# GEMINI 2412

# User Guide

## Dual Vintage style State Variable Filters

Thank you for purchasing the AJH Synth Gemini 2412 Dual VCF module, which like all AJH Synth Modules, has been designed and handbuilt in the UK from the very highest quality components. We hope that it will help and inspire you towards creating some great music and soundscapes!

Comprising two completely independent Vintage SEM style filters, with a central mixing bus for both audio and frequency control voltages which allow the two VCF's to be combined in both serial and parallel modes, and VCF1 can be inverted against VCF2. So the two VCF's can be combined to behave as a 24dB SEM filter, vocal formant filter and much more!

Each of the two filters are based on the vintage SEM filter, with FET transistor buffers and feature Low Pass, Band Pass and High Pass outputs and a useful Vary output which can be faded from LP to Notch to HP. All outputs can be used simultaneously.

The two filters can be used independently, or can combined in the following modes:

**Dual (Parallel) Mode -** The input to VCF1 is normalled to VCF2, and the two VCF's are placed in parallel, the output mix of VCF1 (OUT 1) against VCF2 (OUT 2) is controlled by the setting of the Audio Mix control, with the output routed to the D-OUT jack.

**Dual (Parallel) INVERTED Mode** - this is the same as Dual mode, however the output of VCF 2 is inverted against VCF 1.

**Cascade (serial) Mode** - The output of VCF 1 is normalled to the IN 2 jack, so that the two filters are cascaded, signals are first processed by VCF 1 and then by VCF 2. In this case the Audio Mix control crossfades between the ouput of VCF 1 (single VCF) and VCF 2 (dual cascaded VCF's). Again, the Cascade output is routed to the D-OUT jack.

Module width is 28 HP of Eurorack space and it is compatible with standard Eurorack cases. The height of the panel is 128.5mm and depth is 24mm . There are four mounting holes at the corners of the module and we provide 4 of M3 rack fixing screws along with a Eurorack compatible power cable. Current consumption is 50mA from the +12V supply rail and 45mA from the -12V supply rail.

All AJHSynth modules are covered by a two year guarantee against manufacturing defects.

*Note:*
*It is very important that the power supply ribbon cable is connected correctly, see the "adjustment and calibration" section for an illustration of the correct orientation.*

AJH SYNTH

www.ajhsynth.com

# Overview

The Gemini 2412 is a very comprehensive and extremely versatile dual filter module. Although it is a complex design, it becomes very easy to understand when we break it down and examine its component parts and the relationship between them. The diagrams and text here will get you up to speed quickly so that you can explore all of the possibilities and capabilities of your Gemini 2412. It comprises:

**1 - Two fully independent Multi Mode VCF's** (VCF 1 and VCF 2)

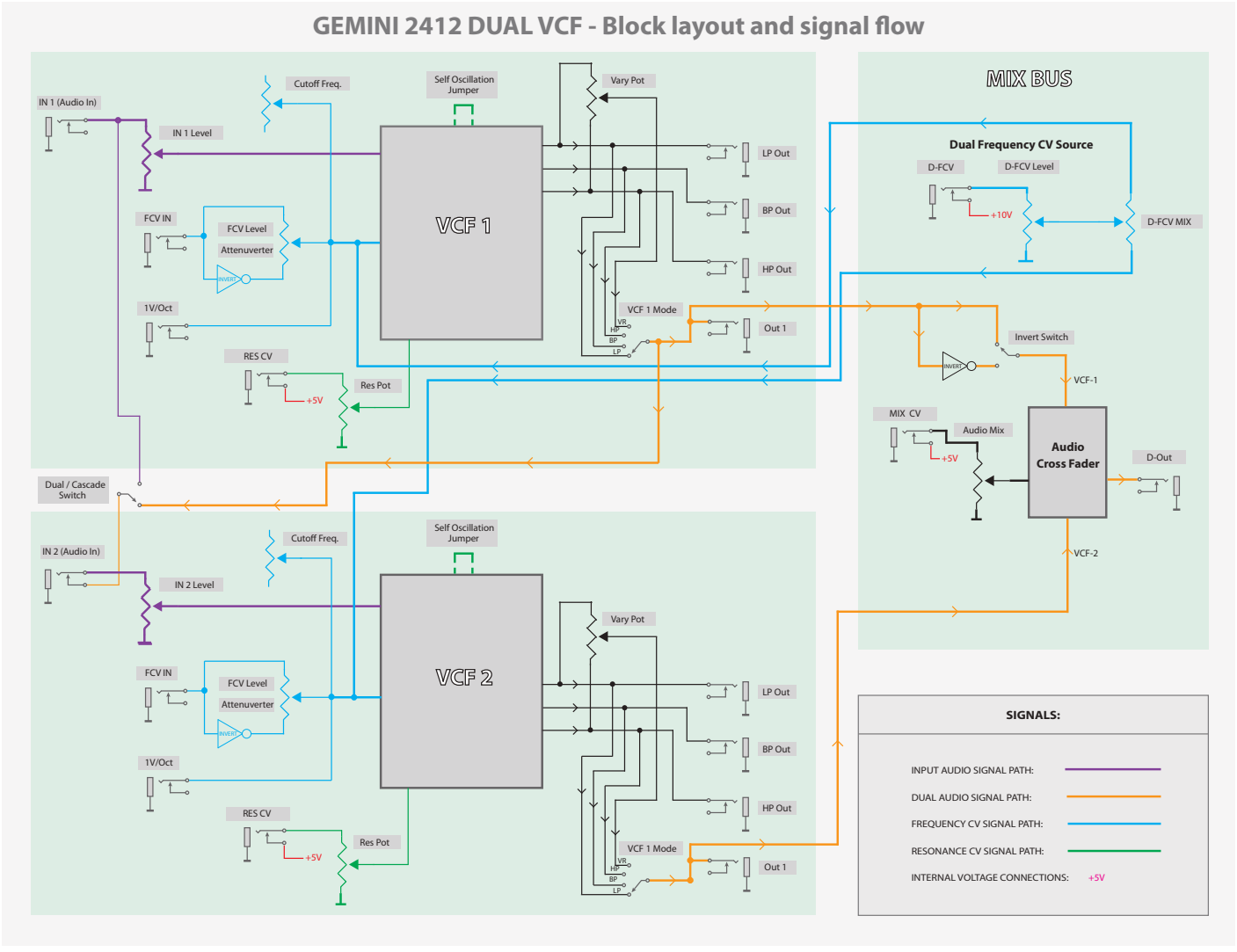
**2 - Audio Cross fader / Panner module** (Mix Bus)

**3 - Dual Frequency CV source with external input and panning mixer** (Mix Bus)

**4 - Audio Inverter** (Mix Bus)

**5 - Parallel / Serial Connection switch** (Dual / Cascade mode)

The block diagram below shows how the above component parts are connected together and the signal flow between them. It can be seen that either Input 1 or the output of VCF 1 can be routed to the input of VCF 2 via the Dual Cascade switch. This connection is made using the internal switch on the IN 2 jack socket, and is connected if no jack socket is connected, but if a patch cable is insered into IN 2 then this connection is broken and the external signal from the patch cable is routed to the input of VCF 2 instead - the technical term for this is normalising.



