nLab Synthesis KOSMO
USER GUIDE

OSC

tune → C1
fold
fm osc 2
noise
q
env
env
seq

tune → C3
fold
fm osc 3
noise
q
lfo a
seq
seq

tune → C4
fold
fm osc 1
noise
q
flwr
Y
env

LPG

offset
ping
lfo b

offset
ping
lfo a

offset
ping
env

ENV

cycle
prob
rnd
lfo a
seq

cycle
prob
rnd
lfo a
seq

cycle
prob
rnd
lfo a
seq

OUT

pan
level
rnd
flwr
fx

pan
level
rnd
flwr
fx

pan
level
rnd
flwr
fx

FX

bp
res
cho
dly
rev I
rev II

mix
freq
res

mix
time
fdb

mix
tail
eq

lfo a
lfo b
lfo a

MASTER

L
peak
R

saturation
leveler
master

pre fx
post fx

nlab synthesis
KOSMO
3-channel experimental
sound generator

LFO A
rate
fdb
slew

LFO B
rate
chaos
sym

SEQUENCER

sliders ?
steps ?

src
LFO A
rate

drift

---

div
sm
9
16
11

mode
len
3

XY

auto
/2
rst
div
6

OPT
global randomizer
follower fall
pitch quantizer
D#
aeo
resonator q

1
2
3

nlab
synthesis

for
REAKTOR
6.4

OVERVIEW:

Kosmo is a virtual instrument based on Native Instruments Reaktor 6.4 (Full Version). Taking inspiration from the so-called "West Coast" synthesis and old soviet synthesizers aesthectic, Kosmo employs and simplifies some of their most important features to build a 3-track experimental groove-box and sound generator combining a distinctive and raw sound with a user-friendly interface offering many creative capabilities. To research and explore your sound, you can move through folded triangle oscillators, low pass gates, cycling envelopes, random sequencer, chaotic LFOs, XY pad and a set of effects. In few steps, you can make a chaotic and distorted percussion pattern as well as an evolving and dreamy soundscape.

FEATURES

Three track based sound generator and groovebox

3 Triangle VCOs with Wavefolder, FM and Pitch Quantizer
3 Low Pass Gate filters
3 Cycling Envelope Generators (AD)
3 Pan parameters
3 FX Insert switches

Random LFO with Self-Feedback option
Multiwave LFO with Symmetry and Chaos randomizer
3 Channels and 8-Step Sequencer with shared Sliders, Steps and Sequence Length
XY Pad with automation mode
3 FX modules wired in series (Resonator/Band-Pass Filter, Chorus/Tape Delay, Vintage/Space Reverb)
Master section with Saturator and Leveler compressor

MODULATIONS

Even if Kosmo has a modular approach in its veins the are no cables or patch points to wire modulations, instead there are several modulation boxes through we can do it. In order to have a moderate degree of flexibility but in a simple and easy way, there was a cost to pay. Only the most important and useful parameters have been selected to be modulated. This is a limit as well a resource by which to unleash the full potential of Kosmo ecosystem.
Note: some parameters have the opportunity to be modified by internal modulators (ex. Pan Randomizer).

Modulation Source allows to select one of the various available modulation sources:

- empty (no source)
- Env (AD Envelope)
- LFO A
- LFO B
- Sequencer (each track is assigned to its relative synth track)
- X (X of XY Pad)
- Y (Y of XY Pad)
- Fllwr (Envelope Follower)

All sources can only send positive values.

Bipolar

Unipolar

Modulation Amount adjusts the amount of the selected modulation source. It can be of two types:
bipolar knob (ranging between -1 and +1);
unipolar knob (ranging between 0 and +1).

You can also find different modulation boxes, available in the effects section (FX). They have a very close design but with an added parameter by which to select the modulation destination (indicated by the 3 circled up-arrows). Note: you can choice only one of the three destinations at once.

Modulation Destination allows to assign a destination for the modulation input. It's positioned below the corresponding target parameter of the effect.
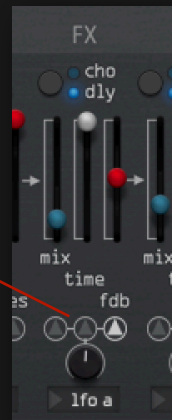
Kosmo is built around 3 synthesizers channels identified by the 3 small colored dots (red, blue and green) located at the left border of the instrument. Each one provides a monophonic synthesizer voice with independent controllers over an oscillator (OSC), an envelope (ENV), a filter (LPG), a volume, a pan and an FX insert (OUT). All channels can pass or be bypassed through the effects chain and after that summed in the Master section.
The channels can be turned on or off through the red switch placed in the top-right corner of the OUT section of each channel (See OUT chapter).
Important to note the same color scheme (in the below picture) is also adopted when referring to the sequencer tracks and the channels scope.

