But it is up to you. There are a lot solutions.

**Do some light tests.** If there is too much plastic wrap inside, the light will not shine through. You have to find the right setup.



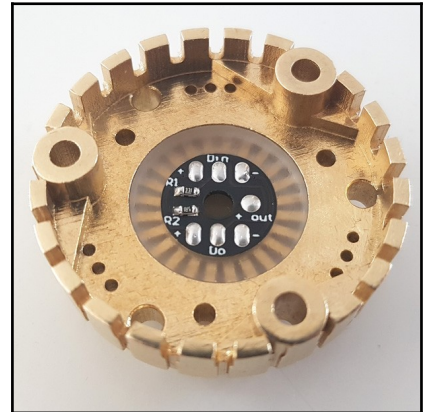
## Plasma Gate NeoPixel ring

The mb-sabers **NeoPixel ring** is specially designed to illuminate the plasma tube with 6 Pixel. It is very small. 11.7mm diameter. The **Pixel ring holder** is 3D printed.

### Parts:

Pixel Ring shop: [LINK](#)

Pixel Ring holder shop: [LINK](#)



**R1:** 0603 resistor pad for data (usually **330 Ohm**)

**R2:** 0603 resistor pad for + out

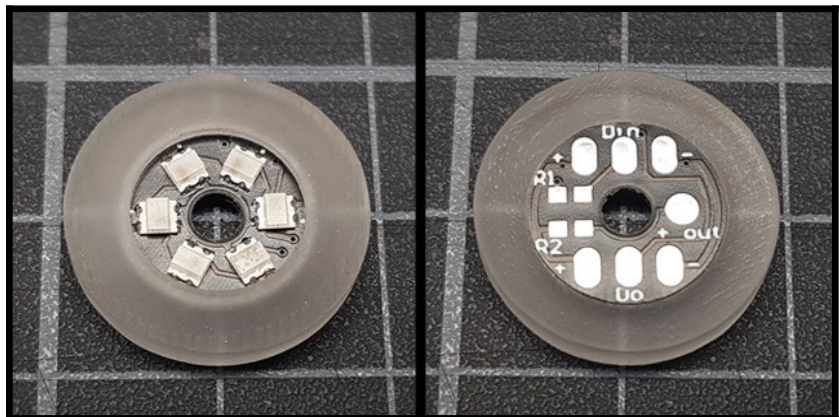
**Din:** Data in (AWG 32)

**Do:** Data out (AWG 32)

**+:** Vcc (AWG 26)

**-:** GND (AWG 26)

**+ out:** This pad is for additional electronics like extra LEDs or a motor which are placed inside the plasma tube. The **+ wire** can then be routed through the PCB hole into the tube. This pad also has an own resistor pad **R2!**

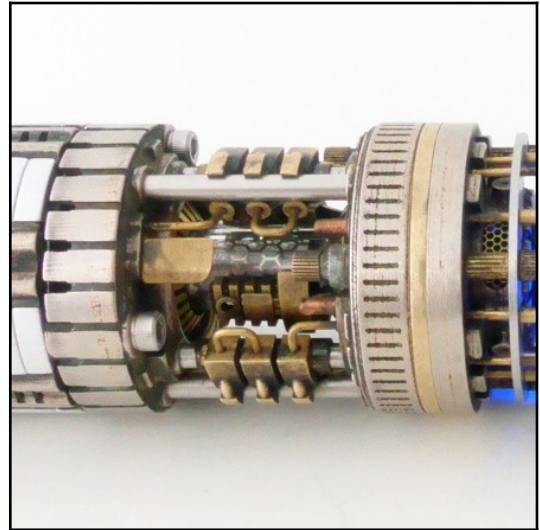


**IMPORTANT!** Don't use it in series with the blade Pixel strip. The Pixel ring cannot handle much current!

### Additional metal wire details

The final step is to add details or metal wires like shown on the picture. There are several holes in the Plasma Gate parts. These holes can be used to install metal wires or other kinds of details. There is no general way to add them. The picture shows an example.

**IMPORTANT:** First add the 3 Blade-holder 4/40 UNC mounting screws before adding the metal wires. There will be not enough space to add them later



### Add the Part 01 spacer to Part 02

To connect the Plasma Gate to Part\_02 the “**spacer-ring**” between Plasma Gate and Part\_02 is necessary. Otherwise the motor would not fit into the chassis.

