

# WARNING

**You are dealing with very high energy levels when using this system, which may result in personal injury or fire when handled improperly. Take appropriate safety measures and use this system with great caution. Never leave it unattended while being powered.**

**This product contains small parts, keep out of reach of children!**

**This system produces significant magnet fields, do not use it when you have a cardiac pacemaker!**

**Always apply appropriate safety precautions when following this guide – they will not be explicitly mentioned in the following. If you are unsure how a specific step is properly and safely executed, don't do it!**

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# KWELD ASSEMBLY GUIDE

The *kWeld* “Next level” battery spot welder is available in kit form:

<https://www.kicksurfer.de/index.php/product-category/kspot-welder-kit/>

This guide refers to *kWeld* revision 3. The revision number of your system is printed on the main electronic module, below the rotary encoder:



The kit is available in different completion grades. If you have purchased the raw materials from the shop (or have sourced them by yourself from your local hardware store), and wish to build the welder from scratch by yourself using your own tools, then you'll want to walk through the entire document. All the necessary work steps are described in detail in the following, in an illustrated way that should be easy to follow.

If, on the other hand, you have selected higher completion grades, then you'll have to check which sections are for you and which sections to skip. For example, if you have ordered a fully pre-assembled kit, then you can directly jump to the *SYSTEM* assembly section at the end of this document. It is important to mention that this last assembly step is always your task – it involves only simple tools and little time. There is no plan to sell fully assembled systems for two reasons:

- I could be made liable for any possible damage to you, others, or your or other's property that may directly or indirectly result from using this system. I cannot accept this responsibility, especially because the welder deals with very high levels of energy, especially when used with high-discharge batteries like Lipos, and thus is a dangerous product either way. **You are responsible for handling this system safely.**
- As this is a small-volume niche product created for DIYers, it would not be economical to go through tedious multi-national certification processes like CE or FCC. I can only deliver raw parts to you, and it needs to be your task to create a usable product from them – and **you must take full responsibility for using it.**

The guide includes a list of required tools for each work step. Most of the pictures are showing the actual tools that I am using in my workshop, and I can recommend them all. Please only use them as an indication, because of course in many cases there are other possibilities - for example, heat shrink tubing can also be shrunk with a cigarette lighter when dosed carefully, the cable lugs can also be soldered instead of crimping them. There are many other options...

As you are dealing with electronic components when building the kit, this advice is a must as well:



ESD damage is caused by a build-up of static electricity that is released into the circuitry when you accidentally touch a conductor on the circuit board. The build-up can come from either the board, or from you, or both. I package all the kits in an ESD-safe environment and ship all units in metallic ESD safe bags, eliminating static during production. During assembly and open-frame use, please take precautions to reduce ESD:

- Avoid conditions that result in high static electricity. For example, don't unpack or handle the unit while standing on carpet. Cool and dry air is very conducive to ESD. If you're in an area or season with a lot of lightning storms, you're probably more susceptible to ESD and require more caution.
- Ground yourself immediately prior to handling by touching a metal object that is connected to mains earth. Examples of these are desktop computers, all electric devices that have a metal housing, your professional soldering station, and of course the exposed ground contact of your electrical outlet.
- Notice that your body will only sense electrostatic discharge at voltages greater than approximately 1000 volts, but electronic components will already break at voltages well below that. This means that, if you don't recognize ESD, this doesn't mean that it does not happen. The mentioned precautions are even more important now!

# CABLE AND ELECTRODE HOLDERS

## REQUIRED EQUIPMENT

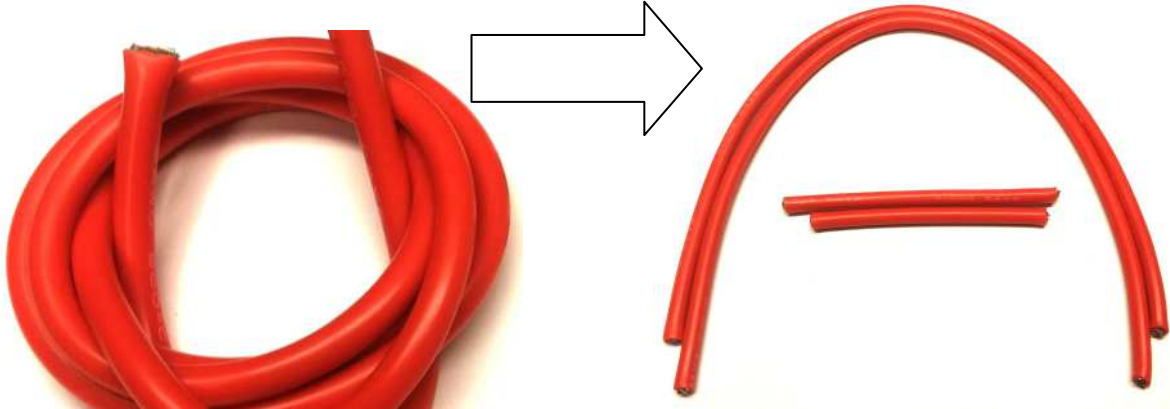
Cable stripper	
Cable cutter	
Cable lug crimp tool, hexagonal aperture with <b>5mm</b> inner diameter (6mm <sup>2</sup> insert)	
Heat gun	

## REQUIRED PARTS



1m	Cable, high-flex silicone, AWG8
2	CNC machined brass tubes
4	Ring cable shoes, 10mm <sup>2</sup> , 6.5mm hole, tinned copper
4	Grommets for ring cable shoe
100mm	Heat shrink tubing, 12mm diameter before shrinking

