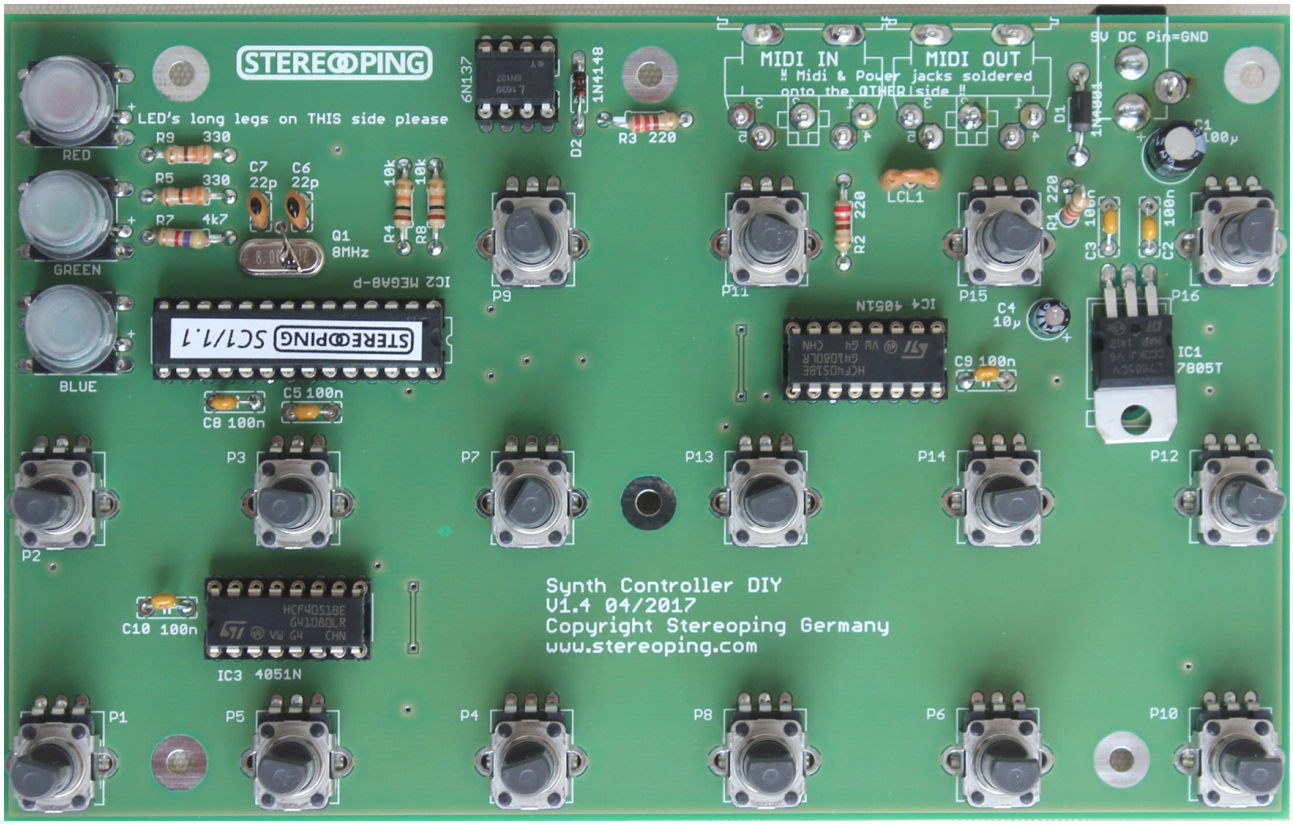
Synth Controller

Building instructions V1.8

(for PCB Rev. V1.4)



Building instructions 'Stereoping Synth Controller'
V1.8 - 01.2021
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Hello

Hi and thank you for having chosen the 'Stereoping Synth Controller' assembly kit. We will use 'SSC' as an abbreviation for 'Stereoping Synth Controller' in this building instructions. If you were looking for the manual you are unfortunately wrong here, this is the building instructions for getting together the assembly kit. You can find the manual here: www.stereoping.com -> Products -> SynthController -> Downloads.

If you experience any problems during building this kit, are coming up with a genious improvement feature, if you wish special photographs or simply are enoyed by something, even if you just want to write us that you LOVE our product ...
go ahead. We are looking forward to receiving your Mail!

hello@stereoping.com

This building instructions came out quite large because we don't want you to make mistakes or experience any bad emotions while building this synth controller. The kit and the instructions were developed very thoroughly and are verified multiple times. If you follow the instructions carefully, your controller will work perfectly right from the beginning.

Nevertheless we can not be held responsible for any problems or damage caused by the building or usage of this assembly kit. Nor can we replace or repair PCBs, parts or complete kits, damaged or destroyed by inappropriate building or usage.

Your PCB (printed circuit board) has got a version printon. The current version is 1.4 suitable to this instruction manual. Some pictures were taken with the now obsolete V1.1. please don't worry if the pictures slightly differ from your PCBs look.

These instructions contain the following parts:

1. Content of the kit

2. Building the kit

3. First time operation & knobs

4. Technical data

5. Imprint

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1. Content of the kit

Resistors with their values in Ohm and the color codes

3x	220	Red-Red-Brown-Gold
2 x	10 k	Brown-Black-Orange-Gold

Editions with 3rd LED in Yellow

3 x	330	Orange-Orange-Brown-Gold

Editions with 3rd LED in Blue

2 x	330	Orange-Orange-Brown-Gold
1 x	4,7 k	Yellow-Purple-Red-Gold

16 x pot 10 k linear

Capacitors with their values

2 x	22 p
6 x	100 n
1 x	Elko 10 µ
1 x	Elko 100 µ

Semiconductors

1 x	Atmega8	Processor
2 x	4051	Multiplexer
1 x	6N137	Optocoupler
1 x	7805	Voltage regulator
1 x	4004	protection diode
1 x	4148	diode
1 x	Crystal 8MHz	

Others

1 x	IC-Socket 8pin
2 x	IC-Socket 16pin
1 x	IC-Socket 28pin
2 x	Midi-jack
1 x	Power-jack
1 x	T-Filter (not shown on pic above)
1 x	PCB with preassembled buttons, LEDs and buttoncaps
1 x	steelcase with frontlabel
4 x	thread screw M3 / 5mm (upper half to lower half of case)
6 x	thread screw M3 / 5 mm (pcb to upper half of case)
16 x	knob

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2. Building the kit

Tools you will need

To build the kit you will need the following tools:

- solder iron or better a solder station
- lead free or leaded solder (works perfect with both)
- a side cutter to cut the wires from the parts after having them soldered onto the pcb
- a multimeter to check the operation voltage before attaching the ICs (Intergrated circuits)
- a philips screwdriver mid size for the screws holding the pcb into the upper half of the case and to screw the two halfs of the case together

Before we start ...

Assembly should be finished within an hour. Please take your time, enjoy the process of building your controller, concentrate on what you are doing. It happens quite fast to mix up two parts or solder one on the wrong side of the pcb. This manual describes the whole process very detailed. If you follow it thoroughly, your controller will work perfect immediately.

If something goes wrong

It should not happen but of course does from time to time: you've put a part into a wrong position or alignment and have to get it out again. Althoug we cannot teach you here all about desoldering, you'll get pointed into the right direction if you scan the web looking for the terms desoldering pump or desoldering braid. If you soldered one of the IC sockets the wrong way that's no problem. It can of course keep as it is as long as you put the IC into it as printed on the PCB.

