entity
ULTRA-KICK

SSF

RED STRIPE

-12V

SYNOPSIS

First of all, thank you for your interest in the Entity Ultra-Kick (UK). This module has been in the back of my mind ever since I had to discontinue the Bass Drum Synthesizer (BDS) and I am extremely happy to finally release it into the wild. I have taken into account the many user suggestions, wish lists and criticisms, as well as my own desires while designing the UK. This resulted in a unique kick drum topology that while may not fulfill all of the above, does offer a combination of complimentary features that provide a more user friendly sound designing experience and substantially more versatile sound palette while still covering ground on suggestions that are not explicitly included.

The UK is at it's heart a kick drum module. But like it's predecessors, offers the ability to synthesize more than the name implies. Users of the BDS requested that the control range be a little easier to manage when it came to producing kicks. The UK features finer control over the parameters such as pitch and decay time while still offering a relatively extended range for producing bass and other percussion, as well as general synth sounds. I hope you find it to be a bit more manageable and enjoy the extended range of sweet spots for producing a myriad of kicks and more.

New to the UK is a dual-core resonator topology evolved from the original Entity's single core designs. The main core handles the frequency component while the character core provides a whole new level of sound sculpting beyond what the original designs were capable of. The character control is a major feature of the UK and is critical for the ability to craft a wide variety of impulse/attack styles and overall sound characteristics. Having two resonator cores also permits one of the cores to be modulated by the other. The addition of the ripple feature accomplishes this by allowing an adjustable amount of the main core to modulate the character core. Ripple dramatically enhances the initial impulse transient offering a novel means to shape clicks and accents, as well as providing additional girth and frequency modulated tones. Since a resonator is essentially a filter, the additional core via character can provide low-pass filtering for muted and softer kicks as well as unison resonant boosting when the main and character frequencies are matched. Overall I hope you find these features to be worthy additions to this Entity's design.
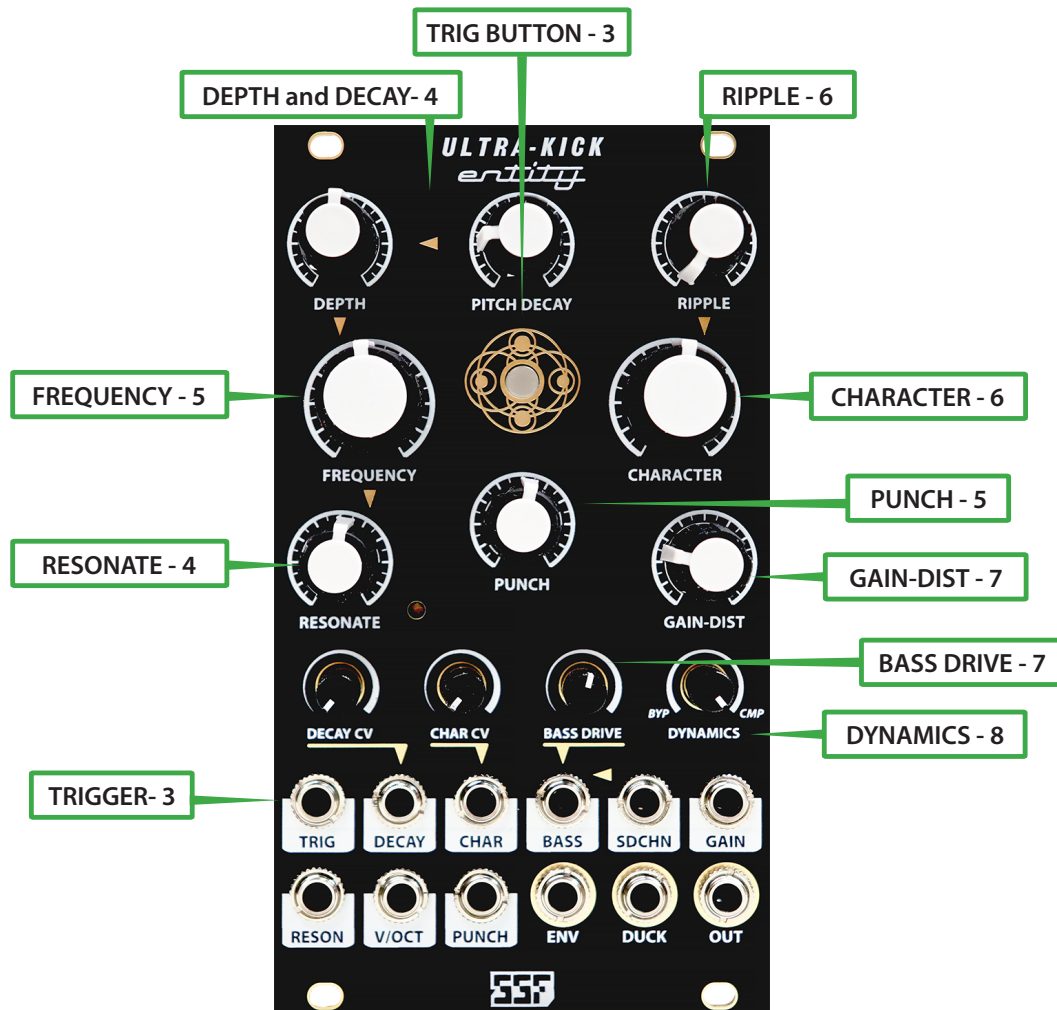
As a big fan of distortion and specifically transistor soft-saturation, I have included an interstage saturation circuit that sits in between the resonator cores. This was originally the output stage of the BDS, with an improved version with less noise and more gain ported into the UK. Having this feature sit before the second core allows for an even greater level of control and variety of effects on your sound. While this is a great feature for adding gain and beefing up the low end when used subtly, it has a great effect on the emphasis of a kick, especially when coupled with the character and ripple controls. A lot of head-room is provided for more extreme distortion if you so desire.

