STEERPIKE

BBD *Delay Ensemble*

v2.1.0

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Re Rack Extension

Steerpike BBD Delay Ensemble

Steerpike is a multi-tap delay providing up to six delay lines, based on the classic Bucket Brigade Delay integrated circuits of the 1970s and 1980s, found in many a classic delay pedal.

BBD Delay

A BBD is a type of Integrated Circuit (IC), which is a Sample & Hold device with a fixed number of stages, known as a delay line; an audio input would be held as if it was a bucketful of water being passed along a line of people (hence, "bucket brigade"). For a chip such as the SAD512D, think of it as if there were 512 people in the line. Other BBD ICs had differing lengths, up to 4096 stages.

Although *Steerpike* is not designed to be a literal recreation of a specific BBD—they have different dynamic ranges, SNR and THD figures etc, not to mention sound differences caused purely by changes in operating temperature—or a particular delay module, this super-BBD-ensemble-delay has been designed to give you the flexibility to sculpt your delay by giving access to a breadth of parameters you would not normally be able to access: it can be as subtle or insane as you choose!

Steerpike overview

Six BBD delay lines are available in *Steerpike*, Delay Lines 1 to 6. Each BBD can have independent delay times, set by number of stages (**#**), time (**ms**) or tempo synced to the Reason transport. For the first time in Reason, tempo sync ranges are no longer entirely determined and limited by the designer: you can select any beat division from /2 (minim) to /16 (semiquaver) and all halved and triplet steps up to /256 using the **Subdivision** control, and any the number of delays to that division using the **Duration** control, from 1 to 16. Thus you can create flexible and creative tempo synced delay times such as 3/7, 13/5, 3/2, 5/3, 2/15 as well as the Reason standard 3/16, 1/8 and so on.

Each Delay Line supports up to eight seconds of delay time, regardless of the sample rate or song tempo, and each Delay Line can be independently set as a reverse delay without feedback.

The delay time is linked to the global BBD clock rate, and so the delay time will be correct for whatever the clock rate is set to.

Steerpike features a dual LFO for delay time modulation, an envelope, low and high pass filters, a three channel EQ, and separate pan control for the dry input. Each Delay Line also has a Tap Out and Tap In audio connection, essentially send

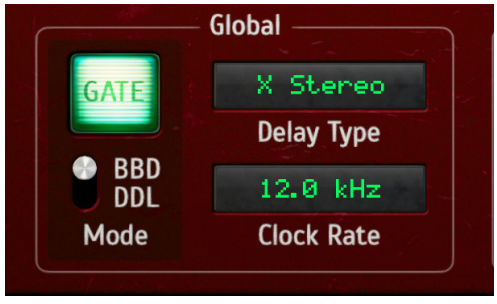
and return breakout jacks for feedback loops. Audio can be input directly before the BBD of each Tap, and can be sent out directly after the BBD Tap level adjust. The Tap In has its own level adjust on the front panel.

GLOBAL Section

Bypass/On/Off Switch

This is an important control! In an emergency, if the delay audio is doing things you would rather it not be doing, set this to **Off** to immediately stop audio output. This will also purge all the delay lines. Setting to Bypass will not clear the delays.

Delay Type



Steerpike features five alternative modes: X-Stereo, Parallel, Serial, Feedback and Ping-Pong. Select the desired mode by clicking the **Mode** display and selecting from the pop-up menu.

Some modes make use of pairs of BBDs, in which case a "Link" indicator will light up between Delay Lines 1 and 2, 3 and 4, and 5 and 6. Each **Mode** is explained in later in this guide (page 12).

Gate (Audio to Delay Line In)

This useful oversized button turns the delay line gate off and on. If turned off, no audio enters the delay lines, and is only passed to the Dry/Wet mixer in the Dry output. When on, the audio is also passed to the delay lines.

What is particularly useful about the **Gate** function is that turning it off *doesn't* clear the delay line, so it allows you to shut off new audio into the delay line while still allowing the already delayed audio in them to progress and finish playing. With infinite delays—where feedback set to 100%—this is especially important, as you can effectively record the delay like a loop, letting it play indefinitely, while shutting off the delay line input to prevent it swamping the dry signal as you continue playing a unique input over the top with the dry signal.

Try mapping **Gate** to your sustain pedal for delay-sustain.

Mode

Use this button to switch between **BBD** and **DDL** (Digital Delay Line) modes. Use BBD for a vintage analogue pedal delay. **DDL** is the typical interpolated digital delay typically used in plugins. With **DDL** mode you will avoid aliasing entirely (see Clock, below). More usefully it will allow you to have longer feedbacks, even infinite feedbacks, without the sound degradation that would occur when using **BBD** mode, or with tape delays, even with **THD** at minimum. As with **Bypass/On/Off Switch** Off, switching BBD mode will also instantly clear the delay line of all active channels.

Clock Rate

Set the clock rate to a value between 1.5kHz and 100kHz when **BBD** mode is enabled. There is a strong relationship between clock rate and aliasing: the lower the clock rate the more you should reduce the low pass filter (**LPF**) frequency if you want to prevent aliasing. Some BBD delays, especially those using the Panasonic chips, had a minimum clock rate of 10kHz. At this rate the aliasing is noticeable until you reduce the **LPF** down to around 4kHz, but we provide a full range down to 1.5kHz for the creating of lo-fi, aliasing effects. In normal operation for a traditional BBD guitar pedal delay we recommend keeping the clock rate above 20kHz with the LPF control set to around 10–12kHz.

The **DDL** mode on *Steerpike* uses the host sample rate and therefore the clock rate cannot be changed: the display will show "—". Note that due to an unexpected Rack Extension GUI behaviour where the clock rate is adjustable in **BBD** mode, unfortunately this value in **DDL** mode using the same control must equally be automatable otherwise it won't work at all, and thus

it will show up on the Combinator programmer or sequencer (listed as "Internal Rate"), *despite* the fact you can't actually adjust it! In this mode you can safely leave the delay output unfiltered, unless you wish to do so purely for creative purposes.

