

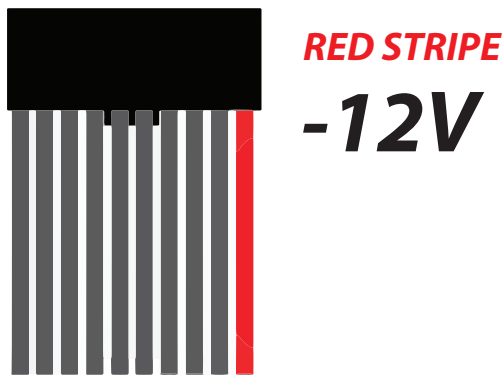
# *entity* **ULTRA-PERC**

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If you don't like reading and just want to start using the module, attached the supplied power cable to the HEADER on the Ultra-Perc. Make sure to align the **RED STRIPE** on the cable with **-12V** marking on the PCB HEADER. Go have fun.

Worried about doing this wrong? No, don't be! Nothing bad will happen other than your module will not seem to be working. Aw jeez...



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Thank you for your interest in the Entity Ultra-Perc (UP). Designed as a successor to the original Entity Percussion Synthesizer. I wanted to improve on that design by addressing some of the criticism of the OG, while also including new features to greatly expand the sound palette and overall versatility. Some of the major features are highlighted below.

The philosophy of the Entity line is to provide an advanced feature set that caters to synthesizing a very wide range of percussive sounds. These features essentially create a specialized full synthesizer voice inherent in the architecture. Therefore, while the UP is a percussion module, it should also be utilized as a specialized synth voice and signal processor for more complex sound design.

The UP is expanded as a signal processor by the ability to combine external signals with the output by routing them through the very circuitry that is utilized to generate the percussive elements. The external input can either be used to generate more advanced percussion or can turn the Ultra-Perc into a twin peak resonant VCF for processing sequences and longer duration signals (acid bass/lead lines and general resonant filtering)

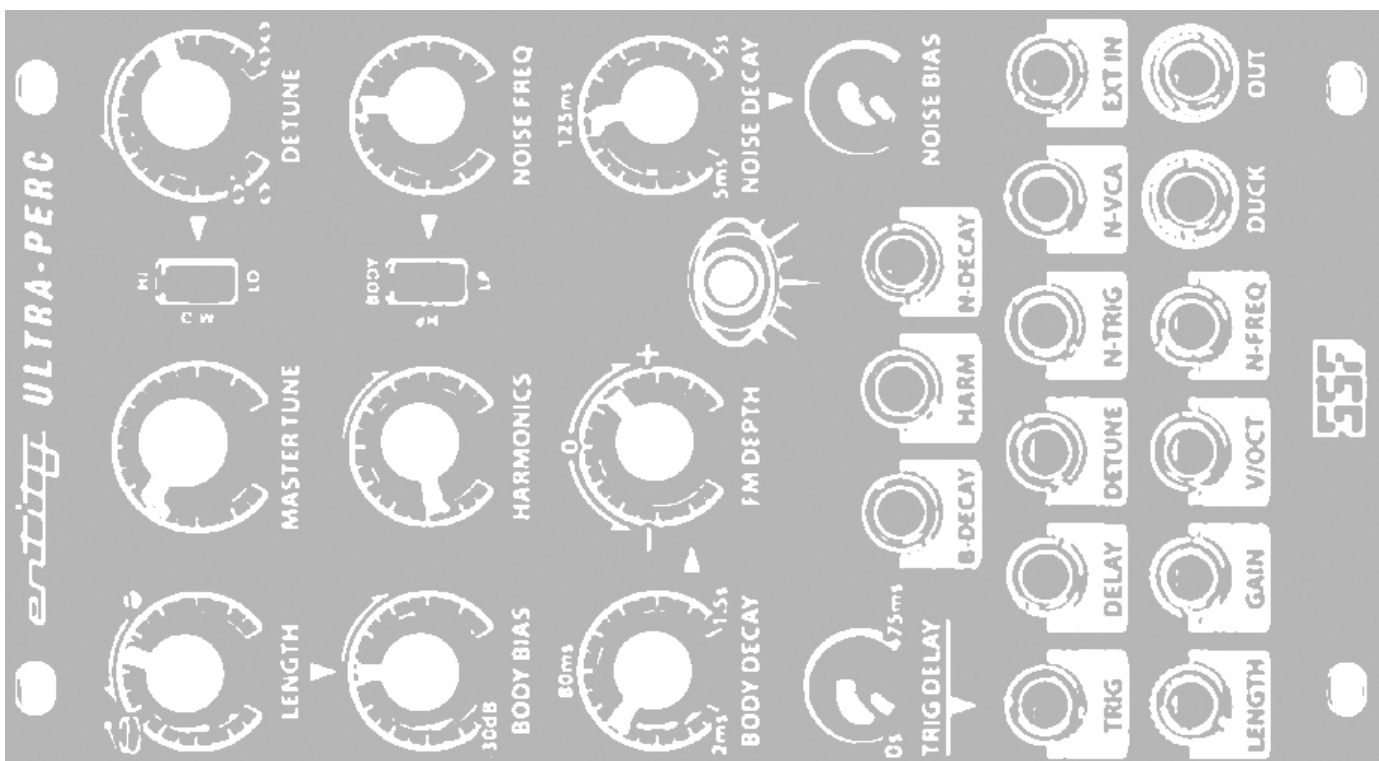
New to the UP is a dual-core resonator topology evolved from the original Entity's single core designs. The Ultra-Perc cores are both fully resonant. MASTER TUNE synchronously controls the pitch of the two cores, while DETUNE is used to set a dyad interval between the two, down to approximately two and a half octaves. The resonant VCF topology allows for simultaneous filtering of the concordant tone, selected via a LO/MID/HI switch - emphasizing the frequency content through the relevant filter mode.