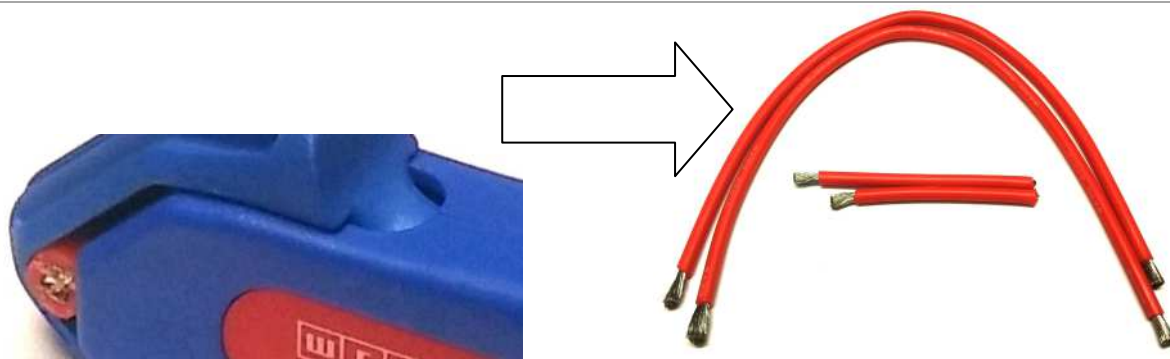
## ASSEMBLY STEPS



Cut cable into chunks of

- 1x 407 mm
- 1x 393 mm
- 1x 107 mm
- 1x 93 mm

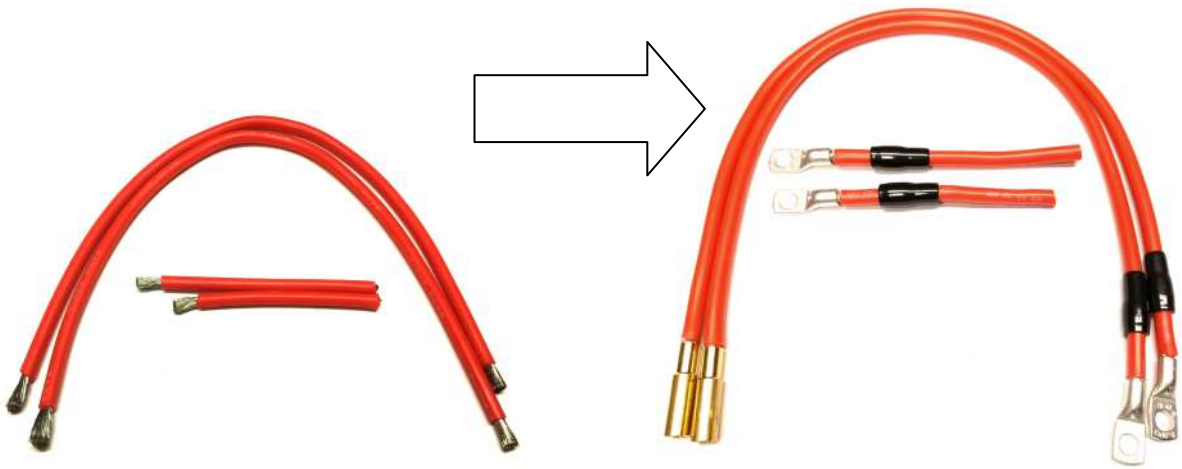
These odd lengths will later compensate for the different mounting positions on the main board. It is easiest to first cut the entire length into half, and then cut a 107mm resp. 93mm chunk off each half.



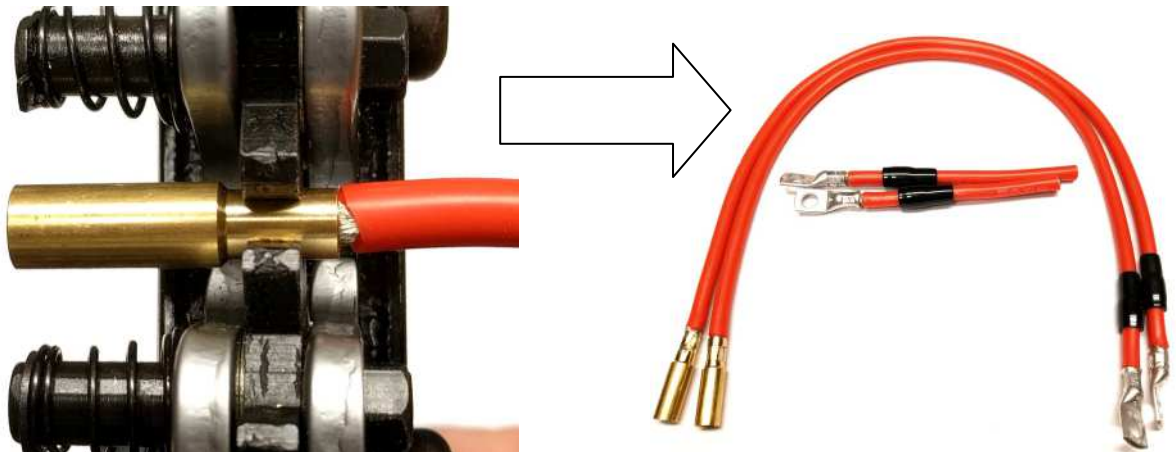
Use the cable stripper to remove the insulation at a length of

- 10mm **at one side** of each of the **short** pieces
- 10mm at both sides of each of the **long** pieces

