

Andrew Macaulay Modules for Voltage Modular



USER GUIDE

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Introduction

This document reflects the individual help pages at <https://andrewmacaulaymusic.uk/modules/help>. The latest help will always be available from the website.

To simplify navigating the file, individual help pages have been kept in alphabetic order after the General Help page with guidance on some of the standard behaviours and features across many of the modules. Details on the Customisation Options and management of defaults are included as the final section of the document.

Note that the online help system has an index which groups the modules by the collection to which they belong as well as providing an alphabetic menu on the right for ease of navigating between help pages.

General Help

There are a number of standard approaches used throughout Andrew Macaulay's Modules. As many modules are deliberately stripped back, these might not be completely obvious to start with, but once you've understood the approach in one module, it will typically be consistent across modules. This section provides a breakdown of some of these common approaches, to help you as you start using the modules.

Clock In / Host Sync

In many of the time-based or beat-based modules, you will see reference to Host Sync and/or Clock In and a Speed/Divider knob. The approach here is simple but flexible:

- **Host Sync** is driven by the host or DAW speed as recognised within Voltage Modular. Effectively this bypasses the need to use the SYNC out on the main input/output panel and a Sync Divider. If nothing is connected, this defaults to 120 bpm.
- **Clock In** allows the timing to be calculated from a gate or trigger input. This takes a couple of gates/triggers to start working (for obvious reasons) and can adjust as the clock is changed – although large changes to the clock may take a few beats to settle down again.
- **Time/Speed/Divider Knob** allows multiplication and division of the speed or time from these inputs – from 1/16 to x16. When used on beat-based modules, the speed increases clockwise, when on time-based modules, the length of time increases clockwise.

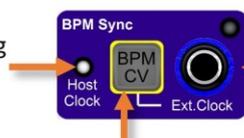
BPM CV Inputs and Outputs

CV signals for BPM are used on a number of modules, both as outputs and inputs. In all these cases, the mapping is 1 Volt = 100 bpm, with an expected range of 0V – 5V (>0bpm to 500bpm) although it does not limit it and only if over 1000bpm does it trap it. If at 0V or negative, it is ignored. This is often included as an option alongside Host and Clock In sync for beat-based modules.

Standardised BPM/Clock Sync User Interface

From Release 6, the user interface for BPM/Clock Sync inputs for most modules has been simplified with a single, multi-purpose jack input and a single button switch to change modes. Older preset will be migrated where possible (where it is clear what the intention was) but **note** that some older presets may have settings which can't be migrated, and a legacy mode for the UI will be presented (see description of Legacy Mode later).

Host Clock LED on when external mode is using the Host Clock for sync (no jack connected)



Ext. Clock/BPM CV input: BPM CV or external gate or clock from which the BPM is measured

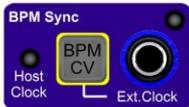
BPM CV button: selects if external input jack is 100bpm/V BPM CV or an external clock source. The jack colour and name change to reflect the selected mode.

Depending on the state of the jack connection and the BPM CV button, the label for and colour of the jack socket change to make it clear which mode the BPM Sync input is currently in. The following images show the three states for the BPM/Clock Sync input jack.

LABELS AND JACK COLOUR



Host Mode: when there is no external clock/BPM jack connected the BPM Sync uses the internal host/DAW clock as the clock source – with LED showing this status



Ext. Clock Mode: when an external clock is connected and the BPM CV switch is off, the BPM is sensed from the external gate/trigger/clock signal

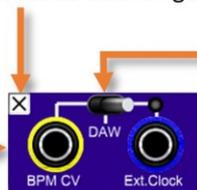


BPM CV Mode: when an external CV is connected and the BPM CV switch is on the BPM is set to the CV using the (standard across my modules) 100bpm/Volt

Legacy Mode

If a preset is opened that cannot be directly migrated to the new UI, e.g. with BPM CV jack connected or with an unusual combination of jacks connected and mode (e.g. Ext.Clock jack connected and mode set to DAW), the Legacy Mode UI will replace the standard UI:

Legacy Mode check-box is shown, together with the Legacy UI, when the panel is in Legacy mode. Click on this check box to close legacy mode once the jack(s) and switches are setup to allow the change. If using the BPM CV input then you need to remove the BPM CV input, exit legacy mode, plug in the jack and switch the BPM CV mode switch on. An error Message box will be shown if something needs to be changed before exiting legacy mode.



BPM CV input: using the 1V/100bpm CV on many of my other Modules

Mode Selector switch: to select the clock source, which can be a BPM CV (at 1V/100bpm), the host DAW clock speed or the calculated speed of the Ext.Clock input.

Ext. Clock input: the input of an external gate or clock from which the BPM is measured.

Speed/Divider Knob LED

On many beat-based modules, there is an LED with the Speed/Divider knob which shows the speed of the internal gate after the speed/divider factor is applied. These will typically (and in time, consistently) flash Blue for the calculated beats and will go Red if a 0bpm signal is received.

Module Bypass Behaviour

Many of the modules support the Module Bypass functionality, where appropriate. Depending on the functionality of the module, the behaviour differs, but the general approach for Bypass mode is that:

- for audio paths (or audio capable paths), bypass mode passes through the audio input to the audio output;
- for CV processing, bypass mode passes the input CV to the output where this makes sense;
- for Envelopes this typically means passing the gate signal to the envelope output;
- for Gate/Trigger modules this typically means passing the input gate/trigger to the output; and
- for modules that simply generate signals and do not process signals, the outputs are often simple nulled.

Voltage Modular I/O Panel Inputs

Many modules have relevant inputs that default (when no jack connected) to the DAW/external controller inputs provided from the I/O Panel (CV Sources, Poly Sources, MIDI). Typically, these inputs will be shown on the module with the input name in a rounded box and arrow to the jack which it is connected to and in some cases, additional switching to disable the internal connection is provided (see below for examples).



Module Customisation

There are a series of personalisation/customisation options available for modules across many of the modules:

1. Mid-Point for Log-Scale Time Controls

Modules which have time-based controls now have the ability to change the mid-point for the logarithmic behaviour of the knobs. This applies to e.g. Delay, Attack, Hold, Decay, Sustain and Release times on envelopes, Gate Times on the Gate Processor (Re-Gater) Module and the Delay and Fade times on the new CV Delay modules.

This setting is available through a “pop-up” configuration box and allows the mid point to be set to 500ms, 750ms, 1000ms, 1250ms, 3000ms (what is effectively a “legacy” mode) as well as to a standard linear mode. The legacy mode is automatically set (on existing modules) when loading presets from previous versions so that their behaviour is as expected.

NOTE that the knobs store and act on (saving and loading) the value of the knob, not the position in any specific mode. As a result, when using the Remote Control module (or similar modules) that control the VALUE of any knob from a CV, it is often best to set the knob into the Linear mode so that the behaviour of the knob is consistent with the indicator on the Remote Control. Note that, unlike the Remote Control module, the PERFORM knobs control the POSITION of the knob, and so the resulting value will be affected by the setting of the mid-point value.

2. Minimum Gate/Envelope Times

Minimum Attack Time, Decay/Release Time and Gate Time switches are also available on many modules such as Envelopes, Gate processing modules, Ratcheting, etc. and allows the default behaviour of allowing the times to be 0ms (a simple trigger for gates) or a minimum of 2ms, even if the control plus a CV make it less. This ensures that the gate will fully open the envelope on Cherry Audio’s standard Envelope Module which has a 2ms minimum Attack time and will remove the possible clicks from envelopes when used at 0ms.

Accessing the Settings

Where a setting is not directly available on the module, the settings will be available through a “pop-up” configuration box accessible by pressing the cogwheel  settings/config button to open the control.

Global and module-specific default behaviours for these customisations, as well as module-wide system settings for Release Notes and custom module-specific tooltips can be set using popup menus in the modules. Full details of these customisation options are in the section “Help: Customisation Options”.

Global UI Customisation

There are a series of customisation options available for all modules related to the display of Release Notes and of the custom popup “tooltip” style help in some modules. These settings are accessible by right clicking on the logo . Full details of customisation options are in “Help: Customisation Options”.

A440 Master Tuning

The **A440 Master Tuning module** allows master tuning adjustments for mono and polyphonic 1V/OCT control voltages, including a set of preset tuning pitches (A440 plus various concert and other historic pitches). The tuning remains standard 12-semitone pitches and does not affect the octave spread, it just affects the base pitch. As well as a set of preset values, manual tuning for the note A4 can be set from 410Hz to 470Hz. In addition, there is a separate transpose section with octave, semitone and fine tuning which can be applied to the master tuned value.

There are CV outputs for the various offsets, plus CV inputs (defaulting to the I/O Panel inputs) and CV outputs with tuning and with tuning+transpose. There is also a sinewave tuning audio signal output (sine wave) with optional mute/50% attenuation which reflects the tuning setting and can therefore be used for manually tuning physical instruments to the pitch.

Tuning Drop-Down Menu: click on this menu to access a set of pre-defined tuning options which sets the tuning knob. The menu offers the standard A440 (which is the default in Voltage Modular) plus various concert and other historic pitches.

When the tuning knob is changed manually this is set to "custom" unless offset set to 0, in which case it resets to A440. *Note that the selected tuning is saved as part of the preset.*

Tuning (Hz) knob: controls the tuning offset for the output signal. This can be set with A4 to between 410Hz and 470Hz.

Transpose Section: provides options for octave, semitone and fine tuning transpose on the signal.

Transpose Output: outputs the offset voltage for the transpose section.

Mono and Poly channel inputs, defaulting to the mono and poly PITCH from the IO Panel



Clock Generator

The **Clock Generator module** generates a clock (gate and trigger) at a rate set by the Speed control. This can be absolute (beats per minute) when in Manual Mode or a multiplier/divider of the host or external clock when in one of the External modes. A separate manual trigger allows the clock start to be sync'd with external devices/DAW and trigger inputs are available to mute the clock and to re-start the clock. The Advanced Panel allows Clock Sync mode to be set to work with gated inputs such as the gate from a sequencer that may be started and stopped.

Reset Trigger input: synchronises the clock with the reset trigger. Allows a sequencer gate to synchronise the clock. Note that reset should be at a slower rate than the clock being generated.

Ext.Clock/Ext.BPM/BPM CV input: when running in "EXT" mode allows input of a clock signal or a 100bpm/V CV when BPM CV switch is engaged.

BPM CV: changes the Ext.Clock input to use a CV (100BPM/1V) to set the base speed behaving like Free Run mode for dotted not and Reset Trigger.

Free Run: allows Ext.Clock to be used simply to set the rate of the clock, enabling dotted note mode and separate sync with the Reset Trigger input.

Clock Sync: means that the Ext.Clock both sets the clock rate but also syncs the clock generator to the external clock. This mode brings up the ADVanced panel for further options:

MAN/EXT mode switch: MANual allows the Speed knob to control the beats per minute (BPM) directly while, in EXTERNAL mode, the "input BPM" will either be the Host BPM from Voltage Modular if there is no jack connected to Ext.Clock, or the derived BPM from the Ext.Clock (or BPM CV) if there is a jack connected.

Sync Mode display and Speed LED: status display which shows current mode of the clock generator: Manual, Host BPM, External Clock, External BPM or BPM CV In; as well as a speed LED indicator.

Speed knob: controls the speed of the clock being generated and works in two ways:

- In MANUAL mode the speed is directly controlled by the knob (setting in the speed in BPM)
- In SYNC mode the speed is a multiple or division of the input BPM, between 1/16th and 16x

In MAN mode the BPM value is shown while, in EXT mode, the factor as well as the base BPM is shown.

Editing the value directly also adjusts, allowing for input of the simple number in BPM or the factor using "x" or "" for multiples and "/" for division.*

Gate Width/Gate Time knob: setting the gate width for the Gate Out to between 0% and 100% or, when the MODE is set to ms mode, time directly in milliseconds.

Note that, if the gate width is longer than the clock time, the module will retrigger the gate.

Mute/Enable/Running: controls whether the clock generator is muted or enabled, both from a button (RUNNING/MUTED, also acts as the status display) and from the Mute and Enable trigger input jacks.

When in Clock Sync mode, the Free/Sync switch allows you to select whether the Enable trigger (or button) waits for the next gate to start, allowing the clock to remain synchronised with the external Gate signal.

In any of the other modes, the Sync mode means that the Enable/Start action also generates a Reset Trigger to sync the clock with the start action.

Ext.Sync Mode controls if the clock sync:

- I. Waits for the second clock in to start (the original behaviour);
- II. Starts on first clock with best guess/last known good for the speed;
- III. As II but automatically resets after # beats set on **Beats knob**. Useful for using fixed speed sequencers that can be started/stopped as the Ext.Clock.

Panic button allows a manual reset to the BPM sensed in case it gets confused.

1st Gate sets the min.gate time in ms (either mode) to improve "best guess".

Dotted Note (1.5x) mode: available in Free Run (External BPM), BPM CV and External Host modes.

Speed indicator: showing the resulting speed of the adjusted speed that will be used (in BPM).

BPM CV out: a control voltage that can be used with other Gate and Trigger utilities as well as other modules like the Formula module. This is the speed, using 1 Volt per 100 bpm as the scale.

Trigger Out: outputs a trigger signal based on the speed as set above – this can be seen as the "raw" clock signal.

Triggers are almost zero length pulses of 0-5V which are useful to control percussion-related modules and other time-based modules.

LIMITATIONS of Ext.Clock Sensing: Note that, although there are a number of techniques that try to provide "best guess" timing for the first received clock from an external clock source (such as last known good and saving the current BPM in presets), the module cannot read ahead and therefore, when the BPM is initially being sensed from the external clock source, it will take two clock signals to "know" the actual BPM rate. Also, if the clock rate speeds up or slows down, any gate-width that is being calculated from the BPM can take two clock signals for the reflect the new clock rate.



Clock Multiplier/Divider

The **Clock Multiplier/Divider module** takes a clock input signal (clock, gate or trigger) and multiplies or divides the clock rate by between 1 and 32 to allow you to synchronise faster or slower sequences, etc. to the master clock for your patch. With a Reset gate input to synchronise the beat and a Run Gate which can be inverted, this can be used in many situations where you are synchronising various elements in the patch.

The clock can be reset (to sync with sequencers, etc.) and a “run gate” allows the clock output to be switched on and off by a gate or trigger input. Additional sync options taken from the Clock Generator support syncing and gating the output correctly when used on gated inputs such as sequencers that may start and stop. Options to sync the latched mode Run Gate and Reset inputs to the clock mean that this module can be used in complex patches.

Clock In: provides the input which is used to drive the clock multiplier or divider. The LED shows when a clock trigger has been received.

Reset In: a trigger input that synchronises the clock to the reset trigger. This can be used to synchronise the clock being multiplied/divided to, for example, a sequencer gate. The LEDs show if the Reset is waiting for the next clock in, and when the Reset action occurs.

Run Gate: takes a standard Gate to enable/disable the clock running. When the Invert switch is OFF, then gate off = no clock out and gate on = clock out. When the Invert switch is ON, this is reversed. The LEDs show the sync status and run status.

Factor knob: sets the multiplier or divider of the input clock, between 1/16th and 16x. When the mode is changed, the display of the value is changed, with sync mode showing the factor as well as the base BPM.

Trigger 0ms/2ms switch: sets the output clock to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The  button allows you to manage these defaults.



Clock Sync mode selects if the BPM sensing used to drive the multiplier/divider:

1. **Legacy Mode** which waits for the second clock in to start (original behaviour for the module);
2. **Gated Variable BPM Mode:** Starts on first clock with best guess/last known good for speed, and continues to sense even if long gaps;
3. **Gate Stable BPM Mode:** Starts on first clock with best guess/last known good; automatically resets after 1.75 beats, useful for using with fixed speed sequencers that can be started/stopped.

Control Sync mode provides additional control over the behaviour of the Reset/Start inputs (latched only):

1. Legacy mode, with immediate Reset/Start
2. Run Gate Waits for Clock with Auto-Reset so that e.g. multiplier will reset on next clock in
3. Waits for Clock but continues count so that multiplier will reset on next expected clock out

Invert/Latch Switch: three options for the CV for the Run Gate:

- **Gate** mode, taken the gate as a normal On/Off switch: gate on to run, and gate off to stop.
- **Invert** the gate input, so that gate on will stop the clock, and gate off allows it to run;
- **Latched** taking a Trigger input, with the trigger swapping the mode from On to Off and back.

Clock Out: outputs a clock (0-5V) signal based on the speed calculated from the adjusted CV in value.

LIMITATIONS of Clock In BPM Sensing: Note that, although there are a number of techniques that try to provide “best guess” timing from external clock sources on the first received clock (such as last known good and saving the current BPM in presets) the module cannot read ahead, so when the BPM is first being sensed from an external clock source, it will take two clock signals to “know” the actual BPM rate.

Clock to CV to Clock

The **Clock to CV to Clock module** is a cut-down version of the clock sensing used in the Clock Generator that provides the ability to take a gate/clock in and generate a control voltage (1V per 100bpm) output which can be used with other Gate and Trigger utilities. It also outputs the internal Host Clock as a 1V per 100bpm CV and can generate a clock signal based on a Control Voltage input. The module also provides a trigger output when the host tempo (Voltage Modular Stand-Alone or DAW) changes.

This small module can be used with Formula to do complex handling of BPM rates, as well as using LFOs, Envelopes, Sequencers, etc. to control the clock.

Gate to CV section: takes the clock-in signal from a gate or trigger and calculates the Beats per Minute measurement, output in 1V per 100bpm.

Gate input: provides the clock in signal used to derive the clock rate in the “Gate to CV” section.

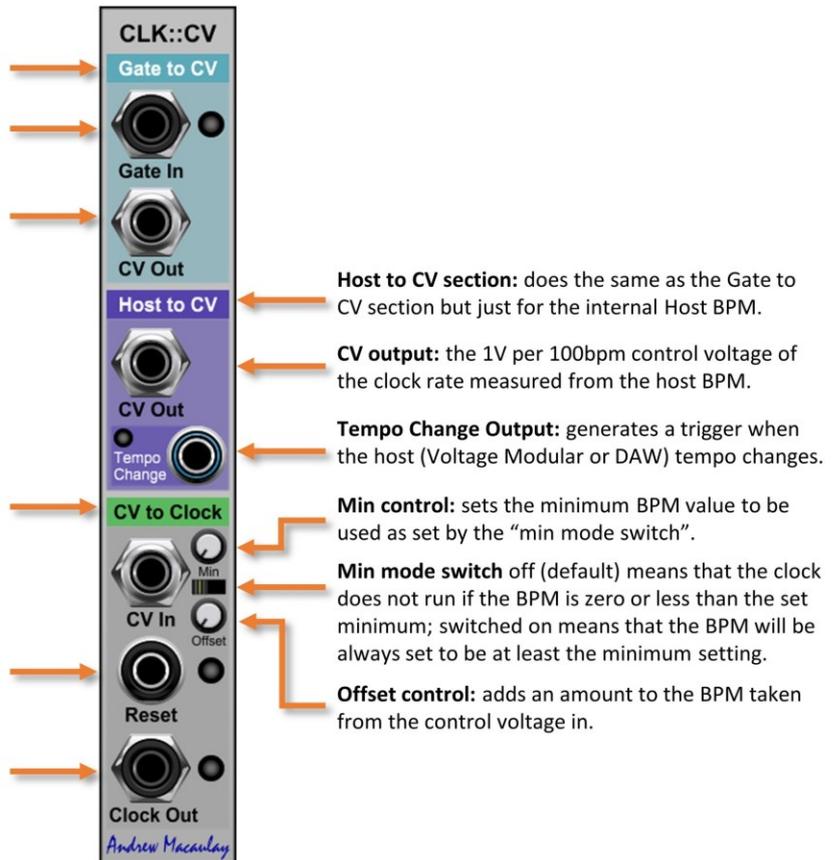
CV output: the 1V per 100bpm control voltage of the clock rate measured from the Gate input.

This can be used to drive many of the other Gate and Trigger Utilities, optionally with other modules including the Formula module to do “interesting” things with the BPM control voltage.

CV to Clock section: takes the 1V/100bpm control voltage and generates a clock at this rate.

Reset Trigger input: synchronises the clock with the reset trigger. Allows, for example, a sequencer gate to synchronise the clock. Note that the reset should be at a slower rate than the clock being generated.

Clock Out: outputs a clock (0-5V) signal based on the speed calculated from the adjusted CV in value.



Host to CV section: does the same as the Gate to CV section but just for the internal Host BPM.

CV output: the 1V per 100bpm control voltage of the clock rate measured from the host BPM.

Tempo Change Output: generates a trigger when the host (Voltage Modular or DAW) tempo changes.

Min control: sets the minimum BPM value to be used as set by the “min mode switch”.

Min mode switch off (default) means that the clock does not run if the BPM is zero or less than the set minimum; switched on means that the BPM will be always set to be at least the minimum setting.

Offset control: adds an amount to the BPM taken from the control voltage in.

CV Change Gate

The **CV Change Gate module** monitors a control voltage and generates a trigger when the CV changes. There are controls for the sensitivity (how much it has to change) as well as ranges where the trigger is monitored; these can both be set as Voltages or as notes/semitones. When the minimum change is non-zero, you can have the trigger on changes between states, or changes since the last-changed state.

This module can be used to, for example, generate accents or additional notes on changes to a note - especially useful with sequencing which may have a note repeating with occasional change of pitch. For ease of use, the input defaults to using the Pitch panel CV Input but can be overridden by jacks.

CV Input which defaults to the PITCH input on the IO Panel, from the DAW or external controller/s.

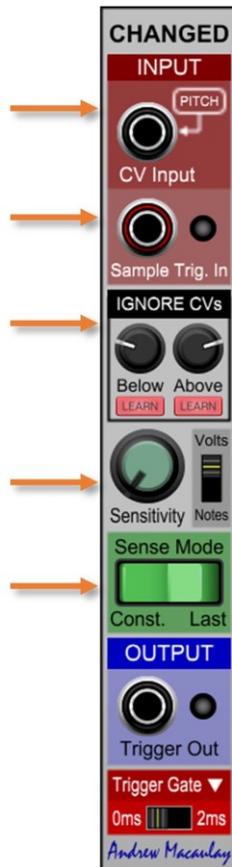
Sample Trigger Input: allows the CV to be sampled and tested only at specific trigger points. This can be used to sync the output with a clock such as a sequencer, etc.

Ignore CVs Below: any voltages below this value will be ignored for the processing in this module. Note values (i.e. A#1, Gb-2, C4, etc.) can be input using the knob editing dialog.

Sensitivity sets the minimum change required to generate a trigger. For example, if using notes, a 5 semitone sensitivity would mean that a move from C0 to D0 is ignored while a move from C0 to F0 would generate a trigger.

Sense Mode switch: works with the Sensitivity as follows:

- **Constant** means that each change of voltage or note is tested, so a sequence C – E – F – A# with Sensitivity 5 semitones would only generate a trigger on the first C and then the A#, i.e. the first jump between individual notes of 5 semitones;
- **Last** means that the test is against the last time a trigger was generated, so the sequence C – E – F would trigger on C and F, the first time there were more than 5 semitones from the last triggered (C)



Ignore CVs Above: any voltages above this value will be ignored for the processing in this module. Note values (i.e. A#1, Gb-2, C4, etc.) can be input using the knob editing dialog. Voltage range for both knobs is -10V to +10V to allow complete range of 1V/OCT CV inputs.

Learn buttons are available for the below and above knobs, using the current CV input.

Volts/Notes Switch: to select whether the Ignore CVs and Sensitivity knobs display Volts or Notes. For the sensitivity, this will be semitones, for the Ignore range this is absolute notes (with Middle C as C4).

Output: provides the trigger output. The LED shows when a clock trigger has been generated.

Trigger 0ms/2ms switch: sets the output trigger to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The ▼ button allows you to manage these defaults.

CV Delay and Processor

The **CV Delay and Triple CV Processor module** brings together a comprehensive Delay/Fade envelope with flexible processing and routing for up to three, typically CV signals, to generate delayed LFO and other similar effects.

The Delay and Fade envelope includes multiple slope types for the fade, and the timings for the delay and fade can be set manually or sync'd to the BPM (host, external clock or CV). The delay CV can be mixed with up to three other CV inputs such as keyboard after-touch and mod wheel. Default signal paths are provided to simplify patching.

New Standard BPM Sync UI: if an older preset requires it, a legacy version of the UI will automatically be displayed. See the help about the Standard External BPM Sync for more detail on the UI behaviours as well as the legacy mode.

Host Clock LED on when external mode is using the Host Clock for sync (no jack connected)

BPM CV button: selects if external input jack is 100bpm/V BPM CV or an external clock source. The jack colour and name reflect the selected mode.

Ext. Clock/BPM CV input: BPM CV or external gate or clock from which the BPM is measured. Allows sync with LFO-driven clock/sequencer.

Manual/BPM mode: switches between the manual (time-based) and BPM-based mode for the Delay and Fade controls

Trigger input: used to trigger the delay/fade process. This defaults to IO Panel TRIGGER when no jack (switchable)

Delay and Fade: control the time of the Delay (no signal) and Fade (up to full signal) based on the Manual Switch:

- In MANUAL mode the time is controlled by the knob
- In SYNC mode the time is a multiple of the input BPM, between 1/16th and 16x

When the mode is changed, the display of the value is changed. Editing the value directly also adjusts, allowing for input of the time in ms or the factor using "x" or "*" for multiples and "/" for division.

CV In 1-3, Trim and switches: provides three different CV inputs which will be added to the delay envelope, e.g. to include after-touch and/or mod wheel to work alongside the delay envelope. The trim knob adjusts the input from ±100%; the switch determines if negative values are allowed. 1 and 2 default to IO Panel inputs if no jacks (switchable).



Slope mode buttons/knob: select slope of the Fade as either linear/log (3 modes). You can also adjust the slope using the knob.

Config button: brings up the configuration pop-up allowing control of the log mode knob behaviour.

CV Processors: modules allowing three separate CV inputs to be controlled by the module, each in its own specific way.

Mode buttons: selects whether the CV is passed through (bypass), or uses the "limited", "adder" or "custom" values.

CV Amount: the amount of CV (±100%) to be applied to the processed CV.

Input: expected to be a CV input, to be processed by the delay/CV mix; e.g. pass an LFO through this for a delayed LFO effect.

Output: the processed signal (normally a CV)

LIMITER, ADDER, CUSTOM

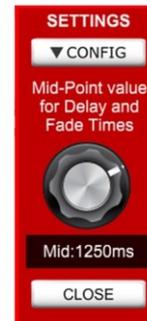
The module provides three different ways to mix the delay and CVs:

- Limiter** which limits the total CV to a range of -5V to +5V. The resulting CV, if used with an LFO, will ensure that even if the delay has finished and you add a CV such as the mod-wheel, the LFO amount will not be greater than you expected.
- Adder** which does not limit the value, so you can "add" more modulation with the additional CVs
- Custom** which uses the "custom recipe" to provide fine-tuned control of the mix of the various CV sources as well as the limiting of the range.

Custom Recipe settings: allows a specific mix of the delay, CV1, CV2, CV3 together with options to allow (or not) -ve values, limit the resulting CV to 5V or a custom value.

CV Outs: separate CV outs for the different modes, including a CV amount (±100%) for the output.

CONFIGURATION DIALOG



Brings up menu to manage global and module defaults

Sets mid-point for the time knobs log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode

Delay and Fade knobs control the time in milliseconds using a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 1250ms unless changed in the global or module defaults (see general help for more).

CV Note Display

The **CV Note Display module** is simple display module that displays three channels of the MIDI note numbers and name/octaves for their CV input. The input voltage is quantized (which can be using low/round/top) and the display can be set so that MIDI Note 60 (Middle C) is C3, C4 or C5 to reflect different software.

Each of the three channel display can be held by Sample&Hold and Release inputs and the manual button/LED (track and hold) and each channel provides a Quantized (and track/hold) output.

MIDI Note display shows the MIDI note number (0-127) as calculated from the 1V/OCT input CV (-3V = 0). If the voltage on the input is outside this range, shows **ERR**

Input: takes the 1V/OCT input control voltage to be displayed for the channel

Under/Over LEDs shown if the input voltage is over or under the exact amount used for the quantized note

S&H Gate/Trigger Input sets the hold mode to "ON" and samples every time a trigger is received.

Hold Indicator and Button shows the status of the hold and can be used for manually setting and releasing the hold mode

Quantizer mode switch selects the quantizer mode (rounding approach) as follows:
Low – note 1.1 is 1, 1.5 is 1 and 1.9 is 1
Rnd – note 1.1 is 1, 1.5 is 2 and 1.9 is 2
Top – note 1.1 is 2, 1.5 is 2 and 1.9 is 2

Note/Octave display shows the note and octave for the MIDI note calculated. The scale uses G, G#, ... for notes and Octaves are based on the MIDI Note 0 setting below

Quantized Output provides an output of the quantized value as currently shown, so is also subject to the HOLD button

Release Gate/Trigger Input releases the hold mode to "OFF"

Middle C (MIDI Note 60) Selector to choose whether MIDI Note 60 is displayed as C4, default for Voltage Modular and used in many devices/DAWs, C3 as used by Yamaha and Steinberg (Cubase) or C5, where MIDI 0 is C0 as used by default in e.g. Cakewalk.

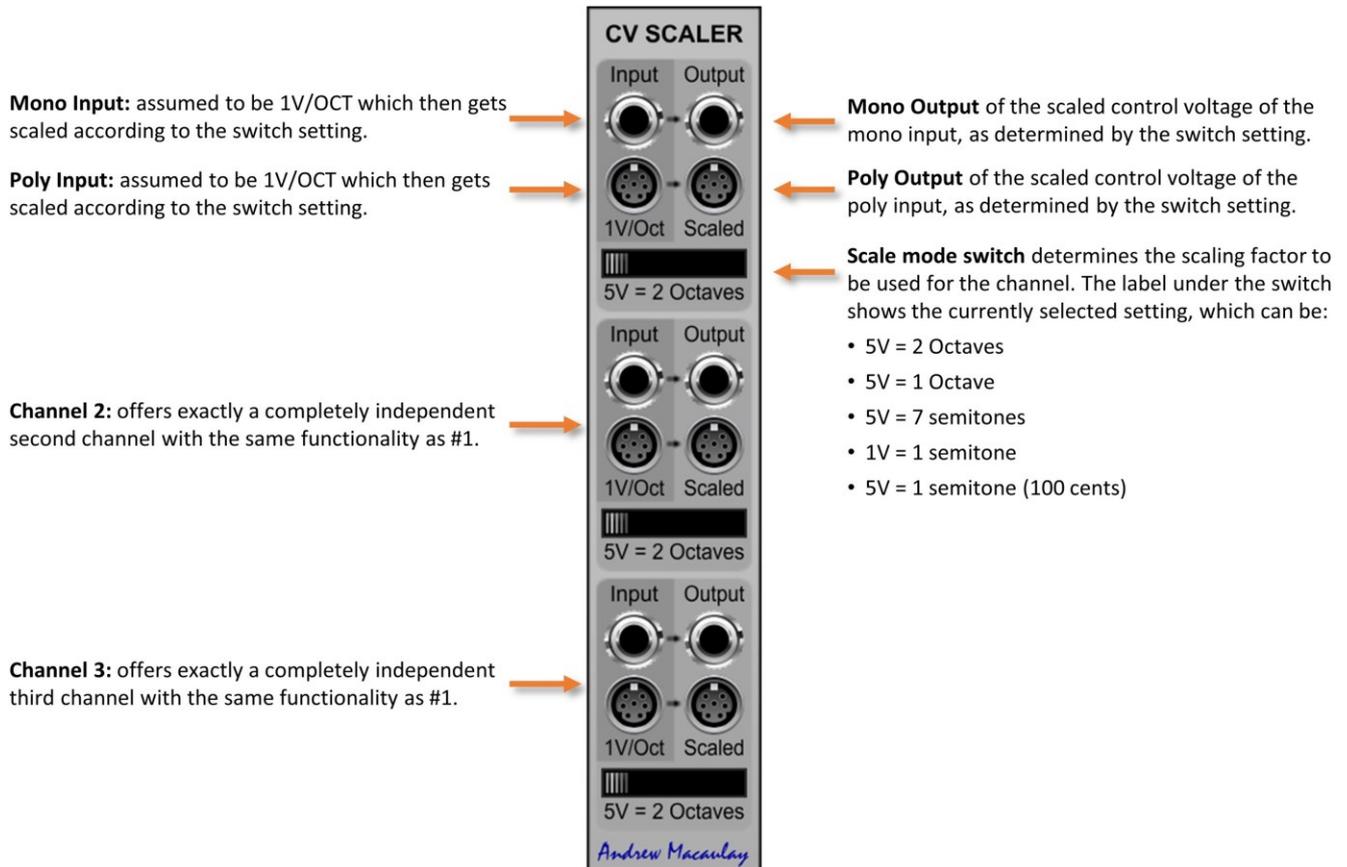
There are three independent channels, although the Quantizer and MIDI Note 0 settings are global across all three

Breaking Change: the original approach of selecting what note MIDI 0 was (C-3, C-2, C-1) has been replaced with the new approach of selecting what will be displayed for Middle C (MIDI Note 60). Old presets will be brought across where possible, with the original options for C-2 and C-1 being C3 and C4 in the new mode – however the C-3 option is no longer available (it does not match any known software) and sets the module to the lowest available C3 mode.

CV Pitch Scaler

The **CV Pitch Scaler module** provides three mono/poly channels with simple scaling of control voltages with ratios designed for use on 1V/Octave signals. This can be useful where you want an LFO to affect an audio oscillator by exactly one semitone or you want to use the Drift Generator to drive an oscillator directly without having to set the CV amount to e.g. 8.33333% for a drift of no more than 50 cents.

Designed originally to make it easy to connect the Drift Generator to control micro-tuning of oscillators where the 5V = 1 semitone/100 cents option is ideal, this module can also be a useful helper when using LFOs, envelopes, etc. to control oscillator modulation without having to input e.g. 1/12ths in decimal.



CV to Gate

The **CV to Gate module** provides the ability to take any control voltage and create a gate signal based on the voltage going above a trigger voltage and falling below the release voltage. The trigger is sensed against the set voltage on a rising signal and the release is sensed against the set voltage on a falling signal. The thresholds can be separate or synchronised (set to the same value) using the Sync switch.

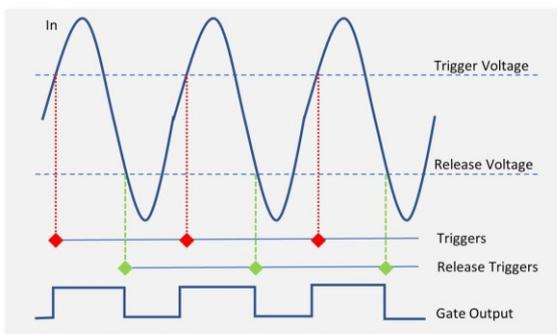
At its simplest, this allows gate, trigger and release triggers from clock sources, but it can also be used with any source such as an LFO or random signal to generate triggers/gates or even to generate audio frequency pulse waves.

CV input: is the source for the processing, allowing any control (or audio) voltage to be used to create gates and triggers.

Trigger Voltage: setting the value above which the gate will start and the trigger generated.

Release Voltage: setting the value below which the gate will stop and the release trigger generated.

Example:



Locked switch: when enabled, makes the Trigger and Release voltages the same, so that on a sine or triangle wave, the gate would be centred on the peak value.

Gate Out: provides a +5V gate signal which goes on at the start and off at the end of the generated gate

Trigger Out: provides a +5V trigger signal from the start of the generated gate

Release Out: provides a +5V trigger signal from the end of the generated gate

CV Utilities

The **CV Utilities module** is simple module with three utility functions for control voltages with two channels each providing Linear to Volume CV conversion, Volume to Linear CV conversion and CV Smoothing with smoothing times of between 0ms to 10ms.

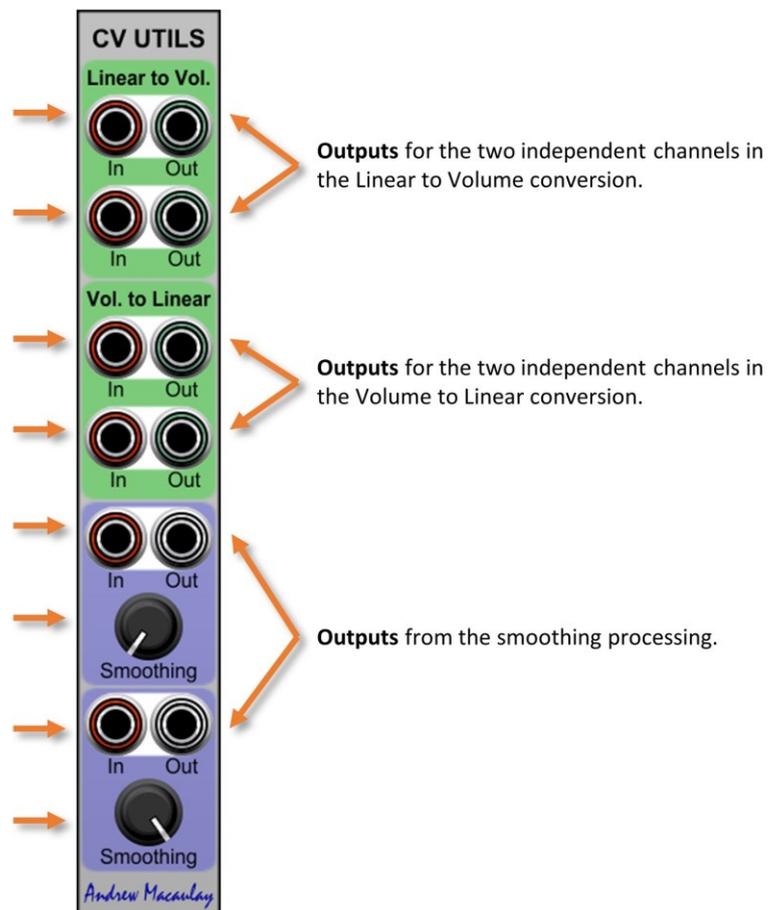
Linear to Volume control voltage conversion, takes the 0V-5V input as a linear percentage and converts it to a 0V-5V exponential output better suited for audio Volume control. There are two independent channels for this section.

Volume to Linear control voltage conversion, takes the 0V-5V input as a percentage Volume control and converts it to a 0V-5V linear output. The opposite of the above module. There are two independent channels for this section.

Smoothing section takes a control voltage and applies a smoothing amount set by the **Smoothing** value knob (0ms-10ms).

This can be useful if there are spiky voltages being generated that may cause clicks in audio. Try passing through this with very low settings to get rid of the clicks. Note that, if applied to a fast Attack/Decay event it may reduce the peak value achieved.

There are two independent smoothing channels each with their own smoothing control.



Delayed LFO

The **Delayed LFO module** brings together the CV Delay module and an LFO, allowing the mixing of a delayed envelope (delay/fade) as used for Delayed LFO effects, with additional CV inputs available to support e.g. the mod wheel to control the built-in LFO.

The Delay and Fade section offers multiple slope types for the fade and timings for the delay and fade can be set manually or sync'd to BPM (host, external clock or CV). The Delay CV can be mixed with up to two other CV inputs with flexible range limiting, allowing the mixing of e.g. after-touch or mod wheel with the delay envelope.

The manual or BPM sync'd LFO section includes CV speed control (with limiting), multiple waveform outputs and unprocessed and processed (by the delay and CV inputs) outputs providing a flexible way to provide delayed LFO.

CV In 1 and 2 / Allow -ve: two CV inputs which will be added to the delay envelope, e.g. to include mod wheel or after-touch alongside the delay envelope. Default inputs from the IO Panel are used if no jack connected. The switch on each input determines if negative values are allowed.

Trigger input: used to trigger the delay/fade process, and optionally used for LFO sync.

Delay, Fade and Manual/BPM: control the time of the Delay (0V) and Fade (up to +5V) based on the Manual Switch:

- In MANUAL mode the time is controlled by the knob
- In BPM mode the time is a multiple of the input BPM, between 1/16th and 16x

CV Mixing Stage: mixes the delay, CV1 & CV2; includes options to allow (or not) -ve values, limit the resulting CV to 5V or a custom value.

Speed: controls the speed of the LFO. Can be set manually (in Hz) or as a multiple of the BPM used above. The switch allows the times and LFO to be sync'd to the host BPM separately.

Outputs: the LFO outputs for all 7 waveforms processed by the delay and CVs from the CV Mixing Stage.

Direct LFO Outputs: with unprocessed LFO outputs for all 7 waveforms.

Speed CV, Trim and Sync: allows LFO to sync waveform to the trigger input, and LFO speed to be trimmed/CV controlled (1V=1Hz, with attenuator and x10 option)

New Standard BPM Sync UI: if older preset requires it, legacy version of the UI automatically displayed. See help about Standard External BPM Sync for more detail on the UI as well as the legacy mode.

Host Clock LED on when external mode is using the Host Clock for sync (no jack connected)

BPM CV button: selects if external input jack is 100bpm/V BPM CV or an external clock source. The jack colour and name reflect the mode.

Ext. Clock/BPM CV input: BPM CV or external gate/clock from which the BPM is measured. Allows sync with LFO-driven clock/sequencer.

Slope mode buttons/knob: select slope of the Fade as either linear/log (3 modes). You can also adjust the slope using the knob.

Delay CV Out: outputs just the delay envelope.

Mixed CV Out: outputs the mixed control voltage for use with other modules.

Config button: brings up the configuration pop-up allowing control of the log mode knob behaviour.

CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for Delay and Fade Times

Mid: 1250ms

CLOSE

Sets mid-point for the time knobs log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode



Min and Max Speed settings to control the min and max LFO speed, especially useful alongside use of speed CV

Width: controls the pulse width of the LFO pulse waveform, from 0-100% (with a small minimum).

LFO Waveforms: the LFO provides 7 waveforms: Sine, Triangle, Sawtooth, Ramp, Square, Pulse (with pulse width control) and an "Opposing Ramp" which merges square and triangle with control of the mix – which provides some interesting ways to modulate signals!

Waveform: controls the mix of a square/ramp wave, adjusts from -100% to +100% with the centre point being the square wave or triangle wave depending on the switch above the knob.

Delay and Fade knobs control the time in milliseconds using a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 1250ms unless changed in the global or module defaults (see general help for more).

Drift Generator

The **Drift Generator module** generates very slow-moving (up to 2 hours 30 minutes) single-shot ramps and random drift patterns, typically used to give a patch a “more vintage” feel.

The module has two sections: the main (single shot) Drift Generation section used to generate the “drift” that often occurs with vintage analogue synths getting up to a stable temperature; and a separate S&H/Random Drift section which runs at a very slow frequency and can be used to provide random small amounts of change over time.

The **Drift Generation** section provides a simple ramp (0V to 5V, 5V to 0V) and a 0V to 5V to 0V “triangle” with adjustable shape, all with optional smoothing (exponential and S-shapes).

The **Sample and Hold/Random Drift** section includes a default random source or can be used with an external source, and the same lengths of timing can be used independently or linked to the ramp to add even more drift.

Direct outputs from each section and a mixed output are available. The times can also have more randomness applied with the option to add a percentage random length on each time the ramp or sample and hold are triggered.

Designed to work with the Stretch Tuning, Micro Tuning and A440/Master Tuning modules for tuning drift but can be used with any voltage-controlled modules to introduce small imperfections.

Ramp Time and Secs/Mins Switch: sets the ramp time value for the basic ramp. This can be in seconds or minutes and is between 0.01 and 150, allowing a ramp of up to 2hrs 30mins.

Start Trigger input and manual button resets and starts the ramp process.

Stop Trigger input and manual button stops the ramp process.

Smooth amount: adds an exponential shape to the fixed ramp outputs with the default (0) amount being linear.

Ramp outputs provide the individual outputs for the ramp signal in normal and inverted (around 0V) mode.

Mix Ramp Type and Ramp Amount selects the Ramp Type and the amount (positive or negative, defaults to 100%) to be used for the mixed signal output.

Link mode switch links the random drift to the Ramp so that the S&H processing only runs when a Drift is active.

Sync mode switch sync's the start of the S&H clock to the start trigger from the Drift section.

External input allows an external source to be used for the S&H random drift. If no jack is connected an internal random number is generated. If using an external source be careful to attenuate the value if you want a drift effect.

Drift Gate and End Trigger outputs a gate signal while the drift is active and an end trigger when the drift completes.

Clock Out outputs a trigger signal each time the random drift is started.

Drift amount adds a random amount (which can be +ve or -ve) to the drift time each time a drift is triggered. Set as a percentage.

Shape control allows the “triangle” output to be anything from a ramp down, to a ramp up or any triangle shape between this.

Smooth amount adds an exponential shape to the triangle shaped drift with the default (0) amount being linear.

S&H/Random OnRamp Amount is the amount of random drift added to the mixed output when the Ramp is active.

Mixed Output includes the mix of Ramp and Random Drift

S&H/Random Backgrd Amount is the amount of random drift added to the mix when the Ramp is NOT active.

