Morphor®

Echo
Analogue Quad Tap BBD Stereo Delay

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Warranty

THIS PRODUCT IS COVERED BY MORPHOR'S LIMITED WARRANTY, FOR TWO YEARS FOLLOWING THE DATE OF PURCHASE (PROOF OF PURCHASE/INVOICE REQUIRED).
THIS WARRANTY COVERS ANY DEFECT IN THE MANUFACTURING OF THIS PRODUCT.

THIS WARRANTY DOES NOT COVER ANY DAMAGE OR MALFUNCTION CAUSED BY INCORRECT USE - SUCH AS, BUT NOT LIMITED TO: POWER CABLES CONNECTED BACKWARDS, WRONG POWER SUPPLY VOLTAGES, BACKWARDS OR REVERSED EURORACK BUS BOARD CABLE CONNECTION, EXCESSIVE VOLTAGE LEVELS, ABUSE OF THE PRODUCT, REMOVING KNOBS, CHANGING FACE PLATES, EXPOSURE TO EXTREME TEMPERATURE OR MOISTURE LEVELS, OR ANY OTHER CAUSES DETERMINED BY MORPHOR TO BE THE FAULT OF THE USER ARE NOT COVERED BY THIS WARRANTY, AND NORMAL SERVICE RATES WILL APPLY.

THE WARRANTY COVERS REPLACEMENT OR REPAIR, AS DECIDED BY MORPHOR. PLEASE CONTACT OUR CUSTOMER SERVICE (SUPPORT@MORPHOR.IO) FOR A RETURN AUTHORIZATION BEFORE SENDING THE MODULE. THE COST OF SENDING A MODULE BACK FOR SERVICING IS PAID FOR BY THE CUSTOMER. CHANGES AND/OR MODIFICATIONS TO THE MODULE NOT APPROVED BY MORPHOR COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

THE INSTRUMENT IS TO BE SHIPPED IN THE ORIGINAL PACKAGING ONLY. ANY INSTRUMENT SHIPPED TO US FOR RETURN, EXCHANGE, WARRANTY REPAIR, UPDATE OR EXAMINATION HAS TO BE IN ITS ORIGINAL PACKAGING! ALL OTHER DELIVERIES WILL BE REJECTED. THEREFORE, MAKE SURE YOU KEEP THE ORIGINAL PACKAGING AND TECHNICAL DOCUMENTATION.

PLEASE FOLLOW THE INSTRUCTIONS FOR USE OF THE INSTRUMENT CAREFULLY BECAUSE THIS WILL GUARANTEE PROPER OPERATION OF THE INSTRUMENT. DUE TO THE FACT THAT THESE INSTRUCTIONS TOUCH ON PRODUCT LIABILITY, IT IS ABSOLUTELY IMPERATIVE THAT THEY BE READ CAREFULLY. ANY CLAIM FOR DEFECT WILL BE REJECTED IF ONE OR MORE OF THE ITEMS HAS NOT BEEN OBSERVED. DISREGARD OF THE INSTRUCTIONS CAN VOID THE TWO YEARS COVERED BY WARRANTY.

Package Contents

In the Morphor Echo - Analogue Quad Tap BBD Stereo Delay box you will find:

- A Morphor Echo - Analogue Quad Tap BBD Stereo Delay module
- A 16-to-16-pin Eurorack power cable
- 2 high-quality thumb screws (knurlies)
- An original Morphor brand sticker

If any of the above items is missing, please contact your dealer or send an email to support@morphor.io.

Safety Instructions

I.   Never use the instrument in a humid or wet environment, nor near flammable goods. The instrument must never be operated outdoors but solely in dry rooms.

II. No liquids or conducting substances must get into the instrument. Should this be the case, the instrument is to be disconnected from mains power immediately and examined, cleaned and possibly repaired by a qualified technician.

III. Never expose the instrument to temperatures above +50° C or below -10° C. Before operation, the instrument should have a temperature of at least 10° C. Do not expose the instrument to direct sunlight. Do not install the instrument near heat sources like heaters, open fire places, central heating etc. Keep the top of the instrument clear in order to allow proper ventilation, otherwise the instrument could eventually overheat.