At the top of my list for features as always to include a compressor. The UK's compressor borrows from the Autodyne with an auto response, NY style dry/wet blending and a side-chain filter. Except this time the side-chain filter is variable via a control called bass drive with voltage control. Bass drive gives you the ability to recoup lost bass response from the compression process as well as increase bass distortion and growl. Even more gain and distortion is further controlled via an aptly named gain-dist knob and, yet another final layer and flavor of gain control and distortion is provided via limiter circuitry located in the final stage of the UK, hopefully now fulfilling your distorted needs. Finalizing the compressor section we have the bypassed and fully wet blend control called dynamics to give you the greatest control over compression and final stage distortion.

Please take your time to read through the manual. There are many controls that may be new to you and understanding how they work and interplay will be to your benefit. I hope you enjoy the Entity Ultra-Kick and what it has to offer. Have fun and be careful not to break any windows...

Below is a picture of the UK. The major functions 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. All functions with the exception of Envelope DEPTH and RIPPLE depth are voltage controllable. The associated CV inputs with abbreviated labels are found on the bottom of the module. DECAY and CHARACTER feature attenuators for your convenience. Encircled with gold are the ENVELOPE, DUCK and MAIN OUTPUTS.

TRIG BUTTON - 3

DEPTH and DECAY- 4

RIPPLE - 6

ULTRA-KICK entity

DEPTH

PITCH DECAY

RIPPLE

FREQUENCY - 5

FREQUENCY

CHARACTER - 6

CHARACTER

PUNCH - 5

RESONATE - 4

PUNCH

RESONATE

GAIN-DIST - 7

GAIN-DIST

BASS DRIVE - 7

DECAY CV

CHAR CV

BASS DRIVE

BYP   CMP

DYNAMICS

DYNAMICS - 8

TRIGGER- 3

TRIG   DECAY   CHAR   BASS   SDCHN   GAIN

RESON   V/OCT   PUNCH   ENV   DUCK   OUT

TRIGGER

The UK is excited by patching a positive voltage into the TRIG input. Any signal can be used to trigger the UK as long as it is positive and transitions between 0 and 2.5V. A trigger conditioning circuit takes care to produce the proper trigger amplitude and duration that the UK 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.

