

BBD-4A

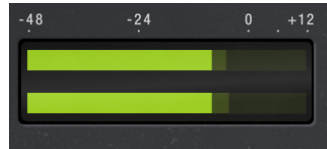
4 TAP BUCKET BRIGADE DEVICE



V 1.0.0

Input Meter

Stereo level meter showing the signal level after the **Drive** stage. Useful for monitoring how hard you're pushing the input.



Drive

Controls the input gain going into the delay. At center position the signal passes at unity gain. Turning it down fades the input to silence; turning it up boosts up to +12 dB. The signal passes through a soft saturation stage which adds warmth that increases as you push the drive harder.

Filter (LP / BP / HP)

A 12 dB/oct state-variable filter on the input signal, placed after the drive and saturation stages. Three modes are available: **Lowpass**, **Bandpass**, and **Highpass**. The **Frequency** knob sweeps from 50 Hz to 20 kHz. **Resonance** adds emphasis at the cutoff frequency. The filter can be modulated by the internal LFO (see Modulation section). With the frequency knob fully clockwise (20 kHz) in Lowpass mode, the filter is effectively transparent.



Delay Time & Sync Behavior

BBD-4A models a chain of four BBD chips, connected in series, each with 4096 "buckets" that hold and pass on audio to delay it according to the internal clock rate set by the **Time** knob. The value displayed is the delay time for the first chip or "Tap 1". The remaining chips derive their times from ratios of the first chip, determined by the current **Mode**.

Time (Clock rate)

The delay time and the quality of audio is directly linked to the clock rate. The per-chip delay time is constrained to 10.24 to 409.6 ms. This means that tap 1 is always the shortest delay, ranging from ~10 ms to ~410 ms. The longest delay is tap 4 and the time depends on the current **Mode**.

Free vs Synced

In **Free** mode the **Time** knob sweeps continuously across the full range. In **Synced** mode the knob selects a musical note division. The actual delay in milliseconds depends on your DAW tempo. See chart on page 4.

MODE (A-F)

MODE selects one of six tap spacing patterns that define where taps 1-4 sit along the BBD delay chain. Mode A gives classic even spacing; the other modes compress, stretch, or cluster the taps in different ways, giving each mode a distinct rhythmic character. When Ping Pong is enabled, **MODE** also controls the left-to-right stereo ordering of the taps.



Time spread ratios

Mode Ratios

A	1, 2, 3, 4
B	1, 1.9, 2.75, 3.65
C	1, 1.33, 1.66, 2
D	1, 1.5, 2.25, 3.375
E	1, 1.12, 1.62, 3.85
F	1, 2.75, 3.5, 4.0

Description

A	Linear: even spacing
B	Space Echo head ratios + extrapolated 4th
C	Dense: half range, thick/chorus
D	Geometric $\times 1.5$: accelerating gaps
E	Sparse: tight pair + distant tap
F	Late cluster: big gap then bunched at end

Stereo spread

The spread adapts to how many taps are active. For example, with all four taps selected:

Mode	Tap 1	Tap 2	Tap 3	Tap 4
A Forward	L	LC	RC	R
B Reverse	R	RC	LC	L
C Outside-in	L	RC	R	LC
D Inside-out	RC	L	LC	R
E Odds/Evens	L	RC	LC	R
F Evens/Odds	RC	L	R	LC

With fewer taps selected, the active taps redistribute to fill the stereo field evenly. For example in **Mode A** with only Tap 1 and Tap 4 active: Tap 1 → Left, Tap 4 → Right (the positions tighten or widen depending on how many taps are in play).

Modulation

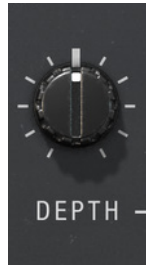
The modulation section provides an internal LFO that can modulate both the filter frequency and the delay time simultaneously, each with independent **Rate** and **Depth** controls.