**I recommend testing and adjusting the fit of all parts first, before all other work-steps.**

For all following work-steps the crystal chamber must be completely assembled!

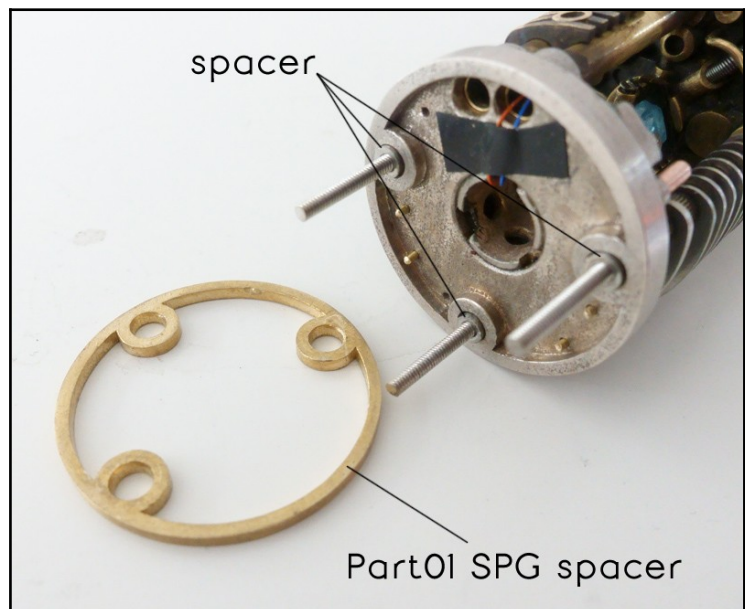
Now each **threaded main chassis rod** get a **3mm long M2 spacer nut**.

**I recommend to use threaded spacer.**

**Spacer-nut size:** 2.8mm diameter / 3mm height

It is easier to attach the Plasma Gate when the Part\_02 and the crystal chamber is safe attached to the main chassis.

These three spacer-nuts are also holding the **Part\_01\_spacer** in position.

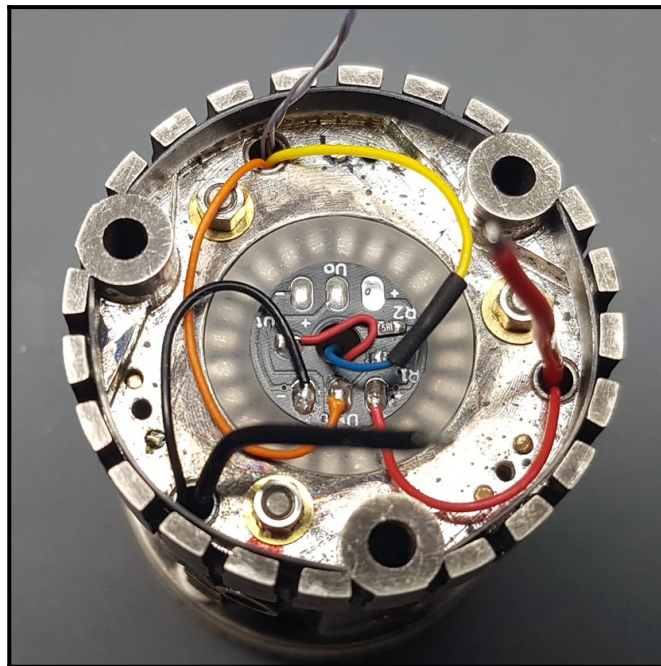
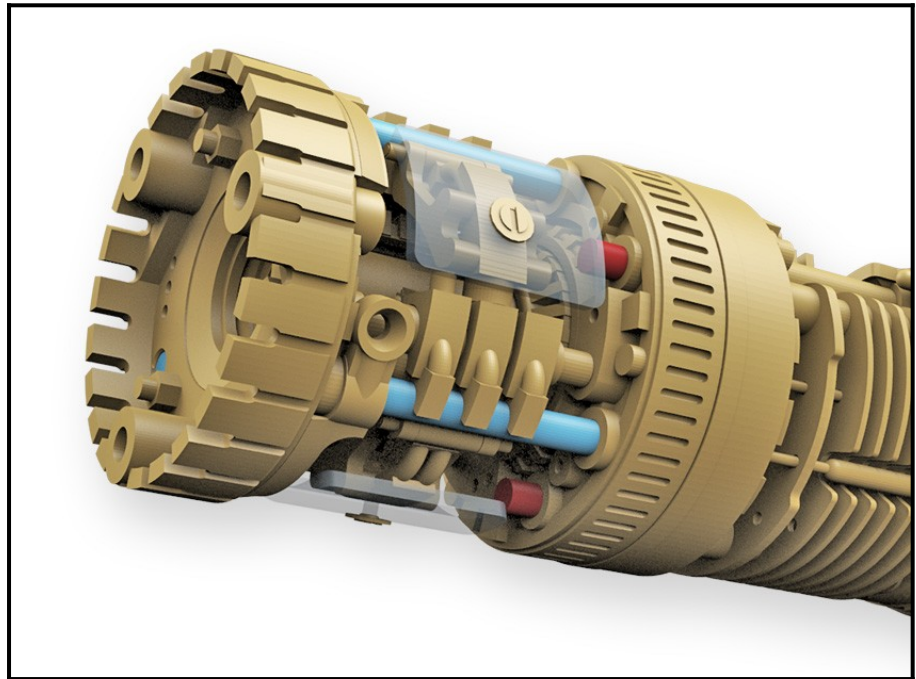


