



In 1987 Thomas Henry published a book called *Build A Better Music Synthesizer*, which enabled the reader to build himself a music synthesizer. It covered all basic synthesizer modules and made use of state-of-the-art integrated circuits of that time (i.e. CEM).

About 20 year later in 2006 Thomas Henry once again published a book called *An Analog Synthesizer for the 21st Century*, which again contained circuits for all basic synthesizer functions (available via lulu.com).

This time Thomas Henry made use of commonly available integrated circuits of this time. However, for the VCF and VCA the SSM2164 was used, a high quality quad audio VCA. Meanwhile this IC is used a lot by Intellijel and Behringer, which kept the IC in production.

In the past years I provided PCBs and Panels for various Thomas Henry projects, alas, there has not been a filter yet. So now, here we go with the VCF/VCA from the above mentioned book. As always Thomas Henry provides circuits for musically usable modules, and it is my pleasure and privilege to have the permission to provide PCBs and Panels for this project.

The VCF is a vanilla 2-pole 12db Stave Variable filter, which could be used as 1V/oct sine wave VCO when in self oscillation.

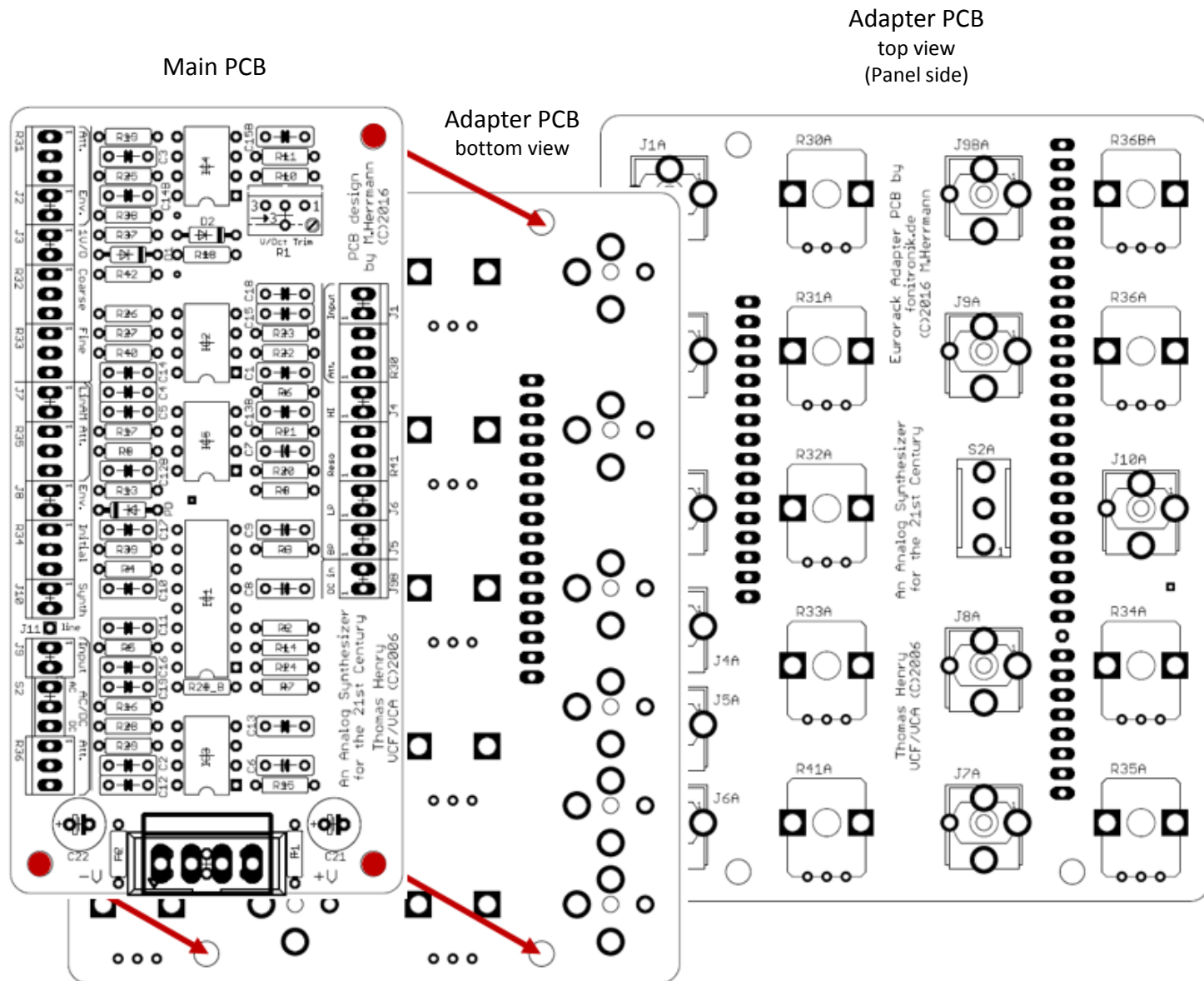
The linear VCA has both an DC coupled input and a selectable AC or DC coupled input, which is normalled to the LP output of the VCF.

