

Equipment Report



PS Audio DirectStream DAC MK2

Digital Evolution

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PS Audio's new DirectStream DAC MK2 digital-to-analog converter is the focus of this review, and I should begin by making it clear that it is one of a relatively small number of digital products that define the current state of the art in high-end sound. At the same time, I'm writing this review at a point when TAS is entering its early 50s, and I cannot approach an analysis of the best in today's digital sound without remembering the earliest days of digital playback and noting how much its quality has improved over time.

I can remember the first days of digital audio all too well. These were back in the early 1980s when Sony and Phillips—who pioneered CD—introduced their CD players as providing “perfect sound forever.” The reality—much like the introduction of the first solid-state amplifiers—fell radically short of the claims. The performance of the first CD players and CDs was not even mediocre, and the “forever” technology used in the first CD players has been updated and improved at a nearly annual level for decades.

TAS made the initial limits to digital sound clear from the start. I remember talking to Harry Pearson (HP) just after he got his first CD player and discs. His reaction—and it soon appeared in print—was that their sound was anything but “pure and perfect.” He made it clear that he had no intention of making such players something he would use to define the high end for even a day.

My own experiences with one of the first Sony CD players were no better. It did not sound quite as bad to me as it did to HP, but its upper midrange was too hard, low-level and soundstage detail was significantly less musical than the sound from a top phonostage and high-quality LP, and its technically superior dynamics sounded less realistic. In fact, the Sony player that I'd rushed out to buy as a first adopter was bad enough that I promptly sold it to someone else, who was both desperate enough to be a first adopter and willing to ignore my warnings about the sound of what he would actually get.

Well, decades and a constant process of evolution have worked at least some wonders. The cutting edge in today's best digital sound

is a far different story. Equipment like the Perfect Wave Direct Stream DAC MK2 from PS Audio shows that some 40 years of advances have made the best digital sound far more musical and realistic, and the best highest-resolution PCM, DSD, and DSD/SACD discs and streaming now outperform the best-sounding LPs that I've heard. I still would not dream of using words like “pure,” “perfect,” or “forever,” but in the real world, “best currently available” is as good as high-end sound can now get.

Putting the DirectStream DAC MK2 in Perspective

The DirectStream DAC MK2, which is the next generation of the digital technology that Paul McGowan refers to in his comments in the sidebar, is a symbol of the steady advance in the quality of digital sound. It makes no claim to be “pure and perfect forever”—in fact, it is designed so that it can be updated with future digital downloads, but I did find it to be yet another step forward in exploiting digital's capability to provide more dynamic range, lower distortion, and more accurate frequency response

than analog sound. Moreover, it provides that superior sound at a time when high-resolution streaming offers access to a far greater range of music than any private record or digital-disc collection and when streaming has a far larger share of the current market than CDs.

At the same time, I should put that praise for the MK2 in perspective. Virtually all contemporary DACs and digital players sound far better than the first two decades of such units, and far, far better than the first “pure,” “perfect,” and “forever” units. If you are on a budget, you do not have to buy a cutting-edge DAC like the MK2 that costs \$8000 to get better sound—or the kind of rival that costs more than five times the price of the MK2.

Almost any current DAC or digital front end will outperform a comparable unit that is several years old in each price range, and it is time to consider a new unit. Basing your current judgment of digital sound on listening to older units is a little like judging today's electric vehicles on the basis of the carriage-like performance of the battery-driven cars that faded out in the 1920s. One set of examples is the fact PS Audio's cheapest DAC and analog preamp combination costs only a quarter of the price of the DirectStream DAC MK2, and its Stellar Strata combines an analog preamp, a DAC, and a

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Specs & Pricing

Digital audio inputs: I²S (2), coax, XLR balanced (2), Optical, USB

Analog audio output: RCA single-ended or balanced, XLR balanced

Output impedance: <100 ohms (unbalanced); <200 ohms (balanced)

Frequency response: 20Hz–20KHz ± 0.25dB

THD+N @ 1kHz (full scale): <0.1%

Weight: 21 lbs.

Dimensions: 14" x 4" x 17"

Price: \$7999

PS AUDIO

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150W stereo amplifier for half the price of the MK2.

