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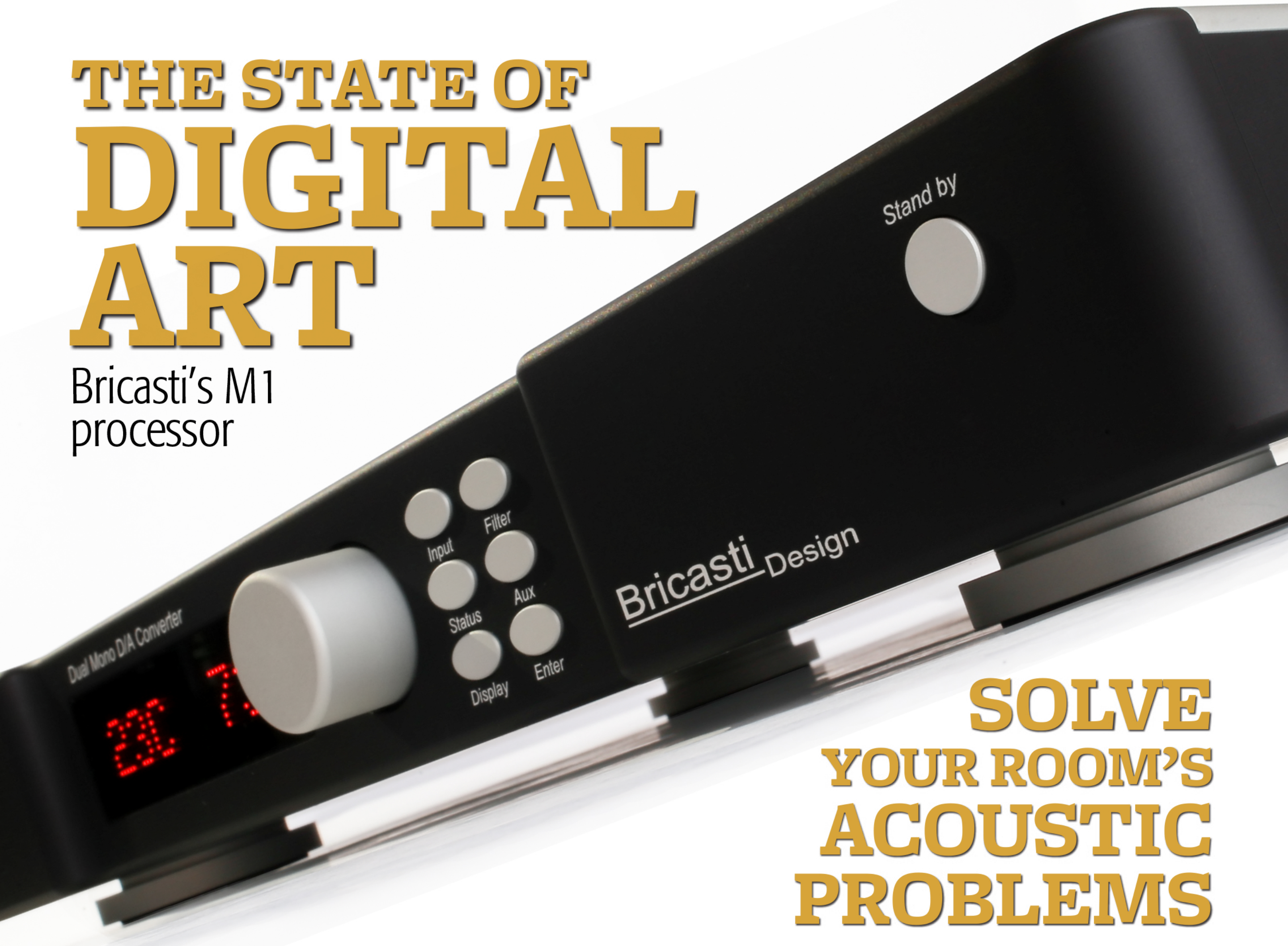
THE STATE OF DIGITAL ART

Bricasti's M1 processor



SOLVE YOUR ROOM'S ACOUSTIC PROBLEMS

"The Bricasti M1 is a worthy successor to the Mark Levinson No.30.6 as New England's stakeholder in state-of-the-art D/A processors."

A SOURCE INTERLINK MEDIA PUBLICATION

JOHN ATKINSON

Bricasti Design M1

D/A CONVERTER

Back in the late 1980s, it seemed a good idea: Separate a CD player's transport section from its D/A circuitry so that each could be optimally designed, and, as D/A technology improved, the sound of your CD player could be upgraded by replacing the outboard D/A processor. The catch was that the transport and D/A chassis needed to be connected with a serial data link: S/PDIF in optical or electrical flavors, or balanced AES/EBU. To minimize the number of cables required, the format of that link embedded the clock data within the audio data, which rendered the link sensitive to interface timing uncertainty, or jitter. (See "Bits Is Bits?," by Malcolm Hawksford and Chris Dunn, www.stereophile.com/features/396bits/index.html.)

