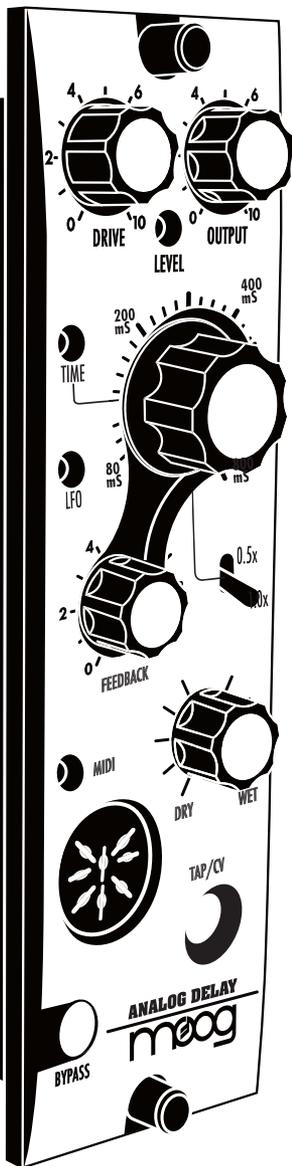
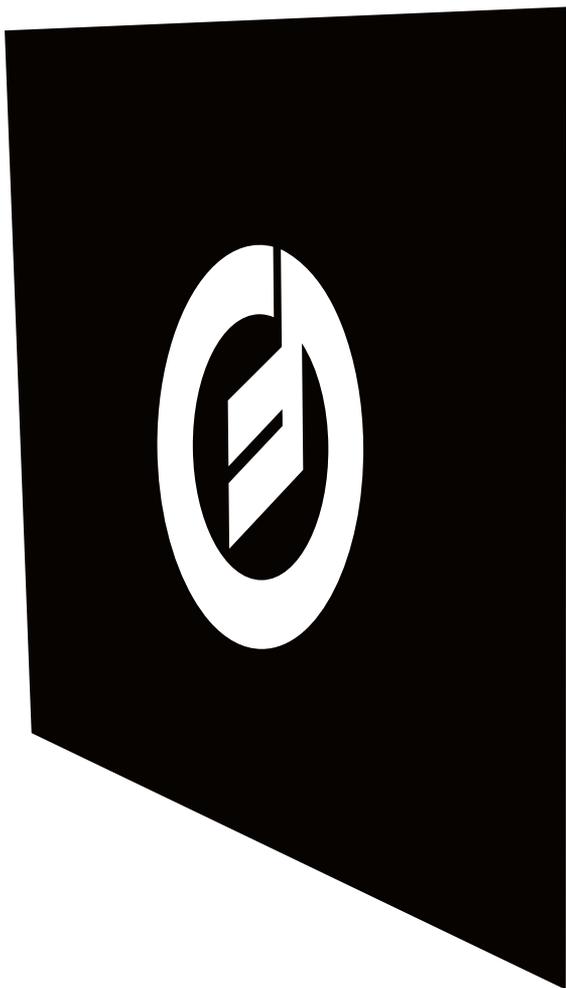




500 SERIES - ANALOG DELAY

USER'S MANUAL



MOOG 500 SERIES ANALOG DELAY

Thank you for purchasing the Moog 500 Series Analog Delay - the world's first delay designed exclusively for the 500 Series format. The Analog Delay features 800ms of the warmest, and most musical analog delay on the planet, an all-analog signal path, and a LFO capable of modulating Delay Time for a wide array of modulated delay line effects including chorus, pitch shifting, vibrato, and tape delay.

The Analog Delay is stereo linkable and designed to work with a wide range of line-level signals from both -10dB and +4dB balanced standards. Its assignable TAP/CV input accepts a tap tempo switch, expression pedal or other control voltage for controlling Delay Time, Feedback Amount, LFO Amount, LFO Wave Shape, and LFO Rate.

The Moog 500 Series Analog Delay is handcrafted in Asheville, NC with premium components for the lowest noise and best performance possible. No software emulation can impart the same depth and life into your mixes like the Analog Delay.

DOWNLOAD & INSTALL THE EDITOR

Included with your Analog Delay is a VST/AU/RTAS/Stand-Alone editor offering complete under-the-hood control of the module. To download the free installer, register your product at www.moogmusic.com/register. Then go to www.moogmusic.com/analogdelay and click the downloads tab.

TERMINOLOGY

The term Delay Line refers only to the Bucket Brigade Devices (BBDs) and analog signal processing between the input and output stages. Delay and Analog Delay refer to the entire 500 Series Module.

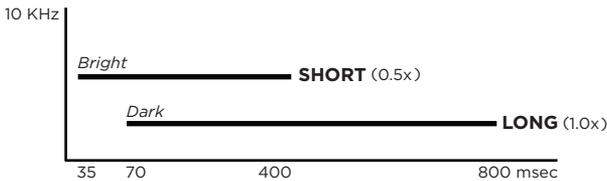
GAIN STAGING

Unlike digital delays, pushing the Analog Delay into overdrive is a very musically useful effect. When the **LEVEL LED** flashes **ORANGE**, built-in limiters are activated. Beyond this point, higher **DRIVE** settings will result in gentle saturation and increasing harmonic content added to the signal. **RED** flashes indicate clipping. We encourage you to experiment with different **DRIVE** settings and their effect on multiple sound sources.

