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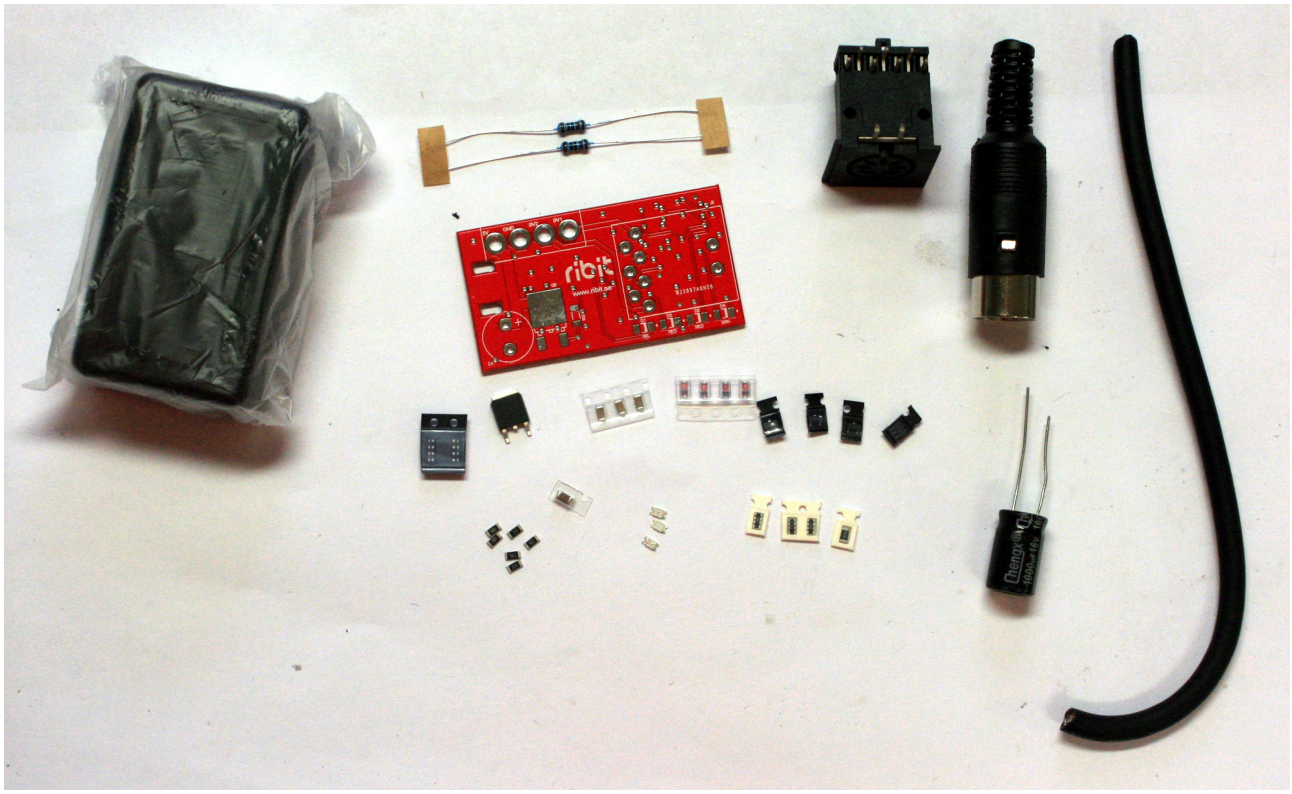
Soldering manual, RiboCop(tm) v2.0

(updated 2019-05-24)



Rikard B. IT
Karlsbergsvägen 10
462 60 Vänersborg

service@ribit.se
http://www.ribit.se

RiBIT.se on Facebook

IBAN: SE6080000828910235094760
BIC: SWEDSESS

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About this document

This soldering instruction will instruct you, step by step, how to solder RiboCop64 v2.0 using the kit.

NOTE: The kit is **not** for beginners, since this construction is very advanced and has some caveats. Almost all components are surface mounted (1206). You can solder these using a normal soldering station, but hot air is recommended. SMD-pinchers, flux, soldering braid and other tools are strongly recommended.

The opamp (U1) is **INCREDIBLY SENSITIVE TO ESD**, so you really need to handle it with utmost care. If this opamp becomes ESD-damaged, then its behaviour will be completely unanticipated. This means the final product acts like it's working, when it's not. Since the soldering skills required are very high for this project, and your soldering skills cannot be anticipated, this kit is sold without any warranty at all. Use at own risk.

There are two manufacturing errors on the PCB. One is fatal (short-circuit) while the other just affects the LEDs making them indicate incorrect. Instructions on how to patch these errors will be provided in this document.

This document strives to be kept updated and inform about the common caveats, but there is no guarantee that all information here within is correct.

TL;DR:

THIS KIT IS NOT INTENDED FOR BEGINNERS

PRODUCT WARRANTY DOES NOT APPLY

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Amount	Symbol	Description	Marking	Comment
3	C1-C3	100nF	-	SMD
1	C4	1000uF	1000uF / 10V	TH
1	C5	47uF	-	SMD
1	R1	3kΩ	302	SMD
1	R2	2kΩ	202	SMD
1	R3	560Ω	561	SMD
2	R5-R6	1kΩ	1001 or 102	SMD
1	R7	2.4kΩ	242	SMD
1	U1(*)	Opamp	TS3702	SO8
1	U2	Current monitor	AAB0	SOT23-6
1	Q1	Voltage reference	AA8SE	SOT23-3
1	Q2	BJT	3F	SOT23-3
1	Q3	BJT	1F	SOT23-3
1	Q5	MOSFET	FDD6637	D2PAK
1	D1	Blue LED	-	SMD
1	D3	Red LED	-	SMD
1	D4	Green LED	-	SMD
4	D5-D8	1N4148	-	SMD
2	RN1, RN3	10k array	103	SMD
1	RN2	1k array	102	SMD
1	RS	Shunt	R010	SMD
1	J1	DIN-connector	-	Cable
1	J2	DIN-connector		PCB-mount
1		Circuit board		
1		Cable tie		
1		Box		

*) **Very ESD-sensitive!**

****) U3, Q4 and R4 are not used**

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Absolute minimum of required tools for assembly:

- Drills: 3mm (3 holes), 6.5mm (1 hole), 16mm (1 hole)
- Hot air station
- Solder, as thin as possible
- Cutters

Tools that will simplify the work:

- Flux
- Soldering braid
- PCB-clamps
- Hooks
- Microscope
- Variable power supply (for functional testing)
- Multimeter with continuity tester and diode tester (for testing)
- Files, flat and round
- Dremel

Before you start soldering you should drill and prepare the box. This because the PCB will used as a safety guard for one of the four snap locks.

