

BASTL INSTRUMENTS KASTLE 2 ALCHEMIST



KASTLE 2 ALCHEMIST

Kastle 2 Alchemist is a patchable hybrid-synthesis based instrument that empowers you in discovering melodies and even harmonies despite being monophonic.

Patch programmable sequencing via the control signals into the two PITCH MOD inputs opens up a world of melodic inspiration beyond classic arpeggios while staying in your preferred SCALE.

It has a carefully tuned wide timbral range across 5 synthesis modes (FILTER, FM, SUPERSAW, HYPERSINE and GLITCHNOISE) accessed by main TIMBRE sweep that is refined by the RATIO control.

The ENV macro knob affects different parts of the synth and sequencing engine to maximize musicality and it even lets you continually morph between the synthesis modes and access truly unique sounds.

The timbral palette is further extended by the dual FX section which offers either a wide delay that will smear the arpeggios into echoed harmonies or a chorus-flanger-distortion-combfilter macro custom tuned for each synth mode.

You can also access gliding rubber textures with the PITCH SLIDE macro that applies pitch envelope and portamento.

You can customize its rhythms and scales with the [web-based editor](#).

The Kastle 2 Alchemist is a compact, portable instrument that runs on 3 AA batteries or USB-C, so it can inspire you anywhere, anytime. It loves to jam with your other portable gear—sync it with the sync in/out ports, and use the audio input to mix external signals with the Alchemist's output or run them through its built-in effects.

All main parameters can be modulated and tightly sequenced by the surprisingly powerful CV and GATE pattern generator alongside with syncable LFO that can be modulated as well.

The Alchemist is a semi-autonomous companion that keeps surprising you with fresh ideas. Kastle 2 is not just a sound box—it's a powerful MIDI controller and sequencer. Send finely curated USB MIDI data to your DAW or USB MIDI instrument, and discover new ways of playing and interacting through a modular interface.

Alchemist both sends and receives USB MIDI, making studio integration a breeze!

Do not write melodies! Let them emerge from the behaviour you set-up by the patch interaction of various modulation sources.

Features

- 5 synth modes
 - FILTER
 - FM
 - SUPERSAW
 - HYPERSINE
 - GLITCHNOISE
- Hybrid synthesis
 - 4 oscillators
 - FM with feedback
 - Raw Waveform mixing
 - Ring mod
 - Track and hold
 - Stereo noise with track and hold
 - Stereo Filter
 - Transient shaper
- Dual FX section
 - Delay to the left
 - Chorus/Flanger/Distortion to the right
- stereo audio processing at 44kHz/16-bits

- PITCH knob with range of ± 2 octaves (4 octaves total)
- PITCH MOD attenuverter knob for modulating pitch
 - NOTE input: quantized pitch with selectable scales (updates on trigger)
 - ►PLAY input: 3rd, 5th and octave above NOTE - triggers envelope on change, time quantized to PLAY GRID - great for arpeggios!
 - user-defined scales ([via web app](#))
 - BANK+PITCH MOD to change quantizer scale
 - BANK+TIMBRE MOD for root note adjustment
 - BANK+LFO MOD for fine tuning
 - BANK+PITCH to change and preview octave
- TIMBRE knob for main timbral sweep
 - refine TIMBRE sweep with RATIO (oscillator detune ratios and wave mixing ratios)
 - hit the SHIFT button to trigger the sound
 - TRIGGER input to trigger sound
 - TIMBRE MOD input with attenuversion
- MODE input with attenuation to change synth MODE with CV
- ENV knob
 - turn right to set decay and focus TIMBRE on transients
 - turn left to add attack and decay and focus TIMBRE on BODY
 - fully left and right enters DRONE mode
 - slows down arpeggio at long envelopes
 - MODE MORPHING to the left
 - ENV MOD input with attenuverter
 - ENV MOD updates only at trigger
 - patchable ENV output of the envelope
- LFO with triangle and pulse output, reset input, attenuverting modulation, synced or free
- Tempo generator with tap tempo, divider, and external clock input
- Pattern generator (tempo synced) with GATE and CV output, patch-programmable
- GATE generator contains user-programmable RHYTHM patterns ([via web app](#))

- stereo input with input gain (up to +12db), accepts up to 6 Vpp signal
 - input can be mixed at the output or run thru the built in effects
 - stereo output capable of driving headphones up to 250 Ohm
 - analog sync input
 - analog sync output
 - modular I/O connections via right channel of the sync jacks
-
- USB MIDI Input (clock, notes, CCs, pitch bend)
 - USB MIDI Output to use as a MIDI controller/sequencer (clock, notes, CCs)

TECHNICAL DETAILS

- USB-C (firmware updates, USB MIDI, editor features)
- 3x AA battery power (both rechargeable and non)
- power consumption approx. 100–150 mA, should last up to 15–18 hours on 3xAA batteries.

Introduction

For starters, let me tell you: **Follow the white cats!**

The knobs with the white cats control the main parameters for your sound: PITCH, TIMBRE and ENV. All other knobs come alive once you start patching.

Hit (short press) the SHIFT button to preview your sound.

The Kastle 2 Alchemist can be experienced in various ways. It is absolutely legit to just explore and let your ears guide you. If that's your game, you might appreciate the Quick Start guide.

The Quick Start guide is linked [here](#).

MANUAL

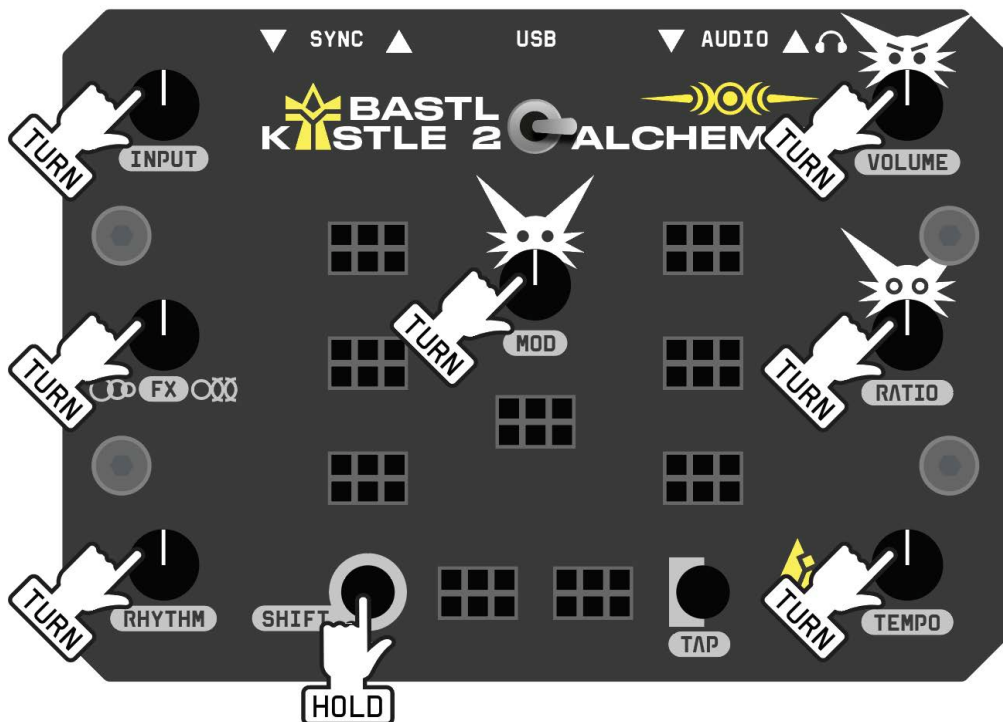
This full manual will give you a better understanding of the Alchemist's inner workings and help you achieve the results you desire. It provides plenty of tips and shows you just how deep the cat's secret goes—get ready for an adventure!

Shift

Hit or tap the SHIFT button to **trigger the sound**.

NOTE: The trigger signal happens at the button release.

Hold the SHIFT button to access the **silver-labeled functions**. For example, hold SHIFT and turn the PITCH knob to adjust the VOLUME.



Button Combos

Short SHIFT press = trigger synth (on button release)

SHIFT + KNOB = secondary function in silver

SHIFT + MODE = Tap tempo

MODE (short press) = next synth mode

MODE + SHIFT = previous synth mode

SHIFT + MODE >2s = enter/leave ADVANCED SETTINGS (input behavior etc.)

SHIFT + MODE >10s = MEMORY RESET

Connecting KASTLE 2

SHIFT + PITCH MOD knob = set input gain

SHIFT + PITCH knob = set output volume

SHIFT + MODE >2s = ADVANCED SETTINGS (input behavior etc.)

SHIFT + Knob Combos

SHIFT + TIMBRE MOD = adjust FX - delay or chorus distortion

SHIFT + LFO = adjust tempo

SHIFT + LFO MOD = load preset rhythm on the GATE pattern generator

SHIFT + ENV = attenuation of the ENV input

SHIFT + TIMBRE = adjust RATIO

MODE + Knob Combos

MODE + PITCH MOD = change quantizer scale

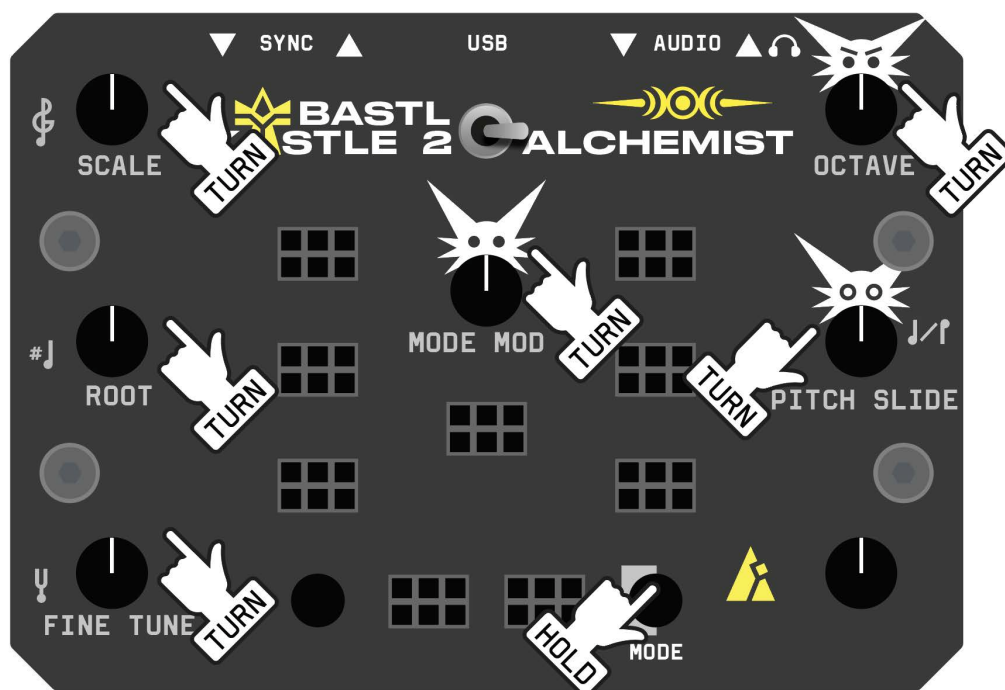
MODE + PITCH = change octave

MODE + TIMBRE MOD = adjust root note

MODE + LFO MOD = fine tune pitch after quantizer

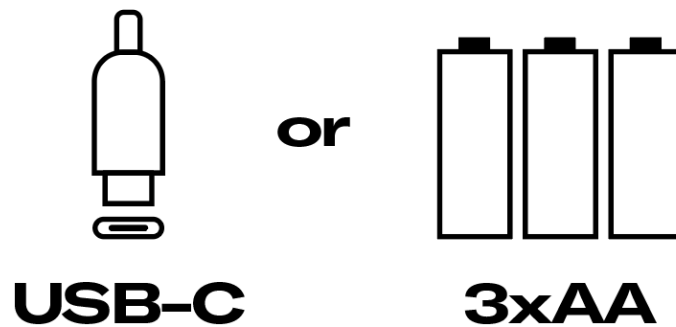
MODE + ENV = modulation attenuation for MODE input

MODE + TIMBRE = adjust pitch slide settings



POWER

Kastle 2 can be powered by USB-C (5V) or 3x AA batteries—either rechargeable or non-rechargeable.



Low battery levels will cause the backlight colors to turn red.

Colors and sound should still function properly down to about 3V. Power voltage levels below 3V indicate dead batteries.

Fresh non-rechargeable alkaline batteries: $3 \times 1.5V = 4.5V$

Fully charged NiMh batteries: $3 \times 1.2V = 3.6V$

To turn ON the device, move the POWER switch to the right position. Push it to the left position to turn it OFF.



Depending on your power source the maximum output voltage of the output patch points might change. With rechargeable batteries it might only read 3.6 volts ($3 \times 1.2V$) or lower when drained. With USB-C the output voltage will almost reach 5 volts (around 4.8V).

NOTE: Kastle 2 does not charge or draw power from your batteries when connected via the USB port.

USB

The USB port is used for power, USB MIDI, firmware updates, and adjusting SCALES and RHYTHMS via the [editor app](#).

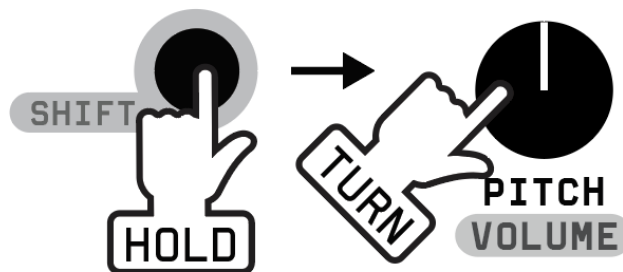
AUDIO

Connect the **AUDIO OUT** jack of the Kastle 2 ALCHEMIST either to headphones or further devices that receive line level audio.



👉 🖱️ To set the output **VOLUME**, hold **SHIFT** and turn the **PITCH** knob.

SET VOLUME



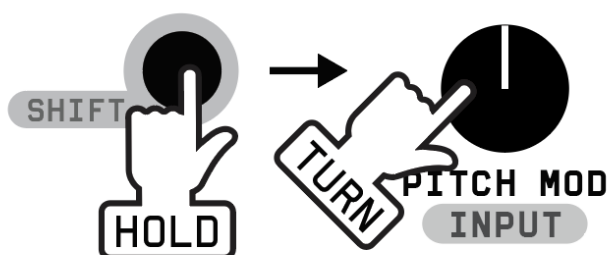
Connect your sound source to the **AUDIO IN** jack.

The signal at Audio input will get mixed with the sounds coming from the ALCHEMIST at the output.

You can also route the input to go through the effects of the ALCHEMIST - delay and chorus/flanger. See the [Advanced settings](#) section for the [Input Routing](#) setting.

👉 🖱️ To set the **INPUT** gain hold **SHIFT** and turn the **PITCH MOD** knob. **Input gain** is the amount of amplification of your input signal.

