JiGGERY·POKERY

Ammo 400R / 1200BR

v1.2.0

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AVAILABLE IN THE propellerhead shop

www.jiggery-pokery.com

Re Rack Extension

Contents

Lock & Load

Welcome to *Ammo*, a modulation device for creating and processing audio and control voltage (CV) signals in Reason.

The brief was to a create a device dedicated to creating lots of cv, and end the decade-long standing Reason tradition of using a small section of entire synthesizer just to get one waveform to modulate a flanger. *Ammo* has been designed to be a permanent fixture of your Reason template, always armed and ready to provide a stream of bombardment on an unsuspecting target device at a moments notice.

Unlike basic Rack Extension CV devices such as Pulsar, which offer a handful of basic analogue waveform shapes with largely unpredictable results created by combining basic shapes, *Ammo* can provide predictable results with 136 high-calibre waveforms from basic to complex variants, with a huge rate of fire, from 0.001 Hz to 8.4 kHz.

The package is available in two versions. **Ammo 1200BR** contains the four oscillator *Ammo* module, the *Battery* processing module, featuring an additional eight LFO-rate oscillators, and the *Re-ARM* modulation routing device. **Ammo 400R** contains the same *Ammo* oscillator device but with a modified *Re-ARM* modulation routing section, which has one less routing target per source, but includes several useful functions from *Battery*, including the envelope.

The entire process chain of *Ammo* and *Battery* is at audio rate, thus *Ammo* functions as a monophonic synthesizer as well as an advanced LFO creator. External audio signals can be processed independently of the *Ammo* oscillators, or can be added to them. *Re-ARM* modulations are at standard Reason cv rate (1/64th of audio rate), except for FM (frequency modulation) and AM (amplitude modulation) from the subsequent *Ammo* oscillator in the chain, which are both at full audio rate for true FM and AM effects.

Oversampled, non-aliasing audio

Ammo's high quality oscillators have built-in oversampling providing *non-aliased* audio up to a massive 18 kHz of harmonic content, even using a 44.1 kHz sample rate. No additional oversampling is required: Nyquist peered momentarily down the barrel of this gun, then gallantly ran away like brave Sir Robin.

Now to unleash the total shock and awe of *Ammo* in your Reason rack, and retreat to a safe distance.

ammo

analogue matrixed modulation oscillators

Oscillators

The business end of your new Reason Rack Artillery is in the *Ammo* oscillator section, providing four audio oscillators with 121 unique waveforms, plus a further fifteen pre-inverted selections for a total of 136 shapes appropriate for both LFO and synthesizer output.

Channels B, C and D can be synced to Channel A, or have their rates controlled by the Channel A Rate knob. Thus Channel A can be considered the master oscillator, and Channels B, C and D as slave oscillators.

Oscillator A [Master Oscillator]

The following functions are available in the Oscillator A module:

- **Oscillator Off/On**:
  —Turn the oscillator off or on as required. By default Oscillator A is On
- **Rate display**:
  —This window shows the current rate of the oscillator according to the **Range** and **Rate** settings as explained below
- **Range selector**:
  This button sets the frequency range of the oscillator. Press repeatedly to cycle through the five options:
  —*Low*: 0.001 Hz to 30.0 Hz [from a 15-minute LFO single waveform cycle up to note B0]
  —*High*: 30.0 Hz to 8.4 kHz (8,372 Hz) [a note range of B0 to C9]. Default is A4 (440 Hz)
  —*Tempo Synced*: 32/1 to 1/128T
  —*Semitone*: +/- 36 semitones from the *High* range frequency
  —*Cents*: +/- 50 cents detune from the frequency as determined by *High* and *Semitone* ranges
- **Rate knob**:
  —Adjust the oscillator frequency within selected Range, *Low*, *High*, *Tempo Synced*, *Semitone*, and *Cents*
  —You can switch between ranges as required and the **Rate** knob remembers the setting each **Range**
- **Master Rate button (B-C-D)**:
  —Turn this button on to use the Oscillator A Rate knob to set the same rate for all four *Ammo* oscillators
  —Please note that **Rate** knob and Displays for the slave channels (B-C-D) can not be updated to show the Master rate
- **Depth knob**:
  —Control the amplitude of the waveform
  —This is an inverting control. Use +1 (full right) for maximum amplitude, set to 0 (middle) for no output, and -1 (full left) for a maximum inverted amplitude
- **Phase knob**:
  —Use this control to set the starting point within the waveform in degrees (°)
- **Keyboard control/Portamento amount (Kbd)**:
  —Turn the knob fully counter-clockwise to disconnect keyboard note pitch control to the oscillator, allowing you to modulate another parameter by the fixed Rate only, rather than the Rate scaled by note frequency input
  —Turn slightly clockwise to enable keyboard note to oscillator frequency control; this is a monophonic retrigger mode
  —Continue to turn clockwise to select Portamento; increase the portamento time (slide length) between notes
  —For a smooth glide between pitches in portamento mode, play the notes with legato
- **Envelope button (Env)**:
  —Turn on to apply the **Envelope** from *Battery* (**Ammo 1200BR**) or *Re-ARM* (**Ammo 400R**), or an external envelope connected to **Envelope A CV In** to the amplitude. The waveform is retriggered from per gate in oscillator *Low* range
- **1-Shot button**:
  —With this button enabled the entire waveform will play once, holding the final level, per gate on event
  —The final held level may not be consistent if the one-shot oscillator is being modulated
  —This control is best used in *Low* range
- **Waveform selector**:
  —Use either the up/down buttons to step through the waveforms, or drag up/down on the display to rapidly move through them
  —Waveforms W001–005 are basic analogue waves, sine, triangle, saw up and down, and square
  —Waveform W136 is square random (noise); "soft" random can be made by adding **Lag** via the VPM (see page 11)

Oscillators B, C & D [Slave Oscillators]

The following functions are available for the other three *Ammo* oscillators:

- **Oscillator Off/On**:
  —Turn each oscillator off or on as required. To conserve ammunition, by default Oscillators B, C and D are Off
- **Rate display**:
  —This window shows the current rate of the oscillator according to the **Range** and **Rate** settings as explained below
- **Range selector**:
  This button sets the frequency range of the oscillator. Press repeatedly to cycle through the five options:
  —*Low*: 0.001 Hz to 30.0 Hz [from an LFO of nearly 15 minutes up to a note equivalent B0]
  —*High*: 30.0 Hz to 8.4 kHz (8,372 Hz) [a note range of B0 to C9]. Default is A4 (440 Hz)
  —*Tempo Synced*: 32/1 to 1/128T
  —*Semitone*: +/- 36 semitones from the *High* range frequency
  —*Cents*: +/- 50 cents detune from the frequency as determined by *High* and *Semitone* ranges
- **Rate knob**:
  —Adjust the oscillator frequency within selected Range, *Low*, *High*, *Tempo Synced*, *Semitone*, and *Cents*
  —You can switch between ranges as required and the **Rate** knob remembers the setting of each **Range**
  —When Oscillator A **Master Rate** button is enabled, the **Slave Rate LED** indicators will be lit and the individual slave Rate knobs will have no effect
- **Sync button**:
  —Enable the **Sync** button to synchronise the slave oscillator to the Master Oscillator
  —There are three different synchronisation modes available, described on page 8
- **Depth knob**:
  —Control the amplitude of the waveform
  —This is an inverting control. Use +1 (full right) for maximum amplitude, set to 0 (middle) for no output, and -1 (full left) for a maximum inverted amplitude
- **Phase knob**:
  —Use this control to set the starting point within the waveform in degrees (°)
- **Keyboard control/Portamento amount (Kbd)**:
  —Turn the knob fully counter-clockwise to disconnect keyboard note pitch control to the oscillator, allowing you to modulate another parameter by the fixed Rate only, rather than the Rate scaled by note frequency input
  —Turn slightly clockwise to enable keyboard note to oscillator frequency control; this is a monophonic retrigger mode
  —Continue to turn clockwise to select Portamento; increase the portamento time (slide length) between notes
  —For a smooth glide between pitches in portamento mode, play the notes with legato
  —When **Master Rate** is enabled in Oscillator A the portamento range of the Slave Oscillators are ignored
- **Envelope button (Env)**:
  —Turn on to apply the **Envelope** from *Battery* (**Ammo 1200BR**) or *Re-ARM* (**Ammo 400R**), or an external envelope connected to the appropriate **Envelope [B, C or D] CV In** to the amplitude. The waveform is retriggered from the beginning per gate in oscillator *Low* range
- **1-Shot button**:
  —With this button enabled the entire waveform will play, holding the final level, per gate on event
  —The final held level may not be consistent if the one-shot oscillator is being modulated
  —This control is best used in *Low* range
- **Waveform selector**:
  —Use either the up/down buttons to step through the waveforms, or drag up/down on the display to move rapidly through them
  —Waveforms W001–005 are basic analogue waves, sine, triangle, saw up and down, and square
  —Waveform W136 is square random (noise); “soft” random can be made by adding **Lag** via the VPM (see page 11)

The waveforms are band-limited to provide a clean, alias-free audio output under standard conditions.

Advanced Keyboard and Envelope control

Different combinations of **Kbd** screw and **Env** button can provide different effects.

1. **Fixed frequency, constant signal**
   Kbd = Keyboard Off
   Env = Off
   The oscillator signal will be continuous, if the **Depth** and **Output** controls are greater than zero, at the frequency set by the Rate knob. Use this for modulation effects like vibrato/tremolo which need to be "always on" at a fixed rate.

2. **Keyboard pitched frequency, constant signal**
   Kbd = Keyboard On / Portamento [x]
   Env = Off
   The oscillator output will be continuous, if the **Depth** and **Output** controls are greater than zero, but at the last frequency as set by keyboard note value. Use this (with a high portamento value) for a Theremin-esque gliding monosynth by playing legato style, and modulation effects which need to be "always on" but at a rate *scaled* by the keyboard pitch.

3. **Fixed frequency, gated signal**
   Kbd = Keyboard Off
   Env = On
   The oscillator signal will be continuous at the fixed **Rate** value so long as there is a gate input; **Depth** is scaled by an envelope. Use this for modulation effects at a fixed rate but where you want the effect to fade in and out after specific periods of time.

4. **Keyboard pitched frequency, gated signal**
   Kbd = Keyboard On
   Env = On
   The oscillator signal will be continuous at the last frequency as set by keyboard note value for the duration of a gate; **Depth** is scaled by an envelope. Use this for typical monosynth behaviour, and for modulation effects at a fixed rate but where you want the effect to fade in and out after specific periods of time, and where modulation rates are scaled by the keyboard pitch. Add portamento via the Kbd screw if required.

In all four scenarios parameters such as **Rate** and **Depth** can still be adjusted via modulation source/target as set in *Re-ARM*. Remember that keyboard pitches are also determined by the oscillator's **Rate** value itself, such as the default 440 Hz in *High* Range. MIDI Velocity is available as a *Re-ARM* source that you can use to scale, for example, oscillator Depth to control the volume of signal per note.

Env is tied closely to the **1-Shot** mode. **1-Shot** is really only appropriate in *Low* Range as it will play the selected waveform from the start position as set by the **Phase** control, just once per gate on event. Likewise **Env** will also retrigger the waveform from the set start position in *Low* Range.

Remember that you can mix functions of different oscillators, so you can have each of settings #1–4!

Quadrature LFO and the Master Rate function

Quadrature LFO modules output four signals at 90° phase offset from each other. The default device patch **{Ammo/Quadrature Sine Default.}**, if "Load Default Patches" is enabled in your Reason preferences, is set up to provide a typical quadrature sine wave output. Oscillator A is at 0° (sine), Osc. B wave is 90° relative to Osc. A (cosine), Osc. C at 180° (inverse sine) and Osc. D at 270° (inverse cosine). Try using different waveforms for different effects. Other quadrature presets are available.

In modular synth terminology don't confuse "Quadrature LFO" with "Quad LFO", which is what the Oscillators A–D are in their most basic application when all are set merely set to *Low* range. For Quadrature LFO it is recommended to have the **Master Rate** button enabled, to control all four oscillator frequencies from the Oscillator A Rate.