The HARMONICS control folds the output of the resonators for increased harmonic content and distortion. For short percussive sounds, this feature is very important when synthesizing impact dynamics and creating more complex textures for sounds of any duration. The complexity of this parameter is enhanced by the relationship with both the DETUNE control and related multi-mode filtering features.

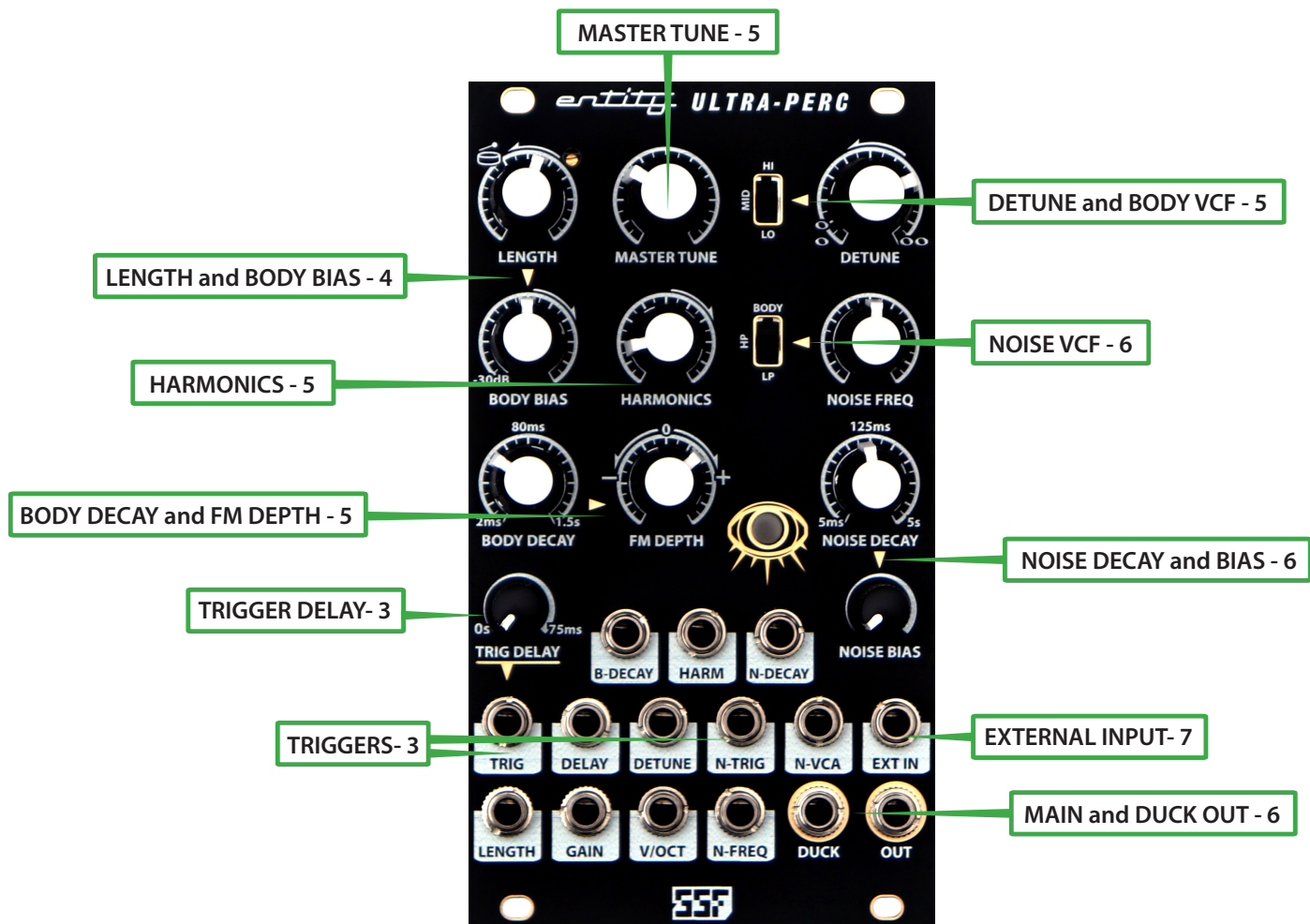
New to the UP is a revamped duo of controls dedicated to amplitude dynamics. The synthesized (BODY) and NOISE sections feature BIAS parameters for offsetting and attenuating these signals for greater control over sustained elements and decay transients set by LENGTH and NOISE DECAY.

Other notable improvements include an independently trigger-able NOISE section with a dedicated LP/HP VCF and additional NOISE VCA CV input.

Please take your time to read through the manual to get into the details not yet mentioned or fully explained. I hope you enjoy the Entity Ultra-Perc and what it has to offer. Have fun and be careful not to scare anyone...



Below is a picture of the Ultra-Perc. The major parameters are indicated with an associated page number to find detailed information for the relevant feature. You will also find important details for all functions throughout the manual and are encouraged to read all sections. The UP features two signal generation sections called BODY and NOISE. They can be independently controlled or used together in the number of ways described in this manual. All functions with the exception of FM DEPTH are voltage controllable. The associated CV inputs with abbreviated labels are found on the bottom of the module. Encircled with gold are the DUCK and MAIN OUTPUTS.



## TRIGGERS

The UP is excited by patching a positive voltage into the TRIG input. Any signal can be used to trigger the UP as long as it is positive and transitions between 0 and at least 1.5V. A trigger conditioning circuit takes care to produce the proper trigger amplitude and duration that the UP needs to operate. You may also choose to use the included button to audition the sounds you create. The LED will light up when a trigger is active. The duration of the LED being on is only indicative of the trigger length applied to this input.

A signal applied to TRIG activates both the BODY and NOISE (via N-TRIG jack normal.)

N-TRIG is used to directly trigger the NOISE generator's VCA envelope, independent of the signal applied to TRIG.