After the box is done, it's preferrable to solder all surface mounted components on the bottom side as it's easier to solder when the top side is flat. When the bottom side is done you go to the top side and finish it. In the very end you solder the DIN-connector, the large capacitor, and the cable.

When everything is finished, the assembly needs to be tested. For this purpose, a multimeter and a variable power supply is the absolute minimum requirement. Otherwise you will not be able to test and see how the board reacts to an over voltage situation.

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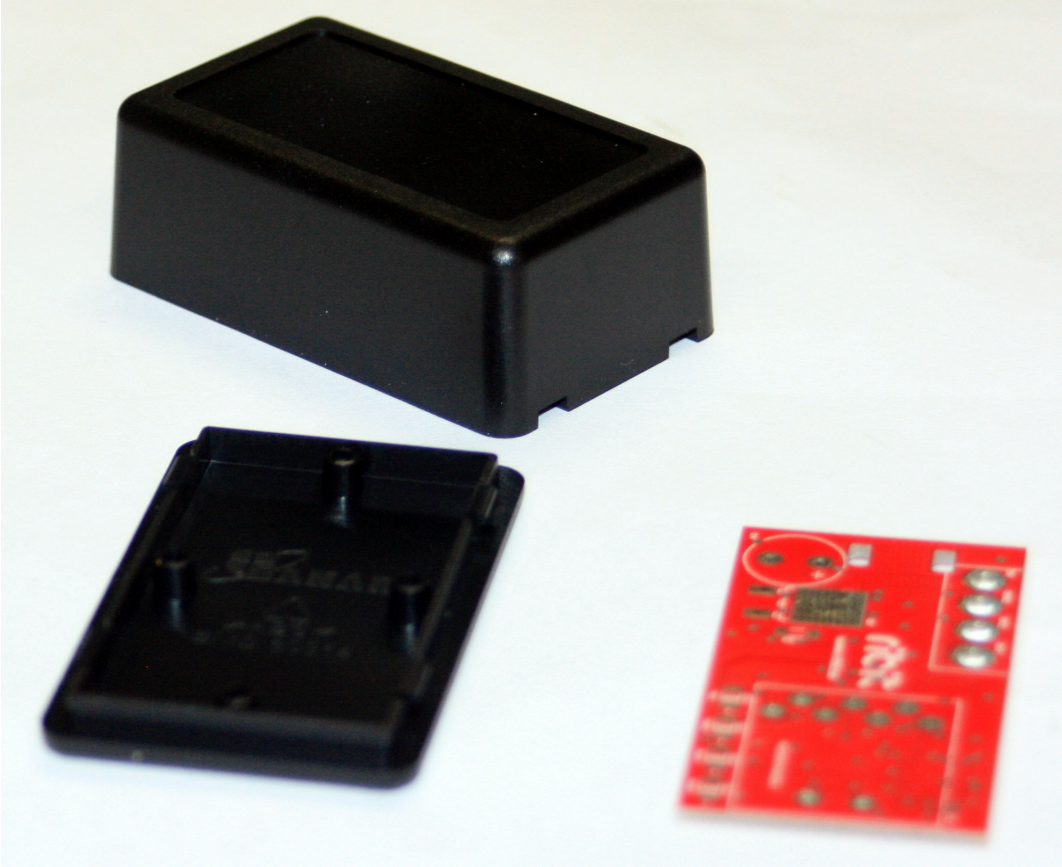
Preparing the box

1. Bring out and open the box by putting pliers, or similar, in the two holes shown in the picture. Twist the pliers and the lid will snap open. There are two holes on the box, on the side where the DIN-connector will be facing.



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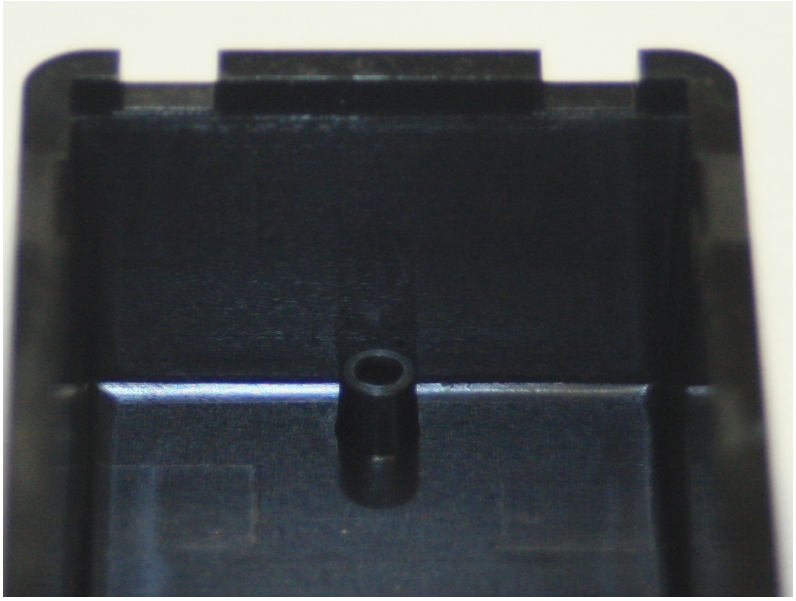
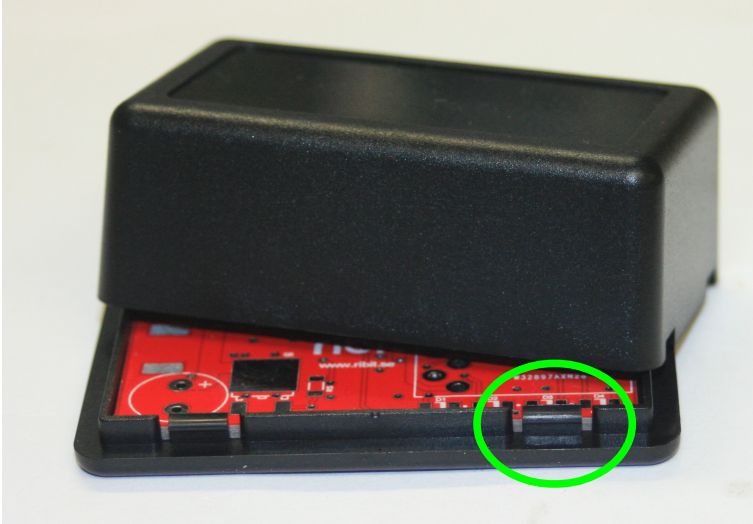
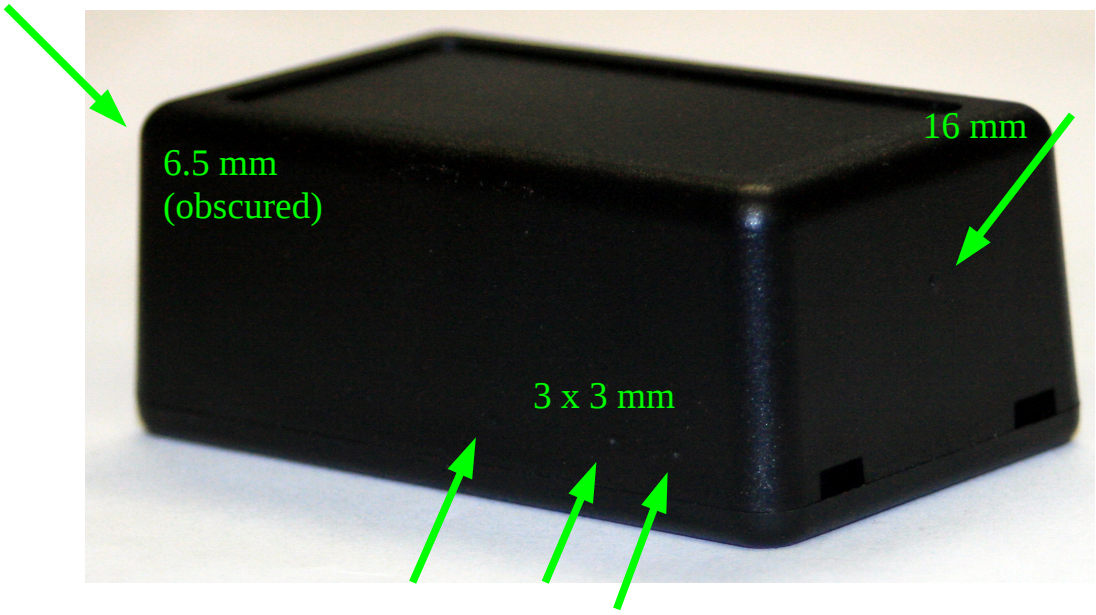
2. Take a look at the lid and you will see four raised stops. All of them needs to be cut off using pliers or any tool of your choice. The surface of the lid needs to be flat; no bumps from the cut off stops, or anything like that. Otherwise the PCB will not fit.