TRACKING VOLTS/OCTAVE

A **V/OCT** input is included for properly pitch tracking bass and other percussive melodies. The UK will track at least 5 octaves. As a suggestion, patching sequences that vary within 1 octave or less will offer some pleasant variability to your drum patterns. It is important to understand tracking pitch on a percussion module such as the UK. I recommend that you don't bother trying to use a tuner unless the UK is self-oscillating and no modulation is active beyond a V/OCT input. A percussive sound is very complex in comparison to a VCO and will confuse a tuner and yourself if you are expecting any kind of steady result. You will understand this better if not already when you review the rest of the manual. While the UK is calibrated with a precision voltage source, you may need to make tiny adjustments in time. Front panel access to the calibration trimmer is provided to simplify this process. Please see the end of the manual for the calibration procedure.

RESONATE CONTROL

To the right we see how the **RESONATE** control effects the excited waveform. The main resonator is excited by the input trigger and the **RESONATE** level determines the amount of ringing produced by the excitation. This excitation eventually becomes fully damped provided that a new trigger does not re-excite the resonator core before the ringing transient has ended.

Triggers are required to create sounds with the UK except when the **RESONATE** control is at or near the MAX level. This is the special case when feedback is high enough to support self-oscillation. Please note that a trigger will still provide a transient click effect and while it is not required to initiate self-os-cillation, it can get things going in some instances.

As you can see, **RESONATE** will change the overall duration of the sounds you create with the UK. You will understand via the following section how this function interplays with the **PITCH ENVELOPE** to attain a wide variety of kick, bass, and other percussive sounds.

MIN

RESONATE

MAX
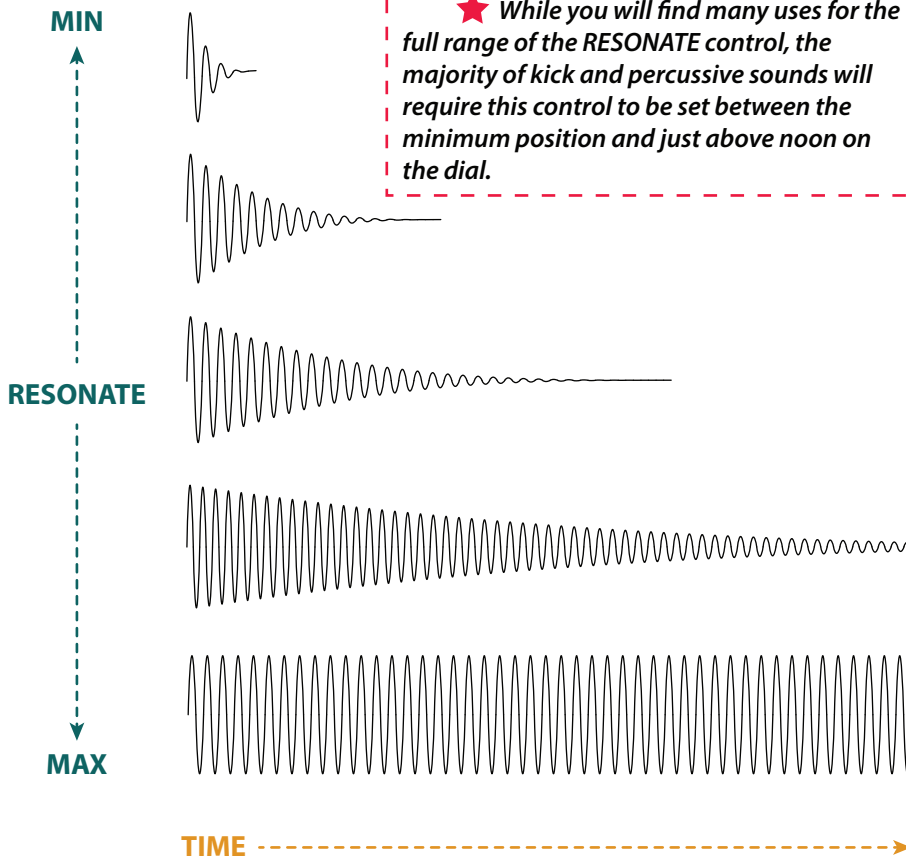
⭐ *While you will find many uses for the full range of the RESONATE control, the majority of kick and percussive sounds will require this control to be set between the minimum position and just above noon on the dial.*