TRIG DELAY adds a timing delay between the applied trigger and when it excites the BODY sound. Up to 75ms of delay (more than enough) is available with this control, which also works as an attenuator when DELAY CV is in use. This is the only VC parameter that works as an attenuator for the relevant CV input. All others behave as offsets.

When applying TRIG DELAY, the noise trigger timing is unaffected, delaying only the BODY. This is useful for synthesizing claps and snaps, as well as thicker, squishier snares and reflective percussion effects.

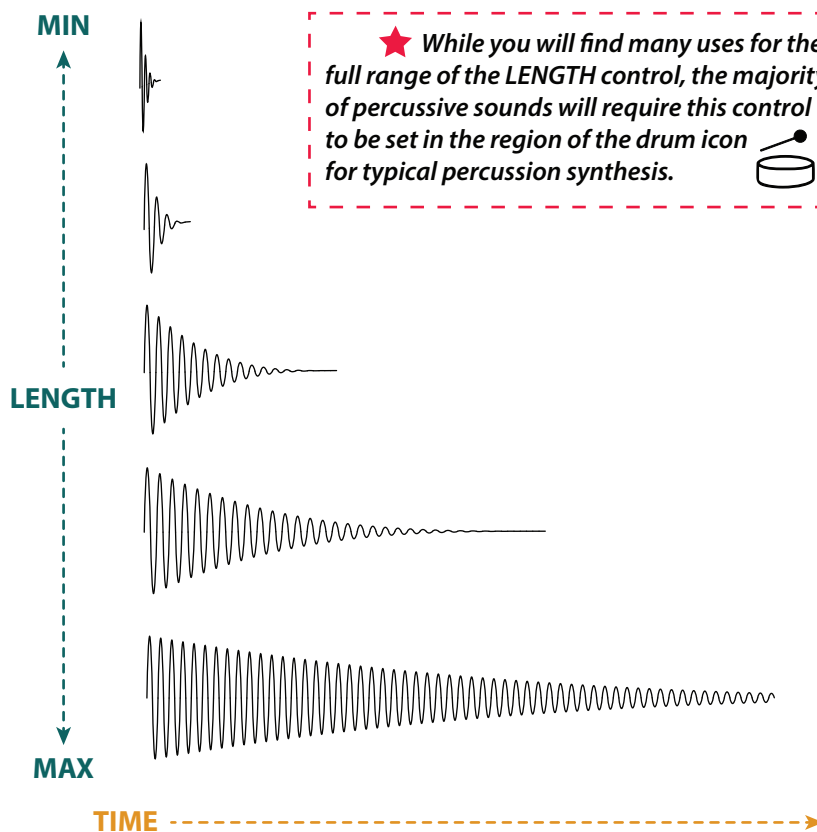
DELAY CV can also be used to skip BODY triggers when a negative control voltage is applied. The control must be turned up a little to activate this effect. *Keep this control at minimum to synchronize the BODY and NOISE.*

**LENGTH** controls the duration of the percussive transient. This duration will vary between very short clicks at the minimum setting, to long decayed synth sounds at maximum. The arrow and drum icon denote the region of control where the more common drum sound durations will be synthesized.

Since the Ultra-Perc is not limited to drum sounds, you can utilize the longer lengths for bass, lead, and external signal processing (see EXT INPUT).

To the right we see how the **LENGTH** control effects the excited waveform. The resonators are excited by the input trigger and the **LENGTH** level determines the amount of ringing *and* amplitude decay produced by the excitation. This excitation eventually becomes damped and attenuated provided that a new trigger does not re-excite the resonator cores before the ringing transient has ended.

While **LENGTH** will change the overall duration and resonant emphasis of the sound, **BODY BIAS** will affect the amplitude dynamics - explained below.



★ While you will find many uses for the full range of the **LENGTH** control, the majority of percussive sounds will require this control to be set in the region of the drum icon for typical percussion synthesis.