More broadly, this year's Recommended Components issue of TAS (April 2023), and its Editor's Choice Awards issue (March 2023) list a range of less expensive units—some highly rated. The best current, moderately priced units will not live up to the sound quality of the MK2, but they will make streaming easier and get far better sound from even older CDs than their recent predecessors in the same price range.

I should also stress that the DirectStream DAC MK2 is a DAC only. It does not include a disc player, and it is not an analog preamp. It is designed to work with a wide range of digital inputs, but it does not have a disc-playing mechanism. If you still use digital discs, you'll need a matching disc player like the PerfectWave SACD Transport (\$7000). This choice is not a minor issue because I find that actual hard discs—particularly SACDs and DSDs—often sound better than streaming the same recording and performance using the best DACs or integrated players. I'd be careful about given up my collection or relying on transferring them to a hard drive.

Much of the MK2's relative cost will, however, depend on how you plan your audio future. I still use a full separate preamp both for its analog inputs and convenience, but if you don't have a collection of CDs or digital discs, LPs, or tapes, you might consider shifting to streaming and to using an all-digital front end. Unlike

many other DACs and DAC setups, the DirectStream DAC MK2 can be used as a preamp in a purely digital system. It may not have an analog input, but it does have balance and phase controls as well as a volume control.

Technology

At the same time, there are some features of its design and technology which do need emphasis in a review. One is that the MK2 upsamples all inputs. As the manual states, "CDs, streaming audio, high-resolution PCM or DSD-based media are all expertly upsampled in the DirectStream MK2 to 20 times DSD rate and output as pure analog directly into your amplifier or preamplifier." This may explain why I heard relatively little improvement going to high-resolution downloads of PCM recordings, although it does help explain why I found SACD and DSD recordings to sound consistently more nuanced and musically nature than PCM recordings.

Another is the technical claim that the DirectStream MK2 is less sensitive to the vagaries of input source types and their level of jitter than most DACs, as well as to the differences in input cables. The manual states that this is partly a result of the fact that the "DirectStream MK2 is galvanically isolated, which means there are no physical connections between the

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noisy digital source and the sensitive DAC. Power supplies that power noisy inputs are galvanically isolated from the rest of the system. Galvanic isolation aids in the reduction of jitter and unwanted audio artifacts."

Finally, the technical feature in the MK2 that PS Audio says is most important has the most complicated summary explanation and one, I suspect, that only a fully qualified digital sound engineer can assess. The manual states that "the heart of DirectStream MK2 is the DSD engine itself." The manual then goes to provide a long explanation of why its components and technology provide exceptional input options, upsampling, bit rates, headroom, and transitions to an uncolored output stage. I suspect that few audiophiles who read this explanation will have the technical background to evaluate it, but it still helps explain the key design goals behind the product. It's also worthwhile skimming through the MK2's specifications. They are listed at the end of this review, and they are worth examining.

Operating Features

I should note that my initial "straight out of the box without reading" setup worked just fine, but the manual does include some important instructions. The DirectStream DAC MK2 has operating features that many DACs do not have and ones that include



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the ability to adjust for different grounding levels. If this review makes you want to fully evaluate the MK2, you do need to go to the PS Audio website, read the technical literature, and get a full picture of its switching and remote-control options.

One caution. The DAC MK2 is easy to operate, but if you carelessly press the wrong button, you can create operating problems. As is the case with any complicated piece of high-end audio equipment, the irony behind all the technology in the MK2 is that you can't count on hearing it properly unless you are literate enough to read the operating manual.

The Sound

As you might expect from this introduction, the DirectStream MK2 does sound significantly better than its predecessor—the MK1—which I used as one of my previous references. At the same time, its performance needs to be put in context. Both generations of the DirectStream DAC, like the other top digital designs that have emerged over the last few years, have shown me just how good digital playback can be. Moreover, the improvements that I am about to describe in the MK2 are matters of nuance and largely the kind that take extensive listening to fully appreciate.

Even the best digital front ends are voiced in ways where each sounds somewhat different in frequency response and timbre, in sonic detail and dynamics, in soundstage, and in all the other measures of high-end sound quality. At the same time, the differences between the best digital front ends are now generally smaller than the differences in the sound of the best phono cartridges and tape recorders, most phono and high-level preamps, many power amps, and most loudspeakers.