Matthias Herrmann, Sep 2016

The PCB/Panel combo is comprised of one main PCB, an adapter PCB, and an Eurorack format panel. Nevertheless, one can always use just the main PCB to build a module in any other form factor, if desired. The PCB provides MTA-100 headers to make the manual wiring more easy.

Use 16pin and 34pin SIL connectors to stack the PCBs.

The part designators follow the original schematic as published in the book *An Analog Synthesizer for the 21st Century*, however, I added a few features and parts. Therefore a complete new BOM and schematic are included in this documentation. The designators on the adapter PCB correspond to the designators on the main PCB/schematic, they just show the index "A" (for Adapter).



Adapter PCB
top view
(Panel side)

Main PCB

Adapter PCB
bottom view

Main PCB

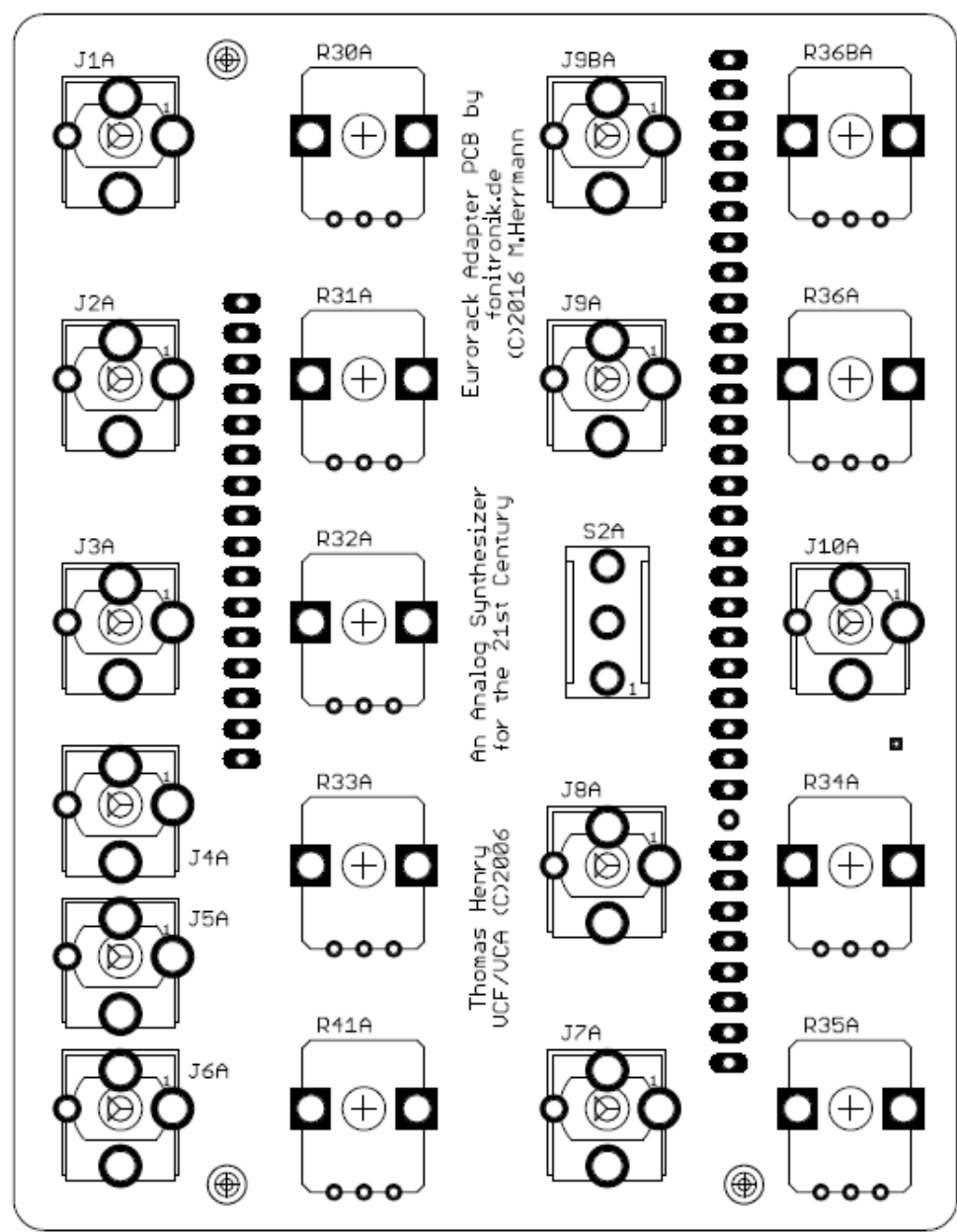
