

TubeOhm SMR4P-multi VCF

DIY manual



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SMR4P- multi VCF assembly guide V 1.03

TubeOhm

technical specifications:

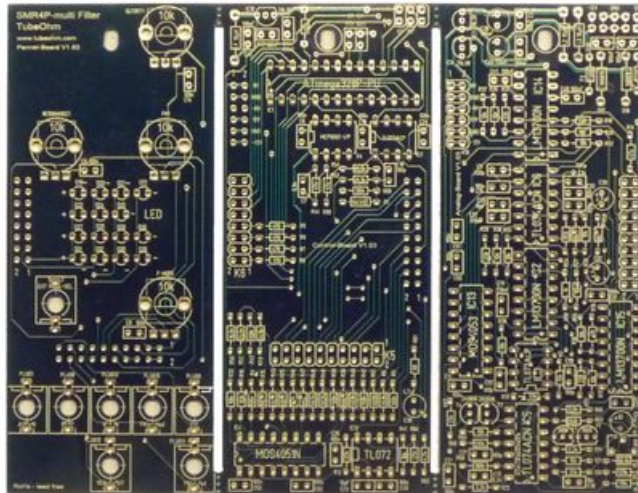
- multimode 4 pole filter
- 20 Hz.. 22kHz (res 24dB)
- max signal amp input 5V p
- resonance control intern/ext. 0..10 v
- cutoff control intern/ext 0..10v V/OCT
- modulation ext. 0..10 v
- inbuild filter FM
- inbuild VCA , ext. control 0..10 v
- 15 filtermodes available ,6+12+18+24dB LP, 6+12+18 dB HP, 6+12 dB BP, HP2LP, HP3LP,Notch,Phaser, Notch+LP1, Phaser+LP1. Voltage controlled 0..10 V
- Current 30 mA on -12 V, 50 mA on + 12 V
- Dimensions : 50,5mmx128,5mm = 10TEx3HE eurorack format
- power +/- 12 Volt

Schematics and BOM

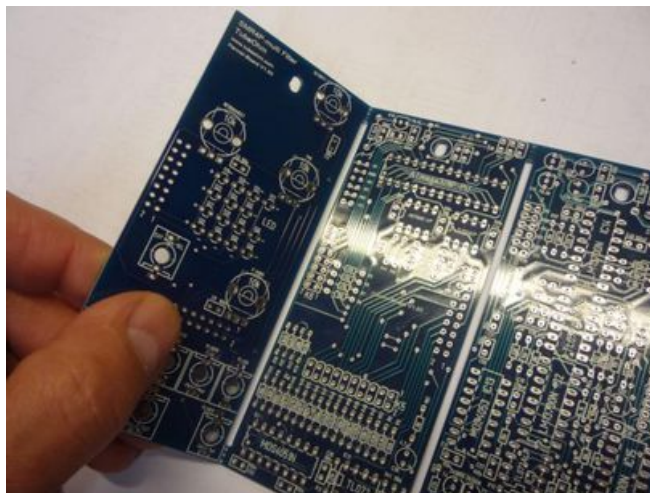
The BOM and the schematics can be found on TubeOhm.com

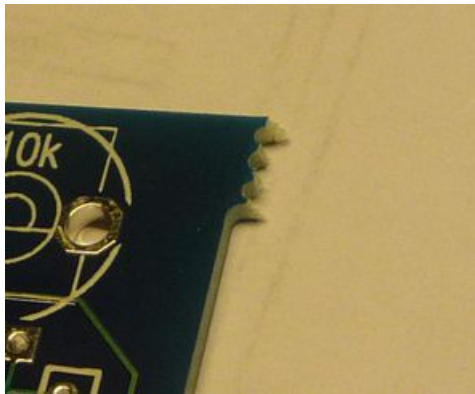
1:) Prepare the PCB

Separate the PCB in three parts . Simply break the PCB into 3 peaces and cut with a cutter the little rest on the top and back of the PCB.

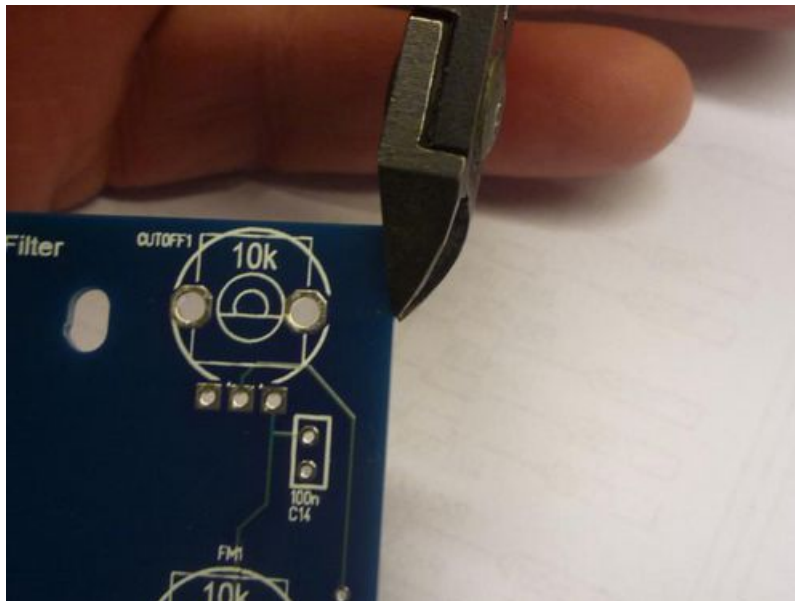


break it into three peaces



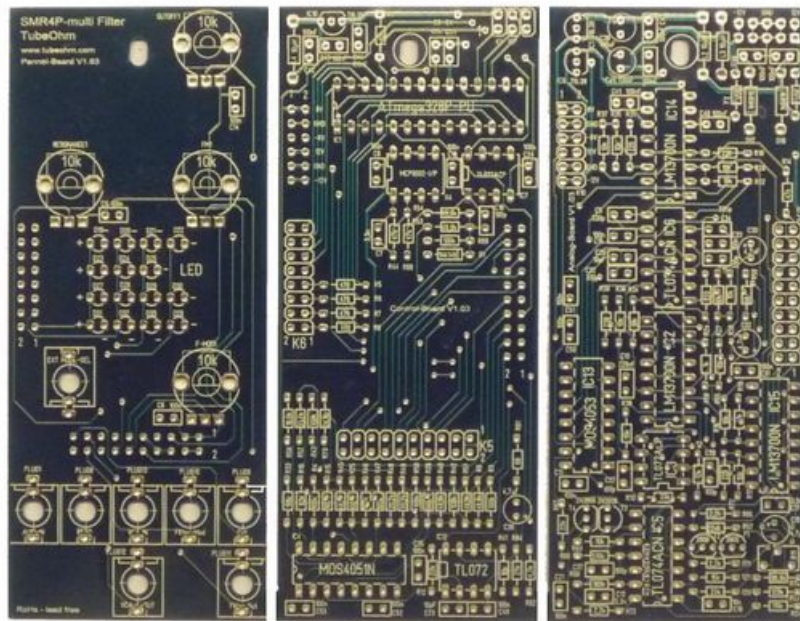


cut the rest with a cutter



smooth it with a file





1

2

3

Now we have three PCB's

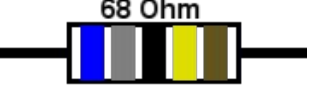
- 1) the Panel Board V 1.03
- 2) the Control Board V 1.03
- 3) the Analog board V 1.03

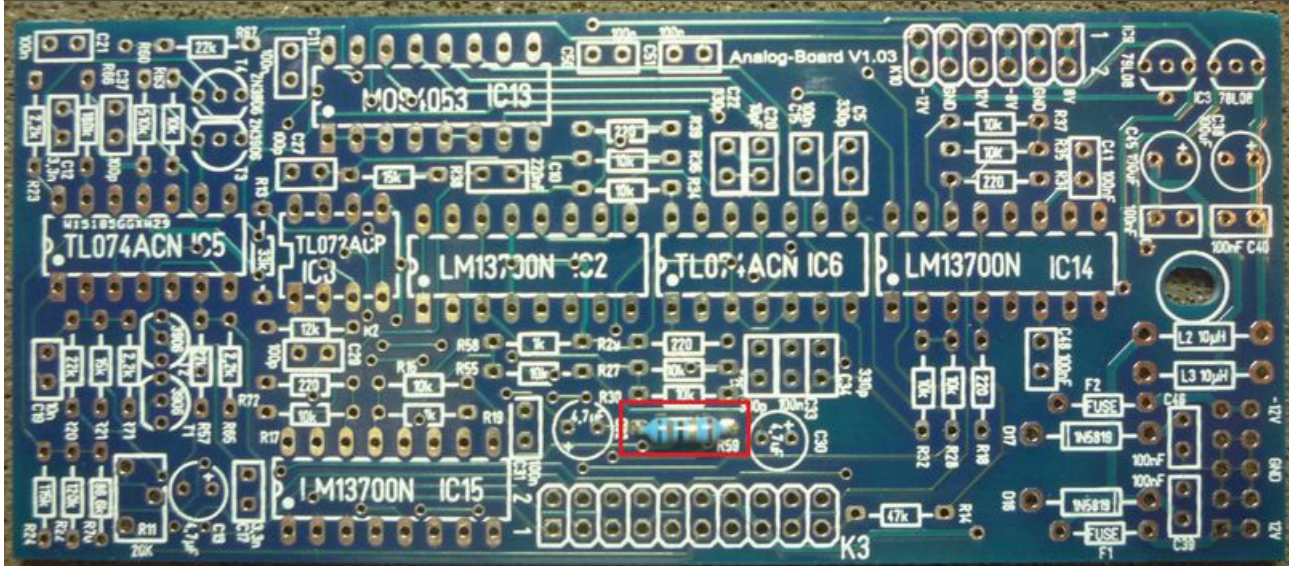
for the pots, LED's, plugs
for the CPU, and the pole mixing
the complete filter board

Let us start with the analoge board V 1.03


| | |
|--------|---|
| first | we solder all resistors and coils - diode |
| second | all caps |
| third | the IC sockets and transistors / power regulators |
| forth | the headers and pin connectors |

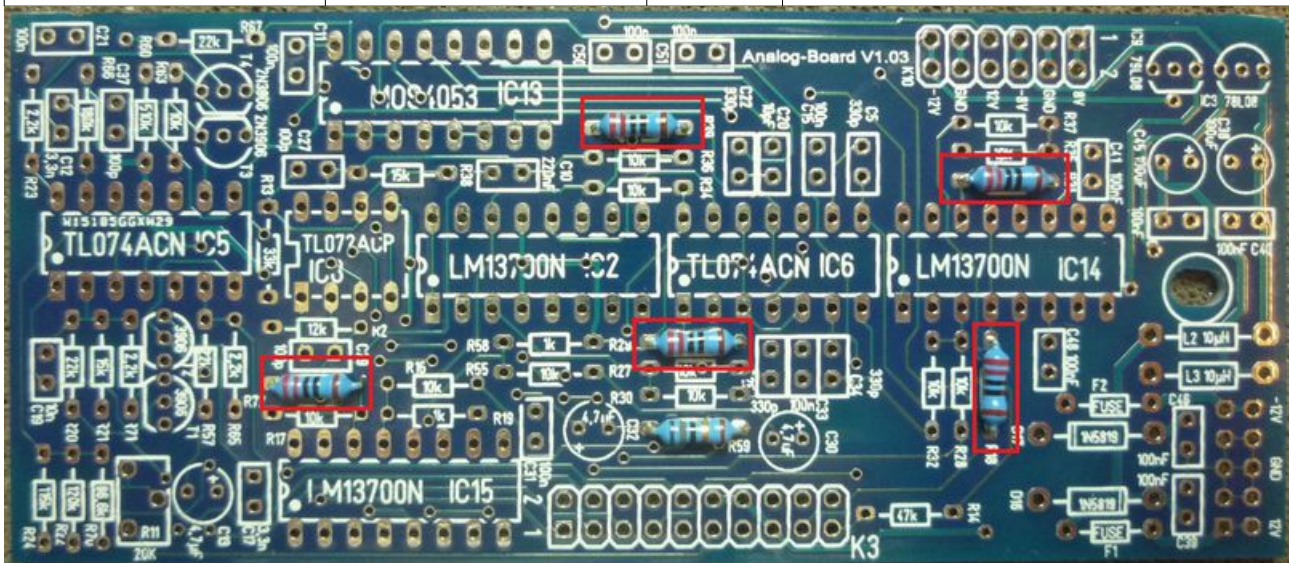
we start with R 59 = 68ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--------------------------------------|
|  | 68 ohm | 1 | Blue, gray, black, gold brown R59 |




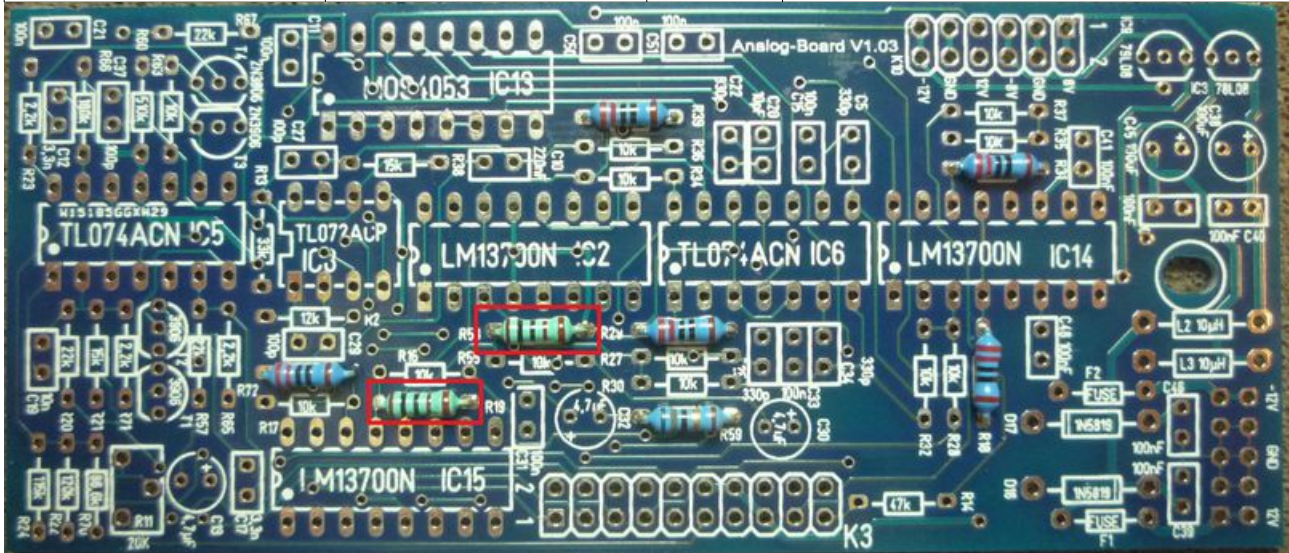
than 5 x 220 ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 220 ohm | 5 | Red,red,black,black, brown R18,29,31,39,72 |




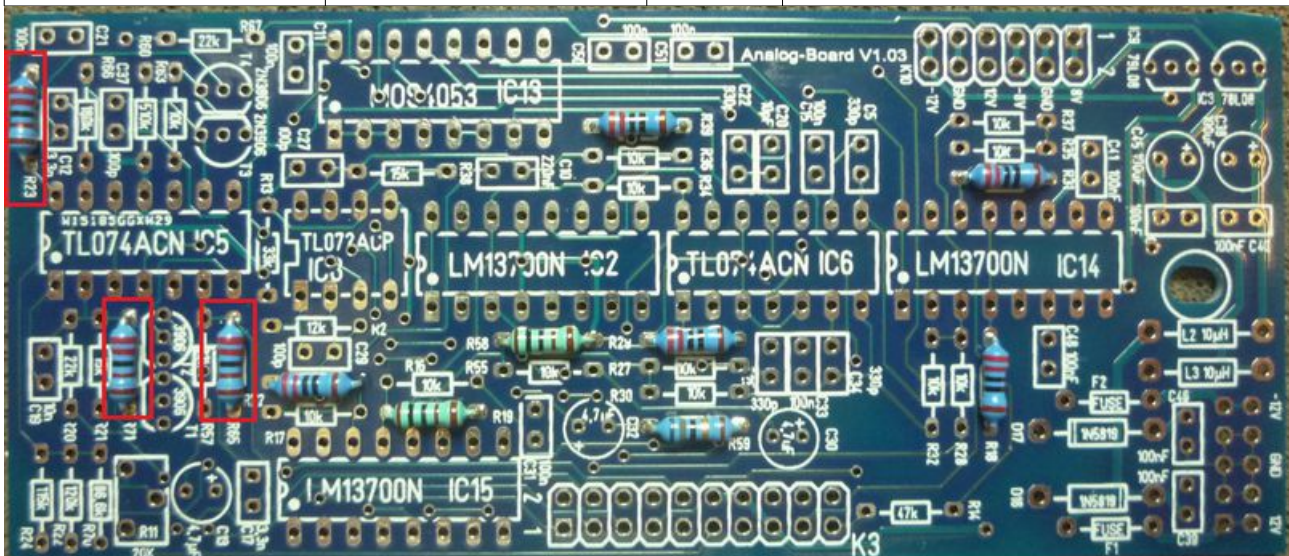
2x 1k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 1k ohm | 2 | Brown,black,black,brown,brown R19,58 |




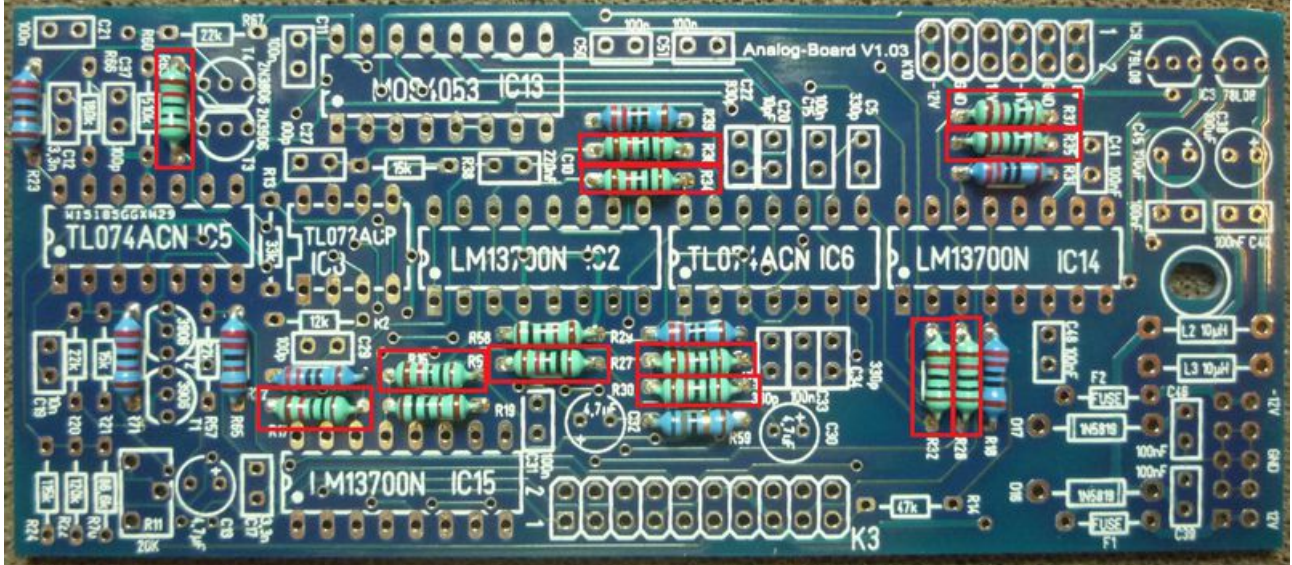
3x2,2k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | 2,2k ohm | 3 | Red,red,black,brown,brown R23,65,71 |




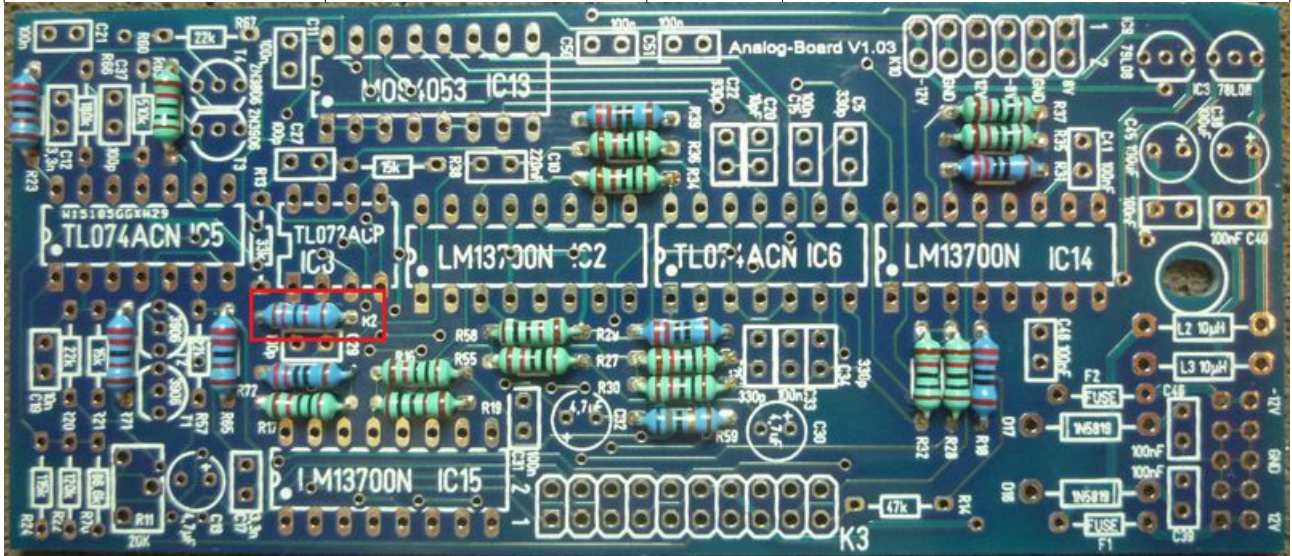
12x 10k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 10k ohm | 12 | Brown,red,black,black,brown R16,17,27,28,30,32,34,35,36,37,55,63 |




