Berkeley Audio Design Alpha USB Interface

theabsolutesound.com/articles/berkeley-audio-design-alpha-usb-interface/

The high-end audio industry has a remarkable track record of making fundamentally limited technologies sound good. Most of these technologies were created for mass-market consumption where low price is the overriding design mandate. But because these technologies have become the standard, the high-end industry has had no choice but to attempt to create silk purses out of sows' ears.

Here are just a few examples: the CD format (its creators would be astounded at the advances in just, say, digital filtering); the RCA plug and jack (compare the connections on 1970s equipment to today's Cardas or WBT RCAs); and the Compact Cassette (Nakamichi 1000, anyone?).

A more recent, and perfect, example is the Universal Serial Bus, or USB interface. Designed to connect computer peripherals, USB was never intended to be a high-resolution digital-audio interface. But the rapid growth of computer-based music systems has, once again, foisted upon the high end a standard that requires exceptional re-engineering to meet the demands of high-quality music reproduction. Because of the contributions of high-end designers, today's best USB interfaces are light years beyond the basic implementations.

In this overall drive toward a good-sounding USB interface, one company stands out for pushing the envelope—Berkeley Audio Design. The company that brought us the amazing Alpha DAC has turned its considerable engineering chops and uncompromising work ethic toward solving the USB interface problem. The Alpha USB reviewed here—only the second product from Berkeley—has been nearly two years in the making, largely, I surmise, because Berkeley is run by engineering-driven perfectionists who kept discovering during the design process better and better techniques and implementations. Berkeley is the kind of company that would repeatedly delay a product launch until it had wrung out every last bit of performance.

Why Do We Need a USB Converter?

Before looking at the Alpha USB in detail and considering its sound quality, let's review the options for getting music out of a computer-based server and into a digital-to-analog converter (DAC). For now, we'll ignore the turnkey systems such as Sooloos and the Olive O6HD (reviewed in this issue) to focus on do-it-yourself servers based on a personal computer.

The first option is to install a soundcard with integral DACs in your PC. You simply connect the soundcard's analog outputs to your preamplifier and you're in business. The compromises of this approach are fairly obvious—the inside of a computer is not the best place to perform digital-to-analog conversion. The second option is to use a soundcard's S/PDIF or AES/EBU digital output for connection to an external DAC. In our previous issue (May/June) Karl Schuster surveyed and reported on eight such soundcards. This approach requires opening your PC to install the card, and configuring software. Moreover, building a PC server that is "bit transparent" (one that doesn't change the ones and zero representing the music) is easier said than done.

The third method, which is by far the most popular, is to simply run a USB cable from the computer to a DAC equipped with a USB input. Although simple in practice, the USB interface audibly degrades the signal passing through it, even in the better implementations. As noted, USB was never designed for audio; it is a "packetized data" format in which data are split up into discrete chunks, wrapped up with information about those chunks, transmitted, and then put back together at the receiving end. This is in sharp contrast with the continuous bitstream of digital audio formats such as S/PDIF. Moreover, until recently USB has been limited to a maximum sampling frequency of 96kHz. And let's not forget that many of us have older DACs that still sound good but lack a USB input. It is for these reasons that my own server, which I use exclusively to play high-resolution music, is a PC fitted with a Lynx AES16 card that outputs its digital signal as AES/EBU on an XLR plug. (I also use a Meridian Sooloos to access my CD music library.)

The solution to these myriad problems is an outboard box that takes USB from the computer and outputs S/PDIF—if this can be accomplished without compromising sound quality. Although USB converters are widely available, none could be considered an all-out assault on the state-of-the-art. Rather, they are largely utilitarian in purpose.

