

SLQ51X BLACK

Introduction

Let me Introduce this nice Program - Equalizer in the Style of a British 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 Black 4000 EQ with an extra THAT 1246 In- and THAT 1646 Outputstage. In my Version I added switchable Low Cut and High Cut Filters for full Flexibility in colouring the sound with this EQ Module. This Guide will help with setting up this nice EQ. Have Fun!

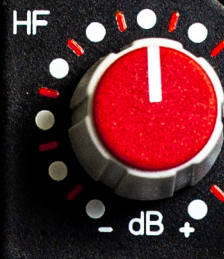
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DISCLAIMER: Proceed at your own risk. I am not liable for any damage, harm or loss of any kind resulting from the assembly and/or use of this PCB set. Safety provisions should always be exercised whenever working with any electronics. The following 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 +/-18dB Gain



This Button switches from BELL-MODE into SHELF-MODE of the HF-Band

This Pot levels the amount of the High Mid Frequency Band in a range of +/-18dB Gain



This Pot sets the Frequency of the High Frequency Band in a range of 1.4kHz to 14kHz

This Pot sets the Q-Factor of the HMF Band from narrow to wide



This Pot sets the Frequency of the High Mid Frequency Band in a range of 0.6kHz to 7kHz

This Button enables the High Cut Frequency Filter at 8kHz

This Pot levels the amount of the Low Mid Frequency Band in a range of +/-18dB Gain



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

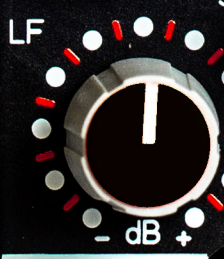
This Switch enables the Low Cut Frequency Filter at 80 Hz

This Pot sets the Q-Factor of the HMF Band from narrow to wide



This Pot sets the Frequency of the Low Mid Frequency Band in a range of 0.2kHz to 2 kHz

This Pot levels the amount of the Low Frequency Band in a range of +/-18dB Gain



This Pot sets the Frequency of the Low Frequency Band in a range of 30 Hz to 450 Hz

This Buttons switches from BELL-MODE into SHELF-MODE of the LF-Band



SLQ51X

Variants of Filters

First of all these nice High and Low Cut Filters are set at fixed Frequencies. In my design i set this Frequency for the Low Cut at 80Hz and for the High Cut at 8kHz. For learning about Filter design I really can recommend this webpage:

<http://sim.okawa-denshi.jp/en/Fkeisan.htm>

For all that want to change these Frequencies, you are welcome to do it on your own by changing some resistor values. The Calibration Process of this Filter will shown at the end of the guide.

LOW CUT Resistor changes

Change these to the same value **RH8,RH9,RH10**

50Hz - 33k

60Hz - 27k

80Hz - 20k (standard value supplied with the kit)

100Hz - 16k

120Hz - 13k

160Hz - 9.1K

HIGH CUT Resistor changes

Change these to the same value **RL10,RL8,RL9**

5Khz - 330R

6Khz - 270R

8Khz - 200R (standard value supplied with the kit)

10kHz - 160R

12Khz - 130R

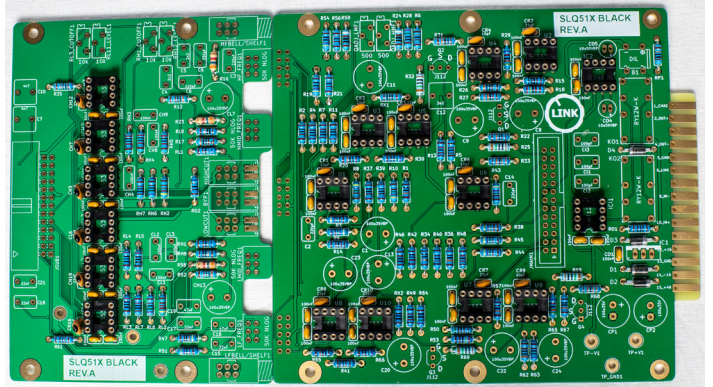
16Khz - 91R

Stuffing Boards

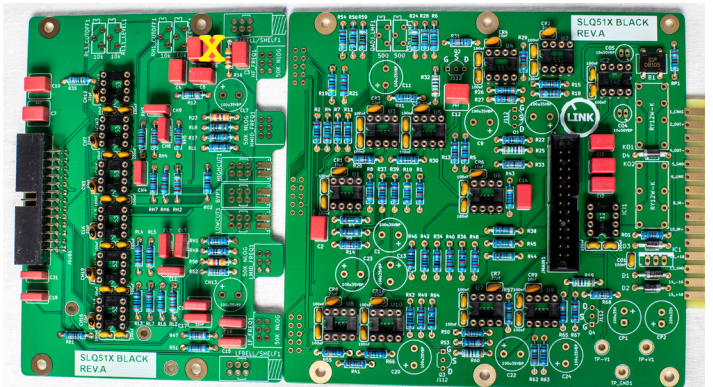
ATTENTION DON'T USE C6 (330pF) JUST LEAVE BLANC! HIGHLIGHTED WITH CROSS

After we decided which High and Low Cut Filters we want use, we will go over to stuffing the 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!

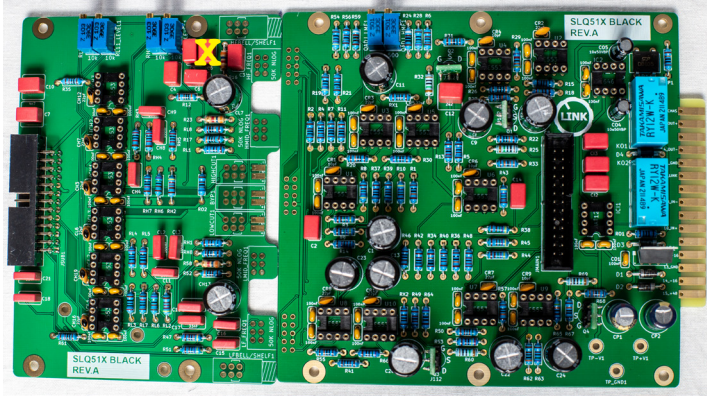
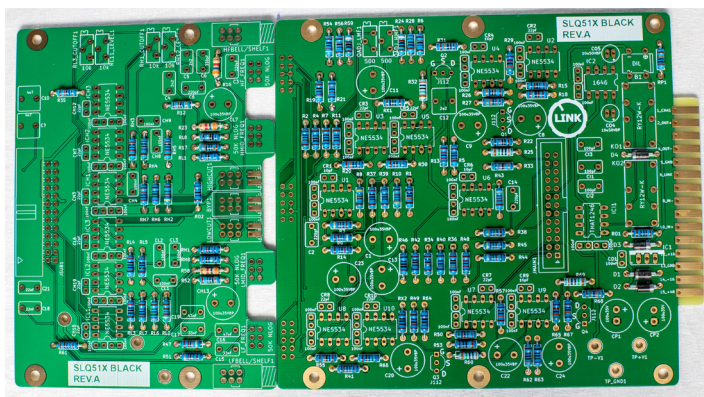
After Placing and Soldering all Resistors, we solder the next bigger parts like IC-Sockets and small Capacitors, like 37x100nF and 16x22pF