NOTE: For many audio interfaces, a **DRIVE** setting for unity gain will be between 2 and 4, with an **OUTPUT** setting between 6 and 8. **DELAY TIME** and **FEEDBACK** settings also affect the output level from the Delay Line. Increasing **FEEDBACK** increases the output level due to the cumulative effect of sending output signals back into the BBDs. Decreasing the **DELAY TIME** decreases the output level via shorter voltage charge and discharge rate of the capacitance sections in the BBDs.

FREQUENCY RESPONSE AND LEVELS

The Analog Delay was designed with an area of filter overlap in the 0.5x (Short) and 1.0x (Long) delay ranges, with the 0.5x range (35ms-400ms) having a broader frequency response. This provides the ability to fine tune the tonal characteristics of the delayed sound.



High Frequency Cutoff vs. Delay Time

CONTROLS, INDICATORS, AND INPUTS

The Analog Delay has been designed with a combination of physical and virtual controls for modern studio and live sound workflow. Primary controls for the Delay Line are located on the Delay's front panel.

The 6-waveshape LFO is controlled by the free plugin/stand-alone editor or via MIDI messages. There are no LFO controls on the front panel.

NOTE: Upon launching the editor for the first time you will be prompted to set the MIDI port for the Analog Delay.

FRONT PANEL

DRIVE: Sets the input sensitivity of the Analog Delay providing a 30dB range of adjustment for optimum signal path, level matching, or over-driven sounds.

LEVEL LED: Works in conjunction with the DRIVE control. **RED** indicates clipping (this can be used for adding color). **ORANGE** flashes indicate the start of limiting.

GREEN indicates the presence of signal at or below the nominal level. Steady **GREEN** with brief, occasional **ORANGE** flashes indicates the nominal signal level for best signal-to-noise ratio.

OUTPUT: Allows gain or attenuation of the output signal for level optimization. The **OUTPUT** control is designed so that an overall boost, attenuation or unity gain state can be achieved with any **DRIVE** setting.

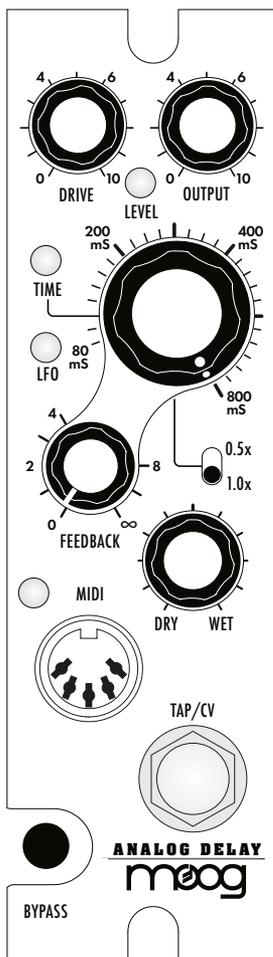
TIME LED:

- Flashes **RED** to indicate the DELAY TIME is controlled by the TIME knob or via MIDI.
- Flashes **GREEN** once indicating the Tap Tempo destination is set to DELAY TIME. Flashes **GREEN** when synced to tap tempo beat.
- Flashes **ORANGE** when synced to MIDI clock.

LFO LED:

- Flashes **RED** to indicate LFO RATE and **SHAPE**, with the transition between on and off states indicating the selected WAVEFORM.
- Flashes **GREEN** once indicating the Tap Tempo destination is set to LFO RATE. Flashes **GREEN** when synced to tap tempo beat.
- Flashes **ORANGE** when synced to MIDI clock.

TIME KNOB: Adjusts delay times from 35-400mS (0.5x setting) and 70-800mS (1.0x setting). **NOTE:** Also controllable with the plug-in/stand-alone editor or via MIDI message. See separate sections on Tap Tempo and Control Voltage.



FRONT PANEL CONTINUED

TIME RANGE : Selects between short (0.5x) and long (1.0x) delay times. Switching from 0.5x to 1.0x will lower the sound in the “feed-back loop” one octave, while switching the other direction will double the pitch and time of sound in the Delay Line. This control also selects between Bright (0.5x) and Dark (1.0x) filter settings. Since the Delay’s internal anti-alias filter must change with the Delay Time, the 0.5x setting yields a brighter tone for the same delay time as 1.0x. **Note:** *The default filter associations can be overridden using the **DELAY FILTER** switch in the editor.*

FEEDBACK : Sets the amount of Delay Line output fed back into the input of the BBDs. The feedback is variable from zero to infinite repeats. Self-oscillation and swelling delay sounds will occur at settings above 8.

NOTE: *Also controllable with the plug-in/stand-alone editor or via MIDI message.*

MIX: Cross fader control to vary the amount of wet vs. dry signal heard on output.