## Attaching the Plasma Gate (Part01) to the chassis (Part02)

1. Pull/push all wires through the **wire tubes (blue)** of the Plasma Gate to the front.

2. Push Part\_01 over the threaded rods and attach **M2 nuts (red)** to the rods. Use washer underneath the nuts.

If you use the basic **assembly kit**, add the three **threaded spacer (red)** to the end of the three main rods.



## 8. Blade Holder - Emitter

### Backplate

Two different **backplates** can be used. The thin one for NeoPixel setup and the thick version for high brightness LED setup. **The thick back plate works as heat sink.**

### Blade stop

Two different blade stop rings can be used. A 3D printed nylon version. Or an aluminum version.

**The high brightness LED setup works only with the aluminum blade stop!**

The nylon version has a guiding groove and **slots for five accent NeoPixel LED**. They can illuminate the five Emitter vents.



### High brightness LED setup

Mount the HB-LED directly onto the **backplate**. Lead the LED wires through the backplate hole.

**IMPORTANT: Only use the aluminum blade stop ring with HB-LED. The nylon blade stop would melt!**



### NeoPixel setup

1. Prepare the NeoPixel connector PCB (hilt).

**IMPORTANT: Only use NeoPixel connectors with low profile Pogo pins! I recommend to use the high quality PCBs from ShtokCustomWorx**

2. **Tap the three holes** in the thin back plate. Use a M1.4 tap.

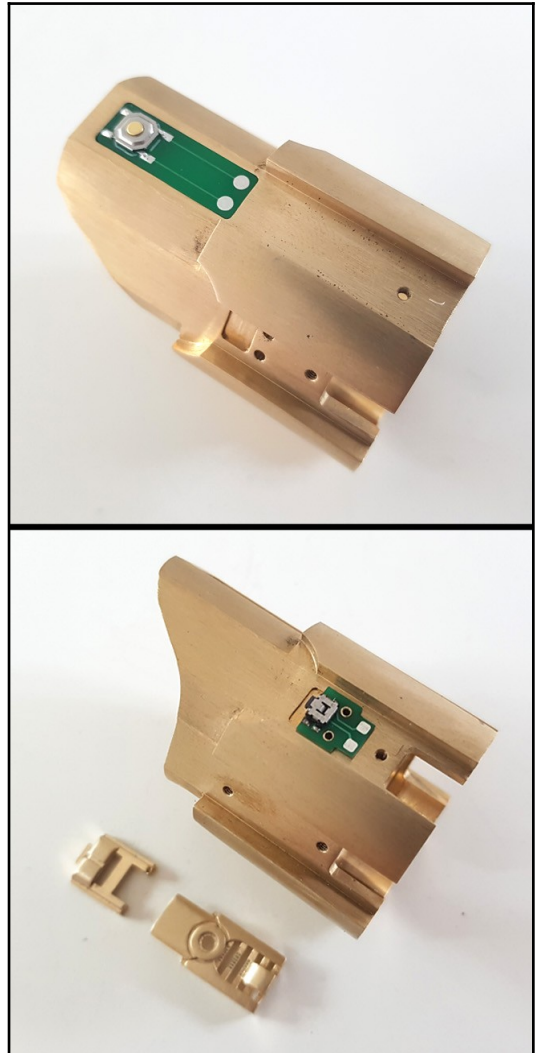
3. Install the **connector holder** onto the thin Back plate. Use three M1.4 screws.

