Introduction

Let me Introduce this nice Program - Equalizer in the Style of a German Console EQ. I have designed this familiar EQ in 500 API compatible Format. It works in 500 VPR or 51X Lunchboxes on the +16V and -16V rails. I used mainly the schematic of the W492 EQ with an extra THAT 1246 In- and THAT 1646 Outputstage. In my Version I added a switchable Low Cut Filter and Output Trim for full Flexibility in colouring the sound with this EQ Module. This Guide will help with setting up this nice EQ. Have Fun!

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DISCLAIMER: Proceed at your own risk. I am not liable for any damage, harm or loss of any kind resulting from the assembly and/or use of this PCB set. Safety provisions should always be exercised whenever working with any electronics. The following instructions are guidelines only. I can make no guarantee of the accuracy of contents contained within this document.

Functions

This Pot levels the amount of the High Frequency Band in a range of +/-15dB Gain. This Frequency Band is a Shelf Filter

This Buttons enables HF-Band

This Pot sets the Frequency of the High Frequency Band in a range of 3kHz to 10kHz

This Pot levels the amount of the High Mid Frequency Band in a range of +/-15dB Gain. This Frequency Band is a Bell Filter

This Buttons enables HMF-Band

This Pot sets the Frequency of the High Mid Frequency Band in a range of 1kHz to 16kHz

This Pot levels the amount of the Low Mid Frequency Band in a range of +/-15dB Gain. This Frequency Band is a Bell Filter

This Buttons enables LMF-Band

This Pot sets the Frequency of the Low Mid Frequency Band in a range of 0.06kHz to 1 kHz

This Pot levels the amount of the Low Frequency Band in a range of +/-15dB Gain. This Frequency Band is a Shelf Filter

This Buttons enables LF-Band

This Pot sets the Frequency of the Low Frequency Band in a range of 50 Hz to 400 Hz

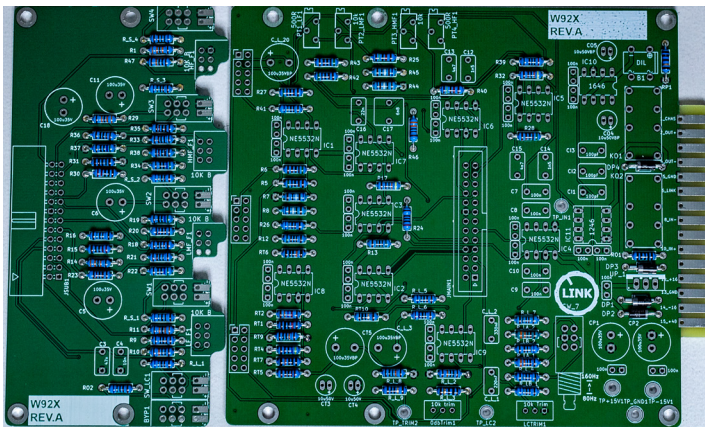
This Pot levels the Output of the EQ module in a range of +/-20dB Gain

This Switch enables the Low Cut Frequency Filter. The Frequency can be switched internal from 80 Hz to 160 Hz

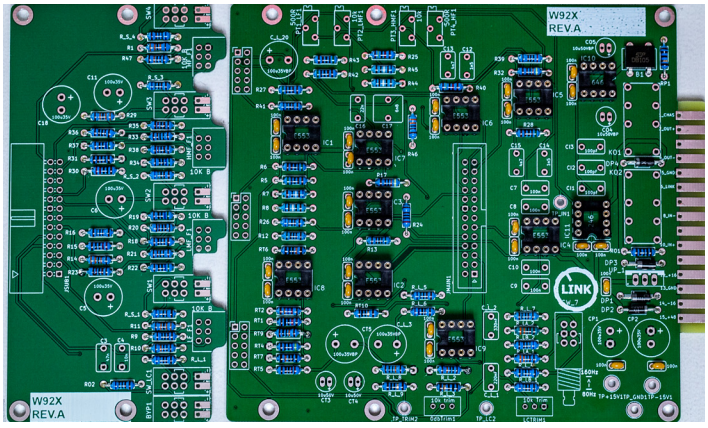
This Button enables the Equalizer. If it is not pressed the Unit is in True Bypass.

Stuffing Boards

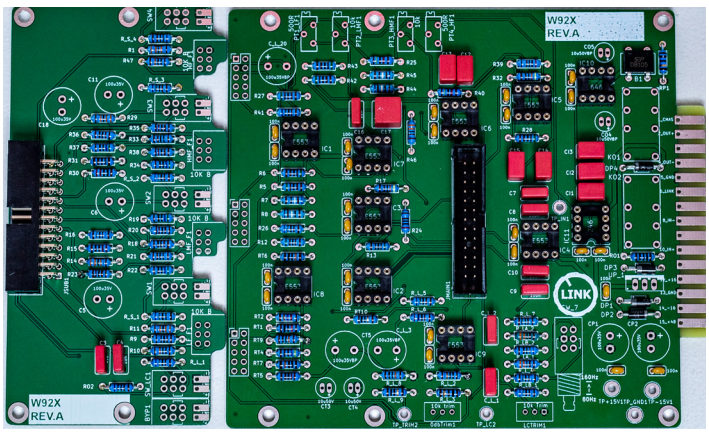
First Step is to place all Resistors and Diodes. Check before Soldering if your Diode-Placement is right. Check for right Diode orientatation before soldering!



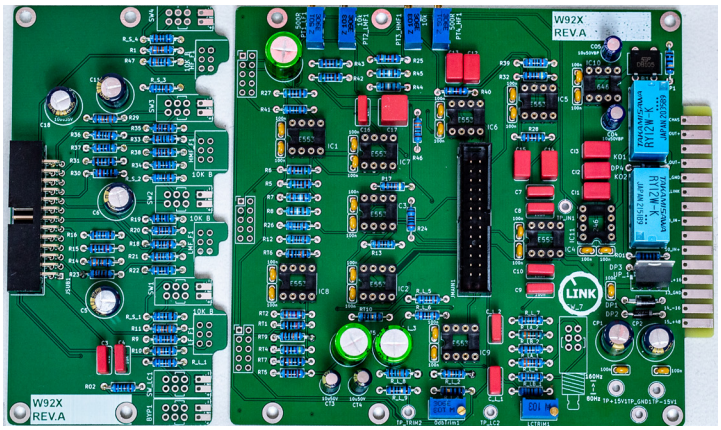
After Placing and Soldering all Resistors, we solder the next bigger parts like IC-Sockets and small Capacitors, like 100nF Caps



After that Step solder all Wima Capacitors and Board Connectors like on the pictures. On the Small Board, the short pins are soldered as close as possible to the board. Its important that you press them flush in place during soldering. We need them to sit flush and straight for the mechanical assembly later.

