ELECTRONIC AUDIO EXPERIMENTS

OBSTRUCTURES

Technical Manual

0xEAE Fuzz

Revision B

May 23, 2023

John W Snyder

1 Introduction

Thank you for purchasing the 0xEAE Fuzz, the second collaboration pedal from Electronic Experiments and Obstructures. This manual is an in-depth guide for properly understanding and enjoying your pedal. Below is a bit of context. If you would like to skip ahead to how the pedal works, look for the Detailed Operating Instructions section below.

The aesthetic format of the 0xEAE Boost has become a blank canvas for the realization of other auditory power tools. With more utilitarian needs addressed, we set our sights towards wilder and weirder sounds. We stripped away any pretense of transparency or fidelity in a brute force, single-minded pursuit of extreme fuzz.

The 0xEAE foundation consists of an over-built power supply and a robust buffered relay bypass scheme. The fuzz circuit is built on this framework. From a conceptual standpoint its design is starkly minimal: at its core, cascaded op amp gain stages attempt to amplify the signal by a factor of 10000 (80dB), failing gloriously in the process. At the input is a lightly resonant high pass filter controlled by the Weight slider, which dramatically alters the feel of the gain stages from sharp to sludgy. But the real centerpiece of this fuzz is the Texture control, which blends an analog octave up into the input of the fuzz. By using a precision full-wave rectifier, the signal is folded on itself for an extremely prominent 2nd harmonic plus several other tonal and atonal artifacts. With this slider you can get something approximating a classic octave sound, or you can completely annihilate your signal with intermodulation products far beyond a vintage style octave fuzz.

We are extremely proud of this pedal and hope you enjoy it. Thanks for reading!

John Snyder (EAE)
Matt Hall, Brian Johnson, Nathan Matteson (Obstructures)

2 Power and I/O

To power your 0xEAE Fuzz, use a standard, reliable 9VDC center-negative supply with a 2.1mm barrel tip. The pedal has a current draw of approximately 200mA when active. An isolated power supply is preferred when using a signal chain consisting of multiple pedals. Recommended brands include Truetone™, Voodoo Lab™, Cioks™, etc.

The power input is protected against over-voltage, under-voltage, and reverse polarity conditions up to ±20V. The unit will not turn on if an incorrect power supply is used. Please note that all Electronic Audio Experiments products do not use batteries.

Use standard 1/4" patch cables to patch the 0xEAE Fuzz into a pedal chain, as normal. The input jack is on the top right and the output jack is on the top left.

3 Controls

The controls are as follows:

Level Output volume level. Slide right to get loud. Very, very loud.

Texture Slide right to blend in an analog octave up at the input of the fuzz circuit. Low settings add broken harmonics, high settings add a strong 2nd harmonic with harsh overtones and sub-bass artifacts.

Gain Primary gain stage. Slide right to add gain up to an irresponsible +80dB. For conventional sounds, keep below halfway. This control is not for the meek. Expect, embrace, and channel the noise.

Weight Changes the cutoff of a high pass filter at the input to alter the attack and thickness of the fuzz. Slide left for a tight attack, slide right for crushing bass frequencies. Highly interactive with the Texture and Gain controls.

Footswitch Activates the effect.

The 0xEAE Fuzz has soft-touch electronic switching with buffered bypass. When the effect is disengaged, your signal passes through a high-headroom op amp buffer to preserve its integrity over long cable runs and ensure a consistent high-impedance load to your instrument.

4 Detailed Operating Instructions

4.1 Using the Pedal

When applying power to the Boost, allow the power supply about half a second to stabilize. The bypass LED will light up briefly and then turn off.

To start, set the Texture and Weight sliders to the left position with Gain and Volume centered. Press the footswitch to engage the fuzz. The LED will glow violet to indicate the effect is active. The resulting tone should be a sharp, distorted sound with a sizzly high end. To thicken it up, increase the Weight slider and observe how the attack of the fuzz changes. Higher Weight settings will impart a slowness or sag to the dynamic response (especially noticeable on palm mutes) while also increasing the bass content and sustain. These controls go far beyond the typical ranges and well into noisy, unstable territory. If both the Weight and Gain sliders are up high, feedback and noise may result. For very bass heavy settings you may want to reduce the Gain to compensate. At lower settings of the Gain and Weight sliders, the fuzz circuit behaves more like a tight distortion sound which is also quite useful. And, of course, the Level slider is capable of extremely high output volumes if amp smashing is desired.

