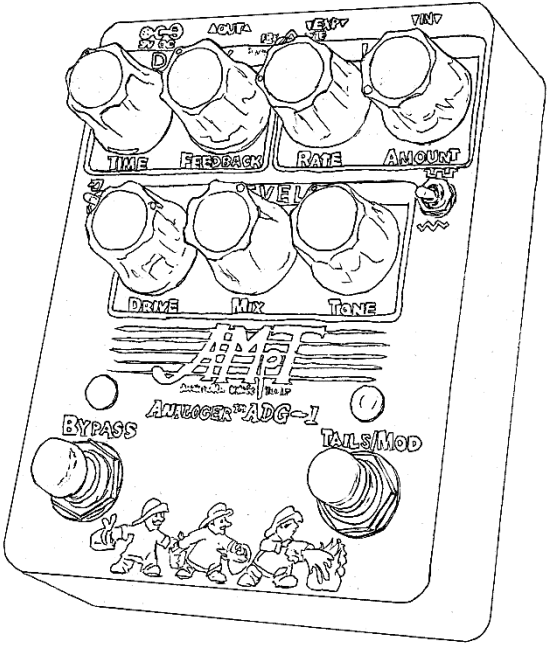
ASHEVILLE MUSIC TOOLS

Analoger™ ADG-1

100% Analog Bucket Brigade Delay

User Manual Revision C

Last Revision 4/05/2022



Introduction

Thank you for your purchase of the Asheville Music Tools Analoger™ Series ADG-1 Analog Delay. This pedal, engineered by renowned analog designer Hawker, features two reissue Bucket Brigade Delay lines for up to 700ms of delay. The onboard Low Frequency Oscillator and sophisticated control voltage topology guarantee the best sound, features, and control available in any fully analog delay currently on the market. We hope you enjoy many years of use from your ADG-1 and find it as inspiring and fun to play as we have.

The ADG-1 is a marriage of vintage audio processing techniques and advanced, high-tech electronics. It is designed using modern, quality components for uncompromising sound, features, and reliability. We started with a high voltage 15V power supply powering a pair of studio-grade MN3005 BBDs, unlike the lower cost MN320x pedal-grade BBDs found in most stompboxes. We then added a special blend of two tightly tuned high-Q 5^{th} order anti-alias and reconstruction filters, VCA feedback control, a unique 5-amp high current BBD driver, and an analog clock with exponential modulation technology to obtain unprecedented sound, richness, clean tails, and true fractional delay in a compact footprint.

This is the first of what we hope to be a long line of time, phase, and frequency modulation effects with a synthesizer-inspired control voltage approach. The ADG-1 draws upon Hawker's decades of experience and expertise designing delay-based effects for other companies.

A special thank you and mention is needed for two people:

Kelly Bowers, my life partner, land-mate and co fur-parent for her love, faith and dedication, and for pushing me to start designing products for myself rather than others.

John Snyder, from Electronic Audio Experiments, for his friendship, collaboration and help in bringing this pedal to market. His experience, patient advice, handholding and support were what made this possible. I could not have done it without him.

Hawker's Log: About BBDs

I am often asked what gives analog delays their characteristic sound. The answers I usually see given are not why I think they sound different.

A BBD (Bucket Brigade Delay) works by storing a momentary snapshot "sample" or charge in a capacitor isolated by a FET network. It passes this sample from one capacitor to the next via a bi-phase clock until it reaches the output. These capacitors are like water in a bucket brigade line, passing the audio sample from one "bucket" to the other until it reaches the "fire" at the end. BBDs were originally designed for distance measurement with radar. When a radar signal is sent out, a copy was delayed through a BBD and compared to the reflected signal. By sweeping the time until the reflection cancels out the delayed sample, the delay time, and thus distance, is measured. Early digital oscilloscopes, like the Tektronix 2440, also used them as temporary storage since Analog to Digital converters of the time were too slow. CCD cameras still do this today for the same reason. Today they are used almost exclusively for audio processing in delay, chorus, and flanger effects.

