MSB TECHNOLOGY
PLATINUM DAC IV DAC & POWER BASE

You just can’t satisfy some manufacturers. When Californian outfit MSB Technology wanted to build a digital-to-analogue converter, it didn’t like the ones everyone else uses: pre-fab versions from Burr-Brown, Wolfson, Analog Devices, and Sony, etc.—so it decided to build its own DACs from scratch... and by hand... using discrete logic and components. The company claims that it is unique in building its own DACs and I certainly can’t think of any other company in the world that does. However, the company took another step out into the void by deciding not to use either of the usual methodologies used to convert digital code to analogue audio signals. Whereas everyone else (and we mean everyone!) uses either standard ‘ladder’ DACs or DeltaSigma DACs, MSB uses a special type of conversion system which it calls a ‘Sign Magnitude Ladder’ DAC (the same type used in the Burr-Brown PCM1704 IC), but which is actually a type of R-2R resistor ladder network. That isn’t all. Whereas most companies build in a fixed filter to the output of the DAC, and a few high-end companies offer the ability to switch between different filters, MSB allows audiophiles to build their own filters: You just send MSB a list of the FIR filter coefficients and it will format them into a CD loadable file for you. You can also ask MSB to design a filter specifically to suit your particular system and the discs you play most often. Or if you have no idea how to design your own filter, and don’t want to pay MSB to design one for you, you can simply pick and choose from the list of ‘ready-to-roll’ software filters the company has on offer.

However, if you think that’s good, wait until you hear the next bit! If you have a stack of different MSB filters stored and you find that one of the filters you don’t use much actually works really well with one particular CD you own, you can have the MSB Platinum DAC IV load that specific filter into memory immediately prior to playing that CD. When you load a different CD, you can then have it pre-load a different filter that best suits that CD... and so on... the variety is endless. And if at any time you wish to switch back to one of the four standard ‘factory’ filters that are built into the DAC IV, it’s simply a matter of using either the filter select button on the front panel or the one on the remote.

THE EQUIPMENT

MSB has come a long way with its approach to the industrial design of the exteriors of its products. When it first started out in 1986 the exteriors of its products were typical of a company driven by engineering—they looked terrible! (Ask any engineer and he’ll tell you about this, as in “who cares what it looks like, it’s how it works that’s important.”). For proof of this, you need only look at historical photos of its first Platinum CD player or, worse, the Reference CD III (and matching DAC III) that are pictured on MSB’s own website.

As you can see from the photographs in this review, the new MSB equipment looks fantastic! The chassis are thin, sleek and rounded, and the way the components stack, using integral spikes and vibration isolators is brilliant. I even liked the look of the finning down the sides, though the fins are dangerously sharp... I ruined a $150 shirt by getting too close. I did note, however, that the engineers at MSB still don’t have an eye for typographical detail. On the three MSB components provided to me for review, each one had a different MSB logo and different type on the front panel. This may have been because they came from different production runs, but I think it would be better if the front panels could all match each other in terms of logos and typestyles.

The Platinum DAC IV can accept any type of digital input (but USB input is an optional extra) and can operate with any digital word length and all sampling frequencies from 32kHz up to 384kHz. It also has an analogue input, so if you option in the volume control, you can actually use the DAC IV as a pre-amp, assuming you only need the single analogue input and you don’t need any gain. You can, however, option in an additional analogue input. The volume control is an added-cost option: the standard DAC IV comes without one. However, you also have a choice of volume controls. There’s a standard volume control that operates in 2dB steps, or you can get one that operates in 0.25dB, 0.5dB or 1.0dB steps. Note, too, that the volume control is not a potentiometer, but a true stepped volume control, using fixed resistors, so you get perfect steps, perfect tracking and minimum noise. (Interestingly, even MSB says of the 0.25dB and 0.5dB steps that: ‘in most cases this level of resolution is not audible.’) In addition to the optional extra analogue input, you can also option in an integrated Pod dock, which then sits ‘in’ the top of the DAC IV. Output can be unbalanced (via gold-plated RCA outputs) or balanced (via gold-plated XLR outputs). Maximum unbalanced voltage output is 2.62V, while maximum output (balanced) is 5.22V.

