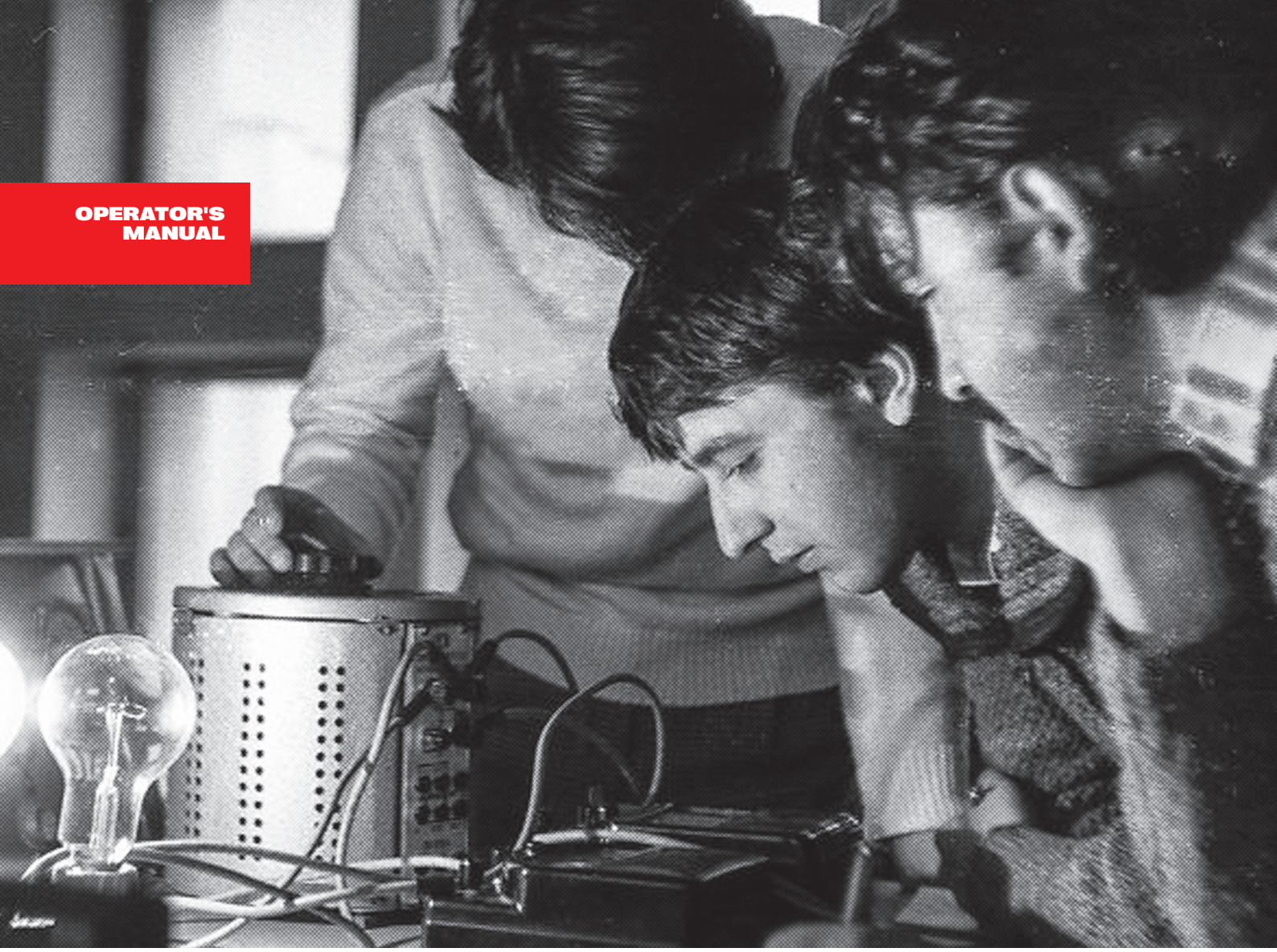

OPERATOR'S MANUAL

TIMISZOARA
DEVA

VOLTAGE CONTROLLED DSP EFFEKTOR
& FEEDBACK LOOP COMMANDER
Models of 1970

Timiszoara: 24–bit stereo DSP engine · Up to three parameters can be voltage controlled · Low-noise, voltage-controlled analog wet/dry crossfader · Voltage-controlled program selection · Programs stored on Micro SD card · OLED screen · Open architecture for adding and organizing user–designed programs

Deva: 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

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INSTALLATION

Salut! Thank you for purchasing these Xaoc Devices products. Timiszoara [ˌtimiʃoˈara] is a stereophonic, Eurorack compatible, voltage-controlled multi-effect signal processor based on the popular Spin Semiconductor FV-1 DSP chip. It features a full stereo signal path with two adjustable audio inputs, two outputs, and a stereo voltage-controlled wet/dry mixer.