IV. Never place heavy objects on the instrument.

V.   Transport the instrument carefully, never let it drop or fall over. Make sure that during transport and in use the instrument is supported properly and cannot drop, slip or fall over because people might get injured.

VI. The instrument may only be used for the purpose described in this operating manual. Due to safety reasons, the instrument must never be used for other purposes.

Conformity

This device meets the requirements of the following standards and/or directives: 2014/30/EU, 2014/35/EU, 2009/125/EC, 2011/65/EU, 2012/19/EU, EN 60065, EN 55032, EN 55035. Please refer to the online Declaration of Conformity for detailed information regarding compliance.
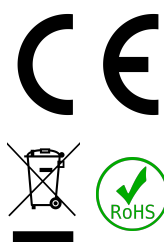
Installation

Before you start

Morphor modules are designed to be used with an Eurorack compatible case and power supply. We recommend you to use a case with an adequate high-quality power supply. Before installing the module in your case, you must ensure your power supply has a free Eurorack standard PSU connector (2x8 pin header connector) and sufficient available capacity to power the module:

1. Make a separate sum of the +12 V, -12 V and +5 V maximum current draws respectively for all your modules, including the new one. The maximum current draw is specified in the manufacturer's technical specifications for each module. You can use a tool like ModularGrid to help you calculate the total values for your case.

2. Compare each of these sums to the specifications of your case's power supply.

3. Proceed only with the installation if none of the total values exceeds the power supply's specifications. Otherwise you must remove some modules to free up some capacity or upgrade your power supply to allow more capacity in your case. If you do not adequately power your modules, it may result in damage to your modules or power supply. If you are unsure, please contact us before proceeding.

4. Make sure your case has enough free space (20 HP) to fit this module. To prevent screws or other debris from falling into the case and shorting any electrical contacts, do not leave gaps between adjacent modules, and cover all unused areas with blank panels. Similarly, do not use open frames or any other enclosure that exposes the backside of any module or the power distribution board.

Installing your module

Always turn off the power to the case and disconnect the power cable when installing or removing a module from your case to avoid injury or equipment damage.

The **Morphor Echo - Analogue Quad Tap BBD Stereo Delay** uses the -12 V rail, +12 V rail and optional the +5 V rail of the power supply (using a standard Eurorack 2x8 pin connector). The red stripe of the included ribbon cable (-12 V side) must be oriented on the same side as the "RED -12 V" marking on the module and on your Eurorack power distribution board.
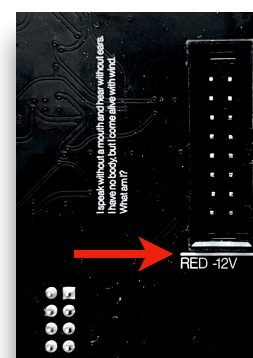
Power connector on the rear side of the module

Power Setting

When using the **5 V FROM RACK** setting (selectable using the switch on the back), the module draws a maximum current of **155** mA from the +12 V rail, maximum **120** mA from the -12 V rail and maximum **50** mA from the +5 V rail.

When using the **5 V INTERNAL** setting, the module does not use the rack's +5 V rail and generates its own +5 V and will then draw a maximum current of **205** mA from the +12 V rail and maximum **120** mA from the -12 V rail.