Once you have delivered a signal to the DAC IV, you can upscale it (pick one of three upsampling choices), invert it, apply one of four fixed filters or any other type of filter available, alter the DAC level, apply or remove dither, program the start-up volume, turn re-clocking on or off, lift or connect analogue ground, and choose between balanced or single-ended operation. If you choose to re-clock the incoming digital data, it will be read into memory (buffered) and then streamed out under the control of MSB’s own ultra-low-jitter TCXO-based clock.

Like many DACs, the MSB Platinum DAC IV does not have its own power supply. But unlike most of the others, which use ‘wall wart’-style supplies, the power supply for the DAC IV is a state-of-the-art design that is as big as the DAC IV itself. But there isn’t just a single power supply for the DAC IV—you have a choice of a number of different power supplies, which MSB Technology calls ‘Power Bases.’ There’s a ‘Standard’ base, a ‘Signature’ base, a ‘Platinum’ base, a ‘Diamond’ base and a ‘Signature Transport’ base. You can option in front panel controls on the power bases, and you can also option in extra power supply outputs, so the one base can power two MSB products. The power supply supplied with my review DAC IV was the Platinum model, fitted with...
SIGN MAGNITUDE LADDER DACS
Digital audio systems have traditionally used laser-trimmed, current-source ladder DACs in order to achieve sufficient accuracy. However, even the best such DACs have low-level nonlinearities because of errors in the major carry bipolar zero transition. It is because of these errors that so-called ‘one-bit’ (delta-sigma) architectures were developed. However, delta-sigma DACs introduce other errors because they generate huge amounts of noise, which needs to be filtered, introducing a whole new set of problems with the filters themselves. A sign magnitude ladder DAC gives the best of all worlds: superior performance at both high and low signal levels, combined with a very high signal-to-noise ratio. The sign-magnitude architecture uses two DACs, each of which steps away from zero in the opposite direction, which avoids glitching and linearity errors. The two (complementary-arranged) DACs share both a common reference and a common R-2R ladder. The R-2R ladder uses dual balanced current segments to ensure ideal tracking. By interleaving the individual bits of each DAC a highly accurate match between the two DACs can be achieved. In theory, this is quite easy since an R-2R ladder is relatively easy to manufacture. However, if you use the simplest process of using only single-value resistors, the drawback of the system is that it’s essential that the values of the resistors be extremely accurate, and the required level of accuracy will double for each additional bit. This means that even an 8-bit converter would require the use of 0.4 per cent tolerance resistors! Higher resistor tolerances can be achieved by laser-trimming, which is how on-chip R-2R DACs are made. However, since MSB makes its DACs by hand, I can only assume that it uses unequal value resistors and forms its ladders one single bit at a time, selecting each successive ‘rung’ and ‘leg’ of the ladder so that the rung value matches the leg value plus the equivalent resistance of the previous rungs. MSB says that it has resisters specially made for it with tolerances of better than 0.005 per cent, but even using such high-tolerance resistors, building an MSB DAC by hand must be so incredibly expensive and so incredibly time-consuming that I cannot conceive why you’d even consider doing it! Eventually you’d need to use literally dozens of resistors for each rung to get the required accuracy. I haven’t figured it out exactly, but I’d guess that each DAC must cost them hundreds of dollars in labour and parts to make… whereas you can buy a mass-produced 24/96 Burr Brown Sign-Magnitude DAC straight off the shelf for less than twenty bucks! (Which is precisely what most other high-end DAC manufacturers do.) And the Platinum uses four of MSB’s handmade DACs.

an extra output to drive the MSB Universal Media Transport, which I used in conjunction with the DAC IV for this review.

As you have likely gathered already, there is an almost-bewildering number of circuit and feature options available for all MSB’s products—and I haven’t even begun to talk about the colour options that are available. Although it is certainly bewildering, it at least affords you with the opportunity to build exactly the type of component you want, using only those features you’d like, so you don’t have to pay for features you don’t think you’ll need. However you will still probably require lots of guidance from your dealer because, for example, there is no point in ordering the USB option for the DAC IV if you’re also buying an MSB Universal Media Transport, because the UMT has two USB inputs already.

The number of options available—and how you use them if they’re fitted—plus the fact that MSB Technology seems to feel obliged to provide super-detailed explanations of why it has implemented certain features in certain ways, means that the owners’ manual is very complex and quite difficult to understand. Its design (typographically and artistically) also seems to hark back to the 1940s, so if you weren’t even born then, you’ll find it strange, to say the least! It also doesn’t help that a couple of the technical explanations are actually incomprehensible because the graphic artist has chopped out some of the words in order to fit the illustrations in.