Be aware this requires the Slave oscillators are locked to the Master phase as well as the frequency. Applying rate modulation to other oscillators would mean you lose phase coherence, since the oscillators otherwise are free-running. The **Master Rate** button, when enabled or re-enabled, will reset all Oscillators B, C and D to phase-sync with Oscillator A: rate modulation such as via portamento should be made to Oscillator A only to maintain phase coherency, so portamento and 1-Shot functions are ignored on the Slaves. Re-enabling a disabled oscillator may also require re-resetting the **Master Rate** button to re-sync them. We recommend leaving them all turned on for Quadrature: set individual **Depth** controls to zero to mute them.

Sync modes

To the left of the *Ammo* oscillators and below the performance control wheels you will find the oscillator **Sync Mode** module, which features two controls.

The first switch toggles between **Soft** and **Hard** sync modes.

Hard sync

Set to **Hard** the Slave oscillators will restart their waveform playback from the beginning every time the Master oscillator wave restarts at its set **Phase** position. So if the Master oscillator Phase is 0°, the Slaves will retrigger at the start of their selected waveform every time the Master waveform playback is at zero degrees, regardless of their own playback position. If the Master oscillator Phase is 140°, the Slaves will restart every time the Master "restarts" at 140°.

Set the switch to **Soft** and you can further select between two types of soft sync using the switch to its right.

Soft sync / Phase

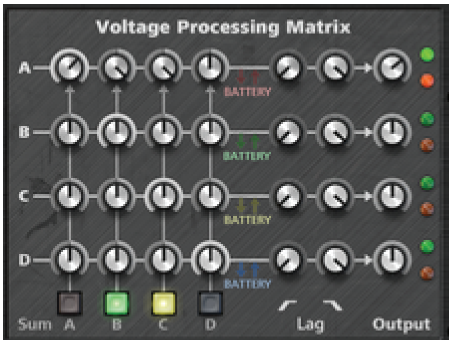
In Phase mode a synced slave oscillator wave will advance to its next zero crossing whenever the master oscillator level reaches it's set Phase position or, zero. This create a very phasey sound.

Soft sync / Overlap

If you set **Soft** sync to **Overlap**, the slave wave is retriggered as with hard sync, but the existing wave is also allowed to complete, thus you have two waves which are summed together, providing a smooth transition when using waveforms with a zero start and end level.

Depending on the waveforms being used Soft Sync/Overlap and Hard sync may sound similar or very different, but generally you'll find *Ammo*'s Overlap synced oscillators will sound brighter than it's Hard synced oscillators. Remember that you can use Oscillator A as the Master but only use the Audio outputs of the Slaves, which creates some interesting effects.

Voltage Processing Matrix (VPM)



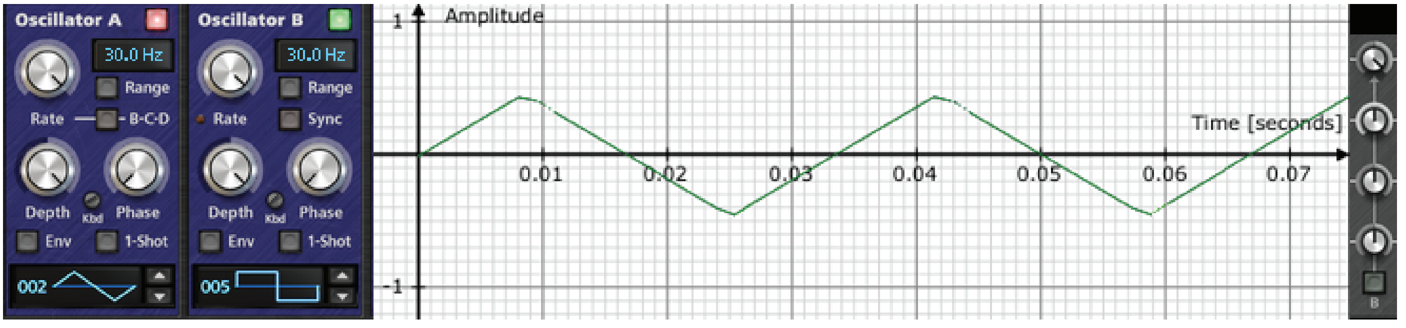
Ammo's VPM is the first attack vector on your preset waveforms. It can be thought of as simply a waveform mixer.

Oscillators A–D are mapped vertically in white, with the Oscillator A inputs into Channel A at the top, then Oscillators B, C and D to their respective channels. Each channel fires along a horizontal path through the VPM to the output.

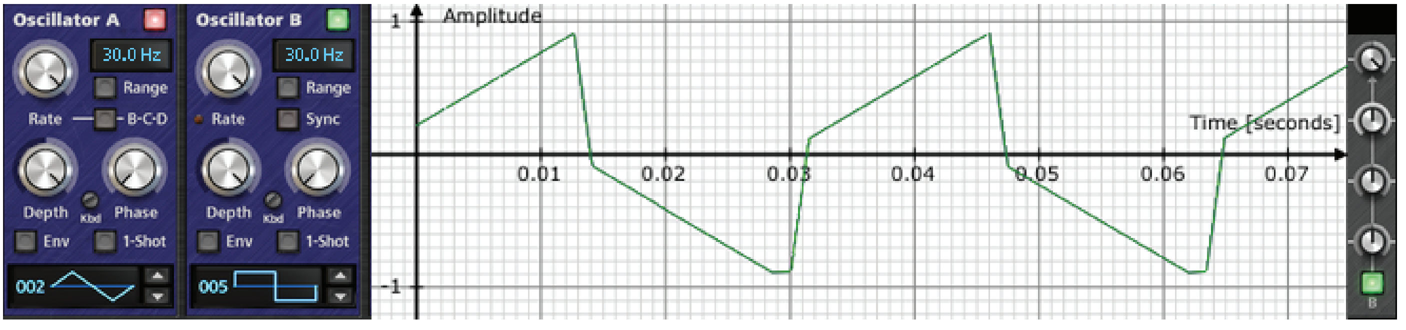
The VPM itself appears to be in two sections, a 4x4 controller grid, with the Oscillators duplicated in black along the bottom, then a 3x4 Output grid for lag and master output amount.

While the white Channel rows indicate the route from an oscillator to its output, the black inputs operate vertically: turning them on allows us to add, invert and crossfade signals from other oscillators.

For example, say we have a triangle wave on Osc.A and a square wave on Osc.B.



Now turn on the **Sum B** button at the bottom, this routes Osc.B into all the channels on the second column of controllers. Raise the level of this input on the A channel by increasing the second knob from the left on the top row, to give you A+B (Oscillator A plus Oscillator B). Reduce the level of the input to a negative value to give you A-B (Oscillator A *minus* Osc. B).



Now by selecting the **Sum A** input and increasing/decreasing the top left controller you can crossfade between the A and B signals.

The A/A, B/B, C/C and D/D controls are dual functioned, set by the **VPM X-Fade** switch in *Battery* (**Ammo 1200BR**) or in *ReARM* (**Ammo 400R**). Toggle the **VPM X-Fade** switch to it's Off position to use A/A, B/B, C/C and D/D to add/subtract those signals with themselves, and now by adjusting the **Sum A** input and increasing the top left controller you can feed the signal back into itself for A+A, as well as adding signals from the other three oscillators. In some situations, such as the example above where we are just A and B, the result may be the same regardless of which VPM mode is selected, but the choice comes into it's own more if adding further oscillators to the signal.

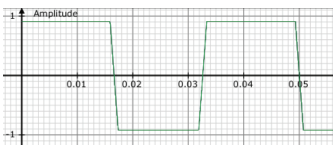
VPM breakouts to and from *Battery* (Ammo 1200BR only)

After the Sum section, the Oscillator mixes can be plotted a new trajectory to the *Battery* section for further processing if required. The return path back into the VPM can also includes external any audio input on the same Channel. The LED arrows indicate the path the audio signal is taking.

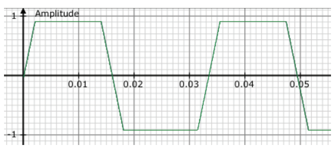
VPM Lag processing / Low Pass Filter

Also known as a slew limiter, the Lag processor is a filter which will smooth out waveforms back to a sine wave at maximum setting. This is normally used for waveforms with sudden changes in peak value, such as square-based waves. The VPM has two Lag processors per channel, one for the "up" part of the waveform, the second for the "down" part. The amount of smoothing increases as you turn the lag controllers towards maximum: at 0 (zero) no smoothing takes place. The **Up** knob is clockwise, and **Down** knob is counter-clockwise. If the output of the entire Channel is a basic sine wave with no processing, leave them at zero, as there will be no benefit. Since it's a kind of filter, output level, especially at CV rate, will drop as you increase the amount of lag, but for audio this acts as a type of crude but effective low pass filter, cutting the brightness of the audio output; unlike standard filters here you have an advantage of treating each side of the waveform peak separately.

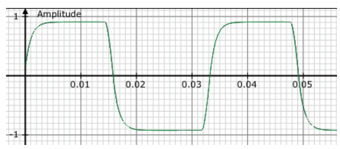
There are two different algorithms you can use for the Lag processors, linear or logarithmic. For **Ammo 400R** use the **Lin/Log** mode selector switch in *ReARM* to change both the up and down Lag processors. With **Ammo 1200BR** the up and down lag algorithms available can be selected independently, so you could have logarithmic on the up part of the wave, and linear on the down part or vice versa. Use the **Up Lin/Log** or **Down Lin/Log** selector switches in the global section of *Battery*.



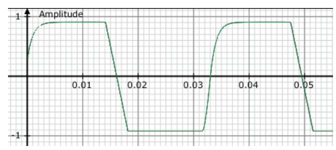
Square Wave



Square: Lin Up/Lin Down



Square:Log Up/Log Down



Square:Log Up/Lin Down (1200BR only)

Channel Outputs

The last column of the VPM is the Channel **Output Gain** adjusters. With these you have the option, if you so wish, to use these as a single control for the cv levels going to your target device, instead of that devices' own default cv mod amount trim knob on the back. In that instance, set that devices cv trim to maximum, then use the VPM output to then control the level. These knobs default to a multiplier value of 1.0, so the output value will be the same as the input, and is applied to both CV and Audio outputs on the respective Channel.

Oscillator audio signals are each split into two prior to the Output Gain knob in to provide audio rate signals for the Audio Out jacks, and downsampled CV rate signals to the Channel CV Out jacks. External audio inputs processed via *Battery* are sent to the Audio Out jacks only.

Unipolar/Bipolar Outputs

Most waveforms are bipolar, that is they have both negative and positive values (-1 to +1). Several waveforms do have a preset unipolar range, -1 to 0, or 0 to +1 which can be used on their own.

You can however easily make any waveform unipolar through one of two methods.

Use Waveform 134/135 into the VPM [400R / 1200R]

Select DC waveform W134 (+1) or W135 (-1) on one oscillator and add/subtract it to another oscillator using the VPM. The signal will now be unipolar. See **{Sine Rate Modulation Unipolar.}** for an example.

Adjust the Shift control [1200R only]

The Shift control in *Battery*'s Attenuator section will raise or lower the centre point, allowing you to set positive or negative unipolar output on the channel (see page 22).

You may want to increase the Channel **Output Gain** multiplier to 2.0.

Random/S&H waveform (136)

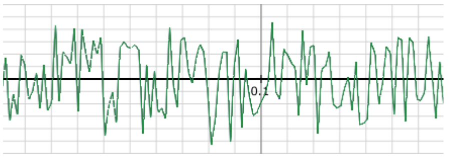
The random waveform supports several useful applications, including noise and S&H-style output, for experimental, avant-garde and special effect purposes.

Audio Noise

With High Range selected, the random waveform acts as noise and you can use both **Rate** and **Phase** controls to adjust the sample rate of the noise. The lag controls act as filters which can be used to adjust the “colour” of the noise.

CV Noise

In Low Range set the **Phase** to 0° for a fast CV noise.



