

Delayl022

Analog BBD delay

I. Introduction

This module is no classic echo, but a delay designed for audio rate feedback and sound sculpturing. The 1V/oct. tracking and feedback CV input makes it suitable for many VCO-like applications, for creating drum and string –like sounds (Karplus-Strong) and/or for room ambience. There is a certain amount of noise, as to be expected from analog BBD delay modules, however the Delay1022's clear and brilliant sound in combination with the manually controllable output low pass filter makes this completely tolerable.

2. Features

- Delay times from 2.5 ms to 50ms (without T CVin)
- CV controllable delay time (\triangleq feedback frequency)
 - Good 1V/oct tracking
- Feedback CV control input
- 2nd delay output behind feedback-contolling VCA
 - Delay muting
 - Noise reduction
- Manually controllable output lowpass (12dB)
 - Noise reduction
 - $\circ \quad \text{Sound control} \quad$
- Switchable low cut filter

- Eurorack module
- Width: 12 HP
- Dimensions:
 - 128,5 mm x 60,6 mm
- Depth: 52mm
- Supply voltage: ±12V
- Current: +12V: \approx 78mA; -12V: \approx 58mA
- Available with banana or 3,5mm minijacks



Minijack version



Banana version



Drawing (Rev.6)

1



3. Functions



BBD selector This switch decides if one (512 stages) or two (1024 stages) BBDs (Bucket Brigade Device) are used for delay generation. (3) (5)

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Delay Time Manual control of ②delay time. The range is from around 25ms to 1,3ms for BBD switch ① in upper position and from ca. 50ms to 2,5ms for the switch in its lower position (\triangleq 20–400Hz / 40–760Hz in self–oscillating mode). This knob adjusts the frequency of the internal BBD clock VCO from \approx 10kHz to \approx 200kHz.

The range can be extended by adding a CV to one of the respective inputs.

Feedback Loop mode switch In 3 the upper position 'normal', the delayed signal is routed back to the BBD's input with its normal polarity.

(Amount of the back-routed signal depends on the setting of the poti 'Feedback' ⁽¹²⁾ and/or a control voltage applied on 'Feedback CVin' ⁽¹⁴⁾)

In middle position 'open', the feedback loop is interrupted. This allows to insert devices like filters, modulators etc. in the loop by using the 'In2' input O and the 'Delay Out' output O.

In the lower position 'inv.', the delayed signal is inverted and sent back to the BBD's input with negative polarity.

- ④ Input1 The BBD's audio signal input. The signal applied on In1 will be mixed with the BBD's delay output; the mixed signal is provided on output socket ⑥ ('Mix out'). The ratio of the mix (dry-wet) is adjusted with knob ⑧ ('In1 ↔ Delay').
- \bigcirc In1 Level adjusts the level of the audio signal from In1 \bigcirc feeding the BBDs.
- 6 Mix Output Output signal mix of the BBD's delayed output and the input signal applied on 'In 1'④. The ratio between the two signals (△ dry-wet) can be adjusted by using knob ⑧ ('In1↔ Delay').
- Input2 2nd audio signal input for the BBD. Unlike 'In 1' ④, this input has no input level control knob and no dry/wet mixing.
- (8) In1 ↔ Delay Ratio between the signal from input ④ 'In1' and the delayed signal (△ dry ↔ wet). The mixed signal is provided at ⑥.

It Cut Filter (previously 'Lowpass') Manual cutoff frequency control for the 12db lowpass filter at the end of the BBD stage. This control knob may be used for sound control and/or for noise reduction.

Note: The lowpass filter is also affecting the 1V/oct. behaviour of the delay. By default, the 1V/oct. tracking is best matched for a value of \approx 3-4 on scale of the lowpass filter knob.