Put simply, reviewing the sound of a component like the DirectStream MK2 poses the problem that the better digital gets, the more the colorations in the sound of other components in the system, the listening room and position, and the recording drive the overall sound and synergy, which inevitably is marked by its most “colored” elements.

I did, however, find the sound of the MK2 to be some of the best that I've ever heard. It did not lift seven veils from any recording, to deliberately mix a metaphor, but it did do a significantly better job of exposing the strengths of both older and new digital recordings than its predecessor, the MK1, and then the other DACs that I've had in my system to date.

These improvements were particularly clear in reproducing the soundstage in recordings of live performances whose soundstage had both a complex and realistic character. The MK2 did not add any hardness to the upper midrange of strings, brass, woodwinds, or female and tenor voices. Soundstage depth, width, and image size were exceptionally detailed and stable. The MK2 could not fix the tendency of some recording engineers to insist on miking pianos as if they were 30 feet wide, but good solo piano recordings had a more natural sound and size.

The differences between the string sections of orchestral music were also much clearer on really good recordings. One good example was its ability to reproduce the nuances in the interplay of the clarinet and strings in variety of recordings of Mozart's Clarinet Concerto and between older and more modern string instruments. Low-level and peak dynamics were clearly reproduced on even the

most complex orchestral recordings, and if you listened carefully to low-level passages, the faint haze or noise you hear from many digital recordings and other DACs was less apparent.

Because of its superior transparency, the MK2s also did a better job of showing which recordings really did benefit from higher bit and sampling rates, the sonic benefits the best SACD and DSD recordings have over most PCM recordings, and the often-minor sonic differences between recordings of the same performance on different streaming services.

I should note, however, that the Mk2 is not euphonic in any respect. Its superior performance with good recordings will call your attention to the problems in mediocre or bad ones. It also raises the same questions as other top DACs about the extent to which some digital recordings that are claimed to have higher sampling and bit rates are recorded and then produced at such rates. Several recordings that claimed to be hi-res didn't seem to live up to their label when I compared them to really good recordings, and one has to wonder if such recordings had only been upsampled or lost some of their detail by being assembled or altered by their sound engineers.

Finally, the level of synergy and superior nuances I encountered in my system was not unique. The DirectStream MK2 performed well in the systems of several of my friends with very expensive digital equipment, who voice and adjust their systems to emphasize different musical nuances and who have far more interest in popular music and immersive recordings. If you

get the opportunity to audition the MK2, I suspect you'll hear the same advantages that I do.

Summing Up

The PS Audio DirectStream DAC MK2 is a truly excellent unit whose sound exemplifies the increasingly subtle advances being made in digital technology. As is always the case, these advances will continue, and I cannot promise you “pure, perfect sound forever,” any more than Sony and Philips could 40 years ago. However, the PS Audio DirectStream DAC MK2 shows that digital has made immense advances over time. I was particularly impressed with the sound of SACD and DSD, even when it was compared to the best PCM recordings. It is now one of my reference DACs.

Paul McGowan and the History of Digital Audio

IT IS interesting to note that the DirectStream DAC MK2 digital-to-analog converter has a history almost as old as TAS. For those of you who don't know the history of PS Audio, its beginnings were focused on analog electronics and on phono. In fact, HP told me about Paul McGowan—one of PS Audio's founding partners—when he and his first partner were developing a phono preamp.

Few people have now had as much experience in designing and producing analog and digital, and I couldn't resist asking Paul what he now thought of the earliest days of CD sound.

Paul's comments about the first CD players and discs matched both HP's views and mine, but he went on to trace the evolution of digital sound to its current level of performance, and I think this makes an interesting side note to this review. I should note that his comments on PS Audio products do reflect the pride (or bias) that I find top high-end manufacturers always feel in their products, but they also provide an historical perspective that both suits TAS's 50th anniversary and is a useful introduction to the Perfect Wave Direct Stream DAC MK2.