MOD LFO Section

This section sets the internal LFO used for modulating each BBD. The amount of modulation applied is set per Delay Line using its individual **Mod** control. Steerpike has a fast LFO and slow LFO, the output of each added together.

Phase Offset

This button adds phase offsets for the LFO. Unlike in sister product *Chenille*, there is no significant benefit to multiple phase modes, so here we have a fixed relationship using *Chenille*'s CE-1 mode. With **Phase Offset** off, the same LFO is sent to each BBD.

Shape

Use the **Shape** control to adjust the LFO waveform shape from filtered square (0%) through triangle (33%) to sine (66%) and to smooth random (100%). Use the latter for a random "wow & flutter" tape speed modulation type effect.

LFO Slow/Fast Rate

The **Slow LFO** rate can be set between 0.01 Hz and 4.0 Hz. Default is 2.0 Hz. The **Fast LFO** can be set between 1.0 Hz and 11 Hz, the default is 6.0 Hz. If both are set to a Hz value then the output of both is mixed, but you can use just one internal LFO by setting the other to the "Off" position at the extreme left of its control range.

6-DELAY LINE BBD/DDL CONTROL Section

The main area adjusts the parameters for each Delay Line output. Note that in some delay modes some controls, such as **Pan** will have no effect.

Delay Time

At the left of each Delay Line is the most important control: the **Delay Time**. Drag the mouse up and down directly over the value to adjust the delay time. There are three different ways you can set the delay time, by clicking on a button to the right of the display to change the delay time mode.

- **Stages (#):** Use this mode to set the fixed number of stages the BBD uses, from 2 to 16,384. The hold time between each stage can be changed via the **Clock** rate in the Global Section.
- **Time (ms):** This mode allows you to set the delay time in milliseconds (0.01–999ms) or seconds (1.0–8.0s). In **BBD** mode *Steerpike* internally sets the number of stages to provide the correct time based on the current **Clock** rate setting.
- **Tempo Sync (Duration/Subdivision):** These two controls allow you to independently set duration and subdivision for tempo sync values. In **BBD** mode *Steerpike* converts these to a number of Stages based on the current **Clock** rate setting. (*Note: There are two tempo sync selector buttons to maintain backwards compatibility with Steerpike version 1; for version 2 either button can be selected, but they show exactly the same display*). Use the left side of the display to control the Duration value, the right side to adjust the Subdivision.

Why two Tempo Sync values?

Normally in Reason devices you are given a fixed list of tempo synced values by the designer of the device. This list usually has to be fairly short so as not to be overwhelming, but has the disadvantage of providing a limited range of rates, at a limited range of BPMs with which to use them.

In *Steerpike*, while we do still have a preset list for tempo syncing the built-in envelope, the BBD delay itself can be freely set to a massive range of creatively tempo synced delay times by adjusting the **S**ubdivision (the right hand number, the beat division) and the **D**uration (the left hand number, the duration, or number of beats at the set subdivision). While some are settings are going to be the same as others, (e.g. 2/128 is the same as 1/64), you can simply dial in the precise number you want rather than have to work out what is equivalent to what. You can select from 1 to 16 beats over 36 subdivisions: that's 576 possible tempo synced delay lengths, per BBD. With some thought, in Serial mode that's 3,456 possible tempo synced delay lengths!

For displaying the length we have, for consistency, used US style numeric subdivision values, from /2 (Half Note) to /256 (Two Hundred and Fifty-Sixth Note). The most important ones you may wish to be aware of are /16 (Sixteenth Note/Semiquaver), /12 (Triplet quaver), which is often listed in Reason as 8T, and /24 (Triplet semiquaver), aka /16T.

Steerpike Duration	Steerpike Subdivision	Equivalent to:	
1 to 16	/256		
1 to 16	/192	/128T	
1 to 16	/128		Demisemihemidemisemiquaver
1 to 16	/96	/64T	
1 to 16	/64		
1 to 16	/48	/32T	Thirty-Second Note Triplet
1 to 16	/32		Thirty-Second Note / Demisemiquaver
1 to 16	/24	/16T	Sixteenth Note Triplet
1 to 16	/20		Sixteenth Note Quintuplet
1 to 16	/16		Sixteenth Note / Semiquaver
1 to 16	/15		
1 to 16	/14		
1 to 16	/13		
1 to 16	/12	/8T	Eighth Note Triplet
1 to 16	/11		
1 to 16	/10		
1 to 16	/9		
1 to 16	/8		Eighth Note / Quaver
1 to 16	/7		Quarter Note Septuplet
1 to 16	/6	/4T	Quarter Note Sextuplet
1 to 16	/5		Quarter Note Quintuplet
1 to 16	/4		Quarter Note / Crochet
1 to 16	/3	/2T	Half-note triplet
1 to 16	/2		Half Note / Minim

Naturally /16 is the most useful at typical BPMs, so /16 is the default for the **S**ubdivision value. If requiring just /16 values, you'll only ever need to change the **D**uration figure. At slow BPMs however, you might find it's easier to use /32 or even /64, while at very fast BPMs /8 or /4 become useful.

But we only have a delay buffer of eight seconds! Well actually eight seconds is a *very* long time for a delay. It's likely to be rare you'd need a delay time that long: if you have a *really* long delay time, such as 16/2 and your song is 58 BPM, or perhaps you have set a delay time of 16/4 and a song tempo of 27 BPM, in both cases the required buffer size for that delay to be achievable is too big when in **DDL** mode and will trigger the **MEM** warning lamp to the left of the **Delay Time** display. The delay time for that Delay Line will still be limited to eight seconds. If you need that 16/4 delay time at lower than 28 BPM, then you can still use **Serial** or **Feedback Modes**, which use each delay as part of the delay time, and split the delay over multiple Delay Lines.

