Instruction Manual for the Metal Master chassis system 14650 and 18650 version 1.0 and 2.0

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 the instructions for **14650** and **18650** Metal Master chassis versions.
1.0 and **2.0**
Most of the work-steps of both versions are identical!

All deviating and additional work steps for the 18650 chassis are written in blue.

This manual will be updated frequently
Last Update: Oct.07.2020

Contents

1. Tools

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

- sandpaper (240 grain and 600 grain)
- drill heads 1mm, 2mm, 3mm, 4mm
- small slot screwdriver
- double-sided adhesive tape
- scalpel / small cutter
- tap M1.2
- glue (Pattex repair EXTREME and Epoxy)
- screw-lock (**medium** and **Loctite 648**)
- files with **diamond grid** (small and medium)
- Soldering-iron and solder
- tweezers
- liquid rubber
- insulating tape
- belt sanders (for example Proxxon)
- driller (Dremel or Proxxon)

2. Additional parts

Basic parts (Metal Master assembly kit)

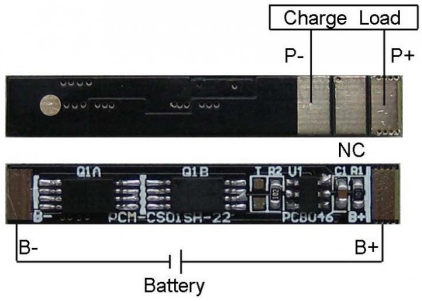
- 3x M2 threaded brass or stainless steel rods
- 1x M1.2 threaded brass rod
- 2x 40mm brass rods (1mm diameter)
- 4x 95mm brass rods (1mm diameter)
- 1x 130mm brass rod (1mm diameter)
- 2x brass tubes 40mm x 4mm diameter
- 3x M1.2 screws
- 6x M2 nuts DIN934
- power switch
- charge port (4.2mm / 1.1mm)
- 2x AAA battery spring contacts
- 2x AAA battery contacts
- 3x M2 washer
- speaker chamber end cover (brass)
- speaker chamber accent LED spacer

Plasma Gate assembly kit

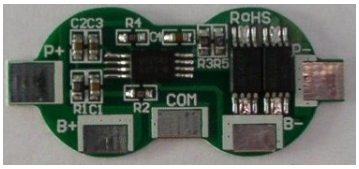
- 3x screws 4-40 UNC 3/4”
- LED holder
- 3x M2 nuts
- 1x polycarbonate tube (10mm diameter)
- 2-3x aluminum or steel tubes (3mm diameter)
- one or two 3mm LED holder
- one or two 3mm ultra bright LED (blue color)

Electronic parts

- Battery for 14650 version - 2x 3.7V 14650 Li-Ion cells (**unprotected only!**)
- Battery for 18650 version - 1x 3.7V 18650 Li-Ion Battery (**protected only!**)
  recommended Battery: **Keeppower 3,7V 18650 Lithium-Ion 3500 mAh**
- PCB for 3.7V setup (cell protection board) **2x 14650 Li-Io cells parallel**



- PCB for 7.4V setup (cell protection board) serial number: PCM-Li02S8-040



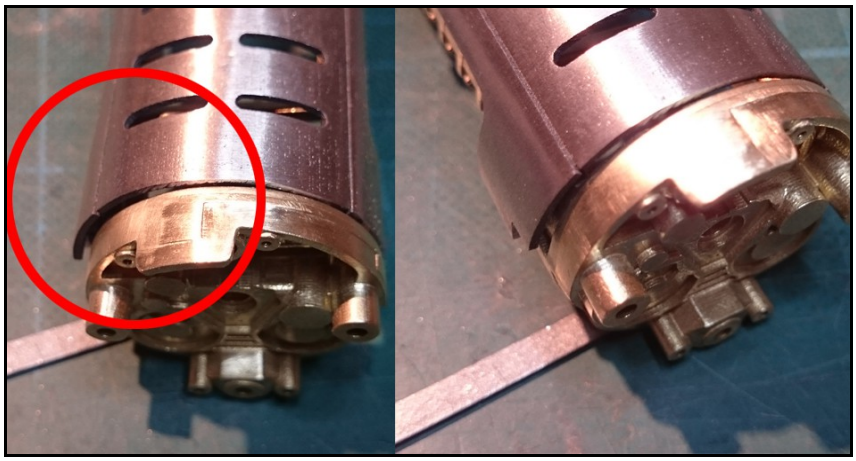
- 1x 28mm speaker (max 12mm high)
- 0.15mm diameter enameled electric wire for accent LEDs
- 0.04 mm² wire for speaker
- 0.09 mm² wire for power supply
- 3mm accent LEDs
- 9x SMD LEDs 0805
- Soundboard

3. Check the metal printed parts

When the printed parts arrive they have to be checked first.
Most materials do not pose much of a problem. But parts printed in steel materials can have defects. Parts from nylon or precious metal should not pose problems.
Check all parts for:

- **closed / blocked holes** (try to push rods through each hole)
If there is a blocked hole make a picture before you do anything else (for Shapeways).
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** (fit on the parts)
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 careless. Please reprint this part.

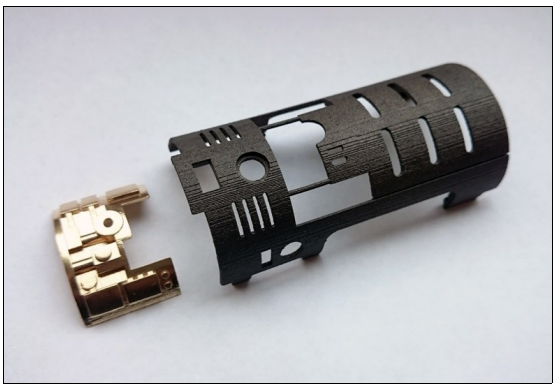
3. Sanding the surface

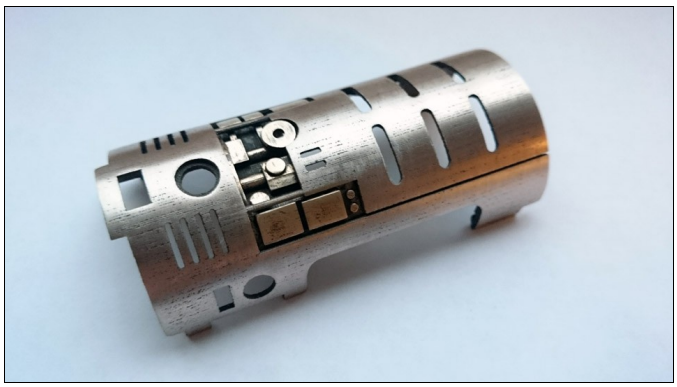
Parts from steel:

All steel parts do not fit without sanding.

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

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

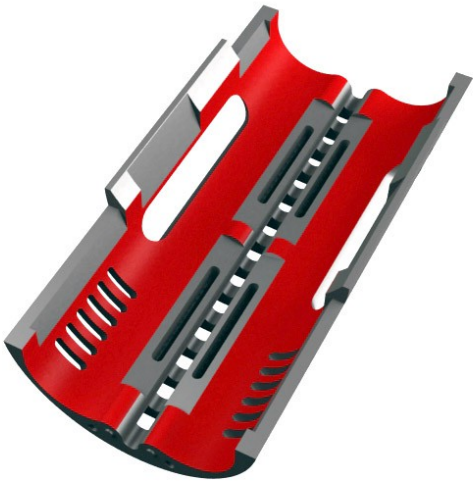




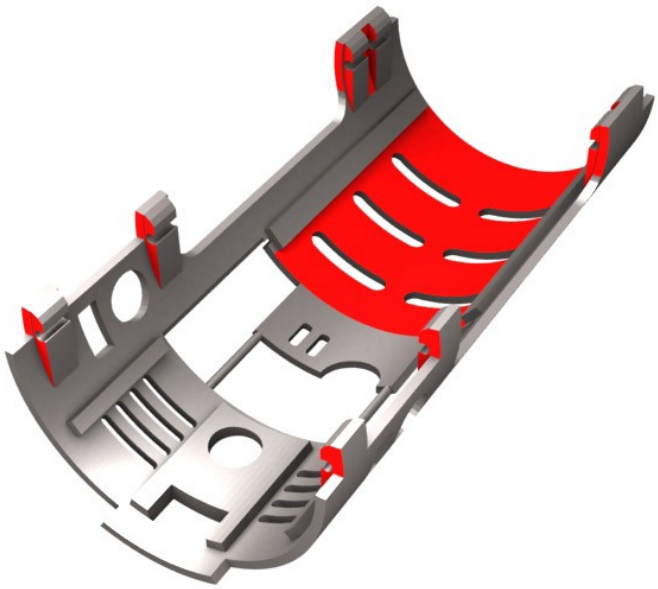
Battery cover Metal Master 07:

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

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



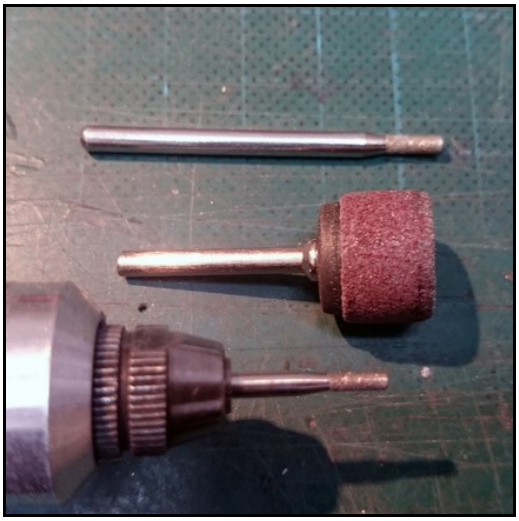
Soundboard cover Metal Master 06:

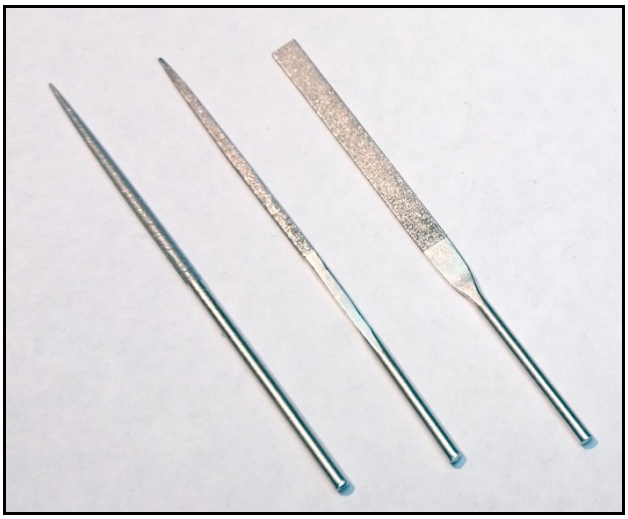


Some areas of the soundboard cover **Metal Master 06** need special attention.
The area around the “light holes” inside the cover need to be sanded carefully to make sure the LED holder fits. This area has to be nice and smooth.
Other areas at the holders must be sanded to make the cover fit on the main part **Metal Master 05.**
Check the fitting first. Then decide where and how much material has to be removed. Each steel print is different.

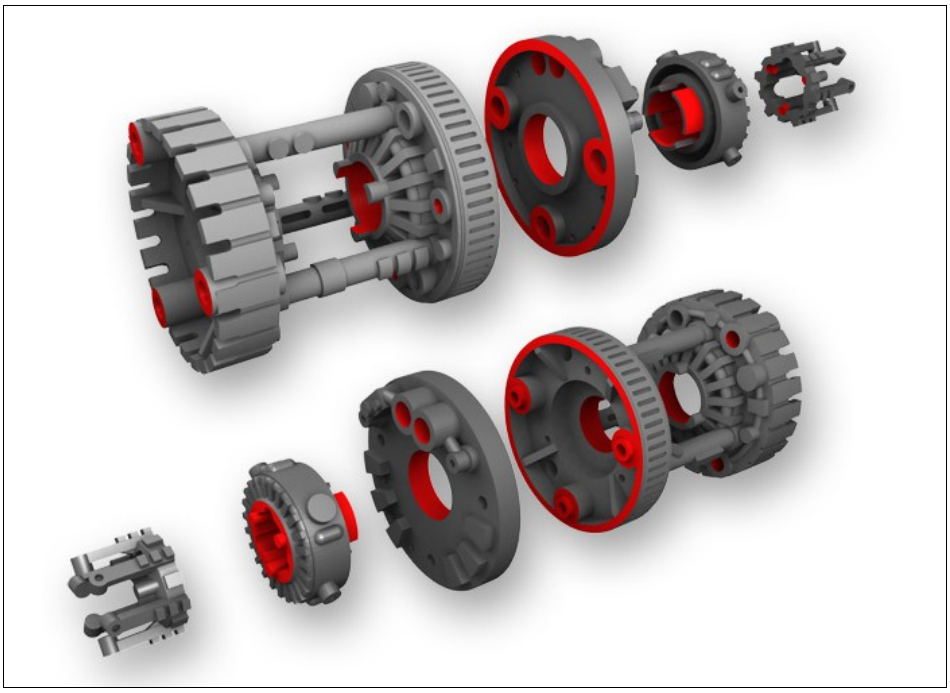
Holes and other areas:

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. Steel material is not easy to drill. Always use grinding heads, sand-paper or a diamond file.

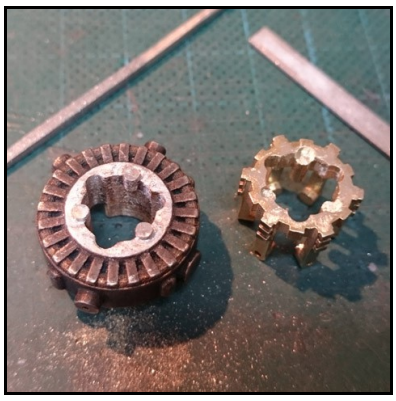




All areas marked in **red** have to be sanded to make the parts fit.



Take your time to make everything fit together.



Satin finish...
I recommend a Graflex Flash like satin finish on all parts.
Imperfection makes it perfect.
Use a satin-finish-bit or sandpaper (240 grit) for the final touch.

Brass parts in general:

Brass material (precious metal) can be ordered as polished or raw.
I recommend to order the raw version. It is a lot cheaper. It is easy to sand or polish yourself.
Also polished *precious metal* lose detail and edges are rounded.
For finishing brass parts, only sandpaper and small files are needed.

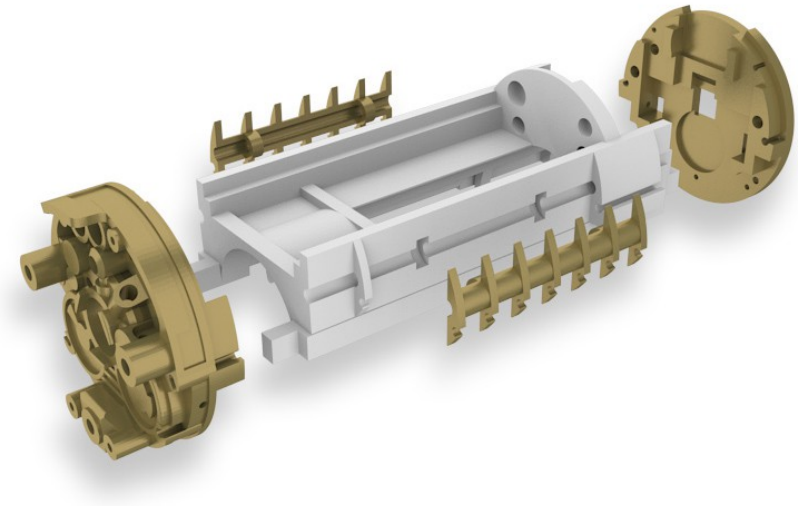
4. Installation

! Safety first !

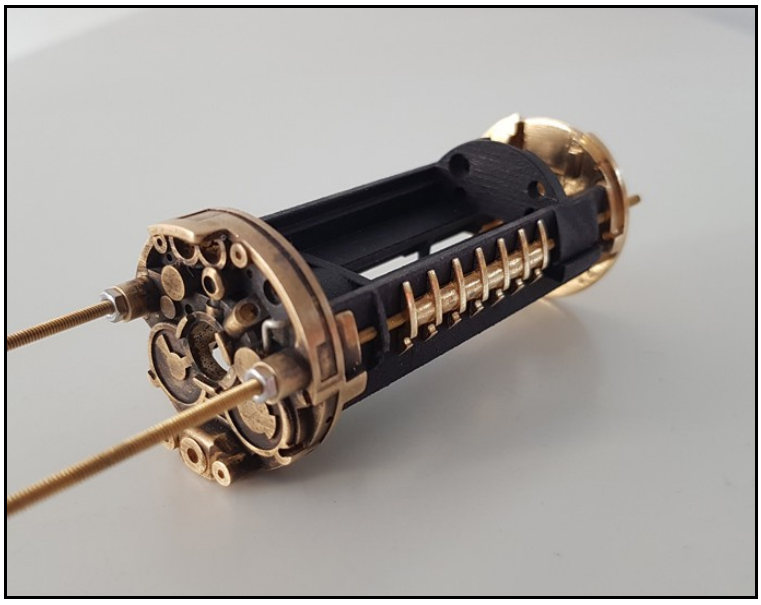
Please remember that metal materials are conductive! You have to make sure that the battery contacts are well insulated as well as all other electronic parts.
Do not mix up the electronic poles. Install the contacts like shown on the pictures.

~~Metal Master 2.0 part 05 kit assembling (18650)~~ **Not available anymore!**

The Metal Master 2.0 part 05 (18650) as a four parts kit.



No Glue is necessary to assemble the part 05 kit!
It is held together by the two main threaded rods and four 1mm rods.

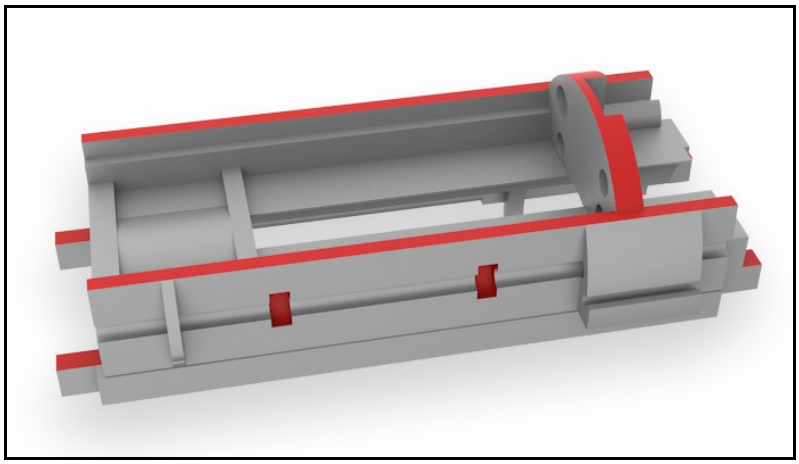


Middle-part preparation

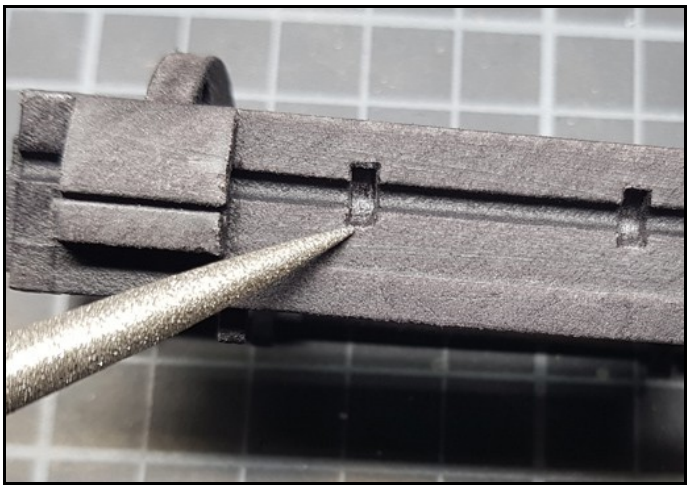
The middle-part is available in **Versatile Plastic material** and **black PA12 Nylon Plastic**.

1. Versatile Plastic has a grainy surface finish. This material must be sanded to get a smooth surface. **Only remove the grainy finish!**

2. PA12 material usually has got a tighter fit. It has got more added material in Z-print-direction (up). Due to the printing process.
As a result, part06 (top cover) does not fit proper first!
All surfaces pointing up have to be sanded to make part 06 (top cover) fit perfectly! (right picture shows the areas in red)

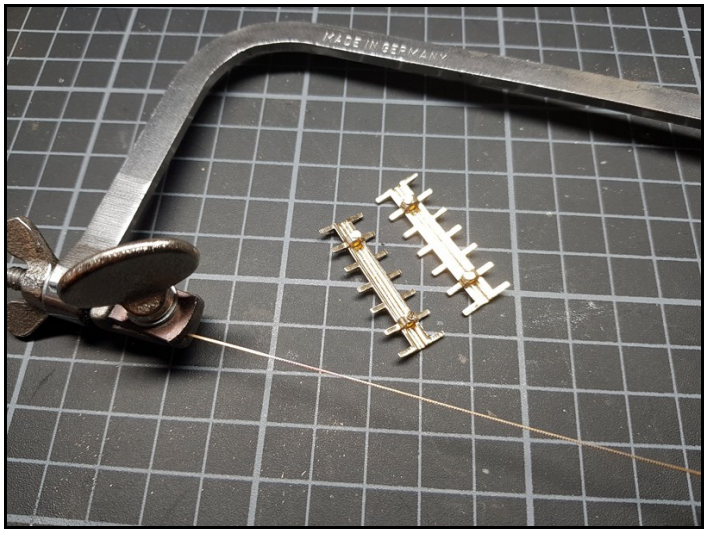


Also, the **indentations for the side parts** have to get a little bigger when PA12 material is used. Or remove a little material from the **side-parts**, to make them fit easy into the indentations.