SET INPUT LEVEL



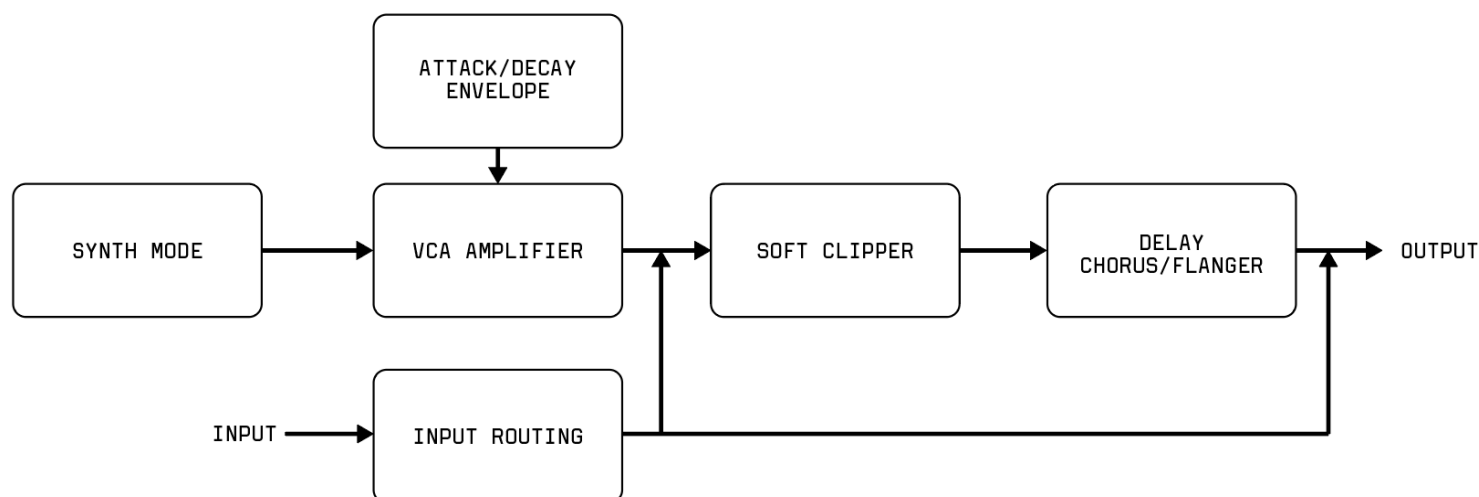
INPUT LEVEL INDICATION



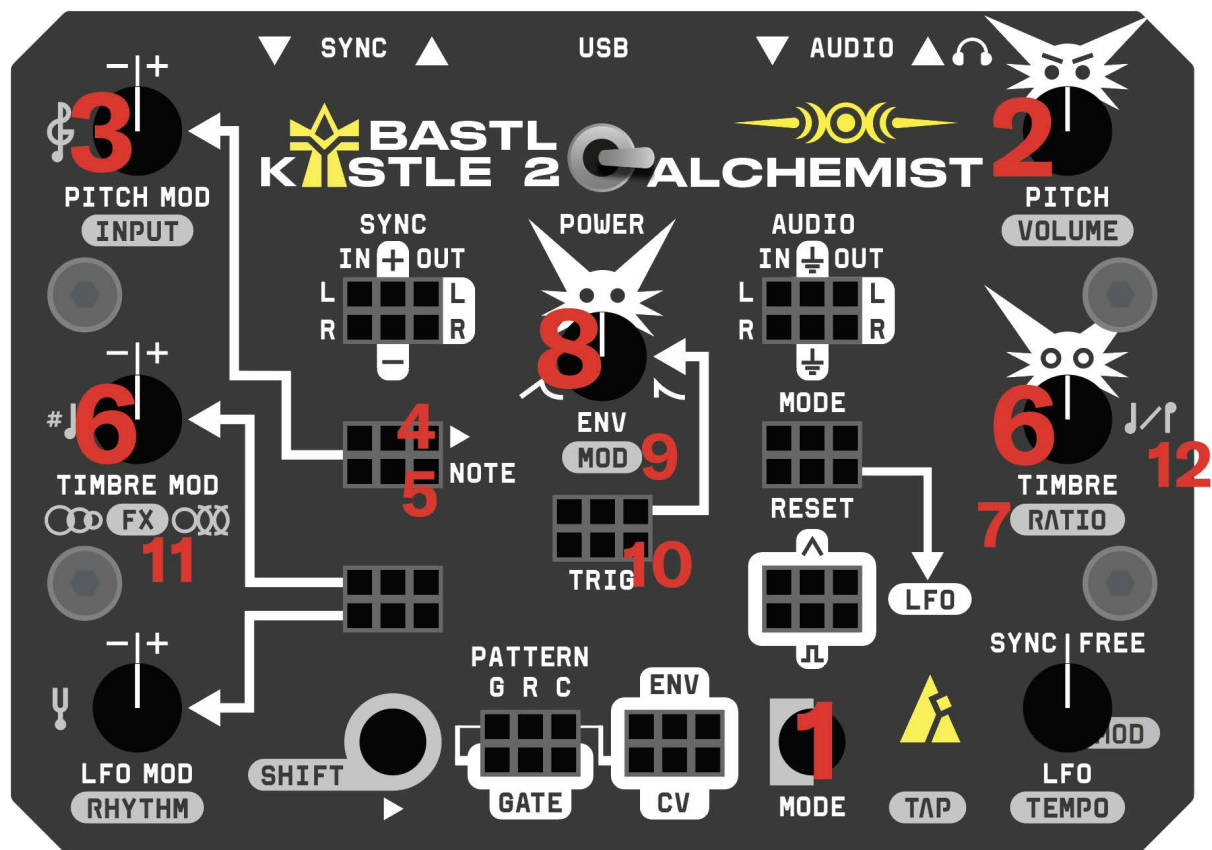
While holding the SHIFT button, the signal strength is indicated by the light in the word KASTLE and when it reaches RED, it is clipping at the input, and you should lower your input gain (unless you want to go for that distortion 🤘). Keep the input gain so the signal is peaking into orange.

NOTE: When connecting an audio signal higher than 6 Vpp (e.g. from Eurorack), the clipping might not be shown (because it already clips on the analog input before it reaches the digital codec). If you want to use a signal higher than 6 Vpp, you need to attenuate it first externally.

Block diagram



Main sound controls



1. MODE

The **MODE** button cycles between different synthesis modes:

- short press MODE = next synth mode
- hold MODE and press SHIFT = previous synth mode

The synthesis mode can be modulated on MODE input.

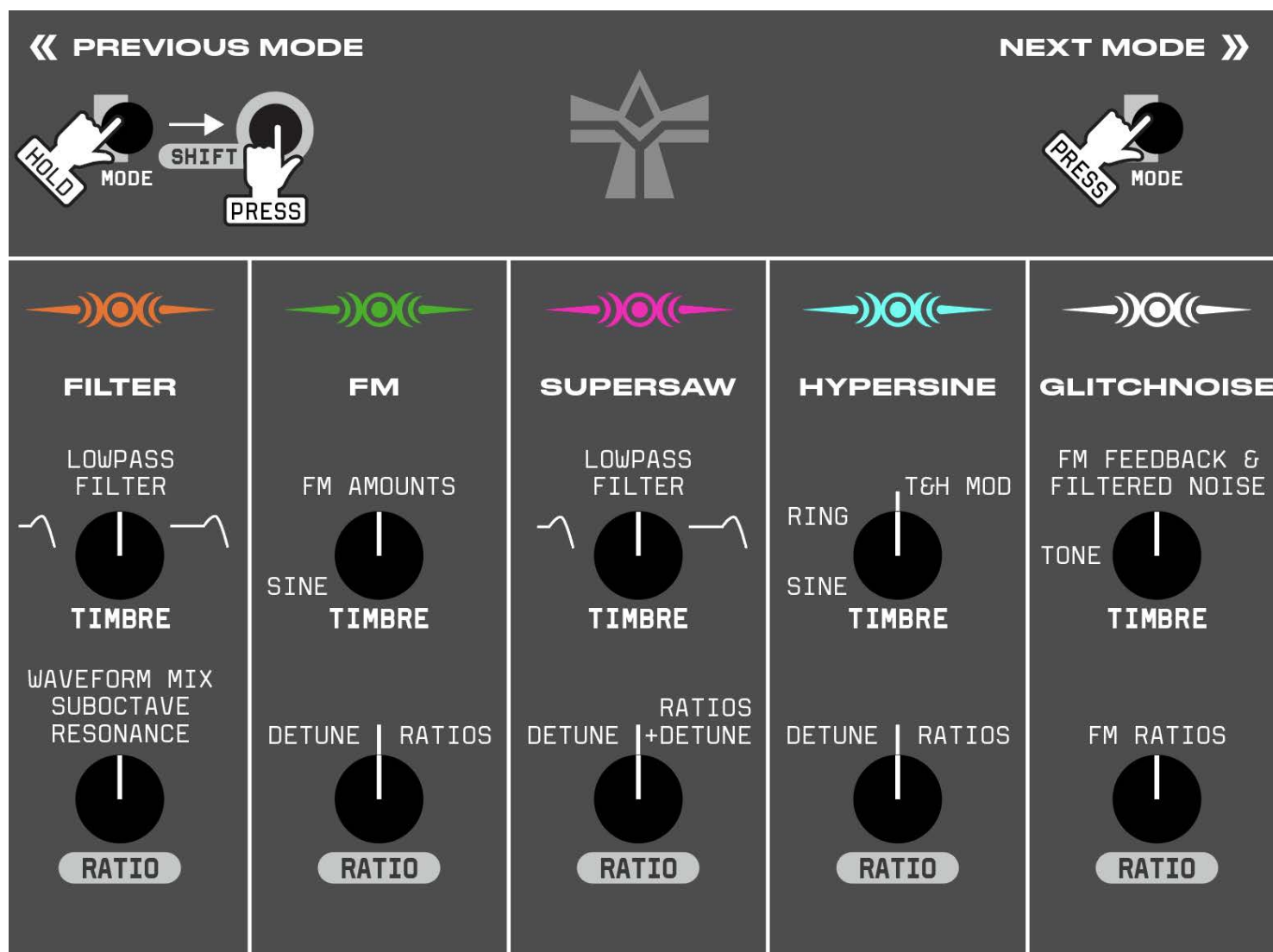
👉 🖱️ Hold MODE and turn ENV is the amount of modulation.

Fully left is no modulation and fully right is positive modulation.

Each mode has two main timbre parameters

- **TIMBRE** tweakable and modulatable
- **RATIO** refines the main TIMBRE sweep.

👉 🖱️ Hold SHIFT and turn TIMBRE to set Ratio.



Filter (Orange)

Subtractive synthesis staple. 3 oscillators with harmonically rich waveforms (saw and square) are detuned and mixed (RATIO) and then they hit resonant lowpass filter (TIMBRE).

FM (Green)

The FM is a classic phase modulation inspired by the likes of DX7. The main Carrier oscillator has two modulators. It produces bell-like sounds with distinct transients or detuned atonal timbres. Set oscillator ratios/detune with RATIO and depth of phase modulation with TIMBRE.

Supersaw (Magenta)

Classic trance music staple with a twist. Detune three saw wave oscillators (RATIO) and filter them with plain lowpass filter (TIMBRE)

Hypersine (Cyan)

Unique sounding digital mode inspired by the original Kastle Synth. Two oscillators ringmodulate each other while the third adds track and hold modulation in higher TIMBRE settings. Detune the oscillators with Ratio.

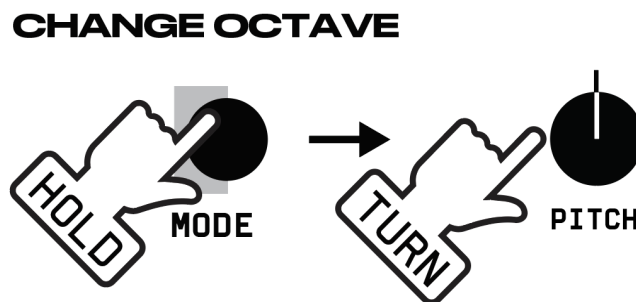
Glitchnoise (White)

Noisy and unpredictable with a lot of strange and unique sweetspots to hunt for. Honestly, I do not even know what is really happening... but I love it!

2. PITCH knob

The PITCH knob sets the base NOTE over 6 octaves. It starts with the selected ROOT note and the knob sweep is quantized to the selected SCALE.

👉 🖱️ Hold MODE and turn PITCH knob to change the octave. The current melody will be transposed by the octave if you do so.



3. PITCH MOD

The PITCH MOD knob sets how much the PLAY and NOTE inputs affect the pitch. To the right the pitch will go higher, in the middle it will not affect the pitch and to the left the pitch will go lower.

The interplay of the two pitch modulation inputs is where intricate sequences and arpeggios unfold.

4. NOTE

The NOTE input is updated only when a trigger is detected at the TRIG input.

The **base NOTE** is established by the position of the PITCH knob and the voltage at the NOTE input (attenuated by the PITCH MOD knob).

The base NOTE will always be aligned to the selected SCALE (see the [Quantizer](#) section for more information).

When PITCH MOD knob is fully clockwise NOTE input tracks V/Oct. To enable all semitones - choose the chromatic SCALE.

Note: Because the Note input updates only with TRIG it might result in a hanging remembered voltage. If the input is detected as unpatched for a while it will reset back to 0V.

5. ►PLAY

The ►PLAY input generates 3rds, 5ths and octaves above the **base NOTE**. These intervals will always be quantized to the selected SCALE.

When voltage at the PLAY input (attenuverted by the PITCH MOD knob) changes it will trigger the envelopes.

The envelope triggers will be time aligned to a PLAY GRID. The PLAY GRID is typically a faster version of the clock and the exact division/multiplication is affected by the ENV knob and the TEMPO. It is tuned to be always in a musical time scale.

Understanding the ►PLAY and NOTE interaction

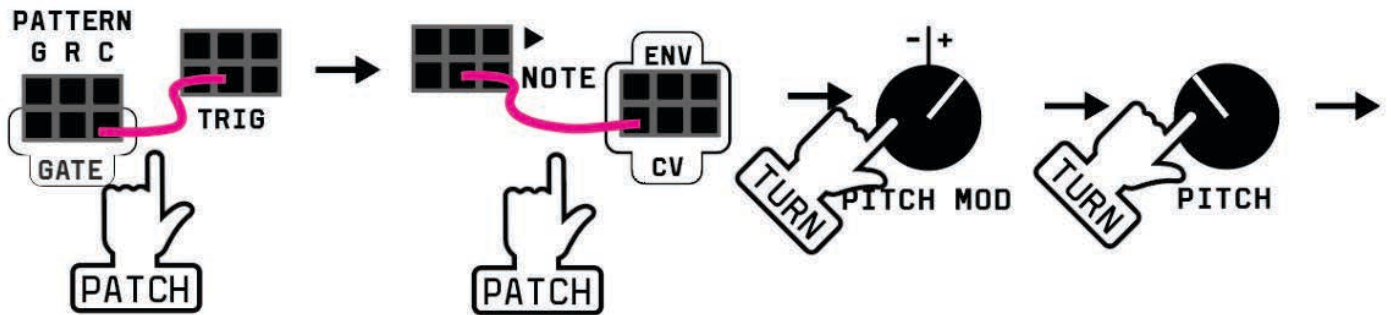
The ►PLAY input can give you great arpeggios. Patch in the triangle LFO while feeding the NOTE input with CV and the TRIG input with GATE.

In musical theory terms the CV would be the root note of your arpeggio chord. The LFO would be the arpeggio shape and the GATE would be the harmonic rhythm at which you progress the chord progression.

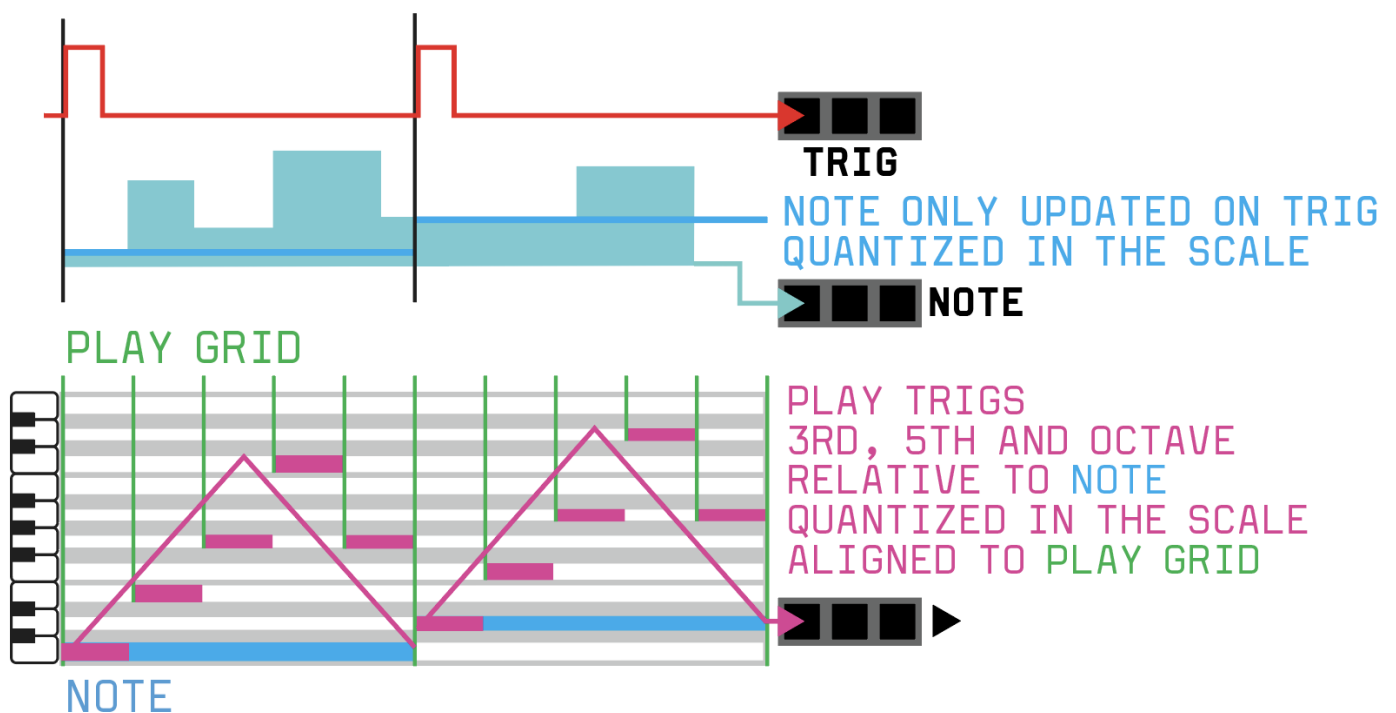
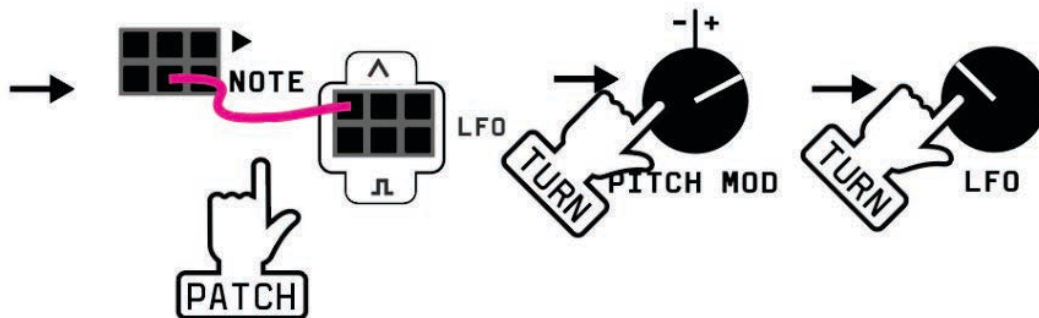
This builds understanding regarding the mechanics of the PITCH MOD inputs.

