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ELECTRONICALLY REPRINTED FROM JANUARY 2016

NEXT-GEN DIGITAL

Bryston BDP-2 Digital Player

From Revolution to Evolution

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How time flies when you're having fun! It hardly seems like four years since my review of Bryston's BDP-1 Digital Player in issue 215. Since its auspicious debut, the BDP-1 has remained my reference digital playback component, consistently delivering engaging music without provoking complaint. *Contentment* is rare in audiophile circles; the dominant sentiment seems to be an insatiable desire for the next best thing. I have continued exploring alternative music-file playback architectures, but I must confess that whenever I return to the BDP-1, I feel *relief*, thankful that Bryston has taken care of the tweaky details and eliminated the erratic glitches that can turn computer-based audio into a tedium.

Of course, the industrious folks at Bryston have not rested on their proverbial laurels. Not long after the introduction of the BDP-1, they released the slightly more expensive BDP-2, incorporating the same digital audio circuitry, but a more powerful system board and a correspondingly heftier power supply. Processor speed and memory capacity were both increased. Connectivity was expanded to include an internal SATA connection, an eSATA port, two gigabit Ethernet ports, and six full-current USB 2.0 ports.

Cognizant of the increasing availability of digital-to-analog converters with USB Audio inputs, Bryston then differentiated the digital player family further, shrewdly removing the customized SPDIF and AES/EBU digital output board from the BDP-1, yielding the new BDP-1USB with only USB Audio output, but at a substantially *lower* price.

On the software side, the Canadian programming crew has continued to refine the BDP user interface and add features well beyond the scope of the original design. The latest "Manic Moose" (smile!) firmware includes an updated Media Player application, the enhanced configuration Dashboard, Bryston's bRadio interface to search and play Internet radio stations, and access to the Tidal Internet music-streaming service (still in beta-test phase at the time of this writing). The Bryston digital players operate in accordance with the open-source Music Player Daemon (MPD) protocol. Users can now switch between several different MPD versions. The latest firmware (S2.18 2015-09-29) includes MPD v0.17.6, v0.18.21, and v0.19.9 for the BDP-2, but the BDP-1/USB hardware is incompatible with MPD v0.19.

While "Direct Disc" playback from connected storage drives remains the core operational mode—and a principal performance differentiator—the BDP can now also play files from Network Attached Storage (NAS) devices or shared folders on networked computers, function as a DLNA client, renderer, or server, and play music streamed from AirPlay/SharePlay and Squeezebox-format sources. Each of these new features can selectively be activated from the BDP's browser-based interface, facilitating interoperability with other networked devices: computers, tablets, Blu-ray players, media streamers, game consoles, smartphones, toasters, etc.

Bryston's BOT-1 Optical Disc Transport further expands the functionality of the digital players. While a traditional CD transport connects directly to a DAC via a SPDIF or AES/EBU cable, the BOT-1 operates only in conjunction with a BDP, connected via a USB cable. In CD playback mode, the BDP accesses the BOT-1 as a CD-ROM drive, effectively "ripping" CDs on-the-fly and buffering the output datastream through the BDP's memory, in the same manner as files played from storage drives. For those of us of a certain age who recall the expensive, heavily engineered, high-end CD transports of days past, the prospect of bit-perfect real-time CD playback from a modestly sized (and modestly priced) add-on optical drive is most enticing. Additional BOT-1 functions include ripping CDs directly to attached storage drives—with metadata tag editing via the BDP's browser interface—and burning CDRs of CD-resolution (16 bit 44.1 kHz) music files from custom playlists.

While these ongoing improvements have added functionality and enhanced the operational ease of the Bryston digital players, the primary impetus for this review came from a recent change to the BDP-2's audio circuitry: replacing the venerable ESI Juli@

sound card and Bryston's custom digital output board with a new Integrated Audio Device (IAD), designed entirely in-house. The IAD is powered directly from the BDP-2's higher-capacity linear power supply, rather than from the motherboard's PCI bus, and thus cannot be retrofitted to the BDP-1. However, owners of the original BDP-2 can upgrade to the IAD for a modest charge of $500.

It is completely understandable why Bryston would want to "get out from under" the need to source the Juli@ PCI Audio Interface from ESI Audiotechnik, especially in light of the Bryston's unrivaled reputation for long-term customer support. Several years ago, Bryston ran into a dilemma faced by many high-end manufacturers, when a supplier stopped building the drive mechanism used in its BCD-1 CD player. Unfortunately, that remarkably good-sounding CD player entered the history books far too prematurely.