5 V selector switch on the rear side of the module

Introduction
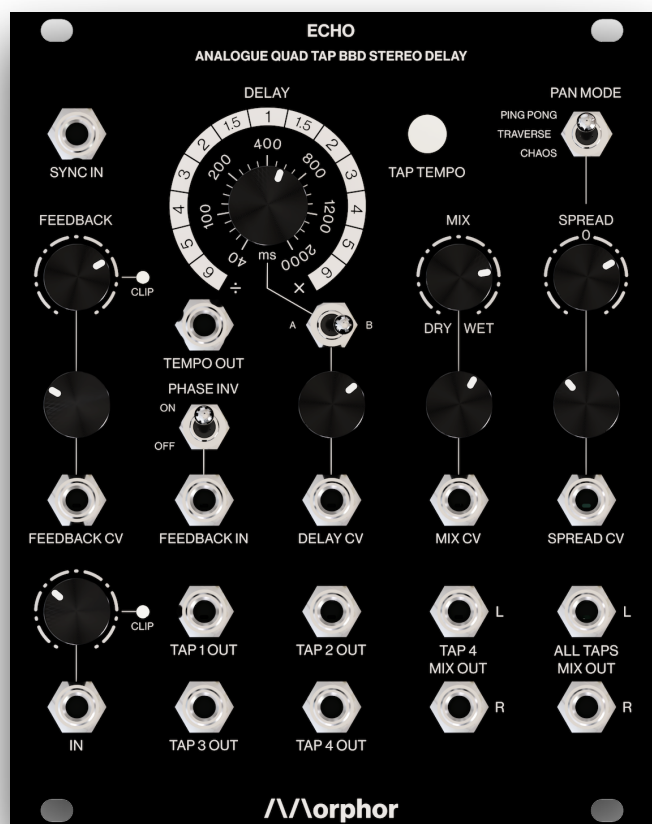
The **Morphor Echo** merges the lush, classic warmth of analog sound with modern, flexible control options, delivering a versatile stereo delay module for Eurorack. Taking up 20 HP in your rack, this syncable delay features four 4096-stage Bucket Brigade Devices (BBDs) with individual tap outp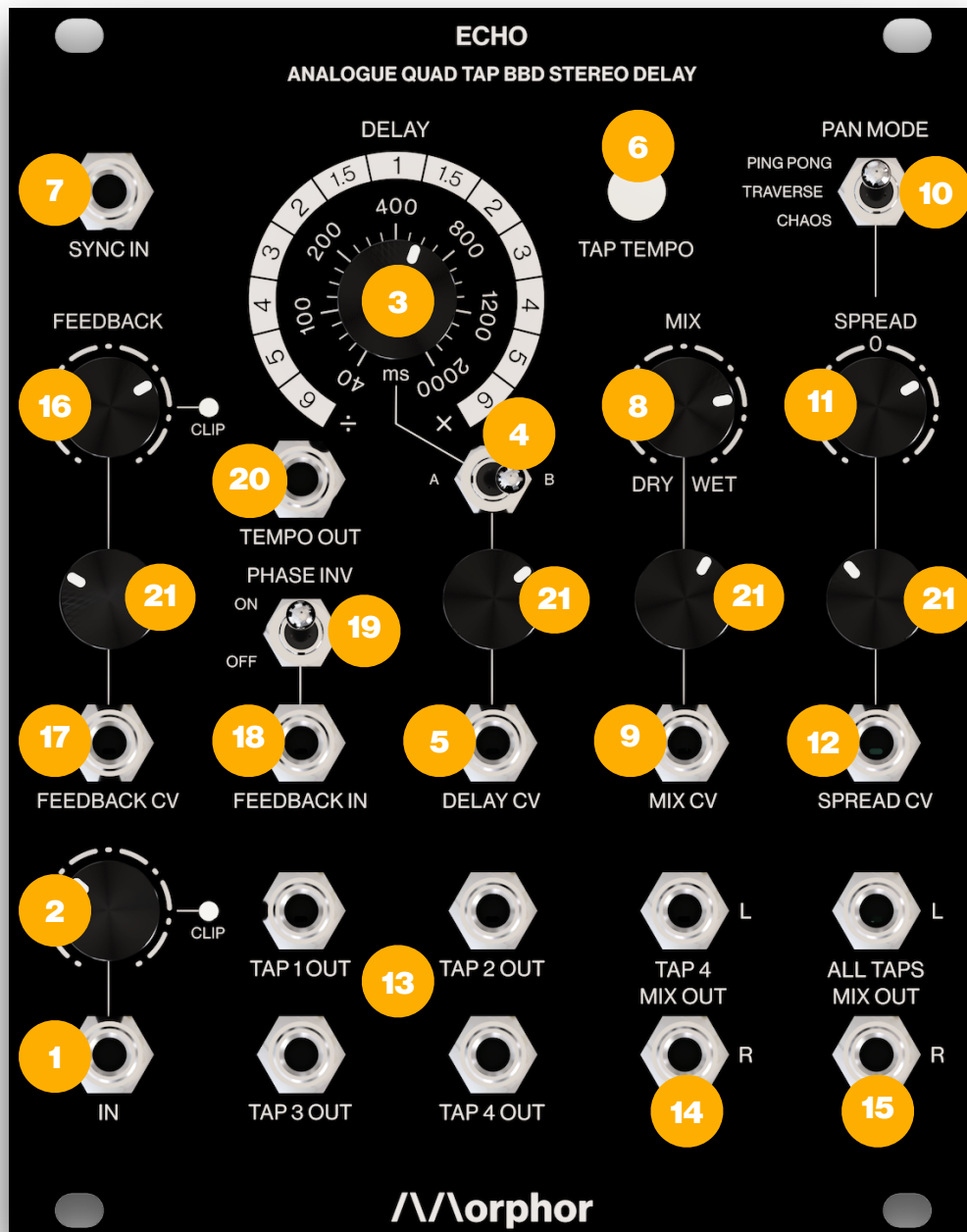uts and a mix output, creating complex, rich, and textured delay effects with a delay range from 10 ms to 2040 ms. The Echo offers three distinct panning modes—Ping-Pong, Traverse, and Chaos—each with adjustable spread for stereo imaging.

