CASPER

BASTL

SOFTPOP

## SP II

FEEDBACK
COMMUNICATOR
ED. 2022

Softpop SP2 digital VCO reference manual

Softpop SP2 is a radical subtractive synth under the influence of unconventional digital control. It's a rare beast that excels both at melody and noise in equal measure.

SP2's favorite sounds include bassline bangers, angelic chord progressions, distorted beats, and water droplets. Softpop also has an external input with enough gain and saturation to process any sound thru its filter and VCA.

HEART AND BRAIN

The heart of SP2 is an analog, modular synth replete with lush tones and a chaotic disposition. Its brain is a complex digital sequencer and quantizer that brings (some) order to the chaos. The analog heart and the digital brain support each other while also pushing their behaviors out of the usual routines in surprising ways.
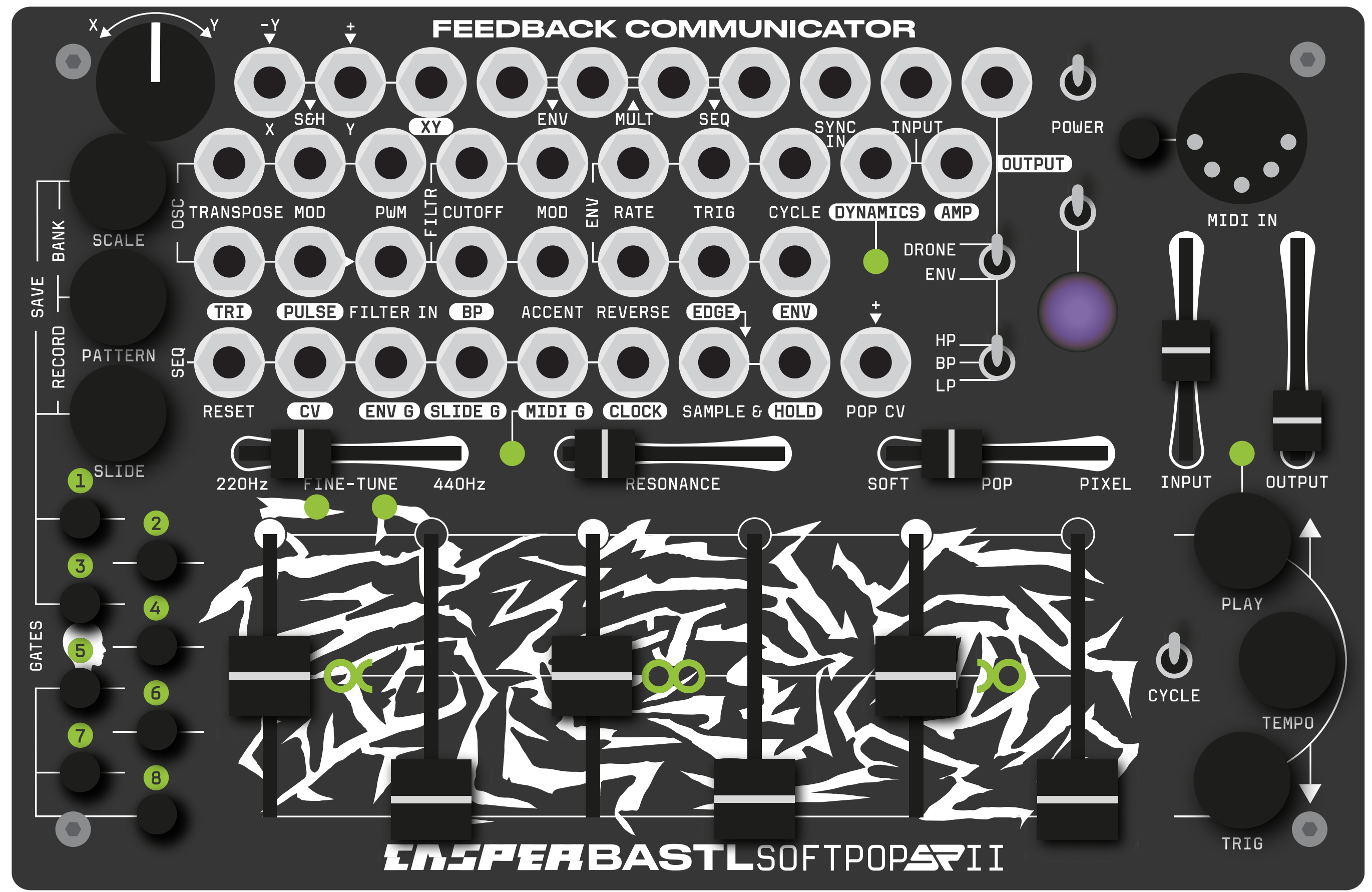
Manual

Links:

**QUICK START**
VIDEO CONTENT
PRODUCT PAGE

Reference Manual:

In this manual, we will gradually uncover all the secrets of the Softpop SP2. Feel free to jump around to the sections that are of the most interest (see SECTIONS) or follow this guide from beginning to end for a full understanding of SP2's wily ways.

Regardless of how you use this manual, we suggest you start with the Quick Start guide before proceeding.

Here is what the controls are called throughout this manual:

4
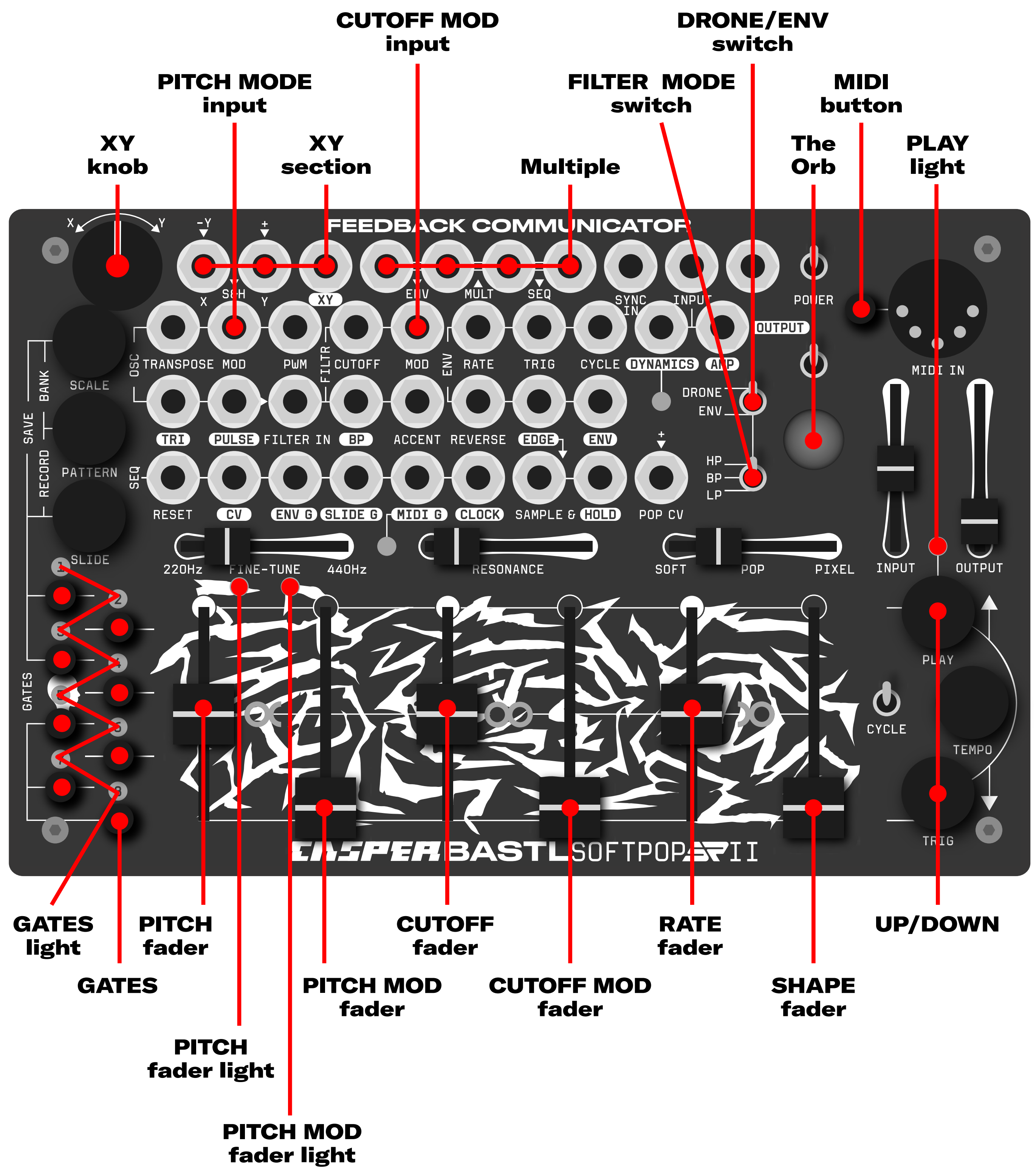
Architecture

At first glance, SP2 has a conventional subtractive synthesizer structure with an **oscillator** producing a harmonic-rich waveform (PULSE) fed thru a **filter** that takes away some of the harmonics to shape the timbre and finally an **envelope** that controls the loudness of the output thru a VCA (voltage controlled amplifier).

```
┌──────────────┐      ┌──────────────┐      ┌──────────────────┐
│  OSCILATOR   │ ──▶  │    FILTER    │ ──▶  │ ENVELOPE (VCA)   │ ──▶  OUT
└──────────────┘      └──────────────┘      └──────────────────┘

    PITCH                 TIMBRE                 LOUDNESS
```

The deeper you delve into the SP2 architecture, the more clearly you will see the internal routing; and by fiddling with the MOD faders, you will uncover an unconventional synth-creature with unique behaviors. This architecture, including internal routings and normalizations, is illustrated on the front-facing side panel.
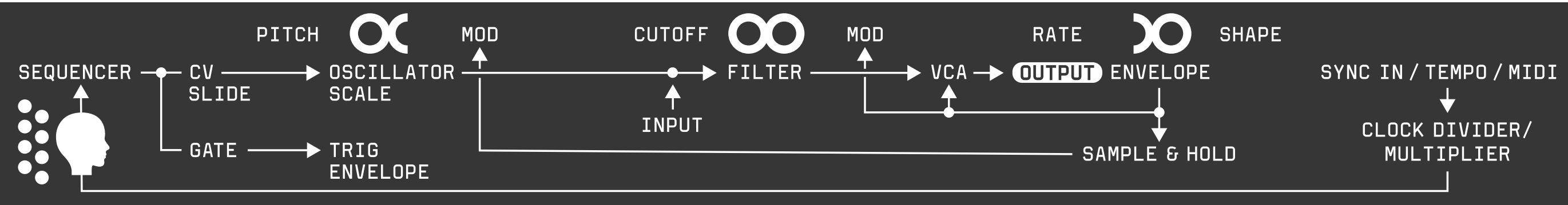
The envelope is normalized to the CUTOFF MOD, so you can use it to control the timbre of the filter by bringing up the CUTOFF MOD fader.
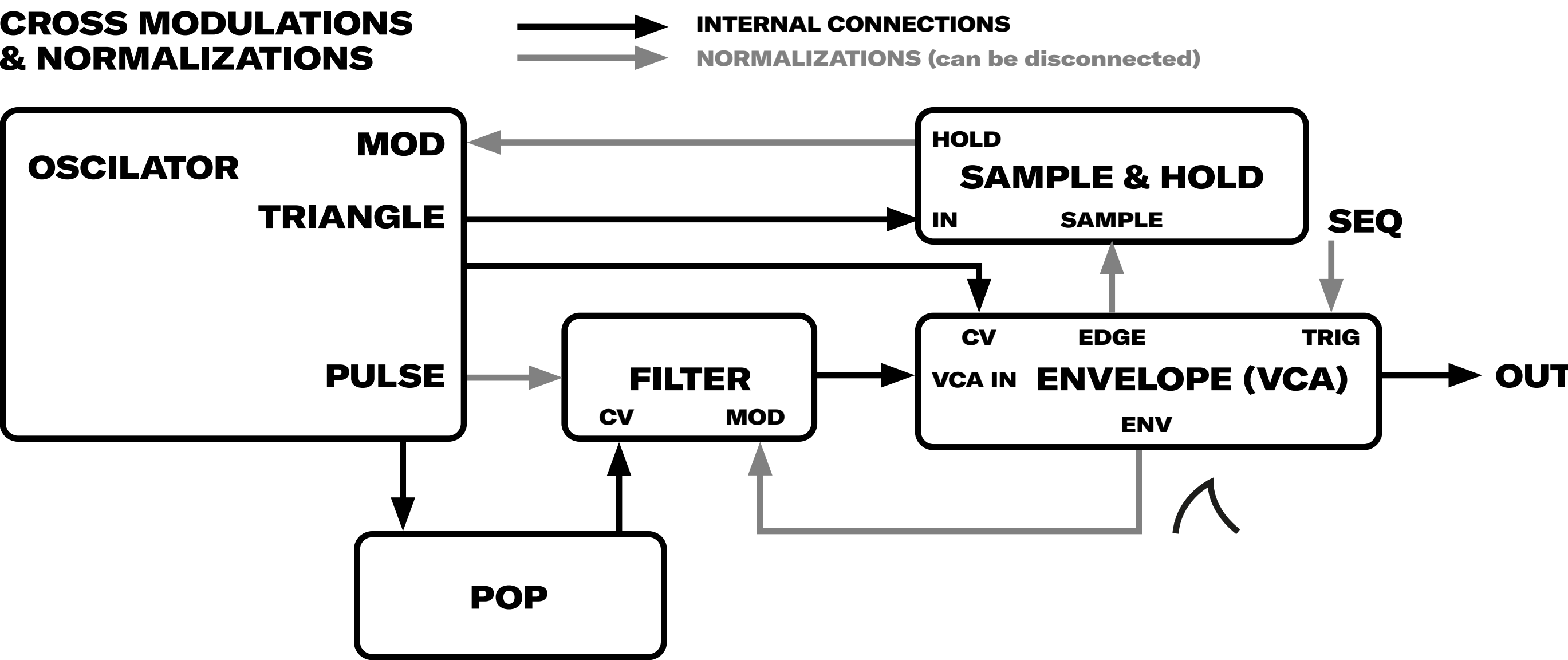
The envelope also triggers the Sample & Hold circuit that generates pseudo-random voltages that can be used to control the pitch of the oscillator via the PITCH MOD fader. Therefore, each time you trigger the envelope (either by pressing the TRIG button, cycling it with the CYCLE switch, or triggering it from the sequencer), it will trigger the Sample & Hold and can add randomness to the melody. The more you push the PITCH MOD fader up, the more pronounced the effect will be.

We suggest you get to know the behaviors and interactions described above before engaging the sequencer. There is a lot to explore!

Patchbay

OUTPUTS are labeled with inverted text (black in the white field).
INPUTS are labeled with normal text (white on black).
All inputs and outputs are safe to use with modular/eurorack signals. The analog outputs (TRI, PULSE, BP, ENV, HOLD, DYNAMICS, AMP) have slightly lower levels than the standard eurorack signal, but that won't be an issue in most situations. See the list of <u>Features</u> at the end of the manual for exact amplitudes.

NORMALIZATIONS + CROSS MODULATIONS

CROSS MODULATIONS & NORMALIZATIONS

→ INTERNAL CONNECTIONS
→ NORMALIZATIONS (can be disconnected)

OSCILATOR — MOD — TRIANGLE — PULSE

SAMPLE & HOLD — HOLD — IN — SAMPLE — SEQ

FILTER — CV — MOD

ENVELOPE (VCA) — CV — EDGE — TRIG — VCA IN — ENV — OUT

POP

Normalizations are pre-made connections within the instrument that can be interrupted by plugging new signals into the dedicated normalization jacks. These jacks are marked with arrows showing the signal that is normalized to the jack.

MAIN NORMALIZATIONS:
● PULSE>FILTER IN - the pulse signal from OSC is normalized to the audio input of the filter.
● ENV>(CUTOFF) MOD - the ENV output from the envelope generator is normalized to the filter cutoff MOD input jack. The amplitude of this input signal is adjusted using the filter MOD fader.

● S&H>(PITCH) MOD - the chaotic stepped voltage output from Sample & Hold is normalized to the pitch MOD jack. The amplitude of this input signal is then adjusted using the filter MOD fader.

● SEQ>TRIG - the sequencer produces 3 output signals called CV, SLIDE G (slide gate), and ENV G (envelope gate). The envelope gates are normalized to the TRIG (trigger) input of the envelope generator.

● EDGE>SAMPLE - the EDGE output is normalized to the Sample & Hold trigger input. This means the S&H will sample the signal at its input (TRI) every time it receives a trigger at the SAMPLE input.

● TRI>RATE* - the TRI output of the oscillator modulates the RATE of the envelope.

*This is a hardwired normalization that cannot be disabled (except by cutting the TRI>RATE solder jumper on the circuit board)
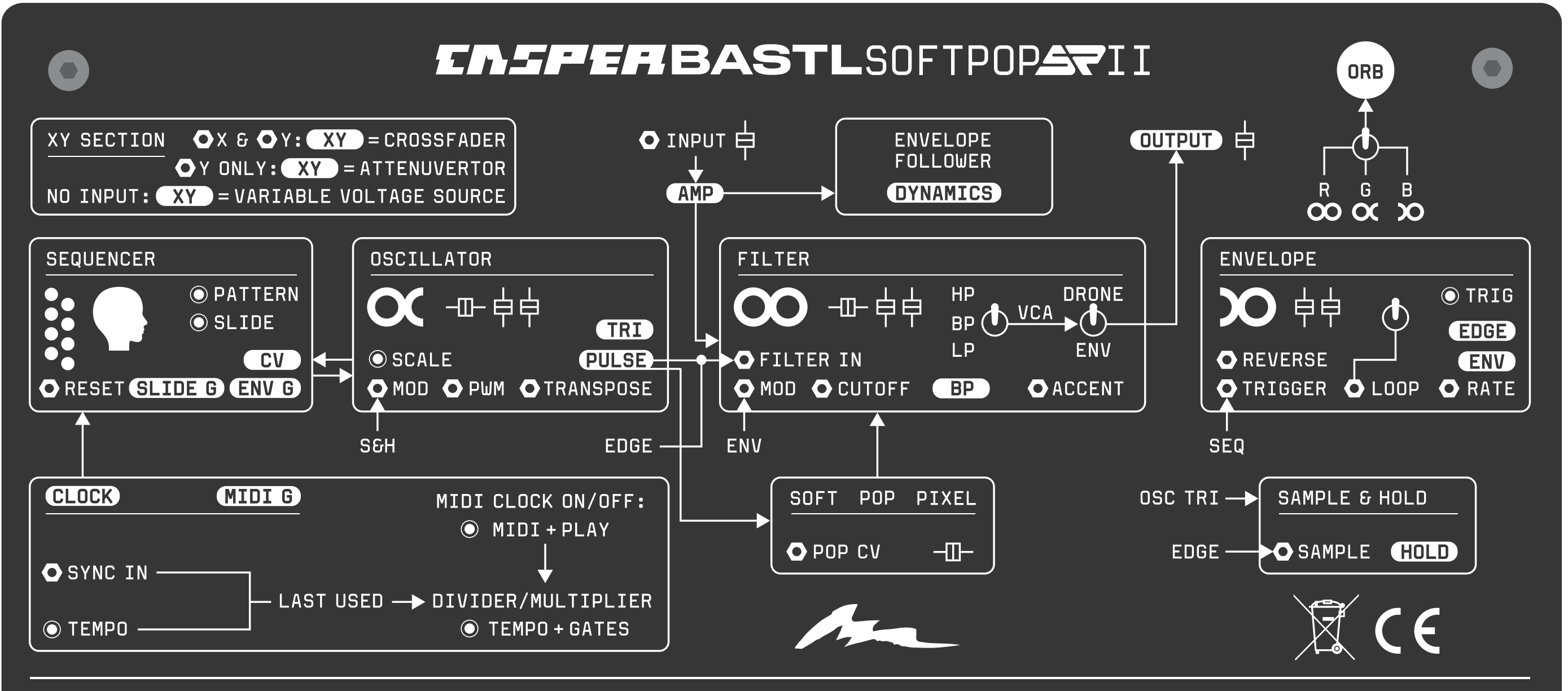
Button combinations

There are many features on the SP2 that are accessed by button combinations. When combining buttons, the PLAY and TRIG buttons are referred to as UP and DOWN buttons. The GATE buttons are often used as selectors when used with other context buttons. Usually, one press of one GATE makes the selection, and the context button should be released. If multiple GATES are pressed while holding a context button, it might result in defining a chain of that context button (e.g., scales or patterns). See all the button combinations below.