LISTENING SESSIONS
Most of my listening was done using MSB’s UMT as the source, loaded with either CDs or SACDs, but I also listened to standard and high-res files input via S/PDIF. MSB isn’t exactly hiding the fact that its UMT is based around an Oppo Blu-ray chassis, because when it’s powered up, the friendly words ‘Hello Oppo’ show up in the front panel display! However, the fact it’s an Oppo display also results in a bit of a styling mismatch, because the display on the UMT is a bright green/blue LED-style, whereas the DAC IV’s display is a fairly dull grey-on-black LCD style. When you power-up the DAC IV, there’s an ‘About’ option that tells you everything you need to know about the particular model you’re powering up: the year it was manufactured, the options fitted to it, the versions of the three different software packages inside it, the serial number, plus quite a bit more… even the name of the Australian distributor makes an appearance!

When you’re listening to the MSB DAC IV, what will strike you most about the sound is the way the fine details are presented. I didn’t think I was hearing any more detail than usual from a high-end DAC, but I did perceive that there wasn’t any of the usual aural ‘clutter’ around that detail, so the end result actually seemed somehow clearer. I was trying to think of a visual analogy that might explain this better.

I would like to say that the MSB Platinum DAC IV is the ultimate DAC. But it isn’t.
and all I could come up with was the difference between reading words printed black on white and reading the same words printed black on white (with exactly the same depth of black and white, and the same resolution) but with the black type slightly raised from the white surface. Both would be easily and clearly visible, but the raised type would have more visual impact… that’s what I thought about the detail I was hearing from the MSB DAC IV. It’s something I have not previously heard from any audio component… ever. This is such a small thing, but what a difference it made to my appreciation as I listened to music I had previously thought I was familiar with. I could do no better than give the example of Trio Kroma performing Andreas Spath’s Song of the Alps. The micro-shifts in pitching of soprano Elena Xanthoudakis’ voice made more conceptual sense, and it was as if you could anticipate her getting ready for the next interval. And somehow the echo of Clemens Leske’s piano from the wall behind gelled more cohesively with the direct sound from the instrument, with the result that I had a far better appreciation of the acoustic of the performing space.

The MSB DAC IV even excels when no music is playing at all! I find that so many digital components fall down in this respect, because when the music stops, it’s as if someone has stopped up your ears… in other words, there’s a total but completely unrealistic (and somewhat dullish) silence. This isn’t what happens in real live performances, or even in the recording studio. Listen to the DAC IV and you’ll hear what I mean. When the music stops, everything is quiet and totally silent, but nothing has gone ‘missing’… there is no dullness to the silence. It is perhaps because this effect is also happening in the brief silences between individual notes (not just at the end of phrases…) that the sound from the DAC IV is so aurally impressive. I found that with well-recorded sources, the high-frequency performance of the DAC IV was outstanding no matter which filter I used: the differences between them, audible though they were, were more akin to shifting from one seat to another in the same concert hall. However it was also obvious that with poorly recorded sources, one filter could render clear—albeit subtle—improvements in the high frequencies. Other differences could be induced by altering the upsampling and so on, but so many combinations of them—that I found it incredibly difficult to keep track of which settings best suited which recordings so I could repeat the settings when I played that disc again. (If MSB could work out a way of automating this process, I’d be forever grateful!) I did notice when reading MSB’s manual that it says that if you don’t use an MSB transport, you may in some very rare circumstances hear a ‘skip’, which will be caused by an overflow in the DAC IV’s buffer memory. I am happy to report this didn’t happen to me at all, using either MSB’s UMT or even when I tried connecting another—fairly inexpensive—transport. But even if I had heard a skip, well… I can live with the odd skip, but if you can’t, MSB says it can fix it by installing a special ultra-high-accuracy clock in your transport.

CONCLUSION

I would like to say that the Platinum DAC IV is the ultimate digital-to-analogue converter. But it isn’t. Because there’s a ‘Diamond’ version of the DAC IV that even MSB admits came about as the direct result of a quote ‘wild abandon in the engineering budget’ unquote.