4. Install the wired NeoPixel connector into the connector holder.



## Switch PCBs

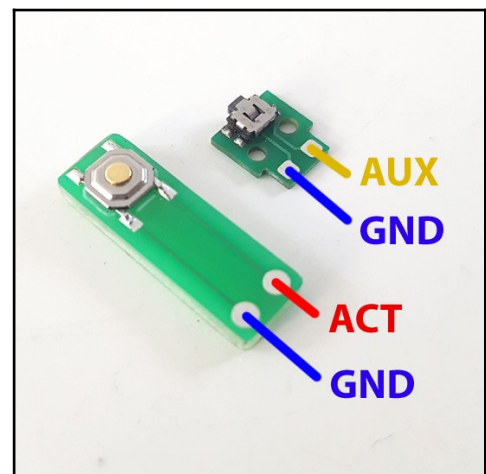
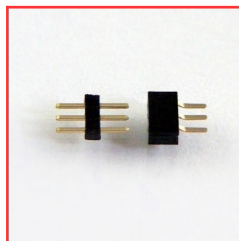
1. Solder the smd switches onto the two PCBs. Add **AWG 34 wires** later when the Emitter is done.
2. **Adjust the PCB thickness.** Sand down the PCB bottom a bit till the switch covers fit and work perfectly. Especially the **ACT switch PCB** should be reduced in height. So that there is more distance between the switch and the switch cover. Otherwise the switch could respond too easily.
3. **Install two 1.5mm brass rods** into the AUX switch **PCB mounting holes.** Adjust the height. They should line up with the switch PCB surface.
4. Place both PCBs into their position. **No glue needed!**
5. Mount the switch cover A and C over the switches and **test the function.** Does it work smoothly? Especially the AUX switch cover needs attention. It should move nice and easy. If not, more sanding is needed.



## Switch wiring

Solder AWG 34 wires to the pads. Both GND wires can be combined!

**TIP:** Use a small (1mm grid) connector for the switch wires to connect with the wires coming from the chassis.



## Activation switch “frame” (Emitter add-on B) installation

The ACT switch cover is framed by **Emitter Add-On B** which has to be installed first!  
Take your time to get the parts in the perfect position.

**1. Install the Emitter Add-On A** (ACT switch cover) with a M1.6 screw.

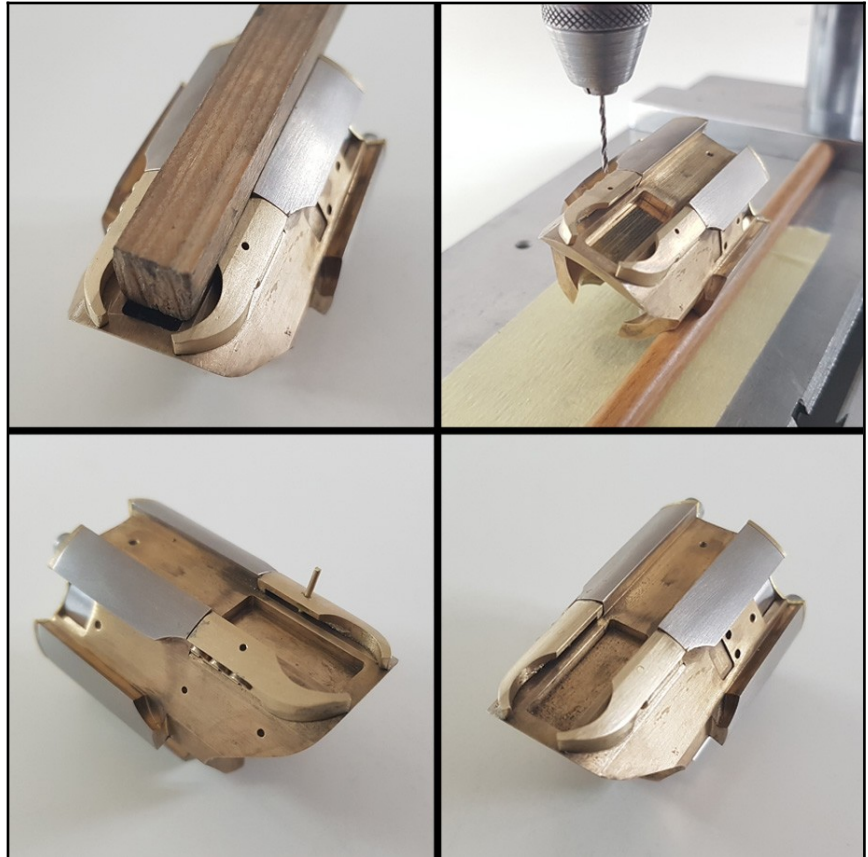
**2. Separate the switch frame parts** (Add-On B) and place them into position.