Overcoming the effects of jitter back then required heroic engineering at heroic prices. In February 1992, when we reviewed the Mark Levinson No.30 Reference D/A processor from Madrigal Audio Labs, which successfully addressed the interface problem, it cost a staggering $13,950. But the No.30 also illustrated an advantage of the standalone D/A processor: It was not limited to the CD's 44.1kHz sample rate and 16-bit word length. The No.30 was originally a 20-bit device operating at 44.1 and 48kHz; subsequent upgrades allowed it to handle 24-bit data at sample rates up to 96kHz, and to decode HDCD datastreams. But again, this all came at a price: the upgraded version, the No.30.5, released in 1994, cost $15,950 (see http://tinyurl.com/8y4wjqm); the final version, No.30.6, from 1999, cost $16,950 (see www.stereophile.com/digitalprocessors/159/index.html).

I bought the 1992 review sample of the No.30, and purchased both the .5 and .6 upgrades. The No.30 was my reference D/A processor until 2009, when its separate power supply stopped working. The failure was hardly surprising—the unit had been powered up almost continually for 17 years.

Unfortunately, although Madrigal had committed to supporting their Reference products indefinitely,[1] Harman's purchase of Madrigal and the subsequent closings of first the Connecticut facility that used to manufacture Mark Levinson products, then of Lexicon's Massachusetts facility, where Levinson production had been moved, meant that Harman would no longer repair broken No.30.6s—or any other old Mark Levinson gear.

I have since discovered a Massachusetts dealer that offers Mark Levinson repair by experienced staff,[2] and have shipped them my No.30.6 for surgery. In the meantime, I've been auditioning 21st-century D/A processors that are claimed to offer state-of-the-art performance—including the subject of this review, the M1 ($7995) from Bricasti Design Ltd.

The Bricasti M1

I had been alerted to the existence of the M1 by the August 2011 installment of John Marks's column, "The Fifth Element" (www.stereophile.com/content/fifth-element-67). "Fast, detailed, effortlessly powerful, musically revealing. Fatigue-free listening," he wrote, concluding that the M1 offered "The best digital playback I have heard." John offered

1 Props to McIntosh Labs for making the same commitment and living up to it. This, to me, is what high-end audio should be about: customer support of the same caliber as the product's performance.

2 The Service Bench, 227 Carnegie Row, Norwood, MA 02062. Web: www.hometheaterconcepts.com.

SPECIFICATIONS

Description Description 24-bit, 8x-oversampling delta-sigma digital/analog converter with seven choices of reconstruction filter. Digital inputs: AES/EBU on XLR, S/PDIF electrical on RCA and BNC, S/PDIF optical on TosLink. Word-clock input on BNC. Analog outputs: 2 stereo (1 XLR, 1 RCA). Sample rates handled: 44.1–192kHz. Maximum output level: 4V, balanced (adjustable); 2V, single-ended. Output impedance: 40 ohms (balanced or single-ended). Frequency response (44.1kHz sample rate): 10Hz–20kHz, +0/–0.2dB. Dynamic range: >120dBA. THD+noise at 1kHz: 0.0006% at 0dBFS, 0.0004% at –30dBFS. Jitter: 8ps at 48kHz, 6ps at 96kHz. Power consumption: 28W (6W in standby).

Dimensions 17" (432mm) W by 2.5" (64mm) H by 11" (280mm) D. Weight: 12 lbs (5.5kg).

Finish Black anodized aluminum.

Serial Number of Unit Reviewed Demo 2.

Price $7995. Approximate number of dealers: 25.

Manufacturer Bricasti Design Ltd., 123 Fells Avenue, **Medford, MA 01255. Tel: (781) 306-0420. www.bricasti.com.**


Converter
Stand by
Input
Filter
Status
Aux
Display
Enter
Bricasti Design

to send me the M1 for measurement and some listening. Well, he didn't so much offer as *order*.

Not that I needed much persuading–the M1's lineage ties it to my Mark Levinson No.30.6. Bricasti's cofounders, Casey Dowdell and Brian Zolner, had respectively been a DSP-software engineer and international sales manager at Lexicon before Harman International closed its New England operations.[3] While Bricasti writes all its own signal-processing software, it contracts out some of the hardware engineering to AeVee Labs, a company in New Haven, Connecticut, founded by Bob Gorry, who used to be Chief Engineer at Madrigal Audio Labs.