The ADG-1 uses a recreation of the Matsushita/Panasonic MN3005 PMOS BBD from Xvive™. The MN30xx series BBDs use a higher voltage for superior clarity, noise, headroom, and distortion compared to the MN320x NMOS types usually found in most stompboxes. However the MN320x BBDs are capable of shorter delay times with a faster clock. The reissue BBDs sound very close to the Panasonic parts but are more transparent and have a lower noise floor, though with less animated character. In addition, the sound does not vary over delay times as much as their predecessors did.

Perhaps the biggest reason BBDs can do what digital often cannot is due to Fractional Delay, often referenced as the Doppler Effect. Since the clock moves continuously, the delay time has every single continuous increment between each step. That is why analog delays make great dive-bombing sounds. The ear is very sensitive to this and perceives this as distance and movement. This trick is how movies pan sound or make you think a bullet just whizzed over your head. Most digital delays simply cannot do this.

With a fixed clock frequency, they can only take a sample step every 48 or 96KHz and step at that increment. This only simulates fractional delay and is not true fractional delay. The ear can perceive this difference, and so it does not feel correct to the brain. Early digital delays like the Lexicon PCM 41/42 did use a variable clock using a different, now obsolete, process, but these are the exception not the rule. Most digitally-controlled analog delays that use a processor generated clock do not use steps small enough for true fractional delay, so while they may use a BBD the modulation does not sound as natural as some picosecond step clocks or true analog modulation.

In addition, BBDs have some other "artifacts" that give them their unique sound. The transfer characteristics, gain, noise, distortion and frequency response vary depending on the bias voltage and clock frequency making the sound change as the delay time changes. They also do not put out the entire signal at the same time. Half the signal is a ½ clock behind the rest of the signal, yet combined at the same time, making for a strange, smeared mixing of the signal samples slightly out of time.

The other components in a BBD circuit are also responsible for the signature sound of analog delays. BBDs require companding and emphasis/de-emphasis networks to improve the signal to noise ratio, but these add an animated "breathing" compression character to the sound. The design of the filters affects the frequency response, peaking or ringing, and potential aliasing or ring modulation. There are many more parts of the analog design often overlooked in digital recreations that affect the sound as well including the clipping, feedback network, clock stability, modulation wave shaping/curves (exponential or linear, etc.) that are all important to get that great analog delay sound.

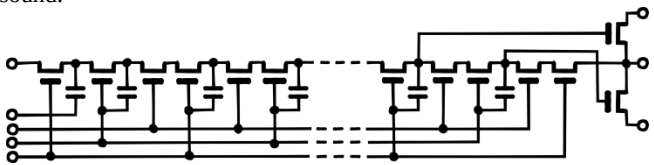
For more reading about BBDs check out these great websites:
https://www.electrosmash.com/mn3007-bucket-brigade-devices
https://www.premierguitar.com/articles/25035-behind-the-bucket-brigade
https://pedals.thedelimagazine.com/bbd-chips-the-magic-behind-analog-delay-pedals/

About the Firemen and the ADG-1 Artwork

Our pedal artwork pays homage to *Hawker*'s past pedals and classic modular synthesizers. The lines and boxes around function blocks lend themselves to classic modular synthesizer layouts, which were organized by function. You may notice the use of synthesizer terms such as "LFO, VCO, CV" and very literal function knob names rather than the more sonic based names of guitar pedals (FEEDBACK and TIME rather than Regeneration and Manual for example). This helps the user see the logical function blocks and signal flow to understand what is happening without obscuring the meaning.

The schematic drawing was adapted from the original Panasonic sketch of the BBD internals and shows the bi-phase clock and capacitor storage to the output. The careful observer will note that each clock pulse moves only half the buckets forward preventing them from colliding with the next stage, and hence the two clocks fire at different times to move the signal and part of the output signal is one clock behind the other part.

The firemen used in our artwork and literature come from the 1990s Panasonic data books and an applications note released for their and Digikey's marketing. On the cover and back of this book was a picture of firemen in a bucket brigade line. This represents the BBDs function of passing the sound from one capacitor or "bucket" to another 4096 times before it goes out (8192 times for us) by varying the clock, thus delaying the sound.