**3. Check the fit.** Maybe some adjustment is required.

**4. Temporarily replace Add-On A** with a 10mm x 10mm square wooden stick.

This is the best way to make sure the parts line up perfectly.

**5. Clean the surface** where the two frame parts will be placed and roughen it a bit.



**6. Glue both parts in position. Use Loctite 648!**

**7. After the glue dried the mounting holes can be drilled.**

***Use a drill-stand to get a perfect result. Align the Emitter to the drill head so that the mounting holes in the frame parts can be continued into the Emitter body. Stick a short 1mm rod into the mounting holes temporarily for easy alignment!***

**9. Install 1mm rods into the mounting holes and add Loctite 648.**

**10. Cut the rod to length and sand the surface smooth.**



### Emitter Glass-Eye adapter

1. Push the Glass-Eye adapter into position.
2. Mount it with two **M1.6 cylinder head screws**.

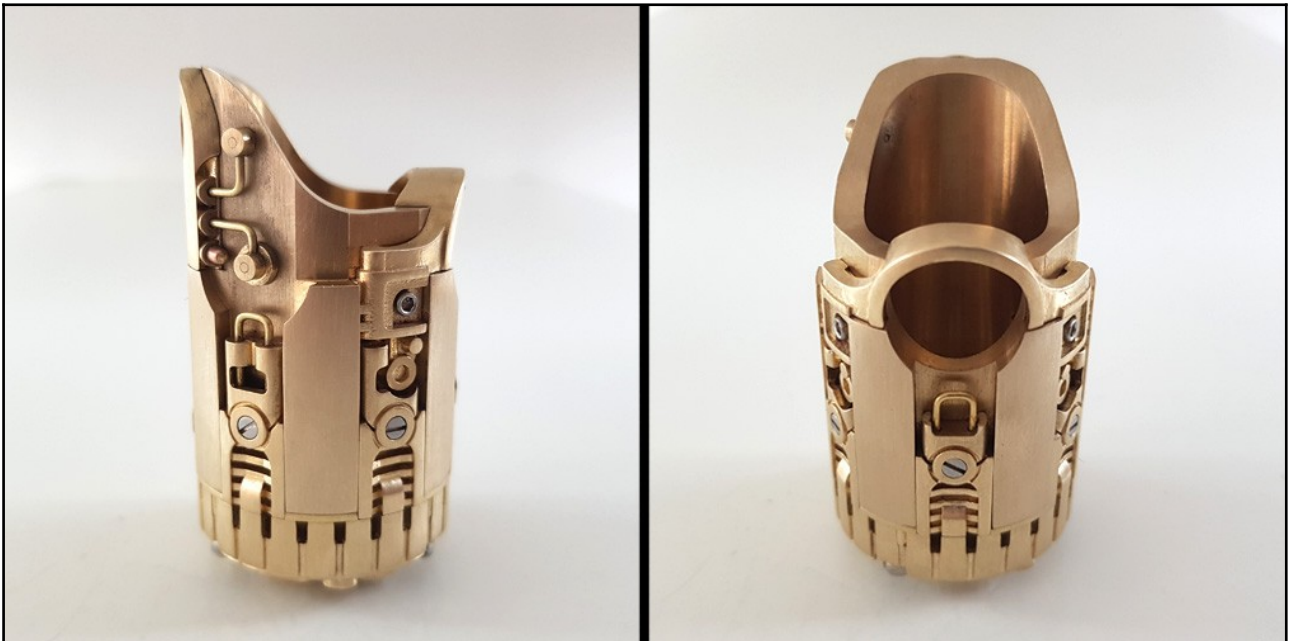
### Emitter Add-On D

1. Separate all Add-On D parts and check for fit.
2. Add brass wire details and Install each part with a **M1.6 countersunk screw**.