BASICS
PLAY=▲ and TRIG=▼ when used with other buttons
GATE=press any one gate
GATES=press multiple gates one after another while still holding the context button

PATTERN+SLIDE=RECORD pitch sequence
SLIDE+MIDI+GATES=select waveform
SLIDE+FINE-TUNE=set waveshape
SCALE+SLIDE=SAVE bank
SCALE+PATTERN+GATE=LOAD bank

SCALE+GATE=select a scale
SCALE+GATES=chain scales
SCALE+▲/▼=select a semitone
SCALE+TEMPO=semitone on/off (indicated by PLAY LED and GATE 1)
SCALE+TEMPO+▲/▼=transpose whole scale by one semitone
SCALE+MIDI=copy MIDI defined scale to currently edited scale

SEQUENCER
PATTERN+GATE=select a pattern
PATTERN+GATES=chain patterns
PATTERN+▲/▼=shift a whole pattern by 1 step
PATTERN+TEMPO=copy currently selected pattern to the next selected pattern

SLIDE+GATE=activate/deactivate slide on that step
SLIDE+▲/▼=set slide rate (1=no slide)

PLAY (short)=start and stop sequencer
PLAY+GATE=select playmode
PLAY+GATES=chain playmodes

TEMPO+TEMPO=tap tempo
TEMPO+▲/▼=increase/decrease tempo
TEMPO+▲/▼>1s=gradually increase/decrease tempo
TEMPO+GATE=select divider/multiplier
TEMPO+▲+▼=learn tempo from looping envelope

TRIG=trigger envelope
TRIG+GATE=activate temporary FX (hold several to combine)
TRIG+PLAY+GATES=record loop of temporary FX
TRIG+PLAY=erase loop of temporary FX

PATTERN+MIDI=toggle Triggered pitch mode
TRIG+SLIDE=toggle SLIDE G trigger/gate mode
TRIG+PATTERN=toggle ENV G trigger/gate mode

STEP EDIT MODE
PATTERN+SLIDE (when seq. stopped)=enter/leave step edit mode
In the step edit mode (one step is blinking):
GATE=preview and select step (always triggers envelope)
GATE+move PITCH FADER=edit steps pitch
GATE+▲/▼=transpose step in quarter tones

MIDI
MIDI >5s=MIDI learn
MIDI+GATE=set MIDI channel to 1 to 8
MIDI+selected GATE=set MIDI channel to 8+1 to 8
MIDI+PLAY=activate/deactivate MIDI clock
MIDI+SCALE=activate/deactivate MIDI scale mode
MIDI+PATTERN=activate/deactivate CV Out generating Velocity CV
MIDI+TRIG=toggle Trigger Envelope at Note On mode

BOOT SETTINGS

Hold SCALE at power up=toggle VCO Pitch Limiter mode

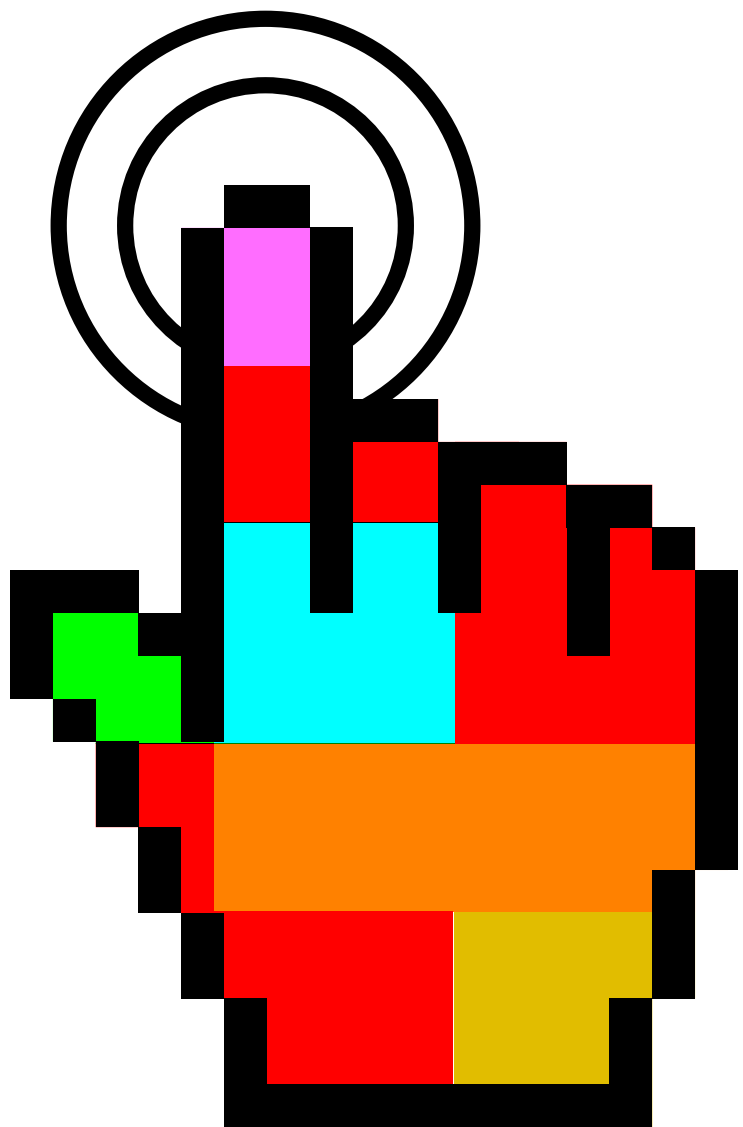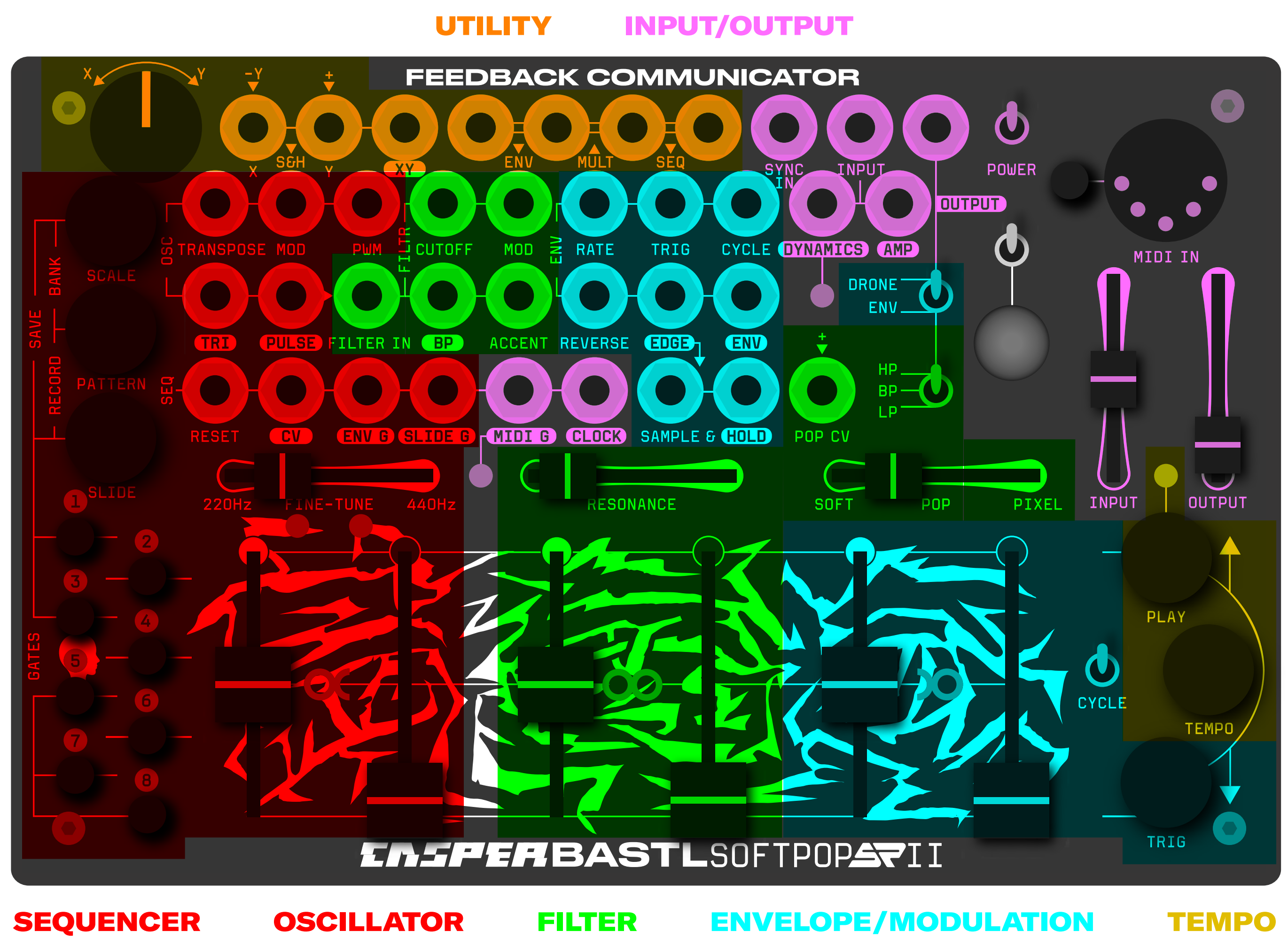Hold PATTERN at power up=toggle CV Pitch tracking mode

Hold SLIDE at power up=toggle FINE-TUNE fader function
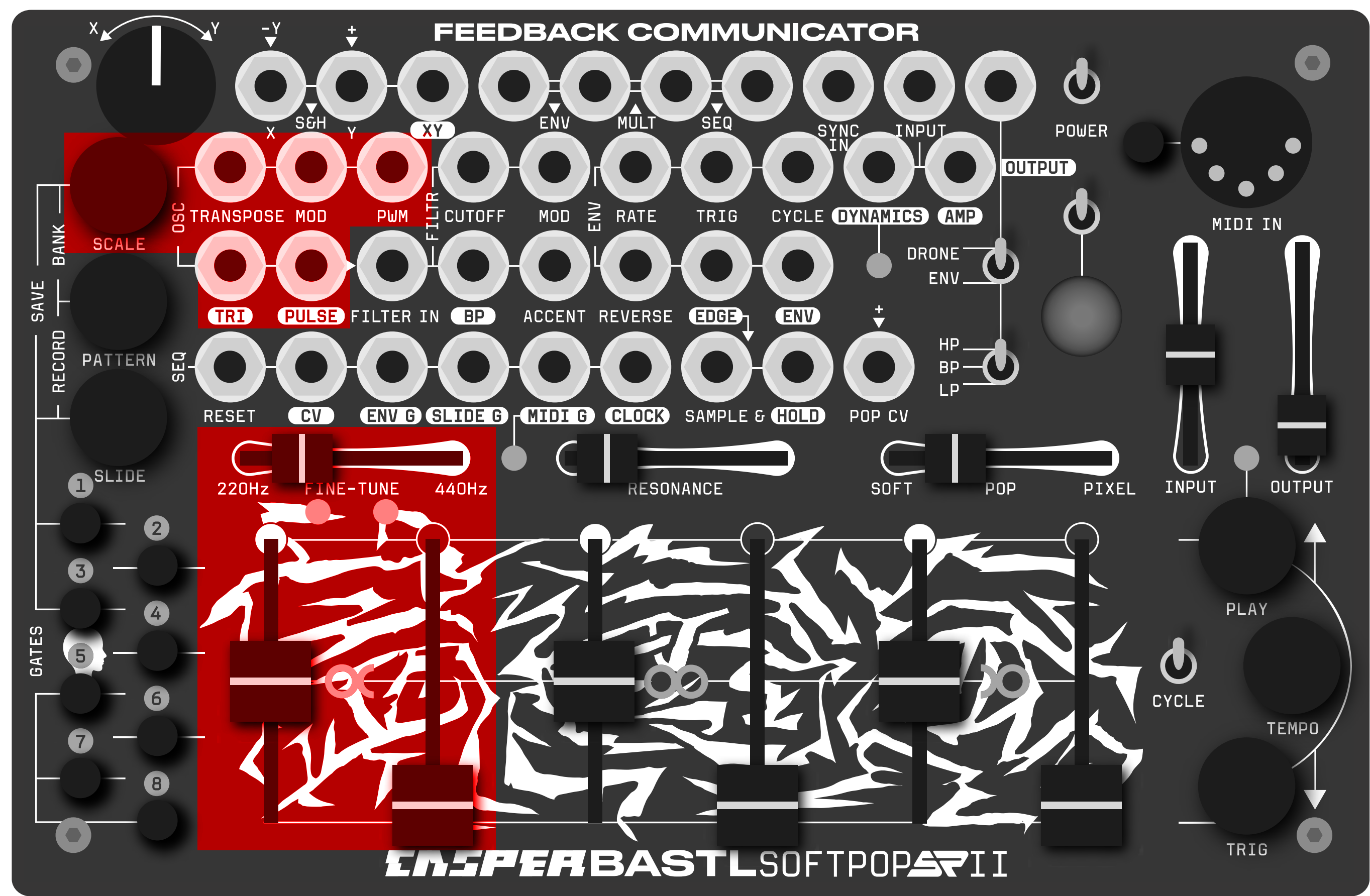
Hold PLAY+TEMPO+TRIG at power up=factory reset

Hold SCALE+SLIDE at power up=calibration and test mode

Hold MIDI at power up=firmware update mode (play firmware audio into RESET input)
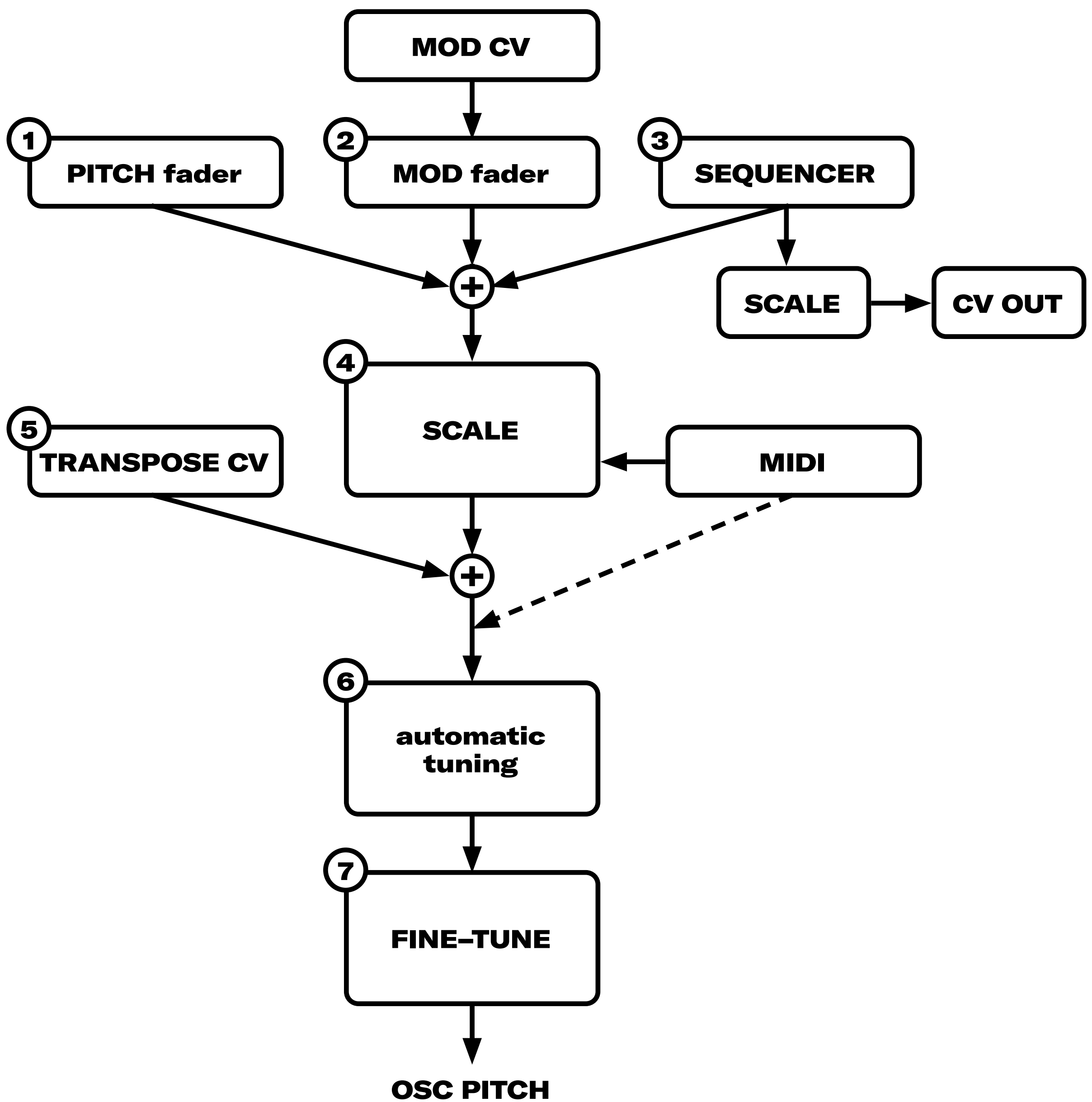
Sections

Oscillator section

The oscillator is Softpop's source of tonality. It is either an analog oscillator that is digitally analyzed and controlled or a fully digital oscillator. This manual describes the digital oscillator functionality. For more information on the analog oscillator functionality, see the respective manual [here](#).

PITCH

There are several factors that contribute to the final pitch of the oscillator.

```
                        ┌──────────┐
                        │  MOD CV  │
                        └────┬─────┘
                             │
  ①┌────────────┐  ②┌─────────────┐  ③┌──────────────┐
   │ PITCH fader │   │  MOD fader  │   │  SEQUENCER   │
   └──────┬──────┘   └──────┬──────┘   └───┬──────────┘
          └────────►  (+)  ◄────────┘      │
                      │           ┌────────┴──┐     ┌──────────┐
                      │           │   SCALE   │────►│  CV OUT  │
                      ▼           └───────────┘     └──────────┘
  ④┌──────────────────────────────┐
   │            SCALE             │◄──────┐
   └──────────────┬───────────────┘       │
  ⑤┌──────────────┐               ┌───────┴──────┐
   │ TRANSPOSE CV │               │     MIDI     │
   └───────┬──────┘               └──────┬───────┘
           └────────►  (+)  ◄┄┄┄┄┄┄┄┄┄┄┘
                       │
  ⑥┌─────────────────┐
   │   automatic     │
   │    tuning       │
   └────────┬────────┘
  ⑦┌─────────────────┐
   │   FINE–TUNE     │
   └────────┬────────┘
            ▼
        OSC PITCH
```

1   The primary control that sets the pitch is the **PITCH** fader. It is used for recording sequences and can further transpose them. It reaches from sub-audio LFO territory thru bass to higher registers.

2   The **PITCH MOD** fader attenuates the PITCH MOD input. If it is down, there is no modulation, and the higher you go, the more pronounced the effect will be. If nothing is patched to the PITCH MOD input, there will be static semi-random voltage from the Sample & Hold circuit triggered by the envelope (TRIGGER or CYCLE the envelope to hear the changes). In default, the PITCH MOD fader sets the amount of randomness added to the melody.

3   The **SEQUENCER** is the Softpop's melody maker. Hold SLIDE+PATTERN and move the PITCH fader to RECORD sequences. For more, see the or the .

4   PITCH+MOD+SEQUENCER are added together and processed

through the **Scale Quantizer**. The quantizer will search for the nearest active semitone in the SCALE and snap the pitch to that semitone. You can save 8 user-definable scales that can be set to any number of semitones. See more in the Scale section.

5 After the SCALE, the **TRANSPOSE** CV is added. It is calibrated to correspond to V/Oct and is quantized to semitones. It can transpose your music by any number of semitones.

6 Only for the analog oscillator firmware: The **automatic** tuning is superior to all the processes above. Press SCALE+MIDI to tune (>2s for full tuning).

7 The **FINE-TUNE** fader is the final piece in the chain. Keep it all the way to the right for most cases. You can swipe the whole octave down with the fader and therefore use it as a performative pitch-bending control.

WAVEFORMS AND WAVESHAPES

The digital oscillator of the SP2 provides several waveforms that all have a wave shape parameter. This adds a lot of potential for changing the timbre of the instrument.

SLIDE+MIDI+GATES=select waveform
SLIDE+FINE-TUNE=set waveshape

Note: The digital waveforms are output from the TRI jack. To hear these new waveforms most clearly, it is best to patch TRI out to FILTER IN to override the normalization of PULSE to FILTER IN
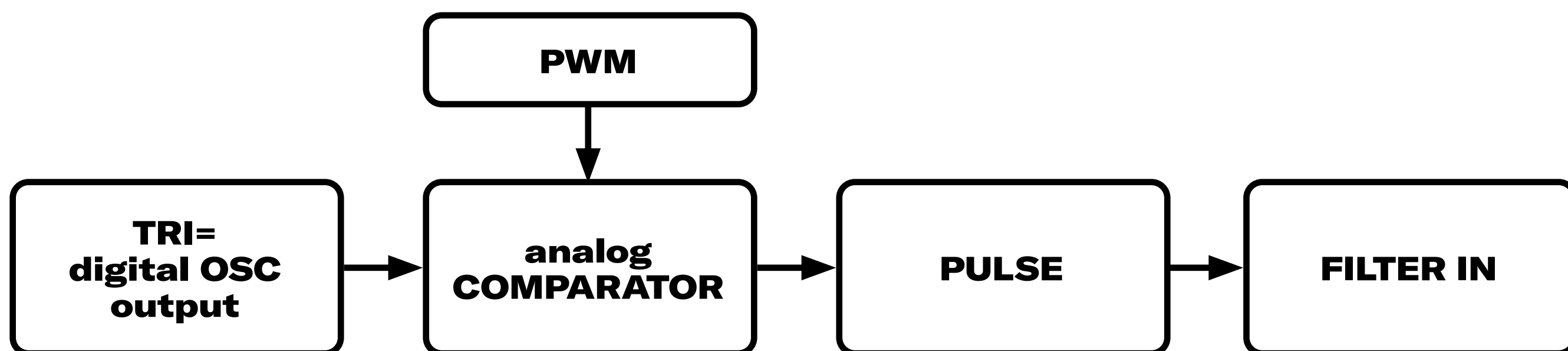
To select a WAVEFORM, hold both the SLIDE and MIDI buttons and press one of the GATE buttons.

Hold the SLIDE button and move the FINE-TUNE fader to adjust the waveforms variable WAVESHAPE parameter.