The M1 is Bricasti's second product, the first being the M7 reverberation engine, aimed at the pro-audio market. Housed in a single 17"-wide black chassis with brushed-aluminum control knob and pushbuttons and a central red alphanumeric LED display, the M1 bears a superficial resemblance to Mark Levinson products of yore. Clockwise from the bottom left, the six pushbuttons control Display brightness, input Status, Input select, Filter select, Aux input S/PDIF or word-clock select, and Enter. When one of the first five buttons is pushed, the rotary control allows you to scroll through the choices offered, which are then selected by pressing Enter.

On the center section of the rear panel are the IEC AC inlet, the power switch, and four transformer-isolated digital inputs: AES/EBU on an XLR, S/PDIF electrical on an RCA, S/PDIF optical on the usual TosLink jack, and a BNC jack that can be switched either to S/PDIF (default) or Word Clock, the latter allowing the M1 to be slaved to other digital devices. Unusually, there is no USB port, but there is a remote trigger jack. To the left and right of this central area are the analog output sections, each offering balanced signals via an XLR jack and unbalanced via an RCA. Each of these sections also has a small back-lit level-trim control for the balanced output, adjustable from +8 to +22dBm (1.95–9.75V). The default output level is +14dBm (3.9V).

Internal LEDs on the circuit board glow a soft red through the M1's perforated side panels; the effect is elegant and attractive. The M1 runs hot; after the review sample had been powered up for a day, its top panel stabilized at 103°F (39°C).

Technology

Other than a central signal-processing board and its switch-mode power supply, the M1's internal construction is dual-mono. The analog circuitry for each channel is constructed on an Arlon printed-circuit board (another echo of Mark Levinson gear); the layouts of the two channels' components mirror each other. Each channel is powered by its own toroidal AC transformer mounted behind the front panel, followed by extensive voltage regulation.

The selected digital input is fed to a large Analog Devices ADSP-21368 SHARC digital signal-processing chip. This appears to include the S/PDIF receiver, and also manages the front-panel display and controls, synchronizes the clocking of each channel's D/A converter, and provides the oversampled reconstruction filters. Also on this board are a Xilinx FPGA chip and another Analog Devices processor, an ADSP-BF532 Black Fin chip. Each channel's oversampled and low-pass–filtered data are fed to its board via ribbon cable, where they're converted to analog with an Analog Devices AD1955 24-bit/192kHz chip. The AD1955 is a two-channel part, but in the M1, each chip is operated in differential-output mode for increased dynamic range. The D/A converter's differential current outputs are followed by four high-slew-rate (250V/µs)

3 Dowdell and Zolner presented a master class on high-end product design, "The Fine Line between Voicing and Design," at the Audio Engineering Society Convention in New York on October 20, 2011. From the abstract: "When the design brief of a digital to analog conversion system calls for performance regardless of cost, a series of known concepts can be put in place. When performance is the highest priority, the execution and fine tuning of these concepts changes the design brief and project schedule."

MEASUREMENTS

I used *Stereophile*'s loan sample of the top-of-the-line Audio Precision SYS2722 system to measure the Bricasti M1 (see www.ap.com and the January 2008 "As We See It," http://tinyurl.com/4ffpve4); for some tests, I also used my vintage Audio Precision System One Dual Domain and the Miller Audio Research Jitter Analyzer.

The Bricasti's electrical inputs successfully locked to datastreams with sample rates ranging from 44.1 to 192kHz; the TosLink input would not lock to datastreams with sample rates greater than 96kHz, which is normal. As supplied for review, the M1's maximum output level was 4.3V from the balanced XLR jacks and 2.01V from the single-ended RCAs, sourced from output impedances of 58 and 29 ohms, respectively, at all frequencies. Both sets of outputs preserved absolute polarity (*ie*, were non-inverting), the XLRs being wired with pin 2 hot.

I examined the impulse response of each of the seven filters by feeding the M1 digital black data into which I had

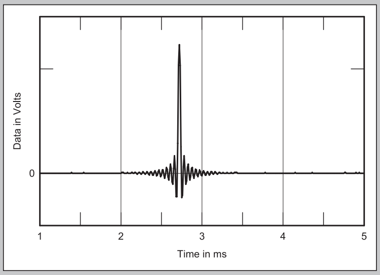


Fig.1 Bricasti M1, Filter 4, impulse response (4ms time window).

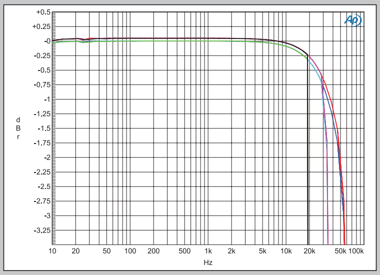


Fig.2 Bricasti M1, Filter 1, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red). (0.25dB/vertical div.)

