



LYRA-8
ORGANISMIC
SYNTHESIZER

USER
MANUAL



STRUCTURE

LYRA is based on eight generators, which will be referred to as voices. Their design is not like a traditional subtractive synthesis VCO. Instead of having a linear or logarithmic dependency on control voltage, they resemble the tone generators in old electric organs. Hence the use of "voices" instead of "VCOs" in this manual. Lyra uses non-linearity a lot, and the voices are constructed in such a way that allows for non-linearity to express itself.

The voices are divided into four pairs (12, 34, 56, 78). All the pairs are divided in two groups, with two pairs in each (1234, 5678).

Each voice has its own TUNE knob. FAST, MOD, modulation source selector and SHARP affect two voices simultaneously. HOLD and PITCH control the whole group of two pairs/four voices. VIBRATO, TOTAL FB and the FM structure switch control all eight voices together.

The voices can function either in an eight-voice electric organ mode, or in an FM synthesis mode with each of the voices and its envelope acting as a separate FM operator. The voice's impact on FM synthesis will decrease along with the decay of its envelope.

There's a CV IN (on the rear panel) to modulate the selected voice groups with an external signal.

The HYPER LFO is a complex low-frequency generator, whose waveform is synthesized from two simple LFOs by summation or multiplication of their frequencies. It also has an FM synthesis mode. The LFO can modulate the selected pairs of voices and the MOD DELAY.

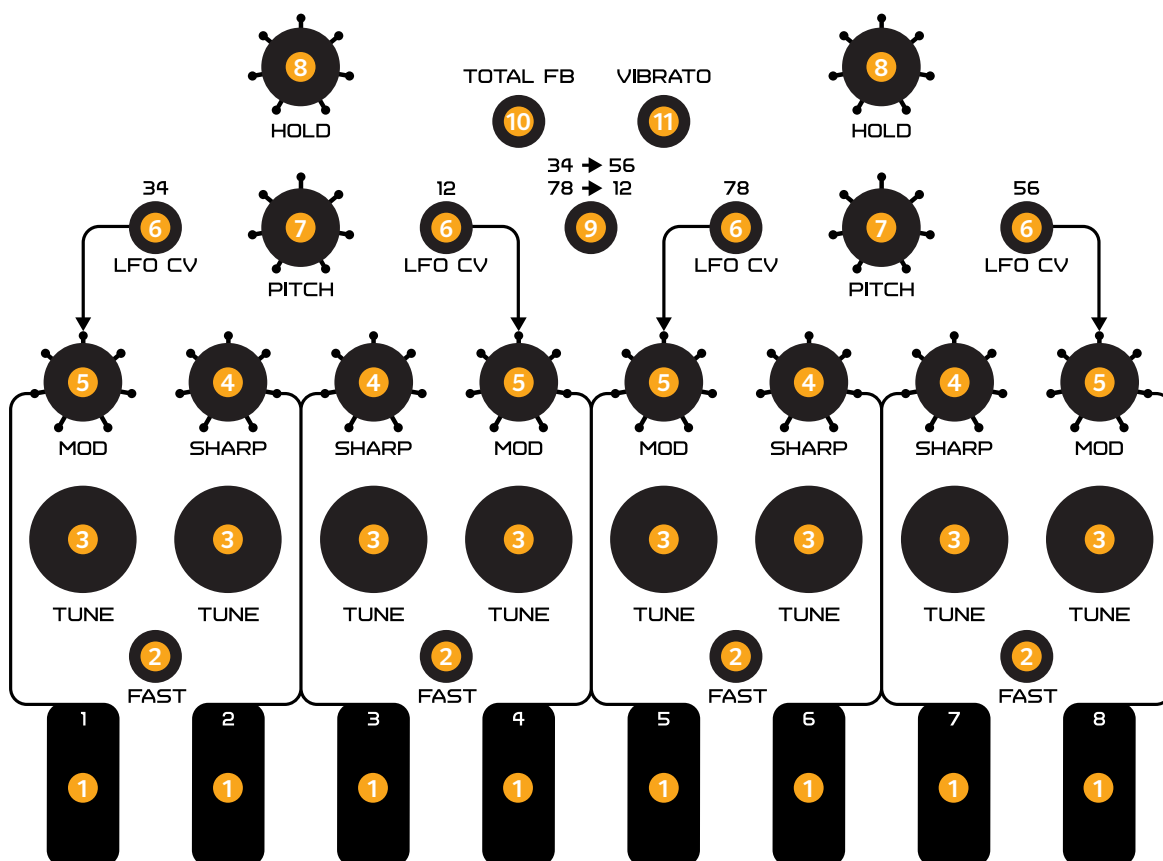
The MOD DELAY consists of two lines of delay with cross-feedback and a special architecture that enables resonance between the two lines. Each line's delay time can be individually modulated from various sources, including external ones.