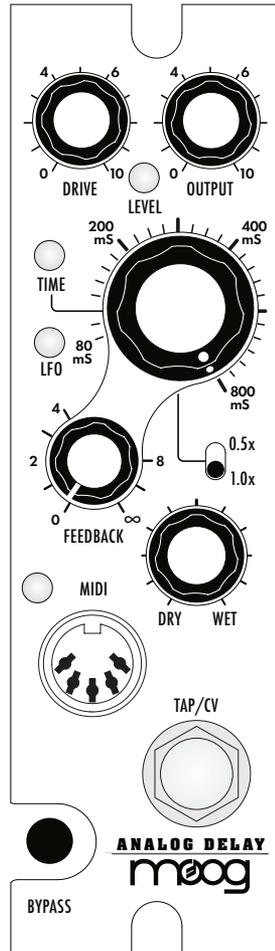
MIDI LED: Illuminates to indicate received MIDI messages, but not clock.

MIDI IN: 5 Pin DIN input for controlling the Analog Delay via MIDI.

TAP/CV IN : Assignable 1/4” TRS jack that can be used with a Moog EP-2 expression pedal for variable control, Moog FS-1 tap switch for tap tempo, or external control voltage source.

NOTE: *The TRS input provides a +5V reference on the ring, input on the tip and ground on the sleeve. NOTE: See separate sections on Tap Tempo and Control Voltage.*

BYPASS BUTTON: The **BYPASS BUTTON** is illuminated when the delay is engaged. When the Delay is off, the **BYPASS BUTTON** is off.



DELAY LINE CONTROL - VIA EDITOR

The editor provides additional “under the hood” control of the Delay Line. For controls that are available on both the front panel and the editor, settings made using the editor (or via MIDI) will take priority over front panel settings. Adjusting a front panel control will re-establish priority until another editor or MIDI message supersedes it.

The following section details the editor’s Delay Section controls and corresponding MIDI CC#:



DELAY SYNC: When **SYNC** is on, **DELAY TIME** is linked to MIDI clock and delay knob is set to a **CLOCK DIVISION** of the current MIDI BPM.

MIDI CC#: 76

FEEDBACK: Sets the amount of Delay Line output fed back into the input of the BBDs. *NOTE: Also controllable via front panel or MIDI message.*

MIDI CC#: MSB-13, LSB-45

DELAY TIME: Adjusts delay times from 35-400mS (0.5x setting) and 70-800mS (1.0x setting). *NOTE: Also controllable via front panel or MIDI message. Sets clock divisions in MIDI sync mode.*

MIDI CC#: MSB-12, LSB-44

TIME RANGE: Selects between short (0.5x) and long (1.0x) delay time.

NOTE: Also controllable via front panel or MIDI message. MIDI CC# - 74

SLEW RATE: Sets the speed at which the **DELAY TIME** transitions from a prior setting to a new one when changing delay time via LFO or directly.

MIDI CC#: MSB-5, LSB-37

MULTIPLIER: Depending on **DELAY TIME** and **TIME RANGE** settings, the **MULTIPLIER** enables longer **DELAY TIMES**. Some settings can result in “illegal” delay times causing aliasing and other audio artifacts. **MIDI CC# - 75**

CLOCK DIVISION: Sets Delay **CLOCK DIVISIONS** to a defined number of beats at the MIDI tempo (Only used when synced to MIDI. See MIDI Clock Divisions table). **MIDI CC# - 77**

DELAY FILTER: Sets **DELAY FILTER** to Dark (less high frequencies) or Bright (full fidelity). This control overrides the normal filter setting as per the **TIME RANGE**. **MIDI CC# - 89**

LFO CONTROL - VIA EDITOR

The Analog Delay contains an LFO module which can be used to modulate the delay time, creating tape delay, doubling and echoes with chorus, vibrato, and other pitch shifting effects. The LFO is accessible via the plug-in/stand-alone editor, MIDI or with the **TAP/CV INPUT**.

The following section details the editor's LFO Section controls and corresponding MIDI CC#:



LFO RATE: Adjusts the **LFO RATE** (and Clock Divisions when synced to MIDI) from 0.05 Hz to 50 Hz.

MIDI CC#: MSB-15, LSB-47

LFO SHAPE: Selects from Sine, Triangle, Square, Ramp, Sawtooth, Sample and Hold, and Smooth Sample and Hold modulations as well as **OFF** (no LFO). **MIDI CC#: 17**

SYNC: When **SYNC** is on, the **LFO RATE** is linked to MIDI clock and can be set to a **CLOCK DIVISION** of the current MIDI BPM. **MIDI CC#: 78**

LFO AMOUNT: Determines the amount of LFO modulation of the Delay Time. **MIDI CC#: MSB-16, LSB-48**

DUTY CYCLE: Adjusts the duty cycle for the square wave LFO shape from 0% (fully off) to 100% (fully on). Low percentage duty cycle is mostly off with a short high going pulse. High percentage duty cycle is mostly on with a short low going pulse. With the editor's knob at 12:00 both high and low states are equal duration (50% duty cycle = perfect square wave).