Delay Line Enable

This the master enable button for the entire delay line. Leave delay lines you do not require turned off. Switching a delay line off will also instantly clear its own delay line.

Level

Centre is zero output level. Increase the value positively to the right to set the individual delay level into BBD Mixer. Increase the value negatively to the left to phase invert and high pass filter the output. Note the HPF on the inverted level is a fixed frequency and independent of the global HPF in the Filter/EQ section.

Pan

Set the stereo position of the delay line output. Be aware that in **Serial** or **Feedback** modes the pan is only applied using the **Pan** control of *the last active channel in the chain*.

Feedback

Use this control to the feedback amount of the delay. *Steerpike*'s **Feedback** control provides up to 100% Feedback for infinite delay. In **BBD** mode destructive interference because of sample & hold will still cause the delay to fade, so **DDL** mode will normally be the preferred option when you require a continuous, non-fading repetition that will continue until you clear the delay line, but even then in **DDL** mode for infinite delays you will likely not want to use internal EQ/filtering or LFO modulation.

To the left of the **Feedback** control is a small indicator lamp to notify of whether this control is available. Different Delay Modes have different needs: in Serial mode all the channels can add **Feedback**, but in Feedback mode, only the last active channel can use **Feedback**. For Ping-Pong mode only the left channel of each pair needs this functionality, while setting any channel to reverse delay disables the **Feedback** control.

THD [Total Harmonic Distortion]

Harmonic distortion is introduced by BBD circuits. The more stages in the BBD the more distortion is introduced. The **THD** knob controls the Total Harmonic Distortion produced. Typically you might expect approximately 1% of THD per 1,024 stages. In *Steerpike* you can drive the THD from zero right up to 36% independently of the number of stages, although that 36% figure is fairly arbitrary: it's based on a sine wave of 80Hz at a particular input level, so the *actual* THD amount, as you would therefore expect, will not necessarily reflect what is set by this control.

The effect of this control will be most obvious on signals with less harmonics to begin with.

Tap

This control adjusts the input level of the **Tap In** audio jack. **WARNING: There is a serious risk of a loud feedback loops with high Feedback and Tap In levels. Use Tap with caution and reduce levels first and increase gradually!**

Mod

Adjust the depth/amount of delay time modulation, whether from *Steerpike*'s internal Mod section or from an external LFO.

Env

This controls the amount of effect the envelope has on the output level of that delay. Remember that an ***external gate is required to trigger the envelope***, so you won't hear any delay if this control is greater than 0% and there is no active gate.

Rev [Reverse]

Each channel can be independently set as a Reverse delay by enabling the **Rev** button. This disables the **Feedback** of that channel. See the next section for more information on this feature.

EQ

Enable the EQ button to route the output of that delay through the EQ section. The EQ is outside of the feedback loop to prevent nasty things happening. Be aware that this button does not effect the Filter section, which the delay lines are always routed through.

Reverse Delay

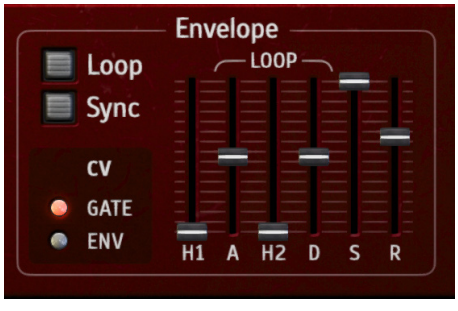
Reverse delays are complex to produce, since of course we cannot predict the future: everything we want to reverse must be in the delay buffer *before* we can reverse it! To get a reverse delay with feedback is even more complex, as it requires two buffers, one for the delay and feedback, and another to reverse it. For example, to reverse delay a one second block of audio with feedback requires up to three seconds of delay: the first to delay and add feedback, and up to two seconds for the reverse (since the reverse recording is free-running, its point of recording the loop may not be where you need it). You also cannot, for most practical scenarios, have the reverse in the same buffer as the feedback or else you will get a forward-reverse-forward-reverse effect.

Adding two 8-second buffers for six channels *all* the time, even when you don't need reverse (since all required device memory must be reserved at startup), it makes no sense to include the feedback when enabling Reverse, as we can easily achieve this using the *existing* buffers by simply by putting *Steerpike* into Serial mode and setting BBD1 as the regular forward delay where you add feedback, then set BBD2 as your Reverse delay. This will give you the classic "Backtalk"-style reverse delay pedal effect, as shown in this example patch from the Reverse Delay patch folder {**"Feedback Reverse 16ths"**}. With another four BBD delay lines available, you could even have forward-reverse-forward-reverse-forward-reverse if you wanted!

While *Steerpike*'s reverse delay is available in all **Delay Time** modes, there's no doubt the preferred usage will be when tempo synced, as that largely avoids the free-running behaviour. It may even help to not think of reverse delay as a "delay" at all, but simply as the length of a record loop. You can use the keyboard trigger, as described in the next section, to "arm" the recording, play the material, then retrigger the channel to play the reverse buffer immediately.

Channels with Reverse delay enabled feature a blue metronome lamp in the upper right of their **Delay Time** display to help you time triggering and recording of the loop. As you may find you need to predict the future, it is likely there will be scenarios where to get the reverse ending at precisely the correct moment, such as at the end of a bar, you will have to manually move the required clips until the timing is correct.

