

Quadra & Expander

Quad Function / Envelope Generator



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Overview

The Intellijel Quadra and Expander modules comprise four parallel function generators (more commonly referred to as “Envelope Generators,”) plus numerous CV controls. The Quadra function generator has three modes, AD (Attack, Decay), ASR (Attack, Sustain, Release) and Cycle (a perpetually repeating AD envelope, which acts like a unipolar LFO). Each function can be configured to have a linear or exponential curve, and each features a wide time-base control from 0.5ms to over 30 seconds. The Expander enhances Quadra’s core functionality by allowing attenuated voltage control over Attack and Decay for each function generator; plus a Quadrature mode and an analog OR mixer for each function generator pair.

This manual discusses both the Quadra and its optional Expander module.

Quadra Features

- Four function generators with Attack and Decay times ranging from from 0.5 milliseconds to over 30 seconds.
- Three modes: AD (attack, decay), ASR (attack, sustain, release), Cycle (AD envelope loops)
- Exponential and Linear envelope curves

Additional Expander Features

- Four End of Cycle pulse outputs corresponding to the four function generators.
- Voltage control of attack and decay (with attenuators) of all four envelopes
- Two analog OR (Also known as Peak Circuit) logic outputs that are normalled to the two pairs of envelopes with attenuators.
- Special Quadrature modes.

Installation

Intellijel Eurorack modules are designed to be used with a Eurorack-compatible case and power supply.

Before Your Start

Before installing a new module in your case you must ensure your case's power supply has sufficient available capacity to power the module:

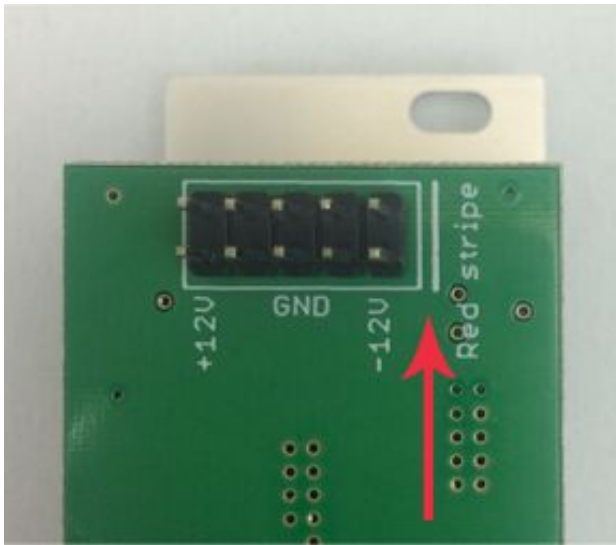
- Sum up the specified +12V current draw for all modules, including the new one. Do the same for the -12 V and +5V current draw. The current draw will be specified in the manufacturer's technical specifications for each module.
- Compare each of the sums to specifications for your case's power supply.
- Only proceed with installation if none of the values exceeds the power supply's specifications. Otherwise you must remove modules to free up capacity or upgrade your power supply.

You will also need to ensure you have enough free space (hp) as well as free power headers in your case to fit the new module.

You can use a tool like [ModularGrid](#) to assist in your planning. Failure to adequately power your modules may result in damage to your modules or power supply. If you are unsure, please [contact us](#) before proceeding.

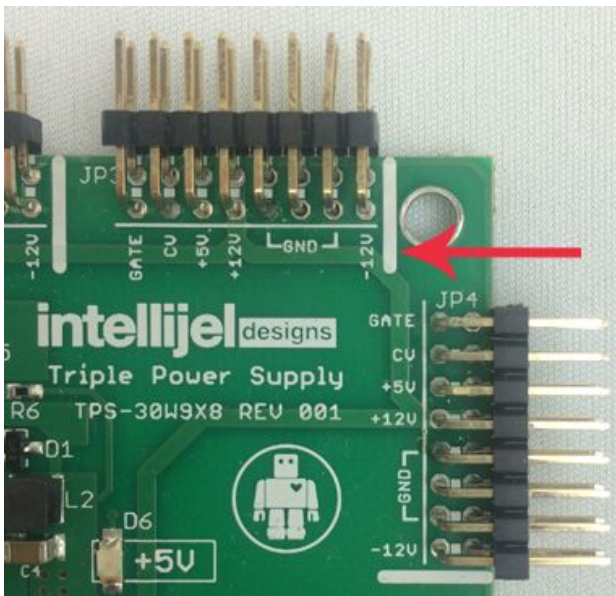
Installing Your Module

When installing or removing a module from your case always turn off the power to the case and disconnect the power cable. Failure to do so may result in serious injury or equipment damage.