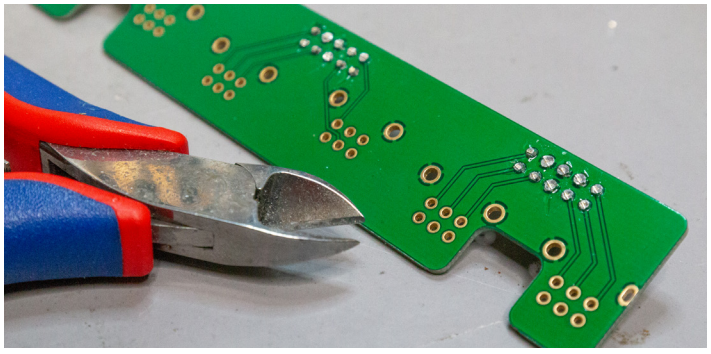


Now we change over to bigger parts like Relais, Voltage Regulator and Electrolyt Capacitors. Pay extra attention to the orientation of CP1 and CP2 as they are polarized. The other Capacitors are NonPolarized/Bipolar so the Orientation doesn‘t matter. After this step you can clean the boards. After cleaning boards with alcohol/water/your preferred method you can solder the trimpots. But don‘t clean after the Trimpots are installed. Trimpots, Switches, Potentiometers don‘t like cleaning and that can lead to problems with electrical contact.



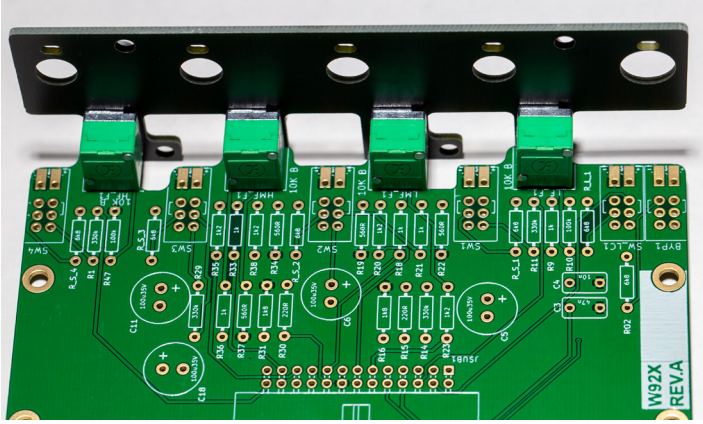
Potentiometers, Switches and LEDs

Now we are heading again to the subboards. First we take the small one and cut all leads of the pinrows as short as possible. We will be doing this process later also with the potentiometers since we need to make sure that this Equalizer don‘t touch any neighbour modules of any kind

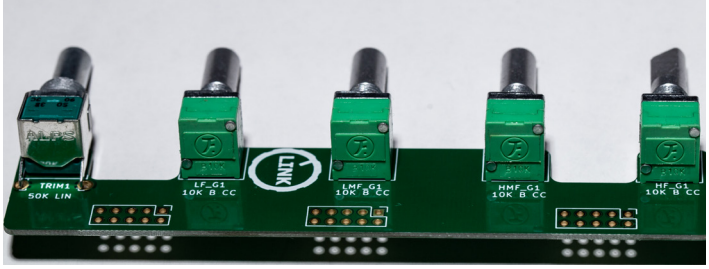


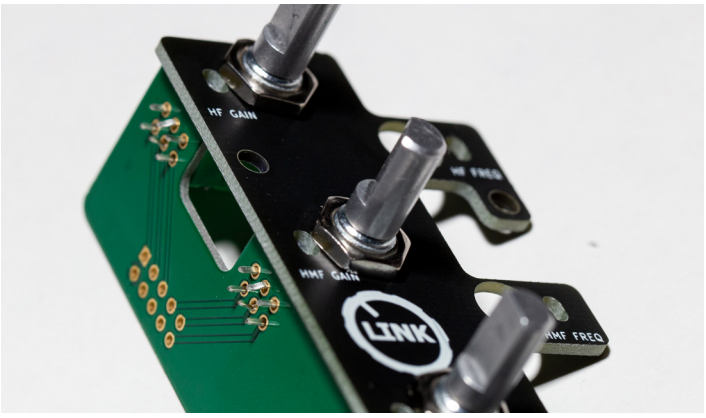
After we shortened all the pins we install all pots on this board at the same time. **It‘s really important to check for your Gain Pots that they are center detent. From the outside they look the same with B10K, but in the Kit we provide 4pcs Center Detent and 4pcs without detent. There is one additional Pot for Trim, that is a B50K Center Detent Potentiometer.**

Get all pots on the PCB and solder just one pin in the middle and press the POT as much as possible on to the PCB. After Soldering one Pin make sure the alignement of the pot is flush and straight. You can check that with printed silkscreen on the PCB.

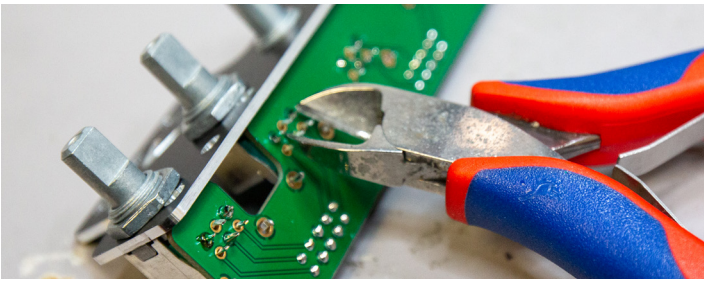


After having one pin of each pot soldered we add the bracket like shown in the picture above. The direction of the bracket is shown in the picture below. After having all pots screwed to the bracket, we can solder all pins, then we need to cut the pins.