# Front panel controls

**VCF 1**

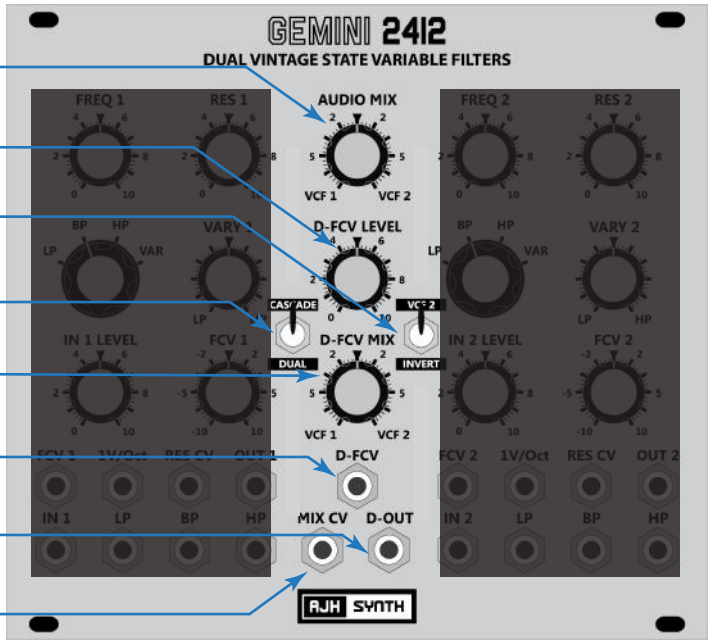
1. VCF 1 Resonance
2. Vary 1 Control
3. Freq CV 1 Level
4. VCF 1 Frequency
5. VCF 1 Mode
6. INPUT 1 Level
7. VCF 1 Output
8. VCF 1 RES CV
9. 1V/Oct Input
10. VCF 1 FCV IN
11. VCF 1 Input
12. VCF 1 LP Out
13. VCF 1 BP Out
14. VCF 1 HP Out

**VCF 2**

4. VCF 2 Frequency
5. VCF 2 Mode
6. INPUT 2 Level
1. VCF 2 Resonance
2. Vary 2 Control
3. Freq CV 2 Level
10. VCF 2 FCV IN
9. 1V/Oct Input
8. VCF 2 RES CV
7. VCF 2 Output
14. VCF 2 HP Out
13. VCF 2 BP Out
12. VCF 2 LP Out
11. VCF 2 Input


**MIXING BUS**

15. Audio Mix
16. D-FCV Level
17. Invert Switch
18. Dual/Cascade
19. D-FCV Mix
20. D-FCV Input
21. Dual Output
22. MIX CV Input



## Description of individual filter controls

*VCF1 and VCF 2 are identical and independent, these labels apply to both.*

(1) VCF Resonance : Manually sets the amount of Resonance (feedback) through the filter core. When a patch cable is inserted into the RES CV jack (8) then this control acts as an attenuator for the incoming RES CV level.

(2) Vary Control : This control fades from LOW PASS response (fully counter clockwise) to NOTCH response (control at 12 o'clock) and through to HIGH PASS response (fully clockwise). The resulting filtering is routed to the VAR position of the VCF MODE switch (5).

In VARY mode the LP setting is 12dB slope, the NOTCH is 6dB slope and the HP 12dB slope

(3) Freq CV Level : This control is an attenuverter, which determines how much of the regular (or inverted) Frequency CV signal patched to the FCV jack (10) is passed to the filter core to control the cutoff frequency.

With this control at (approximately) centre position non of the Frequency CV signal will be passed, however as this control is rotated clockwise then increasing amounts of FCV signal will be passed to the filter core. Rotating the control anticlockwise from centre has a similar effect, however the FCV signal is inverted.

For example, lets say that a +5V voltage is patched to the FCV Input jack (10). With this control central then zero volts will be applied as a cutoff voltage, but when rotated fully clockwise +5V will then be passed to the filter as a cutoff voltage, thus "opening" the filter. If the control is rotated fully anticlockwise then -5V will be applied to the filter as a cutoff voltage, thus "closing" the filter.

(4) VCF Frequency: Manually sets the cutoff of the filter. Any external control voltages introduced from the FCV Control, 1V/Oct and D-FCV Mix control are summed with this control setting, so in this case it acts as a +/- offset control.

(5) VCF MODE Switch : This selects the filter type that is routed to the OUT jack (7) and to the central mixing bus.

(6) INPUT Level : This is an attenuator that determines how much of the signal from the Input jack (11) is passed to the filter input.

It also includes an overdrive function; if a regular Eurorack level audio signal (10V p/p) is fed to the Input (11), then full signal level and unity gain corresponds to a setting of around 8 on this control, and if it is rotated further clockwise then the output level will still rise, but the filter core is driven into distortion and an "overdriven" sound is created.

(7) OUTPUT : Filter output. This is downstream of the VCF mode switch, so the filter type determined by the MODE switch (LP, BP, HP or Vary) is routed to this jack. Please note that this output is available simultaneously with other output jacks (12, 13 & 14). For example, if the MODE switch is set to LP then this output will be low pass, however a low pass output will still also be available from the LP OUT jack (12)

*Note: This is the only way to get a Vary output from the front panel, as Vary does not have a dedicated front panel output jack.*

(8) VCF RES CV : Patch a voltage or signal (modulation from an LFO or audio rate) to this input to externally control the filter Resonance. The amount of this signal passed to the filter core is determined by the setting of the VCF RESONANCE control (1), which acts an an attenuator when a patch cable is inserted into this jack socket.

The accepted signal range for this input is 0 to +5V. Negative signals will be ignored and positive signals higher than +5V will be capped to +5V. Maximum permissible voltage to this input is +/-12V.

## Description of individual filter controls (cont.)

*VCF1 and VCF 2 are identical and independent, these labels apply to both.*

(9) 1V/Oct INPUT :

This is a frequency cutoff modulation input with a fixed control level corresponding to one volt per octave. It can be useful to patch a pitch cv to this input so that the filter automatically "opens" at this rate as the pitch gets higher. This input can be used simultaneously with the other frequency control inputs FCV and D-FCV.

Also, when the filter is in SELF OSCILLATION mode then applying a pitch control voltage to this input allows the filter to be used as a Sine wave VCO with reasonably accurate tracking over a four octave range, however do note that there is no temperature compensation on this, so it is calibrated to only track well at regular room temperature (21 degrees C)

(10) VCF FCV Input :

This is the main frequency control input for the filter, and voltages or signals patched to this input control the cutoff of the filter at a level (and inversion) set by the Freq CV Level control.

The FCV input can be a fixed voltage or a waveform, either at low frequency from an LFO or similar for modulation or at audio rates from a VCO.

The accepted signal range is -5V to +5V. Any voltages higher or lower than this will be capped to +5 or -5V. Maximum permissible voltage to this input is +/-12V.

(11) VCF Input :

This is the audio input to the filter, and it is routed to the Input level control (6).

In no input is patched to VCF 2 Input (IN 2) then it is normalised to Input 1 if the Dual/Cascade switch is set to DUAL, and it is normalised to the OUPUT of VCF1 Mode switch if the Dual/Cascade switch is set to CASCADE. Plugging a patch cable into IN 2 will defeat this normalising and the external signal patched in then takes priority.

*Please note: This filter (like many vintage synth filters) is intended for processing audio signals only as it is AC coupled - so is therefore it is not suitable for processing control voltages through the audio input. It won't cause a problem, the input capacitor simply blocks any DC voltages.*

(12) LP Output :

This is the Low Pass output, the cutoff slope is 12db per Octave.

(13) BP Output :

This is the Band pass output, the slope is 6db per Octave.

(14) HP Output :

This is the High Pass output, the cutoff slope is 12db per Octave.

## Description of Mixing Bus controls

*Controls mixing and configuration of the two individual filters*

(15) Audio Mix :

The Audio Mix control cross-fades between the outputs of VCF 1 and VCF 2. It's exact function depends on the setting od the Dual/Cascade switch (18)

In manual mode, with the control fully anti-clockwise, only the output of VCF 1 will be heard from the D-OUT output.