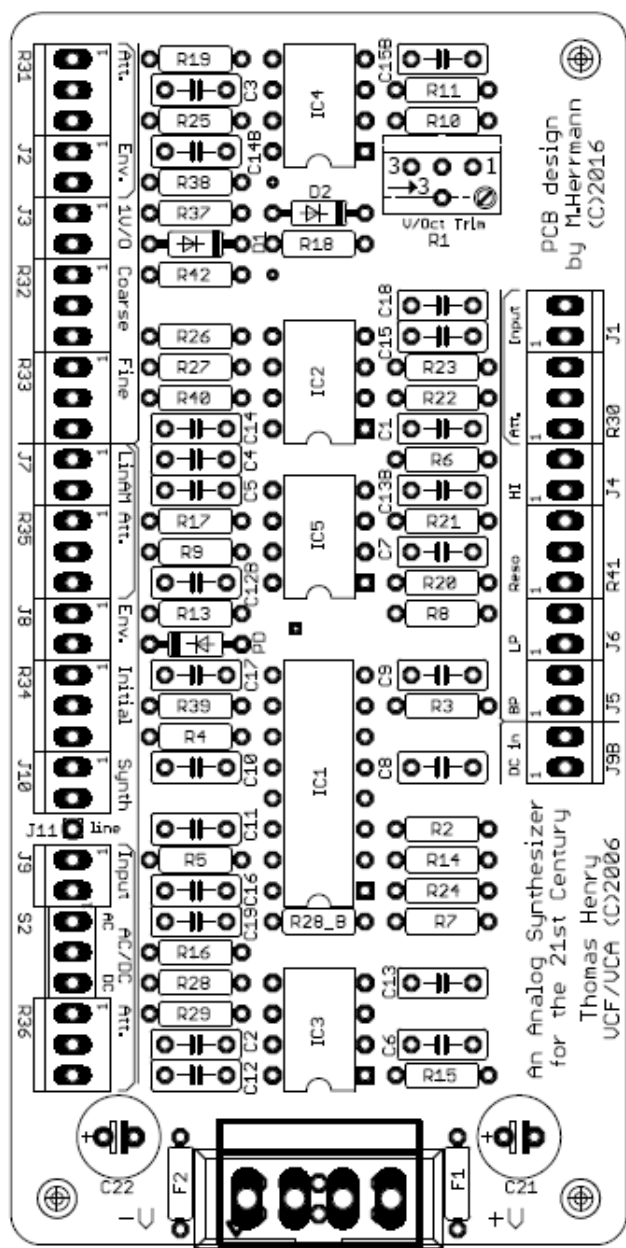
Qty	Value	Package	Parts	Notes
Resistors				
2	10R	0207/7	F1, F2	or ferrites
4	510R	0207/7	R2 - R5	
4	1k	0207/7	R6 - R9	
1	2k	0207/7	R10	PTC (tempco) +3500ppm/C
1	2.7k	0207/7	R11	
1	15k	0207/7	R13	
4	30k	0207/7	R14 - R17	
2	47k	0207/7	R18, R19	
11	100k	0207/7	R20 - R28, R28_B, R29	
1	150k	0207/7	R37	
1	160k	0207/7	R38	200k (15V)
2	300k	0207/7	R39, R40	
1	3.3M	0207/7	R42	
1	500R	S64Y/W	R1	1V/oct Trimmer
Capacitors				
2	10pF	C050-025X075	C1, C2	
1	22pF	C050-025X075	C3	
4	100pF	C050-025X075	C4 - C7	COG/NPO
4	560pF	C050-025X075	C8 - C11	
10	100n	C050-025X075	C12/B, C13/B, C14/B, C15/B, C16, C17	
2	220n	C050-025X075	C18, C19	Film
2	10uF	E2,5-7	C21, C22	Elec, 35Vmin
Semi's				
1	BAT85	DO35-7	PD	
2	1N4148	DO35-7	D1, D2	
1	SSM2164	DIL16	IC1	or V2164
4	TL072B	DIL08	IC2 - IC5	or OPA2134
Misc				
1			Eurorack power header	
1			MTA-156 power header	

