

# PRO AUDIO REVIEW

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**equipment**  
*review*

## Crane Song HEDD 192 Digital Processor

*by Bob Katz*

The Crane Song HEDD 192 (Harmonically Enhanced Digital Device) is a handsomely designed, brushed-aluminum, one-rackspace device that is solidly built with custom-molded "Crane Song-green" knobs and a neat, old-fashioned incandescent power indicator.

### Features

No one will miss this piece in a crowded rack. The HEDD 192 (\$3,495) is a complete design upgrade from the original 48 kHz HEDD. The look and feel is analog, although the processing and control is totally digital. Unlike most digital devices, the shaft encoders have end-stops, and the knobs have physical detents, so it feels like an analog piece as you make adjustments. No need to look at an LCD screen for feedback to know when you are halfway up or all the way to #10 (fully clockwise). Supported sample rates are 44.1 kHz, 48 kHz, 88.2 kHz and 96 kHz, with an upgrade path to 192 kHz sample rate as soon as a standard is established.

In addition to the S/PDIF and AES/EBU digital ins and outs, there are stereo balanced analog I/Os with 24-bit converters and adjustable trim levels. The DSP process can be inserted in any combination, including D-to-D, which is how I evaluated the unit.

It is possible to process an analog source and simultaneously use the D/A converter to monitor a separate digital source. A word clock I/O can be used to slave the A/D, or to slave an external device. But the word clock cannot be used to drive the D/A for lower jitter; the DAC must be driven from the clock embedded in the AES



or S/PDIF line.

There is a front panel bypass switch, with a short, noiseless crossfade between the processed and unprocessed signal. In 24-bit mode, the output is bit-transparent to the input (identical to bypass mode) when all three process knobs are fully counter-clockwise, an excellent design philosophy. The HEDD's distortion-generating algorithms are additive (mixed in) rather than using complicated nonlinear multiplications. This means that the added distortion is smartly mixed with the unaltered original source signal, assuring maximum transparency for musical sources.

I regret to say that my old SPL Machine Head (see *PAR*, 9/99, p. 42) seems long in the tooth by comparison, for I always heard a slight veil to its sound even when the process was fully off. This is not the case with the Crane Song HEDD, which sounds very transparent, even when processing strongly.

The HEDD's large multisegment stereo meter is easy to read, even across the room. You can choose one of two meter modes with an internal jumper, either infinite hold with front panel reset, or 2-second peak hold. Infinite hold is useful if you have to run out of the room and find out that an over (one sample over) occurred while you were out. I wish the meter modes were switchable from the front panel, as I like to

### At a Glance

#### Applications:

Studio, mastering

#### Key Features:

24-bit analog, S/PDIF and AES/EBU I/O, 96 kHz sampling support and 192 kHz with upgrade

#### Price:

\$3,495, upgrade to 192 kHz TBA

#### Contact:

Crane Song Ltd., at 715-398-3627

have both available.

When processing at a FS = 44.1 kHz sample rate, some aliasing against the sample rate can be observed on an FFT when inputting a high-amplitude, high-frequency signal. This is quite common at low sample rates, and is the case with the SPL Machine Head and most current digital compressors. This is why a good digital compressor should oversample before compressing, according to an article in the *Journal of the AES* ("A Worst Case Analysis for Analog-Quality (Alias Free) Digital Dynamics Processing," by Dan Mapes-Riordan, *AES Journal*, 11/99, Vol. 47, Number 11).

I found the HEDD 192 to be extremely

pure-sounding (probably due to the additive algorithm), while the SPL has a remnant of “digititis.” The unwanted aliasing components in the HEDD at 44.1 kHz are typically below -100 dB FS, which should be swamped when the user adds aesthetic low-frequency distortion. In addition, when operating at higher sample rates, the aliasing components will probably be inaudible, a good reason to work at the higher rates.

Dave Hill, president of Crane Song, has performed original research on the non-linear transfer characteristics (the “spice”) of several popular analog devices. The result is musically satisfying. Going beyond the Tape simulation of the SPL, the Crane Song adds two other controls, labeled Triode and Pentode. I call them “sugar,” “salt” and “pepper” when talking to musical clients.