S&H

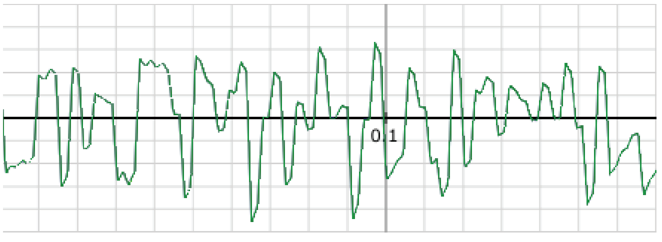
Still in Low Range you can either increase the **Phase** value to slow down the time between samples, or for fine control set the Phase to 1° and use the **Rate** knob to adjust the frequency.

For S&H random oscillator pitch effects route a Low Range random slave oscillator to a High Range audio Master oscillator, e.g. “Osc.B 100% > Osc.A Rate”. Set the master pitch on Osc.A and use the Depth on Osc.B to control the amount the pitch changes, although note the resulting pitch itself won’t be tuned as the random voltage can result in pitch frequencies between notes.

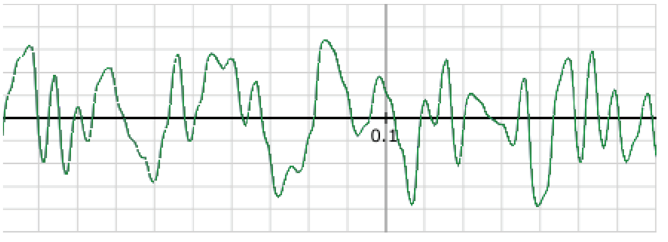
In Tempo Sync Range, set the **Phase** to 360°, and use the **Rate** control to set the sample length; due to the way Ammo operates you will get two samples per cycles, so set the rate to double the value you need for a single value. So for a fixed random value of one bar, set the **Rate** to two bars (2/1).

Add Lag for smooth random

Smooth random waveforms can be made by simply adding lag, but of course with Ammo you can smooth just one side the random waveform, and select between logarithmic and linear smoothing. In this scenario replace the above routing suggestion with “Osc.B CV Out > 100% > Osc.A Rate” if using the Internal Routing Matrix, for sliding random pitchchange.



Random



Random smooth:

100% Lag Up (Logarithmic)
100% Lag Down (Logarithmic)

There are several presets featuring examples of S&H pitch effects available and strongly encourage knob twiddleage!

Ammo external I/O

On the back of the Ammo module you will find all the main CV connections.

Sequencer Gate In / CV In

These are standard Reason gate/cv (note) inputs for use with devices such as Matrix and RPG-8.

Performance CV In

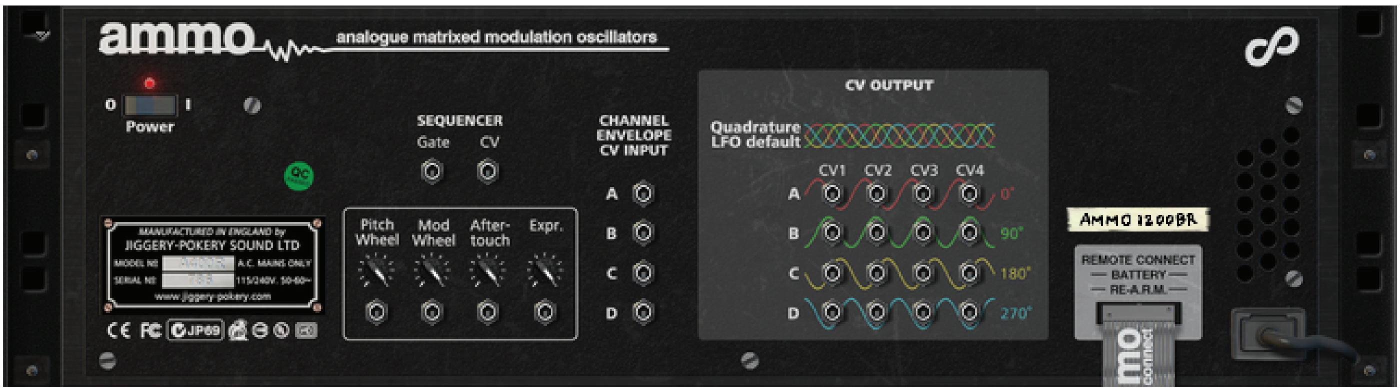
Standard CV in and trimpots for Pitch Wheel, Mod Wheel, Aftertouch and Expression controllers. Use *Re-ARM* to set up the destination of those controllers.

Envelope CV In

These CV inputs over-ride the built-in envelope to specific oscillators, for use with external envelopes such as *Charlotte 9-Stage Envelope Generator & Voice Splitter*.

CV Outputs

Each Channel output from the VPM is sent all four CV rate outputs on the same Channel.



Patch browser

A patch browser is available in both folded and unfolded device views, and several patch files **{.repatch}** and Combinator setups are available by selecting *Ammo* in the Rack Extension section of your Reason file browser. Patches may include free-running audio rate oscillators, so keep your system audio volume to sensible levels! Such patches will have the suffix **{On}** in the patch name, and are located in the "Live Ammunition" folder.

Ammo patches aim for "FSB standard" volume peak of around -12 dB. For *Ammo* this level is based on a single note at C3. Some patches with a great deal of depth modulation may seem quieter at certain stages of playback, or may peak slightly above -12 dB at times.

Where default patches are enabled in Reason Preferences, the default patch on creation is "Simple Osc A Synth Setup".

"Reset Device"—or where default patches are not enabled in Reason Preferences—sets the entire **400R/1200BR** device to a clean state for CV operation, while **{Ammo/True Init Patch.}** zeros everything for real "from scratch" patch-making.

Please note that a small audio glitch may occur while changing patches.

Most *Ammo* synth repatches output on Audio Out A only; house stereo patches use Audio Outs A and B, while Quadraphonic patches require all four audio outputs. Patches provided by other sound designers may differ.

Only the Audio Out A jack features auto-connection; other jacks will require manual connection. For CV only operation it is recommended to hold the shift key while creating the Ammo device to prevent the audio auto-routing to a new Mix Channel.

MIDI note to oscillator frequency

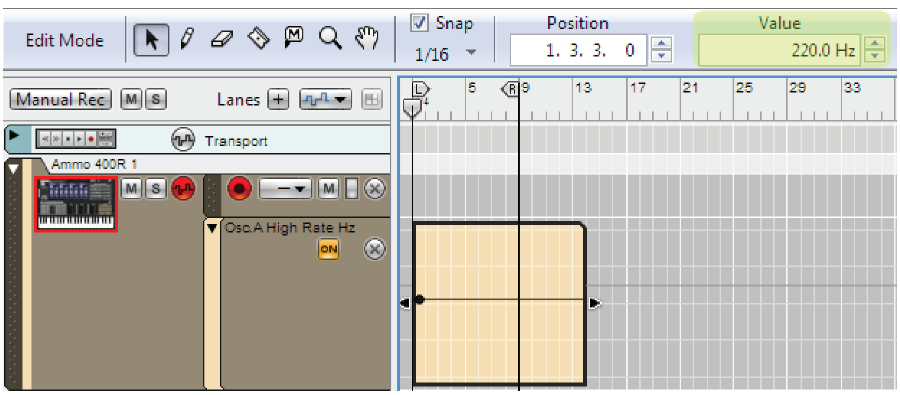
Select Semitone or Cents ranges to change oscillator frequency relative its High range setting. The High range default is A4 (440.00 hz), so typically leave that frequency at 440, then add or subtract Semitones in Semitone range, i.e. +7 semitones for the fifth. Use the Cents range for fine detuning between oscillators.

Use the following table to manually set the frequency of the *Ammo* oscillators in High Range.

http://www.phy.mtu.edu/~suits/notefreqs.html

Note	(Hz)	Note	(Hz)	Note	(Hz)	Note	(Hz)	Note	(Hz)
C0	16.35	C1	32.70	C2	65.41	C3	130.81	C4	261.63
C#0/Db0	17.32	C#1/Db1	34.65	C#2/Db2	69.30	C#3/Db3	138.59	C#4/Db4	277.18
D0	18.35	D1	36.71	D2	73.42	D3	146.83	D4	293.66
D#0/Eb0	19.45	D#1/Eb1	38.89	D#2/Eb2	77.78	D#3/Eb3	155.56	D#4/Eb4	311.13
E0	20.60	E1	41.20	E2	82.41	E3	164.81	E4	329.63
F0	21.83	F1	43.65	F2	87.31	F3	174.61	F4	349.23
F#0/Gb0	23.12	F#1/Gb1	46.25	F#2/Gb2	92.50	F#3/Gb3	185.00	F#4/Gb4	369.99
G0	24.50	G1	49.00	G2	98.00	G3	196.00	G4	392.00
G#0/Ab0	25.96	G#1/Ab1	51.91	G#2/Ab2	103.83	G#3/Ab3	207.65	G#4/Ab4	415.30
A0	27.50	A1	55.00	A2	110.00	A3	220.00	**A4**	**440.00**
A#0/Bb0	29.14	A#1/Bb1	58.27	A#2/Bb2	116.54	A#3/Bb3	233.08	A#4/Bb4	466.16
B0	30.87	B1	61.74	B2	123.47	B3	246.94	B4	493.88

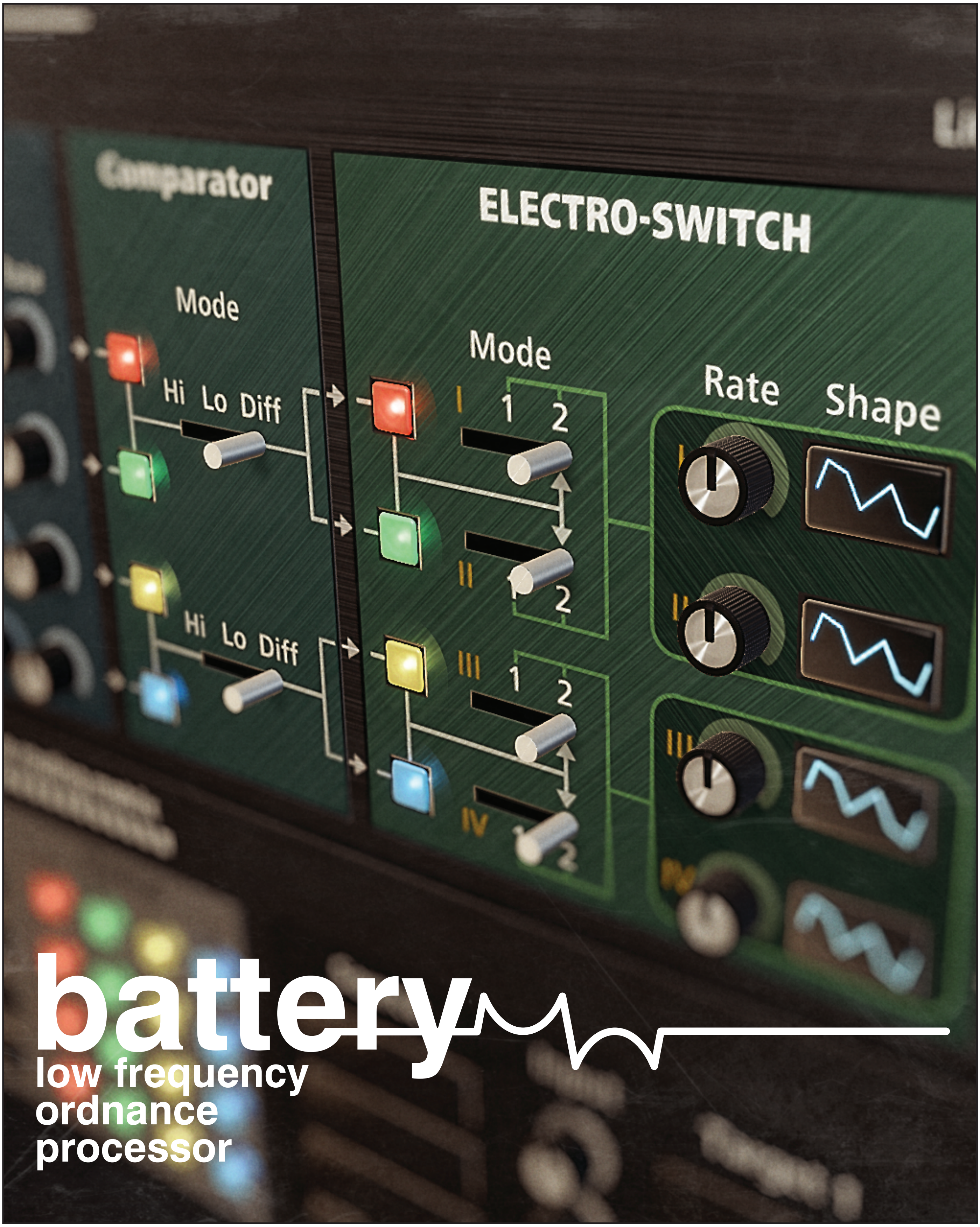
Note	(Hz)	Note	(Hz)	Note	(Hz)	Note	(Hz)	Note	(Hz)
C5	523.25	C6	1046.50	C7	2093.00	C8	4186.01	C9	8372.00
C#5/Db5	554.37	C#6/Db6	1108.73	C#7/Db7	2217.46	C#8/Db8	4434.92		
D5	587.33	D6	1174.66	D7	2349.32	D8	4698.64		
D#5/Eb5	622.25	D#6/Eb6	1244.51	D#7/Eb7	2489.02	D#8/Eb8	4978.03		
E5	659.26	E6	1318.51	E7	2637.02	E8	5274.04		
F5	698.46	F6	1396.91	F7	2793.83	F8	5587.65		
F#5/Gb5	739.99	F#6/Gb6	1479.98	F#7/Gb7	2959.96	F#8/Gb8	5919.91		
G5	783.99	G6	1567.98	G7	3135.96	G7	6271.93		
G#5/Ab5	830.61	G#6/Ab6	1661.22	G#7/Ab7	3322.44	G#8/Ab8	6644.88		
A5	880.00	A6	1760.00	A7	3520.00	A7	7040.00		
A#5/Bb5	932.33	A#6/Bb6	1864.66	A#7/Bb7	3729.31	A#8/Bb8	7458.62		
B5	987.77	B6	1975.53	B7	3951.07	B8	7902.13		