When using the adapter PCB use SIL connectors.

Adapter PCB

Qty	Value	Package	Parts	Notes
Potentiometers				
8	100k	vertical 9mm	R30A - R36A, R36BA	
1	1M	vertical 9mm	R41A	
VCF Sockets				
1	AUDIO INPUT	PJ-301B	J1A	
1	ENVELOPE CV	PJ-301B	J2A	
1	1V/OCT	PJ-301B	J3A	
1	HIGH PASS	PJ-301B	J4A	
1	BAND PASS	PJ-301B	J5A	
1	LOW PASS	PJ-301B	J6A	
VCA Sockets				
1	LINEAR AM	PJ-301B	J7A	
1	ENVELOPE CV	PJ-301B	J8A	
1	AUDIO INPUT	PJ-301B	J9A	
1	DC INPUT	PJ-301B	J9BA	
1	SYNTH OUT	PJ-301B	J10A	
1	AC/DC	Miniature	S2A Switch	SPDT on-on

The assembly is straight forward. Nothing special to consider here. For the actual filter caps C6 & C7 I use COG/NPO which show almost the same characteristics as polysterene type caps. The 220n caps are in the audio path, I use boxed film caps. All the 100n caps are just for decoupling and one could use any type of ceramic cap here. In general I use linear potentiometers all over the place. Nevertheless, you might want to use a reverse log pot for resonance. Not a must, though. If you don't need/want temperature compensation use just a common 2k for R10. That's what I did. For F1/F2 normally ferrite beads are used, however, one could use 10R or 20R resistors as well, which would work as kind of protection, if made an error in the build (short) or the power supply of the module. The adapter PCB is made for PJ-301B jack sockets. Don't use any other socket with this PCB unless you are absolutely sure the pinout is identical.