Which is where the Berkeley Alpha USB comes in. Berkeley's goal with the Alpha USB was not just to create the best-sounding USB interface, but to completely eliminate the problems of USB and build a state-of-the-art solution for getting music out of a computer and into a DAC. Concomitantly, Berkeley wanted to create a product that allowed anyone, not just those with technical expertise, to realize state-of-the-art computer-based audio performance. When Berkeley's Michael Ritter told me about the Alpha USB, he invited me to compare its sound with that of the AES/EBU output of the Lynx AES16 card in my fan-less, drive-less PC server, a setup that many considered the state-of-the-art in computer audio (see my review of this system in Issue 189). The PC with the Lynx card starts off with the considerable advantage of never converting the audio data to the USB format. If the Alpha USB did sound better than my PC (with both driving the same DAC), it would not only represent a breakthrough in sound quality, but make it much easier for non-geeky music lovers to enjoy the benefits of computer-sourced audio.

Functional and Technical Description

The Alpha USB is housed in an unusual chassis that's significantly larger than that of most USB converters, but smaller than full-sized components. As with the Alpha DAC, the Alpha USB features a no-cosmetic-frills chassis. The front panel's only indicator is a single LED that lights up amber when powered on, and then switches to green when connected to an active USB source (the computer). The rear panel is also minimalist, with AES/EBU and S/PDIF outputs (the latter on a BNC jack) selectable via a small toggle switch. The Alpha USB lacks an RCA output because the RCA's characteristic impedance is 50 ohms, not the 75-ohm standard for S/PDIF. A BNC interface, which has a characteristic impedance of 75 ohms, is vastly superior to RCA for carrying digital audio. AC power is via an IEC jack. There is no power switch; the unit, which draws 4.5W in standby mode, is designed to be left continuously powered. Macintosh computers running Snow Leopard or later will automatically talk to the Alpha USB. Windows users will need to install driver software, which is included on a CD.

The Alpha USB is the epitome of "form follows function." The unusual chassis size and shape were chosen for sonic performance. In broad terms, the Alpha USB isolates the "dirty" USB circuitry from the "clean" digital-audio output, and provides a high-precision clock for that audio output. The USB input jack is mounted on a plastic insert rather than directly in the chassis to prevent capacitive coupling of noise between the USB input and the digital-audio output. This isolation between the two "halves" of the Alpha USB is improved by powering the circuitry associated with the USB input from the computer via the USB bus, and powering the clocks and digital-audio output drivers

from a clean, linear power supply built into the Alpha USB. Berkeley extends this isolation concept by recommending that the computer be powered from one AC outlet and the Alpha USB, DAC and analog components from another, and that the USB cable between the computer and Alpha USB be routed away from the Alpha USB's chassis and any analog cables or components. It goes without saying that the Alpha USB's USB interface is "asynchronous," meaning that the Alpha USB's output clock is not locked to the computer's clock. That is, the timing precision of the Alpha's S/PDIF output is not affected by the computer. A conventional "adaptive" USB interface, in which the computer serves as the master clock, is simply a non-starter for critical applications.

The digital audio signal is clocked with one of two precision oscillators, one for the 44.1kHz family of sampling frequencies (44.1kHz, 88.2kHz, and 176.4kHz) and the other for the 48kHz family (48kHz, 96kHz, 192kHz). To give you an idea of how meticulously designed and executed the Alpha USB is, consider that each oscillator is measured on a $90,000 instrument that creates a spectragraph of the oscillator's phase noise. Only the best measuring parts go into the Alpha USB; the rest are rejected. This measurement process costs many times what the actual part costs, but Berkeley discovered that this performance parameter was crucial to sound quality.

The Alpha USB's designer, Michael "Pflash" Pflaumer, comes from a multidisciplinary background that includes writing the DSP code that made HDCD possible, analog design, and RF design. When the first microprocessor became available, Pflash wrote his own operating system for it and built a computer around it. It's rare for an engineer who can write DSP code to also have an intimate understanding of how electromagnetic fields behave. It's even rarer when that engineer is also a musically sensitive listener who uses his ears to guide product development.

System Context and Set-up Notes

Berkeley sent to me a bare-bones iMac ($1199) loaded with music, including most of the Reference Recordings HRx 176.4kHz/24-bit titles (which I also have on my PC server). They also shipped a Straightwire Info-Link AES/EBU cable and a Straightwire USB-Link USB cable (both 1.5 meters). The iMac ran iTunes along with the latest version of Pure Music, a $129 piece of software that improves sound quality (see Steven Stone's review of Pure Music in Issue 209). Berkeley recommends Pure Music, and includes with the Alpha USB a $25 discount coupon for the software. The complete digital front end of an iMac, Alpha USB, Alpha DAC, Pure Music, Straightwire USB and Straightwire AES/EBU costs about $8300.