Ensure the 10-pin connector on the power cable is connected correctly to the module before proceeding. The red stripe on the cable must line up with the -12V pins on the module's power connector. The pins are indicated with the label -12V, a white stripe next to the connector, the words "red stripe", or some combination of those indicators.

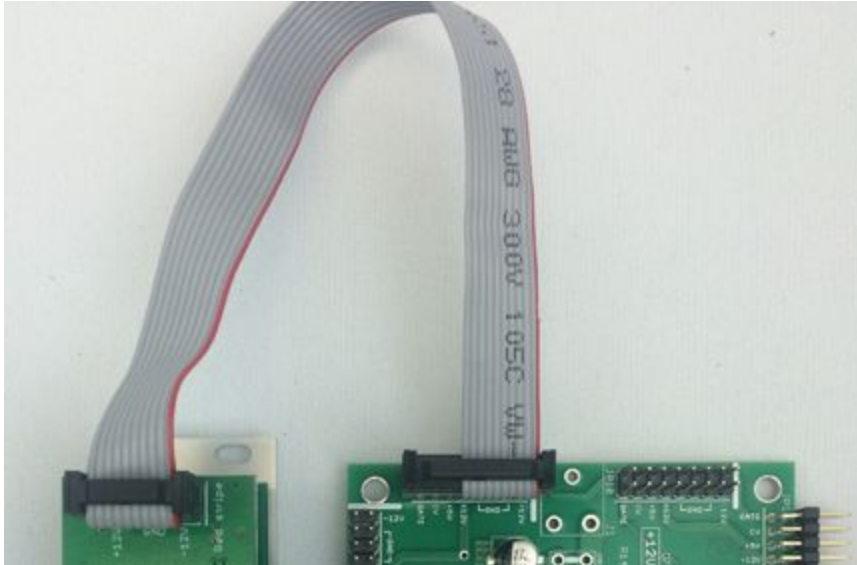
Most modules will come with the cable already connected but it is good to double check the orientation. Be aware that some modules may have headers that serve other purposes so ensure the cable is connected to the right one.



The other end of the cable, with a 16-pin connector, connects to the power bus board of your Eurorack case. Ensure the red stripe on the cable lines up with the -12V pins on the bus board. On Intellijel power supplies the pins are labeled with the label "-12V" and a thick white stripe.

If you are using another manufacturer's power supply, check their documentation for instructions.

Once connected, the cabling between the module and power supply should resemble the picture below:



Before reconnecting power and turning on your modular system, double check that the ribbon cable is fully seated on both ends and that all the pins are correctly aligned. If the pins are misaligned in any direction or the ribbon is backwards you can cause damage to your module, power supply, or other modules.

After you have confirmed all the connections, you can

reconnect the power cable and turn on your modular system. You should immediately check that all your modules have powered on and are functioning correctly. If you notice any anomalies, turn your system off right away and check your cabling again for mistakes.

Quadra Front Panel

Controls

1. **ATTACK** - This knob (x4) controls the time of the attack portion of the function (rising from zero to the maximum level). Slower times will create a fade-in effect while faster times are used for snappy percussive sounds.
2. **DECAY** - This knob (x4) controls the fall-to-zero time. In ASR mode this will act as the release time. In Cycle mode the total time of ATTACK plus DECAY sets the frequency of the LFO.
3. **Exponential/Linear Switch** - This switch (x4) changes the attack and decay curves. Depending on what you are patching the Quadra into, this setting may need to be changed. For example if you patch into an exponential VCA you'll probably use linear mode. The fastest envelope times are achieved when in linear mode.
4. **Mode Switch** - This switch (x4) sets each function generator to one of three modes: AD, ASR or Cycle mode. AD is an envelope that ignores the incoming gate time and is simply triggered.



This is often used with sequencers. ASR is similar to an ADSR in that it continues to sustain while the input gate is high. Cycle mode acts like a unipolar LFO.

5. **LED** - The brighter this LED (x4), the higher the function generator's amplitude.

