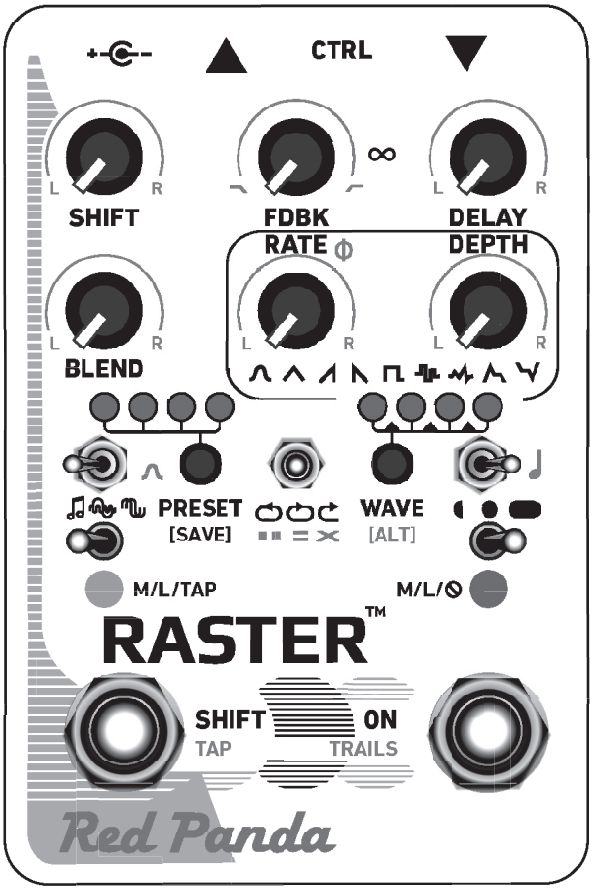
RASTER 2

Stereo Delay With Pitch Shifter



Red Panda®

Plymouth, MI • www.redpandalab.com

Raster 2

Owner's Manual

Firmware 2.0+
June 2022

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Please register your product at redpandalab.com/register

Product manuals and firmware updates are available at redpandalab.com/downloads

For technical support, email support@redpandalab.com

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Introduction

Thank you for purchasing the Raster 2. The Raster™ is a digital delay with a pitch and frequency shifter integrated into the feedback loop. Forward or reverse delay can be shifted once or have continuously shifted repeats. It delivers a wide range of sounds including modulated and harmonized delays, reverse delays, chorus, arpeggios, infinite descents, chaotic self-oscillation, and continuously evolving soundscapes.

The core of the Raster™ is a clean delay with 1600 milliseconds of delay time. Three delay ranges allow you to precisely dial in resonant feedback sounds and instantly change delay time with rhythmic shifts. The feedback control has infinite repeats at 3 o'clock and chaotic, textured feedback loops at higher levels. Knob responses are carefully tuned for exploration of self-oscillation and feedback on the verge of blowing up. A tone control sweeps from dark analog-style repeats to digital clarity and emphasizes the attack at higher settings. The left and right delay times can be set as a ratio, so a single knob changes both in sync. The two delay channels can be arranged in series, parallel or ping pong.

Pitch shifting repeats up or down in semitone steps creates tempo-synced arpeggios and alien organ sounds. The detune setting can dial in micro pitch shifts and chorused repeats. The left and right channels can be shifted by the same amount, a ratio, or opposite directions. At subtle settings, repeats evolve in a way that sounds natural, but different from analog delays.

Beyond pitch shifting, a combination phase/frequency shifter creates subtle evolving repeats, dissonant harmonies, and barber pole flanging. It can be pushed to extremes for ring modulation and inharmonic shifted delays that distort and break apart.

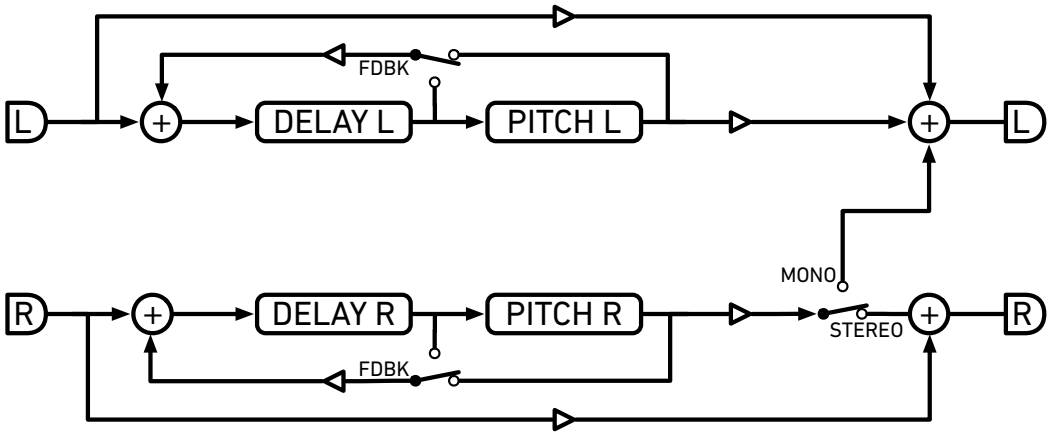
The Raster's modulation section has seven waveforms that can be assigned to delay time, pitch shift, or amplitude (for tremolo). There are two random waveforms for glitchy pitch jumps, wow and flutter, and broken tape deck effects. Envelope and inverse envelope enable dynamic flanging and pitch bent delays. Stereo controls adjust the modulation amount and phase between channels, for subtle shifts or swirling psychedelic washes.

We started designing version 1 of the Raster in 2012 and released it in 2015. It was a simple looking delay pedal, but the controls were carefully tuned and all of the functionality fit together perfectly, making it extremely fun to use.

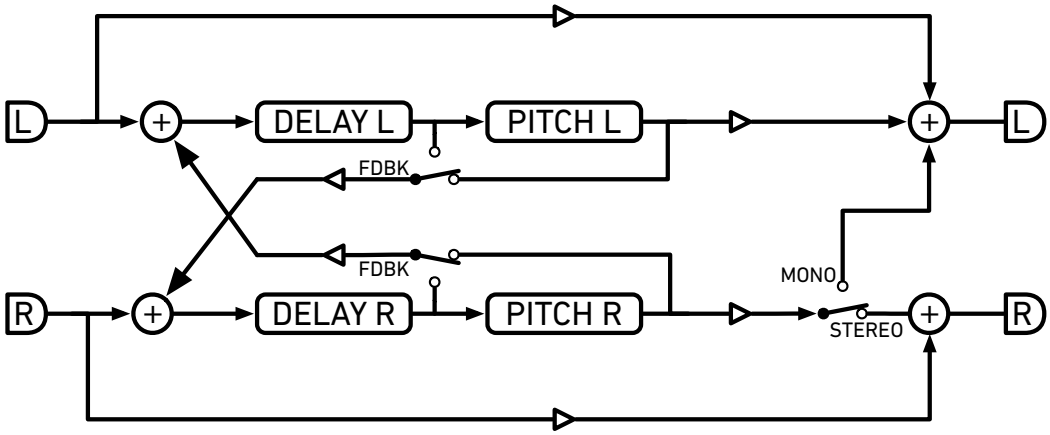
While designing the Raster 2, we wanted to enable as many classic rack mount digital delay tricks as possible while keeping the fast and intuitive control that made the original Raster so fun to use. All of the parameters are always available, so you can mix and match different effects and explore new sounds in between.