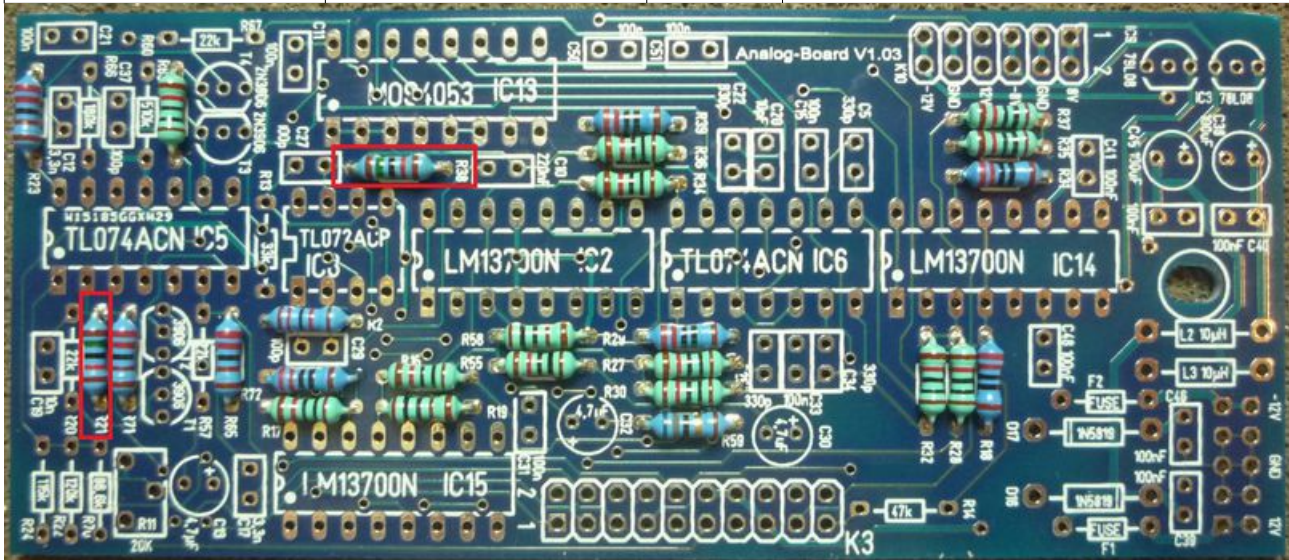
1x 12k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|----------------------------------|
|  | 12k ohm | 1 | Brown,red,black,red,brown R 2 |




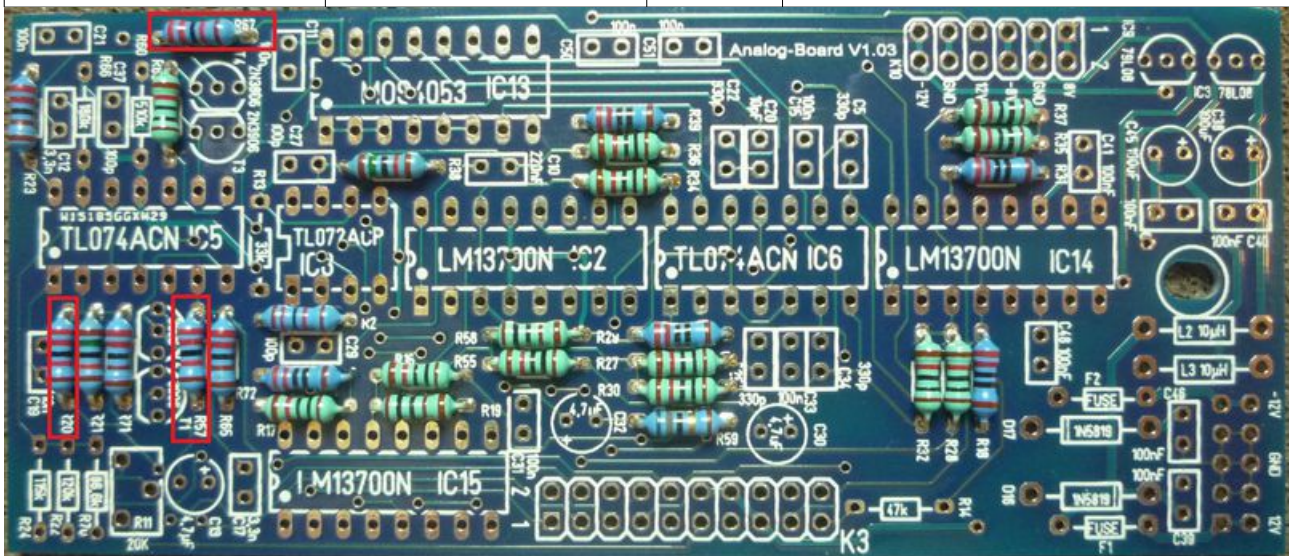
2x 15k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | 15k ohm | 2 | Brown,green,black,red,brown R 21,38 |




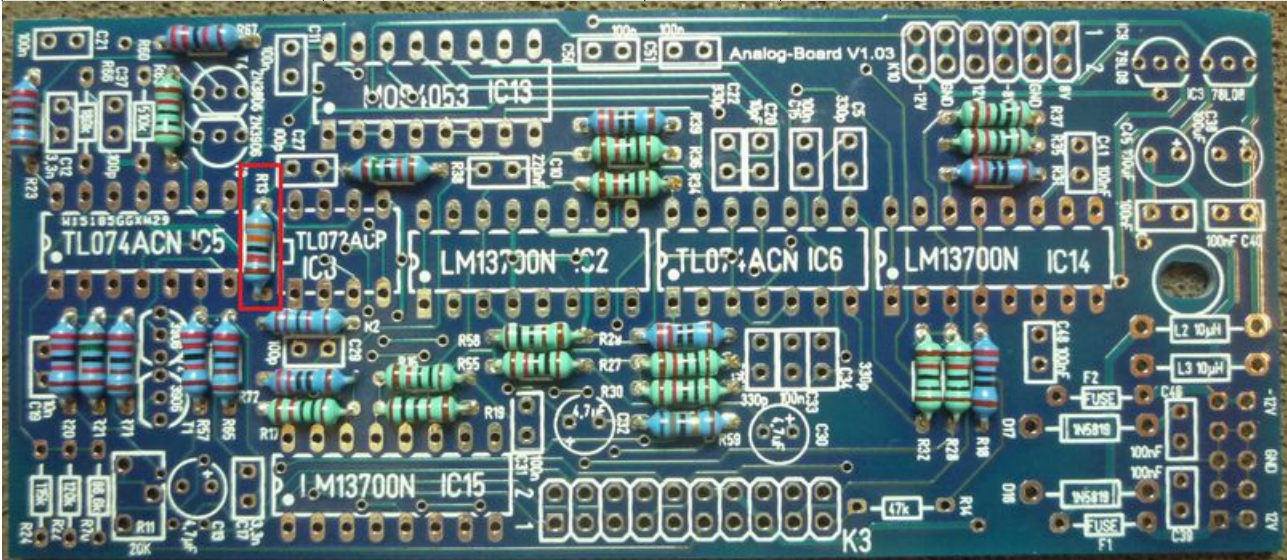
3x22k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---------------------------------------|
|  | 22k ohm | 3 | Red,red,black,red.brown R 20,57,67 |




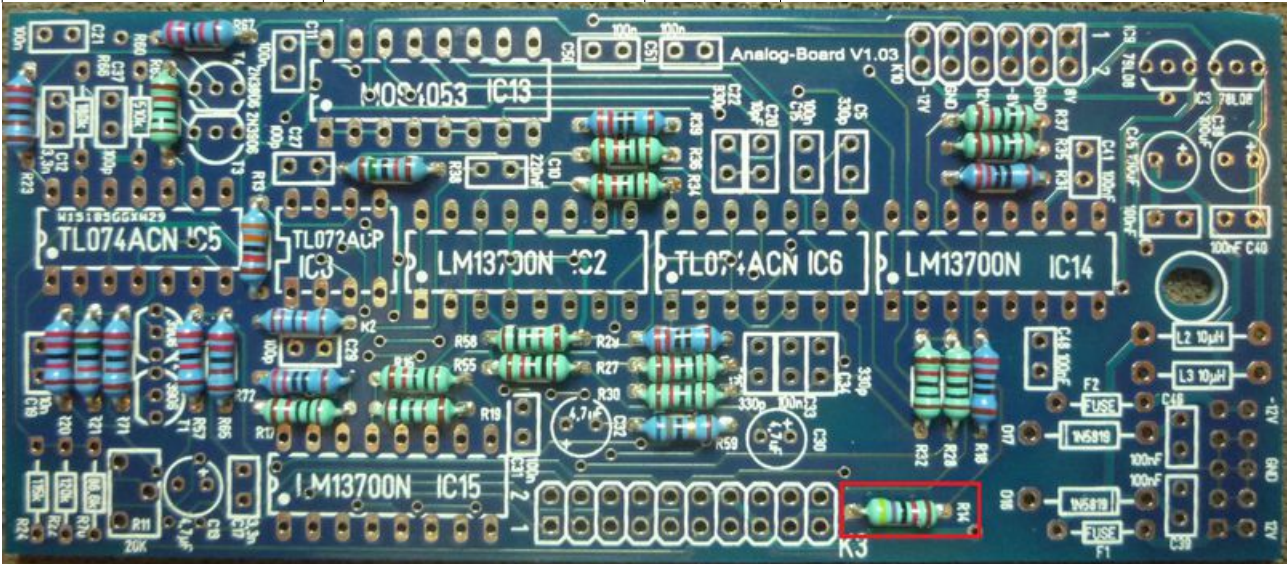
1x 33k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | 33k ohm | 1 | Orange, orange, black, red, brown R13 |




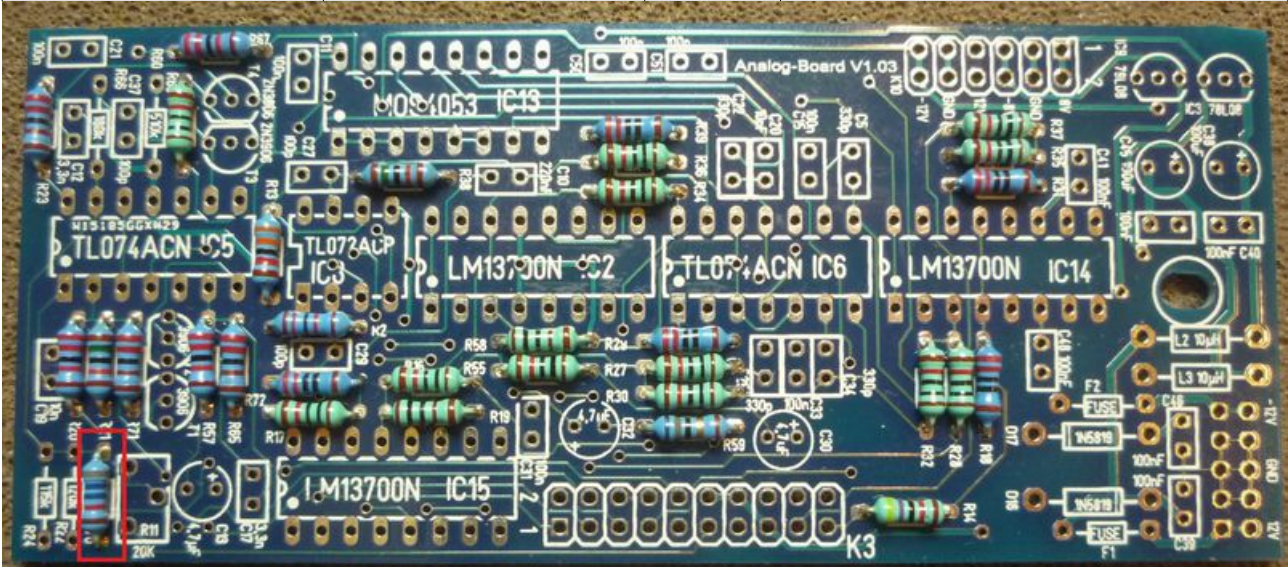
1x47k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | 47k ohm | 1 | Yellow, purple, black, red, brown R14 |




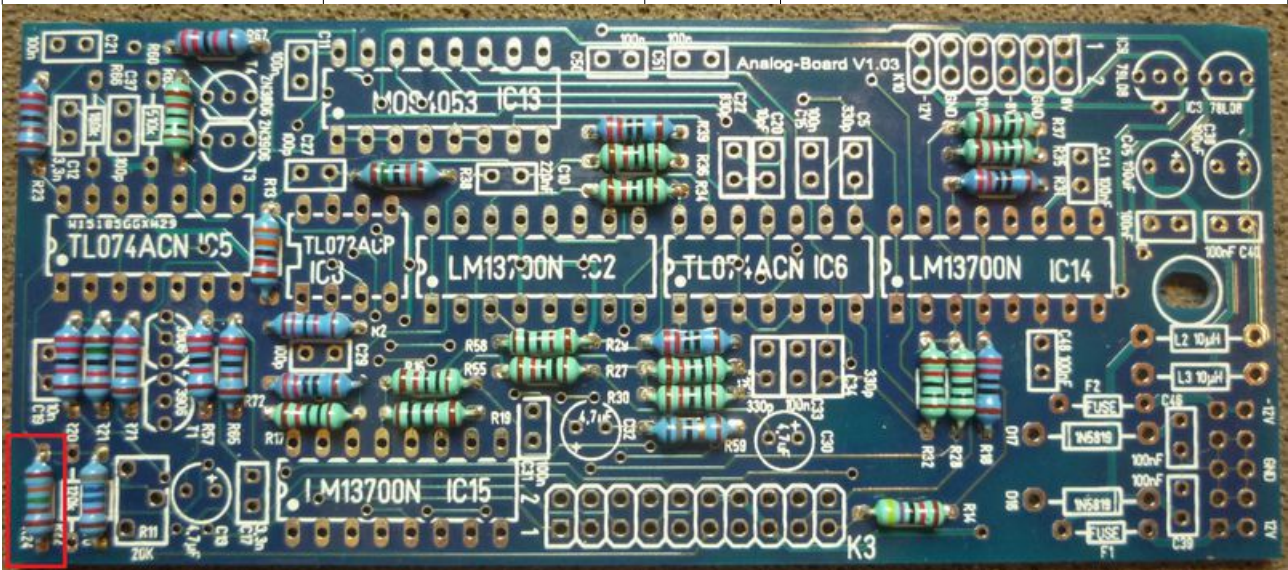
1x 86,6k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---------------------------------|
|  | 86,6k ohm | 1 | Gray,blue,blue,red brown R70 |




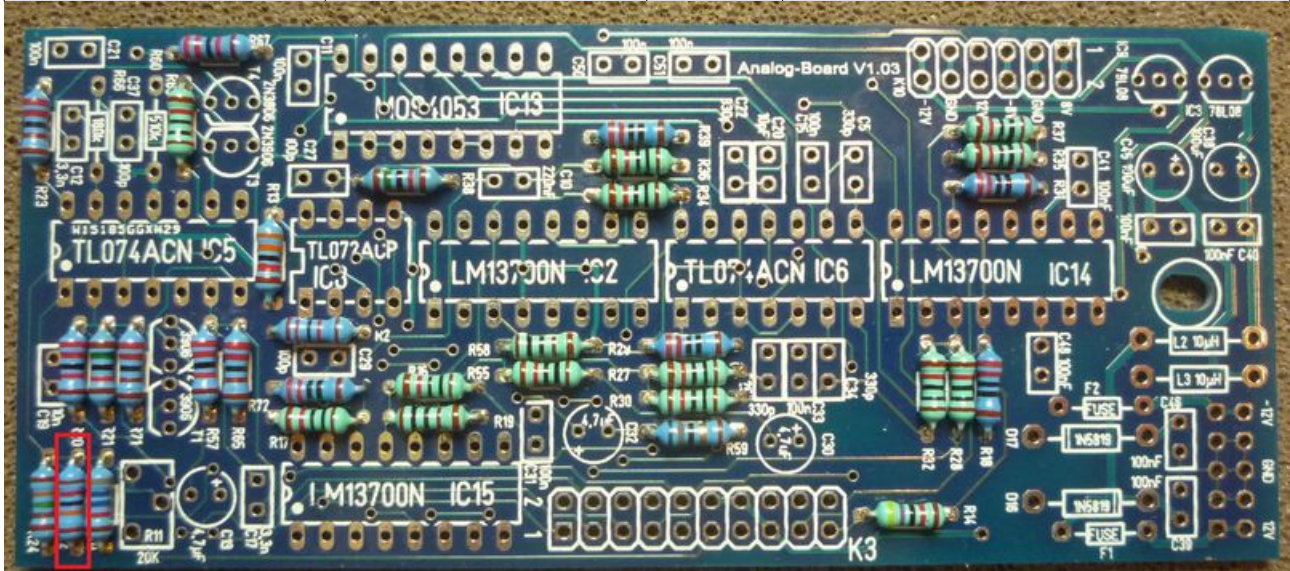
1x 115 k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---------------------------------------|
|  | 115k ohm | 1 | Brown,brown,green,orange,brown R24 |

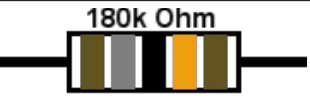


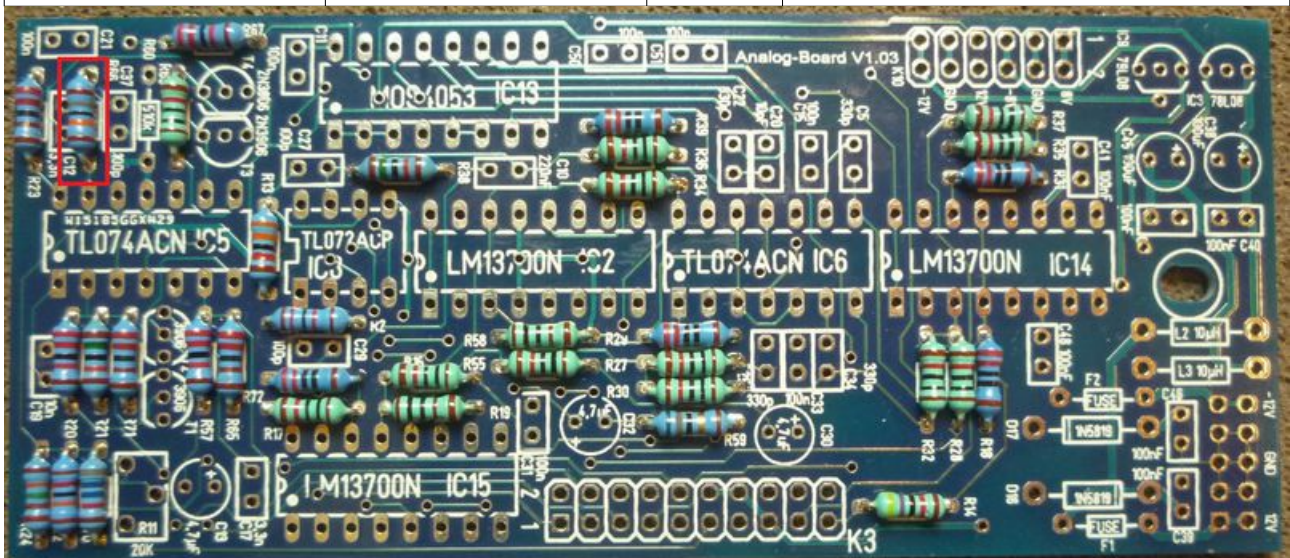
1x 120 k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|-------------------------------------|
|  <p>120k Ohm</p> | 120k ohm | 1 | Brown,red,black,orange,brown R22 |




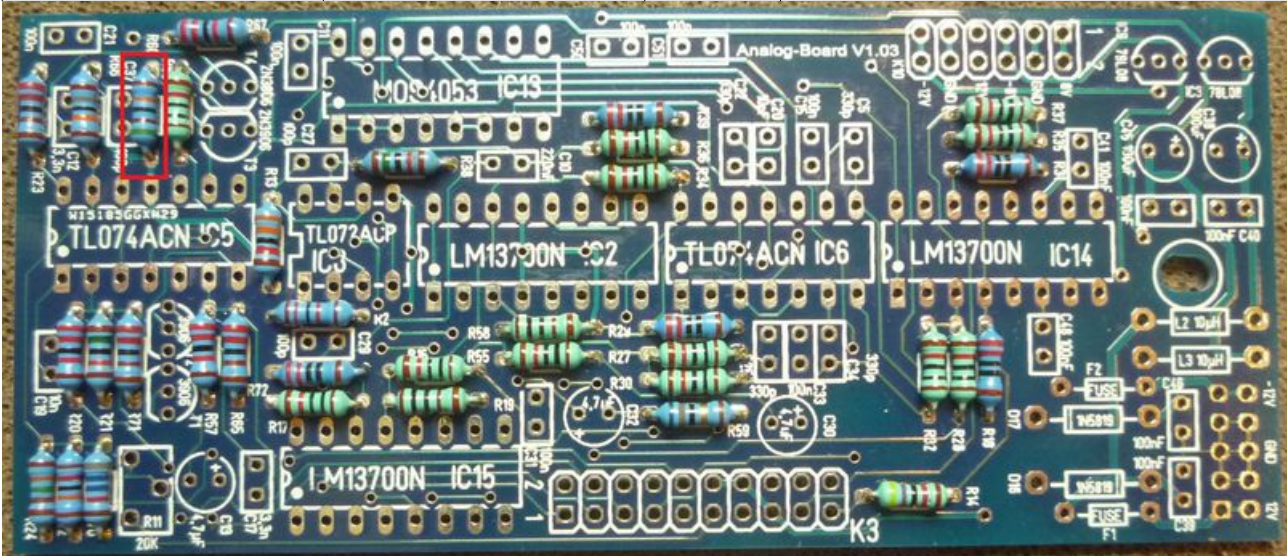
1x 180k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  <p>180k Ohm</p> | 180k ohm | 1 | Brown, gray,black,orange, brown R66 |



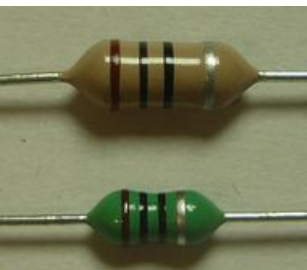
1x 510 k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | 510k ohm | 1 | Green,brown,black,orange, brown R60 |

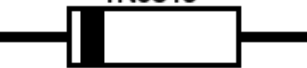


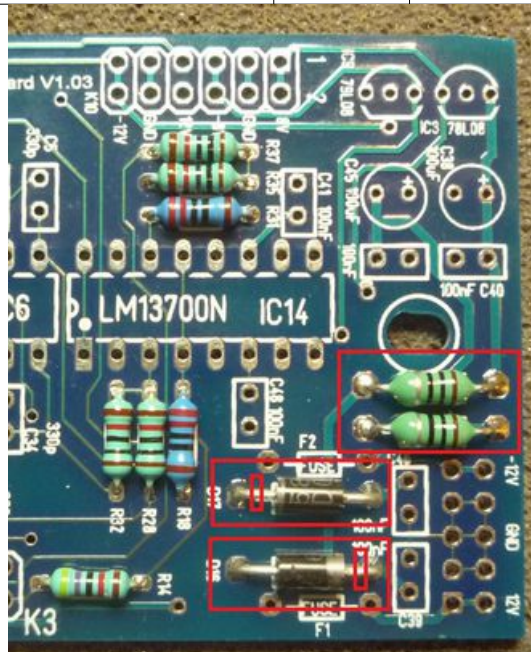
Now all resistors are in place.