The Diamond version of the DAC IV uses eight 26-bit DACs (four per channel) to give true 27-bit resolution. However a fully-optioned MSB Diamond DAC IV will run you past the $55,000 mark. The Platinum DAC IV (including Platinum Power Base) reviewed here costs a smidgin over $15,000 and delivers performance that’s as good—or better—than any other high-end DAC I have ever heard, even models selling at twice the price and more. But although I have not personally heard a fully-optioned-up Diamond DAC IV, I am prepared to go out on a limb and predict that the sound quality of the Platinum DAC IV is so close to perfect that any difference in sound quality could not possibly be worth spending an extra $40,000… which makes the MSB Platinum DAC IV something of a bargain! –greg borrowman
**TEST RESULTS**

All the measurements made by Newport Test Labs for the Platinum DAC IV are ‘worst-case’ because in almost all cases (one of the notable exceptions being the frequency response and distortion analysis shown in Graph 10), only standard CD-format (16-bit/44kHz) test signals were used rather than any of the higher-res data formats, and although all the various permutations of the DAC IV were evaluated, the settings that produced the ‘least good’ measured results are the ones shown here. All of which means that in real use, owners will always be able to get superior performance to that revealed here, though as you’ll see from the graphs, even the DAC IV’s ‘worst case’ results are so exceptionally good—in most cases better than any other DAC I’ve ever seen—that this just won’t be an issue.

Graph 1 shows the output of the MSB DAC IV at its maximum output level when driven by a maximum value digital input signal and you can see that almost all the harmonic distortion components are more than 100dB down (0.001%) and the six distortion components that are slightly higher in level (the second, third, fourth, fifth, eighth and tenth) are all more than 90dB down (0.003%). This is an excellent result, particularly since you will never experience these high levels on ordinary programme material due to the need for recording engineers to leave some headroom. Almost the same ‘distortion signature’ was exhibited with a 16/44.1 test signal at –3dB. The test at –10dB, which is getting down to where most CDs put their maximum levels, shows lower distortion again, at least for the most part. The graph shows a second harmonic at –90dB (0.003%) and a third at –92dB (0.002%), however all other components except the seventh harmonic, which is at –95dB (0.001%) are more than 100dB down. Performance with a test signal at a recorded level of –60dB was excellent, as you can see from Graph 4. This signal was not dithered, which is why you can see the ‘grass’ on the noise floor, but you can see that there are no harmonically-related distortion components, and that the noise floor is more than 120dB down right across the audio bandwidth. The influence of dithering is shown in Graphs 5 through to Graph 8. Graph 6 shows a –80.70dB recorded signal and you can see there are no distortion components visible at all and that the noise floor is now close to 130dB.
Graph 10 shows the -20dB frequency response and distortion (referred to 0dB) of the MSB DAC IV with a 24-bit/48kHz test signal. As you can see the frequency response at the top of the graph is ruler flat (the line is truncated at both ends, because the test signal starts at 18Hz and stops at 20kHz). Distortion is so low down as to be essentially unmeasurable (the trace shows it to be around –170dB down, but as this exceeds the capability of the measuring instruments I suspect we’re looking at a measurement artefact). The frequency response using standard 16-bit/44kHz test signals is shown in detail in Graph 11, and also using all four filter settings of the DAC IV, hence the multiple traces. You can see the responses are all superbly flat, because although all four traces appear to ‘roll off’ above 3kHz, if you look at the graph scale, you’ll see that all the traces are only around 0.07dB down at 20kHz. Channel separation was exceptionally good… better than 132dB right across the audio bandwidth and channel balance was better than 0.01dB, which is also exceptionally good. Signal-to-noise ratios were also superbly good—indeed the best I have seen for any DAC!—with the overall wideband figures being measured by Newport Test Labs at –111dB unweighted and at –123dB when a standard A-weighting filter was applied. Linearity error was equally good… so good that ‘error’ seems to be the wrong word for the test, because with the DAC IV there was no measurable error at all at any level until levels dropped to –90dB, at which point the error was measured at 0.01dB, either dithered or undithered, which is within the limits of measurement error and, obviously, a level that would be completely inaudible and undetectable.

The signal voltage at the MSB DAC IV’s outputs is just a little higher than most other DACs, at 2.6V (unbalanced) and 5.2V (balanced), so it’s more than sufficient to be able to directly drive a power amplifier via a passive volume control, should you want a minimalist installation.

To conclude, I have to say that I was gob-smacked by the incredibly high level of performance from this DAC: it truly and very effectively represents the state-of-the-art in digital-to-analogue conversion technology. —Steve Holding