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.

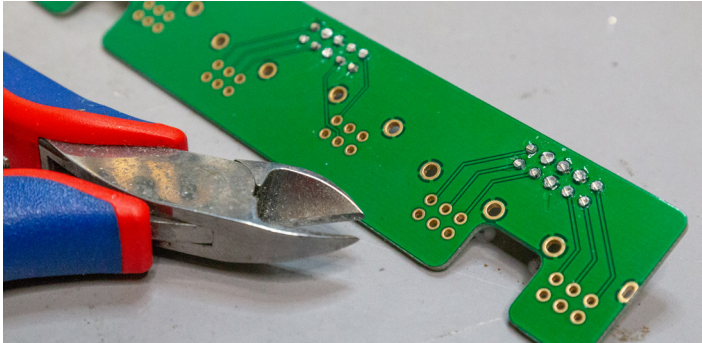


Now we change over to bigger parts like Relais, Voltage Regulator, JFETs and Electrolyt Capacitors. Pay extra attention to the orientation of CP3 and CP4 as they are polarized. The other Capacitors are Non-Polarized/Bipolar so the Orientation doesn't matter. After this step you can clean the boards. 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.

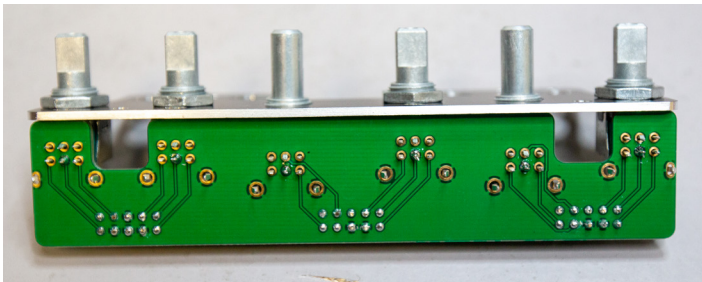


Potentiometers, Switches and LEDs

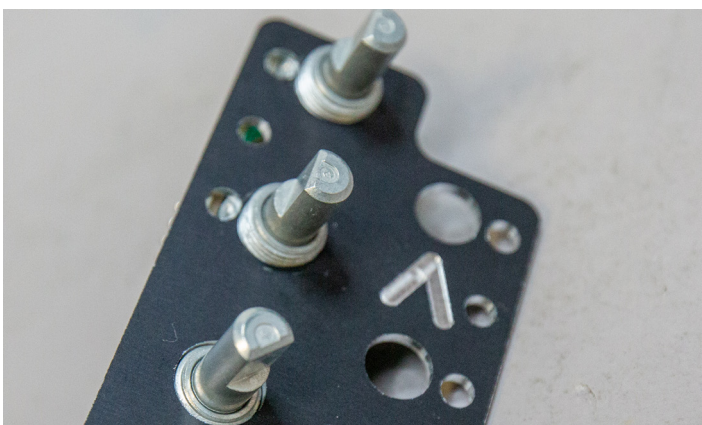
Now we are heading again to the subboards. First we take the small one and cut all leads of the pinrows as short as possible. We will be doing this process later also with the potentiometers since we need to make sure that this Equalizer don't touch any neighbour modules of any kind



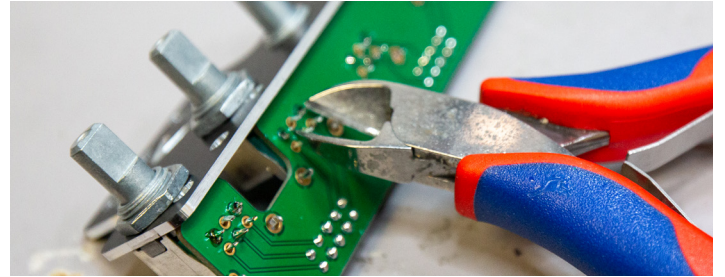
After we shortened all the pins we install all pots on this board at the same time. Get all pots on the PCB and solder just one pin in the middle and press the POT as much as possible on to the PCB. After Soldering one Pin make sure the alignment of the pot is flush and straight. You can check that with printed silkscreen on the PCB.



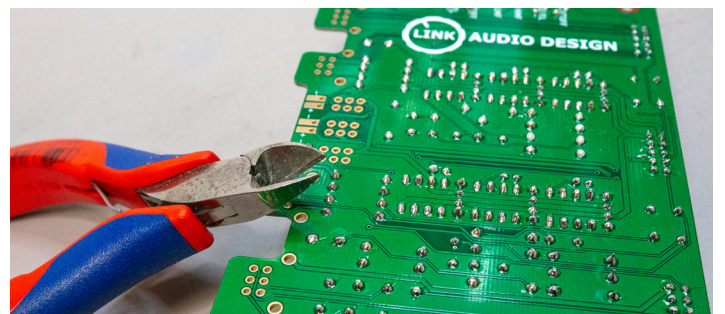
After having one pin of each pot soldered we add the bracket like shown in the picture above. The direction of the bracket is shown in the picture below. After having all pots screwed to the bracket, we can solder all pins, then we need to cut the pins.