Envelope and Keyboard Triggering



Steerpike includes an internal envelope that can be used to fade the delays in and out. It is a six-stage envelope with pre-delay (**H1**), **Attack**, hold (**H2**), **Decay**, **Sustain** and **Release**. **Sustain** sets the final **Decay** level; all other stages are time-based. Stages **Attack** to **Decay** are loopable by enabling the **Loop** button. This particularly of use for infinite delays. You will find it works best if the **Attack**, **Decay**, **Sustain**, and **Release** values are not zero, otherwise you will notice unwanted "clicking" artefacts.

Some thought is required to ensure that, for example, the **H1** and/or **Attack** time of the envelope is less than the decay of the feedback repetitions, otherwise the delay will have finished before you hear it! So the envelope is likely to be used only on de-

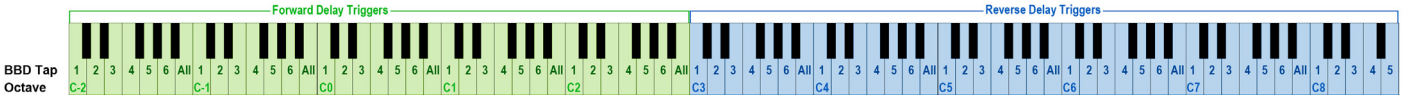
lays with high to infinite feedback amounts. Enable the **Sync** button to change the envelope time from milliseconds/seconds to tempo sync.

While only one actual envelope shape is available, each Delay Line can have its own envelope "voice", or you can trigger all at the same time. The keyboard is split at C3: B3 and below will trigger the channel/s that have **Rev** disabled, while C3 and above will trigger the channel/s where **Rev** is enabled.

If you create a dedicated Sequencer track for your *Steerpike* (right-click the device panel as usual and select "Create Track for Steerpike") and now you can trigger the envelope directly with your keyboard:

Note C: Triggers Delay Line 1
Note D: Triggers Delay Line 2
Note E: Triggers Delay Line 3
Note F: Triggers Delay Line 4
Note G: Triggers Delay Line 5
Note A: Triggers Delay Line 6
Note B: Triggers all Delay Lines simultaneously.

These note triggers are mapped across all MIDI octaves, so *any* C from C-2 to C2 will trigger Delay Line 1, *any* B from C-2 to B2 will trigger all Delay Lines and so on, if they are not Reverse-enabled. With Reverse enabled, same principle applies but the range is C3 and above.



This means you could also create a Combinator instrument with any single octave keyboard range, such as C1-B1, dedicated to triggering *Steerpike*, with C2-C8 triggering the instrument notes as usual. Remember that if using *Steerpike* in a Combinator, you will need to manually arm its "Receive Notes" option.

Since you are in the Combinator, you could hook your sustain pedal to trigger the **Gate** function for additional control!

Below the envelope faders are a pair of radio button LEDs marked **CV Gate** and **CV Env**. If triggering *Steerpike* from an external source this allows you to set whether to merely use the external gate to trigger the internal envelope, by selecting **CV Gate**, or over-ride the internal envelope completely if using an external envelope such as *Charlotte Envelope Generator*, in which case select **CV Env**.

Channels triggered via MIDI will display a green "note on indicator" in the bottom right of their **Delay Time** display.

Reverse triggering example

In the following test case we trigger a crash cymbal and then play it back in reverse, ensuring it triggers at the correct moment.

In this Combinator (and you don't need a Combinator for this, you can simply provide a separate sequencer track for each) we have arranged a default RedRum kit and a default *Steerpike* patch, mapping the former to the low half of the keyboard, and the latter to the upper half. We enable the Rev button on Delay Line 1 and set the time delay to four seconds.

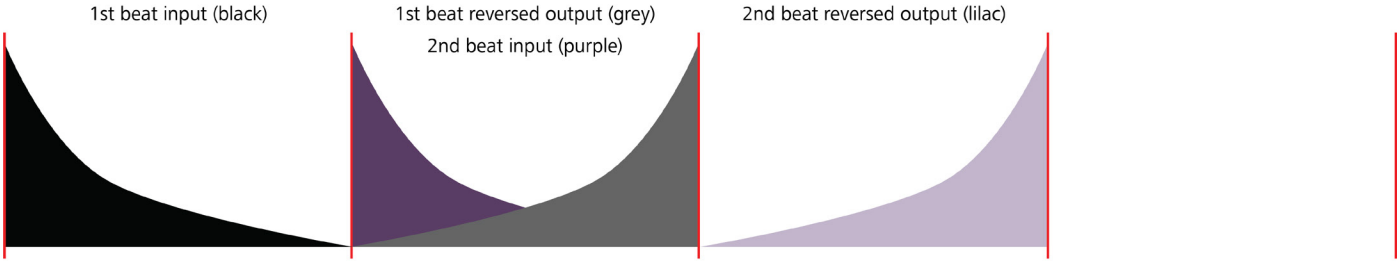
Because the reverse delay is always "recording" it is free-running, so we need to ensure that it starts recording at the correct time. Our song tempo is 120bpm, which means 4 seconds is two whole bars in 4/4. In the sequencer we program the reverse delay to start by entering a C3 (or any C above C3, to reverse trigger just Delay Line 1), and for the drum hit, here we're hitting the crash cymbal on A1. We programmed the drum hit just slightly later than the "Arm" trigger.

If you now play the song you hear the regular crash, then the 4 second reverse recording should start to play back after four seconds, with the reverse crash finishing with the initial crash transient at 8 seconds, shown in green.

