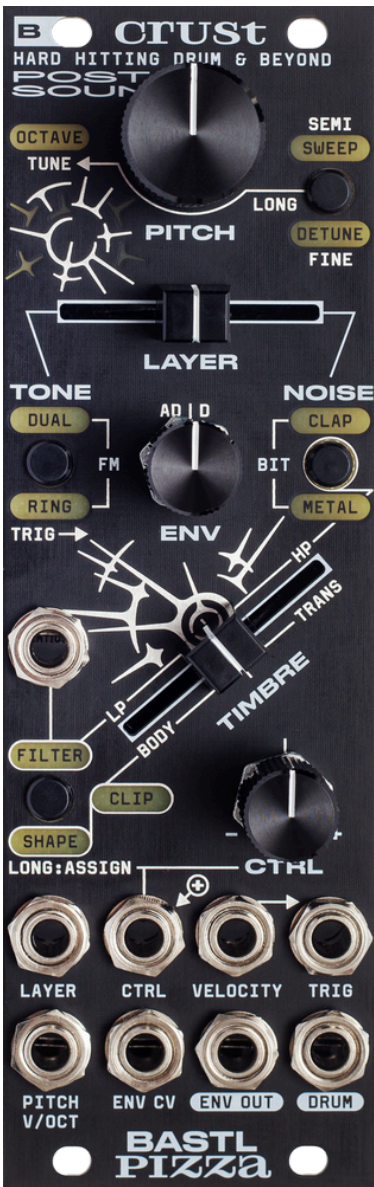


# B CRUST

A Hard-Hitting  
Drum Voice



# BASTL



# INSTRUMENTS

# PIZZA CRUST

## A hard-hitting drum voice

Pizza **CRUST** is a hard-hitting drum voice that goes way beyond drum territory. It consists of two layers – the **NOISE** source and dual oscillator **TONE** generator. Hard-hitting drums need a lot of transient attention and CRUST has you covered with the combination of pitch envelope, layer mixing, FM envelope and transient shaper with hard-clipping.

The **NOISE** source has built in low-pass/high-pass **FILTER** and 4 modes (white noise, clap, bit and metal).

The **TONE** has 4 oscillator configurations (FM, FM2, dual and ring modulation), pitch envelope, detune, V/Oct input and timbral **SHAPE** control.

The **LAYER** fader crossfades between the layers, but also adjusts their relative decay envelopes to achieve drum-kit like playability.

The **ENV** knob makes shortest envelopes in the middle and elongates the decay to the right and both attack and decay to the left making more of a shaker/reversed/synth timbres.

The **TIMBRE** section either focuses on the whole body of the sound (left) or is focused towards the transient (right).

The final **CLIP** distortion stage with either soft clipping with a bass boost (left) or transient shaper with hard clipping (right) makes the drums go super-hard.

While keeping the module compact the CRUST is oriented towards performance. The assignable **CTRL knob** and **CV** can give you another performance control of your choice so you only perform with the parameters that are important and don't accidentally change your set and forget settings.

# FEATURES

- complex drum voice
- dual oscillator TONE layer with pitch settings
- OCTAVE, DETUNE, pitch SWEEP, SEMI and FINE tune
- 4 TONE shaping algorithms: FM, FM2, RING and DUAL
- NOISE layer with filter and 4 algorithms: WHITE, BIT, CLAP and METALLIC
- LAYER fader macro for balancing the TONE and NOISE layer by envelope settings and volume
- ENV knob to lengthed decay to the right (CW of 12 o'clock) and both attack and decay to the left (CCW of 12 o'clock)
- dedicated CV input for LAYER and ENV
- ENV output
- V/OCT input with calibration to tune the TONE layer
- TIMBRE section with 3 parameters: FILTER, CLIP and SHAPE and a dedicated CV input
- FILTER is lowpass/highpass filter of the NOISE layer
- CLIP is a clipper with transient focus (hard clip) or body bass boost focus (soft clip)
- SHAPE settings for the TONE layer with BODY focus or TRANSIENT focus
- trigger input
- sample & hold for every CV input (can be toggled on/off)
- manual triggers
- velocity input - when trigger not connected it acts as input for external envelope
- assignable CTRL knob and CTRL CV option
- firmware updates via micro USB
- interchangeable HW with the Bastl Pizza Oscillator and Pizza Basil (just a different panel)

## **TECHNICAL DETAILS**

- 8 HP
- PTC fuse and diode protected 10 pin power connector
- 24 mm deep
- current consumption: +12 V: 90 mA; -12 V: 20 mA
- -5/+5 V range on all CV inputs