### Emitter Add-On E

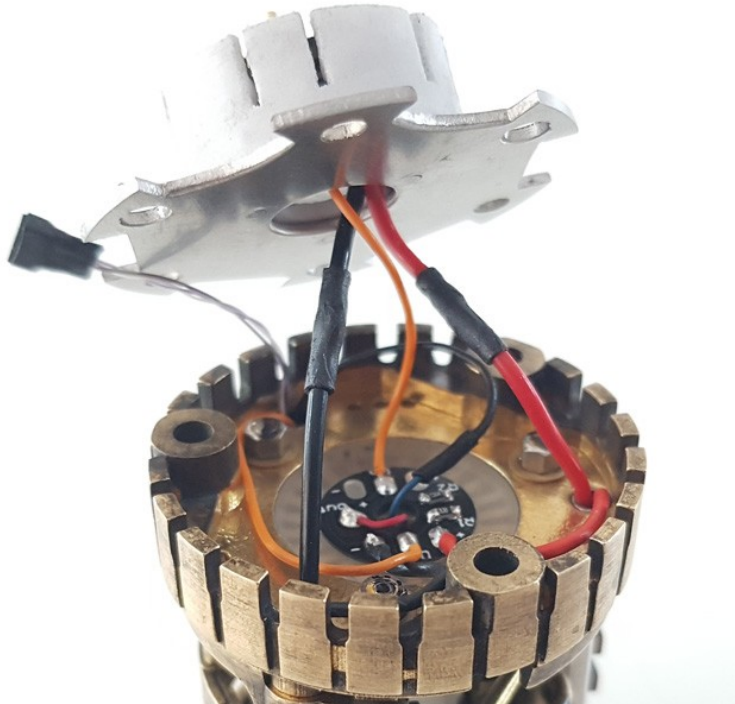
1. Separate both Add-On E parts.
- Tip: Insert two long 1mm rods into each piece first. So that they don't get lost.**
2. Glue two short (2cm) 1mm Brass rods into the designated mounting holes on the Emitter.  
**Use Loctite 648**
3. Put the printed parts **loos** onto the installed rods.
4. Attach the brass wire details.
5. Adjust the position. When everything looks good add **Loctite 648**

The Emitter now should look like this:



## Emitter installation

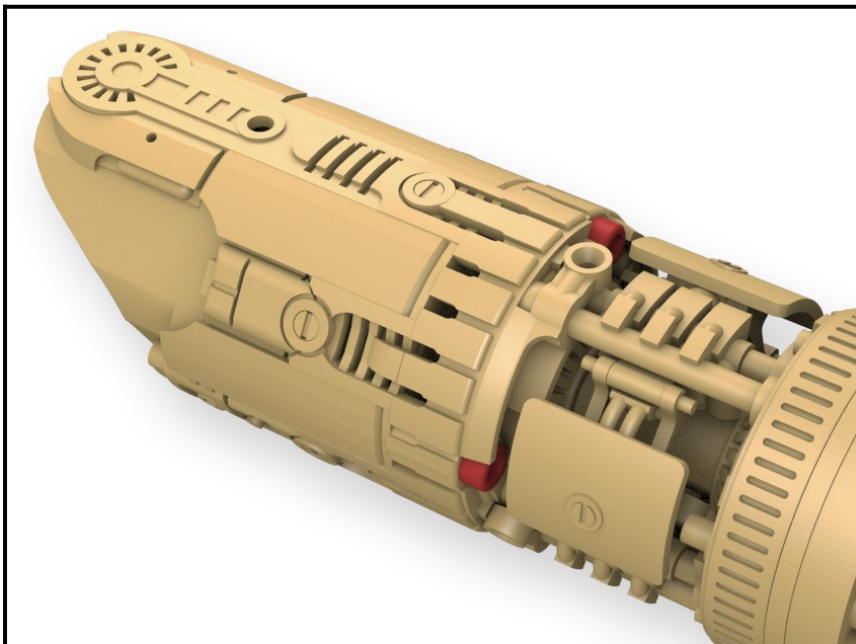
**1. Connect all wires coming from the chassis to the wires from the blade holder back plate. (High power LEDs or NeoPixel connector)**