The Texture slider deserves extra attention. Sliding right blends an analog octave up at the input of the circuit. Analog octave circuits are found in many kinds of fuzz pedals and are great for adding a searing, scrambled quality that occasionally sounds like a ring modulator. Our implementation is unique in a few ways, but can achieve some familiar sounds. Like any good analog octave circuit, it will freak out if you play chords. But, you can get a clear octave up if you use your neck pickup, roll back your guitar's tone knob to zero, and play around the 12th fret. It is worth nothing that, because the octave circuit is placed before the Gain control, the Texture and Gain sliders will interact in unique ways. For high Texture settings, it is usually worth reducing the Gain. Weight will also interact with the Texture setting. Cut bass for a thin, broken sitar sound, or add bass to overload the octave circuit and emphasize the sub frequency content it creates. For more on how this circuit achieves its distinctive sound, read below.

4.2 On Analog Octave Circuits

Analog octave circuits have a unique way of operating, and I thought this manual would be a good opportunity to talk about that. The octave circuit in the 0xEAE Fuzz consists of a precision full-wave rectifier. A rectifier circuit flips the negative side of a waveform in the positive direction. Math nerds will recognize this as the absolute value or $|x|$. If x is greater than or equal to zero, it is not changed. If it is less than zero, it is made positive. Rectifiers are traditionally used in power supplies to convert AC voltages to DC voltages. But, they're a useful signal processing tool as well. The sonic impact is better shown than told. The graphs in Figure 1 show what happens to various input signals when they pass through the rectifier circuit.

By "folding" the negative-going half of a sine wave up, the output strongly resembles a signal with twice the frequency of the input—in other words, an octave up. The first two graphs display this in action. It's not a perfect octave up because the bottom side is still

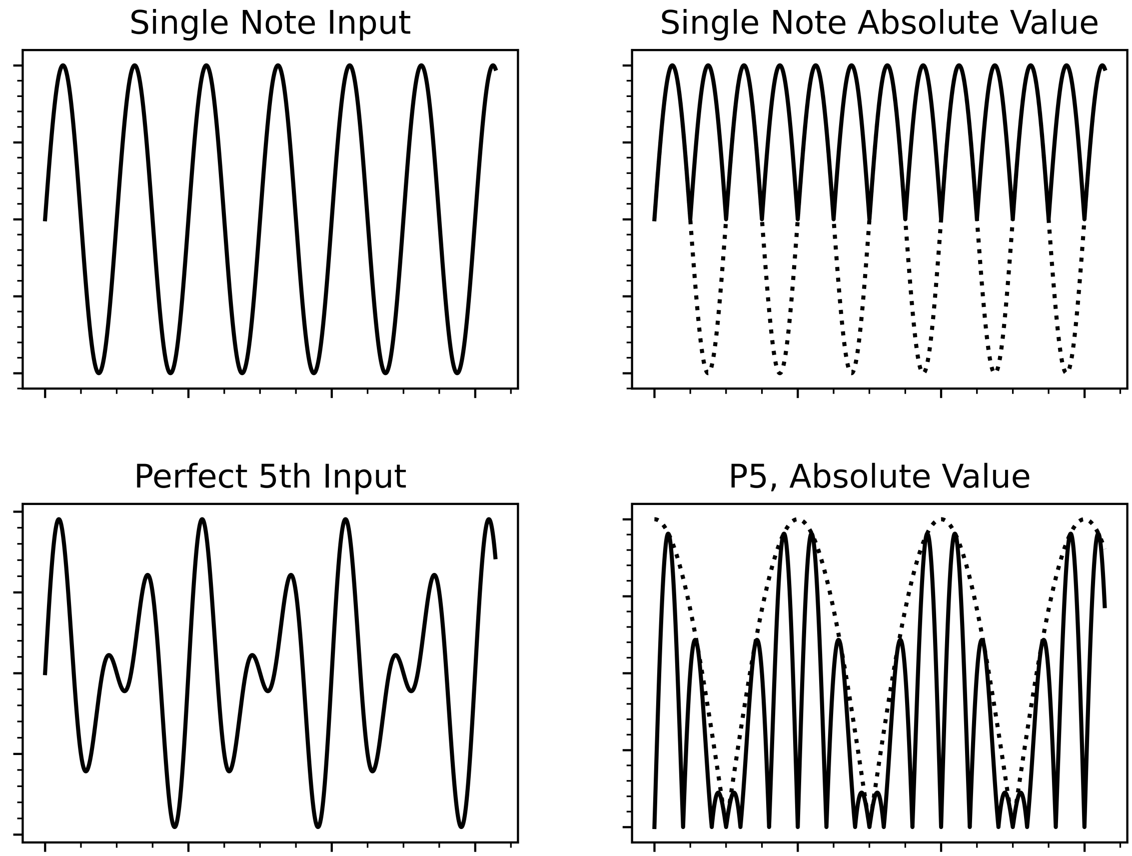
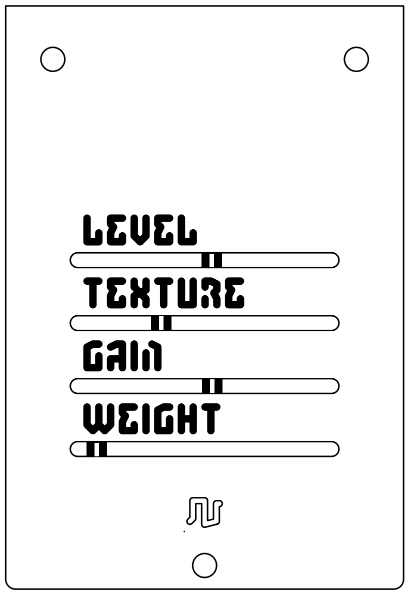