2 coils 10 uH

| Image | Description | Quantity | Notes |
|---|--|----------|---|
|  | Coil 10 uH in this version or this version | 2 | Brown,black,black,silver L2,L3 ** attention , looks like a resistor , but is a coil |

and 2x Diode 1N5819


| Image | Description | Quantity | Notes |
|---|------------------|----------|---------|
|  | 1N5819 polarized | 2 | D17,D16 |



Step 1 – resistors, coils and diode - is ready .


Step two -now we solder the capacitors

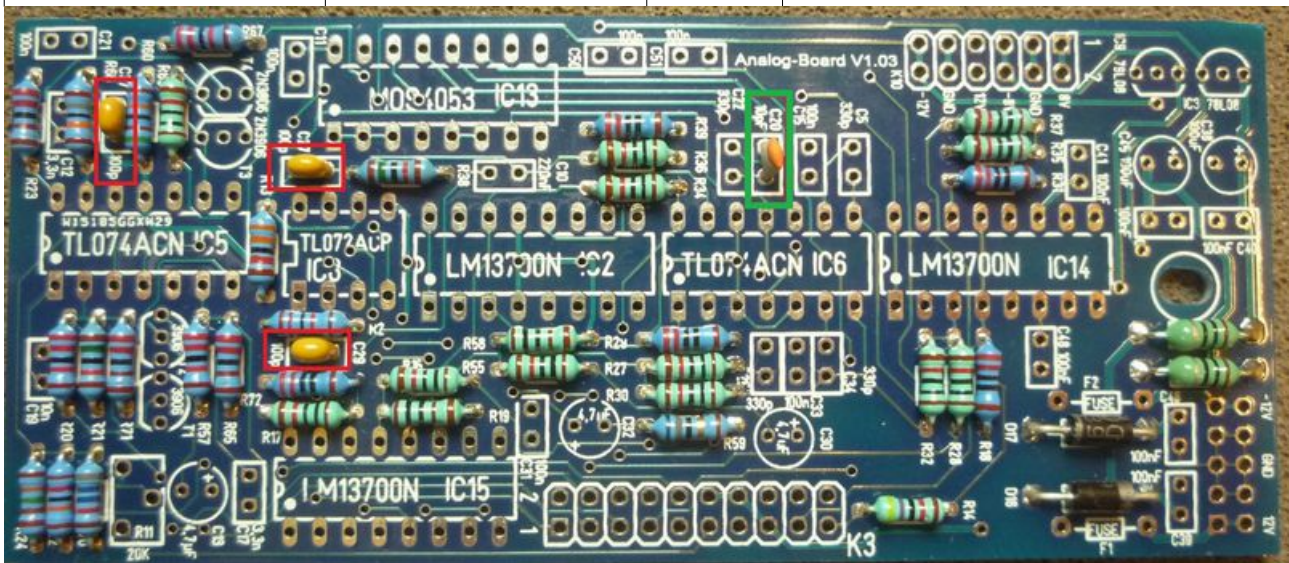
1x 10 pF

| Image | Description | Quantity | Notes |
|---|---------------|----------|----------------------------------|
|  | 10 pF ceramic | 1 | marked with [10pF] C20= 10 pF |


and

3x 100 pF

| Image | Description | Quantity | Notes |
|---|----------------|----------|--|
|  | 100 pF ceramic | 3 | marked with [101] C27,29,37= 100 pF |




2x 3,3nF

| Image | Description | Quantity | Notes |
|---|---------------|----------|------------------------------------|
|  | 3,3nF ceramic | 2 | marked with [332] C12,17= 3,3nF |


And

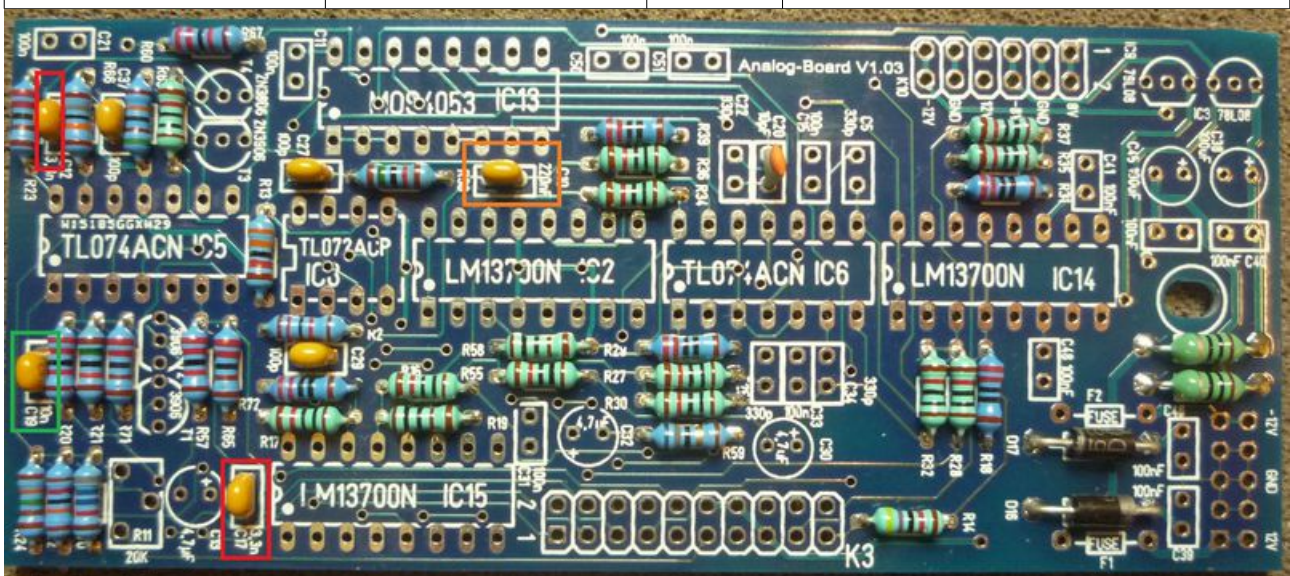
1x 10 nF

| Image | Description | Quantity | Notes |
|---|---------------|----------|---------------------------------|
|  | 10 nF ceramic | 1 | marked with [103] C19= 10 nF |


And

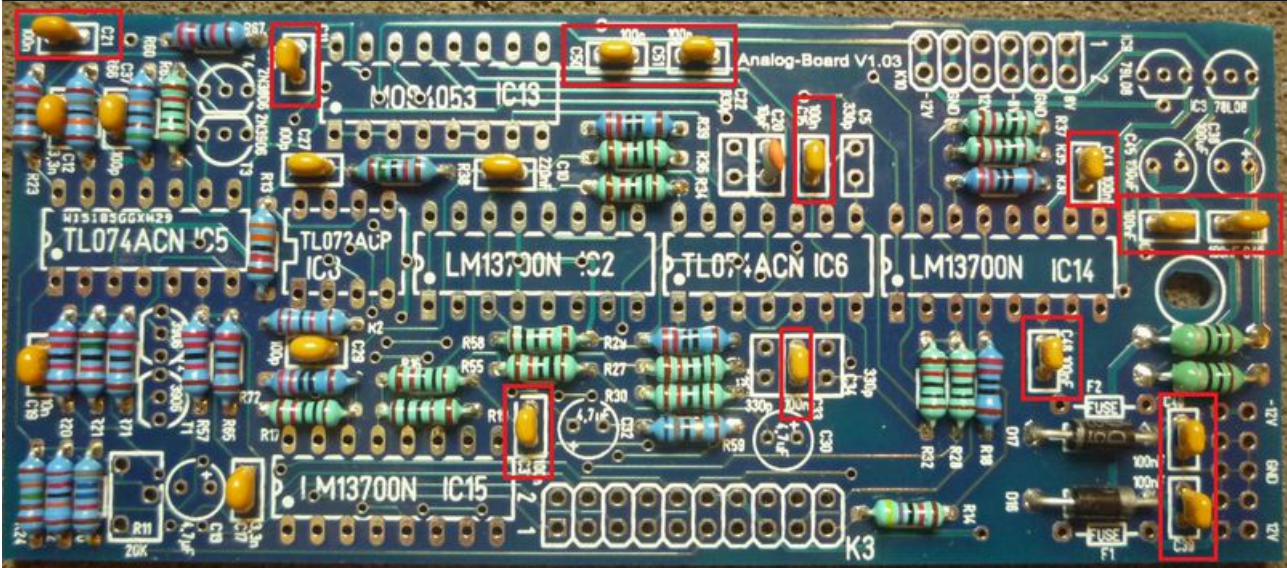
1x220nF

| Image | Description | Quantity | Notes |
|---|----------------|----------|---------------------------------|
|  | 220 nF ceramic | 1 | marked with [224] C10= 220nF |




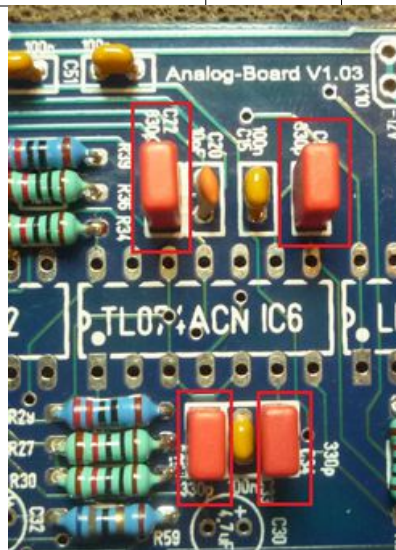
13x 100nF

| Image | Description | Quantity | Notes |
|---|----------------|----------|---|
|  | 100 nF ceramic | 13 | marked with [104] C11,15,21,31,33,39,40,41,46,47,48,50,51= 100nF |




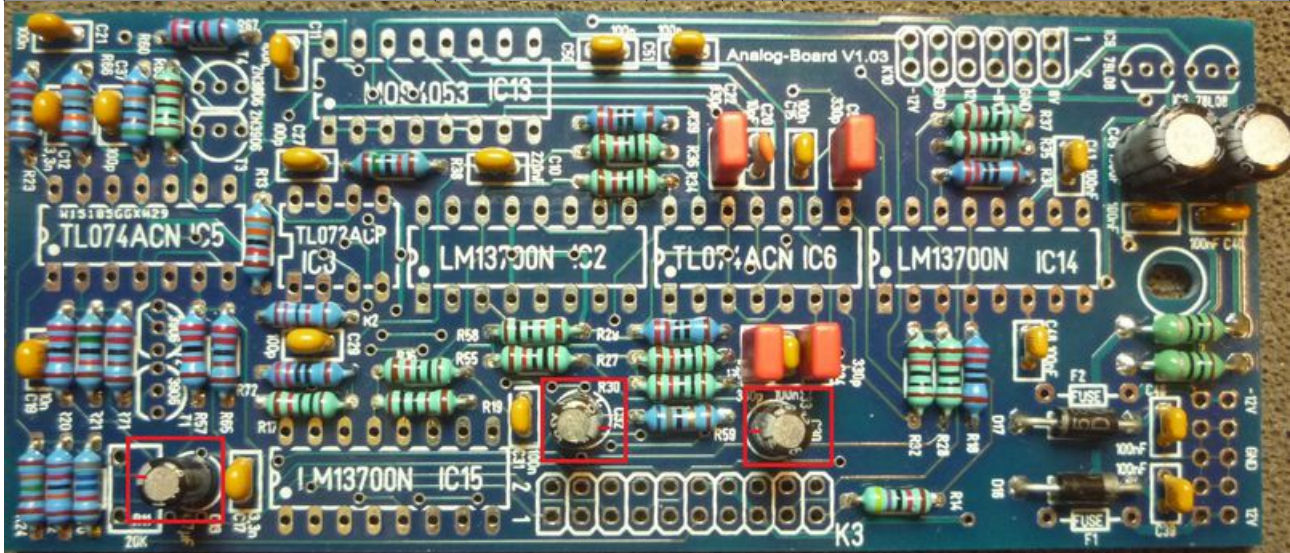
4x330pF

| Image | Description | Quantity | Notes |
|---|-------------------------------|----------|--|
|  | 330 pF for the filterpoles | 4 | marked with [330] C5,22,25,34 =330p Caps for the for filterpoles |




1x4,7uF polarised

| Image | Description | Quantity | Notes |
|---|--------------------------|----------|--|
|  | 4,7 uF elko,polarized | 3 | marked with 4,7uF + - polarised it is a specially small cap C13,30,32 =4,7uF |



2x100uF polarised


| Image | Description | Quantity | Notes |
|---|--------------------------|----------|--|
|  | 100 uF elko,polarized | 2 | marked with 100uF polarised it is a specially small cap C38,45 |



Now step two is ready – all caps should be soldered now


Now we come to step three- the transistors/voltage regulators

78L08

| Image | Description | Quantity | Notes |
|---|--------------------------|----------|-------------|
|  | 8 Volt positiv regulator | 1 | IC 3 =78L08 |


And

79L08

| Image | Description | Quantity | Notes |
|--|---------------------------|----------|-------------|
|  | -8 Volt negativ regulator | 1 | IC 9 =79L05 |




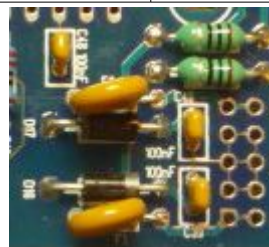
4x2N3906

| Image | Description | Quantity | Notes |
|---|-------------------|----------|------------------|
|  | Transistor 2N3906 | 4 | T1,2,3,4 =2N3906 |



2x polyfuse


| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | Fuse 200 MA | 2 | F1,2 =FUSE *** alternative you can take a normal 3,3 ohm resistor |



*** Attention, solder the fuses as flat as you can in the analog board.



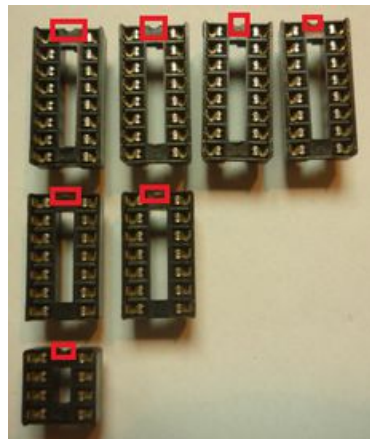
1x pot 20k ohm

| Image | Description | Quantity | Notes |
|---|---------------|----------|---|
|  | Poti 20 k ohm | 1 | R11= poti 20 k ohm adjustment >> filter linearity |



Step four, now the IC sockets/connectors

4x 16 pin, 2x 14 pin , 1x 8 pin. Attention to the mark. Later it is much easier to put the IC's into the right direction



TIP, how to solder the sockets ?

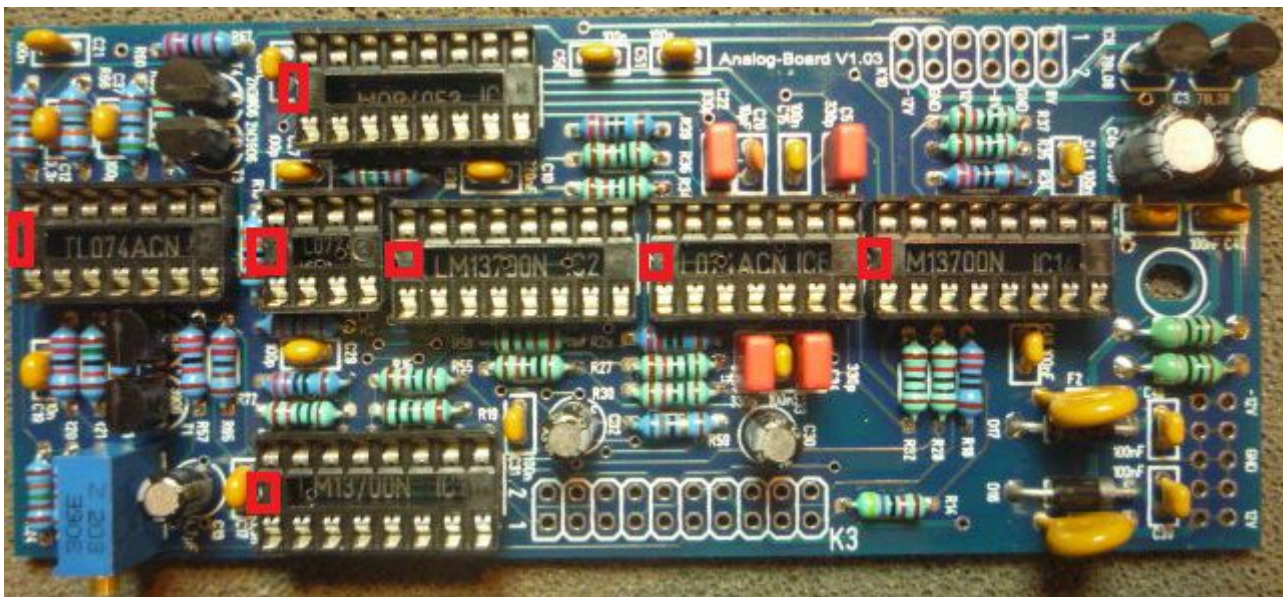
First solder only 2 points – like in the picture here:



Take a look that the IC sockets are flat on the PCB. If not, make first one solder pin warm while press the IC socket to the PCB. Then warm up the second solder pin while press the IC socket against the PCB .

Now the socket should lay flat on the PCB . If all is OK you can solder the rest .

Do this procedure for all IC-sockets. You can do it also with the headers and connectors .



aaahhhhh- short before end.