The DISTORTION is last in the chain, after the delay. It enables the delay to also influence the distortion.

For all its experimental character, LYRA is a professional instrument. Its output dynamics are balanced, so that even in extreme modes it won't harm an amp or speaker on-stage. The frequency response has been adjusted for live performance, where you naturally have that screaming high-midrange and not enough low-end. To compensate for this, low frequencies have been boosted a little, while the highs sound softer. Unless you push the limits and use extreme modes of course...

CONTROLS DESCRIPTION

VOICES SECTION



1 Sensors 1...8. Consist of a pair of contacts each. The upper contact is sensitive, the lower is the control voltage. Put your finger between the contacts to close the circuit with your body's conductivity. The current is very low, several orders below sensitivity threshold, and is absolutely safe:-)

The sensors launch envelope generators for each voice. Eight voices, eight envelope generators, eight sensors. By varying your touch and technique, you can vary a voice's attack and volume. With a light touch or a series of fast short strokes, you can get a slow attack. Apply less pressure, and you open the envelope generator only partially. The sensor behaviour is affected by skin moisture level, and, in turn, by the performer's emotional state.

At high humidity levels (e.g., an open-air show at night when dew appears, or in rainy weather), humidity may affect the sensors' circuit, which could lead to some of the voices sounding continuously. This won't harm the instrument, just allow it to dry in a dry room or in the sun and it will be all right again. Just note that it might affect the performance.

2 The FAST switches, in downward position, give a fast release to the voices they're in between. Additionally, the sensors to the left and right of the switch become less sensitive. They become a little bit slower to trigger and require more pressure. When the Fast switch is on (down), a higher HOLD setting is required for the voices to sound. That pair of voices will start sounding later, and the HOLD knob for them must be set higher than the HOLD for the voices with the FAST off. This lets you leave some of the voices silent when using the

HOLD function. Flipping up and down the Fast switch can be used to cut short the decay of a sounding voice, sooner than its release ends. When the FAST switch is in upper position, it only takes a light stroke to trigger a voice with the sensor.

3 The TUNE knobs set the pitch of the voices. This was conceived as a fully functional intonation tool, albeit a slow one. It uses a special alternate variable resistor that makes it possible to set each voice's pitch in steps smaller than a semitone, in a range from tens to thousands of hertz. To thoroughly use this instrument you need to learn how to build notes and intervals with these knobs, as well as play simple melodies.

Voices 1 and 2 have a lower range than voices 3 through 6. 1 and 2 can be regarded as bass voices, though they can generate higher notes as well.

Voices 7 and 8 are twice as high as voices 3 through 6. They're sort of high frequency voices, though they can also sound low. 3 to 6 are mid-range.

4 The SHARP knobs slowly change the waveform of a voice pair from triangle to square, adding "sharpness" to the sound. The set waveform will also work for FM synthesis.

5 The MOD knobs set a selected voice pair's modulation depth. These knobs can make things sonically extreme: in FM synthesis mode, higher settings have a bright-sounding effect, and maximum settings will result in self-oscillation of the modulation loop.

6 The FM modulation source switches. A central position means that the modulation for a group is turned off and the MOD knob has no effect. Flipping the switch up will turn those voice pairs into FM modulation sources. Flipping the switch down to LFO CV, with the TOTAL FB switch also down, will turn the LFO into a modulation source. When the TOTAL FB is in upward position, modulation will come from the device's output. When a cable is plugged into the CV VOICES input, an external source is used for modulation.

7 The PITCH knobs transpose all of group 1234 or 5678, preserving the intervals between the voices. Close to maximum is the normal position for these knobs.

8 The HOLD knobs set the minimal volume level for a voice group. This enables voices to sound continuously at a given volume. With HOLD off, the voices will decay according to their envelopes. The FAST switch makes a given voice pair less sensitive to the HOLD knob. Unless the HOLD knob is all the way up, you can make the voices louder by touching the sensors and launching the envelope that's limited from below by the HOLD function. That's both the HOLD and sensor-controlled envelopes working in parallel.

