



## DS Audio Grand Master Cartridge and Grand Master Equalizer

### Setting a Standard—Again

Jonathan Valin

**I**t seems like it was only yesterday that I reviewed DS Audio's Master1 phono cartridge and Master1 EQ unit, at the time DS's most advanced entries in that tiny new niche of analog playback—the optical cartridge (oc). While we've grown used to regular game-changing advancements in digital audio (MQA and streaming being the latest), analog is a different story. Since Ortofon's patent of the moving coil circa 1946, Norman Pickering's invention of the moving-magnet cartridge with user-replaceable styli and (along with Joe Grado) the moving-iron cartridge circa 1948, and Columbia's introduction of the long-playing record in 1949, there haven't been many game-changers in the world of vinyl. This is not to say that improvements weren't made in cartridges throughout the latter half of the twentieth century and the start of the twenty-first; just that those improvements have tended to be refinements of previous designs. So, the advent of something truly new (and in many respects, better) is something to write home about—which is what I'm doing now.

#### How Optical Cartridges Work

Unlike CD or SACD players, there is nothing digital about optical phono transducers. All DS Audio cartridges use conventional diamond styli to read the modulations engraved in a record's grooves. Where they differ from conventional magnetic cartridges is in the way they turn those tiny modulations into electrical

signals. Unlike mm, mi, and mc carts, oc's don't transmit vibrations to an assembly of coils and magnets for conversion into voltages. Instead, they translate that constant stream of jiggles and jogs into variations in the intensity of light from an LED built into the cartridge body, the brightness of which is altered by a thin, lightweight "shading plate" mounted to the cantilever, close by the stylus. Each jiggle or jog causes this shading plate to move in concert with the stylus, blocking some of the light from the LED, and, thereby, changing the strength of its beam. This continuously varying stream of LED light and shade is subsequently read by high-precision photoelectric sensors (also built into the cartridge), which convert it to continuously varying volt-

ages for each channel. Those voltages are equalized by one of DS Audio's dedicated EQ boxes, which must be purchased with the cartridge, before being sent to your pre-amp or integrated amp. (DS offers quite a variety of these EQ boxes at substantially different price points, all of which will work with *any* DS cartridge.)

Why go to all this trouble when magnets and coils have worked pretty darn well for the past one hundred years? Because, says DS, magnets and coils generate magnetic resistance to the movement of the stylus, impeding tracking; they are also relatively heavy devices, whose internal mass has to be leveraged by the cantilever, further encumbering the stylus. A light beam isn't magnetic, so it generates no resistance to stylus movement; plus, unlike magnets and coils, a light beam is virtually weightless, so inertia and moving mass are reduced to nearly zero.

As I said in my review of the Master1, eliminating magnets and coils appears to have many audible advantages—not the least of which are dead-quiet background silences, without a hint of RF or hum (provided that the tonearm is properly grounded), the elimination (at least in theory) of the inevitable treble peakiness of moving-coil cartridges, and a bass response that (once again in theory) can extend down to 1Hz. (There are also drawbacks to optical transducers, which I'll come to in a moment.)

#### A Bit of Optical History

Calling the optical cartridge "new," as I did a few paragraphs ago, isn't exactly the

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case. The idea of using light to generate voltages in a phono cartridge dates all the way back to 1941, when Philco introduced its “Beam of Light” transducer, which employed a lightweight sapphire stylus (as opposed to the massive steel styli of the 78 era) mounted on a mirror to modulate the beam from a miniature bulb and reflect it into an “electric-eye” photodetector. Toshiba re-introduced this idea in the 1970s with its C-100P optical cartridge, which also used a small filament lamp as a light source.