In addition, there is a microSD memory card slot on the front panel that allows for loading factory and custom effects without any restrictions or copyright protection, which means you can use many effects available on the Internet and even create your own.

Effect PROGRAMS *are organized in* BANKS *of 8 and can be selected using a rotary encoder, as well as CV and trigger signals. Timiszoara features a crisp OLED screen that displays the* PROGRAM *parameters and its name. It also facilitates navigating the list of* BANKS*. Up to three parameters per effect can be controlled from the front panel with illuminated slider potentiometers and dedicated CV inputs.*

Deva ['dɛva] is an expander for the Timiszoara. It adds an external stereo analog feedback loop, 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.

TIMISZOARA INSTALLATION

Timiszoara requires 10hp worth of free space in the Eurorack cabinet. Always turn the power off before plugging the module to the bus board using the supplied 16-pin ribbon cable, paying close attention to power cable pinout and orientation. The red stripe indicates the negative rail and should match the **–12v** *mark on the bus board and the unit. Timiszoara is internally secured against reversed power connection; however, flipping the 16-pin header* **MAY CAUSE SERIOUS DAMAGE** *to other components of your system because it will short circuit the +12V and +5V power lines. Always pay particularly close attention to the proper orientation of your ribbon cable on both sides!* **NOTE:** *There is a second, 10-pin header at the back of the module for connecting an expander.*

DO NOT PLUG POWER INTO THIS HEADER, AS IT WILL DESTROY YOUR MODULE!

Deva 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. To better understand these devices, we strongly advise the user to read through the entire manual before use.

TIMISZOARA OVERVIEW

The front panel of Timiszoara is shown in fig. 1. The OLED screen ❶ *and the single rotary encoder* ❷ *allow easy navigation between the effect* PROGRAMS *organized into* BANKS *of eight. The* BANKS *are loaded from the microSD memory card inserted into the slot* ❸*. During normal operation, the screen displays the name of the current effect and the names of its three parameters.*

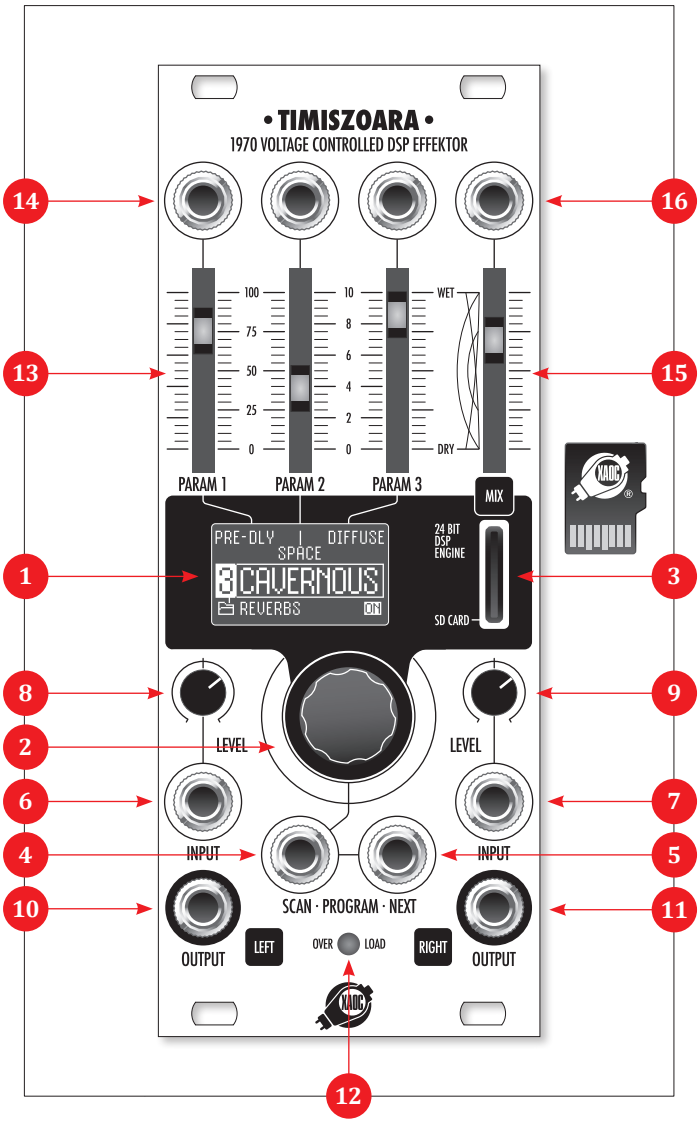
Two inputs below the rotary encoder allow for remote changing of the PROGRAMS *within the* BANK*: using continuous CV plugged to the* **SCAN** *input* ❹ *and using trigger impulses via the* **NEXT** *input* ❺*.*