Let's get started

After comparing the bill of material with the content of your package we can start with the assembly. The order is arbitrary. The pcb should be lying in front of you with the buttons in the upper left corner. This is the relevant pcb-orientation when we talk about something like "diode in the upper right corner of the pcb"

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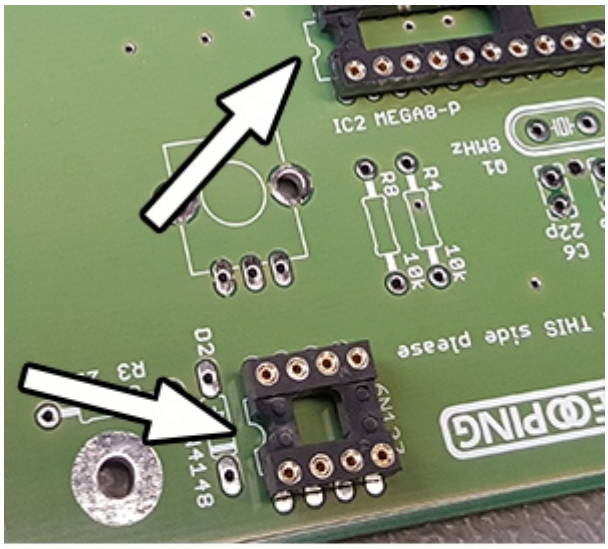
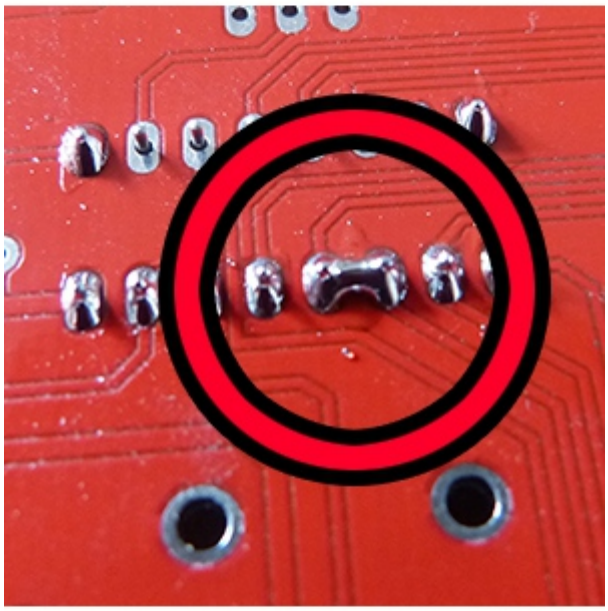
IC-sockets

Let's start with the sockets for the ICs. Each socket has a small notch on one of its shorter sides. This notch must match the printed outline of the socket on the pcb. See upper photo to the right.

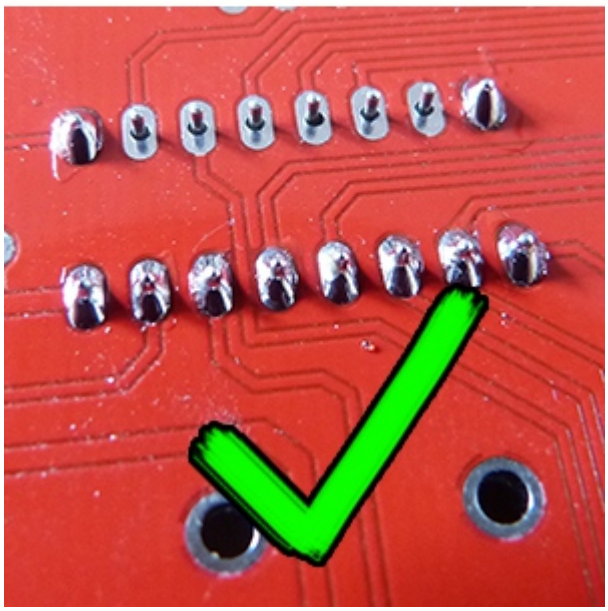


The notch can also be found on the IC and tells you, where pin 1 of the IC can be found, which in fact is important. A wrongly attached IC gets a wrong power supply which might destroy the chip! Some ICs have a notch, others have a small circular indentation on the top of the body to mark their pin 1.

Attach the sockets according to the printed outline on the pcb now. Start by just soldering one leg in a corner. Have a look from all sides to ensure, the IC is lying perfectly flat on the pcb and solder the other legs.



Pay attention not to solder two adjacent legs together like in the middle photo. All legs should be separate like in the lower pic.



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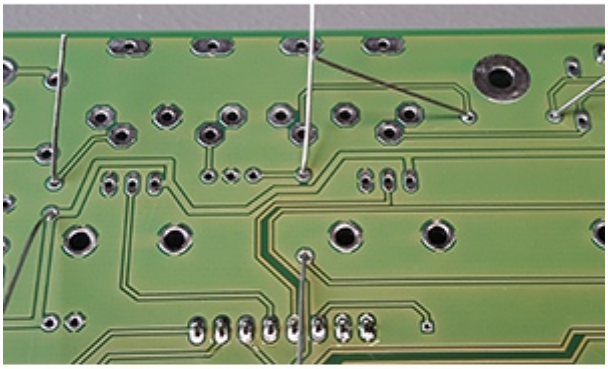
Resistors

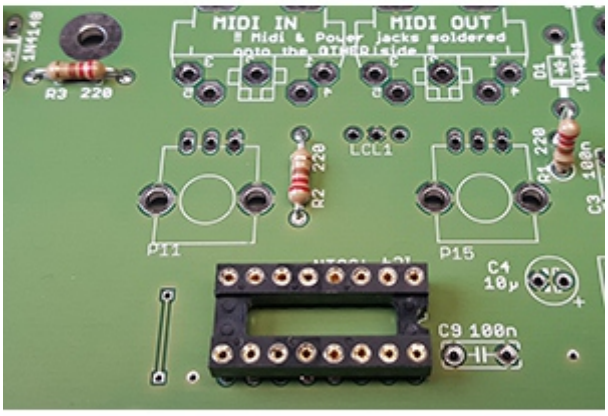
We continue with the resistors which are marked with a "R" on the silkscreen. Its value (e.g. '220' for 220 Ohm) stands right beside. The resistors are color coded, you find the appropriate colors in the bill of material at the beginning of this document.



Resistors have no polarity, the direction you put them on the pcb does not matter. But try to keep them lying flat on the pcb to ensure, their legs will not have electrical contact with the metalcase later. One leg of the third 220 ohm resistor has to be bent sharply by 180 degrees to stand vertical.



After placement you can bend the legs below the pcb like in the second pic to prevent the resistors from slipping out of the holes when turning the pcb for soldering. After soldering, cut the wires right above the solder.



Now on to the remaining resistors. These 3 resistors near the buttons can vary, according to the edition you purchased. Your kit should be armed with the right resistors suiting your edition. There will not be any parts left over in the end.



If you can't see the LED colors just take the transparent caps off the buttons.

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Most editions use red, green, blue.

Tubbutec editions 1oh1 und Juno66: These use LED colors white, blue, red.

SixTweak edition: Here we got white, white, red.

And these are the suitable resistors to be soldered next to the led color:

Red	330 Ohm (Orange – Orange – Brown - Gold)
Yellow	330 Ohm
Green	330 Ohm
Blue	4,7k Ohm (Yellow – Magenta – Red - Gold)
White	4,7k Ohm

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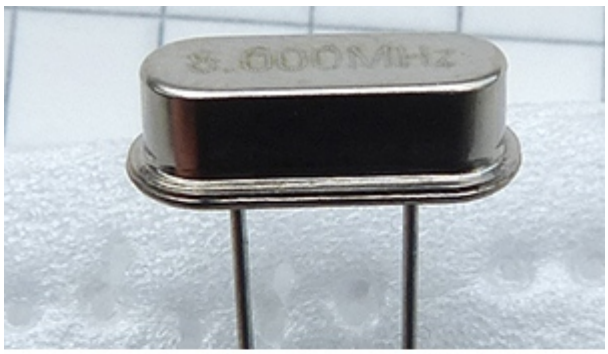
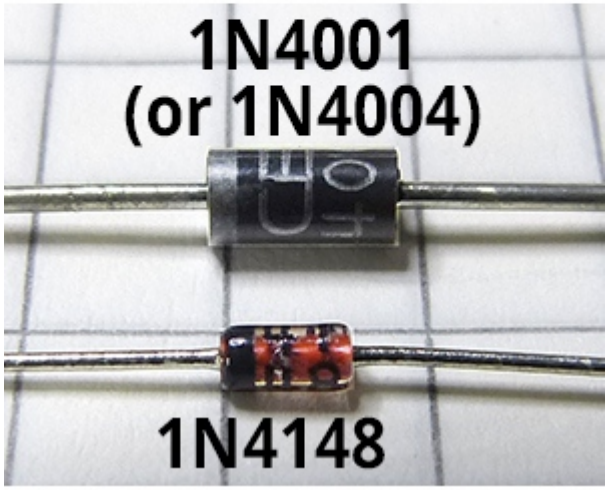
Crystal and diodes

The silver thingy with the label "8.000MHz" is a crystal. It sits near the main processor and has to be put near the label "Q1 8MHz". The crystal has no polarity, just put it in the drilling holes as you like, bend the legs on the other side to prevent it from slipping out when turning the pcb to solder it. In the section "capacitors" you will find a pic of it in its final position on the pcb.

