JON IVERSON

Musical Fidelity M1CLiC

UNIVERSAL MUSIC CONTROLLER

The taxonomy of audio products used to be easy. An amp, a preamp, speakers, a disc player or two—done. Now that hard drives, streaming clouds, and computers have entered the scene, unless your world revolves around only an iPod or a disc player, you have choices—lots of choices.

And so a new product type, along with dozens of subtypes, has emerged that helps you keep up with the incoming bits. I like to refer to this branch of the audio kingdom as digital "hubs." Think of a hub as the ultimate audio adapter: whatever you need to connect to or with, the hub makers try to have a port or software for it. Wherever you source your music, even if it's scattered across the physical and virtual worlds, they try to unify your ability to control it.

Musical Fidelity's M1CLiC is one of the latest generation of digital hubs that can also function as a basic preamplifier. Though sourcing digital music has become a complicated process, MF has decided to take their hardware in the opposite direction, simplifying the front panel as much as possible while keeping the component's flexibility intact.

SPECIFICATIONS

Description Single-box, remote-controlled, network-connectable, analog/digital preamp and DAC. Digital inputs: Supports up to 24-bit/192kHz via front USB, Ethernet, optical, and coax (2) inputs. Supports up to 16-bit/48kHz via USB DAC input and iPod dock connection on rear panel. File formats supported: FLAC (up to 24/192 on wired LAN, up to 24/96 on wireless LAN), WMA/9 (up to 16/48), AAC, HE-AAC (up to 24/96), LPCM (up to 24/192 on wired LAN, up to 24/96 on wireless LAN), Ogg vorbis 1.0 (up to 16/32), MP3 (up to 16/48). Analog inputs: 3 pairs stereo RCA jacks, Aux 1, Aux 2, Aux 3. Analog outputs: 2 pairs stereo RCA jacks, one fixed, one variable. Color LCD: QVGA, 320x240 pixels. Preamp Output Level: 0–300mV RMS nominal, 8V RMS maximum. Preamp Output Gain on Aux inputs: 4.5x (13dB) at maximum volume. Signal/noise ratio: >119dB, A-weighted. Frequency response: 10Hz–20kHz, <–0.1dB. Power requirement: 25W.

Dimensions 8.6" (220mm) W by 3.9" (100mm) H by 11.7" (300mm) D. Weight: 7.25 lbs (3.3kg).

Serial Number Of Unit Reviewed IPG0041.

Price $1999. Approximate number of dealers: 30.

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Anyone familiar with how the original iPod display (and quite a few other devices these days) allowed you to move from menu to menu on a small screen will get what MF has done with the M1CLiC's control interface. Though Apple has moved on to apps and touchscreens, their original menu approach can still work within the confines of a small screen and the buttons (in this case on the provided remote control) needed to navigate those menus. With simplicity can come trade-offs, however, as we shall see.

Innies and Outies

Before we get to that, let's take a look at the basic hardware. On the front of the M1CLiC's black box, which is about as big as a one-year stack of *Stereophile*s, is a Power/Standby/Mute switch, an LCD color display measuring about 3" wide by 2¼" high, an IR receiver, and a USB input. That's it.

The rear panel, however, bristles with connectors. At the top left are three sets of line-level RCA stereo input jacks, allowing the use of disc players, phono preamps, and maybe even a tape player as sources. Below that are two pairs of stereo RCA outputs: one set labeled Preamp Out, for connecting to your power amplifier, and one pair of fixed outputs for connection to a preamp.

To the right of the analog section are three rows of digital and networking jacks. The top row contains a USB jack labeled iPod, for connecting your iDevice; what looks like an RS-232 port for factory-only use; and a small connector for the supplied WiFi antenna. Below those is an RJ45 (Ethernet) jack labeled Networking, for connecting to the Internet and UPnP devices, and below that are the digital inputs: one labeled USB DAC, and one optical and two coaxial RCA-S/PDIF connectors. To the right of all that is the inlet for the detachable power cord.