The **LEFT** ❻ *and* **RIGHT** ❼ *signal* **INPUTS** *are associated with individual attenuators* ❽ *and* ❾ *used for adjusting the input level. Both* **IN-**

PUTS *are normalled to one another, with the normalization occurring before the input attenuators; therefore, it is necessary to adjust both input attenuators even with a single mono signal. The* **LEFT** ⑩ *and* **RIGHT** ⑪ *signal* **OUTPUTS** *are located just below. There is a single clipping detection LED* ⑫ *at the bottom of the panel. This LED illuminates when the inputs, outputs, or signal inside the CPU is too hot. In some* PROGRAMS *(e.g., in some distortion effects), it is normal for the LED to flash continually.*

Above the screen, there are four sliders corresponding to the four CV inputs above. The first three **PARAM 1, 2, 3** *potentiometers* ⑬ *and jacks* ⑭ *are direct controls for the three parameters of the current* PROGRAM *with their names displayed just below.*

fig. 1: TIMISZOARA FRONT PANEL LAYOUT AND CONTROLS



The final **MIX** *slider potentiometer* ⑮ *and CV input* ⑯ *control the analog wet/dry mixer that combines the original signal with the processed one.*

NAVIGATING THROUGH THE CARD

During normal operation, turning the encoder selects the effect PROGRAM *from the currently loaded* BANK *of up to eight* PROGRAMS *(fig. 2). The* PROGRAM *is only loaded when the selection is confirmed by pressing the encoder. Pressing and holding the encoder knob for one second displays the content of the memory card as a folder list, with each folder corresponding to a single* BANK *(fig. 3). There is a* **CANCEL** *option at the end of the list for returning to the last loaded* BANK*. Press the encoder knob to confirm the selection. If there is no card present, only two options are available:* **SPIN DEMO** *(the internal* BANK *of the Spin chip) and* **CANCEL***. The* **SPIN DEMO** BANK *is also available with the card inserted in the module. Although the* PROGRAMS *included in this* BANK *are nothing spectacular, they are more than adequate in an emergency such as a faulty or lost memory card.*

Once a particular BANK *has been selected and confirmed by a short encoder press, it is loaded into memory. Even if the card is removed, all eight* PROGRAMS *from the loaded* BANK *are still accessible.*

CV CONTROLS

The three parameters of the current effect PROGRAM *may be controlled manually or with control voltage patched into a jack above each corresponding* **PARAM** *slider potentiometer. The CV inputs accept 10Vpp. With the slider in the middle position, an incoming ±5V LFO sweeps the entire range. Likewise, with the slider set at minimum, a 10V envelope sweeps the entire range. The same rule applies to the* **MIX** *potentiometer and its CV input.*

Selecting PROGRAMS *from the current* BANK *is performed either with the rotary encoder knob, or externally with CV and/or trigger.*

Feeding a trigger to the **NEXT** *input has the same effect as turning the encoder CW and pressing it. In other words, the next* PROGRAM *in the list will be loaded and confirmed automatically. The list is arranged in a loop to switch back to 1 after the 8th position.*

Patching a voltage to the **SCAN** *input allows shifting from the currently loaded* PROGRAM *backward and forward (to the following or preceding* PROGRAMS*). This input accepts voltages in the range of -5V to +8V, and each change by 1V causes a switch to the next position above or below the current one. Removing the cable is equivalent to plugging 0V which means the selection returns to the state from before the application of CV control.* **NOTE:** *The FV-1 chip needs a moment to load each new* PROGRAM *and re-initialize its internal state; thus,* PROGRAMS *cannot be scanned instantaneously.*

SOUND QUALITY CONSIDERATIONS

Timiszoara has been designed with great care taken to provide high audio quality. Audiophile-grade op-amps handle the entire signal path while the digital section is separated from the analog one. The FV-1 DSP features 24-bit converters and operates with a 32.768kHz sampling rate which means the effective signal bandwidth is slightly limited. Since modular signals often contain very high frequencies, special care has been taken to avoid aliasing by using additional input and output filters.

