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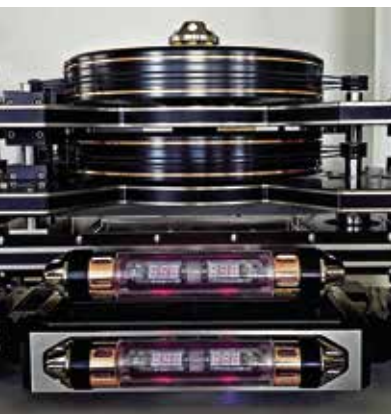
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Warwick Acoustics BRAVURA electrostatic headphone system

by Alan Sircom

If you cast your mind back to the early days of Warwick Acoustics, its first product that set the wheels in motion for its high-end and even automotive plans, was the Sonoma M1 electrostatic headphone and amplifier. Although largely eclipsed by the APERIO system, the Sonoma M1 is still on Warwick Acoustics' books. At least, for now.

The BRAVURA is the result of three years development into Warwick's unique HPEL (High-Precision Electrostatic Laminate) drive unit, the core of Warwick's transducer system for its headphones. It's designed as a direct, drop-in replacement for the Sonoma M1 Headphones, so those with the original matching Sonoma M1 Amp can simply buy a new pair of BRAVURAs. It's also available as a complete kit, including the Sonoma Amp. The latter is also available in a spiffy new black finish to run alongside the existing deep brushed 'Silver' model. This 'Black Edition' and the Silver Sonoma amps are available separately, with the idea that owners of the original M1 who fancy a bit of a change to the desktop can buy a new amp/DAC. I think what's more likely is Sonoma M1 owners will try the BRAVURA with their existing DAC, end up keeping both headphones, and adding a second Sonoma amp/DAC for a second room system at a later date. For reasons that will become clear later, I think the number of people who will try the BRAVURA system and decide the M1 is still for them is likely fairly small. Regardless, it's good to keep all the options open.

Put simply, if you already own a Sonoma M1 then you can buy the BRAVURA just as a headphone, but if you don't then you will need to buy the BRAVURA and the Sonoma M1 Amp as a complete system. And now, you can buy the Sonoma M1 Amp in a rich shade of black. The nomenclature could get a little tangled, so for the sake of clarity, 'Sonoma M1' means the previous headphone/amp system while 'Sonoma M1 Headphones' or 'Sonoma M1 Amp' refers only to that specific part. It's simpler than it sounds... honest!

A lot has happened since the original Sonoma M1 launched, and given the similarities – and more importantly – the differences between Sonoma M1 and BRAVURA, it's worth climbing into the Wayback machine to run through that Sonoma M1.

Originally an engineering project conducted at the University of Warwick, HPEL was an entirely new way of making electrostatic headphone drive units. HPEL, short for High-Precision Electrostatic Laminate, allows the manufacture of light and highly responsive electrostatic drivers in large multi-layer sheets, from which multiple drivers of virtually any desired size or shape could be cut and trimmed. The limits are more about the size of the laminate sheet and the equipment used to make the laminates, but we will soon see the possibility of making HPEL drivers large enough to be used as full-range domestic electrostatic loudspeakers, or shaped into car door panels, parcel shelves or footwells to act as active noise cancellation systems. It's still early days, but the options are legion, especially as HPEL production methodology offers exceptional driver-to-driver consistency and longevity—something not easily achieved with conventional electrostatic driver manufacturing techniques.

The HPEL driver has a unique form of electrostatic driver construction; where most electrostatic designs have two metal grids, one on each side of the highly-charged diaphragm, the Sonoma M1 Headphone driver only has a single grid and a diaphragm that is structured into hexagonal cells. This significantly reduces distortion.

In essence, each driver consists of a three-layer 'sandwich' comprising a stainless steel mesh grid that faces the rear side of the ear cup, a centrally-positioned open-cell insulating spacer made of a high spec engineering grade polypropylene, and then a machine-tensioned, 15µm-thick, flexible film laminate diaphragm that faces the front (or ear) side of the ear cup. The diaphragm is made of bi-axially oriented propylene film (BOPP) with a vapour deposited



aluminium surface sealed with a synthetic lacquer. This diaphragm is then clamped within a two-piece protective cassette made of 40% glass-filled polyphenylene sulphide (PPS) from which the driver is isolated by precision-made PORON™ microcellular urethane foam gaskets. This cassette drops into the headphone ear cup. When an audio signal is superimposed on a 1350V DC bias voltage, the 'drum-skins' formed by the flexible membrane vibrate, producing sound. Gaskets and protective cassette frame aside, there is nothing between the flexible film diaphragm and the wearer's ears.

The Sonoma M1 Amp features a single-ended, FET-based Class A amplifier capable of a maximum amplitude of 145V. This is powered by an outboard, very high-quality switch mode power supply with extensive filtering and a

fixed frequency switcher that operates at over 85 kHz. This connects to the energiser via a custom made, shielded 'umbilical cord' fitted with locking connectors. Internally, the energiser incorporates multiple low-noise, high-current linear regulators, with separate regulators feeding both analogue and digital sections of the energiser, as well as high and low-current circuit stages. The energiser has a built-in DAC based around a 32-bit/384 kHz ESS DAC chip for processing digital sources, and a 32bit/384 kHz ADC chip for digitising analogue inputs. It also uses DSP to produce a pseudo-diffuse field frequency response curve; this explains the digitisation process for analogue sources because they later need to be passed through that digital signal processing. This does effectively lock a Warwick user into the brand's equipment, ►



“The BRAVURA is the product of years of HPEL development.”