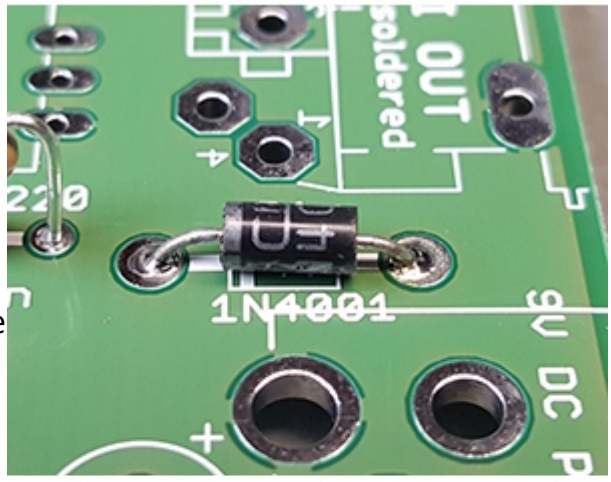


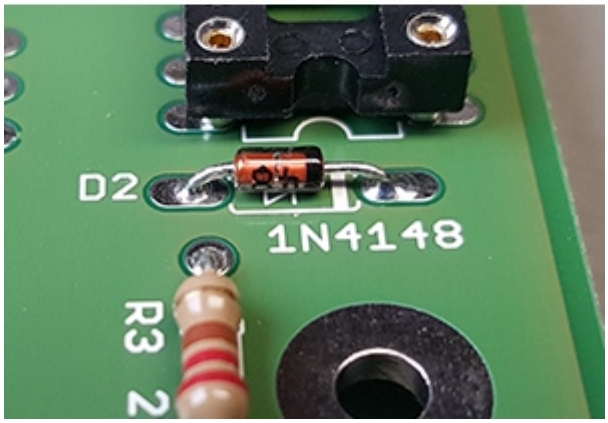
Since PCB version 1.2 there is a small soldering point between the 22p capacitors. If you are a perfectionist you can solder the crystal's case to this point with a short piece of wire. Not too long, crystals don't like heat. But the controller will work perfect even if you don't.

Now on to the diodes 1N4148 (the red one) and 1N4004 (Black). Instead of a 4004 you might as well find a diode labeled e.g. 4001. That is not really important for our purposes. Its task is to protect the electonics from being damaged by a wrongly polarized power supply unit.



Diodes have a ring on one of their ends. This ring can also be found on the silkscreen. Please insert the diodes in the direction for the rings on the silkscreen and the diode to match. Compare your result with the pictures to the right.





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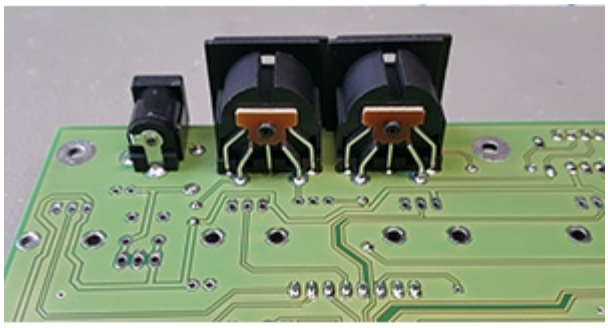
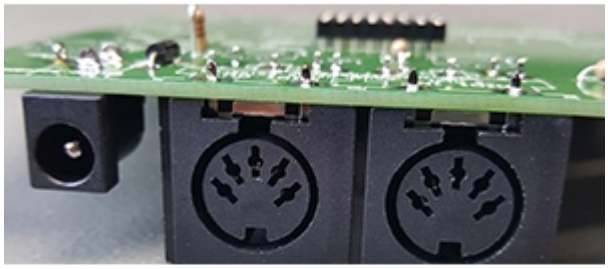
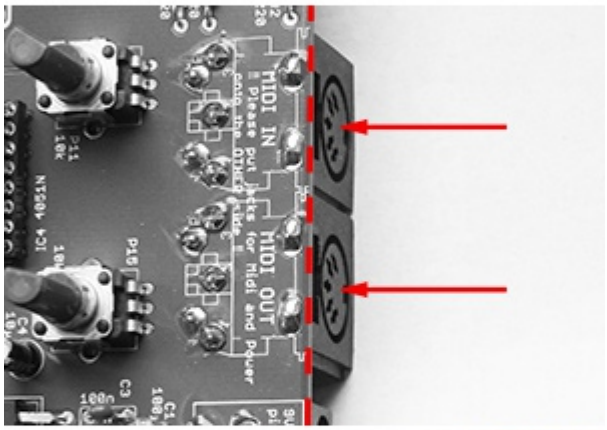
Power- and Midi-jacks



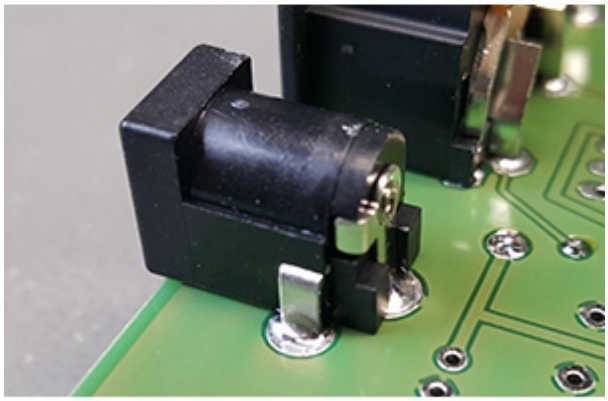
Caution! The jacks for power and midi will be put on the pcb's backside as shown in the picture to the right.
The silkscreen on the pcb-frontside also features a warning saying "Please put jacks for Midi and Power onto the OTHER side".



It is important to have all 3 jacks aligned flat on the pcb like in pics to the right. Otherwise your midi- or power-cables plugged in later will sit crooked. That would not be what you want.

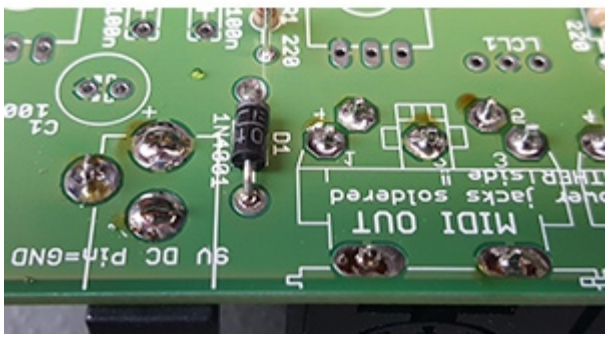


Another detail concerning the midi jacks: they are nearly touching the backside of the steelcase later and should therefore not stand out of the dashed line in the b/w-picture to the right. After putting them in place they can still move about 1/2 mm. Try to push them a bit in the direction of the red arrows while soldering the first pin to ensure they won't stand out of the PCB.



