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Resolution Audio's
Cantata Music Center

**KILLER LOOKS,
THRILLING
SOUND**

Resolution Audio

Cantata Music Center

JON IVERSON

CD PLAYER-D/A PROCESSOR

DESCRIPTION Single-box digital-to-analog converter and CD player. Digital inputs: supports up to 24-bit/96kHz via USB and Ethernet inputs (upgrade to 24/192 to be available Q4 2011); up to 24/192 via optical, AES/EBU, coax. Control options: supplied hardware remote; free app for Apple iPhone, iPad, iPod Touch. Analog output jacks: left & right, RCA & balanced, both fixed or variable. Frequency response: 20Hz–20kHz, +0/–0.4dB. Output impedance: 100 ohms. Maximum output: 2V RMS, 2.5V RMS (RCA), 5.5V RMS (XLR). Power requirement: 35W.

DIMENSIONS 17" (430mm) W by 2" (50mm) H by 9" (230mm) D. Weight: 13.2 lbs (6kg).

SERIAL NUMBER OF UNIT

REVIEWED 2210163.

PRICE Cantata Music Center, \$6000; Cantata Pont Neuf USB Bridge, \$400. Approximate number of dealers: 15.

MANUFACTURER Resolution Audio, San Francisco, CA. Tel: (415) 553-4100. Fax: (415) 840-0098. Web: www.resolutionaudio.com.

The dual subwoofers were bumping and our pant legs were flapping. Only moments before, we'd been treated to a polite viola da gamba. Not now. Resolution Audio's designer, Jeff Kalt, had brought only two discs with him to ensure that his company's Cantata Music Center was functioning properly in my system: Jordi Savall and Hespèrien XXI's *Altre Folle, 1500–1750* (CD, Alia Vox 9844), and Tool's *10,000 Days* (CD, Tool Dissectional/Volcano 81991). After changing a few things around with the chamber music, we'd advanced to the hard rock of Tool.

Next to Kalt on the couch, his girlfriend, Maryann, was nodding her head up and down to the music. At the loud level Kalt had set, the staccato start/stop style of "Jambi" had taken control of the room. He turned to me, remote in hand, and tilted his head toward the volume setting, as if to ask "Can I turn it up?" I nodded, and we all proceeded to bounce (yes, the floor and couch were bouncing a little) to the onslaught as Tool's glory pinned our ears back even tighter.

"Jeff and I bonded to the music of Tool," Maryann confided to me later. Two such sweet, almost shy people—I never would have guessed. Under their unassuming surface were an intensity of purpose and an intelligence that, I would come to discover, are also present in Kalt's products.

When I get a new product in hand I normally shun its manufacturer's advances, preferring to experience my first impressions of the product just as a regular buyer would. But when Kalt pointed out that his dealers often offer a setup service for new customers, I relented. Turns out the Cantata was easy to set up and use, but I discovered that this attention to the customer was, indeed, pretty standard for Resolution Audio. Take the box the Cantata comes in: a sturdy, handmade, stamped wooden crate carefully lined with foam that perfectly cradles the product.

Senses Working Overtime

Audio products are here to stimulate our sense of hearing, but the Cantata also pulls sight and touch into the mix. Jeff Kalt says he worked closely with his metal fabricator to get the most unique casework I've seen enclosing an audio product: the top is an undulating sea of scalloped aluminum waves. It must be seen to be believed, and touched to be understood. Stunning. The Cantata is also fully packed; at 13 lbs, it weighs more than its looks suggest, and that top panel got a bit warm (about 102°F).

For those who, like me, have left analog sources behind, the Cantata may be all that's needed in addition to amplification (a matching Cantata 50 amplifier is available) and speakers. The Cantata is a digital preamp with a built-in CD player,

and a DAC for everything else digital. And I mean *everything*.

On the front right half of the low-slung Cantata's front panel is an array of small holes; splashed across the 1"-thick edge of the aluminum top, these holes hide a retro- yet oddly futuristic-looking large alpha-numeric display. Below the aluminum slab is a row of buttons on a black background. From left to right, these are power, input select, volume up/down, the disc-player controls, and the built-in CD player's all-but-invisible disc drawer. Clean and to the point.