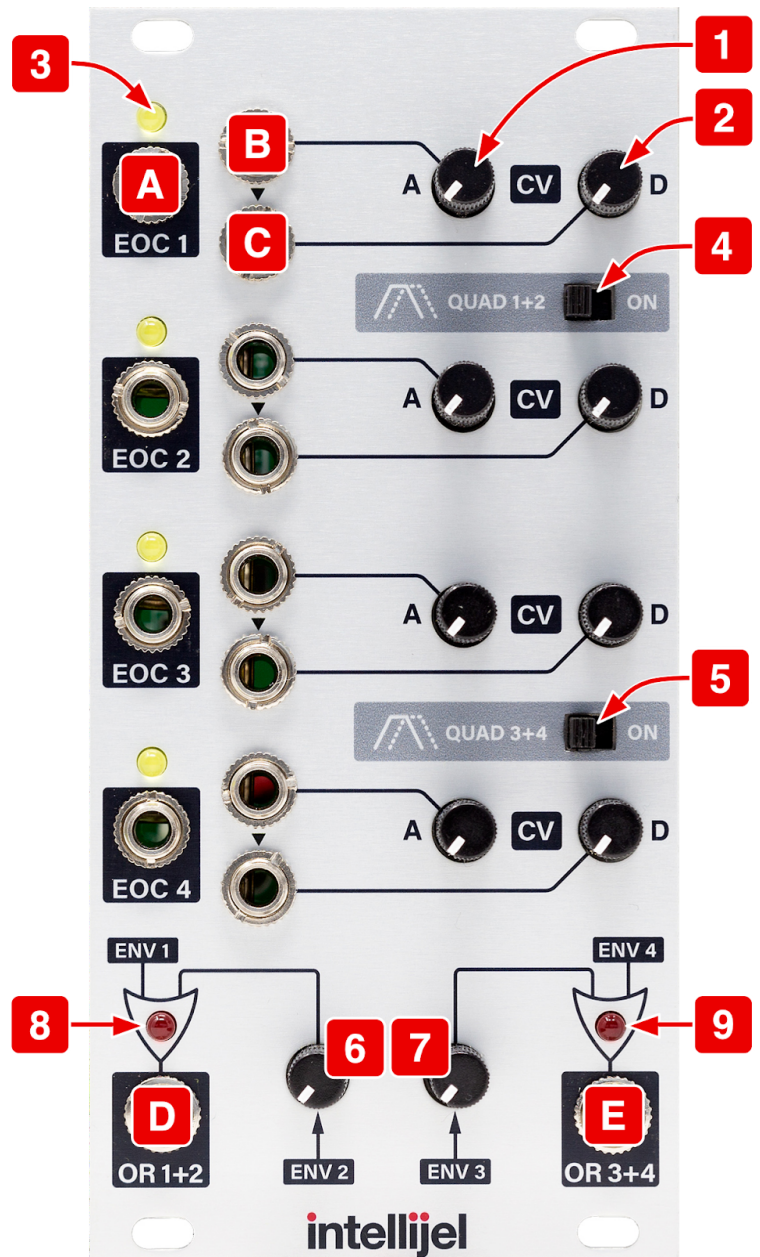
Inputs and Outputs

- A. **TRIG Inputs** - Patch a trigger or gate signal here to launch the function generator. There are four TRIG inputs — one for each of the four function generators.
- B. **ENV Outputs** – The function generator is output here as a unipolar 0-8v control signal. There are four ENV outputs — one for each of the four function generators.

Expander Front Panel

Controls

1. **Attack CV Input Attenuator** - Controls the range of CV modulation applied to the function's attack phase. The range increases as the knob turns clockwise. Generally best results are achieved by starting at zero and then increasing the amount until the desired level of modulation is discovered.
2. **Decay CV Input Attenuator** - Controls the range of CV modulation applied to the function's decay phase.
3. **End of Cycle LED** - Indicates the completion of an envelope's decay phase, corresponding with a gate signal sent out of the EOC output.
4. **Quad 1+2 Mode Switch** - Engages [Quadrature Mode](#) for 1+2. When on (switched to the right), function 1's end of attack will trigger function generator 2.
5. **Quad 3+4 Mode Switch** - Engages [Quadrature Mode](#) for 3+4. When on, function 3's end of attack will trigger function generator 4.



6. **ENV 2 Or Amount Attenuator** - Sets the level of **ENV 2** into **OR 1+2**.
7. **ENV 3 Or Amount Attenuator** - Sets the level of **ENV3** into **OR 3+4**.
8. **OR 1+2 LED** - Shows the state of the function generator amplitude for **OR 1+2**.
9. **OR 3+4 LED** - Shows the state of the function generator amplitude for **OR 3+4**.