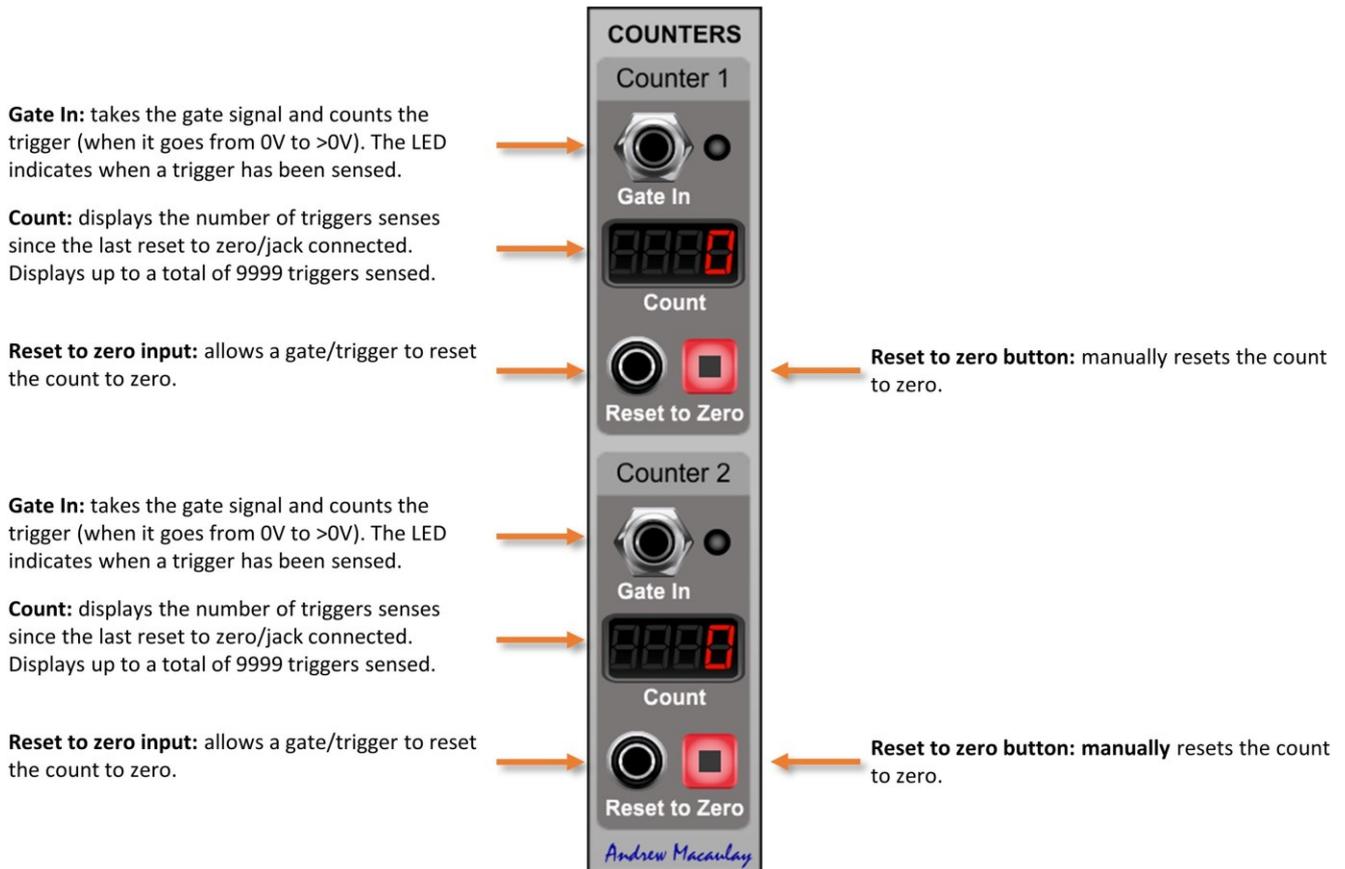
S&H/Random Time and Drift Settings (like the Ramp Time and Drift Amount) sets the sample time for the random drift section in seconds or minutes with the option of a drift amount which is applied to the time for each sample.

Normal S&H/Random Output provides the output of the random drift with no gating (i.e. a background amount).

Gated S&H/Random Output provides the output of the random drift only when the Ramp is active.

Dual Counter

The **Dual Counter module** provides the ability to simply count gates received. This can be useful in when using modules such as the Probability Generator or other random modules to check how many gates are generated. Each of the two sections is identical.

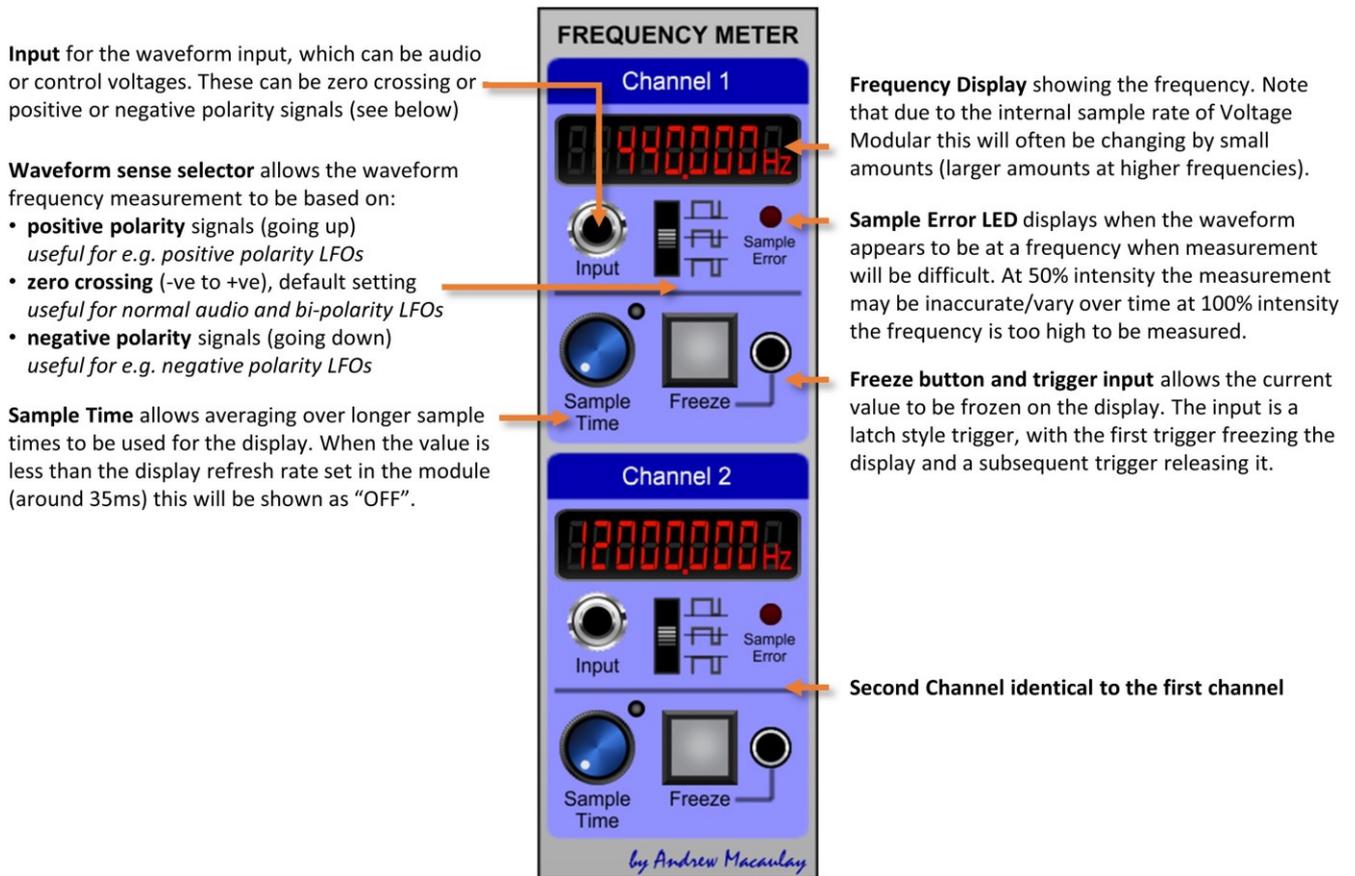


Dual Frequency Meter

The **Dual Frequency Meter module** provides a way to measure the frequency of an input (monophonic) waveform. The measurement supports zero-crossing (waves that run from -ve to +ve) as well as positive and negative polarity waves (measured at 2.5V and -2.5V respectively).

Like the Dual Voltmeter, there is a selectable sample time (averaging the value over that time) which can be set OFF or between around 50ms and 1 second and there is a freeze button and trigger input.

Due to the internal sample rate in Voltage Modular and the measurement approach used, the module works best with simple waveforms (that don't cross zero multiple times) and for lower frequencies – although it can measure frequencies up to around 21kHz.



Dual VCA and Inverter

The **Dual VCA and CV Inverter module** hosts two simple voltage-controlled amplifiers and a voltage inverter. The flexible inverter has control over the input range and the inversion point, useful with envelopes.

The dual independent VCAs can be switched between linear or exponential modes, can allow inversion with negative CVs or have negative CV values meaning 0V, and have optional Zero Crossing sensing to help reduce clicks when using switching or aggressive envelopes.

CV In: is the control voltage to be processed by the Inverter function.

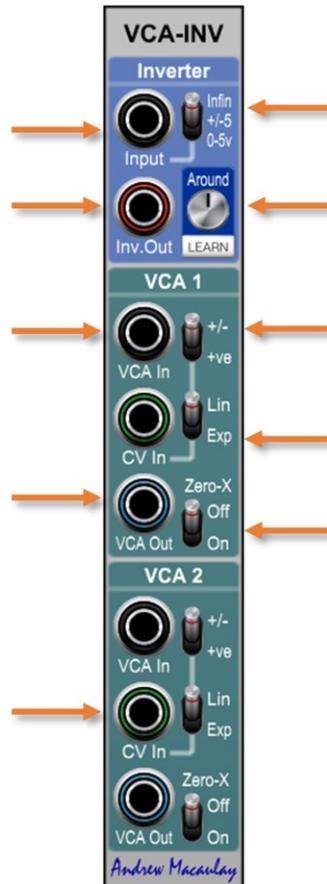
INVERTED CV Out: is simple $5V - \text{the input value}$, which is constrained to between 0 and 5V.

VCA In: is the input for the signal to the voltage-controlled amplifier. This will be attenuated by the value of the CV input.

CV In: is the control voltage used to determine the attenuation of the signal in the VCA. Assumed to be an input of 0-5V.

VCA Out: is the output from the voltage-controlled amplifier, attenuated by the CV input.

VCA 2 section which is independent of and identical in functionality to VCA 1.



Input Range controls how input values are sensed – infinite allows ANY input value to be inverted, +/-5V and 0-5V provide specific ranges. Older presets loaded in the module will automatically set this to 0-5V for backwards compatibility.

Around knob allows the inversion to be around a value other than 0V which can be useful, for example, when inverting envelopes around their Sustain Level. The LEARN button allows this to be set easily.

CV Range switch in +/- mode will invert signal with -ve CVs or in +ve mode will switch off the signal at 0V or -ve values.

Lin/Exp switch selects if VCA driven in a Linear or Exponential (volume) mode.

Zero-X switch selects whether zero-crossing processing is used on the VCA.

Zero-Crossing Processing minimises the clicks that can occur with fast changes in the input CV such as gates or fast attacks/decays by aligning such fast changes with the input signal crossing zero (so avoiding the click).

Dual Voltmeter

The **Dual Voltmeter module** provides the ability to display the voltage of an input, both the instantaneous value or a DC or AC average value. Each of the two sections is identical in features and behaviour.

In instantaneous mode, the measurement is made every 50ms; in DC mode, the meter measures the average of the CV voltage it receives during the measurement period (set by the measurement frequency control); and in AC mode, the meter measures half the peak-to-peak value (again over the measurement period), which is half the difference between the highest voltage and the lowest voltage it receives.

CV In: takes the CV to be measured. The display will cope with up to +/-99.99999 so easily copes with a +/-10V range.

Freeze Button: freezes display at the current value. The button is an on/off type so pressing again "releases" the freeze.

Sample time knob and LED: when in DC or AC mode, this sets the time over which the voltage is sampled/averaged and the display refresh.

Second Channel identical to the first channel

Measurement type switch: selects between the:

- Instantaneous (Inst) mode where the voltage is measured on each screen refresh (every 25ms)
- DC mode, where the value is simply an average of all measurements over the sample time
- AC mode, where the average is based on half the max (+ve) to min (-ve) voltage measured in the sample time

Display Decimal Places: sets number of decimal places to be displayed, from 1 to 5 (default). Also adjusts DP on display to allow for larger voltages.

Freeze Trigger Input: freezes display at current value on the input trigger. The trigger in toggles the freeze button – the first freezes the display, the next one unfreezes, etc.

Example of massive voltages possible when set to 1 decimal place

Eight DC Sources

The **Eight DC Sources module** is a simple high-density module that provides eight independent DC sources each with a coarse -10V to +10V control and a -0.1V to +0.1V fine control. The module can be set into a quantize mode for CV note information or normal mode. In quantize mode, the knobs show the CV note (course) and cents (fine) as well as the voltages.

There is a CV input and learn button that can be applied to individual or all DC source channels, setting the course and fine knobs and, in addition to entering the values in Volts, editing allows of entry of notes (e.g. A#4, C-1, Gb+3) on the coarse knobs, cents (e.g. +100c) on the fine knob and semitone values (e.g. +10semi) on both.

There is a Master Offset/Transpose Knob for +/-1V (+/-1 Octave) shifts for all outputs and the eight outputs are also made available as a Poly Out which can be switched to channels 1-8 or 9-16 (if the polyphony setting allows).

This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Mode can be **Variable Voltage** mode where inputs are in volts and are not quantized, or **Quantize Coarse** mode which sets the inputs to notes, changes the way the Coarse knob behaves and the default displays of values.

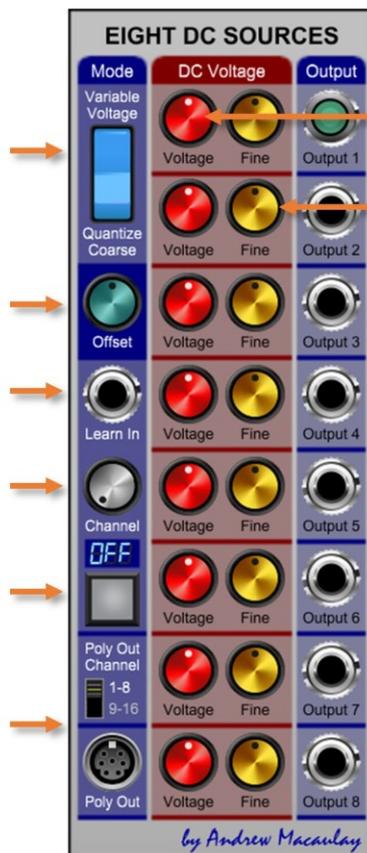
Offset (Transpose) knob applies an additional offset to ALL of the outputs, which can be especially useful for easily transposing the set of notes when in Quantize Coarse mode.

Learn Section provides features to allow the setting of individual or all channels to an input CV (from the **Learn In** jack).

Channel selection can be set to OFF, 1 to 8, or ALL to specify the channel(s) Learn will affect.

Pressing the LEARN button will take the value from the Learn In CV and use it to set the channel(s) selected above. In note mode it will set Coarse to the nearest note with the fine value set for any difference.

Poly Out takes the 8 channels and outputs them as a Poly value. If polyphony is set to more than 8, then the **Poly Out Channel** switch allows you to select whether the channels are output as poly channels 1-8 or as poly channels 9-16. *If less than 8 channels available, it outputs from channel 1 up.*



Coarse voltage (or note) setting which will set exact notes in Quantized mode. Direct Input in either mode can be volts or as notes using the format A#3, Gb-2, C4, etc.

Fine voltage setting which displays Cents in Quantized modes. Direct input for this knob can be in volts, semitones (1s, 1semi, etc.) or cents (1c, 1cent).

CV Output of the resulting DC signal. Each channel is completely independent.

In **Quantize Coarse (Notes)** mode the module shows the following labels, to make it clearer what the inputs are:



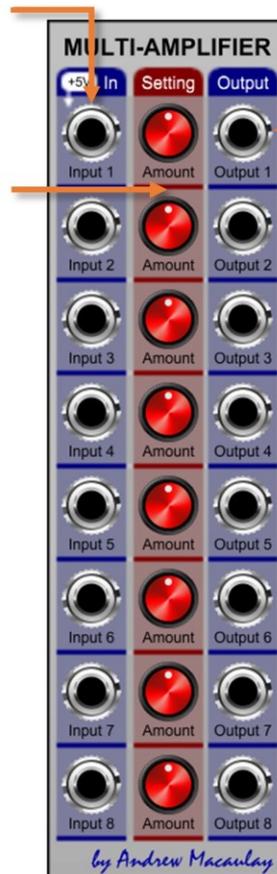
Eight Mono Amplifiers

The **Eight Mono Amplifiers module** is a simple, high-density module with eight independent monophonic channels of manually controlled attenuverters/amplifiers, with each channel having a mono signal input, an attenuation knob from -200% to +200% and a mono signal output.

This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Mono Input for the audio or CV to be processed. If no jack is connected a +5V DC signal is automatically used so that the setting knob can be used to provide a variable DC voltage out.

Amount knob which can be set between -200% and +200% allowing inversion and x2 amplification of the signal as well as attenuation.



Mono Output of the resulting signal. Each channel is completely independent.

Eight Mono Gated Switches

The **Eight Mono Gated Switches module** is a simple, high-density module with eight independent mono channels of voltage-controlled switches, with each channel having a signal input, a gate/trigger input with latching switch and options for gate (normal or inverted) and trigger (latched mode) behaviours, and a signal output with optional smoothing (de-clicking or short fade) for audio signal switching.

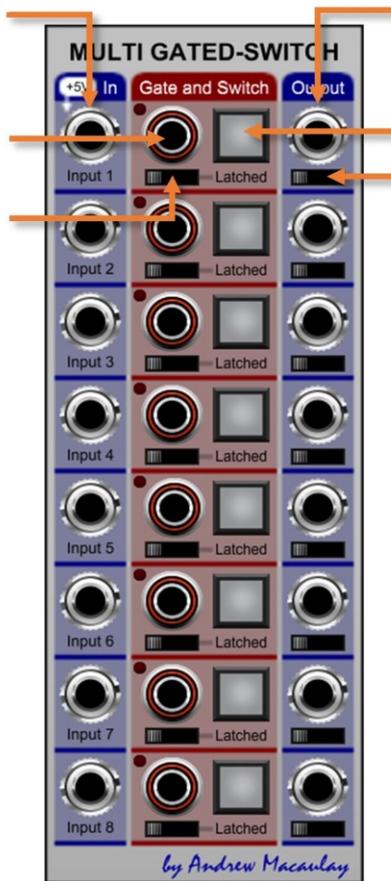
This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Mono Input for the audio or CV to be processed. If no jack is connected a +5V DC signal is used.

Gate/Trigger Input (works with switch below) allows a gate signal to be used to control the state of the switch or a trigger signal to switch between latched states.

Input Mode switch has three modes for the input above:

- **Normal Gate** mode (default) where gate signal being on will pass the input to the output;
- **Inverted Gate** mode, where the gate signal being off passes the input and gate signal being on blocks the signal;
- **Trigger/Latched** mode, where a trigger signal or start of gate signal will change the state of the switch between on and off. This mode also enables the manual switch.



Mono Output of the resulting signal. Each channel is completely independent.

Latch Mode Indicator and Manual Switch shows the state of the switch and, when in latched mode, allows manual switching.

Smoothing Switch allows smoothing to be applied to the switching:

- **Normal** mode is a pure switch useful for control voltages where there is no smoothing applied – with audio this can cause clicks on the switching;
- **De-Clicked** mode where 2ms smoothing is applied on each change of state, typically not audible and removes the worst clicks when switching audio;
- **Faded** mode where 10ms smoothing is applied, which is typically heard as a short fade on audio.

Eight Mono VCAs

The **Eight Mono VCAs module** is a simple, high-density module with eight independent mono channels of voltage-controlled amplifiers (VCAs), with each channel having a signal input, a CV input with a fixed response of 0V=0% and 5V=100%, options for linear or exponential response to the CV and a mono signal output.

This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Mono Input for the audio or CV to be processed

Mono VCA control voltage input which takes 5V as 100% passthrough and which allows values greater than 5V for amplification and negative values for voltage-controlled inversion.



Linear or Exponential mode switch allowing the VCA input to be used in a linear mode or multiplied by itself (5V=100% in both cases).

Mono Output of the resulting signal. Each channel is completely independent.

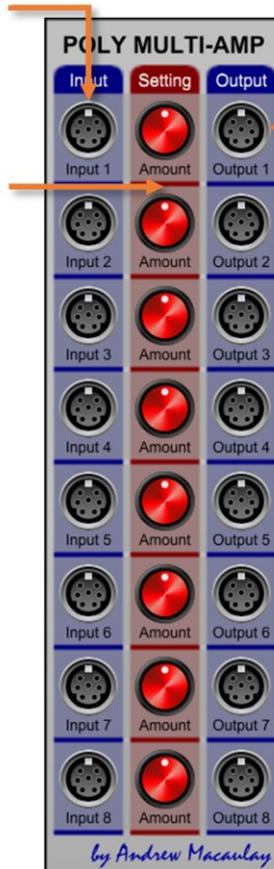
Eight Poly Amplifiers

The **Eight Poly Amplifiers module** is a simple, high-density module with eight independent polyphonic channels of manually controlled attenuverters/amplifiers, with each channel having a poly signal input, an attenuation knob from -200% to +200% and a poly signal output.

This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Poly Input for the audio or CV to be processed. No default input is provided for the Poly version.

Amount knob which can be set between -200% and +200% allowing inversion and x2 amplification of the signal as well as attenuation.



Poly Output of the resulting signal. Each channel is completely independent.

Eight Poly Gated Switches

The **Eight Poly Gated Switches module** is a simple, high-density module with eight independent poly channels of voltage-controlled switches, with each channel having a signal input, a gate/trigger input with latching switch and options for gate (normal or inverted) and trigger (latched mode) behaviours, and a signal output with optional smoothing (de-clicking or short fade) for audio signal switching.

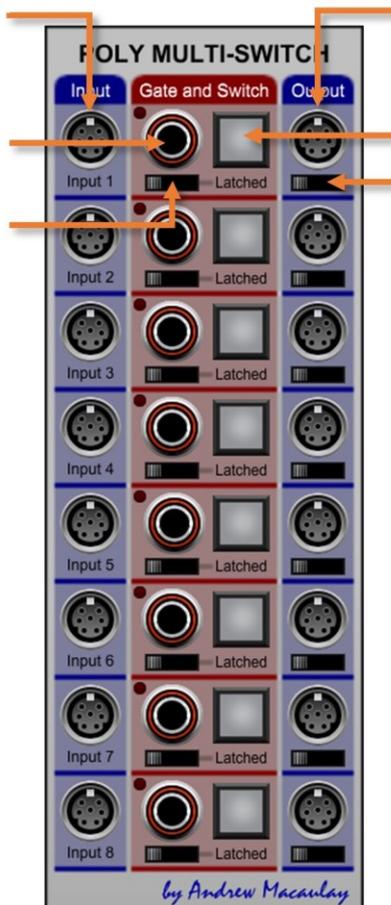
This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Poly Input for the audio or CV to be processed. If no jack is connected a +5V DC signal is used.

Gate/Trigger Input (works with switch below) allows a gate signal to be used to control the state of the switch or a trigger signal to switch between latched states.

Input Mode switch has three modes for the input above:

- **Normal Gate** mode (default) where gate signal being on will pass the input to the output;
- **Inverted Gate** mode, where the gate signal being off passed the input and gate signal being on blocks the signal;
- **Trigger/Latched** mode, where a trigger signal or start of gate signal will change the state of the switch between on and off. This mode also enables the manual switch.



Poly Output of the resulting signal. Each channel is completely independent.

Latch Mode Indicator and Manual Switch shows the state of the switch and, when in latched mode, allows manual switching.

Smoothing Switch allows smoothing to be applied to the switching:

- **Normal** mode is a pure switch useful for control voltages where there is no smoothing applied – with audio this can cause clicks on the switching;
- **De-Clicked** mode where 2ms smoothing is applied on each change of state, typically not audible are removes the worst clicks when switching audio;
- **Faded** mode where 10ms smoothing is applied, which is typically heard as a short fade on audio.

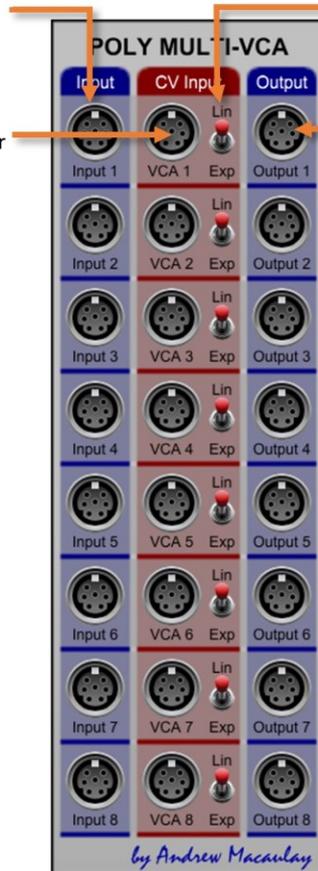
Eight Poly VCAs

The **Eight Poly VCAs module** is a simple, high-density module with eight independent poly channels of voltage-controlled amplifiers (VCAs), with each channel having a signal input, a CV input with a fixed response of 0V=0% and 5V=100%, options for linear or exponential response to the CV and a poly signal output.

This module is part of a suite of eight-channel monophonic and polyphonic modules designed for simple actions on signals or control voltages.

Poly Input for the audio or CV to be processed

Poly VCA control voltage input which takes 5V as 100% passthrough and which allows values greater than 5V for amplification and negative values for voltage-controlled inversion.



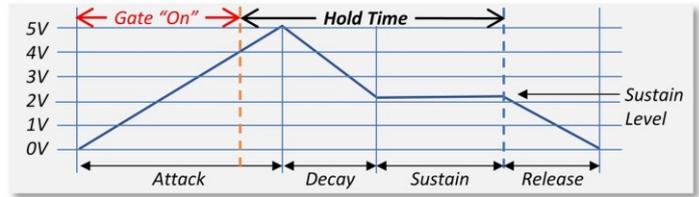
Linear or Exponential mode switch allowing the VCA input to be used in a linear mode or multiplied by itself (5V=100% in both cases).

Poly Output of the resulting signal. Each channel is completely independent.

ENV-20 EG2 Envelope

A small form-factor ADSR envelope generator inspired by the Korg MS-20 EG2 envelope generator. This module supports legato and retrigger modes for the hold time, normal or “Fast” Attack shapes and the optional linking of Decay time to Release time, supports options for the mid-point of the time controls from the “options” cog-wheel button and defaults the Gate In to the I/O Panel Gate if no jack is connected, for simpler patching.

The **ENV-20 EG2 Envelope** offers an alternate ADSR envelope inspired by the Korg MS-20 EG2 envelope with its unique Hold behaviour. The Hold time on this module only starts AFTER the gated signal has been released, extending the envelope sustain by the Hold time.



Gate input: the key input for the envelope. The gate going on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, defaults to Gate In on the Input Panel.

Hold time: sets the time that the envelope will stay running AFTER the gate is released – effectively this Hold is added to the end of the gate.

Attack time: sets the time it will take after the Delay for the envelope output to go from 0V to 5V.

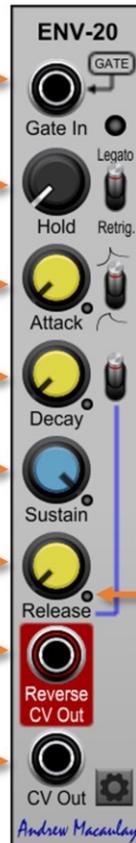
Decay time: sets the time it takes for the envelope to go from the Hold Level down to the Sustain Level.

Sustain level: the level which is output during sustain phase, until the “gate” is released back to off AND after any additional Hold has completed.

Release time: sets the time it takes for the envelope to return to zero after the end of the Sustain phase.

CV Rev Out is also modelled on the Korg MS-20 EG2, with the envelope inverted BUT with 0V set to the Sustain level.

CV Out is the output for the envelope, with values between 0V (off/delay stage) and 5V (peak).



Legato/Retrig mode determines if the envelope will always complete the Hold or retrigger.

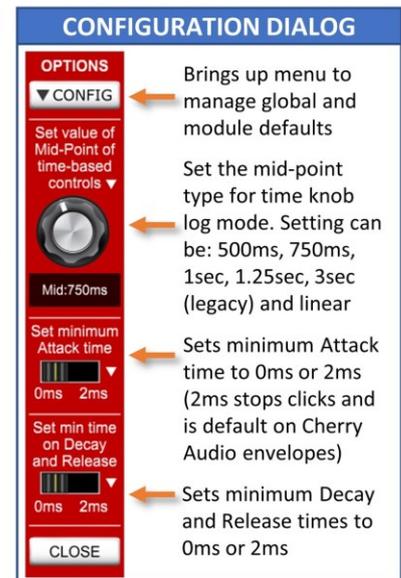
There are two retrigger modes: “soft” (Retrigger I) and “hard” (Retrigger II). The soft retrigger reflects the original behaviour and restarts the envelope from the current value, the hard retrigger restarts from 0V.

Fast Attack switch changes attack from a slow start (exponential) to a “fast start” (logarithmic) shape

Decay Time switch, locks Decay time to Release time. When this is on, the Decay knob becomes disabled.

Status LEDs: show stage envelope is currently at.

Config: opens configuration dialog, see →



All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

Exponent Shaper

The **Exponent Shaper module** processes voltage signals with a variable linear to exponential control, which is also voltage-controlled. The exponential, non-linear settings are anything from very subtle to quite extreme, so this can be used for audio signals where it changes the timbre of the waveform, as well as control voltages and modulation. The module has two independent channels.

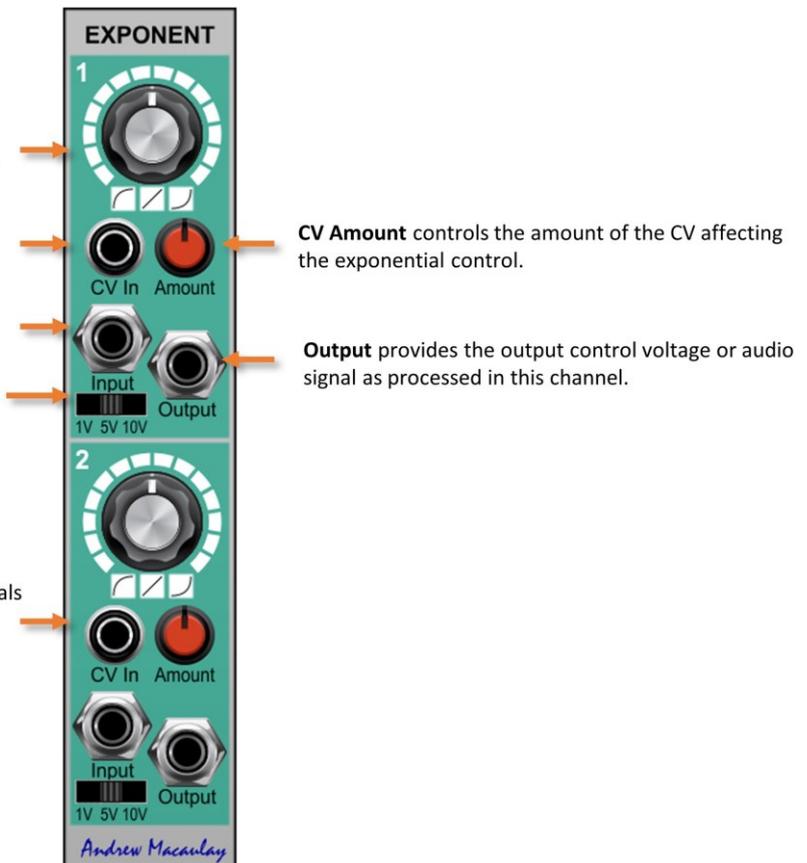
Exponent shape: controls the amount of exponential factor used for the shaping. The larger the amount in either direction, the more pronounced it will become. The mid-point (0) is linear, the extreme anti-clockwise position turns a sine wave into almost a square wave.

CV Input to control the exponent shape. Allows the exponential slope to be controlled by modulation.

Input the CV or audio voltage to be processed by the exponential processor.

Input Range specifies whether the CV or audio input (above) is +/-1V, +/-5V or +/-10V which is needed for the exponential calculations to work as expected. However, you can get some quite interesting audio effects/distortions by using an audio input of +/-5V and setting this to e.g. +/-1V.

A second identical channel allowing two separate signals to be processed at the same time in this module.

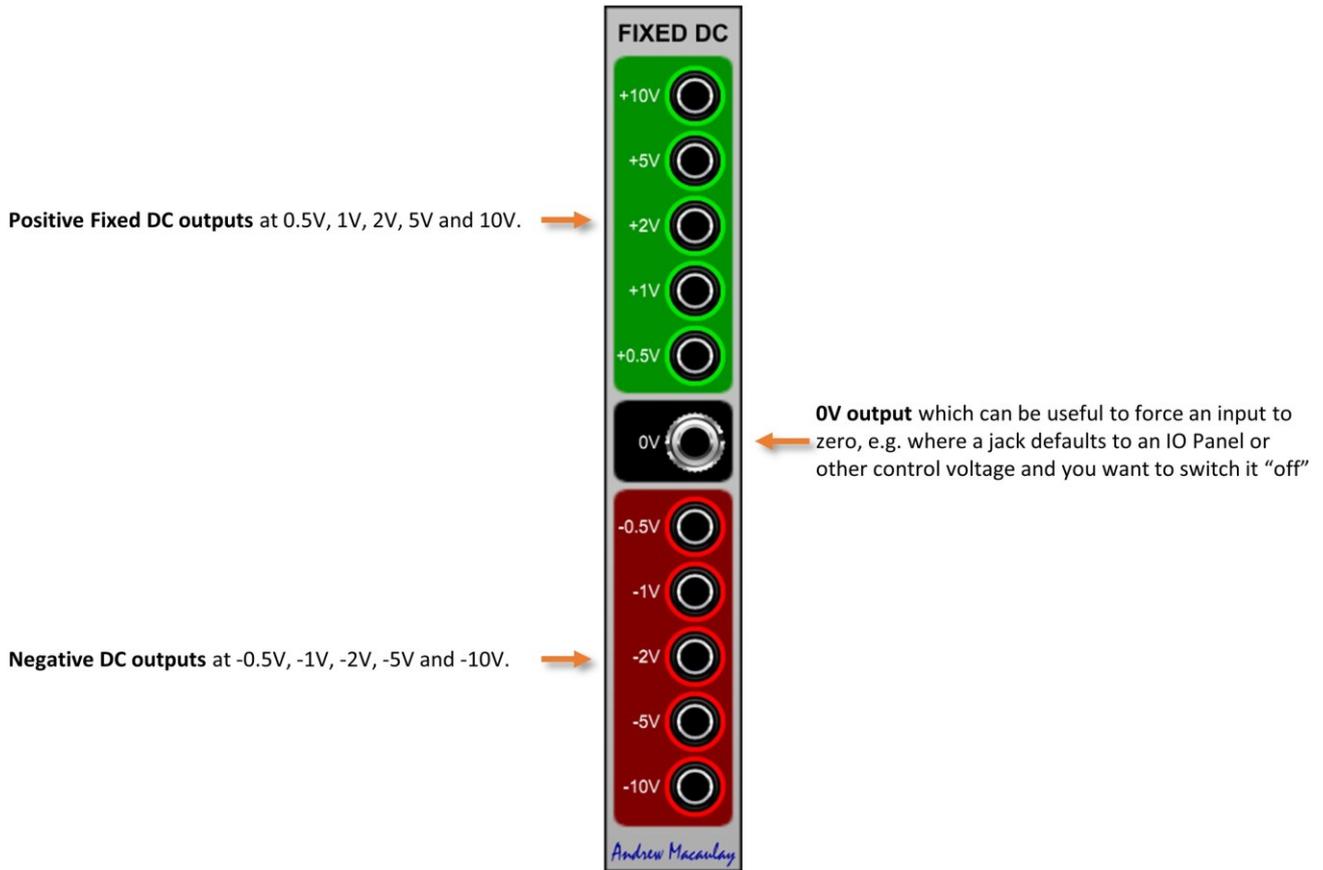


CV Amount controls the amount of the CV affecting the exponential control.

Output provides the output control voltage or audio signal as processed in this channel.

Fixed DC Voltages

The **Fixed DC Voltages module** is the simplest of modules which simply outputs fixed DC voltages at values between -10V and +10V for use in Voltage Modular. This can be useful when you simply need a fixed e.g. 5V DC voltage for use in a switch or other piece of logic. It also includes a 0V output which can be useful if you need to tie an input to 0V where, for example, the input uses the I/O Panel if no jack is connected.



Frequency to CV

The **Frequency to CV module** allows measurement (using similar approaches to the Frequency Meter) of input waveform frequencies and output of as a control voltage.

The module takes an input waveform at audio or low frequencies (working best with simpler waveforms), calculates the frequency of the input using selectable zero-crossing, positive or negative polarity sensing and outputs the frequency as a control voltage in multiple forms:

- Frequency CV outputs as 1V/OCT “Pitch CV” for use with oscillators and other audio modules, with options for 0V to be C0, C1 (default) or C2 and as Hz/V with settings for the output to be 1V/10Hz, 1V/100Hz or 1V/1kHz;
- BPM CV using the Andrew Macaulay Modules standard of 1V=100bpm, which can be useful to sync LFO inputs or gates with low frequency sources; and
- WaveTime CV at 10ms/V, 100ms/V or 1sec/V allowing control of audio slew rates on the Slew Processor or envelope times on the Voltage-Controlled Envelope. The WaveTime CV also has settings for full cycle, half-cycle or quarter-cycle timing and divide by 2 using the same options as the Pitch CV to Wavetime module.

Due to the internal sample rate and the measurement approach, frequency measurement works up to around 21kHz and there is some small amount of drift in the measured values (which can be more noticeable at higher frequencies), which can be reduced by the included optional smoothing of up to 10ms on the frequency measurement.

Input for the waveform input, which can be audio or control voltages. These can be zero crossing or positive or negative polarity signals (see below)

Sample Error LED displays when the input appears to be at a frequency where measurement will be difficult or inaccurate. At 50% intensity the measurement may be inaccurate, and at 100% intensity the frequency is too high to be measured.

Waveform sense selector allows the waveform frequency measurement to be based on:

- **positive polarity** signals (going up) *useful for e.g. positive polarity LFOs*
- **zero crossing** (-ve to +ve), default setting *useful for normal audio and bi-polarity LFOs*
- **negative polarity** signals (going down) *useful for e.g. negative polarity LFOs*

Trim knob allows a trim of -50% to +50% on the signal. This is specifically used when the module is driving the Slew Processor and allows timings to be further matched to specific waveforms.

Div.2 switch simply divides the output by 2 to make it easier to use with the Slew Processor where the CV Inputs for Slew Up and Slew Down stages have a maximum setting of 200% (fully clockwise).

Cycle Time CV Output Scale (1 Volt/) switch selects the “per Volt” time output, which can be 10ms/V, 100ms/V or 1sec/V to align with settings on e.g. the Slew Processor, which can be set to 10ms/V or 1sec/V.

1V/OCT Offset switch selects the octave that to be represented by 0V on the output. The default setting of C1 is when A440 represents A4.

Hertz Output Scale switch selects the “per Volt” output for the Hz/V connection, with options for 1V=10Hz, 1V=100Hz and 1V=1kHz.



Sync Out provides a sync signal that can be used for the hard sync of audio oscillators or reset of LFOs, noting that the frequency fluctuations due to the internal sample rate might make this sub-optimal for hard sync of audio at higher frequencies.

Smooth amount allows smoothing of the measured frequency to remove some of the “noise” resulting from internal sampling constraints. If this value is set too high, it may result in short glides between notes if used on audio.

Cycle Time Output as set by the 1Volt/ms, Cycles and Div.2 switches – which can be used on e.g. the Slew Processor to drive the slew time on varying oscillator signals to change waveforms.

Cycle switch allows selection of the timing to be based on the Full Cycle, Half Cycle or Quarter Cycle. *When used to drive the Slew Processor, the most appropriate setting is often the Quarter Cycle.*

1V/OCT Output provides a standard CV that can drive audio oscillators

100bpm/V Output using the “standard” BPM CV used across many of Andrew Macaulay’s Modules. *Only really useful for sensing timing from LFOs.*

Hz/V Output which may be useful for driving LFOs and other modules.

Gate Length Processor (Re-Gater)

The **Gate Length Processor (Re-Gater) module** allows you to change the gate width of a clock, trigger or gate signal. The module supports independent monophonic and polyphonic signal paths, with the mono input processed and output on the mono output and the poly input processed and output on the poly output. At the very least can be used to take a trigger and generate a gate, but the options allow this module to be used in many more scenarios.

The gate length can be manually set in milliseconds, controlled by CV or set as a divider/multiplier of the host (DAW) or external (gated) BPM. The module also includes setting of the mid-point of the log-scale speed dial (from the “options” cog-wheel button) and a re-trigger option.

External Clock Input: takes a gate, trigger or clock input and derives the speed (in BPM) of the clock, which can then used to control the length of the new gate output.

Length knob: controls the “length” of the output gate signal, and works in two ways:

- In TIME mode the length is directly controlled by the knob
- In HOST mode the speed is a multiple or division of the input BPM, between 1/16th and 16x, which can be from the Host/DAW or, if the External Clock Input is connected, from the external clock.

When the mode is changed, the display of the value is changed, with sync mode showing the factor as well as the base time.

Editing the value directly also adjusts, allowing for input of the simple number in BPM or the factor using “x” or “” for multiples and “/” for division.*

Time/Host switch: selects whether the Length is manually controlled or uses a multiple/division of the Host or External Clock (derived from the BPM).

Fine adjustment control: allows secondary control of the gate time, so that if you a gate to be just short of the whole time from the host-based clock, you can achieve this.

Mono and Poly Gate Outputs output gate (0-5V) signals based on the gate/trigger in and the gate length as set above – for the mono and poly inputs.



Mono and Poly Gate inputs: the trigger generated from the gate input (going above 2.5V) or the specific trigger inputs start the gate for the Mono and Poly signal paths (mono-mono and poly-poly only)

External Clock Input display: shows the triggers from the external clock input, if connected.

Re-Trig: switch allows the gate to be triggered again while still running.

Config: opens configuration dialog, see →



Brings up menu to manage global and module defaults

Set mid-point type for the gate length knob log mode to be 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum gate time to 0ms or 2ms

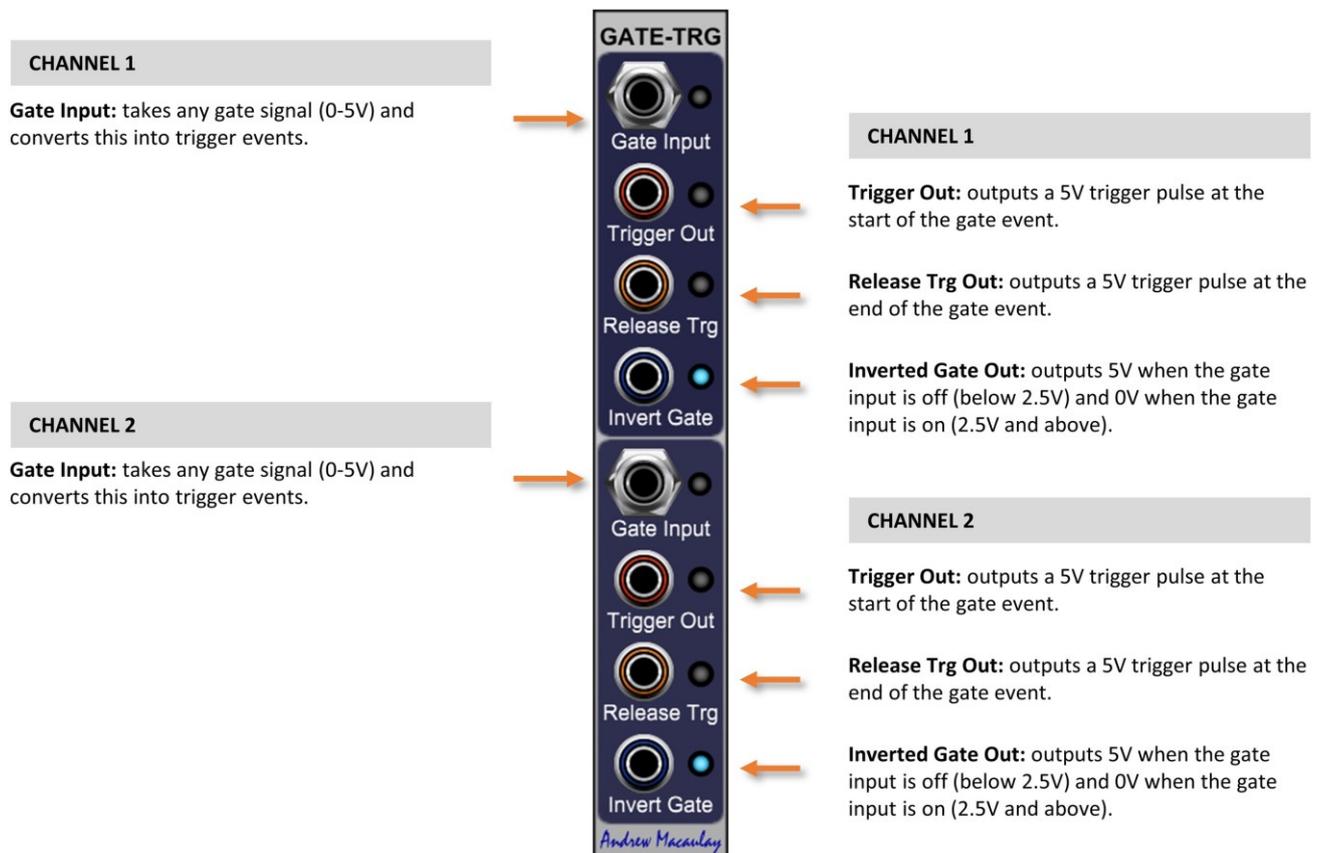
Gate Width CV calibration selects the CV in to be 5V=12s (legacy) or 1V = 10ms, 100ms or 1 second.

Gate Width CV input and control: allows a control voltage to adjust the length of the gate, with a control that takes -100% to +100% of the CV.