Please note that FV-1 operates on a low level signal; hence a particular gain staging had to be applied. The signal must be strongly attenuated internally before the DSP and then amplified after processing. Such amplification always brings up some noise, and if your power supply is very dirty, it may affect the output audio. We do not recommend using switching-type regulators as a linear PSU is always the best solution, and hybrid (switching+-linear) is a good compromise. Also, some digital modules introduce digital noise to the GND rail of the bus board, so its quality is critical (i.e., keeping the common resistance as low as possible). Finally, avoid using "flying bus" cables as they invite noise and interference between modules.

Avoid feeding very quiet signals to your Timiszoara and amplifying the output signal to compensate. Conversely, observe the **ADC CLIP** *indicator to avoid overdriving the unit. Use input attenuators to adjust the signal's amplitude and keep in mind that some program algorithms may cause internal clipping. In general, it is physically impossible to prevent distortion when a loud continuous signal is fed to a process with very deep feedback (not to mention one set at 100%) because the internal*

fig. 2: MAIN SCREEN

fig.3: BANK LIBARY SCREEN

fig. 4: SERVICE MENU SCREEN

- **A** PROGRAM *position within the* BANK
- **B** PROGRAM *name*
- **C** PROGRAM *parameter names*
- **D** **ON** *icon indicates whether the* PROGRAM *is currently active*
- **E** *Current* BANK *name*
- **F** **ON** *icon indicates whether the* BANK *is currently active*
- **G** *Entering the* BANK
- **H** *Fixed Spin FV-1 internal* BANK

energy will increase infinitely. In addition, when signal quality is important, many long reverb and delay effects are unsuitable for drone-like input, especially raw waveforms from oscillators.

FILE STRUCTURE & NAMING

You can use the factory card included with the module, or a different card to add more effect pro-

grams. Remember to format a new card to a FAT file system (FAT16 or FAT32). Effects can be written in the assembler language of the FV-1 chip or designed visually using the SpinCAD Designer, and they must be compiled to binary form (e.g., using the ASFV1 compiler). Please consider the hardware constraints: each program may have no more than 128 instructions, use no more than 32 internal registers, and no more than 32768 words of delay memory. **NOTE:** *Xaoc Devices do not offer technical support for third-party software.*

Timiszoara requires that each compiled binary (i.e., a bank of eight programs) is located in a separate folder with the same name and associated with a text file containing the names of all eight programs together with the three names of their parameters, separated with commas (but no spaces).

Each effect PROGRAM *can have up to three parameters controlled by the three* **PARAM** *slider potentiometers and their corresponding CV inputs.* BANK *names may be up to eight characters long. The same goes for parameter names.* PROGRAM *names may be up to nine characters long. When preparing custom files for Timiszoara, we recommend following the structure and naming convention of the factory files.*

FACTORY PROGRAMS

Timiszoara comes with a microSD card holding factory PROGRAMS *covering a wide range of effects: delays, reverbs, modulations, filters, pitch shifters, distortions, glitching, and stuttering. Many of these effects perform in stereo (i.e., they consist of two nearly independent signal paths). However, certain effects benefit from utilizing most of the resources for a single signal path. In such a case, the* PROGRAM *downmixes the stereo signal to mono before processing. Keep in mind that the total amount of memory in the FV-1 chip allows for only one second of delay, which must be split between channels. Though, some included combo* PROGRAMS *feature a different effect in each channel.*

FACTORY PROGRAMS HIGHLIGHTS

We have prepared quite a few BANKS *of algorithms that cover most effects needs: delays, reverbs, filters, modulation effects (such as choruses and flangers), pitch shifters, and, of course, shimmers (no multi-effects unit would be complete without its share of those). However, we wanted to ensure that users had access to some more adventurous* PROGRAMS, *so we created the following* BANKS *to allow you to take a walk on the wild side.*

• **GLITCH** *includes algorithms emulating various dirt-inducing glitching behaviors such as a skipping CD, bit reduction, dropouts, and other digital signal degradation gems.*

• **DECONSTR** *and* **RECONSTR** *are two* BANKS *especially suited for the brutal destruction of your signal (the former) and creating soundscapes based on it (the latter). Cleverly interwoven feedback paths, extreme gain values, oscillations responding to the dynamics of the incoming audio—all that and more.*