More comprehensive control is available via either the Cantata's medium-size remote control or, with a free app, your



"An undulating sea of scalloped aluminum waves."

iPad, iPhone, or iPod Touch. The beautifully designed app controls all of the Cantata's functions, and Kalt has created the best implementation of touchscreen volume control I've seen. Instead of the

typical slider bar, which can accidentally be pushed to full window-shattering volume with a single errant tap (trust me, I've done it), the Cantata app has a calibrated virtual wheel that spins forward and back as you swipe at it. Elegant and idiot-proof.

On the Cantata's rear panel are, from left to right: the power switch, fuse, and detachable grounded power-cord socket; a Cantata Link (for hooking up to RA's Cantata amps); Ethernet, USB, TosLink, AES/EBU, and coax inputs; and balanced and unbalanced stereo outputs. Unlike the Ethernet jacks found on most components these days, this one is not only for

MEASUREMENTS

I used *Stereophile's* loan sample of the Audio Precision SYS2722 system to measure the Resolution Audio Cantata (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. As well as driving the Cantata with S/PDIF data from the Audio Precision analyzers, I used a MacBook running Mac OS10.6.8 and Pure Music 1.8 to play test-signal files via USB.

The Macintosh USB Prober utility identified the device as the "Cantata Music Center" from "Resolution Audio." It also reported that the Cantata's USB input operated in the jitter-rejecting asynchronous mode with 24-bit resolution and data sampled at 44.1, 48, 88.2, and 96kHz.¹ The maximum output level at 1kHz was 5.53V balanced and 2.57V unbalanced. (The latter is 2.2dB higher than the CD standard's 2V RMS.) Both sets of outputs preserved absolute polarity

¹ Although I didn't test the Cantata with Ethernet-sourced data, USB Prober reported that Resolution Audio's Pont Neuf USB-Ethernet bridge also operated in the asynchronous USB mode with 32-bit resolution as claimed by Resolution, and with data sampled at 44.1, 48, 88.2, and 96kHz.

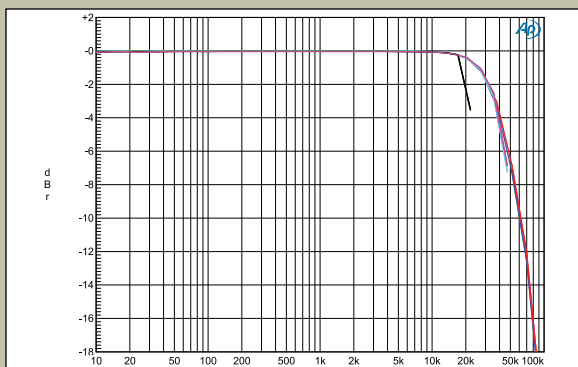


Fig.1 Resolution Cantata, frequency response at -12dBFS into 100k ohms with data sampled at: 44.1kHz (left channel green, right gray), 96kHz (left cyan, right magenta), 192kHz (left blue, right red). (0.25dB/vertical div.)

(*ie*, were non-inverting). The XLR jacks are wired with pin 2 hot. The volume control operated in accurate 0.5dB steps; *ie*, a setting of "88" was equivalent to -6dB. The output impedance was to specification from the unbalanced jacks, at 100 ohms, but half that figure from the balanced XLRs, which is unusual; typically, the balanced output impedance is twice that of the unbalanced output.

Tested as a CD player with the Pierre Verany Test CD, which has laser-cut gaps in its data spiral, the Cantata had the best error correction/concealment I have encountered, there being no audible glitches in the reconstructed audio even when the gaps reached 4mm in length!

The Cantata's frequency response followed the same basic shape regardless of sample rate (fig.1), the only difference between the outputs at 192kHz (blue and red traces), 96kHz (cyan and magenta traces), and 44.1kHz (green and gray traces) being the sharp falloff just below half the sample rate. Channel separation (not shown) was superb at >110dB in both directions below 1kHz, though this decreased to 85dB at 20kHz due to the usual capacitive coupling between the two channels' circuits.

