

HELIX

Give Your Panda A Bucket

Students usually find that there are a few basic rules to follow when learning any new discipline – most of which are really just refined examples of “best practices” taken from years and years of experience in that field. Chefs learn that a cooked steak needs to rest before being cut on the bias, electricians learn to test high voltage wires with the back of their hands not their open palms, and scientists learn how to test observations using the Scientific Method.

For engineers, a classic example of one such rule is “noise is a by-product of inefficiency”. This one is observable every time you hear a muscle car from two blocks away yet can’t hear a luxury sedan idling next to you: the muscle car has a ton of power and can reach high speeds, but that power comes at the expense of efficiency, and the by-product of that inefficiency is excessive noise and lower gas mileage.

But enough of the Science Speak! This kind of stuff is relevant for pure designs, but we’re guitar players! We distort things on purpose! Like, really distort the bejesus out of them, sometimes. We often want a guitar to be that muscle car, so to speak, and we just deal with any added noise as a necessary evil of getting the sound we want. When it comes to guitar tones, pure science must sometimes be mixed with the smelly stuff.

Case in point: some of the most sought-after delay pedals ever made make use of a “Bucket Brigade” (“BBD”) chip under the hood. These are idiosyncratic devices with all sorts of design shortcomings, but BBD chips have gooey and organic sonic attributes that play an essential part in some of the most revered guitar sounds of all time.

The chip got the name “bucket brigade device” due to the way that each stage handed off audio to the next – mimicking the way that buckets of water were passed from person-to-person to fight fires before the dawn of fire hydrants. The chip itself is interesting in that it’s analog, but the delay time is controlled digitally by altering the sample rate.

This is important because when you decrease the sample rate, you are effectively lowering the resolution of the audio passing through the chip by moving the samples farther apart. Lower resolution means that the audio sounds more processed and a bit nasty.

Did I mention that BBD’s are also noisy, and roll off quite a bit of high-end as well?

So you have a noisy chip that sounds dull, has relatively short available delay times

and gets funky-sounding at the longest settings. Sounds like a terrible design! However, BBD-based delays have been holding down spots on pedal boards for 30 years now, so there must be something more going on.

Oddly enough, the chip's shortcomings were part of what made it useful for guitarists. The treble roll-off is beneficial because the delayed notes are slightly duller-sounding than the originals. This means that the repeats stay out the way of live playing, and the delay rarely sounds harsh. A compander (compressor/expander) circuit was added to try and tame the noise by turning up the level of the repeats as they began to decay – which mostly worked – but as a bonus it added a wonderful organic gooeyness to the sound of the repeats due to the added compression.

Due to all of these idiosyncratic characteristics, it has been nearly impossible to create a faithful bucket brigade delay in embedded software up to this point. Previous guitar products have been able to mimic the real behavior for a few knob settings, but for Helix we wanted to go further. We wanted to offer fully realistic recreations of these classic pedals, where not only was the knob interaction correct, but the distinctive audio artifacts were preserved as well.

In the end, we created two self-governing software components specifically for these delay pedals: a bucket brigade chip we call “Bucketier”, and a compander circuit we call “Panda”.

Both of these components run standalone in the virtual delay circuits, behaving precisely as their analog counterparts do. Panda creates the same glued-together dynamic behavior that the original circuit had, and Bucketier performs the change in delay time by altering its own internal sample rate, thereby recreating the same lossy resolution as the original units at long delay times. In addition, having the Bucketier as a standalone component means that we can create variations of these pedals that would have been prohibitive to make in the real world, while still retaining the authentic behavior of the original bucket brigade chip. As an example, the Adriatic Delay in Helix has the ability to add additional BBD chips for longer delay times than would have been possible on the original modeled pedal.

So if you're a vintage delay junkie, you owe it to yourself to find a Certified Helix dealer and check one out – it's vintage gooey delay heaven. For more information on all of this stuff, check out www.line6.com/helix.