# **CRUST MANUAL**

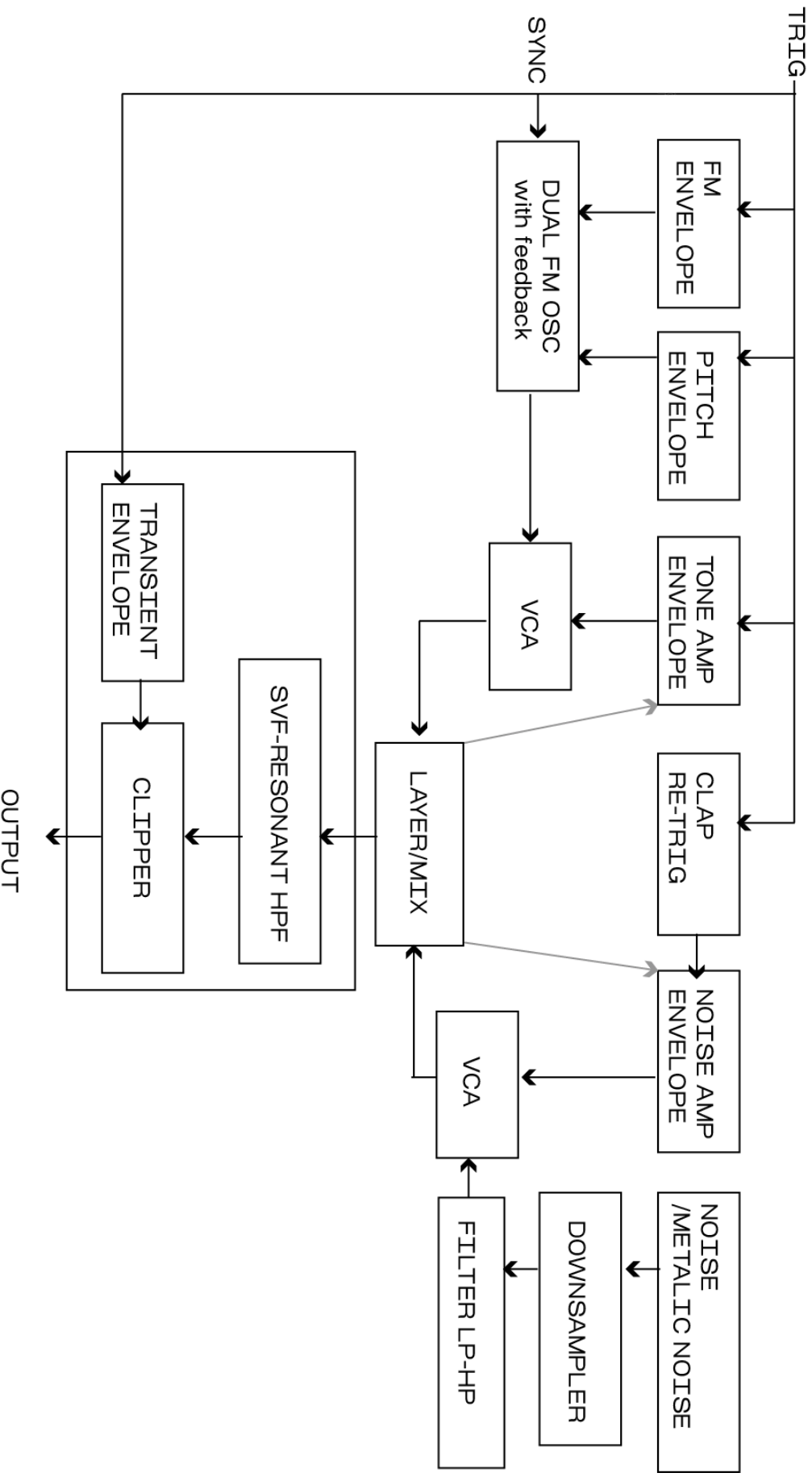
## **Note:**

**If CRUST boots and animates a sequence of 2 flashes near the NOISE button and the lights on the left side of the module pointing down, it requires the V/OCT input to be re-calibrated. This can happen when the power rails in your system are balanced differently than in the previous modular case.**

**To calibrate: Plug a patch cable from DRUM to PITCH V/OCT, wait for a few seconds and then disconnect the cable. CRUST will boot to normal operation.**

# tone

# noise



# ARCHITECTURE

**B**

# CRUST

HARD HITTING DRUM & BEYOND  
POST  
SOUL

**PITCH**

OCTAVE TUNE ← **3**

LONG **4**

SEMI SWEEP

DETUNE FINE

**LAYER**

**5**

**TONE**

DUAL **7** FM

RING

TRIG →

**NOISE**

AD | D **9**

BIT **8**

CLAP

METAL

**ENV**

**15**

**13**

LP BODY HP TRANS

**FILTER**

**14** CLIP

SHAPE

**CTRL**

LONG: ASSIGN

**6** LAYER

**17** CTRL

**12** VELOCITY

**1** TRIG

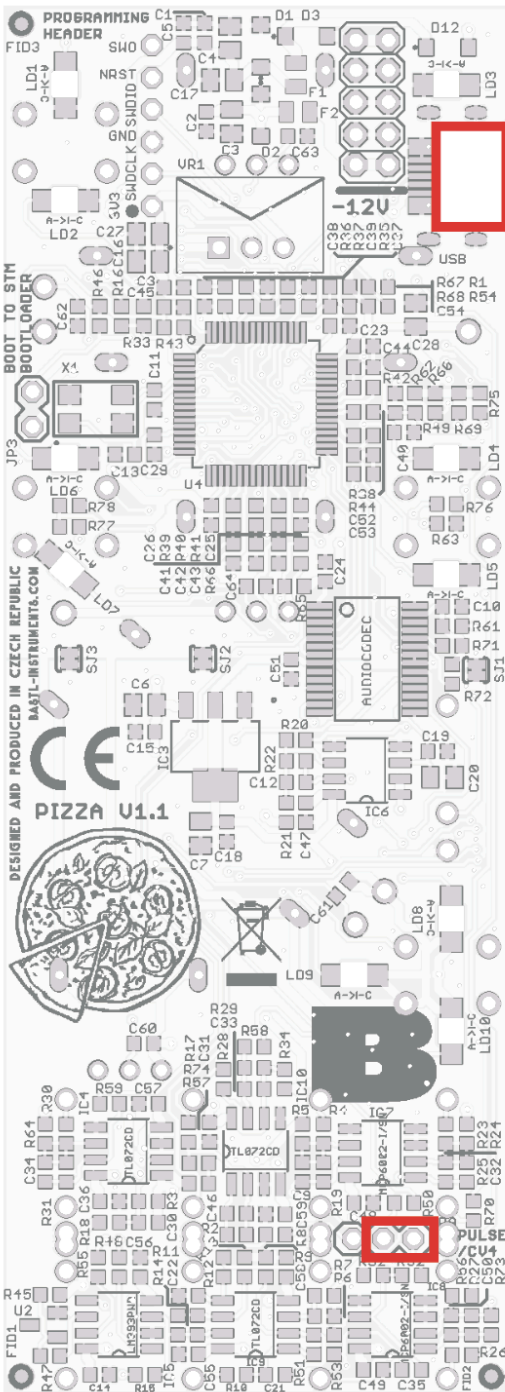
**18** PITCH V/OCT

**10** ENV CV

**11** ENV OUT

**2** DRUM

# BASTL PIZZA



**A**

**MICRO USB CONNECTOR FOR FIRMWARE UPDATES**

**B**

**TO USE THE ENV CV INPUT, THE JUMPER MUST BE IN THIS POSITION**



# **BUTTON COMBOS**

**TIMBRE >2s** = CTRL assignment (press nearest button to assign)

**PITCH>2s** = TUNE mode

**TONE + NOISE** = manual trigger

**TONE + PITCH knob** = stepped detune

**TONE + ENV knob** = pitch envelope decay time – shortest in the middle and two different exponential curves when adjusted to left or right