The length knob controls the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

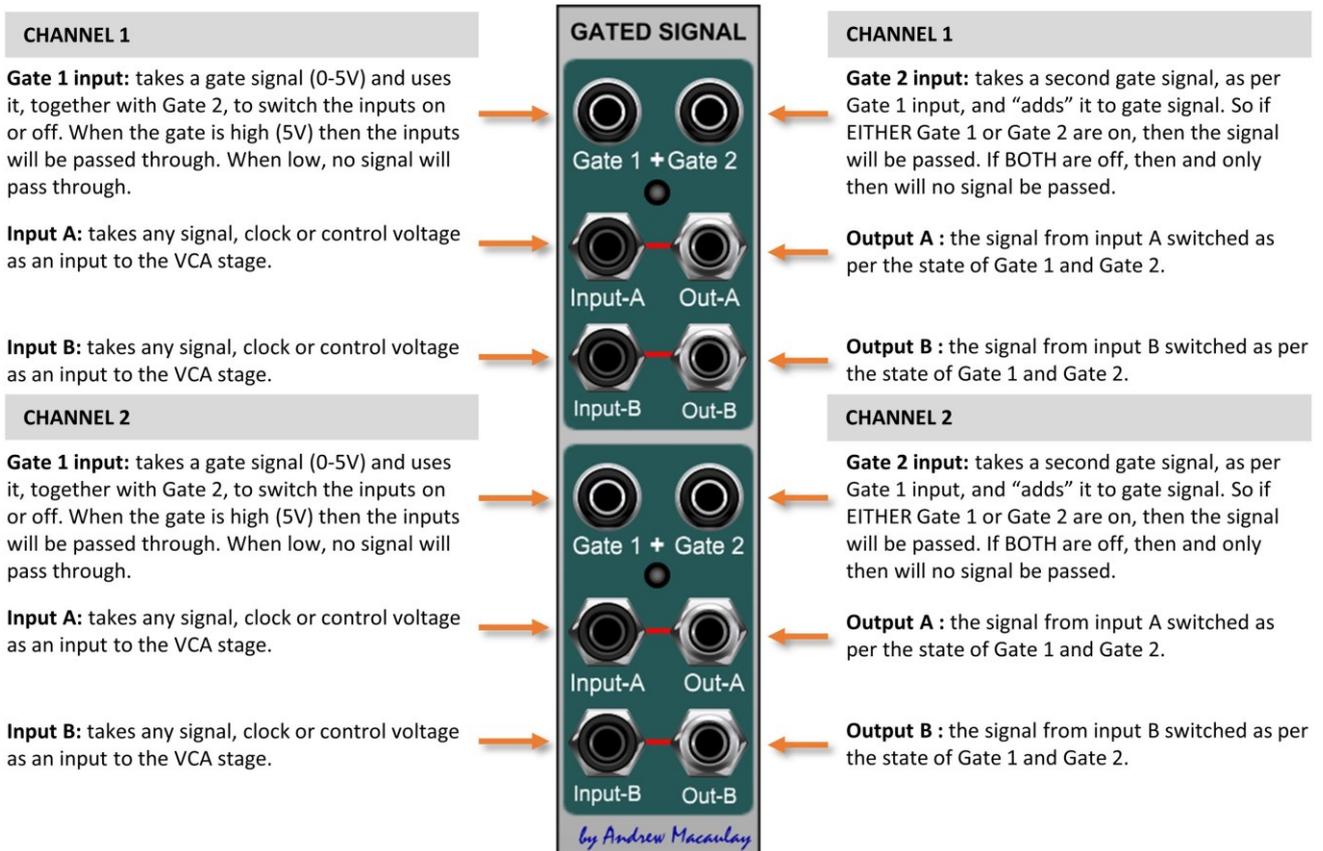
Gate to Trigger

The **Gate to Trigger module** provides the ability to convert a Gate signal into a Trigger and a Release Trigger. The trigger is the leading edge of the gate, and the release trigger is the trailing edge. The module also provides an Inverted Gate output.



Gated Signals

The **Gated Signal module** provides the ability to use a gated input to switch on/off the signal for two independent channels, effectively a simple gated VCA which can be used for audio, clock and control voltage signals. Each channel has two gate inputs jacks (added) and two independent gated input/output signal paths.



I/O Bus Plus

The **IO Bus Plus module** takes the Gate, Trigger, Note and Sustain CV inputs from the Voltage Modular I/O Panel (or from external signals) to generate Legato (Single Trigger) and Retrigger (Multi-Trigger) outputs with and without Sustain as well as providing a keyboard CV with Pitch Bend with optional limiting of the bend amount. The module also provides a trigger when the Host (stand-alone or DAW hosted) BPM changes and a 1V/100bpm CV output of the host tempo.

INPUTS allows overriding the default inputs for Pitch, Gate, Trigger, Sustain and Pitch Bend signals. Note that Pitch, Gate and Trigger should be from the same basic source for the algorithm to work as e.g. Pitch changes as well as Triggers are used to identify some retrigger scenarios.

Sustain Legato Mode switch selects behaviour of the legator sustain output:

- **Pass Through (legacy):** legato is active during sustain but MULTI/SINGLE gate setting passed through (like the Sustain Processor module) when not sustained;
- **Pure Legato** where the output is legato both with and without the Sustain active.

HOST TEMPO section exposes additional host tempo based CVs and triggers.

1V per 100bpm Tempo Output provides a CV (1V/100bpm) output for the current host tempo.

Tempo Change trigger out sends a trigger when the host tempo (stand-alone or DAW) changes.



NORMAL GATE section extends the normal gates, without the Sustain feature.

Legato Output: provides a +5V gate which is only triggered when a key has been released.

Retrigger Output: provides a +5V gate which is retriggered on each key press, irrespective of whether the previous key was released.

SUSTAIN GATE section extends the normal gates reflecting the status of the Sustain input.

Legato Output provides a sustained gate signal where the sustain overrides any retriggering of the notes or provides a legato plus sustain as set with the Legato Mode switch (to left).

Retrigger Output provides a sustained gate signal where any Trigger input will retrigger the notes during sustain.

PITCH+BEND section extends the normal outputs by combining PITCH and PITCH BEND signals with control over the maximum bend amount.

Pitch With Bend Output: provides the 1V/OCT pitch output with the bend applied, subject to the limits set by the Bend Limit knob.

Bend Limit Knob limits the pitch bend amount to between ± 1 semitone and ± 2 octaves, with default of ± 1 octave. The 0 position passes the pitch bend wheel through giving a maximum pitch bend of 1V/OCT resulting in ± 5 octaves.

Legato Processor

The **Legato Processor module** takes inputs from the keyboard, DAW or sequencer and outputs the gates from them in Legato (“single” mode), Retrigger (“multi” mode) as well as the trigger. This can be used so that parts of a patch respond to every note pressed whilst others only (re)trigger on the first note of a set of notes played in legato style.

With options that support Sequencers, and a voltage-controlled switchable Legato/Retrigger output allowing the use of e.g. a sustain pedal to select between legato and retriggered or having a sequence with some steps legato and others retriggering, this module can be used to generate interesting live and sequenced performances.

The inputs default to the panel connections to simplify patching - note that if ANY jack is connected to the inputs, then they ALL must be setup manually to ensure consistent behaviours.

The fundamental approach in the module is that, when a note value changes there is always a retrigger generated (and the multi-trigger can be ignored for the legato output) and when the note does not change and the gate ends, then that is the end of the legato sequence.



Gate Input: takes the Gate output from a keyboard, DAW or sequencer. If connecting to the Voltage Modular CV Outs, or a MIDI module, this can be in SINGLE or MULTI mode. Defaults to **GATE** if not connected.

Trigger Input: takes the Trigger output from the same source as the Gate above. Defaults to **TRIG**.

Pitch Input: takes the Pitch (1V/Oct) CV output from the same source as the Gate Input above. Defaults to **PITCH** from panel if not connected.

LEDs: shows if using the Panels input, and if the Jacks needed (Red) or Jacks connected fully (Blue). Either all from Panel or all must be manually setup.

Legato Output: provides a +5 gate which is only triggered when a key has been released.

Retrigger Output: provides a +5 gate which is retriggered on each key press, irrespective of whether the previous key was released.

Trigger Out: provides a +5V trigger signal for each retrigger point.

Trigger Oms/2ms switch: sets the output triggers to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The  button allows you to manage these defaults.

Inputs: the module needs **ALL three** of these inputs connected (from the same device) to be able to work out the gates/triggers. See images to the left for examples of the sources.



Normal or Sequence Mode: when set to normal mode, the gate off is used to end a legato; when in Sequence (ignore gate) mode, the legato is not ended by the end of the gate. When used in the Sequence mode you should also connect a Stop In to end a legato session.

Stop In: allows a trigger to end the legato, forcing an Gate End signal even when in Sequence mode. Typically you will set this up to use the same trigger as used to stop the sequencer.

Run In: provides a trigger to start the running of the legato processor. Typically you will connect this to Sequencer Start trigger, along with the Stop In, to control legato when used in Sequencer Mode.

Switch In: takes a gate (0-5V) to determine the mode of the Legato/Retrigger switch. If connected, this overrides the switch. Values < 2.5V are “off” and >= 2.5V are “on”.

Std/Inv mode: sets whether gate on = Retrigger (Std) or gate on = Legato (Inv).

Legato/Retrigger mode: selects whether Gate Out will be outputting the Legato or the Retrigger gate.

Gate Out: outputs the gate (0-5V) signal for either Legato or Retrigger based on the switches and CV settings – allowing swapping of legato to retrigger e.g. by sequencer or by footswitch.

Manual Triggers

The **Manual Triggers module** provides four separate manual trigger buttons, with the ability to latch the switches with their current state saved in presets. These four trigger buttons can be used to control scenarios such as multiple sequencers, envelopes or other gated modules.

Trigger Button: has two behaviours, depending on the Latched mode switch:

- in unlatched mode, pressing this button generates a gate (+5V) signal for the duration the button is pressed. Releasing it resets the output to 0V;
- in latched mode, pressing the button toggles between On and Off state.



Gate Out: outputs 5V when the gate is "on" or 0V when the gate is "off".

Trigger Out: outputs a 5V trigger pulse when the trigger button is pushed.

Latched switch: switches from normal to latched operation. The LED is on if the button is set to latched mode.

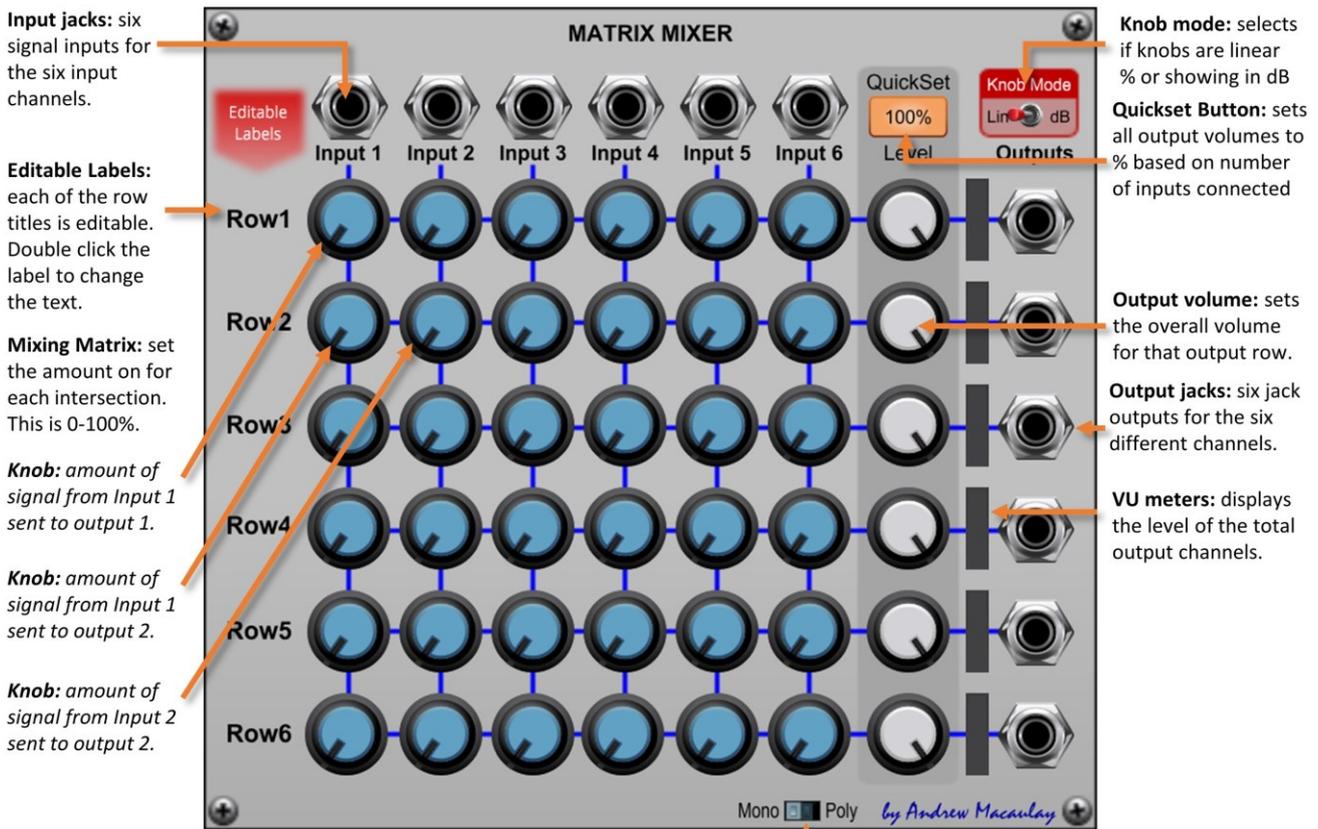
There are four identical buttons and outputs in this module.

Matrix Mixer (6x6)

The **Matrix Mixer module** allows you to mix 6 inputs to 6 outputs (mono OR poly) in a matrix form, so you can for example send input 1 and input 3 to output 1, input 1 and input 2 and input 5 to output 2, etc. The signal can be Control Voltages or Audio Signals. Mixing uses a simple linear 0-100% mix. This module is useful for routing and other mixing duties, for example, taking the outputs from each VCO and mixing them differently into different signal chains such as filters, etc.

To assist with setting up the mix, a “QuickSet” button sets the output levels based on the number of connected inputs (so 3 jacks connected will set all output levels to 33%) and all the controls can be set to be used as linear (percentage-based) controls or as dB controls.

The module can be used for either polyphonic or monophonic signals. A switch allows changing between the modes when there are no signal input or output jacks connected.



Mono/Poly switch: select this switch to select whether the module is working is Mono mode or Poly mode (partially shown below). Note that you cannot change mode if there is any signal jack connected and a tooltip is displayed for the switch if this is the case.

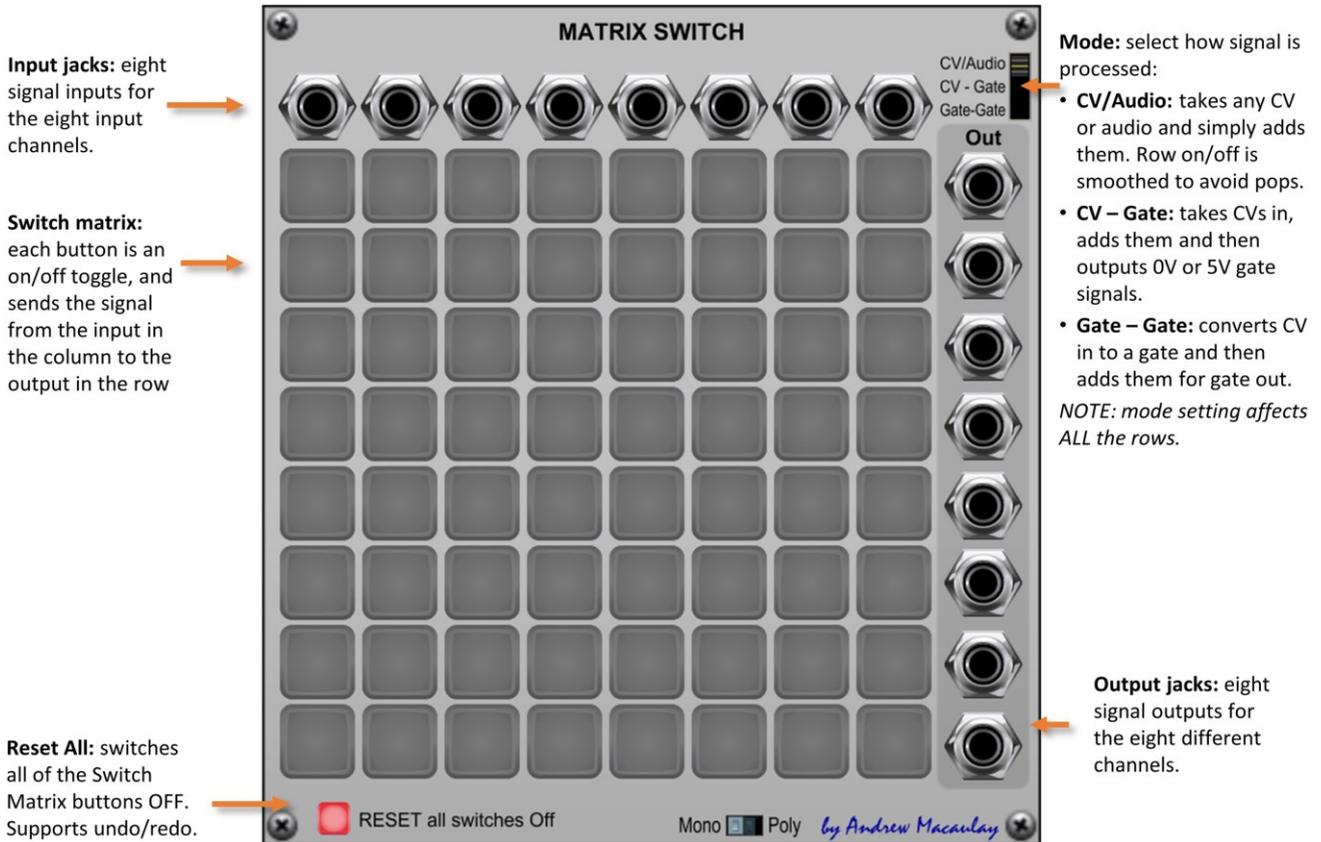


Matrix Switch (8x8)

The **Matrix Switch module** allows you to switch 8 inputs to 8 outputs (mono OR poly) in a matrix form, so you can for example send input 1 and input 3 to output 1, input 1 and input 2 and input 5 to output 2, etc. The signal can be Control Voltages, clocks or Audio Signals.

There are options to set the switching to specifically support Audio/CV inputs where the on/off switches are smoothed to remove ‘pops’ if used whilst playing audio, a CV Input to Gate Out mode which adds values together to then output a 5V/0V gate signal, and the Gate In/Gate Out mode which converts the input on all inputs to gates (<2.5V is “off”, >= 2.5V is “on”) before adding them together.

The module can be used for either polyphonic or monophonic signals. A switch allows changing between the modes when there are no signal input or output jacks connected.

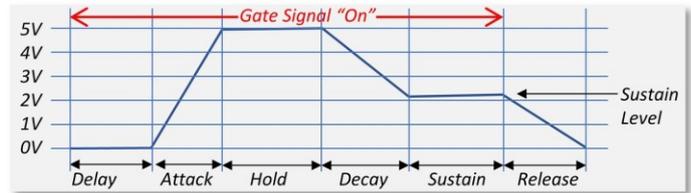


Micro Envelope

A simple Delay, Attack, Hold, Decay, Sustain, Release envelope in a tiny module, ideal when you want to minimise the space use, for example when you want to control the Additive Oscillator with multiple envelopes.

Gate Input defaults to Panel Gate if no jack connected for simpler patching, allows normal or “Fast” Attack shapes, and has the option to link the Decay time to the Release time. Supports setting the mid-point of the log-scale time controls from the “options” cog-wheel button.

The **Micro Envelope module** provides simple but flexible DAHDSR envelope in a very small form-factor. This was originally designed to work with the Additive Oscillator to provide individual envelopes for each of the eight partials.



Gate input: the key input for the envelope. The gate going on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, uses the GATE from the Panel Inputs.

Delay time: sets a delay after the trigger/gate goes on, where the output remains at zero before the envelope starts.

Attack time: sets the time it will take after the Delay for the envelope output to go from 0V to 5V.

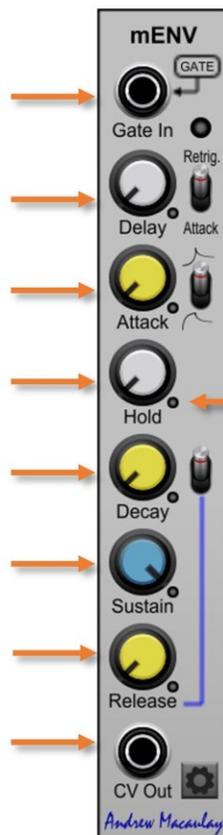
Hold time: sets the time the envelope stays at the full amount of 5V after the Attack phase finishes.

Decay time: sets the time it takes for the envelope to go from the Hold Level down to the Sustain Level.

Sustain level: the level which is output during sustain phase, until the “gate” is released back to off.

Release time: sets the time it takes for the envelope to return to zero after the end of the Sustain phase.

CV Out is the output for the envelope, with values between 0V (off/delay stage) and 5V (hold stage).



Delay Retrigger Mode switch allows the retrigger to start the Delay stage (default) or go straight to the Attack stage.

Fast Attack switch changes attack from a slow start (exponential) to a “fast start” (logarithmic) shape

Status LEDs: show stage envelope is currently at.

Decay Time switch, locks Decay time to Release time. When this is on, the Decay knob becomes disabled.

Config: opens configuration dialog, see →

CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls ▼

Mid:750ms

Set minimum Attack time

0ms 2ms

Set min time on Decay and Release

0ms 2ms

CLOSE

Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum Attack time to 0ms or 2ms (2ms stops clicks and is default on Cherry Audio envelopes)

Sets minimum Decay and Release times to 0ms or 2ms

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

Micro Envelope VCA

The **Micro Envelope VCA module** provides simple, small form-factor Attack, Hold, Decay, Sustain, Release (AHDSR) envelope (with an Envelope CV Output) teamed up with a Voltage Controlled Amplifier. This can be used effectively when you want to control multiple waveform outputs from the oscillators by individual envelopes.

The envelope section includes Fast and Normal attack curves and the Decay Time sync switch to lock the Decay and Release Times. The envelope section fully supports setting the mid-point of the log-scale time controls from the “options” cog-wheel button.

The VCA section can be controlled by the envelope in Linear or Exponent mode and has optional Zero Crossing processing for the VCA to reduce clicks when using aggressive envelopes.

Gate input: the key input for the envelope. The gate on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, the module uses the GATE signal from the Panel Inputs.

VCA In is signal input to be controlled by the envelope, can be an audio or control voltage.

Attack time sets the time it will take after the initial trigger for signal to go from 0% to 100%.

Hold time sets the time the signal stays at the full amount of 100% after Attack phase finishes.

Decay time sets the time it takes for envelope to go from Hold Level down to Sustain Level.

Sustain level sets the level which is output during sustain phase, until the “gate” is released back to off.

Release time sets time taken for envelope to return to zero after gate is released.

Config button opens the CONFIGURATION DIALOG as shown to the right

Zero Cross switch enables the optional zero-crossing processing on the VCA to minimise clicks from aggressive envelopes. It does this by only changing the envelope level used when a signal crosses zero (a form of sample and hold).



Lin/Exp switch selects if the VCA driven in a Linear or Exponential mode.

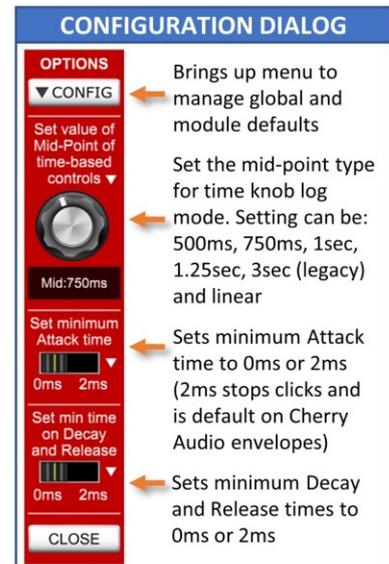
Fast Attack switch changes attack from a slow start (exponential) to a “fast start” (logarithmic) shape

Status LEDs: show stage envelope is currently at.

Decay Time switch locks Decay Time to Release Time. When this is on, Decay knob is disabled.

CV Out allows direct use of envelope CV. This signal is not affected by the Zero Cross switch. *Could use this with Dual VCA Inverter module to use on stereo signals.*

VCA Out is the signal (from VCA In) controlled by the built-in envelope (0%-100%).



Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum Attack time to 0ms or 2ms (2ms stops clicks and is default on Cherry Audio envelopes)

Sets minimum Decay and Release times to 0ms or 2ms

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more).

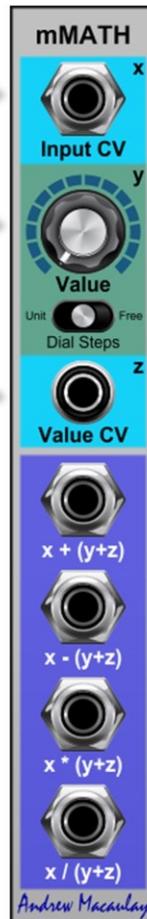
Micro Maths

The **Micro Maths module** provides a simple, small form-factor control voltage processor that provides some basic functions available in Cherry Audio's Formula module but in a much easier and smaller module. Providing addition, subtraction, multiplication and division of the input CV (x) by a fixed amount (y) plus an external CV (z), this can be useful for manipulating control voltages.

Input CV (x): allows the input of a CV into the maths module. This is referred to as 'x' in the output formulae.

Value (y): a standard linear control knob that provides in the input 'y' for the formulae.

Value CV (z): provides a CV control over the value, for more complex formulae. Referred to as 'z' in the output formulae.



Dial Steps: allows control of the number of steps on the Value knob – from Units, to 1/10th of Units to completely free mode.

Outputs: with the various formulae for processing the input CV:

X + (Y + Z): adds to the control voltage, which can be used for instance to provide transpose up for standard 1V/OCT control.

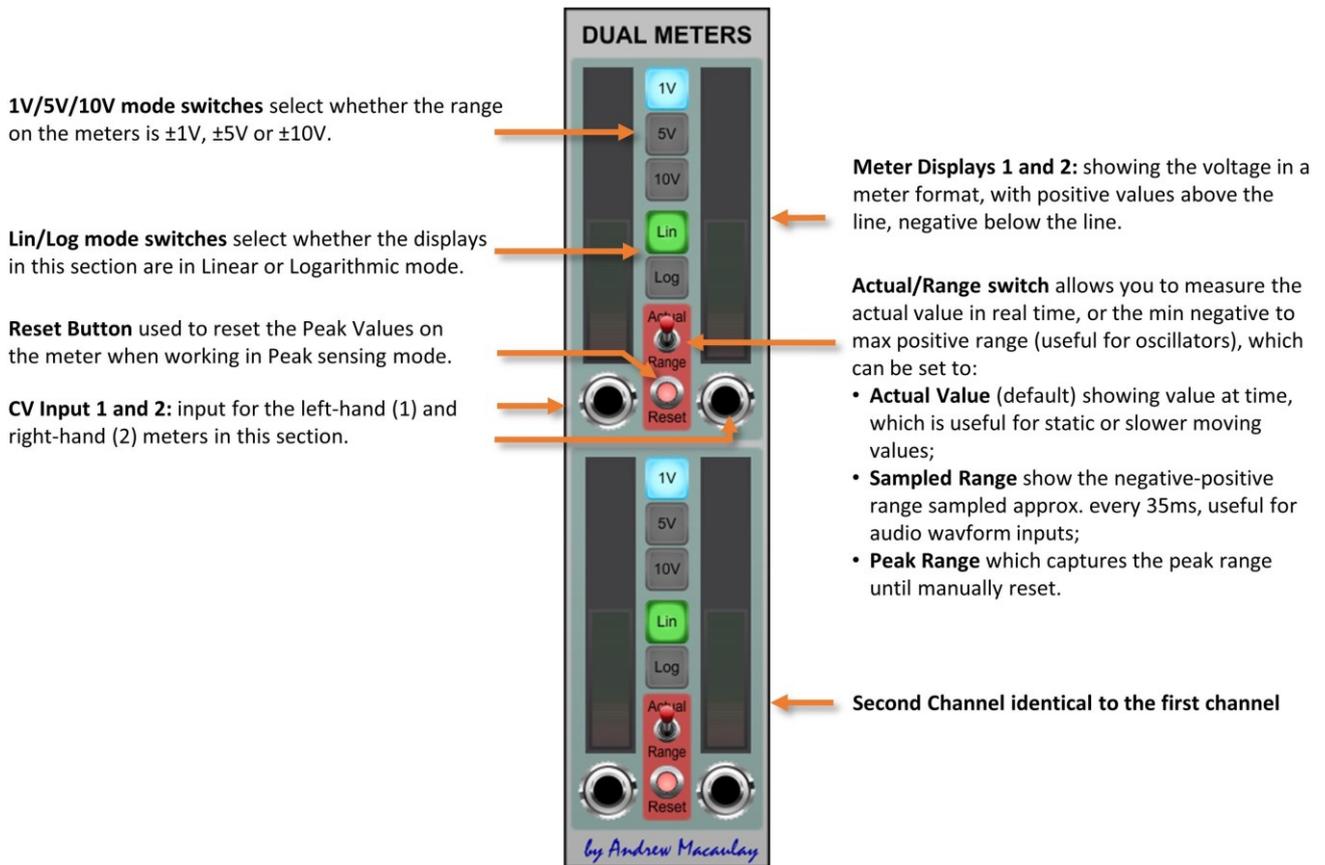
X - (Y + Z): subtracts to the control voltage, which can be used for instance to provide a transpose down for standard 1V/OCT control.

X * (Y + Z): multiplies to the control voltage, which can be used for instance with a BPM (1V/100BPM) control to increase the speed.

X / (Y + Z): divides to the control voltage, which can be used for instance with a BPM (1V/100BPM) control to slow the speed.

Micro Meters

The quad (dual, two-channel) **Micro Meter module** is a small module that displays the instantaneous real-time value of the input, or the maximum/minimum (over time, with a reset button) of a wave on logarithmic or linear-mode positive and negative meters that support ranges of -1V to +1V, -5V to +5V or -10V to 10V. Each two channel section has the same functionality.



Micro Mixbus

The **Micro Mixbus module** is a small form-factor bus inspired by those found on Moog Modulares. With twelve inputs and twelve outputs which can be configured in n-m mixing up to the connected output. The control knobs can be set (at module level) to be linear percentage-based or dB based.

Connecting an output jack mixes the signals up to that jack (from a previous output jack). The UI clearly shows the signal routing and the attenuation is +/- 100% on each input. There is also a "Direct Injection" input at the start to allow easy chaining of these units if needed.

This can be useful for mixing the multiple audio or CV waveforms from an oscillator before the "main" mixing stage, or for controlling the amount of multiple CVs for a module.

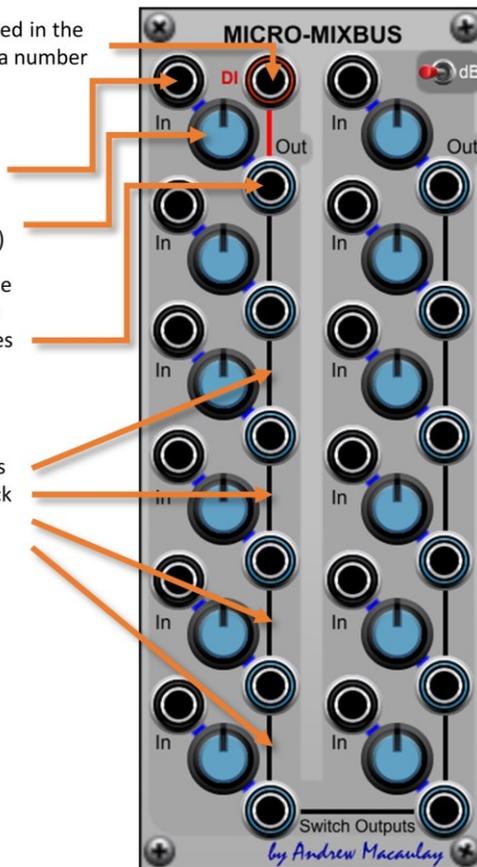
DI input: input which is always included in the first section at 100%. Useful to chain a number of these modules together.

Input: the signal input to be mixed

Mix value: the mix of this input into this part of the bus (-100% to +100%)

Output: an output of the mix from the previous inputs in the chain. The jack being connected in at any point makes that jack the "end" of the mix for inputs up to that point.

Indicator on module: lines between outputs clearly show where the mix is being taken from. Once an output jack is connected, the "following" line is hidden.



dB Switch: changes the mixers from linear % based values to logarithmic dB based values. This switch changes the behaviour of the whole module.

More detail, an example:

Connections:

- Input signals connected to Input 1, Input 2, Input 3, Input 4, Input 5 and Input 6;
- Outputs are connected to Output 3 and Output 5 sockets.

Signal paths:

- Output from Jack 3 will be the mix of inputs 1, 2 and 3;
- Output from Jack 5 will be the mix of inputs 4 and 5;
- Input 6 is ignored.

If you then connect Output 12, the output from this will be just a mix of Input 6.

Micro Ratcheter

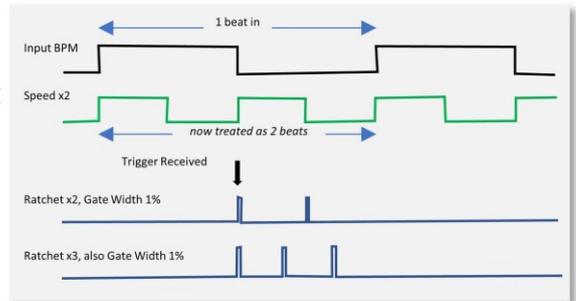
A simple, fixed ratcheting gate module with 6 outputs fixed at 2x, 3x, 4x, 5x, 6x and 8x with an overall control of the speed locked to either the Host BPM (typically from the DAW) or optionally from a gate/clock input (which is used to calculate the BPM) and the gate width for all outputs.

Note the the BPM sensing process does have limitations (as with hardware) in that it takes a few beats to work out the speed of the input. The module includes a switchable minimum 2ms gate-width for the output, useful when used with e.g. Cherry Audio Envelopes which have a min Attack Time of 2ms.

A simple "baby brother" to the Pattern Ratcheter which has a lot more flexibility built in. Can be used with the 8-1 Switch or my Voltage Controlled Switch to providing complex ratcheting for sequences.

The **Micro Ratcheter module** provides a way to “ratchet” sequences, in a style like Tangerine Dream and especially Chris Franke. This means taking a step and gating/trigging it multiple times within the step so you get, for example, a triplet on a ratcheted step.

This module can be used together with a manual trigger or gated triggers from e.g. the Drum Sequencer together with voltage-controlled switches to provide complex options.



Trigger In: provides the trigger (gate on) signal for the ratchet to start on all outputs.

BPM CV button: selects if external input jack is 100bpm/V BPM CV or an external clock source. The jack colour and name reflect the selected mode.

Host Clock LED on when external mode is using the Host Clock for sync (no jack connected)

Speed knob: provides a clock multiplier/divider for the clock speed as captured in the above section. This can be up to 16x or 1/16th of the BPM rate, and is used to determine “1 beat” for the ratcheting process – that is, a ratchet will generate 2, 3, 4, etc. triggers within this one “beat”.

Gate Width knob: controls the gate width of all of the ratchets as a percentage of the total time.

LIMITATIONS of Ext. Clock BPM Sensing: Although there are a number of techniques that try to provide “best guess” timing from the clock on the first received clock such as last known good and saving current BPM in presets, the module cannot read ahead – so when the BPM is first being sensed from an external clock source it takes two clock signals to “know” the BPM rate and therefore be able to calculate the ratchet speed. Therefore, if there is no last known good or saved BPM rate, the first clock in will simply generate a single clock out. More advanced control of the BPM sensing is provided in the Pattern Ratcheter and the Voltage Controlled Ratcheter.



New Standard BPM Sync UI: if an older preset requires it, a legacy version of the UI will automatically be displayed. See the help about the Standard External BPM Sync for more detail on the UI behaviours as well as the legacy mode.

Ext. Clock/BPM CV input: BPM CV or external gate or clock from which the BPM is measured. Allows sync with LFO-driven clock/sequencer.

Speed LED: provides a visual indicator of the beat to be used for the ratcheting.

Min Gate 0ms/2ms switch: sets the output gate to have a forced minimum time of 2ms which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The  button allows you to manage these defaults.

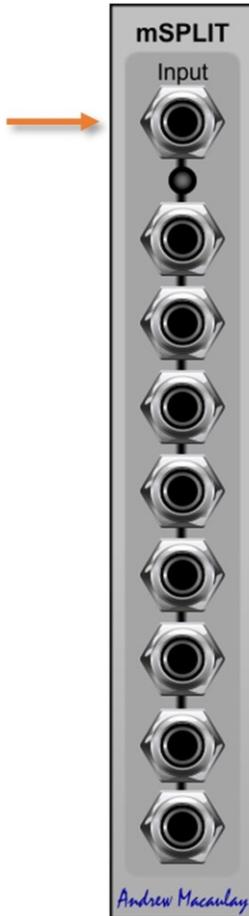
Ratchet Out jacks: provide the fixed ratcheting rates of x2, x3, x4, x5, x6 and x8 for 2 triggers per beat, 3 triggers per beat...

Micro Signal Splitter

The **Micro Signal Splitter module** is a simple module that allows multiple outs from a single input. As each jack can host 6 jacks, this means 6 inputs to 48 outputs.

The aim of this was to allow easier visual patching where multiple outs were needed, for example sharing a single gate signal across eight envelopes when using eight Micro-Envelopers with the Additive Oscillator.

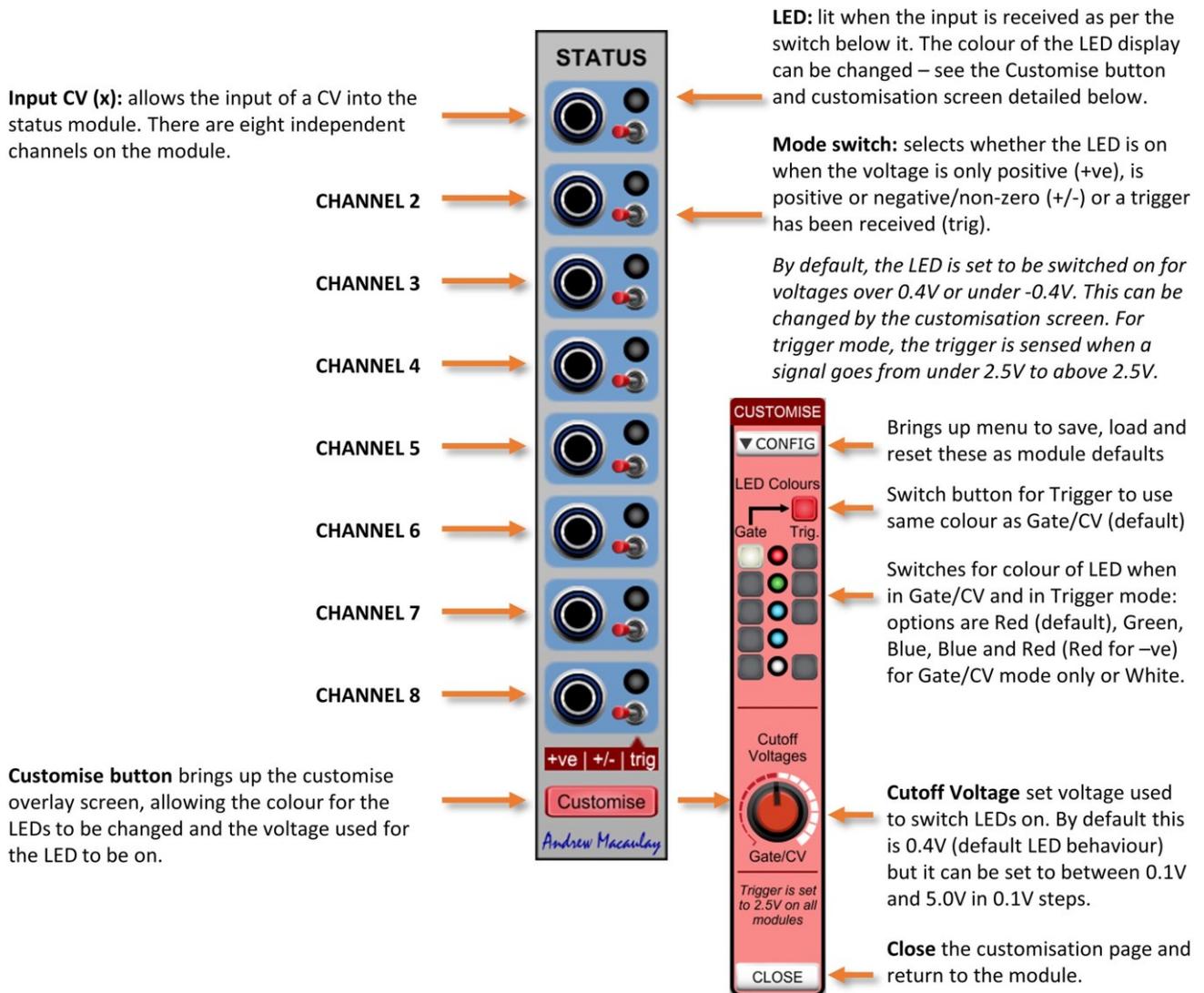
Input jack: the input to be processed by the modules. As normal in Voltage Modular, up to six inputs can be connected. This input can be an audio or control voltage.



Output jacks (8 of): simply passing the input value through. Each of these jacks can support up to six jack connections, allowing a 6 to 48 set of connections!

Micro Status

The **Micro Status module** provides a simple LED visual indication for up to eight inputs. This can be set for each input to be for positive voltages only, positive and negative (non-zero) voltages or a trigger being received (when the LED will flash once for each trigger received).



Micro Switch

The **Micro Switch module** is a simple module that allows switching of voltage on/off for eight outputs. As the state of each switch is remembered in presets, can be used to control parameters in a preset. Off is always set to 0V, and On can be set to either 5V (the default) or 1V for all switches.

Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.

Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.

Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.

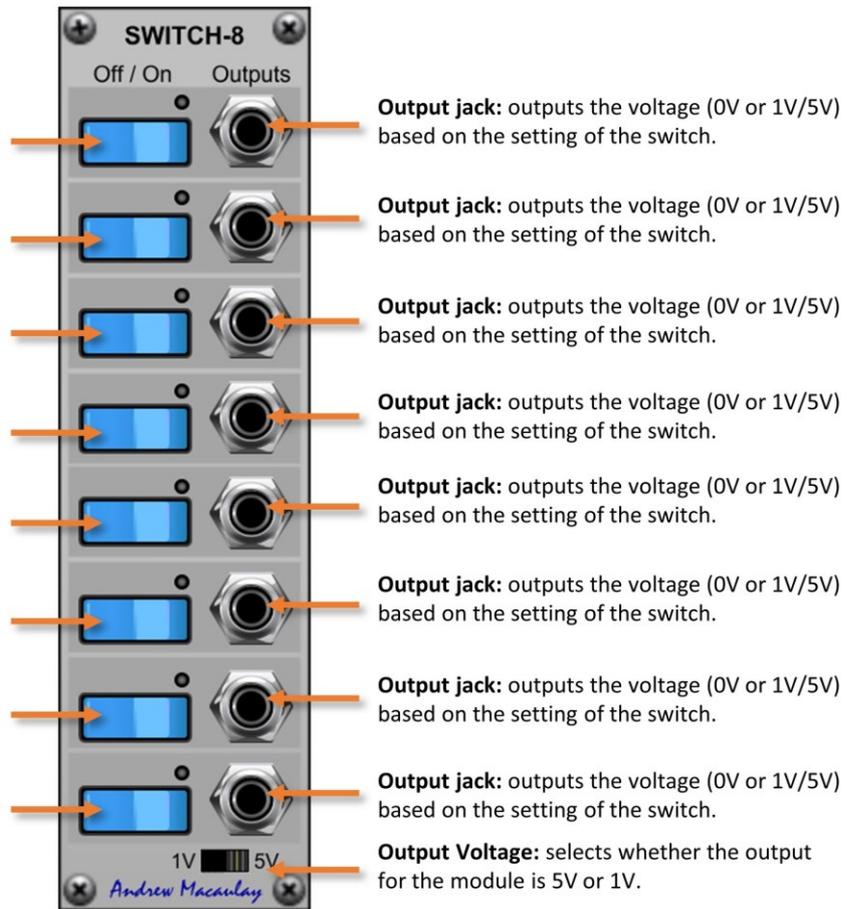
Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.

Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.

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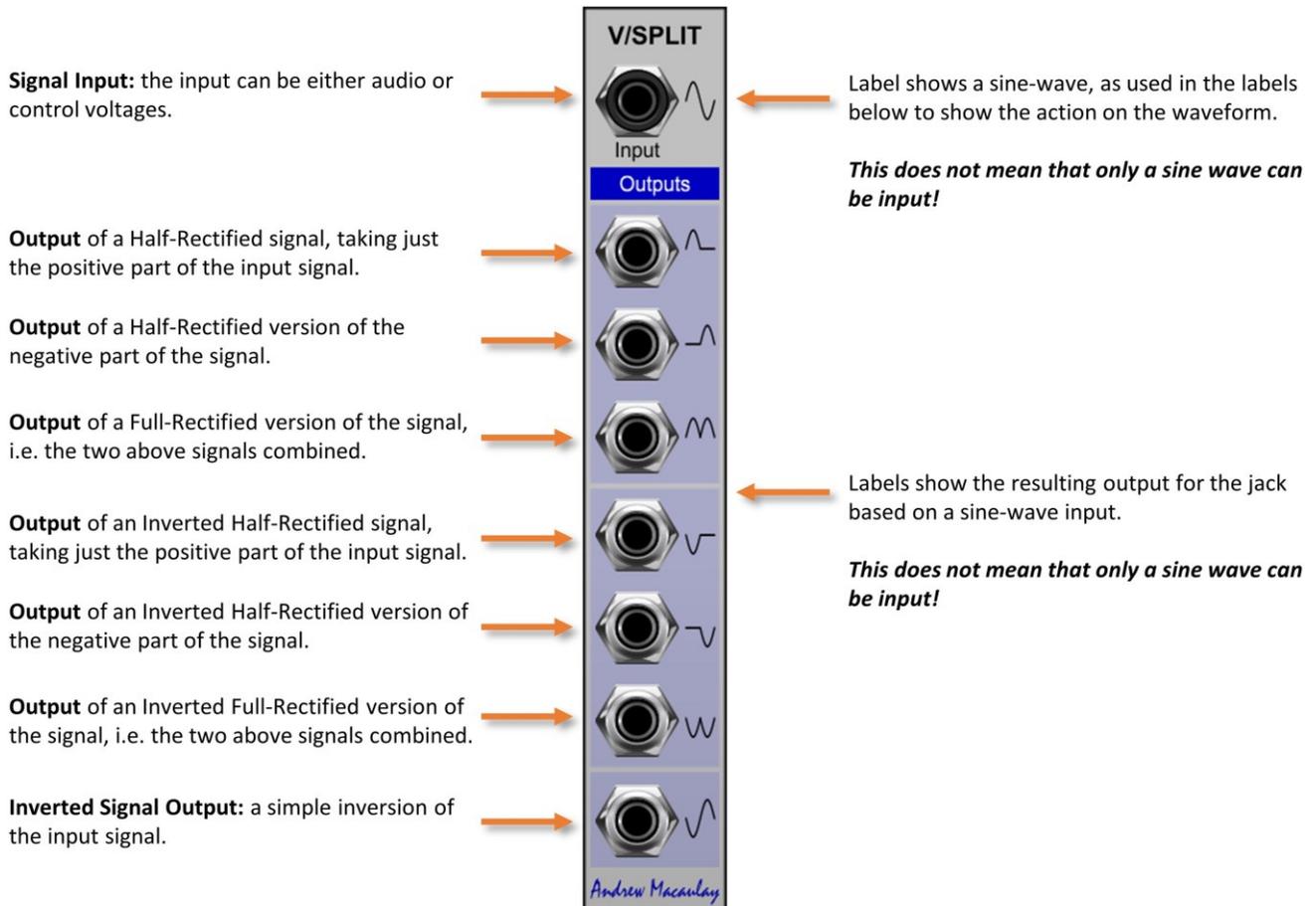
Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.