Unfortunately, both the Philco and the Toshiba systems were prone to failure, chiefly due to the heat generated by the bulbs of their lamps (and the necessity for factory-replacement of those bulbs when they burned out, which was soon and often). With advances in the LED and photoelectric-sensor technology used in computer-era optical “mice,” Tetsuaki Aoyagi, a young Japanese engineer with the Digital Stream Corporation (which, alongside Microsoft, co-developed the optical mouse), had the happy idea of adapting these cool-running, high-precision, high-reliability, miniaturized devices for use in a new Toshiba-like phono cartridge. (Indeed, “Aki,” as Aoyagi calls himself, sought and received the help of the C-100P’s designer, Hamaguchi Kazuo, for this project.) Suddenly, heat and the wear and tear it exercised on the wiring of oc’s were no longer problems. Neither was bulb failure. Inertial mass was also tremendously reduced. And the accentuation of high frequencies (an unavoidable side effect of any velocity-reading system like that of a conven-

tional magnetic phono cartridge) was theoretically eliminated.

DS Audio has made a big deal out of the technical (and consequently audible) superiority of the mechanical/electrical interface of its optical transducers. As I noted in my review of the Master1, conventional moving-coil or moving-magnet cartridges read the velocity of a stylus’ vibrations; so, the strength of their output signal depends on how *fast* the stylus moves. Optical cartridges, on the other hand, read the amplitude of the stylus’ vibrations; so, the strength of their output signal depends on how *far* the stylus moves. According to DS, this is significant because velocity-proportional devices move faster at higher frequencies, thus making the voltage of those frequencies overly strong (and that of the slower-vibrating bass notes relatively weak). Although the RIAA circuits in phonostages are intended to invert this

accentuation of the treble and reduction of the bass (and loading mc cartridges down can further dampen this treble pre-emphasis), it is a fact that mc’s, in particular, are relatively “bright” by nature. Thanks to its amplitude-proportional technology, the Master1’s electrical output is not frequency dependent, at least according to DS Audio. Thus, it does not exaggerate the treble or reduce the bass, making equalization relatively simple and extending linear low-end response to well below what mm and mc’s are typically capable of.

As I said in my Master1 review, DS Audio’s claims for the superiority of its optical operating system are a bit disingenuous in one regard. What DS is deliberately ignoring in its literature is the way that reading the amplitude of a signal, rather than its velocity, accentuates the bottom octaves.

Though the output of every DS EQ box is piped through one of several user-selectable bass filters, the reason for this “must-use” filtration is not fully explained. At first, you might think it is there to block the rumble and subsonics that are owed to the cartridge’s greater low-end extension, but that isn’t the whole of it. My guess is that, after making so much of the inherent non-linearity of conventional magnetic cartridges, DS chose *not* to point out that, just as reading the speed with which a stylus is moving accentuates the strength of higher-velocity treble signals (and diminishes that of slower-vibrating bass ones) in an mm, mi, or mc, reading the distance that the stylus moves in an oc’s amplitude-proportional system accentuates the strength of “stronger/longer” low-bass signals and reduces that of “weaker/shorter” treble ones. Thus, DS’s claim that the output of an optical cartridge is not frequency-dependent isn’t entirely accurate. Bass notes will inevitably produce higher voltages than treble ones in an amplitude-proportional transducer—thus, the necessity of limiting low-end bandwidth and reducing bottom-octave amplitudes via filtration.



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## What's New in the Grand Master?

As has been the case with each fresh iteration of DS Audio's cartridges, the Master1 oc and its companion Master1 EQ electronics (Issue 306) incorporated many functional improvements, though the basic geometry of the operating system remained the same. In addition to being a good bit more expensive than its predecessors, the Master1 had a different-shaped stylus (line-contact), a different stylus rod (made of sapphire), a lower-mass shading plate positioned nearer to the stylus, and a different, more vibration-resistant cartridge body (made of duralumin rather than aluminum).