**NOISE + PITCH knob** = tune the NOISE PITCH parameter

**TIMBRE + PITCH button >2s** = enters calibration mode of v/oct

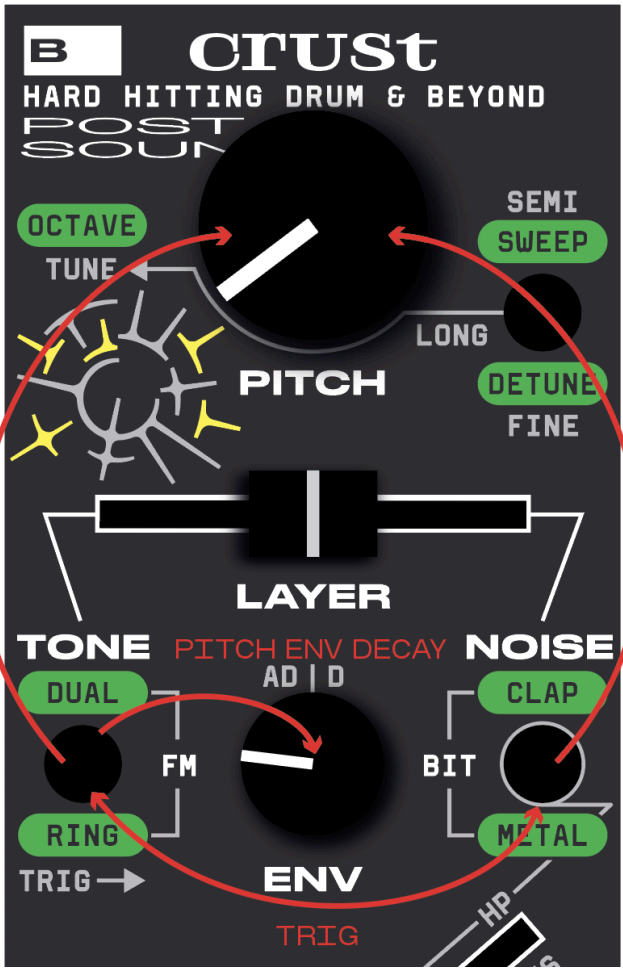
**TONE+NOISE+plug jack to CV input** = enable/disable sample & hold behavior on the desired CV input.

When the sample & hold behavior is enabled, the CV is only updated when a trigger event is detected at the TRIG input.

When sample & hold behavior is disabled, the CV inputs are updated continuously.

To toggle the behavior on and off, hold both the TONE and NOISE buttons and plug a jack into the input whose behavior you wish to change.

Note: The sample & hold CV modes are only active when the TRIG input has a jack plugged into it.



STEPPED  
DETUNE

NOISE PITCH  
adjustment

# POWER

Before connecting the ribbon cable to this module, disconnect your system from power! Double-check the polarity of the ribbon cable and that it is not misaligned in any direction.

The red wire should match the -12V rail both on the module and the bus board.

## **! please make sure of the following:**

- you have a standard pinout eurorack bus board
- you have +12V and -12V rails on your bus board
- the power rails are not overloaded by current

Although there are protection circuits on this device, we do not accept any responsibility for damages caused by the wrong power supply connection. After you've connected everything, double-checked it, and closed your system (so no power lines can be touched by hand), turn on your system and test the module.

## 1 TRIGGER input

Pizza Crust is waiting for your triggers to start doing its tasty magic. Send triggers into the TRIGGER input (or alternatively to the VELOCITY input. See the [ENVELOPES](#) chapter).

You can manually trigger Crust by holding TONE and then pressing NOISE!

Note: The received trigger will be indicated by a brief dip in brightness of the TIMBRE section lights.

## 2 Main OUT

To hear the crunchy Crust results, listen to your sounds through the DRUM output.

## PITCH

The PITCH knob and button provide access to all the tuning-related duties.



## 3 PITCH KNOB

The PITCH knob always controls the parameter selected by the PITCH button – as indicated by the light.

## 4 PITCH button

A single press of the PITCH button will switch between the OCTAVE, SWEEP, and DETUNE modes. In each mode, the PITCH knob serves different functions.

## OCTAVE

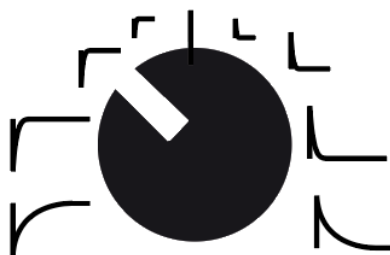
In OCTAVE mode, the PITCH knob adjusts the octave (with a total range of 10 octaves)

## SWEEP

SWEEP controls the pitch envelope, allowing you to create either a transient kick-type sweep to the right or a softer membrane-type sweep up to the left.

The SWEEP mode controls both the depth and decay of the envelope. To change only the decay of the envelope and make it longer or shorter, hold the TONE button and adjust the ENV knob. The shortest setting of the decay is in the middle, providing a steeper exponential curve when turning the knob to the right and a more relaxed curve when turning the knob to the left.

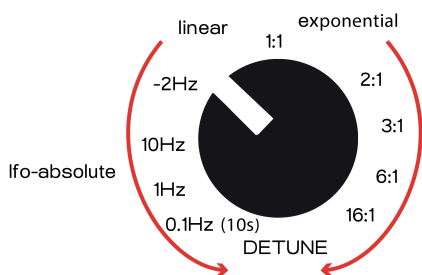
For independent control, the SWEEP depth or SWEEP decay can be controlled by the CTRL knob. See the [CTRL section](#) for more details.



PITCH SWEEP

- There's no pitch sweep in the middle of the knob.
- To the left, the pitch bends down after the trigger and returns to the main pitch. This modulation can bring you closer to some skin percussion.
- To the right, there will be a short downward sweep typical for kick drum sounds.

# DETUNE



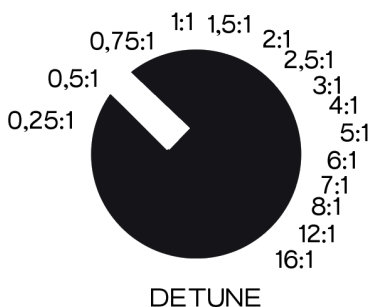
## LINEAR & EXPONENTIAL DETUNE

Turning the PITCH knob to the left results in a linear detune from the main pitch, extending into the absolute Hz LFO range that is independent of the main PITCH.

Turning the PITCH knob to the right allows you to set an exponentially detuned ratio up to 16:1.

## STEPPED DETUNE

You can tune the ratio between oscillators in fractions of intervals, which is great for creating FM timbres. To do this, hold the TONE button and turn the PITCH knob.



# TUNE

TUNE mode is an extended setting for the [PITCH section](#). It allows precise tuning of your oscillators.

