

Varimu Mastering Compressor



Specification

Custom made

Analog tube compressor

Based on Thermionic Culture Phoenix

Mullard & Philips NOS tubes

Sowter in- and output transformers

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This page contains mods and tips for the VariMu Compressor (Chiswick VK1) project on [Prodigy Pro](#) and [DIY Racked](#). These are my observations with my limited knowledge. By no means can I be called an expert and don't claim that every detail I present here is 100% flawless. I know it all worked out perfectly for me, but you're responsible for your own build. Only a limited amount of PCBs and cases were sold by Purusha, not much of building this project is available in the public domain. This document contains some of my experiences building and modifying the unit and maybe helps others.

First and foremost the PCB is flawless and the unit works perfect, as long as you use all the right documents. The following files are located at <http://purusha.smokinggunrecording.com/XVXDY/>.

- vk1_schems.pdf
- VK1 pcb overlay changed resistor values.jpg
- WIRING HEATERS.pdf
- WIRING SIDECHAIN.pdf
- WIRING DUAL RELEASE.pdf
- VariMu Calibration Procedure.doc
- VK1Sowter.JPG
- vk-1_150x250.pdf
- Changed resistor values.doc
- 1V3.pdf
- BOM_upd_18_6_08.xls

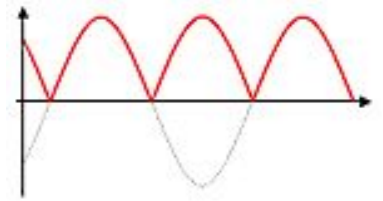
The start

I've printed all the documents twice and read them and then reread them to understand what goes where and how it all works. I use one set as back-up and one set to mark all the mods, changes, ideas, etc. Understanding the basic flow of the compressor (vk1_schems.pdf) is really essential.

Audio enters through the input pot into the input transformer. There's also an input pad of 12dB before the pot. You can bypass the R120 resistor of the pad. The unit can handle 0dBFS (0 dB out of a computer) without any problems. The pad is useful if you run something really hot before it. Both the pad and input level will decrease the volume before the transformer and tubes, therefore it's not possible to distort the transformers and after that attenuate the volume before the tube stage. If there is any distortion, it's from most likely from the tubes.

After the transformer the audio goes to a 6BZ7/ECC85 tube which runs in a balanced configuration. Next tube stage is the balanced 12AT7/ECC81 after which it goes to the output transformer. The output volume control is placed after the transformer, which means that the output control does not influence the sound (possible distortion) of the output transformer.

The output of the 12AT7 stage also goes to the Threshold pot, where the 6AL5 (a dual diode tube) does its work. It acts as a full wave rectifier because it's fed by a balanced tube stage.



This is very handy when you use the compressor in linked mode. It's not sensitive to phase difference between the left and right channels and maintains a perfect stereo image. Some compressors don't have this, which makes the compressor insensitive/less sensitive to out of phase signals and can cause some very unwanted side effects.

From the 6AL5 tube the control signal goes through two resistors. R112 can be bypassed by the Thump option. This changes the compression ratio from light to hard compression. If you want to do some extra mods, you can remove the R112 and place a rotary switch or pot which gives you more options between normal and thump mode. I've not done this, but it should work.

The release and attack options follow, as well as the dual release option, link point (to link the channels together) and the path feeding back to the 6BZ7 tube.

Attack & release

My version is used for mastering, therefore I chose to build one with the stepped switches instead of pots. I found the attack time very fast, but it also acts different from a VCA compressor.

After some testing I really liked it with 1M, 2M and even 3M Ohm resistance for the attack. More than 10 times slower than a stock unit. The compressor sounds completely different, almost as if it was used as a parallel compressor. If you are going to build yours, it might be a good idea to rethink the steps of the switches. My advice is to recalculate the original resistance in to 9 or 10 steps and then add 1M resistors on switch point 11 and 12. I didn't want to do all the rework and went for a quick fix and added a 1M resistor to switch point 12.



This mod is just great, at the fastest attack setting the unit reacts extremely fast and sounds great. At 220k resistance it has some nice transients before the compression. With 1M added it sounds more open, but still compresses great, totally different from a VCA type compressor. If you want to use a pot in your machine, replace the stock 220k linear pot with a 1M pot.

With some additional testing I still had the wish for more control over longer attack times. A quick fix would be to increase the value of C100 by placing another capacitor in parallel. But this affects the release times greatly, which are already on the large side imo. Therefore the attack control was removed and rewired again. There are a lot of options to choose from, on the right is my final list. This gives me more then enough control over fast attacks but also a large list of longer attack times which sound great with this compressor.

The release control could be rewired as well, again with a lot of options. An easier solution is what I used, because the release control is harder to remove from the front panel. I wired a 150k resistor to switch point 1 (black wire) and the other end of the resistor was soldered to a wire which goes to ground. This way the original R9 goes from 150k to 75k.

step	resistor value	ms
1	0	0
2	47.000	5
3	47.000	9
4	100.000	19
5	100.000	29
6	150.000	44
7	150.000	59
8	150.000	74
9	500.000	124
10	500.000	174
11	500.000	224
12	500.000	274

I'm very, very pleased with the results. It gives you an incredible wide range of options, which is quite rare on analog gear. If you haven't build your unit, then I advice you to replace R9 with 75k. This gives you a few more fast release settings for some aggressive compression and leaves the longer release times in tact. According to the front panel of an original VK-1 compressor the release time goes from 25ms to 2,5s, with this mod you'll have aprox 13ms, 21ms and 30ms for fast times, which should do the trick.