Off/On switch: switches the voltage output to 0V (off) or 5V (on). The LED shows the status of the switch.



Micro Voltage Splitter

The **Micro Voltage Splitter** is a small module that takes an input signal, splits it into the positive and negative phases and does simple processing (on/off/inverted) on them to generate a fixed set of seven fixed outputs that combine these for Full and Half Rectified signals, positive part only, negative part only and various inverted variants.

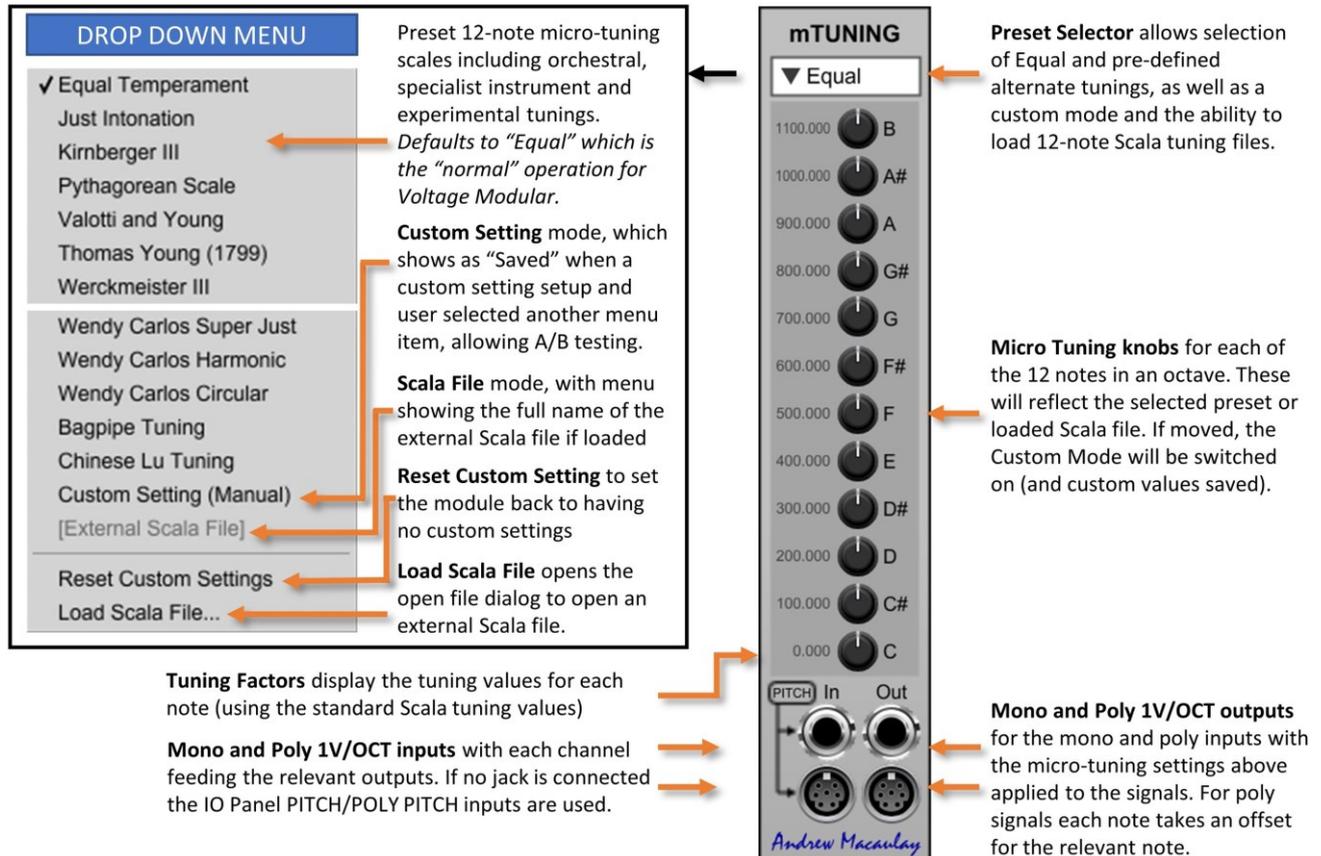


MicroTuning

This small form-factor **MicroTuning module** allows individual control of the tuning for the notes in the standard 12-note scale. The design was inspired by the micro tuning available on some vintage Korg polyphonic modular synths and allows alternate tunings to be applied, as well as manual imperfections for a vintage feel.

The module takes mono and poly inputs (defaulting to the I/O Panel) and allows +/-100 cent adjustment for each note in the 12-note scale. The tuning has a fixed set of micro-tuning presets available as well as the ability to load Scala tuning files. The preset tunings were largely sourced from <http://www.microtonal-synthesis.com>. The module can also be used to manually detune notes to get a more vintage feel.

Due to the way the module identifies the notes, this module should always be used as the first in the chain of modules affecting the 1V/OCT pitch control as it uses the voltage to infer the note being played. It can also be used with the new A440 Master Tuning module (which should be used after this module).



*Note that Scala files that are **not** 12-note scales will not be loaded and will have an error message displayed. Equally, if the Scala file cannot be read for any other reason, the file will not be loaded and an error message displayed.*

Any custom settings when shown in the menu as "saved" will be saved with any preset, so that you can return to the custom setting even if the preset was saved with another scale selected.

MicroTuning Plus

The **MicroTuning Plus module** brings together the Micro Tuning Module and the Stretch Tuning Module, adding a voltage-controlled section to allow individual control of the tuning for the notes in a standard 12-note scale as well as note specific drift and other vintage random and controlled tuning effects.

The micro-tuning section can be manually controlled (+/- 100 cents) and has a fixed set of presets available as well as the ability to load Scala tuning files. The preset tunings were largely sourced from <http://www.microtonal-synthesis.com>. The module can also be used to manually detune notes to get a more vintage feel.

CV Amounts knobs for the amount of CV micro-tuning for each note. When not jacks connected these are additional fixed micro-tuning knobs.

CV Inputs with a single master input which defaults to fixed 5V (100%) and individual note inputs.

Quick Set buttons to set all amounts for the CV Tuning knobs to OFF (0%), to match the value for B (top knob) or spread values equally from top to bottom.

Preset Selector allows selection of tunings as well as a custom mode. The menu includes:

- **Presets** for set of 12-note micro-tuning scales including orchestral, specialist instrument and experimental tunings.
- **Custom Setting** mode, which shows as "Saved" when a custom setting setup and user selected another menu item, allowing A/B testing.
- **External Scala File** mode, with full name of the external Scala file if loaded.
- **Reset Custom Setting** to set the module back to having no custom settings.
- **Load Scala File** opens the open file dialog to open an external Scala file.

Micro Tuning knobs for each of the notes in an octave. These will reflect the selected preset or loaded Scala file. If moved, Custom Mode is enabled (and custom values saved).

Tuning Factors display the tuning values for each note, using standard Scala tuning values.

Mono and Poly 1V/OCT inputs with each channel feeding the relevant outputs. If no jack is connected the IO Panel PITCH/POLY PITCH inputs are used.

Mono and Poly Scale outputs for the main input CV plus any micro-tuning scale adjustments.



Randomize button to set the amount knobs in the Tune by CV section to random values, between the Min and Max knobs below.

Stretch Amount knob sets the amount of stretch (by octave) to be applied to the 1V/OCT input signal.

Semitone or Voltage Mode selects whether the stretch is based on the semitone (excludes micro-tuning) or voltage (including any micro-tuning).

Root Note for Stretch allows selection of the note that will not be changed by the stretch. The up/down buttons allow changing by note and octave. Double click on the display to reset to the default A4/A440 (MIDI Note 69).

Stretch CV Input and Amount allows the stretch amount to be modulated by a CV input.

Mono and Poly Stretch outputs for the completely processed output, with the default routing takes PITCH or main input and includes the micro-tuning, the CV-tuning and the stretch.

Mono and Poly CV-Tune outputs for micro-scaled or external signal plus CV Tuned values.

Alt.In inputs for each part of the processing. Default is to use previous stage, but insert a jack in these and the input to the stage is the external source. Can be used to split process signals or to add "inserts" in the signal chain.

The drift section defaults to a +5V input across all notes, which means that the control knobs affect the offset immediately. These can be Quick Set to 0 cents, to the same setting as the note B (the top knob) or spread between the setting on the B knob (top) and the C knob (bottom). There is also a randomizer function with a minimum and maximum setting allowing completely random settings for the CV amount knobs. The Octave Stretch section provides control of the stretch (up to 2 Cents per semitone) with control over the "root" note to be used. Each stage has the option to insert an input or take the input from the previous stage, so that the module can be used for complex routing or multiple tuning processing.

Use very slow (ideally minutes long) changing values as CV inputs to the module to get a vintage feel through the drift that was often an issue for the first analogue synths!

The mono and poly outputs take the processed information as 1V/OCT inputs available to oscillators and/or instruments to provide basic micro-tuning support for any patch/instrument. The module should always be used as the first in the chain of modules affecting the 1V/OCT pitch control as it uses the voltage to infer the note being played. It can also be used with the new A440 Master Tuning module (which should be used after this module).

MicroTuning Presets and Menu

The drop-down menu for MicroTuning presets and managing custom settings is the same as the MicroTuning module and has the layout as shown in the illustration on the right.

Loading Scala Files

Note that valid Scala files that are **not** 12-note scales will not be loaded and will have an error message displayed.

Also, if the Scala file cannot be read for any other reason, the file will also not be loaded and an error message displayed.

Custom Settings

Any custom settings when shown in the menu as “saved” will be saved with any preset, so that you can return to the custom setting even if the preset was saved with another scale selected.

DROP DOWN MENU

- ✓ Equal Temperament
- Just Intonation
- Kirnberger III
- Pythagorean Scale
- Valotti and Young
- Thomas Young (1799)
- Werckmeister III
- Wendy Carlos Super Just
- Wendy Carlos Harmonic
- Wendy Carlos Circular
- Bagpipe Tuning
- Chinese Lu Tuning
- Custom Setting (Manual)
- [External Scala File]
- Reset Custom Settings
- Load Scala File...

Preset 12-note micro-tuning scales including orchestral, specialist instrument and experimental tunings. Defaults to “Equal” which is the “normal” operation for Voltage Modular.

Custom Setting mode, which shows as “Saved” when a custom setting setup and user selected another menu item, allowing A/B testing.

Scala File mode, with menu showing the full name of the external Scala file if loaded

Reset Custom Setting to set the module back to having no custom settings

Load Scala File opens the open file dialog to open an external Scala file.

MIDI Display

The **MIDI Display module** provides a display of the last MIDI message received. The data can be filtered by channel and command type, and the stream can be paused, run and cleared manually or with trigger inputs. Using these Pause/Run/Clear inputs allows you to inspect the MIDI messages coming through the system.

Channel Filter: allows the MIDI messages to be filtered by the MIDI Channel. Each channel is controlled individually.

The "All On" button enables all channels, the "All Off" button disabled all channels and is useful if you want just 1 channel monitored.

By default all channels are enabled.

Message Filter: allows the MIDI messages to be filtered by the MIDI message type.

The types available are Note Off, Note On, Poly Pressure, Continuous Change, Programme Change, Channel Pressure, Pitch Bend, Channel Mode (special data) and System Messages.

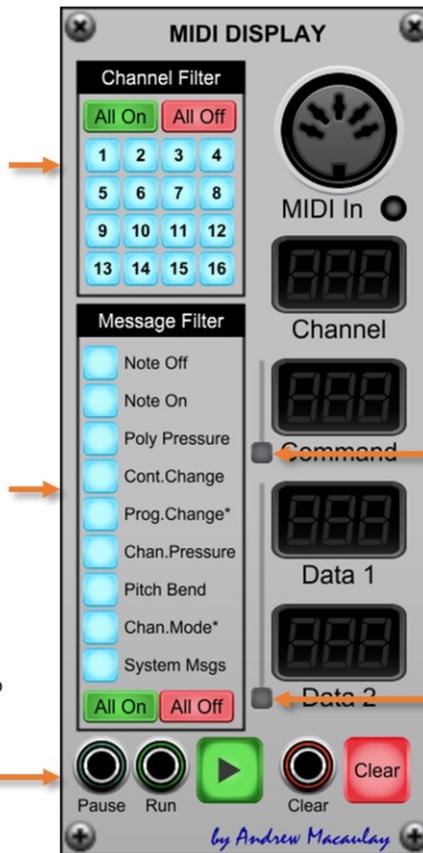
There are push buttons to switch the individual message types all on or off.

By default all message types are enabled.

Pause/Run trigger inputs: allows triggers to pause and run the display of messages.

Pause/Run mode button: allows manual control and shows the mode.

Note that PAUSE does not clear the list of messages to be displayed.



MIDI In: provides the connection for MIDI signals to this module.

MIDI Channel: displays channel number of the MIDI event (decimal only)

Command: displays the MIDI Command from the MIDI event. By default this is in decimal but it can also be set to hex.

Hex Mode for Command: when on, the Command is displayed in hexadecimal.

Data 1 and Data 2: displays the value of the two bytes of data, where there is additional data for the command. It is blank if there is no information with the command. This can be in decimal or hex.

Hex Mode for Data: when on, the data 1 and 2 values are displayed in hexadecimal.

Clear trigger input/button: clears the current queue of MIDI messages to be displayed – can be used in conjunction with Pause/Run.

IMPORTANT NOTE: Program Change messages (MIDI Command 192) will only be displayed in this module WHEN the option that "MIDI Program Change Messages Should Change Current Preset" on the Voltage Modular Interface Settings page is switched OFF (unticked).

PLEASE NOTE also that there appears to be a limitation with VST3 plugins (due to the VST3 spec) where VST3 plugins do not receive MIDI Program Change messages from their host. This limitation does not seem to affect other plugin formats or the standalone version of Voltage Modular.

Mini Delayed LFO

The **Mini Delay LFO** module brings together the CV Delay module and an LFO in a simplified form for a narrow form factor. There is no sync to BPM options, but this still provides useful limited mixing of CV and the delay signal, for performance scenarios.

The Delay CV can be mixed with up to two other CV inputs, allowing the mixing of e.g. keyboard after-touch, mod wheel, etc. with the delay envelope. The resulting control voltage is limited to 0-5V to control the LFO which offers manual speed control and selectable waveform.

Delay Time: control the time of the Delay (at 0V) set in milliseconds, with the mid-point of the knob controlled by the config dialog.

Fade Time: controls the time of the Fade from 0V up to +5V in milliseconds, with the mid-point of the knob controlled by the config dialog. Note that the fade itself is only LINEAR in this module.

CV In 1 and 2: two CV inputs which will be added to the delay envelope, e.g. to include keyboard after-touch and/or the mod wheel to work alongside the delay envelope. If no jacks are connected to these, they will use the MOD WHEEL input (CV1) and the AFTERTOUCH input (CV2) from the I/O Panel.

LFO Rate: manually controls the speed LFO speed to values between 0.01Hz and 30Hz.

Waveform: select the output waveform from the LFO (one of 6): Sine, Triangle, Sawtooth, Ramp, Square and Pulse (with pulse width control).

Delay CV Out: outputs just the delay envelope.

Trigger input: used to trigger the delay/fade process, and optionally used for LFO sync. If no jack is connected this will take the Trigger from the main CV Inputs I/O Panel.

CV Mixing: mixes the delay, CV1 & CV2. The total is always limited to a range of 0V to +5V.

Config button: brings up the configuration pop-up allowing control of the log mode knob behaviour.

Sync to Trigger: enables the start of the LFO wave to be sync'd to the trigger input, useful for vibrato.

Pulse Width: controls the width of the LFO pulse waveform, from 5%-95% and defaulting to 50%.

LFO Out: outputs the LFO as controlled by the delay and CV inputs.

CONFIG DIALOG
 Brings up the menu to manage the global and module defaults

SETTINGS
 ▼ CONFIG

Mid-Point value for Delay and Fade Times

Mid: 1250ms

CLOSE

Set mid-point type for knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear.

The Delay and Fade knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances of this module is 1250ms unless changed in the global or module defaults (see general help for more).

Mini Envelope VCA Plus

The **Mini Envelope VCA Plus** is a mini form-factor Delay, Attack, Hold, Decay, Sustain, Release envelope generator with an included dual VCA module and the including the ability to set long envelopes (5 minutes for each stage), a sustain pedal input as well as some less common CV output forms.

All times are set using standard 0 to 12 second controls (with mid-point setting) plus a 0 to 300 second coarse control (in 10 second steps). The envelope can also be set to be triggered in one-shot or looping Delay-Attack-Hold-Decay mode and has End of Decay and End of Sustain trigger outputs.

The sustain pedal and gate input default to the IO Panel for easier patching (the sustain pedal input can be disabled) and retriggering options allow full legato (no retrigger during sustain), normal retrigger during sustain (default) and hard retrigger with return-to-zero. The retrigger can be set to start a new Delay or go straight to the Attack stage.

The Dual Voltage Controlled Amplifier section can allow two independent signals (including stereo audio signals) to be controlled by the envelope, with either Linear or Exponential control, and they both have a Zero Crossing mode that removes clicks when using very fast envelope settings.

Coarse Time Settings for Delay, Attack, Hold, Decay and Release. These can be set to between 0 and 300 secs (5 minutes) in 10 second steps and are added to the standard time settings

Fine (Normal) Time Settings for Delay, Attack, Hold, Decay and Release. These are standard 0ms to 12000ms (12 second) time setting knobs which are added to the Coarse Time settings.

Envelope Mode switch controls the behaviour of the envelope (see examples below):

- I. **Normal Gated Envelope** with fully gated behaviour going straight to Release even if Delay or Attack have not completed;
- II. **DAHD Always Completes** even on very short gates (or triggers) but works as normal when gate extends into Sustain stage;
- III. **Gated Looping DAHD** mode loops the DAHD stages while the gate is active, completing any Release stage when gate released.

Gate input: the key input for the envelope. The gate on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, the module uses the Gate signal from the Panel Inputs.

Sustain Pedal Input: when the sustain pedal in is "on" (>2.5V) the envelope is kept sustained even if the gate has been removed. Sustain is engaged if the gate is active and is removed when the sustain pedal signal is "off".

The input defaults to using the Sustain Pedal input from the IO Panel, but can be disabled with the small button or overridden with a mono jack signal input. An LED shows when the sustain pedal input is active.

Dual VCA inputs: two signal inputs for the two independent channels of the dual VCA, which will be processed by the envelope in "normal" mode subject to the Exp and ZeroX switched.



The following CV voltages reflect the Env.Out CV output levels (and internal CV for the VCAs)

Delay time: sets a delay after the trigger/gate goes on, where the CV remains at zero before the envelope starts.

Attack time: sets the time it will take after the Delay phase completes for the envelope to go from 0V to 5V. *See also retrigger mode.*

Hold time: sets the time the envelope stays at the full amount of 5V after the Attack phase finishes.

Decay time: sets the time it takes for the envelope to go from 5V down to the Sustain Level set below.

Sustain level: the level which is output during sustain phase, until the "gate" is released back to off. This is set as a percentage.

Release time: sets the time it takes for the envelope to return to zero after the end of the Sustain phase.

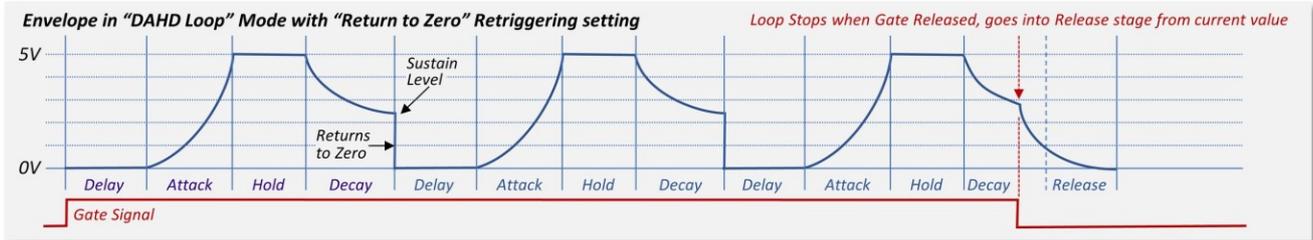
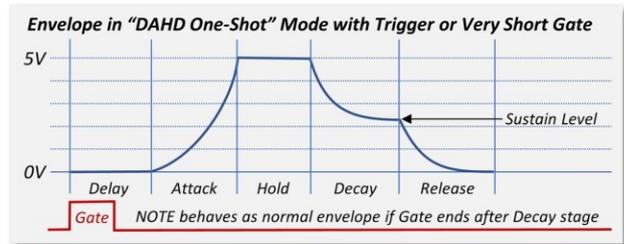
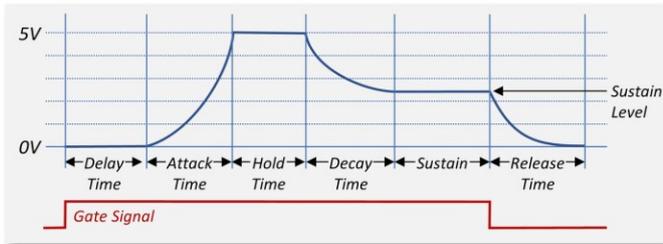
Dual VCA output: two signal output from the two independent channels of the dual VCA.

Exp. mode switch for the Dual VCA (affects both channels): when off envelope controls VCA in linear mode, when on (down/ set to Exp.) envelope controls VCA exponentially.

ZeroX switch for the Dual VCA (affects both channels): when enabled Zero Crossing processing is used to reduce clicks from audio signals when using fast envelope times.

All the 0 to 12 second (fine) time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

Typically, the two DAHD (always complete and looping) modes would be used with 0% sustain and Release either 0ms or matching the Decay setting – but it is not limited to these, so that the always complete can be used both for percussive envelopes but also in a manner similar to the ENV-20 EG2 behaviour, providing a minimum time for the envelope. The following illustrations show these behaviours.



Fast Attack switch changes the attack from a slow start (exponential) shape to a "fast start" (logarithmic) shape.

Delay Retrigger Mode switch selects whether a retrigger starts at the **Delay** stage (default) or goes straight to the **Attack** stage.

Legato/Retrig mode switch determines how the envelope behaves when retriggered, for example while holding one note and playing another (a typical mono trill style). This also affects how retriggers work when a Sustain Pedal is active:

- **Legato During Sustain** means retriggers will start the new envelope at the current level, so an attack will start at e.g. the current level of a release – noting that, if a Delay time is set, the envelope continues the Release while the Delay is active.
In this mode, retriggers with the Sustain Pedal active are ignored.
- **Retrigger During Sustain** uses the same approach as Legato, with soft retriggers, but allows retriggers while the Sustain Pedal is active.
- **Hard Retrigger (RTZ)** means any retrigger always resets the envelope back to 0V (Return To Zero) so that any Delay stage will be clearly audible, but the retrigger can also be quite harsh.



CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls

Mid: 750ms

Set minimum Attack time

0ms 2ms

Set minimum Decay time

0ms 2ms

CLOSE

Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode, options: 500ms, 750ms, 1sec, 1.25sec, 3sec and linear

Sets minimum Attack time to 0ms or 2ms. 2ms stops clicks and is default on Cherry Audio envelopes

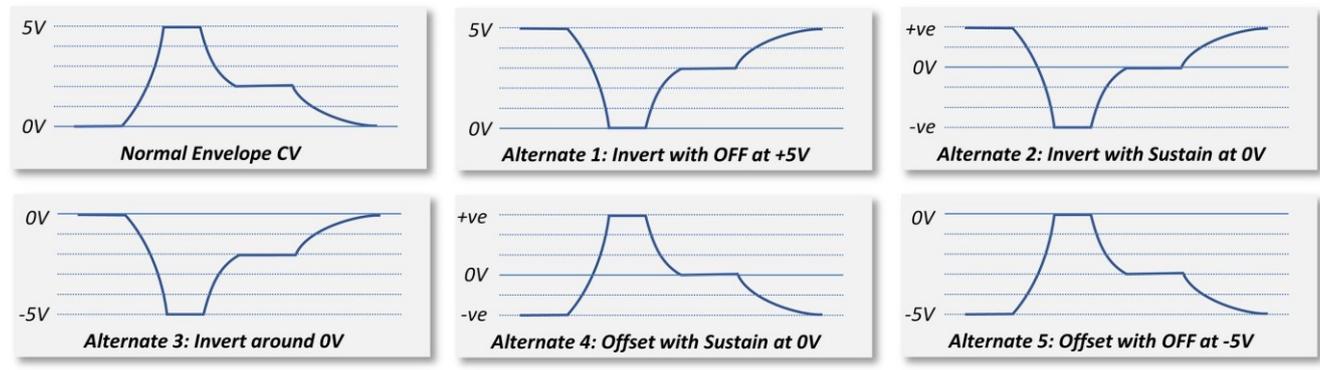
Sets minimum Decay and Release times to 0ms or 2ms

Env.Out outputs the standard envelope as a 0V-5V control voltage.

Alt.Env outputs inverted or offset envelope signals, with the knob allowing settings for invert around 0V, invert around sustain, etc. (see illustrations following)

End.Dec and **End.Rel** trigger outputs provide a +5V trigger pulse when the Decay stage and the Release stage complete.
Note that these only fire IF the stage completes, so they do not fire if the stage is "interrupted" by a retrigger, or if the gate is released during the Decay stage.

Envelope and Alt. Envelope CV Output Examples:



Multi A/B Input Selector

The **Multi A/B Input Selector** module is a simple A/B selector for multiple monophonic CV and audio signals controlled by a button or via triggers/gates which allow direct setting of A or B, toggling (latched triggers) or a gate signal (normal or inverted) to control the selected set of inputs. This can be used to switch between two sequences (patching e.g. CV, Gate and Trigger through three channels) or to switch or morph between two sets of signals.

Each of the six channels can be set to switched mode or to have smoothing enabled (Cross-Fade) to stop clicks if switching audio or to fade between a set of control voltage inputs to morph between settings. The cross-fade speed (for the whole module) defaults to 25ms but can be set to between 0ms and 12secs. The module also provides a Gate Out (off=A, on=B) so that multiple modules can be cascaded if you need more than six channels switched at the same time.

A/B Manual Switch and LEDs: a manual button to toggle the selection of A or B with red and green LEDs showing the status. When in Gate or Inverted Gate mode the button will not affect the selection.

Six independent channels: all controlled by the A/B selection. On this variant of the module there are A and B inputs for each channel.

xF (Cross-Fade) switches: select whether channel switches between A and B directly (switch off/up) or by fading (switch on/down). Used to remove audio clicks or provide slower morphing for audio and CV signals.

The speed of the fade is set by the knob in the Cross-Fade area at the bottom of the module. This speed is the same for all channels.

Gate Out: provides a gate (0V=A, 5V=B) output to allow for chaining of modules for Manual or other control modes. Plug the Gate Out into a Gate In on another module and switch it to "Gate" mode.

Gate/Trigger Inputs: one or two trigger or gates inputs based on the Gate/Trigger mode switch. The labels will reflect the mode and the LEDs indicate signal on the input.

Gate/Trigger mode: select mode for switching inputs: "Trig." has separate trigger inputs for A and B, "Latch" has a single trigger to swap A/B, "Gate" takes a gate with 0V=A, 5V=B and "Inv." inverts to gate to 0V=B, 5V=A.

Output for the switched A or B signal for each of the six channels.

Cross-Fade (xF) Time knob sets the timing for the smoothing & morphing. Defaults to 25ms but can be set from 0ms to 12s.

Options button for configuration of the log/linear mode for the Cross-Fade Time

CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for the Cross-Fade Time

Mid:500ms

CLOSE

Sets mid-point for the cross-fade log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Multi A/B Poly-In Selector

The **Multi A/B Poly-In Selector** module is a simple A/B selector to route multiple polyphonic CV and audio signals controlled by a button or via triggers/gates which allow direct setting of A or B, toggling (latched triggers) or a gate signal (normal or inverted) to control the selected set of inputs. This can be used to switch or morph between two sets of signals or CV settings of modules.

Each of the six channels can be set to switched mode or to have smoothing enabled (Cross-Fade) to stop clicks if switching audio or to fade between a set of control voltage inputs to morph between settings. The cross-fade speed (for the whole module) defaults to 25ms but can be set to between 0ms and 12secs. The module also provides a Gate Out (off=A, on=B) so that multiple modules can be cascaded if you need more than six channels switched at the same time.

A/B Manual Switch and LEDs: a manual button to toggle the selection of A or B with red and green LEDs showing the status. When in Gate or Inverted Gate mode the button will not affect the selection.

Six independent channels: all controlled by the A/B selection. On this variant of the module there are A and B inputs for each channel.

xF (Cross-Fade) switches: select whether channel switches between A and B directly (switch off/up) or by fading (switch on/down). Used to remove audio clicks or provide slower morphing for audio and CV signals.

The speed of the fade is set by the knob in the Cross-Fade area at the bottom of the module. This speed is the same for all channels.

Gate Out: provides a gate (0V=A, 5V=B) output to allow for chaining of modules for Manual or other control modes. Plug the Gate Out into a Gate In on another module and switch it to "Gate" mode.

Gate/Trigger Inputs: one or two trigger or gates inputs based on the Gate/Trigger mode switch. The labels will reflect the mode and the LEDs indicate signal on the input.

Gate/Trigger mode: select mode for switching inputs: "Trig." has separate trigger inputs for A and B, "Latch" has a single trigger to swap A/B, "Gate" takes a gate with 0V=A, 5V=B and "Inv." inverts to gate to 0V=B, 5V=A.

Output for the switched A or B signal for each of the six channels.

Cross-Fade (xF) Time knob sets the timing for the smoothing & morphing. Defaults to 25ms but can be set from 0ms to 12s.

Options button for configuration of the log/linear mode for the Cross-Fade Time

CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for the Cross-Fade Time

Mid:500ms

CLOSE

Sets mid-point for the cross-fade log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Multi A/B Output Selector

The **Multi A/B Output Selector** module is a simple A/B selector to route multiple monophonic CV and audio signals to A or B outputs controlled by a button or via triggers/gates which allow direct setting of A or B, toggling (latched triggers) or a gate signal (normal or inverted) to control the selected set of inputs. This can be used to route CV and audio to different modules (e.g. two different filters with different settings and different envelopes).

Each of the six channels can be set to switched mode or to have smoothing enabled (Cross-Fade) to stop clicks if switching audio or to fade between a set of control voltage inputs to morph between settings. The cross-fade speed (for the whole module) defaults to 25ms but can be set to between 0ms and 12secs. The module also provides a Gate Out (off=A, on=B) so that multiple modules can be cascaded if you need more than six channels switched at the same time.

A/B Manual Switch and LEDs: a manual button to toggle the selection of A or B with red and green LEDs showing the status. When in Gate or Inverted Gate mode the button will not affect the selection.

Six independent channels: all controlled by the A/B selection. On this variant of the module there are A and B outputs for each channel.

xF (Cross-Fade) switches: select whether channel switches between A and B directly (switch off/up) or by fading (switch on/down). Used to remove audio clicks or provide slower morphing for audio and CV signals.

The speed of the fade is set by the knob in the Cross-Fade area at the bottom of the module. This speed is the same for all channels.

Gate Out: provides a gate (0V=A, 5V=B) output to allow for chaining of modules for Manual or other control modes. Plug the Gate Out into a Gate In on another module and switch it to "Gate" mode.

Gate/Trigger Inputs: one or two trigger or gates inputs based on the Gate/Trigger mode switch. The labels will reflect the mode and the LEDs indicate signal on the input.

Gate/Trigger mode: select mode for switching inputs: "Trig." has separate trigger inputs for A and B, "Latch" has a single trigger to swap A/B, "Gate" takes a gate with 0V=A, 5V=B and "Inv." inverts to gate to 0V=B, 5V=A.

Outputs A and B for the six channels. If the xF switch is on for the channel, the Cross-Fade process morphs between outputs A and B.

Cross-Fade (xF) Time knob sets the timing for the smoothing & morphing. Defaults to 25ms but can be set from 0ms to 12s.

Options button for configuration of the log/linear mode for the Cross-Fade Time

CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for the Cross-Fade Time

Mid:500ms

CLOSE

Sets mid-point for the cross-fade log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Multi A/B Poly-Out Selector

The **Multi A/B Poly-Out Selector** module is a simple A/B selector to route multiple polyphonic CV and audio signals to A or B outputs controlled by a button or via triggers/gates which allow direct setting of A or B, toggling (latched triggers) or a gate signal (normal or inverted) to control the selected set of inputs. This can be used to route CV and audio to different modules (e.g. two different filters with different settings and different envelopes).

Each of the six channels can be set to switched mode or to have smoothing enabled (Cross-Fade) to stop clicks if switching audio or to fade between a set of control voltage inputs to morph between settings. The cross-fade speed (for the whole module) defaults to 25ms but can be set to between 0ms and 12secs. The module also provides a Gate Out (off=A, on=B) so that multiple modules can be cascaded if you need more than six channels switched at the same time.

A/B Manual Switch and LEDs: a manual button to toggle the selection of A or B with red and green LEDs showing the status. When in Gate or Inverted Gate mode the button will not affect the selection.

Six independent channels: all controlled by the A/B selection. On this variant of the module there are A and B outputs for each channel.

xF (Cross-Fade) switches: select whether channel switches between A and B directly (switch off/up) or by fading (switch on/down). Used to remove audio clicks or provide slower morphing for audio and CV signals.

The speed of the fade is set by the knob in the Cross-Fade area at the bottom of the module. This speed is the same for all channels.

Gate Out: provides a gate (0V=A, 5V=B) output to allow for chaining of modules for Manual or other control modes. Plug the Gate Out into a Gate In on another module and switch it to "Gate" mode.

Gate/Trigger Inputs: one or two trigger or gates inputs based on the Gate/Trigger mode switch. The labels will reflect the mode and the LEDs indicate signal on the input.

Gate/Trigger mode: select mode for switching inputs: "Trig." has separate trigger inputs for A and B, "Latch" has a single trigger to swap A/B, "Gate" takes a gate with 0V=A, 5V=B and "Inv." inverts to gate to 0V=B, 5V=A.

Outputs A and B for the six channels. If the xF switch is on for the channel, the Cross-Fade process morphs between outputs A and B.

Cross-Fade (xF) Time knob sets the timing for the smoothing & morphing. Defaults to 25ms but can be set from 0ms to 12s.

Options button for configuration of the log/linear mode for the Cross-Fade Time

CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for the Cross-Fade Time

Mid:500ms

CLOSE

Sets mid-point for the cross-fade log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Multi A/B Processor

The **Multi A/B Processor** module is an A/B CV Processor module that allows switching or morphing between two settings (A and B, each between -100% and +100%) for each of six channels, with the setting attenuating the signal from the channel's input (or, if no jack connected, a fixed +5V). The A/B morphing is controlled by an External CV (0V to 5V or -5V to +5V with +5V=B) or Internally, using the same approach as the Multi A/B Selectors, i.e. by a button or via triggers/gates for direct setting of A or B toggling (latched triggers) or a gate signal (normal or inverted) to control the selected set of inputs.

When controlled Internally and like the Multi A/B Selectors, each of the six channels can be set to switched mode or to have smoothing enabled (Cross-Fade) to stop clicks if switching audio or to fade between a set of control voltage inputs to morph between settings; the cross-fade speed (for the whole module) defaults to 25ms but can be set to between 0ms and 12secs; and the module also provides a Gate Out (off=A, on=B) so that multiple modules can be cascaded if you need more than six channels switched at the same time.

This module is designed to be used to morph or switch between two different patches or settings of modules by having a set of different DC outputs (to control e.g. Filter Frequency/Q settings) and/or different levels of CV controls (such as LFOs, etc.) in the A and B modes. The morphing of the patch can then be controlled manually by a mod wheel, a slow LFO or even a long/delayed envelope triggered by the keyboard.

EXT external mode button allows the mode to be switched between internal (Manual/Gated) mode and the External CV. *This button is disabled when no Ext CV Input jack is connected.*

A/B Manual Switch and LEDs: a manual button to toggle the selection of A or B with red and green LEDs showing the status. When in Gate or Inverted Gate mode the button will not affect the selection. **Not used in EXT mode.**

Ext CV Input jack takes a CV of 0V to 5V or -5V to +5V (see CV In Switch below) and uses this to control the state of the A/B "mix". With lowest (0V or -5V) value meaning **A** and +5V meaning **B** and a linear response between them.

If there is no jack connected, then the module goes into manual/gated mode using the Manual Button and Gate or Trigger inputs (as other A/B modules).

Six independent channels: all controlled by the A/B selection. On this variant there are six inputs for CV/signals which are then attenuated by the value of **A** the value of **B** depending on the setting of the A/B switch.

*If there no jack connected to a channel, then the input is set to a fixed +5V to allow the **A** and **B** values to be used to control settings, e.g. filter frequency.*

CV In switch sets whether the CV input assumes 0V to 5V or -5V to +5V with +5V always meaning "B" mode.

Gate Out: provides a gate (0V=A, 5V=B) output to allow for chaining of modules for Manual or other control modes. *Plug the Gate Out into a Gate In on another module and switch it to "Gate" mode.*

Gate/Trigger Inputs: one or two trigger or gates inputs based on the Gate/Trigger mode switch. The labels will reflect the mode and the LEDs indicate signal on the input. **Not used in EXT mode.**

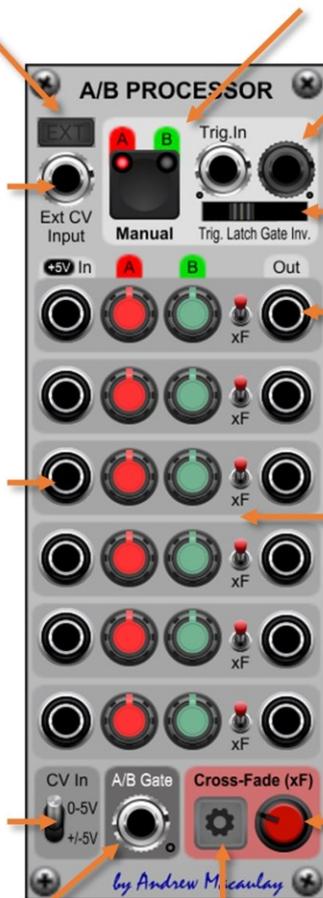
Gate/Trigger mode: select mode for switching inputs: "Trig." has separate trigger inputs for A and B, "Latch" has a single trigger to swap A/B, "Gate" takes a gate with 0V=A, 5V=B and "Inv." inverts to gate to 0V=B, 5V=A.

Output jacks for the six channels. The output is either **A** x Input or **B** x Input depending on the state of the A/B switch, or morphing between them based on the Ext CV input or Cross-Fade settings for the channel.

xF (Cross-Fade) switches: select whether channel switches between A and B directly (switch off/up) or by fading (switch on/down). Used to remove audio clicks or provide slower morphing for audio and CV signals. **In EXT mode these switches are all ignored.**

Cross-Fade (xF) Time knob sets the time used in the smoothing and morphing. *Defaults to 25ms but can be set from 0ms up to 12s.*

Options button for configuration of the log/linear mode for the Cross-Fade Time



CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for the Cross-Fade Time

Mid:500ms

CLOSE

Sets mid-point for the cross-fade log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Multi A/B Poly-Processor

The **Multi A/B Poly-Processor** module is an A/B Polyphonic CV Processor module that allows switching or morphing between two settings (A and B, each between -100% and +100%) for each of six channels, with the setting attenuating the signal from the channel's input. The A/B morphing is controlled by an External CV (0V to 5V or -5V to +5V with +5V=B) or Internally, using the same approach as the Multi A/B Selectors, i.e. by a button or via triggers/gates for direct setting of A or B toggling (latched triggers) or a gate signal (normal or inverted) to control the selected set of inputs.

When controlled Internally and like the Multi A/B Selectors, each of the six channels can be set to switched mode or to have smoothing enabled (Cross-Fade) to stop clicks if switching audio or to fade between a set of control voltage inputs to morph between settings; the cross-fade speed (for the whole module) defaults to 25ms but can be set to between 0ms and 12secs; and the module also provides a Gate Out (off=A, on=B) so that multiple modules can be cascaded if you need more than six channels switched at the same time.

This module is designed to be used to morph or switch between two different patches or settings of modules by having different levels of CV controls (such as LFOs, envelopes, etc.) in the A and B modes. The morphing of the patch can then be controlled manually by a mod wheel, a slow LFO or even a long/delayed envelope triggered by the keyboard. This can also be used alongside the monophonic version which can also provide DC signals to control, for example, the Frequency and/or Q of a filter to completely morph between sounds.

EXT external mode button allows the mode to be switched between internal (Manual/Gated) mode and the External CV. *This button is disabled when no Ext CV Input jack is connected.*

A/B Manual Switch and LEDs: a manual button to toggle the selection of A or B with red and green LEDs showing the status. When in Gate or Inverted Gate mode the button will not affect the selection. **Not used in EXT mode.**

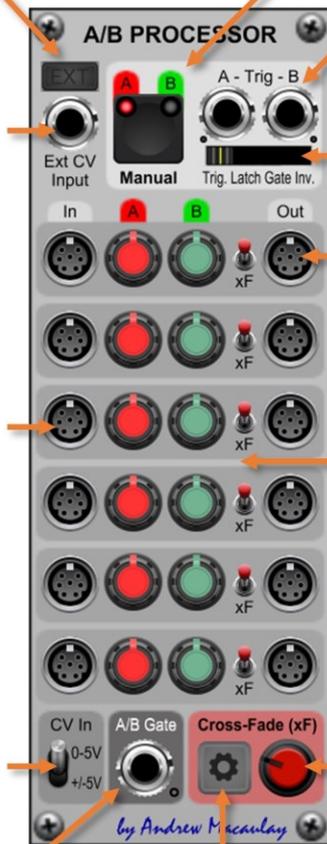
Ext CV Input jack takes a CV of 0V to 5V or -5V to +5V (see CV In Switch below) and uses this to control the state of the A/B "mix". With lowest (0V or -5V) value meaning **A** and +5V meaning **B** and a linear response between them.

If there is no jack connected, then the module goes into manual/gated mode using the Manual Button and Gate or Trigger inputs (as other A/B modules).

Six independent channels: all controlled by the A/B selection. On this variant there are six inputs for CV/signals which are then attenuated by the value of **A** the value of **B** depending on the setting of the A/B switch.

CV In switch sets whether the CV input assumes 0V to 5V or -5V to +5V with +5V always meaning "B" mode.

Gate Out: provides a gate (0V=A, 5V=B) output to allow for chaining of modules for Manual or other control modes. *Plug the Gate Out into a Gate In on another module and switch it to "Gate" mode.*



Gate/Trigger Inputs: one or two trigger or gates inputs based on the Gate/Trigger mode switch. The labels will reflect the mode and the LEDs indicate signal on the input. **Not used in EXT mode.**

Gate/Trigger mode: select mode for switching inputs: "Trig." has separate trigger inputs for A and B, "Latch" has a single trigger to swap A/B, "Gate" takes a gate with 0V=A, 5V=B and "Inv." inverts to gate to 0V=B, 5V=A.

Output jacks for the six channels. The output is either **A** x Input or **B** x Input depending on the state of the A/B switch, or morphing between them based on the Ext CV input or Cross-Fade settings for the channel.

xF (Cross-Fade) switches: select whether channel switches between A and B directly (switch off/up) or by fading (switch on/down). Used to remove audio clicks or provide slower morphing for audio and CV signals. **In EXT mode these switches are all ignored.**

Cross-Fade (xF) Time knob sets the time used in the smoothing and morphing. *Defaults to 25ms but can be set from 0ms up to 12s.*

Options button for configuration of the log/linear mode for the Cross-Fade Time

CONFIG DIALOG

Brings up the menu to manage the global and module defaults

SETTINGS

▼ CONFIG

Mid-Point value for the Cross-Fade Time

CLOSE

Sets mid-point for the cross-fade log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Notes Panels (8HP/16HP)

The **Notes Modules (8HP and 16HP)** provides modules that you can add your notes into a preset. The modules are simple blank panels with two editable areas for a heading and for notes (using double-click to edit) with a font size selector and a background colour selector with silver/grey, yellow, red, blue or green backgrounds.

Available in a 16HP and 8HP module, developed to help provide in-preset help information and tutorial information as part of the collections, but can be used for note taking in your own presets.