The improvements in Aki's new, third-generation flagship, the Grand Master, go several steps beyond those in the Master1. Indeed, and for the first time, they include a fundamental change in the geometry of the optical system itself. Where every previous DS Audio oc used a single LED and a single largish shading plate, the Grand Master has separate LEDs and shading plates for each channel. In addition, the shading plates themselves have been substantially improved. They are now made of 99.9% pure, incredibly stiff and strong, featherweight beryllium (rather than aluminum). The result is a 50% reduction (from 1.56mg to 0.74mg) in the mass of the only part of an oc, outside the stylus and stylus rod, that actually moves, which, one would think, should boost the sensitivity and accuracy with which the plates register vibrations and transmit optical signals to the photo diodes.

On top of that, the sapphire cantilever of the Master1 has been replaced in the Grand Master by an even more rigid diamond one. The duralumin cartridge body has also been streamlined for maximum rigidity and lower mass (it is shorter and weighs about a half gram less than the body of the Master1). To reduce impedance, the Grand Master now uses internal wire that is 1.6-times thicker than the wire used in previous-gen DS Audio oc's.

The sonic results of these many improvements are said to be substantial. Indeed, DS is claiming a 75% increase in output voltage (from 40mV to 70mV), a large parallel improvement in SNR (resulting in an even lower noise floor and higher resolution from a cartridge that was already spooky quiet and extremely finely detailed), and the complete elimination of crosstalk, increasing left/right channel separation in the high frequencies by 10dB and boosting channel separation at 1kHz to what *Hi-Fi News & Record Review* measured as an impressive 34dB.

The Grand Master's companion equalizer is also a substantially improved critter. Unlike the single-box Master1 EQ (and all the other DS EQs), the Grand Master EQ is housed in two hefty, stylish chassis, one for the power supply electronics and one for the equalizer electronics, joined together by three power cables (supplied in two lengths). Inside the power-supply box are three transformers (one for the left channel, one for the right, and one for the cartridge), each with a capacity 25% greater than those in the Master1 EQ, and banks of electrolytic capacitors with a total capacitance of 2.97-million micro-Farads. The electronics box has also seen an uptick in capacitance (to 2.34 million micro-Farads), and the addition of custom-made film capacitors and custom-wound resistors—all of which are claimed to improve the strength and stiffness of the power supply and, consequently, to improve the reproduction of low frequencies.

The Grand Master EQ also includes a change to the bass filtration, which was limited in the Master1 EQ to three progressively steeper roll-offs of the bottom octaves via different combinations of first- and first- and second-order filters. The Grand Master increases the number of user-selectable bass filters from three to six by means of a switch on its back panel, which allows you to choose two different, nominal "starting points" (50Hz or 30Hz) for the roll-off(s). The goal here was to permit better bass control and blending with a wider variety of speaker systems, and, IMO, that goal has been reached.

## Setup

When it comes to setup, the Grand Master follows closely in the footsteps of its predecessor. As with the Master1, extra care should be taken to make sure the tonearm shaft fully clears the 'arm rest once VTA has been set. (The 'arm lift may need to be lowered to keep the tonearm shaft from rubbing against it during playback, inducing severe mistracking or no tracking at all, although the Grand Master's shorter chassis may not present the same problem that the Master1's taller one did.) As was the case with the Master1, setting VTF may require fiddling with the tonearm's counterweights (or adding mass to the headshell)—this is a very light cartridge at 7.7g.

As with any phono cartridge, setting overhang geometry properly via a double-null-point grid is essential to best performance. Where the Master1 seemed to fare better at a VTA of 90° (i.e., level with the surface of the LP), the Grand Master works well at the "standard" VTA

of 92° (i.e., slightly elevated at the rear). The Grand Master also differs in recommended tracking force, which has been upped to 2.0–2.2g (nearly half a gram higher than the recommended VTF of the Master1).

As is the case with any top-flight cartridge, dialing in every parameter, including azimuth (via a Fozzometer or a computer program) and anti-skate, is not just good practice; it will also produce immediately audible results. Like a Goldfinger Statement or an Air Tight Opus 1, the DS Audio Grand Master is extremely "transparent-to-setup," registering every little tweak with the sensitivity of a seismometer.