**BODY BIAS** can increase or decrease the breadth, impact, and decay of the output and along with **LENGTH**, is an important control for shaping transients.

\*\*\*The *default* setting for **BODY BIAS** is in *center position*.

**BODY BIAS** will effectively emphasize the frequency content of your sounds as well. Settings above center tends to bring out more sustain with bass elements, while settings to the left offer a more staccato high-passed effect. In both cases you will find variations in how the **LENGTH** reacts in these situations and the extent to which the **BODY** dynamics can be tailored with just these two parameters.

Positive adjustment increases the gain and sustain of the output VCA envelope. Setting **BODY BIAS** and **LENGTH** control to maximum will sustain the signal for several minutes.

Negative adjustment attenuates the **BODY** sound down about -30dB relative to the maximum **BODY** VCA envelope level.

You may also use **BODY BIAS** to offset CV applied to the associated **GAIN CV** input, controlling the output VCA.

A large amount of gain is available from the **BODY BIAS** control. In some cases (during silence), this can raise the noise floor quite a bit. Typically, you will only need to raise the **BIAS** enough to fit the length of the **BODY** sound and increase the sustain and tail appropriately without introducing extra noise in higher gain situations.

\*\*\*When processing external signals, you may want to reduce the overall resonance while retaining nominal signal amplitude levels. In these cases you can set **LENGTH** to a sufficiently low level while applying a +5V offset or external envelope to the **GAIN CV** input. *More details can be found in the EXT IN section.*

★ **BODY BIAS** works in conjunction with the **LENGTH** control.

**MASTER TUNE** controls the frequency of the **BODY** sound. The range of this control is approximately **25-800 Hz**. The **BODY** pitch can be further scaled and modulated using the **DETUNE**, **BODY DECAY**, and **FM DEPTH** controls. A wider range of frequencies are available when using the **V/OCT CV** input. The Ultra-Perc will reliably track 4-5 octaves.

**DETUNE** controls the frequency offset of the secondary resonator to set a dyad interval between the two resonator cores. Detuning happens when this control is turned in the counterclockwise direction. When fully clockwise, the second resonator frequency will be in *unison* with the first resonator. Approximately 2.5 octaves of detuning are available when **DETUNE** is set to a minimum. Use this control to synthesize more complex percussive and bass/lead tones as well as the harmonics and in-harmonics associated with toms, snares, and more metallic sounds. Use of the wave folder via the **HARMONICS** control can greatly emphasize these effects.

Use the **DETUNE CV** input to voltage control the detuning parameter. Audio rate modulation may be applied here for a wide range of *FM sounds*. You can get creative variations of a drum pattern by patching a sequenced envelope or trigger into this input as well. Use an external attenuator or variable amplitude modulation source to fine tune this effect.

Three **DETUNE FILTERING MODES (LO/MID/HI)** are selected using the switch next to the **DETUNE** control, indicated by the golden arrow. These modes are essentially multi-mode filter responses, and can have a dramatic effect on the frequency spectra of the sounds you can synthesize via emphasizing the range of the selected frequency mode. The selected mode will also change the response of the following **HARMONICS** section of the signal path.

## HARMONICS

This parameter adds additional **HARMONICS** to your sound. This can be very useful for shorter synthesized drum sounds like snares but is also very effective for toms and more metallic percussion – as well as bass and lead sounds when a longer **LENGTH** is employed. **DETUNE** position and selected **DETUNE MODE** have a major impact on the response of the **HARMONIC** parameter. Experiment as needed.

Set this control to a minimum to achieve cleaner tones that focus on the tuning intervals set by the frequency controls. Just a touch of **HARMONICS** adds a bit of gain for extra punch in the **LO** frequency mode.

Use the **HARM CV** input to modulate this parameter. *This CV input only responds to positive control voltages*, but it is perfectly safe to apply a CV with negative transitions.