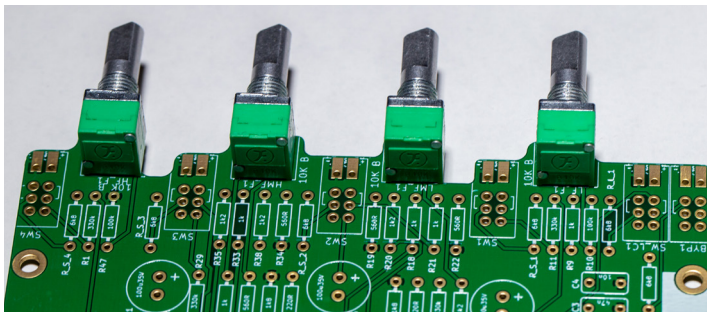




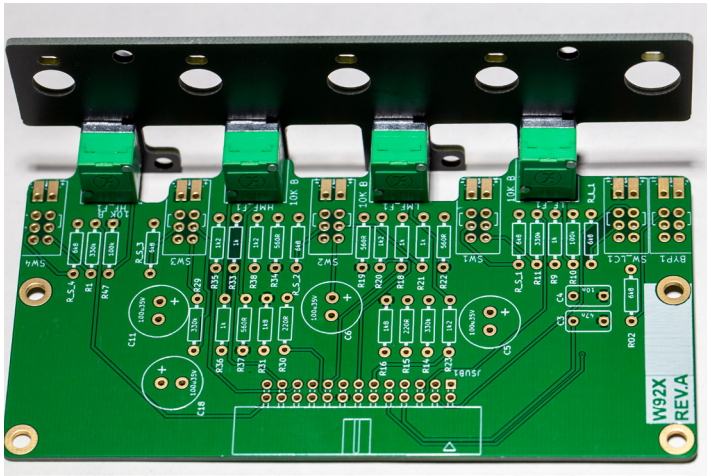
I cut all the pins before soldering, then they look better, but you can also cut them afterwards. Then unscrew the board from the bracket again.

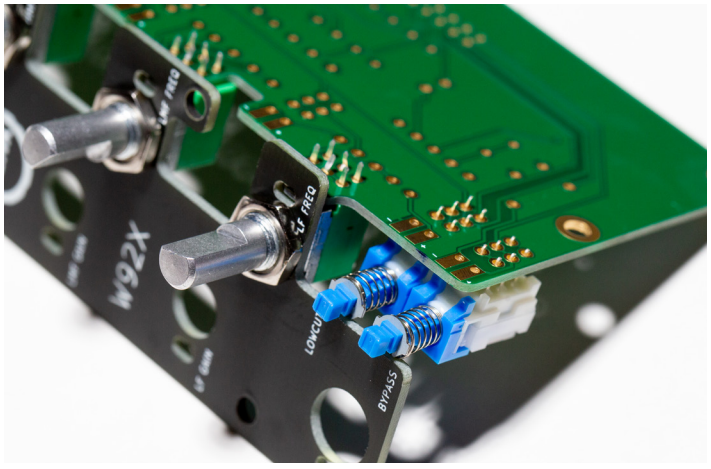


The next step is focusing on the pots and switches of the upper subboard, we can solder all pots and switches. Make sure to press them flush and firm to the poard and fix them with one solder point.

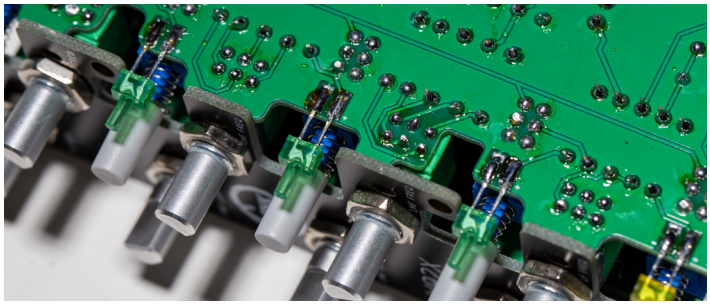


Check the alignment of the switches and pots from the upside again and try to bring them in line like the silkscreen is printed. After that install the blank bracket on the upper subboard and solder the pots in place.

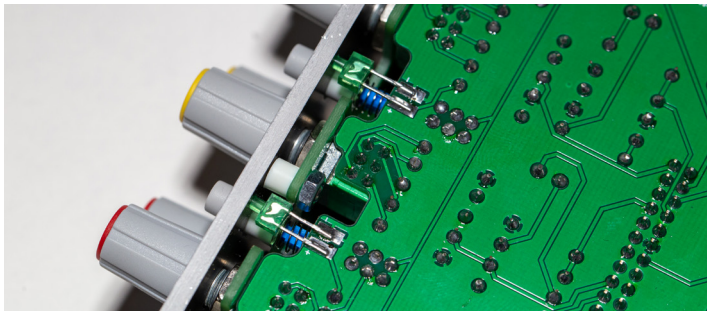




Now it‘s time to use the Frontpanel for the first time to get the Switches and LEDs in place. Use the spacers and bring the Frontpanel in place with the subboard. You can use the nuts to screw it together, but you also can use clamps to press bracket and frontpanel together. Install the pushbuttons and rearrange the switches on the PCB until they are in the middle of the hole of the Frontpanel. After this process you can solder them completley. After soldering in all of the Pots and Switches make sure that their leads are also trimmed short.



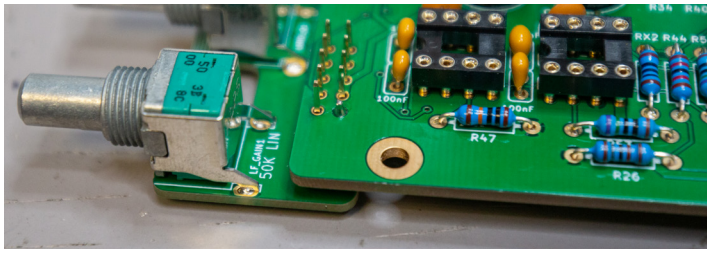
Now we will cut the LEDs legs. Make sure you have the right leg for + and - (Long leg is + and short leg is -). I usually don´t cut them straight and keep two different size legs, so you still know which leg is + and which is -. Make sure the LED is sitting flush with the frontpanel. First solder one leg to make sure the LED is in place, then solder the other leg. After soldering all LEDs to the Mainboard unscrew the Frontpanel and bracket again, we need that for next step.



