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BAT's flagship REX 500 power amp lights our fire!



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BAT REX 500

Less is very much more in BAT's flagship stereo power amp where its third-generation 'SuperPak+' PSU meets a fully balanced output stage featuring N-channel MOSFETs
 Review: **Mark Craven & Paul Miller** Lab: **Paul Miller**

Here's a fun game to play: look through the product catalogue of US manufacturer Balanced Audio Technology and try to spot the odd one out. It should only take you a matter of seconds because all of its current models, bar one, employ tubes in either their power or preamp stages. And if you still haven't realised I'm talking about the new REX 500 power amplifier, it's the one that's roughly twice as big as all the others.

A two-channel model rated at 500W a side, but with the option to be specified at purchase as a 1kW mono design, the REX 500 is described as BAT's 'flagship solid state' amplifier, but at £22,500 also counts as its flagship amp, full stop. Below it is the £14,995 tube-toting VK-90t. This is also something of a beast, claiming 2x80W from its 6C33C-B triode power tubes and weighing 45kg, yet the REX 500 goes further, tipping the scales at 63.5kg. The arc-shaped handle mounted to its rear, which echoes a design detail found on other BAT models, is therefore useful when it comes to getting the amplifier in place.

SECRET SAUCE

BAT's web page, and accompanying 'white paper', for the REX 500 tell us that the amplifier employs solely N-channel FETs in both its driver and power stages, and provides a hint of the thinking behind its 'SuperPak' power supplies with their parallel mix of electrolytic and hybrid silver foil/oil reservoir capacitors. There is no mention, however, of the high running temperature (55-65°C across the chassis) or the fact it's pulling 500W from the wall when idle [see boxout, p46].

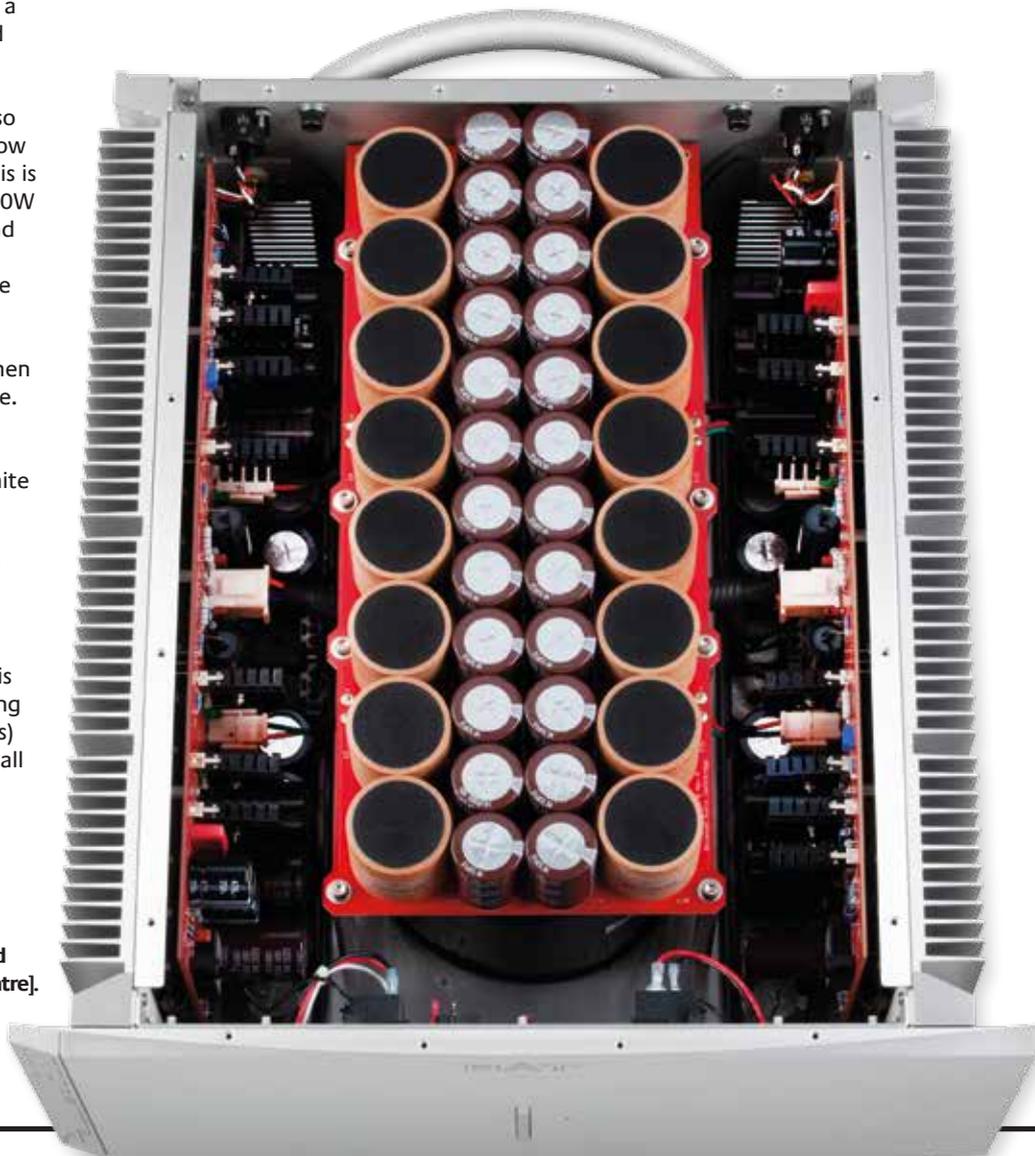
Designer Victor Khomenko [see interview sidebar, p45] is very cautious about calling the REX 500 a 'Class A