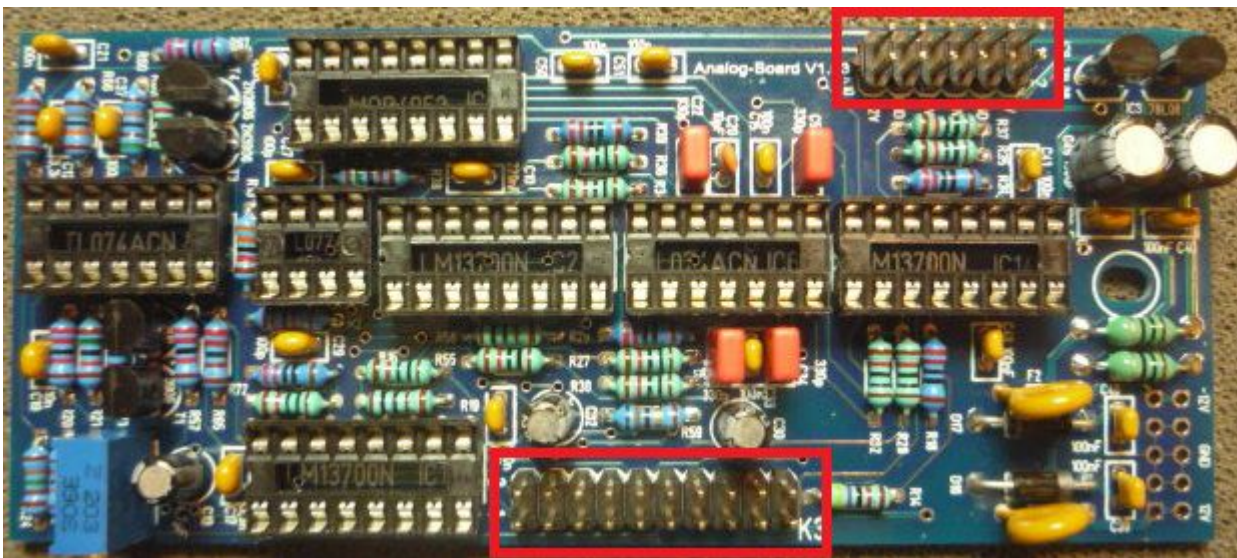
Now we must solder the male headers into the PCB.

We need

K10 = 2x6 pin



K3 = 2x10 pin



K2 = 2x5 pin power connector, attention this connector must be soldered from the backside.



Cleaning the PCB

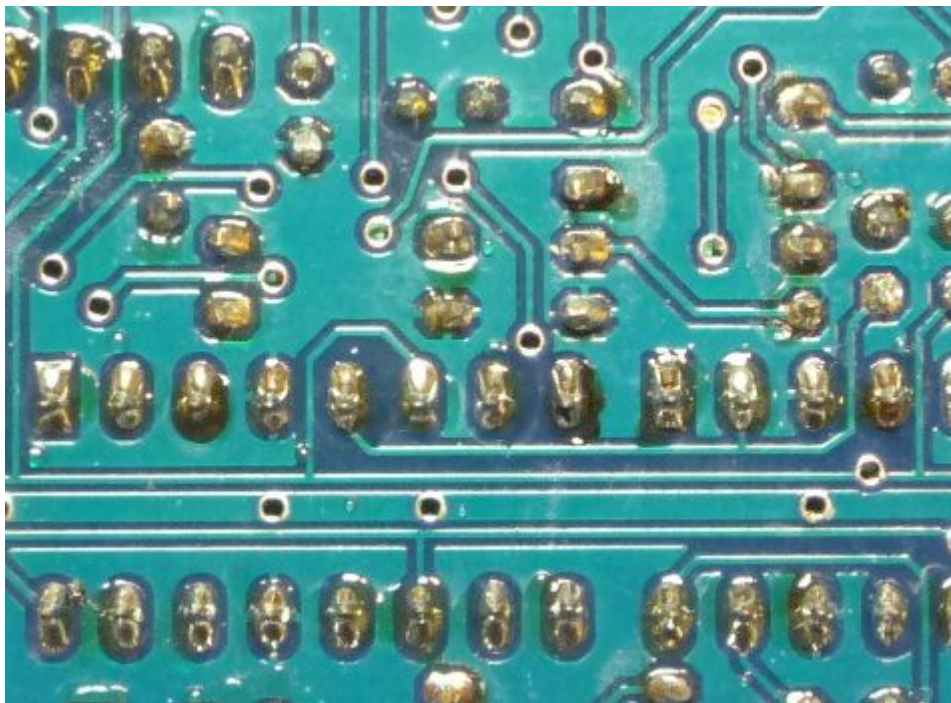
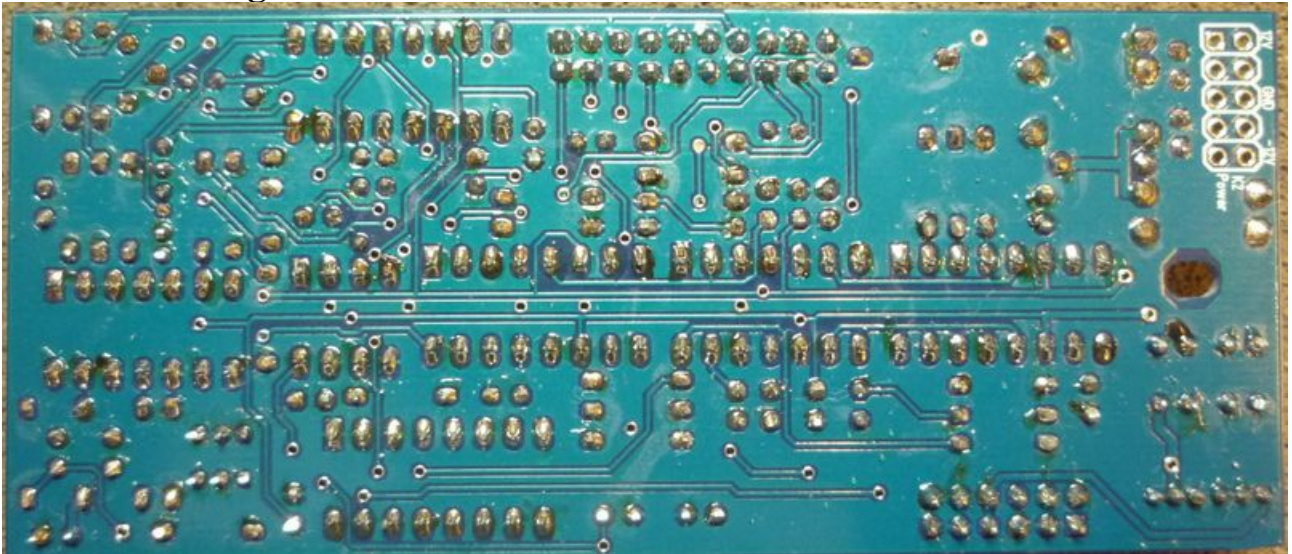
You should clean the PCB . It looks much better – and you see better if all solderpoints in good conditions.

If you use Solder with PB , you can use methylalcohol and a towel.

If you use solder leadfree, simply clean the PCB with water. (***) depends of your solder flux)

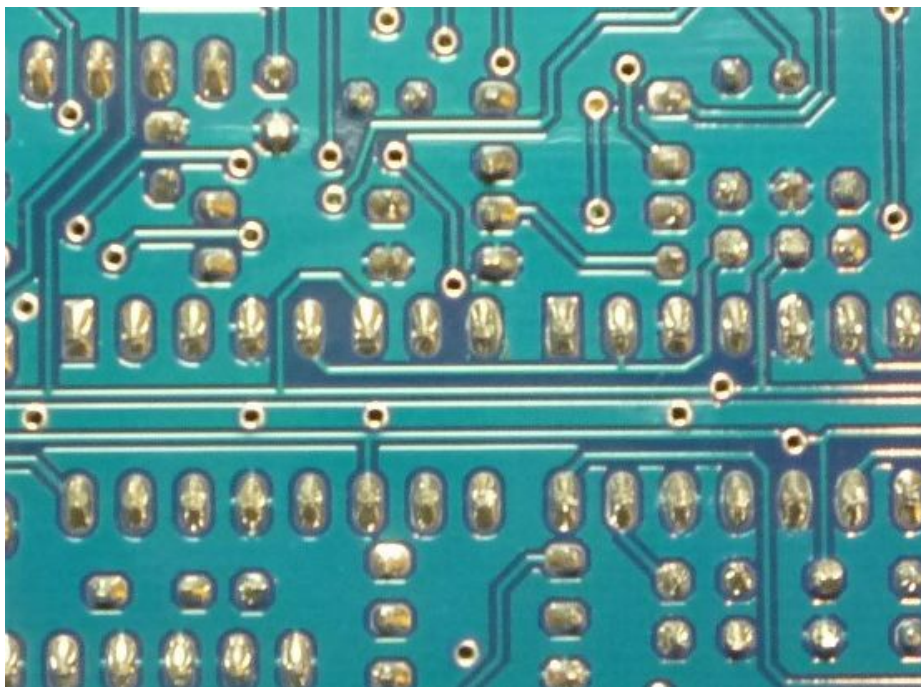
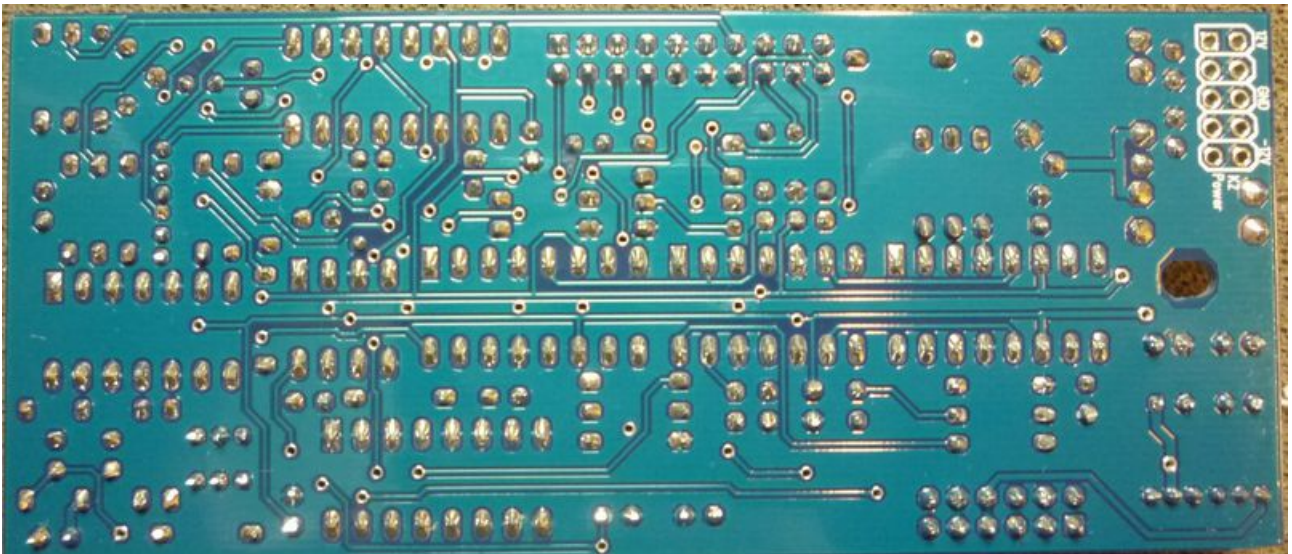
Can be that you must do some tests how you get the PCB clean.

Before cleaning



After cleaning

I hope that I have convinced you. For me it is essential to clean my PCB's. As you see, you can control the solderpoints much better without solder fluxx than with.



Your Analog board is ready and we can test the voltage on the IC- sockets – first without the IC's.

Voltage control

The SMR4P uses the 12 volt rails to generate its voltages .

On the analoge board we use four different voltages .

Specially the +/- 12 Volt depends of your power supply and is not regulated on the SMR4P.

Note – if your eurorack power supply had - for example 12,3 Volt – you will measure also 12,3 volt.

Part tolerance

measure of the part tolerance of the regulators it can be, that the voltage can be a little higher or deeper .

Normally 8 Volt , you measure 7,9.....8,1 Volt – this is ok

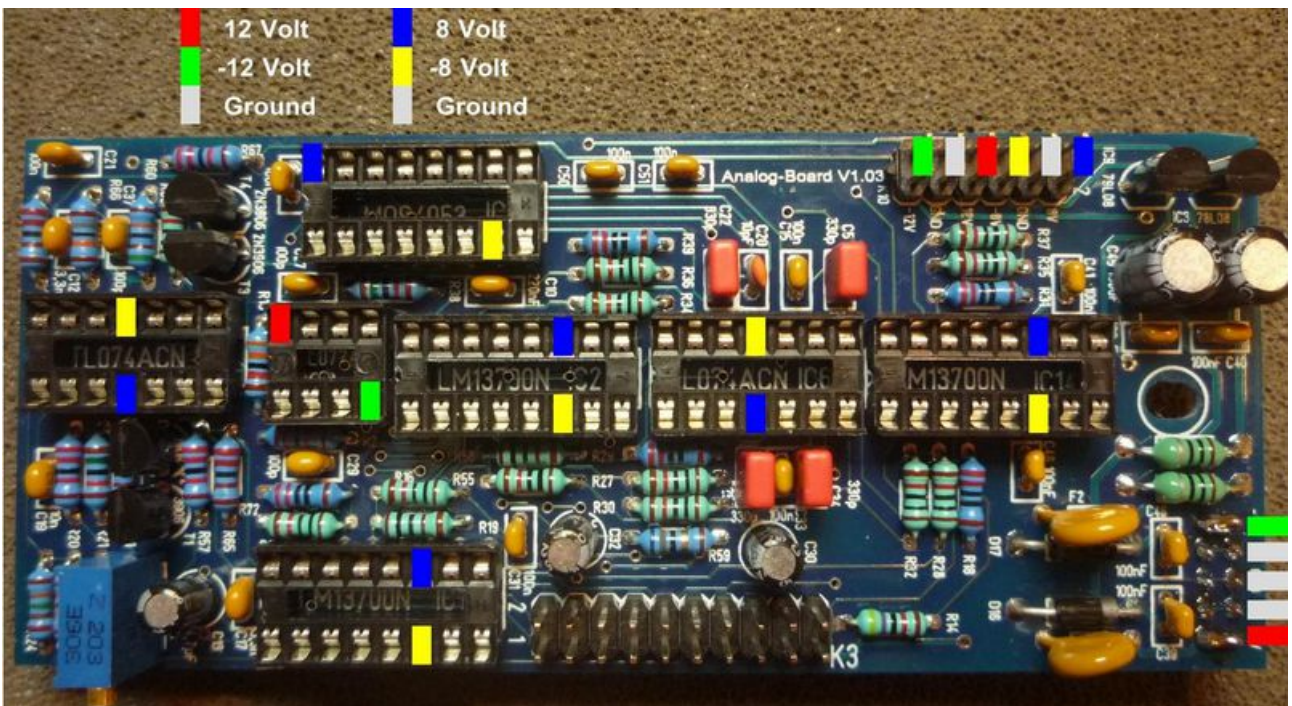
Normally – 8 volt , you measure -7,9...-8,3 volt – this is also ok

Normally 5 Volt , you measure 4,9 ...5,1 Volt – this is also ok

The difference can come from your Multimeter , or the part tolerance.

Voltages are :

| | |
|------------|--------|
| +12volt | Red |
| -12volt | Green |
| +8volt | Blue |
| -8 volt | Yellow |
| and Ground | Grey |



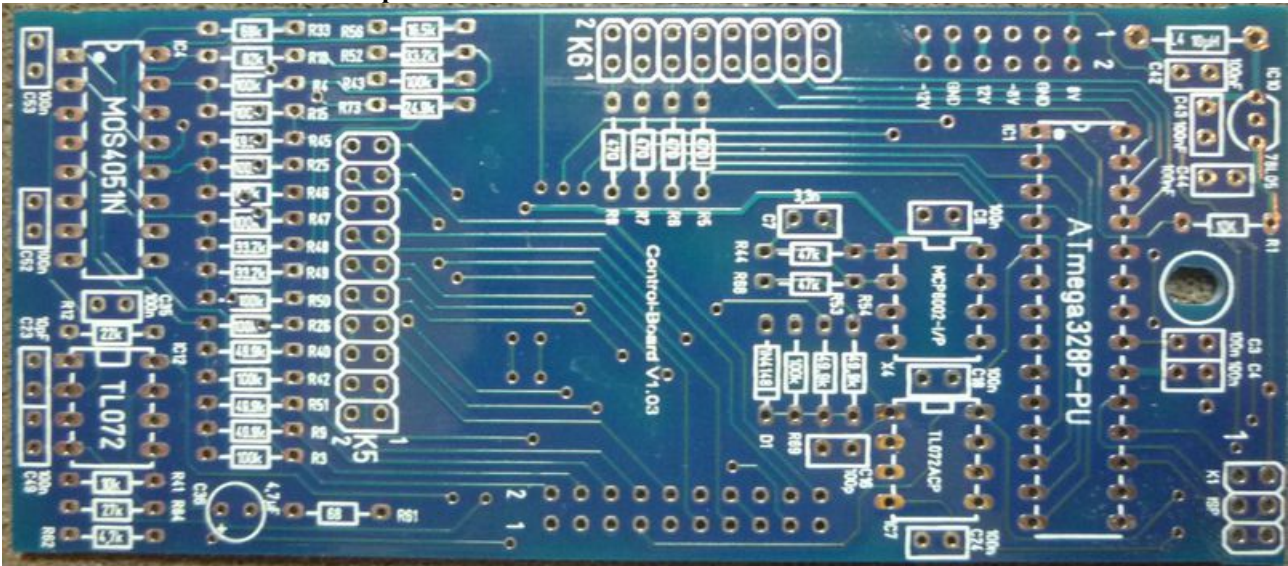
All ok ? congrats - you have finished now the analoge board .

the control board V 1.03

Step by step :

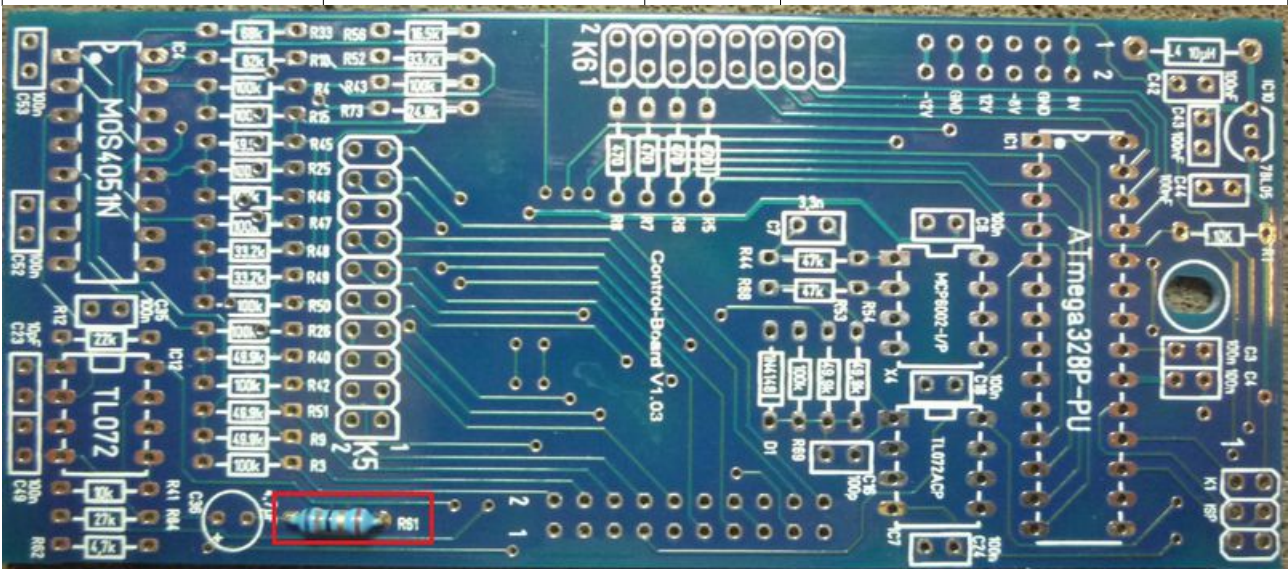
- first we solder all resistors and coils
- second all caps
- third the IC sockets and transistors / power regulators
- forth the headers and pin connectors

here is the control board without parts




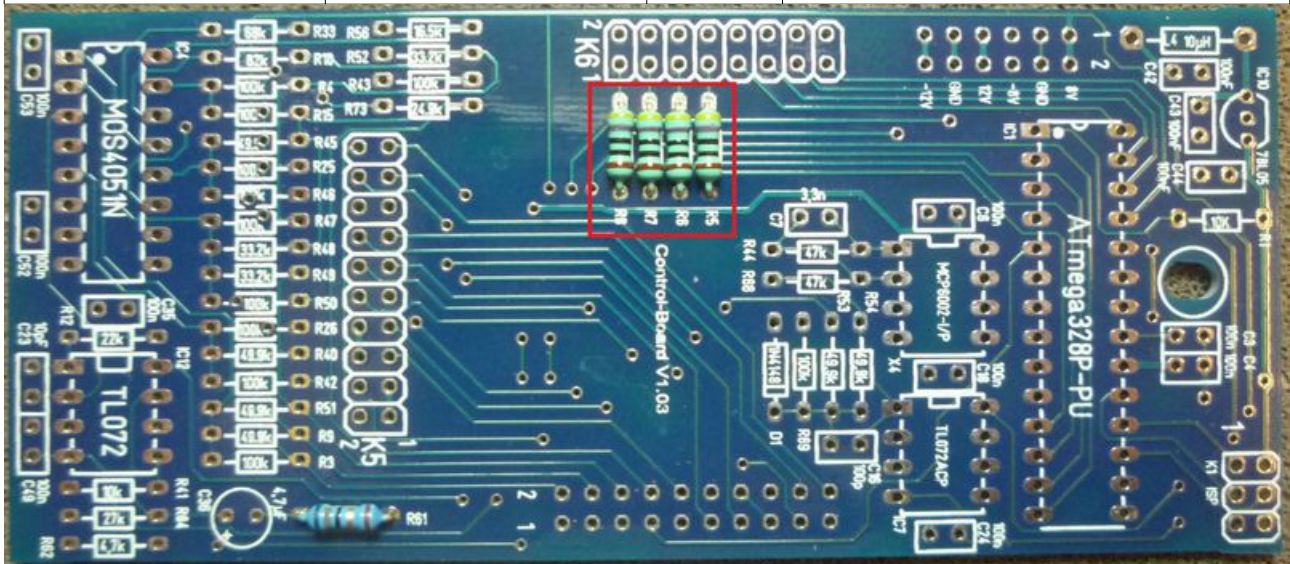
1x 68 ohm


| Image | Description | Quantity | Notes |
|-------|-------------|----------|---------------------------------------|
| | 68 ohm | 1 | Blue, gray, black, gold brown R 61 |