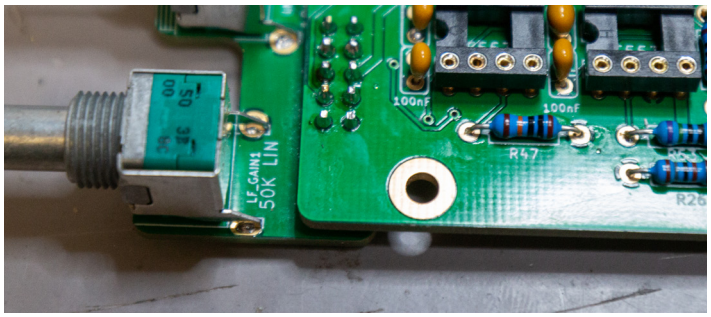
Final Assembly

For the final assembly we need first to bring the small subboard and the mainboard together. For this we need to build two small adapters for the right height. We use a screw and a nut from the hardware pack. Both adapters used in the corners and are placed there just during the process of soldering on a table.

Now we gonna solder the pins of the headers. First one pin of each row. Every time we solder one pin we press the boards together.

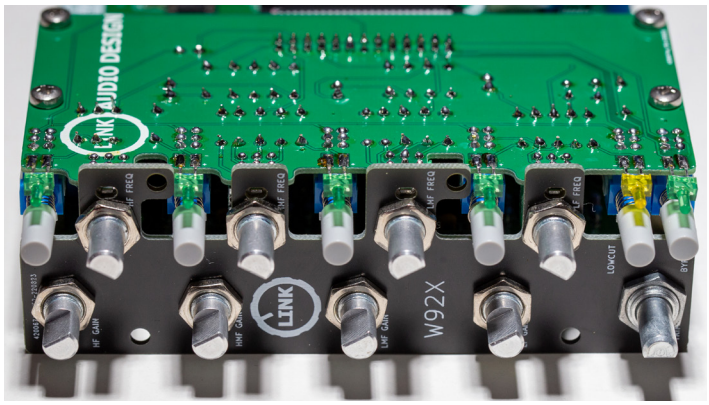


After that we can solder all the other pins and cut the pins also as short as possible. Then you can split our built adapter screws in two parts again.

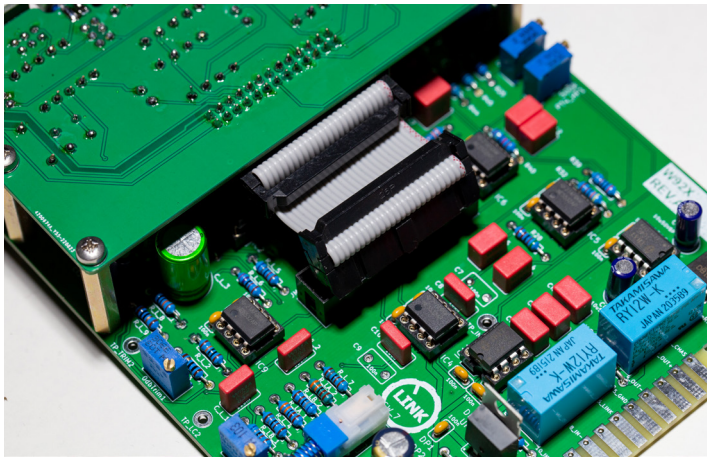


Now we have soldered all parts and want to check without the IC and Opamps installed if the voltages are right. For that we don‘t use the Frontpanel or the bracket. We use the ribbon cables to connect the boards. Use an adapter for your lunchbox/or power it up on another way to measure all Voltages near the ICs. The Voltage Meter should show something close to +/-15,3V, because of the drop of the diodes at the power input. Check also if the LEDs are working and the relais are switching. If everything seems good install the ICs. Check the Orientation of each IC before installing. Check the Datasheets of NE5532, THAT1246 and THAT1646 to find the Input Pins where the Opamps get their Supply Voltage.

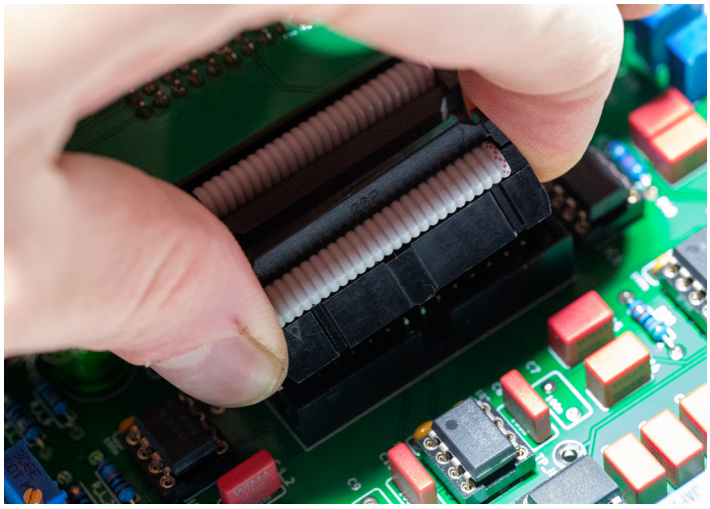
First we use the bracket to install the mainboard with the M7 nuts for the Gain and Frequency Pots.