Experiment! There are no rules - only your imagination.

DISCOVER A MELODY

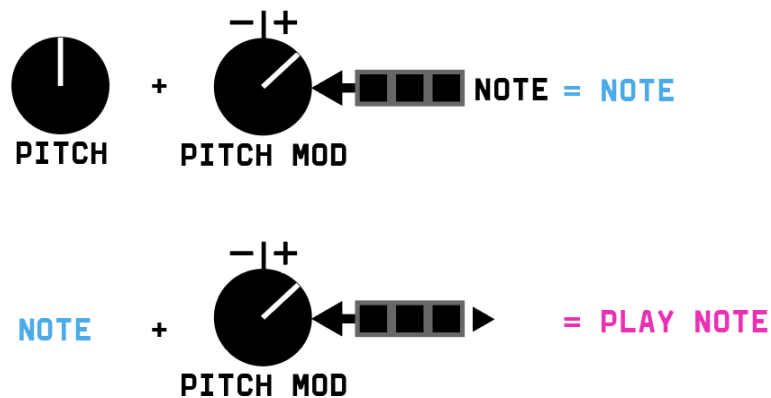


ARPEGGIATE IT



TIP: Speed up unsynced LFO to be faster than the PLAY GRID to generate semirandom arpeggio shapes.

Below is a simplified diagram of how the NOTE and ►PLAY inputs combine. The resulting note will always be quantized to the selected SCALE.

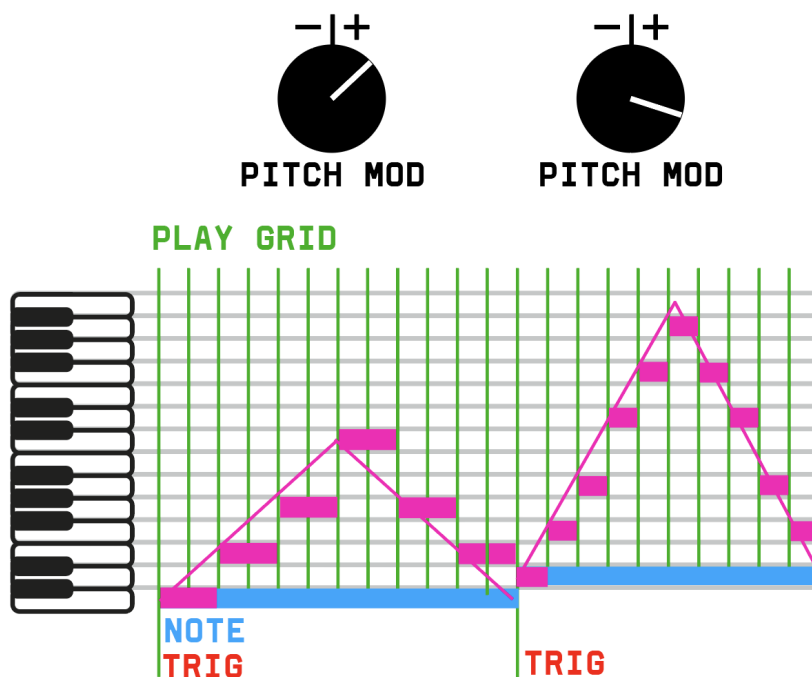


Opening the PITCH MOD knob will generate more PLAY NOTES. This is a great way to make faster arpeggios that span a bigger pitch range.

Note: Turning ENV further to the left or right will result in sparser PLAY GRID and therefore sparser arpeggio which goes well with longer attack/decay envelopes.

Play with LFO, ENV, PITCH MOD and PITCH knobs to find the perfect arpeggio!

OPENING PITCH MOD WILL GENERATE MORE PLAY NOTES

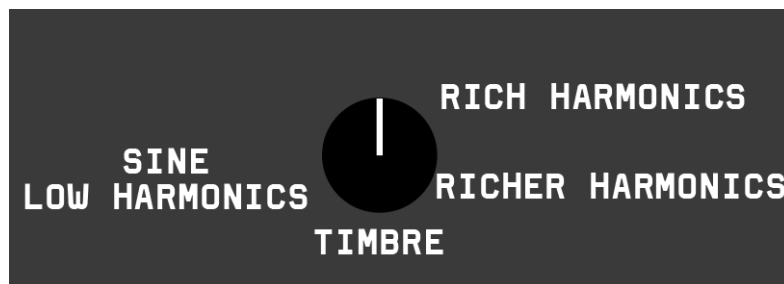


TIP: If using GATE to feed the TRIG input also patch it to the RESET of unsynced LFO. This results in interesting musical arpeggio shapes.

6. TIMBRE

The TIMBRE knob is the main control to go from low harmonic sine waves to full spectrum timbres. It changes the mechanics of adding the waveform complexity from synth mode to synth mode.

The TIMBRE MOD knob sets how much the TIMBRE knob is modulated via the TIMBRE MOD input. In the middle there will be no modulation, to the right it will increase positive modulation and to the left it will increase negative modulation.

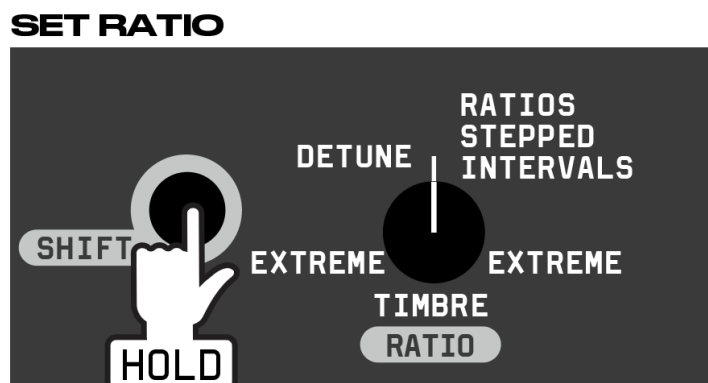


7. RATIO

👉🕒 Hold SHIFT and turn TIMBRE knob to adjust RATIO.

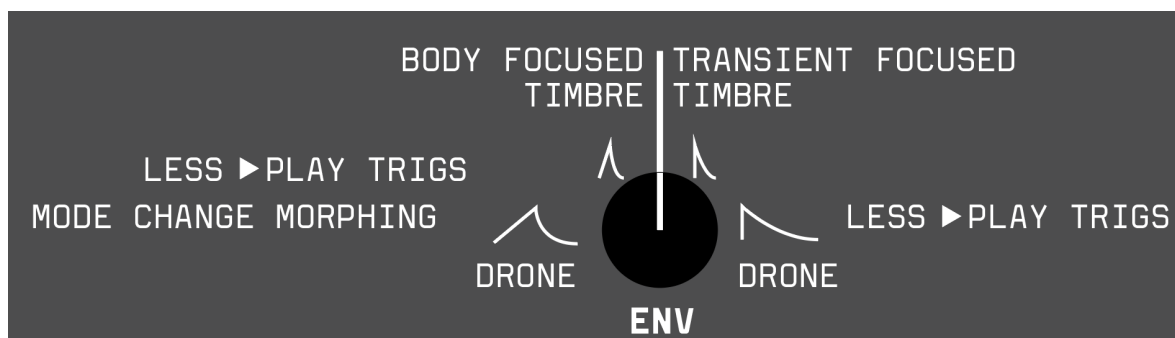
RATIO refines the main TIMBRE sweep and defines character for each synth mode. In most cases it sets the detuning/ratio of the different oscillators as well as the ratios of their different waveform mixing. The exact function depends on the synth MODE.

RATIO is remembered and autosaved for each synth mode separately.



8. ENV

The ENV knob is literally the center piece of the ALCHEMIST; it does influence other parameters in a musical way and it becomes sort of a PAD/REVERSE/PLUCK/DRONE macro knob.



ENV knob to the **right**

- increases the DECAY time
- the TIMBRE control will focus more on transients
- above 3 o'clock it makes sparser PLAY GRID (slower arpeggios)
- fully right it activates drone mode

ENV knob to the **left**

- increases both ATTACK and DECAY
- focuses TIMBRE more towards the body of the sound
- the main volume envelope does not re-trigger in the ATTACK phase
- below 9 o'clock it makes the PLAY GRID sparser
- below 9 o'clock it introduces MODE MORPHING for continuous transition between synth modes – perfect when MODE is modulated
- fully left it activates morphing drone mode

9. ENV MOD



Hold SHIFT and turn ENV knob to adjust the amount of ENV modulation.

The envelope and the macros it adjusts can be modulated via the ENV MOD input. ENV MOD in the middle of the knob will mean no modulation and will increase positive modulation to the right and increase negative modulation to the left.

Note: for empirically tested reasons we decided it is better to not enter/leave drone mode via modulation. The drone mode can be only set by the knob position.

ENV OUT

The ENV output mirrors the main amplitude envelope with the exception of the drone mode at both extremes of the ENV knob. In those positions it will simply render a long envelope that can still be triggered and can still be used for modulation.

ENV MOD is only updated when envelopes are triggered. It does not require a trigger from the TRIG input. It updates also on triggers caused by the ►PLAY input.

TIP: You can enter drone mode with the ENV knob position and because you cannot modulate out of a drone mode you can still modulate the ENV MOD input and get various envelopes from the ENV output that can be used for timbral modulation.

10. TRIG

The TRIG input is the main out of the 5 different ways to trigger envelopes and sound on the Alchemist. Detecting the rising edge on the TRIG input will trigger all internal envelopes and also will update the NOTE input. That means you can use various different signals to trigger stuff.

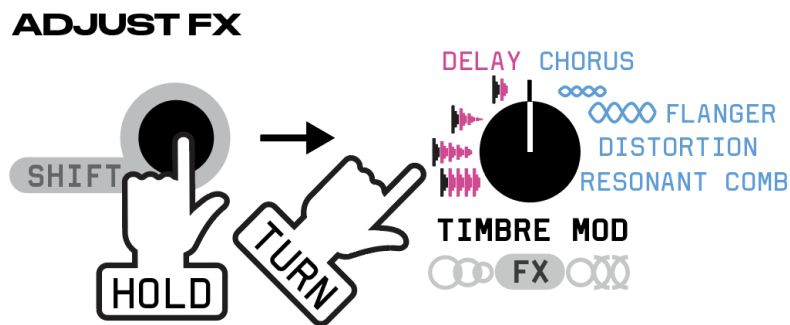
5 ways to trigger the sound on the Alchemist:

- Rising edge on the TRIG input
- Short press of the SHIFT button
- Modulation the ►PLAY input
- Entering drone mode with the ENV knob
- Sending MIDI notes via USB MIDI

11. FX

👉🔧 Hold SHIFT and turn TIMBRE MOD knob to set the FX.

The timbral palette of the Alchemist extended by the dual FX section which offers either a wide delay that will smear the arpeggios into echoed harmonies or chorus-flanger-distortion-combfilter macro custom tuned for each synth mode.



The Delay is always synced to TEMPO and set to 3/8th of a note. Increase tempo for shorter delays and vice versa.

TIP: to modulate the delay time you can use LFO PULSE patch it to SYNC IN and then modulate the LFO.

The right side of the FX knob is custom tailored to each synth mode. It usually starts by widening the stereo field with a chorus that becomes more resonant as you increase the FX knob. Some modes also introduce various types of distortion that have exciting interplay with the TIMBRE and RATIO settings.

TIP: The right-most FX setting in both FM and GLITCHNOISE modes creates a resonant delay line aka comb filter aka Karplus-Strong resonator with its frequency aligned to the PITCH. Set the ENV knob slightly to the right of the centre for short impulses to excite the FX resonator. Make pitch go really low with negative PITCH MOD to explore extreme sound design.

12. PITCH SLIDE 🎵📏

👉🔲 Hold MODE and turn TIMBRE knob to set the PITCH SLIDE.

Pitch Slide is a great way to change the expression of your patch by applying pitch envelope and portamento.

- to the right applies positive envelope to pitch
- early to the left it applies inverse envelope to the pitch
- further to the left increases portamento (all pitch change is slowed down)

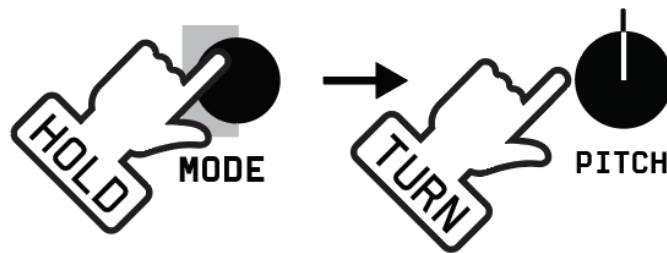


QUANTIZER

You can play the synth quantized to pitch in a musical scale.

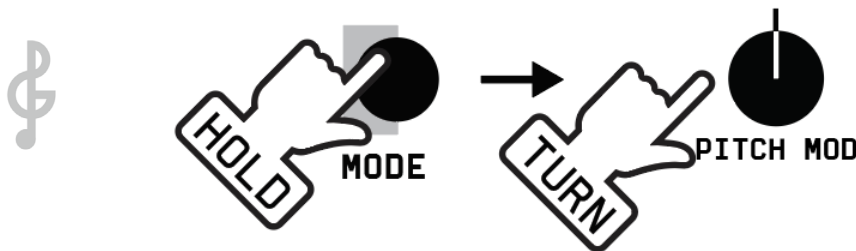
The NOTE PITCH MOD patch point modulates the pitch in a quantized manner, based on the selected scale. It updates the pitch only when the TRIG is triggered.

CHANGE OCTAVE

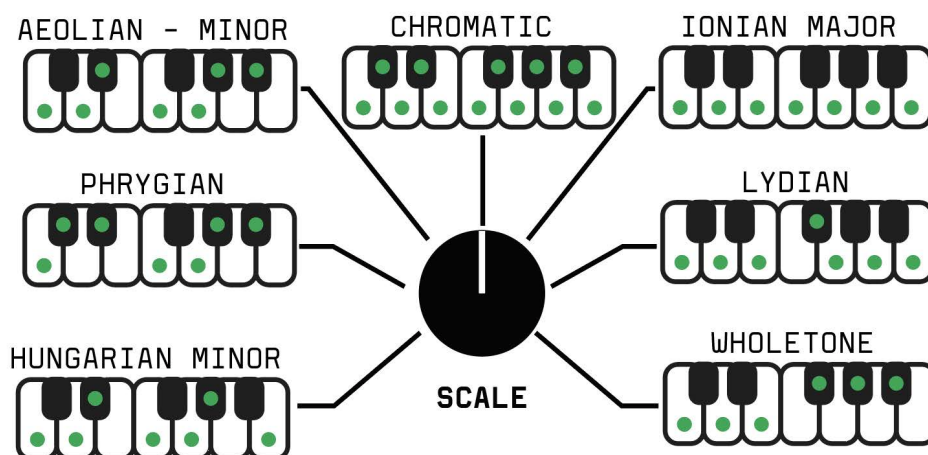


👉🖱️ Hold **MODE** and turn the **PITCH knob** to select the octave.

SELECT SCALE

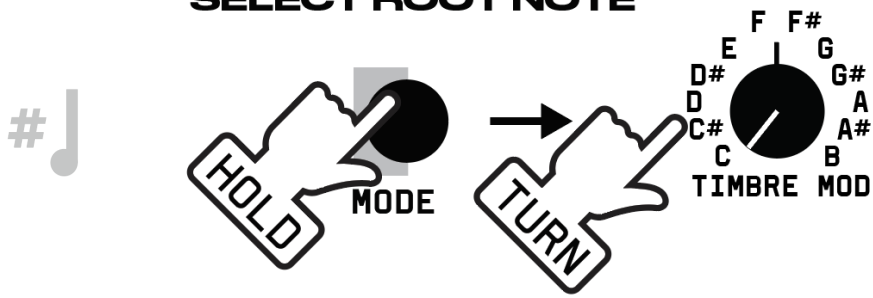


👉🖱️ Hold **MODE** and turn the **PITCH MOD knob** to select the quantizer scale. When the scale changes, the lights will briefly dim. The following picture illustrates this with the **ROOT** set to **C**.



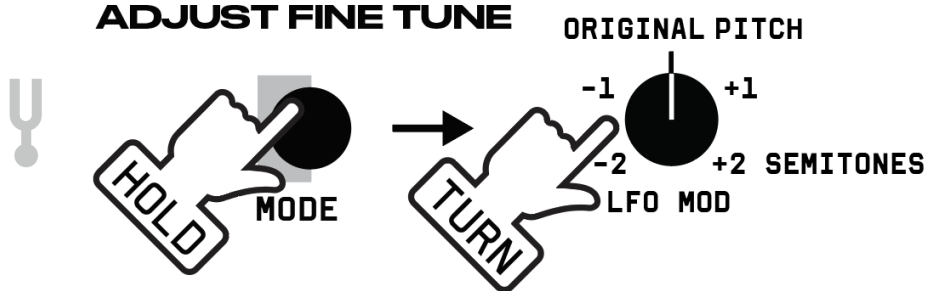
You can edit all scales via the **WEB APP** Refer to the [WEB APP](#) section for more details.

