# vertice〜

## analog filterbank

### [ USER'S MANUAL ]

# E.S.L.

## EUTERPE SYNTHESIZER LABORATORIES

# vertice

## analog filterbank

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# USER'S MANUAL

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*Dedicato a Walt, Bruno e Lorenzina,*
*con immenso amore,*
*Stefano*

# FOREWORD

## FROM STEFANO BERSANETTI (ELECTRONIC DESIGNER)

When a technology makes obsolete a previous one grants to that the freedom to become an art form.

*Stè*
*(from a Marshall McLuhan concept)*

The VERTICE filterbank.
We spent many days working on it, and many nights dreaming of it.
Probably our most agitated nights ever.
Because the machine which is now in your hands is a true little bastard. We think it as it is, full of character.
In everyone's character there is place for brilliant heights and sordid ugliness, amazing performance and bad defects. It's called "character" because there is no other word for it.
Well, VERTICE have a strong character indeed.
Imagine a filterbank which can manage a stereophonic signal coming from one of the many stereo-synth available today and, at the same time, *another* mono signal, splitting it, and take care of them all in a totally independent or completely related way.
Or three mono signals together, summed, distorted and cut in an easy, efficient and congruent mode.
Imagine a filterbank which accepts the external CV GATE signal and, in certain position, just explodes at the touch of your fingers.
Imagine a filterbank not steady, not tired: our VERTICE lives its own life, and gives that vitality to your timbres.
Maybe you can imagine this machine: big heavy knobs, cold 2 mm aluminum panels and some exotic Italian musical terminology somewhere.
Yes, this is the VERTICE Filterbank. Totally hand made, hand thought, hand tested and dreamed.
This is the VERTICE Filterbank, and when it's ON you know that.

Thank you for purchasing it,
your creativity deserves it.

# THE BASICS

## WHAT DO YOU REALLY NEED TO KNOW ABOUT VERTICE (AND NOBODY SAID TO YOU)

Things about Vertice are enough to full this 70 or more pages manual but we are at page 7 and the chances that you realistically reach page 10 are incredibly low since nobody reads manuals anymore. So in this section we'll introduce some important "phylosophic" concepts concerning the Vertice Filterbank that you really need to understand.
In the following one instead you'll find some practical basic tips to master your Vertice.

The philosopher says:
- Vertice is preeminently **creative**: is not a surgery bistoury, is not a totally controllable machine. It has a sort of inner will. No traces of MIDI, nor facility for patch memory. You must deserve your tones, like with a violin
- Vertice can *also* be used like a **tone and dynamic correction unit**: you can equalize and clean sum, you can technically expand and compress but if you seek a totally clean and purely technical machine you will have to control Vertice's faders very well. Vertice is mostly projected to destroy and deeply change signals. There's plenty of really good pure technical machines in stores right now. Vertice try to bring out something new in your sound palette, also if you don't want it  :)
- Vertice is **incredibly dynamic**: it will reach the max dynamics into the first stages thanks to the three preamplifier and eventualy with the clipping overload of the A filter. *Then* it will push the signal more and more up in the VCAs stage, the last one. Here you will find tons of dB gain and, since the two VCAs are pushed beyond the limits, also incredibly metallic and jarring tones. Pushing the VCAs too high have also some contraindications, like you will discover in the dedicated chapter (**page 38**). Be always careful when switching from VCF to VCA. The EG can turn your VCAs into nuclear weapons
- VERTICE'S OUTPUT ARE VERY **DEPENDENT FROM THE INPUT LEVELS** since its almost passive and true analog nature. Any behavior you can obtain from this machine is deeply subject to the rule: MORE GAIN = MORE SUFFERING = MORE SATURATION = NASTY SOUND DESIGN, and the contrary is also true. You should never forget this rule using Vertice
- Vertice's output are set in order to get a common recording level of **approx -12dBfs** when: Staccato/Continuo is at the beginning of the safety zone (the orange zone on the panel) and A input level is to max, OR when Staccato/Continuo is to max and A input level is to flat position. Obviously the external signal level matters on the resulting output level. We trim it using a quite strong line level (1,5Vpp) since Vertice must relate with modular synth preeminently, the oscillators of which usually come out at higher levels
- **Emphasis** is also very level-related: Vertice tends to be predominant on tones when the Emphasis pots are over the flat posistion. When you want use hard Emphasis settings you should use also strong input levels and high amplification ratios. In this way the Emphasis will drown into the signal obtaining very usable, screamy and killer tones
- Besides from the input levels there are some setting in which Emphasis will become really weird, unstable, sometimes annoying. It's the way we like the Vertice
- To **tame** a too crazy Emphasis there is nothing better than an audio-rate CV (from ext sources, from the internal EG or from a Vertice Rear output) that fastly move the Cutoff. With this method you can fruitfully use high Emphasis settings
- **Serial** is more impacting, **Parallel** is more aether (in fact it's a way to get stereo)
- The **C filter** always come out by *both* the output ports. In Serial mode the C filter have the most impacting dynamic behavior and needs to be used knowing that. In Stereo mode the C filter is free and available to add to both the outputs its mono signal
- Using some rear ports into some front ports, making **feedbacks**, is a cool way to waste your day (obtainig self-adapting bass lines above your drum loop, on/off unstable behaviors and other crazy stuff)
- A and B rear outs come out at CV level. So simply injecting an audio signal into one of this two modules you'll obtain the CV copy of it. It can be useful sometimes
- The **EG** (Envelope Generator) seems a regular "oh-I-already-know-this-stuff" EG but it is not. To obtain a more predictable looping EG just patch the rear EG out into the front EG in
- Use **CV ports** and move those Cutoffs: this is simply one of the best thing Vertice can do

- **Vertice is like a violin. Nobody says that you have to take the tenth year Conservatory's degree to play it, but you should approach to it slowly, paying attention to small things, and trying to incorporate them into yourself with the use and age.  And Vertice will repay, large and shiny, with the CreativityCoin, the only crypto currency accepted here at Euterpe  ;)**

# THE "PRACTICALLY-HELP-ME-TO-FASTLY-BECOME-THE-SLAVE-OF-THIS-MACHINE-'CAUSE-I-ALSO-HAVE-OTHER-THINGS-TO-DO-IN-MY-SAD-USEFUL-LIFE" PAGE

There are people that can't wait to use its Vertice. Ok, you payed for it, seems right. So, for you that can't resist a minute this brief page can help to understand the panel and some hidden features fastly. The rest of the Manual is nothing to care about, just a pile of wasted paper. Plus, it is demonstrated that reading this manual can permanently damage your sight and your brain, so better if you stop here at page 8 before it's too late.

The technician says:
- The three filterboard are totally indipendent
- Also the three input preamplifier
- The two VCAs instead are linked together
- C$f$ means Cutoff Frequency
- No Resonance. Search for Emphasis instead
- MC$f$ (Master Cutoff Frequency) act like a bias for the three filters C$f$
- With MC$f$ in flat position, under each of the three C$f$s you have quite the whole audio spectrum available
- MC$f$-CV have a larger range if compared to the three singular C$f$-CV input port
- Staccato/Continuo is the "main level" of the machine
- Audio Inputs can carry also CV-level signals, obviously easily distorting them
- Vertice haven't the "wrong hole syndrome". But it have all the others mental issues you can imagine
- C comes out from both the Output ports,Ser and Par, both front and rear. So C comes out 4 times litterally
- The internal EG can push your two VCAs to very high output levels so **be careful when switch from VCF to VCA**
- The internal Eg is our design and is a bit weird sometimes. If you want to Loop it, that generally is the first thing you want to do when you see the related command, just **left a bit of Release space and do not push the Attack too much.** Generally the Attack must be lower than the Release. In triggered mode instead no problem, use the ADSR configuration you like more
- Use an audio Drum Loop to drive the EG Gate, is funny and creative
- Using EG to VCA (via switch) and Rear EG out into MC$f$ CV input at the same time is a great way to understand the machine and demolish that wall that's so long you want to break down to create a totally open-space concept in your Studio  :)
- The momentary switch on the panel act like a gate signal, exactly like using the EG Gate input with a common Gate-emitting keyboard
- Rear outputs are great to feedback them into front inputs
- For example you can have a **weird heavy oscillator** just patching Rear A into Front audio A and giving Overload to it
- Rear outputs A and B come out at high CV level (max 14,6Vpp) purposely: be careful when connecting to other gear (generally audio circuits hallow this levels. Pro music tools work at 30V or even 48V, so their circuit can handle this levels. But economic, often digital, designs can suffer sometimes, especially if they're 5V or 3.3V based (like Ardunino projects for example)
- Don't use your Vertice into microphonic inputs (use TRS 1/4" or TS 1/4", often called "Jack", sockets. Also 1/8" Jaks are ok generally. Avoid XLR socket. In a combo socket use the Jack)
- The two resonance ways (Diode ▶┣ and Transistor ⬡ ) are <u>complementary to each other</u>. They are not useful both to obtain the same thing (except for a small potentiometer range)
- Need weak classic VCF tone: use low level Diode
- Need screaming metallic tone: use mid-high Transistor, better if audio-rate CV controlled, and drown it into a loud input signal
- Need pure untamable noise: use Diode to high settings and try to match the C$f$
- If in Diode mode your C$f$ slip into the high frequency area without any reason it's normal. This large crazy space, that can be easily misunderstood like a misfunction or a design error is totaly wanted because of the experimental possibilities it can generate, especially when driven via CV or internal EG.
- The Transistor mode is here to fill the "usability hole" leaved by the Diode mode at high values
- Need straight "almost a VCO" tone: use Transistor from flat to max
- The strange Klingon symbol actually is a Sigma, and it's the mathematic way to say "sum"
- Stereo is obtained by: Left to A, A to Sum. Right to B, B to Stereo
- When using too loud inputs it is possible that the Overload function "kill" some of the bottom part of the signal. It is an obvious consequence of a too steroidal use of this module
- There is not by-pass command. Unpatch Vertice is the only way  :)
- Frequently repatch your Vertice can strongly help creative processes and synth addiction

# Setting-up quick overview
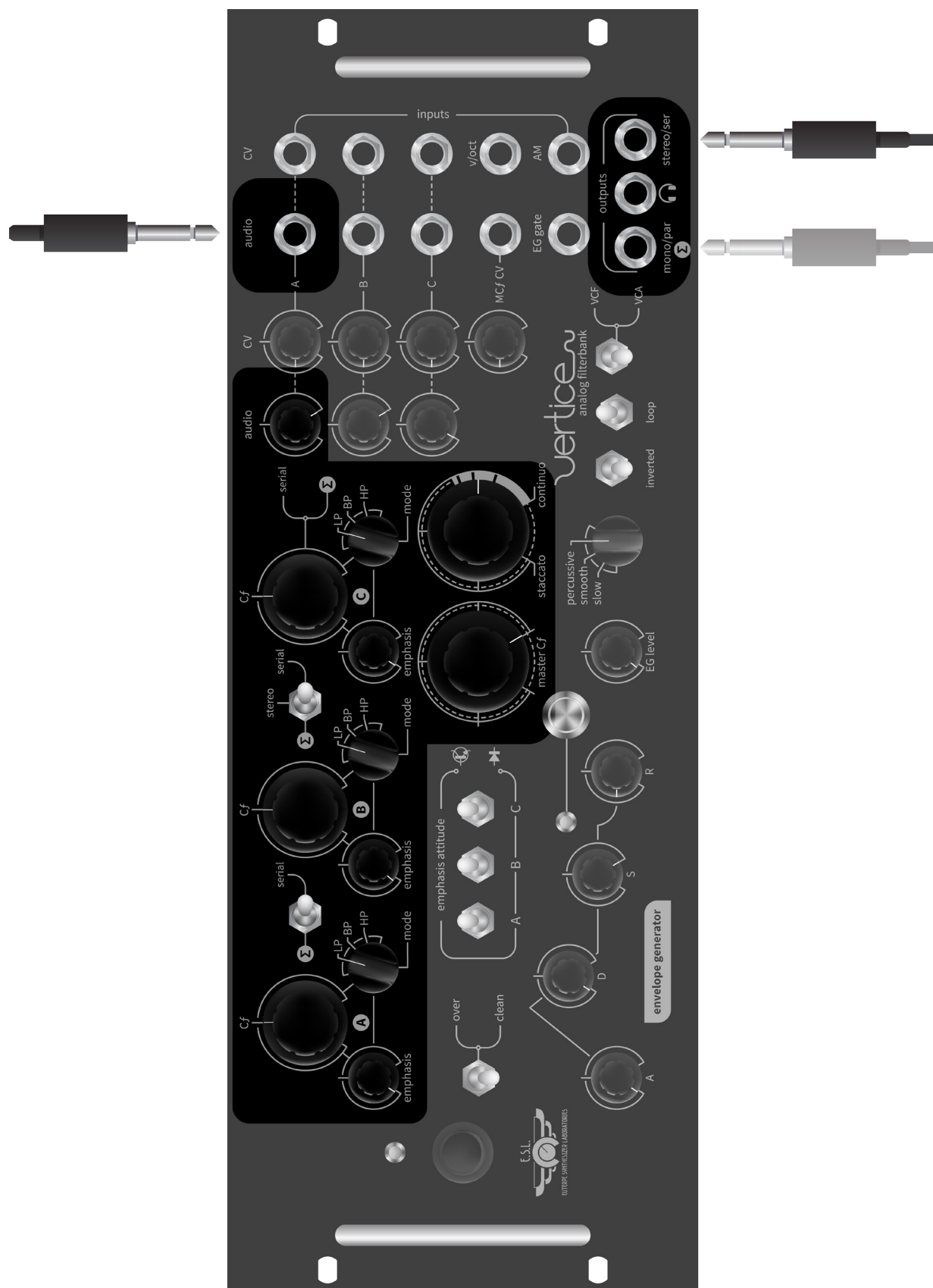


Your first patch: signal unto A, raise the A audio level, let the signal flow into the B and the C filter in serial mode. Use the Serial out (or the Parallel, in this case is the same) to hear how it sounds

# HOW TO USE THIS MANUAL

This manual is organized into sections to assist you in setting-up, playing and fully understand your new E.S.L. VERTICE Analog Filterbank. It is a complex machine and the learning curve is not exactly short. So read through the pages below before this filterbank takes a look inside your Soul. Sometimes VERTICE is not a benevolent god...

***The Set up and Connections*** section provides a brief description of the first basic things to do in order to get the VERTICE safety powered and playable. It also makes a clear point on the panels and related graphics, some of which are ancient Italian musical terminology, with the quick panel overview.
Then it focuses on the particular audio and CV routing of VERTICE.

***The Components*** section offers detailed explanations of the various modules of VERTICE. Read a bit of this section even if you are expert in sound synthesis, some things here are common, some other not.

The ***Using the VERTICE Filterbank*** section provides in-depth description of some inside dynamics and various usage tips and tricks. Please read this chapter to fully understand your VERTICE Analog Filterbank. Some functions mixed to another mixed to another etc. can create very weird results that can surprise you even if you're a well-weaned synth user.

**Please read *at least one* section of this manual: the *VCA*-related chapter. Maybe is better if you also take a look at the *EG* (alias ADSR) section. This two parts are very important to understand VERTICE and to take <u>less risks</u> of electro-acoustical damages both to you and to your equipment.**

Throughout this manual you'll find icons that indicates some important note, characteristic aspects, useful patches or safety warnings.
They mean:

an important note about the operation of the VERTICE

a useful idea, playing patch or combination

a technical information for advanced user or maintenance personnel

a very important note about your safety, and that of your equipment during use or maintenance. Please give your full attention when you meet this symbol: generally they are important notes.

# SET UP AND CONNECTIONS

**Check the contents in the shipping pack**

The VERTICE is shipped with the following items:
- the VERTICE itself. If it's a bag full of potatoes please return it to customer service.  :-)
- some big-sized warning note and internal connections conceptual scheme
- a not finished "authenticity sample" of the wood we use for side panels (optional), for touch, smell and chemical-analysis fans
- this User's Manual
- a small M6 allen key (if ordering the optional side wood panels)
- Schuko (aka German) thermosealed power cord for European units. The "Serie Americana" units have a standard American power chord instead. You can understand to which series belongs your unit simply reading the rear metal label, but probably you don't need because it's supposed you know in which part of the world you live. If you don't you can always contact the nearest embassy, generally they know that.

**What you will need**
- a standard 19"/4U rack place or a stand or a table sufficient to support the VERTICE Filterbank. When racked, to dedicate 5 or more patchbay ports to the Rear Vertice's Outs is <u>highly recommended</u>: whitout them you can miss some of the best routing possibilites Vertice can offer
- some ¼" TS instrument cables
- a standard digital audio interface or amplifier connected to some kind of reproduction system, like studio monitors or stereo speakers. A guitar amplifier is good enough (until your neighbour knok on the door)
- some waveforms

> **(!)**  **MORE GAIN = MORE SUFFERING = MORE SATURATION = NASTY SOUND DESIGN.**
>
> **Do you need soft tones? Keep the pot down. Easily your Emphasis will be more present than with an high level input signal, and that will lead you to limit your Emphasis level (if not you'll obtain the classis too-resonancenant whistle).**
> **Do you need power, madness and to massacre some synth line / drum loop? Raise up both volume and Emphasis control, or extra gain the VCAs (via EG), or switch-on the Overload function, or multiply the signal via external Mult module and sum them into the Vertice's three filterboard and so on... There are many way to obtain raw power from Vertice, the only limit is ~~your fantasy~~ your Studio power supply max limit (in Italy is 3.3kW for housing situations).   :)**

**POWER ON THE UNIT**

Now, if you dare, turn on that switch. Is the only plastic switch you can find in the machine. Plastic was choosen for this particular to increase safety perfomance since this is one of the few dangerous places in the whole machine (which, by-the-way, for the rest of the circuitry works at +/-15VDC, so a not dangerous voltage level). In less than one second you should see the dedicated LED blink up saying "Yeah, bitch!"

> **(!)**  **When you switch it ON you can eventually turn down STACCATO/CONTINUO knob, fully counterclockwise in STACCATO position. This is the most silent way to switch-on the filterbank if you are already connected with a playback system.**

Now you can plug an ¼" TS cable (a standard jack) to one of the two available outputs positioned in the right side of the panel, but maybe that's obvious. It's less obvious instead which of the two ports to choose. Try the *MONO/PARALLEL* one for the first time, it's the one that "sound always".
For additional information about the available outputs please read the **PANEL GRAPHIC OVERVIEW** (**page 13**) and the CONNECTIONS PANEL description (**page 17**).

With the unit power ON and the output patched you can feed every kind of audio signal into the VERTICE jaws simply by plugging another ¼" TS cord in the A-filter *AUDIO IN*. Follow the indications at **page 15** to let the signal flow through the whole machine and start to play with your new killer audio tool.

If instead nothing happen check all connections and the vitality of VERTICE looking at the power LED status or by pushing the momentary switch. If the problem persists please contact our customer support at <u>euterpesynth@gmail.com</u>.
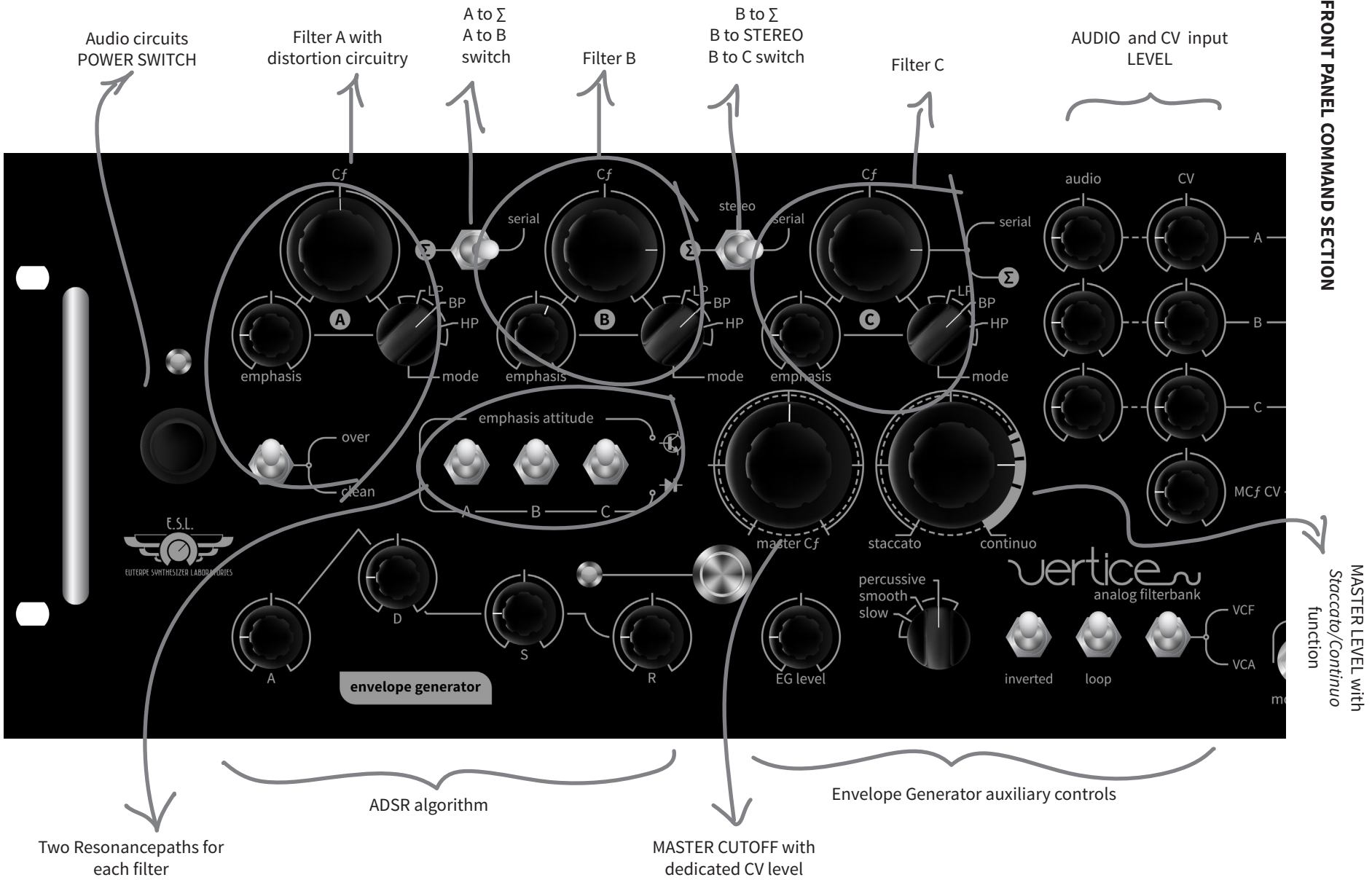We will reply with the maximum rapidity.

**Wake up VERTICE**
If you turn VERTICE on with a "just ready" continuos input signal and an output cable connected to your reproduction system you will notice a strange behavior: VERTICE turns on instantly, then "turns off" for some seconds, then it works again. This is a particular consequence of its very analog structure. It's not a problem of your unit, or a problem at all, every machine has its own particular way to wake up.

**Heating period**
VERTICE doesn't really have a "just-turned-on-heating-period", it is fully functional and big sounding as soon as the little "wake-on" time is elapsed, max 5-6 sec from switching on. But in normal applications the possible temperature going from an approximate 18-20°C of the room to the internal 25-30°C after about 15 minutes: with this not-huge, but also not so little, temperature variation range it is reasonable to think that a small change in tone with the same settings can be detected, and, if you like the analog philosophy, this is the "genuine product" proof, like as in orange juice that if it deposits then it is good.

Audio circuits
POWER SWITCH

Filter A with
distortion circuitry

A to ∑
A to B
switch

Filter B

B to ∑
B to STEREO
B to C switch

Filter C

AUDIO and CV input
LEVEL

Cf

serial

Cf

stereo serial

Cf

serial

audio    CV

A

∑

A

LP
BP
HP

∑

B

LP
BP
HP

∑

C

LP
BP
HP

∑

B

emphasis

emphasis

emphasis

C

mode

mode

mode

over

clean

emphasis attitude

A — B — C

master Cf

staccato    continuo

MCf CV

E.S.L.

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A

D

S

R

EG level

percussive
smooth
slow

vertice
analog filterbank

VCF

VCA

envelope generator

inverted    loop

MASTER LEVEL with
*Staccato/Continuo*
function

Two Resonancepaths for
each filter

ADSR algorithm

MASTER CUTOFF with
dedicated CV level

Envelope Generator auxiliary controls

## FRONT PANEL CONNECTIONS

**AUDIO IN**
Allows you to feed audio into VERTICE

**CV IN**
You can control the corresponding Cf with an external CV signal

A, B and C filterboards INPUTS

Master Cutoff INPUTS

AM input let you control the dynamic of the two VCAs. You should be careful, it is very sensitive. Using an attenuable CV signal is preferable

Serial take its signal from the C filter

Headphones is a stereo output that allow the use of professional passive headphones. Designed for 55ohm headphones.