- Enter the TUNE mode by holding down the PITCH button.
- The PITCH LEDs will fade in and out to indicate you are in TUNE mode.
- Press the PITCH button to cycle through three different selections (indicated by silver text below the lights). The PITCH knob will control these functions.
- Exit the TUNE mode by long-pressing the PITCH button again.



**SEMI** – semitone selection



**FINE** – fine tune adjustment



**TUNE** – broad pitch control

(similar to OCTAVE mode, but going through the whole range of the oscillator)

You can think of TUNE mode as set & forget. For example, in TUNE mode, you can select which root note you want the oscillator to be with the SEMI option and then go through different octaves of this tone with your OCTAVE selection.

Alternatively, you can completely freely change the frequency with the TUNE and FINE options if you want to select a frequency outside of common notes.

However, TUNE mode doesn't have to be set & forget and can still be used performatively!

# LAYERS

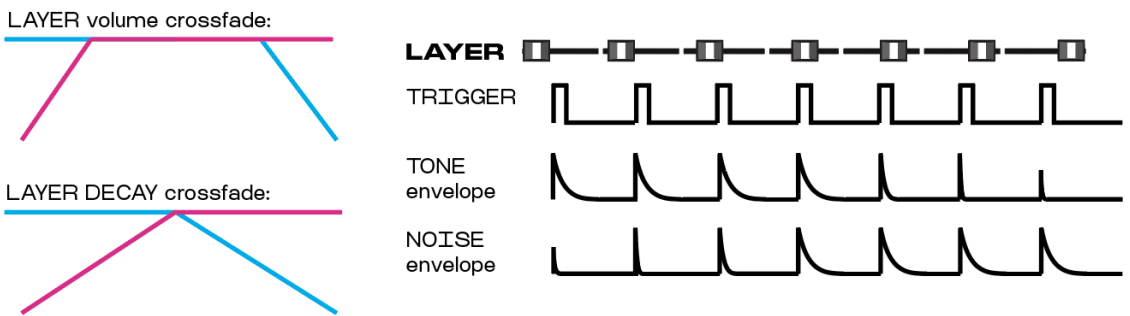
Crust consists of two separate layers, TONE and NOISE, each responsible for very different sounds. By combining these layers, you can achieve a plethora of variable results.

## 5 LAYER fader

The LAYER fader mixes between the TONE and NOISE layers of your drum sound.

It crossfades by shortening the decay of the amplitude envelopes on either the NOISE or TONE side.

This allows you to create tonal sounds with noisy transients (kick) or longer noisy sounds with tonal transients (snare/clap). Moving the LAYER fader is almost like playing a drum kit.



## 6 LAYER input

With the LAYER CV input, you can control the LAYER mixing externally. The LAYER fader's position still affects the result.

Note: This input can be updated either continuously or each time a trigger event is detected. Toggle these modes by pressing TONE + NOISE and plugging a jack into the input. See the [button combos](#) section for more information.

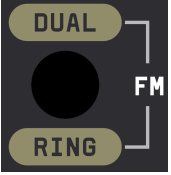
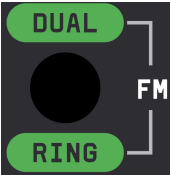
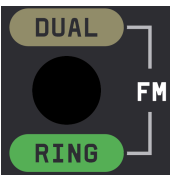
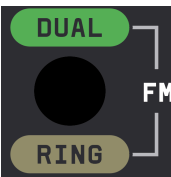


## 7 TONE modes

The TONE section is a dual oscillator setup with four different configurations (modes).

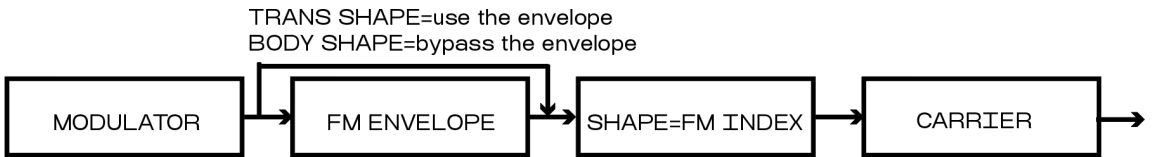
Press the TONE button to select one of the four modes for the tone character of the drum voice. The lights indicate the active setting.

The four options are:

<b>FM</b>		The <b>FM mode</b> is the classic 2-operator sound. It's great for adding transient punch to kicks or for making bell/metallic sounds.
<b>FM2</b>		The <b>FM2 mode</b> is a harsher version of the FM algorithm. It adds FM feedback at the extremes of the TIMBRE fader, resulting in tipping the tone into noise.
<b>RING</b>		<b>RING modulation</b> – the two oscillators are multiplied together. When the SHAPE fader is in the middle, adjust the DETUNE parameter to achieve various ring modulation tones. For added texture, incorporate the TIMBRE fader to introduce FM feedback grit.
<b>DUAL</b>		<b>DUAL mode</b> simply mixes the two oscillators together. The TIMBRE fader applies the FM feedback differently to the oscillators, so you can have richer timbres.

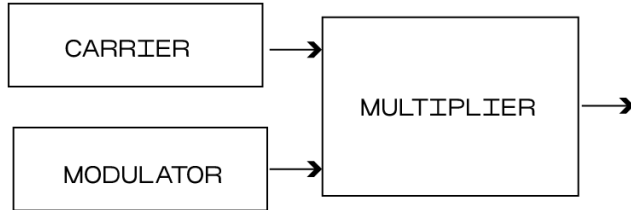
# TONE MODES

## FM 2 MODE:



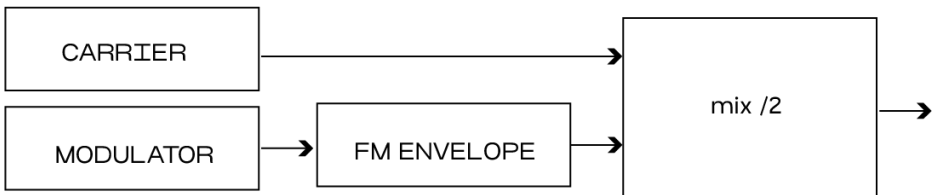
## RING MODE:

BODY SHAPE=sets more carrier feedback and bit of modulator feedback  
TRANS SHAPE=sets more modulator feedback and bit of carrier feedback



## DUAL MODE:

BODY SHAPE=sets more carrier feedback and bit of modulator feedback  
TRANS SHAPE=sets more modulator feedback and bit of carrier feedback



## 8 NOISE modes and NOISE PITCH

Press the NOISE button to choose from one of four noise characters for the drum voice.