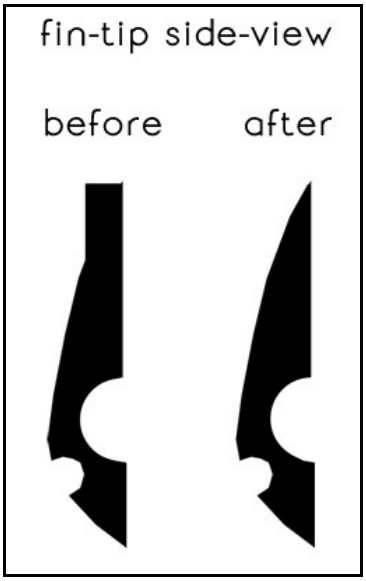


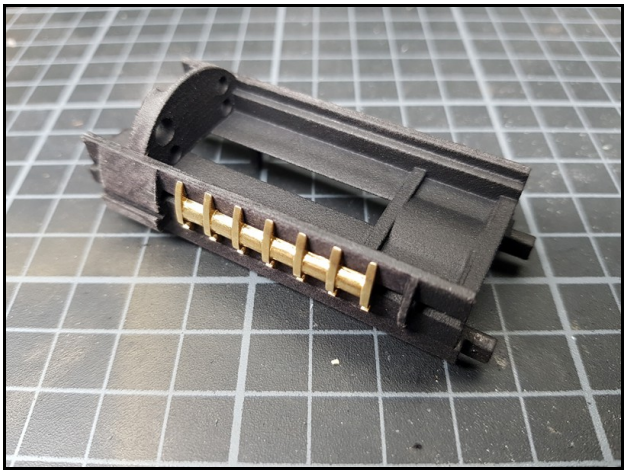
Side-part preparation

The side-parts have to be separated from each other. They are connected at two points.
Use a fine hand saw for metal. Then clean the connection points by sanding.
Try to attach the side parts to the middle part and do adjustments if necessary.



Now give the fin-**tips** a nice round shape. Use a file or sandpaper. The tips got extra material to be printable, which now has to be removed!

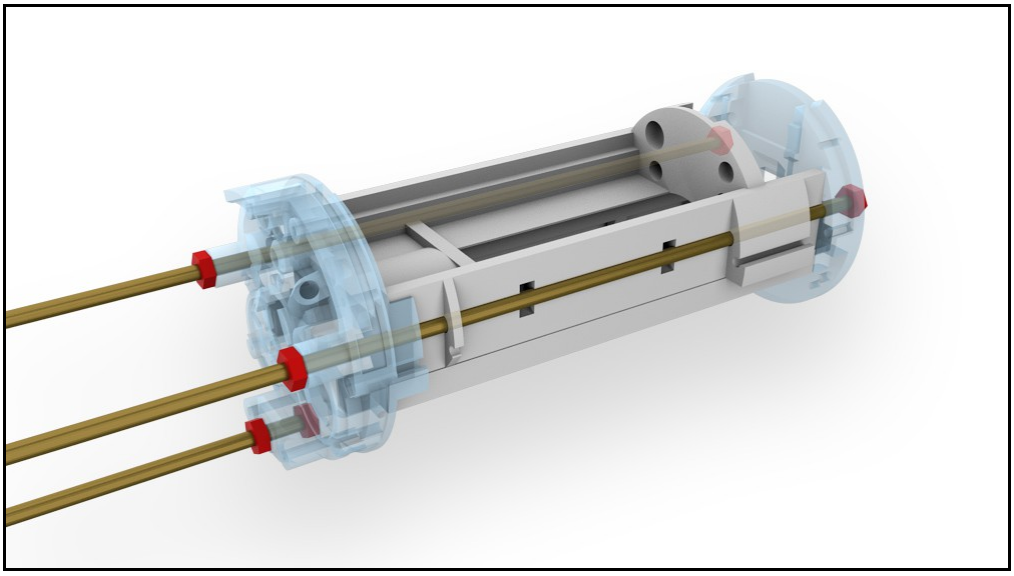




Now attach the side-parts to the middle-part. They must be in direct contact to the middle-part!

Part 05 kit assembling

Assembling the parts needs **no glue**. Everything is mainly held together by the two main threaded rods. Like shown on the picture below!

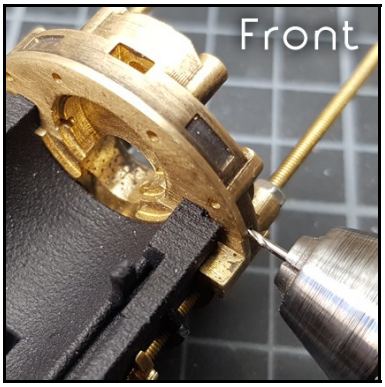


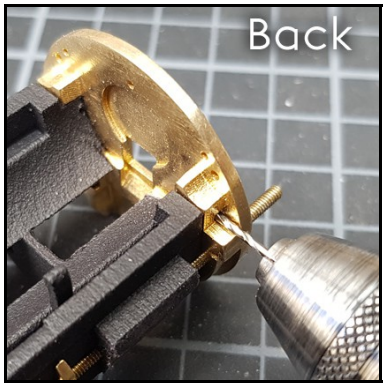
- Add a nut to each rod end and glue them into position (use **Loctite 648).** Let it dry over night.
- Attach the **side-parts, Front and Back to the middle-part**.
- Insert the threaded rods and add nuts to the opposite and tighten them.

Very important: Make them finger tight! Do not crank them up! Otherwise the middle-part starts to bend!

Now add **four 1mm rods (two on each side)** to anchor each connection...

- Make sure the nuts are finger tight. And everything is well connected.
- Front and back-part have two 1mm diameter holes each. One on each side. Drill through these holes and completely through the middle-part! Use a 1mm drill-head! (**Pictures below!**)





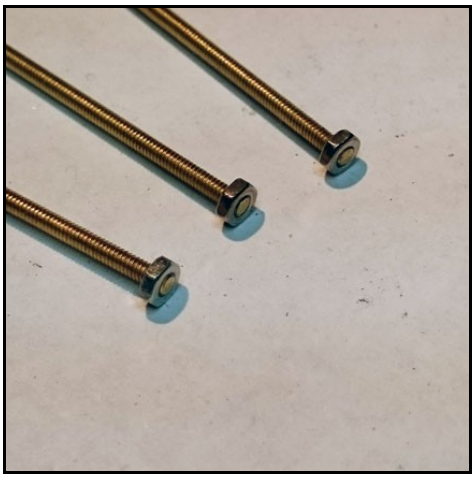
- Now push one 1mm diameter rod into each hole. **Make sure the correct length is used...**

Rod length FRONT: **10mm**
Rod length BACK: **5mm**

Done! Now the part05 is ready to install...

Threaded brass rods installation

Install one M2 nut on each M2 threaded rod **end** (3x).
For the 18650 chassis you need two long M2 rods. The third one is shorter and will be installed later!

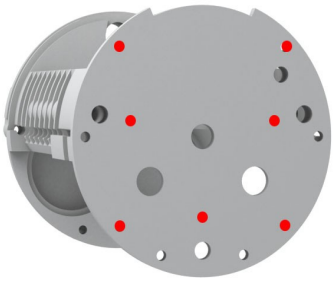


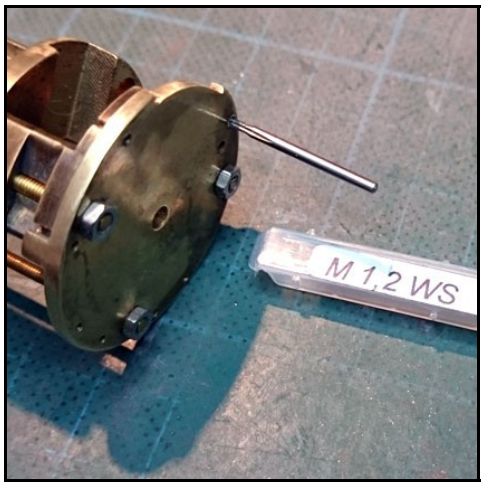
Use **Loctite 648** to glue them in position. Let it dry over night.
These three rods have to be installed before the speaker chamber is screwed on...

Speaker-Chamber installation

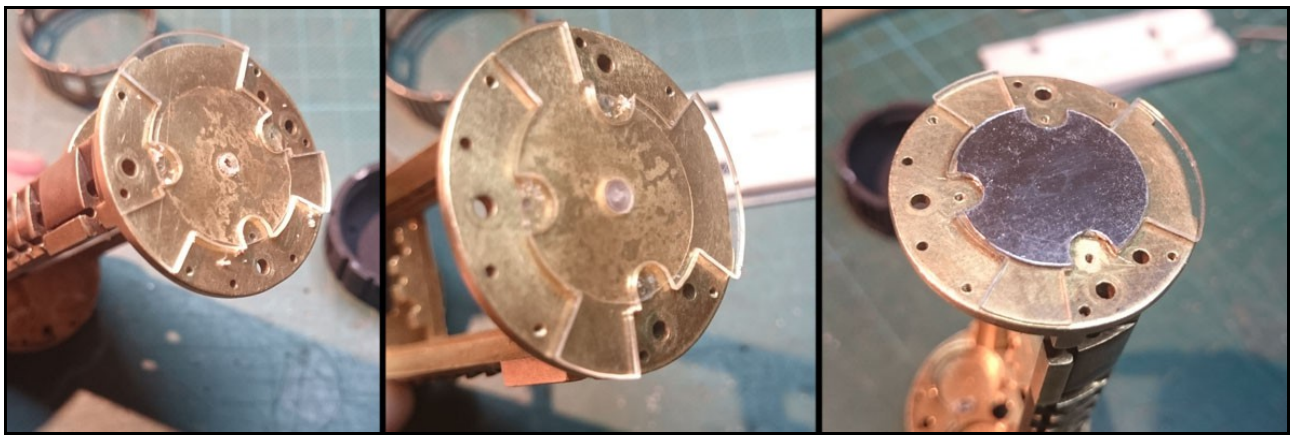
Seven holes in the back of Part 05 (Metal Master 05) need cut threads (1.2M). These are important for the speaker chamber installation. You need a M1.2 tap (1.2mm). Please be careful.

If you have problems to get a tap like this send an email at info@mb-sabers.com

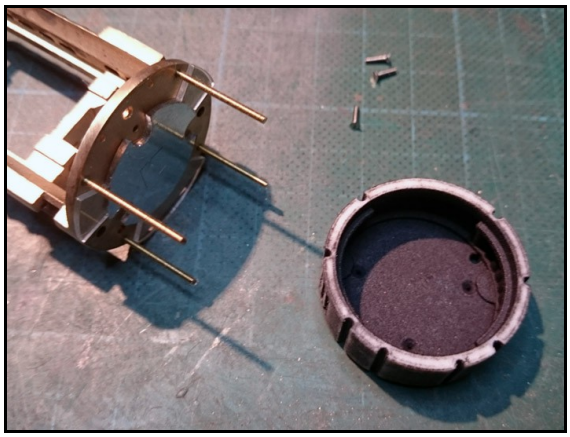




Remove the blue foil from the **LED spacer.**
This part does not have to be glued on. Just place it between part 05 and the speaker chamber. Check if the accent LED fits. Flatten down the 3mm LED to get a plane surface.

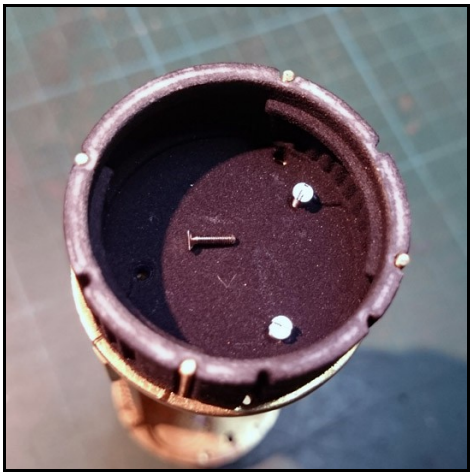


For the **18650 chassis** version it is necessary to cut two notches into the LED-spacer like shown on the picture... The 18650 chassis has different rod positions.

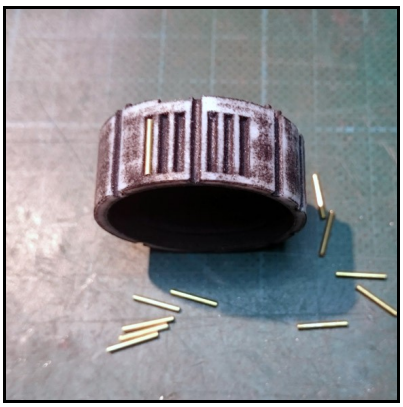


Cut four **threaded rods (M1.2)** to 20mm length. Screw them into the four threaded holes at the border. Use screw-lock (medium). Let it dry.

Shorten three M1.2 screws to 4mm.



Don´t forget to install the M2 threaded main rods first!
Install the speaker chamber and use the three 1,2M screws to screw it on. Shorten the four 1.2M threaded rods to length.

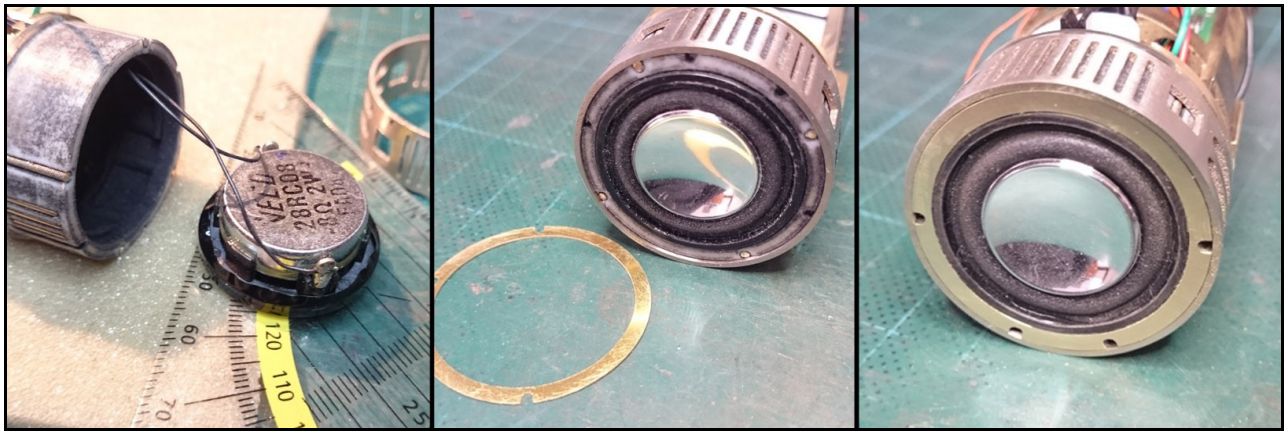


Details...
Cut **12x 1mm brass rods** to 8mm length. Glue them into the indentations of the speaker chamber.

Speaker installation

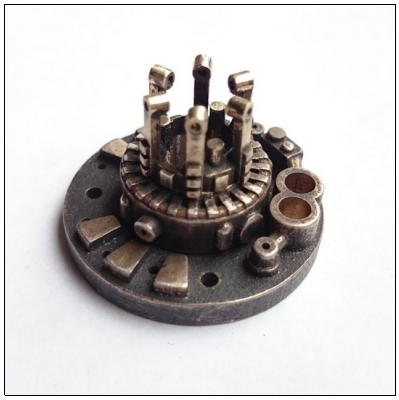
(This work step can also be done later, if an accent LED has to be installed first)

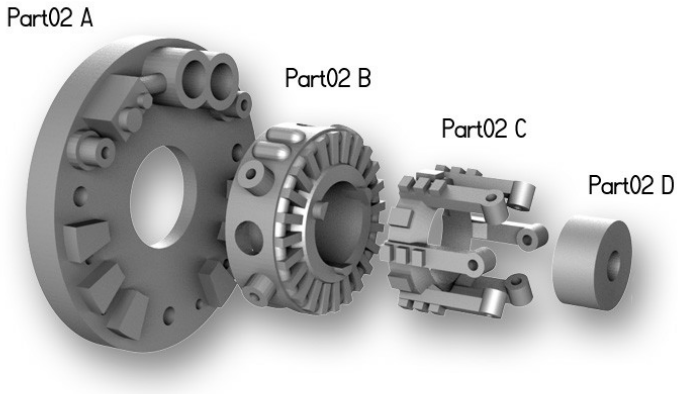
Make the speaker tightly fit to the chamber. Use adhesive tape or foil. Guide the speaker wires through the supporting hole. Press it into the chamber. Most **28mm diameter speaker** fit into this chassis. The chamber is deep enough for 12mm high bass speaker. But you can also use flat speaker.
Install the metal printed speaker chamber cover. Make it fit tightly. Do not glue it on.
Glue on the **brass ring** cover.



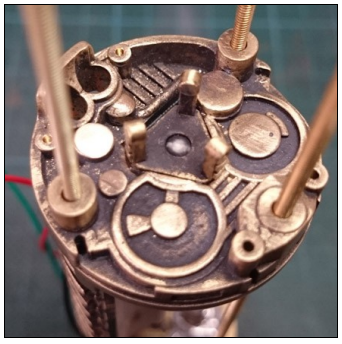
Crystal Holder installation

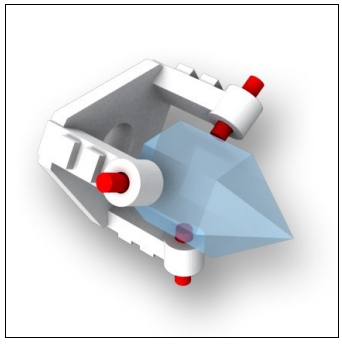
When **Part 02 A**, **Part 02 B** and **Part 02 C** are prepared and all parts fit, glue them together.
Part 02 D is the accent LED holder. Install the accent LED after assembling Part 02 A,B,C,D.
The same with the **crystal holder** and **Metal Master Part 05 (all versions).**





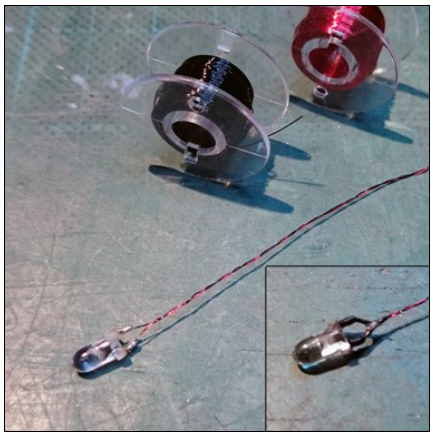
The Crystal holder at the main chassis part 05 has holes at the three arms. These are for 1mm brass rods or screws to adjust the holder diameter.
Metal Master 2.0 has three holder variations.
For 3mm, 5mm and pixel LEDs.





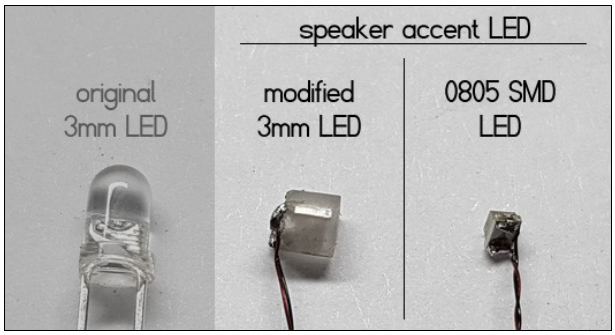
Accent LED installation Part 05 Metal Master 1.0

You need at least one 3mm LED for the Plasma Gate, two 3mm LEDs for the Crystal-Chamber, one 3mm LED for the Speaker-Chamber and six SMD-LEDs for the Soundboard-cover later.