Remember you can type in precise figures, including decimal places, by creating an automation lane for the **Rate** knob, drawing a value, then typing the required value directly into the Value edit box. The automation lane can then be deleted if it is no longer required and the value will remain fixed unless the **Rate** knob is adjusted. While not an ideal solution it is an important workaround to be aware of when setting oscillator rate values. Rates over 1,000 Hz don't really need decimal places.

If you have *Ammo* as a permanent encampment in your Reason template song files, you could add automation lanes for each oscillator rate in the template too, so you always have instant edit access to precise frequency values and don't need to keep recreating them. Be aware that internally there are separate parameters for *Low-* and *High-Range* oscillator behaviours (and indeed another for tempo synced LFO), so if you want precise access to the frequencies of both you'll need an automation track for each range per oscillator.

Both the **400R** and **1200R** automatically provide a new sequencer track and note lane on device creation. When using Ammo as an LFO-only device, remember to either mute the device via it's Mix Channel, or disconnect the audio cable, otherwise you'll be adding unwanted low frequency audio into your regular audio chain. If creating it as a new device for LFO, hold Shift while creating it to prevent auto-routing the audio cable.



battery

low frequency ordnance processor

What is *Battery*?

When the walls need to come a-tumblin' down, you need the full artillery: the *Battery Low Frequency Ordnance Processor.*

Multi-LFO cross-processing

Battery extends the armoury of each of your four Channels by processing them with additional LFOs, adding noise, sample & hold (S&H), comparative pairs, oscillator feedback and scalers, creating unique and modulating waveforms not possible anywhere else. As well as attacking *Ammo*'s own oscillators, *Battery* can process up to four external audio inputs.

Each *Battery* module has the same four A–D channels. The processing chain order is:

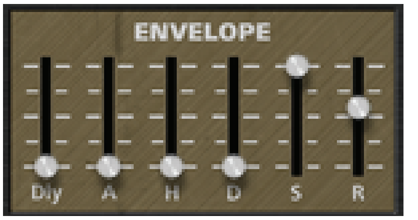
S & H → Comparator → Electro-Switch → Attenuator → Limiter

then back to the VPM on the same channel. You can use any or all of these modules per channel by turning each modules Channel Input button on, otherwise that module in the Channel is bypassed completely. At the start of the chain, to the left of the S&H module are a column of large buttons headed "Breakout from VPM". Oscillator audio is routed in from the equivalent channel on the VPM as required by selecting the appropriate **Breakout from VPM** button; if there is an external audio input on the same channel, it will be added to the oscillator at this point.

Two internal audio route routes are available, allowing you to use the *Ammo* lag/output section for CV only, while the audio is sent post-Limiter section to the audio outputs rather than to the VPM.

Global functions (1200R only)

Envelope



The Envelope section controls the depth level of each oscillator provided their **Env** button is selected, and there isn't a connection to its **Envelope CV In** jack. It requires a gate input to trigger, either a note on from your keyboard controller or Reason sequencer, or via a **Gate CV In** trigger. This is a 6-stage envelope with Delay, Attack, Hold, Decay, Sustain and Release. The time-based stages (Delay, A, H, D and R) are up to 20 seconds. As with other synthesizers it is recommended that the Attack stage is not set to zero when using as a synth to prevent unwanted artifacts.

Env [Trigger Mode]

Choose from two modes for retriggering the envelope.

- **Reset**:
  —The envelope starts at zero on each new gate

- **CF**:
  —The envelope starts at the end envelope level of the previous gate event. This is the preferred mode for synth use.

FM

Choose from two modes for internal Rate (FM) and Depth (AM) modulation (see page 27).

- **Lin**:
  —Frequency and Amplitude Modulation will be controlled linearly (CV rate only)

- **Exp**:
  —Frequency and Amplitude Modulation will be controlled exponentially (Audio and CV rates)

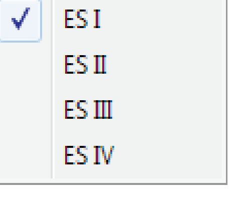
Lag Up and Lag Down Mode

Select between linear or logarithmic waveform smoothing for the Lag controls in the VPM, as discussed on page 10.

VPM XF

Turn Off to allow the oscillator to be summed/negated by itself in the VPM, or On, where the oscillator is simply crossfaded with the sum any other channel signals input into the same row.

E-S Pulse Width



Adjust the **E-S Pulse Width** slider to control the pulse widths of the Electro-Switch. While the slider icons show a square wave for purposes of clarity, this is in fact applied to all 25 E-S waveforms, and be used as a "shuffle" type effect. Select which of the four signals you want to adjust by using the **Pulse Width Target Selector** display to the right of the slider. The positions of all four are stored separately and that pulse width value will be recalled as you change the display number. The display values are in the following order: "E-S i", "E-S ii", "E-S iii", and "E-S iv".

All four E-S LFOs default to the central, unshuffled position.

Audio In / Oscillator processing

Audio In module

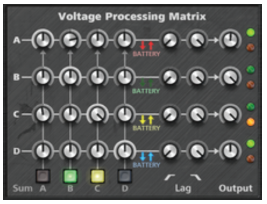
Use the **Audio In** knobs A–D to adjust the input level in decibels (dB) of signals connected via its respective Audio In jack.

For stereo signals while you can use consecutive pairs, i.e, Audio In A and B, if you process two stereo signals you may find it's preferable to use non-consecutive pairs, i.e. Audio In A and C for stereo input 1, and Audio In B and C for stereo input 2, due to the way the comparator and electro-switch modules operate.

In the **{/LFO Tools/}** folder are several stereo tremolo presets using a variety of waveforms, and can liven up otherwise static pads and leads. Some use just the Electro-Switch LFOs, others the main oscillators, and even using the main oscillators to modulate the Electro-Switch LFOs. All except #8 use the A and B external audio inputs; #8 requires A and C, and which uses E-S II and IV in "DC Line" mode by setting the pulse width to maximum. Experiment with changing the waveforms used in the tremolo preset patches, and the oscillator **Rate** and **Phase** to create new tremolo rhythms. And remember that the E-S waves can be "shuffled" using the **E-S Pulse Width** control.

Breakout from VPM buttons

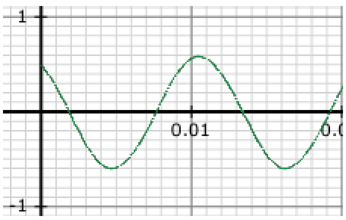
These buttons route the oscillator audio signal on the appropriate channel from the VPM, post sum section, into Battery. If external audio is also being processed on the same channel, that channel's oscillator signal will be added to the audio one. An arrow LED will be lit in the VPM to indicate the breakout from the channel path; the return arrow will light depending on the whether the **Return Audio Route** is set to Channel VPM Return or Bypass VPM Return (see page 22).



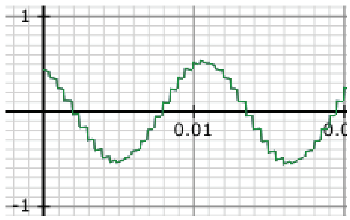
Sample & Hold module

The Sample & Hold (S & H) unit takes an incoming signal at a specified sampling rate and "freezes" it for a set amount of time.

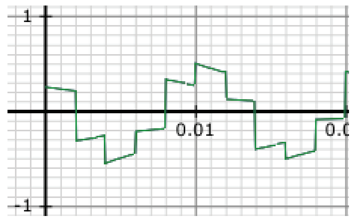
Using a square wave as the S & H modulator, adjust the **Rate** to set the length of time the waveform is held at that fixed value. By applying S & H to it we can create a random "stepped" effect. A sine wave looks like these next images:



Wave 001



S&H Rate = 2000 Hz

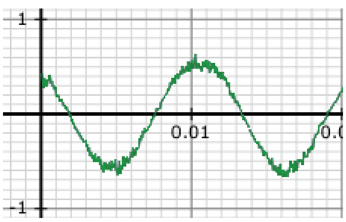


S&H Rate = 500 Hz

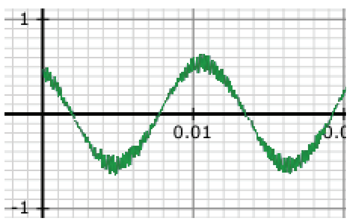
This particular S & H infantry is also able add a noise modulator to the output. With *Battery* you can select from three different noise colours: **P**ink, **W**hite, or **B**lue. Click-drag the switch itself, or click the coloured icons to select between the modes.

White noise has an equal power density at any bandwidth, pink noise reduces the density at -3dB per octave, while blue noise *increases* the power density at 3dB per octave. In layman's terms simply consider pink and blue noises as white noise with, respectively, a 3dB/octave low-pass or high-pass filter. Please note that since this is for modulation purposes, pink and blue noises in this device are not intended as accurate noise sources of those types, but close approximations.

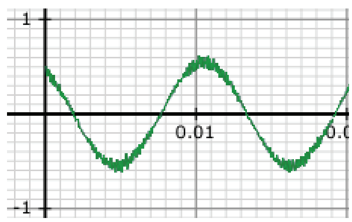
The following images below shows noise at -12dB applied to the sine wave.



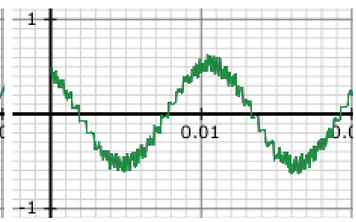
Wave 001 + Pink noise



+ White noise



+ Blue noise



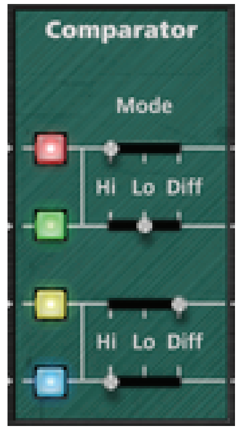
+ White Noise + S&H 500 Hz

The maximum Rate available is 8,372 Hz, the same as the Ammo oscillators, thus it is reducing the signal to a maximum of 8-bit. So on audio the S&H module is essentially a bitcrusher: it samples the incoming signal according the sample rate set by the Rate knob; this can be applied either to the building oscillator signals (whether in audio or CV ranges) or the external audio. The maximum S&H rate is effectively 8-bit, as it's maximum frequency is 8,372 Hz.