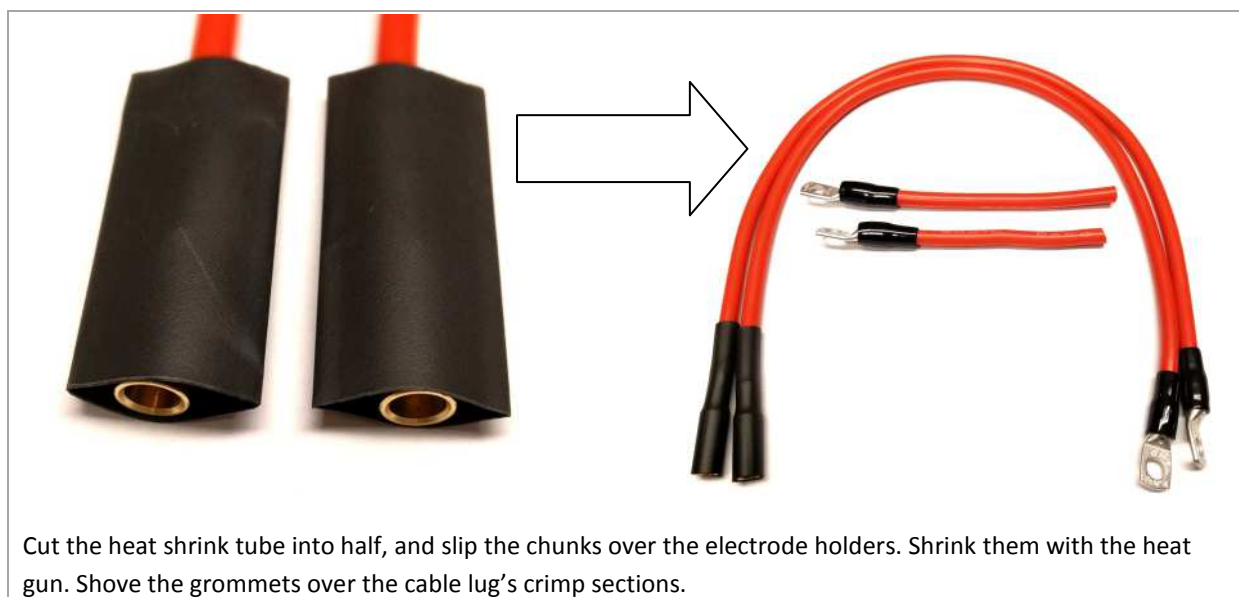
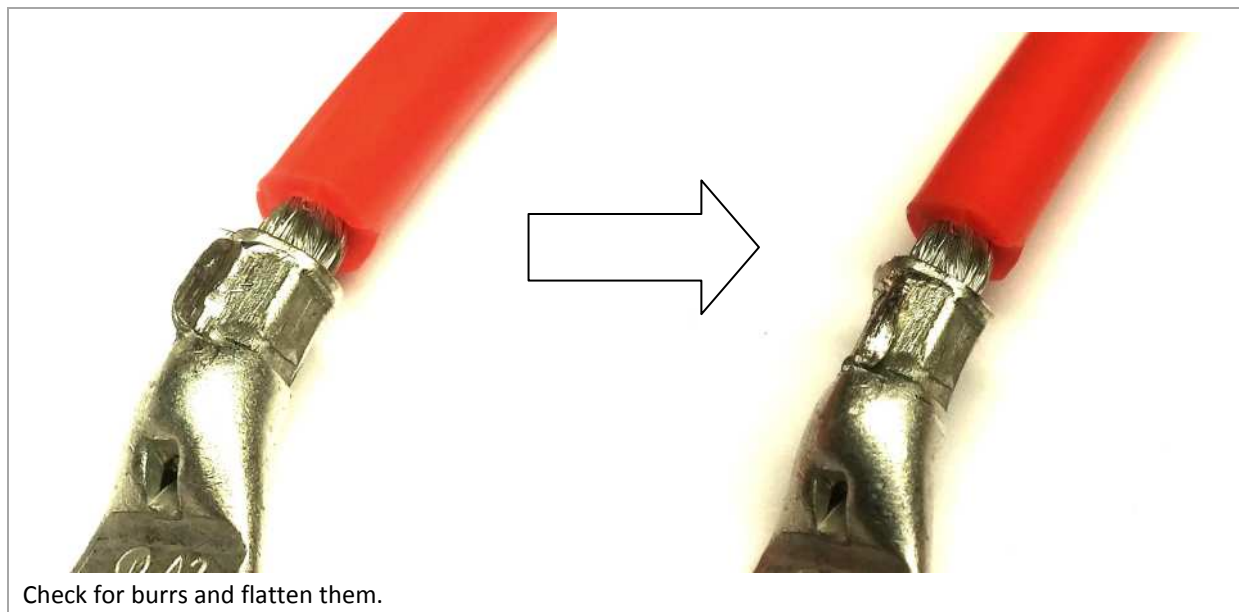
Strip the insulation on the other side of the two short pieces at a length that suits your input connector. When using the XT150 connector from the shop, the recommended length is 5mm.



Attach grommets, cable lugs and brass tubes to the cable ends. Insert as many strands of the core as possible. It should be possible to insert all strands, it helps to rub and spin the core between your fingers to further compress them. Do not excessively twist them, because that *increases* their diameter.



Press cable lugs and brass tubes using the heavy duty crimp tool. Carefully center each part as shown on the left to achieve a good fit. This is especially important for the brass tubes, as this material is more brittle than copper and may crack otherwise.





# ELECTRODES

## REQUIRED EQUIPMENT

Cable lug crimp tool, hexagonal aperture with **6mm** inner diameter (10mm<sup>2</sup> insert)

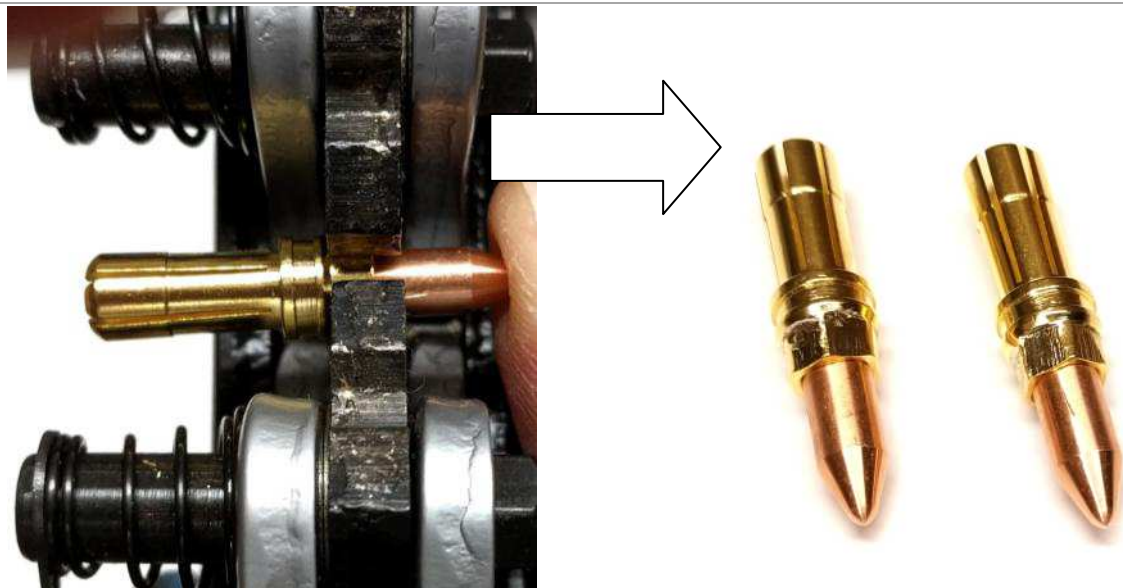


## REQUIRED PARTS



- |   |                          |
|---|--------------------------|
| 2 | CNC machined copper tips |
| 2 | XT150 type male bullets  |

## ASSEMBLY STEPS



Join bullet connector and copper tip using the heavy duty crimp tool. Ensure to crimp the right width of the bullet's solder cup as shown in the pictures; that length measures 4-5mm. To achieve a straight alignment and ensure full insertion, it helps pushing the tip into the bullet while the latter is gently being held in place by the crimp tool. Close the tool slowly and observe the process.