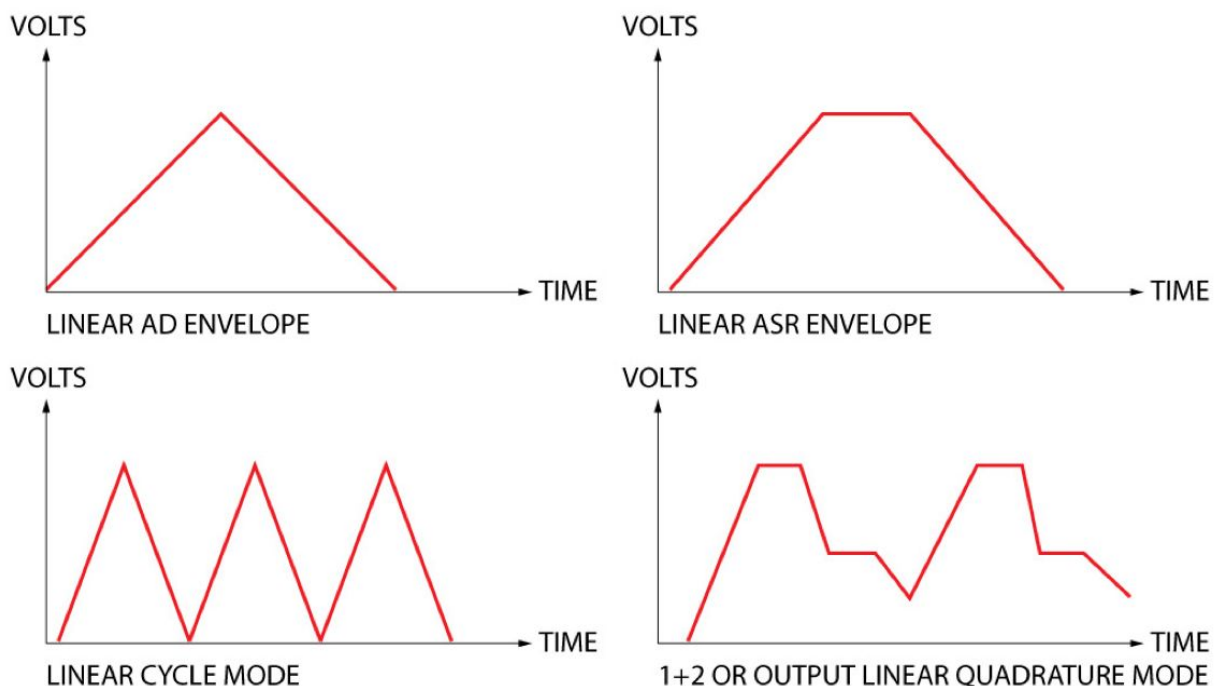
Inputs and Outputs

- A. **EOC** – Outputs a high gate signal when the function generator has completed its Decay phase. The associated yellow LED **[3]** indicates when the respective function generator has reached the end of its cycle.
- B. **Attack CV Input** - Allows an input signal to modulate attack time. This input is normalised to **Decay CV Input [C]**, allowing both to be controlled together or separately via CV.
- C. **Decay CV Input** - Allows an input signal to modulate decay time.
- D. **OR 1+2 Output** - This is the mixed **OR** signal of **1+2**. When using **QUAD 1+2** mode use this output for complex function shapes. See [ADSR Envelope Generation Using the OR Outs](#) and [Quadrature Mode](#) more information.
- E. **OR 3+4 Output** - This is the **OR** mixed signal of **3+4**. When using **QUAD 3+4** mode use this output for complex function shapes.

Functions and Envelopes

While envelope generators may not seem as exciting as other modules like filters, oscillators, and effects, they play a critical role in creating movement and life in a patch. If you come from a more traditional synthesizer background, all this talk of function generators and [Quadrature mode](#) may seem overwhelming. Or perhaps you find it strange that we talk about the Quadra as an envelope generator but then do not mention the most common envelope type — the ADSR. This is because the design concept of the Quadra is inspired by what is commonly referred to as “West Coast” synthesis concepts (a nod to Don Buchla, a pioneer in synth design from California). You can think of each function generator in the Quadra as a simple envelope generator. However, since the Quadra can also create very complex looping LFO shapes in [Quadrature mode](#), or create complex interacting combinations using the **OR** outputs, we use the more traditional name of “Function Generator”.

You can use the Quadra on its own as four AD or ASR envelope generators. If you are not using a traditional keyboard controller AD mode is preferred by many since it is independent of the incoming gate times. Once the AD is triggered, it will move through its stages until completion. This is ideal for sequencer or random based patches. You can use the Expander CV inputs to control the decay time which is like controlling the gate time at the sequencer, but has a different sound.