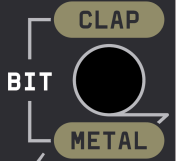
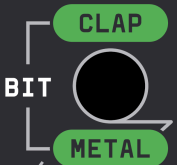

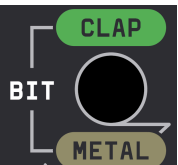
The lights will indicate the active setting.

Each NOISE mode includes the NOISE PITCH setting, which can be accessed by either holding the NOISE button and turning the PITCH knob or by assigning it to the CTRL knob.

Note: The NOISE section is independent of the PITCH of the TONE section. However, the METAL noise has a tonal element with a fundamental frequency of 2 octaves higher than the main TONE oscillator.

TIP: The noise can be influenced by the resonant high-pass filter that provides a bass boost for the CLIP processor. The high-pass frequency of the CLIP processor matches the main TONE oscillator, so you can hear clear resonant high-pass filtering when turning the TONE pitch very high.

The four options are:

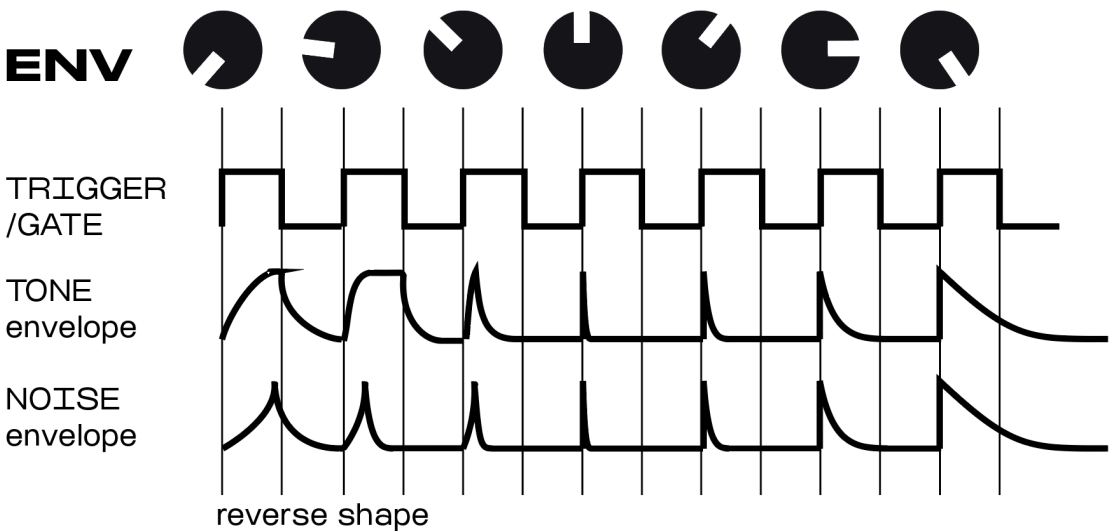
<p>WHITE</p> 	<p>WHITE noise is the default mode. Use the FILTER to cut the low or high frequencies.</p>	<p>NOISE PITCH =amplitude modulation frequency and depth</p>
<p>BIT</p> 	<p>BIT is a downsampled version of the white noise, adding a crunchy 8-bit character to the noise.</p>	<p>NOISE PITCH =downsample rate</p>
<p>METAL</p> 	<p>METAL is slightly tonal, FM feedback-based noise with a little bit of tonal quality to it. When you apply the high-pass FILTER, you will get 808ish hi-hats. With low-pass, you will get more of a cowbell flavor.</p>	<p>NOISE PITCH =metallic FM modulator frequency, FM feedback and depth. The pitch of the metallic noise is tied to the pitch of the main Crust oscillator.</p>
<p>CLAP</p> 	<p>CLAP uses a bit less downsampled white noise with lower resonance on the filter. It has an envelope retrigger aiming to emulate the sound of an analog clap.</p>	<p>NOISE PITCH =rate and number of retriggers</p>

# ENVELOPES

## 9 ENV knob

This knob macro controls both the TONE and NOISE amplitude envelopes.

- In the central position, you'll get the shortest envelope click.
- Turning clockwise increases the decay (D).
- Turning counter-clockwise increases both attack and decay (AD). This results in more synth-style envelopes on the TONE side and reversed envelopes on the hi-hat side.
- You can adjust the pitch envelope decay time by pressing the TONE button and moving the ENV knob. The shortest decay is in the middle, with two different exponential curves when adjusted to the left or right.



## 10 ENV CV

ENV CV adds the value it is receiving to the ENV knob value.

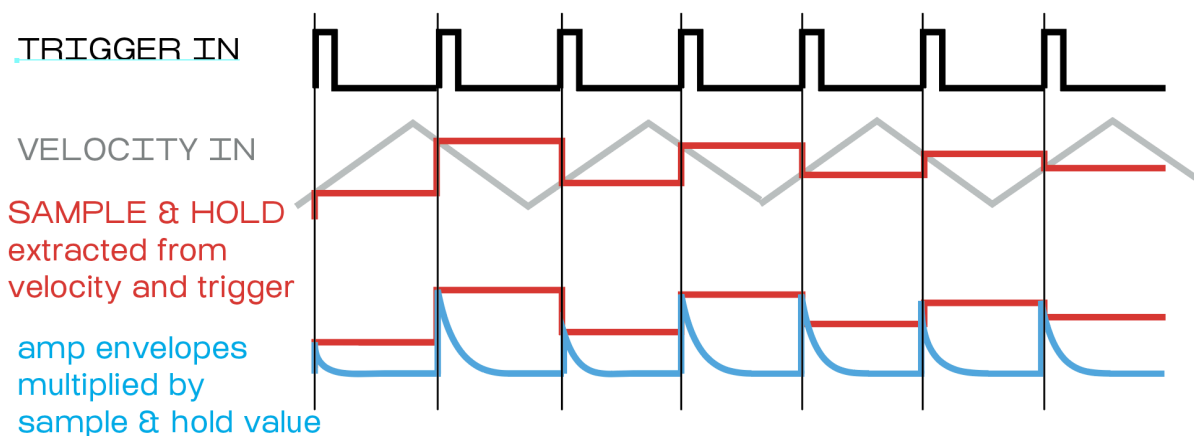
Note: This input can be either updated continuously or each time a trigger event is detected. See the [button combos](#) section for more information.

## 11 ENV OUT

The envelopes generated in CRUST can be utilized elsewhere using the ENV OUT. The output range is 0 V to +5 V.