- **Triangle:** A smooth, continuously sweeping waveform. Classic choice for chorus and vibrato effects when modulating delay time, or filter sweeps when modulating the filter.
- **Random:** Sample-and-hold random values – a new random level is picked each LFO cycle. Creates unpredictable, stepped modulation. Great for experimental textures and evolving delays.
- **Square:** Alternates between two fixed levels with a 50/50 duty cycle. Useful for rhythmic effects – the delay time or filter frequency snaps between two values in tempo.
- **Sync:** When Sync is off, the LFO rate is set freely from 0.1 Hz to 10 Hz. When Sync is on, the rate locks to musical divisions of the host tempo, from 2/1 (two whole notes) down to 1/16.

Depth

The **Depth** knob is bipolar, centered at 12 o'clock (no modulation). Turning it clockwise adds positive modulation above the base value, the LFO sweeps upward from the knob setting. Turning it counter-clockwise subtracts from base value, the LFO sweeps downward from the knob setting. This unipolar add/subtract behavior means the base delay time or filter frequency is always the starting point, and modulation only moves in one direction from there.



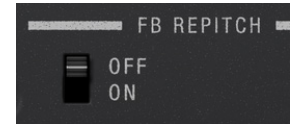
Repitch (On/Off)

Controls how delay time modulation behaves:

- **Off:** The delay time changes without any pitch shift. This is done by crossfading between the base delay time and the modulated delay time.
- **On:** This shifts the pitch (up to one octave up or down) while keeping the echo timing intact. Periodically re-captured from the live signal to keep the content fresh rather than looping old material indefinitely.

FB Repitch (backside)

Apply repitching also to feedback (on/off)



Feedback Tap (FB Tap)

Selects which of the four taps feeds back into the delay input. Since the taps are at increasing delay lengths, this controls the repeat spacing of the feedback loop. For example, selecting tap 1 gives short, rapid repeats while tap 4 gives longer, spaced-out repeats.

P-P (Ping-Pong)

In **Ping-Pong** mode, the selected output taps are spread across the stereo field. The **Mode** setting determines which tap goes where.

With a single tap selected, **Ping-Pong** works like a classic ping-pong delay, each echo alternates between left and right through the feedback path.



With multiple taps selected, each tap is assigned a pan position. The **Mode** setting controls the stereo pattern, which taps land on the left, right, or in between.

Try different modes to find interesting spatial rhythms!

Tone (Treble / Bass)

A two-band EQ for shaping the delay sound. **Treble** and **Bass** each offer up to 12 dB of boost or cut. Tone can be placed in the feedback loop by enabling the yellow **TONE** button.



• **In Feedback** (Yellow **TONE** button ON): The tone control is placed inside the feedback loop. Each time the signal passes through the loop, the EQ is applied again, so the tonal change accumulates with each repeat.

! Note that at zero feedback, this setting has no audible effect since the signal never passes through the feedback path where the tone is applied.

• **Post Feedback** (Yellow **TONE** button OFF): The tone control is applied to the wet output signal, after the feedback loop but before the dry/wet mix. This colors the entire delay output equally, every echo gets the same tonal treatment regardless of feedback amount. Use this when you want consistent EQ on the delay sound.

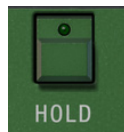
Hold

Freezes the delay buffer, creating an infinite loop of whatever is currently in the buffer. When Hold is engaged:

- New input is blocked from entering the delay buffer
- The existing buffer content loops seamlessly at the current delay time
- Feedback is temporarily disabled (the loop sustains itself)

Hold can be triggered by the front panel button or by the **Hold CV input** on the back panel (gate signal). This makes it easy to automate or trigger from a sequencer for rhythmic stutter and glitch effects.

When used together with Repitch modulation, Hold becomes a creative pitch tool, the frozen loop plays back at the modulated speed, shifting the pitch of the looped content up or down.