TIME ->

ENVELOPE CONTROLS - PITCH DECAY and DEPTH

The UK features a built in quasi-exponential enve-lope generator with a fixed attack and a voltage controlled decay. This envelope provides a control voltage for frequency modulating the main and charac-ter resonators as well as a fixed amplitude control signal for the character core's resonance behavior. A fixed amplitude copy of the envelope is also available via the **ENV** output jack. This may be used externally or patched back into one of the voltage controllable functions of the UK. A scaled, inverted and positively offset version of the envelope for ducking external VCAs is available via the **DUCK** output jack.

**DEPTH:** controls the intensity of modulation.

PITCH DECAY: changes the decay time of the modula-tion envelope.

Below the depiction of the envelope are three simplified examples of how it can affect the excited waveform. It is important to understand that the duration of the waveform determined by the **RESO-NATE** control can be shorter or longer than the decay time of the envelope. This will have a big impact on the sounds you can create and *should* most certainly be utilized in that manner. Therefore, if your goal is to match the decay and resonate time, you must adjust both parameters appropriately to do so.

DEPTH

PITCH DECAY
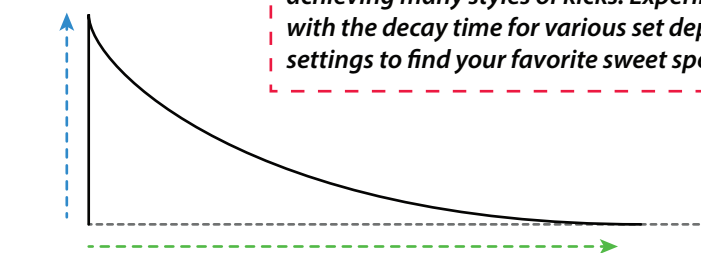
⭐ *DEPTH and DECAY are critical for achieving many styles of kicks. Experiment with the decay time for various set depth settings to find your favorite sweet spots.*
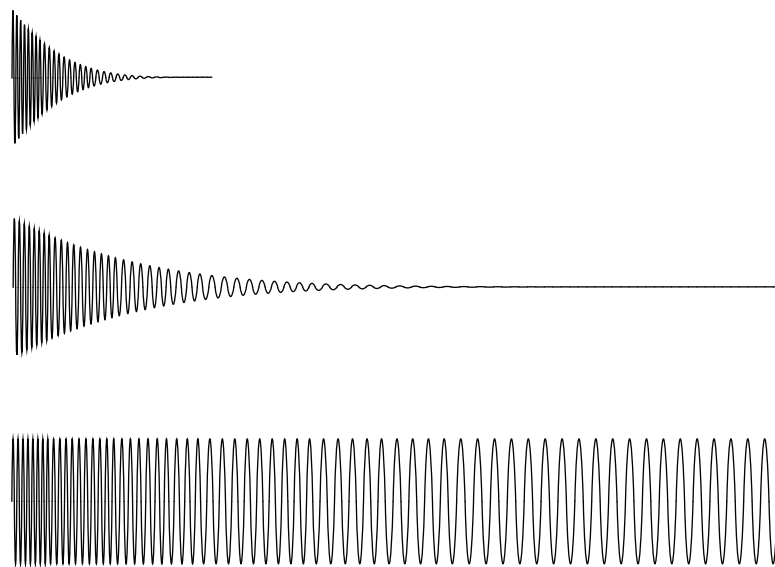
The main resonator core's pitch is set by the **FREQUENCY** control. The range of this control is approximately *8 to 80Hz*. However, there is a distinction between this set 'base' frequency and the resulting output frequency which is largely dependent on the depth and duration of the modulation envelope, which by design, will increase the pitch of the main resonator until the modulation envelope has subsided. This behavior was touched upon briefly in the envelope section and is necessary to understand in order to get the results you may seek. In the light of this, you must consider the pitch set by the **FREQUENCY** control to behave as a base level or offset to any incident modulation, be it internally, or externally via the **V/OCT** input.