Note: Affects square wave LFO shape only. **MIDI CC#: MSB-20, LSB-52**

PHASE RESET: Resets the LFO phase to zero (the start of the waveform) when pressed. **MIDI CC#: 72**

CLOCK DIVISION: Sets the length of one LFO cycle to a defined number of beats at the MIDI tempo. For example, if the **LFO CLOCK DIVISION** is set to one whole note, the LFO will complete one cycle in four beats. See **MIDI CLOCK DIVISIONS** table for more information. **MIDI CC#: 79**

OVERVIEW OF LFO WAVEFORM CHARACTERISTICS

SINE : A periodic wave that smoothly transitions from peak to trough with no harmonics. Creates vibrato and chorusing effects when used to modulate Delay Time.

TRIANGLE: A periodic wave creates a triangle shape in moving from peak to trough. Creates similar effects to a sine wave when modulating Delay Time, but with a sharper transitions.

SQUARE: A wave that alternates almost instantaneously between two states. Creates octave and other pitch shifting effects when used to modulate Delay Time.

Sawtooth: A wave that very quickly reaches a peak and then ramps down more slowly. When used to modulate Delay Time creates pitch shifting effects that change tempo.

RAMP: A type of sawtooth wave that ramps up slowly to a peak then drops down quickly. When used to modulate Delay Time creates pitch shifting effects that change tempo.

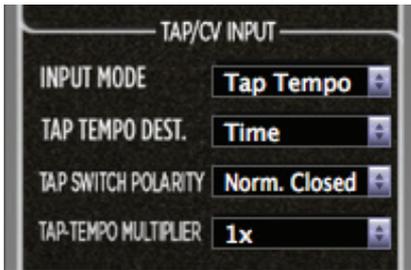
SAMPLE AND HOLD: Also known as a random step, a square-ish wave that randomly changes its an up and down state, and wave height.

SLEWED SAMPLE AND HOLD (SMOOTH): Transitions smoothly between the Sample and Hold steps

TAP/CV INPUT ASSIGNMENT

The editor contains controls for configuring the **TAP/CV INPUT**.

The following section details the editor's TAP/CV INPUT controls and their MIDI mappings:



INPUT MODE: Sets the **TAP/CV INPUT** to Tap Tempo or CV control of **DELAY TIME**, **FEEDBACK**, **LFO RATE**, **LFO SHAPE**, or **LFO AMOUNT**.

MIDI CC#: 90

TAP TEMPO DESTINATION: Sets the Tap Tempo destination to Delay TIME or LFO RATE. Note: only applicable when INPUT MODE is set to Tap Tempo. **MIDI CC#: 87**

TAP SWITCH POLARITY: Sets the TAP/CV INPUT to work with switches that are Normally Closed (such as Moog FS-1) or Normally Open.

MIDI CC#: 114

TAP TEMPO MULTIPLIER: Selects whether a tap equals a quarter note (1x), eighth note (2x) etc. **MIDI CC#: 86**

MIDI KEYBOARD CONTROL

The editor contains controls for setting MIDI keyboard parameters.

The following section details the editor's MIDI keyboard controls and their MIDI mappings.



NOTE NUMBER-> DELAY TIME: When engaged, MIDI notes sent to the Analog Delay will adjust the delay time to pitch bend the delayed audio by the musical ratio corresponding to the semitones between the notes.

MIDI CC#: 82

NOTE ON-> LFO RESET: When engaged, each MIDI note ON message restarts the LFO cycle. **MIDI CC#: 73**

MOD WHEEL-> LFO AMOUNT: Engages keyboard mod wheel control over the **LFO AMOUNT** setting. Note the mod wheel will control to a maximum level set by the current **AMOUNT** setting. If **LFO AMOUNT** is set to 0 then the **MOD WHEEL** will have no effect. **MIDI CC#: 85**

PITCH BEND-> DELAY TIME: Engages keyboard pitch bend wheel control over the **DELAY TIME** and how far it will bend the **DELAY TIME'S** pitch.

MIDI CC#: 80

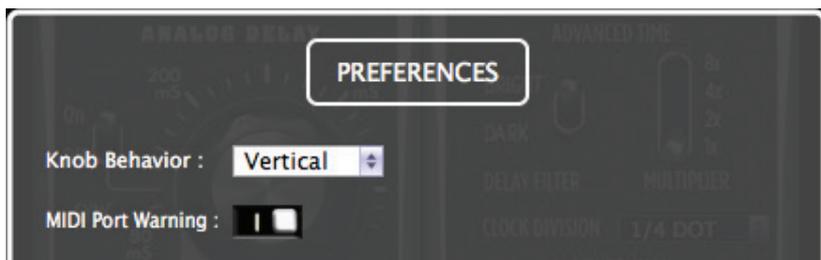
MIDI OUTPUT: Selects which MIDI port is assigned to the Analog Delay.

MIDI CC#: 119

SEND ALL AND PREFERENCES



SEND ALL: Send all current editor settings to the Analog Delay.