# INPUT CONNECTOR

## REQUIRED EQUIPMENT

Soldering iron with at least 80W and large tip



Solder with flux core



Tack flux



Two pairs of pliers



Kapton tape



## REQUIRED PARTS



- 1 Set of two male XT150 terminals (contacts and red+black housings)
- 2 Assembled input cables

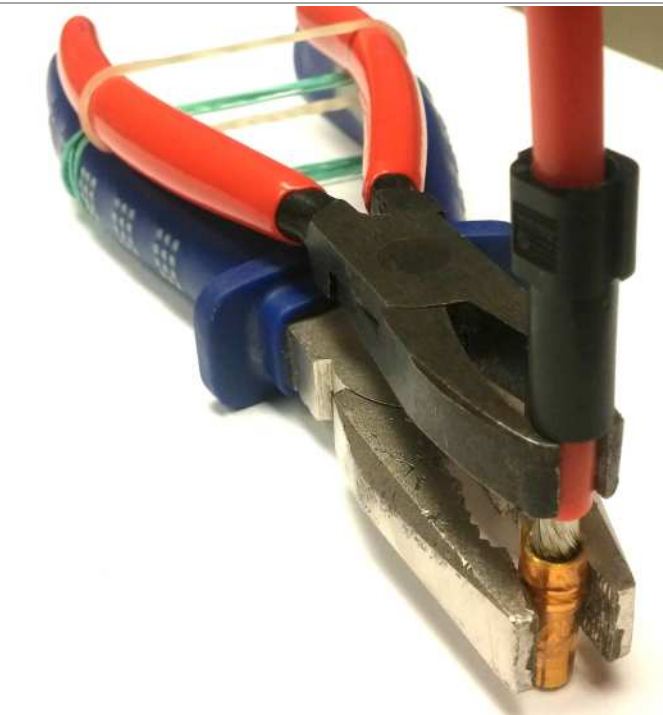
## ASSEMBLY STEPS

**IMPORTANT!** The two input cables have different lengths. It is important that you match them correctly with the input terminals:

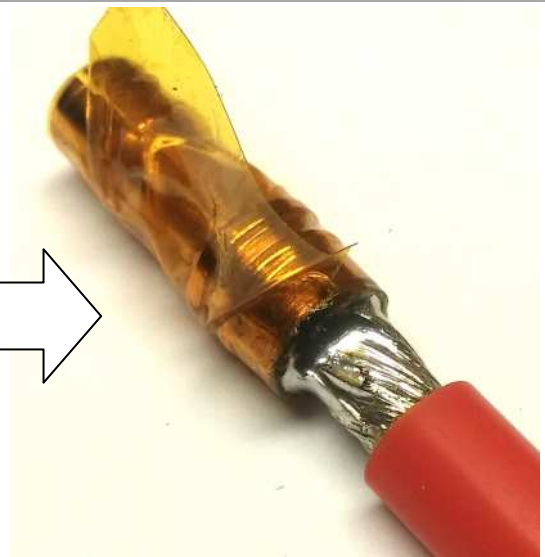
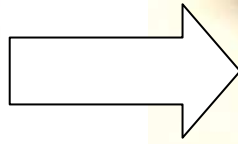
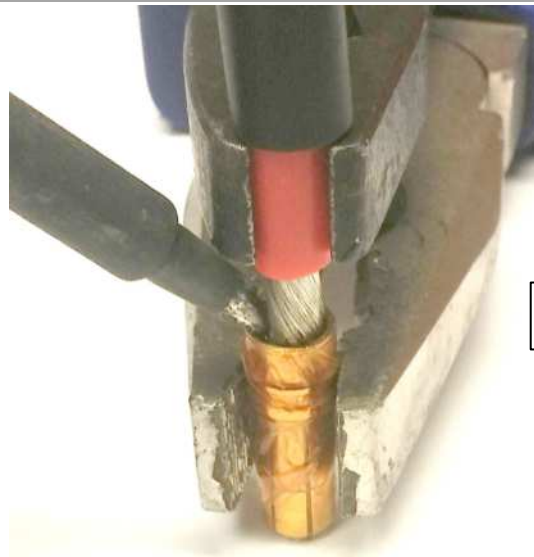
- The **longer** cable receives the positive / **red** terminal
- The **shorter** cable receives the negative / **black** terminal



Wrap a few layers of Kapton tape around the XT150 contact element (left picture). This serves two purposes: it adds thermal insulation and eases soldering when the element is clamped in the pliers, and it prevents solder from flowing down the sides of the element. Pour some tack flux into the cup as shown in the right picture. Fill roughly 1/5 of the cup depth.



Wrap rubber bands around both plier's handles. Build a stack as shown above and clamp the contact element in the lower one, and the cable in the upper one. Carefully insert all strands of the cable core. Make sure not to forget the contact housing in this setup! I know what I'm talking about...



Hold the soldering iron as shown above, making sure to touch both the contact piece and the cable core. After a heating phase of approximately ten seconds, start adding solder to that joint. Continue with patience, until the cup is entirely filled and the liquid solder has formed a meniscus between contact and cable core. The result should look like in the right picture.



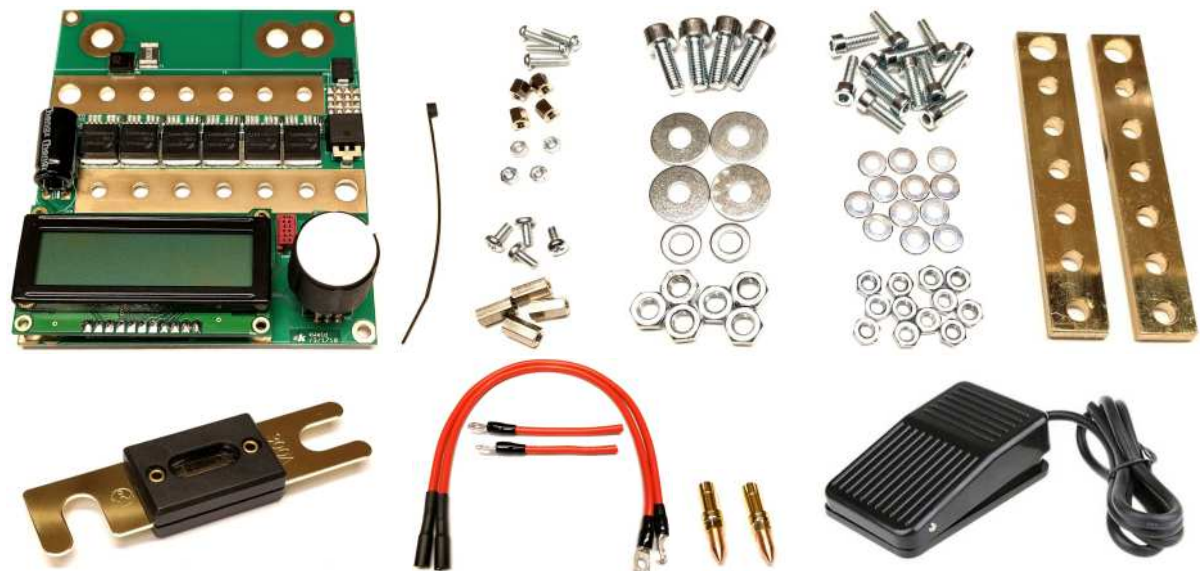
Remove the Kapton tape, and pull the contact housing into position. It clicks noticeably when it locks, you have to pull firmly.