9 The 34>56 78>12 FM structure switch sets the overall structure for FM synthesis. If voices are selected for all the FM modulation sources, the downward position of the switch turns Lyra into two separate structures of cross-modulation, each group locked into itself. The sources correspond to the numbers by the switch.

With the switch up, pair 34 becomes the mod source for pair 56, and pair 78 the mod source for pair 12 (pairs 12 and 78 themselves are still modulated as indicated by their controls). Thus all the voices make for one closed loop of FM synthesis. When the LFO is selected, or the FM Mod source switch is set to a middle position on some voices, that loop will be partially unlocked.

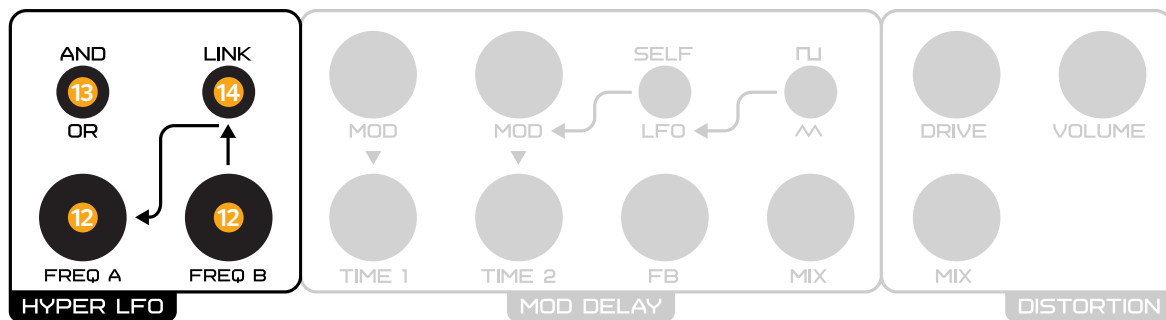
10 The TOTAL FB switch causes the signal from Lyra's output (after distortion) to replace the LFO signal. With TOTAL FB on, plus LFO CV set as the modulation source on some voices, the entire instrument, including the envelope generators, delay and distortion, turns into one single and complex FM synthesis structure.

11 The VIBRATO switch turns on vibrato for all voices. Each voice has its own unique vibrato frequency, as there are eight independent vibrato generators in the instrument.

HYPHER LFO SECTION

12 FREQ A and FREQ B: Two operators for synthesis of a complex LFO. They're two simple LFOs, in essence.

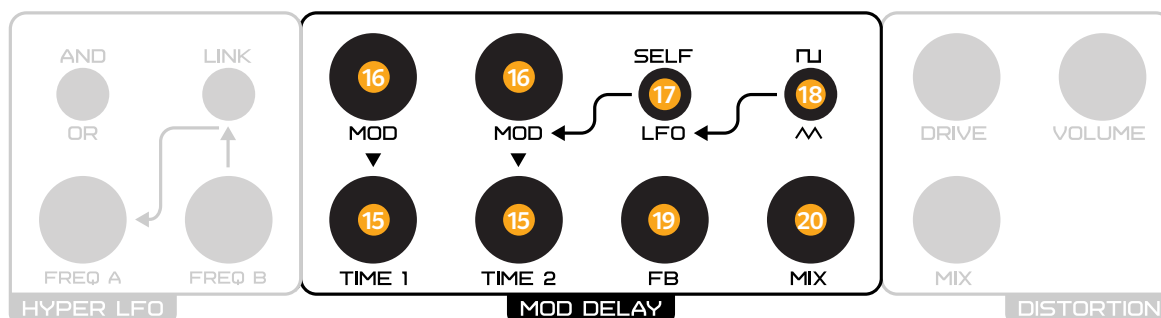
13 The AND/OR switch: In downward position, an LFO is synthesized by adding FREQ A to



FREQ B. In upward position, FREQ A is multiplied by FREQ B, which is the logical operation AND. Both operations are conducted on a square waveform. The addition is analogue, and the LFO output signal has a gradient.