Heading: double click here to edit the heading (fixed font size)

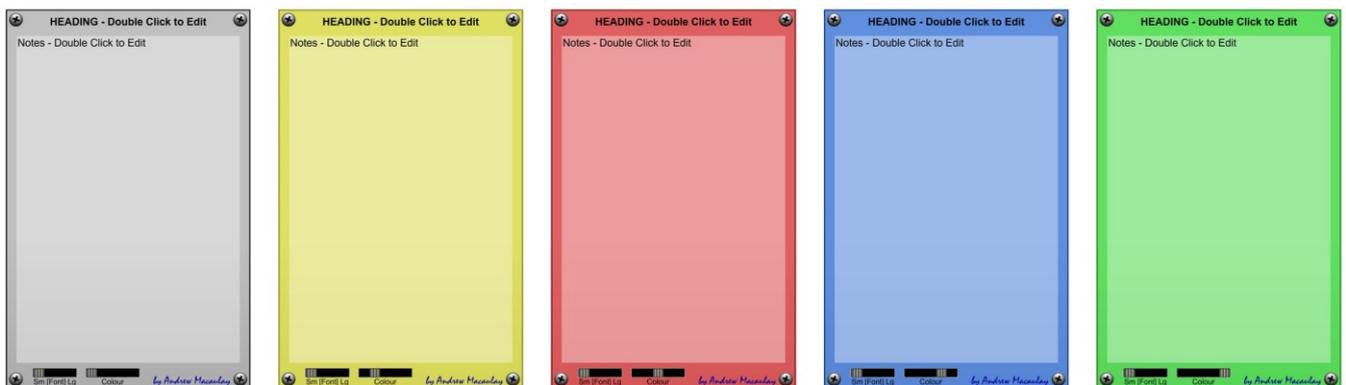
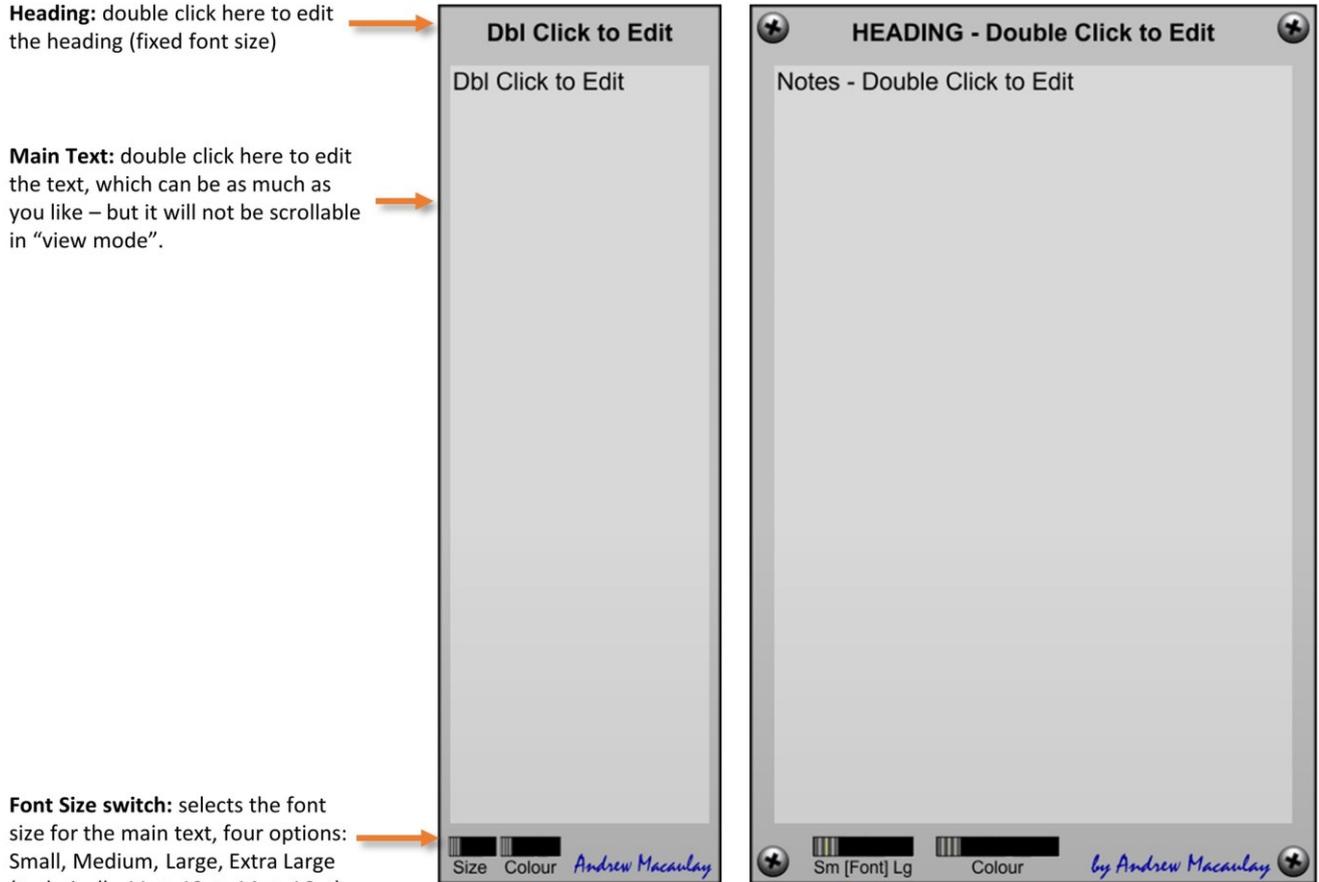
Main Text: double click here to edit the text, which can be as much as you like – but it will not be scrollable in “view mode”.

Font Size switch: selects the font size for the main text, four options: Small, Medium, Large, Extra Large (technically 11pt, 12pt, 14pt, 16pt)

Colour (5-way) jack: to select the colour of the panel, as shown below

Font Size switch: selects the font size for the main text, four options: Small, Medium, Large, Extra Large (technically 11pt, 12pt, 14pt, 16pt)

Colour (5-way) jack: to select the colour of the panel, as shown below



Patch Bay (10 Mono/10 Poly)

The **Patch Bay (10 Mono)** and **Patch Bay (10 Poly)** modules are the simplest of modules, providing 10 pass-through mono or poly connections (depending on the version used) which allows you to daisy chain two or more cables to match other signal paths for patches where sample-accurate synchronisation is needed. You can daisy chain the connections to achieve more than a single sample delay.

Currently, each cable connection in Voltage Modular introduces a one sample delay, so if you are timing things to the sample-level but have a module in the sequence on one path and none on the other, you can see sample offsets. These modules allow you to easily address this. You can also daisy chain the connections to achieve more than a single sample delay.

Signal Inputs. 10 independent mono or poly input channels (depending on module) to be send to the individual outputs with no processing. This signal can be anything – audio, CV, gates, triggers, etc.



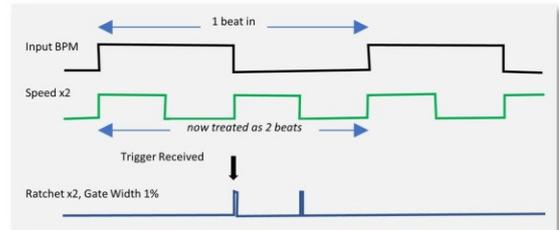
Signal Outputs. 10 independent mono or poly (depending on module) outputs simply sending the input signal with no processing.

Pattern Ratcheter

A timed ratcheting unit with 8 steps and customisable patterns and gate times, including CV control over the gate times. Can be used in fixed mode (runs the whole sequence, 1 to 8 steps) or re-trigger mode. Outputs the combined trigger/gate signals plus individual step gates, and a chain trigger so that multiple 8-step units can be chained.

The timing can be from the host clock or from an optional gate input – the host/DAW mode is selected when no jack plugged into the clock in socket. In both cases, the rate can be set using the Beats control, from 1/16 beat to 16 beats per BPM. The gate width has a switchable minimum 2ms setting useful for Cherry Audio (and other) Envelopes, which have a minimum Attack Time of 2ms, and there are controls to set the individual gate widths to a single value or master value.

The **Pattern Ratcheter module** provides comprehensive “ratchet” effect that can be used for Tangerine Dream-like sequencing and many more rhythmic effects. Ratcheting means taking a “step” (beat) and gating it multiple times within the beat so you get, for example, a triplet on a ratcheted step. This module has extensive pattern-based options and step-specific gate widths, to allow to allow much more flexibility. It also provides the ability to chain Ratcheters to give you ratchets of 16 steps or even more.



Trigger In: provides the signal for the pattern ratcheting to start (at the rate set by the steps and Speed setting).

Step On/Off button: select these to switch each step on or off. If the step is off, no gate/trigger is sent at the time of the step. Only steps that are available, based on the Steps/Beat knob can be changed.

Step LED: shows the step which is currently active in the ratchet, this is shown whether the step is on or off.

Step width to “Master Gate Width”. When selected, the LED will light on this button and the gate width for this step will be the width as set by the “Master Gate Width” control.

Step Width control: sets the gate width for the individual step which, together with selecting steps on and off, allows for complex rhythms to be setup in the ratcheting process. This is active by default and unless the “Step width to Master Gate Width” button has been selected on the step.

Individual Gate out jacks: provide a gate out from each step, allows triggering of different events or sounds on each step of a ratchet.

Retrigger mode: allows a ratchet to be retriggered early. When off, the default mode, a Trigger In arriving during the ratchet will be ignored. When on, a “Trigger In” signal that arrives during the ratchet will start a new ratchet from Step 1.

To#1 [set all widths to Step1 width]: pressing this button simply sets all the step gate width controls to be the same as the gate width set for Step 1. Note, this does NOT lock them.

Mast [set all to “Master Gate Width” mode]: pressing this button simply sets all the “Step width to Master Gate Width” buttons to on, and **Manual** mode to set them all to manual mode.

Chain out jack: provides the next gate after a ratchet event, so you can chain multiple 8-step ratcheters together by feeding the Chain out into the Trigger In on a second ratcheter, etc.



Steps per beat: selects between 1 and 8 steps per beat.

New Standard BPM Sync UI: if an older preset requires it, a legacy version of the UI will automatically be displayed. See the help about the Standard External BPM Sync for more detail on the UI behaviours as well as the legacy mode.

Ext. Clock/BPM CV input: BPM CV or external gate/clock from which the BPM is measured. Allows sync with LFO-driven clock/sequencer.

BPM CV button switches ext. input to be 100bpm/V BPM CV source (name/colour changes) with the **Host Clock** LED showing when host clock used (no jack connected)

Speed knob/LED: clock multiplier and divider (1/16th to 16x BPM). This determines what “1 beat” for the ratcheting process is.

Width CV In and adjustment knob: allows a CV to control the gate width over time with a -100% to +100% control amount. Affects the gate width of the current step.

Advanced Ext.Clock sense switch: gated mode input (e.g. sequencer) or normal mode (varied BPM); and reset-time setting for gated mode.

Ratchet Gate Out jack: the ratchet gate signal, with the gate width as set for the individual step.

Min Gate Width: sets min. gate width to 0ms/2ms. Some envelopes need 2ms for attack to complete. The default setting of this uses the setting in the global and module configuration. The ▼ button allows you to manage these defaults.

Master Gate Width setting: sets the gate width to be used on any step where the “Step width to Master Gate Width” button is selected. Can be set from 0% (trigger) to 100%.

Ratchet Trigger out: a trigger out (0% gate width) signal at same time as gate out which can be used for e.g. percussion envelopes.

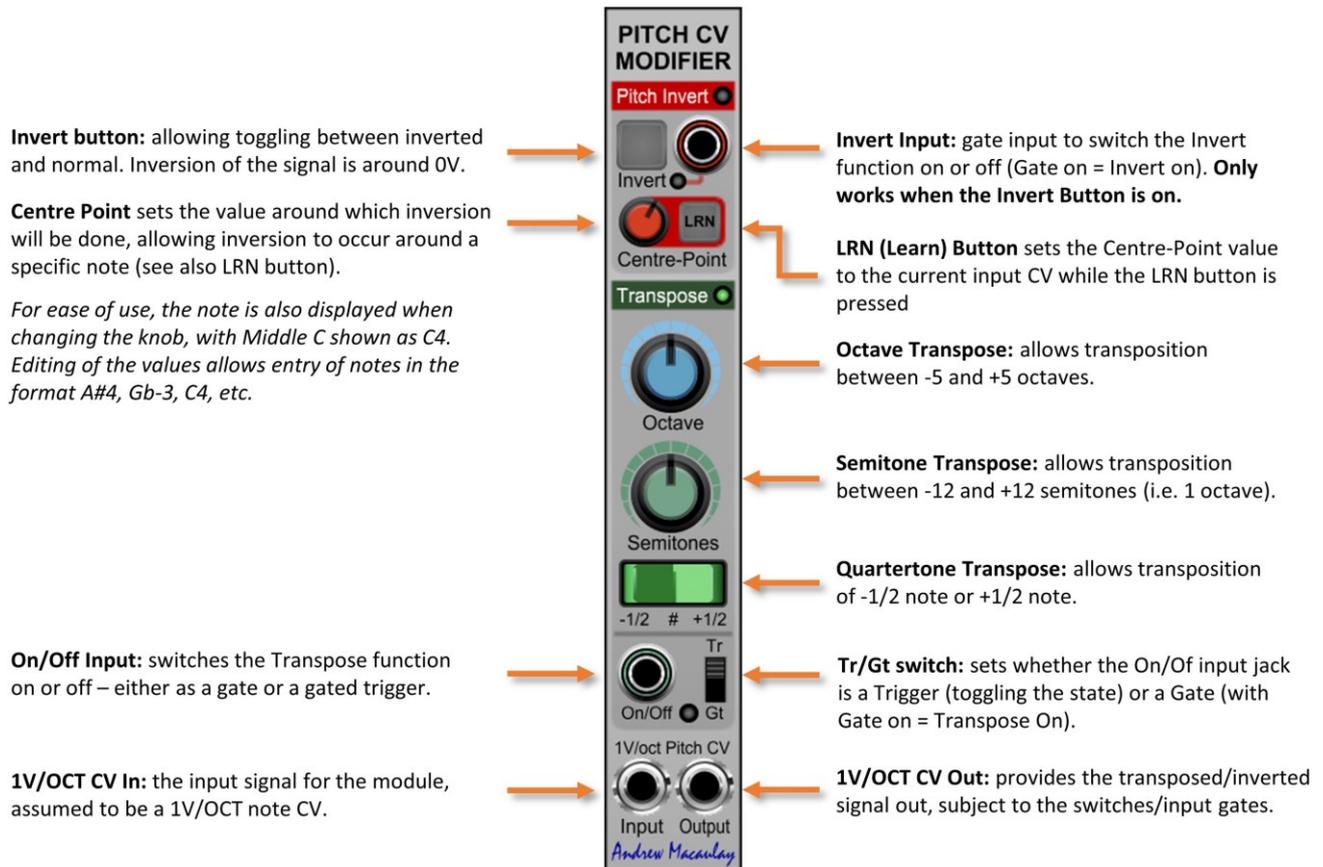
Pitch CV Modifier

The **Pitch CV Modifier module** is a CV transpose module (NOT AN AUDIO SIGNAL MODULE) which can transpose 1V/OCT inputs in octaves, semitones and quartertones.

Taking inspiration from some physical Eurorack modules, this module allows inversion of the signal and switching of the inversion and transposition on and off.

The inversion point can be controlled (useful for inverting envelopes around the sustain level) with a Learn button to set the level to the current input. To make setting the inversion point as easy as possible, the value can also be set to specific notes using the notation A#4, C-1, Gb+3, etc. in addition to entering as a normal voltage value.

Using gates to switch these modes can generate interesting harmonic variations. Using a number of these with voltage-controlled switches or sequential switches can generate interesting harmonic movement.



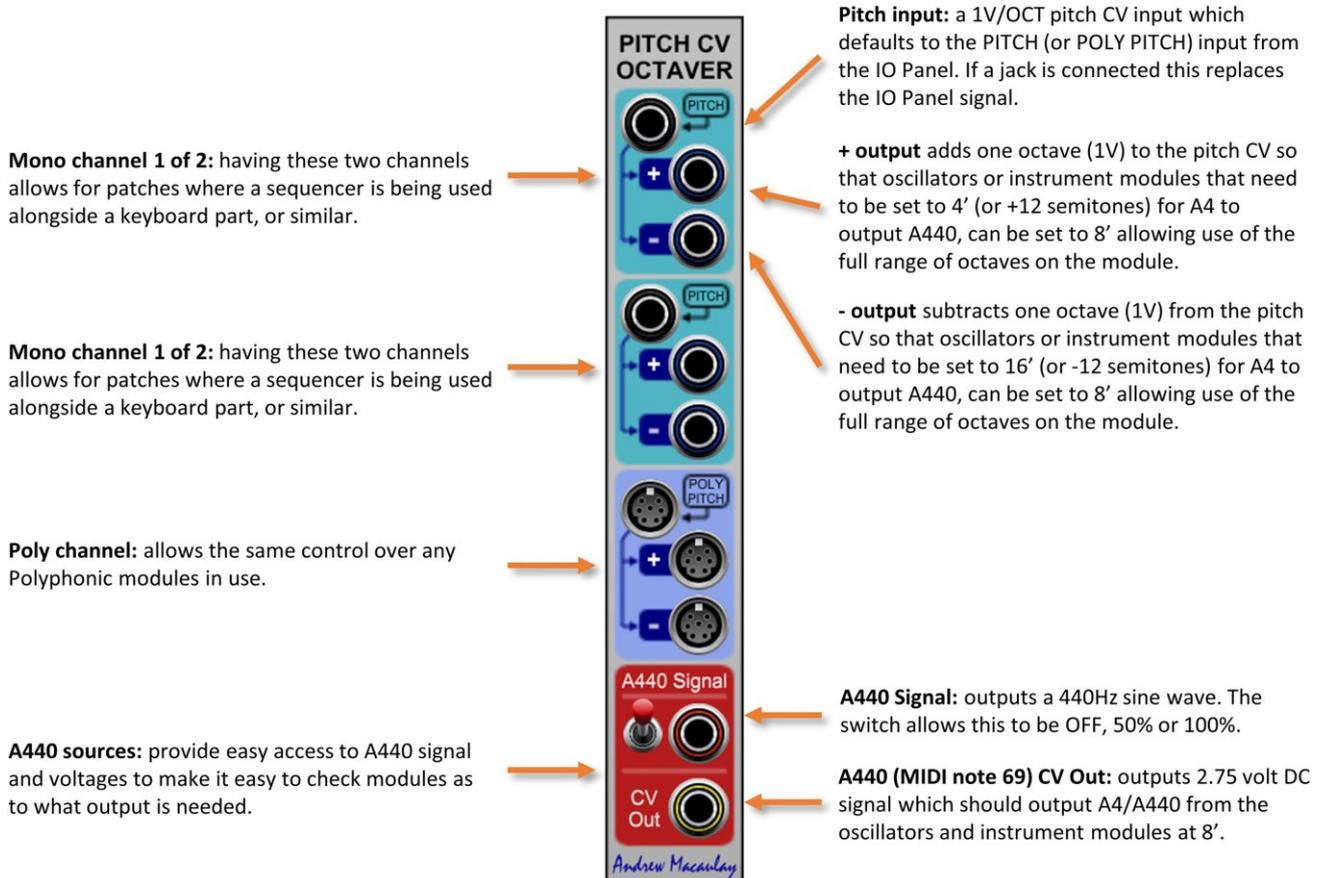
Pitch CV Octaver

The **Pitch CV Octaver module** is a fixed CV transpose module (NOT AN AUDIO SIGNAL MODULE) to help with those oscillators and instrument modules which need to be set to 16' or 4' for A4 (MIDI note 69) to output 440Hz. This can be used to make it simpler to use multiple modules in a patch.

This small module takes the 1V/OCT CV input, adds an octave for those oscillators which have to be set to 4' or +12 semitones for A4 to output 440Hz, and subtracts an octave for those oscillators (including the main Cherry Audio oscillators) that have to set to 16' for A4 to output 440Hz. This means that you can control all your oscillators and instrument modules with the 8' octave setting outputting A4 (MIDI note 69) as 440Hz.

By default, the PITCH (and POLY PITCH) signal from the I/O Panel is used on each channel, with the option to patch in your own cable - allowing sequencers, etc. as well as keyboards/DAWs. The small form factor module includes three channels, two of which are monophonic and one of which is polyphonic.

The module also includes an A440 audio source and A4 voltage output to allow easy checking of individual modules.



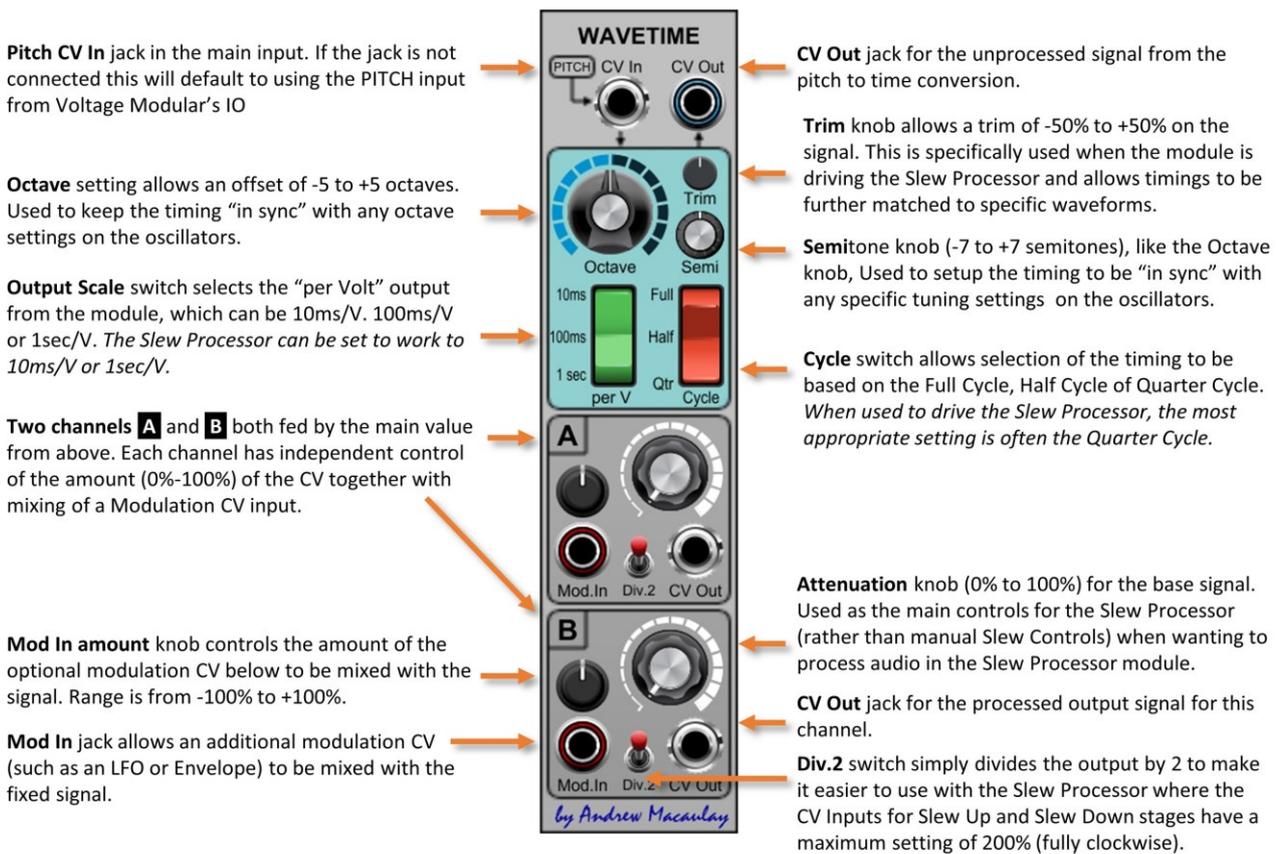
Examples where CV Pitch Octaver can be helpful include **FM Station** where the **+** signal allows the module to be set to 8' for A4 as 440Hz (needs to be set to 4' otherwise), and **Synthvoice** and many of the **Cherry Audio oscillators** where the **-** signal allows the modules to be set to 8' for A4 as 440Hz (need to be set to 16' otherwise).

Pitch CV to Wave Time

The **Pitch CV to WaveTime module** was originally conceived as a simple way to drive the Slew Processor for Audio Signals by converting 1V/OCT pitch control voltages to the time of the waveform. Although the main features of the module are focussed on this use, it can also be used to control features on other modules such as the times on the Voltage-Controlled Envelope.

The module takes a 1V/Octave CV input (which defaults to the Pitch input from the Voltage Modular I/O panel) and converts this to a CV representing the time-period of a waveform at that frequency. The calculated time then has a global Octave and Semitone offsets, settings for full cycle, half-cycle or quarter-cycle timing and scaling of the output signal to 10ms/V, 100ms/V or 1 second/V.

In addition to a simple CV output, two additional processors allow this amount to be attenuated and to have a modulation CV source mixed in so that you can easily control the Up and Down channels of the Slew Processor for used with audio signals. The module can also be used for other scenarios, such as adjusting the envelope times in the Voltage-Controlled Envelope.

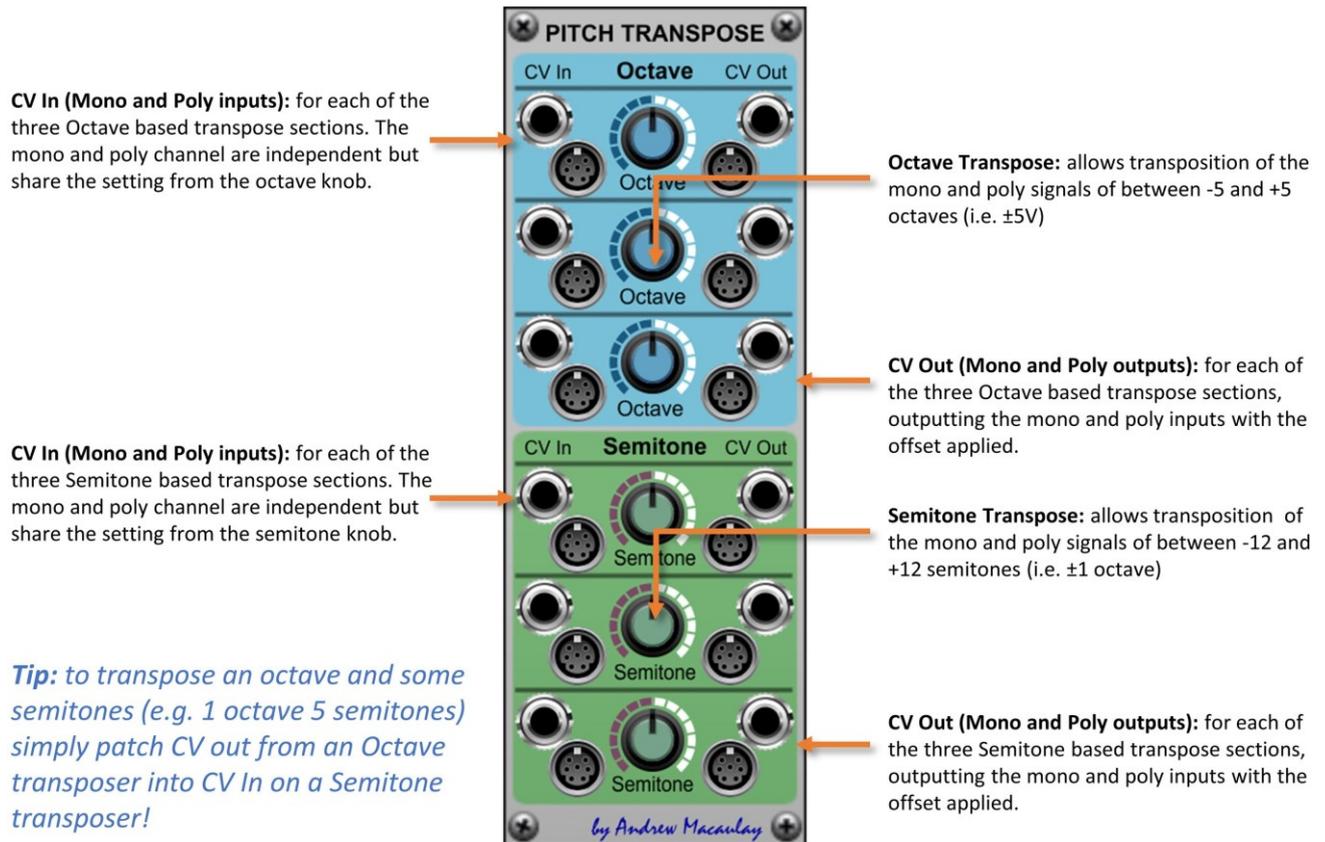


For a "typical" use of this module with the Slew Processor, connect the PITCH to the same sources as used for the Oscillator being processed in the Slew Processor; send the waveform into the Slew Processor In; match the Octave, set to 10ms/V in this module and in the Slew Processor; connect CV Out from A and B to the CV Inputs on Slew Up and Slew Down; set the Manual Slew setting to 0 and the CV Amount to 200% and switch Div.2 on. Then you can use the **A** and **B** attenuation knobs to adjust the amount of slew on the audio and add modulation such as an LFO or Envelope controlled with the Mod In amount.

Pitch CV Transpose

The **Pitch CV Transpose module** is a simple CV transpose module (NOT AN AUDIO SIGNAL MODULE) which can transpose both Monophonic and Polyphonic 1V/OCT inputs in Octaves (3 channels) and in Semitones (3 channels).

The module supports both mono and polyphonic signals (at the same time) on each of the six channels.



Poly Delayed LFO

The **Poly Delayed LFO** module provide a polyphonic Delay and Fade envelope controlling the built-in monophonic LFO as well as two additional VCAs to use more powerful LFOs or other modulations with the delay module. The delay can be triggered on each separate polyphonic note, on the first note (effectively a legato mode for the LFO) or retriggered across all notes on each new note; this allows you to simulate the delayed LFO that was provided on vintage devices such as string machines.

The delay CV can be mixed with up to two mono CV inputs and two polyphonic CV inputs, allowing the mixing of e.g. keyboard after-touch, mod wheel, etc. with the delay envelope. Default routing for the POLY GATE input, as well as the MOD-WHEEL and AFTER-TOUCH inputs make this module easy to use whilst flexible. Support for +ve and -ve control voltages and mixing, as well as limiting to a specified range allow flexible control voltages.

The built in simple LFO, as controlled by the delay/modulation, is available with separate outputs for Sine, Triangle, Sawtooth, Ramp, Square and Pulse (with a variable pulse width control) and the delay module has its own polyphonic output so that you can drive other modules with this.

Delay and Fade: control the time of the Delay (no signal) and Fade (to full signal).

Config button: brings up the config pop-up, allowing control of the delay and fade time knob behaviour.

Gate input: used to trigger the delay/fade process – defaults to the POLY GATE from the I/O panel if no jack is connected.

Trigger mode: selects **Poly** mode where each note starts its own delay; **First** mode where first note starts delay, others pick current level; and **Retrigger** mode, where each note starts all notes' delays.

Delay CV Mix: controls the amount of Delay in the CV mix. Defaults to 100%. Off button to quickly disable the delay input.

Mono CV In 1/Mix: mono input of CV to be added into CV. Defaults to MOD WHEEL from I/O panel if no jack connected.

Mono CV In 2/Mix: mono input of CV to be added into CV. Defaults to AFTER TOUCH from I/O panel if no jack connected.

Poly CV In 1/Mix: polyphonic input of CV to be added to CV controlling LFO amount.

Poly CV In 2/Mix: polyphonic input of CV to be added to CV controlling LFO amount.

CV Mix Limiter: controls limiting of the CV mix: "Off" is no limiting; "Norm." make sure that the mix totals to ±100% and "Limit" places a hard limit of ±100% on the resulting CV.

Curve: changes the fade curve from exponential to linear (default) to logarithmic.

Delay output: outputs the delay envelope in standard 0V-5V range.

Trigger Sync: when on, forces the LFO to start its cycle – which can be on First note or Retriggered.

LFO Rate: sets the rate for the LFO. The LED shows the speed.

Pulse Width control: controls the pulse width for the Pulse output.

LFO Outputs: provide the LFO signals as controlled by the CV mixed including the delay and other CV inputs.

CV Processing takes mono or poly signal and processes using CVs used on LFO.

CONFIGURATION DIALOG

SETTINGS

▼ CONFIG

Mid-Point value for Delay and Fade Times

Mid:750ms

CLOSE

Brings up menu to manage global and module defaults

Set mid-point type for the gate length knob log mode to be 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Delay and Fade knobs control the time in milliseconds using a logarithmic or linear scale, configured through the settings config dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 1250ms unless changed in the global or module defaults (see general help).

Poly Dual VCA and Inverter

The **Poly Dual VCA and CV Inverter module** is a polyphonic version of the polyphonic version of the Dual VCA and Inverter and hosts two simple voltage-controlled amplifiers and a voltage inverter. The flexible inverter has control over the input range and the inversion point, useful with envelopes.

The dual independent VCAs can be switched between linear or exponential modes, can allow inversion with negative CVs or have negative CV values meaning 0V, and have optional Zero Crossing sensing to help reduce clicks when using switching or aggressive envelopes.

CV In: is the control voltage to be processed by the Inverter function.

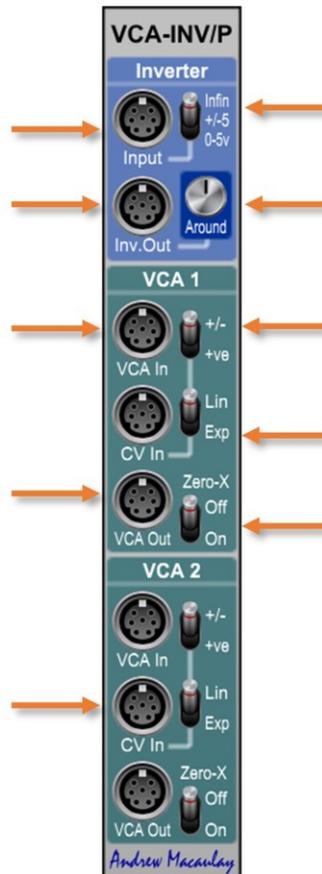
INVERTED CV Out: is simple 5V – the input value, which is constrained to between 0 and 5V.

VCA In: is the input for the signal to the voltage-controlled amplifier. This will be attenuated by the value of the CV input.

CV In: is the control voltage used to determine the attenuation of the signal in the VCA. Assumed to be an input of 0-5V.

VCA Out: is the output from the voltage-controlled amplifier, attenuated by the CV input.

VCA 2 section which is independent of and identical in functionality to VCA 1.



Input Range controls how input values are sensed – infinite allows ANY input value to be inverted, +/-5V and 0-5V provide specific ranges. Older presets loaded in the module will automatically set this to 0-5V for backwards compatibility.

Around knob allows the inversion to be around a value other than 0V which can be useful, for example, when inverting envelopes around their Sustain Level. The LEARN button allows this to be set easily.

CV Range switch in +/- mode will invert signal with -ve CVs or in +ve mode will switch off the signal at 0V or -ve values.

Lin/Exp switch selects if VCA driven in a Linear or Exponential (volume) mode.

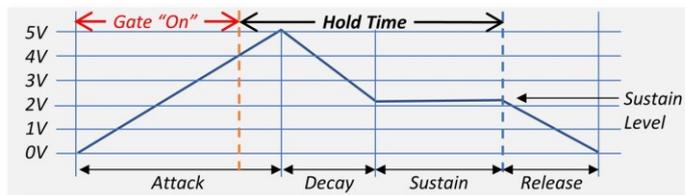
Zero-X switch selects whether zero-crossing processing is used on the VCA.

Zero-Crossing Processing minimises the clicks that can occur with fast changes in the input CV such as gates or fast attacks/decays by aligning such fast changes with the input signal crossing zero (so avoiding the click).

Poly ENV-20 EG2 Envelope

A polyphonic version of the ENV-20 EG2 Envelop, a small form-factor ADSR envelope generator inspired by the Korg MS-20 EG2 envelope generator. This module supports legato and retrigger modes for the hold time, normal or “Fast” Attack shapes and the optional linking of Decay time to Release time, supports options for the mid-point of the time controls from the “options” cog-wheel button and defaults the Gate In to the I/O Panel Gate if no jack is connected, for simpler patching.

The **Poly ENV-20 EG2 Envelope** offers an alternate ADSR envelope inspired by the Korg MS-20 EG2 envelope with its unique Hold behaviour. The Hold time on this module only starts AFTER the gated signal has been released, extending the envelope sustain by the Hold time.



Gate input: the key input for the envelope. The gate going on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, defaults to Gate In on the Input Panel.

Hold time: sets the time that the envelope will stay running AFTER the gate is released – effectively this Hold is added to the end of the gate.

Attack time: sets the time it will take after the Delay for the envelope output to go from 0V to 5V.

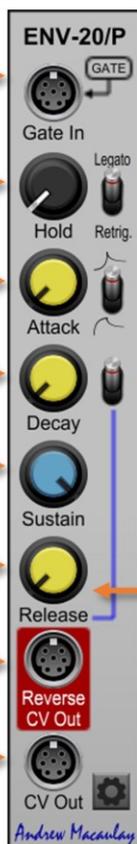
Decay time: sets the time it takes for the envelope to go from the Hold Level down to the Sustain Level.

Sustain level: the level which is output during sustain phase, until the “gate” is released back to off AND after any additional Hold has completed.

Release time: sets the time it takes for the envelope to return to zero after the end of the Sustain phase.

CV Rev Out is also modelled on the Korg MS-20 EG2, with the envelope inverted BUT with 0V set to the Sustain level.

CV Out is the output for the envelope, with values between 0V (off/delay stage) and 5V (peak).



Legato/Retrig mode determines if the envelope will always complete the Hold or retrigger.

There are two retrigger modes: “soft” (Retrigger I) and “hard” (Retrigger II). The soft retrigger reflects the original behaviour and restarts the envelope from the current value, the hard retrigger restarts from 0V.

Fast Attack switch changes attack from a slow start (exponential) to a “fast start” (logarithmic) shape

Decay Time switch, locks Decay time to Release time. When this is on, the Decay knob becomes disabled.

Status LEDs: show stage envelope is currently at.

Config: opens configuration dialog, see →

CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls ▼

Mid:750ms

Set minimum Attack time

0ms 2ms

Set min time on Decay and Release

0ms 2ms

CLOSE

Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum Attack time to 0ms or 2ms (2ms stops clicks and is default on Cherry Audio envelopes)

Sets minimum Decay and Release times to 0ms or 2ms

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

Poly I/O Bus Plus

The **Poly IO Bus Plus module** enhances the IO Bus polyphonic inputs (or alternate inputs) by outputting Monophonic Gates in in Legato (“single”) and Retrigger (“multi”) mode, Monophonic Triggers for the first note (“single”) and retriggered (“multi”), Sustained versions of the polyphonic gates and a poly-pitch output with the pitch bend included (and control over the maximum bend).

The module offers two modes of operation for how it deals with "note stealing" when you have exceeded the number of notes set as the maximum polyphony - standard operation, whereby the gate output and sustained gate output behave as the normal gate, with often legato behaviour when playing a sequence of notes which exceeds the polyphony; and note triggered mode which always triggers when a new note is seen (the module expects raw notes here, i.e. without any pitch bend or vibrato).

Poly Pitch Input defaulting to the Poly Pitch input from the IO Bus when no jack is connected.

Poly Gate Input defaulting to the Poly Gate input from the IO Bus when no jack is connected.

Note Retrigger option to help with poly sustain scenarios. When on, a note changing on a poly channel generates a new trigger on that channel.

Min Gate 0ms/2ms switch: sets the output gate to have a forced minimum time of 2ms which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms. The default setting of this uses the setting in the global and module configuration. The button allows you to manage these defaults.

Sustain Pedal Input defaulting to the Sustain Pedal input from the IO Bus when no jack is connected.

Mono Pitch Bend Input defaulting to the Pitch Bend input from the IO Bus when no jack is connected.

MONO GATES taking the polyphonic gate inputs and output mono gates for:

- Legato Output:** provides a +5V gate which is only triggered when a key has been released.
- Retrigger Output:** provides a +5V gate which is retriggered on each key press, irrespective of whether the previous key was released.

MONO TRIGGERS taking the polyphonic gate inputs and output mono triggers for:

- Legato Output:** provides a +5V gate which is only triggered when a key has been released.
- Retrigger Output:** provides a +5V gate which is retriggered on each key press, irrespective of whether the previous key was released.

Sustain Polyphonic Gate Output adds sustain pedal information to the input polyphonic gate, simplifying the use of sustain with envelopes that don't have a separate sustain CV input.

Bend Limit Knob limits the pitch bend amount to between ± 1 semitone and ± 2 octaves, with a default of ± 1 octave. The 0 position passes the pitch bend wheel through giving a maximum pitch bend of 1V/OCT resulting in ± 5 octaves.

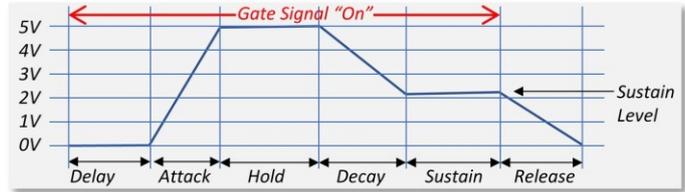
Pitch With Bend Output: provides the 1V/OCT pitch output with the bend applied, subject to the limits set by the Bend Limit knob.

by Andrew Macaulay

Poly Micro Envelope

A polyphonic version of the Micro Envelope, a simple Delay, Attack, Hold, Decay, Sustain, Release envelope in a tiny module, ideal when you want to minimise the space use, for example when you want to control the Additive Oscillator with multiple envelopes. Gate Input defaults to Panel Gate if no jack connected for simpler patching. Includes fast and normal attack curves, has the option to link the Decay time to the Release time and fully supports setting the mid-point of the log-scale time controls available from the “options” cog-wheel button.

The **Poly Micro Envelope module** provides a simple but flexible polyphonic DAHDSR envelope in a very small form-factor. This is a poly version of the Micro Envelope module.



Gate input: the key input for the envelope. The gate going on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, uses the Panel Input POLY GATE.

Delay time: sets a delay after the trigger/gate goes on, where the output remains at zero before the envelope starts.

Attack time: sets the time it will take after the Delay for the envelope output to go from 0V to 5V.

Hold time: sets the time the envelope stays at the full amount of 5V after the Attack phase finishes.

Decay time: sets the time it takes for the envelope to go from the Hold Level down to the Sustain Level.

Sustain level: the level which is output during sustain phase, until the “gate” is released back to off.

Release time: sets the time it takes for the envelope to return to zero after the end of the Sustain phase.

CV Out is the output for the envelope, with values between 0V (off/delay stage) and 5V (hold stage).



Delay Retrigger Mode switch allows the retrigger to start the Delay stage (default) or go straight to the **Attack** stage.

Fast Attack switch changes attack from a slow start (exponential) to a “fast start” (logarithmic) shape

Decay Time switch, locks Decay time to Release time. When this is on, the Decay knob becomes disabled.

Config: opens configuration dialog, see →

CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls ▼

Mid:750ms

Set minimum Attack time ▼

0ms 2ms

Set min time on Decay and Release ▼

0ms 2ms

CLOSE

Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum Attack time to 0ms or 2ms (2ms stops clicks and is default on Cherry Audio envelopes)

Sets minimum Decay and Release times to 0ms or 2ms

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

Poly Micro Envelope VCA

The **Poly Micro Envelope VCA module** is a polyphonic version of the Micro Envelope VCA, a simple and small form-factor Attack, Hold, Decay, Sustain, Release (AHDSR) envelope (with an Envelope CV Output) teamed up with a Voltage Controlled Amplifier. This can be used effectively when you want to control multiple waveform outputs from the oscillators by individual envelopes.

The envelope section includes Fast and Normal attack curves and the Decay Time sync switch to lock the Decay and Release Times. The envelope section fully supports setting the mid-point of the log-scale time controls from the “options” cog-wheel button.

The VCA section can be controlled by the envelope in Linear or Exponent mode and has optional Zero Crossing processing for the VCA to reduce clicks when using aggressive envelopes.

Gate input: the key input for the envelope. The gate on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, the module uses the GATE signal from the Panel Inputs.

VCA In is signal input to be controlled by the envelope, can be an audio or control voltage.

Attack time sets the time it will take after the initial trigger for signal to go from 0% to 100%.

Hold time sets the time the signal stays at the full amount of 100% after Attack phase finishes.

Decay time sets the time it takes for envelope to go from Hold Level down to Sustain Level.

Sustain level sets the level which is output during sustain phase, until the “gate” is released back to off.

Release time sets time taken for envelope to return to zero after gate is released.

Config button opens the CONFIGURATION DIALOG as shown to the right

Zero Cross switch enables the optional zero-crossing processing on the VCA to minimise clicks from aggressive envelopes. It does this by only changing the envelope level used when a signal crosses zero (a form of sample and hold).

envVCA/P
 GATE
 Gate In
 VCA In Lin Exp
 Attack
 Hold
 Decay
 Sustain
 Release
 CV Out
 Zero Cross VCA Out
 Andrew Macaulay

Lin/Exp switch selects if the VCA driven in a Linear or Exponential mode.

Fast Attack switch changes attack from a slow start (exponential) to a “fast start” (logarithmic) shape

Status LEDs: show stage envelope is currently at.

Decay Time switch locks Decay Time to Release Time. When this is on, Decay knob is disabled.

CV Out allows direct use of envelope CV. This signal is not affected by the Zero Cross switch. *Could use this with Dual VCA Inverter module to use on stereo signals.*

VCA Out is the signal (from VCA In) controlled by the built-in envelope (0%-100%).

CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls ▼

Mid:750ms

Set minimum Attack time

0ms 2ms

Set min time on Decay and Release

0ms 2ms

CLOSE

Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum Attack time to 0ms or 2ms (2ms stops clicks and is default on Cherry Audio envelopes)

Sets minimum Decay and Release times to 0ms or 2ms

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more).

Poly Mini Envelope VCA Plus

The **Poly Mini Envelope VCA Plus** is a poly version of the Mini Envelope VCA, a mini form-factor Delay, Attack, Hold, Decay, Sustain, Release envelope generator with an included dual VCA module and the including the ability to set long envelopes (5 minutes for each stage), a sustain pedal input as well as some less common CV output forms.