Set up

Use only standard, **9VDC REGULATED**, center-negative power supplies rated for at least 200mA, from a reputable vendor for all your Asheville Music Tools effects. Vintage style, rectified & filtered, but unregulated, supplies are **not acceptable** for use with this product. We like the Truetone™ One Spot® and similar products. When using other pedals in your signal chain, we recommend an isolated power supply.

The ADG-1 may draw over 150mA when engaged. Use caution if using multi output supplies with 100mA outputs. **Use the higher current outputs when using this type of supply. Never use a higher voltage with this product.** There are no sonic benefits and you risk damaging the pedal and voiding the warranty. The pedal will not turn on if it detects an overvoltage supply or high ripple from an unregulated supply. Our products do not use a conventional 9V battery due to the high current draw.

Your Analoger Series Pedal ships with a clear plastic protector over each of the knobs. Feel free to peel it off if its presence shows on the knob top.

The ADG-1 has input level control and flexible bypass making it able to be used in various configurations for guitar, synthesizer, or line level applications, including:

- **Standard pedal use:** ADG-1 connected into an amplifier input, with or without other pedals. You may use the pedal in either Buffered or True bypass mode in this configuration.
- **Insert Effect:** Connect the ADG-1 to the effects send/return of your power amp or mixing console. You can also use the ADG-1 to replace the existing preamp if connected to just the return. Use this way in buffered Bypass mode only.
- **DI (Direct Input):** The ADG-1 can be used to line match to a mixer or DAW input for the correct drive and signal conversion from the guitar's high impedance out to a console or DAWs low impedance line in. It can also be used as a buffered drive pedal placed before other pedals. For best results use with 10K or higher line input. Not suitable for 600ohm input impedance of some classic consoles. Use this in buffered Bypass mode only.

Getting Started

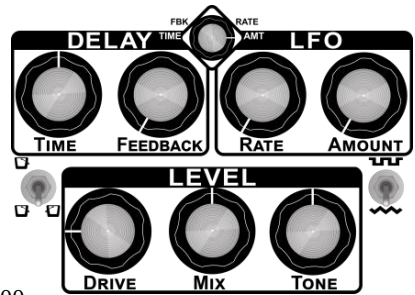
Let us explore the range of controls on your ADG-1.

Connect your guitar or other instrument to the **IN**put jack. Connect an amplifier, mixer, or DI box to the **OUT**put jack. If you have an expression pedal (or 0-5V control voltage source like a synthesizer output), connect it to the **EXP**ression input.

Use a 9V regulated 2.1mm, center-negative, power supply, capable of providing at least 200mA of power and connect it to the 9V DC input.

Be sure to power up the ADG-1 **BEFORE** turning on your amplifier to prevent speaker pop and the potential to damage your speakers or headphones.

Note: If not using the expression input; be sure the expression switch is **NOT SET TO THE TIME POSITION** to start. We recommend setting it to **AMT** if not using this feature.



To start, set the ADG-1 to the *Home* position as shown in the graphics to the right.

Set **TIME**, **MIX** & **TONE** straight up (12:00).

Set **FEEDBACK**, **RATE** & **AMOUNT** switch fully counterclockwise (7:00).

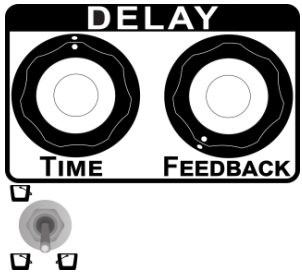
Set **DRIVE** slightly up, around 9:00.
Set the Bucket and LFO switches to the down position.

There is no way to damage the ADG-1 through knob settings so feel free to have some fun exploring how each control works There are some hidden tricks, gotchas, and advanced possibilities, so once you are done having fun read on to learn more about the ADG-1.

Operation

The ADG-1 is laid out in homage to modular synthesizers with three main modules. They are the **DELAY** Module, the **LFO** (Low Frequency Oscillator) and the **LEVEL** Module. Let us look closer at these modules.

DELAY MODULE



TIME: The TIME knob adjusts the delay time from 35ms to 700ms. If you change the delay time while playing, you will also notice a pitch change as the signal currently captured in the BBDs is spit out faster or slower, therefore compressing or expanding the delay time. This is how analog delays make that great pitch-up or dive-bomb sound. Try playing with a short delay with lots of feedback then quickly turning the knob clockwise for massive dive bombs.