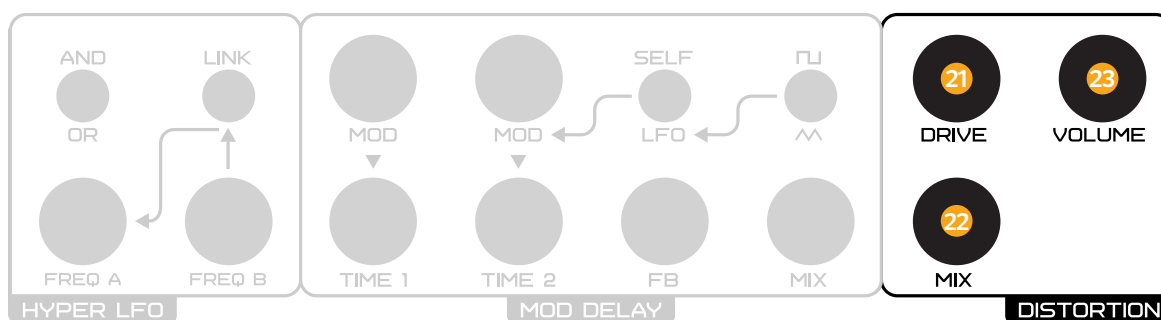
14 The LINK switch: Adds a soft FM between the operators. FREQ A modulates FREQ B.

MOD DELAY SECTION



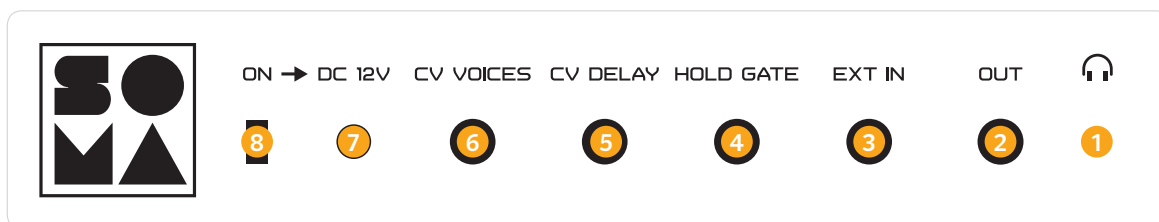
- 15 The **TIME 1** and **TIME 2** knobs set the delay time for each line.
- 16 The **MOD** knobs set the modulation depth for a given delay line.
- 17 The **SELF/LFO** switch: With the switch up, the delay time is modulated by its own output signal; a unique mode allowing for interesting FX. With the switch down, the delay time is modulated by the LFO.
- 18 The **TRIANGLE/SQUARE** switch selects the LFO waveform for modulating the delay. The square is taken from the "AND" synthesis formula. The triangle is synthesized by a special algorithm, available only for delay modulation. It's a summation of two triangular signals with the frequency of FREQ A and FREQ B.
- 19 The **FB** knob: The delay line feedback. This might get extreme. At a setting just over the middle the delay starts to self-oscillate. At the verge of the self-oscillation, very interesting effects can emerge. With self-oscillation in full swing, the delay becomes a synth unto itself.
- 20 The **MIX** knob sets the balance between clean and delayed signals.

DISTORTION SECTION



- 21 The **DRIVE** knob adjusts the amount of distortion applied.
- 22 The **MIX** knob sets the balance of clean and distorted signals. The distortion is applied after the delay.
- 23 The **VOL** knob controls the volume of the main output signal.