**2. Attach the back plate to the Emitter and connect the switch wires.**

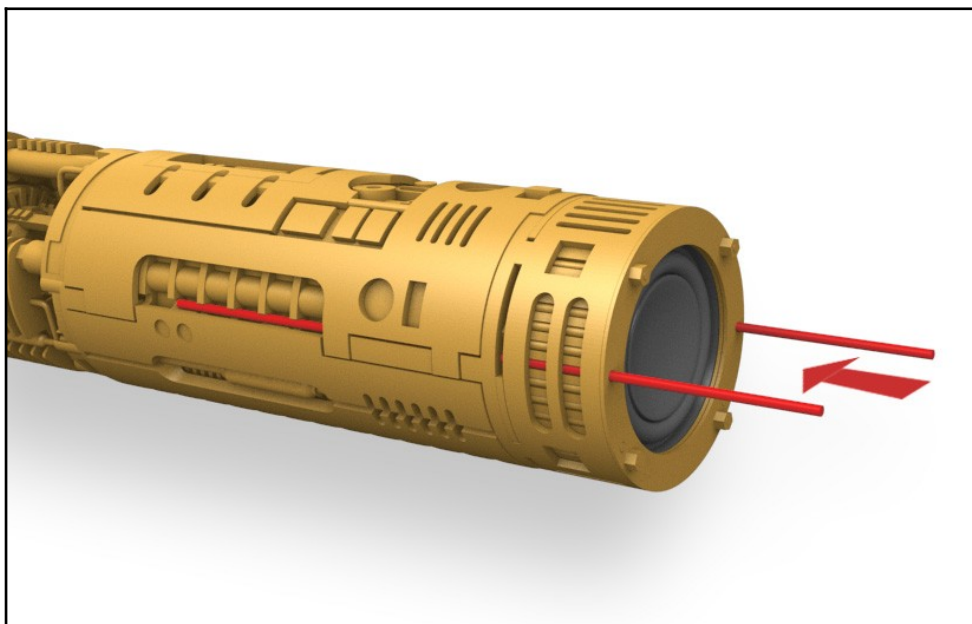
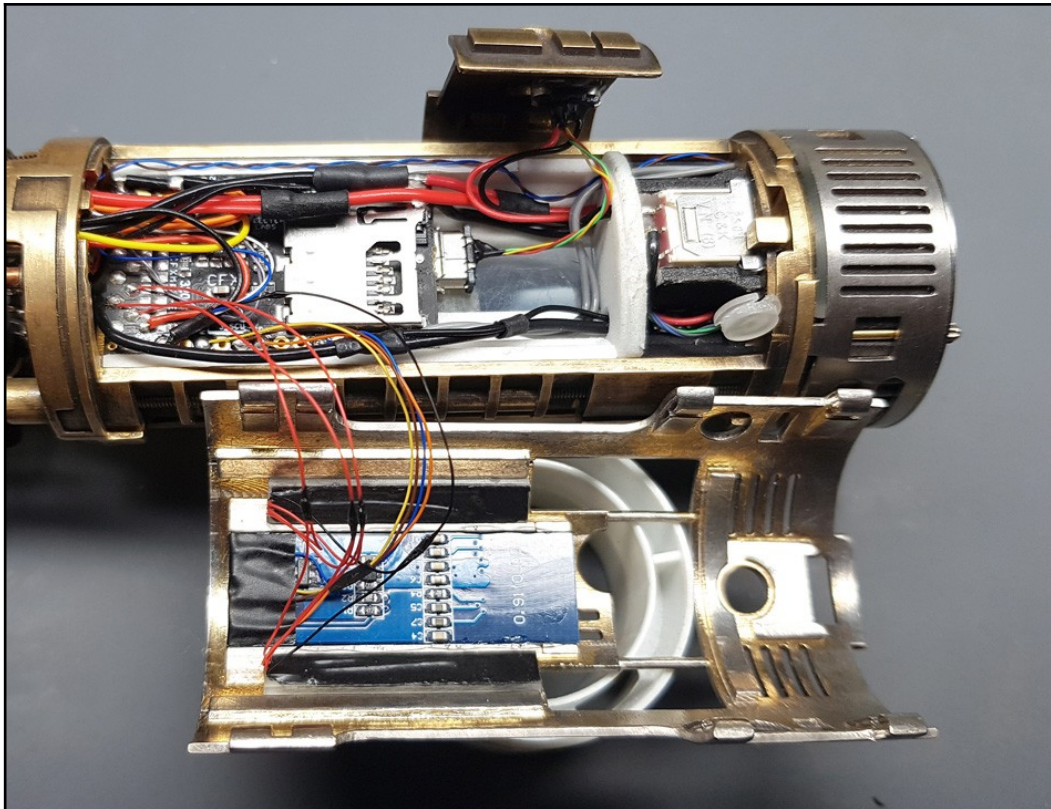
**3. Install 3x 4-40 UNC 3/4" cylinder head screws into the Emitter mounting holes.**

**4. Screw on the Emitter. **No screw lock needed!****



## 9. Installing Soundboard cover Part 06

1. Solder the wires coming from the top cover to the soundboard.
2. Place the tech-details loose onto Part 05.
3. Place the Metal Master Part 06 onto Part 05. Make sure the indicator LED is aligned.
4. Install two 1mm diameter rods from the back.