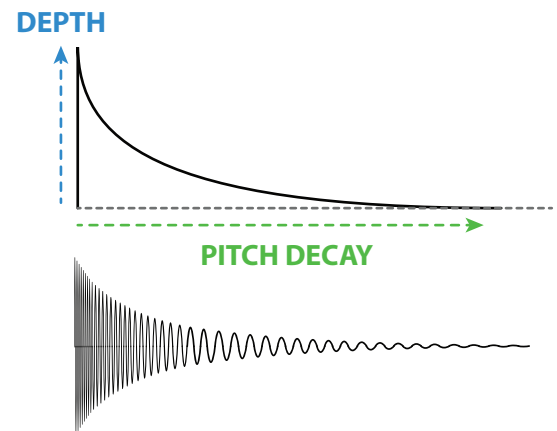
*\*\*\*Apply audio rate modulation to the HARM CV input for an interesting take on FM/AM drum sounds and effects.*

## BODY DECAY and FM DEPTH

**BODY DECAY** offers a wide range of decay lengths roughly indicated by the timing marks surrounding this control. The first 30% of the control range from the **2ms** mark will be most practical when shorter settings of the **LENGTH** control are in use. However, some users who prefer very short FM for tuned percussion and bass will also take advantage of these shorter decay times. Use the **B-DECAY CV** input to voltage control the FM envelope's **DECAY** time. Any CV source may be used.

**FM DEPTH** controls how much of the **BODY DECAY** envelope affects the frequency of the **BODY** sound. This control can apply both positive and negative FM effects. *Therefore, full attenuation is found when this control is in center position as indicated by the "0" marking at 12 O'clock*. Depth can also extend the effective timing of the decay affect on the frequency.

These parameters are very important for altering the impact transients and frequency scaling of the **BODY**. In some cases you may choose to not apply any FM at all when producing bass-lines, leads, and muted drum sounds. However, most drum sounds require this type of FM element, and you are encouraged to experiment with different combinations of **DECAY** time and **DEPTH** to understand the full range of sounds you can synthesize with these parameters.



★ **DEPTH** and **DECAY** are critical for achieving many styles of percussion and more. Experiment with the decay time for various set depth settings to find your favorite sweet spots.

The **NOISE** is generated using an analog noise source. This is then fed into a voltage-controlled **single pole LP/HP VCF** and wide range output **VCA**. Three panel controls and three CV inputs are dedicated to the noise section of the Ultra-Perc. The **NOISE** section is comprised of the **NOISE FREQ** control with topology/routing switch, **NOISE DECAY**, and **NOISE BIAS** parameters. A dedicated trigger (**N-TRIG**) may be used to trigger the **NOISE** separately if desired. **N-TRIG** is normalized from the main trigger input (**TRIG**) if nothing is patched into it.

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## NOISE FREQ

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Controls the cutoff frequency of the **NOISE VCF**. The switch selects between an **LP** or **HP** filter response or routes the **LP** response into the input of the **BODY** resonators and filter (**BODY** position). The latter option is useful for resonant noise sounds and more chaotic drum sounds, as well as variants of claps and snaps. See the clap patch at the end of the manual for more details.

*\*\*\* When the VCF is set to BODY mode, this can also change the character of the BODY sound, even when the noise is fully attenuated. Resulting in a less resonant and muted tone. Be mindful of this setting to fit your needs.*

The **NOISE** cutoff frequency tracks with **MASTER TUNE** and the **V/OCT** input so that the noise can follow the tuning changes of the **BODY** sound. This is useful for a snare sound, for example.

The **NOISE FREQ** control features enough headroom to offset the tracking effect to a minimum if desired. Otherwise, the noise frequency and filter topology are set using these controls to match a particular **BODY** sound or as an accompaniment to the **BODY** if triggering the **NOISE** separately via **N-TRIG**.

Use the **N-FREQ CV** input to apply linear modulation to the **NOISE FREQ** parameter. Any CV type and range may be used although the effects are upper limited to a few kHz of modulation frequency.