**OUTPUTS**
Allow you some output configurations like:
- mono
- true stereo
- false stereo
- duplicate mono signal

Parallel take its signal from the SUM and from the C filter at the same time

EG Gate: here you can use a standard Gate signal or wathever you want, also **audio**, to trigger the EG

Panel labels visible: audio, CV, A, B, C, inputs, MCf CV, v/oct, EG gate, AM, VCF, VCA, outputs, mono/par Σ, stereo/ser
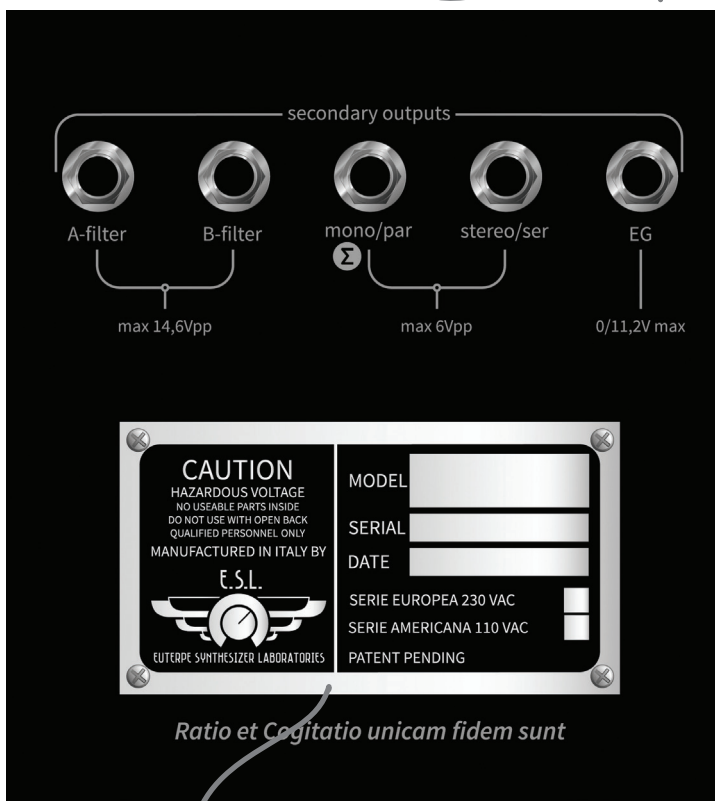
## REAR PANEL CONNECTIONS

Maybe it is a good idea to dedicate to the rear connection a small part of your patch-bay, if you use one. The rear connections are intended to widely expand routing possibilites and having them concentrated in a section of your patch bay can be a great creative advantage (e.g. you can use the same EG signal in order to control both MCf and Staccato/Continuo simply routing it to the first via switch on the panel and the second via dedicated AM input. Obviously respecting the IN/OUT labels, the above considerations is true for all the rear ports)

Rear auxiliary connections.
A and B are the direct outputs from A and B filters.
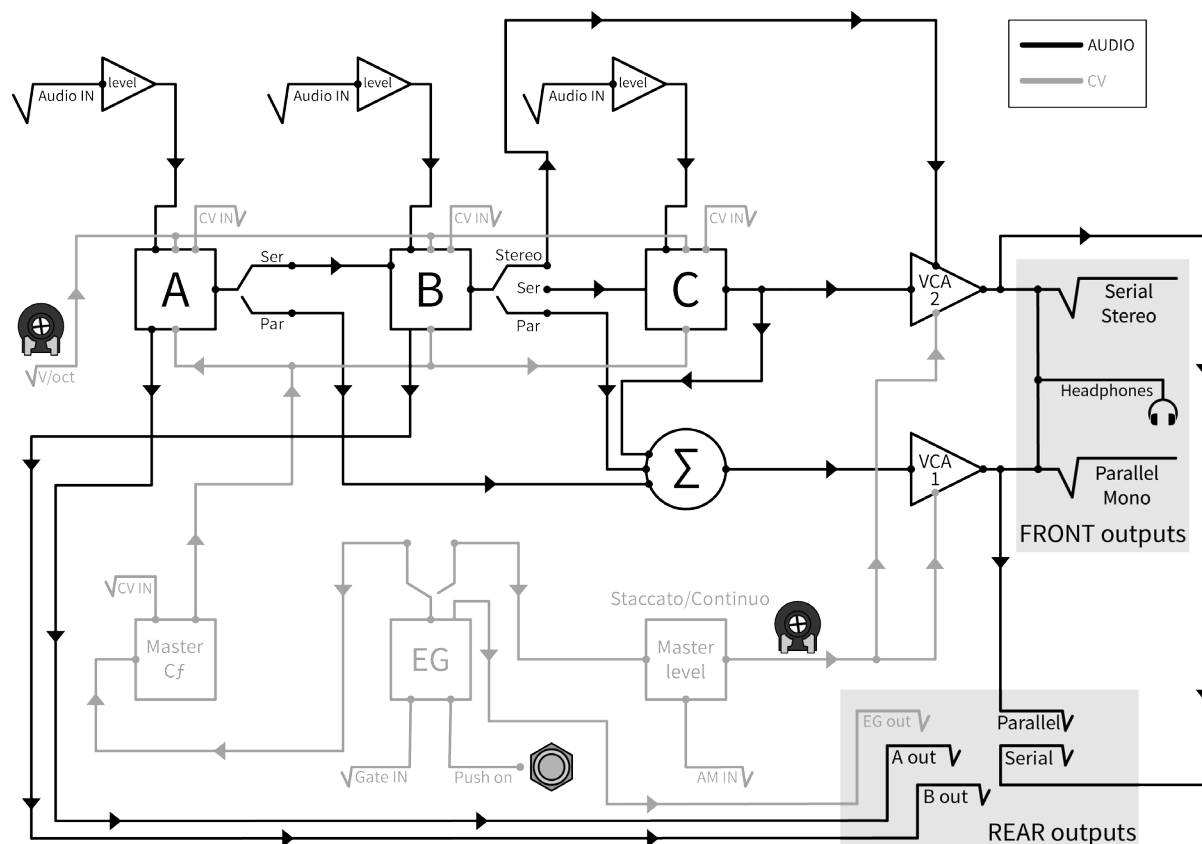EG is a simple buffered copy of the EG signal.
SER and PAR are copies of the front panel main outputs

secondary outputs

A-filter    B-filter    mono/par Σ    stereo/ser    EG

max 14,6Vpp          max 6Vpp          0/11,2V max

CAUTION
HAZARDOUS VOLTAGE
NO USEABLE PARTS INSIDE
DO NOT USE WITH OPEN BACK
QUALIFIED PERSONNEL ONLY
MANUFACTURED IN ITALY BY

E.S.L.
EUTERPE SYNTHESIZER LABORATORIES

MODEL
SERIAL
DATE
SERIE EUROPEA 230 VAC
SERIE AMERICANA 110 VAC
PATENT PENDING

*Ratio et Cogitatio unicam fidem sunt*

Serial number label

eng.: reason and thought are the only faith
it.: la ragione ed il pensiero sono l'unica fede

# SIGNAL FLOW

Audio IN  level
Audio IN  level
Audio IN  level

AUDIO
CV

CV IN    CV IN    CV IN

A    Ser    B    Stereo    C
Ser
Par    Par

V/oct

VCA 2    Serial Stereo

Σ    VCA 1    Headphones

Parallel Mono

FRONT outputs

CV IN

Master Cƒ    EG    Staccato/Continuo    Master level

EG out
Parallel
A out
Serial
B out

Gate IN    Push on    AM IN

REAR outputs

The signals shown here are two: **Audio signal** and **CV signal**.

*Audio* carries the audio informations being filtered and distorted by VERTICE. The A preamplifier leads to the A filter that can let the audio continue to the B filter or to the summing point. Almost the same happens for the other two filters. C is always connected to both outputs.

*CV* is the control signal which you can use to modulate the singular VERTICE's components or controls.
In this version the only external-controllable pots are the three *Cƒ*, the *Master Cƒ* and the *STACCATO/CONTINUO*. The *Master Level* unit you can see in figure is labeled *STACCATO/CONTINUO* on the panel. This pot is external controllable via AM external input or via CV GATE input and subsequent internal activation of the EG module. For more detailed explanation please refer to **page 18**, **page 39** and **page 46** .

About the audio signal there are some different ways of routing:
- SERIAL or MONO. A simple sequence of two or three filters giving you a wide range of monophonic impacting and tough-sounding possibilities
- PARALLEL. Using the Σ module it is possible to sum the A, B or C outputs. It is a noble possibility if you notice there are three independent audio inputs, it means real analog summing process, very useful to combine up to three signals in the best-congruous way also if you are not looking for "cutting performances"
- STEREOPHONIC. Bypassing the C module and using the A and B inputs at the same time you can obtain a **true stereo** modality. Obviously the C filter is "offline" only if you do not plug any signal directly into it. Instead it will *sum* its processed signal to both output ports, "centering" a bit the stereo figure but maintaining the mix fully equilibrated.

> **C is "Mono"**
> Note that, as just mentioned and shown in the picture, there is a routing particularity about the C filterboard: it has two output ports, Serial *and* Parallel, at the same time. The outgoing signal is duplicated. This is a really uncommon feature that make the VERTICE very comfortable and very flexible at the same time. Please keep this consideration in mind every time you work with the two audio outputs at the same time, wich is recommended:
> C is always mono, giving monophonic nuances to the resulting stereo audio outs.

**Cutoff modulations**

The CV signals you can use to control VERTICE are related to the Cutoff Controls. You can do modulated or linear control of the four Cutoffs: A, B and C filter have independent controls but the *Master Cf* command all the others. So on the same filter Cutoff you can sum two CV modulation, the dedicated *and* the master, plus the obvious results of an audio serial mode which make the latter filterboard the preeminent one, giving it "the last word" on all the audio chain. This is actually an effect that "sum" a further modulated cutting behavior over the resulting output audio. It's nice, isn't it?

**GATE the EG**

Besides of the dedicated, and very sensitive, AM input, the only CV input which isn't frequency related is the *EG GATE* input. In this port you should inject a gate signal, commonly a 0/+5V square wave, but other standards, and other waveforms, are accepted too. Try simple percussive audio, for example.
Notice that our GATE circuitry works only with the positive part of the wave and can show only the "square" behavior, ON or OFF. Square input signal however can obviously produce smooth outputs CV thanks to the ADSR controls.

**Contrabass tone routing tips: the first simple patch to do**

This is a very basic configuration, hosted in this chapter only to stimulate your imagination. To obtain a contrabass-like tone you can set the three filterboards in *SERIAL*. Inject into the A-board a medium-level sawtooth from one singular VCO. Then close all the *Cf* and set the *MasterCf* counterclockwise enough to obtain the classic bass tone. A bit of *Emphasis* and using the *Overload* circuit may be useful.
Disconnect the *V/oct* plug for a more solid bass note in the bottom of the range, otherwise it could close too much the Master C*f* between the note change, weakening the low frequency response.
Note that this is the typical tone which take advantage by an "EG-controlled VCA" instead of VCF.

**Tone correcting**

The VERTICE is preeminently a creative filterbank but it can also easily be used as a simple tone corrector for re-tracking. Just explore combining soft or sharp HP or BP filtering with various SER/PAR routing combinations. Some are clean, some have more low presence, some are more creamy or full-sounding. You just have to take them out of the box.

# THE COMPONENTS

## THE CONNECTIONS PANEL

The VERTICE Analog Filterbank is externally composed of:
*   the **Inputs and Outputs** section, which hosts most of the playing connections the VERTICE can allow. They are here to easily "plug-and-play" your ideas
*   the **Main** section, which is the place where you can really play with it
*   the **Rear** panel where you can find serial number, rear ouput ports, power socket and fuse replacements.
Follow the detailed explanations of these sections.

**The INPUTS and OUTPUTS on the front panel**

It's the right side of the machine and provides several ports for Audio and CV managing, properly labeled.

In the nine Input ports you can respect their designated functional domain or try some more creative patches. An oscillating CV is certainly a CV but it's also an oscillation... you can try to plug it into the "wrong hole", generally it is not dangerous for the VERTICE's health. However try to use only "musically known" signals, avoiding e.g. direct 380VAC or radioactive gamma ray. Higgs boson also should be avoided.

The two OUTPUT ports also can be "mistaken". The natural destination is the *MONO* or the summing *PARALLEL* out for the first one, and the *STEREOPHONIC* or *SERIAL* for the second one. Later in this manual all the nuances of the two/three/four modalities are fully investigated. For now treat them as your intuition suggests, like i.e. "Parallel = sum of signals, Serial = sequence of signals".

**Reference Labelling**
In addition to this quick description here you can find some reference terminology valid of course throughout the labels on the whole Filterbank and frequently used in this manual:

*   *A / B / C*: is related to the three filterboards, heart of VERTICE, in left to right sequence

*   *Cf* is the acronym of Cutoff Frequency

*   *MCf*: this label indicates the *MASTER CUTOFF* frequency control hosted in the middle of the front panel

*   *Emphasis* mean Resonance, a controllable feedback that preeminently define the filter character.

*   *CV* is the acronym of Control Voltage. In the synthesisers world this way of control something else came before the MIDI age, when everything was to be controlled by simple variations of voltage at a given point of the circuit. This method, exept for some accurate situations like VCOs exponential converters, was not so much precise, using a large scale of values (0/+5V or even +/-10V). This lack of precision was not a big problem since the analog subtractive synthesis was (and still be) very coarse and inaccurate, THEN creative. Errors make us artists.
Inappropriate precision make us instruments. My CD player play the same virtuoso solos of Vivaldi exactly the same at every listen. No-one real human can do that. I call it lucky, and it isn't a problem at all. :)
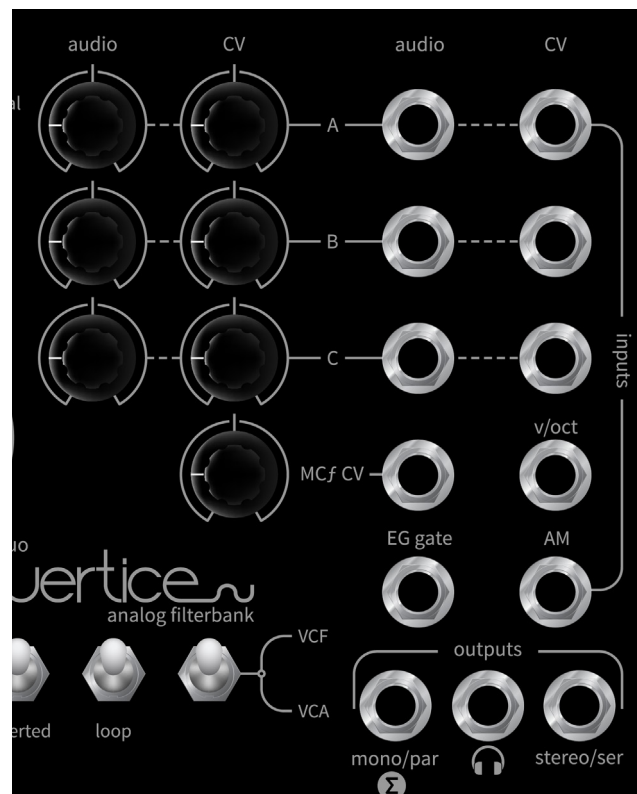
- *V/oct*: it's a standard CV terminology. With this feature you can play a CV-emitting keyboard, sometimes labeled with "Pitch", and make the *MasterCf* follow your performance. Note that the VERTICE is an old style filterbank and its circuitry is very "primitive": so don't pretend a perfect correspondence ratio between the injected V/oct signal and the behavior of the *MCf* control. If you go up or down it follow you, that's all.

> **About the V/oct behavior**
> Before shipping, during the calibration process, we take care to trim every VERTICE to make it respect the Moog Law (1V/oct). We use Moog equipment as a reference for calibration. Although the Moog's V/oct tracking is precise, who is not precise at all is VERTICE, especially in auto-oscillating modality, due to the old-style design of her circuitry. So, again, don't wait for precise "VCO" tracking, it is quite difficult to obtain.
> There is a trimmer dedicated to V/oct regulation. It's called obviously V/OCT and you can find it opening the unit and looking on the bottom side of the main pcb, the one with the big Euterpe's logo on. One indicative dot is placed here to show approximately the point of standard Moog 1V/oct, but your unit can be slightly setted differently because of the component tolerances in this passive old-style regulation system.
> Adjusting this setting is possible for users and almost damage-free but you should know that before shipping we do not simply adjust the trimmer near the dot but really we match the 1V/oct standard playing Vertice as follows:
> MCf flat, all three filterboard's Cfs flat and all three Emphasis to Transistor and to max lev, without any incoming audio signal into the filters. This is the settings we use to match your filterbank with Moog V/oct. However the trimmer is still available to follow any alternative tuning methods you can dream to reach with the Power of the Holy Screwdriver.

- *EG*: it's the acronym of ENVELOPE GENERATOR, frequently named ADSR. The EG emits a Control Voltage signal. You can find its dedicated controls in the bottom side of the front panel and functional explanation later in this manual  (**page 41**).

- *GATE*: it's another standard CV signal. It's a square signal which occurs when you play a note in a CV-emitting keyboard. Plugging this signal in this port make the EG module keyboard-controllable, but you can try also other CV sources, like a square LFO. See some tricks below in the related EG section of this manual (**page 46**)

- *AM:* the Amplitude Modulation is the basic function of any standard VCA. It means controlling the amplificator gain factor applying a CV to it, in order to remotely bias it.
  Often in the synthesis world "applying a CV to the VCA" is assimilated to a "modulation" over the VCA, making difference between that and an audio-range modulation, particularly called AM and creating some understanding inconvenience.
  AM is the procedure of controlling, modulating or not, the VCA: if you do it in the audio range you have an audio-range AM. If you do it slowly you have an LFO modulating the amplitude. If you do it steadily you have an external hand-control of the output level of the VCA.
  All these three way are the same thing - AM, obviously - obtaining very different results.
  Other basic and important information concerning AM usage can be found in the Staccato/Continuo section, **page 38.**

> **USAGE NOTE of Vertice AM INPUT:**
> - AM input accepts standard 0/+5V, 0/-5V, +/-5V and standard audio voltage levels
> - this input port is almost direcly-connected with the VCAs control point so, since Vertice's VCAs are very dynamic and responsive the signal that control them should be carefully set. Obviously this input port is placed in the front panel in order to give importance to this patching possibility, something with which you can easily overdrive the outputs or injecting into them an audio-rate control waveform and so on. But please remember that this is a very sensitive point of the circuit so try it starting from low, external-attenuable voltage levels.
> - touching the tip and the sleeve of the cable that is already inserted into AM input socket can cause very surprising reactions. Try it, if you dare...
> - if you want to avoid "strange" behaviors when using the AM input you should unplug the cable from the front panel. Cables left patched on AM IN and not patched at the other side can cause muting, strange humming and electro-magnetic-field sniffing from the last (and from the one that can gain tons of dB) stage of Vertice
> - one high-level audio rate control signal can be very sound-destructive, causing deep phase cancellations and other dark misdeeds. This is wanted
> - the Staccato/Continuo possibility is still available also with this patching method. The AM input socket makes it possible to apply an external EG signal so you can explore Staccato/Continuo possibilities while the internal EG is at the same time modulating the MCf. This is another reason to need an external level control of your incoming AM signal: often, if you need a Staccato performance, you must turn down the VCAs level reaching zero. Here, with a standard 0/+5V you can "open" the VCAs reaching max output level. But maybe you don't want a totally squared squashed tone. Ok, if it is the case you need to attenuate the external CV that fill the AM input (because Staccato/Continuo is in Staccato mode, alias zero level)

- if too much voltage level is injected into this port you can shut-up your VCAs. This side-effect often happens when doubling the EG signal, routing it both to VCA (via switch on the panel) and to AM input (from rear EG out socket). This is a not-dangerous-but-still-unhappy situation for the VCAs, so don't keep your Vertice a long time under these settings. Also because, by-the-way, if set-up like this it can play nothing but silence (VCAs are in "alarm mode"). To restore the normal situation just lower the incoming signal from the AM or, in the specific previously mentioned case, the double EG, just don't double your EG. One single internal EG signal is enough to obtain all possible sonic nuances from your VCAs. We have told you so...

**Want to hear something strange?**
Everithing you put into the AM IN can be a sourprise. But try to patch the A Rear output into the AM IN. Then give a saw to A, all serial, then let the three Emphasis go.
Try some different mode combinations and prepare your soul to a blind-date with the just uncaged, thirsty and barking Demon of the Cursed Amplitude Modulation.

- *MONO*: it's the classic label for a single audio signal. Because of the unique interior layout of VERTICE this output port is also the *PARALLEL* (aka $\Sigma$) out. You can better understand this method by looking the SIGNAL FLOW section of this manual (**page 15**) or the $\Sigma$/*STEREO/SERIAL* description (**page 35**

- *STEREO*: unlike the most analog filterbanks in the market the VERTICE provides a stereo modality which you can activate using this port and the *MONO* output at the same time. Then you need a Left input inserted in the Filter A audio input and a Right input inserted in the Filter B audio input. If the $\Sigma$/*STEREO/SERIAL* switch in the front panel is set to *STEREO* you can use the VERTICE as a *true stereo* unit with 12dB/oct slopes for each channel.

**The INPUTS and OUTPUTS on the rear panel**
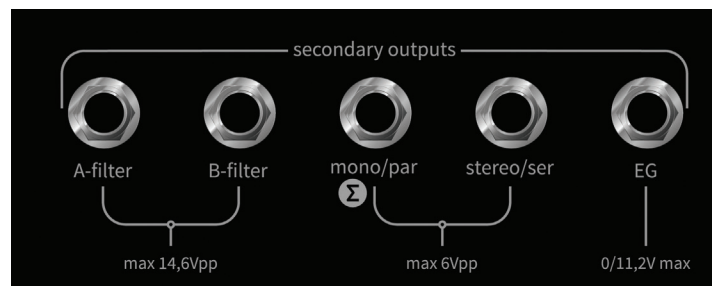


- *A and B:* these two ports carry the corresponding filter audio signal directly taken from the last point before the related routing switches, and often giving a 15Vpp signal level. They come out at a more high level than a standard CV, and for that reason they are useful in both audio and CV applications, like using an audio signal to command some external moudule. This is an uncommon possibility and often lead to a whole new meanings of the word "craziness": we strongly recommend the use of these two ports in order to create *audio feedback* into the signal path. If you never used these two ports you are missing one of the best chances Vertice can offer to be astonished and deeply touched by it. It is also highly recomended to patch these ports into your patch-bay to obtain more comfort during patching.
E.g. you may want to create something like this:
Audio into B, B into C, C to output. Then you can take the B signal and route it into A, which is also going into B. In this way you just made an audio feedback between B and A-to-B, and if it sounds weird on paper try to imagine this patch in the real world.
You can also route A into A itself! In this case, WITHOUT the presence of ANY OTHER EXTERNAL SIGNAL, you often may obtain a sort of strange unstable VCO when the pitch is "determined" by all the Cutoff frequencies involved and audio levels, and with a waveform "casually regulated" by other settings like *Emphasis* or *Mode* (of all the various filters involved). And there is plenty of other routing possibilities, like the "Drilled-by-the-Dentist Cat" and the "Domestic Whale". You *have* to try it. For more info **page 54.**

- *Mono/Par and Stereo/Ser*: born simply to give extended patching simplicity, avoiding the two fixed output cables constantly dangling from the panel, these two ports are simply copies of the outgoing main audio front ports. Nothing more, but nothing better to create other really weird patching possibilities, feedbacks and melt-mind puzzles like: "but, what? who did, wait, what?!"
We really recomended to try also this two sockets, especially in front of some friends. :)

- *EG:* required to bypass the VCF/VCA limitation, this rear port is a copy of the EG signal. It follows the main rule for a doubled signal: it's the same of the first one. So what you see from the front LED is what you get from the output socket, assuming that obviously in the meantime you actually control the VCF or the VCA via front panel switch.
  So you can have your loop or your triggered ADSR response driving both MCf (aka VCF) and e.g. A filterboard (**A-Cf CV input**), or both MCf and VCA (via *AM input*), or VCA (*AM in*) and *B filter* (*B-CV input*) and so on.
  But you can also obtain something like Master Vertice that lead another Slave Device that can follow a square LFO (created by the internal EG in looping mode), like an analog sequencer, and now re-use this "following Vertice's tempo" informations to command the filterboards, another device Tuning factor or other parameters, the VCA (*AM input*), the *V/oct*, even the GATE of the EG itself. It's sound weird? Yes.

Try to imagine how much deeply can become the audio manipulation on Vertice using these five socket with a bit, nothing more, of creativity.
If you need to cry this is the moment.

> **Searching for an almost normal LFO?**
> It's simple. Just feedback the rear EG out into the front EG Gate input. Then with Sustain and Release to minimum you have a basilar Attack/Decay looping LFO. This configuration cut away the push button (it doesn't work until you unplug the cable).

# THE FILTERS SECTION

It's the upper side of the front panel. It's the home of the three filterboards and related audio preamplifier and CV injection circuits and controls.
They are labeled as A, B and C.
Most of the features available are common for all three filters, with the exception of the A Filter Overload circuitry, shown in form of *OVER/CLEAN* switch, and the B-*STEREO* mode.
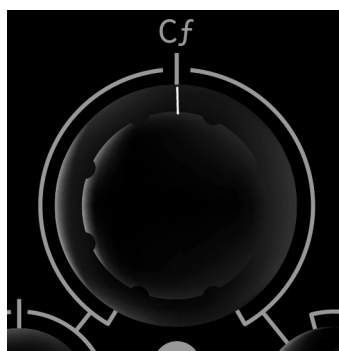
> **The Circuit**
> The three filters are our personal elaboration of the Sallen-Key filter thought by Nyle Steiner in his 1974 version of his famous design, hosted in the great Steiner-Parker Synthacon. It was a 12 dB/oct slope and it still remains a 12 dB/oct slope. But via the internal routing of VERTICE you can reach a slope of 36dB/oct nominal. In real-life however attenuation is less, max about 30 dB/oct, depending by input level, resonance control and Mode type. Electronically speaking: a diode network is used in place of the two variable resistors which make Sallen-Key filters useful for music. The obvious characteristic of a synthesis filter is the voltage-modulable Cutoff, so here is the magic: using a "side effect" of diode, their variable resistive behavior in front of a direct bias current, he made it. However diode generally are for other purposes, so this particular use can be source of "strange" behaviors.
> Diode are common to reject current flow if the potential difference between anode and katode are less than, usually, 0,5-0,7V (silicon, small signal): if this difference is not reached they stay deactivated. So, since is exactly the audio signal which flow into the diode network it can activate, or not, a diode. It can be little up or little down than its threshold. This is why Steiner filter can show high instability especially when high Resonance values are involved. As we will see later indeed, Resonance is a signal feedback directly into the audio path, in this case directly into the diode network.
> You can see the original 1974 Steiner VCF circuit in the inside back cover of this manual. Values are effective (with these component values you can build a working 1974 Sallen-Key Steiner filter).

*Cƒ* means *CUTOFF Frequency*. It is the point in the audible range where the filter start to run. It's the principal control of the singular filterboard.
Its value is expressed in Hz and in the case of the VERTICE's circuital design the excursion between maximum (fully counterclockwise) and minimum is about *10≤Hz≥22000*., obviously biased by the MCƒ position. We do not make any clear reference on the panel graphics about the Hz values because of the VERTICE's strong *musical* character. If the intended use were measurements or other more precision purposes like mic amplifications, compressions and other meter-related applications it would be useful and reasonable to give them, but it's not the case. We want you to decide by your ears, not by your eyes. We follow this philosophy on every models/modules we design.

As said the control of *MasterCƒ*, explained later (**page 37**) exerts a strong influence in the behavior of the three individual Cƒ, so it is therefore useful to operate the four controls concurrently, although not necessarily at the same time. With five minutes of use you can easily understand the ratio between the four elements.

> **Where is my Cutoff Frequency?**
> To understand at what frequency you have placed your Cutoff simply you can increase the Emphasis value to obtain a signal peak around the Cutoff frequency. Conversely if you leave the Emphasis control *close* to zero you will notice instead the classic -3dB behavior. By mathematical definition in fact the Cutoff frequency is located in correspondence of this attenuation.
> In real tough life instead, with a true zero Emphasis setting you don't really obtain a -3dB behavior from Vertice. The signal loss is a bit more giving a "10-11 dB/oct" slope. This happen because of a small potential leak due to the passive feedback method, so it's natural, almost vegan I should say...  :)

**Why in all filters there is always a -3dB level attenuation on the Cutoff frequency: a brief mathematical analisys**

-6 and -3dB are two very well known values in music, almost iconic. At certain point studying this subject seems that everything in the universe is -6 or -3dB related.

Well, "start to run" means just that: on the Cutoff frequency there is a "totally unsuspected" *-3dB level attenuation*. This is not a characteristic of our filterbank only, in fact it is a junction point across all the Filters literature. Understand why this "strange" coincidence appears everywhere is all about physics and mathematics. What follow is a brief simplification of this totally not obvious argument so take it for what it is: an attempt to intrigue and illustrate the operation baseline of one of the most complex arguments of Electronics.

**Do you really want to talk about math on a musical instrument users manual?**

Why not. Filters basically are made by some capacitors and some resistors connected in various ways through the signal path. Resistors and caps are two typical *passive components,* like cables, diodes or inductances, so something that work with electricity just because they are naturally involved, not forced by some sort of parallel power supply or logic computation. They are stupid, in one word, and repetitive. So they are predictable and mathematically understandable even if we aren't Chuck Norris (because Chuck doesn't have an intellectual quotient, he has *two* of them...).

Of course there can be complex filters based on interactions of integrated circuits and other component's but capacitor and resistor remain the basic building toys almost always.

Capacitor, the most important frequency-related component, has on the current flow an important consequence: it blocks the direct current, or DC (frequency of a DC signal = zero Hz). Audio is, for its oscillating nature, an alternated signal, AC (frequency of an AC signal = not zero Hz), and this is enough for the capacitor: the signal pass through. But, like so much in physics, it is all a *transient* matter. This means that capacitors don't show a "square" behavior, ON or OFF, but a gradual blocking activity on the *becoming continuous* signal. In other words capacitors don't stop an alternated flow only if it is *alternating enough.* This is the explanation for the smooth response of a simple passive RC filter, like the one shown below (simple filters like this one are actually used into some areas of Vertice).
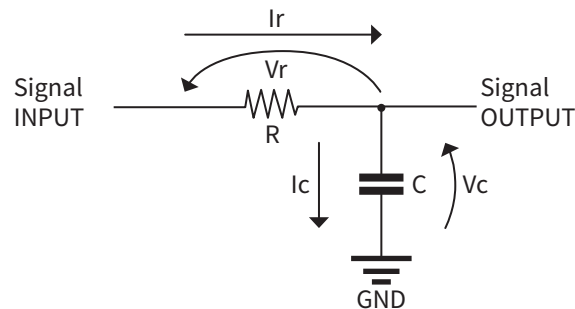


**LP 1 pole RC passive filter (1 pole = 6dB/oct)**

R = resistor (passive component)
C = capacitor (passive component)
V = voltage (or potential difference)
I = current (Ampere)
$f$ = frequency (numbers of occurrences of a repeating event per unit time)
F = frequency response (which in filters theory is quite equal to *Gain factor at given frequency*)
$\omega$ = angular velocity (directly related to frequency, inversely related to $\tau$)
$\tau$ = RC time constant (basics of capacitors theory)
c = capacitance (the ability to store electric charges)
Z = capacitive o resistive impedance (impedance is the measure of the opposition that a circuit present to a flowing current)

If in this simple circuit there is current flow there also must be a potential difference across R and vice versa. We can mathematically preview the system voltage behavior with the simple following considerations.
In an alternated signal situation $\omega$ is called *angular velocity* and is equal to  $\omega = 2 \cdot \pi \cdot f$
so it is frequency directly-related.

If $V_{out} = \dfrac{Z_c}{Z_r + Z_c} \cdot V_{input}$ and $Z_c = \dfrac{1}{\omega \cdot c}$  then:

at **low frequencies** we have angular velocity ($\omega$) very low, zero if we feed a real continuous signal (zero in this case mean no oscillations, and consequently no calculable frequency, so a very low, or null, angular velocity). A low $\omega$ means an high $Zc$ ('cause 1/0=∞) and consequently a negligible[1] $Zr$, so the first equation can become

$$V_{out} = \frac{Z_c}{Z_c} \cdot V_{input} = 1 \cdot V_{input}$$

1 In electronics the ratio 10:1 between two elements is enough to made the lower value ignored

The audible results is a simple "neutral" flow of this low frequency signal.