- 1 Delay Time CV Input 1 knob for the signal level of a delay time CV (Control Voltage) signal applied on socket T CVin 1 16.
- (1) **Feedback CV Input knob** (Polarizer) Adjusts the level of feedback CV (Control Voltage) for a feedback CV signal input applied on socket Feedback CVin (a). In center position (denter locked) the input level is 0. Turning this knob clockwise, the incoming feedback CV signal will be normally added to the feedback control signal adjusted with knob (a). By turning the knob ccw, the polarity of the CV signal becomes inverted resulting in a substraction/attenuation of the feedback control voltage.
- Feedback knob: Manual control of feedback. The delay output is fed back into the BBD input via an internal VCA (Voltage Controlled Amplifier). The feedback VCA can be manually controlled with this knob and/or by adding a control voltage to the feedback CV input ⁽¹⁾. From 5-6 on the scale the delay is beginning to self-oscillate.
- (3) Delay Time CV Inversion Switch Inverts the incoming signal on socket 'T CVin 1' (6).
- Feedback CV Input Control voltage input for the feedback amplification. The amount and polarity can be adjusted by using the Feedback CV in knob ①. A positive voltage will increase the feedback; a negative voltage will attenuate or mute the feedback.
- (5) **Low Cut** (*new from Rev.6*) The switch in its upper position is activating a BBD highpass coupling: deeper frequencies in the delay route will be reduced. May be used to avoid too dominant bass response.
- Delay Time CV Input1 Control voltage input for delay time (feedback frequency). Polarity of the incoming signal can be inverted with 'Inv.' switch ⁽³⁾; its amount is adjustable by using knob 'T CVin 1' ⁽¹⁾.
- Delay Time 1V/Oct. CV Input 1V/Octave input. The feedback frequency (e.g. in self-oscillating mode) is a function of the delay time (Frequency = 1/T).
 Note: The 1V/oct. tracking is also a little bit dependent of the lowpass filter ⁽⁹⁾ setting.
 For 1V/oct. adjustment, see chapter '4. IV/Oct. Adjustment'
- Delay Output This 2nd delay output is behind the internal feedback VCA. Unlike output 'Mix' 6, the output level is directly dependent of the settings of knob 'feedback' ¹/₂ and/or the input on socket 'Feedback CV in' ¹/₄; e.g. if the 'Feedback' knob ¹/₂ is set on '0' on scale (fully ccw), there will be no

output signal. This muting option can be useful to reduce noise and/or for sound modelling. This output can also be used – in combination with input 'In 2' \bigcirc – to insert filters, modulators etc. into the feedback loop.

Audio routing



4. IV/Oct. Adjustment

The Delay1022's Timebase VCO is already carefully adjusted to 1V/oct.

If you realize that the Delay1022 isn't in tune with your further analog synthesizer equipment, it could be necassary to retune it.

Procedure (Suggestion)



- 1. Switch on your equipment and the Delay1022 and wait ½ hour until the oscillators have warmed up.
- 2. Set manual frequency control O to \approx '2' on scale and bring BBD selector O in upper position.
 - Turn the 'Hi Cut' filter knob (9) (previously called 'Lowpass') to \approx 3-4 on scale (the lowpass filter is affecting the 1V/oct. behaviour; if you prefer another default filter setting for best 1V/oct. tracking, than you may change the lowpass filter setting for this adjustment procedure).
- Connect a CV from a keyboard (or a similar CV source) both to your favorite VCO's 1V/oct. input and to the Delay1022's 1V/oct. input ¹/₀.

(You can also use the Bus CV; to activate the Delay1022's Bus CV input see chapter5: '*Bus CV*')

- **4.** Connect both devices, your favorite VCO and the Delay1022, to a sound system, that you can listen to them simultaneously.
- 5. Bring the Delay1022 in self-oscillating mode by turning knob 'Feedback' 12 fully clockwise.
- **6.** Play a 'C' (65,41Hz), or a similar note, on your keyboard . The VCO should be in pitch with the keyboard. The note should be nearby the tone you have adjusted on the Delay1022.
- 7. Adjust poti 'Time' 2 until the pitch of the Delay1022 is the same as that of the 2nd VCO.
- **8.** Play a note $\approx 2-3$ octaves higher (e.g. c2, $\leq 523,3$ Hz). Adjust trimmer Tr1 1 on the back of the module (see above) until the Delay1022 is tracking to the 2nd VCO (zero-beat).
- **9.** Play a note 1 octave higher than in step **8**, e.g. 1046,6 Hz (3-4 octaves higher than the ground note). If necessary, adjust HF trimmer 🖲 until both tones are tracking (zero-beat).
- 10. Go back to step "6" and repeat all other steps until both devices are in tune.