## 12 VELOCITY input

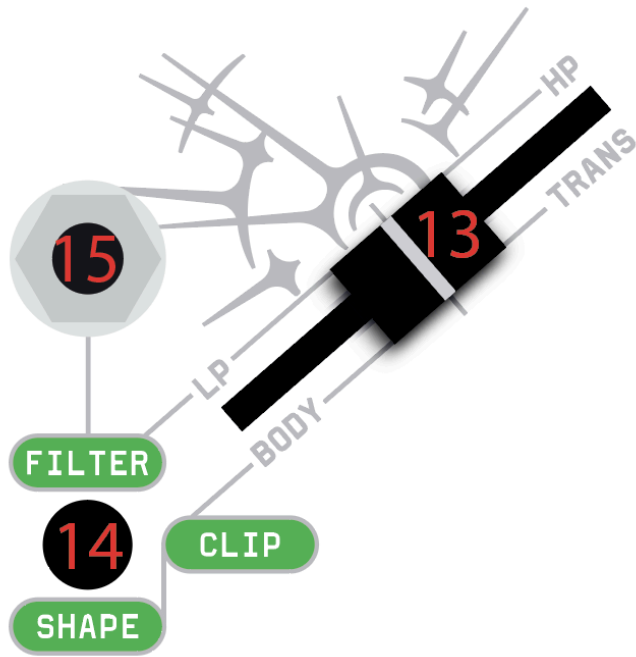
Adjusts the amplitude of the envelopes, thereby controlling the final loudness of the drum voice.



**!** If there is no cable connected to the TRIG input and voltage is applied to the velocity input, you can utilize it as a VCA (Voltage-Controlled Amplifier). When a rising voltage is detected on the velocity input, it triggers internal envelopes for FM, pitch, transient clipping as well as the envelope with the dedicated CV output.

# TIMBRE

The TIMBRE section has 3 additional parameters to refine your drum sound: FILTER, CLIP & SHAPE. These parameters affect the TONE and NOISE processes.



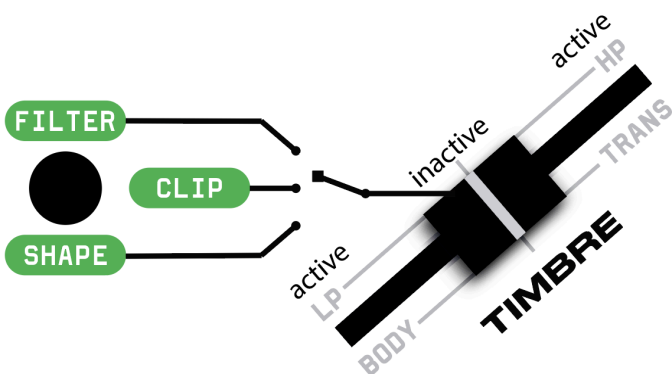
## 13 TIMBRE fader

The TIMBRE fader controls the character and intensity of the three TIMBRE parameters.

When positioned in the middle, the TIMBRE parameters are inactive.

Moving left or right selects two distinct parameter flavors.

! All TIMBRE settings are retained as you switch between them. Watch out, as this can be confusing at times. For instance, if you fully filter out your noise in one setting, and then switch to another TIMBRE setting, you may wonder where it has gone.



## 14 TIMBRE button

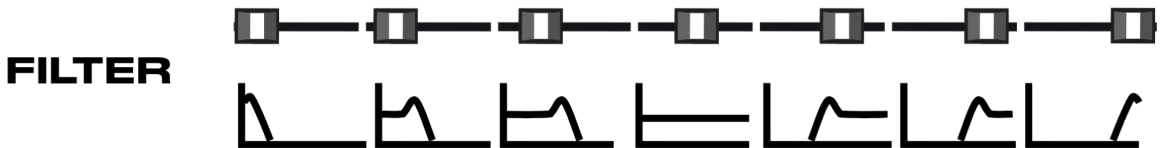
Pressing the TIMBRE button cycles through the three TIMBRE options:



### ! Only for NOISE

This is a DJ-style filter cutoff for the noise generator.

- Low-pass (LP) to the left
- Open in the middle
- High-pass (HP) to the right

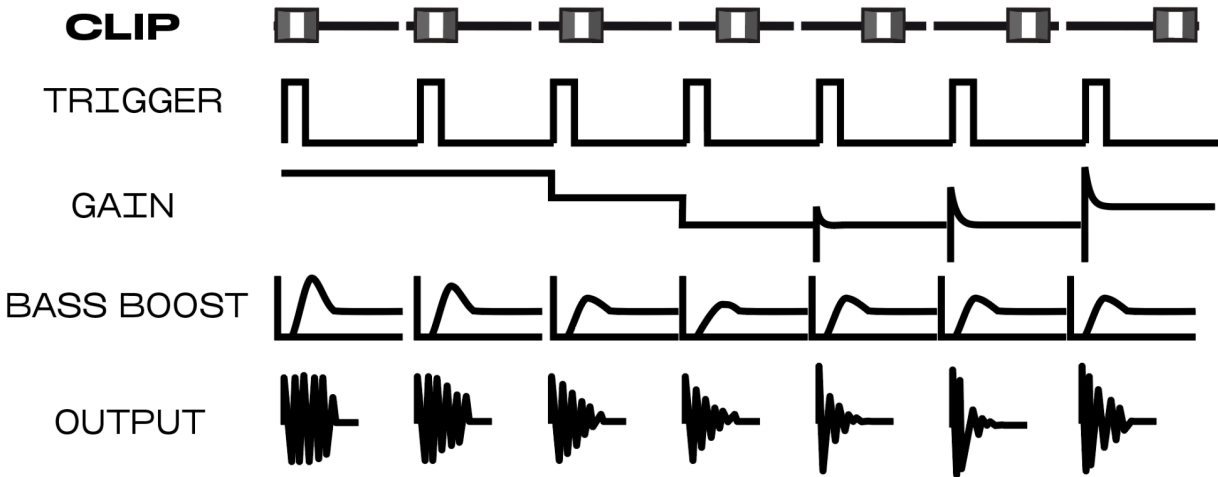


### ! For both TONE & NOISE

The CLIPPING stage represents the final step in the signal chain, occurring after the TONE and NOISE have been mixed. It consists of several distinct components, each operating differently on the left and right sides.

On the left side, a resonant high-pass filter is employed, tuned to match the frequency of the main oscillator. This ensures a bass boost or amplification of the fundamental frequency. Next, the sound is amplified into a soft-clipper, which makes the decay tails sound and lose overtones in a natural way.