Unless wanting extreme effects, leave the S&H rate above 3,000 Hz, but add a little noise as act as a sonic glue, then either add a bit of lag to filter the high harmonics, or use an external filter/EQ.

For CV, the S&H effectively creates stepped waveforms from any of the waveform types, so decreasing the S&H rate makes the steps longer; adding noise gives you randomness and instability to the output. Again, the dual lag controls are useful to turn the the steps into smoother signal.

Comparator module



Comparators take two inputs and outputs just one of them based on which fulfills the specified criteria during each sampling batch (your Reason/ASIO audio sample rate, i.e. 48 kHz). For the *Battery* Comparator cavalry, the channels operate in pairs, A / B, or C / D. For each pair to operate comparatively a different signal must be present on both inputs into the pair.

For example, in **High** mode if input A = 0.5v and input B = 0.1v, then **input A** is output.
If input A = 0.4v and input B = 0.6v, then **input B** is output.

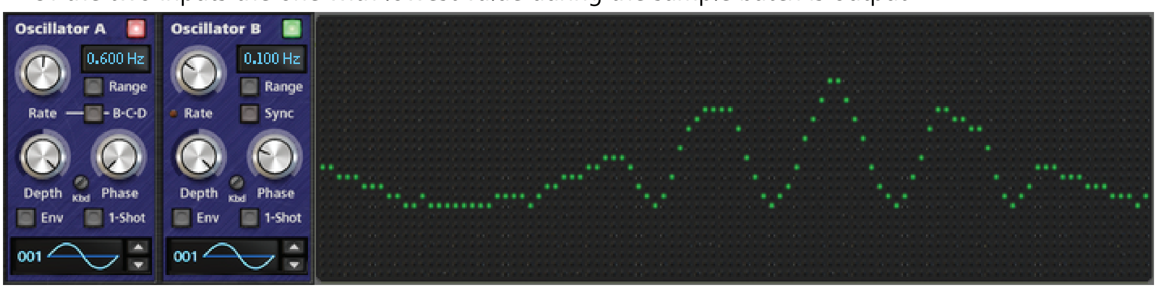
Especially on audio signals, you can imagine this switching happens extremely quickly (once every 23µs at 44.1kHz sample rate!), resulting in waveform mixing where the waveforms aren't simply summed or multiplied, but are still independent. This creates some wonderfully fluid waveforms that are quite different to merely mixing and crossfading. With a comparator per channel, you could have Lo output on A and Hi output on B for some interesting stereo separation. Don't just try it on internal waveforms, either, stick a couple of SubTractors or mono Malstroms on inputs A and B.

Note that in this module channel signals will be input automatically if present, regardless of whether it is enabled: the Off/On button for each comparator determines whether the signal is output on that channel. In this way you can compare A and B, with the Channel A button off, and Channel B button on, allowing compared signals to be output on B, but A to also be passed through unaffected to the Electro-Switch module.

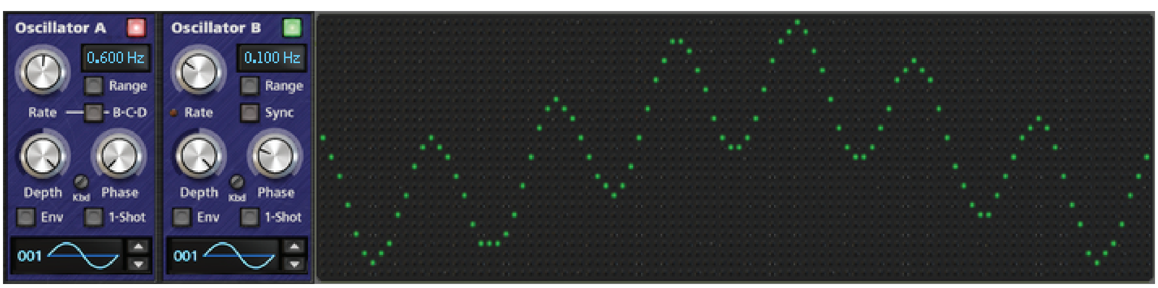
There are three modes to choose from, with an example here, comparing *just two sine waves* at different frequencies and phases, displaying the output through Scope Jnr. Try changing Oscillator B to a square wave.

- **Hi**:
  —Of the two inputs the one with the highest value during the sample batch is output

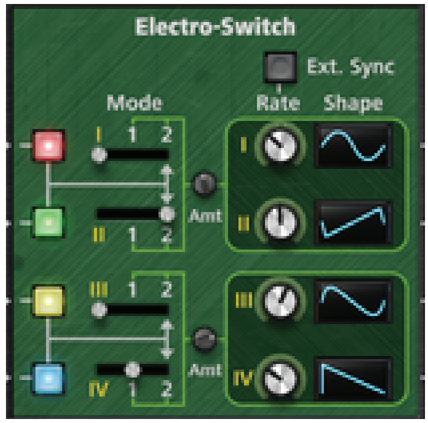
- **Low**:
  —Of the two inputs the one with lowest value during the sample batch is output



- **Diff**:
  —The difference value between the two inputs during the sample batch is output



Electro-Switch module



This proprietary electronic signal switching system that can create very fluid but strange pulses using some additional behind-the-scenes shenanigans.

The Electro-Switch has four additional LFOs: E-S LFOs I, II, III and IV. The frequency of this switching and the Electro-Switch waveform shapes can be adjusted using the **Rate** and **Shape** controls.

All the waveforms in the Electro-Switch can be "shuffled" by selecting the required E-S LFO in the Global sections **E-S Pulse Width Target Selector** then setting a unique pulse width with the slider (see page 17).

You will also notice that these LFOs are subgrouped: Electro-Switch 1 contains E-S LFO I and E-S LFO II and Electro-Switch 2 has E-S LFO III and E-S LFO IV. The two Electro-Switches each has screw knob labelled **Amt** for adjusting the depth of the effect.

Let us once more assume you have signals coming into the Electro-Switch on both A and B channels. You can use the **Electro-Switch Select** switch to choose from three modes.

[I, II, III, IV] Feedback E-S

In this mode the input channels are independent, but so are the Electro-Switch LFOs, i.e., **E-S LFO I** is only applied to channel A, **ES LFO II** to channel B, etc. The channel's own oscillator is also fed into the modulating signal, and so is additionally modulated by itself. Thus the Channel A input from the VPM is modulated by E-S I and itself.

External audio signals are **not** *processed in Feedback mode.*

[1] Mode 1: Standard

With the **Selector** switch set to Mode 1 you have a basic Electro-Switch that uses Electro-Switch **LFOs I** and **II**, to control channels A *or* B, or both channels independently.

[2] Mode 2: Crosstalk

Put the **Selector** switch into Mode 2 and now you use the Electro-Switch 1 **LFOs I** and **II**, to swap between **both** A and B channels with the positive and negative cycles of the combined waves.

As with the Comparator module, *Battery*'s Electro-Switch also uses the channels in pairs in Mode 2.

Again, please note that in this module channel signals will be input automatically if present, regardless of whether it is enabled: the Off/On button for each Electro-Switch channel determines whether the signal is *output* on that channel. This means you can operate the Electro-Switch using both A and B channels, but only output this processed signal on the A channel alone: the original B channel signal will pass through unaffected to the Attenuator, or you can additionally process A and B with a different Mode on the B Channel.

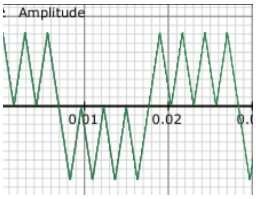
While Modes 1 and 2 use two E-S LFOs, you can set each mode to use just one, by setting the pulse width of just one of the LFOs in the pair to maximum (-1.0 or +1.0) with the **E-S Pulse Width** slider. Now you have a flat Line, in effect allowing you to use just one E-S LFO. Using a square wave you'll have a DC line of plus or minus one; other waveforms may provide a reduced fixed level.

All four E-S LFOs can be routed via Re-ARM either to internal targets, or to a set of "spare" CV outputs.

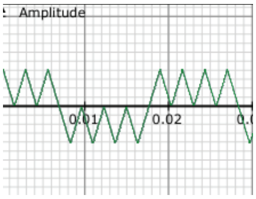
Attenuator/Limiter and Return Audio Route

Attenuator

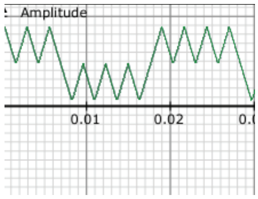
The Attenuator module has two useful functions offering an extra 1v on top of the standard LFO **Depth**. The **Scale** control, like **Depth** will compress or expand the signal (i.e., the peaks and troughs of the waveform increase/decrease relative to each other). Use the **Shift** control to increase or decrease the voltage with no gain change to the relative signal levels (i.e., the peaks and troughs of the waveform stay the same relative to each other). This is handy for turn bipolar signals into unipolar ones. Since the **Shift** control imparts a DC line it is recommended this function is only used for CV signals.



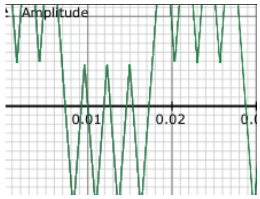
Wave 053



Scale (Depth) -0.5



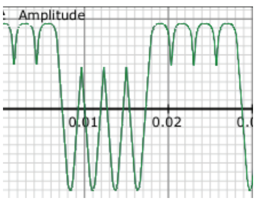
Shift +0.5



Scale +2.0; Shift +0.5

Limiter

Each channel features a soft limiter that smooths a signal over 0 dB from -2 dB to a maximum level of 0 dB.



Wave 053

Scale +2.0

Shift +0.5

+ Soft Limiter

Note that subsequently adding gain using the VPM Output knobs may raise the signal above 0 dB again.

Return Audio Route switch

This switch allows you to route audio directly to the audio jacks after the Sum section, rather than into the VPM for Lag processing and the Output level adjusters. This essentially separates the *Ammo* section from the *Battery* section. *Ammo* oscillator signals will be sent to the CV outputs jacks at CV rate, and to the audio outputs directly from the Sum section of the VPM. However you *can* still use the **Breakout from VPM** buttons to route the oscillators into *Battery*, and that audio, merged with external audio on the same channel if applicable, will then be sent to the audio jacks after the Limiter. That does however mean that there will be <u>no CV output available on those channels *where the breakout is active*</u>!

- **Channel VPM Return**:
  —All audio from *Battery* is sent (external audio) or returned (*Ammo* signals) to the VPM from the Limiter, for lag processing and output level adjustment
- **Bypass VPM Return**:
  —All audio is sent straight to the audio jacks after the Limiter section. Output level adjustment should be made via the Attenuator and/or the audio input level adjusters (if using external audio). The orange bypass arrow will light and return signal arrows in the VPM, where enabled by the **Breakout from VPM** buttons, will be off

The **Bypass VPM Return** switch is really designed for independently using *Ammo* as a CV-only unit, and *Battery* for external audio processing.

Battery external I/O

On the back of the *Battery* device you will find modulation inputs for several *Battery* parameters plus audio input and output jacks.

Sample & Hold Rate / Electro-Switch Rate / Attenuator Shift and Scale CV In

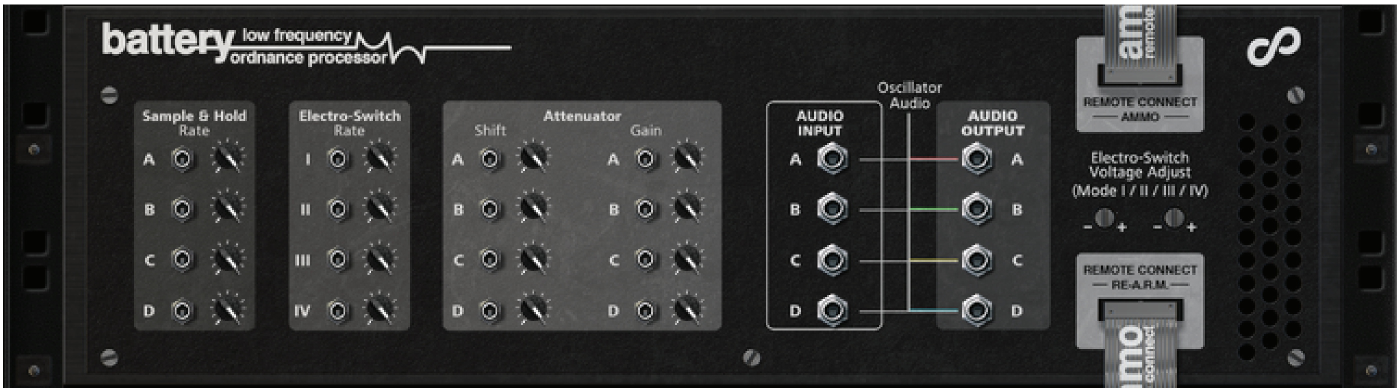
Standard CV in and trimpots for three of the *Battery* modules.