Solder just one of the midi-jack's pins on the front edge of the pcb and have a thorough look onto the area where the jack hits the pcb. There should not be any gap. If there is one, press the jack onto the pcb with forefinger and thumb and heat up the solder again, the jack should jump into the flat position then.

Solder all pins of the jack and do not be stingy with solder. If you have got a soldering station, give it another extra heat now (i use 400° C with leaded solder).



If the pins and pads get enough heat, the solder will flow onto the other side of the pcb like shown in the third pic with the power-jack.

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That's what we want and makes the jacks sit very stable on the pcb which is quite important due to the mechanical stress the jacks are exposed over the years.

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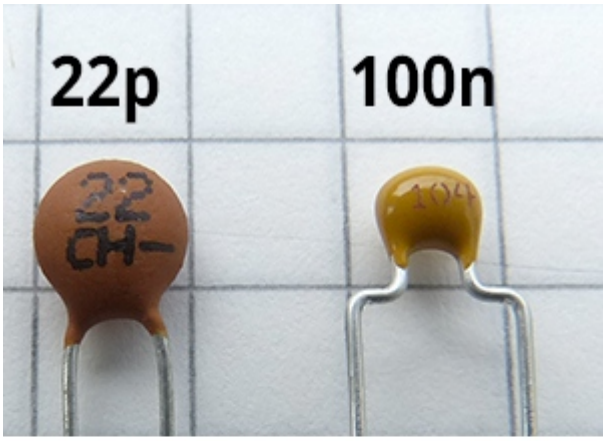
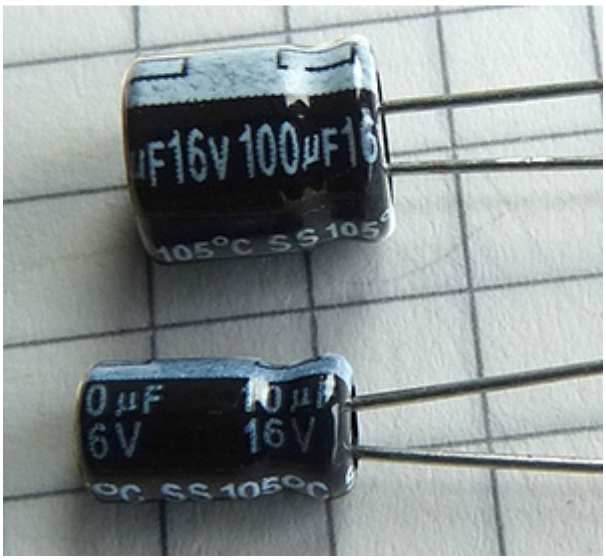
Capacitors

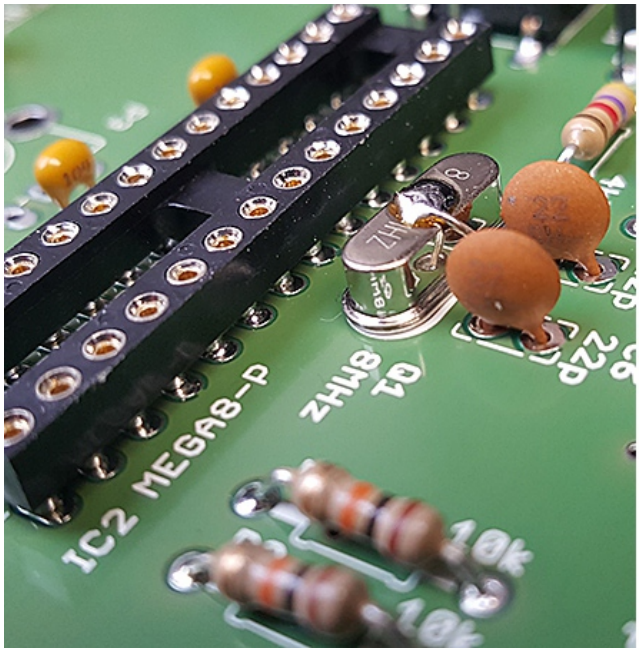


The capacitors (silkscreen label "C") contain two Elektrolytic capacitors ("Elko") where we must care about polarisation, they got a plus and a minus end. They are shown on the second picture to the right. Elkos have a grey stripe with some "-" signs in it. The other end means "Plus" and has a longer leg. The elko-symbol in the silkscreen has a small "+" on one of its drilling holes. I guess you know, which direction to put the Elkos?
When the pcb is lying the way as mentioned in the beginning, the grey minus-stripe of the big 100µ elco should point to the right, the stripe of the smaller 10µ should point to the left.



The other 8 capacitors do not care about polarisation. The two brown ceramic capacitors with the label "22" ("22 picoFarad") have to be put near the crystal.

See the pictures below for comparison.





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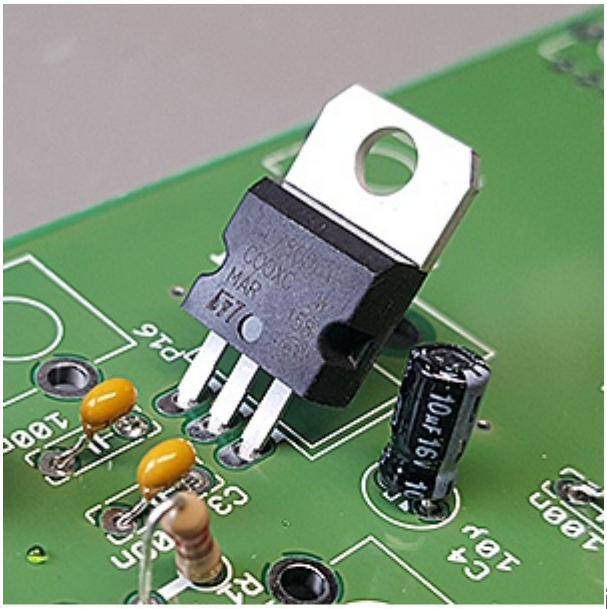
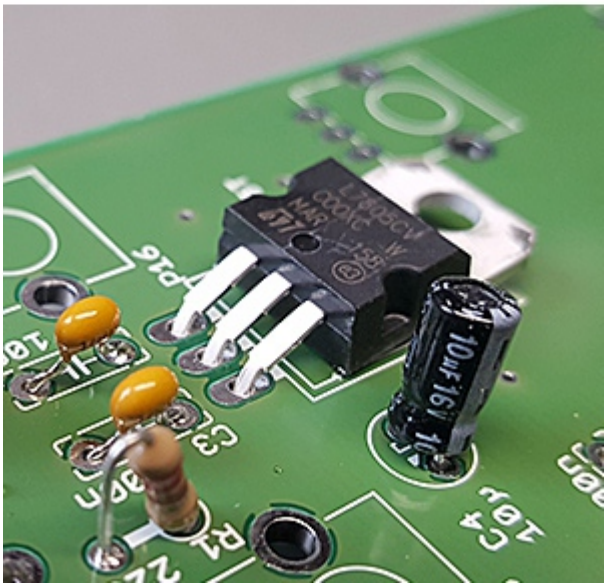
Voltage regulator



The regulator must not stand vertical later as it would scratch the steelcase body. The silkscreen and the lower picture show you how it should find its end position.

Put the 7805 in its drilling holes with its label pointing into the direction towards the midi-jacks. Put it completely into its drilling holes, do not solder it yet!

Bend it to the back like in the lower pic until it is lying flat in the pcb. The regulator automatically lifts its legs a bit out of the holes. Now you can solder the regulator in that position. Maybe you need to hold it down with a finger when the pcb is turned upside down for soldering.



The voltage regulator won't even get lukewarm in operation. There is no need to screw it onto the pcb or even use a heatsink.