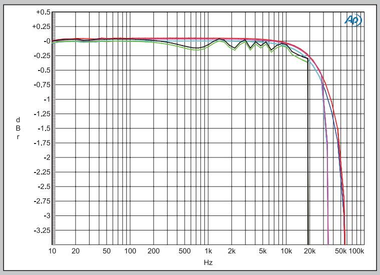
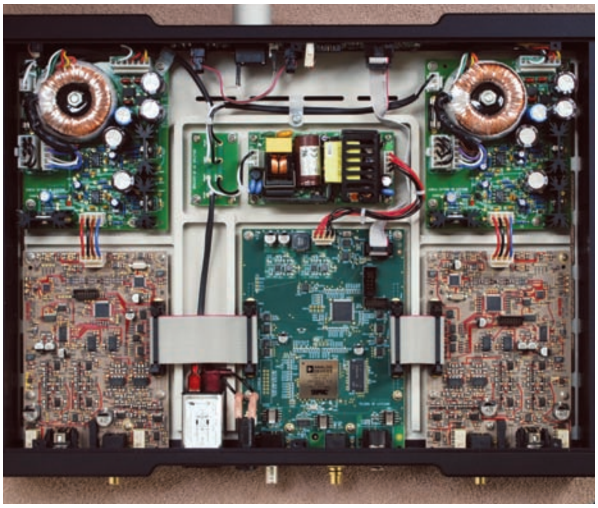


Fig.3 Bricasti M1, Filter 4, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red). (0.25dB/vertical div.)



Other than the digital processing board, the M1's construction is true dual-mono.

op-amps, these Analog Devices AD843s, which are followed in turn by two discrete-transistor output buffer sections, one balanced, one unbalanced.

The AD1955 includes a digital-domain volume control, but this is not used in the M1. The D/A converter chip also has an internal reconstruction filter, this available as Filter 0 in the Bricasti's Filter menu, and described in the manual as a "basic half-band filter" with 6dB attenuation at the Nyquist Frequency. The other six filters are Bricasti's own. They are:

- Filter 1: 20kHz bandwidth, stop-band at Nyquist Frequency with low ripple and high attenuation.
- Filter 2: Similar to 1, with a filter of slightly gentler slope.
- Filter 3: Steepest slope, highest bandwidth.
- Filter 4: Low-delay filter with full attenuation at Nyquist Frequency but higher passband ripple.
- Filter 5: Second version of a half-band filter with 6dB attenuation at Nyquist frequency.
- Filter 6: Low-delay filter starting at 18kHz and full attenuation at Nyquist frequency.

None of these filters is a minimum-phase or apodizing type, but given the flexibility of the M1's DSP platform, I don't see why such filters couldn't be offered as a firmware upgrade.

Sound Quality

Because the M1 lacks a USB input, I used the Empirical Audio Off-Ramp4 USB-S/PDIF converter I reviewed in December 2011 to take the audio data from the Mac mini I use as a music server, connecting its output with a 75-ohm BNC cable to the Bricasti's Aux input. For silver discs, I connected the AES/EBU output of my Ayre Acoustics C-5xe^{MP} universal player to the M1 with a 1m length of DH Labs Silver Sonic cable.

The first order of business was to choose a reconstruction filter. Like John Marks, I felt Filter 0 was flat and uninvolving. However, while John's favorite was Filter 4, I felt this tended to smooth over fine detail a little. I ended up doing almost all my auditioning with Filter 6, which I felt struck the right balance between the presentation of detail and the ability to throw a deep, well-defined soundstage. With Filter 6, Ray Brown's double bass in "Exactly Like You," from his *Soular Energy* (24/192 ALAC file ripped from DVD-Audio, HiRez Music HRM2011), had exactly the right balance between the body of the instrument's tone and the leading edges of the notes. And Gene Harris's piano on this recording had an almost crystalline clarity but without sounding forced.

That piano had presumably been close-miked, but the M1's sympathetic way with piano extended to more distantly miked instruments. For example, the 9' Steinway D used

inserted a single sample at full scale. The filters all had similar time-symmetrical, linear-phase impulse responses; fig.1 was taken with Filter 4. However, the filters did differ in their frequency-domain behavior. Fig.2 shows the response of Filter 1 with data sampled at 44.1kHz (green and gray traces), 96kHz (cyan, magenta), and 192kHz (blue, red). This filter has a sharp rolloff just below 20kHz with 44.1kHz data, though the higher sample rates follow the gentle rolloff seen above 10kHz. Both 96 and 192kHz roll off earlier than with other D/A processors, the responses being –3dB at 33 and 55kHz, respectively. Fig.3 shows the behavior of Filter 4. The 96 and 192kHz responses are identical to Filter 1, but some passband ripple is now evident at 44.1kHz. This is generally felt not to be a good thing, but John Marks actually preferred the sound of Filter 4 to the other six. Fig.4 shows the response of Filter 6, which I preferred, while fig.5 shows the response of Filter 0, which neither of us liked but which gives the widest bandwidth at all sample rates.