The right side adds gain to the transients and feeds them into a hard-clipper, making very punchy and overtone-rich transients. At the extreme, some more gain is added for an extra hard-clipping flavor in the decay tail.



**! Only for TONE**

The SHAPE option does slightly different things for each of the TONE modes:

	<b>TIMBRE FADER TO THE LEFT (BODY)</b>	<b>TIMBRE FADER TO THE RIGHT (TRANSIENT)</b>
<b>FM</b>	static FM amount	FM envelope amount
<b>FM2</b>	static FM amount + FM feedback	FM envelope amount + FM feedback
<b>RING</b>	static FM amount + FM feedback	FM envelope amount + FM feedback
<b>DUAL</b>	FM feedback	FM envelope amount + FM feedback

## 15 TIMBRE CV

The TIMBRE CV input adjusts the selected TIMBRE setting. To control two TIMBRE parameters simultaneously, you'll need to assign one to the CTRL knob.

Note: This input can be either updated continuously or each time a trigger event is detected. See the [button combos](#) section for more information.



# CTRL

The CTRL is an assignable control. While most assignable parameters are already controllable, some represent synth parameters that are otherwise inaccessible. The CTRL opens a wide array of control and modulation options, making CRUST a highly versatile voice module.

## 16 CTRL knob (-6V to +6V)

The CTRL knob can act as a static control for many parameters. When applied to a parameter with its own dedicated fader/knob, it adds its value to the fader/knob.

## 17 CTRL CV

The CTRL CV input controls the assigned CTRL destination. When voltage is applied to the CTRL CV input, the CTRL knob acts as an attenuverter for the incoming CV.



! CTRL always controls a single function at a given time and cannot be unassigned.

Note: This input can be either updated continuously or each time a trigger event is detected. See the [button combos](#) section for more information.

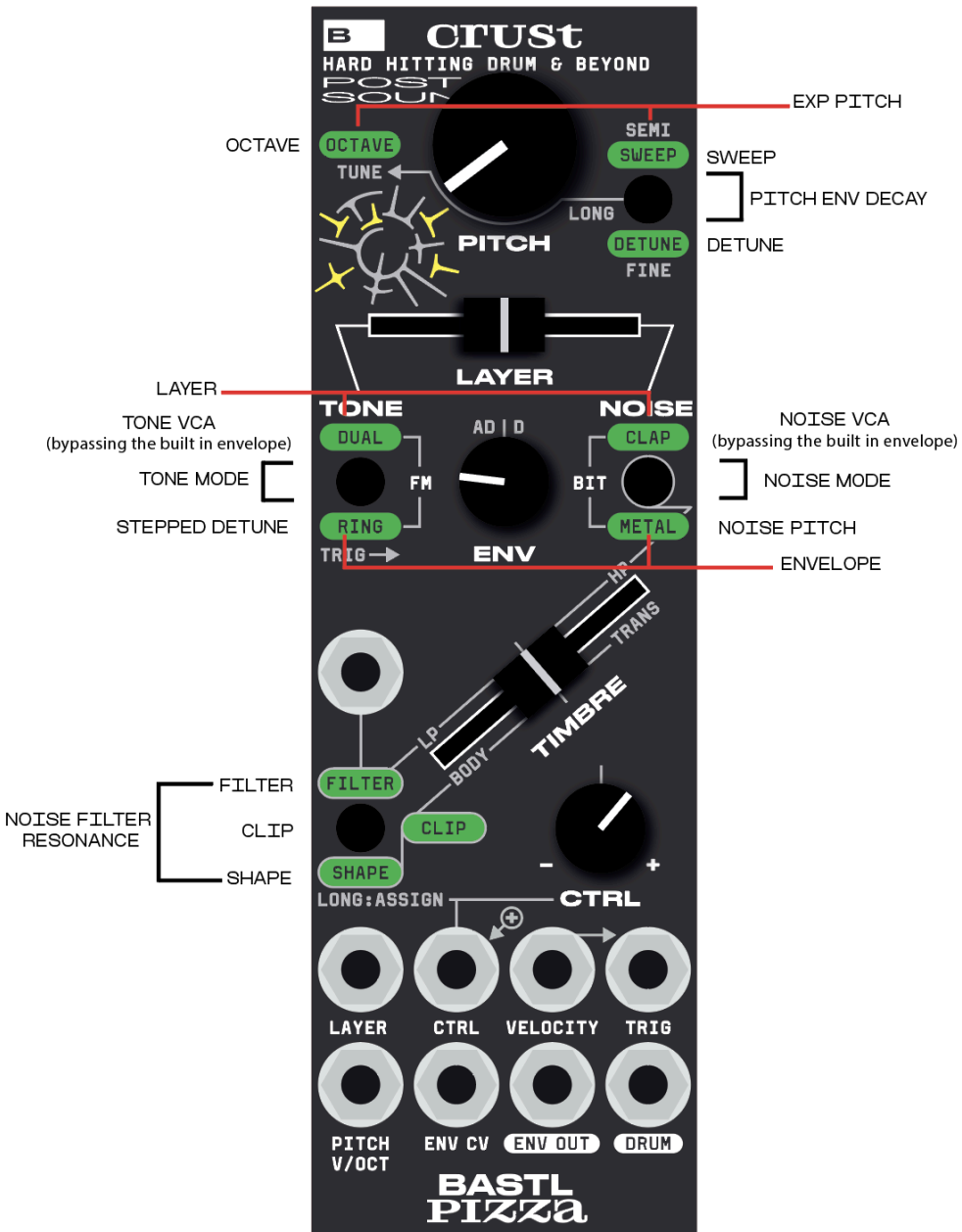
### **To assign a parameter destination to the CTRL :**

- Press and hold the TIMBRE button for a few seconds.
- The currently assigned CTRL destination will start blinking. Select the desired destination by pressing the nearest button.
- Long-press the TIMBRE button again to return to normal operating mode.

