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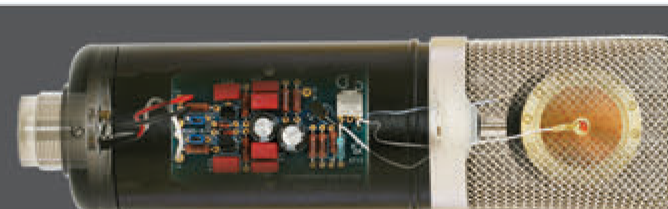

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OCTOBER 2016

Bricasti Design M1 Dual Mono D/A Converter

Deluxe Limited Edition

Bricasti Design recently introduced its new M1 Dual Mono DAC—Deluxe Limited Edition and *audioXpress* had access to this improved state-of-the-art system.

Photo 1: The Bricasti M1 Deluxe Limited Edition has a clean front-panel layout. The display brightness is adjustable, and the volume control enables the unit to be directly connected to a power amplifier. (Photo courtesy of Bricasti Design, Ltd.)

By
Gary Galo
(United States)

Bricasti Design was founded in 2004 by former Harman Specialty Group employees Brian Zolner and Casey Dowdell. Zolner started working at the original Lexicon in 1984 and held various positions in sales, including development of its international sales network for both the professional and the consumer markets. At the time of his departure, he was Lexicon's vice president of worldwide sales. Dowdell joined Lexicon as a DSP software engineer where his primary focus was algorithm development for professional and consumer products, including work on high-end reverberation and Logic 7 (a multichannel surround-sound technology). He later worked on development of Mark Levinson products when parent company Madrigal Audio Laboratories ceased operation.

Bricasti Design M1 Dual Mono DAC—Deluxe Limited Edition
Bricasti Design, Ltd.
2 Shaker Rd., Bldg. J100
Shirley, MA 01464
(978) 425-5199
www.bricasti.com
info@bricasti.com
Price: $10,000, including remote control

Bricasti Design

Bricasti Design introduced its first audio product in 2007—the M7 Stereo Reverb Processor, which established the company as a leader in the field of high-end digital reverberation. With literally thousands of units installed, the M7 is widely used around the world by some of the most respected recording studios and engineers. In 2011, Bricasti introduced the M1 DAC to the hi-end consumer market. Since that time, the M1 has been acclaimed by the high-end audio press as state-of-the-art in digital audio reproduction. The M1 is based on the proven digital conversion and analog circuit design used in the M7, ensuring a stable product with excellent long-term reliability and performance. No cost was spared in the design and implementation of the M1, including analog and digital circuit design, component selection, digital signal processing, power supplies, layout, and construction.

As with all of Bricasti's products, the M1 is designed and built entirely in the United States, mostly in the Shirley, MA, facility. Some of the hardware design for Bricasti products is contracted to AeVee Labs, a company based in New Haven, CT, and run by a small group of former Madrigal Labs employees (www.aevee.com). The designers at AeVee worked on many of the classic products designed at Madrigal, and bring a wealth of knowledge and years of experience in product design for both the high-end professional and consumer markets. There is a short but interesting video on the Bricasti website (bricasti.com) with a few shots of the M1 manufacturing process, including stuffing of PC boards and machining of the chassis. As with all Bricasti products, the M1 chassis pieces are machined out of solid blocks of aluminum.

The M28 Mono-Block Power Amplifier

Bricasti's most recent audio product is the M28 mono-block power amplifier, a reference-class amplifier targeted at both the professional and the consumer markets. The M28 has balanced inputs matched to the balanced outputs on the M1 DAC, so no preamp is needed between them. At 200 W into 8 Ω, weighing close to 80 lbs, and carrying a list price of $30,000 per pair, the M28 is obviously a serious product for serious—and well-heeled—users. A five-minute testimonial by recording engineer John Newton can be found on the Bricasti website.

M1 Special Edition

Last fall Bricasti introduced a new Special Edition version of the M1 that incorporates a number of improvements over the original version. Bricasti describes the improvements as follows:

"Presented in the classic anodized black and aluminum finish, the M1 Special Edition incorporates Stillpoints feet that are engineered and optimized exclusively for the design. The added stability improves isolation from vibration which translates to a more transparent sonic presentation. Point-to-point wiring, a labor intensive process, improves signal flow by eliminating various connectors which can degrade a signals performance. Finally, the next-generation power improvements have been incorporated in this edition to further improve filtering of unwanted noise and power ripple."