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## NOISE DECAY and NOISE BIAS

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**NOISE DECAY** controls the decay time of the dedicated **NOISE VCA** envelope. The decay time can be voltage controlled via the **N-DECAY CV** input. Any range of control voltage can be used.

**NOISE BIAS** controls the level and sustain of the noise envelope affecting the noise **VCA**. Nominal position of **NOISE BIAS** is in center position. The noise will be fully attenuated when **NOISE BIAS** is set to a minimum.

The **BIAS** plays an important role in shaping the decay and impact level of the **NOISE**. Plenty of gain is available for emphasizing shorter decay times or very high-passed filtered noise.

**NOISE DECAY** and **NOISE BIAS** should be thought of as a unit when shaping your sounds.

The **N-VCA CV** input can be used to directly control the **NOISE** level via a dedicated signal path, separate from the triggered noise and decay envelope. You can patch an additional sequenced envelope or other CV source to add compounded layers of noise effects onto your single shot percussive sound or complex rhythms. Use of an external attenuator for this CV input is recommended.

**N-VCA** can accept negative control voltages as well. Negative voltages will duck all noise elements when the CV level is sufficient to do so.

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## MAIN and DUCK OUTPUTS

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The **BODY** and **NOISE** are summed and exit through the **OUT** jack.

Ultra-Perc produces a ducking envelope (inverted and positively offset) for ducking external **VCAs** whenever the triggered **BODY** sound is active. This envelope is derived from the body's output **VCA** and exhibits some dynamic characteristics dependent on the **LENGTH** and **BODY BIAS** control settings. For instance, the ducking effect is magnified when the **BIAS** is low and reduced when the **BIAS** is high.

Use the **DUCK** output to control **VCAs** when using the Ultra-Perc with the other elements of your mix.

The **EXT IN** jack is provided for mixing and processing external signals. This can be useful to both expand the palette of possible percussive sounds - or turn the Ultra-Perc into a unique external signal processor, providing a dual core multi-mode resonator, wave-folder, and VCA to augment external signals.

Applied signals to this input follow the signal path of the **BODY** circuitry. The Ultra-Perc will process these sounds while also generating it's own sounds to meld with the external signal.

It is important to note that the controls take on a dual role when using the Ultra-Perc as a signal processor. Most notably; **LENGTH** has an impact on the applied resonance. You may patch a variable DC offset control voltage into the **GAIN CV** inputs to achieve greater control over the resonance and sustain of the signal.

**FOR EXAMPLE:** Setting **LENGTH** to minimum will reduce the resonance and the length of the **BODY** VCA envelope. As this will also limit the sustain and decay, **BODY BIAS** is typically used to compensate for this reduction. While this may be sufficient for shorter duration effects, you may require longer decay or full on sustain of your processed signal in combination with reduced resonance. *You can apply a positive DC offset into the **GAIN CV** input* to add just enough gain for longer decays or extended sustain of the processed signal.

You can also use **EXT IN** as an alternate trigger input in conjunction with the main trigger for the **BODY** sound. Dynamic fading drum patterns are achievable when utilizing this feature. The dynamic effects are largely based on the trigger timings (duration and tempo) used, as well as your **LENGTH** and **BODY BIAS** settings. For instance, if you apply a trigger that is two or more times the frequency of the main **TRIG** into **EXT IN**, you can simulate a decaying drum roll effect -similar to a delay. Using alternate divisions of the main trigger timing produces variations of the **BODY** sound. More complex arrangements are possible, and you are of course encouraged to experiment with this feature.

The duration of triggers and gates used for this function can have a big effect on the resulting pattern effects. I suggest you use a source with variable gate length or pulse width to get the most out of this function.

## ACID PATCH:

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One of my favorite uses for the **EXT IN** is to create acid bass and leads...