All times are set using standard 0 to 12 second controls (with mid-point setting) plus a 0 to 300 second coarse control (in 10 second steps). The envelope can also be set to be triggered in one-shot or looping Delay-Attack-Hold-Decay mode and has End of Decay and End of Sustain trigger outputs.

The sustain pedal and gate input default to the IO Panel for easier patching (the sustain pedal input can be disabled) and retriggering options allow full legato (no retrigger during sustain), normal retrigger during sustain (default) and hard retrigger with return-to-zero. The retrigger can be set to start a new Delay or go straight to the Attack stage.

The Dual Voltage Controlled Amplifier section can allow two independent control signals (including stereo audio signals) to be controlled by the envelope, with either Linear or Exponential control, and they both have a Zero Crossing mode that removes clicks when using very fast envelope settings.

Coarse Time Settings for Delay, Attack, Hold, Decay and Release. These can be set to between 0 and 300 secs (5 minutes) in 10 second steps and are added to the standard time settings

Fine (Normal) Time Settings for Delay, Attack, Hold, Decay and Release. These are standard 0ms to 12000ms (12 second) time setting knobs which are added to the Coarse Time settings.

Envelope Mode switch controls the behaviour of the envelope (see examples below):

- I. **Normal Gated Envelope** with fully gated behaviour going straight to Release even if Delay or Attack have not completed;
- II. **DAHD Always Completes** even on very short gates (or triggers) but works as normal when gate extends into Sustain stage;
- III. **Gated Looping DAHD** mode loops the DAHD stages while the gate is active, completing any Release stage when gate released.

Gate input: the key input for the envelope. The gate on triggers the envelope to start, and the gate going off releases from the sustain mode. If no jack connected, the module uses the Gate signal from the Panel Inputs.

Sustain Pedal Input: when the sustain pedal in is "on" (>2.5V) the envelope is kept sustained even if the gate has been removed. Sustain is engaged if the gate is active and is removed when the sustain pedal signal is "off".

The input defaults to using the Sustain Pedal input from the IO Panel, but can be disabled with the small button or overridden with a mono jack signal input. An LED shows when the sustain pedal input is active.

Dual VCA inputs: two signal inputs for the two independent channels of the dual VCA, which will be processed by the envelope in "normal" mode subject to the Exp and ZeroX switched.



The following CV voltages reflect the Env.Out CV output levels (and internal CV for the VCAs)

Delay time: sets a delay after the trigger/gate goes on, where the CV remains at zero before the envelope starts.

Attack time: sets the time it will take after the Delay phase completes for the envelope to go from 0V to 5V. *See also retrigger mode.*

Hold time: sets the time the envelope stays at the full amount of 5V after the Attack phase finishes.

Decay time: sets the time it takes for the envelope to go from 5V down to the Sustain Level set below.

Sustain level: the level which is output during sustain phase, until the "gate" is released back to off. This is set as a percentage.

Release time: sets the time it takes for the envelope to return to zero after the end of the Sustain phase.

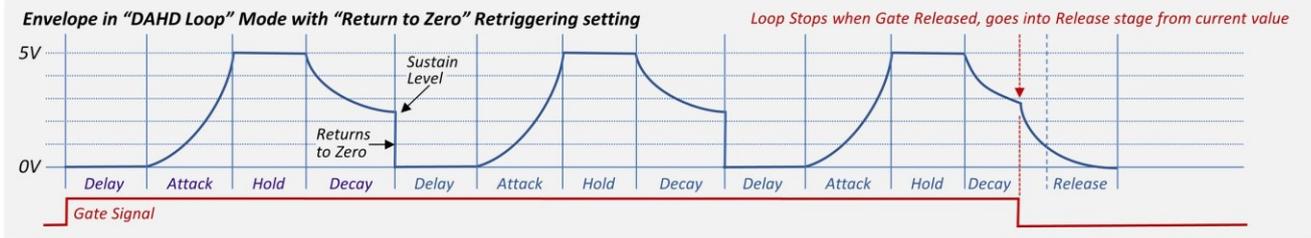
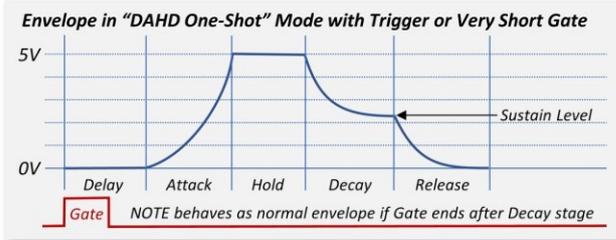
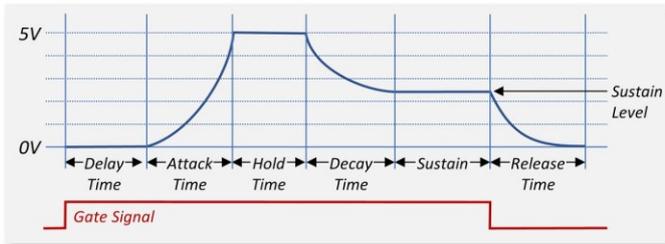
Dual VCA output: two signal output from the two independent channels of the dual VCA.

Exp. mode switch for the Dual VCA (affects both channels): when off envelope controls VCA in linear mode, when on (down/ set to Exp.) envelope controls VCA exponentially.

ZeroX switch for the Dual VCA (affects both channels): when enabled Zero Crossing processing is used to reduce clicks from audio signals when using fast envelope times.

All the 0 to 12 second (fine) time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more). Note that the mid-point is automatically set to be 3 seconds when legacy saves/presets are loaded as the old log-mode knobs had a fixed mid-point of 3 seconds. This can be changed and the adjusted mid-point is saved if the preset is re-saved.

Typically, the two DAHD (always complete and looping) modes would be used with 0% sustain and Release either 0ms or matching the Decay setting – but it is not limited to these, so that the always complete can be used both for percussive envelopes but also in a manner similar to the ENV-20 EG2 behaviour, providing a minimum time for the envelope. The following illustrations show these behaviours.



Fast Attack switch changes the attack from a slow start (exponential) shape to a "fast start" (logarithmic) shape.

Delay Retrigger Mode switch selects whether a retrigger starts at the **Delay** stage (default) or goes straight to the **Attack** stage.

Legato/Retrig mode switch determines how the envelope behaves when retriggered, for example while holding one note and playing another (a typical mono trill style). This also affects how retriggers work when a Sustain Pedal is active:

- **Legato During Sustain** means retriggers will start the new envelope at the current level, so an attack will start at e.g. the current level of a release – noting that, if a Delay time is set, the envelope continues the Release while the Delay is active.
In this mode, retriggers with the Sustain Pedal active are ignored.
- **Retrigger During Sustain** uses the same approach as Legato, with soft retriggers, but allows retriggers while the Sustain Pedal is active.
- **Hard Retrigger (RTZ)** means any retrigger always resets the envelope back to 0V (Return To Zero) so that any Delay stage will be clearly audible, but the retrigger can also be quite harsh.



CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls

Mid: 750ms

Set minimum Attack time

0ms 2ms

Set minimum Decay time

0ms 2ms

CLOSE

Config button opens Options dialog →

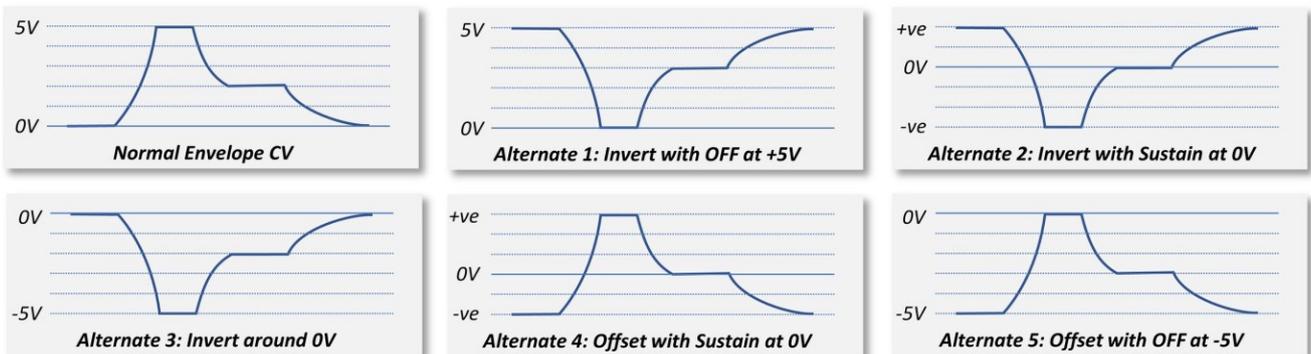
Env.Out outputs the standard envelope as a 0V-5V control voltage.

Alt.Env outputs inverted or offset envelope signals, with the knob allowing settings for invert around 0V, invert around sustain, etc. (see illustrations following)

End.Dec and **End.Rel** trigger outputs provide a +5V trigger pulse when the Decay stage and the Release stage complete.

Note that these only fire IF the stage completes, so they do not fire if the stage is "interrupted" by a retrigger, or if the gate is released during the Decay stage.

Envelope and Alt. Envelope CV Output Examples:

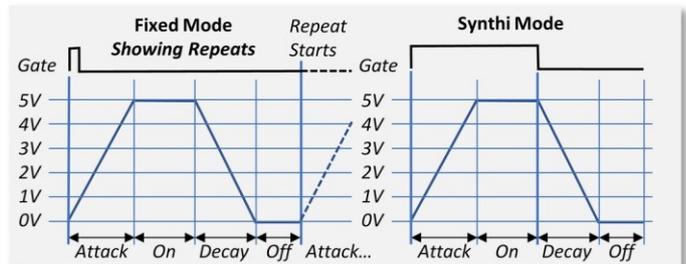


Poly Trapezoid Envelope VCA

A Polyphonic version of the Trapezoid Envelope module with included VCA. Featuring flexible linear and logarithmic slopes for both the attack and decay phases, voltage-controlled decay time, plus options for gated or fixed on stage, and single-shot, repeating or gated repeat mode, the module takes the ideas from the EMS VCS/Synthi and allows even more creativity.

The module also includes a simple VCA path to allow easy use of the envelope with audio or control signals, which has optional linear or exponential CV modes as well as smoothing options including Zero-Crossing processing to reduce clicks when audio processing.

The **Poly Trapezoid Envelope and VCA** module provides an EMS VCS/Synthi inspired Trapezoid Envelope Generator (with some additions) and an included VCA for easy use of the envelope with audio or CV signals. Multiple modes allow use of the Trapezoid as a looping envelope and a single-shot envelope. See the diagrams to the right to see how the main modes behave.



Gate In controls the envelope. The gate going “on” (or a trigger) always triggers the trapezoid to start. Gate “off” only affects the trapezoid if the On stage is in Synthi mode, where the gate determines when the On stage will end, if it is longer than On time.

Attack time: sets the time in ms it will take after the initial trigger for the signal to go from 0V to 5V (0%-100%).

On time: sets the time the signal stays at the full amount of 5V (100%) after the Attack phase finishes. This time is the minimum time it will stay on, if in Synthi mode then the gate can extend this.

Decay time: sets the time it takes for the envelope to go from 5V back to 0V.

Off time: when switch on, the time after the decay has finished and the next repeat of the trapezoid.

Lin/Exp switch selects if VCA driven in a Linear or Exponential (volume) mode.

VCA Section provides a simple, linear VCA for audio and control voltages, linked to the output of the trapezoid envelope generator.

VCA In for the input signal to the VCA to be adjusted by the trapezoid envelope.

Slope controls (Attack and Decay) allows a log, linear or exponential slope to be set to adjust how the envelope “feels”, with the log and exponential slopes variable.

Stop In provides as trigger signal input to stop looping when in Synthi mode

Retrigger Damping provides control of whether a retrigger returns the envelope to zero when set to 0% (legacy behaviour) through to just taking the existing value (i.e. if during on/decay) when set to 100%.

On Gate Mode: determines behaviour of the On stage: “Fixed” means that the On stage only runs for the On time; “Synthi” mode means the On stage runs for all the On time, or the time the Gate is on if this is longer.

Decay CV input and controls with a Decay CV amount knob and the Normal/Continuous switch mode. In normal mode the time is taken when the decay starts, in continuous mode, it can change during decay.

Config button opens the time CONFIGURATION DIALOG as detailed below

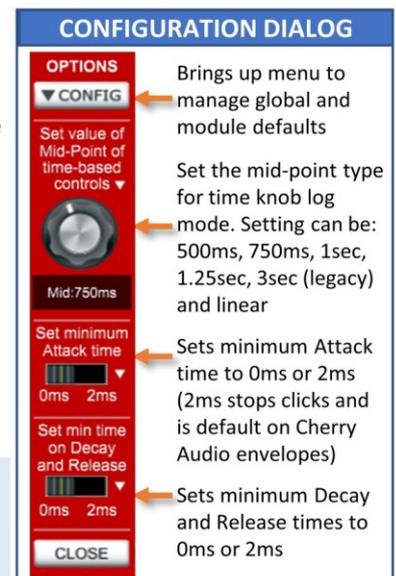
CV Outputs offer both standard 0V to 5V output and the “Bipolar” -5V to +5V output, useful for looping as LFO.

Repeat Mode: “Off” for single-shot; “Gated” for repeat while gate is on; and the “Synthi” mode which continues after trigger until a manual Stop signal is received.

VCA Out is output from the VCA stage as controlled by envelope.

CV Smooth controls the minimising of clicks caused by aggressive envelopes in the VCA stage. The options available are : **Smoothed** (Legacy) which uses a fast glide on the signal; **Zero Crossing Mode**, which uses the input waveform to determine when envelope can change (works well for audio signals); and **None** which can be useful when sending CVs rather than audio signals through the VCA.

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more).



Poly Zero Crossing Processor

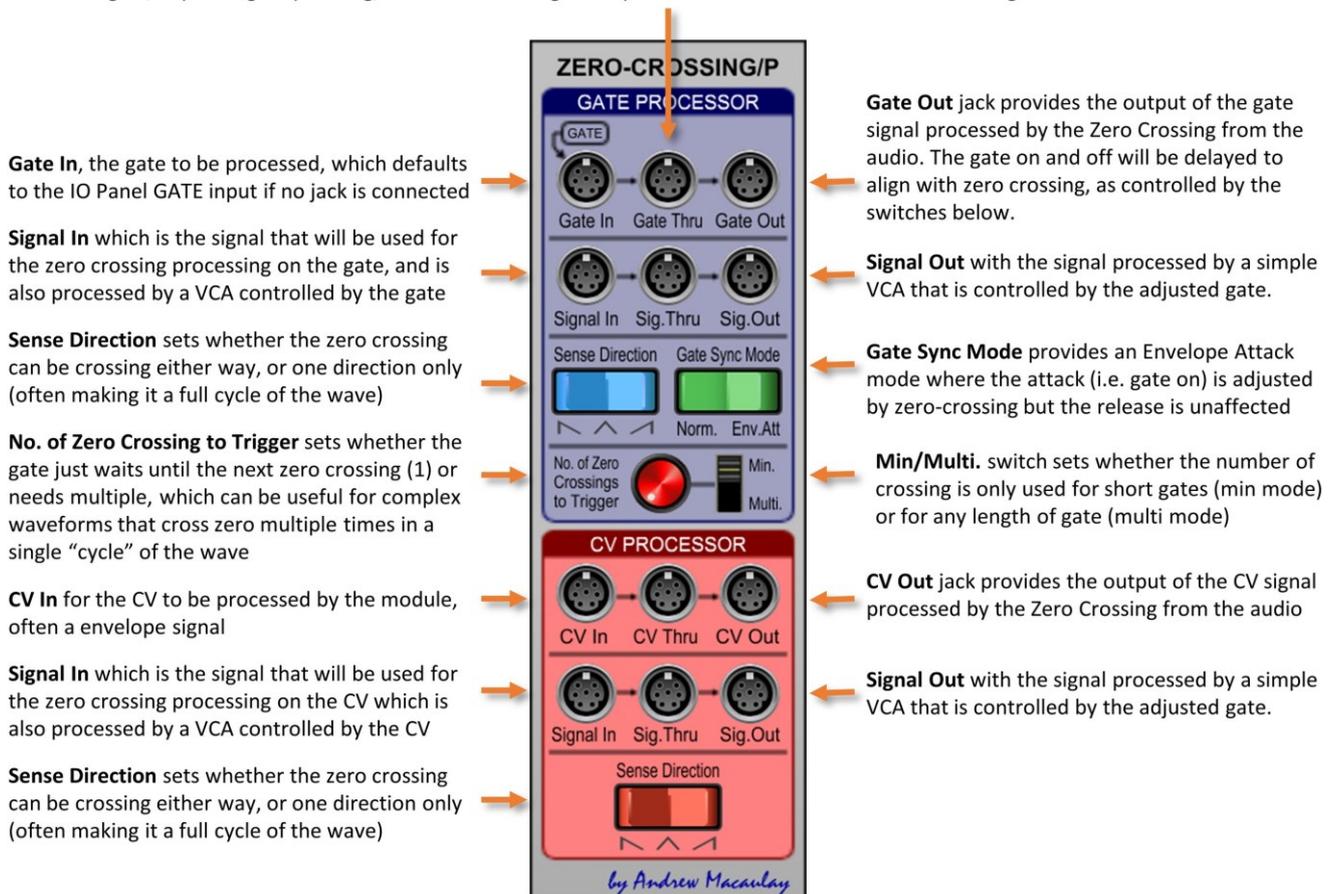
The **Poly Zero Crossing Processor** is a poly version of the Zero-Crossing Processor a utility module that provides “zero-crossing” processing for Gate and CV signals, taking inspiration from Expert Sleepers Persephone. This process is designed to remove or reduce clicks generated when gates/CVs allow the signal through when the signal is not at zero, and especially when the signal is +5V or -5V. See the section [Zero-Crossing Explained](#) for more about Zero-Crossing processing.

The module has two independent sections, one for processing Gate signals and the second for processing CV signals. As the zero-crossing process is aligned at sample level, each input has a thru output as well as a processed output so that the source can be used in modules further down the signal chain knowing that they are fully aligned at the internal sample rate. Each section has a signal path which is needed to provide the zero-crossing information, but which also offers a VCA out with the processed Gate or CV.

The Gate Processing section adjusts the start and end time of the gate signal so that they are always at the time that the input signal crosses zero. This can be controlled so that it senses zero-crossing in any direction, or just crossing up or down. This section also allows the minimum (or gate on time) to be aligned to multiple crossings to work better with complex waveforms. Note that the Gate Processing section may not remove all clicks (but will reduce them) at higher audio frequencies due to the limitations of the internal sample rate.

The CV Processing section uses a sample and hold model on the CV, so that the CV is stepped whenever the signal crosses zero, so that e.g. aggressive envelopes can be tamed so that they don't cause clicks. This can be controlled so that it senses zero-crossing in any direction, or just crossing up or down. This section also allows the minimum (or gate on time) to be aligned to multiple crossings to work better with complex waveforms.

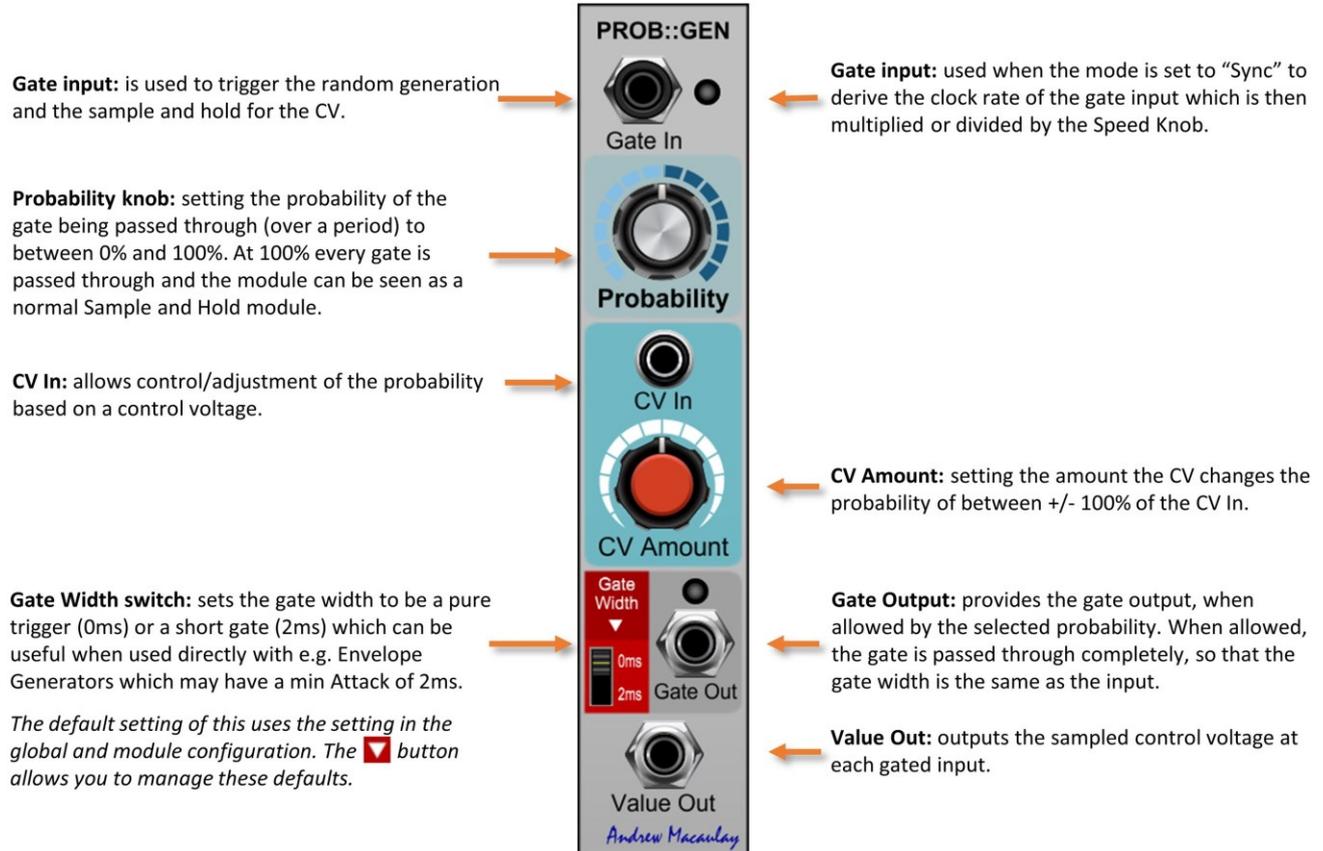
Thru outputs are provided for all signal paths to provide “sample-accurate” signals without any processing, where the original signal is needed later. Especially important with Signal Thru where being used by e.g. a filter/other processing controlled by the CV Out. Without the Thru signal, depending on patching, there can be a single-sample difference between the CV and the Signal which could cause clicks.



Probability Generator

The **Probability Generator module** is designed to generate random events on a gated input. Specifically, it will take a gate input, and on each gate in (used as a trigger) will generate a random number.

The random number is then used to first determine by the probability knob (0-100%) whether or not the gate will be passed through and, second, determine the control voltage to be output in a Sample and Hold style of operation. This can be used to generate random “sequences” by passing the CV through the standard Quantizer.

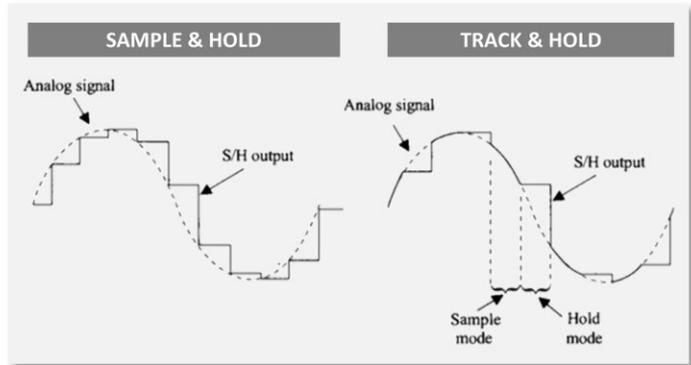


Sample/Track and Hold

A Sample and Hold and Track and Hold module with some additional features. Featuring an internal clock or fully external gating for flexible use, this module supports both the “normal” Sample and Hold approach AND the Korg MS-20 inspired Track and Hold mode where the signal is passed through while the gate is on, and is only sampled when the gate is off.

In addition, the Sample and Hold mode features controls that restrict the amount of change between samples – both as a percentage of the amount of change, or a limit of a fixed voltage. It also features a switch to quantize the output and supports dotted note multipliers (except when in external clock mode).

The **Sample/Track and Hold module** provides a sample and hold module with some additional features including Sample & Hold AND Track & Hold modes. Track & Hold is inspired by the Korg MS-20 S&H module, as illustrated in the diagram to the right. The module also includes Quantizer and the Restrict and Limiter features that limit the change between samples. The module includes an internal clock, but also supports external clocking, including non-regular clocks.



Input signal for the sample and hold. This is often used for inputs such as noise, for a random effect.

Mode switch: to select between Sample and Hold or Track and Hold (inspired by the Korg MS-20) modes.

Restrict: limits the amount of change between the samples by a percentage based algorithm. Restrict and Limiter settings only apply in S&H Mode.

Reset Trigger input synchronises the internal manual or sync'd clock with, e.g. a sequencer.

BPM CV input: using 1V/100bpm CV on many of my other Modules

Clock Selector buttons: to select MANUAL mode or synchronised with the host DAW clock speed, a BPM CV (1V/100bpm) or the speed of the Ext.Clock input. The **EXT** mode is a “pure” external clock mode where the clock is the time when a sample is triggered. This gate signal can also be Inverted by the **Invert** switch.

Trigger 0ms/2ms switch: sets the output clock to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The  button allows you to manage these defaults.



Output of the input as processes by the Sample/Track and Hold processing.

Quantize button which, when enabled, quantize the outputs to notes.

Limiter: limits the amount of change between the samples to a specific amount (voltage). Works in conjunction with the Restrict setting.

Ext. Clock input: the input of an external gate or clock from which the BPM is measured or, when set to EXT mode, the actual clock used to trigger the sample and hold, which can be inverted by the Invert switch

Speed knob: controls the delay of the trigger being generated and works in two ways: in “manual” mode the delay (in milliseconds) is directly controlled by the knob; in Host/BPM mode, the delay is a multiple or division of the input BPM, between 1/16th and 16x. The display of the value is reflects the mode and editing directly also adjusts, allowing for input of the simple number in BPM or the factor using “x” or “*” for multiples and “/” for division.

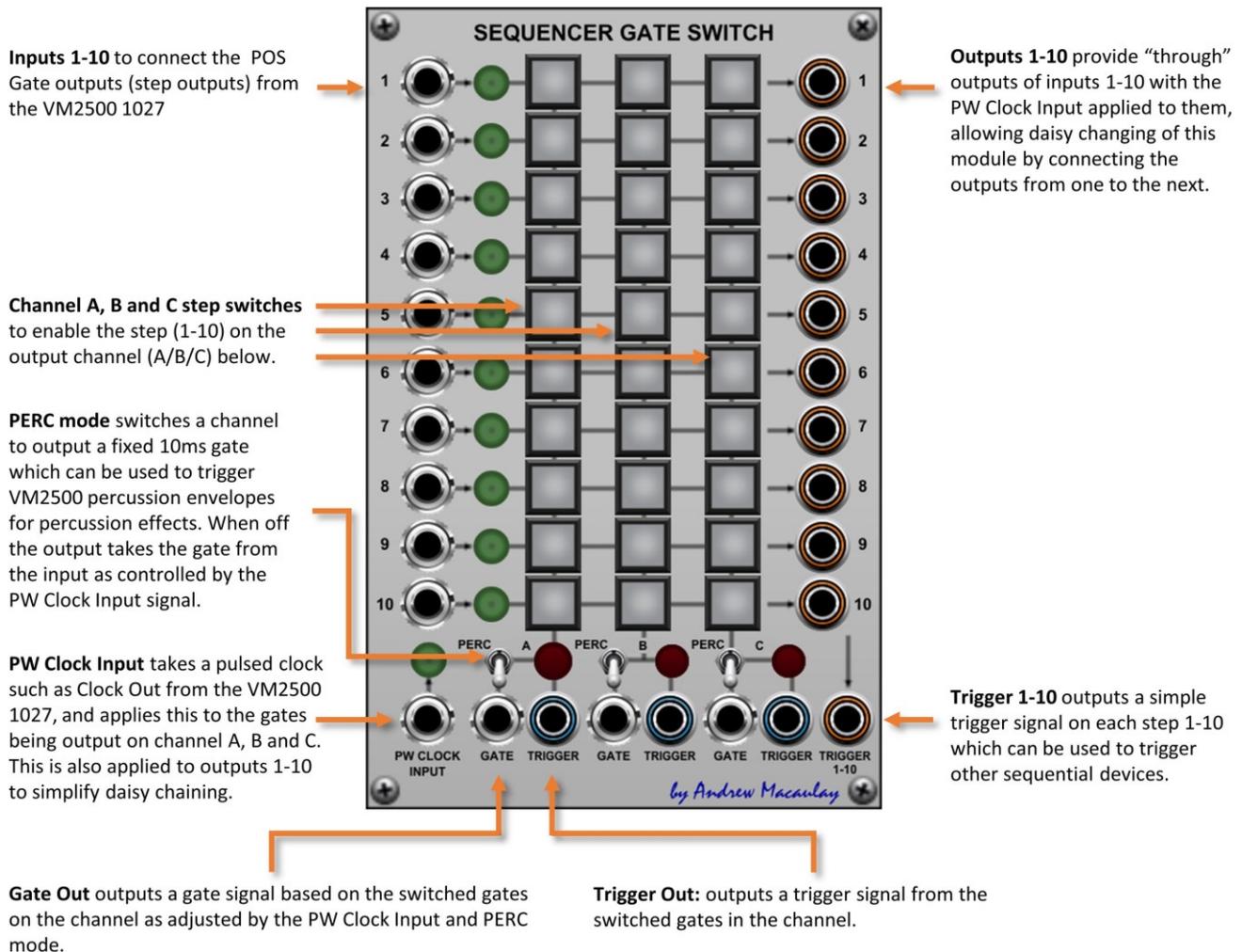
Clock Out: outputs a clock (0-5V) signal based on the speed calculated from the adjusted CV in value.

Sequencer Gate Switch for VM2500

The **Sequencer Gate Switch for VM2500 module** was designed to enhance Cherry Audio’s VM2500 1027 Clocked Sequential Control (part of Cherry Audio’s VM2500 Collection) but can be used with other sequencers in a similar manner. This help is focussed on describing its use with the VM2500 module.

This module allows you to easily use the VM2500 1027 Clocked Sequential Control as a drum sequencer, taking the 10 POS gates output from the 1027 as inputs, together with (optionally) the CLOCK OUT from the 1027 for gate width information, and provides three channels of switched gate outputs (each step individually switched) with Gate and Trigger outputs as needed by some VM2500 envelopes, especially when the gate width is set to 100% on the 1027 for legato sequencing of notes.

The Gate output on each of the three channels can optionally be switched to “Percussive” mode, a fixed short gate width allowing triggering of VM2500 envelopes with no sustain phase for drum and other uses. There are 10 outputs (which each incorporate the gate width information) which can be used to daisy-chain more modules if more than three channels are needed. The module also provides a trigger output from steps 1-10 adding a trigger output for the 1027 if needed for normal sequencing duties.



Slew Processor

The **Slew Processor module** provides comprehensive slew/slide processing for control voltages. With separate Slew Up and Slew Down controls, options for Up only, Up/Down and Down only modes, manually and voltage-controlled times, options to link Up/Down times, a slew enable gate, sample and glide mode and optional quantization of the signal (for glissando effects), the module can be used in many situations for note glides and glissandos as well as to treat other control voltages (and maybe even try it with audio).

This can be a great way to introduce flow into sequences, etc. as well as great for live use. Can also be used with oscillators and gates to perform wave-shaping and simple envelopes.

Slew Enable Gate input takes the gate and enables Slew (as per controls below) when the gate is on (or when off if **INV** switch on). *This can be used with the keyboard gate to only glide when playing legato, or only when playing staccato – or with a sequencer to only glide between specific steps.*

Slew Up panel, allows control over the slew when new voltage is more than the previous voltage (note higher than previous).

This section, like the **Slew Down** panel, will be enabled depending on the Slew Mode.

Slope control which allows the slope for the Slew to be Linear, Exponential or Logarithmic with a setting of how much the effect will be.

Rate control which sets the slew rate in milliseconds.

LINear/CONstant buttons select if the slew rate is for 5V change (linear) where smaller jumps will be faster, or for the amount of change of the current slew (constant).

CV in and controls with a CV input, selector for 10ms/V or 1sec/V and control knob which sets this to be -200% to +200%.

Input for the control voltage (or audio) that you want the slew applied to. By default (without a jack connected) this will use the PITCH input from the Panel, providing the pitch from the DAW or external controller/s.



Sample & Glide in samples the next target value when the gate/trigger is >2.5V.

Rise Active outputs a gate (5V) when the slew up stage is active.

Rise Done trigger outputs a trigger signal when the rise stage completes.

Quant CV In selects if the Quantize CV input is trigger (flips mode), gate or inverted gate.

Slew Mode buttons select whether the Slew will be active Up only, Up/Down or Down only. The SYNC button is a variant of Up/Down where the settings of the Slew Up panel are used for up and down.

Fall Active outputs a gate (5V) when the slew down stage is active

Fall Done trigger outputs a trigger signal when the slew down stage completes.

Trigger 0ms/2ms switch: sets the “done” triggers to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The ▼ button allows you to manage these defaults.

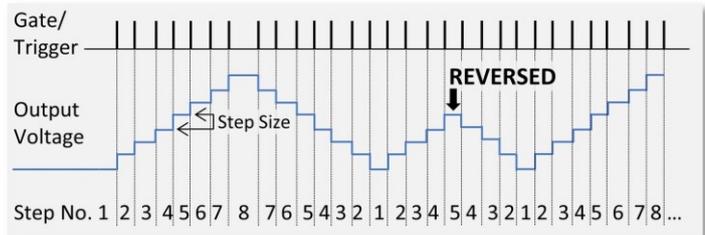
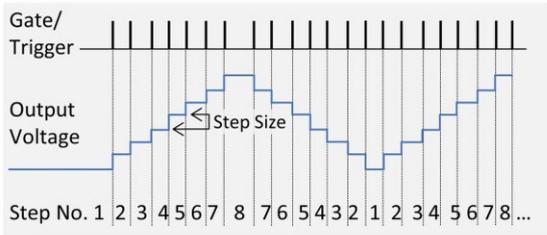
Output from the slew module.

Output Mode to quickly select between the fully slewed output (Slew), the output of the Sample & Hold section (S&H) or the direct input signal (Thru).

Step Generator

The **Step Generator module** provides a way to generate sequential Control Voltage steps from a Gate In. The steps can be a ramp Up, Up/Down, Down/Up or a ramp Down with optional Repeat when changing direction. The start, end, number (up to 256) and size of steps are all controllable and the stepping can be reset and reversed by additional inputs. A quantization mode for the steps is available, for use as a 1V/OCT source.

With a reverse button/gate, a reset button/gate and using an external clock to drive the stepping, this can be used to generate simple sequences including quantized notes. The End output allows One-Shot step sequences to trigger other modules or sequencers for even more flexibility and the Steps (gate/trigger) output allows other modules to be synch'd with active stepping.



Trigger In: provides the trigger/gate input that moves the step onto the next in sequence. Ideally a pure trigger signal should be used to ensure that the Reset is sync'd to the clock.

Reset to Starting: button/trigger input that resets step count to the start of the sequence, the Start value (Up, Up/Down) or End value (Down, Down/Up) ready for the next Trigger.

Reverse button/trigger input reverses current steps back until the start of that stage of the step sequence – see the diagrams above.

Start Value: manual control (-10V to +10V) or CV input for the value for the Start (lowest value) of the steps. If End is set lower, this is automatically adjusted to the same as End.

End Value: manual control (-10V to +10V) or CV input for the value for the End (highest value) of the steps. If Start is set higher, this is automatically adjusted to the same as Start.

Step Size: manual control (0V to +5V) or CV input for the voltage for each individual step.

Number of Steps: manual control or CV input for the number of steps, from 1 to 256.

Note that the CV inputs for all of the settings above override the manual setting, and are NOT additive.

End Out Trigger: sends a trigger at the end of the steps when in One Step mode. This can be used to trigger another module to create end-to-end steps/sequencer, etc.



Mode buttons and Triggers In: controls the direction of the step process, as follows:

- UP runs Start value ⇒ End value;
- UP/DOWN runs Start ⇒ End ⇒ Start value;
- DOWN/UP runs End ⇒ Start ⇒ End value;
- DOWN runs End value ⇒ Start value.

• REPT on means in Up/Down or Down/Up mode "end" note duplicated e.g. 1-2-3-3-2-1. When a trigger is received/button is pressed, the steps automatically reset to the Start. In loop mode, the series repeats, but for all cases, the start/end value are triggered once each time (see the diagrams above).

Mode CV In: allows mode to be CV selected: +1V=Up,+2=Up/Down, -1=Down, -2=Down/Up.

1Shot Trigger In: alternates the Loop/One-Shot mode.

Quantize Values button: when on, all settings are quantized – and the knobs show additional info about the MIDI keys selected.

CALC buttons: selects control to be calculated from the other value (disables the control/CV).

Quickset 0.10V and 0.05V buttons to quickly set the Step Size to 0.1V or 0.5V per step.

Loop mode: the steps can be looped, or set to a One-Shot mode which then leaves the output CV as the end value for the sequence (and the End Out trigger is sent in this mode).

CV Output: The output control voltage signal of the step sequence.

Counter shows the current step number. Note that this starts at 1, as per diagrams.

Stereo Mid-Side Processor

The **Stereo Mid/Side Processor module** is an audio processing module designed to take audio inputs in Stereo, Mid/Side encoded or Mono and process them in the stereo field (with voltage-controlled actions) including Balance, Stereo Width and channel flipping.

The module takes Stereo, Mid-Side or Mono inputs with trim and phase inversion and allows voltage-control over the channels (with panning for Stereo/Mono and volume for Mid-Side) and overall balance and stereo width and then outputs the results in Stereo, Mid-Side and Mono.

The module includes a Secondary Mid/Side to Stereo Decoder so that the M/S Output can be processed with other modules and then recombined in Stereo without another instance of the module.

Release 6 fixed some issues with possible glitching when very large CVs were applied. Older presets will be migrated automatically where possible. Where this is not possible, a legacy mode option will be made visible in the “Advanced Settings” panel, which can also be accessed if you want to play with extreme settings!

Input Channels: two audio input channels, which can be configured for normal Stereo (Left/Right), Mid/Side or Mono (Channel 1 and Channel 2).

Input Mode: selects whether the input is Stereo, Mid/Side or Mono. *The labels on the Input Channels change to reflect this choice.*

Audio Input: provides the audio input for the channel. Also a VU meter displays the trimmed level.

Trim (dB) allows +6dB to -6dB adjustment of the input signal.

Phase Invert button inverts the signal on this channel.

Pan (or Volume) knobs, CV inputs and CV amounts: part of the overall processing stage – for Stereo and Mono, these control the pan of the signal; for Mid/Side these affect the volume. *The labels reflect the mode.*

Swap L/R knob and gate/trigger input swaps the L/R channels. The CV input can be set to Trigger (flips mode), Gate (gate on=swapped) and an Inverted Gate (gate off=swapped).

Balance knob, CV in and CV amount controls the relative volumes of the left and right channels in the stereo image, according to the Pan Law.

Secondary M/S to Stereo Decoder provides an extra, simple Mid/Side to Stereo decoder with a Channel Swap control to reverse Left/Right (depends on the M/S algorithm).

This is especially useful if you are doing some additional Mid/Side processing using other modules.

Advanced Settings Panel hides additional legacy mode settings, which allow signal glitching with larger CVs. If an older preset which may have settings that may have this is loaded, the panel automatically opens. Click on the panel to open it manually.

Close button hides panel

Legacy mode or Normal mode

Pan Law panel includes controls to set the Pan Law/Centre Cut for pan and balance controls:

- Flat:** sets the pan/balance to be linear with 0dB centre cut.
- Linear/Square Law/Sin Law:** sets the pan/balance to use a linear (voltage based) scale or a non-linear (power related) approach.
- Centre Cut dB:** adds a centre cut (logarithmic) of 0dB, -3dB, -4.5dB or -6dB to the panning process. This adjusts for centred volumes sounding louder if simply added (*plenty on the Internet about the theory and practice of Pan Law*)

Bypass switch to simply bypass the processing in this section. This does not affect the channel Trim and Phase Invert controls.

Stereo Width knob, CV and CV amount sets the stereo width to between +100% and -100% (mono) using simple M/S level adjustments.

Outputs: provides outputs for Stereo (L/R), Mid/Side and Mono signals – all at the same time.

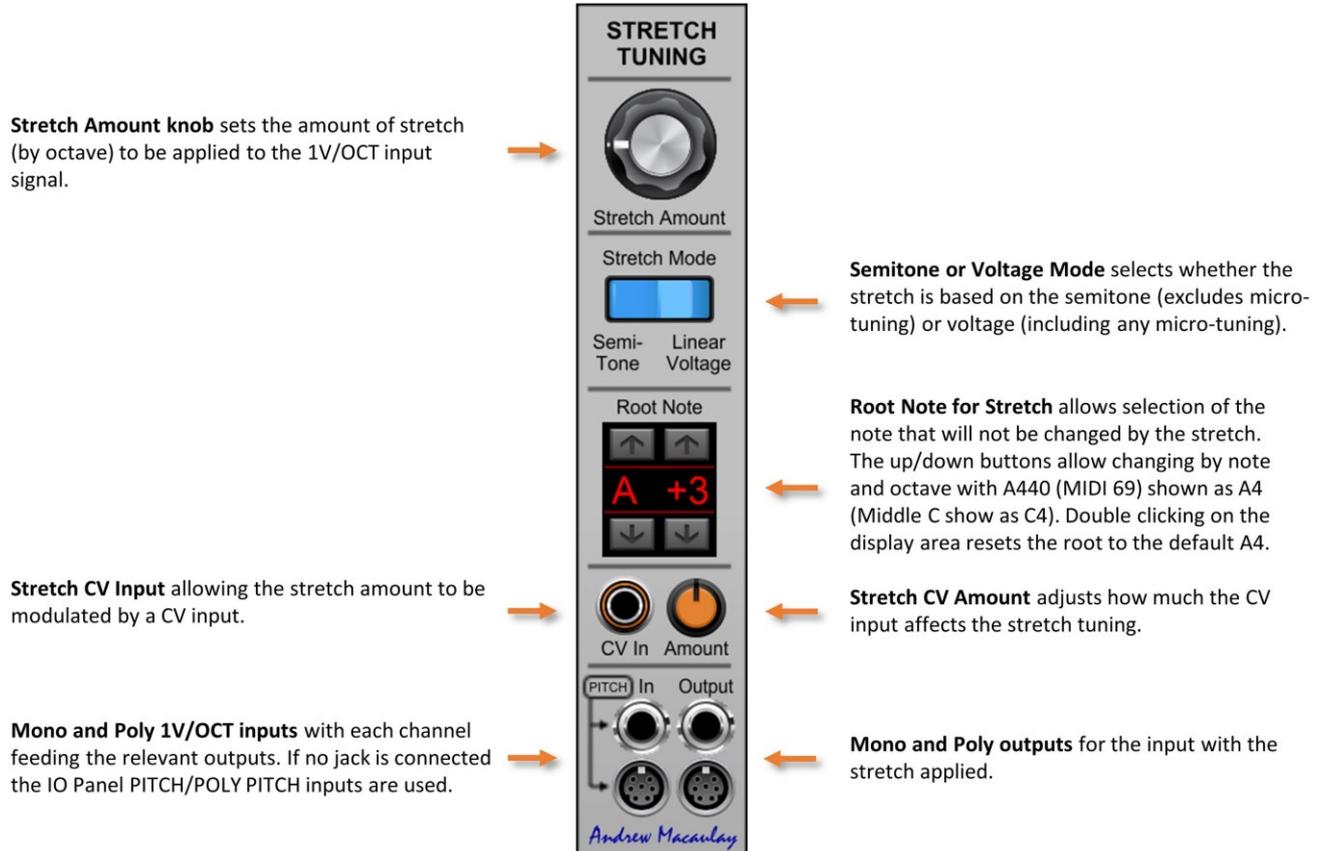
The Mono output is level adjusted when it has been derived from Stereo or Mid/Side signals.

What is Mid/Side processing? Mid/Side processing is a way to process stereo signals. Simply put, Mid/Side processing allows you to process (with EQ, compression, etc.) the middle/centre of the stereo spectrum (“Mid”) separately from processing the sides (“Side”) of the stereo spectrum (stuff panned hard left and right). Mid/Side processing is often used to add space to a stereo image (as with the Stereo Width control here) but can also be used in other creative ways.

Stretch Tuning

The **Stretch Tuning module** allows mono or polyphonic 1V/OCT inputs from keyboards, sequencers, etc. to be “stretched” by up to 2 cents/semitone so that 1 octave is either more than an octave or just smaller than an octave. Some custom tunings (and orchestral tunings) use this to get a more natural feel to the music.

The stretch can be set to be around any “root note” (using A4=A440 as the scale) and the stretch can be tied to the note (quantized) or be completely linear with the 1V/OCT voltage, stretching pitch bends or vibratos.



Sustain Processor

The **Sustain Processor module** takes the Gate and Sustain (pedal) inputs to create a sustained gate signal that can be used with the standard envelopes; with a trigger input this can include re-triggering from the keyboard. The module also outputs trigger signals for the start of Gate, end of Gate, start of Sustain and end of Sustained Gate signals for other creative uses.

Default input (without jack connected) for **Gate Input** is from the standard gate on the Panel from a DAW or external controllers/s. The button allows this to be disabled. If either a Gate or Trigger jack are plugged in, the Gate and Trigger buttons are both switch off by default.

Default input (without jack connected) for **Trigger Input** is from the standard trigger input on the Panel from a DAW or external controllers/s. The button allows this to be disabled.

Default input (without jack connected) for **Sustain Input** is from the Sustain pedal (gate) input on the Panel from a DAW or external controllers/s. The button allows this to be disabled.

Gate On Trigger Out provides a trigger out when the gate first starts.