Signal Flow

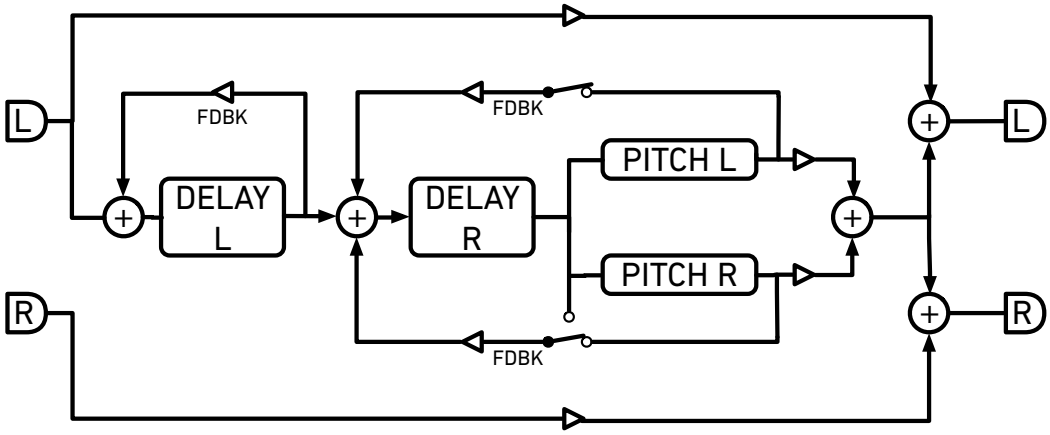
= Parallel



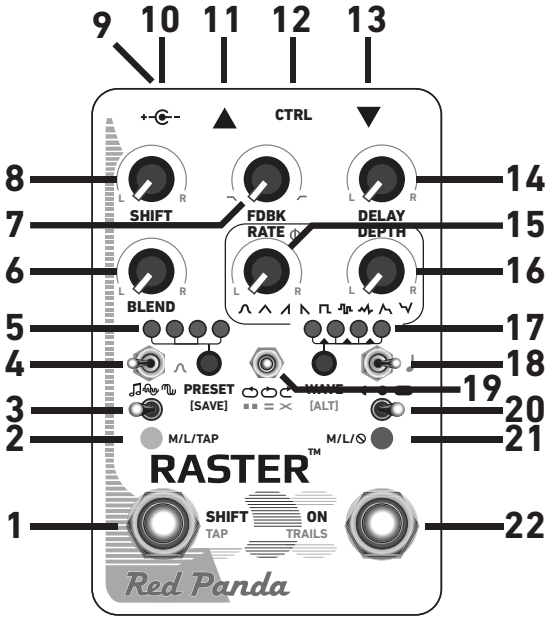
⤫ Ping Pong



▪▪ Series

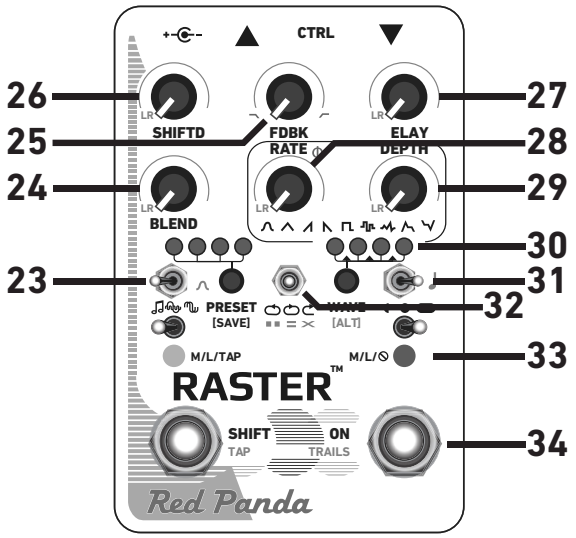


Front Panel



1. **SHIFT** footswitch.
2. Shift indicator.
3. **SHIFT** footswitch mode: momentary (**M**), latching (**L**), or tap tempo (**TAP**).
4. Shift mode switch: transpose by semitones (♫), detune (〰), or phase/frequency shift (〽).
5. **PRESET** button and indicators. Hold to save.
6. **BLEND** knob. From 100% dry to 100% wet.
7. **FDBK** knob. Delay feedback amount. Self-oscillates at 3:00 (∞) and above.
8. **SHIFT** amount knob. Unison at 12:00.
9. USB mini B receptacle for MIDI and firmware.
10. Power jack. 9V DC, 250 mA.
11. 1/4" TRS stereo output.
12. **CTRL** port. 1/4" TRS jack for expression pedal, tap tempo, remote switch, or MIDI.
13. 1/4" TRS stereo input.
14. **DELAY** time knob.
15. Modulation **RATE** knob.
16. Modulation **DEPTH** knob.
17. Modulation **WAVE** button and indicator.
18. **DELAY** range switch: 400 ms (◖), 800 ms (●), or 1600 ms (▬).
19. Feedback mode switch: reverse delay (⟲), or forward delay with repeats continuously shifted (⟲) or shifted once (↺).
20. **ON** footswitch mode: momentary, latching, or mute output in bypass.
21. Effect on indicator. Blinks yellow for tempo.
22. **ON** footswitch.

Alternate Controls



Hold down **WAVE/[ALT]** button to edit secondary parameters. Right LED will turn cyan.
Settings are saved to presets and remembered when power is off. Knobs at center to turn off.

23. Modulation destination: amplitude (♫), shift (〰), or delay (〽).
24. **BLEND** left/right balance.
25. Tone control from dark lowpass to full range to highpass.
26. **SHIFT** left/right balance.
27. **DELAY** left/right ratio knob.
28. Modulation left/right relative phase (**Φ**) knob.
29. Modulation **DEPTH** left/right balance knob.
30. Hold **[ALT]** to edit alternate controls.
31. **DELAY** note divisions: 8th (◖), dotted 8th (●), or quarter note (▬). More available via editor and MIDI.
32. Delay structure: series (▪▪), parallel (=), or ping pong (✕).
33. Effect on indicator is cyan if editing alternate controls.
34. Trails on/off.

Getting Started

The Raster 2 is a stereo digital delay with two pitch and phase/frequency shifters integrated into the delay structure. The delay lines and shifters are independent, but are usually adjusted in ratios or by "tilting" the effect to the left or right channel. The delay structure is configurable, so that the shifters can be inside the feedback loop for continuously shifting repeats, or outside the feedback loop to shift all repeats to the same pitch. The two delay lines can be in series for stacked delays (mono), parallel stereo delay lines, or cross feedback (ping pong) with the repeats swapping between left and right channels.

Almost all parameters have stereo controls, Used subtlely, you can create delays that shear apart or gradually pull towards one channel, micro pitch shifting, and random stereo chorusing. It is also possible to create chords, octave up+down shifts, arpeggios, quadrature or inverted delay modulation, and a wide variety of other delay- and pitch-based effects. Stereo functions are labeled in gray and accessed by holding down the **ALT** button. They are saved to presets, and remembered when the pedal is turned off. Secondary (alternate) functions allow us to pack in more functionality without increasing the size or cost of the pedal, but they can make it easier to get lost while you are editing. To make it less confusing, all of the alternate controls are off when the corresponding knob is at center (12:00).

The modulation section has seven LFO waveforms, envelope, and inverse envelope modulation. Delay modulation changes the pitch - like an analog or tape delay - as the Raster reads and writes the delay memory faster or slower. Modulation can also be assigned to the wet signal amplitude for tremolo effects, or the shift amount for pitch and frequency modulation.

This section will help you get started with the Raster 2. The following sections will discuss the controls in depth and discuss how to create a wide range of delay- and pitch-based effects.

We also have a growing library of tutorial videos at http://redpandalab.com/rtfm

Plugging In

The Raster 2 requires an isolated power supply that can supply at least 250 mA of current (300+ mA preferred). Most problems are due to inadequate or overloaded power supplies. See our knowledge base for information about specific power supplies.

If you purchased your Raster 2 used, first do a factory reset to initialize all settings to their defaults (page 27).

The Raster 2 has TRS stereo inputs and outputs, configurable using the web editor. The default configuration is mono in/stereo out, but you can plug in a mono cable if stereo output is not needed. A variety of input/output configurations, bypass modes, and maximum signal levels are available to adjust the Raster for your pedalboard or studio.

Connect your instrument to the Raster's input using a TS (mono cable), and connect the Raster's output to your amplifier or audio interface using a TS cable.

Turn down the volume on your amplifier and connect a power cable to the Raster, then adjust your amplifier's volume to a comfortable level. Press the right footswitch to turn on the Raster.

Using the Raster

Ignore the **ALT** controls (gray labels) until you are comfortable with the basic operation of the Raster 2.

For now, turn the **RATE** and **DEPTH** controls all the way down (7:00) and **SHIFT** control to center (12:00). Put all toggle switches in their center position.

The **BLEND**, **FDBK**, and **DELAY** controls can be used as an 800 millisecond 3-knob delay.

Self Oscillation

The Raster's **DELAY** and **FDBK** knobs are tuned for exploration of self-oscillation and feedback. Start with **BLEND** at center (12:00), **FDBK** at center (12:00), and **DELAY** at center (12:00). Reduce the **DELAY** time until you hear a hollow, resonant sound, then play with the **FDBK** and **DELAY** controls

The **FDBK** control is scaled for infinite feedback at 3:00 (∞) and greater than unity gain above that. The feedback signal can get very loud, so **use caution and protect your hearing**.

Digital Delay Tricks

Unlike analog delay pedals, the Raster 2 does not change the pitch as you turn the **DELAY** knob. Fast knob movements jump smoothly to the new delay time. Slow knob movements gradually change the delay time, with the Raster analyzing the signal to minimize glitches.

Start with **BLEND** at center (12:00), **FDBK** at minimum (7:00), and **DELAY** at center (12:00). Play staccato notes or a drum loop.

Quickly turn the **DELAY** knob to the maximum, pause, then turn it back to the middle. Then slowly turn it between the minimum and maximum positions. Increasing the delay time will drag the audio, creating time stretch effects. Reducing the delay time will compress the signal, skipping slices of audio. By experimenting with the speed and range of knob movements with different signals, you can get a range of time stretching and glitchy stutter effects.

Now, adjust the **DELAY** knob for quarter note repeats. Increase **FDBK** to about 10:30 so the repeats quickly fade out. While playing a steady rhythm (or drum loop), Move the delay range (right top) toggle switch between the three positions. The delay time jumps between 8th notes, quarter notes, and half notes, creating smooth rhythmic changes with no pitch shift.

Web Editor

We provide a web-based editor to configure your Raster, access hidden parameters, and fine-tune presets. See "Web Editor" on page 25 for more information.. It requires the Google Chrome browser, and can be accessed at
https://www.redpandalab.com/content/apps/raster-editor/index.html

Note the "http**s**" URL protocol. "http" will not allow Chrome to access MIDI devices

Inputs and Outputs

DC POWER	Connect a 9V DC center negative power supply rated at 250 mA or higher.
USB	USB mini B connector for MIDI, web editor, and firmware updates.
IN	1/4" TRS mono or stereo input.
CTRL	1/4" TRS jack for expression pedal, remote, or MIDI.
OUT	1/4" TRS mono or stereo output.