My primary test for assessing a digital product's resolution is to sweep a 1/3-octave bandpass filter from 20kHz to 20Hz while it decodes dithered data representing a 1kHz tone at -90dBFS. The top pair of traces in fig.2 were taken with 16-bit data; while no distortion products can be seen, and the spectrum above 1kHz is dominated by the dither noise, the midrange output is marred by the presence of power-supply-related spurious at 120Hz and its harmonics. While these spurious are still low in absolute terms, I'd rather they weren't there at all. Increasing the bit depth to 24 drops the higher-frequency noise floor by 9dB or so (fig.2, middle pair of traces), which suggests the Cantata's ultimate resolution is not much better than 17.5 bits or so, and again the supply-related spurious can be seen. When I tested the Cantata for linearity with 16-bit data (not shown), there was little linearity error down to below -100dBFS, though with 24-bit data, a tone at -120dBFS was reproduced as -116dBFS (fig.2, bottom traces).

controlling the Cantata via your network, it's also a digital audio input (as I'll explain shortly).

Swiss Army DAC

I set out to test as many methods of running digital audio through the Cantata as possible. These included using the CD slot on the front; the S/PDIF, TosLink, and USB inputs on the back; and from my Apple computer, via the rear-panel Ethernet jack, connecting to Resolution Audio's Cantata Pont Neuf Bridge USB adapter (see below), and to a wireless WiFi bridge (also via the Cantata's Ethernet jack and the Pont Neuf).

Nightmares of lo-rez audio iClouds got you down? Create your own local full-resolution audio cloud. Most folks will integrate a computer as a source

component into their system via USB, and while regular USB DACs require a computer in the listening room due to the 1–2m limit on the length of USB cables for best performance, Resolution has come up with a way to create a wireless “bridge” between a computer or USB music source in another room and your system, like a Sonos system on steroids.

This last option is one of the Cantata's more interesting features: using a wireless bridge and a remote computer, you can wirelessly stream, via WiFi, audio of resolutions up to 24-bit/96kHz. To make this work, Jeff Kalt created the Pont Neuf USB to Ethernet Bridge (\$400). (Pont Neuf, French for “new bridge,” is also the name of one of the Paris bridges spanning the Seine.) It looks like a mini Cantata—it, too, has a

top plate of scalloped aluminum—and is the size of a pack of chewing gum. At one end of the USB-powered Pont Neuf is a USB plug for inserting into your computer and, at the other end, an Ethernet jack.

To test this type of connection, I ran the USB output of my Mac to the Pont Neuf, which I then connected to my WiFi network locally with an Ethernet cable. I then connected the Cantata, in the listening room in another part of the house, via its Ethernet jack to an Apple Airport Express. I controlled the remote computer's music libraries with my iPad. The Cantata wasn't connected to the network directly via Ethernet, only through the Airport Express. After I'd configured the AE to join my WiFi network and restarted it, setup was simple, and within minutes I was

measurements, continued

Fig.3 repeats the spectral analysis for the –90dBFS tone using an FFT technique. Again, the increase in bit depth drops the noise floor by around 10dB, but now the 24-bit tone can be seen to be accompanied by some very low-level harmonic spuriae. Perhaps there are some slight math-

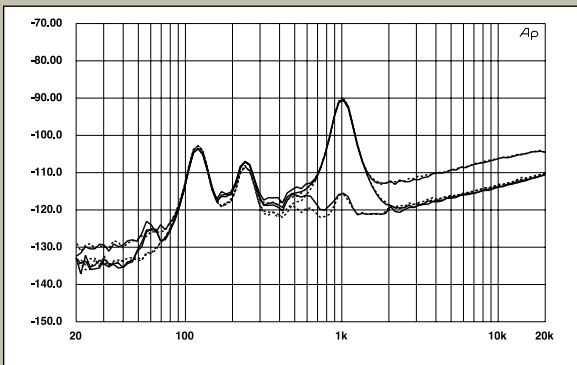


Fig.2 Resolution Cantata, 1/5-octave spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS, with: 16-bit data (top), 24-bit data (middle), dithered 1kHz tone at –120dBFS with 24-bit data (bottom). (Right channel dashed.)