3. Inside the box there are four stops as well. The one near the two holes needs to be cut, while the three others can be as is. Cut and make sure the area is flat by using a file or dremel, or any other tool of your choice.



4. Before performing the drilling, put the PCB within the lid and snap-close the box. Pay great attention to the snap-lock on the bottom right in the picture. Two drills will go through it, and if you push the drill too hard, the snap-lock **will break** and the box will then be difficult to close. If there is one step in this whole kit you need to take great care and time to perform, it's this one!





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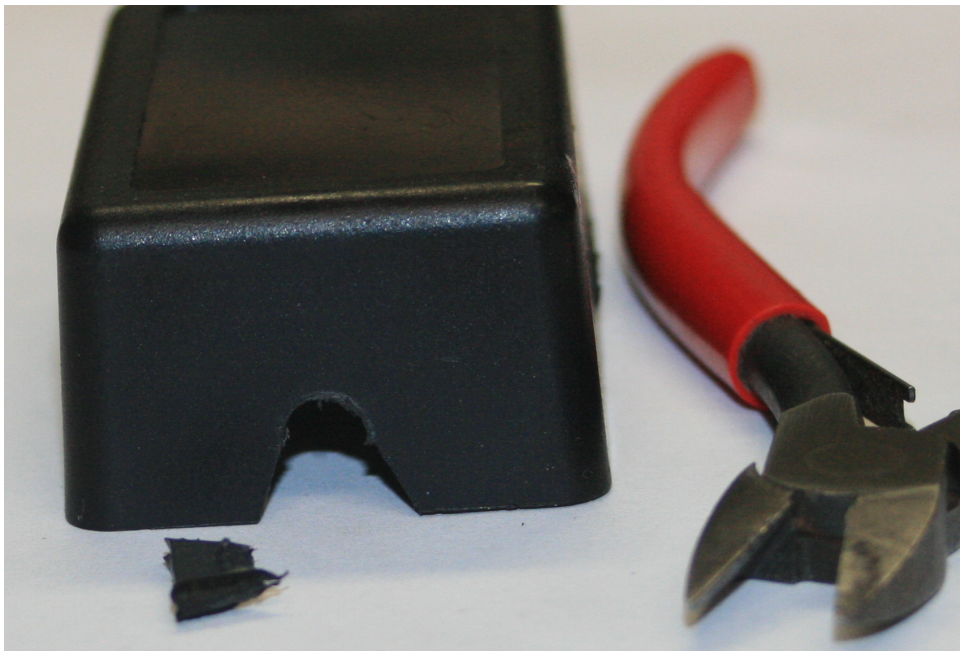
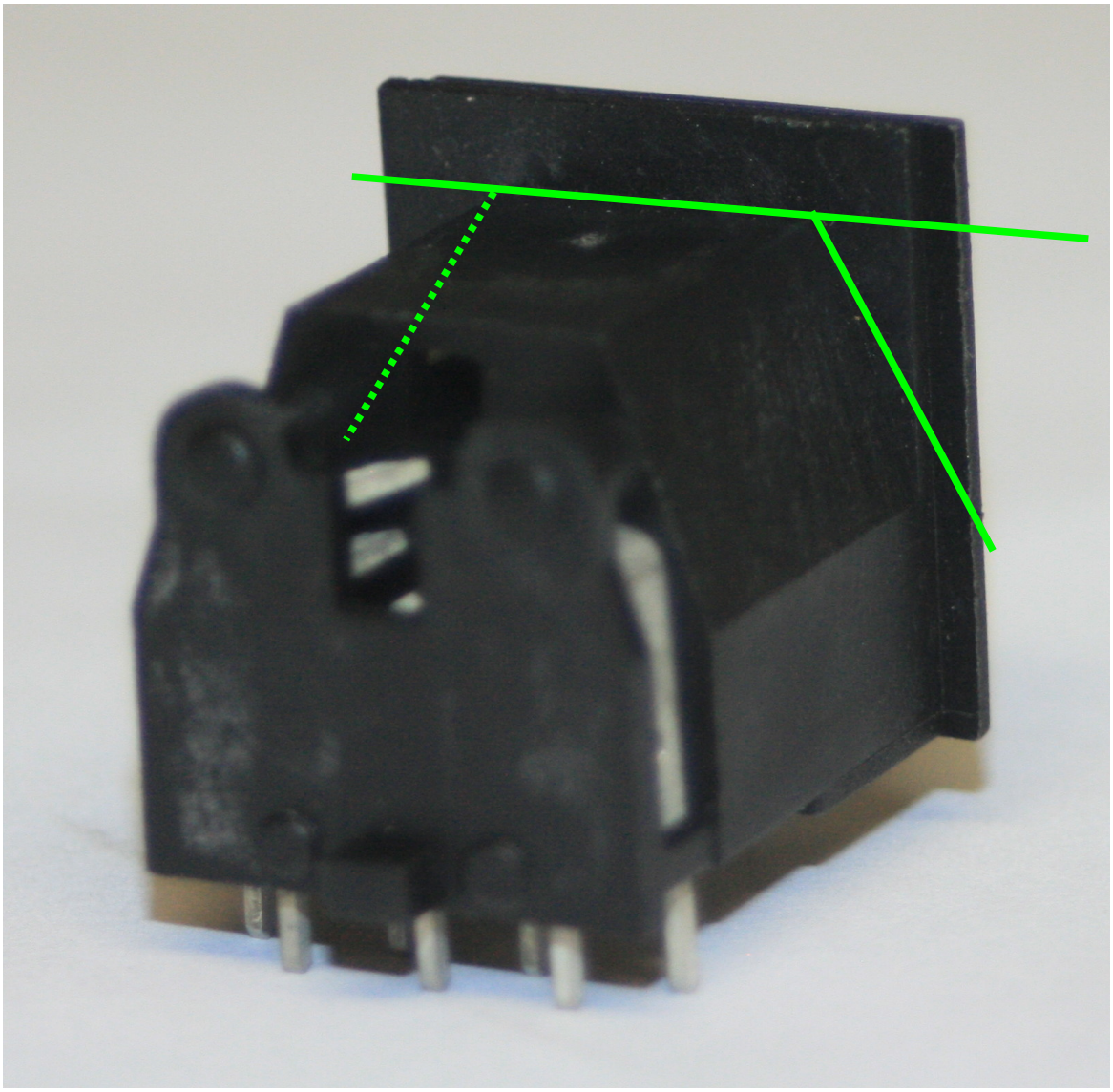
OPTIONAL:

5. After drilling the 6.5 mm-hole, you can cut it open using pliers. If you cut it open, the cable insertion / removal will be a lot easier. If you choose not to cut it, the cable will be stuck in the hole and bring the whole box. This is generally not a problem unless you need to perform a modification on the PCB after it's assembled.



6. When the box is finished, you will need to perform surgery on the DIN-connector, otherwise it will not fit in the box. Pliers will help you out cutting the areas marked in green, and a file will help you making the top flat. One tiny bump and the connector might not fit the box. The good news is that you can use trial and error for this step to work, repeating it until the connector fits.



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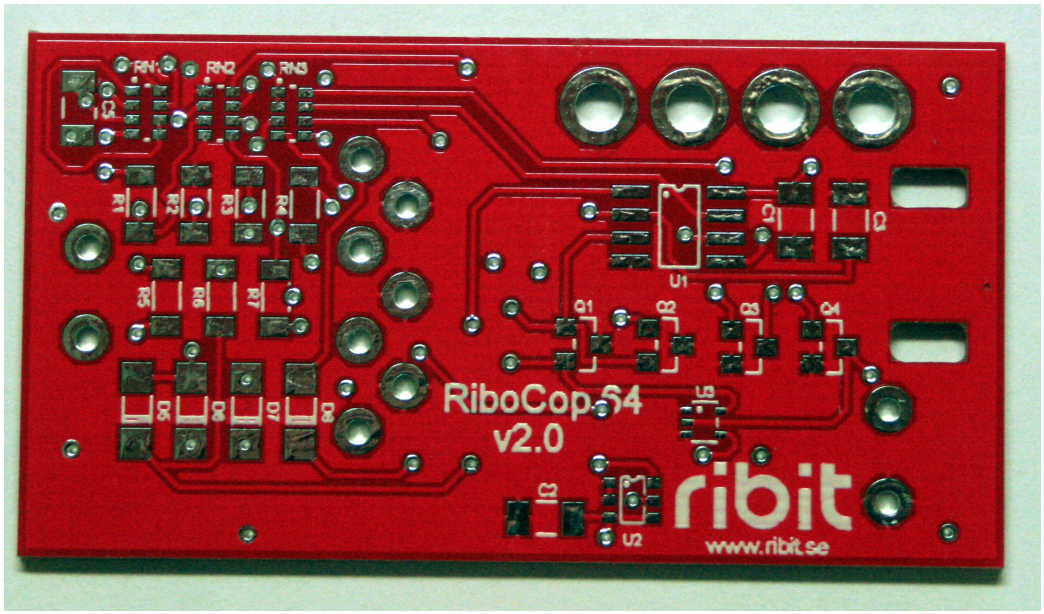
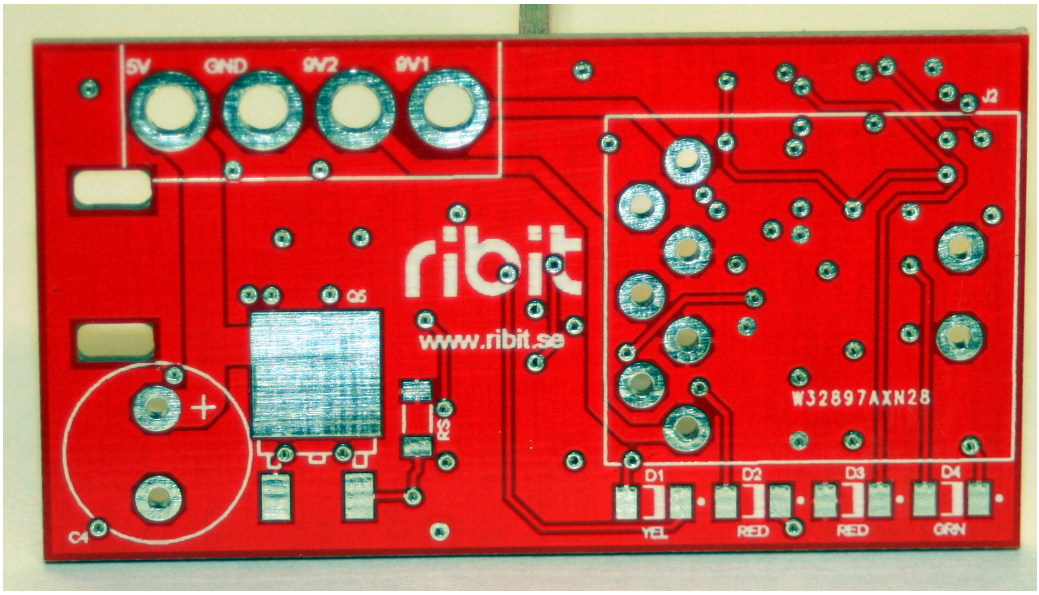
PCB-assembly