## Grand Master Sonics

So...how does the Grand Master compare sonically to the superb Master1? The answer, as you might expect, is that, despite a strong family resemblance, it exceeds it in every audible and measurable way—and is particularly improved, as you will shortly see, in the areas where the Master1 falls a bit short. When used with DS Audio's ION-001 ionizer and Stein Music's Pi Carbon Signature record mat on the platter, the Grand Master achieves a tape-like smoothness and organicism that are kind of astonishing in a phono cartridge. Indeed, its level of neutrality and "completeness" is unexceeded by that of any other cartridge or phonostage of my experience, and its consequent level of realism (on the best sources) is very nearly nonpareil.

Take, for example, the superb MusicMasters recording of Naumburg Foundation First Prize-winner Nadia Salerno-Sonnenberg, performing Prokofiev's Violin

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Sonata No.1 in F minor [MM 20022].

Though begun three years before World War II, Prokofiev's first violin sonata wasn't finished until after that inferno had ended, and the terrible cost of the war casts a shadow over the piece, darkening and confounding its lyricism, as if the urge to make music were itself the price of all the slaughter. Of course, a mix of sweet and bittersweet typified Prokofiev's work well before the Great Patriotic War, but in this late masterpiece the mix is realized without laughter or sarcasm to haunting effect.

The engineering (by David B. Hancock, who was also a concert pianist) and the mastering (by Bill Kiper of Masterdisk) of this must-own disc are so good, on both Salerno-Sonnenberg's dark, voluptuous-sounding Guarnerius violin and Sandra Rivers' concert grand (itself a darkish and voluptuous-sounding Baldwin D), that it would be tough to find a cartridge that didn't make this record sound gorgeous. But making it sound gorgeous *and* real *and* fully expressive...that's a rare trick. The Grand Master does all three—and does it better, which is to say more fully, than any other transducer I've had in my system.

Keep in mind this is a recording I've heard many times through many different cartridges on many different stereo systems. It is an LP I know by heart, a piece of music that I adore, and a performance that is hard to better, even by Oistrakh, for whom it was written, to whom it was dedicated, and who played its first and third movements at Prokofiev's funeral.

What makes the Grand Master stand out on the so-

nata isn't that it is reproducing the sound of Salerno-Sonnenberg's violin and Rivers' piano with greater beauty (though it is). It's that it's more clearly (which is to say, more wholly and near visibly) supplying what you usually *can't* hear (or hear and see as you would in life): the skill, thought, and feeling the performers are bringing to what they play. The Prokofiev sonata is beautiful, yes. But, as is so often the case with Prokofiev at his finest, it is a harsh, melancholy beauty—an ineffable mix of glittering winter sun and wind-blown winter snow, as in the muted violin scales at the end of the first movement (reiterated at the end of the fourth), which Prokofiev famously said (to Oistrakh) should sound like “wind passing through a graveyard,” or the dialogue between trembling *pianissimo* sixteenth-note triplets on the piano and gorgeous, lower-register violin in the third movement, which, as Prokofiev biographer Harlow Robinson observes, “produces a similarly mysterious effect.” To play these passages in the way that Prokofiev intended them to be played isn't simply a matter of technique; it is also a matter of understanding the thought and feeling that the composer invested in the music and wanted to elicit in performance.