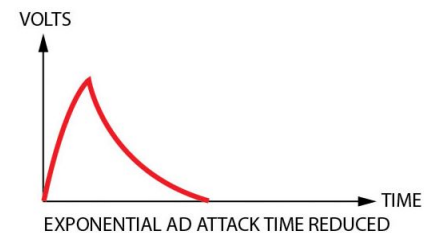
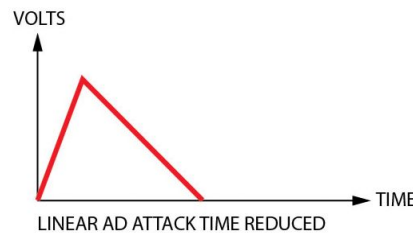
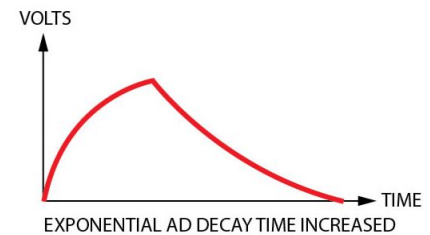
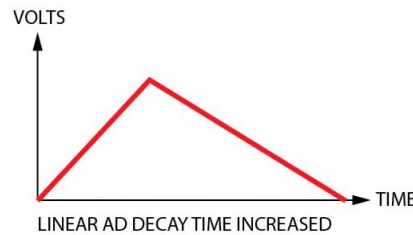
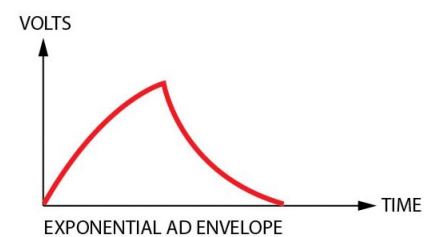
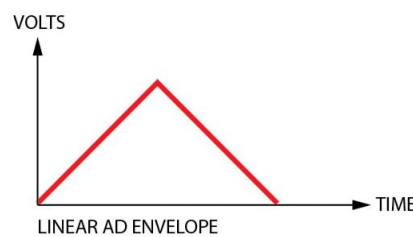
Why would you use so many envelopes? If you consider the average synthesizer voice needs at least two envelopes, one for final VCA, the other for filter cutoff, it is not hard to imagine in a

more complex voice how to use more. For example, another AD envelope could be used to control the modulation index of a two VCO FM patch. You can use envelopes to control the amount an LFO controls the filter via another VCA, or use a mulited VCA in parallel with the final VCA to act as an effect send. You can see how with a little imagination and a lot of VCAs you will quickly run out of envelope generators, especially once you start designing percussive sounds.

Linear Versus Exponential Shapes

Linear Mode (switch to the right) - The Quadra makes straight lines as shown by the examples in the left column of this illustration. This is best used with exponential VCAs. The fastest envelope times are achieved when in linear mode.

Exponential Mode (switch to the left) - The Quadra creates a musical curved shape found on many classic envelope generators (as shown by the examples in the right column of this illustration). This is best used with linear VCAs. The results in this mode tend to have a more plucked character.

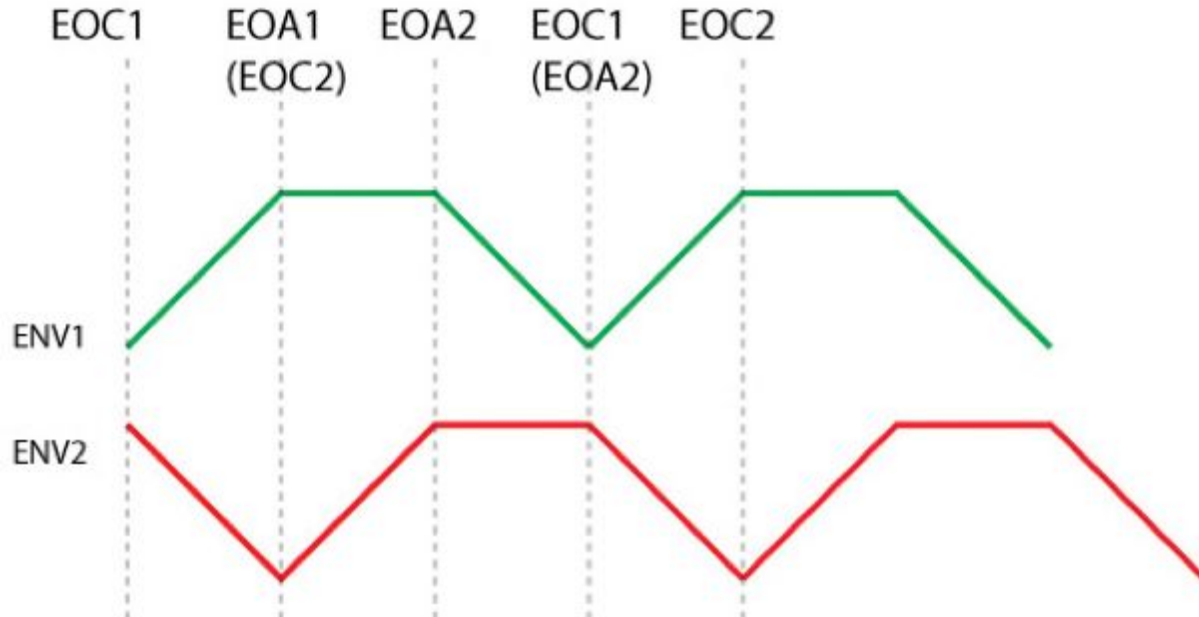


Quadrature Mode

Quadrature Mode links the function generators into two pairs of looping envelopes that have interdependent timing. It vaguely resembles two waveforms that are phase shifted 90 degrees relative to each other (hence the “quadrature” label). Each pair is independent and functions identically, so we will concentrate on the function generator pair **1+2** for this section.