Photo 2: The M1 rear panel features five digital input connections, including USB, AES/EBU, Toslink optical, and S/PDIF via both RCA, and true 75 Ω BNC connectors. Balanced and unbalanced analog outputs are included. The spacing of the analog outputs reflects the dual-mono design. (Photo courtesy of Bricasti Design, Ltd.)

Stillpoints is a company specializing in isolation products for loudspeakers and other audio equipment. The special isolation feet used on the M1 are actually loose until the unit is set in position on a shelf or other support. When set in position, the weight of the M1 puts pressure on a small stainless steel bearing

Photo 3: Inside view of the M1 DAC. The dual-mono design includes separate linear power supplies for the left and the right channel audio boards, shown on either side. The linear digital power supply and digital PC board are in the center. Construction is robust, with all chassis pieces machined out of solid blocks of aluminum. (Photo courtesy of Bricasti Design, Ltd.)

in each foot. Bricasti individually adjusts the four Stillpoints on each M1, on a perfectly level stone table, to ensure even distribution of weight. The point-to-point wiring changes refer to the power supply connections. As Zolner explained, Faston connectors have been removed and the DC cables from the analog power supplies are hard-wired to the power supply board, eliminating one set of connectors. The signal connections between the digital board and the analog boards are still done with ribbon cables and connectors.

In addition to these improvements, the M1 incorporates all the features of its Classic version, which is still available. Early versions of the M1 had three digital inputs—AES/EBU, S/PDIF coaxial, and Toslink optical. Current units also include a USB 2.0 input, as well as a second S/PDIF input.

The M1 accepts standard pulse code modulation (PCM) sampling frequencies up to 192 kHz via the AES/EBU and S/PDIF inputs. The USB input will also accept PCM at 352.8 and 384 kHz. All inputs accept pulse code modulation (PCM) word lengths up to 24-bit. All except the Toslink input will accept DSD 64 and DSD 128 data streams using the DoP protocol. The USB input incorporates the latest-generation asynchronous interface, reducing jitter to 6 pS. Bricasti's proprietary filter technology includes nine linear-phase and six minimum-phase filters, which are user selectable.

Operation and Connectivity

The front panel layout is clean and straightforward (see **Photo 1**). The main power switch on the rear panel is normally left on—the front-panel Standby button is used to activate the M1. The M1 will remember the state in which it was powered down. If the main power is cut, the unit will come back on when AC power is restored. This enables the M1 to be switched on from an external power line conditioner without having to press the Standby button.

The center of the front panel contains the display, the level control, and six buttons that control the M1's various functions. The Input selector toggles through the five inputs and also has an Auto position in which the M1 will find the first input connected to an active digital source. When the M1 is powered on for the first time, it defaults to the Auto position—after that, the unit will power up to the last selected input. The Status button has eight possible choices, one added in a recent firmware upgrade. (My review sample was shipped with V. 1.22; the update changed it to V. 9.29.) An updated user guide reflecting the current firmware should now be available for download.

The first Status choice displays the type of input selected and the input sampling frequency. The second choice displays the output sampling frequency after oversampling. This will either be 352.8 kHz for input sampling frequencies divisible by 44.1 kHz, or 384 kHz for those divisible by 48 kHz. If the source is DSD 64× or 128×, either 2.822 or 5.664 MHz will be displayed. The third position selects the over-tracking display.

Digital overs—peaks above digital 0 dB, which result in clipping—are displayed for each channel. You'd be surprised how many commercial CDs, even classical, are intentionally over-recorded to make them play louder, which is a violation of the most basic rule of digital recording.

The fourth and fifth positions indicate the internal temperature of the M1, and the firmware version. The sixth indicates absolute polarity, which Bricasti incorrectly calls "phase." Once selected, the polarity can be inverted by rotating the level control. The seventh selects the function of the mini-phone jack on the rear panel. It can either be used as a 12 V trigger to power up the M1 from a remote trigger source, or as the receiver connection for the optional remote control. The eighth, newly-added function allows the user to select either a Wide or Fine Sync on the digital data stream (previous versions were equivalent to the Wide choice). One piece of information that the M1 won't display is the bit depth.