If the input frequency is a very **high frequencies** signal instead, say 100kHz, the behavior will be opposite than the previous one: the angular velocity ω is high and so Zc is near to zero making the first equation become $V_{out} = \dfrac{0}{Z_r + 0} \cdot V_{input} = 0V$

This means there is no signal flow to the output: it is all "discharged" to ground, the circuital equivalent of an highway (less traffic = it is more easy to go fast. Charges always choose the faster way).

This considerations are true for the Low-pass configuration, but, read in "reversed mode", are also true for the High-pass modality.
So, this is the generic "engine" function behavior.
Now, if you are not dead yet, we can try to look inside the *frequency response* of a given-value system, putting out circuit into three interesting situations.
The Cutoff frequency is located on the Hz line by resistor and capacitor sizing.

The relation here is $f_c = \dfrac{1}{2 \cdot \pi \cdot \tau} = \dfrac{1}{2 \cdot \pi \cdot R \cdot C}$

Using this formula you can know *where* the Cutoff frequency will be at given resistor-capacitor values. Now, knowing the filters slope and mode you can easily deduce the behavior of the circuit, but you can't *explicate* it. You know what it does but you don't know *why*.
The equation to calculate F, the Frequency Response of the system, is $F = \dfrac{Z_c}{Z_r + Z_c}$

Turning this equation into something useful is not exactly simple: this procedure involve Pythagoras and a vector analysis of both Z and the phases involved, which capacitors systematically change as a construction characteristic. This is not the right place to dwell around this argument, just be content of the sequent little reasoning.

Using Pythagoras and vectors we can transform the previous equation into $F = \dfrac{1}{\sqrt{(\omega \cdot R \cdot C)^2 + 1}}$

When we are in the **low frequency** range, injecting a low frequency signal, ω is equal to zero, so $F = \dfrac{1}{1}$

meaning the gain of the whole structure equal to 1, so "transparent". All the injected spectrum have the same gain factor. No attenuations on this low freq signal by this circuit.

When we are in the **high frequency** range, injecting an high frequency signal, ω is comparable with ∞ so the previous equation will become $F = \dfrac{1}{\omega \cdot R \cdot C}$ (we can ignore +1 because of the high value of ω). In this range you can observe a *progressive* gain decrease when you increase the input frequency. A classic low-pass behavior. The progressive characteristic is due to the *transient* comportment of the universe: in this case the greater the frequency the smaller the gain.

When we are in the **Cutoff frequency** range, inputting an audio waveform with frequency value *comparable* to the position of the Cutoff frequency of the circuit we are in a **particular situation**:
by definition $\tau = R \cdot C$

If $\omega = \omega_{cutoff} = \dfrac{1}{\tau} = \dfrac{1}{R \cdot C}$ so $F = \dfrac{1}{\sqrt{(\omega \cdot R \cdot C)^2 + 1}}$ become $F = \dfrac{1}{\sqrt{\left(\dfrac{1}{R \cdot C} \cdot R \cdot C\right)^2 + 1}}$ so $F = \dfrac{1}{\sqrt{\left(\dfrac{1}{1}\right)^2 + 1}} = \dfrac{1}{\sqrt{2}}$

The two $R \cdot C$ modules are erased by themselves so the final equation become $F = \dfrac{1}{\sqrt{2}}$
which is another way to say $F = \dfrac{V_{out}}{V_{input}}$

Now, since this formula can't be so exhaustive as it is we are forced to turn it into a more recognizable form. To derive dB values from a measure you can use the Pressure Level dB general equation.

It can be expressed as $20 \log_{10} \dfrac{measured\ value}{reference\ value} = 20 \log_{10} \dfrac{V_{out}}{V_{input}}$

so we can conclude that: $20 \log_{10} \dfrac{1}{\sqrt{2}} = -3dB$

**This is why all the filters across the world shows a -3dB behavior on the Cutoff frequency.**

**Filters output phases**
In this particular case the phase shift between the input and the output signal is equal to the vector of

$$-\frac{\pi}{2}+\frac{\pi}{4}=-90°+45°=-\frac{\pi}{4}=-45$$

In other configurations phase differences introduced by the capacitor's constructive characteristics, which are not small at all, show themselves in various way but we ignored here the subject for evident lack of need. These phase changes are the reason why over-aggressive cut slopes (e.g. 36 or more dB/oct) are <u>less musical</u> than a smooth one and they can be sources of unwanted cancellations and other audio artifacts. This is true for all the processes that involve filters, especially analog or digital equalizers, from which we generally want strictly functional, not creative, performances, so smooth, clean and transparent.
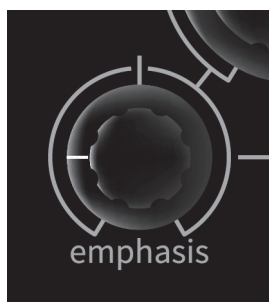
*Emphasis* mean *Resonance*. We chose this antiquated formulation to remember the synthesizers of the 60s, when the word Resonance was not a standard yet.
Emphasis is a *level-controllable audio signal feedback across the filter's path*. It can produce some very interesting timbre variations that you can explore.
Use the *Emphasis* controls to increase the presence of the C*f* in the sound, or to create whistles, wind, drops, goa-kick and a very unstable auto-oscillation.
In this filterbank the basic range of the three controls are heavily subjected to Emphasis Attitude settings giving two deeply-diferent behaviors.
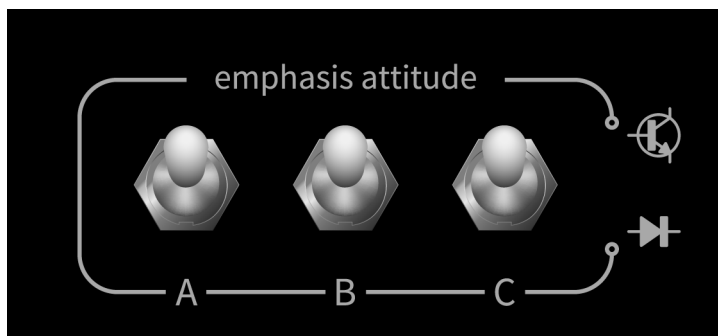
To give to our filterbank personality and uniqueness we work a lot around this Emphasis-related function that we label as Emphasis Attitude.
This switch allows you to choose between Classic Steiner's way, named Diode ⊶ and our personal design, the Transistor ⊶ (actually this is the BJT Npn transistor symbol...)
NOTE: in the following "pot-pictures" arrows indicate where the circuit generally start the auto-oscillation behavior.
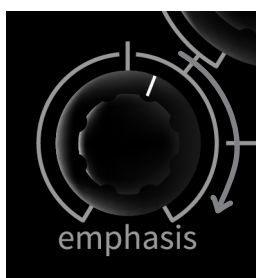
**Classic way (⊶):** this passive re-injection of signal into the audio path is the key to obtain the classic synthesizers sound of sweeping filter but not only: it's useful for increase the high frequency band levels to emphasize too dark tracks, making vibrating and prominent Charleston lines or to shape the impact of weak snares.
The most important thing you can know about *this* Emphasis control (other kind of filter have other kind of response) is that it increases the level of the output signal of many dB, especially in the mid-frequency range, since it is limited only by passive resistors, nothing else. In the next chapter you can find some graphs concerning this behavior **(page 27)**.
In addition to that it's very useful to know how Emphasis effects the resultant filter slopes, making it more or less aggressive on the harmonic contents. Generally speaking, in Vertice MORE EMPHASIS = MORE AGGRESSIVE SLOPES
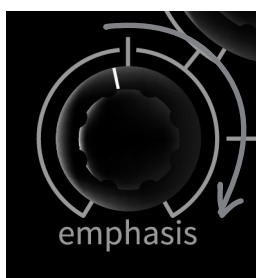
**Alternative Emphasis way (⊶):** in order to tame the too much dynamics that the Classic Emphasis way has, something funny but not so frequently musically usable, in this long year of Vertice re-design work we projected our own personal resonance way. The selected simbol to label it is the transistor because two active silicon transistors are used to compress and distort audio signal traveling into them.
This is maybe the first time a dynamic and tonal distortion is dedicated specifically to the resonance path, that is only <u>a part</u> of the signal in the filterboard, and that is SUMMED into it, giving unmistakable nuances.
Furthermore this more controlled resonance path give a very useful static auto-oscillation, something that allows you to use Vertice also like a triple oscillator, if you dare.
You have to know that this Transistor way, like so much things in Vertice, is very sensitive to the incoming signal level. Moderate the input if you want the Transistor Emphasis "VCO effect" very prominent and "in face" or drown it into a sea of very loud wave (maybe using also the overload funcion) to get out more nasty nuances.

At low Emphasis levels this circuit often give back whistles-sounding performances, sometime not very useful, but when amplified you will easily obtain some very distorted and screamy sounds, especially when the incoming audio level is high. Remember that this is half natural signal, half Emphasis signal.

The goal here was to create a more stable resonance path than the Diode mode, but also to implement this pure electric distortion above the Resonance path. Audio results vary from a bird chirp to screaming pig with all other farm animals in the middle. Obviously with a reasonable mix of the two Attitude modality through the signal path very interesting audio things can happen, especially "tuning" the three cutoffs and modulating them with various CV, like mixed LFOs or S&H random sequences.

Note that *the auto-oscillation point is placed differently for the two attitude*. In the Transistor way is easy to get it at relatively low Emphasis settings *because the point of this circuit is to produce audio <u>that have to be drowned</u> into the flowing hi-level audio signal*. In the Diode way instead the auto-oscillation start late in the pot race and soon it takes on characteristics of heavy instability, eventually slipping up the Cf. You can have an idea of the auto-oscillation starting point just looking at the arrows on the two dedicated pictures of the Emphasis pot.

**VCO style**
If you try to use one or more Vertice's filter like a pure wave generator you will easily make it autooscillate simply passing the flat position when in Transistor modality. However, since the oscillating circuit is not only the Transistor-way module but all the passive Steiner's circuitry is involved, don't ever imagine a static auto-oscillation "à la Moog". It will be very inaccurate both in level and intonation and you can often notice a sensitive pitch instability during the flowing of the minutes.
Mixing the three autooscillating VCF togheter can produce very interesting results going from pure sinewave to talking aliens to RadioAM poltergeist.
I tell you a secret: if you play a bit with autooscillating Emphasis without an injected audio, find some interesting combinations of Emphasis levels, Cf and Mode, and *then* let the audio, an old good heavy sawtooth, flow into the filters, often you've made your day. :)

**Modulating high value Transistor Emphasis**
When in stressed Transistor mode, if modulating the VCA (via switch on the panel) and MCf (via EG rear out and MCf-CV in) togheter using the built-in EG you can easily find stomping techno beats and screamy uplifts at LFO values, and going crazy with zombie horror Ktulu-call at audio-range rates. And Ktulu knows how to play a synthesizer...

**Emphasis circuital implementation.**
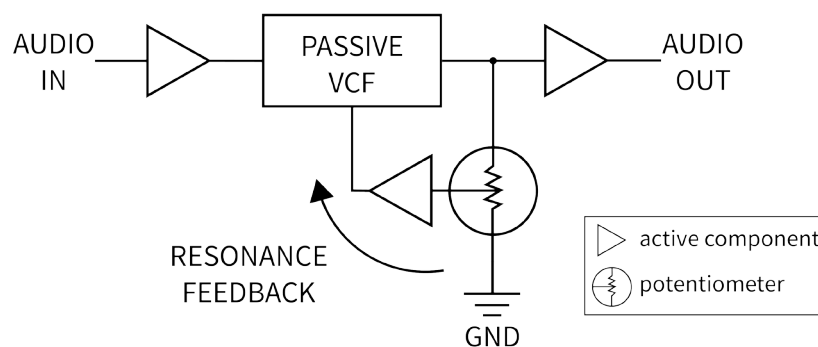


As you can see in the picture saying "level-controllable audio signal feedback" is not a fancy definition. This is a feedback in the Larsen meaning, just like a mic to amp to mic to amp etc. system. And, just like it, if it is made with passive and authentic circuitry it can be very difficult to control and tame, but also more intense and vibrant than, e.g., a digital filter module, the behavior of which is determinated by the Human thought beside by the Phisycs basic rules. The real circuital difference between the two paths is right here: in the Classic one the signal travel through an almost passive way, in the Transistor one instead the signal level is actively controlled by the two little ancient components.
As you may know a transistor is a very simple component, summed up in a easy-to-get image: it is a little piece of silicon in a small plastic house, which try to act like a valve. How accurate can it be?

**Not a VCO**
The VERTICE is a filterbank, not an oscillator-bank. However it can oscillate, and quite loudly. The auto-oscillation behaviors are very different besides the two attitude style. The Transistor mode has a more "standard" way to oscillate, something you can find in the Ladder or other well known filters, only more distorted and aggressive. The Diode way instead is not classic at all, and surely not predictable, at high values. And, of course, in that extreme range of settings it does not follow any real V/oct parameter. Again, our filterbank is not a precision tool, a bistoury. It's more like a Viking battle-axe. We designed the alternative resonance way (transistor) specifically to cover the lack of stability that high resonance value can give in the passive Steiner's way. Then it comes out that distortion can be a welcomed plus and, after many circuits tried and invented, the audio results of this choice is over your fingers. This Transistor way is to be intended like an ALTERNATIVE and creative way to use our filterbank, not as "the standard", concept which Vertice does not even understand. However if "a standard" is needed and mandatory to set a conceptual starting point, that can be the Diode way at low settings.

**From EG to VCO**
Also the EG can create a sort of auto-oscillation, in some way more stable and useful than the extreme Emphasis settings just described (...but it can be mixed with...). With the *LOOP* mode set to ON and the *PERCUSSIVE* status selected, in some configurations it can reach around 170Hz in a quite limited waveform variety, but still waveform... then you can route this oscillation, with it's level control and via the *VCF/VCA* switch, to the *MCƒ* (alias *VCF*) or the *STACCATO/CONTINUO* (alias *VCA*) controls and then see what happens. For other details about the EG see the related section (**page 41**)

**Need an oscillator?**
When you need an oscillator and nothing but Vertice is left in your lonely home after your divorce you can obtain a very-hard tunable Oscillator simply patching the Rear A out into the Front A audio input. Try it alone then, if you need some tip and tricks about this strange sort of analog oscillator, you can look at **page 54**.

**Need a disturbing Noise Generator?**
You're too happy and feeling great in a brilliant shiny day with the sun up right there and smiling birds flying around and suddenly need to return to your usual dark daily sadness? Vertice is here to help!
Why don't you bring out a 110dBrms pure electric satanic noise and let your hears spitting blood for all the place? It's sounds a great idea! Try this:
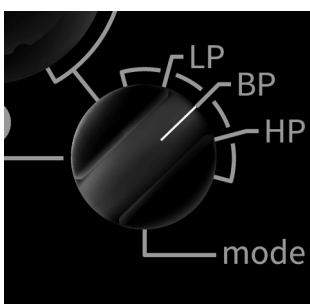**Mode**: Serial LP
**Attitude**: Diode
**Emphasis**: all three very high but not max
**Cutoffs**: try to match them.
There is a point, or a small range of, that the Diode Emphasis try to skip up your Cutoff. Here is the clue. If you set all the three filterboards like that you have great chances to bring out one of the meanest brain-disturbing Noize Gen ever...



*Mode* varies the response of the singular filterboard between the three classic states: *Low-pass, Band-pass, High-pass*. This control is independent for every one section. *Low-pass* means that the low frequency will be the last to disappear, cutted away from the Cutoff action, in this case turning it counterclockwise.
*High-pass* is the opposite of a Low-pass in both harmonic cutting and pot rotation ways.
*Band-pass* is made serializing a Low-pass with a slighty more open Cutoff with an High-pass with a relatively slightly lower Cutoff point, making them move together, so only the central part of the harmonic content will pass through the filter and see the rest of the world.

The basic and nominal slope in Vertice measure 12dB/oct, so quite tender. But it can be less (10-11 dB/oct minimum when zero Emphasis is set. It depend also by the input signal level) or strongly increased in various way using the Emphasis controls or the *PAR/SER* internal routing.

There follows some spectrum analysis (*Bode diagrams*) of the behavior of a single VERTICE filterboard. In this case we investigate on the A filter with Steiner's classic resonance way (diode) inserted, changing the filtering mode and reasoning a bit on what we see.
The *A-Cƒ* is set to **1kHz** so the reference frequency for measurement is **2kHz**, the octave up. The source is a simple low frequency Moog sawtooth at medium level. The responses of the three filters are *highly dependent* on the input level.

**-3dB**
Note for those who do not use dB and Bode diagram everyday: a 3dB difference is a BIG difference. It means in the most cases a gain (or loss) of the double (or half) of the perceived loudness. Please read the following diagrams knowing it.

**DIODE ATTITUDE RELATED BODE DIAGRAMS**

- **LP with a very moderate Emphasis settings**
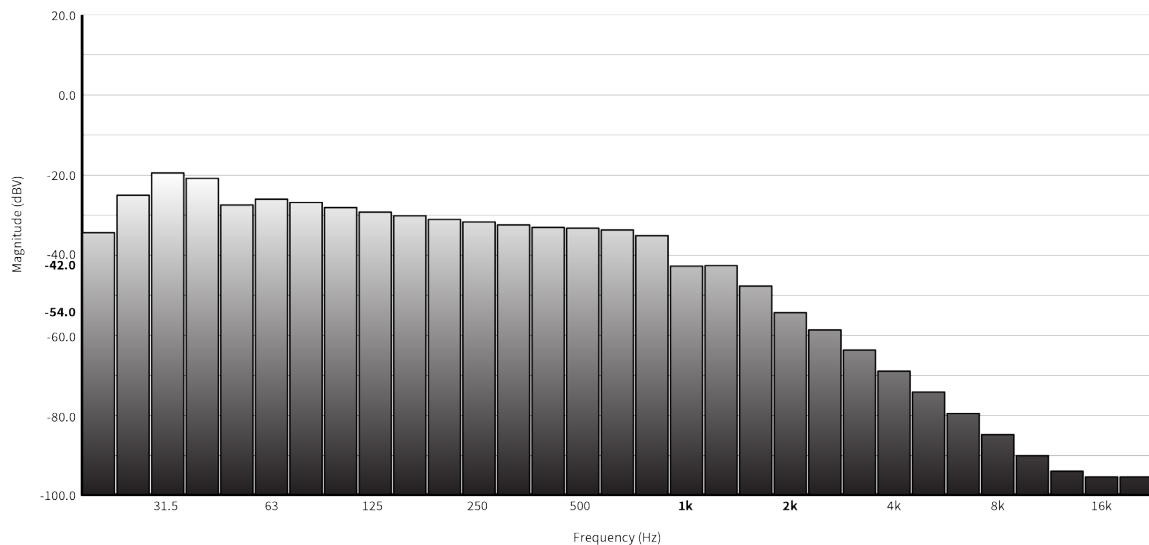


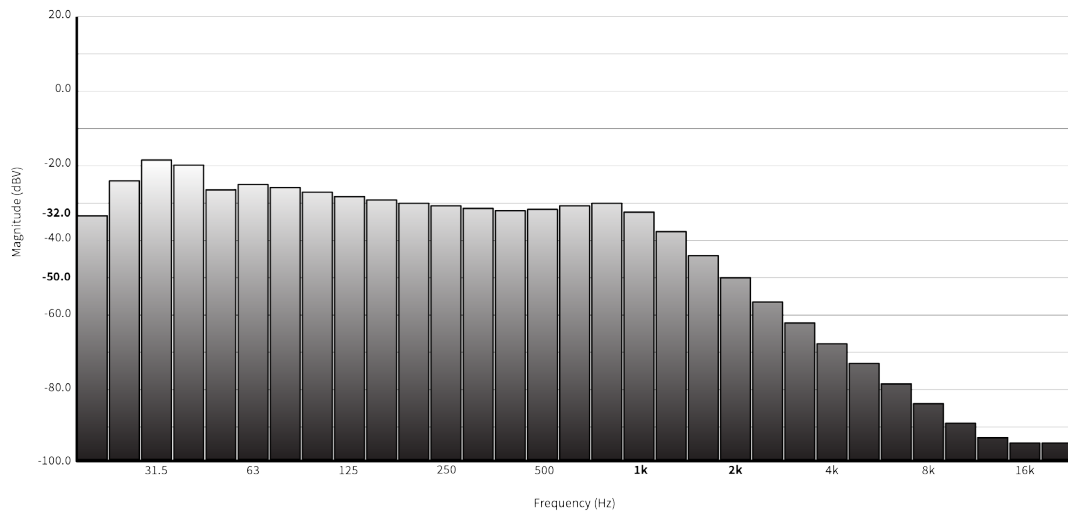1k is equal to -42dB and 2k is approx -54dB. It works!

The curve is not so harsh, giving "natural" sounding nuances. Low Emphasis levels are useful to create slow bassline and to correct too dark track without impacting too much on their harmonic structure. Remember that low slope values are equal to less phase shift, so less introduction of sonic artifacts (it is assumed that with this kind of soft manipulation the musician is seeking more for purity than for other heavier results. It should also be understood that if you want your sound really clean and untouched you should unplug Vertice and connect the source with the audio interface with a common, standard, easy to use, very reliable and widely available direct phone-jack cable).  :)
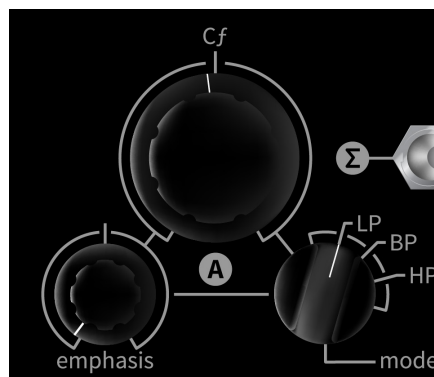


**Sallen-Key behavior**
Notice the slight recovery in correspondence of the fourth octave (starting from 1k), approximately at 16kHz, is natural for this kind of Sallen-Key ultra passive design; it's the normal behavior of this circuitry and it is one of the reasons why we decided to work on this particular one.

- **LP with increased Emphasis settings**



1k is equal to -32dB and 2k is approx -50dB. It means **18dB** lost in the first octave up.
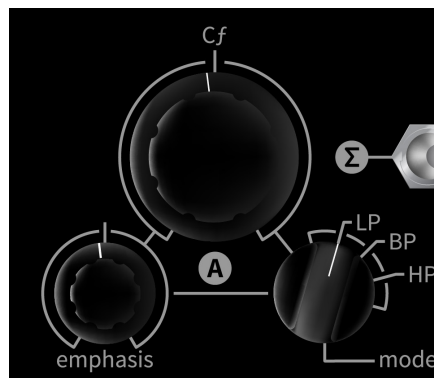


In this range of settings the Emphasis control make a big tone difference between the input and the unprocessed signal. Here you can obtain the classic synthesis filter sound with a number of small variations between nothing and too-much Emphasis.

As a general info, valid for both Diode or Transistor position, you can split the Emphasis pot race into two half: to the left the "safe" zone, to the right the "ok, let them understand who I am" zone. There is a third zone, at the extreme clockwise end. We can call it the "Kill 'em all" zone, and I think there is nothing more to explain about it.

- **LP with near-to-auto-oscillation Emphasis settings (let them understand who I am)**
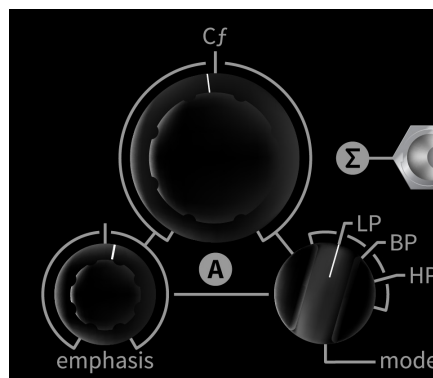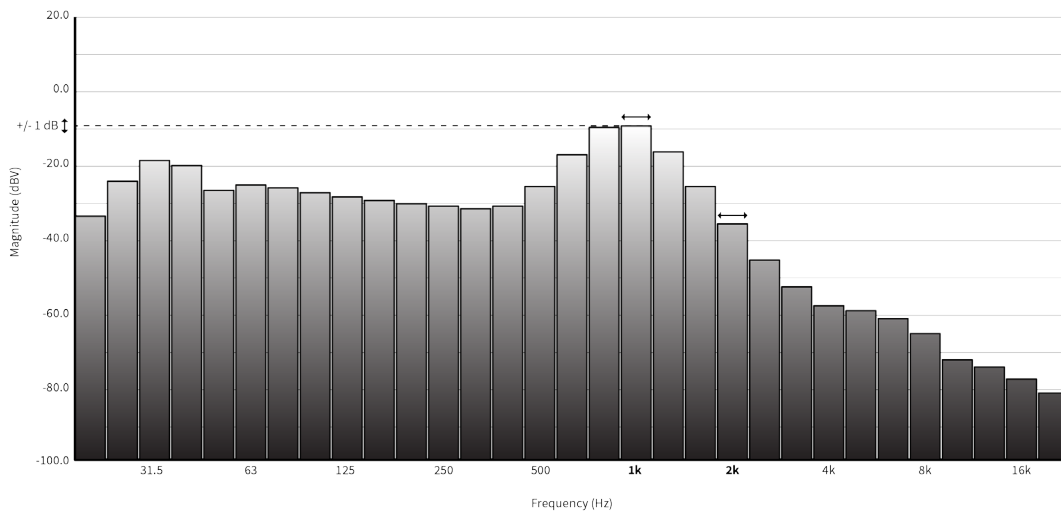




Going further clockwise we are in the becoming famous "ok, let them understand who I am" zone, as just said.
Basically here you will obtain two very different results if using Transistor or Diode mode.
In the *Transistor* way a loud (but controllable) auto-oscillation appears, starting to add the screaming factor to the signal.
In the *Diode* way instead you will gradually notice that the behavior become very unstable, with changes in both fast and slow rates, with cyclic-sometimes-random ballet.
Arrows in the graph are indicating this behavior; instability however is spread all over the frequency range, not only in the range of 1 and 2k like arrows seem to indicate.
The input level also can introduce more or less instability.
Note that instability in a creative musical filter is a great *plus* almost always. It gives automatic realism and human/robot touch to the processed signals, making it sound more interesting. Try various settings of *Emphasis* to achieve very different tastes from the same input signal.

- **LP response with an overstressed Emphasis level, set to maximum and fully auto-oscillating (the kill 'em all setting)**
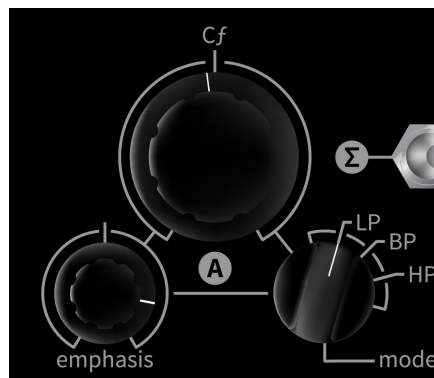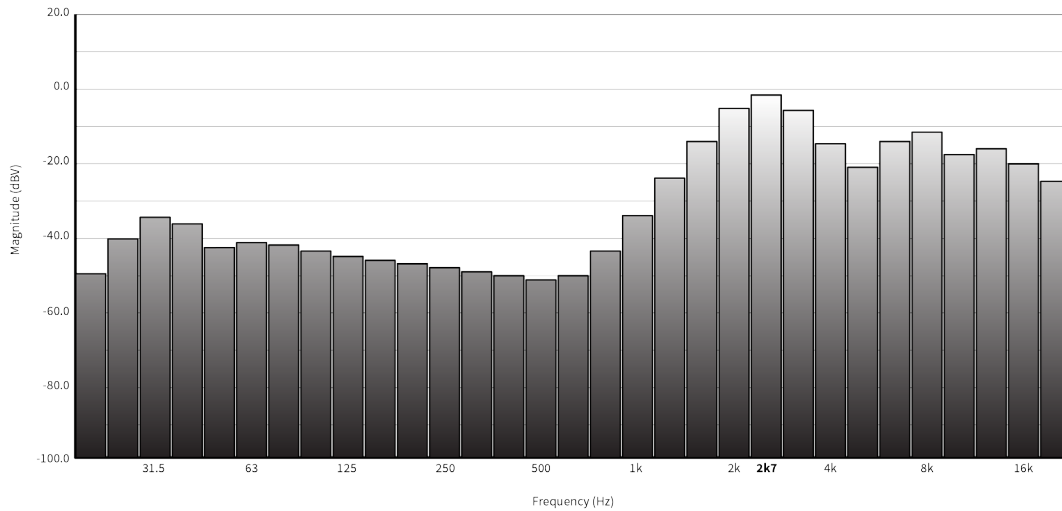




A further increased Emphasis level completely deconstructs the input waveform and the related Bode graph appears very different from the natural saw harmonic distribution.