# SYSTEM

## REQUIRED EQUIPMENT

Allen keys 3mm and 5mm	
Wrenches 5mm, 7mm, and 10mm	
Flat-tip screwdriver 2mm	
Philips head screwdriver PH1	

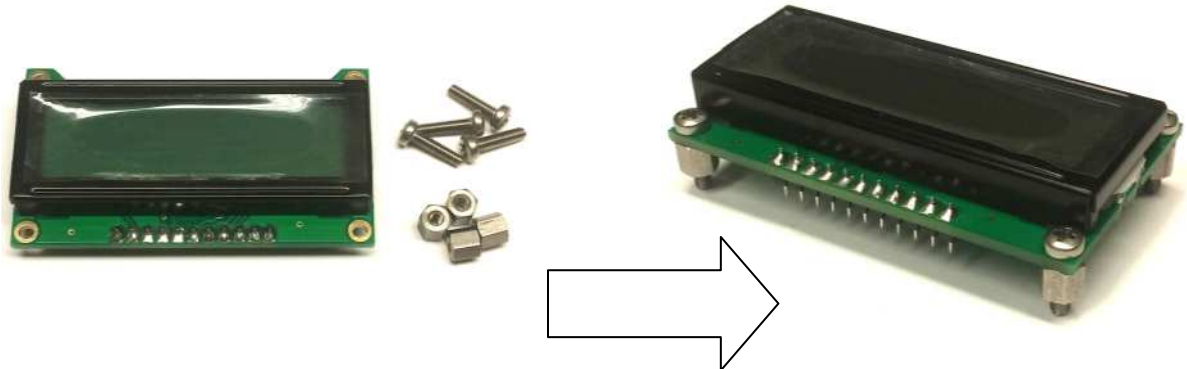
## REQUIRED PARTS



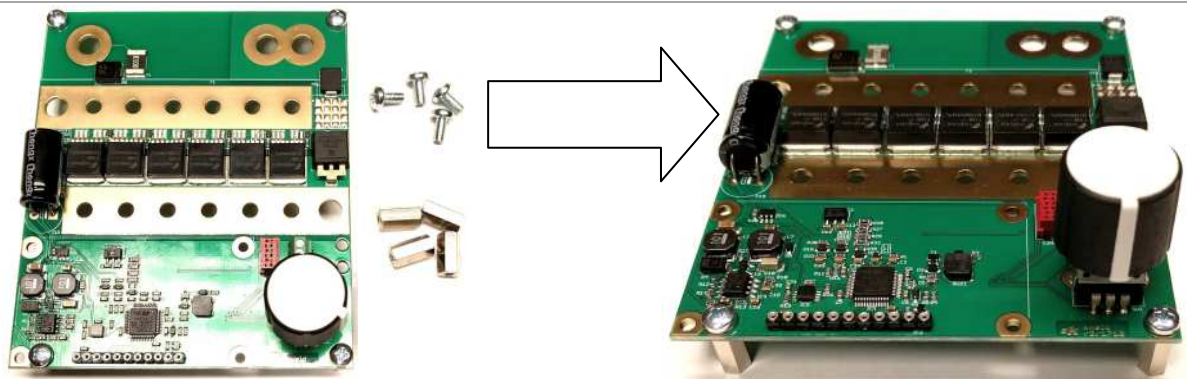
1	Assembled electronics module with dial knob and LCD
2	Assembled electrode cable assembly with electrodes
2	Assembled input cables
2	CNC machined brass bus bars
1	Foot switch
1	Fuse ANL 300A
12	Screw DIN912, M4 x 12mm, steel galvanic
4	Screw DIN912, M6 x 16mm, steel galvanic
12	Nut DIN934, M4, steel galvanic
6	Nut DIN934, M6, steel galvanic
12	Washer DIN125, M4 x 9mm x 0.8mm, steel galvanic
2	Washer DIN125, M6 x 12mm x 1.6mm, steel galvanic
4	Washer DIN9021, M6 x 18mm x 1.6mm, steel galvanic
4	Standoff M3 x 10mm, female-female, brass galvanic
4	Screw DIN7985, M3 x 6mm, steel galvanic
4	Standoff M2.5 x 5mm, female-female, brass galvanic
4	Screw DIN7985, M2.5 x 12mm, steel galvanic
4	Nut DIN934, M2.5, steel galvanic
1	Cable tie, 100mm x 2.5mm



## ASSEMBLY STEPS

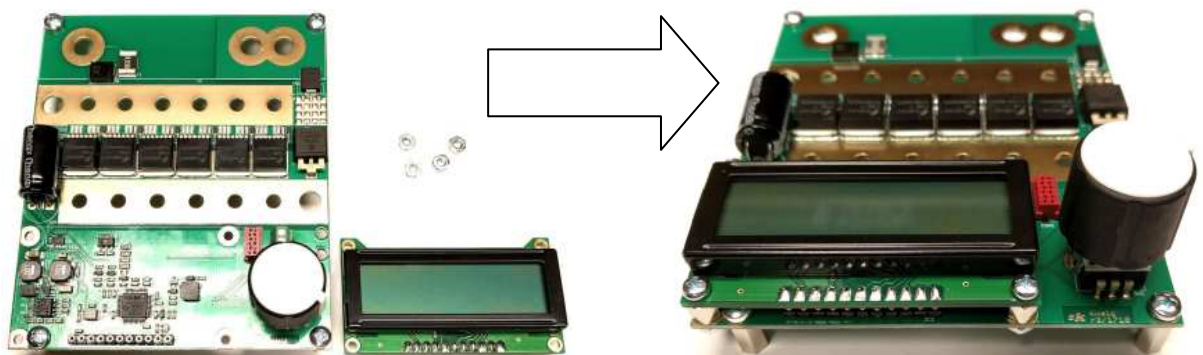


Carefully lift the LCD off the main board from its socket, making sure that the **connecting pins don't get bent**. Use the Philips screwdriver and the 5mm wrench to fasten the M2.5 screws and short standoffs to the LCD. Use only moderate torque here.