The M1's channel separation (not

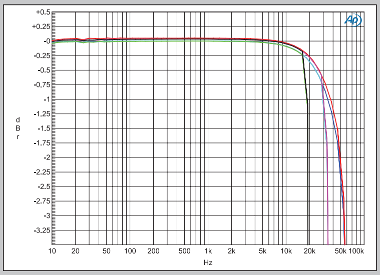


Fig.4 Bricasti M1, Filter 6, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red). (0.25dB/vertical div.)

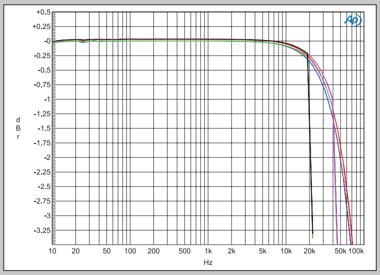


Fig.5 Bricasti M1, Filter 0, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red). (0.25dB/vertical div.)

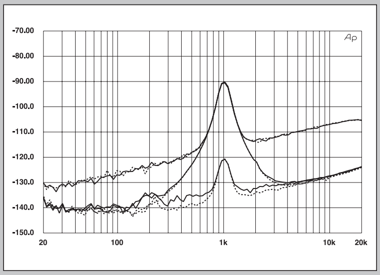


Fig.6 Bricasti M1, ⅓-octave spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS, with: 16-bit data (top), 24-bit data (middle), dithered 1kHz tone at –120dBFS with 24-bit data (bottom). (Right channel dashed.)

by Robert Silverman in his recording of Liszt's Sonata in B Minor (CD, Stereophile STPH008-2) had superb weight to its low frequencies, yet without sounding muddy. And the supportive acoustic of Albuquerque's First United Methodist Church was nicely resolved.

When I recorded the Elgar Piano Quintet at the 1998 Santa Fe Chamber Music Festival for release on *Bravo!* (CD, Stereophile STPH014-2), I had to mike the players closely because we weren't allowed to turn off the air-conditioning system of St. Francis Auditorium. In postproduction I used a Lexicon PCM 90 digital reverberator to produce a synthesized acoustic that matched, as closely as I could judge, the sound of the hall. As D/A converters have improved over the years, I worry that their increasing transparency will eventually unmask the difference between the artificial and real acoustics on this CD. The Bricasti surprised me with the Elgar; its reproduction of this performance pushed the string quartet and piano farther back in the soundstage compared with my expectations. While there was no audible conflict between the residual reverb of the auditorium and that produced by the Lexicon, the overall balance was more reverberant—as if the reverberation tails were being more clearly resolved—than I remembered hearing when I mastered the CD using the Levinson No.30.6.

This high degree of resolution, however, was not achieved by exaggerating detail, which would emphasize a recording's flaws. I do much of my classical radio listening these days via the Internet, using my Logitech Transporter. With this connected to the M1 via S/PDIF, I could enjoy live classical concerts from Chicago's WFMT, for example, without being reminded overmuch (other than the missing top octave) that the music was being squeezed through a lossy pipe.

So the Bricasti M1 offered superb soundstaging, extended and weighty low frequencies, and a cleanly musical midrange. How did it measure up against other well-regarded DACs?

Comparisons

I first compared the Bricasti M1 with the Weiss DAC202 ($6670, reviewed by Erick Lichte in January 2012), and then with the dCS Debussy ($10,999, reviewed by Michael Fremer in January 2011), which since its review has had its USB input updated to handle audio data with sample rates up to 192kHz. The DAC202 was connected via an AudioQuest FireWire cable to my Mac mini's FireWire port. The hard drive containing my iTunes library was connected via another AudioQuest FireWire cable to the DAC202. (The other option, connecting the drive between the Mac mini and the DAC202, resulted in occasional clicks.[4]) As the Mac can't send audio data simultaneously through its USB and FireWire ports, for direct comparisons I fed the Weiss's AES/EBU output to the Bricasti M1 or the dCS Debussy. Playback was with Pure Music, and the output levels of all three processors were matched to within 0.1dB at 1kHz.

