DEVA

FEEDBACK LOOP COMMANDER

Model of 1970

OPERATOR'S MANUAL *rev. 1970/X/1.0*

SALUT

Thank you for purchasing this Xaoc Devices product. Deva ['dɐvɐ] is an expander for the Xaoc Devices Timiszoara Eurorack digital multi-effect module. It adds an external stereo analog loop to Timiszoara, allowing you to combine the power of digital effects with analog processing. The left and right channels each have a pair of send and return jacks, a polarity switch, an analog VCA, and a voltage-controlled tilt-type filter. Deva also features a CV input and indicator for the internal clock that drives Timiszoara's DSP engine; this allows for speeding up or slowing down the rate of computing which affects the scale of time and frequency, allowing for effects such as long lo-fi delays and crunchy reverbs.

INSTALLATION

The module requires 8hp worth of free space in the Eurorack cabinet. Deva does not require connecting to bus board power, as power is supplied from Timiszoara via the same ribbon cable that provides communication between modules. Connect your Deva to Timiszoara using the supplied 10-pin ribbon cable, paying close attention to polarity orientation. A mark on both boards indicates the red stripe's downward position. The cable supplied with Deva is deliberately short to ensure low signal interference and make it difficult to connect the wrong way.

ATTENTION: NEVER CONNECT A POWER CABLE TO ANY PIN HEADER ON THE BACK OF YOUR DEVA; IT WILL DESTROY THE UNIT!

Both Deva and Timiszoara modules should be fastened by mounting the supplied screws before powering up.

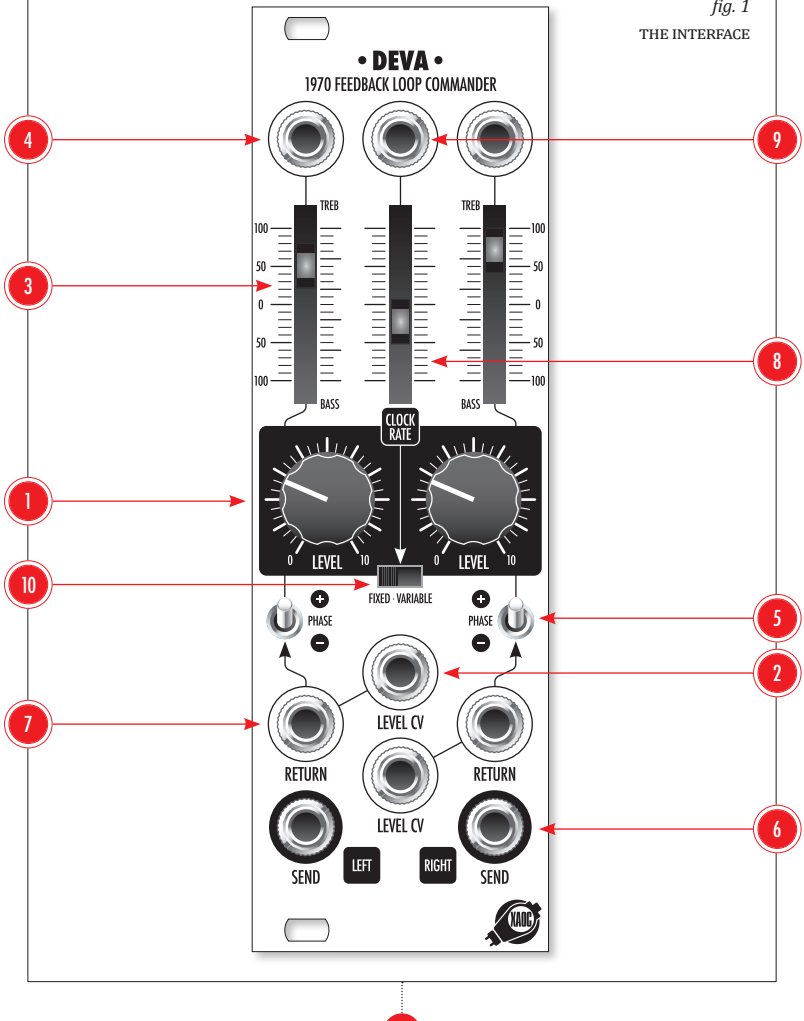
MODULE OVERVIEW

The front panel of Deva is shown in fig. 1. The two channels have separate controls and signal jacks, creating an analog signal loop that feeds some of Timiszoara's wet DSP output back to its input with voltage control over the amount of feedback, filtering, analog saturation, and optional external processing.