The Raster supports multiple input and output configurations, bypass modes, and signal levels. These can be configured using our web editor, or by sending MIDI System Exclusive strings.

The default configuration is mono in / stereo out with DSP bypass and trails, with a maximum signal level of +8 dBu, which works well in most situations.

Power

Use a 9V center negative (Boss-style) regulated power supply that can provide 250 mA or more of current. The plug should have 2.1mm inside diameter and 5.5mm outside diameter. This is the type of power supply used by almost all guitar pedals, and we recommend using one designed specifically for effects. If you have a few pedals, we recommend a multi-pedal power supply with independent regulated outputs (not daisy chained).

If our pedals detect a problem with the power supply, the bypass LED with change to magenta (or pink), the pedal will switch to bypass and enter a low power mode. After a few seconds, the pedal will restart. The most common reasons are that the power supply is not providing enough current, or it is an unregulated voltage converter. Note that some multi-pedal supplies are rated at 100 mA except for a couple of high-current outputs. Some multi-pedal power supplies also share current across multiple outputs. You need to make sure the total current required for all connected pedals is within the power supply's limits.

For additional information, please see our knowledge base.

Input/Output Configuration

Mono in / mono out	Input and output use 1/4" TS (mono) plugs.
Mono in / stereo out (default)	Input uses 1/4" TS plug. Output uses 1/4" TRS plug with left signal on tip, right on ring.
Stereo in / stereo out	Input uses 1/4" TRS plug with left signal on tip, right on ring. Output uses 1/4" TRS plug with left signal on tip, right on ring. You can use 1/4" TS plugs in this mode for mono signals.

Bypass Mode

Auto (default)	Uses analog or DSP bypass, depending on other configuration.
DSP	Dry signal and bypass passes through DSP. Our pedals use studio-quality A/D and D/A converters with low latency. This is a good choice in most situations.
Analog	Dry signal passes through DSP when effect is on, and buffered analog signal path in bypass. Depending on the input signal, there could be a small click when the effect is engaged.
Analog + FX Level	Dry signal passes through a unity-gain analog signal path.
Kill Dry	Dry signal is always muted. Useful for wet/dry parallel effects chains and mixer aux sends. The **BLEND** knob acts as an effect level control, but keeps the same response as other modes.

Analog + FX Level is useful if you want your dry signal to always be at unity gain, because the dry signal does not go through the A/D and D/A converters, and there is no latency.

Analog + FX Level and **Analog** bypass modes are not compatible with Mono In / Stereo Out, because the analog signal path cannot send the left input to both output channels. A workaround is to use a female TS to male TRS mono to stereo adapter to split the mono input signal to both channels, with Stereo In/ Stereo Out configuration.

Kill Dry is typically used for one or more instruments while recording using a mixer auxilliary send. The dry signal level is controlled by the channel fader(s) and the output of the pedal only includes the wet sound. It can be brought back into the mix using an aux. return or a mixer channel. Using a DAW send/ return is similar.

Raster 2 Controls

Controls are identified by their front panel labels in **BOLD**. Alternate controls are labeled in gray, and are related to the primary (blue) control label. They are saved to presets and remembered when the pedal is turned off. Each each knob's alternate function is related to its primary function and the default setting is 12:00 (center).

To adjust alternate parameters, hold the **WAVE/[ALT]** pushbutton until the right LED turns cyan. For left/right controls (labeled "**L** / **R**"), the **PRESET** and **WAVE** LEDs will show the setting as the knob is moved. Left/right controls are off when the two middle LEDs are lit:

○○○● ●○○○ Indicates left/right control is off.

Almost all of the Raster's functionality is available on the front panel, but a few parameters are only available by using MIDI, the web editor, or other editors. Those features are marked with a MIDI port symbol. Editor/MIDI-only parameters are saved in presets and remembered when power is turned off.

On / Bypass

Press the right footswitch to switch the Raster between enabled and bypass.

On indicator (right LED)

Off	Bypass
Red	On
Cyan	Editing secondary controls
Yellow (blink)	Tap tempo MIDI clock
Green (blink)	Preset saved CTRL config saved

ON Footswitch Mode

M	Momentary	Effect is active while the footswitch is held down, and switches to bypass as soon as it is released.
L	Latching	Pressing the footswitch alternates between active and bypass.
ø	Mute Output	Pressing the footswitch alternates between active and bypass. In bypass, the output is muted and the pedal continues recording the input signal. Trails are disabled.

Mute Output allows you to repeat or loop what you previously played (based on the delay length). To loop what you just played, set the **FDBK** knob to the ∞ position and set the delay time to the length of the loop. When you have played a phrase that you want to repeat, turn the pedal on and it will loop. To

rewind what you just played, turn down the feedback and use reverse delay feedback mode.

Trails

Delay trails allow the repeats to decay naturally after the pedal has been switched to bypass.

Global trails setting

OFF	Echoes stop immediately when effect is turned off.
ON (default)	Echoes decay naturally after effect is turned off.

The right LED blinks green on startup to indicate whether trails are on or off:
2 long blinks: trails off
4 short blinks: trails on

Use **[ALT]-ON** to toggle the global trails setting on or off. You can also change the global trails setting on the Config page of our web editor.

Preset trails setting

OFF	Echoes stop immediately when effect is turned off.
ON	Echos decay naturally after effect is turned off.
GLOBAL (default)	The global trails setting is used.

Trails can be turned on or off at the preset level using our web-based editor. By default, presets use the global trails setting.

If the **ON** footswitch mode is **ø** (mute output), trails are disabled so that you get hear the last phrase played while in bypass, without extraneous repeats.

Delay Controls

The Raster has two delay lines that can be arranged in parallel or series and assigned to the left or right channel, depending on the delay structure and input/output configuration. See "Signal Flow" on page 6 for the available configurations.

The **DELAY** control adjusts the delay time within four ranges. Fast knob movements jump smoothly to the new delay time. Slow knob movements gradually change the delay time, with the Raster analyzing the signal to minimize glitches. By experimenting with the speed and range of knob movements with different signals, you can get "drag", time stretching and even glitchy stutter effects.

The **DELAY** control is scaled to allow fine tuning of short delay times for resonant effects. The minimum setting has no delay (0 ms) when no feedback is used, for pure pitch shifting and amplitude modulation effects. When feedback is used, the minimum delay time automatically increases.

Delay Left/Right Ratio

[ALT]-DELAY adjusts the offset or ratio between the left and right delay. Turn the knob left or right to control which delay is heard first. Turning the control counter-clockwise from 12:00 will shorten the left delay time. Turning the control clockwise will shorten the right delay time.

[ALT]-DELAY settings close to 12:00 will add a small time offset between delay channels (0-30 ms). That causes a sense of space and motion as the repeats gradually separate or shear apart.

At higher settings, the delay times are set to ratios: 3:4, 2:3, 1:2, 3:8, 1:3, and 1:4. The **DELAY** knob adjusts both delay times proportionally.

Delay Ranges

The right top toggle switch adjusts the delay range, between 400 ms and 1600 ms maximum delay times. Each delay range is 2x the previous range, so that you can make rhythmic changes by halving or doubling the delay time. 3200 ms forward delay (with 1600 ms reverse) is available using the editor or MIDI. It is saved in presets and remembered when power is off. Moving the delay range switch will reset the range.

Delay range switch

	Short	0-400 ms delay
	Medium	0-800 ms delay
	Long	0-1600 ms delay
		0-3200 ms forward delay, with 1/2 time reverse delay *available via editor or MIDI CC*

Tone Control

The **TONE** control gives a wide range of filter responses, from analog-style dark echoes to a high-pass-filter that causes repeats to thin out as they decay. Clean repeats work well for sound-on-sound effects, or you can emphasize the picking similar to some classic tape delays. Tone affects the initial delay and all repeats.

The **TONE** control can be changed by holding down the **[ALT]** button and adjusting the **FDBK** control. The ton setting stored in presets and remembered when the pedal is turned off.

Tone control settings (approximate)

7:00	Very dark repeats
9:00	Dark repeats similar to analog delay
12:00 (default)	Bright repeats
1:30	Bright repeats with emphasis on attack (picking)
3:00	Highpass filtered
5:00	Bandpass "telephone" filtered

Feedback

The **FDBK** control adjusts the delay line feedback (regeneration). Infinite repeats at approximately 3:00 (∞), with greater than unity feedback above that. Due to nonlinearity and filtering in the feedback path, the exact spot where self-oscillation occurs will depend on the input signal and tone control. Increasing the **FDBK** control beyond self-oscillation will add distortion.

Using the **SHIFT** control with continuously shifting repeats (↺ or ↻) will suppress self-oscillation, except at very small shifts, because the signal frequencies are different each time through the feedback loop and are not reinforced. Using one of the single-shift feedback modes (↻) allows you to generate feedback and self-oscillation that is independent of the delay time.

The feedback mode (center) toggle switch selects forward or reverse delay and whether the pitch/phase/frequency shifter is inside or outside the feedback loop.

Feedback mode switch

↺	Reverse / shift all	Reverse delay with continuously shifted repeats
↻	Forward / shift all	Forward delay with continuously shifted repeats
↻	Forward / shift once	Forward delay with repeats shifted once
⊙	Reverse / shift once	Reverse delay with repeats shifted once *available via editor or MIDI CC*

Feedback left/right balance

⊙ **Feedback left/right balance** is adjustable via the editor or MIDI. At 50%, both delay lines use the **FDBK** control setting. Below 50%, the left delay feedback remains the same and the right delay feedback is reduced. Above 50%, the right delay feedback remains the same and the left delay feedback is reduced. The **FDBK** control will adjust both values proportionally. The setting is stored in

presets and remembered when the pedal is off.