amplifier' and prefers the term 'heavily biased Class A/B'. Furthermore, while the amplifier does not use complementary PNP/NPN transistor pairs, neither is its design quasi-complementary in the fashion of so many early transistor amps from the 1960s. Instead, the REX 500 takes its design cues from the Circlotron triode tube circuit patented by Wiggins in the US in 1958, though others had published similar topologies earlier. In fact, all BAT's

amplifiers, whether tube or transistor, have employed a modified form of the bridged Circlotron configuration.

FLOAT LIKE A BUTTERFLY...

The REX 500 follows suit with two single-ended groups of 12 N-channel FETs per channel, bridged and with floating power supplies. Moreover, because the preceding N-channel driver stage is fully balanced, both phases are already present to feed the



RIGHT: BAT's 'SuperPak+' PSU includes two huge toroidal transformers with eight hybrid silver foil/oil capacitors per side [orange, centre]. The two (voltage/power amp) stages employ N-channel MOSFETs only, the latter featuring 24 IR FETs in a balanced/bridged configuration [on each heatsink]



'The unusual design translates into what is, perhaps, an unusual sounding amplifier...'

POWER AMPLIFIER



ABOVE: The curvaceous industrial design of the REX 500 reflects an aesthetic first introduced to celebrate BAT's 25th anniversary. Just one control breaks the broad sweep of the heavy fascia – a long on/off rocker and blue LED

two bridged single-ended blocks directly (ie, no additional inverter stage is required).

The circuit looks elegant enough, and benefits from a very soft transition from Class A to A/B at higher power, but requires great care in its optimisation and stability – the same can be said when attempting to measure this amplifier. Also, because the REX 500's output is floating it should not be connected to any loudspeaker with a grounded 'black' terminal...

That consideration aside, setup and operation are a breeze – once you've realised the amp has two IEC sockets to feed its twin, separate PSUs, another facet of its 'true dual-mono design'. In between these are PSU fuse holders, and above are reset buttons for each channel should you manage to trigger the REX 500's protection circuits. Inputs are offered on balanced XLR only, to match the connections on BAT's REX 3 preamplifier.

HEAVY METAL

While the weight of this amp might pose some installation questions – it will surely end up on a low stand on the floor – it's just a little more than 'standard width' at 483mm wide and BAT's industrial design does help it appear at least somewhat sleek. The metal chassis, offered in silver or black, has a smart brushed finish and a slight swoop effect courtesy of the widened front fascia. BAT's logo and the standby/power button take centre-stage:

the only thing upsetting its symmetry is the model number, engraved on the lefthand side. The overall impression is of a premium amp that's been very well put together.

PM's boxout [p46] reports on the REX 500's warm-running nature (and power consumption). Both should, of course, be taken into account, but it's also worth stressing that this amplifier isn't alone in the high-end hi-fi arena in this regard. Judicious use of its power button is probably recommended though, on the understanding that the REX 500 will sound of its best once it's fully warmed up.