When I looked at the M1CLiC's specifications, a couple of things surprised me right away. First, the USB DAC input

The M1CLiC features analog inputs as well as outputs, all on RCAs.

on the rear is set up as a 16-bit/48kHz adaptive port, which strikes me as somewhat primitive in these days of 24/96 and higher USB sources. The alternative asynchronous USB connection, which lets the DAC clock the data out of the source, is the USB buzzword these days, but Musical Fidelity claims that minimizing jitter is taken care of by their own reclocking-and-upsampling process. [*M1CLiC owners can get an asynchronous USB connection operating up to 24/96 by adding Musical Fidelity's V-Link, which Amazon was offering for $99 when we went to press.—Ed.*] This USB DAC input is where you plug in the USB cable from a computer running something like iTunes. But the USB jack on the front, which is intended only for memory sticks and USB drives stuffed with music, is fully 24/192-capable. The M1CLiC also provides onscreen navigation for a USB drive or stick plugged into the front, or an iPod connected to the third USB connector on the back. The iPod jack on the back and the front USB jack are not interchangeable—your iPod will not work from the front jack. The front jack supports only drives formatted as FAT16 or FAT32. I had to reformat one of my Mac drives to get it to work.

MEASUREMENTS

I used *Stereophile*'s loan sample of the top-of-the-line Audio Precision SYS2722 system to measure the Musical Fidelity M1CLiC (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 and updated the M1CLiC's firmware.

Looking first at the M1CLiC's performance as an analog preamplifier, the input impedance was usefully high at close to 100k ohms at low and middle frequencies, dropping inconsequentially to 48k ohms at 20kHz. The analog input preserved absolute polarity (*ie*, was non-inverting), and the gain from the fixed-output jacks was just under unity. The maximum gain from the variable outputs was 11.85dB. The source impedance from the fixed-level outputs was a still low 146 ohms at high and middle frequencies, rising slightly to 171 ohms at 20Hz, presumably due to a series coupling capacitor. The impedance from the variable jacks was 47 ohms at high and middle frequencies, rising to 76 ohms at 20Hz.

The analog frequency response was extremely wide, the output at 200kHz dropping by just 2.6dB (fig.1). Note the superb channel matching in this graph. Channel separation via the analog inputs was >110dB below 400Hz, decreasing to a good 77dB at 20kHz (not shown). THD+noise at 4V into 100k ohms from the fixed outputs—at least twice as high as the Musical Fidelity will be asked to deliver in practical use—was less than 0.003% below 4kHz, rising to a still-low 0.015% at 20kHz. The output clipped at a very high 9.7V into 100k ohms, again much higher than will be required in real life. Some electronic volume controls will overload with even moderately high input levels. However,

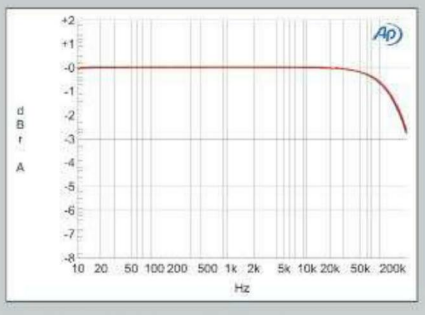

Fig.1 Musical Fidelity M1CLiC, analog input frequency response at 1V into 100k ohms with volume control at maximum (left channel blue, right red). (1dB/vertical div.)

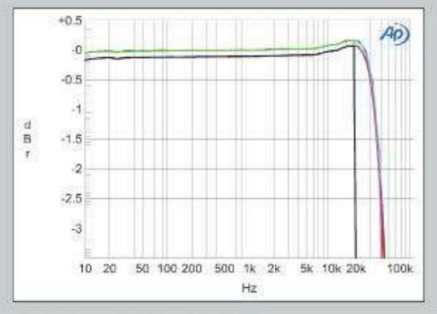

Fig.2 Musical Fidelity M1CLiC, frequency response at –12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red). (0.25dB/vertical div.)