Color Scheme Reference

Red
1st Synth Channel
1st Sequencer Track

Blue
2nd Synth Channel
2nd Sequencer Track

Green
3rd Synth Channel
3rd Sequencer Track

Channel Randomizer
(colored dot button) allows to randomize the whole relative channel. The amount of randomness is set by Global Randomizer Amount (see OPT chapter). Level, Channel Activator, FM (when disabled) are free from randomization.

Section Randomizer (section label button) allows to randomize the whole relative channel. The amount of randomness is set by Global Randomizer Amount (see OPT chapter). OPT and MASTER are free from randomization. FX randomizer controls the master saturator. X and Y are randomized only when automation is off. Whatever you press LFO A and LFO B, you have only a one button randomizer operates on both of them.

OSCILLATOR (OSC)

The Oscillator section is the core of the Kosmo sound and it's equipped with a triangle oscillator (gently saturated) with controls over the pitch (semitones). In addiction there is also a simplified wavefolder circuit (Fold) and a frequency modulation input (FM) to explore the sharpest tones.
Wavefolding is very similar to digital clipping. The main difference is that in wavefolding, the curved amplitude peaks get inverted into a series of folds. These folds produce complex spectra from simple waveforms so very strange harmonics may emerge.
The modulator oscillator modulates the frequency of the waveform generated by the carrier oscillator within the audio range, thus producing new harmonics.
Kosmo FM input works by using each oscillator as carrier of the following one (acting as modulator). See the FM routing block diagram below.

Oscillator Tune sets the pitch of the oscillator in semitones from A0 to A6.

Pitch Display shows the current pitch in musical notes.

Fold sets the depth of the wavefolding effect. This is very useful to obtain complex spectra from simple waveforms (like a Triangle).

Fine adjusts the pitch in cents within a range of -1/+1 semitone.

Fm / Noise switch selects which feature is enabled between FM modulation and Noise source. Since the switch isn't affected by Global Randomizer, it might be convenient to turn off to avoid to reproduce unwanted FM or Noise sounds.

The "q" switch at the bottom-left turn on/off the quantizer of the pitch modulation, according to the Root and Scale settings of the Pitch Quantizer. See OPT chapter for further information.

In Fm mode you can set the amount of frequency modulation applied to the oscillator. The modulator signal is always wired to the oscillator next to the current one. See the FM routing picture.
In Noise mode, you can adjust the mix between the oscillator and a white noise.

Pitch Modulation Source and Amount allow to modulate Pitch (bipolar values), Wavefolder (bipolar) and FM (unipolar).

FM ROUTING

OSC 1

OSC 2

OSC 3
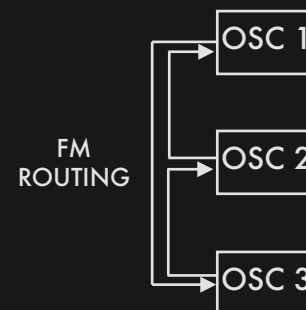
LOW PASS GATE (LPG)

Low Pass Gate is a mainstay of the West Coast Synthesis approach. It's essentially a low pass filter whose cutoff frequency goes down into the subsonic range, resulting in the input signal being filtered almost into silence. Its peculiarity consists in being controlled by vactrols (a specific electronic component often used in west-coast synthesizers) that produce a non-linear response which made the LPG a good way for imitating some tuned percussion sounds. Kosmo LPG is inspired by a vintage reproduction of a non-resonant one with a slope curve of 6db/octave.

Offset sets the initial frequency level or offset of the LPG. When it's in fully counter-clockwise position the signal is completely filtered, inversely it allows the whole signal to pass.

LPG Modulation Source and Amount allow to set the modulation of the LPG Level (unipolar) through vactrols.

Ping enables a Gate/Trigger to strike vactrols and quickly modulate the frequency.
Ping can generate a sort of "bongo" sound, maybe the most famous west-coast signature. The source is fixed on the Envelope Trigger.
LPG Modulation Amount and Ping could be used in combination to create a more complex and dynamic modulation.