SHOCK AND AWE

The REX 500's unusual design translates into what is, perhaps, an unusual sounding amplifier... and a very, very good one. Here we have a heavyweight solid-state amp with sufficient power to comfortably drive a pair of Perlisten's exacting S7t Limited Edition floorstanders, yet beyond that the story is as much about the REX 500's

presentation and 'voice' as it is the obvious grunt. Perhaps I shouldn't be surprised that an amplifier designed by a company with an obvious love of tubes manages to tread a similar path, but its performance is nevertheless an absolute head-turner.

Without wanting to pigeonhole the REX 500 as 'good for only one genre', I had a whale of a time using it to listen to 1970s rock. There's something about its lush, characterful tonality that perfectly fits this era, while its sheer energy drives home the flamboyance of the likes of Page, Bonham, Iommi, *et al.* The opening synth notes of 'Friday Night', from Dennis Wilson's solo set *Pacific Ocean Blue* [Caribou Records] ⇨

'The REX 500 gave equal footing to every tone and texture'

VICTOR KHOMENKO

Balanced Audio Technology's Chief Designer, Victor Khomenko, is responsible for 95% of the brand's design effort. He is one of two founders who met while employed at Hewlett-Packard, then developing instrumentation for analytical chemistry. Victor was already a committed audiophile, 'though we didn't have that word back then', he says, 'we were just as obsessive'.

Growing up in Russia, his first system was entirely home built, but after moving to the USA in 1979 Victor bought a Linn LP12 deck, SAE electronics and KEF speakers. 'But I have always had a passion for reel-to-reel', he admits, 'and I now have about 50 heavy-duty machines'.

Victor jointly started BAT in 1993 before launching the VK5 preamp and VK60 power amp – both tube designs – in 1995 at CES in Las Vegas. The introduction was memorable, not least because his amplifiers were driving John Dunlavy's mammoth Signature CS-VI speakers that were also being debuted at the show.

Nearly 30 years later and all BAT's amplifiers are either tube or N-channel-only transistor designs. 'P-channel devices are always inferior – slower, with poorer response', claims Victor. 'N-channel devices always seem to sing with more freedom.' BAT typically has two solid-state amps in its lineup, 'one big and one small, but we are still working on the small one', Victor confides.

And what about the REX 500's heat? 'We set the bias for a target heatsink temperature of 55°C' – a throwback to Victor's HP days – 'hot, but not so you'll burn yourself'. PM

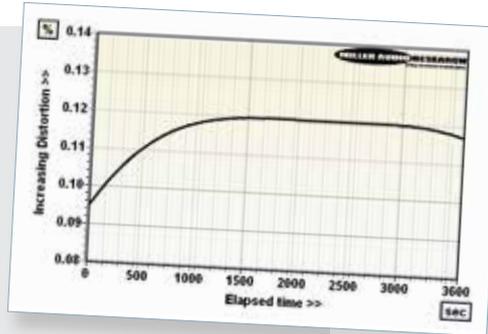


POWER AMPLIFIER

HOT STUFF!

BAT's REX 500 is the only model in its range that's not a tube or tube-hybrid design [HFN Sep & Dec '21] but neither is it a cool-running exemplar of solid-state modernism. Instead this amplifier gets cookin', its side-mounted heatsinks showing hot spots up to 65°C after one hour at idle where both sides are pulling 235-260W from the wall. While richly biased power output stages – a novel balanced/bridged N-channel MOSFET stage in this instance – generally enjoy some subjective uplift, in combination with low levels of compensation (feedback) they can exhibit a degree of thermal drift. In this case the REX 500's harmonic distortion increases with increasing temperature, as illustrated in the inset Graph which shows a change from 0.095-0.12% between 20°C-60°C over 30mins (re. 1kHz/10W/8ohm over one hour, and note the *linear* Y scale here).

In our review of the far smaller, though equally toasty Musical Fidelity A1 amplifier [HFN Jan '24], I discussed the basic calculations for a conventional Class A push-pull output configuration. That little integrated drew ~80W from the AC mains for 2x10W/8ohm of Class A power which illustrates how practical implementations almost always fall well short of the theoretical 50% efficiency. By the same measure, the BAT REX 500 is operating in Class A to at least 50W/8ohm per channel even though the brand makes no boast, idle or otherwise, about this very generous envelope. With hindsight, and bearing in mind it's pulling half a kilowatt from the wall, perhaps 'greedy' might be a better adjective... But it offers a glorious sound, and it keeps the listening room warm on those chilly winter evenings! PM



of the song, Page overlays a second guitar part to give the main line a curious harmony – this effect was wonderfully clear and distinct, just as it was easy to pin-point the position of the following guitar solo, thanks to the amp's supreme skill at creating a wide, accurate soundstage.