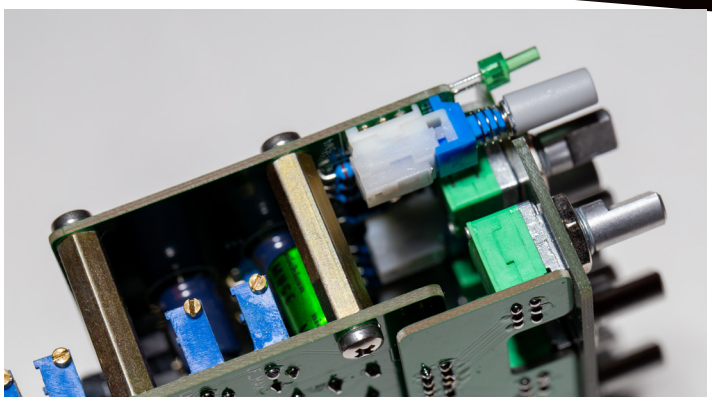
Then check all ICs for the right orientation again. Next put all the ribbon cables on the mainboard.



Now we install the upper subboard by holding it angled and connect the ribbon cables at the same time.

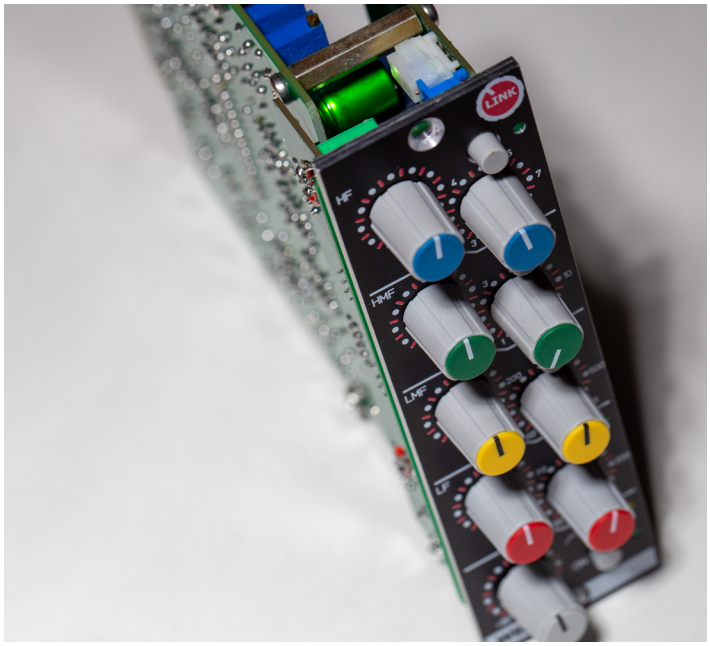


Now we add the 24mm Spacers between the two boards and screw them together.

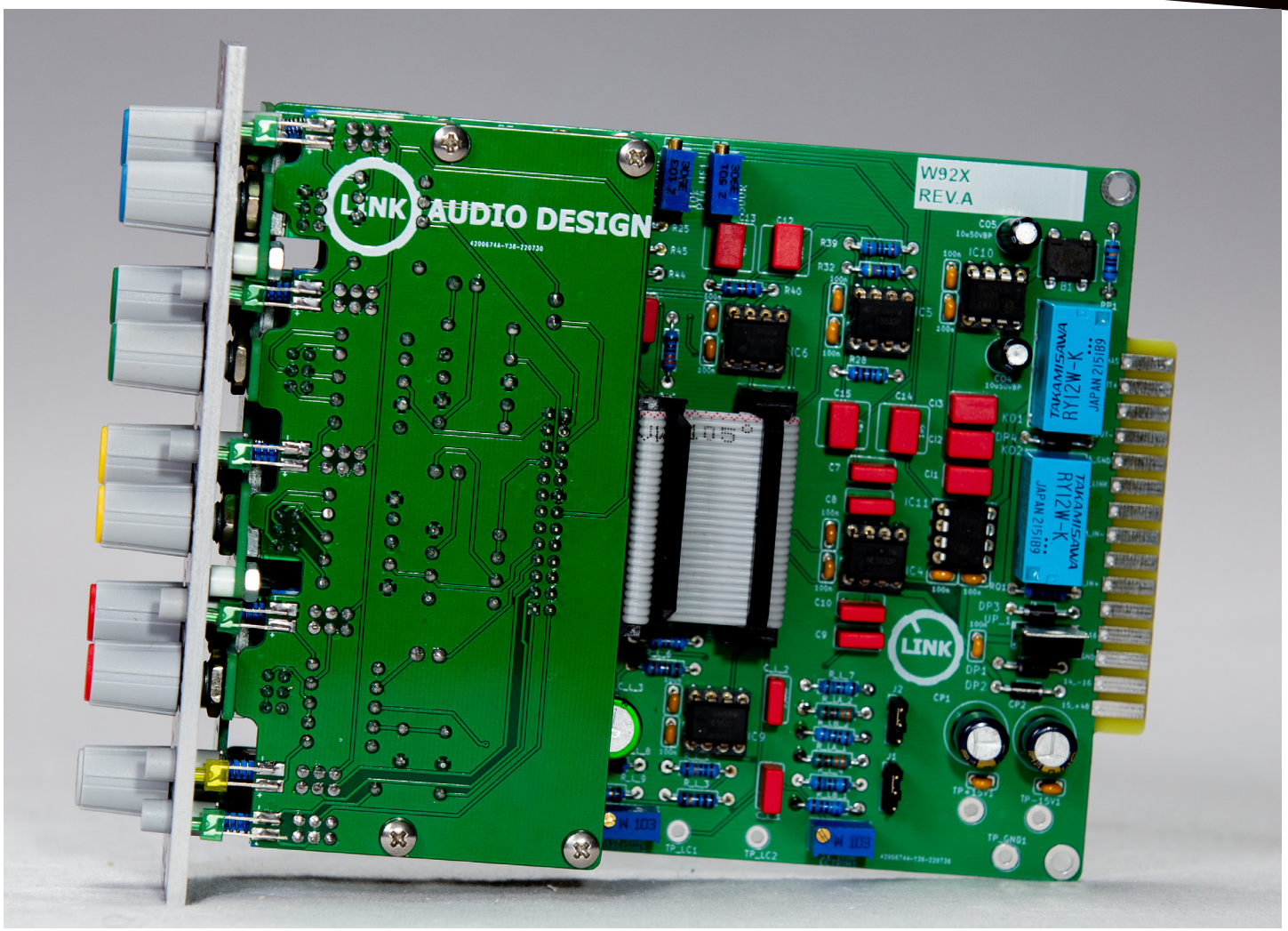


Now it‘s time to add the Frontpanel to complete the Equalizer. Use the spacers and the M3 Nuts to finish it. The Caps for the Knobs are sorted as following:

Blue - HF
Green - HMF
Yellow - LMF
Red - LF
Grey - Trim



After finishing try to run an Audio Signal thru the Unit and try all switch modes, if everything works fine. If you have a bump when switching the Low or Highcut Filter, don‘t worry these filters need to be calibrated to have the right level. Try also if all Gains and Frequency Pots are working. You can do that either in the measure software or with Audio Signals. In the next step we will calibrate this wonderful Equalizer.