AD ENVELOPE (ENV)

Kosmo envelope is an Attack-Decay envelope with cycling feature which comes again from the West-Coast approach. It can be used as a classic AD envelope (after selecting the trigger source), as well as a LFO through the cycling system. It also equipped with 2 extra features: a probability trigger and a decay randomizer.

Led Meter to monitor the envelope coarse.

Attack/Rise adjusts the attack time of the envelope, ranging from near zero to 10 seconds.

Decay/Fall adjusts the decay time of the envelope, ranging from near zero to 10 seconds.

Cycle allows to loop the envelope according to Attack/Decay settings. When turned on it works as a LFO.
At low values it works in audio range.

Envelope Trigger Source selects which source to be used to start the envelope. Available options are: LFO A (taking the clock) or Sequencer (taking the active steps).

Decay Randomizer sets the amount of randomization applied to the decay time on each arriving trigger or cycle. It works best on fast decay setting to produce interesting envelope variation.

Probability Trigger sets the amount of chance of an incoming Trigger (selected on Envelope Trigger Source) being executed. A minimum position means that incoming triggers pass totally (100%). Inversely every triggers will be filtered out.

OUTPUT (OUT)

In this section you can set further important parameters about the synthesizer channel before to send audio signal to FX or Master. Included parameters are Pan with its internal random LFO, Level, FX insert and Envelope Follower Send.

Channel Level (Level) sets the desired audio level before to go to Fx or Master. At high levels it may distort the signal.

Pan determines the position of a signal in the stereo image (from Left to Right).

Channel Activator enables the audio channel. In Off position audio is muted, but if a signal is routed to the Envelope Follower (To Flwr), it will remain active.

Pan Randomizer Rate (Rnd) sets the speed of the internal random LFO applied to Pan. Speed range is between 0,05 Hz and 8 Hz.

Led Level Indicator serve to monitor the stereo audio level of the channel. When the signal is distorted the indicator is temporarily coloured by red.

Pan Randomizer Activator enables the random LFO to modulate the panorama.

FX Insert (Fx) enables the ability to route a signal (post-fader) in the FX section in which it will be processed and mixed together with the other channels. Its main purpose is to have the opportunity to choice if a specific channel will be processed or not through the effects.

Envelope Follower Send (to flwr) allows to send the channel to the Envelope Follower. It's has a pre-fader routing, so it works even if the Channel Activator is disabled and regardless of the channel level.

LFO A & LFO B

Kosmo is equipped by 2 different LFOs to make possible complex modulations. LFO A (also called RND) is based on a Sample & Hold circuit with a smoothing function and a self-feedback control to make it more unpredictable. It also can be used as a clock source generator to trigger sequences or envelopes. LFO B has a multiwave LFO with an extra Chaos parameter (to influence LFO B FM and AM).

LFO Rate sets the frequency at which LFO oscillates. Increase or decrease this value to speed up or slow down the modulation. Frequency Range is between 0.004 and 10 Hz on LFO A, while from 0.005 to 5 Hz on LFO B.

LFO B Waveform allows to select one of the 3 waveforms provided (Sine, Triangle and Pulse).

Self-Feedback (Fdb) sets the amount of the return of its own modulation signal to modify the LFO Frequency (FM). in this way you can create intriguing time variations, also useful when you need a random clock.

LFO B Waveform Symmetry (Sym) adjusts the symmetry/width of the selected waveform.

Slew Limiter/Smooth (Slew) allows to control the smoothing time between sampled values of the S&H circuit. The output can be gradually controlled to generate modulations ranging from stepped to smoothed values.

Chaos allows to inject the LFO A modulation over the LFO B frequency and amplitude. It can be used to bring some interesting and unpredictable movement to a simple modulation.

LFO Scope shows the LFO waveform modulation.

SEQUENCER

Kosmo is provided with a powerful, compact and easy-to-use sequencer. Its main feature is to have 3 tracks (for each synth channel) with shared parameters (Sliders and Steps) and to play them at different time division. This sequencer method allows to play with harmonic relationships and to obtain interesting patterns in a more straight way. The sequencer use the same color scheme of the synth channels. You can also set several parameters like clock sources, speed/frequency, player mode, glide for each track, global length. As a bonus feature there are two synced functions about Sliders and Steps that add random values on each sequencer loop.

Sequencer Switch turns on the sequencer.