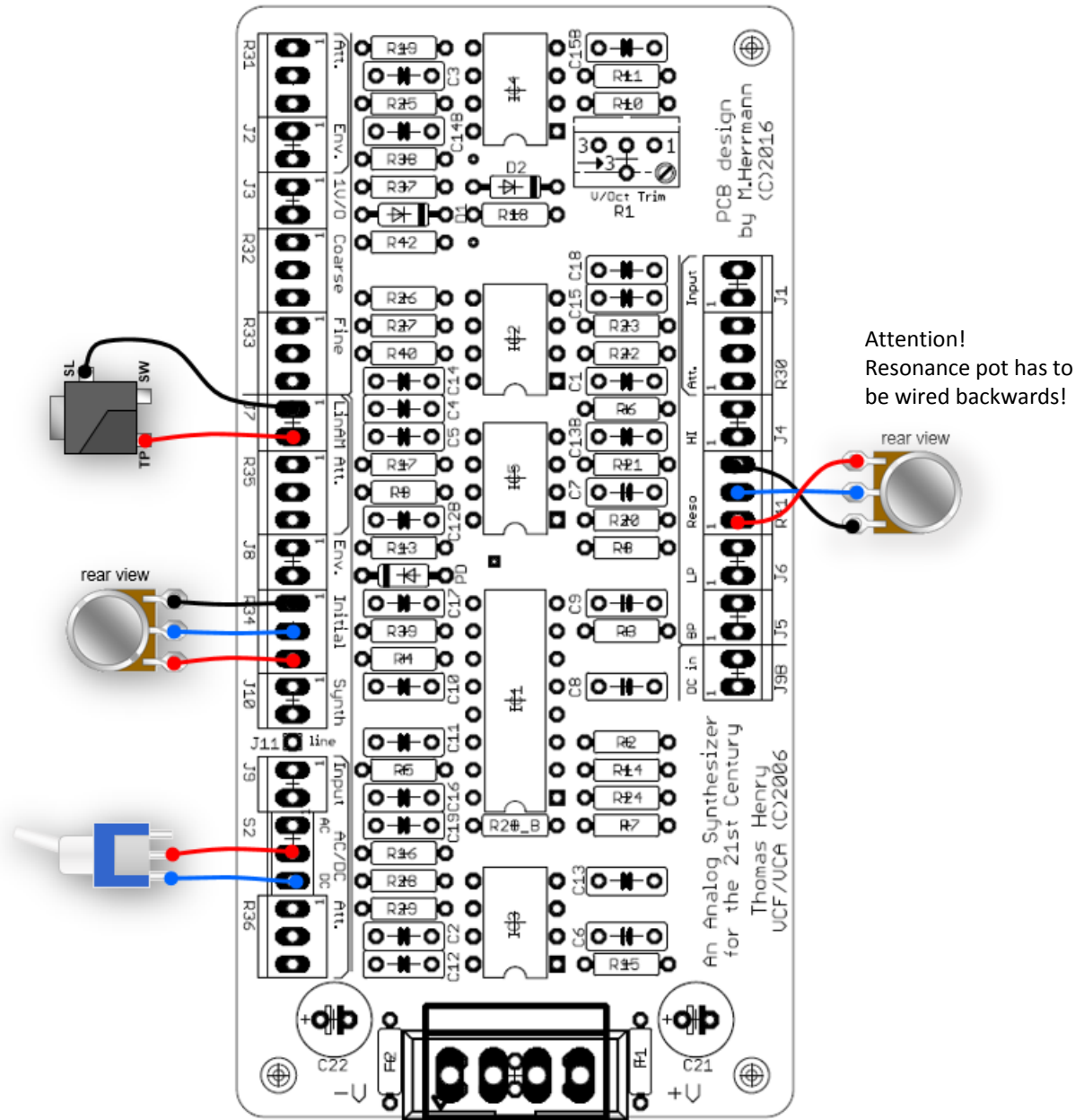
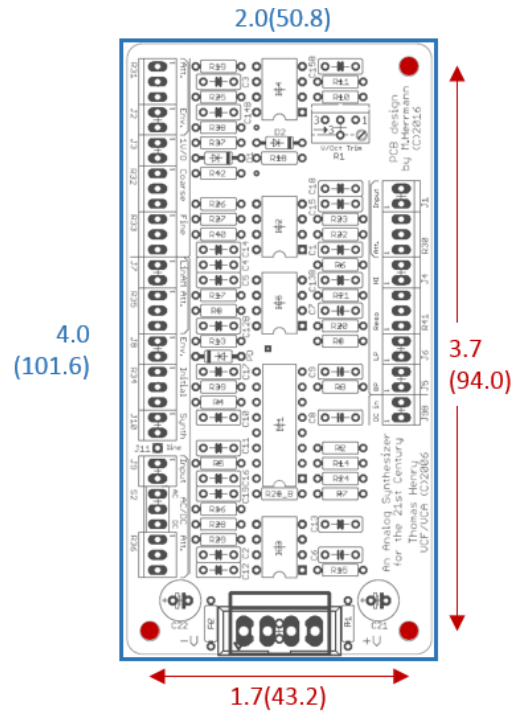