AMERICAN MUSCLE

Joining this is the sheer atmosphere the REX 500 brings to tracks, big or small. 'My Home Is In The Delta' by Muddy Waters [Folk Singer; Geffen 96kHz/24-bit] was immensely evocative. Tiny details of his slide guitar playing were picked out, and the intimacy and ambience of this sparse recording shone through. At the other end of the scale, 'America', from Deutsch Grammophon's live capture of Bernstein's *West Side Story* featuring Jose Carreras and Kiri Te Kanawa [96kHz/24-bit], saw vocalists placed along a wide, deep stage. Dynamic brass moments arrived with force – a counterpoint to softer percussion and shimmering latino guitar parts. This chaotic track is as much of a melting pot as its subject matter, yet the REX 500 gave equal footing to every tone and texture.

BAT's amp performs just as admirably with music of a more modern bent.

BELOW: The REX 500 is offered in matt silver and, illustrated here, black colourways, the vents in the top-plate and up behind the fluted heatsinking are all part of its cooling regime

88985368632], burst from the Perlisten towers, possessing wonderful texture, presence and scale. The soundstage was huge, the imaging holographic. And once I heard the rolling, rich piano chords, I was completely smitten.

PAGE AND PLANT

Led Zeppelin's 'Black Dog' [Led Zeppelin IV; Atlantic 8122796446] features a classic

Jimmy Page riff, played in unison by the bass guitar. Here it was rendered with a fat, distorted and warm presentation that instantly evoked the paisley shirts and lanky hair of the 1970s. Robert Plant, meanwhile, was a floating, wailing siren bang in the middle of the speakers, and the snare and tom-toms of the drumming accompaniment seemed to acquire an almost physical presence. Toward the end



BAT REX 500

BAT's flagship stereo amplifier is offered with a very sparse specification, nevertheless its core 500W/8ohm and 1kW/4ohm rating is well met in practice. Achieving 495W at 0.5% THD and 565W at 1% THD into 8ohm – one or two channels driven as the REX 500 is a dual-mono amp right back to the two transformers and AC inlets – the amp has sufficient stiffness in its supply to support 1.04kW/4ohm at 1% THD. Under dynamic conditions the REX 500 lifts its game to the tune of 595W, 1.165kW and 1.132kW into 8, 4 and 2ohm loads, respectively, at <1% THD before 'relaxing' back to 585W/1ohm at 2% THD (or 24.2A). At no point during these tests was BAT's electronic over-current protection triggered [see Graph 1, below].

BAT is not alone in claiming 'no global feedback' and while this does not preclude local/nested feedback to optimise the gain, bandwidth and linearity of individual stages, the REX 500 does exhibit some common 'low feedback' features such as moderate levels of distortion and a high-ish output impedance. THD increases with level from 0.04%/1W to 0.13%/10W, 0.23%/100W and 0.52% at the rated 500W/8ohm (all re. 1kHz) while also increasing with frequency to, for example, 0.1%/1W, 0.33%/10W and 1.65%/100W [all re. 20kHz, see Graph 2]. The output impedance increases from 0.32ohm to 0.52ohm across the 20Hz-20kHz audioband and to 2.65ohm/100kHz, the latter influencing its frequency response according to the HF impedance trend of the attached loudspeaker. Into a non-reactive 8ohm load, response is flat to within ±0.2dB (20Hz-20kHz) but dips to -0.8dB/20kHz into 2ohm. The 84.5dB A-wtd S/N ratio (re. 0dBW) is perfectly 'average' for the breed. PM



ABOVE: Truly dual mono, with two IEC mains inlets feeding two independent PSUs (and with two replaceable fuses). Balanced inputs on XLRs only, with speaker outputs on 4mm binding posts. Buttons allow manual re-setting of the electronic protection

Daft Punk's 'Giorgio By Moroder' [*Random Access Memories*; Sony Music 88883716862] began with a sonorous rendering of Moroder's monologue and an almost surround sound delivery of the background ambience. Then we're into wah-wah guitar and a club vibe, hammered home by a pounding kick drum and deep bass. The Perlisten S7t LE speakers were kept on a tight leash here, and the imaging between them was seamless.