1. Put the PCB on the desk and make yourself familiar with it. Bottom vs. top side shown below.





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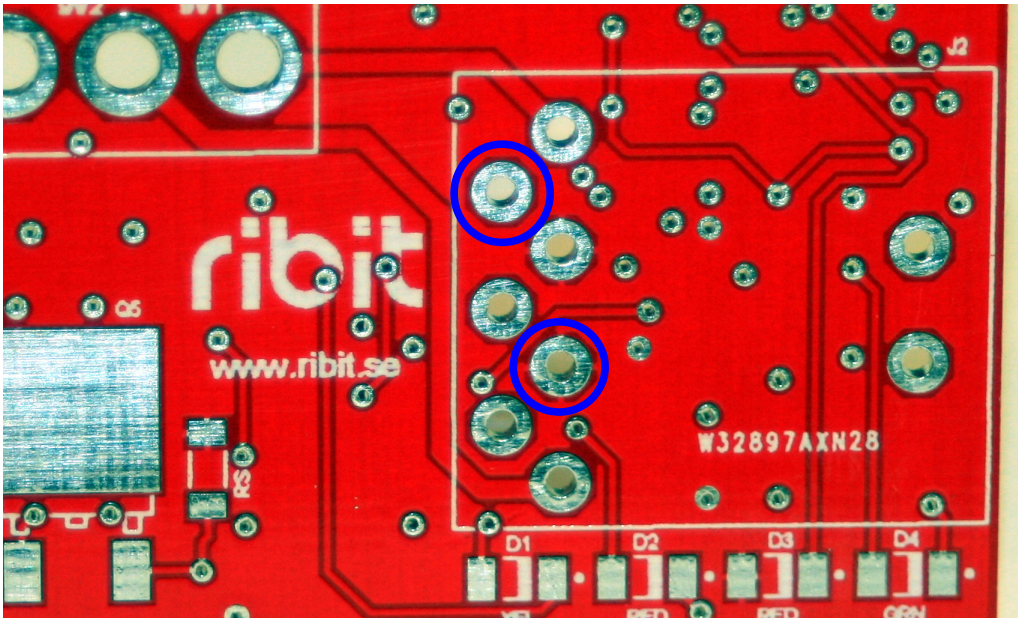
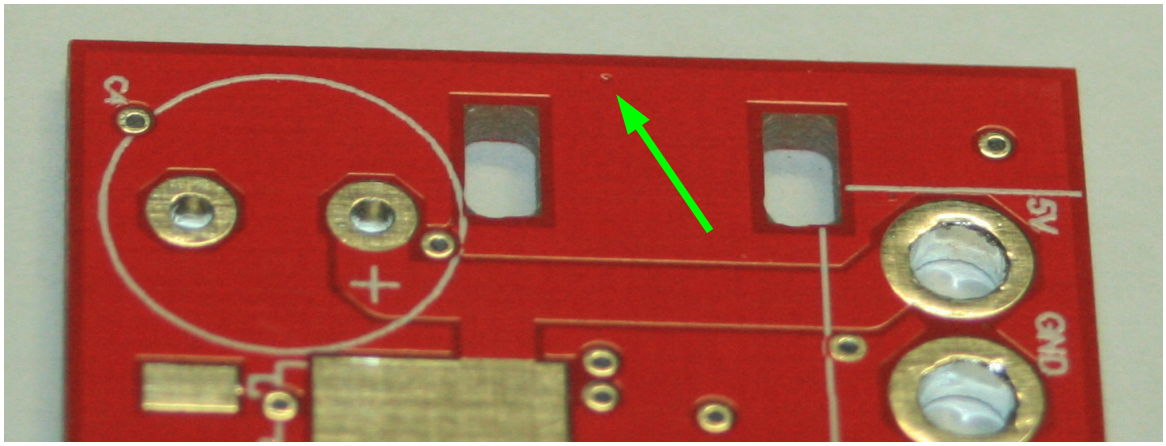
2. There's a fatal manufacturing error on the board, where a buried via is shorting VCC with the ground-plane. To verify the bug, use a multimeter in continuity mode. Put the probes on the two spots marked in the first photo. If you get a measure – beep or whatever – that means the short is there.

Have a look at the second image below and see the arrow pointing at a tiny via. This via is the culprit. Use a drill, a dremel, or any sort of cutting tool to drill it so the via is disconnected from the copper plane. The via can be seen both on the top and the bottom side of the board, and you can cut either of these two. Cutting on the top side is better (aesthetically) since it will be obscured. After cutting, use your multimeter once again to verify there is no connection between the pads marked in blue.





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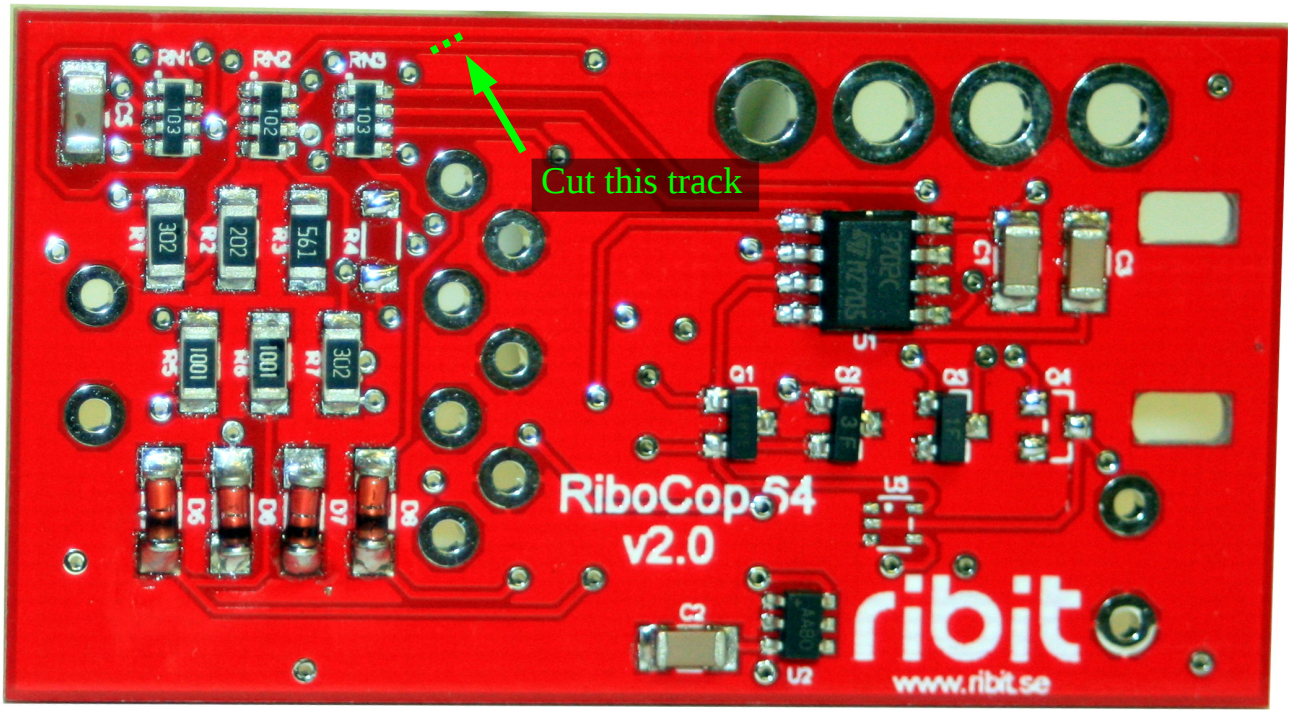
3. Solder all the surface mounted components on the bottom side. R4, Q4 and U3 is not used. Use the image as reference as to where to put the components. Have a look at C1-C3 (100nF): they all look the same, while C5 (47uF, top left) is slightly larger.