The module supports inverted feedback and offers an external feedback input for additional routing options. Delay time is controlled through a tap tempo button, CV input, or clock sync input, with both quantized and continuous adjustments available. Additional features include CV control for dry/wet mix, feedback, and spread, a phase inversion toggle, tempo output, and a clock sync input that accepts both 1 and 24 PPQN. Whether you need rhythmic precision or organic, evolving delays, the Morphor Echo is designed to meet the demands of creative sound design.

Key Features

- 100% analog audio path
- 4x 4096 stage BBDs
- Delay time range 10-2040 ms
- Stereo output (tap 4 + dry mix)
- All taps mix stereo output (tap 1 + 2 +3 + 4 / dry mix)
- 4 individual mono tap outputs
- CV control for dry/wet mix, feedback, and spread
- Phase inverted feedback toggle
- External feedback input jack
- 3 stereo panning modes (Ping-Pong, Traverse, Chaos)
- Clock Sync Input (1 or 24 PPQN)
- Quantized or continuous CV
- Tap tempo button with RGB LED
- Multiplied/divided tempo output
- Attenuators on all CV inputs

Controls & Connections

ECHO
ANALOGUE QUAD TAP BBD STEREO DELAY

DELAY

PAN MODE
PING PONG
TRAVERSE
CHAOS

SYNC IN

TAP TEMPO

FEEDBACK

MIX

SPREAD

CLIP

TEMPO OUT

DRY WET

PHASE INV
ON
OFF

FEEDBACK CV

FEEDBACK IN

DELAY CV

MIX CV

SPREAD CV

CLIP

TAP 1 OUT

TAP 2 OUT

TAP 4
MIX OUT

ALL TAPS
MIX OUT

IN

TAP 3 OUT

TAP 4 OUT

[1] INPUT JACK

Mono input for the signal to be delayed. This input input accepts 10 V$_{pp}$ signals (-5 V to +5 V).

[2] INPUT ATTENUATOR

Input attenuator with red clipping LED. The LED starts the light up when clipping is near.

[3] DELAY TIME

The Delay Time knob adjusts the delay duration from 10 ms to 2040 ms.
In continuous mode, the outer ring indicates the exact delay time.
When in sync mode, the knob functions as a clock multiplier, with the delay time based on the external sync input or the tempo set via the tap tempo button. The inner ring displays the tempo division or multiplication. Turning the knob counterclockwise (CCW) divides the tempo, while turning it clockwise (CW) multiplies it. Available division and multiplication values include 1, 1.5, 2, 3, 4, 5, and 6.
Accepts maximum 10 V$_{pp}$ signals (-5 V to +5 V).