The iMac was unbelievably easy to set up and use; my Windows PC was a different story. To use the Alpha USB with a Windows machine, you must install the supplied driver. This will let the PC and Alpha USB talk to each other but will not allow you to realize the system's full sonic potential. You must also install an ASIO driver to avoid data corruption. For Windows XP users, the available ASIO drivers will degrade the sound. Machines running Windows 7 can use a more sophisticated WASAPI driver that

reportedly delivers performance as good as that possible from a Macintosh. Installing the ASIO driver on my XP machine was a hassle. Moreover, switching between the Lynx card and the USB output required going into a couple of menu layers in MediaMonkey to manually change a setting.

Considering my experience with both an iMac and a Windows PC, I can unequivocally say that the Macintosh is vastly superior (and I've used PCs for all other computing since the late 1990s). The Mac is far more elegant, easier to set up, better sounding, and doesn't require that you jump through hoops to realize its optimum performance. Even if you own a PC that you are thinking of using as a server, I encourage you to spend the $1199 for an iMac—you'll be glad you did.

Listening

I began by comparing the sound of the iMac/Alpha USB to my PC-based server equipped with the Lynx AES16 card. The bitstreams from each computer driving the Berkeley Alpha DAC were identical. How do I know this? Every HDCD recording carries a flag in the least significant bit that identifies the recording as HDCD-encoded. An LED on the Berkeley Alpha DAC's front-panel illuminates when this flag is detected. If the data were corrupted, that LED would not illuminate. In all my tests, the HDCD LED remained lit when playing any Reference Recordings title (CD or high-res file). It follows that the bitstreams were identical for non-HDCD recordings, as well.

Listening to 176.4kHz/24-bit Reference Recordings HRx files through the Constellation Audio electronics ($65k Altair preamplifier and $140k Hercules power amplifiers) driving Sonus faber's $200,000 flagship loudspeaker is as critical a situation as one could devise. These exquisite recordings contain so much fine information, dense spatial cues, micro-transient detail, and rich timbral colors that any degradation is instantly identifiable. The playback system is truly of reference quality.

Comparing the PC-based server with the Lynx card to the iMac and Alpha USB (by changing which AES/EBU cable was connected to the Alpha DAC) revealed that the PC setup I'd thought was the state-of-the-art was actually a step down from what was possible. Simply put, the Alpha USB took the system to another level of resolution and musicality.

The USB Problem Is Finally Solved

Although the PC server sounds phenomenally great, the iMac/Alpha USB was better in virtually every sonic criterion and inferior in none. First was the sense of space and the naturalness of the staging. The iMac/Alpha USB had a slightly less forward perspective along with much greater soundstage depth. Although the front of the stage was a little set back, instruments in the back of the hall sounded much more distant. The sense of bloom around individual instrumental outlines was more realistic and palpable. The Alpha USB made the PC/Lynx sound slightly congested and homogenized by comparison.

Within this sense of expansive space, I could more easily hear fine recorded detail, particularly instruments toward the back of the hall. Switching over to the Alpha USB system was like sharpening the focus on a camera; very-low-level detail that had been just a bit indistinct or smeared snapped into vivid clarity. I thought I had heard the HRx recordings in their full glory with my PC server, but I was astonished to discover another level of resolution and clarity.

The treble through the Alpha USB was smoother and, paradoxically, slightly more prominent. The presentation wasn't brighter, just more alive and vivid. The treble had greater texture and increased density of information, yet was more finely filigreed and delicate. The top octaves also had greater smoothness and ease, particularly on high-level, high-frequency transients such as the upper octaves of *fff* piano passages.