Fractal Triangle ●

● **2×Fractal Triangle**

Animated Fractal Triangle ●

● **Exp Saw Detune**

Super Triangle ●

● **Super Saw**

Triangle To Noise ●

● **Glitch Radio**

The waveforms and their waveshaping parameters are:

1	fractal triangle		fractal transformation
2	super fractal triangle: 2 detuned triangles fractal-transforming each other		exp. detune & lin. detune*
3	animated fractaled triangle		fractal to pulsing saw
4	exponential saw detune		exp. detune
5	super triangle: 2 detuned triangle waves mixed together		exp. detune & lin. detune*
6	super saw: 2 detuned saw waves mixed together		exp. detune & lin. detune*
7	triangle to noise		glitch morph
8	glitch radio		radio tune

*exp. detune & lin. detune: *At the lowest setting, the two oscillators are one octave apart and slightly detuned. Sweeping up to the middle setting, the lower oscillator will pitch up to almost the frequency of the static oscillator, creating a typical beating LFO effect. The second half of the fader is the linear detune of the two oscillators which means the beating LFO frequency should remain very similar across the octaves. At the highest setting, the two oscillators are at an almost identical frequency.*
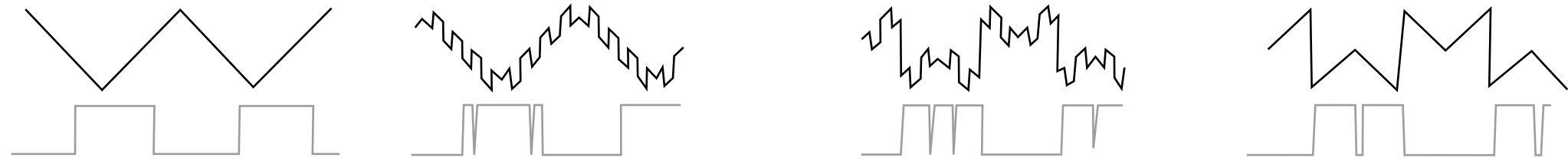
Waveshape
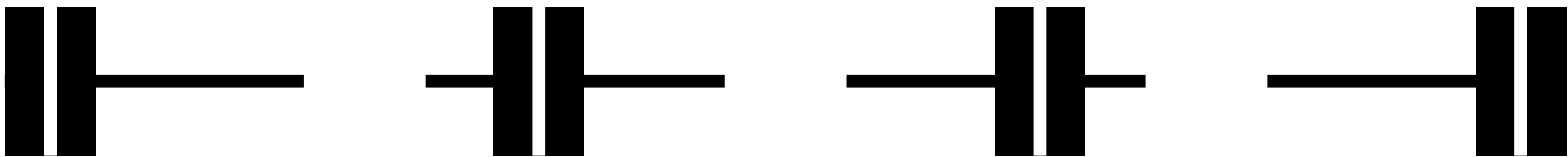
Waveform
the gray waveform is the pulse output derived from the tri output via analog comparator

1. fractal triangle: triangle being processed by increasing amount of xor bit operator
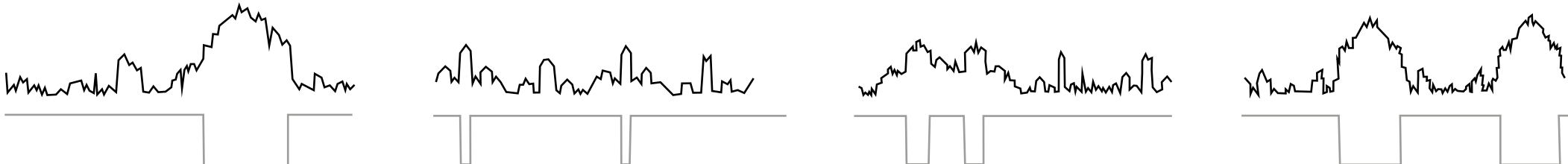
Fractal triangle

Pulse

2. super fractal triangle: two detuned triangles cross modulating via xor bit operator

Super fractal triangle

Pulse

3. animated fractal triangle: triangle being processed by or bit operator of amplifying sub oscillator

Animated fractal triangle

Pulse

4. exp saw detune: two saw waves detuned exponentially up to an octave apart

Exp saw detune

Pulse
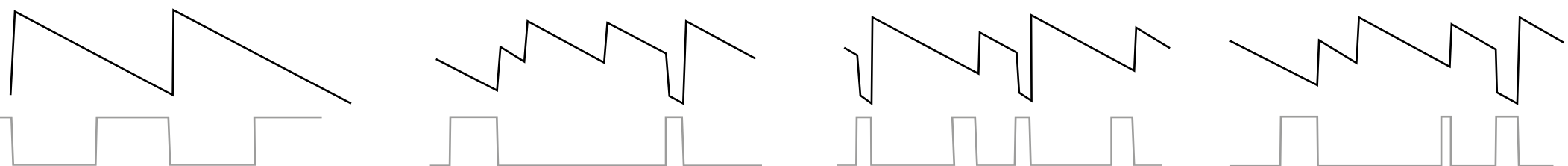
5.super triangle: two detuned triangles mixed together

Super triangle

Pulse

6.super saw: two detuned saws mixed together

Super saw

Pulse

7. triangle to noise: glitchy transformation via overflowing multiplication

Triangle to noise

Pulse

8. glitch radio: granual sonification of the ram memory of the sp2

Glitch radio

Pulse

Hold SCALE at power up=toggle VCO Pitch Limiter mode
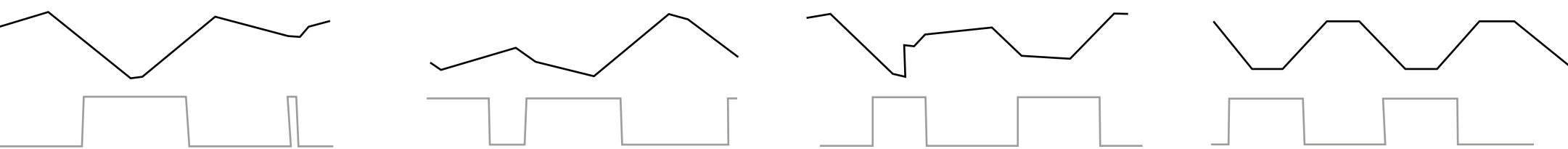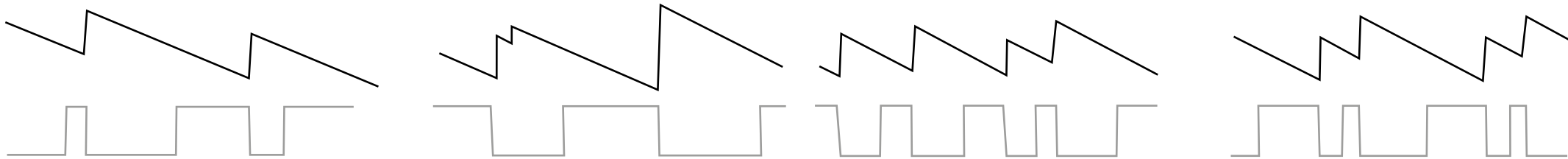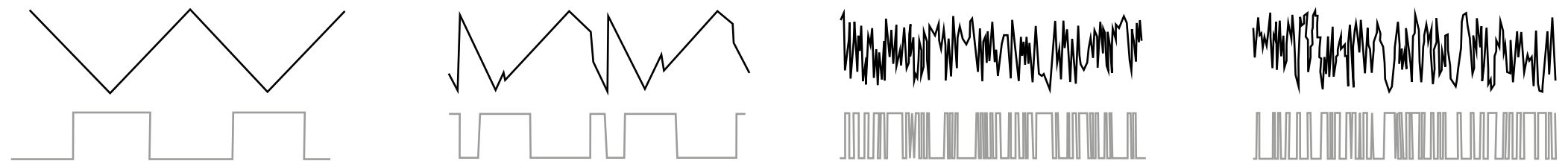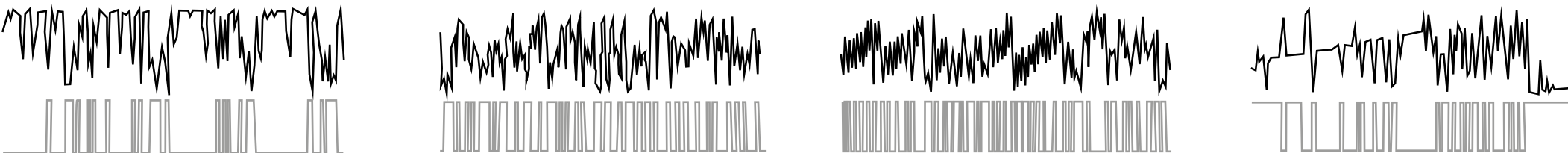Hold SLIDE at power up=toggle FINE-TUNE fader function

VCO PITCH LIMITER MODE

For more focused tonal work, the PITCH fader can be limited to avoid the subsonic LFO territory. Hold SCALE while powering up the unit to toggle the VCO Pitch Limiter mode. If the mode is activated, it will be indicated by GATE light 2 at startup.

FINE-TUNE FADER MODE

The default FINE-TUNE fader function can be altered, so that the WAVESHAPE is the default function, and the FINE-TUNE function is only accessed by holding the SLIDE button and moving the fader. To change the default function of the FINE-TUNE fader, hold the SLIDE button while powering up the unit. If the WAVESHAPE is the default, it will be indicated by GATE light 6 at startup.

SCALE QUANTIZER

The Scale Quantizer is the tonal brain of the Softpop. The selected scale defines which notes are available to be played back by the sequencer. In each bank, there are 8 user-definable scales that can also be chain-sequenced. As shown earlier, the PITCH fader, the PITCH MOD fader, and the sequencer melody are added together before entering the Scale Quantizer.

SCALE+GATE=select a scale
SCALE+GATES=chain scales
SCALE+ ▲ / ▼ =select a semitone
SCALE+TEMPO=semitone on/off (indicated by PLAY LED and GATE 1)
SCALE+TEMPO+ ▲ / ▼ =transpose whole scale by one semitone
SCALE+MIDI=copy MIDI defined scale to currently edited scale

SCALE+GATE

To select a scale, hold the SCALE button and press one of the eight GATE buttons (and release the SCALE button). A scale is defined by active and non-active semitones. The scale repeats in every octave.

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The default scales are:

1 Unquantized (no semitone is active)
2 Chromatic (all semitones active)
3 A minor triad (A, C, E)   **4** G major triad (G, H, D)
5 F major triad (F, A, C)   **6** E minor triad (E, G, B)
7 D minor triad (D, F, A)   **8** C major triad (C, E, G)

Note: To select a scale, hold the SCALE button, then press and release any one of the GATES. If you press multiple GATES while holding SCALE, you will create a chain that will play back in the order the GATES were pressed.

SCALE+GATES to chain scales

To create a SCALE chain, press several GATE buttons consecutively while holding the SCALE button – the selected scales will be chained in the same order in the sequencer. That means that each time the first step starts, the active scale will advance to the next scale in the chain. When the sequencer is stopped, the SCALE chain can be moved to the next scale by triggering the RESET input.

Example: Make a simple 8 step sequence. Keep holding the SCALE button and press the following GATE buttons in this order: 8+8+5+4. You have just written down this chord progression: Cmaj Cmaj Fmaj Gmaj (with the factory default scales) that advances with every repetition of the 8 steps.

SCALE EDITING

Select a scale (SCALE+GATE). To edit the scale, keep holding SCALE and press the UP/DOWN/TEMPO button. Once you press one of these, you are in the Scale Edit mode. The GATE lights indicate a currently selected semitone and whether it is active in the scale.

To exit the Scale Edit mode, release SCALE or press another GATE to select a different scale. To stay in the Scale Edit mode, keep holding SCALE.
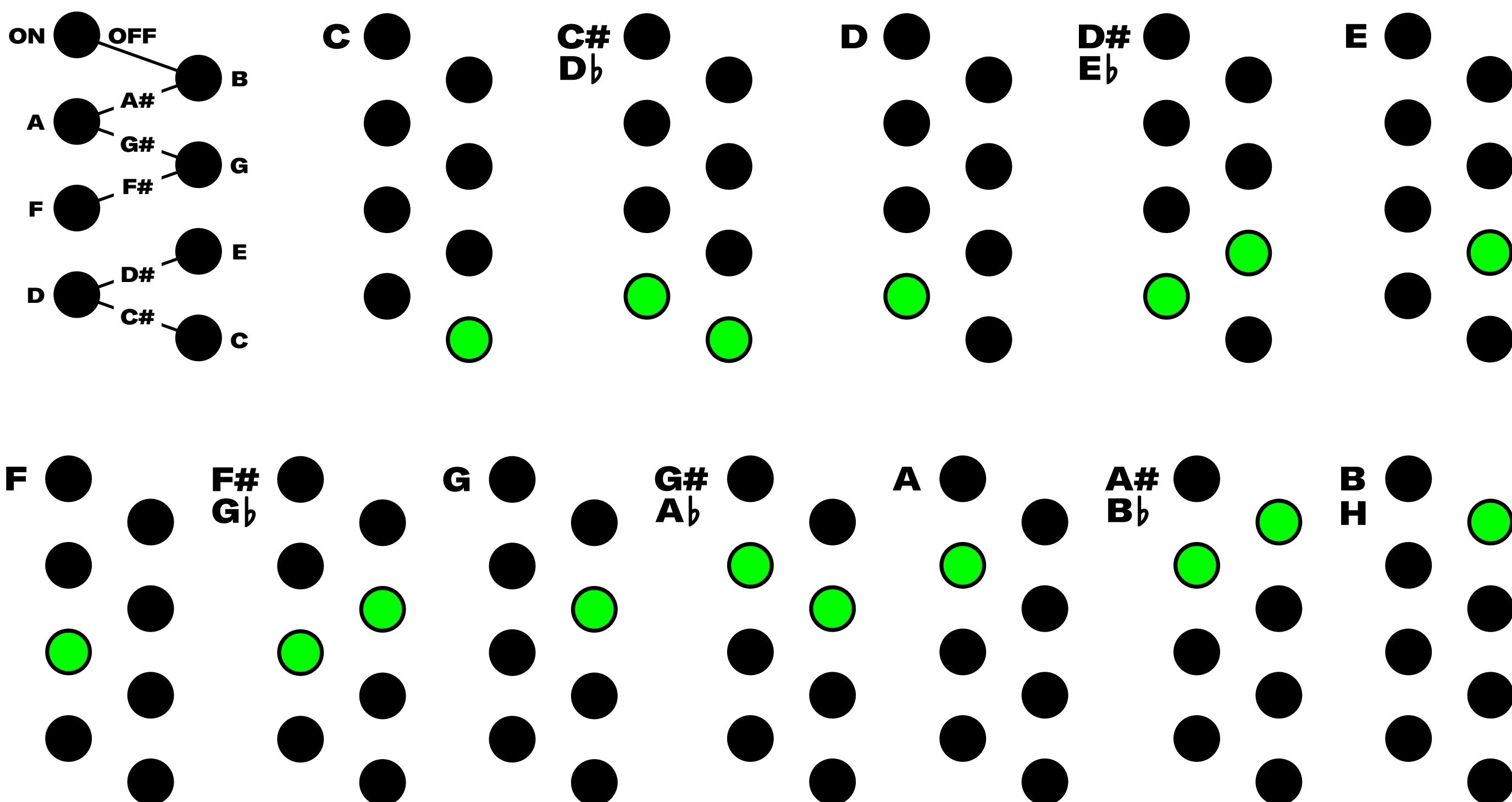
While still holding the SCALE button:

Use the UP/DOWN buttons to navigate through the semitones.

Combinations of GATE LEDs show which semitone is selected. Both GATE 1 and PLAY light will indicate whether the semitone is active or not.

Use the TEMPO button to activate/deactivate a semitone.

Press the MIDI button to copy the scale defined by the MIDI input to the currently edited scale (you still need to be in the Scale Edit mode).

While still holding SCALE, hold TEMPO and press UP/DOWN to shift the whole scale up or down by a semitone.

If all semitones in the SCALE are deactivated, it will make that SCALE unquantized. Or rather quantized to quarter tones so you can also hit the tones in between the semitones!

PATCH POINTS

● TRANSPOSE input is a V/OCT calibrated input that can be used to transpose the OSC section pitch. Transpose is applied to the OSC after the Scale Quantizer. The TRANSPOSE input is quantized in semitones. When using positive voltages on the transpose input, you can get to a point when the maximum pitch produced by the SPII is reached. Instead of clipping the signal and producing a static pitch, the Softpop will play the desired pitch but an octave lower. In other words: the pitch will overflow. This means that you should not get "wrong" notes when playing high V/OCT voltages into the TRANSPOSE input.

● MOD input is a pre-Scale Quantizer pitch control input for the oscillator pitch. Anything sent to the input will be quantized to the active scale before setting the pitch. The MOD input is attenuated by the PITCH MOD fader. This means the intensity of how much it affects the pitch is set by this fader (no effect if down, full effect if up).
The SAMPLE & HOLD stepped chaotic voltage is normalized to the MOD input. So if nothing is plugged into the PITCH MOD input, the PITCH MOD fader effectively sets the amount of randomization in the sequence.

● PWM (pulse-width modulation) input sets the pulse width of the PULSE signal. 💡 Increasing the voltage at the PWM input effectively takes away the lowest (fundamental) harmonic from the PULSE signal or changes its timbre. It can be modulated by voltages (e.g., ENV or HOLD) or set statically by the XY output.

● TRI is the variable output of the digital oscillator, and the PULSE signal is derived from the TRI output.
💡 Use the TRI output to boost bass by routing it to the main INPUT. TRI is also used as the input for the S&H, and it also slightly modulates the RATE of the envelope. TRI is 5Vpp.

● PULSE is the primary source for Softpop's filter. It is the variable pulse output derived from the TRI output. It is based on a comparator output internally comparing the TRI and PWM signals. 💡 Modulate the PWM input to affect the sound of PULSE. It can also be silenced by applying enough positive or negative voltage to the PWM input. PULSE is 3.5Vpp unipolar.

Filter section
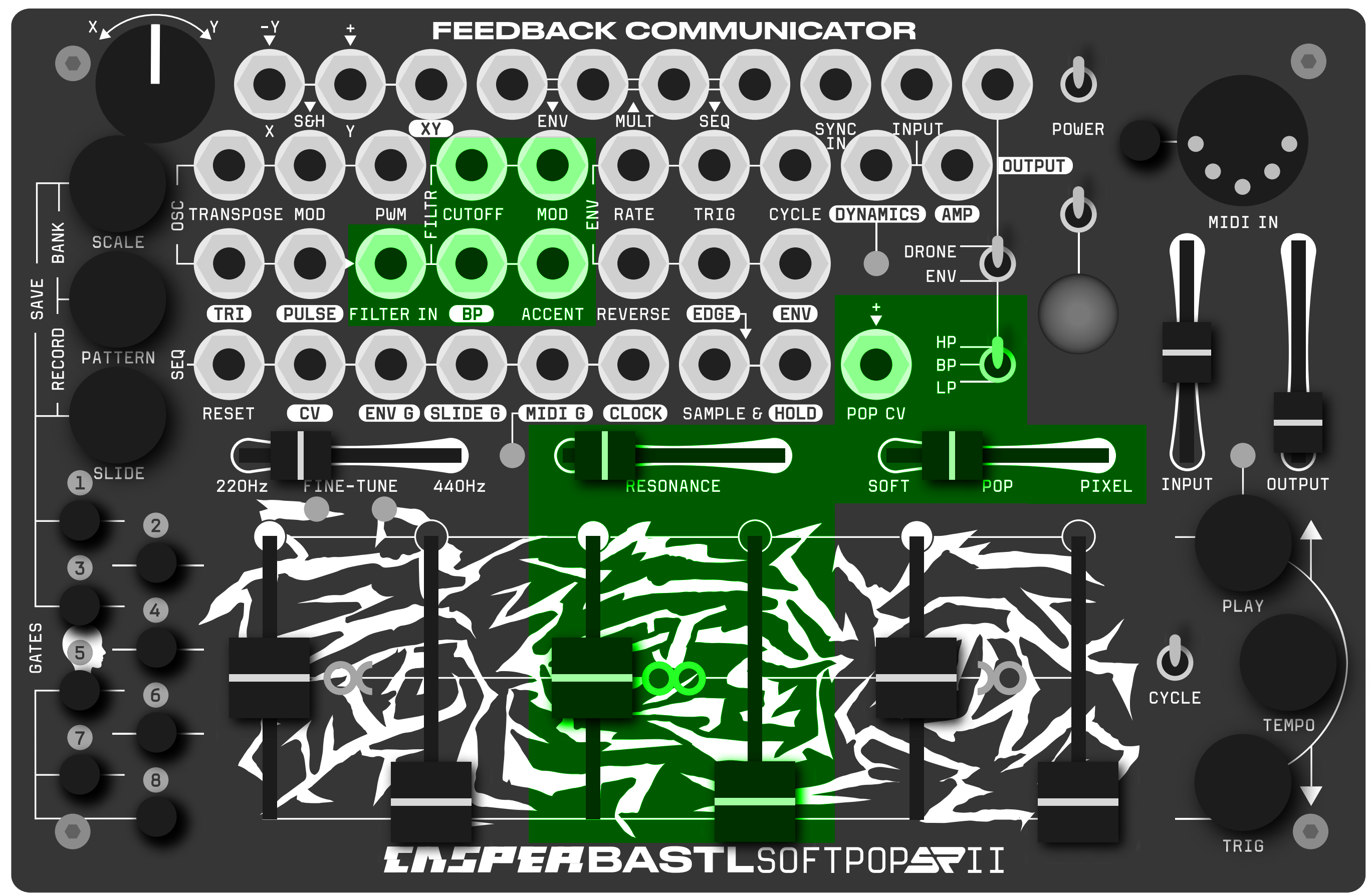
The filter is the main timbral shaping tool on the Softpop. You can use it to take away specific frequencies and harmonics while accentuating others. You can also animate that process and create the iconic filter sweep. Softpop's filter is also a unique sound source: it is optimized for extended filter techniques such as overdriving, pinging, self-oscillation, or filter FM.

The primary control of the filter is the CUTOFF fader that sets the cutoff frequency. This frequency tells the filter to remove the frequency spectrum either above (lowpass), around (bandpass), or below (highpass) the CUTOFF.

Softpop's filter has 3 modes of filtering selectable with the LP/BP/HP switch.
It is a state variable filter with a 6dB/oct slope on the bandpass and a 12dB/oct slope for the lowpass and highpass modes.

Resonance

Cutoff

LP Lowpass   **BP Bandpass**   **HP Highpass**
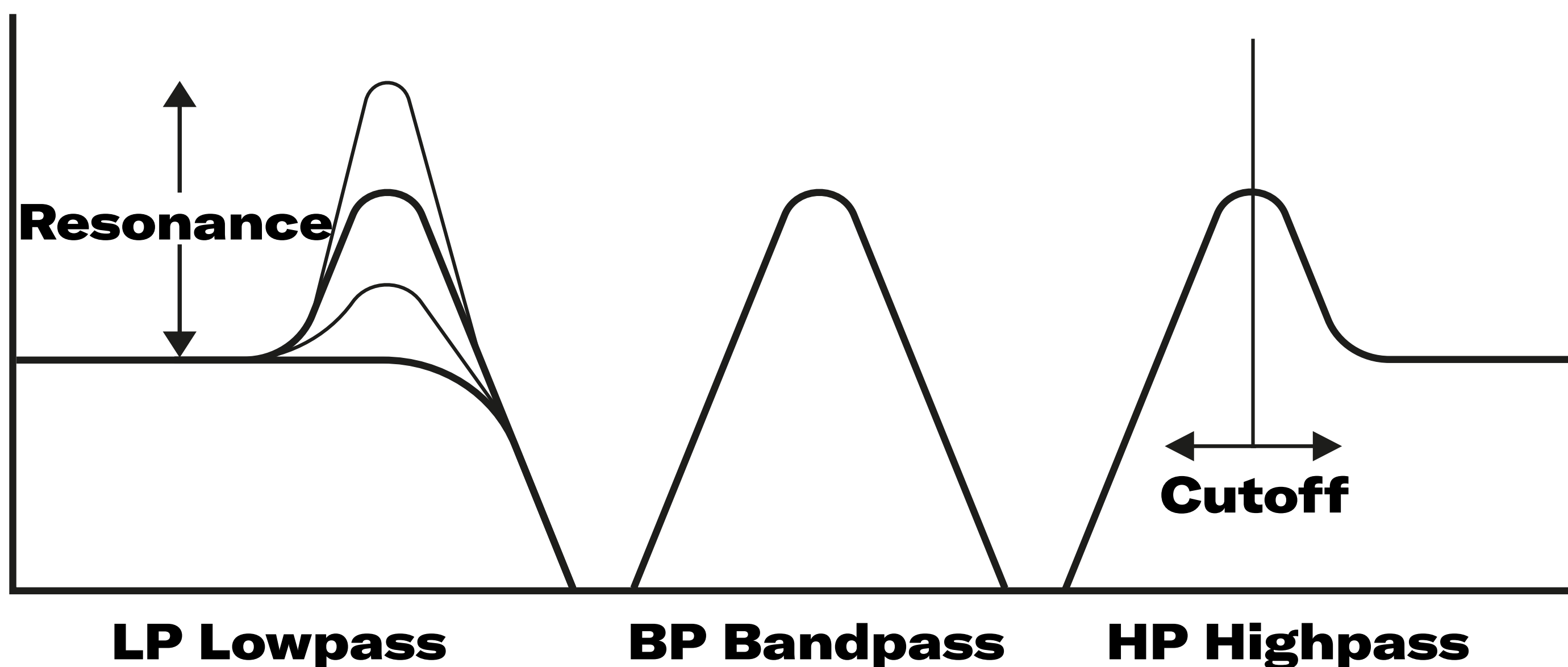
RESONANCE fader sets how much the CUTOFF frequency is emphasized. It creates a resonant peak in the spectrum, and when pushed even further, it will make the filter ring out (pinging technique) or even self-oscillate.