Audio In / Out

Audio Output A will auto-route on device creation and effect insertion; all other inputs require manual connection.

Electro-Switch Voltage Adjust

These screws can adjust a global voltage level used in part of the processing in Electro-Switch modes I, II, III, IV. Normally these can be left alone; adjusting them may give interesting results in certain circumstances.



re-a.r.m..........

remote analogue routing matrix

Performance Controllers

Re-ARM device allows you to freely route most signals to other level-adjustable parameters in *Ammo* and *Battery*. It also provides a separate "spare" set of four CV inputs and outputs.

To access the list of Sources and Targets simply click the display name. At the time of writing Rack Extensions do not support grouped pop-up lists, and so unfortunately this does mean the target lists do require scrolling to reach the lower echelons. The first selection in all lists is blank, which you can use to clear the Target (or you can simply Ctrl-click the display as with all Reason parameters).

Performance Controller Routing Matrix

The PCRM is a quick way of linking four major performance controls, Pitch Wheel, Mod Wheel, Aftertouch and Expression, to most *Ammo* parameters. Simply select which type of target you want the controller to affect, set an input modulation amount (positive or negative), then click all the Channels that you want it to apply to.

So to apply pitch-bend to Oscillators A and D pitch (frequency/rate), click the display on Pitch Wheel row, select "Rate" in pop-up list, then enable buttons A and D on the same row, and set a value for the Input knob.

Pitch-bend control, incidently, is preset to a two octave range at +/-100%. This means each note is around 4% of the available Input amount: 1 semitone will be 4%, 2 semitones will be 8%, a fifth (7 semitones) is 28%, one octave equals 50% etc.

Rate Mod Range selector

On the back of Re-ARM is an adjustment screw for Rate modulation sensitivity. At a basic level you can use this to adjust the pitch-bend range, but it has a more significant use as it also allows greater range for other modulation sources. Remember that *Ammo* oscillators have a very wide frequency range, and so using say, Mod Wheel > Rate with the oscillator at a very low rate, i.e., 0.01 Hz is not going to get the rate to move very far even with a maximum input level: a one octave range up from 0.01 Hz is only going to be 0.02 Hz. To push 0.001 Hz to even 30 Hz by using repeat Mod Wheel targets in the routing section would require seventeen targets!

So to compensate for this you can set the sensitivity of all the *Ammo* and *Battery* oscillator rates to modulation input:

- **Low**:
  —100% Pitch-Bend range = Seventh
- **Standard**:
  —100% Pitch-Bend range = Octave
- **High**:
  —100% Pitch-Bend range = Two octaves (default setting)
- **Full**:
  —100% Pitch-Bend range = 26 octaves

The Full setting may not be particularly practical using 100% modulation input settings to a High Range oscillator, but will be especially useful a very low rates.

Internal Routing Matrix

For advanced internal routing the *Re-ARM* IRM provides up to four Sources to two Targets for the 400R, or four Sources to three Targets on the 1200BR. The latter also features an automatable Off/On button for each row of Sources.

As with the PCRM click any display to access the list of Sources or Targets available. There are too many targets to go through them all, and most are self-explanatory. Once again the first entry on the list is blank, and can be selected or you can of course reset the selection by Ctrl-Clicking on the display without needing the popup.

The most common use will be to adjust the rate or depth of one oscillator with another, such as Oscillator D rate modulating Oscillator A rate. You have several options available.

Osc.D > % > Osc.A Rate

This will scale the output of Oscillator D and use it to modulate Oscillator A frequency.

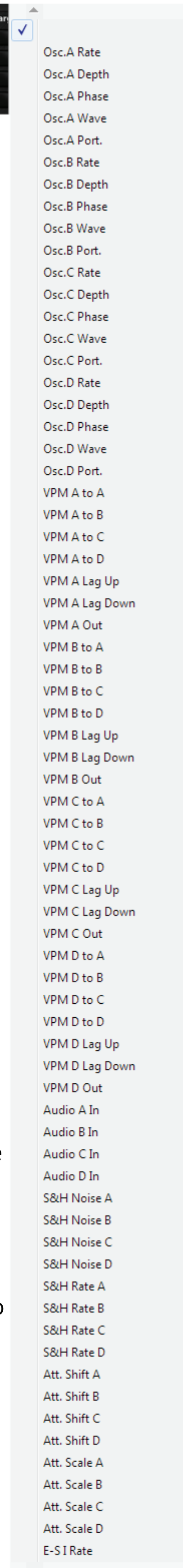
An alternative might be to use the output of Oscillator D after processing through the VPM (or Battery); for example you could use a stepped waveform that has been slightly smoothed with the lag filters. While you can hit Tab and hook a cable from a D CV outputs to the the Rate A CV Input, you could also do the following the IRM:

Ch.D CV > % > Osc.A Rate

Try using performance control on Oscillator D to add modulation only when using the mod wheel, or one-shot events.

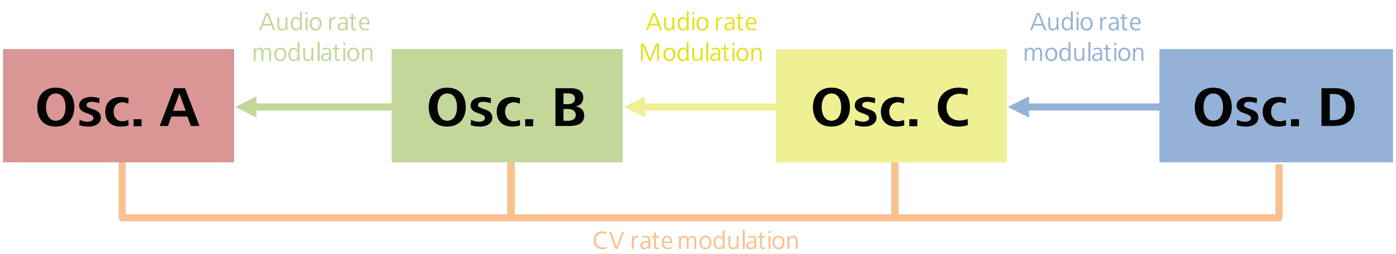
IRM notes

- **MIDI Key / MIDI Velocity** (Source)
  —These are of "last note" type, that is, a MIDI value is held until the next MIDI event received
- **Ch.[X] CV Out** (Source)
  —This is an internal CV signal from the VPM, after the Output level
  —Use these when using a summed waveform mixture or lag function in the VPM channel and you want to use these as a modulation source without needing to use CV cable connections
- **Pitch Wheel/Mod Wheel/Aftertouch/Expression** (Source & Target)
  —These are available as both Sources, for routing them to additional Targets not listed in the PCRM, and as Targets, for automatic modulation by an internal or external CV source
- **VPM [Y] to [Z]** (Target)
  —This is the vertical oscillator [Y] inputs into Channel row [Z]
- **Global Envelope** (Target)
  —The internal envelope can be routed to any available Target provided there is a gate input to trigger it, regardless of whether any of the Oscillators have their **Env** button activated
- **Use the back panel CV inputs** (Target)
  —Extra targets can be created by additional cable routing at the back, so don't feel you have to waste a whole line in the IRM on a basic setup like Osc.D to Osc.A Rate.
  —Don't forget that the Electro-Switch LFOs can be routed. This is particularly useful when all four oscillators are already in use and you need some extra modulation. Use the IRM to route internally or to the *Re-ARM* CV Outputs to route externally to other devices or back into Ammo modules
- The IRM does not include routes to the PCRM/IRM Input level amounts, however these are available to the TS8450 programmer when the device is within a Combinator

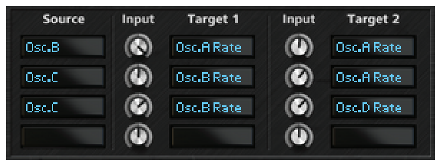


Audio rate FM/AM processing

Internal connections from oscillator to the preceding oscillator **Rate** and **Depth** in the MBRS are available at full audio rate. Thus Oscillator B can modulate Oscillator A **Rate** and **Depth** at audio rate, Oscillator C can modulate Oscillator B **Rate** and **Depth** at audio rate and Oscillator D can modulation Oscillator C **Rate** and **Depth** at audio rate. Any oscillator can modulate the **Rate** and **Depth** of any other oscillator at CV rate, which is also available via Rate/Depth CV modulation inputs on the back of *Re-ARM*.



- The oscillator being modulated is known as the "carrier", the oscillator providing the modulation is the "modulator"
- Only the first Re-ARM rule that matches each of the three Oscillator-to-Oscillator FM/AM rules is applied at audio rate. If you duplicate the target, it will use CV modulation for the second and subsequent duped targets. In the following image, only the Source 1 to Target 1, and Source 2 to Target 1 will be Audio rate. All other Source>Targets will be CV rate



- Ideally, both the carrier and modulator should track the keyboard pitch being played (set **KBD** = Keyboard On for both the carrier and modulator) and be set to the same **Rate** frequency or octave
- FM works best where the harmonic content of both waveforms is similar. You will find certain combinations of carrier and modulator wave will not be the most pleasant audio experience you have heard. If this happens, simply select a different modulator waveform until pleasure is attained
- Audio rate FM in *Ammo* is currently exponential only. You can however set CV rate FM to linear using the **FM Mode** switch in *Battery's* Global section
- To prevent aliasing the upper limit of *CV rate* modulation depends on the sample rate and oscillator frequency/pitch. At 44.1kHz this limit will be reached at around 700 Hz (F5). Above this frequency the modulation will cease and the sound will return to the default waveform of the target oscillator. Note that the limit can be determined by either the source or target oscillator depending on it's current pitch, so remember to set **Keyboard** to Off if you don't need it on either oscillator. The higher the sample rate the higher the CV modulation limit: for 88.2 kHz the effective limit will be around 1,300 Hz

Global functions (400R only)

The *Re-ARM* section of the **Ammo 400R** contains the following global functions.

Envelope

The Envelope section controls the depth level of each oscillator provided their **Env** button is selected, and there isn't a connection to its **Envelope CV In** jack. It requires a gate input to trigger, either a note on from your keyboard controller or Reason sequencer, or via a **Gate CV In** trigger. This is a 6-stage envelope with Delay, Attack, Hold, Decay, Sustain and Release. The time-based stages (Delay, A, H, D and R) are up to 20 seconds. As with other synthesizers it is recommended that the Attack stage is not set to zero when using as a synth to prevent unwanted artefacts, but note that only envelope retrigger is available in the 400R.

Lag Mode

Selects between linear or logarithmic waveform smoothing for both Up and Down Lag controls in the VPM, as discussed on page 10.

X-Fade

Turn Off to allow the oscillator to be summed/negated by itself in the VPM, or turn On, where the oscillator is simply cross-faded with the sum of other channel signals input into the same row.

Re-ARM external I/O

On the back of the *Re-ARM* device you will find oscillator modulation inputs, a spare set of CV input/outputs, and the Oscillator Audio Outputs (400R only).

Oscillator Rate/Depth/Phase/Waveform CV In

Standard CV in and trimpots for the main oscillator controls.

Re-ARM CV

This is an additional set of useful CV inputs and outputs that can be used as Re-ARM sources (CV In) or targets (CV Out).

Oscillator Audio Output (400R only)

The audio outputs (post-VPM) for the four oscillators.