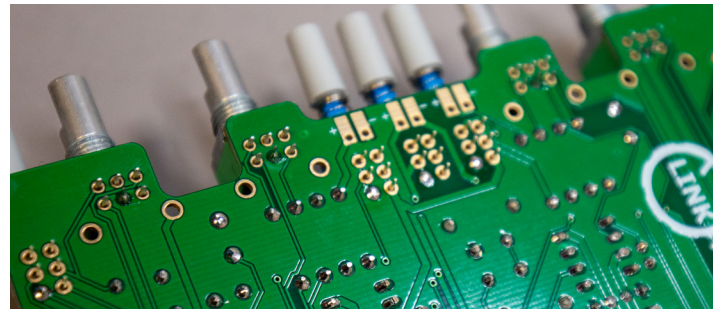
I cut all the pins before soldering, then they look better, but you can also cut them afterwards. Then unscrew the board from the bracket again.



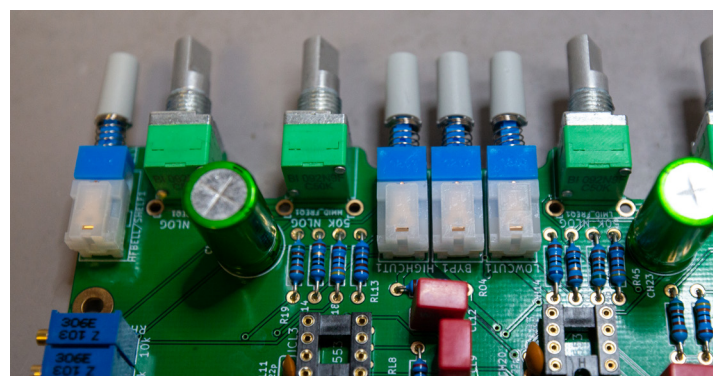
In the next Step we cut all leads on the upper subboard as short as possible.



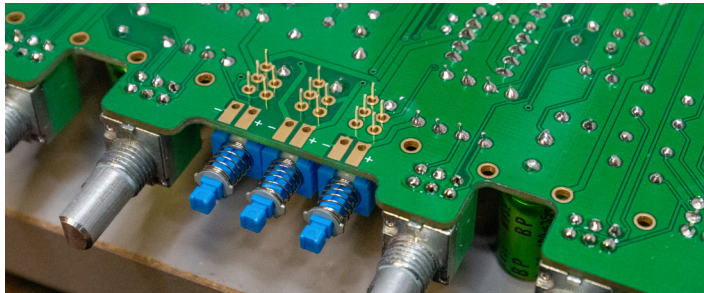
The next step is focusing on the pots and switches of the upper subboard, we can solder all pots and switches. Make sure to press them flush and firm to the board and fix them with one solder point.



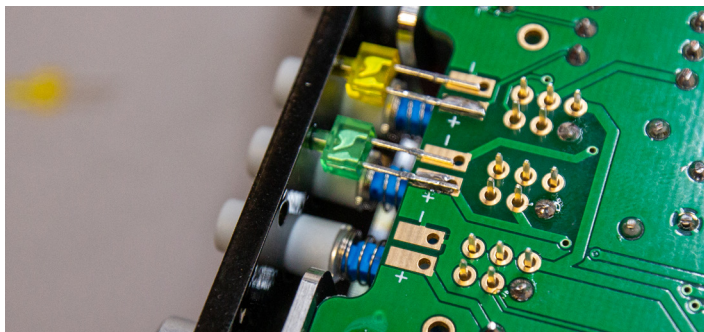
Check the alignment of the switches and pots from the upside again and try to bring them in line like the silkscreen is printed. After that install the blank bracket on the upper subboard and solder the pots in place.



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 completely. 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.

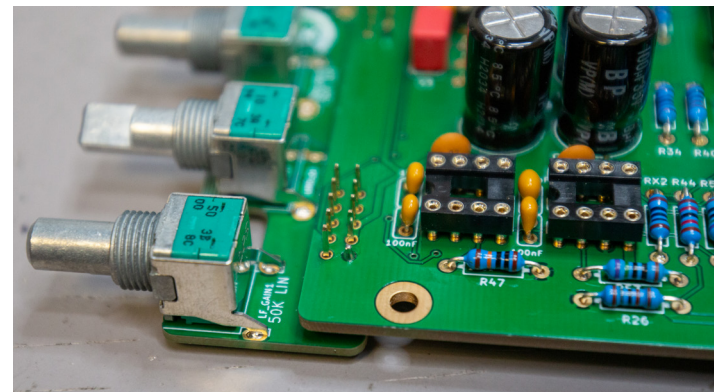


Final Assembly

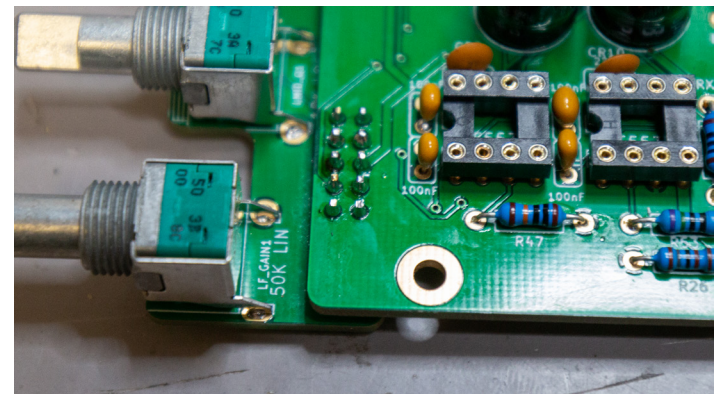
For the final assembly we need first to bring the small subboard and the mainboard together. For this we need to build two small adapters for the right height. We use a screw and a nut from the hardware pack. Both adapters used in the corners and are placed there just during the process of soldering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

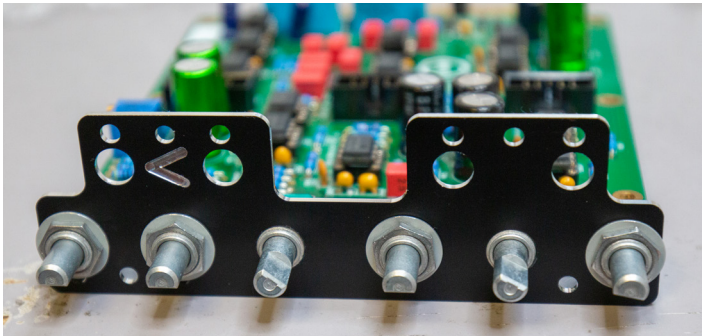


After that we can solder all the other pins and cut the pins also as short as possible. Then you can split our built adapter screws in two parts again.