Throughout my time with the BDP-2, I tested a variety of permutations, as outlined in the *Configuration & Optimization* article available on the tas.com website. Rather than winding my way through the highways and byways of that journey, I'll zoom directly to the finish line: The Bryston BDP-2's new Integrated Audio Device reduces coloration and digital artifacts even further than its standard-setting predecessor.

The first order of business was obviously to compare the BDP-2's new Integrated Audio Device against the BDP-1's customized ESI Juli@ PCI audio interface. Bryston's BDA-2 DAC proved an ideal platform for this comparison, as its two BNC-coaxial SPDIF inputs facilitated simultaneous connection of both digital players. As I became familiar with the BDP-2, I began to hear residual colorations and distortions from the BDP-1 that previously had escaped notice, absent an even more neutral reference. (This inviolate truism of audio evaluation persists regardless of listening experience!) Compared with the BDP-2, the BDP-1 imposes a sweet sparkle in the high treble, with a glint of excess energy just below, accompanied by marginally over-ripe, rounded weight in the bottom end. It imbues music with a slightly loose "wet" vibe, and an engaging presence that remains enticing in its own way.

In contrast, the BDP-2's new Integrated Audio Device exhibits a more strictly linear tonal balance, with more refined upper octaves and a bass range characterized by improved pitch definition, timbral differentiation, and expressive nuance. The BDP-2 opens up the volumetric space of well-recorded acoustic music, without the slight center-weighted emphasis of the BDP-1. During complex, dynamic passages, the BDP-2 does a better job of keeping everything solidly grounded in its proper place. With tighter focus and even less time-domain smearing than its predecessor, the BDP-2 renders every instrument and voice with more distinctive character and a richer tonal palette, since harmonic relationships are preserved with greater fidelity and presented with better-defined note shape, from initial transient through resonant bloom to natural decay.

I've listened to Wes Montgomery's *A Dynamic New Sound* hundreds of times, but the BDP-2 granted me even deeper insight into the legendary jazz guitarist's exquisite phrasing and expressive dexterity. The BDP-2's superior timing accuracy was made manifestly clear by the scalpel-sharp precision of Die Deutsche Kammerphilharmonie Bremen dissecting the rhythmic complexities of Stravinsky's *A Soldier's Tale* under Paavo Järvi's expert direction. All considered, the BDP-2 is simply more transparent to the recording, taking a relaxed, unforced approach to uncovering detail in both the musicians' performances and the sounds of their instruments.

After extensive comparative listening confirmed my impressions of the relative merits of the BDP-1 and the BDP-2, I moved on to assess other aspects of the BDP-2's performance. Historically, I have found that the best BNC-terminated 75-ohm coaxial SPDIF cables convey purer tonality, richer timbres, and superior three-dimensional body than AES/EBU cables fitted with their reflection-prone XLR plugs. However, after testing a recent upgrade to my AES/EBU cable design via the BDP-2's superior IAD output board, I am finally convinced that the AES/EBU interface is capable of performance that can match, and perhaps even surpass, SPDIF.

In light of the BDP-2's superlative performance playing files from attached USB drives, I was curious to compare playback from networked storage drives. I copied a set of test files to the internal SATA hard drive of a Dell mini-tower PC, running a bloatware-free clean installation of Windows 7. Enabling File Sharing of the "Music" folder on the PC allowed the BDP-2 to access it as a Network Attached Storage (NAS) device. I also activated the UPnP/DLNA Media Server function of the Foobar 2000 music player program running on the host PC, so that the those files could be streamed from the same storage location to the BDP-2's DLNA client.

I was surprised to find that playback of DLNA streamed files sounded consistently more refined, open, and relaxed than playback of those same files accessed through the shared NAS folder. Perhaps the DLNA protocol provides additional local data handling at the source end, facilitating smoother transmission over the network. Playback via NAS file-share access imposed a crude, grainy, airless haze over the music. Using the BDP-2's DLNA client to play the same files streamed by the source computer's DLNA server substantially reduced those unpleasant artifacts.

However, neither networked playback mode came close to the performance of the directly connected USB hard drive. Music played over the network exhibited a disembodied, diffuse quality, lacking foundation, substance, and presence, never remotely suggestive of the real thing. The notes were there, but not the instruments that generated those notes. In stark contrast, music played from a USB hard drive connected directly to the BDP-2 engages the listener's attention with vitality, immediacy, and dramatically superior resolution.

