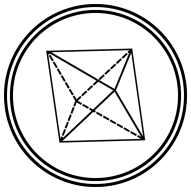

ELECTRONIC AUDIO EXPERIMENTS

Technical Manual

Hypersleep

Version 2

November 16, 2021

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1 Introduction

Thank you for purchasing the Electronic Audio Experiments Hypersleep. This manual is an in-depth guide for properly understanding and enjoying your pedal. Below is a bit of context for how Hypersleep came to be. If you would like to skip forward to how the pedal works, begin reading at the Operation section on the next page.

Hypersleep is an analog, solid-state reverberator constructed around the unusual and obsolete MN3011 bucket brigade device (BBD). The BBD reverbs of the mid 80s were panned as unnatural, metallic, and low-fidelity. Indeed, they sound little like a typical room, spring, or plate; as such, they were quickly overtaken by far more flexible digital signal processors that algorithmically emulated these physical structures. Like so many science fiction works of the era, MN3011 reverb was a vision of the future that never came to pass.

After falling in love with a particularly spaced-out prototype of the EHX Solid State Reverb, a particular MN3011 design relegated to the dustbin of stompbox history, I decided to create my own take on BBD reverb from scratch. I started with my own preamplification and filter blocks in order to ensure low noise and musical handling of high amplitude input signals. Other improvements were purely utilitarian, such as a sturdy regulated boost converter supply and an embedded microcontroller clock. Both offer substantial improvements in the noise floor and sound quality compared to vintage designs while still retaining the uniqueness of the MN3011. However, the most notable departure from vintage BBD reverb effects is the addition of an LFO to modulate the delay time. This is a common feature in analog delays and BBD chorus units, but the effect is strikingly different when applied to a complex multi-tapped reverb output.

Hypersleep was a labor of love over two years in the making. I owe special thanks to Scott McCombs for his work on the embedded microcontroller code, Jon Ashley from Bondi Effects for his useful insights about digital clocks, Rick “Hawker” Shaich for his endless wisdom regarding BBDs, Mike Moschetto and Donovan Ford for being early beta testers, and finally to Dan “Danger” Niejadlik for sharing with me the bizarre EHX prototype that started me down this path.

And, a brief note on Version 2: once we realized just how limited the MN3011 supply was, we made a second pass at the design to make it as good as we possibly could. The biggest change was improved filtering, for a brigher reverberation with more overtones and clarity.

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

-John Snyder, EAE

PS—the artwork for the Hypersleep pays homage to the Voyager Golden Record, with a little extra influence from the game Lunar Lander. (Thanks to Zach for his fantastic interpretations of both.)

2 Product Changelog

Version 2

Released in December 2021

- Updated filter scheme for improved bandwidth and clock suppression
- Optimized power supply for reduced current draw and background noise
- Bypass relay replaced with silent electronic switch

Version 1

Original release in 2020.

3 I/O and Power

Bypass: Electronic switching with FET-input op amp bypass buffer

Input impedance @ 1KHz: 1MΩ

Output impedance @ 1KHz: <1kΩ

Power: 9VDC, 2.1mm center negative barrel. The current draw is 60mA.

To power your Hypersleep, use a standard regulated 9VDC center-negative supply with a 2.1mm barrel tip. We recommend a supply rated for 100mA minimum. The Hypersleep has a current draw of 60mA when active. We suggest the use of an isolated power supply when using the Hypersleep 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 up to 24V. 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.

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

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

4 Controls

Level overall effect level, gracefully overloads at higher settings

Space delay time of the BBD, simultaneously controlling six taps on a single delay line

Mix blend of clean and effected signals, from full dry to full wet

Feedback increases the decay time of the reverb; will self-oscillate at extreme settings

Rate modulation rate, from imperceptibly slow to nearly audio rates

Depth modulation depth, from subtle vibrato to warped pitch bending

The Hypersleep has soft-touch electronic switching with buffered bypass. When disengaged, your signal passes through a high-headroom, op amp buffer to preserve its integrity over long cable runs.

5 Detailed Operating Instructions

At the heart of Hypersleep is a clock controlled directly by the Space knob. In turn, this clock sets the delay/reverb time for the BBD. The lowest settings yield a slapback echo with a blurry decay. As the knob is turned clockwise, the echoes begin to separate and smear out, until the delay time of the longest tap reaches a maximum of approximately 200 milliseconds.

The Feedback knob plays a critical role in determining the reverb character—or indeed, whether Hypersleep functions as a reverb at all. At low settings, the echoes function more akin to a traditional short analog delay, despite the aforementioned smearing of the repeats. It is at this setting where modulation effects will take on a more traditional character as well (see below). At higher settings, the outcome is dependent on the Space setting. Short time settings will result in unusual resonances and comb-filtered textures as certain delay lines constructively and destructively interfere. At longer settings, increasing Feedback means the reverb output will ring out longer, with a distinctive fluttery characteristic. When the Feedback is turned counterclockwise, increased decay will give way to self-oscillation.

Together, Rate and Depth control the low frequency oscillator (LFO) tied to the Space setting. This modulation is akin to wiggling the Space control back and forth. The waveform is triangular in shape, with a moderately exponential response designed for an even-sounding pitch vibrato at all settings. Rate is the speed of the modulation, from imperceptibly slow to nearly in the audio range. Depth controls the intensity of the modulation. At minimum the LFO is entirely off, at maximum the LFO is manic and seasick. Tthe maximum amount is scaled with the Space control to optimize the usable range at all combinations of knob positions.

The outcome of the LFO depends greatly on the other settings. When applied to a typical reverb sound it can be used to subtly animate the reverb trails, or warp them into an indistinguishable mess. If Feedback is set low, the LFO may even be used for chorus, vibrato, and quasi-flanger textures, particularly at low Space settings. At higher Feedback settings the pitch-bent echoes can compound on themselves for an exaggerated effect.

The Level and Mix controls have a self-explanatory function. The Mix control will range from full dry to full wet with every possible shade in between. Full wet settings are particularly useful for lo-fi effects and pitch vibrato. The Level control is primarily intended for matching the output to the unaffected tone. At higher settings hotter signals will clip slightly. This is normal and can be used to great effect.

Document Revision History

Version	Changes
1	Release for Hypersleep V2
0	Release for Hypersleep V1