

ELECTRONIC AUDIO EXPERIMENTS

Technical Manual

Halberd

Version 2

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1 Introduction

Thank you for purchasing the Electronic Audio Experiments Halberd. This manual is an in-depth guide for properly understanding and enjoying your pedal.

The Halberd is a transistor-based overdrive engineered for i) high dynamic range, ii) superior note clarity, and iii) musical shaping of an instrument's frequency response into an overdriven amplifier. The Halberd tends towards a jagged treble response, which is a result of my affinity for the tones of 90s post hardcore bands and (somehow also) Neil Young. I would hesitate to call it a transparent drive, because it does not automatically preserve the tone of one's signal chain. It is more like a chameleon, responding in a unique way to different pickups, string gauges, picking attack, even chord voicings. The pre-gain Depth control shapes the gain in a tactile fashion, allowing the user to morph their transients from sharp and immediate to fuzzy and blown out.

The signal path of the Halberd is comprised of discrete transistor gain stages. Integrated circuits, such as the op amps found in our Longsword drive (and countless other pedals), consist of many transistors working in tandem—so many that the quirks of individual devices are smoothed over, and the function of a particular amplifier block becomes abstracted into arithmetic. Filters and gain stages may be configured in a straightforward and predictable manner via external components. In contrast, when working with single transistors the bias, gain, and frequency response all interact in a dynamic and nonlinear fashion. Of course, no approach is inherently superior. But I feel that the unique qualities of the Halberd come from embracing the quirks and nonlinearities of discrete transistors while channeling them into something controllable and decidedly modern.

While the Halberd began as a standalone iteration of the preamp in our Sending delay, originally released in summer 2018. The concept was transformed and refined through several months of intense and occasionally manic engineering development. The final outcome would never have been possible without the help of some relentlessly discerning beta testers. In particular, I would like to thank Bryan from Soursound and Matt from Electrofoods U Ltd. for their critical ears, sage circuit advice, and encouragement.

In 2021 we decided to develop Halberd V2 in a smaller form factor. While doing so, we successfully designed out the hard-to-source new old stock germanium transistor, reduced the power consumption by over 60%, and added a new Voice toggle to provide expanded tonal options.

I am extremely proud of this pedal and hope you enjoy it. Thanks for reading!

-John Snyder, EAE

2 Product Changelog

Version 2

Released in August 2021

- New mechanical form factor; size reduced from BB-type enclosure to 125B-type enclosure.
- NOS germanium transistor no longer used. Circuitry updated accordingly to preserve tonal characteristics¹.
- Current draw reduced to 50mA when engaged (previously ~180mA in V1)
- Added Voice toggle.
- Added PSU input over-voltage protection.
- Low control renamed to Depth; High control renamed to Tone.

Version 1

Original release in Fall 2019. Built in a BB-type enclosure and uses a NOS Germanium transistor in one of its gain stages.

¹The germanium transistor in V1 required careful selection as well as an extra calibration procedure during assembly. When replacing it with a silicon transistor we optimized the filtering and clipping response to closely resemble the original design and subtly improve where possible. The end result is, in fact, slightly smoother sounding than V1 at low gain.

3 Power and I/O

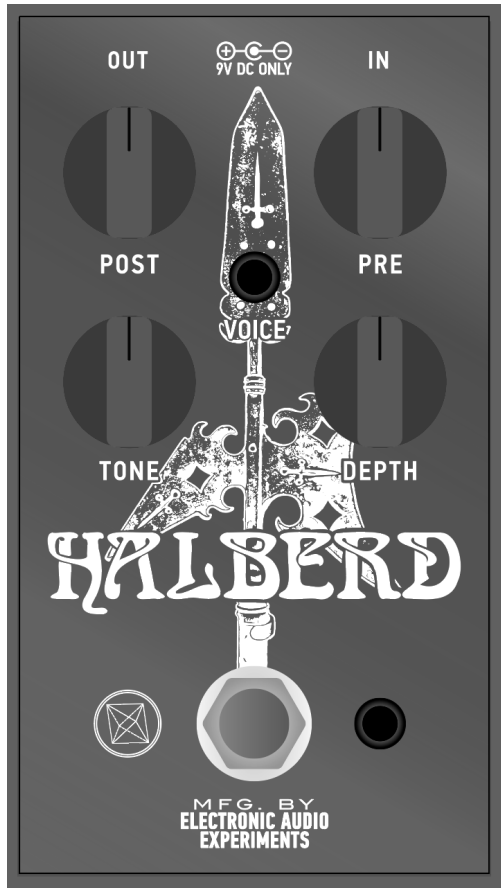
To power your Halberd, use a standard, reliable 9VDC center-negative supply with a 2.1mm barrel tip. The Halberd has a current draw of 50mA when active. We suggest the use of an isolated power supply when using the Halberd in a signal chain with several pedals. Recommended brands include Truetone™, Voodoo Lab™, Cioks™, etc.