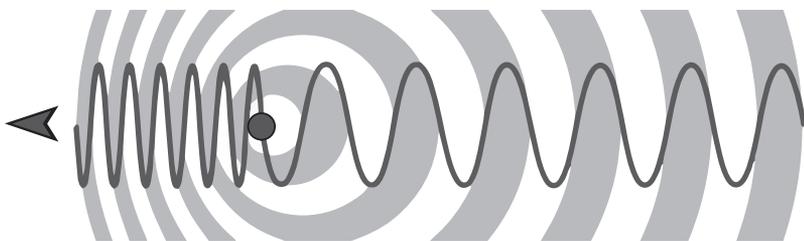
Knob Behavior: Selects between vertical and rotary knob scrolling.

MIDI Port Warning: Activates a warning when a MIDI port is unreachable.

LFO THEORY OF OPERATIONS

DELAY TIME AND PITCH SHIFTING

When you adjust the **DELAY TIME** control of the Analog Delay you are actually changing the clock rate of an oscillator that determines how fast signals go through the individual circuits in the Bucket Brigade Devices. If you do this with an input signal present, echoes from the Delay Line will be momentarily shifted in pitch. This creates a sound similar to the Doppler Effect, with the delayed signal becoming stretched or compressed as it goes through the Delay Line, thereby speeding up or slowing down the vibrations and changing the pitch.



Note: Changing the 0.5x (short)/1.0x (long) switch position either halves or doubles the **DELAY TIME** and thus compresses or stretches the delayed signal currently in the Delay Line by a factor of two. This results in the pitch of the delayed signal being shifted up or down one octave.

COMPLEX DELAY TIME MODULATIONS

The LFO acts like an invisible hand on the **DELAY TIME** control, creating modulations (adjustments) of the length of time audio remains in the BBDs. These modulations are based on the chosen **WAVEFORM**, **LFO RATE**, and **AMOUNT**.

EXAMPLES



CHORUS EFFECT

With the **DELAY TIME** at a short setting, **MIX** at 12:00, the LFO settings smoothly modulate the **DELAY TIME** so that the delayed signal has its pitch slightly raised and lowered, creating a chorus effect.



BOUNCE OCTAVE PITCH SHIFT

With Delay Line settings as in the previous example, these LFO settings modulate the **DELAY TIME** so that the delayed signal has its pitch shifted up and down by an octave.

NOTE: SLEW RATE: 0%

TAP/CV INPUT

TAP TEMPO

The **TAP TEMPO** input on the Analog Delay can be used to control either the **DELAY TIME** or the **LFO RATE**.

SET A TEMPO: Simply plug in a Moog FS-1 footswitch and tap at the desired tempo in quarter notes. After the third tap the Delay will begin calculating the tempo and keep the average tempo as you continue to tap.

SET A NEW TEMPO: Wait five seconds and then press the switch three times to set a new tempo.

CHANGE TAP TEMPO DESTINATION: use the **TAP TEMPO DESTINATION** control on the plugin/stand-alone editor, or press and hold the tap tempo footswitch to toggle between **DELAY TIME** and **LFO RATE**. The destination LED (**DELAY TIME** or **LFO RATE**) will flash green one time to indicate the destination. The LED indicator for the function being controlled by Tap Tempo will flash green and in sync with the chosen tempo

***NOTE:** When either destination is synchronized to MIDI Clock, Tap Tempo is disabled.*

LFO EFFECTS ON DELAY TIME SET USING TAP TEMPO

If you set the **DELAY TIME** via Tap Tempo and then modulate the **TIME** with the LFO, you may find that your tapped tempo has changed. This is due to the LFO averaging the **DELAY TIME**.

CONTROL VOLTAGE

DELAY TIME: A setting of 0 volts or **GROUND** sets the **DELAY TIME** to the shortest possible time while a 5v setting sets the **TIME** to the longest possible time, based on the current 0.5x/1.0x and **TIME MULTIPLIER** settings. To modify the **DELAY TIME** from minimum to maximum via control voltage or expression pedal, set the **DELAY TIME** control to the lowest setting via the panel, editor or MIDI message.

FEEDBACK: A setting of 0 volts or **GROUND** allows for no feedback while a 5v setting gives infinite feedback. To change the **FEEDBACK** amount from zero to infinite via control voltage or expression pedal, set the **FEEDBACK** to the lowest setting via the panel, editor or MIDI message.

LFO RATE - A setting of 0 volts or **GROUND** sets LFO Rate to 5 Hz while a 5v setting sets the **RATE** to 50 Hz. To modify the **LFO RATE** from minimum to maximum via control voltage or expression pedal, set the **LFO RATE** to the lowest setting via the editor or MIDI message.

LFO AMOUNT: A setting of 0 volts or **GROUND** sets the **LFO AMOUNT** at zero while a 5v setting sets the **AMOUNT** to maximum. To modify the **LFO AMOUNT** from minimum to maximum via control voltage or expression pedal, set the **LFO AMOUNT** control to the lowest setting via the editor or MIDI message.