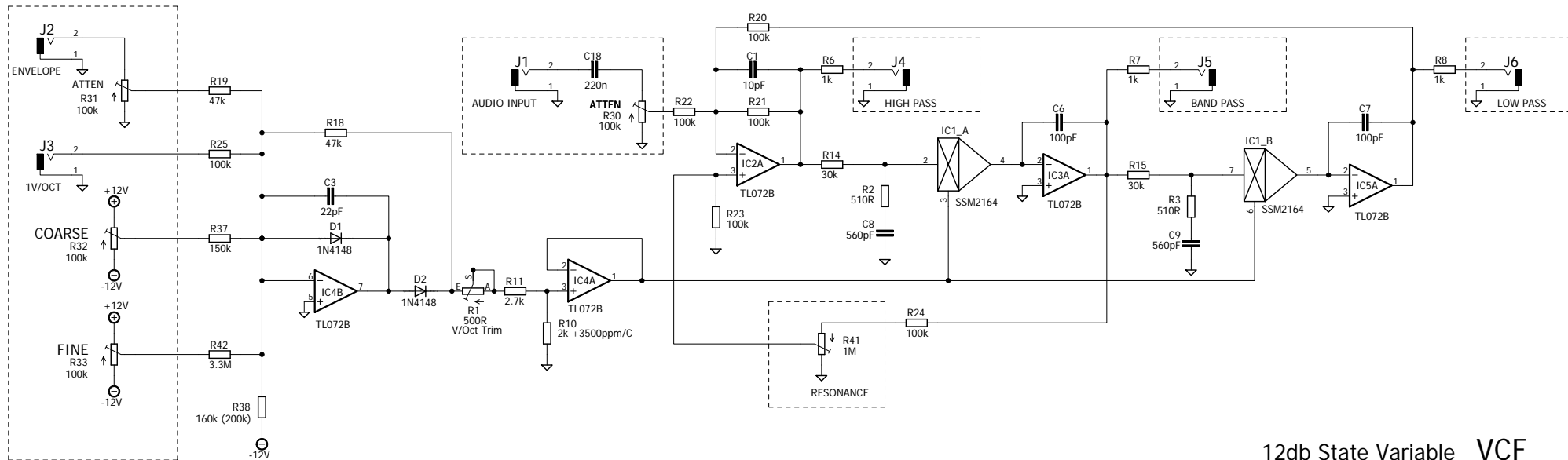
The manual wiring is quite straight forward, I guess. The PCB provides footprints for MTA-100 headers to make thing more easy. If you use them, make sure to get MTA-100 plugs that could be stringed together!

In the picture to the right I give only wiring examples for a few components. All in all this is rather self explaining, I believe.