It was the performance expected of a flagship amp at £22k – yet still astonishing. True, some rough and tumble drum 'n' bass in the shape of 'Black' by DJ SS [Formation Records 44.1kHz/16-bit], where every element has been pushed up to ten, found a slightly brazen edge, but the slam of the drums was far more notable, and a better produced example of the genre – LTJ Bukem's jazz-tinged 'Flip The Narrative' [Drum & Bass Arena DNBA056] – sounded blissfully clear and rhythmic.

PURE PLEASURE

Even Enslaved's epic 'Thoughts Like Hammers' [*Riitii*; Nuclear Blast 0727361293260], a favourite torture track, dazzled: the impossibly thick downtuned guitar riff had the consistency of liquid metal, its final vibrato note loading the room. The following 'singing' was listenable, rather than grating, even at chest-thumping volume.

The rest of my listening notes are indicative of the pure pleasure the REX 500 evokes. For Lana Del

Ray's 'Video Games' [*Born To Die*; Polydor 2787091], I simply wrote 'a cathedral of sound', while Hans Zimmer's 'The Mole' from *Dunkirk* [WaterTower Music; 44.1kHz/24-bit] was 'a frightening soundscape that

grows in size and stature until your speakers seem ready to burst'.

But it was Black Sabbath's 'War Pigs' [*Paranoid*; Warner/Rhino RR2 3104] that summed up

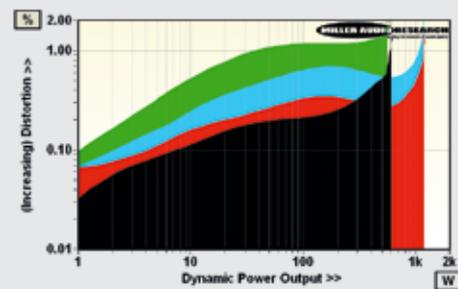
everything that's right about the REX 500. Tony Iommi's snarling guitar parts sounded raw and in the room, while Bill Ward's edge-of-the-seat drum rolls were writ large but focused. The reverb that fades to silence before Ozzy starts his tirade about generals gathered in black masses elicited goosebumps. There was power and attack, effortless detail and startling scale. As Ozzy himself yelps: 'Oh Lord, yeah!'. ☺

'A downtuned guitar riff the consistency of liquid metal'

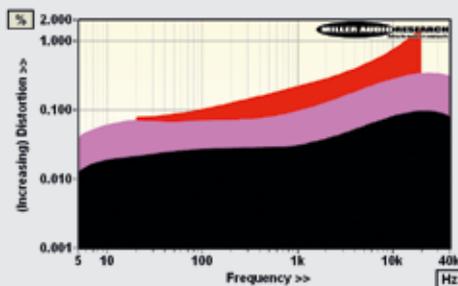
HI-FI NEWS VERDICT

Audiophiles loyal to the American brand will be pleased to hear that BAT's new solid-state powerhouse inherits the tube-centric company's DNA. On offer are unburstable power, rich tonality, fine detail and sublime soundstaging, making music listening an utter joy. The REX 500 is amplifier royalty, and surely ranks as one of the very best at its price – or above. You might even want to pick up two of 'em.

Sound Quality: 90%



ABOVE: Dynamic power output versus distortion into 8ohm (black trace), 4ohm (red), 2ohm (blue) and 1ohm (green) speaker loads. Max. current is 24.2A



ABOVE: Distortion versus frequency versus power output (1W/8ohm, black; 10W, pink; 100W, red)

HI-FI NEWS SPECIFICATIONS

Power output (<1% THD, 8/4ohm)	570W / 1040W
Dynamic power (<1% THD, 8/4/2/1ohm)	595W / 1170W / 1140W / 585W
Output imp. (20Hz-20kHz/100kHz)	0.32-0.52ohm / 2.65ohm
Freq. resp. (20Hz-20kHz/100kHz)	+0.0dB to -0.2dB/-2.95dB
Input sensitivity (for 0dBW/500W)	132mV / 3040mV
A-wtd S/N ratio (re. 0dBW/500W)	84.5dB / 111.5dB
Distortion (20Hz-20kHz, 10W/8ohm)	0.07-0.33%
Power consumption (Idle/Rated o/p)	235W / 865W (per channel)
Dimensions (WHD) / Weight (total)	483x254x597mm / 63.5kg