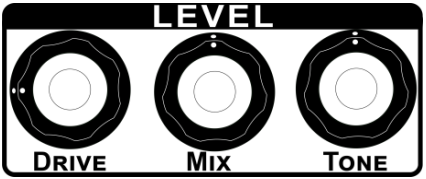
BUCKET SWITCH: selects whether the sound you are hearing travels through 1 or 2 BBDs (4096 or 8192 stages) and so halves or doubles the delay time (17-350ms vs 35ms – 700ms). While there clearly is some overlap in the settings, as you can often get the same delay time from either setting, the tone is slightly different in each, so you may prefer one position over the other. In general, use the down position for long reverberant delays. Use the up position for more sparkly shimmering delays, or when doing chorus or flange-like sounds.

FEEDBACK: The FEEDBACK knob affects how much post TONE delayed signal is fed back into the buckets. This affects the number of repeats and the fade-out time. Past around 3:00, it puts the ADG-1 into self-oscillation for some wild swishing sounds that change as you move the TIME knob. Try it out, get lost. Come back after and read the next section.

Be sure to read the control voltage section for information on this module with expression pedals or control voltages.

MIX MODULE

The **LEVEL** modules provide level matching, wet/dry blending, and tonal control of the ADG-1.



DRIVE: The DRIVE knob provides up to +23dB of drive and level matching as well as some attenuation for hot input signals. Unity gain is around 9:00. Try cranking it for some soft clipping & limiting, or to drive the BBDs hard. The DRIVE affects both the wet and dry signals but each has a separate limiter with a different knee and threshold.

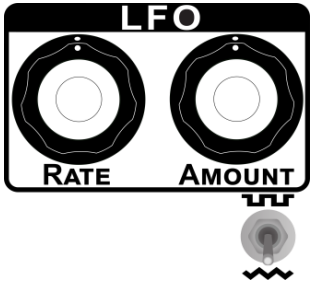
MIX: The MIX knob provides a cross-faded wet/dry mix between the delayed and clean tone. To make it easier to adjust and less tweaky, this knob does not go 100% wet or dry but very close. It gets to almost 100% wet with only a slight "ghost" dry signal but does not approach as close to fully dry so you will still hear a slight delay sound in the mix. This is to make the knob easier to adjust and dial in an exact MIX.

*Note: If you are applying a sustained steady pitch to the ADG-1 and have the **MIX** knob set near 12:00, you may find that the direct and delayed signals alternately reinforce and cancel each other in rapid succession as the **DELAY TIME** is varied. This is a normal result of mixing a steady pitch with a delayed replica of itself. This phase cancelation is the analog delay equivalent of "standing waves" in a reverberant room.*

TONE: The TONE knob is *Hawker*'s new touch on tonal control for his delays. It is a modified, non-symmetrical, "tilt type" filter with a soft curve and center flat position. It provides both high pass and low pass control with a knee around 605Hz. It is placed after the buckets and INSIDE the feedback loop, hence used to make each repeat sound progressively different with each repetition. You may use it either in Low Pass mode to make the sound fold under your playing, or in high pass mode to make each repeat punch and stand out with a bright, metallic sound.

LFO MODULE

The Low Frequency Oscillator (LFO) module is a modulation source for animating your delay time and for bending the pitch of the delayed signal. Unlike traditional delays, our LFO uses exponential modulation for musical and balanced movement, the way the ear and brain want to hear it. In the synthesizer world this is the familiar Volt/Octave tracking used for pitch and frequency. Our modulation is symmetrical around the TIME setting, changing above and below it. This means that as you reduce the LFO amount the pitch and time will stay centered, where you have it, and not shift offset with the AMOUNT setting (requiring TIME to be adjusted) as with traditional modulation.



RATE: The RATE knob adjusts the speed or rate of modulation from about 0.08Hz to 40Hz (wider range via control voltages). Lower settings provide a slow whoosh or a rhythmic pitch shift. Medium speeds are a chorus like effect while faster rates provide a gargle, bubble, or vibrato sound.