SELECT ROOT NOTE



👉🖱️ Hold **MODE** and turn the **TIMBRE MOD knob** to select the root note of the quantized scale. When the root note changes, the lights will briefly dim.

ADJUST FINE TUNE



👉🖱️ Hold **MODE** and turn the **LFO MOD knob** to adjust the fine-tuning by ± 2 semitones. This adjustment is applied after the quantizer.

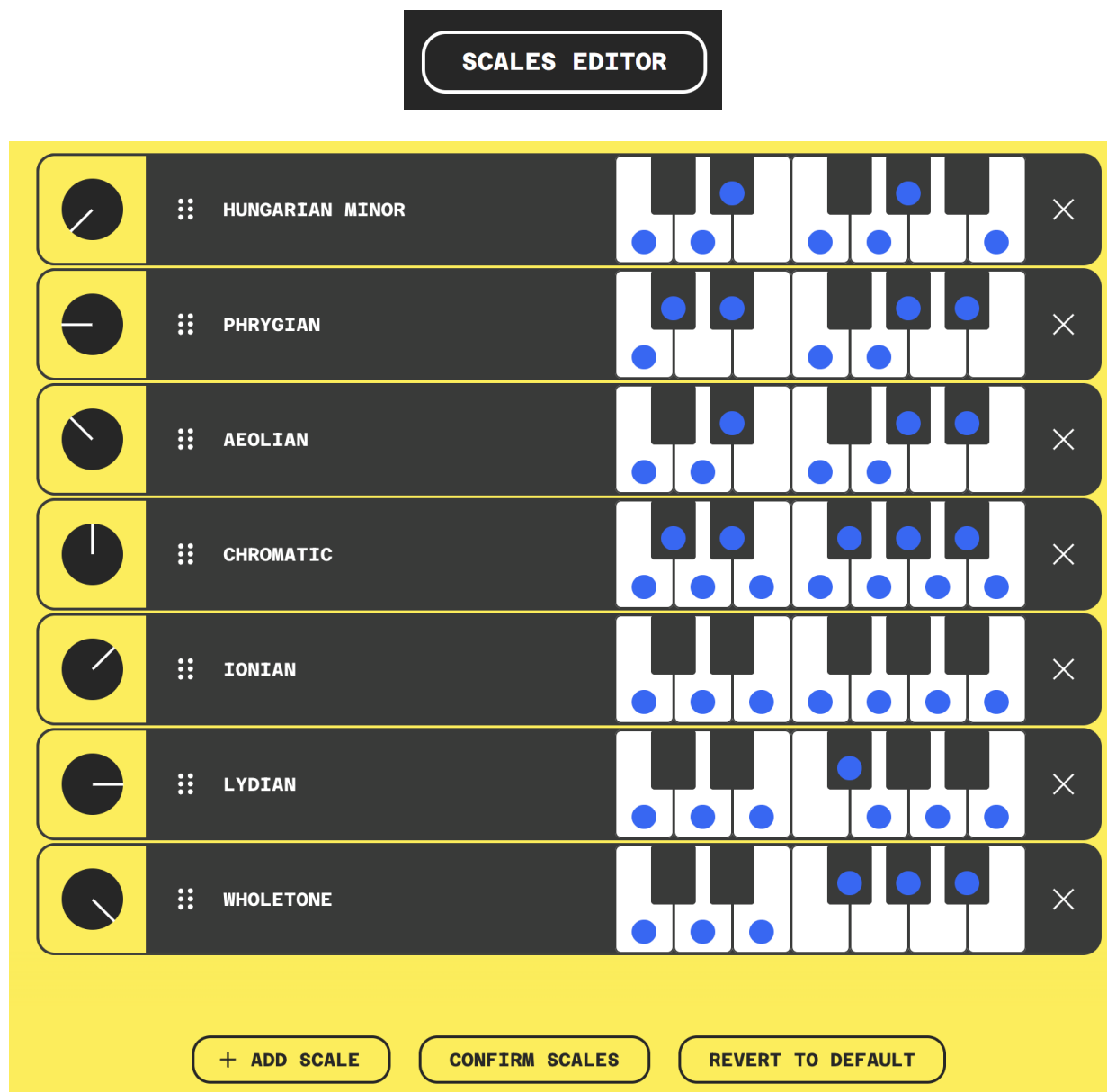
EDITOR

The online editor app allows you to edit RHYTHMS and SCALES.

<https://apps.bastl-instruments.com/alchemy-laboratory/>

Scales Editor

Click on the SCALES EDITOR button to access the editor.



Edit Scales

Click on the piano keys to edit your scales.

NOTE: Scales remain accurate if the **ROOT** note is set to **C**, and the **FINE** tune knob is centered. Refer to the **Quantizer** section for additional details.

Preview and Manage Scales

- Preview the entire scale by clicking on its name.
- Rearrange scales by dragging the dots on the left side of each scale.
- Delete scales by clicking the **X** icon.
- Add new scales using the **+ADD SCALE** button.

Scale Limits

- Minimum number of scales: **3**; Maximum number of scales: **32**

Finalize Edits

- Use the **CONFIRM SCALES** button to save your changes.
- Undo edits with the **REVERT TO DEFAULT** button.

Rhythms Editor

Access the editor by clicking on the **RHYTHMS EDITOR** button.

On the **ALCHEMIST**, rhythms can be loaded by holding **SHIFT** and turning the **LFO MOD knob**. These rhythms will be sent as triggers through the **GATE** output.



Edit Your Rhythms

- Click on the steps to edit your rhythms.
- Preview the rhythm by clicking the **PLAY** button and stop it using the **STOP** button.
- Add new rhythms by clicking the **+ADD RHYTHM** button.

Manage Rhythms

- Rearrange the order of rhythms by dragging the dots on the left side of each rhythm.
- Delete rhythms by clicking the **X** icon.

Rhythm Limits

- Minimum number of rhythms: **3**; Maximum number of rhythms: **32**

Finalize Edits

- Save changes by clicking the **CONFIRM CHANGES** button.
- Undo edits with the **REVERT TO DEFAULT** button.

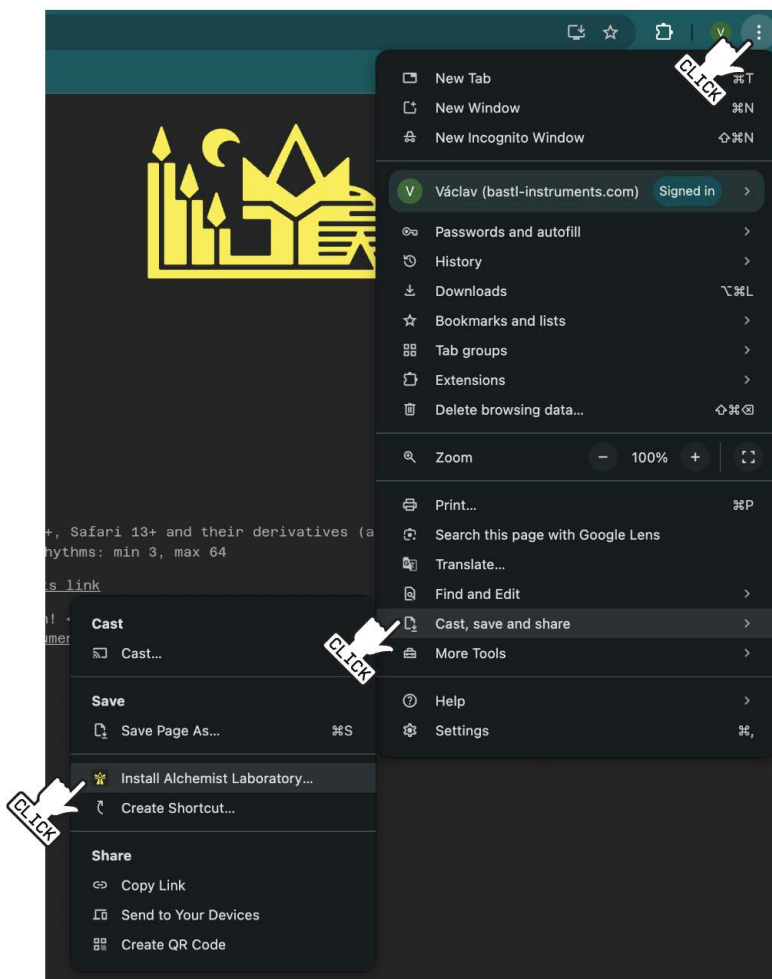
Supported Browsers

Chrome 76+, Edge 79+, Firefox 76+, Safari 13+, and their desktop derivatives.

App Offline Mode

Even though the **ALCHEMIST Laboratory** is a web app, you can install it as a local application using **Chrome** (or its derivatives) and access it even without an internet connection.

NOTE: Safari and Firefox are not supported due to their lack of PWA (Progressive Web App) technologies.

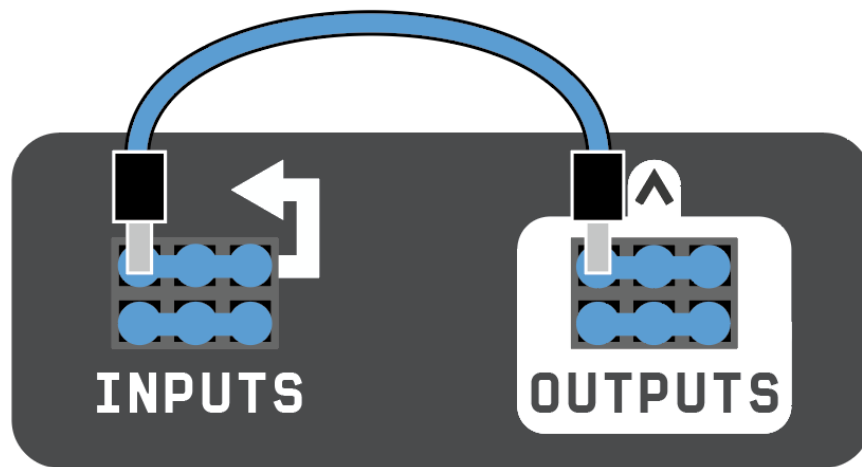


PATCHBAY

The **Patchbay** on the **Kastle 2** consists mainly of triple patch points, where the three horizontal points are interconnected.

Exceptions:

- **AUDIO** and **SYNC** labeled connectivity patch points.
- **PATTERN GENERATOR** inputs, where each patch point serves a unique purpose.



Patchbay Details

- **Outputs:** Marked with a white outline and labeled within the outline.
- **Inputs:** Labeled with white text or white arrows pointing towards their respective modulation destinations. Inputs do not have a white outline.

Compatibility

The patch points are 0–5 volt compatible:

- **Inputs** accept voltages between 0 and 5 volts.
- **Outputs** can output between 0 and 5 volts or less, depending on the power source.

Connections

Typically, **Outputs** are connected to **Inputs**, but multiple Outputs can be connected to a single Input. The patchbay is designed to combine signals, so don't worry—it's built to handle this without causing any issues.

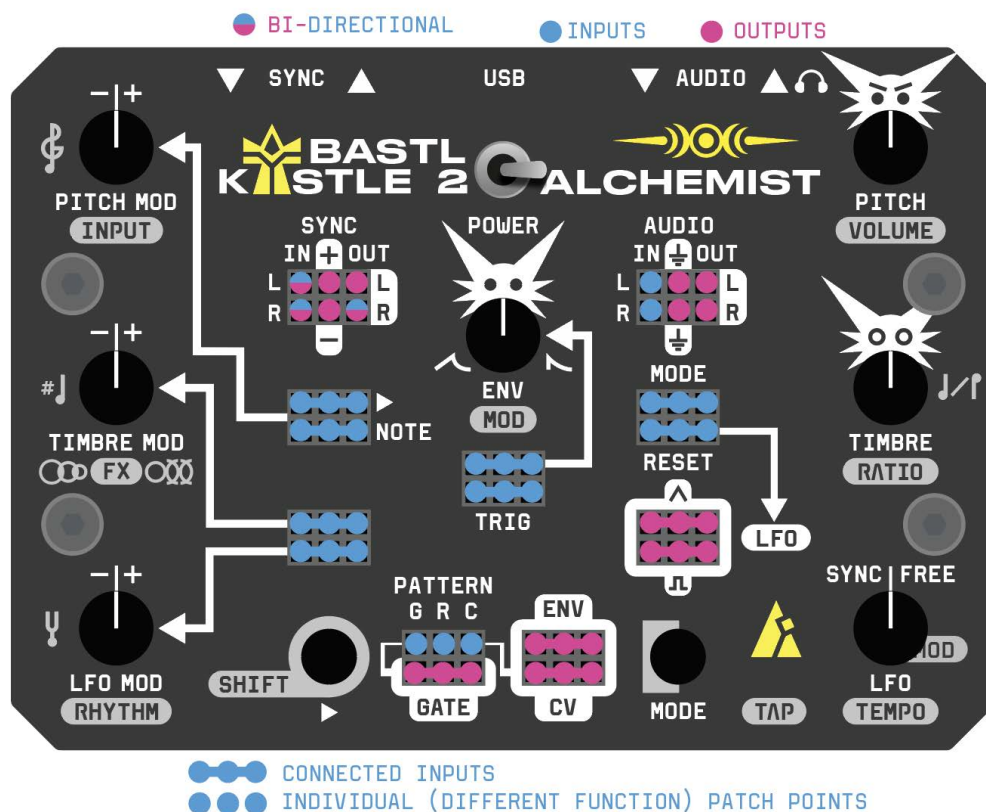
Bi-Directional Patch Points

There are three **Bi-Directional patch points** that can be used for sending signals in or out of the **Kastle** via the **TRS jacks** located at the back.

- **Plus (+)**: Represents a logic high output (~5V).
- **Minus (-)**: Represents a logic low output (~0V).
- Both outputs are resistor protected, so patching them together results in a combined voltage of approximately 2.5V.
- **Ground Symbol ($\equiv$)**: Serves as a direct ground reference, ideal for interfacing with multiple devices, breadboards, etc.

NOTE: When patching multiple **Kastles** or devices with compatible headers, it is essential to connect the grounds of all devices.

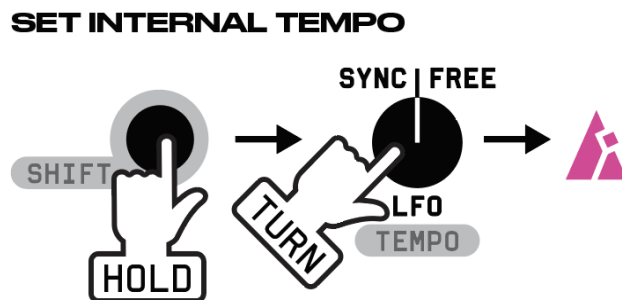
- This connection happens automatically when using **audio** or **sync jacks**.
- If you wish to avoid this, use the **Ground symbol ($\equiv$)** patch point and connect it to the **ground** or **minus (-)** patch point on the other device.



TEMPO GENERATOR

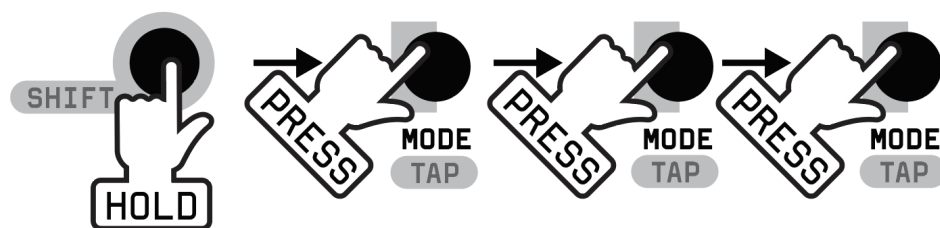
The **Tempo Generator** operates independently from the **LFO** but allows the **LFO** to be synchronized to the tempo. The tempo source can be either internal or external.

Set the Internal Tempo



👉🖱️ Hold **SHIFT** and turn the **LFO knob**, indicated by the magenta-colored metronome light.

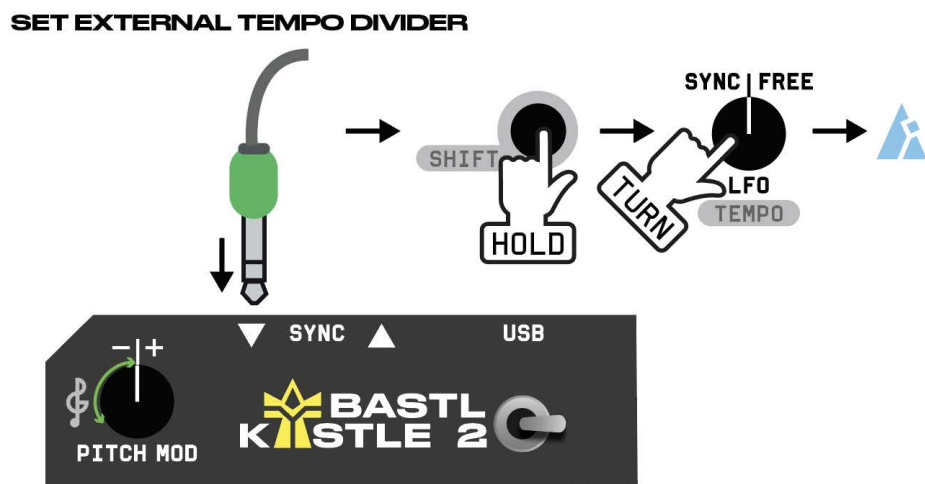
TAP TEMPO



👉👉 Hold **SHIFT** and press **MODE** repeatedly to **TAP** the tempo.