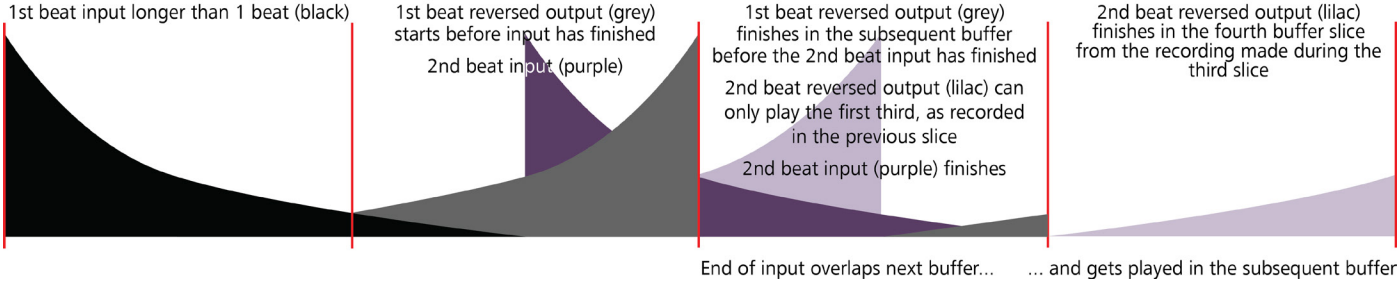
But by programming a second "Fire" trigger on C3, the reverse delay will re-align to the beginning and thus immediately play whatever is in its buffer and not wait the full four seconds. You will find the end position of the reverse is now more arbitrary, shown here in blue.

The same principle is available in tempo sync delay time modes as well. The key to understanding and using reverse delay is to remember that the reverse delay should end at twice the delay time you have set. So for a 1 bar delay the first transient of the input signal should arrive at the end of the second bar. As suggested earlier, when especially requiring "one-shot" reverse, think of reverse delay as the length of a record loop: 1/4 delay = 1/4 record time. This recording length needs to be at least as long as the input:

Snare drum sample that is exactly 1/4 (2/8) in length at 120bpm
Reverse delay set to 1/4



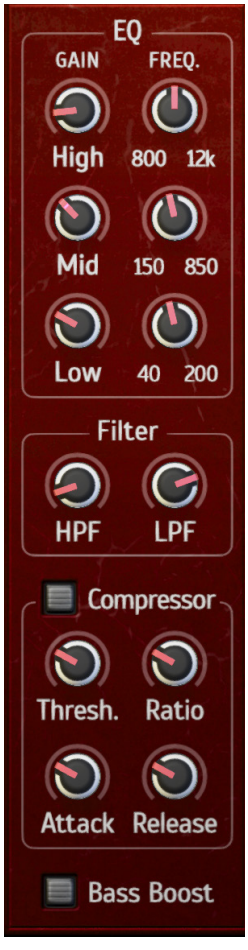
Snare drum sample that is exactly 1/4D (3/8) in length at 120bpm
Reverse delay still set to 1/4



The graphic shows how setting a reverse time of 1/4 creates recording "slices" of 1/4, that are replayed consecutively while recording a new slice in another buffer. The entire slice is reversed, so something at the beginning of the record buffer will be played at the end of the playback buffer.

The first example works as the length of the snare is equal to or less than the recording time of the slice. In the second example, to play the reverse correctly you should increase the delay time to 3/8, to ensure the entire drum hit is still recorded in the same slice, otherwise the end of it will be in the subsequent slice, and the start of the reverse might be truncated. This is still a useful effect in its own right, but be aware of the pitfalls!

Filter/EQ Section



The 48dB/octave **LPF** filter is primarily used as the low-pass anti-aliasing/reconstruction filter for the **BBD** mode, but can be used as a creative effect or shelving filter in its own right, by leaving it high in **BBD** mode to make use of the aliasing, or as a traditional, if steep, filter in **DDL** mode to reduce the high frequencies that might be swamping the dry signal, allowing the latter to cut through more cleanly. The 36dB/octave **HPF** is a global and adjustable high-pass filter that you can use to cut low-end so that the delay does not muddy your mix. This HPF control does not effect the separate fixed frequency HPF applied using the phase inverted left-side range of the **Level** control: it is an additional filter.

Next to the filters is a 3-band parametric EQ with adjustable frequency and gain (+/- 18dB). Ranges available are: **Low** (centre frequency 40–200 Hz), **Mid** (150–850 Hz) and **High** (800 Hz – 12kHz). Only BBDs with their **EQ** button enabled are passed through the EQ section.

Bass Boost

Turn this on for small low shelf boost which can add some low-end "warmth". Note that this boost is on the wet signal only and will be removed entirely if you increase the **HPF** above 200 Hz.

Compressor

This switch enables an extra internal compressor. They were prevalent in early analog/digital delay devices as part of a compander (compressor-expander), used to reduce internal noise by effectively boosting the SNR signal-to-noise ratio; as *Steerpike* is a noise-free software device, low SNR is not an issue, but the compressor is included in *Steerpike* for experimenting with delays where you may like to model more accurate response, especially those that are quite aggressive on transients, which guitar pedals frequently were.

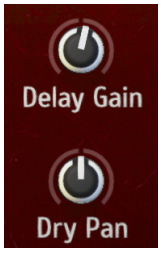
Unlike *Chenille*, we don't include the expander as the internal topology of *Steerpike* is far more complicated and it was not viable include it, but on the plus side you can additionally set the **Threshold**, **Ratio**, **Attack** and **Release** of the compressor as required.

Master Section

Dry/Wet

Predictably, this knob controls the amount of Dry and Delayed signal in the output. Unlike the equivalent control on *Chenille*, where the value is an important component in patch designing, on *Steerpike* this parameter is *not* saved with the .repatch file, as the ability to patch browse with the same wet level is more beneficial. The value is of course saved in Combinator (.cmb) and song files.

Delay Gain



Use this control to trim or boost the overall delay level from all the delay lines into the **Dry/Wet** mixer. It is effectively the "master fader" for all the delays.