CUTOFF MOD fader says how much of the signal connected to the MOD input will affect the cutoff frequency. By default, the envelope is normalized to the MOD input.

There are two audio inputs to the filter. The FILTER IN patch point, which has the oscillator PULSE signal normalized to it, and the main INPUT, equipped with a saturation pre-amp. You can plug a dummy cable to the FILTER IN and set the resonance to the maximum to make the filter self-oscillate and become an oscillator. You can also feed a signal to the INPUT and drastically amplify it to overload the filter and change its core characteristics. Try patching the TRI signal to the INPUT to get more bass boost and saturation from the filter.

The POP is a unique and powerful timbral shaping tool of the SP2. It fades from plain vanilla filter resonance response (SOFT) to more liquid type filtering towards distorted digital sounding tones (PIXEL). It takes a version of the OSC PULSE signal and feeds it to the cutoff frequency. 💡 The sound of POP can be further affected by modulating the PWM input with ENV, for example.
The POP has a CV input that is normalized to static voltage. This means that as soon as you plug a signal into the POP CV input, the POP fader will act as an attenuator for that signal. This is very useful when using gate signals to bring in the POP character for specific steps (distorted snare sounds or liquid slides).

Nerd note: In the historical timeline of synthesis, there has been analog synthesis being replaced by digital synthesis. Eventually, digital technology has become good enough to emulate analog gear, glorifying the imperfections of analog technology. Imperfections of digital technology, such as digital compression and glitches, have also been used in music and found their way into the design of several niche instruments (Bastl has made several of those too).

The POP character on the Softpop is a fun spin on this development because it succeeds in emulating a very digital type of distortion with purely analog means. In other words, emulating the digital imperfections by analog technology creates this sort of historical countercurrent that can be fun to play with.

PATCH POINTS

● FILTER IN is the audio input of the filter. PULSE is normalized to this input, so plugging in another signal will replace the OSC, allowing the filter to be used independently.

● CUTOFF is a voltage input to control the cutoff of the filter. It is scaled to be roughly V/OCT, so it can make the filter track with the oscillator.

● MOD is an attenuated voltage input to control the cutoff of the filter. Use the CUTOFF MOD fader to bring in the amount of modulation. By default, the ENV signal is normalized to the MOD input.

● BP is an independent bandpass output directly from the filter (before the VCA). 💡 This output can be used for distorted resonance by patching it to the INPUT, or it can be used to modulate things in the patchbay. It can be used to create a stereo image with the main OUTPUT (when using LP or HP setting). Also, if the filter is self-oscillating as a sine-wave with no input signal, there will be a 90 degrees phase shift between the BP and either LP or HP outputs. This way, you can use it, for example, as a quadrature oscillator with a sine and cosine wave to create visuals on an XY oscilloscope. BP is 4Vpp.

Envelope / Sample & Hold / VCA section
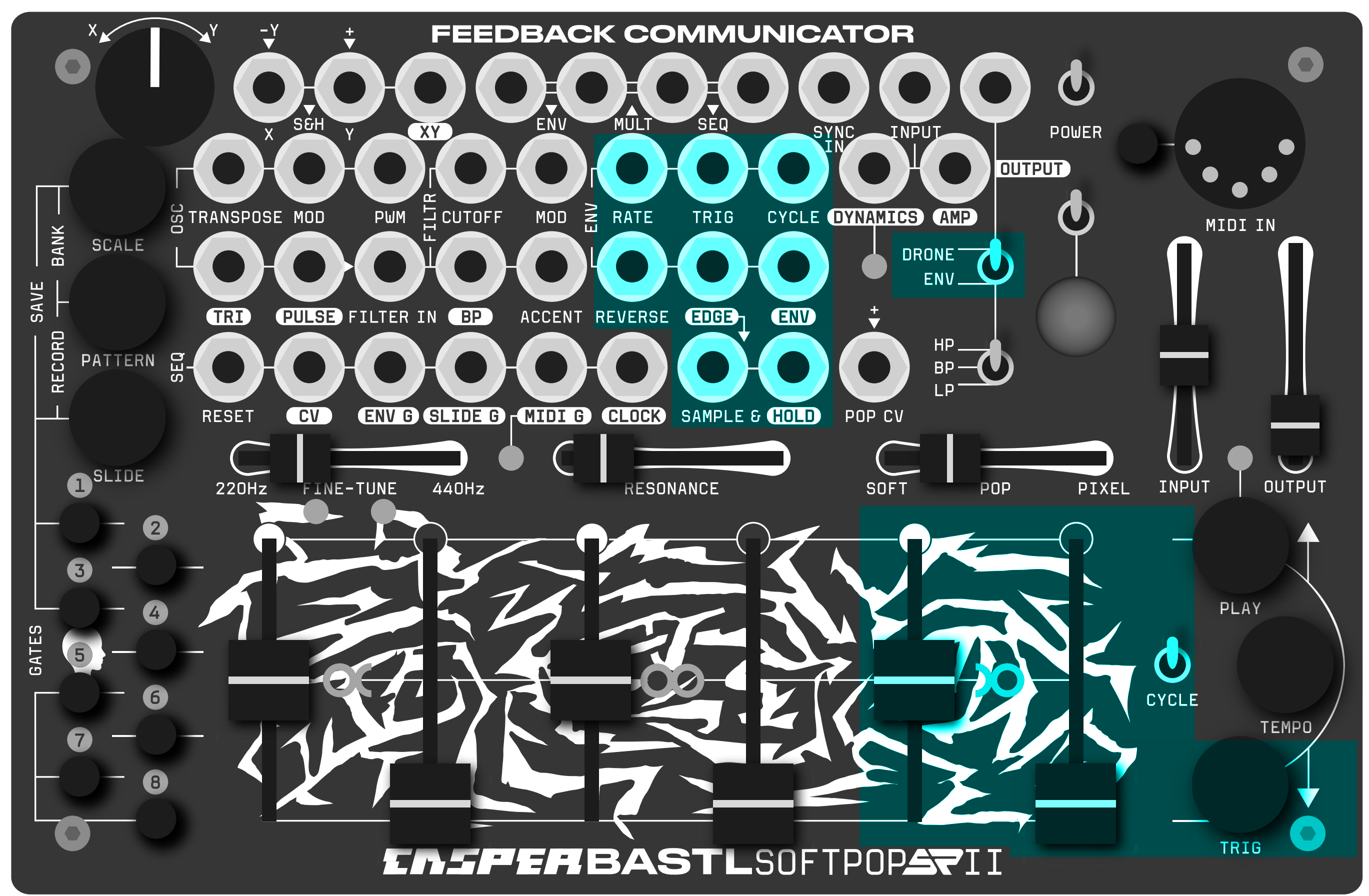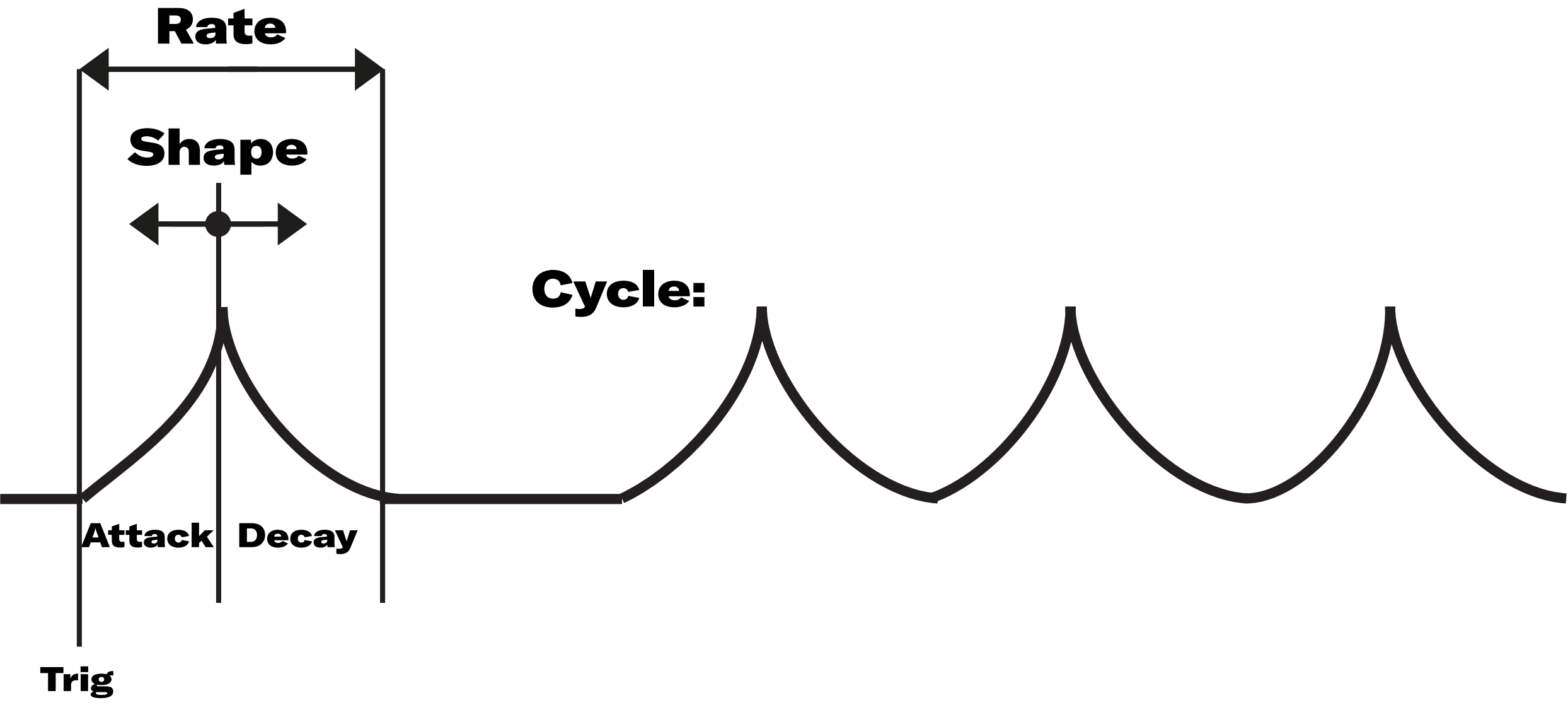

ENVELOPE

Envelope and Sample & Hold are the two primary modulation sources of Softpop.

An envelope is a simple time function that, once triggered, goes up (attack) and down (decay). It can also be cycled to function as an LFO (low-frequency oscillator).

The main envelope controls are RATE, which controls how fast both attack and decay happen, and SHAPE, which sets the proportion between attack and decay. The SP2's envelope has an exponential shape in both the attack and decay phases, which works great for the percussive decay character and gives the longer attack shapes a reversed feel.

The envelope can be triggered by a short press of the TRIG button or by active gates of the sequencer (normalized in the patchbay).

If the CYCLE switch is in the upper position, the envelope will repeat its shape infinitely (becoming an LFO).

The SP2's envelope is very flexible when it comes to voltage control. Use the RATE input to control the RATE parameter or send gates to the REVERSE input to invert the proportion of attack and decay times set by the SHAPE fader. You can also activate cycling by a high gate on the CYCLE input.

Note: There is also internal normalization of a small amount of the oscillator TRI signal controlling the RATE of the envelope. This results in a more organic character when the oscillator is in the LFO range and adds a tiny bit of a ring-modulated character when the DRONE/ENV switch is in the ENV position.
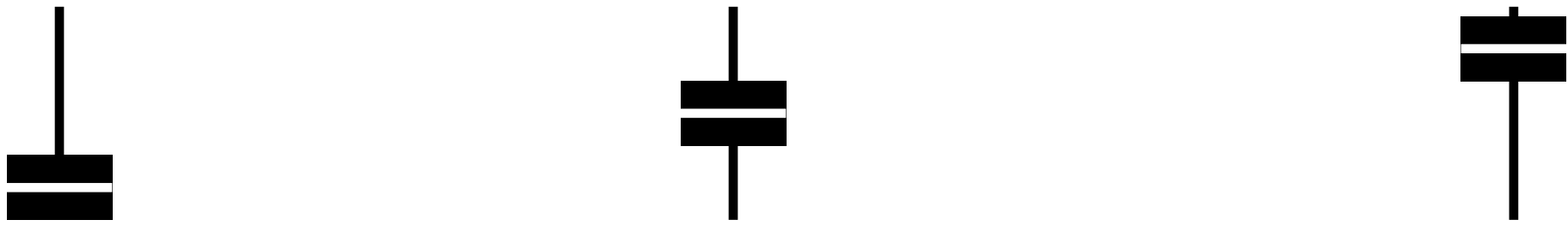
Shape
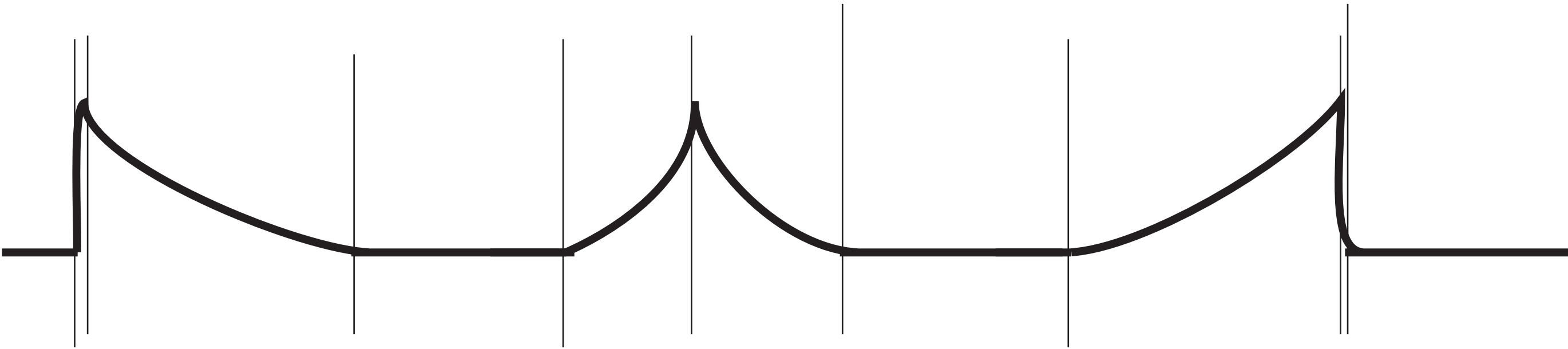
Reverse High

VCA – Voltage-Controlled Amplifier

The DRONE/ENV switch allows you to quickly dial in a VCA that will change the loudness of the output signal based on the state of the envelope. That means it will be silent until the envelope is triggered or cycled. Furthermore, the loudness of the VCA can be controlled via the ACCENT input.

Sample & Hold

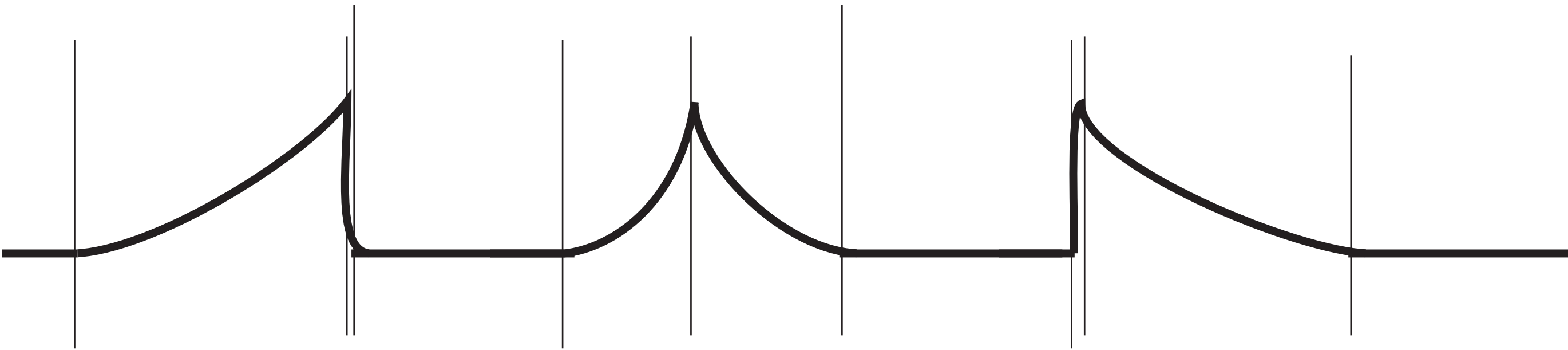Sample & Hold is a classic analog synth circuit that is used to provide stepped random modulation voltages. The Sample & Hold on the SP2 is inspired by this classic circuit but uses a clever feedback trick to provide a lot more than just random steps.

The input of the S&H, aka the voltage it is sampling, is the TRI output of the oscillator.

The Sample & Hold circuit waits for a trigger at the SAMPLE input. At that moment, it freezes the value of the TRI signal and holds it as a static voltage at the HOLD output until a new trigger is detected.

If the rate of the input oscillator is much faster than the SAMPLE rate (which is the most common configuration), the HOLD output will be random (left image). If the trigger rate is much faster than the oscillator, then the HOLD output will be a stepped wave (right image).
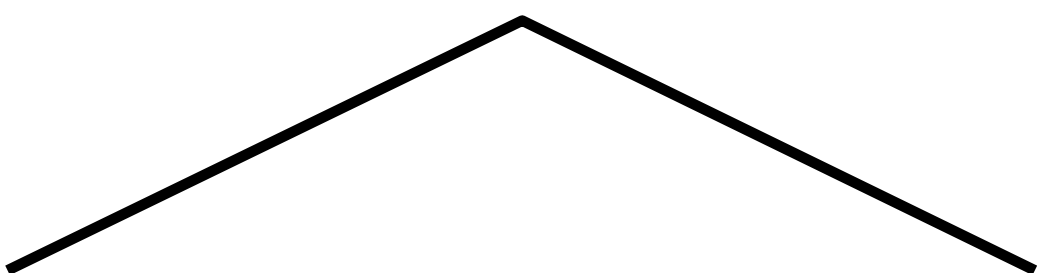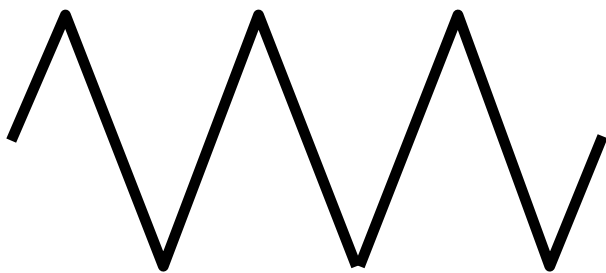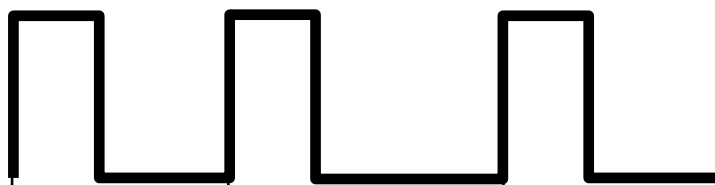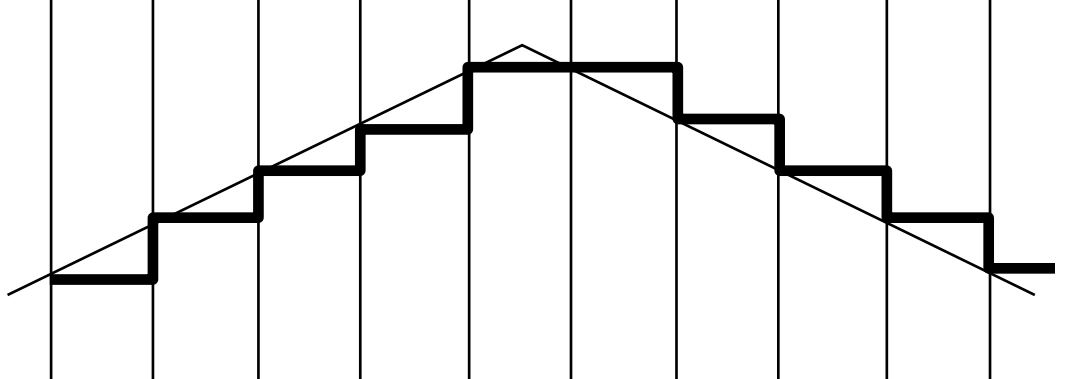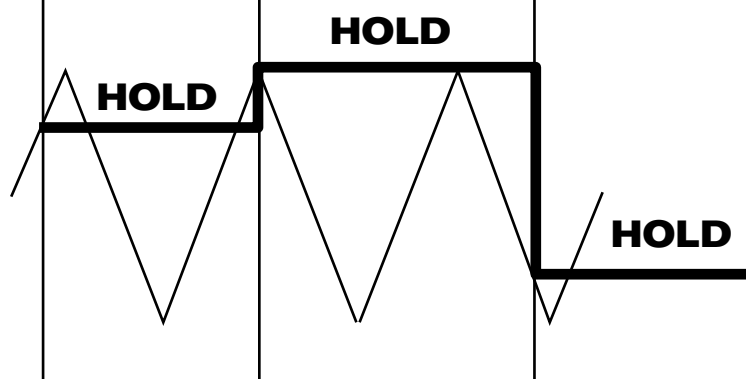
And if the rates are very close to each other, you can uncover a wide range of pseudo-random/ pseudo-repeating patterns to explore.

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Patch points

● RATE input controls the speed of the envelope. It sets both the attack and decay times.

● TRIG input triggers the envelope. The SEQ is normalized to this input, and it triggers the envelope at the beginning of every step that has ENV GATE enabled.

● CYCLE input can activate the cycling of the envelope when a positive voltage is applied. It is only active when the CYCLE SWITCH is low (not cycling).

● REVERSE input can invert the proportion between the attack and decay times set by the SHAPE fader.

● EDGE output is a gate output that is HIGH when the envelope is in the ATTACK phase. Adjust the SHAPE fader to make the gate longer or shorter. EDGE is 3.5Vpp unipolar.

● ENV output is the main output of the envelope. ENV is 4Vpp unipolar.

● ACCENT input is a CV input controlling the VCA (voltage-controlled amplifier). It can affect the final loudness of the Softpop. 💡 It is designed to work well with the GATE outputs from the sequencer to provide accents, but you can also use voltages (HOLD, TRI, DYNAMICS) to control it. Use the XY section to invert the DYNAMICS output and patch the signal to the ACCENT input to obtain a compressor effect. (DYNAMICS to Y, XY knob CCW, XY to ACCENT). You can also make the ACCENT input responsive to the velocity of the incoming MIDI notes by patching it to the sequencer CV output.

● SAMPLE input triggers when the voltage is sampled. By default, the EDGE signal from the envelope is normalized to the SAMPLE input.
💡 Patch CLOCK or other gates to SAMPLE to trigger it remotely.