In truth, ‘evolution’s is probably all you need here. The Sonoma M1 was generally extremely well-received, and praised for its mid-band and top end clarity. However, it wasn’t without its criticisms, most of which were levelled at the Sonoma M1 Headphone. In particular, the bass was criticised for being ‘thin’ and ‘light’ sounding, and its sound pressure levels were on the ‘quiet’ side too. The Sonoma M1 system wasn’t the ‘headbanger’s friend’ was the general conclusion.

Aside from some sneak previews at Rocky Mountain Audio Fest 2016 the Sonoma M1 system began arriving in people’s hands in the next year. Four years is a long time in headphone design and a lot has happened at Warwick since those early days. Most importantly, as you might expect from a very new technology, the intervening years have seen several step-changes in the manufacturing techniques.

The BRAVURA is the product of years of HPEL development to refine Warwick’s core technology, in the process improving upon the Sonoma M1. The latest evolution of the single-ended HPEL uses a new stator design and more advanced materials that are suggested to result in ultra-low distortion, increased SPL and a wider bandwidth.

Critics will, of course, see this as both a vindication of their views on the original Sonoma M1, and see this as response to their criticism. In fact, it’s technological

▶ because no third-party energiser maker will use DSP to modify the response curve of the headphone, and no energiser will make the Sonoma M1 Headphone sound quite as good as the matching amplifier. However, that also ties Warwick Acoustics into making electrostatic headphones that work with that DSP engine (even in subsequent generations of the energiser), meaning a headphone like BRAVURA is inherently more evolution than revolution.

development on an inherently new concept; the point in a technology where the delta of change is at its steepest. That being said, Warwick has reacted to customer feedback of the Sonoma M1 Headphone, especially in the use of a new headband and revised cabling. The former helps a lot, because the BRAVURA feels less ‘clumpy’ than before, but the latter helps a hell of a lot ; the older model’s cable system was prone to ‘touch it, you hear it’ effects. ▶

“These are more comfortable headphones that feel better built than their predecessors. The black finish feels good to the touch.”

▶ Judging by the BRAVURA, this is a subtle, yet significant evolution over the Sonoma M1 Headphone. First, let's get the 'artist's response to just criticism' part out of the way. These are more comfortable headphones that feel better built than their predecessors. The black finish feels good to the touch (I didn't have the silver models to hand, so I cannot compare directly) and the more traditional comfort strap across the headband does make the BRAVURA sit considerably more easy on the head. The previous headband was at once more rigid (translation: tighter feeling) and more sonically conductive (translation: if you are a glasses wearer, or the kind of fidget who ends up touching their head a lot during listening sessions, the Sonoma M1 Headphone's headband was prone to 'chattering'). The new headband scores well here, both in terms of overall comfort and reducing that plasticky 'thock, thock' sound you get when accidentally tapping a bit of ABS.

Then, there's the cable. The older one was a low-tangle cable, with some very nicely made custom connectors at both ends. It conducted electrical signals quite well too. If this sounds like the cable-equivalent of 'lovely hair' praise, well... the other cable blotted its copy book by being more than a little bit microphonic. I'm pleased to say the new cable fixes that (that might have something to do with today's connections in the BRAVURA headphone ear cup itself, but they look functionally identical, so I am going with the cable). This didn't make a low thrumming sound if you move around a bit fast, or little thuds each time it hits a shirt button. Instead, it was an almost noise-free (and still tangle-free) cable. It's not made of spooky headphone magic so it's not fully immune to sound conduction effects because such immunity is more a myth than a reality, but the cable has gone from a 'could do better' C+ to a solid 'outstanding' A or even A+.

Now on to the meaty part. The sound of the BRAVURA really does take all the good parts of the Sonoma M1 Headphone, take away all the bad bits, and deliver a sound that at once respects the heritage of what went before while adding much to the parts that were a little wanting.

The BRAVURA treads lightly over the same ground, benefitting from that subtle DSP; that 'modified pseudo-diffuse field' frequency response curve, which already created a remarkably natural presentation. Having heard what the Sonoma M1 can do, this was the key 'if it ain't broke, don't

fix it' part of the overall performance and remains unchanged between Sonoma M1 Headphone and BRAVURA. This yields an even greater consistency to a system that is already inherently consistent, but the combination of BRAVURA and the DSP on the Sonoma M1 Amp has an additional level of clarity and tonal precision that most other headphone systems fail to get close to achieving. This comes over as sublime clarity and extension to voices, such as that of Joyce DiDonato [Stella De Napoli, Erato]. Here, she sounds on peak form, which is impressive because she always sounds on peak form, but the BRAVURA just lets her get on with singing with absolute clarity and extension. A true delight... as it was with the Sonoma M1 Headphone.