The internal DAC, built around the core circuitry of MF's M1DAC ($749), provides reclocking for jitter reduction and 24/192 upsampling. (See Sam Tellig's full review of the M1DAC in the March 2011 issue for more about how this works.) Unfortunately, I didn't have a standalone M1DAC on hand, so I can't really say if the M1CLiC is a chip off the old block, though Musical Fidelity assures me that it is.

Maiden Voyage

I decided to plug in the M1CLiC and see what I could do without referring to the manual. Everything, it turned out—setting up the M1CLiC was incredibly easy. The user interface is very intuitive and well conceived, and right away—after using the remote control to navigate the input menu—I was using the coax-S/PDIF input.

I began to explore the other menu items and came upon Network. I plugged an Ethernet cable into the back, then into an Ethernet switch, and was instantly online. I then proceeded to check for updates to the M1CLiC (there were none), set my time zone, and poked around the other options. The MF's option for setting up a wireless WiFi network quickly found my Airport Extreme router.

After first running the M1CLiC's fixed and variable analog outputs into my preamp to make sure there were no unexpected clicks, pops, or problems with runaway volume control, I proceeded to set up the MF as my main preamp–DAC–digital hub, and connected the variable analog outputs directly to my Classé CAM 350 monoblocks.

I have a Western Digital Network Attached Storage (NAS) drive crammed with music and some photos. With the Twonky uPnP player installed on the NAS, the M1CLiC recognized the drive right away (it also found my DirecTV box and Oppo BDP-83 universal Blu-ray player); I could easily find my tracks via the MF's onscreen menu, and display photos from the drive on the screen. I've been spoiled by my Sooloos music server's powerful touchscreen interface, which makes navigating among my thousands of albums a snap. In contrast, if you have more than a few hundred albums, using the M1CLiC's onscreen menu will quickly become a chore. This is not a knock on MF's programming—the same is true of Apple's click-wheel iPods.

Ethernet, USB and iPod ports, as well as TosLink and coaxial S/PDIF inputs.

However, there are quite a few apps, some of them free, that let you control your M1CLiC-NAS library from an iPad, iPhone, etc.[1] Using Linn's free Kinsky app on an iPad2, I now had a more complete touchscreen experience—not quite Sooloos easy, and still a major pain with a large library, but a night-and-day improvement over the M1CLiC's screen and remote control. However, I found one Kwirk with Kinsky: The track-timing information of high-definition files

1 Musical Fidelity will have released its own control app by the time this issue hits the stand, but it was not available when we went to press with this review.—**Ed.**

with the M1CLiC's control set to unity gain, the preamp circuit didn't overload until the input level was 9.785V, well above what is necessary.

Turning to the digital performance, the maximum level at 1kHz was 2.016V from the fixed outputs and 8V from the variable outputs, the latter below the level at which the analog stage clips. The TosLink input locked to S/PDIF data with sample rates up to 192kHz, and the coaxial input locked to 176.4 and 192kHz data. Apple's USB Prober utility identified the M1CLiC as "USB Audio DAC" from "Burr-Brown from TI," and confirmed that the rear-panel computer USB input was restricted to 16-bita data with sample rates of 32, 44.1, and 48kHz, operating in the usual isochronous adaptive mode. The rear-panel iPod input takes the data in digital form, but is restricted to sample rates of 48kHz and below, of course. The M1CLiC played WAV files with bit depths of 16 and 24 with sample rates from 44.1 to 192kHz from a USB RAM drive plugged into the front-panel USB port. It also played FLAC files with sample rates up to 192kHz, including files at 176.4kHz, which Jon Iverson had problems playing via his network with the Twonky uPnP software and the Kinsky controller running on his iPad.

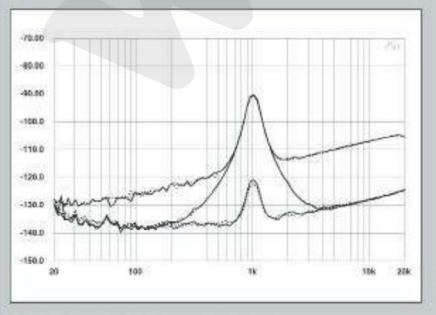
Fig.3 Musical Fidelity M1CLiC, 1/3-octave spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS, with: 16-bit data (top), 24-bit data (middle), dithered 1kHz tone at –120dBFS with 24-bit data (bottom). (Right channel dashed.)