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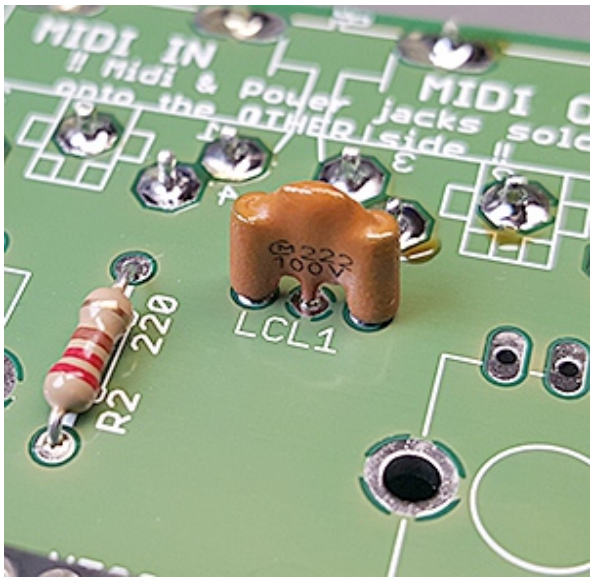
LCL

The LCL device is made of two ferrite beads and a capacitor. It helps to protect your microcontroller midi output pin against electro statical discharge. There is no polarity, put it into the holes as you like. The pix to the right show how it should look like on the PCB.



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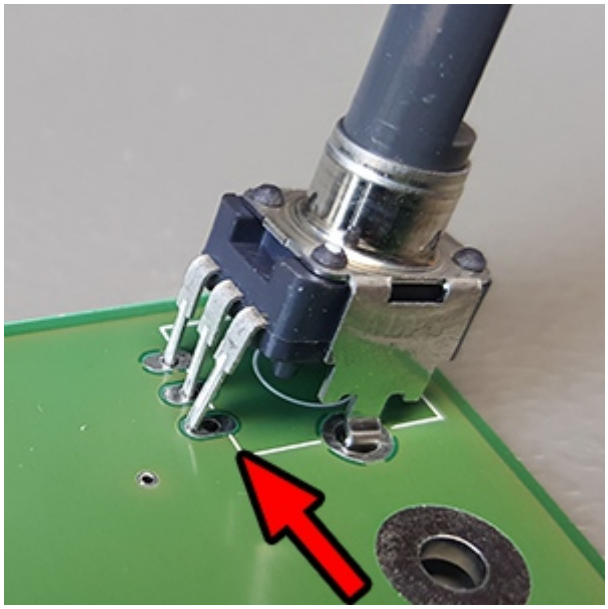
Potentiometer



Update in PCB version 1.2: the drilling diameters for the pot brackets were increased. The pots are now much easier to put into their position.

At least we are coming to the pots. They are all identical, you can't mix them up.

There are some serious traps here. To get a pot straight again after it was soldered in a crooked orientation is NOT fun.

Source of error 1: have a careful look for all 3 pins to find their drilling holes before pushing the pot down onto the pcb. The pins could be bent from transportation. It happened to ourselves we overlooked one leg and twisted it seriously while pressing the pot's metal brackets into the pcb with force.

Put them all in place but do not solder them yet!

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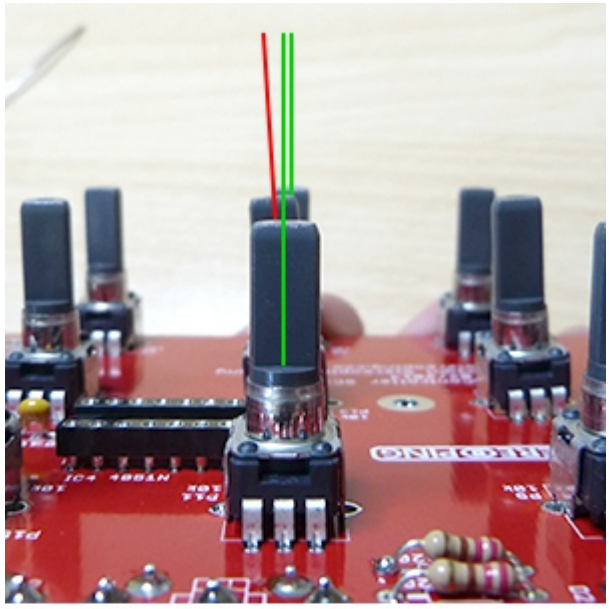
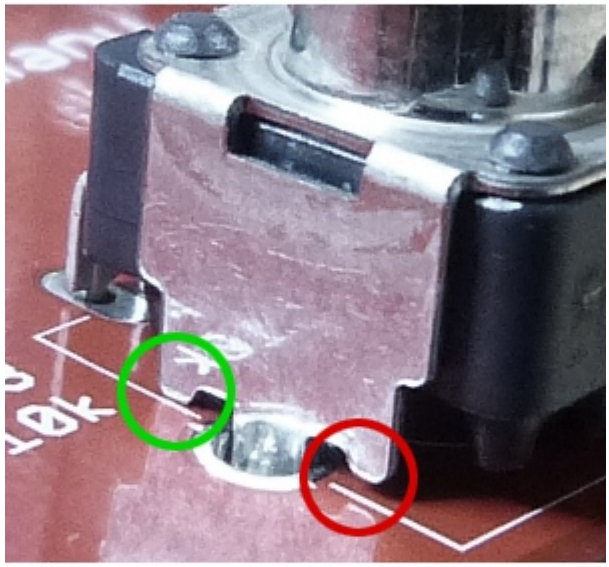
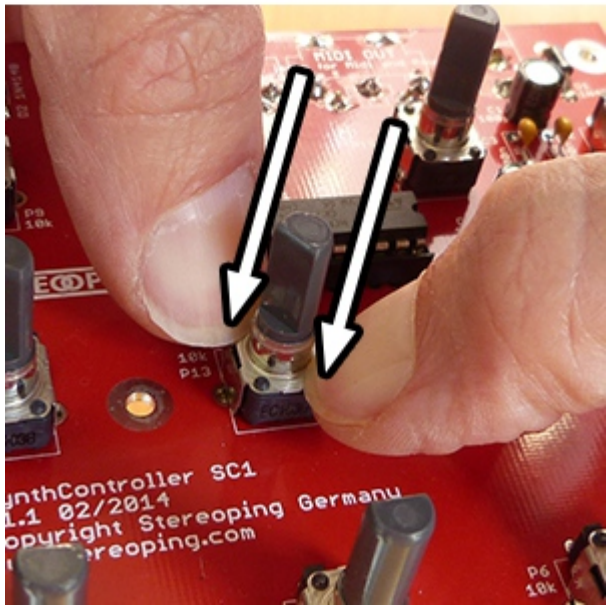
Source of error 2: Even after the pot's metal brackets have snapped into the holes, the pot still can have some slight freedom to move. There might be the one or other pot pointing into a crooked direction. You therefore have to examine each of the 16 pots for being in line with the others when you look with one eye straight through the lines. It's a good idea to do this multiple times. E.g. after each session of soldering another pin of the 16 pots.



In addition both cones of the bracket on both sides of the pot must lie flat on the pcb. In the second picture you see a bracket snapped into the pcb but one cone is still floating above the pcb.



A technique we experienced quite helpful is to press the (already snapped in) pot down with the two thumbnails on opposing corners like shown in the third pic. You will feel a slight movement of the pot sometimes and find it is perfectly flat afterwards and ready to be soldered.



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If you are very very certain now each pot is perfectly vertical you might solder its middle pin first and - YES - check all pots again. **It makes perfect sense to lay the pcb into the upper half of the steelcase to have a look with another reference.**

You might find, we are hysteric here. But think for a moment, you do this step once for the whole life of your Synth controller which might be 10, 20 or even 30 years or beyond. If only ONE pot is crooked, you will regret not having taken enough care for the whole time you will use your SSC.