Clock Source (Src) selects from 4 different sources to get the clock.

INT - Internal Clock
LFO A - Random LFO Clock
EXT - External/Host Clock

INT enables to set the Drift parameter.

Rate sets the speed of the sequencer. When INT is selected it works on a range between 0.5 and 10 Hz. If Src is on LFO A has no rate control which is fixed at the LFO A rate. When EXT is selected, the sequencer is externally synced but you can also multiply or divide the speed by 2 and 4.

Drift deliberately inserts 4 degrees of desynchronization from the reference rate: OFF, LOW, MID, HIGH.
It's well suited to add a slightly jitter effect to a straight tempo as well as to produce a completely chaotic clock. It work only with the internal clock (INT).

Step (1-8) allows to turn on or off the step trigger and the related slider value. Each step button is shared between the 3 tracks. The steps that are off do not output the trigger.

Color Scheme Reference

Red - 1st Track - 1st Synth Channel
Blue - 2nd Track - 2nd Synth Channel
Green - 3rd Track - 3rd Synth Channel

Multitrack Steps Visualizer shows the step advancement of the 3 tracks.

Slider (1-8) sets a value from 0 to 1. If the corresponding step (trigger) is off, the sequence will sustain the previous values.

Slider and Steps Synchronized Randomizer allow to switch on the randomization of all the sliders and steps. New values are generated for each sequencer cycle (at Div = 1).

Time Division (1-16) allows to select the Time Division used to trigger the steps for each track. At the value of 1 there are no division.

Glide/Smooth (Sm) adjusts the amount of the smoothing time between Step Slides values for each track. At minimum values the sequence is fully stepped.

Sequence Length (Steps 2-8) defines the last step to be played before sequence restarts.

Mode allows to select in which direction the sequence will play.

>	Forward
<	Reverse
<>	Reverse and Forward
|<>|	Reverse and Forward alternative
?	Random

XY PAD CONTROLLER

XY Pad Controller section permits to control up to 2 parameters simultaneously. It has an X-axis and Y-axis and you can assign each of these axes to different parameters. When automation is turned its movements are recordable for several seconds. An extra feature is the possibility to restart the automation through the trigger/sync signal coming from the sequencer (according to the selected clock division value).

Auto (Automation) enables to record movements from the XY Pad. If activated, it starts to record as soon as you move the XY pointer and it plays immediately after you release it. The automation time can last several seconds, according to the Reaktor clock tempo value. At a speed of 120 BPM is possible to record up to 30 seconds.

XY Pointer allows to control parameters over the XY Pad. An x-y axis, also known as a cartesian coordinate system or a coordinate plane, is a two-dimensional plane of points defined uniquely by a pair of coordinates. Values are within 0 and 1.

Half-Speed defines which speed is used to record or play the automation. When activated the recording will go at half of the normal speed, by increasing the whole time length twice. A common use of this function is to record at normal speed and then plays at half-speed.

Automation Length graphically displays the progress bar indicating the length of the automation. When the maximum value is reached, it will stop as well as the recording.

Automation Reset allows to reset and play the automation from the beginning. Triggering occurs through the sequencer clock division. It can be very useful to make an arbitrary automation more predictable.

Reset Led Indicator displays the triggering of the reset, according to the selected clock division.

Reset Clock Division (1-16) selects the clock division value to be used to reset the automation. At the value of 1 there are no clock division and the speed is the same of the sequencer clock.

FX

FX presents the effects section of Kosmo. It composed by 3 effects blocks wired in series, from left to right. Each block has 2 different type of effects with a specific purpose. The first block has a 2-pole bandpass filter and a resonator effect. The second one has a chorus/ensemble and a tape delay. The last one has a "vintage" reverb and a "space" reverb. Each block contains 3 parameters and one modulation box. This last allows to assign a modulation input to one parameter at once.

Fx switch selects one of the 2 effects for each effect block.

FX 1:
2-pole Bandpass Filter/Resonator (Bp/Res)

Mix adjusts the balance between "Dry" and "Wet" (processed) audio signal.

Frequency/Pitch (Freq) adjusts the filter frequency (in Hz) or the resonator pitch (over the first 4 octaves). In OPT section we can select if to quantize or not the resonator pitch (according to **Pitch Quantizer**).

Feedback/Depth (Fdb) sets the amount of the filter resonance or the resonator depth. At high values it may cause distortions and unpredictable behaviours.