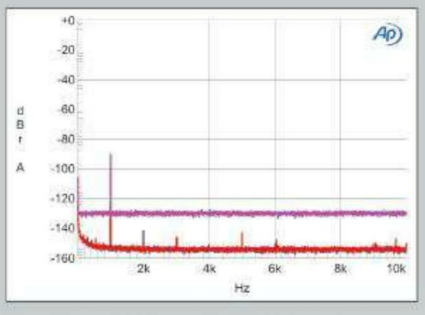

Fig.4 Musical Fidelity M1CLiC, FFT-derived spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS, with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red).

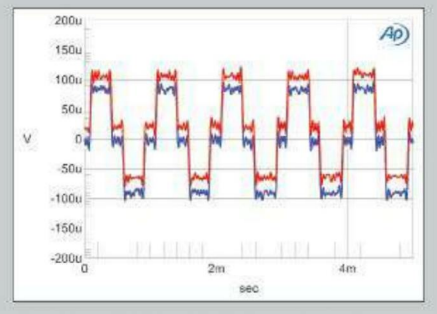

Fig.5 Musical Fidelity M1CLiC, waveform of undithered 1kHz sinewave at –90.31dBFS, 16-bit data (left channel blue, right red).

with sample rates higher than 44kHz was multiplied by as much as four for 24/192 files.

Other than that Kuriosity, everything played fine—until I tried a 24/176.4 file that had been originally sourced from an SACD. That's when things went the opposite direction, in that the music slowed down. It sounded as if the file was playing at half speed. According to the M1CLiC's manual, FLAC files up to 24/96 and at 24/192 will play over the network, but sampling rates *between* 96 and 192kHz will not. This was addressed in a mid-December firmware update.

I also set up a memory stick for use via the front USB port, connected my computer via the USB DAC input on back, and hooked up an iPod Touch to the iPod USB port. I connected the Sooloos via one of the coax-S/PDIF inputs and ran my Monolithic Sound PS-1 phono preamp, driven by an Oracle Delphi 2 turntable, into one of the analog inputs, with my Oppo disc player plugged into another. Last but not least, I set up several Web radio stations via the excellent built-in vTuner software. I should note that the M1CLiC's three analog inputs are not digitized and are analog from ins to outs.

Everything worked, but using the front-panel interface to switch sources was a bit tedious—especially if I'd just navigated out on a branch to find a song. The remote's Play View/Browse button helped a little, but I would have loved it had it had a button for direct access to each input, instead of my having to go back and forth through the menus—even just a Home button would have been a help. The remote includes control buttons for a Musical Fidelity disc player; I would have easily traded them for more direct control of the M1CLiC's preamp functions.

While I'm at it, I would also have liked a volume up/down button on the front panel (only the remote has them), for those times when the remote was at the other end of the room. Still, I can understand the desire for an uncluttered panel—Apple would have left the buttons off. Maybe MF should release an app for the M1CLiC with these functions, as well as built-in control of an NAS or memory-stick library.

Listening in Guilty Mode

After playing with the M1CLiC's comprehensive input options, I had two ways to compare its sound with those of other DAC-hubs: run them side by side into another preamp, or run the external DAC into an analog input on the M1CLiC and compare to the same source via the M1CLiCs digital input. I decided on the former, as it seemed more fair: an external DAC would not have its sound possibly changed by the M1CLiC's analog circuitry. A quick comparison didn't reveal that the analog input sounded obviously different, but I wanted to reduce as many variables as possible for the duration of my long listening period. I used FLAC files for testing.

I set up several Web radio stations via the excellent built-in vTuner software.