Sync to External Tempo

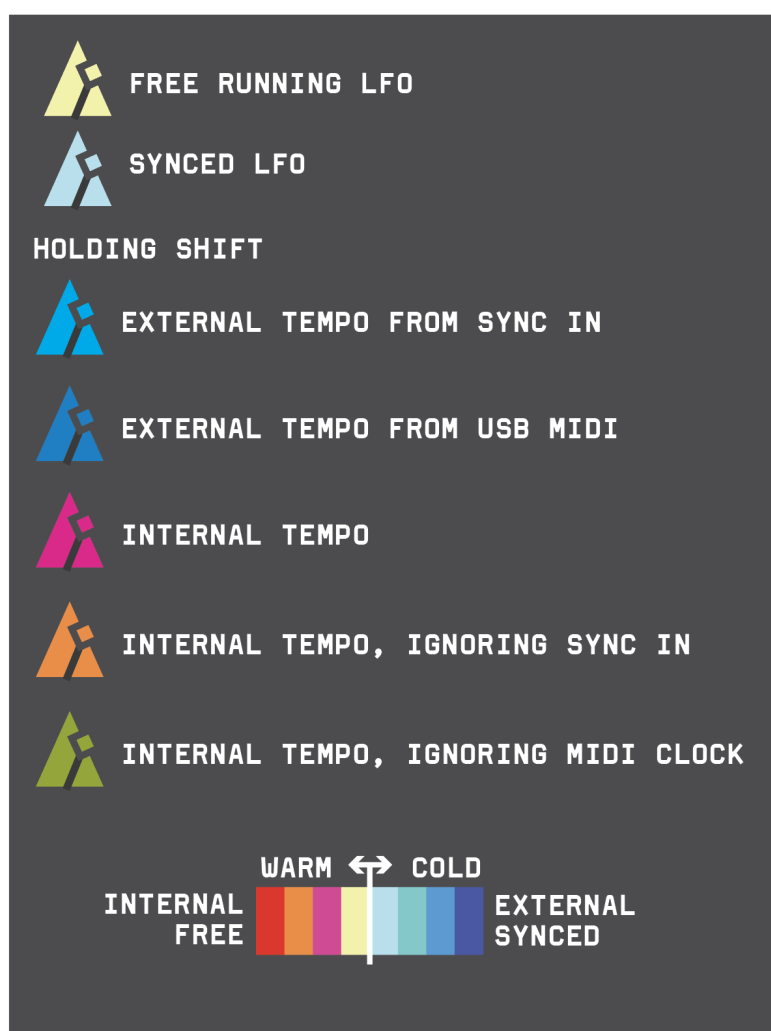
Connect an analog clock signal to the **SYNC IN**.



👉🔲 Hold **SHIFT** and turn the **LFO knob** to select the tempo divider, indicated by the cyan-colored metronome light.

While holding the **SHIFT button**, the metronome light indicates the clock status:

- **Light blue (cyan):** External tempo is active.
- **Light pink (magenta):** ALCHEMIST is running on the internal clock.
- **Blue:** ALCHEMIST is running on the USB MIDI clock. See the [USB MIDI](#) section for more info.
- **Orange:** ALCHEMIST is using the internal clock and ignoring the external analog clock.
- **Khaki:** ALCHEMIST is using the internal or external clock and ignoring the MIDI clock.



NOTE: The regular clock priority is: USB MIDI clock, over the SYNC IN, over the internal clock.

NOTE: To toggle between allowing or ignoring the external clock or MIDI clock, refer to the [Advanced settings](#) section.

SYNC

SYNC IN

To sync the **ALCHEMIST** to an external clock, connect an analog clock source to the **SYNC IN** jack. The clock signal will be detected on the left channel of the jack and used as the tempo source.

While holding the **SHIFT button**, the metronome light blinks **light blue (cyan)** to indicate that external tempo is active.

Adjust the tempo divider/multiplier by holding **SHIFT** and turning the **TEMPO knob**.

If the clock signal is not detected for more than 2 seconds, the **Pattern Generator** will reset to its first step, ensuring alignment with your external sequencers when the clock resumes.

NOTE: When the **SYNC IN** jack is connected, the **ALCHEMIST** will always wait for the external clock and will not switch to the internal clock—unless the external clock is set to be ignored. See the [Advanced settings](#) section for more details.

If a jack cable is not connected to the **SYNC IN** jack, you can instead patch a clock signal to the **SYNC IN** patch point in the **patch bay**.

If a clock is detected there, the **ALCHEMIST** will automatically sync to that clock.

When the clock patched through the **patch bay** is not detected for more than 2 seconds (while no jack is connected to **SYNC IN**), the **ALCHEMIST** will switch back to its internal clock.

NOTE: When connecting the **LFO PULSE output** to the **SYNC IN patch point**, ensure the **LFO knob** is in the free (unsynced) section to avoid glitches.

SYNC OUT

Connect **SYNC OUT** to the clock input of a receiving instrument to synchronize it with the clock of **ALCHEMIST**.

You can set the **TEMPO** on the **ALCHEMIST** by holding **SHIFT** and turning the **LFO knob**.

Additionally, you can patch from the **SYNC OUT** patch point to various inputs.

SYNC THRU

When an external clock is connected to the **SYNC IN**, the **SYNC OUT** acts as a **SYNC THRU**. While you can adjust clock dividers/multipliers on the **ALCHEMIST**, all downstream devices will remain synchronized with the master clock.

USB MIDI sync

ALCHEMIST can be synced to USB MIDI clock. Please see the [USB MIDI chapter](#) for more information.

Right Channel Routing

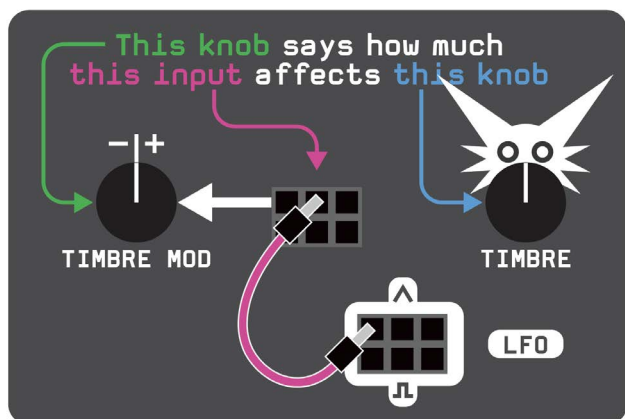
The right channels on the **SYNC IN** and **SYNC OUT** jacks are routed to the **SYNC IN R** and **SYNC OUT R** patch points. These can be used for sending or receiving other control signals.

Refer to the [Modular Connections](#) section for more details.

MODULATION

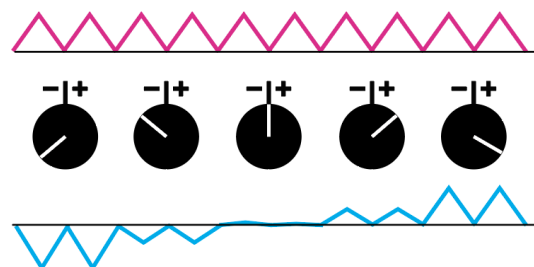
The **Kastle 2** features several modulation sources:

- The **Pattern Generator** is always synced to the tempo.
- The **LFO** can operate in either synced or free mode.
- The **ENV** serves as the primary envelope applied to the volume.



LFO

MODULATION EFFECT



Envelope (ENV)

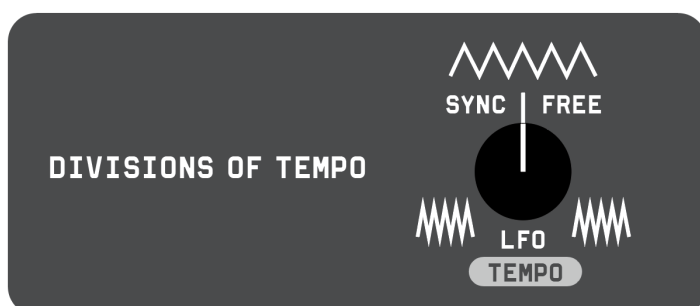
The **ENV output** originates from the main **ALCHEMIST** envelope, adjusted by the **ENV knob**. This envelope controls the loudness or the synth sound. For additional details, refer to the [ENV chapter](#).

The **ENV output** can also be used to modulate the **TIMBRE MOD** or other parameters.

LFO

The **LFO speed** is adjusted via the **LFO knob**:

- At the **middle position**, the LFO operates at its slowest speed.
- Turning the knob **left syncs** the LFO to the tempo, indicated by **cold white light**, with the knob setting the tempo divider.
- Turning the knob **right sets** the LFO to **free-running mode**, indicated by **warm white light**, with increasing speed as the knob turns further.



LFO Outputs and Inputs

LFO offers **TRI** and **PULSE** outputs, **RESET** input and **LFO MOD** input.

- **LFO TRI:** The triangle shape is variable by patching **LFO PULSE** to **RESET** or **LFO MOD** (see below).
- **LFO PULSE:** Outputs a high signal when the triangle is rising.
- **LFO RESET:** The rising edge resets the LFO to the highest point of the triangle waveform.
- **LFO MOD:** Attenuverting input allows for variable LFO shapes when **LFO PULSE** is patched into it.

NOTE: Modulation does not switch between synced and free LFO modes but only speeds up or slows down the LFO.

Changing Modulation Shapes

Modulation shapes can be adjusted through **patch programming**.

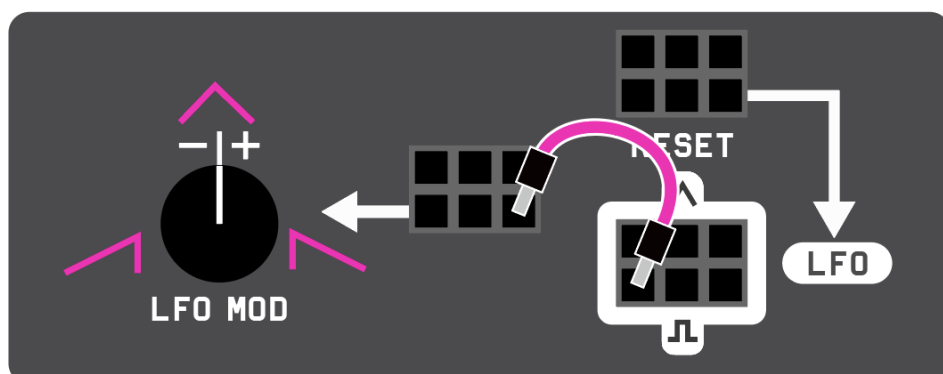
NOTE: The following methods will also affect the LFO speed.

The **LFO PULSE** output changes its pulse width, remaining high while the triangle rises and low while it falls.

LFO Patch Programming variants

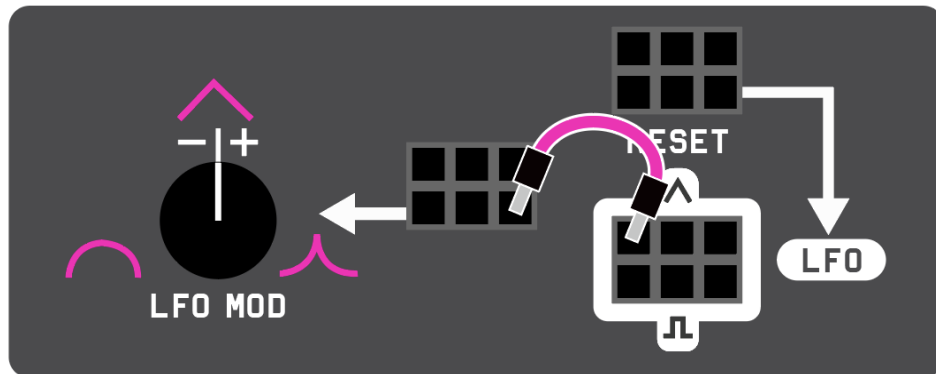
- **Ramp or Saw Shape:**

Patch the **LFO PULSE** to the **LFO MOD input** and adjust the **LFO MOD** to tilt the triangle into a ramp or saw shape. Adjust the **LFO knob** to fine-tune the result, as turning the **LFO MOD** will affect the LFO frequency.



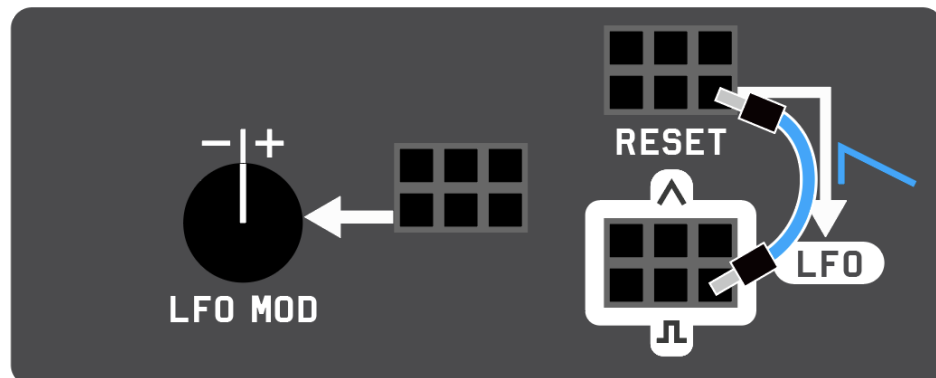
■ Exponential or Logarithmic Shape:

Patch the **LFO TRI** to the **LFO MOD** input and adjust the **LFO MOD** to make the triangle shape more exponential or logarithmic.



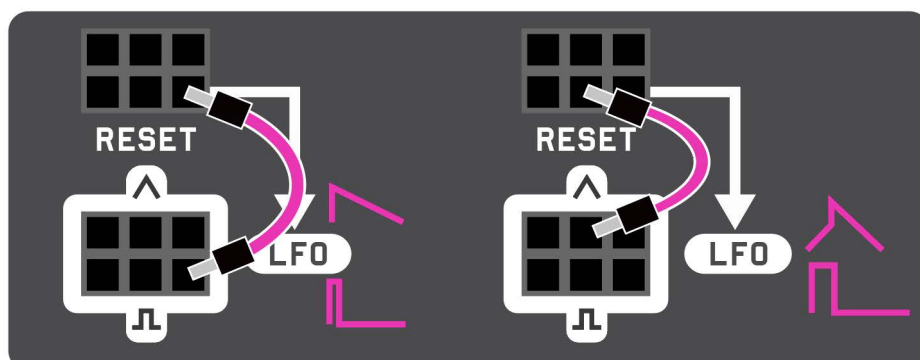
■ Saw Wave Shape:

Patch the **LFO PULSE** to the **LFO RESET** to transform the triangle shape into a saw wave.



■ Hybrid Wave Shape:

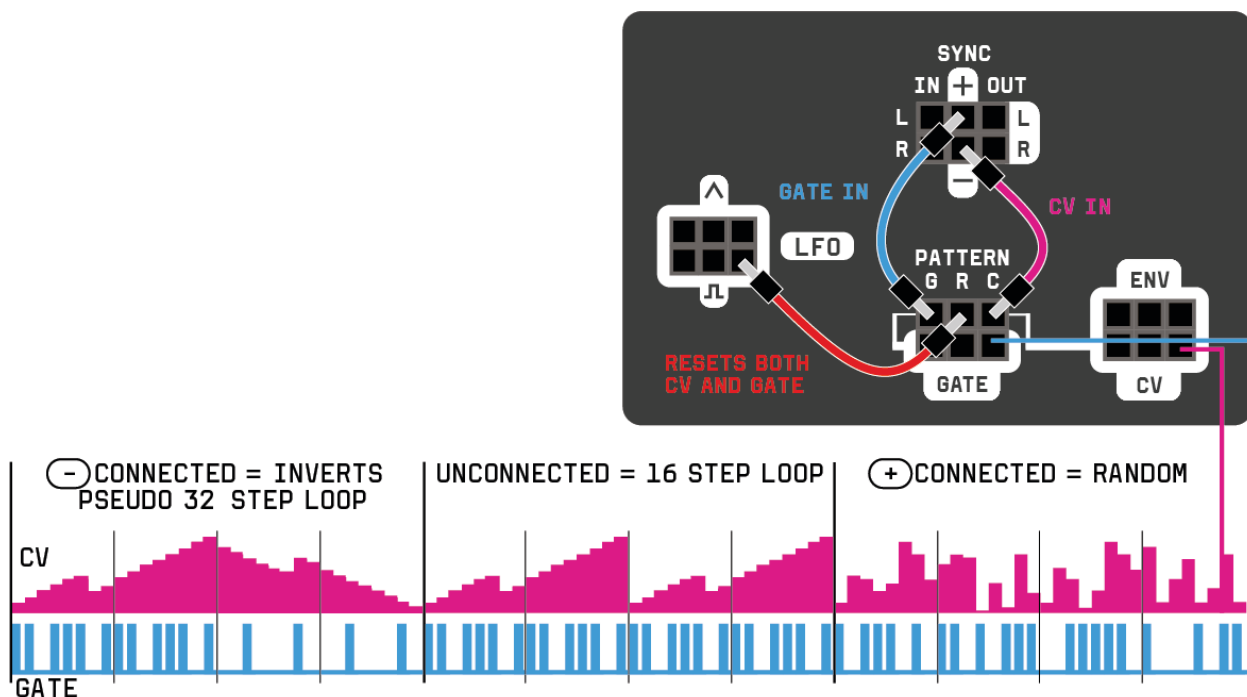
Patch the **LFO TRI** to the **LFO RESET** to create a hybrid wave from the triangle shape.