Also **cut the thin track** shown in blue. You can use a scalpel, dremel, or whatever you want, just make sure it's cut.

Take **great care** when soldering U1. This chip is **extremely sensitive** to ESD, and must also not be heated for too long.



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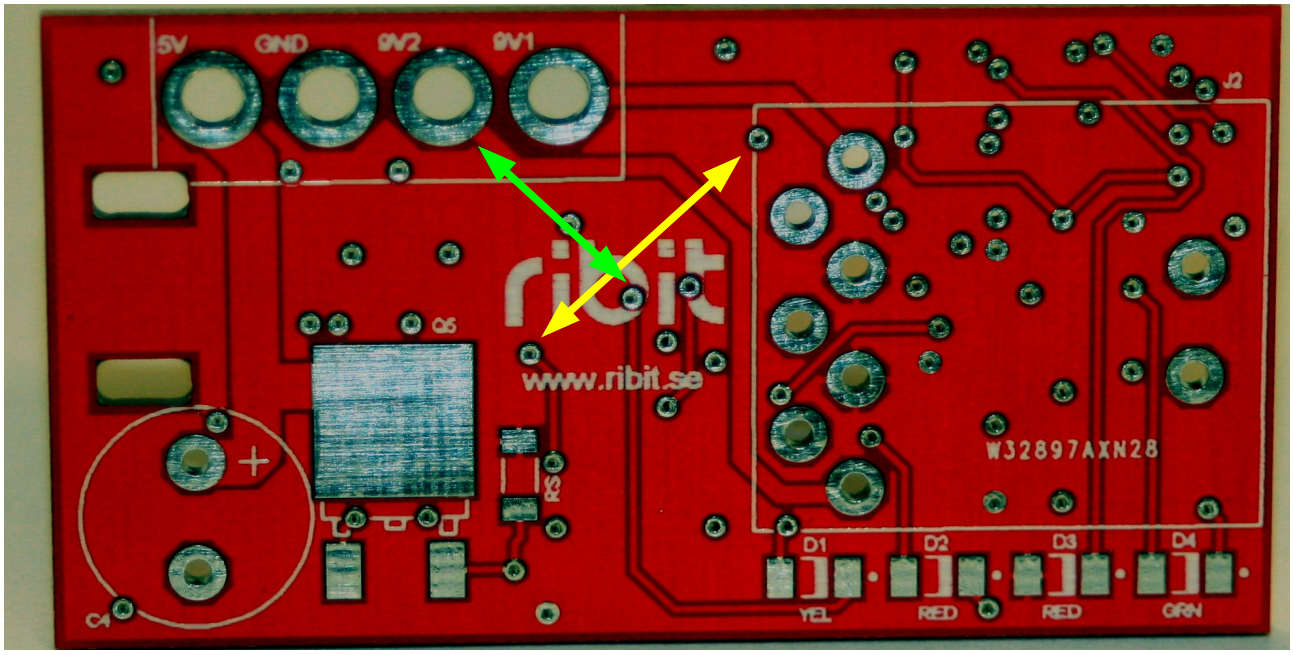
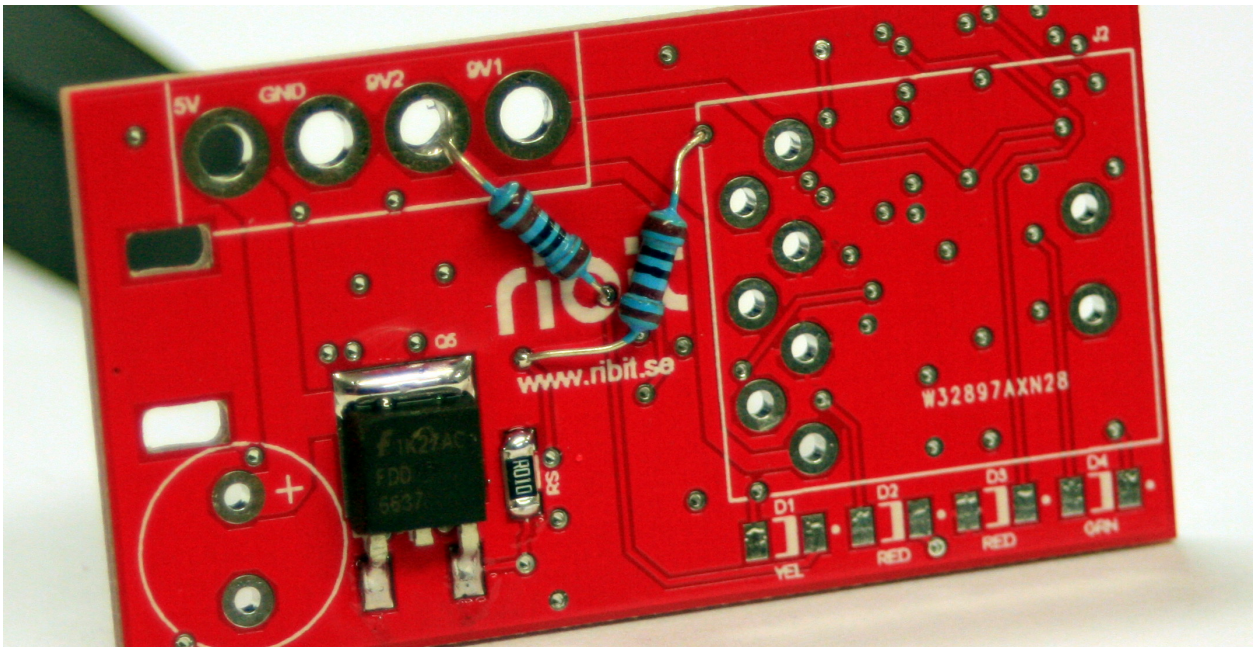
4. Flip the board to the top side to patch it using two 1k-resistors. Connect the first one in the holes marked in yellow, and the second one in the holes marked in green. Make sure the leads do not touch any other holes. After the 1k-resistors are done, solder Q5 and RS.