Referring back to the details of the **RESONATE** and **ENVELOPE** control sections it should now be understood how these parameters will expectedly interplay in order to produce a wide range of sounds. Some scenarios are listed below to further these points:

1. You want a very fast and intense impulse with a low frequency bass tail:

    You would then set the **PITCH DECAY** to a minimum setting, **DEPTH** to medium-high or high and **FREQUENCY** to medium-low to match your lowest desired pitch. You would adjust **RESONATE** to reach the desired duration of the sound.

2. You would like a softer, bouncier kick.

    You would then set **PITCH DECAY** to medium or medium-low, **DEPTH** to medium and **FREQUENCY** to somewhere just below noon on the dial. Then adjust **RESONATE** to reach the desired length of the kick's bass tail.

3. You would like to achieve more of a mid-tom or hi-tom sound.

    You would then set **PITCH DECAY** relatively high in order to attain a longer pitch envelope and give the character core resonance a bit more juice. Then set **DEPTH** to about noon and **FREQUENCY** between noon and 3 O'clock on the dial. **RESONATE** will then determine the length somewhere in the 11-2 O'clock region.

4. You want to make a huge laser kick.

    You then would set **PITCH DECAY** as long as you want your laser beam to go. Set **DEPTH** relatively high and **FREQUENCY** to match the pitch that you want the laser to end on. Then set **RESONATE** to match the laser beam length you set with the **DECAY** control.

Any of the examples above could of course be improved upon using the six additional sound shaping parameters of the UK, which we will describe in the following sections.

PUNCH CONTROL

PUNCH controls an interstage transistor soft clipper/saturater. If you are unfamiliar with this concept, soft clipping is similar to hard clipping in that it adds gain and eventually chops the peaks of the waveform and generating distortion. This type of distortion is considered harsh as high frequencies are generated at the transitions into clipping. Soft clipping rounds off these transitions resulting in a warmer and more bass heavy distortion. Getting back to the **PUNCH** feature, this circuitry sits between the output of the main **FREQUENCY** resonator core and the input to the **CHARACTER** resonator core. When this control is turned all the way down, the input signal is undistorted and attenuated a bit. Subtle application of this effect will boost volume and low end until moving into soft clipping territory, and as you might expect, higher levels result in yet greater saturation. We will mention **PUNCH** again later on and the effects it can have when used along with the other parameters of the UK. You can utilize the **PUNCH CV** input at the bottom of the UK for voltage control. Sufficiently negative CV can also attenuate the signal for tremolo effects.

MAIN CORE → *PUNCH* → *CHAR CORE*
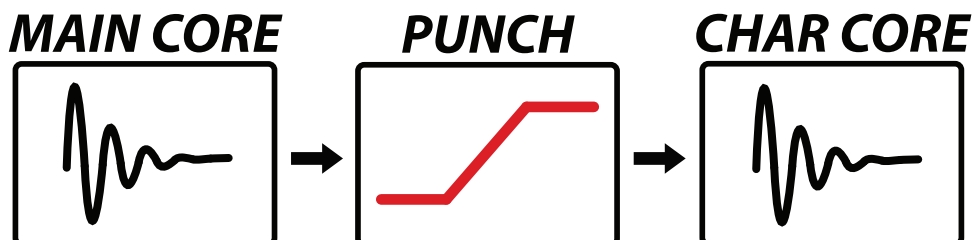
CHARACTER controls the other half of the UK's dual core architecture. It is the second and final resonator stage that allows for greater control over the impulse transient and overall auditory character of the excited waveform. The effects range from subtle variation of the impulse transient to unison effects and overall low-pass filtering of the main core's resonant waveform.