You can set the feedback left/right balance control to its minimum or maximum value to disable feedback for the right or left delays, respectively. With the series delay structure, for example, that allows you to put a slapback delay in front of a longer delay with feedback.

Intermediate settings are useful for balancing the overall decay time with different delay times. A longer delay will need less feedback for the same overall decay time, since there are fewer repeats.

Subtle settings will cause the signal to shift to one side as it fades out. That can be combined with small left/right delay time differences to create a sense of movement.

Feedback Invert

Inverting the phase of the delay feedback changes the character of resonant flanging sounds. It will only be noticeable with short delay times.

Use the editor or MIDI to set **feedback invert**. The setting is stored in presets and remembered when the pedal is turned off.

Shift Controls

Each delay line has an associated pitch/phase/frequency shifter. The dual pitch shifters can be placed inside or outside of the feedback loop, for continuously shifted repeats or repeats that are shifted up or down and stay there. With the series structure, both shifters are assigned to the second (right) delay. See "Signal Flow" on page 6 for an illustration.

Shift indicator (left LED)

Off	Shift off
Orange	Shift on

The **SHIFT** footswitch turns the shift effect on or off, at the amount set by the **SHIFT** control. Momentary footswitch mode is useful for injecting pitch jumps. If the **SHIFT** footswitch mode is set to **TAP**, the shift indicator will turn on or off based on the **SHIFT** control value.

Shift footswitch mode

M	Momentary	Shift is on while the footswitch is held down
L	Latching	Footswitch toggles shift between on and off
TAP	Tap tempo	Footswitch is used for tap tempo

The **SHIFT** control adjusts the amount of pitch, phase, or frequency shifting. The function and scaling depend on the shift mode toggle switch.

Shift mode switch

♫	Transpose	Transpose ±12 semitones
	Detune	Smooth detuning from a fourth down to a major third up
	Frequency shift	Frequency shift ±500 Hz

Shift Left/Right Balance

[ALT]-SHIFT adjusts the **shift left/right balance**. In most shift modes, turning the control counter-clockwise will cause the right channel to shift less, then no shift, then shift opposite the right channel at the minimum. Turning the control clockwise will keep the right shift constant while reducing, disabling, and then inverting the left delay shift. The **SHIFT** control will affect both channels. See the "Transpose," "Detune," and "Phase / Frequency Shifting" sections below for details about each mode.

The **shift left/right balance** is stored in presets and remembered when power is off. Set the **[ALT]-SHIFT** control to 12:00 to set equal shifts on both delay lines.

Independent Left/Right Shift

If you prefer to set the left and right shift amounts independently, use the editor or MIDI to turn on **indepent left/right shift**. With this setting, the **SHIFT** control sets the left delay shift amount and **[ALT]-SHIFT** sets the right shift amount.

Transpose

Transpose mode shifts up or down one octave in semitone steps. This mode is useful for pitch shifting, arpeggiated delays, harmonized delays, and generating chords from single note lines.

The expression pedal (or MIDI CC 4) will adjust the pitch shift smoothly, enabling sweeps and pitch dives.

Shift left/right balance will adjust the right delay shift relative to the left shift amount set by the **SHIFT** control. The **PRESET** and **WAVE** LEDs will show the selection. For chords and inversions, the right shift will adjust as the **SHIFT** control is moved to maintain useful ratios.

Position (approx.)	LEDs	Right shift
7:00	○○○○ ○○○○	Off
8:30	●●○○ ○○○○	-1 octave
9:30	●○○○ ○○○○	Inversion
10:30 11:30	○●○○ ○○○○ ○○●○ ○○○○	Chord inversions
12:00	○○○○ ○○○○	Unison
12:30 1:00 2:00 3:00	○○○○ ●○○○ ○○○○ ○●○○ ○○○○ ○○●○ ○○○○ ○○○●	Chords

Position (approx.)	LEDs	Right shift
5:00	○○○○ ○○●●	+1 octave

If **independent left/right shift** is enabled, the LEDs will show the control position instead of the patterns above.

Detune

Detune mode smoothly shifts from a 4th down to a major third up, with emphasis on small pitch ratios. Small shifts created chorused or detuned sounds. When used with delay, subtle detuning will cause each repeat to change slightly, creating a unique but interesting and natural evolution as the sound decays.

The **Shift left/right balance** control will keep the left (CCW) or right (CW) delay shift constant while reducing and then inverting the detuning of the other delay. Turning the control counter-clockwise will keep the left shift constant while reducing, disabling, and then inverting the right delay shift. Turning the control clockwise will keep the right shift constant while reducing, disabling, and then inverting the left delay shift. At the minimum and maximum settings, the delays will be detuned in opposite directions. The **SHIFT** control will affect both channels proportionally.

Phase / Frequency Shifting

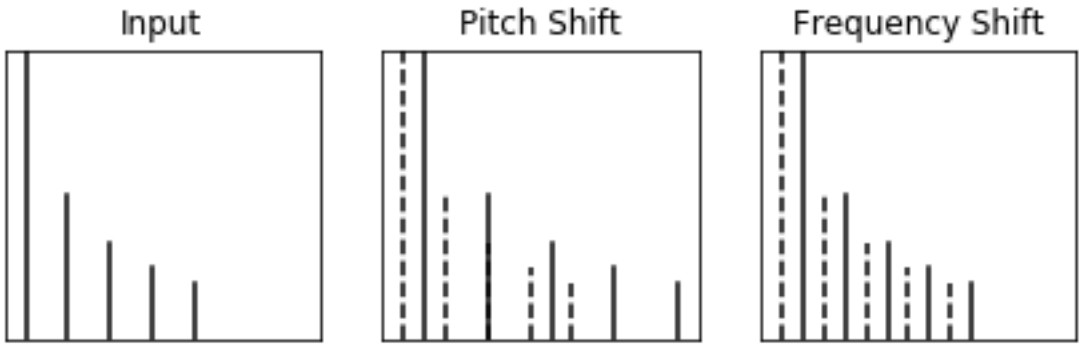
Around 12:00, the **SHIFT** control will add phase shifting. Phase shifting with very short delays is good for bubbling resonant sounds. With longer delays, the repeats evolve in a way that sounds different from analog or tape delays.

Higher and lower **SHIFT** settings use frequency shifting (single sideband modulation), which destroys the harmonic relationship between signal components. Each partial is shifted up or down by a fixed number of Hertz (0-500). Frequency shifting creates metallic sounds. With frequency shifting in the feedback loop, the harmonic structure of the notes is pulled farther apart with each repeat.

The difference between pitch shifting and frequency shifting can be illustrated by looking at the first 5 harmonics of a A above middle C (A440) when the fundamental is shifted to 660 Hz using pitch shifting and frequency shifting.

Harmonic	**A440 (Hz)**	**Pitch Shift + perfect fifth**	**Frequency Shift + 220 Hz**
Fundamental	440	660	660
2nd harmonic	880	1320	1100
3rd harmonic	1320	1980	1540
4th harmonic	1760	2640	1980

Harmonic	A440 (Hz)	Pitch Shift + perfect fifth	Frequency Shift + 220 Hz
5th harmonic	2200	3300	2420



The **shift left/right balance** (**[ALT]-SHIFT**) control will keep the left (CCW) or right (CW) delay shift constant while reducing and then inverting the shift of the other delay. Turning the control counter-clockwise will keep the left shift constant while reducing, disabling, and then inverting the right delay shift. Turning the control clockwise will keep the right shift constant while reducing, disabling, and then inverting the left delay shift. At the minimum and maximum settings, the delays will be shifted in opposite directions. The **SHIFT** control will affect both channels proportionally.

Frequency shifting creates similar sounds as ring modulation, but all of the new components are either above or below the original frequency. Ring modulation adds new components above and below the original. You can get a ring modulation effect by setting the **shift left/right balance** to its minimum or maximum value and using a series delay structure or mono output.

Blend Controls

The **BLEND** control adjusts the wet/dry blend from 100% dry to 100% wet. The dry signal level is at full volume until approximately 12:00.

[ALT]-BLEND adjusts the left/right balance of wet/dry levels. At 12:00, the left and right delay outputs use the same wet/dry blend. Turning counter-clockwise, the left delay output remains at the **BLEND** control setting and the right delay output level is reduced. Turning clockwise, the right delay output remains at the **BLEND** control setting and the left delay output level is reduced. When a left/right balance is set, the **BLEND** control will affect both delay outputs proportionally; the favored delay will follow the **BLEND** control, and the other delay will get proportionally quieter.

If you prefer a unity-gain analog dry signal with the **BLEND** control acting as an effect level, use the editor to select **Analog + FX Level** bypass mode.

Modulation Controls

MOD DEPTH adjusts the amount of modulation by the LFO or envelope. For envelope modulation, **MOD DEPTH** may need to be adjusted based on the signal level.

MOD RATE adjusts the modulation LFO frequency from approximately 0.05 - 10 Hz. The modulation waveform LED blinks at the LFO frequency (if **MOD DEPTH** is not off).