Emphasis recirculates input signal on the feedback path and the Larsen effect is the major characteristic here.

Note that here the difference between the two Attitude settings is most evident: the Transistor way was designed with the specific goal of limiting this crazy and often unuseful behavior. Keep this in mind, especially when in live situations:

At high settings **Transistor** is a **loud but controllable scream**, Diode produce **noisy and suffering unstable** Cutoff performances.

> **Instability of maximum level Emphasis**
> Because of Steiner's classic resonance way (diode) strongly analogue nature these high Emphasis levels makes the Cutoff so unstable to generate a big slip from 1kHz to, in this case, 2,7kHz. This is an error, a functional deficit. But we decided to save it. If is not useful do not use it. But sometimes, with the three filterboards in series, with the three $Cfs$ tuned and the Emphasis controls well beyond the common sense it can be source of pure physical generated very funny or very scary situations. Explore it without moderation: we think the best machines are the surprising ones and certainly this "error" summed with a little bit of creativity can blow your mind.

- **BP 18dB/oct response**
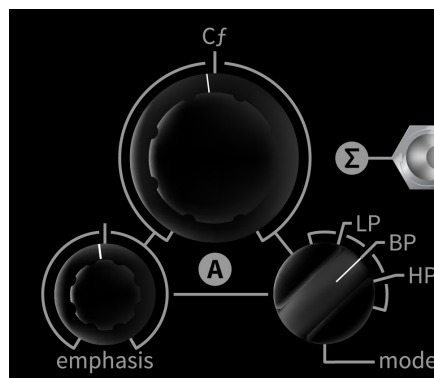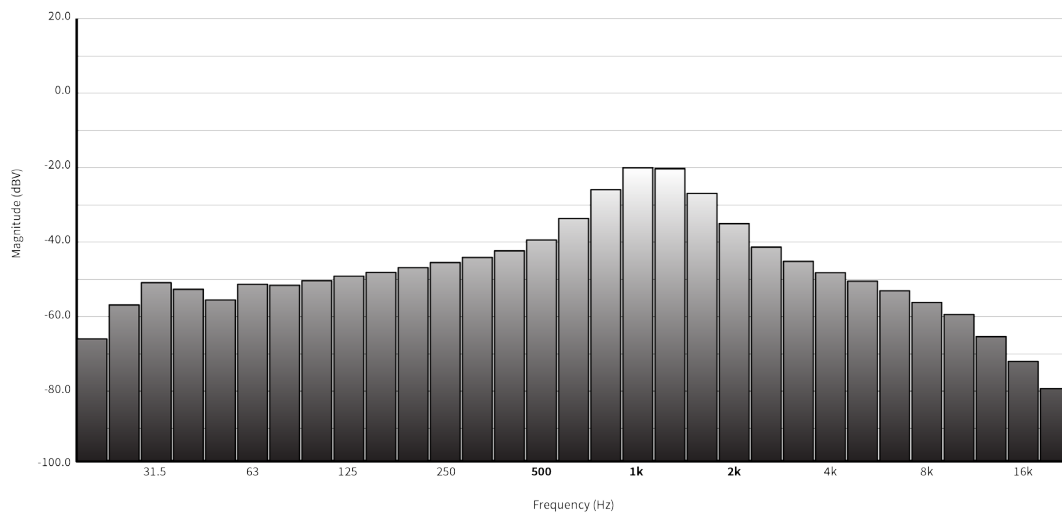




The behavior represented here can seem too weak but just try it with a very hostile mid-band monophonic Leader line and then see what happens...

The idea is not to cut-off all the unwanted harmonics, just attenuate them. This method in the most case can help the congruity of the mixed material, giving less "artificial" separation between signals of different harmonic base (e.g. bass line *vs* mid-range synth).

We don't produce analysis gear. We don't want anything perfect if it's not the Music itself to ask us. And in the case of the filters we think that a response too sharp often results too unnatural and unmusical compared to a softer, although effective, slope. 18dB/oct is not 24 but is also not zero. And you can achieve a more aggressive slope using the serial methods described in the SIGNAL ROUTING chapter (**page 15**)

Sallen-Key BP filters generally sound very consistent and in-your-face. Vertice is not an exception.

In VERTICE this is probably the most aggressive mode also because it is a LP / HP combination.
Using it in a semi-serial routing can be sources of intense, unstable and angry tones. It is highly-recommended to try, for example, LP A into BP B into BP C, giving decreasing emphasis level during the signal flow.

- **HP 19dB response**
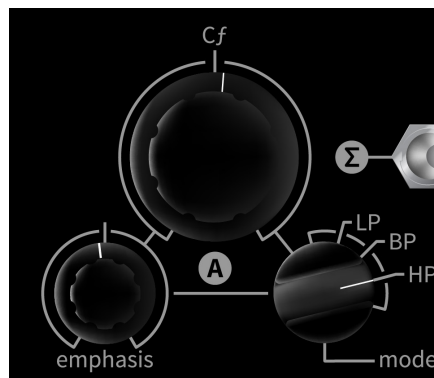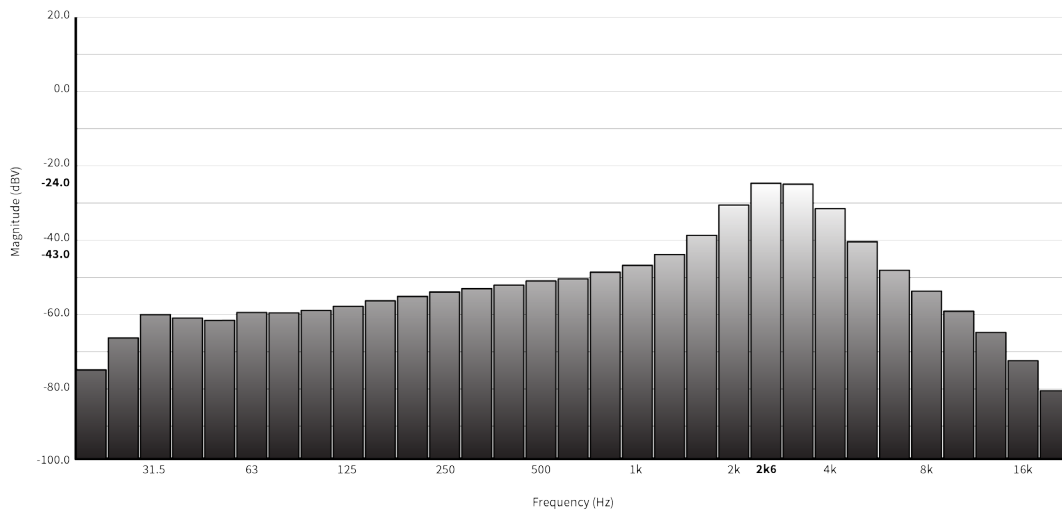




Here the C$f$ was raised up to 2,6kHz for a better view of the slope. The slope here represented is about 19dB/oct, obtained with the intervention of the *Emphasis* control.

Sallen-Key HP filters sound very selective and preeminent in the mix. Try it to emphasize the high content of snares, hi hat, atmo pads and whatever need a full-chlorine clarification.

In simple re-amp modality HP can be useful if presence is the target, sacrificing bass response.

> **!** **Emphasis is dangerous**
> This Emphasis control in HP mode can create very loud and very unpredictable output signal, especially when the three C$f$ are tuned. For your safety please use this pot with this concept clear in mind.
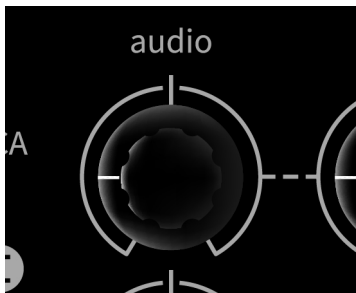
**Audio** is the control which indicates the level of the signal injected into the singular filterboard. Small signals need high values which mean more noise flowing into the circuitry. A careful balance of the source output level, this control and the *STACCATO/CONTINUO* pot can help to obtain productive-clean tracking.
Allways remember the good old rule MORE GAIN = MORE SUFERING = MORE DISTORTION = NASTY SOUND DESIGN

**The Preamplifier Circuit**
    The three preamplifiers incorporate a circuit design from the 1970s hosted in the early hi-end Cambridge Audio systems. The maximum gain is set to +16dB to amplify a 150mV line input to approximately 1V with a small safety margin. If you want to overload it, however, this precautionary headroom is easily fill up by a small increment of the external input level. In most modulars and hi-end synthesis devices this 150mV level is rather low and you can easily overload the preamplifier stage since most systems have oscillator's levels even at 5Vpp. Other weaker sources maybe need some sort of level push-up, but it's rare. At the time of the preparation of this document we have tested this preamplifier design with the following synthesis sources: Minimoog Voyager XL, Moog Slimphatty, Synthesizer.com Q106, Q141, Q112 and Q108, Oakley MU VCO, Arturia Minibrute, Roland MC909, Roland MC808, Roland TR808, Korg MX1, Korg MS-10 (1978), Korg MS-20Mini, an original 1982 Formanta Polivoks, Waldorf Rocket, Waldorf Blofeld, Access Virus TI, Yamaha S70XS, Siel Orchestra, Davoli Davolisint, an original Binson Echorec, MRL Lord of the Ring, MRL ChatterBoxResonancenator, Kinetik Laboratories GORT the Robot, Protean and Dao, Grendel Dronecommander, Buchla Easel, Metasonix D1000 and D2000, MFOS Minisynth, LittleBits SynthKit and even with a Doepfer A-143-4 Quad VCLFO in VCO mode (circa 8,5Vrms).
In all the circumstances, except for the well-know very-low Davoli's output level, the behavior of the VERTICE's input stage is optimal and the range until full distortion is larger than most consumer and pro audio devices.
The control law offered by this circuitry is logarithmic, going from **-40 to +16 dB rms** and the difference between the A-board preamp stage and the equivalent B or C is minimal, about 0.3-0.4 dB maximum, which is not perceptible in normal audio applications.
This is a solid low noise configuration that can manage every sort of audio signal with reliable and almost transparent response.
The noise performance of this design going from **-114,5 to -90,0dBu** at full volume. The produced noise at this last setting may look a bit too much but at unity gain level it is set well below -100dBu, or more exactly at **-107,5dBu**, which is quite good considered the consequent circuitry (the very noisy and almost totally passive filterboards) and the commons applications required (e.g.. tracking, classic subtractive synthesis, droning etc.).

**Hi-level audio signal distortion**
    On the other hand at full volume configuration there are great chances to overload the following filterboard circuitry, with all the THD consequences. Not be afraid of that: VERTICE can afford very high signal levels and it must be forced to work in this zone, making it a very powerful distortion machine.
The idea is to create more harmonics after the input stage than in the original timbre and then cut them out. It's a simple but efficient way to obtain really rich and creative sound manipulations and to amplify the beating between multiple sound sources.
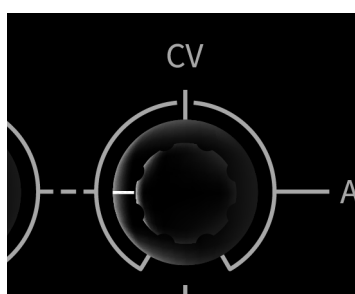


**CV** means Control Voltage. It's the name of the standard voltage range utilized since the sixties in synthesizer architecture. This pot identifies the level of the related CV signal injected into each filter or into the Master Cutoff control.
The attenuation law of this section is almost linear.

**The CV pots**

This pot is a simple *passive attenuator*: it means that it "discharge" part of the injected energy to the main ground plane of Vertice. This is a non-professional, non-clean approach and I'm here to underline it. Why?  Well, First because there is nothing bad about trashing a bit the audio signal moving the zero volt plane *according to the external modulation*: you can see this sort of dirt like the microphone recesses in a good old-school all-together 2inch tape recording, when the other-members-of-the-band sounds contribute to create the sound nuance around the main signal in the observed microphone.
The second reason is that you will note it, soon or later, simply giving zero audio signal and a consistent load of CV so why don't explain that this is normal and wanted? You will notice that you can hear the cutoffs moving and stomping, something like drops or similar sounds (the audio result depend from a bunch of different factors). So, don't worry about a bit of CV modulation into your audio signal: generally there is a difference of so many dB between them that it is not a problem, is a simple nuance.

The Moog CV standard, which later becomes the almost-only one on the market (actually Don Buchla designed his systems to use 1.2 V/Oct rather than 1 V/Oct and for a very good reason: a semi-tone is 0.1V rather than 0.083 recurring), is about 1V/oct for the controls moving on the frequencies range (VCO frequency and note-related cutoff movements) and +/-5V for the other control types (but in the Organ there are 10 octaves! Exactly dude...)
In the VERTICE filterbank the 1V/oct correspondence is highly satisfactory in the range of normal required applications, e.g.. keyboard tracking, but do not expect perfect musical intervals correspondence.
On the other hand the VERTICE filterbank, because of its very early analog architecture, doesn't use the standard +/-5V CV system; it manages the CV in a different *but compatible* way which allows to feed only positive voltage, in the range of 0/+10V, into the various CV inputs available.
It's means some things:
- in the case of **+5V** source (e.g. Oakley MU ADSR/VCA) it's common to achieve *almost-full* modulations. In the normal circumstances there is no problem to obtain a convenient musical modulation, especially when driving the *MasterC𝑓* control (because *MasterC𝑓* have an extended range if compared with the one of the singular filterboards)
- In the case of **+/-5V** source, like the Doepfer A-143-4 or some Moog module, you can obtain a *very large* range of control. This kind of source requires a little bit of adjustments with the *MasterC𝑓* and the singular *C𝑓* but it's the best solution to fully modulate your VERTICE
- In the case of less powerful sources, like the Moog Voyager main LFO (**+/-2,5V**), the behavior is quite similar to a +5V source, but limited. It is not the full excursion but in the most case it's sufficiently usable, maybe with some limits. The fact here is that often you don't need the full 20-20kHz excursion to be musically productive, so a +/-2,5V CV can be fruitfylly used as a modulation source
- There is one ultimate case: in combination with a more powerful source, which is rare, maybe you can't use an half of your CV waveform. In a simple oscillating modulation it means a perceived halving of the frequency rate, nothing more. However using the related control (C𝑓) as an offset pot you can obtain a good response even from a **+/-10V** source, and remember that the pot discussed here is an attenuator, so use it to attenuate when needed.  :)

**Polarized CV**

To virtually expand a *linear* +5V source you can use a simple mechanism which simulates a 0/+10V signal: use a polarized summing module. Some example can be the Doepfer A-138e, the Synovatron CVTools or our E.S.L. Matrice 01. A polarized level pot is a very easy circuit where the CV sent into can be attenuate in two ways: linear, via standard attenuation circuitry, and, of course, polarized: in this second mode you can obtain a full attenuation in the flat position of the pot, a positive response from one side and a negative response from the other.
In the case of a normal level control a +/-5V modulation is been attenuated by an amount of V due to the limiting of the resistance of the pot and circuitry involved. So you can use e.g.. +/-5, +/-4, +/-3 and so on, and of course all the values in the middle of these steps.
When you use a polarized way instead, with a *linear* +5V source you can obtain a *false* 0/+10V output range, tricking the three filters to work at full interval. It is useful for example if you want to control the VERTICE filterbank from a too-far system.
Polarized, a +5V can become a +/-5V depending to the position of the pot, so it can be "mistaken" for a 0/+10V signal by the VERTICE filters. Obviously the filters must be set on purpose for this trick: it can be done simply giving it a "more open" basic position on the panel.
If you use a *modulated signal* instead of a linear one then you will obtain a simple inverted output, not so useful in this case, but still remains funny (for one or two minutes maybe).

## ∑ / SERIAL
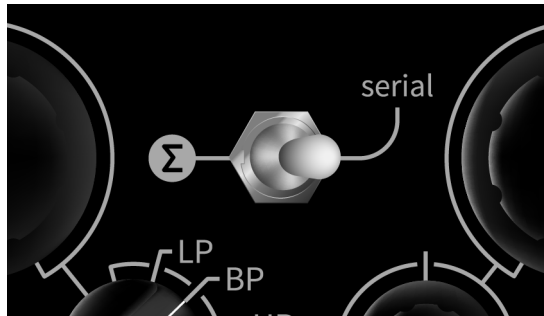
It's the first of the two switches that convey the audio signal, forming the audio path articulation settings into Vertice. Two directions available:

• ∑ route the audio signal to the Parallel summing section where the three processed signals are mixed

• *SERIAL* route the signal to the following filterboard (in this case the B-filter receive the signal from the A-filter).

This selection have an heavy impact on the logic beyond the use of the entire VERTICE and should be the first question you may answer to: where I need to direct this signal?

The answer must be formulated thinking at what kind of tone you have in mind. Bass line, drum kick, snares, heavy wobble and so on are generally monophonic signals, so probably using the *SERIAL* modalities can be effective. Atmospheric pads, melodic leaders, long evolving soundscapes, piano sequences etc. generally are benefited by *STEREO* treatment, discussed in the following note.

Obviously VERTICE give you also some mid-way position you can use for manipulate timbres with a more creative approach, combing various routing themes with *MODE*, *EMPHASIS*, *LEVEL*, *CV* and other heavy impacting settings.

## ∑ / STEREO / SERIAL
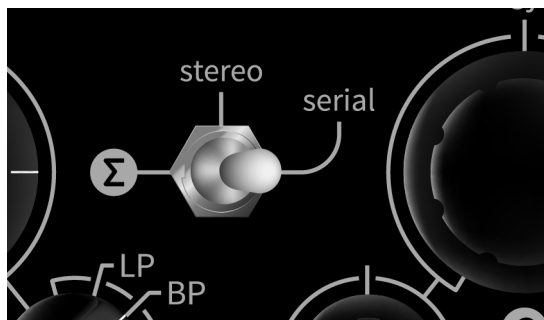
It is identical to the previous control but it has the peculiarity of the *STEREO* mode.

Obtained by a true bypass of the C-filterboard, which actually remains available for a third signal, this routing status can allow you to feed VERTICE with a stereo signal. *LEFT to A and RIGHT to B*, balanced via the dedicated Audio pots can make a true stereo couple from the related two output ports. The stereophonic signal is obviously processed by the two A and B filters, linked via *MASTER Cutoff* control. In this configuration *PARALLEL* becomes MONO and presumably the LEFT out. *SERIAL* instead becomes STEREO or the RIGHT output of your stereo couple.

Remember to hard pan the relative input channels of the mixer to obtain a wide-open stereo field.

> **The ∑ Circuit**
> The summing point is a sensible part of every musical machine: it have to sum properly, without unbalancing between channels, and to carry a good amount of signal without distortion. Whitout distortion? Why? It is not true, and phisically impossible: you **always** introduce some sort of harmonic distortion using a module. Not even the stupid cable is really transparent with all its resistive and inductive behaviors.
> Our ∑ module is an simple active op-amp circuit with zero gain factors and hi-frequency reduction obtained by a quite normal integrator configuration. The signal flow through low values resistance (the lower is an 82Ω) in order to control Johnson noise. Nothing more than what your electro-techer want from you  :)

> **The stupid switches**
> Why Vertice cost a lot of money? Because it is hand made, because it is unique and so on all the various reason that everyone tells you everyday, the quality, the quality also if they are producing drawing pins or toilet paper the QUALITY seems everywhere. Well, I tell you why Vertice cost so much: this stupid swithces. They are essentially more bigger than usual, to improve manipolation, more sturdy than usual, to last, and more aestethically appealing, to inspire you "touch my panel" will. So, they cost at least 10 times than the regolar, smaller ones, but they worth it.
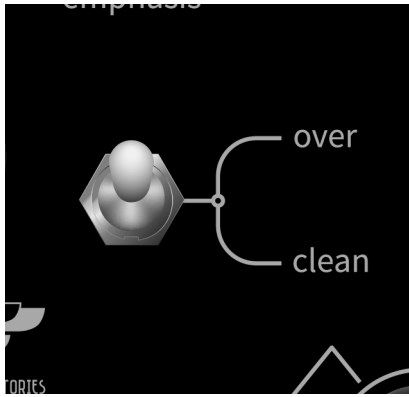
**The Input Clipper**

A very analog actionable hard clipper is inserted between the A-preamplifier and the A-filterboard. It is useful to smash your tones, squeeze dynamics and devastate the even-harmonics content of the signal.

We did not put it there for any technical reasons, like compression, limiting or something else: we put it only for fun. The idea is always the same: morphing harmonics. In this case this process is made *before* all the cutting circuitry, with a clear nasty purpose in mind.

In the VERTICE filterbank you have also other components which makes a different-sounding brutal distortion, but *after* all the signal routing, just before get out to see the outside world: it is the VCA circuitry and we take care of it at **page 38**.

**The Overload Circuit**

The Input Clipper is made by a simple active buffered circuit that make a true electric distortion caused by a current overload of two transistors. We make them suffer. Obviously the A-preamplifier represents the input level for this circuit, and the more you turn it clockwise the more it squares-off the sound, until disrupting the low content and destroying all eventual lasting dynamics.

This circuit is simple but not stupid. It is active, which means it doesn't use the basic back-to-back diodes configuration neither a biased-diode circuit, like the most passive distortion modules. That way is commonly the noisy way. To reduce noise, which can be very present in this kind of circuitry, we made it active. That means a different approach to the overload circuit giving improved flatness and square-sounding tones.

In addiction to that the presence of an IC buffer means a further noise floor dropped down and an increased distortion at a given input level.

Be naughty and switch that button!  :)

# THE MASTERS SECTION
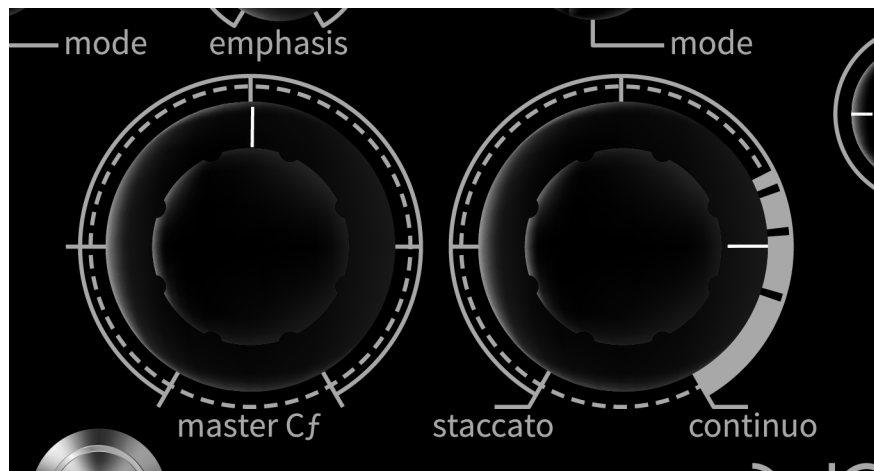


Occupying the central part of the VERTICE Filterbank, the **Masters Section** is a very important operational zone. Handle with care for precision and clean results or with sugar-free spirit to achieve all the brutality hidden, but not so deep, in this machine.

**The Master Cutoff**
As you know the cutoff is the cutoff, and the Master Cutoff is nothing more than a pot which manages all the three C$f$s at the same time.
Our *Master Cutoff* is only that, one pot to rule them all. Simply turn the knob to virtually move the others. But behind this obvious note there are a couple of concepts to know.

The first argumentation is about the *position of the related controls*. When you use the Master C$f$ it acts like a bias for the three "slave C$f$s", transporting them across the audio band. Obviously the start position of the slaves is important. If you, when in *LP mode*, turn all the slaves fully clockwise then the *Master Cutoff* can't work so much. The timbre is affected by some harmonic changes only when the Master reaches the fully counterclockwise position. This is also true for the other Mode settings , obviously "adjusted" for the case.
We take care of the trimming bias levels between this four controls. The three slaves are set to give a full Master C$f$'s range when they are in flat position. All the virtually infinite steps between the two extremes modifies the *Master*'s range like its position does to the slaves. To achieve good musical intervals set the *Master C$f$* to flat (centered) position. Here is where we trim the three filterboard in calibration tests before shipping.

Another piece of advice concerning the *modulations sent* into the Master C$f$ CV port. Like the others Cutoffs it accepts the standard +/-5V and the "irregular" 0/+10V. And just like the slaves it's attenuated by the related *CV level* potentiometer, graphically connected on the panel.
But remember that the Master just controls the slaves: so, as a-moment-ago mentioned, it's affected by the slaves position. For the widest modulation range set the three slaves in flat position. It is the place from where you can start getting your Master C$f$ modulation sounds. Then, since modulation tend to "open" the Master C$f$ initial state, eventually close (counterclockwise in LP mode) the Master C$f$ and the three C$f$ to reach perfect balance between modulation amount and the central point of the cutting performance. These adjusting movements seem difficult on paper but they are almost obvious when playing.

*Setting the three slaves independently* can be a great advantage:
*   With a single source you can tune the three Cutoff frequencies to make a "Cutoff chord". Use the *Emphasis* control to boost the harmonic content near the cutoff zones and move it relatively to your mono line. Very creative possibilities here. Try also the Parallel mode, very useful to "separate" the singular C$f$ behaviors.
*   With two or three different inputs and with the large flexibility of the VERTICE's routing you can sum+cut+ distort+emphasize+modulate three completely different (or very similar) signals. It maybe can be useful for some complex timbres made by different sources which need to become one.
*   The *V/oct* input on the connections panel is graphically linked at *Master Cf* for quick panel-looking understanding. Although during the use this representation may seem correct, it is not the real way it works. In fact the V/oct acts directly on the three slaves only, leaving the *Master Cf* fixed. The playing result – keyboard tracking – is the same but the *Master Cf* remains widely available for external and manual modulations, without a range reduction, which happen to slaves.

**The two VCAs: the STACCATO/CONTINUO control**

> ⚡ **Output Levels**
> Very high audio signal levels can be produced. Read carefully this section of the manual in order to operate in safety for your gear and your ears.

There is a lot of thinking behind this one-pot module.
We just wanted a VCA: a simple Master Level control which could also make the *staccato* function via Envelope Generator *Gate-in*, so you can play some oscillators like a real pro.
In addition to that, however, it turned out that this module could also be a great source of brutal, creamy, painful distortions. So we also decided to implement this feature through the circuital design and underline it. That's the reason because you can't find any meter or I/O levels LEDs beside this control. We just prefer to not influence your ears with an indicator of the "suffering status" of the VERTICE's circuitry. It's very difficult to broke something inside just using high level signals. In all the tests we have done until today never a unit has been damaged by that kind of audio materials, and we can produce very high not-standard levels. So use the entire range you have, keeping in mind that it is very large and sometimes may take to some strange behaviors.

**STACCATO**
In the *STACCATO* position the *Master Level* control **cuts the sound off** completely. It's the silent way to turn on the machine and it's also the "shut up a second!" way.
*Staccato* have few meanings: in contemporary Italian means "turn off, disconnected, or disjoined", about the same as in eighteenth century when, musically speaking, this label was applied to a musical form meaning playing short notes articulated between silences.
When you direct the Envelope Generator output CV into the VCA (via switch on the panel or via patching rear EG out into front AM in) and playing producing a GATE signal you can easily do Staccato performances. **EG level is designed to get a full output VCA level when EG level is to max and the VCAs are in Staccato position.**

> ≋ **Noise values**
> In the most common case when silence is needed, with e.g. an oscillator plugged in, audio input fully open, distortion ON and mid-working *Cutoffs* and *Emphasis*, a very loud situation circuitally speaking, the whole machine's noise floor is -77dB (+/-2) in a 24bit digital scale. It is not exceptional at all, but it is quiet enough to meet the most case of applications. Obviously turning down the input material or cut it totally off can reduce this floor to -85dB, an absolute good result for a totally analog hand made synthesis device. This considerations means that *also the silence between the two Staccato note* will be at such low noise value, a great plus for delicate virtuoso performances.

**CONTINUO**
In the *CONTINUO* position **the level is up**. This is the classic setting for clean summing process, drone-like tones, long evolving soundscapes, disturbing beatings, horror-movie enharmonic textures and of course for exploring the VERTICE Filterbank and the darker side of your soul.