[4] A/B SWITCH (in non-sync mode)

When in non-sync mode (i.e. when not using **TAP TEMPO [6]** or **SYNC INPUT [7]**), you can choose between an **early** or a **late low-pass filter action**. This setting determines if the intern internal low-pass filter will start tracking the delay early or late.

- In **late tracking mode**, the **MODE INDICATOR** LED blinks `white`

- In **early tracking mode**, the **MODE INDICATOR** LED blinks `purple`

Early tracking mode provides better noise reduction at longer delay times but produces a darker/duller sound, as the tracking LPF cut-off frequency is set lower. This feature may be useful if you want to tame the inherent noise of the BBD circuit (more info in the BBD Noise section).

Note: The selected filter tracking mode in non-sync mode remains active when switching to sync mode. The MODE INDICATOR LED will change to the sync mode color. To adjust the filter tracking mode,

switch back to non-sync mode, use the A/B SWITCH to select the desired mode, and then return to sync mode.

[4] A/B SWITCH (in sync mode)

In sync mode (i.e. when using **TAP TEMPO [6]** or **SYNC INPUT [7]**), the A/B Switch determines how the CV input affects the delay time:

- **Position A**: The CV input controls the clock multiplier/divisor, adjusting the delay time in sync with the external clock. This allows for quantized changes to the tempo, locking it to precise multiplications or divisions of the clock signal.

- **Position B**: The multiplier/divisor remains fixed, and the CV input provides continuous control over the delay time. This mode bypasses the quantized steps of the multiplier/divisor, enabling smoother, more precise adjustments to the delay. When switching from Position A to Position B, the current delay time is maintained as the center point, and the applied CV input allows for continuous variation of the delay time by -25% to +25% from the current center value. This setting is ideal for fine-tuning the delay for subtle, non-quantized effects.

[5] DELAY CV INPUT

Modulates the delay time using an external CV signal. This CV input accepts maximum 10 V$_{pp}$ signals (-5 V to +5 V).

[6] TAP TEMPO BUTTON/MODE INDICATOR

The Tap Tempo button manually sets the delay time based on the average of at least four consecutive taps. When using Tap Tempo, the module automatically switches to **tap sync mode.** and the LED will blink `orange` at the set tempo.

In **continuous mode** (default at startup), the LED blinks `white` to indicate the current tempo.

When using the **SYNC INPUT [7]**, the LED blinks `blue` to reflect the externally synced tempo.

[7] SYNC INPUT

Accepts external clock pulses (5 V) to sync the delay time with an external tempo source. It supports both 1 PPQN and 24 PPQN (pulses per quarter note), selectable via a jumper on the back of the module.
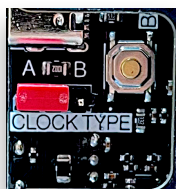
A = 1 PPQN
B = 24 PPQN

Note: A restart is required to apply the selected setting.

Jumper on rear side of the module.

Note: When using 1 PPQN, the input requires at least 4 pulses to set the tempo. When using 24 PPQN, it requires at least 24 pulses to set the tempo.

[8] DRY/WET MIX

Adjusts the balance between the dry (unaltered) signal and the wet (delayed) signal. Fully CCW gives only the dry signal, while fully CW results in a 100% wet signal.

[9] DRY/WET MIX CV INPUT

Allows external CV control over the dry/wet mix. Accepts maximum 10 V_{pp} signals (-5 V to +5 V).

[10] PAN MODE

Selects the panning mode for the stereo output. Each mode alters how the taps are spatially distributed. The three modes are:

✳ **Ping-Pong:** This stereo delay mode dynamically alternates the panoramic placement of the four taps i.e. echoes between full left and full right as the spread increases, creating a ping-pong effect across the stereo field.