AMOUNT: The AMOUNT knob controls the range of pitch movement at the speed of the LFO, or the amount of effect. Use low amounts for subtle shimmer and larger amounts for octave or greater pitch shifts or spaceship warbles.

LFO SHAPE SWITCH: Selects a slewed square wave(up), a rounded triangle wave (down) or off (center). At higher speeds the shape becomes more and more rounded or slewed. Use triangle wave for traditional gradual ramped modulation and square waves for rapid pitch jumps above and below the note played.

Be sure to read the control voltage section for information on this module with expression pedals or control voltages.

CONTROL VOLTAGE or EXPRESSION SECTION:

Using the EXP knob and an external EXPression pedal or control voltage with your ADG-1 will greatly increase the dynamic playing and tonal possibilities as well as expand the control range beyond the extent of the knobs. Use a standard 10-50K linear expression pedal that uses the +5V voltage supplied on the ring jack and outputs the control voltage on the tip, or use a 0-5V external CV voltage from a Eurorack module, Synthesizer, DAW or similar source.

CAUTION: Voltages over +5V or below 0V may damage your ADG-1. Use only standard 0-5V control voltages. If your expression pedal has a trim knob you may find it helpful to use this feature to reduce the range of the expression pedal to less than a full knob sweep to make it easier to dial in the exact sound you seek.

Please note in order to give a wider playing capability with expression inputs, the control setting selected by the EXPression switch will reduce the minimum knob setting slightly. The FEEDBACK, RATE & AMOUNT control voltages are additive (CV is offset from knob position). This means that the knob position is added to the expression position. For full control voltage range set the knob to the most counterclockwise (CCW) setting.

TIME behaves differently as it is bi-polar. This means that, as the TIME level is decreased around a 2.5V midpoint the pitch will not shift, resulting in not having to re-adjust the center delay time based on the modulation amount. **This means that for full expression range the TIME knob must be set near the center position when using an expression pedal.**

Use only your fingers, a plastic screwdriver, guitar pick or similar plastic device to turn the 4-position EXP rotary switch. Never use a metal object that could damage the shaft. If you use this feature frequently, we have included a knob (C&K part # 297F02000). Note this knob will turn the shaft but there is not enough shaft length through the enclosure to permanently secure the knob to the shaft and it may fall off. Do not glue the knob to the shaft or your ADG-1 will not be serviceable.

FOOT SWITCHES

BYPASS FOOTSWITCH: Turns the effect on or off. The LED is lit when engaged. The switch is user selectable for true bypass or buffered bypass by a selector switch inside the ADG-1.

TAILS / MOD FOOTSWITCH: Depending on the mode (set internally), this switch will either engage or disengage the LFO modulation or provide Tails (also known as Spill-Over or Trails). In Tails mode any sound in the buckets and feedback loop will continue to sound or fade out (depending on the FEEDBACK setting), however any new sound will play over this sound and not add to the delay. The LED will flash at the LFO rate (triangle only) while either of these modes are engaged and turn off when not engaged.

UNDER THE HOOD SWITCHES

If you carefully remove the 4 screws holding the cover on to the back of your ADG-1 you will see 2 switches underneath the jack board on the edges of the PCB. These are the ONLY user accessible options on your ADG-1. They select two functional options for the pedal's behavior. **Do not adjust any of the carefully calibrated factory set trim pots.**

TRUE BYPASS / BUFFERED BYPASS: Use this switch, on the left side of the jack board, to select true bypass (Default) or buffered bypass. In true bypass when the effect is not engaged the input is coupled directly to the output and does not pass through any electronics. If you have loading, tone or noise issues from long cable runs select buffered bypass to use the internal JFET as a simple buffered output with approximately 4K ohm output impedance. Buffered bypass may have a slight gain loss depending on the impedance match. This is normal.

MOD / TAILS: Use this switch to select if the 2nd stomp switch acts as a modulation kill switch (default) or engages Tails mode. See above for an explanation of how these two modes behave.

Technical Overview

Utilizing over 400 carefully selected components, the entire ADG-1 was designed for a 100% analog signal chain. We began with a classic delay architecture using a pair of Xvive™ MN3005 reissue BBDs and a step-up boost power supply to power our premium audio-grade op amps and high-tolerance, non-microphonic capacitors, providing performance, temperature & voltage stability, low noise and maximum headroom.