Dry Pan

An incredibly useful feature, this allows you to set the pan position of the Dry signal. Reason's Main Mixer does not handle insert delays particularly well, as if you have, for example, a delay on the left channel and want the dry on the right, it can't actually be done via Main Mixer at all. Pan the Main Mixer channel right and you lose the delayed left signal. So traditionally one has typically needed to add insert delays using the extra hassle of setting up a Line Mixer or ReMix and bypass the Main Mixer panner entirely to allow for both wet and dry to be panned differently.

If the input is mono this control will pan the dry signal left or right. If the input is stereo the control adjusts the balance between left and right.

Ducking

Increase the **Amount** amount to reduce the delay audio level when there is incoming dry audio, the higher the setting the greater the wet level reduction. As the dry audio level drops, the delay output increases to full level as set by each delay line **Level** and the master **Delay Gain**. You can also use a separate sidechain input instead of the dry signal by connecting the sidechain input on the back, which over-rides the internal dry input. You can adjust the recovery time of the **Duck** compressor (10–400ms) using the **Speed** control. For near-instant recovery of delay output level as dry signal level drops, set this to a low value; to fade the delay back in gradually as the dry signal level drops, set this to a high value. The **Duck Speed** is also applied if you are using external **Sidechain In** to trigger the compressor instead of the dry signal.

Steer

The Steer knob is a bipolar control that adjusts the delay times of all six channels simultaneously, up to 16 times slower or faster. Use it for strange speed-up/slow-down effects!

Delay Modes

There are five delay modes available in *Steerpike*. The following section explains the setup of each mode.

I. **X-Stereo (Cross Stereo)**

X-Stereo mode is *Steerpike*'s true stereo mode, and is the preferred option when using a stereo input. X-Stereo is a Link mode: in this mode, the left channel input is sent to Delay Lines 1, 3 and 5, and the right channel input is sent to delay lines 2, 4 and 6.

For real "cross stereo", delay lines 1, 3 and 5 should be panned right, and Delay Lines 2, 4 and 6 panned left. You can of course pan the Delay Lines as you see fit and leave the output pan the same as the input. A mono input is sent to the delay line of each pair.

II. **Parallel**

Parallel mode uses a mono (left) input, or summed mono for stereo inputs. The mono or summed mono signal is sent to each Delay Line at the same time, processed separately, then mixed to a stereo output. Reverse modes are unable to use feedback, so the Feedback lamp will be unlit.

III. **Serial**

Serial mode can be used for extra long delay times, creating a single output of multiple mono delays. Each BBD output is also sent to its own monophonic Tap Out after the **Level** adjust, so you can get the current output state at any of five intermediate delay points. Each BBD also receives its own monophonic tap in, so audio can be added at any of the additional tap points.

Note that **Pan** is only applied in the final active BBD stage. You can use any number of Delay Lines, just remember that the final *active* channel is the one that is output to the Stereo Mixer. Feedback, however, is applied per channel.

As well as extra long delay times, Serial mode is important when using a Delay Line with Reverse, as you can use the preceding—or subsequent—Delay Lines to the one that's doing the reversing to add feedback.

IV. [**Serial] Feedback**

Serial Feedback, like Serial mode can be used to extra long delay times, creating a single output of multiple mono delays. The difference here is that the output of the last active Delay Line in the chain is fed back to the input of the first active Delay Line. The Feedback Lamp will indicate which Feedback knob is currently active.

V. **Ping-Pong**

Ping-Pong is a Linked mode, so Delay Lines 1 and 2, 3 and 4, and 5 and 6 operate in pairs, but unlike X-Stereo mode, the input is always monophonic/summed mono.

Ping-Pong delays alternate two delay lines. For a *non-offset* delay, the Delay Time of each Delay Line in the pair must be the same. For example, if using a tempo sync delay, trying setting both Delay Line 1 and Delay Line 2 to 3/16 for a non-offset Ping-Pong. You will hear an even "bounce" between each Delay Line output. For an ***offset*** Ping-Pong set Delay Line 1 to 3/16 but Delay Line 2 to 1/16, and now the "bounce" is uneven, with the second delay sounding quickly after the first.

Note that the "left" Delay Line of each pair, that's 1, 3 and 5, is always processed first. Each Delay Line output is also sent to its own monophonic Tap Out. Only the left **Feedback** control is required, so the right **Feedback** knob is disabled, but note that

when the left **Feedback** is at zero, *only* the left Delay Line output will be heard. *This is normal and expected behaviour*. So increase the **Feedback** of the left Delay Line channel to hear the ping pong effect.

Reverse Ping-Pong is not currently available natively, but can be achieved by leaving Rev turned off and putting either another *Steerpike* (or *Titus*) before it and set that to output in reverse mode instead.

Back Panel Connections

On the right are the main input/output jacks and an audio sidechain input, which overrides the dry signal level into the ducking compressor, allowing you to use a different signal (e.g. a kick drum) for the delay line ducking. Use the **Duck** knob on the front to adjust the intensity of the compression in the same way you would use the main dry input to duck the delay level. On the left are CV inputs for Clock Rate (BBD mode only), a CV trigger for the **Gate** button, and Steer control modulation. The Env Gate CV input will trigger all six channels simultaneously.

Each Delay Line features monophonic tap in and tap out audio jacks, as well as external CV inputs for envelope triggering, and modulation. The Gate/Env In row override the internal envelope on a per channel basis. Whether "global" or per channel, remember to set **CV Gate** or **CV Env** on the front as appropriate: **CV Gate** takes just the gate input and triggers the delay according to the internal envelope, while **CV Env** triggers the delay using an external envelope. Also available per channel is a Mod LFO input: this overrides the internal LFOs to that particular channel. The **Mod** and **Env** knobs on the front can be used as normal to adjust the external inputs amount. Delay Time, Feedback, Level and Pan round out the channel CV ins.

Finally, there is a CV output for the Mod LFO if you wish to modulate other devices with the same values.