> ❗ **This is not the maximum**
> audio level that VERTICE can produce. Keep that knowledge firmly in mind. You can push it further.

> ≋ **VCAs levels dBfs references**
> The two VCAs are set to get a common recording level of approx -12dBfs when: Staccato/Continuo is at the beginning of the safety zone (the orange zone on the panel) and A input level is to max, OR when Staccato/Continuo is to max and A input level is to flat position. The resulting -12dB value is obviously dependant by the input signal level but should still be practically easily recordable with a unity gain factor on your mixer

> ❗ **Stress Position**
> You may also know that Continuo is a stress position for the VCA, which is now close to 100dBrms of gain, a very high ratio. In this particular setting the internal gain of the output circuitry, which collects all the audio and noise from the preceding stages, is *just* at the edge of the VCA distortion threshold. We set it on purpose, approximately to leave undistorted the output signal when *Staccato/Continuo* stay before the orange "something happens here" graphic on the panel. Yes, it distorts in this zone (and we like it). But it also pump up the noise. So be aware from this increased noise floor: it's the price for an extreme range level.

> 💡 **EG to VCA Overload**
> The just mentioned "all-is-lost threshold" can be easily overloaded by involving the built-in Envelope Generator module to achieve very extreme sonic explorations. You are invited to, but remember the high level of signal can be produced: keep mixer's faders down.
> In the EG sections it's detailed explained how to play with internal Amplitude Modulations, see

**Audio Chain Warning**
Beware of your mixer/audio-interface's preamp! Very high audio levels can be produced. Maybe it's a good idea using the regular line input instead of the microphone preamplifier. The microphone input ports of standard audio mixers commonly has a gain factor of about 60dB or more and the VERTICE's outputs can be dangerous for it. If you use a mic preamp be careful, the channel gain factor <u>must</u> be low[1].

**USAGE NOTEs for the Vertice AM INPUT: a delicate point in the circuitry**
- AM input accepts standard 0/+5V, 0/-5V, +/-5V and standard audio voltage levels. With this values you have an extreme amplification range in your hand so maybe raise down the *Staccato/Continuo* to the Staccato position
- this input port is almost directly connected with the VCAs control point so, since Vertice's VCAs are very dynamic and responsive the signal that control them should be carefully attenuated. Obviously this input port is placed in the front panel in order to give importance to this patching possibility, for easy massive overdrive, sub-audio control or audio-rate modulation. But please remember that this is a very sensitive point of the circuit so try it starting from low, external-attenuable voltage levels
- touching the tip and the sleeve of the cable that is already inserted into AM input socket can cause very surprising reactions. Try it, if you dare...
- one high-level audio rate control signal can be very sound-destructive, causing deep phase cancellations and other dark misdeeds. This is wanted
- the Staccato/Continuo possibility still available also with this patching method. This is exactly the primary needs about this input socket, leaving the internal EG control the MCf and however use the Staccato/Continuo possibility via external EG or similar sources. This is another reason to need an external level control of your incoming AM signal: often, if you need a Staccato performance, you must turn down the VCAs level reaching zero. Here, with a standard 0/+5V into the AM input you can "open" the VCAs reaching max output level. But maybe you don't want a totally squared, squashed tone. Ok, if it is the case you need to attenuate the external CV that fill the AM input
- if too much voltage level is injected into this port you can shut-up your VCAs. This side-effect often happens when doubling the EG signal, routing it both to VCA (via switch on the panel) and to AM input (via rear EG out socket). This is a not-dangerous-but-still-unhappy situation for the VCAs, so don't keep your Vertice a long time under this settings. Also because, by-the-way, if set like that it can't play nothing but silence (VCAs are in "alarm mode"). To restore the normal situation just lower the incoming signal for the AM or, in the specific previously mentioned case, the double EG, just don't double your EG. One single internal EG signal is enough to obtain all possible sonic nuances from your VCAs. We have told you so...

**Useful Routine**
You can avoid most of the level-related problems learning a simple routine: *just turn down a bit the STACCATO/CONTINUO pot when you're about to switch the EG* signal into it. It is very common to start to play with VERTICE using the EG linked to the MC*f*. In this case VERTICE can produce some sounds only if set close to the CONTINUO position. The effect of a max EG LEVEL setting is enough to cover all the audio bandwidth but the effectively level modifications are in the decreasing-way because it is a filter, not exactly the situation of an EG-controlled VCA. This VCA, when controlled by EG, <u>does not subtract </u>level at all (unless you are in the INVERTED mode). Using this simple method can prevent all the level-related problems showed before.

**Alternative Routine**
Instead of lowering the *Master level* you can attenuate the *EG leve*l. The result is almost the same but with a little of "I don't know"...

**The IC**
The VCA circuitry is designed around two **THAT2181B** that make the most of the work. This Blackmer-cells-based-amplifier is a really affordable and powerful component with highly satisfactory Gain range (>130dB), Dynamics range (>120dB) and Noise performances (from -98 to -88dBv typical). With its wide bandwidth of 20MHz[2] it's a typical specifically-designed-IC for audio applications, taking historical paternity by the noble **DBX2150**, heart of some famous hi-end Dbx and SSL dynamic compressors. And, damn it, is *very* expensive.

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1 To be fully understandable: the mixer's Line inputs commonly use the standard 1/4"TRS (Jack) connector. In the most cases Mic inputs use the XLR (Cannon) cable instead. Obviously there is plenty of exceptions, like all the gear produced with combo-connector, e.g.. a lot of audio interfaces. Combo ports are not a problem, just use the TRS socket. The rule should be: if you can avoid the XLR ports. If you can't, use your mic preamp with caution.

2 Obviously limited by the necessary co-working circuitry and related gain factor

### The Circuit: THD (Total Harmonic Distortion) of our VCA design

Measured, our design display average THD values that are around 0,03% with higher values reaching 0,04% and lower values around 0,005%, a very nice result for an 1kHz digital sinusoidal signal used to test this total analog system.

As you may suppose this performance can vary from one unit to another because of the hand-made characteristic of VERTICE that leave all the component's tolerances do their work, giving slightly variable results comparing two different units.

The values of maximum THD are obviously intended at low input and gain levels, *without* any of the effects of overload which may be caused by, e.g., a strong injection of CV from the EG module or, as already said, from too high input or by extreme gain values. In those last cases if you have VERTICE powered-on and plugged to your reproduction system *you will be absolutely sure that actual THD is not the low value indicated before* as "max THD", also without referring to an accurate THD test gear that shows values: I'm sure that your ears are more than enough. :-)
Obviously this is a precise design choice: we tried to give of course a creative, unstable, easy distortive unit, this is one of the main targets for VERTICE, but also, if possible, a reliable, stable, very dynamic and clean *summing and amplifying electro-musical machine*. Use VERTICE to re-amp something, to sum something, to just amplify something.

We know digital is the best productive way to be precise and full-optional-controllable: nothing better than a polyphonic multitimbral CPU-exhausting fully exploited VST to be creative, memorizable, MIDI-re-thinkable and totally integrated into your DAW. It have almost everything: so give to your plug-in all the **sound** it need.

### Dynamics behavior when using guitar pedals

The VCA circuitry is limited to work at 9/10Vpp (= 4,5/5,0VAC) for safety and technical reasons. Besides this is a limited behavior the output amount can be very strong; as you may know regular line level audio is placed around 1-1.5V, and to record at the advisable -12/-18dBfs level they are ok. So when using a guitar pedal effect or other devices that have a 9DC power supplies please be adviced that this power amount can be not sufficient to full manage all the dynamic that Vertice can produce. The limiting factor depends on how the receiving device is designed.

### Customizing VCA dynamics

It is possible to want less final amplification coming from your VERTICE: possibly in the case of live situations with some guitar pedals such digital delay or reverb and without a mixer between the audio chain. In order to lower the main (and Rear) audio outputs we put the related trimmer inside the machine in a quite easy to reach position when the chassis is open. To open the chassis just unscrew the four screw that hold the two handles. When you do this operation be absolutely sure to have disconnected Vertice from the wall plug. It is important. 220 or 110 VAC are not a joke and you can find it in the machine in at least two places. Please be careful.
You can find the trimmer in the MainAudio pcb, the one with the big ESL logo on it. Is labeled as BIAS. Since you generally don't have to touch it, it is clearly identificated by an intimidatory warning message, so you must REALLY want to do this customization.
If you want to lower this level you can contact our customer's service in order to receive detailed explanation about. It's a simple procedure that involve a screwdriver and 10 minutes of time, but maybe is better if you are advised about the right way to do it.
We treat this trimming possibilities with this sort of "you can but you shouldn't" because this trimmer is the command that set the basic output volume of the whole machine. You have to set it carefully and turn it only in decreasing way. The Bias level set before shipping is the sweet point between max dynamics and Staccato/Continuo musical performances. Turn it in order to get further amplification is pointless and sometimes risky for the VCA circuitry and your audio reproduction system. Turn it ONLY down or, at least, contact us to have some further explanations about the limits you need to have.
Damaged units by this kind of unnecessary customizations will not see the warranty honored.
Damaged units by this kind of unnecessary customizations are clearly recognizable by us even if you reset the trimmer at original value.

Two trimmer are involved in VCA circuitry, but only BIAS have some effect on output level.
The trimmer called THD, placed in the other side of the pcb, is a fine regulation which allows to increase or decrease the third harmonic level (principally), in order to obtain a really low distortion signal treatment. Without a decent THD analyser and a bit of knowledge around the matter it is not recommended to deal with this trimmer: the audible differences at its charges are not exactly flashy and we take care of it's value before shipping. Furthermore we put it in a not quite easy to reach zone.

# THE ENVELOPE GENERATOR SECTION
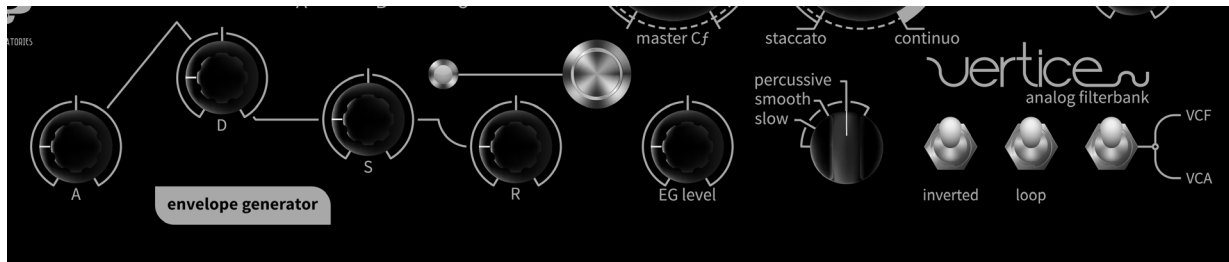


This Envelope Generator is a totally analog op-amp design, made without digital timers or counter, customized for very fast and very low performances. It is not the common EG structure even as it migh seem so. We chose to implement and use this design knowing its differences between it and a "normal" EG. But VERTICE and "normality" are two separated things, so...

Our EG is comprised of:
• the classic *ADSR* envelope controls, which allow to shape the output CV in both time and level axes
• a *Level* attenuator, which gives huge control possibilities when modulating filters, VCA or external devices (via dedicated rear port)
• the *Percussive/Smooth/Slow* switch, changing the "time range" of the EG, both in triggered or looping mode
• the *Inverted* switch, to obtain an increasing positive response or a decreasing (positive) one
• the *Loop* activator, which can produce from very slow to audio-range modulations (max circa 170Hz)
• the *VCF/VCA* selector, to route the CV between the two main modules
• the anti-vandal high-end super-professional *Trigger* button, to have the pleasure of pushing something hard and smooth at the same time (10000 cycles min)   :)
• the fashionable old-style *LED,* to let you and your hardwood cigarette mouthpiece always contextualized
• the *REAR* dedicated buffered *OUTPUT*
• the *Gate* input port, very useful to control and sync VERTICE via audio, CV signals and Gate signals

This chapter will focus a bit more on these elements, trying to give a starting-point, and tips and tricks to help apply the main modulation source of Vertice to best effect.
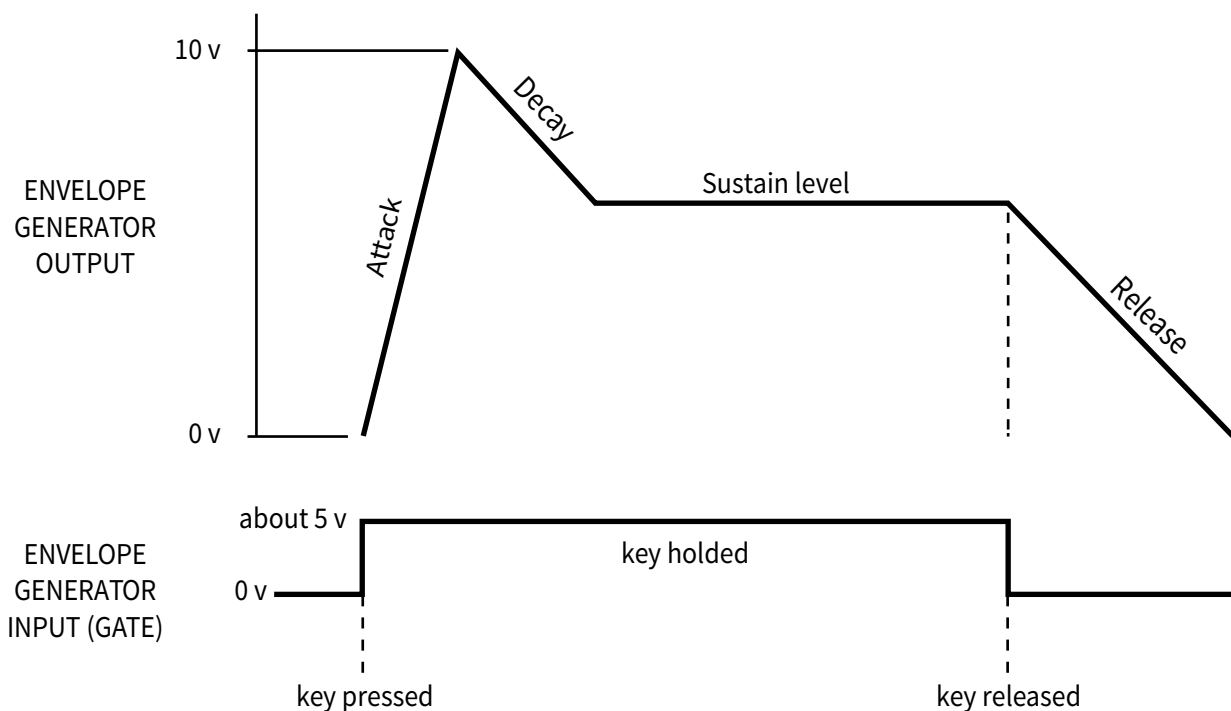


Here is the classic representation of an ADSR algorithm and the related GATE signal injected to get it work.
This is a time-related graph. Time flow from left to right.
A squared CV input and pushing the Trigger button generates the same effect.

**Attack**. Set the time elapsing from receiving the GATE input until the maximum producible CV level is reached by the EG module. Every time a GATE signal is injected into the dedicated port the EG starts to produce its 0/+10V output: taking more or less time doing it is only an *Attack* settings matter.
*Attack* is very useful to smooth the initial Level/Cutoff status of the timbre, to make the classic long evolving synthesizers sweeps. In the other hand it is obviously helpful to achieve very fast and staccato-sounding solutions or to vary the initial shape of the EG output waveform generated by an audio-range looping settings (from a square wave to a ramp wave).
*Attack* is a time control, and thus it's affected by the *Percussive/Smooth/Slow* switch position.

**Decay**. As in most EG designs this control is about the time the output voltage takes to reach the Sustain settled level from the just mentioned max level reached during the *Attack* time. The behavior is always the same: GATE – Attack time – MAX LEV – Decay time – SUSTAIN LEV.
*Decay* control is the key to obtain fast percussive and contrabass shapes.
*Decay* is a time control, and thus it's affected by the *Percussive/Smooth/Slow* switch position.

**Sustain**. It's a level indication, the "note-on" level. It's the level of the EG output CV with the key held down. This parameter is useful to make less mechanical-sounding shapes, giving a bit of humanity to the iron-golem-keyboard-player hidden at the bottom of the stage.
It is also very useful to obtain the almost obvious but still crucial staccato–organ note. Just set the *Attack* and *Release* to zero and *Sustain* to max. In this circumstances the *Decay* setting doesn't matter at all.
*Sustain* is a level control, so it is not affected by the *Percussive/Smooth/Slow* switch.

**Release**. Once reached the Sustain level the output voltage of the EG remains steady until the key is released. When it happens the *Release* setting determines the time taken to change from the Sustain level to zero volts.
*Release* is the key to obtain the classic "not-muted piano" shapes or, in combination with the other three parameters, slowly moving esoteric pads.
*Release* is a time control and thus is affected by the *Percussive/Smooth/Slow* switch position.

**EG Level**. This pot can attenuate to zero the CV produced by the EG module. It's the only way to turn it off, if you don't count the obvious "do not feed it with the GATE signal" and the very similar "loop function OFF".
Behind this simple pot there are a lot of headaches. It must communicate elegantly with the Master C*f* circuitry, command it in all the Hz range, but also give to VCA a convincing and silent Staccato possibilities and, by consequence, the extreme amplifications of an EG controlled VCA in *Continuo* position. It is not easy to put all together, technically speaking.

> **GATE waveform**
> The EG GATE input is not a typical CV port. It can manage only positive signals. Therefore, although you can feed it with any form of CV you like without damages, only the positive part of them will be functional to activate the EG. Try it with different kind of modulations and input levels: with some creativity you can easily turn your Envelope Generator into an "absurd things" generator.

> **EG GATE input port tech stuff**
> In this Seconda Serie of Vertice this port have a better relationship with simple audio signal than the previous Prima Serie had thanks to a simple amplification system right after the EG GATE input. This feature, beside allowing the use of not-standard GATE-CVs, help to obtain dynamic compression directly from audio materials via EG side chain, when key signal is obviously audio level, therefore less than the classic 0/5V commonly used in classic gate patches.

**Percussive, Smooth and Slow**
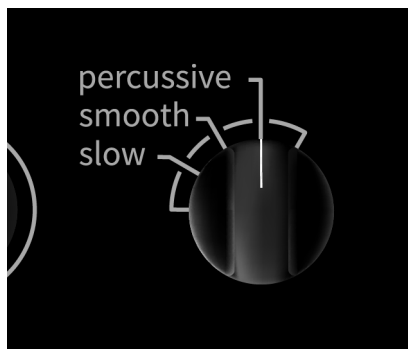


This switch indicates and determines the EG Rate. It is a very useful and quite common feature in the analog circuit designs but, as always, we did it in our own way. As it seems, it changes the basic time range in which the EG controls works. So only with a click and without changing the ADSR positions you can achieve a very different result once the key is pressed.
This switch simply use a capacitor or another one of different dimensions. Our timer is a little metallic box full of acid. Less digital than that I don't know what to do... maybe a little japanese dwarf caged into the chassis, that count seconds or his family dies, I don't know...

- **Smooth**. It's the common range of use, where you can find sufficient but not stunning-fast settings and sufficient but not too-slow modulations. *Smooth* is the middle way setting and often it's the more usable one. Trust it for normal EG applications.
- **Slow**. In the *Slow* position you can find very relaxed behaviors, to make extreme dilated modulations with or without the *Loop* activated.
- **Percussive**. The *Percussive* position is the "strange one". We put it there to give you the possibility to achieve very fast settings, many of which can result too-fast to be normally usable. In this modality the common feature is not playing the *staccato*, although it can be done, but looping the EG, eventually reaching the audio range. Exciting possibilities here, due to the organic instability of the three filters and the not-so-straight looping behavior of our EG. Also play something with fingers and a looping Percussive setting is very funny sometimes.

### Inverted
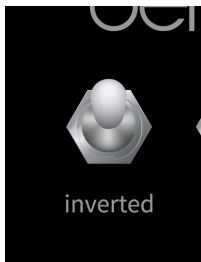
It's the switchable choice between the common usage direction when a key is pressed, min to max, and the respective inverse, max to min.

This is an important feature for one reason: with it you can <u>automatically overload</u> the VCA circuitry. Follow this argument for a while: in the normal mode, not inverted, when the key is hold down a GATE signal is flowing to the input port of the EG and this forces the EG to work with related settings. Instead if you switch to Inverted mode the EG will "stop to run" with the key pressed, having now an opposite behavior to the previous one. But, if you now release the key – magic! – it will emit a positive CV that will raise up the VCA level. So try different EG Level settings. It can be very impacting on your resulting audio output, especially when MIDI to CV lines are involved.

> **Extreme Noise Floor Amplification**
> Here is one of the *worst* behavior you may have heard from a fully-functional machine (it is almost a record): in the following situation, when *CONTINUO* position meets a total cut-offed sound (or a zero input level) and a total raised up <u>inverted</u> EG level you can notice a very loud unstable rumble noise, an Inferno of exploding fat frogs. It is normal, although it might not seem. We call it "the Unnatural position". See **page 56** for further details.
>
> Think a second: if you raise up the VCA level so much something just *must* happen. This is a very high amplification, far beyond the commonly-required amplification ranges, and the brutal noise you hear is only the extreme consequence of an excessive setting. We know this "problem" but we *don't want* to solve it: VERTICE must be a construction-destruction unit and this circuital "error" certainly make destruction available. And the fact that it is easily to achieve does not mean that you have to use it in your every song. This is <u>not the normal way</u> to use it. We put this opportunity to give you a wide range of really analog extreme sound explorations, wider than what other brands often offer, and we hope you may understand and enjoy this rumbling noisy choice.

### Loop

Switching this control can activate the *Loop* function. We say "can" because the effective looping situation is highly dependent on the ADSR and Rate settings. All the four parameters contribute to modify the looping rate and status, so there are various positions achievable:

- Always active loop
- Trigger or GATE deactivating loop
- Trigger or GATE activating loop
- Trigger or GATE varying loop.
- Deactivated loop by the ADSR controls

Let's follow this example to understand how to tame this circuit.

Please set your ADSR in the following position:
The default values to define the ADSR controls gives the organ-like shape, where
*Attack* = 0
*Decay* = 0 (in the organ shape the Decay control doesn't really count because of Sustain set to max. But to follow our argumentation please set it to zero)
*Sustain* = max
*Release* = 0

- *Always active loop.*

It's the regular situation, an infinite repeating cyclic waveform that can be quickened or slowed by the ADSR controls. To achieve this feature you must have the *Loop* switch turned on and at least the *Release* control <u>different from zero enough</u>. This is sufficient to effectively start the looping mode.

*Attack* = 0

*Decay* = 0

*Sustain* = max. Note that our EG, differently from other more classic designs, can loop with both Sustain to max or minus, giving different results that you cannot obtain with other EGs

*Release* = <u>not zero</u>. This is necessary in this very analog structure. Loop has to have its "Release space". If not the looping-EG remains steady because the point of the circuit that auto-triggers the loop is inhibited by too short Release settings.

> **❗ Attack settings**
> Note that the Attack is set to zero and everything goes fine. You can slightly turn it right to smooth a bit the initial shape of the loop. But Attack is another tricky part of this circuit and it often turns off your loop when in flat or more clockwise position, due to the "minimum Release space" previously argued. I mean that Attack setting **must always be short than Release setting for regular looping situations**. Just know it. When we chose to proceed with this design we knew this "problem". Simply we accept this limitation in order to maintain the "unpredictable" character of this EG. It was a conscious choice, supported by the fact that this "limit" can be avoided just reading the following note.

Starting with this configuration you can further modify the rate turning down the *Sustain* level, which causes a fall of the CV emitted inside the given "Release space", and an increase of the frequency rate.

**So with the following settings you have great chances to activate the Loop fucntion:**

*Attack* = 0

*Decay* = 0

*Sustain* = 0

*Release* = not zero

> **💡 Perc-mode, smooth-difference**
> In Percussive mode only, Decay and Sustain don't react exactly the same when increasing or decreasing the loop rate. It's another practical consequence of our decision to implement this particular circuit design. In particular Decay affects on the EG rate in a more intense way than Sustain, so you can prefer to play with it for relatively-faster manipulations. In the Smooth and Slow position the behavior variations are unnoticeable.

> **💡 Need a stupid LFO?**
> We know that our EG design can lead to some disturbing reactions so, before take all things you have under hands and crushing them into the wall please note that if you connect the Rear EG Out with the front EG GATE In you'll obtain a regular, classic, boring, exactly-like-the-one-you-had-when-you-were-a-child LFO (it deactivate Sust, Rel and Pushbutton).

> **💡 Doubling Continuous Waves**
> Try to tune the EG audio-range loop congruently with your input audio waveform: both frequency and amplitude modulation available here! Try some of this patches to inject very intense attitude to your timbre via EG level pot.
> This feature can give extremely interesting sound solutions, like hard beating timbres and some heavy untuned manipulations. Use that to completely deconstruct your drone and bring out all the madness that VERTICE can offer.

> **❗ Fine Tuning**
> In *Percussive* mode you can use the *Release* pot as a logarithmic Fine Tune. Use that to closely match your input and modulation waves.

> **❗ Combining Ext-GATE with Loop Mode**
> Injecting a GATE signal via external keyboard or via internal trigger button in *Percussive* mode causes a nearly unpredictable decrease of the looping frequency. This is a very uncommon and sometimes funny feature. Trying to get exact intervals from this lowering is not so easy and often luckiness do the most part of the work.

**EG as Oscillator**
Without an input sound source a filterbank generally can't be used stand-alone. Of course you can take the Resonance to full auto-oscillation and use that like an oscillator, if the architecture allows it, but often results are not so satisfactory. Better with more harmonics, maybe.
Going fast with your looping Eg you can fall into the audio frequency range and use something going from the lowest audible from about 170Hz in various, gradually morphing, shapes. Into the audio frequency range the EG allows you to use the Master C*f* or the VCA level like a pure fixed oscillator. The output waveform is loud and full of harmonics, and it changes if using Master C*f* or STACCATO/CONTINUO as destination for the EG out. Remember that when the EG is Master C*f*-linked it always try to reduce amplitude, while when linked to the VCA it reacts in the opposite way, strongly increasing levels…

**Setting the Waveform**
Triangular, "almost-saw" and square available.
Almost saw: A = 0, D = 0, S = 0, R = a bit more than zero
Triangular: A = smoothed, D = 0, S = 0, R = a bit more than zero
Square: increase *EG level* and you obtain often a squared behavior.

- *Trigger or GATE <u>deactivating loop</u>*. In the "always active" loop mode we suggest to put a bit of *Release* and the *Sustain* set to maximum level. This configuration is a reliable source of good modulations but it has the particularity of stop themselves when the trigger button, or an external key, is pressed, generating the GATE signal. "Stop" has to be intended like a full sustained note, as the max Sustain level suggests. This feature is not so bad musically speaking, also considering that the full sustained note can be obviously made not-so-full just by lowering the *Sustain* level.

- *Trigger or GATE <u>activating loop</u>*. If in some settings the trigger button available on the panel turns off the existing loop, in other cases the EG can produce the looping mode *only* when the trigger (or external GATE) is held down. To achieve this feature please set:
  *Attack* = zero or not. You can use a wider part of this potentiometer, more than the in the "always active" position
  *Decay* = a little bit
  *Sustain* = zero or close to
  *Release* = zero
  and play some note or push the button.
  This feature works well with sub-audio EG frequencies: it makes the classic re-triggered played loop, useful in most creative synthesis applications like heavy wobbles and "over the beat" synth phrases.

- *Trigger or GATE <u>varying loop</u>*. In some applications can be useful or just funny to play two different rates when key is pressed or not. Try this settings:
  *Percussive* mode
  *Attack* = minus than flat (to activate the loop)
  *Decay* = flat position, and from there to max is functional
  *Sustain* = a little bit before flat
  *Release* = no problem (remember: a zero Release resets the loop function)
  This configuration is highly recommended for its creative unstable behavior.

- *Deactivate the loop using the ADSR controls*. This is the case of an organ-like shape (the first setting we suggest to start with) turned into the looping modality. It simply doesn't work. There is not enough Release level to maintain looping and the max Sustain setting produces a straight note when key is pressed. Just slightly open the *Release* control to start the *Loop* mode. High Release values are equal to slow behaviors. As mentioned before take a look also at the Attack setting. It easily can turn off the loop.
  This considerations are valid for all the three Rate mode but sometimes the Attack behavior can vary a bit from one to another modality.