LFO SHAPE: A setting of 0 volts or **GROUND** sets **LFO SHAPE** to **OFF** while a 5v setting sets **SHAPE** to Smooth S-H. To modify the **LFO SHAPE** from minimum to maximum via control voltage or expression pedal, set the **LFO SHAPE** control to the lowest setting via the editor or MIDI message

***NOTE:** An expression pedal used with the Analog Delay should contain a 50K Ohm linear taper potentiometer. Other values will work at either reduced range or increased noise.*

ABOUT ANALOG DELAYS

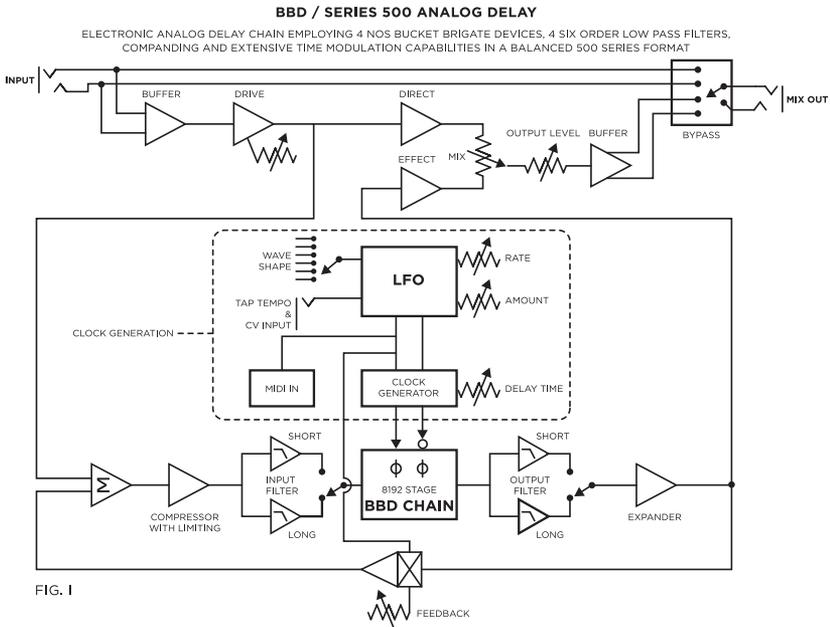
A delay circuit produces a replica of an audio signal a short time after the original signal is received. If you listen to the original (direct) signal and the delayed signal together, the delayed signal will sound like an echo of the direct. To make a whole series of echoes that die out gradually, you feed the delayed output signal back to the input. You can determine how far apart the echoes are by adjusting the delay time of the delay circuit, and you can adjust how fast the echoes die out by adjusting the amount of feedback from the delay. In addition, you can determine how loud the echoes are by adjusting the mix between the direct signal and the delayed signal.

During the early 1970's, large-scale semiconductor analog delay circuits became available. These are called Bucket Brigade Delay (BBD) chips, because they function by passing the audio waveform down a chain of several thousand circuit cells, in analogy to water being passed by a bucket brigade to put out a fire. Each cell in the chip introduces a tiny delay. The total time delay depends on the number of cells and on how fast the waveform is "clocked", or moved from one cell to the next.

In the Analog Delay, the LFO creates a control voltage that is used to modulate the time function of the delay. The BBDs in the Delay Line contains 8192 "buckets". With the time unmodulated the signal spends the same amount of time in each bucket based on the selected delay time. With the time modulated by the LFO, time is no longer a linear function and audio signals already in the buckets get compressed or stretched. A good analogy for picturing this is a clock with a sweep hand to show the seconds. Imagine that you could hold the sweep hand and either slow it down or speed it up. Yet, when you let it go the sweep hand instantly went to the correct position on the clock face. In a sense, this is how the LFO modulates the Delay Line.

CIRCUIT CONFIGURATION

The figure below is a simplified block diagram of the Analog Delay.



MIDI CONTROL OF THE ANALOG DELAY

The following section explains the MIDI implementation of the Analog Delay. For information about what MIDI is and how it works, you can go to the following webpage for tutorials: www.midi.org/aboutmidi/tutorials.php

MIDI CHANNEL

The default MIDI Channel for the Analog Delay is Channel 1. To change this, send the MIDI channel you wish to change to CC 119 on the existing channel. The MIDI channel is the value sent. +1 i.e. to set the Delay to receive on MIDI channel 2 send a value of 1 to CC119. The **MIDI LED** will flash **ORANGE** indicating that the message has been received. The Delay will now only receive MIDI messages on that channel. The current MIDI Input channel is stored in memory on power down.

Note: MIDI Clock and System Exclusive messages are NOT Channel Mode messages, and are received by the Analog Delay regardless of the current MIDI Input Channel.

MIDI CONTROL CHANGE (CC) MESSAGES

The settings of the Analog Delay can be controlled by MIDI Control Change (CC) messages. In addition to the front panel controls, there are a number of advanced features that can be enabled and edited with Control Change messages.

A MIDI CC message has both a CC# from 0 to 127 and a value from 0-127. The CC values that affect panel controls replace the physical setting of the front panel controls. When the corresponding front panel control is changed after receiving a MIDI CC message, the value will return to that panel control.