This resonator is exited by the output of the main core and like the main core, is also pitch modulated by the internal envelope and shares the V/OCT tracking input. The resonance behavior is however different from the main core. **CHARACTER's** resonance behavior is far more damped in comparison and is unaffected by the RESONATE setting. As mentioned in the **ENVELOPE** and **FREQUENCY** sections, the **PITCH DECAY ENVELOPE** is coupled to **CHARACTER's** resonance circuitry and provides an extra push to excite the character core's initial impulse. This provides a way to create a more complex impulse transient resulting in a novel means to control accents, clicks and overall percussive attack styles. **CHARACTER's** resonance will also become less damped as the **DECAY** envelope time is increased and allow for the two cores to beat against one another very briefly, therefore adding to the complexity of the initial impulse transient. These effects are substantially accentuated and pushed into more complex territory when used with the **RIPPLE** control, described in the following section. But before we do, please note the **CHAR CV** input and attenuator at the bottom of the module and use it to modulate the **CHARACTER** feature.

RIPPLE CONTROL

RIPPLE introduces the excited waveform of the main **FREQUENCY** resonator into a dedicated FM input on the secondary **CHARACTER** resonator core. Nuanced application of this feature adds an extended palette of impulse transient sounds, especially when combined with the **CHARACTER** and **PUNCH** parameters. Broader levels of **RIPPLE** increase the intensity and breadth resulting in interesting FM and wave distortion effects.

PUNCH will in some cases dramatically alter the effects of **RIPPLE**. With **PUNCH** set to minimum, **RIPPLE** effects will be the cleanest but may also not be very aggressive. Adding some **PUNCH** from 9 O'clock and up will introduce more grit and emphasis to increase the impact and transient effects - favoring more presence and aggression. Extreme levels of **PUNCH** in this case will begin to favor distortion over **RIPPLE** effects.

As you might expect, **CHARACTER** levels will also have an impact on **RIPPLE** effects and you are encouraged to experiment with **RIPPLE**, **PUNCH** and **CHARACTER** level combinations in order to understand how they can interact to your benefit.

It might also be obvious but worth mentioning that increased levels of **RESONATE** will increase the extent that the main resonator (**FREQUENCY**) core is affecting the **CHARACTER** core via **RIPPLE**. Therefore, **RIPPLE** may also be utilized for wave shaping duties beyond initial transient sound design. For instance, referring back to that tom drum example discussed in the **FREQUENCY** section, adding a bit of **RIPPLE** would greatly improve the synthesis of a tom or bongo sound.

CONCLUSION of the MAIN FEATURES

So far we have discussed how the FM **ENVELOPE** functions and how it will affect the excited waveform, and how the **RESONATE** control functions and works in conjunction with the **PITCH DECAY ENVELOPE**. We learned about the relationship between the **FREQUENCY** core control and the envelope parameters, the path and function of the **PUNCH** control, and the function and relationship of the **CHARACTER** control to the others, including **RIPPLE's** functioning.

While the combination of the previously discussed parameters offer a great level of control over designing bass, kick and general percussive sounds; it is common practice in many cases to need greater control over this type of signal's amplitude levels. Whether to sit better in a mix or have that special type of sound or feel to it, a compressor is typically the tool needed to achieve such goals. Luckily for us the UK includes a high end auto-compressor and some additional fun compressor related features to add even more sound sculpting tools to your bag. In the following sections we will now discuss the dynamics section of the UK. Leeet'sss gooooo!

The dynamics feature set consists of a feed-forward auto compressor, a voltage controlled 6db/octave high pass side-chain filter called **BASS DRIVE**, ,"New York" style wet level cross-fader labeled **DYNAMICS**, and a voltage controlled **GAIN-DISTORTION** with a discrete feedback style distortion Limiter. We will discuss these features in detail, below.