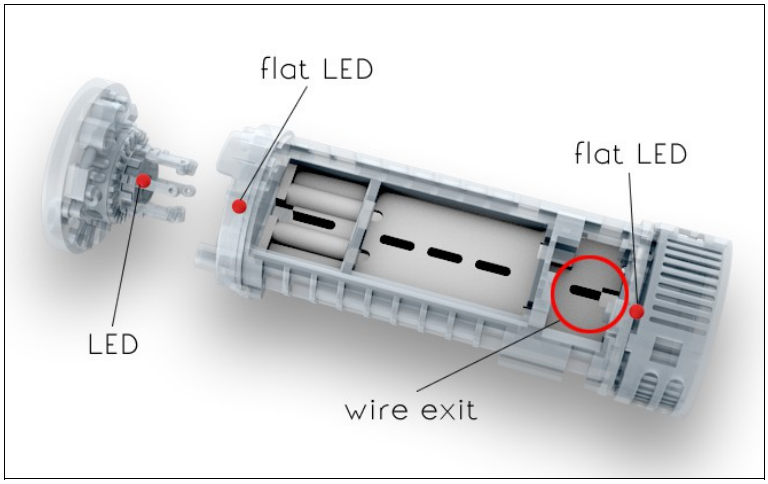


All accent LEDs should get **0.15mm diameter enameled electric wires**. These LEDs do not need bigger wires. It saves space and makes installation much easier.
Use liquid rubber for insulation.
Insulation is very important!

The two accent LEDs for the main Part 05 have to be flattened. Sand it down. Otherwise they would be too long to fit.
Especially for the **18650 chassis** the **speaker accent LED** has not much space. The 3mm LED has to be modified like shown on the picture below. Or use a 0805 SMD-LED.

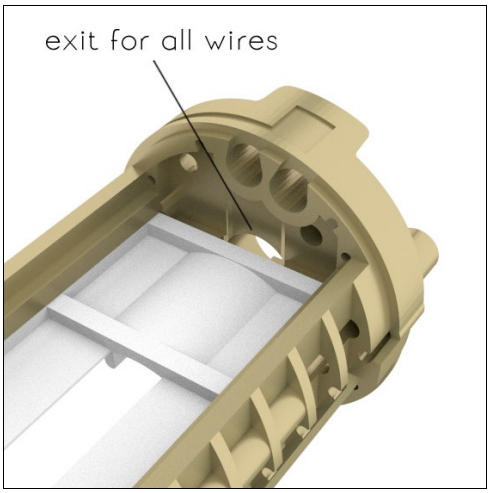


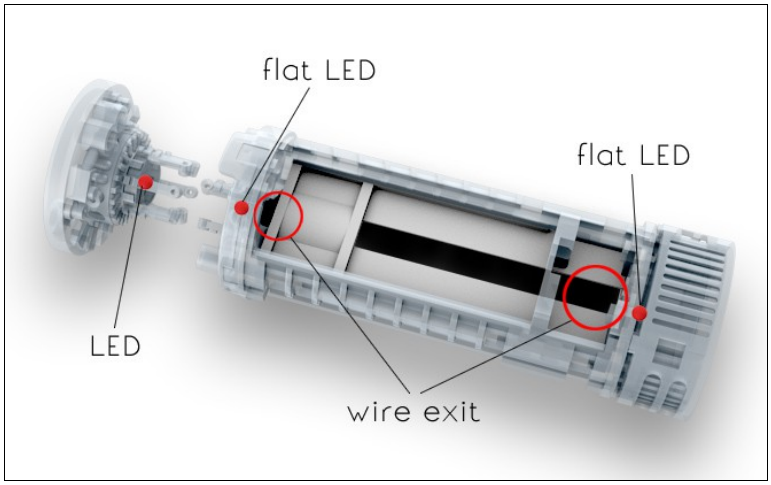
The **14650 Nylon-Plate 1.0** has got a wire guide with supporting holes. The Accent LED wires should be guided to the last hole at the end of the Nylon-Plate. Please take a look at the picture.
Install the two accent LED into the main chassis **Metal Master 1.0 part 05 first.** Then install the **center Nylon-Plate** and guide the wires.
The **18650 1.0 Nylon-Plate** has different support holes. Use the wire guide for the spring-contact-wire.



Accent LED installation Part 05 Metal Master 2.0

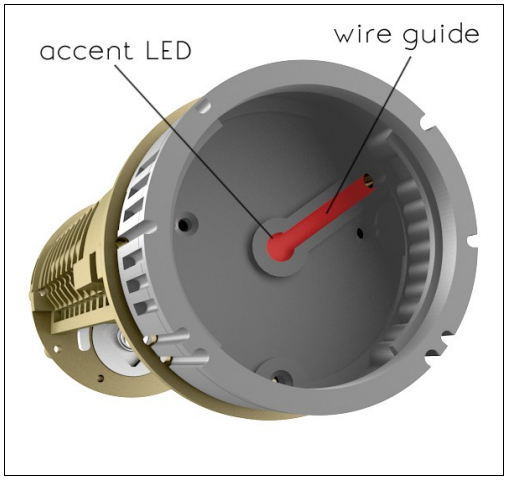
The **Metal Master 2.0** Part 05 has got **new support holes for all wires.**
Both versions (14650 and 18650) have got more room in the front behind the crystal chamber (right picture). All wires from the battery and the crystal accent LED have the same exit hole.

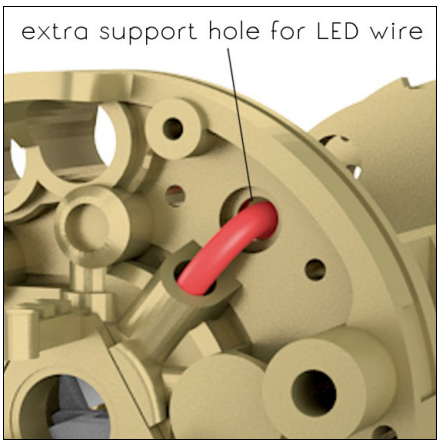




The position of the three accent LED are still the same (left picture).

There is one important difference between the 14650 and 18650 version (2.0):
The **14650 chassis version (2.0)** has got the standard wire guide. The LED has to be installed into part05.
But for the **18650 chassis this accent LED** has to be installed into the speaker chamber**!**
Drill a 3mm hole into the center of the speaker-chamber, install the LED into that hole and guide the LED-wires to the support hole (right picture).
The LED top has to be flattened. Make sure the speaker still fits!

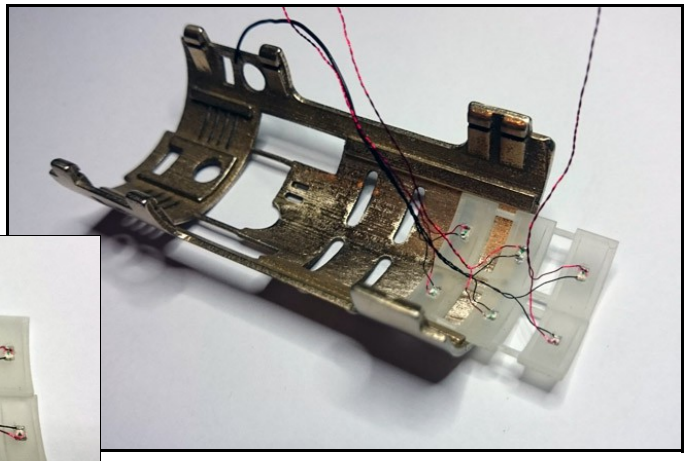


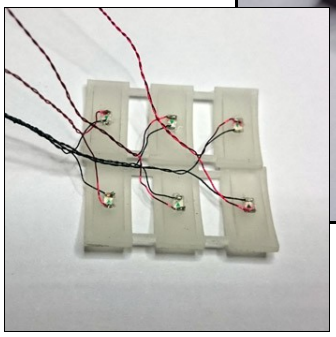


Extra support hole for crystal accent LED...
Part05 (2.0) has got an additional way to guide wires to the crystal accent LED (left picture). It is big enough for **AWG 22** wires if a **pixel LED** is used.

Top cover (Part 06) accent LED installation

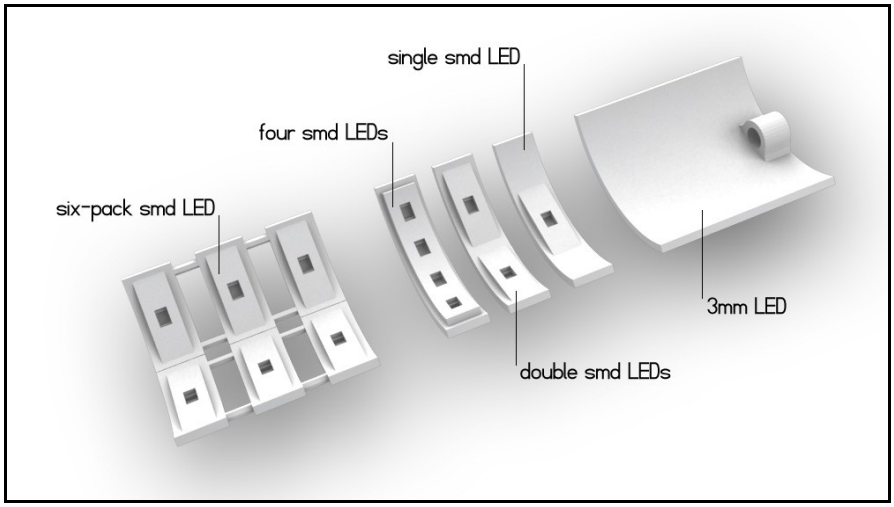
For the light holes in the top cover **Metal Master 06** you need **smd LEDs (size: 0805).** The Metal Master LED holder is designed for these accent LEDs. Glue the LEDs in and then push the holder into the guide rail. (Maybe some tape or glue is necessary to hold it in position)





There are different smd LED holder available...
The six-pack is only for the top cover with six light holes V1. All other smd LED holder can be used with all Metal Master top covers.

One version is for one 3mm LED.
The single holder are available for **one, two or four smd LEDs**. You can also combine them.



Top cover (Part 06 Oled) Oled display installation

The top cover **Metal Master 06 Oled** is designed to integrate an standard Oled display with **128x32 pixel resolution**.

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...

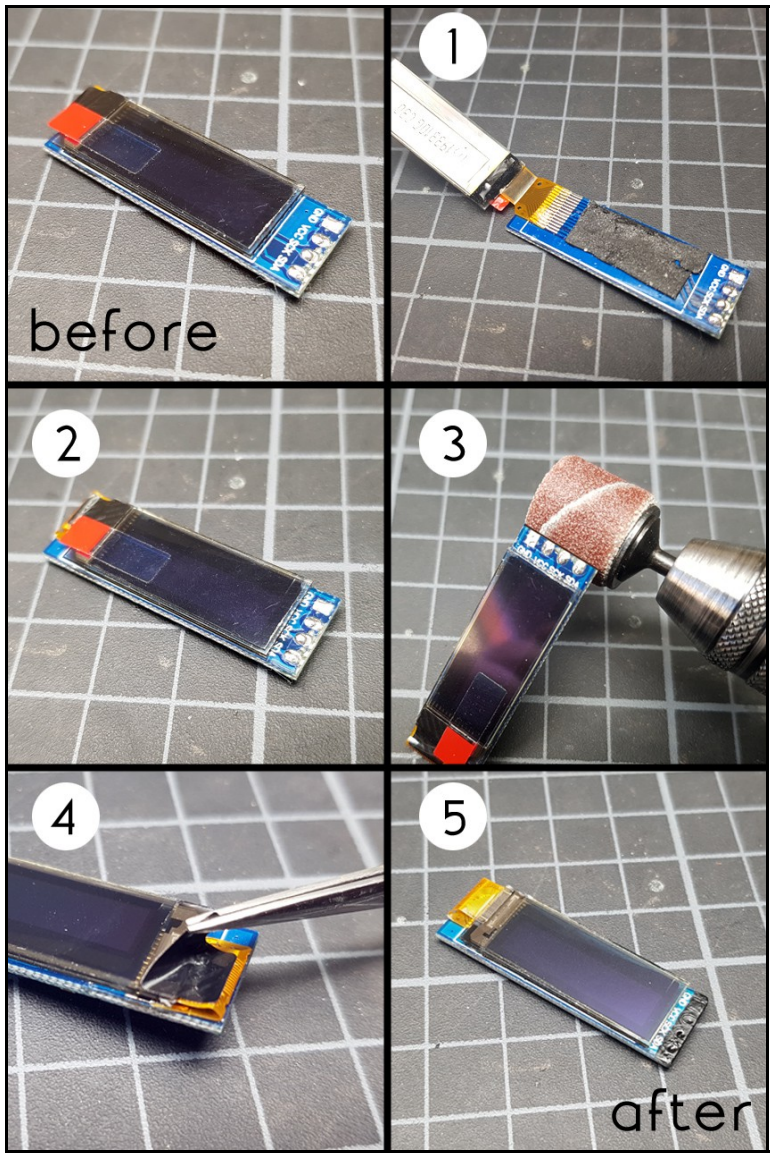
1. Remove the display carefully from the board. It is held by an double-sided adhesive film. Do not remove this film or replace it with a similar double-sided adhesive film. Be careful with the flat flexible wire.

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 or tape.



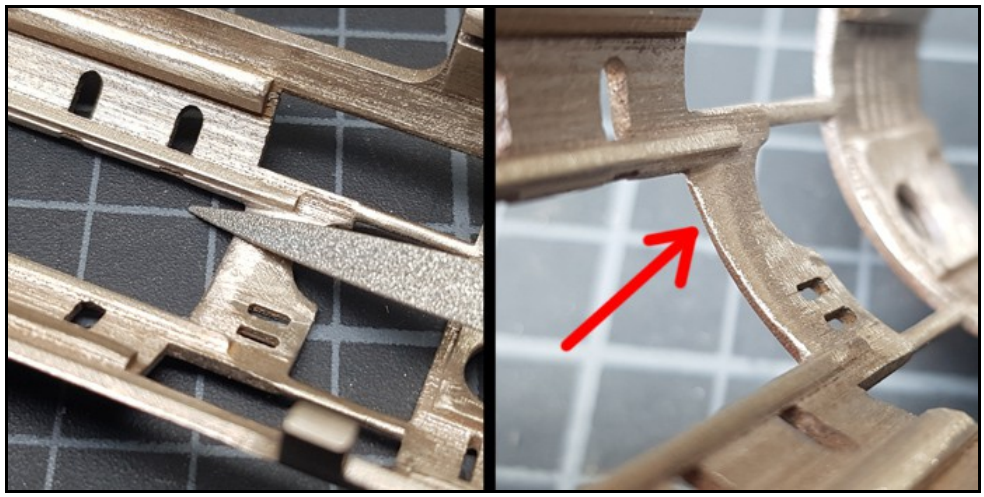
Cover (part 06 Oled) modifications

The 3D printed cover "**Metal Master part 06 Oled"** also has to be modified.

1. Prepare it like a standard Metal Master part 06. **Make it fit to the Metal Master part 05.**

2. Make sure the display fits into the frame. Place the Oled display into the part 06. If it does not fit easy, enlarge the frame of part 06 with a diamond file or sand-paper till the display fits.

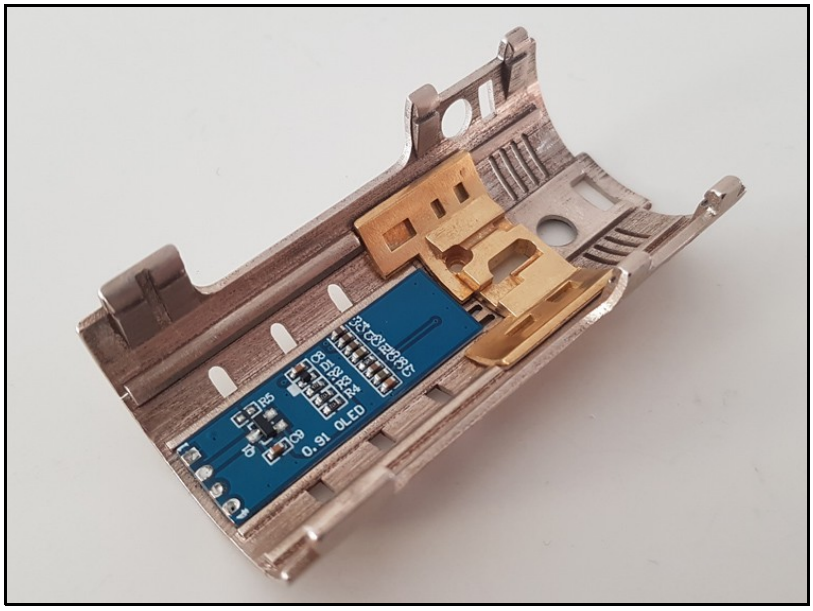
3. The area where the flat wire will be placed must be flattened. Otherwise the display cannot be attached straight. Removed material with a diamond file or a rotating grinding head like shown on the right picture.



This is how the attached Oled display should look like...

Glue it in.
After adding the electronic wires, the Oled board should be covered by an foil.

The six holes on the sides can still be used to add accent LEDs!



14650 Battery contact installation - Metal Master 1.0 and 2.0

The 14650 chassis is designed to carry most electronic parts in the main Part 05. That makes it possible to have a Crystal-Chamber at the correct position and more room in the front for more special effect details. I optimized the design to the limit. This has the consequence that there is not much space for the Batteries. **Especially not enough space for a 14650 battery-pack.**

ALL 14650 setups (3,7V and 7,3V) are **not for NeoPixel!**

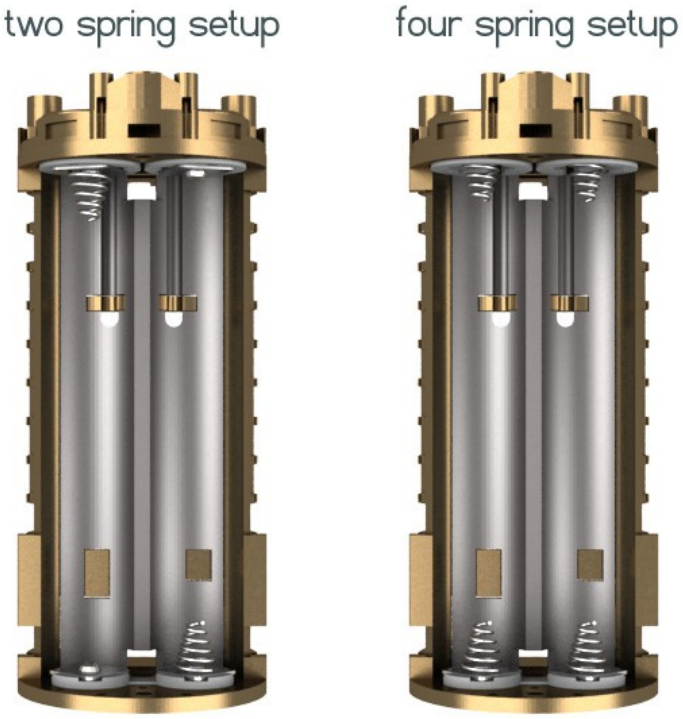
Individual unprotected flat head 14650 batteries must be used!

All labels have to be removed from the batteries!

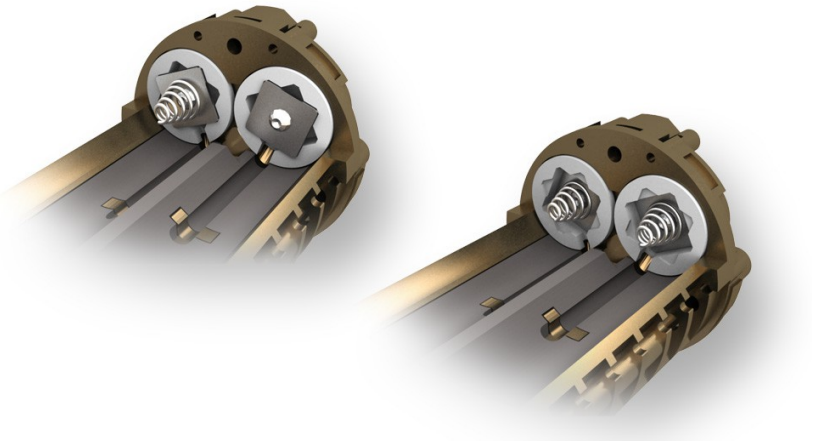
Do not remove the shrinking foil/insulation from the Batteries!

Spring contacts make the battery installation very easy. They can be replaced at any time by removing the battery cover.

There are two options for the battery-contact setup.
1. Setup with **one spring- and one flat- contact** for each battery.
The setup with one spring- and one flat- contact per battery makes it easier to replace the batteries. **The spring contact has to be the negative pole (-)!** All contacts have to be glued to the upper position of the printed insulation parts.



2. Two spring contacts for each battery.
The setup with two spring contacts per battery makes sure that you will never loose contact while sword fighting. But the batteries are not easy to replace. It´s a little tricky.
All contacts have to be glued to the lower position of the printed insulation parts.