> **The Bricasti M1 offered superb soundstaging, extended and weighty low frequencies, and a cleanly musical midrange.**

Erick Lichte called it correctly: The Weiss DAC202 sounds smoother than the dCS Debussy. However, when I listened to "Singing the Blues," from Robert Plant and Alison Krauss's *Raising Sand* (24/96 ALAC file converted from FLAC, Rounder/HDtracks 11661), the Weiss, set to its slow-rolloff Filter B, sounded softer in the bass than both the English and the American

4 I at first thought these clicks due to digital clipping, but the M1's display menu includes the option to individually log the numbers of digital "overs" for the left and right channels. There were none, so I had to look for a different solution to the problem, which was to change the FireWire cable setup.

measurements, continued

shown) was superb, at >125dB in both directions below 1kHz and still 113dB at the top of the audioband. For reasons of consistency with the digital tests I have performed since 1989, my first test of a processor's dynamic range is to sweep a ⅓-octave bandpass filter from 20kHz to 20Hz while the processor decodes a dithered 1kHz tone at –90dBFS. The results of this test are shown in fig.6: with 16-bit data (top pair of traces), all that can be seen is the spectrum of the dither noise used to encode the signal. With 24-bit data (middle pair of traces), the noise floor drops by 20dB, implying that the M1 has almost 20 bits' worth of dynamic range, easily enough to allow the decoding of a dithered tone at –120dBFS (bottom traces). This is excellent performance, and, just as important, the lowering of the noise floor with the greater bit depth has not unmasked any supply-related spuriae. FFT analysis confirms this excellent resolution (fig.7), and no harmonic distortion components can be seen, though a supply component at 180Hz is now evident in the left channel at a roots-of-the-universe

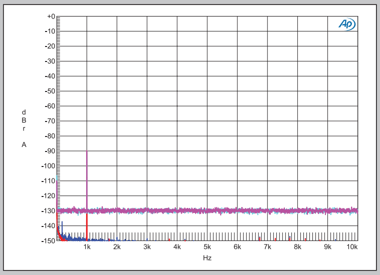


Fig.7 Bricasti M1, FFT-derived spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS, with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red).

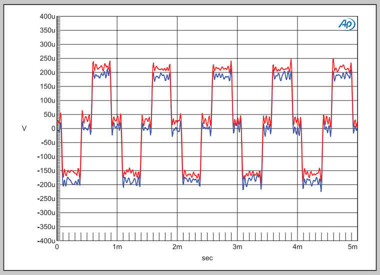


Fig.8 Bricasti M1, waveform of undithered 1kHz sinewave at –90.31dBFS, 16-bit data (left channel blue, right red).

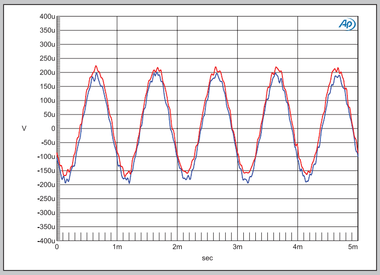


Fig.9 Bricasti M1, waveform of undithered 1kHz sinewave at –90.31dBFS, 24-bit data (left channel blue, right red).

Analog outputs on the left and right; digital inputs in the center.

way, in the chorus, the horns emphasize "Take a good look at my face" and "you'll see my smile seems out of place" by taking an extra two measures to play the same figures. But this mid-'60s recording suffers from the usual Motown ills of analog tape distortion and hiss, and overload on the vocals. The Bricasti sounded a little brasher than the Weiss in its handling of the inevitable combination of these mastering problems and the mid-1980s transfer to digital on Smokey Robinson and the Miracles' *Greatest Hits* CD. Even with its apodizing filter, the Debussy was even less kind to this almost-half-century-old recording than the Bricasti, sounding too lean.

processors. This is not a step in the right direction through the Sonus Faber Amati Futura speakers I have in for review, which themselves are balanced on the warm side of neutral. Although Filter A sharpened a bit the definition of the DAC202's low frequencies, it still didn't match the clarity of the Bricasti's bass. But in "Vigilante Man," from Ry Cooder's *Live at the Record Plant (Sausalito), July 7 1974* (16/48 ALAC file converted from FLAC, downloaded from Wolfgang's Vault), the percussive nature of Ry's playing of the acoustic guitar had more palpability with Filter B, the instrument hanging there in space, than it did with the Debussy or Bricasti.

The Bricasti, with Filter 6 and fed AES/EBU data from the Weiss, had bigger, deeper, better-defined low frequencies, the bass guitar on Ry Cooder's interpretation of Alfred Reed's "How Can a Poor Man Stand Such Times and Live?" providing more of a foundation to the music.

Set to Filter B, the Weiss seemed a little kinder to old recordings, which was particularly welcome with the very revealing TAD Compact Reference CR1 speakers. Smokey Robinson's "The Tracks of My Tears" is a favorite of mine, not least because of the artful poetry of the lyrics—"My smile is the makeup I wear since my breakup with you"—and the

See more in-depth reviews online at: www.stereophile.com/equipment-reviews.