**MIDI Sync?**
No, the VERTICE can't be MIDI syncable. So this function can't be MIDI controlled at all. Just use a MIDI to CV device if in modular, or a synth that is both MIDI syncable and a GATE generator. Or study your tracks for short-editing postproduction method. Or prepare to be <u>very</u> patient.  :)
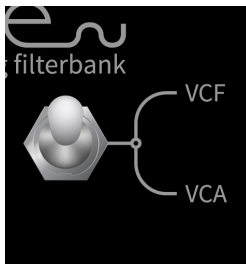
**VCF/VCA switch.** The way to route your EG output signal.
VCF means *Master Cutoff* and VCA is the *STACCATO/CONTINUO* pot instead. By using this selector you can send the EG's CV to the three filters (actually the MCf) or to the two VCAs, labeled as Staccato/Continuo. Obviously there is no possibilities to not route the EG into one of this module without using the EG level attenuator fully counterclockwise, which can be seen like the "third option": the unconnected setting.
*VCF or VCA* is a really fundamental choice that can be very stunning, and impacting on sound manipulation.

⚡ **Use high EG levels carefully** with high *STACCATO/CONTINUO* settings: it can be dangerous for your equipment, for your ears and for you mental health.

⚡ **Achtung!** When you patch the rear EG out into the AM input port please remember that the VCA is extremely dynamic and sensitive to CV. So, for example, avoid to doubling the EG signal to the VCA module via rear port + panel switch. It probably will be musically pointless and eventually dangerous for circuitry. If you want to do it please don't insist too much and don't leave the unit alone like that for hours.

💡 **J.S.Bach Tones**
The VCA has been labeled *STACCATO/CONTINUO* surely to remember the old times when the music spoke Italian. In *STACCATO* position, however, you can really get out classic tones. Simply route the EG to the VCA manipulating the *Cutoff* in order to obtain an attenuation of the high frequencies of an harmonic-rich timbre, such as a sawtooth, play some baroque line and you've just become Wendy Carlos!  :-)

💡 **False-Delay**
You can also obtain a very funny "True-Analog False-Delay" with a simple arrangement: just take a +/-5V LFO in saw position and plug it into the *MasterCf CV input*. Then use the internal EG to play the *STACCATO* mode with the following settings:
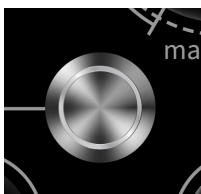A = close to zero
D = enough to obtain a slow percussive behavior, slower than the MasterCf external CV
S = zero or close to
R = to taste
EG LEV = enough to play staccato. Enjoy!

The anti-vandal high-end super-professional **Trigger button**. It's a simple on/off momentary switch for the Envelope Generator mechanism (but costs like a Mercedes) and it acts exactly like a pressed CV-keyboard key. So for this command every recommendation made about the reaction of the EG are absolutely true and effective.
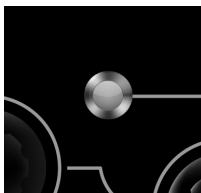
The fashionable old style **LED** is the only visual indication about the EG work status.
This LED monitors the CV emission of the Envelope Generator. Or, in another way, it shows how it works and if there is output signal (the LED is positioned after the EG out level circuitry in order to visually show also the output level of EG). If there isn't an external GATE or if you do not push the Trigger there are no chances to see something work unless you make it loop or you invert the output phase. Raise EG lev to obtain more light for nocturnal promotional shooting in the studio.

The **Gate** input port allows you to obtain one of the most important and musical functions of the filterbank: it makes the MCf or the Staccato/Continuo playable by any CV coming from a CV emitting keyboard, module or synth. Some modern analog synths like Moog Voyager or Arturia Minibrute can produce standard GATE CV signal via dedicated port. In most modular Eurorack or MU structures there is almost always one MIDI to CV module so there are good chances that you can use this function. It is strongly recommended to try it also with audio material like drums loops, gated synth or wathever, that can give consistent MCf movements, Compression, pumping side-chain effect and Expansion (**page 57**).

**Playing with your fingers**
With an unplugged cable inserted into the GATE port the note is always ON. This is an interesting trick to have a DC signal flowing in direction of *MCf* or *VCA*, obviously via *EG-LEVEL* attenuator. What is this for? Well, you can play the EG only touching the tip and the sleeve of the cable together. You don't need a keyboard to play staccato! :-)
This behavior is a consequence of some circuit design decisions and it is also the reason why if you put the mentioned cable into a generic port of another device the LED blink. It is normal.

**Sequencing the GATE**
Obviously you can use a fake GATE signal to control the EG. Just plug a +/-5V, or less (or more, it doesn't really matter until 13V, after that it can become dangerous because if you push it further you can break the EG input), square CV into the GATE port and you have a brand new one-note sequencer. Shape it with the ADSR controls or duplicate the main rate with an EG modulation, just with the activation of the *LOOP* function. This can be very enjoyable.

**Do you like drops?**
Of course you like them! It's started as a joke but then it comes out that this thing could be useful in some esoteric ambient situations. The goal was to emphatize drops. What kind of drops I'm talking about? Well, you know, surely it's happen also to you to turn OFF your sound source when the receiving module, often a filter, still be power ON and modulating under some sort of angular LFO wave, like saw or square. The basic noise of the circuit, shaped by the cutting and resonance settings, continue to flow and often, with the mandatory huge-chatedral-reverb and some digital delay set to " beyond infinity", thousands of elegant, cinematic, perfect-to-close-a-really-noisy-two-hours-live-performance drops starting to falling down from your monitors or PA. Could we forget this fact? Could we ignore that it's 3:00 in the morning and you want to go to sleep but our machine is still ON and, beside you don't want to play anymore, and this is why you shout down the signal source, VERTICE is not tired enough? VERTICE want to play drops right now, and you can't do anything about that, bitch.
Well, to giving to our beloved VERTICE users some sort of control about those drops, to avoid mass suicide after 48 hours of continuous constant drop playing, we managed the main pcb in order to obtain something that a good engineer with a straight engineer approach would certainly avoided: two a little bit too close tracks. The B filter preamplifier start with a 47kΩ and close to that zone we routed the EG output track to let it pass near this resistor. Yes, dangerous. But effective. The two elements couple themselves electromagnetically, mainly 'cause of the huge EG output level, and this is it, now you have the **Drops Level**! Let's find another company that can say that. ;)
Ok so: no signal, EG loop ON, now listen only the B filter. Obviously you'll hear the EG hitting the three C*f* giving "the beat". Now try to open the B filter level. Raise it. It's important that you don't have a coupled ground on B, or in another words you have to unplug the Audio IN cable from the B and turn up the B level. This is sufficient to activate this Drop Level possibility. You have to raise the volume close to max to have a clear increase of presence of drops, but now you can.
Remeber that this is audio signal now, not an EG modulation. So everything affecting the regular audio will change something also in your drops.

Ok, this thing, as allways in all "Fantasia" designs, can lead to some problems. You will notice that when compressing a BD (the SD have better behaviors due to its mid frequency content) you'll hear the "drops".
First: in VERTICE the audio signals generally are thounsand times bigger than drops.
Second: if it annoys you just raise down the B level or just plug a cable connected to some turned on but silent machine. This two solutions are valid by their owns and lead to the same results: you'll have zero EG-modulation-sound into the B filter, 'cause in both case the mentioned 47kΩ resistor is wired to ground.
Drip, drop, drip, drop.
Rain is falling down.
Drip, drop, drip, drop.
Splashing all around.

# THE POWER MODULE

Our power supply module is the only part of VERTICE we don't build by our own for obvious safety reason. It is produced by *Traco Power*, a Swiss company based in Baar, Switzerland which is focused on hi-quality and medical power modules. We chose to use an hi-end supply module because of its major importance on the related working circuitry: the power module don't sound but it *allow the rest* to sound.

In order to improve the EMF performance of the whole machine a **custom conductive metal carter** (a metal enclosure) is placed over the plastic housing of the power module. This simple device act a as Faraday cage, allowing many dB of noise rejection and is a great advantage for low level audio performances.

Our power module **characteristics** are:
*   Fully incapsulated
*   Compact low-profile plastic casing
*   Universal input (85-264VAC, 47-440Hz)
*   Protection class II
*   IEC / EN / UL 60950-1 approval, CB-report
*   Protection against overheating
*   Protection against shorts and overloads
*   Typical efficiency: 79% (the 79% of the energy that you pay to let Vertice work is effectively used. The rest thermal losses, very useful to save on home heating)
*   Output max power: 500mA @ 15V
*   Voltage set accuracy: +/-2% max
*   Minimum load: 10% of rated max current
*   Ripple and noise (20MHz BW): 1% of Vout (mVpp)
*   Overload protection by current limit: 105% min of Inom, fold back, automatic recovery
*   Overvoltage protection: typ. 120% of Vout by Zehner diode
*   Wake-up time: 400ms
*   Hold-up time: 20ms
*   Max capacitive load: 1500uF
*   Temperature range: -25°C to +70°C
*   Power derating: 5%/K above +65°C to +70°C
*   Over temperature protection: @ 90°C (automatic recovery at 67°C)
*   Temperature coefficient: 0.02 %/K
*   Humidity (non-condensing) 95 % rel. H max
*   Isolation voltage (60 sec.) (Input/Output): 3000 VAC
*   Isolation resistance (Input/Output): 100 MOhm (at 500 VDC)
*   **Max Altitude during operation: 3000 m** (9840 ft) approved. Don't you dare to fly onto your hot-air balloon at more than 3000m playing Vertice! Strictly forbidden also high-altitude paragliding and, please, when you're on a CIA mission or when parachuting on some Norman hinterland left your fucking Vertice at home and think about shooting on those Nazi. Try to act like a grown-up man for one time...
*   Electromagnetic compatibility (EMC), emissions: EN 55022, level B, FCC Part 15 level B
*   Protection class II to IEC/EN 60536
*   Safety standards: UL/cUL 508
*   Reliability /calculated MTBF: >280'000 h
*   Casing material: plastic resin + fiberglass (UL 94V-0 rated)
*   Environmental compliance: RoHS directive 2011/65/EU

# USING THE VERTICE FILTERBANK

## THE NATURAL POSITION

There are some positions that VERTICE like so much and other for which is not exactly enthusiastic. In this section we talk a little about these situations.

**THE NATURAL MONO SERIAL**

This is the most classic situation: a single audio signal is flowing into the A-audio input and then, via the routing switches, sent to the sequent filterboard until it reaches the *SERIAL* output. Do not formalize on the *STEREO* label here. In this configuration there is nothing of stereophonic.
This is the starting position to obtain a large range of cutoff slopes:
- the soft, stable and orchestral-sounding **10dB/oct**, obtained with zero *Emphasis* setting
- the **18-22 dB/oct** achieved by an increased *Emphasis* level of two filterboards. A very expressive, unstable and tonic timbres maker. Just set it over a simple sawtooth and wait for a while: you will notice a slow morphing irregular wave upon your stable oscillation. This mean injecting *life* into the sound!
- the **24-26 dB/oct** with the three filters involved. Just try to tune the three *Cutoffs*. Strange things can happen here...

Note that in this description there is *Emphasis* playing a relevant role. Like widely argued before, in this kind of very early circuit design it's the physics, more than the human think, to rule. So take it for what it is: a very creative and *real* filterbank, not a perfect surgical instrument. We want the VERTICE sound raw, crazy. We want it can be astonishing for a long time since you bought it, not just a one-night love. There is plenty of more perfect, more usable, more inexpressive and money-saving analog and digital filterbanks around here. Why propose the same stuff again and again? We really hope you will turn on our machine for years not just because you need LEDs for chrismas tree but because you *love* this little buddy.

> **Tone Considerations**
> Natural mono serial is the most common choice for mono bass, contrabass-like tones, very sharp wobble, low-mid leaders, bass drums and snares and, on the contrary, very classic smooth orchestral sounds.

> **Different Modes in Serial Configuration**
> Obviously there is not only the *LP* mode. Feel free to use any of the three modes in any filterboard. But remember the seriality of this configuration, like the sequent notation try to explain.

> **This is a serial mode!**
> It means there are subsequent cuts, in most cases on the same cutoff frequency. So it's normal if the B or C-Cutoffs in some configurations seems to not work, especially if they are set in different *Mode* settings (LP, BP or HP). There is nothing broke: they only try to work on a silent part of the timbre, just erased by the previous board. Use these possibilities to push your creativity behind the common sense line, or die trying it. In the VERTICE there is always a distortion somewhere you can use to really re-invent the sound, boosting the Emphasis scream tendencies into really mad Edvard Munch themes...
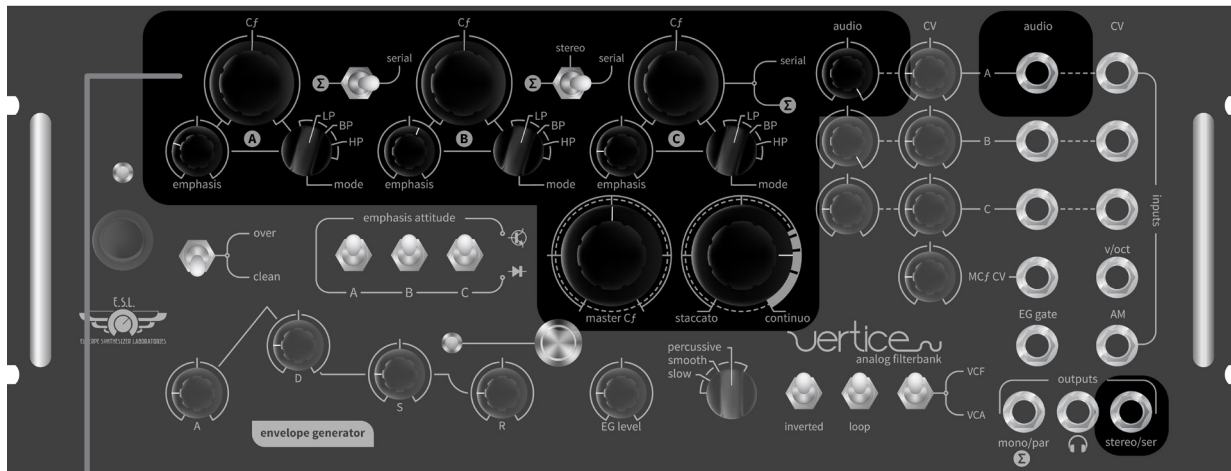
**The Triple LP Mono Serial Natural Position**
If you set the three *Cƒs* exactly to zero the *MasterCƒ* range is a little limited. Set them to the flat position to allow the maximum possible Master Cƒ range.

**Did you know?**
The Serial mode is the more loud position because of a 18 times fixed gain for each filterboard, that multiply themselves during the signal path.

## THE NATURAL MONO PARALLEL AND FALSE-STEREO PARALLEL

This is not a common configuration for a filterbank. As you can see in the images the Σ / SERIAL switches are in Σ position. It means that you do not send the audio processed by the A-board to the B-board but into the Summing Circuitry instead, labeled by the Greek and mathematical Σ symbol. In this case this routing method can exclude the B-filter, and obviously also the C, from *this* audio line. But remember that all the three filterboards have their own audio input.

This simple routing method allows some uncommon patching possibilities:

•     A-board going to *Parallel* port, 12 dB/oct nominal
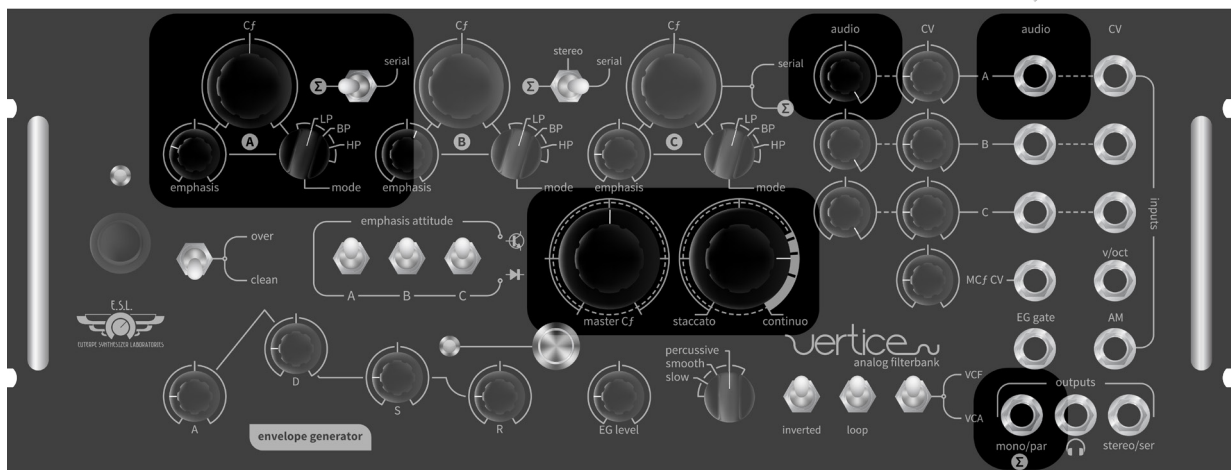
- A-board going to *Parallel* port summed to a second oscillator/audio source sent into the B-board and then going to *Parallel* port.
  12 dB/oct nominal + 12 dB/oct nominal
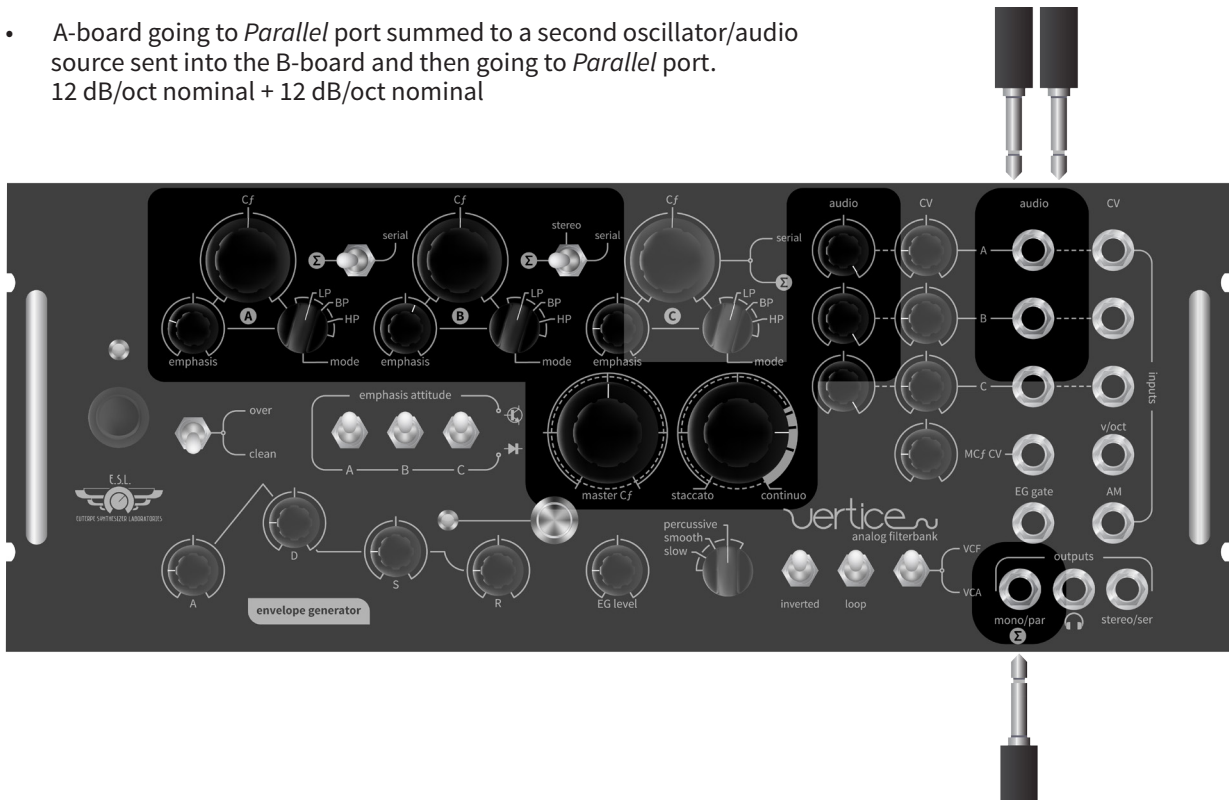


- Three different audio inputs to the three boards, summed and going to *Parallel* port. This is a *real analog summing process* and you can use this VERTICE particularity stand-alone, not only when the cutting characteristic is required. In other words VERTICE can be a reliable source of well mixed, very boosted, pure electric audio material. So you can use it not only for filtering, general mix needs are satisfied too. 12 + 12 + 12 dB/oct nominal
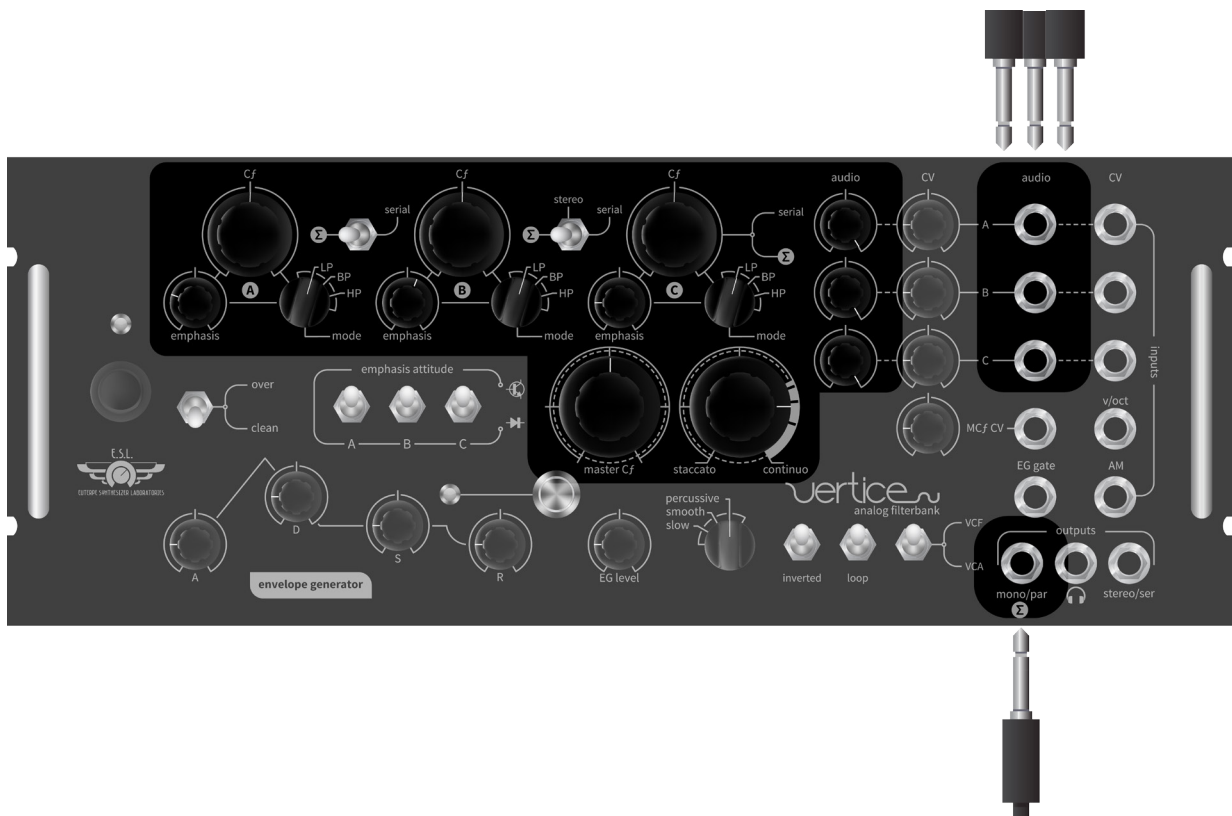


**Just Re-amp**
VERTICE has three hi-end discrete preamplifiers and two hi-end VCA circuits. Don't worry if you don't use the *Cutoffs*. Sometimes digital timbres are almost perfect, just too weak, vanishing. They only need to get out from your cold VST and take a ride inside some real analog circuits. So just re-amp that sound!

> **Analog Σ**
> Real analog summing process means some aesthetic differences compared to a DAW full digital summing process. It's a more respectful summing method, leaving the singular signals well defined and recognizable, avoiding the equivocal results that appears, especially in the bass ranges, in a complex totally digital mix. It also allows to manage the dB range of analog inputs completely in the analog domain, so according to the VU standard (0dBVU = 1,22V), which implies a considerable headroom and the possibility of pleasantly distort the signal along the way.

- Three different audio input to the three boards, summed and going to *Parallel* <u>and</u> *Serial* ports. It's like the previous one but with also the serial output port cabled. It's the *False Stereo* mode and it's obtained because of the C board that simultaneously emit by Parallel and Serial output. So in this configuration you can obtain the three inputs summed from the Parallel port and *also* the singular C signal from the Serial port.
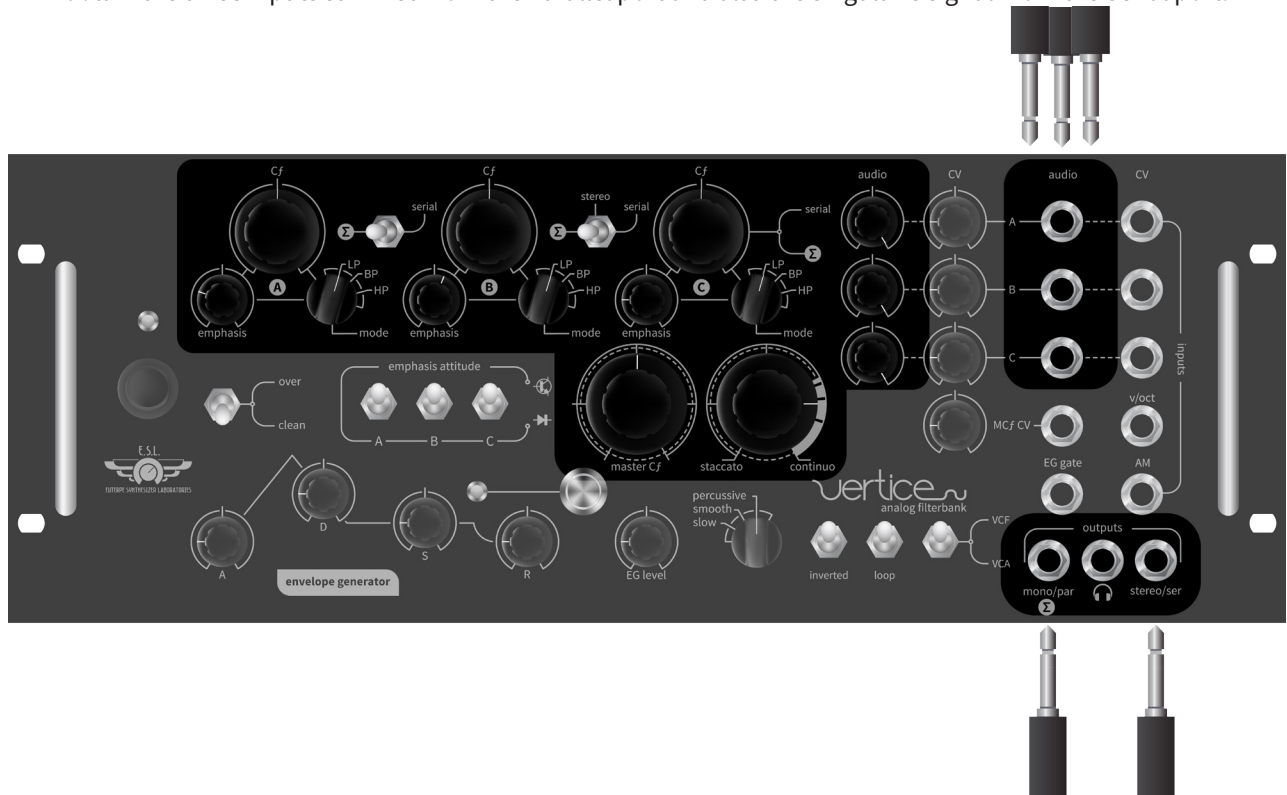


- Mixed combination of routed parallel *and* serial board. These configurations are useful to obtain different slope mixed material. Follow a brief list:
  1. audio signal into A, A to B, B to Σ, audio signal into C. Remember that C is internally wired both to Σ and *Serial* out. It's a combination of a <u>24 dB/oct</u> (A to B) summed to a variable <u>12 dB/oct</u> (C to Σ) from the *Parallel* port, *and* the C-filter <u>12 dB/oct</u> signal from the *Serial* port.
  2. audio signal into A, A to Σ, audio signal into B, B to C. It's a combination of a <u>12 dB/oct</u> (A to Σ) summed to the <u>24 dB/oct</u> obtained by the B to C series. Due to the double outputs of C, the B to C <u>24 dB/oct</u> is available pure from the *Serial* Out and summed with the A <u>12 dB/oct</u> from the *Parallel* Output.
  3. obviously there are more complex combinations, sons of the two previous, especially using the rear ports and the CV inputs together. Experiment with some different audio input materials and routing solutions to get very different results. To enjoy your experimentation you can start from there: audio into A and another audio into B. Then filter A into filter B, in order to obtain the processed signal by the A-filterboard summed to the *clean* B audio input. We know it may seem a pointless complication and in fact, at least initially, it can be. But put the VERTICE for a while near your 150000$ modular synthesizer (we are sure you have one!) and then see if you not deserve the three separate input lines.