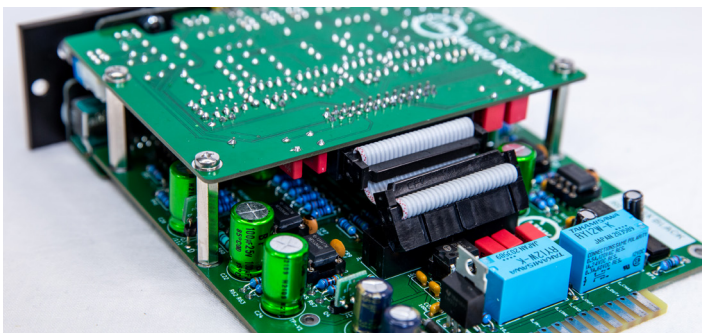


Now we have soldered all parts and want to check **without the IC and Opamps installed if the voltages are right.** For that we don't use the Frontpanel or the bracket. We use the ribbon cables to connect the boards. Use an adapter for your lunchbox/ or power it up on another way to measure all Voltages near the ICs. The Voltage Meter should show something like +/-15,3V, because of the drop of the diodes at the power input. Check also if the LEDs are working and the relays are switching. If everything seems good install the ICs. Check the Orientation of each IC before installing.

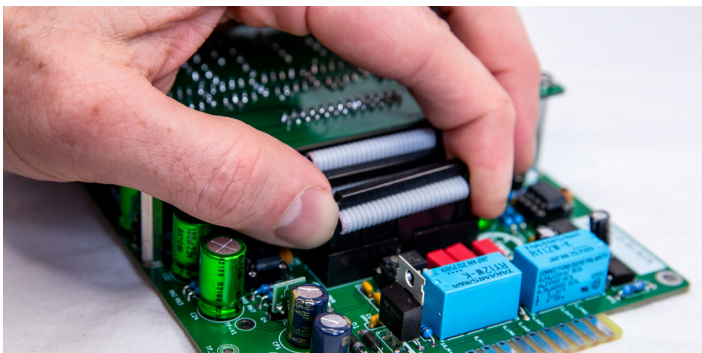
First we use the bracket to install the mainboard with the M9 nuts for the Gain Pots.



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



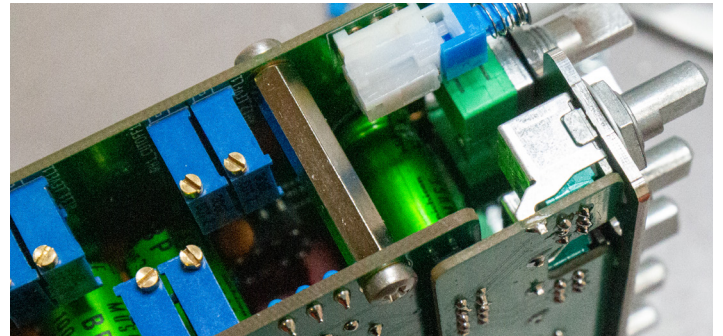
Now we install the upper subboard by holding it angled and connect the ribbon cables at the same time.



Add the nuts for the M7 Frequency Pots.

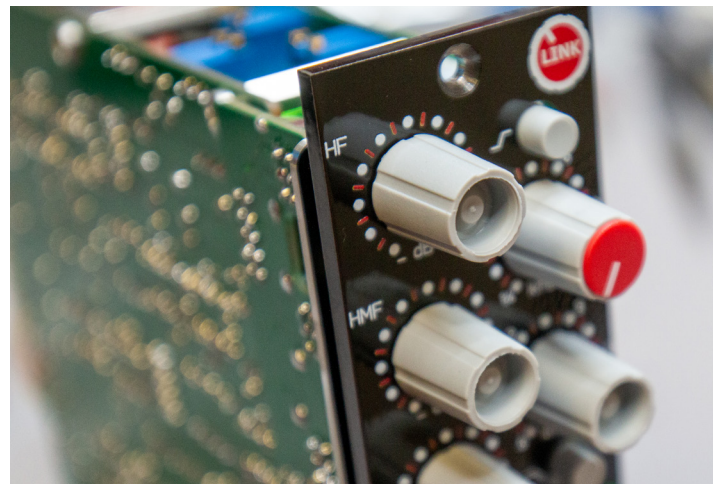


Now we add the 25mm Spacers between the two boards and screw them together.