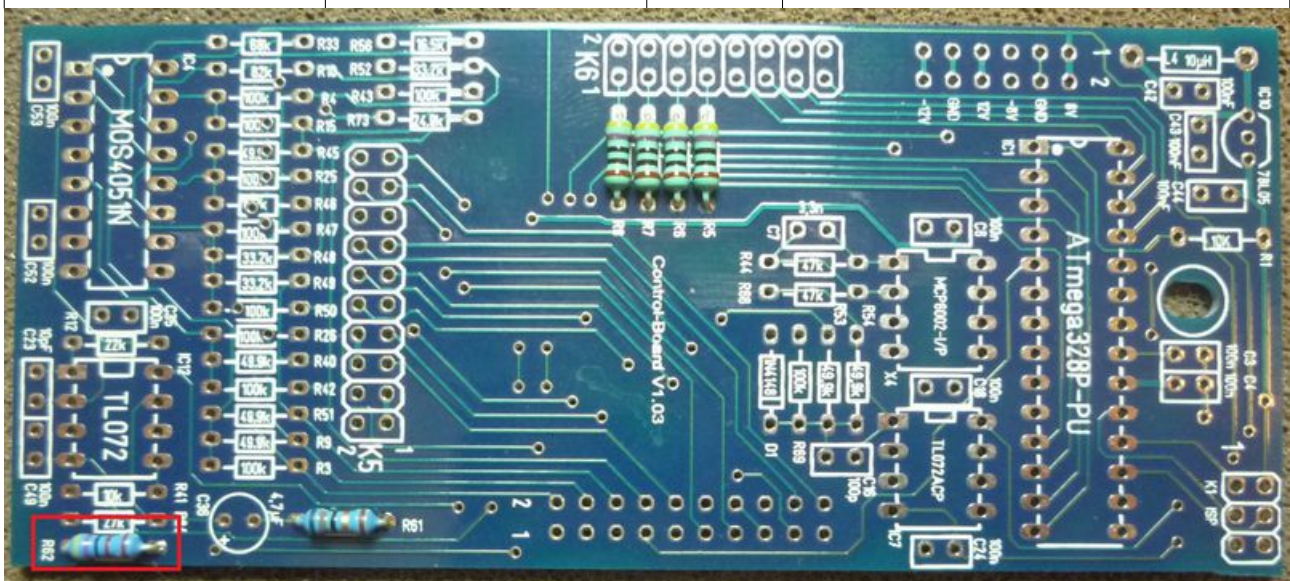


4x 470 ohm


| Image | Description | Quantity | Notes |
|---|-------------|----------|--|
|  | 470 ohm | 4 | Yellow,purple,black,black,brown R 5,6,7,8 |

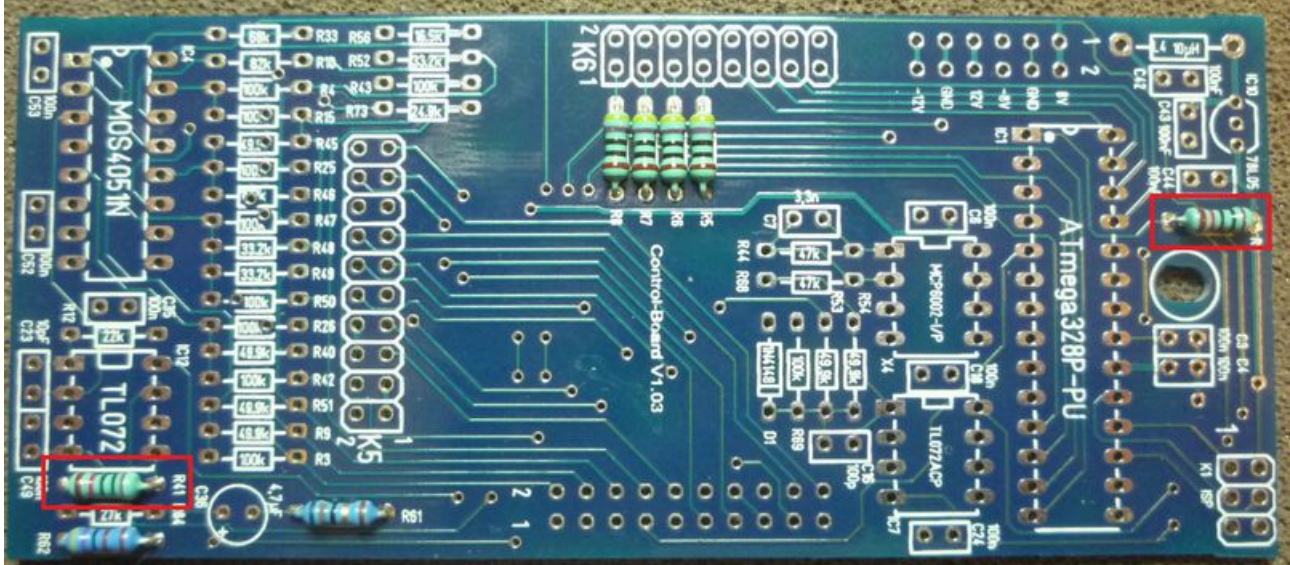


| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 4,7 k ohm | 1 | Yellow,purple,black,brown,brown R 62 |




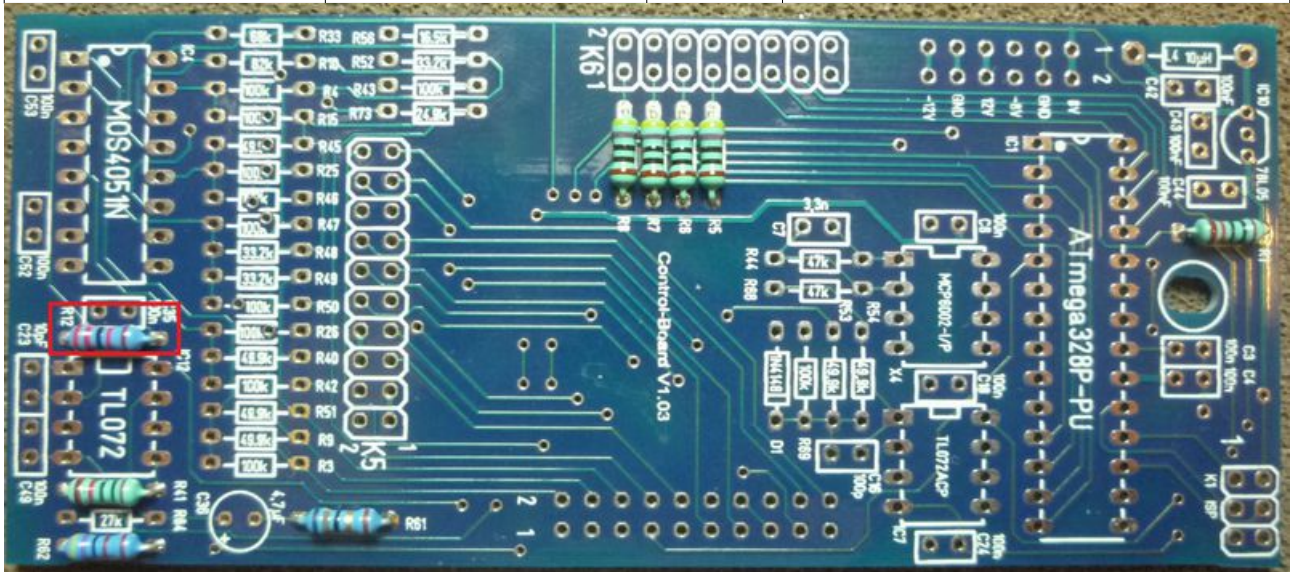
2x10k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|--------------------------------------|
|  | 10k ohm | 2 | Brown,red,black,black,brown R1,41 |




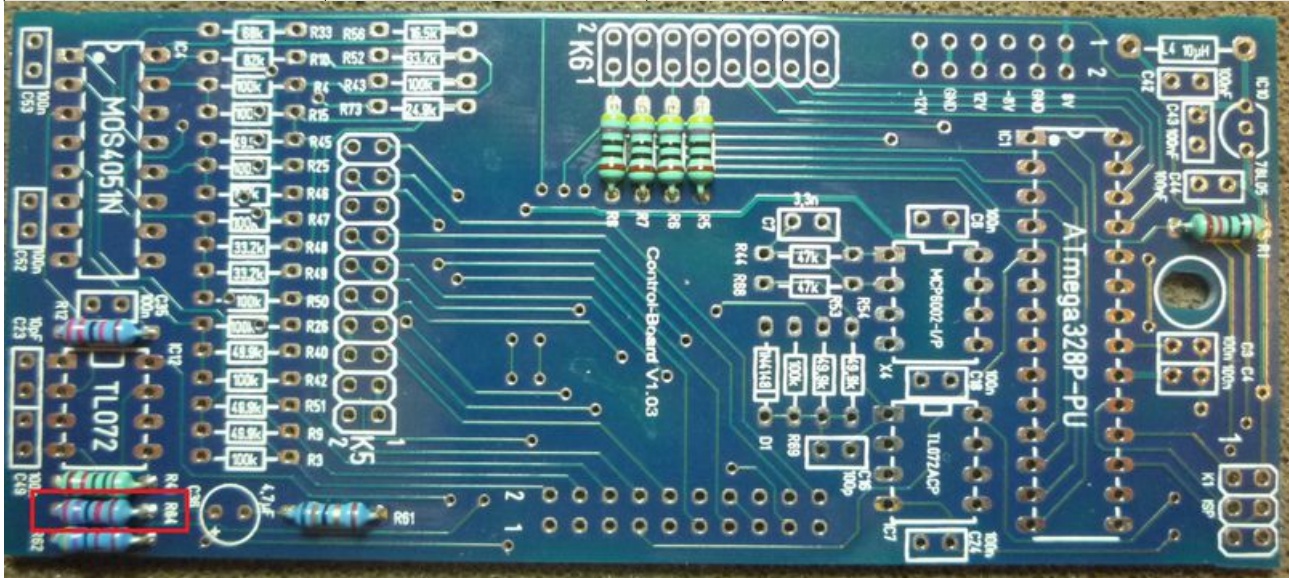
1x 22k

| Image | Description | Quantity | Notes |
|---|-------------|----------|---------------------------------|
|  | 22k ohm | 1 | Red,red,black,red,brown R 12 |




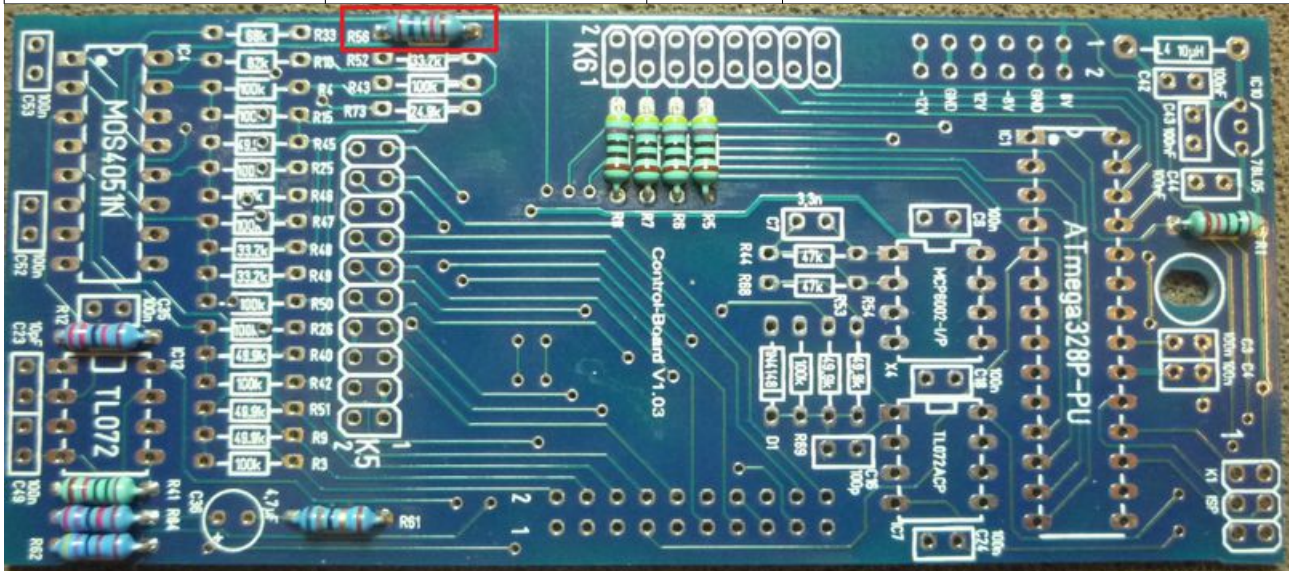
1x 27k ohm

| Image | Description | Quantity | Notes |
|--|-------------|----------|------------------------------------|
|  <p>27k Ohm</p> | 27k ohm | 1 | Red purple,black,red,brown R 64 |

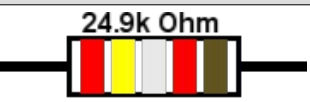


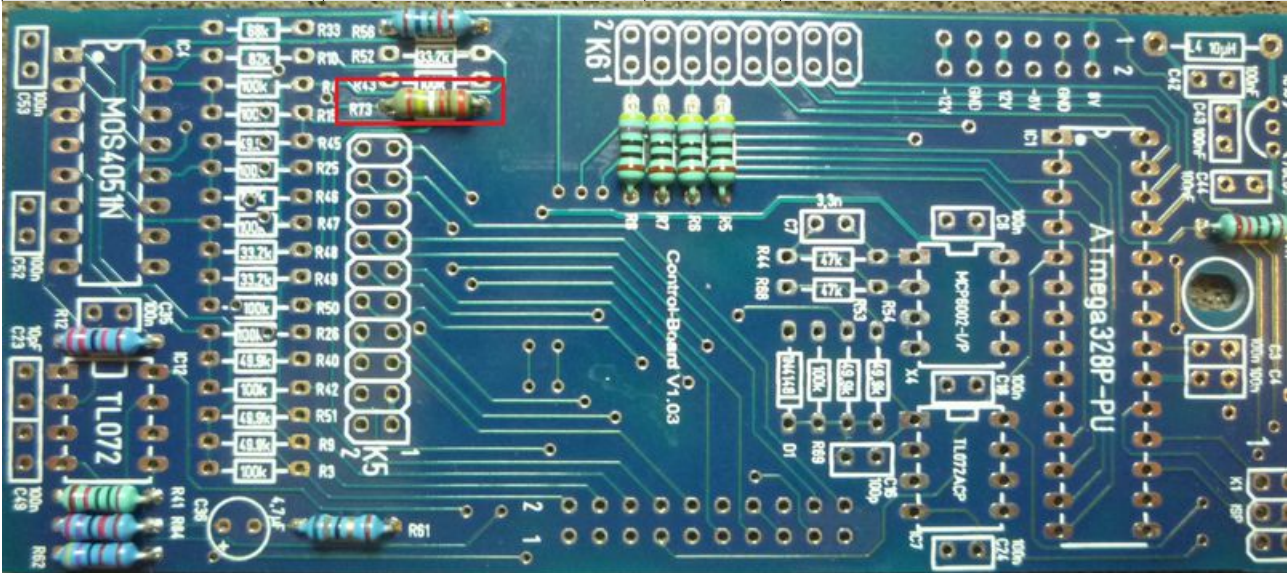
1x 16,5k ohm

| Image | Description | Quantity | Notes |
|--|-------------|----------|---------------------------------------|
|  <p>16.5k Ohm</p> | 16,5k ohm | 1 | Brown,blue, green, red, brown R 56 |

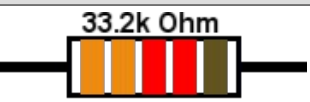


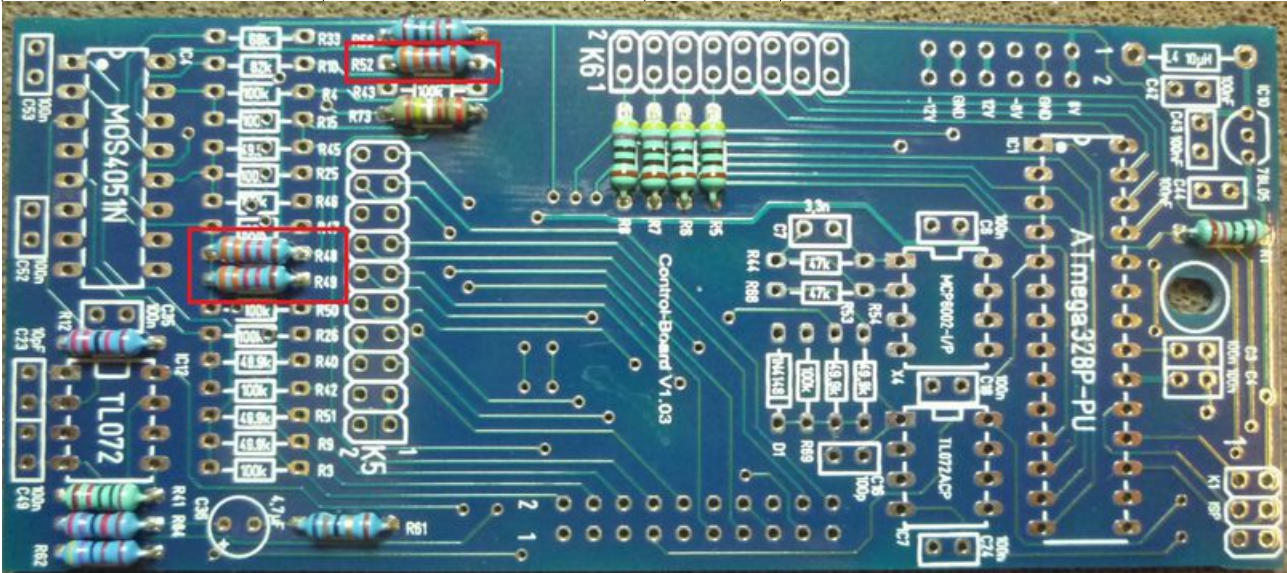
1x 24,9k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 24,9k ohm | 1 | 5 ring =red, yellow, white,red,brown 6 ring=red,yellow,white,red,brown,red R 73 |

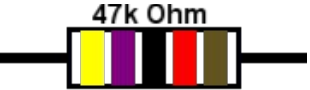


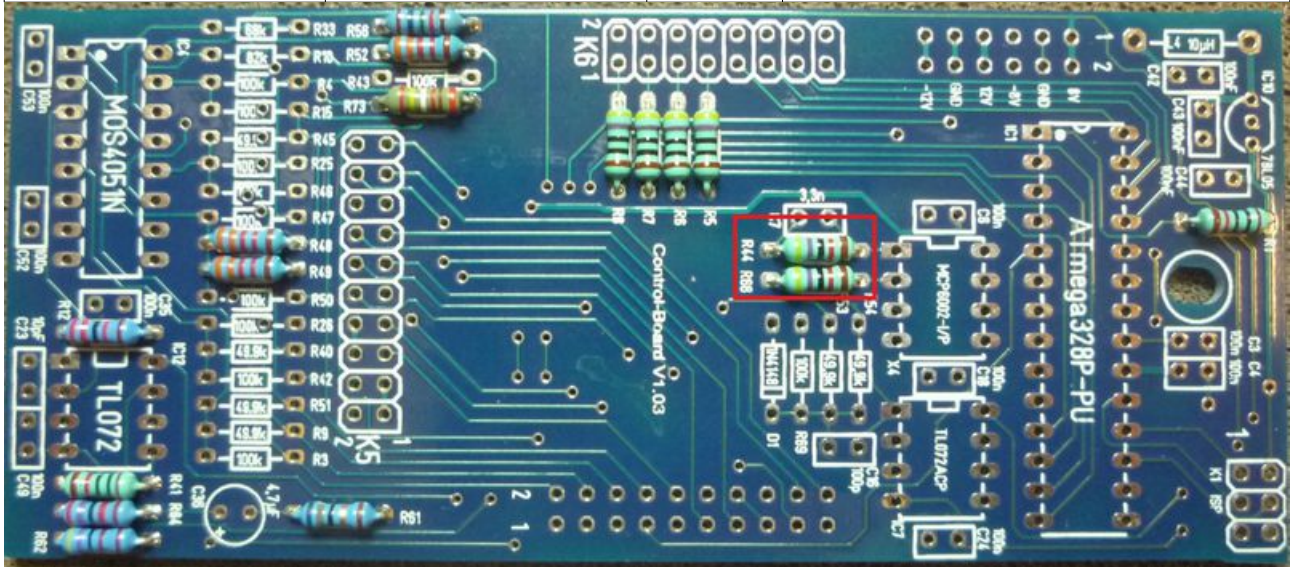
3x 33,2k ohm

| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 33,2k ohm | 3 | Orange,orange,red,red,brown R 48,49,52 |