The BDP-2 performs at least as well as other networked audio products that I have heard, ranging from entry-level Blu-ray players to expensive high-end streaming clients. I'm glad to see that Bryston has added these convenient network functions for playing background music; however, realizing the BDP-2's true potential as a reference-class primary music source remains contingent on its

original core function—playing files from storage drives connected directly to its USB ports.

Bryston has been rather coy in describing the technology of the BDP-2's new Integrated Audio Device. Consulting the Audio Devices page of the player's web interface provides the missing clue, describing the IAD as "Bryston BDP Audio Device—*BUC Board*." The "BUC" acronym is recognizable as a reference to the company's BUC-1 external Bryston USB Converter. Yes, the new IAD is not a PCI audio interface in the traditional sense, as was the original customized ESI Juli@ card, but rather a dedicated USB-to-SPDIF-and-AES/EBU converter, connected by a short jumper to an internal USB port on the BPD-2's motherboard. Inspection of the IAD itself reveals the same essential configuration as both the BUC-1 and *its* progenitor, the asynchronous USB input of Bryston's BDA-2 DAC. Amortizing the development costs of this robust state-of-the-art asynchronous USB input stage across multiple platforms is a well-considered, forward-looking design decision—provided that the technology proves its mettle in the listening room, which it most assuredly does from both the BDA-2's USB input and the BDP-2's Integrated Audio Device.

As someone who has been generally disappointed with USB Audio—not due to dogmatic bias, but because most such products that I've auditioned have failed to deliver the performance that I routinely achieve with SPDIF sources—I was thrilled (and, frankly, relieved) to hear the USB-derived SPDIF and AES/EBU outputs of the BDP-2's Integrated Audio Device deliver across-the-board improvements above and beyond the performance of its predecessor's customized ESI Juli@ PCI audio interface. At last, here was "proof of principle" evidence that the USB interface could function as an audio conduit of the highest caliber.

In truth, I'd already come to this conclusion several months before, also courtesy of Bryston's USB Audio technology. As detailed in the accompanying review, the Oyaide Neo d+ Class A USB 2.0 cable has enabled the BDA-2 DAC to achieve an unprecedented level of performance from its USB input, when driven from the USB output of a BDP-1 or BDP-2. This exciting development raises a logical question for the potential buyer of a Bryston Digital Player to consider: Which BDP model is the best choice?

The prudent answer for most listeners will be: the BDP-2. The BDP-2 enables any high-resolution DAC to perform to the best of its abilities, whether connected by SPDIF, AES/EBU, or USB. In contrast, the ultimate performance of the BDP-1USB is contingent on the quality of the USB input of the partnering DAC. Hopefully, additional listening will confirm my initial positive impressions of the eminently affordable Oyaide d+ Class A USB cable, but the issue of the quality of a DAC's USB input remains a significant variable. In order to assess the real-world implications of this potential constraint, I tested both the BDP-2 and BDP-1 with two alternate DACs, in addition to the Bryston BDA-2.

The $4500 Esoteric D-07X, enthusiastically reviewed by Alan Taffel in Issue 230, requires a proprietary USB driver to operate in its "optimal" high-speed mode. Nevertheless, it sounded quite respectable when operating in its "compatible" high-speed mode driven by the USB output of either Bryston digital player. However, the D-07X *never* sounded better via any USB cable than it did via SPDIF from the BDP-2.

At an entirely different price point, the value-leading Schiit Audio Bifrost Uber DAC (not the latest "new and improved and even less expensive" $400 model, but the previous fully-loaded $519 version) sounded outrageously, spectacularly, shout-it-from-the-rooftops good when connected to the BDP-2 via SPDIF, but only achieved a pale shadow of its potential via USB. This observation should not be construed as a criticism of Schiit; those irreverent guys are a bastion of rationality, candor, and intellectual honesty in this over-bloated industry, and have frankly acknowledged that if you want USB to perform as well as SPDIF, you'd better be prepared to pour a significant amount of money into the USB input circuitry. And therein lies the rub.

Unless you already know that your current DAC's USB input is capable of performing at the same level as its SPDIF and AES/EBU inputs, or unless you know that the USB input of a future DAC that you plan to buy is capable of performing at the same level as its SPDIF and AES/EBU inputs, you will be best served by the Bryston BDP-2 Digital Player, which is capable of class-leading performance from *any* of its digital outputs.

It has been both reassuring and rewarding to follow Bryston's evolutionary development of its Digital Player product family. With the latest iteration of the BDP-2, it has progressively built upon the revolutionary foundation of its predecessor, adding features, expanding connectivity, refining the user interface, and pushing the boundaries of music-file playback performance even further.