The Display button selects three brightness levels for the display, along with a sleep mode. The sleep mode will turn the display off after 20 seconds with no active digital input, leaving one LED dimly lit. Pressing any button will wake up the display. The Filter button enables the user to toggle through the various linear- and minimum-phase filters. The Level button activates displays the front-panel level control and displays the output level in decibels.

If a preamplifier is used between the M1 and the power amplifier, the output level control is normally set to maximum, or 0 dB. If the M1 is connected directly to a power amplifier, I suggest starting with the level control at minimum (the display will read "Lvl OFF"). Then raise the level to the desired listening position. After that, the M1 will power up to the previously selected level. The Enter button selects the settings chosen in the other menus. If you're connecting the M1 directly to a power amplifier for the first time, be absolutely certain that you begin with the level turned down.

Photo 2 shows the rear panel. The left and right analog outputs are on either end, the spacing reflecting the dual mono design. The balanced outputs are standard XLR connectors and the unbalanced outputs are gold-plated, Teflon-insulated RCA jacks. The M1 doesn't have a headphone output. The center section of the rear panel contains all of the input connections, including a filtered IEC AC

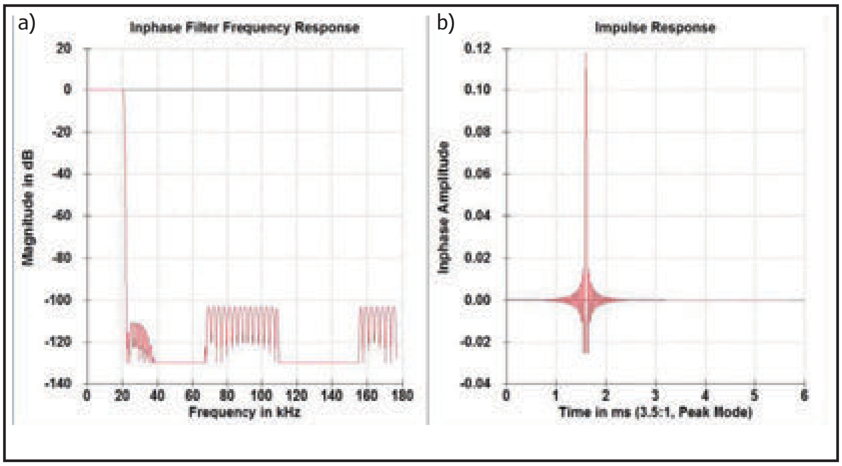

Figure 1: The frequency (a) and impulse (b) responses of a brick-wall, linear-phase filter are shown for a sampling frequency of 44.1 kHz. Pre-ringing, a performance limitation of linear-phase filters, can be seen in the impulse response. (Image courtesy of Bricasti Design, Ltd.)

power inlet and the main on-off switch. From left to right, the digital input connections include USB, Toslink optical, RCA S/PDIF coaxial, a standard three-pin XLR connector for the AES/EBU input, and the additional S/PDIF coaxial input using a true 75 Ω BNC connector. The BNC connector used by Bricasti is a panel-mount type, rather than a PC mount. Inside, there's a short length of 75 Ω coaxial cable between the connector and the PC board.

The S/PDIF interface is a 75 Ω transmission line and proper impedance termination will yield the lowest clock jitter. RCA connectors rated for 75 Ω operation (e.g., the Canare RCAP series) will yield a voltage standing-wave ratio (VSWR) of less than 1.1:1 up to a frequency of 200 MHz. True 75 Ω BNC connectors (e.g., the Canare BCP series) will yield the same VSWR up to 2 GHz. Given the wide bandwidth of the digital audio datastream, an interface with low VSWR is important and becomes more so at higher sampling frequencies.

As an option, Bricasti offers a remote control for the M1, which duplicates the front-panel controls. A small infrared receiver must be plugged into the rear panel of the M1 using the supplied stereo mini-phone cable. The receiver is powered with a 5 V wall-wart-type switching power supply. The M1 is supplied with a standard 18 AWG, IEC-type power cord, which I found a bit surprising. The M1 can certainly benefit from a power-cord upgrade, with heavier-gauge wire and shielding. I used a Pangea AC-14SE, an excellent performer at an extremely reasonable price.