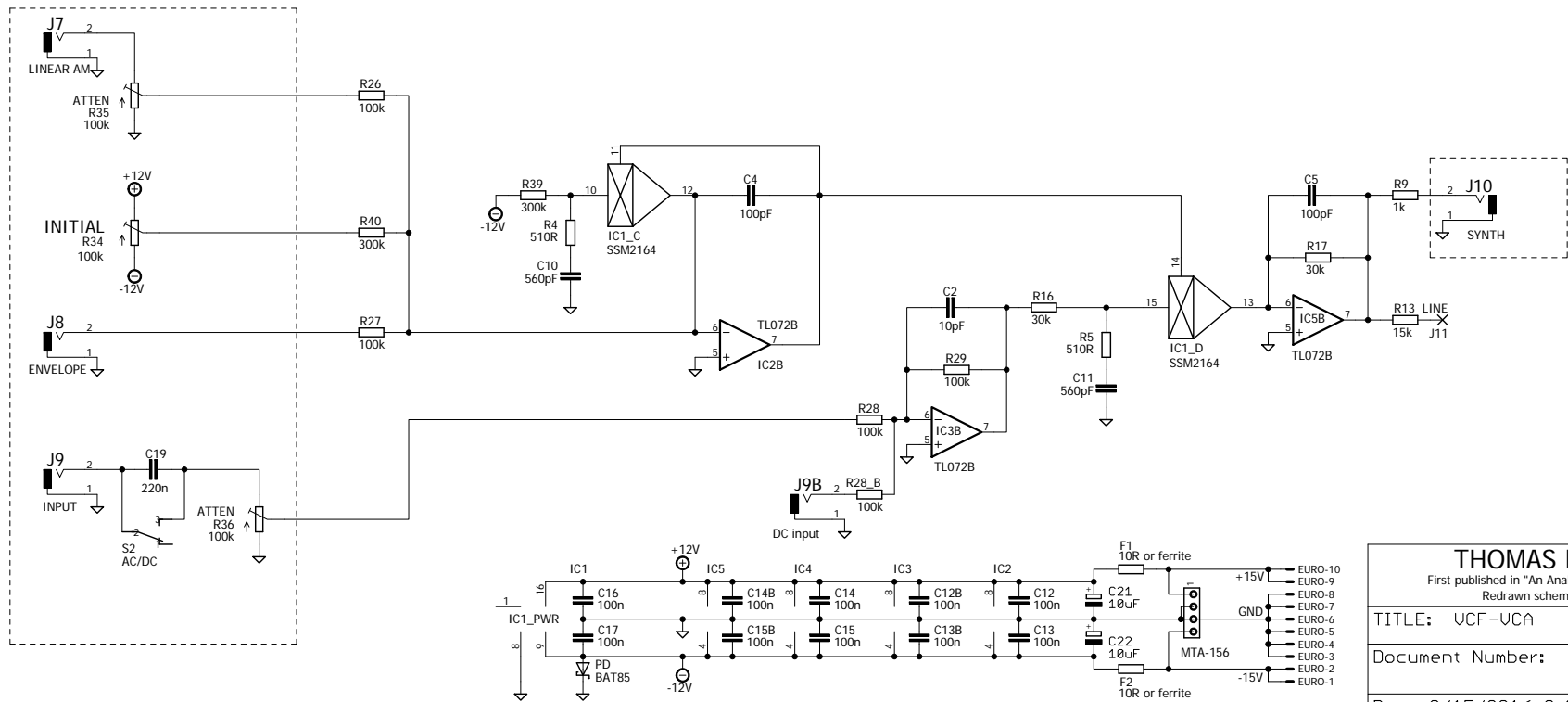
Please, take note that the resonance pot has to be wired backwards.

Refer to the schematics to see and decide what you need.





12db State Variable VCF
linear VCA



THOMAS HENRY VCF/VCA
 First published in "An Analog Synthesizer for the 21st Century" (C)2006
 Redrawn schematic by Matthias Herrmann 2015

TITLE: VCF-VCA		REV: 1.0
Document Number:		
Date: 9/15/2016 8:43 AM	Sheet: 1/1	