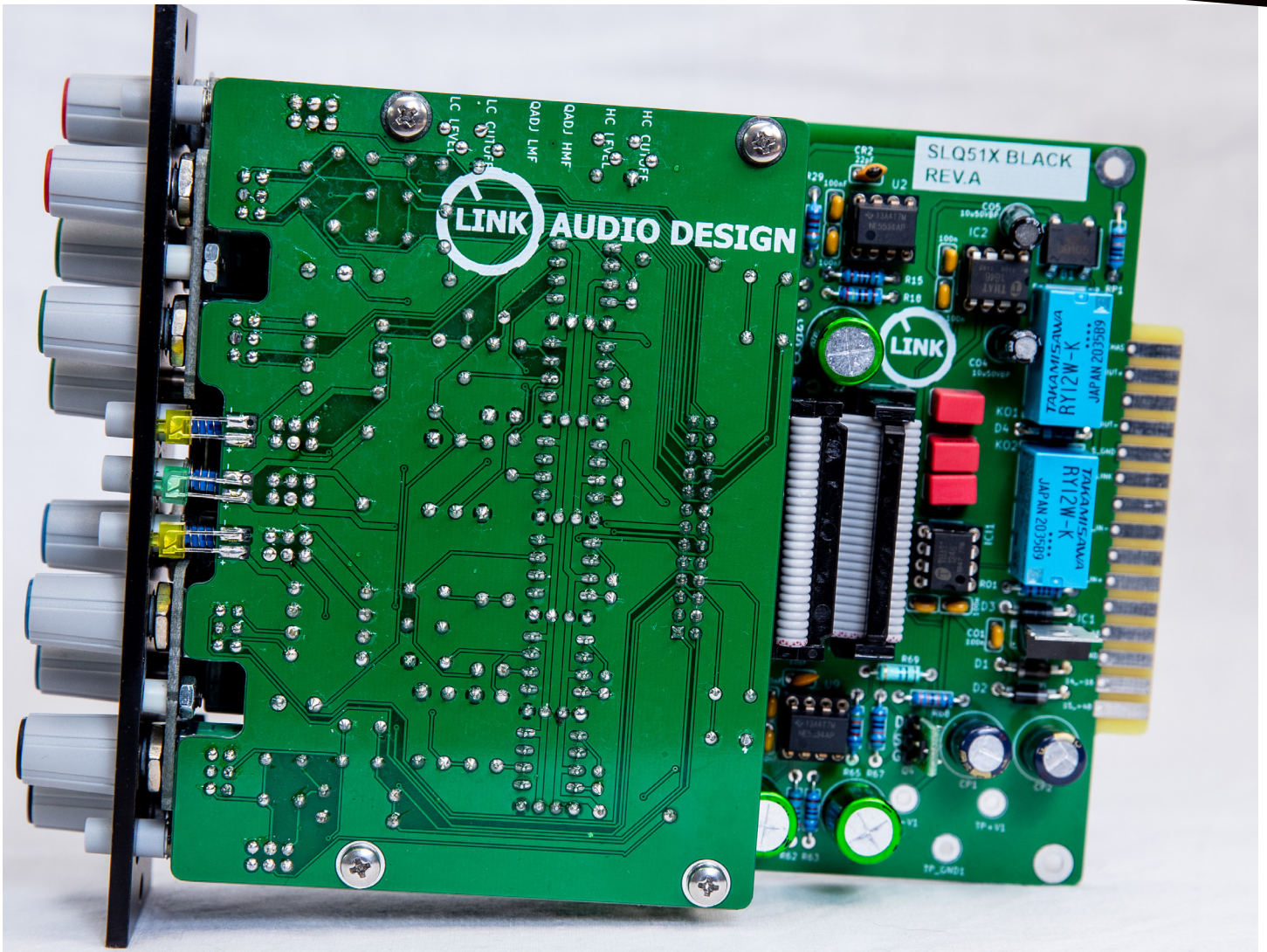


Now it's time to add the Frontpanel to complete the Equalizer. Use the spacers and the M3 Nuts to finish it. The Caps for the Knobs are sorted as following:

- Red - HF**
- Green - HMF**
- Blue - LMF**
- Black - LF**



After finishing try to run an Audio Signal thru the Unit and try all switch modes, if everything works fine. 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. That works with every DAW but the easiest way to calibrate this EQ is using the freeware software REW.

Calibrating HMF and LMF

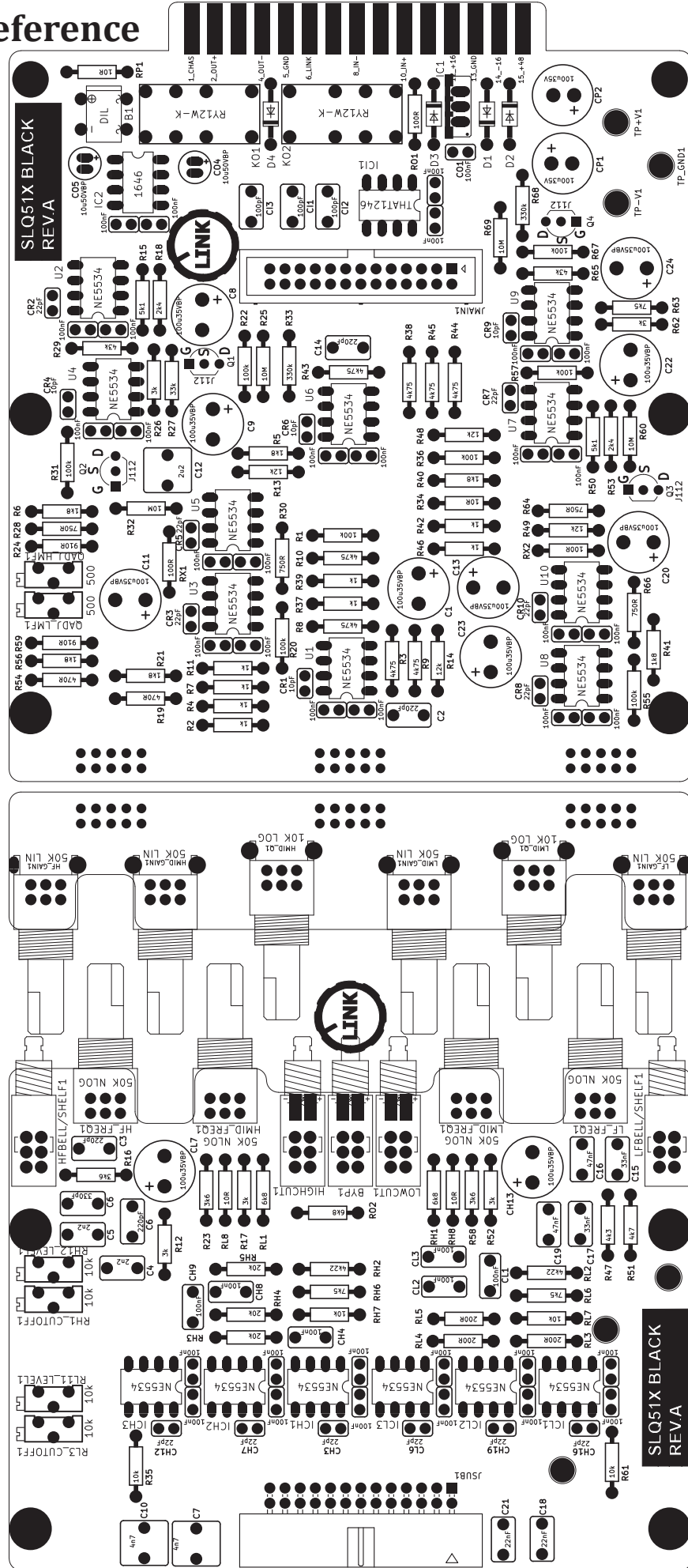
Set the Oscillator frequency to 3kHz, switch the EQ section in with full HMF boost, and narrow ,Q'. All other gain controls should be set to their detent positions (flat). Adjust the frequency control until the output level peaks. At this frequency and ,Q' setting the Boost/Cut control should give +18dB of gain. Set the **Q-Adjust trimmer** that you read a boost of +18dB. This should be set with the preset control marked ,**QADJ HMF**'. Repeat the above at 1kHz for the LMF section using ,**QADJ LMF**'. There is no ad-

justment for the HF or LF sections.