Manufacturer's Specifications

Digital Inputs
XLR: AES/EBU 24-bit Single Wire
BNC: SPDIF
RCA: SPDIF
USB: USB 2
Sample Rates AES, SPDIF: 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, 176.4 kHz, 192 kHz PCM
Sample Rates USB: 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz, 176.4 kHz, 192 kHz, 352.8 kHz, 384 kHz PCM; DSD 64fs 128Fs as DoP
Sample Rates, Toslink: 44.1 kHz, 48 kHz, 88.2 kHz, 96 kHz PCM
Jitter: 8 pSec at 48 kHz; 6 pSec at 96 kHz

Balanced Analog Outputs
Connectors: XLR balanced (pin 2 hot)
Impedance: 40 Ω
Output Level Range: +8 dBm to +22 dBm
D/A Conversion: 24-bit delta sigma 8× oversampling
Frequency Response: 10 Hz–20 kHz +0 dB, −0.2 dB at 44.1 kΩ
Dynamic Range: >120 dB, A-weighted
THD+N at 1 kHz: 0.0006% at 0 dBfs; 0.0004% at -30 dBfs

Unbalanced Analog Outputs
Connectors: RCA
Impedance: 40 Ω
Output level: +8 dBm (2 V RMS)
D/A Conversion: 24-bit delta sigma 8x oversampling
Frequency Response: 10 Hz–20 kHz +0 dB, −0.2 dB at 44.1 kΩ
Dynamic Range: >120 dB, A-weighted
THD+N at 1 kHz: 0.0006% at 0 dBfs; 0.0004% at -30 dBfs

General Specifications
EMC
Complies with: EN 55103-1 and EN 55103-2 FCC part 15, Class B
RoHS
Complies with: EU RoHS Directive 2002/95/EC
Safety
Certified to: IEC 60065, EN 55103-2
Environment
Operating Temperature: 32°F to 105°F (0°C to 40°C)
Storage Temperature: -22°F to 167°F (-30°C to 70°C)
General
Finish: Anodized Aluminum
Dimensions: 17″× 12″ × 2.5″ (43.2 cm × 30.5 cm × 6.4 cm)
Weight: 12 lbs (5.4 kg)
Shipping Weight: 15 lbs (6.8 kg)
Shipping Dimensions: 22″ × 17″ × 7″ (55.9 cm × 43.2 cm × 17.8 cm)
Mains Voltage: 100, 120, 220, 240 VAC, 50–60 Hz
AC inlet fuse: T1A, 250 V slow blow for all voltages/frequencies
Trigger In: TRS connector for 5 V external trigger
Power consumption: 28 W (6 W standby)
Warranty: Two years, parts and labor

Design Details

Internally, the Bricasti M1 is a technical tour-de-force (see **Photo 3**). The M1 is a true dual-mono design and the chassis houses six PC boards: two analog/DAC boards, one digital board, two analog/DAC power supply boards and one digital power supply board. The AES/EBU and S/PDIF inputs are coupled with wide-bandwidth pulse transformers. The USB input is routed through an XMOS programmable microcontroller, which provides advanced USB decoding and complete galvanic isolation of the USB input from the M1 ground and power grid. This is important since it maintains complete isolation between a connected computer and the audio system.

Bricasti doesn't use one of the standard digital input receiver chips, most of which have an on-board analog phase-locked loop. The heart of the digital board is an Analog Devices SHARC processor, specifically an ADSP 21369. (SHARC is an acronym for Super Harvard Architecture.) This advanced DSP chip is a 32-bit fixed/40-bit floating-point device optimized specifically for high-performance audio processing. The ADSP 21369 has an internal S/PDIF-compatible input receiver along with four independent, asynchronous sample rate converters.

The programmable SHARC chip provides the user-selectable digital filtering, level control and 8x oversampling. The digital datastreams from the SHARC chip are fed to Analog Devices AD9951 Direct Digital Synthesizer chips—one on each analog board. The DDS chips receive instructions from the SHARC chip, and re-clock the data to remove jitter. The digital sync is accomplished in the DDS chip and, as mentioned earlier, is now user-selectable between wide and fine as a result of the firmware upgrade.