For further comparisons with the dCS Debussy, I fed USB data to the Empirical Off-Ramp4, then connected the Off-Ramp's S/PDIF output to the Bricasti and its AES/EBU output to the dCS. (While the Bricasti can handle data with sample rates greater than 96kHz over a single-wire connection, the Debussy can't, so I couldn't do A/B comparisons with 192kHz files with this setup.) Again, levels were matched at 1kHz, using the Debussy's level control. Fed natural-sounding material, such as my Santa Fe Chamber Music Festival recording of Brahms's Piano Quartet 2, from *Encore* (16/44.1 ALAC file ripped from CD, Stereophile STPH011-2), I was hard-pressed to hear any significant difference between the M1 and the Debussy. Both gave full weight to the piano, both were true to the somewhat astringent tones of the violin, viola, and cello, and each threw a wide, deep soundstage.

But after much listening, and swapping the digital connections to the two processors halfway through the comparisons

measurements, continued

–137dBFS!

Looking at how the Bricasti's noise floor changed with differences in signal level, nothing was evident other than what could be attributed to the Audio Precision's gain-ranging circuitry, so I haven't shown it. Similarly, all that could be seen in the graph of the M1's linearity error was the recorded dither noise, so I haven't shown that either. With its very low background noise and excellent linearity, the Bricasti's reproduction of an undithered tone at exactly –90.31dBFS was superbly symmetrical; the three DC voltage levels and the Gibbs Phenomenon "ringing" on the waveform's leading edges were all cleanly defined (fig.8).[1] With undithered 24-bit data, the result was a good representation of a sinewave, despite the very low signal level (fig.9).

Harmonic distortion into high impedances was very low, and predominantly the third and fifth harmonics (fig.10), these respectively lying at –110dB (0.0003%) and –119dBFS (0.0001%). These odd-order harmonics rose by 10dB into the punishing 600 ohm load (fig.11), and were joined by the second and fourth harmonics—but in absolute terms, they are all still very low in level.

The Bricasti's performance in the high-level, high-frequency intermodulation test depended on which reconstruction filter was selected. The levels of the difference tone at 1kHz and the higher-order intermodulation products at 18 and 21kHz were the same with all filters and were all very low in level, but the best rejection of ultrasonic images of the 19 and 20kHz tones was with Filter 0 (fig.12), the worst with Filter 4 (fig.13). Although a couple

1 The significance of this test is that in the 2s-complement encoding used in the Compact Disc, the transition from 0 to +1LSB involves just the LSB changing value, while the transition from 0 to –1LSB involves all 16 bits changing value. It therefore offers a quick way of identifying bit-magnitude errors (though with modern delta-sigma D/A converters, such errors are very rare).

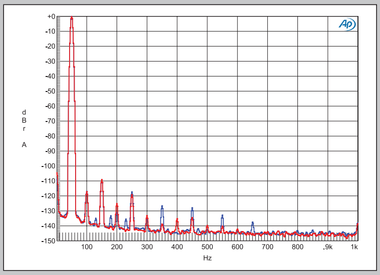


Fig.10 Bricasti M1, spectrum of 50Hz sinewave, DC–1kHz, at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

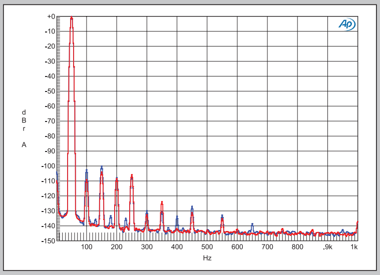


Fig.11 Bricasti M1, spectrum of 50Hz sinewave, DC–1kHz, at 0dBFS into 600 ohms (left channel blue, right red; linear frequency scale).

to minimize the effect of that variable, I felt the Bricasti sounded both very slightly warmer and offered a slightly more transparent view of the soundstage. With many classical recordings this warmth was a good thing, but with Vytautas Sriubikis's performance of J.S. Bach's Flute Sonata in E Minor (24/96 ALAC file, downloaded from Lessloss Music), the continuo bassoon sounded a little too tubby; through the Debussy, it sounded more natural.

The Bricasti M1 is a worthy successor to the Mark Levinson No.30.6 as New England's stakeholder in state-of-the-art D/A processors.

The main area of difference among these three processors was their imaging. The dCS correctly limns the outlines of acoustic objects within the soundstage, whereas the Bricasti did a better job of presenting the bodies of the objects within those outlines. The Weiss balances both aspects of imaging, but at the expense of a too-smooth sound. Each processor also offers a different feature set that will make it more suitable for some systems than others. The Weiss and dCS offer digital-domain volume controls that will allow their owners to dispense with a preamplifier, and computer connectivity for files with sample rates up to 192kHz, via FireWire and USB2.0, respectively. The Bricasti M1 is less well featured, but offers sound quality that, on balance, I preferred to the other two processors.