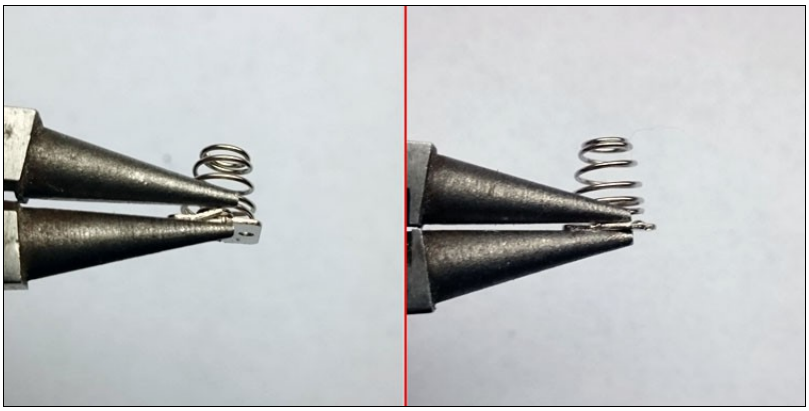


Battery Setups – 2x 14650 parallel or in series – only for high-power LED setup!

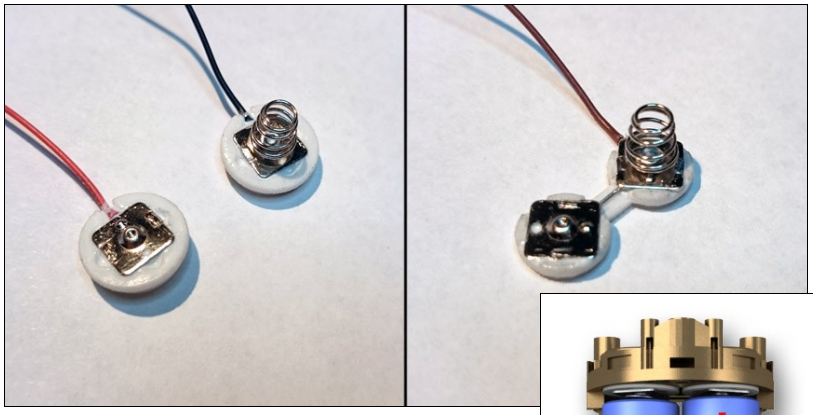
There are different 14650 battery setups possible...

Soundboard	2 x 14650 Battery Setup
3.7V Soundboards	2 x **unprotected** cells **parallel** with **external PCB**
7.4V Soundboards	2 x **unprotected** cells **in series** with **external PCB**
hacked 3.7V **(7.4v)** Soundboards	2 x **unprotected** cells **parallel** with **external PCB**

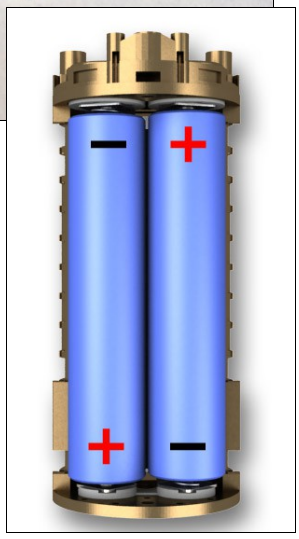
Contact-plate-hooks...
... have to be flattened!



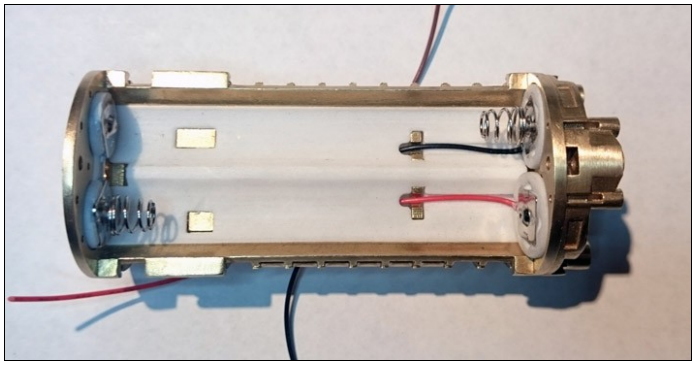
14650 Battery contact installation in series – for 7.4V with extra PCB



1. Flatten the edge-hook on each contact-plate!
2. Roughen the bottom of each contact-plate with 240 sandpaper or grinding bits
3. Solder wires to the contact-plates. One red (+) one black (-). The flat contact must be the + (positive pole). The spring contact is the – (negative pole).
4. Connect one spring and one flat contact with a wire (**jumper**). Connect also **an additional ground wire for the PCB board.**
5. Glue all contacts onto the printed insulation parts. Use **Epoxy glue .** Make sure the contacts are well attached.
6. Guide all wires through the supporting holes to the top of Part05
7. Push the insulation-contacts-parts into their position-holes.

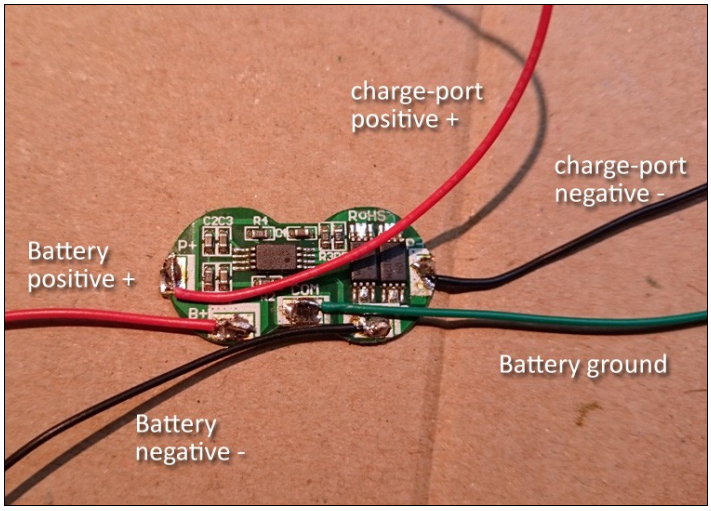


Example for installed contacts (in series setup):



PCB installation (in series 7,4V setup)

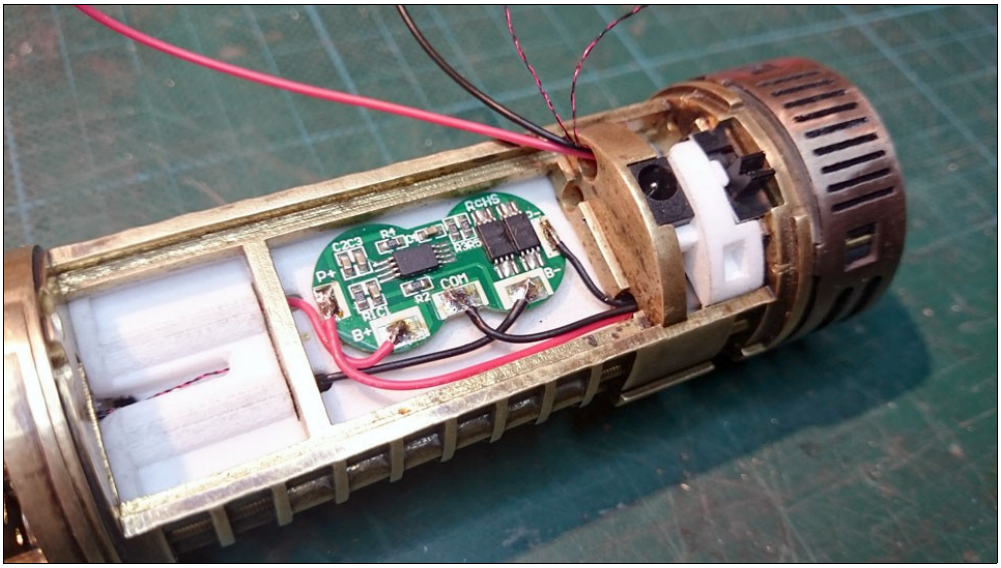
This PCB board is important to protect the two unprotected 14650 cells connected **in series**.



This PCB can only be used with unprotected cells! **Do not use protected 14650 with this setup.**

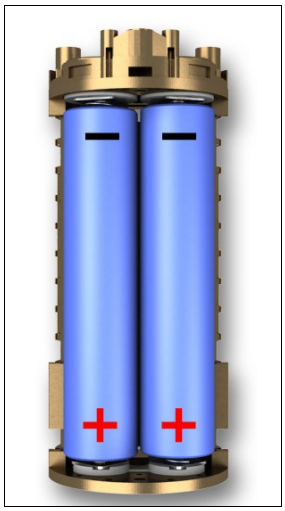
IMPORTANT: This PCB has to be activated after all electronic parts are installed!
It gets activated by charging (plug in the charger).
Also, it has to be reactivated each time cells were replaced. If it is not activated the soundboard gets no power.

This is how the PCB is connected. **Install the charge-port, power-switch and battery-contacts first. Then install the PCB with adhesive tape and solder all wires to the PCB (like on the picture below)**



14650 Battery contact installation parallel - for 3.7v with extra PCB

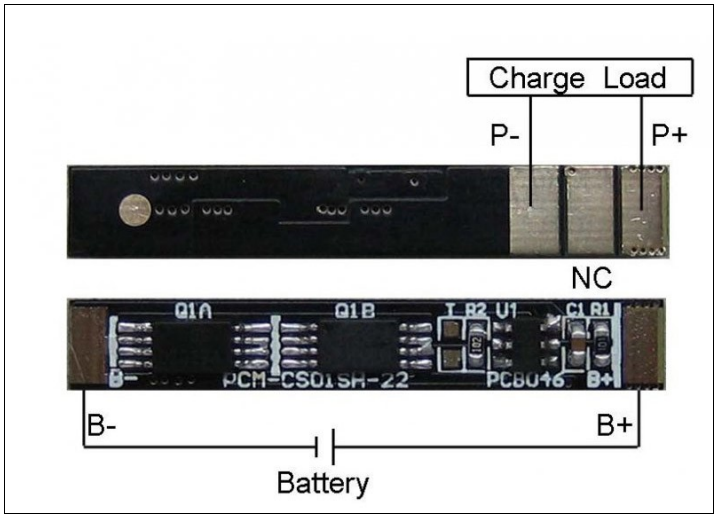
This setup is not recommended for NeoPixel blades!
Two 14650 batteries have a too low discharge current rate!
For 3.7V setups one single 18650 battery is recommended. Use two parallel 14650 only if necessary.



1. Flatten the edge-hook on each contact-plate!
2. Roughen the bottom of each contact-plate with 240 sandpaper or grinding bits
3. Solder wires to the contact-plates. Two red (+) two black (-). **The flat contact must be the + (positive pole). The spring contact is the – (negative pole).**
4. Glue all contacts onto the printed insulation parts. Use **Epoxy glue .** Make sure the contacts are well attached.
6. Guide all wires through the supporting holes to the top of Part05
7. Push the insulation-contacts-parts into their position-holes.

PCB installation (parallel 3.7V setup) – not for NeoPixel setups!

Use a PCB for 3.7V Li-Ion batteries!
Solder both positive battery contact-wires to the B+ contact on the PCB board.
Solder both negative battery contact-wires to the B- contact on the PCB board.
Solder +/- wires from the charge-port to the PCB.
IMPORTANT: The PCB has to be activated after all electronic parts are installed!
It gets activated by charging (plug in the charger).
Also, it has to be reactivated each time cells were replaced. If it is not activated the soundboard gets no power.



18650 Battery contact installation – recommended for NeoPixel setup
For Metal Master version 1.0 and 2.0

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

Battery versions

The 18650 Metal Master chassis **(1.0 and 2.0)** is designed for **protected 18650 Lithium-Ion Batteries**.
Depending on the Battery version, you need to install the right contact-insulation.
Battery versions are:
1. Standard protected 18650 Battery with raised top (plus pole)
2. Short protected 18650 Battery with flat top

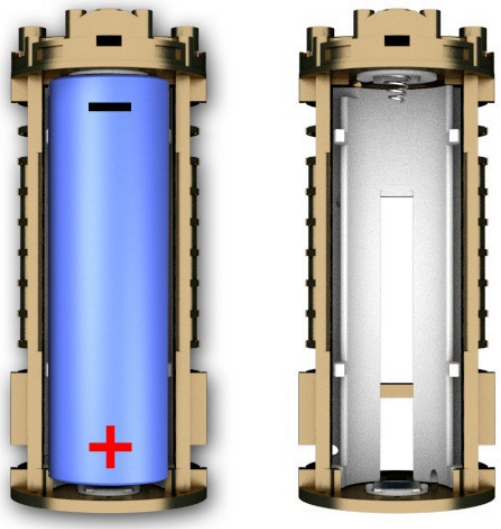
I recommend to use this battery brand:

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

The electric pole orientation for 18650 battery

The orientation is always the same. This is important especially for the standard Battery with raised top.

Front (spring-contact): negative (-)
Back (flat-contact): positive (+)

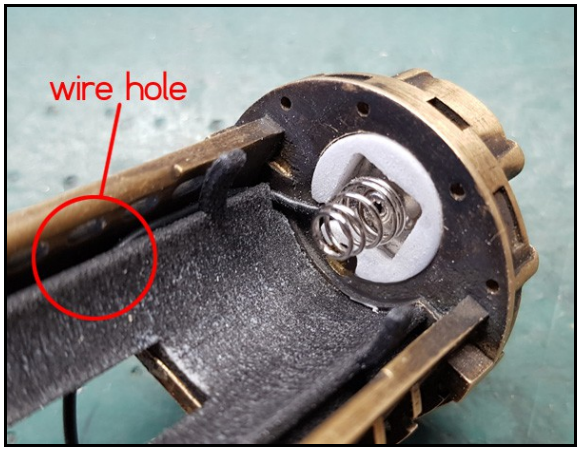


1. Standard 18650 protected Battery (raised top) setup - Metal Master 1.0

For the standard size 18650 Batteries two things are important:
- Use the **standard 3D printed insulation part** for the spring-contact
- **The contact-plate (positive pole) has to be modified, otherwise the Battery will not fit!**

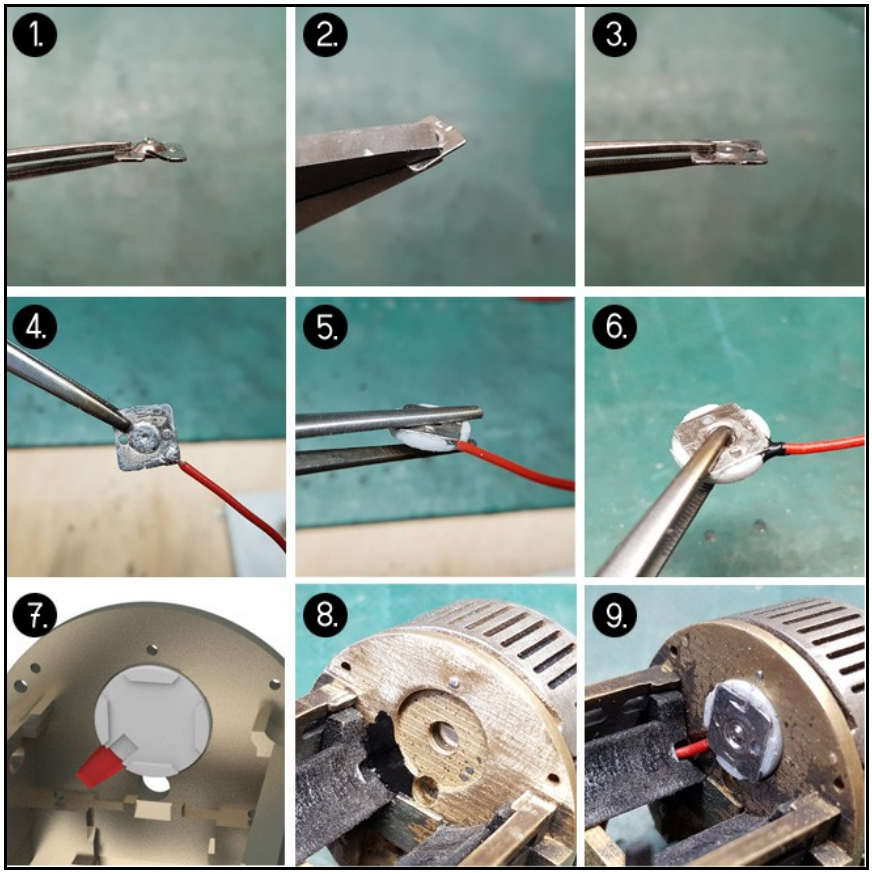
Spring-contact installation

1. Flatten the edge-hook on each contact-plate!
2. Roughen the bottom of the contact-plate with 240 sandpaper or grinding bits
3. Solder a black electric wire to the contact-plate
4. Glue the contact into the printed insulation part. Use **Epoxy glue or similar.** Make sure the contact-plate is well attached.
5. Guide the wire through the wire hole to the top of Part05
6. Push the insulation-part into the position-hole



Contact-plate modification and installation

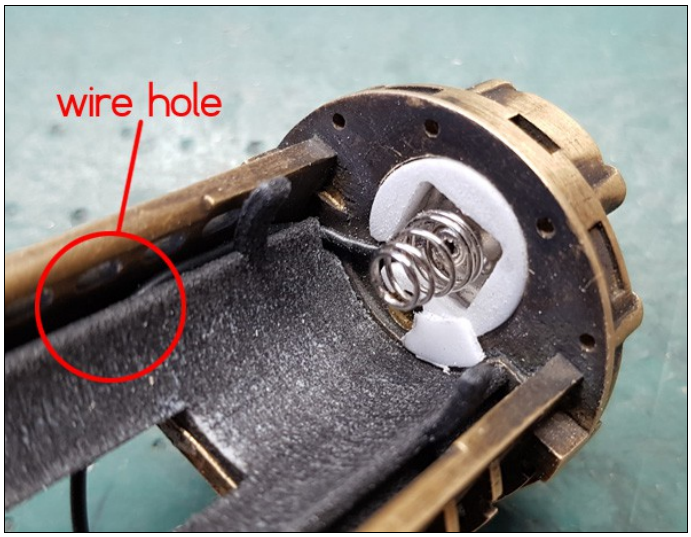
1. Flatten the complete contact-plate.
2. Use pliers to flatten the bulge
3. final contact-plate. **You can also use other metal plates with the same size.**
4. Solder a red wire to the contact-plate. It can be placed on top or bottom
5. Glue the plate onto the printed insulation part. Use **Epoxy glue.** Make sure the contact is well attached.
6. Use liquid rubber to insulate the electric wire connection
7. wire guide position
8. Use liquid rubber or tape to insulate the wire guide. This is very important to make sure it is safe
9. Push the insulation-part into their position-hole



2. Short 18650 protected Battery (flat top) setup – Metal Master 1.0

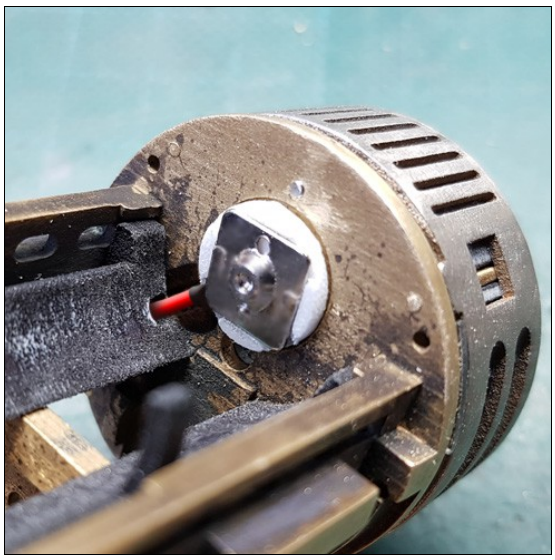
Spring-contact installation

For **short 18650 Batteries with flat top** it is necessary to use the special **insulation part** for the spring-contact. It has an additional **spacer** to hold the shorter Battery in position...
The installation is the same as for the standard insulation part.



Contact-plate (positive pole) installation

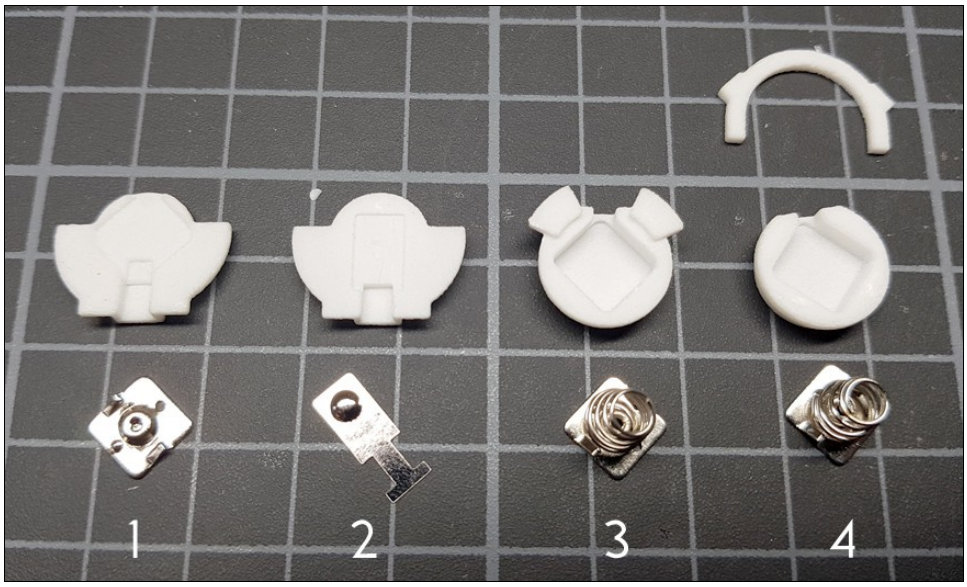
The installation for the contact-plate is the same as for the standard Battery. **But without the modification.** Do not flatten the bulge.
Only flatten the hooks!