Each analog/DAC board has its own Analog Devices AD1955 DAC chip configured for mono operation, which receives the digital datastream from the DDS chip. The AD1955 is a Sigma-Delta design that's been in production for nearly 15 years, but it's used strictly for D/A conversion in the M1—as noted earlier, PCM upsampling and digital filtering is done in the SHARC DSP chip. The AD1955 has an external filter mode that enables it to accept the up-sampled data from an external digital filter. As with the vast majority of DAC chips, the upsampling digital filter in the AD1955 is a linear-phase filter. Bricasti has implemented their own linear-phase and minimum-phase filters in the SHARC chip, bypassing the AD1955's internal filter altogether.

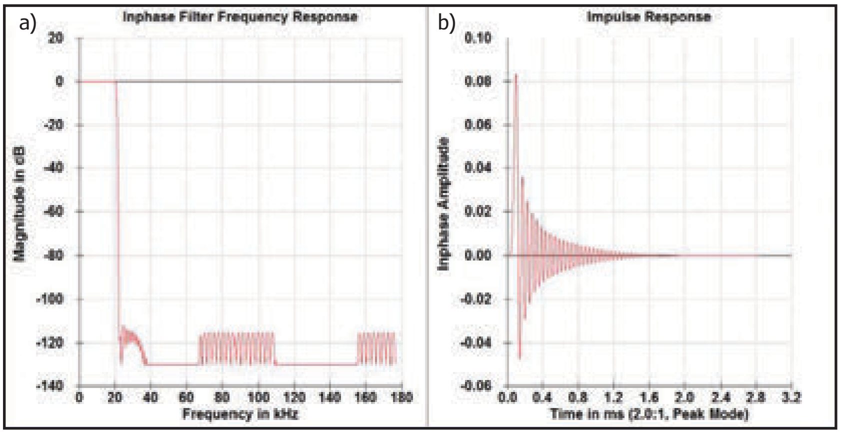

Figure 2: The frequency (a) and impulse (b) responses of a brick-wall, minimum-phase filter are shown for a sampling frequency of 44.1 kHz. Note the absence of pre-ringing in the impulse response. This is a major performance advantage of minimum-phase filters. (Image courtesy of Bricasti Design, Ltd.)

The current output of the AD1955 is fed to Analog Devices AD843 op-amps for current-to-voltage (I/V) conversion. The AD843 is manufactured with Analog Devices' CBFET process and it has a slew rate of 250 V/µSec and a gain-bandwidth product of 34 MHz. Once the analog current signal from the DAC has been converted to voltage, there are no IC op-amps in the signal path. The I/V converters feed the audio to passive analog output filters and discrete, servo-controlled output buffers. The balanced and unbalanced analog outputs have separate output buffers, so the loading on one will not affect the other—both outputs can be simultaneously used, if desired. AD8510A op-amps are used as the servo amplifier for the unbalanced outputs, and the dual AD8512As are used for the balanced outputs. The "A" grade chips in the AD8510-series are JFET-input op-amps with low noise (typically 8 nV/√Hz), low offset (0.1 mV) and low input bias current (21 pA), making them ideal for servo amplifiers.

Filter Choices

The array of over-sampling, anti-aliasing reconstruction filter choices offered by Bricasti can seem daunting. Bricasti publishes a two-page tutorial on linear phase and minimum phase filters that will help sort it all out. Another guide, listed under Resources, is available on the Ayre Acoustics website. First, it's important to remember that there is no such thing as a perfect filter—each type has advantages and disadvantages. Second, the brick-wall filters used in digital audio all produce ringing at the corner frequency. Where that ringing takes place may determine which filter is preferred by the listener.