"PS Audio jumped on the CD bandwagon early. Not long after the first CD players were launched by Philips (marketed in this country as Magnavox) and Sony, we released one of the very first high-end CD players, the PS Audio CD-1. To build this product, we purchased off-the-shelf Magnavox players, ripped out the unit's internal DAC and output stage, and replaced them with our own designs.

"It's perhaps instructive to remember that when digital audio first launched, there was no such thing as higher resolution, up-samplers, or anything resembling what we are blessed with today. What we were listening to were steep 'brick wall' analog filters that were 'flat' to 20kHz and many dBs down at 22kHz. Those filters were rife with audible phase shift and were partly responsible for the harsh and brittle sound quality of CDs.

"Couple the not-so-great-performance of those early CD players with the emerging infantile digital audio recording technologies of the nearly 1980s, and it's no wonder Sony's claim of 'Perfect Sound Forever' was the laughingstock of audiophiles.

"Before long, Yamaha, Philips, and Sony had launched new digital audio chips that upsampled digital audio by factors of 4x and even 8x, along with new digital filters. These early upsamplers and DSP technology made a significant sonic improvement because they allowed DAC designers to move away from brickwall analog filters and turn instead to gentle noise filters that had no impact on the audible band.

"At the same time, A/D technology also advanced so that recordings were getting better too. By the mid-to-late 1980s, when digital audio pioneering high-end audio companies began producing separate DACs that could take the SPDIF output of off-the-

shelf CD players and make great sound, we were gaining steady ground on analog systems.

"In the 1990s, chip manufacturers like TI, National, ESS, and Analog Devices began marketing complete DAC chips that greatly broadened the marketplace for outboard D-to-A converters. Unlike those earlier DACs that relied upon cobbling together disparate chips and expensive hybrids.

"These early DAC chips were ladder DACs, meaning their conversion mechanisms were a 'ladder' of 16, 18, and even 20 precision resistors switched in and out by active current switches. They were at the theoretical limits of what was possible in DACs.

"In the early-to-mid 2000s, we started seeing higher bit-depth chips from these same manufacturers. Now, instead of being limited to 20-bit resolution, we were seeing 24- and even 32-bit resolution—something technically not possible with ladder DACs. These new chips were using Sigma Delta Modulators (essentially DSD) to achieve their higher bit depths. Along with higher bit depths we were also treated to higher sample rates, with these new chips capable of speeds up to 192kHz at 32-bit resolution.

"Suddenly, digital audio leaped ahead of analog, at least in resolution and dynamics (though in fairness, even the first CD players had an easy 20 to 30dB greater dynamic range than the best analog). As DACs and digital audio became more mainstream and people sold or retired their collection of albums for CDs, more and more audiophiles jumped on board the digital bandwagon.

"While all this was going on the inventors of the CD, Sony and Phillips, weren't sitting on their haunches. In the mid-1990s, as an alternative to the Pulse Code Modulation (PCM) encoding used in CDs, Sony and Philips began working on the next great leap in technology: DSD. DSD offered a significantly higher sampling rate of 2.8224MHz (as opposed to CD's 44.1kHz) and a 1-bit depth. The SACD format was officially introduced in 1999, and the hybrid SACDs around 2001. Hybrid discs contained both a standard CD player and a high-resolution DSD layer.

"Before too long, all modern DAC chips were using a form of DSD in their SDMs before conversion to PCM. The chips got bigger, faster, more complex. But, because of the inherent limitations of a DAC on a single piece of silicon (like heat and size constraints), a few pioneers began looking at alternative ways to build even better solutions with higher sample rates and better sonics.

"One such pioneer was our own Ted Smith. Smith, a long-time advocate for the superior sonics and higher resolution of DSD started toying with the idea of staying in the PDM (DSD) domain entirely. To do that (as opposed to converting back to PCM, as all modern DAC chips do), he would need to move away from off-the-shelf chips and build his own based on hand-written software. Smith turned to a type of customizable integrated circuit called a FPGA (Field Programmable Gate Array).

"Using an FPGA gave him the freedom to design anything he wanted, and he did. The results of that groundbreaking work were launched in PS Audio's first all-DSD FPGA-based DAC called the DirectStream. This product revolutionized the sound of DACs as well as allowed us to break free of the constraints of off-the-shelf chip-based DACs." **TAS**