Comparing the various inputs, I quickly concluded that I preferred the sound of an NAS drive via the M1CLiC's Ethernet networking input, or the Sooloos via the MF's coax inputs. The differences were subtle and may not matter to a lot of listeners, but were apparent after several tests. So from here on out it was NAS/Ethernet and Sooloos/coax, to show the M1CLiC in its best sonic light.

I'd always wanted to use a Herb Alpert track as a reference recording, but hesitated—what would John Atkinson and the rest of the bunch think? But when JA himself bravely blazed the trail with an Alpert-inflected track in his

measurements, continued

However, though it would play AAC and MP3 files, the M1CLiC wouldn't play Apple Lossless files, displaying the message "File Format Error." To my surprise, the M1CLiC did play the audio tracks of MP4 movie files, though it didn't display the video.

Fig.2 shows the Musical Fidelity's digital frequency response with WAV files via its S/PDIF inputs and its front-panel USB port. The response at 44.1kHz (green and gray traces) starts to rise in the top octave before dropping sharply just below the Nyquist Frequency (half the sample rate). With 96kHz data (cyan and magenta traces), the rise peaks by 0.2dB at 20kHz, then rolls off by 3dB at 40kHz. Like Musical Fidelity's M1DAC, which Sam Tellig reviewed in March 2011 (see http://tinyurl.com/78wkcur), the M1CLiC's response with 192kHz data (blue and red traces) doesn't extend any higher in frequency than it does at 96kHz, presumably due to the product's use of a sample-rate converter chip ahead of the D/A chip to minimize the effects of datastream jitter. The left channel is about 0.1dB higher in level than the right. Channel separation below 4kHz with the digital inputs was better than with the analog inputs, at >105dB R-L and >110dB R-L, though at 20Hz this decreased in both directions to 86dB, as with the M1DAC.

The M1CLiC's digital performance was very similar to the M1DAC's, though I found it less sensitive to grounding issues when hooked up to either Audio Precision analyzer. The top two pairs of traces in fig.3, taken by sweeping a 1/3-octave bandpass filter from 20kHz to 20Hz while the M1CLiC decoded dithered data representing a tone at -90dBFS, indicate that the increase in bit depth from 16 to 24 drops the noise floor by almost 20dB in the treble, which is easily enough resolution to allow the D/A to decode a tone at -120dBFS

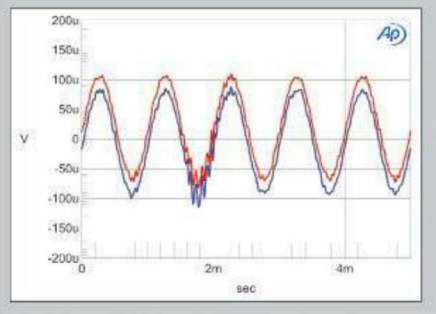

Fig.6 Musical Fidelity M1CLiC, waveform of undithered 1kHz sinewave at -90.31dBFS, 24-bit data (left channel blue, right red).

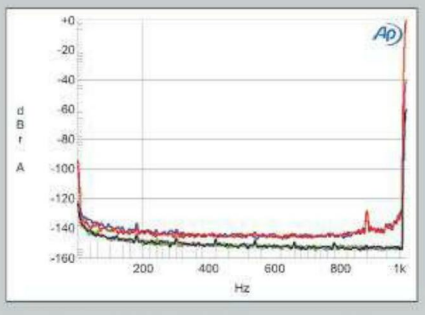

Fig.7 Musical Fidelity M1CLiC, spectrum of 1kHz sinewave, DC–1kHz, at 0dBFS into 100k ohms (left channel blue, right red), -40dBFS (left cyan, right magenta), and -60dBFS (left green, right gray; linear frequency scale).

September 2011 review of Musical Fidelity's AMS100 amp, I knew that light had turned green. So many of Alpert's albums still stand up today for their tight arrangements and playing and their simple, honest engineering. Okay, you either like the music or you don't—but I played trumpet as a kid, and Alpert got the girls.

