

As Good As It Gets

Benchmark Media Systems DAC1

by Frank Wells

On one end of Benchmark Media Systems' product line are clever and affordable interfaces, some literally built on the backs on panel mount connectors. Benchmark also has a sterling reputation as a manufacturer of what might be called premium utility products. These distribution amplifiers, A/D and D/A converters, metering systems and other devices are staples of broadcast facilities. Benchmark has quietly gathered a throng of devoted followers of their high-performance converter products; with the DAC1, the two ends of their

know to operate the DAC1, though internal jumpers add a few options—fixed input selection, termination for the coax input, or fixed pads for the XLR outputs (to give a practical volume knob range when used to drive sensitive, powered monitors).

Along with the sharp appearance of the DAC1 and the elegant simplicity of its operational performance, the unit offers the sonic excellence to match Benchmark's best converters. In a word, they sound great. Air, space, imaging, dynamics—every characteristic nuance of my standard battery of reference tracks trans-

unique process provides jitter immunity I've never seen achieved with PLL-based approaches, while providing phase coherency to the input clock. Benchmark reports that this coherency is remarkably maintained between multiple DAC1s (say, a 6-channel surround signal from a mixer sent via three AES signals to three separate DAC1s), even though there is no common reference clock other than the input source.

It's hard to find things to complain about on the DAC1. If you need to flip the output-mode switch often, the fact that it's on the rear might annoy, but it also keeps it from being tripped in



product line meet with resounding success.

The DAC1 offers a pair of reference-quality digital-to-analog conversion channels in a simple and flexible package that suits a broad range of uses. The DAC1 can be used to replace a master volume control (read: no more need for a small analog mixer as a sidecar to a DAW just to add a volume knob for studio monitoring). It can serve as a headphone amp for a digital source, and can function as a master converter. Three digital inputs—TOSLink, coax and XLR—can be connected. Source selection is via a front-panel toggle switch. Any input can receive either AES or S/PDIF format at sample rates up through 96 kHz. XLR and coax inputs can receive sample rates through 192 kHz.

The front-panel volume knob always controls the level of the pair of front-panel headphone jacks. The feeds to the pair of balanced, line-level outs on XLR and to the pair of unbalanced, -10 dBV outs on RCA/phono, are controlled by a single rear-panel toggle. They are fed from the front-panel volume knob or from rear-panel precision trimmers, or these outputs can be muted. That's really all you need to

lated superbly through the DAC1. With CD sources and with high-resolution 96 kHz/24-bit tracks, the DAC1 offered a level of performance I associate with converters with starting prices at least double the DAC1's \$850 price tag.

On the test bench, I expected the DAC1 to fare well, given its audible performance and past experience with Benchmark products. Even with high expectations, I was still surprised at the DAC1's stunning distortion-, noise- and jitter-rejection performance. I wouldn't have guessed it possible to achieve a signal so clean from the components used—not that there is anything wrong with the parts chosen (obviously), but most manufacturers can't quite make these parts sing and dance like Benchmark does in the DAC1.

This performance is mirrored by the HPA-2 headphone circuitry, which drives a set of modern, low-impedance phones superbly (and plenty loud for everyone save, perhaps, the drummer). The HPA-2 is available as a separate product from Benchmark, one of those circuits-on-a-connector I mentioned; mount it and its volume knob to a device's chassis, strap leads to the unit's power and output, and you've added an audiophile headphone circuit to most any piece of gear.

Benchmark's proprietary UltraLock anti-jitter clocking wrings performance from an Analog Devices AD1896 sample-rate converter chip that probably surprised even AD. Benchmark negates interface jitter by controlling the up-sampling rate used to up-convert the incoming PCM signal prior to the converter chip. This

error. Some DAC1 users have wished for a dedicated monitor out, or for more inputs, though these requests are understandable. Form meets function meets price in the DAC1, and it's a feature-packed value as is.

Another frequent and obvious request from DAC1 users is for a companion ADC. Benchmark reports that such a device is in development, perhaps in two versions. Both would offer sampling up to 192 kHz/24-bit. Both would offer full LED metering and a ref in jack that would auto-recognize AES, word clock or Superclock. XLR, coax and lightpipe outputs will be standard, the latter selectable between 2-channel or ADAT protocols. The premium model, expected to retail for under \$1,700, will be fitted with a pair of "ultra-high-performance" mic pres, phantom power and an auxiliary output port for 16-bit/44.1 kHz refs, regardless of the master rate. To fulfill the price expectation set by the DAC1, the second version will come in closer to \$1,100, sans the mic pres.

When I was a wet-behind-the-ears radio engineer, Benchmark president Allen Burdick's *A Clean Audio Installation Guide* was a valued source of practical advice and guidance (you can download this timeless tome from Benchmark's website). I also remember the first time I called the company. Not only did Burdick answer the phone personally, he gave a half hour of his time to a discussion of a project I was starting. Some two decades later, Benchmark still offers that same corporate personality, along with products that offer practicality, quality and value. For evidence, look no further than the DAC1.

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The Drawing Board

A typical Benchmark product is designed with an application and customer in mind. In a weakened economy, and slow broadcast market, and acknowledging that its high-end products may be perceived as a bit expensive and a bit industrial in appearance, Benchmark set a price target and asked themselves what they could build for a broader market in that price range. "The DAC1 is really the result of that, knowing that I had to have a product where I could sell thousands of these things," explains Benchmark president, Allen Burdick.

The DAC1 was designed by Burdick and by Benchmark's director of engineering, John Siau. While the DAC1 uses readily available components, it is innovation in their application that sets Benchmark's circuitry apart from the pack.

Analog Devices chips are used in the conversion stage of the DAC1, with the award-winning AD1896 sample-rate converter on the front end to up-sample the input prior to feeding the DAC chip. The AD1896 "does a super job," according to Burdick. "It has better filtering than the DAC chip itself."

The AD1896 is also a key component in Benchmark's UltraLock technology—its highly praised input-jitter-rejection scheme. "We are able to use the 1896 across multiple units and have very close to identical phase response," says Burdick.

Implementation is the key again in the headphone stage, where a BUF635 high-current buffer follows a common 5532 op-amp. "We're able to get 0.0003 percent THD+Noise, at the output, into headphones, under load," Burdick says of the HPA-2 headphone amp circuit.

As further proof of Benchmark's attention to detail, the analog circuitry is overspec'd, providing headroom above the maximum the digital conversion will demand. "You can send full-scale digital in," Burdick elaborates, "but you cannot clip in the analog circuitry anywhere."

What Burdick calls "details most people wouldn't focus on"—areas where many manufacturers targeting the DAC1 price point would be tempted to scrimp and compromise—have a cumulative effect on the performance of the DAC1. "We're using some very special circuit board layout techniques, which is no small thing," Burdick says of another such aspect of their approach. "When you have both digital devices and a power transformer in the same box with your high-quality analog circuits, they fight the output cleanliness. The transformers radiate leakage magnetically into the traces and chips, and we don't want that. The digital chips want to radiate RF that the analog chips don't want to know about."

The DAC1's PCB uses ground-plane layers as shields to keep the analog clean. Burdick says that as they've taken their designs to outside test labs for RF-compliance measurements, they've continued to improve their performance to the point that the labs can hardly find anything to measure. "A lot of that comes down to how you deal with PCBs, as the computer people have discovered," says Burdick. The DAC1 has just achieved CE approval, which allows European distribution to begin.

Product information

DAC1 2-channel D/A converter: \$850

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