Metal Master 2.0 18650 insulation parts and wire guide

Contact insulation parts

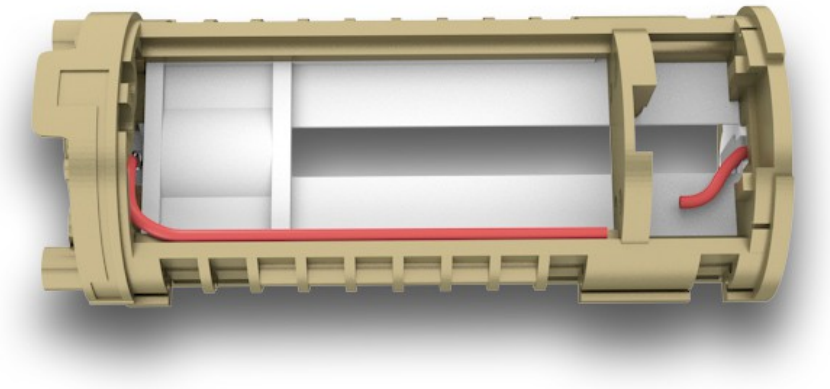
Metal Master 2.0 has different battery contact insulation parts. Please take a look at the picture below...



flat-head batteries : **1** and **3**
raised-head batteries: **2** and **4**

Battery wire guide

Metal Master 2.0 has different battery wire guides. Please take a look at the picture below...
Both wires (+ and -) have to be guided (to the charge port) like shown on the picture.



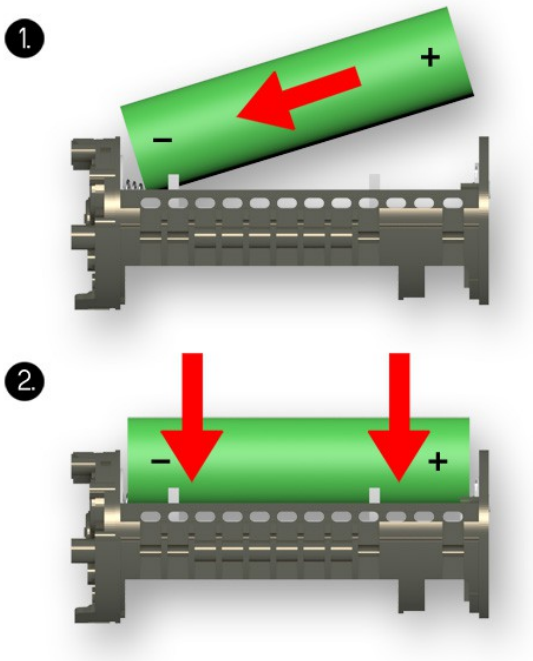
Installing the 18650 Battery

General 18650 Battery installation

Both 18650 Battery versions (flat-top or raised-top) have to be installed the same way.

1. Push the spring-contact with the **lover 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 down the other end with the positive pole.

2. When the battery is horizontal, push it down to the final position.



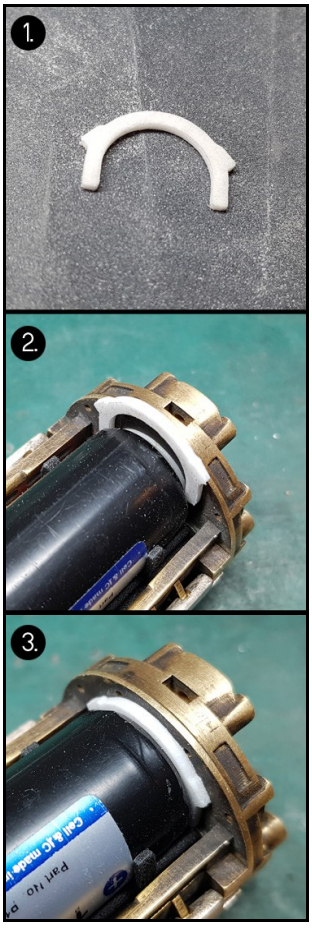
Spacer for short flat-top Batteries

The spacer for short Batteries comes with the 3D printed insulation pack.
This part makes sure that the Battery does not loose connection.
It is not absolutely necessary. The insulation-part already has an integrated spacer. This extra spacer just makes it safer.

1. Sand down the spacer till it fits between the Battery and the chassis wall. It is not much.

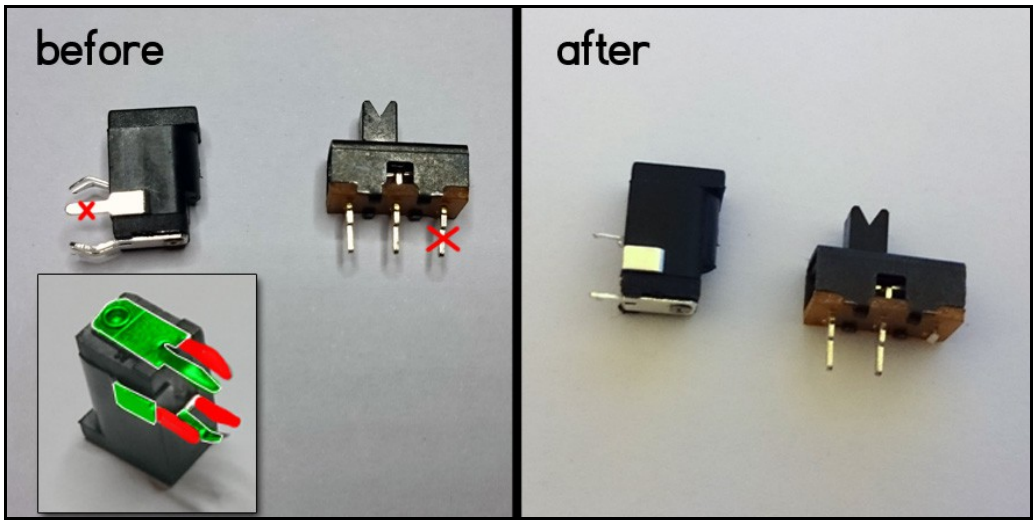
2. Push the spacer in position.

3. If the Battery-cover MM Part07 does not fit anymore, sand down the top of the spacer a bit.
For removing the spacer use the hooks on the sides.

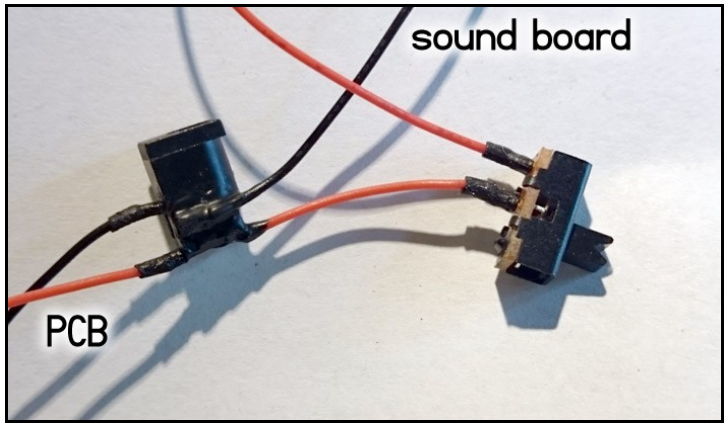


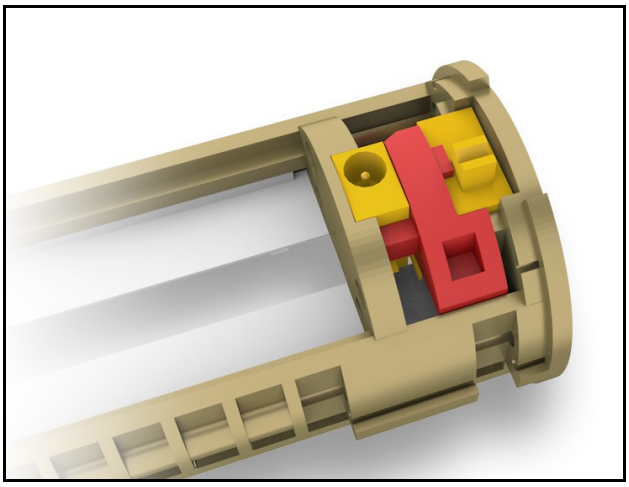
Charge-Port and Power-Switch installation

The charge-port and the switch have to be modified first. Like on the pictures. Remove the red contacts.



Connect the wires to the charge-port and the main power-switch like it is shown on the pictures. For insulating and protecting the contacts use **liquid rubber.**
Connect the **+/- wires** from the charge-port **to the PCB board or battery contacts**!



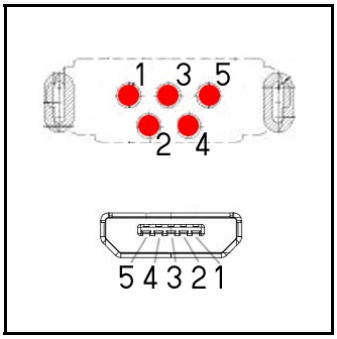


Charge-port-spacer
For installing the charge-port and the switch **(yellow)** use the **charge port-spacer (red)**. This spacer should be placed between port and switch to hold both in position. **You do not need any glue!!!**

Micro USB-B port installation - R.I.C.E.

If you use a **Crystal Focus** Soundboard from Plecter Labs , it is possible to add a R.I.C.E. port. For this **a micro USB port** has to be installed into the ***Part06 tech USB.***

How to install the external USB port into *Part06-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!**

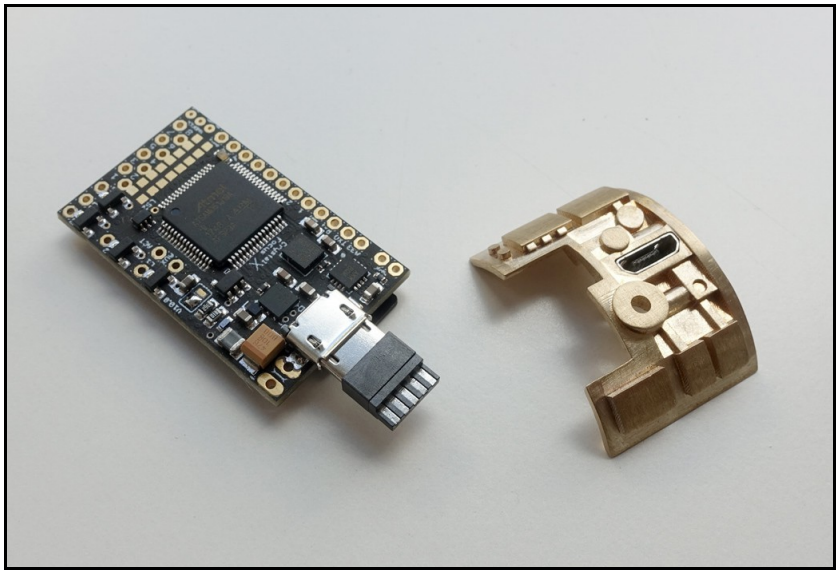


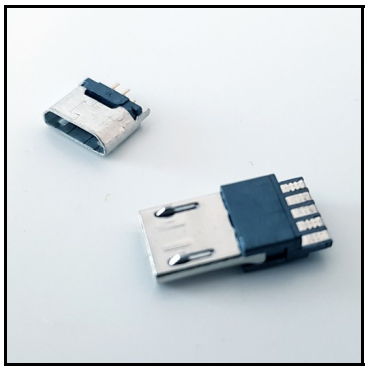
After the external USB port is installed...
Solder wires to the Soundboard (**TXD** and **RXD** pad) and to the battery pack negative (-). Connect these wires to the USB port:
TXD = 3
RXD = 2
GND = housing

(While it's possible to wire the sleeve (GND) wire to the GND pad of the board, *Plecter Labs recommend connecting it* ***to the battery pack negative*** *and not to the board negative****.)***

Next gen Soundboards like **CFX** or **Proffie** have an **integrated micro USB port**.

This port can be extended by plugging an USB connector with an additional **extension cable** to the external USB port.
(right picture)





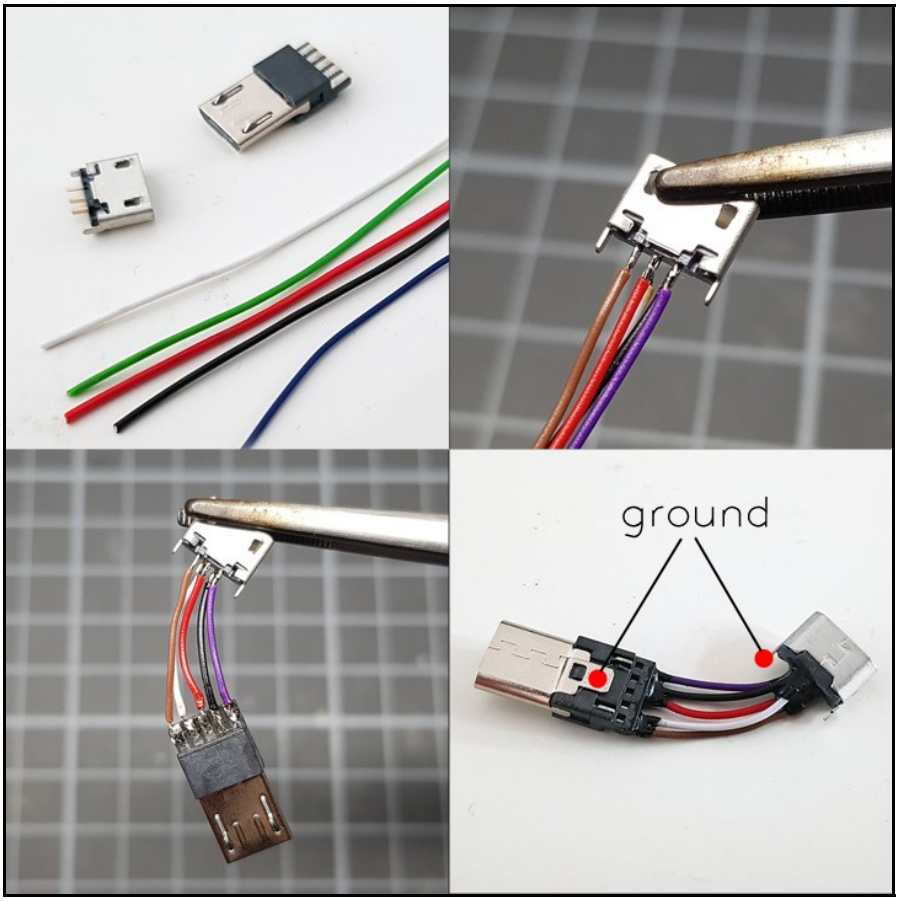
USB port and connector are available in my shop on **www.mb-sabers.com**.

The part "**Metal Master 06 tech USB"** for adding an external USB port is available at my **Shapeways shop**.

For **the extension** you need 5 thin electric wires, a connector and the port. Since the wires do only guide informations and no high current, they can be as thin as possible. Use enameled electric wire.

Solder each wire to one of the five port pins.
The extension does not have to be long. Cut the wires to length and solder each **in the same order** to one of the five connector contacts. **Do not confuse the order!**

If necessary a GND (ground) wire can also be installed between port and connector!



After all wires have been added, all solder joints should be insulated well with liquid rubber!

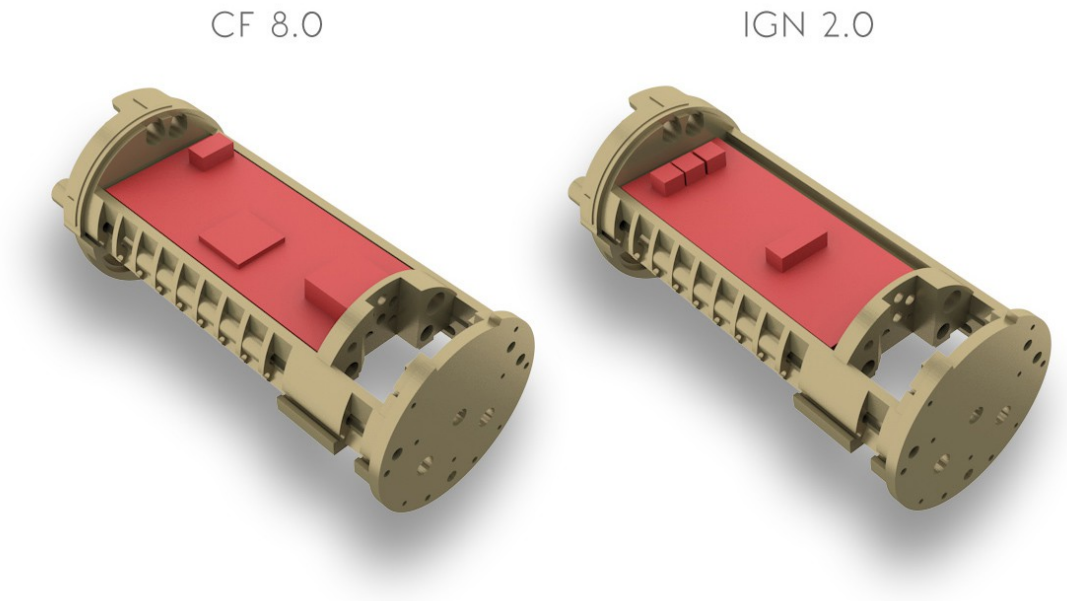
Soundboard position Metal Master 1.0

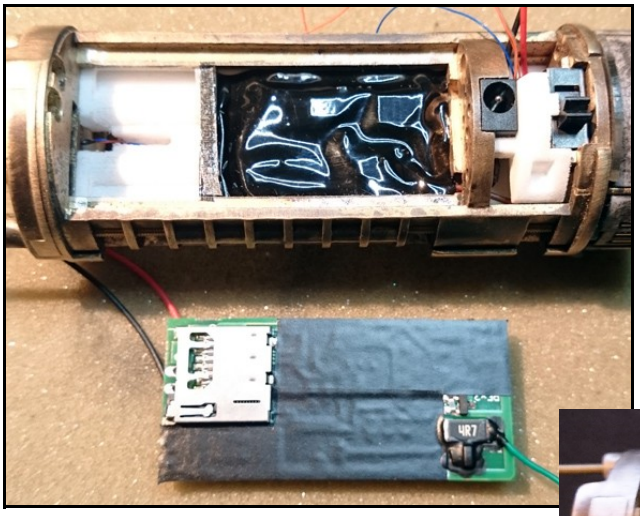
Metal Master 1.0 is designed for Igniter and Plecter Labs Soundboards up to version 9.
For CFX (Crystal Focus 10) or Proffie Boards please use Metal Master 2.0 parts!
After installing battery-contacts, charge-port, main-switch and speaker it is time to install the Soundboard.

It is absolutely important to insulate everything well!

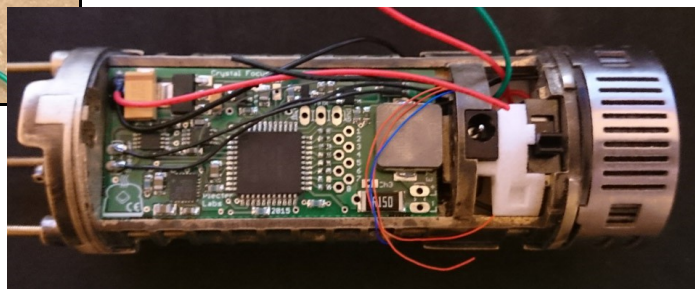
How the Soundboard is attached is up to you. You can glue it... or use double sided adhesive tape... or use something different.