CONNECTIONS



- 1 PHONES:** For headphones with a resistance of 8 to 64 Ohm.
- 2 OUT:** A balanced mono output. Works as a typical TS jack output in unbalanced mode; can also be connected via an XLR adaptor directly to a multicore. This eliminates the need for DI boxes, which, if passive, can degrade the signal's bass and sub-bass.
- 3 EXT IN:** Input for an external audio source. The external signal mixes with Lyra's voices and is processed by the delay and the distortion. It turns Lyra into a cool FX processor and also makes it possible to play a synth or drum line together with Lyra's voices through the internal FX units. When TOTAL FB or SELF in the delay section are turned on, the external signal will influence resonance and warp the modulation loops, thereby affecting overall synth behaviour.
- 4 HOLD GATE:** A dynamic input for controlling the HOLD function. An input voltage of +5 volt will fully open the VCA. The more the voltage is lowered, the more it will close the VCA. With the control voltage at 0, the voice levels will decay according to their individual envelopes. Use the HOLD knob to adjust the level for each of the two voice groups. When set to FAST, the synth will react faster to a decrease in control voltage.
- 5 CV DELAY:** This input allows using control voltage to modulate the delay time. When a cable is plugged in, the SELF and LFO modes are automatically disabled and delay modulation comes from an external source, regardless of the delay switch positions. Set the modulation amount with the individual MOD knobs for each delay line. The input signal must have a positive value and a 3 to 12 volt amplitude. The relation of delay time to the control voltage is linear.
- 6 CV VOICES:** This input is for using control voltage to control the pitch of voices. The CV input will control the voice pairs with LFO CV chosen as their modulation source. Plugging in a CV source cable in the CV VOICES input will cause the control voltage to replace the LFO and TOTAL FB signals (which are bypassed automatically). The amount of modulation is set by the MOD knob in a given voice section. This CV input doesn't offer the standard 1V/oct logarithmic function necessary for achieving a tuned musical scale. It's a modulating input, not a tone-precise VCO control that covers the entire frequency range. Nevertheless, a step sequencer can be used to build melodic lines by ear. Combined with the internal modulation, this will yield interesting results. You can also try connecting an audio source to this input, e.g. a drum machine or another synth.
- 7 DC 12V:** The plus is in the centre (centre positive). A 100-240V switching power supply with EU plug is included. In case of replacement, use a stabilised 12-volt power supply with a minimum of 200 mA (0,2A). It's recommended to use a recent switched-mode power supply with a wide input voltage range and excellent stability.
- 8 POWER SWITCH**

MASTERING THE INSTRUMENT

LYRA was conceived as a unique, fully-fledged instrument with controls and playing techniques all its own. Its knobs and switches are not mere parameter controls to set-and-forget, they are hands-on musical controllers meant to be played in real-time. Particularly so, the TUNE, PITCH, MOD, TIME 1, TIME 2, FB knobs and the FM structure switches.

The instrument will fully reveal itself when the player has developed an intuitive feel of the controls, much like feeling the strings on a guitar. This might require some time and dedication. To help you along with this process, a way to learn LYRA's key modes and techniques is described below.

STEP 1. THE ORGAN

Set the FM modulation source selectors of the voices to the centre position (i.e. off), HOLD at zero, PITCH close to maximum, delay MOD at zero, TIME—11 to 3 o'clock, FB below middle, delay MIX below 2 o'clock, overdrive mix at zero.

Let's try to build a musical scale; the lower the number of the voice, the lower the pitch. If you know and hear the musical intervals, try to build scales or intervals. If not, just create a sound you find interesting.

Next, try to intentionally get consonant and dissonant scales and harmonies.

Try building some chords with the eight voices, try interpreting the higher harmonies with lower bass notes. Try soloing with one voice on top of an interval or a chord.

Now, try slowly changing chords while playing. E.g., in a C-E-G chord, try raising G to A to get a C-E-A chord; then raise E to F and get a C-F-A chord; then lower C to B \flat and get a B \flat -F-A...

Now, try transposing one of the voice groups right while you're playing, thus simultaneously shifting several voices down one-fourth. Use it as a harmonic tool.

STEP 2. FM SYNTHESIS

Set the FM modulation source selectors upward to positions 34 12 78 56. Turn off (down) the FM structure switch 34>56, 12>72, set MOD of the voices to 12 o'clock. LYRA is now locked into two cross-modulation loops. One loop, one group.

Let's explore the changes, listen how the synth now reacts to touching the sensors, and how voice pitch is influenced by which of the neighbouring voices are triggered.

Try changing the modulation depth. Important: the higher a voice is tuned, the less sensitive it is to FM modulation. The lower frequency range has the highest sensitivity.

Let's explore the near-maximum positions of the MOD knobs. The modulation chain will start to behave as a low-frequency oscillator—try playing with this. It's an extreme sort of mode, yielding spontaneous responses from the instrument.

Try going to the organ mode by switching the modulation source switches to the middle, and back to the FM.

Add HOLD and play with the knobs only (Lyra will now act as a drone synthesizer).

Try using one voice group as a drone (HOLD on), and another for solo (HOLD off).

STEP 3. LFO

Assign LFO modulation to some of the voices and listen. Explore the summing and multiplying of various FREQ A and FREQ B settings. Try to get rhythmic pulsations in the sound.