Conclusions

I agree with John Marks: Bricasti Design's M1 is a Class A+ digital processor. I would add that it is priced relatively reasonably for what it offers in terms of both sound and build quality. For my own needs, I would have preferred two AES/EBU inputs rather than one, though the lack of a USB input can be readily compensated for by using one of the asynchronous USB adapters from (in ascending order of price) Musical Fidelity, Halide, or Empirical Audio. But all things considered, the Bricasti M1 is a worthy successor to the Mark Levinson No.30.6 as New England's stakeholder in state-of-the-art D/A processors. Enthusiastically recommended. ■

ASSOCIATED EQUIPMENT

Digital Sources Ayre Acoustics C-5xe^{MP} & DX-5 universal players; Apple G4 Mac mini running OS10.5.8, iTunes 10, Pure Music 1.84; Shuttle PC with Lynx AES16 soundcard & dual-core AMD Athlon processor running Windows 7, Foobar 2000, Adobe Audition 3.0; dCS Debussy, Weiss DAC202, Logitech Transporter D/A converters; Halide S/PDIF Bridge, Empirical Audio Off-Ramp4 USB-S/PDIF converters.
Preamplifier Ayre Acoustics K-5xe^{MP}.
Power Amplifiers Classé CT-M600, MBL Reference 9007 (both monoblocks).
Loudspeakers BBC LS3/5a, Sonus Faber Amati Futura, TAD Compact Reference CR1.
Cables Digital: DH Labs Silver Sonic, AES/EBU; AudioQuest Coffee, Belkin Gold, USB; AudioQuest Diamond, FireWire. Interconnect (balanced): AudioQuest Wild. Speaker: AudioQuest Wild. AC: PS Audio Lab, manufacturers' own.
Accessories Target TT-5 equipment racks; Ayre Acoustics Myrtle Blocks; ASC Tube Traps, RPG Abffusor panels; Shunyata Research Dark Field cable elevators; Audio Power Industries 116 Mk.II & PE-1, APC S-15 AC line conditioners (computers, hard drive). AC power comes from two dedicated 20A circuits, each just 6Ð from breaker box.—**John Atkinson**

measurements, continued

of aliasing products are visible in the audioband with Filters 4 and 6, these are still at –130dB or lower and are therefore inconsequential.

The Bricasti M1's rejection of jitter was one of the best I have measured; any jitter-related spuriae lay below the resolution limit of the Miller Analyzer. The cyan and magenta traces in fig.14 show the spectrum of the M1's analog output while it decoded a 16-bit version of the diagnostic J-Test signal via its TosLink input. The spectral lines visible are the residual odd-order harmonics of the low-frequency squarewave; these are not accentuated in any way, nor are any other sidebands visible other than a single pair at ±180Hz, these lying at almost –140dB. With the 24-bit version of the J-Test (blue and red traces), all the squarewave harmonics have disappeared, and the central spike that represents the 11.025kHz tones has narrower skirts. Jitter rejection was just as impressive via the M1's AES/EBU and S/PDIF inputs.

Bricasti Design's M1 has state-of-the -art measured performance.—**John Atkinson**

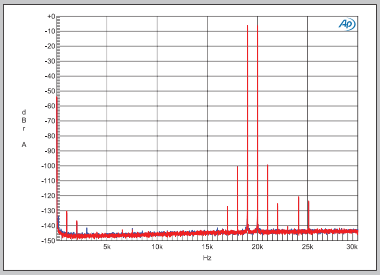


Fig.12 Bricasti M1, Filter 0, HF intermodulation spectrum, DC–30kHz, 19+20kHz at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

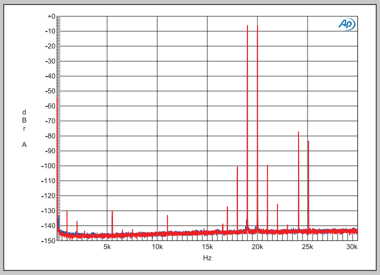


Fig.13 Bricasti M1, Filter 4, HF intermodulation spectrum, DC–30kHz, 19+20kHz at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

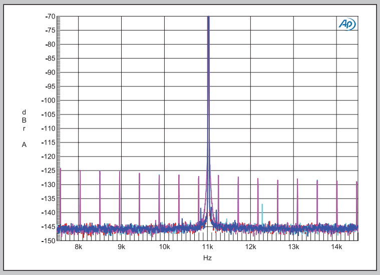


Fig.14 Bricasti M1, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit data via TosLink from AP SYS2722 (left channel cyan, right magenta), 24-bit data (left blue, right red). Center frequency of trace, 11.025kHz; frequency range, ±3.5kHz.