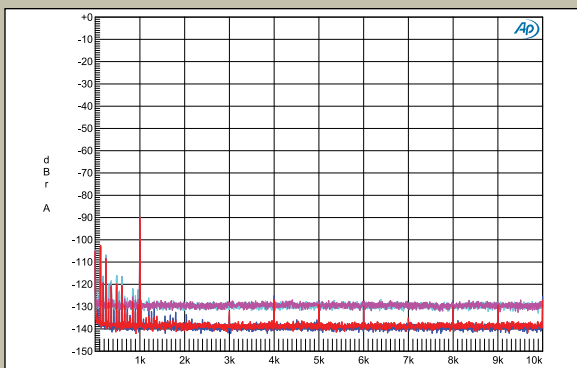


Fig.3 Resolution Cantata, FFT-derived spectrum with noise and spuriae of dithered 1kHz tone at –90dBFS, with: 16-bit data (left channel cyan, right magenta), 24-bit data (left blue, right red).

ematical limitations in the Cantata's DSP engine? With some other D/A processors, I have noticed that there is some modulation of the noise floor with signal level. Fig.4 shows the low-frequency spectrum of the Cantata's output while it reproduced a 1kHz tone at 0dBFS (blue and red traces),

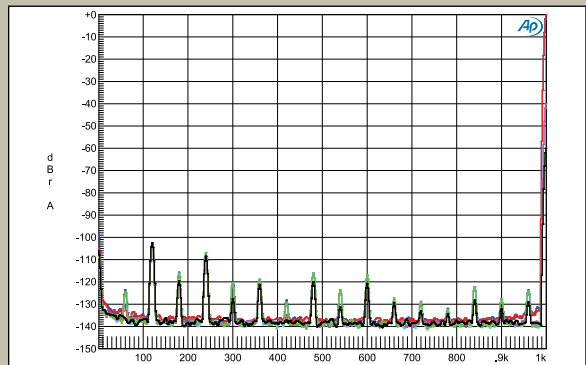


Fig.4 Resolution Cantata, spectrum of 1kHz sinewave, DC–1kHz, at 0dBFS (left channel blue, right red), –40dBFS (left cyan, right magenta), –60dBFS (left blue, right red). (Linear frequency scale.)

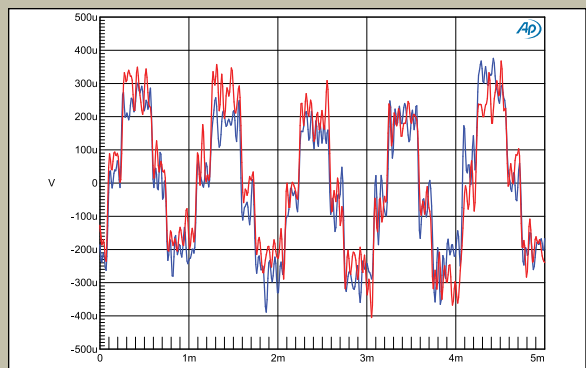


Fig.5 Resolution Cantata, waveform of undithered 1kHz sinewave at –90.31dBFS, 16-bit data (left channel blue, right red).

streaming from both iTunes and the VLC player (for FLAC files) at any sampling rate up to 96kHz. And it sounded great.

In fact, I tried dozens of cuts, and couldn't hear a reliable difference between using a wireless bridge via Ethernet and the Pont Neuf, and direct S/PDIF or the Cantata's disc player. I was prejudiced to hear some flaws with the WiFi-Ethernet connection, but could never hear any. Same thing after adding USB to the mix. This surprised me quite a bit.

Macca On the Mac

During this review, I received CD copies of the new Abbey Road remasterings of Paul McCartney's *McCartney* and *McCartney II*; then HDtracks.com made available downloads of the 24/96



All the usual digital inputs, but also an Ethernet port.

FLAC versions. These two releases are confusing in that *McCartney II* was released 10 years and many Paul McCartney and Wings albums after *McCartney*. Something to do with how each was recorded as one-man solo effort in a small studio, and the albums in between were full-on studio/band affairs.

Other than a couple of songs, I never learned to love *McCartney II* (1980). But *McCartney* (1970) is a different matter entirely. (*Mojo* magazine rated these the other way round, which I think will go

down in history as one of their biggest screwups.) With much of it recorded direct to multitrack analog tape, *McCartney* is packed with great tunes and ambience and sports wonderfully honest sound, reminding me of the best of what a "home" recording can be. It has its technical flaws, primarily a sandpapery quality to the voice and some instruments, but it just feels right to crank up and revel in the joy and freedom that such a straightforward recording technique can offer. Perfect demo material, and splendid music.

measurements, continued

-40dBFS (cyan and magenta traces), and -60dBFS (green and gray traces). Commendably, the noise floor hardly changes with the change in signal level, though it is about 10dB higher than with the very best D/A processors I have measured, and the low-level supply-related spurious are evident. This graph was taken from the balanced outputs; the

picture remained the same from the unbalanced outputs.