Calibration

Calibration of this unit is no Rocket Science and it‘s quite easy. You need to playback different Sinus tones in different levels and frequencies. Make sure you have enough headroom that you don‘t get clipping when capturing the response of the EQ. I try to have at least 20dB headroom before my interface clips. That Calibration works with every DAW but the easiest way to calibrate this EQ is using the freeware sofware REW.

First of all we need a constant reference level, I use the Software REW. I calibrated my Output Measure signal to +6dBU as my maximum output and Input, you should read on your multimeter 1,545Volts. My reference Sine signal is set at -12dBU. The Voltage equilvalent on your multimeter should be 0,154Volts. I switch in REW for a better Overview to dBFS scaling.

To calibrate your Measuring System and learning about levels I highly recommend. The Setup of REW by DIYRE (3 parts on Youtube):

https://www.youtube.com/watch?v=OwwKV-4QTfwU

To calculate levels i use the Calculator of Sengpiel:

http://www.sengpielaudio.com/Rechner-db-volt.htm

Calibrating the Unit

- First set all controls to their detent positions
- Switch the EQ section in
- Send a constant White Noise signal through the unit and check all bands if they work, check boost and cut of each band and also change frequency
- You can check that with a scope or by hearing on a control system if the unit changes the sound
- If all of the above mentioned conditions are met we can calibrate the bands
- Set your reference Signal to SINE-SIGNAL

Output Trim Calibration

- First set all controls to their detent positions
- Set all Bands to off
- Set Output Trim on the Frontpanel to its Center Detent postion
- Switch the EQ section in
- Send 1kHz Sine Signal at +6dBu in the unit.
- Connect a Probe to TP_IN1 and GND and measure AC Voltage. You should read here 1,32Volts
- Connect a Probe to TP_TRIM2 and GND and measure AC Voltage.
- Adjust the **‚0DbTrim1‘** trimmer until the output level is at the same Voltage. You can meausre also the level with REW and match input and Output

Low Cut Calibration

- Set all Bands to off
- Set Output Trim on the Frontpanel to its Center Detent postion
- Switch the EQ section in
- Switch the Low Cut section in
- Send 1kHz Sine Signal at +6dBu in the unit.
- Connect a Probe to TP_IN1 and GND and measure AC Voltage. You should read here 1,32Volts
- Connect a Probe to TP_LC2 and GND and measure AC Voltage.
- Adjust the **‚LCTRIM1‘** trimmer until the output level is at the same Voltage. You can meausre also the level with REW and match input and Output

HF Calibration

- First set all controls to their detent positions
- Set the Oscillator frequency to 3kHz(-12dBU)
- Switch the EQ section in
- Switch HF Section in, other switches off
- Full HF Boost CW(clockwise +15dB)
- HF Frequency Fully ACW(anti clockwise 3kHz)
- Adjust **‚HF_MAX‘** trimmer that the level meter reads 15dB Boost.

HMF Calibration

- First set all controls to their detent positions
- Set the Oscillator frequency to 1kHz(-12dBU)
- Switch the EQ section in
- Switch HMF Section in, other switches off
- Full HMF Boost CW(clockwise +15dB)
- HMF Frequency Fully ACW(anti clockwise 1kHz)
- adjust generator frequency and find the maximum level (peak of the curve)
- Adjust **‚HMF_MAX‘** trimmer that the level meter reads 15dB Boost.