Configuration and Optimization of Music File Playback

In light of the firmware updates and new features that have been added to the digital players in the four years since the BDP-1 was first covered in these pages, I revisited a range of set-up, configuration, and playback options while testing this latest incarnation of the BDP-2. Many of the following observations are equally applicable to any music file playback system, and not just Bryston products.

As with the BDP-1's ESI Juli@ PCI audio interface, the BDP-2's new Integrated Audio Device provides parallel signal paths to isolated transformer-coupled SPDIF (coaxial BNC) and AES/EBU (XLR) jacks, so those outputs remain active simultaneously. Both of these industry-standard digital audio interfaces function as "dumb" transmitters: They present a signal at their respective outputs, and the connected DAC receives that signal, synchronizes to its embedded clock, and extracts the digital data for conversion to analog.

An asynchronous USB audio interface operates in an entirely different manner. "Asynchronous" here means that there is no clock signal transmitted between the source and the DAC. Rather, the DAC is controlled by its own internal clock, and requests data packets over the USB interface from the source component at appropriate intervals to insure that the DAC's input buffers never empty or overflow.

Bearing in mind these qualitatively different operational modes, I decided to enable only one digital output of each digital player at a time, to eliminate the possibility that simultaneous operation might compromise performance. Fortunately, MPD control programs allow the user to selectively activate the different digital audio output options on each player. At least for critical comparative listening tests, a few extra mouse clicks seemed a prudent measure to insure that each BDP was operating optimally for a specific digital output.

For the past several years, I have been using 1TB and 1.5TB Seagate GoFlex FreeAgent Portable hard drives for music file storage. These bus-powered drives incorporate a unique feature that differentiate them from other portable USB hard drives: detachable modular interfaces for each connectivity format. My drives are fitted with USB 3.0 interfaces, but modules for USB 2.0, eSATA, and FireWire were also offered. Alas, as external hard drives became commodity-priced items, the GoFlex FreeAgent Portable drive series was discontinued, in favor of less-expensive models with integrated USB ports. For reasons that remain inexplicable—but *easily* demonstrable—the GoFlex FreeAgent Portable drives remain unsurpassed thus far in my experience as storage drives when used with music players capable of Direct Disc file playback, such as the Bryston digital players.

While testing the BDP-2, I compared a 1.5TB Seagate GoFlex FreeAgent Portable drive against a few recent additions to my external hard drive collection. Files played from both the bus-powered portable 2TB Western Digital My Passport Ultra, and the self-powered 5TB Seagate Expansion Desk USB hard drives lacked the dynamic contrast, bass power and clarity, and energetic drive evident when those same files were played from the GoFlex FreeAgent Portable USB drive. Without sophisticated measurement equipment, one can only speculate as to the reasons for this surprising observation, but based on the *consistency* of this result over several years now, I encourage open-minded readers to peruse eBay, Amazon, etc. for a factory-refurbished or used GoFlex FreeAgent Portable hard drive; its merit is not contingent on fortuitous synergy with the Bryston BDP players, as an industry associate recently confirmed after a quick, definitive comparison on an entirely different platform.

Some computer-audio aficionados contend that playback from a solid-state drive (SSD) sounds better than from a mechanical hard-disk drive. From an intuitive perspective, retrieving data from flash memory chips certainly seems cleaner and less complex than reading data from a rapidly rotating mechanical platter. To test this hypothesis, I connected a heretofore unused, freshly formatted (NTFS) 128GB Samsung 830 SSD to the Bryston BDP-2's internal SATA connector. Playback of files stored on the internal SSD sounded *okay*, but compromised by a veiled, closed-in, turgid character, lacking verve, finesse, and expressiveness.

After removing the Samsung SSD from the BDP-2's internal SATA connector, I connected it to one of the aforementioned Seagate GoFlex FreeAgent's detachable USB 3.0 interface modules, thereby removing that variable from the equation entirely. Thus, the only difference for the next comparison was the Samsung SSD vs. the SATA hard drive in the Seagate GoFlex FreeAgent chassis, both connected to the BDP-2 by the same USB cable. Again, the hard drive trumped the SSD; the latter still sounded anemic, muffled, and sluggish.

I use Samsung 830, 840, and 850 SSDs in my notebook and desktop PCs, and even hacked my fanless ASUS EeePC netbook to replace its internal hard drive with a 64GB Samsung 830 SSD (to make it silent, with no moving parts), but after having compared file playback from hard drives against SSDs at least half a dozen times over the past decade, and observing the same sonic differences every time, I'm beginning to sense a trend.