The Cantata's noise floor is still sufficiently low to allow to be depicted the three DC voltage levels that describe an undithered 16-bit tone at exactly -90.31dBFS (fig.5), and its resolution is good enough for undithered 24-bit data to produce a good facsimile of a sinewave at the same level (fig.6).

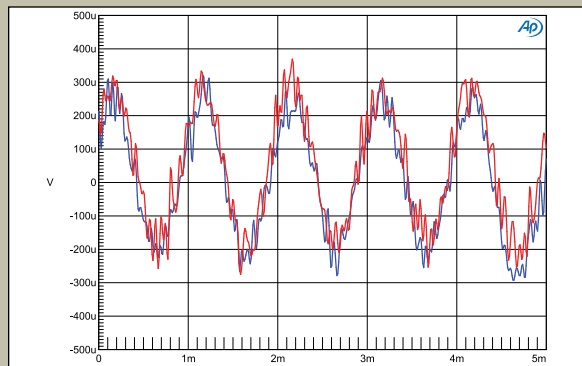


Fig.6 Resolution Cantata, waveform of undithered 1kHz sine wave at -90.31dBFS, 16-bit data (left channel blue, right red).

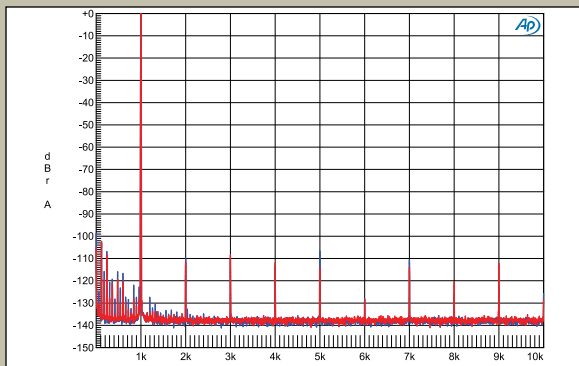


Fig.8 Resolution Cantata, spectrum of 50Hz sine wave, DC-10kHz, at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

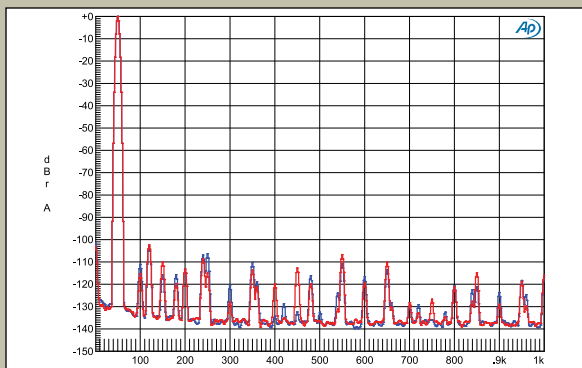


Fig.7 Resolution Cantata, spectrum of 50Hz sine wave, DC-1kHz, at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

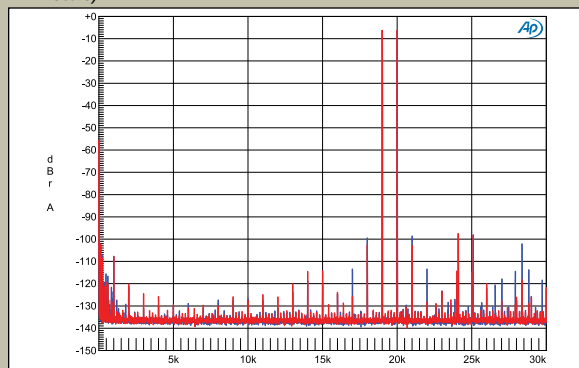


Fig.9 Resolution Cantata, HF intermodulation spectrum, DC-30kHz, 19+20kHz at 0dBFS into 100k ohms (left channel blue, right red; linear frequency scale).