Two rotary **LEVEL** *potentiometers at the center* ❶ *are manual attenuators for the feedback return. They have an optimized response that rapidly increases the feedback when turned CW from zero while also offering more precise control near the maximum. Their max position corresponds to the self-oscillation point, provided the DSP code in Timiszoara does not modify the signal gain. Feedback depth may also be modulated by CV via the two* **LEVEL CV** *inputs* ❷*. Positive values of these voltages (up to +8V) increase the feedback gain; however, it is limited by an internal threshold at 0dB. Similarly, negative values (down to -8V) subtract from the value set by the potentiometers, allowing one to reduce the feedback to zero.*

The feedback signal in each channel is filtered by a tilt-type filter controlled by a **TREB/BASS** *slider potentiometer* ❸ *as well as control voltage (-5V to +5V) plugged into the jack above it* ❹*. The illuminated bi-color LED in the slider indicates whether the high frequen-*

fig. 1
THE INTERFACE



cies (red) or low frequencies (green) dominate in the signal.

PHASE *toggle switches located below the feedback* **LEVEL** *potentiometers* ❺ *allow for flipping the polarity of the signal.*

The wet stereo signal from Timiszoara (before the wet/dry mix) is available in the pair of outputs labeled **SEND** ❻*. Above them are a corresponding pair of inputs labeled* **RETURN** ❼*. These pairs of jacks allow for inserting external processing into the feedback loop. The* **RETURN** *inputs are normalled to the corresponding* **SEND** *outputs, thus closing the loop when nothing is patched.*

The middle **CLOCK RATE** *slider potentiometer* ❽ *and the CV input above* ❾ *control the DSP clock rate. The bi-color LED in the slider indicates whether the clock rate is above the nominal 32kHz (red) or below it (green). Note that the neutral point (nominal clock speed, LED unlit) is located at 3/4 of the travel to give finer control over the more interesting low range. At any point, you can disengage this control by using the miniature switch* ❿*.*

PRINCIPLE OF OPERATION

Figure 3 shows the signal flow between Timiszoara and Deva. The stereo pair of wet audio signals from the DSP in Timiszoara is fed to Deva via the ribbon cable. Deva's signals are buffered, and their polarity can be changed using the front panel switches. These signals are delivered to the pair of front panel jacks labeled **SEND***, and also normalled to the* **RETURN** *pair of jacks. Therefore, plugging any module or a chain of modules between sends and returns introduces external processing into the feedback loop while leaving it unpatched automatically closes the loop.*

The returned signals are further processed by VCA blocks, allowing separate manual and CV control of the feedback amount for each channel. In addition, these VCAs feature a soft-clipping circuit to prevent hard distor-

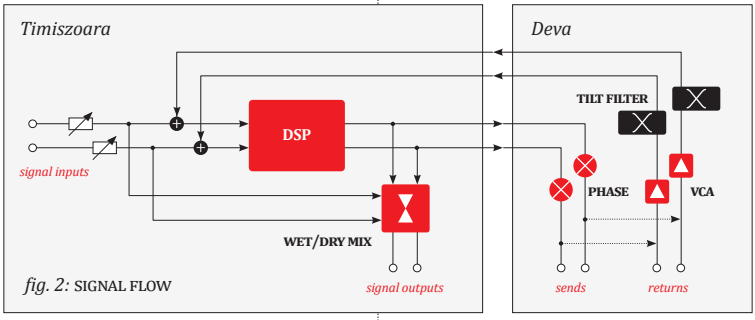


fig. 2: SIGNAL FLOW

tion if your signal becomes too hot for the subsequent circuits.