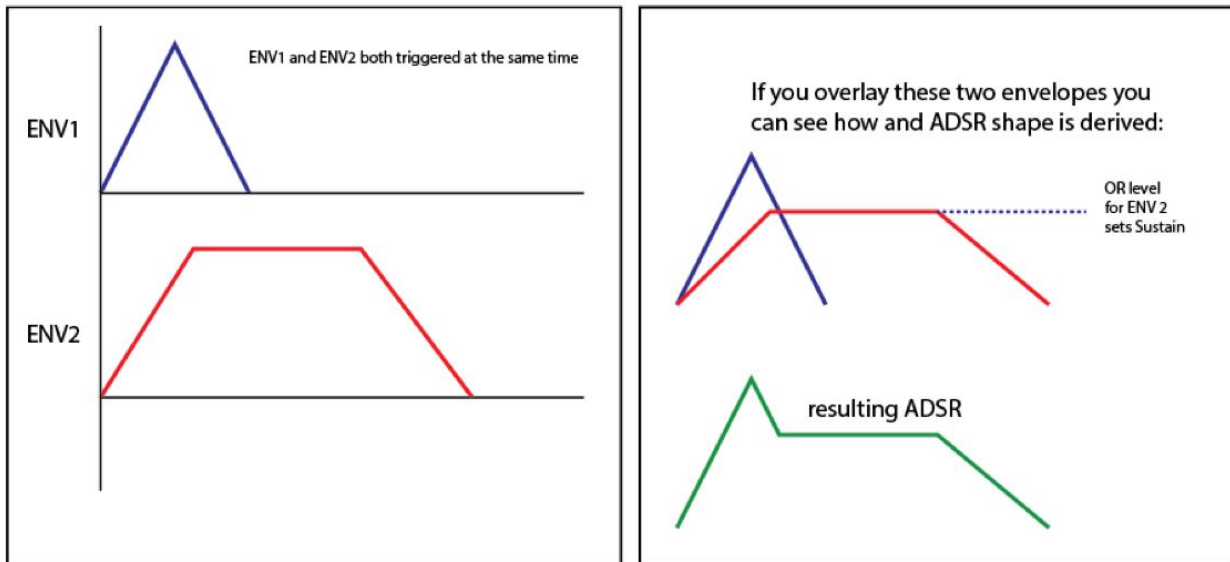
In this mode, **1** is triggered and retriggered by its own end of cycle. **1** will not enter its decay phase until both **1** and **2** have completed their attack phase. **2** can either be triggered by the end of attack of **1**, or by a gate or pulse sent to the **TRIG 2** input. **2** will not enter its decay phase until it has completed its attack, and **1** completes its decay. This means that sometimes **2** will retrigger before completing its decay phase because **1** may complete its attack first. If **2** is set to cycle with short enough attack and decay values, it will cycle during **1**'s attack.

It may take some trial and error to gain a full understanding of how this mode works, and how best to take advantage of its behaviour. Quadrature mode is great for creating out of phase modulation of two related parameters. For example, modulating the waveforms or pulse width of two oscillators.