We then implemented a vintage-style compandor with emphasis/de-emphasis coupled with two discrete transistor, 5th-order, anti-aliasing and reconstruction filters to provide a familiar character with superior clarity, noise reduction, and dynamic feel. The feedback circuit uses a voltage-controlled transconductance amplifier as a VCA, to provide classic, warm regeneration tone while offering an accurate method of dialing in infinite repeats without runaway or for achieving total feedback overload.

The input preamplifier consists of a discrete, high impedance, JFET input stage that can be used as an always-on buffer. The preamplifier circuit provides gain and impedance matching, or it can be used to overdrive the delay line and mixer section for unique artifacts and character that only an analog delay can provide.

The analog clock generation, modulation, oscillator, and even the switch logic are all fully analog. Our VCO, with temperature compensated exponential modulation, drives the BBDs at extremely high current to eliminate artifacts and provide a clear tight sound. An assignable expression input increases the flexibility and control available to the user.

The ADG-1 was designed using a multi-layer PCB with dedicated split power and ground planes for the lowest noise and cross talk. The power input is fully protected from reverse polarity and over-voltage conditions. Our MHz range, step up, high voltage power supply is designed to eliminate sources of noise and radio frequency interference (RFI/EMI) and the I/O is designed to protect from electrostatic discharge (ESD) spikes to ensure carefree operation in any studio or performance environment.

Functional Specifications:

Note: All specifications subject to change at the whim of our overloads.

Time, **Feedback**, **Rate** and **Amount** control range all extended with the use of Expression Pedal or control voltage input.

- **Delay Time**: 35ms – 700ms Bucket switch down (all BBDs), 17.5ms – 350ms with switch up. 24ms – 900ms with LFO or Control Voltages
- **Feedback:** 0 to greater than infinite. Capable of self-oscillation.
- **Rate:** LFO RATE, from 0.08Hz to 40Hz (75Hz with CV control)
- **Amount:** LFO depth control from OFF to 56% of TIME sweep.
- **Drive:** up to +23dB of control or level matching.
- **Mix:** Center 50%. Adjust from near 100% wet to -44dB dry
- **Tone:** ~605Hz center tilt like filter. Center = Flat to 0.25dB High +5dB to -12dB, Low +4dB to -7dB.
- **Bucket Toggle:** 1 or 2 BBDs (4096 or 8192 buckets)
- **LFO toggle**: Rounded Triangle, slewed Square wave or OFF
- **Bypass Footswitch:** effect on/off user selectable True Bypass or JFET Buffered
- **Tails/Mod Footswitch:** User selectable modulation kill or engage tails bypass (sometimes called Spillover).
- **Expression Switch:** 4 position rotary selects Time, Feedback, Rate or Amount controlled by expression pedal. Time is bi-polar modulation (0V=-50%, 5V=+50%) all others are additive control.

Under the hood switches: (Accessible by removing ADG-1 Cover)

- **True Bypass / Buffered bypass:** Selects between true bypass and classic JFET buffered bypass
- **2nd Stomp Switch function:** Selects if 2nd stomp switch enables/disables modulation or is Tails mode.

Electrical Specifications: *(subject to change)*

- **Type: 100% Analog signal and control path**
- **Power:** 9VDC @ <150mA. 75-125mA typical. Up to 250mA start up. Standard pedal center negative 2.1mm x 5.5mm barrel.
- **Bypass:** Switchable true bypass or JFET-buffered bypass with switchable tails
- **Expression / CV input:** TRS input assignable to Time, Feedback, Mod Rate or Mod Amount, (CV range is 0-5V). Ring supplied current limited 5V output. Control input on Tip.
- **Delay Time:** <35ms – 700ms Dual BBD mode, 17ms - 350ms single bucket mode. 24ms – 900ms with LFO or Control Voltages
- **Input impedance:** >1MΩ
- **Output impedance**: 1KΩ Max (5k max for buffered bypass)
- **Max input level:** +15dBµ (4.3V RMS)
- **Max output level:** +14dBµ (3.9V RMS)
- **Maximum drive:** >23dB (covers attenuation to gain)
- **Noise Reduction:** 2:1 broadband with 12dB HF emphasis

Physical Specifications:

- Genuine Hammond™ die-cast aluminum enclosure
- Dimensions: D=4.95” (12.5 cm), W=3.75” (9.4 cm), H=2.25” (5.8 cm)
- Weight: 15oz (425g)

Presets:

The following are ideas for setting your ADG-1. Since all analog products have some variability, the exact knob setting may be slightly different from that shown in these presets. Experiment and enjoy.