AUTO COMPRESSOR: This feed-forward style compressor senses the signal level exiting the **CHARACTER** core and reacts automatically to the amplitude of the frequency content of this signal. Unlike some compressors, the time constant is not set via individual attack and release controls, but rather a level sensing auto attack/release that is tailored to the sound palette of the UK. Therefore, the compression behavior will vary depending on what you do or *don't* (*side-chain filter*) put through it. You typically do not have to put too much thought into this as simply using the UK and understanding how the previous and following controls work allows for a user friendly compressor experience.

BASS DRIVE: This is the VC side-chain filter. As the name implies, turning this control up removes lower frequencies from entering the compressor's side-chain by essentially not allowing the side-chain to sense them. This stops the bass frequencies below the filter's cutoff frequency from being compressed, allowing them to pass relatively unhindered onto the subsequent **GAIN-DIST** and **LIMITER** circuitry. Therefore, while allowing for those frequencies to be louder, they are also going to be susceptible to pre-release ,and depending on **DEPTH**, **FREQUENCY** and **RESONATE** levels, more notable post-release distortion effects. To explain this in a bit more detail, **PITCH DEPTH** will of course increase the frequency of the excited waveform beyond the cutoff of the side-chain filter for the initial impulse portion of the waveform; initiating compression. **FREQUENCY** sets the offset and pitch that the waveform will eventually fall to, and **RESONATE** determines if that lower level is actually reached before the signal is fully damped. If **RESONATE** is set long enough to exceed the compressor's release phase, the lower tail frequencies passed through via **BASS DRIVE** will be much louder than the initial half of the waveform. While a majority of kicks are shorter (*lower* **RESONATE** *settings*) and within the time constant of the compressor, it is important to understand this behavior and how to compensate for it, if needed. Adjusting **BASS DRIVE**, **PUNCH** and **GAIN-DIST** all affect gain and will enhance or mitigate low end distortion in all cases. Beyond that, you will typically use **BASS DRIVE** to apply some bass boost - In this case just dial it in or back it off if unwanted distortion is present.

To the right we see a simplified representation of the compressor action on a highly resonant waveform. The compression phase is illustrated in blue. We also see the pitch envelope superimposed via the dashed green line. At the tail of the waveform in light purple we see the region where the maximum gain implied by the **BASS DRIVE** cutoff frequency would occur.

⭐ *The frequency range of the* **BASS DRIVE** *filter is approximately 20Hz-530Hz. Hence, pre-release distortion of the higher frequencies is definitely possible when using high levels of* **BASS DRIVE.**

COMPRESSION PHASE

RESONATE - - - - - - - - - - - - - - - - - →
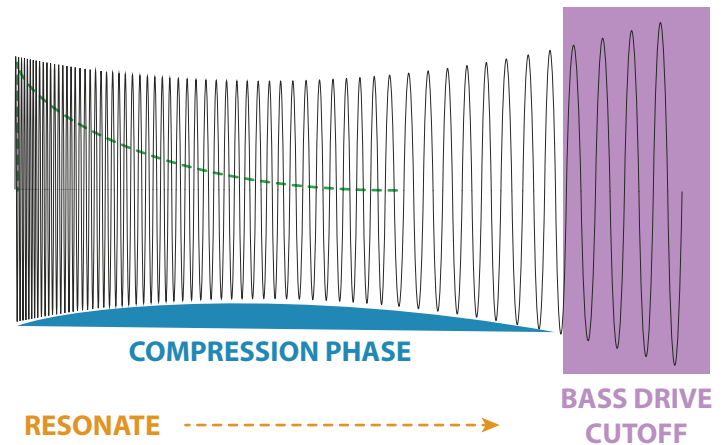
BASS DRIVE CUTOFF

Finalizing **BASS DRIVE**, the CV input labeled **BASS** offers a way to voltage control this feature. The control itself will behave as an offset. It is possible to lower the cutoff frequency even lower than the control can offer as well using negative control voltages. Positive CV will increase the drive level.