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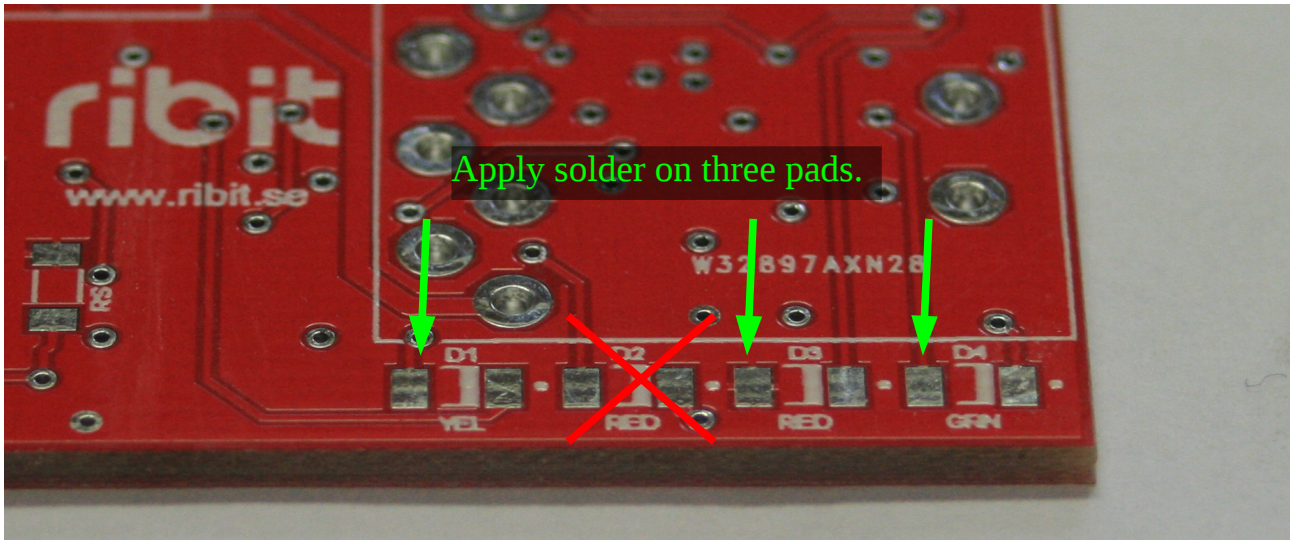
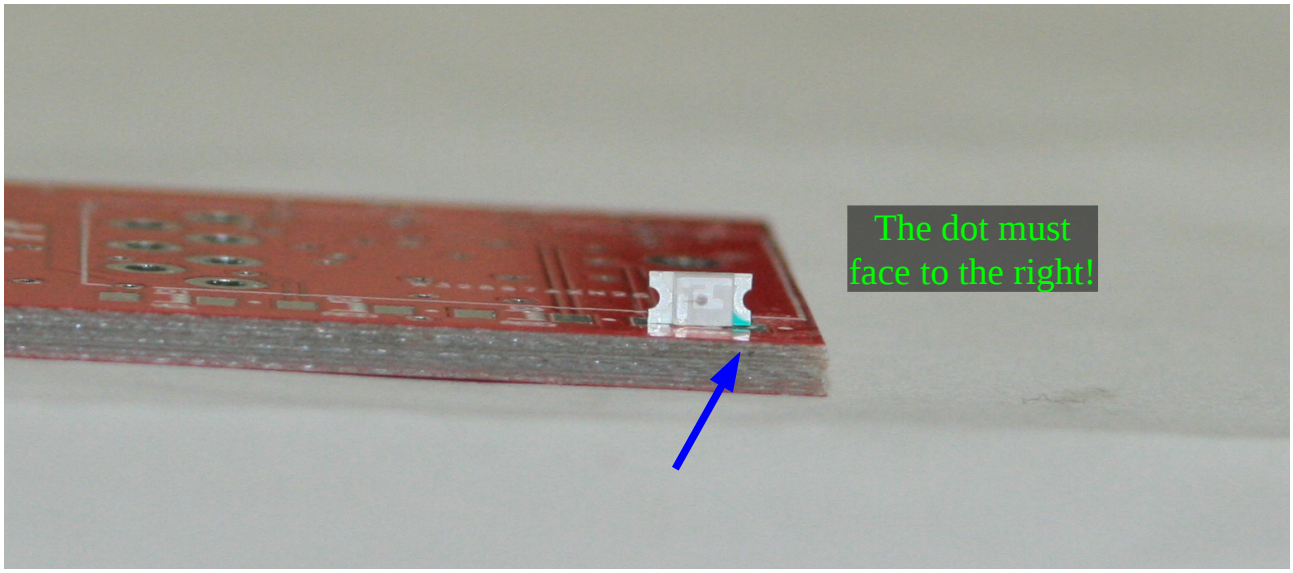
5. Before you solder the DIN-connector to the board you should solder the three LEDs. All the LEDs use a clear case, which means you cannot see which LED is which color. Use your multimeter in diode setting to find which color it is.

Find D1-D4 on the bottom right corner on the PCB. The easiest way to solder the LEDs is to first apply solder to one of the pads for D1, D3 and D4 respectively (D2 is not used), and then solder them each while they're **standing**. All the LED:s have a tiny green dot on them. The dot tells you where the cathode is, and the LED-dot should face the dot on the PCB. Or, in other words: the dot should face **right.** The LEDs are sensitive to heat, so do not solder them too long or they will die.





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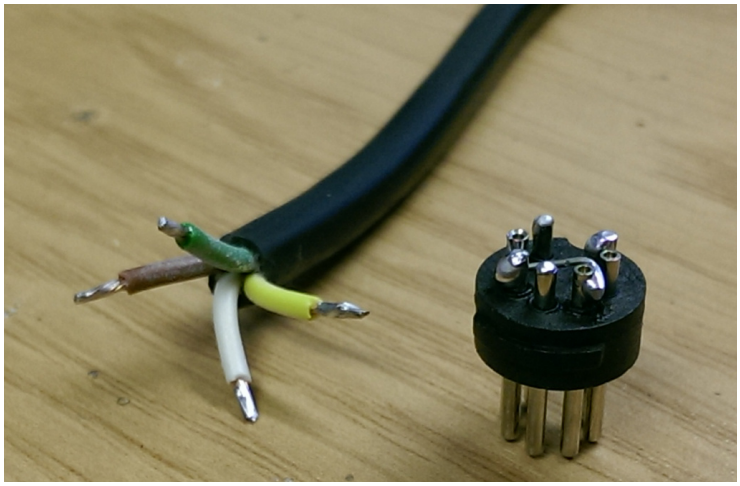
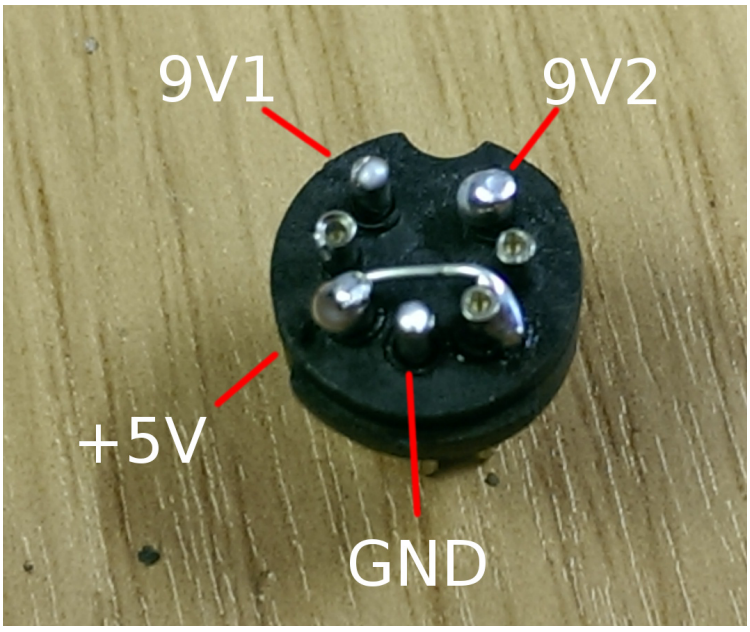
11. Solder the cable to the DIN7-connector. Depending on what cable you got the colors might differ (see table below). Join the two 5V-pins.