When envelope or inverse envelope modulation is selected, this control will have no effect.

The **MOD PHASE L/R (ø)** control adjusts the relative phase of the modulation between the left and right delay lines. At 7:00 and 5:00 the LFO waveforms will be inverted relative to each other. At approximately 9:30 and 2:30, the LFO waveforms are 90° out of phase (quadrature), which creates a wash or tumbling effect. At any setting besides 12:00, the random LFO waveforms are independent.

The setting is stored in presets and remembered when the pedal is turned off.

The Raster's modulation section has seven LFO waveforms and an envelope follower that can be assigned to delay time (default), shift amount, or wet signal amplitude (tremolo).

The LFO waveforms are bipolar (-1 to +1). The **RATE** control adjusts the LFO frequency from approximately 0.05 Hz to 10 Hz. It can be synced to tap tempo and MIDI clock using the editor or MIDI continuous controller messages. The modulation waveform LED blinks at the LFO frequency (if **MOD DEPTH** is not off).

The modulation depth L/R control (**[ALT]-DEPTH**) will decreate the modulation amount on the right channel as it is turned left, and vice versa. It emphasizes modulation on the left (counter-clockwise) or right (clockwise) channel, with the maximum set by the **DEPTH** control. Moving the **DEPTH** control will affect both channels proportionally.

The **RATE** control has no effect on envelope and inverse envelope. Envelope modulation is unipolar, either up (envelope) or down (inverse envelope). For stereo inputs, the envelope detector uses the maximum of the left and right channels.

Delay modulation
(Default)

Delay modulation changes the pitch - like an analog or tape delay - as the Raster reads and writes the delay memory faster or slower.

LFO waveforms will modulate the delay time above and below the set delay time. That gives you modulated delay, chorus, flanging, and primitive pitch shifting sounds.

Envelope and inverse envelope will increase or decrease the delay time, respectively, as the signal level increases. It is most noticeable with short delay times and high feedback, and useful for dynamic flanging sounds. It can also be used to subtly bend the delay signal up or down on the attack of each note.

Shift modulation

The modulation signal is added to the **SHIFT** control position. For LFO waveforms, the shift amount will change smoothly above and below the control position.

Amplitude modulation

The **DEPTH** control sets the modulation depth similar to a tremolo control. Lower settings will give small changes in amplitude, while the maximum setting will completely mute the signal at the bottom of the waveform.

Inverse envelope modulation can create delay repeats that duck when a new note is played.

Structure Controls

The flexibility of the Raster comes from the way the pitch/phase/frequency shifter can be placed inside or outside of the feedback loop, assignable modulation, and three different delay structures. See "Signal Flow" on page 6 for illustrations.

Hold the **[ALT]** button and adjust the middle toggle switch to change the delay structure.

[ALT] Structure switch

sta	Series	Output of the left delay is fed into the right delay.
=	Parallel (default)	Forward delay with continuously shifted repeats.
><	Ping pong	Output of each delay is cross-fed to the input of the other delay.

Tempo Synchronization

Delay time and modulation can be synchronized to tap tempo or MIDI timing clock.

Modulation can be synchronized to tap tempo or MIDI clock using the editor or MIDI.

Raster V1 Controls

To use the Raster 2 like the Raster 1:
- Set the **RATE** and **DEPTH** controls to minimum (7:00).
- Set the delay range (◖ ●▬) toggle switch to the middle position.
- Set both lower toggle switches to the middle position.
- Set all of the alternate controls to 12:00.

The **SHIFT**, **FDBK**, **DELAY**, and **BLEND** knobs, shift mode switch, and feedback mode switch match the controls from the Raster 1. The delay time and control responses are similar, but audio quality is improved.

Control Input

The **CTRL** (control) input supports different methods of remotely controlling the pedal:
- Expression pedal
- Control voltage (CV) with 0-3.3V range
- Tap Tempo
- TRS MIDI in (tip active)
- Remote switch

To configure a expression pedal or remote switch, hold down the right footswitch while plugging it in. The pedal will detect which device is connected using the steps below. You can also use our web editor to configure the port.

The configuration is remembered when power is turned off. Expression pedal assignments and remote switch settings are stored in presets and remembered when power is turned off.

Expression Pedal

An expression pedal can be assigned to any combination of knob settings at the heel and toe position (up to 6 parameters). Moving the expression pedal will morph between the settings.

You can also calibrate the range of the expression pedal, to ensure that its full travel is used.

Calibrating Expression Pedal Range (no knob assignments):
1. Start with the pedal powered on and nothing plugged into the **CTRL** port.
2. Hold the right footswitch while plugging in the expression pedal. The right LED will blink yellow three times to indicate it is in **CTRL** configuration mode. You can release the right footswitch and begin configuration immediately.
3. Move the expression pedal to the heel down position.
4. Move the expression pedal to the toe down position.
5. Hold the right footswitch for 3 seconds to save the configuration. The right LED will blink green to indicate that the configuration has been saved.

Configuring Expression Pedal Knob Assignments
1. Start with the pedal powered on and nothing plugged into the **CTRL** port.
2. Hold the right footswitch while plugging in the expression pedal. The right LED will blink yellow 3 times to indicate it is in **CTRL** configuration mode. You can release the right footswitch and begin configuration immediately.
3. Move the expression pedal to the heel down position.
4. Adjust the knobs for the desired sound.
5. Move the expression pedal to the toe down position.
6. Adjust the knobs for the desired sound.
7. Hold the right footswitch for 3 seconds to save the configuration. The right LED will blink green to indicate that the configuration has been saved.

Knobs that are not adjusted during configuration will not be affected by the expression pedal. Expression pedal assignments are stored in presets and when the expression pedal is unplugged or power is turned off. Expression pedals with 5-25 kΩ linear potentiometers work best.

Control Voltage

Control voltage input is configured the same way as an expression pedal.

CV Range: 0-3.3V (with over/under-voltage protection)
Tip: 0-3.3V input
Ring: 3.3V output (with current limiting)
Sleeve: ground

The expression input has current limiting in case you use a TS cable, but it is preferable to use a 1/4" TRS cable with the ring unconnected. We sell a suitable cable at our web site, and the Expert Sleepers 'floating ring' cable is another option. Instructions for building your own cable are available on our Knowledge Base.

Tap Tempo

Uses a normally open momentary switch. Configure it using the web editor.

TRS MIDI

Select **MIDI (TRS)** in the web editor to use the control port as a MIDI input. This is a non-standard MIDI interface, because there is no optocoupler on the input to prevent current loops, but it is used by many guitar pedals. You will need a converter or a MIDI controller with 1/4" TRS outputs, which are available from Empress Effects, Disaster Area Designs, and others. Refer to our Knowledge Base for information.

Remote Switch

A remote switch has up to 4 modes of 4 switches that can access presets and pedal functions. It works with our remote switches, some third-party switches, and is DIY friendly for different control interfaces. See our Knowledge Base for infomation on building a compatible switch. Note that the switch uses parallel resistors, and switches with shorting contacts will not work without an adapter (most tap-tempo switches and the Roland FS-6, for example).

1, 2, 3, and 4-button switches are supported. The modes and functions accessible will depend on the number of buttons. A single-button switch can load or save your favorite sound.

To save a preset, hold the corresponding button for two seconds. The right LED will blink green to indicate that the preset has been stored. Presets are also accessible via the **PRESET** button and MIDI program change messages.

Configuring a Remote Switch:

1. Start with the pedal powered on and nothing plugged into the **CTRL** port.
2. Hold the right footswitch while plugging in the remote switch. The right LED will blink yellow 3 times to indicate it is in **CTRL** configuration mode. You can release the right footswitch and begin configuration immediately.
3. Press one of the buttons on the remote switch to select a mode.
4. Hold the right footswitch for 2 seconds to save the configuration. The right LED will blink green to indicate that the configuration has been saved.

Remote Modes

Mode	Switch	Function	LED Indication
1	A	Preset 1 Double tap: manual settings Hold (4 sec): save	Blinks green when saved
	B	Preset 2 Double tap: manual settings Hold (4 sec): save	Blinks green when saved
	C	Preset 3 Double tap: manual settings Hold (4 sec): save	Blinks green when saved
	D	Preset 4 Double tap: manual settings Hold (4 sec): save	Blinks green when saved
2	A	Left footswitch	
	B	Right footswitch	
	C	Preset down	
	D	Preset up	

Default configuration

The default control port configuration is expression pedal controlling delay time.

Web Editor

The web editor can be used to configure your pedal, access hidden parameters, and fine-tune presets. It is intended for "offline" configuration and editing. For live performance editing, we recommend using dedicated MIDI hardware or software and MIDI control change messages.

Connect your pedal to a computer using a USB cable and go to the web editor URL using Chrome:

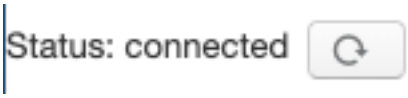
https://www.redpandalab.com/content/apps/raster-editor/index.html

Note the **https** in the URL. **http** will not allow the browser to acess your MIDI devices.

The editor uses Web MIDI, which is not supported by all browsers. We officially support Chrome.

Pedal Status

The web editor indicates whether the pedal is connected. If the status is "not found", ensure that the pedal is turned on and connected to your computer. Click the refresh button to refresh the status.