With the control (approximately) centred at 12 o'clock, an equal mix of the outputs of VCF 1 and VCF 2 will be heard at the D-OUT output.

With the control fully anti-clockwise, only the output of VCF 1 will be heard from the D-OUT output.

External control of audio mixing is possible by applying a control voltage to the MIX CV Input (22) and in this case the audio mix control becomes an attenuator for the incoming CV voltage.

(16) D-FCV Level :

The D-FCV control allows a second cutoff voltage to be sent to both VCF 1 and VCF 2, and the D-FCV MIX control determines how this frequency CV is split between VCF 1 and VCF 2. This is a hugely powerful feature, as the cutoff frequency of both filters can be altered using a single control, and varying amounts of CV directed to each filter to create asymmetric sweeps.

An external control voltage can also be patched to the D-FCV jack, and in this case the D-FCV control becomes an attenuator for the incoming external D-FCV signal.

(17) Invert Switch:

This switch inverts the output of VCF2 with respect to VCF 1, so that when both filters are combined in DUAL mode one filter output is inverted against the other, which causes a different set of frequency and phase cancellations from non inverted. It is only effective when the Dual/Cascade switch is set to the Dual position.

(18) Dual / Cascade:

The Dual / Cascade switch determines how VCF 1 and VCF 2 are combined together in the Mix Bus. This allows them to be can be connected in Dual (Parallel) or Cascade (Series)

DUAL - VCF 1 input is normalised to VCF 2 input, so that the same signal is presented to both filters, and the AUDIO MIX control (15) cross fades between the outputs of VCF 1 and VCF 2, and the resulting mix is sent to the D-OUT jack. It is also possible to connect a different signal or waveform to VCF 2 Input (IN 2) and in this case the audio mix will cross-fade between the individually filtered outputs of VCF 1 and VCF 2.

CASCADE - The output of VCF 1 (OUT-1) is connected to the input (IN 2) of VCF 2, so that the Signal is first processed by VC 1, and then passed into VCF 2 for further treatment. The Audio Mix control still cross-fades between VCF 1 and VCF 2, so in this case it cross fades between one or two VCF's.

For example, lets say both VCF's are set to Low Pass mode, with equal control of the filter cutoff on each. Now each filter has a cutoff slope of 12db/Octave, however because we are treating the sound twice then this cutoff slope is doubled by the second filter, so we can now have a SEM style filter with a four pole 24dB/ Octave slope! And we can freely crossfade between the 12dB and 24dB variants!

## Description of Mixing Bus controls (cont.)

*Controls mixing and configuration of the two individual filters*

(19) D-FCV MIX: This control pans the D-FCV signal - to VCF 1 only (Control fully anti-clockwise) or VCF 2 only (Control fully clockwise) or it can be panned and a mix of the signal is sent to both filters, with the signals being split equally between VCF 1 and VCF 2 when it is in the 12 o'clock, mid way position.

(20) D-FCV Input: The D-FCV voltage can be either an internal or external control voltage, for external control a CV should be patched to the D-FCV jack (20), and when the patch cable is inserted the D-FCV Level control becomes an attenuator for the incoming CV signal.

With the D-FCV control fully clockwise the effective control range for the D-FCV control voltage is -10V to +10v, and the maximum permissable voltage to this input is -12V to +12V.

(21) Dual Output: The D-OUT is the output from the MIX BUS, which is where the two VCF's are mixed together. This is the only output that combines the mix of VCF 1 and VCF 2, so to use the DUAL, CASCADED and DUAL INVERTED modes this jack must be used as the output.

All of the other outputs on VCF 1 and VCF 2 are still active and available, however they are obviously individual to VCF 1 and VCF 2 and only a single filter will be heard when any of these are used.

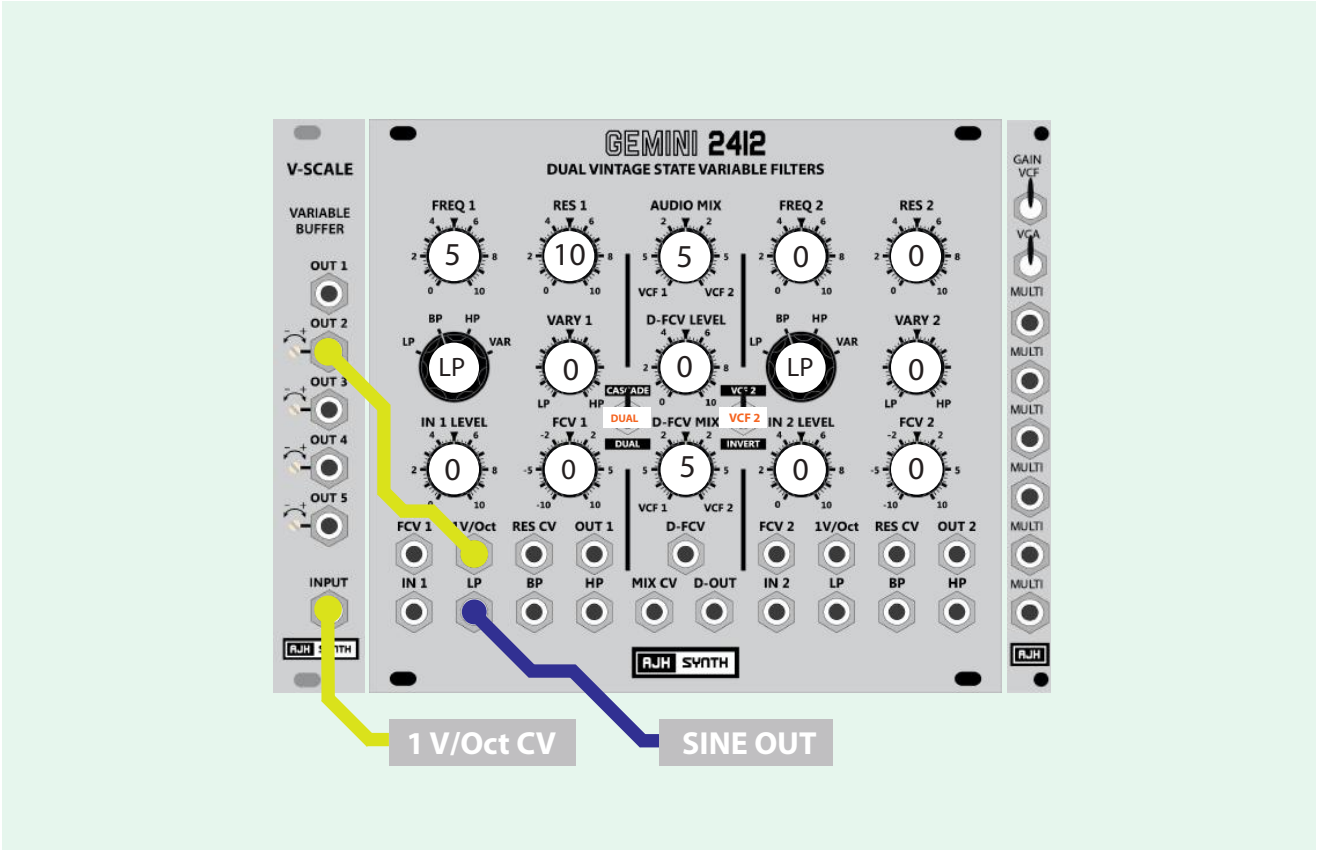
(22) MIX CV Input: The cross-fading between VCF 1 and VCF 2 can be controlled with an external CV by patching a control voltage to this MIX CV jack. When the patch cable is inserted the AUDIO MIX control (15) then becomes an attenuator for the incoming CV signal.