I picked several tracks from *McCartney* and ran them a variety of ways through the Cantata: as 24/96 downloads and CD-ripped FLAC files via my Meridian Sooloos music server, as a CD played in the Cantata's drive, as FLAC files played via USB from my Mac, and over the Pont Neuf bridge with Ethernet or WiFi bridge from my MacBook Pro playing FLAC files in the other room. This took several hours of listening; to make things even more interesting, I tossed in a Steve Hoffman-mastered CD version of *McCartney* from 1992 (DCC Compact Classics GZS-1029).

Listening to the new CD remasterings through all the various inputs yielded sounds similar enough that the Cantata's overall character came

through consistently. Comparing the remastered CD and CD-derived files to the 24/96 HDtracks.com or DCC versions was another matter entirely. The 24/96 files are easily more musical and pleasing in the midrange than the remastered CD, while the DCC falls somewhere in between. The remastered CDs have a punched-up midrange that I don't care for. In descending order of preference, it's the 24/96 download, followed closely by the DCC CD, and not so closely by the remastered CD.

I compared HDtracks' 24/96 FLAC files from the computer via USB direct and USB-Pont Neuf-Ethernet, and via S/PDIF from the Sooloos. From the Sooloos or from the computer, all inputs were properly identified as 96kHz on the Cantata's display. On the

computer that was sending the 24-bit stream, however, the Pont Neuf kept forcing the bit depth to 32 in my computer settings. Hmmm.

I e-mailed Jeff Kalt. He responded that it's 32-bit from host computer via USB to the Pont Neuf, then it's back to 24- or 16-bit from the Pont Neuf via Ethernet to the Cantata. "The host computer will pad out the bottom 8 bits with zeros, which are just discarded by the Pont. So the data path is bit-accurate for 16- to 24-bit sources. This is because the Pont Neuf operates at 32-bit instead of 24-bit over the USB interface. It still sends just 24 bits over Ethernet to the Music Center. This is done for technical reasons, as 24 bits is an odd data path for a 32-bit processor and is too much of a burden in the Pont Neuf, which has to

FFT spectral analysis of the Cantata's output while it reproduced a full-scale 50Hz tone into 100k ohms (fig.7) indicated that the harmonic-distortion components are generally lower in level than the supply-related components at 120 and 240Hz, the exception being the fifth harmonic, at 250Hz, which is at the same level. Repeating the analysis with a 1kHz tone (fig.8) confirms that the fifth harmonic is the highest in level, though this differs in the two channels, lying at -116dB (0.00015%) in the right channel and -107dB (0.0004%) in the left. All other harmonics lie at or below -110dB (0.0003%), so this low-level lack of linearity might well be subjectively harmless. Nor did it change when the 100k ohm laboratory load was replaced by the punishing 600 ohm load. To put these test results into perspective, however, the best-sounding D/A processors offer no high-order harmonic distortion products at all. Intermodulation distortion was superbly low in level (fig.9).

Fig.10 shows the Cantata's rejection of jitter when fed J-Test data via its TosLink input with 16-bit (cyan and magenta traces) and 24-bit data (blue and red traces). With the exception of a single pair of sidebands at $\pm 229\text{Hz}$, which the Miller Analyzer estimated as being equivalent to 120 picoseconds in the left channel and 82ps in the right, the odd-order harmonics of the $F_s/192$ tone are at the residual level in the 16-bit traces. However, the single pair of sidebands remains at that level with the 24-bit version of the J-Test; as they shouldn't be present at all with 24-bit data, this suggests that these sidebands are due not to interface jitter but to some other mechanism. With the Cantata fed the same 16- and 24-bit J-Test data via USB (fig.11), the traces are free from all jitter-related artifacts: evidence for the efficacy of the Cantata's asynchronous USB receiver. Although I didn't test it, the Cantata's Ethernet input should similarly be jitter-free. With CD data (not shown), the jitter was below the resolution limit of the Miller Analyzer.

The Resolution Audio Cantata's low-level performance is not quite up to the state of the art. But it is otherwise a well-engineered product, with superb rejection of jitter in all performance modes and the best error correction I

have encountered in a CD player. It is also drop-dead gorgeous!