Gate Off Trigger Out provides a trigger out when the gate is released, irrespective of the sustain.

Trigger Oms/2ms switch: sets the output clock to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The  button allows you to manage these defaults.



Gate Input is for the standard gate which for this module typically will be from a keyboard control. This could be from the DAW, directly or via MIDI or from the Legato Processor to get complete Legato behaviour with and without Sustain.

Sustain Input is for the Sustain pedal (gate) input, typically from the DAW, directly or via MIDI.

Trigger Input is for the standard trigger input from the same device as the gate. This allows for the re-triggering of notes/envelopes whilst keeping the sustain pedal on.

Legato Output provides a sustained gate signal where the sustain overrides any retriggering of the notes. *Note that without the Sustain being active this output passes through the GATE from the Panel with its setting of SINGLE or MULTI.*

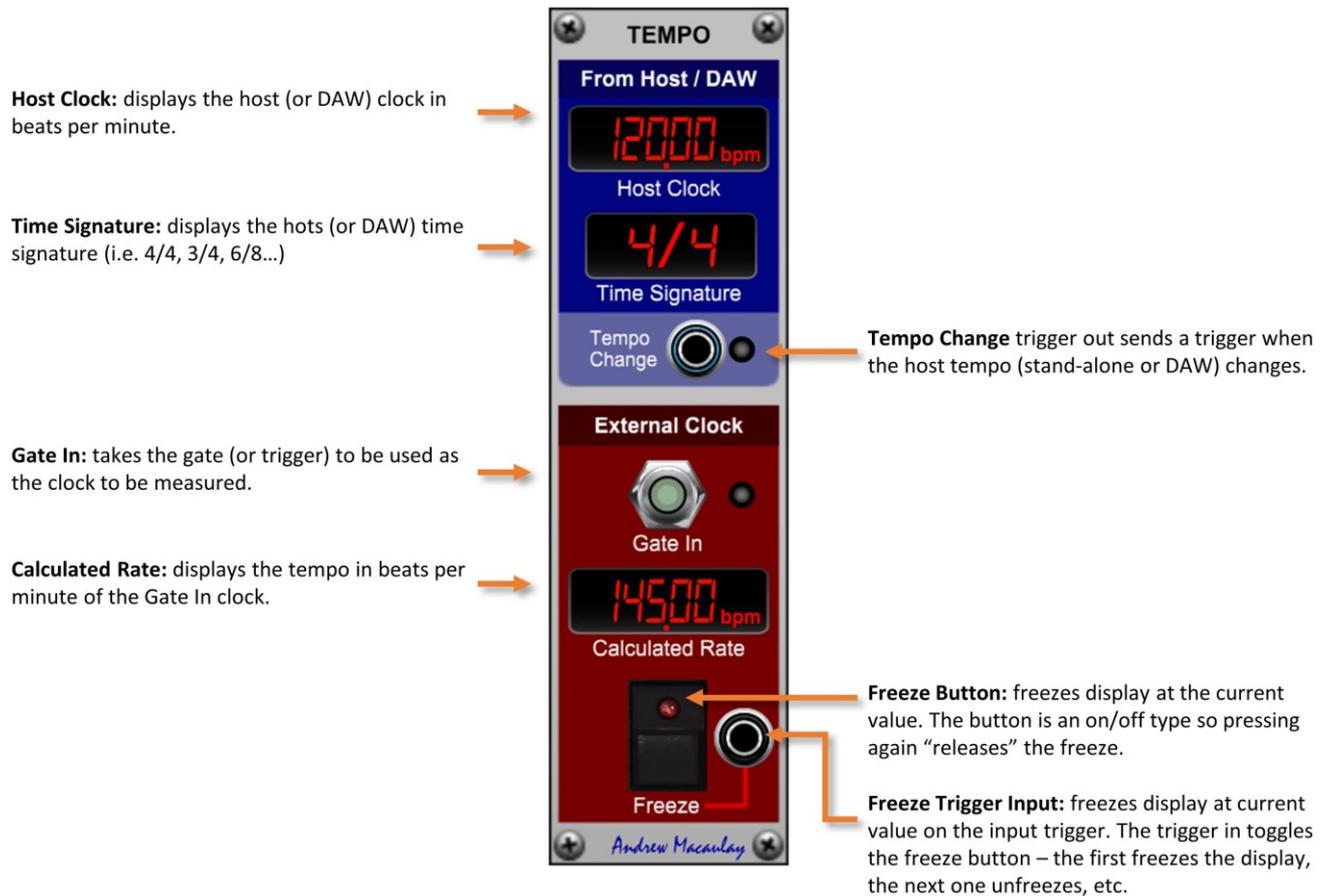
Retrigger Output provides a sustained gate signal where any Trigger input will retrigger the notes during sustain. NOTE that for this to work, the Trigger input needs to be connected, otherwise this functions the same as the Legato.

Sust. On Trigger Out provides a trigger when the Sustain is started, i.e. when a Gate is active and the Sustain pedal is pressed.

Sust. Off Trigger Out provides a trigger when the sustain process has finished, that is when any Gate AND any Sustain are been released.

Tempo Display

The **Tempo Display module** is a module that shows the BPM and time signature reported from the host (DAW), provides an indicator and Trigger output when the host tempo changes and measures the BPM of an incoming gate signal. The measurement of incoming gate BPM has a very small amount of drift (due to timing constraints) and needs at least two gates/triggers to start measuring.



Time Meter

The **Time Meter module** measures the samples and time (in milliseconds) between various events/values to enable measurement of the time an envelope takes (from 0V back to 0V), between two values to measure audio or low frequency oscillators, gate width or between two triggers.

The measurement has multiple modes which include measuring gates, two separate trigger inputs, zero-crossing (e.g the measure cycle-time on waves), envelope specific measurement (0V through to return to 0V) or a more flexible value-based setting with multiple modes.

Measuring gates, triggers, longer CV changes between different voltages and envelopes is accurate to the internal sample rate of Voltage Modular, while measuring waveform cycle time accurately (especially for audio waveforms) can be more challenging depending on the waveform being measured.

Samples shows the number of samples between the two measurement points and the number of samples per second.

Value 1 and 2 settings when in value-based mode, plus locked and tracked buttons:

- **locked mode** makes value1 and value2 the same whatever their value (set on either knob);
- **tracked mode** makes each value change in the opposite direction to the other when changed e.g. starting at 0V, tracking on, value1 set to -1V will set value2 to +1V.

Sense Mode selecting the way that the time will be sensed, with the following options:

- **Gate Sense** simply using the gate start and end points and calculating the time between them;
- **Trigger Inputs**, which is only available when an input is connected to the End Trig. Input, which measures the time between the CV input as a “start” trigger and the “end” trigger;
- **Envelope** mode measuring between the start of an envelope (moving from 0V to positive) to the end of an envelope (back to 0V from positive);
- **Value Based** mode, using the values set above and the options below to control how this works.

CV/Start input taking the CV to be used or a start gate (in Trigger Inputs mode) for the time measurement

Time shows the measured time in milliseconds, with a minimum that can be measured of one sample at the sample rate.
When the time is over 99,999.999ms (100 sec), the decimal place moves to the right allowing values up to 999,999.999ms (or 11.5 days!)

Measurement Section with indicators for start, end and timer (gate) and the two values set when in any of the value-based modes.

Learn and Quick Set values for Value 1 and Value 2 with Learn using the CV input getting maximum and minimum values whilst the Learn button is pressed. **Clear** button clears the display (like Clear Input).

Value Based Options provide four algorithms for calculating time on a value-based process:

- **Cycle Time** between Value 1 and Value 2;
- **Hi** value/going up across Value 1;
- **Lo** value/going down across Value 2;
- **Going from Level 1 to Level 2.**

Clear input allows an external trigger to clear the display/measurement. Same as the Clear button.

End Trigger input used in the Trigger Inputs mode to signal the end of the time to be measured.

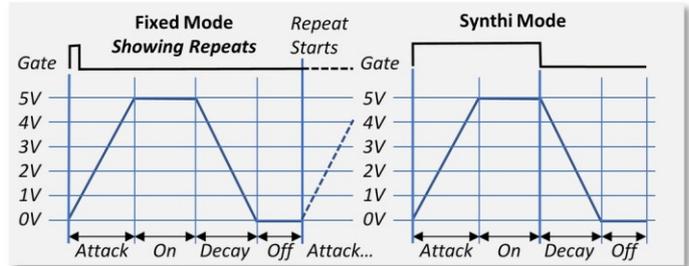
Note that each patch cable in a signal chain in Voltage Modular introduces a one sample delay of the signal. With the internal sample rate at 48000 samples/second, this delay is less than 0.021ms and should not be an issue in normal circumstances. However, this may become noticeable when measuring the time between triggers, etc. For example, if using the direct output of the I/O Panel Trigger on CV/Start and a trigger processed by one or more modules for the End Trig. where there will be two or more patch cables used, the sample count and time displayed can be one or more samples than expected. Modules such as the Trigger Delay cope with this behaviour by having a Trigger Out signal from the module which you can then measure against and you can also use the free Patch Bay module to add the necessary patch cables to give the sample-level accuracy.

Trapezoid Envelope VCA

A Trapezoid Envelope module with included VCA. Featuring flexible linear and logarithmic slopes for both the attack and decay phases, voltage-controlled decay time, plus options for gated or fixed on stage, and single-shot, repeating or gated repeat mode, the module takes the ideas from the EMS VCS/Synthi and allows even more creativity.

The module also includes a simple VCA path to allow easy use of the envelope with audio or control signals, which has optional linear or exponential CV modes as well as smoothing options including Zero-Crossing processing to reduce clicks when audio processing.

The **Trapezoid Envelope and VCA module** provides an EMS VCS/Synthi inspired Trapezoid Envelope Generator (with some additions) and an included VCA for easy use of the envelope with audio or CV signals. Multiple modes allow use of the Trapezoid as a looping envelope and a single-shot envelope. See the diagrams to the right to see how the main modes behave.



Gate In controls the envelope. The gate going "on" (or a trigger) always triggers the trapezoid to start. Gate "off" only affects the trapezoid if the On stage is in Synthi mode, where the gate determines when the On stage will end, if it is longer than On time.

Stop In provides as trigger signal input to stop looping when in Synthi mode

Attack time: sets the time in ms it will take after the initial trigger for the signal to go from 0V to 5V (0%-100%).

On time: sets the time the signal stays at the full amount of 5V (100%) after the Attack phase finishes. This time is the minimum time it will stay on, if in Synthi mode then the gate can extend this.

Decay time: sets the time it takes for the envelope to go from 5V back to 0V.

Off time: when switch on, the time after the decay has finished and the next repeat of the trapezoid.

Status LEDs visual display of the stage that the envelope is currently at in its process

Lin/Exp switch selects if VCA driven in a Linear or Exponential (volume) mode.

VCA Section provides a simple, linear VCA for audio and control voltages, linked to the output of the trapezoid envelope generator.

VCA In for the input signal to the VCA to be adjusted by the trapezoid envelope.

Slope controls (Attack and Decay) allows a log, linear or exponential slope to be set to adjust how the envelope "feels", with the log and exponential slopes variable.



Manual Start and Stop push buttons that allows the manual operation of the trapezoid generator, simulating the Gate In and Stop In signals.

Retrigger Damping provides control of whether a retrigger returns the envelope to zero when set to 0% (legacy behaviour) through to just taking the existing value (i.e. if during on/decay) when set to 100%.

On Gate Mode: determines behaviour of the On stage: "Fixed" means that the On stage only runs for the On time; "Synthi" mode means the On stage runs for at least the On time, or the time the Gate is on if this is longer.

Decay CV input and controls with a Decay CV amount knob and the Normal/Continuous switch mode. In normal mode the time is taken when the decay starts, in continuous mode, it can change during decay.

Config button opens the time CONFIGURATION DIALOG as detailed below

CV Outputs offer both standard 0V to 5V output and the "Bipolar" -5V to +5V output, useful for looping as LFO.

Repeat Mode: "Off" for single-shot; "Gated" for repeat while gate is on; and the "Synthi" mode which continues after trigger until a manual Stop signal is received.

VCA Out is output from the VCA stage as controlled by envelope.

CV Smooth controls the minimising of clicks caused by aggressive envelopes in the VCA stage. The options available are : **Smoothed** (Legacy) which uses a fast glide on the signal; **Zero Crossing Mode**, which uses the input waveform to determine when envelope can change (works well for audio signals); and **None** which can be useful when sending CVs rather than audio signals through the VCA.

CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Set value of Mid-Point of time-based controls ▼

Mid:750ms

Set minimum Attack time

0ms 2ms

Set min time on Decay and Release

0ms 2ms

CLOSE

Brings up menu to manage global and module defaults

Set the mid-point type for time knob log mode. Setting can be: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) and linear

Sets minimum Attack time to 0ms or 2ms (2ms stops clicks and is default on Cherry Audio envelopes)

Sets minimum Decay and Release times to 0ms or 2ms

All time knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more).

Trigger Counter Plus

The **Trigger Counter Plus module** generates triggers (or 2ms gates) a number of triggers and gates based on the count of input triggers received, which can be used in one-shot or looping mode with voltage control of the number to be counted and transport buttons and inputs to automate its use.

Trig. In takes a gate or trigger signal and counts the triggers (starts of gates) received. The LED next to the jack shows when a trigger has been received.

Trigger Count knob sets the count to be used between 1 and 99. The number displayed to the right shows the value set with the knob.

ONE SHOT or **LOOP** mode selector controls how the Trigger Counter Plus is working:

- In **ONE-SHOT** mode the count is made up to the maximum and then stops, ignoring any further triggers;
- In **LOOP** mode the count is made to the maximum, the count reset and immediately starts again, so that the outputs will effectively be a divider of the input triggers

Gate Width switch sets the trigger outputs to be a pure trigger (0ms) or a short gate (2ms) which can be useful when using these directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The  button allows you to manage these defaults.

Count with Current CV display shows the count to be used based on the count set by the knob together with the current CV and CV amount. This display is blank when there is no CV input jack connected.

Count CV In allows a CV to adjust the set count. The amount of the CV is set by the knob, and can be between -100% and +100% for -5V to +5V signals, so that +100% means the count would be double that set. When the value results in 0 or negative values, any input triggers received are ignored.

Green number display shows current number of triggers received. In LOOP mode, this resets to 0 before the first new trigger is received.

Start, Stop and Reset buttons and trigger in jacks allow control over the counting either manually or externally. The Start button shows the running state of the counting.

Trigger Outputs provide the trigger out, or 2ms gate out, signals for the First received trigger, the Last received trigger and the "Gated" set of triggers (i.e. from first to last)

Gate Output provides a gate signal that starts on the first received trigger and ends when the Last output trigger is sensed (at the end of the count)

by Andrew Macaulay

Trigger Delay

The **Trigger Delay module** is a trigger utility that generate a delayed trigger (with the delay set in milliseconds) and a separately timed repeating trigger (set in milliseconds) with a selectable number of repeats. These times can be separately synchronised to the Host/BPM clock.

The trigger outputs can be set to 0ms or 2ms (gate) mode to allow direct triggering of envelopes that often have a 2ms minimum and the modules supports log scale/mid-point settings from the “options” cog-wheel button and uses the I/O Panel Gate (for ease of patching) when no input jack connected.

Gate In: the main input for this module, taking the gate input signal and using this signal to generate a trigger from the start of the gate (defaults to IO Panel Gate input if no jack connected).

Trig Out: simply passes on the start trigger (0% width) signal from the input gate.

Delay knob: controls the delay of the trigger being generated and works in two ways: in “manual” mode the delay (in milliseconds) is directly controlled by the knob; in Host/BPM mode, the delay is a multiple or division of the input BPM, between 1/16th and 16x.

The display of the value reflects the mode and editing directly also adjusts, allowing for input of the simple number in BPM or the factor using “x” or “” for multiples and “/” for division.*

Fine adjustment control: allows secondary control of the delay time, useful to adjust the delay time to be slightly off pure BPM-based numbers.

BPM Gate In: allows a gate/clock signal to be used to determine the tempo (beats per minute) for use in the delays. Synchronises the module with others (sequencers, etc.). If no input connected here, the Voltage Modular Host/DAW tempo will be used.

Delay knob (Repeat Section): controls the delay of the repeating triggers being generated and works in two ways: in “manual” mode the delay (ms) is directly controlled by the knob; while in Host/BPM mode, the delay is a derived multiple or division of the input tempo (BPM) of between 1/16th and 16x.

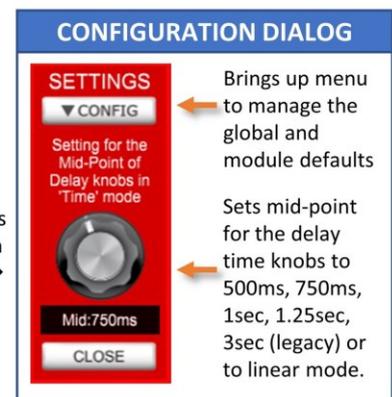
The display of the value reflects the mode and editing directly also adjusts, allowing for input of the simple number in BPM or the factor using “x” or “” for multiples and “/” for division.*

Initial Trigger switch: if set to OFF then the first trigger output will be after the delay as set; if set to ON, then the initial trigger will also be included.



Host/BPM mode switch: switched off, the delay is set in milliseconds; if switched on the delay is derived as between x16 and 1/16th of a beat

Trigger Out: the output trigger from the delay stage of the module.



Brings up menu to manage the global and module defaults

Sets mid-point for the delay time knobs to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Config: opens configuration dialog, see →

Host/BPM mode switch: switched off, the delay is set in milliseconds; if switched on the delay is derived as between x16 and 1/16th of a beat

Repeats knob: allows selection of the number of repeats (which are after the initial delay) from between 1 and 16.

Trigger Out: the output trigger from the repeat stage of the module.

Output mode Gate or Trigger selects whether the outputs from both the delayed and repeated gates are simple triggers or are 2ms gates which can be used with most envelopes for percussive envelopes.

The delay knobs control the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more) and is set to 3sec when legacy saves/presets are loaded.

Trigger Sync and Gate Toggle

The **Trigger Sync and Gate Toggle (Trig:Util)** module provides two utilities around triggers and gates. The first, the trigger-sync utility, allows an input trigger from, say, a key press or a Manual Trigger button, to only occur on the clock/gate to synchronise it. The second allows a gate to be simple switched on and off by triggers.

Click here for a message box with some reminders about this module's behaviour.

Trigger input: the main input for this feature, often this will be from a keyboard press being filtered or a Manual Trigger button being pressed. If removed, any armed state will be reset (not triggering an output).

Armed mode LED: shows when a trigger has been received (arming the state) but not released by the "Trigger It". NOTE this state is NOT stored in presets!

Trigger It input: takes a gate/trigger input which then allows the trigger to be sent. This typically will be a clock signal, making he manually set trigger to be sent on a clock beat.

Click here for a message box with some reminders about this module's behaviour.

On Trigger in: takes a gate/trigger that will switch the status to ON irrespective of current mode.

Toggle state LED: showing whether the toggle state is set or not. Note that the state of the Toggle is stored in presets/saves.



Auto Reset switch: default is that the armed state will be automatically reset after 10 seconds without triggering an output. If this switch is OFF then the armed state will remain infinitely unless released or the jack taken out.

Unset button: also can be used to manually unset the armed state without sending a trigger out.

Trigger Out: the output trigger from the trigger-sync functional of the module.

Toggle input: takes a gate/trigger input and simply toggles the output from 0V to +5V, effectively creating gate behaviour, but also useful in other scenarios.

Off Trigger in: takes a gate/trigger that will switch the status to OFF irrespective of current mode.

Out: the gate/output (0-5V) resulting from the gate-toggle function of the module.

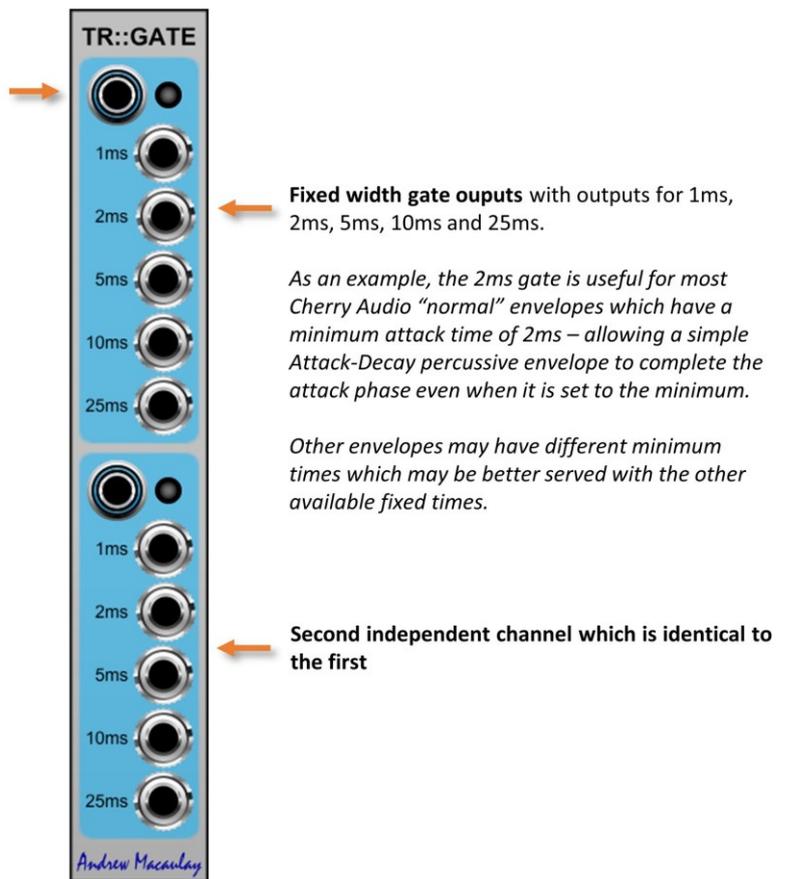
Trigger to Fixed Gates

The **Trigger to Fixed Gate module** is a simple module that takes a trigger (or the leading edge of a gate) signal and creates a fixed length gate from it. This can be useful in driving some envelopes for simple percussive effects from a simple trigger without the need to use the Re-Gater module. There are two identical channels in this small form factor module.

This module has two channels taking a Trigger input (either from a pure Trigger signal or from the leading edge of a Gate signal) and outputs a set of fixed length Gate signals (1ms, 2ms, 5ms, 10ms and 25ms) which can be used to trigger envelope generators where a percussive effect is wanted from an envelope generator (i.e. just minimal attack and decay/release).

This is a simple, fixed-value version of the Gate Length Processor module in a small form factor and can be especially useful when using a sequencer for both notes (where the gate time may be longer) and percussion. The available times reflect different types of envelope generators available from Cherry Audio and third parties.

Input which can be a pure trigger or a gate signal, with the leading edge of the gate being used as the trigger, specifically when the voltage goes from below 2.5V to above 2.5V.



UI Settings Configurator

The **UI Settings Configurator module** is a stand-alone module (with no audio or CV processing) that allows users to easily configure the default behaviours of any of the Andrew Macaulay Modules that have custom settings for the time-knob mid-point or minimum attack, decay/release or gate times.

The module also allows users to configure the Release Notes popup behaviour and custom help tooltips behaviour and delay setting (not available in the modules themselves). The settings are shared between all Andrew Macaulay Modules and reflect the defaults that can also be set within the modules. **This module does not do any processing at all** and, once used, can be removed from the patch as the values are saved as they are changed.

Most of the settings in the module can also be set from individual modules where module specific settings are also available, but this module provides a clearer view of all the global settings and adds some options that are not surfaced in individual modules.

Time Controls are the settings for time knobs (mid point) and the minimum times for envelopes and generated gate signals.

These are available on those modules where required and have an options "control panel" or the individual control with drop-down menus to allow setting and the management of the module and global defaults.

User Interface settings for release note popup and module help are available on all module from the right-click menu on the logo.

The **Help Tooltips Delay** time in this section (custom help tooltips) is only available in this module but affects all modules.

Refresh Value from Saved Values allows you to make changes in another module and refresh the values in this module.



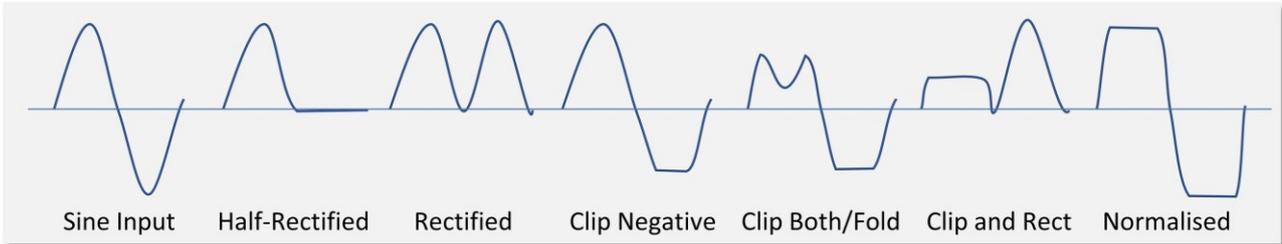
Click on the description box for a dialog box with some more help about the configurator.

Options Setting drop down menus show "Module Default" plus the specific options available for the setting.

Reset All To System / Module Defaults button sets the Time Controls to use the module defaults and the User Interface to use the system defaults, including setting the Help Tooltips Delay to 700ms.

Voltage Processor

The **Voltage Processor module** processes control and audio voltages by splitting the positive and negative sections (“phases”) of the voltage and then can clip, fold and “flip” of the signals (see below), with voltage control of each setting to provide some interesting waveforms for modulation, and interesting timbres for audio. The module has auto-gain features for the clipping, the ability to alter the DC offset of the resulting waveform and Direct Outputs from the Negative and Positive Phase Channels.



Input is the signal input for the module. It will take any voltage-based control (-/+5V) including modulations and audio.

Clip Point (volts) for the negative “phase” of the signal (range of -5V to 0V)

CV in and Amount for clipping the negative “phase” of the signal

Normalise switch amplifies the value of this “phase” based on the manual Clipping setting

Fold amount as percentage (-200% to 200%) of the value over the clip point: 0% = clipped, +100% = original shape, -100% = normal fold.

CV in and Amount for clipping the negative “phase” of the signal

Flip amount for the negative “phase” of the signal (range of -5V to 0V). 0% leaves voltage as is, 50% makes it 0 (Half-R) and 100% makes it positive (full Rectification).

CV in and Amount for flipping the negative “phase” of the signal

Direct Output (Negative and Positive Phase) provides separate Clipped/Flipped outputs for the Negative and Positive phases, which can be used for further voltage processing with, for example, the Exponent Shaper.

Quick Outputs provides fixed output for the basic transforms of Inversion, Half-Wave Rectification and Full-Wave Rectification (diagram above illustrates these)

Clip Point (volts) for the positive “phase” of the signal (range of 0V to +5V)

CV in and Amount for clipping the positive “phase” of the signal

Normalise switch amplifies the value of this “phase” based on the manual Clipping setting

LED indicators show clipping status: red for clipping “set” and blue clipping happening.

Fold amount as percentage (-200% to 200%) of the value over the clip point: 0% = clipped, +100% = original shape, -100% = normal fold.

CV in and Amount for clipping the negative “phase” of the signal

Flip amount for the positive “phase” of the signal (range of -5V to 0V). 0% leaves voltage as is, 50% makes it 0 (Half-R) and 100% makes it positive (full Rectification).

CV in and Amount for flipping the positive “phase” of the signal

Output of the modified signal, which will be between -5V and +5V.

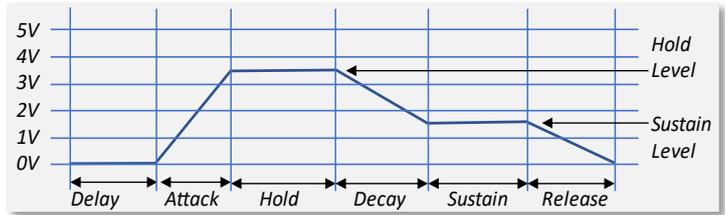
DC Offset and Estimate button allows a DC offset to be added to adjust the waveform. The Estimate button takes current values to provide an offset based on the manual Clipping and Flip settings.

Trim (dB) knob allows adjustment of the gain on the final output, measured and shown in dB, with manual entry available as dB, 25%-400% or a simple multiplier number.

Voltage-Controlled Envelope

An advanced Voltage-Controlled Envelope Generator which includes a Delay and an optional timed Sustain stage, as well as the normal Attack, Hold, Decay, Sustain and Release stages.

The Hold Level can be set within the limitation that it must be the same or more than the Sustain Level, the Sustain Time can be controlled for both minimum and fixed length operation, and all these settings can all be controlled using CV inputs.



Basic Operation (Free Running Mode)

In “free running” mode the times are all set in milliseconds/seconds. The Gate In, Sustain In, CV In 1 and CV In 2 have default inputs from the I/O Panel for when no jack is connected. For the Gate and Sustain inputs these are switchable (these switches default to OFF for previous saves/presets).

- Delay time:** sets the delay before envelope starts.
- Attack time:** time it takes for the envelope output to go from 0V to Hold Level.
- Hold time:** time envelope stays at the Hold Value, which defaults to 5V.
- Hold level:** the max value of the envelope out to be controlled. This level is always the greater than or equal to the Sustain level.
- Decay time:** time it takes for envelope to go from Hold to Sustain Level.
- Sustain time:** when Fixed Length button on, time Sustain continues for; when off, minimum time for Sustain where 0 gives normal Gated behaviour.
- Sustain level:** level in Volt output in Sustain phase.
- Release time:** time for envelope to return to zero after end of Sustain phase.
- Min knobs** below each time set a minimum time (0-10ms) for that stage, including any CV values
- All time-controls:** in FREE mode the time is set in milliseconds, See later for details of BPM mode.

Sustain In: gate CV in that keeps Gate “On”. Defaults to IO Panel Sustain unless this is disabled by button.

Gate input: where “Gate On” starts an envelope and “Gate Off” starts release stage, unless in Fixed Length mode. The **Manual Trigger** button provides alternate way to generate this signal. Defaults to IO Panel Gate unless disabled by button.

Re-Trig In “resets” envelope back to Attack stage. Typically used in Looping Mode or with sequencer.



Free/Host switch: selecting Free mode means that all times are set in milliseconds or seconds. Next section details BPM mode.

Latch Gate In: once gate received the envelope keeps sustain/looping until the next gate/trigger is received or the Manual Gate button is pressed.

Fixed Length: changes Sustain time from being based on gate input with an optional minimum to being fixed to the time as set using knob/CV.

Inverted/Offset Env. Out and Mode Switch for different inversions/offsets on the CV output

Envelope Out provides the standard (0V-5V) CV output with no inversion or offset applied

Stage Gate outputs for separate gate signals from each stage of the envelope process

Module Options: pressing the settings “cog-wheel” button opens the configuration dialog:

CONFIGURATION DIALOG

▼ CONFIG
OPTIONS
CLOSE

Mid-Point value for time-based controls

Mid:750ms

Set minimum Attack Time

0ms 2ms

Set minimum Decay/Release

0ms 2ms

Mid Point sets mid point for all time-based controls to log 500ms, 750ms, 1sec, 1.25sec, 3sec or linear.
 Min time switches set attack and decay/release times to min 0ms or 2ms (to match std Envelope)

- Looping options:** allow various looping modes, with the default being the normal “single shot”:
- **(d)AHD:** loops on Attack, Hold, Decay;
 - **(d)AHSR:** loops on Attack, Hold, Decay, Sustain and Release and switches “Fixed Length” mode on;
 - **dAHD:** loops on Delay, Attack, Hold, Decay;
 - **dAHSR:** loops whole envelope with fixed length.
 - **Start on Attack** starts dAHD and dAHSR loops at Attack while keeping the Delay stage in the loop.

The module fully supports setting the mid-point of the log-scale time controls (from the “options” cog-wheel button) and setting the minimum attack and delay/release times to either 0ms or 2ms. There are also manual controls for minimum times (0ms-10ms) for the Attack, Hold, Decay, Sustain and Release stages (subject to the 2ms minimum from the settings page) allowing more flexibility in setting up complex scenarios to avoid pops due to 0ms timings, especially useful for voltage-controlled scenarios or looping.

There are gate outputs from each stage of the envelope and looping options that can include the Delay stage, the Attack/Hold/Decay stages, or (with timed Sustain) the whole Delay, Attack, Hold, Decay, Sustain, Release cycle. Together with a Manual Trigger button, a re-trigger (Attack stage) input and latching of the gate, this can be used for complex envelope and other rhythmic purposes.

An Inverted Envelope output supports multiple inverted and offset modes including e.g. inversion around the sustain level (similar to the Korg MS-20’s EG2), offsets as well as normal inversion around 0V.

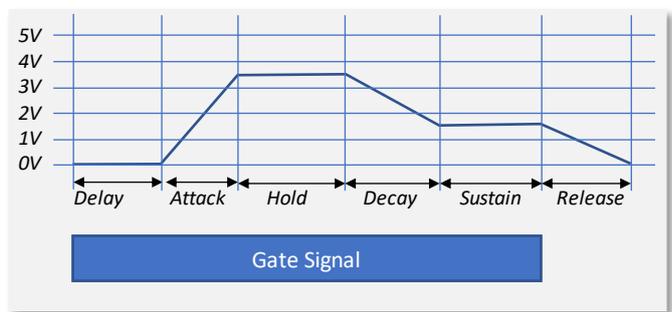
Modes of Operation

There are a number of ways that the Voltage Controlled Envelope can be used: the “traditional” Gated Mode, a Minimum Sustain Time mode (similar to the Korg MS-20’s EG2 Hold behaviour), a Fixed Length mode and a series of Looping modes. The following details the gated/sustain modes available:

Normal Gated Mode: the envelope starts the Delay Stage when the gate signal goes high, which in Andrew Macaulay’s Modules is when it goes more than 2.5V. The gate input typically reflects a Note On/Note Off signal.

The envelope goes **straight to the Release Stage** as soon as the gate is released or, if the sustain input is being used, the sustain input is released whichever is the later.

If the gate finishes before the attack stage has completed, the release starts from that point.



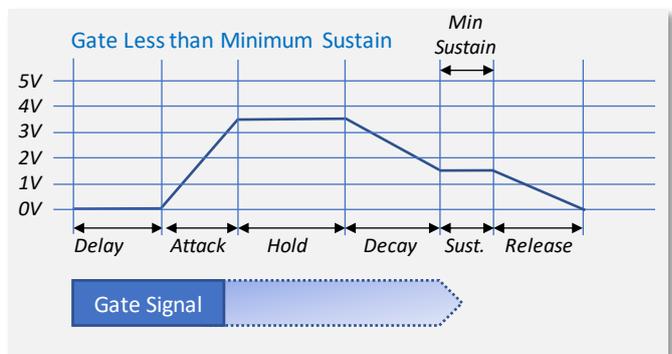
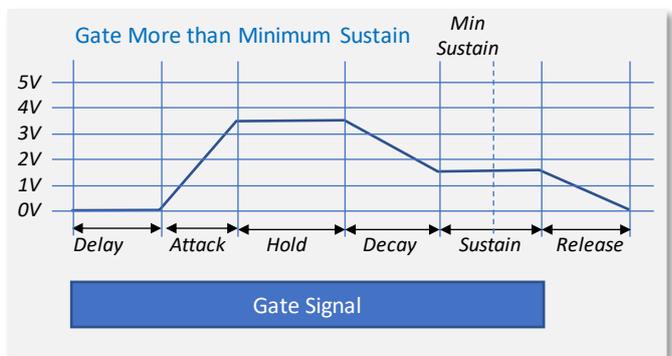
Minimum Sustain Time Mode: if the sustain time is not zero (and the Fixed Length mode is off) then the behaviour changes in two ways:

1. the sustain will always be at least as long as the minimum length set; and
2. the envelope will always run completely, even if the gate finishes during the attack or even the delay stage

The diagrams show the behaviour of the envelope for the two possible scenarios with Minimum Sustain Time:

1. **Gate More than Minimum Sustain:** the gate is long enough to mean that the Sustain is longer than the Minimum Sustain Time set, and the envelope behaves like a “normal” envelope.
2. **Gate Less than Minimum Sustain:** the gate finishes at any point before the set Minimum Sustain Time has completed, where the whole envelope completes in full, with the Minimum Sustain time.

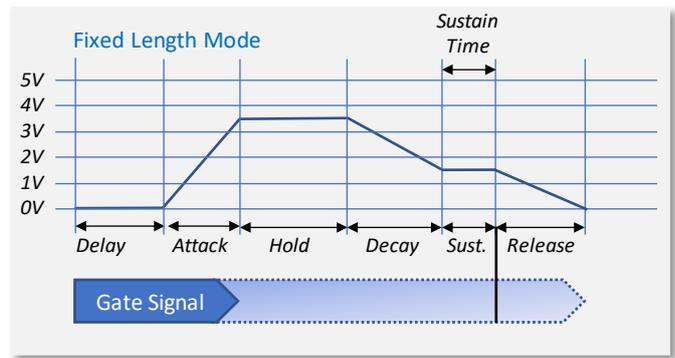
In both these cases, the Sustain Input is being treated as being “included” in the Gate Signal.



Fixed Length mode (the Fixed Length button is enabled) is similar to the Minimum Sustain Time behaviour, but always holds the Sustain stage for the specified time, irrespective of the Gate input.

In Fixed Length mode you can set a Sustain Length of 0ms which can be useful both in normal operation and also in Loops if you want to have different speeds for the decay and the release stages but with no holding at the sustain level.

Fixed Length mode is enabled (and cannot be disabled) when in either (d)AHDSR or dAHDSR looping modes.



Looping option buttons allow for various envelope looping modes, with the default being the normal “single shot” mode, which interacts with the sustain length modes and behaviours described above.

In any looping mode, all loops are active while the Gate Input is active and go to the Release stage once the gate is released unless the Latch Gate In switch is on, in which case they are kept active while the latch is active.

The looping modes are:

- **(d)AHD** starts on Attack and loops through Hold and Decay back to Attack, repeating while the gate is active;
- **(d)AHDSR** starts on Attack and loops through the rest of the envelope, switching “Fixed Length” sustain mode on;
- **dAHD** starts on Delay or Attack (see below), goes through to Decay and then loops back to Delay;
- **dAHDSR** starts on Delay or Attack (as above), completes the envelope and looks back to Delay with Fixed Length on.

The **Start on Attack** option for the dAHD and dAHDSR modes means that the loop will start on the Attack stage, but will include any Delay in subsequent loops.



BPM Sync'd Mode

The BPM/Host Sync option allows you to sync the timings of the envelope to the DAW, a gate input BPM rate or the BPM CV input (100bpm/V, used widely across Andrew Macaulay Modules).

When in any of the BPM sync'd modes, the envelope also has a /32 setting for the overall external sync'd timings (clock, host or CV) and /16 setting for each of the sync'd times for much faster sync'd envelopes.

All time-controls: in BPM mode the time is a multiple or a division of the time derived from host BPM.

The extra “/16” button by each control allows faster sync'd times on each stage.

BPM CV button changes Ext.Clock input to be a 100bpm/V input to drive time-sync'd envelopes.

Ext.Clock/BPM CV input jack. When in BPM mode and a jack is connected, the length uses this input as a source for length.



Host Clock indicator: on when no jack connected in BPM mode. Length is then calculated from the Host BPM from Voltage Modular/DAW.

Free/BPM switch: selecting Free means all times are set in milliseconds (see previous). Set to BPM, the “input BPM” will either be the Host BPM from Voltage Modular or the clock derived from Ext Clock, if it is connected.

When set to Host, the Length (Beats) knob provides a multiplier/divider from the clock to beats that are used on the individual times on the envelope. The “/32” button can be used for shorter sync'd times.

CV Inputs

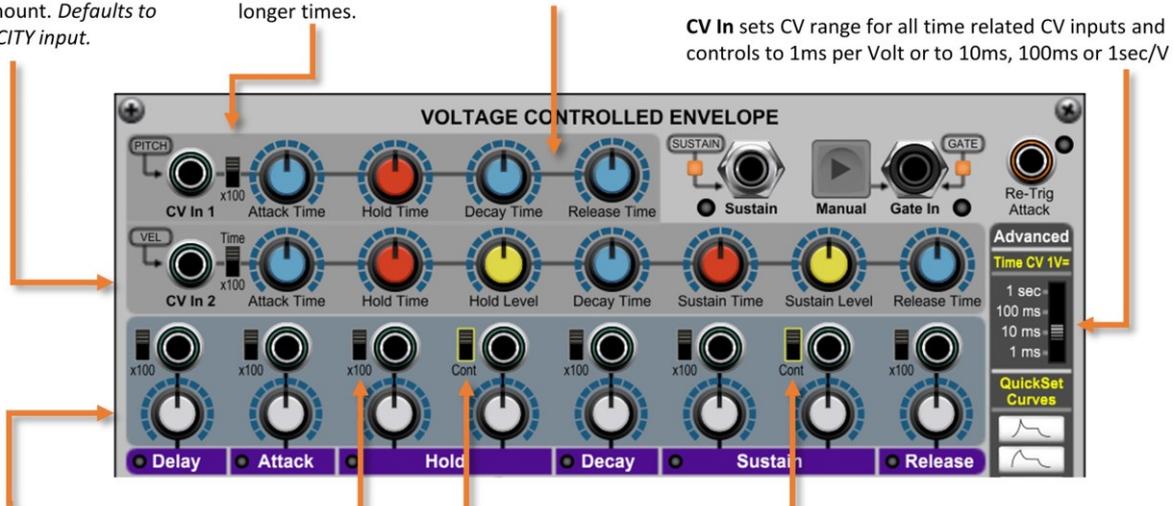
There are two general CV inputs which can control multiple aspects of the envelope, typically used for Keyboard Following changes to envelope times, and Velocity changes to times and levels, as well as individual CV inputs for each control. The time-related CVs can be set to be 1ms/V (legacy mode), 10ms/V, 100ms/V, 1sec/V and have x100 time multipliers for the general and individual CVs.

Control Voltage #2 input: control all aspects of the envelope. The knobs adjust the amount of the CV input (-200% to +200%) for the specific time/amount. Defaults to IO Panel's VELOCITY input.

x100 switches: multiplies related input CV time controls x100 for longer times.

Control Voltage #1 input: to control attack, hold, decay & release times. Knobs adjust amount of CV (between -200% to +200%) for the specific time e.g. to allow Pitch to adjust the timing where higher notes have shorter release times. *If no jack connected, this automatically uses the IO Panel PITCH CV input.*

CV In sets CV range for all time related CV inputs and controls to 1ms per Volt or to 10ms, 100ms or 1sec/V



Individual CV in and knobs: for individual control over each stage of the envelope. The knobs adjust the input CV from -200% to +200%. The time related CV inputs are subject to the "Time CV 1V=" settings.

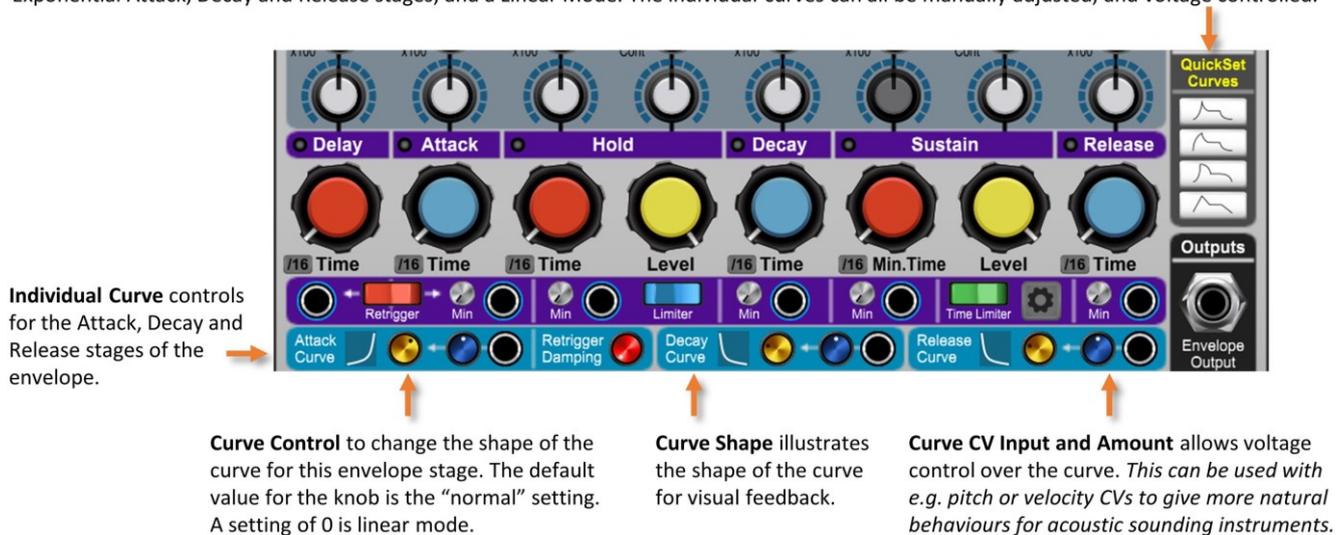
x100 switches: multiplies related input CV time controls x100 for longer times.

Level direct CV input sense Cont. switches with the CV for direct inputs (only) to these levels sensed at envelope start (normal operation) or continuously during the stage. *Continuous mode can be useful for having aftertouch applied to the hold/sustain level or adding a small amount of LFO to the hold/sustain level without affecting the attack/decay/release.*

Advanced Features: Envelope Curves

The attack, decay and release stages now support envelope curve controls. These curves allow you to change how quickly or slowly the stage "starts" with options for Exponential through to Logarithmic behaviour as well as Linear modes. Each stage can be set individually and can have CV control over the setting.

QuickSet Curves buttons set the Attack/Decay/Release Curve knobs to the: the Normal Voltage Modular Envelope shape with an Attack stage that starts slowly (Exponential); a Fast Attack Voltage Modular shape with the attack starting more quickly (Logarithmic shape); a setting with Exponential Attack, Decay and Release stages; and a Linear Mode. The individual curves can all be manually adjusted, and voltage controlled.



Individual Curve controls for the Attack, Decay and Release stages of the envelope.

Curve Control to change the shape of the curve for this envelope stage. The default value for the knob is the "normal" setting. A setting of 0 is linear mode.