With the AUDIO MIX control fully clockwise the effective control range for the MIX CV control voltage is 0 to +5V. Any negative voltages are seen as 0V and voltages higher than +5V are capped at +5V. The maximum permissable voltage to this input is -12V to +12V.

(Cont.)

# SELF OSCILLATION MODE

**Using the GEMINI 2412 as a Sine Wave Oscillator**




Usually 12dB state variable filters such as those in the Gemini 2412, Oberheim SEM and other synthesisers do not go into self -scillation at high resonance settings, this is because of damping in the filter core itself which prevents this from happening. However, we have included some additional circuitry that can be connected into the filter using a PCB mounted jumper on the back of themodule. The effect of this circuitry is to overcome the internal damping and force the filter core into self oscillation, and it then behaves as a Sine Wave Voltage Controlled Oscillator (VCO) that tracks 1V/Octave over (approximately) a 4 octave range.

See the "Adjustment and calibration" page for information on the location of the self oscillation jumpers.

There are a few points to note about self oscillation mode:

1) Because we have to force the circuitry into self oscillation the resulting signal level is quite high - around 19V p/p rather than the usual 10V p/p that most Eurorack modules produce, this is not a problem as long as it is feed into another module that has a level control - for example the AJHSynth MiniMod VCA - this has input level controls and simply turn these down to the point where the are of similar volume to other VCO's etc and there will be no problem. If you feed it at full output into other Eurorack modules without attenuating the level then you may get some ugly clipping distortion. With this in mind, if using the GEMINI 2412 in CASCADE Mode with VCF 1 as a Sine wave oscillator and then feeding the output into VCF 2 then do keep the IN 2 LEVEL control turned down to 5 or lower to prevent overloading the input of VCF 2.

(Cont.)

## SELF OSCILLATION MODE (cont.)

2) The frequency control circuitry is NOT temperature corrected, so it will only track 1V / Octave at a given temperature (it is factory calibrated to 21 degrees celcius ambient). If you use it in much colder, or much hotter conditions then the SCALE trimmer may need to be adjusted to correct the tracking to the ambient temperature level.

3) The sine wave is not a perfectly pure waveform, it has some slight clipping to the top and the bottom of the waveform - this gives it a very slightly brighter sound than a pure sine wave.

4) No input is needed for self oscillation, simply connect the pcb jumper, turn the Resonace control around to 10 and set the Frequency control so that the oscillation can be heard at the desired frequency. Use the LP output

With the above points in mind it is a very useful addition, and each VCF can be set to Sine Wave VCO mode individually, so VCF 1 could be used as an oscillator and the output passed into a wavefolder or similar circuit to add harmonics, and then this signal can be passed through VCF 2 and filtered.

The V-Scale buffer can be a useful addition if the self oscillation mode is used often and accurate 1V/Octave scaling is required - it allows scaling to be adjusted from the front panel without having to remove the GEMINI 2412 from the Eurorack case and adjust the small trimmers on the back of the module.

The addition of a Gain Switch Multi (a 2HP wide module) allows the self oscillation jumpers to be switched from the front panel. The two switches on Gain Switch Multi are connected to the jumpers on the rear of the GEMINI 2412, so that self oscillation mode can be selected from the front panel without having to remove the Gemini from the Eurorack Case. Switch UP activates self oscillation mode, switch DOWN is regular SEM style filter. Self oscillation can be individually selected for either or both VCF's.

## AUDIO RATE MODULATION

The GEMINI 2412 has a wealth of modulation inputs, including FCV 1, FCV 2, Resonance CV, D-FCV, Audio Mix, 1V/Oct etc, and all of these handle fixed control volages and modulation waveforms from LFO's for low frequency modulation, however all of these inputs can also be used with audio rate modulation too, which can sometimes give very interesting and unexpected sounds, so just because it's a modulation input don't be afraid of patching in a VCO or other audio rate signal for some extra sounds!

(Cont.)

# GEMINI 2412 - PATCHING EXAMPLES

## 1 - Configuration as two independent VCF's

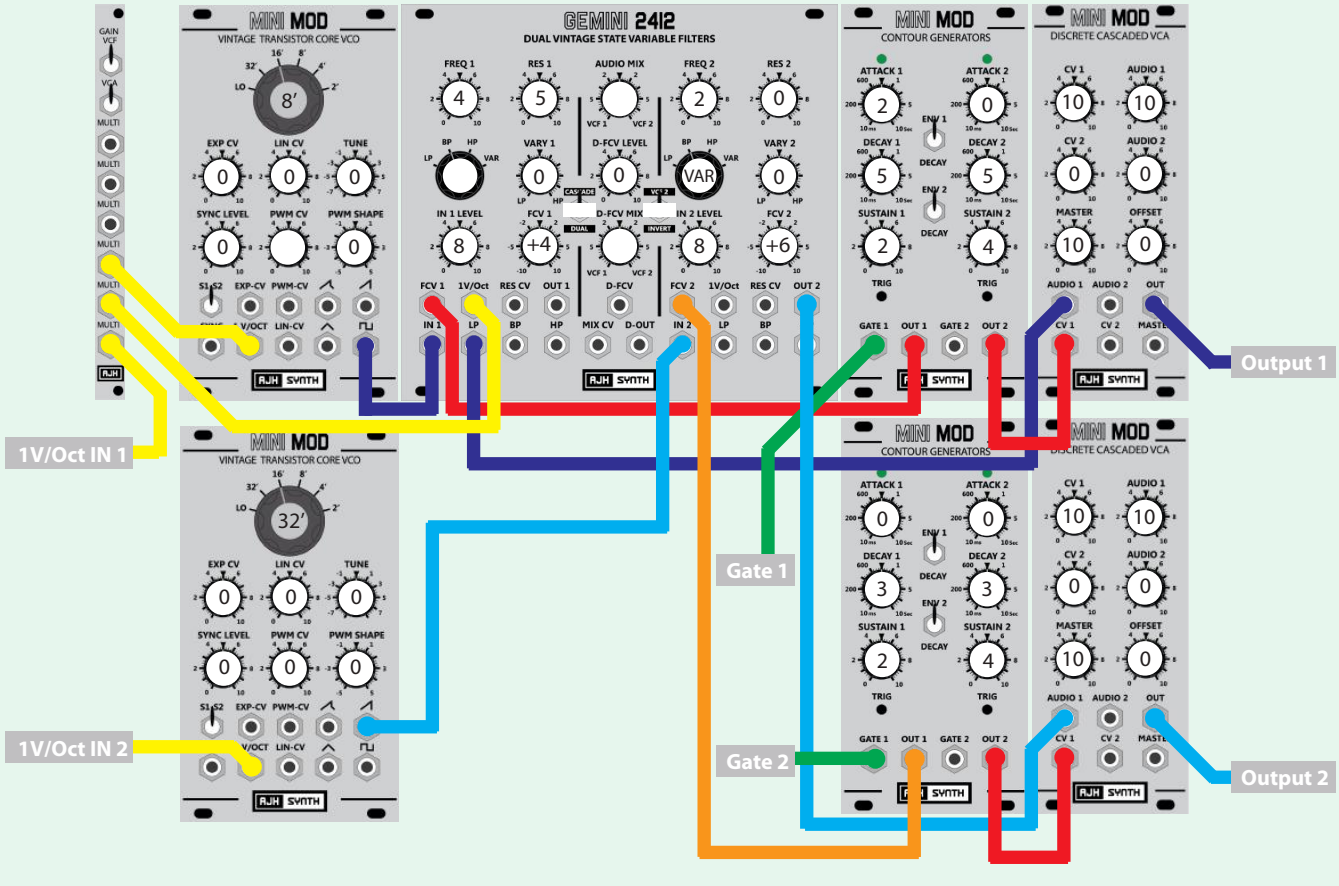
Here the Gemini 2412 is configured as two completely independent VCF's in a two voice setup. VCF 1 of the Gemini is used as part of a Lead Voice and VCF 2 is used in a Bass Voice. We do not need to use the centre Mix bus here, however the D-FCV and D-FCV MIX controls are still active, so can be used for additional frequency control if desired - if not required then keep the D-FCV control set to zero.