Figure 1 shows the frequency response and impulse response of a brick-wall, linear phase filter with a corner frequency just below 22.05 Hz (the Nyquist frequency for a sampling rate of 44.1 kHz). Linear-phase filters are used in the vast majority of digital players and DACs. A linear phase filter, as the name implies, is time-coherent at all frequencies in the pass band, so that at the output of the filter there will be no time difference between audio at 20 Hz and 20 kHz. On the face of it, this would seem to be ideal, but linear phase comes at a price. The side-effect of achieving linear phase is that the filter introduces the pre-ringing, which can be seen in the right-hand graph of **Figure 1**. Instead of the transient (or impulse) beginning instantaneously, several cycles of ringing occur ahead of the transient attack. This is unnatural-sounding because real, live instruments don't "pre-ring."

Figure 2 shows the frequency and impulse responses of a minimum-phase filter with the same corner frequency. This type of filter was first used in digital audio by Meridian. They call it an "apodizing" filter. A minimum-phase filter will cause some phase shift in the pass band, but the benefit is that there is no pre-ringing, as shown in the right-hand illustration of **Figure 2**.

There is greater post-ringing with this type of filter, but it's largely masked by the continuation of audio after the initial transient, whether the music continues to play or decays as hall ambience. Proponents of minimum-phase filters claim that the absence of pre-ringing makes this type of filter the lesser of two evils. It's also worth remembering that phase shifts in the audible spectrum are reduced at higher sampling frequencies. A website calling itself "Mr. Apodizer's Blog" has some technical information on the minimum-phase filter that's worth reading (see Resources).

Within the categories of linear and minimum phase, the main differences between the filters are the passband and stopband frequencies, and the amount of passband ripple. These characteristics are shown in **Table 1** for sampling frequencies of 44.1 and 48 kHz. Filter type 0–5 are available for both linear- and minimum-phase characteristics. Filter types 6–8 are available only as linear-phase. **Figure 3** shows a graph of total harmonic distortion across the audio spectrum. This measurement was taken by Bricasti using a Rohde and Schwarz audio analyzer. The graph shows THD to be around 0.0006% across most of the audio spectrum. Above 2 kHz there's a gradual rise to around 0.0025% at 15 kHz, dropping back to 0.0006% between 15 and 20 kHz.

44.1 kHz	Passband	Stopband	Passband ripple	Stopband attenuation	Delay
Filter 0	20 kHz	22.05 kHz	0.001 dB	110 dB	1.43 ms
Filter 1	20 kHz	22.05 kHz	0.161 dB	71 dB	0.72 ms
Filter 2	19.5 kHz	22.05 kHz	0.046 dB	82 dB	0.72 ms
Filter 3	19 kHz	22.05 kHz	0.014 dB	92 dB	0.72 ms
Filter 4	18.5 kHz	22.05 kHz	0.005 dB	102 dB	0.72 ms
Filter 5	18 kHz	22.05 kHz	0.001 dB	112 dB	0.72 ms
Filter 6	20 kHz	24 kHz	0.0002 dB	111 dB	0.78 ms
Filter 7	19 kHz	22 kHz	0.001 dB	110 dB	1 ms
Filter 8	20 kHz	22 kHz	0.001 dB	110 dB	1.5 ms

48 kHz	Passband	Stopband	Passband ripple	Stopband attenuation	Delay
Filter 0	20 kHz	24 kHz	0.001 dB	111 dB	0.73 ms
Filter 1	20 kHz	24 kHz	0.005 dB	102 dB	0.63 ms
Filter 2	19.5 kHz	24 kHz	0.004 dB	103 dB	0.56 ms
Filter 3	19 kHz	24 kHz	0.005 dB	102 dB	0.51 ms
Filter 4	18.5 kHz	24 kHz	0.003 dB	106 dB	0.5 ms
Filter 5	18 kHz	24 kHz	0.001 dB	114 dB	0.5 ms
Filter 6	21.8 kHz	26.3 kHz	0.0002 dB	110 dB	0.72 ms
Filter 7	20 kHz	24 kHz	0.001 dB	110 dB	0.7 ms
Filter 8	20 kHz	24 kHz	0.001 dB	110 dB	0.7 ms

Table 1: M1 filter characteristics at 44.1 kHz and at 48 kHz

The Sound

I normally use my OPPO Digital BDP-105 digital player as a transport with my outboard DAC, a Benchmark DAC2 DX (web review, http://audioxpress.com/article/Fresh-from-the-Bench-Benchmark-DAC2-DX-Stereo-D-A-Converter.html, July 22, 2015). The OPPO Digital's second HDMI output feeds a KanexPro HAECOAX HDMI Audio De-Embedder (reviewed in *audioXpress*, July 2016). The de-embedder feeds the outboard DAC via an S/PDIF interface. This ensures that high-resolution DVD-Audio and Blu-ray Audio discs are played at their full, native resolutions by the outboard DAC. My HDMI interconnect is a Pangea HD-24PCE; for S/PDIF I use D.H. Labs D-75 cable fitted with Canare 75 Ω RCA and BNC connectors. This interface also worked well with the Bricasti M1 DAC.