● HOLD is the output of the Sample & Hold. Each time the rising edge of a trigger is detected on the SAMPLE input, the TRI signal is held at the HOLD output. It updates again with every newly detected trigger. HOLD is normalized to the PITCH MOD input, so the PITCH MOD fader effectively acts as a randomness amount for the Softpop. HOLD is 5Vpp.

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Inputs and Outputs
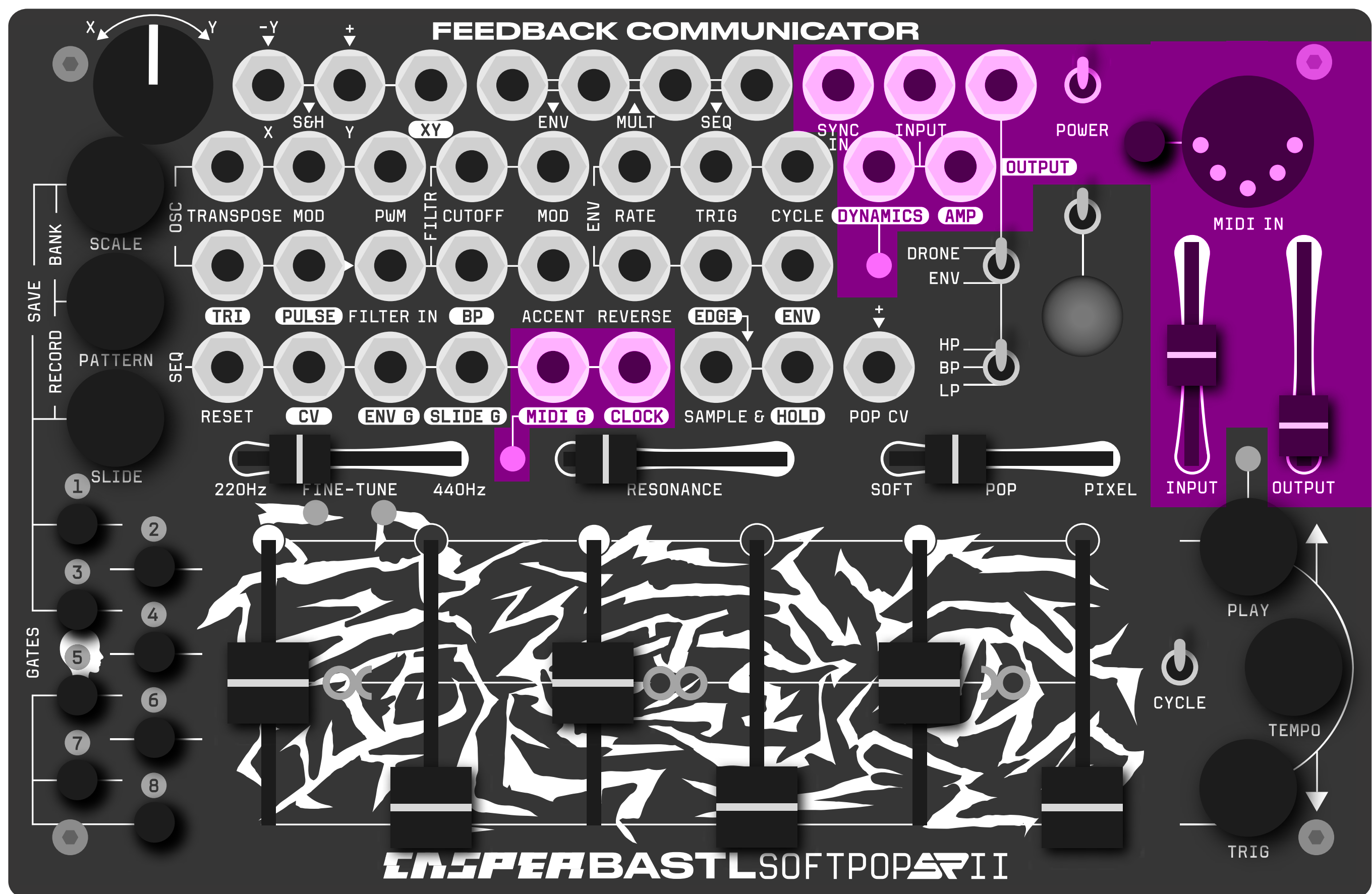
Softpop is equipped to interface with other instruments in several different ways.

OUTPUT can drive headphones or be connected to any line-level input.

Audio INPUT can accept a wide range of signals to be processed with the Softpop. It has a Zener saturation pre-amp for added character, a dedicated AMP output, and a DYNAMICS envelope follower output handy for dynamic processing. See the Effect Patch Ideas section for more information about audio processing.

MIDI IN serves for tonal control and sequencer synchronization, along with the SYNC IN, which accepts analog clock format that can work with various devices since the SP2 has a built-in divider/multiplier. See the TEMPO section for more information.

Patch points

● CLOCK output generates a pulse each time the sequencer would be advanced. It obeys the divider/multiplier TEMPO settings and the selected clock source. See the <u>TEMPO section</u> for more on that. 💡 Use CLOCK to interface with external gear or use it to modulate/trigger processes within the Softpop. CLOCK output is 0 to 5V.

● MIDI Gate is a gate signal that is HIGH if more than one MIDI note on a specified input MIDI channel is set ON by the MIDI input. 💡 Patch it to the TRIGGER input of the envelope or the ACCENT input to directly control the VCA. MIDI Gate is 0 to 5V.

● SYNC IN is an external analog clock input for the sequencer. If used, use the TEMPO+GATEs to set the divider/multiplier of this clock.

● INPUT is expecting line-level signals to be processed inside the Softpop. Use the INPUT fader to amplify this signal from -inf to +26db (x20 gain). The signal is also going through a Zener clipping stage, so it gives nice smooth saturation. After that, it is internally routed to the input of the filter.

● AMP output gives you an amplified (and overdriven) version of the input signal. 💡 It can be used to boost the input signal going into the filter even more by patching AMP to FILTER IN. It can also be used to modulate anything within the patchbay. AMP is up to 7Vpp.

● DYNAMICS output gives you a voltage that represents the loudness of the INPUT signal after amplification. In other words, it is an envelope follower. 💡 Use it to modulate the filter, or other voltage inputs, to make them respond to the dynamics of your input signal. DYNAMICS is 4Vpp unipolar.

● OUTPUT is the main audio output of the Softpop. It is a dual-mono (left and right) output capable of driving headphones. Use the OUTPUT fader to set the level. OUTPUT is up to 5Vpp.

Tempo (Clock)
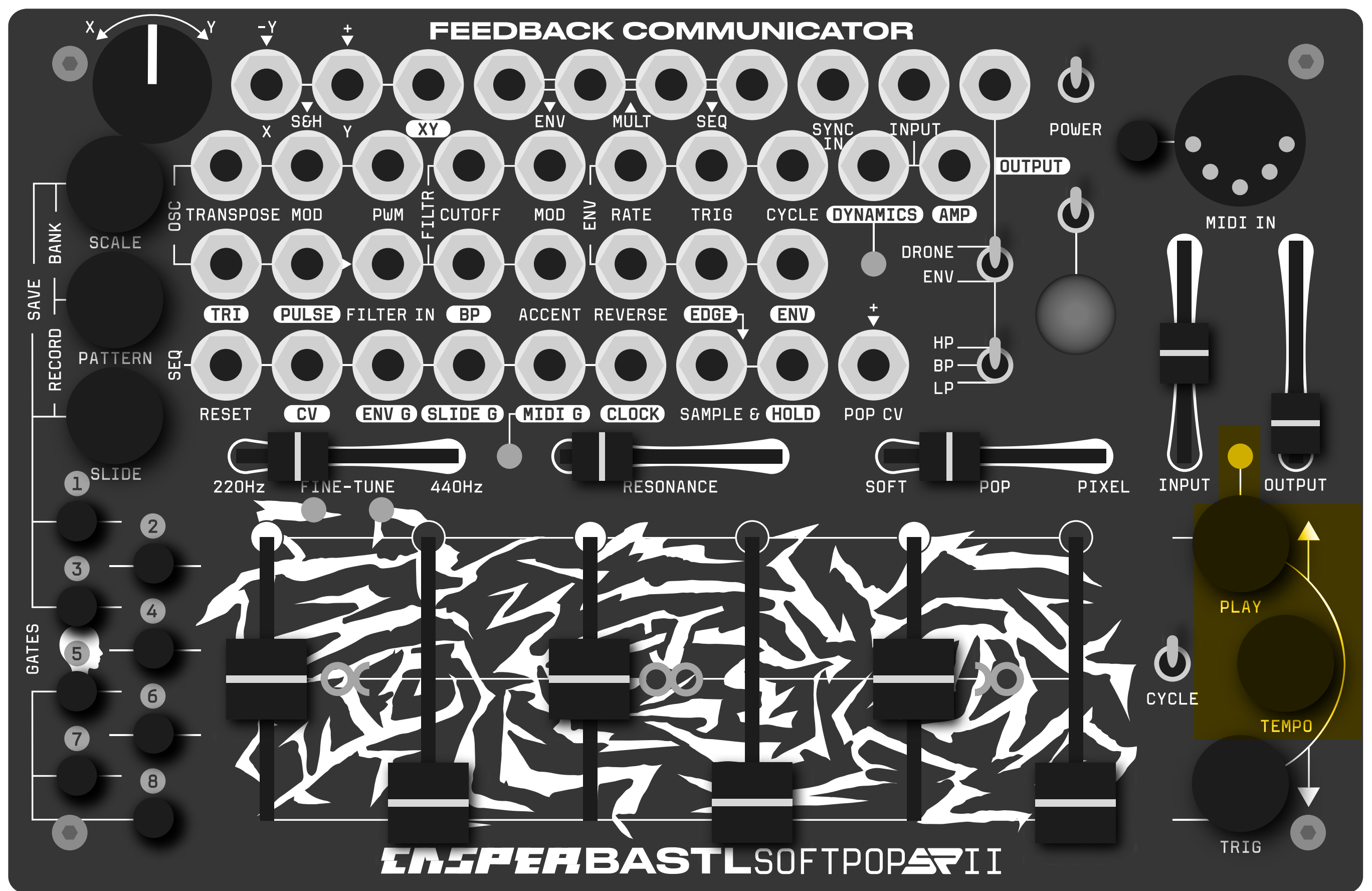
TEMPO+TEMPO=tap tempo

TEMPO+ ▲ / ▼ =increase/decrease tempo

TEMPO+ ▲ / ▼ >1s= gradually increase/decrease tempo

TEMPO+GATE=select divider/multiplier

TEMPO+ ▲ + ▼ =learn tempo from looping envelope

This section takes care of clocking the sequencer. Press PLAY to start or stop the sequencer. When playing, the PLAY light blinks each time the tempo section sends a signal to advance the step on the sequencer. When stopped, the PLAY light stays ON.

There are 3 different ways how the sequencer can be clocked:

1 Internal clock

2 External analog clock via SYNC IN jack

3 MIDI clock

TEMPO (CLOCK)

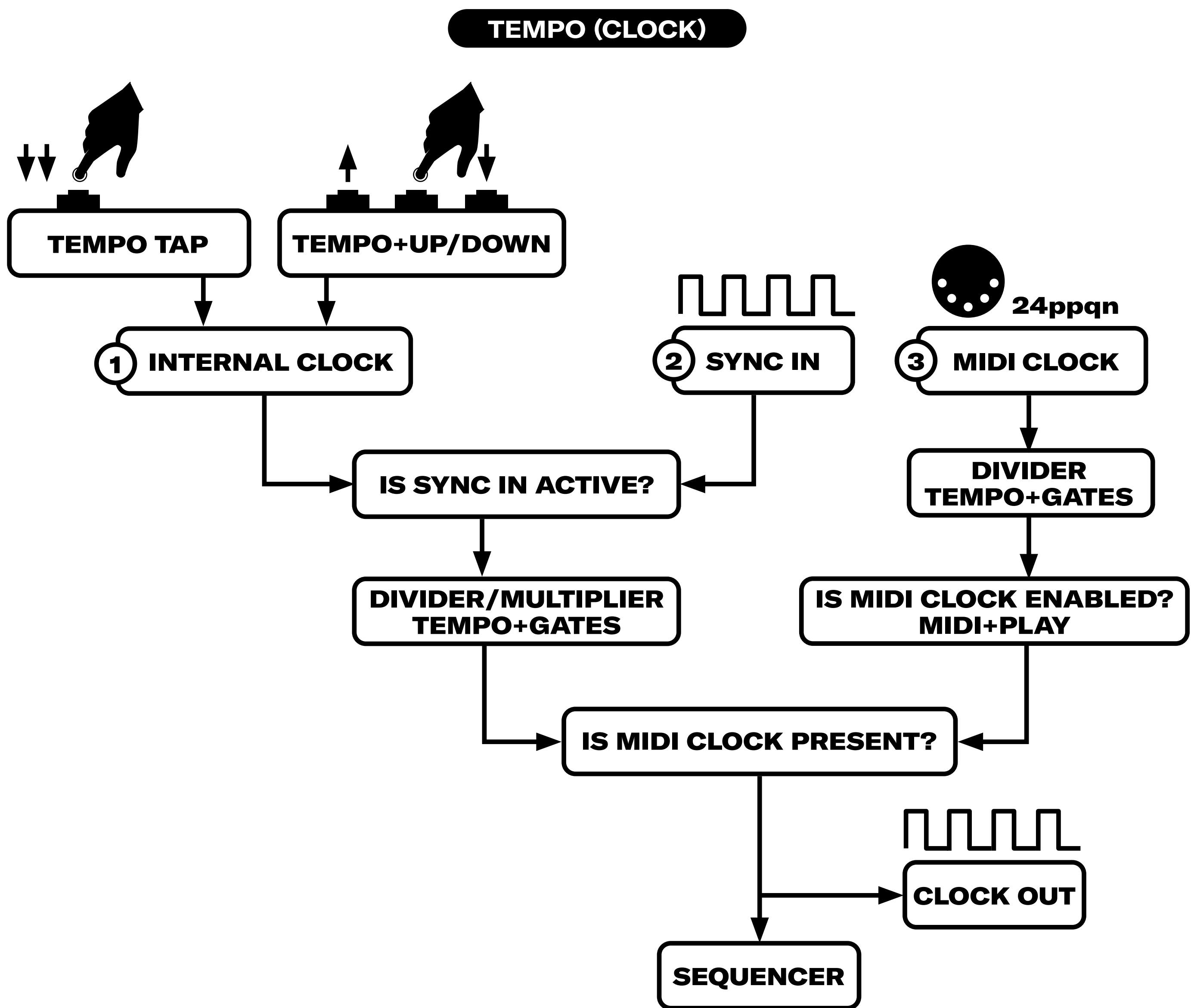**TEMPO TAP**

TEMPO+UP/DOWN

① INTERNAL CLOCK

② SYNC IN

③ MIDI CLOCK — 24ppqn

IS SYNC IN ACTIVE?

DIVIDER TEMPO+GATES

DIVIDER/MULTIPLIER TEMPO+GATES

IS MIDI CLOCK ENABLED? MIDI+PLAY

IS MIDI CLOCK PRESENT?

CLOCK OUT

SEQUENCER

Hold the MIDI button and press PLAY to enable/disable the MIDI clock (indicated by the PLAY light). Use TEMPO+GATES to select a divider to the tempo, at which the sequencer will be clocked.
If the MIDI clock is enabled and present, it will always take over. If it is enabled but not present, the internal clock and multiplier will be engaged.

If the MIDI clock is disabled, the internal clock and multiplier/divider will engage.
If a clock is detected at the SYNC IN jack, the internal clock will sync to that.

If no clock is being input via MIDI or the SYNC IN jack, then you can set the internal clock tempo a few different ways:
TAP TEMPO - tap the TEMPO button 3 or more times to set the tempo.
INCREMENTAL - hold the TEMPO button and press or hold UP or DOWN to adjust the tempo gradually.
ENVELOPE RATE - set the envelope to CYCLE and then hold TEMPO, UP, and DOWN at the same time to learn the tempo from the cycling envelope. This is the same as patching the EDGE output to SYNC IN.
MULT/DIVIDE - hold TEMPO and press a GATE button to multiply or divide the base tempo.

Both TEMPO tapping and SYNC IN pulses go through the same divider/multiplier that will set the speed at which the sequencer is clocked. Because analog clocks are relative, and each device can use a different standard of PPQN (pulses per quarter note), the speed is not necessarily related to a 4/4 bar.

All clock sources go through a divider/multiplier that sets how many impulses it takes for the sequencer to progress one step. The CLOCK OUT gives out a pulse each time the sequencer would be advanced.

TEMPO+GATES:

analog driver / multiplier
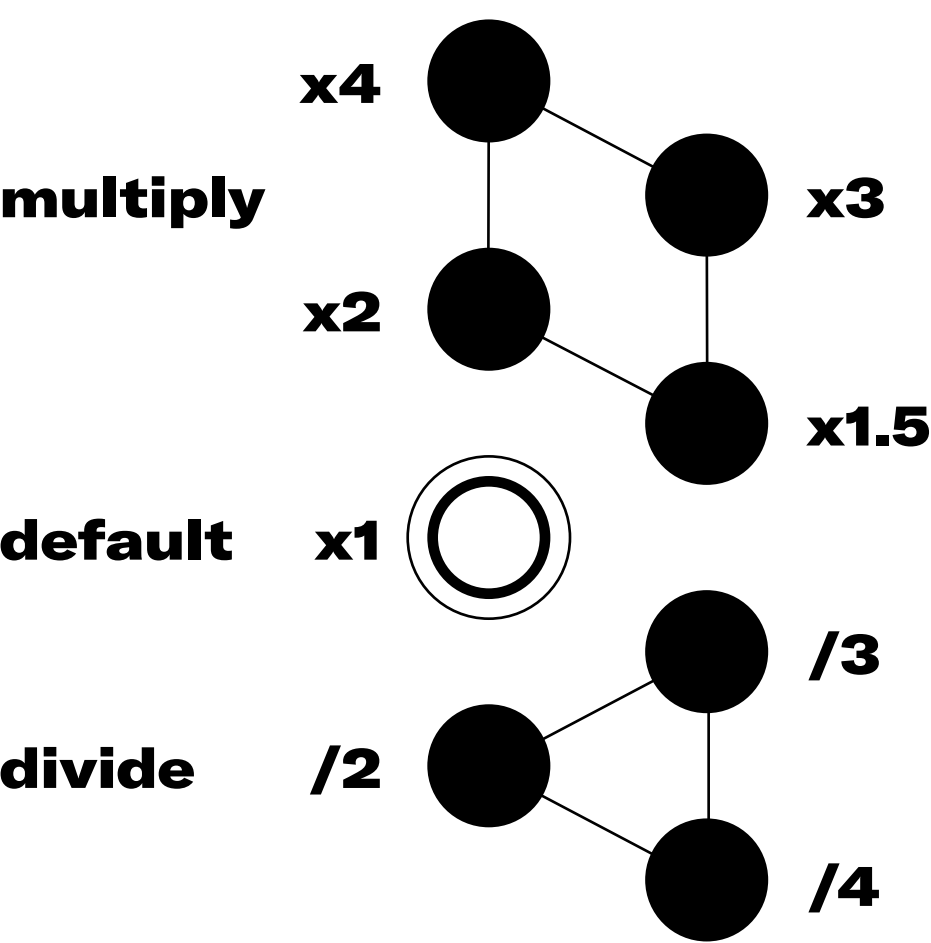
MIDI clock
Sequencer advances with a division relative to a 4/4 bar
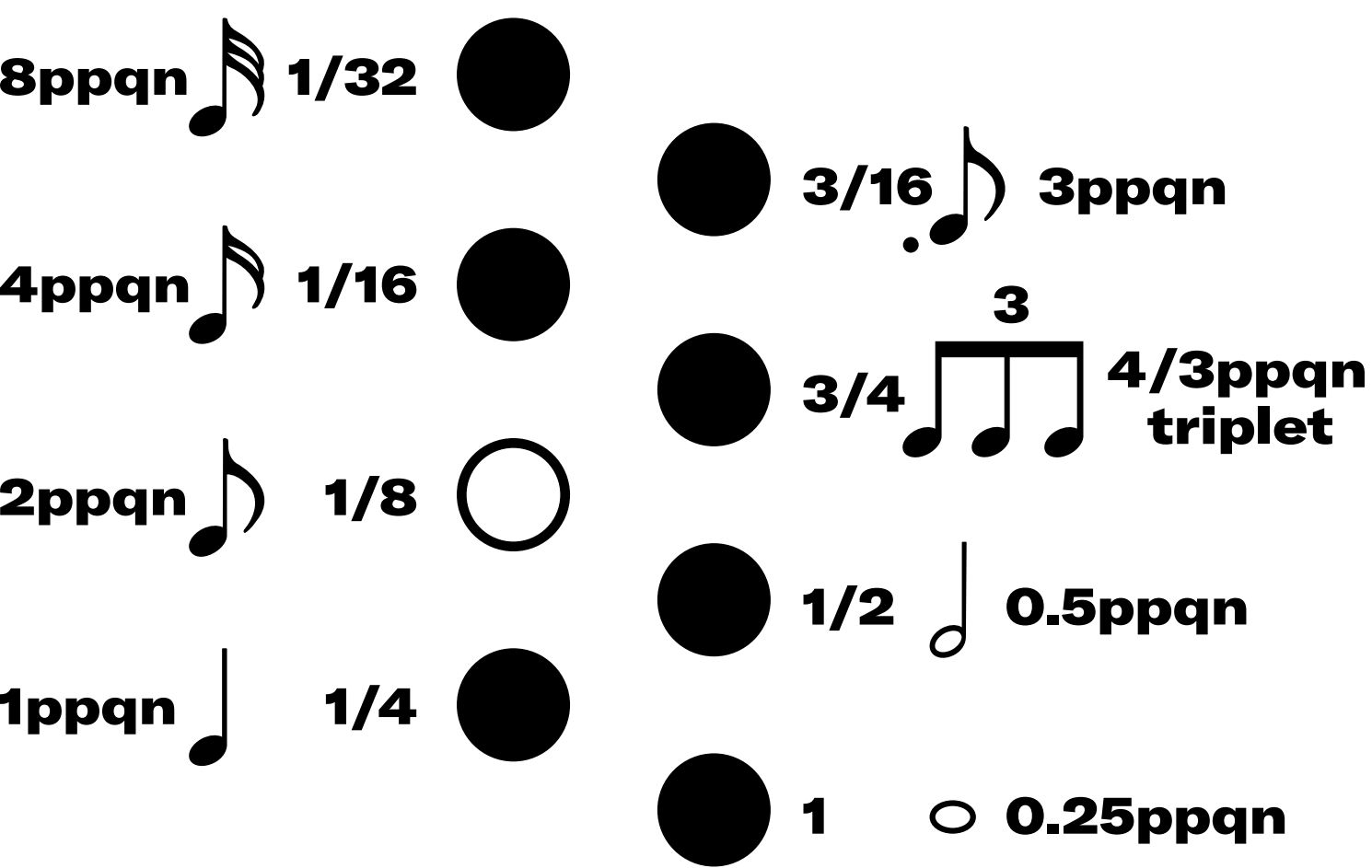
The divider on GATE 5 is the default for both clocking options. Use it when unsure.