Reverberant Lead: Subtly modulated long delay with overdrive. Great for lead licks. Crank up the DRIVE for an even more aggressive sound or dial it back and try it with arpeggios.

Cavernous Hallway: Hello? Hello? Hello? Is there anybody in there? Do we have an echo in here? Reverberant echoes. Try dialing up some modulation for more fun. *(Modulation off)*

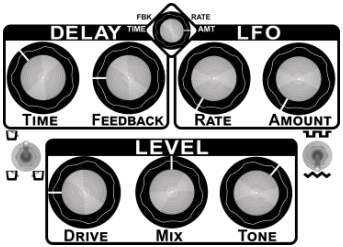
Fold Under (low pass) Delay: Long repeat delay where each echo slowly becomes less and pronounced as it fades out. Each repeat loses detail and folds under your mix allowing you to play over without delay tails getting in the way. Perfect for late night ambient jams. *(Modulation off)*

Springy Bubbles: Silly gurgling nonsense. Have fun and don't laugh too hard, especially if you dial up the AMOUNT more. Pro Tip: Use an expression pedal on the RATE or AMOUNT to get audio rate modulation. Adjust AMOUNT or flip the wave shape for stuttering warbles like a broken film projector (younger players, ask your parents about 16mm school projectors)

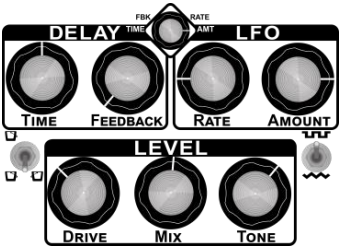
Faux Flanger: Phased hollow delay with peaky and present movement. It is similar to a Flanger, yet with longer delay times. Adjust the FEEDBACK to find that sweet spot right before oscillation and the AMOUNT to bring out the tone the best.

Wet Pseudo Chorus: A long drippy, lush, chorused sound with longer than average delay times. Dial in RATE and AMOUNT until you get it just right. TIME sets the level of drip. Way out dude! Only use a chorus pedal on one song? You are covered!

Tin Pan Alley. A unique hollow, peaky sound that is more tonal than delay. Sounds like you are at the end of a tunnel talking through an old telephone. *(Modulation off)*



Square Jumps: Tune this by ear using the AMOUNT and TIME controls for a bouncy, whimsical octave echo or a chaotic, atonal warble!



Tape Wash: Bright repeats fade away into the ether. No motor repair necessary. Wow others with the flutter. *(Modulation off)*

Lead Fattener: Make your solo stand out of the mix. Bonus points if you turn your amp to 11. *(Modulation off)* Alternatively, try a hair of modulation with RATE around 12:00 and just a hair on the AMOUNT knob

Lofi Vibes: Take advantage of the ADG-1's lush filter to construct a lo-fi vibrato evocative of vintage recordings.

Slap Back Delay: Short delay doubling. Chicken-Pickin' and finger licken' good. *(Modulation off)*

ASHEVILLE MUSIC TOOLS

in collaboration with

HYPERTRIANGLE

Audio Manufacturing Collective

Tools To Inspire Your Creative Muse

Designed By Hawker

Proudly Designed, Manufactured, Machined & Assembled in the mountains of Western North Carolina

Changelog

Revision	Date	Notes
Rev C	4/05/2022	2022 Production run and art updates
Rev B	4/30/2021	Small updates and clarifications for Rev B PCB
Rev A1	12/28/2020	Production: Web release: Small formatting and typo fixes.
Rev A	12/12/2020	Pre-Production release:
Rev 1	11/20/2020	Prototype manual

Visit our website for more information, mods, hacks, and presets.

www.AshevilleMusicTools.com