## CTRL destinations

Possible CTRL destinations	 Select by pressing	 Indicated by lights
OCTAVE	PITCH	OCTAVE
PITCH exponential	PITCH	OCTAVE + SWEEP
SWEEP depth	PITCH	SWEEP
SWEEP decay	PITCH	SWEEP + DETUNE
DETUNE	PITCH	DETUNE
TONE VCA (unipolar)	TONE	DUAL
TONE mode select	TONE	DUAL + RING
DETUNE stepped	TONE	RING
LAYER	TONE or NOISE	DUAL + CLAP
ENV	TONE or NOISE	RING + METAL
NOISE VCA (unipolar)	NOISE	CLAP
NOISE mode select	NOISE	CLAP + METAL
NOISE PITCH	NOISE	METAL
Noise FILTER cutoff	TIMBRE	FILTER
CLIP	TIMBRE	CLIP
SHAPE	TIMBRE	SHAPE
Noise FILTER resonance	TIMBRE	FILTER + SHAPE

CTRL DESTINATIONS  
PRESS CLOSEST BUTTON TO GO THRU OPTIONS



## 18 PITCH V/OCT (-5V to +8V)

The V/OCT input allows external control over the oscillator's pitch and offers various features to ensure precise tuning. In modular synthesis, achieving harmony between your V/OCT source and oscillator can be challenging. Crust has you covered with the V/OCT CALIBRATION MODE.

Note: This input can be either updated continuously or each time a trigger event is detected. See the [button combos](#) section for more information.

## V/OCT CALIBRATION MODE

Enter the V/OCT CALIBRATION MODE by holding the TIMBRE and PITCH buttons. All LEDs will turn on to indicate the mode.

Press the TIMBRE button to quantize the PITCH V/OCT input (stepped animation on SHAPE LEDs) or leave it unquantized (smooth fading of SHAPE LEDs).

Exit the V/OCT CALIBRATION MODE by pressing the TIMBRE and PITCH buttons together.

Press the PITCH button to initiate **automatic** V/OCT calibration. The LEDs will animate pointing down towards the PITCH V/OCT jack.

1. Connect the DRUM output to the PITCH V/OCT input and wait until all LEDs turn ON.
2. Unplug the cable, and the module will return to the V/OCT CALIBRATION MODE.

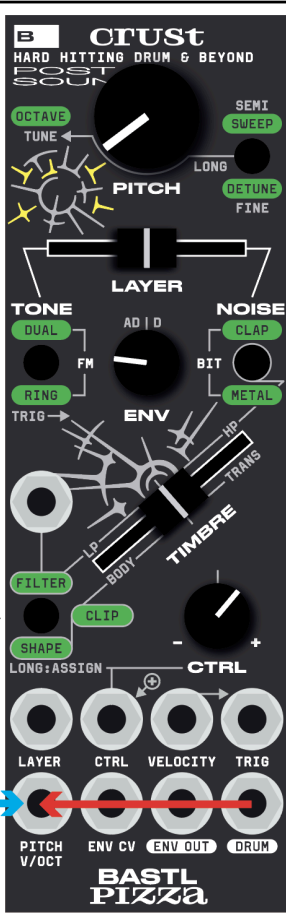
This method uses internally calibrated DRUM output and calibrates the PITCH V/OCT input by sending precise voltages.

Press the NOISE button to initiate **external** V/OCT calibration.

1. Plug a cable from your V/OCT source to the PITCH V/OCT input of Crust.
2. METAL is blinking = apply 0V (C note in lowest octave) on your V/OCT source.
3. Press the NOISE button to learn what 0V means.
4. CLAP starts blinking = apply 2V on your V/OCT source (play a note that's two octaves higher =2V).
5. Press the NOISE button to learn what 2V means and Crust will return to V/OCT CALIBRATION MODE.

## V/OCT CALIBRATION MODE

**START**  
 HOLD PITCH & TIMBRE  
 TO ENTER THE V/OCT  
 CALIBRATION MODE  
 (ALL LIGHTS COME ON)  
 HOLD BOTH TO LEAVE



### AUTOMATIC CALIBRATION

PRESS THE PITCH BUTTON  
 TO START AUTOMATIC CALIBRATION  
 1 - CONNECT A CABLE FROM DRUM TO PITCH V/OCT  
 2 - WAIT FOR ALL LIGHTS TO GO ON AND  
 THEN DISCONNECT THE CABLE

### EXTERNAL CALIBRATION

PRESS THE NOISE BUTTON  
 TO START EXTERNAL CALIBRATION  
 1 - Plug a cable from your V/OCT source to the PITCH V/OCT input of Crust.  
 2 - 0 is blinking = apply 0V (C note in lowest octave) on your V/OCT source.  
 3 - Press the NOISE button to learn what 0V means.  
 4 - 2 starts blinking = apply 2V on your V/OCT source. (play a note that's two octaves higher =2V)  
 5 - Press NOISE button to learn what 2V means and Crust will return to V/OCT CALIBRATION MODE.

V/OCT SOURCE  
 0V & 2V



# BOOT SETTINGS

- Hold the PITCH button at powerup to enter the **firmware update mode**.
- Hold the TIMBRE button at powerup to **reset user settings** (FINE delay settings, CTRL destinations).
- Hold TIMBRE and NOISE at powerup to perform a **factory reset** (resets user settings and calibration). This puts you into calibration mode, requiring recalibration.
- Hold TIMBRE and TONE at powerup to enter the **factory test mode**.

# FIRMWARE UPDATE

1. Connect a micro USB cable to the Pizza Crust module.  
(Make sure it's a data cable and not just a power cable.)
2. Hold the PITCH button and plug the USB into your computer
3. The SWEEP LED will start flashing
4. Crust shows up as an external disk on your computer
5. Copy the pizza\_crust\_\*.uf2 file to this drive and wait for the Pizza Crust module to update and boot to normal operation
6. Successful update is indicated by the DETUNE LED lighting up briefly, unsuccessful update is indicated by SWEEP & SHAPE LED lighting up
7. After a successful update, disconnect the USB and install the Pizza Crust module in your rack

Crust shows the firmware version by a static light of the LEDs at startup. The first release firmware has the SHAPE light on.

# CREDITS

**Development Team:** Marek Mach, Florian Helling, Martin Klecl & Václav Mach

**Supervised by:** Václav Peloušek

**Bootloader:** Lennart Schierling (Binary Labs)

**Main Tester:** John Hornak

**Beta Testers:** David Žáček, František Hruška, David Herzig, Matěj Mžourek, Pavlo Shelemba, John Dinger, Václav Mach, Peter Edwards, Oliver Torr, Patrik Veltruský, Niels Aras, Leoš Hort, Stefano Manconi, Martin Klecl, Antonín Gazda, Jiří Březina, Florian Helling, Jan Pavlacka, Matteo Ruggiero, Wes Langill

**Management:** John Dinger

**User Manual:** František Hruška, Václav Peloušek, Martin Vondřejc

**Graphic design:** Anymade Studio

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



# BASTL

more info

and video tutorials

[www.bastl-instruments.com](http://www.bastl-instruments.com)