Signal	Color variant #1	Color variant #2
9V1	Brown	Yellow
9V2	Yellow	White
5V	White	Red
GND	Green	Black





12. Solder the DIN-connector and C4 on the top side of the board. Then solder the four cables, and attach the cable using a cable tie.

MAKE SURE THE CORRECT CABLE GOES INTO THE CORRECT HOLE!
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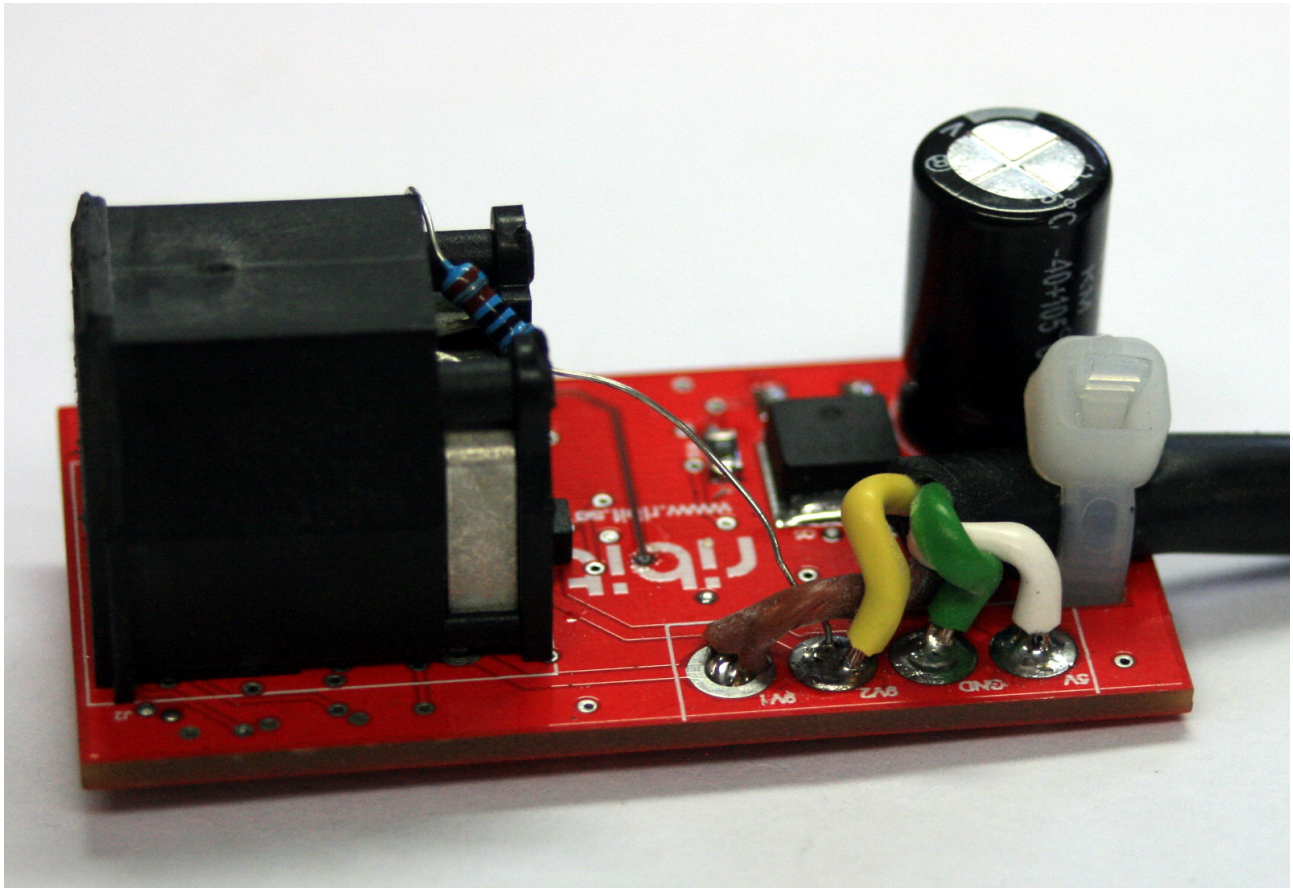

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Testing

1. Connect a variable power supply to one of the two incoming 5V-pins on the board. Make sure the voltage is around 5V, and power on. If you have done everything correct, green LED (and nothing else) will light up.

If the green LED is not lit, disconnect the power and use a multimeter in diode mode to verify that the LED is working.

If the red LED is lit, make sure the power supply is sourcing between 5.0-6.0V.

When only the green LED is lit, measure the output and verify the voltage is equal to the input voltage (give or take 100-200mV)

2. Increase the voltage to atleast 6.0V. This will trigger RiboCop(tm), and it will cut the output. When triggered, only the red LED should be lit.

While the red LED is lit; measure the output voltage. There's not supposed to be anything here, except if RiboCop is not having a load resistor; then you will measure the voltage from the big output capacitor. If you want you can use a 100 ohm resistor to short the output, then the capacitor won't delay its charge during a trig.

If the input voltage is above 6.0V and the green LED is still lit, then something is wrong and you have to find out what and where. When a trig is due, these points should have these corresponding voltages:

U1 pin 1	0-0.5V
U1 pin 2	> 2.5V
U1 pin 3	< 3V
U1 pin 7	> 4V

If any of these does not match, turn off the power supply and verify all the solder points to exclude shorts. Pay extra attention to Q1, since its three pins are really near each other; there's a great risk that some solder are shorting them.