Igniter and CF position:
The SD-card slot is behind the crystal chamber. It is important to push all Soundboards to the front/left position **to have easy access to the SD card later.**





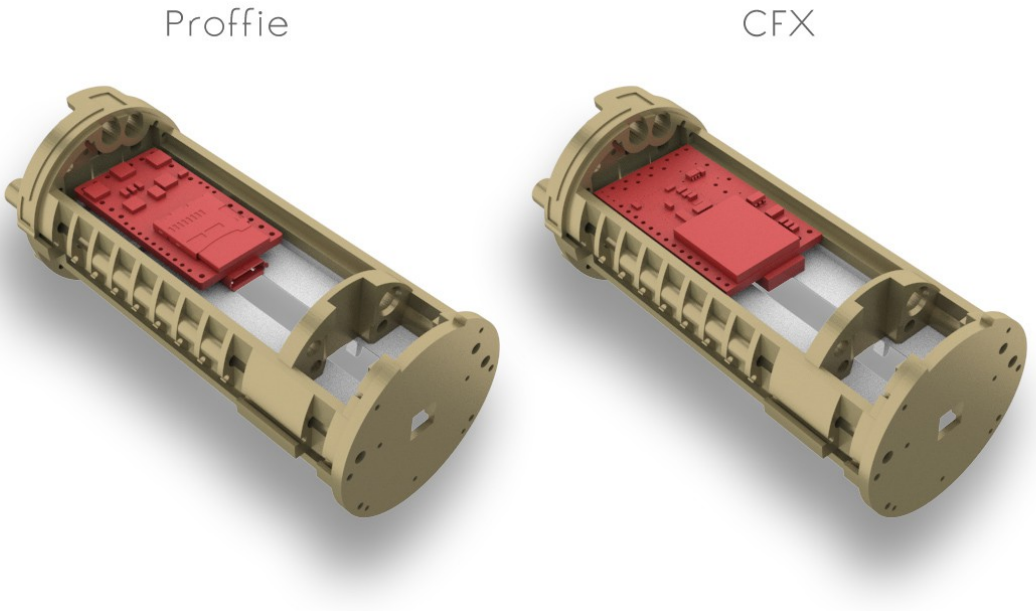
Insulate the PCB and the Soundboard well.
Cover both with insulation tape or foil. If necessary cover open contacts with liquid rubber.



Soundboard position Metal Master 2.0

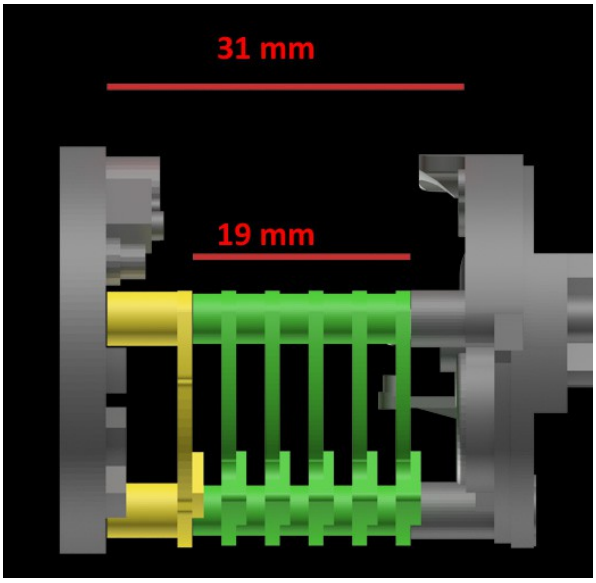
After installing the battery-contacts, charge-port, main-switch, speaker and RICE it is time to install the Soundboard...
Metal Master 2.0 *Part05 is designed for the* ***new soundboard generation****. These boards are smaller and have an integrated USB port. The SD card will no longer be accessible from outside the chassis!*
But the USB port can be extended to the new chassis part "Part06 Tech USB" which has got a slot for an external USB port.

It is absolutely important to insulate everything well!



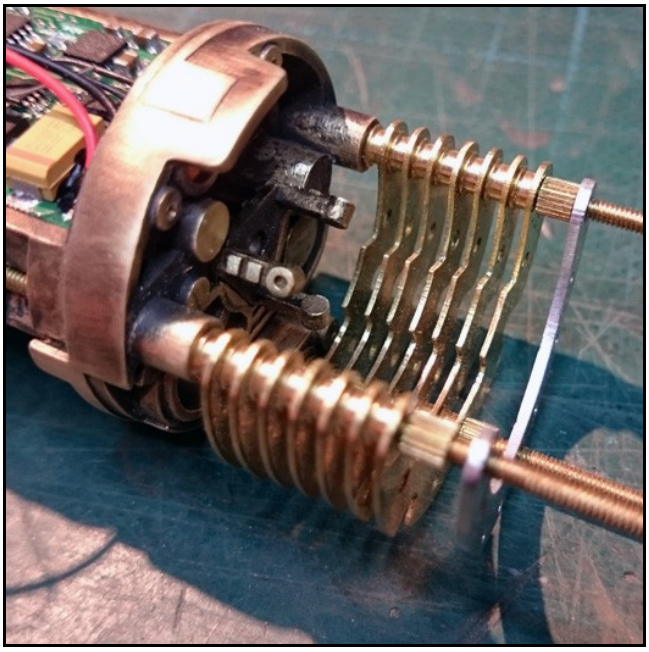
How the Soundboard is attached is up to you. You can glue it... or use double sided adhesive tape... or use something different to hold it in place.

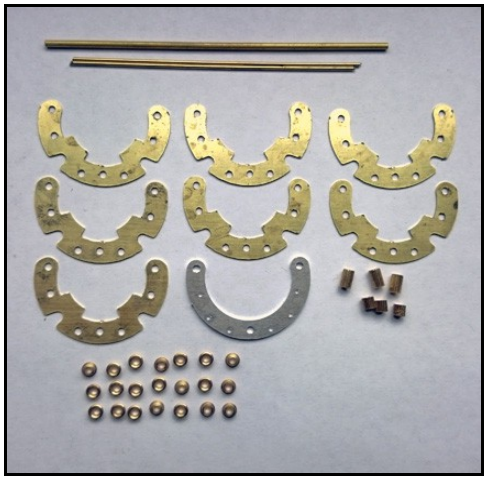
Fins installation (3D printed or laser cut)



It is possible to use laser cut fins instead of Part04 fins. That makes this chassis much more customizable.
Actually you can do what ever you want to customize the chamber. Important is only to keep the length equal or smaller than 31mm.
So, if you use the 1mm laser cut fins, you have to choose **2.8mm spacer** to make sure the chamber is not longer than 31mm.

This is the **brass fins setup** with the deluxe kit from **mb-sabers.com**.
It contains 7 brass fins, 21 spacers, 6 threaded spacer and one aluminum fin (replacing Shapeways Part 02 C).
Also included are two rods for the U-rod and a 1.8mm diameter brass tube.

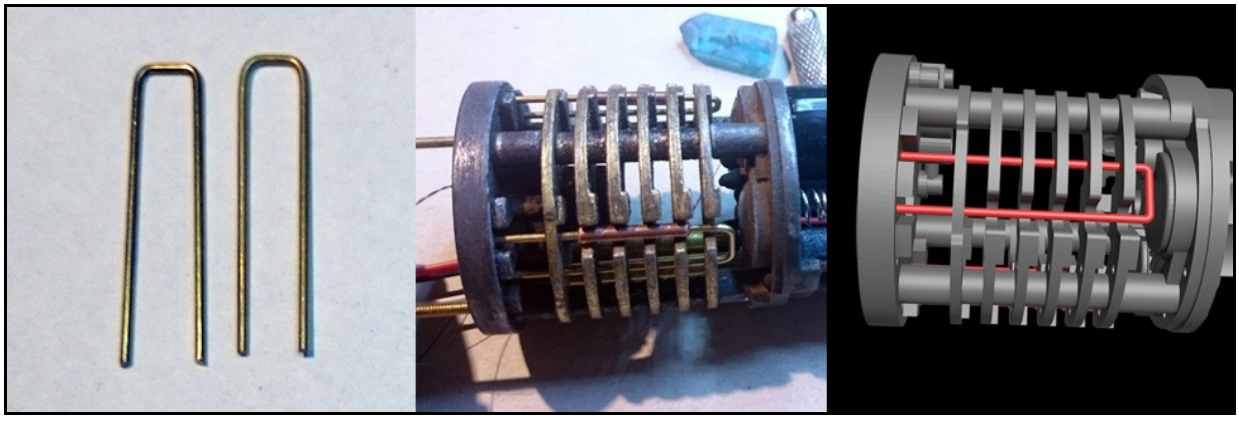




All fin holes and spacer holes have to be filed a little larger to make the installation easier . Use a small round file.

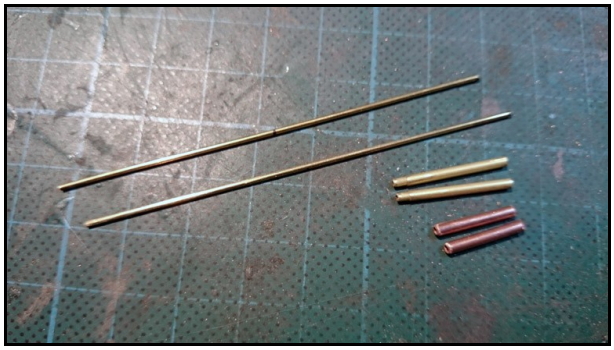
Fin rods and U-rods installation

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.

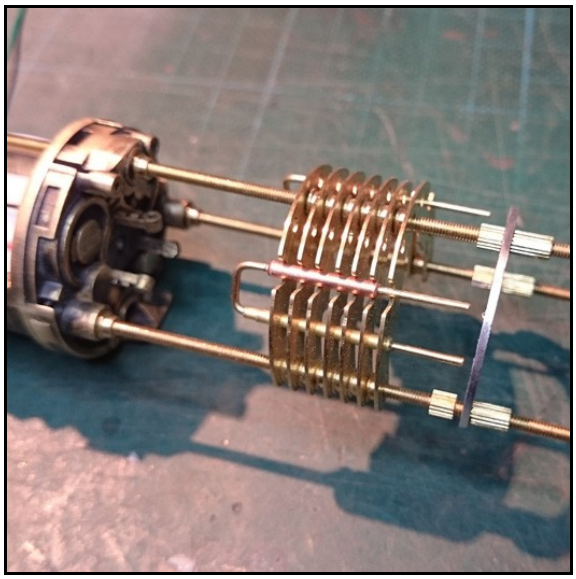


Bend them with **round nose pliers** to the U-shape you can see on the pictures. The distance between both ends is 5.5mm.

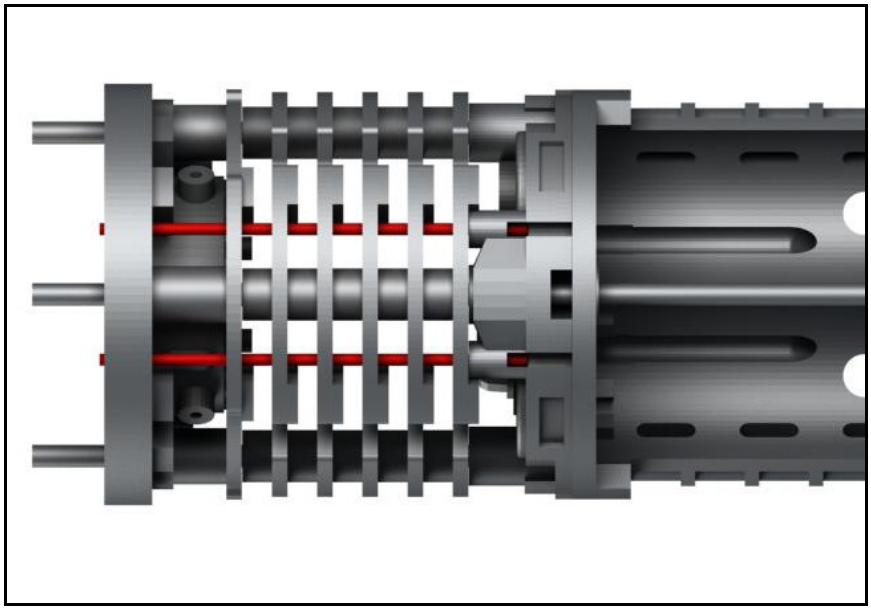
The next pictures show **advanced U-rod designs**. Some 2mm diameter tubes were added.
These U-rods can be combined with the **brass fins** from the mb-sabers.com shop.



Install the U-rods together with the fins.

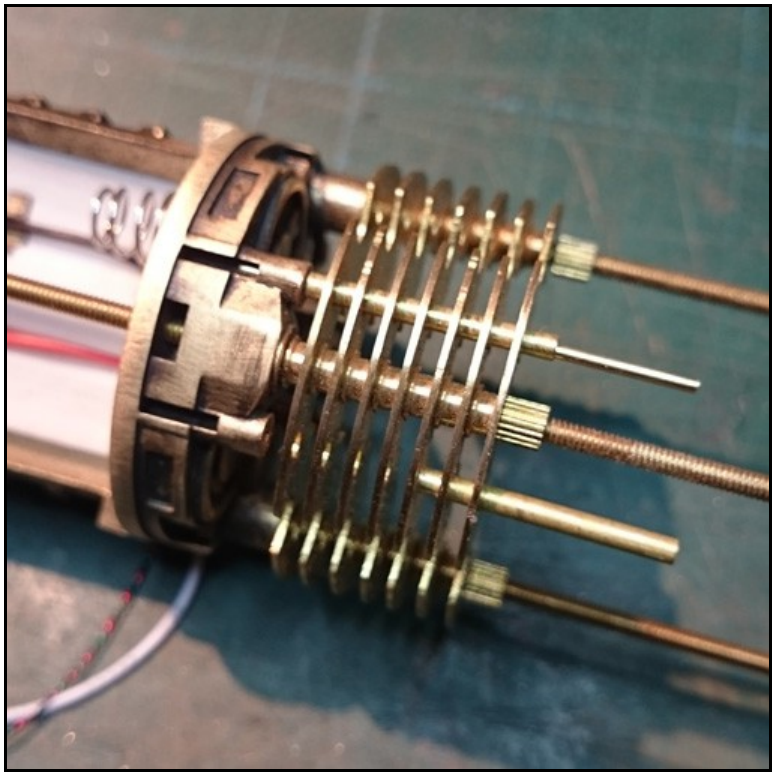


Now install the **short rods** into the lower fin holes. The rods should be 35-37mm long.
The fin rods and the battery-cover-rods (which holds the battery cover in position) are offset!



The next pictures show an advanced short rod set up with the **brass fins** from the **mb-sabers.com shop.** For the brass fins you need 1.8mm diameter tubes and 1mm diameter rods. Both included in the **brass fins deluxe kit.**

Cut the tubes to length and push them into the lower fin holes.
Then insert the rods into the tubes like on the picture.



Plasma Gate 2.0

The **plasma gate** is only available for **mb-Sabers´ EMITTER Bladeholder.**

Additional parts for the plasma gate 2.0:

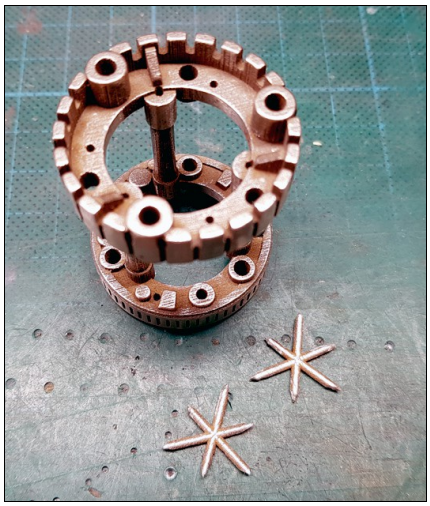
- 35mm poly-carbonate tube with 10mm outer diameter
- 3x 35mm aluminum, steel or brass tubes with 3mm outer diameter
- plastic wrap / clingfilm
- 3mm LED, 5mm LED or pixel LED
- LED holder

Deluxe or standard

Part 01 Plasma Gate 2.0

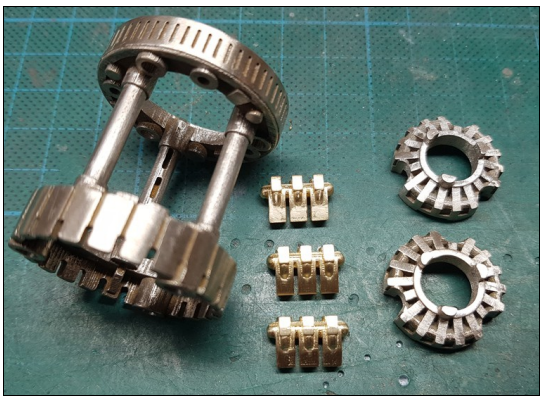
Part 01 Plasma Gate 2.0 deluxe

The Plasma Gate 2.0 is available as **standard or deluxe** version. The deluxe version has separated Plasma tube holder. That gives the opportunity to combine two materials.



The "***Part01 Plasma Gate 2.0 deluxe"*** part has **supporting sprues**. These sprues have to be removed (picture on the right)! **The cast metal version does not have supporting sprues!**

After removing the sprues, the **deluxe details** (tube holder) **can be installed**. Glue them into position.



Also remove the sprues from the three Plasma Gate **tech-details** and put them in position.

After that install the **three wire guide tubes**. Glue them into position.

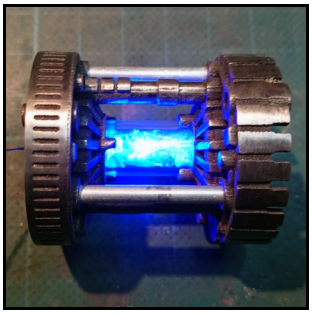
This Picture shows how all parts come together

Plasma Tube

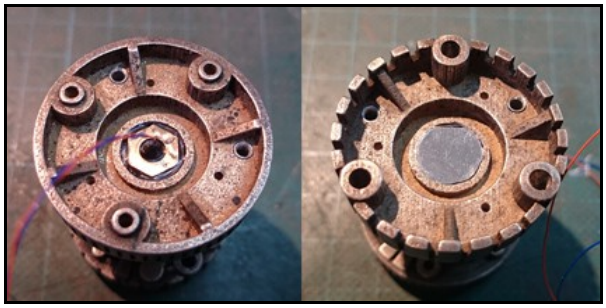
Prepare the **LED holder (example)**. Cut down the LED holder. Glue it into the tube. Then install the tube.

(***This is just a suggested solution.*** *Actually you can do what you like. Be creative. It is also possible to stick the LED completely into the tube... or more than one LED in row... or one from each side. It´s up to you. Also the LED holder can be different)*

Next step is to fill the poly-carbonate tube with something **to scatter the light**. I would use some **plastic wrap**. But it is up to you. There are a lot solutions.



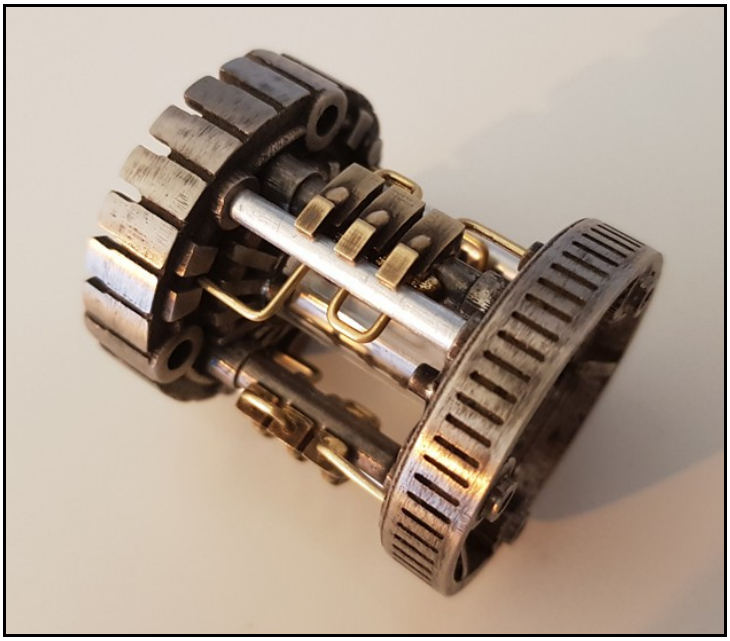
Do some light tests. If there is to much plastic wrap inside, the light will not shine through. You have to find the right setup.



Close the other end of the tube with mirrored tape.

Additional brass wire details

The final step is to add metal wires like shown on the picture below. There are holes in the **tech-details** part and the plasma gate main part. These holes can be used to install the **metal wires**. There is no general way to add them. The picture below is an example.



Spinning Plasma Gate (Part 01 SPG)

The **Spinning Plasma Gate (SPG)** is only available for **mb-Sabers´ EMITTER Blade holder.**
It is compatible with all mb-Sabers Graflex chassis. Old Part01 versions can easily be replaced.
It includes a spinning object called the “magnet”.