When changing the TEMPO divider, the sequencer will re-synchronize to a step it would be at if the sequencer was running at that divider the whole time since it was started. This means you can change the tempo divider performatively and be able to go back to your main divider of choice.

Sequencer section
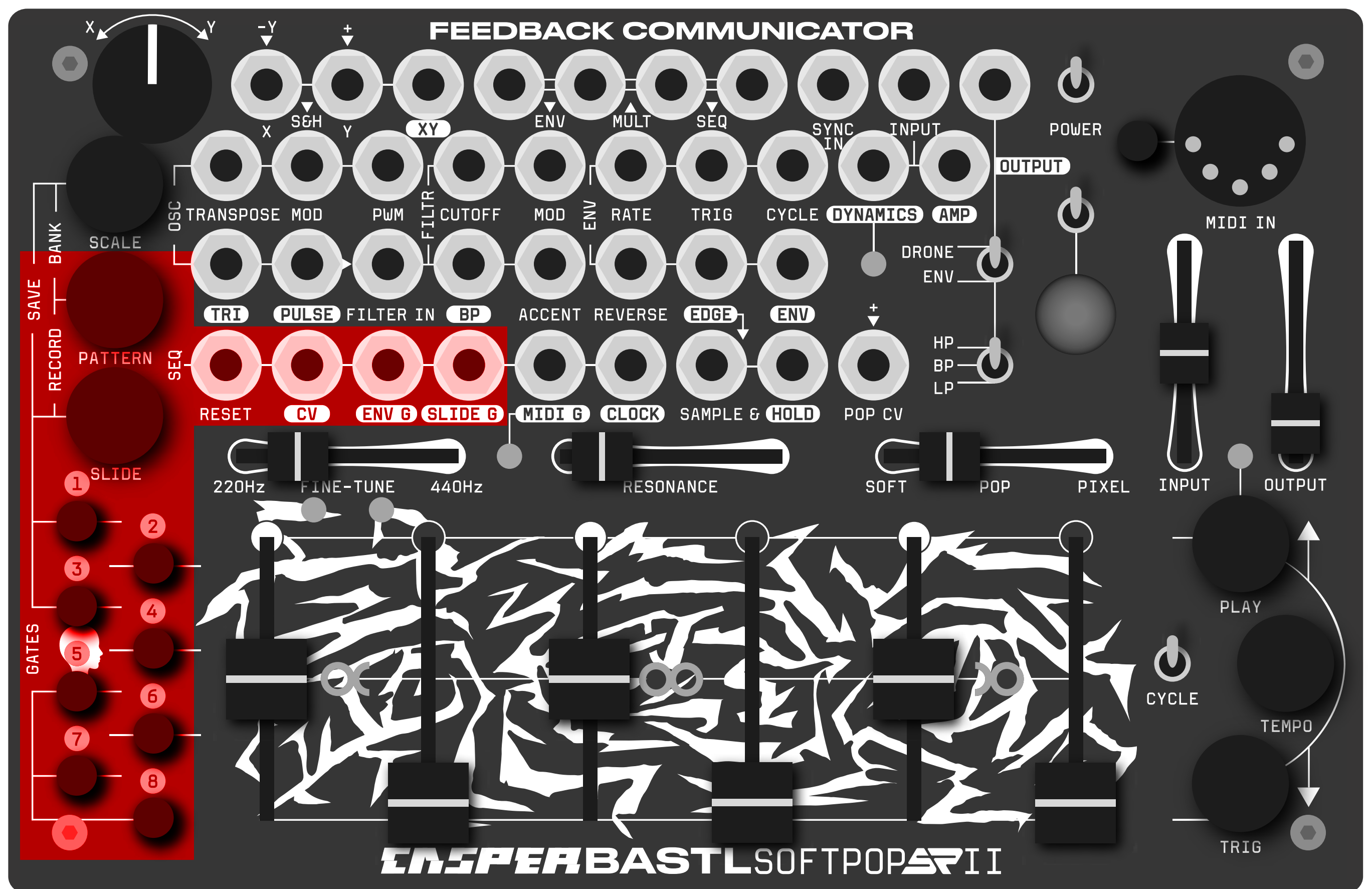
The sequencer is the brain of the Softpop. It makes it very musical and yet still very experimental. SP2's sequencer is built around simple 8-step loops of notes, gates, and slides called PATTERNS. These PATTERNS (8 per BANK) can be played and chained in any order (and in real-time) to create longer sequences. Softpop's sequencer expands on this classic format by adding 8 SCALES of user-definable quantization, 8 playback modes, and 8 performance FX, all of which can be independently chained and looped!

PATTERN+SLIDE=RECORD pitch sequence
SLIDE+MIDI=fix oscillator pitch drift
SLIDE+MIDI >2s=full automatic tuning in all octaves
SCALE+SLIDE=SAVE bank
SCALE+PATTERN+GATE=LOAD bank

PATTERN+GATE=select a pattern
PATTERN+GATES=chain patterns
PATTERN+ ▲ / ▼ =shift a whole pattern by 1 step

PATTERN+TEMPO=copy currently selected pattern to the next selected pattern

SLIDE+GATE=activate/deactivate slide on that step SLIDE+ ▲ / ▼ =set slide rate (1=no slide)

PLAY (short)=start and stop sequencer
PLAY+GATE=select playmode
PLAY+GATES=chain playmodes

TRIG=trigger envelope
TRIG+GATE=activate temporary FX (hold several to combine)
TRIG+PLAY+GATES=record loop of temporary FX
TRIG+PLAY=erase loop of temporary FX

STEP EDIT MODE
PATTERN+SLIDE (when seq. stopped)=enter/leave step edit mode
In the step edit mode (one step is blinking):
GATE=preview and select step (always triggers envelope)
GATE+move PITCH FADER=edit steps pitch
GATE+ ▲ / ▼ =transpose step in quarter tones

PATTERN+MIDI=toggle Triggered pitch mode
TRIG+SLIDE=toggle SLIDE G trigger/gate mode
TRIG+PATTERN=toggle ENV G trigger/gate mode
Hold PATTERN at power up=toggle CV Pitch tracking mode

PLAY/STOP
AND FADER FREEZING
Start the sequencer by short-pressing the PLAY button and stop it the same way. When the sequencer is playing, the PLAY light will blink each time the sequencer goes to a new step. When it is stopped, it will just stay ON.
The PITCH and PITCH MOD faders are controlled digitally. They can be "frozen" to temporarily deactivate their operation to ensure smooth interaction with the sequencer and the user expectations. When the faders are active, their light is on; when they are not, it is off. To reactivate

the fader, either move it quickly or hit the value on which it is frozen, and the light will come back on.

Once the sequencer is stopped, the PITCH fader will freeze, and its light will go off. It will freeze at the pitch of the last played note.

MAKING A PATTERN

Each pattern has 8 steps, and each step has 3 components: envelope gate, slide gate, and oscillator pitch.

To edit envelope gates, press the GATE buttons to turn them on/off.

To edit slide gates, hold the SLIDE button and press the GATE buttons to activate/deactivate slide on that step.
To change the rate of the slides, hold SLIDE and press UP/DOWN: 1 = no slide, 8 = longest slide. If you set the slide rate to 1 (no slide), you can use the SLIDE GATE output to modulate whatever you like without introducing the sliding pitch effect.

There are two ways of adjusting the oscillator pitch stored in the sequencer: RECORD and STEP EDIT.

RECORD

Start the sequencer (press PLAY). The steps of the pattern will flash in order to indicate that the sequence is running.
To RECORD, hold SLIDE and PATTERN, and move the PITCH fader.
While holding RECORD the pitch of the oscillator during each step of the pattern is being saved. Recording stops when RECORD is released and the sequence will begin to loop. NOTE! The duration of a recorded loop is 8 steps long by default. Longer recordings can be made by chaining multiple patterns together and then holding RECORD as they play back.

When recording stops, the PITCH and MOD faders freeze to ensure accurate playback. The two LEDs between PITCH and MOD will turn off to indicate that the controls are frozen. To reactivate the faders, you either need to move them quickly or hit their initial position (for PITCH, it's the middle position, and for MOD, the lowest), and their lights will come on. Once the sequence is playing, the PITCH fader acts as a transpose, and the MOD fader still adds modulation to the sequence.

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If the PITCH MOD fader was engaged during recording, it would also record the modulation of the pitch sequence and then loop it.

STEP EDIT MODE

Stop the sequencer and hit RECORD (PATTERN+SLIDE) to enter the STEP EDIT mode.

Once in the STEP EDIT mode, one of the steps will blink, and the buttons can be released.

Pressing GATEs will select the step to edit and trigger the envelope (via the normalized trigger that can be disabled by plugging in a cable to the TRIG input).

Pressing GATEs here acts as a musical keyboard, which can be used as a performance mode.

Hold one of the GATEs and move the PITCH fader to adjust the pitch on that step.

Hold one GATE and press UP/DOWN to adjust that step's pitch. It will go to the nearest semitone in the selected scale.

Leave the STEP EDIT mode by hitting RECORD again or simply hitting PLAY.

CHANGING, CHAINING, AND COPYING PATTERNS

To select a PATTERN, hold the PATTERN button and tap any one of the GATE buttons (and release the PATTERN button).

To chain multiple patterns, hold the PATTERN button and tap multiple GATE buttons in such order as you want them to play back, then release PATTERN to complete your selection.

For example 1 - 1 - 2 - 3. Now you have created a 32 step chain of four 8-step patterns. Pattern 1 will repeat twice, followed by pattern 2 and then 3. The maximum number of patterns you can chain is 16 (128 steps). To reset the chain, simply select a single pattern. In other words, you create a chain that is just one pattern long.

To copy a currently selected pattern, hold PATTERN and press TEMPO. While still holding PATTERN, press a GATE to select another pattern and paste the copied pattern onto it.

ENV G AND SLIDE G TRIGGER/GATE MODES

The ENV Gate and SLIDE Gate outputs can now be either a gate or a trigger signal.
Hold TRIG and press PATTERN to change the ENV_G from gate to trigger.
Hold TRIG and press SLIDE to change the SLIDE_G from gate to trigger.

While holding the TRIG button, the trigger/gate mode is indicated by the fader lights:
PITCH fader light OFF=ENV_G trigger mode
PITCH fader light ON=ENV_G gate mode
PITCH MOD fader light OFF=SLIDE_G trigger mode
PITCH MOD fader light ON=SLIDE_G gate mode

TRIGGERED PITCH CHANGE MODE

Hold PATTERN and press MIDI to activate/deactivate the mode in which the oscillator pitch is updated only at active envelope gates. That means if you only have active envelope gates at steps 1 and 5, the oscillator pitch will also update only at steps 1 and 5. The envelope gate probability is taken into account when rendering the oscillator pitch.
Note: This setting is not stored in the memory after SAVE.

CV SEQ VS. CV PITCH TRACKING MODE

In the original CV SEQ mode, the CV only outputs voltages from the sequencer – excluding slides, pitch fader, transpose, and pitch modulation. In the CV pitch tracking mode, the CV output can reflect the exact voltage that represents the pitch of the SP2 oscillator (including slides, excluding fine-tune).
To alternate between these two modes, hold PATTERN while powering up the unit. If the CV pitch tracking mode is enabled, it will be indicated by the GATE light 4 at startup.
Note: SPII can output higher pitches than can be reflected with voltage on the CV output; therefore, the highest octave will produce voltages one octave/volt lower, and the last octave will repeat.

MIDI+PATTERN switches between CV Out being used either for Velocity CV or CV output.

PATCH POINTS

💡 RESET input will reset the sequencer to the first step when it detects the rising edge of a gate or voltage. It will also advance the SCALE chain when the sequencer is stopped. 💡 Trigger RESET by any of the available sequencer gates to shorten the sequence to any number of steps.

💡 CV is the voltage output of the sequencer. It only outputs the voltage coming from the sequencer, and it is not affected by the oscillator controls: PITCH FADER, PITCH MOD, TRANSPOSE, FINE-TUNE. The CV output can also be set to output the voltage corresponding to the velocity of the incoming note (MIDI+PATTERN). CV output range is -3V to +3V.

💡 ENV Gate is a gate signal that is HIGH, while a step with an active envelope gate is being played by the sequencer. ENV Gate is 0 to 5V.

💡 SLIDE Gate is a gate signal that is HIGH, while a step with an active SLIDE setting is being played by the sequencer. SLIDE Gate is 0 to 5V.

PLAY MODES

Play Modes are alternate paths of how the sequencer can browse through the 8 steps to add variation and randomness. The sequence still stays 8 steps per pattern but re-maps those steps to a different order or skips specific steps (indicated by the numbers in brackets). This means all chains will still be advanced every 8 steps.
Hold PLAY and press a GATE to select a Play Mode (and release PLAY). To chain multiple Play Modes, hold PLAY and press multiple GATEs. Reset the chain by selecting just one Play Mode. The maximum number of chained Play Modes is 16.

1 forward (1,2,3,4,5,6,7,8)
2 backward (8,7,6,5,4,3,2,1)
3 first 4 steps only (1,2,3,4,1,2,3,4)
4 last 4 steps only (5,6,7,8,5,6,7,8)
5 first 3 steps only (1,2,3,1,2,3,1,2)
6 last 3 steps only (6,7,8,6,7,8,6,7)
7 random first 4 steps only
8 random all 8 steps

1 FORWARD
1-2-3-4-5-6-7-8
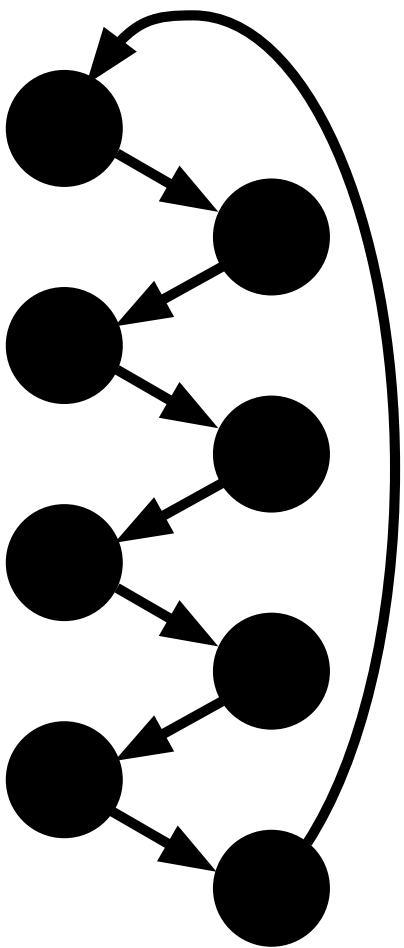
2 BACKWARD
8-7-6-5-4-3-2-1
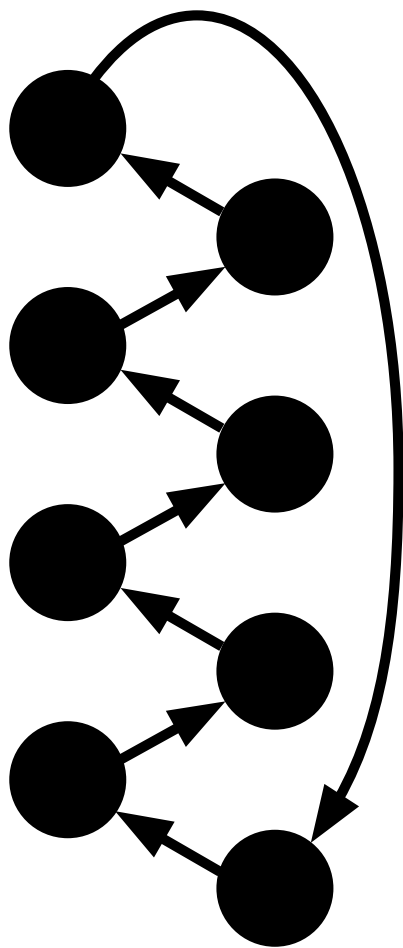
3 STEP 1–4
1-2-3-4-1-2-3-4
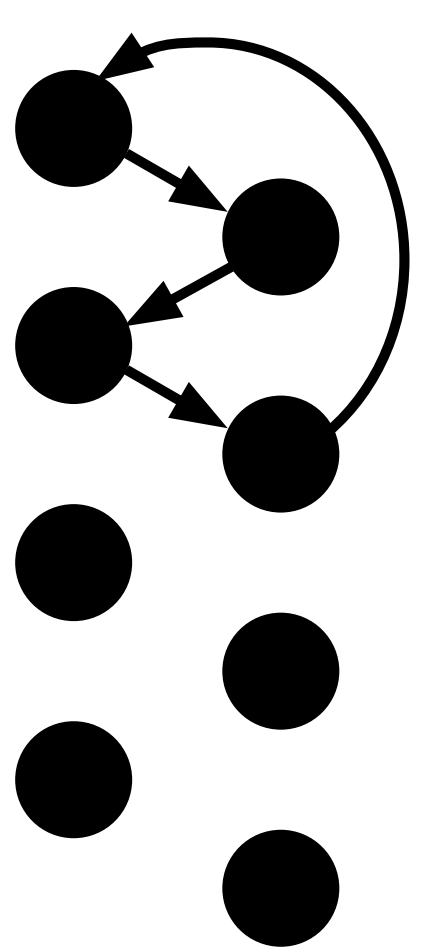
4 STEP 5–8
5-6-7-8-5-6-7-8
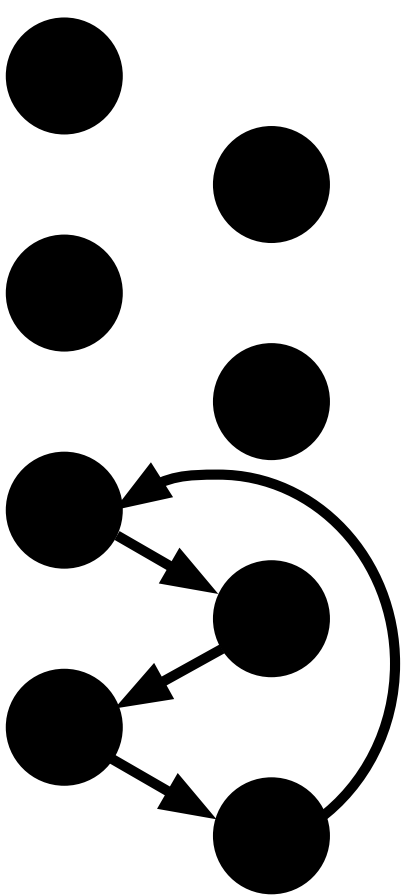
5 STEP 1–3
1-2-3-1-2-3-1-2
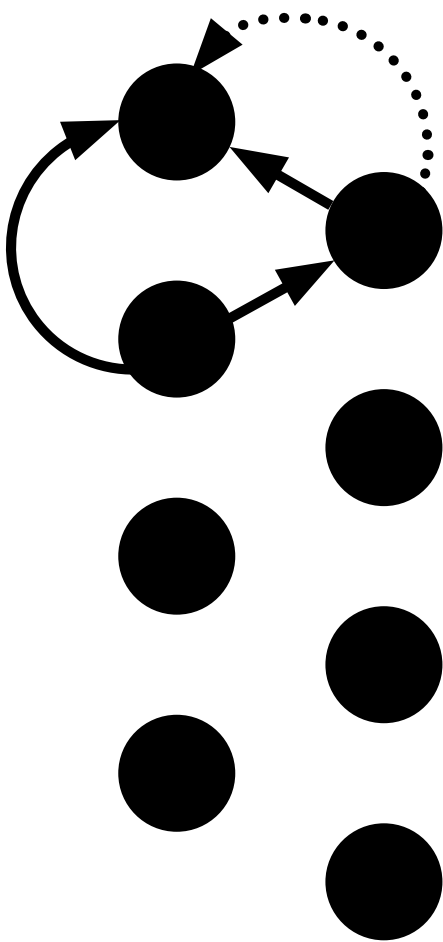
6 STEP 6–8
6-7-8-6-7-8-6-7
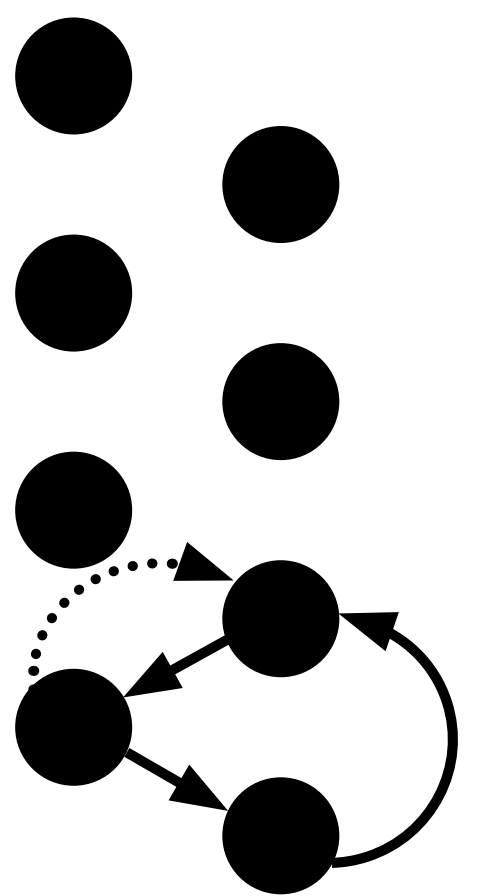
7 RANDOM STEP 1–4
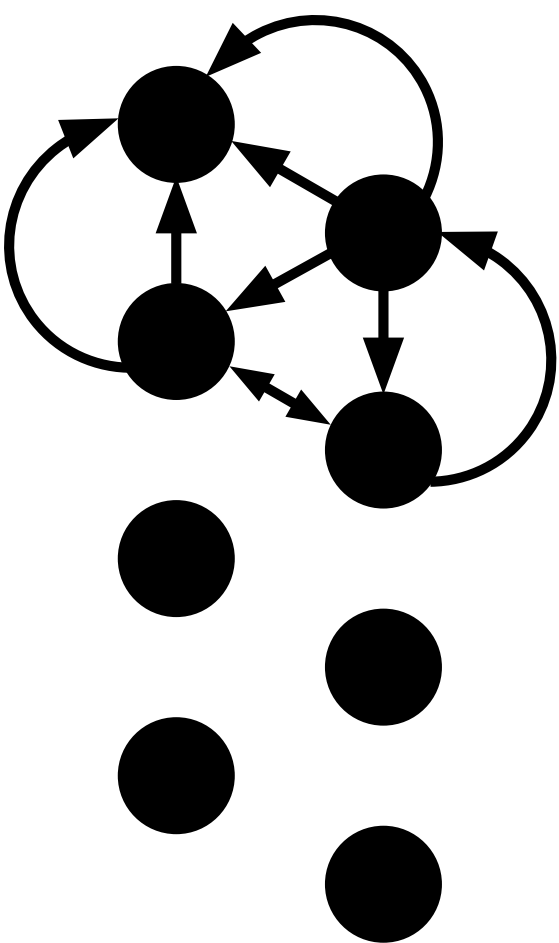
8 RANDOM
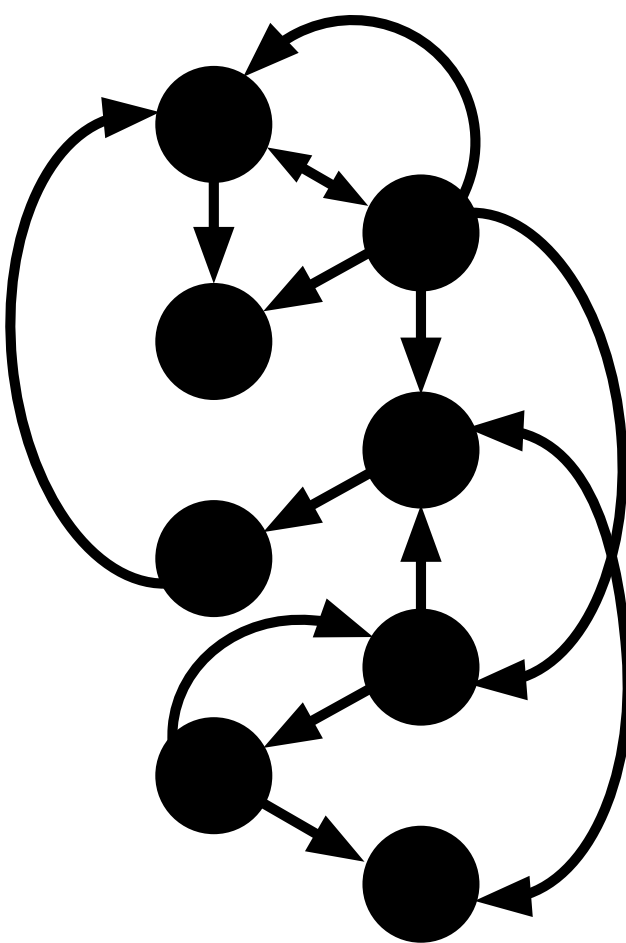
TEMPORARY FX

Temporary FX bring a few extra possibilities for sound design, build-ups, and sequencing. They are utilizing the tight integration of the digital brain and the analog heart of the SP2.