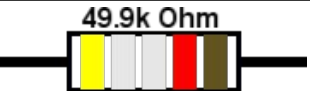


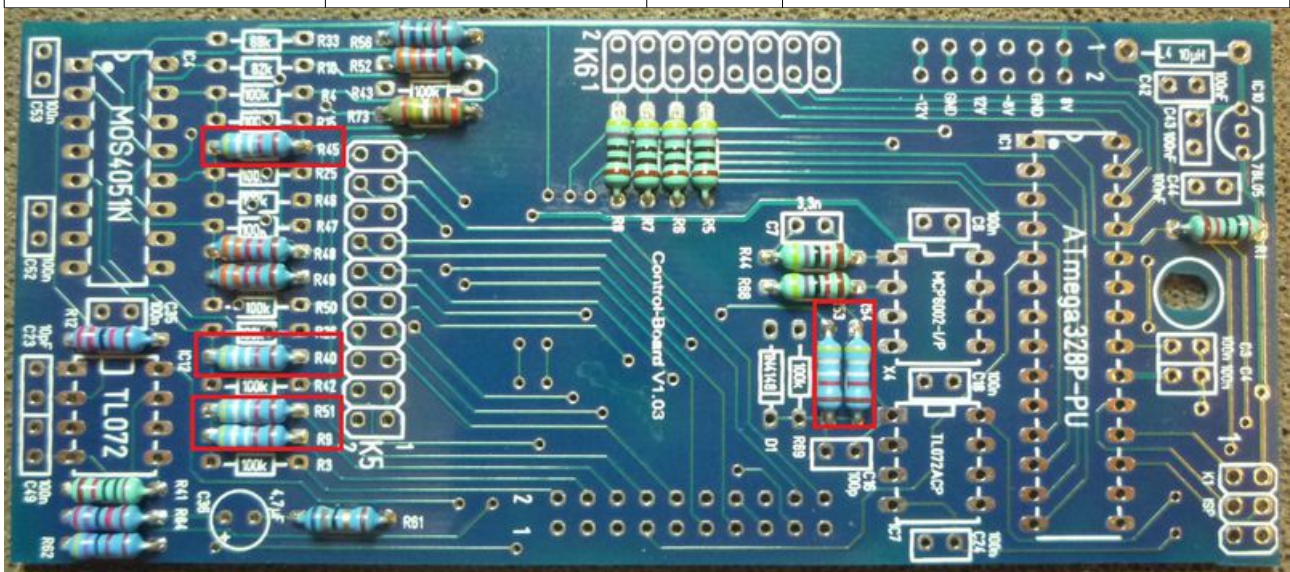
2x47k ohm

| Image | Description | Quantity | Notes |
|--|-------------|----------|--|
|  <p>47k Ohm</p> | 47k ohm | 2 | Yellow,purple,black,red,brown R 44,68 |



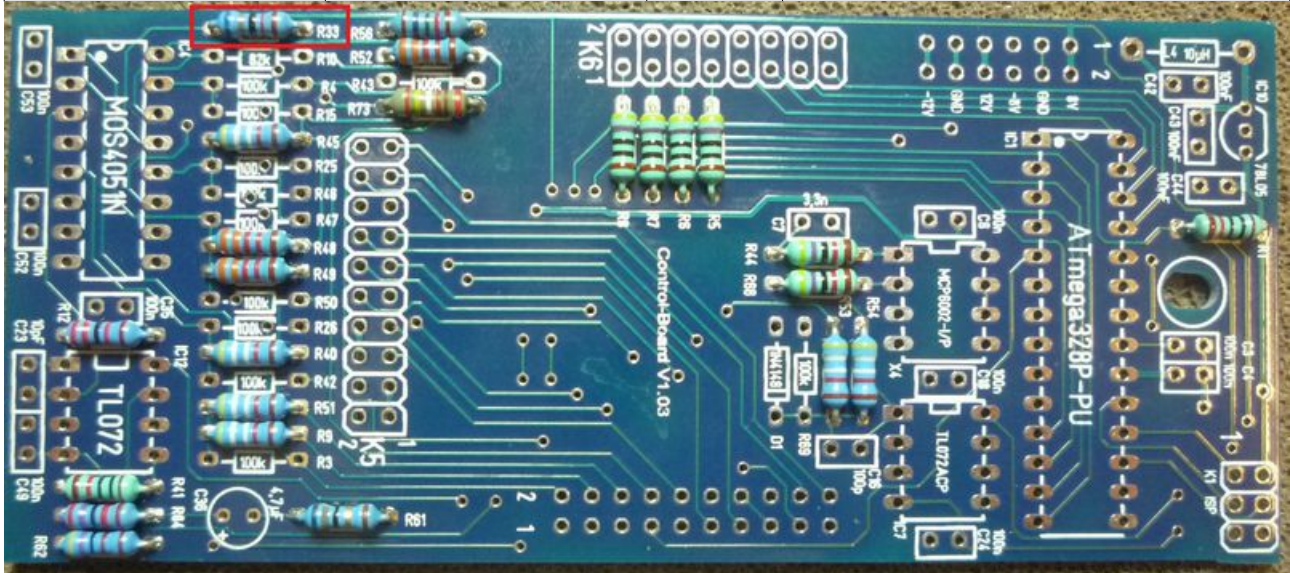
6x49,9k ohm

| Image | Description | Quantity | Notes |
|--|-------------|----------|---|
|  <p>49.9k Ohm</p> | 49,9k ohm | 6 | Yellow,white,white,red,brown R9,40,45,51,53,54 |



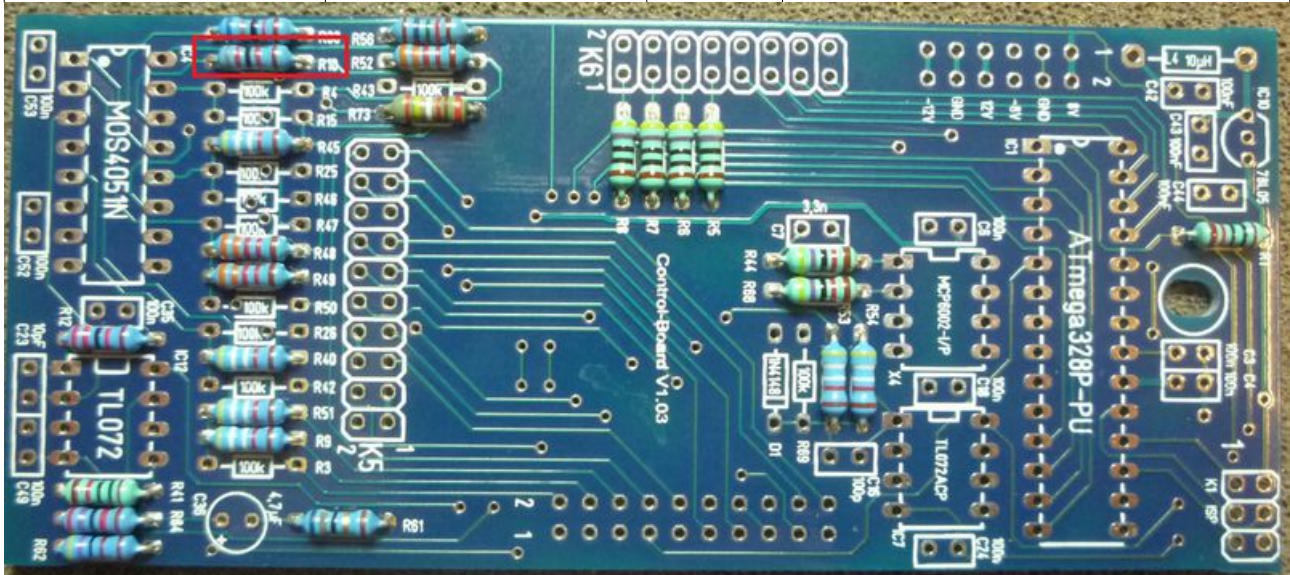
1x 68k ohm

| Image | Description | Quantity | Notes |
|-------|-------------|----------|----------------------------------|
| | 68k ohm | 1 | Blue,gray,black,red,brown R33 |




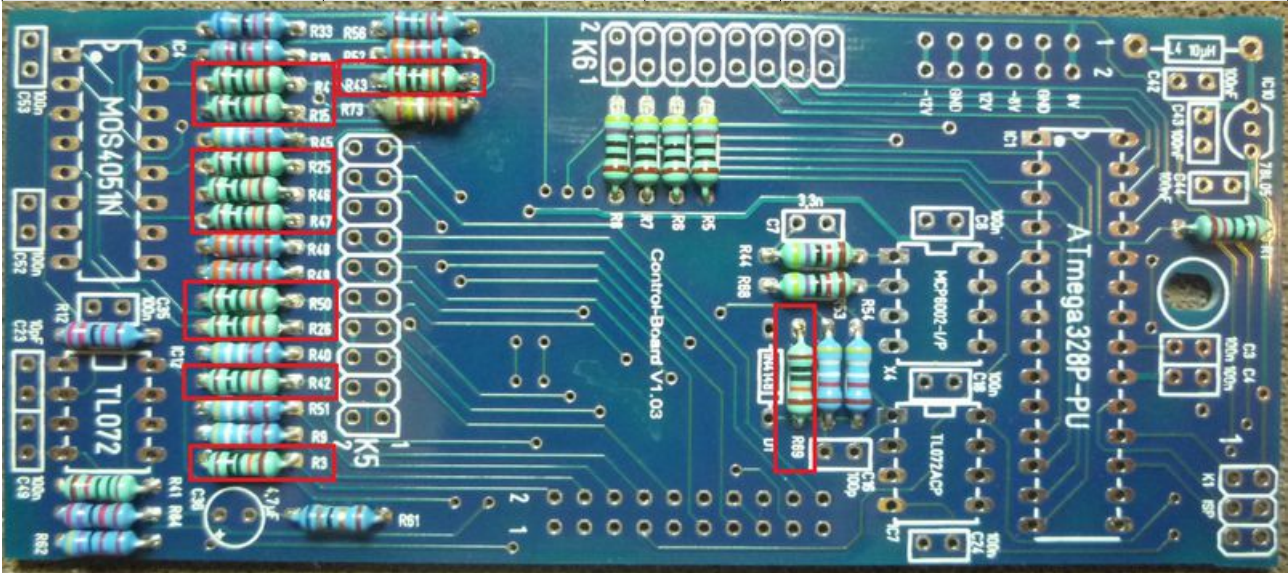
1x82k ohm

| Image | Description | Quantity | Notes |
|-------|-------------|----------|---------------------------------|
| | 82k ohm | 1 | gray,red,black,red,brown R10 |




11x100k ohm

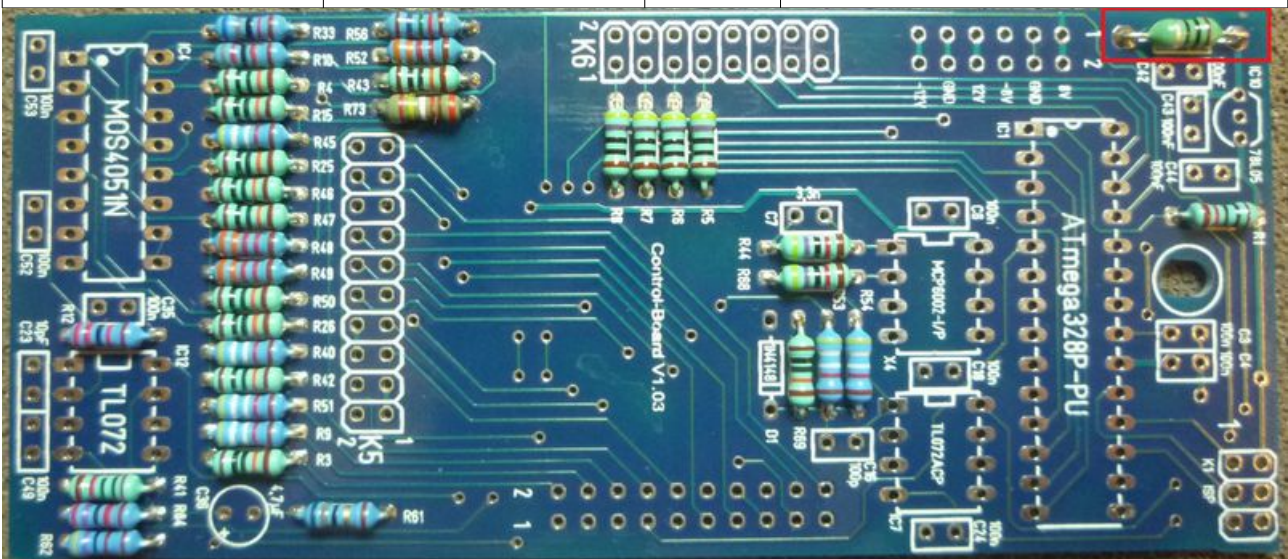
| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 100k ohm | 11 | Brown,black,black,orange,brown R3,4,15,25,26,42,43,46,47,50,69 |



Now we have all resistors in the control board


one coil 10 uH

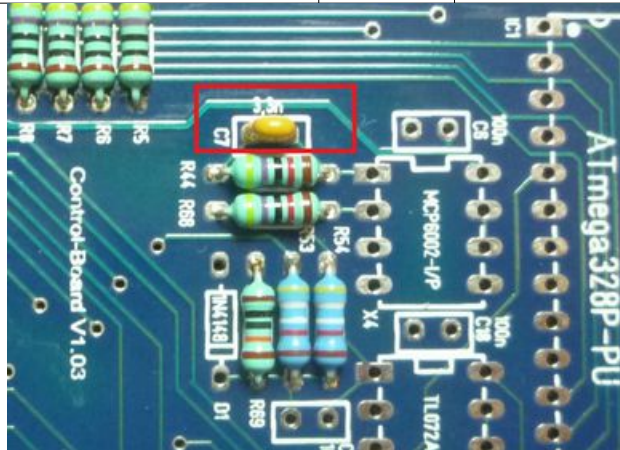
| Image | Description | Quantity | Notes |
|---|--|----------|--|
|  | Coil 10 uH in this version or this version | 1 | Brown,black,black,silver L4 ** attention , looks like a resistor , but is a coil |




second step

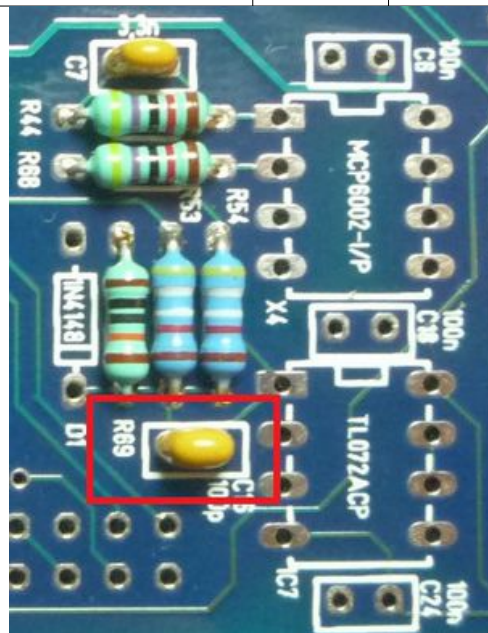
1x3,3nF

| Image | Description | Quantity | Notes |
|---|----------------|----------|--------------------------------|
|  | 3,3 nF ceramic | 1 | marked with [332] C7= 3,3nF |




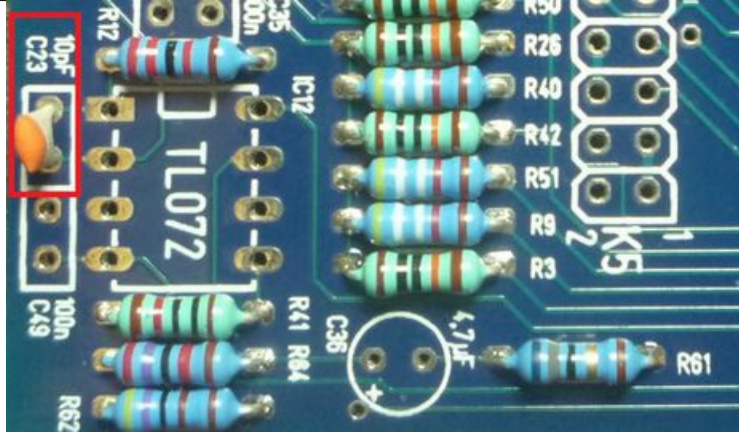
1x100pF

| Image | Description | Quantity | Notes |
|---|----------------|----------|----------------------------------|
|  | 100 pF ceramic | 1 | marked with [101] C16 = 100pF |




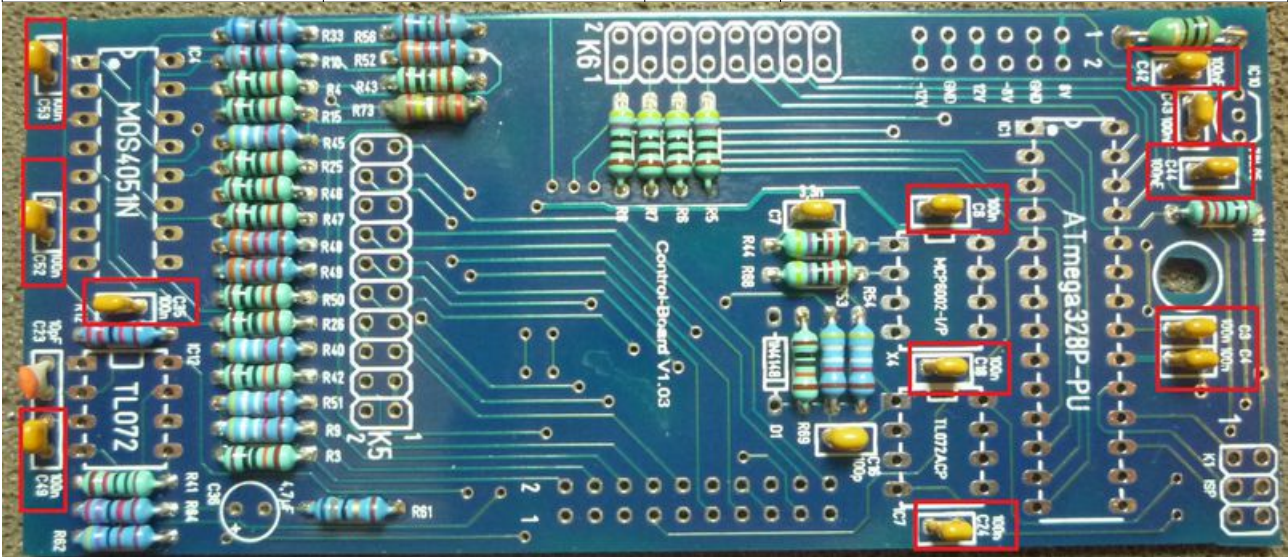
1x10pF

| Image | Description | Quantity | Notes |
|---|---------------|----------|--|
|  | 10 pF ceramic | 1 | marked with [100] or 10p C23 = 10pF |




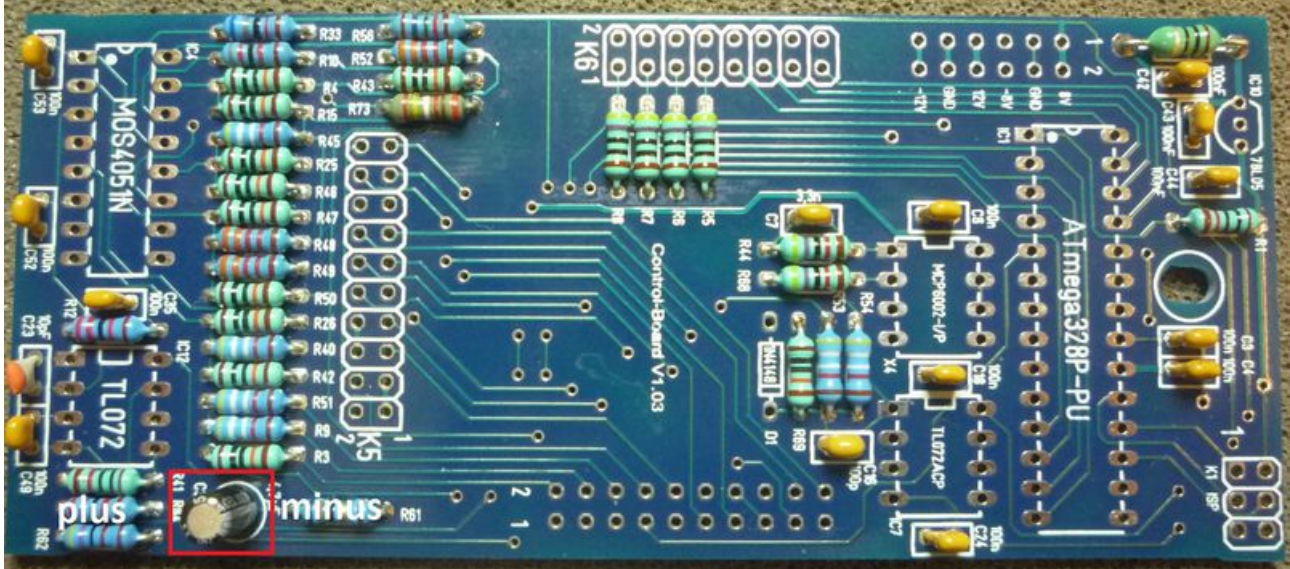
12x100nF

| Image | Description | Quantity | Notes |
|---|----------------|----------|--|
|  | 100 nF ceramic | 12 | marked with [104] C3,4,6,18,24,35,42,43,44,49,52,53 |