BBD Delay Times

Clock Rate kHz	BBD Stages									
	2	10	50	256	512	1024	2048	4096	8193	16384
	ms	ms	ms	ms	ms	ms	ms	ms	ms	ms
1.5	0.6667	3.333	16.667	85.3	170.7	341.3	682.7	1,365.3	2,731.0	5,462.0
2	0.5000	2.500	12.500	64.0	128.0	256.0	512.0	1,024.0	2,048.3	4,096.5
3	0.3333	1.667	8.333	42.7	85.3	170.7	341.3	682.7	1,365.5	2,731.0
4	0.2500	1.250	6.250	32.0	64.0	128.0	256.0	512.0	1,024.1	2,048.3
5	0.2000	1.000	5.000	25.6	51.2	102.4	204.8	409.6	819.3	1,638.6
6	0.1667	0.833	4.167	21.3	42.7	85.3	170.7	341.3	682.8	1,365.5
7	0.1429	0.714	3.571	18.3	36.6	73.1	146.3	292.6	585.2	1,170.4
8	0.1250	0.625	3.125	16.0	32.0	64.0	128.0	256.0	512.1	1,024.1
9	0.1111	0.556	2.778	14.2	28.4	56.9	113.8	227.6	455.2	910.3
10	0.1000	0.500	2.500	12.8	**25.6**	51.2	102.4	204.8	409.7	819.3
11	0.0909	0.455	2.273	11.6	23.3	46.5	93.1	186.2	372.4	744.8
12	0.0833	0.417	2.083	10.7	21.3	42.7	85.3	170.7	341.4	682.8
13	0.0769	0.385	1.923	9.8	19.7	39.4	78.8	157.5	315.1	630.2
14	0.0714	0.357	1.786	9.1	18.3	36.6	73.1	146.3	292.6	585.2
15	0.0667	0.333	1.667	8.5	17.1	34.1	68.3	136.5	273.1	546.2
16	0.0625	0.313	1.563	8.0	16.0	32.0	64.0	128.0	256.0	512.1
17	0.0588	0.294	1.471	7.5	15.1	30.1	60.2	120.5	241.0	481.9
18	0.0556	0.278	1.389	7.1	14.2	28.4	56.9	113.8	227.6	455.2
19	0.0526	0.263	1.316	6.7	13.5	26.9	53.9	107.8	215.6	431.2
20	0.0500	0.250	1.250	6.4	12.8	25.6	51.2	102.4	204.8	409.7
25	0.0400	0.200	1.000	5.1	10.2	20.5	41.0	81.9	163.9	327.7
30	0.0333	0.167	0.833	4.3	8.5	17.1	34.1	68.3	136.6	273.1
35	0.0286	0.143	0.714	3.7	7.3	14.6	29.3	58.5	117.0	234.1
40	0.0250	0.125	0.625	3.2	**6.4**	12.8	25.6	51.2	102.4	204.8
45	0.0222	0.111	0.556	2.8	5.7	11.4	22.8	45.5	91.0	182.1
50	0.0200	0.100	0.500	2.6	5.1	10.2	20.5	41.0	81.9	163.9
55	0.0182	0.091	0.455	2.3	4.7	9.3	18.6	37.2	74.5	149.0
60	0.0167	0.083	0.417	2.1	4.3	8.5	17.1	34.1	68.3	136.6
65	0.0154	0.077	0.385	2.0	3.9	7.9	15.8	31.5	63.0	126.0
70	0.0143	0.071	0.357	1.8	3.7	7.3	14.6	29.3	58.5	117.0
75	0.0133	0.067	0.333	1.7	3.4	6.8	13.7	27.3	54.6	109.2
80	0.0125	0.063	0.313	1.6	3.2	6.4	12.8	25.6	51.2	102.4
95	0.0105	0.053	0.263	1.3	2.7	5.4	10.8	21.6	43.1	86.2
96	0.0104	0.052	0.260	1.3	2.7	5.3	10.7	21.3	42.7	85.3
100	0.0100	0.050	0.250	1.3	2.6	5.1	10.2	20.5	41.0	81.9