Pattern Generator

The **Pattern Generator** produces two signals: **GATE** and **CV**, both of which are always clocked by the tempo and run on a 16-step sequence.

- **GATE:** Provides rhythmic information, with the gate length fixed at 75% of the step duration.
- **CV:** Outputs varying stepped voltages.



Reset

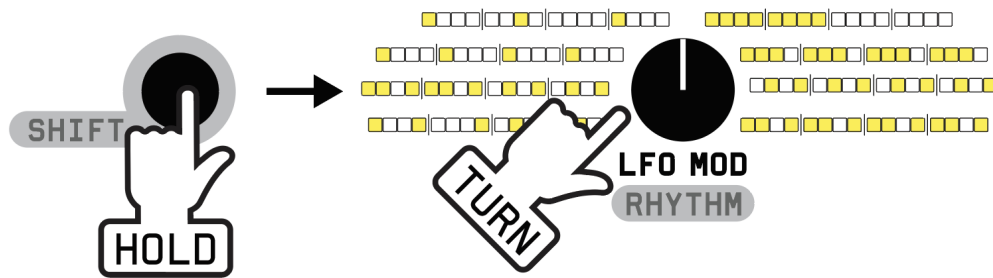
The **GENERATOR RESET** input (PATTERN R – the middle pin) resets both the **GATE** and **CV sequences** upon detecting a rising edge.

- This can be used for synchronization purposes.
- It can also shorten the pattern sequence, for example, by patching in the **LFO**.

Gate

👉🔧 Hold **SHIFT** and turn the **LFO MOD** knob to generate the **RHYTHM sequence** at the **GATE output**. The sequence will be selected from a table of patterns, which are editable via the [WEB APP](#).

SELECT GATE RHYTHM



The **GATE GENERATOR input** (PATTERN G – the left pin) modifies the **GATE sequence** in the following ways:

- **Unconnected:** The gate sequence remains unchanged.
- **Connected to +:** The current position in the gate sequence is randomized.
- **Connected to -:** The current position in the gate sequence is inverted (inactive steps become active and vice versa).

TIP: Try connecting and disconnecting the + or - output to randomize or invert the steps in the pattern until the sequence fits your needs.

CV

The **CV GENERATOR input** (PATTERN C – the right pin) modifies the **CV sequence** in the following ways:

- **Unconnected:** The CV sequence remains unchanged.
- **Connected to +:** The current level of the CV sequence is randomized.
- **Connected to -:** The current level of the CV sequence gets inverted around a center at 2.5V (e.g., 0V becomes 5V, 1V becomes 4V, and 2V becomes 3V, etc.).

TIP: Connect varying voltages to this input to create semi-random and evolving sequences.

Try connecting and disconnecting the + or - output to randomize or invert the steps in the pattern until the sequence fits your needs.

NOTE: If left connected to -, the sequence will continuously invert itself, making it appear **32 steps long**.

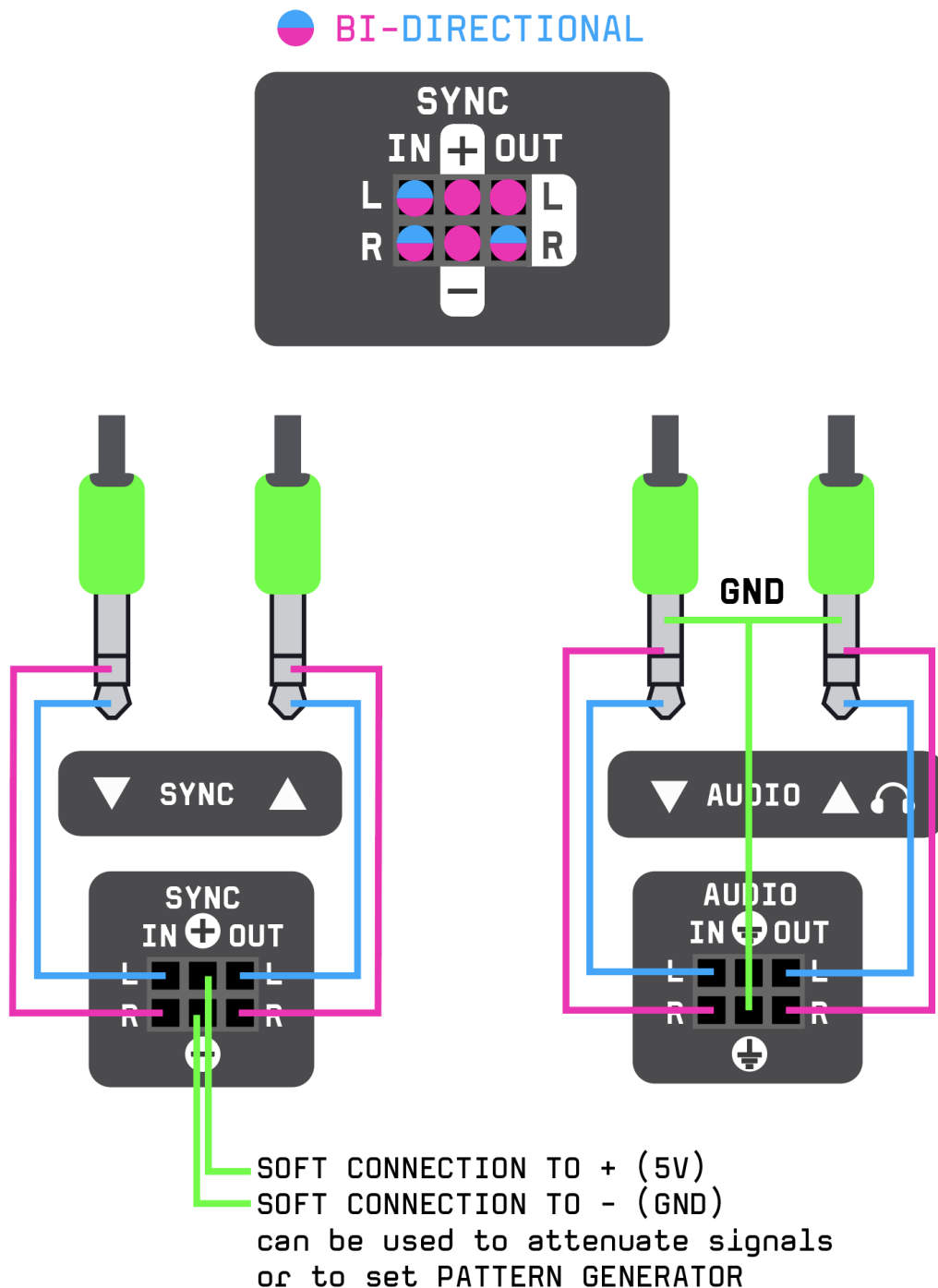
ADVANCED CONNECTIVITY

Modular Connections

The **Kastle 2** features three **bi-directional ports** that can send signals **In** or **Out** to other instruments.

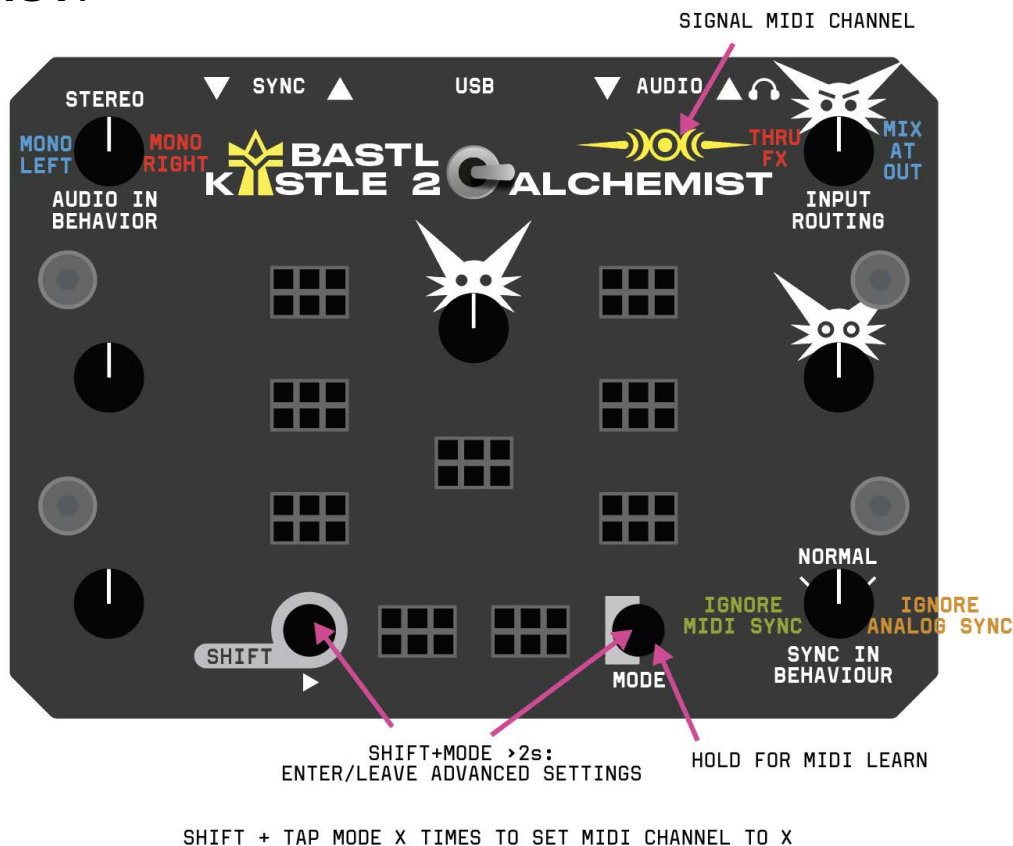
To fully utilize these ports, you may need a **Left and Right splitter adaptor**, as these ports are direct connections to the **TRS** jacks.

NOTE: If you want to use the **SYNC IN** left channel for purposes other than sync/clock signals, you can ignore its default behavior—refer to the [Advanced Settings](#) section for more details.



Advanced Settings

Press and hold both the **SHIFT** and **MODE** buttons for over 2 seconds to enter **Advanced Settings mode**. This mode unlocks expanded connectivity options, allowing you to enhance the capabilities of your **ALCHEMIST**.



Audio Input Behavior

While in **Advanced Settings mode**, adjust the **PITCH MOD** knob, and the **KASTLE logo light** will change colors to indicate the input mode:

- **BLUE**: Mono input (left channel only). Turn the knob **left**.
- **WHITE**: Stereo input. Leave the knob in the **center position**.
- **RED**: Mono input (right channel only). Turn the knob **right**.

Use the **mono input** setting if you are processing a mono signal and want the left channel to be processed by both the left and right channels of the **Kastle FX core**. This can be particularly useful:

- When sending a clock signal on the right channel and audio only on the left channel (or vice versa—hello, TE-PO).
- When your device outputs only a mono signal.

For additional details, refer to the [Syncing with Pocket Operators](#) guide.

Input Routing

Use the **PITCH knob** to determine the internal routing of **AUDIO IN**:

- **Turn Right (BLUE LIGHT)**: Mix the AUDIO IN with the **ALCHEMIST** sounds at the output.
- **Turn Left (RED LIGHT)**: Route the AUDIO IN through the **ALCHEMIST's** effects.

Ignore USB MIDI Clock / Sync Input

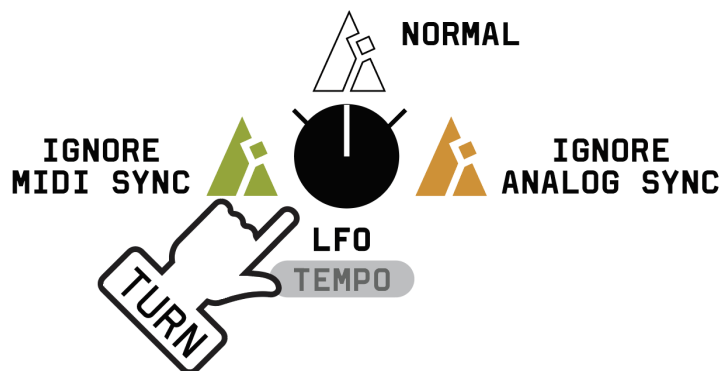
You can configure your **ALCHEMIST** to always use its internal clock and ignore the external clock connected via the **USB MIDI, SYNC IN jack** or **patch input**.

This allows the **SYNC IN jack** to be repurposed for inputting external voltages and routing them to desired destinations.

While in **Advanced Settings mode**, adjust the **LFO knob**, and the **LFO light** will change colors:

- **KHAKI**: Ignore MIDI Clock (turn the knob **left**).
- **WHITE**: Normal operation (knob in the **center** position) = honors the regular clock priority: MIDI clock, over the SYNC IN, over the internal clock.
- **ORANGE**: Ignore sync input (turn the knob **right**).

SET INPUT CLOCK HANDLING



To exit **Advanced Settings mode**, either:

1. Turn the **Kastle ON/OFF** (settings are automatically saved).
2. Hold **SHIFT** and **MODE** for 2 seconds.

MIDI IMPLEMENTATION

Setting the MIDI channel

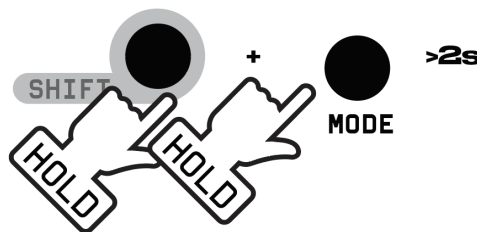
Kastle 2 uses the same MIDI channel for both input and output.

NOTE:

The MIDI channel applies to Note, Pitch Bend, and CC (Control Change) messages. As the MIDI Clock messages do not carry channel information, channel settings have no effect on clock transmission or reception.

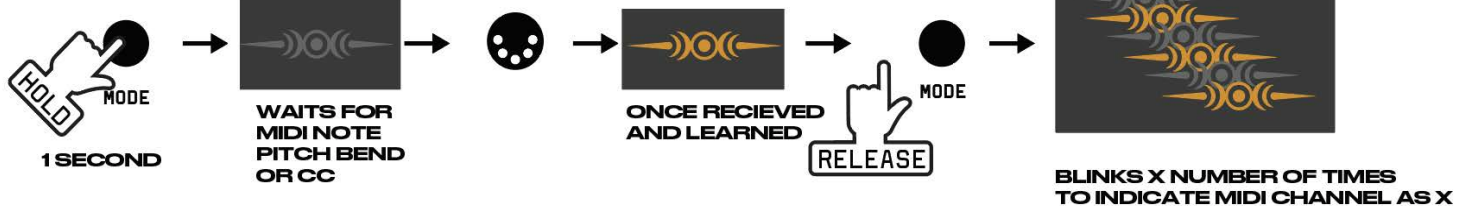
You can learn or set the MIDI channel in the Advanced settings mode. Enter (or leave) the Advanced Settings mode by holding SHIFT and MODE for 2 seconds.

ENTER ADVANCED SETTINGS



Learn the MIDI channel

LEARN MIDI CHANNEL



To MIDI learn the MIDI input/output channel, hold the MODE button for at least 1 second. The top right light will turn off.

Send any MIDI message (Note, CC, or Pitch Bend). The channel of the received message will be assigned as the new MIDI input/output channel. The top right light will turn orange to confirm the assignment.

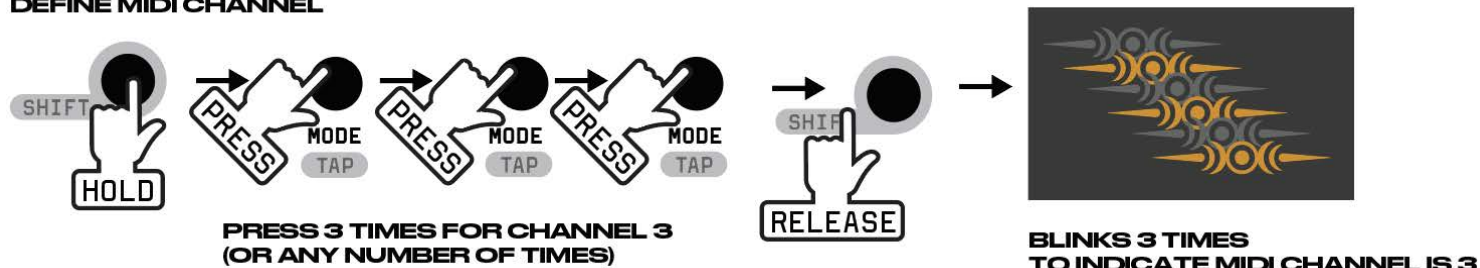
Release the MODE button. The top right light will blink to indicate the selected MIDI channel number (e.g., 3 blinks = channel 3).

NOTE: If MODE and SHIFT buttons are held simultaneously, the MIDI Learn function will NOT be activated.