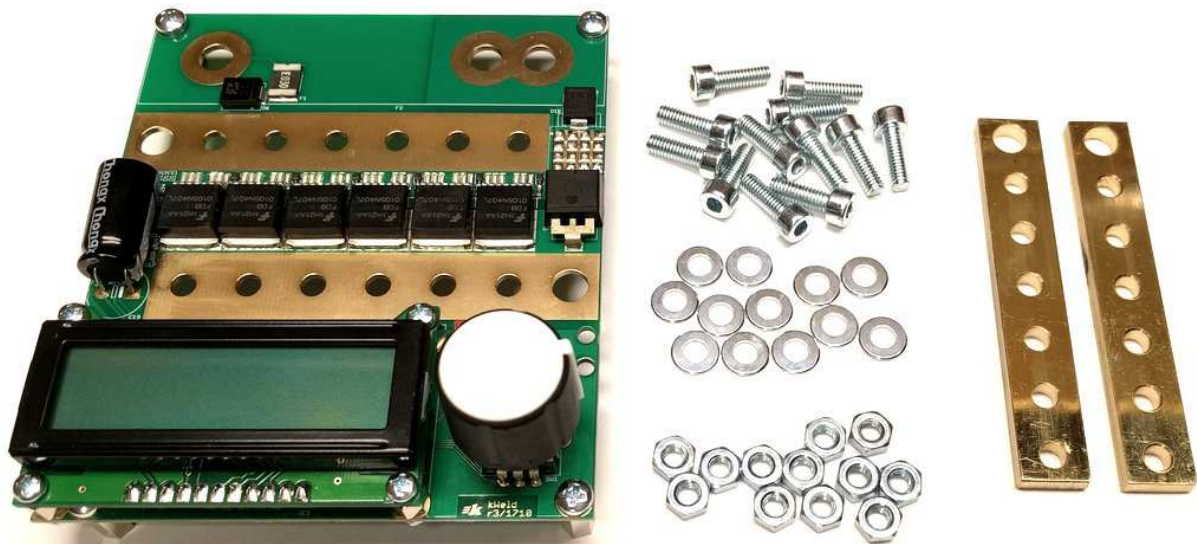


Use the Philips screwdriver and the 5mm wrench to fasten the M3 screws and long standoffs to the main board.

**NOTE:** if you plan to enclose the system with the *kWeld* housing, then please skip this step and do **not** mount these standoffs and screws.



Use the 5mm wrench to mount the LCD to the main board with the M2.5 nuts. On the lower left side, there is not much space between the already mounted standoff and the screw, and it may be necessary to change the standoff's orientation to make enough space for the nut to turn.



Mount the bus bars to the main board with M4 screws, washers and nuts, using the 7mm wrench and the 3mm Allen key. The washers go at the bottom side of the circuit board. When fastening the nuts, make sure that you never use the circuit board to counter the tools, and especially stay away from the large capacitor on the left. Keep paying attention to this in the following as well.

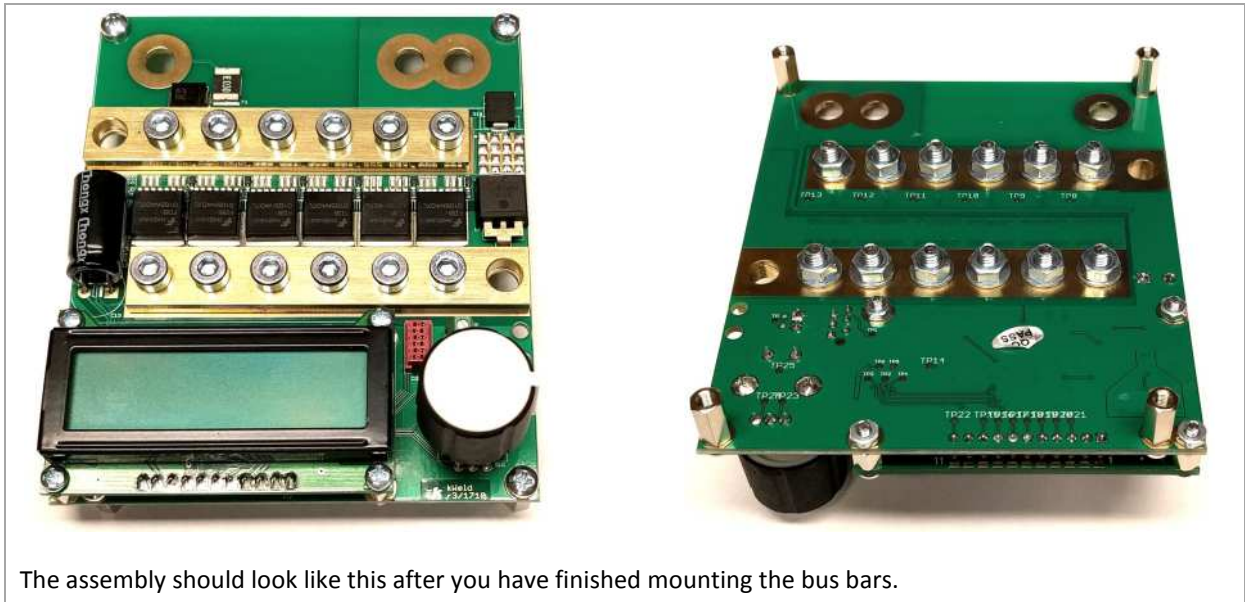


Observe correct orientation of the washers, you may damage the circuit board otherwise.

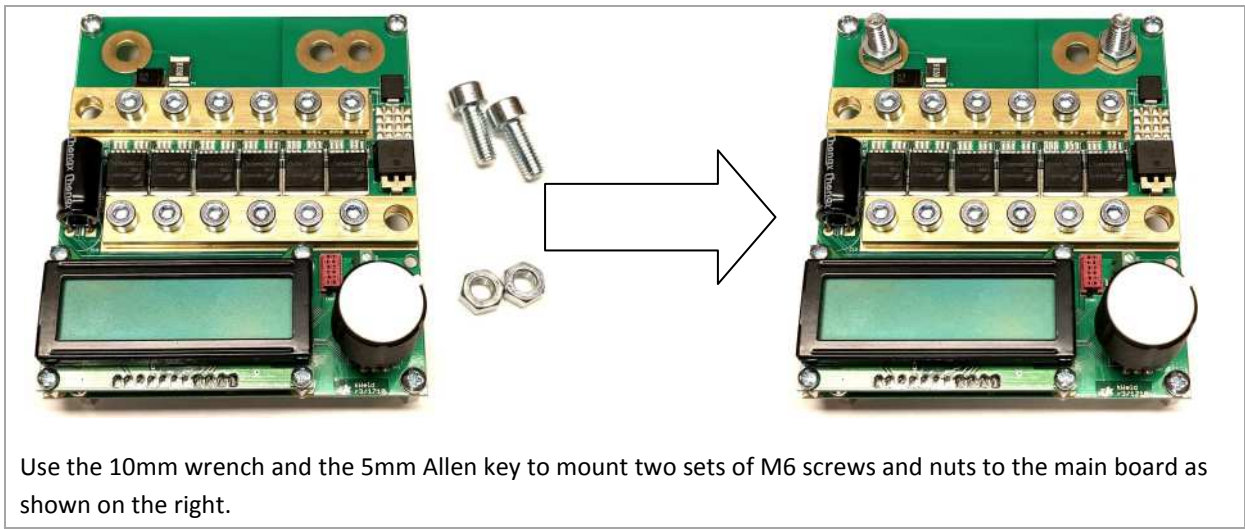


Make sure that the two 6mm holes are correctly aligned before fastening the screws.