Example of ratios and their equalent in milliseconds:

Rate	100 BPM	120 BPM	140 BPM
1/128	18.8 ms	15.6 ms	13.4 ms
1/64	37.5 ms	31.3 ms	26.8 ms
1/32	75.0 ms	62.5 ms	53.6 ms
1/16	150.0 ms	125.0 ms	107.1 ms
1/8T	200.0 ms	166.7 ms	142.9 ms
1/8	300.0 ms	250.0 ms	214.3 ms
1/4T	400.0 ms	333.3 ms	285.7 ms
3/16	450.0 ms	375.0 ms	321.4 ms

Clamping

Because the internal BBD clock has hard limits, the delay time will clamp at the boundaries. For example:

- At slow tempos, longer divisions may hit the 409.6 ms ceiling. At 80 BPM, 3/16 would be 562.5 ms, it clamps to 409.6 ms and no longer tracks the tempo precisely.
- At very fast tempos, short divisions may approach the 10.24 ms floor.

This is not a bug, it's how real BBD hardware behaves. The display always shows the actual clamped value so you can see exactly what delay time is being used.

Why Not 1/4 or Longer?

Many digital delays offer half-note or whole-note sync divisions. BBD-4A's per-chip maximum of ~410 ms means a quarter note (500 ms at 120 BPM) already exceeds the range. The longest available division — 3/16 (dotted eighth, 375 ms at 120 BPM) — sits comfortably within the BBD range at typical tempos. For longer effective delay times, use the **Out Tap** knob: Tap 4 in **Mode A** multiplies the base time by 4x, turning a synced 1/8 into an effective half-note delay. Unconventional divisions, perhaps, but constraints like these are part of what gives hardware-derived devices their character!

Audio Inputs

- **Audio In L / R:** Main stereo audio input. This is where the signal enters the device.
- **Feedback Breakout In L / R:** External feedback insert return. When cables are connected here, the external signal replaces the internal feedback path. This lets you process the feedback through other Reason devices (EQ, distortion, filters, etc.) before it re-enters the delay. When nothing is connected, the internal feedback loop is used.



Audio Outputs

- **Audio Out L / R:** Main stereo output. Carries the mixed dry + wet signal after the output level and width controls.
- **Feedback Breakout Out L / R:** The feedback send signal – this is what the selected feedback tap is outputting before it re-enters the delay. Use this with the Feedback In jacks to create an external feedback processing loop.

Tap Outputs

The four tap stereo outputs carry the direct signal from each BBD stage, pre-mix and pre-output level. These outputs are well suited for quadraphonic setups, parallel processing chains, or feeding separate effects with naturally staggered delay times.

CV Inputs

- **Filter Freq CV:** Modulates the input filter frequency. Bipolar CV adds to or subtracts from the current knob position.
- **BBD Time CV:** Modulates the delay time. Bipolar CV adds to or subtracts from the current delay time setting.
- **BBD Feedback CV:** Modulates the feedback amount. Bipolar CV adds to or subtracts from the current knob position.
- **BBD Mix CV:** Modulates the dry/wet mix. Bipolar CV adds to or subtracts from the current knob position.
- **Tone Treble CV:** Modulates the treble EQ amount. Bipolar CV adds to or subtracts from the current knob position.



- **Tone Bass CV:** Modulates the bass EQ amount. Bipolar CV adds to or subtracts from the current knob position.
- **Hold CV:** Gate input for the Hold function. Any positive voltage above 50% engages Hold; below 50% releases it. Works alongside the front panel Hold button (either can trigger Hold).

CV Outputs:

- **Filter Mod CV Out:** Outputs the current internal filter LFO signal. Useful for syncing other devices to the same modulation or for monitoring the LFO shape.
- **Time Mod CV Out:** Outputs the current internal time LFO signal. Useful for syncing other devices to the same modulation rhythm.



Thank you for supporting Ekssperimental Sounds Studio!

Ekssperimental Sounds Studio is a one man project driven by the passion for experimental electronic sounds, new and old synthesizers and music gear. As a Reason user since 2001 it truly is a dream come true to finally be able to create my own synthesizers and effects for the Reason rack. Thanks to all of you who buy my products I can continue to learn and develop more fun and inspiring devices for our beloved rack.

I hope you will enjoy BBD-4A!

Cheers,
Erik Söderberg 2026



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