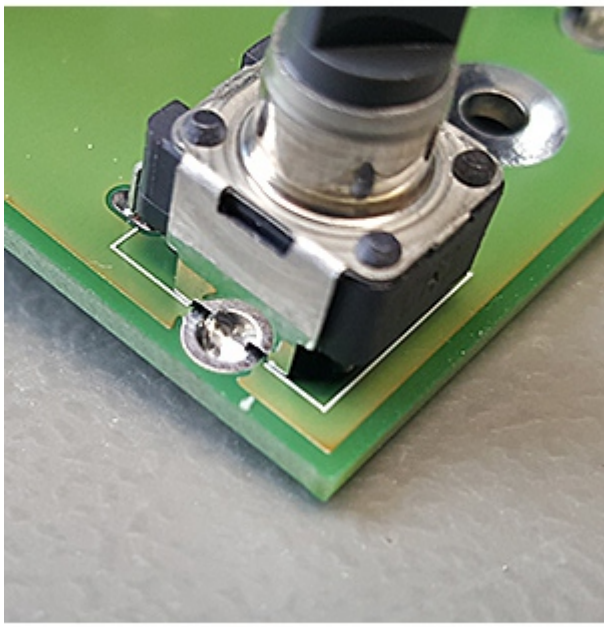
Ok, now you are really sure all pots are straight - solder the remaining pins and brackets.

I increase the temperature of my solder station another 50 extra degrees (400° celsius, leaded solder) because the metalbrackets conduct a lot of the heat away from where we want it. It works better with more heat. After each bracket, i clean the tip to get rid of the slag. New solder will not get tainted by the slag, resulting in a better fluid characteristics and heat conduction and therefore a better soldering result.

Your solder result should look like shown in the pics to the right.







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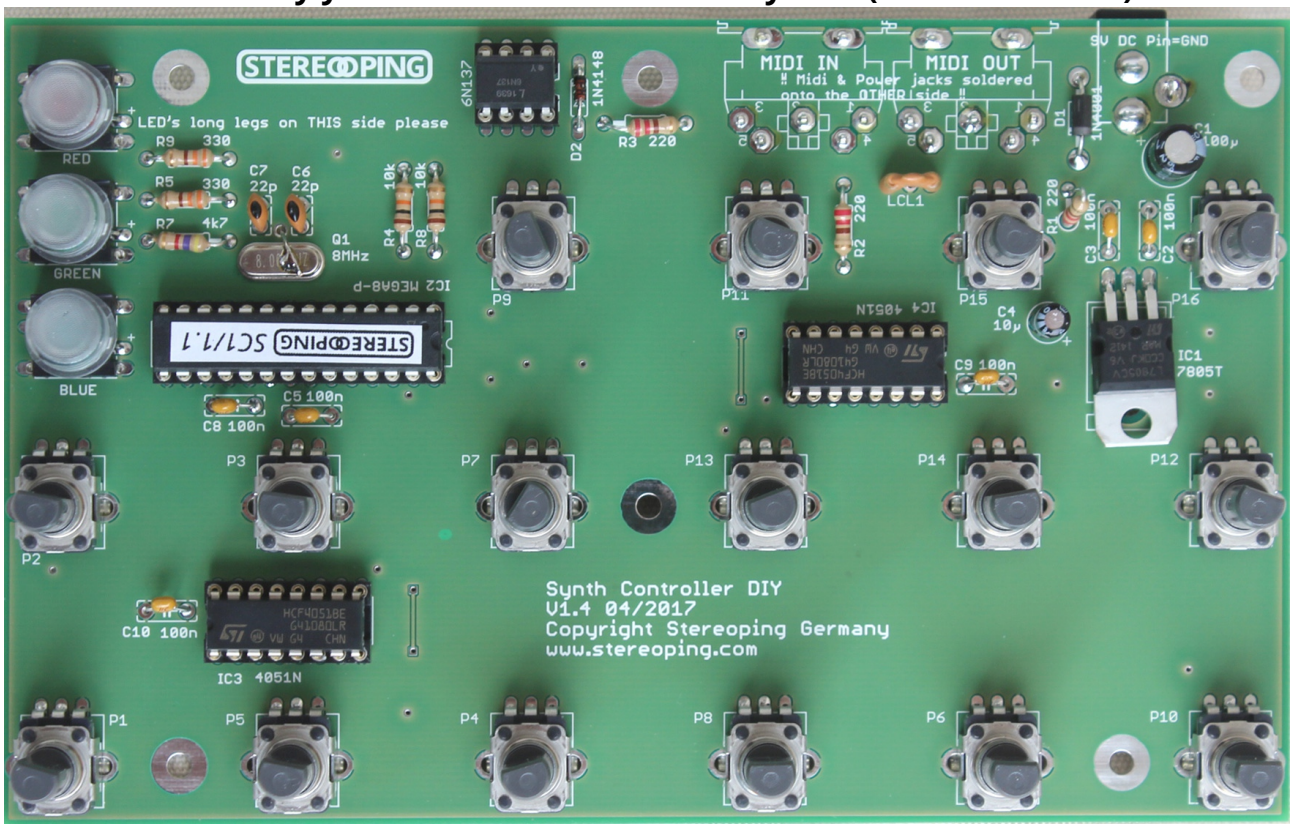
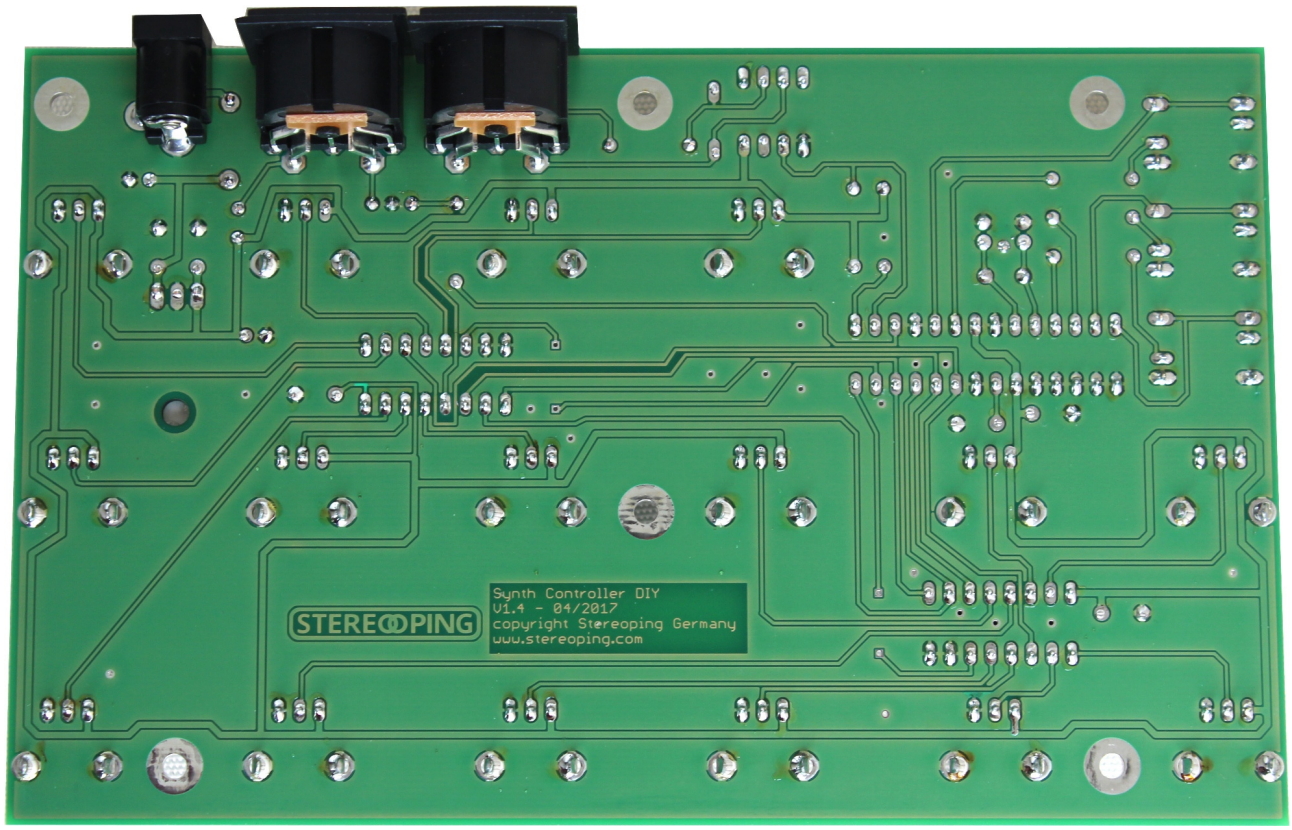
Now that's the way your built should look like by now (but without ICs):