STEP 4. DELAY

To achieve a reverb-like effect, set TIME 1 and 2 around 12 to 3 o'clock, but so that their positions differ. FB around 10-11 o'clock. MIX at 12 o'clock. MOD at zero.

For a chorus-like effect, set the delay times close to minimum.

Now, listen to various types of modulation.

Add FB to a stage of self-oscillation and try only playing the delay by changing the delay time and modulation depth. Here, the slightest turn of a knob will affect the sound dramatically. There are standing waves in the delay lines now, and changing or modulating the delay times will change the parameters of these stable vibrations.

Let's try the SELF mode. With the self-modulation added, the stable resonances occurring at strong feedback become unstable and will modulate. Try playing with this.

Now, set the FB on the edge of self-oscillation and try to drive the delay into it by playing the voices with various techniques.

STEP 5. DISTORTION

Add the overdrive. Try changing the drive's amount and mix as dramatic tools.

NOISE AND BLEED

1. All Lyras have quite a noisy output and this is a necessary part of the design. I'll try to explain why. I applied some unusual (compared to other synths) approaches in the circuit that create the distinctive Lyra sound. For example, there is no VCA at the end of the chain that closes every time when the note is off, which would create pure silence. Part of the circuit is open at all times and can therefore produce some noises.

In fact, Lyra's envelope generators are part of the oscillators and have an impact on their pitch and waveform. At the same time it is also a kind of waveshaper. It allows for complex and interesting behavior to take place if some FM is applied. But at the same time, it creates additional noise and bleeding. If I would design it in the "normal" way we will get quite a boring machine with two simple waveforms and just several different sounds and we will lose 80% of its character. Or I would need to make the circuitry much more complex and make the price higher as well. In this way, we still can lose a part of Lyra's distinctive sound.

2. Between all parts of the Lyra, there is significant crosstalk. It creates many interesting subtle effects as everything can modify everything and make the sound breathe. But as a drawback, we can hear silent oscillators in the sound of triggered oscillators, especially with high tunings.

This bleeding is a normal part of the behavior and we would once again lose a significant part of Lyra's nature if I would try to make a perfect isolation. Also, this bleeding can be audible only in pure silence and can't affect a real performance.

3. The Lyra has a noisy delay, especially with long delay times. The delay is Lo-Fi and the noise is a normal part of its behavior. The circuitry allows using the delay far above its normal time in order to achieve a long delay and some cool abstract effects with the self-modulation, but as a side-effect there is audible noise in the maximum of TIME knobs position. As the creator, I personally love this noise as it can create interesting soundscapes on its own even without an input signal, if you use FEEDBACK, LFO, SELF MODULATION.

The bottom line: All the noise and bleeding are either a part of the sound design or have a low enough volume which is completely masked by the normal LYRA sound. That is why you can't hear it in the demo videos from the web. You can try it yourself – when you play normally you don't hear the artifacts, except if you set the distortion to a lot of gain (in which case any audio equipment will be noisy).

In general, there are a large amount of digital and virtual instruments (part of them for free) with absolutely pure silence and stable and pure waveforms. So I don't see any point in trying to achieve the same in analog synthesizers like Lyra. My aim was actually to destroy this purity and stability that sound dead to me and, instead, create a kind of wild magic nature, a bit dangerous and unpredictable, noisy and alive.

LYRA'S HISTORY AND PHILOSOPHY

I have spent many years exploring the brain and nervous system of the living organism. One of the things I wanted to understand was how and why a several-hundred-neuron nervous system in the smallest of insects and the simplest of animals is capable of producing the complex and multifaceted behaviour that our most powerful computers still fail to model today. One of the answers I found is that the brain is an analogue system with a large number of non-linear, chaotic processes. The brain, as well as the whole bio-organism, has many loops of positive and negative associations. Like a very complex see-saw, it's searching for balance while in constant motion. It's this balancing act on the brink of chaos in a highly non-linear state, that enables an organism and the brain as part of it, to react to the outside world so effectively and dynamically, and also to create inner worlds of its own.

This cannot be modelled by a digital machine, because in the process something essential is lost. In the age of digitalisation we've been consciously deleting all chaos or controversy from digital chains – which was their very essence. It's what makes even a simple living organism so effective: its every cell, when you look close enough, turns out to be a highly complex, virtually endless, unpredictable and open system – a mini-universe, a microcosm. Analogue electronic circuits give us something similar.