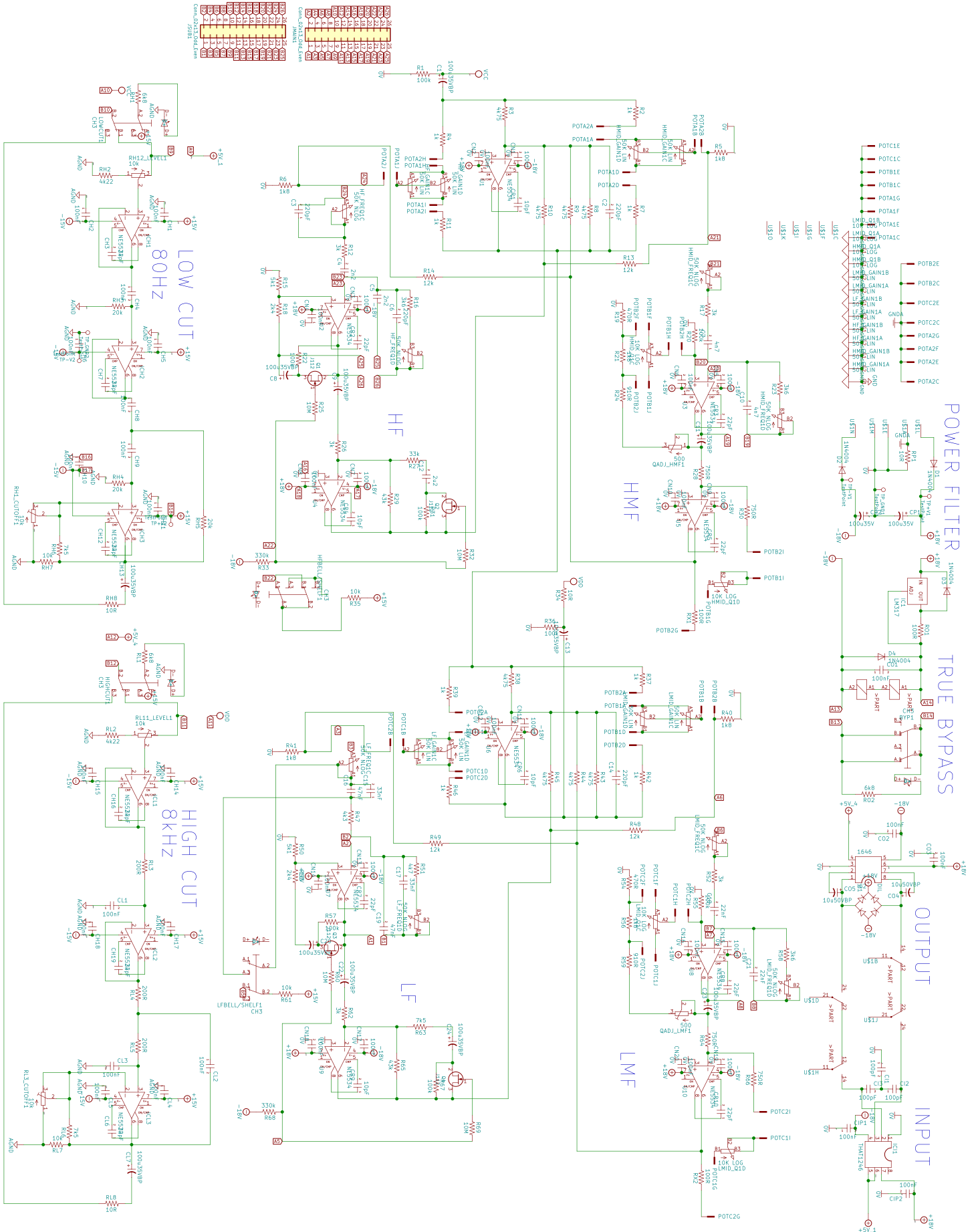
Calibrating LOW CUT and HIGH CUT

Set the Oscillator frequency to 1kHz. All gain controls should be set to their detent positions (flat). Enable LOW CUT Switch and read Level. Adjust ,**LC LEVEL**' to the Same Level you are reading without Low Cut enabled. Then Set the Oscillator frequency to 80Hz. Read the Level and then adjust then ,**LC CUTOFF**' Trimmer. You should now read a -3dB drop at 80 Hz. Set the Oscillator frequency to 1kHz and adjust the Low Cut Level to the same Level you are reading without Low Cut enabled. After that set the Oscillator frequency to 80Hz and check if the drop is -3dB at 80Hz. Repeat this process until both conditions are set. When you're done with Low Cut repeat this process for the High Cut, First 1Khz with ,**HC LEVEL**' then 8 KHz and -3dB drop with ,**HC CUTOFF**'. Both Calibration need some time but if done, congratulation to your SLQ51X !