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3. First time operation

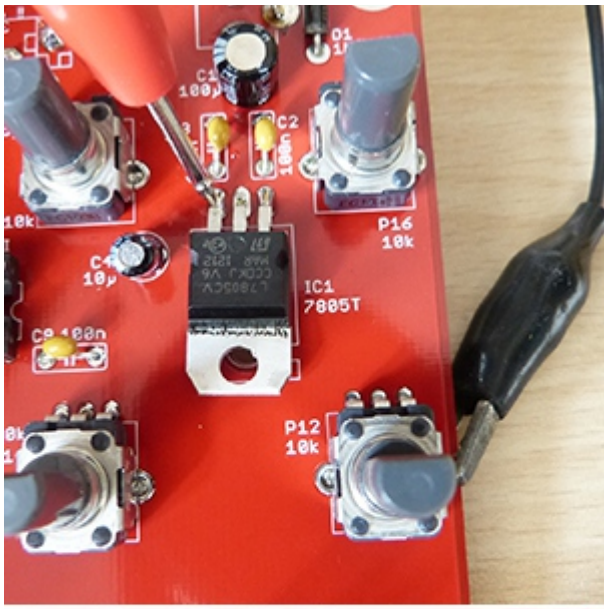
Checking voltage regulator

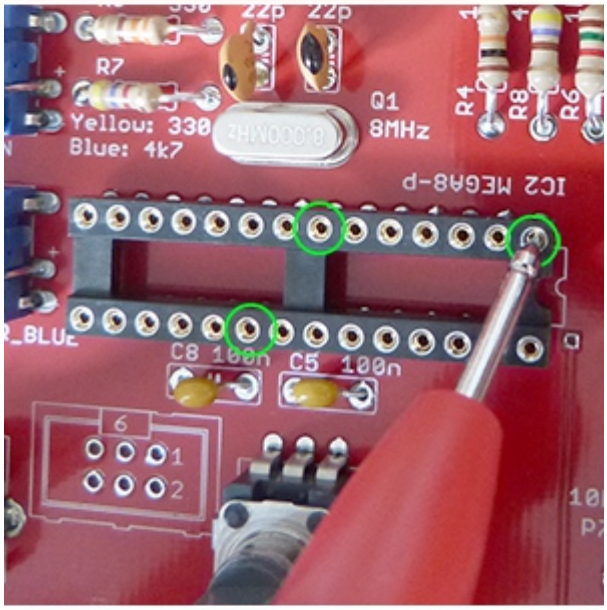
Before we put the ICs into place we should check the operation voltage. Plug the PSU into the jack. The black ground cable of the multimeter can be clamped on any of the pots metal brackes, they are all grounded.

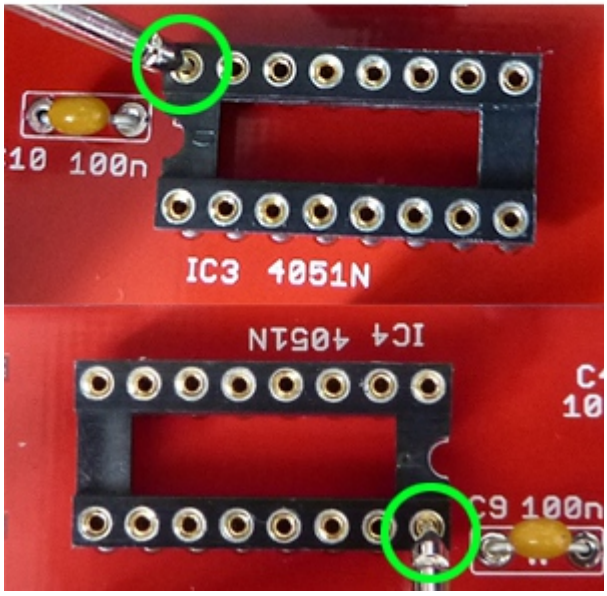
Now hold the red multimeter cable onto the left pin of the 7805-regulator. It should provide + 5 Volt. If you read 4.97 or 5.02 Volt, do not worry, it's ok.

If you do not get +5 Volt please check polarization of your PSU. Middle pin should be Ground, outer pin should be Plus.

The other two pics show points where you should also find points to measure + 5 Volt.







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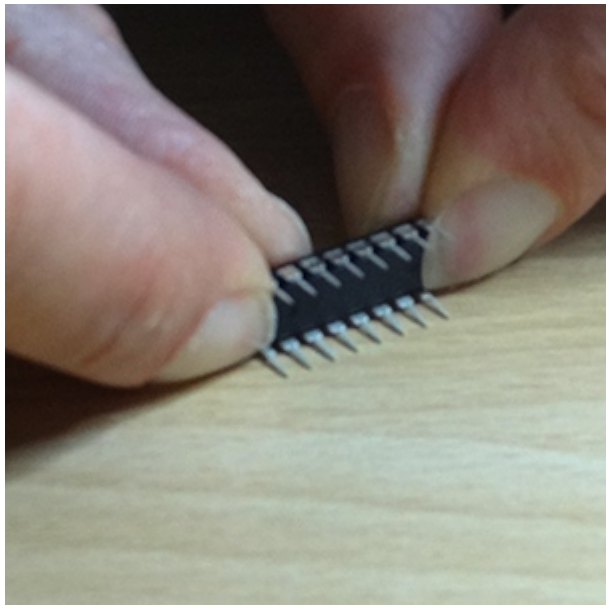
Putting ICs into place

Before we attach the ICs we should remove the power supply again!



Maybe you must bend the legs of an IC before it will fit into its socket. When ICs are coming from the factory, their leg rows often are bent wider than the ordinary socket demands.

If the IC's legs do not fit, one or more legs could be bent completely crazy or break apart while pressing the IC into its socket!

To match the IC's legs with the socket's holes we can do the following: we grab the IC with both forefingers and thumbs from the top on its short sides. Then we press it on the table with the complete leg row and bend the whole leg row a bit inside by twisting the IC carefully away from us. Try to not only bend the thin part of the leg, bend the WHOLE leg which starts directly at the devices body.

Now we start by putting in place the smallest IC, the 8 pin optocoupler 6N137. You see the small circle in the printon on the top of its body? This is where pin 1 is and this must point towards the notch of its socket which is pointing to the right (assuming your pcb lies in front of you, buttons in upper left corner). So we must turn the 6N137 for the label to read upside down. Set it onto the socket, take care all legs are gliding into the holes of the socket and gently press it down in its socket.