Looking for some context, I cued up several cuts from the excellent Signature Series reissues of the Tijuana Brass catalog, and noticed right away that the M1CLiC had a slightly different sound from the Resolution Audio Cantata digital hub that had been in my system for the last few months following my review last November. For example, in "Work Song," from *S.R.O.*, (ripped from CD, King 3107), the edges of images were rounded a tad, and the soundstage flattened a bit. To be fair, the *ca* $6000 Cantata earns its better depth and detail at three times the price of the M1CLiC (it also includes a world-class CD player), and it's tough to beat. I cruised the TJB catalog some more and further confirmed these characteristics.

Since we're doing guilty musical pleasures, I moved on to Tommy James and the Shondells and pulled out my reference D/A converter, a Benchmark DAC1 USB. Having just finished reading James's fascinating autobiography (with Martin Fitzpatrick), *Me, the Mob, and the Music: One Helluva Ride* with Tommy James and the Shondells, and though he still comes off as a bit of a dork (white leather shoes and matching belt!!), I have a better appreciation for his recordings and how they were made—and, of course, for how corrupt the music business can be. Though they start out sounding wonderful, some of the instruments in the title track of the remastered *Crimson & Clover* (ripped from CD and originally released on LP in 1968) develop a hard, glassy edge; the M1CLiC helpfully rounded things off a bit compared to the Benchmark, which, though providing more precision, was somewhat irritating on the brighter peaks.

One of the greatest guitar-bass-drum intros in rock'n'roll is found at the beginning of James's "Draggin' the Line" (from James's *Christian of the World*, a 1971 Roulette LP release). This later recording sounds better than "Crimson & Clover" until the chorus, where the upper midrange and compression are goosed to help crank up the energy—a typical pop-song problem. Again, the M1CLiC smoothed out the dynamics and imaging a bit. Some might prefer this, but I missed the Benchmark's overall more detailed and tighter sound—as long as I didn't turn it up too loud.

I quickly concluded that I preferred the sound of an NAS drive via the M1CLiC's Ethernet networking input.

A few more Shondells tracks later, I'd begun to get the sense that the brighter the recording, the more the M1CLiC's sound worked to its advantage—but thrown a muddled mix, it had a little trouble untangling the parts.

Take *Young Men Gone West*, a long-lost guilty-pleasure gem from City Boy (CD, Renaissance RMED00298). The band's Queen-ELO-Supertramp tendencies never caught on in a big way, but this album is a carefully crafted time capsule of mid-'70s pop with strong tunes and arrangements. The mix gets congested, compressed, and all around not so fun when things get going, and the MF just couldn't make the most of it, compared to the Peachtree iDac or the Benchmark. But it did take the edge off.

Crank up a guilty-pleasure hi-def track like "A Hit By Varèse," from Chicago's *V*, and the sonic gap closed. I've

measurements, continued

(bottom pair of traces). This is close to 19-bit resolution, which is excellent performance and confirmed by FFT analysis (fig.4). Note the absence of power-supply-related artifacts in these two graphs, though some very low-level harmonic spuriae visible in fig.4 have been unmasked by the drop in the noise floor with 24-bit data. Repeating the analysis in fig.4 with 24-bit data on a USB stick plugged into the front-panel USB port gave the same result, confirming that the M1CLiC correctly decodes 24-bit data via this input.

The Musical Fidelity's linearity error with 16-bit data (not shown) was dominated by the recorded dither noise down to -120dBFS, suggesting that the error was negligible. As a result, and with the very low level of analog noise, the M1CLiC's reproduction of an undithered 16-bit sinewave at exactly -90.31dBFS was essentially perfect (fig.5), with a symmetrical waveform and the three DC voltage levels well differentiated. The time-symmetrical Gibbs Phenomenon "ringing" on the wave's tops and bottoms is also clearly visible. With undithered 24-bit data, the result was a good sinewave despite the lack of dither (fig.6). Noise modulation was low well away from the signal frequency (fig.7), and was of the order of the changes introduced by the Audio Precision's gain-ranging circuitry. However, there was a shift in the noise floor close to the signal at 0dBFS, and sidebands appear at the power-supply-related frequencies of ±120Hz. As these lie at almost -130dB, they will have no audible consequences. This graph also reveals that the odd-order harmonics of the power-supply frequency that result from magnetic interference from the M1CLiC's AC transformer are negligible.