VCF 1 is the Lead voice, and here we are using the LP output which is patched to a VCA. One envelope controls Gemini VCF 1, the second envelope controls the VCA. Here we are splitting the Lead synth Pitch CV with a passive Multi and feeding 1V/Oct to the filter cutoff too, so that as the pitch gets higher the filter opens more. Frequency CV control is also added from the Envelope Generator which is patched into the FCV 1 Input - turning the FCV 1 control clockwise from centre position gradually adds more of the Envelope CV voltage to the filter, turning it anti-clockwise from centre adds the inverse of the Envelope CV, so it will close down rather than open up the filter cutoff point.

The bass voice is fed to Gemini VCF 2 from the lower VCO. This time on the Gemini we are using the OUT 2 jack, and the filter type used by OUT 2 is set by the four way rotary switch. We have selected VAR (Variable) as the Mode, so in this case the VAR 2 control also comes into play - we have selected 0 (Fully anti-clockwise), which gives us a Low Pass configuration, but turning the VARY control clockwise will take us to a NOTCH filter at the 12 o'clock position and on to a High Pass filter with the VARY control fully clockwise.

***Note: The numbers used to illustrate control knob positions do not relate to the markings on the module itself, but are simply a scale from zero to 10 with 5 being the control centre position. For attenuverters the control positions are -10 to +10, with zero being centre position for the control knob.***

### Using the Gemini 2412 as two independent VCF's



# GEMINI 2412 - PATCHING EXAMPLES

### 2 - Dual Parallel VCF's Inverting Mode, for Band Pass Vocal sounds

In this patch we are using the Gemini in Dual Inverting Mode, so the Dual and Invert switches are both in the down position.

We are feeding the audio into IN 1, however do note that there is no patch cable in the IN 2 input - it is not needed as in DUAL mode IN 1 is normalised (connected) to IN 2 internally, so the single input is automatically patched to both VCF 1 and VCF 2.

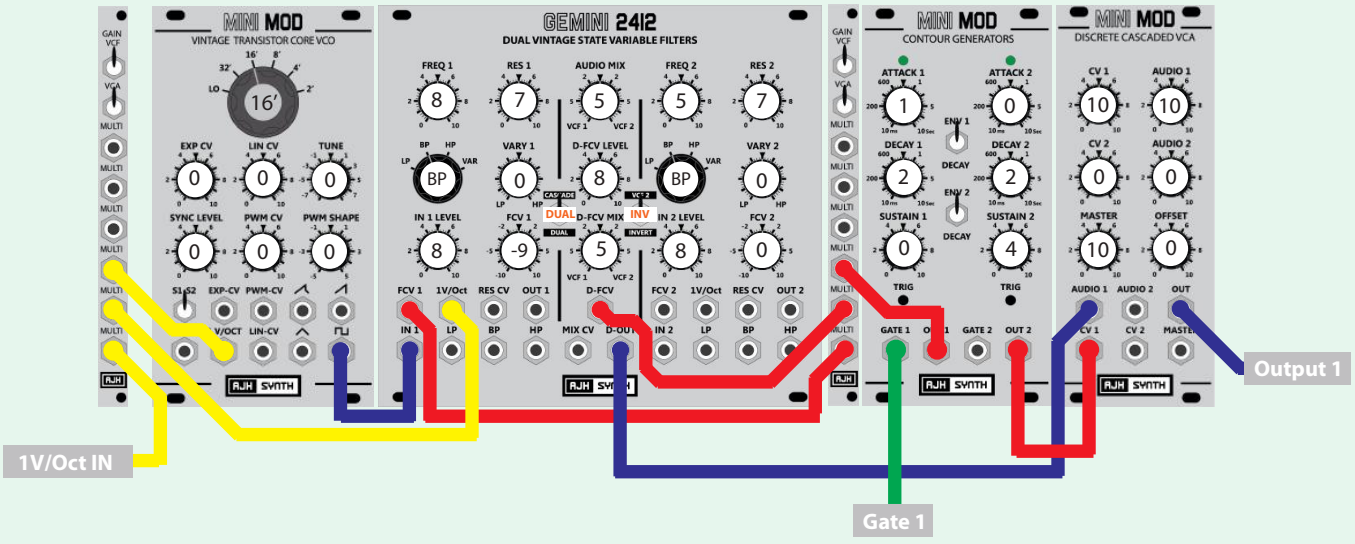
Note that the Envelope OUT 1 is connected to a Multi, so that we can patch it to both FCV 1 and D-FCV inputs simultaneously - also, with the FCV control we have it set to -9, so it is applying a negative control voltage to the filter cutoff (because the FCV control is an attenuverter). But we are also routing this same envelope out CV to the D-FCV Input, and with the D-FCV Control set to 8 most of this voltage is passing through, because the D-FCV Control acts as an attenuator on external CV voltages and it is almost fully open.

We are taking the output from the D-OUT jack, so that we can cross fade between VCF 1 and VCF 2 using the Audio Mix control. As both VCF 1 and VCF 2 are set to Band Pass and have quite a large amount of resonance added we get some classic vowel sounds, and sweeping between the filters gives interesting tonal variation. Try different settings with the Invert Switch, D-FCV Mix and Freq 1, Freq 2 and FCV 1 controls to vary the sounds, and also try HP and Notch settings too for further variations.

Also, try controlling the Audio Mix by patching a second Envelope (or other control voltage source) to the MIX CV jack, and set the AUDIO MIX control fully clockwise to get the full range of control, just back it off a little if the CV voltage is peaking too high so that you get a full sweep from VCF 1 to VCF 2

***Note:** The numbers used to illustrate control knob positions do not relate to the markings on the module itself, but are simply a scale from zero to 10 with 5 being the control centre position. For attenuverters the control positions are -10 to +10, with zero being centre position for the control knob.*

**Dual Parallel VCF's Inverting Mode, for Band Pass Vocal sounds**



# GEMINI 2412 - PATCHING EXAMPLES

### 3 - Cascade Mode - creating a 12dB BP filter by combining LP and HP filters

In this patch we are using the Gemini in Cascade Mode, so the Dual/Cascade and Invert switches are both in the up position.