**THE REAL STEREOPHONIC NATURAL POSITION**

This is another very uncommon feature in the analog filters world. It's simple: audio into A, audio into B. Then switch the Σ/SERIAL to Σ, the Σ/STEREO/SERIAL to *STEREO* position, take the Left (filter A) signal from the *Mono/Parallel* port and the Right (filter B) signal from the *Stereo/Serial* port. Obviously you can invert the cable but if you do as we suggest there is a straight correspondence of Left/Right cables, modules and ports.
Since this true separation is obtained excluding the C-filter from the audio path, as you can see in the ROUTING chapter at **page 15**, the C-filter virtually can't be available for any use. But in the real life C is still functional and available for crazy Emphasis auto-oscillations and to receive another mono audio signal, doubling it. C now is a total independent stand-alone filter, and this is useful especially since it has two outputs, summing its signal to the two stereo channels equally.
So VERTICE, besides being able to easy and trustful manage a true stereophonic signal, can transform a mono signal into two slightly different one's, simplifying your mono to stereo re-amp performances.
This stereo function is very useful doing compression on a complex mix, like you can read in the dedicated chapter **page 57**.
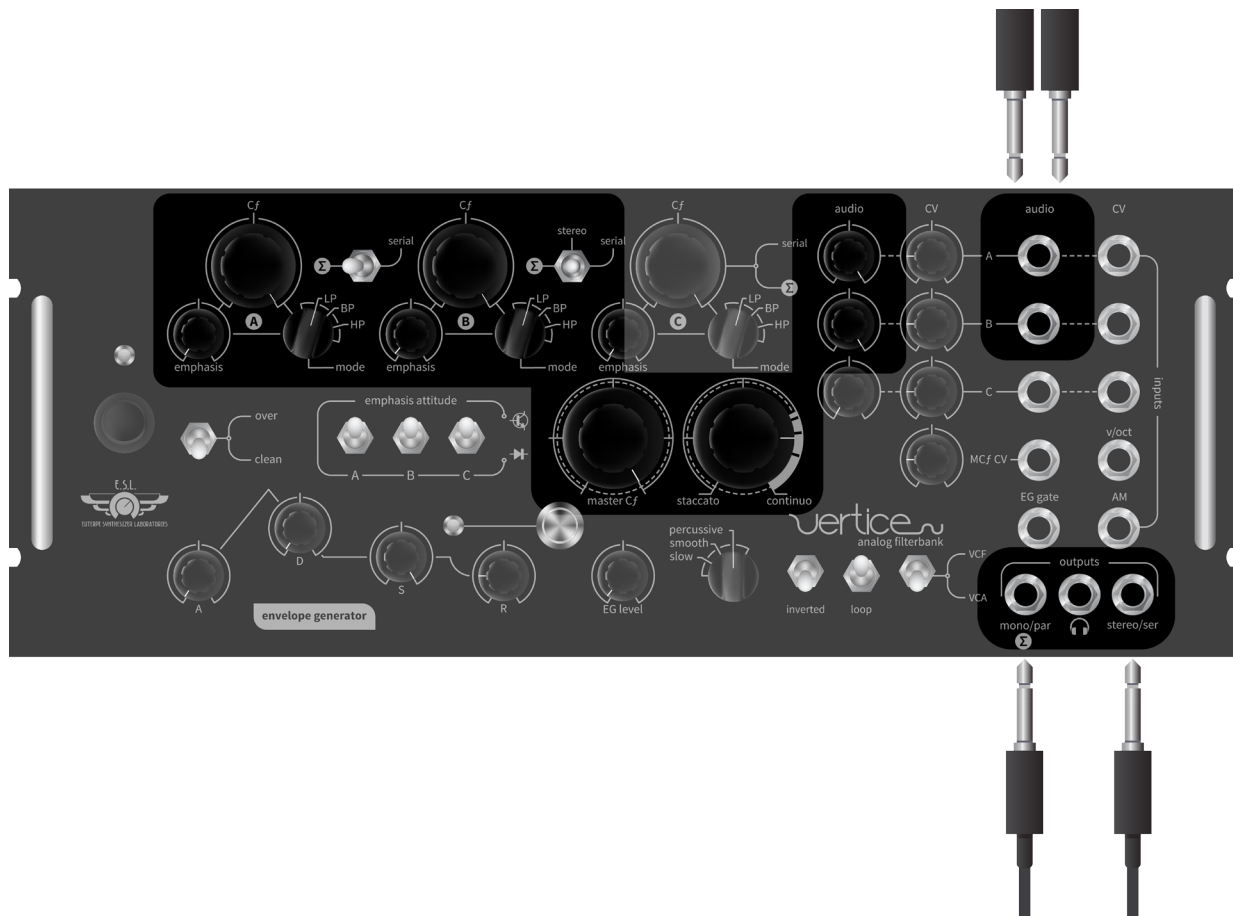
# THE "WITHOUT ANY EXTERNAL AUDIO INPUT" POSITION

**HOW TO TURN VERTICE INTO A COMPLETE RAW STANDALONE SYNTHESIS SYSTEM**

As mentioned at **page 26** you can obtain "something that oscillates" using the audio feedback over one filter. We will use the inside noise to create an amplified loop, a classic "positive feedback" approach. A positive feedback is something that increases itself by increasing itself. I know it's disturbing to read a sentence like this but it is the only way I can imagine to briefly explain this concept.

Here is the simple "all-my-standard-oscillators-are-gone-and-I-feel-so-alone" method:
- the start position can be the simple LP serial mode: A serial to B, B serial to C, all LP
- overload function ON. This will boost the self noise of A filter helping the positive feedback
- A Rear output into A Front Audio input
- B and C Cutoffs fully clockwise
- MCf = flat
- A Cf = flat
- now raise the A audio level: the A filter will oscillate in a almost-triangle wave. You will realize soon that the audio level doesn't only start the oscillation but it also is an effective "pitch" command
- if you open the A Cf you will see an huge accumulation of harmonics, your almost triangle is becoming a nasty squarewave
- if you close one of the remaining cutoffs, B or C, you will cut away the squarewave, as usual

That's funny isn't it? Now you have a drone-like complete synth with redundant filter chain just *not* using Vertice for what it was thought for... interesting...

Now is up to you. I'm sure you're craving for experiments, like moving the Emphasis level or changing the Mode: every command here can cause really strange effects so why don't try? You will soon realize that this feedback is preeminently generated around the C*f* frequency position and changing that position often generate a very musical half tone difference from the foundamental note, besides changing the waveform. So you absolutely *have* to try to drive the MC*f* with percussive audio loop. You will be astonished by the bassline you can automatically produce with VERTICE, both in normal or in inverted mode. Remember that also your EG can easily oscillate into audio range. And you have TWO output for it, one of which can directly be used like an audio input for, let me see, the B filter, or the C! From now on you can forget your 150000$ modular system of whom we spoke before. Well... maybe.

This feedback method can also be applied to the B filter but the results are less stunning because of the lack of the Overload function. Just raise up the input level to the max and oscillation is almost mandatory but in a quite limited low frequency range.
Better reactions can be obtained using the Mono/Parallel or Stereo/Serial signals like audio feedbacks, since they are after the VCAs, and you know that our VCAs are tough guys. Strong signals make selfoscillation become easy.

Changing the Mode also improves oscillation chances, but it also moves your "VCO" to "some octave up". BP has a more low "native octave" than HP that reaches the more high frequencies range in this "do-it-yourself-filter-oscillator".
What is really cool, in our humble opinion, is the fact that Vertice is a filterbank but you can use it also alone and its sound palette still remains huge and charming.
And, by-the-way, try to obtain this kind of trick with a VST... this is a challenge! :) (this "oscillator effect" is caused by amplifying internal noise, and VST doesn't produce internal noise...)

**Let's do some stunning patch!**

3 OSCILLATOR FROM PURE SILENCE
- Rear A into Front A
- Rear B into CV B
- Rear Par into Front B
- Rear Ser (or headphone out, why not?) into Front C
- A to Par, B to Stereo

You'll obtain 3 crazy fucked up oscillators that depends from the A rate first, and second from the Master Level (Staccato/Continuo). Try to BP or HP the B or the C filter, really interesting audio self looping things can happen.

HARD TECHNO AUTOMATIC BRUTAL BASS
- Symply substitute the feedbacked C input of the first patch with a regular 4/4 straight techno beat.
- Apply the beat also to the EG Gate input
- Then prepare for madness. Going up with Master Level you will find that feedbacks growing up and saturate everything in your studio, making absolutely funny and productive your day
- Remember to try also the B BP or HP mode and always try the two routing switches: you will extremely mono-distort (serial) or cruelty hard panning (Stereo and Parallel), generating some side effect that can really be astonishing. Do this kind of triks at tempo and you're just become a real pro.

FEEL THE DARKNESS
- Rear A into Front B
- Rear Ser into Front A
- A to Par, B to Stereo
- Just raise up the A Emphasis level to obtain something like be inside Alien, not the movie, I mean the mouths (an harsh really creepy "black" noise)
- Add Rear B into MCf CV for extreme antiphase results
- Add Headphone to MCf to increase instability and to obtain Geiger counter radioactivity noises without loosing the bass floor
- Add Rear B to MCf to let your Vertice start to produce automatic noizy sweeps
- Add Rear Par to AM to transform your MCf into a manual not linear at all short sweep generator (do that at tempo with a good amount of reverb/delay send)
- Add a beat to EG Gate and Alien, with you inside, start to jump like a pinball

Try all of this possibilities and then realize that you don't have touched the the C filter yet.

Ok, maybe you start to understand that when you see a socket in Vertice you may consider that you have a whole spectrum of possibilities around it, just letting yourself go, closing your eyes and put that cable well pushed to the bottom of it.

Just respect the rule: Out into In, In into Out. Then prepare for your daily waveform mayhem.

# THE UNNATURAL POSITION

As mentioned before in the VCA and in the EG sections the so called *unnatural position* can be obtained with a zero level input (or a totally closed LP Cutoff) and a VCA position at full *extra* gain (CONTINUO position + straight max EG level and note ON or inverted max EG level without key pressed).
In this position you can hear a very raised up noise floor: it is almost like hearing the direct electron flowing or something. Is a very splatter lump of tones, like a rumbling stressed unsatisfied earthquake, like a microscopic explorer that hear a woman in labor internal organs. Something wet and dark and suffocating.
This is the consequence of the crazy extreme amplifications on the VCA ICs obtained by overbiasing the control pin of the integrated circuits. It is not so dangerous but maybe also not so useful, musically speaking. We leave it there only as a "side effect" of a strongly-wanted huge dynamic range, with all the expressive and tonal possibilities related. And obviously is a side effect of our brutal death metal musical childhood. Face it.

In this situation the *Master Cƒ* hand-control *can* suffers by some scratching noise during fast manipulations. At normal line level those schratches are not perceptible at all and are not an audio defect but simply a not perceivable operating characteristic that all analog machine that use carbon potentiometers have. Strange behaviors instead can be noticed when in Unnatural Position because if you put the VCA level at this very high settings something wrong just must happen. Simply you *shouldn't* use this position. Again, this is the very dark side of the machine, leaved here to achieve extreme dynamics, and some bloody unexplored place where to pass the cold night crying alone, shivering, unheard.
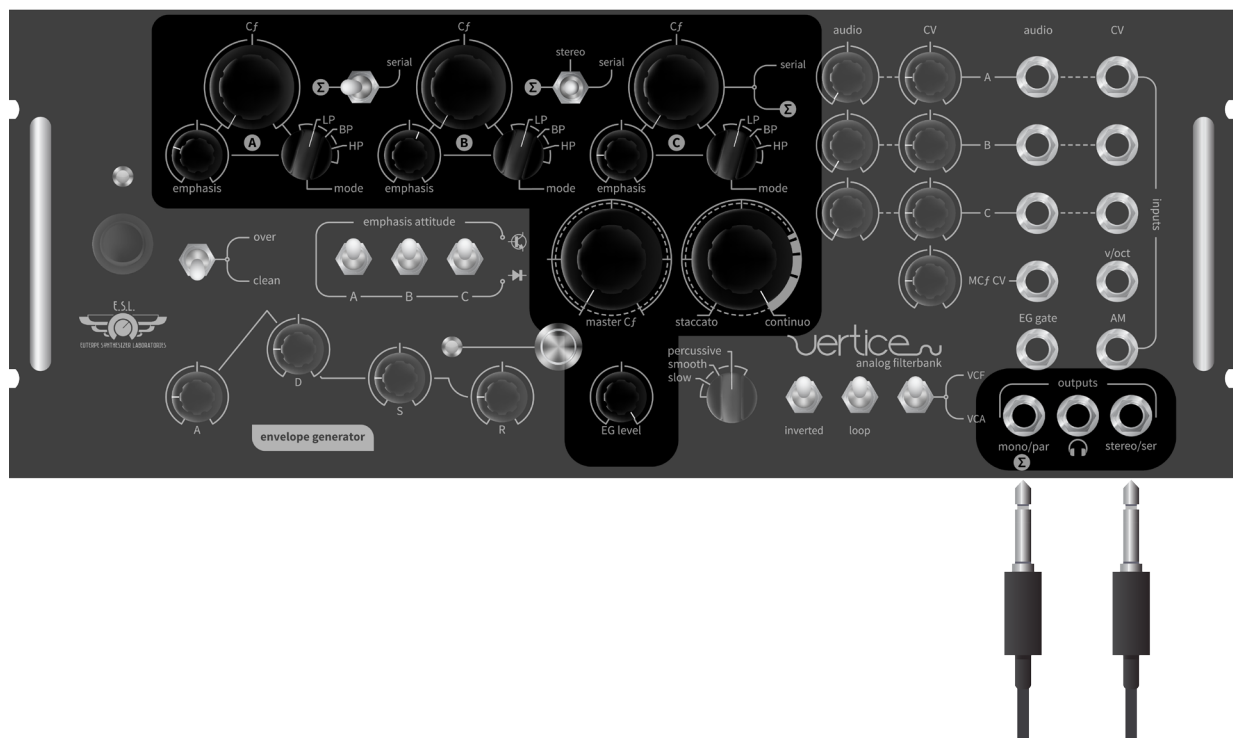
# VERTICE AS A COMPRESSION/EXPANSION UNIT

Everyone in the music industry know how much dynamic control can affect the total result of a complex mix, digitally or not obtained. Punching out fast transient Compression is the key to achieve recognizable and easy-assembled bass drum and bass combinations, while Expansion can get out from a complex riff the most loud parts, giving to them further more level and sense of impact. Generally this kind of machines are hosted in a secret space into audio engineers minds, the space where only The Best can live together because "there is not enough room for two of us in this rack". Seems that this kind of "hi-end" signals treatments can be outline for VERTICE, too unstable, too "crazy-synth" and not so much "professional" but in real life they *are not*. In fact VERTICE can be more than a normal compressor/expander.

Starting from the fact that its VCAs host the just mentioned THAT2181, a very hi-end IC with great technical performances, we can imagine that VERTICE *can* compress, or expand.

Yes, compression is available. And what a compression! During this chapter we will dwell on that matter because of its major importance in tracking and re-amping moments, giving to compression a relevant argumentation role but keeping in mind that almost all said about compression is also true, generally in reverse-biased mode, for expansion function, which is the exact opposite of compression.

To set VERTICE in order to obtain compression you must involve both VCAs and external audio-drive Eg. No other possibilities, unless you want to define the Overload function as a compression, which can be also true under a general mode of view, but also incorrect under other lights so we ignore that function as a compression matter: it is a distortion matter, which is of course a particular sort of compression, or dynamics manipulation, that's all.

Another intro: we will argue using a particular example, something that has a relevant role on music production. We will refer to a Bass Drum signal, so something with fast transient feature and very solid low frequency body. This is primarily because to compress you have to use your signal as a key-signal for Eg GATE input to achieve compression, and BD is generally a heavy signal that can easily trigger the Eg circuit. Second, we use this particular example because BD+compression represents a very common combo in music today and so its procedures and behaviors are easily to understand since most of the compression literature dwell on this particular kind of signal a lot.

So to use VERTICE as a compressor you must:
1. Procure yourself a stereo BD signal (or obviously any other signal that may trigger the Eg)
2. Use one cable to feed audio signal into audio path of VERTICE. It can be A, B or C audio input, it's not so important right now. Amplify it to obtain a properly gain-staged signal without introducing any audible distortion
3. Use the other cable to drive the EG GATE input. Your BD signal will flow to both ports at the same time. This is important. Note that the part of the signal that pass the EG activating threshold is only a matter of source machine output level, to be set correctly high to obtain different results over a wide range of processable audio materials. This relation between injected level and compression behavior is the typical idea behind the common *side-chain* modality, also investigated later in this chapter.
   The blinking LED will be your only visual reference in this process. Obviously an integrated 20-LED-strip or a fancy VU meter should be useful in this case to show at least Gain Reduction values, but VERTICE is born with a strong synthesis character so this feature was avoided during project phase because too directed to this particular function. For a more visual full of unuseful meters approach you can refer to one of the thousand compression VSTs available today on the net.  :)
4. Setting up the rest of VERTICE means in the most case to switch it into a general serial modality, but of course you can set it differently. The tone result will be naturally different but this is a timbre matter only, while we are talking about dynamics right now, so you are right if want to try other options like using both the two output ports of VERTICE to obtain a mono to false-stereo signal or use it to apply a false stereo BD from C-filter summed to the rest of the processed material, even the entire main track, as mentioned later. So let's continue our demonstration with the simple serial BD
5. Set VCF/VCA switch to VCA. In this position the two VCAs are really dynamic and can give very high signal values. Be careful with both STACCATO/CONTINUO pot and EG LEVEL. Starting from a zero output level, to hear something you must raise up the VCA level, e.g. to flat position.
6. Then you can set the ADSR as follow:
   A = zero
   D = zero
   S = max
   R = close to zero but not zero
7. *Percussive* mode to obtain fast-transient response. It's useful now, giving the fastest response VERTICE can allow.
8. *Inverted* or *straight* mode are the key to choose from Compression (inverted) or Expansion (normal) function. We continue our example with *Inverted* mode inserted
9. *EG Level* value defines how much your VCA will be affected by the EG time-subjected output.

It's important to understand that right now *EG level* and *VCA level* are strictly connected, as if they were a single

pot. When, with an increased *VCA level* value, you can obtain a principle of distortion in your timbre, if further pushed up by the EG output the distortion will naturally grow so you may turn down the *VCA level* a bit in order to compensate. But now a doubt arises: if we are in inverted mode shouldn't we obtain a *decrease* of the VCA level instead of any further amplification? Are we try to compress this BD or what?

Yes, we are about to compress it but we must understand the full mechanism: when in inverted mode, if no one GATE signal flow to force the EG to work, the EG apparently *will still work*, especially if we had set Sustain to max, as we suggest, giving a continuous control signal. So in this case the VCA level is always subject to the EG out level positive signal *except when EG is triggered and still solves its time algorithm*. This is the point. GATE triggers the EG so it, in inverted mode, decreases the VCA level. On the contrary when the EG *is not* triggered and Release function reach the end of its time window (0V) the whole machine level will reach the value that Sustain and EG Lev together force it to be, so level grow.

It's a bit tricky but this is the only way you can use to obtain compression from VERTICE. It can be a very silent compression and still remains strongly effective on a wide range of input levels and audio materials, just be prepared to experiment a bit with *STACCATO/CONTINUO* and *EG Level* potentiometers together.

> **Brief tip**
> Pretend that the *Eg Lev* pot + *STACCATO/CONTINUO* pot together (summed values) are like the Threshold and Make-up commands (separately) of a common compressor. Due to this primitive analog side-chain structure when you raise up the EG lev you should turn down the Staccato/Continuo Lev simultaneously to avoid intense distortions.

> **Ratio**
> Having historical and practical importance Dbx's device are very well known and recognizable by a pair of trained ears. Although this facilitation being entirely devoid of visual references on VERTICE makes the recognition of the value of Ratio very difficult. Our ears seem to indicate a very squared compression behavior like the one you can find in a 10:1 or more intense limiting ratio settings. But this is an unsure conclusion because this value is very related to both Staccato/Continuo and EG Lev positions, besides the obvious impact of the injected signal level value.
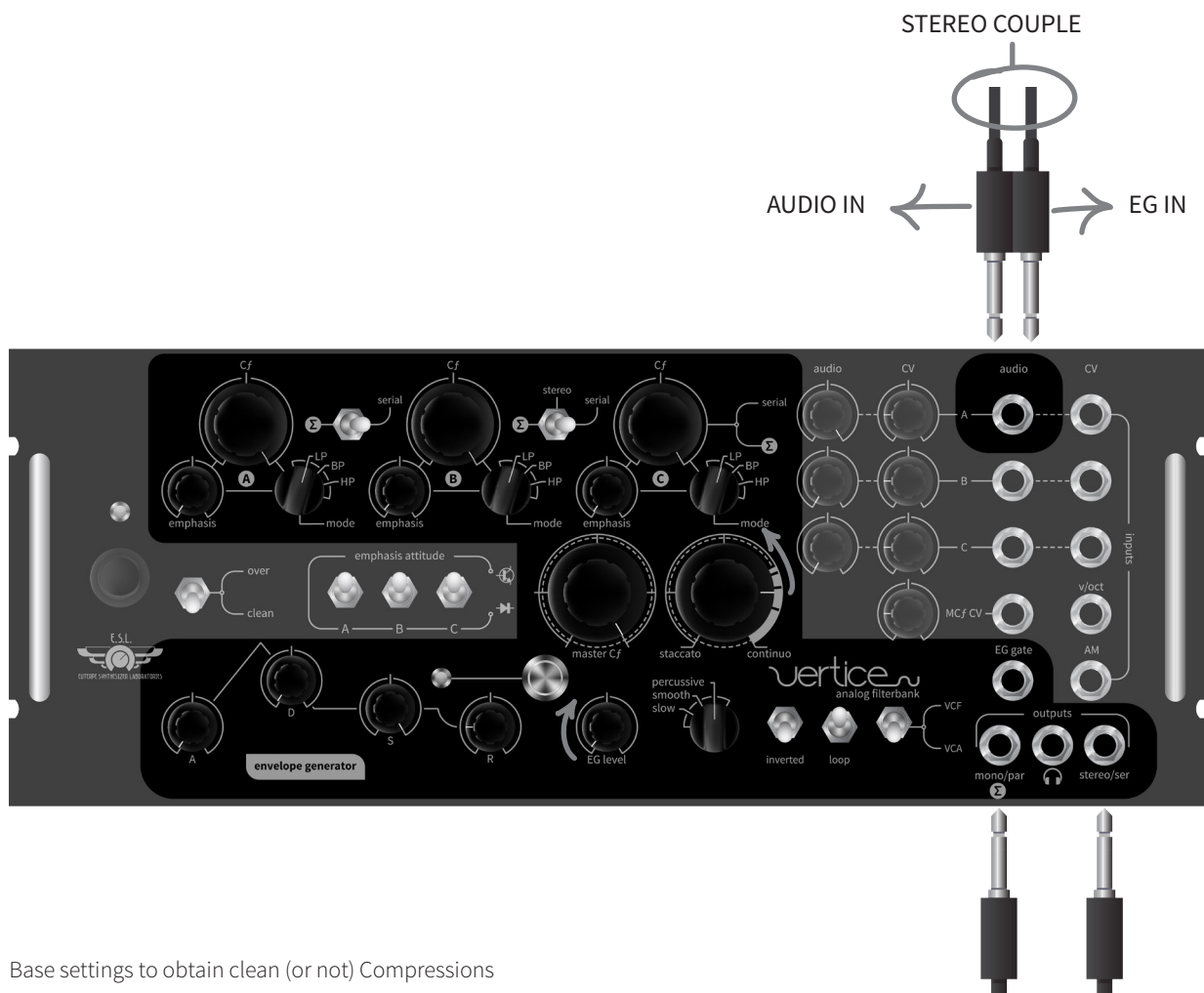


Base settings to obtain clean (or not) Compressions

Now, if filters allow it, you can hear your compressed BD. Play a bit with Attack and Release settings and discover how productive/creative this function can be. Generally with a clean input signal and audio path, low Attack settings and VCA set to ¾ the following situations can occur:

- **EG level = zero**. The almost natural BD is beating in your studio monitor
- **EG level = ¼**. The compression is very recognizable. Snapped hit, squeezed body, the BD assumes the well known Dbx and SSL's nuances. Don't be sad to limit your fingers in the lower part of the scale. If you want a strictly technical sounding drum pattern is here where you have to look, not with this two values increased. Stay here and punching mix will not be a problem anymore.
- **EG level = almost flat**. Here some strange things become to be heard. A subtle raised up noise floor, some vinyl-like electric dust and so on. The tone is a bit distorted. This is due to the previously explicated reason but lowering a bit the VCA level strongly reduces distortions and all the noise just mentioned, while producing a very effective compression. So EG Lev = "threshold/ratio", VCA Lev = "make up/dirt generator". Generally you have to set your EG Lev status and then lower the VCA Lev in order to "clean" your drum loop from distortion that an increased EG Lev often produces
- **EG level = just after flat**. Here too much amplification. You clearly can hear white noise + electric noise from all the circuitry at regular signal level. This must be taken like an unusual creative opportunity instead of a design fault. As said before we wanted to give to VERTICE a really extreme dynamic range, and we did it for sure. This extreme side effect can have annoying results when just re-amp BD but no further amplification or compression nuances can be obtainable from now on. Purely technical manipulations are to be researched in all the various STACCATO/CONTINUO and EG Lev low level matching, not in such higher levels palette. From now on we want to destroy.
- **EG level = ¾**. Destroying the injected dynamics is a matter that VERTICE can handle very well. It starts with a very pumping side chain effect over the power supply noise floor, extremely amplified. It means that a VERTICE in the USA will sound different than an unit in Belgium? YES, of course! Ten more Hz for 110VAC users. This is funny.
- **EG level = max**. Here you can feel... the darkness. You are in a pumping version of the Unnatural Position described earlier.

> **⚠ Preserve your VERTICE**
> At this high level the VERTICE circuitry is certainly under stress. Use it with free spirit to play and record all the time you want but please be patient with physics, take care to not leaving it alone too much time switched on and with this kind of stressing set up. When you have done with the take turn down *STACCATO/CONTINUO* or EG level instead — it's enough to preserve VERTICE from bad diseases.

I'm not here to explain to you the Compression theory, giving it as a common knowledge, but a brief consideration about Attack and Release matter can be done.

**Attack**. With it you set the EG intervention time. Triggered by the injected signal the EG will act as a level subtractor exactly as a common compression interface may do transforming the injected signal into an Envelope Follower behavior, "slowing it". So you can slow this very musically-fast response in order to leave a greater or lesser part of the signal unprocessed. The musicality of this process must be tried and we strongly recommend it to all VERTICE users. It can maintain the tons of pressure generated by the EG but recovering a bit of naturality for your compressed drumshots.

**Release**. With Release you can obtain two very different situations. The normal one is obtained turning it clockwise (starting from the initial setting up = fast but not zero). The EG remain more and more time active, imposing one shot compression over the consequent beat, giving the classic "too much release" behavior. Know it seem pointless but is primarily to underline the similarities between VERTICE and standard compression tools. In common compressors this settings can be used to reduce dynamics gently and widely all over the processed materials, that generally can be a complex mix or part of (like stems and subgroups).

The second, not-standard-at-all, behavior is obtainable turning completely counterclockwise the Release. The situation here is the very opposite of the "too much release" one: a very fast loop over the audio shot, caused by a "too frequently zero crossing" GATE signal. The GATE input in this case is not a standard flat 0/+5 signal but an alternated audio-range frequency signal. And so the 12V/microsec of medium slew rate of the VERTICE various circuitry turn up and down, up and down the VCA level many time/second. Sometime it is called Amplitude Modulation and is the thing you will apply to your drum loop if you turn the Release pot to zero. A very hard distortion can be obtained here, something that is totally unrelated with compression in the common sense.