If anything, there is even more clarity on offer. Her voice is so powerful, it can challenge even the most dynamic system on offer, and here her ability to 'belt out' an aria is met by a considerably lower distortion system. Her voice is constrained only by the microphone here; the BRAVURA keeps that sound smooth and effortlessly natural, even at some 'level'.

The big change is in the bottom end. While in the original review, Chris Martens found little to fault with the bass of the original system, I don't think he listens to as much electronica as I do, and a spot of Squarepusher or Mogwai through the Sonoma M1 highlighted a truncated low frequency, arguably to the point where you could argue the Sonoma M1 Headphone 'didn't work' with deep bass and the music that exploits that bass.

The BRAVURA nails this low frequency aspect. There's close to an octave more depth to this headphone compared to its predecessor. Undistorted low frequencies are going to be something of a new thing for many listeners; we've long been used to a bit of port noise in loudspeakers or headphones changing their tonal balance as the beats go down and the volume goes up. None of that happens here; instead you have clean, articulate, dry sounding bass; not overbearing unless it's called for; such as the low rumbles on 'Chameleon' [Trentemøller, *The Last Resort*, Poker Flat] fill the soundfield with menace. Oddly given this music is all synthesis, that menace takes on an organic, natural quality through the BRAVURA. Bass might not have the artificial 'bounce' that a wooden box does so well, but a few seconds with the BRAVURA shows what you are losing to gain that 'bounce'. ▶

“The BRAVURA is more of a headbanger than the Sonoma M1 Headphone could ever muster.”

► The two other big feathers in the BRAVURA’s cap is greater headroom. I’m tempted to say the BRAVURA has performed wonders here, and added some more volume headroom than before. The BRAVURA is more of a headbanger than the Sonoma M1 Headphone could ever muster, but the headphone still isn’t the kind that will leave you waiting for your ears to relax after all that pounding music. The BRAVURA can play loud; louder than before, but not tinnitus loud, and that could be a good thing long term in terms of ear-saving.

Above all, though, where the BRAVURA does shine is in extending the performance of the Sonoma M1 Headphone. There’s a sense of ‘totality’ or especially a ‘gestalt’ where the process of scrutinising individual components of the sound are swept aside by the whole. The Sonoma M1 was already excellent in this field. Now it’s outstanding because it has greater reach, both in frequency extension and volume level.

The BRAVURA’s improvement over the Sonoma M1 Headphone reflects how much can happen in a few years, especially in a fast-moving channel of audio. The same cannot be said for the Sonoma M1 Amp, though. I’m not a great fan of the great DSD arms race, with products delivering ever-higher sampling frequencies, especially when there’s little or no verifiable software at those super high resolutions. Nevertheless, support for DSD 64 and DSD 128 and PCM will not sit right with those demanding support for DSD 512 or higher ‘because they can’. I fear this is where 2021 catches up with what 2017 had to offer. I think a BRAVURA amplifier/DAC is in order soon, complete with support for higher-res DSD and PCM files (and probably showing off a set of indicator lights on the front panel to denote selected resolution). If that doesn’t happen (or if it does and ‘in the meantime’)... the Sonoma M1 Amp looks great in black, like it was made to be in that finish.

Warwick Acoustics made a very good Proof of Concept with the Sonoma M1 system, but in the BRAVURA, that concept has been realised. All the things it did well it still does well, a few of the things it did well it does a little better and all the areas where some improvement was needed (bass, frequency extension, volume headroom) have seen improvements to bring them up to the headphone’s standard elsewhere. The name ‘BRAVURA’ means ‘great technical skill shown in a performance’ in Italian. It’s deserved... bravo! +

TECHNICAL SPECIFICATIONS

headphone

Type: Circumaural, open-back, electrostatic headphone

Drivers: Full-range, low mass, single-ended electrostatic drivers

Effective driver area: 3570 mm²

Frequency response: 10 Hz–60 kHz

Weight: 403 grams (excluding cables)

energiser/DAC

Type: Class A solid-state electrostatic headphone energiser with built-in DAC, ADC, and DSP functions

Inputs: One USB digital input, one coaxial S/PDIF digital input, two stereo analogue inputs (one high-level via RCA jacks, one low-level via 3.5mm mini-socket)

Outputs: One electrostatics headphone/bias voltage output jack

DAC: Dual mono, 32-bit/384 kHz ESS DACs with balanced outputs

Digital audio formats supported:

USB: All PCM inputs up to 32 bit/384 kHz and DSD via DoP (DSD64/DSD128)

Coaxial S/PDIF: All PCM inputs up to 24-bit/192 kHz

Device Drivers: An XMOS device driver is required when the BRAVURA system is used in Windows environments

Frequency response: Bandwidth > 65 kHz

Distortion + Noise: <0.05%

Dimensions (HxWxD): 57 × 190 × 290mm

Weight: 2.45 kg

Price: BRAVURA Silver Headphone: £1,700, Black Edition, £1,995. Silver System (with Sonoma amp), £5,495. Black Edition system (with Black Edition Sonoma Amp), £5,995

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