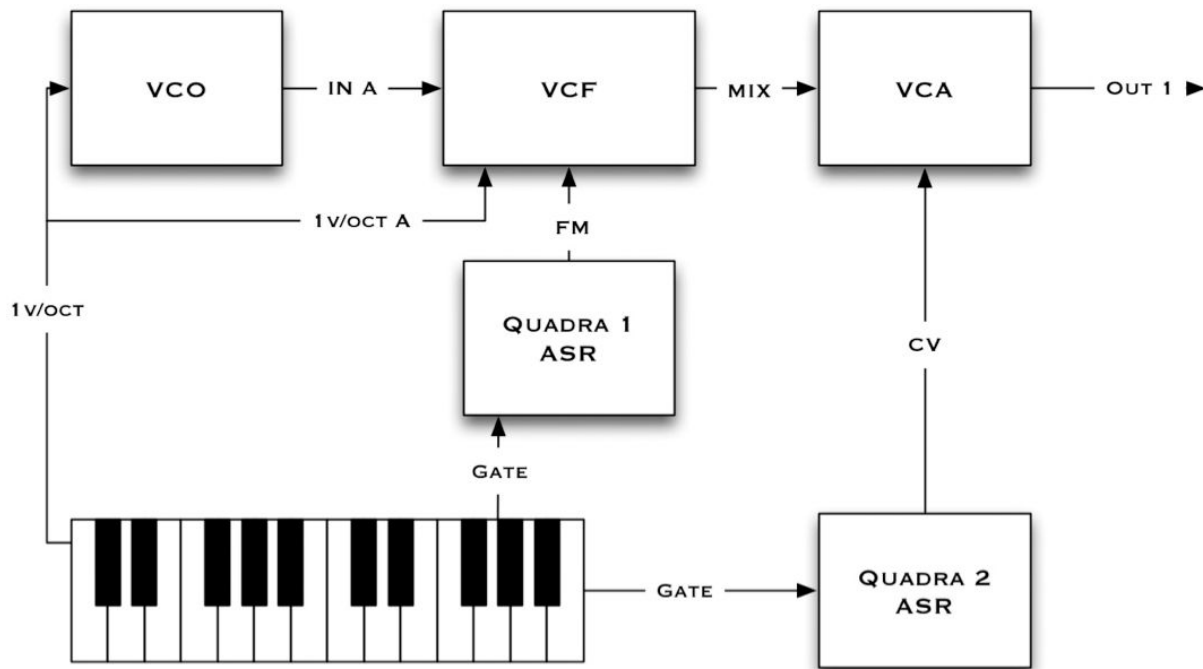
ADSR Envelope Generation Using the OR Outs

By using the **OR** output of the Expander and triggering two paired function generators with the same trigger or gate signal, an ADSR envelope can be achieved. For example, with **1** and **2** triggered together, if **1** is set to AD and **2** is set to ASR, the **OR 1+2** output will send an ADSR envelope. The **Envelope 2 Amount Attenuator** can be used to set the sustain level.



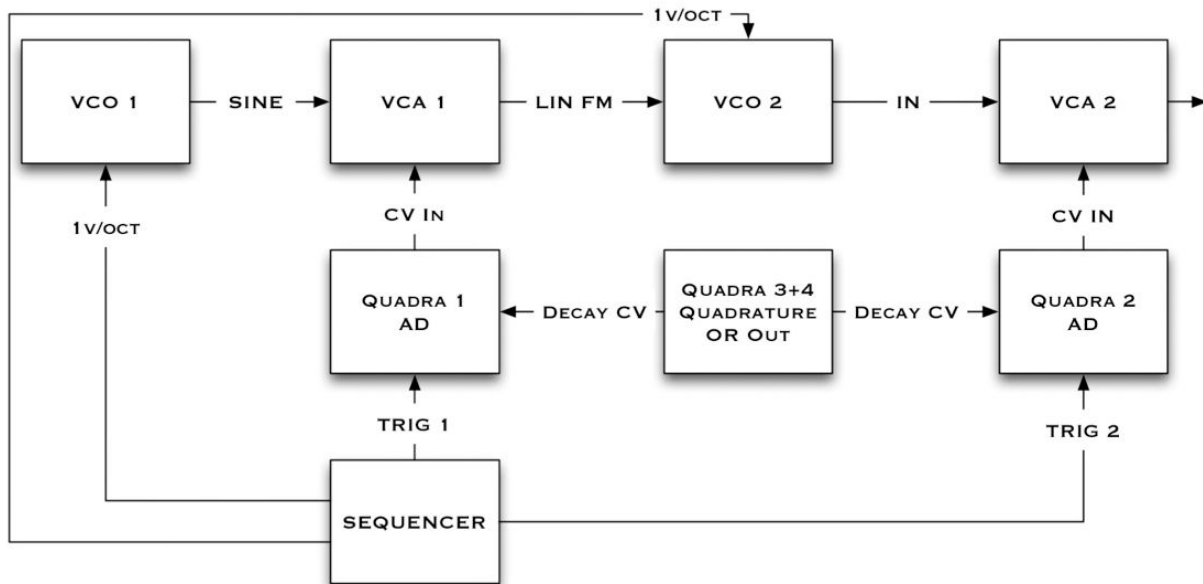
Patch Examples

Patch 1: Basic Voice With ASR Envelopes



This is a simple patch that uses the Quadra as two ASR envelope generators for a basic synthesizer voice. The reason ASR is chosen over AD in this example is because ASR will sustain as long as the keyboard key is held down. This is because an ASR envelope has a sustain section that stays high as long as the input gate is high. Once the keyboard key is released and the input gate goes low, the envelope will move into its decay phase, which in ASR mode is referred to as release. ASR stands for Attack, Sustain, Release.