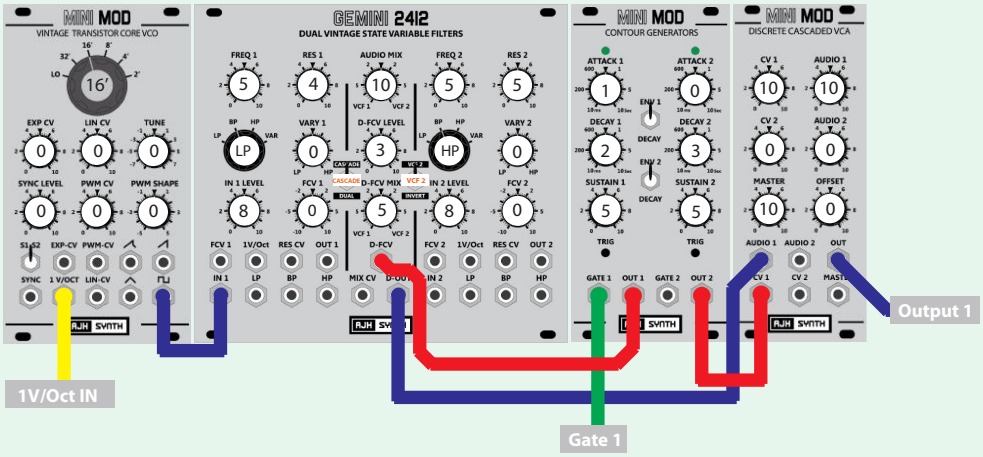
By feeding a signal first through a LP (low pass) filter, and then feeding it through a second filter set to HP (High pass) we create a BP (band pass) filter. The first question would be.... why bother? We already have a BP filter on each of the individual filters.....BUT the individual fiters are each 6dB slope when set to BP filter, wheras if we combine the two filters together we can get a BP filter with a 12dB slope, which has a higher Q and covers a narrower band. And of course we also have the option of fading from LP response (VCF 1 only) and BP responce (VCF1 and VCF 2 in series) by using the AUDIO MIX control, and we can automate this cross fading by patching an external CV to the MIX CV jack.

We are feeding the audio into IN 1, however do note that there is no patch cable in the IN 2 input - it is not needed as in CASCADE mode OUT 1 is normalised (connected) to IN 2 internally, so the single input is automatically patched to both VCF 1 and VCF 2.

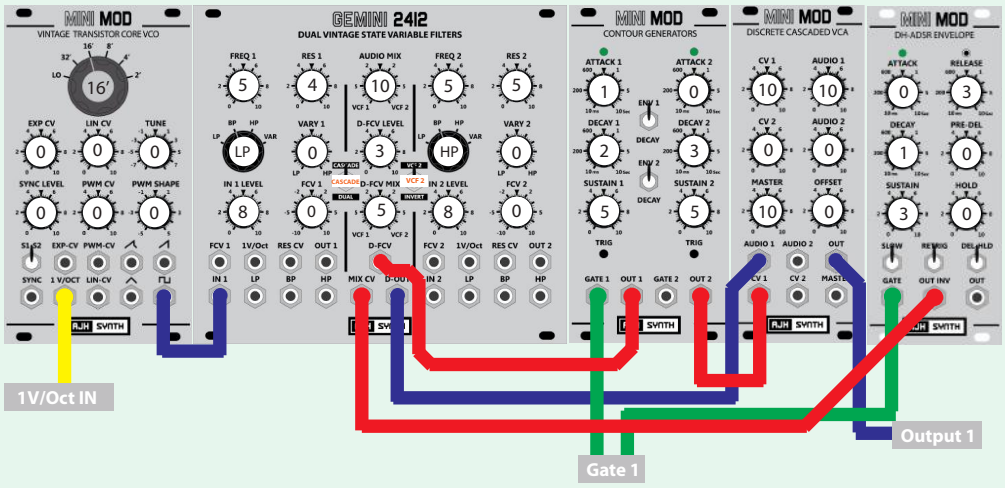
The D-FCV IN input is fed from the contour generator, and here we have the D-FCV Mix control at mid point, so that the D-FVC control signal is being sent equally to VCF 1 and VCF 2.
We have also included a variant on this patch (lower picture) which shows the inverse output from an envelope generator being used as the control voltage to automate the control of the Audio mix from Low Pass to Band pass response, obviously other modulation sources can also be used for this, and the effective range of the control is 0V to +5V to cross fade fully when the Audio Mix control is set to fully clockwise. .

***Note: The numbers used to illustrate control knob positions do not relate to the markings on the module itself, but are simply a scale from zero to 10 with 5 being the control centre position. For attenuverters the control positions are -10 to +10, with zero being centre position for the control knob.***

**Cascade Mode - creating a 12dB BP filter by combining LP and HP filters**




**Cascade Mode - creating a 12dB BP filter by combining LP and HP filters**
**With added CV control of AUDIO MIX**



# GEMINI 2412 - PATCHING EXAMPLES

### 4 - Cascade Mode - creating a 24dB LP filter by combining 2 x LP filters in series

In this patch we are using the Gemini in Cascade Mode, so the Dual and Invert switches are both in the up position.

By connecting two LP (Low pass) filters in series we can double the cutoff slope of the filter - many famous vintage synths such as Moog and Arp used 24dB VCF's, so we can use the Gemini 2412 to mimic this response too.

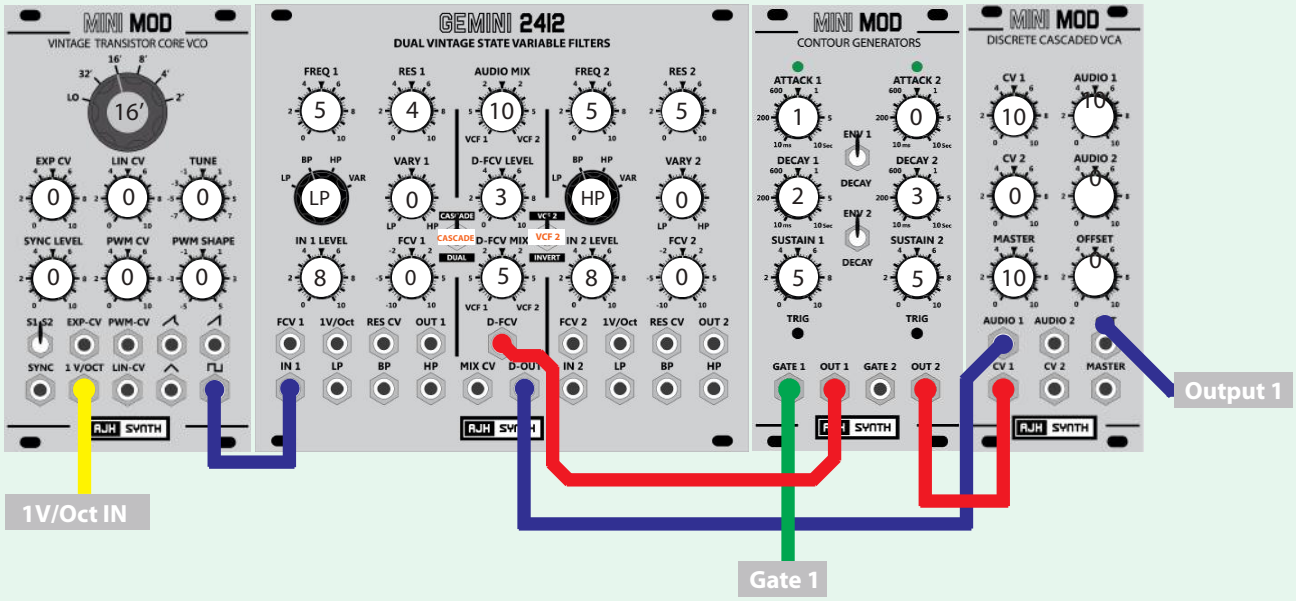
We are feeding the audio into IN 1, however do note that there is no patch cable in the IN 2 input - it is not needed as in CASCADE mode OUT 1 is normalised (connected) to IN 2 internally, so the single input is automatically patched to both VCF 1 and VCF 2.

The D-FCV IN input is fed from the contour generator, this saves having to patch individually to VCF 1 and VCF 2 FCV Inputs, and here we have the D-FCV MIX control at mid point, so that the D-FVC control signal is being sent equally to VCF 1 and VCF 2, thus it behaves as a single filter.