Remote Mapping

```
//Remote Map template for       Effects          Jiggery-Pokery Sound: Steerpike BBD Delay Ensemble
Scope  Jiggery Pokery    com.jiggerypokery.Steerpike
//       Control Surface Item       KeyRemotable Item      Scale     Mode
//Map   _control_          Delay Mode
//Map   _control_          Delay Line Gate
//Map   _control_          Clock Rate
//Map   _control_          Delay Ducking
//Map   _control_          Steer
//Map   _control_          BBD Enable

//Map   _control_          LFO Phase Offset
//Map   _control_          Modulation Shape
//Map   _control_          Slow LFO Rate
//Map   _control_          Fast LFO Rate

//Map   _control_          BBD1 Delay Time Mode
//Map   _control_          BBD1 Stages
//Map   _control_          BBD1 Time
//Map   _control_          BBD1 Sync Duration
//Map   _control_          BBD1 Sync Subdivision
//Map   _control_          BBD1 Level
//Map   _control_          BBD1 Pan
//Map   _control_          BBD1 Feedback
//Map   _control_          BBD1 THD
//Map   _control_          BBD1 Tap Level In
//Map   _control_          BBD1 Modulation Depth
//Map   _control_          BBD1 Envelope
//Map   _control_          BBD1 Enable
//Map   _control_          BBD1 EQ Enable
//Map   _control_          BBD1 Reverse Enable

//Map   _control_          BBD2 Delay Time Mode
//Map   _control_          BBD2 Stages
//Map   _control_          BBD2 Time
//Map   _control_          BBD2 Sync Duration
//Map   _control_          BBD2 Sync Subdivision
//Map   _control_          BBD2 Level
//Map   _control_          BBD2 Pan
//Map   _control_          BBD2 Feedback
//Map   _control_          BBD2 THD
//Map   _control_          BBD2 Tap Level In
//Map   _control_          BBD2 Modulation Depth
//Map   _control_          BBD2 Envelope
//Map   _control_          BBD2 Enable
//Map   _control_          BBD2 EQ Enable
//Map   _control_          BBD2 Reverse Enable

//Map   _control_          BBD3 Delay Time Mode
//Map   _control_          BBD3 Stages
//Map   _control_          BBD3 Time
//Map   _control_          BBD3 Sync Duration
//Map   _control_          BBD3 Sync Subdivision
//Map   _control_          BBD3 Level
//Map   _control_          BBD3 Pan
//Map   _control_          BBD3 Feedback
//Map   _control_          BBD3 THD
//Map   _control_          BBD3 Tap Level In
//Map   _control_          BBD3 Modulation Depth
//Map   _control_          BBD3 Envelope
//Map   _control_          BBD3 Enable
//Map   _control_          BBD3 EQ Enable
//Map   _control_          BBD3 Reverse Enable

//Map   _control_          BBD4 Delay Time Mode
//Map   _control_          BBD4 Stages
//Map   _control_          BBD4 Time
//Map   _control_          BBD4 Sync Duration
//Map   _control_          BBD4 Sync Subdivision
//Map   _control_          BBD4 Level
//Map   _control_          BBD4 Pan
//Map   _control_          BBD4 Feedback
//Map   _control_          BBD4 THD
//Map   _control_          BBD4 Tap Level In
//Map   _control_          BBD4 Modulation Depth
//Map   _control_          BBD4 Envelope
//Map   _control_          BBD4 Enable
//Map   _control_          BBD4 EQ Enable
//Map   _control_          BBD4 Reverse Enable

//Map   _control_          BBD5 Delay Time Mode
//Map   _control_          BBD5 Stages
//Map   _control_          BBD5 Time
//Map   _control_          BBD5 Sync Duration
```

//Map	_control_	BBD5 Sync Subdivision
//Map	_control_	BBD5 Level
//Map	_control_	BBD5 Pan
//Map	_control_	BBD5 Feedback
//Map	_control_	BBD5 THD
//Map	_control_	BBD5 Tap Level In
//Map	_control_	BBD5 Modulation Depth
//Map	_control_	BBD5 Envelope
//Map	_control_	BBD5 Enable
//Map	_control_	BBD5 EQ Enable
//Map	_control_	BBD5 Reverse Enable
//Map	_control_	BBD6 Delay Time Mode
//Map	_control_	BBD6 Stages
//Map	_control_	BBD6 Time
//Map	_control_	BBD6 Sync Duration
//Map	_control_	BBD6 Sync Subdivision
//Map	_control_	BBD6 Level
//Map	_control_	BBD6 Pan
//Map	_control_	BBD6 Feedback
//Map	_control_	BBD6 THD
//Map	_control_	BBD6 Tap Level In
//Map	_control_	BBD6 Modulation Depth
//Map	_control_	BBD6 Envelope
//Map	_control_	BBD6 Enable
//Map	_control_	BBD6 EQ Enable
//Map	_control_	BBD6 Reverse Enable
//Map	_control_	Envelope Delay ms
//Map	_control_	Envelope Attack ms
//Map	_control_	Envelope Hold ms
//Map	_control_	Envelope Decay ms
//Map	_control_	Envelope Sustain
//Map	_control_	Envelope Release ms
//Map	_control_	Envelope Delay Tempo Sync
//Map	_control_	Envelope Attack Tempo Sync
//Map	_control_	Envelope Hold Tempo Sync
//Map	_control_	Envelope Decay Tempo Sync
//Map	_control_	Envelope Release Tempo Sync
//Map	_control_	Envelope Loop
//Map	_control_	Envelope Tempo Sync
//Map	_control_	CV Trigger Mode
//Map	_control_	HPF Frequency
//Map	_control_	LPF Frequency
//Map	_control_	EQ1 Frequency
//Map	_control_	EQ2 Frequency
//Map	_control_	EQ3 Frequency
//Map	_control_	EQ1 Gain
//Map	_control_	EQ2 Gain
//Map	_control_	EQ3 Gain
//Map	_control_	Dry/Wet
//Map	_control_	BBD Mixer Gain
//Map	_control_	Dry Signal Pan
//Map	_control_	Duck Speed
//Map	_control_	Compressor
//Map	_control_	Compressor Threshold
//Map	_control_	Compressor Ratio
//Map	_control_	Compressor Attack
//Map	_control_	Compressor Release
//Map	_control_	Bass Boost

Version history

2.1.0

- **Delay time selector displays updated to use custom displays; tempo sync mode can now display both duration and subdivision on the same screen for improved usability**

2.0.0

- **Beautiful new design by esselfortium**
- **Bass Boost, Compressor and Duck Speed controls are now available on the front panel, and automatable/Remote™-able**
- **Bug fixes**

1.0.1

- **Fixed error in compressor threshold**

1.0.0

- **Initial release**

Special thanks to the Steerpike *testing and patch crew: Dogboy1973, JesseRyckman, 0zone0, meowsqueak, alteree, kylelee, NaviRetlav, xcountrycoach.*

Steerpike BBD Delay Ensemble was designed and assembled by Jiggery-Pokery Sound, of London, England; DSP coding by Pitchblende Ltd, of Middle Earth.

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- **Shelob Audio Bypass Splitter** - 4 x 5 channel stereo audio splitter with independently switch-able outputs, mirroring, and auto-fade control
- **Steerpike BBD Delay Ensemble** - Vintage style 6-tap BBD device, with multiple delay modes including parallel, serial, and reverse
- **Titus BBD Delay Line** - A lightweight 1U delay device featuring a single Steerpike delay line, with reverse

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