• **REVERBS2** *is a* BANK *of of reverb effects with a twist. These* PROGRAMS *are much more "out there" than the customary programs included in the* **REVERBS1** *BANK, which means more modulation, more size, and even more modulation!*

• **PARALLAX** *is a* BANK *of delays featuring two parallel delay lines with various feedback paths, thus offering different time-mangling flavors. Besides the usual controls over delay time and feedback, our parallax delays have a third parameter called* **SKEW** *that adjusts the time displacement of the two delay lines with regard to one another.*

• **RESONATE** *is a set of resonator algorithms covering all the bases, from subtle to overboard, including filtered, unfiltered, single-voice and minor/major chord varieties.*

• **RINGMOD** *does what it says and includes stereo, controlled by an envelope follower, modulated by an LFO, 2-band, Mid/Side (!), and cross-modulation—we've got you covered. Release your inner Dalek!*

For a complete list of factory PROGRAMS *and their parameters, visit xaocdevices.com.*

FIRMWARE UPDATES

Updating Timiszoara's firmware is a simple procedure (see fig. 4) and details will be included with any firmware updates available on our website.

DEVA OVERVIEW

The front panel of Deva is shown in fig. 5. 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* (17) *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* (18)*. 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.*

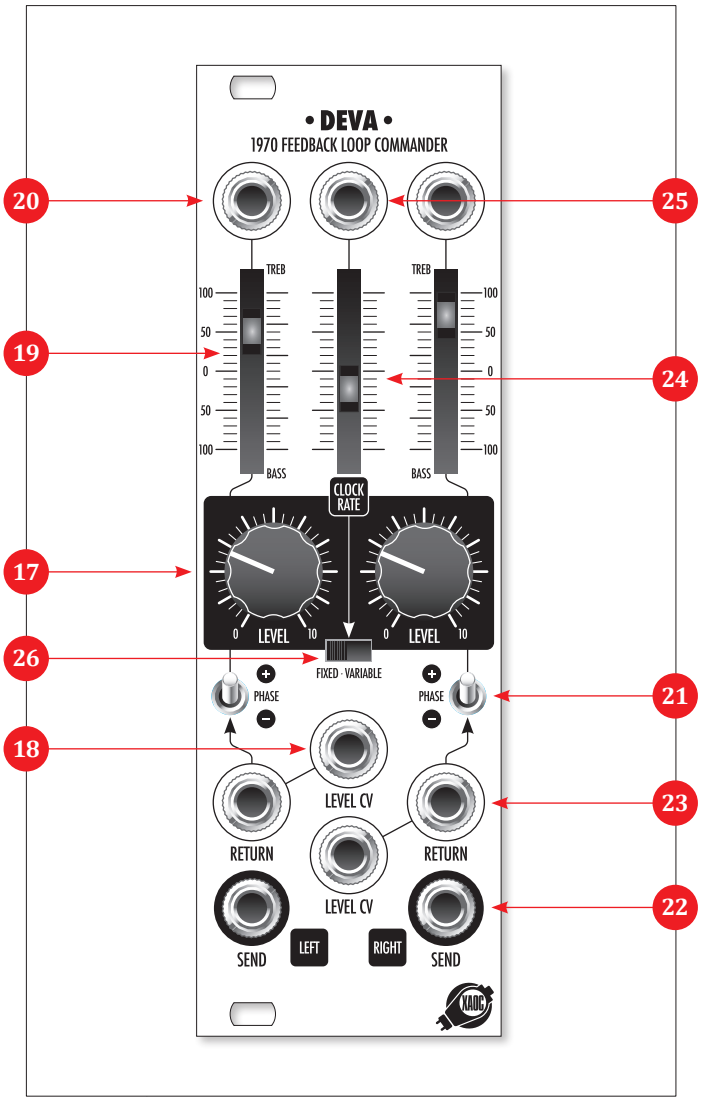
The feedback signal in each channel is filtered by a tilt-type filter controlled by a **TREB/BASS** *slider potentiometer* (19) *as well as control voltage (-5V to +5V) plugged into the jack above it* (20)*. The illuminated bi-color LED in the slider indicates whether the high frequencies (red) or low frequencies (green) dominate in the signal.*