To better hear the way that Sonnenberg and Rivers rise to this challenge, a cartridge must reproduce...everything. And must reproduce it impartially, without added accents of its own. With a piece like this one, that “everything” is a particular challenge, given the supremely virtuosic nature of the score—the abrupt changes of color, meter (e.g., alternating 3/4-4/4 time in

the first movement, complex 5/8-7/8-8/8 in the last), dynamic (when in rehearsal pianist Lev Oborin played a certain passage, marked *forte*, too gently, because he was afraid of drowning out the violin, Prokofiev told him: “It should sound in such a way that people should jump in their seat, and make them say, ‘Is he out of his mind?’”), performance style (with the violin required to go from singing legato to bouncing spiccato to expressive pizzicato, from open strings to muted, in the space of a few bars). Allowing you to “see” how the performer is playing—and, just as importantly, allowing you to hear the thought and feeling he or she is playing with—requires supreme resolution, flawlessly neutral and natural tonal balance, unfettered dynamic range, and a complete absence of self-noise. If you think that recipe is easy to cook up, you haven't listened to a lot of cartridges.

The ravishingly beautiful, realistic, and expressive reproduction of violin and piano in the Salerno-Sonnenberg/Rivers recording can also serve to illustrate the two chief ways in which the Grand Master markedly outperforms its superb predecessor. The first difference reflects directly on the passage from my Master1 review I quoted above. Where the earlier DS cartridges had a certain timbral leanness, verging on (but not quite edging over into) brightness in the upper midrange and lower treble (owing to a steep rise at around 6–7kHz), the Grand Master has *no* leanness or edginess in the upper octaves at all. (This is something you would hear clearly on Salerno-Sonnenberg's violin—something that would, for example, make her pizzicatos sound more as if they were being snapped by the nail, rather than being plucked by the meaty part of the finger, thereby turning Prokofiev into, oh, Bartók.) The Grand Master is exceedingly smooth, rich, and faithful through the presence range, with a natural tonal warmth from top to bottom that the Master1, for all its other virtues, just doesn't possess. Though the Grand Master does have a rise in response in the brilliance range above 10kHz, that rise doesn't add brightness or forwardness or overly accentuate starting transients (at the cost of the full development of steady-state tone and decay) like the Master1's 6–7kHz rise tended to do. Indeed, I could only detect the Grand Master's 10kHz rise as a slight bit of extra zip on very hard transients and a welcome dollop of extra air on the very top—rather like the presentation of a good ribbon tweeter.

The second distinguishing difference in the Grand Master has to do with those silences that wowed me in the Master1. I won't go so far as to say that the Grand Master makes its older brother sound noisy, but I do hear *big* improvements in resolution, channel separation, soundstage width and depth, the preservation and duration of instrumental decays, and transient response and dynamic range. Rivers' piano, for instance, is played very loudly in the percussive hammering figure at the start of the Allegro Brusco, and very softly in the dirge-like ostinatos that accompany the “wind in the graveyard” finish of the same movement. The Grand Master reproduces both dynamic extremes with remarkable fidelity, with truly lifelike pitch, timbre, intensity, and duration.

I could pad this review out with other musical examples—such as the Grand Master's uncannily realistic reproduction of voice on Acoustic Sound's superb collection of female jazz and pop

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singers (*The Wonderful Sound Of Female Vocals*); the incredibly wide dynamic contrasts it reveals on rock, pop, and classical LPs, most of which just don't sound as fully expressed or expressive through other transducers (try Rachel Price's blistering vocal on "Good Kisser" from Lake Street Dive's *Free Yourself Up*); the improved soundstage width, depth, and focus on something like Ry Cooder's *Bop till You Drop*, which, in spite of its digital heritage (it was the first digitally recorded major-label pop album) is still a uniform musical delight. But what would be the point? You've already got the picture—at least, in theory.

Of course, until you hear the Grand Master—and grasp what an improvement its background silence makes—you can't fully appreciate what I'm raving about. If you imag-

ine the quiet of a CD, without the digital deadness of a CD's silences, mated to the tone, texture, body, and bloom that the very best phono cartridge you've ever heard can supply, then you can wrap your mind more fully around what the Grand Master offers.

## Conclusion

This is a great cartridge.

