LYRA·4

ORGANISMIC SYNTHESIZER

USER
MANUAL

STRUCTURE

LYRA•4 is based on four 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 two pairs (12, 34). Each voice has its own TUNE knob. FAST, MOD, modulation source selector and SHARP affect two voices simultaneously. HOLD, PITCH, VIBRATO and TOTAL FB control all four voices together.

The voices can function either in an four-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.

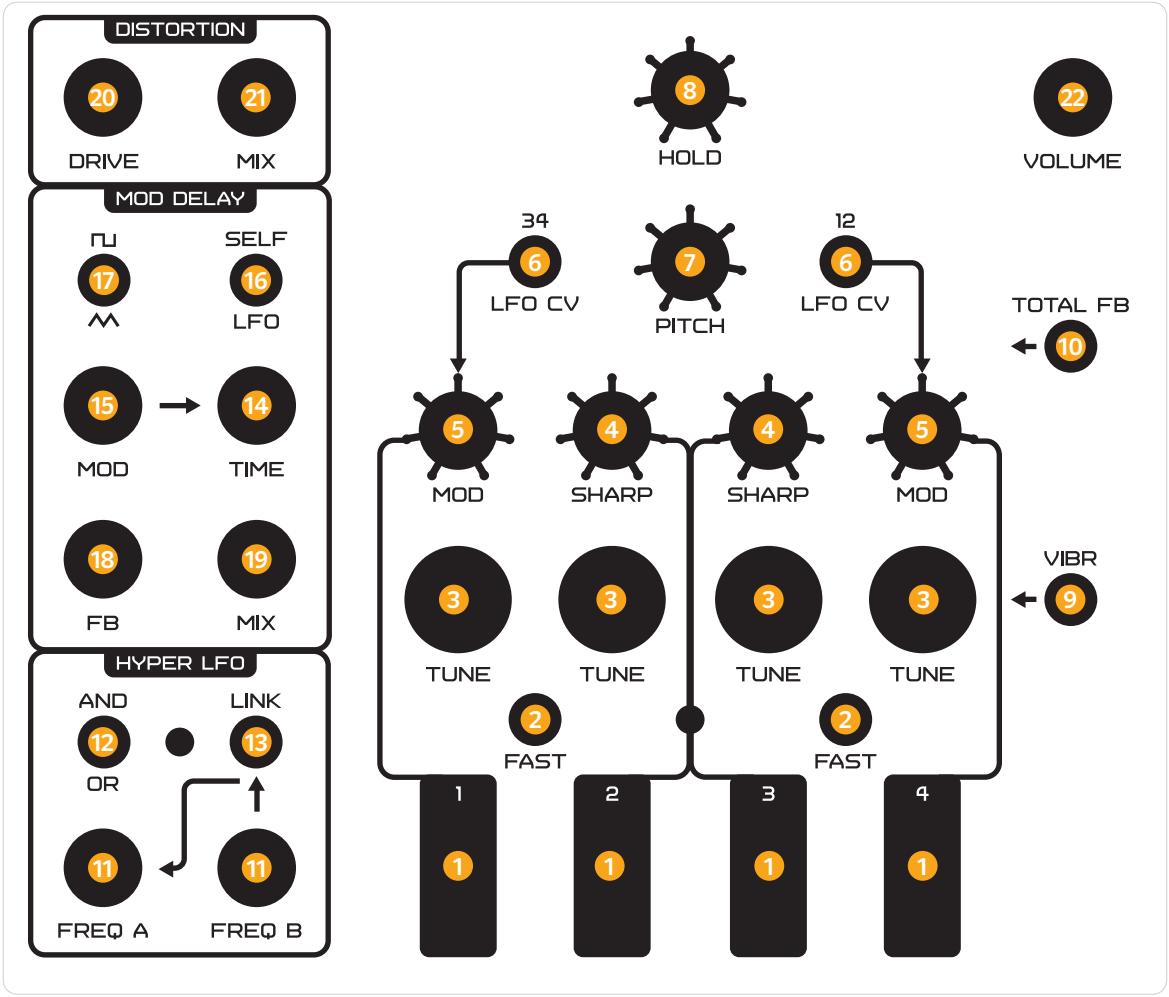
The HYPER LFO is a complex low-frequency generator, whose waveform is synthesized from two simple LFOs by summation or multiplication of their frequencies. It also has an FM synthesis mode. The LFO can modulate the selected pairs of voices and the MOD DELAY.

The MOD DELAY consists of a delay, with modulation of the delay time 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...4.** 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. Four voices, four envelope generators, four 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 and 4. 1 and 2 can be regarded as bass voices, though they can generate higher notes as well.
Voices 3 and 4 are twice as high as voices 1 and 2. They're sort of high frequency voices, though they can also sound low.

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** transposes all voices, preserving the intervals between of them. Close to maximum is the normal position for these knobs.

8 **The HOLD knobs** set the minimal volume level for all voices. 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 VIBRATO switch** turns on vibrato for all voices. Each voice has its own unique vibrato frequency, as there are four independent vibrato generators in the instrument.

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.

HYPER LFO SECTION

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

12 **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.

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

MOD DELAY SECTION

14 **The TIME** knobs set the delay time.

15 **The MOD knob** set the modulation depth for the delay line.

16 **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.

17 **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.

18 **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.

19 **The MIX knob** sets the balance between clean and delayed signals.

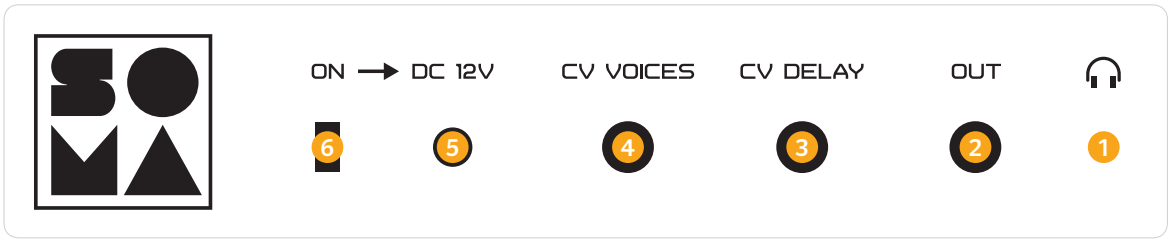
DISTORTION SECTION

20 **The DRIVE knob** adjusts the amount of distortion applied.

21 **The MIX knob** sets the balance of clean and distorted signals. The distortion is applied after the delay.

22 **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:** An unbalanced mono output. Works as a typical TS jack output in unbalanced mode.

3 **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.

4 **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.

5 **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.

6 **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 and FB knobs.
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 about 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 four 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 Bb and get a Bb-F-A...

Now, try transposing all the voices while you're playing. Use it as a harmonic tool.

Step 2. FM SYNTHESIS

Set the FM modulation source selectors upward to positions 34 12. LYRA is now locked into two cross-modulation loops.

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).

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 around 11-3 o'clock. FB around 12-3 o'clock. MOD at zero.

For a chorus-like effect, set the delay time 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. There are standing waves in the delay line now, and changing or modulating the delay time 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.

Step 5. DISTORTION

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

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 jack
Output resistance	10 KOhm
CV DELAY	unipolar, range of 0 to +5 volt
CV DELAY	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	1.2 watt
Dimensions	241 x 203 x 62 mm
Weight (without power supply and packaging)	1.2 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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Idea for the HOLD function: Vitaly Ignatoff.

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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