FX 2:
Chorus/Tape Delay (Cho/Dly)

Mix adjusts the balance between "Dry" and "Wet" (processed) audio signal.

Time adjusts the delay time (between 100 and 1200 ms) or the chorus frequency (between 0.02 Hz and 5 Hz).

Feedback/Depth (Fdb) sets the amount of the chorus depth or the delay feedback. In **DLY** mode and at the max value it may self-oscillate.

FX 3:
Vintage/Space Reverb (Rev I/Rev II)

Mix adjusts the balance between "Dry" and "Wet" (processed) audio signal.

Tail adjusts the decay time of the reverb. In **Rev I** mode it simulates a tunable spring decay time, ranging from few milliseconds to about 3-4 seconds. In **Rev II** mode it simulates a virtual space going up to 20 seconds.

Tilt Equalizer (Eq) is a simple and effective method to equalize an audio signal. By the twist of the fader, you can equalize the frequency spectrum of the reverb (post-reverb routing). In middle position no eq is applied. if you turn the fader up, it will attenuate the lows and boost the highs. Go down, and the opposite happens, the sound gets fatter and darker.

Modulation Source, Amount and Destination allow to select the modulation source of one of three parameters of the each effect block. Sequencer tracks can't be used as source. Destinations are selected through the up-arrow icons referred to the above parameter.

MASTER & OPTIONS (OPT)

Master section has different features oriented to monitor and control the final stage of the audio signal before to go externally. There are two complementary ways to check the audio levels. One way is to use Multicolor Scope to check its 3 synthesizers audio levels (each with their color) prior to go to FX (pre-FX routing). The other way is allowed from 2 VU meters (Left and Right), that show the master level to avoid distortions. There are also included 2 master processors (Saturator and Leveler) inserted before the master volume controller.
Options section contains some further global settings about Global Randomizer, Follower (an envelope follower) and Pitch Quantizer.

Multicolor Scope (Red, Blue, Green) to monitor the individual levels of each synth channel (mono, pre-FX). Helpful to balance the mix between different dynamics.

VU Meters (L+R) display the master level of the left and right channels (ranging from -20 dB to +4 dB). The first red line form left indicates the 0 dB. Peak is a led blinks when audio goes into distortion.

Saturation adjusts the saturation amount applied to the resulting stereo signal coming from FX section or directly from the channels (FX bypassed). It can sound like a tube/FET overdrive when gently pushed. At high values you enter into a more aggressive and fuzzy territory.

Saturation Pre/Post FX allows to switch the routing position of the saturator. To bypass it, press the button until all the leds are inactive. Set on Post-Fx for extreme/noisy sounds. If a channel bypass FX and Saturation is set on Pre-Fx, it will be routed on a parallel saturator compared to the other channels.

Global Randomizer allows to set and randomize most of the instrument parameters, adjusting the deviation from the previous value.

Scope Play Speed sets between 2 rate of play speed (normal/fast).

Leveler adjusts the amount of the AGC Processor (Automatic Gain Control). It operates as a one-knob compressor/limiter with a fixed ratio and an auto release function. Used sparingly, it can bring a sort of "glue effect" to the mix elements. At high levels and with rhythmic material it may cause a creative pumping effect.

Master Activator enables/disables the master volume.