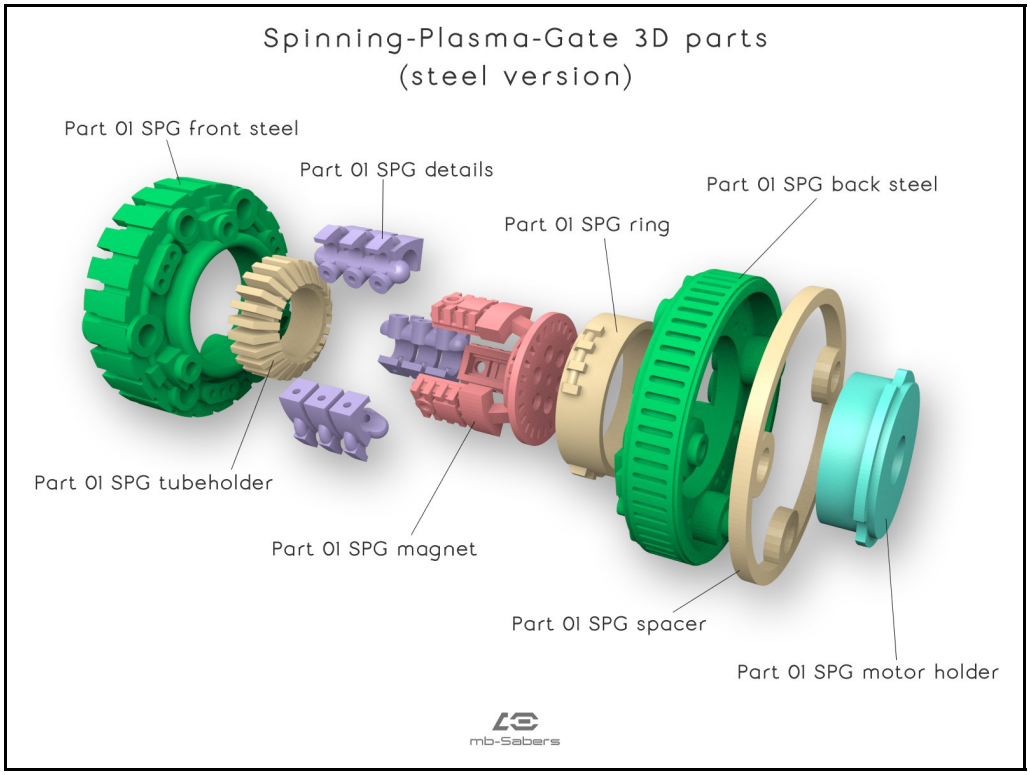
Required additional parts for the SPG:

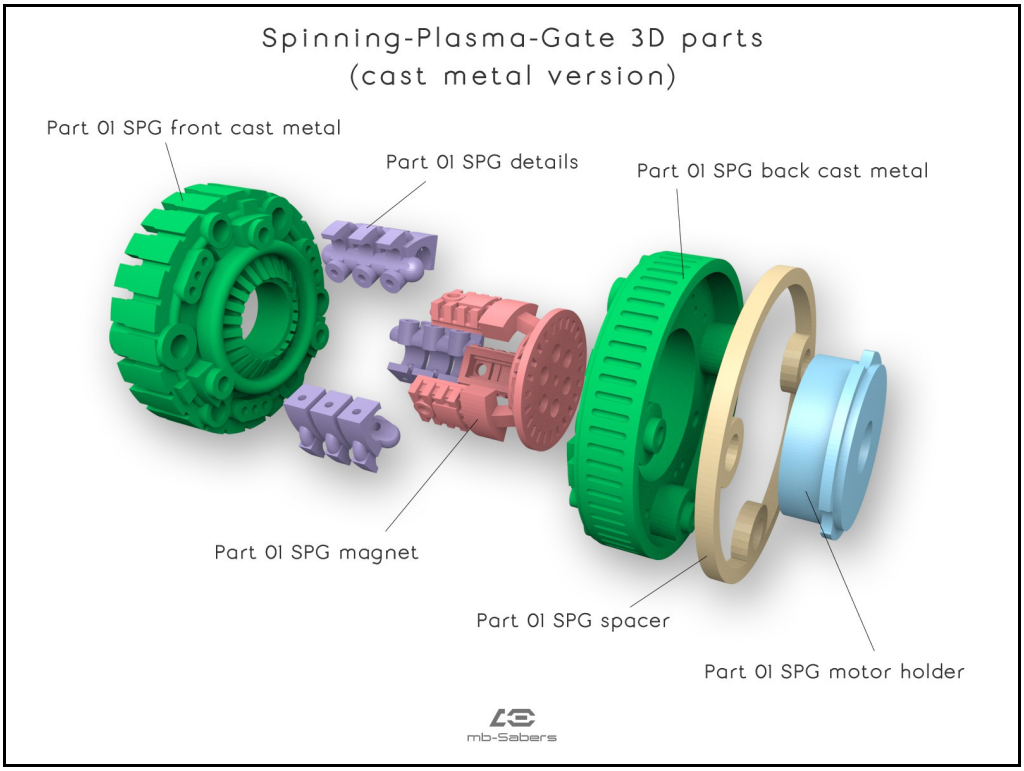
- 35mm **poly-carbonate tube** with 10mm outer and 7mm inner diameter
- 3x 35mm **steel tubes** with 3mm outer diameter and thin wall
  Link to shop
- 3x 15mm **brass tubes** with **4mm outer** and **2mm inner** diameter
  Link to shop
- 3x 40mm steel **threaded rods** M2
  Link to shop
- 2x **bearing** (dimensions are listed in the description below)
  Link to shop
  Link to shop
- 12x M2 **model-nuts (steel)**
  Link to shop
- **plastic wrap** / clingfilm
- 3mm **LED**, 5mm LED or pixel LED
- LED holder
- electronic **motor with gear installed (200 rpm) 6mm diameter!**
  Link to shop

3D printed steel or cast metal material:

The **Spinning Plasma Gate** (**SPG**) is available **as steel or cast metal version.**
The steel version has two more 3D printed parts!
On the pictures below are all 3D printed parts listed for both variations.

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



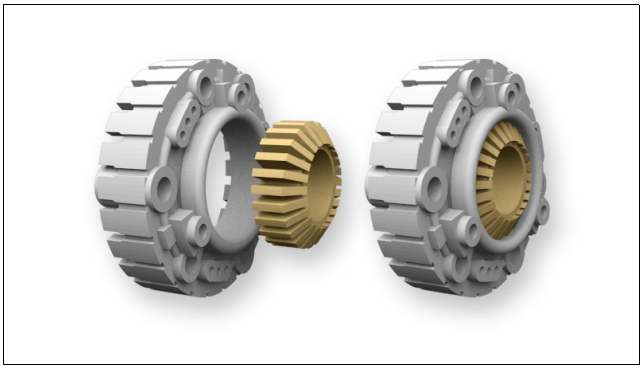


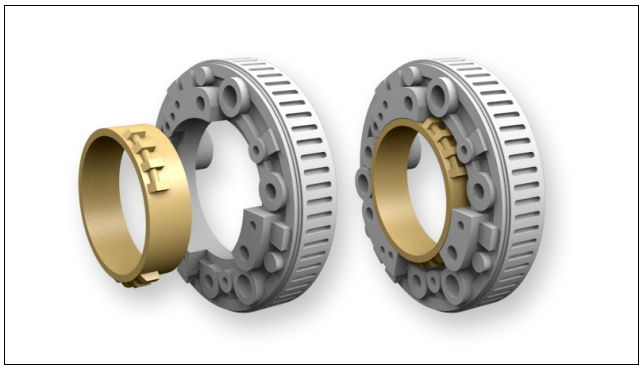
Steel part preparation

The **steel version parts have sprues** to avoid deformation.
These sprues **must be removed**. Use a rotating tool or a diamond saw.
Also important is to sand down the **surface and holes (!)** of all steel parts!

Tube-holder and SPG ring

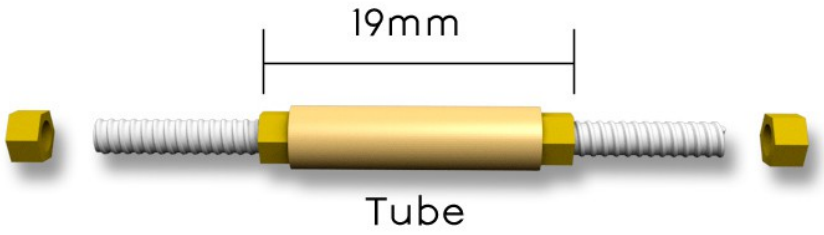
The **steel version has two more parts:** The **tube holder** and the **SPG ring** (pictures below).
The insides of the holes provided must be sanded until the parts (tube-holder and ring) fit in.
The parts of the cast metal version have these design elements already integrated!





Threaded rod setup (very important step)

Part01-front and **Part01-back** are connected by three threaded **M2** steel rods.
Each rod gets a metal tube as spacer (4mm outside/2mm inside). These tubes **MUST** have the same **exact length (+/- 0.05mm)** AND both ends have to **be parallel**. Otherwise the whole construction does not work. A lathe is best for exact cutting the tubes. Together with **two M2 nuts,** holding the tube in position, the length should be around 19mm (+/- 0.5mm). **These additional nuts are absolutely necessary!**
After all three rods are prepared attache them to **Part01 SPG back.** Add a washer and a nut to each and fasten the nuts.



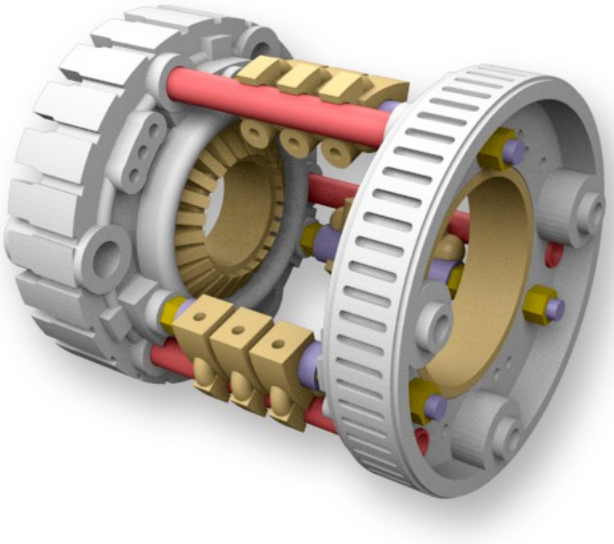
Tech-details

Remove the sprues from the **Part01 SPG tech-details**.
Put all three tech-details loose over the already attached spacer/steel rods.

Electric wire guide tubes

Add three **thin walled steel tubes** (3mm diameter) to **Part01 SPG back.**
Make sure the ends are smooth without sharp edges. Otherwise electric wires could get damaged!
Attach them with **screw-lock medium** to hold them in position.

Add **Part01 SPG front** to the Plasma Gate. Add washers and nuts. Fasten the nuts. The Plasma Gate should now look like that:



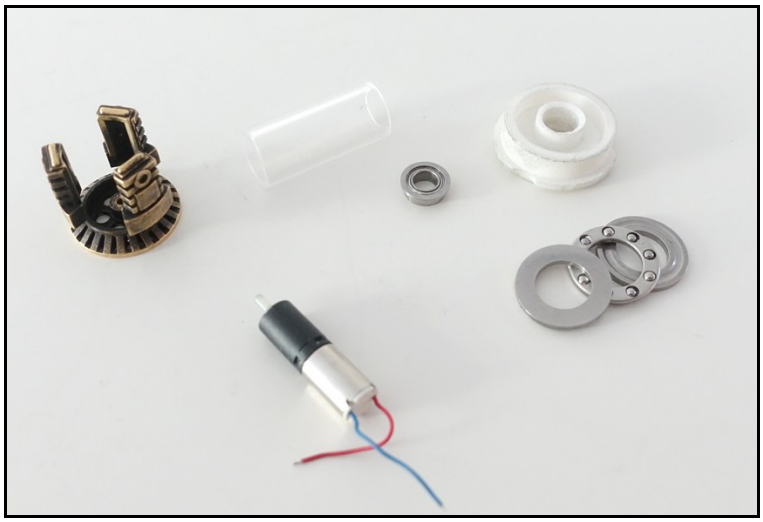
Motor-holder

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!**

Magnet and motor installation

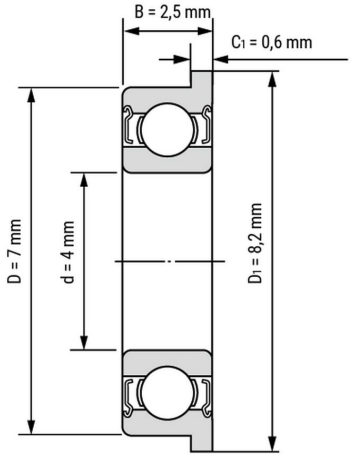
Use a small 6mm diameter electric motor with attached gear.
Depending on the manufacturer, the motors have different shaft diameter. Some have 2mm others have 1.5mm or less.
The spinning “Magnet” has a 1mm hole. **Adjust the hole size to the shaft size.**
The shaft should slip in with medium pressure. But do not make it fit loose! The shaft will not be glued into the “magnet”!
If the shaft fits loose, use small round pliers to press the Nylon-shaft slightly flat. This makes the shaft fit tighter.

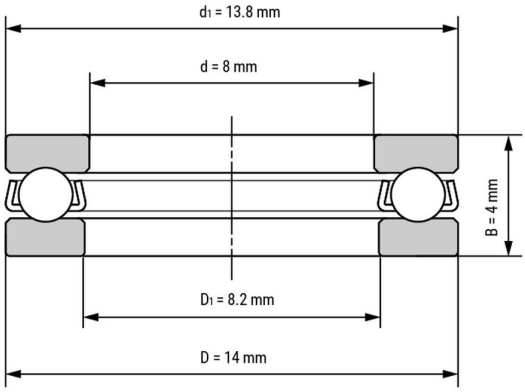
Motor section parts



Bearings

These are the two bearings for the SPG.

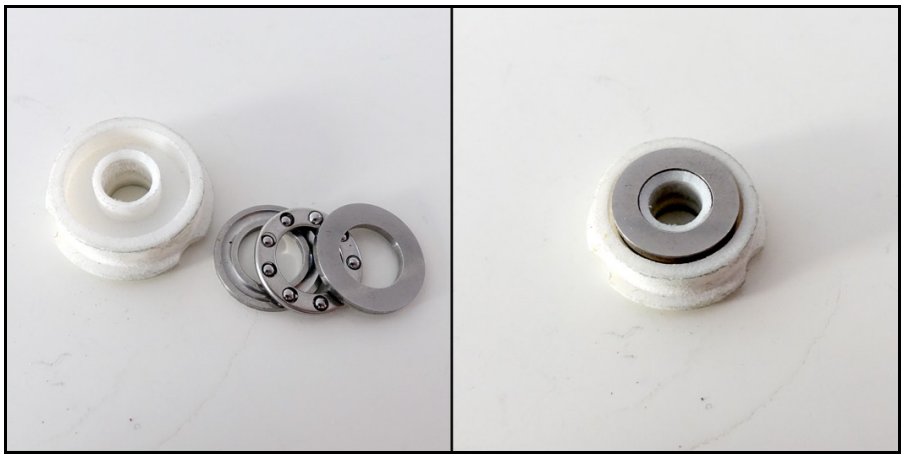




Assembling the motor section

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).



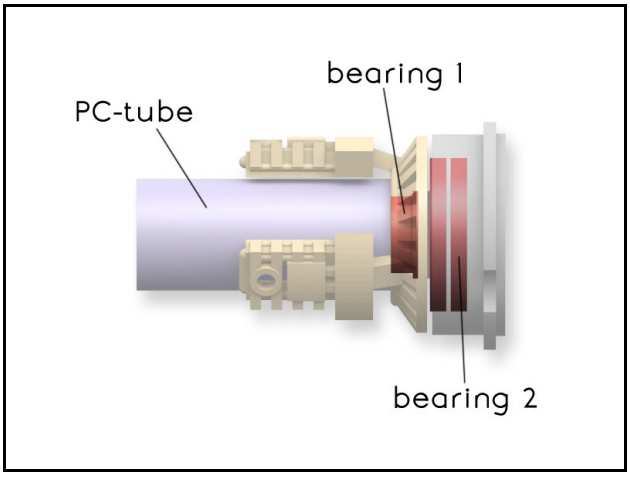
Install the motor.

Push the “magnet” 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 “magnet”) into **Part01 SPG back.**

Install the poly-carbonate tube

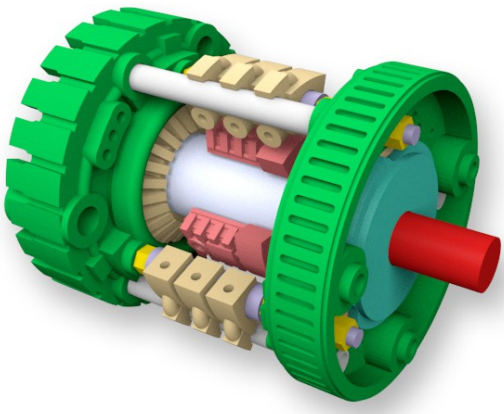
The poly-carbonate tube is a very important part for the spinning function.
The tube holds one of the bearings (bearing 1).
This bearing is very important!
The tube needs a planar and smooth right-angled end to make sure the rotation axis is straight!



Install the bearing 1 and **push the PC-tube through the tube-holder** down to the **bearing1**.
Check the length of the tube and make adjustments if necessary.
The tube should touch the bearing without pressure!
Run the motor and make a test. 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).**

Attach PC-tube and motor

Install the motor-holder again and use 1-2 Epoxy drops to just fix the position.
Add some flexible glue to the PC-tube and push it into the tube holder down to the bearing1.
Again...**The tube should touch the bearing without pressure!**
Run the motor for a moment and let everything dry well!



Now the SPG should look like this...

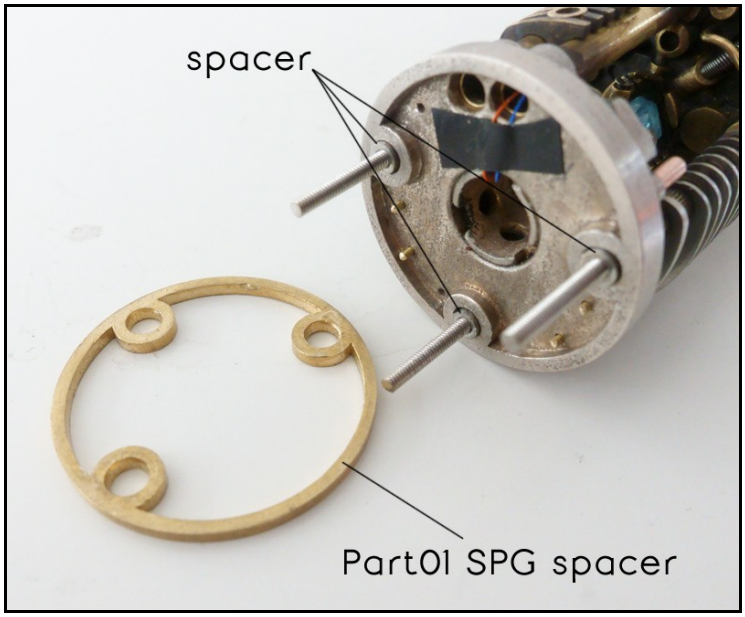
Connecting SPG to Part02

To connect the SPG to Part02 a “spacer-ring” between Part01 and part02 is necessary. Otherwise the motor would not fit into the chassis. The spacer is called **Part01 SPG spacer.**

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 attached!
Now each **main threaded chassis rods get a spacer.**
I recommend to use threaded spacer (rounded nuts). But this is not absolutely necessary!
It is just easier to attach the **spinning plasma gate** when the Part02 and the crystal chamber is safe attached to the main chassis.

These three spacer are also holding the **Part01 SPG spacer** (between **Part01 SPG** and **Part02**) in position.



Spacer size: 2.8mm diameter / 2.75mm height

Create the threaded spacer

The easiest way to get the right spacer is to use **three washer and one M2 nut** for each threaded rod.

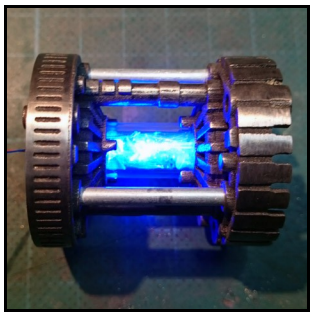
Reduce the diameter of the washers and the nuts to make them fit into the deepenings.

Attach a M2 threaded rod (3cm length) to a rotating tool (Dremel).
Attach the washers and the nuts to the rod.
Turn on the rotating tool and hold the attached rotating washers and nuts against a file or sandpaper to **reduce the diameter to max 2.8mm**.

Plasma 3mm/5mm LED installation (or use a pixel LED)

Prepare the **LED holder (example) for the PC-tube**. Cut down the LED holder. Glue it into the installed PC-tube.