The Triode control is extremely subtle, adding just a touch of salt whenever you need it. Dominated by second harmonic, it fattens the bottom of the signal and, if you turn it up, the harmonic structure richens, just like with a triode tube.

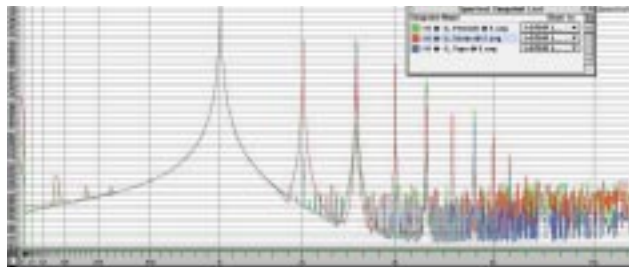
The Tape control adds odd harmonics, starting with the third and fifth, fattening up the bottom even more than the triode, and gradually compressing the high frequencies with increased level. This is the sugar of the set, for if you turn it all the way up it becomes a thick molasses that is too much for mastering applications, but might be the bee’s knees for some instruments during mixdown.

The Pentode knob is the pepper. Versatile, at low levels it produces mostly third harmonic (sweet pepper), but as you push the Pentode gain, it adds higher order signal-dependent odd harmonics like a pentode going into overload. This adds some pleasant brilliance to the sound and brings out inner details. Naturally, we don’t turn up highs indiscriminately; this is useful for dull musical sources that may need some life.

At position #10, you get a kind of flubby effect, like an overmodulated or gassy tube. At this point it is more like Tabasco sauce, or hot pepper. Still, I have to say “very cool, man!” Extreme Pentode setting will make some very interesting sounds during tracking or mixing.

The Spectra-Foo FFT (see **Figure 1**) shows the Triode response in red, Pentode in green and Tape in blue, with each knob halfway up (#5), with a -3 dB FS 1 kHz sine wave at 44.1 kHz sampling. What appear to be subtle differences on the FFT are actually quite dramatic sonically. The highest harmonic level is -37 dB FS, which is quite significant, and the “grass” is around -139, which is probably inaudible.

Unlike the SPL, the HEDD has no output level control. You just turn up your chosen



**Crane Song HEDD 192 distortion in Triode, Pentode, Tape Modes**

distortion control(s) and listen. As you dial in your choice of spice, the loudness goes up appreciably. Harmonics add level while reducing chances of an over, reducing peak-to-average ratios much like a compressor, but without need for attack or release times.

The downside of not having an output level control is there is no ability to compare at unity gain. If the volumes do not match, it can be terribly deceiving, even for an experienced mastering engineer. Just make sure you have another place in your chain where you can switch monitor gain as you insert and remove the processor.

Hill probably chose not to add an output level control because it would require multiplicative DSP on the main signal and destroy the purist additive approach he has taken. A low-resolution level control can easily take sound quality downhill.

I tested the 16- and 20-bit dithered modes, and discovered that the HEDD’s dither output extends down to the 24th bit even if its amplitude is destined for 16. So if you want to audition the dither as it will be used, be sure to listen through a device that truncates the signal. Note that not all DAT machines truncate their input signal to 16 bits until you record and then play back. My Sony models (even the consumer units) pass full 24-bit wordlength when they are in E-E or record.

According to the manual, the Crane Song dithers are proprietary, and optimally shaped for the best sound. I found that the 16-bit dither has an interesting curve, with some boost at the high end, but far from the amount that is used by POW-R dither, for example, with its ninth order noise-shaping. I consider the HEDD’s dither to be a bonus — better than standard flat dither; pleasant sounding and not harsh, but it will not reveal the ultimate in low-level ambience or depth recovery.

The manual states that it is not a problem if you only use 16 bits of the output when coming from a 16-bit source, even if the dither is turned off. Ordinarily, I would quibble with a designer who spouts these controversial words. The unique additive DSP architecture of the HEDD means that the original source signal is not altered *per se*.

The additional bits consist of the added harmonics, which are rendered to 24-bit precision. Thus, truncating the distortion signal will only distort the distortion! In other words, a touch more pepper (though quantization distortion sounds more like hot pepper than sweet pepper). If you want the Pentode effect anyway, the added grunge will likely not be bothersome, and if you’re using the triode or tape effect, truncation artifacts will likely be masked by the heavier lower harmonics of the distortion generator itself.