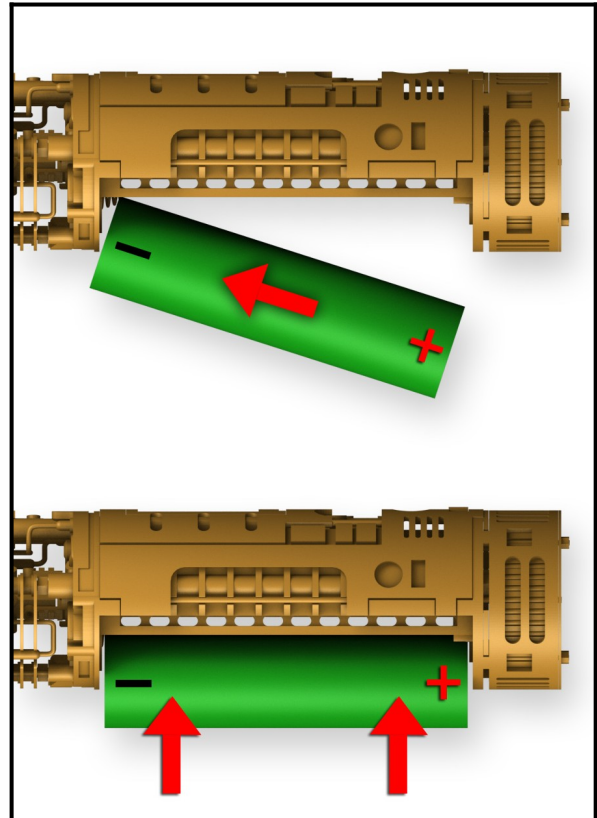


## 10. Installing the Battery

### Battery installation

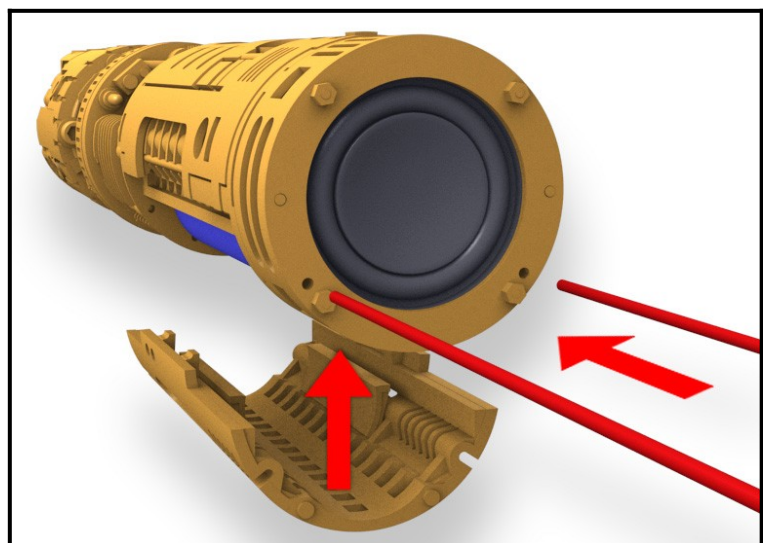
**IMPORTANT:** Don't mix up the poles!

1. Push the spring-contact with the **edge** of the Battery-end (negative pole) into the spring housing. **Do not try to push with the center of the Battery-end. It would not work that way.** Then tilt the other end with the positive pole.
2. When the battery is horizontal, push it in to the final position.



### Installing the Battery cover Part 07

Place the **battery cover Part\_07** over the battery and install the two steel rods. Make sure the rods have the correct length.  
For removing the battery you have to remove the two rods again.  
Push the rods out. Use pliers. Then pull them from the back.  
Remove the cover.



**If you have any questions, feel free to contact me:  
info@mb-Sabers.com**