- 1.) Patch a pitch sequenced VCO into **EXT IN** (saw and square waves work great for this.)
- 2.) Patch a trigger that is related to the pitch sequence into the **TRIG** input.
- 3.) Use **LENGTH** to control the resonance and amplitude decay.
- 4.) Compensate for the level of sustain using the **BODY BIAS** control.
- 5.) Use **BODY DECAY** and **FM DEPTH** to control the percussiveness of the sound.  
These controls will also affect the resonant squelch effects.
- 6.) Use **MASTER TUNE** and **DETUNE** for sweeps and combinations of the two for a wide range of filtered acid.  
Experiment with the three **DETUNE** filtering modes (**LO/MID/HI**.)
- 7.) Set **HARMONICS** to minimum or apply to any degree for more extreme sounds and distortion.

## BONUS FEATURE

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As an alternative use to the **EXT IN** for signal processing, the Ultra-Perc may be triggered at audio rates for operation as a very vocal signal processor. This works very well for sub-audio up to a few hundred kHz. You may use higher speeds for a more unstable effect.

Patch a VCO into the **TRIG** input. The controls take on multiple personalities as they will now affect the shape of each cycle of the waveform you hear. Experiment with combinations of all the controls and modes.

While a wide range of your basic percussion sounds are subjective and generally very easy to patch once familiar with the Ultra-Perc's controls, I will highlight some possibly unintuitive methods for making claps and similar sounds.

### CLAP/SNAP PATCH:

- 1.) Start by setting the NOISE filter mode to BODY.
- 2.) Turn LENGTH all the way down and BODY BIAS all the way up.
- 3.) Use NOISE DECAY and NOISE BIAS to set the decay time and level of the noise.
- 4.) Use NOISE FREQ to set the frequency offset (low pass) before going into the BODY filters controlled by MASTER and DETUNE
- 5.) Use BODY DECAY and FM DEPTH to control the FM of the filtered NOISE.
- 6.) Add additional gain and distortion using the HARMONICS control.
- 7.) Set TRIG DELAY between min and halfway to vary the slap back echo effect of a clap or snap.

TIPS: There are many possible variations of this patch.

Spending some time to experiment with different NOISE DECAY and BIAS levels, as well as FM DEPTH and DECAY in conjunction with the DETUNE filters and overall tuning offers a wide range of sounds in this realm.

### V/OCT CALIBRATION PROCEDURE

Recalibration of the V/OCT scaling may be required from time to time. You will most likely only need to make very small adjustments to correct any calibration issues. Turn LENGTH and BODY BIAS and DETUNE up all of the way. Follow by turning MASTER TUNE to about 1/3 of the way. Set FM DEPTH to ZERO. Set BODY DECAY and HARMONICS to minimum. Patch a precisely calibrated V/OCT source signal into the V/OCT input. Patch the output into a calibrated tuner. push the button once to initiate oscillation. Monitor the tuner while sequentially changing the source voltage from zero to five volts and back down to zero volts. Make a note of any scaling errors. For example, is the tuning falling flat or going sharp as you go up in voltage?

***If falling flat as you go up in voltage:*** Turn the trimmer (located through the hole near LENGTH) a tiny amount at a time in the CLOCKWISE direction until desired precision is attained.

***If going sharp as you go up in voltage:*** Turn the trimmer (located through the hole near LENGTH) a tiny amount at a time in the COUNTER-CLOCKWISE direction until desired precision is attained.

Small adjustments are key in order to avoid unnecessary frustration.

### TECHNICAL INFORMATION

MAX POWER CONSUMPTION: +/- 125mA	DECAY CV RANGE: ANY	LENGTH CV RANGE: ANY
WIDTH: 14hp	DETUNE CV RANGE: ANY	GAIN CV RANGE: ANY
DEPTH: 23mm	HARMONICS CV RANGE: 0-10V	All NOISE CV RANGE: ANY
OUTPUT RANGE: 0-20Vpp	TRIG DELAY CV RANGE: 0-5V	EXT IN RANGE: ANY