I should probably leave it at that. But there is the little matter of price. The Grand Master costs \$15,000, and that doesn't include the dedicated, two-box Grand Master EQ electronics, which add an extra 45 grand to the bottom line. Sixty g's for a cartridge and a phono preamp is scarcely chump change (though it is \$25,000 less than what my Goldfinger Statement and Soullution 755 phonostage cost). However, there is a sunny side to this dilemma.

DS Audio's U.S. distributor, Musical Surroundings, is offering the Grand Master separately, rather than as a "kit" packaged with its pricey EQ electronics. So, you can buy the cartridge by its lonesome and use it with any DS Audio EQ you already own (or choose to buy). I actually tried the Grand Master with the Master1 EQ, and the combo was pretty damn marvelous—so close to what I'm raving about here that I'd have to think long and hard about shelling out another \$45k. Then again, if I were made out of money and simply had to own the *ne plus ultra* in LP playback, I would unquestionably go ahead and get the Grand Master EQ, because, well, it's better—in every conceivable way.

In his sterling review of the Grand Master in HFNR, Ken Kessler said something he seldom says about products under review. To wit, this is possibly the best cartridge he's ever heard.

I hate to be a copycat, but...ditto. **tas**

## Specs & Pricing

### Grand Master Optical Cartridge

**Cantilever:** Diamond

**Stylus:** Micro-ridge

**Chassis material:** Super duralumin

**Output signal level:** >70mV

**Channel separation:** >27dB

**Recommended tracking force:**

2.0g–2.2g

**Weight:** 7.7g

**Price:** \$15,000

### Grand Master Equalizer and Power Supply

**Output voltage:** 700mV

**Input terminals:** 1x RCA

**Output terminals:** 3x RCA, 3x XLR

**Impedance:** 120 ohms (RCA and XLR)

**Dimensions:** 2x 425 x 152 x 486mm

**Weight:** 55.2 lbs. (EQ box), 66 lbs.

(power supply box)

**Price:** \$45,000

### JV's Reference System

**Loudspeakers:** MBL 101 X-treme, Magico M3, Børreson Acoustics 05, Voxativ 9.87, Avantgarde Zero 1, MartinLogan CLX, Magnepan 1.7 and 30.7

**Subwoofers:** JL Audio Gotham (pair), Magico QSub 15 (pair)

**Linestage preamps:** Soullution 725, MBL 6010 D, Constellation Audio Altair II, Siltech SAGA System C1, Air Tight ATE-2001 Reference

**Phonostage preamps:** Soullution 755, Goldmund PH3.8 NEXTGEN, Walker Proscenium V, Constellation Audio Perseus, DS Audio Master1, EMM Labs DS-EQ1

**Power amplifiers:** Soullution 711, MBL 9008 A, Constellation Audio Hercules II Stereo, Air Tight ATM-2001, Zanden Audio Systems Model 9600, Siltech SAGA System V1/P1, Odyssey Audio Stratos, Voxativ Integrated 805

**Analog source:** Clearaudio Master Innovation, Acoustic Signature Invictus Jr./T-9000, Walker Audio Proscenium Black Diamond Mk V, TW Acoustic Black Knight/TW Raven 10.5, AMG Viella 12

**Tape deck:** United Home Audio Ultimate 4 OPS, UHA Superdeck

**Phono cartridges:** DS Audio Grandmaster, DS Audio Master1, Clearaudio Goldfinger Statement, Air Tight Opus 1, Ortofon MC Anna, Ortofon MC A90

**Digital source:** MSB Reference DAC, Soullution 760, Berkeley Alpha DAC 2

**Cable and interconnect:** CrystalConnect Art Series da Vinci, Crystal Cable Ultimate Dream, Synergistic Research Galileo UEF, Ansuz Acoustics DTC

**Power cords:** CrystalConnect Art Series da Vinci, Crystal Cable Ultimate Dream, Synergistic Research Galileo UEF, Ansuz Acoustics DTC