The power input is protected against over-voltage, under-voltage, and reverse polarity conditions. 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.

<p>⚠ Warning: Halberd V1 units have a current draw of 180mA and will be damaged if a supply other than 9V is used.</p>

Use standard shielded 1/4" cables to patch the Halberd into a pedal chain. The input jack is on the top right and the output jack is on the top left.

4 Controls



Pre Overall input gain level. Turn clockwise to increase overall signal gain. Lower settings impart light compression, then increasing amounts of clipping up to a medium overdrive, depending on pickup output and the Depth setting.

Depth Adjustable low frequency shelving filter at the input. Turn clockwise to increase the bass content and produce a round, fuzzy drive tone. Turn counterclockwise to cut bass for a tighter or more clangy sound. Very interactive with the setting of the Pre control.

Tone Adjustable high shelf cut at the output. Turn clockwise to open up high frequencies, or turn counterclockwise for a darker tone. When below about 9:00, it can produce an effective bass boost in conjunction with higher Post settings.

Post Overall output level. Note that extremely loud signals are possible here. This control is buffered for full transparency at all settings.

Voice This dramatically alters the voicing of the overdriven signal. There are three switch positions, Clang (up), Standard (middle), and Deep (down). *Note: available on V2 only.*

The Halberd has soft-touch electronic switching with buffered bypass. When the Halberd is disengaged, your signal passes through a high-headroom, class A JFET buffer to preserve its integrity over long cable runs.

5 Detailed Operating Instructions

When using the Halberd for the first time, we recommend using a clean amplifier and no other pedals. Begin by turning the Pre, Tone, and Depth knobs to noon and the Post knob fully CCW. Move the Voice toggle to its middle position. Activate the pedal by pressing the footswitch, and then slowly turn up the Post knob until the desired volume level is reached. You should hear a medium-gain overdrive tone. Adjust the Pre control to your preferred level of gain. The Tone knob can be used to tame harsher harmonics at higher gain settings, or bring in chime at lower gain settings.

At this point you can adjust the Depth. You will likely observe that it is highly interactive with the gain from the Pre knob. The unique transistor gain stages experience clipping differently across the frequency spectrum. Bass frequencies become fuzzy with slower “blown out” transients, whereas midrange and high frequencies take on a glassy sheen of upper harmonics. The Depth control therefore has a huge impact on the headroom, compression, and clipping waveform. Turn it up for a fuzzy tone, or turn it down for a more chimey tone.

The Voice toggle is also interactive with the Depth and Pre settings. It has three positions: the center position is identical in voicing to a V1 Halberd. There is a gentle midrange emphasis and a moderate amount of gain. The up position (Clang) adds a significant high mid boost, to achieve more aggressive sounds than what the Depth control offers on its own. Similarly, the down position (Deep) adds a full range gain boost that can become very heavily saturated at high Depth settings.

The Tone knob spans a wide range, and its ideal position will depend on the other control settings. When the Depth control is turned counterclockwise, the Tone knob may be turned down to tame harshness or focus the output into a narrow band of midrange. As more low frequencies are brought in via the Depth control, one may perceive an effective reduction in high frequencies. The Tone control may then be increased to compensate.

Finally, the Post control is capable of an enormous level of output. At higher Pre settings the output signal can exceed +25dBu peak, which is more than enough to overwhelm the input stage of an amplifier. Use judiciously.

Document Revision History

Version	Changes
2	Release for Halberd V2
1	Release for Halberd V1
0	Draft Copy