PCB layout for reference



Schematics



Component	Value	Component	Value
U1	NE5534	U6	NE5534
U2	NE5534	U7	NE5534
U3	NE5534	U8	NE5534
U4	NE5534	U9	NE5534
U5	NE5534	U10	NE5534
R1	100k	R51	100k
R2	100k	R52	100k
R3	100k	R53	100k
R4	100k	R54	100k
R5	100k	R55	100k
R6	100k	R56	100k
R7	100k	R57	100k
R8	100k	R58	100k
R9	100k	R59	100k
R10	100k	R60	100k
R11	100k	R61	100k
R12	100k	R62	100k
R13	100k	R63	100k
R14	100k	R64	100k
R15	100k	R65	100k
R16	100k	R66	100k
R17	100k	R67	100k
R18	100k	R68	100k
R19	100k	R69	100k
R20	100k	R70	100k
R21	100k	R71	100k
R22	100k	R72	100k
R23	100k	R73	100k
R24	100k	R74	100k
R25	100k	R75	100k
R26	100k	R76	100k
R27	100k	R77	100k
R28	100k	R78	100k
R29	100k	R79	100k
R30	100k	R80	100k
R31	100k	R81	100k
R32	100k	R82	100k
R33	100k	R83	100k
R34	100k	R84	100k
R35	100k	R85	100k
R36	100k	R86	100k
R37	100k	R87	100k
R38	100k	R88	100k
R39	100k	R89	100k
R40	100k	R90	100k
R41	100k	R91	100k
R42	100k	R92	100k
R43	100k	R93	100k
R44	100k	R94	100k
R45	100k	R95	100k
R46	100k	R96	100k
R47	100k	R97	100k
R48	100k	R98	100k
R49	100k	R99	100k
R50	100k	R100	100k
C1	100nF	C11	100nF
C2	100nF	C12	100nF
C3	100nF	C13	100nF
C4	100nF	C14	100nF
C5	100nF	C15	100nF
C6	100nF	C16	100nF
C7	100nF	C17	100nF
C8	100nF	C18	100nF
C9	100nF	C19	100nF
C10	100nF	C20	100nF

Pin	Component	Value
1	POT1A	100k
2	POT1B	100k
3	POT1C	100k
4	POT1D	100k
5	POT1E	100k
6	POT1F	100k
7	POT1G	100k
8	POT1H	100k
9	POT1I	100k
10	POT1J	100k
11	POT1K	100k
12	POT1L	100k
13	POT1M	100k
14	POT1N	100k
15	POT1O	100k
16	POT1P	100k
17	POT1Q	100k
18	POT1R	100k
19	POT1S	100k
20	POT1T	100k
21	POT1U	100k
22	POT1V	100k
23	POT1W	100k
24	POT1X	100k
25	POT1Y	100k
26	POT1Z	100k
27	POT2A	100k
28	POT2B	100k
29	POT2C	100k
30	POT2D	100k
31	POT2E	100k
32	POT2F	100k
33	POT2G	100k
34	POT2H	100k
35	POT2I	100k
36	POT2J	100k
37	POT2K	100k
38	POT2L	100k
39	POT2M	100k
40	POT2N	100k
41	POT2O	100k
42	POT2P	100k
43	POT2Q	100k
44	POT2R	100k
45	POT2S	100k
46	POT2T	100k
47	POT2U	100k
48	POT2V	100k
49	POT2W	100k
50	POT2X	100k
51	POT2Y	100k
52	POT2Z	100k

Pin	Component	Value
1	U1	NE5534
2	U2	NE5534
3	U3	NE5534
4	U4	NE5534
5	U5	NE5534
6	U6	NE5534
7	U7	NE5534
8	U8	NE5534
9	U9	NE5534
10	U10	NE5534
11	U11	NE5534
12	U12	NE5534
13	U13	NE5534
14	U14	NE5534
15	U15	NE5534
16	U16	NE5534
17	U17	NE5534
18	U18	NE5534
19	U19	NE5534
20	U20	NE5534
21	U21	NE5534
22	U22	NE5534
23	U23	NE5534
24	U24	NE5534
25	U25	NE5534
26	U26	NE5534
27	U27	NE5534
28	U28	NE5534
29	U29	NE5534
30	U30	NE5534
31	U31	NE5534
32	U32	NE5534
33	U33	NE5534
34	U34	NE5534
35	U35	NE5534
36	U36	NE5534
37	U37	NE5534
38	U38	NE5534
39	U39	NE5534
40	U40	NE5534
41	U41	NE5534
42	U42	NE5534
43	U43	NE5534
44	U44	NE5534
45	U45	NE5534
46	U46	NE5534
47	U47	NE5534
48	U48	NE5534
49	U49	NE5534
50	U50	NE5534

Pin	Component	Value
1	R1	100k
2	R2	100k
3	R3	100k
4	R4	100k
5	R5	100k
6	R6	100k
7	R7	100k
8	R8	100k
9	R9	100k
10	R10	100k
11	R11	100k
12	R12	100k
13	R13	100k
14	R14	100k
15	R15	100k
16	R16	100k
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19	R19	100k
20	R20	100k
21	R21	100k
22	R22	100k
23	R23	100k
24	R24	100k
25	R25	100k
26	R26	100k
27	R27	100k
28	R28	100k
29	R29	100k
30	R30	100k
31	R31	100k
32	R32	100k
33	R33	100k
34	R34	100k
35	R35	100k
36	R36	100k
37	R37	100k
38	R38	100k
39	R39	100k
40	R40	100k
41	R41	100k
42	R42	100k
43	R43	100k
44	R44	100k
45	R45	100k
46	R46	100k
47	R47	100k
48	R48	100k
49	R49	100k
50	R50	100k

Pin	Component	Value
1	C1	100nF
2	C2	100nF
3	C3	100nF
4	C4	100nF
5	C5	100nF
6	C6	100nF
7	C7	100nF
8	C8	100nF
9	C9	100nF
10	C10	100nF
11	C11	100nF
12	C12	100nF
13	C13	100nF
14	C14	100nF
15	C15	100nF
16	C16	100nF
17	C17	100nF
18	C18	100nF
19	C19	100nF
20	C20	100nF
21	C21	100nF
22	C22	100nF
23	C23	100nF
24	C24	100nF
25	C25	100nF
26	C26	100nF
27	C27	100nF
28	C28	100nF
29	C29	100nF
30	C30	100nF
31	C31	100nF
32	C32	100nF
33	C33	100nF
34	C34	100nF
35	C35	100nF
36	C36	100nF
37	C37	100nF
38	C38	100nF
39	C39	100nF
40	C40	100nF
41	C41	100nF
42	C42	100nF
43	C43	100nF
44	C44	100nF
45	C45	100nF
46	C46	100nF
47	C47	100nF
48	C48	100nF
49	C49	100nF
50	C50	100nF

Bill of Materials (BOM)