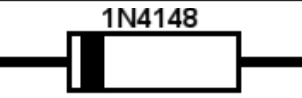


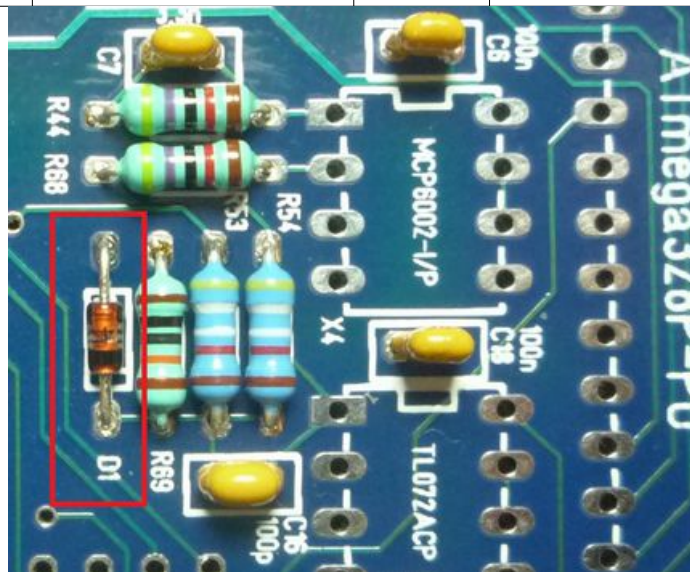
1x4,7uF polarised

| Image | Description | Quantity | Notes |
|---|-------------|----------|---|
|  | 4,7 uF elko | 1 | marked with 4,7uF + - polarised it is a specially small cap C36 |




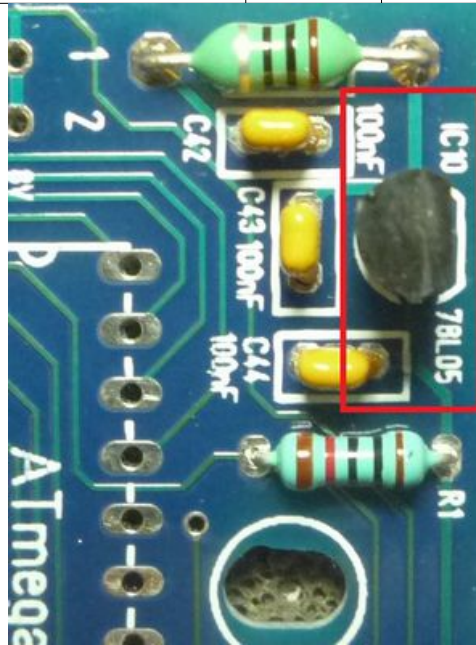
third step
1x1N4148

| Image | Description | Quantity | Notes |
|---|------------------|----------|-------|
|  | 1N4148 polarized | 1 | D1 |



1x 78L05

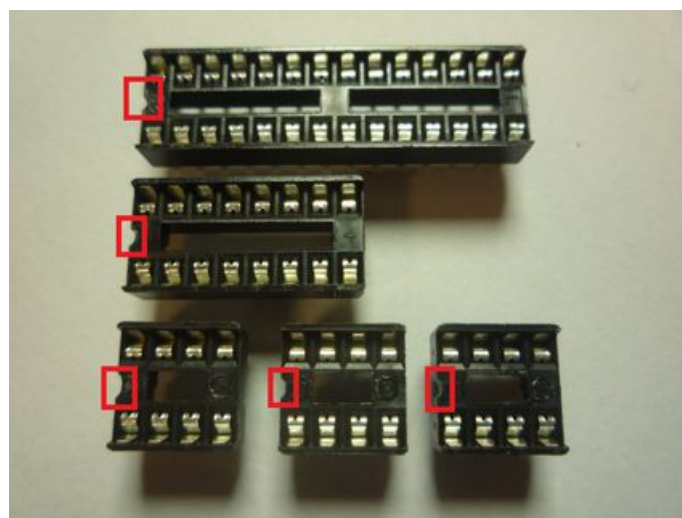
| Image | Description | Quantity | Notes |
|---|-----------------|----------|--------------|
|  | 5Volt regulator | 1 | IC 10 =78L05 |



fourth step

IC sockets and the pin connectors

the sockets, 3x8 ,1x16,1x28 Attention to the mark. Later it is easier to push the IC's with the right direction in the sockets .



TIP>>>IC socket 28 pin - and all others

Socket 28 pin -Solder at first only 2 pins , pin 1 and 15.

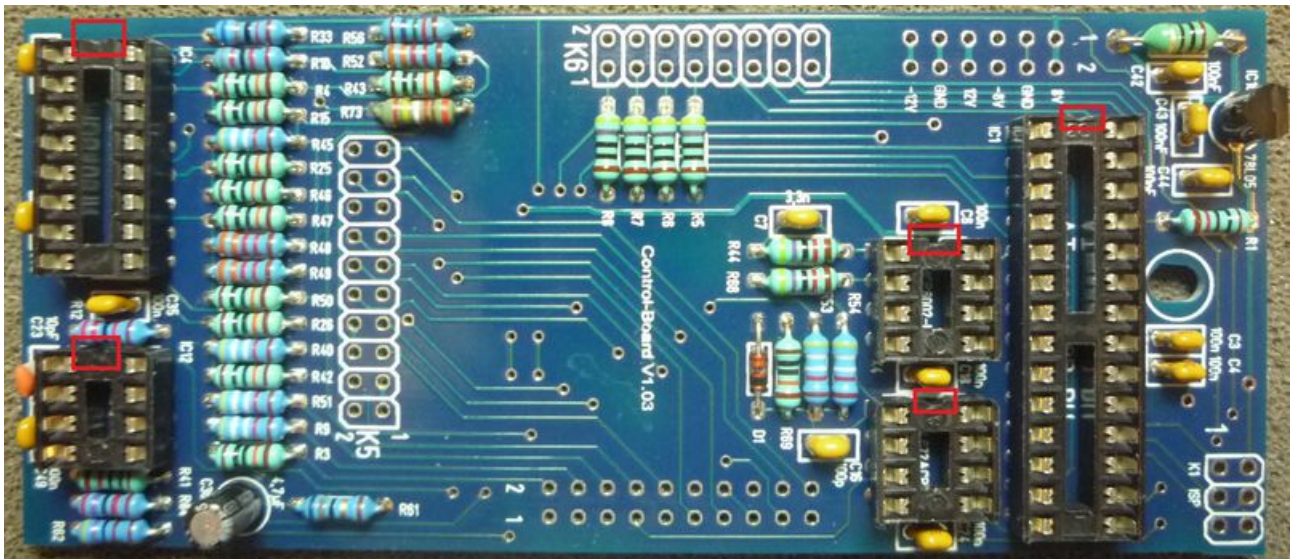
Is the IC socket flat on the PCB ?

If not, heat first pin 1 with the solder iron while press the IC socket with the finger against the PCB.

Do the same with pin 15. Now the IC socket should be flat on the PCB .

After this you can solder the rest .

Do the same procedure with all IC sockets .



Now we build in the three male connectors

K1=2x3 ISP male connector



K6=2x8 male connector

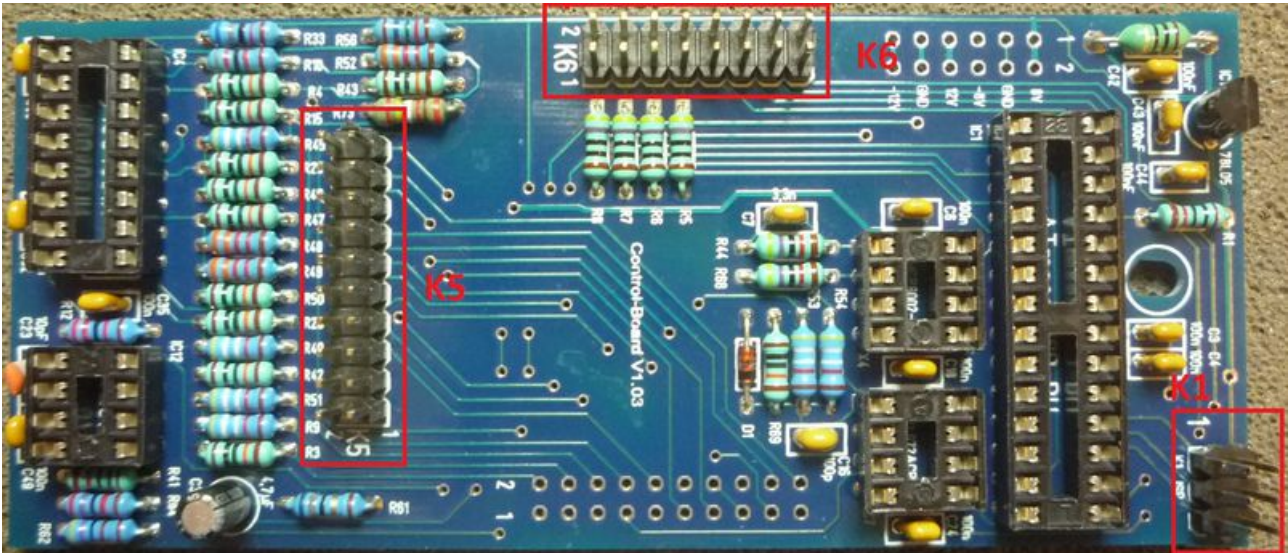


K5=2x10 male connector



Like the IC sockets, first solder 2 pins . Pay attention that the connectors are straight installed.

Now it should look so



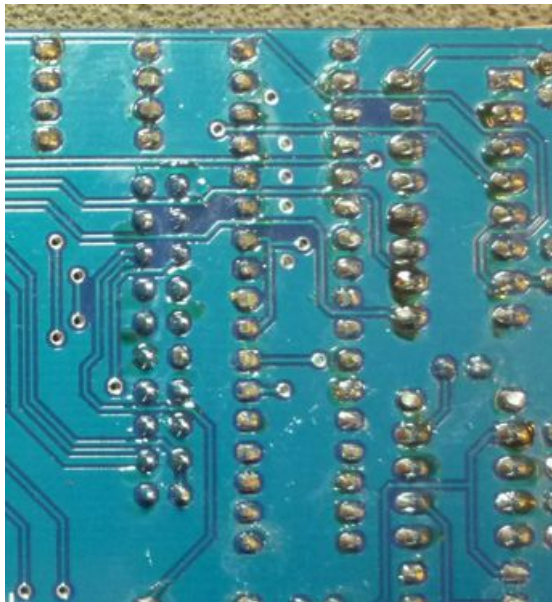
Cleaning the PCB

before you solder the measure connectors, you should clean the PCB . It looks much better – and you see better taht all solderpoints are good.

If you use solder with PB , you can clean the PCB with methylalcohol and a towel.
If you use solder leadfree, simply clean the PCB with water. (** depends of your solder flux)

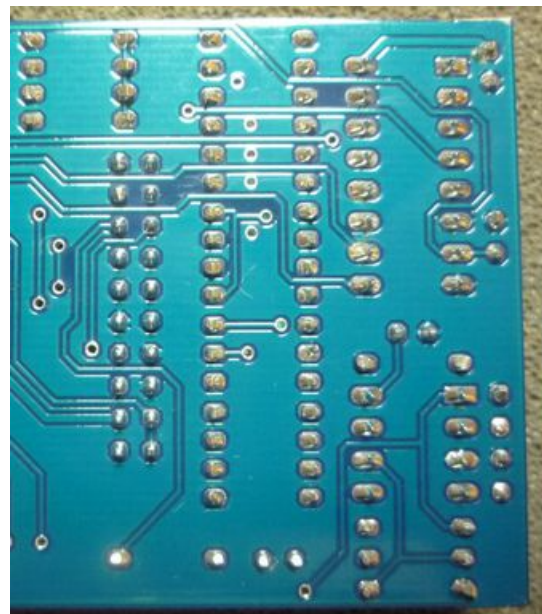
Can be that you must do some tests how you get the PCB clean.

Here an example



before cleaning

and



after cleaning

it looks much better !!

No the last step - the two measure connectors on the backside

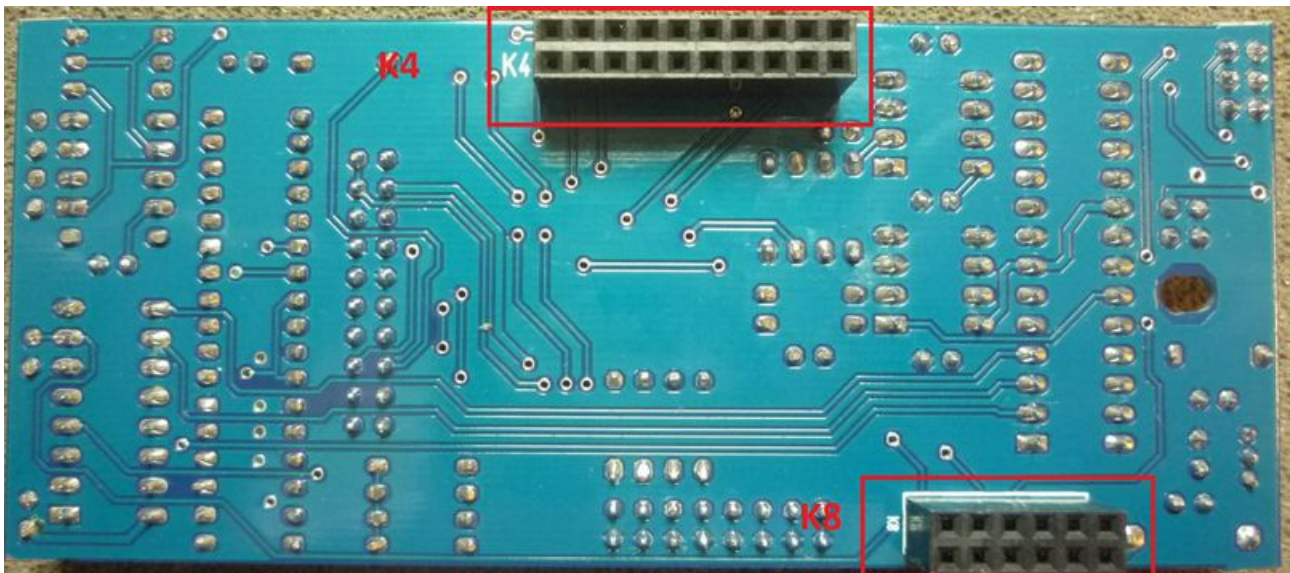
K4=2x10



K8=2x6



Attention , first solder 2 pins and press the Connector against the PCB while soldering.
Be sure that all the connectors are 100% correct and straight build in .



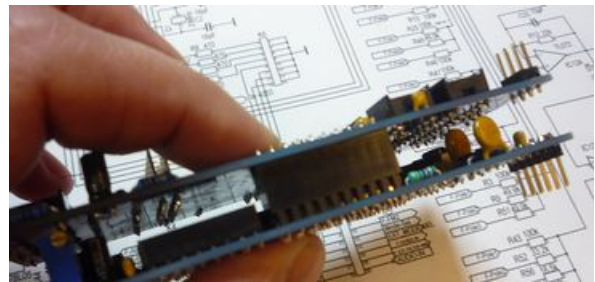
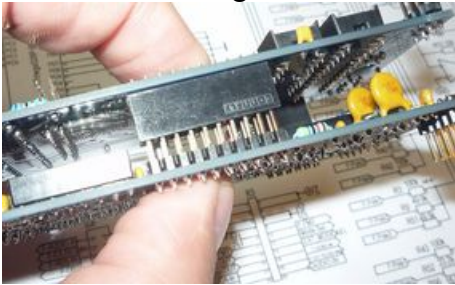
Congrats – now the control board is ready .

Voltage test for the control board .

We measure now the voltage on the control board.

Procedure .

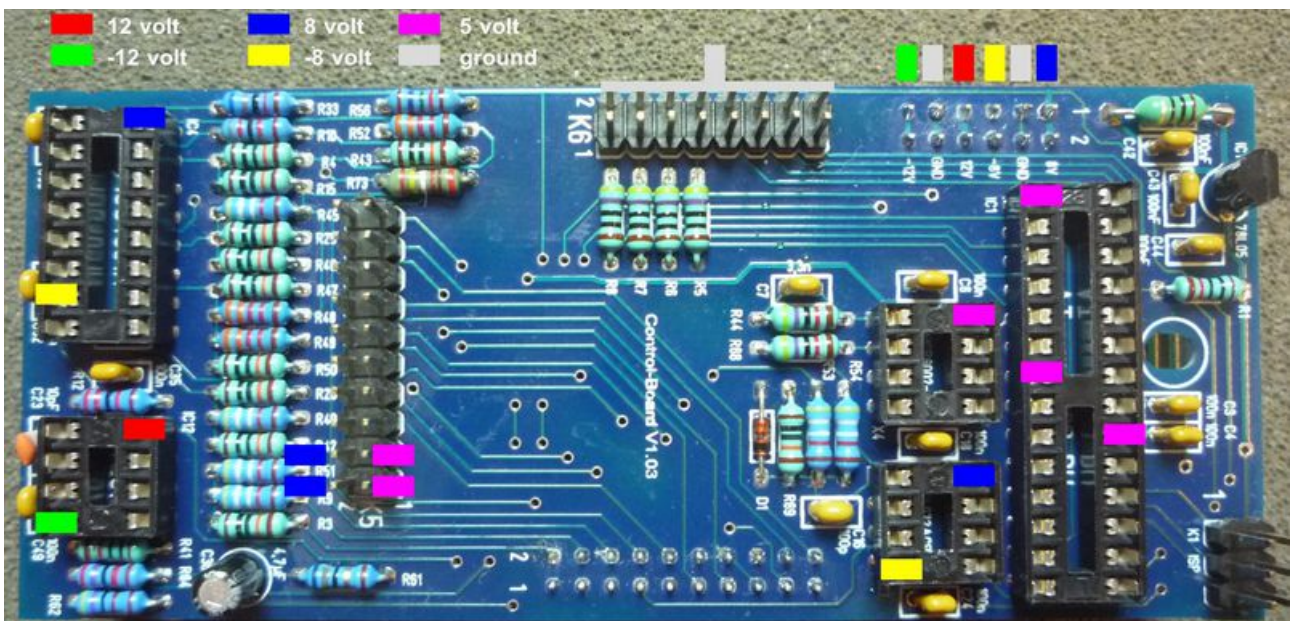
Connect the analog board with the control board.



Then measure the following points with a Multimeter .

Voltages are :

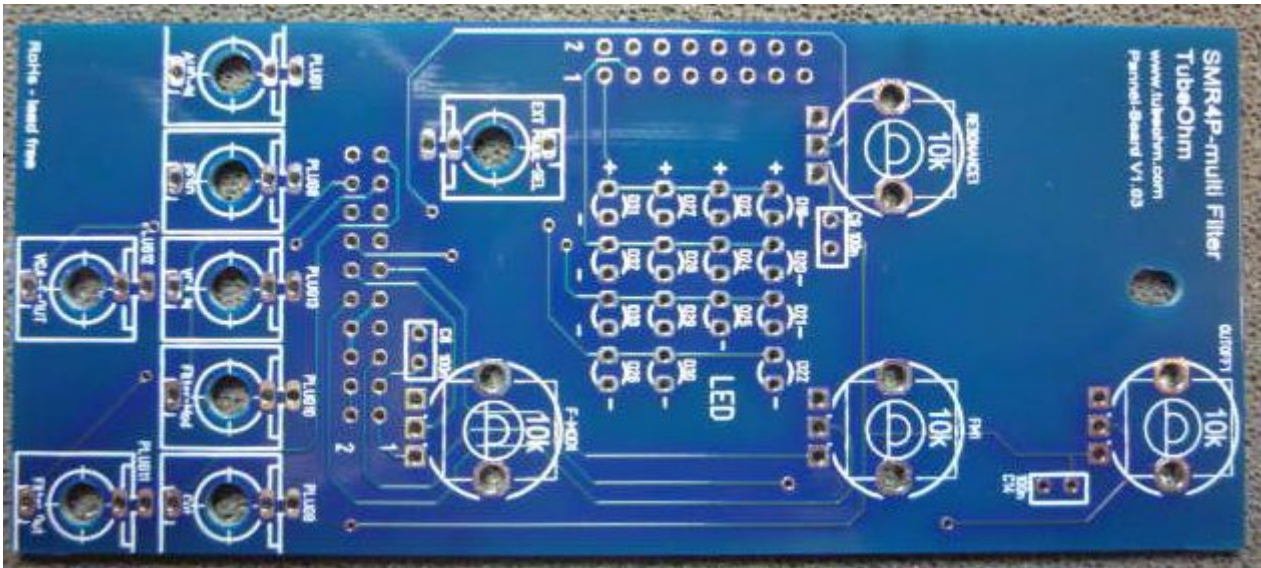
| | |
|------------|--------|
| +12volt | Red |
| -12volt | Green |
| +8volt | Blue |
| -8 volt | Yellow |
| 5 volt | Purple |
| and Ground | Grey |



all voltage OK ?