Like the M1DAC's, the M1CLiC's harmonic distortion was superbly low, and dominated by the subjectively innocuous second and third harmonics (fig.8), though the third harmonic from the

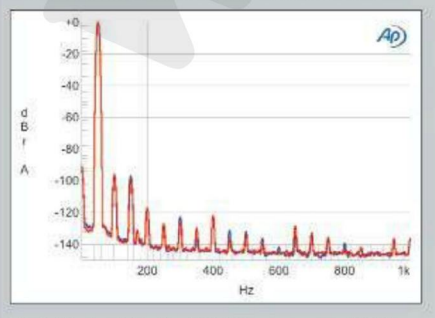

Fig.8 Musical Fidelity M1CLiC, spectrum of 50Hz sinewave, DC–1kHz, at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

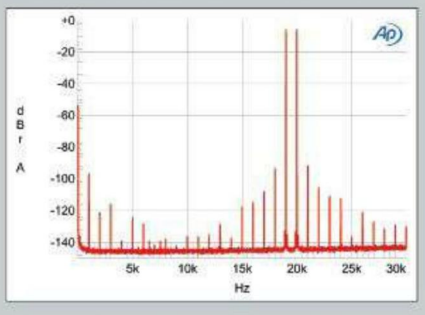

Fig.9 Musical Fidelity M1CLiC, HF intermodulation spectrum, DC–30kHz, 19+20kHz at 0dBFS into 600 ohms (left channel blue, right red; linear frequency scale).

been ripping my DVD-Audio discs to hard drive this past year, and two of the sonic standouts are this album, which was released in both 24/96 and 24/192 versions, and the Doors' catalog in two-channel 24/96. (This edition of the Doors albums boasts different mixes from the original vinyl and CD releases, with added details, instruments shifted around the soundstage, and in some cases different track timings.) Here's where the Musical Fidelity could hold its head high; the sheer weight and assuredness of these recordings came through loud and clear.

I still give the Benchmark and Peachtree the nod for detail and soundstage size, but the louder I played HD music through the M1CLiC, the better it compared. At lower levels, dynamics and detail again receded. What this means for your listening pleasure depends on how you listen and what you look for. Ultimately, I opt for extra detail even at the expense of pleasant sound. Others may prefer something more forgiving. Luckily, we have choices.

A CLiC Conclusion

What to make of such a versatile and ambitious component that demonstrates clear trade-offs in usability? It depends on what you need going into it. I can't see using a product like this if all you need is a really good $1000–$2000 DAC without all the features. And if you're put off by anything that requires menu navigation (which is why I've never taken to Logitech's products), steer clear—especially if you have a huge library on hard drive and don't plan on using an iPad as a controller.

I've been a little tough on the M1CLiC's sound, but really, the differences between it and other DACs are subtle and subject to personal preference. Sam Tellig loved the M1DAC's sound, but I found, at least in its implementation in the M1CLiC, that it sounded softer than what I had on hand.

ASSOCIATED EQUIPMENT

Analog Source Oracle Delphi 2 turntable modified by Brooks Berdan, Origin Live Encounter tonearm, Soundsmith Aida cartridge.
Digital Sources Apple MacBook Pro computer (2.66GHz Intel Core 2 Duo, 4GB RAM, 320GB HDD) running OS 10.6.8, iTunes 10.5, Sonic Studios Amarra 2.2, Songbird 1.9.3, XLD; Oppo BDP-83 universal Blu-ray player; Meridian Sooloos Music Server (Control 15, 3 TwinStores); Apple iPod Touch 1G; Apple iPad2; Resolution Audio Cantata, Benchmark DAC1 USB, Peachtree iDac D/A converters.
Preamplification Monolithic Sound PS-1 phono preamplifier, Marantz AV7005 preamplifier in Pure Direct Mode.
Power Amplifiers Classé CAM 350 monoblocks.
Loudspeakers MartinLogan Prodigy & Descent subwoofers (2).
Cables USB: Cardas Clear. S/PDIF: Cardas Neutral Reference, XLO. Interconnect: Kimber Kable various line-level, XLO HT Pro line-level. Speaker: Kimber Kable BiFocal XL.
Accessories Dedicated 20A line (amplifiers), dedicated 15A lines (digital & analog components).—**Jon Iverson**