✳ **Traverse:** This stereo delay mode progressively pans the four taps i.e. echoes from left to right across the stereo field using the spread control setting. The first and fourth taps move to full left or right respectively, while the second and third taps move to intermediate stereo positions.

✳ **Chaos:** This mode dynamically alters the stereo panning of each tap using a scaled chaos-based random factor (set by the spread amount). While each tap's stereo levels are randomly adjusted, the sum of the left and right levels will never exceed 100%. The spread control sets the chaos-based random factor.

When feedback is used with this mode, the random panning of each echo causes the analog delay lines to overlap and interact unpredictably across the stereo field. This results in a smearing effect, where the sonic textures blend and diffuse, creating a lush and atmospheric sound.

*Note: When using the **TAP 4 MIX OUT [14]**, only the fourth tap and dry is used. In this case, the tap will not alternate between channels but instead will be panned according to the Spread setting.*

[11] SPREAD

Controls the stereo width of the delayed signals. When the spread is set to zero (center position), all taps are equally centered (i.e. mono).
Turning the knob increases the stereo spread, distributing the delayed taps further apart in the stereo field according to the selected **PAN MODE [10]**.

In **Ping-Pong** mode, negative spread pans Tap 4 to the left, Tap 3 to the right, Tap 2 to the left, and Tap 1 to the right. Positive spread reverses this, with Tap 4 panned right, Tap 3 left, Tap 2 right, and Tap 1 left.

In **Traverse** mode, negative spread starts starts the tap traverse from right to left so Tap 4 is left panned. Positive spread starts the tap traverse from left to right so Tap 4 is right panned.

In **Chaos** mode, when spread is positive, random panning is applied to both left and right channels, with values ranging between 0% and 100%. The higher the control value, the more random the panning will be, creating a chaotic and independent stereo field.

When spread is negative, the left and right pan values are inversely proportional, summing to 100%. This creates a smooth, controlled stereo field where one channel decreases as the other

increases, maintaining a balance but shifting dominance between left and right.

[12] SPREAD CV INPUT

Allows external CV control over the spread. Accepts maximum 10 Vpp signals (-5 V to +5 V).

[13] TAP OUTPUTS

Individual mono outputs for each of the four taps of the BBD. Each tap represents a different stage in the delay. Use these outputs to capture distinct points in the delay buffer, each producing a unique delay time for creative routing and processing. Maximum 10 Vpp signals (-5 V to +5 V).

[14] TAP 4 + MIX OUTPUT

Stereo output for the fourth tap mixed with the dry signal. Provides a balanced stereo delay effect using the final tap in the delay circuit. If the right output (R) is not plugged in, all voices are summed (!) to a mono signal on the left channel output (L). Maximum 10 Vpp signal (-5 V to +5 V)

[15] ALL TAPS + MIX OUTPUT

Stereo output that mixes all four taps with the dry signal. This output creates a rich, multi-tap delay effect, great for building complex rhythmic patterns or layered textures. If the right output (R) is not plugged in, all voices are summed (!) to a mono signal on the left channel output (L). Maximum 10 Vpp signals (-5 V to +5 V).

[16] FEEDBACK

Controls the amount of feedback in the delay circuit. Turning the knob clockwise (CW) increases the feedback, resulting in more repeats. The CLIP LED indicator will light up when the feedback reaches saturation levels.
By default, the last tap (Tap 4) is used for feedback. However, when an external signal is connected to the **FEEDBACK IN [18]** jack, this internal connection is broken, allowing you to route any desired feedback signal into the delay circuit.

[17] FEEDBACK CV INPUT

Allows external CV control over the feedback. This input input accepts 10 V_{pp} signals (-5 V to +5 V).

[18] FEEDBACK INPUT

This input allows you to override the default feedback path, which normally uses the last tap (Tap 4) for feedback. When a signal is plugged into this jack, the internal feedback loop is interrupted, and the external signal takes its place. This gives you the flexibility to route any custom signal—such as another tap or other processed signals—into the feedback loop, allowing for more creative control over the delay's sound.

[19] PHASE INVERT

This switch toggles the phase inversion on the delay feedback signal.
Phase inversion alters the character of the delay feedback and overall tonality.