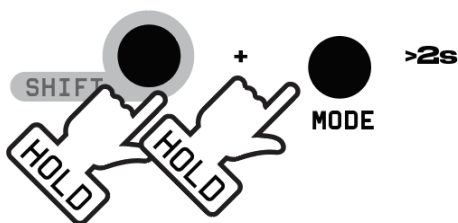
Set the MIDI channel directly

Hold the SHIFT and press the MODE button a number of times to set the MIDI channel number manually. The number of presses will be counted once the SHIFT button is released and the top right led will blink the number of times to indicate the MIDI channel number.

DEFINE MIDI CHANNEL



LEAVE ADVANCED SETTINGS



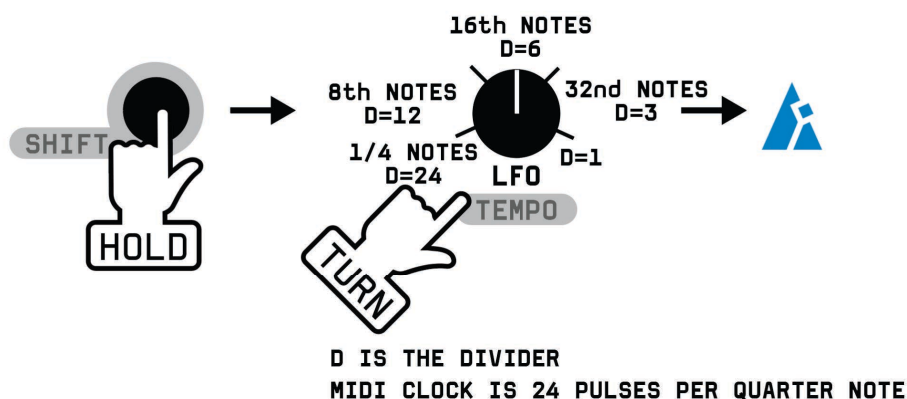
Receiving MIDI Sync (Real Time Messages)

Kastle 2 automatically syncs to the MIDI clock. If it is present on the USB, it will take the highest priority over the internal and external sync clock.

MIDI Clock

When the MIDI clock is active, TEMPO (SHIFT+LFO) selects the divider of the MIDI clock.

SET MIDI CLOCK DIVIDER



The pattern generator will render a step each:

- 24 MIDI clocks ($\frac{1}{4}$ note)
- 12 MIDI clocks (8th note)
- 6 MIDI clocks (16th note)
- 3 MIDI clocks (32nd note)
- 1 MIDI clock (1:1)

The Transport Controls behavior:

- MIDI Start resets the pattern generator to the first step and waits for the MIDI clock to start running. Resets the LFO when LFO is in sync mode.
- MIDI Stop resets the pattern generator and stops the sequencer (the MIDI clock may continue running in the background, but the pattern will not run). The MIDI clock is still used to sync the LFO when present even after MIDI Stop.
- MIDI Continue starts running the pattern generator from its current position but does not reset it.

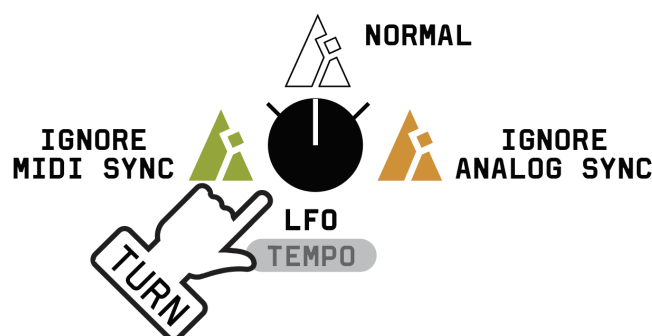
When holding SHIFT, the LFO light is BLUE to indicate that the MIDI clock sync is active.

You can set Kastle 2 to ignore the MIDI Clock in the Advanced settings mode. Enter (or leave) the Advanced Settings mode by holding SHIFT and MODE for 2 seconds.

The LFO knob now offers 3 options for clock handling:

- Turn it LEFT to ignore the MIDI clock, indicated by khaki light.
- In the CENTER position, it follows the standard clock priority: MIDI clock over SYNC IN, over internal clock, indicated by white light.
- Turn it RIGHT to ignore analog SYNC IN, indicated by orange light.

SET INPUT CLOCK HANDLING



Sending MIDI sync (Real Time Messages)

Kastle 2 sends out MIDI clock and transport controls only if it is NOT receiving MIDI Clock. If MIDI Clock was received during a session, you'll need to stop sending it and tap the internal tempo (SHIFT+MODE) or restart the Kastle 2. Alternatively, you can activate the Ignore MIDI Clock feature in Advanced settings mode to resume sending MIDI Clock.

When using the internal clock source, the MIDI clock is always being sent. Resetting the pattern generator with the PATTERN R input will send both MIDI Stop and MIDI Start messages consecutively.

When SYNC IN is used as the clock source, Kastle 2 will convert it to MIDI Clock. The conversion rate is based on the clock divider setting (TEMPO knob), and MIDI Clock messages are sent as if the pattern generator were advancing on every 16th note (this translates to 6 MIDI Clock ticks per pattern step).

If SYNC IN is inactive for more than 2 seconds (or twice the previous clock interval), the Kastle 2 will send a MIDI Stop message and stop sending the MIDI Clock.

Once the external clock resumes, the Kastle 2 will send a MIDI Start message and continue sending MIDI Clock.

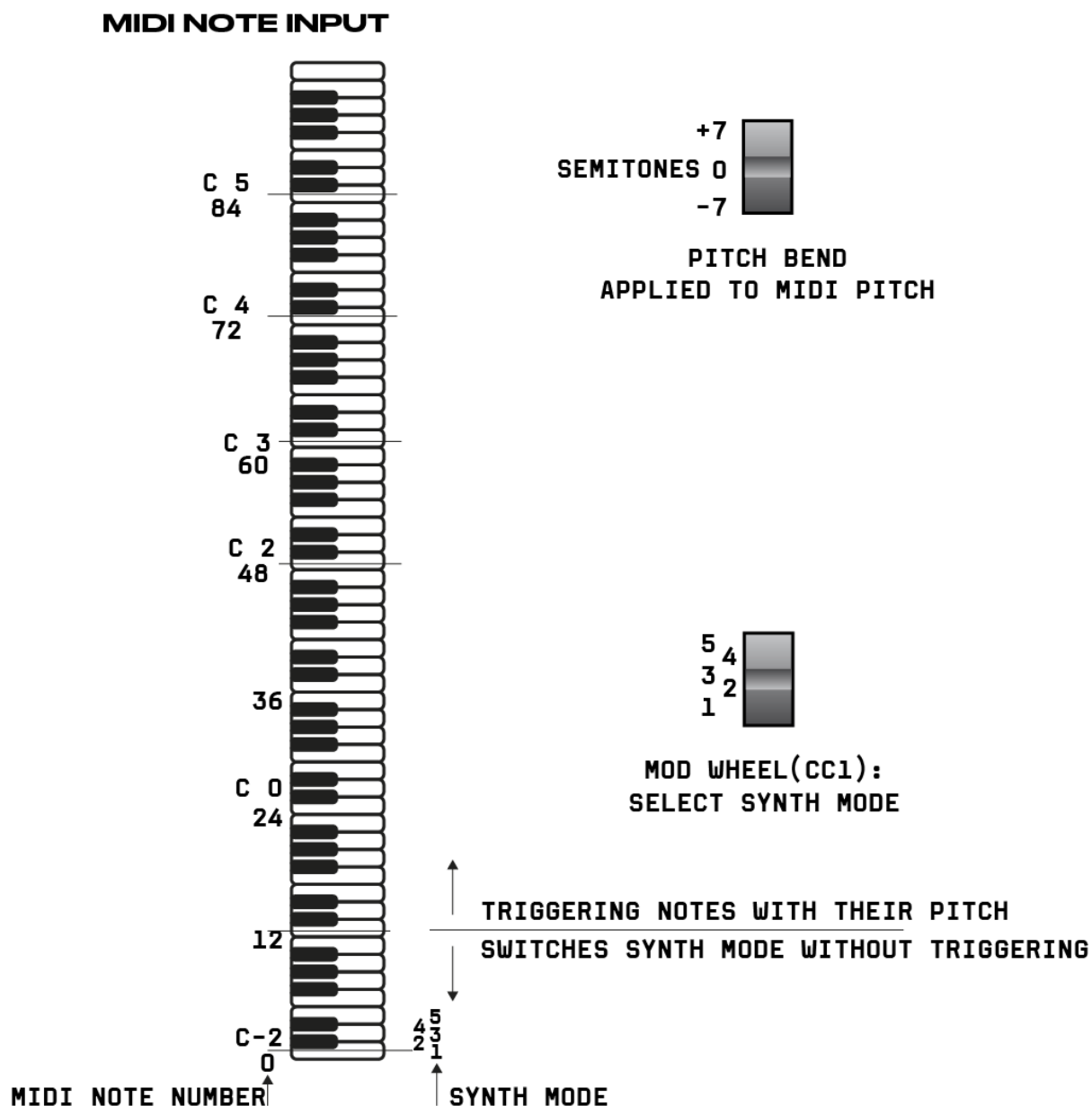
Receiving MIDI Notes

The Kastle 2 reacts to MIDI Note On messages. Velocity information is not utilized. Note Off messages are ignored.

MIDI Notes in the lowest octave (0–11) will switch the synth mode without triggering it. The first synth mode (FILTER) is aligned to note C.

NOTE:

- SYNTH MODE switching is controlled by using the mod wheel on CC1.
- Notes above note 12 trigger the note and adjust its pitch.



When using MIDI notes there will be two ways to calculate the pitch of the synth: MIDI Pitch and Patch Pitch.

The MIDI Pitch is turned on by a Note On message and kept until one of the following happens (then it switches back to Patch Pitch):

- change on any PITCH input is detected
- adjusting Pitch knob
- adjusting the Scale (MODE+PITCH MOD)
- adjusting the Root of the Scale (MODE+TIMBRE MOD)

PATCH pitch = scale(NOTE + PITCH knob + PLAY) + root + fine + slide

MIDI pitch = MIDI Note pitch + quantizer(PLAY) + fine + slide

NOTE: When adjusting the PITCH knob, SCALE or ROOT via CC, the Kastle 2 will also switch back to patch pitch.

Sending MIDI Notes

When a note is triggered either by the TRIG input, NOTE or PLAY input, manual trigger via SHIFT button or the MIDI input, the Note On message is sent with the same pitch information as the played note.

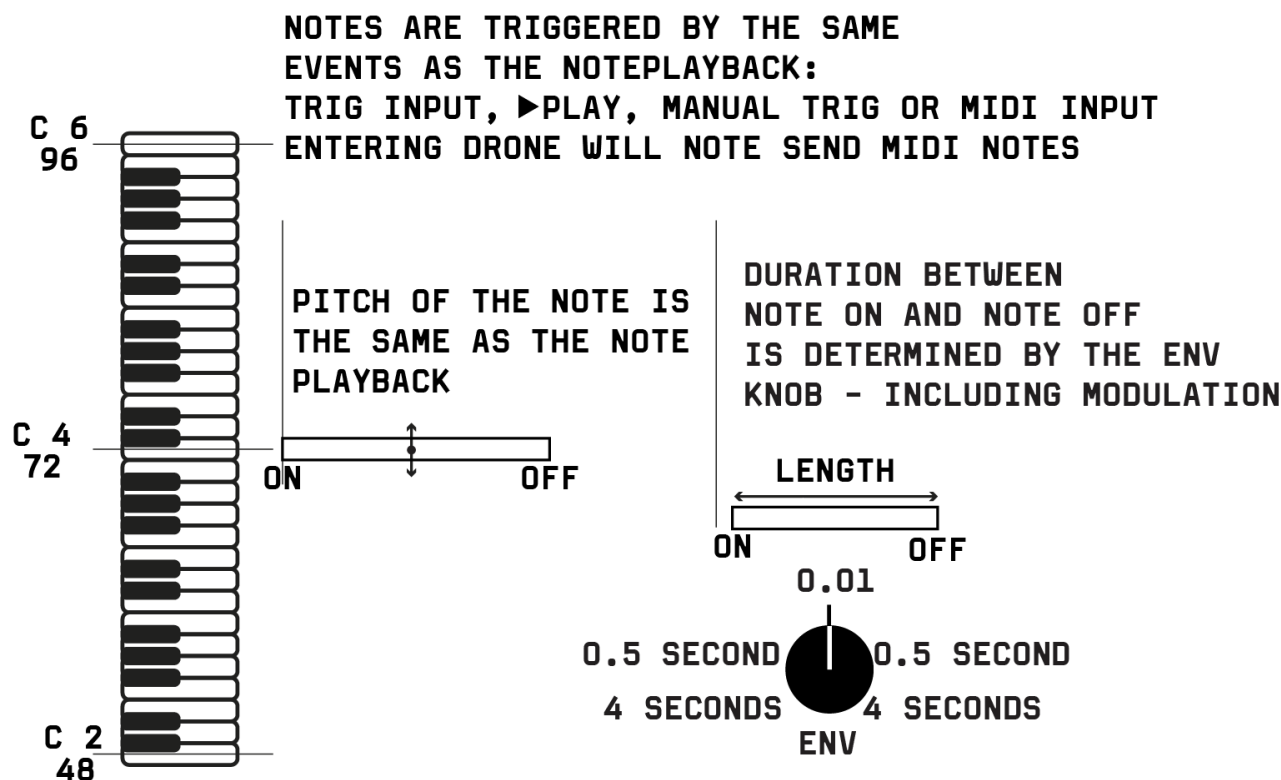
The MIDI Note Off message will be sent when the envelope at ENV OUT fades out. The MIDI Note On/Off will NOT reflect entering/leaving the DRONE mode.

The MIDI Note represents the Alchemist's final pitch with the exception of the FINE TUNE setting and PITCH SLIDE (pitch envelope and portamento).

MIDI Note Off is sent after the duration defined by the ENV knob has passed.

Note Off is also sent right before re-triggering another note (if the previous note hasn't finished yet).

MIDI NOTE OUTPUT



Receiving Pitch Bend

Receiving the Pitch Bend message adjusts the pitch continuously in the range of +/- 7 semitones.

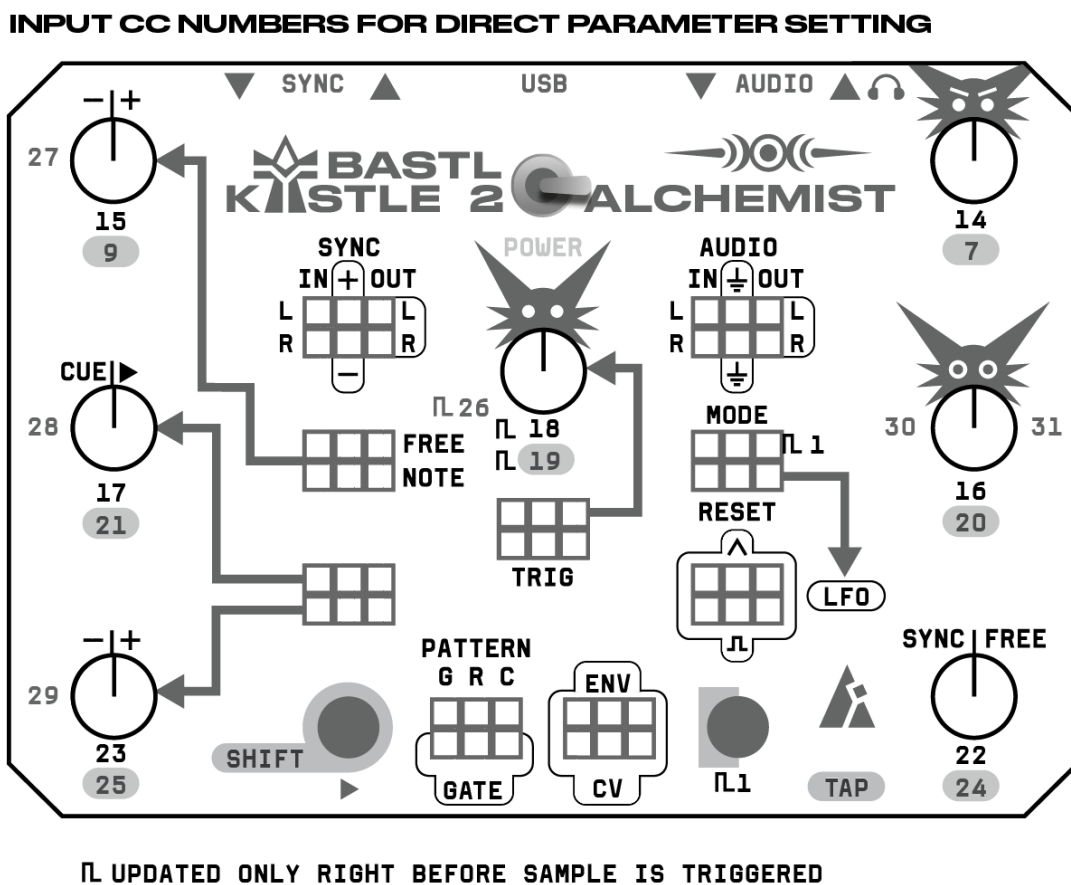
NOTE: Pitch Bend message is applied only to MIDI Pitch which means you need to send some Note On message to be able to use Pitch Bend message. When modulating the Note input the Kastle 2 will return to Patch Pitch and Pitch Bend will be disabled.