The sense of hearing more information was partially the result of the Alpha USB's superior rendering of transient detail. Listen to a Latin percussion instrument such as the *güiro*; the Alpha USB better resolved the instrument's dynamic envelope to create a greater impression of hearing the instrument itself rather than a re-creation of it. Percussion seemed to "pop" from the soundstage with greater life. Micro-transients were also noticeably superior; listen to brushes on cymbals, to triangles, and to tambourine. By better resolving this low-level transient detail, the Alpha USB made the presentation more lifelike and musically vivid. I could better hear the mechanisms by which the sounds were created, which is always a good sign.

Finally, the Alpha USB had a greater sense of ease on high-level peaks, particularly during dense and complex passages. The music got louder more gracefully, with smoother textures and less homogenization of images. The presentation remained more coherent during the loudest orchestral passages, contributing to the overall sense of ease and involvement I experienced.

Because the Alpha DAC was receiving the same bitstream from both music servers, the only difference was in the timing precision—jitter.

Some of these differences could be attributable to the different computer platforms, so I compared the sound of the Lynx card in my PC to the PC's USB output through the Alpha USB. The Alpha USB sounded better overall, although the disparity was not as great as when comparing the PC/Lynx to the iMac/Alpha USB. The specific sonic characteristics were the same, but the magnitude of the difference was reduced, suggesting that the Macintosh platform has a sonic advantage over the PC. That difference might be erased by a PC running Windows 7 and a better WASAPI driver, but I was unable to hear that configuration. Even if a Windows 7 PC can sound as good as the Macintosh, the Apple platform is much more pleasant to use.

Conclusion

The Berkeley Audio Design Alpha USB is a breakthrough product that not only overcomes the limitations of the USB interface, but provides a state-of-the-art method

of getting audio out of a computer. Moreover, the Alpha USB makes this reference-quality performance available to non-technical music lovers who have a Macintosh and a DAC.

Though the Alpha USB's $1895 price is considerably more than that of other USB converters, the Alpha is a bargain when you consider that it provides a simple, foolproof path for creating a state-of-the-art music server. Moreover, the entire digital front end of the iMac, Alpha USB, Alpha DAC, Pure Music software, and Straightwire digital interconnects costs about $8300. That's not chump change by any measure, but it's eminently reasonable for a music server and a DAC that deliver this level of performance. I listened to this digital front end as a source for electronics and loudspeakers that together cost more than $400k, yet never felt that the digital source was the weak link in the chain. In fact, I had the opposite reaction: This source allowed me to hear these ultra-exotic electronics and loudspeakers at their best.

One day computer-based music systems will be simple to set up, foolproof, ubiquitous, and uncompromised in sound quality. The Berkeley Alpha USB represents a giant leap forward in realizing this goal.

SPECS & PRICING

Type: USB-to-S/PDIF converter
Input: High-speed USB 2.0, Type B jack
Output: Switch selectable— coaxial SPDIF on BNC, balanced AES on XLR
Supported sampling rates: 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz, 192kHz
Supported word lengths: Up to 24 bit
Supported operating systems: Apple Macintosh and Microsoft Windows
Mains power: 100 or 120 or 240VAC, 50/60Hz, IEC power input connector
Power consumption: 3 Watts line, 1.5 Watts USB, designed for continuous operation
Dimensions: 10.5" x 2.5" x 5" (including feet)
Weight: 2.5 lbs.
Price: $1895

Associated Components
Sonus faber "The Sonus faber" loudspeaker, BAlabo BC-1 Mk-II preamplifier and BP-1 Mk-II amplifier, Constellation Altair preamplifier and Hercules power amplifiers, Berkeley Audio Design Alpha DAC, Meridian 808.3 and Meridian Sooloos system (Ethernet connected), dCS Puccini/UClock, custom fanless and driveless PC server with Lynx AES16 card; Basis Inspiration turntable with Basis Vector 4 tonearm, Air Tight PC-1 Supreme cartridge; Aesthetix Rhea Signature phonostage; Shunyata V-Ray V2, Triton, and Talos power conditioners, Audience aR6t power conditioners; Shunyata CX-series AC cords; Transparent XL Reference interconnects; Transparent XL Reference loudspeaker cables; Straightwire USB-Link USB cable; Shunyata Anaconda interconnects and cables; ASC 16" Full-Round Tube Traps