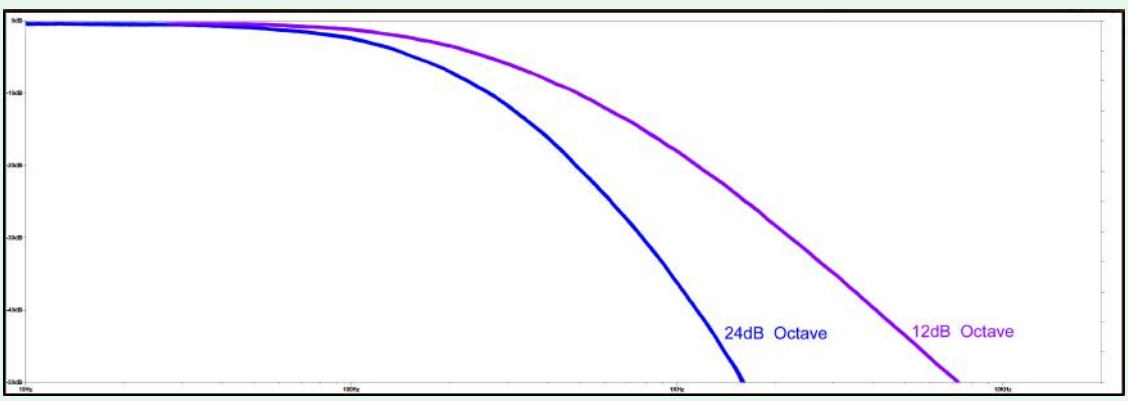
Rotating the AUDIO MIX control clockwise from zero to 10 fades between single 12dB LP configuration (VCF 1 only) and 24dB configuration (VCF 1 and VCF 2 cascaded in series). You will not that the 24dB setting sounds "duller" and less bright than the 12dB LP filter - this is exactly as expected, because we are removing higher frequencies at a rate of 24dB per octave instead of 12dB per octave. The actual filter LP slopes (with resonance set to zero) for the Gemini 2412 are shown in the graph below.

***Note: The numbers used to illustrate control knob positions do not relate to the markings on the module itself, but are simply a scale from zero to 10 with 5 being the control centre position. For attenuverters the control positions are -10 to +10, with zero being centre position for the control knob.***

**Creating a 24dB LP filter by combining 2 x LP filters in series**




**A comparison of GEMINI 2412 12dB and 24dB filter slopes**



# GEMINI 2412 - PATCHING EXAMPLES

### 5 - DUAL Mode - mixing and filtering two audio input sources

For this patch we are using the Gemini in DUAL Mode, so the Dual switch is down and the Invert switch is up (off).

In this example we are looking at mixing and filtering two different audio sources to a single output. The audio inputs can be anything - VCO's, full synth voices, noise or external audio - however they both need to be at Eurorack Modular levels - i.e. 10V p/p.

The two audio inputs are patched to inputs IN 1 and In 2 respectively, and here we are using the central Mixing bus to cross fade and combine the two signals into a single audio output, which is fed to the D-OUT jack.

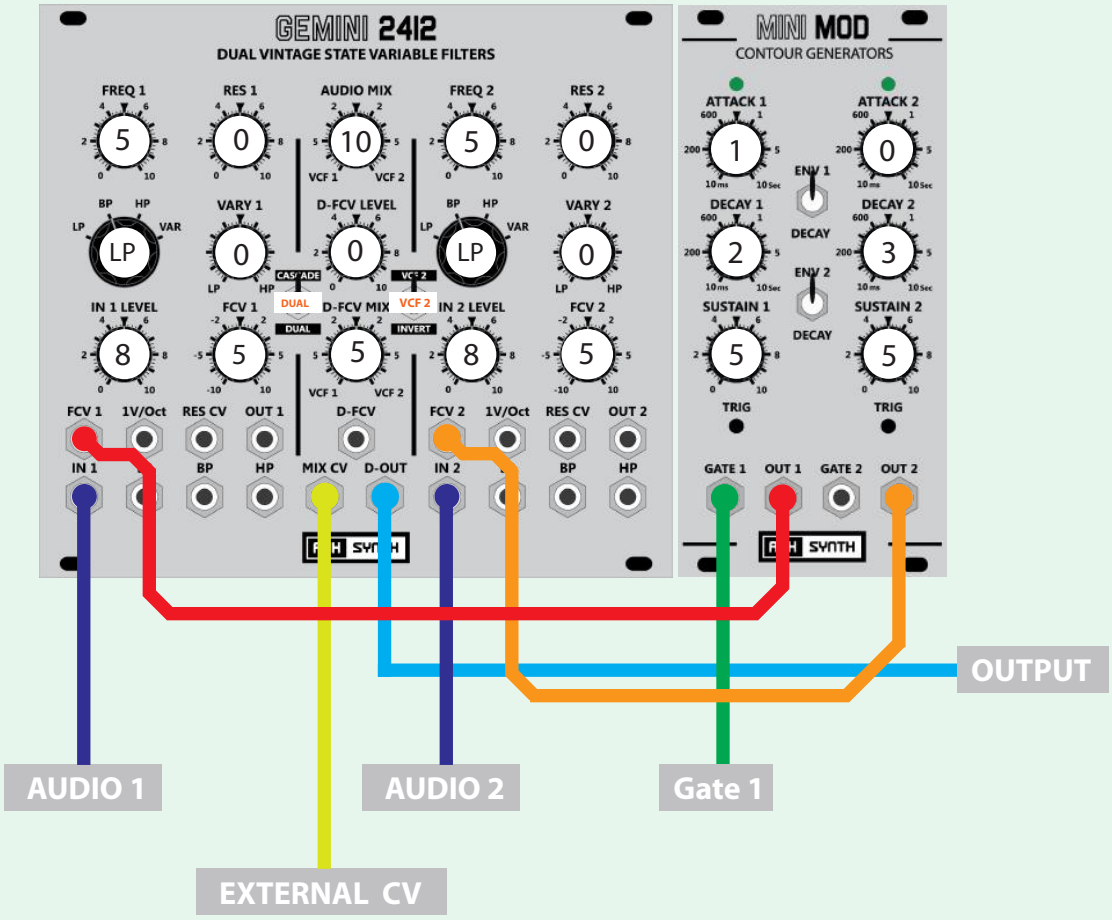
We can cross fade from VCF 1 to VCF 2 either manually with the AUDIO MIX control (when no cable is patched to the MIX CV input), or we can use a CV voltage of 0 to +5V, patched to the MIX CV jack, to pan between the two filters. The AUDIO MIX control acts as an attenuator for this control voltage, so simply set it to a position that gives the desired panning range.

We have also shown a dual envelope generator to control the cutoff of each filter individually, obviously this is optional and and is shown as one of many modulation possibilities.

Please note that even with the filter cutoff's set full open and the resonance set to zero there is still some colouration and distortion to the resulting sound due to the filter circuitry, and in many cases this is desirable, don't expect this to be a super low distortion Pro-Audio mixing solution... It is shown as a combined mixing and filtering modular patch which will add some character too!

***Note: The numbers used to illustrate control knob positions do not relate to the markings on the module itself, but are simply a scale from zero to 10 with 5 being the control centre position. For attenuverters the control positions are -10 to +10, with zero being centre position for the control knob.***

**Mixing and filtering two audio input sources**



# GEMINI 2412 - Specification

**Description:** Dual 12dB / Octave state variable filters, with integrated panning mixer, Dual Frequency CV source with external input and CV panner, Audio Inverter and switchable combination modes.

**Dimensions:** 28HP x 3U Eurorack, 141mm x 128.5mm

**Power usage:** +12V, -12V and a 10 pin to 16 pin Eurorack power cable is supplied. Reverse polarity protection is built in.