Let me say at the outset that the Bricasti M1 Deluxe Limited Edition is simply the finest digital audio playback that I have ever heard. But, the sonic character of the M1 changes noticeably with the different filter choices, and the exceptional sonic performance of the M1 makes it easy to hear those differences. I believe that Minimum 0 filter is the most natural sounding of all (Brian Zolner agrees with this).

I spent quite a bit of listening time comparing Minimum 0 and Linear 6, the latter having the same characteristic as the internal filter in the AD1955 DAC chip (which, as noted above, are not used in the M1). Minimum 0 is—hands down—superior. Transient response is noticeably cleaner and faster, bass is tighter and better-defined, and the treble region is airier and has greater clarity. Once I settled on Minimum 0, I had no desire to go back to any of the other filters. The M1 also performs at its best with the internal Sync set to Fine. There's no need to use the wide setting unless the M1's Fine setting won't lock onto the datastream from the transport.

Good soundstage reproduction, once a stumbling block in digital audio, is largely a solved problem in high-end digital audio. But, there are still noticeable differences in how players and DACs render that soundstage. The M1's soundstage reproduction is certainly wide, deep, and precise, but what sets it apart is how it reproduces the acoustic space between individual instruments and sections of a symphony orchestra. The musicians are connected by that space with an uncanny level of realism.

DACs are no different than amplifiers and preamps in that some lean toward the analytical and others toward the euphonic. The Benchmark DAC2 converters fall slightly on the analytical side (though not excessively so), whereas the Monarchy M24 (reviewed in *audioXpress*, October 2007), via its tube outputs, has a warmer and more euphonic sonic character. Audio products designed for maximum accuracy can be too analytical, lacking in warmth, whereas those designed for warmth often sacrifice detail and resolution.

The Bricasti M1 strikes an ideal balance between both worlds. As mastering engineer Alan Silverman notes in an interview on the Bricasti website, Bricasti seems to have found the "sweet spot." The M1 almost redefines the term "transparency" in digital audio.

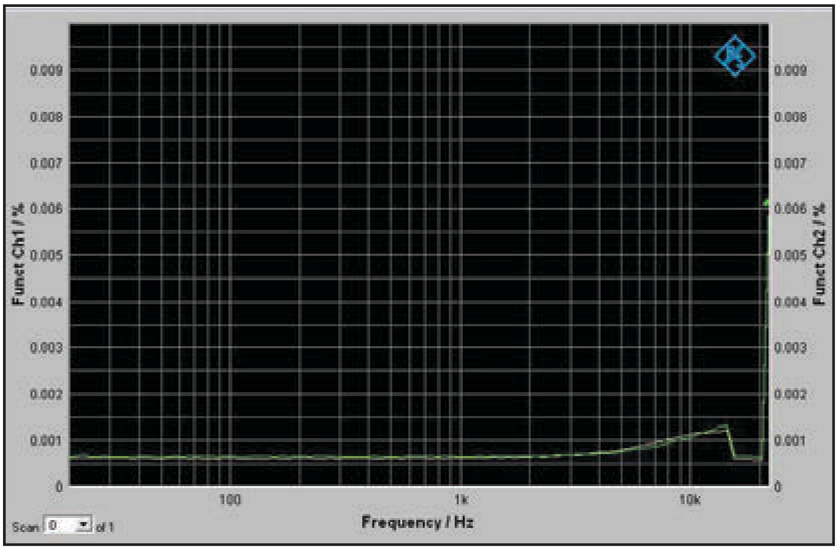

Figure 3: A total harmonic distortion graph of the M1, measured with a Rohde and Schwarz analyzer, shows total harmonic distortion (THD) to be around 0.0006% across most of the audio spectrum. Above 2 kHz, there's a gradual rise to around 0.0025% at 15 kHz, dropping back to 0.0006% between 15 and 20 kHz. (Image courtesy of Bricasti Design, Ltd.)