(***This is just a suggested solution.*** *Actually you can do what you like. It is also possible to stick the LED completely into the tube... or more than one LED in row... or one from each side. It ´s up to you. Also the LED holder can be different)*



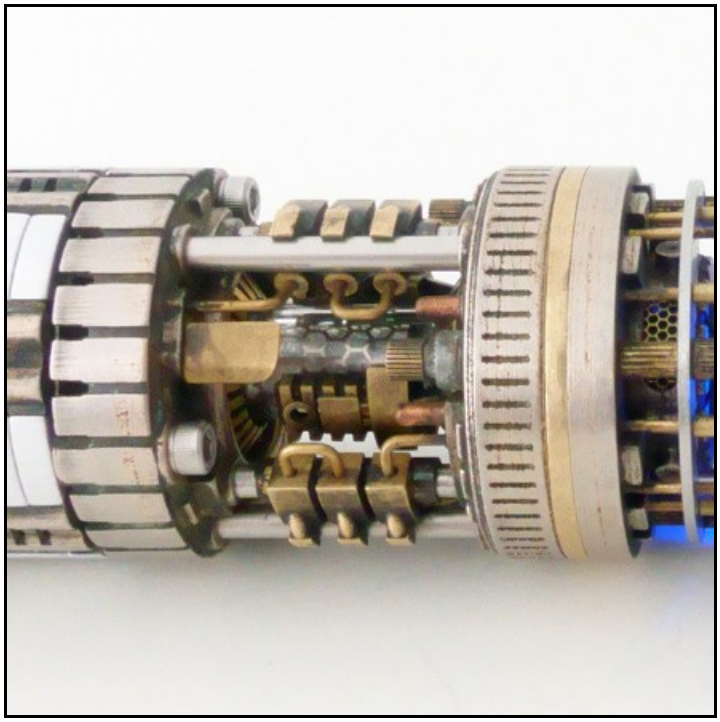
Next step is to fill the poly-carbonate tube with something **to scatter the light**. I would use some **plastic wrap**. But it is up to you. There are a lot solutions.

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

Additional brass wire details

The final step is to add metal wires like shown on the picture below. There are holes in the **tech-details** part and the plasma-gate main part. These holes can be used to install the **metal wires**. There is no general way to add them. The picture below is an example.

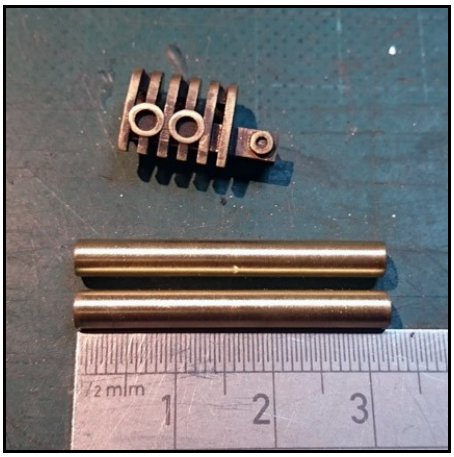
IMPORTANT: First add the 3 Blade-holder 4/40 UNC mounting screws before adding the metal wires. There will be not enough space to add them later.

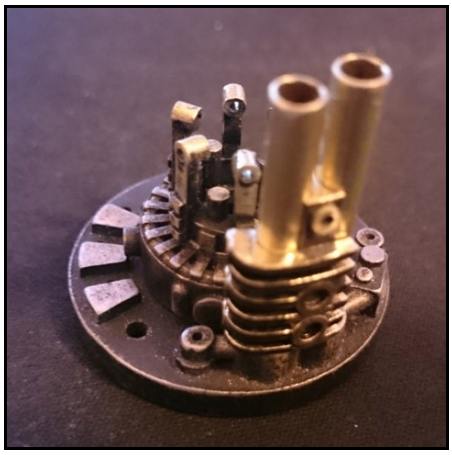


Final assembly

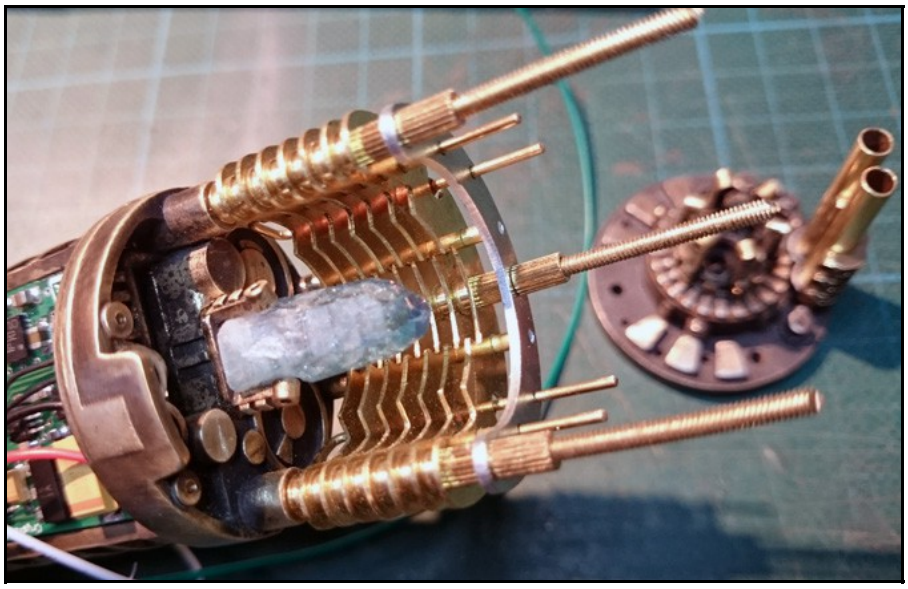
(**After installing:** Speaker, power-switch, charge-port, battery-contacts, Soundboard, U-rods and fins...)

- Two brass tubes (40mm long / 4mm diameter) have to be stick into the two holes from Part02A. When they are attached slide the **tubes-add-on** loose over the tubes. Don´t glue it.

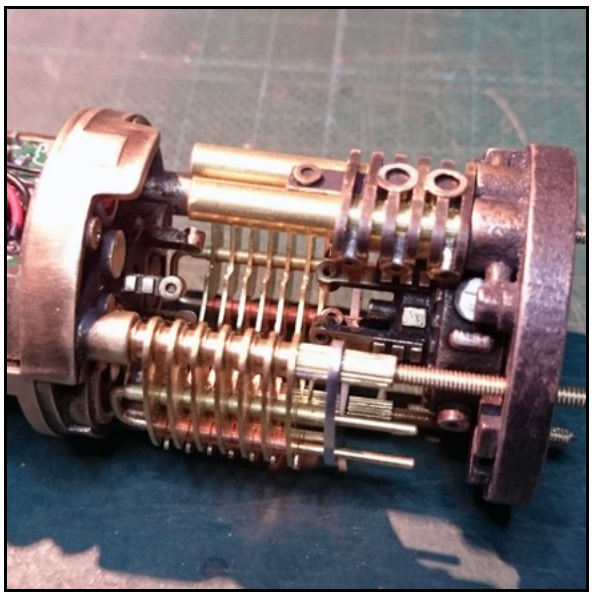




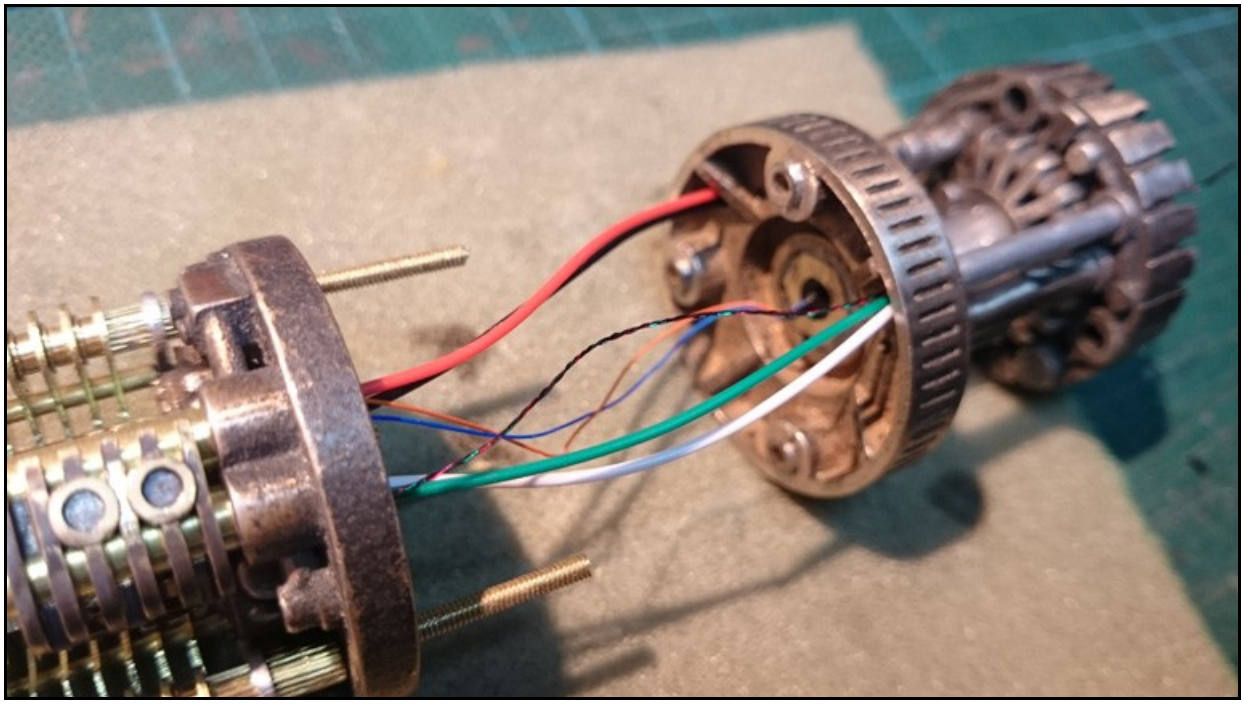
- Install the crystal...



- Place Part02 with installed brass tubes over the three threaded main rods and push all together. Guide all wires from the soundboard through the two brass tubes...

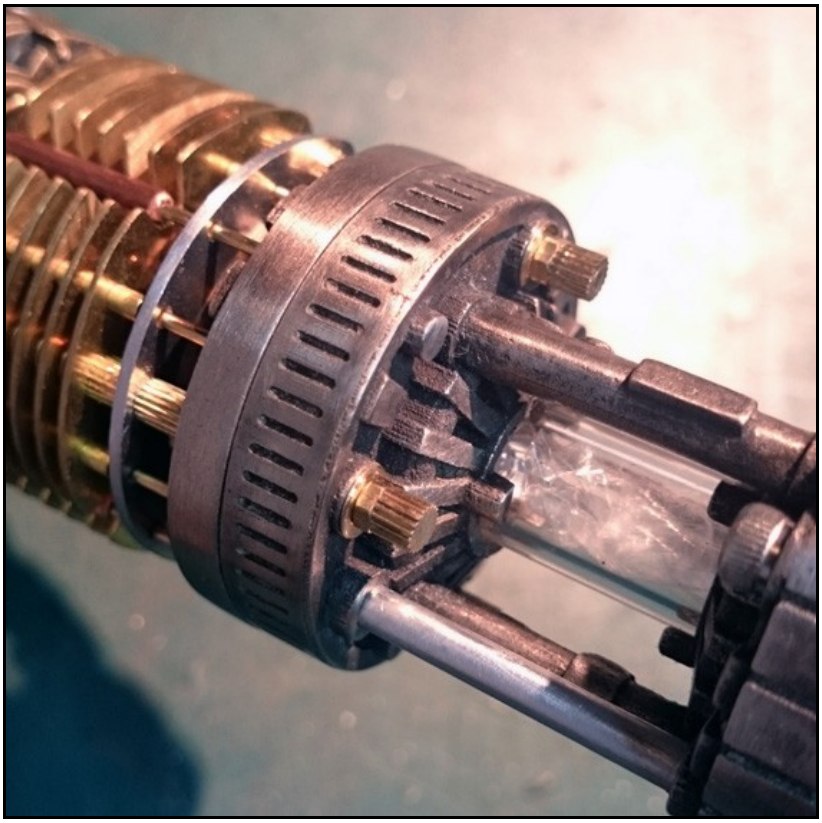


- Pull/push all wires through the guiding pipes from Part01 to the front.

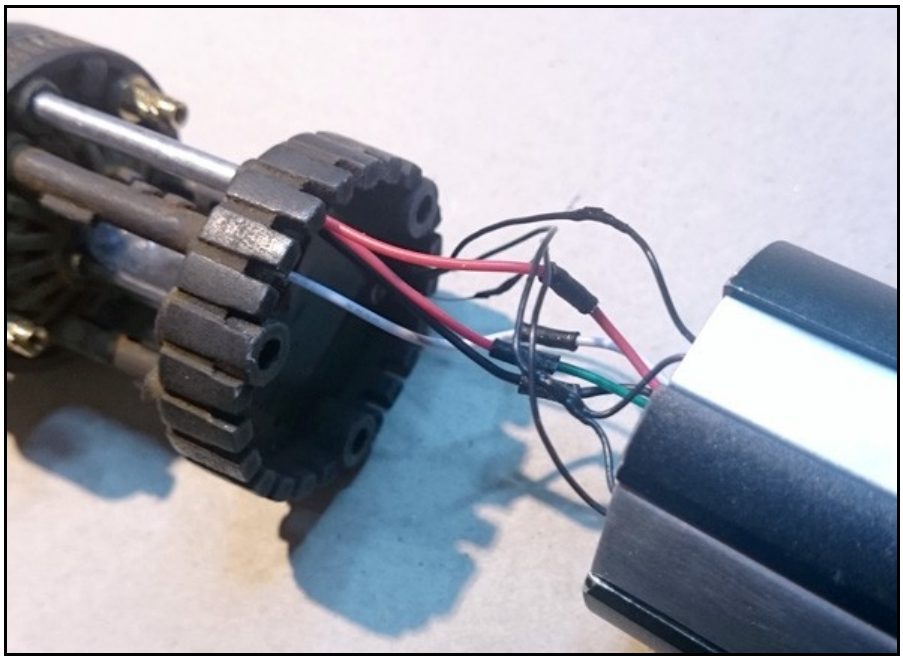


- Push Part01 over the threaded rods and attach M2 nuts to the rods. Use washer underneath the nuts.
Use screw-lock (medium)!

If you use the Plasma Gate **assembly kit**, add the three threaded spacer to the end of the three main rods.

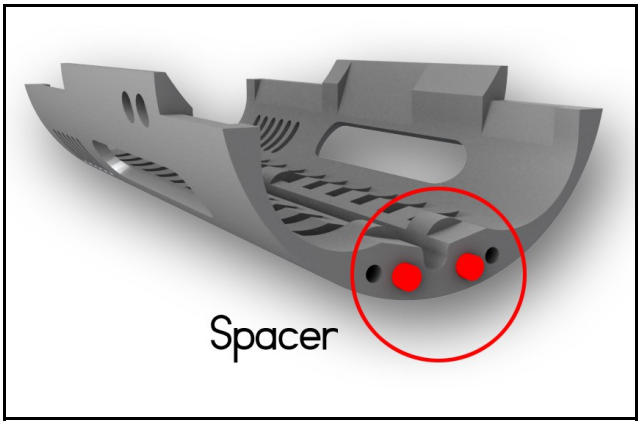


- Connect all wires from the chassis to the wires from the bladeholder.
Activation switch, AUX switch, High power LEDs …
The picture shows the Part01 SoHo connected to the Solo´s Hold bladeholder.

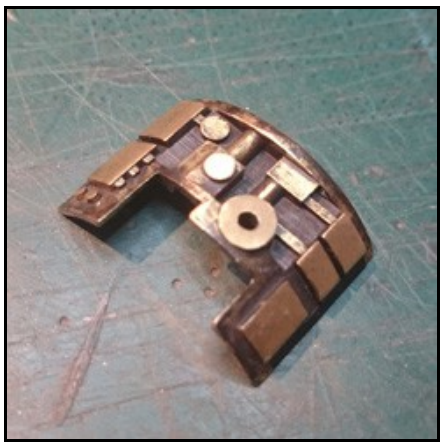


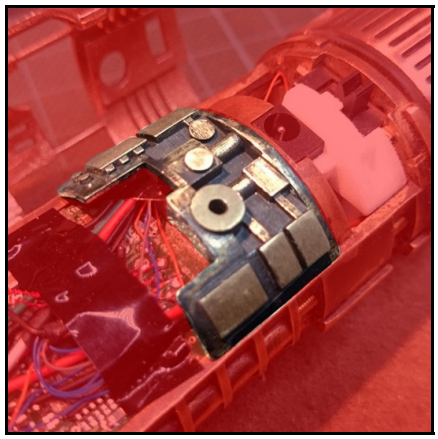
- Attach the Blade-holder to the chassis.
- Place the two 14650 Li-Ion batteries into position. **Don´t mix up the poles!**
- Place the battery-cover over the batteries and install **two 1mm diameter rods** from the back.

Metal Master 08 has got four spacers to make sure the cover has a nice fit. Steel material has +/- 5% tolerance in any dimension. The four spacers must be adjusted in length till the cover fits.

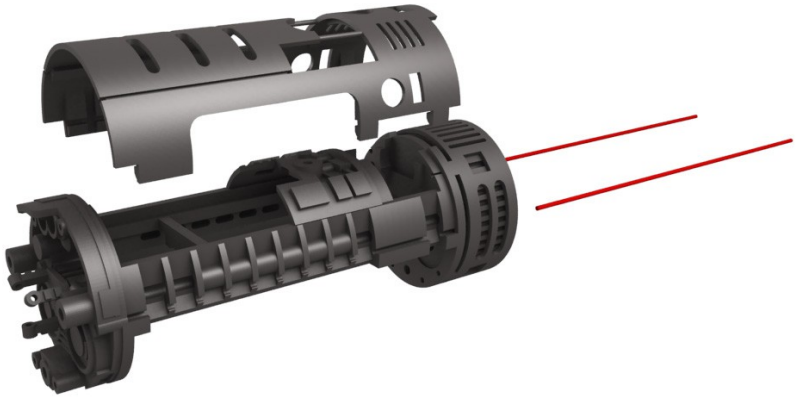


- Place the tech-details loose onto Part 05.





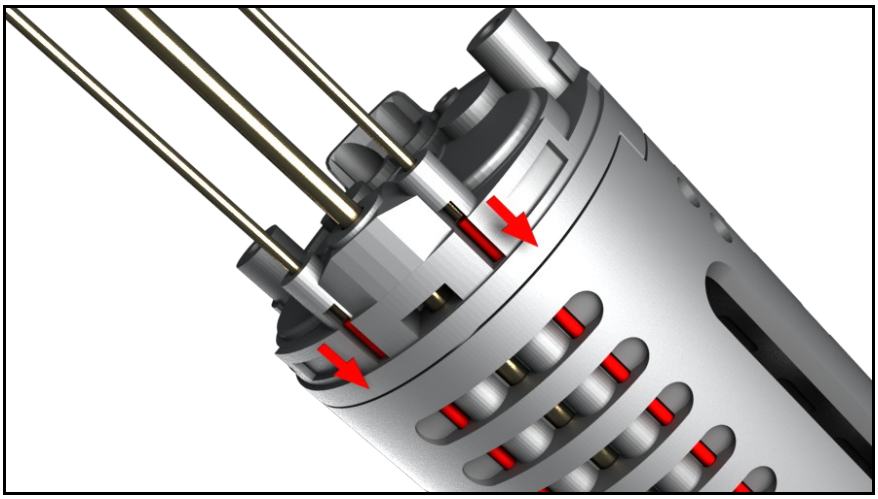
- Place the Metal Master Part 06 onto Part 05.
- Install two 1mm diameter rods from the back.

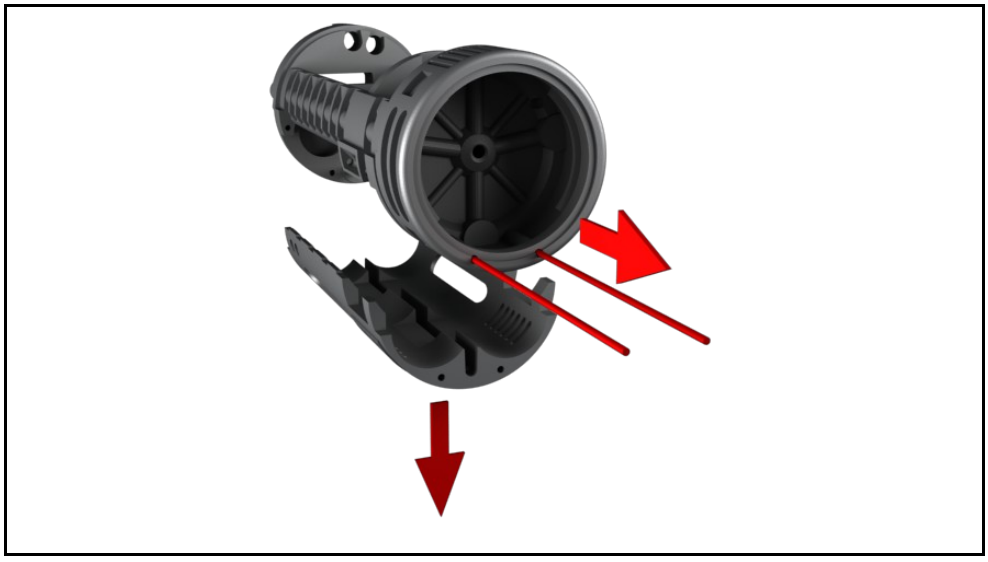


- install crystal-chamber details / rods.
This step is up to you. You can add details to the crystal-chamber the way you like.
This is an example:

Replacing the Batteries

For removing the cells you have to remove the two rods holding the battery-cover first.
Push the rods out. Use a small tool. Then pull them from the back.
Remove the cover.





If you have any questions, feel free to send me an eMail at:

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