The last stage of processing is a voltage-controlled tilt filter allowing you to cut the lows or the highs with a soft 6dB/octave slope. Finally, the filtered signal is returned to Timiszoara via the ribbon cable and mixed at the DSP's input.

OPERATING THE FEEDBACK

It is important to remember that adding feedback around a signal processing device usually increases the signal's strength because the energy recycled in the loop adds to the new incoming energy, and this process continues infinitely. Figure 3 shows how much the signal increases with positive feedback around a memoryless device. While this increase is spread in time whenever there is a delay within the loop, it is easy to see that it can quickly run out of control and cause distortion.

Many effect PROGRAMS *in Timiszoara already feature internal digital feedback as a part of the algorithm. However, adding additional external analog feedback with Deva can cause a situation where more than 100% of the processed signal is returned to the input yielding extreme overdrive and clipping distortion. Therefore, start your experiments with the internal feedback at minimum (in reverb algorithms, this is the* SIZE *parameter) and operate only the external analog feedback in Deva.*

In some cases, however, an essential part of processing (e.g., a pitch change) is performed

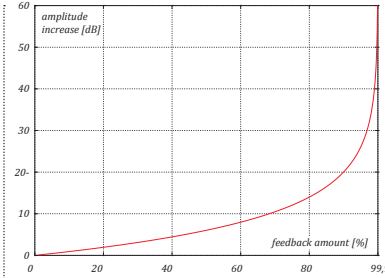


fig. 3: INCREASE OF SIGNAL AMPLITUDE WITH A MEMORYLESS DEVICE WITH POSITIVE FEEDBACK

within the internal digital feedback, so it might be necessary to open the internal feedback enough for the processing to take effect.

Depending on the nature of some effect PROGRAMS, *they may gracefully respond to moderate and even high amounts of feedback or instantly blow up, producing a wall of nasty distortion (which, depending on taste, may be desirable or unbearable). For example, delay effects benefit from analog filtered feedback up to 99%, while reverbs (often already operating at the edge of self-oscillation) lose most of their subtlety with more than a few percent of additional feedback.*

The response of the **LEVEL** *potentiometers and the VCA blocks in Deva is carefully crafted to allow precise feedback control near 99%. The level starts quickly from the CCW position and reaches about 90% near half of the turn. Note that this response is affected by the gain of devices patched between the* **SEND** *and* **RETURN** *jacks.*

PHASE/POLARITY

When discussing the impact of feedback, there is often a distinction between positive and negative feedback, but this distinction only makes sense for memoryless devices. When there is any delay involved, various spectral parts of the signal are shifted in phase differently; hence the whole is no longer in phase with the original, and its inverse is no longer anti-phase. Deva features manual **PHASE** *switches (which actually change the polarity) that sometimes offer a different flavor of the feedback effect. Neither option is truly positive or negative feedback; thus, cancellation and reinforcement of certain frequencies may be unpredictable.*

TILT FILTER

The **TREB/BASS** *tilt filter is an efficient solution for timbre control using only one potentiometer (and CV input). The middle position of the slider suggests a neutral setting; however, it is deliberately not flat and instead gently attenuates at both ends of the signal spectrum while adding analog warmth.*

*Setting the slider above the middle causes the filter to attenuate low frequencies making it sound thinner. For example, with a delay effect, this results in brighter echoes (***NOTE:** *the filter does not accentuate higher frequencies). A similar effect is obtained by feeding a positive voltage (up to +5V) to the CV input.*

Setting the slider below the middle causes the filter to attenuate mid and high frequencies, thus introducing darker coloration to the signal returned to Timiszoara. For example, with a delay effect, this results in darker echos. A similar effect is obtained by providing a negative voltage (down to -5V).

DSP CLOCK CONTROL

By default, the Spin FV-1 chip at the heart of Timiszoara operates with a system clock of 32768Hz that determines both the sampling rate of the signals (and bandwidth of 16kHz), the computing speed, and the algorithms' timing. Since the internal memory is precisely 32768 words, this results in a maximum of 1 second of total delay.