Curve Shape illustrates the shape of the curve for visual feedback.

Curve CV Input and Amount allows voltage control over the curve. *This can be used with e.g. pitch or velocity CVs to give more natural behaviours for acoustic sounding instruments.*

Advanced Features: Retrigger Mode/Damper and Limiters

The retrigger mode switch, damper knob and limiter switches provide even more flexibility to the module: the retrigger damping and mode switching allows control over how a retrigger will work with the existing envelope state, for example providing the original return to zero approach or the analogue continue from existing level; the time limiter switch allows Unlimited times to be set using CVs or BPM-based timing, especially useful for ambient and generative patches.

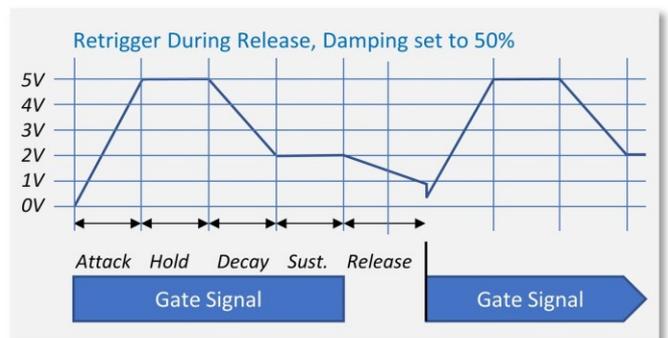
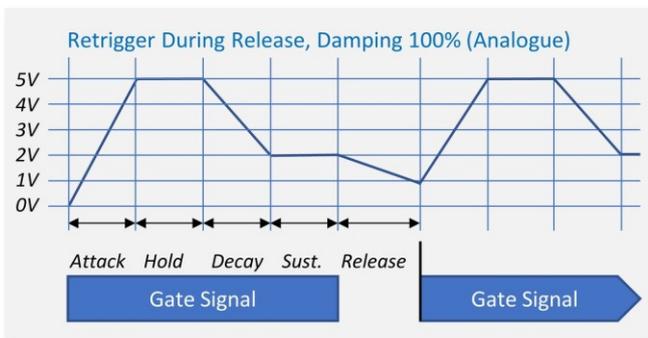
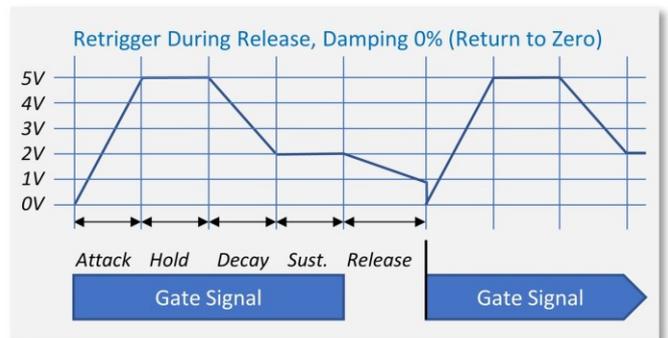
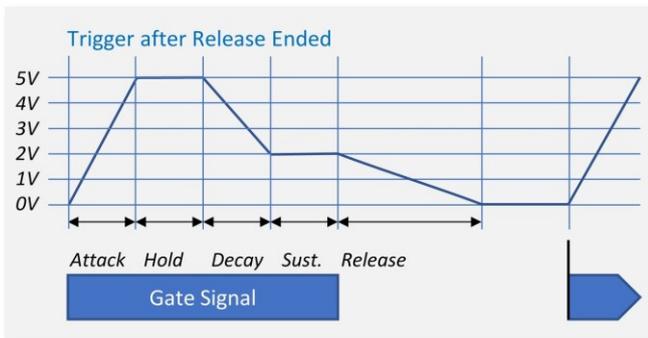
Retrigger Mode switch controls whether a retrigger will start a new Delay stage or jump straight to the Attack stage. When used with the Retrigger Damper control, this gives a great deal of control over how retriggers are processed.



Retrigger Damper allows control over the retrigger process. When set to 0% (default) any retrigger will take the envelope value back to 0V. When set to 100%, the retrigger will start at the current level of the envelope (which may mean no attack if this is during a Hold stage or a 5V Sustain stage). Values between 0% and 100% determine the amount of the current level to be used. See illustrations below:

Hold Level Limiter switch limits the level calculated from the knob plus any CV inputs to 5V. When off the Hold Level can be any value.

Time Limiter switch controls whether the times set by BPM and/or with CV inputs can exceed the default 12 seconds. When OFF (default for new patches) the envelope times can be minutes or even hours long. When ON (default for older patches) it limits any stage to a maximum of 12 seconds.



Voltage-Controlled Matrix Mixer

The **Voltage-Controlled Matrix Mixer module** allows you to mix 6 inputs to 6 outputs (mono or poly) in a matrix, so you can for example send input 1 and 3 to output 1, input 1 and 2 and input 5 to output 2, etc. The signal can be Control Voltages or Audio Signals. Mixing uses a simple linear 0-100% mix.

When you connect a jack into the Switch In connections, the module will take a “best guess” at how you want the links to be set, linking earlier rows together, and splitting where there is a jack. When CV Switch is in Gate:On mode, the ganged enable buttons will be switched to Disable the row – and the “All On” button will only switch any Enable buttons on that are not under the control of the Switch In signals.

Switch In Mode to set whether the Switch In (all inputs) is a trigger (swaps on/off) or gate, with options for Gate On=OFF/Gate On=ON.

Switch In inputs: the input gate or trigger signals switches a row **or gang of rows** on or off, with their state shown in the switches.

Mixing Matrix: set the amount on for each intersection. This is 0-100% linear controls.

Quickset Button: sets all output volumes to % based on number of inputs connected (e.g. 3=33%)

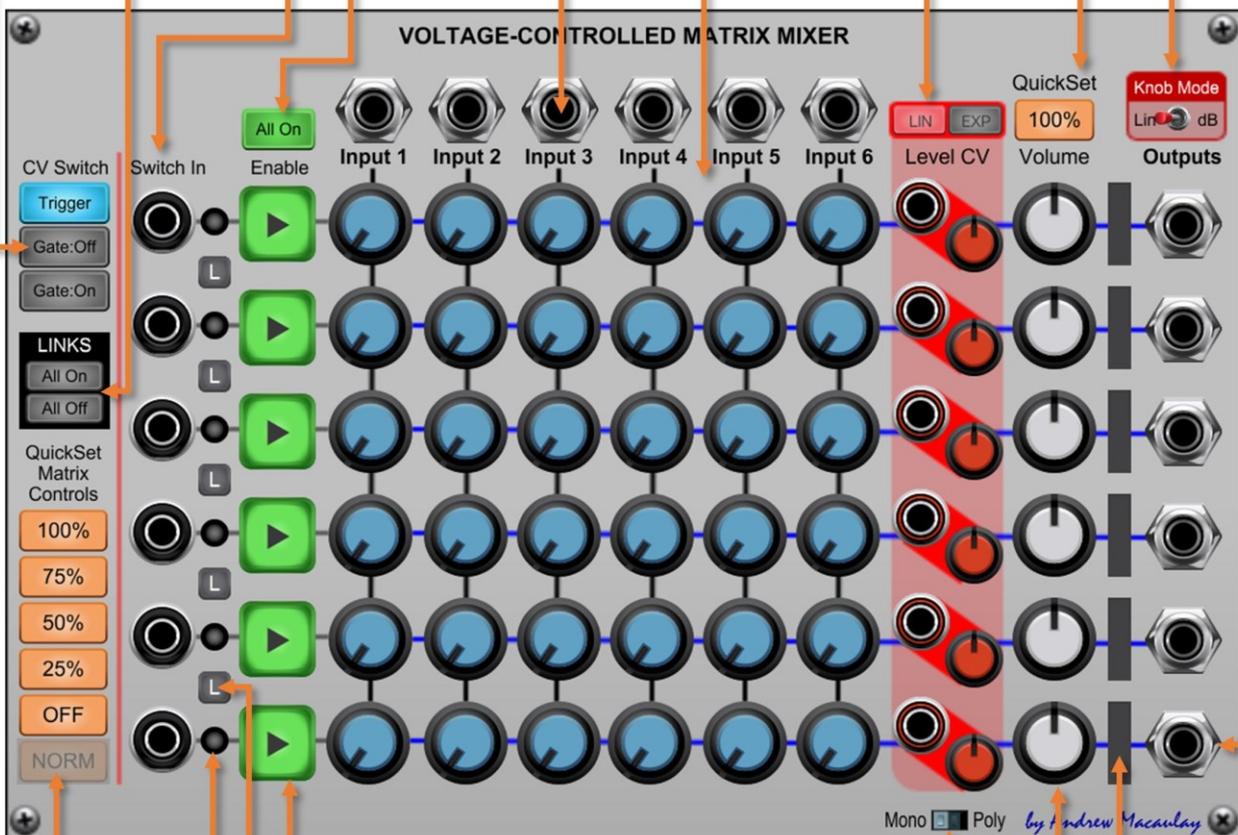
Links All On/Off: for quick switching of all link buttons.

All On: switches all rows to “on”

Input jacks: six signal inputs for the six input channels of the matrix (Mono or Polyphonic).

Level CV In and Amount: control voltage for each row’s VCA, with amount control. Can be set to use Linear or Exponential (for audio)

Knob mode: selects if knobs are linear % or showing in dB



QuickSet: sets all Matrix knobs to fixed values or to % based on number of inputs connected

Switch mode LEDs shows the status for each input CV.

Link Buttons: links CV control between the rows to allow “ganged” control of the rows. When you insert a jack in a row, it automatically switches the link off to the next row.

Row enable/disable switches: enables or disables each rows completely. The switches also show the status of the row if being set by the Switch In control voltages.

Mono/Poly switch: selects if the module is in Mono or Poly mode, for the Signal Input and Signal Outputs only (see below). You cannot change mode if there is any signal jack connected and a tooltip is displayed for the switch in this case.

VU meters for output level of each row.

Output jacks for the signal output of the six rows – Mono or Poly as inputs.



Output Volume: sets level for outputs from 0-200% (or in dB)

Voltage-Controlled Matrix Switch

The **Voltage-Controlled Matrix Switch module** allows you to switch 8 inputs to 8 outputs in a matrix form (the module is switchable to work for either mono or polyphonic signals), so you can for example send input 1 and input 3 to output 1, input 1 and input 2 and input 5 to output 2, etc. The signal can be Control Voltages, clocks or Audio Signals. The row switches, which can also be voltage controlled, can be ganged up so that one input can switch can control multiple rows.

When you connect a jack into the Switch In connections, the module will take a “best guess” at how you want the links to be set, linking earlier rows together, and splitting where there is a jack. When CV Switch is in Gate:On mode, the ganged enable buttons will be switched to Disable the row – and the “All On” button will only switch any Enable buttons on that are not under the control of the Switch In signals.

Link Buttons: links CV control between the rows to allow “ganged” control of the rows. When you insert a jack in a row, it automatically switches the link off to the next row.

All On: switches all rows back on

Input jacks: eight signal inputs for the eight input channels.

Output jacks: eight signal outputs for the eight different channels.

Switch In inputs: the input gate or trigger signals switches a row **or gang of rows** on or off, with their state shown in the switches.

Switch In Mode to set whether the Switch In (all inputs) is a trigger (swaps on/off) or gate, with options for Gate On=OFF/Gate On=ON.

Links All On/Off: for quick switching of all link buttons.

Mode: select how signal is processed:

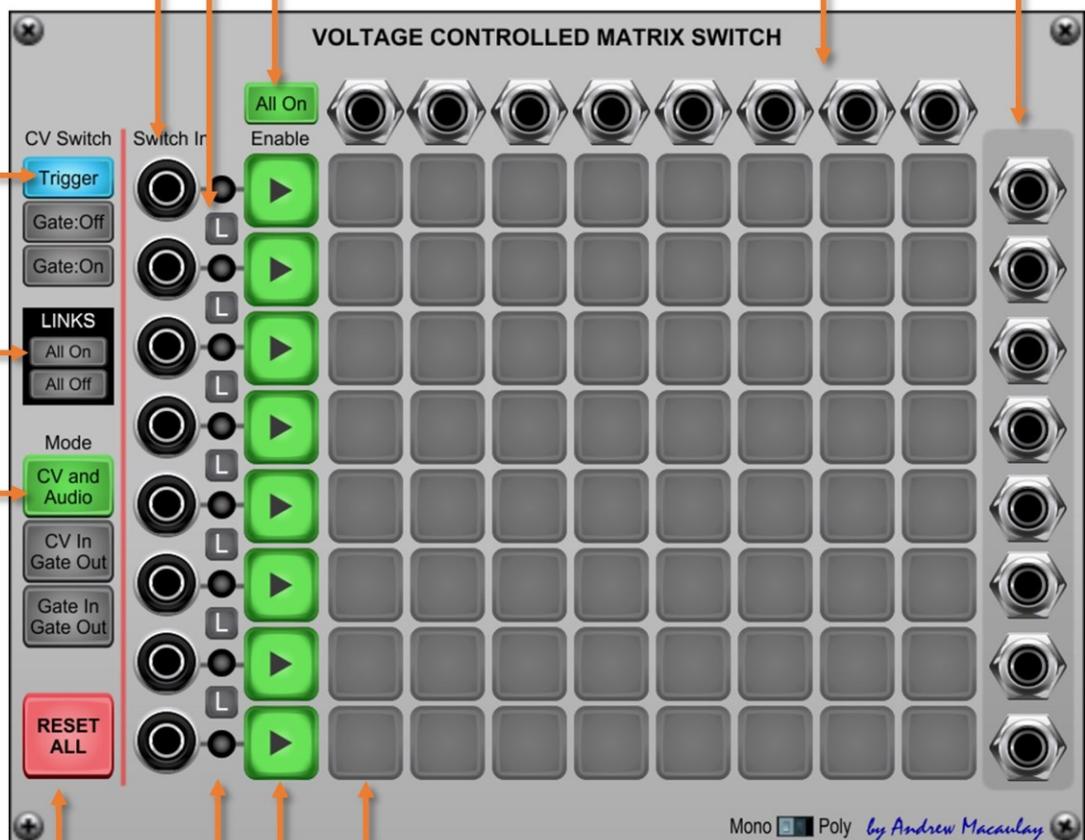
- **CV/Audio:** takes any CV or audio and simply adds them. Row on/off is smoothed to avoid pops.
- **CV In/Gate Out:** takes CVs in, adds them and then outputs 0V or 5V gate signals.
- **Gate In/Gate Out:** converts CV in to a gate and then adds them for gate out.

NOTE: mode setting affects ALL the rows.

Reset All: switches all of the Switch Matrix buttons OFF. This button, as well as the other “set all” buttons support Undo/Redo.

Switch Mode LEDs shows status of each input CV.

Row enable/disable switches: enables or disables each rows completely. Also show status if being set by Switch In.



8x8 Switch matrix: each button is an on/off toggle sending the signal from the input in the column to the output in the row. See the mode for how the signals are combined.

Mono/Poly switch: selects if the module is in Mono or Poly mode, for the Signal Input and Signal Outputs only (see below). You cannot change mode if there is any signal jack connected and a tooltip is displayed for the switch in this case.

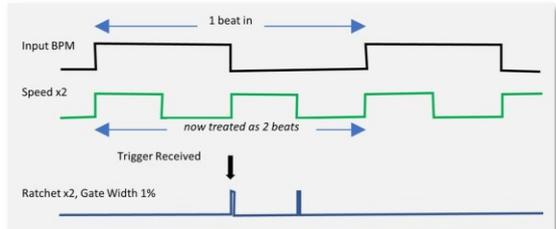


Voltage-Controlled Ratchet

A voltage-controlled ratcheting module that allows a simple CV in to set the number of beats that the ratchet will use for the gate in, allowing up to 16 beats in a single beat. The input CV can be set using a range of voltages, 1V/step or 0.1V/step.

The module has an internal clock that can be driven or synchronised with external clocks (BPM and CV-based), with a trigger to start the ratchet. Setting the mode to Sync will use the external clock as both the trigger and the clock sync source, making its use with sequencers straight-forward. Now with added gate features, optional pass through when single step and an Enable gate/trigger input for manual use.

The **Voltage Controlled Ratcheter module** provides a way to “ratchet” sequences, in a style like Tangerine Dream using a voltage control input to determine the number of steps on each gate. This means taking a step and gating/triggering it multiple times within the step so you get, for example, a triplet on a ratcheted step.



New Standard BPM Sync UI: if an older preset requires it, a legacy version of the BPM input UI will be displayed. See help about the Standard External BPM Sync for more detail on this Legacy mode.

Gate In: provides the trigger (gate on) signal for the ratchet to start on all outputs.

BPM CV button: selects if the Ext.Clock in is 100bpm/V BPM CV input or an Ext.Clock sense.

Ext. Clock/BPM CV in: BPM CV or external gate or clock from which the BPM is measured.

Gate Mode: switches the way that the Gate Width is generated for the ratchet between:

- **Sense** – uses the external gate’s information to identify the gate width (regular clocks only)
- **Merge** – merges the manual values and the external gate, retriggering the external gate while it is active and using the Gate Width settings when the external gate is off.
- **Fix %** – uses the Gate Width and CV Input below to control the gate width.
- **Fix ms** – uses the Gate Time (ms) knob and the CV Input below to control the gate time.

Using the Merge mode and playing with the Gate Width of the source signal (e.g. Sequencer) and of the Ratchet will create some really interesting patterns – so have a play with this!

Sync/Manual/Host selects clock source, which can be Sync’d to the Gate In, a manual speed, the host DAW speed (if no Ext.Clock jack) or sensed from an Ext.Clock signal or a BPM CV (at 1V/100bpm – see BPM CV button).

Advanced Ext.Clock Sync mode: gated mode input (e.g. sequencer) or normal mode (varied BPM); with reset-time setting for gated mode. Only available in Sync Mode.

Speed knob: a manual speed or clock multiplier/divider for the clock speed as captured in the above section. The BPM sync’s amount can be between 1/16th and 16x of the BPM rate, and is used to determine “1 beat” for the ratcheting process – that is, a ratchet will generate 2, 3, 4, etc. triggers within this one “beat”.



Dotted Note option is also available except in Sync or Manual modes.

Manual setting: if Step CV In is not connected, this sets the number of ratchets from 1 to 16.

Steps CV In: used to determine the number of steps in the ratchet effect. This value is sampled on each trigger, so can be changed by a sequencer or even a noise source for random effects. This can be 0 (no gate/skip a beat) through to 99.

Enable input for a gate or trigger signal to enable and disable the ratcheting output, where:

- a Trigger on this input will mean that the ratchet will occur on the next Trigger In.
- a Gate signal means that the ratchet will occur on each Trigger In while the gate is on.

Custom CV to Step settings: controls the Custom mapping of CV to steps – with controls for the number of steps at 0V and the number at 5V. You can set 5V to a lower number than 0V.

Preset CV Ranges: selects the way the voltage in drives the number of steps. This switch has preset settings for 0.1V/Step and 1V/Step (starting at 0V) as well as the Custom mode.



Gate Width/Time: controls the width of the ratchet gate (0%-100%) for Merge/Fix % modes or time of the ratchet gate for the Fix ms mode.

(CV) Amount knob to set the amount of the CV In to be used to control the Gate Width.

Ratchets: shows the number of ratchets currently selected. When using the CV input, this is selected at the start of each Trigger In.

CV In: a control voltage to alter the Gate Width when in Merge and Fixed (% or ms) modes.

Ext.Gate Passthrough on Single: switch that either forces use of the generated gate even on single-step ratchets, or passes the Gate In through, so reflecting the original gate.

Min Gate Width: a switch to set the gate width to have a minimum of 2ms or 0ms. Useful when driving the standard Cherry Audio envelope as this has a 2ms minimum attack time, and a shorter gate will never finish the attack phase.

The default setting of this uses the setting in the global and module configuration. The button allows you to manage these defaults.

Gate Out: the Gate signal (0V/5V) for the ratchet using all of the gate-width (and time) settings above.

Trigger Out: a trigger signal output for the ratchet which is also controlled by the Min.Gate switch. This can be used to trigger percussion envelopes and other fast trigger envelopes at the same time as having control over the gate width on the Gate Out.

Voltage-Controlled Switch

The **Voltage-Controlled Switch module** provides a flexible 8-to-1 signal switch module with comprehensive voltage-controlled options. The module takes up to 8 inputs (audio or control voltage) and switches the output to using one of these based on the input voltage or through manual operation.

The range used for switching can be set by the CV Max and CV Min knobs (supporting up to -5V to +5V) with a set of quick-set combinations available. The module supports the setting of the mid-point of the log-scale for the time control (from the “options” cog-wheel button).

The module can help with Ratcheting and other effects where you want to have one of up to 8 inputs selected at once, either manually or from a voltage-controlled source such as a sequencer, random or keyboard input.

Indicator/Button: both used to show the currently selected input and, when to manually select an input.

Reset to 1: a trigger that resets the input to number 1, useful for start of sequences and other uses.

Input 1 to 8: control voltage or audio input to be switched by the module.

Learn buttons: set the CV Min knob or the CV Max knob to be the current input CV, useful to set to e.g. keyboard notes.

CV Min: sets the voltage that indicates output 'n' where this is the maximum set by the Max # Inputs knob.

Quick Set: brings up a drop-down menu to allow you to select from a range of voltage- and keyboard-based settings for Min and Max values. Clicking off the drop-down menu leaves the values as are.

Auto Reset: when on, the input will automatically revert to Input 1 after the time set in milliseconds (ms).

Auto Reset Time: the time set in ms after which the input will revert to Input 1, if the Auto Reset switch is on.

Max # Inputs: sets the max number of inputs to be available, meaning that the max. input CV will select the highest of this number.

CV In: the control voltage used to select the input.

S&H Gate In: allows a gate or trigger to lock the input until the next gate, so that you can use for example noise as the CV in for random selections.

CV Max: sets the voltage that indicates output 'n' where this is the maximum set by the Max # Inputs knob.

CONFIGURATION DIALOG

OPTIONS

▼ CONFIG

Setting for the Mid-Point of the Manual Time (ms) knob

Midpoint: 750ms

CLOSE

Brings up menu to manage the global/module defaults

Set mid-point type for “reset time” knob log mode to 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy) or to linear mode.

Output: the output from the module, i.e. Input 1 through 8 as selected with no further processing.

The auto reset time knob controls the time in milliseconds with a logarithmic or linear scale, configured through the settings configuration dialog. The options in the configuration dialog are: 500ms, 750ms, 1sec, 1.25sec, 3sec (legacy mode) and linear mode. Default setting for new instances is 750ms unless changed in the global or module defaults (see general help for more) or is set to 3sec when legacy saves/presets are loaded.

Wave Mixer

The **Wave Mixer module** provides a sequence of different mixing algorithms, specifically for the mixing of waveforms, both for audio and LFO use. Allows similar waveform effects as available in Cherry Audio’s Super Oscillator’s controls, but for ANY source.

This wave mixer allows you to blend waves using normal “x-fade” mixing followed by an additive and an amplitude modulation (multiplier) which multiple algorithms including Ring Modulation. Well worth using the Oscilloscope to see what the effect is on the waveforms.

Designed for audio and low-frequency oscillators running in sync at the same frequency or multiples but can be used with any sources.

Input A and B: first two inputs to the first stage of the processor – a simple A-B mix of the signals. If only one input is used, then the signal is always passed through at full strength.

CV Input and Amount: allows CV control over the mix. The amount attenuates the CV from -100% to 100%, and the total mix can only be between full A or full B.

CV Input and Amount: allows CV control over the mix. The amount attenuates the CV from -100% to 100%, and the total mix can only be between full A or full B.

Input C: provides signal input into the Adder stage. If no signal input here, then the mix from A/B is passed through completely.

CV Input and Amount: allows CV control over the mix. The amount attenuates the CV from -100% to 100%, and the total mix can only be between full A or full B.

Mult by D mode: switches between 4 modes for this stage: xM is the original mixed multiplier mode; AM provides a pure AM mode; RM provides a digital Ring Modulator mode and Exp add Log slopes to the input and multiplier values for a more analogue Ring Mod.

A-B Mix: controls the simple mix of signals, from 100% A to 100% B with the mid-point being 50% of each signal. This is a linear control.

Add C Amount: this adds the C signal into the mix, with a range from -500% to +500%. The result of, for example, Square + offset Triangle at 100% generates a stepped triangle wave.

Input D: provides input into the Multiplier stage. If no signal input here, then the mix from the Adder stage is passed through completely.

Mult by D Amount: controls the amount of D used to multiply the signal with (Amplitude Modulation) with a range from -100% to +100%. Fast AM with different pitches generates some interesting waves!

Output: The output signal from the complete chain, with all processing included.

by Andrew Macaulay

CV inputs: it is worth trying both LFO and Envelopes with the CV inputs, to see what this can do to the timbre of the sound. Similar to FM synthesis, you may find ways to generate timbres without the use of filters.

Wave Peaks to CV

The **Wave Peaks to CV** module provides a comprehensive way to measure the peak (maximum) and floor (minimum) values of a signal. Designed to sense the peak and floor values from waveforms, but usable with other signals, it was originally designed to complement the Wave State Processor module.

The module can also be used for any max/min sensing work, by default expecting the input to hit/cross zero (i.e. a traditional waveform from an oscillator or LFO) but has the option to sense a maximum or minimum that might be one polarity (e.g. +1V minimum +5V maximum, or -10V minimum and -3V maximum). The module includes fine tuning knobs (+/-0.5V) for both outputs to allow for fine adjustment of target CVs.

The module has inputs to automate the learning process and reset the module, as well as internal (25ms-2.5secs) and external sample and hold behaviour to automatically track changing amplitude waveforms with careful use of the settings.

Wave In for the signal you are wanting to measure the maximum and minimum values of. This can be an audio signal or a CV signal.

LEARN button starts the learn process based on the mode selected below:

- **Push** means the LEARN button is simply pushed for the duration you want to learn, the LED indicator is hidden and the Learn Input jack expects a gate signal replicating the button.
- **Latch** means that the button becomes a toggle (On/Off) and the Learn Input expects a trigger that toggles the learn mode. The LED indicates the current state.
- **Continuous** means the process runs all the time, either every Sample Time (**Int** mode) or on an external clock (**Ext** mode).

Auto-Reset mode means that when the next Learn is started, the values are first reset before values are calculated. When off, each Learn will only get values that are outside the current peak and floor.

Ext S&H Trig.In jack provides the external inputs for continuous mode sampling, when Continuous mode is set to EXT.

Learn Gate/Trig.In and **Reset Trig.In** jacks provide external inputs for the LEARN and RESET buttons, subject to the settings above.

Sense Mode selector to determine how the peaks are sensed:

- **ZeroX** assumes signal will hit or cross zero: max is always 0V or +ve and min is always 0V or -ve.
- **AnyV** allows for Any Voltage, so you could have a +ve Minimum or a -ve Maximum

RESET button sets the peak and floor values to “undetermined” so that they will be calculated again, allowing lower maximum/minimum values to be picked up.

Sample Time sets the time between samples in the Continuous INT mode. Each sample first resets the values and then calculates the new values while the output and displayed values retain their last calculated value (a sample and hold approach)

Peak (Max) Indication is lit when a value has been recognised.

Peak (Max) Output of the CV of the value found. When undetermined, this is set to 0V.

Peak (Max) Adjust allows manual adjustment of the value to be output, so that when you have waveforms that vary a little over time, you can allow for this variation.

Peak (Max) Display shows the voltage recognised (allows for range of +/-99.9999V). The display shows “-----” when the value not yet calculated

Floor (Min) Section is the same as the Peak (Max) section but for the floor (min) values.

by Andrew Macaulay

Wave State Processor

The **Wave State Processor** module uses the zero crossing capabilities together with other wave sensing logic to allow a wave to be broken into multiple parts which can then be processed. This can be used effectively with LFOs to create interesting waveforms. If used on audio signals, especially at higher frequencies, there will often be digital artefacts due to the internal sample rate of Voltage Modular.

Designed primarily for LFO and CV use, the module will generate triggers and gates for various stages of a waveform including moving up from zero, hitting a set peak (or floor) value, being at or above the set peak (or floor) value, etc. The peak and floor values can be set manually or by CV (with a fine adjustment available) and the recognition of change at the “top” or “bottom” of the waveform can also include simply changing direction.

The signal input has a “through” output to provide sample-accurate use of the source waveform in downstream modules (to mix with any processed waveforms from the module), and the main stages also have VCA gated outputs of the signal so that you can pass the various parts through attenuverters, voltage-controlled amplifiers, exponential or other voltage processing to create completely new composite waveforms.

The module can be used at audio frequencies BUT, at higher frequencies, there will be some digital artifacts due to the internal sample rate and resulting rounding errors.

Signal and Gate Outputs are provided for all the various stages within the waveform. The layout of these aligns as far as possible with the Trigger Outputs. The “Above” gate output combines the Above Zero Up, Down and Peak gates and the “Below” gate output combines the Below Zero Up, Down and Floor gates.

Signal In for the module, typically this will be an oscillator CV but can be any signal

Thru Output provides a sample-accurate unprocessed signal where the modified signals are to be mixed with the original signal

Direction Change Sense option to use direction changes where signals may not reach peak or floor levels.
This is optional because complex waveforms may change direction multiple times during a single cycle.

CV In for the Crossing setting will override the Coarse/Fine manual entry (disabling the knobs)

Coarse/Fine settings are used to manually control the Crossing value for the Peak and Floor settings. These default to -5V for the Floor and +5V for the Peak.



Trigger Outputs as the waveform passes the various stages (positive):

- Leaving 0V going up towards peak
- Reaching Peak as set in module
- Leaving Peak as set in module
- Reaching 0V coming down

The arrows and layout of the jacks reflect the way that these triggers are working and the LEDs blink as each trigger is fired.

Graphic representing the 0V level to make the positioning of the output jacks as clear as possible

Trigger Outputs as the waveform passes the various stages (negative):

- Reaching 0V coming from floor
- Leaving 0V going towards floor
- Reaching Floor as set in module
- Leaving Floor as set in module

Gate Width switch: sets the width of the Trigger Outputs to be a pure trigger (0ms) or a short gate (2ms) which can be useful when used directly with e.g. Envelope Generators which may have a min Attack of 2ms.

The default setting of this uses the setting in the global and module configuration. The button allows you to manage these defaults.

Zero Crossing Processor

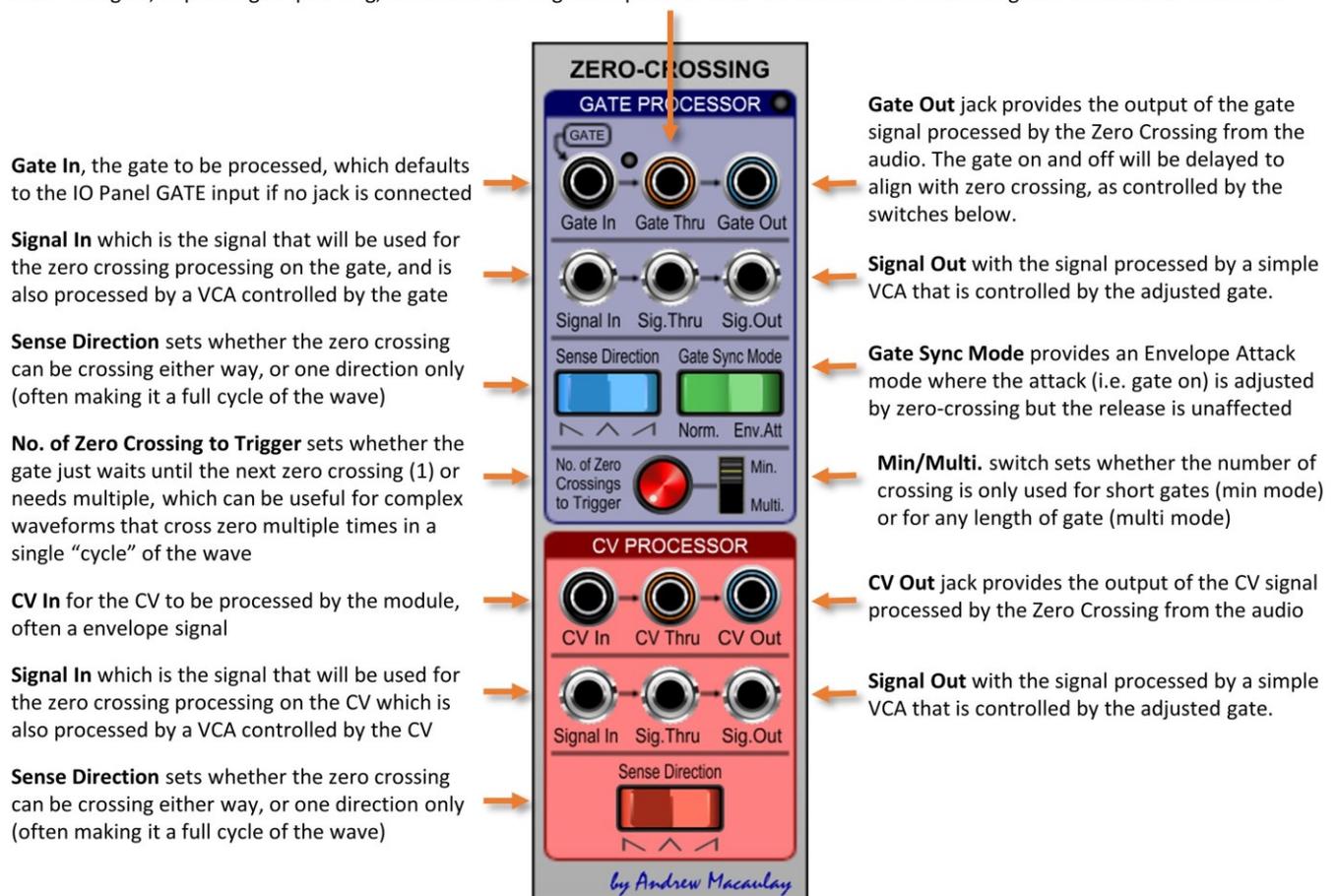
The **Zero-Crossing Processor** module is a utility module that provides “zero-crossing” processing for Gate and CV signals, taking inspiration from Expert Sleepers Persephone. This process is designed to remove or reduce clicks generated when gates/CVs allow the signal through when the signal is not at zero, and especially when the signal is +5V or -5V. See the section [Zero-Crossing Explained](#) for more about Zero-Crossing processing.

The module has two independent sections, one for processing Gate signals and the second for processing CV signals. As the zero-crossing process is aligned at sample level, each input has a thru output as well as a processed output so that the source can be used in modules further down the signal chain knowing that they are fully aligned at the internal sample rate. Each section has a signal path which is needed to provide the zero-crossing information, but which also offers a VCA out with the processed Gate or CV.

The Gate Processing section adjusts the start and end time of the gate signal so that they are always at the time that the input signal crosses zero. This can be controlled so that it senses zero-crossing in any direction, or just crossing up or down. This section also allows the minimum (or gate on time) to be aligned to multiple crossings to work better with complex waveforms. Note that the Gate Processing section may not remove all clicks (but will reduce them) at higher audio frequencies due to the limitations of the internal sample rate.

The CV Processing section uses a sample and hold model on the CV, so that the CV is stepped whenever the signal crosses zero, so that e.g. aggressive envelopes can be tamed so that they don't cause clicks. This can be controlled so that it senses zero-crossing in any direction, or just crossing up or down. This section also allows the minimum (or gate on time) to be aligned to multiple crossings to work better with complex waveforms.

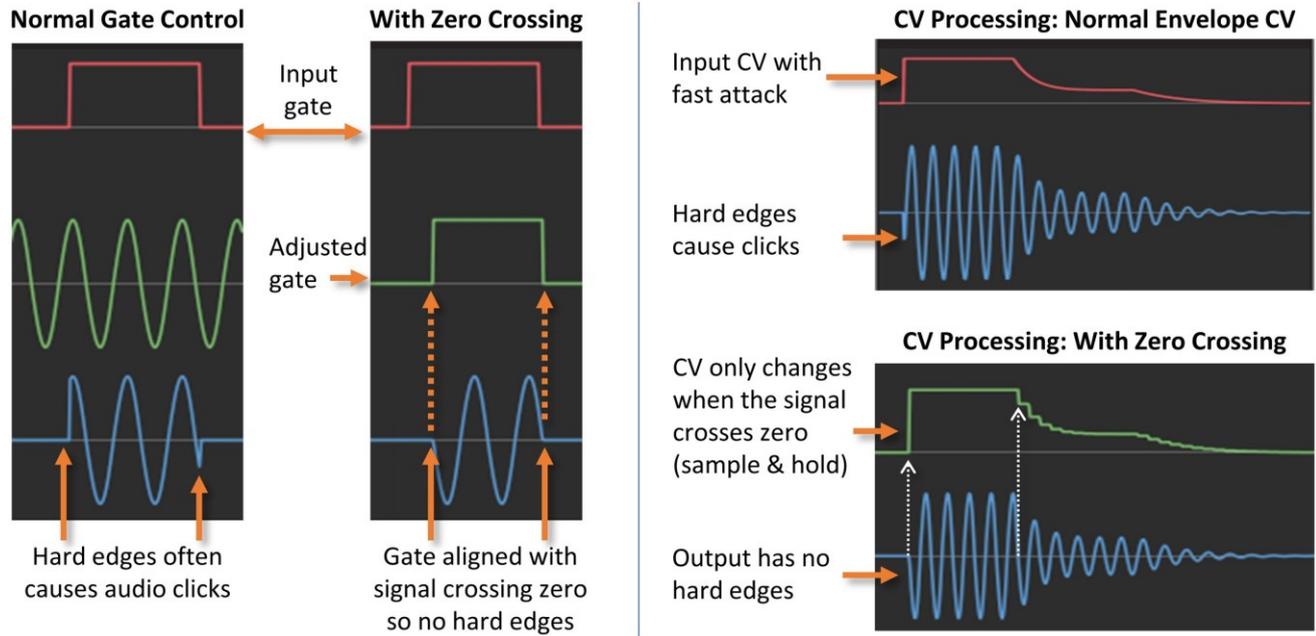
Thru outputs are provided for all signal paths to provide “sample-accurate” signals without any processing, where the original signal is needed later. Especially important with Signal Thru where being used by e.g. a filter/other processing controlled by the CV Out. Without the Thru signal, depending on patching, there can be a single-sample difference between the CV and the Signal which could cause clicks.



Zero Crossing Explained

Zero-Crossing processing can be used to reduce/remove clicks from audio signals when using aggressive envelope changes (such as simple gates or fast attack or decay times). The zero-crossing processing has two approaches depending on its use: zero-crossing for gates and zero-crossing for CVs.

With the Zero-Crossing Gate Processing (in the Zero-Crossing Processor modules) the gate edges are shifted to align with the signal crossing zero; with Zero-Crossing CV Processing (in the Zero-Crossing Processor and some VCAs) the envelope is adjusted by a sample and hold approach based on the signal crossing zero. The diagrams below illustrate these two approaches.



Using these techniques, the Zero-Crossing Gate Processing can be used in the Zero-Crossing Processors to extract part, complete or multiple cycles of a waveform as well as helping with reducing audio clicks.

Customisation Options

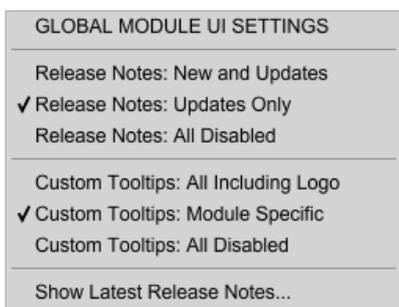
Personalisation and customisation options and the management of defaults was integrated into the modules during Release 5 of the modules. The customisation options can be divided into three areas:

1. control over the behaviour of the UI/module for time-based controls and gate/envelope times;
2. control over the tooltip-style popup help available in varying degrees across the modules; and
3. the control over whether/how the automatic release note messages are provided.

The following describes these configuration options and the management of the global and module-level defaults available.

Release Note and Custom Tooltips Settings

By default the custom tooltip help is enabled and shows “Right-Click to open the Release Note settings” when you hover over the logo, and any Release Notes will display the first time you open an updated module/new release of modules. Behaviours for the Release Notes and Custom Tooltips can be controlled by the Global Module UI Settings menu accessed by right-clicking on the logo *by Andrew Macaulay*:



- **Release Notes: New and Updates** shows Release Notes when you load a new/updated module even if it is your first time using that module.
- **Release Notes: Updates Only** shows Release Notes when you load an updated module that you have previously used.
- **Release Notes: All Disabled** will not show any Release Notes when the modules are loaded.
- **Custom Tooltips: All Including Logo** displays any custom help tooltips on the module, including the tooltip for the Logo.
- **Custom Tooltips: Module Specific** displays only module-specific custom tooltips for modules which have them (i.e. excluding the Logo tooltip).
- **Custom Tooltips: All Disabled** all of the custom help tooltips for Andrew Macaulay’s Modules are switched off.
- **Show Latest Release Notes** displays the current Release Notes dialog.

Customisation of Time-Based Controls and Gate/Envelope Times

There are two aspects of customisation available on relevant modules: control over the mid-point for time-based settings and setting of an optional minimum 2ms time for gates and envelope times:

1. Mid-Point for Log-Scale Time Controls

Modules with time-based controls have the ability for the mid-point of these times to be adjusted to provide logarithmic behaviour of the knobs. This applies to e.g. Delay, Attack, Hold, Decay, Sustain and Release times on envelopes, Gate Times on the Gate Processor (Re-Gater) Module and the Delay and Fade times on the new CV Delay modules.

This setting is available through a “pop-up” configuration box and allows the mid-point to be set to 500ms, 750ms, 1000ms, 1250ms, 3000ms (effectively a “legacy” mode) as well as to a standard linear mode. The legacy mode is automatically set (on existing modules) when loading presets from previous versions so that their behaviour is as expected.

2. Minimum Gate/Envelope Times

Minimum Attack Time, Decay/Release Time and Gate Time switches are also available on many modules such as Envelopes, Gate processing, Ratcheting, etc. and allows the default behaviour of allowing the times to be 0ms (a simple trigger for gates) or a minimum of 2ms, even if the control plus a CV make it less. This ensures that the gate will fully open the envelope on Cherry Audio’s standard Envelope Module which has a 2ms minimum Attack time, and will remove the possible clicks that can occur with envelopes when used at 0ms.

Accessing the Settings

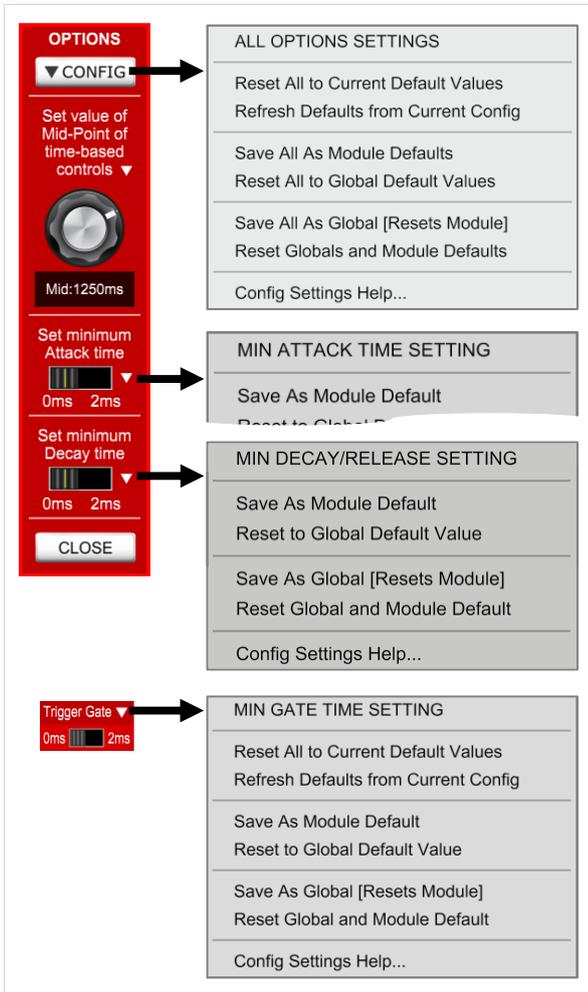
The settings are either available directly on the module – this is typically only where there is one optional setting, for example a Minimum Gate Time, as shown to the right – or through a “pop-up” settings panel accessed by pressing the cogwheel  settings button to open the settings panel.



Saving/Managing Defaults

Starting with Release 5.3, global and module-specific defaults for the customisations can be managed from within the modules. The following illustration shows the ways in which the menus can be accessed to manage the defaults.

Note that for the pop-up configuration page, where there is more than one customisation item, the main menu under the **▼ CONFIG** button will operate on ALL of the items on the configuration page. Defaults for the individual items can be controlled by the **▼** button. The menu options available are:



- **Reset All to Current Default Values** resets all controls to the current module/global defaults.
This menu item is not available on individual controls on the pop-up config page.
- **Refresh Defaults from Current Config** applies the current global/module-level defaults without changing the current values.
This menu item is not available on individual controls on the pop-up config page.
- **Save (All) As Module Defaults** saves the current setting(s) as a module-level default.
- **Reset (All) to Global Default Values** resets current setting(s) back to using the global default values, changing the current value of the control(s) to this global default.
- **Save (All) As Global [Resets Module]** saves current setting(s) as a global default AND automatically resets the setting(s) to use the global default.
- **Reset Globals and Module Defaults** resets the setting(s) to revert back to the default values built into the modules.
- **Config Settings Help...** brings up a dialog box with some simple help on the customisation options.

Note that module defaults always take precedence over global defaults and if there are no module or global defaults for a specific control setting, the module-specific (designed) default will be used.

UI Settings Configurator Module

Added in Release 6, this stand-alone module provides an easy way to configure the Global settings used in Andrew Macaulay's Modules, including the Time Based global settings and the Release Note and Custom Tooltips Settings. See the [UI Settings Configurator](#) for more information.

Configuration Files

The new configuration information is stored by Voltage Modular in the settings files (alongside the standard Voltage Modular settings file) in the **manufacturer-properties.xml** and **module-properties.xml** files.

As these settings files are shared for all modules, it is not recommended to make changes directly to the files – and all defaults and settings for Andrew Macaulay's Modules can be managed from the modules themselves.