About the Author

Gary Galo retired in June 2014 after 38 years as an Audio Engineer at the Crane School of Music, SUNY, in Potsdam, NY. He now works as a volunteer, transferring vintage analog recordings in the Crane archive to digital format. He is the author of more than 300 articles and reviews on both musical and technical subjects, in more than a dozen publications. He is an active member of the Association for Recorded Sound Collections (ARSC) and has been a regular presenter at ARSC conferences. Several of his conference papers have been published in the *ARSC Journal* (www.arsc-audio.org). Gary has been writing for *audioXpress* and its predecessors since the early 1980s. He has also written for *Linear Audio*, including "An Archival Phono Preamp" and "RIAA Equalization for Displacement-Sensitive Phono Cartridges" (www.linearaudio.net).

Detail and resolution are exceptional, yet the M1 remains highly musical at all times. Some digital audio products deliberately offer some euphonic coloration in order to hide what their designers perceive to be defects that still exist in digital audio. Bricasti's approach has been to eliminate the defects on the digital end, as far as is possible with current technology, allowing the music character of the recording to emerge with as little alteration as possible. This is a difficult balance to achieve in audio electronics, especially digital recording and reproduction.

Tonally, the M1 is neutral and well-balanced, with an exceptionally smooth and musical treble region. Most importantly, it reveals the character of the original recordings, and the differences between recordings, to a greater degree than I've previously experienced with digital audio.

The Mercury CD of Antal Dorati conducting Ottorino Respighi's *The Birds* was made in 1957 with analog tape and tube electronics, which enhance the exceptional harmonic richness of the massed strings (433 007-2). Reference Recordings' high-resolution HRx recording of three Igor Stravinsky works, conducted by Eiji Oue, was also recorded on analog tape, but with solid-state electronics (HR-70). The strings in both recordings are highly musical, but the M1 gives the listener a clean window on the generational differences in the equipment used to capture the original string sound. The Mercury is more euphonic and the Reference Recordings is more accurate. Recording engineers will appreciate the exceptional resolving power of the M1, allowing them to hear precisely what they've captured on their original recordings, whether pure digital or analog tape converted to digital.

With the best recordings, the M1 reveals the warmth of the original instruments and the recording venue. But, the M1 is also more forgiving of less-than-ideal digital sources than any other DAC I've heard. CDs made with dated digital technology, such as the DG Galleria series, offer a more pleasant listening experience on the M1, with less of the brightness and glare I'm used to on these discs. It's not that the M1 is masking any of the problems on those discs—it's simply able to reproduce them without adding any problems of its own.

The M1 reproduces dynamics and bass effortlessly, with excellent low-frequency extension and control. The low end on Oue's recording of Stravinsky's *The Rite of Spring* is actually overpowering, to the point of being unnatural. At times, the bass drum overwhelms the orchestra. But, faced with such demands, the M1 never gives the impression of running out of control or headroom. The better outboard DACs, to one degree or another, tend to bridge the gap between conventional Red Book CDs and high-resolution formats.

The M1 does so to a greater degree than any other DAC I've heard. The openness in the treble and spaciousness of the sonic presentation on regular CDs gets the listener one step closer to the sound of high-resolution digital.

Conclusions

The Bricasti M1 Deluxe Limited Edition is, indeed, a state-of-the-art DAC. Though it will be out of monetary reach for most audio enthusiasts, it demonstrates what's possible in a no-holds barred approach to digital-to-analog conversion. For recording engineers, the M1 will serve as an ultimate reference tool in the evaluation of their digital recording, final mixes and mastering.

The M1 was in my audio system for 10 weeks, and during that time, I experienced a level of musical realism that I may not hear again for some time to come. It was pure pleasure. If you can afford it, the M1 will be a revelation.

Editor's Note: All audioXpress *articles from 2001 to present can be found on the aX Cache, a USB drive available from www.cc-webshop.com.*

Resources

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