[20] TEMPO OUTPUT

Outputs a clock signal that mirrors the current delay time, either multiplied or divided. Use this to synchronize other modules with the Morphor Echo's delay time.

Note: This output is not intended for clock synchronization and does not adhere to the PPQN setting. The tempo output produces pulses with a period matching the current delay time, regardless of whether 1 PPQN or 24 PPQN sync settings are used.

[21] CV ATTENUATORS

All CV inputs on the module come equipped with built-in attenuators, allowing you to precisely control the amount of modulation applied to each parameter. This gives you fine-tuned control over the influence of external CV signals on delay time, feedback, mix, and spread, ensuring optimal flexibility in shaping your sound.

BBD Noise

It is quite normal to hear some white noise in the audio signal passing through the Echo. It is a Bucket Brigade Device (BBD) circuit, even with the internal compression action on the input and an expander on the output, BBDs are known for their characteristic warmth and analog sound, but they inherently introduce noise for a few reasons:

1. **Clock Noise and Aliasing**: BBD circuits rely on a clock signal to shift the audio signal through capacitor stages. Lower clock frequencies, especially at longer delay times, can introduce aliasing noise and clock whine. This noise can sometimes be heard as a faint hiss or tonal artifacts in the background.

2. **Signal Degradation Over Stages**: In a BBD, the signal is passed through numerous tiny capacitors, with each stage slightly degrading the signal. This cumulative effect adds noise, especially at longer delays (where the signal passes through more stages).

3. **Thermal Noise and Leakage**: BBDs produce thermal noise from the analog components and potential leakage currents in the capacitors, both of which contribute to a general background noise.

4. **Compression/Expansion Artifacts**: Although the internal compression and expansion (companding) help reduce the noise floor, they cannot fully eliminate noise inherent to the BBD itself. Noise may be more noticeable during quieter passages due to how these dynamics work.

To mitigate this, you can:

- Use the early filter tracking mode of the internal low-pass filter.

- Increase the clock frequency to reduce aliasing noise, though this will reduce the maximum delay time.

- Low-pass filtering on the output can help attenuate high-frequency noise but may dull the high end of the audio signal.

- Filtering in the feedback loop can further smooth the signal, though this may require experimentation to avoid overly dampening the sound.

- Create a custom output stage by filtering individual delay taps with your own filter setup and using this in the feedback path.

Firmware Update

If a firmware update is required, follow these steps:

1. Unplug the module from your rack.
2. Connect the module to your PC using a USB-C data cable **while holding down the Tap Tempo button** for at least 3 seconds until the LED turns `green`. (The LED is `orange` while pressing)
3. On your PC, open a WebUSB-compatible browser (e.g. Google Chrome (preferred), Microsoft Edge, Opera) and navigate to the Morphor Echo product page (https://morphor.io/products/modules/echo/).
4. Follow the on-screen instructions to complete the firmware update.

Technical Specifications

module width	20 HP (101.6 mm)
module height	3 U (128.5 mm)
module maximum depth (incl. power cable)	38 mm (including power connector)
module mass	245 g
maximum current draw (5V FROM RACK)	155 mA @ +12 V 120 mA @ -12 V 50 mA @ +5 V
maximum current draw (5V INTERNAL)	205 mA @ +12 V 120 mA @ -12 V
input impedances	100 kOhm
output impedances	1 kOhm
front panel	2 mm anodized aluminum

Support

To provide the best possible performance with the highest quality and reliability for music professionals, all Morphor's products are designed, manufactured and tested in-house with the highest possible standards. In case your module is not functioning as it should, make sure to check your Eurorack power supply and all connections first.
If the problem persists, contact your dealer or send an email to support@morphor.io. Please mention your serial number, which can be found on the module's rear side.

Module Revision History

Revision 1.0 - initial release

Manual Version

27/09/2024 - initial release
28/10/2024 - add dark filter mode

Firmware Version

v1.0.0 - initial release
v.1.1.0 - add dark filter mode

Designed & made in Belgium