Than we move to the Pannel board PCB

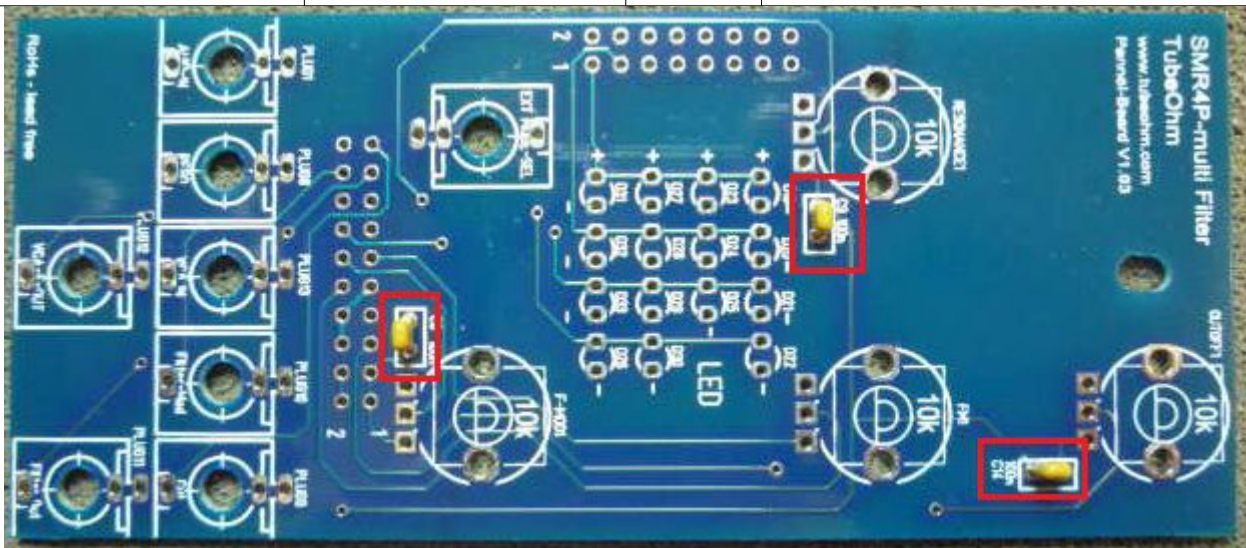
Panel PCB board



Mount the panel board is a special. To get the Pots straight in the middle of the holes of the Alu panel we must work with the Panel PCB and the frontpanel. On the right side you see a 'longhole'. So you have the possibility to move the PCB a little to right or left on the frontpanel.

Now we start with the 100nF caps .
3x100nF

| Image | Description | Quantity | Notes |
|---|----------------|----------|------------------------------|
|  | 100 nF ceramic | 3 | marked with [104] C8,9,14 |



the connectors

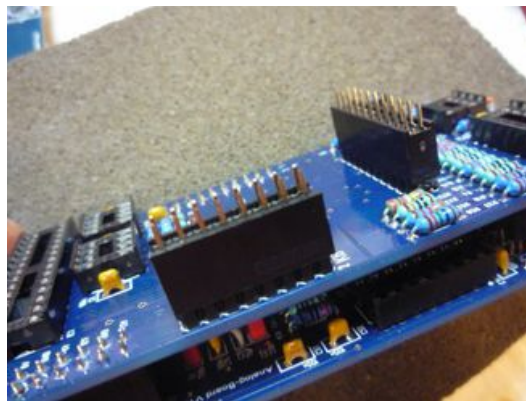
K9=2x8 pin



K7=2x10 pin



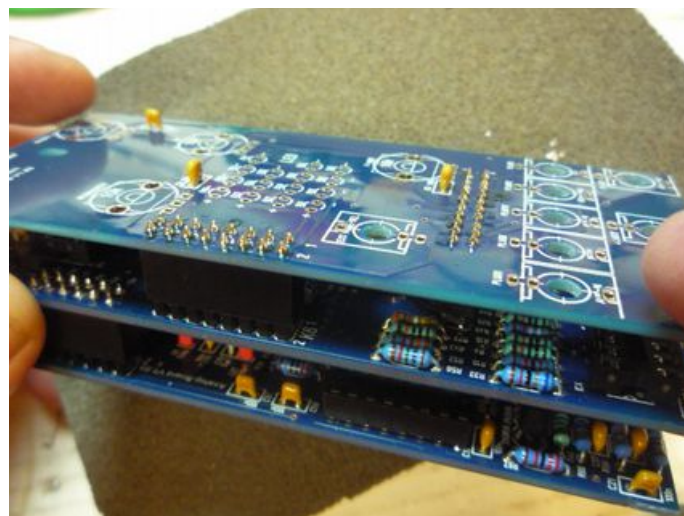
Connect the headers at first to the control board on K5 2x 10 pin and K6 2x 8 pin .



Then put the Panel board from the top to the connectors . Be sure that the pins fit in the holes.
Solder at first one pin from K7 and K9.

All straight and the connectors are flat on the Panel board ??

Then you can solder the rest of the Pins from the connector K7 and K9




Now separate the Frontpanel from the control board PCB.

We come to the special part of the mounting




We need 4 pots

4x 10k ohm pots

| Image | Description | Quantity | Notes |
|---|--------------|----------|---|
|  | 10k ohm pots | 4 | marked with CC103B CUT,RESO,FM,F-MOD |

And 8x Thonkiconn

| Image | Description | Quantity | Notes |
|---|--------------------|----------|---|
|  | 3,5 Eurorack jacks | 8 | Ext-Mode Sel, Audio-in Reso, VCA-in Filter-mod, Cut, VCA-E-Out, Filter-out |

First we put the pots and only 2 Jacks in the positions – without soldering



Solder now only the two 3,5 Jacks.

Take the frontpanel and screw it from the backside to the panel board .



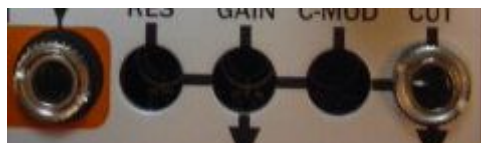
Screw it from the backside. You see that the pots not soldered yet.



Now put the knobs on the pots and center it so good as you can .



You must also screw the jacks with its nuts on the front panel .



All is in center and looks good ??
OK , than you can solder the pots .

Now we solder the jacks on the panel board.




First one pin – look that all jacks are flat on the PCB , after this solder the rest of the pins. Check that the Jacks fit in the holes of the frontpanel .



LED mounting

The SMR4P-multi used flat green LED's. If you don't like the green ones – coming with the kit – you are free to use LEDs in another color . The LED output (470 ohm) can deliver round about 5 mA current .

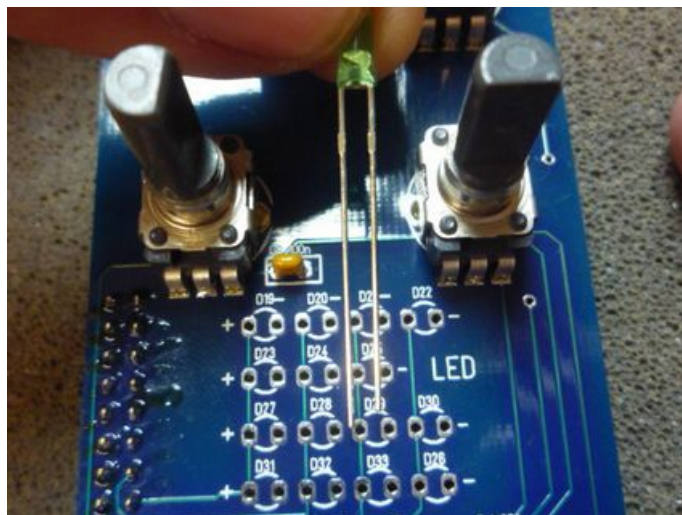
15xLED flat green

| Image | Description | Quantity | Notes |
|---|---|----------|-----------------------------|
|  | LED flat green polarized , short leg is minus. | 15 | D 19....33 = LED flat green |

Now we take tape and glue it over the LED holes of the front panel.

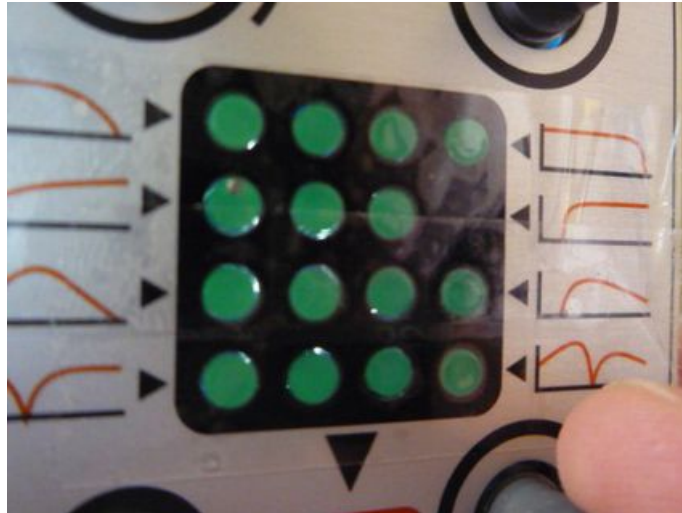


In the next step you put all 15 LED's into the pannel pcb.
Long leg to left , short leg to right. **Don't solder the LED's now !**



Take now the Frontpanel with the tape , and screw it together with the pannel PCB.
Screw it from the backside and then take 2 nuts for two jacks on the front.

Now it should be clear why we use the tape. The LED's glue on the tape and we get a nice surface.



You can solder the LED's. **Are all LED's in the right direction ?**
Like ever – first solder one leg , all straight ? , all in the same height ?
And then solder the second leg.

After you had solder the LED's , you can remove the tape from the frontpanel. Clean the Frontpanel it with Methylalcohol. Now it should look like in this picture .

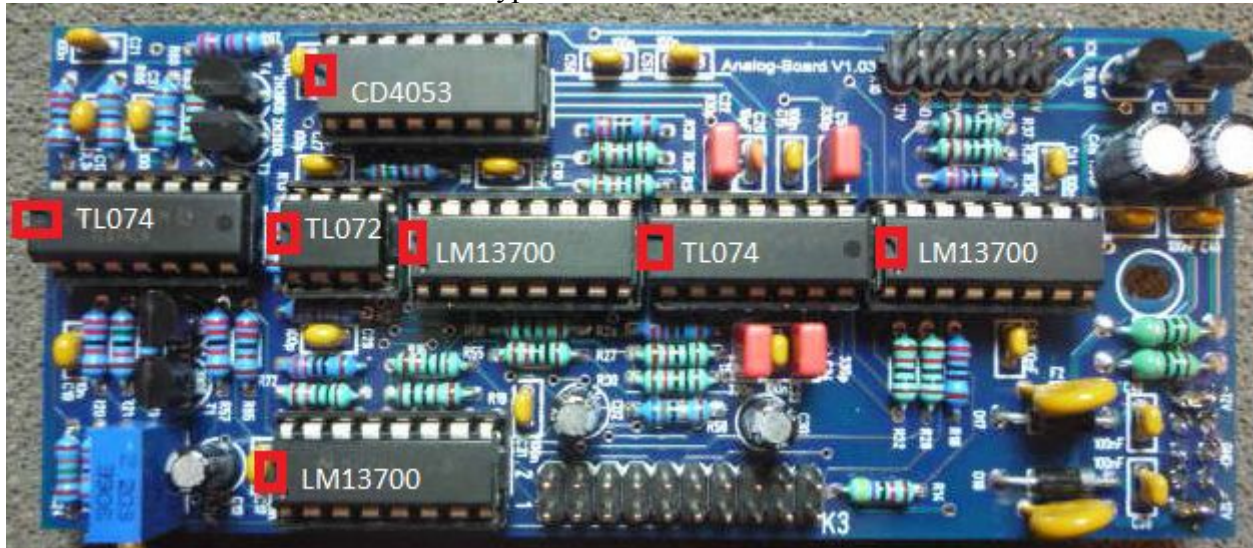


Last chapter , mounting the IC's, mounting the PCB's and the volt pro octave adjustment.

Insert the IC's in the analog board .

We need the following IC's:

- 2x TL074 quad opamp
- 3x LM13700
- 1x TL072 dual opamp
- 1x CD4053 - must be the CMOS type NOT a 74HC4053

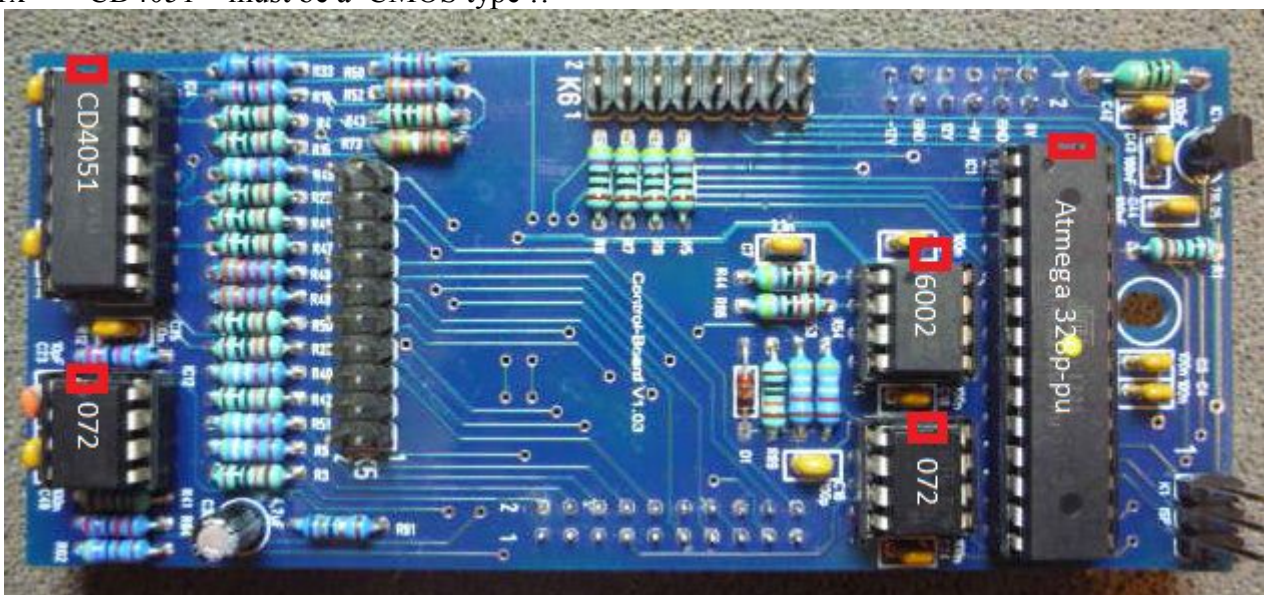


The direction of the IC's is marked in RED

Next step is the control board .

We need the following IC's

- 1x Atmega 328P-PU
- 1x MCP6002
- 2x TL072
- 1x CD4051 – must be a CMOS type !!

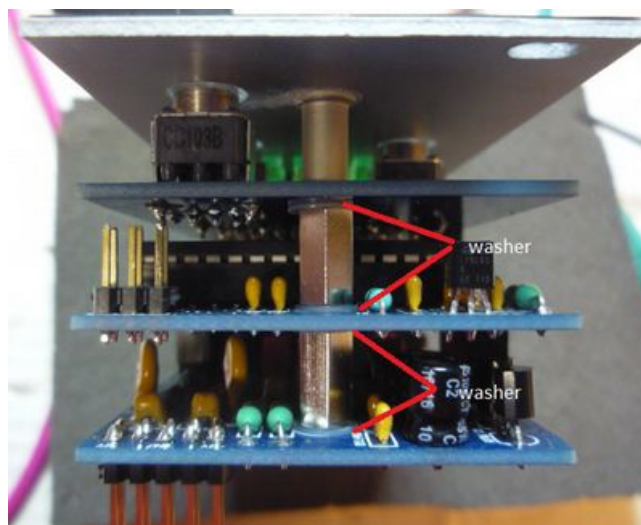
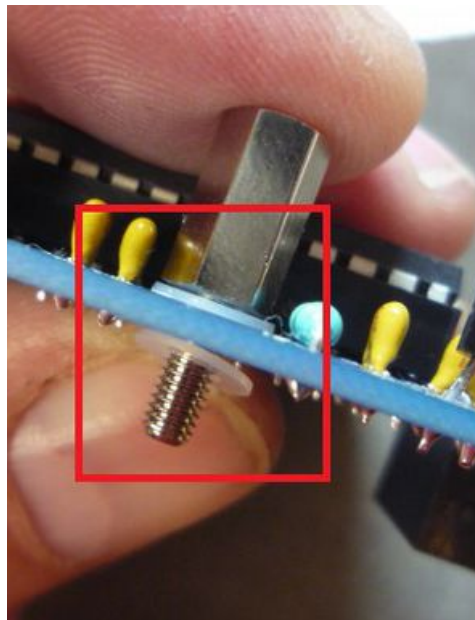


Now we mount the three PCB'S together .

The distance between each PCB is 11 mm. You need 2 spacer a 10 mm and two washer for each spacer. **Attention , use the washer to prevent shorts near the holes on the PCB.**

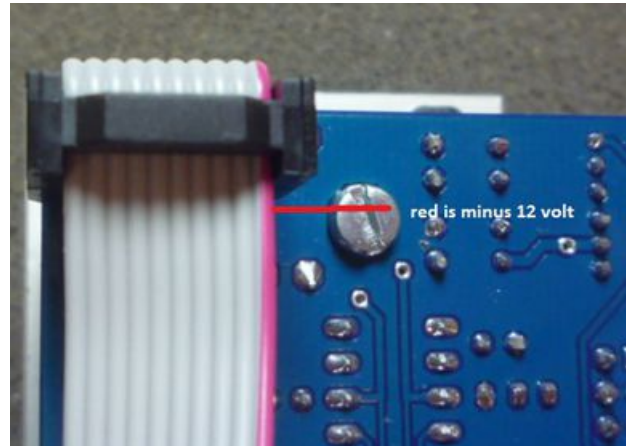
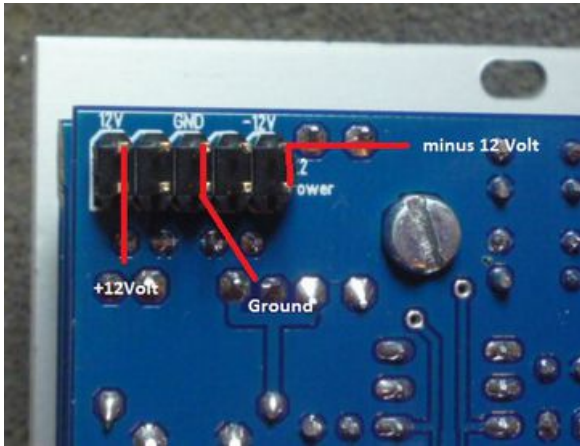
If you source yourself, the Washer is for M3 screws and 0,5mm thick.

So 10 mm spacer +2 x 0,5mm washer is 11 mm distance total.



Screw the analog board with this M3 6mm Screw to the spacer.
Mount the 4 Knobs to the pots. And screw the jack's to the frontpanel.
The mechanical assembly is finished.

Now you can connect the filter to +/-12 volt power.



Test at first the complete filter. For this it is helpful to have a scope.

If you don't have a scope, connect a audio signal to AUDIO in.
Set with the 'MODE' pot the filter to 6dB LP, it is the first LED left top.



Connect the VCF output. If you now route a audiosignal to 'AUDIO out' you must hear something.

Test:

- 1:) does the Cutoff pot work ?
- 2:) does the Resonancy pot work ?
- 3:) does the Filtermode Pot work ? Can you select different filtertypes ??

OK , if all pots works we test now the voltage control.

You should have a control voltage 0..10 Volt. From Eurorack or a separate power supply . Connect the voltage to the 'RES' jack. If you now increase the Voltage from 0..10 Volt the resonancy increases from 0 to maximum .

Include the SMR4P-Multi is also a VCA. Direct output (VCF) is only the VCF signal. The VCA output 'VCA' and it is controlled with the GAIN input voltage.

Here the configuration VCA



The input voltage 'GAIN' controls the volume of the Filter output (VCA). Test it with 0..10 Volt.

C-MOD is a second control voltage for the Cutoff frequency -for an LFO for example. Test it with 0..10 Volt

CUT controls the cutoff in Volt pro Octave 1Volt = 1 Octave

Now we come to the last step - the Filter calibration in V/Octave

Information.

You need a frequency counter and a multimeter. Guitar tuner is also OK.



Procedure

- 1:) You need **NO** signal input
- 2:) set Resonancy to **MAX**, Filter FM to left=0
- 3:) set the filtermode to 24 dB – first line, fourth LED
- 4:) connect a frequency counter to the VCF output (usefull is our Filter Kalibrator4free)
- 5:) Use only the 'CUT' input for the calibration voltage .
- 6:) calibration voltage is first 0 volt, adjust the resonance frequency with the Cutoff pot to 100 Hz.
- 7:) now set the calibration voltage to 1 volt, the frequency must be double to 200 Hz if not , adjust it with R11 to 200 Hz .
- 8:) set now the voltage to 2 Volt , does the frequency counter shows 400 Hz ??
- 9:) set the voltage to 3 Volt – now it must be 800 Hz .



Plus/minus a few HZ is OK.

Congrats .Now you have finished the SMR4P-Multi complete .

I hope you had fun while building.

The BOM and the schematics/layout you find on: [TubeOhm SMR4P-multi](http://www.tubeohm.com/page9.html)

<http://www.tubeohm.com/page9.html>

If you have questions or suggestions feel free to contact me on : Kontakt@TubeOhm.com

The SMR4P-Multi is a combination of the SMR4-MK2 and also the Four Pole Mission filter board for Shruthi/Phoenix with enhanced measure.

Special thanks to Olivier Gillet for his work on the 4PM and the SMR4MKII.

TubeOhm

04.12.2017