Master Volume sets the master level of the instruments. Ranging between completely muted and 8.8 dB. At 0 position it's equal to 0 dB.
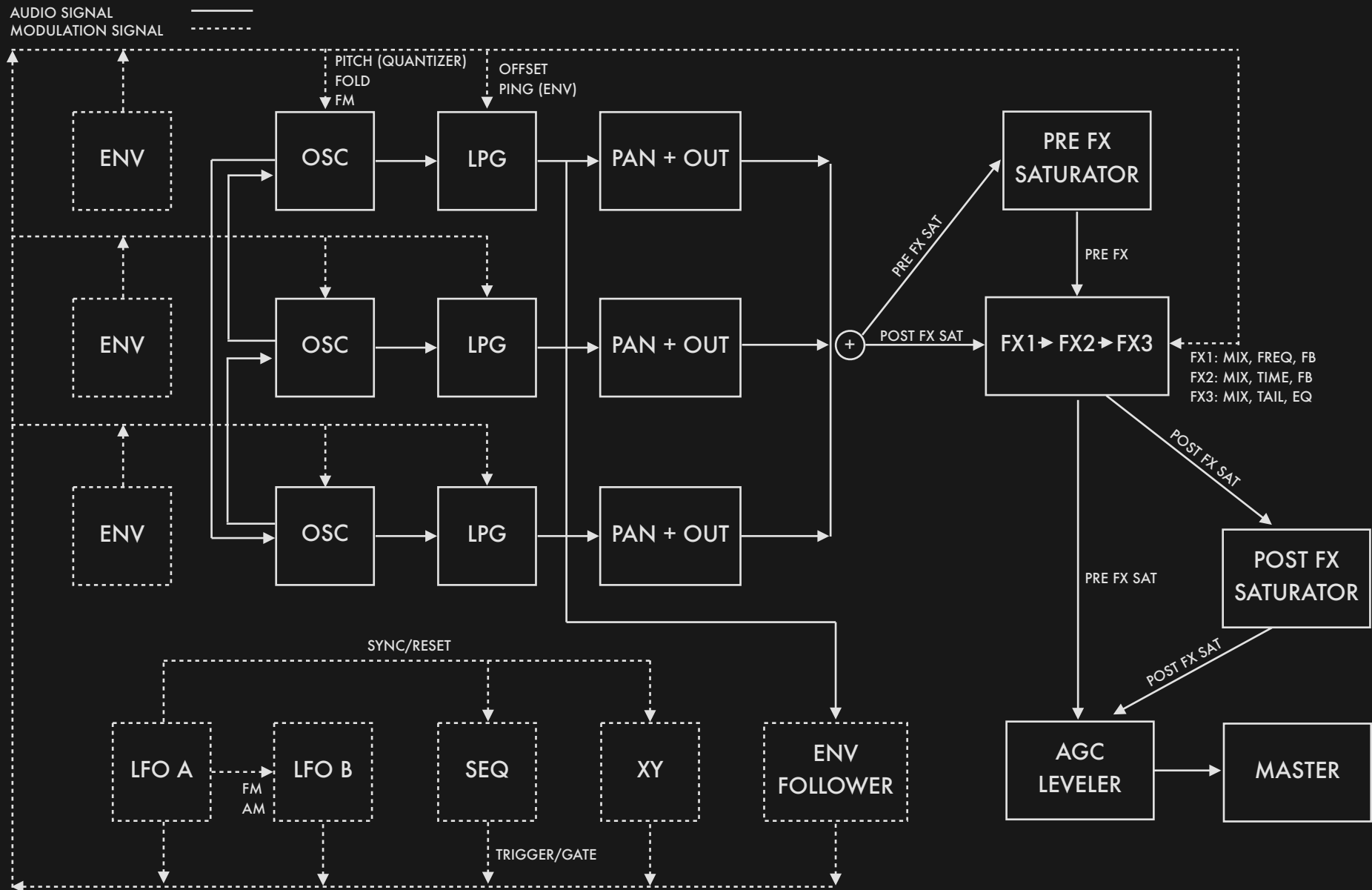
Envelope Follower Fall sets the release time of the envelope follower (Flwr). Ranging from 3 ms to 1 second.

Pitch Quantizer sets the root/base note (within 12 semitones) and the music scale (a selection of 10 most common scales) of the quantization applied to the modulation of Oscillator Pitch.

Resonator Quantizer enables the pitch of the resonator effect to be quantized through the selected root and scale.

AUDIO SIGNAL
MODULATION SIGNAL

PITCH (QUANTIZER)
FOLD
FM

OFFSET
PING (ENV)

ENV

OSC

LPG

PAN + OUT

PRE FX
SATURATOR

ENV

OSC

LPG

PAN + OUT

PRE FX SAT

PRE FX

+

POST FX SAT

FX1 ▸ FX2 ▸ FX3

FX1: MIX, FREQ, FB
FX2: MIX, TIME, FB
FX3: MIX, TAIL, EQ

ENV

OSC

LPG

PAN + OUT

POST FX SAT

POST FX
SATURATOR

PRE FX SAT

SYNC/RESET

LFO A

FM
AM

LFO B

SEQ

XY

ENV
FOLLOWER

POST FX SAT

AGC
LEVELER

MASTER

TRIGGER/GATE

* Detailed information of some blocks or paths are simplified for the general understanding.

A special thanks for his support to my friend Felix of Makunouchi Bento - https://makunouchibento.bandcamp.com

https://gumroad.com/nlabsynthesis
https://nonorder.wordpress.com