Edit

The Edit tab shows all of the pedal's realtime parameters. The on-screen controls are updated to match the current state of the pedal, but hidden parameters are not updated. Press the **Refresh** button to update all of the parameters. The web editor's controls allow higher resolution changes than MIDI continuous controller messages.

Ctrl Port

The Ctrl Port tab allows you to configure the pedal's **CTRL** port for an expression pedal or remote switch. The control port mode (expression or remote) is stored globally, but expression pedal assignment and remote switch configuration are stored in each preset.

The expression pedal can be assigned to up to 6 parameters, with a minimum/maximum range for each.

Preset

The Preset tab allows you to send MIDI program change messages and save presets to the pedal's onboard memory. Preset 1 is also available via the pedal's **PRESET** footswitch.

Config

The Config tab allows you to configure the pedal for your setup.

If the pedal detects an error condition, a diagnostic code will be displayed on this tab.

This tab also displays the installed firmware version and the input power supply (PSU) voltage. A low PSU voltage may indicate that the power supply is not able to provide enough current to properly power the pedal.

Help

The **Show MIDI Devices** button on the Help tab will display all of the MIDI devices accessible by your browser.

Reset to Factory Defaults

Use the following procedure to reset the Raster's configuration data to factory default settings. This will erase any advanced configuration and control port settings, but presets will not be affected. Note that this is rarely useful for troubleshooting problems with your pedal.

1. Start with the pedal unplugged.
2. Set the delay range and right footswitch mode toggle switches to the left.
3. Press and hold the **ON** footswitch while plugging in power. The right LED will be solid blueish white.
4. Move the delay range and right footswitch mode toggle switches to the right.
5. Release the ON footswitch.
6. When the factory reset is complete, the LEDs will cycle through different colors.
7. Power cycle the pedal to continue.

Effects Design With the Raster 2

The Raster 2 combines delay, modulation, pitch, phase, and frequency shifting (all in stereo). It is capable of a wide range of delay-, pitch-, and amplitude-based effects. Some effects can be acheived multiple ways, with slightly different sounds. Some are approximations of commonly-used techniques, which give you familar effects with unique textures.

We will expand this section with more effects and details in future versions of the manual, and stay tuned to our YouTube channel or social media for video tutorials.

Basic Delay

Set the alternate controls (gray labels) to 12:00. Start with all toggle switches in their center positions. Set **RATE** and **DEPTH** to minimum (7:00). Set the **SHIFT** control to noon and turn off the **SHIFT** footswitch. The **BLEND**, **FDBK**, and **DELAY** control act as a three knob delay. The delay range switch will change the delay time to 400 ms, 800 ms, or 1600 ms.

To have the **BLEND** control act as an effect level control instead of wet/dry blend, use the editor to set the bypass mode to **Analog + FX Level**.

Analog Voiced Delay

Start with the "Basic Delay" sound. Set the tone control (**[ALT]-FDBK**) to 9:00 or lower for a dark delay sound.

Modulated Delay

Start with the "Basic Delay" or "Analog Voiced Delay" sound. Set the modulation **WAVE** to sine (●○○○) or triangle (●●○○) and adjust the **RATE** and **DEPTH** controls for a modulated delay sound.

Try the smooth random waveform (○○●●) for a constantly changing sound.

Stacked Delays

Use the series structure (▪▪) so that the left delay is fed into the right (page 6). Set the delay L/R ratio (**[ALT]-DELAY**) between 8:00-9:00 so the first (left) delay is shorter (1:3 or 3:8 ratio). Set the **DELAY** control around 1:00 using the medium delay range (●). Start with the **FDBK** control around 10:30.

Set **WAVE** to triangle (●●○○). Set the modulation depth left/right balance (**[ALT]-DEPTH**) to 5:00 so no modulation is applied to the first (left) delay, then set the **RATE** and **DEPTH** controls to 9:00 for sublte pitch modulation.

Glitchy Pitch Shifting

To simulate glitchy, unstable pitch shifting, set the modulation destimation to **SHIFT** (**[ALT]-**). Use transpose (♫) mode with **SHIFT** set to 5:00 for one octave up and **BLEND** at 12:00.

MIDI Continuous Controller Messages

CC Num	Destination	Notes	
4	Expression pedal	CTRL input	
14	Blend		
15	Blend L/R tilt		
16	Shift		
17	Shift L/R tilt		
18	Delay time		
19	Delay time L/R tilt		
20	Feedback		
21	Feedback L/R tilt		
22	Modulation rate		
23	Modulation phase L/R tilt		
24	Modulation depth		
25	Modulation depth L/R tilt		
26	Tone		
80	SHIFT/TAP footswitch	Use gated mode to send 127 on press and 0 on release. Matches footswitch behavior.	
		0-63 64-127	Off (release) On (press)
81	ON footswitch	Use gated mode to send 127 on press and 0 on release. Matches footswitch behavior.	
		0-63 64-127	Off (release) On (press)
88	Bypass (Receive only)	0-63 64-127	Bypass Effect On

Using MIDI

Your pedal supports USB MIDI (in/out) and 1/4" TRS MIDI (input only). Every parameter (and more) is fully controllable, allowing you to synchronize the pedal with sequencers, integrate it with your DAW, and change presets on multiple pedals with one button during a performance. Even if you do not use MIDI directly, it is the underlying protocol for our web editor and pedalboard controllers.

USB MIDI

Your pedal is a class-compliant USB device, which allows you to:

- Control all parameters
- Access additional hidden parameters

The pedal can work with any USB MIDI host, including:

- Macintosh and Windows computers. The pedal shows up as a MIDI device and is available to all programs.
- Apple iPad, iPod touch, and iPhone using the Lightning to USB 3 Camera Adapter.
- Standalone USB MIDI hosts allow you to connect the Tensor to hardware with 5-pin DIN MIDI connectors without the use of a computer. Examples include:
  iConnectivity iConnectMIDI4+
  iConnectivity mio4
  Disaster Area Designs Gen3 MIDI controllers with their gHOST option
  Kenton MIDI USB Host MkII
  MidiPlus USB MIDI Host
  See our Knowledge Base for up-to-date information

The pedal sends and receives on MIDI channel 1 by default. You can change the MIDI channel using MIDI System Exclusive messages or our web-based editor. The MIDI channel is remembered when power is off. See "System Exclusive (SysEx)" on page 36 for more information.

TRS MIDI Input

See "Control Input" on page 22 for information about configuring TRS MIDI. Only MIDI input is supported, so you can use the web editor to change parameters and configuration settings, but it will not show the current state of the pedal.

Troubleshooting

A utility program that displays MIDI messages can be useful for tracking down MIDI configuration problems. Examples are MIDI Monitor (Mac OS), MIDI-OX (Windows), and Pocket MIDI (Mac OS and Windows)..

See our Knowledge Base for more troubleshooting information.

CC Num	Destination	Notes	
89	Tap (Receive only)	64-127	Remote tap
90	Shift on/off (Receive only)	0-63 64-127	Shift off Shift on
102	Modulation waveform	0 1 2 3 4 5 6 7 8	Sine Triangle Ramp up Ramp down Square Random step Random smooth Envelope Inverse envelope
103	Modulation destination	0 1 2	Wet amplitude (tremolo) Shift Delay time (default)
104	Shift mode	0 1 2	Transpose Detune Phase/frequency shift
105	Delay structure	0 1 2	Parallel (default) Ping pong Series
106	Feedback mode	0 1 2 3	Forward Forward / shift once Reverse Reverse / shift once
107	Delay range	0 1 2 3	400 ms 800 ms 1600 ms 3200 ms (1600 reverse)
108	Delay note division	See “Note Divisions” table	
109	Modulation note division	See “Note Divisions” table	
110	Receive MIDI clock (global)	0-63 64-127	Off On (default)
111	Trails mode	0 1 2	Off On Use global setting
112	Left footswitch mode*	0 1 2	Shift momentary Shift latch Tap

CC Num	Destination	Notes	
113	Right footswitch mode*	0 1 2	Momentary Latch Mute output in bypass
114	Shift link left/right channels	0 1	Linked (tilt, default) Independent
119	Feedback invert**	0-63 64-127	Off On

* indicates values that are remembered when pedal is turned off, but not saved in presets.

- ** indicates values that are saved in presets, but not remembered when pedal is turned off.

Note Division Continuous Controller Values

Delay time range: 1/128th note to whole note.

Modulation rate range: 1/32nd triplet to 8 measures.