WARNING: Moving a front panel control when the control is simultaneously receiving MIDI CC messages will result in conflicting values.

MIDI CC NUMBERS AND VALUES

PARAMETER	MSB CC#	LSB CC#	TYPE	VALUES	PERSISTENT
Time Slew Rate	5	37	Continuous	0-16383	
Time	12	44	Continuous	0-16383	
Feedback	13	45	Continuous	0-16383	
LFO Rate	15	47	Continuous	0-16383	
LFO Shape	17		Discrete [8]	0(Off),16(Sine) 32(Triangle), 48(Square), 64(Saw), 80(Ramp), 96(S&H), 112(Smth. S&H)	
LFO Duty Cycle	20	52	Continuous	0-16383	
LFO Phase Reset	72		1-Shot	Send value 64 when UI button clicked, or when host automation transitions from Off(value<half) to on(value>half)	
LFO MIDI Note Reset On/Off	73		Discrete [2]	0(off), 64(on)	Yes
Time Short/Long	74		Discrete [2]	0(0.5x),64(1.0x)	
Time Multiplier	75		Discrete [4]	0(1x),32(2x), 64(4x),96(8x)	
Time Sync on/off	76		Discrete [2]	0(off), 64(on)	Yes
Time Clock Div.	77		Discrete [21]	See MIDI Clock Division Chart	
LFO Sync on/off	78		Discrete [2]	0(off), 64(on)	

PARAMETER	MSB CC#	LSB CC#	TYPE	VALUES	PERSISTENT
LFO Sync on/off	78		Discrete [2]	0(off), 64(on)	
LFO Clock Div.	79		Discrete [21]	See MIDI Clock Division Chart	
Pitch Bend Amt.	80		Discrete [8]	0(off), 16(2 semi-tones), 32(3 semi), 48(4 semi), 64(5 semi), 80(7 semi), 96(12 semi), 112(24 semi)	Yes
MIDI Note Mode Select	82		Discrete [3]	0(off), 43(delay time)	Yes
Tap Tempo A	83		1 Shot	0-127 = a Tap	
Mod Wheel to LFO Amount	85		Discrete [2]	0(off), 64(on)	Yes
Tap Tempo Multiplier	86		Discrete [4]	0(1x), 32(2x), 64(3x), 96(4x)	
Tap Tempo/ Sync Destination	87		Discrete [2]	0(time), 64(LFO)	
Filter Dark/Bright	89		Discrete [2]	0(Bright), 64(Dark)	
CV Input Mode Select	90		Discrete [8]	0(Tap Tempo), 16(CV->Time), 32(CV->Feedback), 48(CV->LFO Rate), 64 (CV->LFO AMT), 80(CV->LFO Shape)	Yes
Tap Switch Polarity	114		Discrete [2]	0(Normally Closed), 64(Normally Open)	Yes
Tap Tempo B	115		Discrete [2]	0-63=Tap Switch Off 64-127=Tap Switch On	
Time LED Divider	116		Discrete [8]	0-15=x1, 16-31=x2, 32-47=x3, 48-63=x4, 64-79=x5, 80-95=x6, 96-111=x7, 112-127=x8	
MIDI Channel Select	119		Discrete [16]	value+1 = New MIDI Channel	Yes

The **DELAY TIME MULTIPLIER** multiplies the delay time by 2, 4 or 8, vastly extending delay time. This feature is for obtaining unusual and lo-fi echo effects. When the delay time is increased past the default maximum delay time available on the front panel, the BBD Clock signal will be audible.

MIDI CLOCK DIVISIONS

(DELAY TIME CC#77, LFO RATE #79)

CC VALUE	CLOCK DIVISIONS	NUMBER OF CLOCKS
0-5	4 Whole	64-69
6-11	3 Whole	70-75
12-17	2 Whole	76-81
18-23	WH + 1/2 Dot	82-87
24-29	WH + 1/2	88-93
30-34	WH + 1/4	94-98
35-40	WH	99-104
41-46	1/2 Dot	105-110
47-52	WH T	111-116
53-58	1/2	117-122
59-63	1/4 Dot	123-127
64-69	1/2 T	64-69
70-75	1/4	70-75
76-81	1/8 Dot	76-81
82-87	1/4 T	82-87
88-93	1/8	88-93
94-98	1/16 Dot	94-98
99-104	1/8 T	99-104
105-110	1/16	105-110
111-116	1/116 T	111-116
117-122	1/32	117-122
123-127	1/32 T	123-127

MIDI NOTE MODES: The Analog Delay's **DELAY TIME** can be controlled from MIDI Note On messages. Tuned pitch shifting effects using the Short or Long mode can be played from a keyboard or sequencer. When this mode is enabled the unit receives a MIDI "Note On" message. The "Note ON" number determines the Delay time. The unit responds to MIDI note numbers 0 to 90. The MIDI Note On Velocity value is ignored.