PHASE *toggle switches* (21) *located below the feedback* **LEVEL** *potentiometers 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** (22)*. Above them are a corresponding pair of inputs labeled* **RETURN** (23)*. 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* (24) *and the CV input above* (25) *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* (26)*.*

fig. 5: DEVA FRONT PANEL LAYOUT AND CONTROLS



PRINCIPLE OF OPERATION

Figure 6 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.*

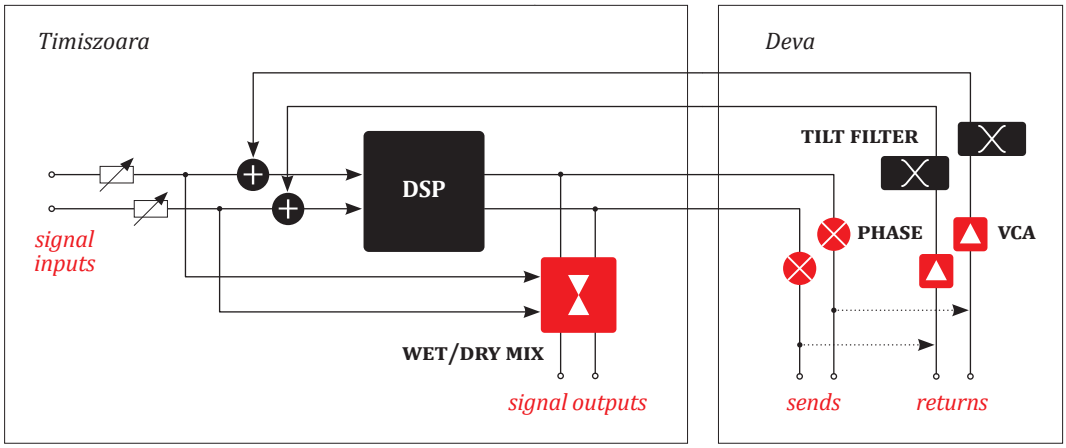


fig. 6: TIMISZOARA & DEVA SIGNAL FLOW DIAGRAM

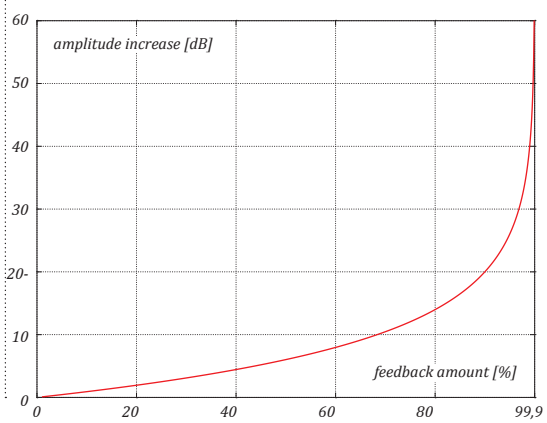
The returned signals are further processed by VCA blocks, allowing separate manual and CV control of the feedback amount for each channel. In addition, these VCAs feature a soft-clipping circuit to prevent hard distortion if your signal becomes too hot for the subsequent circuits.

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 7 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.

fig. 7: INCREASE OF SIGNAL AMPLITUDE WITH A MEMORYLESS DEVICE WITH POSITIVE FEEDBACK



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 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 components 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 of the Xaoc Devices modules. Sold separately. Ask your favorite retailer. •

TIMISZOARA TECHNICAL SPECIFICATION

WIDTH	DEPTH TOTAL	CURRENT DRAW	REV. POWER PROTECT.
10hp	*45mm*	*+120mA* *-45mA*	*protected*

INPUTS		OUTPUTS	
INPUT L, R	*0 to 10Vpp (attenuated)*	**OUTPUT L, R**	*0 to 16Vpp*
PARAM 1, 2, 3	*-5V to +5V*		
MIX	*-5V to +5V*		
SCAN PROGRAM	*-5V to +8V*		
NEXT PROGRAM	*+5V gate*		

FREQUENCY RANGE
8Hz to 15kHz

DEVA TECHNICAL SPECIFICATION

WIDTH	DEPTH TOTAL	CURRENT DRAW	REV. POWER PROTECT.
8hp	*45mm*	*+90mA* *-55mA*	*not applicable, power drawn from Timiszoara*

INPUTS		OUTPUTS	
RETURN L, R	*0 to 10Vpp (attenuated)*	**SEND L, R**	*0 to 16Vpp*
LEVEL CV L, R	*-8V to +8V*		
BASS/TREB L, R	*-5V to +5V*		
CLOCK RATE	*-5V to +5V*		

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