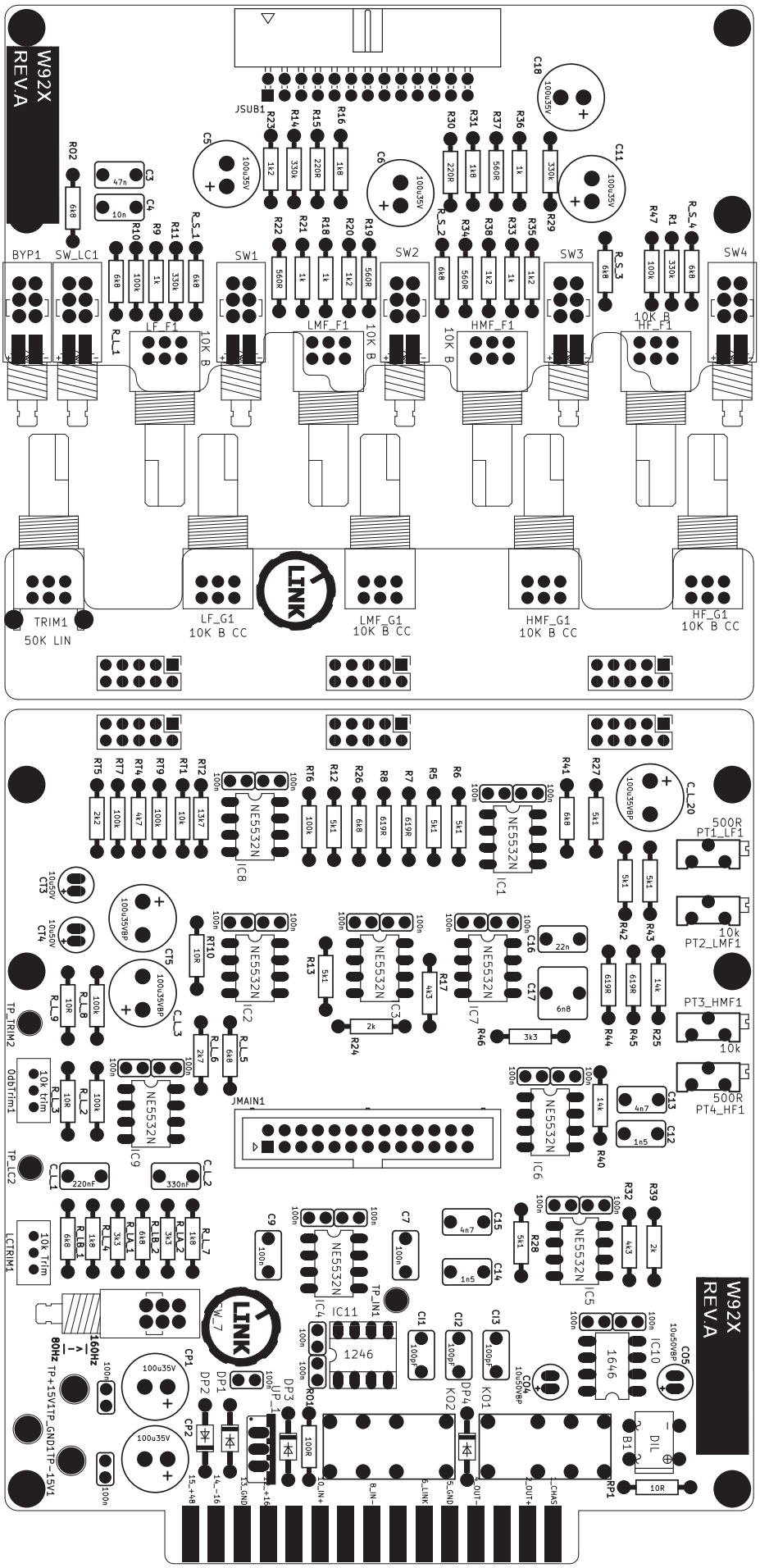
LMF Calibration

- First set all controls to their detent positions
- Set the Oscillator frequency to 1kHz(-12dBU)
- Switch the EQ section in
- Switch LMF Section in, other switches off
- Full LMF Boost CW(clockwise +15dB)
- LMF Frequency Fully CW(clockwise 1kHz)
- adjust generator frequency and find the maximum level (peak of the curve)
- Adjust **‚LMF_MAX‘** trimmer that the level meter reads 15dB Boost.

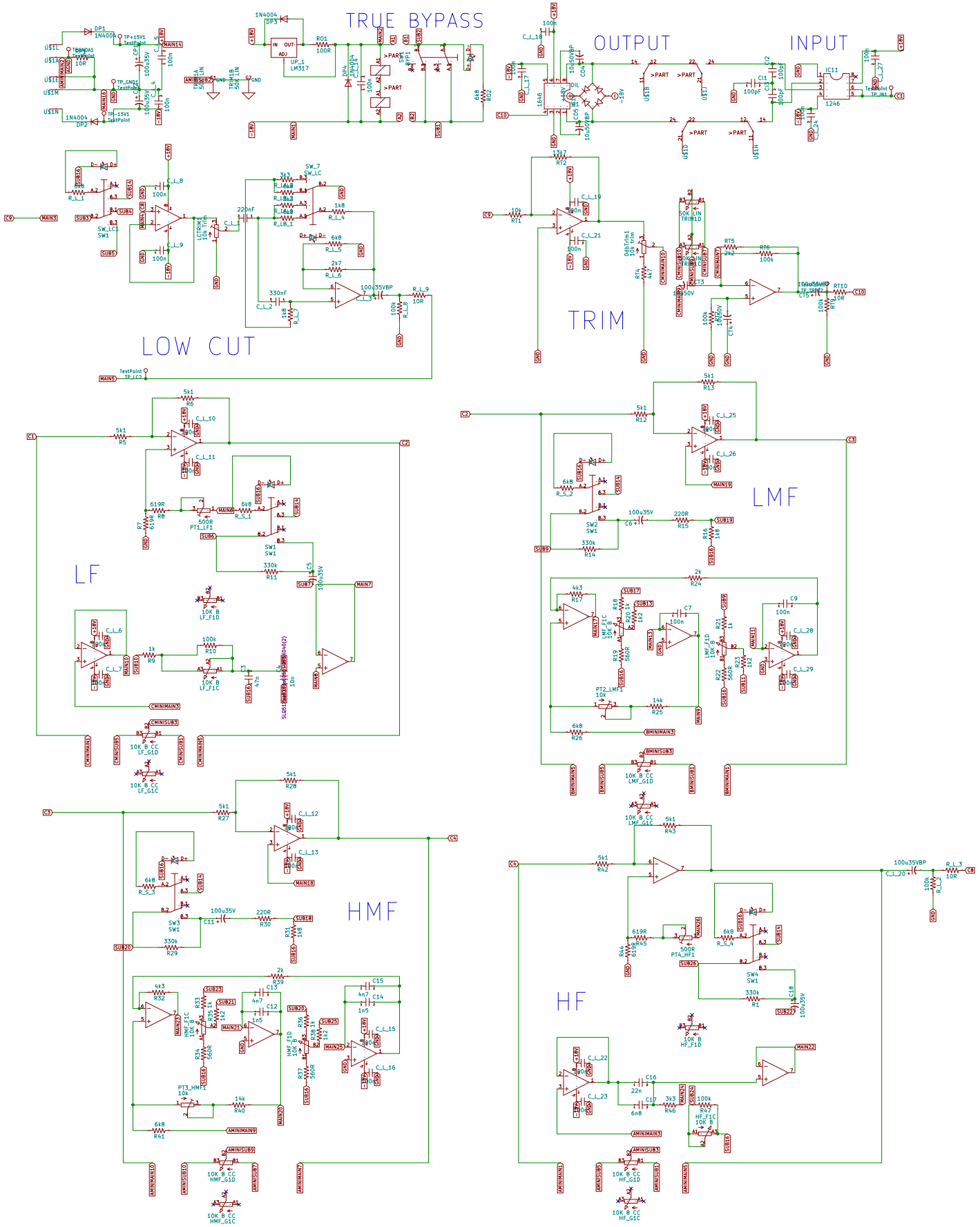
LF Calibration

- First set all controls to their detent positions
- Set the Oscillator frequency to 400Hz(-12dBU)
- Switch the EQ section in
- Switch LF Section in, other switches off
- Full LF Boost CW(clockwise +15dB)
- LF Frequency Fully CW(clockwise 400Hz)
- Adjust **‚LF_MAX‘** trimmer that the level meter reads 15dB Boost.