5. Bus CV

Jumper "JP1" up = "off" position (PCB side): The	Jumper "JP1" down = "on" position (PCB side): The	
Bus CV is not connected.	Bus CV is controlling the Delay1022's delay time.	

6. Further Adjustments



1 1V/Oct. Adjustment

See above: 4. IV/Oct. Adjustment

2

BBD1 output attenuator

(Feedback insertion point)

Output attenuator for BBD1; due to the position of knob 'Feedback' ⁽¹²⁾, ensuring the same amplitude and feedback level for BBD1 in relationship to BBD2 and to avoid upcoming self-oscillation when switching between BBD1 and BBD2 (switch ⁽¹⁾).

3 VCA operating point

The setting of this trimmer determines the VCA's working point – at which position of knob 'Feedback' ⁽¹⁾ the delay will begin to self-oscillate; by default this point is set on 5-6 on the scale (2 o'clock).

4 Feedback compensation for short delay times

For short delay times, the audio signal gets more attenuated - causing a shorter feedback for short delay times. To avoid this, this effect is internally compensated. Value of compensation is set by this trimmer.

8 HF-Trim

See above: 4. IV/Oct. Adjustment

For completeness - however these settings should not be changed:

5 VCA output offset

6 BBD chips input bias

$\fbox{7}$ Feedback time potentiometer 2 range

7.Patches

Simple patches (with other CG Products' modules)

Patch	Description	Audio Link
Form matrices Form M	1. Delay1022 triggered with short impulses The dynamic pulse output of the <u>PEAK+HOLD</u> (or any other impulse source) feeding the Delay1022 is a simple way to create percussive drum and string-like sounds.	http://www.cg-products.de/ Audio/Delay- Patch1_ImpulseIn-350.mp3
Provide the second seco	2. Delay1022 triggered with noise-bursts Better, because allowing more dynamic range and more sound options, is using short noise-bursts or another short envelope- shaped sound source to trigger the delay. The <u>X</u> multiplier in this example is working as a linear VCA.	http://www.cg-products.de/ Audio/Delay-Patch2_X- ImpulseIn-355+357.mp3
	3. Delay1022 & <u>XR22 VCO</u> The combination of the Delay1022 with the <u>XR22 VCO</u> opens up a wide variety of fascinating sounds.	XR22 VCO AM in: Rhythm machine; XR22 VCO frequency modulated with PEAK+HOLD; Delay time modulated with sequencer & 2 nd VCO: <u>http://www.cg-products.de/</u> <u>Audio/Delay-</u> <u>Patch3_XR22VCO-364.mp3</u>
Notice 10 The second s	4. Delay1022 \underline{X} modulated With the delay's FB loop in inversion mode (Switch ③ in lower position 'inv') and the delay's output amplitude-modulated with itself, a 2 nd 'voice' with interesting timbres and exponential dynamic can be produced, useful e.g. in stereo applications.	Delay In: Rhythm machine <u>http://www.cg-</u> <u>products.de//Audio/Delay-</u> <u>Patch4_outputX-367.mp3</u>
Pre- Corrections of the second secon	5. Delay1022 & <u>Pre</u> Embed acoustic instruments and sounds via microphone or pickup. Delay effects, flanging, phasing etc.	PRE In: Microphone/Trumpet Delay time modulation with sinewave <u>http://www.cg-products.de/</u> <u>Audio/Delay-Patch5_Pre-</u> <u>trump-377+378.mp3</u>



8. Contact & Support

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Product webpage: <u>https://www.cg-products.de/module/delay1022/</u>

This is Revision 6.2 or higher

Documentations for previous versions see here: <u>https://www.cg-products.de/documentations/Delay1022_documentation_Rev.5.5.pdf</u> <u>https://www.cg-products.de/documentations/Delay1022_documentation_Rev.3.pdf</u>

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