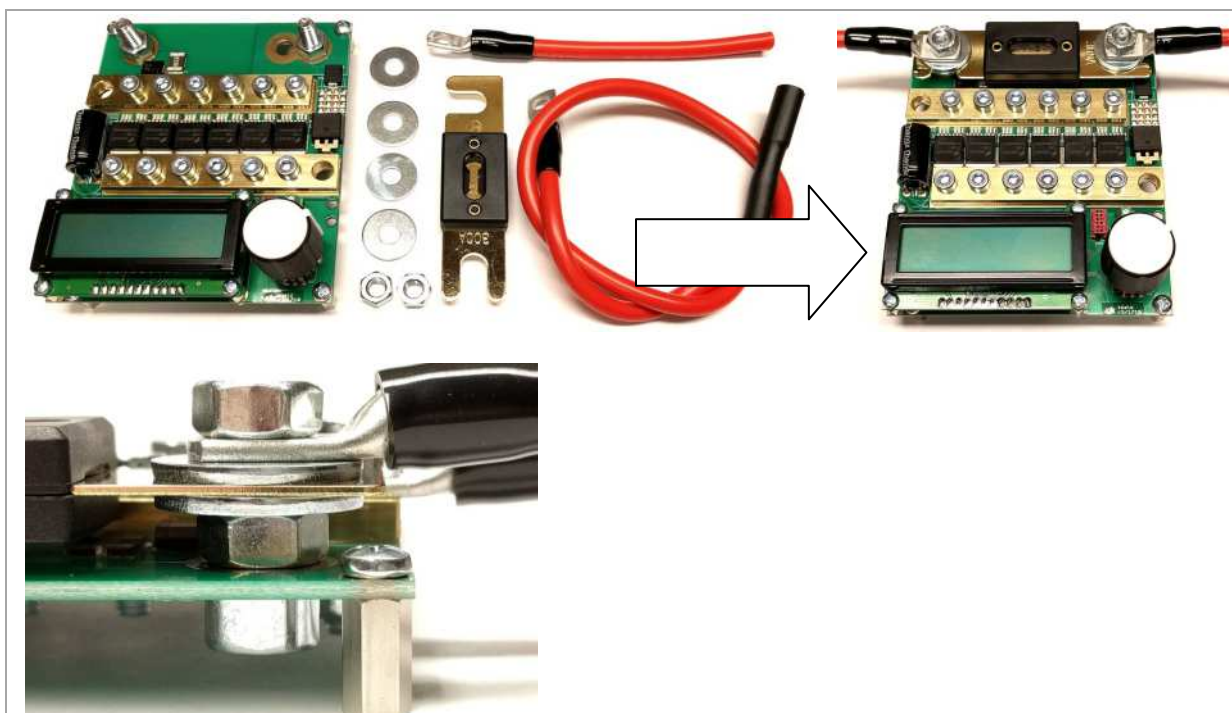




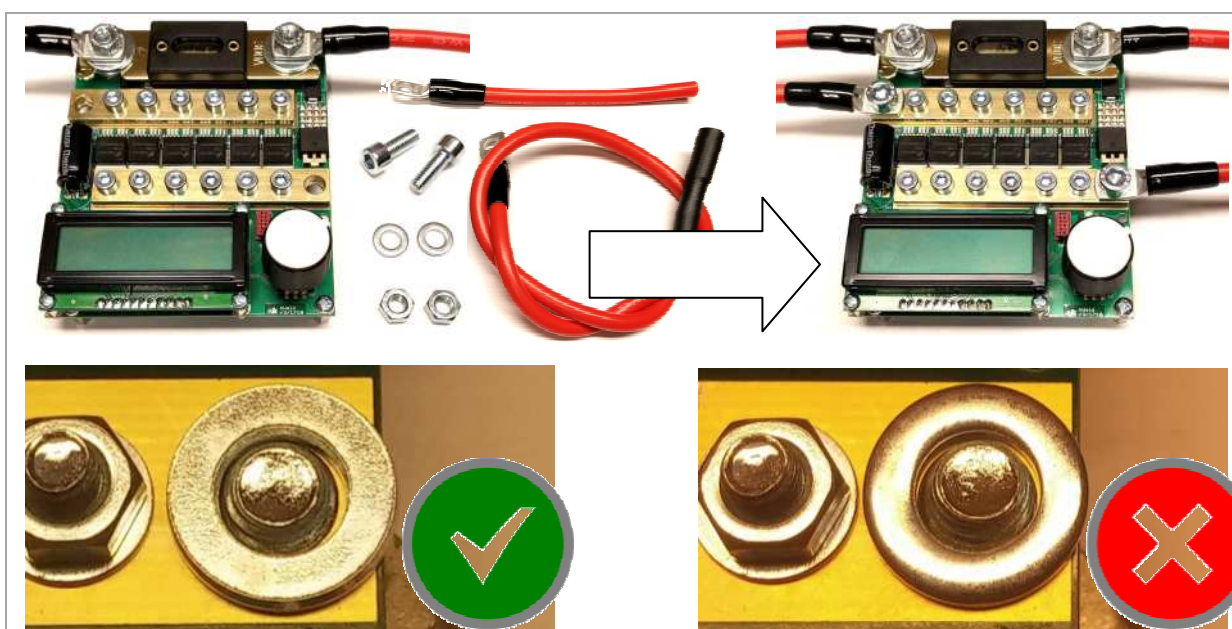
The assembly should look like this after you have finished mounting the bus bars.



Use the 10mm wrench and the 5mm Allen key to mount two sets of M6 screws and nuts to the main board as shown on the right.