Hold TRIG and press GATES to engage temporary effects. Pressing multiple GATES at the same time will combine the FX together.

TREMOLO ●
● FAST RE–TRIG
RE–TRIG ●
● ARPEGGIO
PITCH ENVELOPE ●
● LONG SLEW
NOISE ●
● GATE PROBABILITY
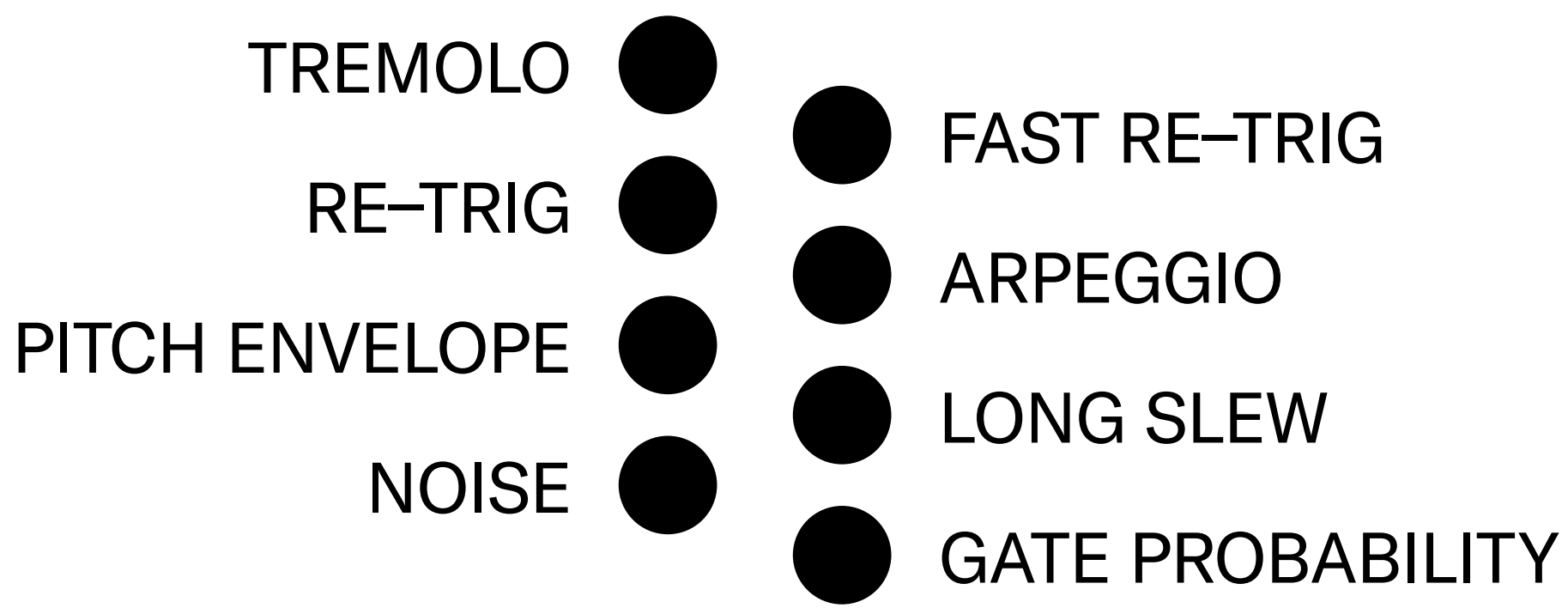
1 Tremolo - switching the VCO rhythmically to LFO range (speed is affected by RE-TRIG)

2 Fast RE-TRIG

3 RE-TRIG - combine with fast RE-TRIG to get 3rd speed ratchets

4 Arpeggio - fast four-octave jumps - combine with RE-TRIG to change the speed

5 Pitch Envelope - combined with FX 6 makes less depth

6 Long Slide - just slow slew rate - affects everything pitch-related

7 Noise VCO modulation - combined with FX 6 makes deeper noise

8 Gate Probability 50% - when activated, the ENV Gate output and triggering the envelope from the sequencer will be subject to a probabilistic function. On every active gate, the Softpop will flip a coin and decide whether to play the step or not. The chances are 50:50.

To sequence-record the temporary FX, hold TRIG+PLAY and press GATES. Release PLAY (while still holding TRIG) to loop the recorded interaction. The length of the loop will be quantized to the nearest 8 steps; the maximum length is 64 steps.

Holding TRIG+short press and release of PLAY (while still holding TRIG) will reset the temporary FX sequence.

You can also overdub and add more effects once the sequence is running by holding TRIG+PLAY and pressing more GATES.

SEQUENCING OVERVIEW

There are 8 patterns with 8 steps each. The patterns can be chained to create longer sequences.

Scales can also be chained and run independently from the pattern chains. Both are stored in memory when pressing SAVE.

On the right side of the unit, you can sequence-record the temporary FX and chain the Play Modes. Their length is set independently from the chained scales and patterns, so you can use different numbers to create varying sequences.

Temporary FX loop and Play Mode chains are not stored in the memory and are not impacted when loading new BANKS of patterns and scales. You can load different BANKS of patterns and scales to run underneath the Play Modes and temporary FX.

Utility
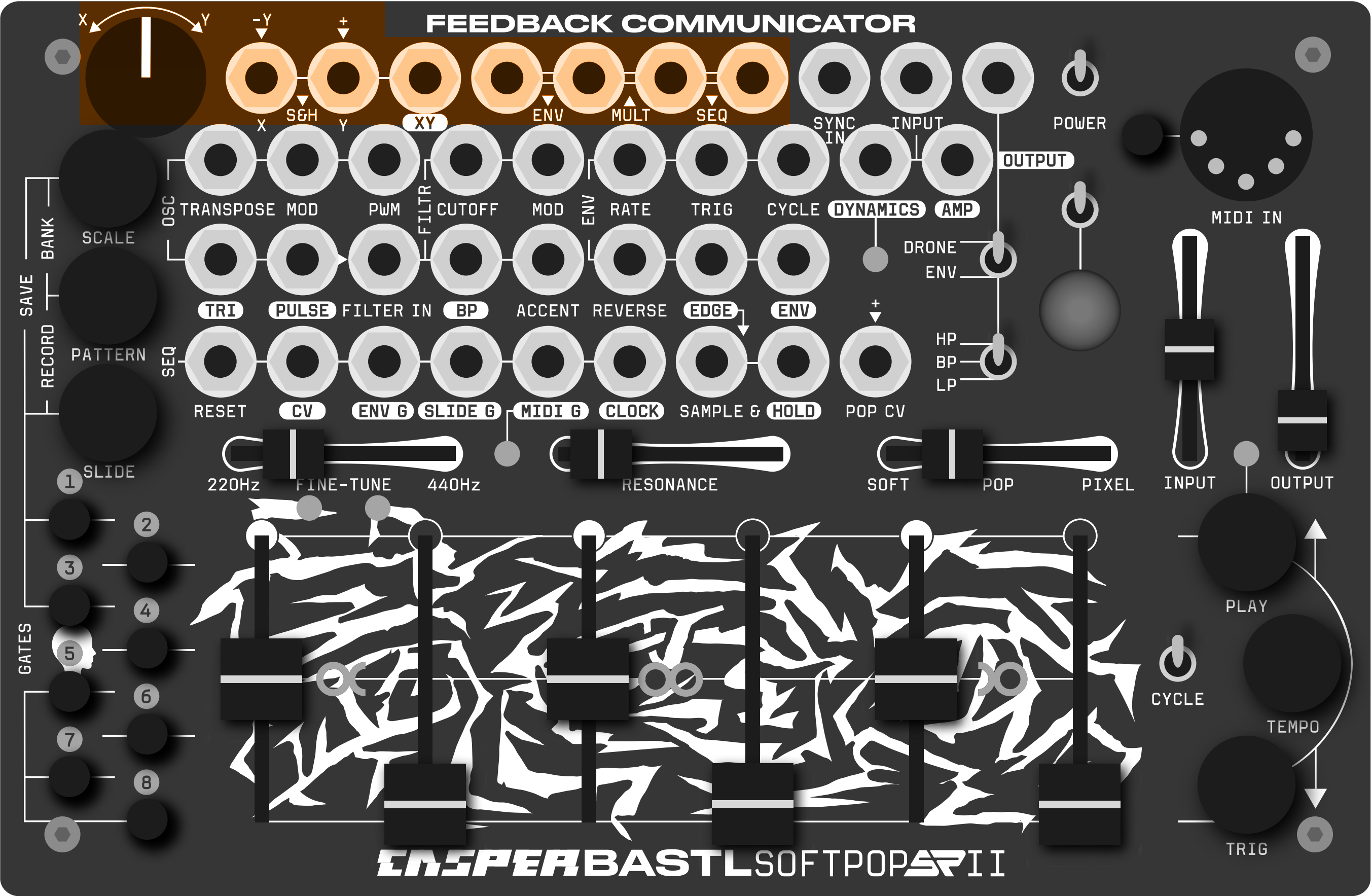
XY CROSSFADER

XY crossfader is a simple and yet powerful utility. It allows you to mix two signals, X and Y, and crossfade between them with the knob. If only X or Y (or neither) are connected, the function changes.

The XY crossfader is a simple but powerful utility that can function as a mixer, a crossfader, an attenuverter, a signal offset, or a variable bipolar voltage source, depending on how it is patched.

If neither X nor Y is connected: XY output gives voltage based on the position of the knob from -2V to +2V. Patch it, for example, to the PWM input to control the timbre of the oscillator.

If only Y is connected: XY becomes the attenuverter of the Y signal. XY crossfades between the Y signal and its inverted version normalized to the X input. Use in this configuration with XY knob fully left for signal inversion. Patch CV to Y and patch XY to RATE to create dynamic envelopes.

If only X is connected: XY output crossfades between the X signal and

the positive voltage of +2V normalized into the Y input. This is useful to offset the X signal.

Both X and Y are connected: XY mixes the signals in a ratio set by the XY knob. Use it to mix/crossfade audio, gates, voltages or create a dry/wet mix of your audio.

PATCH POINTS

● X is the input that goes to the XY output when the knob is fully CCW. The inverted version of Y input is normalized to this input.

● Y is the input that goes to the XY output when the knob is fully CW. A static voltage of +2V is normalized to this input.

● XY is the section's output and is 4Vpp if nothing is plugged into X and Y.

MULTIPLE

These four jacks are simply connected together and can be used to split your signals and route them to multiple destinations. 💡 You can also connect two or three **outputs** into the multiple to passively mix them. This will give you a combined average voltage and can be a cool way to make complex modulation signals.

THE ORB

The Light Orb visualizes a few key parts of Softpop's operation. It can help you understand the Softpop on a deeper level, but it can also be turned off and saved for special moments. It also pairs well with phone cameras. Put your camera in video mode and hold it right up to the Orb to see some super-interesting visuals.
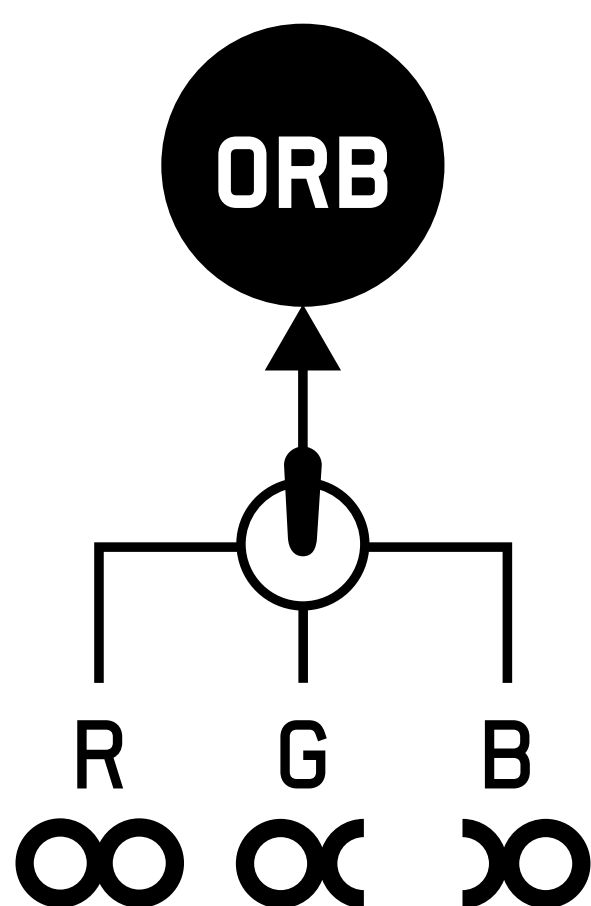
MIDI

Softpop can receive a MIDI clock to sync the sequencer. Hold the MIDI button and press one of the GATES to set the input channel. Press the selected channel again to select channels 9-16, and the light indication will invert.

MIDI >5s=MIDI learn
MIDI+GATE=set MIDI channel to 1 to 8
MIDI+selected GATE=set MIDI channel to 8+1 to 8
MIDI+PLAY=activate/deactivate MIDI clock
MIDI+SCALE=activate/deactivate MIDI scale mode
MIDI+PATTERN=activate/deactivate CV Out generating Velocity CV

MIDI+TRIG=toggle Trigger Envelope at Note On mode

Example: select 2, select 2 again (lights invert) and the channel number is incremented by 8:
CH = 2 + 8 = 10

MIDI CHANNEL after pressing the MIDI+GATE twice:

9	10	11	12	13	14	15	16
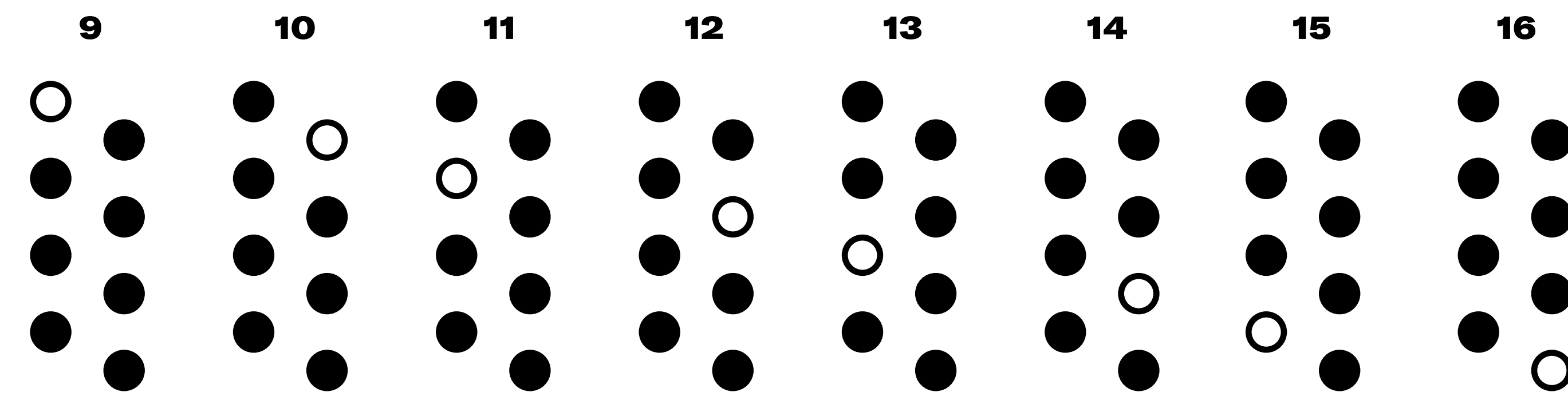
Hold the MIDI button for 5s to enter MIDI Learn Mode. In MIDI Learn Mode, the SP2 will wait for a MIDI Note On message, remember its channel, and save it as the input channel.

MIDI GATE is HIGH when any MIDI Note on the selected input MIDI Channel is on. Patch it to TRIG to trigger the envelope or also to ACCENT to create a sustained note.

MIDI+PLAY button will enable/disable the MIDI clock.

To enable the MIDI clock, hold the MIDI button and press PLAY, so the PLAY light is on.
TEMPO + GATE will set the divider for the MIDI clock.
See the TEMPO section for more information.

There are 2 modes for interpreting MIDI notes. To alter between the 2 modes, hold the MIDI button and press SCALE. The PITCH FADER light will be on for the MIDI SCALE mode and off for the MIDI PITCH mode.

1 MIDI SCALE mode is optimized to set the scale (until the active scale is changed on the Softpop – either manually or by chaining). It works as a sort of keyboard arpeggiator. MIDI Notes in different octaves will transpose the sequence.
2 MIDI PITCH mode is designed for direct monophonic playback. To ensure the correct functionality, stop the sequencer. When the sequencer is running, it will have similar functionality as the MIDI SCALE mode, except for octave transposition.

Hold the MIDI button and press PATTERN to activate MIDI Velocity mode (indicated by PITCH MOD fader light). In MIDI Velocity mode, the velocity of the active note will be reflected on the sequencer CV output.

Note: a MIDI-defined scale is a collection of notes played legato. In other words, if you play the notes together, or at least one note is held while pressing other notes, it will take all these notes into that scale. The scale repeats in all octaves. This is useful when playing chords, for instance.

FX CONTROLLED BY MIDI NOTES
MIDI notes above the 8th octave (above note 96 = C7) control the temporary FX.
Notes 96-103 = FX 1-8, Notes 104-111 = FX 1-8 etc.

ENVELOPE TRIGGERED BY NOTE ON MODE
Hold MIDI and press TRIG to activate/deactivate triggering of the envelope with every received MIDI Note On message. While holding the MIDI button, the state is indicated by the MIDI Gate light.

MIDI CC IMPLEMENTATION:

CC 0	BANK select: values 0-7 (1-8)
CC 1 (mod wheel)	WAVESHAPE 0-127
CC 2	PITCH fader 0-127
CC 3	PITCH MOD fader 0-127
CC 5	SLIDE time 0-127
CC 16	PATTERN selection: values 0-7 (1-8) (removes chain)
CC 17	SCALE selection 0-7 (1-8) (removes chain)
CC 18	select PLAY MODE 0-7 (1-8) (removes chain)
CC 19	SAVE current bank (any value)
CC 20	select WAVEFORM 0-7 (1-8)
CC 64 (sustain)	sustain pedal off <64, on >=64
CC 123	all notes off – clears midi buffers

MIDI TRANSPOSE

MIDI notes on channel 16 will transpose anything happening on the SP2. The MIDI transpose adds together with the transpose CV input. Note C2 (note 36) means no transpose. Notes above C2 are positive transpose in semitones (note 37 = +1 semitone), and notes below C2 are negative transpose (note 35 = -1 semitone).

Bank Load/Save/Copy

Softpop can permanently store 8 banks where one bank consists of 8 patterns (pitch, gate slide), 8 user scales, and both of their chains. These settings need to be SAVED by the user by pressing SCALE+SLIDE.

Softpop also stores tempo, divider, and MIDI settings (MIDI clock selection, MIDI channel, MIDI Pitch mode, MIDI Velocity mode). These settings are common to all banks, and MIDI settings are automatically saved when changed. Tempo and divider are saved when pressing SAVE.

SP2 does NOT store Play Mode chains, Triggered pitch change mode, or temporary FX loops.

To load a different bank, hold SCALE and PATTERN, and press one of the 8 GATES to load the corresponding bank. Banks can be performatively changed while the sequencer is running. Re-loading a bank or loading another bank will undo all changes done to the bank since the last moment the bank was saved.

To copy an active bank to another slot, hold SCALE+PATTERN and press TEMPO. While still holding SCALE+PATTERN, press a GATE to select another bank and paste the copied bank to that slot.

Patch Ideas

1 Patch TRI to INPUT and use INPUT FADER to add more bass. Push the fader even further to saturate the triangle and overload the filter. This way, the filter gets a whole new character.

2 Patch HOLD to REVERSE for randomized envelope shape variations.

3 Patch HOLD to RATE for randomization of envelope speed.

4 Patch EDGE to SYNC IN to control the tempo with the cycling envelope. Use gates to trigger the envelope and different tempo dividers/multipliers for varied rhythms. Control the RATE of the envelope for even more clock variation. You can also turn off the cycling of the envelope and clock the sequencer manually by the TRIG button.

5 Patch ENV to PWM for enhanced timbral control of the oscillator. Combine with extreme settings of POP for animated analog-emulated digiverse.

6 Patch BP to INPUT for radical screaming filter resonance.

7 Patch CV to Y, XY to RATE, and adjust the XY knob to get diverse musical feels of the envelope relative to the pitch sequence.

8 Patch SLIDE Gate to REVERSE to invert the shape of the envelope on the sliding steps.

9 Patch SLIDE Gate to the RESET input. Add slides to steps to shorten your sequences to any number of steps. Combine with Play Modes and their chaining for even more fun.