PCB layout for reference



Schematics



Bill of Materials (BOM)

ID	PART ON PCB	TYPE	COUNT	VALUE
1	R1,R11,R14,R29	RESISTOR	4	330k
2	R_S_4,R_S_1,R_S_3,R_L_1,R_S_2,RO2,R_L_5,R26 ,R_LB_1,R41,R_LB_2	RESISTOR	11	6k8
3	R10,R47,R_L_2,RT6,RT7,RT9,R_L_8	RESISTOR	7	100k
4	R23,R20,R35,R38	RESISTOR	4	1k2
5	R31,R16,R_L_7,R_L_4	RESISTOR	4	1k8
6	R21,R36,R18,R9,R33	RESISTOR	5	1k
7	R19,R37,R22,R34	RESISTOR	4	560R
8	R15,R30	RESISTOR	2	220R
9	R8,R7,R45,R44	RESISTOR	4	619R
10	R_L_3,R_L_9,RP1,RT10	RESISTOR	4	10R
11	R40,R25	RESISTOR	2	14k
12	R17,R32	RESISTOR	2	4k3
13	R39,R24	RESISTOR	2	2k
14	R46,R_LA_2,R_LA_1	RESISTOR	3	3k3
15	RT5	RESISTOR	1	2k2
16	RT4	RESISTOR	1	4k7
17	R_L_6	RESISTOR	1	2k7
18	RO1	RESISTOR	1	100R
19	R13,R5,R6,R28,R27,R12,R42,R43	RESISTOR	8	5k1
20	RT1	RESISTOR	1	10k
21	RT2	RESISTOR	1	13k7
22	C_L_27,C_L_28,C_L_18,C_L_14,C_L_10,C_ L_16,C_L_6,C_L_23,C_L_24,C_L_29,C_L_1 7,C_L_21,C_L_26,C_L_22,C_L_19,C_L_11,- C_L_15,C_L_25,C_L_4,C_L_13,C_L_7,C_L_5,- C_L_12,C_L_9,C_L_8	CERAMIC 2,5mm	25	100nF
23	CI2,CI3,CI1	WIMA 5mm	3	100pF
24	C4	WIMA 5mm	1	10n
25	C3	WIMA 5mm	1	47n
26	C7,C9	WIMA 5mm	2	100n
27	C_L_1	WIMA 5mm	1	220nF
28	C_L_2	WIMA 5mm	1	330nF
29	C16	WIMA 5mm	1	22n
30	C13,C15	WIMA 5mm	2	4n7
31	C14,C12	WIMA 5mm	2	1n5
32	C17	WIMA 5mm	1	6n8

33	C_L_3,C_L_20,CT5	ELECTROLYT	3	100u 25V/35V BiPolar
34	CO4,CO5	ELECTROLYT	2	10u35V/50V BiPolar
35	C18,C6,C11,C5,CP2,CP1	ELECTROLYT	6	100u35V
36	CT4,CT3	ELECTROLYT	2	10u50V
37	PT2_LMF1,PT3_HMF1	TRIMMER	2	10k Trim 64Z
38	0dbTrim1, LCTRIM1	TRIMMER	2	10k Trim 64W
39	PT4_HF1,PT1_LF1	TRIMMER	2	500R Trim64Z
40	DP2,DP1,DP4,DP3	DIODE	4	1N4007
41	ON, Filter Bands	GREEN LED	5	FLAT LED
42	Low Cut	YELLOW LED	1	FLAT LED
43	JMAIN1	CONNECTOR	1	Conn_02x13_ Odd_Even
44	JSUB1	CONNECTOR	1	Conn_02x13_ Odd_Even
45	Buscable	BUSCABLE	1	Buscable
46	Interconnect	INTERCON	3	Interconnect
47	KO2,KO1	RELAIS	2	RY12W-K
48	UP_1	RECTIFIER	1	LM317
49	SW_7 SW1,SW3,SW2,SW4,SW_LC1,BYP1	SWITCH	6	ALPS
50	TRIM1	POT	1	50K LIN
51	HF_F1,HMF_F1,LF_F1,LMF_F1	POT	4	10K B
52	LF_G1,LMF_G1,HF_G1,HMF_G1	POT	4	10K B CC
53	IC10	OPAMP	1	THAT1646
54	IC11	OPAMP	1	THAT1246
55	IC5,IC1,IC7,IC2,IC9,IC3,IC4,IC6,IC8	OPAMP	9	NE5532
56	B1	RECTIFIER	1	DIL
57	SOCKET-08	SOCKET	11	GS 8P
58	24mm Spacer	HARDWARE	4	24mm Spacer
59	Screw M3	HARDWARE	8	Screw M3
60	Nut M3	HARDWARE	4	Nut M3
61	Spacer 0.145	HARDWARE	4	Spacer 0.145
62	Washer M7	HARDWARE	8	Washer M7
63	Screw M7	HARDWARE	8	Screw M7
64	Washer M9	HARDWARE	1	Washer M9
65	Screw M9	HARDWARE	1	Screw M9

66	Pushbutton Knob	KNOB	6	Pushbutton Knob
67	Knob 11mm	KNOB	9	Knob 11mm
68	Knobcap Green	KNOB	2	Knobcap Green
69	Knobcap Blue	KNOB	2	Knobcap Blue
70	Knobcap Red	KNOB	2	Knobcap Red
71	Knobcap Yellow	KNOB	2	Knobcap Yel-low
72	Knobcap Grey	KNOB	1	Knobcap Grey
73	Mainboard	MAINBOARD	1	Mainboard
74	Subboard1	SUBBOARD	1	Subboard1
75	Subboard2	POTBOARD	1	Subboard2
76	Backpanel	BACKPANEL	1	Backpanel
77	Frontpanel	FRONTPANEL	1	Frontpanel