But—and it's a big but—if your emphasis is on flexibility and a wide variety of input choices, both analog and digital, in a clean, minimalist package, all for a reasonable price, then the Musical Fidelity M1CLiC may be the perfect balance of features, performance, and sound. I recommend you play with it before buying something else. And its options are bound to grow as new apps come online for leveraging all the stuff you can connect to the M1CLiC. Its small footprint and ease of setup are just icing on the cake. ■

measurements, continued

'CLiC's unbalanced output is a little higher than it was from the 'DAC's balanced output. This graph was taken into the benign 100k ohm load; the picture didn't change significantly into 600 ohms (not shown). Intermodulation distortion was also very low, even into 600 ohms (fig.9).

Like the M1DAC's, the M1CLiC's rejection of jitter was superb. Fig.10 shows the spectrum of its output when reproducing 16- and 24-bit versions of the Miller-Dunn J-Test data stored as WAV files on a USB stick inserted into the front-panel port. The behavior was identical for both coaxial and TosLink S/PDIF data: with 16-bit data (blue and magenta traces), the odd-order harmonics of the low-level, low-frequency squarewave all lie at the residual level and are not accentuated in any; with 24-bit data (cyan and red), all that can be seen is a slight broadening of the skirts of the spike that represents the 11.025kHz tone, a pair of very low-level sidebands of unknown origin at ±1230Hz, and a pair of sidebands at the supply-related frequencies of ±120Hz. However, these sidebands are too low in level to be resolved by my Miller Analyzer. To my surprise, the ±120Hz sidebands disappeared when I repeated the 16-bit J-Test with my iPhone plugged into the rear-panel port (fig.11), though they reappeared with an iPod Classic (not shown). Despite operating in the jitter-prone adaptive USB mode rather than the theoretically better asynchronous mode, the M1CLiC's USB input, fed 16- and 24-bit J-Test data, performed as well as did its S/PDIF inputs.

Overall, Musical Fidelity's M1CLiC offered superb measured performance.—**John Atkinson**

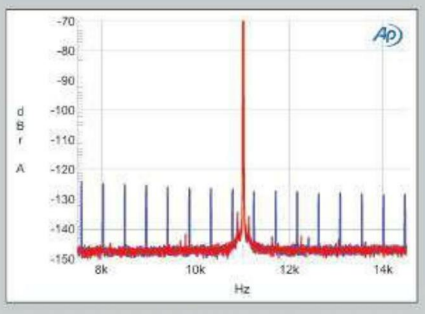

Fig.10 Musical Fidelity M1CLiC, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit data via front USB port (left channel blue, right magenta), 24-bit data (left cyan, right red). Center frequency of trace, 11.025kHz; frequency range, ±3.5kHz.

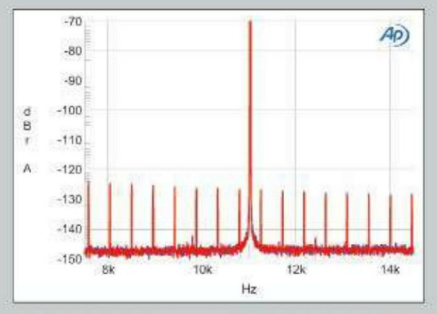

Fig.11 Musical Fidelity M1CLiC, high-resolution jitter spectrum of analog output signal, 11.025kHz at –6dBFS, sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit data via iPhone plugged into rear USB port (left blue, right red). Center frequency of trace, 11.025kHz; frequency range, ±3.5kHz.