—John Atkinson

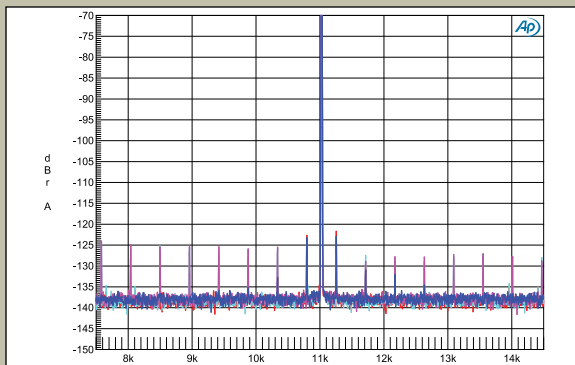


Fig.10 Resolution Cantata, high-resolution jitter spectrum of analog output signal, 11.025kHz at -6dBFS , sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit data via 15' TosLink S/PDIF from AP SYS2722 (left channel cyan, right magenta), 24-bit data (left blue, right red). Center frequency of trace, 11.025kHz; frequency range, $\pm 3.5\text{kHz}$.

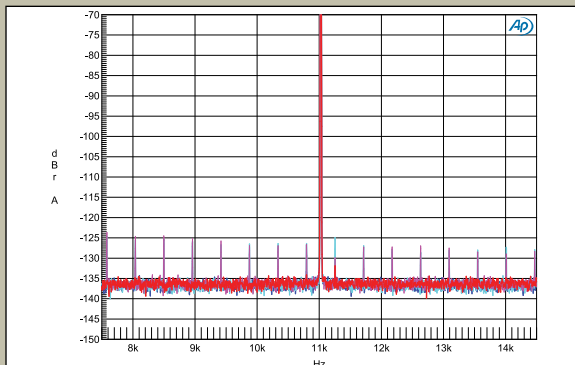


Fig.11 Resolution Cantata, high-resolution jitter spectrum of analog output signal, 11.025kHz at -6dBFS , sampled at 44.1kHz with LSB toggled at 229Hz: 16-bit data via USB from MacBook (left channel cyan, right magenta), 24-bit data via USB (left channel blue, right red). Center frequency of trace, 11.025kHz; frequency range, $\pm 3.5\text{kHz}$.

move data through both the USB and Ethernet interfaces.”

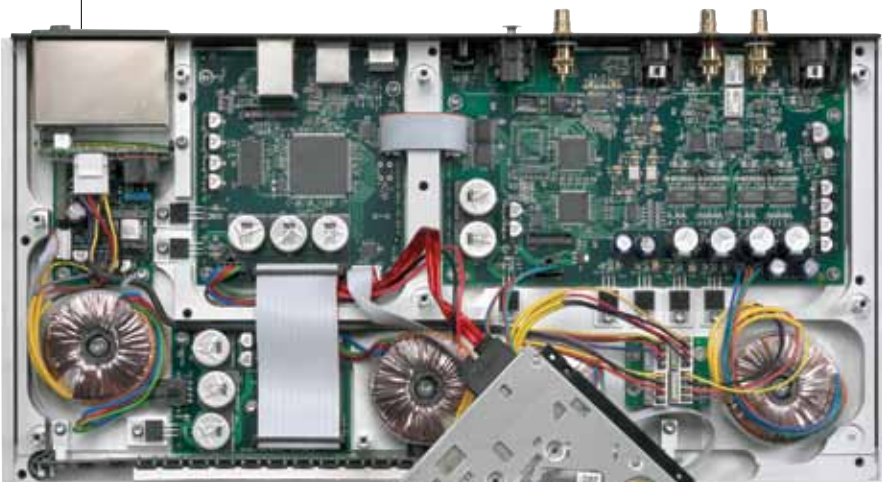
Still, I was surprised at how close all the various inputs sounded, including the wireless WiFi bridge. We'll see what John Atkinson's measurements reveal, but this is one of the most self-consistent-sounding DACs I've heard—and one of the best-sounding all around. In a direct comparison with my reference Benchmark DAC 1 USB, the Cantata sounded noticeably smoother and more natural, the Benchmark more forward and a bit edgier. When comparing DACs, I generally prefer the Benchmark's honesty—it offers clarity and detail that a lot of cheaper DACs obscure—but in this case the clarity was there with the Cantata, *without* the edge. Wonderful.