Next, I sought to ascertain whether there was any sonic difference between uncompressed (WAV, AIFF) files and losslessly encoded files (FLAC, ALAC, etc.). If a file playback chain is operating optimally, then there *should* be no sonic difference, since losslessly encoded files contain exactly the same data as uncompressed files. In some circles, the contention has been put forth that playing a losslessly encoded file demands higher CPU usage from the playback device.

I tested this hypothesis by playing both WAV and FLAC files (Level 4 FLAC encoding) of a 24/96 recording, using Foobar 2000 v1.3.8 running on an ASUS Windows 7 Netbook PC, fitted with a 1.6GHz dual-core Intel Atom N2600 processor and 1MB of RAM. The files were played from a USB hard disk drive.

No effort was made to optimize operation for audio playback: real-time anti-virus monitoring, firewall blocking, the wireless network adapter, etc., all remained active. While playing the files, I used the Windows 7 Resource Monitor to chart various system parameters.

Surprisingly, the full system CPU load when playing the WAV file was *higher* (4% to 31%, averaging about 15%) than when playing the equivalent FLAC file (2% to 24%, averaging about 10%). Neither file format ever came remotely close to demanding full CPU usage.

Disc usage was also considerably different, as would be expected, since FLAC files are roughly half the size of their WAV or AIFF equivalents. While playing the 24/96 WAV file, the disc transfer rate ranged steadily between 512 and 640KB/s, with occasional spikes of significantly higher throughput, and a few instances of lower activity. In contrast, while playing the 24/96 FLAC file, the disc transfer rate cycled between 0 and 512KB/s, with occasional spikes of significantly higher throughput. The only exception to this pattern was during the first 10 seconds playing the FLAC file, when the disc transfer rate remained as high as when playing the WAV file.

This data retrieval profile makes perfect sense: When playback of a FLAC file first begins, enough data must be pulled off the disc to initially load the program's memory buffer, but thereafter, disc access demonstrably has sufficient time to return to latency before the next chunk of the FLAC file needs to be retrieved from the disc for decoding. In contrast, during playback of uncompressed WAV and AIFF files, data from the disc must be streamed at a sustained, higher rate. While far from definitive, this simple test clearly demonstrates that even an entry-level computer is capable of playing high-resolution, losslessly encoded FLAC files in real-time with *lower* CPU usage and disc transfer activity than is required for playback of uncompressed WAV and AIFF files.

I'm not suggesting that people aren't hearing what they report hearing if they prefer the sound of uncompressed files over losslessly encoded files; that may very well be the case with *their* playback systems. However, there's no reason why losslessly encoded files *can't* sound either the same as, or perhaps better than, uncompressed files.

In fact, early during my ownership of the Bryston BDP-1, I was chagrined to find that it sounded better playing WAV files than FLAC files. Fortunately, a firmware update way back on January 4, 2013, fixed that problem. Ever since, FLAC and WAV files have sounded nearly indistinguishable, though I now have a slight preference for the FLAC files. Revisiting this issue with the BDP-2 confirmed what I've been hearing over the past couple of years from my BDP-1: The more efficiently packed FLAC files sounded more continuous, lucid, immediate, and tonally rich than the equivalent WAV files.

Next up, I was curious to ascertain if any sonic changes could be attributable to the three different MPD server software cores that can now be loaded via the player's web interface. When I began comparing the BDP-2 against my BDP-1, MPD v0.17.6 was installed. After getting a firm handle on the relative sonic differences between the two players, I re-configured the BDP2-2 to use MPD v0.18.21—easily accomplished with a few clicks on the Music Player Daemon configuration page, followed by a reboot.

I immediately preferred the sound of the BDP-2 running MPD v0.18.21, which reduced a residual tinge of euphonic ripeness and mid-treble spotlighting evident with MPD v0.17.6. Updating my BDP-1 to MPD v0.18.21 also improved neutrality, but not to the same extent as on the BDP-2. Finally, I installed MPD v0.19.99 on the BDP-2 (but heeded Bryston's red-letter warning that the BDP-1 hardware cannot support MPD v0.19). I was taken aback by the BDP-2 running MPD v0.19.99: It sounded curiously *familiar*, but perplexingly lacked many of the improvements that I'd been hearing from its new Integrated Audio Device. After a short while, it dawned on me that the BDP-2 with MPD v0.19.99 installed sounded rather too similar to my BDP-1 with its ESI Juli@ card! Amused, I did a few quick back and forth comparisons to confirm this impression, and then promptly reinstalled the considerably more neutral, linear MPD v0.18.21. tas