**Side chain**
As previously said this function is obtained in VERTICE with a common side-chain method. What it is? As most of you know compression is a reducing levels of a transient signal matter. And this is obtained forcing a VCA with some commands. If the information come from the same processed signal you will have, with a threshold crossing level, a reduction of gain and then, as we know, compression. But the point is: you can use also *another* signal to drive the EG. And so? Try with your entire musical base, without BD, flowing stereo into VERTICE and the BD driving the GATE input from one side and a mono channel of your mixer by the second one. THIS is re-amp, baby! Try various kind of pumping modifications, levelling and summing. Your BD and your base have never been so easy to put together with a level-giving base and the very in-face BD protected by level reduction simply bypassing Vertice. Or simply move your triple saw/square with rhythmical modulation and remain synchronized with the other machines of your set-up.
And with all these continuous controls and modules relations, you will be able to experiment and make surprising discoveries for a long time to come.

**About expansion**
As a compression unit VERTICE can offer its very personal view of the matter. The same occurs with expansion, obtainable setting the EG in the regular way of use (not Inverted). Less useful than compression, expansion in this synthesis machine can be used as a creative modifier. Try it with a BD and other percussive material mixed, like a drum machine pattern. You will understand quickly that the most relevant part of the signal, often the BD, will be push to an higher level further, engraving the perceived loudness of the other lower instruments, like snare drum or hi hat, giving a distortive/pumping nuance to all. Obviously like many of the other functions of VERTICE you can push it to very crazy results just turning up those potentiometers....

# Service and Support information

## WARRANTY

Your warranty covers a **two years** lapse of time. In this period all the eventually present manufacture defects should shown themselves. We take care of testing your gears for days before shipping and, since probably you have bought your unit directly from us, we list also your purchase date, which coincides with the shipping date. Generally our repairing method consist of:

• Being contacted by the costumer which shows us the problem.
  Contact us at euterpesynth@gmail.com or via our online form at euterpesynth.com/contact-us/
• Try to solve the defect *without* return to us your product.
  You have to explain us the detailed failure and try, with our help, to solve it. Most of the problem are often minor exceptions, like a slightly wrong cable connection, that causes some strange behaviors. In those cases we think returning the unit to the mother-house is an excessive procedure, wasting time and money for everyone, and in some very unlucky cases it may be a factor of further damages due to lack of care of the postal workers. Our machines are true heavy handicraft pieces. Due to these reasons also a short shipping travel can be very stressful than take a world tour for an iPhone® stock.
  So we can try to solve it "online".
  This is true even after the two years warranty period is elapsed. Every time, with or without the warranty expired, you can rely on our customer service for free as long as you remain in the online-mode or, obviously, in a active warranty situation
• After this investigations, if the problem is a solder defect or a component failure we need to take direct care of the unit. So we will give you all the necessary informations to return it to our laboratory.

> **Programmed Obsolescence**
> If you notice a problem and have the skills and material possibilities to solve it by your own, eventually after a brief communication, it's a great success for us: it means we have done a good job in the circuital design process. In this era of low-fi, programmed obsolescence technology, when something, even small, goes wrong and you are forced to throw the whole machine away and buy another new one, we think large, old design can be evaluated as an advantage.
> How much time an old FourVoices, Model D, Arp2600 will last in the future?
> And how much of them will survive to us? Maybe more than our Yamaha super-delicate digital piano, our Samsung "smart" or (absolutely sure) the super-AmoLED-equipped-damn-washing-machine, we think.
> With the Euterpe Synthesizers Project we try to made impacting, characterful and in-some-way-different machines, but also we try to make *reliable* and *long-lasting* technology. Like an old synth which is not good if something blow away, but it's also not a tragedy.
> Ok, an electrolytic has failed.
> Ok, let me see if someone I know have this thing around somewhere.
> Ok, it needs a 33µF and my Diy friend have only some 47µF. Ask to us, and maybe the answer is "*Try to put them, it's not a problem...*" There are certain zones of the circuitry where changing some specified value is not a cause of trouble at all.
> So if you are an electronic engineer or a diy enthusiast don't hesitate to tell us, we are happy and proud to help you. Commonly it's a very high satisfactory moment when a broken unit come to life again.

> **VERTICE when not bough from us**
>
> Simply write an email to euterpesynth@gmail.com giving:
>
> • your purchase date
> • the shop name
> • your name and address
> • serial number
> • name of the machine
> We will update our list starting your countdown from the purchase date.

# RETURNING YOUR PRODUCT TO E.S.L.

We accept the broken units also without the original package, but take care of use a good protection method, like bubble wrap inserts and solid packing system like double wave carton, polystyrene panels etc.
The warranty will not be honored if the product is not properly packed, like too tight box that don't close completely, packs that can let water and other materials come inside, just a Vertice left inside a too large box floating around and hitting everywhere everytime a guy take it in hand... so, if you can, use the original box and protections. Remember that it's *yours Vertice* and is a unique piece, with it's story even before you bought it.

The warranty cover all the repairing issues, giving the unit back fully functional. All the transportation and insurance costs to our facilities are at your charge. All the shipping costs to your home are paid by us.

The warranty will not be honored also in the case of:
*   obvious improper use, like wrong power supply AC values, contact with liquid, acid, lighters (to see inside circuitry in a dark place), powder extinguisher, sand, glue, blood, mojito-part, metal object and other flagrant lack of common sense
*   wrong repairing or maintenance methods, like incorrect measurements practices, electric current injected directly in some delicate points of the circuits, "wrong hole" internal cables. We send it to you fully functional so the cables will be right when you receive it
*   user circuital modifications or substitutions. Contact us before use your solder on the pcbs, even if you just want to modify something small. It's better having a little, maybe obvious, advise from us, and then have the job done, than expiring instantly your warranty for nothing. If you communicate your idea to us we take care to note down it and your warranty will remain active[1]. If not, and something goes wrong, we are sorry to terminate your warranty protection.

Once received we will:
*   contact you for "just arrived" infos
*   examine the unit for any obvious signs of user abuse or shipping damages
*   try to understand what's wrong
*   contact you for a detailed explanation of the revealed problem and our repair solutions
*   give an estimate of the repair cost if the product is out of warranty
*   happily ship your unit back ready to rock again

**Remember that I personally weld and mount every single unit, every single resistor. I know my machine :)**

**With honest, quick and careful communications there is no problem that can't be solved.**

**Knob Paranoia**
Note that if you, for some reason, lost one or more of the american heavy phenolic knobs you can easily contact us for replacement. We know it can be difficult for a not-electronic enthusiast to deal with Mouser, Farnell or SmallBear just to buy one or two pieces. Furthermore our knobs are not so common. This kind of service is extra-warranty also for the brand new units. We will send to you all the requested replacements at Supplier selling price at the moment of the order, plus shipping and eventual custom fees.

**Free "Call-Center"**
All e-mail or telephonic consulting about VERTICE or other Euterpe Synthesizers units is absolutely free of charge.

# INTERNATIONAL SHIPPING

We can ship worldwide. Please refer to your country and ask us to confirm your AC standards before shipping because we have to customize the power module of your specific unit for a trouble-free experience.
You are responsible for VAT, custom fees and duties imposed by your country authority on imported goods.

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1  Obviously if the proposed modifications are entirely agreed by our Staff

# TECHNICAL SPECIFICATIONS

## LEVELS

- **maximum input levels**: not a problem. You can inject signals well above the standard 700/1000mV of several hi-end and commercial devices. We tested the VERTICE in a very large scale of input voltages, even the absurd 10Vpp (+/-5V) of the Synthesizers.com Q106 VCO (we say "absurd" in the case of direct audio use, but obviously it's made with great wisdom if intended like a CV module...). So not be worried about the maximum input voltages: it is around +/-13V, an unreached threshold by every kind of audio equipment of all time, if you exclude some truly vintage valve design, and even in this case it is a very uncommon level. However giving a 30Vpp (+/-15V) in the audio inputs can be destructive, but maybe not fatal. Our machine has balls.
- **maximum output levels** (@max A level+max VCA level+max EG level @ VCA+triggered EG):
  - Mono/Parallel out: 9-10Vpp
  - Stereo/Serial   out: 9-10Vpp
  - A and B Rear   out: 14,6Vpp
- **normal output levels** (@max A level+max VCA level+EG @ VCF+medium emphasis settings): 1,5-2Vpp

## CIRCUITRY

The VERTICE is fully analog. The only time it saw a computer it was for pcb proto and trimming tests. And maybe for one or two goodbye takes before it leaves us.

The VERTICE is fully analog and you notice that even before you switch it on, because of it's weight. However if you are curious to see the internal circuitry you will notice that no-one digital chips are used, even the little 7555 timer are avoided. We just prefer not.

Digital may do spectacular things and we know that. But we also think that everyone may do the job that's right for himself. So OK digital, but "*staccato"* from our pcb's.

> **Looking into VERTICE**
>
> If you unscrew the four handle holdings screws you can easily reach the circuitry. Please take care to UNPLUG the power cable from the wall socket before open or touch anything. **THERE IS THE 220V/110V INSIDE THE UNIT EVEN IF IT IS TURNED OFF**. It is on two different point and touching them by accident is not so difficult (trust me...). Be careful, especially if you're not an electronic pro (as said, unplug that power cable and no problems can occur).
>
> As always taking a look inside your new machine can be a rich source of knowledge about it and about the rest of the world. Please note the dimensions of our pcbs, of our power supply and related anti-EMF carter, the cure about the internal graphics and cables, the aluminum panels, the not-conductive finish method, eventual date and signs inside the unit (!) and so on.
>
> Our aesthetic and technical research are made with extreme care and look inside the machine this is readily apparent. And we are honestly proud of the result.

## VARIOUS

- **All pure through hole tecnology**, slowly hand mounted by the machine creator. For vintage unit all single old component is manually checked, every rheophore is cleaned with propyl alcohol and double welded
- **Low production rate** (max 20 unit/year), high quality standards for a reliable devastation of your sawthooths
- **Neutrik** female ¼" TS mono **connectors** and TRS N.C. stereo connectors (EG Gate, AM In and Head Out)
- **Heavy phenolic fluted knobs** with white top indicator line. Easy to turn, satisfactory touch sensations, fashionable vintage looking, "touch-my-tits-please" message to the eyes.
- **Alpha carbon potetiometers** (15000 cycles @ full load)
- **Finger-breaking panzerfaust switches**, to pretend to be on a T34 tank (100000 make and break cycles @ full load)
- **Professional anti-vandal Momentary Switch** (200000 cycles electrical, 1000000 cycles mechanical)
- **Power-On Switch on panel** (10000 cycles electrical @ full load)
- **All washers** are manually braked by chemical mid-strenght **threadlocker**
- **Panasonic** double layer industrial **high standard Pcb**, made in Italy
- **20/10 Aluminum chassis** with dark smooth matt RAL9005 self-extinguishing **non-conductive finish** (hardened carboxylated polyester resin, crosslinked with epoxy resins, resistant to mineral oils, lubricants and cleaning products), made in Italy
- **Internal Power Supply** with custom conductive **10/10 metal carter** for EMF rejection, made in Switzerland
- **Dimensions**: W 145 mm, H 176 mm (4U), L 482mm (19"), concordingly to the CEI IEC 297-2 International Standard
- **Weight**: about 6Kg
- **Operating** internal average **temperature**: 25°-30°C
- **Operating temperature range**: 0°C to 70°C
- **Electrical power consumption**: max 500 mA
- **Maximum output level** (EG @ max to VCA @ max): 9-10Vpp
- **Medium output level** (EG to VCF, VCA @ beginning of orange zone and A Input @ max): 1,8-2Vpp
- **Mental healt consumption**: uncertain, but still high...

# LEGAL NOTES

⚡ RISK OF FIRE, ELECTRIC SHOCK and PERSONAL INJURY.

ESL is not responsible for breakage and damage to your equipment due to misuse or bad maintenance. This manual clearly explains the possible issues and how to approach them in order to avoid malfunctions.

ESL tests its products with 230VAC (*Serie Europea*) and 110VAC (*Serie Americana*). Do not use any kind of power supplies that does not conform to these two parameters.

ESL marks the correct VAC power on the rear license plate: **do not** use voltages that do not meet the recommendations. Before to take your VERTICE into a trip to the other side of the ocean please contact us to receive infos about your specific needs. The most of the time the only thing you have to do is to change a replaceable fuse into the power module fuse holder, something like involve one minutes or less. But if you have questions or need the right fuse please contact us, we will suggest the right one or ship it to you rapidly (shipping and part cost at your charge).

Do not use this product near **water**. It's really hard to believe that there are some people in the world who still do not know that not distilled water is an electrical conductor and the contact with a potential difference can make current flow and severely damage people and things, starting fires and similar. In any case, we have told you. If it rains, if there is water flowing on the floor, if there is some water source around like bathtub, kitchen sink or swimming pool please be sure to operate at reasonable safety distance. The thing here is: if you want to commit suicide that's ok, but don't blame our product: electricity can kill also not involving a 2000€ hand made audio unit that, by-the-way, can easily outlive you after this experience. There's plenty of high voltage pylons in our cities and no one even subtle difference can be found dying thunderstruck in one way rather than in another. Plus, pylons give you an instant open-air death, that is just much better than dying in a cold silent empty apartment, furthermore giving you incredibly fast authority response to your last act on this earth and maybe some "advertise" on local newspapers.  :)

Care also should be taken so **liquids are not spilled into** the enclosure through openings. Like any other electronic device the VERTICE circuitry is very sensitive to water, rain or other kind of liquid, especially if they contain diluted sugars or salts. If some sort of liquid is in touch with the circuits TURN OFF THE UNIT IMMEDIATELY, then unplug it from the outlet. If the unwanted liquid is simple water there is the possibility that everything returns to normality just waiting for it to dry. The VERTICE circuitry, because of their ancient, obsolete nature, are very strong and unwilling-to-die.
If instead the unwanted liquid is Rum&coke then you need some experts help (and to drink less...).

Do not use this product with an **insufficient stand** or support. VERTICE weighs about 6kg.

Do not let it **fall** or let it take mechanical **shock** caused, for example, by a lazy disposal during transport.

This product in combination with power amplifier, headphones and other reproduction systems like mixers connected with a PA or listening monitors can produce very high signal levels that could cause **permanent hearing loss**. Do not operate for a long period of time at high or uncomfortable volume level.

This product should be located **away from heat** sources like radiators, ovens and flamethrowers. When you take it in a hot war zone please take care to operate at an reasonable distance from tanks, armored vehicles, mortars and pieces of siege artillery since they can be heavily damaged by Vertice's heavy soundwaves. Also Napalm should be avoided, when possible.

**Do not introduce ANYTHING inside** the unit. Some customized VERTICE have openable rear panel. This is for easy-looking the circuitry and easy-reaching them in case of maintenance needs, not exactly to hide something inside, even if it is a metal-free object, like weed, to casually name one. Yes, weed.  :)

RESPECT OUR WORK (and your VERTICE): **do not attempt to service this device** beyond that described in this instructions. All other servicing should be referred to qualified personnel only. If you are an expert Diy or a professional electronic technician please let us know, trying to explain the problem: probably our conclusions will be the same of yours and then you will have gained two things: you kept your warranty active and you will have the unit running.

ESL is not responsible for illnesses, euphoria, excessive adrenaline/dopamine/serotonin production, artistic and ancestral visions or pathological addiction caused by excessive use of its products.

We are the primary victims of those afflictions, so act like a grown-up and don't complain about those stuff.

If after using VERTICE you feel the need to start over your psychological therapy it's completely, absolutely normal.

**ENVIRONMENTAL AND HAZARD LEGAL DECLARATIONS**

**VERTICE is ROHS compliant** because it do not contain:

- Lead
- Mercury
- Cadmium
- Hexavalent chromium
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ethers (PBDE)

According to the provisions of Directive 2011/65/EU, the maximum weight concentrations present in the homogeneous materials contained in the products listed above are lower than those established in Annex II ("Substances with restrictions of use referred to in Article 4 , paragraph 1, and values of maximum tolerated concentrations by weight in homogeneous materials ")

**VERTICE is CE compliant**, following the sequent EEC Standards:

LV Directive 2014/35/UE with following technical standards: EN 60335-2-40:2003 + A11:2004 + A12:2005 + A1:2006 + EC:2006 + A2:2009 + A13:2012 + A13/EC:2013, EN 60335-1:2002 + A11:2004 + A1:2004 + A12:2006 + A2:2006+ A1/EC:2007 + A13:2008 + EC:2009 + EC:2010 + A14:2010 + A15:2011
and
EMC Directive 2014/30/UE with following technical standards: EN 60335-1:2012, EN 55014-1:2006 + A1:2009 + A2:2011, EN 61000-3-2:2006 + A1:2009 + A2:2009, EN 61000- 3-3:2013, EN 55014-2:1997 + A1:2001 + A2:2008
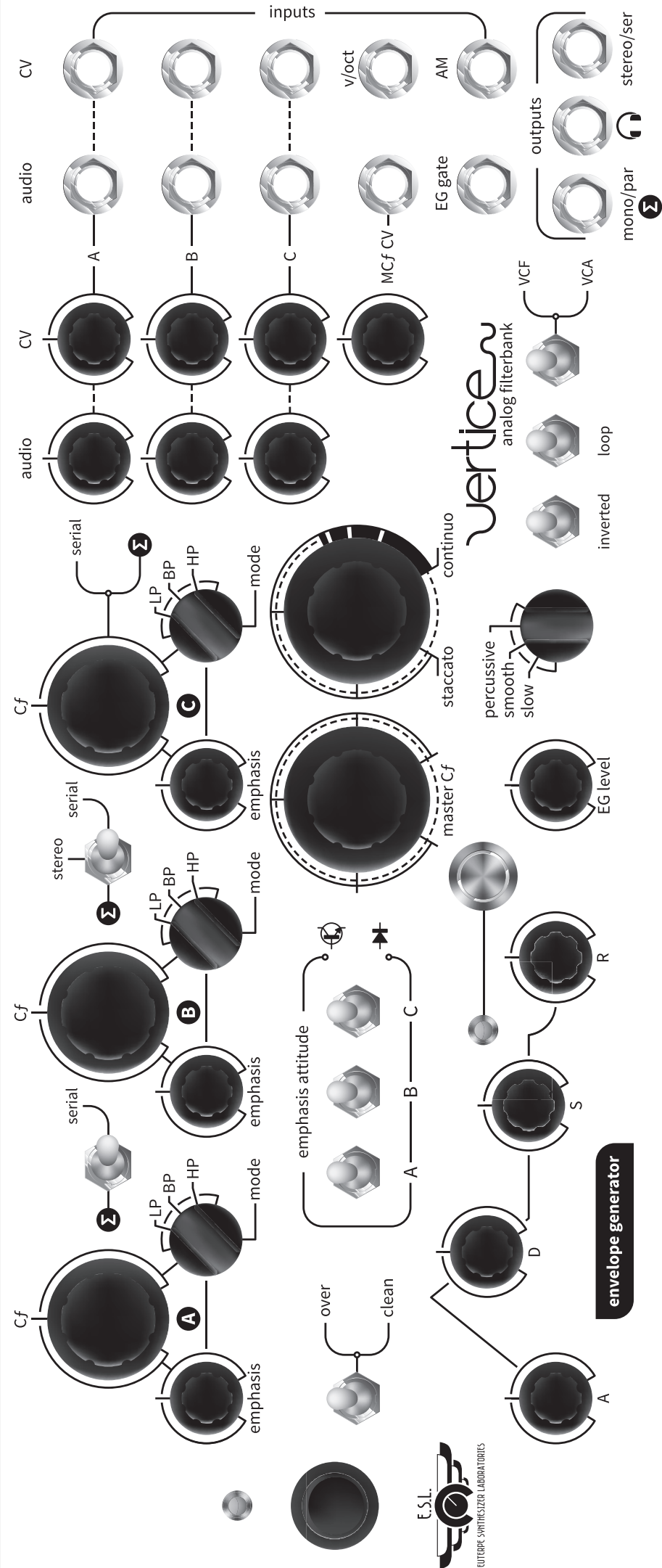
**VERTICE needs WEEE** (waste electrical and electronic equipment) and **RAEE** (Rifiuti di Apparecchiature Elettriche ed Elettroniche) precautions due to WEEE 2012/19/EU Directive and D.M.65/8/03/2010 of Italian law
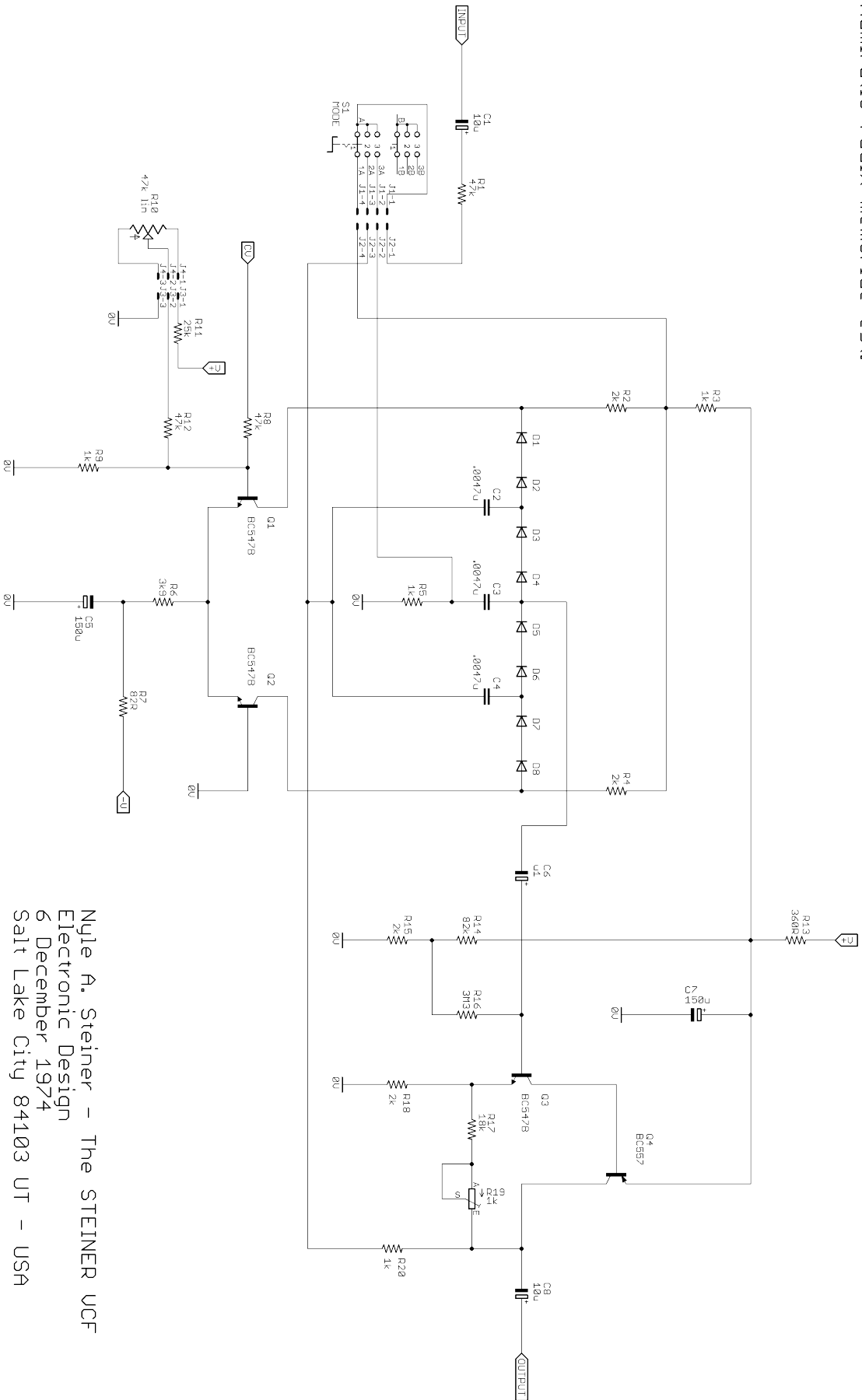
inputs

CV   audio

A   B   C   MCƒ CV

v/oct   AM   EG gate

outputs   stereo/ser   mono/par

CV   audio

serial   Σ
LP   BP   HP   mode

stereo   serial   Σ
LP   BP   HP   mode

serial   Σ
LP   BP   HP   mode

Cf   A   B   C

emphasis

emphasis attitude
A   B   C

over   clean

continuo   staccato

master Cƒ

percussive   smooth   slow

EG level

VCF   VCA   loop   inverted

vertice
analog filterbank

envelope generator

R   S   D   A
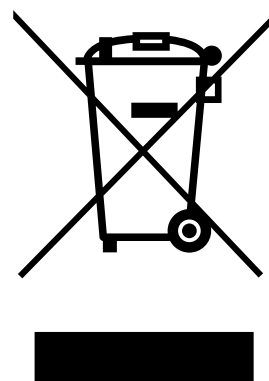
E.S.L.
EUTERPE SYNTHESIZER LABORATORIES

| INPUT SETTINGS | A-FILTER | B-FILTER | C-FILTER | MASTER CUTOFF | EG-GATE | AM-INPUT |
|---|---|---|---|---|---|---|
| AUDIO SOURCE | | | | | | |
| CV SOURCE | | | | | | |

VERTICE Seconda Serie Analog Filterbank User's Manual
2015-2020
E.S.L. Euterpe Synthesizer Laboratories, VAT n. / P.IVA n.: 03742090040
codice fiscale: BRSSFN82M18B791D
via Madonna del Popolo 30, 12040 Sanfrè CN Italia
Text and illustrations by Stefano Bersanetti

Ratio et Cogitatio
Unicam Fidem Sunt

Admiratio radix memoriae est.

INPUT

C1 10u
R1 47k

S1 MODE

3B 2B 1B
3A 2A 1A
J1-1 J2-1
J1-2 J2-2
J1-3 J2-3
J1-4 J2-4

0V

R10 47k lin
J1-1 J1-2 J1-3
J3-1 J3-2 J3-3

R11 25k
R12 47k
R9 1k
0V

+U

R8 47k
0V

Q1 BC547B

R2 2k
R3 1k

D1
D2
D3
D4
D5
D6
D7
D8

C2 .0047u
C3 .0047u
C4 .0047u

R5 1k
0V

R6 3k9
C5 150u
0V

Q2 BC547B

R7 82R
-U
0V

R4 2k

C6 u1

R15 2k
R14 82k
R13 360R
+U
0V

R16 3M3

C7 150u
0V

R18 2k
Q3 BC547B
R17 18k

Q4 BC557

S
R19 1k
E

R20 1k

C8 10u
OUTPUT

Nyle A. Steiner - The STEINER UCF
Electronic Design
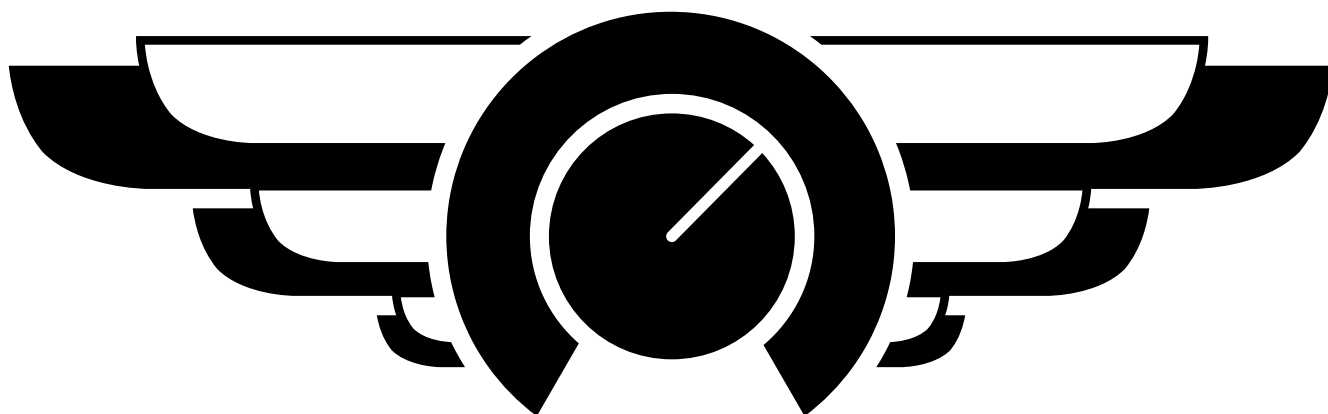6 December 1974
Salt Lake City 84103 UT - USA

Euterpe
Synthesizers
Laboratories

Steiner UCF 1974
30/07/15 16:29
Sheet: 1/1
>Bersanetti S. Vigna M.

# E.S.L.



# EUTERPE SYNTHESIZER LABORATORIES