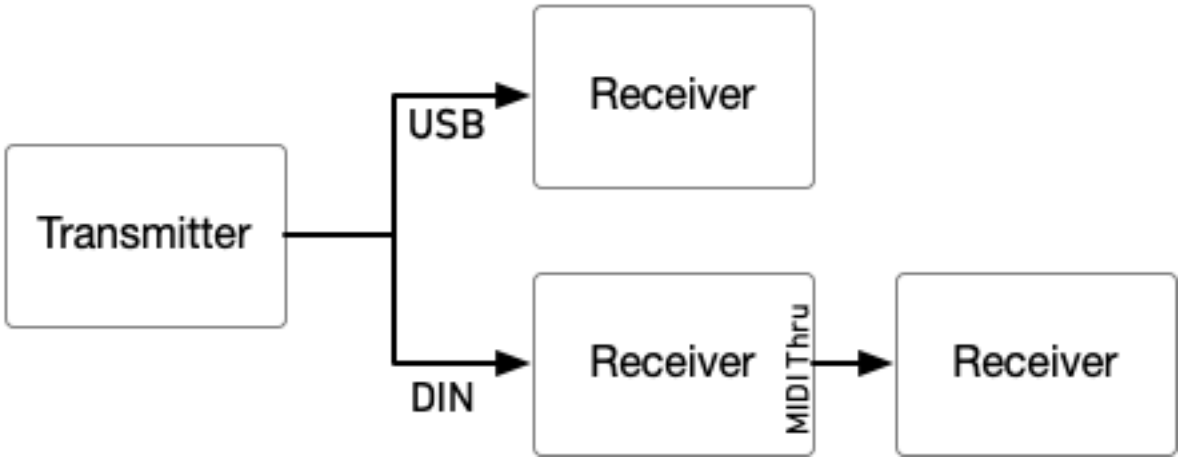
CC Value	Note Division
0	Off (tap tempo disabled)
1	8 measure
2	7 measures
3	6 measures
4	5 measures
5	4 measures
6	3 measures
7	2 measures
8	2 measure triplet
9	Dotted whole note
10	Whole note
11	Whole note triplet
12	Dotted half note
13	Half note
14	Half note triplet
15	Dotted quarter note
16	Quarter note
17	Quarter note triplet
18	Dotted eighth note
19	Eighth note
20	Eighth note triplet
21	Dotted 16th note
22	16th note

MIDI Timing Clock

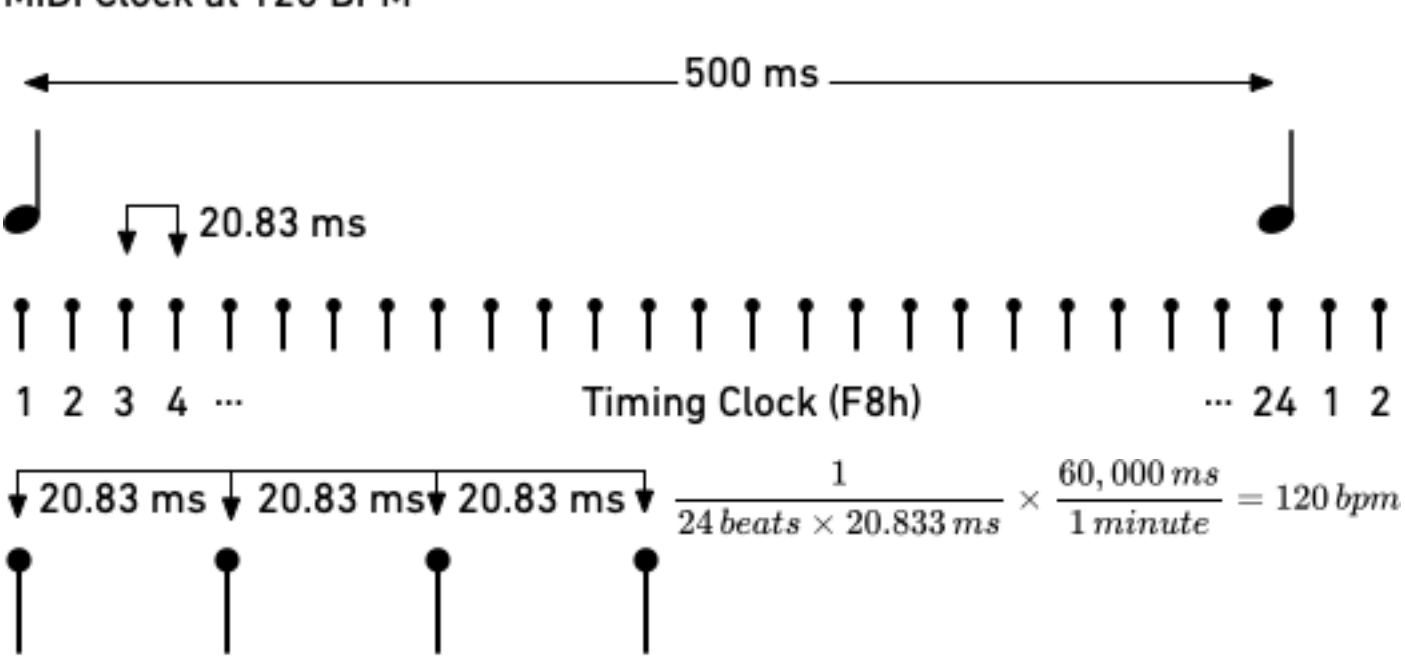
MIDI timing clock messages are used to synchronize multiple MIDI devices to a single clock transmitter. The clock is typically provided by a DAW in computer-based setups and a sequencer or drum machine in hardware-only setups. Dedicated MIDI clock generators are available for more complicated setups that need tight synchronization, and some devices can convert between MIDI clock, DIN sync, and taps.

How MIDI clock works

MIDI clocks are sent out at regular intervals by a clock *transmitter* to one or more *receivers*. The transmitter controls playback and sets the tempo.
The transmitter never tells the receivers the actual tempo. Instead it sends 24 timing clock messages

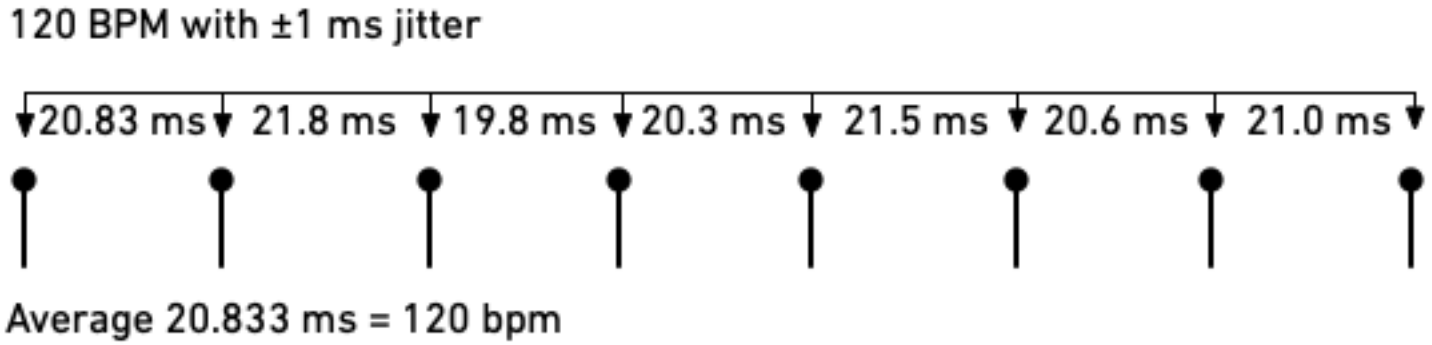


every quarter note (24 PPQ) and the receivers each calculate the tempo independently.
Start, stop, and continue messages are used to synchronize playback between devices. The transmitter



continues sending timing clocks when it is stopped so that receivers can be ready when playback starts or continues. A start message will reset playback to the first beat, and a continue message will pick up where playback left off.

MIDI real time messages are high-priority messages that can interrupt other MIDI messages to ensure the best possible syncronization timing. However, the accuracy of the clock depends on the transmitter and any devices it passes through. It is common to have +/-1 milliseconds of *jitter*, with is irregular timing due to individual clock ticks arriving too early or too late. All equipment that receives MIDI clock needs to smooth out the timing to maintain a stable tempo. The smoothing algorithm needs to handle jitter, but also track sudden or gradual tempo changes accurately and naturally. Different manufacturers use different synchronization algorithms, which can lead to sloppy timing. This was more of a problem with older MIDI equipment that had slower processors and complex setups with long MIDI chains and routers. It can also be a useful technique, synchronizing multiple hardware sequencers to give each musical part a slightly different timing and feel.



Some devices do not transmit start, stop, and continue messages, so the pedal will begin synchronizing if it receives a MIDI timing clock message without a start or stop message first.

Comparison to tap tempo

Tap tempo is set by tapping quarter notes on a footswitch. It is simpler to set up, but is not synchronized to other equipment unless you are using a multi-pedal tap tempo controllers. Tap tempo controllers have an electronic switch on each output that simulates a footswitch press.

Neither tap tempo nor MIDI timing clock sends tempo information. The pedal calculates the tempo from the input and adjusts to tempo changes. Because MIDI timing clock sends 24 clock ticks per quarter note instead of 1 tap per quarter note, it enables tighter synchronization between equipment.

Note divisions for the pedal's parameters are configured the same way for tap tempo and MIDI clock, so you can switch between methods for recording and live use.

Configuring your pedal for MIDI clock

In the web editor's **Config** tab, set **Receive MIDI Clock** to On. You can also send MIDI continuous controller #110 to the pedal with a value of 64-127. The MIDI clock setting is remembered when power is turned off.

Setting note divisions

Configure note divisions using the pedal's "shift" mode, or using the web editor. See "Note Division Continuous Controller Values" on page 32 for information about note divisions for each parameter.

CC Value	Note Division
23	16th note triplet
24	Dotted 32nd note
25	32nd note
26	32nd note triplet
27	Dotted 64th note
28	64th note
29	64th note triplet
30	Dotted 128th note
31	128th note

MIDI System Exclusive Messages

The Raster uses MIDI System Exclusive Messages to get and set configuration properties and state. The following System Exclusive messages can be used to configure the Raster, read current configuration, and access other functionality that is not available through standard MIDI messages (for example, saving presets to internal memory). You can use these messages to write a custom editor or configure a MIDI controller to control the Raster.