GAIN-DIST: This is the output stage of the compressor. Use this control in small amounts to increase the level of the output. This is useful if you would like to add a bigger presence to the sound overall. Greater levels will eventually introduce distortion as both the compressor VCA and the subsequent limiter stage become overdriven. Higher levels of **PUNCH** and **BASS DRIVE** will effect the onset of distortion as well. You can adjust all three of these parameters to achieve various flavors of saturation, gain and distortion behavior. A CV input labeled **GAIN** is provided for voltage control. Positive voltage increase gain and distortion and negative voltages will decrease and can also attenuate the output, if desired. The control will behave as an offset to CV.

DISTORTION LIMITER: The final output stage consists of a discrete feedback limiter. The limiter maintains a maximum amplitude of approximately 19.5Vpp in order to keep the output from overloading external modules that may be susceptible to phase reversal distortions. This limiter also allows for various types of distortion to be present without requiring too much gain to produce. When the upper ceiling is reached through the controls that add gain to the signal, the output is also squashed very aggressively, adding an additional layer of clipping distortion.

SIDE-CHAIN INPUT: An external side-chain input, labeled **SDCHN** is included on the UK. While it is a bit unorthodox to side-chain a kick (kicks are usually used as a side-chain to duck a bass-line, for instance.) This input was included because it offers some additional transient shaping capabilities when used with the right types of inputs. There are essentially two ways to go about it, with one being relatively straight forward and the other a bit more nuanced and advanced. To begin, **BASS DRIVE**, **PUNCH** and **GAIN** should be set to minimum as the UK's waveform will be completely out of the side-chain when anything is patched into the **SDCHN** input. You may want to add some of these back in at some point but I highly recommend you keep them all the way down initially as you will generally get the best results if you do.

The most simple procedure is to apply another percussive element into this input. For instance you may want to compress the level of the UK a bit when another percussive element is active, or you may want to layer multiple kicks and impart another kick's dynamic content to control the UK's dynamics.

The more advanced procedure is to trigger a function generator with the same trigger you are using to excite the UK and patch the function output into the **SDCHN** input. This method behaves like a pseudo attack/release control for the compressor and requires that the timing of the function stays consistent with the length of the bulk of the UK's output waveform. Increasing the attack time will delay the onset of compression, beefing up the front end of the UK's transient waveform. Both linear and logarithmic functions tend to offer the most interesting results but remember that these timing elements need to remain relatively fast, especially for the release portion when using a linear fall shape. Increasing release time will re-position the most compressed phase of the UK's waveform. You may find this useful not only to nuance the dynamics from the context of how the transient sounds, but also to aid in polishing the way the kick sits in a mix with other percussive elements.

DYNAMICS CROSS FADER: Last but not least is the wet/dry control for the compressor labeled **DYNAMICS**. In the audio engineering world, use of this feature is known as New York style compression. You can set this control all the way *CCW* to completely bypass the **DYNAMICS** section but even better, this control offers a means to mix the original, uncompressed signal with the fully wet output of the compressor (*CMP*). This will give you much greater control over the sound dynamics and is especially useful for dialing in the presence of heavy distortion effects. Please note that since **BASS DRIVE** and **GAIN-DIST** are both part of the compressor, these features will do nothing when the **DYNAMICS** control is set to 100% bypass (*BYP*).

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. Start by turning down all controls. Now turn RESONATE up all of the way. Follow by turning FREQUENCY and CHARACTER up all of the way. Patch a precisely calibrated V/OCT source signal into the V/OCT input. Patch the output into a calibrated tuner. 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 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 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

POWER CONSUMPTION: +/- 110mA	DECAY CV RANGE: 0-10V	GAIN-DIST CV RANGE: +/- 10V
WIDTH: 14hp	CHARACTER CV RANGE: +/- 10V	RESONATE CV RANGE: +/-10V
DEPTH: 23mm	BASS DRIVE CV RANGE: +/- 10V	PUNCH CV RANGE: +/-10V
OUTPUT RANGE: 0-19.8Vpp	SDCHN INPUT RANGE: 23Vpp	ENVELOPE OUTPUT: 0-8V