Rate Mod Range

It also features the Rate Mod Range screw, as described on page 25.

Re-ARM tips

It's always useful to check the wind direction before firing, so here are some tips for Re-ARM targeting.

Dupe targets for greater modulation range

As with Thor's MBRS you can route a Source to the same Target more than once for greater range. This is particularly useful for rate ranges and depth amounts. In particular you can use this method to get frequencies lower than the standard 16.67 minute (0.001 Hz) minimum. Apply a W134 (DC +1) with maximum **Depth** on Oscillator B to the **Rate** knob of Oscillator A (the rate of the DC line itself doesn't matter as it's a fixed value), and set the Input amount to -100%. This will halve the frequency (one octave lower). So with Oscillator A **Rate** knob set to 0.001 Hz, you'll now actually have an Oscillator A Rate of 0.0005 Hz, which is 33.33 minutes; add a second target to Oscillator A Rate and you'll halve the value again, to 0.00025 Hz, and the time doubles to 66.67 minutes and so on.

Waveform modulation

The order in which the *Ammo* waveforms have been arranged was chosen mostly to group similar types of LFO shapes together, rather than provide a typical wavetable that might be based on one waveform but with different harmonics. This allows the commonly used basic shapes at the beginning, with random stepped easily available right at the end for easy location and selection.

Modulation between waveforms is still quite possible though and indeed, *Ammo* has been set up to provide smooth cross-faded modulation between them. Best results are achieved by keeping the modulation to within the "similar LFO group", by using only a low oscillator Depth or Re-ARM Input amount: **{Wavesequencer.}**, for example, only has 6% Re-ARM target Input value. For most sonically pleasing purposes, 1–6% will be enough.

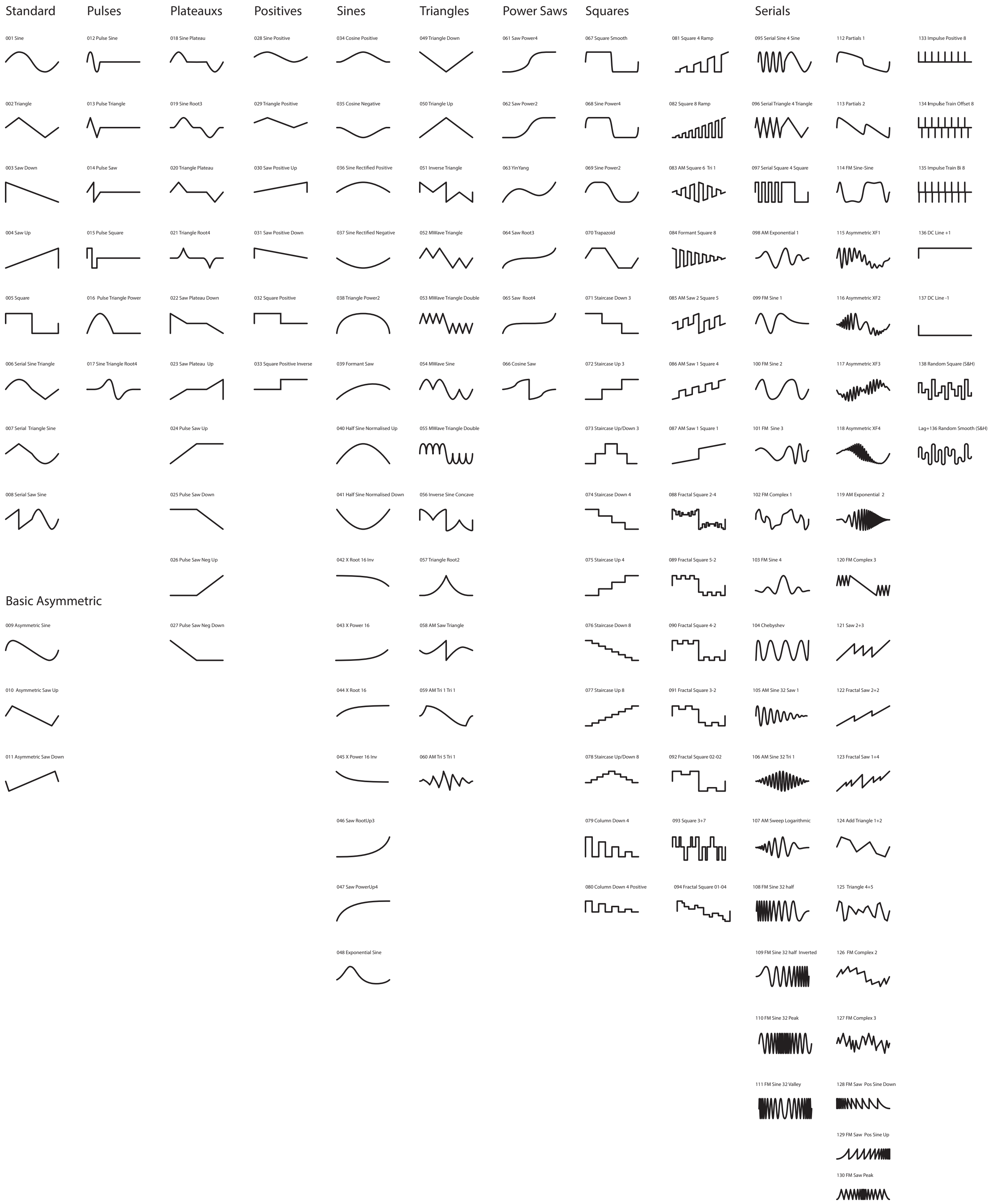
W136 (Random) is ignored by waveform modulation.

Route PCRM source to a Modulator Depth for performance-related modulation

To add pressure-sensitive vibrato to Oscillator A, for example, set Osc. D to 7.00 Hz, and it's Depth to zero, then set up the following *Re-ARM* MBRS route: Osc.D > 100% > Osc. A Rate.

In the PCRM section set Aftertouch > 10% > Depth > Channel Button D. Try **{Culverin.}** for an example of this type of behaviour. Try changing the PCRM assignment for the Osc. D Depth to the Mod Wheel and use that to add vibrato instead.

Ammo internal waveform list



Remote Mapping: 400R (page 1/2)

```
//Remote Map template for	Instruments	Jiggery-Pokery Sound: Ammo 400R Modulation Oscillators
Scope	Jiggery Pokery	com.jiggerypokery.Ammo400R
//	Control Surface Item	Key	Remotable Item	Scale	Mode
//Map	_control_		Osc.A On
//Map	_control_		Osc.A Range
//Map	_control_		Osc.A Low Rate Hz
//Map	_control_		Osc.A High Rate Hz
//Map	_control_		Osc.A Rate Tempo Sync
//Map	_control_		Osc.A Rate Semitone
//Map	_control_		Osc.A Cents Detune
//Map	_control_		Osc.A Depth
//Map	_control_		Osc.A Phase
//Map	_control_		Osc.A Keyboard
//Map	_control_		Osc.A Env Sync
//Map	_control_		Osc.A Oneshot
//Map	_control_		Apply Master Rate to Slaves
//Map	_control_		Osc.A Waveform

//Map	_control_		Osc.B On
//Map	_control_		Osc.B Range
//Map	_control_		Osc.B Low Rate Hz
//Map	_control_		Osc.B High Rate Hz
//Map	_control_		Osc.B Rate Tempo Sync
//Map	_control_		Osc.B Rate Semitone
//Map	_control_		Osc.B Cents Detune
//Map	_control_		Osc.B Depth
//Map	_control_		Osc.B Phase
//Map	_control_		Osc.B Keyboard
//Map	_control_		Osc.B Osc Sync
//Map	_control_		Osc.B Env Sync
//Map	_control_		Osc.B Oneshot
//Map	_control_		Osc.B Waveform

//Map	_control_		Osc.C On
//Map	_control_		Osc.C Range
//Map	_control_		Osc.C Low Rate Hz
//Map	_control_		Osc.C High Rate Hz
//Map	_control_		Osc.C Rate Tempo Sync
//Map	_control_		Osc.C Rate Semitone
//Map	_control_		Osc.C Cents Detune
//Map	_control_		Osc.C Depth
//Map	_control_		Osc.C Phase
//Map	_control_		Osc.C Keyboard
//Map	_control_		Osc.C Osc Sync
//Map	_control_		Osc.C Env Sync
//Map	_control_		Osc.C Oneshot
//Map	_control_		Osc.C Waveform

//Map	_control_		Osc.D On
//Map	_control_		Osc.D Range
//Map	_control_		Osc.D Low Rate Hz
//Map	_control_		Osc.D High Rate Hz
//Map	_control_		Osc.D Rate Tempo Sync
```

Remote Mapping: 400R (page 2/2)

//Map	_control_	Osc.D Rate Semitone
//Map	_control_	Osc.D Cents Detune
//Map	_control_	Osc.D Depth
//Map	_control_	Osc.D Phase
//Map	_control_	Osc.D Keyboard
//Map	_control_	Osc.D Osc Sync
//Map	_control_	Osc.D Env Sync
//Map	_control_	Osc.D Oneshot
//Map	_control_	Osc.D Waveform
//Map	_control_	Sync Mode
//Map	_control_	Soft Sync Mode
//Map	_control_	VPM A Sum A
//Map	_control_	VPM A X-Fade B-C-D
//Map	_control_	VPM A Sum B
//Map	_control_	VPM A Sum C
//Map	_control_	VPM A Sum D
//Map	_control_	VPM A Lag Up
//Map	_control_	VPM A Lag Down
//Map	_control_	VPM A Output
//Map	_control_	VPM A
//Map	_control_	VPM B Sum A
//Map	_control_	VPM B Sum B
//Map	_control_	VPM B X-Fade A-C-D
//Map	_control_	VPM B Sum C
//Map	_control_	VPM B Sum D
//Map	_control_	VPM B Lag Up
//Map	_control_	VPM B Lag Down
//Map	_control_	VPM B Output
//Map	_control_	VPM B
//Map	_control_	VPM C Sum A
//Map	_control_	VPM C Sum B
//Map	_control_	VPM C Sum C
//Map	_control_	VPM C X-Fade A-B-D
//Map	_control_	VPM C Sum D
//Map	_control_	VPM C Lag Up
//Map	_control_	VPM C Lag Down
//Map	_control_	VPM C Output
//Map	_control_	VPM C
//Map	_control_	VPM D Sum A
//Map	_control_	VPM D Sum B
//Map	_control_	VPM D Sum C
//Map	_control_	VPM D Sum D
//Map	_control_	VPM D X-Fade A-B-C
//Map	_control_	VPM D Lag Up
//Map	_control_	VPM D Lag Down
//Map	_control_	VPM D Output
//Map	_control_	VPM D

//Map	_control_	Envelope Delay
//Map	_control_	Envelope Attack
//Map	_control_	Envelope Hold
//Map	_control_	Envelope Decay
//Map	_control_	Envelope Sustain
//Map	_control_	Envelope Release
//Map	_control_	Lag Mode
//Map	_control_	X-Fade Mode
//Map	_control_	Pitch Wheel Input
//Map	_control_	Mod Wheel Input
//Map	_control_	Aftertouch Input
//Map	_control_	Expression Input
//Map	_control_	Pitch Wheel to Osc.A
//Map	_control_	Mod Wheel to Osc.A
//Map	_control_	Aftertouch to Osc.A
//Map	_control_	Expression to Osc.A
//Map	_control_	Pitch Wheel to Osc.B
//Map	_control_	Mod Wheel to Osc.B
//Map	_control_	Aftertouch to Osc.B
//Map	_control_	Expression to Osc.B
//Map	_control_	Pitch Wheel to Osc.C
//Map	_control_	Mod Wheel to Osc.C
//Map	_control_	Aftertouch to Osc.C
//Map	_control_	Expression to Osc.C
//Map	_control_	Pitch Wheel to Osc.D
//Map	_control_	Mod Wheel to Osc.D
//Map	_control_	Aftertouch to Osc.D
//Map	_control_	Expression to Osc.D
//Map	_control_	Source 1 Target 1 Input
//Map	_control_	Source 2 Target 1 Input
//Map	_control_	Source 3 Target 1 Input
//Map	_control_	Source 4 Target 1 Input
//Map	_control_	Source 1 Target 2 Input
//Map	_control_	Source 2 Target 2 Input
//Map	_control_	Source 3 Target 2 Input
//Map	_control_	Source 4 Target 2 Input