The basic format is the same for all messages:

Byte (hex)	Description
F0	System Exclusive (SysEx)
00	Red Panda ID byte 1
02	Red Panda ID byte 2
23	Red Panda ID byte 3
01	Raster family ID
04	Raster product ID
00	Message version
1 byte	Message type: 0x34: get property 0x35: reply to get property 0x36: set property
2 bytes	Property ID
nn bytes	Property data (length depends on ID)
F7	End of Exclusive (EOX)

Example: Save Preset to Internal Memory 3

Byte (hex)	Description
F0	System Exclusive (SysEx)
00	Red Panda ID byte 1
02	Red Panda ID byte 2
23	Red Panda ID byte 3
01	Raster family ID
04	Raster product ID
00	Message version
36	Set property
7F	Save preset to memory byte 1
13	Save preset to memory byte 2
03	Preset location (0-based program change number)
F7	End of Exclusive (EOX)

Properties

Firmware Version

Get	Set	ID 1	ID 2	Data Bytes	Data
X		7F	01	8	Firmware version: 0: Major 1: Minor 2: Patch 3: Release type (ascii) 4-7: Build number

Returns the firmware version.

Input voltage

Get	Set	ID 1	ID 2	Data Bytes	Data
X		7F	0B	2	100 * PSU voltage in Volts

Returns the approximate input voltage. Can be useful for diagnosing power issues.

Maximum input level (headroom)

Get	Set	ID 1	ID 2	Data Bytes	Data
X	X	7F	10	1	02: +5.2 dBu max (4.0 Vpp) (default) 03: +0.5 dBu max (2.3 Vpp) 04: +8 dBu max (5.7 Vpp) 05: +12 dBu with -3 dB pad

Adjusts the input/output gain to accommodate different signal levels.

Bypass Mode

Get	Set	ID 1	ID 2	Data Bytes	Data
X	X	7F	11	1	01: analog bypass 02: DSP bypass 03: kill dry 05: analog + FX level (unity gain analog dry)

Input / Output Configuration

Get	Set	ID 1	ID 2	Data Bytes	Data
X	X	7F	15	1	00: mono in / mono out 01: mono in / stereo out 02: stereo in / stereo out

MIDI Channel

Get	Set	ID 1	ID 2	Data Bytes	Data
X	X	7F	12	1	00: channel 1 (default) 01: channel 2 ... 0F: channel 16

Get or set MIDI channel.

Save preset

Get	Set	ID 1	ID 2	Data Bytes	Data
	X	7F	13	1	Preset location (MIDI program number)

Save a preset to internal memory.

Get / Set Parameter Value (high resolution)

Get	Set	ID 1	ID 2	Data Bytes	Data
X	X	*yy*	*yy*	1	U1.23 fixed point value encoded as 4 7-bit digits

Uses internal parameter IDs to get and set parameters with high resolution. The property IDs (*yyyy*) are not currently documented, but can be found using our web editor and a MIDI monitor. We reserve the right to change the IDs and data format, so please email us if you plan to use them (or have any questions). Values are unsigned 1.23 fixed point numbers from 0 to 1, inclusive.

Support, Repairs, and Warranty

Technical Support

Please register your product at redpandalab.com/register within 30 days of purchase.

For technical support, send your question via email to support@redpandalab.com or use the contact form on our web site. Be sure to include your serial number. We are a small company with limited resources for technical support, so it might take us a few days to reply.

Product manuals and firmware updates are available at redpandalab.com/support

Repairs

If you think your product needs repair, first send an email with your serial number and a description of the problem to support@redpandalab.com. We may be able to get you up and running again without sending in the pedal, but if it does need repair we will arrange for it to come back to us or an authorized service center close to you. Warranty repairs are done for free, and non-warranty repairs will be done at the lowest possible cost to you.

Warranty

ONE YEAR LIMITED MANUFACTURER'S WARRANTY

1. Limited Warranty. For one (1) year following the date of purchase, Red Panda, LLC will repair or replace, in its sole discretion, the Product, in order to correct defects in material or workmanship that existed when the Product was purchased (collectively, "Manufacturing Defects". For purposes of this Limited Warranty, "Manufacturing Defects" includes only defects in the Product at the time of purchase and does not include normal wear and tear, modification post-sale, misuse, accidental damage or destruction, or other abuse occurring after purchase.

2. SOLE AND EXCLUSIVE REMEDY. THE REPAIR AND/OR REPLACEMENT OF THE PRODUCT SHALL BE THE SOLE AND EXCLUSIVE REMEDY FOR MANUFACTURING DEFECTS. PROOF OF ORIGINAL PURCHASE DATE IS REQUIRED TO RECEIVE REPAIR OR REPLACEMENT OF THE PRODUCT.

3. DISCLAIMER OF IMPLIED WARRANTIES. IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED TO ONE YEAR OR THE SHORTEST PERIOD ALLOWED BY LAW. RED PANDA MAKES NO REPRESENTATIONS REGARDING THE PERFORMANCE OF, THE QUALITY OR THE DURABILITY OF THE PRODUCT OTHER THAN THOSE EXPRESSLY SET FORTH HEREIN.

4. LIMITATION OF REMEDIES, EXCLUSION OF INCIDENTAL AND CONSEQUENTIAL DAMAGES. THE SOLE AND EXCLUSIVE REMEDY UNDER THIS LIMITED WARRANTY SHALL BE PRODUCT REPAIR OR REPLACEMENT AS PROVIDED HEREIN. RED PANDA SHALL NOT BE LIABLE FOR ANY INCIDENTIAL OR CONSEQUENTIAL DAMAGES. Some states and countries do not allow this exclusion or limitation, so these limitations and exclusions may not apply to you.

5. Return and/or Replacement of Product due to a Manufacturing Defect. In the event of believed manufacturing defect, you should contact Red Panda at support@redpandalab.com, with the date of original purchase, a copy of the receipt and a description of the asserted Manufacturing Defect. Red Panda will, at its sole discretion, notify you to return the Product at the specified location or, alternatively ship a replacement Product within thirty (30) days of receipt. You are solely responsible for the payment of shipping costs and expenses to ship the Product to Red Panda. Red Panda will pay the cost of shipping the repaired or replacement Product to you. If the Product is returned for service and/or repairs, Red Panda will complete the repairs within sixty (60) days of receipt and ship the Product back to you. The Product will be warranted for the remaining term of the original Product's warranty period.

Firmware Updates

The Raster's firmware can be updated via drag and drop using any Mac or PC. No driver or special software is required.

To tell which version of firmware your pedal is running:

1. Hold down the SHIFT (left) footswitch and connect power.
2. The right LED will blink blue.
3. Continue holding the SHIFT footswitch for 2 seconds.
4. The LED will turn solid blue. The pedal is now in USB Mass Storage mode.
5. Connect the pedal to the computer using a mini USB cable.
6. Open the RASTER or USB DRIVE drive on your computer.
7. Open the VERSION.TXT file in a text editor.

Downloading the new firmware

1. Go to http://www.redpandalab.com/downloads/#raster
2. Download the firmware (.zip) file to your computer.
3. Unzip the downloaded file to extract the binary firmware file (.bin).

Caution

- Do not rename the extracted file.
- Never turn off the pedal's power while an update is in progress. Otherwise the system software or the pedal itself may be destroyed.

Update procedure:

1. Hold down the SHIFT (left) footswitch and connect power.
2. The right LED will blink blue.
3. Continue holding the SHIFT footswitch for 2 seconds.
4. The LED will turn solid blue. The pedal is now in USB Mass Storage mode.
5. Connect the pedal to the computer using a mini USB cable.
6. Open the RASTER or USB DRIVE drive on your computer.
7. Drag and drop the firmware binary (.bin) file to the drive.
8. The preset LEDs will blink to show progress.
9. After the firmware update is complete, the right LED will turn solid green.
   If the firmware update seems to stall, eject the drive from your computer and it should resume. If not, retry the procedure.
10. If an error occurred, the red LED will blink instead.
11. Eject the RASTER or USB DRIVE drive from your computer:
    Mac: click the eject button or drag the icon to the trash
    Windows: right-click on the icon in My Computer and select "Eject"
12. Disconnect the USB cable.
13. Turn the pedal's power off.

Troubleshooting

If the left LED blinks red or the process stalls, turn the Raster off, then on, and try again.

If you continue to have problems, please email support@redpandalab.com. Please tell us what type of computer and which operating system version you are using.

Specifications

Maximum input level:	+0.5 dBu (high gain) +5.2 dBu (default) +8 dBu (max with unity gain) +12 dBu (max with -3 dB pad)
Frequency response:	20-20 kHz, +0/-0.5 dB
Input impedance:	1 MΩ
Output impedance:	< 1 kΩ
Bypass:	analog buffered or DSP
Power supply:	9V DC, center negative
Power connector:	2.1mm I.D. x 5.5mm O.D. barrel connector
Power consumption:	250 mA
Dimensions:	78 (W) x 124 (D) x 59 (H) mm 3.1 (W) x 4.9 x 2.3 (H) inches
Weight:	0.4 kg / 14 oz

Credits

Design and engineering	Curt Malouin
Documentation	Curt Malouin
Web editor	Curt Malouin
Graphics	Sylvie Demers Morgan Marentic
Testing	Eric Iverson Randy Molina