10 Set SLIDE time to 1 (no slide) and use the SLIDE Gate to modulate CUTOFF or anything in the patchbay.

11 Patch ENV Gate to X and SLIDE Gate to Y and use XY as stepped modulation based on the combination of these gates.

12 Use the gate/clock outputs to modulate any CV inputs (especially POP, REVERSE, VOLUME, CYCLE). Use the XY section to combine the gate outputs or patch up to 3 gates to the passive multiple and use the 4th output to get stepped variations as well.

13 Patch SLIDE Gate to INPUT, and the DYNAMICS output will generate a short envelope for extra modulation needs.

14 Patch ENV to OSC MOD and enjoy exponential arpeggios. Stop the sequencer, chain several scales, and patch EDGE to RESET to browse through chained scales with every run of the arpeggio.

15 Patch ENV to Y, patch XY to RATE, and use the XY knob to change the curve of the envelope. Turning XY to the right will make it more exponential. Turning the knob left will linearise the envelope. Going further will even make it logarithmic. Combine with the previous patch for more control of the arpeggios.

16 Patch PULSE to TRIG, patch ENV to FILTER IN, and use higher settings of the RATE to obtain oscillator sync sound (by loopop).

17 Patch CV to CUTOFF to make the filter track with the pitch sequence (both CV and CUTOFF are scaled V/OCT).

18 Side-chain pumping: patch a signal with a kick drum (your side chain signal) to the INPUT. Patch DYNAMICS to Y, XY to ACCENT, and keep turning the XY knob to the left until it starts ducking the SP2 sound when the side-chain signal appears.

19 Girl-boss mode: Patch dummy cable into the FILTER IN, set RESONANCE to the max, and use the filter as a primary sine wave source. Patch CV to CUTOFF, patch TRI to the filter MOD, and use the MOD fader to bring in some FM timbres. Bring in some POP modulation for even more timbral variation and patch ENV to PWM to get an even richer character out of it. Patch PULSE to INPUT and use the INPUT fader to fade in the default Softpop sound. Best enjoyed with the SP2 sequencer triggering shorter envelopes controlling the amplitude.

20 Demon with a flute player behind on zoom call with shit wifi: connect an amplified microphone to INPUT, split DYNAMICS in the MULTIPLE, and patch it to RATE, TRIG, and TRANSPOSE. Use the DRONE mode and play with the pitch. (by Oliver Torr)

21 A capybara and a bird dance together, and also a fly joins for a bit: Connect contact microphone into the INPUT, split DYNAMICS in the MULTIPLE, and patch it to CYCLE and CUTOFF MOD. Patch TRI to POP CV, CV to RATE, and AMP to FILTER IN. Turn off the CYCLE and use DRONE mode, and they fight (but only for fun). (by Oliver Torr)

22 Turn off the sequencer, set the DRONE/ENV switch to DRONE, and lower the PITCH MOD fader. Set the envelope to cycle. Patch the XY pot to the envelope RATE to increase the speed into audio range. Patch the HOLD output to the external INPUT or into the FILTER MOD and listen to the complex patterns that emerge as the ENV and PULSE rates both enter the audio range.

Effect Patch Ideas

Plug any external audio signal into the SP2 to radically transform its sound with the built-in filter, VCA, and input gain saturation. Create stepped modulation with the sequencer and auto-wah style effects with the input-tracking envelope follower. Randomize it all with the Sample & Hold, use the 37-point patchbay, and dive into the modulation madness.

SETTING UP

To start with the audio processing, connect your source to the INPUT and bring up the INPUT FADER. Patch AMP to FILTER INPUT to get even more signal boost and disconnect the oscillator from the filter.

For starters, set the DRONE/ENV switch to DRONE mode and use the LP setting of the filter, minimal resonance, and CUTOFF fader all the way up.

To obtain additional dry/wet control, you can patch OUTPUT to Y, AMP to X, and listen to the XY output. Set the INPUT and OUTPUT faders to balance the dry and wet levels and use the XY knob as a dry/wet control for the processed signal.
Note: This is not technically dry/wet because already you can be applying the pre-amp saturation. If you want a true dry/wet patch, you need to split your input signal in the passive multiple and patch it to X and INPUT, patch OUTPUT to Y and listen to XY.

PATCHES

1 Overdrive: bring up the INPUT higher and higher to hear the character of the soft clipping of Softpop's pre-amplifier.
2 Slicer: set the DRONE/ENV switch to ENV mode and use sequencer gates to trigger the envelope. Use the Play Modes and temporary FX to gain even more complexity. Synchronize via MIDI or analog clock with a drum machine.
3 Auto Filter (auto-wah): patch DYNAMICS to CUTOFF MOD and play with the filter faders to get different versions of filtering based on the input signal. Use BP setting for wah-type sounds.

4 Stepped filter (S&H): patch HOLD to FILTER MOD, CYCLE the envelope, and use the RATE fader to control the speed of the modulation. Set pitch high for a seemingly random character; set it low for a staircase effect.

5 Distortion/audio modulated filter: bring up the POP to hear the oscillator PULSE affecting the filter. Patch ENV to PWM to animate that sound. Turn down POP, patch TRI to FILTER MOD, and use the fader for a different flavor. Use the sequencer or MIDI to control the oscillator. Bring up RESONANCE and patch DYNAMICS to PITCH MOD for even crazier effects.

6 Ring modulator: patch TRI to ACCENT and use PITCH fader to set the ring modulation carrier. Alternatively, patch TRI to Y and XY to ACCENT to gain control over the amount of ring modulation. Use PULSE signal instead (or mix it with TRI in XY) for an even harsher sound. Combine with resonant filtering for more timbral options. Use the sequencer or MIDI to control the oscillator.

7 Compressor/expander/side-chain: patch DYNAMICS to Y and XY to ACCENT. Now the loudness of the OUTPUT is affected by the loudness of the INPUT. When turning the XY knob to the left, you will get a compressor effect, and, turning it to the right past 12 o'clock, you will get the expander effect.

8 Side-chain: you can achieve the side-chain compression ducking effect by modifying the previous compressor patch by plugging your main signal to the FILTER IN and the side chain signal to INPUT (but note that the INPUT signal is still going to be mixed into the filter). Try side-chain filtering by patching the XY into the CUTOFF instead.

NEW POWER UP ANIMATION

New animation helps you easily tell apart analog VCO and digital VCO modes.

Digital VCO:

1 All lights are ON except one blinking – this light indicates the version of the digital VCO firmware.

2 lights 1, 3, 5, and 7 animate while:

the state of light 2 indicates the VCO Pitch Limiter mode

the state of light 4 indicates the CV Pitch tracking mode

the state of light 6 indicates the flipped function of the FINE-TUNE fader

ANALOG VCO
Firmware at startup
**Lights OFF and one blinks
to indicate the version**
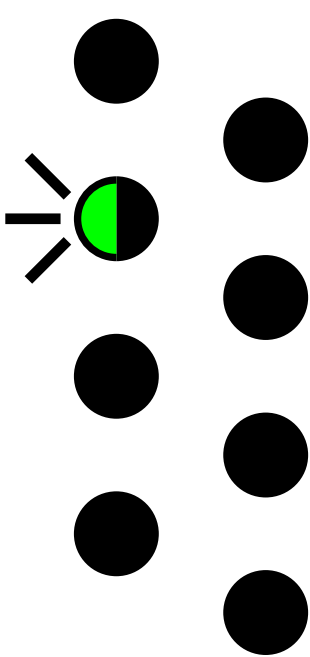
DIGITAL VCO
Firmware at startup
**Lights ON and one blinks
to indicate the version**

1.

2.

3×

● Pitch limiter mode

🟢 CV pitch tracking
mode

🟢 FINE-TUNE fader
waveshape mode
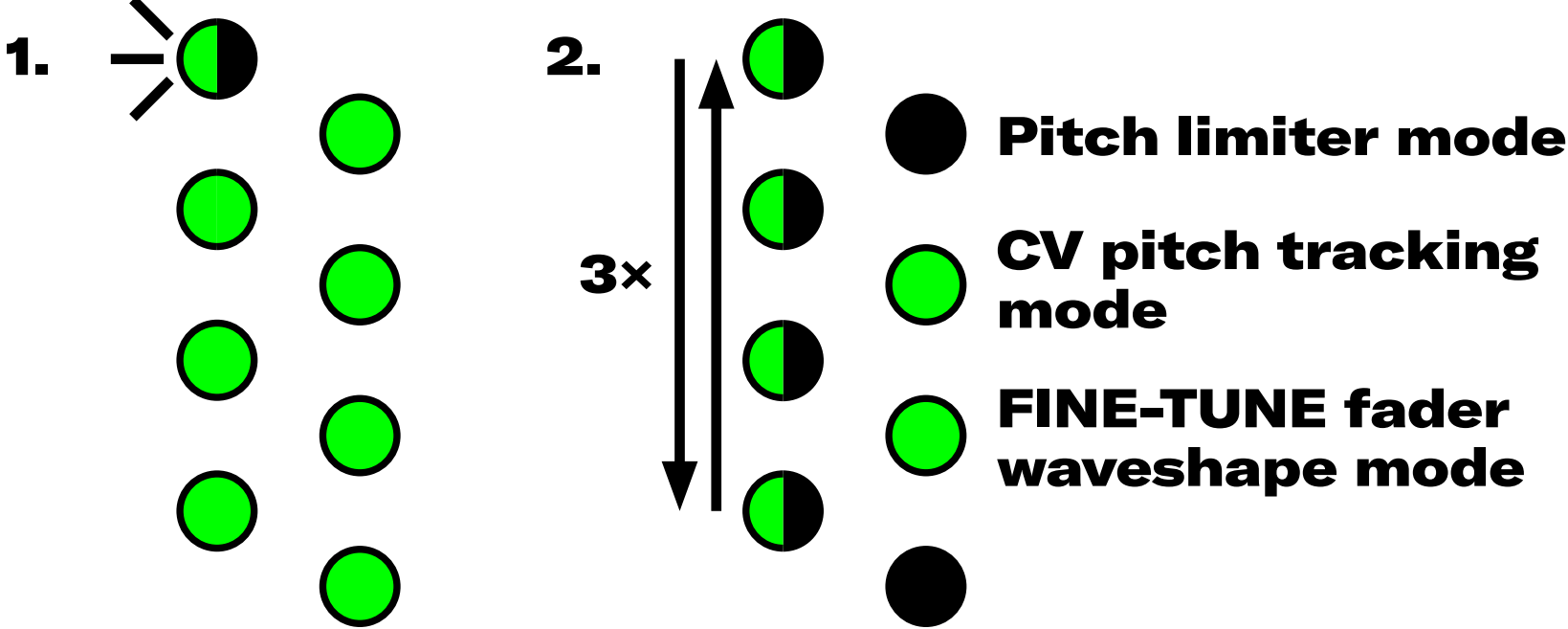
Digital vs. Analog VCO

Softpop can run either analog or digital VCO. To run either, you need to open the back of the unit, place the jumper in the required position, and upload the corresponding firmware. A video manual of the upgrade to digital VCO is available at our YouTube channel.
The analog VCO can only run with dedicated firmware (which lacks some newer features).

ADJUSTING THE JUMPER SETTING

Take a Phillips screwdriver and undo the backplate of your Softpop. Before removing the back plate, secure the side panels in place with tape. Reassembling the case after the upgrade will be much easier.
Inside you will find a jumper marked VCO with ANALOG and DIGITAL positions. Move the jumper to the DIGITAL position, i.e., connect the middle pin to the outer right pin to make the new digital oscillator modes and firmware work.
Put the backplate back on, aligning the sides properly in the slots, then put the screws back.

Analog VCO

Analog   VCO   Digital

Digital VCO

Analog   VCO   Digital
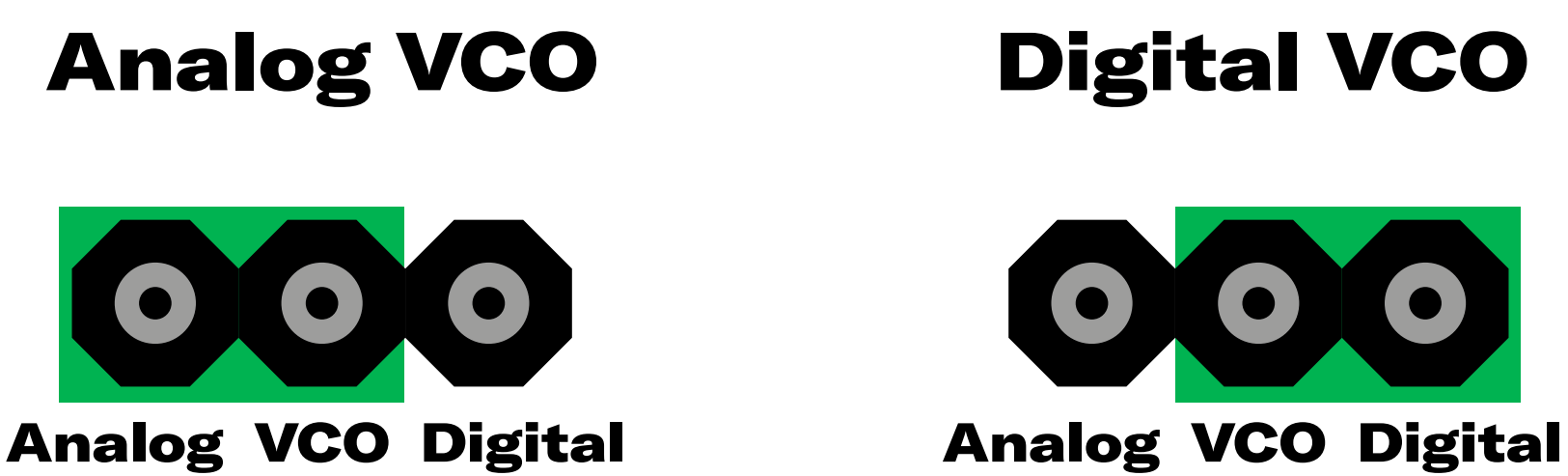
Firmware upload

The Softpop's firmware can be updated by playing a wav file into its RESET jack.

Hold the MIDI button at startup to enter bootloader mode.

To upload new firmware, connect a cable from the RESET input to your computer/phone audio output, and play the wav file downloaded from the product page at maximum volume. Lights should animate the progress, and all should light up when the process is done. Power off and on after all lights come on.

The firmware version is indicated at startup by the corresponding number blinking several times.

Calibrating the TRANSPOSE input

We recommend to re-calibrate the TRANSPOSE input after the update. Patch the CV output to TRANSPOSE input and hold SLIDE+SCALE while powering up the unit. Wait until the GATE lights go off. Unpatch the cable and power cycle the unit.

If you want the calibration to be accurate, make sure you use a high-quality power source! We recommend a good quality wall charger or USB power bank.

Firmware upload troubleshooting

In case the SP2 does not boot to normal operation, get back to bootloader mode and check the following:

● Check that you have set the jumper on the circuit board to the correct position - i.e., that you have bridged the middle and right pins (DIGITAL). The jumper is small and can easily be misaligned, so make sure it actually connects the pins.

● Powering via USB and playing audio from the same computer can sometimes cause issues (depending on the computer). Also, some power supplies may introduce noise into the device, which can disrupt the firmware update. That can also apply to expensive externally powered USB hubs. Sometimes changing the power source may help with updates

if they fail repeatedly. We recommend updating the SP2 while powered by a good-quality wall charger or USB power bank.

● When updating the firmware via audio from the phone/computer, the GATE LEDs should run smoothly in one direction. If they do not move at all, the audio volume is too low or too high.

● If your audio output level is too low for the RESET jack, connect your phone/laptop audio output to INPUT on the SP2. Set the INPUT slider in the middle, patch AMP to RESET, and play the wav file again.

● Make sure your phone or computer does not make any sound (e.g., notification/alerts) during the firmware upload, as this will cause the process to fail, and your unit will not work properly. We recommend turning on airplane mode before starting.

● If you still have no luck updating your SP2 via the RESET connector directly from your phone/computer, you can try the following method:

1 Connect your phone/notebook audio output to the AUDIO INPUT on the SPII.

2 Patch AMP to FILTER IN.

3 Patch OUTPUT to RESET.

5 Set the Filter Mode switch to LP (low-pass).

5 Set the RESONANCE fader to the minimum (all the way to the left).

6 Set the POP fader to SOFT (all the way to the left).

7 Set the CUTOFF fader to the maximum (fader all the way up).

8 Set the CUTOFF MOD fader to the minimum (fader all the way down).

9 Set the Input and Output faders to the maximum (all the way up).

10 Play the FW upgrade audio.

11 Re-calibrate the TRANSPOSE input after the update.

All Button Combos

BASICS
PLAY=▲ and TRIG=▼ when used with other buttons
GATE=press any one gate
GATES=press multiple gates one after another while still holding the context button

PATTERN+SLIDE=RECORD pitch sequence
SLIDE+MIDI+GATES=select waveform
SLIDE+FINE-TUNE=set waveshape
SCALE+SLIDE=SAVE bank
SCALE+PATTERN+GATE=LOAD bank

SCALE+GATE=select a scale
SCALE+GATES=chain scales
SCALE+▲/▼=select a semitone
SCALE+TEMPO=semitone on/off (indicated by PLAY LED and GATE 1)
SCALE+TEMPO+▲/▼=transpose whole scale by one semitone
SCALE+MIDI=copy MIDI defined scale to currently edited scale

SEQUENCER
PATTERN+GATE=select a pattern
PATTERN+GATES=chain patterns
PATTERN+▲/▼=shift a whole pattern by 1 step
PATTERN+TEMPO=copy currently selected pattern to the next selected pattern

SLIDE+GATE=activate/deactivate slide on that step
SLIDE+▲/▼=set slide rate (1=no slide)

PLAY (short)=start and stop sequencer
PLAY+GATE=select playmode
PLAY+GATES=chain playmodes

TEMPO+TEMPO=tap tempo
TEMPO+▲/▼=increase/decrease tempo
TEMPO+▲/▼>1s=gradually increase/decrease tempo

TEMPO+GATE=select divider/multiplier
TEMPO+▲+▼=learn tempo from looping envelope

TRIG=trigger envelope
TRIG+GATE=activate temporary FX (hold several to combine)
TRIG+PLAY+GATES=record loop of temporary FX
TRIG+PLAY=erase loop of temporary FX

PATTERN+MIDI=toggle Triggered pitch mode
TRIG+SLIDE=toggle SLIDE G trigger/gate mode
TRIG+PATTERN=toggle ENV G trigger/gate mode

STEP EDIT MODE

PATTERN+SLIDE (when seq. stopped)=enter/leave step edit mode
In the step edit mode (one step is blinking):
GATE=preview and select step (always triggers envelope)
GATE+move PITCH FADER=edit steps pitch
GATE+▲/▼=transpose step in quarter tones

MIDI

MIDI >5s=MIDI learn
MIDI+GATE=set MIDI channel to 1 to 8
MIDI+selected GATE=set MIDI channel to 8+1 to 8
MIDI+PLAY=activate/deactivate MIDI clock
MIDI+SCALE=activate/deactivate MIDI scale mode
MIDI+PATTERN=activate/deactivate CV Out generating Velocity CV
MIDI+TRIG=toggle Trigger Envelope at Note On mode

BOOT SETTINGS

Hold SCALE at power up=toggle VCO Pitch Limiter mode
Hold PATTERN at power up=toggle CV Pitch tracking mode
Hold SLIDE at power up=toggle FINE-TUNE fader function
Hold PLAY+TEMPO+TRIG at power up=factory reset
Hold SCALE+SLIDE at power up=calibration and test mode
Hold MIDI at power up=firmware update mode (play firmware audio into RESET input)

OUTPUT AMPLITUDES

OUTPUT 5Vpp
TRI 5Vpp
PULSE 3.5Vpp unipolar
BP 4Vpp
EDGE 3.5Vpp unipolar
ENV 4Vpp unipolar
SAMPLE & HOLD 5Vpp
DYNAMICS 4Vpp unipolar
AMP 7Vpp
XY 4Vpp
Gate/Clock outputs 0 to 5V
CV output -3 to +3V

FEATURES

● Fully analog signal path with integrated digital control
● Patchbay with 37 eurorack compatible patch-points for ultra-flexibility
● Light orb for psychedelic inspiration
● Analog triangle core oscillator with PWM input and pulse and triangle outputs or digital oscillator with several waveforms and waveshaping
● Automatic oscillator tuning and octave-wide fine-tune control (for analog VCO)
● Quantized V/OCT semitone transpose
● State variable resonant filter with lowpass, bandpass, and highpass modes
● POP control for unique subtle and distorted timbres
● Flexible attack-decay cycling envelope with a ton of control inputs
● Drone or envelope mode switch for the VCA
● Musical sequencer with a lot of tricks
● 8 step sequencer with pattern chaining to extend the length
● Sequenceable Scale Quantizer with 8 user-editable scales
● 8 patterns per bank, 8 banks (saved on demand)
● Envelope gates per step
● Slide option per step for that acid feel
● Playback modes will turn your simple patterns on their head
● Temporary FX section (ratchets, arps, noise, and more)
● CV, gate, and clock outputs from the sequencer
● External input for processing audio with dynamics analyzer
● Analog sync Input

● Tempo section with divider/multiplier
● MIDI input for sync and musical control
● XY crossfader utility section and 4-way multiple for advanced patches

IN THE BOX:

Softpop SP2
Quickstart guide
5 patch cables (15cm: Green, Dark Green, Brown, Black, and White)
Micro USB cable (excl. power supply)
Rubber feet
Sticker

TECHNICAL SPECS

USB power (micro): <250mA
Dimensions: 173 x 112 x 41 mm
Inputs are capable of receiving eurorack signals
16 pin protected eurorack power connector requires 5V from busboard: <250mA
Eurorack size rail adaptors available as open-source files
All outputs are 5Vpp except for PULSE, EDGE, ENV, BP, and DYNAMICS, which are 4Vpp

DOWNLOADS

Quickstart guide pdf
Patch sheet pdf
Media files (hi-res pictures, wallpapers, etc.) drive
Latest firmwar
    wav
    zip
Upgrade manual video
FAQ
Eurorack adaptor gitHub

CREDITS

Softpop SP2 was developed by Bastl Instruments and Casper Electronics.

Lead designers are Peter Edwards and Václav Peloušek.

Additional circuit design, manufacturing optimization, and circuit layout by Martin Klecl.

Graphic design by Anymade Studio.

Beta testing by Juha Kivekäs with the help of Felix Hüesken (Tuesday Night Machines) Max Ravitz, Wes (soffter), Patrik Veltruský, Milan Říha, David Žáček, John Dinger (all four from Bastl), Niels Aras, Oliver Torr and David Herzig (all three from Noise Kitchen).

Video content and patch ideas by Patrik Veltruský, Václav Peloušek, Oliver Torr, Niels Aras and David Herzig.

Manufacturing, quality control, and distribution by the whole Bastl Instruments team.

Manual was written by Václav Peloušek.

Code uses the Arduino MIDI Library and a modified version of Mutable Instruments audio bootloader.

BASTL

more info
and video tutorials