ID	PART ON PCB	TYPE	COUNT	VALUE
1	RH2,RL2	RESISTOR	2	4k22
2	RH5,RH4,RH3	RESISTOR	3	20k
3	QADJ_HMF1,QADJ_LMF1	TRIMMER	2	500R TRIM
4	RH1_CUTOFF1,RL11_LEVEL1,RL3_CUTOFF1,RH12_LEVEL1	TRIMMER	4	10k TRIM
5	D4,D1,D3,D2	DIODE	4	1N4007
6	ON	GREEN LED	1	FLAT LED
7	LPF, HPF	YELLOW LED	2	FLAT LED
8	RL3,RL5,RL4	RESISTOR	3	200R
9	R24,R59	RESISTOR	2	910R
10	R45,R44,R3,R9,R8,R43,R10,R38	RESISTOR	8	4k75
11	R13,R49,R48,R14	RESISTOR	4	12k
12	RO2,RH1,RL1	RESISTOR	3	6k8
13	R34,RP1,RH8,RL8	RESISTOR	4	10R
14	RO1,RX2,RX1	RESISTOR	3	100R
15	R54,R19	RESISTOR	2	470R
16	R63,RH6,RL6	RESISTOR	3	7k5
	4			
17	CN9,CN11,CN20,CN12,CN19,CN13,CN8,CN10,CN18,CN3,CN17,CN1,CN7,CN4,CN2,CN5,CN6,CN14,CN16,CN15,CO2,CIP1,CO3,CIP2,CO1,CH6,CH1,CH17,CH18,CH5,CH11,CH2,CH14,CL5,CH15,CH10,CL4	CERAMIC 2,5mm	37	100nF
18	CI3,CI2,CI1	WIMA 5mm	3	100pF
19	C4,C5	WIMA 5mm	2	2n2F
20	C7,C10	WIMA 5mm	2	4n7F
21	CL1,CH8,CL3,CL2,CH9,CH4	WIMA 5mm	6	100nF
22	C15,C17	WIMA 5mm	2	33nF
23	C16,C19	WIMA 5mm	2	47nF
24				
25	JMAIN1	CONNECTOR	1	Conn_02x13_Odd_Even
26	JSUB1	CONNECTOR	1	Conn_02x13_Odd_Even
27	Buscable	BUSCABLE	1	Buscable
28	Interconnect	INTERCON	3	Interconnect

29	CO4,CO5	ELECTROLYT	2	10u35V/50V BiPolar
30	CP1,CP2	ELECTROLYT	2	100u35V
31	KO2,KO1	RELAIS	2	RY12W-K
32	IC1	RECTIFIER	1	LM317
33	HFBELL/SHELF1,LFBELL/SHELF1,HIG- HCUT1,BYP1,LOWCUT1	SWITCH	5	ALPS
34	LMID_GAIN1,LF_GAIN1,HMID_GAIN1,HF_GAIN1	POT	4	50K LIN
35	HMID_Q1,LMID_Q1	POT	2	10K LOG
36	HF_FREQ1,LMID_FREQ1,LF_FREQ1,HMID_FREQ1	POT	4	50K NLOG
37	IC2	OPAMP	1	THAT1646
38	ICI1	OPAMP	1	THAT1246
39	U6,U9,U5,U7,U10,U1,U2,U4,U3,U8,ICH1,ICH2,ICL3, ICH3,ICL2,ICL1	OPAMP	16	NE5534
40	B1	RECTIFIER	1	DIL
41	SOCKET-08	SOCKET	18	GS 8P
42	25mm Spacer	HARDWARE	4	25mm Spacer
43	Screw M3	HARDWARE	8	Screw M3
44	Nut M3	HARDWARE	4	Nut M3
45	Spacer 0.145	HARDWARE	4	Spacer 0.145
46	Washer M7	HARDWARE	4	Washer M7
47	Screw M7	HARDWARE	4	Screw M7
48	Washer M9	HARDWARE	4	Washer M9
49	Screw M9	HARDWARE	4	Screw M9
50	Pushbutton Knob	KNOB	5	Pushbutton Knob
51	Knob 11mm	KNOB	10	Knob 11mm
52	Knobcap Green	KNOB	3	Knobcap Green
53	Knobcap Blue	KNOB	3	Knobcap Blue
54	Knobcap Red	KNOB	2	Knobcap Red
55	Subboard2	POTBOARD	1	Subboard2
56	Backpanel	BACKPANEL	1	Backpanel
57	Frontpanel	FRONTPANEL	1	Frontpanel
58	R39,R37,R42,R46,R11,R4,R7,R2	RESISTOR	8	1k
59	R62,R26,R12,R17,R52	RESISTOR	5	3k
60	R28,R66,R30,R64	RESISTOR	4	750R
61	R27	RESISTOR	1	33k

62	R18,R53	RESISTOR	2	2k4
63	R67,R31,R22,R55,R20,R36,R1,R57	RESISTOR	8	100k
64	R25,R69,R60,R32	RESISTOR	4	10M
65	R47	RESISTOR	1	4k3
66	R33,R68	RESISTOR	2	330k
67	R15,R50	RESISTOR	2	5k1
68	RH7,RL7,R35,R61	RESISTOR	4	10k
69	R56,R5,R21,R41,R40,R6	RESISTOR	6	1k8
70	R51	RESISTOR	1	4k7
71	R29,R65	RESISTOR	2	43k
72	R16,R23,R58	RESISTOR	3	3k6
73	CR6,CR9,CR4,CR1	CERAMIC 2,5mm	4	10pF
74	CR7,CR3,CR10,CR2,CR8,CR5,CL6,CH19,CH7,CH3,CH12,CH16	CERAMIC 2,5mm	12	22pF
75	C2,C14,C6,C3	WIMA 5mm	4	220pF
76	C18,C21	WIMA 5mm	2	22nF
77	C12	WIMA 5mm	1	2u2
78	C24,C8,C11,C22,C9,C23,C13,C1,C20,CH13,CL7	ELECTROLYT	11	100u 25V/35V BiPolar
79	Q4,Q3,Q1,Q2	J-FET	4	J112
80	Knobcap Black	KNOB	2	Knobcap Black
81	Mainboard	MAINBOARD	1	Mainboard
82	Subboard1	SUBBOARD	1	Subboard1