Deva offers manual and voltage-controlled over- and underclocking of the DSP chip from 2x down to 1/16 of the normal speed. With the miniature switch in the **VARIABLE** *position, setting the central* **CLOCK RATE** *slider at maximum changes the clock to over 64kHz, signaled by the LED turning red. A CV of 5V plugged into the jack above it achieves a similar effect. Setting the slider at the minimum position changes the sampling frequency to 2kHz, shown by a green LED. Using a negative CV has a similar effect.*

It is important to remember that while the sampling and processing rate of the signal changes with the clock, the bandwidth of the analog input and output filters in Timiszoara do not change. Therefore, with low-frequency sampling, aliasing artifacts are very audible. For example, at the lowest speed, the effective bandwidth is only 1kHz, so all spectral com-

ponents above it will be aliased. On the other hand, all time-based effects will sound quite different because they will be stretched proportionally.

PATCH EXAMPLES

• LO-FI GRIT: *One of the first and easiest things you can do with your Deva is to use the DSP clock rate control to add some nice signal degradation to color the sound. Engage the* **CLOCK RATE** *control (set it to* **VARIABLE***) and set the* **CLOCK RATE** *slider somewhere around the middle position for a start (adjust it later to taste). Keep the feedback* **LEVEL** *potentiometers at their minimum position and enjoy some longer and grittier delays and dirtier reverbs. Remember that your dry signal is unaffected by the clock rate change—only the wet signal receives the lo-fi treatment.*

• ANIMATED FILTERING AND DISTORTION: *One interesting idea is to use a sequencer to control the DSP clock rate. Experiment with different sequences. Try setting your sequencer to bipolar output (our Moskwa II can do that) and combine the sequencing of the* **CLOCK RATE** *with two medium to slow LFOs running slightly out of phase patched into the feedback return* **LEVEL CV** *control jacks to get some proper panorama movement. Try this setup with the* **LP_VINT** PROGRAM *from the* **FILTER** BANK *(***CUTOFF** *around the middle,* **RESO** *in the upper half,* **DIST** *almost all the way up) for a patch that works particularly well with drums.*

• CRAZY GLITCHING: *The setup from the previous patch also suits the* **GLITCH** BANK, *especially the* **RAND+GRIT** PROGRAM. *Keep the Deva settings from the* ANIMATED FILTERING AND DISTORTION *patch and set the* **RATE** *parameter of the algorithm to just above the middle position,* **RAND_MOD** *a tiny bit higher, and the* **BUFFER** *control slightly lower than the leftmost slider. Overzealous glitching galore! Remember to keep the* **MIX** *slider close to the minimum position so the processed signal doesn't overwhelm the input audio.*

• SOPHISTICATED DELAYS: *This patch explores using Deva's feedback loop with an external processor. Load the* **PING+FILT** PROGRAM *from the* **DELAY_MS** BANK. *Set Deva's feedback return* **LEVEL** *potentiometers to a position just below noon and the* **CLOCK RATE** *slider to somewhere in the middle. Patch two medium to slow LFOs running slightly out of phase into the feedback return* **LEVEL CV** *control jacks. Patch the left and right feedback* **SENDS** *to inputs of Xaoc Devices Koszalin (or any other stereo frequency shifter). Sequence Koszalin's frequency with a sequencer via the* **LIN TZ FM** *input (attenuated to taste). Set the* **REGEN** *and* **DENSITY** *controls somewhere above the middle position and engage the* **COMBI** *feedback mode. Patch Koszalin's* **UP-SHIFTED** *outputs to Deva's* **RETURN** *jacks and enjoy this delay effect with a continuously evolving frequency shifted wet signal.*

ACCESSORY

Our Coal Mine black panels are available for all Xaoc Devices modules. Sold separately. Ask your favorite retailer. •

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RETURN POLICY

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FEATURES

Two external feedback loops (left and right) with positive and negative feedback

Tilt filters for treble/bass tone control

DSP clock control (over and underclocking Timiszoara's CPU)

CV control over everything

SPECIFICATION

Eurorack synthesizer format compatible

8hp wide, 43 mm deep (including the ribbon cable and bracket)

Current drawn from Timiszoara: +90mA/-55mA