An additional feature was added. Switch point 12 of the release control was wired to ground (through a 200 ohm resistor acting as a jumper). At this setting the release time is infinitely fast and in theory will surely distort the sound on higher gain reduction which can be a cool affect. In reality this cancels the gain reduction in total.

The dual release switch needs a ground point, I used a dedicated wire for this which goes to the starground point. One of the building docs recommend adding a wire underneath the PCB to be able to use the link point. I used a two wire cable from the link point right next to the input transformer, which feeds both the link and a dual release switch.

Bypass and power supply

True bypass is a must for me and added the [Bypass Relay Board](#) from the Prodigy Pro forum. In- and output XLRs are wired to the board, bypass on/off is linked to both channels and I use the left bypass switch on the front panel to control it. It's a DPDT switch, the other side is used to power the leds of the panel meter.

The right bypass switch is now used as input pad for both channels. This can be handy with hot signals, although I slightly prefer the sound without the pad.



The bypass board uses 6V relays which are fed by the heater voltage on the PCB. On the front right of the PCB I've drilled two extra holes and added a connection point for the power of the relays.



Underneath the PCB I wired it directly to the regulated 6V point. This 6V point is also used for the leds of the panel meter and the jewel light.

I've used an external extra large heatsink for the 6V regulator (LM350). This will get hot and a good heatsink is a must. BTW don't forget to get some form of isolation between the regulators and the heatsinks it self, as it will short. I've used dedicated mica isolation set with a sheet, washers and screws.

A starground point was drilled into the case. Here the powersupply, the pcb and a ground trace on the front panel (used for the dual release) all come together.

Panel meter

The panel meter from Conrad sucks imo. Technically it works fine, but the construction used to fasten it to the front panel is really lame and far from sturdy. I replaced the original 1ma background with my own design and added two orange leds. These were too large and I sanded them down to a smaller size, I'm sure there are stock leds/lights available for this which will fit.



The compressor gave 5ma to the panel meter in my case. I added a 5k precision pot in parallel between the pos/neg connection points and which made it easy to find the zero point (= 1ma full scale point) of the panel meter.

Ouput

The output attenuator is a 6x2 rotary switch. I couldn't find a nice way to wire the resistors to the switch and just made a small PCB with the resistors and soldered the switch directly on it, including the connection points of the switch to the transformer and the bypass PCB. For these connections I used shielded microphone cable. The building instructions recommend to leave R144 out which I did, so I can't comment on how it sounds with it.



High pass filter

The optional high pass filter is great, couldn't live without it. But the rotary switch is on the back, which makes it hard to reach. I chose to solder the standard caps directly to the front panel switch and the caps for the highest filter on the other end. On the PCB I left the original caps out and used it as a connection point to the switch. Take care in positioning the caps, the switch is close to the edge of the case and if you place them too wide the front panel won't fit.

Additional mods

Someone suggested to remove R102 and R103, these are negative feedback resistors of the 12AT7 stage. These are used to prevent distortion and tame the output. By leaving them out should increase the overall volume, chance of distortion and apparently increase the amount of gain reduction.

My first version still had these resistors. But the threshold was always on max to get the needle moving. Therefore the resistors where clipped off and this improved it a great deal. Now the threshold works like you would expect. There is also more gain/volume available within the unit which is not unwanted. I highly recommend everyone to remove the R102 and R103 resistors.



The thump switch is something you can mod too. For example you could make it a 3 position switch: 1 stock, 2 parallel resistor, 3 jumper. This would give you an in between mode.



Build tips

I started placing the resistors first, caps next, connector point, tube sockets, etc. etc. and the transformer last. Then I build the complete front panel and made the connection cables between the front panel, the PCB and the case (XLR, powersupply, etc). The rotary switches are screwed in front panel after I added a metric thread. And something I wondered for a long time: how does everybody get those wires twisted in a nice way? The solution is simple: put one end of all the leads in your drill and make sure the other end is held tight. Now turn on the drill and you get perfectly twisted cables!

Materials used in my version

Sowter input and output transformers
Mullard ECC81 matched NOS tubes
Philips ECC85 matched NOS tubes
GE 6AL5 matched NOS tubes
Mallory 150 series cap in signal path
WIMA caps for the rest
Dale CMF55 resistors where possible, 1% precision
Neutrik XLRs

Final thoughts

The unit sounds fantastic. The schematics and build docs are perfect and the project isn't too hard to build. Most importantly the compressor sounds like nothing else and imparts a very nice sonic boost. It's easy to get 2dB of gain reduction, but even up to 9dB is possible and it still sounds great!!

At www.tubefreak.com/varimu/ you can find pics and sound samples of my unit (before I removed the negative feedback resistors). Original samples are run through the unit in bypass, the compressed files have the amount of gain reduction in the title. These are all quickly done and an example of what the unit can do, by no means are the settings perfect. Almost all files have the high pass filter on, fast release and no thump, unless mentioned otherwise.

Kind regards,
Maarten van Helden



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