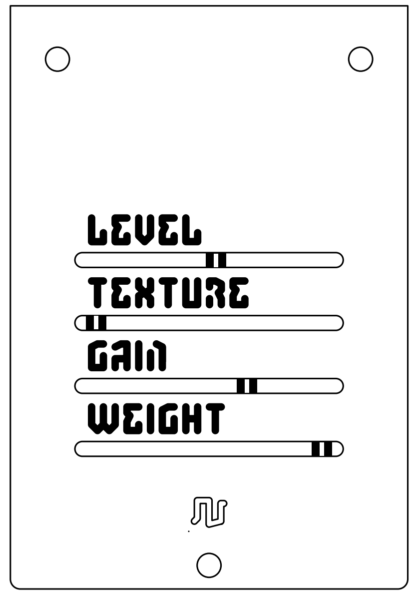
Figure 1: Impact of a rectifier on various signals.

pointy (technical term), but this works pretty well for single notes that are as close to a pure tone (sine wave) as possible. As the input signal becomes more complex, the output breaks down in fascinating ways. By complex, I mean anything more than just a pure sine wave. This is why analog octave circuits are good for fuzz pedals, and why DSP is the preferred medium for pitch shifting effects where clean, predictable tracking is required. As an example we use a perfect 5th as an input signal. The 5th of a note is 1.5 times its frequency. Already, we can see some strange results. By applying the $|x|$ function to two sine waves a perfect 5th apart, new frequencies emerge. The dotted line in the last graph shows a frequency component equal to 0.5 times the fundamental—in other words, an octave down! (Technically, this more closely resembles the absolute value of two octaves down, which is sort of like one octave down, but you get the idea.) This is an example of how analog octave fuzzes can sound so massive with power chords. I speculate that this is why some classic units like the Foxx Tone Machine and the Univox Superfuzz have an aggressive notch filter at the output, because it helps to emphasize the sub frequencies that chords can generate. This analysis barely scratches the surface, but can hopefully give you an idea of why octave fuzzes sound so distinctive.

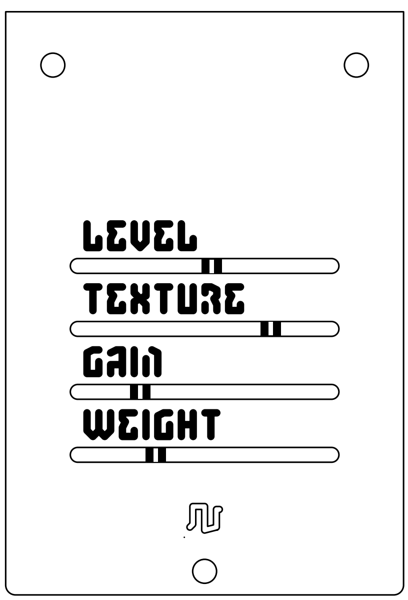
5 Suggested Settings



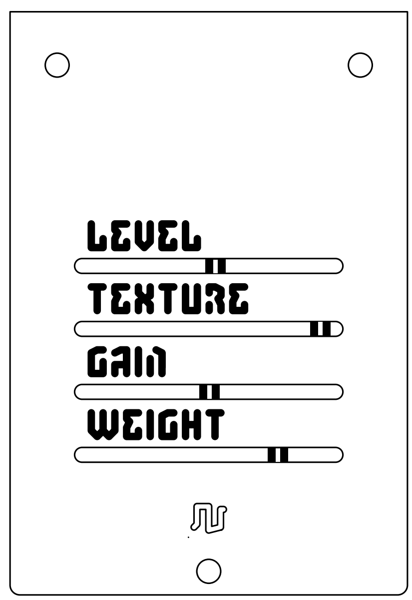
(a) Speaker Rippage



(b) Smelting Accident



(c) Angle Grinder



(d) Beyond Recognition

Figure 2: Some settings to try. These should help familiarize you with the controls and how they interact. Level is just a suggestion and can be set to taste.

Revision History

Revision	Changes
B	Fixed typos, updated incorrect image in suggested settings
A	Original Release