MIDI CLOCK SYNC: The **DELAY TIME** and **LFO RATE** can be synchronized to MIDI System Real-time Clock messages. These messages are 24 ppq. To enable sending of these messages, consult the user manual for your MIDI device. When the Analog Delay receives MIDI Clock messages, the LED indicator for the synchronized function turns orange to indicate that it is synchronized to MIDI Clock. The **DELAY TIME** and **LFO RATE** can be set to divisions of this tempo via the front panel (Delay **TIME** only), the editor, or from MIDI CCs# 77 and 79 (see Clock Divisions table).

MIDI SYSEX MESSAGES: Used for updating or finding out the unit's firmware version. For more information about this, refer to user notes with any firmware updates posted in the Analog Delay section of the www.moog-music.com website.

STEREO LINKING TWO ANALOG DELAY UNITS

The included Stereo Linking Kit allows you to link two units together via special stereo linking cable. With two Delays linked, one device becomes the master and the other the slave.

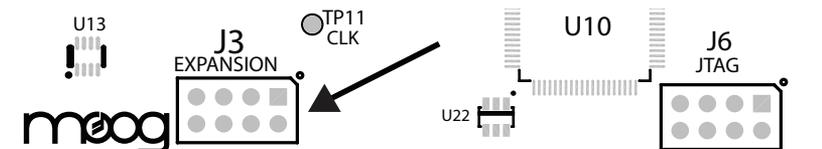
- In a stereo-linked pair of Analog Delays, the master device controls the slave device's: **DELAY TIME**, **TIME RANGE (0.5x/1.0x)**, **FEEDBACK**, **LFO RATE**, **LFO SHAPE**, and **LFO AMOUNT** settings
- **DRIVE**, **OUTPUT**, and **MIX** controls are analog, independently controlled and not linked.
- The **TAP/CV** Input works across the stereo link from the master to the slave only.
- All MIDI messages received by the master will be echoed to the slave with the exception of MIDI system exclusive (SysEx) messages

INSTALLATION

Please note that the end of the stereo linking cable connector designed to attach to the slave device has an additional wire loopback.

- Locate the expansion connector labeled J3 on the bottom center edge of the Analog Delay circuit boards.
- When plugging in the cable, the red stripe must face the rear edge of the Analog Delay Module. (The edge that plugs into the chassis)
- Plug the end without the wire loop into the Delay you wish to be the master unit.
- Plug the end with the wire loop into the slave unit.

When two units are linked in stereo mode the **TIME** and **FEEDBACK** controls on the slave unit will be disabled.



SPECIFICATIONS

BALANCED LINE LEVEL VIA 500 RACK: +18dBQ to -12dBQ

INPUT IMPEDANCE: 1Mff Differential or single ended, common Mode 48Kff.

OUTPUT IMPEDANCE: Nominally 50ff differential 25ff single ended.

MAX. OUTPUT LEVEL: Better than +28dBQ, balanced.

DRIVE GAIN: 30dB Range of control

OUTPUT GAIN: 30dB Range of control

FREQUENCY RESPONSE: Dry Better than +/-0.5dB 20Hz - 20KHz pass band. Wet, 0.5x 20Hz -2.6Khz, 1.0x 20Hz - 1.65KHz nominal.

BYPASS: Hard Relay True Bypass

POWER CONSUMPTION: 130mA +16V, <60mA -16V

**Specifications subject to change without notice.*

LIMITED WARRANTY

Moog warrants its products to be free of defects in materials or workmanship and conforming to specifications at the time of shipment for a period of one year from the date of purchase. During the warranty period, any defective products will be repaired or replaced, at Moog's option, on a return-to-factory basis. This warranty covers defects that Moog determines are no fault of the user.

The Moog Limited Warranty applies to USA purchasers only. Outside the USA the warranty policy and associated service is determined by the laws of the country of purchase and supported by our local authorized distributor. A listing of our authorized distributors is available at: <http://www.moogmusic.com/support/international-distributors>

If you purchase outside of your country, you can expect to be charged for warranty as well as non-warranty service by our in-country distributor.

RETURNING YOUR PRODUCT TO MOOG

You must obtain prior approval in the form of an RMA (Return Material Authorization) number from Moog before returning any product. Click "Customer Service" to request the RMA # via email or call us at (828) 251-0090. All products must be packed carefully and shipped with the Moog supplied power adapter. Sorry, the warranty will not be honored if the product is not properly packed. Once you have received the RMA# and carefully packed your Moog, **Ship** the product to Moog Music Inc. with transportation and insurance charges paid, and include your return shipping address.

WHAT WE WILL DO

Once received, we will examine the product for any obvious signs of user abuse or damage as a result of transport. If the product abused, damaged in transit, or is out of warranty, we will contact you with an estimate of the repair cost. Warranty work will be performed and Moog will ship and insure your product to your United States address free of charge.

HOW TO INITIATE YOUR WARRANTY

Please initiate your warranty online at www.moogmusic.com . Click "Product Registration". If you do not have web access, fill out all the information on the card included with your shipment and mail to:

**MOOG MUSIC INC.
160 BROADWAY
ASHEVILLE, N.C. USA 28801
ATTN: NEW PRODUCT REGISTRATION**

Note: Specifications subject to change without notice.

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