Remote Mapping: 1200BR (page 1/3)

```
//Remote Map template for  Instruments          Jiggery-Pokery Sound: Ammo 400R Modulation Oscillators
Scope      Jiggery Pokery      com.jiggerypokery.Ammo400R
//         Control Surface Item           Key       Remotable Item     Scale     Mode
///Map     _control_             Osc.A On
//Map      _control_             Osc.A Range
//Map      _control_             Osc.A Low Rate Hz
//Map      _control_             Osc.A High Rate Hz
//Map      _control_             Osc.A Rate Tempo Sync
//Map      _control_             Osc.A Rate Semitone
//Map      _control_             Osc.A Cents Detune
//Map      _control_             Osc.A Depth
//Map      _control_             Osc.A Phase
//Map      _control_             Osc.A Keyboard
//Map      _control_             Osc.A Env Sync
//Map      _control_             Osc.A Oneshot
//Map      _control_             Apply Master Rate to Slaves
//Map      _control_             Osc.A Waveform

//Map      _control_             Osc.B On
//Map      _control_             Osc.B Range
//Map      _control_             Osc.B Low Rate Hz
//Map      _control_             Osc.B High Rate Hz
//Map      _control_             Osc.B Rate Tempo Sync
///Map     _control_             Osc.B Rate Semitone
//Map      _control_             Osc.B Cents Detune
/Map       _control_             Osc.B Depth
//Map      _control_             Osc.B Phase
//Map      _control_             Osc.B Keyboard
//Map      _control_             Osc.B Osc Sync
//Map      _control_             Osc.B Env Sync
//Map      _control_             Osc.B Oneshot
//Map      _control_             Osc.B Waveform

//Map      _control_             Osc.C On
//Map      _control_             Osc.C Range
//Map      _control_             Osc.C Low Rate Hz
//Map      _control_             Osc.C High Rate Hz
//Map      _control_             Osc.C Rate Tempo Sync
//Map      _control_             Osc.C Rate Semitone
//Map      _control_             Osc.C Cents Detune
//Map      _control_             Osc.C Depth
//Map      _control_             Osc.C Phase
//Map      _control_             Osc.C Keyboard
//Map      _control_             Osc.C Osc Sync
//Map      _control_             Osc.C Env Sync
//Map      _control_             Osc.C Oneshot
//Map      _control_             Osc.C Waveform

//Map      _control_             Osc.D On
//Map      _control_             Osc.D Range
//Map      _control_             Osc.D Low Rate Hz
//Map      _control_             Osc.D High Rate Hz
```

Remote Mapping: 1200BR (page 2/3)

```
//Map	_control_	Osc.D Rate Tempo Sync
//Map	_control_	Osc.D Rate Semitone
//Map	_control_	Osc.D Cents Detune

//Map	_control_	Osc.D Depth
//Map	_control_	Osc.D Phase
//Map	_control_	Osc.D Keyboard
//Map	_control_	Osc.D Osc Sync
//Map	_control_	Osc.D Env Sync
//Map	_control_	Osc.D Oneshot
//Map	_control_	Osc.D Waveform

//Map	_control_	Sync Mode
//Map	_control_	Soft Sync Mode

//Map	_control_	VPM A Sum A
//Map	_control_	VPM A X-Fade B-C-D
//Map	_control_	VPM A Sum B
//Map	_control_	VPM A Sum C
//Map	_control_	VPM A Sum D
//Map	_control_	VPM A Lag Up
//Map	_control_	VPM A Lag Down
//Map	_control_	VPM A Output
//Map	_control_	VPM A

//Map	_control_	VPM B Sum A
//Map	_control_	VPM B Sum B
//Map	_control_	VPM B X-Fade A-C-D
//Map	_control_	VPM B Sum C
//Map	_control_	VPM B Sum D
//Map	_control_	VPM B Lag Up
//Map	_control_	VPM B Lag Down
//Map	_control_	VPM B Output
//Map	_control_	VPM B

//Map	_control_	VPM C Sum A
//Map	_control_	VPM C Sum B
//Map	_control_	VPM C Sum C
//Map	_control_	VPM C X-Fade A-B-D
//Map	_control_	VPM C Sum D
//Map	_control_	VPM C Lag Up
//Map	_control_	VPM C Lag Down
//Map	_control_	VPM C Output
//Map	_control_	VPM C

//Map	_control_	VPM D Sum A
//Map	_control_	VPM D Sum B
//Map	_control_	VPM D Sum C
//Map	_control_	VPM D Sum D
//Map	_control_	VPM D X-Fade A-B-C
//Map	_control_	VPM D Lag Up
//Map	_control_	VPM D Lag Down
//Map	_control_	VPM D Output
//Map	_control_	VPM D

//Map	_control_	Envelope Delay
//Map	_control_	Envelope Attack
//Map	_control_	Envelope Hold
//Map	_control_	Envelope Decay
//Map	_control_	Envelope Sustain
//Map	_control_	Envelope Release

//Map	_control_	Envelope Trigger Mode
//Map	_control_	FM Mode
//Map	_control_	Lag Up Mode
//Map	_control_	Lag Down Mode
//Map	_control_	X-Fade Mode
//Map	_control_	PW Select
//Map	_control_	PW ES I
//Map	_control_	PW ES II
//Map	_control_	PW ES III
//Map	_control_	PW ES IV
//Map	_control_	Return Audio Route

//Map	_control_	Audio A in Level
//Map	_control_	Audio B in Level
//Map	_control_	Audio C in Level
//Map	_control_	Audio D in Level

//Map	_control_	Ch.A to Battery
//Map	_control_	Ch.B to Battery
//Map	_control_	Ch.C to Battery
//Map	_control_	Ch.D to Battery

//Map	_control_	Ch.A S&H
//Map	_control_	Ch.B S&H
//Map	_control_	Ch.C S&H
//Map	_control_	Ch.D S&H
//Map	_control_	Noise Mode

//Map	_control_	S&H Noise A Level
//Map	_control_	S&H Noise B Level
//Map	_control_	S&H Noise C Level
//Map	_control_	S&H Noise D Level
```

Remote Mapping: 1200BR (page 3/3)

```
//Map	_control_	S&H Sample Rate A
//Map	_control_	S&H Sample Rate B
//Map	_control_	S&H Sample Rate C
//Map	_control_	S&H Sample Rate D

//Map	_control_	Ch.A Comparator
//Map	_control_	Ch.B Comparator
//Map	_control_	Ch.C Comparator
//Map	_control_	Ch.D Comparator
//Map	_control_	Ch.A-B Comparator Mode	*
//Map	_control_	Ch.B Comparator A-B Mode
//Map	_control_	Ch.C-D Comparator Mode	**
//Map	_control_	Ch.D Comparator C-D Mode

//Map	_control_	Ch.A ES
//Map	_control_	Ch.B ES
//Map	_control_	Ch.C ES
//Map	_control_	Ch.D ES

//Map	_control_	Electro-Switch Tempo Sync
//Map	_control_	ES 01 LFO i Free Rate
//Map	_control_	ES 01 LFO ii Free Rate
//Map	_control_	ES 02 LFO iii Free Rate
//Map	_control_	ES 02 LFO iv Free Rate
//Map	_control_	ES 01 LFO i Sync Rate
//Map	_control_	ES 01 LFO ii Sync Rate
//Map	_control_	ES 02 LFO iii Sync Rate
//Map	_control_	ES 02 LFO iv Sync Rate
//Map	_control_	ES 01 LFO i Waveform
//Map	_control_	ES 01 LFO ii Waveform
//Map	_control_	ES 02 LFO iii Waveform
//Map	_control_	ES 02 LFO iv Waveform
//Map	_control_	Ch.A ES Mode
//Map	_control_	Ch.B ES Mode
//Map	_control_	Ch.C ES Mode
//Map	_control_	Ch.D ES Mode
//Map	_control_	Electro-Switch 1 Depth
//Map	_control_	Electro-Switch 2 Depth

//Map	_control_	Ch.A Attntr
//Map	_control_	Ch.B Attntr
//Map	_control_	Ch.C Attntr
//Map	_control_	Ch.D Attntr

//Map	_control_	Attntr Shift A Level
//Map	_control_	Attntr Shift B Level
//Map	_control_	Attntr Shift C Level
//Map	_control_	Attntr Shift D Level
//Map	_control_	Attntr Scale A Level
//Map	_control_	Attntr Scale B Level
//Map	_control_	Attntr Scale C Level
//Map	_control_	Attntr Scale D Level
//Map	_control_	Ch.A Limiter
//Map	_control_	Ch.B Limiter
//Map	_control_	Ch.C Limiter
//Map	_control_	Ch.D Limiter

//Map	_control_	Pitch Wheel Input
//Map	_control_	Mod Wheel Input
//Map	_control_	Aftertouch Input
//Map	_control_	Expression Input

//Map	_control_	Pitch Wheel to Osc.A
//Map	_control_	Mod Wheel to Osc.A
//Map	_control_	Aftertouch to Osc.A
//Map	_control_	Expression to Osc.A
//Map	_control_	Pitch Wheel to Osc.B
//Map	_control_	Mod Wheel to Osc.B
//Map	_control_	Aftertouch to Osc.B
//Map	_control_	Expression to Osc.B
//Map	_control_	Pitch Wheel to Osc.C
//Map	_control_	Mod Wheel to Osc.C
//Map	_control_	Aftertouch to Osc.C
//Map	_control_	Expression to Osc.C
//Map	_control_	Pitch Wheel to Osc.D
//Map	_control_	Mod Wheel to Osc.D
//Map	_control_	Aftertouch to Osc.D
//Map	_control_	Expression to Osc.D

//Map	_control_	Source 1 Target 1 Input
//Map	_control_	Source 2 Target 1 Input
//Map	_control_	Source 3 Target 1 Input
//Map	_control_	Source 4 Target 1 Input
//Map	_control_	Source 1 Target 2 Input
//Map	_control_	Source 2 Target 2 Input
//Map	_control_	Source 3 Target 2 Input
//Map	_control_	Source 4 Target 2 Input
//Map	_control_	Source 1 Target 3 Input
//Map	_control_	Source 2 Target 3 Input
//Map	_control_	Source 3 Target 3 Input
//Map	_control_	Source 4 Target 3 Input
//Map	_control_	Source 1
//Map	_control_	Source 2
//Map	_control_	Source 3
//Map	_control_	Source 4
```

* Original A-B Comparator
** Original C-D Comparator

Version history

1.2.0

- **Vastly improved startup performance should clear “Song too slow” errors on songfile loading.**

1.1.5

- **Fixed rare property notification issue at startup**
- **Fixed crash when connecting C CV Out to C Env In**

1.1.1

- **Adjusted waveforms 42–45 to a more useful exponential half-range**
- **Fixed sample error on waveforms 77–78**
- **Disabled playhead sync when using One-Shot Mode, where it is not required**
- **Improved behaviour of waveform 136 (random) in Tempo Sync Range: set Phase to 360° and use Rate control only. Note that there are still two samples per cycle, so set the Rate to half what you require for a single sample value.**

1.1.0

- **Added Semitone and Cents ranges to Ammo oscillators**
- **Added separate Comparators for Channels B and D**
- **Added Depth control to Electro-Switch 1 and 2**
- **Improved zero-centre locating of invertable knobs**
- **Fixed song playhead sync when using Tempo Sync Ranges (Ammo oscillators and Electro-Switch oscillators)**

1.0.0

- **Initial release**

Notes:

v.1.x Nektar Panorama control

The device creation process prevents the Nektar master fader from accessing the Mix Channel fader due to the way Reason currently handles jack labelling. To recover automatic master fader control, copy the device text from the Sequencer track and paste-replace the text in the Mix Channel

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Special thanks to the Ammo *testing crew.*

Ammo 400R & *Ammo 1200BR* were designed and assembled by Jiggery-Pokery Sound, of London, England; DSP coding by Pitchblende Ltd.

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180°
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