Patch 2: Basic West Coast Voice (Requires Expander)

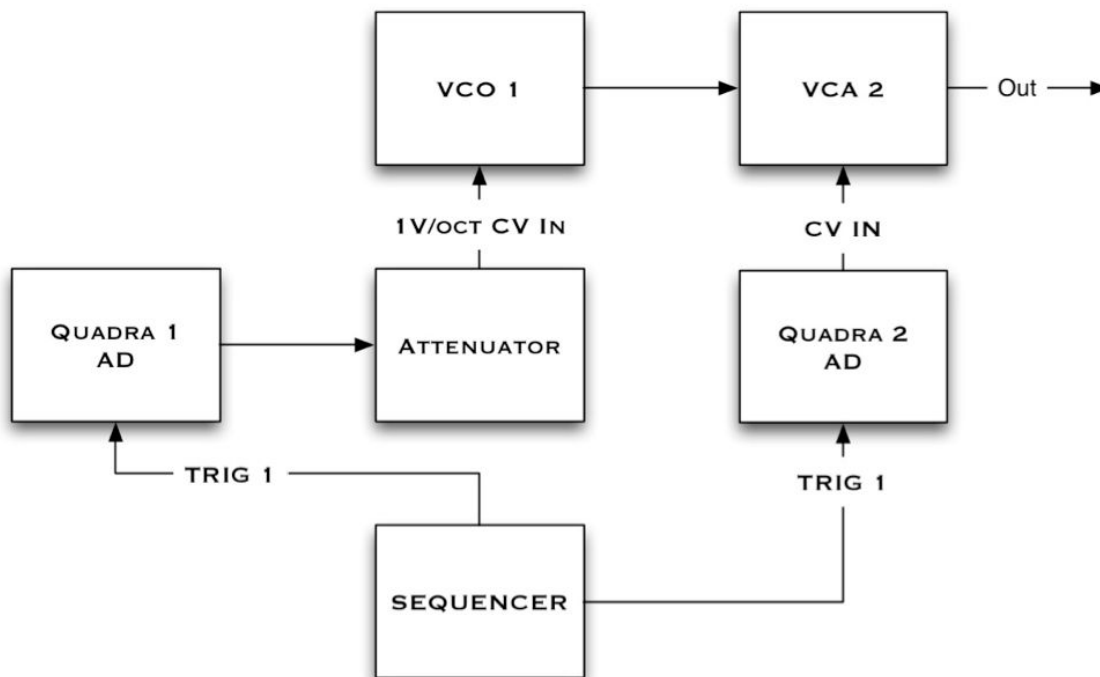


This patch uses the Expander for its CV inputs as well as [Quadrature mode](#).

A simple example of what is referred to as a “West Coast” voice. As with most west coast style patching, a filter is not used for timbre control, instead linear frequency modulation (FM) is used in a two-operator FM configuration. Quadra’s function 1 in AD mode controls the amount of harmonics by controlling VCA 1’s level. Quadra’s function 2 also in AD, and VCA 2 are used for the final output volume. Make sure you adjust the pitch of VCO 1 to alter the harmonics produced by VCO 2.

Although a sequencer is used in this example, a keyboard could be used instead. Adding more LFOs and sequencers to various timbre shaping parameters such as VCO 1 pitch and Quadra’s attack and decay CV inputs is definitely worth trying.

Patch 3: Kick Drum



This is a very simple patch that will produce a nice snappy kick drum depending on the VCO used. A self oscillating VCF can also be used, for example the Intellijel Morgasmatron makes excellent fat kicks with a bit of Q drive since it is not a true sine wave.

First take the sine wave output of your VCO and patch it into your VCA. Then patch the same trigger from a sequencer or other source into Quadra's **TRIG 1** and **TRIG 2** inputs. Patch **ENV 1** into the pitch input on your VCO, using an attenuator if the oscillator does not have an attenuator on the pitch or FM input. Without reducing the range of the AD signal, the kick will sound more like a zap than a snap. **ENV 2** connects to the CV input of your VCA to control the amplitude of the sound. Both ADs should be set with a fast attack and a medium decay, with the pitch decay shorter than the amplitude decay. To reduce clicks, slow down the attack of the AD feeding the VCA. Try starting at 9 o'clock. Adjust the pitch of your VCO and the attenuator until you get a nice boomy tone. Then adjust the Quadra's AD times until you get the shape and timbre of the kick that you desire.

Technical Specifications

Width	6 hp
Maximum Depth	44 mm
Current Draw	52 mA @ +12V 5 mA @ -12V