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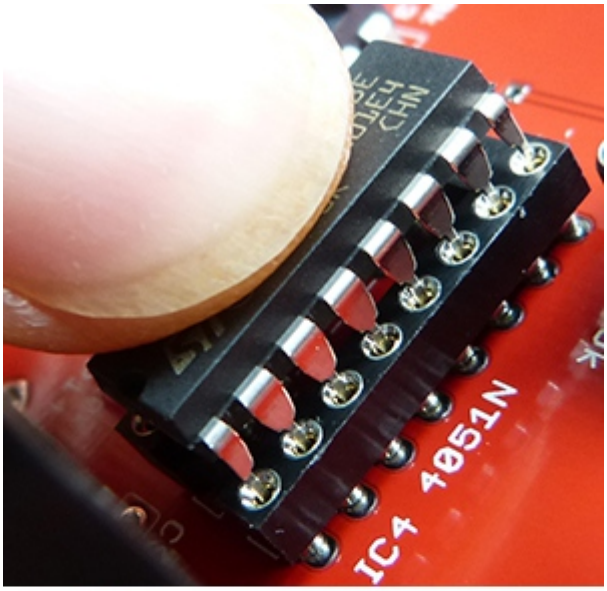
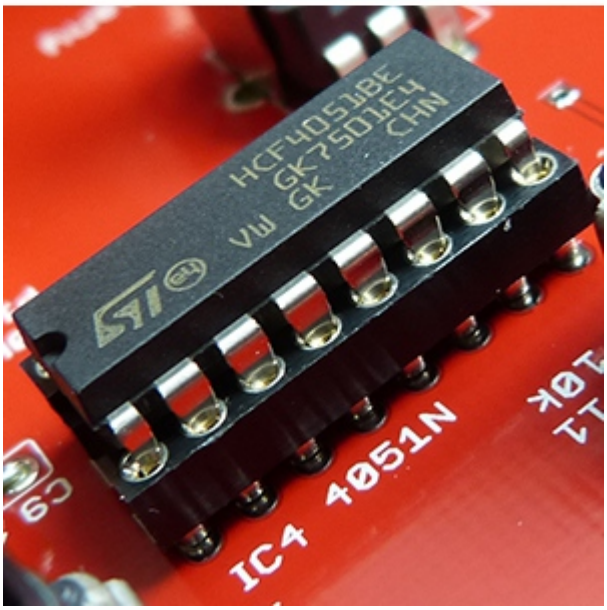
The two 4051-multiplexer have a notch on one small side, like the sockets. The left 4051 will be put in place with the label reading normally and its notch to face to the left. The 4051 to the right will be turned upside down like the optocoupler with its notch pointing to the right.

Put the chip into the socket until it is fully down. If it won't want to glide into the socket have a careful look, there might be a leg screwed somehow and needs to be pulled straight. You can get the chip out again with a normal screwdriver levering it out repeatedly from both small sides.

The pictures to the right show you how to do it: bend the leg rows until the IC's legs perfectly find their position above the sockets holes. Then press from above onto the chip, it should slide down 1 or 2 millimeters into the jack. At the end it should look like in the lower picture.





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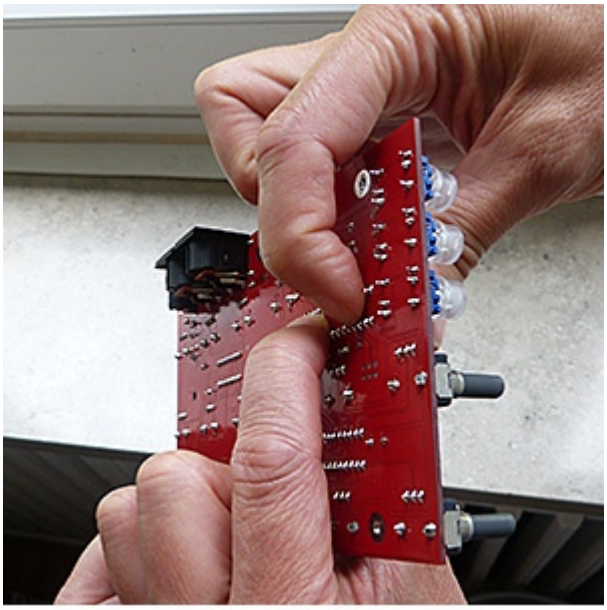
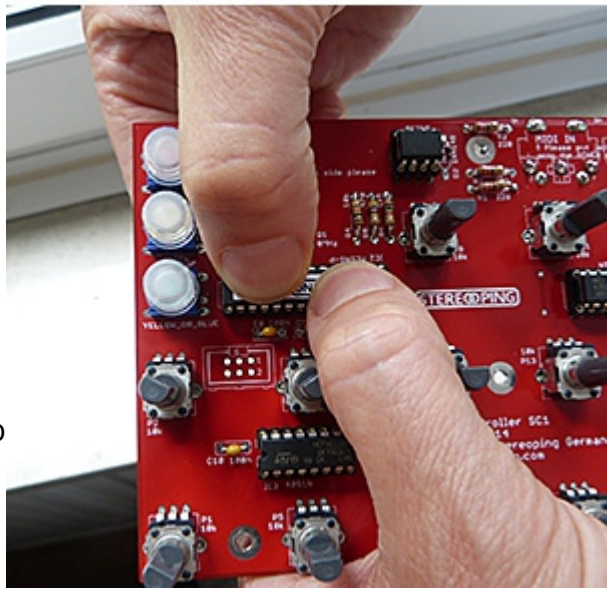
Now the last step is the main processor with its 28 pins. This is the most difficult chip to attach because of its pin count. The by far most important thing is, all pins must sit above the socket's hole before you start pressing the processor down.



Pins sitting on the rim or even outside the sockets hole will be bent. You might fix a bent leg once or even twice. After that, it will break away, that would not be good. So please use the leg-bending technique we spoke of some pages ago until the IC sits perfectly in the socket. Take care, the processor's notch matches the sockets notch which should point to the left. That means, the processor's label also reads upside down, as does the label "IC2 MEGA8-P" on the silkcreen.



Most probably the pins of the processor will already be aligned because it must have been pre-programmed in a ic-socket before shipping.

Now is the time! Use both hands: your forefingers go under the pcb between the two leg rows, pressing onto the solderpins would hurt your skin. Your thumbs go onto the top of the processor. Now press it down, it is perfectly normal you will need some force for it to glide into the socket.

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The big moment has come: after pluging in the powersupply you should see a warm welcome from the SSC by repeated flashings of the 3 LEDs. Press all 3 buttons one another, the appropriate LED should keep on shining after pressing any button.

If everything works so far, you can screw the PCB into the upper half of the steelcase using the 6 threaded screws. Screw all 6 losely first to allow the pcb to center itself. Then screw them tight, well not too tight, a bit tight will do.

At least use the black self tapping screws to connect the halfs of the steelcase. Make it the same way: all 4 screws losely first to center the steelcase halfs, then screw them in fully.

Putting the knobs onto the pots

You can't do anything wrong when puting them onto the pots, they center themselves automatically. The flattening of the knob must suit the flattening of the potentiometer of course.

The knobs we used from 2019 are taller to allow throwing the faceplate over the knobs. Unfortunately the dimension of their D-axis does not fit 100% the dimensions of the pot's axis. They can – with a little force - be turned +/- 5-10 degrees on the pot's axis. All the knob caps are put onto the knob's body for the marking to be corret if the pot is turned fully counterclockwize. If a marking of a knob does not seem to go far enough when turned fully ccw and at the same time go to far when turned clockwize: turn the knob fully to the left (ccw) and – with a littlebit of force – keep turning. You will feel the knob slide on the axis until it hits the limit of the possible movement.

Attaching aluminium knobs with screws

If your edition has those neat aluminium knobs with a small screw: turn the lower row of pots with their flattening pointing perfectly towards the upper edge where the midijacks are. Now you can screw the knobs with their markings pointing perfectly vertical. With the other knobs it is a bit clumsier. The screw has to be positioned most perfect to the opposite side of the flattening, still allowing to lead a screwdriver between the other knobs. This works quite well by turning the knobs to their most counterclockwize position.

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Congrats

Your Synth Controller is finally finished and you can be proud for having it built on your own. Now we wish you happy knobbing.

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4. Technical data

Do It Yourself assembly kit for Hardware Midi Controller

Connections: Midi In, Midi Out, Power supply

Operation voltage 9V direct current, middle pin is Negative

Current flow ca. 30 mA

Size incl. knobs 180 x 130 x 60 mm

Weight incl. plastic knobs 661 Gramm

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5. Imprint

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