Regardless, I still recommend recording the output of the HEDD to a 24-bit medium whenever possible, so the highest resolution rendering of the distortion signal can be passed on to subsequent processors. And if the source is 20- or 24-bit, be sure to use proper dithering or record to 24-bit.

I tested the power amplitude of the 16-bit dither, and it was around -93 dB FS RMS, which is normal. In my unit, however, the 20-bit dither measured too hot (around -96 dB FS).

Unlike the SPL, there is no MIDI remote control. In fact, there is no remote control at all, which I consider a minus in a processor at this price point. I am not a “process on load in” kind of guy, I am one of the growing 10 percent or so of mastering engineers who like to process on load out. So this is a meaningful missing feature for me. I like to have the freedom of adjusting all processing automatically and in album context, since I feel the decision on the sound of the first tune definitely affects the feel of the whole record. But I can live without the remote, notating settings and maybe even tweaking a knob once or twice while cutting a master, just like the old days of LP cutting. But add MIDI to the wish list.

## In use

The first project I tried with the HEDD was perfect for testing its ability to mimic the incomparable sound of analog tape. Avant-pop group Mercy Machine arrived with a half-inch analog mixdown. I produced an excellent-sounding master without need of the HEDD. But the group also wanted to do an instrumental-only master for a possible movie score.

The 16-bit instrumental DAT sounded very good, but it was a bit dry and missed the essential fatness that had been achieved in the analog. So I added the Crane Song to the processing chain. I found that setting the Tape control to about #6 yielded an excellent representation of the analog tape, warm, full and clear.

Remarkably, the transparency of the source was also preserved, a testament to Crane Song’s minimalist DSP philosophy.

Comparing the analog tape version to the DAT/Crane Song version is like comparing two fine wines. They both have body, they taste only slightly different, but both have good blush and bloom. I will go out on a limb to say that the Crane Song HEDD 192 has truly nailed analog tape simulation. I never gave my SPL a better grade than 90, and in retrospect, it should have been an 85.

I am glad they recorded the DAT at 48 kHz, because the HEDD produces significantly fewer aliasing products at this rate, especially after sample rate conversion to 44.1, removes the aliases between 20 and 24 kHz.

For more than 20 years, I have been railing about the sound of what I now call cheap digital, using some of these terms: cold, harsh, murky, small, fatiguing, bright ... And I have been writing about the reasons behind these problems, among them: aliasing, clock leakage, jitter, premature truncation, too much dithering, too little dithering, bad filter design, etc. Although digital recording has gotten much better,

cheap digital still proliferates.

No matter what music comes in, as mastering engineers, we have got to make the very best of it. That is our job. So, is the Crane Song HEDD-192 up to the job? Absolutely.

### Summary

This box is habit-forming, especially in these days when I often receive grainy, brashy digital mixes that need serious help. The HEDD allows me to dial in a sound that used to require a whole analog chain to achieve. I have not thrown out my analog mastering gear, but I am using it a lot less these days. Heresy? Try it yourself and be amazed. With the addition of the HEDD-192 and a Weiss DS1-MK2, my digital processing chain is now comparable to the best analog chains. Unfortunately, good-sounding digital processing is still very expensive.

The HEDD 192 looks like analog, feels like analog, acts like analog and sounds like analog! In 2001, there can be no higher praise for a digital processor.

## Product Points

### Crane Song HEDD-192

#### Plus

- Habit-forming
- Analog look, feel and sound,
- Addictive algorithm processing

#### Minus

- No remote or MIDI control
- No output level control

#### The Score

An essential processor for the high-end mastering studio and for any digital recording and mixing studio.

*Bob Katz has been an audio professional for more than 30 years and has mastered hundreds of discs, including two Grammy award winners. His mastering house is Orlando-based Digital Domain. In September, Katz will chair the AES Mastering workshop.*



2117 East 5th Street  
Superior WI 54880 USA  
tel. 715 398 3627 fax 715 398 3279  
[www.cranesong.com](http://www.cranesong.com) email [staff@cranesong.com](mailto:staff@cranesong.com)