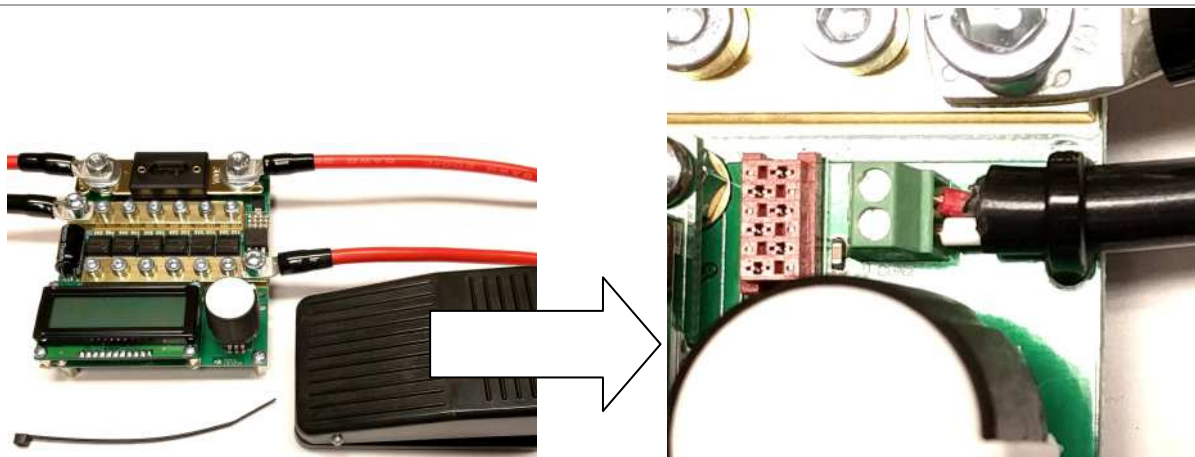
Use the 10mm wrench and the 5mm Allen key to mount the fuse, the **longer** input cable (**positive / red** terminal), and the **longer** of the two electrode cables. Use two **large** M6 washers on each side, plus one M6 nut. The input cable is attached to the left fuse terminal, and the electrode cable to the right. The lower left picture shows the correct stacking: circuit board – nut – washer – fuse – washer – cable lug – nut. Pay attention to center-align the fuse.



Use the 10mm wrench and the 5mm Allen key to mount the **shorter** input cable (**negative / black** terminal), and the shorter of the two electrode cables to the bus bars with one set of M6 screw, **small** M6 washer and nut on each side. Again, the input cable is attached to the left bus bar terminal, and the electrode cable to the right. Pay attention to the correct orientation of the washer as shown.



Strip the connecting cable of the foot switch: outer jacket by 8mm, inner jackets by 5mm. Cut off the black wire, it is not needed. Twist each remaining core.



Insert the tinned cable strands of the foot switch into the screw terminals on the right (above the dial, polarity does not matter), and fasten the screw terminals with the 2mm flat-tip screwdriver. Work gently as the screw terminals can bend otherwise. Make sure that the screw terminals are fully open before inserting the wires, as shown on the lower right. Slide the cable tie through the two circuit board holes and clamp the cable with it, creating a strain relief.

Congratulations! You have successfully assembled the *kWeld* kit. At this point, I suggest to double-check all connections, as a loose screw is the last thing you need at current flowing in excess of 1000 A. Also, double-check for correct wiring:



To complete the kit and make it operational, you need to connect it to a suitable power source. The *kWeld* operation manual discusses its requirements and a number of different options; this is not within the scope of this document.

Furthermore, I strongly recommend enclosing the system with a suitable housing before connecting it to a power source. An accidental short circuit that is in front of the fuse can easily result in catastrophic failures like burning cables or batteries.



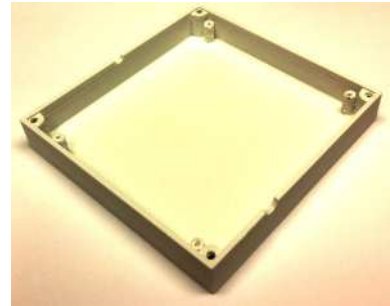
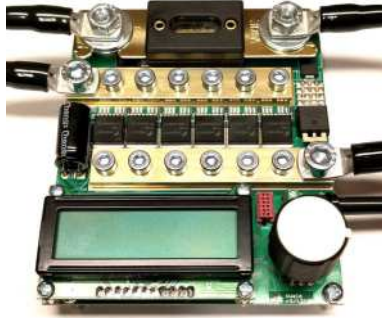
# HOUSING

## REQUIRED EQUIPMENT

Philips head screwdriver PH1

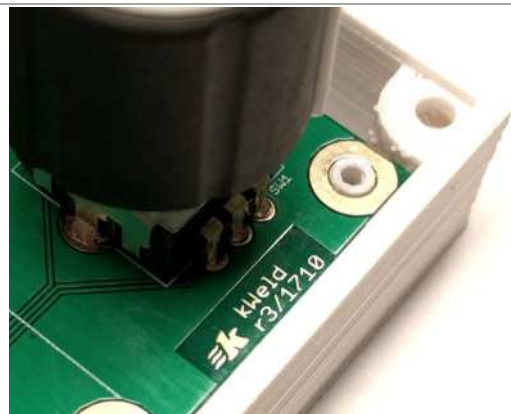


## REQUIRED PARTS



1	Assembled <i>kWeld</i> system
1	Lower <i>kWeld</i> housing shell
1	Upper <i>kWeld</i> housing shell
4	Self-tapping screw DIN 7981, 2.9mm x 9.5mm
4	Adhesive rubber foot

## ASSEMBLY STEPS



Push the circuit board into the lower shell. Ensure the correct orientation by matching the foot switch cable with the corresponding cutout. Make sure that all four edges are completely sunken into position as shown on the right.

**NOTE:** if you had assembled the M3 standoffs, then you need to remove them now. To remove the lower left one, you also need to temporarily disassemble the LCD. Lift the LCD straight and do not bend the connecting pins.



Fit the upper shell, carefully flip the entire package, and fasten the four screws with the Philips screwdriver. As the housing is 3D printed, take great care not to over tighten them.



Stick on the bumpers – finished!



## REVISION HISTORY

1.0	2017-07-30	First published, still incomplete version
2.0	2017-08-25	First complete version for <i>kWeld</i> hardware revision 2 <ul style="list-style-type: none"><li>- New electrode / holder system</li><li>- Completed electronics soldering steps</li><li>- Completed system assembly steps</li><li>- Cabling lengths modified to compensate unequal main board bolt positions</li><li>- Completed pictures</li><li>- Preliminary housing assembly guide</li></ul>
3.0	2017-12-29	Updated to <i>kWeld</i> hardware revision 3