Power consumption: Positive rail: 50 mA, Negative rail: 45mA

**Inputs:** IN 1 & IN 2 - Expected signal level 10V p/p, centred around 0V. Audio signals only, DC signals are ignored.

**Outputs:** All VCF outputs are nominally 10V p/p, noise <35mV

**CV Inputs:** FCV 1 & FCV 2: - The accepted signal range is -5V to +5V. Any voltages higher or lower than this will be capped to +5 or -5V. Maximum permissible voltage to this input is +/-12V.

D-FCV: The accepted signal range is -10V to +10v, and the maximum permissable voltage to this input is -12V to +12V.

RES CV & MIX CV: The accepted signal range is 0V to +5V. Any voltages higher or lower than this will be capped to 0V or +5V, so negative voltages are ignored. Maximum permissible v,oltage to this input is +/-12V.

### Information on suitable Eurorack power supplies:

There are presently three different types of Eurorack power supplies available - Linear, Switched Mode and Hybrid (Switched Mode with Linear post regulation).

Linear power supplies, which were used exclusively on vintage analogue synthesisers, are very low noise and very suitable for sensitive analogue modules such as the Gemini 2412 filter. Likewise, hybrid power supplies such as the Doepfer PSU3 are also very low noise and equally suitable. Switched Mode supplies are generally usable; however, under certain conditions some switched mode power supplies can be problematic - this is because of the way in which they work - they switch the power rails at a very high frequency (typically between 100kHz and 1MHz) and the resultant power line noise noise can be up to 150mV per rail, however it is argued that this is well above the audio spectrum and is therefore inaudible - but we have found that in some cases (due to load level, asymmetric loading etc) that heterodyning can bring this down into the audio range, so we may experience up to 150mV of digital hash on the power rails at audio frequency. The powerline noise rejection of the module itself cannot remove such high levels of noise and it can therefore find its way to the outputs of the module itself where it can be heard as low level noise on the output. Thankfully this is a fairly rare occurance, but if excessive noise is noticed on the GEMINI 2412 outputs then the first thing to do is try it with a different power supply - ideally a Linear or Hybrid suppy.

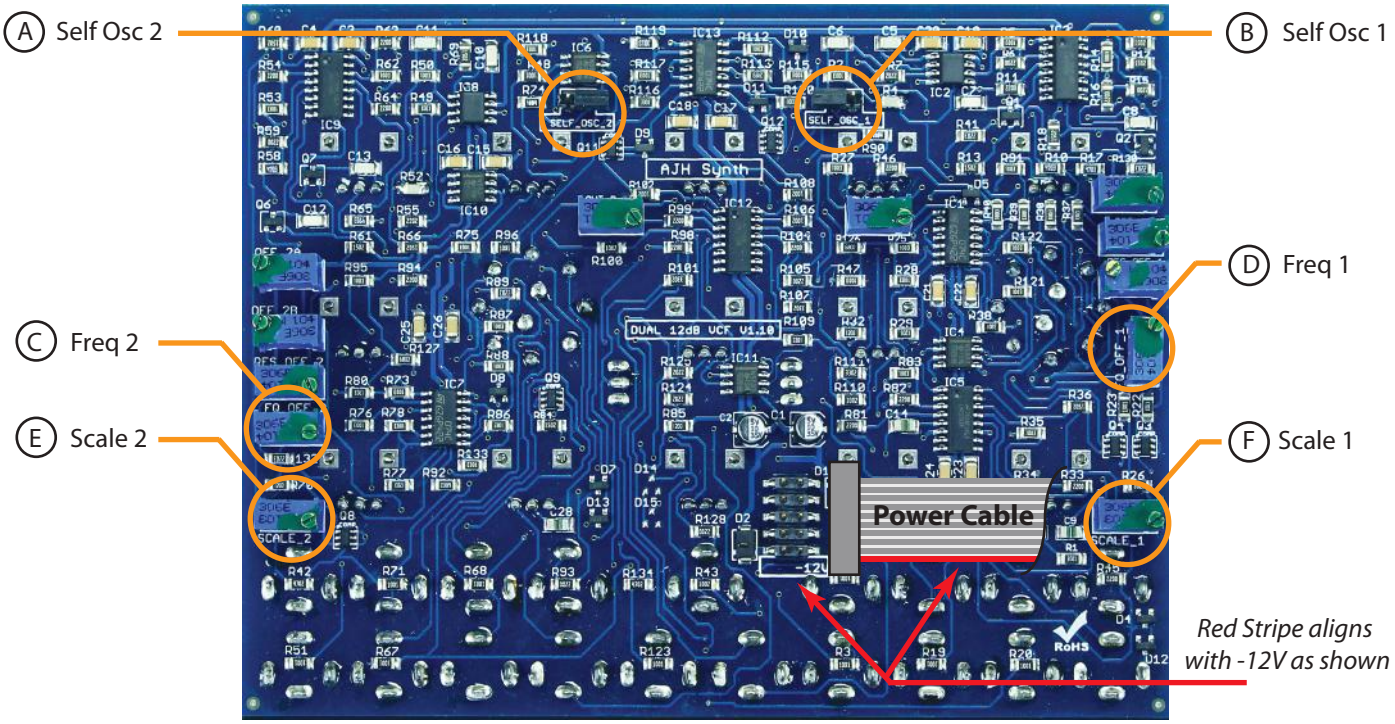
Also, there are a few Eurorack modules which are badly behaved and can introduce noise back onto onto the Eurorack power rails too - the way to find these is to disconnect all modules from the case, then re-connect modules one at a time while monitoring the output of the GEMINI 2412 until the culprit is found.

This information relates to analogue Eurorack modules in general - most modern Eurorack modules are digital in nature and much more tolerant towards power line noise than their sensitive analogue counterparts!

# Adjustment and Calibration

***Important note:***

*The Gemini 2412 module is calibrated after manufacture and under normal circumstances should not require any user adjustment. Trimmers not documented are for manufacturer's use only and have tamper paint over the adjuster. We will not accept any modules returned for repair under warranty because the module has been incorrectly adjusted by users, to correct this and bring the unit back to full working order full calibration will be required, this is a fairly lengthy process and in this case will be a chargeable service.*




**A Self Osc 2:** Shorting this jumper across both exposed pins connects extra circuitry that forces the VCF 2 filter core to be self - oscillating at high resonance settings. When the jumper is only connected to one pin, or removed completely, the filter is in standard vintage SEM mode and will not go into self oscillation. It is acceptable to have one VCF self oscillating and the other in vintage SEM mode, or both self oscillating too.

**B Self Osc 1:** Shorting this jumper across both exposed pins connects extra circuitry that forces the VCF 1 filter core to be self - oscillating at high resonance settings. When the jumper is only connected to one pin, or removed completely, the filter is in standard vintage SEM mode and will not go into self oscillation.

**C Freq 2:** This trimmer adjusts the freqency centre point for the front panel VCF 2 Frequency control.

*Note: For use by experienced technicians only - Only try small adjustments then test tracking again!*

**D Freq 1:** This trimmer adjusts the freqency centre point for the front panel VCF 1 Frequency control.

*Note: For use by experienced technicians only - Only try small adjustments then test tracking again!*

**E Scale 2:** This trimmer adjusts the 1V/Octave tracking of VCF 2. Turning it anti-clockwise reduces (shortens) the scaling and turning clockwise increases scaling.

*Note: For use by experienced technicians only - Only try small adjustments then test tracking again!*

**F Scale 1:** This trimmer adjusts the 1V/Octave tracking of VCF 1. Turning it anti-clockwise reduces (shortens) the scaling and turning clockwise increases scaling.

*Note: For use by experienced technicians only - Only try small adjustments then test tracking again!*

If you need any help using this module or have any technical questions please feel free to contact us at support@ajhsynth.com