Receiving MIDI CC = Control Change / knob values

Any MIDI CC message contains three key pieces of information:

1. MIDI Channel – indicates which channel the message is sent on.
(See instructions on [setting MIDI channels](#).)
2. CC Number – Acts as the address of which knob or parameter is being controlled (e.g. CC16).
3. Value – Represents the position of the knob.

💡 When a CC message with the correct number is received, the corresponding knob is virtually adjusted to match the value—and it stays there until the physical knob is moved again.



CC	ALCHEMIST	Note
1	MODE – updated only right before trigger or Note On	Maps 0–127 to 0–number of values
7	Output Volume	SHIFT + top right knob
9	Input Gain	SHIFT + top left knob
14	PITCH	Top right knob
15	PITCH MOD	Top left knob
16	TIMBRE	Middle right knob
17	TIMBRE MOD	Middle left knob
18	ENV – updated only right before trigger or Note On	Center knob
19	ENV MOD – updated only right before trigger or Note On	SHIFT + center knob
20	RATIO	SHIFT + middle right knob
21	FX	SHIFT + middle left knob
22	LFO	bottom right knob
23	LFO MOD	bottom left knob
24	TEMPO	SHIFT + bottom right knob
25	RHYTHM	SHIFT + bottom left knob
27	SCALE	MODE + top left knob
28	PITCH ROOT	MODE + middle left knob
29	FINE TUNE	MODE + bottom left knob
30	Portamento	MODE + middle right knob CCW
31	Pitch envelope	MODE + middle right knob CW
121	Reset all controllers	Goes back to knob control for values

Sending MIDI CC = Control Change

The knobs (when adjusted) send their values scaled to 0-127 on specific CC numbers.

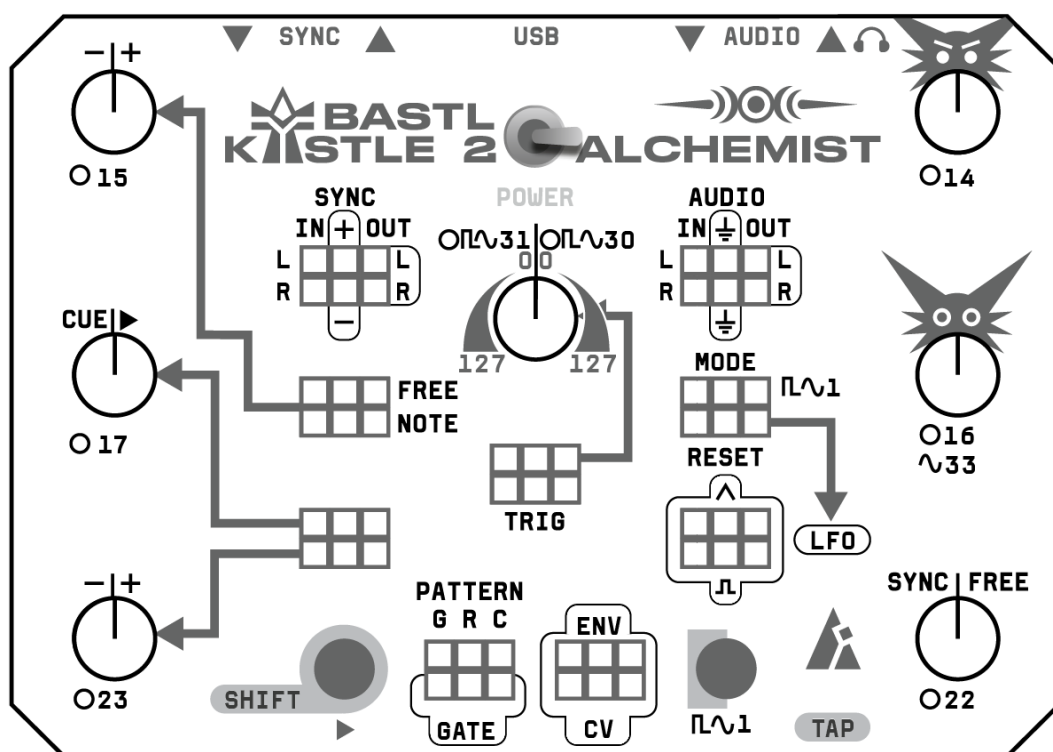
On the ALCHEMIST some carefully considered modulations can be also forwarded to the MIDI stream in order to not overload it and make it easy to map in DAW.

CC messages are sent on the same MIDI channel as the incoming MIDI channel. See the [Setting the MIDI channel](#) section.

Mapping guide: To map the CCs sent by the knobs undo all patch cables first. After entering MIDI mapping (in your DAW) make sure to move only the desired knob.

CC1 is always sent when triggered. Patch only GATE or LFO to the TRIG input to map CC1.

OUTPUT CC NUMBERS - DIRECT KNOB POSITION



- DIRECT KNOB POSITION
- ⌊ UPDATED ONLY RIGHT BEFORE SAMPLE IS TRIGGERED
- ~ MODULATION APPLIED TO THE FINAL CC VALUE

CC	ALCHEMIST	Note
1	MODE	Mapped to 0–127 always sent right before Note On/trigger. Not sent on manual trigger (short SHIFT press)
14	PITCH knob	Knob value (sent when knob moved)
15	PITCH MOD knob	Knob value (sent when knob moved)
16	TIMBRE knob	Knob value (sent when knob moved)
17	TIMBRE MOD knob	Knob value (sent when knob moved)
22	LFO knob	Knob value (sent when knob moved)
23	LFO MOD knob	Knob value (sent when knob moved)
30	ENV decay(right half)	0–127 sent when knob moved in the forward range or right before Note On / trigger when modulation changed - applied together with modulation.
31	ENV attack (left half)	127–0 sent when knob moved in the backward range or right before Note On / trigger when modulation changed
33	TIMBRE MODULATION	TIMBRE + TIMBRE MOD mapped 0–127 sent continually if changed. Sent on manual trigger (short SHIFT press)

ALCHEMIST SPECIFIC MIDI CC output

In order to utilize the power of the sequencing on the Alchemist there are few extra special CC messages sent.

CC1: (MOD WHEEL)

Sends Synth mode mapped to 0-127

Mapping guide: CC1 is always sent when sound is triggered. Unpatch all cables and patch only GATE or LFO to the TRIG input to send CC1.

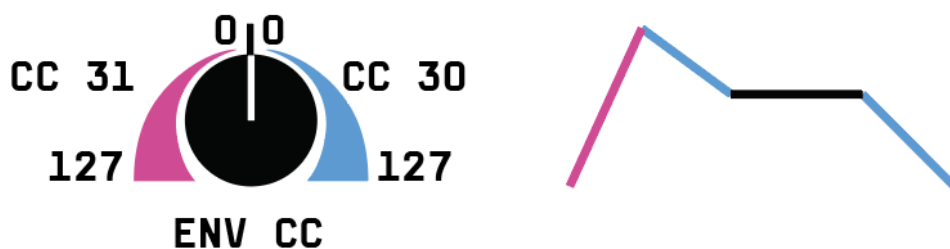
Bipolar ENV CC30 and CC31

The forward and backward direction of the ENV knob are sent as a separate CC number so you can map them for example to ATTACK and DECAY/RELEASE separately.

CC30 has value 0 in the middle and increases in the clock-wise direction. Counter-clock-wise direction does not send CC30.

CC31 has value 0 in the middle and increases in the counter-clock-wise direction. Clock-wise direction does not send CC31:

This CC value includes the ENV modulation combined with the ENV knob and is sent when the knob is adjusted or right before the sound is triggered when the input is modulated.



Mapping guide: Unpatch all cables and move the ENV knob either to forward or backward range. Start the mapping and move the knob slightly to map either forward CC30 or backward CC31.

Final TIMBRE CC33

This CC value includes the modulation thru the TIMBRE MOD knob combined with the TIMBRE knob and is sent continually when the combined value changes, or when note is triggered manually with short press of the SHIFT button.

Mapping guide: Unpatch all cables and manually trigger the sound by short pressing the SHIFT button.

MEMORY RESET

Press and hold the **SHIFT** and **MODE** buttons for over **15 seconds** to perform a memory reset. This will restore all settings to their default values, including tempo, volume settings, input behavior etc.

FIRMWARE UPDATE

- 1) Use a **USB-C cable** to connect your **Alchemist** to your computer.
- 2) Turn the power switch **off** (to the left).
- 3) Hold the **SHIFT button** and turn the power switch **on** (to the right).
- 4) The **Alchemist** will boot into **Update Mode** (no sound will play).
- 5) Copy the **.uf2 file** to the **RPI-RP2 disk** that appears on your computer.

Check Firmware Version

- 1) **Boot into Test Mode:** Hold the **MODE** button and turn the power **ON**.
- 2) **Listen to Audio Output:** The **Alchemist** will announce the firmware version via its voice output.

PATCH TIPS

The printable cookbook with patchtips: [here](#)

The printable MIDI cheat sheet: [here](#)

Blank template for your patches: [here](#)

How to sync with Pocket operators guide: [here](#)

APPENDIX

Test Mode

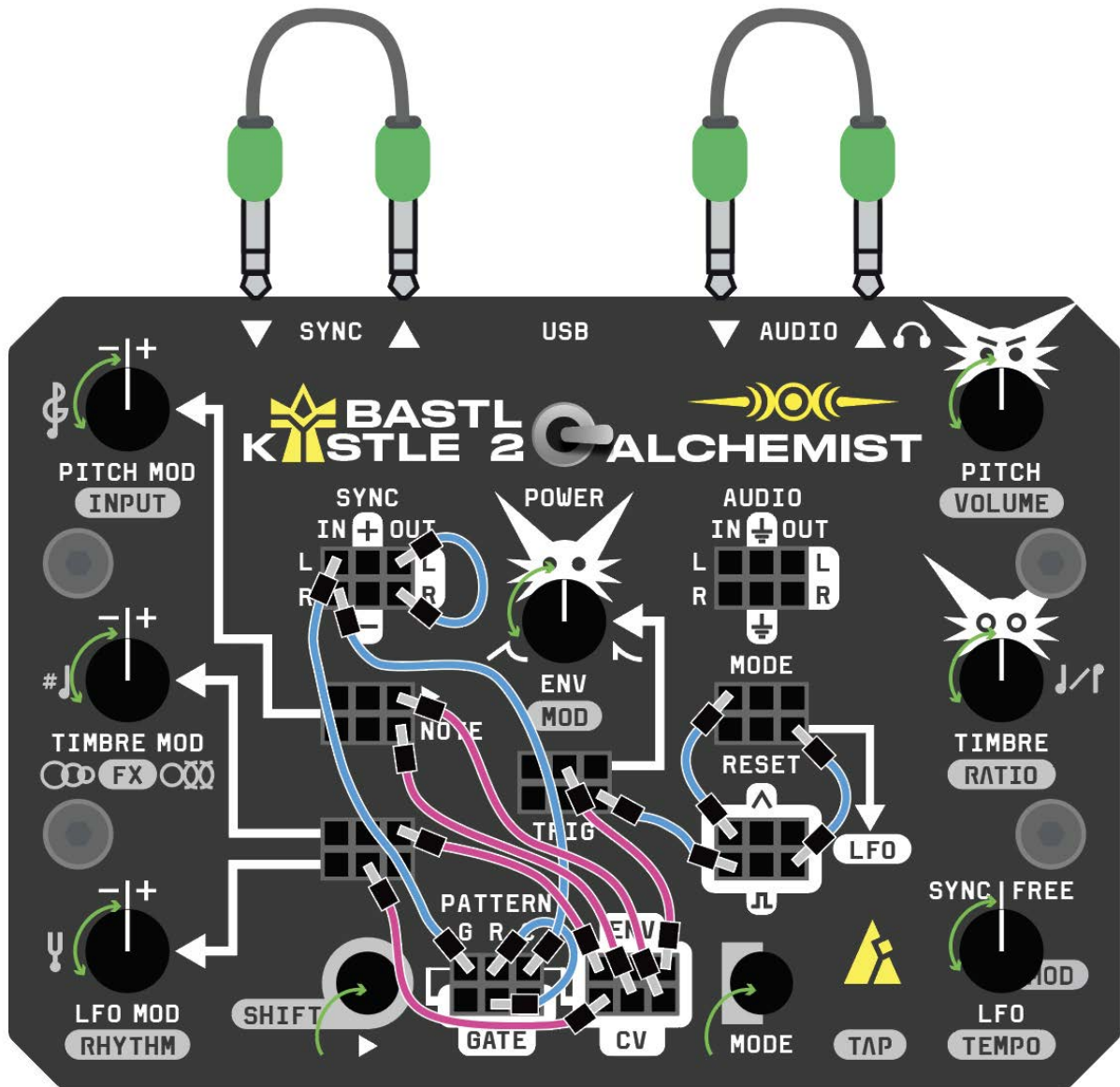
In order to test the hardware, the Kastle 2 includes an integrated test mode.

Hold MODE and turn power ON to enter the test mode. Listen to Audio Out and the Kastle 2 will announce the firmware version via its voice output.

To perform the full HW test do the following:

1. Turn the power switch off and connect the USB-C cable to the unit (**NOTE:** The test will fail if running only on batteries.)
2. Patch the following connections with stereo TRS cables
 - a. SYNC OUT jack to SYNC IN jack
 - b. AUDIO OUT jack to AUDIO IN jack
3. Patch the following connections with jumper cables:
 - a. LFO PULSE to LFO RESET
 - b. LFO PULSE to TRIG
 - c. SYNC OUT L to SYNC OUT R
 - d. SYNC IN L to PATTERN "G"
 - e. SYNC IN R to PATTERN "C"
 - f. ENV to TIMBRE MOD
 - g. ENV to ENV MOD
 - h. CV to PLAY PITCH MOD
 - i. CV to NOTE PITCH MOD
 - j. CV to LFO MOD
 - k. LFO TRI to MODE IN
 - l. GATE to PATTERN "R"
4. Hold **MODE** and turn the power **ON**.
5. The Kastle 2 will announce the introduction.
6. LEDs will light **red** and automatic testing will start. Each successful test is signaled by a **ding sound**.
7. All automated tests should **pass** and LEDs turn **blue**.

8. Turn all the knobs all the way left and all the way right.
9. Press both buttons.
10. The test should be complete and indicated by green lights, and the Kastle 2 announcing “Test Success”.



CREDITS

DEVELOPMENT TEAM: Václav Mach, Marek Mach, Martin Klecl

SUPERVISED BY: Václav Peloušek

MAIN TESTER: John Hornak

BETA TESTERS: Martin Klecl, Tomáš Niesner, John Dinger, czarw, Václav Chlad, Patrik Veltruský, Michal Synovec, Peter Edwards, Florian Helling, Oliver Torr, Jakob Holm, Matěj Mžourek, Wes Langill, boop_e, AA Battery, Michal Křipač, Stefano Manconi, Leonard Reidy

MANAGEMENT: John Dinger

MANUAL: Václav Peloušek, David Žáček, Martin Vondřejc

WEB APP: Václav Mach

RELEASE VIDEO: Michal Synovec, Patrik Veltruský | **music:** Oliver Torr |

starring: Václav Peloušek, Adéla Konečná

VIDEO MANUAL: Wes Langill

GRAPHIC DESIGN: Anymade

The idea turned into reality
thanks to everyone at Bastl Instruments
and thanks to the immense support
of our fans.

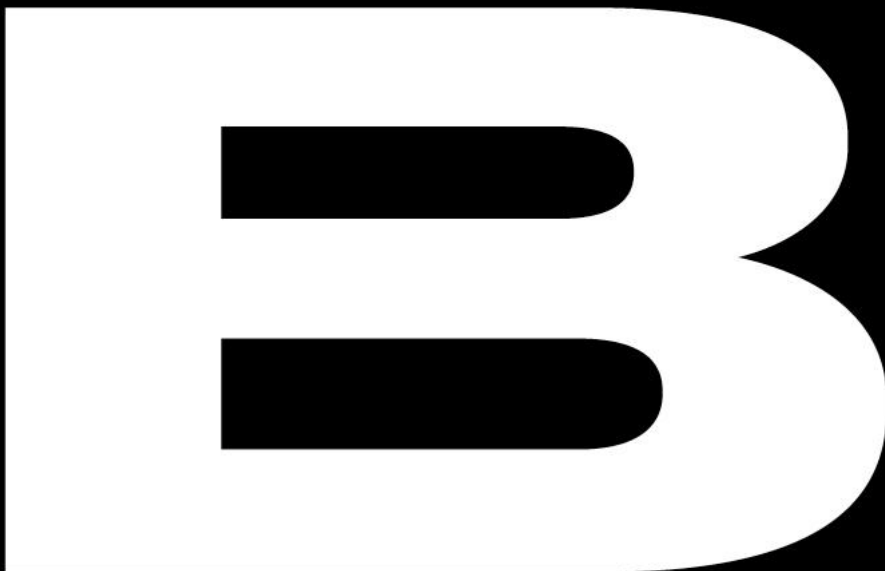


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**WISHING YOU THE BEST OF LUCK
ON YOUR SONIC ADVENTURES!**