Currently, the Cantata's USB and Ethernet inputs support up to 24/96, but Kalt says that a drop-in 24-bit/192kHz upgrade (\$250) for the USB input should be ready by the time this review is published. An upgrade for the Ethernet input may follow, though Kalt says it might be difficult to get a 24/192 data rate going reliably over most residential WiFi networks. He says that this upgrade will also increase the speed of the Cantata's processing eightfold, and will support future software updates, including UPnP functionality and FLAC decoding.

Comparisons

Clearly, the Resolution Audio Cantata was the best DAC in the house. (At the time, I also had on hand the Peachtree iDac, which I reviewed in October, as well as the Rega DAC.) But I remembered how wonderful the Ayre Acoustics QB-9 sounded a while back (Wes Phillips reviewed it in the October 2009 issue), and asked JA if he could send me one for a few days to put head to head with the Cantata. Last year, the QB-9 was king of the hill, easily besting my other DACs, but with only a USB input, it wouldn't really work for me, given my use of the Sooloos system with its S/PDIF output. Still, I wanted to know how it would compare, since it was the best digital I'd heard up till then.

Audio pal Bruce Rowley was in town again, so we fired up the Ayre, the Benchmark, and the Cantata with the same cuts we'd used for my review of the Peachtree iDac. The first event



The Cantata's interior is tightly packed, yet logically and neatly laid-out.

was Benchmark *vs* Cantata, and once again, the Resolution Audio was the favorite for both of us: better control and less edge in the top end, with plenty of clarity and smoothness. No question.

Comparing the Ayre with the Cantata was another matter. Before we started, I had Bruce compare the Cantata's USB and S/PDIF inputs, and he agreed that they sounded too close to reliably call.

ASSOCIATED EQUIPMENT

DIGITAL SOURCES Apple MacBook Pro computer (2.66GHz Intel Core 2 Duo, 4GB RAM, 320GB HDD) running OS 10.6.7, iTunes 10.2.2, Sonic Studio Amarra Computer Music Player 2.2, Songbird 1.9.3, or XLD; Oppo Digital BDP-83 universal Blu-ray player; Meridian Sooloos Music Server (Control 15, TwinStore x3); Apple iPod Touch 1G; Ayre Acoustics QB-9, Benchmark DAC1 USB, Peachtree iDac, Rega DAC D/A processors.

PREAMPLIFIER Marantz AV7005 (Pure Direct Mode).

POWER AMPLIFIERS Classé CAM 350 monoblocks (2).

LOUDSPEAKERS MartinLogan Prodigy & Descent subwoofers (2).

CABLES USB: Cardas Clear. Interconnect: Cardas Neutral Reference S/PDIF, Kimber Kable line-level (various), XLO HT Pro line-level, XLO S/PDIF. Speaker: Kimber Kable BiFocal.

ACCESSORIES Dedicated 20A line for amplifiers, separate dedicated 15A lines for digital & analog components.

—Jon Iverson

We cued up identical rips of the same cuts on both the computer and the Sooloos, and went back and forth. A whole afternoon later, we still couldn't declare a winner.

Small advantages would flip from QB-9 to Cantata and back again, depending on the track. The Ayre tended to exaggerate sibilants on some recordings, the Cantata sounding more natural. But with other tracks, the midrange filled out a tad better with the Ayre.

Bruce sent me his notes from the listening session: "I could detect more sibilance from the Ayre on Bryan Ferry's vocals on the Roxy cut [the title track from *For Your Pleasure*], which made me lean toward the Resolution, which I thought sounded a bit more natural. Then I thought the Ayre sounded a slight bit better through the midrange on the Santana tracks [from the remastering of *Santana III*, Columbia/Legacy CK 65491]. There was no clear winner for this one."

Conclusions

In our minds, the Ayre Acoustics QB-9 had met its match—no small feat. With the Cantata Music Center's added inputs and ability to act as a digital preamplifier *and* CD player, not to mention its killer looks and truly high-end wireless streaming, it's a relative value, even at more than twice the Ayre's price.

The world of computer audio is rapidly evolving, and keeping your digital options open is a must. Resolution Audio's Cantata Music Center lets you do that in both features and sound. It's a short-list contender for anyone looking for a great-sounding and striking-looking digital hub for their system.