I decided I wanted to apply these concepts to building synthesizers, as synths are a huge interest of mine – my second love. LYRA's secret isn't the modules as such – they've all been around for decades. Rather, it's how they connect and interact. LYRA's schematics aren't linear, unlike classic subtractive synths with blocks in series that gradually process the signal. Here, for example, the envelope generator can affect a voice's pitch, or in some modes change the parameters of FM synthesis or even of the delay when it's set to self-modulation mode (SELF on + MOD and FB high enough). LYRA is a structure that reacts to your slightest touch. It's a bizarre animal that twists and turns under your fingers, rather than a precise mechanism. This is why it's called "organismic".

Another important source for my experience has come from exploring acoustic instruments, such as the violin. And that presented the question: how is it that a musician can consciously spend a profound lifetime with a piece of wood with four pieces of metal wire on it, with nothing more than a horse-tailed stick? How is it possible then that a musician gets bored in a matter of months with the most powerful synthesizer with a thousand controls? The answer I came to was that the best instruments are those that allow for the most direct and the most tactile connection between the player's body and the "tone generator". This gives the musician the most immediate control over the sound and, as such, the ability to express the aspirations of their soul. This is why we call a violin a "live" instrument.

Then an insight came: a synthesizer can act similarly if we rebuild the connection once broken. Just look at how many little machines stand in the way between the tone generators and the player's body in today's traditional synth: sequencers, quantizers, envelope generators, LFOs etc. The player, in fact, can't control the sound source as such; they just choose the algorithm for those machines to use to control the tone generator. From this standpoint, the perfect "live" synthesizer was the very first of them – the Theremin. Just one monophonic oscillator and one simple waveform, but it's so connected to the player's movements. And, quite importantly, the Theremin is perhaps the only synth to have preserved its original structure despite the enormous progress in electronics since the 1920s – which goes to show that the principle once found was absolutely right!

I rewound the history of synth schematics to the beginning and took some of the most archaic and rawest solutions. My intention was to give the player maximum control over the generated sounds, with minimal quantization or automation. I've made a complete stage-ready instrument where any position of controls creates a good soundscape. The direct, non-tempered control over the pitch means that you are not bound by the chromatic scale, and instead can let your own hearing of notes and intervals work entirely free in order to create unique scales, play around with microtonalities and so on. In other words, LYRA is a complex, futuristic electronic violin that can hear you.

The third source for LYRA's philosophy is taken from the North-Indian musical tradition, with its remarkable attention to the inner states of the player, the listener and the world, and the ability to interact with them. LYRA was greatly inspired by a deep study of the Indian ragas, where the art of mastering your mental and emotional state is essential. The idea came about to create an instrument with a sound texture and overall behaviour that invite the player into deeper states of perception and awareness, to guide the listener into that stream, and to allow enough space and freedom for immersion.

SPECIFICATIONS

Max output voltage	2 v 0-to-peak
Output connector	mono 6.3 mm TS or TRS (balanced) jack
Output resistance	100 Ohm
EXT IN	1 v 0-to-peak
EXT IN connector	6.3 mm TS jack
HOLD GATE	full HOLD volume +5 V
HOLD GATE connector	6.3 mm TS jack
CV DELAY	unipolar, range of 0 to +5 volt
CV DELAY connector	6.3 mm TS jack
CV VOICES	unipolar, range of 0 to +5 volt
CV VOICES connector	6.3 mm TS jack
Power supply	stabilised, +12 V, 0.2 A, centre positive
Power Consumption	2 watt
Dimensions	266 x 266 x 62 mm
Weight (without power supply and packaging)	2.5 kg

PACKAGING

The box Lyra comes in should not be thrown away. Its lightweight, sturdy and durable construction makes it an ideal transport case for the instrument, perfect for local shows and for travels if accompanied by an understanding person.

CREDITS

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Many thanks for your invaluable help!

I would also like to thank everyone who supports the project with their sincere attention and interest and simply with kind words and wishes

ABOUT SOMA

The word SOMA is an abbreviation from SOund MAchines.

SOMA is also a psychedelic ritual drink used in ancient vedic (Indian) culture, as well as in Iranian (known as Haoma) and Persian ancient traditions. The drink is mentioned in the ancient East's sacred books, e.g. in Rigveda, one of the earliest religious texts still existing. The recipe is long lost.

Other meanings of the word include a neuron's cell body and a town in Japan.

Enjoy
SOMA:)
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